OCS EIS/EA
MMS 2002-006

Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007

Final Environmental Impact Statement
April 2002

Volume II

MMS U.S. Department of the Interior
Minerals Management Service

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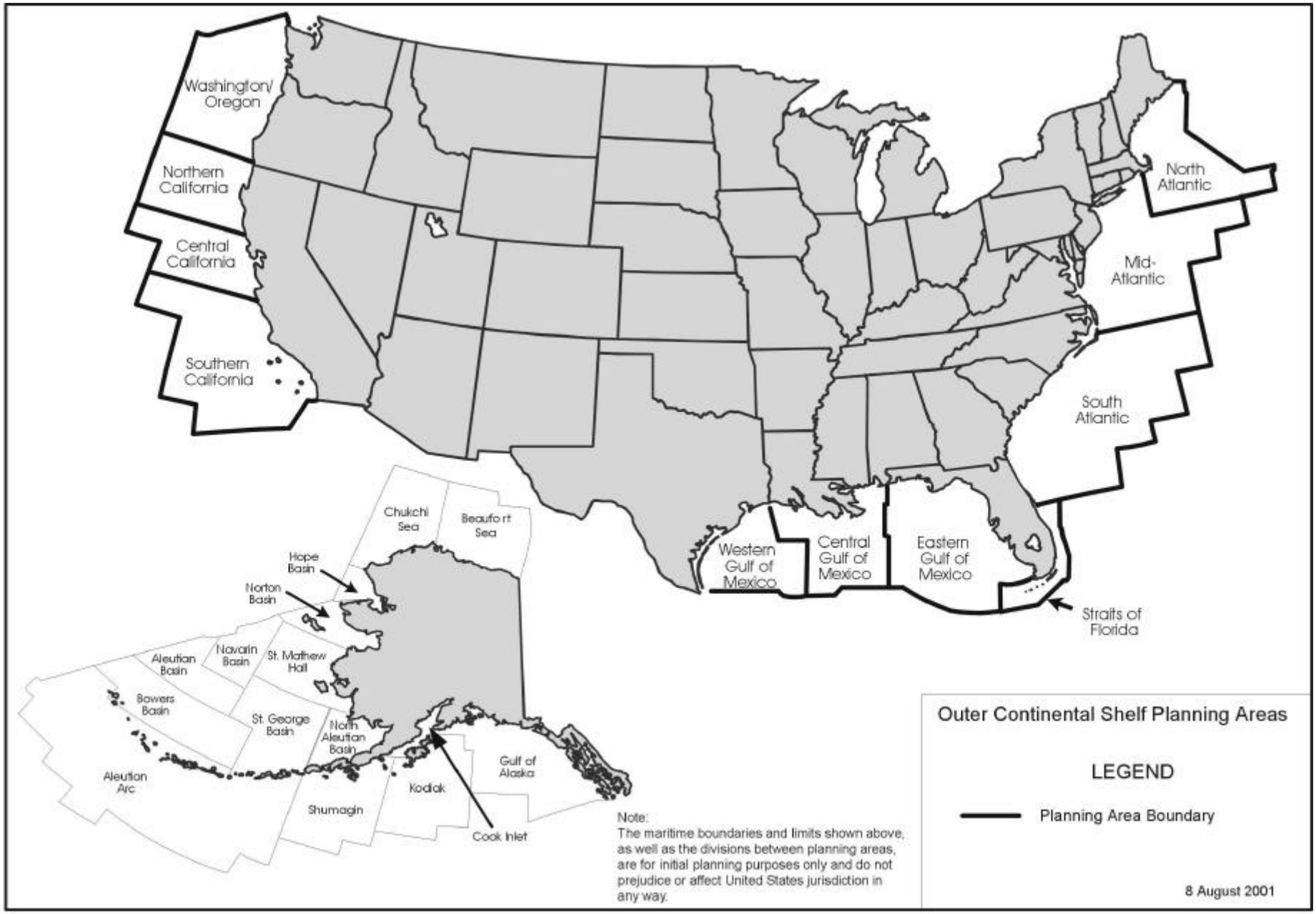

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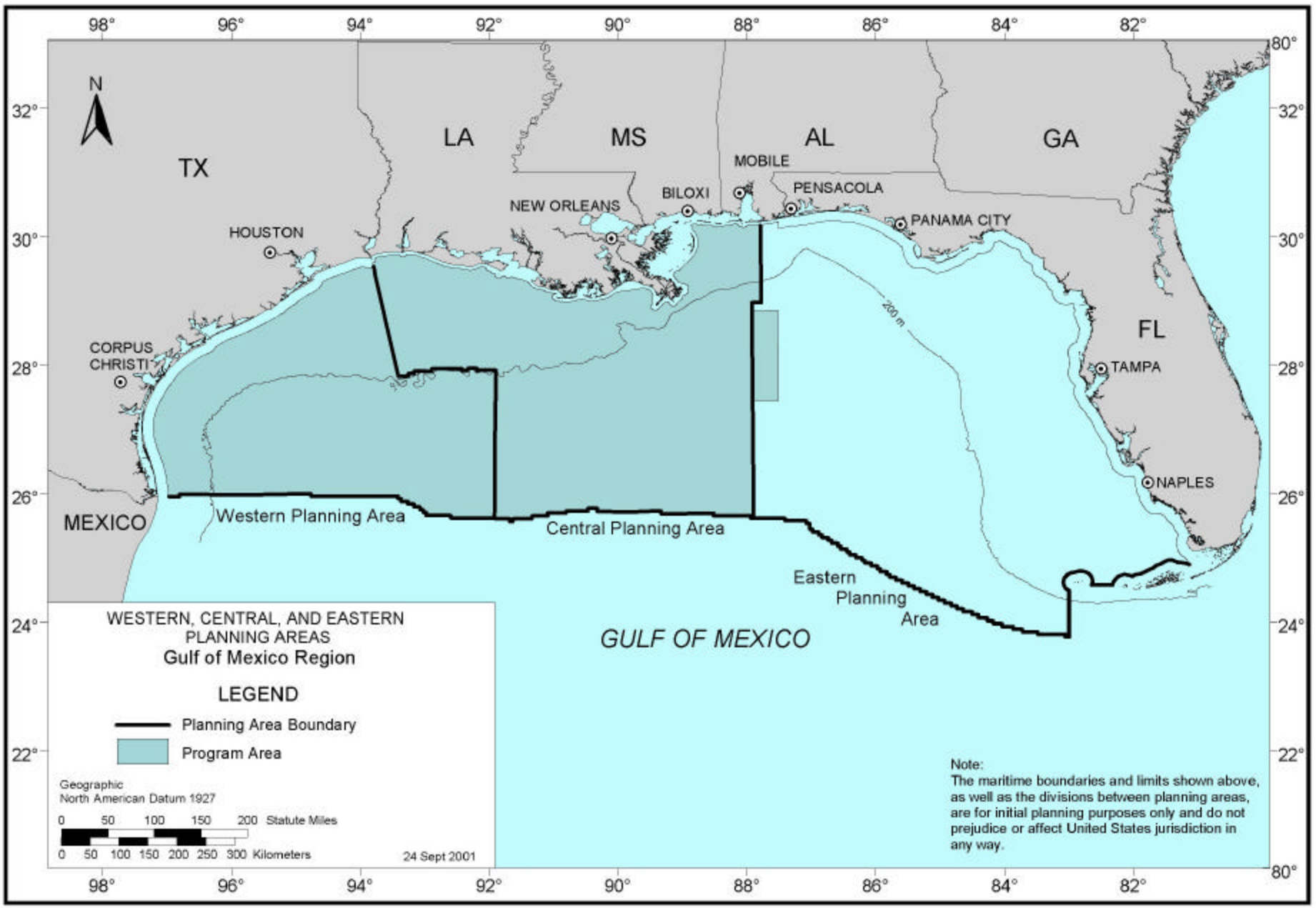

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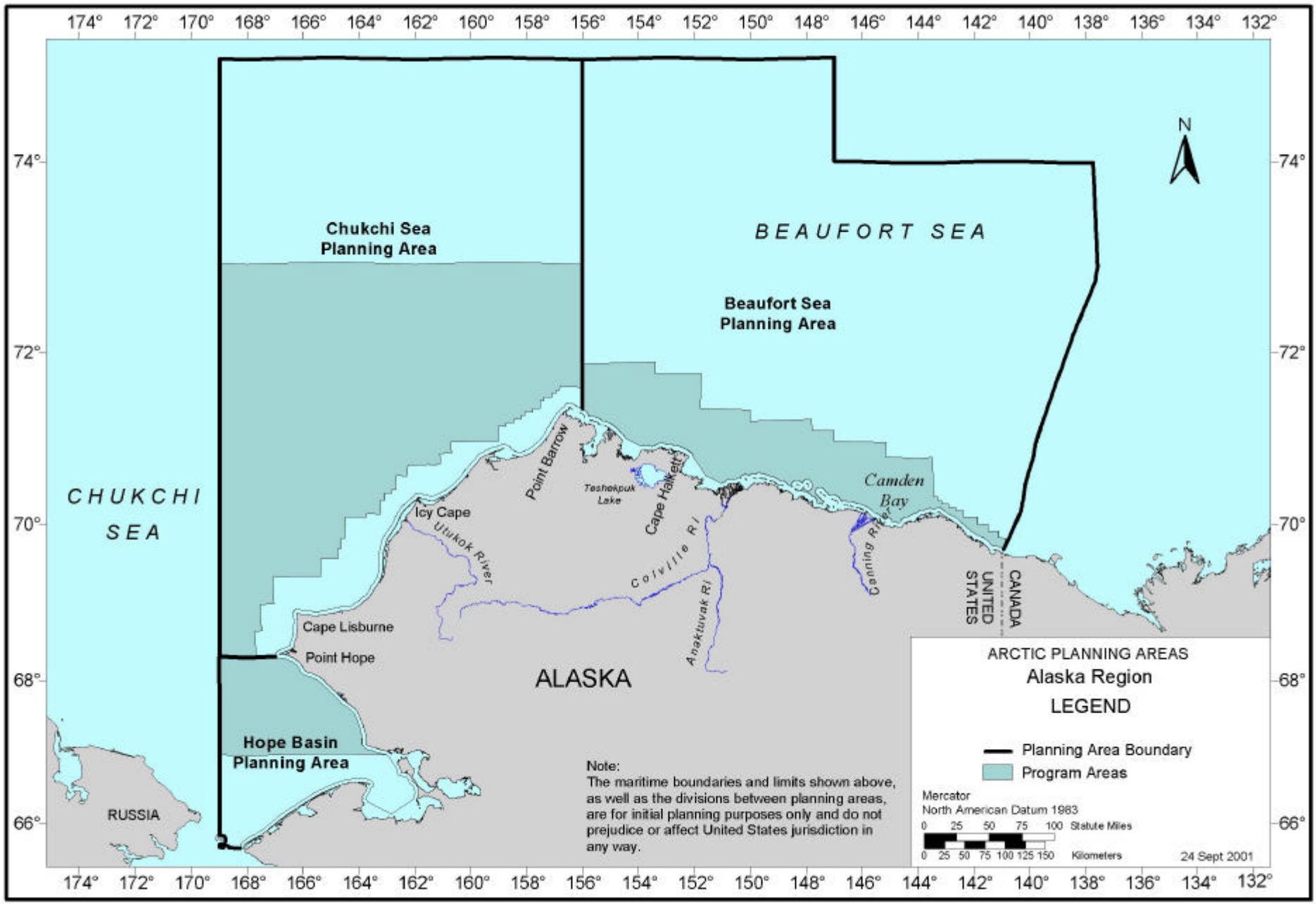

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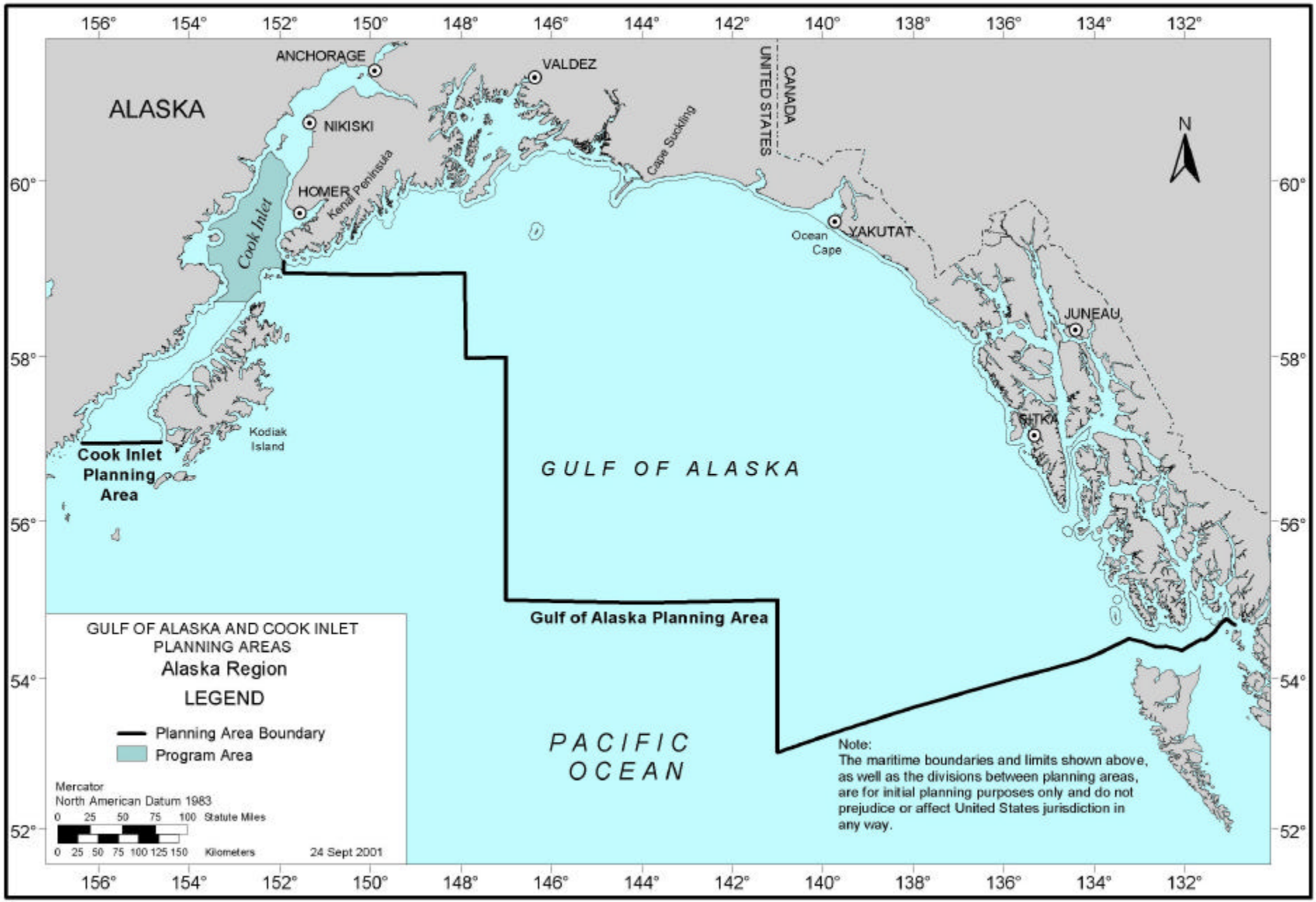

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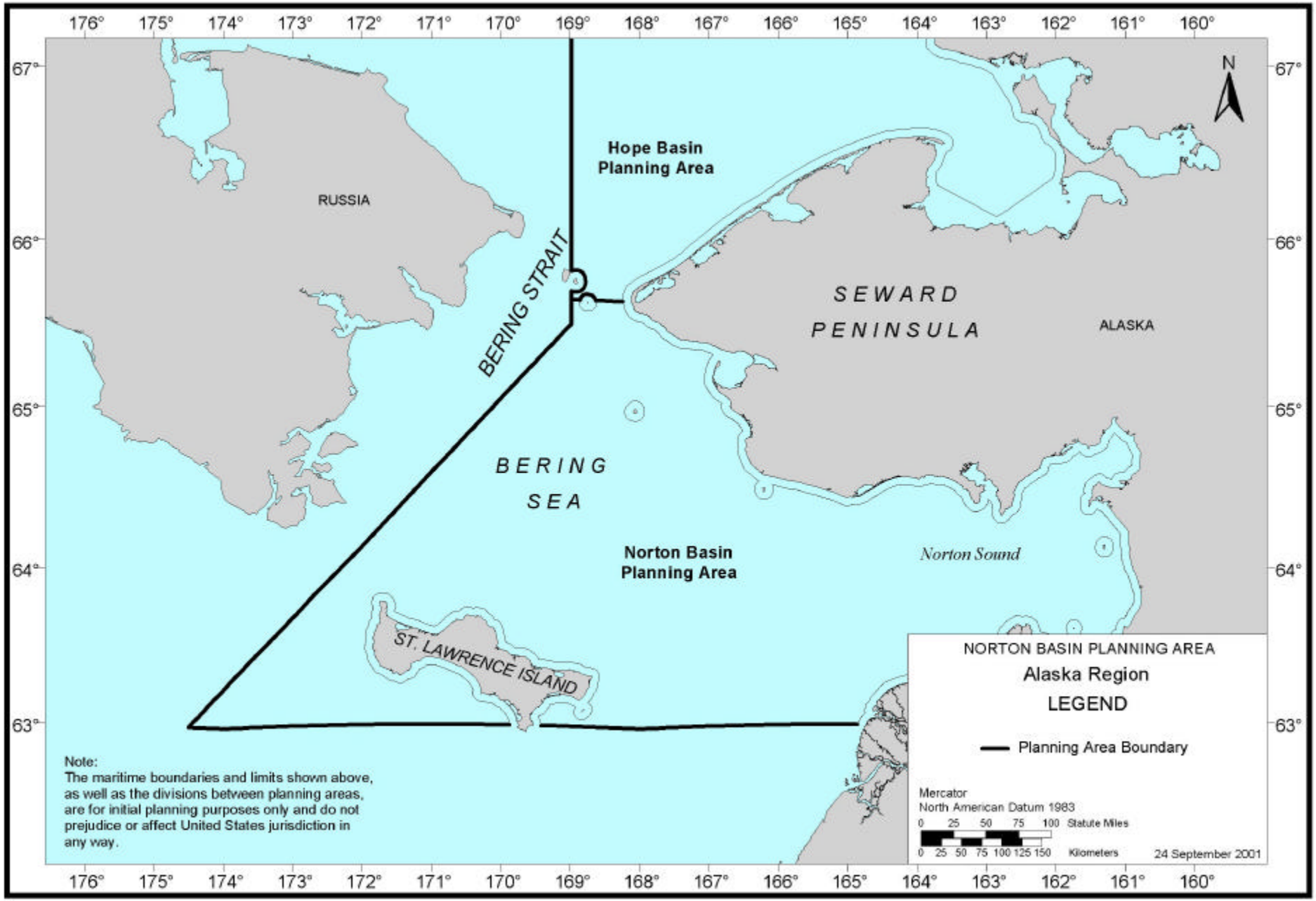

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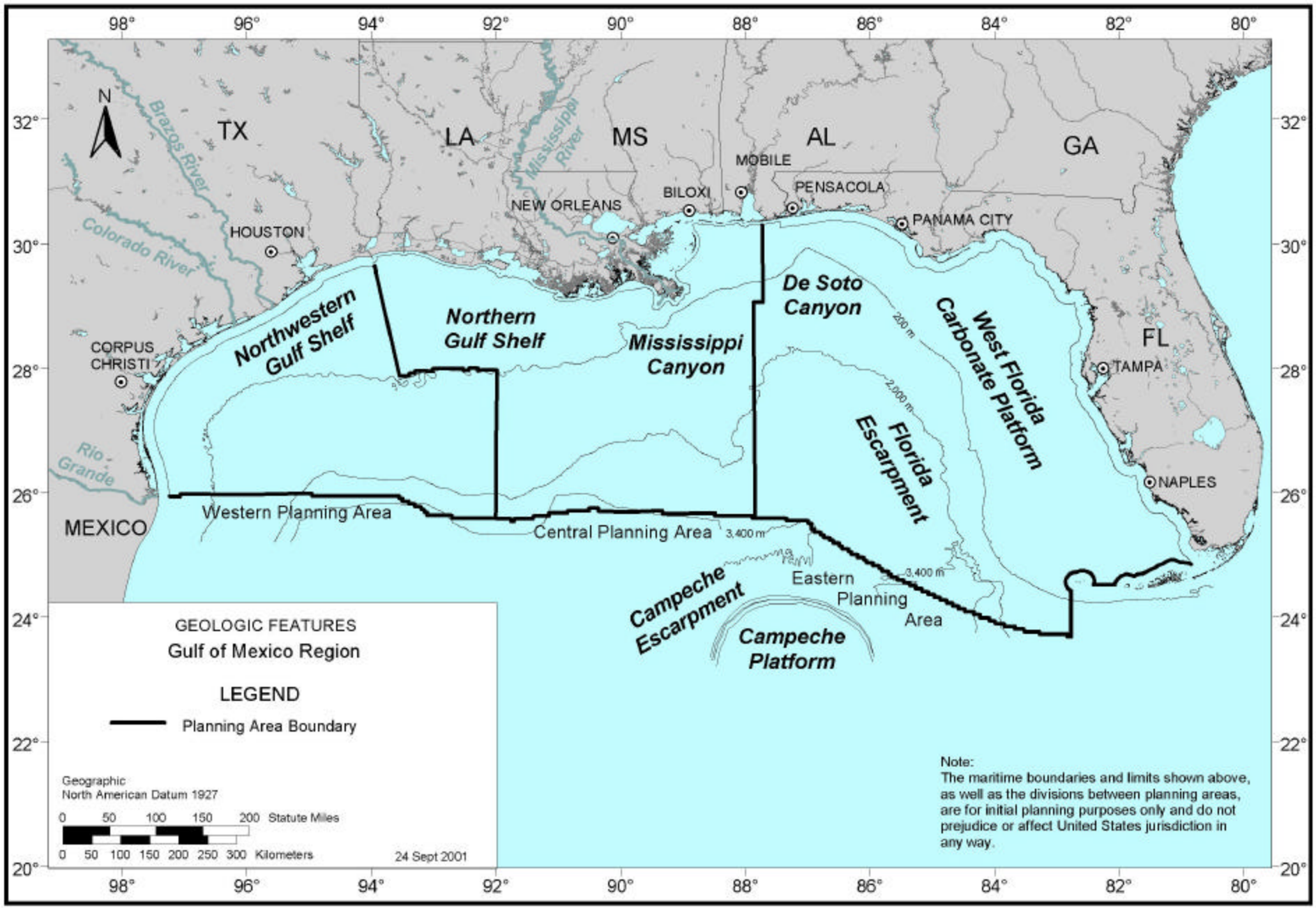

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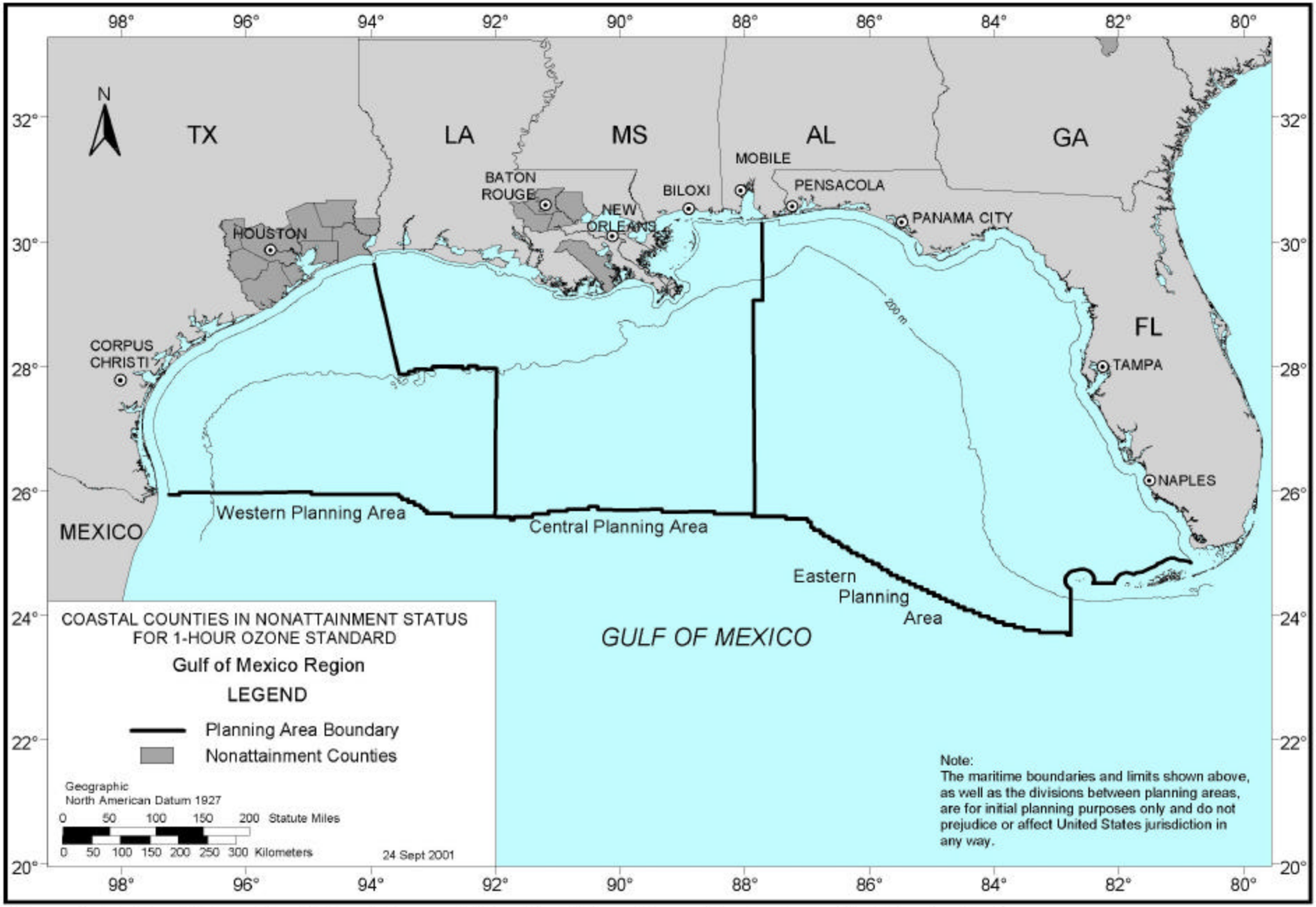

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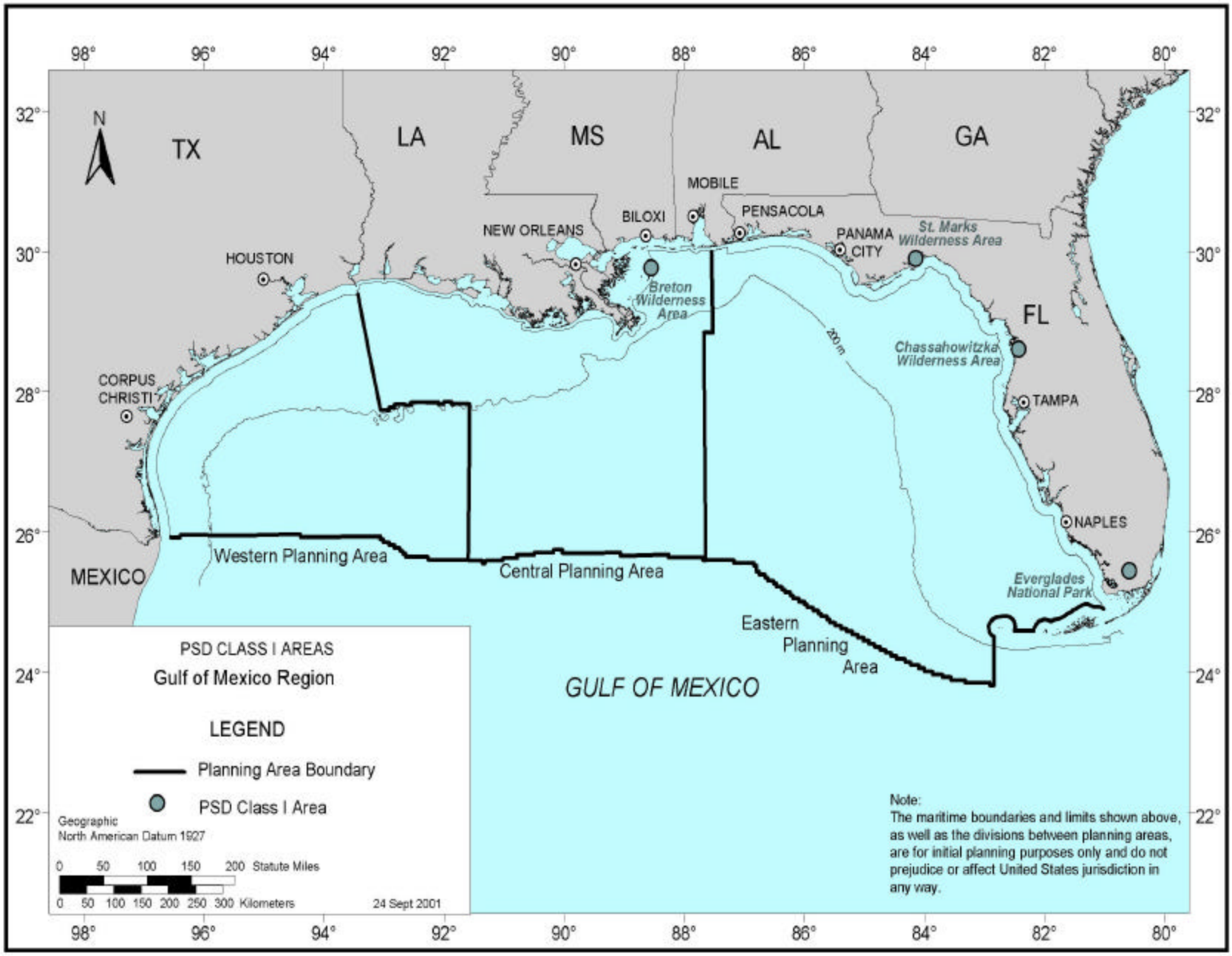

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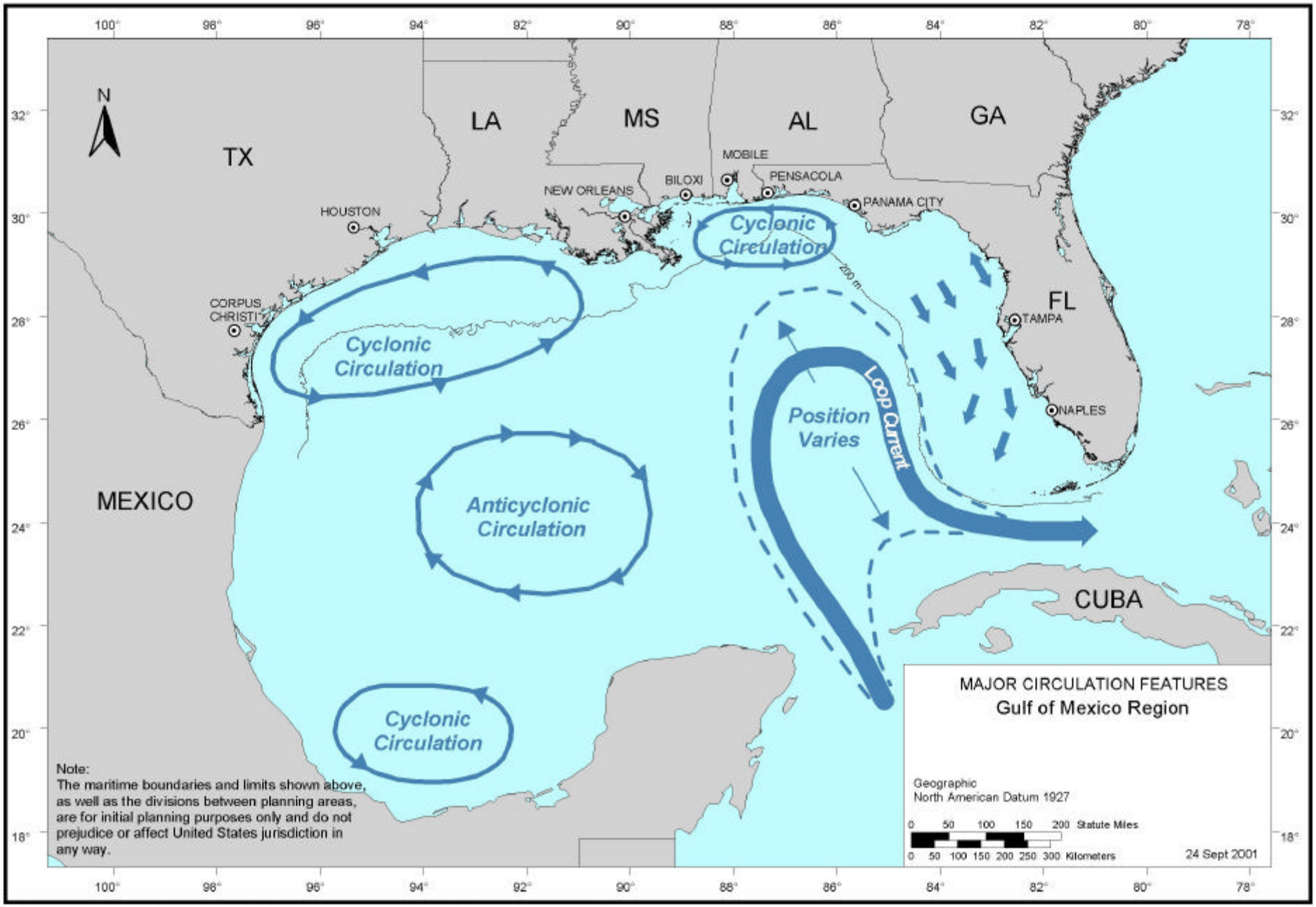

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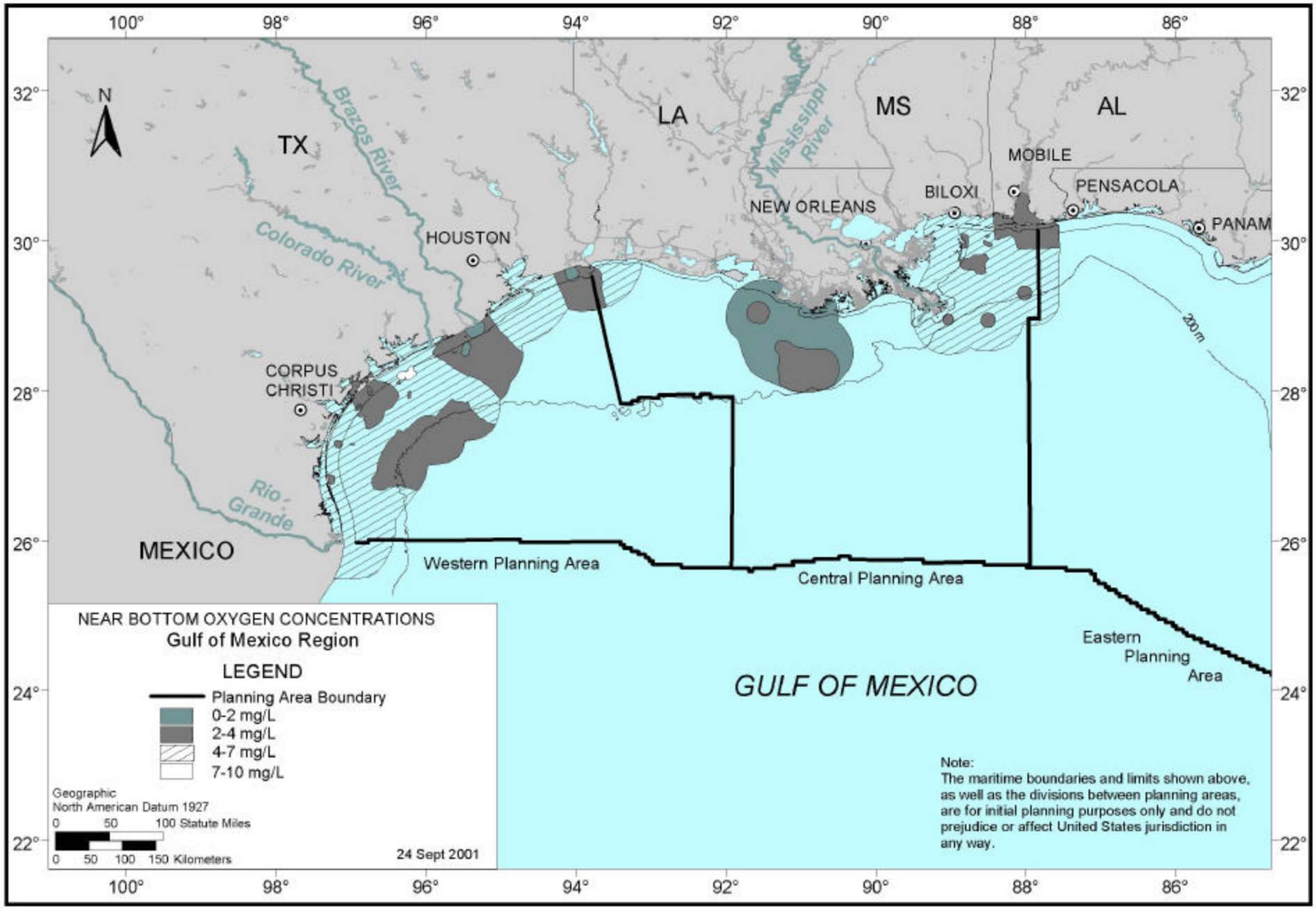

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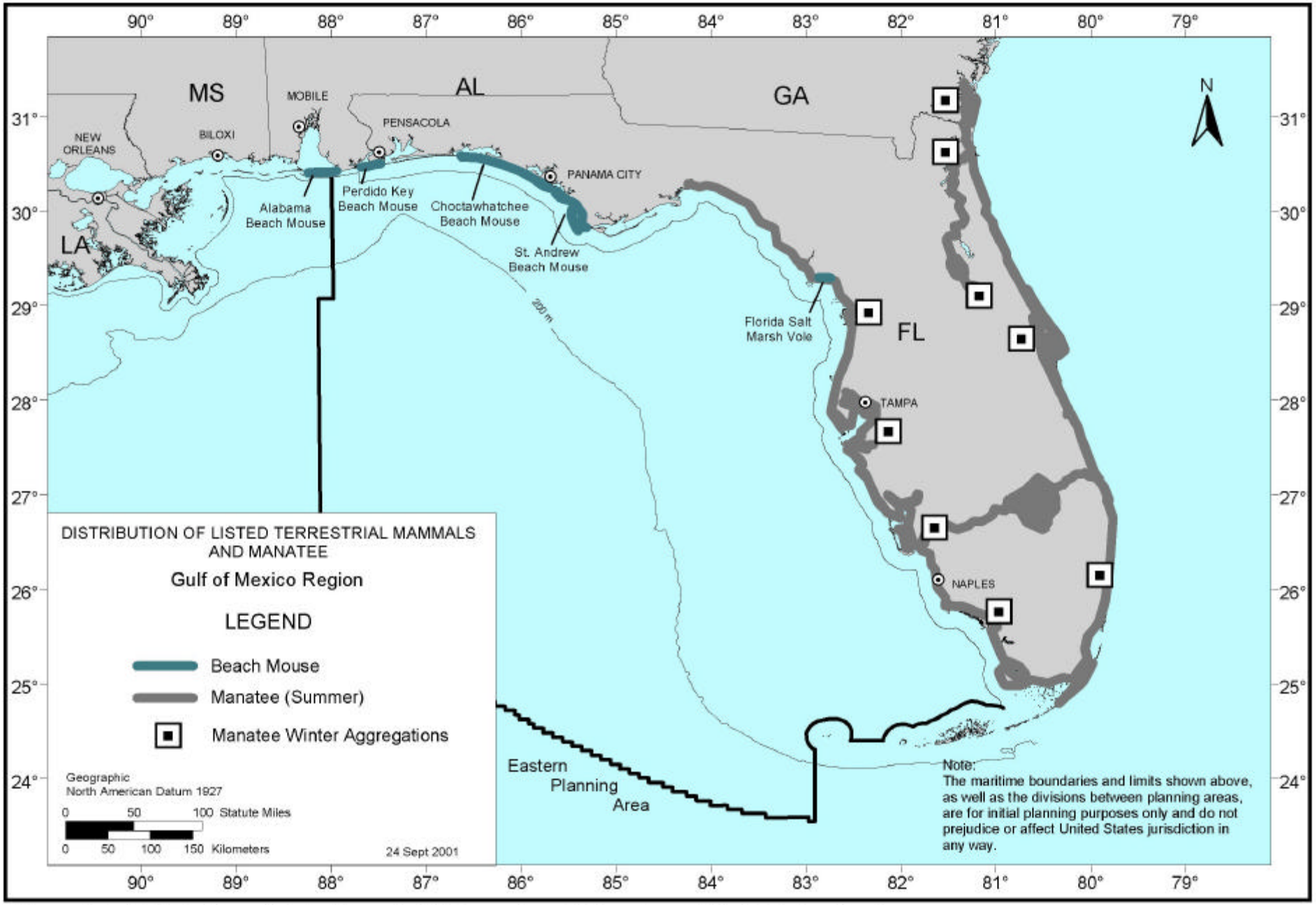

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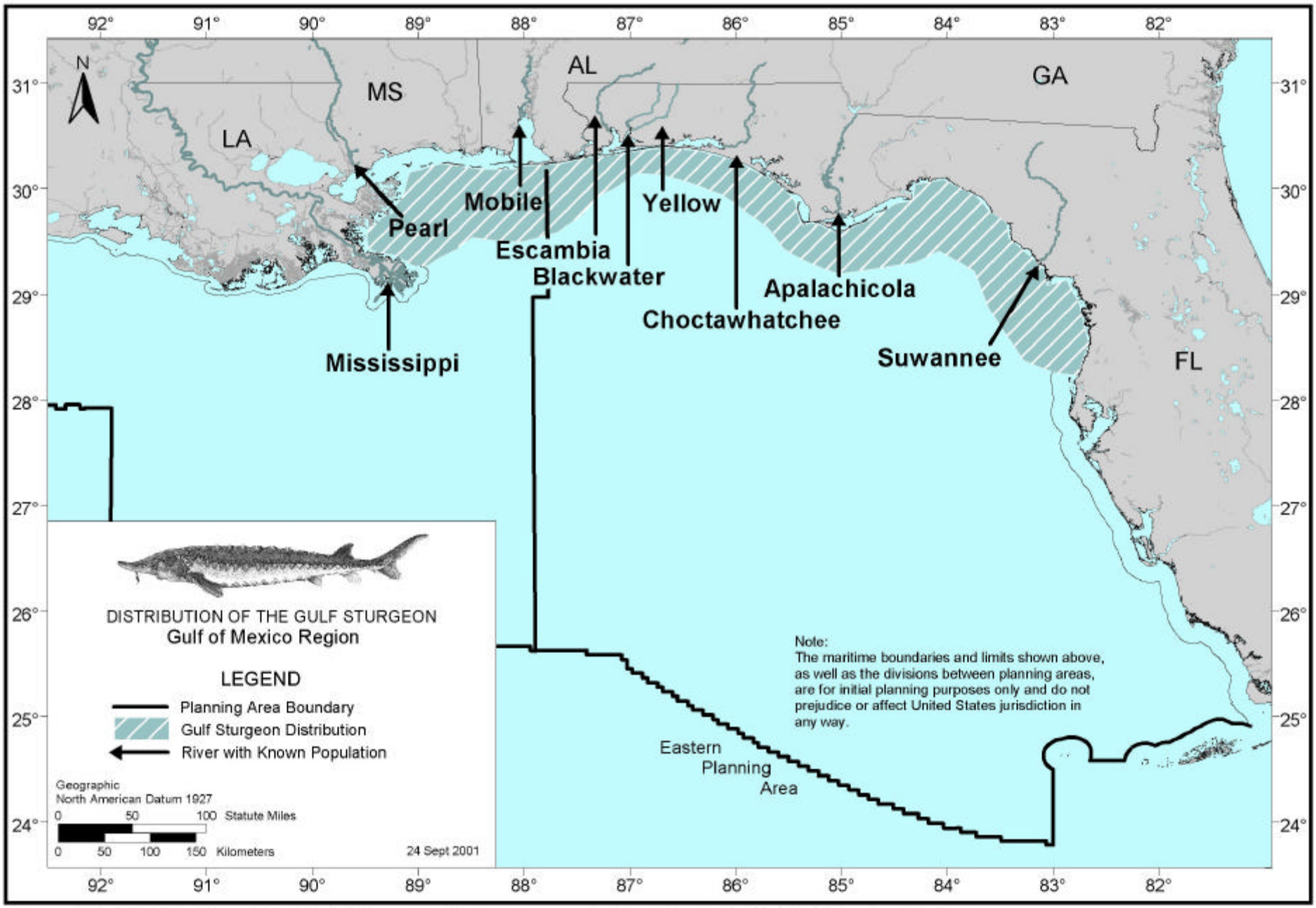

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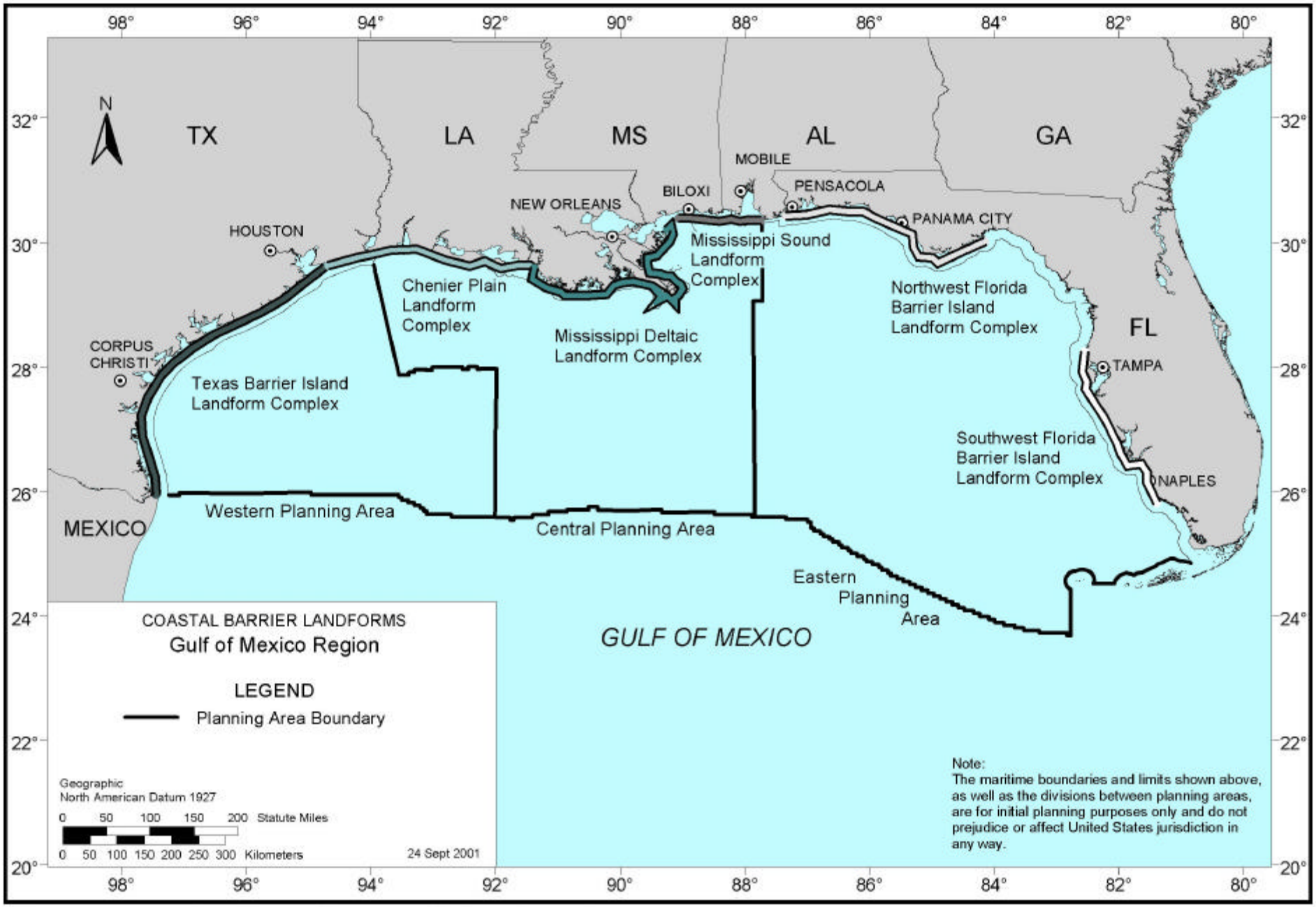

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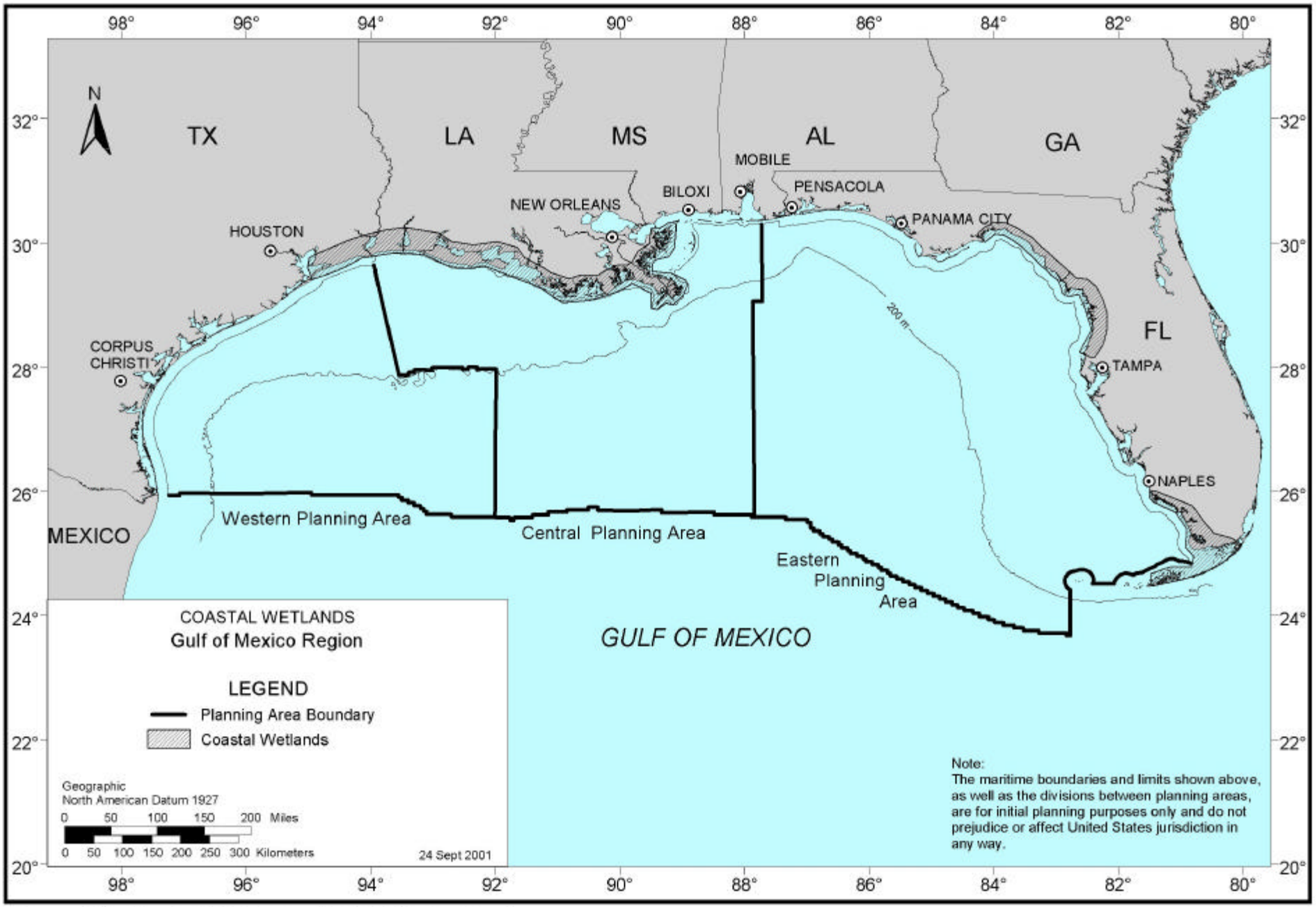

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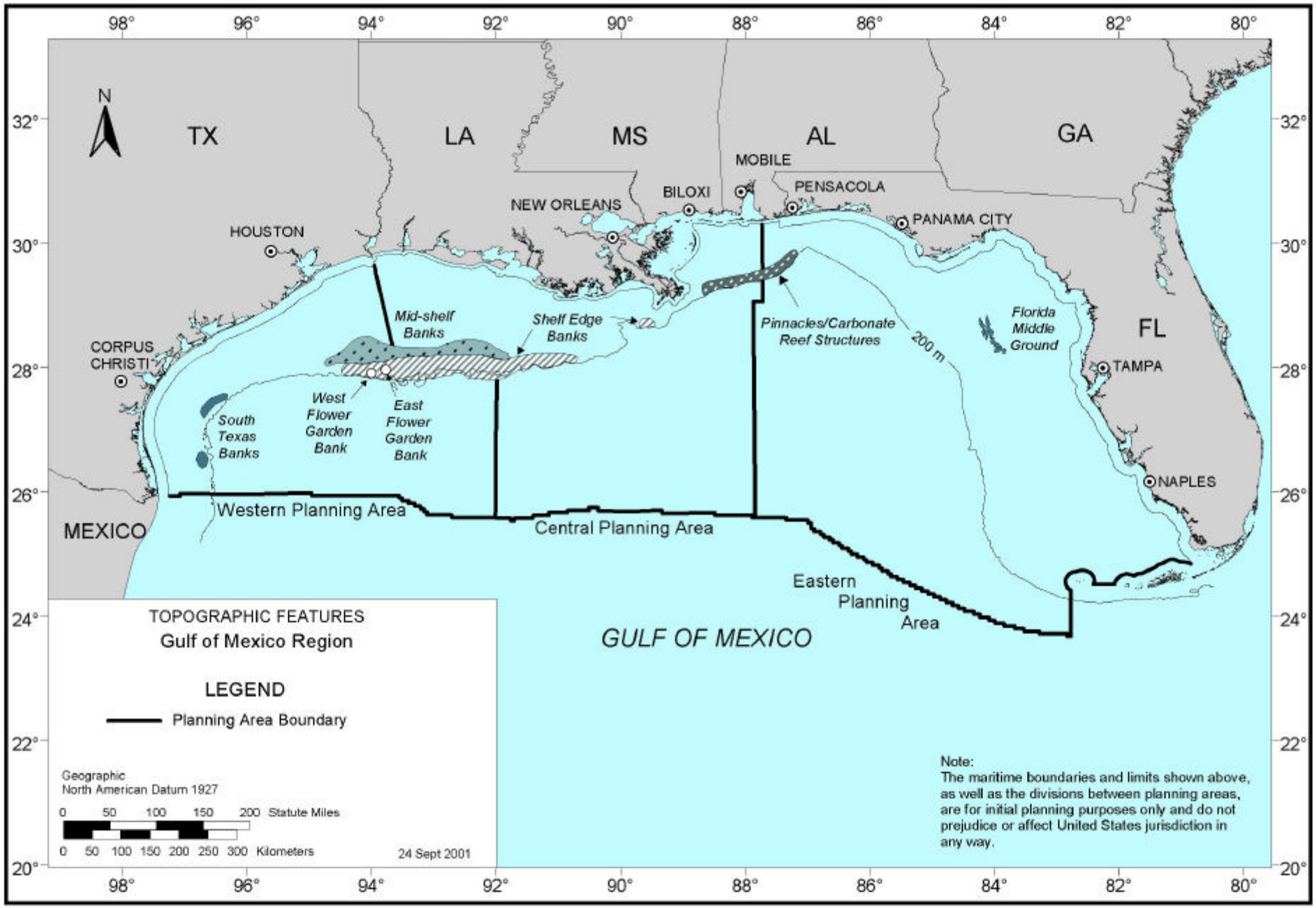

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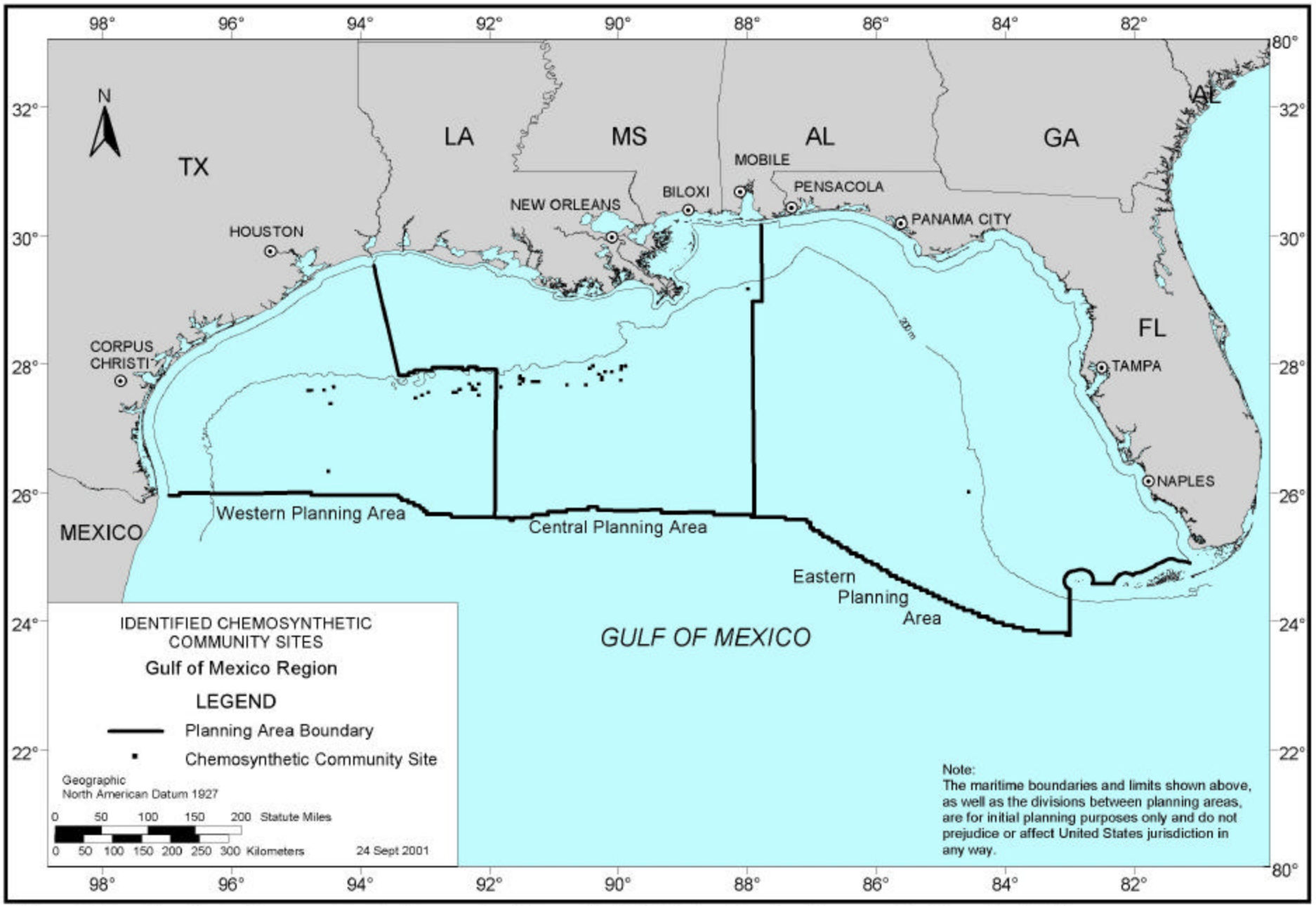

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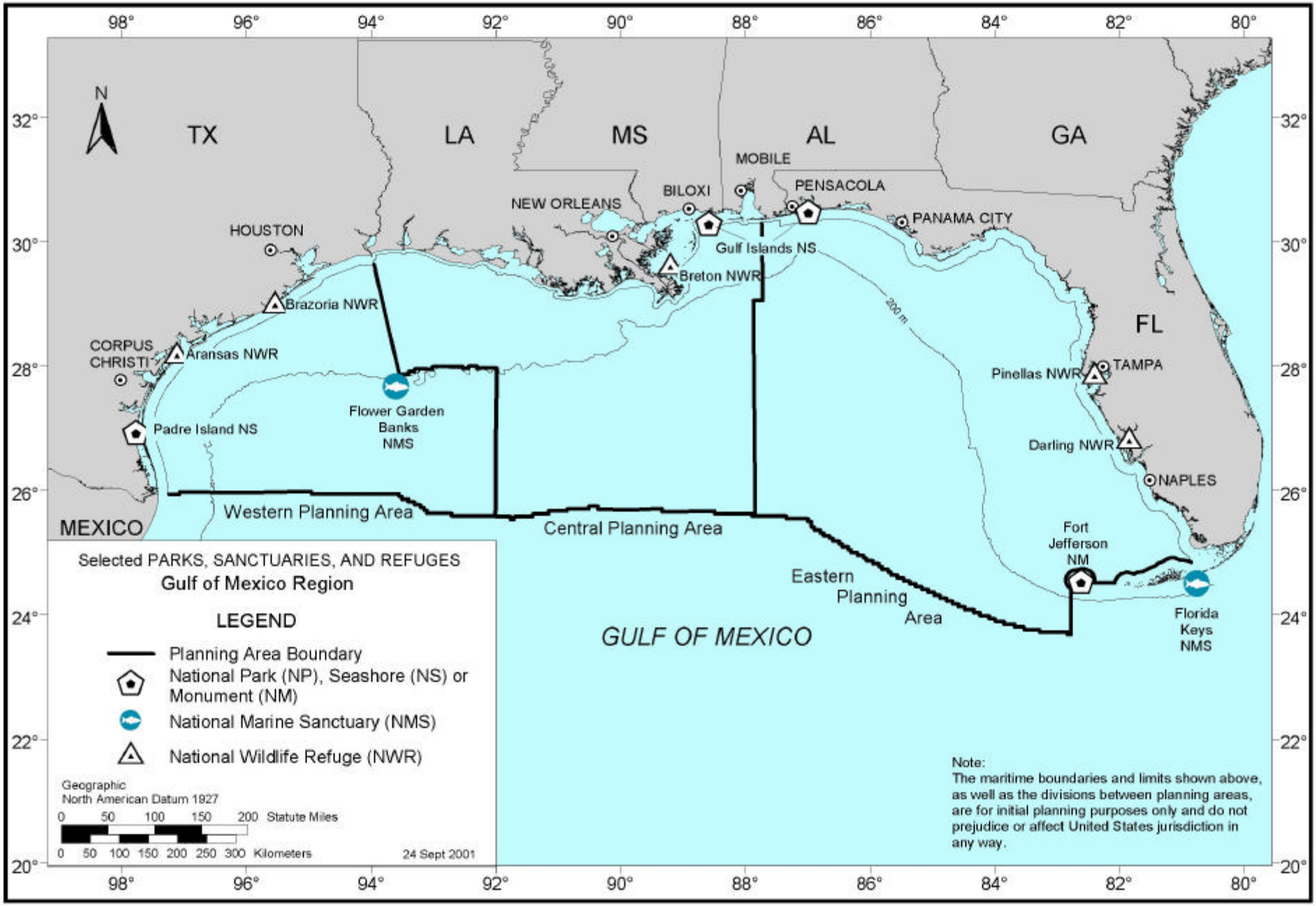

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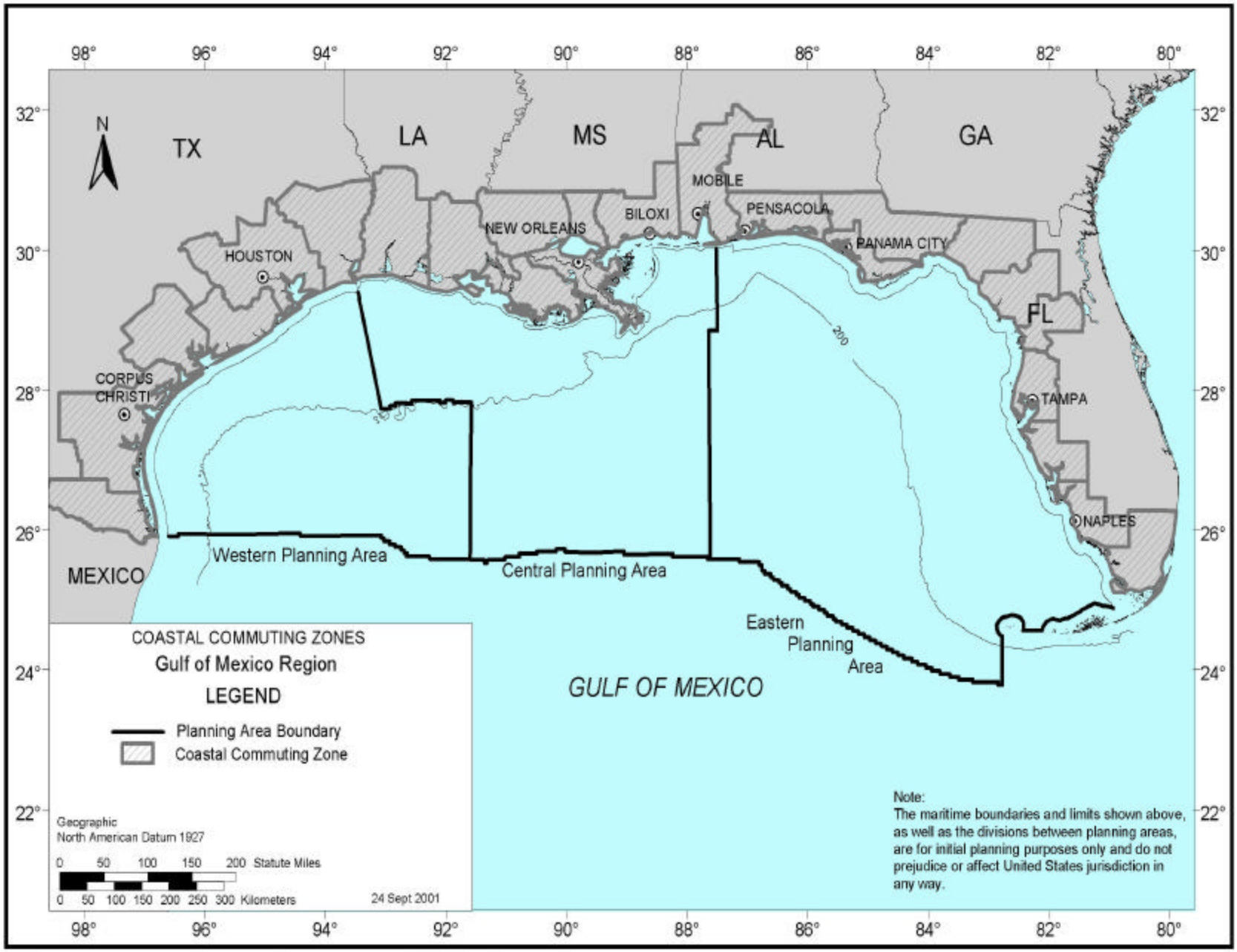

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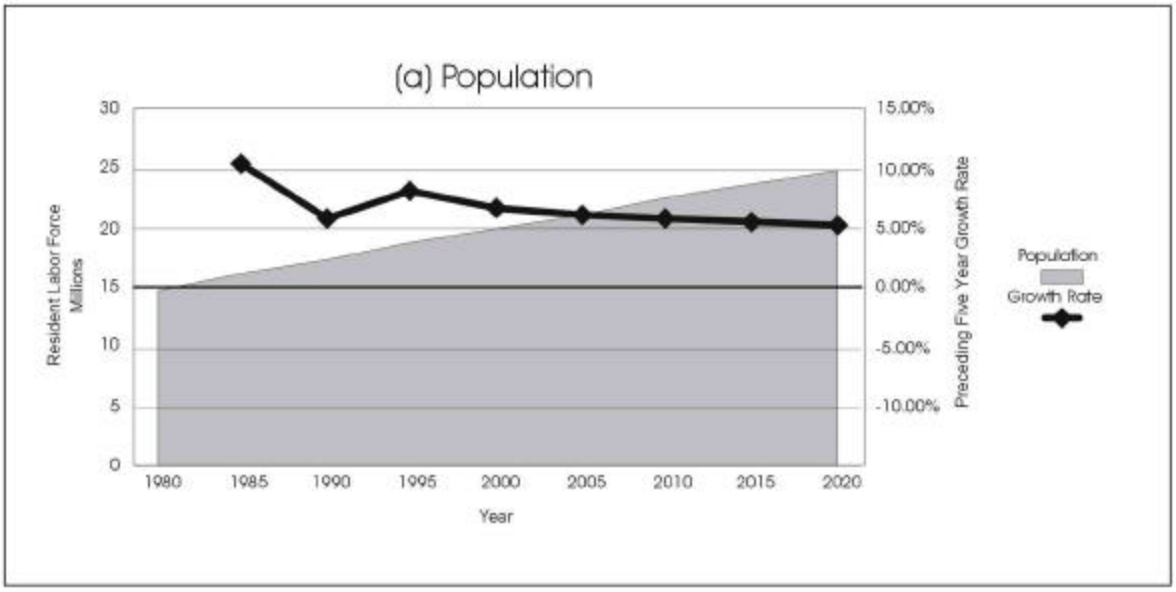

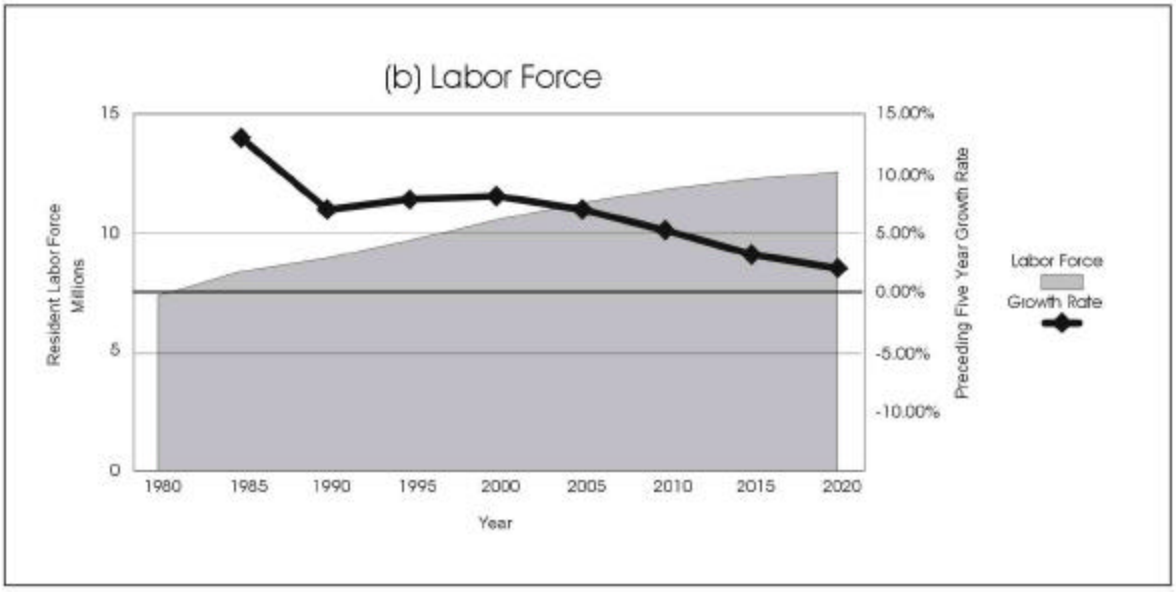

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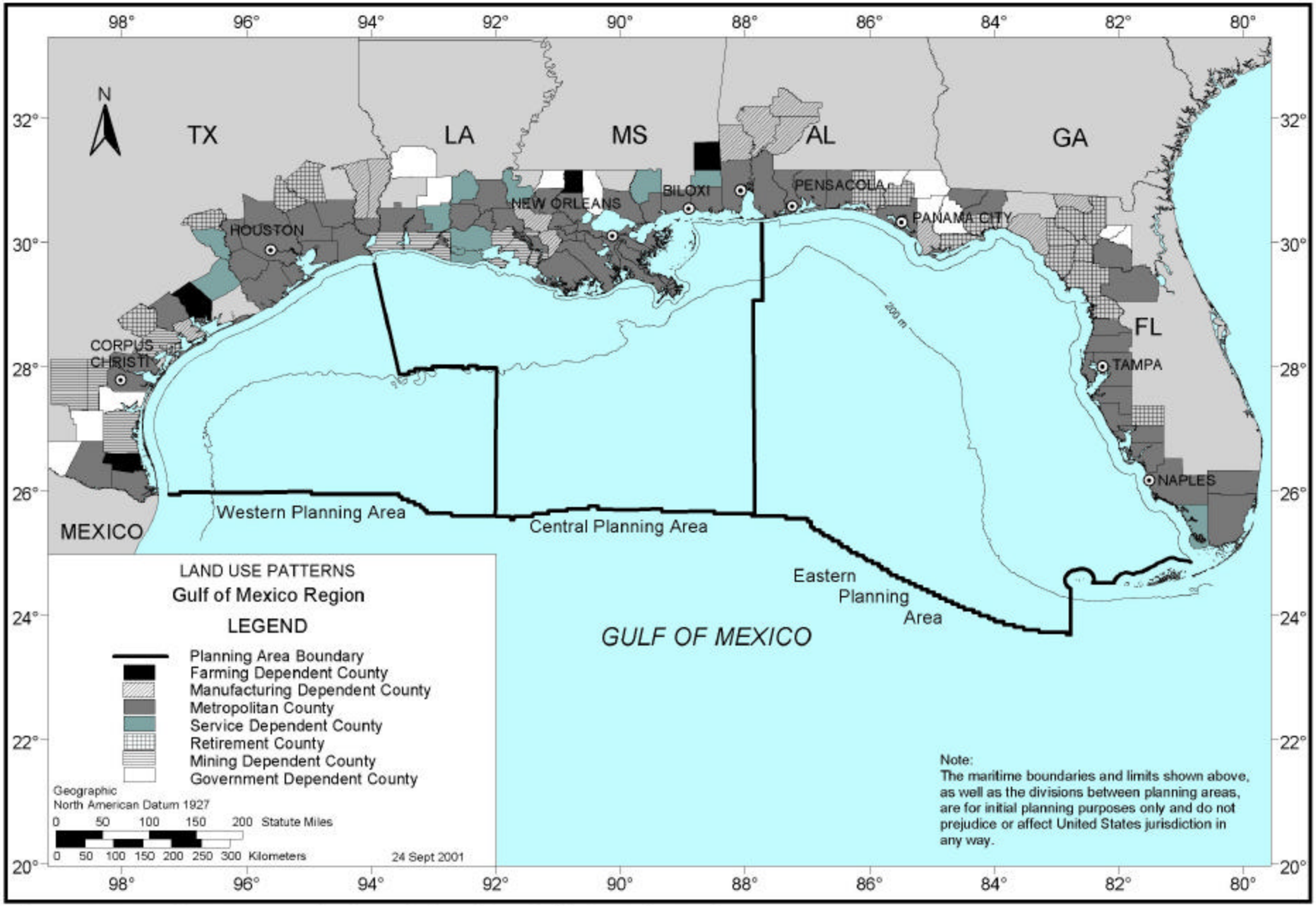

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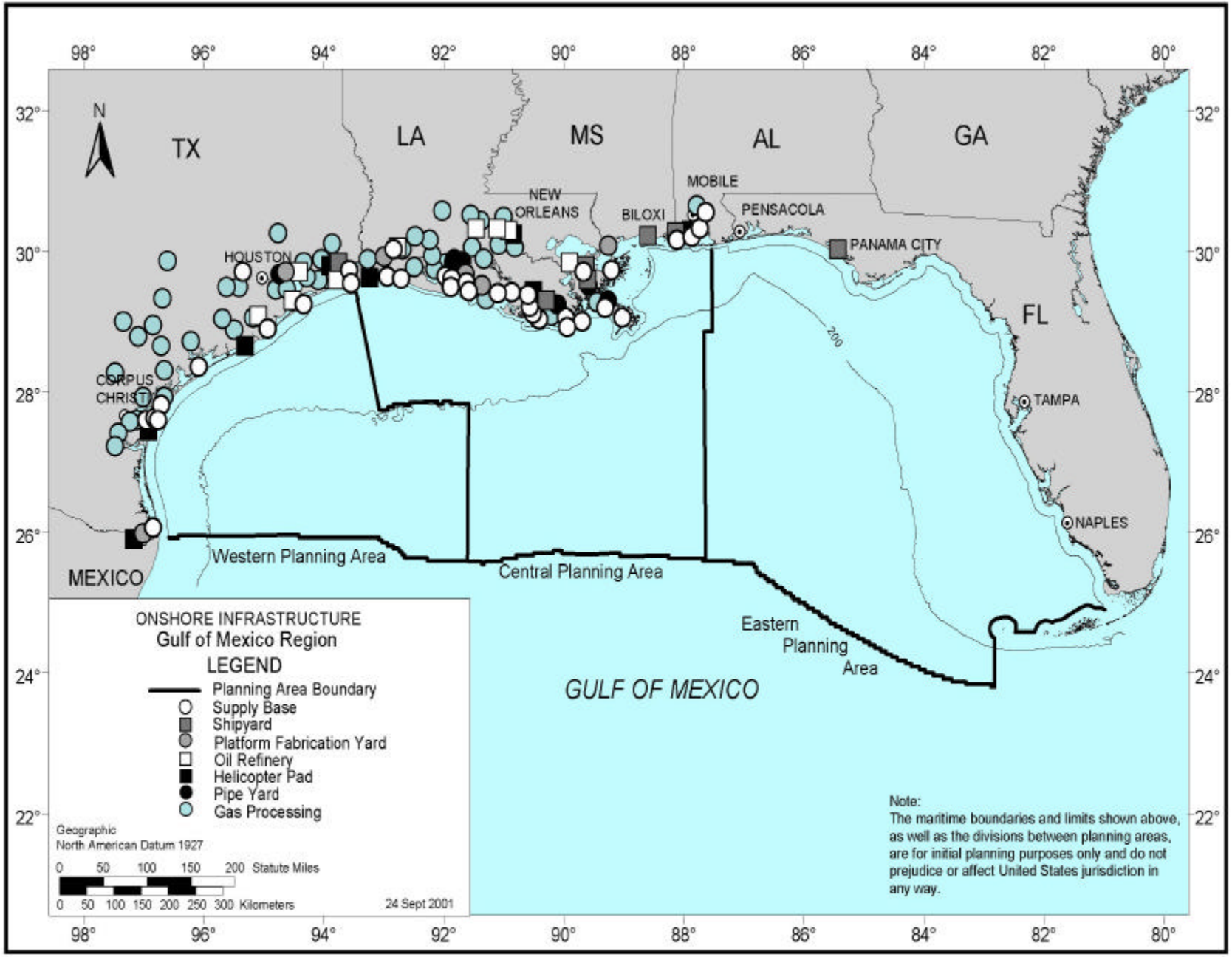

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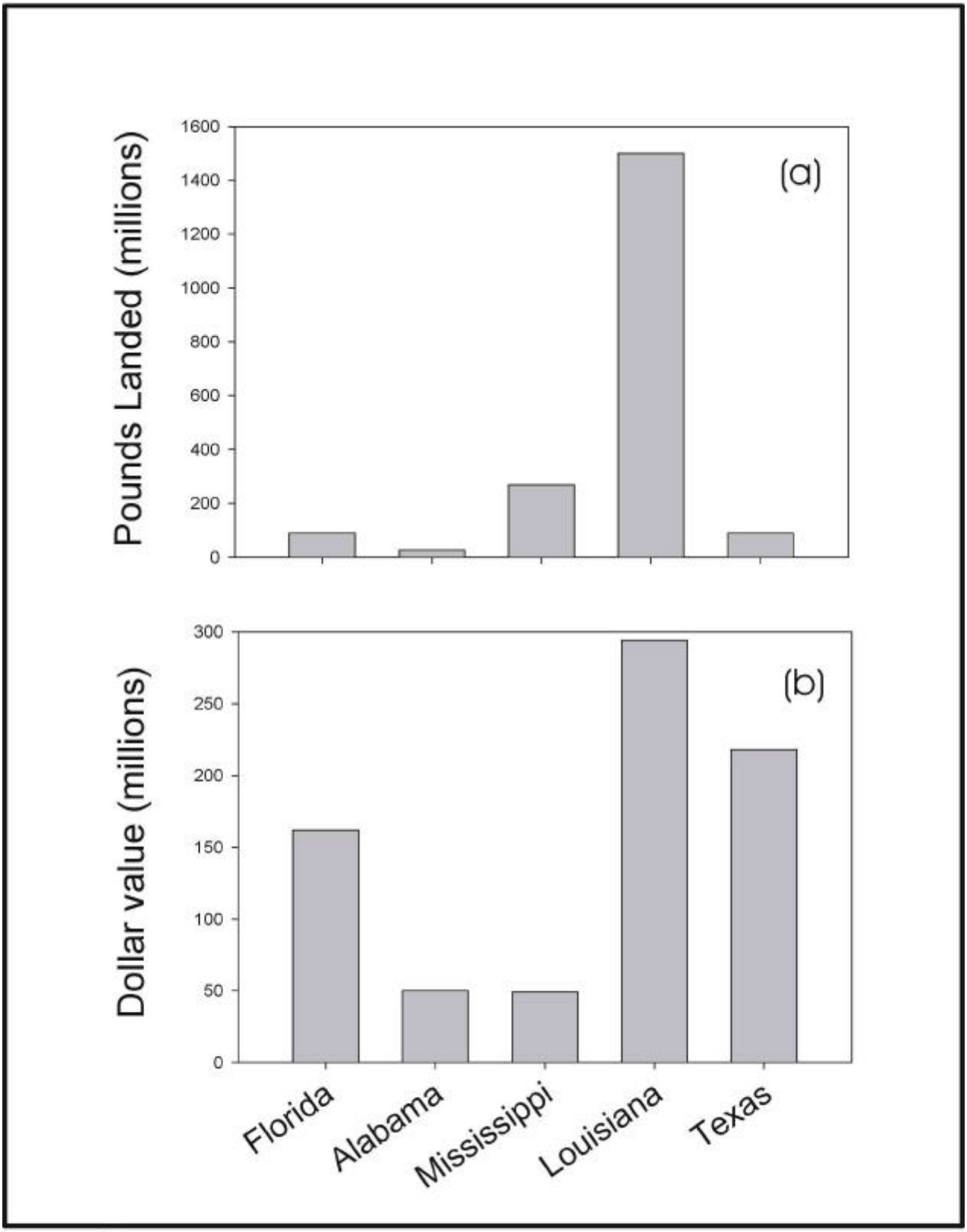

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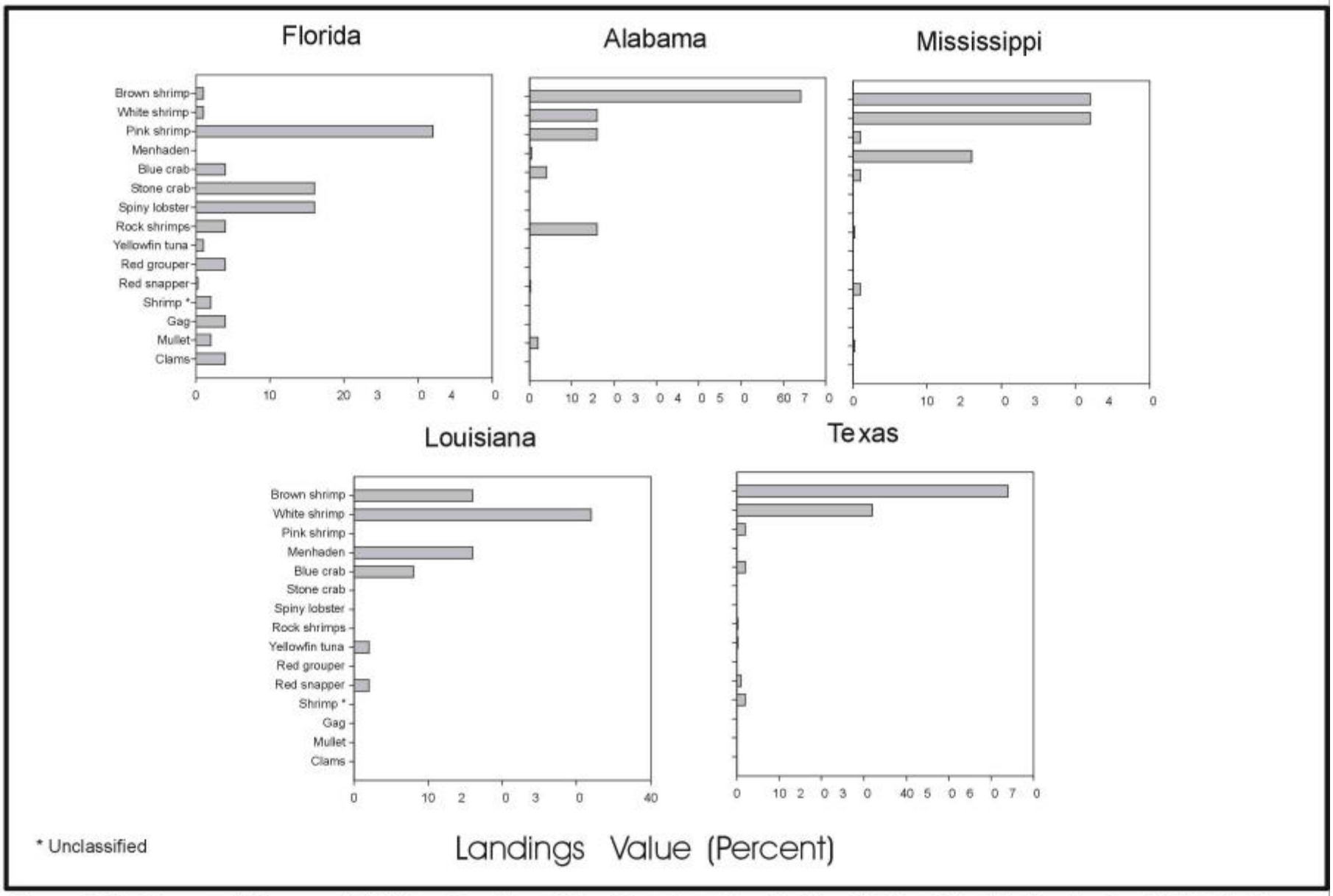

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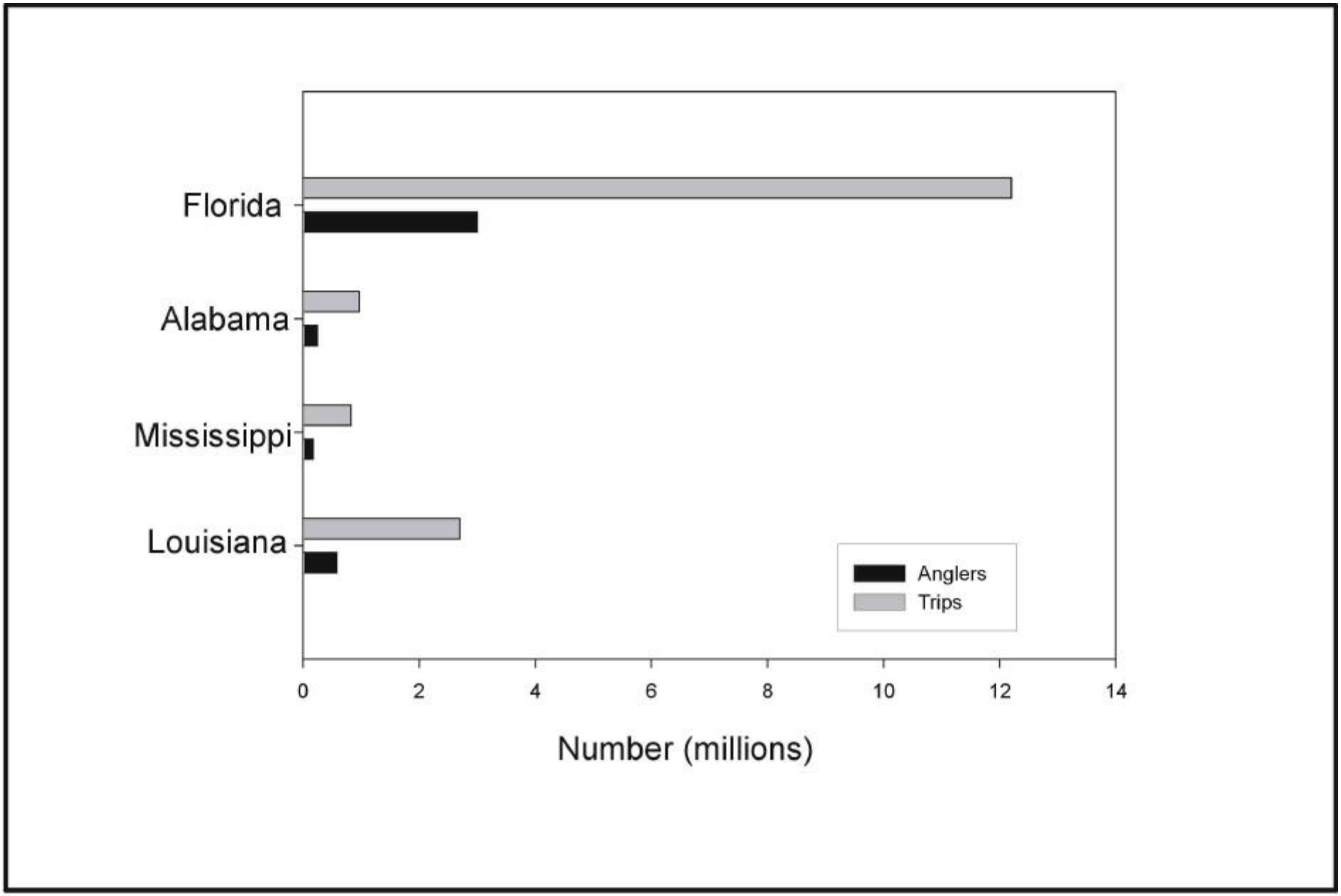

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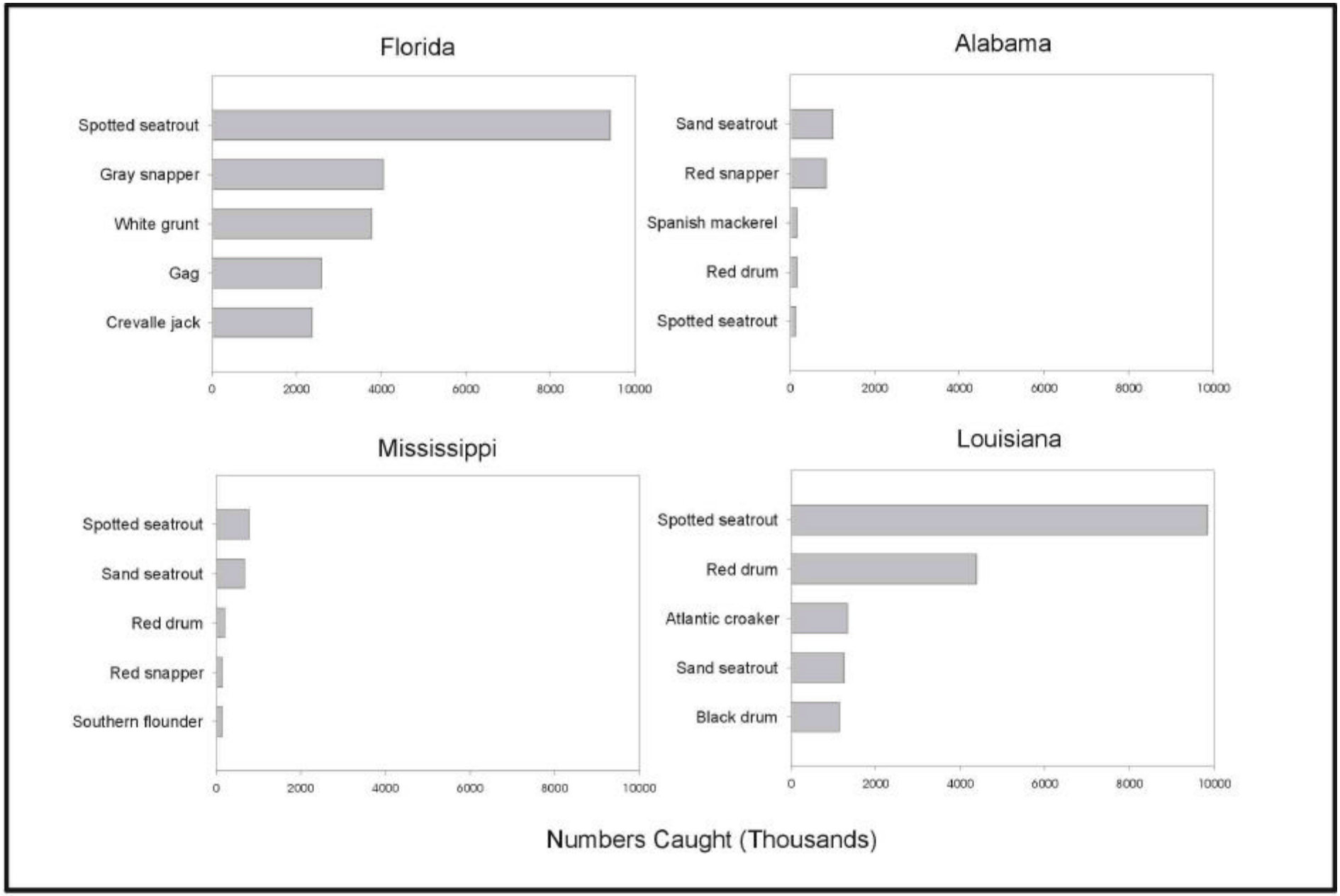

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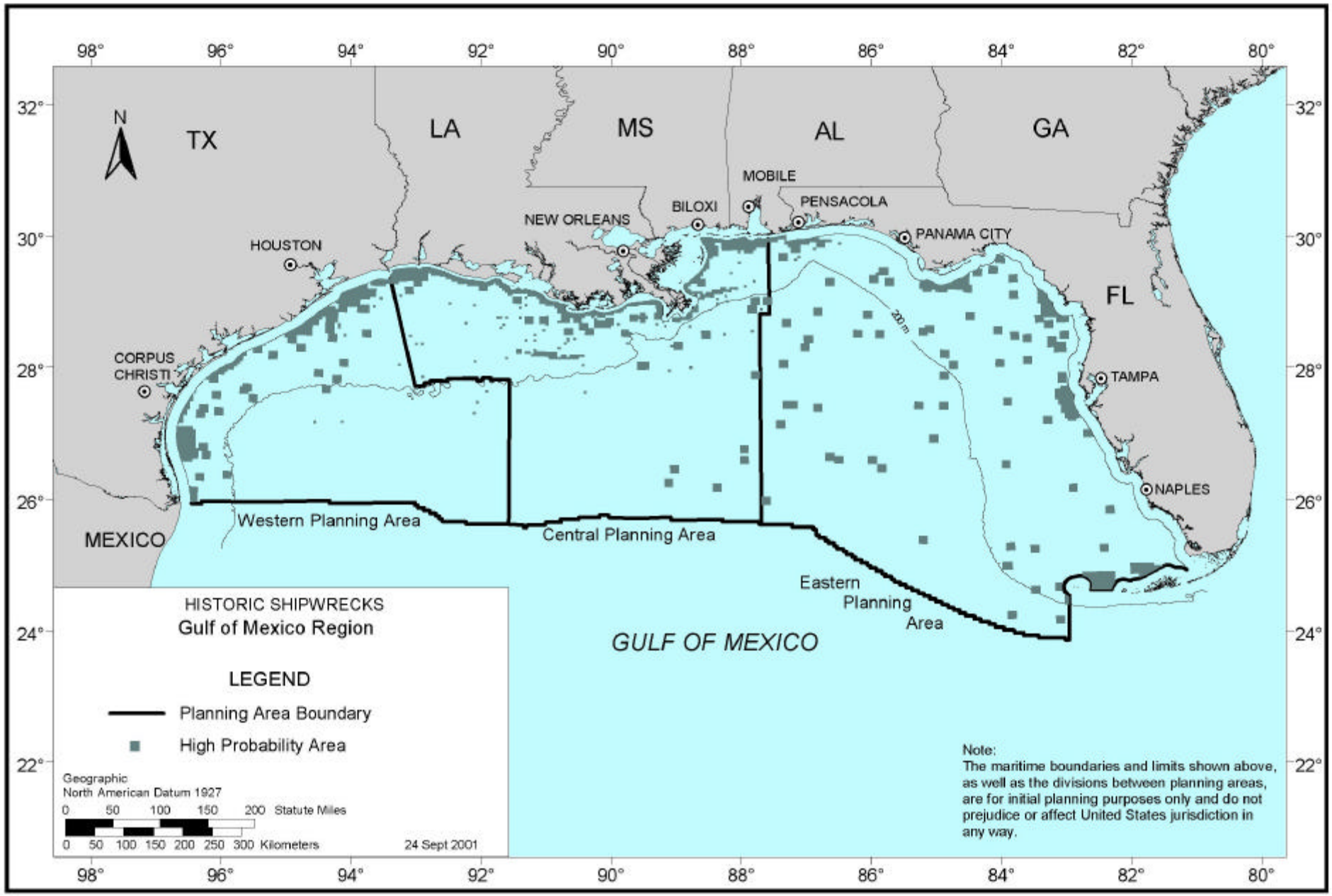

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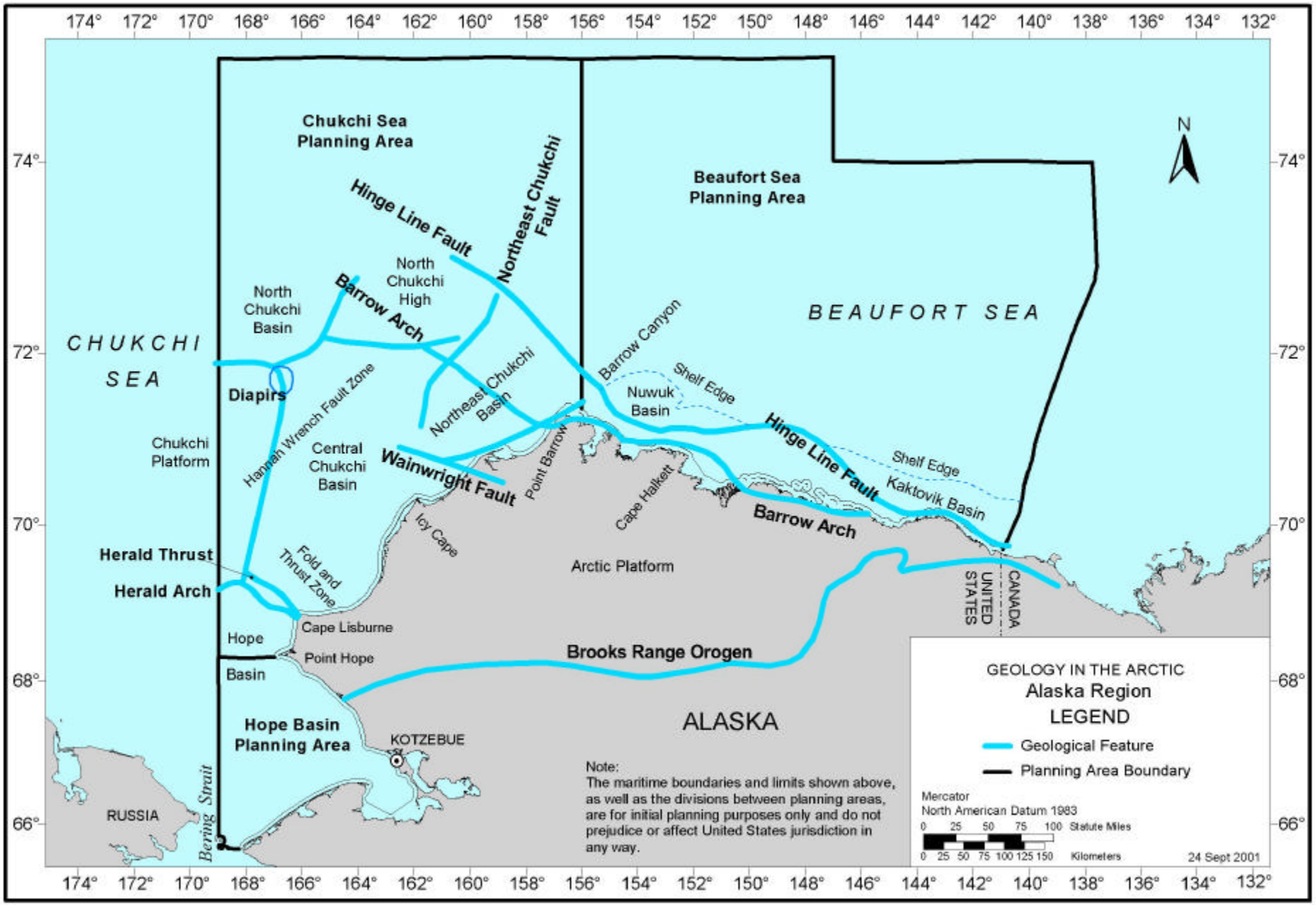

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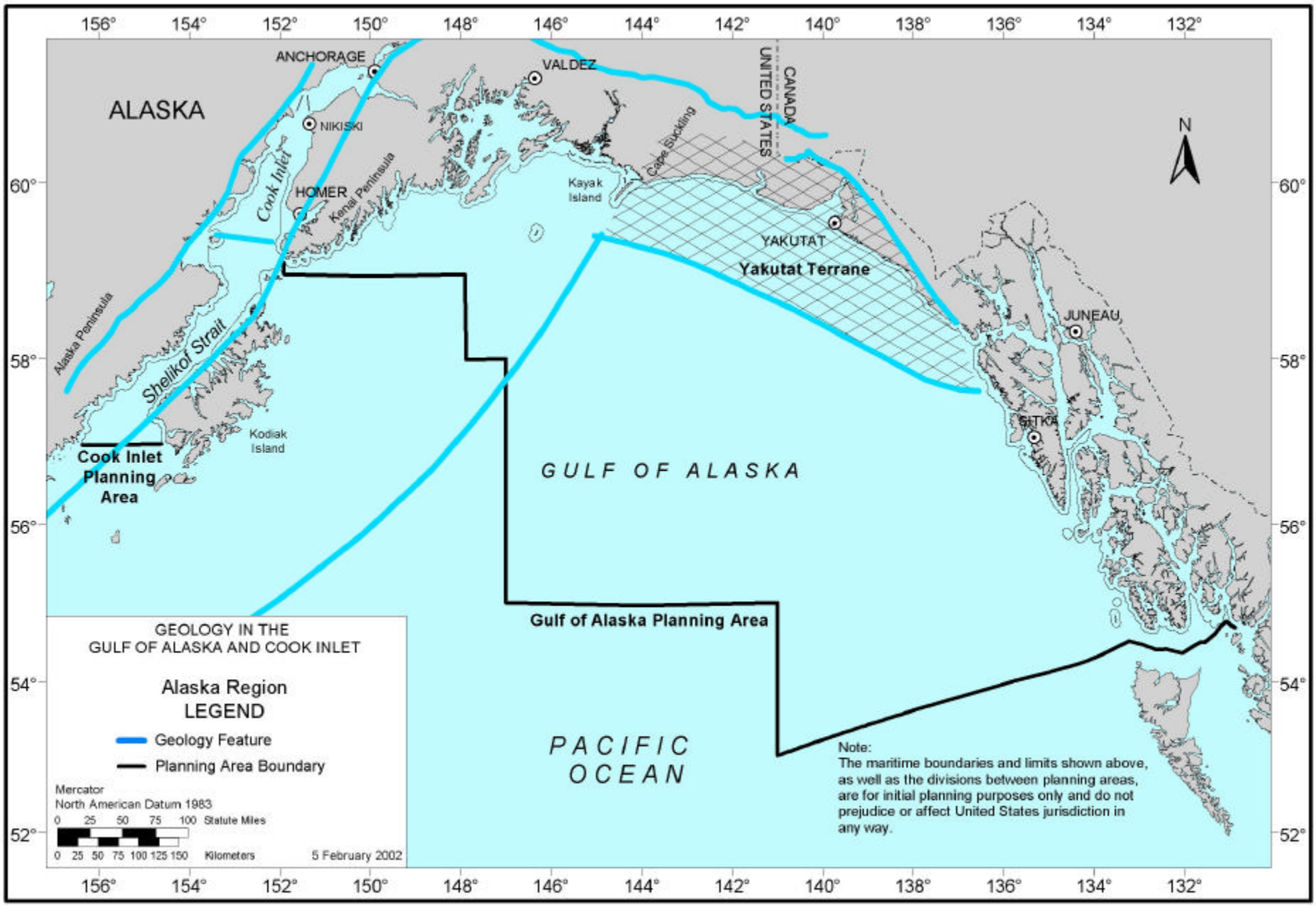

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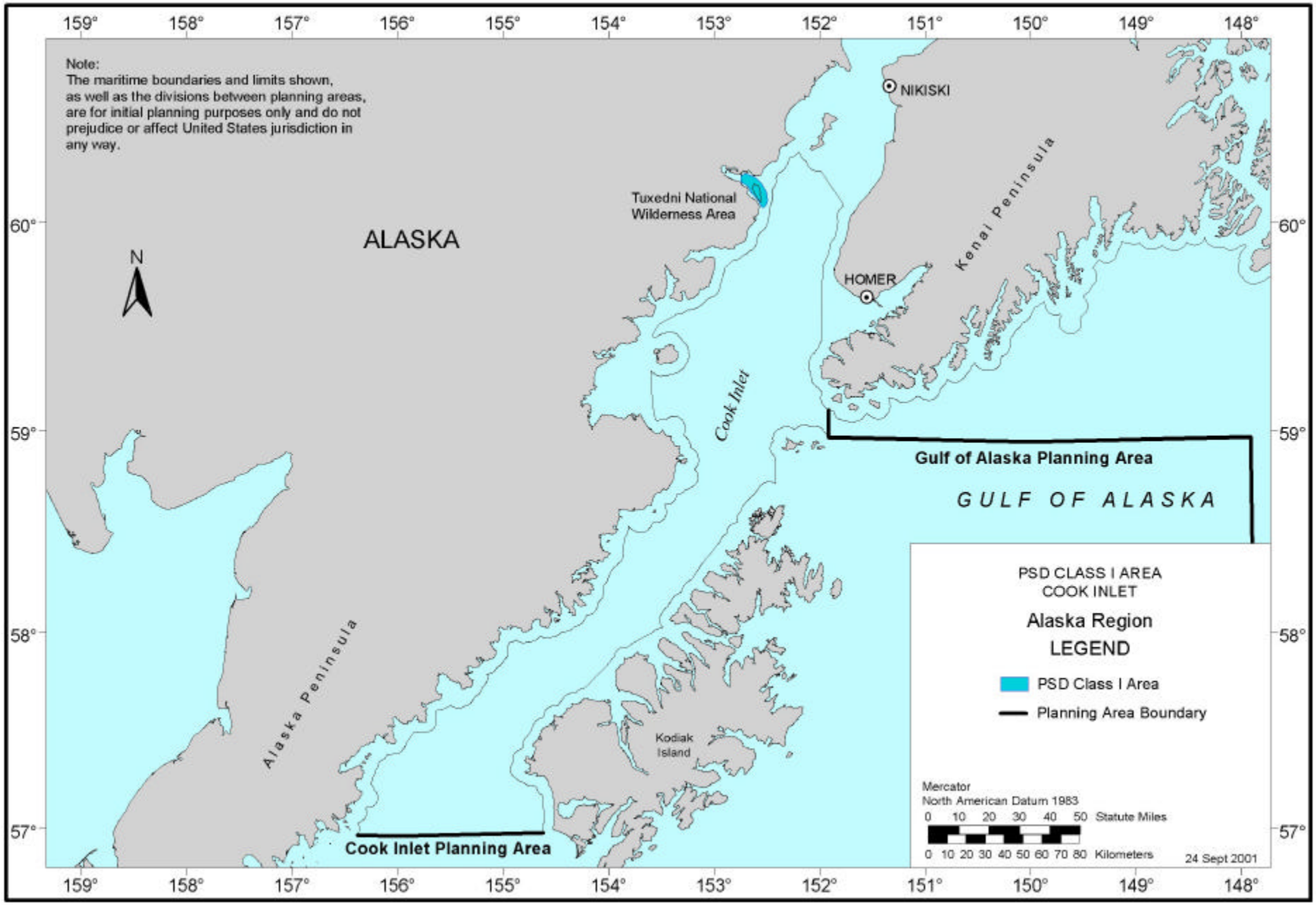

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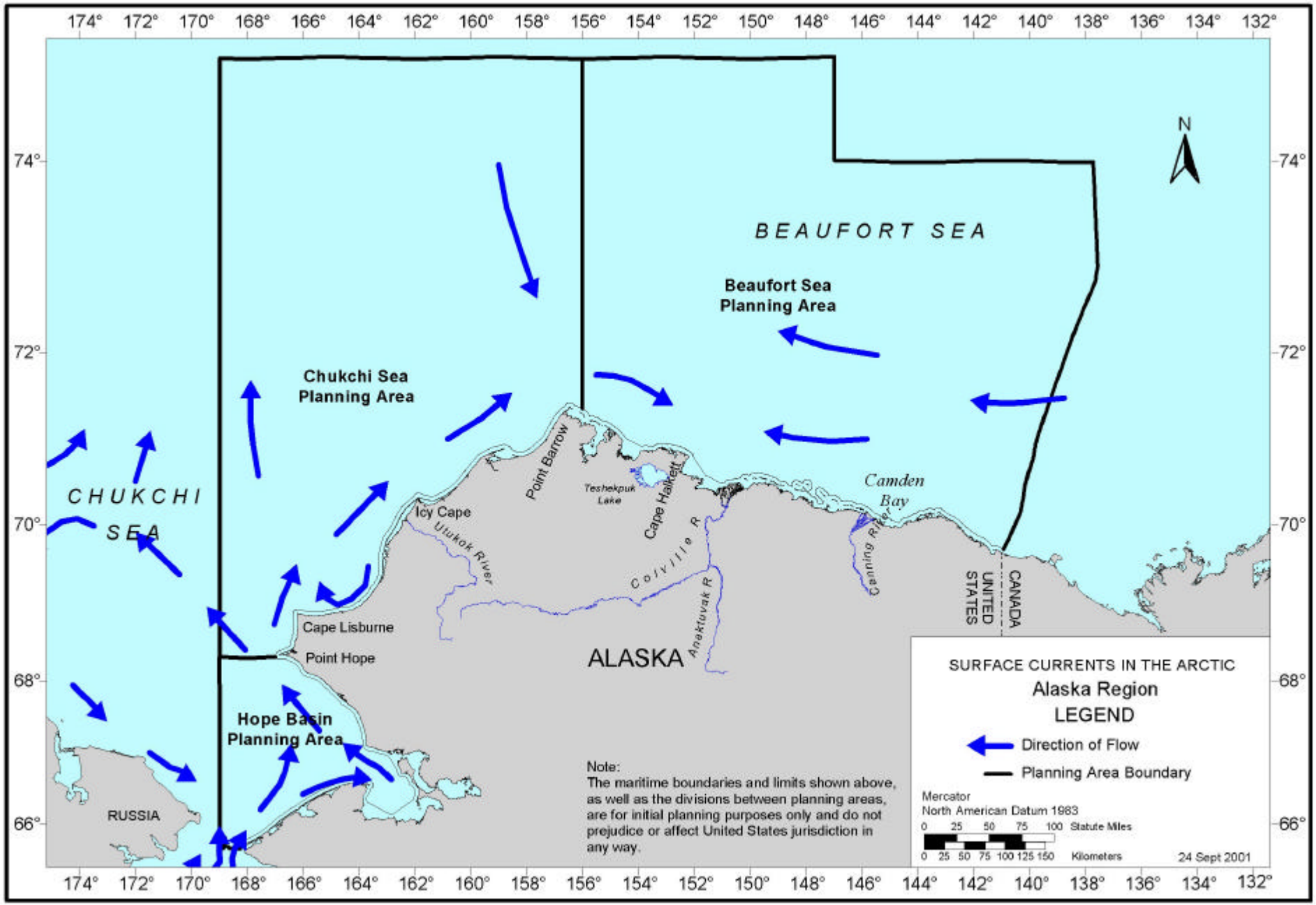

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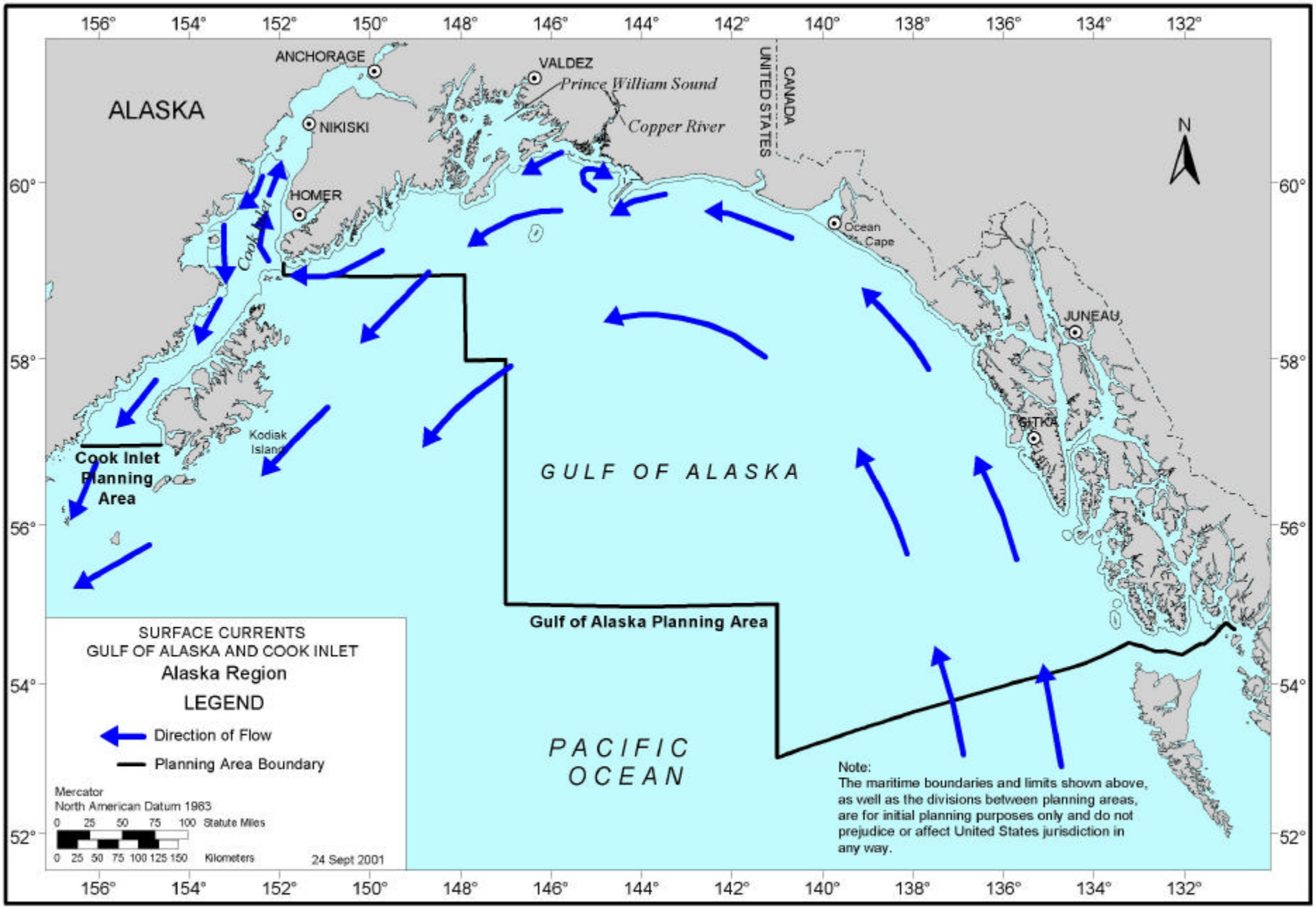

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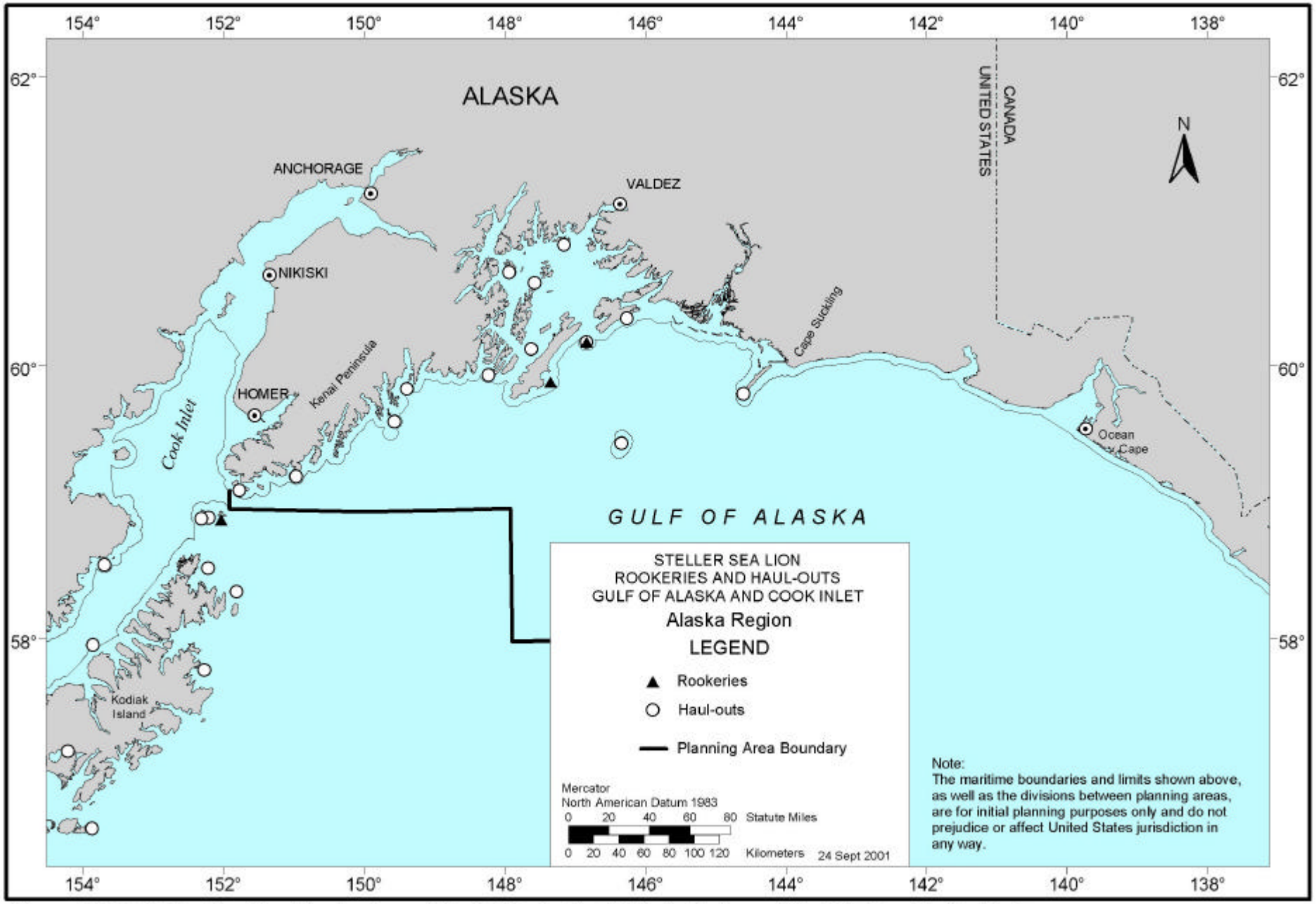

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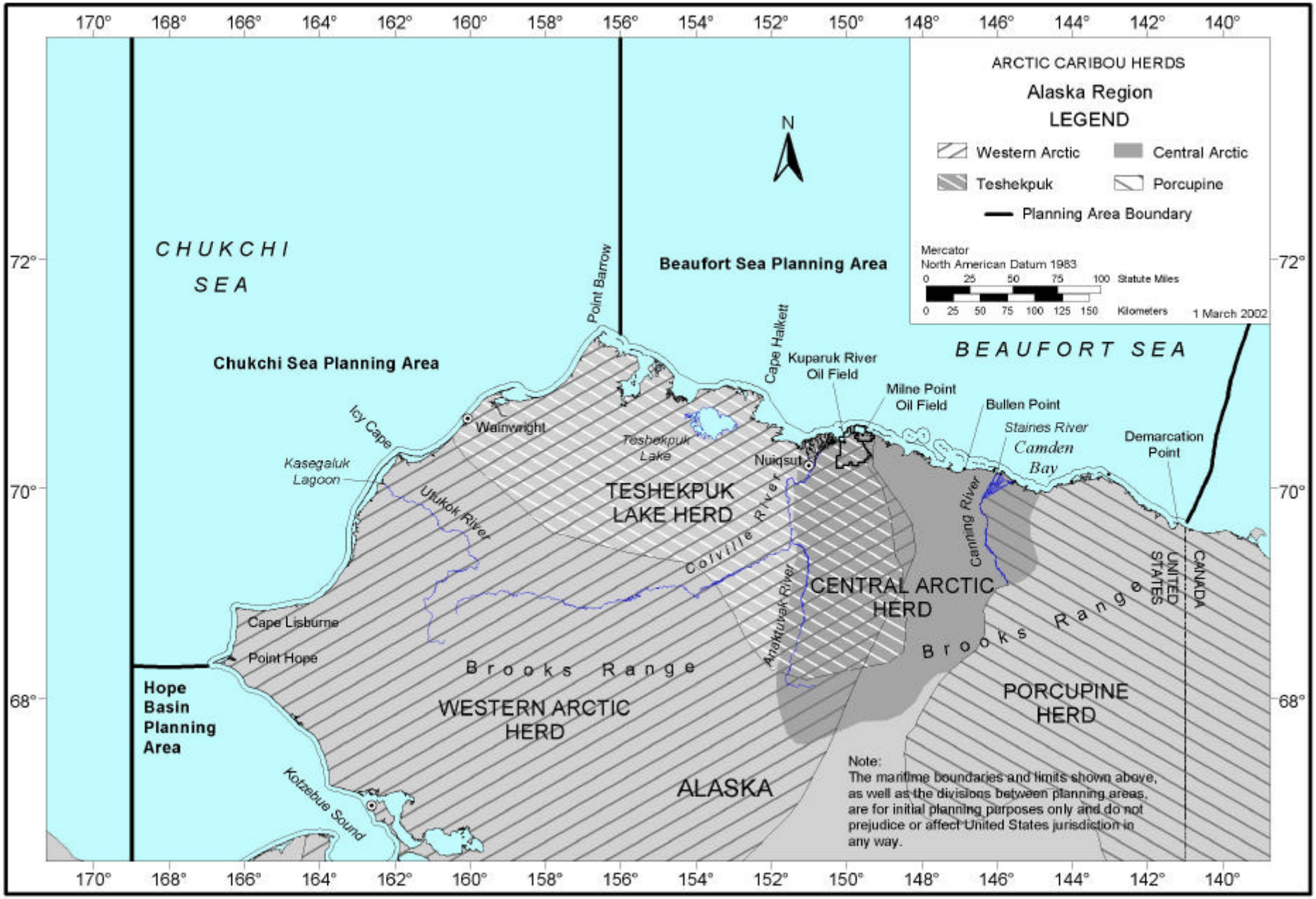

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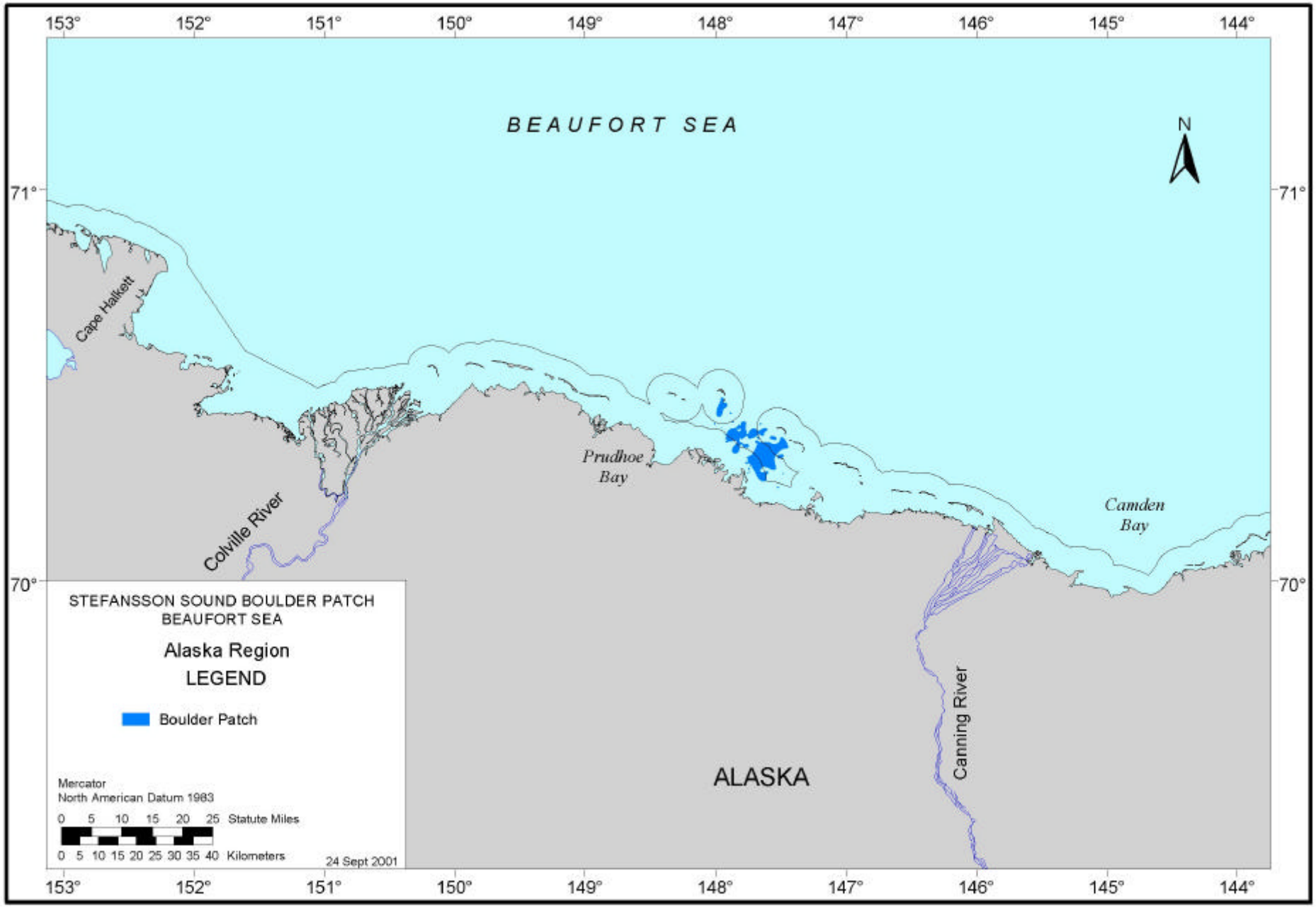

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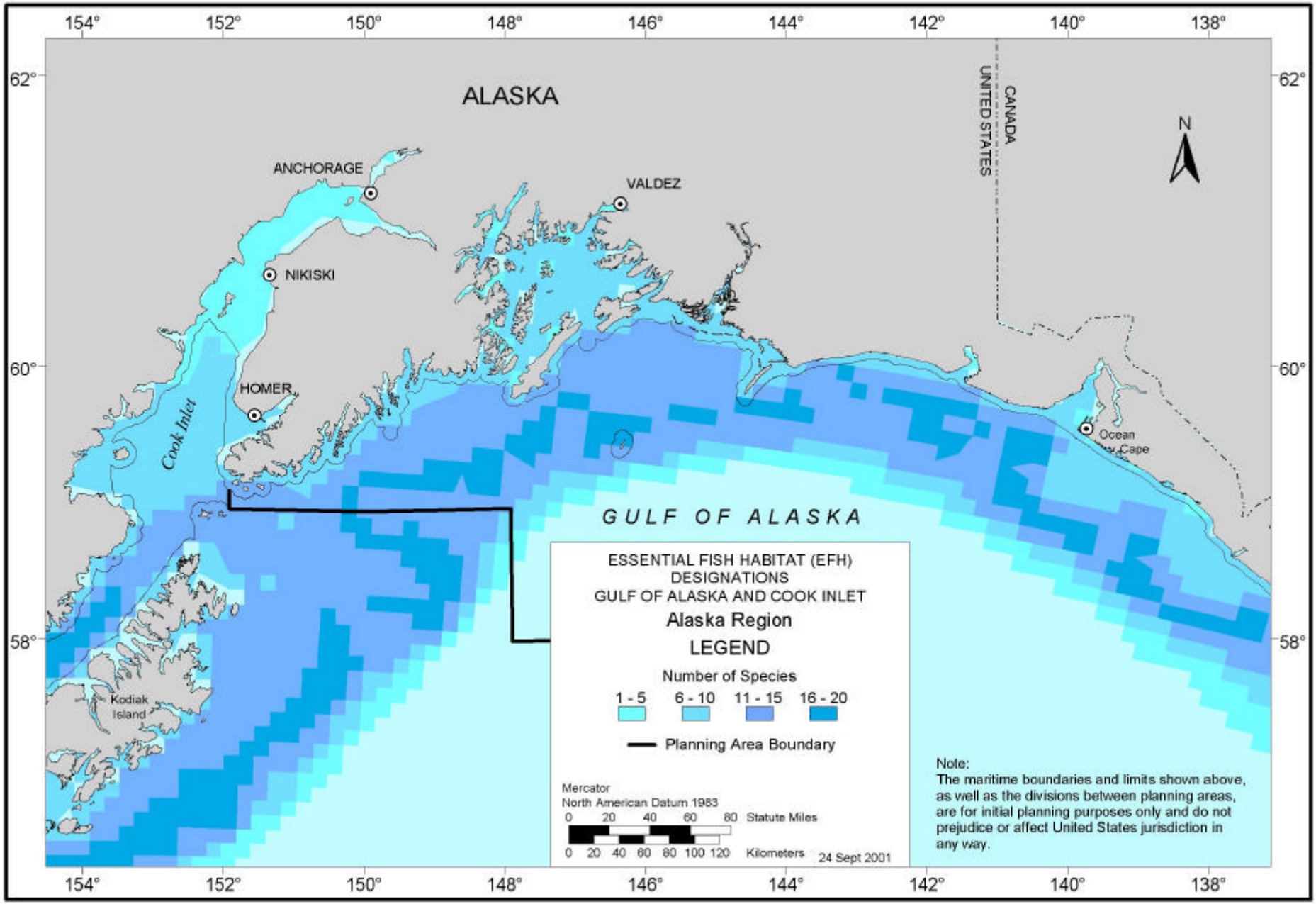

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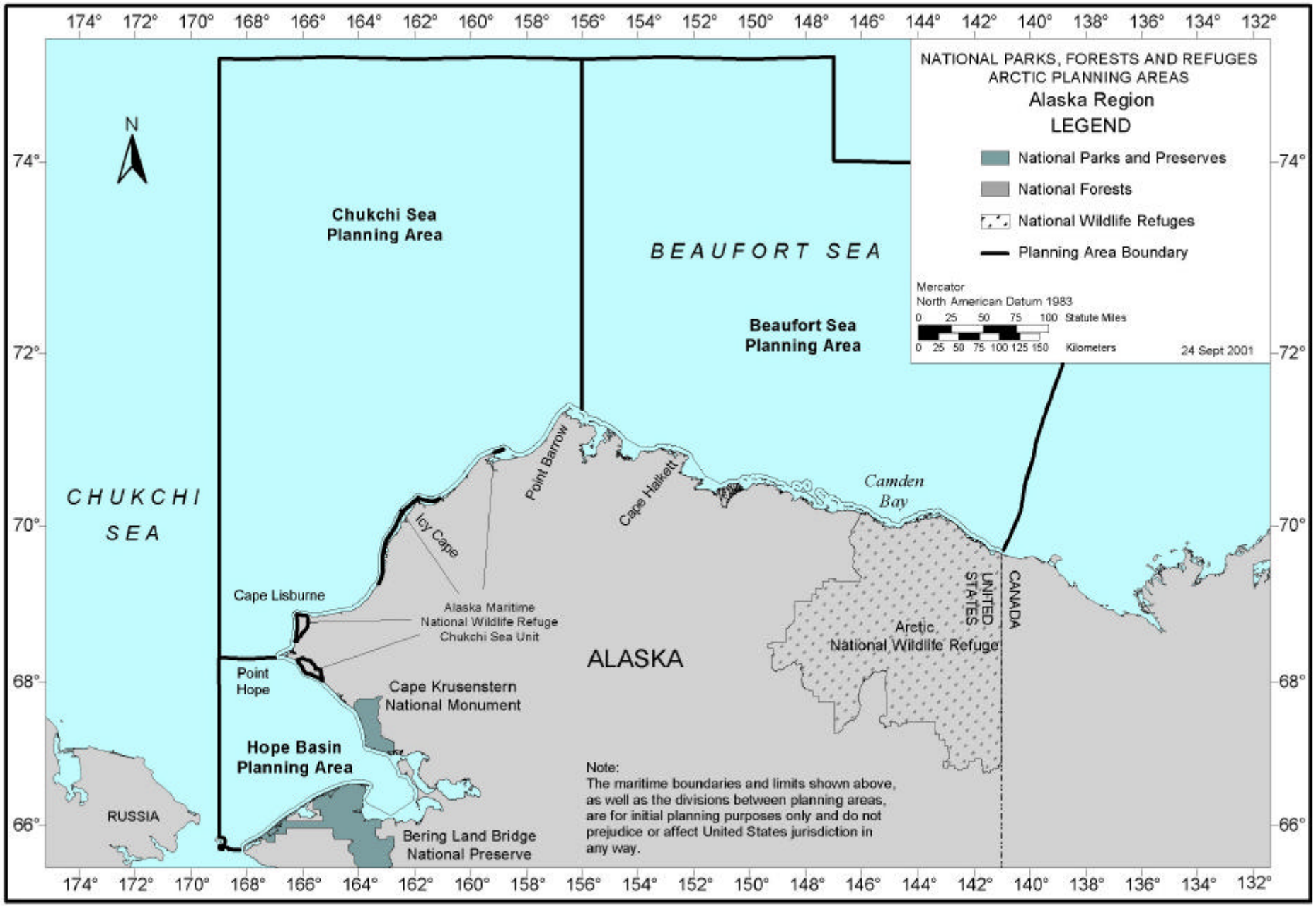

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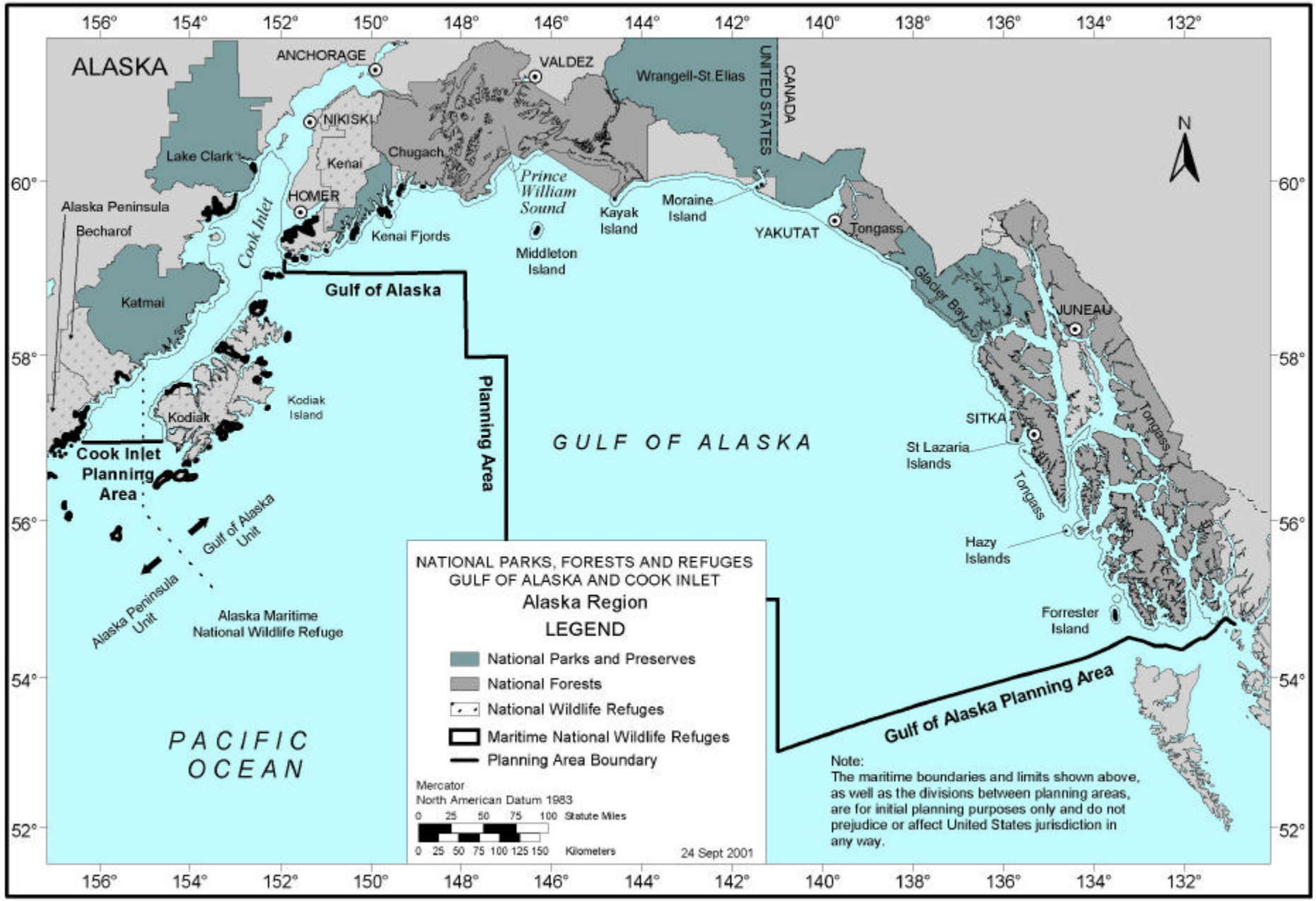


Figure 3-32. National Parks, Forests, and Refuges that Border the Gulf of Alaska and Cook Inlet Planning Areas - Alaska Region

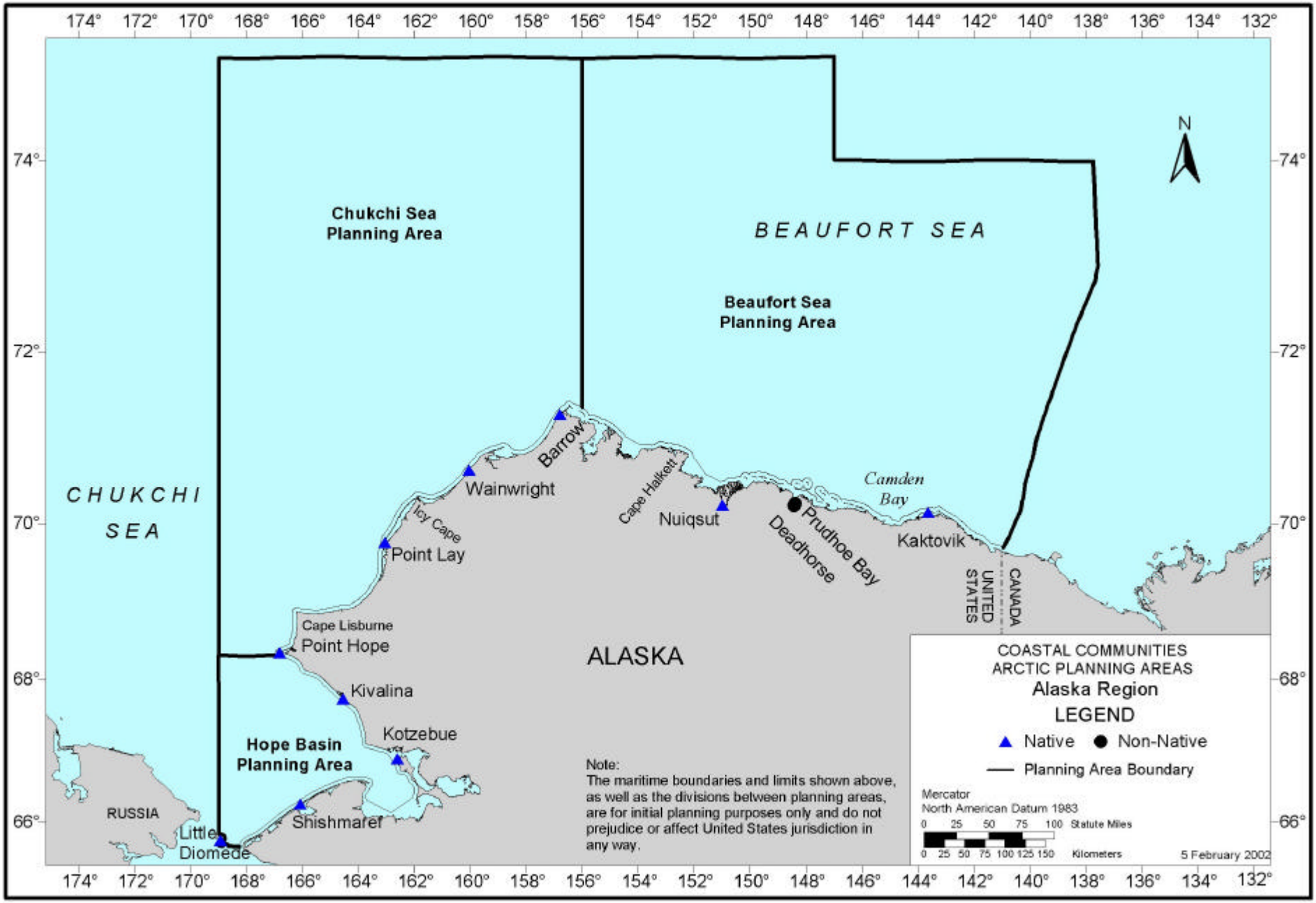
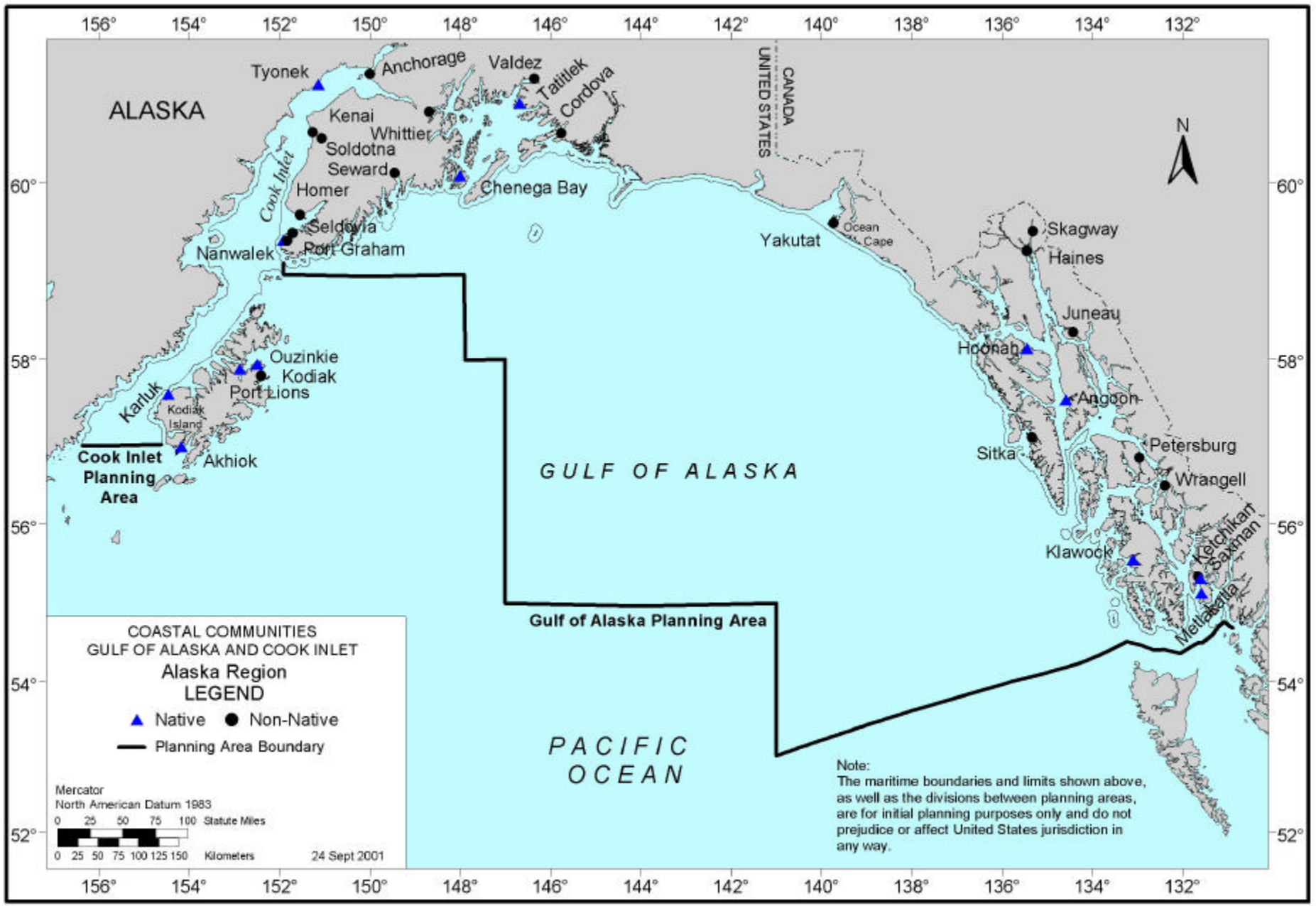


Figure 3-33. Coastal Communities Bordering the Arctic Planning Areas - Alaska Region



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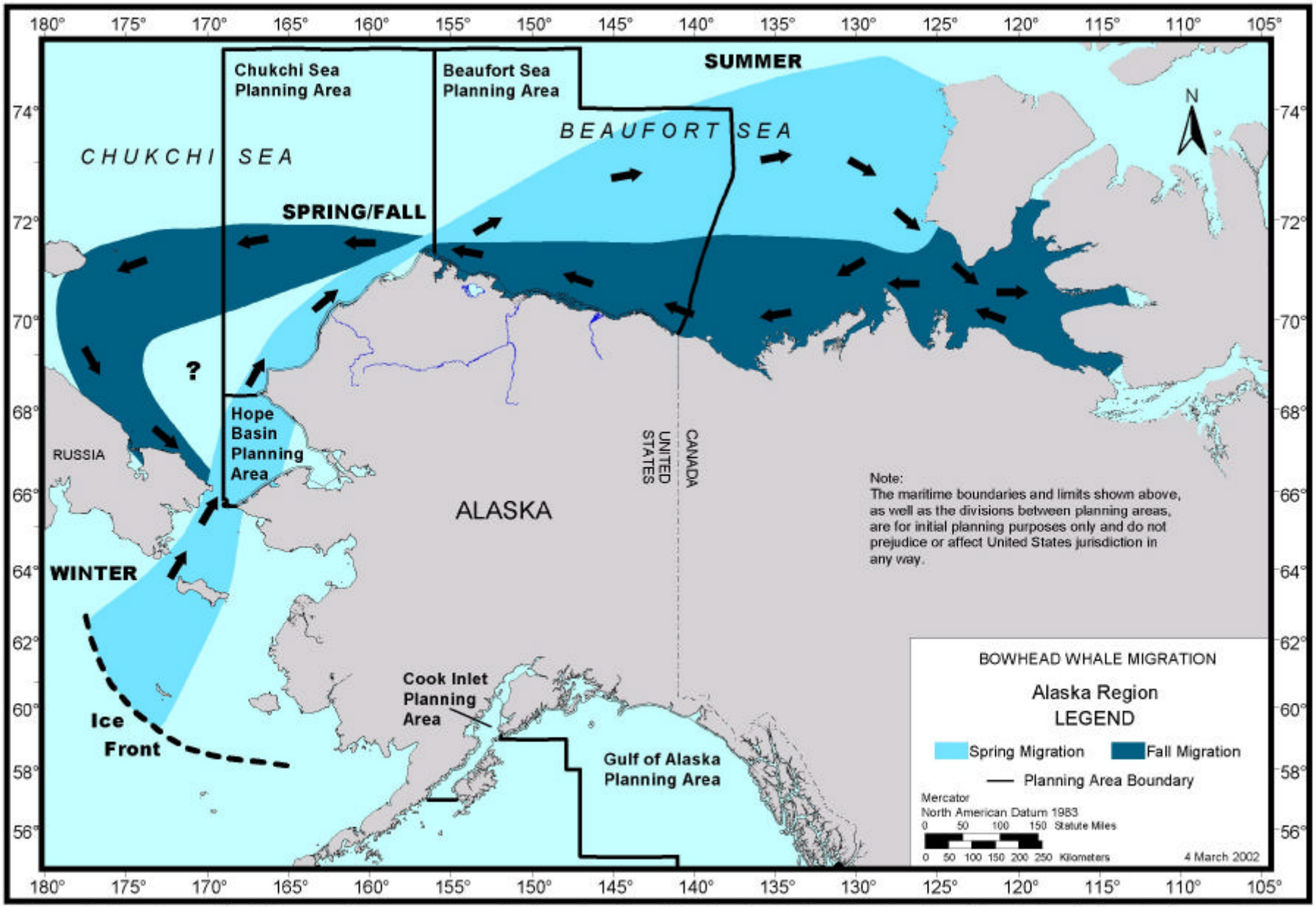


Figure 3-35. Generalized Seasonal Occurrence and Migration Corridor for the Bering Sea Bowhead Stock Depicting Spring and Fall Pathways. Source: Image georeferenced and reformatted from Burns, John J., J. Jerome Montague, and Cleveland J. Cowles, editors. The Bowhead Whale. Society for Marine Mammology. 1993.

TABLES

Table 3-1. Marine Mammals of the Gulf of Mexico

Species	Status[a]	Occurrence[b]	Typical Habitat		
			Coastal	Shelf	Slope/ Deep
ORDER CETACEA					
Suborder Mysticeti (baleen whales)					
Family Balaenidae					
Eubalaena glacialis (northern right whale)	E	1	--	X	X
Family Balaenopteridae					
Balaenoptera musculus (blue whale)	E	1	--	X	X
Balaenoptera edeni (Bryde's whale)	--	3	--	X	X
Balaenoptera physalus (fin whale)	E	2	--	X	X
Megaptera novaeangliae (humpback whale)	E	2	--	X	X
Balaenoptera acutorostrata (minke whale)	--	2	--	X	X
Balaenoptera borealis (sei whale)	E	2	--	X	X
Suborder Odontoceti (toothed whales and dolphins)					
Family Physeteridae					
Kogia simus (dwarf sperm whale)	--	3	--	--	X
Kogia breviceps (pygmy sperm whale)	--	3	--	--	X
Physeter macrocephalus (sperm whale)	E	4	--	--	X
Family Ziphiidae					
Mesoplodon densirostris (Blainville's beaked whale)	--	2[c]	--	--	X
Ziphius cavirostris (Cuvier's beaked whale)	--	2[c]	--	--	X
Mesoplodon europaeus (Gervais' beaked whale)	--	3[c]	--	--	X
Mesoplodon bidens (Sowerby's beaked whale)	--	1[c]	--	--	X
Family Delphinidae					
Stenella frontalis (Atlantic spotted dolphin)	--	4	--	X	X
Tursiops truncatus (bottlenose dolphin)	--	4	X	X	X
Stenella clymene (clymene dolphin)	--	4	--	--	X
Pseudorca crassidens (false killer whale)	--	3	--	--	X
Lagenodelphis hosei (Fraser's dolphin)	--	4	--	--	X
Orcinus orca (killer whale)	--	3	--	--	X
Peponocephala electra (melon-headed whale)	--	4	--	--	X
Stenella attenuata (pantropical spotted dolphin)	--	4	--	--	X
Feresa attenuata (pygmy killer whale)	--	3	--	--	X
Globicephala macrorhynchus (short-finned pilot whale)	--	4	--	--	X
Grampus griseus (Risso's dolphin)	--	4	--	--	X
Steno bredanensis (rough-toothed dolphin)	--	4	--	--	X
Stenella longirostris (spinner dolphin)	--	4	--	--	X
Stenella coeruleoalba (striped dolphin)	--	4	--	--	X
ORDER SIRENIA (dugongs and manatees)					
Family Trichechidae					
Trichechus manatus (West Indian manatee)	E	2	X	--	--

[a] Status: E = endangered under the Endangered Species Act of 1973.

[b] occurrence: 1 = extralimital; 2 = rare; 3 = uncommon; 4 = common (adapted from Würsig et al., 2000).

[c] beaked whales in the Gulf of Mexico may be uncommon or common rather than rare or extralimital. Their population status is uncertain because they are difficult to see and identify to species. Most surveys have been conducted in sea states that are not optimal for sighting beaked whales.

Table 3-2. Marine and Coastal Birds of the Gulf of Mexico

Category	Order	Family Name	Common Name
Seabirds			
	Charadriiformes	Laridae	gulls and terns
		Scolopacidae	phalaropes
	Gaviiformes	Gaviidae	loons
	Pelicaniformes	Fregatidae	frigatebirds
		Pelicanidae	pelicans
		Phaethontidae	tropicbirds
		Phalacrocoracidae	cormorants
		Sulidae	gannets and boobies
	Procellariiformes	Diomedeidae	albatrosses
		Hydrobatidae	storm-petrels
		Procellariidae	petrels and shearwaters
Shorebirds			
	Charadriiformes	Charadriidae	plovers
		Haematopodidae	oystercatchers
		Recurvirostridae	stilts and avocets
		Scolopacidae	sandpipers, snipes, and allies
Wetland Birds			
	Charadriiformes	Jacanidae	jacanas
	Ciconiiformes	Aramidae	limkins
		Ardeidae	bitterns, egrets, and herons
		Ciconiidae	storks
		Threskiornithidae	ibises and spoonbills
	Gruiformes	Gruidae	cranes
		Rallidae	rails and coots, moorhens, and gallinules
	Pelicaniformes	Anhingidae	darters and anhingas
	Podicipediformes	Podicipedidae	grebes
Waterfowl			
	Anseriformes	Anatidae	ducks, geese, and swans

Table 3-3. Common Taxa Representing Major Shelf and Oceanic Fish Assemblages in the Gulf of Mexico

Category	Assemblage	Common Name	Scientific Name
Shelf Fishes			
	soft bottom		
	pink shrimp	dusky flounder	*Syacium papillosum*
		sand perch	*Diplectrum formosum*
		silver jenny	*Eucinostomus gula*
		pigfish	*Orthopristis chrysoptera*
		Atlantic bumper	*Chloroscombrus chrysurus*
	brown shrimp	longspine porgy	*Stenotomus caprinus*
		horned sea robin	*Bellator militaris*
		leopard sea robin	*Prionotus scitulus*
		dwarf goatfish	*Upeneus parvus*
	white shrimp	Atlantic croaker	*Micropogonias undulatus*
		star drum	*Stellifer lanceolatus*
		Atlantic cutlassfish	*Trichiurus lepturus*
		sand sea trout	*Cynoscion arenarius*
		silver sea trout	*Cynoscion nothus*
		hardhead catfish	*Arius felis*
	hard bottom		
	(< 50 m depths)	tomtate	*Haemulon aurolineatum*
		red snapper	*Lutjanus campechanus*
		gag	*Mycteroperca microlepis*
		bank sea bass	*Centropristis ocyurus*
		blue angelfish	*Holacanthus bermudensis*
		gray triggerfish	*Balistes capriscus*
	(> 50 m depths)	roughtongue bass	*Pronotogrammus martinicensis*
		bank butterflyfish	*Chaetodon aya*
		scamp	*Mycteroperca phenax*
		tattler	*Serranus phoebe*
		short bigeye	*Pristgenys alta*
	coastal pelagic	Spanish mackerel	*Scomberomorus maculatus*
		king mackerel	*Scomberomorus cavalla*
		cobia	*Rachycentron canadum*
		crevalle jack	*Caranx hippos*
		bluefish	*Pomatomus saltatrix*
Oceanic Fishes			
	epipelagic	blue marlin	*Makaira nigricans*
		yellowfin tuna	*Thunnus albacares*
		dolphin	*Coryphaena hippurus*
		wahoo	*Acanthocybium solanderi*
		swordfish	*Xiphias gladius*
	midwater	bristlemouths	Gonostomatidae
		lanternfishes	Myctophidae
		hatchetfishes	Sternoptychidae
	demersal	grenadiers	Macrouridae
		cusk-eels	Ophidiidae
		hakes	Gadidae
		eels	Synaphobranchidae

Table 3-4. Sea Turtles of the Gulf of Mexico

Species	Status	Typical Adult Habitat	Juvenile/Hatchlings Potentially Present?	Nesting
Family Cheloniidae				
Caretta caretta (loggerhead turtle)	T	estuarine, coastal, and shelf waters	Yes	some nesting along northern Gulf Coast; main U.S. nesting beaches are in southeast Florida
Chelonia mydas (green turtle)	T,E[a]	shallow coastal waters, seagrass beds	Yes	isolated and infrequent nesting in northern Gulf
Eretmochelys imbricata (hawksbill turtle)	E	coral reefs, hard bottom areas in coastal waters; adults not often sighted in northern Gulf	Yes	nesting in continental U.S. is limited to southeastern Florida and Florida Keys
Lepidochelys kempi (Kemp's ridley turtle)	E	shallow coastal waters, seagrass beds	Yes	nests mainly at Rancho Nuevo, Mexico; minor nesting on Padre and Mustang Islands, Texas
Family Dermochelyidae				
Dermochelys coriacea (leatherback turtle)	E	slope, shelf, and coastal waters; considered the most "pelagic" of the sea turtles	Yes	some nesting in northern Gulf, especially Florida Panhandle; nearest major nesting concentrations are in Caribbean and southeast Florida

Status: E = endangered species and T = threatened species under the Endangered Species Act of 1973.

[a] Green sea turtles are listed as threatened except for Florida where breeding populations are listed as endangered.

Table 3-5. Topographic Features of the Central and Western Gulf of Mexico

Shelf Edge Banks	Midshelf Banks	South Texas Banks
Bright Bank	Sonnier Bank	Mysterious Bank
McGrail Bank	29 Fathom Bank	Baker Bank
Rankin Bank	Fishnet Bank	Aransas Bank
Alderdice Bank	Claypile Lump	Southern Bank
Rezak Bank	32 Fathom Bank	North Hospital Bank
Sidner Bank	Coffee Lump	Hospital Bank
Ewing Bank	Stetson Bank	South Baker Bank
Jakkula Bank		Dream Bank
Bouma Bank		Blackfish Ridge
Parker Bank		Big Dunn Bar
Sackett Bank		Small Dunn Bar
Diaphus Bank		
Sweet Bank		
East Flower Garden Bank		
West Flower Garden Bank		
Geyer Bank		
Elvers Bank		
MacNeil Bank		
Applebaum Bank		

Source: USDOI, MMS (1996a).

Table 3-6. Benthic Zones Characteristic of Western and Central Gulf of Mexico Topographic Features

Benthic Zone	Depth Range	Description
Diploria-Montastrea-Porites	< 20 – 36 m	diverse community of hermatypic corals and coralline algae
Madracis and leafy algae	28 – 46 m	branching coral *Madracis mirabilis* and various species of leafy algae
Stephanocoenia-Millepora	36 – 52 m	less diverse community of hermatypic corals and coralline algae
algal-sponge	55 – 85 m	coralline algae producing algal nodules with abundant leafy algae and sponges
Millepora-sponge	< 20 – 36 m	hydrocoral *Millepora* sp. and various sponges abundant
antipatharian	85 – 90 m	antipatharians and crinoids most abundant fauna
nepheloid	> 90 m	highly turbid zone with occasional deepwater octocorals and solitary stony corals

Source: Rezak et al. (1983).

Table 3-7. Deep-Sea Faunal Zones in the Gulf of Mexico

Faunal Assemblage	Depth Range
Shelf/Slope Transition Zone	300 – 500 m
Upper Archibenthal Zone	500 – 800 m
Lower Archibenthal Zone	800 – 1,650 m
Upper Abyssal Zone	1,650 – 2,250 m
Mesoabyssal Zone	2,250 – 3,000 m

Source: Gallaway and Kennicutt (1988).

Table 3-8. Managed Species of Invertebrates and Reeffishes for Which Essential Fish Habitat Has Been Designated in the Gulf of Mexico

Species	Life Stages (Reproductive Activity)	Habitat
Invertebrates		
brown shrimp (*Penaeus aztecus*)	adults; larvae	soft bottom; pelagic
white shrimp (*Penaeus setiferus*)	adults; larvae	soft bottom; pelagic
pink shrimp (*Penaeus duorarum*)	adults; larvae	soft bottom; pelagic
STONE CRAB (*MENIPPE* SPP.)	adults; larvae	soft bottom; pelagic
SPINY LOBSTER (*PANULIRUS ARGUS*)	adults; larvae	hard bottom; pelagic
ROYAL RED SHRIMP (*HYMENOPENAEUS ROBUSTUS*)	adults; larvae	soft bottom; pelagic
Reeffish		
red grouper (*Epinephelus morio*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
gag (*Mycteroperca microlepis*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
scamp (*Mycteroperca phenax*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
red snapper (*Lutjanus campechanus*)	adults; juveniles; eggs and larvae	hard bottom; soft bottom; pelagic
lane snapper (*Lutjanus synagris*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
yellowtail snapper (*Ocyurus chrysurus*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
tilefish (*Lopholatilus chamaeleonticeps*)	adults and juveniles; eggs and larvae	soft bottom; pelagic
greater amberjack (*Seriola dumerili*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
lesser amberjack (*Seriola fasciata*)	adults and juveniles; eggs and larvae	hard bottom; pelagic
gray triggerfish (*Balistes capriscus*)	adults; eggs; larvae and juveniles	hard bottom; pelagic
black grouper (*Mycteroperca bonaci*)	adults; eggs; larvae and juveniles	hard bottom; pelagic
vermillion snapper (*Rhomboplites aurorubens*)	adults; eggs; larvae and juveniles	hard bottom; pelagic
gray snapper (*Lutjanus griseus*)	adults; eggs; larvae and juveniles	hard bottom; pelagic

Source: Gulf of Mexico Fishery Management Council (1998).

Table 3-9. Managed Species of Coastal Pelagic Fishes and Red Drum for Which Essential Fish Habitat Has Been Designated in the Gulf of Mexico

Species	Life Stages (Reproductive Activity)	Habitat
Coastal Pelagic Fishes		
cobia (*Rachycentron canadum*)	adults; juveniles/subadults; larvae and eggs	pelagic
king mackerel (*Scomberomorus cavalla*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
Spanish mackerel (*Scomberomorus maculatus*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
dolphin (*Coryphaena hippurus*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
bluefish (*Pomatomus saltatrix*)	adults; juveniles/subadults; larvae and eggs (spawning area))	pelagic
little tunny (*Euthynnus alletteratus*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
Red Drum		
red drum (*Sciaenops ocellatus*)	adults; larvae and eggs (spawning area)	soft bottom; pelagic

Source: Gulf of Mexico Fishery Management Council (1998).

Table 3-10. Managed Highly Migratory Species for Which Essential Fish Habitat Has Been Designated in the Gulf of Mexico

Species	Life Stages (Reproductive Activity)	Habitat
Swordfish		
swordfish (*Xiphias gladius*)	adults; larvae and eggs (spawning area)	pelagic
Tuna		
skipjack tuna (*Katsuwonus pelamis*)	adults; larvae and eggs (spawning area)	pelagic
yellowfin tuna (*Thunnus albacares*)	adults; juveniles/subadults; larvae and eggs (spawning area)	pelagic
bluefin tuna (*Thunnus thynnus*)	adults; larvae and eggs (spawning area)	pelagic
Sharks		
nurse shark (*Ginglymostoma cirratum*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
longfin mako shark (*Isurus paucus*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
blacknose shark (*Carcharhinus acronotus*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
spinner shark (*Carcharhinus brevipinna*)	late juvenile/subadult	pelagic
silky shark (*Carcharhinus falciformis*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
bull shark (*Carcharhinus leucas*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
blacktip shark (*Carcharhinus limbatus*)	late juveniles/subadults	pelagic
dusky shark (*Carcharhinus obscurus*)	neonates/early juveniles	pelagic
Caribbean reef shark (*Carcharhinus perezi*)	adult; late juveniles/subadults	pelagic
sandbar shark (*Carcharhinus plumbeus*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
tiger shark (*Galeocerdo cuvieri*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
lemon shark (*Negaprion brevirostris*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
scalloped hammerhead (*Sphyrna lewini*)	adults; late juvenile/subadults	pelagic
great hammerhead (*Sphyrna mokarran*)	adults; late juvenile/subadults	pelagic
bonnethead (*Sphyrna tiburo*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	adults; late juvenile/subadult; neonates/early juveniles	pelagic

Source: USDOC, NMFS (1999).

Table 3-11. National Wildlife Refuges Along the Gulf of Mexico Coast From Texas Through Florida

National Wildlife Refuge Name	Total Area (ha)	Includes Wetlands
Texas		
Laguna Atascosa	23,402	+
Aransas	46,296	+
San Bernard	12,249	+
Brazoria	17,767	+
Anahuac	13,880	+
Texas Point	3,623	+
Louisiana		
Shell Keys	3	–
Bayou Sauvage	9,009	+
Delta	19,749	+
Breton	3,661	+
Mississippi		
Grand Bay	2,072	+
Alabama		
Grand Bay	1,010	+
Bon Secour	2,703	+
Florida		
St. Vincent	5,055	+
St. Marks	27,164	+
Cedar Keys	361	+
Chassahowitzka	12,482	+
Pinellas	160	+
Egmont Key	133	–
Passage Key	26	–
Matlacha Pass	159	+
Island Bay	8	+
Pine Island	244	+
J.N. Ding Darling	2,556	+
Ten Thousand Islands	14,178	+
Caloosahatchee	16	+
Key West	84,302	+
Great White Heron	77,939	+
National Key Deer	3,486	+
Crocodile Lake	2,707	+

Sources: National Audubon Society (2001); U.S. Department of the Interior, Fish and Wildlife Service (2001).

Table 3-12. Gulf of Mexico Coastal Population Overview

State	1970	1980	1990	1999
Texas	3,565,529	4,832,892	5,640,750	6,778,314
Louisiana	2,632,415	3,072,924	3,119,663	3,276,906
Mississippi	296,851	368,852	388,725	447,024
Alabama	435,958	502,814	534,425	597,685
Florida	4,428,247	6,365,036	8,131,722	9,393,160

Table 3-13. Gulf of Mexico Coastal Region Population and Employment Composition

Population Variable	1970	1980	1990	1999
total population	11,359,000	15,142,518	17,815,285	20,432,908
percent change from previous period	--	33.31	17.65	14.69
Population Variable	**1970**	**1980**	**1990**	**% change (1970-1990)**
Age Structure (%)				
0 – 5	8.5	7.4	8.9	3.89
6 – 15	20.7	15.8	14.3	-30.57
16 – 17	5.7	5.1	2.8	-51.95
18 – 24	11.2	12.8	9.8	-12.46
25 – 34	12.0	16.3	17.1	42.67
35 – 44	11.2	11.0	14.6	30.11
45 – 54	10.7	9.7	10.1	-6.23
55 – 64	9.2	9.5	8.7	-5.86
65+	10.7	12.5	13.8	28.44
Race and Ethnic Composition (%)				
Black	18.4	17.2	17.1	-6.97
Hispanic	9.7	13.4	17.2	77.55
White	71.6	68.2	63.7	-10.99
Other	0.3	1.2	1.9	510.42
Education of Persons Age 25+ (%)				
0 – 8 years schooling	31.9	20.5	13.3	-58.20
9 – 11 years schooling	20.1	15.8	16.8	-16.06
high school graduates	27.2	32.1	30.3	11.24
13 – 15 years schooling	10.6	16.0	20.0	89.07
college graduates	10.2	15.7	19.5	90.50
Labor Force Size				
civilian	3,983,979	6,363,346	7,747,442	94.46
military	119,341	81,664	95,819	-19.71
total	4,103,320	6,445,010	7,843,261	91.14
Employment by Industrial Sector (%)				
agriculture, forestry, mining	5.7	5.8	4.0	-29.75
construction	8.9	10.6	7.6	-14.74
business services	3.6	5.3	5.4	49.43
communications, utilities	3.5	3.6	2.9	-18.18
nondurable manufacturing	8.9	8.3	5.9	-33.63
durable manufacturing	7.8	8.9	6.1	-21.43
finance, insurance, real estate	5.3	7.3	6.9	32.17
services	29.0	19.0	33.2	14.69
wholesale, retail trade	22.8	25.4	23.1	1.26
transportation	4.5	5.8	4.8	6.13
Employment by Occupation Group (%)				
management, professional	10.5	12.8	14.5	37.75
technical	1.6	3.8	4.6	181.52
sales	9.3	13.5	16.1	73.28
clerical	19.9	20.1	19.3	-2.94
precision craft	17.6	17.7	14.6	-16.85
operative, transportation	11.7	7.4	5.6	-51.91
service, except household	16.8	15.3	17.0	1.31
farming, fishing, forestry	2.9	2.7	2.7	-6.93
household service	3.0	1.0	0.8	-73.91
laborers	6.6	5.8	4.8	-28.16

Note: Data for 1999, other than total population, were not available at the time of this report.

Table 3-14. Gulf of Mexico Coastal Commuting Zones Population Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	0-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	4,816,860	31.7	3,862,580	25.5	4,592,630	30.3	1,904,190	12.6	15,176,260	–
1985	4,982,390	29.6	4,367,210	26.0	5,298,300	31.5	2,163,390	12.9	16,811,290	10.8
1990	5,226,510	29.2	4,286,390	24.0	5,905,400	33.0	2,464,370	13.8	17,882,670	6.4
1995	5,629,340	29.1	4,162,360	21.5	6,857,030	35.4	2,706,100	14.0	19,354,830	8.2
2000	5,957,170	28.8	4,004,280	19.4	7,840,400	37.9	2,880,080	13.9	20,681,930	6.9
2005	6,134,000	27.9	4,175,000	19.0	8,587,000	39.1	3,058,000	13.9	21,964,000	6.2
2010	6,310,000	27.1	4,464,000	19.2	9,091,000	39.1	3,410,000	14.7	23,275,000	6.0
2015	6,491,000	26.4	4,786,000	19.4	9,338,000	37.9	4,005,000	16.3	24,620,000	5.8
2020	6,789,000	26.2	4,904,000	18.9	9,501,000	36.6	4,465,000	17.2	25,938,000	5.4

*Mid-year estimates (July 1) for each year.

Table 3-15. Gulf of Mexico Coastal Commuting Zones Labor Force Projections

Year	Age Group								Total Population*	5-Year Growth Rate
	16-19		20-34		35-64		65+			
	Number	% of Total	Number	% of Total	Number	% of Total	Number	% of Total		
1980	1,090,910	14.3	3,062,470	40.2	3,242,640	42.6	222,040	2.9	7,618,060	--
1985	1,021,320	11.8	3,550,360	41.1	3,851,770	44.6	210,900	2.4	8,634,350	13.3
1990	1,010,010	10.9	3,514,000	37.9	4,490,930	48.4	261,230	2.8	9,276,170	7.4
1995	1,071,650	10.7	3,398,080	33.9	5,269,120	52.5	292,910	2.9	10,031,760	8.2
2000	1,213,080	11.2	3,274,170	30.1	6,105,980	56.1	290,150	2.7	10,883,380	8.5
2005	1,291,000	11.1	3,413,000	29.2	6,662,000	57.1	314,000	2.7	11,681,000	7.3
2010	1,365,000	11.1	3,650,000	29.6	6,938,000	56.3	370,000	3.0	12,324,000	5.5
2015	1,323,000	10.4	3,915,000	30.8	7,026,000	55.2	465,000	3.7	12,729,000	3.3
2020	1,357,000	10.4	4,017,000	30.9	7,082,000	54.4	556,000	4.3	13,012,000	2.2

*Mid-year estimates (July 1) of working age population, for each year.

Table 3-16a. Gulf of Mexico Coastal Commuting Zones Employment Projections

Industry	2000	2005	2010	2015	2020	% Change (2000-2020)
all-industry total	13,515,460	14,431,000	15,259,000	15,927,000	16,502,000	22.1
farm	225,790	223,000	220,000	216,000	200,000	-11.3
non-farm	13,579,900	14,509,000	15,357,000	16,052,000	16,668,000	22.7
private	11,546,800	12,379,000	13,139,000	13,762,000	14,329,000	24.1
agric. services, forestry	222,200	246,000	267,000	283,000	299,000	34.6
mining	149,320	142,000	137,000	132,000	122,000	-18.5
oil and gas	**143,490**	**136,000**	**131,000**	**126,000**	**116,000**	**-19.0**
construction	853,190	903,000	949,000	985,000	1,011,000	18.5
manufacturing	1,066,780	1,072,000	1,080,000	1,086,000	1,068,000	0.1
durables	514,580	512,000	511,000	510,000	496,000	-3.6
nondurables	552,140	560,000	569,000	576,000	572,000	3.6
transportation & utilities	648,470	681,000	709,000	731,000	744,000	14.7
wholesale trade	623,500	659,000	688,000	708,000	719,000	15.3
retail trade	2,470,450	2,620,000	2,767,000	2,879,000	2,966,000	20.1
finance, insurance, real estate	946,490	994,000	1,037,000	1,073,000	1,100,000	16.2
services	4,566,040	5,062,000	5,505,000	5,884,000	6,300,000	38.0
Government	2,033,210	2,131,000	2,218,000	2,290,000	2,339,000	15.0
Federal civilian	207,940	207,000	206,000	206,000	200,000	-3.7
military	212,190	211,000	212,000	213,000	213,000	0.5
State and local	1,612,920	1,712,000	1,800,000	1,871,000	1,925,000	19.4

Table 3-16b. Gulf of Mexico Coastal Commuting Zones Earnings Projections (in 1987 $millions)

Industry	2000	2005	2010	2015	2020	% Change (2000-2020)
all-industry total	21,820	24,000	27,000	28,000	30,000	39.2%
farm	256	270	280	280	270	6.1%
non-farm	22,181	25,000	27,000	29,000	31,000	39.7%
private	18,344	20,000	23,000	24,000	26,000	41.6%
agric. services, forestry	215	250	290	320	350	62.5%
mining	468	460	460	460	440	-5.3%
oil and gas	**274**	**270**	**260**	**260**	**250**	**-9.5%**
construction	1,796	2,000	2,200	2,300	2,500	38.6%
manufacturing	2,449	2,600	2,700	2,800	2,900	18.1%
durables	1,046	1,100	1,100	1,200	1,200	14.9%
nondurables	1,361	1,400	1,500	1,500	1,600	16.2%
transportation & utilities	812	900	900	1,000	1,000	24.4%
wholesale trade	1,398	1,500	1,600	1,700	1,800	30.0%
retail trade	2,299	2,500	2,700	2,800	2,900	27.4%
finance, insurance, real estate	1,578	1,800	2,000	2,200	2,400	50.4%
services	6,983	8,000	9,000	10,000	11,000	61.0%
Government	3,677	4,000	4,300	4,600	4,900	32.0%
Federal civilian	547	600	600	600	600	10.9%
military	289	300	310	330	330	15.6%
State and local	2,795	3,100	3,400	3,600	3,900	38.0%

Table 3-17. Primary Commercial Fishing Methods, Species Sought, Seasons, and General Areas Fished in the Gulf of Mexico

Fishing Method	Species Sought	Primary Fishing Season	Primary Fishing Area
bottom trawling	brown shrimp, pink shrimp, white shrimp, seabob, royal red shrimp, and groundfishes	year-round, depending on species and seasonal closures	soft bottom, shelf waters offshore all Gulf States
purse seining	menhaden, butterfish, scads, blue runner, and spanish sardines	spring and summer months	menhaden off Louisiana and Mississippi, scads and sardines off Florida Panhandle
gillnetting	coastal sharks, mullet, black drum	spring and summer, depending on species and seasonal closures	
hook-and-lining (bottom fishing and trolling)	snappers, groupers, amberjacks, triggerfishes, sharks, king mackerel, Spanish mackerel, and cobia	year-round; effort varies with species-specific closures	oil platforms, artificial reefs, and natural hard-bottom areas throughout the Gulf
surface longlining	sharks, swordfish, tunas, and dolphinfish	year-round with summer peaks	open Gulf seaward of 200 m
bottom longlining	groupers, snappers, tilefishes, and sharks	year-round; effort varies with species-specific closures	outer shelf waters from Florida to Texas on suitable bottom type
trapping	spiny lobster, stone crab, and reeffishes	stone crab (Oct. to Mar.); spiny lobster (July to March); fishes (year-round)	Florida shelf waters

Bottom trawling: a large net held open at the entrance by "doors" is dragged along the bottom or up in the water column behind a towing vessel.
Purse seining: a long rectangular net with a weighted bottom edge and buoyant top, floated by the cork line, is run around a school of fish. The line running along the bottom edge of the net is hauled in closing the bottom of the net and trapping the fish.
Gillnetting: nets used range from several hundred to several thousand feet in length. The size of the mesh in a gillnet reduces the amount of bycatch by allowing most smaller fish to swim through the openings.
Longlining: a continuous mainline supported by float lines (mainline may be surface or subsurface) with regularly spaced leaders with an additional section of monofilament line perpendicular to the mainline, each ending with a baited hook.

Table 3-18. Employment in Tourism-Related Industries in 1990, Gulf of Mexico Coastal Region

Labor Market Area	Non-Tourism Employment	Tourism Related Employment	Percent Employment From Tourism
Biloxi, MS	151,649	24,197	14
New Orleans, LA	504,747	113,611	18
Houma, LA	87,287	19,375	18
Baton Rouge, LA	276,377	51,698	16
Lake Charles, LA	113,760	19,812	15
Lafayette, LA	178,456	26,944	13
Tampa, FL	797,114	165,051	17
Sarasota, FL	213,886	46,252	18
Miami, FL	1,346,820	331,191	20
Fort Myers, FL	183,110	39,816	18
Lake City, FL	42,622	6946	14
Ocala, FL	93,859	16,845	15
Gainesville, FL	101,255	19,930	16
Tallahassee, FL	149,061	27,736	16
Panama City, FL	51,453	13,123	20
Pensacola, FL	182,999	34,460	16
Mobile, AL	240,460	32,127	12
Victoria, TX	85,008	9449	10
Brownsville, TX	218,768	39,714	15
Corpus Christi, TX	183,047	32,234	15
Brazoria, TX	112,192	15,725	12
Houston, TX	1,601,032	267,930	14
Beaumont, TX	165,918	26,334	14

Table 3-19. Marine Mammals of the Alaska Region

Species	Status[a]	Typical Occurrence[b]	
		Arctic	Subarctic
ORDER CETACEA			
Suborder Mysticeti (baleen whales)			
Family Balaenidae			
Eubalaena glacialis (northern right whale)	E	--	X
Family Balaenopteridae			
Balaenoptera acutorostrata (minke whale)	--	X	X
Balaenoptera borealis (sei whale)	E	--	X
Balaenoptera musculus (blue whale)	E	--	X
Balaenoptera mysticetus (bowhead whale)	E	X	--
Balaenoptera physalus (fin whale)	E	X	X
Eschrichtius robustus (gray whale)	--	X	X
Megaptera novaeangliae (humpback whale)	E	X	X
Suborder Odontoceti (toothed whales and dolphins)			
Family Physeteridae			
Physeter macrocephalus (sperm whale)	E	--	X
Family Delphinidae			
Delphinapterus leucas (beluga whale)	D	X	X
Orcinus orca (killer whale)	--	X	X
Family Phocoenidae			
Phocoenoides dalli (Dall's porpoise)	--	--	X
Phocoena phocoena (harbor porpoise)	--	X	X
ORDER CARNIVORA			
Suborder Pinnipedia (seals, sea lions, and walrus)			
Family Otariidae			
Callorhinus ursinus (northern fur seal)	S	--	X
Eumetopias jubatus (Steller sea lion)	E	--	X
Family Phocidae			
Erignathus barbatus (bearded seal)	--	X	--
Odobenus rosmarus divergens (Pacific walrus)	--	X	--
Phoca fasciata (ribbon seal)	--	X	--
Phoca hispida (ringed seal)	--	X	--
Phoca largha (spotted seal)	--	X	--
Phoca vitulina richardsi (harbor seal)	--	--	X
Suborder Fissipedia (sea otters and polar bears)			
Family Mustelidae			
Enhydra lutris (sea otter)	E	--	X
Family Ursidae			
Ursus martimus (polar bear)	--	X	--

[a] Status: E = endangered under the Endangered Species Act of 1973; D = depleted stock (applies to Cook Inlet stock of belugas); S = strategic stock.

[b] Occurrence in and near OCS planning areas. Arctic refers to Beaufort Sea, Chukchi Sea, and Hope Basin Planning Areas; Subarctic refers to Gulf of Alaska and Cook Inlet Planning Areas.

Table 3-20. Terrestrial Mammals That Could Occur Adjacent to Alaska Planning Areas

Common Name	Scientific Name	Profiled in Text
barren-ground shrew	*Sorex ugyanak*	--
tundra shrew	*Sorex tundrensis*	--
dusky shrew	*Sorex monticolus*	--
arctic ground squirrel	*Spermophilus parryii*	--
brown lemming	*Lemmus trimucronatus*	--
collared lemming	*Dicrostonyx groenlandicus*	--
northern red-backed vole	*Clethrionomys rutilus*	--
tundra vole	*Microtus oeconomus*	--
singing vole	*Microtus miurus*	--
tundra hare	*Lepus othus*	--
least weasel	*Mustela nivalus*	--
short-tailed weasel	*Mustela erminea*	--
river otter	*Lutra canadensis*	X
red fox	*Vulpes vulpes*	--
arctic fox	*Alopex lagopus*	X
wolverine	*Gulo gulo*	--
coyote	*Canis latrans*	--
gray wolf	*Canis lupus*	--
black bear	*Ursus americanus*	X
grizzly bear	*Ursus arctos*	X
moose	*Alces alces*	--
barren-ground caribou	*Rangifer tarandus*	X
muskox	*Ovibos moschatus*	X
Sitka black-tailed deer	*Odocoileus hemionus sitkensis*	X

Table 3-21. Water Bird Species Occurring in the Alaska Planning Areas. (Some Rare and Accidental Species Are Not Included.)

Common Name	Scientific Name	ESA Status[a]	Occurrence[b]	
			Arctic	Subarctic
common loon	*Gavia immer*	--	Acc	U/B,W; C/M
Pacific loon	*Gavia pacifica*	--	C/B	U/B; C/M,W
red-throated loon	*Gavia stellata*	--	C/B	C/B,M; U,W
yellow-billed loon	*Gavia adamsii*	--	U/B	U/M; U/W
red-necked grebe	*Podiceps grisegena*	--	C/B	U/W
horned grebe	*Podiceps auritus*	--	C/B	U/W
tundra swan	*Cygnus columbianus*	--	U/B	C/M
trumpeter swan	*Cygnus buccinator*	--	R/B	C/B,M
greater white-fronted goose	*Anser albifrons*	--	C/B,M	C/B,M
snow goose	*Chen caerulescens*	--	U/B,C/M	C/M
emperor goose	*Chen canagica*	--	R	U/M,W
brant	*Branta bernicla*	--	C/B,M	U/M
Canada goose	*Branta canadensis*	[c]	C/B	C/B,M
green-winged teal	*Anas crecca*	--	U/B	C/B,M
mallard	*Anas platyrhynchos*	--	R/B	C/B,M
northern pintail	*Anas acuta*	--	C/B,M	C/B,M
northern shoveler	*Anas spatula*	--	R/B	C/B,M
gadwall	*Anas strepera*	--	Acc	U/B
American wigeon	*Anas americana*	--	U/B	C/B,M
canvasback	*Aythya valisineria*	--	Acc	U/B,M
ring-necked duck	*Aythya collaris*	--	Acc	R/B,M
greater scaup	*Aythya marila*	--	U/B	C/B,M
lesser scaup	*Aythya affinis*	--	Acc	R/B,M,W
common eider	*Somateria mollissima*	--	C/B,M	U/B,M,W
king eider	*Somateria spectabilis*	--	C/B,M	U/M,W
spectacled eider	*Somateria fischeri*	T	U/B,M	Acc
Steller's eider	*Polysticta stelleri*	T	U/B,M	U-C/W
harlequin duck	*Histrionicus histrionicus*	--	R/B	C/B,M
long-tailed duck	*Clangula hyemalis*	--	C/B,M	C/M,W
black scoter	*Melanitta nigra*	--	Acc	C/M,W
surf scoter	*Melanitta perspicillata*	--	U/B	C/M,W
white-winged scoter	*Melanitta fusca*	--	U/B	C/B,M,W
common goldeneye	*Bucephala clangula*	--	Acc	R/B; C/M,W
Barrow's goldeneye	*Bucephala islandica*	--	--	C/B,M,W
bufflehead	*Bucephala albeola*	--	Acc	R/B; C/M,W
hooded merganser	*Lophodytes cucullatus*	--	--	R/B,M,W
common merganser	*Mergus merganser*	--	--	C/B,M,W
red-breasted merganser	*Mergus serrator*	--	R/B,M	C/B,M,W

[a] Federal status under the Endangered Species Act of 1973. Abbreviations: T = threatened.

[b] Occurrence information from Johnson and Herter (1989), Armstrong (1990), Isleib and Kessel (1973), U.S. Department of the Interior, Fish and Wildlife Service (1999a), and DeGange and Sanger (1986). Abbreviations: C = common, U = uncommon, R = rare, Acc = accidental, B = breeding bird, M = migration, and W = winter.

[c] The formerly threatened subspecies, the Aleutian Canada goose (*Branta canadensis leucopareia*) was removed from the list of threatened and endangered wildlife by the U.S. Fish and Wildlife Service on March 20, 2001.

Table 3-22. Shorebird Species Occurring in the Alaska Planning Areas. (Some Rare and Accidental Species Are Not Included.)

Common Name	Scientific Name	ESA Status[a]	Occurrence[b]	
			Arctic	Subarctic
black-bellied plover	*Pluvialis squatarola*	--	U/B	C/M
lesser golden-plover	*Pluvialis dominica*	--	C/B	C/M
semipalmated plover	*Charadrius semipalmatus*	--	U/B	C/B,M
black oystercatcher	*Haematopus bachmani*	--	--	C/B,M,W
greater yellowlegs	*Tringa melanoleuca*	--	Acc	C/B,M
lesser yellowlegs	*Tringa flavipes*	--	Acc	C/B,M
solitary sandpiper	*Tringa solitaria*	--	Acc	R/B; U/M
wandering tattler	*Heteroscelus incanus*	--	--	U/B; C/M
spotted sandpiper	*Actitis macularia*	--	--	C/B,M
whimbrel	*Numenius phaeopus*	--	U	C/M
Hudsonian godwit	*Limosa haemastica*	--	R	U/B,M
bar-tailed godwit	*Limosa lapponica*	--	U/B	U/B,M
ruddy turnstone	*Arenaria interpres*	--	C/B	C/M
black turnstone	*Arenaria melanocephala*	--	Acc	C/M; U/W
surfbird	*Aphriza virgata*	--	--	U/B; C/M
red knot	*Calidris canutus*	--	R/B	C/M
sanderling	*Calidris alba*	--	R/B	U/M; R/W
semipalmated sandpiper	*Calidris pusilla*	--	C/B	U/M
western sandpiper	*Calidris mauri*	--	U/B	C/M
least sandpiper	*Calidris minutilla*	--	U/B	C/B,M
white-rumped sandpiper	*Calidris fuscicollis*	--	R/B	Acc
baird's sandpiper	*Calidris bairdii*	--	C/B	U/M
pectoral sandpiper	*Calidris melanotos*	--	C/B	C/M
rock sandpiper	*Calidris ptilocnemis*	--	--	C/M,W
dunlin	*Calidris alpina*	--	C/B	C/M,W
stilt sandpiper	*Calidris himantopus*	--	U/B	R/M
buff-breasted sandpiper	*Tryngites subruficollis*	--	U/B	Acc
short-billed dowitcher	*Limnodromus griseus*	--	--	C/B,M
long-billed dowitcher	*Limnodromus scolopaceus*	--	C/B	C/M
common snipe	*Gallinago gallinago*	--	C/B	C/B,M; R/W
red-necked phalarope	*Phalaropus lobatus*	--	C/B	C/B,M
red phalarope	*Phalaropus fulicaria*	--	C/B	C/M

[a] Federal status under the Endangered Species Act of 1973.

[b] Occurrence information from Johnson and Herter (1989), Armstrong (1990), Isleib and Kessel (1973), and DeGange and Sanger (1987). Abbreviations: C = common, U = uncommon, R = rare, Acc = accidental, B = breeding bird, M = migration, and W = winter.

Table 3-23. Seabird Species Occurring in the Alaska Planning Areas. (Some Rare and Accidental Species Are Not Included.)

Common Name	Scientific Name	ESA Status[a]	Occurrence[b]	
			Arctic	Subarctic
short-tailed albatross	*Diomedea albatrus*	E		Acc
black-footed albatross	*Diomedea nigripes*	--		C/S,M
laysan albatross	*Diomedea immutabilis*	--		R/M
northern fulmar	*Fulmarus glacialis*	--	R/S	C/S,M; R/W
sooty shearwater	*Puffinus griseus*	--		C/S,M
short-tailed shearwater	*Puffinus tenuirostris*	--	R/S	U/S,M
fork-tailed storm petrel	*Oceanodroma furcata*	--		C/M
Leach's storm petrel	*Oceanodroma leucorboa*	--		U/S
double-crested cormorant	*Phalacrocorax auritus*	--		C/B,M; U/W
Brant's cormorant	*Phalacrocorax penicillatus*	--		R/S
pelagic cormorant	*Phalacrocorax pelagicus*	--	R/S	C/B,M,W
red-faced cormorant	*Phalacrocorax urile*	--		U/B,M,W
pomarine jaeger	*Stercorarius pomarinus*	--	U/B; C/M	C/M; R/S
parasitic jaeger	*Stercorarius parasiticus*	--	C/B	C/B,M
long-tailed jaeger	*Stercorarius longicaudus*	--	C/B	R/B,M
Bonaparte's gull	*Larus philadelphia*	--	Acc	C/B,M
mew gull	*Larus canus*	--	R/S,M	C/B,M,W
ring-billed gull	*Larus delawarensis*	--		R/S,M,W
herring gull	*Larus argentatus*	--	R/S,M	C/M; R/S,W
Thayer's gull	*Larus thayeri*	--	R/M	R/S,W,M
glaucous-winged gull	*Laurs glaucescens*	--	Acc	C/B,M,W
glaucous gull	*Larus hyperboreus*	--	C/B,M	R/S,W,M
black-legged kittiwake	*Rissa tridactyla*	--	C/S,	C/B,M; U/W
Ross's gull	*Rhodostethia rosea*	--	C/M	Acc
Sabine's gull	*Xema sabini*	--	C/B,M	U/M; R/S
arctic tern	*Sterna paradisaea*	--	C/B	C/B,M
Aleutian tern	*Sterna aleutica*	--	Acc	U/B,M
common murre	*Uria aalge*	--	Acc	C/B,M,W
thick-billed murre	*Uria lomvia*	--	C/B	R/M,W
black guillemot	*Cepphus grylle*	--	U/B	
pigeon guillemot	*Cepphus columba*	--		C/B,M,W
marbled murrelet	*Brachyramphus marmoratus*	--		C/M,W
Kittlitz's murrelet	*Brachyramphus brevirostris*	--	R	C/S; U/W
ancient murrelet	*Synthliboramphus antiquus*	--		U/S,M,W
Cassin's auklet	*Ptychoramphus aleuticus*	--		R/S,M
parakeet auklet	*Cyclorrhynchus psittacula*	--	Acc	R/B,M
crested auklet	*Aethia cristatella*	--	R/S	U/S,W
rhinoceros auklet	*Cerorhinca monocerata*	--		R/S,M
tufted puffin	*Fratercula cirrhata*	--	Acc	C/B,M; R/W
horned puffin	*Fratercula corniculata*	--	R/S	U/B,M; R/W

[a] Federal status under the Endangered Species Act of 1973. Abbreviations: E = endangered.

[b] Occurrence information from Johnson and Herter (1989), Armstrong (1990), DeGange and Sanger (1987), and Isleib and Kessel (1973). Abbreviations: C = common, U = uncommon, R = rare, Acc = accidental, B = breeding bird, M = migration, W = winter, and S = summer.

Table 3-24. Species for Which Essential Fish Habitat Has Been Designated in the Gulf of Alaska and Cook Inlet

Forage Fish	Groundfish	Flatfish	Rockfish	Salmon	Scallops
rainbow smelt	skates	yellowfin sole	thornyhead	sockeye	weathervane
eulochon	sculpin	rock sole	yelloweye	pink	pink scallops
capelin	sablefish	rex sole	shortraker and rougheye	coho	spiny scallops
sand lance	Pacific cod	Greenland turbot	Pacific ocean perch	chum	
myctophids	atka mackerel	flathead sole	northern	king	
bathylagids	walleye pollock	Dover sole	dusky		
sand fish	sharks	arrowtooth flounder			
euphausiids	octopus	Alaska plaice			
pholids	red squid				
stichaeids					
gonostomatids					

Note: Essential fish habitat for crab species are designated for the Bering Sea Aleutian Islands but not for Gulf of Alaska and Cook Inlet Planning Areas, so they are not included in table.

Table 3-25. Alaska Comparative Population and Income Measures

GEOGRAPHICAL AREA	1970	1980	1990	1998
State of Alaska				
median age of population	22.9	26.1	29.6	32.4
income factors				
number of families	66,670	96,840	134,806	
median income	$12,507	$28,395	$46,581	
mean income			$54,200	
per capita income			$21,191	$24,969
poverty factors				
no. families below poverty level	6,199	NA	9,198	
% persons below poverty level	13%	16%	9%	
Beaufort Sea and Northern Chukchi Sea Planning Areas				
North Slope Census Area				
median age of population	20.6	24.7	26.6	27.0
income factors				
number of families	433	994	1,688	
median income	$8,575	$31,378	$50,473	
mean income	$9,408	$35,507	$58,845	
per capita income			$23,422	$23,637
poverty factors				
no. families below poverty level	120	81	101	
% persons below poverty level	32%	11%	9%	
Southern Chukchi Sea and Hope Basin Planning Areas				
Kobuk Census Area/NW Arctic Bor.				
Median age of population	< 17	21.5	22.9	22.9
Income factors				
Number of families	694	1,149	1,543	
median income	$6,571	$17,756	$33,313	
mean income	$8,239	$21,069	$39,885	
Per capita income			$14,672	$18,938
Poverty factors				
No. families below poverty level	224	218	205	
% persons below poverty level	35%	27%	19%	

Table 3-25. Alaska Comparative Population and Income Measures (continued)

GEOGRAPHICAL AREA	1970	1980	1990	1998
Norton Basin Planning Areas				
Nome Census Area				
median age of population	NA	23.4	26.4	26.7
income factors				
number of families	1,010	1,758	2,407	
median income	$7,340	$14,550	$30,144	
mean income	$9,253	$19,728	$36,654	
per capita income			$13,864	$18,008
poverty factors				
no. families below poverty level	315	326	337	
% persons below poverty level	35%	28%	22%	
Cook Inlet Planning Area				
Kenai-Cook Inlet Census Area/Kenai Pen. Bor.				
median age of population	NA	26.3	31.3	35.4
Income factors				
Number of families	3,344	8,656	14,323	
median income	$12,969	$23,660	$42,403	
mean income	$14,150	$27,901	$50,816	
Per capita income			$21,102	$22,979
Poverty factors				
No. families below poverty level	239	568	640	
% persons below poverty level	9%	12%	8%	
Municipality of Anchorage				
median age of population	NA	26.3	30.1	32.1
Income factors				
Number of families	29,992	60,826	83,043	
median income	$13,593	$27,375	$43,946	
mean income	$15,059	$32,073	$52,809	
Per capita income			$24,664	$29,343
Poverty factors				
No. families below poverty level	1499	2677	3116	
% persons below poverty level	7%	7%	7%	

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992); Alaska Department of Labor (2000b); Williams (2000).

Table 3-26. State of Alaska Population Projections by Age, 1998-2025

Age	1998	2000	2005	2006	2010	2015	2020	2025
0 – 4	52,036	51,000	53,000	54,000	59,000	66,000	70,000	71,000
5 – 9	57,823	56,000	54,000	54,000	56,000	62,000	69,000	73,000
10 – 14	55,756	59,000	59,000	58,000	57,000	58,000	65,000	72,000
15 – 19	48,622	52,000	58,000	59,000	58,000	56,000	57,000	64,000
20 – 24	34,485	38,000	47,000	48,000	52,000	52,000	50,000	52,000
25 – 29	39,401	35,000	40,000	43,000	51,000	57,000	56,000	54,000
30 – 34	49,539	47,000	37,000	36,000	43,000	53,000	59,000	59,000
35 – 44	120,347	117,000	103,000	98,000	84,000	79,000	95,000	111,000
45 – 54	89,752	99,000	111,000	112,000	109,000	96,000	78,000	74,000
55 – 59	24,826	27,000	40,000	42,000	48,000	50,000	46,000	39,000
60 – 64	16,119	18,000	25,000	26,000	36,000	43,000	45,000	41,000
65+	32,694	36,000	44,000	47,000	58,000	78,000	103,000	124,000
Total	**621,400**	**635,000**	**670,000**	**679,000**	**709,000**	**751,000**	**793,000**	**833,000**
median age	32.4	32.9	33.4	33.2	32.4	32.2	32.4	32.7
males/100 females	108.3	107.9	106.8	106.6	105.8	104.7	103.8	102.9
youth dependency	50.2	49.6	47.7	47.5	46.5	48.9	53.2	56.6
aged dependency	8.3	8.9	10.5	10.9	13.0	17.4	22.7	27.5

Source: Alaska Department of Labor (1998).

Table 3-27. Alaska Population and Employment Composition

Population Variable	1970	1980	1990	1998	
total population	300,382	401,851	550,043	621,400	
percent change from previous period		33.8	36.9	13.0	
Age Structure (%)					
0 – 5	10.7	9.7	9.9	8.4	
6 – 15	23.6	17.2	17.2	18.3	
16 – 17	8.9	9.2	4.1	7.8	
18 – 24	11.8	11.2	2.6	5.5	
25 – 34	16.4	22.7	17.0	14.3	
35 – 44	12.7	13.4	21.5	19.4	
45 – 54	9.0	8.4	14.3	14.4	
55 – 64	4.6	5.3	7.1	6.6	
65 +	2.3	2.8	6.3	5.3	
Race and Ethnic Composition (%)					
White	78.8	77.6	75.5	73.9	
American Native	5.4	16.0	15.6	16.8	
African American	3.0	3.4	4.1	4.4	
Asian/Pacific Islander	0.9	2.1	3.6	4.9	
Other	11.9	0.9	1.2	0.0	
Education of Persons Age 25+ (%)					
number of persons	134,948	211,397	323,429		
0 – 8 years schooling	18.4	9.0	5.1		
9 – 11 years schooling	14.9	8.5	8.2		
high school graduates	37.7	38.9	28.7		
13 – 15 years schooling	14.9	22.6	34.9		
college graduates or more	14.1	21.1	23.0		
Labor Force Size (%)					
civilian	76.6	89.3	91.5		
military	23.4	10.7	8.5		
total (number)	131,553	204,682	293,957		
Employment by Occupation Sector (%)					
management and professional	24.6	28.6	30.0		
technical, sales, administrative support	34.6	30.5	30.7		
precision production, craft, repair	11.4	12.5	11.2		
operatives, fabricators, laborers	11.5	11.2	11.0		
farming, forestry, fishing	1.6	3.7	2.7		
service occupations	16.3	13.4	14.4	**ADOL Data**	
Employment by Industry Group (%)				**1990**	**1998**
agriculture, forestry, fishing	1.8	3.1	3.5	0.5	0.5
mining	2.5	2.9	3.6	4.9	3.8
construction	8.8	8.0	6.6	4.4	4.9
manufacturing	7.1	6.3	5.9	7.3	5.3
transportation, communications, utilities	11.6	11.2	10.7	8.7	9.4
wholesale and retail trade	18.8	17.6	19.2	19.5	20.8
finance	3.7	5.1	4.6	3.9	4.2
services	45.7	46.0	45.8	21.1	24.7
nonclassifiable (1998 ADOL data only)	--	--	--	0.3	0.1
total Government (1998 ADOL data only)	--	--	--	29.5	26.3

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992); Alaska Department of Labor (ADOL) (2000a,b).

Table 3-28. Beaufort Sea and Chukchi Sea Planning Areas Population and Employment Composition (North Slope Census Area)

Population Variable	1970	1980	1990	1998
total population	2,663	4,199	5,979	7,403
percent change from previous period		57.7	42.4	23.8
Age Structure (%)				
0 – 5	11.1	9.8	13.9	9.6
6 – 15	28.7	17.7	19.6	25.0
16 – 17	8.9	12.1	4.1	8.4
18 – 24	10.7	11.1	2.2	4.9
25 – 34	13.8	20.9	17.2	13.4
35 – 44	11.2	11.5	17.9	16.8
45 – 54	5.1	8.8	12.6	11.9
55 – 64	5.9	4.5	7.2	5.9
65 +	4.6	3.6	5.3	4.0
Race and Ethnic Composition (%)				
White	12.4	21.8	21.3	30.7
American Native	0.4	76.8	72.5	56.2
African American	0.5	0.3	0.7	1.7
Asian/Pacific Islander	0.1	0.8	4.8	11.4
Other	86.6	0.2	0.7	0.0
Education of Persons Age 25+ (%)				
number of persons	1033	960	3183	--
0 – 8 years schooling	72.5	9.2	19.0	--
9 – 11 years schooling	8.4	12.9	12.5	--
high school graduates	9.0	39.1	30.5	--
13 – 15 years schooling	3.6	19.1	23.9	--
college graduates or more	6.5	19.8	14.1	--
Labor Force Size (%)				
civilian	84.9	92.3	99.7	--
military	15.1	7.7	0.3	--
total (number)	713	2,031	2,964	--
Employment by Occupation Sector (%)				
management and professional	21.3	21.3	27.0	--
technical, sales, administrative support	15.5	20.6	26.4	--
precision production, craft, repair	18.5	22.7	15.7	--
operatives, fabricators, laborers	26.4	14.9	13.6	--
farming, forestry, fishing	0.0	0.7	0.2	--
service occupations	18.2	19.8	17.2	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	0.0	1.0	0.6	0.0
mining	10.1	5.1	4.9	45.4
construction	3.4	22.4	13.9	4.4
manufacturing	0.7	1.4	1.3	0.1
transportation, communications, utilities	12.2	11.7	12.1	5.1
wholesale and retail trade	12.0	7.8	8.1	6.5
finance	1.3	3.6	1.9	2.1
services	60.3	47.1	57.1	12.2
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	24.3

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).
[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-29. Hope Basin Planning Area Population and Employment Composition (Kobuk Census Area)

Population Variable	1970	1980	1990	1998
total population	10,217	11,368	14,401	16,246
percent change from previous period		11.3	26.7	12.8
Age Structure (%)				
0 – 5	12.7	11.5	14.1	11.2
6 – 15	30.6	21.4	21.4	24.6
16 – 17	10.7	11.7	4.7	8.5
18 – 24	7.3	10.3	2.8	5.5
25 – 34	12.4	17.4	15.9	12.9
35 – 44	9.4	9.7	16.6	15.6
45 – 54	7.9	8.1	10.0	10.6
55 – 64	5.2	5.1	7.0	5.4
65 +	3.9	5.0	7.3	5.6
Race and Ethnic Composition (%)				
White	17.1	17.6	19.9	15.3
American Native	0.3	81.9	78.9	83.5
African American	0.3	0.2	0.1	0.4
Asian/Pacific Islander	0.2	0.2	0.7	0.9
Other	82.2	0.1	0.4	0.0
Education of Persons Age 25+ (%)				
number of persons	3,940	8,182	7,195	--
0 – 8 years schooling	63.8	20.7	23.2	--
9 – 11 years schooling	8.4	10.2	12.3	--
high school graduates	13.1	34.9	32.6	--
13 – 15 years schooling	6.7	19.0	18.9	--
college graduates or more	8.2	16.5	13.1	--
Labor Force Size (%)				
civilian	89.6	97.7	98.5	--
military	10.4	2.3	1.5	--
total (number)	2,453	3,844	5,422	--
Employment by Occupation Sector (%)				
management and professional	38.1	34.2	32.5	--
technical, sales, administrative support	16.5	27.1	29.4	--
precision production, craft, repair	11.2	10.0	9.6	--
operatives, fabricators, laborers	14.6	7.9	0.0	--
farming, forestry, fishing	0.7	0.7	0.8	--
service occupations	18.9	20.1	18.7	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	1.5	0.6	0.9	0.1
mining	2.9	2.0	4.6	7.2
construction	3.9	4.5	3.4	2.3
manufacturing	2.2	1.6	1.2	0.4
transportation, communications, utilities	13.7	11.4	12.1	9.3
wholesale and retail trade	14.3	11.9	15.6	10.6
finance	0.4	2.5	1.9	6.2
services	61.1	65.4	60.3	27.0
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	37.0

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).

[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-30. Cook Inlet Planning Area Population and Employment Composition (Kenai-Cook Inlet Census Area, Kenai Peninsula Borough, Municipality of Anchorage, and Matanuska-Susitna Borough)

Population Variable	1970	1980	1990	1998
total population	138,792	199,713	267,140	307,597
percent change from previous period		43.9	33.8	15.1
Age Structure (%)				
0 – 5	10.6	9.4	9.4	8.3
6 – 15	27.5	16.9	16.3	17.4
16 – 17	8.5	8.9	4.2	7.5
18 – 24	6.8	11.3	2.6	5.7
25 – 34	17.2	23.3	16.9	15.0
35 – 44	14.9	14.1	22.0	19.6
45 – 54	9.5	8.7	15.0	14.6
55 – 64	3.7	5.2	7.5	6.6
65 +	1.4	2.1	6.1	5.2
Race and Ethnic Composition (%)				
White	90.8	86.6	82.3	79.9
American Native	1.6	5.4	6.5	7.9
African American	3.8	4.7	5.5	6.2
Asian/Pacific Islander	0.8	2.2	4.2	6.1
Other	3.0	1.0	1.4	0.0
Education of Persons Age 25+ (%)				
number of persons	6351	106,714	161,078	--
0 – 8 years schooling	10.3	4.6	3.0	--
9 – 11 years schooling	14.9	7.8	7.1	--
high school graduates	42.4	40.2	26.7	--
13 – 15 years schooling	17.1	24.7	37.7	--
college graduates or more	15.3	22.7	25.5	--
Labor Force Size (%)				
civilian	78.6	89.7	92.8	--
military	21.4	10.3	7.2	--
total (number)	625,98	106,888	149,507	--
Employment by Occupation Sector (%)				
management and professional	31.2	79.3	31.2	--
technical, sales, administrative support	27.3	10.1	33,7	--
precision production, craft, repair	15.4	3.5	10.5	--
operatives, fabricators, laborers	12.8	3.0	9.2	--
farming, forestry, fishing	0.2	0.4	1.5	--
service occupations	13.2	3.7	13.9	
Employment by Industry Group (%)[1]				
agriculture, forestry, fishing	0.7	1.7	0.3	0.5
mining	3.5	4.2	0.7	3.5
construction	10.4	8.0	0.8	5.4
manufacturing	4.0	3.9	0.6	2.6
transportation, communications, utilities	11.4	11.6	1.5	10.1
wholesale and retail trade	21.2	19.6	2.8	24.0
finance	5.0	7.2	74.7	4.9
services	43.6	43.7	18.6	26.7
nonclassifiable (1998 ADOL data only)	--	--	--	0.0
total government (1998 ADOL data only)	--	--	--	22.2

Source: U.S. Department of Commerce, Bureau of the Census (1973, 1983, 1992).

[1] 1998 data: Alaska Department of Labor (ADOL) (2000a,b).

Table 3-31. Threatened or Endangered Marine Mammals in the Pacific Region

Species	Status[a]
ORDER CETACEA	
Suborder Mysticeti (baleen whales)	
Family Balaenidae	
Balaena (Eubalaena) glacialis (includes *australis*) (right whale)	E
Family Balaenopteridae	
Balaenoptera borealis (sei whale)	E
Balaenoptera musculus (blue whale)	E
Balaenoptera physalus (fin whale)	E
Megaptera novaeangliae (humpback whale)	E
Suborder Odontoceti (toothed whales and dolphins)	
Family Physeteridae	
Physeter macrocephalus (sperm whale)	E
ORDER CARNIVORA	
Family Otariidae	
Arctocephalus townsendi (Guadalupe fur seal)	T
Eumetopias jubatus (Steller [=northern] sea lion)	T[b]
Family Mustelidae	
Enhydra lutris nereis (southern sea otter)	T[c]

Sources: State of California, The Resources Agency, Department of Fish and Game (2000); U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (2001a).

[a] Status: E = endangered, T = threatened under the Endangered Species Act of 1973. Individual Pacific states (e.g., California, Washington) may also designate individual marine mammal species as endangered, threatened, rare, or candidate species under state law.

[b] The Steller sea lions inhabiting the Pacific OCS Region belong to the eastern population, which is still listed as threatened. The western population, all of which is in Alaska, was reclassified as endangered in 1997.

[c] Only the southern California population of the sea otter is threatened. A population established in Washington using translocated Alaskan sea otters is not federally listed.

Table 3-32. Marine Resources of Concern in California

Northern California	Central California	Southern California
Redwood National Park ASBS	Central California Biosphere Reserve	Channel Islands Biosphere Reserve*
Redwood National Park	Gulf of the Farallones NMS*	Channel Islands NMS*
Kelp Beds at Trinidad Head ASBS	Pt. Reyes National Seashore	Channel Islands National Park*
Kings Range MRPA Ecological Reserve	Bird Rock ASBS*	Santa Barbara Channel Ecological Preserve*
King Range National Conservation Area ASBS	Pt. Reyes Headlands Reserve and Extension Area ASBS*	San Miguel Island Ecological Reserve*
MacKerricher State Park	Pt. Reyes Headlands Reserve*	Santa Barbara Island Ecological Reserve*
Pygmy ASBS	Pt. Reyes Headlands National Research Natural Area*	Anacapa Island Ecological Reserve*
Pt. Cabrillo Reserve	Double Point ASBS*	San Miguel, Santa Rosa, and Santa Cruz Islands ASBS*
Russian Gulch State Park	Duxbury Reef ASBS*	Santa Barbara and Anacapa Islands ASBS*
Van Damme State Park	Duxbury Reef Reserve*	San Nicolas and Begg Rock ASBS*
Manchester State Park	Farallon Island ASBS*	Big Sycamore Canyon MRPA Ecological Reserve
Arena Rock Natural Preserve	Farallon Islands Game Refuge*	Mugu Lagoon to Latigo Point ASBS
Kelp Beds at Saunders Reef ASBS	Monterey Bay NMS	Abalone Cove Ecological Reserve
Del Mar Landing Ecological Reserve ASBS	Golden Gate National Recreation Area	Point Fermin Marine Life Refuge*
Del Mar Landing Ecological Reserve	James V. Fitzgerald Marine Reserve ASBS	Santa Catalina Island-Subarea One
Salt Point State Park	James V. Fitzgerald Marine Reserve	Catalina Science Marine Life Refuge
Gerstle Cove ASBS	Ano Nuevo Point and Island ASBS	Santa Catalina Island-Subarea Two
Gerstle Cove Reserve	Pacific Grove Marine Gardens Fish Refuge and Hopkins Marine Life Refuge ASBS	Santa Catalina Island-Subarea Three
Fort Ross State Historic Park	Hopkins Marine Life Refuge	Farnsworth Bank Ecological Reserve
Sonoma Coast State Beach	Pacific Grove Marine Gardens Fish Refuge	Lovers Cove Reserve
Bodega Marine Life Refuge ASBS	Carmel Bay Ecological Reserve ASBS	Santa Catalina Island-Subarea Four
Bodega Marine Life Refuge	Carmel Bay Ecological Reserve	San Clemente Island ASBS
Cordell Banks NMS	California Sea Otter Game Refuge	Newport Marine Life Refuge

Table 3-32. Marine Resources of Concern in California (Continued)

Northern California	Central California	Southern California
	Point Lobos Ecological Reserve ASBS	Newport Marine Life Refuge ASBS
	Point Lobos Ecological Reserve	Crystal Cove State Park
	Point Lobos Reserve	Irvine Coast Marine Life Refuge
	Julia Pfeiffer Burns Underwater Park ASBS	Irvine Coast Marine Life Refuge ASBS
	Julia Pfeiffer Burns State Park	Laguna Beach Marine Life Refuge
	Big Creek MRPA Ecological Reserve	Heisler Park Ecological Reserve
	Ocean Area Surrounding the Mouth of Salmon Creek ASBS	Heisler Park Ecological Reserve ASBS
	Atascadero Beach Pismo Clam Preserve (Clam Refuge)	South Laguna Beach Marine Life Refuge
	Morro Beach Pismo Clam Preserve (Clam Refuge)	Niguel Marine Life Refuge
	Pismo Invertebrate Reserve	Dana Point Marine Life Refuge
	Pismo-Oceano Beach Pismo Clam Preserve (Clam Refuge)	Doheny State Beach
	Vandenberg MRPA Ecological Reserve	Doheny Marine Life Refuge
		City of Encinitas Marine Life Refuge
		Cardiff and Elijo State Beaches
		San Diego-La Jolla City Underwater Park
		San Diego Marine Life Refuge
		Scripps Coastal Reserve
		San Diego Marine Life Refuge ASBS
		San Diego-La Jolla Ecological Reserve
		San Diego-La Jolla Ecological Reserve ASBS
		Cabrillo National Monument
		Point Loma Reserve

Abbreviations: ASBS = area of special biological significance; MRPA = Marine Resources Protection Act; and NMS = national marine sanctuary.

Note (1): Resources denoted by an asterisk (*) may be at greater risk of oil-spill impact due to their location relative to port operations at Los Angeles and San Francisco, or vessel traffic lanes approaching these ports.

Note (2): In addition to federally or State-designated parks and/or monuments, the State of California has established a broad category for unique, sensitive, or valuable marine resource areas, including ASBS's,, ecological reserves, marine life refuges, and reserves and preserves. Combined, these marine resources have been designated as California Marine Protected Areas (CMPA's). While there may be some overlap in the future, CMPA's should be considered distinct from (yet to be federally-designated) marine protected areas (MPA's). The mechanism for establishing MPA's was implemented by President Clinton under Executive Order 13198 in May 2000.

Table 4-1a. The Proposed Action (Alternative 1) – Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	2
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.10 – 0.17
Gas Production (Tcf)	4.05 – 7.20	7.95 – 16.50	0.405 – 0.68
Years of Activity	40	40	40
Platforms	50 – 75	130 – 240	2 – 3
Exploration and Delineation Wells	185 – 575	555 – 1,235	17 – 26
Development and Production Wells	490 – 825	890 – 1,760	30 – 52
Miles of Pipeline	500 – 1,500	800 – 2,400	200 – 350
Landfalls	0 – 5	0 – 5	1 – 2 (gas only)
Vessel Trips/Week	60 – 100	175 – 350	3 – 5
Helicopter Trips/Week	75 – 125	225 – 425	4 – 6
New Shore Bases	0 – 3	0 – 1	0
New Process Facilities	0	0	0
New Waste Facilities	2	4	0
Drill Muds/Well (bbl)			
Exploration/Delineation	7,860	7,860	7,860
Development/Production	5,800	5,800	5,800
Drill Cuttings/Well (bbl)			
Exploration/Delineation	2,680	2,680	2,680
Development/Production	1,630	1,630	1,630
Produced Water/Well (bbl)			
Oil Well	450	450	450
Gas Well	68	68	68
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	4 – 6
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	280 – 490
Platform Removals with Explosives	40 – 60	100 – 190	0

Table 4-1b. The Proposed Action (Alternative 1) – Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	**Chukchi Sea**	**Hope Basin**	**Cook Inlet**	**Norton Basin**
Sales	3	2	2	2	1
Oil Production (BBO)	1.02 – 1.71	0.96 – 2.42	0.010 – 0.020 (condensate)	0.28 – 0.34	0.005 – 0.008 (condensate)
Gas Production (Tcf)	None	None	0.290 – 0.714	0.38 – 0.58	0.260 – 0.400
Years of Activity	30	35	25	35	20
Platforms	6 – 12	2 – 8	2	2 – 6	1
Exploration and Delineation Wells	18 – 30	6 – 24	6 – 10	8 – 18	3 – 5
Development and Production Wells	190 – 325	106 – 320	8 – 18	84 – 108	7 – 10
Miles of Onshore Pipeline	60 – 120	330	0	75	0
Miles of Offshore Pipeline	125 – 160	100 - 260	50 – 100	40 – 125	25 – 55
Landfalls	2	1	1	2 – 4	1
Vessel Trips/Week	3 – 6	1 – 4	1	2 – 8	1
Helicopter Trips/Week	30 – 60	10 - 40	10	10 – 40	5
New Shore Bases	0	1	1	0	1
New Process Facilities	2	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill Muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	18 – 36	6 – 24	6	4 – 12	3
Bottom Area Disturbed – Pipelines (ha)	95 – 120	75 – 195	40 – 75	30 – 95	20 – 40
Platform Removals with Explosives	0	0	0	0	0

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drilling muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4-1c. Oil-Spill Rates for Spill Sources (Spill/Billion Barrels)

Spill Source	Spills ≥ 1,000 bbl		Spills ≥ 10,000 bbl	
	Spill Rate Entire Record[1]	Spill Rates for Last 15 Years[2]	Spill Rates Entire Record[1]	Spill Rates for Last 15 Years[2]
OCS Platforms	0.32	<0.13	0.12	<0.05
OCS Pipelines	1.33	1.38	0.33	0.34
Tankers U.S. Waters	1.03	0.72	0.43	0.25
ANS[3] Crude Tankers	0.88	0.92	0.23	0.34

NOTE: Spill rates are expressed as number of spills (greater than or equal to a certain size) per billion barrels (Bbbl) handled (Bbbl = 1,000,000,000 bbl). Spills ≥ 10,000 bbl are a subset of spills ≥ 1,000 bbl.

[1] Entire record: OCS platforms & pipelines spill rates calculated on 1964-1999 data; tankers in U.S. waters and ANS tankers spill rates calculated on 1974 – 1999 data.

[2] Last 15 Years: spill rates calculated on 1985 – 1999 data.

[3] ANS = Alaska North Slope crude oil tankers; spill rates based on historic spills from carriers of ANS crude.

Source: Anderson and LaBelle (2001).

Table 4-1d. Oil-Spill Rates for OCS Planning Areas (by Production/Transportation)

Region	Production/Transportation Scenario	Entire Record	Last 15 Years[2]
Spills ≥ 1,000 bbl			
WGOM, CGOM	100% Platform, 90% Pipeline 10% Tanker U.S. Waters	1.62	1.44
EGOM, Cook Inlet	100% Platform, 100% Pipeline	1.65	1.51
Beaufort, Chukchi Norton Basin	100% Platform, 100% Pipeline, 100% ANS[3] Tankers	2.53	2.43
Spills ≥ 10,000 bbl			
WGOM, CGOM	100% Platform, 90% Pipeline 10% Tanker U.S. Waters	0.46	0.38
EGOM, Cook Inlet	100% Platform, 100% Pipeline	0.45	0.39
Beaufort, Chukchi Norton Basin	100% Platform, 100% Pipeline, 100% ANS[3] Tankers	0.68	0.73
Spills ≥ 500[3] bbl Using Onshore North Slope Rate & Trans-Alaska Pipeline System (TAPS) Rate **1985 – 1998:** facilities – 0.48, pipelines – 0.12, total – 0.60 spills/Bbbl **1985 – 1998:** TAPS – 0.12 spills/Bbbl			
Beaufort, Chukchi Norton Basin	100% Platform, 100% Pipeline 100% TAPS, 100% ANS[4] Crude Tankers 1,000+ bbl Spills		1.64
Cook Inlet	100% Platform, 100% Pipeline, No TAPS, No ANS[4] Tankers		0.60

Note: Spill rates are expressed as number of spills (greater than or equal to a certain size) per billion barrels (Bbbl) handled (Bbbl = 1,000,000,000 bbl). Spills ≥ 10,000 bbl are a subset of spills ≥ 1,000 bbl.

WGOM, CGOM, EGOM = Western, Central, and Eastern Gulf of Mexico

[1] Entire record: OCS platforms & pipelines spill rates are calculated on 1964 – 1999 data; tankers in U.S. waters and ANS tankers spill rates are calculated on 1974 – 1999 data; OCS platform and pipeline data are based on U.S. Gulf of Mexico and offshore California data.

[2] Last 15 years: spill rates calculated on 1985 – 1999 data.

[3] ANS = Alaska North Slope crude oil tankers; spill rates based on historic spills from carriers of ANS crude.

[4] Areas in Alaska have an alternative estimate of the number of spills likely to occur by using Alaska data for the platform and pipeline spill occurrence estimates. Estimates of the mean number of spills and the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985 – 1998 data of ≥ 500 bbl and greater from Alaska onshore North Slope facilities and pipelines in the TAPS. Using these rates as a proxy for spills ≥ 1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills ≥ 1,000 bbl since spill occurrence frequency varies inversely to spill size. Spill rates from ANS crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Source: Anderson and LaBelle (2001).

Table 4.1e. The Proposed Action (Alternative 1) – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region			Alaska Region				Pacific Region
	Western	Central	Eastern	Beaufort Sea	Chukchi Sea	Cook Inlet	Gulf of Alaska	
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.10 – 0.17	1.02 – 1.71	0.96 – 2.42	0.28 – 0.34	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large Oil Spills from OCS Activity*	1 Shallow Platform Spill 1 Deep Pipeline Spill	1 Shallow Platform Spill 1 Shallow, 1 Deep Pipeline Spills 1 Deep Tanker Spill	1 Shallow Pipeline Spill	1 Platform Spill 1 Pipeline Spill	1 Platform Spill 2 Pipeline Spills in Chukchi	1 Pipeline Spill	1 Tanker Spill (Arctic OCS production)	1 Tanker Spill (Arctic OCS production)
Prob. 1 + Spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 – 85%	86 – 99%	14 – 23%	81 – 94%	up to 98%	16 – 18%	–	–
Spills < 50 bbl Mean No. Spills	60 – 120	125 – 300	9 – 15	90 – 150	85 – 220	25 – 30	–	–
Prob. 1+ Spills**	**	**	**	**	**	**		
Spills 50 –999 bbl Mean No. Spills	5 – 9	10 – 23	1	7 – 12	7 – 17	2 – 3	–	–
Prob. 1+ Spills**	99 – **%	**	50 – 69%	**	**	85 – 90%		

* Large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1 – 49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50 – 999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of spills ≥ 500 bbl from Alaska onshore North Slope facilities and pipelines in the Trans-Alaska Pipeline System. Using these rates as a proxy for spills ≥ 1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills ≥ 1,000 barrels since spill occurrence frequency varies inversely to spill size. Spill rates from ANS crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-2a. Slow the Pace of Leasing (Alternative 2) – Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	1
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.065 – 0.085
Gas Production (Tcf)	4.05 – 7.20	7.95 – 16.50	0.265 – 0.340
Years of Activity	40	40	40
Platforms	50 – 75	130 – 240	1 – 2
Exploration and Delineation Wells	185 – 575	555 – 1,235	11 – 13
Development and Production Wells	490 - 825	890 – 1,760	19 – 27
Miles of Pipeline	500 – 1,500	800 – 2,400	150 – 200
Landfalls	up to 5	up to 5	1
Vessel Trips/Week	60 – 100	175 – 350	2 – 3
Helicopter Trips/Week	75 – 125	225 – 425	2 – 4
New Shore Bases	up to 3	0 – 1	0
New Process Facilities	0	0	0
New Waste Facilities	1	3	0
Drill Muds/Well (bbl)			
Exploration/Delineation	7,860	7,860	7,860
Development/Production	5,800	5,800	5,800
Drill Cuttings/Well (bbl)			
Exploration/Delineation	2,680	2,680	2,680
Development/Production	1,630	1,630	1,630
Produced Water/Well (bbl)			
Oil Well	450	450	450
Gas Well	68	68	68
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	2 – 4
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	210 – 280
Platform Removals with Explosives	40 – 60	100 – 190	0

Table 4-2b. Slow the Pace of Leasing (Alternative 2) – Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	**Chukchi Sea**	**Hope Basin**	**Cook Inlet**	**Norton Basin**
Sales	1 or 2*	1	1	1	1
Oil Production (BBO)	0.68 – 1.14	0.96 – 1.21	0.005 – 0.010 (condensate)	0.14 – 0.17	0.005 – 0.008 (condensate)
Gas Production (Tcf)	None	None	0.145 – 0.357	0.19 – 0.29	0.260 – 0.400
Years of Activity	25	30	20	30	20
Platforms	4 – 8	2 – 4	1	1 – 3	1
Exploration and Delineation Wells	12 – 20	6 – 12	3 – 5	4 – 9	3 – 5
Development and Production Wells	130 – 220	106 – 160	4 – 9	42 – 54	7 – 10
Miles of Onshore Pipeline	60 – 120	330	0	75	0
Miles of Offshore Pipeline	125 – 200	100 – 160	20 – 70	25 – 75	25 – 55
Landfalls	2	1	1	1 – 2	1
Vessel Trips/Week	2 – 4	1 – 2	1	1 – 4	1
Helicopter Trips/Week	20 – 40	10 - 20	5	5 – 20	5
New Shore Bases	0	1	1	0	1
New Process Facilities	2	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	12 – 24	6 – 12	3	2 – 8	3
Bottom Area Disturbed – Pipelines (ha)	95 – 150	75 – 120	15 – 50	20 – 70	20 – 40
Platform Removals with Explosives	0	0	0	0	0

* Amount of oil and gas production and levels of activity in the Beaufort Sea assume 2 sales.

Table 4.2c. Slow the Pace of Leasing (Alternative 2) – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region			Alaska Region				Pacific Region
	Western	Central	Eastern	Beaufort Sea	Chukchi Sea	Cook Inlet	Gulf of Alaska	
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.065 – 0.085	0.68 – 1.14	0.96 – 1.21	0.14 – 0.17	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large Oil Spills From OCS Activity*	1 Shallow Platform Spill 1 Deep Pipeline Spill	1 Shallow Platform Spill 1 Shallow, 1 Deep Pipeline Spills 1 Deep Tanker Spill	1 Shallow Pipeline Spill	1 Pipeline Spill	1 Platform Spill 1 Pipeline Spill in Chukchi	1 Pipeline Spill	1 Tanker Spill (Arctic OCS production)	1 Tanker Spill (Arctic OCS production)
Prob. 1 + Spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 – 85%	86 – 99%	10 – 12%	67 – 85%	79 – 86%	8 – 10%	–	–
Spills < 50 bbl								
Mean No. Spills	60 – 120	125 – 300	6 – 8	60 – 100	85 – 110	13 – 15	–	–
Prob. 1+ Spills**	**	**	**	**	**	**		
Spills 50 –999 bbl								
Mean No. Spills	5 – 9	10 – 23	1	5 - 8	7 – 8	1	–	–
Prob. 1+ Spills**	99 – **%	**	50 – 69%	**	**	62 – 69%		

* Large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1 – 49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50 – 999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of spills ≥ 500 bbl from Alaska onshore North Slope facilities and pipelines in the Trans-Alaska Pipeline System. Using these rates as a proxy for spills ≥ 1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills ≥ 1,000 barrels since spill occurrence frequency varies inversely to spill size. Spill rates from ANS crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-3a. Exclude Some Planning Areas (Alternative 3) – Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	None
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	None
Gas Production (Tcf)	4.05 – 7.20	7.95 – 16.50	None
Years of Activity	40	40	–
Platforms	50 – 75	130 – 240	–
Exploration and Delineation Wells	185 – 575	555 – 1,235	–
Development and Production Wells	490 – 825	890 – 1,760	–
Miles of Pipeline	500 – 1,500	800 – 2,400	–
Landfalls	0 – 5	0 – 5	–
Vessel Trips/Week	60 – 100	175 – 350	–
Helicopter Trips/Week	75 – 125	225 – 425	–
New Shore Bases	0 – 3	0 – 1	–
New Process Facilities	0	0	–
New Waste Facilities	2	4	–
Drill Muds/Well (bbl)			–
Exploration/Delineation	7,860	7,860	
Development/Production	5,800	5,800	
Drill Cuttings/Well (bbl)			–
Exploration/Delineation	2,680	2,680	
Development/Production	1,630	1,630	
Produced Water/Well (bbl)			–
Oil Well	450	450	
Gas Well	68	68	
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	–
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	–
Platform Removals with Explosives	40 – 60	100 – 190	–

Table 4-3b. Exclude Some Planning Areas (Alternative 3) – Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	**Chukchi Sea**	**Hope Basin**	**Cook Inlet**	**Norton Basin**
Sales	3	2	None	2	None
Oil Production (BBO)	1.02 – 1.71	0.96 – 2.42	None	0.28 – 0.34	None
Gas Production (Tcf)	None	None	None	0.38 – 0.58	None
Years of Activity	30	35	–	35	–
Platforms	6 – 12	2 – 8	–	2 – 6	–
Exploration and Delineation Wells	18 – 30	6 – 24	–	8 – 18	–
Development and Production Wells	190 – 325	106 – 320	–	84 – 108	–
Miles of Onshore Pipeline	60 – 120	330	–	75	–
Miles of Offshore Pipeline	125 – 160	100 – 260	–	40 – 125	–
Landfalls	2	1	–	2 – 4	–
Vessel Trips/Week	3 – 6	1 – 4	–	2 – 8	–
Helicopter Trips/Week	30 – 60	10 – 40	–	10 – 40	–
New Shore Bases	0	1	–	0	–
New Process Facilities	2	1	–	0	–
New Waste Facilities	0	1	–	0	–
Drill Muds/Well (bbl)			–		–
Exploration/Delineation	255	565		435	
Development/Production	290	320		220	
Drill Cuttings/Well (bbl)			–		–
Exploration/Delineation	1,520	1,970		1,275	
Development/Production	2,550	2,830		1,600	
Bottom Area Disturbed – Platforms (ha)	18 – 36	6 – 24	–	4 – 12	–
Bottom Area Disturbed – Pipelines (ha)	95 – 120	75 – 195	–	30 – 95	–
Platform Removals with Explosives	0	0	–	0	–

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drilling muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4.3c. Exclude Some Planning Areas (Alternative 3) – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region			Alaska Region				Pacific Region
	Western	Central	Eastern	Beaufort Sea	Chukchi Sea	Cook Inlet	Gulf of Alaska	
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	None	1.02 – 1.71	0.96 – 2.42	0.28 – 0.34	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large Oil Spills from OCS Activity*	1 Shallow Platform Spill 1 Deep Pipeline Spill	1 Shallow Platform Spill 1 Shallow, 1 Deep Pipeline Spills 1 Deep Tanker Spill	–	1 Platform Spill 1 Pipeline Spill	1 Platform Spill 2 Pipeline Spills in Chukchi	1 Pipeline Spill	1 Tanker Spill (Arctic OCS production)	1 Tanker Spill (Arctic OCS production)
Prob. 1 + Spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 – 85%	86 – 99%		81 – 94%	up to 98%	16 – 18%	–	–
Spills < 50 bbl Mean No. Spills Prob. 1+ Spills**	60 – 120 **	125 – 300 **	–	90 – 150 **	85 – 220 **	25 – 30 **	–	–
Spills 50 –999 bbl Mean No. Spills Prob. 1+ Spills**	5 – 9 99 – **%	10 – 23 **	–	7 – 12 **	7 – 17 **	2 – 3 85 – 90%	–	–

* Large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1 – 49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50 – 999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of spills ≥ 500 bbl from Alaska onshore North Slope facilities and pipelines in the Trans-Alaska Pipeline System. Using these rates as a proxy for spills ≥ 1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills ≥ 1,000 barrels since spill occurrence frequency varies inversely to spill size. Spill rates from ANS crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-4a. Accelerated Leasing (Alternative 4) – Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Sales	5	5	3
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.124 – 0.255
Gas Production (Tcf)	4.05 – 7.20	7.95 – 16.50	0.495 – 1.02
Years of Activity	40	40	45
Platforms	50 – 75	130 – 240	3 – 5
Exploration and Delineation Wells	185 – 575	555 – 1,235	21 – 39
Development and Production Wells	490 – 825	890 – 1,760	38 – 78
Miles of Pipeline	500 – 1,500	800 – 2,400	250 – 400
Landfalls	up to 5	up to 5	1 – 3 (gas only)
Vessel Trips/Week	60 – 100	175 – 350	5 – 8
Helicopter Trips/Week	75 – 125	225 – 425	6 – 10
New Shore Bases	up to 3	0 – 1	0
New Process Facilities	0	0	0
New Waste Facilities	2	4	0
Drill Muds/Well (bbl)			
Exploration/Delineation	7,860	7,860	7,860
Development/Production	5,800	5,800	5,800
Drill Cuttings/Well (bbl)			
Exploration/Delineation	2,680	2,680	2,680
Development/Production	1,630	1,630	1,630
Produced Water/Well (bbl)			
Oil Well	450	450	450
Gas Well	68	68	68
Bottom Area Disturbed – Platforms (ha)	75 – 115	200 – 350	6 – 10
Bottom Area Disturbed – Pipeline (ha)	700 – 2,000	1,100 – 3,300	350 – 560
Platform Removals with Explosives	40 – 60	100 – 190	0

* Different than the Proposal (alternative 1)

Table 4-4b. Accelerated Leasing (Alternative 4) – Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	**Chukchi Sea**	**Hope Basin**	**Cook Inlet**	**Norton Basin**
Sales	5	2	2	2	1
Oil Production (BBO)	1.70 – 2.85	0.96 – 2.42	0.010 – 0.020 (condensate)	0.28 – 0.34	0.005 – 0.008 (condensate)
Gas Production (Tcf)	None	None	0.290 – 0.714	0.38 – 0.58	0.260 – 0.400
Years of Activity	35	35	25	35	20
Platforms	10 – 20	2 – 8	2	2 – 6	1
Exploration and Delineation Wells	30 – 50	6 – 24	6 – 10	8 – 18	3 – 5
Development and Production Wells	320 – 545	106 – 320	8 – 18	84 – 108	7 – 10
Miles of Onshore Pipeline	75 – 130	330	0	75	0
Miles of Offshore Pipeline	140 – 180	100 – 260	50 – 100	40 – 125	25 – 55
Landfalls	2 – 3	1	1	2 – 4	1
Vessel Trips/Week	5 – 10	1 – 4	1	2 – 8	1
Helicopter Trips/Week	50 – 100	10 – 40	10	10 – 40	5
New Shore Bases	0	1	1	0	1
New Process Facilities	2 – 3	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill Muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	30 – 60	6 – 24	6	4 – 12	3
Bottom Area Disturbed – Pipelines (ha)	100 – 135	75 – 195	40 – 75	30 – 95	20 – 40
Platform Removals with Explosives	0	0	0	0	0

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drilling muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4.4c. Accelerated Leasing (Alternative 4) – Oil Spill Assumptions

Scenario Elements	Gulf of Mexico Region			Alaska Region				Pacific Region
	Western	Central	Eastern	Beaufort Sea	Chukchi Sea	Cook Inlet	Gulf of Alaska	
Oil Production (BBO)	0.68 – 1.31	1.38 – 3.27	0.124 – 0.255	1.70 – 2.85	0.96 – 2.42	0.28 – 0.34	0	0
Years of Activity	40	40	40	35	40	25	N/A	N/A
Large Oil Spills from OCS Activity*	1 Shallow Platform Spill 1 Deep Pipeline Spill	1 Shallow Platform Spill 1 Shallow, 1 Deep Pipeline Spills 1 Deep Tanker Spill	1 Shallow Pipeline Spill	1 Platform Spill 2 Pipeline Spills	1 Platform Spill 2 Pipeline Spills in Chukchi	1 Pipeline Spill	1 Tanker Spill (Arctic OCS production)	1 Tanker Spill (Arctic OCS production)
Prob. 1 + Spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	62 – 85%	86 – 99%	17 – 32%	94 – 99%	up to 98%	16 – 18%	–	–
Spills < 50 bbl Mean No. Spills Prob. 1+ Spills**	60 – 120 **	125 – 300 **	11 – 23 **	155 – 260 **	85 – 220 **	25 – 30 **	–	–
Spills 50 –999 bbl Mean No. Spills Prob. 1+ Spills**	5 – 9 99 – **%	10 – 23 **	1 – 2 57 – 83%	12 – 20 **	7 – 17 **	2 – 3 85 – 90%	–	–

* Large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1 – 49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50 – 999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of spills ≥ 500 bbl from Alaska onshore North Slope facilities and pipelines in the Trans-Alaska Pipeline System. Using these rates as a proxy for spills ≥ 1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills ≥ 1,000 barrels since spill occurrence frequency varies inversely to spill size. Spill rates from ANS crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-5a. Oil Consumption by End-Use Sector

End-Use Sector	Transportation	Industrial	Residential and Commercial	Electricity Generation	Total
1999 Consumption (quadrillion Btu)	25.4	9.6	2.1	.9	38.0
The Sector as a Percentage of Total 1999 Oil Consumption	66.9%	25.2%	5.5%	2.5%	100.0%
Oil as a Percentage of the Sector (1999)	96.9%	26.8%	5.9%	2.3%	39.1%

Source: U.S. Department of Energy, Energy Information Administration (2001).

Table 4-5b. Natural Gas Consumption by End-Use Sector

End-Use Sector	Industrial	Residential and Commercial	Electricity Generation	Transpor-tation	Total
1999 Consumption (quadrillion Btu)	10.4	8.0	3.2	.8	22.3
Sector As a Percentage of Total 1999 Gas Consumption	46.5%	35.8%	14.2%	3.4%	100.0%
Gas As a Percentage of the Sector (1999)	29.1%	22.8%	8.9%	2.9%	23.0%

Source: U.S. Department of Energy, Energy Information Administration (2001).

Table 4-5a. Oil Consumption by End-Use Sector

End-Use Sector	Transportation	Industrial	Residential and Commercial	Electricity Generation	Total
1999 Consumption (quadrillion Btu)	25.4	9.6	2.1	.9	38.0
The Sector as a Percentage of Total 1999 Oil Consumption	66.9%	25.2%	5.5%	2.5%	100.0%
Oil as a Percentage of the Sector (1999)	96.9%	26.8%	5.9%	2.3%	39.1%

Source: U.S. Department of Energy, Energy Information Administration (2001).

Table 4-5b. Natural Gas Consumption by End-Use Sector

End-Use Sector	Industrial	Residential and Commercial	Electricity Generation	Transpor-tation	Total
1999 Consumption (quadrillion Btu)	10.4	8.0	3.2	.8	22.3
Sector As a Percentage of Total 1999 Gas Consumption	46.5%	35.8%	14.2%	3.4%	100.0%
Gas As a Percentage of the Sector (1999)	29.1%	22.8%	8.9%	2.9%	23.0%

Source: U.S. Department of Energy, Energy Information Administration (2001).

Table 4-5c. Most Likely Response to No Action (Alternative 5)

Sector	% of OCS Production		Quantity Involved	
	Low	High	Low	High
Oil				
OCS Production (BBO)	-100%	-100%	-3.1	-9.2
Onshore Production (BBO)	3%	3%	0.1	0.2
Imports (BBO)	86%	88%	2.7	8.1
Conservation (BBOE)	7%	6%	0.2	0.5
Switch to Gas (BBOE)	5%	4%	0.2	0.4
Gas				
OCS Production (TCFG)	-100%	-100%	-9.3	-17.7
Onshore Production (TCFG)	26%	28%	2.4	4.9
Imports (TCFG)	16%	16%	1.4	2.8
Conservation (TCFGE)	17%	16%	1.6	2.9
Switch to Oil (TCFGE/BBOE)	42%	40%	3.8/0.7	7.1/1.3
Induced Oil Imports (BBO)	NA	NA	0.6	1.1

BBO = billion barrels of oil
BBOE = the Btu equivalent of billion barrels of oil
TCFG = trillion cubic feet of natural gas
TCFGE = the Btu equivalent of trillion cubic feet of natural gas

Table 4-5d. No Action (Alternative 5) – Oil-Spill Assumptions

Variables	Gulf of Mexico	Alaska	Pacific
Total Imports (BBO)	1.29 – 4.06[1]	0.12 – 0.22[2]	2.04 – 4.50
# of Spills $\geq$ 1000 bbl[3]	1 Spill	No Spills	1 Spill
Probability of 1 or More Spills $\geq$ 1000 bbl	54 – 91%	7 – 12%	71 – 93%

[1] Energy markets will respond to the loss of OCS natural gas production under the no-action alternative by switching to an array of energy alternatives. The MMS MarketSim2000 model estimates that on an energy equivalent basis of 40—42% of the lost gas will be replaced by switching to oil. According to the model, about 86 percent of the additional oil demand will consist of additional oil imports. Additional imports will lead to potential additional oil spills. The import estimates for the Gulf of Mexico include imports resulting from switching from natural gas to oil under the no-action alternative.

[2] The oil replacing anticipated OCS production refined in Alaska would not be imported. It would be Alaska North Slope (ANS) oil tankered from Valdez to the refinery at Nikiski. Furthermore, on April 28, 1996, President Clinton signed an order permitting the export of ANS oil. Because this oil is required to remain at least 200 miles from the coast, it is not expected to have any negative environmental impacts outside the Prince William Sound area. The no-action alternative can be expected to diminish the oil available for export; however, this reduction in exports is not expected to make any significant change in oil spills or their environmental impacts.

[3] The import spills were estimated using half of the 0.72 spill/BBO rate for tankers in U.S. waters (based on 1985—1999 spill data). Spills associated with the first half of the import tanker trips are assumed to occur outside U.S. waters.

Table 4-6a. Cumulative Case - Exploration and Development Scenario for the Gulf of Mexico Region

Scenario Elements	Gulf of Mexico Region		
	Western	Central	Eastern
Oil Production (BBO)	3.35 – 5.53	12.01 – 16.53	0.139 – 0.37
Gas Production (Tcf)	42.66 – 58.17	108.27 – 146.27	1.406 – 2.456
Years of Activity	60	60	50
Platforms	620 – 855	2,360 – 3,130	4 – 7
Exploration and Delineation Wells	1,840 – 2,670	7,110 – 8,580	38 – 73
Development and Production Wells	4,510 – 5,860	12,550 – 15,050	60 – 136
Miles of Pipeline	1,500 – 4,500	2,400 – 7,200	350 – 500
Landfalls	0 – 5	0 – 5	2 – 4 (gas only)
Vessel Trips/Week	930 – 1,280	3,540 – 4700	6 – 11
Helicopter Trips/Week	1,240 – 1,700	4,700 – 6,250	8 – 14
New Shore Bases	0 – 3	0 – 1	1
New Process Facilities	0 – 1	0 – 1	1
New Waste Facilities	4	9	1
Drill Muds/Well (bbl)			
Exploration/Delineation	7,860	7,860	7,860
Development/Production	5,800	5,800	5,800
Drill Cuttings/ Well (bbl)			
Exploration/Delineation	2,680	2,680	2,680
Development/Production	1,630	1,630	1,630
Produced Water/Well (bbl)			
Oil Well	450	450	450
Gas Well	68	68	68
Bottom Area Disturbed – Platforms (ha)	500 – 680	1,890 – 2,500	8 – 14
Bottom Area Disturbed – Pipeline (ha)	2,100 – 6,300	3,360 – 10,000	490 – 700
Platform Removals with Explosives	500 – 680	1,890 – 2,500	1 – 2

Table 4-6b. Cumulative Case - Exploration and Development Scenario for the Alaska Region

Scenario Elements	Alaska Region				
	Beaufort Sea	**Chukchi Sea**	**Hope Basin**	**Cook Inlet**	**Norton Basin**
Oil Production (BBO)	1.89 – 3.22	0.96 – 2.42	0.010 – 0.020 (condensate)	0.42 – 0.50	0.005 – 0.008 (condensate)
Gas Production (Tcf)	None	None	0.290 – 0.714	0.56 – 0.86	0.260 – 0.400
Years of Activity	40	35	25	35	20
Platforms	15 – 25	2 - 8	2	4 – 10	1
Exploration and Delineation Wells	40 – 60	6 – 24	6 – 10	12 – 30	3 – 5
Development and Production Wells	350 – 600	106 – 320	8 – 18	130 – 160	7 – 10
Miles of Onshore Pipeline	85 – 140	330	0	75	0
Miles of Offshore Pipeline	160 – 215	100 – 260	50 – 100	70 – 225	25 – 55
Landfalls	2 – 4	1	1	2 – 4	1
Vessel Trips/Week	8 – 13	1 – 4	1	4 – 10	1
Helicopter Trips/Week	75 – 125	10 – 40	10	20 – 50	5
New Shore Bases	0	1	1	0	1
New Process Facilities	3 – 4	1	1	0	1
New Waste Facilities	0	1	1	0	1
Drill Muds/Well (bbl)					
Exploration/Delineation	255	565	350	435	565
Development/Production	290	320	200	220	380
Drill Cuttings/Well (bbl)					
Exploration/Delineation	1,520	1,970	940	1,275	1,970
Development/Production	2,550	2,830	1,520	1,600	3,335
Bottom Area Disturbed – Platforms (ha)	45 – 75	6 – 24	6	8 – 20	3
Bottom Area Disturbed – Pipelines (ha)	120 – 160	75 – 195	40 – 75	52 – 170	20 – 40
Platform Removals with Explosives	0	0	0	0	0

Assumptions

- All cuttings from exploration and delineation wells will be discharged at the offshore well site.
- All cuttings from production and development wells will be disposed of subsurface.
- 80% of drilling muds will be recycled.
- 20% of drilling muds for exploration and delineation wells will be discharged at the well site.
- All spent drill muds for production and development wells will be disposed of subsurface or at onshore waste disposal sites.
- All produced water will be reinjected.

Table 4-6c. Cumulative Case – Oil-Spill Assumptions

Scenario Elements	Gulf of Mexico Region			Alaska Region				Pacific Region
	Western	Central	Eastern	Beaufort Sea	Chukchi Sea	Cook Inlet	Gulf of Alaska	
Oil Production (BBO)	3.35 – 5.53	12.01 – 16.53	0.139 – 0.37	1.89 – 3.22	0.96 – 2.42	0.42 – 0.50	0	N/A
Years of Activity	60	60	50	40	35	35	N/A	N/A
Large Oil Spills from OCS Activity*	1 Shallow Platform Spill 3 Shallow, 1 Deep Pipeline Spills 1 Deep, 1 Shallow Tanker Spill	1 Shallow, 1 Deep Platform Spills 7 Shallow, 6 Deep Pipeline Spills 3 Shallow, 3 Deep Tanker Spills	1 Shallow Pipeline Spill	1 Platform Spill 2 Pipeline Spills	1 Platform Spill 2 Pipeline Spills	1 Pipeline Spill	1 Tanker Spill (Arctic OCS production)	2 Tanker Spills (Arctic OCS production) 1 Pipeline Spill (So. Calif. OCS production)
Prob. 1 + Spills ≥ 1,000 bbl (GOM) ≥ 500 bbl (AK)	** **	** **	19 – 43%	95 – 99%	up to 98%	22 – 26%	–	–
Large Tanker Spills from AK and North Slope oil Production	0	0	0	0	0	0	3	3
Large Oil Spills from Import Tankers*	15	20	12	0	0	0	0	5
Spills < 50 bbl								
Mean No. Spills	300 – 500	1,100 – 1,500	13 – 34	170 – 290	85 – 220	38 – 45	–	–
Prob. 1+ Spills**	**	**	**	**	**	**		
Spills 50 –999 bbl								
Mean No. Spills	23 – 38	80 – 115	1 – 3	13 – 22	7 – 17	3 – 4	–	–
Prob. 1+ Spills**	**	**	75-86%	**	**	94-97%		

* large spill sizes: pipeline: 4,600 bbl; platform: 1,500 bbl; tanker (GOM): 5,300 bbl; tanker (west coast): 7,800 bbl

** Estimated probability greater than 99.5%

OCS Spill Rates, Gulf of Mexico and offshore California spills, 1985-1999:

Spills 1.1-49.9 bbl: 88.46 spills per Bbbl 6.1 bbl average size 3.0 bbl median size
Spills 50-999 bbl: 6.72 spills per Bbbl 167.7 bbl average size 100.0 bbl median size

Estimates of the probability of one or more spills occurring using Alaska rates are based on spill rates calculated on 1985-1998 data of 500 bbl and greater from Alaska Onshore North Slope facilities and pipelines the Trans-Alaska Pipeline System. Using these rates as a proxy for spills >1,000 bbl is conservative, i.e., they should result in an overestimate of the number of spills of 1,000 barrels or greater since spill occurrence frequency varies inversely to spill size. Spill rates from ANS Crude tanker spills ≥ 1,000 bbl were also used for areas where the oil is assumed to be transported by tanker from Alaska to the U.S. west coast.

Table 4-7a. Estimated Greenhouse Gas Emission Rate From Proposed 2002-2007 OCS Program Activities (thousand metric tons of carbon equivalent per year)

Area of Activity	CO_2	CH_4
Gulf of Mexico	90 – 161	29 – 48
Alaska	204 – 456	0.6 – 1.3
Tanker Transportation to West Coast	46 – 105	63 – 144
Total OCS Activities	340 – 722	93 – 193

Table 4-7b. Estimated Greenhouse Gas Emission Rate From OCS Cumulative Program Activities (thousand metric tons of carbon equivalent per year)

Area of Activity	CO_2	CH_4
Gulf of Mexico	386 – 567	144 – 191
Alaska	381 – 723	1.1 – 2.1
Tanker Transportation to West Coast	75 – 134	103 – 184
Pacific	36	10
Total OCS Activities	879 – 1,461	258 – 387

Table 4-8a. Estimated Peak-Year Emissions for the Proposed 2002-2007 OCS Program, Western Gulf of Mexico Planning Area

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	323 – 516	66 – 105	37 – 59	63 – 102	28 – 44
Pipeline Vessels	221 – 735	31 – 102	9 – 30	74 – 246	20 – 67
Helicopters	3 – 6	0.7 – 1	0.8 – 1	8 – 14	0.6 – 1
Tanker and Barge Fugitives	0	0	0	0	219 – 430
Tanker and Barge Exhaust	45 – 88	22 – 44	7 – 14	5 – 9	1 – 2
Platform Construction	632 – 1,053	36 – 60	8 – 14	125 – 208	37 – 62
Exploration Wells	258 – 773	30 – 90	7 – 22	69 – 206	25 – 74
Production Wells	666 – 946	78 – 111	19 – 27	178 – 252	64 – 91
Production Platforms	3,572 – 6,513	600 – 1094	65 – 119	831 – 1,516	2,708 – 4,938
Total	5,719 – 10,629	864 – 1,608	154 – 287	1,352 – 2,552	3,103 – 5,710

Table 4-8b. Estimated Peak-Year Emissions for the Proposed 2002-2007 OCS Program, Central Gulf of Mexico Planning Area

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	544 – 904	111 – 184	62 – 103	107 – 178	47 – 77
Pipeline Vessels	272 – 882	38 – 123	11 – 36	91 – 296	25 – 81
Helicopters	11 – 18	2 – 4	2 – 4	25 – 44	2 – 3
Tanker and Barge Fugitives	0	0	0	0	469 – 1,023
Tanker and Barge Exhaust	96 – 208	48 – 105	15 – 33	10 – 22	3 – 6
Platform Construction	1,264 – 2,528	72 – 144	17 – 34	250 – 499	74 – 124
Exploration Wells	634 – 1,368	74 – 160	18 – 39	169 – 364	61 – 132
Production Wells	1,139 – 2,170	134 – 254	32 – 62	304 – 579	110 – 209
Production Platforms	7,266 – 14,328	1,221 – 2,408	133 – 262	1,691 – 3,334	5,509 – 10,864
Total	11,224 – 22,407	1,700 – 1,495	291 – 574	2,646 – 5,315	6,299 – 12,519

Table 4-8c. Estimated Peak-Year Emissions for the Proposed 2002-2007 OCS Program, Eastern Gulf of Mexico Planning Area

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	30 – 42	6 – 9	3 – 5	6 – 8	3 – 4
Pipeline Vessels	735 – 858	102 – 120	30 – 36	246 – 288	67 – 78
Helicopters	0.2 – 0.3	0.0 – 0.1	0.0 – 0.1	0.4 – 0.6	0.0
Tanker and Barge Fugitives	0	0	0	0	0
Tanker and Barge Exhaust	0	0	0	0	0
Platform Construction	211	12	3	42	12
Exploration Wells	40	5	1	11	4
Production Wells	86 – 129	10 – 15	2 – 4	23 – 34	8 – 12
Production Platforms	366 – 626	62 – 105	7 – 11	85 – 146	278 – 474
Total	1,468 – 1,907	197 – 265	47 – 60	413 – 529	372 – 585

Table 4-8d. Estimated Typical Emissions for Activities Under the Proposed 2002-2007 OCS Program, Alaska Region

Activity	Pollutant (tons)				
	NO_x	SO_2	PM_{10}	CO	VOC
Exploration Drilling[1] – Floating Drilling Vessel in Arctic	2,312	83	75	264	120
Exploration Drilling[1] – Bottom-Founded Vessel in Arctic	1,101	54	54	257	60
Ice Island Construction in Arctic[2]	821	66	58	184	64
Platform Installation in Open Water[2]	176	12	12	42	12
Pipeline Construction[3]	9.3	0.8	0.7	2.1	0.7
Production Well Drilling[4]	36	2.2	0.3	5.9	0.3
Production Facility[5]	268	11	15	184	89

[1] Exploration drilling emissions are in terms of tons/well.
[2] Construction and installation emissions are in terms of tons/facility.
[3] Pipeline installation emissions are in terms of tons/mile.
[4] Production well drilling is in terms of tons/well.
[5] Production facility emissions are in terms of tons/year/facility.

Table 4-9. Gulf of Mexico Proposed Action Employment and Income Projections[1]

Area	Employment[2]	Personal Income[3]
Coastal Texas	983,500 – 2,077,700	$43,561 – $91,223
Average year	24,600 – 51,900	$1,089 – $2,281
Coastal Louisiana	1,234,200 – 2,441,700	$45,913 – $90,605
Average year	30,900 – 61,000	$1,148 – $2,265
Coastal Mississippi & Alabama	91,300 – 224,800	$2,874– $7,039
Average year	2,300 – 5,600	$72 – $176
Coastal Florida	9,800 – 18,000	$329 – $601
Average year	200 – 500	$8 – $15
Rest of Gulf of Mexico	442,800 – 937,900	$18,544 – $38,942
Average year	11,100 – 23,400	$464 – $974
Rest of United States	1,000,200 – 2,116,400	$39,729 – $83,679
Average year	25,000 – 52,900	$993 – $2,092

[1] All estimates are totals of direct, indirect, and induced impacts. The first number in each cell is the low-moderate estimate and the second number is the high estimate. For each State, the first set of estimates is of the total coastal area impact over the life of the activity; the second set below is the average yearly impact.

[2] Employment estimates are in total or per year employee years.

[3] Personal income estimates are in millions of 1998 dollars.

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Coastal Labor Markets							
All-Industry Total	10,883,000	11,682,000	12,324,000	12,729,000	13,012,000	20	100%
Ag. Services, Forestry, Fisheries	184,000	206,000	224,000	235,000	246,000	33	3%
Coastal Tourism/Travel	1,653,000	1,772,000	1,868,000	1,929,000	1,972,000	19	15%
Impact Sensitive Employment	1,837,000	1,978,000	2,092,000	2,165,000	2,218,000	21	18%
Percent Impact Sensitive	17	17	17	17	17		
Western Planning Area							
All-Industry Total	3,708,000	4,012,000	4,288,000	4,499,000	4,696,000	27	100%
Ag. Services, Forestry, Fisheries	54,000	62,000	69,000	74,000	79,000	46	3%
Coastal Tourism/Travel	582,000	628,000	671,000	703,000	733,000	26	15%
Impact Sensitive Employment	636,000	690,000	740,000	777,000	813,000	28	18%
Percent Impact Sensitive	17	17	17	17	17		
Central Planning Area							
All-Industry Total	2,353,000	2,448,000	2,521,000	2,556,000	2,573,000	9	100%
Ag. Services, Forestry, Fisheries	39,000	42,000	45,000	46,000	48,000	25	4%
Coastal Tourism/Travel	380,000	396,000	408,000	414,000	417,000	10	16%
Impact Sensitive Employment	419,000	438,000	453,000	460,000	465,000	11	21%
Percent Impact Sensitive	18	18	18	18	18		
Eastern Planning Area							
All-Industry Total	4,823,000	5,221,000	5,515,000	5,674,000	5,743,000	19	100%
Ag. Services, Forestry, Fisheries	92,000	103,000	110,000	115,000	118,000	29	3%
Coastal Tourism/Travel	690,600	748,000	790,000	813,000	822,000	19	14%
Impact Sensitive Employment	782,000	850,000	900,000	928,000	941,000	20	17%
Percent Impact Sensitive	16	16	16	16	16		
Mobile							
All-Industry Total	319,000	339,000	355,000	363,000	367,000	15	100%
Ag. Services, Forestry, Fisheries	8,000	8,000	9,000	9,000	10,000	22	4%
Coastal Tourism/Travel	52,0001	56,000	58,000	60,000	60,000	15	16%
Impact Sensitive Employment	60,000	64,000	67,000	69,000	70,000	16	20%
Percent Impact Sensitive	19	19	19	19	19		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Biloxi-Gulfport							
All-Industry Total	256,000	276,000	292,000	302,000	307,000	0	100%
Ag. Services, Forestry, Fisheries	10,000	11,000	12,000	12,000	13,000	27	7%
Coastal Tourism/Travel	39,000	42,000	45,000	46,000	47,000	20	21%
Impact Sensitive Employment	49,000	53,000	56,000	58,000	60,000	21	28%
Percent Impact Sensitive	19	19	19	19	19		
New Orleans							
All-Industry Total	736,000	755,000	768,000	773,000	774,000	5	100%
Ag. Services, Forestry, Fisheries	10,000	11,000	12,000	12,000	13,000	27	7%
Coastal Tourism/Travel	97,000	100,000	101,000	102,000	102,000	5	13%
Impact Sensitive Employment	107,000	111,000	113,000	114,000	115,000	7	20%
Percent Impact Sensitive	15	15	15	15	15		
Baton Rouge							
All-Industry Total	432,000	449,000	464,000	471,000	475,000	10	100%
Ag. Services, Forestry, Fisheries	3,000	4,000	4,000	4,000	4,000	32	3%
Coastal Tourism/Travel	78,000	82,000	84,000	86,000	86,000	10	18%
Impact Sensitive Employment	82,000	85,000	88,000	90,000	91,000	11	21%
Percent Impact Sensitive	19	19	19	19	19		
Lafayette							
All-Industry Total	283,000	295,000	303,000	307,000	309,000	9	100%
Ag. Services, Forestry, Fisheries	3,000	4,000	4,000	4,000	4,000	19	2%
Coastal Tourism/Travel	55,000	57,000	59,000	60,000	60,000	9	20%
Impact Sensitive Employment	59,000	61,000	63,000	64,000	64,000	10	22%
Percent Impact Sensitive	21	21	21	21	21		
Lake Charles							
All-Industry Total	180,000	186,000	190,000	191,000	192,000	6	100%
Ag. Services, Forestry, Fisheries	2,000	2,000	2,000	2,000	2,000	23	4%
Coastal Tourism/Travel	32,000	33,000	34,000	34,000	34,000	6	18%
Impact Sensitive Employment	34,000	35,000	36,000	36,000	37,000	7	22%
Percent Impact Sensitive	19	19	19	19	19		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Houma							
All-Industry Total	144,000	148,000	149,000	149,000	149,000	3	100%
Ag. Services, Forestry, Fisheries	2,000	2,000	2,000	2,000	2,000	23	10%
Coastal Tourism/Travel	26,000	26,000	27,000	27,000	27,000	3	18%
Impact Sensitive Employment	28,000	29,000	29,000	29,000	29,000	5	28%
Percent Impact Sensitive	19	19	19	19	20		
Beaumont-Port Arthur							
All-Industry Total	263,000	285,000	304,000	320,000	335,000	27	100%
Ag. Services, Forestry, Fisheries	4,000	4,000	5,000	5,000	6,000	61	3%
Coastal Tourism/Travel	38,000	41,000	44,000	46,000	49,000	27	15%
Impact Sensitive Employment	42,000	45,000	49,000	51,000	54,000	30	17%
Percent Impact Sensitive	16	16	16	16	16		
Houston-Galveston							
All-Industry Total	2,401,000	2,585,000	2,747,000	2,871,000	2,984,000	24	100%
Ag. Services, Forestry, Fisheries	27,000	32,000	35,000	38,000	42,000	51	2%
Coastal Tourism/Travel	380,000	409,000	435,000	454,000	472,000	24	16%
Impact Sensitive Employment	408,000	441,000	470,000	493,000	514,000	26	18%
Percent Impact Sensitive	17	17	17	17	17		
Corpus Christi							
All-Industry Total	275,000	291,000	306,000	317,000	327,000	19	100%
Ag. Services, Forestry, Fisheries	5,000	5,000	6,000	6,000	7,000	47	4%
Coastal Tourism/Travel	52,000	55,000	58,000	60,000	62,000	19	19%
Impact Sensitive Employment	56,000	60,000	63,000	66,000	68,000	21	23%
Percent Impact Sensitive	21	21	21	21	21		
Brownsville-McAllen							
All-Industry Total	516,000	583,000	648,000	698,000	746,000	45	100%
Ag. Services, Forestry, Fisheries	15,000	17,000	19,000	20,000	20,000	34	2%
Coastal Tourism/Travel	68,000	77,000	85,000	92,000	98,000	45	13%
Impact Sensitive Employment	83,000	94,000	104,000	111,000	118,000	43	15%
Percent Impact Sensitive	16	16	16	16	16		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Victoria							
All-Industry Total	84,000	88,000	92,000	95,000	98,000	17	100%
Ag. Services, Forestry, Fisheries	1,000	1,000	2,000	2,000	2,000	43	5%
Coastal Tourism/Travel	14,000	15,000	16,000	16,000	16,000	17	17%
Impact Sensitive Employment	16,000	17,000	17,000	18,000	19,000	19	21%
Percent Impact Sensitive	19	19	19	19	19		
Brazoria							
All-Industry Total	169,000	180,000	191,000	200,000	206,000	22	100%
Ag. Services, Forestry, Fisheries	2,000	2,000	2,000	3,000	3,000	49	3%
Coastal Tourism/Travel	30,000	32,000	34,000	35,000	36,000	22	18%
Impact Sensitive Employment	32,000	34,000	36,000	38,000	39,000	24	20%
Percent Impact Sensitive	19	19	19	19	19		
Pensacola							
All-Industry Total	347,000	384,000	412,000	429,000	440,000	27	100%
Ag. Services, Forestry, Fisheries	4,000	5,000	5,000	6,000	6,000	53	2%
Coastal Tourism/Travel	52,000	58,000	62,000	64,000	66,000	27	15%
Impact Sensitive Employment	56,000	62,000	67,000	70,000	72,000	29	17%
Percent Impact Sensitive	16	16	16	16	16		
Panama City							
All-Industry Total	99,000	109,000	116,000	121,000	124,000	26	100%
Ag. Services, Forestry, Fisheries	2,000	2,000	2,000	3,000	3,000	49	4%
Coastal Tourism/Travel	15,000	16,000	17,000	18,000	19,000	26	15%
Impact Sensitive Employment	17,000	18,000	19,847	21,000	21,000	28	19%
Percent Impact Sensitive	17	17	17	17	17		
Tallahassee							
All-Industry Total	232,000	253,000	268,000	276,000	281,000	21	100%
Ag. Services, Forestry, Fisheries	4,000	5,000	6,000	6,000	6,000	43	4%
Coastal Tourism/Travel	48,000	52,000	55,000	57,000	58,000	21	21%
Impact Sensitive Employment	52,000	57,000	61,000	63,000	64,000	23	25%
Percent Impact Sensitive	23	23	23	23	23		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Lake City							
All-Industry Total	76,000	84,000	90,000	94,000	96,000	25	100%
Ag. Services, Forestry, Fisheries	1,000	1,000	1,000	1,000	1,000	38	2%
Coastal Tourism/Travel	9,000	10,000	11,000	12,000	12,000	25	12%
Impact Sensitive Employment	10,000	12,000	12,000	13,000	13,000	27	14%
Percent Impact Sensitive	134	14	14	14	14		
Gainesville							
All-Industry Total	183,000	200,000	214,000	221,000	226,000	24	100%
Ag. Services, Forestry, Fisheries	2,000	3,000	3,000	3,000	3,000	36	2%
Coastal Tourism/Travel	20,000	22,000	24,000	24,000	25,000	24	11%
Impact Sensitive Employment	23,000	25,000	26,000	27,000	28,000	25	13%
Percent Impact Sensitive	12	12	12	12	12		
Ocala							
All-Industry Total	180,000	203,000	222,000	234,000	241,000	34	100%
Ag. Services, Forestry, Fisheries	4,000	4,000	5,000	5,000	5,000	27	2%
Coastal Tourism/Travel	27,000	30,000	33,000	35,000	36,000	34	15%
Impact Sensitive Employment	31,000	35,000	38,000	40,000	41,000	33	17%
Percent Impact Sensitive	17	17	17	17	17		
Tampa							
All-Industry Total	1,126,000	1,200,000	1,251,000	1,274,000	1,278,000	13	100%
Ag. Services, Forestry, Fisheries	15,0000	16,000	17,000	17,000	17,000	18	2%
Coastal Tourism/Travel	163,000	174,000	181,000	185,000	185,000	13	15%
Impact Sensitive Employment	178,000	190,000	198,000	202,000	202,000	14	16%
Percent Impact Sensitive	16	16	16	16	16		
Sarasota							
All-Industry Total	331,000	361,000	385,000	398,000	403,000	22	100%
Ag. Services, Forestry, Fisheries	7,000	8,000	9,000	9,000	9,000	27	3%
Coastal Tourism/Travel	43,000	47,000	50,000	51,000	52,000	22	13%
Impact Sensitive Employment	50,000	55,000	58,000	60,000	61,000	23	16%
Percent Impact Sensitive	15	15	15	15	15		

Table 4-10. Gulf of Mexico Proposed Action Sensitive Industry Projections (continued)

	2000	2005	2010	2015	2020	% Change to 2020	Proportion of Change
Naples							
All-Industry Total	308,000	344,000	374,000	392,000	403,000	31	100%
Ag. Services, Forestry, Fisheries	9,000	10,000	11,000	11,000	11,000	20	2%
Coastal Tourism/Travel	44,000	49,000	53,000	55,000	57,000	31	14%
Impact Sensitive Employment	53,000	59,000	63,000	66,000	68,000	29	16%
Percent Impact Sensitive	17	17	17	17	17		
Miami							
All-Industry Total	1,940,000	2,082,000	2,184,000	2,235,000	2,250,000	16	100%
Ag. Services, Forestry, Fisheries	44,000	49,000	53,000	55,000	57,000	30	4%
Coastal Tourism/Travel	269,000	289,000	303,000	310,000	313,000	16	14%
Impact Sensitive Employment	313,000	338,000	356,000	365,000	369,000	18	18%
Percent Impact Sensitive	16	16	16	16	16		

Table 4-11. Alaska Proposed Action Employment and Income Projections[1]

Area	Employment[2]	Personal Income[3]
Beaufort (NSB)	2,600 – 4,200	$116 – $187
Average year	90 – 140	$4 – $6
Chukchi/Hope (NSB/NWAB)	3,800 – 7,900	$166– $346
Average year	120 – 250	$5 – $11
Cook Inlet (KPB)	4,400 – 6,900	$112 – $175
Average year	100 – 200	$ – $5
Norton (Local Area & KPB)	1,100 – 1,200	$27 – $31
Average year	60 – 60	$1 – $2
Rest of Alaska	105,900 – 210,700	$3,153 – $6,386
Average year	3,400 – 6,800	$101 – $207
Rest of United States	118,500 – 217,800	$4,236 – $7,790
Average year	4,000 – 7,200	$141 – $256

[1] All estimates are totals of direct, indirect, and induced impacts. The first number in each cell is the low-moderate estimate, and the second number is the high estimate. For each planning area, the first set of estimates is of the total local impact over the life of the activity; the second set below is the average yearly local impact.

[2] Employment estimates are in total or per year employee years.

[3] Personal income estimates are in millions of 1998 dollars.

Table 4-12. Estimated Average Emissions for the Cumulative OCS Program, Gulf of Mexico Region

Activity	Pollutant (tons/yr)				
	NO_x	SO_2	PM_{10}	CO	VOC
Service Vessels	10,167 – 13,743	2,070 – 2,798	1,155 – 1,561	2,001 – 2,705	871 – 1,177
Pipeline Vessels	521 – 1,495	73 – 208	22 – 62	175 – 501	48 – 137
Helicopters	142 – 190	28 – 38	32 – 43	336 – 450	24 – 33
Tanker and Barge Fugitives	0	0	0	0	1,767 – 2,557
Tanker and Barge Exhaust	360 – 521	181 – 262	57 – 83	37 – 54	10 – 15
Platform Construction	10,475 – 14,042	596 – 799	140 – 188	2,069 – 2,773	615 – 824
Exploration Wells	2,969 – 3,740	328 – 414	82 – 103	791 – 996	274 – 345
Production Wells	6,127 – 7,538	689 – 847	167 – 205	1,568 – 1,927	566 – 696
Production Platforms	52,661 – 71,741	8,849 – 12,056	963 – 1,311	12,254 – 16,694	39,930 – 54,398
Total	83,422 – 113,009	12,816 – 17,423	2,618 – 3,556	19,231 – 26,101	44,105 – 60,181

APPENDIX A: GLOSSARY

A. Glossary

anadromous fish – fish that migrate up river from the sea to breed in fresh water.

anthropogenic – coming from human sources, relating to the effect of man on nature.

aphotic zone – Zone where the levels of light entering through the surface are not sufficient for photosynthesis or for animal response.

aromatic – applied to a class of organic compounds containing benzene rings or benzenoid structures.

attainment area – an area which is classified by the USEPA as meeting the primary or secondary ambient air quality standards for a particular air pollutant based on monitored data.

barrel – equal to 42 U.S. gallons.

benthic – bottom dwelling, associated with (in or on) the seafloor.

benthic macroinvertebrate – animals such as worms, clams, or crabs which are large enough to see without the aid of a microscope.

benthos – organisms which dwell in or on the seafloor, the organisms living in or associated with the benthic (or bottom) environment.

biological opinion – an appraisal from either the Fish and Wildlife Service or the National Marine Fisheries Service evaluating the impact of a proposed Federal action, if it is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat, as required by Section 7 of the Endangered Species Act.

bivalves – general term for two-shelled mollusks (clams, oysters, scallops, mussels).

blowout – refers to an uncontrolled flow of fluids from a wellhead or wellbore. Unless otherwise specified, a flow of fluids from a flowline is not considered a blowout as long as the wellhead control valves can be automatically or manually activated. If the wellhead control valves become inoperative, the flow is classified as a blowout. A blowout can also occur below the seabed, from one formation to another.

carrying capacity – the maximum number or weight of individuals that can exist in a given habitat; an appraisal from either FWS or NMFS evaluating the impact of a proposed activity on endangered and threatened species.

cetacean – any of an order (Cetacea) of aquatic mostly marine mammals including the whales, dolphins, porpoises and related forms with large head, fusiform nearly hairless body, and paddle-shaped forelimbs, vestigial concealed hind limbs, and horizontal flukes (tails).

coastal waters – those waters surrounding the continent which exert a measurable influence on uses of the land.

coastal wetlands – include forested and nonforested habitats, mangroves, and all marsh islands which are exposed to coastal waters. Included in forested wetlands are hardwood hammocks, cypress-tupelogum swamps, and fluvial vegetation/bottomland hardwoods. Nonforested wetlands include fresh, brackish, and salt marshes. These areas directly contribute to the high biological productivity of coastal water by input of detritus and nutrients, by providing nursery and feeding areas for shellfish and finfish, by serving as habitat for many birds and other animals, and by providing waterfowl hunting and fur trapping.

coastal zone – the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal States, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches. The zone extends seaward to the outer limit of the United States territorial sea. The zone extends inland from the shorelines only the extent necessary to control shorelands, the uses of which have a direct and significant impact on the coastal waters. Excluded from the coastal zone are lands the use of which is by law subject to the discretion of or which is held in trust by the Federal government, its officers, or agents. (The State land and water area officially designated by the State as "coastal zone" in its State coastal zone program as approved by the Department of Commerce under the CZMA).

coastal zone consistency review – State review of direct Federal activities, or private individual activities requiring Federal licenses or permits, and OCS plans pursuant to the CZM Act to determine if the activity is consistent with the enforceable policies of the State's Federally approved CZM program.

continental shelf – a broad, gently sloping, shallow feature extending from the shore to the continental slope, generally considered to exist to the depth of 200m; that part of continental margin between continental shelf and continental rise (or oceanic trench).

continental slope – a relatively steep, narrow feature paralleling the continental shelf; the region in which the steepest descent to the ocean bottom occurs.

contingency plan – a plan for possible offshore emergencies prepared and submitted by the oil or gas operator as part of the Plan of Development and Production, and may be required for part of the Plan of Exploration.

critical habitat – a designated area that is essential to the conservation of an endangered or threatened species.

crude oil – a mixture of liquid hydrocarbons that exists in natural underground reservoirs as distinguished from refined oils manufactured from it.

crustaceans – any aquatic invertebrate with jointed legs, such as crabs, shrimp, lobster, barnacles, amphipods, isopods, etc.; primarily an aquatic group.

delineation well – an exploratory well drilled to define the areal extent of a field. Also referred to as an "expendable well."

development – activities that take place following discovery of minerals in paying quantities, including geophysical activity, drilling, platform construction, and operation of all onshore support facilities, and that are for the purpose of ultimately producing the minerals discovered.

development and production plan (DPP) – a plan describing the specific work to be performed on an offshore lease, including all development and production activities that the lessee proposes to undertake during the time period covered by the plan and all actions to be undertaken up to and including the commencement of sustained production. The plan also includes descriptions of facilities and operations to be used, well locations, current geological and geophysical information, environmental safeguards, safety standards and features, time schedules, and other relevant information. All lease operators are required to formulate and obtain approval of such plans by MMS before (approval of) development and production activities may begin (can be given); requirements for submittal of DPP are wholly identified in 30 CFR 250.34.

development well – a well drilled into a known producing formation in a previously discovered field, to be distinguished from a wildcat, exploratory well, or an offset well.

dilution – the reduction in the concentration of dissolved or suspended substances by mixing with water.

discharge – something that is emitted; flow rate of a fluid at a given instant expressed as volume per unit of time.

dispersion – a distribution of finely divided particles in a medium.

drillship – a self-propelled, self-contained vessel equipped with a derrick amidship for drilling wells in deepwater.

drilling mud – a special mixture of clay, water, or refined oil, and chemical additives pumped downhole through the drill pipe and drill bit. The mud cools the rapidly rotating bit, lubricates the drill pipe as it turns in the wellbore, carries rock cuttings to the surface, serves to keep the hole from crumbling or collapsing, and provides the weight or hydrostatic head to prevent extraneous fluids from entering the wellbore and to control downhole pressures that may be encountered (drilling fluid).

effluent – the liquid waste of sewage and industrial processing.

emission offset – Emission reductions obtained from facilities, either onshore or offshore, other than the facility or facilities covered by the proposed Exploration Plan or Development and Production Plan The emission reductions achieved must be sufficient so that there will be no net increase in emissions for the area.

endangered and threatened species (endangered species) – This refers to any species which is in danger of extinction throughout all or a significant portion of its range and has been officially listed by the appropriate Federal or State agency; a species is determined to be endangered (or threatened) because of any of the following factors: (a) the present or threatened destruction, modification, or curtailment of its habitat or range; (b) over utilization for commercial, sporting, scientific, or educational purposes; (c) disease or predation; (d) the inadequacy of existing regulatory mechanisms; or (e) other natural or man-made factors affecting its continued existence.

environmental assessment – a concise public document required by NEPA. In the document, a Federal agency proposing (or reviewing) an action provides evidence and analysis for determining whether it must prepare an EIS or whether it finds there is no significant impact i.e., FONSI.

environmental effect – a measurable alteration or change in environmental conditions.

environmental impact statement (EIS) – a statement required by the National Environmental Policy Act of 1969 (NEPA) or similar State law in relation to any major action significantly affecting the environment; a NEPA document.

essential fish habitat (EFH) – those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. This includes areas that are currently or historically used by fish, or that have substrate such as sediment, hard bottom, bottom structures, or associated biological communities required to support a sustainable fishery.

estuary – semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is measurably diluted with freshwater; semi-enclosed coastal body of water which has a free connection with the open sea and within which seawater is often measurably diluted with freshwater.

exclusive economic zone – the maritime region adjacent to the territorial sea, extending 200 nautical miles from the baseline of the territorial sea, in which the United States has exclusive rights and jurisdiction over living and nonliving natural resources. (see "EEZ").

exploration – the process of searching for minerals. Exploration activities include: (1) geophysical surveys where magnetic, gravity, seismic, or other systems are used to detect or infer the presence of such minerals and; (2) any drilling, except development drilling, whether on or off known geological structures. Exploration also includes the drilling of a well in which a discovery of oil or natural gas in paying quantities is made and the drilling, after such a discovery, of any additional well that is needed to delineate a reservoir and to enable the lessee to determine whether to proceed with development and production.

exploration plan (EP) – a plan submitted by a lessee (30 CFR 250.33) that identifies all the potential hydrocarbon accumulations and wells that the lessee proposes to drill to evaluate the accumulations within the lease or unit area covered by the plan. All lease operators are required to obtain approval of such a plan by a Regional Supervisor before exploration activities may commence.

exploratory well – a well drilled in unproven or semi-proven territory for the purpose of ascertaining the presence underground of a commercially producible deposit of petroleum or natural gas.

fault – a fracture in the earth's crust accompanied by a displacement of one side of the fracture with respect to the other.

fauna – the animals of a particular region or time.

fixed or bottom founded – permanently or temporarily attached to the seafloor.

flyway – an established air route of migratory birds.

formation – a bed or deposit sufficiently homogeneous to be distinctive as a unit. Each different formation is given a name, frequently as a result of the study of the formation outcrop at the surface and sometimes based on fossils found in the formation.

fugitive emissions – Emission into the atmosphere which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening.

geologic hazard – a feature or condition that, if unmitigated, may seriously jeopardize offshore oil and gas exploration and development activities. Mitigation may necessitate special engineering procedures or relocation of a well.

geophysical – of or relating to the physics of the earth, especially the measurement and interpretation of geophysical properties of the rocks in an area.

geophysical data – facts, statistics, or samples which have not been analyzed or processed, pertaining to gravity, magnetic, seismic, or other surveys/systems.

geophysical survey – The exploration of an area during which geophysical properties and relationships unique to the area are measured by one or more geophysical methods.

habitat – a specific type of place that is occupied by an organism, a population, or a community; a specific type of place defined by its physical or biological environment that is occupied by an organism, a population, or a community.

haul-out area – specific locations where pinnipeds come ashore and concentrate in numbers to rest, breed, and/or bear young.

herbivores – animals whose diet consists of plant material.

H_2S – hydrogen sulfide.

hydrocarbon – any of a large class of organic compounds containing primarily carbon and hydrogen, comprising paraffins, olefins, members of the acetylene series, alicyclic hydrocarbons, and aromatic hydrocarbons, and occurring in many cases in petroleum, natural gas, coal, and bitumens.

hypothermia – subnormal temperature of the body, usually due to excessive heat loss.

incidental take – Take of a threatened or endangered fish or wildlife species that results from, but is not the purpose of, carrying out an otherwise lawful activity conducted by a Federal agency or applicant.

indirect effects – effects caused by activities which are stimulated by an action but not directly related to it.

industry infrastructure – the facilities associated with oil and gas development, e.g., refineries, gas processing plants, etc.

information to lessees – information included in the Notice of Sale to alert lessees and operators of special concerns in or near a sale area of regulatory provisions enforceable by Federal or State agencies.

jack-up rig – a barge-like, floating platform with legs at each corner that can be lowered to the sea bottom to raise the platform above the water; a drilling platform with retractable legs that can be lowered to the sea bottom to raise the platform above the water.

landfall – the site at which a marine pipeline comes to shore.

lay barge – a shallow-draft, barge-like vessel used in the construction and laying of underwater pipelines.

lighter – a barge or small tanker used to move cargo from a large ship to port; also, to transport by lighter.

macroinvertebrate – animals such as worms, clams, or crabs which are large enough to be seen without the aid of a microscope.

mariculture – the breeding or growth of marine animals and plants to increase their stocks.

marine sanctuary – area protected under the Marine Protection, Research and Sanctuaries Act of 1972.

marshes – persistent emergent nonforested wetlands characterized by vegetation consisting predominantly of cordgrasses, rushes, and cattails.

microcrustacean – any relatively small crustacean (may range from microscopic to slightly over one centimeter in size) including organisms such as beach hoppers (amphipods), copepods, ostracods, isopods, and mysids.

military warning area – an area established within which the public is warned that military activities take place.

mollusks – animal phylum characterized by soft body parts including clams, mussels, snails, squid, and octopus.

mud – the liquid circulated through the wellbore during rotary drilling operations. In addition to its function of bringing cuttings to the surface, drilling mud cools and lubricates the bit and drill stem, protects against blowouts by holding back subsurface pressures and deposits a mud cake on the wall of the borehole to prevent loss of fluids to the formations, also called drilling mud or drilling fluid; also a sediment designation composed of silt and clay sized particles.

mysids – small shrimp-like organisms, also known as opossum shrimp due to their method of egg incubation.

natural gas – hydrocarbons that are in a gaseous phase under atmospheric conditions of temperature and pressure.

nearshore waters – Offshore, open waters that extend from the shoreline out to the limit of the territorial seas (12 nautical miles).

nonattainment area – an area which is classified by the USEPA as not meeting the primary or secondary ambient air quality standards for a particular pollutant based on monitored data.

offloading – another name for unloading; offloading refers more specifically to liquid cargo, crude oil, and refined products.

oil spill contingency plan – a plan submitted by the lease or unit operator along with or prior to a submission of a plan of exploration or a development/production plan that details provisions for fully defined, specific actions to be taken following discovery and notification of an oil spill.

operational discharge – a release of oil that is part of the routine operation of a function.

operator – the person or company engaged in the business of drilling for, producing, or processing oil, gas, or other minerals and recognized by the MMS as the official contact and responsible for the lease activities or operations.

organic matter – material derived from living plant or animal organisms.

Outer Continental Shelf (OCS) – all submerged lands that comprise the continental margin adjacent to the United States and seaward of State offshore lands.

petroleum – an oily, flammable bituminous liquid that occurs in many places in the upper strata of the earth, either in seepages or in reservoirs; essentially a complex mixture of hydrocarbons of different types with small amounts of other substances; any of various substances (as natural gas or shale oil) similar in composition to petroleum.

phytoplankton – plant (photosynthetic) plankton; microscopic, freefloating, photosynthetic organisms that drift passively in the water.

pinniped – any of a suborder (Pinnipedia) of aquatic carnivorous mammals (e.g., seals, sea lions, sea otters, walruses) with all four limbs modified into flippers; any of a suborder (Pinnipedia) of aquatic carnivorous mammals (e.g., seals, sea lions, walruses) with all four limbs modified into flippers.

plankton – passively floating or weakly motile aquatic plants and animals.

planning area – a subdivision of an offshore area used as the initial basis for considering blocks to be offered for lease in the DOI's areawide offshore oil and gas leasing program.

platform – a steel, concrete, or gravel structure from which offshore development wells are drilled; structure can be nonplatform or platform.

postlease – any activity on a block or blocks after the issuance of a lease on said block or blocks.

potential impact (effect) – the range of alterations or changes to environmental conditions that could be caused by an action.

primary production – production of carbon by a plant through photosynthesis over a given period of time; oil and gas production that occurs from the reservoir energy inherent in the formation.

production – activities that take place after the successful completion, by any means, for the removal of minerals, including such removal, field operations, transfer of minerals to shore, operation monitoring, maintenance, and workover drilling.

production well – a well which is drilled for the purpose of producing oil or gas reserves. It is sometimes termed development well.

prospect – an untested geologic feature having the potential for trapping and accumulating hydrocarbons.

recoverable reserves – Portion of the identified oil or gas resource that can be economically extracted under current technological constraints.

recoverable resource estimate – an assessment of oil and gas resources that takes into account the fact that physical and technological constraints dictate that only a portion of resources or reserves can be brought to the surface.

refining – fractional distillation, usually followed by other processing (for example, cracking).

reserves – portion of the identified oil or gas resource that can be economically extracted.

reservoir – a subsurface, porous, permeable rock body in which hydrocarbons have accumulated.

resources – concentrations of naturally occurring solid, liquid, or gaseous materials in or on the Earth's crust some part of which is currently or potentially extractable. These include both identified and undiscovered resources.

rig – a structure used for drilling an oil or gas well.

right-of-way – a legal right of passage, an easement; the specific area or route for which permission has been granted to place a pipeline, (and) ancillary facilities, and for normal maintenance thereafter.

rookery – the nesting or breeding grounds of gregarious (i.e., social) birds or mammals; also a colony of such birds or mammals.

sale area – the geographical area of the OCS being offered for lease for the exploration, development, and production of mineral resources.

scoping – the process prior to EIS preparation to determine the range and significance of issues to be addressed in the EIS for each proposed major federal action.

seagrass beds – more or less continuous mats of submerged rooted marine flowering vascular plants occurring in shallow tropical and temperate waters. Seagrass beds provide habitat, including breeding and feeding grounds for adults and/or juveniles of many of the economically important shellfish and finfish.

seeps-petroleum – Gas or oil that reaches the surface along bedding planes, fractures, unconformities or fault planes through connected porous rocks.

seismic – pertaining to, characteristic of, or produced by earthquakes or earth vibration; having to do with elastic waves in the earth, also geophysical when applied to surveys.

semisubmersible – a floating offshore drilling structure that has hulls submerged in the water but not resting on the seafloor.

shunting – a method used in offshore oil and gas drilling activities where expended drill cuttings and fluids are discharged near the ocean seafloor rather than at the surface, as in the case of normal offshore drilling operations.

stipulations – specific measures imposed upon a lessee that apply to a lease. Stipulations are attached as a provision of a lease; they may apply to some or all tracts in a sale. For example, a stipulation might limit drilling to a certain time period of the year or certain areas.

subsistence uses – the customary and traditional uses by rural residents of wild, renewable resources of direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for making and selling of handcraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade.

supply boat – a vessel that ferries food, water, fuel, and drilling supplies and equipment to a rig and returns to land with refuse that cannot be disposed of at sea.

take – to harass, harm, pursue, hunt, shoot, wound, kill, capture, or collect a threatened or endangered fish or wildlife species, or attempt to engage in any such conduct. (Harm includes habitat modification that impairs behavioral patterns and harass includes actions that create the likelihood of injury to an extent that normal behavior patterns are disrupted).

threatened species – refers to any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range and has been officially listed by the appropriate Federal agency; criteria for determination of threatened status can be found under "endangered species."

trawl – a large, tapered fishing net of flattened, conical shape that is typically towed along the sea bottom.

trophic – trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores, such as man; feeding trophic levels refer to the hierarchy of organisms from photosynthetic plants to carnivores in which organisms at one level are fed upon by those at the next higher level (e.g., phytoplankton eaten by zooplankton eaten by fish).

trunk line – A pipeline for the transportation of oil and or gas from producing areas to refineries or terminals.

turbidity – reduced water clarity resulting from the presence of suspended matter.

vascular plants -plants containing food and water conducting structures; higher plants which reproduce by seeds.

Volatile Organic Compound (VOC) – Any reactive, organic compound which is emitted to the atmosphere as a vapor. The definition does not include methane.

vulnerability -the likelihood of being damaged by external influences. Vulnerability implies sensitivity of a system plus the risk of a damaging influence occurring.

weathering – the aging of oil due to its exposure to the atmosphere and environment causing marked alterations in its physical and chemical makeup.

wetlands – areas periodically inundated or saturated by surface or groundwater and predominantly supporting vegetation typically adapted for life in saturated soil conditions.

zooplankton – animal plankton, mostly dependent on phytoplankton for its food source; animal plankton, small, freefloating animals, may be passive drifters or motile, dependent on phytoplankton as a food source.

APPENDIX B: ABBREVIATIONS AND ACRONYMS

B. Abbreviations and Acronyms

ACP	Area Contingency Plan
ADCED	Alaska Department of Commercial and Economic Development
ADFG	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AEWC	Alaska Eskimo Whaling Commission
ANCSA	Alaska Native Claims Settlement Act
ANILCA	Alaska National Interest Lands Conservation Act
ANWR	Arctic National Wildlife Refuge
API	American Petroleum Institute
ASTM	American Society for Testing and Materials
ATOC	Acoustic Thermometry of Ocean Climate
BACT	Best Available Control Technology
bbl	barrels
Bbbl	billion barrels
BLM	Bureau of Land Management
B.P.	before present
BPXA	British Petroleum Exploration Alaska
BTEX	benzene, toulene, ethylbenzene & xylene
Btu	British thermal units
^{o}C	degrees Celsius
^{14}C	carbon-14
CAA	Clean Air Act
CAH	Central Arctic Herd
CCC	California Coastal Commission
CEC	Commission on Environmental Cooperation
CEI	Coastal Environments, Inc.
CEQ	Council on Environmental Quality
CER	categorical exclusion review
CFC	chloroflurocarbons
CFEC	Commercial Fisheries Entry Commission (State of Alaska)
CFR	Code of Federal Regulations
CH_4	methane

CIAP	Coastal Impact Assistance Program
cm	centimeter
cm/s	centimeter per second
CMP	coastal management program
CO	carbon monoxide
CO_2	carbon dioxide
COE	Corps of Engineers (U.S. Army)
COTP	captain–of–the–port
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibel
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEP	Department of Environmental Protection
DEW	distant early warning
DO	dissolved oxygen
DOCD	Development Operations Coordination Document
DPP	Development and Production Plan
EA	environmental assessment
EEZ	Exclusive Economic Zone
EFH	essential fisheries habitat
EIS	environmental impact statement
EJ	Environmental Justice
EO	Executive Order
EOR	Enhanced Oil Recovery
EP	exploration plan
ERS	Economic Research Service (U.S. Department of Agriculture)
ESA	Endangered Species Act
ESP	Environmental Studies Program
^{o}F	degrees Fahrenheit
FAD	fish attracting device
FCF	Fisherman's Contingency Fund
FCMA	Fishery Conservation and Management Act of 1976
FMC	fishery management council

FMP	fishery management plan
FONSI	finding of no significant impact
FOSC	Federal On-Scene Coordinator
FR	Federal Register
FSB	Federal Subsistence Board (USDOI)
FWPCA	Federal Water Pollution Control Act
FWS	Fish and Wildlife Service (USDOI)
g	gram
g/L	grams per liter
GCM	global climate models
GIS	Geographic Information System
GMAQS	Gulf of Mexico Air Quality Study
GMFMC	Gulf of Mexico Fisheries Management Council
gpd	gallons per day
GRASP	Geologic Resource Assessment Program
ha	hectare
HAPC	habitat area of particular concern
hr	hour
Hz	hertz
IAI	Impact Assessment, Inc.
ICN	Independent Contractor Network
IPCC	Intergovernmental Panel on Climate Change
IR	infrared
ITL	Information to Lessee
IWC	International Whaling Commission
kg	kilogram
kg/yr	kilograms per year
kHz	kilohertz
km	kilometer
km^2	square kilometer
km/hr	kilometers per hour
KPB	Kenai Peninsula Borough
L	liter
LADNR	Louisiana Department of Natural Resources

lb	pound
LC_{50}	lethal concentration resulting in 50% mortality
LMA	labor market area
LNG	liquified natural gas
LOOP	Louisiana Offshore Oil Port
m	meter
m^3	cubic meter
m/L	meters per liter
m/s	meters per second
m/yr	meters per year
MARPOL	International Convention for the Prevention of Pollution from Ships
mg/L	milligrams per liter
ml	milliliter
ml/L	milliliters per liter
MM	million
MMbbl	million barrels
MMm^3	million cubic meters
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MODU	mobile drilling unit
MOU	Memorandum of Understanding
MPA	marine protected area
MPRCA	Marine Plastic Pollution Research and Control Act
MPRSA	Marine Protection Research and Sanctuaries Act of 1972
MRFSS	Marine Recreational Fisheries Statistics Survey (NMFS)
MSA	metropolitan statistical area
MSIS	Marine Safety Information System
MSRC	Marine Spill Response Corporation
NAAQS	National Ambient Air Quality Standards
NAFTA	North Atlantic Free Trade Agreement
NAS	National Academy of Science
NASA	National Aeronautics & Space Administration
NCP	National Contingency Plan
NDBC	National Data Buoy Center

NEPA	National Environmental Policy Act
NEPD	National Energy Policy Development (Group)
NGL	natural gas liquids
NHPA	National Historic Preservation Act
NIST	National Institute of Standards and Technology
NMFS	National Marine Fisheries Service
N_2O	nitrous oxides
NO_2	nitrogen dioxide
NO_x	nitrogen oxide
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NORM	naturally occurring radioactive material
NPDES	National Pollutant Discharge Elimination System
NPR–A	National Petroleum Reserve–Alaska
NRC	National Research Council
NR Corp.	National Response Corporation
NRDA	Natural Resource Damage Assessment
NRT	National Response Team
NSB	North Slope Borough
NS&T	National Status and Trends Program (NOAA)
NTL	Notice to Lessees
NWAB	Northwest Arctic Borough
NWR	national wildlife refuge
O_3	ozone
OCS	Outer Continental Shelf
OCSEAP	Outer Continental Shelf Environmental Assessment Program
OCSLA	Outer Continental Shelf Lands Act
OHMSETT	Oil and Hazardous Materials Simulated Test Tank
OPA	Oil Pollution Act
OSFR	oil–spill financial responsibility for offshore facilities
OSHA	Occupational Safety and Health Administration
OSR Program	Oil–Spill Research Program
OSRP	Oil–Spill Response Plans
OSRO	Oil Spill Removal Organization

OSRV	offshore response vessel
PAH	polyaromatic hydrocarbons
Pb	lead
PCB	polychlorinated biphenyl
PCH	Porcupine Caribou Herd
Pci/L	picocuries per liter
PEL	permissible exposure limit
PFMC	Pacific Fisheries Management Council
PM_{10}	10–micron particulate matter
$PM_{2.5}$	2.5–micron particulate matter
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
PRESTO	probabilistic resource estimates offshore
PSD	Prevention of Significant Deterioration
QI	qualified individual
RCP	Regional Contingency Plan
RCRA	Resource Conservation and Recovery Act
RP	responsible party
RRT	Regional Response Team
s	second
SAIC	Science Applications International Corporation
SBC	Santa Barbara Channel
SBF	synthetic–based fluids
SCB	Southern California Bight
SCCWRP	Southern California Coastal Water Research Project
SIP	State Implementation Plan
SO_2	sulfur dioxide
SWFMC	Southwest Fisheries Management Council
t	metric ton
TAPS	Trans–Alaska Pipeline System
TCE	metric tons carbon equivalent
TED	turtle excluder device
TEIA	Transboundary Environmental Impact Assessment

TLH	Teshekpuk Lake Herd
µg	microgram
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
$\mu g/m^3$	micrograms per cubic meter
µPa	microPascal
USAEDA	U.S. Army Engineer District, Alaska
USCG	U.S. Coast Guard
USDOC	U.S. Department of Commerce
USDOD	U.S. Department of Defense
USDOI	U.S. Department of the Interior
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compounds
VOSS	vessel of opportunity skimming systems
WAH	Western Arctic Herd
WBF	water-based fluid

APPENDIX C: OIL-SPILL RESPONSE CAPABILITIES FOR OFFSHORE OIL AND GAS OPERATIONS

C. OIL-SPILL RESPONSE CAPABILITIES FOR OFFSHORE OIL AND GAS OPERATIONS

1. INTRODUCTION

a. Background

In 1985, the National Academy of Sciences (NAS) conducted a study of the sources of oil in the ocean (*Oil in the Sea: Inputs, Fates, and Effects*) and found the following facts about oil in the world's oceans (NAS, 1985):

- 36 percent came from municipal and industrial wastes and runoff;
- 34 percent came from tanker operations and accidents;
- 11 percent came from other marine transportation and marine terminals;
- 9 percent came from the atmosphere;
- 8 percent came from natural sources including marine seeps and sediments; and
- 2 percent came from offshore production operations worldwide.

The NAS is updating this study for 2001, but has not officially released the results.

For several years, the United States has been importing over half of the oil it consumes (currently over 55%). This means that over half of all U.S. oil arrives by tankers—a transportation mode that contributes 34 percent of all the oil in the world's oceans. (When tanker operations and tanker accidents are added to other marine transportation and marine terminals, sea transportation contributes 45 percent of all oil in the sea.)

This appendix is concerned with the current capabilities of the oil industry to respond to potential spills related to oil and gas leasing activities on the Outer Continental Shelf (OCS). Federal OCS oil and gas leasing activities and offshore production operations in State and foreign waters contribute about 2 percent of the oil in the world's oceans.

A 1969 blowout and oil spill in the Santa Barbara Channel and two 1970 blowouts and associated fires in the Gulf of Mexico raised public concern over potential spills from OCS oil and gas operations. The U.S. Geological Survey (USGS), the U.S. Department of the Interior (USDOI), Minerals Mangement Service's (MMS's) predecessor for regulating offshore operations, adopted stricter requirements, both to prevent oil and gas discharges and to respond to such discharges when they occur. The USGS and MMS have continuously reviewed and modified these requirements since 1969, so that offshore drilling and production facilities have had a 20-year head start in oil-spill response planning compared to vessels and onshore facilities. Vessels and onshore facilities did not have to meet oil-spill response planning requirements until passage of the Oil Pollution Act (OPA) in 1990.

Two key factors in determining the success or failure of spill response are preparedness and response time. Offshore spill response is generally successful when response crews and equipment are adequately prepared and immediately available to respond to a spill.

b. MMS Oil-Spill Research Program

The MMS is the principal U.S. Government Agency funding offshore oil-spill response research, and for more than 20 years, it has maintained a comprehensive, long-term research Oil-Spill Research (OSR) Program. The MMS has recognized expertise in oil-spill preparedness, mechanical containment and recovery of spilled oil, and "in situ burning," whereby spilled oil is burned instead of recovered. The MMS expanded the scope of its OSR Program in 1986 by aligning it with programs at the U.S. National Institute of Standards and Technology (NIST) and Environment Canada, Canada's environmental protection agency. The NIST possesses considerable expertise on in situ burning and burn products, and Environment Canada is recognized for its expertise in chemical treating agents and detection.

The OSR Program brings together, through cooperative research agreements and contracts, expertise in all areas of oil-spill response. The MMS, other U.S. agencies, foreign government agencies, and the oil industry jointly contribute research funding. The OSR Program participates in about 30 concurrent research and development projects. The MMS has cooperated in the exchange of technological information with Norway, United Kingdom, Japan, and France through informal contacts, workshops, and technical meetings such as the biennial International Oil Spill Conference.

Funding for the OSR Program and operation of the Oil and Hazardous Materials Simulated Environmental Test Tank (Ohmsett)—the national oil-spill response test facility—are appropriated from the Oil Spill Liability Trust Fund (OSLTF). The OSLTF receives funds from a $0.05 tax on each barrel of oil produced or imported into or out of the country. As intended by the OPA of 1990, the companies that produce and transport oil support research to improve oil-spill response capabilities.

Current OSR Program projects include laboratory, mesoscale and full-scale experiments, and field investigations. Major topic areas include: remote sensing and detection, mechanical containment and recovery, physical and chemical properties of crude oil, chemical treating and dispersants, in situ burning, deepwater operations, and operation and maintenance of Ohmsett, located in Leonardo, New Jersey.

c. Federal Government Contingency Plan Network

The OPA of 1990 amended section (§) 311(c) of the Federal Water Pollution Control Act (FWPCA) and, in turn, the National Oil and Hazardous Substance Pollution Contingency Plan, or National Contingency Plan (NCP). The NCP was developed according to the FWPCA and the Comprehensive Environmental Response Compensation and Liability Act of 1980. Under Title 40 of the Code of Federal Regulations, Part 300 (40 CFR 300), the NCP establishes responsibilities and criteria for responding to oil spills and spills of hazardous substances.

The NCP establishes a system of interlocking response teams, with the National Response Team (NRT) responsible for overall coordination among Regional Response Teams (RRT's). The U.S. Environmental Protection Agency (USEPA) and the U.S. Coast Guard (USCG) jointly chair the NRT and the RRT's. The RRTs are designated for intergovernmental planning and coordination of preparedness and response actions and are responsible for preparing Regional Contingency Plans (RCP's). An RRT is established for each standard Federal region, except for Alaska, Oceania in the Pacific, and the Caribbean area. Each of these three areas has its own separate-standing RRT. The RCP's fulfill the same requirements on a regional level as the NCP does for the nation. Draft NCP's and RCP's are published in the *Federal Register* (FR) with an appropriate time set for review and comment by interested parties.

Generally, the USEPA has Federal On-Scene Coordinator (FOSC) responsibility for spills onshore, and the USCG has FOSC responsibility for spills in major bodies of water inland and in coastal and offshore areas. Specific boundaries for USEPA or USCG jurisdiction are determined by agreement in the Federal RCP's. As planning proceeds toward the local level, each successive level of planning should contain more site-specific information to permit quick organization of an effective response to any oil spill.

When a spill occurs in coastal and offshore navigable waters of the United States, the USCG Captains-of-the-Port (COTP's) are designated as the FOSC's. There are currently 49 COTP areas. Generally, each COTP serves as predesignated On-Scene Coordinator for each port area. (The 10 USEPA Regional Administrators have designated about 200 On-Scene Coordinators for inland areas.)

An RRT can be convened at the request of a FOSC for coordination and advice during a spill incident. Each RRT is comprised of representatives with environmental expertise from about 15 Federal, State, and local agencies, and Indian tribes. The USDOI has a member on each RRT to assist an On-Scene Coordinator during a spill by providing expertise concerning fish and wildlife habitat. The National Oceanic and Atmospheric Administration provides a Scientific Support Coordinator to coordinate and develop scientific response information, as needed.

The FWPCA, as amended by the OPA, establishes Area Committees which are responsible for preparing Area Contingency Plans (ACP's). The FOSC's Committees are responsible for ensuring that Federal, State, and local response agencies and actions are fully coordinated, especially concerning the use of dispersants or in situ burning.

d. MMS Regulatory Authority for Oil-Spill Planning and Response

Both the OCS Lands Act and the FWPCA contain requirements for oil-spill prevention and cleanup. The OCS Lands Act assigns responsibility for the enforcement of safety and environmental regulations on the OCS to the USDOI Secretary; "the Secretary of the Department in which the Coast Guard is operating"; and the Secretary of the Army. The USCG is currently under the U.S. Department of Transportation (USDOT).

Executive Order (EO) 12777 delegates the President's OPA and FWPCA responsibilities to various Federal Agencies. It empowers the Secretary of the Interior to regulate oil-spill prevention and oil-spill response planning for all offshore oil and gas facilities and associated pipelines, including those located in State waters. This includes regulating the preparation and submittal of Oil-Spill Response Plans (OSRP's). The MMS has been actively coordinating its OPA responsibilities with States affected by offshore leasing such as Alaska, California, Texas, and Louisiana.

Under EO 12777, the USDOI, the USDOT, and the USEPA have overlapping responsibilities for oil and gas exploration and production activities. To reduce regulatory confusion, the USDOI, the USDOT, and the USEPA entered into a Memorandum of Understanding (MOU) under EO 12777. In this MOU, the Agencies divided their respective responsibilities for oil-spill prevention and response according to the definition of "coast line" contained in the Submerged Lands Act. (See 59 FR 9494-9495, Monday, February 28, 1994.)

In March 1997, MMS issued a final rule concerning "Response Plans for Facilities Located Seaward of the Coast Line," (See 62 FR 13991-14003, Tuesday, March 25, 1997.) This regulation is found at 30 CFR 254, and it replaced MMS's pre-OPA oil-spill response regulations in 30 CFR 250.

All OSRPs are reviewed and commented on by other Federal and State agencies—especially USCG. The lessee is the designated "responsible party" (RP) under the OPA and the NCP, and is therefore responsible for responding to a spill under its OSRP. The RP's are required to have the resources necessary to respond commensurate with their exploration or development activity. They are responsible for taking immediate corrective action when a spill occurs. However, if the spill (1) constitutes a substantial threat to the public health or welfare, or (2) is a worst-case discharge for the facility in question, then the FOSC would usually direct all containment and cleanup efforts.

The FOSC is required to make a reasonable effort to have the discharger voluntarily and promptly perform removal actions. The FOSC may also direct and monitor cleanup progress and provide advice and counsel to the RP as necessary. The method of response to a particular spill will depend on many factors including the function of industry spill response cooperatives, the location of the spill in relation to sensitive environmental areas, distance to shore, prevailing weather conditions, and prevailing sea conditions. These factors vary significantly, and planned response actions vary accordingly.

When an oil spill results from oil and gas activity on the OCS, the MMS maintains oversight responsibility for operations on the OCS facility. Since the FOSC would be from the USCG, a potential exists for confusion concerning the division of responsibility. To minimize possible confusion, the USDOI and USDOT initially established an MOU in August 1971 to outline the USGS's and the USCG's respective responsibilities in responding to a spill from an offshore drilling or production facility. This MOU has been updated several times. The most recent version between MMS and USCG was signed in December 1998. (See 64 FR 2660-2667, Friday, January 15, 1999.)

2. Industry Oil-Spill Response Plans

The basic requirements for OSRPs are specified in MMS operating regulations under 30 CFR 254. The RP's (lessees or operators) must submit for MMS approval an OSRP that covers each facility "located seaward of the coast line" before they may use the facility. A lessee's OSRP must be submitted or referenced with every exploration plan (EP), development and production plan (DPP), or development operations coordination document (DOCD).

The MMS regulations allow any lessee to submit a Regional OSRP that covers all of its operations in one area. If an existing and relevant OSRP is on file with MMS, that OSRP may be referenced in a EP, DPP, or DOCD. Regional response plans must address all the elements required for a response plan in 30 CFR 254, Subpart B, "Oil Spill Response Plans for Outer Continental Shelf Facilities," or Subpart D, "Oil Spill Response Requirements for Facilities Located in State Waters Seaward of the Coast Line," as appropriate.

a. Basic Requirements for OSRP's

When developing a Regional Response Plan, RP's must group leases or facilities covered by the plan for the purposes of calculating response times, determining quantities of response equipment, and conducting oil-spill trajectory analyses. The MMS Regional Supervisor for Field Operations has approval authority over the plans and may specify how to address various elements of a Regional Response Plan and, if necessary, require that the plan contain additional information to fully comply with regulations.

The RP's may reference information contained in other readily accessible documents in their response plans. For example, such documents may include the NCP, an ACP, MMS environmental documents, and Oil-Spill Removal Organization (OSRO) documents. The OSRO's are entities contracted by an owner or operator to provide spill-response equipment or qualified personnel in the event of an oil or hazardous substance spill. The RP's must ensure that the Regional Supervisor is provided with copies of all referenced OSRO documents.

In every OSRP, the lessee or designated operator, as the RP, must:

- Identify a qualified individual (QI) and require immediate communication between that person and appropriate Federal officials and response teams in the event of a spill.
- Designate, by name or position, a trained spill management team available on a 24-hour basis. The team must include a trained spill-response coordinator and alternates who have the responsibility and authority to direct and coordinate response operations on the RP's behalf. The OSRP must describe the team's organizational structure as well as the responsibilities and authorities of each position on the team.
- Identify a spill-response operating team, trained and available on a 24-hour basis, to deploy and operate spill-response equipment. The team must be able to respond within a reasonable minimum specified time. The number and types of personnel available from each identified labor source must be included.
- Designate a planned location for a spill-response operations center and provisions for primary and alternate communications systems available for use in coordinating and directing spill-response operations. All relevant telephone numbers, facsimile numbers, and radio frequencies must be provided.
- List the types and characteristics of the oil handled, stored, or transported at the facility.
- Describe procedures for the early detection of a spill.
- Describe provisions for disposal of recovered oil, oil-contaminated material, and other oily wastes.
- Describe provisions for monitoring and predicting spill movement.
- Identify procedures to be followed in the event of a spill or a substantial threat of a spill. Show response levels for various-sized spills, including those involving fire or explosion.
- Describe the training, equipment testing, unannounced drills, and actions of facility personnel.
- Describe procedures to be used to periodically update and resubmit the plan for approval of each significant change.

Owners or operators of facilities located in State waters seaward of the coastline also must submit a spill-response plan to MMS for approval. They may choose one of three methods to comply: (1) modify an existing OCS response plan covering a lease or facility on the OCS to include a lease or facility in State waters; (2) follow a format for an OCS response plan; or (3) submit an OSRP developed under State requirements. If RP's submit an OSRP developed under State requirements, they must provide documentation concerning State regulations and the State agency to which the plan was submitted.

b. Specific Procedures to Be Described in an OSRP

An OSRP must contain details on the following methods and procedures that the RP (lessee or operator) intends to follow in the event of a spill:

- Methods to monitor and predict spill movement;

- Methods to identify and prioritize the beaches, waterfowl, other marine and shoreline resources, and areas of special economic and environmental importance;
- Methods to protect beaches, waterfowl, other marine and shoreline resources, and areas of special economic or environmental importance;
- Methods to ensure that containment and recovery equipment, as well as the response personnel, are mobilized and deployed at the spill site;
- Methods to ensure that devices for the storage of recovered oil are sufficient to allow recovery operations to continue without interruption;
- Procedures to remove oil and oiled debris from shallow waters and along shorelines and to rehabilitate waterfowl which become oiled;
- Procedures to store, transfer, and dispose of recovered oil and oil-contaminated materials and to ensure that all disposal is in accordance with Federal, State, and local requirements; and
- Methods to implement a dispersant use plan and an in situ burning plan.

c. Plans for a "Worst-Case Discharge Scenario"

According to 30 CFR 254, RP's must calculate the volume of oil for their worst-case discharge. All OSRP's must include an appendix for a "worst-case discharge scenario" that includes: (1) the volume of the RP's worst-case discharge estimation, with assumptions and supporting calculations; (2) a trajectory analysis for the specific facility that identifies all potentially affected areas; (3) a list of the resources of special economic or environmental importance that potentially could be affected, as indicated by the trajectory analysis; and (4) a discussion of the RP's response to a worst-case discharge scenario in adverse weather conditions.

d. Dispersant Use Plan

The OSRP's must include a dispersant use plan that must be consistent with the NCP Product Schedule, other provisions of the NCP, and appropriate ACP's. The plan must include: (1) an inventory, by location, of the dispersants and other chemical or biological products which the RP might use on the oils handled, stored, or transported at the facility; (2) a summary of toxicity data for these products and an outline of the procedures the RP must follow to obtain approval to use these products; and (3) a discussion of the application procedures, the location and type of any application equipment required, and estimate of the time to commence application after approval is obtained.

e. In situ Burning Plan

The OSRP's must include provisions for igniting an uncontrollable oil spill, which would be done only with the approval of the FOSC. In situ burning plans must be consistent with guidelines authorized by the NCP or appropriate ACP's. In situ burning plans must include:

- the specific burn equipment and its availability, location, and owner;
- the RP's guidelines for well control and safety of personnel and property;
- burning procedures, including provisions for ignition;
- environmental effects and the circumstances in which in situ burning may be appropriate; and
- procedures that must be followed to obtain approval for in situ burning, with the RP's guidelines for making the decision to ignite.

f. Spill Reporting Requirements

The RP's must immediately notify the National Response Center (1-800-424-8802) if they observe an oil spill from their facility or any other source, known or unknown. If they observe a spill originating from another facility, they must immediately notify the RP for that facility and the MMS Regional Supervisor.

In the event of a spill of 1 barrel (bbl) or more, the RP's must orally notify the Regional Supervisor without delay. They must send a written followup report to the Regional Supervisor within 15 days after the spill has been stopped. All reports must include the cause, location, volume, and remedial action taken.

Reports of spills of more than 50 bbl must include information on the sea state, meteorological conditions, and the size and appearance of the slick. The Regional Supervisor may require additional information after determining that further analysis of the response is necessary.

3. Inspection and Maintenance of Spill Response Equipment

a. Equipment Inventory and Inspection

Each RP must maintain an inventory of spill-response materials and supplies, services, equipment, and response vessels available locally and regionally. The RP must identify each of its suppliers and provide their locations and telephone numbers.

The RP's must ensure that the equipment listed in their OSRP's is inspected at least monthly and maintained to ensure optimal performance. They must describe their procedures for inspecting and maintaining spill-response equipment and must keep records of the inspections and maintenance activities for at least 2 years. These records must be made available to any authorized MMS representative upon request.

The RP's must calculate the effective daily recovery capacity of equipment identified in their response plans for containing and recovering a worst-case discharge. This involves multiplying the manufacturer's rated throughput capacity over a 24-hour period by 20 percent to take into account the limitations of the recovery operations due to available daylight, sea state, temperature, viscosity, and emulsification of the oil being recovered. The calculated rate is used by the RP's to determine whether they have sufficient recovery capacity to respond to their worst case discharge scenario.

The RP's are responsible for any required testing of equipment performance and for the accuracy of the information submitted. They must conduct any required performance testing of booms or skimmers in accordance with MMS-approved test criteria. The MMS Regional Supervisor may require performance testing of any spill-response equipment listed in a RP's response plan to verify its capabilities.

b. Response Training and Drills

Spill response planning done for OCS oil and gas activities must be effective in assuring that lessees or operators (RP's) are prepared to respond to any spill which may occur from their permitted operations. Many potential problems can be discovered and corrected through requirements for operator-initiated inspection, training, and drills. Potential problems include:

- vessels and equipment designated in a plan being unavailable due to relocation or repairs,

- equipment not being in working order due to lack of use,
- personnel identified in a plan having been reassigned, or
- inadequately trained personnel.

The MMS Regional Supervisors periodically initiate unannounced response drills for simulated spills to test the preparedness of RP's. Regional Supervisors may evaluate the results of the exercises and advise RP's of required changes in the frequency or location of the required exercises, equipment to be deployed and operated, or deployment procedures or strategies.

According to 30 CFR § 254.41, RP's must ensure that members of the spill-response management team receive annual training in directing the deployment and use of response equipment. The management teams include QI's and spill-response coordinators and alternates. Members of spill-response operating teams also must attend hands-on training classes at least annually. Their training includes the deployment and operation of the response equipment they plan to use.

The RP's must keep all training certificates and training attendance records at locations specified in their OSRP's for at least 2 years. All records—including records of services, personnel, and equipment provided by OSRO's or cooperatives—must be made available to any authorized MMS representative upon request.

According to 30 CFR § 254.42, RP's must exercise each entire OSRP at least once every 3 years in triennial exercises. They may satisfy this requirement by conducting separate exercises for individual parts of the plan over the 3-year period. For any exercise required under the triennial exercise requirement, the RP's must inform the Regional Supervisor of the date of any exercise at least 30 days before the exercise. This allows MMS the opportunity to witness any exercises. In satisfying the triennial exercise requirement, an RP must, at a minimum, conduct:

- An annual spill management team tabletop exercise. Tabletop drills are indoor management and communications exercises that simulate overall spill response coordination. The exercise must test the spill management team's organization, communication, and decisionmaking in managing a response. The spill scenario must not be revealed to team members before the exercise starts.
- An annual deployment exercise of spill-response equipment staged at onshore locations. An RP must deploy and operate each type of equipment in each triennial period. However, it is not necessary to deploy and operate each individual piece of equipment during each exercise.
- An annual notification exercise for each facility that is manned on a 24-hour basis. The exercise must test the ability of facility personnel to quickly communicate pertinent information to the QI.
- A semiannual deployment exercise of any response equipment which the MMS Regional Supervisor requires the RP to maintain at the facility or on dedicated vessels. The RP must deploy and operate each type of the maintained equipment at least once each year, but all equipment types need not be deployed during every exercise.

Each exercise must simulate conditions in the area of operations, including seasonal weather variations, to the extent practicable. The exercises must cover a range of scenarios over the 3-year exercise period, simulating responses to large continuous spills, small-volume spills, and the worst case discharge scenario. The MMS will recognize and give credit to the RP for any documented exercise conducted that satisfies some part of the required triennial exercise. The MMS also will give credit for an actual spill response if the RP evaluates the response and generates a proper record.

The RP's must maintain all records of spill-response exercises for the 3-year exercise cycle at the facility or a location designated in the plan. Records showing that OSRO's and oil-spill removal cooperatives have deployed each type of equipment also must be maintained for the 3-year cycle.

4. Occupational Safety and Health Administration (OSHA) Requirements

The NCP, 40 CFR § 300.150, "Worker Health and Safety," requires that oil-spill responders (including OCS lessees and operators) adhere to the training and safety requirements outlined in the U.S. Department of Labor, OSHA, Hazardous Waste Operations and Emergency Response regulations at 29 CFR § 1910.120. The NCP specifically requires that "All governmental agencies and private employers are directly responsible for the health and safety of their own employees."

The OSHA requirements are focused on the safety of spill responders, such as equipment operators and general laborers who have a potential for exposure to a hazardous substance. Employees must not be permitted to participate in or supervise field activities until they have been trained to a level required by their job function and responsibility. Spill responders are required to have 24 hours of initial oil-spill response instruction and 1 day of actual field experience under the direct supervision of trained and experienced supervisor. The OSHA requirements also address those spill responders having a potential for exposure to a hazardous substance at levels exceeding the permissible exposure limit (PEL), which are generally those situations requiring use of a respirator and protective clothing. Responders having a potential for exposure to a hazardous substance at levels exceeding the PEL are required to have 40 hours of initial training off site and 3 days of actual field experience under the direct supervision of trained and experienced supervisor.

Onsite managers and supervisors are required to receive the same amount of training as the equipment operators and general laborers having the potential for exposure to a hazardous substance at levels exceeding the PEL. Onsite managers and supervisors must also have 8 hours of specialized training in hazardous waste management. Eight hours of annual refresher training is required of both general employees and managers.

5. Review and Revision of OSRP's

Each OSRP is reviewed by MMS specialists to ensure that the plan meets regulatory requirements and protects biological and other resources that could be affected by exploration or production operations. In cases of site-specific OSRP's that are submitted to the States for review along with EP's and DPP's, the OSRPs' are reviewed and commented on by USCG and State regulatory agencies. (The EP's and DPP's may reference an existing Regional Response Plan rather than having an attached site-specific OSRP.)

In the Gulf of Mexico Region, Regional Response Plans are reviewed and approved by MMS only. In the Pacific Region, under an MOU with the California Office of Spill Prevention and Response, the State is provided a copy of the OSRP for facilities in Federal waters for review. The USCG is also provided a copy of the OSRP for review, but only the MMS approves these plans.

The review process ensures that the proposed equipment and strategies are appropriate, personnel are adequately trained, and the RP is fully prepared to respond to an oil spill from its facility. It also ensures that an RP's identified response time is reasonable, accurate, and sufficient to protect nearby resources and environmentally sensitive areas. Response times are further reviewed to determine whether they include sufficient time for the procurement of a vessel and for mobilization, loadup, transportation, and deployment of equipment. Based on the results of this review, MMS determines

whether the primary oil-spill-response equipment location identified by the operator is appropriate for the subject plan and whether the projected response time allows sufficient containment and cleanup time prior to a spill's potential contact with an environmentally sensitive area.

The RP's must review their response plan at least every 2 years and must submit all resulting modifications to the MMS Regional Supervisor. The Regional Supervisors may require that RP's resubmit their plans if the plans have become outdated or if numerous revisions have made plans difficult to use.

6. Regional Conditions Affecting OCS Oil-Spill Planning and Response

a. Gulf of Mexico OCS Region

Over 90 percent of all OCS oil and gas production has come from the Gulf of Mexico OCS Central Planning Area offshore Louisiana. There are over 4,000 production platforms throughout the Central and Western Gulf of Mexico OCS. Since 1998, the Gulf of Mexico OCS Region has had a program to conduct unscheduled drills of about 20 randomly selected RP's each year. (Before 1998, there were 6 unscheduled drills annually.) The four types of drills developed by the Region include:

- unannounced drills with equipment mobilization only,
- unannounced drills with equipment mobilization and deployment,
- spot tabletop drills, and
- announced tabletop simulations of a large oil spills.

The MMS requires a written report to be submitted within 15 days of the conclusion of each unannounced drill. The MMS witnesses the drills, evaluates the results of these drills, and advises the lessee of any necessary changes in response equipment, procedures, or strategies. In some instances, the MMS issues Incident of Non-Compliance warnings to the RP's.

Although OSRP's for the Gulf of Mexico do not specify response times, the supplemental oil-spill information submitted for EP's, DPP's, and DOCD's provides response times for operations on a particular lease. First response to a drilling-related spill in the Gulf would generally be made using cooperative OSRO equipment. Operators are responsible for supplying their own vessels, cranes, and personnel when using this equipment.

A large number of operators in the Gulf of Mexico propose the use of contract personnel to load and operate OSRO equipment. This typically involves a "no fee" type of contract with one or more of these companies to provide spill response on a 24-hour basis if they are available at the time of a spill. Because these companies are not located in close proximity to all of OSRO equipment bases, the delivery of the contract personnel to a spill base for loadout could increase a projected response time. A 6-hour timeframe to mobilize personnel and equipment is required in some instances.

There is a wide variation in the distances of the leased areas in the Gulf to shorelines that could be affected by a spill. It should be noted, however, that an oil spill over 60 miles from shore would not normally pose an immediate threat to coastlines in the Gulf, primarily for two reasons. First, prevailing winds and currents in the Gulf do not move spills directly toward the shorelines. Second, the greater the distance a facility is from the shore, the greater the time available before a shoreline would be affected, and the greater time available for the generally light Gulf crude oils to be naturally dispersed. Nevertheless, response to a spill should be undertaken as soon as possible with all due concern for safety and practicality.

A study of the projected response times submitted by Gulf of Mexico OCS operators determined that most facilities located more than 60 miles from an onshore equipment base have response times greater than 12 hours. These response times are based on the following:

- an estimated 4 hours for the procurement and mobilization of personnel and a vessel to a base,
- an estimated 2 hours to load the equipment onto the support vessel,
- an estimate that the vessel would travel at 10 mph in open water, and
- an estimated channel run time.

To partially address this problem, OSRO's have equipped several vessels and staged them at offshore locations to reduce the initial response times for certain areas of the Gulf of Mexico.

Many operators have identified vessel procurement as one of the most limiting factors in reducing response times in the Gulf of Mexico. Procurement times of over 12 hours have been projected in some instances. Many operators have planned for a spill equipment base nearer their onshore support base rather than a base closer to their leases to ensure that a vessel could be procured within a reasonable time. Most companies prefer to rely upon vessels they have already contracted with as opposed to attempting to contract or borrow a vessel from another company at the time of a spill. Procurement of large vessels—from 160 to 180 feet in length—also poses a major response problem. Large vessels would be needed to respond to spills in deepwater blocks, and there are a limited number of spill equipment base locations that can accommodate large vessels. These factors could significantly increase an already lengthy response time to a deepwater area.

b. Pacific OCS Region

In the Pacific OCS Region, there are 23 fixed platforms. The MMS Pacific OCS Region has an annual requirement of one unannounced oil-spill drill per facility witnessed by MMS inspectors in addition to the requirement for each operator to conduct semiannual deployment drills. These exercises are designed to involve the primary level of response and activation of the operator's immediate response team. The primary level of response are spill response capabilities located at or near the platform.

The region also conducts one unannounced major oil spill drill at one of the 23 facilities per year. These exercises are designed to involve primary and secondary response levels and the activation of the operator's emergency response team. (Secondary level represents backup response capability identified in an OSRP for a large or continuing spill.)

For a typical spill drill, the MMS representative arrives unannounced at a targeted platform, hands the foreman a written scenario, and observes and records the response. The scenario outlines time, size and cause of the spill. A rough size of the slick is estimated, using the volume and American Petroleum Institute (API) gravity of the spilled oil. Sorbent pads, 18 inches square, are thrown into the ocean to simulate the spill and the direction of the slick drift.

After the platform foreman is satisfied that the cause of the spill is stopped, he activates the on-site response team, and arranges for the deployment of the on-site boom—750 feet or 1,500 feet, depending on the size of the slick—and skimming device. A minimum of three vessels are involved in the containment and cleanup—two to contain the spill and one to do the skimming. During the drill, the foreman notifies all the interested State and Federal agencies, and shows the MMS

representative the spill material inventory and the records of previous equipment inspections and drills. The response team's training records are also verified.

For an unannounced major oil-spill drill, in addition to deploying response equipment, the operator is also required to mobilize their spill-response operations center as described in their OSRP. The MMS representatives and invited observers from other Federal, State, and local agencies arrive unannounced at the operations center to initiate and participate in the exercise. At the conclusion of the exercise, personnel from the agencies and the operator participate in a critique of the exercise to provide the operator feed-back for improvement.

Operators in the Pacific Region are required to keep sufficient equipment on or near the platform to enable them to initiate containment activities immediately. For a second level response, equipment at the platform is supplemented by equipment kept onshore and operated by oil-spill cooperatives formed by the lessees and operators. For example, Clean Seas has prestaged equipment located at Morro Bay, Avila Bay, Santa Barbara Harbor, the Carpinteria Yard, and the Ventura/Port Hueneme area. The three major oil-spill cooperatives on the California coast—Clean Bay, Clean Seas, and Clean Coastal Waters—also have at least six dedicated ocean-going vessels with containment and recovery equipment for oil-spill response. They have formally agreed to provide each other response assistance within the boundaries established by State and Federal regulatory authorities. These cooperatives have also been acquiring new equipment to supplement their existing inventories.

If the FOSC so requests, the U.S. Navy and the USCG Pacific Strike Team can provide additional oil-spill response equipment and personnel located at Stockton and at Hamilton Field in Novato, both in northern California. Also, the Marine Spill Response Corporation (MSRC) has established a Southwest Region Response Center at Port Hueneme on the Santa Barbara Channel (see Section 9.b for a more complete discussion of the MSRC). Equipment from this center may be used for response to a spill from OCS exploration and production operations if so directed by FOSC.

There have been numerous public expressions of concern about oil spills from possible OCS development along the central California coast. Oil-spill risk to the central California coast from OCS operations is low for several reasons. First, there are no OCS operations along the central California coast to create a spill risk, nor are any such operations expected as a consequence of the proposed lease sale schedule. Oil-spill risks to the Central California coast from existing and potential OCS operations more than 100 miles to the south are very low. Thus, there is no need to locate cleanup response equipment for OCS operations along the central California coast.

c. Alaska OCS Region

Because of the remoteness, relatively short drilling season, and other logistical considerations, the MMS Alaska OCS Region does not require unannounced oil-spill response drills for exploration drilling. Unannounced drills may be conducted in the future if production or other long-duration operations exist in the Region.

The Alaska OCS Region requires scheduled oil-spill response drills witnessed by MMS inspectors for all exploratory drilling operations. During these drills, operators deploy onsite spill-response equipment in response to a preplanned scenario approved by the MMS. In addition, each operator is also required to conduct a table top and communications spill-response exercise to demonstrate its ability to implement a major spill response for a blowout. The scenario for this exercise is coordinated with the USCG. The scenario is announced at the time of the exercise, providing an element of surprise for the drill. During the tabletop exercises, spill trajectories are performed;

communications and coordination among agencies are tested; plans and strategies are developed to respond to the spill; and logistics for implementing the spill response and for obtaining additional manpower, response equipment, aircraft, and storage barges are verified.

The activity in the Alaska Region varies significantly from year to year and from location to location. Accordingly, the response equipment in place to respond to spills resulting from activity in the Alaska OCS also varies in response to changes in location of activity. The MMS Alaska OCS Region requires any lessee conducting exploratory drilling operations to have an initial onsite spill-recovery capability of at least 1,000 bbl per day and the ability to mobilize additional equipment and personnel for a larger spill, if necessary. Requirements regarding the type, location, and quantity of equipment are based upon estimates of the maximum spill size and trajectory analysis, as presented in the risk analysis of the OSRP.

Two oil-spill response organizations have been established by the petroleum industry for offshore Alaska: Alaska Clean Seas and Cook Inlet Spill Prevention and Response, Inc. In addition, Alyeska Pipeline Service Company maintains a major spill-response organization for its pipeline and marine terminal operations; however, this equipment is dedicated for response to tanker spills in Prince William Sound, so it may not be available for use in the event of a spill from OCS operations. Many operators in Alaska also maintain their own spill-response personnel and equipment for use as the primary spill response for their operations offshore Alaska.

The limited geographic and temporal presence of open water and slow vessel speeds in broken ice preclude timely spill equipment transport by sea. For larger spills exceeding the local response capability, additional equipment is available from a number of sources. The Alaska OCS environment raises a number of oil-spill concerns because of geographic remoteness and the difficulties of responding to oil spills in arctic conditions. The Section 8 discussion of "Oil-Spill Issues Raised by Arctic Oil and Gas Development" in this appendix will discuss in situ burning as a response measure as well as other aspects of potential oil spills in the Arctic environment.

Because of the remoteness of drilling sites from existing support facilities in the Alaska OCS Region, oil-spill response equipment is normally kept onsite. For example, in the Chukchi Sea, oil-spill response equipment has been maintained on a drillship, on a large nearby icebreaker/support ship, or on a designated oil-spill response barge stationed near the drilling site during the drilling season (approximately July to October). For Chukchi Sea operations, only onsite equipment or equipment transported by helicopter from Point Belcher or Barrow could meet deployment guidelines. If carried by helicopter and weather permitting, spill cleanup equipment from Barrow could reach any point in the Chukchi Sea Planning Area within 3 to 6 hours.

In good weather, equipment transported by plane or helicopter from Point Belcher or Barrow could satisfy the equipment deployment criteria set by MMS for 6-, 12-, and 48-hour responses. Additional equipment from Alaska, Canada, or the lower 48 States also could be airlifted to Barrow or Point Belcher to meet the 48-hour guideline. Other slower-arriving equipment would still be useful in a major spill; but the MMS does not consider such equipment in judging whether the OSRP meets the MMS 48-hour response criteria. (Estimated response times from other onshore oil-spill response bases would be as follows: Deadhorse, 3 to 6 hours (by air); Dutch Harbor, 2 weeks (by sea); and Anchorage, 5 to 8 hours (by air).) Cleanup could continue as long as necessary, without any timeframe or deadline. For example, a winter spill in pack ice might require initial onsite response followed by further oil cleanup in late spring or summer when the oil melts out or pools on top of the ice.

Currently, the only exploration or development offshore the North Slope is being conducted in the Beaufort Sea off Prudhoe Bay. Oil-spill response equipment is staged in Prudhoe Bay/Deadhorse at Alaska Clean Seas facilities. These inventories are sufficient for initial response to a worst-case discharge from any of the facilities in the Prudhoe Bay area. Exploratory work is accomplished during the winter months when solid ice conditions are present. Access to the sites can be gained by air or ice roads in relatively short order depending on visibility.

Onshore support facilities for oil-spill response on Beaufort Sea leases are located primarily at Deadhorse. Equipment stored at Deadhorse is capable of meeting the criteria of the 48-hour response time for major spills. Equipment staged in Deadhorse can be mobilized by air or via ice roads in the winter or by vessel during broken-ice and open-water conditions to spill sites within 3 hours depending on the system.

As a result of the 1989 *Exxon Valdez* spill, a number of critics of the OCS leasing program have observed that a tanker spill originating in one portion of the Alaska OCS can affect a wide area. However, there currently is no production or tankering of oil from OCS leases offshore Alaska; nor are there any plans to transport OCS production by tanker in the Beaufort Sea. Northstar production, which will include OCS oil, is expected to begin in late 2001. This oil will be tankered out of Valdez to the west coast and possibly to the Nikiski Refinery in Alaska. Cook Inlet and Prince William Sound have oil-spill response infrastructure to respond to spills from tankers. Before any OCS development activity could be allowed, a DPP and OSRP would have to be submitted, reviewed, and approved. The DPP would have to describe any proposed tanker activity. If tanker activity were proposed in currently undeveloped areas, the OSRP, OSRO, and other response capabilities would be substantially enhanced to respond to tanker spills.

d. Atlantic OCS

The MMS Gulf of Mexico OCS regional office conducts all leasing and resource management functions for the Atlantic OCS area as well as the Gulf of Mexico OCS Region. The Atlantic OCS area is divided into four planning areas along the Atlantic seaboard: North Atlantic, Mid-Atlantic, South Atlantic, and Straits of Florida. Currently, there are no leases off the Atlantic Coast, and no Atlantic lease sales are planned for the proposed 5-Year OCS Oil and Gas Leasing Program.

7. Effectiveness of Oil-Spill Containment and Cleanup Technology

a. Properties and Behavior of Oil

Before oil-spill response plans are developed or approved, it is important to understand the chemistry and physical behavior of the oil and how its characteristics change over time, once the oil is spilled. The physical and chemical properties of spilled oil change rapidly on the water's surface and often distort the reported volume recovered. Viscosity, density, emulsification, and weathering have a direct bearing on oil recovery operations. These properties influence the selection of response equipment and methods applicable for spill cleanup.

Mechanisms of weathering, evaporation, water-in-oil emulsification, dispersion, dissolution, and photooxidation need to be better understood to accurately predict spill behavior. The MMS and its research partners have several ongoing projects to improve their understanding of spill behavior. Through joint research, the MMS OSR Program and Environment Canada plan to continue the physical and chemical analysis of different types of crude oils and to continue to develop the Catalog of Crude Oil and Oil Product Properties that is available on Environment Canada's website. The

catalog provides a single, complete database of the physical and chemical properties of more than 425 different crude oils.

The Behavior of Oil Spilled at Sea Project is designed to provide a comprehensive collection and review of data and concepts related to oil-spill behavior. Topics also include the lesser-documented topics of oil on land, on freshwater, and in the ground. This project will combine into one source, the literature on oil-spill behavior and findings from previous joint research. Over 5,500 papers have been collected and initially reviewed to date. The oil-in-ice review has been completed. Work is continuing on preparation of sections on solubility, evaporation, and emulsification.

b. Response Capabilities

Response capabilities have improved in recent years, allowing for improved detection, containment, recovery, and removal of spilled oil. In particular, recent advances in fire-resistant boom technology have made in situ burning a viable response tool. Improvements in other areas of response technology, response strategy, and more stringent standards for response planning and preparedness have also enhanced cleanup capabilities. Various types of oil-spill countermeasures are generally considered to have the following rates of effectiveness for oil removal using current technology:

- booms and skimmers, 10-20 percent;
- dispersants, 30-40 percent; and
- in situ burning, 90-98 percent if burning is started soon after the spill and before the oil emulsifies.

Technological advances may eventually raise these figures. Test protocol standards are necessary so that regulatory authorities such as MMS, USCG, and USEPA can better evaluate the effectiveness of equipment included in industry response plans. In February 1992, MMS published two test protocols, one for evaluating oil-spill skimmers and the other for evaluating oil-spill containment booms. The MMS is working with the American Society for Testing and Materials (ASTM) Committee F-20 on Hazardous Substances and Materials and Oil Response to improve existing test protocols and to develop new protocols for various types of oil-spill response equipment.

Most of this work is being carried out at Ohmsett, the national oil-spill response test facility, located in Leonardo, New Jersey. The Ohmsett facility is available on a reimbursable basis to both the public and private sectors as a research center to test oil-spill containment and cleanup equipment or techniques, remote sensing devices, or to conduct spill response training. Current testing at Ohmsett is funded by the MMS, USCG, U.S. Navy, USEPA, Environment Canada, MSRC, academia, and private industry.

The Ohmsett's main feature is an above-ground concrete tank, measuring 203 meters long by 20 meters wide and 3.4 meters deep, and filled with 9.84 million liters of clear salt water. Through a variety of mechanical, electrical, and chemical systems, the following test parameters can be controlled or measured: sea state (wave height, length, and period), tow speed, meteorological data, water temperature and salinity, volume of oil encountered and recovered by equipment or procedures, oil-to-water ratios, physical characteristics of oil, and behavior of treated oils.

c. Response Times

The spread of an oil slick following an incident makes the response time a critical factor. In some cases, winds, currents, and tides may cause spreading to occur at a very high rate. In other cases,

spreading may take place at a far slower rate—currents may be circular in nature and keep a spill localized, or spreading may be in a direction away from sensitive environmental areas. The "appropriate response time" depends on the situation. Nevertheless, the longer it takes for the response team and equipment to get into place, the larger the area they must cover and the more difficult the job they must complete.

As indicated in the Section 6 discussion on "Regional Conditions Affecting OCS Oil-Spill Planning and Response," damage resulting from a spill can be greatly reduced by locating vessels and equipment in advance so that work can be initiated quickly to contain a spill or to place booms to protect environmentally sensitive areas. Responses to initiate containment and cleanup operations should, in all cases, be immediate, taking into consideration the proximity to "target" areas, the degree of sensitivity of those areas, and the length of time it will take prevailing currents to move a spill from the source to those areas.

d. Techniques for Detecting and Monitoring Spilled Oil

Early detection can limit the size of the overall spill as well as shorten the time necessary to initiate a containment and cleanup response. Practical oil-spill detection is still performed by visual observation, which is limited to favorable sea and atmospheric conditions and is inoperable in rain, fog, or darkness.

After several hours, spilled oil is no longer in uniform slicks but may be spread out so that as much as 90 percent of the oil is in 10 percent of the slick. Effective response operations are dependent upon the ability to locate concentrations of oil and to track the movement of oil slicks. Measurement of physical properties (thickness in particular) helps to determine the feasibility of various responses such as mechanical recovery, dispersant applications, and in situ burning

Without accurate and timely thickness information, responders may spend an inordinate amount of time working on thinner and less productive portions of the slick. Modern remote sensing instrumentation can be used to monitor oil on the open ocean during most times and conditions. With knowledge of slick location and movement, response teams can effectively plan cleanup operations. Even though sensor design and electronics are becoming more sophisticated and less expensive, there remains a lack of capability to measure and accurately map the thickness of oil on the water's surface.

Airborne remote sensing packages have been developed using side-looking radar, synthetic aperture radar, infrared and ultraviolet imagers, or false color cameras. However, current airborne remote sensing equipment either is too affected by weather conditions or consistently shows false images that require visual observations to correct. Wind patterns, fresh water, silt, and seaweed all show up as potential slicks. Airborne remote sensing packages cannot yet discriminate between areas of a slick which are thick enough to recover and portions too thin for any reasonable response effort.

The MMS and Environment Canada have initiated research on the measurement of thickness from aircraft so that response teams can direct collection efforts to areas which permit significant recovery. Significant progress has been made on these systems, but more work needs to be done. The MMS and Environment Canada are continuing to work on oil thickness sensor development to accelerate development of a "laser ultrasonic remote sensing of oil thickness" (LURSOT) sensor.

During the *Exxon Valdez* response, infrared and ultraviolet systems were used extensively to aid visual observations. These systems, although not usually available to responders, have proved quite effective in monitoring spill movement (although oil-in-water emulsions are sometimes not detected

in the infrared). New technology has made infrared cheap and practical, despite its limitations. The MMS OSR Program is continuing to fund research to improve ultraviolet, infrared, and false color sensing systems.

The joint MMS-Environment Canada program has been evaluating the laser flourosensor for measuring spill thickness by remote means. This device apparently can detect oil in broken ice conditions. It can also be used to detect oil in complicated marine environments and on shorelines, land, snow, and ice. It can provide positive identification of hydrocarbons and discriminate between hydrocarbon types. It can also be used to create a geo-referenced, real-time, annotated map that may be faxed or downlinked to oil-spill response teams working in the field.

Satellite-borne sensors, particularly radar, are useful; however their low frequency of overpass and lack of spatial resolution make them of marginal use for spills. Also, satellite technology has resulted in false positive discrimination and resolution problems.

Spill response teams need an improved understanding of the transport of oil as it is driven by winds and currents. Computerized oil-spill trajectory models have been developed for this purpose, and the models are being evaluated by drifter buoy studies. Oil-spill tracking buoys have been investigated and used for a number of years. Current versions use Global Positioning Systems to track movements. Tracking buoys are best suited for marking the initial location of a spill and providing a gross estimate of drift speed and direction. They have limited utility as a tactical spill-tracking tool. The MMS OSR Program is conducting further research to evaluate improved tracking buoys that move with the oil slick.

During several spills, it was noted that oil submerged and then reappeared in surf zones and on beaches. This was evidenced by significant shoreline oiling where there had been no visible oil reported seaward of the surf zone. Currently, there are no countermeasures for submerged oil. However, some believe that fish-finding sonar can be used to track submerged oil and that effective countermeasures can be developed for use before the oil washes ashore. Recent research during oil spills has identified several mechanisms that can cause oil to submerge. One goal of the MMS OSR Program is to develop a state-of-the-art sensor to detect the presence of submerged or neutrally-buoyant oil.

Detection of oil spilled under arctic ice is discussed in Section 8 of this appendix.

e. Mechanical Containment and Cleanup Equipment

In 1999, the USCG analyzed 231 oil spills greater than 1,000 gallons from their Marine Safety Information System (MSIS) for the period 1993-1998 ("Response Plan Equipment Caps Review: Are Changes to Current Mechanical Recovery, Dispersant, and *In Situ* Burn Equipment Requirements Practicable?" (Caps Review)). Their analysis indicated that on-water mechanical recovery was a viable response option in 62 percent of all nearshore, offshore and open-water spills. A wide variety of mechanical equipment is available for the containment and cleanup of spilled oil, including booms, skimmers, pumps, and sorbents.

Containment of an oil spill is the process of preventing its spread by confining the oil to the area where it has been discharged. Containment not only localizes the spill but also facilitates its removal by causing it to concentrate in thicker layers on the water's surface. Containment booms are generally the first equipment mobilized at the scene of a spill and the last to be removed.

Following containment, the next step in the cleanup operation is physical recovery of the oil from the water's surface. Three distinct approaches to physical recovery involve mechanical skimmers, sorbents, and manual labor. In most instances, the containment and recovery phases of an oil spill proceed simultaneously.

According to the 1999 USCG Caps Review, mechanical recovery generally results in recovering no more than 20 to 30 percent of spilled oil. Mechanical recovery technology is steadily improving for open-water response as newer designs for containment and recovery systems are refined and operationally tested. However, this technology remains static and rudimentary for ice and fast currents.

Booms: Oil-spill control booms are floating barriers designed to contain and divert spilled oil for recovery. They are also used to protect areas containing commercially valuable or environmentally sensitive resources from oil contamination. A boom is typically constructed of modern materials having a high strength-to-weight ratio and packaged compactly to allow ease in transportation and deployment.

All booms generally incorporate the following features: freeboard to prevent or reduce splashover; subsurface skirt to prevent or reduce the escape of oil under the boom; flotation by air or a buoyant material; and a longitudinal tension member (chain or wire) to withstand the effects of winds, waves, and currents.

The length and size of boom sections are important considerations. The optimum size of a boom is largely related to the sea state under which it is to be used. As a general rule, the minimum height of freeboard to prevent oil splashover should be selected; and the depth of the skirt should be of similar dimensions. Short section lengths of boom are easier to handle and can protect the integrity of the boom as a whole, should one section fail. However, this should be weighed against the difficulty of effectively connecting the sections.

In 1986, the ASTM Subcommittee F20.11 developed a standard for boom connectors. The purpose of the standard is to ensure that booms from different sources will fit together regardless of how or from what materials the connectors are made. The ASTM revised the standard in June 1994.

According to the 1999 USCG Caps Review, the rate at which oil can be collected and contained offshore depends upon the rate of speed through a slick, generally 1 knot or less, and the sweep width of the boom and skimmer combination. (The sweep width is also referred to as the gap width or mouth opening.) Collection rates decrease with increasing sea states. Conventional knowledge indicates that containment booms will not effectively operate in wind speeds over 15 to 20 knots or at tow speeds exceeding 1/2 to 3/4 knots. The USCG Caps Review notes that collecting and concentrating oil in fast currents is difficult and "often impractical at speeds above 3 knots."

Waves heights of 4 feet to 8 feet generally represent the upper limits of boom effectiveness, and response personnel would be placed at very high risk in wave heights even approaching 8 feet. Yet these waves heights are often exceeded on the OCS. (Historically, conventional offshore containment booms usually become ineffective in waves greater than 5 feet; but at least one manufacturer claims to have a boom that has been effectively tested in seas ranging to nearly 10 feet.)

Currently, there are more than 30 different designs of booms in use on the OCS. The relative capabilities of these booms have not been properly quantified through standardized testing techniques or protocols. In April 1994, a series of tests at sea for oil containment booms were conducted jointly by the USCG, MSRC, the U.S. Navy, and MMS. These tests were conducted in lower New York

Harbor Bay and in the Atlantic Ocean near Sandy Hook, New Jersey. Thirty-seven trials were conducted using four types of boom to test various aspects of operational failure. The tests indicated that recorded forces on booms are often much stronger than predicted by equations, especially in higher waves and at high tow speeds. In the large-capacity booms, water was found to accumulate inside the boom so that the freeboard inside the boom was less than the freeboard behind the boom. This process and high-wave conditions account for the greater and unanticipated stresses on the booms. Booms with a higher buoyancy-to-weight ratios were able to sustain higher tow speeds and performed more effectively in higher wave conditions. Oil thickness increased with tow speeds, so greater skirt drafts were required to prevent losing oil under the boom at higher tow speeds. Also, peak tow forces (snatch loads) caused by irregular tow speeds and waves can cause boom failure.

More recently, fire-resistant booms have been employed for in situ burning of spilled oil. Applications of fire-resistant booms are discussed below in the section on in situ burning.

Skimmers and skimmer systems: Skimmers are mechanical devices designed to collect spilled oil from the water surface without changing it chemically or physically. Skimmers are classified based on their operating principles into the following major groups:

- weir skimmers that provide for gravity drain off of oil;
- vacuum skimmers, similar to weir skimmers but which use a power source to actively remove oil;
- centrifugal skimmers in which a power source creates a vortex to drain off oil;
- submersion skimmers that force the oil below the water level and then use its buoyant properties to collect it; and
- oleophilic skimmers that collect oil on moving oleophilic material (ropes, disks, belts, etc.) and mechanically squeeze or scrape the oil into collection tanks.

The overall efficiency of a skimmer system depends upon the effectiveness of individual components of the system. These include containment (boom systems), recovery of spilled oil (skimmers, sorbents, and pumps), separation of oil/water mixtures, and transportation of the mixture to receptacles. Each type of skimmer is best suited for a particular situation, and no skimmer is effective in all conditions. The efficiency of each model depends on several parameters, including oil thickness, oil viscosity, sea state, and storage capability. For example, in cold water the increased viscosity of heavy oil reduces the effectiveness of many weir skimmers and can prevent effective operation of vacuum systems and pumps. However, oleophilic skimmers and pumps work quite well for high viscosity oils, providing the oil will flow.

Available oil skimmers generally are rated as performing "good" in sea state 1 (significant wave height to 1 foot). In a sea state of 2 (significant wave height to 2.9 feet), performance falls off with the majority of skimmers being rated as "fair." In a sea state of 3 (significant wave height to 4.9 feet), the vast majority of skimmers are rated as "fair" or "poor." Skimmers are needed that are capable of operating in the "good" range in these higher sea states. This would mean that skimmers would pick up a larger percentage of the oil in the area covered by the skimmer and would operate at higher speeds, thus enabling the skimmer to cover a larger area in a given amount of time.

Winds and sea states have significant effects on the performance of oil-spill equipment. In general, maximum wind speeds of 15-20 knots pose the upper limit for dynamic upwind recovery, and effective recovery in sea states of over 3-4 feet is essentially undocumented. The period of the waves is also important. When an increase in winds produces short-period localized seas, the efficiency of containment and cleanup devices decreases because choppy waves tend to swamp or break over the

equipment. Large rolling waves or swells have long periods and present fewer problems because the equipment can follow the waves' contours.

According to the 1999 USCG Caps Review, several skimming systems (Marco Voss 19, JBF 3003, Lori Brusk Pack, and Webster Barnes HIB 20) were tested at Ohmsett in 1996 and achieved recovery rates of between 40 and 236 gallons per minute at tow speeds of 3 knots. These systems could be configured with a V-shaped fast-water boom to produce a capable fast-water oil recovery system. The Caps Review notes, however, that most high-speed skimmers start losing throughput efficiency at speeds above 3 knots and as wave heights increase. Additional testing should be done to verify the effectiveness of various skimming systems, especially those systems which claim effective recovery in sea states over 3 or 4 feet.

The USCG Caps Review concluded that the overall recovery of skimmers has not improved much since 1993; however, the integration of new skimmers with various boom configurations has improved skimmer performance in faster currents. Recent design efforts for containment booms and skimmers have focused on higher tow speeds because 69 percent of oil transported on U.S. waterways is in currents that routinely exceed 1 knot.

Recent research and development efforts have involved the integration of higher-speed containment booms with skimmers to form more capable Vessel of Opportunity Skimming Systems (VOSS's). The VOSS's are deployed from single, independent vessels and provide an attractive means of recovering spilled oil offshore. Large sweep systems are advantageous on large, unified slicks; however, a VOSS unit can be deployed more quickly, is more maneuverable (for skimming windrows of oil, for example), and usually requires only one vessel. The VOSS units allow vessels designed primarily for other purposes to be quickly converted for oil-spill response purposes. Thus, VOSS units help to reduce some of the problems of equipment and manpower coordination inherent in an oil-spill response. Operations of single-vessel systems are primarily limited by the deployment and retrieval of the skimming system in rough conditions, rather than by boom performance in the waves.

Portable skimmers come in various sizes and capacities, from small, drum-mounted rope mop models with a maximum recovery capacity of 15 to 30 bbl per hour, to large skid-mounted disk skimmers with recovery capacities of 200 bbl or more per hour. Portable systems are commonly located at drilling facilities as immediate spill-response skimmers. They are also stockpiled by cooperatives for use in conjunction with shoreline cleanup and for use in bays or other areas where oil may collect.

Pumps, oil/water separators, and temporary storage devices: Pumps are necessary in all phases of oil-spill cleanup operations, including collecting oil from containment devices and transferring it to a vessel or facility. Pumps are also necessary for separation, reprocessing, storage, or disposal.

The 1999 USCG Caps Review notes that oil/water separators and temporary storage devices often cause bottlenecks in response operations. Government and industry have undertaken a test and development program for oil/water separators and temporary storage devices. This has led to development of several lightweight and compact oil/water separator prototypes that are capable of handling up to 250 gallons per minute. Also, a "second generation" of temporary storage devices has been developed, and the new devices are commercially available.

The USCG Caps Review reports that some progress has been made to develop efficient portable oil/water separators that can remove water from skimmer effluents on scene. This makes it possible to transfer recovered oil to storage tanks or facilities. According to the Caps Review, there have also been improvements in temporary storage devices:

> Extensive at-sea and Ohmsett [sic] testing was performed on two state-of-the-art temporary storage devices: Canflex Towable Bladder and Lancer Barge. Both have proven successful and are being integrated into spill response inventories in the private sector. U.S. Navy Supervisor of Salvage (SUPSALV) and MSRC also have performed extensive testing of the Dunlop Dracones (oil bladders) and the Engineered Fabrics oil bladder.

Sorbents: Sorbents are those materials that recover oil either by absorption or adsorption. In absorption, oil penetrates the solid structure of the absorbent material's fibers or particles, which then swell in size to accommodate the oil. In adsorption, oil adheres to the surface of the adsorbent material but does not penetrate the fibers or the particles themselves. Sorbent materials are generally classified by their composition: (1) natural organic products, such as hay, peat moss, straw, or wood pulp; (2) mineral compounds, such as ash, perlite, or vermiculite; (3) synthetic products, such as polyethylene, polypropylene, or polystyrene. Sorbents are usually marketed in particulate form as booms, pillows, rolls, or sheets. Synthetic products are generally preferred over natural sorbents because they are able to remove more oil while taking on less water. For this reason, they take up less storage space and pose less of a disposal problem.

Procedures have been developed to test and evaluate the performance of sorbents. The ASTM has established a test protocol, ASTM F726-99 Standard Method for Testing Sorbent Performance, now available on Environment Canada's Internet website. A searchable, Internet database has been developed to incorporate test results. New sorbent products continue to appear on the marketplace. There may be differences in the performance that depend on the way the sorbent is prepared or packaged. Through a joint project agreement with Science Applications International Corporation-Canada (SAIC-Canada), U.S. manufacturers that have their sorbent product tested at Ohmsett, will have the option of having their sorbent product tested and evaluated to the ASTM F726-99 Standard Method for Testing Sorbent Performance at no cost. The results of these tests would be reported in the sorbent database, maintained by SAIC-Canada.

f. In Situ Burning

In situ burning has been demonstrated to be a very effective response tool in open-water conditions when used in conjunction with a fire-resistant boom to confine oil slicks and maintain adequate slick thickness to sustain burning. Test results indicate that in situ burning should be a primary technique for major oil spills that occur during broken-ice conditions and for oil trapped under and within the ice. The 1999 USCG Caps Review recognizes in situ burning as "the only effective countermeasure for broken ice conditions. Recovery on solid ice is possible, but again in situ burning is preferred." The MMS believes that in situ burning is an important response measure for offshore spills, regardless of whether broken ice conditions exist.

In situ burning is a highly effective response measure, provided that the oil is not highly emulsified and the burning is conducted within the first few days of the spill. Generally, oil must be relatively fresh and at least 3 millimeters thick on the water surface to sustain burning. Therefore, it is important to capture and concentrate the oil quickly using booms. Because in situ burning is so effective at removing oil, it greatly reduces the need for recovery, storage, transportation, and disposal of spilled oil.

In their 1999 Caps Review analysis of 231 oil spills greater than 1,000 gallons (MSIS, 1993-1998), the USCG found that in situ burning was a viable response option in 24 percent of all nearshore, offshore, and open-water spills. For each of those cases in which in situ burning was not deemed a viable response option, the USCG gave at least one of three possible reasons: (1) the oil discharged

could not be ignited; (2) the spill occurred less than 3 nautical miles from shore; or (3) the wind speed exceeded 16 knots.

The Caps Review noted that a test burn during the 1989 *Exxon Valdez* spill began to rapidly change perceptions about in situ burning as a primary spill response measure. The test burn used 3M fire resistant boom and was conducted 2 days following the spill. In this test, an estimated 15,000 to 30,000 gallons of North Slope crude oil were burned in approximately 75 minutes with an estimated efficiency of 98 percent (percentage of oil removed from the water surface). The volume elimination rate for this test using a single 500-foot boom was estimated to be between 350 and 500 gallons per minute (500-1,000 bbl per hour) (Allen, 1990).

In 1993, the MMS, USCG, Canadian Coast Guard, and Environment Canada also co-sponsored a large-scale in situ test burn off the coast of Newfoundland, Canada, now referred to as the Newfoundland Offshore Burn Experiment. This experiment demonstrated in situ burn efficiencies of over 90 percent. It helped allay many of the concerns about air pollution from in situ burning and confirmed the validity of in situ burn as an effective response measure.

The USCG Caps Review reports that as a result of the *Exxon Valdez* and Newfoundland tests, in situ burning has become a widely accepted response measure for offshore spills. There is a growing acceptance of in situ burning as a standard countermeasure, and many RRT's and Area Committees are incorporating it into their protocols and OSRP's. However, there is probably a need to demonstrate the success of in situ burning during more actual spill responses before more On-Scene Coordinators are fully confident in proceeding with in situ burning as a primary spill response measure.

Successful in situ burning depends on vaporizing oil and raising its temperature for oxygen to react in a combustion process. The temperature at which vaporization occurs and the combustion process begins varies according to the physical and chemical properties of the crude oil being burned. Once initiated, the combustion reaction produces enough heat to continue vaporizing the oil. For most fresh oils, once a slick is burning it will continue to burn until the slick becomes too thin to sustain burning. The water below the oil slick acts as a heat sink that constantly draws heat away from the oil slick. When the temperature of the oil drops to where it is no longer being vaporized, the combustion reaction ends. Some oil residue remains in the water from all burns.

The Caps Review reports that "ignition of an oil slick is a straightforward procedure with devices and systems already developed and available." For ignition of spills contained in fire-resistant booms, simple floating igniters can be allowed to drift into the oil. The current preferred ignition system is the Helitorch system, which is slung from a helicopter and provides even burning of a gelled fuel mixture. The mixture is ignited by an electric filament and propane jet ignition system. The Helitorch system is flown at a speed of about 40-50 kilometers per hour and at an altitude of from 8 to 23 meters. For emulsified oils, emulsion breakers can be added to the fuel mixture to allow ignition of the oil.

Early ignition of the oil slick is important, because many crudes contain volatile light ends that enable combustion to begin below 50 °C (122 °F). As the oil weathers, the more volatile light ends are lost. This concentrates the more stable heavy ends and raises the ignition temperature. If the oil is spread thin or emulsified, it may be difficult or impossible to conduct effective in situ burning operations.

Some critics of in situ burning have raised questions about the effects of air pollution resulting from the process. Between October 26 and November 10, 1992, the MMS, Environment Canada, and the API conducted six mesoscale burn tests and two evaporation tests to better quantify air quality data

related to in situ burn processes. The data from the mesoscale experiments indicated that burn products reach safe levels within several kilometers of the burn site and that the eventual concentrations of particulates and associated pollutants are several orders of magnitude below acutely toxic levels. Nevertheless, in situ burning can present health hazards to response workers carrying out burning and other response operations downwind. Therefore, all response workers should be well equipped with appropriate respirators and protective clothing when in situ burn operations are underway. Workers also should be rotated and their respirators frequently checked to limit their exposure time to health hazards.

Fire-resistant booms: Manufacturers of fire-resistant booms are using various techniques to improve the longevity of booms, either through new materials or through new technology to allow for heat transfer between the inside of the boom and the water beneath the boom. Tests conducted by Oil Stop Inc. showed that fire temperatures reach 2,000 °F (1,093 °C) and water temperatures reach 212 °F (100 °C). External boom temperatures reach 1,700-1,800 °F (927-982 °C) (Schulze, Keith, and Purcell, 1995).

Other research on fire-resistant booms indicates that there are still problems with boom durability for multiple burns. Also, the sea-keeping ability of fire-resistant booms in seas greater than 3 feet remains a problem. Government development efforts focus on developing protocols for design testing to document performance and to encourage further industry efforts to improve design.

The 1999 USCG Caps Review explained that at-sea fire-resistance testing for booms involving oil release and burning is expensive and difficult to arrange. For that reason, NIST designed several techniques for testing booms in tanks that permit exposure to flame, mechanical stress, and wave action in controlled settings. During 1996-1998, tests were conducted in test tanks at the USCG Marine Fire and Safety Test Detachment in Mobile, Alabama, and the Canadian Hydraulic Centre in Ottowa, Ontario. The test procedures conformed to a draft standard test guideline, "Standard Guide for In Situ Burning of Oil Spills on Water: Fire-Resistant Boom," developed by the ASTM F-20 Committee (unpublished draft under ASTM consideration). The draft standard prescribes boom tests using a burn exposure and cool-down cycle sequence of 1 hour of burning, followed by 1 hour with no burning, 1 hour burning, 1 hour with no burning, and finally 1 hour of burning. The booms are subjected to wave action for the entire test. The draft standard also specifies wave characteristics and burn intensity. The USCG represents the draft standard as a major step forward in the documentation of fire-resistant boom development and performance.

The Caps Review concluded that the performance of fire-resistant boom is improving steadily, although the booms are not as seaworthy as standard open-water booms. Service life in actual burn operations is estimated at 6-10 hours. Advanced designs such as the stainless-steel pocket boom and the water-cooled boom have been developed and tested. The USCG hopes that they may eventually provide service life for extended burn operations of from 1 to several days.

The USCG 1999 Caps Review reports that in situ burning is now preauthorized, except as stipulated, from 1 to 9 nautical miles from shore in all U.S. regions except Region I, New England, and Region IX, California. Under preauthorization, in situ burn is at the discretion of FOSC without further approval of other Federal or State authorities. Preauthorization zones are limited by geographic area, distance from shore, water depth, and season. Preauthorizations are also limited to the first 4-8 hours of burning, after which the On-Scene Coordinator must inform the RRT of progress and obtain an extension of approval to continue burning. The USCG anticipates that in situ burning is most likely to be used in open coastal locations and offshore, particularly in two Regions—Alaska and the Gulf Coast (Region VI).

The USCG Caps Review reports that under favorable spill conditions, a 500-foot section of boom can be used to burn 5,000 bbl of oil per day. Based on the USCG analysis, there is significant in situ burn oil removal capability in place throughout the country. The USCG notes: "Because of the inherent transportability of fire-resistant boom sections and Helitorch systems, resources can be easily moved from one region to another and quickly deployed."

g. Chemical Treating Agents Including Dispersants

There are a variety of chemical agents that can be applied to spilled oil to facilitate its cleanup or removal from the water's surface. Common chemical treating agents include dispersants, surface washing agents, solidifiers, emulsion breakers and biodegradation agents. The USEPA regulates these classes of treating agents and they must pass a series of effectiveness and toxicity tests before being listed.

The most commonly used chemical treating agents are dispersants. These contain chemicals that reduce the surface tension between the oil and water, resulting in the breakup and dispersal of the slick as small droplets throughout the water column. Dispersant use as an oil-spill response option is controversial and always seems less desirable than on-water mechanical recovery. Yet because mechanical recovery generally results in recovering no more than 20-30 percent of spilled oil, dispersants are a necessary component of many OSRPs.

Chemical dispersion does not remove the oil from the environment. It breaks up the oil allowing it to be mixed with the underlying water. Dispersed oil ultimately will be biodegraded, taken up by marine organisms, or incorporated into bottom sediments. Dispersants cannot be applied without approval in accordance with the NCP (40 CFR 300).

The 1999 USCG Caps Review analysis (MSIS, 1993-1998) indicated that dispersants were a viable response option in 45 percent of the spills. They were also a viable response for 21 percent of spills that occurred more that 3 nautical miles from shore.

Dispersants can be an important tool in spill response when it becomes critical to prevent oil from reaching a sensitive resource, such as a coral reef, marsh area, or wildlife sanctuary. These situations justify the intentional dispersion into the water column as a trade-off to prevent greater damage to other resources. Recent research concludes that concerns over the adverse ecological effects in the water column often have been overstated, and that exposure to dispersed oil was unlikely to be an issue except in shallow-water habitats with restricted circulation. Even then, the benefits of shoreline protection could well outweigh potential adverse effects. With respect to effectiveness, there is not enough field evidence to confirm high efficiencies in actual spill-response operations.

As in the case of in situ burning, any decision to use dispersants must be made soon after a spill occurs. This is because weathering of oil will increase oil viscosity and decrease the capability of chemicals to disperse the oil. According to the USCG Caps Review, when some oils weather and undergo turbulent mixing, they accumulate and retain water droplets in the oil phase. This produces a mousse emulsion, which can contain as much as 75-percent water. If treated oil is dispersed quickly, then emulsion will not form. Less oil will contact the shoreline and damage the environment. However, if oil emulsifies before treatment with dispersants, increased viscosity may severely limit the effectiveness of dispersants. If this happens, a major window of opportunity has been lost. According to the Caps Review, the window of opportunity for dispersant use in most spills ranges from several hours to perhaps a day, depending on the oil.

Factors to be considered in making a decision to use dispersants include oil type and properties, environmental conditions, the availability of dispersant and application equipment, and the probable fate of oil without the treatment. Highly viscous oils, oils with pour points near or above ambient temperature, and oils with a high wax or asphaltene content may not be amenable to dispersant treatment at all.

Dispersant formulations have changed in recent years in attempts to develop more effective and less toxic products. The development of dispersant technology has continued at a steady pace since so-called second-generation dispersants were introduced in the late 1970s. The key components of chemical dispersants are surface-active agents (surfactants), which are molecules that have both water-soluble (hydrophilic) and oil-soluble (hydrophobic) ends. These molecules, when applied to an oil spill, orient themselves at the oil-water interface such that the hydrophilic ends of the molecules are in the water, and the hydrophobic ends are in the oil. The result is a reduction of interfacial tension between the oil and water. This action reduces the cohesiveness of the oil slick, and with wave action, finely dispersed oil droplets are formed in the near-surface water. The hydrophilic surfactant groups prevent droplets from recoalescing.

Dispersants may be applied by boat or aircraft. Boat application is limited to small spills or those within a few miles of shore. Aerial spraying is the preferred method because it offers rapid response, coverage of large areas in a short time, good control of treatment rates, optimum use of dispersants, and much better evaluation of treatment results than is possible from boats. Regardless of the method used, dispersants are generally applied only on oil slicks that are 0.25 millimeters thick or less (a 0.25-mm thick slick contains over 4,000 bbl of oil per square mile).

The dispersant must penetrate the oil to reach the oil-water interface. The proper dosage of dispersant must be used to attain the maximum reduction of interfacial tension. (About 3,200 gallons per square mile [or 5 gallons per acre] is an average amount, depending on the dispersant and the oil type). Finally, some form of energy (e.g., wind, wave, or mechanical) must be applied to the oil/water interface to cause the dispersion of oil in the upper part of the water column. Most dispersants are not recommended for use on spills in very calm waters, although newer types of dispersants require very little mixing energy. Some dispersants are formulated for use on marine (saltwater) spills only.

The National Research Council (NRC) of the NAS has addressed the effects of dispersants in its review, "Using Oil Spill Dispersants on the Sea," and made several recommendations regarding future studies. It also recommended that dispersants be considered as a potential first-response option to oil spills, along with other response options. The NRC (1989) addressed two questions about the use of dispersants: (1) Do they do any good? and (2) Do they do any harm?

It is not easy to answer whether dispersants do any good. In a few carefully planned, monitored, and documented field tests and laboratory tests, several dispersants have been shown to be effective, for some oils that were dispersible, in that they removed a major part of the oil from the water surface. However, results in other field tests and accidental spills have shown dispersants to have low effectiveness.

The interaction of various physical and chemical processes involved in oil dispersion are not well understood, and further studies are needed, particularly concerning when dispersants can be used and what the likely environmental consequences will be. There is evidence that dispersants may, in some circumstances, inhibit the effective operation of cleanup systems. For example, the addition of chemical dispersants will generally reduce the adhesive properties of oil. This can adversely affect the use of oleophilic skimmers during cleanup operations.

On the other hand, developing environmentally acceptable methods for use of dispersants could potentially provide a mechanism for dealing with far greater volumes of spilled oil than can be done with mechanical systems and for dealing with oil spills in oceans where sea state precludes use of mechanical devices. This information must be made available to people with authority to make decisions under emergency conditions.

In 1986, the MMS with Environment Canada began to develop standard evaluation protocols for chemical treating agents, including dispersants. These protocols to measure the laboratory effectiveness with various oils have been developed, and over 14,000 evaluations have been conducted.

Concern that chemical dispersants could be harmful to marine life has led to considerable caution in authorizing their use in actual spill situations. Laboratory studies of dispersants currently in use have shown that their acute lethal toxicities are usually lower than crude oils and refined oil products. However, a wide range of sublethal effects of dispersed oil has been observed in the laboratory. These occur in most cases at concentrations comparable to or higher than those expected in the water column during treatment (1 to 10 parts per million), but seldom at concentrations less than those found several hours after treatment of an oil slick (< 1 part per million). The times of exposure in the laboratory (24-96 hours) are much longer than predicted exposures during slick dispersal in the open sea (1-3 hours), and the effects would be expected to be correspondingly less in the field.

Laboratory bioassays have shown that acute toxicity of dispersed oil generally does not reside in the dispersant, but in the more toxic fractions of the oil. Dispersed and untreated oil shows the same acute toxicity. The immediate ecological impact of dispersed oil varies. In open waters, organisms on the surface will be less affected by dispersed oil than by an oil slick, but organisms in the water column, particularly in the upper layers, will experience greater exposure to oil components if the oil is dispersed. In shallow habitats with poor water circulation, benthic organisms will be more immediately affected by dispersed oil. Although some immediate biological effects of dispersed oil may be greater than for untreated oil, long-term effects on most habitats, such as mangroves, are less, and the habitat recovers faster if the oil is dispersed before it reaches the area.

Dispersant use in the Gulf of Mexico has gained acceptance by the five Gulf States in USEPA Regions IV and VI. These States, along with USEPA, have approval authority regarding the use of dispersants in waters off their shores. The States, by their participation in the RRT's and Dispersant Working Groups, have considered relevant data with the goal of approving dispersant use under specified conditions. The RRT for USEPA Region VI first granted prespill authorization for the use of dispersants to the FOSC in 1991. Beginning in early 1995, they also granted prespill authorization for using dispersants, as defined by the RRT VI FOSC Preapproved Dispersant Use Manual. Under this guidance, dispersants may be applied in offshore waters of Texas and Louisiana that are no less than 10 meters in depth and at least 3 nautical miles from the nearest shoreline. The preapproval granted in designated waters would apply to spills from either facilities or vessels of those owners or operators able to comply with the approved plan. In recent years, dispersant use pre-authorization has also been granted to the FOSC in offshore waters by USEPA Region IV.

In the Alaska OCS Region, guidelines for the use of dispersants have been developed for Prince William Sound and Cook Inlet. These guidelines were developed to provide the USCG with "preapproved use" criteria for each specific area, and have been fully endorsed by the Alaska RRT. Other areas off Alaska are being assessed for developing dispersant-use guidelines.

h. Bioremediation

Bioremediation, which is a term for biodegradation, is a technique involving accelerated metabolic breakdown of spilled oil by microbes. This response strategy has routinely resulted in accelerating removal of oil from beaches at a rate of approximately 10 percent over a 1- to 2-year timeframe depending upon temperature. According to the USCG's 1999 Caps Review, bioremediation is generally used only as a "polishing tool" applied to remaining oil residues only after all other cleanup options have been applied.

This technique was used extensively on beaches in Prince William Sound, Alaska, and at sea following the 1990 *Mega Borg* spill in the Gulf of Mexico. Exxon, the State of Alaska, and USEPA are all in general agreement that bioremediation is an effective tool for shoreline cleanup. The USEPA is conducting further research in the laboratory and is interested in developing evaluation procedures for rating performance of various microbial combinations, fertilizers, and fertilizer and microbe combinations.

i. Coastal Cleanup Techniques

When a spill contacts a coastline, several techniques can be used depending on the type and quantity of oil. Other significant factors include the nature of the coast, the depth of oil penetration into sediments, the accessibility and trafficability of the shoreline, and the possible environmental damage to the shoreline by the treatment under consideration.

For many tidal marsh areas, attempts at removal of oil by mechanical means can do more harm than good. The most common response measure for marsh areas is to place protective booms near the entrances of tidal marshes to prevent oil from entering these areas.

Direct suction: The effectiveness of direct suction depends upon thick accumulations of oil and beach type. This technique can be used if oil has pooled in low spots or in areas of poor drainage. Direct suction can be accomplished with pumps, hoses, and storage containers. Recovered oil can be stored in metal storage containers, natural depressions lined with an impervious material, or vacuum trucks equipped with pumps. Direct suction also can be applied to spills in porous soils such as sand or silt. A trench can be cut into the soil for oil collection so that hoses and pumps can be applied.

Manual removal: Manual removal is preferred for cases in which oil contamination is low or sporadic, or where penetration of oil into the soil has been limited. Therefore, it should not be used for marshes and tidally flooded mud flats. Manual recovery involves use of hand tools such as rakes, shovels, buckets, pickaxes, brush cutters, scythes, and power tools. Oil-contaminated material is collected and put into heavy-duty plastic or burlap bags for disposal.

Due to logistical constraints or to access constraints placed on heavy equipment in some areas, manual recovery may be the only cleanup technique possible for some shoreline spills. This type of response permits selective removal of contaminated sediment and vegetation. However, it is inefficient and labor intensive. The effectiveness of a manual response is directly related to the amount of time, labor, and money that can be committed.

Sorbents: Sorbents provide an effective recovery option for smaller spills, spills in confined areas, and shoreline protection. Sorbent pads, booms, or rolls are often used as part of a manual response, or they can be used in conjunction with other techniques. Once the sorbent materials have become soaked with oil, they can be removed manually or they may be burned.

Heavy equipment: Use of heavy equipment requires either the availability of roads or a means of air-lifting or barging the equipment to contaminated areas. Only certain soil types, such as sand or rocky soil or ice, can support heavy equipment. Graders, scrapers, loaders, bulldozers, and backhoes are types of equipment that may be employed.

Flushing or washing: Flushing or washing operations are extremely labor intensive and may damage the sediment by erosion or by driving oil further into the sediment. Thus, care must be used in employing these techniques. Low-pressure flushing or washing can be used for cleaning light oils, such as fuel oil, from lightly contaminated sediments or vegetation. Water is pumped from the ocean and is flushed over the sediment or vegetation to remove the oil. The flushed oil is trapped downstream or downslope in a manmade trench or in a boomed-off area of the ocean close to shore. The trapped oil may be removed by direct suction, skimming, burning, or sorbent pads. High-pressure flushing may be used for rocky coastlines where there is not much risk of either soil erosion or driving oil deeper into coastal sediments.

Steam cleaning and sandblasting: Steam cleaning and sandblasting are techniques that can be used to remove oil from rocks, boulders, and manmade structures. High-pressure jets of steam or sand are used to physically remove oil from contaminated surfaces. Such high-pressure jets can severely erode sediment or damage uncontaminated flora or fauna if care is not used in their use.

Natural dispersion: Natural dispersion is sometimes the only possible alternative for shoreline cleanup when logistics or weather conditions preclude response efforts. Contaminated shorelines adjacent to high-energy ocean environments—particularly sand, gravel, or cobble beaches—can be effectively cleaned by natural dispersion.

8. Oil-Spill Issues Raised by Arctic Oil and Gas Development

a. Concerns About Effectiveness of Oil-Spill Response Technology in Arctic Environments

Industry operators with experience in the arctic have recognized for a number of years that in situ burning is a highly effective measure for cleaning up oil in arctic conditions, particularly in broken ice.

For example, in April 1983, an industry task group representing Amoco Production Company, Exxon Company USA, Shell Oil Company, and Sohio Alaska Petroleum Company published the report, "*Oil Spill Response in the Arctic, An Assessment of Containment, Recovery and Disposal Techniques*" (Amoco Production Company et al., 1983a). This report concluded: "Throughout the literature, in-situ [sic] burning is reported to work with efficiencies of from 75 to 85% for burns of heavy or weathered oil to 99.87% for fresh crude oil inside a fireproof boom."

Later during 1983, the industry task group consulted with the Alaska Department of Natural Resources and the Alaska Department of Environmental Conservation to design field tests to be "performed and evaluated in accordance with criteria developed by the State." Field demonstration tests for in situ burning and other response measures were held during June and July 1983. The field demonstration test for four in situ oil burns in scattered ice demonstrated that:

1) cold waters and ice are beneficial for limiting the initial spread of oil, resulting in equilibrium thicknesses in excess of 0.1 inch;

2) such oil slicks are ignitable using existing techniques, including helicopter deployment of igniters;
3) the oil slicks can be burned, even in scattered ice conditions, with efficiencies of typically 55-85 percent; and
4) the unburned oil and burned oil residue can be recovered using conventional oil sorbent materials.

The field demonstration tests for burning of oil inside a fire containment boom demonstrated that burn efficiencies of 90-95 percent could be attained.

In summary, the field demonstration tests performed and evaluated in accordance with criteria developed by the State of Alaska in June and July 1983 validated the literature findings published by the industry task group in April 1983. The results of the industry field demonstration tests were published in "*Oil Spill Response in the Arctic, Part 2*," in August 1983 (Amoco Production Company et al., 1983b). Several test burns since that time have shown that in situ burning is an effective response measure particularly in broken ice conditions which often exist offshore Alaska. In the earlier section on in situ burning, it was noted that the 1999 USCG Caps Review indicated that in situ burning had become markedly more acceptable as a response measure because of the 1989 *Exxon Valdez* spill demonstration burn and the 1993 Newfoundland Offshore Burn Experiment tests.

Although the results of industry and MMS-funded research has repeatedly demonstrated the effectiveness of in situ burning as a response to arctic oil spills, State and local officials and Area Committees have been reluctant to recognize it as a first response measure in the event of an arctic spill. This is unfortunate, because there is a relatively short window of opportunity for implementing in situ burning operations after a spill. This means that in situ burn operations should be preplanned and preapproved to ensure an adequate and timely response to a spill event. Cooperative international research has shown that potential adverse air pollution effects during in situ burning are almost entirely limited to spill response workers. Response workers can be adequately protected using respirators and protective clothing.

During a 1998 in situ burning conference in New Orleans, Louisiana, an Alaska Clean Seas representative lamented that response planning in Alaskan waters seems too heavily weighted toward mechanical cleanup methods that are less effective and more costly than in situ burn methods. He attributed this attitude to "the public perception that burning is bad, a regulatory bias against in situ burning, and a general lack of comfort on the part of decisionmakers." This speaker noted that the Cook Inlet Citizens' Advisory Council has been a strong supporter of in situ burning as a primary response method in Cook Inlet during broken-ice conditions. He said that the Advisory Council recognized "the limited applicability of mechanical containment and recovery operations in broken ice conditions" (workshop proceedings, "*In Situ Burning of Oil Spills*," New Orleans, Louisiana, November 2-4, 1998, pp. 47-49).

There is further evidence that in situ burning should be considered a primary response measure for the arctic environment, as demonstrated during two recent testing trials for mechanical cleanup operations in Alaskan waters. The trials were conducted in anticipation of the British Petroleum Exploration Alaska (BPXA) Northstar pipeline project becoming operational during the coming year. The trials were required as a condition of the approval for the Northstar OSRP. A primary objective of the trials was to verify that BPXA and Alaska Clean Seas had corrected noted deficiencies from the fall 1999 trials. The BPXA and Alaska Clean Seas were required to have all equipment described in the approved OSRP available and ready for deployment when broken-ice operations were possible.

The first set of trials during July 10-23, 2000, involved the deployment and operation of a spill response barge designated as the "R-19A tactic" in BPXA's OSRP. The tests, conducted in broken-ice conditions, were designed to determine whether the R-19A tactic would be effective and to establish upper operational limits in ice concentrations ranging from 30 to 70 percent coverage of the ocean surface. This included a test of the barge ice deflection system, a large steel grate used to deflect ice from the skimmer, to determine whether the design would standup under broken-ice conditions and protect the skimmer.

The MMS evaluation of the July 2000 trials concluded that BPXA and Alaska Clean Seas demonstrated the capability to mount an oil-spill response in broken-ice conditions. However, the evaluation concluded that current mechanical response capability for broken-ice conditions is overstated in the OSRP for spring ice conditions. The spill response scenarios in the Northstar spill plan had projected response actions in the R-19A tactic configuration in broken-ice conditions up to 70-percent ocean surface coverage. However, the July 2000 trials established an upper operating limit for the R-19A tactic at approximately 30-percent to 50-percent ice coverage, depending on the size of the pieces of ice.

The MMS evaluation concluded that, given this new limit, response plans needed to be changed to reflect these limitations and to identify other means of recovering oil in heavy concentrations of broken ice. The evaluation further noted that "in situ burning as a means of removing oil from the environment, needs to be factored into the decision process when determining if additional equipment is required."

The second set of Northstar trials was held during October 9-11, 2000. The purpose of the fall trials was to deploy and operate spill response equipment in the R-19A tactic barge configuration in various fall ice conditions to determine the tactic’s effectiveness and to establish maximum operational limits.

The R-19A tactic configuration consisted of an ice-breaking barge used as the central oil recovery system with two free-floating LORI brush skimmers, 400 feet of containment boom on either side of the barge, and the barge ice deflection system. In addition to the tactic described in the Alaska Clean Seas Technical Manual, BPXA also conducted trials with weir skimmers and 1,500-foot boom segments. Trials were also conducted with the "R-17 tactic" (as designated in BPXA's OSRP), which consisted of a bay boat with a side-mounted LORI skimmer operating independently of the barge skimming system.

The fall freeze-up ice conditions were completely different from the July breakup conditions. The July ice had been very hard and had well-defined shapes that water and oil flowed around as the skimming system advanced through the water. Unlike the ice encountered during the July trials, the fall ice was very soft and consolidated rapidly. This created a solid mass that plugged the gap between the boom, the barge, and the barge ice deflection system. This, in turn, blocked a consistent flow to the skimmer intake.

Alaska Clean Seas used two types of skimmers during these trials, the LORI brush and the Walosep weir. Both skimmers operated continuously while in the water, but their oil recovery ability was extremely limited due to the ice. Because of the ice’s slushy consistency, it could not be pushed under the boom or the LORI skimmer once the boom and the skimmer intake became clogged. The only effective means of clearing the boom was to accelerate to speeds greater than 3 knots and thereby flush the apex of the collected ice. The skimmer intakes could only be cleared by physically lifting the skimmers out the water.

The floating LORI skimmers also had been modified so that hot air could be blown into the skimming unit. This was done to heat the collection hopper, warm the oil, and melt the collected slush. At advancement speeds of 0.6 knots, the skimming brushes picked up a minimal amount of ice, which was quickly melted by this system. As the hopper was filled, especially at a rapid rate, the hot air appeared to be of minimal benefit in reducing the volume of slush. However, the pump did not appear to have problems emptying the collection hopper of water and slush.

The Walosep skimmer was most effective in very-light-grease ice conditions when there was sufficient water to wash the ice into the skimmer intake. In heavier ice concentrations, the skimmer quickly became surrounded by the ice and would only pump efficiently when the skimmer was lowered below what would have been the oil-water interface to increase water flow through the skimmer. Operating the skimmer in this manner drastically increased the amount of water recovered relative to the amount of oil. This, in turn, required more on-water storage capacity, more frequent lightering operations, or limiting recovery until the excess water could be decanted and removed from the storage vessel.

The MMS evaluation concluded that oil recovery in freeze-up conditions with the given equipment and tactics was ineffective:

> Ice concentrates rapidly in the boom and around skimmers to effectively choke off recovery of oil that may be present. The individual pieces of equipment selected for recovery operations in freeze-up conditions are capable of physically operating in the environment, but once ice is present, the system as a whole does not work. Spill response tactics for the fall freeze-up conditions need to be revised to recognize the extremely limited potential for mechanical recovery.

This finding indicates that in situ burning should be considered as a primary method of responding to oil spills during fall freeze-up ice conditions in the arctic, not a secondary or backup measure. Use of only mechanical containment and cleanup measures for primary response during fall freeze-up conditions could worsen the adverse effects resulting from a significant spill in arctic conditions. There is a relatively short window of opportunity for implementing successful in situ burning operations after a spill. This means that in situ burn operations should be preplanned and preapproved to ensure an adequate and timely response to a spill event.

b. Concerns About Spilled Oil Becoming Trapped in or Under Ice

The prospect that oil might be spilled on the Arctic OCS and become trapped in or under the ice raises serious concerns as to whether such trapped oil may cause ice to become less stable and create problems for travel across the ice. These concerns have been the subject of numerous field, laboratory, and analytical studies.

The two largest field experiments took place in the Canadian Beaufort Sea in 1974-1975, and 1980 (NORCOR Engineering Research Ltd. [NORCOR], 1975; Dickins and Buist, 1981). The NORCOR project involved eight spills under arctic sea ice involving two different crude oils totaling 330 bbl. The project studied the interaction of the crude oil with the ice. Very thick slicks of crude oil were pumped under the ice sheet in a protected bay in winter. There was no effect on the integrity of the ice sheet through the winter. During the spring, the oil began to appear before the snow melted. It accelerated the melt process such that the oiled area melted away about a week before the surrounding ice sheet rotted out (NORCOR, 1975).

A study sponsored by DOME Petroleum Ltd. and supported by Alaskan Beaufort Sea Oilspill Response Body (Dickins and Buist, 1981) simulated a subsea blowout by injecting compressed air and Prudhoe Bay crude oil under landfast ice. In the second research experiment, the oil slick released under the ice sheet in winter was relatively thin (1 mm). The oil and gas released did not affect the subsequent growth of the ice sheet, nor did the oil's appearance on the ice surface the following spring measurably increase the melting or decay of the sheet compared to the surrounding clean ice covered with melt pools (Dickins and Buist, 1981).

Since crude oils generally are less dense than seawater, oil released into the water column under a floating solid ice cover will rise and gather in pools or lenses at the bottom of the ice sheet. The size of the oil pool or lens is controlled by the amount of oil spilled, the physical properties of the oil, and the shape of the ice. Typical under-ice currents within the barrier islands are unlikely to exceed 0.5 feet/second. As a result, almost all of the oil will contact the ice under surface within a few feet of the center of a release.

Under-ice sea currents in the coastal Beaufort Sea will not spread spilled oil beyond the initial point of contact with the ice under surface. Several studies have determined that with the roughness values typical of undeformed first-year sea ice, the threshold current speed required to initiate and sustain movement of an oil lens or pool along the ice undersurface is approximately 0.7 feet/second. This is significantly faster than the highest currents anticipated in the coastal Beaufort Sea. (Cammaert, 1980; NORCOR, 1975; Rosennegger 1975).

Even large spills (tens of thousands of barrels) of crude oil underneath or on top of solid (or landfast) ice will usually be contained within hundreds of meters from the spill source, depending on under-ice currents and ice roughness. Natural variations in first-year ice thickness provide huge natural "reservoirs" to effectively contain spilled oil underneath the ice within a small area. This implies that any mid-winter spill under ice would be naturally contained within a relatively small area when compared to an identical volume spilled on open water.

For apparently smooth first-year ice, the height variation of the ice under-surface can be considerable. This is caused by irregular snow coverage and wind effects. Any released oil will penetrate into the skeletal layer of growing ice at the bottom, a distance of a few centimeters. Oil will not usually penetrate into a first-year ice sheet. Even under porous multiyear ice, oil does not climb far into the open channels in the ice sheet. In a batch release, new ice will completely encapsulate the oil layer within 18-72 hours depending on the time of year, December to late April (Dickins and Buist, 1981). Oil spilled after May 1 may not become encapsulated due to insufficient ice growth. Extensive studies show almost no effect of oil on ice growth. Oil typically does not weather or biodegrade in ice because it is encased and protected from exposure in the ice (NORCOR, 1975).

After oil has spread under the ice and has been encapsulated, it will remain trapped until about March, at which time a process of vertical migration will begin with the gradual warming of the ice sheet. The rate of vertical migration depends on the degree of brine drainage within the ice (this is a function of internal temperature), oil pool thickness, and oil viscosity. During the period from November to February when the ice sheet is cooling and growing rapidly, there are very few passages for the oil to penetrate. Vertical migration of the oil is limited to several inches of initial penetration through the porous skeletal layer of individual ice crystals at the ice/water interface. The internal ice temperature reaches a minimum in late February.

As ice temperatures gradually increase in March and April, brine trapped between the columnar ice crystals begins to drain out of the ice, leaving vertical channels for the oil to eventually rise to the surface. The first evidence of natural oil appearance on the ice surface can be observed in late May or

early June. The rate of oil migration increases rapidly once daily air temperatures remain consistently above freezing.

Natural melting of the ice from the surface down acts as a competing process to expose the encapsulated oil. When surface melting reaches the level where the ice was growing at the time of the spill, the oil is exposed. In most situations of a concentrated thick oil layer in the ice, natural migration will bring most of the oil to the surface before the surface melts down to meet it. Once the oil reaches the ice surface, it lies in melt pools or remains in patches on the melting ice surface after the surface waters have drained. Winds act to herd the oil into thicker layers against the edges of individual pools. Any oil on the ice at final breakup and disintegration of the ice sheet will be released slowly into the water as thin slicks or sheens.

In summary, it is unlikely that spills associated with exploration and development activities in the Alaskan Beaufort Sea would cause the landfast ice to degrade noticeably different from the normal year-to-year variation in the timing of breakup.

c. Concerns About Detecting Oil Spills From Marine Pipelines Under Arctic Ice

The MMS issues rights-of-way for pipelines that cross the Federal OCS. Generally, the MMS is responsible for pipelines upstream of the point where operating responsibility for offshore pipelines transfers from a producing operator to a transporting operator. From that point shoreward, the USDOT's Research and Special Programs Administration, Office of Pipeline Safety, regulates transportation pipelines. The State of Alaska's Pipeline Coordinator's Office issues rights-of-way for pipelines across State submerged lands.

These agencies have similar regulatory requirements that address various aspect of pipeline design, construction, maintenance, repair, inspection, operation, safety, pollution prevention, and environmental protection. They also have enforcement authority to shut down pipelines in the event of regulatory noncompliance or potential problems concerning operational safety.

Generally, computerized leak-detection systems can measure leaks less than 1 percent of the total flow volume. Leak detection systems may be based on measurements of operating pressures, flow rates, or volumetric comparisons of flows entering and leaving the pipeline over a given period, etc. Threshold limits indicating possible leaks are set for the various measuring devices.

For a relatively short and simple pipeline system, the leak detection system can be set at low thresholds to detect leaks quickly. In such a case, response times for detecting a leak and shutting in the pipeline are on the order of minutes, and spill volumes are on the order of a few tens of barrels.

For a larger-volume and more complex pipeline system receiving inputs from several sources, threshold limits must be more widely set to accommodate transient flows as the various sources start up or shut down. Leaks occurring in such systems are more difficult to detect. Below-threshold leak rates of several hundreds of barrels per day could go undetected for several hours or even days.

For leak rates that are less than the threshold, the leak could go undetected until visual inspection or a discrepancy in mass balance between production and sales was identified. Leak rates of several hundreds of barrels per day should be detected from within a few hours to a day or two. To detect leak rates that are less than the threshold, the MMS Regional Supervisor could require that a volumetric line mass balance comparison of line inflows and outflows be conducted at least daily or at several intervals over the course of a day. Such a requirement would ensure that a significant

below-threshold leak would be discovered within a matter of hours. In the event of such a leak, the Regional Supervisor would require that the pipeline system be shut down immediately until repairs are completed.

Pinhole leaks, with rates of a few barrels per day or less, possibly could continue undiscovered for extended periods. Systematic inspection through use of instrumented internal inspection devices (smart pigs) should increase the possibility that leak-causing welding flaws, other defects, or corrosion would be detected before any leaks occur.

One method of searching and detecting the presence of oil leaking at low rates from a marine pipeline in the winter period involves drilling holes at frequent intervals along the pipeline route to expose any oil which could be trapped in or under the ice. This method is expensive, labor intensive, and exposes personnel to the vagaries of extreme weather. The MMS OSR Program is funding research to develop state-of-the-art sensor for searching and detecting the presence of oil in and under sea ice.

In a recent development, however, the new British Petroleum Northstar pipeline project is equipped with a leak detection system called LEOS that has not previously been used either in the arctic or for subsea pipelines. Although the LEOS system has not been tried under arctic conditions, MMS is glad that this type of technology is available for use in this project. LEOS is a sensor tube installed parallel to and along the full length of the Northstar pipeline. It is designed to detect hydrocarbon molecules from very small leaks and determine the location of the leak on the pipeline. If successful, LEOS eventually could be considered among the best available and safest technologies applied in OCS operations. Northstar will be the first pipeline system to transport OCS production from Beaufort Sea leases. The Northstar pipelines are pigable and have a Supervisory Control and Data Acquisition system for leak detection. Offshore segments of the pipelines are isolated by valves on the Northstar Island and at the shore crossings.

9. National Response Organizations

a. National Response Corporation (NR Corp.)

The NR Corp. is the largest for-profit oil-spill response organization in the United States. It has primary offices in Great River, New York; New York, New York; Eureka, California; Seattle, Washington; Houston, Texas; San Juan, Puerto Rico; Tampa, Florida; and Memphis, Tennessee. The NR Corp. is designed to provide a single source of trained personnel and specialized equipment for responding to marine oil spills in accordance with Federal and State oil pollution regulations. The NR Corp. holds the highest OSRO classification designated by the USCG, Level E, in rivers and canals and in inland, nearshore, offshore, and open-ocean environments. The NR Corp. provides Level E OSRO coverage throughout the U.S. east coast, the Gulf Coast, the U.S. Caribbean, and the U.S. inland river system.

The NR Corp. enters into retainer agreements to provide spill response resources to companies required to submit OSRP's to Federal and State agencies and is listed in over 2,500 Vessel & Facility Response Plans filed with both the USCG and the USEPA as the plan holders' primary and contractual OSRO. Since its inception, NR Corp. has responded to more than 290 spills on the east coast, Gulf Coast, west coast, Caribbean, and inland river regions of the United States.

The response strategy of the NR Corp. is based upon managing and coordinating a network of contractors—the Independent Contractor Network (ICN). This network provides a base of over 4,200 trained oil-spill response personnel, including supervisors, foremen, and field technicians. The NR

Corp. originally selected a group of over 50 contractors based on a thorough audit of their individual resources and capabilities. Approximately 12 of these ICN contractors are located in Texas and Louisiana. The ICN is based at 130 locations nationwide.

The NR Corp.'s strategy grew out of the recognition that 98 percent of all spills are less than 10,000 gallons and have been responded to successfully by an existing group of oil-spill contractors who have been in business for years. Because these contractors employ local personnel, they each possess valuable local knowledge essential to a rapid, effective response during a crisis situation.

The NR Corp.-owned equipment is placed with the individual contractors. The NR Corp. quantified the gap that existed between existing contractors' capabilities as a group and the capabilities required by the USCG for complying with OPA regulations. The NR Corp. then proceeded to augment the contractors' capabilities by purchasing high cost capital equipment that individual oil-spill contractors could not justify purchasing from a practical business point of view. Because of the ICN and NR Corp.-owned equipment, the NR Corp. is able to "cascade" massive numbers of personnel and equipment into a response effort as dictated by clients, their OSRP's, and the spill situation being faced.

The International Operations Center in Great River, New York, functions as the NR Corp.'s focal point for coordinating its response efforts. Satellite, single side-band high frequency, and terrestrial phone, fax, and modem capabilities put key International Operations Center personnel in direct contact with all aspects of the response process. This enables NR Corp. managers to communicate and coordinate directly with clients, contractors, support agencies, response vessels, and NR Corp. field operations personnel.

The offshore component of the ICN is the Marine Resource Network, which serves as a source for backup and support to the dedicated vessels in the NR Corp.'s offshore fleet. For its offshore response capability, the NR Corp. utilizes existing offshore supply vessels which continue to engage in commercial activities when possible. The NR Corp. has converted a fleet of 13 vessels and barges ranging in size from 110 to 275 feet in length and outfitted them with high-capacity skimming systems that can provide per vessel total effective derated skimming capacities ranging from 10,000 to 26,125 bbl per day. The NR Corp.'s fleet of oil-spill recovery vessels are located at the following ports:

- Portland, Maine,
- New York, New York,
- Cape May, New Jersey,
- Norfolk, Virginia,
- Charleston, South Carolina,
- Miami and Tampa, Florida,
- Mobile, Alabama,
- Grand Isle, Louisiana,
- Galveston and Corpus Christi, Texas, and
- San Juan, Puerto Rico.

b. Marine Spill Response Corporation and the Marine Preservation Association

The MSRC and the Marine Preservation Association were established in September 1990 with the goal of making MSRC the world's largest oil-spill cleanup organization. Companies who join the Marine Preservation Association have the right to enter into a contract with the MSRC to be designated cleanup organizations. Funding for MSRC is provided through the Marine Preservation Association, which is a separate organization of owners, shippers, and receivers of oil. The Marine Preservation Association members pay annual dues based on the quantity of oil they transported during the previous year. Both organizations are not-for-profit entities, and each is independent of the other. The MSRC uses Marine Preservation Association grants for MSRC's capital, research, and development costs that are not tied directly to an oil-spill response. The expenses incurred by the MSRC during an oil-spill response are recovered directly from either members who have spilled oil or their insurers. The MSRC may also offer its equipment or services directly to the Federal Government, which reimburses MSRC from the Oil Spill Liability Trust Fund.

The MSRC and the Marine Preservation Association grew out of the efforts of an API task force that was set up immediately following the 1989 *Exxon Valdez* disaster. The task force investigated existing resources for responding to other catastrophic oil spills similar to the *Exxon Valdez*, and concluded that the capability did not exist, either in industry or government, to successfully contain and remove a spill of such magnitude. As a result of the task force recommendations and enactment of the OPA, about 20 oil companies began work on a means of responding to catastrophic oil spills. They agreed upon formation of the MSRC and the Marine Preservation Association.

The MSRC regional centers and prestaging areas are designed to ensure a quick response to a large spill in U.S. coastal and tidal waters, out to the limits of the U.S. 200-mile Exclusive Economic Zone. The MSRC is headquartered in Washington, D.C., and has five regional response centers. Each center has the capability of responding to a spill of up to 200,000 bbl of oil, nearly equal to the *Exxon Valdez* spill. In addition to the regional response centers, each region has from three to six prestaging areas.

The MSRC regional centers and prestaging areas will be located as follows:

MSRC Region	**Prestaging Area**
Northeast Region I in Edison, New Jersey	Portland, Maine; Boston, Massachusetts; Narragansett Bay, Rhode Island; Delaware Bay, Delaware; Baltimore, Maryland; and Hampton Roads, Virginia
Southeast Region II in Miami, Florida	Wilmington, North Carolina; Savannah, Georgia; Tampa, Florida; Key West, Florida; and in the U.S. Virgin Islands
Gulf Region III in Lake Charles, Louisiana, near the Texas border	Mobile, Alabama; Venice, Louisiana; Galveston, Texas; and Corpus Christi, Texas
Southwest Region IV in Port Hueneme, California, north of Los Angeles on the Santa Barbara Channel	San Diego, California; Richmond, California; Eureka, California; and Oahu, Hawaii
Northwest Region V in Everett, Washington	Bellingham, Washington; Port Angeles, Washington; and Astoria, Oregon

The MSRC, as a matter of policy, will not compete with existing organizations already established for responding to oil spills. The MSRC offers its customers a full range of oil-spill response capabilities

intended to help meet the planning criteria of the OPA. This is accomplished through a combination of MSRC's own dedicated response capability and contracted resources, including "shoreline protection and cleanup," "shallow water capability," "average most probable discharge," "maximum most probable discharge," and "worst-case discharge." In recognition of these capabilities, the USCG has classified MSRC under its OSRO guidelines of the “Level A through E” OSRO throughout MSRC's primary operational area.

In addition to being designed for major spills, the MSRC is available to assist with smaller spills whenever the USCG takes over direction of a spill cleanup, determines that local response capabilities are inadequate, and then directs the MSRC to provide assistance. The MSRC is intended to augment rather than replace local spill cooperatives and response contractors. Also, MSRC relies on subcontracts with local spill response organizations to supplement MSRC capability during major spill responses.

The MSRC has about 400 full-time employees and maintains vessels, trucks, booms, skimmers, dispersants, and wildlife and shoreline rehabilitation tools. So far, the MSRC has purchased about $220 million worth of vessels and equipment, including 16 offshore response vessels (OSRV’s). The OSRV’s are the principal recovery vessels for MSRC, with 16 over-the-side high capacity skimmers and boom containment systems. The OSRV’s are approximately 210 feet long, have temporary storage for 4,000 bbl of recovered oil, and have the ability to separate oil and water aboard ship. To enable the OSRV to sustain cleanup operations, recovered oil is transferred into other vessels or barges. Each OSRV is normally equipped with the following standard oil containment and recovery devices: one 32-foot support boat; one Transrec 350 skimmer; one Norwegian Oil Trawl skimmer with 110 meters of boom with bottom nets and 95 meters of guiding boom, and two sections of 660-foot Sea Sentry boom. The skimmers are reported to have a manufacturer's advertised removal capacity of up to 2,200 bbl/hour.

The MSRC is outfitted with other specialized response vessels and support equipment, including:

- 17 oil-spill response barges with storage capacities between 32,000 and 68,000 bbls;
- 68 shallow water barges;
- 331,300 feet of boom;
- over 130 skimmers;
- six mobile communications suites comprising telephone and computer connections, and ultra-high-frequency and very-high-frequency marine, aviation, and business band radios; and
- various small crafts and shallow-water vessels.

The MSRC has a computer-assisted spill management system for spill tracking, identifying resources at risk, and directing logistics in real time. It has also developed a program to audit, on a continuing basis, the readiness of response forces to meet their objectives. The MSRC also funds research programs to study the chemical and biological effects of spilled oil in the environment, techniques for on-water recovery and treatment, and the prevention or mitigation of shoreline impacts.

Bibliography

Alaska Department of Environmental Conservation and Minerals Management Service. 2000. Joint evaluation, fall 1999, North Slope drills and exercises response tactics for BP Exploration's Northstar, Prudhoe Bay Western Operating Area and Endicott Operations and ARCO's Prudhoe Bay Unit and Greater Point McIntyre Area. January 18, 2000

Allen, Allan A. 1990. Contained controlled burning of spilled oil during the *Exxon Valdez* spill. Proceedings of the Thirteenth Arctic and Marine Oil Spill Program Technical Seminar. Edmonton, Alberta Canada. pp. 305-313.

Amoco Production Company, Exxon Company USA, Shell Oil Company, and Sohio Alaska Petroleum Company. 1983a. Oil spill response in the arctic, an assessment of containment, recovery and disposal techniques. pp. 22-24.

Amoco Production Company, Exxon Company USA, Shell Oil Company, and Sohio Alaska Petroleum Company. 1983b. Oil spill response in the arctic, part 2. pp. 1, 9-11.

Cammaert, G. 1980. Oil gas under ice laboratory study. Acres Consulting Services for Canadian Marine Drilling Limited and Environment Canada.

Dickins, D., and I. Buist. 1981. Oil and gas under sea ice. Prepared by DOME Petroleum Ltd. for COOSRA, Report CV-1, vols. I and II.

McKenzie, Bruce, and James Lukin. 1998. Preparedness for in situ burning operations: An Alaska perspective *in* In Situ Burning of Oil Spills. Workshop Proceedings, November 2-4, 1998. NIST Special Publication 935 (William D. Walton and Nora H. Jason, eds.). pp. 47-49.

Nash, J. H., and R. W. Hillger. 1988, cited in Tennyson, 1990. Preliminary results of the verification of offshore oil spill containment boom performance evaluation protocol. Proceeding of the eleventh Arctic and marine oil spill program technical seminar. Environment Canada, Vancouver, British Columbia. pp. 267-276.

National Research Council (NRC). 1985. Oil in the sea: inputs, fates, and effects. Washington, D.C.: National Academy Press. 601 pp.

—— 1989. Using oil spill dispersants on the sea. Washington, D.C.: National Academy Press. 355 pp.

NORCOR Engineering Research Ltd. (NORCOR). 1975. The interaction of crude oil with arctic sea ice. Beaufort Sea Technical Report no. 27. Prepared for the Beaufort Sea Project, Department of the Environment Canada, Victoria.

Robertson, T.L., and E. DeCola. 2000. Joint agency evaluation of the spring and fall 2000 North Slope broken ice exercises. December 18, 2000.

Rosenegger, L.W. 1975. The movement of oil under sea ice. Beaufort Sea Technical Report no. 28. Prepared by Imperial Oil Limited for Beaufort Sea Project, Department of the Environment Canada, Victoria.

Schulze, Robert, Virgil Keith, and Colleen Purcell. 1995. World catalogue of oil spill response products. ISSN 1076-4666. Port City Press, Baltimore, MD. 983 pp.

Tennyson, Edward. 1990. Recent results from oil-spill response research. Proceedings of the conference, "Oil spills—management and legislative implications." New York, N.Y.: American Society of Civil Engineers. pp. 117-128.

Tennyson, E.J., and H. Whittaker. 1988, cited in Tennyson, 1990. The 1987 Newfoundland oil spill experiment. Proceedings of the eleventh Arctic and marine oil spill program technical seminar. Environment Canada, Vancouver, British Columbia. pp. 221-227.

U.S. Coast Guard. 1999. Response Plan Equipment Caps Review: Are changes to current mechanical recovery, dispersant, and in situ burn equipment requirements practicable? 297 pp.

APPENDIX D: ASSUMED MITIGATION MEASURES

D. ASSUMED MITIGATION MEASURES

All Minerals Mangement Service (MMS) sale proposals include rules and regulations prescribing environmental controls to be imposed on lease operators. Lease stipulations, Outer Continental Shelf regulations, and other measures provide a regulatory base for implementing environmental protection on leases issued as a result of a sale. The ongoing Environmental Studies Program and analyses directed at activities taking place in a sale area provide information used in the Agency's regulatory control over the life of the leases.

The MMS has broad permitting and monitoring authority to ensure safe operations and environmental protection. Use of the best available and safest technologies during exploration, development, and production and the adopted stipulations are just a few of the measures designed to prevent environmental damage. The MMS also monitors operations after drilling has begun and carries out periodic inspections of facilities (in certain instances, in conjunction with other Federal Agencies such as the U.S. Environmental Protection Agency) to ensure safe and clean operations over the life of the leases.

The analyses in the environmental impact statement assume the implementation of all mitigation measures required by statue or regulation. In addition, the impact analysis assumes that sale-specific stipulations that were commonly adopted in past lease sales are in effect. The following is a brief description of the sale-specific stipulations or other mitigations assumed in the analysis of potential effects of the proposed action.

1. Gulf of Mexico Region

a. Topographic Features

This stipulation designates a "No Activity Zone" around several underwater topographic features commonly called "banks" whose crests may contain biological communities including corals. The No Activity Zone is designed to protect the biota of these features from adverse effects of routine offshore oil and gas activities by preventing the emplacement of platforms, or the anchoring of service vessels or mobile drilling units, directly on the banks and requiring that drilling discharges be shunted in such a manner that they do not settle on the biota.

b. Live Bottom (Pinnacle Trend)

This stipulation is intended to protect the pinnacle trend area and the associated hard-bottom communities from damage from oil and gas activities. If the required live bottom survey report determines that the live bottom may be adversely impacted by the proposed activity, certain measures, such as relocation or monitoring, may be required.

c. Live Bottom (Low Relief)

This stipulation is intended to protect hard-bottom communities not associated with bathymetric features on the sea bottom. Biological communities such as seagrass beds, sponges, and corals may occur on smooth topography. If the required live bottom survey report determines that the live bottom may be adversely impacted by the proposed activity, certain measures, such as relocation or monitoring, may be required.

d. Oil-Spill Response (Eastern Gulf of Mexico)

This stipulation is intended to minimize the risk of oil spills reaching Florida State waters by requiring the staging of state-of-the-art mechanical oil-spill response equipment within specified timeframes and by requiring that oil dispersant chemicals and equipment be maintained in a state of readiness.

e. Military Areas

This stipulation has three sections: hold harmless, electromagnetic emissions, and operational. The hold harmless section serves to protect the U.S. Government from liability in the event of an accident involving a lessee and military activities. The electromagnetic emissions section requires the lessee and its agents to reduce and curtail the use of equipment emitting electromagnetic energy in certain areas. This reduces the impact of offshore oil and gas activities on military communications and missile testing. The operational section requires prior notification of the military when offshore oil and gas activities are scheduled within a military use area to assist in scheduling activities and to prevent potential conflicts.

A second stipulation requires the evacuation, upon the receipt of a directive from the MMS Regional Director, of all personnel from all structures on the lease and the shutting in and securing of all wells and other equipment, including pipelines, on the lease.

Two additional stipulations are applied to leases in the Eastern Gulf of Mexico Planning Area only. In cooperation with the U.S. Air Force, "drilling windows" are established for 6-month periods during which exploratory operations or workover operations may be conducted on leases. This time-sharing arrangement allows military operations to proceed in areas containing leases without being disrupted by oil and gas activities, and without undue disturbance to the exploratory activity and workover operations.

An additional stipulation has been included for the Western Gulf of Mexico Planning Area only. The Naval Mine Warfare Stipulation is intended to eliminate potential impacts from multiple-use conflicts in the Western Planning Area, Mustang Island Area East Addition, Blocks 732, 733, and 734. The U.S. Department of the Navy has identified these blocks as needed for testing equipment and for training mine warfare personnel.

2. Alaska Region

a. Orientation Program

This stipulation is designed to provide increased protection of the environment by promoting an understanding of, and appreciation for, local community values, customs, and lifestyles of Alaskans. It also provides information to industry on the biological resources used for commercial and subsistence purposes, archaeological resources of the area and appropriate ways to protect them, and reducing industrial noise and disturbance effects on marine mammals and marine and coastal birds. The program shall be designed in sufficient detail to inform individuals working on the project of specific types of environmental, social, and cultural concerns that relate to the sale and adjacent areas.

b. Protection of Biological Resources

This stipulation provides a formal mechanism for identifying important or unique biological populations or habitats that may exist in the proposed sale area and require additional protection because of their sensitivity and/or vulnerability. If critical biological resources are identified, the lessee may be required to modify operations to ensure that significant biological populations or habitats deserving protection are not adversely affected. These modifications could include shifts in operational sites, modifications in drilling procedures, and increased consideration of the areas during oil-spill contingency planning.

c. Protection of Fisheries

This stipulation is designed to ensure that the petroleum industry and the participants in commercial and subsistence fishing activities have a mechanism to ensure their activities are coordinated to minimize spatial conflicts. Without safeguards, commercial and subsistence fishing may be subject to interference from offshore oil and gas operations. Lease-related uses will be restricted if restriction is determined necessary to prevent unreasonable conflicts with local subsistence hunts and sport and commercial fishing operations. The stipulation requires the lessee to review planned exploration and development activities (including plans for seismic surveys, drill rig transportation, or other vessel traffic) with potentially affected fishing organizations, subsistence communities, and port authorities to prevent unreasonable fishing gear conflicts. It also provides an opportunity for local communities, including fishing interests, to review and comment to MMS on proposed exploration plans and development and production plans as part of the MMS regulatory review process, which considers such comments prior to any decisions to approve, disapprove, or require modification of such plans.

d. Transportation of Hydrocarbons

This stipulation provides a formal way of selecting a means of transporting petroleum from a sale area. It also informs the lessee that (1) MMS reserves the right to require the placement of pipelines in certain designated management areas, (2) pipelines must be designed and constructed to withstand the hazardous conditions that may be encountered in the sale area, and (3) pipeline construction and associated activities must comply with regulations. This stipulation is intended to ensure that the decision on which method to use in transporting hydrocarbons considers the social, environmental, and economic consequences of pipelines. This stipulation requires the use of pipelines if (1) pipeline rights-of-way can be determined and obtained; (2) laying such pipelines is technologically feasible and environmentally preferable; and (3) in the opinion of the lessor, pipelines can be laid without net social loss, taking into account any incremental costs of pipelines over alternative methods of transportation and any incremental benefits in the form of increased environmental protection or reduced multiple-use conflicts.

e. Industry Site-Specific Bowhead Whale-Monitoring Program

This stipulation requires industry to conduct a site-specific monitoring program to determine when bowhead whales are present in the vicinity of lease operations during exploratory drilling activities, including seismic surveys, and the extent of behavioral effects on bowhead whales due to these activities. It also provides a formal mechanism for the oil and gas industry to coordinate logistics activities with the MMS Bowhead Whale Aerial Survey Project and provide reports of Bowhead whale sightings during monitoring. It is intended to help protect endangered bowhead whales during their migration from significant adverse effects due to exploratory activities. The monitoring plan must provide an opportunity for an Alaska Eskimo Whaling Commission (AEWC) or North Slope Borough (NSB) representative to participate in the monitoring program. No monitoring program will

be required if the MMS Alaska Regional Supervisor for Field Operations, in consultation with the NSB and the AEWC, determines that a monitoring program is not necessary based on the size, timing, duration, and scope of the proposed operations. The stipulation ensures participation by the NSB, the AEWC, and the State of Alaska in the design and review of proposed bowhead whale monitoring plans, and the establishment of an independent peer review of the monitoring plans and draft reports.

f. Conflict Avoidance Mechanisms to Protect Subsistence Whaling and Other Subsistence Activities

This stipulation is designed to reduce disturbance effects on Native lifestyles and subsistence practices from oil and gas industry activities by requiring industry to make reasonable efforts to conduct all aspects of their operations in a manner that recognizes Native subsistence requirements and avoids adverse effects on local subsistence harvests and cultural values. It requires industry to conduct all exploration, development, and production activities in a manner that prevents unreasonable conflicts between the oil and gas industry and subsistence activities, especially the subsistence bowhead whale hunt. This stipulation also requires industry to consult with potentially affected Native communities, the NSB and the AEWC to discuss possible siting and timing conflicts and to assure that exploration, development, and production activities do not result in unreasonable conflicts with subsistence whaling and other subsistence harvests. It also provides a mechanism to address unresolved conflicts between the oil and gas industry and subsistence activities. This stipulation provides for restriction of lease-related uses, when necessary, to prevent unreasonable conflicts with local subsistence activities. These might include a seasonal drilling restriction, seismic and threshold depth restriction, and requirements for directional drilling and the use of other technologies.

g. Information to Lessee

A number of Information to Lessees (ITL's) have been developed to provide specific protection for environmental, social, and cultural concerns. These measures encourage lessees to:

- bring residents of North Slope communities into the planning process; and
- incorporate into their Orientation Programs the Kaktovikmiut and Nuiqsutmiut papers to use as guides to assist in fostering understanding and sensitivity to community values.

Additional ITL's advise lessees of:

- the potential effects of seismic surveys and the specifics of the stipulation on the bowhead whale monitoring program;
- the potential for polar bears to be present in the area of operations, and to conduct activities in a manner which will limit potential encounters and interactions between lease operations and polar bears;
- the review of exploration and development and production plans to ensure that the threatened spectacled and Steller's eiders and their habitats are protected;
- the possible prohibition of shore-based facilities in river deltas that have been identified as special habitats for bird nesting and fish overwintering;
- the possibility that MMS may limit or modify operations if they could result in significant effects on the availability of bowhead whales for subsistence use;
- the U.S. Department of Commerce, National Marine Fisheries Service's review of exploration and development and production plans for activities planned in the spring lead systems of the

bowhead whales to determine whether the planned activities would likely jeopardize the continued existence of the Bowhead whale population;

- the existence of the Arctic Biological Task Force and the consideration of recommendations from this task force in the enforcement of the Protection of Biological Resources Stipulation (see Section D.2.b above);
- the prohibition of exploratory drilling, testing, and other downhole activities in broken-ice conditions unless the lessee can demonstrate the capability to detect, contain, clean up, and dispose of spilled oil in broken ice;
- the fact that disturbance of wildlife could be determined to constitute harm or harassment and thereby be in violation of existing laws and treaties;
- sensitive areas to be considered when developing oil-spill contingency plans to help protect environmentally sensitive areas and their concentrations of marine birds, marine mammals, fishes, and other biological resources;
- the fact that the Steller sea lion is listed as a threatened species and that lessees should conduct their activities in a manner that will limit potential encounters and interactions;
- the fact that oil-spill cleanup plans must be prepared by lessees and approved by MMS prior to approval of exploration and development plans;
- the fact that evidence of oil spill financial responsibility must be established and maintained; and
- the fact that the State of Alaska will review Outer Continental Shelf plans and associated oil-spill contingency plans per consistency review with the Alaska Coastal Zone Management Program.

APPENDIX E: FEDERAL LAWS AND EXECUTIVE ORDERS

E. FEDERAL LAWS AND EXECUTIVE ORDERS

1. Federal Laws

a. The Outer Continental Shelf Lands Act (OCSLA)

The OCSLA of 1953 authorized the Secretary of the Interior to grant mineral leases and to prescribe regulations governing oil and gas activities on Outer Continental Shelf (OCS) lands. The OCSLA defines the OCS as:

> ". . . all submerged lands lying seaward and outside of the areas lands beneath navigable waters as defined in section 2 of the Submerged Lands Act and of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control."

The pertinent provision of the Submerged Lands Act defines "navigable waters" as:

> ". . . all lands permanently or periodically covered by tidal waters up to but not above the line of mean high tide and seaward to a line three geographical miles distant from the coast line of each such State and to the boundary line of each such State where in any case such boundary as it existed at the time such State became a member of the Union, or as heretofore approved by Congress, extends seaward (or into the Gulf of Mexico) beyond three geographical miles . . . . "

Under the OCSLA, the U.S. Department of the Interior (USDOI) is required to:

- manage the orderly leasing, exploration, development, and production of oil and gas resources on the Federal OCS;
- ensure the protection of the human, marine, and coastal environments;
- ensure that the public receives a fair and equitable return for these resources; and
- ensure that free-market competition is maintained.

Within the USDOI, the Minerals Management Service (MMS) is charged with the responsibility of managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCSLA. The MMS operating regulations are presented in Chapter 30, Code of Federal Regulations (CFR), Part 250.

b. The National Environment Policy Act (NEPA)

The NEPA of 1969 is the foundation of environmental policymaking in the United States. The NEPA process is intended to help public officials make decisions based on an understanding of environmental consequences and take actions that protect, restore, and enhance the environment. The NEPA established two primary mechanisms for this purpose:

- The Council on Environmental Quality (CEQ) was established to advise Agencies on the environmental decision making process and to oversee and coordinate the development of Federal environmental policy.
- Agencies must include an environmental review process early in the planning for proposed actions.

The CEQ issued regulations in 1978 implementing NEPA. The regulations include procedures to be used by Federal Agencies for the environmental review process. These regulations provide for the use of the NEPA process to identify and assess reasonable alternatives to proposed actions that avoid or minimize adverse effects of these actions upon the quality of the human environment. Scoping is used to identify the scope and significance of important environmental issues associated with a proposed Federal action through coordination with Federal, State, and local agencies; the general public; and any interested individual or organization prior to the development of an impact statement. The process also identifies and eliminates from further detailed study issues that are not significant or that have been covered by prior environmental review.

The NEPA requires all Federal Agencies to use a systematic, interdisciplinary approach to protect the human environment. Such an approach ensures the integrated use of natural and social sciences in any planning and decisionmaking that may have an impact on the environment. The NEPA also requires the preparation of a detailed environmental impact statement (EIS) on any major Federal action that may have a significant impact on the environment. The EIS must address any adverse environmental effects that cannot be avoided or mitigated, alternatives to the proposed action, the relationship between short-term resources and long-term productivity, and irreversible and irretrievable commitments of resources. Environmental assessments (EA's) are prepared to determine if significant impacts may occur. If an EA finds that significant impacts may occur, NEPA requires preparation of an EIS. The briefest form of NEPA review is the categorical exclusion review (CER). The purpose of a CER is to verify that neither an EA nor an EIS is needed prior to making a decision on the activity being considered for approval.

c. The Alaska National Interest Lands Conservation Act (ANILCA)

In 1980, ANICLA created over 100 million acres of new national parks, refuges, monuments, conservation areas, recreation areas, forests, and wild and scenic rivers in the State of Alaska for the preservation of "nationally significant" natural resources. To address special issues and needs arising from the new land designations, ANILCA contains numerous provisions and special rules for managing Alaska's public lands and nationally important resource development potential. The ANILCA requires Federal land managers to balance the national interest in Alaska's scenic and wildlife resources with recognition of Alaska's economy and infrastructure, and its distinctive rural way of life. Title VIII of ANILCA requires that subsistence uses by "rural" Alaska residents be given a priority over all other (sport and commercial) uses of fish and game on Federal public lands in Alaska. As a compromise, Congress allowed the State to continue managing fish and game uses on Federal public lands, but only on the condition that the State of Alaska adopt a statute that made the new Title VIII "rural" subsistence priority applicable on State, as well as on Federal lands. If the State ever fell out of compliance with Title VIII, Congress required the Secretary of the Interior to reassume management of fish and game on the Federal public lands.

Section 810 of the ANILCA creates special steps a Federal Agency must take before it decides to "withdraw, reserve, lease, or otherwise permit the use, occupancy, or disposition of public land." Specifically, the Federal Agency must first evaluate three factors: the effect of its action on subsistence uses and needs, the availability of other lands for the purposes sought to be achieved, and alternatives which would "reduce or eliminate the use, occupancy, or disposition of public lands needed for subsistence purposes." If the Federal Agency concludes that its action "would significantly restrict subsistence uses," it must notify the appropriate State agency, regional council, and local committee. It then must hold a hearing in the vicinity of the area involved, and must make the following findings:

- such significant restriction of subsistence uses is necessary, consistent with sound management principles for the utilization of public lands,
- the proposed activity will involve the minimal amount of public lands necessary to accomplish the purpose of such use, occupancy, or other disposition, and
- reasonable steps will be taken to minimize adverse impacts upon subsistence uses and resources resulting from such actions. (16 U.S.C. 3120(a)(3)).

In People of the Village of Gambell v. Clark, 746 F.2d 572 (9th Cir. 1984) (Gambell I), the court ruled that the "lands and waters" of the OCS were "public lands" for the purpose of this section. The court later ruled that the provisions of section 810 should not be applied in a staged manner, despite the staged decisionmaking approach set out in the OCS Lands Act and relied upon by the Supreme Court in Secretary of the Interior v. California (People of the Village of Gambell v. Hodel, Civ. No. 85-3877 (9th Cir. Oct. 25, 1985)). As a result of these rulings, the USDOI prepares an analysis under section 810 of ANILCA for OCS lease sales and plans of exploration and development/production for activities offshore Alaska. The provisions of ANILCA do not apply to the 5-Year Program because the USDOI does not make any of the above-described decisions.

d. The Clean Air Act (CAA)

The CAA, as amended, delineates jurisdiction of air quality between the U.S. Environmental Protection Agency (USEPA) and the USDOI, MMS. For OCS operations in the Gulf of Mexico, those west of 87.5° W. longitude are subject to MMS air quality regulations; operations east of 87.5° W. longitude are subject to USEPA air quality regulations.

Under the CAA, the Secretary of the Interior is required to consult with the USEPA Administrator "to assure coordination of air pollution control regulations for OCS emissions and emissions in adjacent onshore areas." The MMS established 30 CFR 250.302, 250.303, and 250.304 to comply with the CAA. The regulated pollutants include carbon monoxide, particulates, sulfur dioxide, nitrogen oxides, and volatile organic compounds (as a precursor to ozone). In areas where hydrogen sulfide may be present, operations are regulated by 30 CFR 250.417. The MMS regulations allow for the collection of information about potential sources of pollution for the purpose of determining whether the projected emissions of air pollutants from a facility could result in ambient onshore air pollutant concentrations above maximum levels provided in the regulations. These regulations also stipulate appropriate emissions controls deemed necessary to prevent accidents and air quality deterioration.

e. The Federal Water Pollution Control Act (FWPCA) and Clean Water Act (CWA)

The FWPCA establishes water pollution control activities to restore and maintain the chemical, physical, and biological integrity of the Nation's waters. The CWA of 1977 amended the FWPCA. Title III of the CWA requires the USEPA to establish national effluent limitation standards for existing point sources of waste-water discharges which reflect the application of the best practical control technology currently available. These standards apply to existing OCS exploratory drillships, semisubmersible vessels, and jackup rigs used in exploration activities. The CWA also requires the USEPA to establish regulations for effluent limitations for categories and classes of point sources that require the application of "best available control technology economically achievable."

Section 311 of the CWA, as amended, prohibits the discharge of oil or hazardous substances into the navigable waters of the United States that may affect natural resources, except under limited circumstances, and establishes civil penalty liability and enforcement procedures to be administered

by the U.S. Coast Guard. The CWA Title IV establishes requirements for Federal permits and licenses to conduct an activity (including construction or operation of facilities) that may result in any discharges into navigable waters. Section 402 of the CWA gives the USEPA the authority to issue National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants. The NPDES permits apply to all sources of wastewater discharges from exploratory vessels and production platforms operating on the OCS.

f. The Coastal Zone Management Act (CZMA) and the Coastal Zone Reauthorization Amendments of 1990

Congress passed the CZMA and created the Coastal Zone Management Program to improve the management of our Nation's coastal areas. The Program, a voluntary partnership between the Federal Government and the coastal States and territories, is administered at the Federal level by the National Oceanic and Atmospheric Administration (NOAA) within the U.S. Department of Commerce (USDOC). The Program's goal is to reduce potential conflicts between environmental and economic interests in the coastal area through the use of federally-approved coastal management programs (CMP's).

The CZMA allows a coastal State or territory, with a federally-approved CMP, to review Federal activities for Federal consistency. Federal consistency is the CZMA requirement that all Federal actions that are reasonably likely to affect any land or water use or natural resource of the coastal zone be consistent with the enforceable policies of a State's/territory's CMP. Section 307 of the CZMA contains the Federal consistency provisions that impose certain requirements on Federal Agencies to comply with enforceable policies detailed in the federally-approved CMP's:

- Section 307(c)(1) requires that any direct Federal Agency activities affecting any land or water use or natural resources of the coastal zone be consistent to the maximum extent practicable with enforceable policies of the State's CMP. This section applies to OCS lease sales.
- Section 307(c)(3)(A) requires that any Federal licenses/permit affecting any land or water use or natural resources of the coastal zone be consistent with enforceable policies of the State's CMP. This section applies to geological and geophysical permits. Additionally, this section prohibits the Federal Agency from issuing the license/permit until the affected State(s) has concurred with or presumed to concur with the applicant's consistency certification or until the Secretary of Commerce has overridden the State's consistency objection to the licensed/permitted activity.
- Section 307(c)(3)(B) requires that activities affecting any land or water use or natural resources of the coastal zone, described in detail in OCS exploration or development and production plans, be consistent with enforceable policies of the State's CMP. The MMS is prohibited from approving an OCS plan until the affected State(s) has concurred with or is presumed to concur with the applicant's consistency certification, or until the Secretary of Commerce has overridden the State's consistency objection.

g. The Endangered Species Act (ESA)

The ESA of 1973 establishes policy to protect and conserve threatened and endangered species and the ecosystems upon which they depend. The ESA is administered by the USDOI, Fish and Wildlife Service (FWS) and the USDOC, National Marine Fisheries Service (NMFS). Section 7 of the ESA mandates that all Federal Agencies consult with the FWS or NMFS to ensure that any agency action is not likely to:

- jeopardize the continued existence of any endangered or threatened species, and/or
- destroy or adversely modify an endangered or threatened species' critical habitat.

The ESA requires Federal Agencies to formally consult when there is reason to believe that a listed (or proposed to be listed) species may be affected by a proposed action. Formal endangered species consultations provide a threshold examination and a biological opinion on the likelihood that the proposed activity will or will not jeopardize the continued existence of the resource, and on the effect of the proposed activity on the endangered species. The biological opinion may include recommendations for modification of the proposed activity. The FWS or NMFS notifies the Federal Agency in writing when insufficient information is available to conclude that the proposed activity is not likely to jeopardize the species or its habitat. In such cases, the Federal Agency must obtain additional information, and, if recommended by the FWS or NMFS, conduct appropriate biological surveys or studies to determine how the proposed activity may affect the endangered species or its critical habitat. After such additional information is received, FWS or NMFS would conclude the consultation process by issuing a formal biological opinion. For OCS activities in the Western and Central Gulf of Mexico Planning Areas, the MMS consults with FWS and/or NMFS at the multisale stage. This consultation covers OCS activities from lease sale through the exploration, development, production, and decommission stages. For other OCS areas, the MMS consults with FWS and/or NMFS at the lease sale stage; however, this consultation only covers leasing and exploration activities. A separate consultation is conducted for development, production and decommissioning stages.

h. The Magnuson-Stevens Fishery Conservation and Management Act (FCMA)

The FCMA of 1976 established and delineated an area from the States' seaward boundary to approximately 200 nautical miles out as a fisheries conservation zone for the United States and its possessions. The FCMA created eight regional fishery management councils (FMC's) and mandated a continuing planning program for marine fisheries management by the FMC's. Also, FCMA requires the FMC to prepare a fishery management plan (FMP), based upon the best available scientific and economic data, for each commercial species (or related group of species) of fish in need of conservation and management within each respective region.

When the Sustainable Fisheries Act of 1996 reauthorized the FCMA, Congress required the NMFS to designate and conserve essential fish habitat (EFH) for those species managed under an existing FMP. By designating EFH, Congress hoped to minimize any adverse effects on habitat caused by fishing or nonfishing activities and to identify other actions to encourage the conservation and enhancement of such habitat. The phrase "essential fish habitat" encompasses "those waters and substrate necessary to fishes for spawning, breeding, feeding, or growth to maturity." As a result of this change, Federal Agencies must consult with NMFS on those activities that may have direct (e.g., physical disruption) or indirect (e.g., loss of prey species) effects on EFH. For OCS activities in the Western and Central Gulf of Mexico Planning Areas, the MMS consults with NMFS at the multisale stage. This consultation covers OCS activities from lease sale through the exploration, development, production, and decommission stages. For other OCS areas, MMS consults with NMFS at each OCS project stage individually (e.g., the lease sale, exploration plan, development and production plan).

i. The Marine Mammal Protection Act (MMPA)

The MMPA was enacted in 1972 to ensure that marine mammals are maintained at, or in some cases restored to, healthy population levels. Jurisdiction over marine mammals under the MMPA is split between two Federal Agencies, FWS and NMFS. The FWS has jurisdiction over sea otters, polar bears, manatees, dugongs, and walrus, while the NMFS has jurisdiction over all other marine mammals.

The MMPA established a moratorium on the taking or importing of marine mammals except during certain activities that are regulated and permitted. Such activities include scientific research, public display, and the incidental take of marine mammals in the course of commercial fishing operations. Taking is defined as "to harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal." Harass is defined as any act of pursuit, torment, or annoyance that has the potential to:

- injure a marine mammal or marine mammal stock in the wild, or
- disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns (e.g., breathing, nursing, breeding).

Upon request, the Secretary (of either the USDOI or the USDOC, depending on jurisdiction) can authorize the unintentional taking of small numbers of marine mammals incidental to activities other than commercial fishing (e.g., offshore oil and gas exploration and development) for a period of 5 years. To authorize the taking, the Secretary must find that the total of the taking during the 5-year period (or less) would have a negligible impact on the affected species. Also, the Secretary shall withdraw or suspend permission to take marine mammals incidental to oil and gas production, and other activities, when:

- the applicable regulations concerning the methods of taking, monitoring, or reporting are not being complied with, or
- the taking is having, or may be having, more than a negligible impact on the affected species or stock.

In 1994, a new subparagraph was added to simplify the process of obtaining "small take" exemptions when unintentional taking is by incidental harassment only. Specifically, the incidental take of small numbers of marine mammals by harassment can now be authorized for periods of up to one year without the rulemaking requirement. The MMS coordinates with the FWS and NMFS to ensure that MMS and offshore operators comply with the MMPA, and to identify mitigation and monitoring requirements for permits or approvals for activities like seismic surveys and platform removals.

j. The International Convention of the Prevention of Pollution from Ships (MARPOL) and Marine Plastic Pollution Research and Control Act (MPPRCA)

In 1978, MARPOL was updated to include five annexes on ocean dumping. By signing onto MARPOL, countries agree to enforce Annexes I and II (oil and noxious liquid substances) of the treaty. Annexes III (hazardous substances), IV (sewage) and V (plastics) are optional. The United States is signatory to two of the optional MARPOL Annexes, III and V. Annex V is of particular importance to the maritime community (e.g., shippers, oil platform personnel, fishers, recreational boaters) because it prohibits the disposal of plastic at sea and regulates the disposal of other types of garbage at sea. The U.S Coast Guard (USCG) is the enforcement agency for MARPOL Annex V within the U.S. Exclusive Economic Zone (EEZ) (within 200 miles of the U.S. shoreline).

The MPPRCA is the Federal law implementing MARPOL Annex V in all U.S. waters. Under the MPPRCA, it is illegal to throw plastic trash off any vessel within the EEZ. It is also illegal to throw any other garbage (e.g., orange peels, paper plates, glass jars, and monofilament fishing line) overboard while navigating in inland waters or within 3 miles offshore. The greater the distance from shore, the fewer restrictions apply to nonplastic garbage. However, dumping plastics overboard in any waters anywhere is illegal at anytime. Fixed and floating platforms, drilling rigs, manned productions platforms, and support vessels operating under a Federal oil and gas lease are required to

develop waste management plans and to post placards reflecting discharge limitations and restrictions. Garbage must be brought ashore and properly disposed of in a trash can, dumpster, or recycling container. Docks and marinas are required to provide facilities to handle normal amounts of garbage from their paying customers. Violations of MARPOL or MPPRCA may result in a fine of up to $50,000 for each incident. If criminal intent can be proven, an individual may be fined up to $250,000 and/or imprisoned up to 6 years. If an organization is responsible, it may be fined up to $500,000 and/or 6 years of imprisonment.

k. The Marine Protection, Research, and Sanctuaries Act (MPRSA)

The MPRSA of 1972 regulates the ocean dumping of waste, provides for a research program on ocean dumping, and provides for the designation and regulation of marine sanctuaries. Also known as the Ocean Dumping Act, it regulates the ocean dumping of all material beyond the territorial limit (3 miles from shore) and prevents or strictly limits dumping material that "would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities." Material includes, but is not limited to, dredged material; solid waste; incinerator residue; garbage; sewage; sewage sludge; munitions; chemical and biological warfare agents; radioactive materials; chemicals; biological and laboratory waste; wrecked or discarded equipment; rocks; sand; excavation debris; and industrial, municipal, agricultural, and other waste. The term does not include sewage from vessels or oil, unless the oil is transported via a vessel or aircraft for the purpose of dumping. Disposal by means of a pipe, regardless of how far at sea the discharge occurs, is regulated by the CWA through the NPDES permit process.

Title III of the MPRSA, later called the National Marine Sanctuaries Act, charged the Secretary of the Department of Commerce to identify, designate, and manage marine sites based on conservational, ecological, recreational, historical, aesthetic, scientific, or educational value within significant national ocean and Great Lake waters. The NOAA administers the National Marine Sanctuary Program. Twelve national marine sanctuaries, representing a wide variety of ocean environments, have been designated.

l. The Merchant Marine Act of 1920 (Jones Act)

The Jones Act regulates coastal shipping between U.S. ports and inland waterways. The Jones Act provides that "no merchandise shall be transported by water, or by land and water . . . between points in the United States . . . in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States . . . ." Therefore, the Jones Act requires that all goods shipped between different ports in the United States or its territories must be:

- carried on vessels built and documented (flagged) in the United States,
- crewed by U.S. citizens or legal aliens licensed by USCG, and
- owned and operated by U.S. citizens.

The rationale behind the Jones Act and earlier sabotage laws was that the United States needed a merchant marine fleet to ensure that its domestic waterborne commerce remains under Government jurisdiction for regulatory, safety, and national defense considerations. The same general principles of safety regulations are applied to other modes of transportation in the United States. While other modes of transportation can operate foreign-built equipment, these units must comply with U.S. standards. However, many foreign-built ships do not meet the standards required of U.S.-built ships and thus are excluded from domestic shipping.

The U.S. Customs Service has determined that facilities fixed or attached to the OCS used for the purpose of oil exploration are considered points within the United States. The OCS oil facilities are considered U.S. sovereign territory and fall under the requirements of the Jones Act; so all shipping to and from these facilities related to OCS oil exploration can only be conducted by vessels meeting the requirements of the Jones Act. Shuttle tankering of oil that is produced at OCS facilities can only be legally provided by U.S.-registered vessels and aircraft that are properly endorsed for coastwise trade under the laws of the United States.

m. The National Fishing Enhancement Act

The National Fishing Enhancement Act of 1984, also known as the Artificial Reef Act, established broad artificial-reef development standards and a national policy to encourage the development of artificial reefs that will enhance fishery resources and commercial and recreational fishing. The national plan identifies oil and gas structures as acceptable material of opportunity for artificial-reef development. The MMS adopted a rigs-to-reefs policy in 1985 in response to this Act and to broaden interest in the use of petroleum platforms as artificial reefs.

n. The National Historic Preservation Act (NHPA)

The NHPA of 1966 requires the head of any Federal Agency possessing licensing authority or having direct or indirect jurisdiction over a proposed Federal or federally-assisted activity to consider the proposed activity's effect on any district, site, building, structure, or object that is included in or eligible for inclusion in the National Register. The historic properties (i.e. archaeological resources) on the OCS include historic shipwrecks, sunken aircraft, lighthouses, and prehistoric archaeological sites that have become inundated due to the 120-meter rise in global sea level since the height of the last ice age (ca. 19,000 years ago).

Because the OCS is not federally-owned land and the Federal government has not claimed direct ownership of historic properties on the OCS, the MMS only has the authority to ensure that any agency-funded and permitted actions do not adversely affect significant historic properties. Beyond avoidance of adverse impacts, MMS does not possess the legal authority to manage the historic properties on the OCS. The MMS has conducted archaeological baseline studies of the OCS to determine where known historic properties may be located and to outline areas where presently unknown historic properties may be located. These baseline studies are used to identify "archaeologically sensitive" areas that may contain significant historic properties. Prior to approving any OCS exploration or development activities within an archaeologically sensitive area, MMS requires the lessee to conduct a marine remote sensing survey and to prepare an archaeological report. If the marine remote sensing survey indicates any evidence of a potential historic property, the lessee either must:

- move the site of the proposed lease operations a sufficient distance to avoid the potential historic property, or
- conduct further investigations to determine the nature and significance of the potential historic property.

If further investigation determines that there is a significant historic property within the area of proposed OCS operations, NHPA consultation procedures are followed.

o. The Oil Pollution Act (OPA 90)

The OPA 90 establishes a single uniform Federal system of liability and compensation for damages caused by oil spills in U.S. navigable waters. The OPA 90 requires removal of spilled oil and establishes a national system of planning for and responding to oil-spill incidents. Additionally, OPA 90 includes provisions to:

- improve oil-spill prevention, preparedness, and response capability;
- establish limitations on liability for damages resulting from oil pollution;
- promote funding for natural resource damage assessment;
- implement a fund for the payment of compensation for such damages; and
- establish an oil pollution research and development program.

The USCG is responsible for enforcing vessel compliance with OPA 90. The Secretary of the Interior is given authority over offshore facilities and associated pipelines (except deepwater ports) for all Federal and State waters, including responsibility for spill prevention, oil-spill contingency plans, oil-spill containment and cleanup equipment, financial responsibility certification, and civil penalties. The Secretary of the Interior delegated this authority to MMS.

The MMS regulations governing oil-spill financial responsibility (OSFR) for offshore facilities and related requirements for certain crude oil wells, production platforms, and pipelines located in the OCS and certain State waters became effective in October 1998. The regulations implement the OPA requirement for responsible parties to demonstrate they can pay for cleanup and damages caused by facility oil spills. Responsible parties can be required to demonstrate as much as $150 million in OSFR if MMS determines that it is justified by the risks from potential oil spills from the covered offshore facilities. The minimum amount of OSFR that must be demonstrated is $35 million for covered offshore facilities located in the OCS, and $10 million for covered offshore facilities located in State waters. The regulation exempts persons responsible for facilities having a potential worst-case, oil-spill discharge of 1,000 bbl or less, unless the risks posed by a facility justify a lower threshold.

p. The Outer Continental Shelf Deep Water Royalty Relief Act

The Outer Continental Shelf Deep Water Royalty Relief Act of 1995 authorizes thc Secretary of the Interior to offer OCS blocks for lease with suspension of royalties for a volume, value, or period of production. Deepwater royalty relief applies to blocks offered for lease in the western and central Gulf of Mexico in water depths exceeding 200 m through November 28, 2000. The MMS has developed procedures for suspension of royalty payment on production from eligible leases.

q. The Ports and Waterways Safety Act

The Ports and Waterways Safety Act authorizes the USCG to designate safety fairways, fairway anchorages, and traffic separation schemes to provide unobstructed approaches through oil fields for vessels using ports. The USCG regulations provide listings of these designated areas along with special conditions related to oil and gas production. In general, no fixed structures such as platforms are allowed in fairways. Temporary underwater obstacles such as anchors and attendant cables or chains attached to floating or semisubmersible drilling rigs may be placed in a fairway under certain conditions. Fixed structures may be placed in anchorages, but the number of structures is limited.

r. The Resource Conservation and Recovery Act (RCRA)

The RCRA provides a framework for the safe disposal and management of hazardous and solid wastes. Most oil-field wastes have been exempted from coverage under RCRA's hazardous waste regulations. Any hazardous wastes generated on the OCS that are not exempt must be transported to shore for disposal at a hazardous waste facility.

2. Executive Orders (EO)

a. Executive Order 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations (February 1994)

The Executive Order on environmental justice (EJ) provides that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." In August 1994, the Secretary of the Interior directed its bureaus to include EJ in NEPA documentation, and in February 1998, the CEQ issued guidance to assist Federal Agencies in addressing EJ.

The EO requires Federal Agencies to incorporate into its NEPA documents analysis of the environmental effects of its proposed programs on minorities and low-income populations and communities. The EJ issues encompass a broad range of impacts covered by NEPA, including impacts on the natural or physical environment and interrelated social, cultural, and economic effects. Thus, these effects must be considered in EIS's and EA's. The EJ concerns may arise from impacts on the natural and physical environment (such as human health or ecological impacts on minority populations, low-income populations, and Indian tribes) or from related social or economic impacts.

The issue of disproportionate, OCS-related impacts has primarily focused on Alaska where subsistence hunting, fishing, and gathering activities occur in coastal areas. However, EJ concerns are considered anywhere (including the Pacific and Gulf of Mexico Regions) where OCS projects and associated NEPA documentation occur.

b. Executive Order 13007: Indian Sacred Sites (May 1996)

The Indian Sacred Sites EO directs Federal land managing Agencies to accommodate access to, and ceremonial use of, Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. It is MMS's policy to consider the potential effects of all aspects of plans, projects, programs, and activities on Indian sacred sites, and to consult, to the greatest extent practicable and to the extent permitted by law, with tribal governments before taking actions that may affect Indian sacred sites located on Federal lands.

c. Executive Order 13089: Coral Reef Protection (June 1998)

This EO directs the U.S. Coral Reef Task Force, co-chaired by the Secretaries of Interior and Commerce, to develop and implement a comprehensive program of research and mapping to inventory, monitor, and "identify the major causes and consequences of degradation of coral reef ecosystems." Additionally, the EO directs Federal Agencies to protect coral reef ecosystems and, to the extent permitted by law, prohibits them from authorizing funding or carrying out any actions that will degrade these ecosystems. Relatedly, the USDOI works with domestic and international partners through the Coral Reef Initiative. This initiative focuses efforts to protect and monitor coral reefs

around the world by building and sustaining partnerships, programs, and institutional capacities at the local, national, regional, and international levels.

d. Executive Order 12114: Environmental Effects Abroad (January 1979)

This EO requires that Federal officials be informed of environmental considerations, and take those considerations into account when making decisions on major Federal actions that could have environmental impacts anywhere beyond the borders of the United States, including Antarctica. Such Federal actions include:

- all major Federal actions significantly affecting the environment outside the jurisdiction of any nation (the oceans or Antarctica). This would apply to proposals that result in actions within the United States, which because of ocean currents, winds, stream flow, or other natural processes, may affect parts of the oceans not claimed by any nation (high seas). Included in this category would be an OCS project that, because of ocean currents, could result in effluents or spilled oil reaching fishing grounds or areas not claimed by another nation.
- all major Federal actions significantly affecting the environment of a foreign nation not involved in the action. This would apply to proposals that result in actions within U.S. territory, or within the EEZ that, because of ocean currents, winds, stream flow, or other natural processes, may affect parts of another nation, or seas or oceans within the jurisdiction of other nations. This category would include an OCS project located upcurrent from the Mexican coastline that could affect Mexico's territory in the event of an oil spill. Also in this category are all major Federal actions in which a foreign nation is a participant and that would normally be covered by the EIS addressing the U.S. part of the proposal. An example would be an OCS right-of-way pipeline bringing Canadian energy resources to the northeast United States.
- all major Federal actions providing a foreign nation with a product, or involving a project that produces an emission or effluent prohibited or regulated by U.S. Federal law because of its effects on the environment or the creation of a serious public health risk.

Federal actions causing significant impacts on environments outside the United States are to be addressed in:

- EIS's (generic, program (5-Year OCS Program EIS), and project-specific (OCS lease sale EIS);
- documents prepared for decisionmakers containing reviews of environmental issues involved in Federal actions, or summaries of environmental analyses (e.g., OCS lease sale decision documents, Records of Decision); and
- environmental studies or research prepared by the United States and one or more foreign nations, or by an international body in which the United States is a member or participant.

The United States, Canada, and Mexico are negotiating a Transboundary Environmental Impact Assessments (TEIA) Agreement through the North Atlantic Free Trade Agreement (NAFTA) Commission on Environmental Cooperation (CEC). The CEC deals with a wide range of environmental and natural resource protection issues common to Canada, the United States, and Mexico. Developing a TEIA process is one of the requirements of the 199l North American Agreement on Environmental Cooperation. Under this agreement, a transboundary environmental impact is any impact on the environment within the area under the jurisdiction of Canada, the United States, or Mexico caused by a proposed project, the physical origin of which is situated wholly or in part within the area under the jurisdiction of one of the three countries. For example, a proposed project on the United States OCS that, because of ocean currents, winds, or proximity to the Mexican coastline, could affect Mexican waters (fishing industry, fish resources, etc.) or the Mexican coastline (oil spill contacts, etc.) would be a project considered to have the potential to cause transboundary

environmental impacts. The agreement recognizes that there is a significant bilateral nature to many transboundary issues and calls upon the three countries to develop an agreement to:

- assess the environmental impacts of proposed projects in any of the three countries party to the agreement (NAFTA) which would be likely to cause significant adverse transboundary impacts within the jurisdiction of any of the other parties;
- develop a system of notification, consultation, and sharing of relevant information between countries with respect to such projects; and
- give consideration to mitigating measures to address the potential adverse effects of such projects.

Negotiations are currently underway between the three parties to the agreement, but the final language had yet to be worked out. Because the requirements of the assessment portion of the agreement are somewhat similar to the requirements imposed by EO 12114, i.e. impacts to foreign territory must be addressed in NEPA documents, MMS requires that EIS's prepared on major Federal OCS actions contain an assessment of potential significant impacts to foreign territory.

e. Executive Order 13158: Marine Protected Areas (MPA's) (May 2000)

The EO defines an MPA as "any area of the marine environment that has been reserved by Federal, State, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein." The EO directs Federal Agencies to work closely with State, local, and nongovernmental partners to create a comprehensive system of MPA's "representing diverse U.S. marine ecosystems, and the Nation's natural and cultural resources." Ultimately, the MPA system will include new sites, as well as enhancements to the conservation of existing sites. Five principal components of the EO are:

- National MPA List: The USDOC and the USDOI will develop and maintain a national list of MPA's in U.S. waters. Candidate sites for the list are drawn from existing programs for Federal, tribal, State and local protected areas. When completed, the list and the companion data on each site will serve several purposes such as ensuring that agencies "avoid harm" to MPA's, providing a foundation for the analysis of gaps in the existing system of protections, and helping improve the effectiveness of existing MPA's.
- The MPA Web Site: The USDOC and USDOI will develop and maintain a publicly accessible Web site to provide information on MPA's and Federal Agency reports required by the EO. Also, the web site will be used to publish and maintain the National MPA List and other useful information, such as maps of MPA's; a virtual library of MPA reference materials, including links to other web sites; information on the MPA Advisory Committee; activities of the national MPA Center; MPA program summaries; and background materials such as MPA definitions, benefits, management challenges, and management tools.
- The MPA Federal Advisory Committee: Created to provide expert advice on, and recommendations for, a national system of MPA's, this advisory committee will include nonfederal representatives from science, resource management, environmental organizations, and industry.
- The Mandate to Avoid Harmful Federal Actions: This mandate directs Federal Agencies to avoid harm to MPA's or their resources through activities that they undertake, fund, or approve.
- The MPA Center: The EO directs NOAA to create a Marine Protected Areas Center (MPA Center). In cooperation with the USDOI and working closely with other organizations, the MPA Center will coordinate the effort to implement the EO and will:
  - develop the framework for a national system of MPA's;
  - coordinate the development of information, tools, and strategies;

- provide guidance that will encourage efforts to enhance and expand the protection of existing MPA's and to establish or recommend new ones;
- coordinate the MPA web site;
- partner with Federal and nonfederal organizations to conduct research, analysis, and exploration;
- help maintain the National MPA List; and
- support the MPA Advisory Committee.

f. Executive Order 13112: Invasive Species (February 1999)

The EO defines an "invasive species" as a species that is nonnative (or alien) to the ecosystem under consideration and whose introduction causes or is likely to cause, economic or environmental harm or harm to human health. This EO requires all Federal Agencies to:

- identify any actions affecting the status of invasive species;
- prevent invasive species introduction;
- detect and respond to and control populations of invasive species in a cost-effective and environmentally sound manner;
- monitor invasive species populations accurately and reliably;
- provide for restoration of native species and habitat conditions in invaded ecosystems;
- conduct research on invasive species and develop technologies to prevent introduction and provide for environmentally sound control of invasive species;
- promote public education on invasive species and the means to address them; and,
- refrain from authorizing, funding, or carrying out actions that are likely to cause or promote invasive species introduction or spread, unless the Agency has determined that the benefits of such actions clearly outweigh the potential harm caused by invasive species and that all feasible and prudent measures to minimize risk of harm will be taken.

Additionally, the EO established the National Invasive Species Council (Council), co-chaired by the Secretaries of Agriculture, Commerce and the Interior, and comprised of the Secretaries of State, Treasury, Defense, and Transportation, and the Administrator of the Environmental Protection Agency. The Council:

- provides national leadership on invasive species;
- sees that Federal efforts are coordinated and effective;
- promotes action at local, State, tribal and ecosystem levels;
- identifies recommendations for international cooperation;
- facilitates a coordinated network to document and monitor invasive species;
- develops a web-based information network;
- provides guidance on invasive species for Federal Agencies to use in implementing the NEPA; and
- prepares an Invasive Species Management Plan to serve as the blueprint for Federal action to prevent introduction; provide control; and minimize economic, environmental, and human health impacts of invasive species.

The MMS requires that EIS's prepared on major Federal OCS actions (e.g., 5-Year OCS Program and OCS lease sales) contain an assessment of the proposed action's contribution to the invasive species problem.

F. REFERENCES

REFERENCES

Ackerman, R.A. 1997. The Nest Environment and the Embryonic Development of Sea Turtles. *In:* The Biology of Sea Turtles. Lutz, P.L. and J.A. Musick (eds.). Boca Raton, FL: CRC Press. pp. 83-106.

Agler, B.A. and S.J. Kendall. 1997. Marine Birds and Sea Otter Population Abundance of Prince William Sound, Alaska: Trends Following the T/V *Exxon Valdez* Oil Spill, 1989-1996. *Exxon Valdez* Oil Spill Restoration Project Final Report (Restoration Project 96159). Anchorage, AK: USDOI/FWS.

Agler, B.A., S.J. Kendall, D.B. Irons, and S.P. Klosiewski. 1999. Declines in Marine Bird Populations in Prince William Sound, Alaska, Coincident with a Climatic Regime Shift. Waterbirds 22:98-103.

Alaska Commercial Fisheries Entry Commission (CFEC). 2001. Commercial Fisheries Entry Commission Web Site, 27 Feb. 2001 <http://www.cfec.state.ak.us>.

Alaska Consultants, Clyde S. Courtnage, and Stephen R. Braund & Associates. 1984. Barrow Arch Socioeconomic and Sociocultural Description. Technical Report No. 101. Prepared for the USDOI/MMS, Alaska OCS Region, Alaska OCS Socioeconomic Studies Program, Anchorage, AK.

Alaska Department of Community and Economic Development (ADCED). 2000. Alaska Community Databae Online. 12 June 2001 <http://www.dced.state.ak.us/mra/CF_COMBDB.htm>.

------- 2001. Alaska Community Database Online. 12 June 2001 <http://www.dced.state.ak.us/mra/CF_COMBDB.htm>.

Alaska Department of Environmental Conservation. 2001. Alaska Cruise Ship Initiative, Part 2 Report. 6 June 2001. 41 pp. Juneau, AK: Dept. of Env. Conservation, Division of Statewide Public Service. <www.state.ak.us/local/akpages/ENV.CONSERV/dsps/documents/acsireport.pdf>.

Alaska Department of Environmental Conservation and Minerals Management Service. 2000. Joint Evaluation, Fall 1999, North Slope Drills and Exercises Response Tactics for BP Exploration's Northstar, Prudhoe Bay Western Operating Area and Endicott Operations and ARCO's Prudhoe Bay Unit and Greater Point McIntyre Area..

Alaska Department of Fish and Game (ADFG). 1986. Alaska Habitat Management Guide. Juneau, AK: ADFG/Habitat Division.

------- 1998. Whiskers! Marine Mammal Database. Anchorage, AK: ADFG/Division of Subsistence. (AskSam format.)

------- 1999. Community Profile Database. Juneau, AK: ADFG/Division of Subsistence. (This is now available in electronic form and is updated on a regular basis.)

Alaska Department of Labor and Workforce Development, Research and Analysis Section. 1998. Population Projections (Gregory Williams). Alaska Economic Trends, Volume 18, Number 9 (September-October 1998.) Juneau, AK: Alaska Department of Labor.

------- 2000a. Employment and Earnings Summary Report for Alaska and 27 Census Areas, 1998.

------- 2000b. Age Structure Information for Alaska and Its Census Areas for 1998. <www.labor.state.ak.us/research>.

------- 2001. Research and Analysis. <www.labor.state.ak.us/research>.

Alaska Department of Natural Resources (ADNR). 1978. Public Hearing on Proposed Pt. Thompson Lease Sale, July 25. Anchorage, AK: ADNR/Division of Oil and Gas.

------- 1989. Alaska Historic Resources File. Computer File and Card File. Anchorage, AK: ADNR.

------- 1997. Oil and Gas Lease Sale 86, Central Beaufort Sea: Final Finding of the Director. Anchorage, AK: ADNR/Division of Oil and Gas.

------- 1998. Oil and Gas Lease Sale 87, North Slope Areawide: Final Finding of the Director. Anchorage, AK: ADNR/Division of Oil and Gas.

------- 2000. Oil and Gas Annual Report. Anchorage, AK: ADNR/Division of Oil and Gas. 112 pp.

Alaska Eskimo Whaling Commission. 1977. Transcript of September 11, 1977 Alaska Eskimo Whaling Commission Hearing on Whaling and the State of Alaska Proposed Pt. Thompson Lease Sale.

Alaska Natural Heritage Program. 1998. Status Report on the Short-Tailed Albatross *(Diomedea albatrus*) in Alaska. Anchorage, AK: The Alaska Natural Heritage Program, University of Alaska Anchorage <http://www.uaa.alaska.edu/enri/aknhp.web/index.html>. Unpublished report on file as reported from the Heritage web site.

Alaska Regional Response Team. 2000. <http://www.akrrt.org/plans.html>.

Albert, T.A. 2000. Comments Regarding Potential Oil-Spill Impacts to Bowhead Whales. Paper Presented at the USDOI/MMS, Alaska OCS Region, Beaufort Sea Information Update Meeting. 28-29 March 2000. Barrow, AK.

Alexander, V., R. Horner, and R.C. Clasby. 1974. Metabolism of Arctic Sea Ice Organisms. IMS Report.

Alexander, S.K. and J.W. Webb. 1987. Relationship of *Spartina alterniflora* Growth to Sediment Oil Content Following an Oil Spill. *In*: Proceedings, 1987 Oil Spill Conference. Washington, DC: American Petroleum Institute. pp. 445-450.

Allen, J.A. 1880. History of North American Pinnipeds. A Monograph of the Walruses, Sea Lions, Sea-Bears, and Seals of North America. U.S. Geol. Geogr. Surv. Terr., Misc. Publ. 12. Washington, DC: U.S. Gov. Print. Off. 785 pp.

Alliston, W.G. 1981. The Distribution of Ringed Seals in Relation to Winter Ice-Breaking Activities in Lake Melvilloe, Labrador. Report from LGL Ltd., St. John's, Newfoundland, for Arctic Pilot Proj., Calgary, Alberta: Petro-Canada. 13 pp.

Alyeska Pipeline Service Company. 1995. Environmental Atlas of the Trans-Alaska Pipeline System. Anchorage, AK: Alyeska Pipeline Service Company.

------- 2001. Resource Guide for Jobs on TAPS. Human Resources, Alaska Native Program, Alyeska Pipeline Company. <http://www.alyeska-pipe.com>. (search for "local and hire").

American Petroleum Institute. 1989. Effects of Offshore Petroleum Operations on Cold Water Marine Mammals: A Literature Review. Washington, DC: American Petroleum Institute. 385 pp.

Amerongen, J. van. 2000. Zilly Pulls the Plug on Trawlers. Alaska Fisherman's Journal 23(9):9-19.

Amstrup, S.C. 1993. Human Disturbances of Denning Polar Bears in Alaska. Arctic 46(3):246-250.

------- 1995. Movements, Distribution and Population Dynamics of Polar Bears in the Beaufort Sea. Ph.D. Dissertation. Fairbanks, AK: University of Alaska-Fairbanks. 299 pp.

Amstrup, S.C. and C. Gardner. 1994. Polar Bear Maternity Denning in the Beaufort Sea. J. Wildl. Management 58:1-10.

Anderson, J.W., D.J. Reish, R.B. Spies, M.E. Brady, and E.W. Segelhorst. 1993. Human Impacts, Chapter 12, pp. 682-766. *In:* Ecology of the Southern California Bight: A Synthesis and Interpretation. Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.). Berkeley, CA: University of California Press. 926 pp.

Anderson, B.A., R.J. Richie, A.A. Stickney, and A.M. Wildman. 1998. Avian Studies in the Kuparuk Oil Field, Alaska, 1997. Final Report Prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage. Fairbanks, AK: Alaska Biological Research, Inc. 69 pp.

Anderson, B.A., A.A. Stickney, R.J. Richie, and B.A. Cooper. 1995. Avian Studies in the Kuparuk Oil Field, Alaska, 1994. Final Report Prepared for ARCO Alaska, Inc., and the Kuparuk River Unit, Anchorage. Fairbanks, AK: Alaska Biological Research, Inc.,

Anderson, D.B., W.W. Anderson, R.Bane, R.K. Nelson, and N.S.Towarak. 1998. Kuuvanmiut Subsistence – Traditional Eskimo Life in the Latter Twentieth Century. First Published in 1976. National Park Service and Northwest Arctic Borough School District.

Andre, M., M. Terada, and Y. Watanabe. 1997. Sperm Whale (*Physeter macrocephalus*) Behavioral Response After the Playback of Artificial Sounds. Reports of the International Whaling Commission 47, SC/48/NA13. pp. 499-504.

Antonelis, G.A., Jr. and C.H. Fiscus. 1980. The Pinnipeds of the California Current. Calif. Coop. Oceanic Fish. Invest. Rep. 25:135-145.

Anuskiewicz, R.J. and J.S. Dunbar. 1993. Evidence of Prehistoric Man at Ray Hole Springs: A Drowned Sinkhole Located 32 km Offshore on the Continental Shelf in 12 m of Seawater. Proceedings of the American Academy of Underwater Sciences Thirteenth Annual Scientific Diving Symposium. September 19-22, 1993, Pacific Grove, CA.

Archer, D., H. Kheshgi, and E. Maier-Reimer. 1998. Dynamics of Fossil Fuel CO_2 Neutralization by Marine $CaCO_3$. Global Biogeochemical Cycles 12(2):259-276.

Armstrong, R.H. 1990. Guide to the Birds of Alaska. Anchorage, AK: Alaska Northwest Books. 322 pp.

Arnold, R.D. 1978. Alaska Native Land Claims. Anchorage, AK: Alaska Native Foundation.

Aten, L.E. 1983. Indians of the Upper Texas Coast. New York, NY: Academic Press.

Auerbach, N.A., M.D. Walker, and D.A. Walker. 1997. Effects of Roadside Disturbance on Substrate and Vegetation Properties in Arctic Tundra. Ecological Applications 7:218-235.

Avery, M.L., P.F. Springer, and N.S. Dailey. 1980. Avian Mortality at Man-Made Structures: An Annotated Bibliography (Revised). FWS/OBS-80/54. Washington, DC: USDOI/FWS Biological Services Program, National Power Plant Team.

Babcock, M.M. 1985. Morphology of Olfactory Epithelium of Pink Salmon, *Oncorhynchus gorbuscha*, and Changes Following Exposure to Benzene: A Scanning Electron Microscope Study, pp. 259-267. *In:* Marine Biology of Polar Regions and Stress on Marine Organisms. Gray, J.S. and M.E. Christiansen (eds.). Wiley, NY.

Baird, P.H. 1993. Birds. Chapter 10, pp. 541-603. *In:* Ecology of the Southern California Bight: A Synthesis and Interpretation. Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.). Berkeley, CA: University of California Press. 926 pp.

Baker, C.S., S.R. Palumbi, R.H. Lambertsen, M.T. Weinrich, J. Calambodkis, and S.J. O'Brien. 1990. Influence of Seasonal Migration on Geographic Distribution of Mitochondrial DNA Haplotypes in Humpback Whales. Nature 344:238-240.

Ballachey, B.E., J.L. Bodkin and A.R. Degange. 1994. An Overview of Sea Otter Studies. *In*: Marine Mammals and the *Exxon Valdez*. Loughlin, T.R. (ed.). San Diego, CA: Academic Press.

Ballachey, B.E., J.L. Bodkin, and P.W. Snyder. 1999. Cytochrome P450A as a Bioindicator of Exposure of Sea Otters to Residual *Exxon Valdez* Oil. Anchorage, AK: USDOI/USGS/Biological Resources Division.

Balsinger, J.W. 2000. Draft Federal Actions Associated with Management and Recovery of Cook Inlet Whales Environmental Impact Statement. Juneau, AK: USDOC/NOAA, National Marine Fisheries Service, Alaska Region. 86 pp.

Banet, S.M. 1998. Norton Basin Assessment Province. *In:* Undiscovered Oil and Gas Resources, Alaska Federal Offshore. Sherwood, K.W. (ed.). OCS Monograph MMS 98-0054. Anchorage, AK: USDOI/MMS. pp. 267-272.

Bannikov, A.G. 1970. Arctic Fox in the U.S.S.R., pp. 121-130. *In:* Proceedings of Conference on Productivity and Conservation in Northern Circumpolar Lands, Morges. Fuller, W.A., and P.G. Kern (eds.). Int. Union for Conserv. of Nature and Nat. Resour. New Ser. Publ. 16. 344 pp.

Barber, R.T., and F.P. Chavez. 1983. Biological Consequences of El Nino. Science 222:1,203-1,210.

BarBh, Russell L. 1991. Potential Effects of OCS Oil and Gas Activities on Oregon and Washington Indian Tribes. OCS Study MMS 90-0034. USDOI/MMS.

Barger, J.E., and W.R. Hamblen. 1980. The Air Gun Impulsive Underwater Transducer. J. Acoust. Soc. Am. 68(4):1,038-1,045.

Barkuloo, J.M. 1988. Report on the Conservation Status of the Gulf of Mexico Sturgeon, *Acipenser oxyrinchus desotoi*. Panama City, FL: USDOI/FWS. 33 pp.

Barlow, J. 1994. Recent Information on the Status of Large Whales in California Waters. NOAA Technical Memorandum. NMFS-SWFSC-203. 27 pp.

------- 1995. The Abundance of Cetaceans in California Waters. Part I: Ship Surveys in Summer and Fall of 1991. Fish. Bull. 93:1-14.

------- 1997. Preliminary Estimates of Cetacean Abundance Off California, Oregon, and Washington Based on a 1996 Ship Survey and Comparisons of Passing and Closing Modes. Adm. Rept. LJ-97-11. (Available from Southwest Fisheries Science Center, P.O. Box 271, La Jolla, CA.) 25 pp.

Barlow, J., and B.L. Taylor. 1998. Preliminary Abundance of Sperm Whales in the Northeastern Temperate Pacific Estimated from a Combined Visual and Acoustic Survey. Unpublished Report Submitted to the International Whaling Commission (SC/50/CAWS/20). 19 pp.

Barnes, Peter W. 1984. Ice Gouging Characteristics and Processes. *In:* The Beaufort Sea: Ecosystems and Environments, Barnes, P.W., D.M. Schell, and E. Reimnitz (eds.). New York, NY: Academic Press. pp. 185-212.

Barnhart, R.A. 1986. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates – Steelhead Trout (Pacific Southwest). Biological Report 82 (11.60); TR EL-82-4. Prepared for Coastal Ecology Group, U.S. Army Corps of Engineers, Vicksburg, MS. 21 pp.

Barry A. Vittor & Associates, Inc. 1985. Tuscaloosa Trend Regional Data Search and Synthesis Study, Synthesis Report, Volume I. OCS Study MMS 85-0056. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Regional Office.

------- 1996. Biological Monitoring of the Destin Dome Block 51 #1 Wellsite. Prepared for Chevron U.S.A. Production Company, New Orleans, LA. 46 pp. + app.

Barth, M.C., and J.G. Titus (eds.). 1984. Greenhouse Effect and Sea Level Rise: A Challenge for This Generation. New York, NY: Van Nostrand Reinhold, Co., Inc. 325 pp.

Bartol, S.M., J. Musick, and M. Lenhardt. 1999. Auditory Evoked Potentials of the Loggerhead Sea Turtle (*Caretta caretta*). Copeia 99(3):836-840.

Bauer, G.B., and L.M. Herman. 1986. Effects of Vessel Traffic on the Behavior of Humpback Whales in Hawaii. Prepared for USDOC/NMFS. Honolulu, HI: Kewalo Basin Marine Mammal Laboratory, University of Hawaii. 151 pp.

Bauer, G.B., J.R. Mobley, and L.M. Herman. 1993. Responses of Wintering Humpback Whales to Vessel Traffic. J. Acoust. Soc. Am. 94(3, Pt. 2):1,848.

Beard, J.H., J.B. Sangree, and L.A. Smith. 1982. Quaternary Chronology, Paleoclimate, Depositional Sequences, and Eustatic Cycles. AAPG Bulletin 66:158-169.

Beamish, R.J., and D.R. Bouillon. 1995. Marine Fish Production Trends Off the Pacific Coast of Canada and the United States. *In:* Climate Change and Northern Fish Populations. Beamish, R.J. (ed.). Can. Spec. Pub. Fish. Aquat. Sci. 121:585-591.

Beck, 1992. Risk Society: Towards a New Modernity. London: Sage Publications.

Becker, P.R. et al. 2001. Persistent Chlorinated Compounds and Elements in Tissues of Cook Inlet Beluga Whales, *Delphinapterus leucas*, Banked by the Alaska Marine Mammal Tissue Archival Project. MMS 2000-067, NISTIR 6702. 66 pp.

Bedinger, C.A. 1981. Pollutant Fate and Effect Studies. *In:* Ecological Investigations of Petroleum Production Platforms in the Central Gulf of Mexico. Bedinger, C.A. (ed.). Prepared for USDOI/BLM. Contract No. AA551-CT8-17. San Antonio, TX: Southwest Research Institute.

Bendock, T. 1997. Fish Resources of Northeastern NPR-A. *In:* NPR-A Symposium Proceedings: Science, Traditional Knowledge, and the Resources of the Northeast Planning Area of the National Petroleum Reserve-Alaska, Anchorage, AK., April 16-18, 1997. Anchorage, AK: USDOI/MMS, Alaska OCS Region. pp. 5-3 to 5-4.

Bent, A.C. 1962a. Life Histories of North American Shorebirds, Part I. New York, NY: Dover Publications. 359 pp.

------- 1962b. Life Histories of North American Shorebirds, Part II. New York, NY: Dover Publications 340 pp.

------- 1986. Life Histories of North American Gulls and Terns. New York, NY: Dover Publications. 337 pp.

Bente, P. 1997. Western Arctic Herd, pp. 24-26. *In:* Caribou. Annual Performance Report of Survey-Inventory Activities. Hicks, M.V. (ed.). Fed. Aid in Wildl. Restor., Grant W-24-5, Stud. 3.0. Juneau, AK: Alaska Department of Fish and Game.

Berger, T.R. 1985. Village Journey - The Report of the Alaska Native Review Commission. New York, NY: Hill and Wang.

Berthold, P. 1993. Bird Migration, A General Survey. Oxford: Oxford University Press, 239 pp.

Berzin, A.A., and A.A. Rovnin. 1966. The Distribution and Migrations of Whales in the Northeastern Part of the Pacific, Chukchi, and Bering Seas, pp. 103-136. *In:* Soviet Research on Marine Mammals of the Far East. Panin, K.I. (ed.),

Bickel, P.M. 1978. Changing Sea Levels Along the California Coast: Anthropological Implications. Journal of California Anthropology 5(1):6-20.

Bigg, M.A. 1969. The Harbour Seal in British Columbia. Fish. Res. Bd. Can. Bull. 172. 33 pp.

------- 1981. Harbour Seal, *Phoca vitulina*, Linnaeus, 1758 and *Phoca largha*, Pallas, 1811, pp. 1-27. *In:* Handbook of Marine Mammals, Vol. 2: Seals. Ridgeway, S.H. and R.J. Harrison (eds.). New York, NY: Academic Press.

Bildstein, K. 1993. White Ibis: Wetland Wanderer. Washington, DC: Smithsonian Institute Press. 242 pp.

Billings, W.D., J.O. Luken, D.A. Mortensen, and K.M. Peterson. 1983. Increasing Atmospheric Carbon Dioxide: Possible Effects on Arctic Tundra. Oecologia 58:286-289.

Bird, J.E. 1983. The California Gray Whale (*Eschrictius robustus*): A Review of the Literature on Migratory and Behavioral Characteristics. Appendix A. *In:* Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior. Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird (eds.). Prepared for the USDOI/MMS, Anchorage, AK. NTIS PB86-174174. Cambridge, MA: Bolt Beranek & Newman Inc. BBN Rep. 5366.

Birket-Smith, K., and F. DeLaguna. 1938. The Eyak Indians of the Copper River Delta, Alaska. Copenhagen: Levin and Munksgaard.

Bishop, R.H. 1967. Reproduction, Age Determination and Behavior of the Harbor Seal, *Phoca vitulina,* in the Gulf of Alaska. M.S. Thesis. AK: University of Alaska. 121 pp.

Bishop, M.A., P.M. Meyers, and P.F. McNeley. 2000. A Method to Estimate Migrant Shorebird Numbers on the Copper River Delta, Alaska. Journal of Field Ornithology.

Bittner, J.E. 1996. Cultural Resources and the *Exxon Valdez* Oil Spill: An Overview. American Fisheries Society Symposium 18:814-818.

Blaha, J.P., and W. Sturges. 1981. Evidence for Wind-Forced Circulation in the Gulf of Mexico. J. Mar. Res. 39(4):711-734.

Blair, W.F. 1951. Population Structure, Social Behavior, and Environmental Relations in Natural Population of the Beach Mouse (*Peromyscus polionotus leucocephalus*). Cont. Lab. Vertebr. Biol. Univ. Mich. 48: 1-47.

Blasko, D.P. 1976. Occurrences of Oil and Gas Seeps Along the Gulf of Alaska, pp. 211-220. *In:* Eighth Annual Offshore Technology Conference, 1976 Proceedings, Dallas, TX. Paper 2444, Vol. 1.

Blaylock, R.A., J.W. Hain, L.J. Hansen, D.L. Palka, and G.T. Waring. 1995. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments. NOAA Tech. Mem. NMFS-SEFSC-363. 211 pp.

Bloom, A.L. 1983. Sea Level and Coastal Morphology of the United States Through the Late Wisconsin Glacial Maximum, pp. 215-229. *In:* Late-Quaternary Environments of the United States, Vol. 1. Wright, H.E., Jr. (ed.). Minneapolis, MN: University of Minnesota.

Bockstoce, John. 1977. Eskimos of Northwest Alaska in the Early Nineteenth Century. Mongraph Series Number 1. Oxford: University of Oxford, Pitt Rivers Museum.

Boehm, P.D. et. al. 1998. Sediment Quality in Depositional Areas of Shelikof Strait and Outermost Cook Inlet. Final Literature Synthesis. Prepared for the USDOI/MMS by Arthur D. Little, Inc. NTIS PB98-138415. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 668 pp.

Boehm, P. D. 2001. ANIMIDA Phase I: Arctic Nearshore Characterization and Monitoring of the Physical Environment in the Northstar and Liberty Development Areas. Final Report. Prepared by Arthur D. Little, Inc., Cambridge, MA. OCS Study MMS 2001-104. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

Boehm, P., M. Steinhauer, E. Creceluis, J. Neff, and C. Tuckfield. 1987. Final Report of Beaufort Sea Monitoring Program: Analysis of Trace Metals and Hydrocarbons from Outer Continental Shelf (OCS) Activities. Prepared for the USDOI/MMS under Contract No. 14-12-0001-30163. MMS 87-0072. Battelle Ocean Sciences.

Boggs, K. 1997. Classification of Community Types, Successional Sequences, and Landscapes of the Copper River Delta, Alaska. General Technical Report PNW-GTR, USDA/Forest Service, Pacific Northwest Research Station. 497 pp.

Bolger, M., S.H. Henry, and C.D. Carrington. 1996. Hazard and Risk Assessment of Crude Oil Contaminants in Subsistence Seafood Samples from Prince William Sound. American Fishery Society Symposium 18:837-843.

Bond, C.E. 1996. Biology of Fishes, Second Edition. Orlando, FL: Saunders College Publishing, Harcourt Brace and Company. 750 pp.

Bonnell, M.L., C.E. Bowlby, and G.A. Green. 1991. Pinniped Distribution and Abundance Off Oregon and Washington, 1989-1990. Chapter II. *In:* Oregon and Washington Marine Mammal and Seabird Surveys. Brueggeman J.J. (ed.). Final Report Prepared for the USDOI/MMS, Pacific OCS Region, Camarillo, CA. OCS Study MMS 91-0093. Bellevue, WA: Ebasco Environmental, and Portland, OR: Ecological Consulting, Inc. 60 p.

Bonnell, M.L., B.J. LeBoeuf, M.O. Pierson, D.H. Dettman, G.D. Farrens, and C.B. Heath. 1981. Pinnipeds of the Southern California Bight. Summary Report, 1975-1978, Part I, Vol. III, Principal Investigator's Reports, Marine Mammal and Seabird Survey of the Southern California Bight Area. Los Angeles, CA: USDOI/BLM, Pacific OCS Office. NTIS No. PB81-248-71. 535 pp.

Bonnell, M.L., and M.D. Dailey. 1993. Chapter 11, Marine Mammals, pp. 604-681. *In:* Ecology of the Southern California Bight: A Synthesis and Interpretation. Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.). Berkeley, CA: University of California Press. 926 pp.

Bonnell, M.L., M.O. Pierson, and G.D. Farrens. 1983. Pinnipeds and Sea Otters of Central and Northern California, 1980-1983: Status, Abundance, and Distribution. Final Report to the USDOI/MMS, Pacific OCS Region, Los Angeles, CA. OCS Study MMS 84-0044. 220 pp.

Born, E.W., F.F. Riget, R. Dietz, and D. Andriashek. 1999. Escape Responses of Hauled Out Ringed Seals (*Phoca hispida*) to Aircraft Disturbance. Polar Biology 21(3):171-178.

Bowen, W.W. 1968. Variation and Evolution of Gulf Coast Population of Beach Mice, *Peromyscus polionotus*. Bull. Florida State Mus. 12:1-91.

Bowen, B.W., and J.C. Avise. 1990. Genetic Structure of Atlantic and Gulf of Mexico Populations of Sea Bass, Menhaden, and Sturgeon: Influence of Zoogeographic Factors and Life-History Patterns. Marine Biology 107:371-381.

Bowlby, C.E., B.L. Troutman, S.J. Jeffries, and R.G. Kvitek. 1988. Sea Otters in Washington: Distribution, Abundance, and Activity Patterns. Final Report Prepared for the National Coastal Resources Research and Development Institute, September 1988. Tacoma, WA: Washington Department of Wildlife, Marine Mammal Investigations. 133 pp.

Bowles, A.E. 1995. Responses of Wildlife to Noise, pp. 109-156. *In:* Wildlife and Recreationalists: Coexistence Through Management and Research. Knight, R.L., and K.J. Gutzwiller (eds.). Washington, DC: Island Press.

Bowles, A.E., M. Smultea, B. Würsig, D.P. DeMaster, and D. Palka. 1994. Relative Abundance and Behavior of Marine Mammals Exposed to Transmissions from the Heard Island Feasibility Test. J. Acoust. Soc. Amer. 96(4):2,469-2,484.

Bowyer, R.T., W.J. Testa, and J.B. Faro. 1994. Changes in Diets of River Otters in Prince William Sound, Alaska: Effects of the *Exxon Valdez* Oil Spill. Can. J. Zool. 72:970-976.

Boyd, R., and S. Penland, eds. 1988. A Geomophologic Model for Mississippi Delta Evolution. *In:* Transactions – Gulf Coast Association of Geological Societies, Volume XXXVIII, 1988.

Boyle, E.A., D.F. Reid, S.S. Huested, and J. Hering. 1984. Trace Metals and Radium in the Gulf of Mexico: An Evaluation of River and Continental Shelf Sources. Earth Planet Sci. Lett. 69:69-87.

Braham, H.W. 1984. The Bowhead Whale, *Balaena mysticetus*. Mar. Fish. Rev. 46(4):45-53.

------- 1992. Endangered Whales: Status Update. Working Document Presented at a Workshop on the Status of California Cetacean Stocks (SOCC/14). 35 pp.

------- 1995. Sex and Size Composition of Bowhead Whales Landed by Alaskan Eskimo Whales, pp. 281-313. *In:* Hunting the Largest Animals: Native Whaling in the Western Arctic and Subarctic. Studies in Whaling No. 3, Occ. Publ. No. 36, McCartney, A.P. (ed.). Alberta, Canada: Canadian Circumpolar Institute, Univ. of Alberta. 345 pp.

Braham, H.W., J.J. Burns, G.A. Fedoseev, and B.D. Krogman. 1984. Habitat Partitioning by Ice-Associated Pinnipeds: Distribution and Density of Seals and Walruses in the Bering Sea, April 1976, pp. 25-47. *In:* Soviet-American Cooperative Research on Marine Mammals. Vol. 1. Pinnipeds. Fay, F.H., and G.A. Fedoseev (eds.). USDOC/NOAA Technical Report NMFS 12.

Braham, H.W., and M.E. Dahlheim. 1982. Killer Whales in Alaska Documented in the Platforms of Opportunity Program. Report of the International Whaling Commission 32:643-646.

Braham, H.W., R.D. Everitt, and D.J. Rugh. 1980b. Northern Sea Lion Decline in the Eastern Aleutian Islands. Journal of Wildlife Management 44:25-33.

Braham, H.W., M.A. Fraker, and B.D. Krogman. 1980a. Spring Migration of the Western Arctic Population of Bowhead Whales. Marine Fisheries Review 42:36-46.

Braham, H.W., and D.W. Rice. 1984. The Right Whale, *Balaena glacialis*, Marine Fisheries Review 46(4):38-44.

Brandon, E.A., and G.S. Fargion. 1993. Mesoscale Temperature Features and Marine Mammals in the Gulf of Mexico, p. 31. *In:* Tenth Biennial Conference on the Biology of Marine Mammals, Abstracts, Galveston, TX.

Briggs, K.T., W.B. Tyler, D.B. Lewis, and D.R. Carlson. 1987. Bird Communities at Sea Off California: 1975-1978. Studies in Avian Biology No. 11. Cooper Ornithological Society. 74 pp.

Briggs, K.T., D.H. Varoujean, W.W. Williams, R.G. Ford, M.L. Bonnell, and J.L. Casey. 1991. Seabirds of the Oregon and Washington OCS, 1989-1990. *In:* Oregon and Washington Marine Mammal and Seabird Surveys. Brueggeman J.J. (ed.). Final Report to the USDOI/MMS, Pacific OCS Region, Camarillo, CA. OCS Study MMS 91-0093. Ebasco Environmental and Ecological Consulting, Inc. 104 pp.

Briggs, L., and C.W. Fowler. 1984. Table and Figures of the Basic Population Data for Northern Fur Seals of the Pribilof Islands. *In:* Background Papers Submitted by the United States to the 27th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, 29 March –9 April 1984, Moscow, USSR.

Bright, T.J., G.P. Kraemer, G.A. Minnery, and S.T. Viada. 1984. Hermatypes of the Flower Garden Banks, Northwestern Gulf of Mexico: A Comparison to Other Western Atlantic Reefs. Bull. Mar. Sci. 34(3):461-476.

Britsch, L.D., and E.B. Kemp. 1990. Land Loss Rates: Mississippi River Deltaic Plain. USA Waterways Experiment Station, Vicksburg, MS. Technical Report GL-09-2. 25 pp.

Broad, A.C., A. Benedict, K. Dunton, H. Koch, D.T. Mason, D.E. Schneider, and S.V. Schonberg. 1979. Environmental Assessment of Selected Habitats in the Beaufort and Chukchi Littoral System, pp. 362-363. *In:* Environmental Assessment of the Alaskan Continental Shelf: Annual Reports of Principal Investigators for the Year Ending 1979. Volume III. Receptors—Fish, Benthos. Boulder, CO: USDOC.

Brooks, J.M. (ed.). 1991. Mississippi-Alabama Continental Shelf Ecosystem Study: Data Summary and Synthesis, Volume I: Executive Summary, Volume II: Technical Narrative, Volume III: Appendices, Part 1 (Appendices A-D), Volume III: Part 2, (Appendix E), OCS Study MMS 91-0062 (I), 91-0063 (II), 91-0064 (III). New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Regional Office. 43 pp.(I), 862 pp.(II), 1,001 pp. (III-1), and 1,001 pp. (III-2).

Brooks, J.M., H.B. Cox, W.R. Bryant, M.C. Kennicutt II, R.G. Mann, and T.J. McDonald. 1986. Association of Gas Hydrates and Oil Seepage in the Gulf of Mexico. Advances in Organic Geochemistry 10:221-234.

Brooks, J.M., D.A. Wiesenburg, C.R. Schwab, E.L. Estes, and R.F. Shokes. 1981. Surficial Sediments and Suspended Particulate Matter, pp. 69-111. *In:* Environmental Effects of Offshore Oil Production. Middleditch, B.S. (ed.). New York, NY: Plenum Press.

Brosted, J. 1975. Ulgunik: A Report on Integration and Village Organization in Alaska. (Mimeographed)

Browder, J., B. Brown, W. Nelson, and A. Bane. 1991. Multispecies Fisheries in the Gulf of Mexico. ICES Mar. Sci. Symp.:194-197.

Brower, T.P., Sr. 1978. Sworn Affidavit as Part of the Public Record of Testimony Concerning the Proposed State of Alaska Pt. Thompson Lease Sale, 10 October.

Brower, W.A., Jr., R.G. Baldwin, C.N. Williams, Jr., J.L. Wise, and L.D. Leslie. 1980. Climatic Atlas of the Outer Continental Shelf Waters and Coastal Regions of Alaska (3 Volumes). Anchorage, AK: USDOC/NOAA, National Climatic Data Center, National Environmental Satellite Data and Information Service, and Alaska Environmental Information and Data Center, University of Alaska.

Brown, E.D., T.T. Baker, J.E. Hose, R.M. Kocan, G.D. Marty, M.D. McGurk, B.L. Norcross, and J. Short. 1996. Injury to Early Life History Stages of Pacific Herring in Prince William Sound After the *Exxon Valdez* Oil Spill. *In:* Proceedings of the *Exxon Valdez* Oil Spill, American Fisheries Society Symposium 18, Bethesda, MD. Rice, S.D., R.B. Spies, D.A. Wolfe and B.A. Wright (eds.). pp. 448-462.

Bruggeman, J.J., G.A. Green, R.A. Grotefendt, and R.W. Tressler. 1989. Marine Mammal Habitat Use on the North Aleutian Basin, St. George Basin, and Gulf of Alaska. pp. 97-108. *In:* Proceedings of the Gulf of Alaska, Cook Inlet, and North Aleutian Basin Information Update Meeting. Jarvela, L.E., and L.K. Thorsteinson (eds.). Anchorage, AK: USDOC/NOAA/NOS/Office of Oceanography and Marine Assessment.

Brueggeman, J.J., G.A. Green, R.W. Tressler, and D.G. Chapman. 1988. Shipboard Surveys of Endangered Cetaceans in the Northwest Gulf of Alaska. Contract No. 85-ABC-00093. Prepared for the USDOI/MMS, Alaska OCS Region, and USDOC/NOAA, Office of Marine Assessment. Contract No. 85-ABC-00093. Anchorage, AK: Envirosphere Company.

Brueggeman, J.J., R.A. Grotefendt, and A.W. Erickson. 1984. Endangered Whale Survey of the Navarin Basin, Alaska. Prepared for the USDOI/MMS. Bellevue, WA: Envirosphere Company.

Brueggeman, J.J., C.I. Malme, R.A. Grotefendt, D.P. Volsen, J.J. Burns, D.G. Chapman, D.K. Ljungblad, and G.A. Green. 1990b. 1989 Walrus Monitoring Program: The Klondike, Burger, and Popcorn Prospects in the Chukchi Sea. Prepared for Shell Western E & P Inc., Houston, TX. Bellevue, WA: Ebasco Environmental.

Bryant, W.R., and J.Y. Liu. 2000. Chapter 3: Geology. *In:* Continental Shelf Associates, Inc. Deepwater Program: Gulf of Mexico Deepwater Information Resource Data Search and Literature Synthesis. Volume I: Narrative Report. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. (Draft Final Report.)

Bryant, W.R., J.Y. Liu, and J. Ponthier. 1995. The Engineering and Geological Constraints of Intraslope Basins and Submarine Canyons of the Northwestern Gulf of Mexico. Gulf Coast Association of Geological Societies Transactions 45:95-101.

Buckland, S.T., K.L. Cattanach, and R.C. Hobbs. 1993. Abundance Estimates of Pacific White Sided Dolphin, Northern Right-Whale Dolphin, Dall's Porpoise and Northern Fur Seal in the North Pacific, 1987/90, pp. 387-407. *In:* Biology, Distribution and Stock Assessment of Species Caught in the High Seas Driftnet Fisheries in the North Pacific Ocean. Shaw, W., R.L. Burgner, and J. Ito (eds.). International North Pacific Fisheries Commission Symposium; 4-6 November 1991, Tokyo, Japan.

Burch, E.S. 1975. Eskimo Kinsmen: Changing Family Relationships in Northwest Alaska.. American Ethnological Society Monograph No. 59. St. Paul, MN: West Publishing Co.

------- 1998. The Inupiaq Eskimo Nations of Northwest Alaska. Fairbanks, AK: University of Alaska Press.

Burgess, R.M., and P.W. Banyas. 1993. Inventory of Arctic Fox Dens in the Prudhoe Bay Region, 1992. Prepared for BP Exploration (Alaska) Inc. Anchorage, AK: Alaska Biological Research, Inc. 104 pp.

Burkett, E.E. 1995. Marbled Murrelet Food Habits and Prey Ecology, pp. 223-246. *In:* Ecology and Conservation of the Marbled Murrelet. General Technical Report, Pacific Southwest Research Station, No. 152. Ralph, C.J., G.L. Hunt, Jr., M.G. Raphael, and J.F. Piatt (eds.). Sacramento, CA: California Department of Fish and Game.

Burns, J.J. 1967. The Pacific Bearded Seal. Alaska Department of Fish and Game, Pittman-Robertson Proj. Rep. W-6-R and w-14-R. 66 pp.

------- 1970. Remarks on the Distribution of and Natural History of Pagophilic Pinnipeds in the Bering and Chukchi Seas. J. Mammal. 51:445-454.

------- 1973. Marine Mammal Report. Alaska Department of Fish and Game, Pittman-Robertson Proj. Rep. W-17-3, W-17-4, and W-17-5.

------- 1981a. Ribbon Seal-*Phoca fasciata*, pp. 89-109. *In:* Handbook of Marine Mammals. Vol. 2. Seals. Ridgeway, S.H., and R.J. Harrison (eds.). New York, NY: Academic Press.

Burns, J.J. 1981b. Bearded Seal – *Erignathus barbatus* Erxleben, 1777, pp. 145-170. *In:* Handbook of Marine Mammals. Vol. 2. Seals. Ridgeway, S.H., and R.J. Harrison (eds.). New York, NY: Academic Press.

Burns, J.J., and F.H. Fay. 1972. Comparative Biology of Bering Sea Harbour Seal Populations. Proc. 23rd Alaska Sci. Conf., College, Alaska (Alaska Div. Am. Assoc. Adv. Sci.). (Abstract)

Burns, J.J., and K.J. Frost. 1979. Natural History and Ecology of the Bearded Seal, *Erignathus barbatus*. Environ. Assess. Alaskan Cont. Shelf, Final Rep. Princ. Invest., NTIS PB 85-200939. Juneau, AK: NOAA. 565 pp.

Burns, J.J., and S.J. Harbo, Jr. 1972. An Aerial Census of Ringed Seals, Northern Coast of Alaska. Arctic 25(4):279-290.

Burns, J.J. and G.A. Seaman. 1985. Investigations of Belukha Whales in Coastal Waters of Western and Northern Alaska. II. Biology and Ecology. Rep. for NOAA, Outer Continental Shelf Environmental Assessment Program. Fairbanks, AK: Alaska Department of Fish & Game. 21 pp.

Burns, J.J., L.H. Shapiro, and F.H. Fay. 1981. Ice As Marine Mammals Habitat in the Bering Sea, pp. 781-797. *In*: The Eastern Bering Sea Shelf: Oceanography and Resources. Vol. 2. Hood, D.W., and J.A. Calder (eds.), Juneau, AK: USDOC/NOAA, Office of Marine Pollution Assessment.

Burris, O.E., and D.E. McKnight. 1973. Game Transplants in Alaska. Game Tech. Bull. No. 4. Fed. Aid Wildl. Restor. Proj. W-17-R. Juneau, AK: Alaska Department of Fish and Game.

Byrnes, P.E., and W.R. Hood. 1994. First Account of Steller Sea Lion (*Eumetopias jubatus*) Predation on California Sea Lion (*Zalophus californianus*). Marine Mammal Science 10:381-383.

Cahoon, D.R. and C.E. Groat (eds.). 1990. A Study of Marsh Management Practice in Coastal Louisiana. Volume II. Technical Descriptions. Final Report. OCS Study MMS 90-0075. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 309 pp.

Calambokidis J., T. Chandler, K. Rasmussen, G.H. Steiger, and L. Schlender. 1999. Humpback and Blue Whale Photo-Identification Research Off California, Oregon, and Washington in 1998. Final Contract Report to Southwest Fisheries Science Center, La Jolla, CA 35 pp.

Calambokidis, J., J.C. Cubbage, J.R. Evenson, S.D. Osmek, J.L. Laake, P.J. Gearin, B.J. Turnock, S.J. Jeffries, and R.F. Brown. 1993. Abundance Estimates of Harbor Porpoise in Washington and Oregon Waters. Final Report Prepared for National Marine Mammal Laboratory, Seattle, Washington. Contract No. 40ABNF201935. Olympia, WA: Cascadia Research Collective. 55 pp.

Calambokidis, J., R. Sears, G.H. Steiger, and J. Evenson. 1995. Movement and Stock Structure of Blue Whales in the Eastern North Pacific, p. 19. *In:* Proceedings of the Eleventh Biennial Conference on the Biology of Marine Mammals, Orlando, FL, 14-18 December 1995. Lawrence, KS: Society for Marine Mammalogy. (Abstract)

Calambokidis, J., and G.H. Steiger. 1994. Population Assessment of Humpback and Blue Whales Using Photo-Identification from 1993 Surveys Off California. Final Contract Report to Southwest Fisheries Science Center/NMFS, La Jolla, CA 31 pp.

Calambokidis, J., G.H. Steiger, J.C. Cubbage, K.C. Balcomb, C. Ewald, S. Kruse, R.Wells, and R. Sears. 1990. Sightings and Movements of Blue Whales off Central California, 1986-88, From Photo-Identification of Individuals. Rept. Int. Whal. Comm. Special Issue 12:343-348.

Calambokidis, J., G.H. Steiger, J.M. Straley, T. Quinn, L.M. Herman, S. Cherchio, D.R. Salden, M. Yamaguchi, F. Sato, J.R. Urban, J. Jacobson, O. VonZeigesar, K.C. Balcomb, C.M. Gabriele, M.E. Dahlheim, N. Higashi, S. Uchida, J.K.B. Ford, Y. Miyamura, P. Ladron de Guevara, S.A. Mizroch, L. Schlender, and K. Rasmussen. 1997. Abundance and Population Structure of Humpback Whales in the North Pacific Basin. Final Contract Report 50ABNF500113 to Southwest Fisheries Science Center, La Jolla, CA

State of California, The Resources Agency, Department of Fish and Game. 2000. State and Federally Listed Endangered and Threatened Animals of California. July 2000. Sacramento, CA: Department of Fish and Game, Habitat Conservation Division, Wildlife and Habitat Data Analysis Branch. 11 pp. (From the California Natural Diversity Database.)

California Department of Fish and Game. 1997. California's Wild Heritage, California Brown Pelican. 12 June 2001. Sacramento, CA: State of California, Department of Fish and Game, Natural Heritage Division. <http://www.dfg.ca.gov/kids/t&e4kids/pelican.html>.

Calkins, D.G., E. Becker, T.R. Spraker, and T.R. Loughlin, 1994. Impacts on Steller Sea Lions, pp. 119-139. *In:* Marine Mammals and the *Exxon Valdez.* San Diego, CA: Academic Press.

Cameron, R.D. 1983. Issue: Caribou and Petroleum Development in Arctic Alaska. Arctic 36:227-231.

Cameron, R.D., E.A. Lenart, D.J. Reed, K.R. Whitten, and W.T. Smith. 1995. Abundance and Movements of Caribou in the Oilfield Complex Near Prudhoe Bay, Alaska. Rangifer 15(1):3-7.

Cameron, R.D., D.J. Reed, J.R. Dau, and W.T. Smith. 1992. Redistribution of Calving Caribou in Response to Oilfield Development on the Arctic Slope of Alaska. Arctic 45:338-342.

Cameron, R.D., and K.R. Whitten. 1979. Seasonal Movements and Sexual Segregation of Caribou Determined by Aerial Survey. J. Wildl. Manage. 43:626-633.

Campbell, R.W. 1990. The Birds of British Columbia., Victoria, B.C.: Royal British Columbia Museum. 2 vols.

Candler, J.E., J.H. Rushing, and A.J.J. Leuterman. 1993. Synthetic-Based Mud Systems Offer Environmental Benefits Over Traditional Mud Systems, pp. 485-499. *In:* SPE/EPA Exploration & Production Environmental Conference, Richardson, TX. SOE 25993.

Capuzzo, J.M. 1987. Biological Effects of Petroleum Hydrocarbons: Assessment from Experimental Results, pp. 343-410. *In:* Long-Term Environmental Effects of Offshore Oil and Gas Development. Boesch, D.F. and N.N. Rabalais (eds.), London: Elsevier Applied Science Publishers.

Carder, D.A., and S.H. Ridgeway. 1990. Auditory Brainstem Response in a Neonatal Sperm Whale. Journal of the Acoustical Society of America. Suppl 1, vol 88, S4

Carefoot, T. 1977. Pacific Seashores. A Guide to Intertidal Ecology. Vancouver, B.C: J.J. Douglas, Ltd. 208 pp.

Carlton, J.T. 1997. Biological Invasions In Coastal (Estuarine and Marine) Environments. Paper Presented at "Introduction of Nonindigenous Species Workshop," Gulf of Mexico Program, Metairie, LA, June 11-12, 1997.

Carls, M.G., and S. D. Rice. 1990. Abnormal Development and Growth Reductions of Pollock *Theragra chalcogramma* Embryos Exposed to Water-Soluble Fractions of Oil. Fish. Bull. 88(1):29-37.

Carney, R.S. 1997. Workshop on Environmental Issues Surrounding Deepwater Oil and Gas Development: Final Report. OCS Study MMS 98-0022, New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 163 p.

Caron, L.M.J., and T.G. Smith. 1990. Philopatry and Site Tenacity of Belugas, *Delphinapterus leucas*, Hunted by the Inuit at the Nastapoka Estuary, Eastern Hudson Bay. Can. Bull. Fish. Aquat. Sci. 224:69-79.

Carr, A. 1996. Suwannee River Sturgeon, pp. 73-83. *In:* A Naturalist in Florida. Carr, M.H. (ed.). Yale University Press.

Carr, A.F., and D.K. Caldwell. 1956. The Ecology and Migrations of Sea Turtles, 1. Results of the Field Work in Florida, 1955. American Museum Novitates 1793:1-23.

Carroll, G.M. 1992. Caribou Survey-Inventory Progress Report, Unit 26A, pp. 177-186. *In:* Alaska Department of Fish and Game, Division of Wildlife Conservation, Fed. Aid in Wildl Restor. Survey-Inventory Management Report, 1 July 1989-30 June 1991. Caribou. Project W-23-3, W-23-4, Study 3.0. Abbott, S.M. (ed.). Juneau, AK: Alaska Department of Fish and Game.

------- 1995a. The Teshekpuk Lake Herd, pp. 200-208. *In:* Caribou. Management Report of Survey-Inventory Activities. Fed. Aid in Wildl. Restor., Grants W-24-2 and W-24-3, Stud. 3.0, Hicks, M.V. (ed.). Juneau, AK: Alaska Department of Fish and Game.

------- 1995b. Game Management Unit 26A Brown Bear Management Report, pp 289-303. *In:* Management Report of Survey-Inventory Activities. Fed. Aid in Wildl. Restor., Proj. W-24-1 and W-24-2., Hicks, M.V. (ed.). Juneau, AK: Alaska Department of Fish and Game.

Carroll, G.M., and J.C. George. 1985. Feeding Activities of the Bowhead Whale (*Balaena mystictus*) During the Spring Migration Near Point Barrow, Alaska. Sixth Biennial Conference on the Biology of Marine Mammals, Vancouver, B.C., Canada, November 22-26, 1985.

Carter, H.R., G.J. McChesney, D.L. Jacques, C.S. Strong, M.W. Parker, J.E. Takekawa, D.L. Jory, and D.L. Whitworth. 1992. Breeding Populations of Seabirds in California, 1989-1991. Vol. I, Population Estimates. Report for the USDOI/MMS, Pacific OCS Region, Camarillo, CA.

Case, D. 1984. Alaska Natives and American Laws. Fairbanks, AK: University of Alaska Press.

------- 1989. Subsistence and Self-Determination: Can Alaska Natives Have a More "Effective Voice?" University of Colorado Law Review 60 (4):24-

Cato, D.H. 1992. The Biological Contribution to the Ambient Noise in Waters Near Australia. Acoust. Austral. 20(3):76-80.

Caulfield, R., and T. Brelsford. 1991. Alaska: Subsistence Policy History, Vol. 1999: NativeNet.

Cavanaugh, C.M., P.R. Levering, J.S. Maki, R. Mitchell, and M.E. Lidstrom. 1987. Symbiosis of Methylotrophic Bacteria and Deep-Sea Mussels. Nature (London)325:346-348.

Centaur Associates, Inc. 1981. Assessment of Space and Use Conflicts Between the Fishing and Oil and Gas Industries. Vol. 1 – Interactions Between Fishing Gear and Oil Structures. Final Report Prepared for the USDOI/BLM, New York OCS Office, New York, NY. 206 pp.

Centaur Associates, Inc. and Center for Environmental Education. 1986. Issue Report and Work Plan for the Development of a Marine Debris Education Program for the Northwestern Atlantic and Gulf of Mexico. Prepared for the USDOC/NMFS. 62 pp.

Center for Marine Studies. 1983. Marine Mammals and Seabirds of Central and Northern California, 1980-1983: Synthesis of Findings. Prepared for USDOI/MMS, Pacific OCS Region. OCS Study MMS 84-0042. August 1983. Santa Cruz, CA: University of California.

Chance, N. 1966. The Eskimo of North Alaska. New York, NY: Holt, Rinehart, and Winston.

------- 1990. The Inupiat and Arctic Alaska: An Ethnography of Development. New York, NY: Holt, Rinehart, and Winston.

Chapin, F.S. III., G.R. Shaver, A.E. Giblin, K.J. Nadelhoffer, and J.A. Laundre. 1995. Responses of Arctic Tundra to Experimental and Observed Changes in Climate. Ecology 76:694-711.

Chapman, B.R. 1989. Seasonal Abundance and Habitat-Use Patterns of Coastal Bird Populations on Padre and Mustang Island Barrier Beaches Following the Ixtoc I Oil Spill. FWS/OBS-83/31. USDOI/FWS. 73 pp.

Chapman, C.J., and A.D. Hawkins. 1969. The Importance of Sound in Fish Behaviour in Relation to Capture by Trawls. FAO Fish. Rept. 62:717-729.

Chesemore, D.L. 1967. Ecology of the Arctic Fox in Northern and Western Alaska. M.S. Thesis, Fairbanks, AK: University of Alaska. 148 pp.

------- 1968. Notes on the Food Habits of Arctic Foxes in Northern Alaska. Can. J. Zool. 46(6):1,127-1,130.

Chesemore, D.L. 1975. Ecology of the Arctic Fox (*Alopex lagopus*) in North America-A. Review, pp. 143-163. *In:* The Wild Canids: Their Systematic, Behavioral Ecology and Evolution. Fox, M.W. (ed.). New York, NY: Van Nostrand Reinhold Co.

Chittenden, M.E., and J.D. McEachran. 1976. Composition, Ecology, and Dynamics of Demersal Fish Communities on the Northwestern Gulf of Mexico Continental Shelf, with a Similar Synopsis for the Entire Gulf. Texas A&M University Sea Grant Publication TAMU-SG-76-298.

Clapp, R.B., R.C. Banks, D. Morgan-Jacobs, and W.A. Hoffman. 1982a. Marine Birds of the Southeastern United States and Gulf of Mexico. Part I, Gaviiformes and Pelicaniformes. FWS/OBS-82/01. Washington, DC: USDOI/FWS, Office of Biological Services. 637 pp.

------- 1982b. Marine Birds of the Southeastern United States and Gulf of Mexico. Part II, Anseriformes. FWS/OBS-82/20. Washington, DC: USDOI/FWS, Office of Biological Services. 492 pp.

------- 1982c. Marine Birds of the Southeastern United States and Gulf of Mexico. Part III, Charadriiformes. FWS/OBS-83/30. Washington, DC: USDOI/FWS, Office of Biological Services. 853 pp.

Clarke, A. 1988. Seasonality in the Antarctic Marine Environment. Comp. Biochem. Physiol. 90b:461-473.

Clark, D.R. Jr., and A.J. Krynitsky. 1980. Organochlorine Residues in Eggs of Loggerhead and Green Sea Turtles Nesting at Merritt Island, Florida—July and August, 1976. Pestic. Monit. J. 14(1):7-10.

Clarke, R. 1956. Marking Whales from a Helicopter. Norsk Hvalfangst-Tid. 45(6):311-318.

Clausen, C.J., and J.B. Arnold III. 1975. Magnetic Delineation of Individual Shipwreck Sites; a New Control Technique. Bull. of the Texas Archaeological Soc. 46:69-86.

Clough, N.K., P.C. Patton, and A.C. Christiansen (eds.). 1987. Arctic National Wildlife Refuge, Alaska, Coastal Plain Resource Assessment. Report and Recommendation to the Congress of the United States and Final Legislative Environmental Impact Statement. Vol. 1. Washington, DC: USDOI/FWS/USGS/BLM.

Cluck, Rodney E. 1998. The Multidimensional Basis of Environmental Attitudes. Mississippi State University. Doctoral Dissertation.

Coastal Environments, Inc. (CEI). 1977. Cultural Resources Evaluation of the Northern Gulf of Mexico Continental Shelf. Prepared for the Interagency Archeological Service, Office of Archaeology and Historic Preservation, USDOI/NPS. Baton Rouge, LA. 4 vols.

------- 1982. Sedimentary Studies of Prehistoric Archaeological Sites. Prepared for Division of State Plans and Grants. USDOI/NPS.

------- 1986. Prehistoric Evaluation on the Northern Gulf of Mexico Outer Continental Shelf: Ground Truth Testing of the Predictive Model. Prepared for USDOI/MMS.

Cochrane, J.D., and F.J. Kelly. 1986. Low-Frequency Circulation on the Texas-Louisiana Continental Shelf. Journal of Geophysical Research 91(C9):10,645-10,659.

Coleman, J.M., H.H. Roberts, and W.R. Bryant. 1986. Late Quaternary Sedimentation, pp. 325-352. *In:* The Gulf of Mexico Basin. The Geology of North America, Geological Society of America. Salvador A. (ed.).

Collard, S. 1990. Leatherback Turtles Feeding Near a Water Mass Boundary in the Eastern Gulf of Mexico. Marine Turtle Newsletter 50:12-14.

Collier, T.K., C.A. Krone, M.M. Krahn, J.E. Stein, S. Chan, and U. Varanasi. 1996. Petroleum Exposure and Associated Biochemical Effects in Subtidal Fish After the *Exxon Valdez* Oil Spill. American Fishery Society Symposium 18: 671-683.

Colonell, J.M., and A.W. Niedoroda. 1988. Nearshore Oceanographic Processes of Potential Importance to Marine and Anadromous Fishes. *In:* Fisheries Oceanography-A Comprehensive Formulation of Technical Objectives for Offshore Application in the Arctic. Prepared for USDOI/MMS, Alaska OCS Region. OCS Study MMS 88-0042.

Commercial Fisheries Entry Commission (CFEC). 2000. Website to download files of fisheries information. http://www.cfec.state.ak.us.

Continental Shelf Associates, Inc. 1987. Southwest Florida Shelf Regional Biological Communities Survey, Year 3, Final Report. Prepared for USDOI/MMS. Contract No. 14-12-0001-29036.

------- 1989. Photodocumentation Survey for Drillsite Locations in Destin Dome Area Block 56 Off the Northwest Coast of Florida. Report prepared for Conoco Inc. 40 pp.

------- 1990. Synthesis of Available Biological, Geological, Chemical, Socioeconomics, and Cultural Resource Information for the South Florida Area. OCS Study MMS 90-0019. Herndon, VA: USDOI/MMS, Atlantic OCS Region. 738 pp.

------- 1991. Southwest Florida Nearshore Benthic Habitat Study, Narrative Report. Prepared by Continental Shelf Associates, Inc. and Geonex Martel, Laboratories, Inc. OCS Study MMS 89-0080. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 55 pp. + app.

------- 1992a. Photodocumentation Survey of Proposed Rainbow Gathering System Pipeline Route from Mobile Bay Area Block 916 to Destin Dome Area Block 56. Pprepared for Chevron U.S.A. Inc.

------- 1992b. Mississippi-Alabama Shelf Pinnacle Trend Habitat Mapping Study. OCS Study MMS 92-0026. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Regional Office. 75 pp. + app.

------- 1992c. Analysis of Potential Effects of Oil Spilled from Texaco's Proposed Pipeline on the Biota of the East Flower Garden, West Flower Garden, Rankin, and MacNeil Banks. Prepared for Texaco, New Orleans, LA. 27 pp.

Continental Shelf Associates, Inc. 1994b. Analysis of Potential Effects of Oil Spilled from Proposed Structures Associated with Oryx's High Island Block 384 Unit on the Biota of the East Flower Garden Bank and on the Biota of Coffee Lump Bank. Prepared for Oryx Energy Company, Dallas, TX. 67 pp. + app.

------- 1995. Final Environmental Impact Report, Subsea Well Abandonment and Flowline Abandonment/Removal Program. June 1995. Prepared for the California State Lands Commission, Sacramento, CA. SLC EIR No. 663, State Clearinghouse No. 94121042. 2 vols.

------- 1996. Baseline Environmental Surveys for the Destin Dome Unit. Final Report to Chevron U.S.A., Inc., New Orleans, LA.

------- 1997b. Radionuclides, Metals, and Hydrocarbons in Oil and Gas Operational Discharges and Environmental Samples Associated with Offshore Production Facilities on the Texas/Louisiana Continental Shelf with an Environmental Assessment of Metals and Hydrocarbons. Prepared for the USDOE, Bartlesville, OK.

------- 1997c. Gulf of Mexico Produced Water Bioaccumulation Study, Definitive Component. Prepared for the Offshore Operators Committee, New Orleans, LA.

Continental Shelf Associates, Inc. and LGL Alaska Research Associatiates, Inc. 2001. Environmental Report for the Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007. OCS Study MMS 2001-0030. Herndon, VA: USDOI/MMS, Environmental Division. March 2001.

Continental Shelf Associates, Inc. and Martel Laboratories, Inc. 1986. Florida Big Bend Seagrass Habitat Study Narrative Report. Report for the USDOI/MMS, Gulf of Mexico OCS Region, Metairie, LA. Contract No. 14-12-0001-30188. 47 pp. + app.

Continental Shelf Associates, Inc. and Texas A&M University, Geochemical and Environmental Research Group. 1999. Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Ecosystem Monitoring, Mississippi/Alabama Shelf Third Annual Interim Report. USGS/BRD/CR-1999-0005, USDOI/USGS, Biological Resources Division. OCS Study MMS 99-0055, New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 211 pp.

------- 2001. Northeastern Gulf of Mexico Coastal and Marine Ecosystem Program: Ecosystem Monitoring, Mississippi/Alabama Shelf; Final Synthesis Report. USGS/BRD/CR-2001-xxxx USDOI/USGS, Biological Resources Division. OCS Study MMS 2001-xxxx. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Congdon, J. D. 1989. Growth and Reproduction in the Blanding's Turtle: A Life History Model for Sea Turtles. *In*: Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology. Eckert, S.A., K.L Eckert, and T. H. Richardson (compilers). pp 31-32. NOAA Tech. Memo. NMFS-SEFC-232, 306.

Cook, P.J., and K.L. Mizer. 1994. The Revised ERS County Typology: An Overview. Rural Development Research Report 89. USDA/ Economic Research Service, Rural Economy Division.

Cooper, C.A., G.Z. Forristall, and T.M. Joyce. 1990. Velocity and Hydrographic Structure of Two Gulf of Mexico Warm-Core Rings. J. Geophys. Res. 95(C2):1,663-1,679.

Cosens, S.E., and L.P. Dueck. 1988. Responses of Migrating Narwhal and Beluga to Icebreaker Traffic at the Admiralty Inlet Ice-Edge, N.W.T. in 1986, pp. 39-54. *In:* Port and Ocean Engineering Under Arctic Conditions, Vol. II. Sackinger, W.M. et al. (eds.). Fairbanks, AK: Geophys. Inst., University of Alaska. 111 pp.

Council on Environmental Quality. 1997. Environmental Justice: Guidance Under the National Environmental Policy Act. Council on Environmental Quality, Executive Office of the President.

Cowles, C.J., D.J. Hansen, and J.D. Hubbard. 1981. Types of Potential Effects of Offshore Oil and Gas Development on Marine Mammals and Endangered Species of the Northern Bering, Chukchi, and Beaufort Seas. Tech. Pap. 9. Anchorage, AK: USDOI/BLM, Alaska OCS Office, NTIS PB83-146142. 2 pp.

Craig, J.D., K.W. Sherwood, and P.P. Johnson. 1985. Geologic Report for the Beaufort Sea Planning Area, Alaska: Regional Geology, Petroleum Geology, Environmental Geology. Anchorage, AK: USDOI/MMS, Alaska OCS Region. December 1985. 192 pp.

Craig, P.C. 1984. Fish Resources. *In:* Proceedings of a Synthesis Meeting: The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development (Sale 85) Girdwood, AK, Oct. 30-Nov. 1, 1983. Anchorage, AK: USDOC/NOAA, OCSEAP, and USDOI/MMS. pp. 240-266.

------- 1989. An Introduction to Anadromous Fishes in the Alaskan Arctic. *In:* Biological Papers of the University of Alaska. Norton, D.W. (ed.). Fairbanks, AK: University of Alaska, Fairbanks, Institute of Arctic Biology. pp. 27-54.

Craig, P.C., R.R. Emerson, R.G. Fechhelm, C. George, J.D. Hall, J.P. Houghton, C. Johnson, T.K. Newbury, and D.R. Schmidt. 1984. Fish Resources, pp. 117-131. *In:* The Barrow Arch Environment and Possible Consequences of Planned Offshore Oil and Gas Development. Truett, J.C. (ed.), Anchorage, AK: USDOC/NOAA and USDOI/MMS.

Crane, N.L., and K. Lashkari. 1996. Sound Production of Gray Whales Along their Migration Route, a New Approach to Signal Analysis. J. Acoust. Soc. Amer. 100(3):1,878-1,886

Crecelius, E.A., J.H. Trefry, M.S. Steinhauser, and P.D. Boehm. 1991. Trace Metals in Sediments from the Inner Continental Shelf of the Western Beaufort Sea. Environmental Geology and Science 181:71-79

Cronin, M.A., S.C. Amstrup, G.M. Durner, L.E. Noel, and W.B. Ballard. 1998. Caribou Distribution During the Post-Calving Period in Relation to Infrastructure in the Prudhoe Bay Oil Field, Alaska. Arctic 51:85-93.

Cross, J.N., and L.G. Allen. 1993. Chapter 9, Fishes, pp. 459-540. *In:* Ecology of the Southern California Bight: A Synthesis and Interpretation. Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.). Berkeley, CA: University of California Press. 926 pp.

Crow, J.H. 1977. Salt Marshes of Port Valdez, Alaska and Vicinity. Final Report to the USDOI. (place of publication unknown). Newark College of Arts and Sciences, Rutgers University. 113 pp.

Cultural Dynamics. 1983. Chukchi Sea Sociocultural Systems Baseline Analysis. Prepared for USDOI/ MMS, Alaska OCS Region, Alaska OCS Social and Economic Studies Program, Anchorage, AK. Technical Report No. 74.

Cummings, W.C., and C.V. Holliday. 1987. Sounds and Source Levels from Bowhead Whales Off Pt. Barow, Alaska. J. Acoust. Soc. Am. 82(3):814-821.

Cummings, W.C., and P.O. Thompson. 1971. Underwater Sounds from the Blue Whale, *Balaenoptera musculus*. J. Acoust. Soc. Am. 50(4, Pt. 2):1,193-1,198.

Cunningham, W.P., and B.W. Saigo. 1999. Environmental Science a Global Concern, Fifth Edition. Boston, MA: McGraw-Hill Companies, Inc. 650 pp.

Curtalo, J.A. 1975. Factors Influencing Local Movements and Behavior of Barren-Ground Caribou (*Rangifer tarandus granti*). M.S. Thesis. Fairbanks, AK: University of Alaska. 146 pp.

Curtalo, J.A., and S.M. Murphy. 1986. The Effects of Pipelines, Roads, and Traffic on Movements of Caribou, *Rangifer tarandus*. Can. Field-Nat. 100:218-224.

Curtalo, J.A., and A.E. Reges. 1984. The Calving Ground of the Central Arctic Caribou Herd. Unpublished Report Sponsored by ARCO Alaska, Inc., Anchorage, AK.

Dahlheim, M.E. 1987. Bio-Acoustics of the Gray Whale (*Eschrichtius robustus*). Ph.D. Thesis. Vancouver, B.C.: University of British Columbia. 315 pp.

------- 1988. Killer Whale (*Orcinus orca*) Depredation on Longline Catches of Sablefish (*Anoplopoma fimbria*) in Alaskan Waters. NWAFC Processed Report 88-14. 31 pp.

Dahlheim, M.E., and C.O. Matkin. 1994. Assessment of Injuries to Prince William Sound Killer Whales, pp. 163-171. In: Marine Mammals and the *Exxon Valdez*. Loughlin, T.R. (ed.). San Diego, CA: Academic Press, Inc.

Dahlheim, M.E. and J.M. Waite. 1993. Abundance and Distribution of Killer Whales (*Orcinus orca*) in Alaska in 1992. Annual Report to the MMPA Assessment Program. Silver Spring, MD: USDOC/NOAA/NMFS, Office of Protected Resources.

Dahlheim, M.E., D. Ellifrit, and J. Swenson. 1997. Killer Whales of Southeast Alaska: A Catalogue of Photoidentified Individuals. Seattle, WA: Day Moon Press. 82 pp.

Damas, D. (ed.). 1984. Handbook of North American Indians, Vol. 5, Arctic. Washington, DC: Smithsonian Institution.

Dames & Moore. 1979. Mississippi, Alabama, Florida Outer Continental Shelf Baseline Environmental Survey, MAFLA, 1977/78. Vol. II: Compendium of Work Element Reports. Final Report for USDOI/BLM. Contract No. AA550-CT7-34.

Dames & Moore. 1990. Effects of Petroleum Contaminated Waterways on Migratory Behavior of Adult Pink Salmon. Report to the USDOI/MMS, Alaska OCS Region and USDOC/NOAA, Outer Continental Shelf Environmental Assessment Program, Anchorage, AK.

------- 2000. California Offshore Oil and Gas Energy Resources. OCS Study MMS 99-0043. USDOI/MMS.

Darling, J.D. 1991. Humpback Whales in Japanese Waters. Ogasawara and Okinawa. Fluke Identification Catalog 1987-1990. Final Contract Report, World Wide Fund for Nature, Japan. 22 pp.

Darnell, R.M., R.E. Defenbaugh, and D. Moore. 1983. Northwestern Gulf Shelf Bio-Atlas, a Study of the Distribution of Demersal Fishes and Penaeid Shrimp of Soft Bottoms of the Continental Shelf from the Rio Grande to the Mississippi River Delta. Open File Report 82-04. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Regional Office.

Darnell, R.M., and J.A. Kleypas. 1987. Eastern Gulf Shelf Bio-Atlas, a Study of the Distribution of Demersal Fishes and Penaeid Shrimp of Soft Bottom of the Continental Shelf from the Mississippi River Delta to the Florida Keys. OCS Study MMS 86-0041. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Regional Office.

Dau, J.R. 1986. Distribution and Behavior of Barren-Ground Caribou in Relation to Weather and Parasitic Insects. M.S. Thesis. Fairbanks, AK: University of Alaska. 149 pp.

------- 1997. Game Management Units 21D, 22A, 22B, 23, 24, and 26A Western Arctic Herd, pp. 158-185. *In:* Management Report of Survey-Inventory Activities, 1 July 1994–30 June 1996. Caribou. Alaska Department of Fish and Game Federal Aid in Wildlife Restoration. Grants W-24-3 and W-24-4, Study 3.0., Hicks, M.V. (ed.). Juneau, AK.

Daum, D.W. 1994. Bald Eagle: Wildlife Notebook Series. <http://www.state.ak.us/local/akpages.fish.game/notebook/bird/eagles/htm>.

Davenport, J., J. Wrench, J. McEvoy, and V. Camacho-Ibar. 1990. Metal and PCB Concentrations in the “Harlech” Leatherback. Mar. Turt. Newsl. 48:1-6.

Davidson, A. 1974. Education and the Subsistence Way of Life, Vol. 1999. Alaska Native Knowledge Network.

Davies, D.K. 1972. Deep Sea Sediments and their Sedimentation, Gulf of Mexico. AAPG Bulletin 56:2,212-2,239.

Davis, J.L., P. Valkenburg, and R. Boertje. 1982. Home Range Use, Social Structure, and Habitat Selection of the Western Arctic Caribou Herd. Final Research Report for the USDOI/NPS. Fairbanks, AK: Alaska Department of Fish and Game. 36 pp.

Davis, R.A., D.H. Thomson, and C.I. Malme. 1998. Environmental Assessment of Seismic Exploration on the Scotian Shelf. Report for Canada/Nova Scotia Offshore Petroleum Board, Halifax, Nova Scotia. King City, ON: LGL Limited Environmental Research Associates and Hingham, MA: Malme Engineering and Scientific Services. 181 pp. + app.

Davis, R.W., W.E. Evans, and B. Würsig (eds.). 2000. Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. USDOI/USGS/BRD, USGS/BRD/CR-1999-005 and OCS Study MMS 2000-003. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Davis, R.W., and G.S. Fargion (eds.). 1996. Distribution and Abundance of Cetaceans in the North-Central and Western Gulf of Mexico: Final Report. Volume II: Technical Report. OCS Study MMS 96-0027. Prepared by the Texas Institute of Oceanography and the National Marine Fisheries Service. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 357 pp.

Dawson, E.Y., and M.S. Foster. 1982. Seashore Plants of California. California Natural History Guides, No. 47. Berkeley, CA: University of California Press. 226 pp.

Defenbaugh, R.E. 1976. A Study of the Benthic Macro-Invertebrates of the Continental Shelf of the Northern Gulf of Mexico. Ph.D. Dissertation. College Station, TX: Texas A&M University. 476 pp.

DeGange, A.R., A.M. Doroff, and D.H. Monson. 1994. Experimental Recovery of Sea Otter Carcasses at Kodiak Island, Alaska, Following the *Exxon Valdez* Oil Spill. Mar. Mamm. Sci. 10:492-496.

DeGange, A.R,. and G.A. Sanger. 1987. The Gulf of Alaska Physical Environment and Biological Resources. RU's 655/656. Hood, D.W. and S.T. Zimmerman (eds.). OCS Study MMS 86-0095. Anchorage, AK: USDOC/NOAA and USDOI/MMS, Alaska OCS Region. NTIS PB 87-103230.

DeGraaf, R.M., and J.H. Rappole. 1995. Neotropical Migrant Birds: Natural History, Distribution, and Population Change. Cornell University Press. 560 pp.

Dekin, A.A., Jr., M.S. Cassell, J.I. Ebert, E. Camilli, J.M. Kerley, M.R. Yarborough, P.A. Stahl, and B.L. Turcy. 1993. *Exxon Valdez* Oil Spill Archaeological Damage Final Report. Contract No. 53-0109-1-00325. USDA/Forest Service.

DeLaguna, F. 1956. Chugach Prehistory. University of Washington Publications in Anthropology No. 13. Seattle, WA: University of Washington.

------- 1964. Archeology of the Yakutat Bay Area, Alaska. Smithsonian Institution Bureau of American Ethnology Bulletin 192. Washington, DC: Government Printing Office.

------- 1972. Under Mount Saint Elias: The History and Culture of the Yakutat Tlingit. Smithsonian Contributions to Anthropology 7. Washington.

DeMaster, D.P. 1995. Minutes from the 4-5 and 11 January 1995 Meeting of the Alaska Scientific Review Group, Anchorage, AK. 27 pp.

Dennis, G.D., and T.J. Bright. 1988. Reef Fish Assemblages on Hard Banks in the Northwestern Gulf of Mexico. Bull. Mar. Sci. 43(2):280-307.

Derksen, D.V., K.S. Bollinger, D. Esler, K.C. Jensen, E.J. Taylor, M.W. Miller, and M.W. Weller. 1992. Effects of Aircraft on Behavior and Ecology of Molting Black Brant Near Teshekpuk Lake, Alaska. Final Report. Anchorage, AK: USDOI/FWS. 227 pp.

DeWald, O. 1980. Severe Storm and Hurricane Impacts Along the Gulf and Lower Atlantic Coasts. *In*: Environmental Information on Hurricanes, Deepwater Technology, and Mississippi Delta Mudslides in the Gulf of Mexico, Section III. BLM Open File Report 80-02. New Orleans, LA: USDOI/BLM. 10 pp.

Dickerson, D.D. 1990. Workgroup 1 Summary, pp. 74-75. *In:* Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11 and 12 May 1988, Jacksonville, Florida. Dickerson, D.D., and D.A. Nelson (comp.). Miscellaneous Paper EL-90-5. Vicksburg, MS: U.S. Army Engineer Waterways Experiment Station. 89 pp.

Dickerson, D.D., D.A. Nelson, M. Wolff, and L. Manners. 1992. Summary of Dredging Impacts on Sea Turtles: King's Bay, Georgia, and Cape Canaveral, Florida, pp. 148-151. *In:* Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation, 26 February-2 March 1991, Jekyll Island, Georgia. Salmon, M., and J. Wyneken (comp.) NOAA Technical Memorandum NMFS-SEFSC-302.

Dieterich, R.A., and D.G. Ritter. 1982. Rabies in Alaskan Reindeer. J. Amer. Vet. Med. Assoc. 181:1,416.

Dinnel, S.P. 1988. Circulation and Sediment Dispersal on the Louisiana-Mississippi-Alabama Continental Shelf. Ph.D. Dissertation, Louisiana State University. 173 pp.

Ditton, R.B., and A.R. Graefe. 1978. Recreational Fishing Use of Artificial Reefs on the Texas Coast. Austin, TX: Texas Coastal and Marine Council. Contract Report (77-79) 0805.

Ditty, J.G. 1986. Ichthyoplankton in Neretic Waters of the Northern Gulf of Mexico Off Louisiana: Composition, Relative Abundance, and Seasonality. Fish. Bull. 84(4):935-946.

Ditty, J.G., G.G. Zieske, and R.F. Shaw. 1988. Seasonality and Depth Distribution of Larval Fishes in the Northern Gulf of Mexico Above 26°00'N. Fish. Bull. 86:811-823.

Divoky, G. J. (Stinson Beach, Calif., Point Reyes Bird Observatory). 1981. Birds and the Ice-Edge Ecosystem in the Bering Sea. *In*: The Eastern Bering Sea Shelf: Oceanography and Resources. Hood, D. W., and Calder, J. A. (eds.). Juneau, AK: USDOC/NOAA/OMPA, and USDOI/BLM. pp. 799-805 (Vol. II).

Divoky, G.J. 1983. The Pelagic and Nearshore Birds of the Alaskan Beaufort Sea. Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators, RU-196. USDOC/NOAA/OCSEAP and USDOI/MMS.

Dixon, E.J., S. Stoker, and G. Sharma. 1986. Alaskan Outer Continental Shelf Cultural Resource Compendium. Technical Report Number 119. OCS Study MMS 86-0018. Anchorage, AK: USDOI/MMS, Alaska Outer Continental Shelf Office.

Dodd, C.K., Jr. 1988. Synopsis of the Biological Data on the Loggerhead Turtle, *Caretta caretta* (Linnaeus, 1758). USDOI/FWS Biol. Rep. 88. 100 pp.

Dodge, R.E., S.C. Wyers, H.R. Frith, A.H. Knap, S.R. Smith, and T.D. Sleeter. 1984. The Effects of Oil and Oil Dispersants on the Skeletal Growth of Hermatypic Coral, *Diploria strigosa*. Coral Reefs 3:191-198.

Dohl, T.P., R.C. Guess, M.L. Duman, and R.C. Helm. 1983. Cetaceans of Central and Northern California, 1980-1983: Status, Abundance, and Distribution. OCS Study MMS 83-005. Los Angeles, CA: USDOI/MMS, Pacific OCS Region. 284 pp.

Dohl, T.P., K.S. Norris, R.C. Guess, J.D. Bryant, and M.W. Honig. 1981. Cetacea of the Southern California Bight. Part II, Principal Investigators' Reports: Summary of Marine Mammals and Seabird Surveys of the Southern California Bight Area, 1975-1978. Los Angeles, CA: USDOI/BLM, Pacific OCS Office. NTIS No. PB81-248-189. 414 pp.

Dokken, Q.R., I.R. MacDonald, J.W. Tunnell, Jr., C.R. Beaver, G.S. Boland, and D.K. Hagman. 1999. Long-term Monitoring of the East and West Flower Garden Banks, 1996-1997. OCS Study MMS 99-0005. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 101 pp.

Doroff, A.M., and J.L. Bodkin. 1996. Sea Otter Foraging Behavior and Hydrocarbon Concentrations in Prey Following the *Exxon Valdez* Oil Spill in Prince William Sound, Alaska, *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Marine Mammal Study 6-8). Anchorage, AK: USDOI/FWS.

Doughty, R.W. 1989. Return of the Whooping Crane. Austin, TX: University of Texas Press. 182 pp.

Dowdswell, J.A. 1997. Quaternary Research 48:1

Dowgiallo, M.J. (ed.). 1994. Coastal Oceanographic Effects of Summer 1993 Mississippi River Flooding. Special NOAA Report. Silver Spring, MD: USDOC/NOAA Coastal Ocean Office/National Weather Service. 76 pp.

Downs, M.A. 1985. Sociocultural Change and Ethnic Identity: The Effect of the Alaska Native Claims Settlement Act in Unalaska, Alaska. Ph.D. Dissertation. San Diego, CA: Department of Anthropology, University of California.

Dumond, D.E. 1977. The Eskimos and Aleuts. London: Thames and Hudson, Ltd.

Dunbar, J.S., S.D. Webb, M. Faught, R.J. Anuskiewicz, and M.I. Stright. 1989. Archaeological Sites in the Drowned Tertiary Karst Region of the Eastern Gulf of Mexico, pp 25 to 31. *In:* Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference. Arnold, J.B. III (ed.). Baltimore, MD: Society for Historical Archaeology.

Dunton, K.H. 1984. An Annual Carbon Budget for an Arctic Kelp Community, pp. 1-65. *In:* The Alaskan Beaufort Sea Ecosystems and Environments. Barners, P.W., D.M. Schell, and E. Reimnitz (eds.). New York, NY: Academic Press.

Dunton, K.H., E. Reimnitz, and S. Schonberg. 1982. An Arctic Kelp Community in the Alaskan Beaufort Sea. Arctic 35:465-484.

Dunton, K.H., and S. Schonberg. 1981. Ecology of Stefansson Sound Kelp Community. Environmental Assessment of Selected Habitats in Arctic Littoral Systems. RU 356. USDOC/NOAA/OCSEAP.

Duronslet, M.J., C.W. Caillouet, S. Manzella, K.W. Indelicato, C.T. Fontaine, D.B. Revera, T. Williams, and D. Boss. 1986. The Effects of an Underwater Explosion on Sea Turtles *Lepidocheyls kempi* and *Caretta caretta* with Observations of Effects on Other Marine Organisms (Trip Report). Galveston, TX: USDOC/NMFS, SEFSC.

Ebeling, A.W., W. Werner, F.A DeWitt, and G.M. Cailliet. 1971. Santa Barbara Oil Spill: Short-Term Analysis of Macroplankton and Fish. USEPA Water Pollution Control Research Series 15080EAL01/71. 68 pp.

Eberhardt, B.S. 1977. The Biology of Arctic and Red Foxes on the North Slope. M.S. Thesis. Fairbanks, AK: University of Alaska. 125 pp.

Eberhardt, L.E., W.C. Hanson, J.L. Bengtson, R.A. Garrott, and E.E. Hanson. 1982. Arctic Fox Home Range Characteristics in an Oil-Development Area. J. Wildl. Manage. 46(1):183-190.

Edwards, R., K. Sulak, and D. Weaver. 2000. Deepwater Structures as Fish Aggregating Devices: A Preliminary Report. Gulf of Mexico Fish and Fisheries Conference, Sponsored by USDOI/MMS, New Orleans, LA (abstract).

Ehrlich, P.R., D.S. Dobkin, and D.Wheye. 1992. Birds in Jeopardy: The Imperiled and Extinct Birds of the United States and Canada, Including Hawaii and Puerto Rico. Stanford, CA: Stanford University Press. 261 pp.

Ellanna, L.J., and G.K. Sherrod. 1984. The Role of Kinship Links in Subsistence Production: Some Implications for Community Organization. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Elliott, B.A. 1979. Anticyclonic Rings and the Energetics of the Circulation of the Gulf of Mexico. Ph.D. Dissertation. College Station, TX: Texas A&M University. 188 pp.

------- 1982. Anticyclonic Rings in the Gulf of Mexico. J. Phys. Oceanogr. 12(11):1,292-1,309.

Ely, C.R., C.P. Dau, and C.A. Babcock. 1994. Decline in a Population of Spectacled Eiders Nesting on the Yukon-Kuskokwim Delta, Alaska. Northwestern Naturalist 75:81-87.

Engle, J.M., R.F. Ambrose, P.T. Raimondi, S.N. Murray, M. Wilson, and S. Sapper. 1998. Rocky Intertidal Resources in San Luis Obispo, Santa Barbara, and Orange Counties. 1997 Annual Report. OCS Study MMS 98-0011. Camarillo, CA: USDOI/MMS, Pacific OCS Region. 73p. + appendices.

Engelhardt, F.R. 1981. Oil Pollution in Polar Bears. Exposure and Clinical Effects, pp. 139-179. *In:* Proceedings of the Fourth Arctic Marine Oil Spill Program Technical Seminar, 16-18 June 1981, Edmonton, Alberta, Canada.

Environment and Natural Resources Institute. 1995. Current Water Quality in Cook Inlet, Alaska. NTIS PB 95-267019. Anchorage, AK: University of Alaska. 146 pp.

Ernst, C.H., R.W. Barbour, and J.E. Lovich. 1994. Turtles of the United States and Canada. Washington, DC: Smithsonian Institute Press. 578 pp.

Espey, Huston & Associates, Inc. 1990. California, Oregon, and Washington Archaeological Resource Study. Prepared for the USDOI/MMS, Pacific OCS Region. OCS Study MMS 90-0087 to 90-0092. Austin, TX: Espey, Huston & Associates, Inc.

Estes, J.A., M.T. Tinker, T.M. Williams, and D.F. Doak. 1998. Killer Whale Predation on Sea Otters Linking Oceanic and Nearshore Ecosystems. Science 282:473-476.

Evans, S. J., Hunter, Elizal, and R. Wahju. 1994. Composition and Fate of the Catch and Bycatch in the Fame Deep (North Sea) *Nephrops* Fishery. ICES Journal of Marine Science. 51: 155-168.

Exxon Valdez Oil Spill Trustee Council. 2000. *Exxon Valdez* Oil Spill Trustee Council 2000 Status Report. Anchorage, AK: Alaska Department of Fish and Game. 28 pp.

------ 2001. *Exxon Valdez* Oil Spill Trustee Council 2000 Status Report. Anchorage, AK: Alaska Department of Fish and Game. 16 pp.

Fancy, S.G., K.R. Whitten, and R.D. Cameron. 1990. Population Dynamics and Demographics of Caribou in Developed and Undeveloped Areas of the Arctic Coastal Plain, pp. 6-15. *In*: Annual Wildlife Inventories, Terrestrial Research: 1002 Area—Arctic National Wildlife Refuge Annual Progress Report, 1989. McCabe, T.R. (ed.). Anchorage, AK: USDOI/FWS.

Faro, J., and D. Calk. 1992. River Otter Restoration Study. Proposal for Recovery Monitoring. Study I.D. Number R95. Soldotna, AK: ADFG.

Faro, J.B. R.T. Bowyer, J.W. Testa, and L.K. Duffy. 1994a. Assessment of Injury to River Otters in Prince William Sound, Alaska, Following the *Exxon Valdez* Oil Spill. *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Terrestrial Mammal Study Number 3). Soldotna, AK: ADFG, Wild. Cons. Div. 76 pp.

------- 1994b. River Otter Component of the Oiled Mussel-Bed Study. *Exxon Valdez* Oil Spill State/Federal Natural Resource Damage Assessment Final Report (Restoration Study Number 103-3). Soldotna, AK: ADFG, Wild. Cons. Div. 10 pp.

Fay, F.H. 1961. The Distribution of Waterfowl to St. Lawrence Island, Alaska. Wildfowl 12:70-80.

------- 1974. The role of Ice in the Ecology of Marine Mammals of the Bering Sea, pp. 383-389. *In:* Hood, D.W. and E.J. Kelley (eds.). Oceanography of the Bering Sea. Univ.Alaska, Inst. Mar. Sci. Occas. Publ. 2.

------- 1981. Walrus—*Odobenus rosmarus* (Linnaeus 1758), pp. 1-23. *In:* Handbook of Marine Mammals. Vol. 1. Ridgeway, S.H., and R.J. Harrison (eds.). New York, NY: Academic Press.

Fay, F.H. 1982. Ecology and Biology of the Pacific Walrus, *Odobenus rosmarus divergens* Illiger. Washington, DC: USDOI/FWS, N. Am. Fauna No. 74. 279 pp.

Fay, F.H. and C.E. Bowlby (comps.). 1994. The Harvest of Pacific Walrus, 1931-1989. Technical Report MMM 94-2. Marine Mammals Management, FWS, Region 7, AK. 44 pp.

Fay, F.H., B.P. Kelly, P.H. Gehnrich, J.L. Sease, and A.A. Hoover. 1984. Modern Populations, Migrations, Demography, Trophics, and Historical Status of the Pacific Walrus. USDOC/NOAA. OCSEAP Final Rep. 37 (1986):231-376. Prepared for USDOI/MMS. OCS Study MMS 86-0021.

Fechhelm, R.G., B.J. Gallaway, and J.M. Farmer. 1999. Deepwater Sampling at a Synthetic Drilling Mud Discharge Site on the Outer Continental Shelf, Northern Gulf of Mexico, pp. 509-513. *In:* 1999 SPE/EPA Exploration and Production Environmental Conference, Richardson, TX. SPE 52744.

Feder, H.M., and S.C. Jewett. 1987. The Subtidal Benthos, pp. 347-396. *In*: The Gulf of Alaska, Physical Environment and Biological Resources. Zimmerman, S.T., and D.W. Hood (eds.). MMS OCS Study MMS 86-0095. Washington, DC: USDOC/NOAA and USDOI/MMS.

Feder, H.M., S.C. Jewett, S.G. McGee, and G.E.M. Matheke. 1981. Distribution, Abundance, Community Structure, and Trophic Relationships of the Benthos of the Northeastern Gulf of Alaska from Yakutat Bay to Cross Sound. Final Report. Fairbanks, AK: University of Alaska and Boulder, CO: USDOC/NOAA/OCSEAP.

Federal Archeology Report. 1994. Volume 7, No. 2, p. 6. Washington, DC: USDOI/NPS, Departmental Consulting Archeologist/Archeological Assistance Program.

Federal Register (FR). 2000. Designating the Cook Inlet, Alaska, Stock of Beluga Whale as Depleted Under the Marine Mammal Protection Act (MMPA). Volume 65 No. 105. Wednesday May 31, 2000/Rules and Regulations. USDOC/NOAA 50 CFR Part 216.

Federal Subsistence Board (FSB). 1999. Subsistence Management Regulations for the Harvest of Fish and Shellfish on Federal Public Lands and Waters in Alaska, Effective October 1, 1999 – February 28, 2001. Anchorage, AK: USDOI/FWS.

Ferrero, R.C., D.P. DeMaster, P.S. Hill, and M.M. Muto. In prep. Alaska Marine Mammal Stock Assessments 2000. To be published as USDOC/NOAA Technical Memorandum NMFS-AFSC. Seattle, WA: USDOC/NOAA/NMFS.

Fidell, S., K.S. Pearsons, M. Grignetti, and D.M. Green. 1970. The Noisiness of Impulsive Sounds. J. Acoust. Soc. Am. 48(6, Pt. 1):1,304-1,310.

Fine, H. 1980. Ecology of Arctic Foxes at Prudhoe Bay, Alaska. M.S. Thesis. Fairbanks, AK: University of Alaska. 76 pp.

Fingas, M.F., D.A. Kyle, I.E. Bier, A. Lukose, and E.J. Tennyson. 1991. Physical and Chemical Studies on Oil Spill Dispersants: The Effect of Energy, pp. 87-106. *In:* Proceedings of the 14th Arctic and Marine Oil Spill Program Technical Seminar, Environment Canada, Ottawa, Ontario.

Fingas, M., F. Ackerman, P. Lambert, K.Li, Z. Wang, J. Mullin, L. Hannon, D. Wang, A. Steenkammer, R. Hiltabrand, R. Turpin, and P. Campagna. 1995. The Newfoundland Offshore Burn Experiment: Further Results of Emissions Measurement. *In:* Proceedings of the Eighteenth Arctic and Marine Oilspill Program Technical Seminar, Volume 2, June 14-16, 1995, Edmonton, Alberta, Canada. p. 915-995

Finley, K.J. 1982. The Estuarine Habitat of the Beluga or White Whale, *Delphinapterus leucas*. Cetus 4:4-5.

Finley, K.J., G.W. Miller, R.A. Davis, and C.R. Greene. 1990. Reactions of Belugas, *Delphinapterus leucas*, and Narwhals, *Monodon monoceros*, to Ice-Breaking Ships in the Canadian High Arctic. Can. Bull. Fish. Aquat. Sci. 24:97-117.

Fiscus, C.F. 1983. Fur Seals. *In:* Background Papers Submitted by the United States to the 26th Annual Meeting of the Standing Scientific Committee of the North Pacific Fur Seal Commission, Washington, DC., 28 March – 5 April, 1983.

Fisher, C.R., I. Urcuyo, M.A. Simpkins, and E. Nix. 1997. Life in the Slow Lane: Growth and Longevity of Cold-Seep Vestimentiferans. Marine Ecology 18:83-94.

Fisher, H.D. 1952. The Status of the Harbour Seal in British Columbia, with Particular Reference to the Skeena River. Fish. Res. Bd. Can. Bull. 93. 58 pp.

Fisher, M.A., R.L. Detterman, and L.B. Magoon. 1987. Tectonics and Petroleum Geology of the Cook-Shelikof Strait Basin, pp. 213-228. *In:* Geology and Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins-Beaufort Sea to Baja, California. Scholl, D.A., A. Grantz, and J.G. Vedder (eds.).

Fisher, M.A., W.W. Patton, M.L. Holmes. 1982. Geology of Norton Basin and Continental Shelf Beneath Northwestern Bering Sea, Alaska. A.A.P.G. Bull. 66(3):255-285.

Fitzhugh, W., and A. Crowell (eds.). 1988. Crossroads of Continents: Cultures of Alaska and Siberia. Smithsonian Institution Press.

Flint, P.L., and J.B. Grand. 1997. Survival of Spectacled Eider Adult Females and Ducklings During Brood Rearing. J. Wildl. Manage. 61:217:221.

Flint, P.L., and M.P. Herzog. 1999. Breeding of Steller's Eider, *Polysticta stelleri*, on the Yukon-Kuskokwim Delta, Alaska. Canadian Field Naturalist 113:306-308.

Flint, P.L., M.R. Petersen, and J.B. Grand. 1997. Exposure of Spectacled Eider and Other Diving Ducks to Lead Poisoning in Western Alaska. Canadian Journal of Zoology 75:439-443.

Flint, R.W., and N.N. Rabalais (eds.). 1980. Environmental Studies, South Texas Outer Continental Shelf, 1975-1977. Contract No. AA551-CT8-51. Washington, DC: USDOI/BLM.

Follman, E.H., and J.L. Hechtel. 1990. Bears and Pipeline Construction in Alaska. Arctic 43:103-109.

Foote, D.C. 1959. The Economic Base and Seasonal Activities of Some Northwest Alaskan Villages: A Preliminary Study. Submitted to the U.S. Atomic Energy Commission.

------- 1960a. The Eskimo Hunter at Point Hope, Alaska, Part I, September 1959 to May, 1960. Report for Bio-Environmental Studies of Project Chariot, United States Atomic Energy Commission.

------- 1960b. The Eskimo Hunter at Point Hope, Alaska, Part II, May to September 1960. Report for Bio-Environmental Studies of Project Chariot, United States Atomic Energy Commission.

------- 1961. A Human Geographical Study in Northwest Alaska. Final Report of the Human Geographical Studies Program, United States Atomic Energy Commission Project Chariot. Cambridge.

Forney, K.A., J. Barlow, and J.V. Caretta. 1995. The Abundance of Cetaceans in California Waters. Part II: Aerial Surveys in Winter and Spring of 1991 and 1992. Fish. Bull. 93(1):15-26.

Forney, K.A., and R.L. Brownell. 1996. Preliminary Report of the 1994 Aleutian Island Marine Mammal Survey. Unpubl. doc. submitted to Int. Whal. Comm. (SC/48/O 11). 15pp.

Forsell, D.J., and P.J. Gould. 1981. Distribution and Abundance of Sea Birds Wintering in the Kodiak Area of Alaska. FWS/OBS-31-13. Washington, DC: USDOI/FWS. 125 pp.

Foster, M.S., and R.W. Holmes. 1977. The Santa Barbara Oil Spill: An Ecological Disaster? pp. 166-190. *In:* Recovery and Restoration of Damaged Ecosystems. Cairnes J., Jr., K. Dickson, and E.E. Herricks (eds.). Charlottesville, VA: University Press of Virginia.

Foster, M.S. and D.R. Schiel. 1985. The Ecology of Giant Kelp Forests in California: A Community Profile. U.S. Fish and Wildlife Service Biological Report. Washington, DC: USDOI/FWS.

Foster, M. S., N. Neushul, and R. Zingmark. 1971. The Santa Barbara Oil Spill. Part 2: Initial Effects on Intertidal and Kelp Bed Organisms. Environ. Pollut. 2:115-134.

Fowler, C.W. 1987. Marine Debris and Northern Fur Seals: A Case Study. Mar. Poll. Bull. 18:326-335.

Fowler, C.W., J.D. Baker, R. Ream, B.W. Robson, and M.Kiyota. 1994. Entanglement Studies on Juvenile Male Northern Fur Seals, St. Paul Island, 1992. pp. 100-136. *In:* Fur Seal Investigations, 1992. E.H. Sinclair (ed.). USDOC/NOAA Tech. Memo. NMFS-AFSC-45.

Fowler, C.W., and T.J. Ragen. 1990. Entanglement Studies, St. Paul Island, 1989; Juvenile Male Roundups. USDOC/ NWAFC Processed Rep. 90-06. 39 pp.

Fox, D.A., J.E. Hightower, and F.M. Paruka. 2000. Gulf Sturgeon Spawning Migration and Habitat in the Choctawhatchee River System, Alabama-Florida. Transactions of the American Fisheries Society 129:811-826.

Fraker, M.A. 1977. The 1976 White Whale Monitoring Program, Mackenzie Estuary. N.W.T. Rep. from F.F. Slaney and Co. Ltel, Vancouver, B.C., for Imperial Oil Ltd., Calgary, Alb. 76 pp. + maps, tables, app.

Frame, G.W. 1974. Black Bear Predation on Salmon at Olsen Creek, Alaska. Z. Tierpsychol. 35(1):23-38.

Franson, J.C., P.S. Koehl, D.V. Derksen, and T.C. Rothe. 1995. Heavy Metals in Seaducks and Mussels from Misty Fjords National Monument in Southeast Alaska. Envr. Monitoring and Assess. 36:149-167.

Frazier, J.G. 1980. Marine Turtles and Problems in Coastal Management. *In:* Coastal Zone '80, Vol. III. Edge, B.L. (ed.). Proc. 2nd Symposium on Coastal and Ocean Management. p. 2395.

Freeland, H. K., Denman, C. S. Wong, F. Whitney, and R. Jacques. 1997. Evidence of Changes in the Winter Mixed Layer in the North Pacific Ocean. Deep Sea Research 44:2,117-2,1129.

Freeman, M.M.R. 1973. Polar Bear Predation on Beluga in the Canadian Arctic. Arctic 26:163-164.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983a. The Distribution and Abundance of Marine Turtles in the Gulf of Mexico and Nearby Atlantic Waters. J. Herpetol. 17:327-344.

Fritts, T.H., A.B. Irvine, R.D. Jennings, L.A. Collum, W. Hoffman, and M.A. McGehee. 1983b. Turtles, Birds, and Mammals in the Northern Gulf of Mexico and Nearby Atlantic Waters. FWS/OBS-82/65. Washington, DC: USDOI/FWS, Division of Biological Services. 455 pp.

Fritts, T.H., and R.P. Reynolds. 1981. Pilot Study of Marine Mammals, Birds, and Turtles in OCS Areas of the Gulf of Mexico. Rept. FWS/OBS-81/36. Washington, DC: USDOI/FWS, Division of Biological Services. 347 pp.

Frost, K.J. 1998. Harvest Report: Statewide Summary for the Eastern Bering Sea Beluga Population, 1995-97. Alaska Beluga Whale Committee Rep. 98-1. 15 pp.

Frost, K.J., and L.F. Lowry. 1980. Feeding of Ribbon Seals (*Phoca fasciata*) in the Bering Sea In Spring. Can. J. Zool. 58:1,601-1,607.

------- 1981. Ringed, Baikal, and Caspian Seals, pp. 29-53. *In:* Handbook of Marine Mammals. Vol. 2. Seals. Ridgway, S.H and R.J. Harrison (eds.). London: Academic Press.

Frost, K.J., L.F. Lowry, and J.J. Burns. 1988. Distribution, Abundance, Migration, Harvest, and Stock Identity of Belukha Whales in the Beaufort Sea, pp. 27-40. *In:* Beaufort Sea (Sale 97) Information Update. Becker, P.R. (ed.). OCS Study MMS 86-0047. Anchorage, AK: USDOC/NOAA/Ocean Assessment Division, and USDOI/MMS, Alaska OCS Region. NTIS PB 88-208616/AS.

Frost, K.J., C.A. Manen, and T.L. Wade. 1994a. Petroleum Hydrocarbons in Tissues of Harbor Seals from Prince William Sound and the Gulf of Alaska, pp. 331-358. *In:* Marine Mammals and the *Exxon Valdez.* Loughlin, T.R. (ed.). San Diego, CA: Academic Press.

Frost, K.J., L.F. Lowry, E. Sinclair, J. Ver Hoef, and D. McAllister. 1994b. Impacts of Distribution, Abundance, and Productivity of Harbor Seals, pp. 97-118. *In:* Marine Mammals and the *Exxon Valdez*. Loughlin, T.R. (ed.). San Diego, CA: Academic Press.

Frost, K.J., and R. Suydam. 1995. Harvests of Beluga Whales, *Delphinapterus leucas*, in Alaska, 1987-1994. Working Paper for Alaska Beluga Whale Committee Scientific Workshop, Anchorage, AK, 5-7 April 1995. 14 pp.

Fry, D.M., R. Boekelheide, J. Swensen, A. Kang, J. Young, and C.R. Grau. 1985. Long-Term Responses of Breeding Seabirds to Oil Exposure. Pacific Seabird Group Bulletin 10:48-49.

Fry, D.M., S.I. Fefer, and L. Sileo. 1987. Ingestion of Plastic Debris by Laysan Albatross and Wedge-Tailed Shearwaters in the Hawaiian islands. Mar. Poll. Bull. 18(6B):339-343.

Fry, D.M., and L.J. Lowenstine. 1985. Pathology of Common Murres and Cassin's Auklets Exposed to Oil. Archives of Environmental Contamination and Toxicology 14:725-737.

Funk, Fritz. 2001. "ADF&G | CMFD: General Information About Alaska Herring Fisheries." Alaska Department of Fish and Game, 27 Feb. 2001 <http://www.f.afg.state.ak.us/eninfo/finfish/herring/ overview/overview.htm>.

Funk, D.W., E.R. Pullman, K.M. Peterson, and P.M. Crill. 1994. Influence of Water Table on Carbon Dioxide, Carbon Monoxide, and Methane Fluxes from Tiga Bog Microcosms. Global Biogeochemical Cycles 8:271-278.

Gabrielson, I.N., and F.C. Lincoln. 1959. The Birds of Alaska. The Stackpole Company and the Wildlife Management Institute, Harrisburg.

Gales, R.S. 1982. Effects of Noise of Offshore Oil and Gas Operations on Marine Mammals-An Introductory Assessment. NOSC TR 844, 2 vol., San Diego, CA: U.S. Naval Ocean Systems Center. NTIS AD-A123699 + AD-A123700. 7 9 + 300 pp.

Galginaitis, M., C. Chang, K.M. MacQueen, A.A. Dekin, Jr., and D. Zipkin. 1984. Ethnographic Study and Monitoring Methodology of Contemporary Economic Growth, Socio-Cultural Change and Community Development in Nuiqsut, Alaska. Unit Technical Report No. 96. Anchorage, AK: USDOI/MMS, Alaska OCS Region, Alaska OCS Social and Economics Studies.

Gallaway, B. (ed.). 1988. Northern Gulf of Mexico Continental Slope Study, Final Report: Year 4. Vol. II: Synthesis Report. Final Report Submitted to the USDOI/MMS, New Orleans, LA. Contract No. 14-12-0001-30212..

Gallaway, B.J., and M.C. Kennicutt II. 1988. Characterization of Benthic Habitats of the Northern Gulf of Mexico, Chapter 2. *In:* Northern Gulf of Mexico Continental Slope Study, Final Report, Year 4. Volume II: Synthesis Report. Gallaway, B.J. (ed.). OCS Study MMS 88-0053. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Gallaway, B.J., R.G. Fechhelm, G.F. Hubbard, and S.A. MacLean. 1998. Opportunistic Sampling at a Synthetic Drilling Fluid Discharge Site on the Continental Slope of the Northern Gulf of Mexico: The Pompano Development, 13-14 March 1998. Report to BP Exploration, Inc., Houston, TX. Bryan, TX: LGL Ecological Research Associates, Inc.

Gambell, R. 1968. Aerial Observations of Sperm Whale Behaviour. Norsd Hvalfangst-Tid. 57(6):126-138.

Garber, S.D. 1985. The Integration of Ecological Factors Affecting Marine Turtle Nesting Beach Management. *In*: Proc. Ninth Annu. Conf. of the Coastal Society, 14-17 October 1984. Atlantic City, New Jersey. pp 311-318.

Garrison, E.G., C.P. Giammona, F.J. Kelly, A.R. Tripp, and G.A. Wolff. 1989. Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico: Reevaluation of Archaeological Resource Management Zone. 3 vols. OCS Study MMS 89-0023, 89-0024, and 89-0025. New Orleans, LA: USDOIMMS, Gulf of Mexico OCS Region,

Garrott, R.A., L.L. Eberhardt, and B.M. Burn. 1993. Mortality of Sea Otters in Prince William Sound Following the *Exxon Valdez* Oil Spill. Marine Mammal Science 9:343-359.

Gaskin, D.E. 1964. Recent Observations in New Zealand Waters on some Aspects of Behaviour of the Sperm Whale (*Physeter macrocephalus*). Tuatara 12(2):106-114.

------- 1984. The Harbor Porpoise *Phocoena phocoena* (L.): Regional Populations, Status, and Information on Direct and Indirect Catches. Rep. Int. Whal. Comm. 34:569-586.

Gentry, R.L., and J.H. Johnson. 1981. Predation by Sea Lions on Northern Fur Seal Neonates. Mammalia 45:423-430.

George, C.G., G.C. Carroll, R.J. Tarpley, T.F. Albert, and R.L. Yackley. 1987. Report of Field Activities Pertaining to the Spring 1986 Census of Bowhead Whales, *Balaena mysticetus* Off Pt. Barrow, Alaska, with Observations on the Subsistence Hunt. Report of the International Whaling Commission.

George, J.C., C. Clark, G.M. Carroll, and W.T. Ellison. 1989. Observations on the Ice-Breaking Barrow, Alaska, Spring 1985. Arctic 42(1):24-30.

George, J.C. and T.A. Albert. 1999. Overview of Current Research Activities of the North Slope Borough Department of Wildlife Management Related to Marine Research. Paper presented at the Seventh Minerals Management Service, Alaska OCS Region, Information Transfer Meeting, 19-21 January 1999, Anchorage, AK.

Georgette, S.E. 1983. Kenai: Resource Uses in a Middle-Sized, Industrial-Based, Road-Connected Community of the Kenai Peninsula Borough. *In:* Resource Use and Socioeconomic Systems: Case Studies of Fishing and Hunting in Alaskan Communities. Wolfe, R.J., and L.J. Ellanna (eds.). Technical Paper No. 61. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Geraci, J.R. 1990. Physiologic and Toxic Effects on Cetaceans, pp. 167-197. *In:* Sea Mammals and Oil: Confronting the Risks. Geraci, J.R., and D.J. St. Aubin (eds.). San Diego, CA: Academic Press.

Geraci, J.R., and D.J. St. Aubin. 1980. Offshore Petroleum Resource Development and Marine Mammals: A Review and Research Recommendations. USDOC/NMFS. Marine Fisheries Review 42:1-12.

------- 1982. Study of the Effects of Oil on Cetaceans. Final Report Prepared for the USDOI/BLM, New York OCS Office, 20 July 1982. 274 pp.

------- 1987. Effects of Offshore Oil and Gas Development on Marine Mammals and Turtles, pp. 587-617. *In:* Long Term Environmental Effects of Offshore Oil and Gas Development. Boesch, D.F., and N.N. Rabalais (eds.). London and New York: Elsevier Applied Science Publ. Ltd.

Gerrard, J.M. 1983. A Review of the Current Status of Bald Eagles in North America, pp. 5-21. *In:* Biology and Management of Eagles and Ospreys. Bird, S.M. (ed.). St. Anne de Bellevue, Quebec, Canada: Harpell Press.

Gerstein E.R., L. Gerstein, S.E. Forsythe, and J.E. Blue. 1999. The Underwater Audiogram of the West Indian Manatee. Journal of the Acoustical Society of America 105(6):3,575-3,583.

Giddings, J.L. 1952. The Arctic Woodland Culture of the Kobuk River. Museum Monographs, Philadelphia, PA: University Museum, University of Pennsylvania.

------- 1961. Kobuk River People. University of Alaska. Studies of Northern Peoples No. 1: College.

------- 1967. Ancient Men of the Arctic. New York, NY: Alfred A. Knopf.

Gilbert, C.R. (ed.). 1992. Rare and Endangered Biota of Florida. Volume II. Fishes. Gainesville, FL: University Press of Florida. 247 pp.

Gitschlag, G. 2000. Fisheries Impacts of Underwater Explosives Used in Platform Salvage in the Gulf of Mexico 1993-1998, pp, 53-59. *In:* Proceedings: Eighteenth Annual Gulf of Mexico Information Transfer Meeting, December 1998. McKay, M., and J. Nides (eds.). OCS Study MMS 2000-030. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Gitschlag, G.R., and B.A. Herczeg. 1994. Sea Turtle Observations at Explosive Removals of Energy Structures. Mar. Fish. Rev. 56(2):1-8.

Gitschlag, G.R., J. Powers, C. Legault, M. Schirripa, and C. Porch. 2000. Estimation of Fisheries Impacts from Underwater Explosives Used in Offshore Oil and Gas Structure Removals. Gulf of Mexico Fish and Fisheries, Sponsored by USDOI/MMS, New Orleans, LA, 24-26 October 2000. (abstract).

Goddard, P.C., and D.J. Rugh. 1998. A Group of Right Whales Seen in the Bering Sea in July 1996. Mar. Mamm. Sci. 14(2):344-349.

Goldsmith, S. 1996. Economic Projections for Alaska and the Southern Railbelt, 1996-2025. Anchorage, AK: Institute of Social and Economic Research, University of Alaska.

------- 1997. Alaska's Gross State Product, 1963-1996. Research Summary Number 58 (July 1997). Anchorage, AK: Institute of Social and Economic Research, University of Alaska.

------- 1998. From Oil to Assets: Managing Alaska's New Wealth. Fiscal Policy Papers Number 19, June 1998. Anchorage, AK: Institute of Social and Economic Research, University of Alaska.

------- 1999. Alaska Gross State Product 1961-1998. Prepared for the Alaska Department of Commerce and Economic Development. Anchorage, AK: Institute of Social and Economic Research, University of Alaska.

Goldsmith, S., and A. Hill. 1997. Alaska's Economy and Population, 1959-2020. Prepared by the Institute of Social and Economic Research for the Alaska Department of Transportation and Public Facilities.

Goold, J.C. 1999. Behavioral and Acoustic Observations of Sperm Whales in Scapa Flow, Orkney Islands. J. Mar. Biol. Assoc. U.K. 79:541-550.

Goold, J.C., and S.E. Jones. 1995. Time and Frequency Domain Characteristics of Sperm Whale Clicks. J. Acoust. Soc. Amer. 98(3):1,279-1,281.

Gordon, J.C.D., D. Gillespie, J. Potter, A. Frantzis, M. Simmonds, and R. Swift. 1998. The Effects of Seismic Surveys on Marine Mammals. *In:* Seismic and Marine Mammals Workshop, 23-25 June 1998, London. Workshop Documentation.

Gorham, E. 1991. Northern Peatlands: Role in the Carbon Cycle and Probable Responses to Climate Warming. Ecological Applications 1:182-195.

Gosho, M.E., D.W. Rice, and J.M. Breiwick. 1984. The Sperm Whale, *Physeter macrocephalus*. Marine Fisheries Review 46:54-64.

Gramling, B., and S. Brabant. 1986. Boomtowns and Offshore Energy Impact Assessment. Sociological Perspectives 29(2):177-201.

Gramling, R. 1994. Oil on the Edge. Albany, NY: SUNY Press.

Gramling, R.B., and S. Laska. 1993. A Social Science Research Agenda for the Minerals Management Service in the Gulf of Mexico. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Grand, J.B., P.L. Flint, M.R. Petersen, and C.L. Moran. 1998. Effects of Lead Poisoning on Spectacled Eider Survival Rates. J. Wildl. Manage. 62:1,103-1,109.

Grauvogel, C. 1967. Prince William Sound Black Bears. Unpubl. Manuscript. Department of Wildlife and Fisheries, Univ. Alaska, Fairbanks. 49 pp.

Green. G.A., M.L. Bonnell, K.C. Balcomb, C.E. Bowlby, R.A. Grotefendt, and D.G. Chapman. 1989. Synthesis of Information on Marine Mammals of the Eastern North Pacific, with Emphasis on the Oregon and Washington OCS Area. *In:* Information Synthesis and Hypothesis Formulation for Oregon and Washington Marine Mammal and Seabird Surveys. Brueggeman, J.J. (ed.). Final Report to the USDOI/MMS, Pacific OCS Region, Camarillo, CA. OCS Study MMS 89-0030. Envirosphere Company and Ecological Consulting, Inc.

Green, G.A., J.J. Brueggeman, C.E. Bowlby, R.A. Grotefendt, M.L. Bonnell, and K.C. Balcomb III. 1991. Cetacean Distribution and Abundance Off Oregon and Washington, 1989-1990. *In:* Oregon and Washington Marine Mammal and Seabird Surveys. Brueggeman, J.J. (ed.). Final Report to the USDOI/MMS, Pacific OCS Region, Camarillo, CA. OCS Study MMS 91-0093. Ebasco Environmental and Ecological Consulting, Inc. 104 pp.

Green, G.A., J.J. Bruggeman, R.A. Grotefendt, C.E. Bowlby, M.L. Bonnell, K.C. Balcomb, III. 1992. Cetacean Distribution and Abundance Off Oregon and Washington, 1989-1990. Chapter 1 *In*: Oregon and Washington Marine Mammal and Seabird Surveys. Bruggeman, J.J. (ed.). USDOI/MMS Contract Report 14-12-0001-30426.

Greene, C.R. 1981. Underwater Acoustic Transmission Loss and Ambient Noise in Arctic Regions, pp. 234-258. *In:* The Question of Sound from Icebreaker Operations: The Proceedings of a Workshop. Peterson, N.M. (ed.). Arctic Pilot Proj., Petro-Canada, Calgary, Alb. 350 pp.

------- 1985. Characteristics of Waterborne Industrial Noise, pp. 197-253. *In:* Behavior, Disturbance Responses, and Feeding of Bowhead Whales, *Balaena mysticetus,* in the Eastern Beaufort Sea, 1980-84. Richardson, W.J. (ed.). OCS Study MMS 85-0034. Report for the USDOI/MMS, Reston, VA. Bryan, TX: LGL Ecological Research Associates Inc.

------- 1987. Characteristics of Oil Industry Dredge and Drilling Sounds in the Beaufort Sea. J. Acoust. Soc. Am. 82(4):1,315-1,324.

Greene, C.R., Jr. and W.J. Richardson. 1988. Characteristics of Marine Seismic Survey Sounds in the Beaufort Sea. J. Acoust. Soc. Am. 83(6):2,246-2,254.

Griese, H.J. 1989. Unit 6 Deer Survey-Inventory Progress Report, pp. 40-77. *In:* Annual Report of Survey-Inventory Activities, Part VI, Deer, Volume XIX. Fed. Aid Wildl. Restor. Prog. Rep., Proj. W-23-1, Study 2.0. Morgan, S.O. (ed.). Juneau, AK: Alaska Department of Fish and Game.

Griffiths W.B., and R.E. Dillinger. 1980. Invertebrates, pp. 10-12. *In:* Environmental Assessment of the Alaskan Continental Shelf, Final Reports of Principal Investigators. Volume 8, Biological Studies. Contract No. 03-6-022-35193.

Grimm, D.E., and T.S. Hopkins. 1977. A Preliminary Characterization of the Octocorallian and Scleractinian Diversity at the Florida Middle Grounds. *In:* Proceedings, Third International Coral Reef Symposium. University of Miami, Rosenstiel School of Marine and Atmospheric Sciences, Miami, FL.

Gross, M.G. 1993. Oceanography (Sixth Edition). Englewood Cliffs, NJ: Prentice Hall. 446 pp.

Grundlach, E., J. Sadd, G. Scott, L. Theabeau, and D. Maiero. 1981. Oil Spill Sensitivity of Coastal Environments and Wildlife, Norton Sound and the Pribliof Islands, Alaska. Rep. To USDOC/NOAA, Ocean Assessments Div., Juneau, AK. 171 pp.

Gubser, N.J. 1965. The Nunamiut Eskimos: Hunters of Caribou. New Haven: Yale University Press.

Gulf of Mexico Fishery Management Council. 1998. Generic Amendment for Addressing Essential Fish Habitat Requirements in the Following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico United States Waters; Red Drum Fishery of the Gulf of Mexico; Reef Fish Fishery of the Gulf of Mexico; Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic; Stone Crab Fishery in the Gulf of Mexico; Spiny Lobster in the Gulf of Mexico and South Atlantic; Coral and Coral Reefs of the Gulf of Mexico. Tampa, FL: Gulf of Mexico Fishery Management Council.

Gulliksen, B., and O.J. Lonne. 1989. Distribution, Abundance, and Ecological Importance of Marine Symnpagic Fauna in the Arctic. Rapp. P. v. Reun. Cons. Int. Explor. Mer. 188:133-138.

Haaker, P.L., D.V. Richards, C.S.Friedman, G.E. Davis, D.O. Parker, H.A. Togstad. 1992. Mass Mortality and Withering Syndrome in Black Abalone, *Haliotis cracherodii*, in California. *In*: Abalone and the World Biology, Fisheries and Culture. Shepherd, S.A., M.J. Tegner, S.A. Gusman del Proo (eds.). Proceedings, 1st International Symposium on Abalone. Cambridge, UK: Cambridge University Press. pp. 214-224.

Hagan, J.M., III and D.W. Johnston (eds.). 1992. Ecology and Conservation of Neotropical Migrant Landbirds. Washington: Smithsonian Institute Press. 609 pp.

Hall, J. 1979. A Survey of Cetaceans of Prince William Sound and Adjacent Waters-Their Numbers and Seasonal Movements. Unpublished Report to Alaska Outer Continental Shelf Environmental Assessment Programs. Juneau, AK: USDOC/NOAA/OCSEAP, Juneau Project Office. 37 pp.

Hall, J.D., M.L. Gallagher, K.D. Brewer, P.R. Regos and P.E. Isert. 1994. ARCO Alaska, Inc. 1993 Kuvlum Exploration Area Site Specific Monitoring Program/Final Report. Report for ARCO Alaska Inc., Anchorage, AK. Walnut Creek, CA: Coastal & Offshore Pacific Corp. 219 pp. + Data Appendix vol. 1,2.

Hall, J.V. 1991. Alaska Coastal Wetlands Survey, pp. 1-15. *In:* Coastal Wetlands. Bolton, H.S. (ed.). New York: American Society of Civil Engineers.

Hamilton, P. 1990. Deep Currents in the Gulf of Mexico. J. Phys. Oceanogr. 20(7):1,087-1,104.

Hancock, J., and J. Kushlan. 1984. The Herons Handbook. New York: Harper and Row. 288 pp.

Hanna, S.R., and P.J. Drivas.1993. Modeling VOC Emissions and Air Concentrations from the *Exxon Valdez* Oil Spill. Journal of the Air & Waste Management Association, Vol. 43, March 1993.

Hanni, K.D., D.J. Long, R.E. Jones, P. Pyle, and L.E. Morgan. 1997. Sightings and Strandings of Guadalupe Fur Seals in Central and Northern California. J. Mammal. 78(2):684-690.

Hansen, D.J. 1981. The Relative Sensitivity of Seabird Populations in Alaska to Oil Pollution. BLM-YK-ES-006-1792. Anchorage, AK: USDOI/BLM.

------- 1992. Potential Effects of Oil Spills on Marine Mammals that Occur in Alaskan Waters. OCS Report MMS 92-0012. Anchorage, AK: USDOI/MMS. 25 pp.

Hansen, D.J. and J.D. Hubbard. 1999. Distribution of Cook Inlet Beluga Whales *(Delphinapterus leucas*) in Winter. OCS Study MMS 99-0024. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

Hansen, J.E., M. Sato, A. Lacis, R. Ruedy, I. Gegen, and E. Matthews. 1998. Climate Forcings in the Industrial Era. Proceedings of the National Academy of Sciences 95:12,753-12,758.

Harcharek, R. 1995. North Slope Borough 1993-1994 Economic Profile and Census Report, Volume VII. George N. Ahmaogak, Sr. Mayor. Barrow, AK: North Slope Borough Department of Planning & Community Services.

Harington, C.P. 1968. Denning Habits of the Polar Bear. Can. Wildl. Serv. Rep. 5:1-30.

Harrison, P. 1983. Seabirds: An Identification Guide. Boston, MA: Houghton Mifflin Co. 448 pp.

------- 1996. Seabirds of the World. Princeton: Princeton University Press. 317 pp.

Hart, J.L. 1973. Pacific Fishes of Canada. Fisheries Research Board of Canada, Bulletin No. 180. Ottawa. 740 pp.

Hartung, R. 1995. Assessment of the Potential for Long-Term Toxicological Effects of the *Exxon Valdez* Oil Spill on Birds and Mammals, pp. 693-725. *In: Exxon Valdez* Oil Spill: Fate and Effects in Alaskan Waters, ASTM STP 1219. Wells, P.G., J.N. Butler, and J.S. Hughes (eds.). Philadelphia, PA: American Society for Testing and Materials.

Harvey, J.T., and M.E. Dahlheim. 1994. Cetaceans in Oil, pp. 257-264. *In:* Marine Mammals and the *Exxon Valdez*. Loughlin, T.R. (ed.). San Diego, CA: Academic Press.

Hayman, P., J. Marchant, and T. Prater. 1986. Shorebirds: An Identification Guide. Boston, MA: Houghton Mifflin. 412 pp.

Hecker, B. 1985. Fauna from a Cold Sulfur-Seep in the Gulf of Mexico: Comparisons with Hydrothermal Vent Communities and Evolutionary Implications. Bulletin Biological Society Washington. 6:465-474.

Hedgpeth, J.W. 1957. Classification of Marine Environments. Geol. Soc. America, Memoir 67:93-100.

Hefner, L.M., B.O. Wilen, T.E. Dahl, and W.E. Frayer. 1994. Southeast Wetlands: Status and Trends, Mid-1970's to Mid-1980's. Atlanta, GA: USDOI/FWS. 32 pp.

Helle, T., and J. Aspi. 1983. Does Herd Formation Reduce Insect Harassment Among Reindeer? A Field Experiment with Animal Traps. Acta Zool. Fennica 175:129-131.

Hemming, C.R. 1988. Aquatic Habitat Evaluation of Flooded North Slope Gravel Mine Sites (1986-1987). Anchorage, AK: Alaska Dept. of Fish and Game, Div. of Habitat. 40 pp.

Hendrickson, J.R. 1980. The Ecological Strategies of Sea Turtles. Amer. Zool. 20:597-608.

Heneman, B. and the Center for Environmental Education. 1988. Persistent Marine Debris in the North Sea, Northwest Atlantic Ocean, Wider Caribbean Area, and the West Coast of Baja California. A Report to the Marine Mammal Commission. Contract MM3309598-5. Chapter V. Washington, DC: USDOC/NOAA, National Ocean Pollution Program Office. 36pp.

Herkhof, D., and C. Marshall, 1998. Comparison of 1-Hour and 8-Hour Ozone Impact Calculations For Gulf of Mexico OCS Activities. *In:* Proceedings: Eighteenth Annual Gulf of Mexico Information Transfer Meeting, December 1998. OCS Study MMS 2000-030.

Herman, L.M., P.H. Forestell, and R.C. Antinoja. 1980. The 1976/1977 Migration of Humpback Whales into Hawaiian Waters: Composite Description. MMC-77/19. Washington, DC: U.S. Mar. Mamm. Comm. NTIS PB80-162332. 55 pp.

Heyland, J.D., and K. Hay. 1976. An Attack by a Polar Bear on a Juvenile Beluga. Arctic 29:56-57.

Hicks, M.V. (ed.). 1998. Brown Bear. Management Report of Survey-Inventory Activities. 1 July 1994 – 30 June 1996. Fed. Aid in Wildl. Rest., Grants W-24-3 & W-24-4, Study 4.0. Juneau, AK: Alaska Department of Fish and Game. 270 pp.

------- 1999. Black Bear. Management Report of Survey-Inventory Activities. 1 July 1995 – 30 June 1998. Fed. Aid in Wildl. Rest., Grants W-24-4, W-24-5, and W-27-1, Study 17.0. Juneau, AK: Alaska Department of Fish and Game. 175 pp.

Hiett, R.L., and J.W. Milon. 2000. Economic Impact of Recreational Fishing and Diving Associated with Offshore Oil and Gas Structures in the Gulf of Mexico: Final Report. Prepared by QuanTech, Inc. for USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Higashi, G.R. 1994. Ten Years of Fish Aggregating Device (FAD) Design and Development in Hawaii. Bull. Mar. Sci. 55(2-3):651-666.

High, W. 1998. Observations of a Scientist/Diver on Fishing Technology and Fisheries Biology. NMFS AFSC Processed Report 98-01. 48 pp.

Hildebrand, H.H. 1995. A Historical Review of the Status of Sea Turtle Populations in the Western Gulf of Mexico, pp. 447-453. *In:* Biology and Conservation of Sea Turtles, Second Edition. Bjorndal, K.A. (ed.). Washington, DC: Smithsonian Institute Press.

Hill, P.S. 1999. Alaska Marine Mammal Stock Assessments. 1999. USDOC/NOAA Tech Memo NMFS-AFSC-110. 166 pp.

Hill, P.S., and D.P. DeMaster. 1999. Draft Alaska Marine Mammal Stock Assessments 1999. Seattle, WA: USDOC/NOAA/NMFS, National Marine Mammal Laboratory, Alaska Fisheries Science Center. 68 pp.

Hill, P.S., and D.P. DeMaster. 2000. Alaska Marine Mammal Stock Assessments 1999. Seattle, WA: USDOC/NOAA/NMFS, National Marine Mammal Laboratory. 174 pp.

Hill, P.S., and E. Mitchell. 1998. Sperm Whale Interactions with Longline Vessels in Alaska Waters During 1997. Unpubl. Doc. Submitted to Fish. Bull.

Hill, B.J., and T.J. Wassenberg. 1990. Fate of Discards from Prawn Trawlers in Torres Strait. Australian Journal of Marine and Freshwater Research 41: 53-64.

Hillestad, H.O., R.J. Reimold, R.R.Stickney, H.L.Windo, and J.H. Jenkins. 1974. Pesticides, Heavy Metals, and Radionuclide Uptake in Loggerhead Sea Turtles from South Carolina and Georgia. Herpetol. Rev. 5(3):75.

Hirth, H.H. 1997. Synopsis of Biological Data on the Green Turtle, *Chelonia mydas* (Linnaeus 1758). Report to the USDOI/FWS. Washington, DC. Biological Report 97(1). 120 pp.

Hobbs, R.C., D.J. Rugh, J.M. Waite, J.M. Briewick, and D.P. DeMaster. 1996. Preliminary Estimate of the Abundance of Gray Whales in the 1995/1996 Southbound Migration. Unpublished document submitted to the International Whaling Commission (SC/48/AS 9). 11 pp. Cited in Hill and DeMaster (2000).

Hodder, J. 1993. The Northern Elephant Seal in Oregon: An Expansion of the Breeding Range and a Pattern of Regular Onshore Occurrence. *In*: Abstracts Tenth Biennial Conference on the Biology of Marine Mammals, Galveston, TX, November 11-15, 1993. p. 61.

Hodder, J., R.F. Brown, and C. Cziesla. 1993. The Northern Elephant Seal in Oregon: A Pupping Range Extension and Onshore Occurrence. Marine Mammal Science 14(4):873-881.

Holland, K.R., R.W. Brill, and R.K.C. Chang. 1990. Horizontal and Vertical Movements of Yellowfin and Bigeye Tuna Associated with Fish Aggregating Devices. Fish. Bull. 88:493-507.

Holland-Bartels, L., et al. 1997. Mechanisms of Impact and Potential Recovery of Nearshore Vertebrate Predators. *Exxon Valdez* Oil Spill Restoration Project Annual Report (Restoration Project 96025). Anchorage, AK: USDOI/USGS, Biological Resources Division. 210 pp.

Holler, N.R. 1992. Choctawhatchee Beach Mouse. *In:* Rare and Endangered Biota of Florida. Volume I: Mammals. Humphrey, S.R.(ed.). Gainesville, FL: University Press of Florida.

Holler, N.R, M.C. Wooten, and M. Oli. 1999. Viability Analysis of Endangered Gulf Coast Beach Mice (*Peromyscus polionotus)* Populations. Project Report for Agreement 1448-0004-94-9174, Mod. 2, Obj. 2 for the USDOI/FWS, Panama City, FL. 16 pp., with Graphs and Tables.

Hom, T., U. Varanasi, J.E. Stein, C.A. Sloan, K.L. Tilbury, and S. Chan. 1996. Assessment of the Exposure of Subsistence Fish to Aromatic Compounds After the *Exxon Valdez* Oil Spill. American Fishery Society Symposium 18:856-866.

Home, W.S. 1984. Ecology of River Otters (*Lutra canadensis*) in Marine Coastal Environments. A Thesis Presented to the Faculty of the Univ. of Alaska in Partial Fulfillment of the Requirements for the Degree of Master of Science. December, 1982. Fairbanks, AK. 323 pp.

Hood, D.W., and J.A. Calder (eds.). 1981. The Eastern Bering Sea Shelf: Oceanography and Resources, Vol. 1 and 2. Juneau, AK: USDOC/NOAA, Off. Mar. Pollut. Assess. 1,339 pp.

Hood, D.W. and S.T. Zimmerman (eds.). 1987. The Gulf of Alaska, Physical Environment and Biological Resources. USDOC/NOAA.

Hopkins, T.L., T.T. Sutton, T.M. Lancraft. 1997. The Trophic Structure and Predation Impact of a Low Latitude Midwater Fish Assemblage. Prog. Oceanogr. 38:205-239.

Hopson, E. 1976. Mayor Eben Hopson's Warning to the People of the Canadian Arctic. Testimony to the Berger Commission.

------- 1978. Mayor Eben Hopson's Testimony, Public Hearing on Proposed Pt. Thompson Lease Sale, July 25.

Horner, R.A., K.O. Coyle, and D.R. Redburn. 1974. Ecology of the Plankton of Prudhoe Bay, Alaska. IMS Report No. R76-2, Sea Grant Report No. 73-15. University of Alaska, Institute of Marine Science.

Horowitz, W.L., D.A. Steffy, and P.J. Hoose. 1989. Geologic Report for the Shumagin Planning Area, Western Gulf of Alaska. OCS Report, MMS 89-0097. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 148 pp.

Horwood, J. 1990. Biology and Exploitation of the Minke Whale. Boca Raton, FL: CRC Press, Inc. 238 pp.

Houghton, J.P., D.A. Segar, and J.E. Zeh. 1984. Beaufort Sea Monitoring Program: Proceedings of a Workshop (September 1983) and Sampling Design Recommendations. Prepared for the Outer Continental Shelf Environmental Assessment Program, Juneau, AK. Anchorage, AK: USDOC.

Houghton, J.T., L.G.M. Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell. 1996. Climate Change 1995, pp. 572. *In:* The Science of Climate Change, Intergovernmental Panel on Climate Change. Cambridge, Great Britain: Cambridge University Press.

Howarth, R.W. 1991. Assessing the Ecological Effects of Oil Pollution from Outer Continental Shelf Oil Production. American Fisheries Society Symposium 11:1-8.

Hsiao, S.I., D.W. Kittle, and M.G. Foy. 1978. Effects of Crude Oils and the Oil Dispersant Corexit on Primary Production of Arctic Marine Phytoplankton and Seaweed. Environmental Pollution 15:209-221

Hsieh, W.W., and G.J. Boer. 1992. Global Climate Change and Ocean Upwelling. Fisheries. Oceanogr. 1:333-338.

Hubbard, H.H. (ed.). 1995. Aeroacoustics of Flight Vehicles, Theory and Practice. Vol. 1, Noise Sources. Acoust. Soc. Am. New York. 608 pp.

Hudson, D.T. 1976. Marine Archaeology Along the Southern California Coast. San Diego Museum Papers 9. San Diego, CA.

Hudson, D.T. 1977. Marine Archaeology Along the Southern California Coast (Revised). San Diego Museum Papers 9. San Diego, CA.

Huff, J.A. 1975. Life History of Gulf of Mexico Sturgeon, *Acipenser oxyrhynchus desotoi*, in Suwannee River, Florida. Florida Mar. Res. Publ. 16:1-32.

Hulings, N. and J. Gray. 1971. A Manual for the Study of Meiofauna. Smith. Cont. in Zoo. 78:1-84.

Human Relations Area Files. 1992. Social Indicators Study of Alaskan Coastal Villages. I, Key Informant Summaries. Volume 1: Schedule A Regions (North Slope, NANA, Calista, Aleutian-Pribilof). Social and Economic Studies Program Technical Report No. 151. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1994a. Social Indicators Study of Alaskan Coastal Villages. III. Analysis. OCS Study MMS 93-0070. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1994b. Social Indicators Study of Alaskan Coastal Villages. V. Research Methodology for the *Exxon Valdez* Spill Area, 1988-1992. OCS Study MMS 93-0071. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1994c. Social Indicators Study of Alaskan Coastal Villages. VI. Analysis of the Exxon Valdez Spill Area. OCS Study MMS 94-0064. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

Humphrey, S.R., and D.B. Harbour. 1981. Status and Habitat of Three Subspecies of *Peromyscus polionotus* in Florida. Journal of Mammalogy 62: 840-844.

Hunt, G.L., Jr., R.L. Pitman, M. Naughton, K. Winnet, A. Newman, P.R. Kelly, and K.T. Briggs. 1981. Distribution, Status, Reproductive Ecology, and Foraging Habits of Breeding Seabirds. *In:* Summary of Marine Mammal and Seabird Surveys of the Southern California Bight Area, 1975-1978, Vol. III, Investigators' Reports, Part III, Book II, Seabirds. Report to the USDOI/BLM, Pacific OCS Office, Los Angeles, CA. NTIS No. PB81-248205.

Huntington, H.P., and N.I. Mymrin. 2000. Traditional Ecological Knowledge of Beluga Whales: An Indigenous Knowledge Pilot Project in the Chukchi and Northern Bering Seas. Summary Available at the Website: <http://www.mnh.si.edu/arctic/html/tek.html>.

Hutchinson, J., and M. Simmonds. 1991. A Review of the Effects of Pollution on Marine Turtles. Greenpeace International. 27 pp.

Imhof, T.A. 1976. Alabama Birds. University of Alabama Press, University. 445 pp.

Impact Assessment, Inc. 1982. North Aleutian Shelf Non-OCS Forecast Analysis.. Alaska OCS Sociocultural Studies Program Technical Report No. 75. 2 Volumes. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1988. Village Economies in Rural Alaska. Alaska OCS Environmental Studies Program Technical Report 132. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

Impact Assessment, Inc. 1989a. Point Lay Case Study. Social and Economic Studies Program Technical Report No. 139. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1989b. Point Lay Biographies. Social and Economic Studies Program Technical Report No. 140. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1990a. Subsistence Resource Harvest Patterns: Nuiqsut. Social and Economic Studies Program Special Report No. 8. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1990b. Subsistence Resource Harvest Patterns: Kaktovik. Social and Economic Studies Program Special Report No. 9. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1990c. Northern Institutional Profile Analysis: Chukchi Sea. Social and Economic Studies Program Technical Report No. 141. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1990d. Northern Institutional Profile Analysis: Beaufort Sea. Social and Economic Studies Program Technical Report No. 142. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1991. Community Profiles Developed for the Social Impact Assessment of the Inshore/Offshore Amendment Proposal. Prepared for the North Pacific Fishery Management Fishery Council, Anchorage, AK.

------- 1994a. Supplemental Social Impact Assessment of the North Pacific Fishery Management Council Specified License Limitations Options for the North Pacific Groundfish and Crab Fisheries. Prepared for the North Pacific Fishery Management Council, Anchorage, AK.

------- 1994b. Sector Description and Preliminary Social Impact Assessment of the North Pacific Fishery Management Council Regulatory Changes in the Groundfish and Crab Fisheries of the Gulf of Alaska and Bering Sea/Aleutian Islands. Prepared for the North Pacific Fishery Management Council, Anchorage, AK.

------- 1998. Inshore/Offshore-III Social Impact Assessment. Prepared for the North Pacific Fishery Management Council, Anchorage, AK

------- Ongoing. Benefits and Burdens of OCS Deep Water Activities on Selected Communities and Local Public Institutions. NLS No. GM-98-10, USDOI/MMS Contract No. 30899.

Ingstad, H. 1954. Nunamiut: Among Alaska's Inland Eskimos. New York, NY: W.W. Norton & Company, Inc.

Intergovernmental Panel on Climate Change (IPCC). 2001a. Summary for Policymakers. A Report of Working Group I of the Intergovernmental Panel on Climate Change, Eighth Session of the IPCC Working Group I, Shanghai, China, January 2001.

------- 2001b. Summary for Policymakers. Climate Change 2001: Impacts, Adaptation, and Vulnerability. A Report of Working Group II of the Intergovernmental Panel on Climate Change, Sixth Session of the IPCC Working Group II, Geneva, Switzerland, February 2001.

Intergovernmental Panel on Climate Change (IPCC). 2001c. Summary for Policymakers. The Intergovernmental Panel on Climate Change Work Group III Third Assessment Report, Sixth Session of the IPCC Working Group III, Accra, Ghana, March, 2001.

International Marine. 2000a. Tidal Current Tables: Pacific Coast of North America and Asia. Camden, ME; New York, NY; San Francisco, CA; Washington, DC;London, England; Tokyo, Japan; International Marine/McGraw-Hill.

------- 2000b. Tide Tables: Pacific Coast of North America and Asia. Camden, ME; New York, NY; San Francisco, CA; Washington, DC; London, England; and Tokyo, Japan; International Marine/McGraw-Hill.

International Whaling Commission. 1991. International Whaling Commission Report. Rep. Int. Whal. Comm. 41:1-2.

------- 1995. Report of the Scientific Committee. Rep. Int. Whal. Comm. 45:53-95.

------- 1996. Report of the Scientific Committee. Rep. Int. Whal. Comm. 46:51-97.

Irons, D.B., S.J. Kendall, W.P. Erickson, L.L. McDonald, and B.K. Lance. 2000. Nine Years After the *Exxon Valdez* Oil Spill: Effects on Marine Bird Populations in Prince William Sound, Alaska. Condor 104:723-737.

Isleib, M.E., and B. Kessel. 1973. Birds of the North Gulf Coast-Prince William Sound Region, Alaska. Biological Papers of the University of Alaska, Fairbanks, AK. 149 pp.

Jacobs Engineering Group, 1989. Air Quality Impact of Proposed OCS Lease Sale No. 95. Prepared for USDOI/MMS. Jacobs Engineering Group, Inc., June 1989 (unpublished).

Jacobson, E.R. 1991. An Update on Green Turtle Fibropapilloma. Research Plan for Marine Turtle Fibropapilloma. NOAA-TM-NMFS-SWFSC-156:71-73.

James, F.C. 1992. St. Andrews Beach Mouse. *In:* Rare and Endangered Biota of Florida. Volume 1: Mammals. Humphrey, S.R., (ed.). Tallahassee, FL: University Presses of Florida. 392pp.

Jefferson, T.A. 1995. Distribution, Abundance, and Some Aspects of the Biology of Cetaceans in the Offshore Gulf of Mexico. Ph.D. Dissertation. College Station, TX: Texas A&M University, 107 pp.

Jefferson, T.A., and A.J. Schiro. 1997. Distributions of Cetaceans in the Offshore Gulf of Mexico. Mammal Rev. 27(1):27-50.

Jefferson, T.A., S. Leatherwood, L.K.M. Shoda, and R.L. Pitman. 1992. A Field Guide for Aerial and Shipboard Observers. College Station, TX: Texas A&M University Printing Center. 92 pp.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO Species Identification Guide, Marine Mammals of the World. Rome, Italy: Food and Agriculture Organization of the United Nations. 320 pp.

Jensen, K.C. 1990. Responses of Molting Pacific Black Brant to Experimental Aircraft Disturbance in the Teshekpuk Lake Special Area, Alaska. College Station, TX: Texas A&M University. 72 pp.

Johannessen, O.M., M. Miles, and E. Bjorgo. 1995. The Arctic's Shrinking Sea Ice. Nature 376:126-127.

Johnsgard, P.A. 1983. Cranes of the World. Bloomington, IN: Indiana University Press. 257 pp.

------- 1990. Hawks, Eagles, and Falcons of North America; Biology and Natural History. Washington, DC: Smithsonian Institute Press. 403 pp.

Johnson, A.G., W.E. Fable, Jr., C.B. Grimes, L. Trent, and J.V. Perez. 1994. Evidence for Distinct Stocks of King Mackerel, *Scomberomorus cavalla*, in the Gulf of Mexico. Fish. Bull. 92:91-101.

Johnson, B.W. 1977. The Effects of Human Disturbance on a Population of Harbor Seals. *In:* Environmental Assessment for the Alaskan Continental Shelf, Vol. 1. Annual Report. Juneau, AK: BLM/NOAA, OCSEAP.

Johnson, C.B., M.T. Jorgenson, R.M. Burgess, B.E. Lawhead, J.R. Rose, and A.A. Stickney. 1996. Wildlife Studies on the Colville River Delta, Alaska, 1995. Fourth Annual Report Prepared for ARCO Alaska, Inc. Fairbanks, AK: Alaska Biological Research, Inc. 144 pp.

Johnson, C.B., B.E. Lawhead, J.R. Rose, M.S. Smith, A.A. Stickney, and A.M. Wildman. 1998. Wildlife Studies on the Colville River Delta, Alaska, 1997. Sixth Annual Report Prepared for ARCO Alaska, Inc. Fairbanks, AK: Alaska Biological Research, Inc. 144 pp.

Johnson, J.F.C. (ed.). 1984. Chugach Legends and Photographs of the Chugach Region. Anchorage, AK: Chugach Alaska Corporation.

Johnson, J.H., and A.A. Wolman. 1984. The Humpback Whale (*Megaptera novaeangliae*). Marine Fisheries Review 46:30-37.

Johnson, M.L., C.H. Fiscus, B.T. Ostenson, and M.L. Barbour. 1966. Marine Mammals, pp. 877-924. *In:* Environment of the Cape Thompson Region, Alaska. Wilimovsky, N.J., and J.N. Wolfe (eds.). Oak Ridge, TN: U.S. Atomic Energy Comm.

Johnson, S.R. 1994. The Status of Lesser Snow Geese in the Sagavanirktok River Delta Area, Alaska: 1980-1993. Prepared for BP Exploration (Alaska) Inc., Anchorage, Alaska. Anchorage, AK: LGL Alaska Research Associates, Inc. 42 pp.

------- 2000 Pacific Eider. *In:* Natural History of An Arctic Oil Field: Development and the Biota. Truett, J.C., and S.R. Johnson (eds.). San Diego, CA: Academic Press. 408 pp.

Johnson, S.R., J.J. Burns, C.I. Malme, and R.A. Davis. 1989. Synthesis of Information on the Effects of Noise and Disturbance on Major Haulout Concentrations of Bering Sea Pinnipeds. LGL Rep. for USDOI/MMS, Alaskan Outer Continental Shelf Region, Anchorage, AK. LGL Rep. No. TA 828.

Johnson, S.R., and D.R. Herter. 1989. The Birds of the Beaufort Sea. Anchorage, AK: BP Exploration (Alaska) Inc. 372 pp.

Johnson, S.R., and L.E. Noel. 1996. The Status of Snow Geese in the Sagavanirktok River Delta, Alaska: 1995 Monitoring Program. Prepared for BP Exploration (Alaska) Inc., Anchorage, AK. LGL Limited Environmental Research Associates and LGL Alaska Research Associates, Inc. 19 pp. + apps.

Johnson, S.R., P.F. Wainwright, and D.A Wiggins. 1991. Marine Bird Use of the Kasegaluk Lagoon Area, Chukchi Sea, Alaska. Part 1: Draft Report of 1989-1990. Prepared for USDOI/MMS, Herndon, VA. Anchorage, AK: LGL Alaska Research Associates, Inc., and Fairbanks, AK: Alaska Department of Fish and Game. 228 pp.

Johnson, S.R., D.A. Wiggins, and P.F. Wainwright. 1992. Use of Kasegaluk Lagoon, Chukchi Sea, Alaska, by Marine Birds and Mammals, II: Marine Birds, pp 57-510. *In:* Use of Kasegaluk Lagoon, Chukchi Sea, Alaska, by Marine Birds and Mammals. OCS Study MMS 92-0028. Report for the USDOI/MMS, Herndon, VA. LGL Alaska Research Associates, Inc. and Alaska Department of Fish and Game.

Johnson, S.R., R.J. Rodrigues, and R.H. Pollard. 1993a. Video Analysis of Predators and Nesting Snow Geese on Howe Island, Sagavanirktok River Delta, Alaska, 1992. Report to BP Exploration (Alaska) Inc., by LGL Alaska Research Associates, Inc. 9 pp.

Johnson, S.R., D. Wiggins, and R.J. Rodrigues. 1993b. Use of Gravel Causeways by Nesting Common Eiders, Beaufort Sea, Alaska, 1992. Report to BP Exploration (Alaska) Inc., by LGL Alaska Research Associates, Inc. 27 pp.

Johnston, R.C., and B. Cain. 1981. Marine Seismic Energy Sources: Acoustic Performance Comparison. Manuscript presented at 102nd Meet. Acoust. Soc. Am., Miami Beach, FL, Dec. 1981. 35 pp.

Jorgensen, J.G. 1990. Oil Age Eskimos. Berkeley, CA: University of California Press.

Juday, G.P. 1987. Climate Change and Its Impacts in Alaska. American Association for the Advancement of Science. The 49th Annual Arctic Division Science Conference Proceedings, University of Alaska Fairbanks, Fairbanks, AK.

Jurek, R.M. 1994. California Least Tern, *Sterna antillarum browni*. State of California, Resources Agency, Department of Fish and Game. Information Leaflet. 3 pp.

Kajimura, H. 1984. Opportunistic Feeding of the Northern Fur Seal, *Callorhinus ursinus*, in the Eastern North Pacific Ocean and Eastern Bering Sea. NOAA Tech. Rep. NMFS SSRF-779. Seattle, WA: Alaska Fisheries Research Center.

Kajimura, H., and T.R. Loughlin. 1988. Marine Mammals in the Oceanic Food Web of the Eastern Subarctic Pacific. Bulletin of Ocean Resources Institute 26:187-223.

Kale, H.W., and D.S. Maehr. 1990. Florida's Birds: A Handbook and Reference. Pineapple Press. 288 pp.

Kanter, R.G. 1980. Biogeographic Patterns in Mussel Community Distribution from the Southern California Bight. *In:* The California Islands: Proceedings of a Multidisciplinary Symposium. Power, D.M. (ed.). Santa Barbara, CA: Santa Barbara Museum of Natural History. pp. 341-355.

Kapel, F.O. 1979. Exploitation of Large Whales in West Greenland in the Twentieth Century. Rep. of Int. Whal. Comm. 29:197-214.

Karinen, J.F., and S.D. Rice. 1974. Effects of Prudhoe Bay Crude Oil on Molting Tanner Crabs, *Chinoecetes bairdi*. USDOC/NMFS. Marine Fisheries Review 36(7):31-37.

Kattenberg, A., F. Giorgi, H. Grassl, G.A. Meehl, J.F.B. Mitchell, R.J. Stouffer, T. Tokioka, A. Weaver, and T.M.L. Wigley. 1996. Climate Models Projections of Future Climate, pp. 285-357. *In:* Climate Change 1995: The Science of Climate Change. Houghton, J.T., L.G.M. Filho, B.A. Callander, N. Harris, A. Kattenberg, and K. Maskell (eds.). Cambridge, UK: Cambridge University Press.

Kato, H., and T. Miyashita. 1998. Current Status of North Pacific Sperm Whales and Its Preliminary Abundance Estimates. Unpublished Report Submitted to International Whaling Commission. 6 pp.

Kawamura, A. 1980. A Review of Food of Balaenopterid Whales. Scientific Report of the Whales Research Institute 32:155-197.

Kelly, B.P. 1988b. Bearded Seal, *Erignathus barbatrus*, pp. 77-94. *In:* Selected Marine Mammals of Alaska. Species Accounts with Research and Management Recommendations. Lentfer. J.W. (ed.). Washington, DC: Marine Mammal Commission.

Kelly, F.J. 1991. Chapter 10, Physical Oceanography/Water Mass Characterization. *In:* Mississippi-Alabama Continental Shelf Ecosystem Study: Data Summary and Synthesis, Volume II. Technical Narrative. OCS Study MMS 91-0063. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 862 pp.

Kelso, D. 1981. Technical Overview of the State's Subsistence Program. Technical Paper Series, Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

------- 1982. Subsistence Use of Fish and Game Resources in Alaska: Considerations in Forming Effective Management Policies. Technical Paper Series. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Kennicutt, M.C. (ed.). 1995. Gulf of Mexico Offshore Operations Monitoring Experiment, Phase I: Sublethal Responses to Contaminant Exposure. Final Report. OCS Study MMS 95-0045. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 709 pp.

Kennicutt, M.C., J.M. Brooks, E.L. Atlas, and C.S. Giam. 1988. Organic Compounds of Environmental Concern in the Gulf of Mexico: A Review. Aquatic Toxicology 11:191-212.

Kenyon, K.W., and D.W. Rice. 1961. Abundance and Distribution of the Steller Sea Lion. Journal of Mammology 42:223-234.

Kertell, K. 1991. Disappearance of the Steller's Eider from the Yukon-Kuskokwim Delta, Alaska. Arctic 44:177-187.

Kessel, B. 1989. Birds of the Seward Peninsula, Alaska: Their Biogeography, Seasonality, and Natural History. Univ. of Alaska, Fairbanks Press. 330 pp.

Kessel, B., and D.D. Gibson. 1978. Status and Distribution of Alaska Birds. Los Angeles, CA: Cooper Ornithological Society. 100 pp.

Ketten, D.R. 1995. Estimates of Blast Injury and Acoustic Trauma Zones for Marine Mammals from Underwater Explosions, pp. 391-407. *In:* Sensory Systems of Aquatic Mammals. Kastelein, R.A., J.A. Thomas, and P.E. Nachtigall (eds.). Woerden, The Netherlands: De Spil Publishers.

------- 1998. Marine Mammal Auditory Systems: A Summary of Audiometric and Anatomical Data and Its Implications for Underwater Acoustic Impacts. NOAA Technical Memorandum NMFS-SWFSC-256

Kevin Waring Associates. 1988. A Demographic and Employment Analysis of Selected Alaska Rural Communities: Volume II (Northern Communities). Prepared for the USDOI/MMS/Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 137.

------- 1992. Hope Basin Socioeconomic Baseline Study. Prepared for the USDOI/MMS, Alaska OCS Region, Alaska OCS Social and Economic Studies Program, Anchorage, AK. Technical Report No. 148. 3 volumes.

Kiliaan, H.P.L., and I. Stirling. 1978. Observations on Overwintering Walruses in the Eastern Canadian High Arctic. J. Mammal. 59:197-200.

King, William E. 2001a. Economic Analysis for the OCS 5-Year Program 2002-2007: Theory and Methodology. OCS Report 2001-088. Herndon, VA: USDOI/MMS. September 28, 2001.

------- 2001b. Energy Alternatives and the Environment. OCS Report 2001-096. Herndon, VA: USDOI/MMS. November 2001.

Kingsford, M.J. 1996. Influence of Pollutants and Oceanography on Abundance and Deformities of Wild Fish Larvae, pp 235-256. *In:* Detecting Ecological Impacts, Concepts and Applications in Coastal Habitats. Schmitt, R.J., and C.W. Osenberg (eds.). San Diego, CA: Academic Press.

Kinney, P.J., J. Groves, and D.K. Button. 1970. Cook Inlet Environmental Data. R/V Acona Cruise 065, 21-28 May 1968.

Klausner, S.Z., and E.F. Foulks. 1982. Eskimo Capitalists: Oil, Politics, and Alcohol. Totowa, NJ: Allanheld, Osmun and Company.

Klima, E.F., G.R. Gitschlag, and M.L. Renaud. 1988. Impacts of the Explosive Removal of Offshore Petroleum Platforms on Sea Turtles and Dolphins. Mar. Fish. Rev. 50(3):33-42.

Knap, A.H., S.C. Wyers, R.E. Dodge, T.D. Sleeter, H.R. Frith, S.R. Smith, and C.B. Cook. 1985. The Effects of Chemically and Physically Dispersed Oil on the Brain Coral, *Diploria strigosa* (Dana), pp. 547-551. *In:* Proceedings 1985 Oil Spill Conference, Los Angeles, CA. American Petroleum Institute Publ. No. 4385.

Koski, W.R., R.A.Davis, G.W. Miller, and E.D. Withrow. 1993. Reproduction, p. 239-274. *In*: The Bowhead Whale,. Burns, J.J., J.J.Montague, and C.J. Cowles (eds.). Soc. Mar. Mamm. Spec. Publ. 2.

Kosygin, G.M. 1966. Some Data on the Feeding of the Bearded Seal in the Bering Sea During the Spring-Summer Period, pp. 78-82. *In:* Soviet Research on Marine Mammals of the Far East. Izv. TINRO 58:153-157. Panin, K.I. (ed.). Translated from Russian by USDOI, Bur. Commer. Fish., Seattle, WA

Krebs, J.R. 1978. Colonial Nesting in Birds, with Special Reference to the Ciconiiformes, pp. 299-314. *In:* Wading Birds. Research Report No. 7. Sprunt IV, A., J.C. Ogden, and S. Winckler (eds.). New York: National Audubon Society.

Krost, P., M. Bernhard, F. Werner, and W. Hukriede. 1990 Otter Trawl Tracks in Kiel Bay (Western Baltic) Mapped by Side-Scan Sonar. Meereforschung 32: 344-353.

Kruse, J.A. 1982. Subsistence and the North Slope Inupiat: The Effects of Energy Development. Man in the Arctic Monograph No. 4, ISER Report Series No. 56. Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

------- 1983. A Description of the Socioeconomics of the North Slope, Appendix: Transcripts of Selected Inupiat Interviews. Prepared for the USDOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 85A. Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

------- 1991a. Alaska Inupiat Subsistence and Wage Employment Patterns: Understanding Individual Choice. Human Organization. Vol. 50. No. 4.

Kruse, J.A., M. Baring-Gould, W. Schneider, J. Gross, G. Knapp, and G. Sherrod. 1983a. A Description of the Socioeconomics of the North Slope. Prepared for the USDOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 85. Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

Kruse, J., J. Klienfeld, and R. Travis. 1981. Energy Development and the North Slope Inupiat: Quantitative Analysis of Social and Economic Change. Man in the Arctic Monograph No. 1, ISER Report Series No. 49. Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

Kruse, S. 1991b. The Interactions Between Killer Whales and Boats in Johnstone Strait, B.C., pp. 148-159. *In:* Dolphin Societies/Discoveries and Puzzles. Pryor, K., and K.S. Norris (eds.). Berkeley, CA: Univ. Calif. Press. 397 pp.

Kushlan, J.A. 1978. Feeding Ecology of Wading Birds, pp. 249-298. *In:* Wading Birds. Research Report No. 7. Sprunt IV, A., J.C. Ogden, and S. Winckler (eds.). New York: National Audubon Society.

Lachenbruch, A.H., and B.V. Marshall. 1986. Changing Climate-Geothermal Evidence from Permafrost in the Alaskan Arctic. Science 234:689-696.

Lackman, G.M. 1988. Evaluation of the Rosby Radius for Offshore-Directed Flow Near a Mountainous Coast, pp. 1-6. *In:* Proceedings of the Fourth Conference on Meteorology and Oceanography of the Coastal Zone, Anaheim, CA, 3-5 January 1988. Boston, MA: American Meteorological Society.

Lafferty, K.D., and A.M. Kuris. 1993. Mass Mortality of Abalone, *Haliotis cracherodii,* on the California Channel Islands: Tests of Epidemiological Hypotheses. Marine Ecology Progress Series 93:239-248.

Laing, K., and R. Platte. 1994. Ledyard and Peard Bays Spectacled Eider Surveys. Trip Report, 18-19 August 1994. Anchorage, AK: USDOI/FWS, Migratory Bird Management. 11 pp.

Lander, R.H., and H. Kajimura. 1982. Status of Northern Fur Seals. *In:* Mammals in the Seas. FAO Fish Ser. 4(5):319-345.

Langdon, S., and R. Worl. 1981. Distribution and Exchange of Subsistence Resources in Alaska. Prepared for the U.S. Department of Fish and Game. Anchorage, AK: University of Alaska, Arctic Environmental Information and Data Center.

Larned, W.W., and G. Balogh. 1997. Eider Breeding Population Survey Arctic Coastal Plain, Alaska, 1992-96. Unpubl. Rept. Anchorage, AK: USDOI/FWS, Migratory Bird Management.

Larned, W.W., and B. McCaffery. 1993. Norton Sound Eider Survey, August 30-31, 1993. Unpubl. Rept. Anchorage, AK: USDOI/FWS, Migratory Bird Management. 11 pp.

Larned, W.W., G. Balogh, and M.R. Peterson. 1995. Distribution and Abundance of Spectacled Eiders (*Somateria fischeri*) in Ledyard Bay, Alaska. Unpubl. Rept. Anchorage, AK: USDOI/FWS, Migratory Bird Management.

Larned, W.W., T.J. Tiplady, R. Platte, and R Stehn. 1999. Eider Breeding Bird Population Survey Arctic Coastal Plain, Alaska, 1997-1998. Unpubl. Report, 28 Jan 1999. Anchorage, AK: USDOI/FWS, Migratory Bird Management. 22 pp.

Larned, W.W. and D. Zwiefelhofer. 2001. Distribution and Abundance of Steller's Eiders *(Polysticta stelleri*) in Kodiak Archipelago, Alaska, Winter 2001. USDOI/FWS. Unpublished Report. 18 pp.

Larntz, K. and R. Garrott. 1993. Analysis of 1991 Bycatch of Selected Mammal Species in the North Pacific Neon Squid Driftnet Fishery. Final Contract Report Prepared for the USDOC/NMFS. 68 pp. + apps.

Larsen, D.N. 1984. Feeding Habits of River Otters in Coastal Southeastern Alaska. J. Wildl. Manage. 48:1,446-1,452.

Larson, E. 1998. An Overview of Alaska's Natural Assets. Prepared for the Alaska Conservation Alliance . Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

Laska, S., V. Baxter, R. Seydlitz, R. Thayer, S. Brabant, and C. Forsyth. 1993. Impact of Offshore Petroleum Exploration and Production on the Social Institutions of Coastal Louisiana. Prepared by the Environmental Social Science Research Institute, University of New Orleans. OCS Study MMS 93-0007. New Orelans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Lawhead, B.E., and R.D. Cameron. 1988. Caribou Distribution on the Calving Grounds of the Central Arctic Herd, 1987. Unpublished Report Sponsored by ARCO Alaska, Inc., Anchorage, AK.

Leatherwood, S., F.T. Awbrey, and J.A. Thomas. 1982. Minke Whale Response to a Transiting Survey Vessel. Rep. of Int. Whal. Comm. 32:795-802.

Leatherwood, S., and R.R. Reeves. 1983. The Sierra Club Handbook of Whales and Dolphins. San Francisco CA: Sierra Club Books. 302 pp.

Ledley, T.S., E.T. Sundquist, S.E. Schwartz, D.K. Hall, J.D. Fellows, and T.L. Killeen. 1999. Climate Change and Greenhouse Gases. EOS 39:453-458.

Lee, T. 1993. Summary of Cetacean Survey Data Collected Between the Years of 1974 and 1985. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-181. 184pp.

Lee, D.S., and M. Socci. 1989. Potential Impact of Oil Spills on Seabirds and Selected Other Oceanic Vertebrates Off the North Carolina Coast. NCSM Biological Survey Rept. No. 90-1. Raleigh, NC: North Carolina State Museum of Natural Sciences.

Lees, D.C., J.P. Houghton, D.E. Erickson, W.B. Driskell, and D.E. Boettcher. 1986. Ecological Studies of Inter-Tidal and Shallow Sub-Tidal Habitats in Lower Cook Inlet, Alaska. *In:* Outer Continental Shelf Environmental Assessment Program, Final Reports of Principal Investigators 44. OCS Study MMS 86-0061. Anchorage, AK: USDOC/NOAA and USDOI/MMS, Alaska OCS Region. 436 pp.

Leighton, F.A. 1990. The Toxicity of Petroleum Oils to Birds: An Overview. Oil Symposium, Herndon, VA.

Lenart, E.A. 1999. Central and Eastern Arctic Slope, pp. 30-43. *In:* Muskox. Fed. Aid Wildl. Rest. Survey-Inventory Manage. Rep. Grants W-24-5 and W-27-1, Study 16.0. Hicks, M.V. (ed.). Juneau, AK: Alaska Dep. Fish and Game. 43 pp.

Lentfer, J.W. 1990. Workshop on Measures to Assess and Mitigate the Adverse Effects of Arctic Oil and Gas Activities on Polar Bears. 24-25 January 1989, Anchorage, AK. Prepared for the Marine Mammal Commission, Washington, DC. 39 pp.

Lentfer, J.W., and R.J. Hensel. 1980. Alaskan Polar Bear Denning. Int. Conf. Bear Res. Manag. 3:101-108.

Lesage, V., C. Barrette, M.C.S. Kingsley, and B. Sjare. 1999. The Effect of Vessel Noise on the Vocal Behavior of Belugas in the St. Lawrence River Estuary, Canada. Marine Mammal Science 15(1):65-84.

Lewis, C.E. 1978. The Subsistence Lifestyle in Alaska. The School of Agriculture and Land Resources Management Seminar Series, Special Publication 1. Fairbanks, AK: University of Alaska.

Lewis, J.P., R. Sellers, S. Miller, D. McAllister, and D. Calkins. 1991. Assessment of the *Exxon Valdez* Oil Spill on Brown Bears on the Alaska Peninsula. Terrestrial Mammal Study Number Four. Final Report. 21 pp. + apps.

LGL Alaska Research Associates, Inc., Woodward Clyde Consultants, Lazy Mountain Research, Applied Sociocultural Research, Jack Lobdell and Associates, and Northern Economics, Inc. 1998. Point Thomson Area Cluster Development Project, Draft Environmental Assessment. BP Exploration, Alaska.

LGL and Greeneridge. 1986. Reactions of Beluga Whales and Narwhals to Ship Traffic and Ice-Breaking Along Ice Edges in the Eastern Canadian High Arctic: 1982-1984. Environ. Stud. 37. Ottawa, Ont: Indian & Northern Affairs Canada. 301 pp.

Link, M.R., T.L. Olson, and M.T. Williams. 1999. Ringed Seal Distribution and Abundance Near Potential Oil Development Sites in the Central Alaskan Beaufort Sea, Spring 1998. LGL Rep. P-430. Rep. for BP Explor. (Alaska) Inc., Anchorage, AK. Anchorage, AK: LGL Alaska Res. Assoc. Inc. 58 pp.

Lissauer, I.M., L.E. Hachmeister, and B.J. Morson. 1984. Atlas of the Beaufort Sea: Final Report, October, 1984. Prepared for USDOT/USCG, Office of Research and Development, Washington, DC. NTIS Report No. CG-D-33-84.

Littler, M.M. 1980. Overview of the Rocky Intertidal Systems of Southern California. *In*: The California Islands: Proceedings of a Multidisciplinary Symposium. Power, D.M. (ed.). Santa Barbara, CA: Haagen Printing. pp. 265-306.

Lindeman, K.C., R. Pugliese, G.T. Waugh, and J.S. Ault. 2000. Developmental Patterns Within a Multispecies Reef Fishery: Management Applications for Essential Fish Habitats and Protected Areas. Bull. Mar. Sci. 66(3):929-956.

Ljungblad, D.K., P.O. Thompson, and S.E. Moore. 1982a. Underwater Sounds Recorded from Migrating Bowhead Whales, *Balaena mysticetus*, in 1979. J. Acoust. Soc. Am. 71(2):477-482.

Ljungblad, D.K., S.E. Moore, D.R. Van Schoik, and C.S. Winchell. 1982b. Aerial Surveys of Endangered Whales in the Beaufort, Chukchi, and Northern Bering Seas. NOSC TD 486 San Diego, CA: U.S. Naval Ocean Systems Cent. NTIS AD-A126542/0. 406 pp.

Ljungblad, D.K., B. Würsig, R.R. Reeves, J.T. Clarke, and C.R. Greene Jr. 1984. Fall 1983 Beaufort Sea Seismic Monitoring and Bowhead Whale Behavior Studies. Interagency Agreem. 14-12-0001-29064. Anchorage, AK: USDOI/MMS. NTIS PB86-196912. 180 pp.

Ljungblad, D.K., B. Würsig, S.L.Swartz, and J.M. Keene. 1988. Observations on the Behavioral Responses of Bowhead Whales (*Balaena mysticetus*) to Active Geophysical Vessels in the Alaskan Beaufort Sea. Arctic 41(3):183-194.

Loescher, R. 1999. Native Subsistence Rights - Where We Stand Now in State and National Politics? Vol. 1999. Sealaska Corporation.

Lokkeborg, S. 1991. Effects of Geophysical Survey on Catching Success in Longline Fishing. ICES CM 40:1-9.

Lokkeborg, S., and A. Soldal. 1993. The Influence of Seismic Exploration with Airguns on Cod (*Gadus morhua*) Behavior and Catch Rates. ICES Marine Science Symposium 196:62-67.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder. 1995 Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environ. Management 19:81-97.

Longwell, A.C. 1977. A Genetic Look at Fish Eggs and Oil. Oceanus 20(4):46-58.

Lonner, T.D. 1980. Subsistence and Economic System in Alaska: Theoretical and Policy Implications. Technical Paper Series. Anchorage, AK: Alaska Department of Fish and Game, Division of Subsistence.

------- 1994. Abundance and Distribution of Harbor Seals (*Phoca vitulina richardsii*) in Southeast Alaska During 1993.. Annual Report, NMFS, MMPA Population Assessment Program, Seattle, WA: USDOC/NOAA/NMFS, National Marine Mammal Lab. 30pp.

Loughlin, T.R. 1997. Using the Phylogeographic Method to Identify Steller Sea Lion Stocks, pp. 329-341. *In:* Molecular Genetics of Marine Mammals, Incorporating the Proceedings of a Workshop on the Analysis of Genetic Data to Address Problems of Stock Identity as Related to Management of Marine Mammals. Dizon, A., S.J. Chivers, and W. Perrin (eds.). Spec. Pub. No. 3 of the Society of Marine Mammalogy, Lawrence, KS.

Loughlin, T.R., D.J. Rugh, and C.H. Ficus. 1984. Northern Sea Lion Distribution and Abundance: 1956-1980. Journal of Wildlife Management 48:729-740.

Loughlin, T.R., G.A. Antonelis, J.D. Baker, A.E. York, C.W. Fowler, R.L. DeLong, and H.W.Braham. 1994. Status of the Northern Fur Seal Population in the United States During 1992. *In:* Fur Seal; Investigations 1992. Sinclair, E.H. (ed.). NOAA Tech. Mem. NMFS-AFSC-45-28. Seattle, WA: National Marine Mammal Laboratory.

Loughlin, T.R., B.E. Ballachey, and B.A. Wright. 1996. Overview of Studies to Determine Injury Caused by the *Exxon Valdez* Oil Spill to Marine Mammals, pp. 798-808. *In:* Proceedings of the *Exxon Valdez* Oil Spill Symposium. Rice, S.D., R.B. Spies, D.A. Wolfe, and B.A. Wright (eds.). Bethesda, MD: American Fisheries Society Symposium 18.

Louis Berger and Associates, Inc. 1983. Social Indicators for OCS Impact Monitoring. Cook, P., J. Jorgenson, D. Kelso, S. McNabb, and R. Weisz (Principal Investigators). A Final Report for USDOI/MMS, Alaska Region, Social and Economics Studies Program. Technical Report No. 77. Vol. 1, Technical Report; Vol. II, Technical Appendices; Vol. III, Baseline Ethnographic Description of NANA and Aleutian-Pribilof Regions.

Louisiana Department of Wildlife and Fisheries. 1992. A Fisheries Management Plan for Louisiana Penaid Shrimp Fishery: Summary and Action Items. November 1992, Baton Rouge, LA. 16 pp.

Louisiana State University, Coastal Marine Institute. Ongoing. Socioeconomic Baseline Gulf of Mexico Region - Phase I (CMI/TO 19913-G). New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

------- Ongoing. Job Loss and Reemployment of Marginal Groups in the GOMR (CMI/TO 19954). New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

------- Ongoing. Labor Migration and the Deepwater Oil Industry (CMI/TO 19958). New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

------- Ongoing. The Effect of Depth and Location on the Composition of the Nekton Community Associated with Petroleum Platforms in the Northern Gulf of Mexico (GM-92-42-47).

Lovejoy, S.B. 1992. Sources and Quantities of Nutrients Entering the Gulf of Mexico From Surface Waters of the United States. Prepared for the USEPA, Gulf of Mexico Program, Nutrient Enrichment Subcommittee. EPA/800-R-92-002. September 1992. 49 pp. + app.

Lowery, G.H., Jr. 1955. Louisiana Birds. Baton Rouge, LA: Louisiana State University Press. 556 pp.

Lowry, L.F. 1984. The Spotted Sea (*Phoca largha*), pp. 1-11. *In:* Alaska Dep. Fish and Game Marine Mammal Species Accounts. Vol. 1. Juneau, AK.

Lowry, L.F., J.J. Burns, and R.R. Nelson. 1987. Polar Bear (*Ursus maritimus*) Predation on Belugas, *Delphinapterus leucas*, in the Bering and Chukchi Seas. Canadian Field Naturalist 101:141-146.

Lowry, L.F., and K.J. Frost. 1984. Foods and Feeding of Bowhead Whales in Western and Northern Alaska. Sci. Rep. Whales Res. Inst. 35:1-16.

Lowry, L.F., K.J. Frost, and J.J. Burns. 1981. Trophic Relationships Among Ice-Inhabiting Phocid Seals and Functionally Related Marine Mammals in the Bering Sea. USDOC/NOAA, OCSEAP Environ. Assess. Alaskan Continental Shelf, Final Rep., Biol.Stud. 11:97-173.

Lowry, L.F., K.J. Frost, D.G. Calkins, G.L. Swartzman, and S. Hills. 1982. Feeding Habits, Food Requirements, and Status of Bering Sea Marine Mammals. Final Report to North Pacific Fisheries Management Council, Anchorage Alaska. 154 pp.

Lowry, M.S., P. Boveng, R.L. DeLong, C.W. Oliver, B.S. Stewart, H. DeAnda, and J. Barlow. 1992. Status of the California Sea Lion (*Zalophus californianus californianus*) Population in 1992. Administrative Report LJ-92-32. La Jolla, CA: USDOC/NMFS Southwest Fisheries Science Center. 34 pp.

Lowry, L.F., K.J. Frost, R. Davis, R.S. Suydam, and D.P. DeMaster. 1994. Movements and Behavior of Satellite-Tagged Spotted Seals (*Phoca largha*) in the Bering and Chukchi Seas. USDOC/NOAA Tech. Memo. NMF-AFSC-38. 71pp.

Lowry, L.F., and G. Sheffield. 2002. Stomach Contents of Bowhead Whales Harvested in the Alaskan Beaufort Sea. *In:* Bowhead Whale Feeding in the Eastern Alaskan Beaufort Sea: Update of Scientitic and Traditional Information (Draft Report). LGL Report TA 2196-6. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Ludwick, J.C., and W.R. Walton. 1957. Shelf-Edge Calcareous Prominences in the Northeastern Gulf of Mexico. AAPG Bull. 41:2,054-2,101.

Lunel, T. 1995. Dispersant Effectiveness at Sea, pp. 147-155. *In:* Proceedings of the 1995 International Oil Spill Conference, Achieving and Maintaining Preparedness. Washington, DC: American Petroleum Institute.

Lunn, N.J., and G.B. Stenhouse. 1985. An Observation of Possible Cannibalism by Polar Bears (*Ursus maritimus*). Canadian Journal of Zoology 63:1516-1517.

Lutcavage, M.E., P.L. Lutz, G.D. Bossart, and D.M. Hudson. 1995. Physiologic and Clinicopathologic Effects of Crude Oil on Loggerhead Turtles. Arch. Environ. Contam. Toxicol. 28:417-422.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human Impacts on Sea Turtle Survival, pp. 387-410. *In:* The Biology of Sea Turtles. Lutz, P.L., and J.A. Musick (eds.). Boca Raton, FL: CRC Press. 432 pp.

Luton, H. H. 1985. Effects of Renewable Resource Harvest Disruptions on Socioeconomic and Sociocultural Systems: Wainwright, Alaska. Prepared for the DOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 91.

Luton, H., R.E. Cluck. 2000. Applied Social Science in MMS: A Framework for Decisionmaking. New Orleans, LA: USDOI/MMS.

Lutz, P.L., M. Lutcavage. 1987. Effects of Oil on the Physiology of Marine Turtles, pp. 173-174. *In:* Proceedings, Seventh Annual Gulf of Mexico Information Transfer Meeting, OCS Study MMS 87-0058. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Regional Office.

------- 1989. The Effects of Petroleum on Sea Turtles: Applicability to Kemp's Ridley. *In*: Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Caillouet, C.W., Jr., and A.M. Laundry, Jr. (compilers). TAMU-SG-89-105.

Lycozkowski-Schultz, J. 1999. Early Life Stages of Fishes in the Vicinity of DeSoto Canyon, pp. 293-299. *In:* Proceedings: Seventeenth Annual Gulf of Mexico Information Transfer Meeting, December 1997. McKay, M. and J. Nides (eds.). OCS Study MMS 99-0042. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Lyons, W.G., and S.B. Collard. 1974. Benthic Invertebrate Communities of the Eastern Gulf of Mexico. Contract No. 233, FDNR/MRL.

MacDonald, I.R. 1992. Sea-Floor Brine Pools Affect Behavior, Mortality, and Preservation of Fishes in the Gulf of Mexico: Lagerstätten in the Making? Palaios. 7:383-387.

------- 2000. Chapter 8: Seep Communities, pp. 209-230. *In:* Continental Shelf Associates, Inc., Deepwater Gulf of Mexico Environmental and Socioeconomic Data Search and Literature Synthesis. Volume I: Narrative Report. OCS Study MMS 2000-049. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

MacDonald, I.R., G.S. Boland, J.S. Baker, J.M. Brooks, M.C. Kennicutt II, and R.R. Bidigare. 1989. Gulf of Mexico Chemosynthetic Communities II: Spatial Distribution of Seep Organisms and Hydrocarbons at Bush Hill. Marine Biology 101:235-247.

MacDonald, I.R., N.L. Guinasso, Jr., J.M. Brooks, R. Sassen, S. Lee, and K.T. Scott. 1994. Gas Hydrates that Breach the Sea-Floor and Interact with the Water Column on the Continental Slope of the Gulf of Mexico. Geology 22:699-702.

Macdonald, K.B. 1977. Plant and Animal Communities of Pacific North American Salt Marshes, pp. 167-192. *In*: Wet Coastal Ecosystems. Ecosystems of the World. Chapman, V.J. (ed.). Amsterdam, Netherlands: Elsevier.

Macfarlane, J.A.F. 1981. Reactions of Whales to Boat Traffic in the Area of the Confluence of the Saguenay and St. Lawrence Rivers, Quebec. Manuscript. 50 pp.

Macpherson, A.H. 1969. The Dynamics of Canadian Arctic Fox Populations. Canadian Wildlife Service Report Service Report Series, No. 8. 52 pp.

Madge, S., and H. Burns. 1988. Waterfowl: An Identification Guide to the Ducks, Geese, and Swans of the World. Boston, MA: Houghton Mifflin. 298 pp.

Madsen, P.T., and B. Mohl. 2000. Sperm Whales (*Physeter catodon* L.) Do Not React to Sounds from Detonators. J. Acoust. Soc. Amer. 107(1):668-671.

Maffione, R.A. 2000. Deep Problems in Optically Shallow Waters. Backscatter 11:28-31.

Mager, A. 1985. Five-Year Status Reviews of Sea Turtles Listed Under the Endangered Species Act of 1973. St. Petersburg, FL: USDOC/NOAA/NMFS. 90 pp.

Mahlman, J.D. 1997. Uncertainties in Projections of Human-Caused Climate Warming. Science 278:1,416-1,417.

Maier, J.A., S.M. Murphy, R.G. White, and M.D. Smith. 1998. Responses of Caribou to Overflights by Low-Altitude Jet Aircraft. Journal Wildl. Manag. 62:752-766.

Malins, D.C., S.L. Chan, H.O. Hodgins, U. Varanasi, B.B. McCain, D.D. Weber, and D.W. Brown. 1981. Sublethal Effects of Petroleum Hydrocarbons and Trace Metals, Including Bio-Transformations as Reflected by Morphological, Chemical, Physiological, Pathological, and Behavioral Indices. Outer Continental Shelf Environmental Assessment Program, Research Unit #73, USDOI/BLM.

Malme, C.I., P.R. Miles, C.W. Clark, P. Tyack, and J.E. Bird. 1984. Investigations of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Migrating Gray Whale Behavior/Phase II: January 1984 Migration. BBN Rep. 5586. Report for USDOI/MMS, Anchorage, AK. NTIS PB86-218377. Cambridge, MA: Bolt Beranek & Newman Inc. Var. pag.

Malme, C.I., P.R. Miles, P. Tyack, C.W. Clark, and J.E. Bird. 1985. Investigation of the Potential Effects of Underwater Noise from Petroleum Industry Activities on Feeding Humpback Whale Behavior. BBN Rep. 5851; OCS Study MMS 85-0019. Report for USDOI/MMS, Anchorage, AK. NTIS PB86-218385. Cambridge, MA: BBN Labs Inc. Var. pgs.

Malme, C.I., P.R. Miles, G.W. Miller, W.J. Richardson, D.G. Roseneau, D.H. Thomson, and C.R. Greene, Jr. 1989. Analysis and Ranking of the Acoustic Disturbance Potential of Petroleum Industry Activities and Other Sources of Noise in the Environment of Marine Mammals in Alaska. BBN Rep. 6945; OCS Study MMS 89-0006. Rep. for USDOI/MMS, Anchorage, AK. NTIS PB90-188673. Cambridge, MA: BBN Systems & Technol. Corp. Var. pgs.

Mangels, K.F., and T. Gerrodete. 1994. Report of Cetacean Sightings During a Marine Mammal Survey in the Eastern Pacific Ocean and the Gulf of California Aboard the NOAA Ships *McArthur* and *David Starr Jordan,* July 28 – November 6, 1993. NOAA Technical Memorandum NOAA-TM-NMFS-SWFSC-221. 88pp.

Mann, M.E., R.S. Bradley, and M.K. Hughes. 1999. Northern Hemisphere Temperatures During the Past Millennium: Inferences, Uncertainties, and Limitations. Geophysical Research Letters 26:759-762.

Manzella, S.A., and J.A. Williams. 1992. The Distribution of Kemp's Ridley Sea Turtles (*Lepidocheyles kempi*) Along the Texas Coast: An Atlas. NOAA Tech. Report NMFS 110.

Marine Mammal Commission. 1999. 26th Annual Report to Congress 1998. Bethesda, MD: Marine Mammal Commission, Committee of Scientific Advisors on Marine Mammals.

------- 2000a. Changes in Arctic Sea Ice Over the Past 50 Years: Bridging the Knowledge Gap Between the Scientific Community and the Alaska Native Community. Marine Mammal Commission Workshop on the Impacts of Changes in Sea Ice and Other Environmental Parameters in the Arctic. 15-17 February 2000, Girdwood, AK.

------- 2000b. 27th Annual Report to Congress 1999. Bethesda, MD: Marine Mammal Commission, Committee of Scientific Advisors on Marine Mammals. 243 pp.

Marquette, W.M., and J.R. Bockstoce. 1980. Historical Shore-Based Catch of Bowhead Whales in the Bering, Chukchi, and Beaufort Seas. Mar. Fish. Rev. 42(9-10):5-19.

Marquez, M.R. 1990. FAO Species Catalogue. Vol 11: Sea Turtles of the World. An Annotated and Illustrated Catalogue of Sea Turtle Species Known to Date. FAO Fisheries Synopsis. No. 125, Vol.11. Rome, FAO. 81 pp.

Martin, R.G. 1978. Northern and Eastern Gulf of Mexico Continental Margin: Stratigraphic and Structural Framework, pp. 21-42. *In:* Framework, Facies, and Oil-trapping Characteristics of the Upper Continental Margin. Bouma, A.H., G.T. Moore, and J.M. Coleman (eds.). AAPG Studies in Geology 7.

Martin, R.G., and A.H. Bouma. 1978. Physiography of Gulf of Mexico, pp. 3-19. *In:* Framework, Facies, and Oil Trapping Characteristics of the Upper Continental Margin. Bouma, A.H., G.T.Moore, and J.M. Coleman (eds.). AAPG Studies in Geology 7.

------- 1982. Active Diapirism and Slope Steepening, Texas-Louisiana Slope, Northern Gulf of Mexico. Marine Geotechnology 5:63-91.

Martin, P.A., Jackson, and W.E. Galloway. 1984. Structural Depositional Styles of Gulf Coast Tertiary Continental Margins: Application to Hydrocarbon Exploration. Continuing Education Course Note Series No. 25. pp. 29-31.

Masaki, Y. 1976. Biological Studies on the North Pacific Sei Whale. Bulletin of the Far Seas Fishery Research Laboratory 14:1-104.

Masters, P.M. 1983. Detection and Assessment of Prehistoric Artifacts Off the Coast of Southern California. *In:* Quaternary Coastlines and Marine Archaeology Towards the Prehistory of Land Bridges and Continental Shelves. Masters, P.M., and N.C. Flemming (eds). London, England: Academic Press. pp. 189-213.

Mate, B. 1977. Aerial Censusing of Pinnipeds in the Eastern Pacific for Assessment of Population Numbers, Migratory Distributions, Rookery Stability, Breeding Effort, and Recruitment. Final Report to the Marine Mammal Commission, Washington, DC. Contract MM5AC001. Report No. MMC-75/01. NTIS No. PB 265 859. 67 pp.

Mate, B.R., B.A. Lagerquist, and J. Calambokidis. 1999. Movements of North Pacific Blue Whales During Their Feeding Season Off Southern California and Their Southern Fall Migration. Mar.Mamm. Sci. 15(4)1246-1247.

Mate, B.R., K.M. Stafford, and D.K. Ljungblad. 1994. A Change in Sperm Whale (*Physeter macrocephalus*) Distribution Correlated to Seismic Surveys in the Gulf of Mexico. J. Acoust. Soc. Amer. 96(5):3,268-3,269.

Mathisen, O.A., and R.J. Lopp. 1963. Photographic Census of the Steller Sea Lion Herds in Alaska, 1956-1958. U.S. Fish and Wildlife Service Special Science Report Fisheries No. 424. 20 pp.

Matkin, C.O., G.M. Ellis, M.E. Dahlheim, and J. Zeh. 1994. Status of Killer Whales in Prince William Sound 1985-1992, pp. 141-162. *In:* Marine Mammals and the *Exxon Valdez*. Loughlin, T.R. (ed.). San Diego, CA: Academic Press, Inc.

Mayfield, H.F. 1983. Densities of Breeding Birds at Polar Bear Pass, Bathurst Island, Northwest Territories. Can. Field Naturalist 97:371-376.

McBeath, G.A. 1981. North Slope Borough Government and Policymaking. Man in the Arctic Monograph No. 3, ISER Report Series No. 51. Anchorage, AK: University of Alaska, Institute of Social and Economic Research.

McCauley, R.D. 1994. Environmental Implications of Offshore Oil and Gas Development in Australia - Seismic Surveys, pp. 19-121. *In:* Report by the Australian Inst. of Marine Sci. (Townsville, QLD) for the Australian Petroleum Exploration Association (APEA) and Energy Research and Development Corporation (ERDC).

McDonald, M.A., J.A. Hildebrand, and S.C. Webb. 1994. Blue and Fin Whales Observer on a Seafloor Array in the Northeast Pacific (unpubl. ms.).

McDowell Group, Inc. 1999. Economic and Social Effects of the Oil Industry in Alaska 1975 to 1995. OCS Study MMS 99-0041. Prepared for the USDOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK.

McEachran, J.D., and J.D. Fechhelm. 1998. Fishes of the Gulf of Mexico, Volume 1. Austin, TX: University of Texas Press. 1,112 pp.

McGrattan, K.B. et al., 1995. Smoke Plume Trajectory From In Situ Burning of Crude Oil in Alaska – Field Experiments, Proceedings of the Eighteenth Arctic and Marine Oilspill Program (AMOP) Technical Seminar, June 14-16, 1995, Edmonton, Alberta, Canada. Volume 2

McIlroy, C.W. 1970. Aspects of the Ecology and Hunter Harvest of the Black Bear in Prince William Sound. M.S. Thesis. Univ. Alaska, Fairbanks. 69pp.

McKenzie, L.S., III, P.J. Xander, M.T.C. Johnson, B. Baldwin, and D.W. Davis. 1993. Socioeconomic Impacts of Declining Outer Continental Shelf Oil and Gas Activities in the Gulf of Mexico. Prepared for USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA. Contract No. 14-12-0001-30335. OCS Study MMS 93-0028. Applied Technology Research Corporation

McLellan, B.N., and D.M. Shackleton. 1988. Grizzly Bears and Resource Extraction Industries: Effects of Roads on Behavior, Habitat Use and Demography. Journal of Applied Ecology 25:451-460.

McNeary, S.A. 1978. Local Exploitation of D-2 Lands in the Gulf of Alaska Region. Fairbanks, AK: Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska. 134 pp. + maps.

Meade, N.F., and V.R. Leeworthy. 1986 Public Expenditures on Outdoor Recreation in Coastal Areas of the USA. Washington, DC: USDOC/NOAA/NOS, Strategic Assessment Branch, Ocean Assessments Division. 18pp.

Meier, G. 1996. The Hypoxia Issue: The Gulf of Mexico Program Report. Presentation at the Sixteenth Gulf of Mexico Information Transfer Meeting, 10-12 December 1996, New Orleans, LA. Sponsored by the USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA.

Melillo, J.M., T.V. Callaghan, F.I. Woodward, E. Salati, and S.K. Sinha. 1990. Effects on Ecosystems, pp. 285-310. *In:* Climate Change, the IPCC Scientific Assessment. Houghton, J.T., G.J. Jenkins, and J.J. Ephramus (eds.). Great Britain: Cambridge University Press.

Mendelssohn, I.A., and K.L. McKee. 2000. Salt Marshes and Mangroves, pp. 501-536. *In:* North American Terrestrial Vegetation, Second Edition. Barbour, M.G. and W.D. Billings (eds.). Cambridge, U.K.: Cambridge University Press.

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea Turtle Nesting Activity in the State of Florida 1979-1992. Florida Marine Research Publications, State of Florida, Department of Environmental Protection, No. 52.

Miles, P.R., C.I. Malme, and W.J. Richardson. 1987. Prediction of Drilling Site-Specific Interaction of Industrial Acoustic Stimuli and Endangered Whales in the Alaskan Beaufort Sea. BBN Rep. 6509. OCS Study MMS 87-0084. Report for USDOI/MMS, Anchorage, AK. NTIS PB88-158498. Cambridge, MA: BBN Labs Inc., and King City, Ont: LGL Ltd. 341 pp

Miller, G.W., R.E. Elliott, R.W. Koski, W.J. Richardson. 1997. Whales. *In:* Northstar Marine Mammal Monitoring Program, 1996: Marine Mammal and Acoustical Monitoring of a Seismic Program in the Alaskan Beaufort Sea. LGL Report TA 2121-2. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller, G.W., R.E. Elliott, R.W. Koski, V.D. Moulton, and W.J. Richardson. 1998. Whales. *In:* Marine Mammal and Acoustical Monitoring of BPXA's Seismic Program in the Alaskan Beaufort Sea, 1997. LGL Report TA 2150-3. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

------- 1999. Whales *In:* Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998. LGL Report TA 2230-3. King City, Ontario, Canada: LGL Ecological Research Associates, Inc.

Miller, D.J., and R.N. Lea. 1972. Guide to the Coastal Marine Fishes of California. California Department of Fish and Game Bulletin, No. 158. Sacramento, CA. 137 pp.

Milne, A.R., and J.H. Ganton. 1964. Ambient Noise Under Arctic-Sea Ice. J. Acoust. Soc. Am. 36(5):855-863.

Mitsch, W.J., and J.G. Gosselink. 1993. Wetlands. 2nd Edition. New York, NY: Van Nostrand Reinhold.

Mizroch, S.A. 1992. Distribution of Minke Whales in the North Pacific Based on Sightings and Catch Data. Unpublished Document Submitted to the International Whaling Commission. 37 pp.

Mizroch, S.A., D.W. Rice, and J.M. Breiwick. 1984. The Blue Whale, *Balaenoptera musculus*. Marine Fisheries Review 46:15-19.

Mobley, C.M., J.C. Haggarty, C.J. Utermohle, M. Eldridge, R.E. Reanier, A. Crowell, B.A. Ream, D.R. Yesner, J.M. Erlandson, and P.E. Buck. 1990. The 1989 *Exxon Valdez* Cultural Resource Program. Anchorage, AK: Exxon Shipping Company and Exxon Company, USA (a Division of Exxon Corporation).

Moein, S.E., J.A. Musick, J.A. Keinath, D.E. Barnard, M.L. Lenhardt, and R. George. 1995. Evaluation of Seismic Sources for Repelling Sea Turtles from Hopper Dredges, pp. 90-93. *In:* Sea Turtle Research Program: Summary Report. Hales, L.Z. (comp.). Prepared for U.S. Army Engineer Division, South Atlantic, Atlanta, GA, and U.S. Naval Submarine Base, Kings Bay, GA. Technical Report CERC-95. 145 pp.

Moles, A. 1980. Sensitivity of Parasitized Coho Salmon Fry to Crude Oil, Toluene, and Naphthalene. Transactions of the American Fisheries Society 109:293-297.

Moles, A., S. Bates, S.D. Rice, and S. Korn. 1981. Reduced Growth of Coho Salmon Fry Exposed to Two Petroleum Components, Toluene and Napthalene, in Fresh Water. Transactions of the American Fisheries Society 110:430-436.

Molotch, H. 1998. Petroleum Extraction in Ventura, Santa Barbara and San Luis Obisbo Counties, California: An Industrial History. Prepared for USDOI/MMS. OCS Study MMS 98-0049. Santa Barbara, CA: Ocean and Coastal Policy Center, Marine Science Institute, University of California.

Montagna, P.A., and D.E. Harper, Jr. 1996. Benthic Infaunal Long-Term Response to Offshore Production Platforms in the Gulf of Mexico. Can. J. Fish. Aquat. Sci. 53:2,567-2,588.

Montgomery, D.R., E.M, Beamer, G. Pess, and T.P.Quinn. In prep. Geomorphological Controls on Salmonid Spawning Distribution and Abundance. (Available from D.R. Montgomery, Dept. Geological Sciences, Univ. of Washington, Seattle, Washington, 98112). 28 pp.

Montgomery, D.R., and J.M. Buffington. 1997. Channel-Reach Morphology in Mountain Drainage Basins. Geol. Soc. Am. Bull. 109:596-611.

Moore, R.M. 1981. Trace Metal Marine Geochemistry and Chemical Tracers in the Arctic Ocean. Research Project for Circumpolar Scientific Affairs Directorate, Indian And Northern Affairs, Canada.

Moore, S.E., and R.R. Reeves. 1993. Distribution and Movement of Bowhead Whales. pp 313-386. *In:* The Bowhead Whale. Burns, J.J., J.J. Montague, and C.J. Cowles (eds.). Society of Marine Mammology, Special Publication No. 2.

Moore, S.E., K.M. Stafford, M.E. Dalheim, C.G. Fox, H.W. Braham, J.J. Polovina, and D.E. Bain. 1998. Seasonal Variation in Reception of Fin Whale Calls at Five Geographic Areas in the North Pacific. Mar. Mamm. Sci. 14(3):617-627.

Morehouse, T.A., and L. Leask. 1978. Governance in the Beaufort Sea Region: Petroleum Development and the North Slope Borough. Springfield, VA: National Technical Information Service.

Morehouse, T.A., G.A. McBeath, and L. Leask. 1984. Alaska's Urban and Rural Governments. Lanham, MD: University Press of America.

Morgan, S.G., C.S. Manooch III, D.L. Mason, and J.W. Goy. 1985. Pelagic Fish Population on *Cerataspis*, A Rare Larval Genus of Oceanic Penaeoid. Bull. Mar. Sci. 36(2):249-259.

Morrow, J.V., Jr., J.P. Kirk, K.J. Killgore, H. Rugillio, and C. Knight. 1998. Status and Recovery of Gulf Sturgeon in the Pearl River System, Louisiana-Mississippi. North American Journal of Fisheries Management 18:798-808.

Moulton, L.L., L.J. Field, and S. Brotherton. 1986. Assessment of the Colville River Fishery in 1985, Chapter 3. *In:* Colville River Fish Study Annual Report, 1985. Collonell, J.M., and L.L. Moulton, (eds.). Anchorage and Barrow, AK: ARCO Alaska, Inc., North Slope Borough and the City of Nuiqsut.

Moulton, V.D., R.E. Elliott, T.L. McDonald, G.W. Miller, W.J. Richardson, and M.T. Williams. 2000. Fixed-Wing Aerial Surveys of Seals Near BP's Northstar and Liberty Sites, 1999, pp.3-1 to 3-72. *In:* Monitoring of Ringed Seals During Construction of Ice Roads for BP's Northstar Oil Development, Alaskan Beaufort Sea, 1999. Richardson, W.J., and M.T. Williams (eds.). Report from LGL Ltd., King City, Ont., and LGL Alaska Res. Assoc. Inc., Anchorage, AK, and Silver Spring, MD. LGL Rep. TA2349. xxiii + 103 pp.

Moyers, J.E. 1996. Food Habits of Gulf Coast Subspecies of Beach Mice (*Peromyscus polionotus* spp.*)* M.S. Thesis. Alabama: Auburn University. 84 pp.

Muche, J.F. 1978. An inundated aboriginal site, Corral Beach, California. *In:* Proceedings of the 9th Conference on Underwater Archaeology. Arnold, J.B., III, (ed.). Austin, TX: Antiquities Committee Publication 6: 101-108.

Mullin, K., and W. Hoggard. 2000. Visual Surveys of Cetaceans and Sea Turtles from Aircraft and Ships, Chapter 4. *In:* Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Davis, R., W. Evans, and B. Würsig (eds.). Prepared for USDOI/USGS, Biological Resources Division, (USGS/BRD/CR-1999-0005) and USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA (OCS Study MMS 2000-003). Texas A&M University at Galveston and the National Marine Fisheries Service.

Mullin, K., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers, and B. Taggart. 1991. Cetaceans on the Upper Continental Slope in the North-Central Gulf of Mexico. Rep. for USDOI/MMS, New Orleans, LA. OCS Study MMS 91-0027. Pascagoula, MS: USDOC/NOAA/NMFS. 108 pp.

------- 1994. Cetaceans on the Upper Continental Slope in the North-Central Gulf of Mexico. Fishery Bulletin 92:773-786.

Muche, J.F. 1978. An Inundated Aboriginal Site, Corral Beach, California. *In:* Proceedings of the 9th Conference on Underwater Archaeology. Arnold III, J.B. (ed.). Antiquities Committee Publication 6:101-108. Austin, TX.

------- 1982. F8A-38: An Inundated Aboriginal Fishing Site, pp. 107-111. *In:* Proceedings of the 11th Annual Conference on Underwater Archaeology. Cummings, C.R. (ed.). San Marino, CA: Fathom Eight Publications.

Murdoch, J. 1892. Ethnological Results of the Point Barrow Expedition. *In:* 9th Annual Report of the Bureau of American Ethnology for the Years 1887-1888, pp. 19-441, Washington, DC: Reprinted by Smithsonian Institution Press. 1988.

Murphy, M.L., R.A. Heintz, J.W. Short, M. L. Larsen, and S.D. Rice. 1999. Recovery of Pink Salmon Spawning Areas After the *Exxon Valdez* Oil Spill. Trans. Am. Fish. Soc. 128(5):909-918.

Murphy, S.M., and B.E. Lawhead. 2000. Caribou, pp. 59-84. *In:* The Natural History of An Arctic Oilfield: Development and the Biota. Truett, J.C., and S.R. Johnson (eds.). San Diego, CA: Academic Press. 422 pp.

Murphy, S.M. and T.J. Mabee. 2000. Status of Black Oystercatchers in Prince William Sound, Alaska, Nine Years After the *Exxon Valdez* Oil Spill. Waterbirds 23:204-213.

Murray, S.N., and R.N. Bray. 1993. Chapter 7, Benthic Macrophytes, pp. 304-368. *In:* Ecology of the Southern California Bight: A Synthesis and Interpretation. Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.). Berkeley, CA: University of California Press. 926 pp.

Murray, S.P., and J. Donley. 1996. Mississippi River Plume Hydrography: Second Annual Report. Prepared for USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 96-0022. 175 pp.

Musick, J.A., and C.J. Limpus. 1997. Habitat Utilization and Migration in Juvenile Sea Turtles. pp. 137-164. *In:* The Biology of Sea Turtles. Lutz, P.L. and J.A. Musick (eds.). Boca Raton, FL: CRC Press. 432 pp.

Myers, M.T. 1958. Preliminary Studies of the Behavior, Migration, and Distributional Ecology of Eider Ducks in Northern Alaska, 1958. Unpublished Manuscript. Canada: University of British Columbia.

Myrberg, A.A., Jr. 1978. Ocean Noise and the Behavior of Marine Animals: Relationships and Implications. pp. 169-208. *In:* Effects of Noise on Wildlife. Fletcher, J.L., and R.G. Busnel (eds.). New York, NY: Academic Press. 305 pp.

Nadelhoffer, K.J., A.E. Giblin, G.R. Shaver, and J.A. Laundre. 1991. Effects of Temperature and Substrate Quality on Element Mineralization in Six Arctic Soils. Ecology 72:242-253.

Naiman, J. 1996. ANILCA Section 810: An Undervalued Protection for Alaskan Villagers' Subsistence. Fordham Environmental Law Journal 7:211-350.

Nasu, K. 1963. Oceanography and Whaling Grounds in the Subarctic Region of the Pacific Ocean. Scientific Report of Whales Research Institute 17:105-155.

National Academy of Sciences. 1983. Drilling Discharges in the Marine Environment: Panel on Assessment of Fates and Effects of Drilling Fluids and Cuttings in the Marine Environment. Washington, DC: National Academy Press.

National Assessment Synthesis Team, 2000. Climate Change Impacts on the United States. The Potential Consequences of Climate Variability and Change. Overview. Washington, DC: US Global Change Research Program.

National Audubon Society. 2001. National Refuge Campaign, Refuge Guide. <http://www.audubon.org/campaign/refuge>.

National Geographic Society. 1999. Field Guide to the Birds of North America, Third Edition. Washington: National Geographic Society. 480 pp.

National Research Council (NRC). 1983. Drilling Discharges in the Marine Environment. Panel on Assessment of Fates and Effects of Drilling Fluids and Cuttings in the Marine Environment. Marine Board; Commission on Engineering and Technical Systems; National Research Council. Washington, DC: National Academy Press.

------- 1985. Oil in the Sea: Inputs, Fates, and Effects. Washington, DC: National Academy Press. 601 pp.

------- 1990. Monitoring Southern California's Coastal Waters. Washington, DC: National Academy Press. 154 pp.

------- 1990. The Decline of Sea Turtles: Causes and Prevention. Committee on Sea Turtle Conservation. Washington, DC: National Academy Press. 183 pp.

------- 1992. Assessment of the U.S. Outer Continental Shelf Environmental Studies Program. III. Social and Economic Studies. Washington, DC: National Academy Press.

------- 2000. Marine Mammals and Low-Frequency Sound. Washington, DC: National Academy Press. 146 pp.

Neff, J.M. 1987. Biological Effects of Drilling Fluids, Drill Cuttings and Produced Waters, pp. 469-538. *In:* Long-Term Effects of Offshore Oil and Gas Development. Boesch, D.F., and N.N. Rabalais (eds.). London: Elsevier Applied Science Publishers.

------- 1997. Metals and Organic Chemicals Associated with Oil and Gas Well Produced Water: Bioaccumulation, Fates, and Effects in the Marine Environment. *In:* Gulf of Mexico Produced Water Bioaccumulation Study. A Report Prepared for the Offshore Operators Committee by Continental Shelf Associates, Inc.

Nelson, C.H., R.L. Phillips, J. McRea, Jr., J.H. Barber, Jr., M.W. McLaughlin, and J.L. Chin. 1994. Gray Whale and Pacific Walrus Benthic Feeding Grounds and Sea Floor Interaction in the Chukchi Sea.. Technical Report for USDOI/MMS / IA No. 14147. OCS Study MMS 93-0042. Menlo Park, CA: USDOI/USGS.

Nelson, E.W. 1899. The Eskimo About Bering Strait. *In:* Eighteenth Annual Report of the Bureau of American Ethnology, 1896-97, pp. 3-518. Washington DC: Government Printing Office. Reprinted by Smithsonian Institution Press, Washington, DC. 1983

Nelson, N.C. 1909. Shellmounds of the San Francisco Bay Region. University of California Publications in American Archaeology and Ethnology 7:309-356.

Nelson, R. 1969. Hunters of the Northern Ice. Chicago, IL: The University of Chicago Press.

------- 1979. Cultural Values of the Land. *In:* Native Livelihood and Dependence: A Study of Land Use Values Through Time. North Slope Borough Contract Staff. National Petroleum Reserve in Alaska 105(C) Land Use Study, Field Study 1. Anchorage, AK: USDOI/BLM, NPR-A Work Group 1.

Nelson, R.K. 1981. Harvest of the Sea: Coastal Subsistence in Modern Wainwright. North Slope Borough, Barrow, Alaska. 125 pp.

Nemoto, T. 1959. Food of Baleen Whales with Reference to Whale Movements. Scientific Report of the Whales Research Institute 14:149-291.

Nerini, M.K., H.W. Braham, W.M. Marquette, and D.J. Rugh. 1983. Life History of the Bowhead Whale, *Balaena mysticetus* (Mammalia: Cetacea). J. Zool., Lond. 204:443-468.

Niesen, T.M. 1994. Beachcomber's Guide to California Marine Life. Houston, TX: Gulf Publishing Co. 192 pp.

Nishiwaki, M. 1966. Distribution and Migration of the Larger Cetaceans in the North Pacific as Shown by Japanese Whaling Results, pp. 172-191. *In:* Whales, Dolphins, and Porpoises. Norris, K.S. (ed.). Berkeley, CA: University of California Press.

Nix, E., C. Fisher, J. Vodenichar, and K. Scott. 1995. Physiological Ecology of a Mussel with Methanotrophic Endosymbionts at Three Hydrocarbon Seep Sites in the Gulf of Mexico. Marine Biology 122:605-617.

Nobmann, E.D. 1997. Nutritional Benefits of Subsistence Foods. Anchorage, AK: University of Alaska Anchorage, Institute of Social and Economic Research.

Noel, L.E., and S.R. Johnson. In Prep. Nesting Status of the Common Eider and Other Barrier Island Nesting Birds on Central Alaskan Beaufort Sea Barrier Islands, 1999. Report for BP Exploration (Alaska) Inc. Anchorage, AK: LGL Alaska Research Associates, Inc.

Noel, L.E., and T.L. Olson. 1999. Bullen Point to Staines River Large Mammal Distribution, Summer 1998 – Final Report. Unpublished Report Prepared for BP Exploration Alaska, Inc. Anchorage, AK: LGL Alaska Research Associates.

Noel, L.E., C.J. Perham, and S.R. Johnson. 1999. Nesting Status of the Pacific Eider and Other Barrier Island Nesting Birds on Flaxman Island and the Maguire Islands, Alaska, 1998. Report for BP Exploration (Alaska) Inc. Anchorage, AK: LGL Alaska Research Associates. 24 pp.

Noel, L.E., S.R. Johnson, and P.F. Wainwright. 2000. Aerial Surveys of Molting Waterfowl in the Barrier Island-Lagoon Systems Between Spy Island and Brownlow Point, Alaska, 1999. Report for BP Exploration (Alaska) Inc., Anchorage, AK. Anchorage, AK: LGL Alaska Research Associates Inc. 64 pp + apps.

Norman, S.A., M.M. Muto, D.J. Rugh, and S.E. Moore. 2000. Gray Whale Strandings in 1999 and a Review of Stranding Records in 1995-1998. Report to the International Whaling Commission. SC/52/AS5.

Norris, J.C., W.E. Evans, and S. Rankin. 2000. An Acoustic Survey of Cetaceans in the Northern Gulf of Mexico, Chapter 5. *In:* Cetaceans, Sea Turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Davis, R.W., W.E. Evans, and B. Würsig (eds.). Prepared for USDOI/USGS, Biological Resources Division, (USGS/BRD/CR-1999-005) and USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA (OCS Study MMS 2000-003). Texas A&M University at Galveston and the USDOC/National Marine Fisheries Service.

North, W.J. 1971. The Biology of Giant Kelp Beds (*Macrocystis*) in California, Germany: Verlag Von J. Cramer

North, W.J., M. Neushel, and K.A. Clendenning. 1964. Successive Biological Changes Observed in a Marine Cove Exposed to a Large Spillage of Mineral Oil. pp. 335-354. *In:* Proceedings of the Symposium on Pollution of Marine Organisms. Monaco: Prod. Petrol.

Northern Economics. 1993. Commercial Fishing Industry of the Gulf of Alaska. Prepared for the USDOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 159.

------- 1994. Commercial Fishing Industry of the Gulf of Alaska. Prepared for the USDOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 159.

North Pacific Rim. 1981. Chugach Region Community Subsistence Profiles. Anchorage, The North Pacific Rim: 58.

North Slope Borough (NSB). 1991. North Slope Borough Land Management Regulations. Barrow, AK: NSB.

------- 1991. Letter of Comment to the State of Alaska on Lease Sale 68, Beaufort Sea. North Slope Borough, Office of the Mayor.

------- 2000. The NSB GIS and the Traditional Land Use Inventory.

North Slope Borough, Commission on History and Culture. 1980. Qiniqtuagaksrat Utuqqanaat Inuuniagininisiqun: The Traditional Land Use Inventory for the Mid-Beaufort Sea. Vol. 1. Barrow, AK: NSB, Commission on History and Culture.

Norton, T.M., E.R. Jacobson, and J. P. Sundberg. 1990. Cutaneous Fibropapillomas and Renal Myxofibroma in a Green Turtle, *Chelonia mydas*. J. Wildl. Dis. 26:265-270.

Norton-Fraker, P., and M.A. Fraker. 1982. The 1981 White Whale Monitoring Program, Mackenzie Estuary. Report for Esso Resources Canada Ltd. (Manager), Calgary, Alb. Sidney, BC: LGL. Ltd. 74 pp.

Novak, J. A. 1997. Home Range and Habitat Use of Choctawhatcee Beach Mice. M.S. Thesis. Alabama: Auburn University. 113 pp.

Nowak, R.M. 1991. Walker's Mammals of the World. 5th Ed. 2 Vols. Baltimore, MD: Johns Hopkins Univ. Press.

Nowlin, R. 1995. Unit 6 Deer Survey-Inventory Progress Report, pp. 59-74. *In:* Annual Report of Survey-Inventory Activities, Deer. Fed. Aid Wildl. Restor. Prog. Rep, Proj. W-24-1 and W-24-2, Study 2.0. Hicks, M.V. (ed.). Juneau, AK: Alaska Dept. of Fish and Game.

------- 1998. Game Management Unit 6, pp 32-54. *In:* Brown Bear Management Report of Survey-Inventory Activities. 1 July 1994 – 30 June 1996. Fed. Aid Wild. Rest. Grants W-24-3 & W-24-4. Study 4.0. Hicks, M.V. (ed.). Juneau, AK: Alaska Dept. of Fish and Game.

Nowlin, W.D., A.E. Jochens, S.F. DiMarco, and R.O. Reid. 2000. Physical Oceanography, pp. 61-121. *In:* Continental Shelf Associates, Inc., Deepwater Gulf of Mexico Environmental and Socioeconomic Data Search and Literature Synthesis. Volume I: Narrative Report. OCS Study MMS 2000-049. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Oceanographic Institute of Washington. 1977. Summary of Knowledge of the Oregon and Washington Coastal Zone and Offshore Areas. Vol. 1. USDOI/BLM. PB-272. 490.

O'Connor, T.P. 1990. Coastal Environmental Quality in the United States, 1990, Chemical Contamination in Sediment and Tissues. A Special NOAA 20th Anniversary Report. Rockville, MD: USDOC/NOAA, National Status and Trends Program. 34 pp.

O'Connor, T.P., and B. Beliaeff. 1995. Recent Trends in Coastal Environmental Quality: Results from the Mussel Watch Project (National Status and Trends Program, Marine Environmental Quality). Rockville, MD: USDOC/NOAA, National Status and Trends Program.

Oey, L.Y. 1995. Eddy- and Wind-Forced Shelf Circulation. J. Geophys. Res. 100(C5):8,621-8,637.

Ognev, S.I. 1935. Mammals of the U.S.S.R. and Adjacent Countries. Vol. 3. Carnivora (Fissipedia and Pinnipedia). Gosudarst. Izdat. Biol. Med. Lit., Moscow. (Transl. From Russian by Israel Prog. Sci. Transl., 1962, 741 pp.).

Ogren, L.H. 1989. Distribution of Juvenile and Subadult Kemp's Ridley Sea Turtles: Preliminary Results from 1984-1987 Surveys.

O'Hara, K.J. 1989. Plastic Debris and Its Effect on Marine Wildlife. pp 395 - 434. *In*: Audubon Wildlife Report, 1988 - 1989. San Diego, CA: Academic Press. Inc. 817pp.

O'Hara, J., and J.R. Wilcox. 1990. Avoidance Responses of Loggerhead Turtles, *Caretta caretta*, to Low Frequency Sound. Copeia 1990(2):564-567.

Ohsumi, S. 1958. Growth of Fin Whales in the Northern Pacific. Scientific Reports of the Whales Research Institute 13:97-133.

Okakok, L. and G. Kean. 1981. Puiguitkaat, The 1978 Elder's Conference. Barrow, AK: North Slope Borough Commission on History and Culture.

O'Keeffe, D.J., and G.A. Young. 1984. Handbook on the Environmental Effects of Underwater Explosions. NSWC TR 83-240. Dahlgren, VA, and Silver Spring, MD: Naval Surface Weapons Center.

Olsen, K.M., and H. Larsson. 1995. Terns of Europe and North America. Princeton, NJ: Princeton University Press. 175 pp.

------- 1997. Skuas and Jaegers. New Haven, CT: Yale University Press. 190 pp.

Omura, H. 1955. Whales in the Northern Part of the North Pacific. Nor. Hvalfangst-Tidende 44:323-345.

Oritsland, N.A., F.R. Engelhardt, F.A. Juck, R.J. Hurst, and P.D. Watts. 1981. Effect of Crude Oil on Polar Bears. Environmental Studies No. 24, Northern Affairs Program, Eastern Arctic Marine Environmental Studies Program. 268 pp.

Oswalt, W. 1967. Alaskan Eskimos. San Francisco, CA: Chandler.

Otvos, E.G. 1980. Barrier Island Formation Through Nearshore Aggredation – Stratigraphic and Field Evidence. Mar. Geo. 43:195-243.

Outer Continental Shelf Environmental Assessment Program (OCSEAP). 1987. Marine Fisheries: Resources and Environments, pp. 417-458. *In:* The Gulf of Alaska: Physical Environment and Biological Resources. Hood, D.W., and S.T. Zimmerman (eds.). USDOC/NOAA, Alaska and USDOI/MMS, Alaska.

Overpeck, J., K. Hughen, D. Hardy, R. Bradley, R. Case, M. Douglas, B. Finney, K. Gajewski, G. Facoby, A. Jennings, S. Lamoureaux, A. Lasca, G. MacDonald, J. Moore, M. Retelle, S. Smith, A. Wolfe, and G. Zielinski. 1997. Arctic Environmental Change of the Last Four Centuries. Science 278:1,251-1,256.

Pacific Fisheries Management Council (PFMC). 1997. Status of the Pacific Coast Groundfish Through 1997 and Recommended Acceptable Biological Catches for 1998: Stock Assessment and Fishery Evaluation. October 1997. Portland, OR: PFMC.

Page, G.W. 1990. Nesting Success of Snowy Plovers in Central Coastal California in 1989 and 1990. Stinson Beach, CA: Point Reyes Bird Observatory. 17pp.

Page, G.W., and L.E. Stenzel. 1981. The Breeding Status of the Snowy Plover in California (*Charadrius alexandrinus*). Western Birds 12(1):1-40.

Palinkas, L.A., M.A. Downs, J.S. Petterson, and J.C. Russell. 1993. Social, Cultural, and Psychological Impacts of the *Exxon Valdez* Oil Spill. Human Organization 52(1):1-13.

Palmer, R.S. (ed.). 1988. Handbook of North American Birds: Diurnal Raptors (Part 2). Vol. 5. New Haven, CT: Yale University Press.

Parametrix, Inc. 1996. Alpine Development Project Environmental Evaluation Document. Anchorage, AK: U.S. Army Corps of Engineers, Alaska District.

Parker, R.O., D.R. Colby, and T.D. Willis. 1983. Estimated Amount of Reef Habitat on a Portion of the U.S. South Atlantic and Gulf of Mexico Continental Shelf. Bull. Mar. Sci 33:935-940.

Patten, S.M. 1993. Acute and Sub-Lethal Effects of the *Exxon Valdez* Oil Spill on Harlequins and Other Sea Ducks, pp. 151-158. *In: Exxon Valdez* Oil Spill Symposium Abstract Book. Spies, B., L.J. Evans, B. Wright, M. Leonard, and C. Holba (eds. and comps.). *Exxon Valdez* Oil Spill Trustee Council; University of Alaska Sea Grant Program; and American Fisheries Society, Alaska Chapter. 2-5 February 1993, Anchorage, AK.

Patten, S.M., and L.R. Patten. 1979. Evolution, Pathobiology, and Breeding Ecology of Large Gulls (Larus) in Northeast Gulf of Alaska and Effects of Petroleum Exposure on the Breeding Ecology of Gulls and Kittiwakes. Boulder, CO: USDOC/NOAA. 35 pp.

Pauley, G.B., B.M. Bortz, and M.F. Shepard. 1986. Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates-Steelhead Trout (Pacific Northwest). Biological Report 82 (11.62); TR EL-82-4. Prepared for the Coastal Ecology Group, U.S. Army Corps of Engineers, Vicksburg, MS. 24 pp.

Paull, C.K., B. Hecker, R. Commeau, R.P. Freeman-Lynde, C. Neumann, W.P. Corso, S. Golubic, J.E. Hook, E. Sikes, and J. Curray. 1984. Biological Communities at the Florida Escarpment Resemble Hydrothermal Vent Taxa. Science 226:965-967.

Paull, C.K., A.J.T. Jull, L.J. Toolin, and T. Linick. 1985. Stable Isotope Evidence for Chemosynthesis in an Abyssal Seep Community, Nature. pp. 709-711.

Peake, D., G. Fargion, K. Mullin, and R. Pitman. 1995. Seabirds of the Northwestern and Central Gulf of Mexico. Abstracts of the Joint Meeting of the Wilson Ornithological Society and Virginia Society of Ornithology, Virginia, 4-7 May 1995.

Pearson, W.H., D.L. Woodruff, S.L. Kiesser, G.W. Felingham, and R.A. Elston. 1985. Oil Effects on Spawning Behavior and Reproduction in Pacific Herring (*Clupea pallasi*). Report to the American Petroleum Institute, Washington, DC. Sequim, WA: Battelle Marine Research Laboratory.

Penland, S., and J.R. Suter. 1988. Barrier Island Erosion and Protection in Louisiana: A Coastal Geomorphological Perspective. Transactions Gulf Coast Associations of Geological Societies. 38:331-342.

Pequegnat, W.E. (ed). 1983. The Ecological Communities of the Continental Slope and Adjacent Regimes of the Northern Gulf of Mexico. Prepared for the USDOI/MMS, Gulf of Mexico OCS Office, Metairie, LA. Contract No. AA851-CT1-12. TerEco Corporation.

Pequegnat, W.E., R.M. Darnel, B.M. James, E.A. Kennedy, L.H. Pequegnat, and J.T. Turner. 1976. Ecological Aspects of the Upper Continental Slope of the Gulf of Mexico. Prepared for USDOI/BLM, Div. of Minerals Environ. Assessment. BLM Contract No. 08550-CT4-12. TerEco Corporation. 360 pp.

Pequegnat, W., B. Gallaway, and L. Pequegnat. 1990. Aspects of the Ecology of the Deep-Water Fauna of the Gulf of Mexico. American Zoologist 30:45-64.

Perez, M.A., and T.R. Loughlin. 1991. Incidental Catch of Marine Mammals by Foreign-Directed and Joint-Venture Fishing Vessels in the U.S. EEZ of the North Pacific, 1973-1988. USDOC/NOAA, Tech. Rep. NMFS-104. 57 pp.

Perham, C.J. 2000. Arctic Fox Den Distribution and Activity Between the Sagavanirktok and Staines Rivers, Alaska, Including the Point Thomson Unit Area. Report to BP Exploration (Alaska) Inc. LGL Alaska Research Associates, Inc. 30 pp.

Perlmutter, M.A. 1985. Deep Water Clastic Reservoirs in the Gulf of Mexico; A Depositional Model. Geo Marine Letters 5:105-112.

Perrin, W.F., E.D. Mitchell, J.G. Mead, D.K. Caldwell, M.C. Caldwell, P.J.H. van Bree, and W.H. Dawbin. 1987. Revision of the Spotted Dolphins, *Stenella* spp. Mar. Mamm. Sci. 3(2):99-170.

Perrin, W.F., D.K. Caldwell, and M.C. Caldwell. 1994. Atlantic Spotted Dolphin, pp. 173-190. *In:* Handbook of Marine Mammals, Vol. 5: The First Book of Dolphins. Ridgway, S.H., and R. Harrison (eds.). San Diego, CA: Academic Press. 418 pp.

Perry, A., C.S. Baker, and L.M. Herman. 1990. Population Characteristics of Individually Identified Humpback Whales in the Central and Eastern North Pacific: A Summary and Critique. Report International Whaling Commission, Special Issue 12:307-317.

Pessah, E. 1982. Dredging Activities of Dome Petroleum in the Arctic and Its Environmental Impact. Calgary, Alberta, Canada: Dome Petroleum Ltd.

Petersen, M.R. 1981. Populations, Feeding Ecology, and Molt of Steller's Eiders. Condor 83:256-262.

Petersen, M.R., W.W. Larned, and D.C. Douglas. 1999. At-Sea Distribution of Spectacled Eiders: A 120-Year-Old Mystery Resolved. Auk 116(4):1,009-1,020.

Phillips, N.W., D.A. Gettleson, and K.D. Spring. 1990. Benthic Biological Studies of the Southwest Florida Shelf. Amer. Zool. 30:65-75.

Philo, L.M., G.M. Carroll, and D.A. Yokel. 1993. Movements of Caribou in the Teshekpuk Lake Herd as Determined by Satellite Tracking. Barrow, AK: North Slope Borough. 60 pp.

Philo, L.M., E.B. Schotts, and J.C. George. 1993. Morbidity and Mortality, pp. 275-312. *In:* The Bowhead Whale. Burns, J.J., J.J. Montague, and J.C. Cowles (eds.). Society of Marine Mammalogy, Special Publication No. 2.

Piatt, J.F., and P. Anderson. 1996. Response of Common Murres to the *Exxon Valdez* Oil Spill and Long-Term Changes in the Gulf of Alaska Marine Ecosystem, pp. 720-737. *In:* Proceedings of the *Exxon Valdez* Oil Spill Symposium. Rice, S.D., R.B. Spies, D.A. Wolfe, and B.A. Wright (eds.). American Fisheries Society Symposium 18, Bethesda, MD.

Piatt, J.F., and R.G. Ford. 1996. How Many Seabirds Were Killed by the *Exxon Valdez* Oil Spill? pp. 712-719. *In:* Proceedings of the *Exxon Valdez* Oil Spill Symposium. Rice, S.D., R.B. Spies, D.A. Wolfe, and B.A. Wright, (eds.). American Fisheries Society Symposium 18, Bethesda, MD.

Picou, J.S. 1992. Distribution and Stress in an Alaskan Fishing Community: Initial and Continuing Impacts of the *Exxon Valdez* Oil Spill. Industrial Crisis Quarterly 1992(6)3:235-257.

------- 1996. Chronic Social Impacts of the *Exxon Valdez* Oil Spill: Community Education as Mitigation. Society for the Study of Social Problems.

Pimental, D., L. Lach, R. Zuniga, and D. Morrison. 2000. Environmental and Economic Costs of Nonindigenous Species in the United States. BioScience 50:53-65.

Pippard, L. 1985. Status of the St. Lawrence River Population of Beluga, *Delphinapterus leuca*. Can. Field-Nat. 99(3):438-450.

Pitcher, K.W. 1981. Prey of the Steller Sea Lion, *Eumetopias jubatus*, in the Gulf of Alaska. Fisheries Bulletin 79:467-472.

Pitcher, K.W., and D.G. Calkins. 1979. Biology of the Harbor Seal, *Phoca vitulina richardsi*, in the Gulf of Alaska. *In:* Environmental Assessment for the Alaskan Continental Shelf, Vol. 1. Final Report. Juneau, AK: USDOI/BLM and USDOC/NOAA, OCSEAP.

Pitcher, K.W., and F.H. Fay. 1982. Feeding by Steller Sea Lions on Harbor Seals. Murrelet 63:70-71.

Plafker, G. 1987. Regional Geology and Petroleum Potential of the Northern Gulf of Alaska Continental Margin, pp. 229-268. *In:* Geology and Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins-Beaufort Sea to Baja, California. Scholl, D.A., A. Grantz, and J.G. Vedder (eds.).

Plotkin, P.T., and A.F. Amos. 1988. Entanglement In and Ingestion of Marine Debris by Sea Turtles Stranded Along the South Texas Coast. pp 79-82. *In*: Proceedings of the Eighth Annual Workshop on Sea Turtle Conservation and Biology,. B.A. Schroeder (compiler). NOAA Tech. Memo. NMFS-SEFC-214.

------- 1990. Effects of Anthropogenic Debris on Sea Turtles in the Northwestern Gulf of Mexico. *In*: Proc. Second Int. Conf. on Marine Debris. Shomura, R.S., and M.L. Godfrey (eds.). NOAA Tech. Memo. NMFS-SWFS-154, Honolulu, HI.

Pollard, R.H., W.B. Ballard, L.E. Noel, and M.A. Cronin. 1996. Summer Distribution of Caribou, *Rangifer tarandus granti*, in the Area of the Prudhoe Bay Oil Field, Alaska, 1990-1994. Can. Field-Nat. 110:659-674.

Pollard, R.H., and L.E. Noel. 1994. Caribou Distribution and Parasitic Insect Abundance in the Prudhoe Bay Oil Field, Alaska, Summer 1993, Vol. I. Final Report to B.P. Exploration (Alaska), Inc. Anchorage, AK: LGL Alaska Research Associates, Inc.

Popov, L.A. 1976. Status of Main Ice Forms of Seals Inhabiting Waters of the U.S.S.R. and Adjacent to the Country Marine Areas. FAO ACMRR/MM/SC/51. 17 pp.

Power, D.M. (ed.). 1980. The California Islands: Proceedings of a Multidisciplinary Symposium. Santa Barbara, CA: Santa Barbara Museum of Natural History. 787 pp.

Prather, M.J. 1996. Time Scales in Atmospheric Chemistry: Theory, GWP's for CH and CO, and Runaway Growth. Geophysical Research Letters 23(19):2,597-2,600.

------- 1998. Time Scales in Atmospheric Chemistry: Coupled Perturbations to N_2O, NO_y, and O_3. Science 279:1,339-1,341.

Pritchard, P.C.H. 1997. Evolution, Phylogeny, and Current Status, pp. 1-28. *In:* The Biology of Sea Turtles. Lutz, P.L., and J.A. Musick (eds.). Boca Raton, FL: CRC Press. 432 pp.

PS Associates. 1987. Archaeological Resource Study, Morro Bay to Mexican Border. Final Report for the USDOI/MMS, Pacific OCS Region, Los Angeles, CA.

Quakenbush, L.T., R.S. Suydam, K.M. Fluetch, and C.L. Donaldson. 1995. Breeding Biology of Steller's Eiders Nesting Near Barrow, Alaska, 1991-1994. USDOI/FWS, Technical Report NAWA-TR-95-03. 53 pp. Fairbanks, AK: Ecological Services.

Rabalais, N.N. 1992. An Updated Summary of Status and Trends in Indicators of Nutrient Enrichment in the Gulf of Mexico. Report to the Gulf of Mexico Program, Nutrient Enrichment Subcommittee. EPA/800-R-92-004. Stennis Space Center, MS: USEPA, Office of Water, Gulf of Mexico Program. 421 pp.

Raftery, A. E., and J.E. Zeh. 1998. Estimating the Bowhead Whale Population Size and Rate of Increase from the 1993 Census. Journal of the American Statistical Association 1998. 93:1-13.

Rahn, K.A. 1982. On the Causes, Characteristics and Potential Environmental Effects of Aerosol in the Arctic Atmosphere. *In:* The Arctic Ocean: The Hydrographic Environment and the Fate of Pollutants. Ray, L. (ed.). New York, NY: John Wiley and Sons. pp 163-195.

Raimondi, P.T., R.F. Ambrose, J.M. Engle, S.N. Murray, M. Wilson. 1999. Monitoring of Rocky Intertidal Resources Along the Central and Southern California Mainland. 3-Yr Report for San Luis Obispo, Santa Barbara, and Orange Counties (Fall 1995-Spring 1998). OCS Study MMS 99-0032, USDOI/MMS, Pacific OCS Region. 142p.

Rappole, J.H. 1995. The Ecology of Migrant Birds: A Neotropical Perspective. Washington, DC: Smithsonian Institution Press. 269 pp.

Rappole, J.H., and G.W. Blacklock. 1994. Birds of Texas. College Station, TX: Texas A&M University Press. 280 pp.

Ray, C.E. 1971. Polar Bear and Mammoth on the Pribilof Islands. Arctic 24:9-19.

Ray, P.H. 1885. Narrative in Report of the International Polar Expedition to Point Barrow, Alaska. Report to the House of Representatives, U.S. Congress. Ex. Doc. 44. Washington DC.

Raymond, P.W. 1984. Sea Turtle Hatchling Disorientation and Artificial Beachfront Lighting, A Review of the Problem and Potential Solutions. Washington, DC: Center for Environmental Education. 72pp.

Read, A.D. 1978. Treatment of Oily Water at North Sea Oil Installations - A Progress Report, pp. 127-136. *In:* Oily Water Discharges. Regulatory, Technical and Scientific Considerations. Johnston, C.S., and R.J. Morris (eds.). Barking, Essex, England: Applied Science Publishers.

Read, A.J. 1990. Reproductive Seasonality in Harbour Porpoises, *Phocoena phocoena*, from the Bay of Fundy. Can. J. Zool. 68:284-288.

Reed, C.E. 1983. Homer: Resource Uses in a Middle-Sized, Industrial-Based, Road-Connected Community of the Kenai Peninsula Borough. *In:* Resource Use and Socioeconomic Systems: Case Studies of Fishing and Hunting in Alaskan Communities. Technical Paper No. 61. Wolfe, R.J., and L.J. Ellanna (eds.). Juneau, AK:, Alaska Department of Fish and Game, Division of Subsistence.

------- 1985. The Role of Wild Resource Use in Communities of the Central Kenai Peninsula and Kachemak Bay, Alaska. Technical Paper No. 106. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Reed, R.K. 1980. Recent Observations of a Large Eddy in the Gulf of Alaska. Marine Fisheries Review, June, 1980:29-31.

Reed, R.K., and J.D. Schumacher. 1986. Physical Oceanography, pp. 57-76. *In*: The Gulf of Alaska: Physical and Biological Resources. Hood, D.W., and S.T. Zimmerman (eds.). USDOI/MMS. OCS Study MMS 86-0095.

Reeves, R.R. 1992. Whale Responses to Anthropogenic Sounds: A Literature Review. Sci. & Res. Ser. 47. Wellington, New Zealand: New Zealand Dep. Conserv. 47 pp.

Reger, D.R., J.D. McMahan, and C.E. Holmes. 1992. Effect of Crude Oil Contamination on Some Archaeological Sites in the Gulf of Alaska, 1991 Investigations. Office of History and Archaeology Report No. 30. Anchorage, AK: Alaska Department of Natural Resources, Division of Parks and Outdoor Recreation.

Regional Response Team (RRT). 1997. Programmatic Agreement on Protection of Historic Properties During Emergency Oil Spill Response Under the National Oil and Hazardous Substances Pollution Contingency Plan.

Relini, M., L.R. Orsi, and G. Relini. 1994. An Offshore Buoy as a FAD in the Mediterranean. Bull. Mar. Sci. 55(2-3):1,099-1,105.

Renker, A.M. 1997. Whale Hunting and the Makah Tribe: A Needs Statement. Report to the International Whaling Commission. IWC/49/AS.

Reynolds, J.R. 1979. History and Current Status of Sitka Black-Tailed Deer in Prince William Sound, pp. 177-183. *In:* Sitka Black-Tailed Deer: Proceedings of a Conference in Juneau, Alaska. Series Number R10-48. Wallmo, O.C. and J.W. Schoen (eds.). Juneau, AK: USDOA/Forest Serv. Alaska Region.

Reynolds, P.E. 1992. Seasonal Differences in the Distribution and Movements of Muskoxen (*Ovibos moschatus*) in Northeastern Alaska. Rangifer 13:171-172.

Reynolds, P.E., J.D. Herriges, and M.A. Masteller. 1986. Ecology of Muskoxen in the Arctic National Wildlife Refuge, Alaska 1982-1985, pp. 573-631. *In:* Arctic National Wildlife Refuge Coastal Plain Resource Assessment: 1985 Update Report Baseline Study of the Fish, Wildlife, and Their Habitats. Garner, G.W., and P.E. Reynolds (eds.). Vol. 2. ANWR Progress Report No. FY86-2. Anchorage, AK: USDOI/FWS.

Rezak, R., T.J. Bright, and D.W. McGrail. 1983. Reefs and Banks of the Northwestern Gulf of Mexico: Their Geological, Biological, and Physical Dynamics. Technical Report No. 83-1-T.

------- 1985. Reefs and Banks of the Northern Gulf of Mexico: Their Geological, Biological, and Physical Dynamics. New York, NY: John Wiley and Sons. 259 pp.

Rice, D.W. 1974. Whales and Whale Research in the Eastern North Pacific. *In*: The Whale Problem: A Status Report. Schevill, W. E. (ed.). Cambridge, MA: Harvard University Press. pp. 170-195.

------- 1989. Sperm Whale, *Physeter macrocephalus*, pp. 177-233. *In:* Handbook of Marine Mammals. Vol 4. River Dolphins and the Larger Toothed Whales. Ridgway, S.H., and R. Harrison (eds.). New York, NY: Academic Press.

------- 1992. The Blue Whales of the Southeastern North Pacific Ocean. pp. 1-3. *In:* Alaska Fisheries Science Center, Quarter. Rept., Oct. – Dec.

Rice, D.W., and A.A. Wolman. 1971. The Life History and Ecology of the Gray Whale, *Eschrichtius robustus*. American Society of Mammalogists Special Publication 3. 142 pp.

Rice, D.W., A.A. Wolman, D.E. Withrow, and L.A. Fleischer. 1981. Gray Whales on the Winter Grounds in Baja California. Report of the International Whaling Commission 31:477-493.

Rice, S.D., D.A. Moles, J F. Karinen, S. Korn, M.G. Carls, C.C. Brodersen, J.A. Gharrett, and M.M. Babcock. 1984. Effects of Petroleum Hydrocarbons on Alaskan Aquatic Organisms: A Comprehensive Review of All Oil-Effects Research on Alaskan Fish and Invertebrates Conducted by the Auke Bay Laboratory, 1970-81. NOAA Technical Memorandum NMFS F/NWC-67. Auke Bay, AK: USDOC/NOAA/NMFS.

Rice, S.D., M.M. Babcock, C.C. Brodersen, M.G. Carls, A.J. Gharrett, S. Korn, A. Moles, and J.W. Short. 1986. Lethal and Sublethal Effects of the Water-Soluble Fraction Cook Inlet Crude Oil on Pacific Herring (*Clupea harengus pallasi*) Reproduction. Final Report, Outer Continental Shelf Environmental Assessment Program, Research Unit 661. Auke Bay, AK: USDOC/NOAA/NMFS, Northwest Fisheries Science Center.

Rice, S.D., R.E. Thomas, R.A. Heintz, A.C. Wertheimer, M.L. Murphy, M.G. Carls, J.W. Shor,t and A. Moles. 2001. Synthesis of Long-Term Impact to Pink Salmon Following the *Exxon Valdez* Oil Spill: Persistence, Toxicity, Sensitivity, and Controversy. Final Report: Project 99329, *Exxon Valdez* Trustee Council. 77 p.

Richard, P.R., A.R. Martin, and J.R. Orr. 1997. Study of Summer and Fall Movements and Dive Behavior of Beaufort Sea Belugas Using Satellite Telemetry: 1992-1995. ESRF Report 134. Calgary, Alberta: Environmental Study Research Funds. 38 pp.

Richards, D.V., and D. Lerma, 2000. Rocky Intertidal Community Monitoring in Channel Islands National Park. 1998 Annual Report for the Channel Islands National Park. Channel Islands National Park Technical Report 2000-03. 30p + appendices.

Richards, W.J., and T. Potthoff. 1980. Distribution and Seasonal Occurrence of Larval Pelagic Stages of Spiny Lobsters (Palinuridae, Panulirus) in the Western Tropical Atlantic. Proc. Gulf Carib. Fish. Inst. 33:244-252.

Richards, W.J., M.F. McGowan, T. Leming, J.T. Lampkin, and S. Kelley. 1993. Larval Fish Assemblages at the Loop Current Boundary in the Gulf of Mexico. Bull. Mar. Sci. 53(2):475-537.

Richards, W.J., T. Leming, M.F. McGowan, J.T. Lampkin, and S. Kelley-Fraga. 1989. Distribution of Fish Larvae in Relation to Hydrographic Features of the Loop Current Boundary in the Gulf of Mexico. Rapp. P.-V. Reun. Cons. Int. Explor. Mem. 191:169-176.

Richardson, W.J. 1996. Acoustic Effects on Bowhead Whales: Overview. pp. 107-110. *In:* Proceedings of the 1995 Arctic Synthesis Meeting, Sheraton Anchorage Hotel, 23-25 October 1995. Prepared for the USDOI/MMS, Alaska OCS Region. OCS Study 95-0065. Costa Mesa, CA: MBC Applied Environmental Science. 206 pp.

Richardson, W.J. (ed.) 1999. Marine Mammal and Acoustical Monitoring of Western Geophysical's Open-Water Seismic Program in the Alaskan Beaufort Sea, 1998. LGL Rep. TA2230-3. Report from LGL Ltd, King City, ONT, and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and National Marine Fisheries Service, Anchorage, AK, and Silver Spring, MD. 390 pp.

Richardson, W.J., C.R. Greene, Jr., W.R. Koski and M.A. Smultea, with G. Cameron, C. Holdsworth, G. Miller, T. Woodley, and B. Würsig. 1991a. Acoustic Effects of Oil Production Activities on Bowhead and White Whales Visible During Spring Migration Near Pt. Barrow, Alaska – 1990 Phase. OCS Study MMS 91-0037. Rep for USDOI/MMS, Herndon, VA. King City, Ont: LGL Ltd. 311 pp. NTIS PB92-170430.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1991b. Effects of Noise on Marine Mammals. Prepared for the USDOI/MMS, Atlantic OCS Region, Herndon, VA. OCS Study MMS 90-0093.

------- 1993. Man-Made Noise and Behavioral Response, pp. 631-700. *In:* The Bowhead Whale. Burns, J.J, J.J. Montague and C.J. Cowles (eds.). Spec. Publ. 2 Soc. Lawrence, KS: Mar. Mammal., 787 pp.

Richardson, W.J., C.R. Greene, Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. New York, NY: Academic Press. 576 pp.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1986. Reactions of Bowhead Whales, *Balaena mysticetus*, to Seismic Exploration in the Canadian Beaufort Sea. J. Acoust. Soc. Am. 79(4):1,117-1,128.

------- 1990. Reactions of Bowhead Whales, *Balaena mysticetus*, to Drilling and Dredging Noise in the Canadian Beaufort Sea. Mar. Environ. Res. 29(2):135-160.

Ricketts, E.F., J. Calvin, and J.W. Hedgpeth. 1985. Between Pacific Tides. Fifth Ed. Revised by D.W. Phillips. Stanford, CA: Stanford University Press. 652 pp.

Ridgway, S.H., E.G. Wever, J.G. McCormick, J. Palin, and J.H. Anderson. 1969. Hearing in the Giant Sea Turtle, *Chelonia mydas*. Proc. Nat. Acad. Sci. 64(3):884-890.

Riedman, M.L. 1983. Studies of the Effects of Experimentally Produced Noise Associated with Oil and Gas Exploration and Development on Sea Otters in California for USDOI/MMS, Anchorage, AK. Santa Cruz, CA: Center for Coastal Marine Studies, Univ. of Calif.

Ritchie, R.J., R.M. Burgess, and R.S. Suydam. 2000. Status and Nesting Distribution of Lesser Snow Geese, *Chen caerulescens caerulescens*, and Brant, *Branta bernicla nigricans*, on the Western Arctic Coastal Plain, Alaska. Canadian Field Naturalist. Vol. 114. 395-404 pp.

Ritter, D.G., and E.H. Follmann. 1995. Rabies Occurrence in Alaska with Reference to Surveillance in Wild Population and Human Exposure. *In:* Proceedings of the Sixth Annual International Meeting on Research Advances on Rabies Control in the United States, Merida, Mexico, 25 October 1995.

Rivers, J.A. 1997. Blue Whale, *Balaenoptera musculus*, Vocalizations from the Waters Off Central California. Marine Mammal Science 13(2):186-195

Roach, E.R., M.C. Watzin, J.D. Scurry, and J.B. Johnston. 1987. Wetland Trends in Coastal Alabama. *In:* Symposium on the Natural Resources of the Mobile Bay Estuary. Lowery, T.A. (ed.). Alabama Sea Grant Extension Service, Auburn University. MASGP-87-007. pp. 92-101.

Robards, F.C. 1952. Annual Report: Game, Fur and Fish. U.S. Fish and Wildl. Serv., Cordova. (Memorandum).

Robards, M., L.E. Noel, B.J. Pierson, and M.A. Cronin. 1996. Arctic Fox Demography and Health in the Prudhoe Bay Region of Alaska. Final Report to BP Exploration (Alaska) Inc., LGL Alaska Research Associates, Inc. 17 pp.

Roberts, H.H., L.J. Rouse, Jr., N.D. Walker, and J.H. Hudson. 1982. Cold-Water Stress in Florida Bay and Northern Bahamas; A Product of Winter Cold-Air Outbreaks. Journal of Sedimentary Petrology 52(1):145-155.

Roberts, K.J., and M.E. Thompson. 1983. Petroleum Production Structures: Economic Resources for Louisiana Sport Divers. Baton Rouge, LA: Louisiana Sea Grant College Program, Louisiana State University, Center for Wetland Resources.

Robertson, T.L. and E. DeCola. 2000. Joint Agency Evaluation of the Spring and Fall 2000 North Slope Broken Ice Exercises. December 18, 2001.

Robson, B.W., M.T. Williams, M. Kiyota, G.E. Merculief, and C.M. Stepetin. 1997. Northern Fur Seal Entanglement Studies: St. Paul and St. George Islands, 1996, pp 29-56. *In:* Fur Seal Investigations, 1996. E.H. Sinclair (ed.). USDOC/NOAA Technical Memo NMFS-AFSC-87. 115 pp.

Roby, D.D. 1978. Behavioral Patterns of Barren-Ground Caribou in the Central Arctic Herd within the Trans-Alaska Pipeline Corridor. M.S. Thesis. Fairbanks, AK: University of Alaska. 200 pp.

Rodrigues, R., R.O. Skoog, and R.H. Pollard. 1994. Inventory of Arctic Fox Dens in the Prudhoe Bay Oil Field, Alaska. Final Report Prepared for BP Exploration (Alaska) Inc., Anchorage, AK: LGL Alaska Research Associates, Inc. 25 pp. + app.

Rogers. 1986. Pacific Salmon, pp. 461-478. *In:* The Gulf of Alaska: Physical Environment and Biological Resources. Hood, D.W., and S.T. Zimmerman (eds.). USDOC/NOAA, Alaska and USDOI/MMS, Alaska.

Ross, D. 1976. Mechanics of Underwater Noise. New York, NY: Pergammon Press. 375 pp.

Rotterman, L.M., and T. Simon-Jackson. 1988. Sea Otter (*Enhydra lutris*), pp. 237-275. *In:* Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Lentfer, J.W. (ed.). Washington, DC: Marine Mammal Commission.

Rowe, G.T. 2000. Chapter 7: Benthic Communities, pp. 189-207. *In:* Continental Shelf Associates, Inc., Deepwater Gulf of Mexico Environmental and Socioeconomic Data Search and Literature Synthesis. Volume I: Narrative Report. OCS Study MMS 2000-049. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region..

Rowe, G.T., and R.L. Haedrich. 1979. The Biota and Biological Processes of the Continental Slope, pp. 49-59. *In:* Geology of the Continental Slopes. Doyle, L.J., and O.N. Pilkey (eds.). Soc. Econ. Paleont. Mineral Spec. Publ. No. 27.

Rozell, N. 2000. The Search for Russia's Lindbergh. Alaska Science Forum, September 10, 1999. Article #1456, University of Alaska, Fairbanks Geophysical Institute. Available electronically at <http://www.gi.alaska.edu/ScienceForum/ASF14/1456.html>.

Ryan, P.G. 1988. Effects of Ingested Plastic on Seabird Feeding: Evidence from Chickens. Mar. Poll. Bull. 19(3):125-128.

Saario, D.J., and B. Kessel. 1966. Human Ecological Investigations at Kivalina, pp. 969-1,041. *In:* Environment of the Cape Thompson Region, Alaska. Wilimovsky, N.J., and J.N. Wolfe (eds.). Oak Ridge, TN: U.S. Atomic Energy Commission.

Sager, W.W., W.W. Schroeder, J.S. Laswell, K.S. Davis, R. Rezak, and S.R. Gittings. 1992. Topographic Features of the Mississippi-Alabama Outer Continental Shelf and Their Implications for Sea Level Fluctuations During the Late Pleistocene-Holocene Transgression, Geo-Mar.Lett. 12:41-48.

Salisbury, C.A. 1992. Alaska Territorial Guard Site - Soldiers of the Mists: Minutemen of the Alaska Frontier. Missoula, MT: Pictoral Histories Publishing Co.

Saloman, C.H., and S.P. Naughton. 1983. Food of Spanish Mackerel, *Scomberomoris maculatus*, from the Gulf of Mexico and Southeastern Seaboard of the United States. NOAA Tech. Memo. NMF-SEFSC-128. 22 pp.

------- 1984. Food of Crevalle Jack, *Caranx hippos*, from Florida, Louisiana and Texas. NOAA Tech. Memo. NMFS-SEFSC-134. 34 pp.

Sarmiento, J.L., J.C. Orr, and U. Siegenthaler. 1992. A Perturbation Simulation of CO_2 Uptake in an Ocean General Circulation Model. J. Geophys. Res. 97 (C3):3,621-3,645.

Sassen, R., J. Brooks, I. MacDonald, M. Kennicutt II, and N. Guinasso. 1993. Association of Oil Seeps and Chemosynthetic Communities with Oil Discoveries, Upper Continental Slope, Gulf of Mexico. Bull. Am. Assoc. Pet. Geol. 77:1,599.

Scarff, J.E. 1986. Historic and Present Distribution of the Right Whale, *Eubalaena glacialis*, in the Eastern North Pacific South of 50 N and East of 180 W. Report to the International Whaling Commission, Special Issue 10:43-63.

Scheffer, V.B., and J.W. Slipp. 1944. The Harbor Seal in Washington State. Amer. Midl. Nat. 32:373-416.

Scherr, J., S.M. Banet, and B.J. Bascle. 1991. Correlation Study of Selected Exploration Wells from the North Slope and Beaufort Sea, Alaska. OCS Report MMS 91-0076. Anchorage AK: USDOI/MMS. 29 pp.

Schick, R.S., and D.L. Urban. 2000. Spatial Components of Bowhead Whale (*Balaena mysticetus*) Distribution in the Alaskan Beaufort Sea. Canadian Journal of Fishery and Aquatic Science 57:2,193-2,200.

Schlesinger, W.H. 1990. Evidence from Chronosequence Studies for a Low Carbon-Storage Potential of Soils. Nature 348:232-234.

------- 1991. Biogeochemistry An Analysis of Global Change. San Diego, CA: Academic Press. 443 pp.

Schliebe, S.L., and T.J. Evans. 1995. Polar Bear Management in Alaska 1988-92, pp. 139-144. *In:* Polar Bears. Proceedings of the Eleventh Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 25-27 January 1993. Copenhagen, Denmark. Wiig, Ø., E.W. Born, and G.W. Garner (eds.).

Schliebe, S.L., S.C. Amstrup, and G.W. Garner. 1995. The Status of Polar Bears in Alaska 1993, pp 125-138. *In*: Polar Bears. Proceedings of the Eleventh Working Meeting of the IUCN/SSC Polar Bear Specialist Group, 25-27 January 1993. Copenhagen, Denmark. Wiig, Ø., E.W. Born, and G.W. Garner (eds.).

Schmidly, D.J. 1981. Marine Mammals of the Southeastern United States Coast and the Gulf of Mexico. FWS/OBS-80/41. Washington, DC: USDOI/FWS, Office of Biological Services. 163 pp.

Schoen, J.W., and L. Beier. 1985. Brown Bear Habitat Preferences and Brown Bear Logging and Mining Relationships in Southeast Alaska. Federal Aid. in Wildlife Restoration Project W-22-3. Juneau, AK: Alaska Department of Fish and Game.

------- 1990. Brown Bear Habitat Preferences and Brown Bear Logging and Mining Relationships in Southeast Alaska. Federal Aid in Wildlife Restoration Research Final Report Study 4.17. Juneau, AK: Alaska Department of Fish and Game. 90 pp.

Schroeder, R.F., D.B. Andersen, R. Bosworth, J.M. Morris, and J.M. Wright. 1987a. Subsistence in Alaska: Arctic, Interior, Southcentral, Southwest, and Western Regional Summaries. Technical Paper No. 150. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Schroeder, R., D. Andersen, and G. Hildreth. 1987b. Subsistence Use Area Map Altas for Ten Kotzebue Sound Communities. Juneau, AK: Alaska Department of Fish and Game, Maniilaq Association and Division of Subsistence.

Schroeder, W.W., M.R. Dardeau, J.J. Dindo, P. Fleisher, K.L. Heck Jr., and A.W. Shultz. 1989. Geophysical and Biological Aspects of Hardbottom Environments on the L'MAFLA Shelf, Northern Gulf of Mexico, pp. 17-21. *In:* Proceeding of Oceans '88 Conference.

Schwartz, C.C., S.D. Miller, and A.W. Franzmann. 1987. Denning Ecology of Three Black Bear Populations in Alaska. Int. Conf. Bear Res. and Manage. 7:281-291.

Science Applications International Corporation (SAIC). 1986. Gulf of Mexico Physical Oceanography Program Final Report: Years 1 and 2, Vol. II: Technical Report. Prepared for the USDOI/MMS, Gulf of Mexico OCS Region. OCS Study MMS 85-0094. 378 pp.

Scott, C.L., L.A. Brown, G.B. Jennings, and C.J. Utermohle. 2000. Community Profile Database. Version 3.0. Juneau, AK: Alaska Department of Fish and Game, Div. of Subsistence.

Seaman, G.A., and J.J. Burns. 1981. Preliminary Results of Recent Studies of Belukhas in Alaskan Waters. Rep. Int. Whal. Comm. 31:567-574.

Sease, J.L., and D.G. Chapman. 1988. Pacific Walrus – *Odobenus rosmarus divergens*, pp. 17-38. *In:* Selected Marine Mammals of Alaska: Species Accounts with Research and Management Recommendations. Lentfer, J.W. (ed.). Washington, DC: Marine Mammal Commission.

Sease, J.L., and T.R. Loughlin. 1999. Arial and Land Based Surveys of Steller Sea Lions (*Eumatopias jubatus*) in Alaska, June and July 1997 and 1998. NOAA Tech. Memo. NMFS-AFSC-100. USDOC/NOAA. 61 pp.

Sease, J.L., J.M. Strick, R.L. Merrick, and J.P. Lewis. 1999. Aerial and Ship-Based Surveys of Steller Sea Lions (*Eumetopias jubatus*) in Alaska, June and July 1996. NOAA Technical Memo NMFS-AFSC-99. USDOC/NOAA. 43 pp.

Sellers, R.A. 1998. Game Management Unit 9 – Alaska Peninsula, pp. 89-100. *In:* Brown Bear. Management Report of Survey-Inventory Activities. 1 July 1994 – 30 June 1996. Hicks, M.V. (ed.). Fed. Aid in Wildl. Rest., Grants W-24-3 & W-24-4, Study 4.0. Juneau, AK: Alaska Department of Fish and Game. 270 pp.

Semenov, U.N. 1965. Quantitative Distribution of Benthic Fauna of the Shelf and Upper Part of the Slope in the Gulf of Alaska, pp. 37-69. *In:* Soviet Fisheries Investigations in the Northeast Pacific, Part IV. Moiseev, P.A. (ed.). Israel Program for Scientific Translations 1968.

Sergeant, D.E. 1981. On Permissible Exploitation Rates of Monodontidae. Rep. Int. Whal. Comm. 31:583-588.

------- 1986. Present Status of White Whales *Delphinapterus luecas* in the St. Lawrence Estuary. Naturaliste Can. 113(1):61-81.

Sergeant, D.E., and P.F. Brodie. 1969. Body Size in White Whales, *Dephinapterus leucas.* Journal of the Fisheries Research Board of Canada 26:2,561-2,580.

Seydlitz, R. and S. Laska. 1994. Social and Economic Impacts of Petroleum "Boom and Bust" Cycles. OCS Study MMS 94-0016. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Sharma, G.D. 1979. The Alaskan Shelf; Hydrographic, Sedimentary and Geochemical Environment. New York, NY, and Heidelberg, Berlin: Springer-Verlag. 498 pp.

Shaughnessy, P.D., and F.H. Fay. 1977. A Review of the Taxonomy and Nomenclature of North Pacific Harbour Seals. J. Zool. (Lond.) 182:385-419.

Sheehan, Glenn W. In the Belly of the Whale, Trade and War in Eskimo Society. 1997. Aurora, Alaska, Anthropological Association (AAA) Monograph Series –VI. Anchorage: AAA.

Shelden, K.E.W. 1995. Impacts of Vessel Surveys and Tagging Operations on the Behavior of Beluga Whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, 1-22 June 1994. Unpublished Report Submitted to Int. Whale Comm. (SC/47/SM12).

Shepard, G.W., P.A. Krumhansl, M.L. Knack, and C.I. Malme. 2001. ANIMIDA Phase 1: Ambient and Industrial Noise Measurements Near the Northstar and Liberty Sites During April 2000. Prepared for the USDOI/MMS by BBN Technologies. OCS Study MMS 2001-0047. Anchorage, AK: Alaska OCS Region. 66 pp.

Shepro, C.E., and D.C. Maas. 1999. North Slope Borough 1998/99 Economic Profile and Census Report: Volume VIII. Prepared for the North Slope Borough Department of Planning and Community Services, Barrow, AK.

Shew, D.M., R.H. Baumann, T.H. Fritts, and L.S. Dunn. 1981. Texas Barrier Island Region Ecological Characterization: Environmental Synthesis Papers. FWS/OBS-81/32. Washington, DC: USDOI/FWS, Biological Services Program. 413 pp.

Shideler, D. 1993. Deterrent Methods, pp. 35-50. *In:* Guidelines for Oil and Gas Operations in Polar Bear Habitats. Truett, J.C. (ed.). Report for USDOI/MMS, Anchorage, AK. OCS Study MMS 93-0008. Bryan, TX: LGL Ecol. Res. Assoc. Inc. 104 pp.

Shideler, R., and J. Hechtel. 1991. Use of Aversive Conditioning to Reduce Grizzly Bear/Human Conflicts in the North Slope Oil Fields. Fairbanks, AK: Alaska Department of Fish and Game.

------- 2000. Grizzly Bear, pp. 105-132. *In:* The Natural History of an Arctic Oil Field: Development and the Biota. Truett, J.C., and S.R. Johnson (eds.). San Diego, CA: Academic Press. 408 pp.

Shiels, W.E., J.J. Goering, and D.W. Hood. 1973. Crude Oil Phytotoxicity Studies, pp. 143-446. *In:* Environmental Studies of Port Valdez. Hood, D.W., W.E. Shiels, and E.J. Kelley (eds.). University of Alaska, Institute of Marine Sciences, Occasional Publication 3.

Shinn, E.A., B.H. Lidz, and C.D. Reich. 1993. Habitat Impacts of Offshore Drilling: Eastern Gulf of Mexico. OCS Study MMS 93-0021. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 73 pp.

Shipp, R. L., and T. L. Hopkins. 1978. Physical and Biological Observations of the Northern Rim of the DeSoto Canyon Made from a Research Submersible. N.E. Gulf Sci. 2(2):113-121.

Show, D. et al. 1998. Interaction Between Marine Humic Matter and Polycyclic Aromatic Hydrocarbons in Lower Cook Inlet and Port Valdez, Alaska. Prepared for USDOI/MMS by University of Alaska, Fairbanks, Coastal Marine Institute. NTIS PB99-106288. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 27 pp.

Shustov, A.P. 1965. Distribution of the Ribbon Seal (*Histriophoca fasciata*) in the Bering Sea, pp. 118-121. *In:* Marine Mammals. Pavloskii, E.H., B.A. Zenkovich, S.E. Kleinberg, and K.K. Chapskii (eds.). Izd. Nauka, Moscow. (Transl. from Russian by U.S. Nav. Oceanogr. Off., Washington, DC., 1970. Transl. 474. 5 pp.).

Simeone, W.E. 1998. Managing Competition: The Copper River Fishery. Cultural Survival Quarterly 22(3):53-57.

Sinclair, E., T. Loughlin, and W. Pearcy. 1994. Prey Selection by Northern Fur Seals (*Callorhinus ursinus*) in the Eastern Bering Sea. Fish. Bull. 92:144-156.

Skalski, J., W. Pearson, and C. Malme. 1992. Effects of Sounds from a Geophysical Survey Device on Catch Per Unit Effort on a Hook-and-Line Fishery for Rockfish (*Sebastes* spp.). Can. J. Fish. Aquatic Sci. 49:1,357-1,365.

Slater, L., G. Byrd, J. Nelson, and J. Ingrum. 1995. Monitoring Seabird Populations in Areas of Oil and Gas Development on the Alaskan Continental Shelf: Monitoring Populations and Productivity of Seabirds at Colonies in Lower Cook Inlet, Alaska in 1993 and 1994. USDOI/FWS, Alaska. NTIS PB96-185707.

Slay, C.K., and J.I. Richardson. 1988. King's Bay, Georgia: Dredging and Turtles. *In:* Proc. 8th Annu. Workshop on Sea Turtle Conservation and Biology, NOAA Tech. Mem. NOAA-TM-NMFS-SEFSC-214, Miami, FL. 109pp.

Small, A. 1994. California Birds: Their Status and Distribution. Vista, CA: Ibis Publishing Co. 342 pp.

Small, R.J. 1996. Population Assessment of Harbor Seals in Alaska: Report of a Workshop Held in Fairbanks, Alaska, 14-16 November 1995. 36 pp.

Small, R.J., and D.P. DeMaster. 1995. Alaska Marine Mammal Stock Assessments 1995. USDOC/ NOAA Tech. Memo. NMFS-AFSC-57. 93 pp.

Small, R.J., G.W. Pendelton, and K.M. Wynne. 1997. Harbor Seal Population Trends in the Ketchikan, Sitka, and Kodiak Island Areas of Alaska, pp. 7-32. *In:* Annual Report: Harbor Seal Investigations in Alaska. NOAA Grant NA57FX0367. Douglas, AK: Alaska Department of Fish and Game, Division of Wildlife Conservation.

Smirnov, N.A. 1929. A Review of the Pinnipedia of Europe and Northern Asia. Izv. Otd. Priklad. Ikhtiol. 9:231-268. (Transl. from Russian by F.H. Fay, Univ. Alaska, Fairbanks.)

Smith, Eric R.A.N. Public Perceptions of Risk Associated with Offshore Oil Development. USDOI/MMS. Task Order 17607.

Smith, Eric R.A.N. Ongoing. A Design for Time Series Study of a NIMBY Response. USDOI/MMS and the Southern California Educational Initiative.

Smith, G.B. 1981. The Biology of Walleye Pollock, pp. 527 – 551. *In:* The Eastern Bering Sea Shelf: Oceanography and Resources. Hook, D.E. and J.A. Calder (eds.). Vol. 1. USDOC/NOAA, Marine Pollution Assessment.

Smith, G.M., and C.W. Coates. 1938. Fibri-Epithelial Growths of the Skin in Large Marine Turtles *Chelonia mydas*. Zoologica 24:379-82.

Smith, M.J.T. 1989. Aircraft Noise. Cambridge, UK: Cambridge Univ. Press. 359 pp.

Smith, S.A., and W.J. Houck. 1984. Three Species of Sea Turtles Collected from Northern California. California Fish and Game 70(1):60-62.

Smith, T.G., and M.O. Hammill. 1981. Ecology of the Ringed Seal, *Phoca hispida*, in its Fast Ice Breeding Habitat. Can. J. Zool. 59(6):966-981.

Sobelman, S.S. 1985. The Economics of Wild Resource Use in Shishmaref, Alaska. Technical Paper No. 112. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Sonnenfeld, J. 1956. Changes in Subsistence Among the Barrow Eskimo. Ph.D. Dissertation. Johns Hopkins University.

Sorensen, P.E. 1990. Socioeconomic Effects of OCS Oil and Gas Development, pp. 609-629. *In:* Synthesis of Available Biological, Geological, Chemical, and Socioeconomic, and Cultural Resource Information for the South Florida Area. Phillips, N.W., and K.S. Larsen (eds.). OCS Study MMS 90-0019. Herndon, VA: USDOI/MMS, Atlantic OCS Region.

Sorensen, P.W., R.J. Medved, M.A.M. Hyman, and H.E. Winn. 1984. Distribution and Abundance of Cetaceans in the Vicinity of Human Activities Along the Continental Shelf of the Northwestern Atlantic. Mar. Environ. Res. 12(1):69-81.

Southern California Coastal Water Research Project (SCCWRP). 1990 Toxicity of Surface Runoff in Southern California. Annual Report 1989-1990. Westminster, CA: Southern California Coastal Water Research Project Authority.

Southward, A.J., and E.C. Southward. 1978. Recolonization of Rocky Shores in Cornwall After Use of Toxic Dispersants to Clean Up the *Torrey Canyon* Spill. Journal of the Fisheries Research Board of Canada 35:682-706.

Southwest Fishery Management Council. 2000. Current Data on Fish Habitat, Coastal Pelagic Species, Highly Migratory Species, Groundfish, Salmon, Rockfish, Shellfish, Flatfish, and Marine Habitats. Website access, October 2000.

Sowls, A., G. Hatch, and C. Lensink. 1978. Catalog of Alaskan Seabird Colonies. FWS/OBS-78.78 USDOI/FWS, Biological Service Program.

Sparks, T.D., J.C. Norris, R. Benson, and W.E. Evans. 1996. Distributions of Sperm Whales in the Northwestern Gulf of Mexico as Determined from an Acoustic Survey, p. 108. 11th Biennial Conference on the Biology of Marine Mammals, 14-18 December 1995, Orlando, FL.

Speller, S.W. 1972. Food Ecology and Hunting Behavior of Denning Arctic Foxes at Aberdeen Lake, NWT. Ph.D. Thesis. Univ. of Saskatchewan. 145 pp.

Spencer, R.F. 1959. The North Alaskan Eskimo: A Study in Ecology and Society. Bureau of American Ethnology Bulletin 171.

Spiess, B. 2001. Corrosion is Constant Enemy, Kuparuk: Oil Company, State Monitors Try to Keep Up With Aging Pipelines. Anchorage Daily News. 22 April 2001: 4.pp. <http://www.adn.com/nation/ pstory/0,2974,25987,00.html>.

Spraker, T.R., L.F. Lowry, and K.J. Frost. 1994. Gross Necropsy and Histopathological Lesions Found in Harbor Seals, pp. 281-311. *In:* Marine Mammals and the *Exxon Valdez*. Loughlin, T.R. (ed.). San Diego, CA: Academic Press.

Stabile, J., J.R. Waldman, F. Paruka, and I. Wirgin. 1996. Stock Structure and Homing Fidelity in Gulf of Mexico Sturgeon (*Acipenser oxyrinchus desotoi*) Based on Restriction Fragment Length Polymorphism and Sequence Analysis of Mitochondrial DNA. Genetics 144:767-775.

Stafford, K.M., C.G. Fox, and D.S. Clark. 1998. Long Range Acoustic Detection and Localization of Blue Whale Calls in the Northeast Pacific Ocean. J. Acoust. Soc. Amer. 104(6):3,616-3,625.

Stafford, K.M., S.L. Nieukirk, and C.G. Fox. 1999. Low Frequency Whale Sounds Recorded on Hydrophones Moored in the Eastern Tropical Pacific. J. Acoust. Soc. Amer. 106(6):3,687-3,698.

Stallard, R.F. 1998. Terrestrial Sedimentation and the Carbon Cycle: Coupling Weathering and Erosion to Carbon Burial. Global Biogeochemical Cycles 12(2):231-257.

Stalmaster, M.V. 1987. Bald Eagle. New York, NY: University Books. 210 pp.

Stanley, D.R., and C.A. Wilson. 1991. A Fishery-Dependent Based Study of Fish Species Composition and Associated Catch Rates Around Oil and Gas Structures Off Louisiana. Fish. Bull. 88:719-730.

Stephan, H.G., M. Hondzo, and X. Fang. 1993. Lake Water Quality Modeling for Project Future Climate Scenarios. J. Environ. Quality 22:417-431.

Stehn, R.A., C.P. Dau, B. Conant, and W.I. Butler, Jr. 1993. Decline of Spectacled Eiders Nesting in Western Alaska. Arctic 46(3):264-277.

Steiger, G.H., J. Calambokidis, R. Sears, K.C. Balcomb, and J.C. Cubbage. 1991. Movement of Humpback Whales Between California and Costa Rica. Mar. Mamm. Sci. 7:30-310.

Steinbeck, J.R., J.M. Groff, C.S. Friedman, T. McDowell, R.P. Hedrick. 1992. Investigations into a Mortality Among Populations of the California Black Abalone, *Haliotis cracherodii*, on the Central Coast of California, USA. *In*: Abalone and the World: Biology, Fisheries and Culture. Shepherd, S.A., M.J. Tegner, S.A. Gusman del Proo. (eds.). Proceedings 1st International Symposium on Abalone. Cambridge, UK: Cambridge University Press. pp. 203-213.

Steinhauer, M.S., and P.D. Boehm. 1992. Composition and Distribution of Saturated and Aromatic Hydrocarbons in Nearshore Sediments, River Sediments, and Coastal Peat of the Arctic Beaufort Sea: Implications for Detecting Anthropogenic Hydrocarbon Inputs. Marine Environmental Research 33(4):223-253.

Stenson, G.B., G.A. Badgero, and H.D. Fisher. 1984. Food Habits of *Lutra canadensis* in the Marine Environment of British Columbia. Can. J. Zool. 62:88-91.

Stephen R. Braund & Associates and Institute of Social and Economic Research. 1997. Northstar Prospect, Mid-Beaufort Sea, North Slope, Alaska: Subsistence Technical Report. Prepared for Dames & Moore in Support of USAED 1999.

Stephenson, M.T. 1991. Components of Produced Water: A Compilation of Results from Several Industry Studies, pp. 25-38. *In:* Proceedings of the First International Conference on Health, Safety and Environment, The Hague, Netherlands. SPE 23313. Richardson, TX: Society of Petroleum Engineers, Inc.

Stephenson, R.O. 1995. Game Management Units 25A, 25B, 25D, 26B, and 26C Brown Bear Management Report, pp. 271-288. *In:* Management Report of Survey-Inventory Activities. Hicks, M.V (ed.). Fed. Aid Wildl. Restor. Proj. W-24-1 and W-24-2. Juneau, AK: Alaska Dept. Fish and Game.

Stephenson, T., and A. Stephenson. 1949. The Universal Features of Zonation Between Tidemarks of Rocky Coasts. Journal of Ecology 37: 289-305.

--------- 1972. Life Between Tidemarks on Rocky Shores. San Francisco, CA: Freeman. 425 pp.

Stewart, B.S., and S. Leatherwood. 1985. Minke Whale, *Balaenoptera acutorostrata*, pp. 91-136. *In:* Handbook of Marine Mammals. Ridgeway, S.H., and R. Harrison (eds.). London, England: Academic Press.

Stewart, B.S., P.K. Yochem, R.L. DeLong, G.A. Antonelis, Jr. 1987. Interactions Between Guadalupe Fur Seals and California Sea Lions at San Nicolas and San Miguel Islands, California, pp. 103-106. *In:* Status, Biology, and Ecology of Fur Seals. Croxall, J.P., and R.L. Gentry (eds.). NOAA-TR-NMFS 51. Silver Spring, MD: National Marine Fisheries Service. 212 pp.

Stickel, L.F., and M.P. Dieter. 1979. Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 1976 Through FY 1978. FWS/OBS-79/23. Slidell, LA: USDOI/FWS, Biological Services Program. 14 pp.

Stirling, I. 1988. Attraction of Polar Bears *Ursus maritimus* to Offshore Drilling Sites in the Eastern Beaufort Sea. Polar Rec. 24(148)1-8.

Stirling, I., D. Andriashek, and W. Calvert. 1981. Habitat Preferences and Distribution of Polar Bears in the Western Canadian Arctic. Report for Dome Petroleum Ltd. and Can. Wild. Serv. 49 pp.

Stirling, I., and W.R. Archibald. 1977. Aspects of Predation of Seals by Polar Bears. J. Fish. Res. Board Can. 34:1,126-1,129.

Stirling, I., and P.B. Latour. 1978. Comparative Hunting Abilities of Polar Bear Cubs of Different Ages. Can. J. Zool. 56(8):1,768-1,772.

Stirling, I., and E.H. McEwan. 1975. The Caloric Value of Whole Ringed Seals (*Phoca hispida*) in Relation to Polar Bear (*Ursus maritimus*) Ecology and Hunting Behavior. Can. J. Zool. 53:1,021-1,027.

Stoker, S.W., and I.I. Krupnik. 1993. Subsistence Whaling, pp. 579-629. *In:* The Bowhead Whale. Burns, J.J., J.J. Montague, and C.J. Cowles (eds.). Society of Marine Mammalogy Special Publication No 2.

Stone, G.S., S.K. Katona, A. Mainwaring, J.M. Allen, and H.D. Corbett. 1992. Respiration and Surfacing Rates of Fin Whales (*Balaenoptera physalus*) Observed from a Lighthouse Tower. Rep. Int. Whal. Comm. 42:739-745.

Stoneburner, J.L., M.N. Nicora, and E.R. Blood. 1980. Heavy Metals in Loggerhead Sea Turtle Eggs (*Caretta caretta*): Evidence to Support the Hypotheses that Demes Exist in the Western Atlantic Population. J. Herp. 14:171-175.

Stotz, D.F., J.W. Fitzpatrick, T.A. Parker III, and D.K. Moskoits. 1996. Neotropical Birds: Ecology and Conservation. Chicago, IL: University of Chicago Press. 478 pp.

Stratton, L. 1989. Resource Harvest and Use in Tatitlek, Alaska. Technical Paper No. 181. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

------- 1990. Resource Use in Cordova, a Coastal Community of Southcentral Alaska. Technical Paper No. 153. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

------- 1992. Cordova: A 1988 Update on Resource Harvests and Uses. Technical Paper No. 204. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

Strickland, R., and D.J. Chasan. 1989. Coastal Washington: A Synthesis of Information. Washington State Offshore Oil and Gas Series. Washington Sea Grant Program Report No. 89-1. Seattle, WA: University of Washington. 233 pp.

Stright, M.J., Lear, E.M., and Bennett, J.F. (1999). Spatial Data Analysis of Artifacts Redeposited by Coastal Erosion: A Case Study of McFaddin Beach, Texas. USDOI/MMS. OCS Study MMS 99-0068. 2 Vol.

Sturges, W. 1993. The Annual Cycle of the Western Boundary Current in the Gulf of Mexico. J. Geophys. Res. 98(C10):18,053–18,068.

Sturges, W., and J.P. Blaha. 1975. A Western Boundary Current in the Gulf of Mexico. Science 192(4,237):367–369.

Sulak, K.J., and J.P. Clugston. 1998. Early Life History Stages of Gulf Sturgeon in the Suwannee River, Florida. Transactions of the American Fisheries Society 127:758-771.

Sutter, F.C., III, R.O. Williams, and M.F. Godcharles. 1991. Movement Patterns of King Mackerel in the Southeastern United States. Fish. Bull. 89:315-324.

Suydam, R.S., D.L. Dickson, J.B. Fadley, and L.T. Quakenbush. 2000. Population Declines of King and Common Eiders of the Beaufort Sea. Condor 102: 219-222.

Swartzman, G.L., C.A. Ribic, and C.P. Haung. 1990. Simulating the Role of Entanglement in Northern Fur Seal, *Callorhinus ursinus*, Population Dynamics, pp. 513-530. *In:* Proceedings of the Second International Conference on Marine Debris, 2-7 April 1989, Honolulul, Hawaii. Shomura, R.S., and M.L. Godfrey (eds.). NMFS-SWFSC-154. USDOC/NOAA/NOAA Tech. Memo.

Swedmark, G. 1964. The Interstitial Fauna of Marine Sand. Biological Review, Vol. 39. 42 pp.

Taggart, S.J. 1987. Grouping Behavior of Pacific Walruses (*Odobenus rosmarus divergens* Illiger), an Evolutionary Perspective. Ph.D. Dissertation. Univ. of California Santa Cruz. 152 pp.

Taylor, B. 1998. Rails: A Guide to the Rails, Crakes, Gallinules, and Coots of the World. New Haven: Yale University Press. 600 pp.

Taylor, M.K., D.P. DeMaster, F.L. Bunnell, and R.E. Scheinsburg. 1986. Sustainable Harvest of Polar Bears (*Ursus maritimus*). Internal Rep., Widl. Serv., Yellowknife, Northwest Territory.

Teal, J.M., and R.W. Howarth. 1984. Oil Spill Studies: A Review of Ecological Effects. Environmental Management 8:27-44.

Teas, W. 1991. Sea Turtle Stranding and Salvage Network: Green Turtles, *Chelonia mydas*, and Fibropapillomas. Research Plan for Marine Turtle Fibropapilloma. NOAA-TM-NMFS-SWSFC-156:89-93.

------- 1994. Annual Report of the Sea Turtle Stranding and Salvage Network Atlantic and Gulf Coasts of the United States January-December 1993. Miami Laboratory Contribution Number MIA-94/95-12. Miami, FL: USDOC/NOAA/NMFS.

Teas, W.G., and A. Martinez. 1992. Annual Report of the Sea Turtle Stranding and Salvage Network Atlantic and Gulf Coasts of the United States, January-December 1989.

Tech Law. Ongoing. Assessment of Historical, Social and Economic Impacts of OCS Activities on GOM Communities. NLS No. GM-94-04. MMS Contract No. 30808.

Terry, J., and T. Hiatt. 1999. Economic Status of the Groundfish Fisheries Off Alaska, 1998. Seattle, WA: USDOC/NMFS, Socioeconomic Assessments Program, Alaska Fisheries Science Center.

The Louis Berger Group**.** Ongoing. Deepwater Program: OCS-Related Infrastructure in the GOM. NLS No. GM-99-01, MMS Contract No. 30955.

Thilenius, J.F. 1995. Phytosociology and Succession on Earthquake Uplifted Coastal Wetlands, Copper River Delta, Alaska. General Technical Report PNW-GTR-346. USDA/Forest Service, Pacific Northwest Research Station. 58 pp.

Thompson, N.P., P.W. Rankin and D.W. Johnson. 1974. Polychlorinated Biphenyls and p,p'-DDE in Green Turtle Eggs from Ascension Island, South Atlantic Ocean. Bull. Environ. Contam. Toxicol. 11(5):399-406.

Thompson, P.O., W.C. Cummings, and S.J. Ha. 1986. Sounds, Source Levels, and Associated Behavior of Humpback Whales, Southeast Alaska. J. Acoust. Soc. Am. 80:735-740.

Thompson, P.O., L.T. Findley, and O. Vidal. 1986. Sounds, Source Levels, and Associated Behavior of Humpback Whales, Southeast Alaska. J. Acoust. Soc. Am. 80(3):735-740.

------- 1990. 20-Hz Pulses and Other Vocalizations of Fin Whales, *Balaenoptera physalus*, in the Gulf of California, Mexico. J. Acoust. Soc. Amer. Suppl. 1, Vol. 88, S5.

Thompson, B.E., J. Dixon, S. Schroeter, and D.J. Reish. 1993. Chapter 8, Benthic Invertebrates, pp. 369-458. *In:* Ecology of the Southern California Bight: A Synthesis and Interpretation. Dailey, M.D., D.J. Reish, and J.W. Anderson (eds.). Berkeley, CA: University of California Press. 926 pp.

Thompson, M.J., W.W. Schroeder, and N.W. Phillips. 1999. Ecology of Live Botton Habitats of Northeastern Gulf of Mexico: A Community Profile. USDOI/USGS, Biological Resources Division, (USGS/BRD/CR—1999-0001) and USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA (OCS Study MMS 99-0004). X pp. + 74 pp.

Thomson, D.H., and W.J. Richardson. 1987. Integration, pp. 449-479. *In:* Importance of the Eastern Alaskan Beaufort Sea to Feeding Bowhead Whales, 1985-86. Richardson, W.J. (ed.). OCS Study MMS 87-0037 for USDOI/MMS. Bryan, TX: LGL Ecol. Res. Assoc. Inc. NTIS PB88-150271. 547 pp.

Thurston, D.K., and L.A. Theiss. 1985. Geologic Report for the Chukchi Sea Planning Area, Alaska. OCS Report, MMS 85-0111. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 193 pp.

Tikhomirov, E.A. 1959. The Feeding of the Sea Lion on Warm-Blooded Animals. Izvestia TINRO 53:281-285.

------- 1966. Reproduction of Seals of the Family Phocidae in the North Pacific. Zool. Zh. 45:275-281. (Transl. from Russian by Fish Res. Board Can., 1971, Transl. Ser. 1889, 19 pp.)

Tillman, M.F. 1997. Estimates of Population Size for the North Pacific Sei Whale. Rept. Int. Whal. Commn., Special Issue 1:98-106.

Titus, J.G., and V. Narayanan. 1995. The Probability of Sea Level Rise. 230-R95-008. Washington, DC: USEPA. 186 pp.

Tolbert, C.M. 1995. OCS Development and Coastal Income Inequality: A Comparative Analysis. OCS Study MMS 94-0052. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Tolbert, C.M., and E. Shihadeh. 1995. Oil and Gas Development and Coastal Income Inequality: Case Studies at the Place Level. Presentation at the Fifteenth Annual Information Transfer Meeting. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Tolbert, C.M., and M. Sizer. 1996. U.S. Commuting Zones and Labor Market Areas: 1990 Update. Staff Paper No. AGES-9614. USDOA/Economic Research Service/Rural Economy Division.

Tolbert, C.M., J.J. Beggs, and G.D. Boudreaux. 1995. PUMSD and Associated Files: CDROM Edition. [machine readable data files]. Baton Rouge, LA: Louisiana Population Data Center, Louisiana State University and Agricultural Center.

Tolson, R.B. 1987. Geology and Stratigraphy of the Hope Basin, Southern Chukchi Sea, Alaska. *In:* Geology and Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins-Beaufort Sea to Baja California. Scholl, D.A., A. Grantz, and J.G. Vedder (eds.).

Tomilin, A.G. 1957. Mammals of the U.S.S.R. and Adjacent Countries, Vol. 9 Cetacea (in Russian). Moscow: Isdatel'stvo Akademii Nauk SSR. (Translated by Israel Program for Scientific Translation) 1967. 717 pp. NTIS Access No. TT65-50086.

Tootle, D., C. Tolbert, and E. Shihadeh. 1999. Sustainable Development in Oil and Gas Country: A Case Study of Abbeville, Louisiana, pp. 228-36. *In:* Proceedings: Seventeenth Annual Gulf of Mexico Information Transfer Meeting, December 1997. OCS Study MMS 99-0042. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 710 pp.

Tornfelt, E. E., and M. Burwell. 1992. Shipwrecks of the Alaskan Shelf and Shore. OCS Study MMS 92-0002. Anchorage, AK: USDOI/MMS, Alaska OCS Region.. The April 1, 1999 Database <http://www.mms.gov/alaska/ref/ships/ index.htm.>

Trasky, L.L. 1976. Environmental Impact of Seismic Exploration and Blasting in the Aquatic Environment. Anchorage, AK: Alaska Department of Fish and Game. 23 pp.

Treacy, S.D. 1991. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1990. OCS Study MMS 91-0055. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 107 pp.

------- 1994. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1993. OCS Study MMS 94-0032. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 78 pp.

------- 1996. Aerial Surveys of Endangered Whales in the Beaufort Sea, Fall 1995. OCS Study MMS 96-0006. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 119 pp.

Troy Ecological Research Associates. 1990. The Fate of Birds Displaced by the Prudhoe Bay Oil Field: The Distribution of Nesting Birds Before and After P-Pad Construction. Report Prepared for BP Exploration (Alaska) Inc., Anchorage, AK. Anchorage, AK: Troy Ecological Research Associates. 51 pp.

------- 1992. Trends in Bird Use of the Pt. McIntyre Reference Area: 1981-1991. Report Prepared for BP Exploration (Alaska) Inc., Anchorage, AK. Anchorage, AK: Troy Ecological Research Associates. 60 pp.

------- 1996. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1994 Status Report. Report Prepared for BP Exploration (Alaska) Inc., Anchorage, AK. Anchorage, AK: Troy Ecological Research Associates. 11 pp.

------- 1997. Distribution and Abundance of Spectacled Eiders in the Vicinity of Prudhoe Bay, Alaska: 1997 Status Report. Report Prepared for BP Exploration (Alaska) Inc., Anchorage, AK. Anchorage, AK: Troy Ecological Research Associates. 11 pp.

------- 1999. Spectacled Eiders in the Beaufort Sea: Distribution and Timing of Use. Report Prepared for BP Exploration (Alaska) Inc., Anchorage, AK. Anchorage, AK: Troy Ecological Research Associates. 19 pp.

Tucker and Associates, Inc. 1990. Sea Turtles and Marine Mammals of the Gulf of Mexico. *In:* Proceedings of a Workshop Held in New Orleans, 1-3 August 1989. OCS Study MMS 90-0009. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 211 pp.

Turner, R.E., and D.R. Cahoon. 1988. Causes of Wetland Loss in the Coastal Central Gulf of Mexico. Prepared under MMS Contract 14-12-0001-30252. OCS Study MMS 87-0119 (Vol. I: Executive Summary), 87-0120 (Vol. II: Technical Narrative), and 87-0121 (Vol. III: Appendices). New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

Turner, R.F., G.C. Martin, D.E. Risley, D.A. Steffy, T.O. Flett, M.B. Lynch. 1986. Geologic Report for the Norton Basin Planning Area, Bering Sea, Alaska. OCS Report MMS 86-0033. Anchorage, AK: USDOI/MMS. 179 pp.

Turnpenny, A.W.H. and J.R. Nedwell. 1994. The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sound Generated by Seismic Surveys. Report by Fawley Aquatic Research Laboratories Ltd. for United Kingdom Offshore Operators Association Limited, London. 40 pp.

Underwood, L., and J.A. Mosher. 1982. Arctic Fox, Chapter 23. *In:* Wild Mammals of North America. Chapman, J.A., and G.A. Feldhamer (eds.). Baltimore, MD: John Hopkins University Press.

Urick, R.J. 1971. The Noise of Melting Icebergs. J. Acoust. Soc. Am. 50(1, Pt. 2):337-341.

------- 1972. Noise Signature of an Aircraft in Level Flight Over a Hydrophone in the Sea. J. Acoust. Soc. Am. 52(3, Pt. 2):993-999.

------- 1983. Principles of Underwater Sound. New York, NY: McGraw-Hill. 423 pp.

Urquhart, D.R. 1973. Oil Exploration and Banks Island Wildlife: A Guideline for the Preservation of Caribou, Musk Ox, and Arctic Fox Populations on Banks Island, NWT. Game Management Division Report. Government of the Northwest Territories. 105 pp.

U.S. Army Corps of Engineers. 1997. Alpine Development Project: Final Environmental Evaluation Document. Anchorage, AK: U.S. Army Engineer District, Alaska. 3 Vols.

------- 1999. Final Environmental Impact Statement, Beaufort Sea Oil and Gas Development/Northstar Project. Anchorage, AK: U.S. Army Engineer District, Alaska. February 1999.

U.S. Army Engineer District, Alaska (USAEDA). 1999. Beaufort Sea Oil and Gas Development/ Northstar Project Final Environmental Impact Statement. Anchorage, AK: U.S. Army Engineer District, Alaska.

U.S. Department of Commerce (USDOC), Bureau of the Census. 1968. Climatic Atlas of the United States, USDOC, Environmental Science Services Administration, Environmental Data Service. June 1968. 80 pp

------- 1973. 1970 Census of Population, Volume 1, Part 3: Characteristics of the Population, Alaska.

------- 1983. 1980 Census of Population, Volume 1, Chapter C, Part 3: Characteristics of the Population, General Social and Economic Characteristics, Alaska. PC80-1-C-3.

U.S. Department of Commerce (USDOC), Bureau of the Census. 1992. 1990 Census of Population, General Population Characteristics, Alaska. 1990 CP-1-3.

------- 2001. County Population Estimates for July 1, 1999, and Population Change for July 1, 1998. Washington, DC: U.S. Census Bureau, Population Division, Population Estimates Program. Accessed via the U.S. Census Bureau website <www.census.gov/population/estimates/county>.

U.S. Department of Commerce (USDOC), National Oceanic and Atmospheric Administration (NOAA). 1980. Final Environmental Impact Statement Prepared on the Proposed Channel Islands Marine Sanctuary. Washington, DC: USDOC/NOAA, Office of Coastal Zone Management.

------- 1988. National Estuarine Inventory Data Atlas, Volume 4: Public Recreational Facilities in Coastal Areas. USDOC/NOAA/National Ocean Service/Office of Oceanography and Marine Assessment, Ocean Assessments Division, Strategic Assessment Branch. 156 pp.

------- 1988. Interagency Task Force on Persistent Marine Debris. Office of the Chief Scientist, Ecology and Conservation Division.

------- 1991. Final Environmental Impact Statement and Management Plan for the Proposed Flower Garden Banks National Marine Sanctuary. Washington, DC: USDOC/NOAA, Sanctuaries and Reserves Division.

------- 1992a. Agricultural Use in Coastal Areas: A National Summary. September 1992. 111 pp.

------- 1992b. Report to the Congress on Ocean Pollution, Monitoring, and Research. USDOC/NOAA, National Ocean Service. November 1990. 56 pp.

------- 1992c. The National Status and Trends Program for Marine Environmental Quality. . March 1992. USDOC/NOAA, National Ocean Service. 18 pp.

------- 2001. NDBC, Historic Data, Climatic Summaries. <www.ndbc.noaa.gov> February 2001.

U.S. Department of Commerce (USDOC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS). 1986. Fisheries of the United States, 1985; Current Fishery Statistics No. 8380. Washington, DC: USDOC/NOAA/NMFS.

------- 1988. Aerial Surveys of the U.S. Gulf of Mexico Waters, 1983-1986. Unpublished Data.

------- 1995. Status Review of the United States Steller Sea Lion (*Eumetopias jubatus*) Population. Seattle, WA: USDOC/NOAA/NFMS/AFSC, National Marine Mammal Laboratory. 61 pp.

------- 1999a. Fisheries of the United States 1999. Silver Spring, MD: USDOC/NOAA/NMFS, Fisheries Statistics and Economic Division. 140 pp.

------- 1999b. Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks, Volume II. 302 pp.

U.S. Department of Commerce (USDOC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS). 1999c. Alaska Marine Mammal Stock Assessments, 1999. NOAA Technical Memorandum NMFS- AFSC-110. Seattle, WA: USDOC/NOAA/NMFS, Alaska Fisheries Science Center. 166 pp.

------- 2000a. Landings Statistics web page. <www.nmfs.noaa.gov>.

------- 2000b. Marine Recreational Fisheries Statistics Survey, Gulf of Mexico Brochure. Silver Spring, MD: USDOC/NOAA/NMFS. 14 pp.

------- 2001. Endangered Species Act Section 7 Consultation (Biological Opinion) for the Arctic Region for Federal Oil and Gas Leasing and Exploration in the Alaskan Beaufort Sea. Anchorage, Alaska: USDOC/NOAA/NMFS.

------- 2001a. Draft Environmental Assessment on Issuing a Quota to the Makah Indian Tribe for a Subsistence Hunt on Gray Whales for the Years 2001 and 2002. January 12, 2001. Silver Spring, MD: USDOC/NOAA/NMFS.. 67 pp.

------- 2001b. Alaska Regional Office website. 27 Feb. 2001 <http://www.fakr.noaa.gov/>.

U.S. Department of Commerce (USDOC), National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS) and U.S. Department of the Interior (USDOI), Fish and Wildlife Service (FWS). 1991a. Recovery Plan for U.S. Populations of Loggerhead Turtle. Washington, DC: USDOC/NOAA/NMFS. 64 pp.

------- 1991b. Recovery Plan for U.S. Population of Atlantic Green Turtle. Washington, DC: USDOC/NOAA/NMFS. 52 pp.

------- 1992a. Recovery Plan for Leatherback Turtles in the U.S. Caribbean, Atlantic, and Gulf of Mexico. Washington, DC: USDOC/NOAA/NMFS. 65 pp.

------- 1992b. Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*). St. Petersburg, FL: USDOC/NOAA/NMFS. 40 pp.

------- 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico. St. Petersburg, FL: USDOC/NOAA/NMFS. 52 pp.

------- 1998a. Recovery Plan for U.S. Pacific Populations of the East Pacific Green Turtle (*Chelonia mydas*). Silver Spring, MD: USDOC/NOAA/NMFS. 84pp.

------- 1998b. Recovery Plan for U.S. Pacific Populations of the Olive Ridley Turtle (*Lepidochelys olivacea*). Silver Spring, MD: USDOC/NOAA/NMFS. 53pp.

------- 1998c. Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle (*Caretta caretta*). Silver Spring, MD: USDOC/NOAA/NMFS. 60pp.

U.S. Department of Defense (USDOD). 1998. Draft Environmental Impact Statement: Beaufort Sea Oil and Gas Development/Northstar Project. Anchorage, AK: USDOD/Army Engineer District.

U.S. Department of Defense (USDOD), Department of the Navy. Draft Environmental Impact Statement/Overseas Environmental Impact Statement, Point Mugu Sea Range. July 2000. Pt. Mugu, CA: Naval Air Systems Command Naval Air Warfare Center, Weapons Division.

U.S. Department of Energy (USDOE), Energy Information Administration. 2001. Monthly Energy Review, January 2001. DOE/EIA-0035(2001/01). Washington, DC: USDOE/EIA, Office of Energy Markets and End Use. 191 pp.

U.S. Department of the Interior (USDOI), Bureau of Land Management (BLM). 1978a. National Petroleum Reserve in Alaska 105(C) Land Use Study, Socioeconomic Profile. National Petroleum Reserve in Alaska Task Force Study Report 3. Anchorage, AK: USDOI/BLM, NPR-A Task Force. (Includes an Oversize Map and Summary Information Sheet for Each Community and the Region.)

------- 1978b. NPR-A 105(c) Values and Resource Analysis. Vol. 3, Study Report 2. Anchorage, AK: USDOI/BLM, NPR-A Task Force. 224 pp.

------- 1980a. Final Environmental Impact Statement, Proposed 1981 Outer Continental Shelf Oil and Gas Lease Sale Offshore Central and Northern California, OCS Sale No. 53. Los Angeles, CA: USDOI/BLM, Pacific OCS Office.

------- 1980b. Final Environmental Impact Statement for Proposed 1981 Outer Continental Shelf Oil and Gas Lease Sale Offshore Central and Northern California, OCS Lease Sale No. 53. Los Angeles, CA: USDOI/BLM, Pacific OCS Region.

------- 1981. Final Environmental Impact Statement, Lower Cook Inlet/Shelikof Strait Proposed Outer Continental Shelf Oil and Gas Lease Sale 60. Anchorage, AK: USDOI/BLM, Alaska OCS Office.

------- 1983a. Oil and Gas Leasing in the National Petroleum Reserve in Alaska, Final EIS. Anchorage, AK: USDOI/BLM.

------- 1983b. 810 Analysis. Anchorage, AK: USDOI/BLM.

------- 1990. Western Arctic Resource Management Plan. Management Situation Analysis. Anchorage, AK: USDOI/BLM, Western Arctic RMP Planning Team.

U.S. Department of the Interior (USDOI), Bureau of Land Management (BLM) and U.S. Department of the Interior (USDOI), Minerals Management Service (MMS). 1998. Northeast National Petroleum Reserve-Alaska, Final Integrated Activity Plan/Environmental Impact Statement. Anchorage, AK: USDOI/BLM.

U.S. Department of Interior (USDOI), Fish and Wildlife Service (FWS). 1987. Recovery Plan for the Choctawhatchee, Perdido Key and Alabama Beach Mouse. Atlanta, GA: USDOI/FWS. 45 pp.

------- 1992. Endangered and Threatened Wildlife and Plants; Determination of Threatened Status for the Washington, Oregon and California Population of the Marbled Murrelet. USDOI/FWS. Fed. Reg. 57:45328-45337.

U.S. Department of Interior (USDOI), Fish and Wildlife Service (FWS). 1993 Final Conservation Plan for the Pacific Walrus in Alaska. Anchorage, AK: USDOI/FWS, Marine Mammals Management. 81 pp.

------- 1994. Conservation Plan for the Pacific Walrus in Alaska. Anchorage, AK: USDOI/FWS, Marine Mammals Management. 79 pp.

------- 1996. Florida Manatee Recovery Plan (*Trichechus manatus latirostris*), Second Revision. Prepared by the Florida Manatee Recovery Team for the Southeast Region. Atlanta, GA: USDOI/FWS. Approved 29 January 1996.

------- 1998a. Polar Bear (*Ursus maritimus*): Alaska Southern Beaufort Sea Stock. Anchorage, AK: USDOI/FWS, Marine Mammals Management. 5 pp.

------- 1998b. Polar Bear (*Ursus maritimus*): Alaska Chukchi/Bering Seas Stock. Anchorage, AK: USDOI/FWS, Marine Mammals Management. 5 pp.

------- 1998c. Pacific Walrus (*Odobenus rosmarus divergens*) Alaska Stock. Anchorage, AK: USDOI/FWS, Marine Mammals Management. 7 pp.

------- 1998d. Endangered and Threatened Wildlife and Plants. 50 CFR 17.11 and 17.12. 31 December 1998. 56 pp.

------- 1999. Population Status and Trends of Sea Ducks in Alaska. Anchorage, AK: USDOI/FWS, Migratory Bird Management, Waterfowl Management Branch. 137 pp.

------- 2000. Draft Revised Recovery Plan for the Southern Sea Otter (*Enhydra lutris nereis*). Prepared by the Southern Sea Otter Recovery Team for the USDOI/FWS, Portland, OR. 64 pp. + app.

------- 2001. Refuges – National Wildlife Refuge System. <http://refuges.fws.gov/>.

U.S. Department of the Interior (USDOI), Fish and Wildlife Service (FWS), and Gulf States Marine Fisheries Commission. 1995. Gulf Sturgeon Recovery Plan. Atlanta, GA. 170 pp.

U.S. Department of the Interior (USDOI), Minerals Management Service (MMS). 1979a. Beaufort Sea Final Environmental Impact Statement, Federal/State Oil & Gas Lease Sale (3 vols.).

------- 1979b. Public Testimony, Sale BF Beaufort Sea Lease Sale (3 vols.), June 4, 1979, Barrow, AK.

------- 1979c. Public Testimony, Sale BF Beaufort Sea Lease Sale, May 15, 1979, Kaktovik, AK.

------- 1979d. Public Testimony, Sale BF Beaufort Sea Lease Sale, May 16, 1979, Nuiqsut, AK.

------- 1982a. Final Environmental Impact Statement, Proposed Outer Continental Shelf Oil & Gas Lease Sale 71, Diapir Field. OCS-0157. 500 p.

------- 1982b. Public Hearing on Beaufort Sea EIS (Diapir), February 2, 1982, Barrow, AK

------- 1982c. Public Hearing on Beaufort Sea EIS (Diapir), February 4, 1982, Kaktovik, AK.

U.S. Department of the Interior (USDOI), Minerals Management Service (MMS). 1982d. Public Hearing on Beaufort Sea EIS (Diapir), February 3, 1982, Nuiqsut, AK.

------- 1983a. Final Regional Environmental Impact Statement: Proposed OCS Oil and and Gas Lease Sales 72, 74, and 79 (Central, Western, and Eastern Gulf of Mexico). January 1983. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 2 vols.

------- 1983b. Final Environmental Impact Statement for Proposed 1983 Outer Continental Shelf Oil and Gas Lease Sale Offshore Central California, OCS Lease Sale No. 73. March 1983. Los Angeles, CA: USDOI/MMS, Pacific OCS Region.

------- 1984a. Gulf of Alaska/Cook Inlet Sale 88 Final Environmental Impact Statement (2 vols.). October 1984. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1984b. Diapir Field Lease Offering (June 1984) Final Environmental Impact Statement OCS EIS/EA MMS 84-0009. Anchorage, AK: USDOI/MMS.

------- 1984c. Final Environmental Impact Statement for Proposed 1984 Outer Continental Shelf Oil and Gas Lease Sale Offshore Southern California, OCS Lease Sale No. 80. Los Angeles, CA: USDOI/MMS, Pacific OCS Region.

------- 1985a. Final Environmental Impact Statement, Proposed Norton Basin Lease Sale 100. OCS EIS/EA MMS 85-0085. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1985b. North Aleutian Basin Sale 92 Final Environmental Impact Statement (2 vols.). OCS EIS/EA MMS 85-0092. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1986. Lease Sale 97, Beaufort DEIS Proceedings, December 12, 1986, Barrow, AK.

------- 1987a. Beaufort Sea Sale 97 Final Environmental Impact Statement (2 vol.). OCS EIS/EA MMS 87-0069. Anchorage, AK: USDOI/MMS.

------- 1987b. Outer Continental Shelf Oil & Gas Leasing Program: Mid-1987 to Mid-1992. Final Environmental Impact Statement. Herndon, VA: USDOI/MMS.

------- 1988. Meteorological Database and Synthesis for the Gulf of Mexico, OCS Study MMS 88-0064, Prepared by Florida A&M University for the USDOI/MMS, Gulf of Mexico OCS Region, New Orleans, LA. 486 pp.

------- 1990a. Gulf of Mexico 131, 135, and 137; Central, Western, and Eastern Planning Areas—Final Environmental Impact Statement. OCS EIS/EA MMS 90-0042. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. Available from NTIS, Springfield, VA. PB90-273590.

------- 1990b. Alaska Outer Continental Shelf Oil and Gas Lease Sale: 124. Final Environmental Impact Statement. OCS EIS/EA MMS 90-0006. Anchorage, AK: USDOI/MMS, Alaska Region.

U.S. Department of the Interior (USDOI), Minerals Management Service (MMS). 1990c. Public Hearing Official Transcripts of Proceedings, Alaska Outer Continental Shelf, Beaufort Sea Planning Area, Oil and Gas Lease Sale 124, Draft Environmental Impact Statement, April 17, 1990, Barrow, AK: USDOI/MMS, Alaska Region.

------- 1990d. Public Hearing Official Transcripts of Proceedings, Alaska Outer Continental Shelf, Beaufort Sea Planning Area, Oil and Gas Lease Sale 124, Draft Environmental Impact Statement, April 18, 1990, Kaktovik, AK: USDOI/MMS, Alaska Region.

------- 1990e. Public Hearing Official Transcripts of Proceedings, Alaska Outer Continental Shelf, Beaufort Sea Planning Area, Oil and Gas Lease Sale 124, Draft Environmental Impact Statement, April 19, 1990, Nuiqsut, AK: USDOI/MMS, Alaska Region.

------- 1990f. The Offshore Environmental Studies Program (1973-1989): A Summary of Minerals Mangement Service Research Conducted on the U.S. Outer Continental Shelf. Herndon, VA: USDOI/MMS, Environmental Policy and Programs Division, Offshore Environmental Studies Program.

------- 1991a. Chukchi Sea Oil and Gas Lease Sale 126 Final Environmental Impact Statement. OCS EIS/EA MMS 90-0095. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1991b. OCS Mining Program Norton Sound Lease Sale. Final Environmental Impact Statement. OCS EIS/EA MMS 91-0009. Anchorage, AK: USDOI, MMS, Alaska OCS Region.

------- 1991c. Navarin Basin Oil and Gas Lease Sale 107 Final Environmental Impact Statement. OCS EIS/EA MMS 91-0008. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1995. Gulf of Mexico Air Quality Study, Final Report. Volume I: Summary of Data Analysis and Modeling. OCS Study MMS 95-0038. New Orleans, LA: USDOI/MMS, Gulf of Mexico Region, August 1995.

------- 1996a. Outer Continental Shelf Oil & Gas Leasing Program: 1997-2002. Final Environmental Impact Statement. OCS EIS/EA MMS 96-0043. Herndon, VA: USDOI/MMS, Environmental Projects Coordination Branch. 2 vols.

------- 1996b. Handbook for Archaeological Resource Protection (620.1-H). Release No. 239; May 21, 1996.

------- 1996c. Beaufort Sea Planning Area Oil and Gas Lease Sale 144, Final Environmental Impact Statement. OCS EIS/EA MMS 96-0012. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1996d. Cook Inlet Planning Area Oil and Gas Lease Sale 149, Final Environmental Impact Statement. OCS EIS/EA MMS 95-0066. January 1996. Anchorage, AK: USDOI/MMS, Alaska OCS Office. 2 vols.

U.S. Department of the Interior (USDOI), Minerals Management Service (MMS). 1997a. Gulf of Mexico OCS Oil and Gas Lease Sales 169, 172, 175, 178, and 182, Central Planning Area. Final Environmental Impact Statement. OCS EIS/EA MMS 97-0033. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

------- 1997b. Beaufort Sea Planning Area Oil and Gas Lease Sale 170, Draft Environmental Impact Statement. OCS EIS/EA MMS 97-0011. May 1997. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1997c. Arctic Seismic Synthesis and Mitigating Measures Workshop Proceedings. March 5 and 6, 1997, Barrow, Alaska. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1998a. Gulf of Mexico OCS Oil and Gas Lease Sales 171, 174, 177, and 180, Western Planning Area, Final Environmental Impact Statement. OCS EIS/EA MMS 98-0008. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

------- 1998b. Final Environmental Impact Statement, Beaufort Sea Planning Area Oil and Gas Lease Sale 170, OCS EIS/EA MMS 98-0007. February 1998. Anchorage, AK: USDOI/MMS, Alaska OCS Region.

------- 1999. Destin Dome 56 Unit Development and Production Plan and Right-of-Way Pipeline Application. Draft Environmental Impact Statement. OCS EIS/EA MMS 99-0040. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 2 vols.

------- 2000. Proposed Use of Floating Production, Storage, and Offloading Systems on the Gulf of Mexico Outer Continental Shelf, Western and Central Planning Areas. OCS EIS/EA MMS 2000-051. August 2000. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region.

------- 2001. Liberty Development and Production Plan, Draft Environmental Impact Statement. OCS EIS/EA MMS 2001-001. Anchorage, AK: USDOI/MMS, Alaska OCS Region. 3 vols.

------- 2001a. Draft Proposed Outer Continental Shelf Oil & Gas Program 2002-2007. Herndon, VA: USDOI/MMS. July 2001. 67 pp. + Appendix

------- 2001b. Proposed Outer Continental Shelf Oil & Gas Program 2002-2007. Herndon, VA: USDOI/MMS. October 2001. 89 pp. + Appendix

U.S. Department of the Interior (USDOI), U.S. Geological Survey (USGS). 1999. The Oil and Gas Resource Potential of ANWR 1002 Area Alaska, Open File Report 98-34.

------- 1988. Map of Coastal Erosion and Accretion. *In:* National Atlas of the U.S.A. Reston, VA: USDOI/USGS.

U.S. Department of the Interior (USDOI), National Park Service (NPS). 1994. IMPROVE Publication, Visibility Protection, August 1994. <www2.nature.nps.gov/ARD/impr/index.htm>.

U.S. Environmental Protection Agency (USEPA). 1993. Development Document for Effluent Limitations Guidelines and New Source Performance Standards for the Offshore Subcategory of the Oil and Gas Extraction Point Source Category - Final. EPA 821-R-93-003. January 1993. Washington, DC: USEPA, Office of Water.

------- 1999. The Ecological Condition of Estuaries in the Gulf of Mexico. EPA 620-R-98-004. Gulf Breeze, FL: USEPA, Office of Research and Development, National Health and Environmental Effects Research Laboratory. 71 pp.

------- 2000a. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1998. EPA 236-R-00-01. April 2000. Washington, DC: USEPA, Office of Policy..

------- 2000b. National Air Pollutant Emission Trends, 1900-1998. EPA-454/R-00-02. March 2000. Research Triangle Park, NC: USEPA, Office of Air Quality Planning and Standard..

------- 2001. Aerometric Information Retrieval System, AIRS Data Websites, Monitors. February 2001. <www.epa.gov/airs>.

------- 2001. Regional Approaches to Improving Air Quality – Regional Efforts to Address Air Pollution. <www.epa.gov/oar/oaqps/airtrans/regional.html>.

van Beek, J.L., and K.J. Meyer-Arendt (eds.). 1982. Louisiana's Eroding Coastline: Recommendations for Protection. Prepared for Coastal Management Section, Louisiana Department of Natural Resources, Baton Rouge, LA.

Van Valin, W.B. 1945. Eskimoland Speaks. Caldwell, ID: The Caxton Printers, Ltd.

Van Vleet, T., and G.G. Pauly. 1987. Characterization of Oil Residues Scraped from Stranded Sea Turtles from the Gulf of Mexico. Carib. J. Sci. 23, 77.

Vanstone, J.W. 1962. Point Hope: An Eskimo Village in Transition. Seattle, WA: University of Washington Press.

Vargo, S., P. Lutz, D. Odell, E. Van Fleet, and G. Bossart. 1986. Study of the Effect of Oil on Marine Turtles. Final Report to the USDOI/MMS. Contract No. 14-12-0001-30063. Prepared by the Florida Institute of Oceanography.

Vazquez de la Cerda, A.M. 1993. Bay of Campeche Cyclone. Ph.D. Dissertation. College Station, TX: Texas A&M University. 108 pp.

Viereck, L.A., C.T. Dyrness, A.R. Batten, and K.J. Wenzlick. 1992. The Alaska Vegetation Classification. USDOA, Pacific Northwest Research Station, General Technical Report PNW-GTR-286. 278 pp.

Vignier, V., J.H. Vandermeulen, and A.J. Fraser. 1992. Growth and Food Conversion by Atlantic Salmon Parr During 40 Days' Exposure to Crude Oil. Transactions of the American Fisheries Society 121:322-332.

Von Huene, R., M.A. Fischer, and T. R. Burns. 1987. Geology and Evolution of the Kodiak Margin, Gulf of Alaska, pp. 229-268. *In:* Geology and Resource Potential of the Continental Margin of Western North America and Adjacent Ocean Basins-Beaufort Sea to Baja, California. Scholl, D.A., A. Grantz, and J.G. Vedder (eds.).

Wada, K. 1971. Food and Feeding Habits of Northern Fur Seals Along the Coast of Sanriku. Bull. Tokai Reg. Fish. Res. Lab. 64:1-37.

Wada, S. 1973. The Ninth Memorandum on the Stock Assessment of Whales in the North Pacific. Report of the International Whaling Commission 23:164-169.

------- 1981. Japanese Whaling and Whale Sighting in the North Pacific 1979 Season. Report of the International Whaling Commission 31:783-792.

Wade, P.R., and T. Gerrodette. 1993. Estimates of Cetacean Abundance and Distribution in the Eastern Tropical Pacific. Report of the International Whaling Commission 43:477-493.

Walker, D.A., and K.R. Everett. 1987. Road Dust and its Environmental Impact on Alaskan Taiga and Tundra. Arctic and Alpine Research 19:479-489.

Walker, D.A., N.D. Lederer, and M.D. Walker. 1985. Vegetation Changes at Permanent Transects Along the Dalton Highway and the Prudhoe Bay Spine Road. *In:* Baseline Monitoring Methods and Sensitivity Analysis of Alaskan Arctic Tundra. Webber, P.J., D.A. Walker, V. Komarkova, and J.J. Ebersole (eds.) Final Report to U.S. Army Cold Regions Research Engineering Laboratory, Hanover, NH.

Walker, D.A., P.J. Webber, M.D. Walker, N.D. Lederer, R.H. Meehan, and E.A. Nordstrand. 1986. Use of Geobotanical Maps and Automated Mapping Techniques to Examine Cumulative Impacts in the Prudhoe Bay Oilfield, Alaska. Environmental Conservation 13:149-160.

Walker, D.A., D. Cate, J. Brown, and C. Racine. 1987a. Disturbance and Recovery of Arctic Alaskan Tundra Terrain, A Review of Recent Investigations. CRREL Report 87-11.

Walker, D.A., P.J. Webber, E.F. Binnian, K.R. Everett, N.D. Lederer, E.A. Nordstrand, and M.D. Walker. 1987b. Cumulative Impacts of Oil Fields on Northern Alaska Landscapes. Science 238:757-761.

Wallace, B., J. Kirkley, T. McGuire, D. Austin, and D. Goldfield. 2001. Assessment of Historical, Social, and Economic Impacts of OCS Development on Gulf Coast Communities: Volume 2, Narrative Report. Prepared for Minerals Mangement Service by TechLaw, Inc., Bethesda, MD. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. April 2001.

Ward, D.H., and R.A. Stehn. 1989. Response of Brant and Other Geese to Aircraft Disturbance at Izembek Lagoon, Alaska. Submitted to Minerals Management Service, Anchorage, AK. Anchorage, AK: USDOI/FWS. 193 pp.

Warham, J. 1990. The Petrels: Their Ecology and Breeding Systems. San Diego, CA: Academic Press. 440 pp.

Waring, G.T., D.L. Palka, K.D. Mullin, J.H. W. Hain, L.J. Hansen, and K.D. Bisack. 1997. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-1996. NOAA Technical Memorandum NMFS-NE-114. 250 pp.

Waring, G.T., D.L. Palka, P.J. Clapham, S. Swartz, M.C. Rossman, T.V.N. Cole, L.J. Hansen, K.D. Bisack, K.D. Mullin, R.S. Wells, D.K. Odell, and N.B. Barros. 1999. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments-1999. NOAA Technical Memorandum NMFS-NE-153. 196 pp.

Watkins, W.A., 1981. Activities and Underwater Sounds of Fin Whales. Sci. Rep. Whales Res. Inst. 33:83-117.

Watkins, W.A. and W.E. Scheville. 1975. Sperm Whales React to Pingers. Deep Sea Research 22:123-129.

Watson, R.T., M.C. Zinyowera, and R.H. Moss. 1998. The Regional Impacts of Climate Change: An Assessment of Vulnerability. Cambridge, England: Cambridge University Press. 518 pp.

Watts, P., and D.E. Gaskin. 1985. Habitat Index Analysis of the Harbor Porpoise (*Phocoena phocoena*) in the Southern Coastal Bay of Fundy, Canada. Journal of Mammalogy 66:733-744.

Weber, D.D., D.J Maynaard, W.D. Gronlaund, and V. Konchun. 1981. Avoidance Reactions of Migrating Adult Salmon to Petroleum Hydrocarbons. Canadian Journal of Fisheries and Aquatic Science 38:779-781.

Weber, M., R.T. Townsend, and R. Bierce. 1992. Environmental Quality in the Gulf of Mexico: Citizen's Guide. Center for Marine Conservation. 2nd Edition. June 1992. 130 pp.

Weingartner, T.J. 1997. A Review of the Physical Oceanography of the Northeastern Chukchi Sea, pp. 40-59. *In:* Fish Ecology in Arctic North America. Reynolds, J.B. (ed.). American Fisheries Society Symposium 19. Bethesda, MD.

Welch, D.W., and S.D. Batten. 1999. Climate Change, Global Warming, and the PICES Mandate-the Need for Improved Monitoring. Pices Press 8:24-27.

Weller, M.W. (ed.). 1988. Waterfowl in Winter. Minneapolis, MN: University of Minnesota Press. 624 pp.

------- 1999. Wetland Birds, Habitat Resources and Conservation Implications. Cambridge, MA: Cambridge University Press. 271 pp.

Weller, W., A. Lynch, T. Osterkamp, and G. Wendler. 1995. Climate Trends and Scenarios. Journal of Biogeography 22:365.

Wells, P.G. 1989. Using Oil Spill Dispersants on the Sea – Issues and Answers, pp. 1-4. *In:* Proceedings of Minerals Management Service Workshop on Technical Specifications for Oil and Dispersants Toxicity, 17-19 January 1989, New Orleans, LA.

Wells, R. 1992. Marine Mammals. *In*: Sarasota Bay: Framework for Action. Roat, P., C. Ciccolella, H. Smith, and D. Tomasko, (eds.). Sarasota, FL: Sarasota Bay National Estuary Program. pp. 9.1-9.29.

Wentworth, C. 1998. Subsistence Waterfowl Harvest Survey-Yukon-Kuskokwim Delta-Comprehensive Report 1987-1997. Anchorage, AK: USDOI/FWS, Migratory Bird Management.

Wertheimer, A.C., and A.G. Celewycz. 1996. Abundance and Growth of Juvenile Pink Salmon in Oiled and Non-Oiled Locations of Western Prince William Sound After the *Exxon Valdez* Oil Spill. American Fisheries Society Symposium 18:518-532.

Whitney, F.A., and H.J. Freeland. 1999. Variability in Upper-Ocean Water Properties in the NE Pacific Ocean. Deep Sea Research.

Whitney, J. 1994. Shoreline Countermeasures Manual. USDOC/NOAA, Hazardous Materials Response & Assessment Division. March 1994.

White, W.A., T.R. Calnan, R.A. Morton, R.S. Kimble, T.G. Littleton, J.H. McGowen, H.S. Nance, and K.E. Schmedes. 1986. Submerged Lands of Texas, Brownsville-Harlingen Area. Austin, TX: Bureau of Economic Geology, University of Texas. 138 pp.

Whitten, K.R. 1995. Porcupine Herd, pp. 176-186. *In:* Caribou. Management Report of Survey-Inventory Activities. Hicks, M.V. (ed.). Fed. Aid Wildl. Restor., Grants W-24-2 and W-24-3, Study 3.0. Juneau, AK: Alaska Department of Fish and Game.

Whitten, K.R., and R.D. Cameron. 1985. Distribution of Calving Caribou in Relation to the Prudhoe Bay Oil Field, pp. 35-39. *In:* Caribou and Human Activity. Martell, A.M., and D.E. Russell (eds.). Ottowa, Ontario: Can. Wildl. Serv. Publ.

Wicker, K.M., R.E. Emmer, D.W. Roberts, and J.L. Van Beek. 1989. Pipelines, Navigation Channels, and Facilities in Sensitive Habitats: An Analysis of Outer Continental Shelf Impacts, Coastal Gulf of Mexico. Vol. I. Technical Narrative. OCS Study MMS 89-0051. New Orleans, LA: USDOI/MMS, Gulf of Mexico OCS Region. 470 pp.

Wiedmer, M., M.J. Fink, J.J. Stegeman, R. Smolowitz, G.D. Marty, and D.E. Hinton. 1996. Cytochrome P-450 Induction and Histopathology in Preemergent Pink Salmon from Oiled Spawning Sites in Prince William Sound. American Fisheries Society Symposium 18:509-517.

Wille, P.C., and D. Geyer. 1984. Measurements on the Origin of the Wind-Dependent Ambient Noise Variability in Shallow Water. J. Acoust. Soc. Am. 75(1):73-185.

Willette, M. 1996. Impacts of the *Exxon Valdez* Oil Spill on the Migration, Growth, and Survival of Juvenile Pink Salmon in Prince William Sound. American Fisheries Society Symposium 18:533-550.

Williams, J.G. 2000. Alaska Population Overview: 1999 Estimates. Alaska Department of Labor and Workforce Development, State of Alaska. Also available from the ADOL website in pdf format.

Williams, S.J., S. Penland, and A.H. Sallenger, Jr., eds. 1992. Louisiana Barrier Island Study: Atlas of Shoreline Changes in Louisiana from 1853 to 1989. USDOI/USGS, Miscellaneous Investigations Series I-2150-A.

Wing, B.L., and K. Kreiger. 1983. Humpback Whale Prey Studies in Southeastern Alaska, Summer 1982. Auke Bay, AK: USDOC/NOAA/NMFS/NWAFC, Auke Bay Laboratory. 51 pp.

Winn, H.E., and P.J. Perkins. 1976. Distribution and Sounds of the Minke Whale, with a Review of Mysticete Sounds. Cetology 19:1-12.

Witham, P.R. 1978. Does a Problem Exist Relative to Small Sea Turtles and Oil Spills? *In*: Conference Proceedings, The Assessment of Ecological Impacts of Oil Spills, American Institute of Biological Science, 1978.

Witherell, D. 1999. Status Trends of Principal Groundfish and Shellfish Stocks in the Alaska EEZ, 1999. North Pacific Fishery Management Council.

Withrow, D.E., G.C. Bouchet, and L.L. Jones. 1985. Response of Dall's Porpoise (*Phocoenoides dalli*) to Survey Vessels in Both Offshore and Nearshore Waters: Results of 1984 Research. Int. N. Pacific Fish. Comm. Doc. Seattle, WA: U.S. Natl. Mar. Mamm. Lab. 16 pp.

Withrow, D.E., and T.R. Loughlin. 1997. Abundance and Distribution of Harbor Seals (*Phoca vitulina richardsi*) Along the South Side of the Alaska Peninsula, Shumagin Islands, Cook Inlet, Kenai Peninsula, and the Kodiak Archipelago in 1996. Annual Report to the USDOC/NOAA/NMFS, MMPA Assessment Program, Office of Protected Resources, Silver Spring, MD.

Witzell, W.N. 1984. The Incidental Capture of Sea Turtles in the Atlantic U.S. Fishery Conservation Zone by the Japanese Tuna Longline Fleet, 1978-1981. Marine Fisheries Review 46(3):56-58.

Wolfe, R.J. 1983. Understanding Resource Uses in Alaskan Socioeconomic Systems. *In:* Resource Use and Socioeconomic Systems: Case Studies of Fishing and Hunting in Alaskan Communities. Juneau, AK: Alaska Department of Fish and Game, Division of Subsistence.

------- 1996. Subsistence Food Harvests in Rural Alaska, and Food Safety Issues. Paper presented to the Institute of Medicine, National Academy of Sciences Committee on Environmental Justice, Spokane, WA, 13 August 1996.

------- 2001. "ADFG – Subsistence Frequently Asked Questions." Alaska Department of Fish and Game 25 Feb. 2001. <http://www.state.ak.us/local/akpages/FISH.GAME/subsist/geninfo/about/subfaq.htm>.

Wolfe, R.J., and R.G. Bosworth. 1994. Subsistence in Alaska: 1994. Update. Alaska Department of Fish and Game, Division of Subsistence.

Wolfe, R.J., and C. Mishler. 1993. The Subsistence Harvest of Harbor Seal and Sea Lion by Alaska Natives in 1992. Final Report for Year One, Subsistence Study and Monitor System (no. 50ABNF20055). Prepared for the USDOC/NOAA/NMFS. Juneau, AK: Alaska Dep. Fish and Game. 94 pp. + apps.

------- 1994. The Subsistence Harvest of Harbor Seal and Sea Lion by Alaska Natives in 1993. Final Report for Year Two, Subsistence Study and Monitor System (no. 50ABNF20055). Prepared for the USDOC/NOAA/NMFS. Juneau, AK: Alaska Dep. Fish and Game. 60 pp. + apps.

Wolfe, R.J., and C. Mishler. 1995. The Subsistence Harvest of Harbor Seal and Sea Lion by Alaska Natives in 1994. Draft Final Report for Year Three, Subsistence Study and Monitor System (No. 50ABNF20055). Prepared for the USDOC/NOAA/NMFS. Juneau, AK: Alaska Department of Fish and Game. 69 pp. + apps.

------- 1996. The Subsistence Harvest of Harbor Seal and Sea Lion by Alaska Natives in 1995. Draft Final Report for Year Four, Subsistence Study and Monitor System (No. 50ABNF20055). Prepared for the USDOC/NOAA/NMFS. Juneau, AK: Alaska Department of Fish and Game. 69 pp. + apps.

Wolfe, R.J., J.J. Gross, S.J. Langdon, J.M. Wright, G.K. Sherrod, L.J. Ellanna, V. Sumida, and P.J. Usher. 1984. Subsistence-Based Economies in Coastal Communities of Southwest Alaska. Prepared for the Alaska Department of Fish and Game, Division of Subsistence, Juneau, AK, and USDOI/MMS, Alaska Region, Social and Economic Studies Program, Anchorage, AK. Technical Report Number 95.

Wolfe, R.J., A.W. Paige, and C.L. Scott. 1990. The Subsistence Harvest of Migratory Birds in Alaska. Alaska Dept. of Fish and Game, Division of Subsistence. Technical Paper No. 197. 183 pp.

Wolman, A.A. 1978. Humpback Whale. *In:* Marine Mammals of the Eastern North Pacific and Arctic Waters. Haley, D. (ed.). Seattle, WA: Pacific Search Press.

Woods, C.A., W. Post, and C.W. Kilpatrick. 1982. *Microtus pennsylvanicus* (Rodentia: Murida) in Florida: A Pleistocene Relict in a Coastal Salt Marsh. Bulletin of the Florida State Museum, Biological Sciences 28:25-52.

Woodward-Clyde Consultants. 1980. Gravel Removal Studies in Arctic and Subarctic Floodplains in Alaska. FWS/OBS-80/08. Anchorage, AK: USDOI/FWS.

------- 1996. The 1995 Northstar Unit Sampling Program, Final Report. Prepared for BP Exploration (Alaska) Inc., Anchorage, AK.

Woodward–Clyde Consultants and Continental Shelf Associates (CSA), Inc. 1983. Southwest Florida Shelf Ecosystem Study – Year 1. Contract No. 14-12-0001- 29142. 4 vol. Metairie, LA: USDOI/MMS.

------- 1985. Southwest Florida Shelf Ecosystem Study - Year 2. Contract No. 14-12-0001-29144 Metairie, LA: USDOI/MMS. 7 vol.

Wooley, C., S. Hillman, and D. O'Brien. 1997. Mapping Cultural Resource Sites for the Prince William Sound Graphical Resource Database. Proceedings of the 20th Arctic and Marine Pollution (AMOP) Technical Seminar, Vancouver, B.C.

Woolington, J.D. 1995. Central Arctic Herd, pp. 211-214. *In*: Caribou. Management Report of Survey-Inventory Activities. Hicks, M.V. (ed.). Fed. Aid in Wildl. Restor., Grants W-24-2 and W-24-3, Stud. 3.0. Juneau, AK: Alaska Department of Fish and Game.

Woolington, J.D. 1997. Game Management Units 26B and 26C, Central Arctic Herd, pp. 219-233. *In:* Management Report of Survey-Inventory Activities, 1 July 1994 – 30 June 1996. Hicks, M.V. (ed.). Caribou. Federal Aid in Wildlife Restoration Report, Grants W-24-3 and W-24-4, Study 3.0. Juneau, AK: Alaska Department of Fish and Game.

Worl, R. 1979. Values of Subsistence to North Slope Inupiat Culture in Native Livelihood and Dependence: A Study of Land Use Values Through Time. North Slope Borough Contract Staff. National Petroleum Reserve in Alaska 105(C) Land Use Study Field Study 1. Anchorage, AK: USDOI/BLM, NPR-A Work Group 1.

Worl, R., and C. Smythe. 1986. Barrow: A Decade of Modernization. Prepared for the USDOI/MMS, Alaska OCS Office, Alaska OCS Socioeconomic Studies Program, Anchorage, AK. Technical Report No. 125.

World Council of Whalers News. 2000. Whaler Profile: Whaling Captain Burton Atqaan Rexford. World Council of Whalers News, Number 12 (September).

Wright, J.W., and P.J. Bente. 1998. Documentation of Active Peregrine Falcon Nest Sites. Alaska Department of Fish and Game, Division of Wildlife Conservation. 15 pp.

Würsig, B. 1986. Delphinid Foraging Strategies, pp. 347-359. *In:* Dolphin Cognition and Behavior: A Comparative Approach. Schusterman, J.R., J.A. Thomas, and F.G. Wood, (eds.). Hillsdale, NJ: Lawrence Erlbaum Associates.

------- 1990. Cetaceans and Oil: Ecologic Perspectives, pp. 129-165. *In:* Sea Mammals and Oil: Confronting the Risks. Geraci, J.R. and D.J. St. Aubin (eds.). San Diego, CA: Academic Press.

Würsig, B., and C. Clark. 1993. Behavior, pp. 157-199. *In:* The Bowhead Whale. Burns, J.J., J.J. Montague, and C.J. Cowles (eds.). Spec. Publ. 2. Soc. Mar. Mammal., Lawrence, KS. 787 pp.

Würsig, B., E.M. Dorsey, M.A. Fraker, R.S. Payne, W.J. Richardson, and R.S. Wells. 1984. Behavior of Bowhead Whales, *Balaena mysticetus*, Summering in the Beaufort Sea: Surfacing, Respiration, and Dive Characteristics. Can. J. Zool. 62(10):1,910-1,921.

Würsig, B., S. K. Lynn, T.A. Jefferson, and K.D. Mullin. 1998. Behavior of Cetaceans in the Northern Gulf of Mexico Relative to Survey Ships and Aircraft. Aquat. Mammals 24:41-50.

Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The Marine Mammals of the Gulf of Mexico. College Station, TX: Texas A&M University Press. 232 pp.

Wyers, S.C., H.R. Frith, R.E. Dodge, S.R. Smith, A.H. Knap, and T.D. Sleeter. 1986. Behavioural Effects of Chemically Dispersed Oil and Subsequent Recovery in *Diploria strigosa* (Dana). Marine Ecology P.S.Z.N., 7, 23-42.

Yano, K., and M.E. Dahlheim. 1995. Killer Whale, *Orcinus orca*, Depredation on Longline Catches of Bottomfish in the Southeastern Bering Sea and Adjacent Waters. Fish. Bull., U.S. 93:355-372.

Yeats, P.A. 1988. Manganese, Nickel, Zinc, and Cadmium Distribution at the Fram 3 and Cesar Ice Camps in the Arctic Ocean. Oceanographica Acta 11(4):383-389.

Yelverton, J.T. 1981. Underwater Explosion Damage Risk Criteria for Fish, Birds, and Mammals. Paper Presented at the Acoustical Society of America, 30 November 1981 – 4 December 1981, Miami Beach, FL. 19 pp.

York, A.E., and P. Kozloff. 1987. On the Estimation of Numbers of Northern Fur Seal, *Callorhinus ursinus*, Pups Born on St. Paul Island, 1980-86. Fisheries Bulletin 85:367-375.

Young, N.M. 1989. Dive and Ventilation Patterns Correlated to Behavior of Fin Whales, *Balaenoptera physalus*, in Cape Cod and Massachusetts Bays, p. 74. *In:* Abstr. 8th Bienn. Conf. Biol. Mar. Mamm., Pacific Grove, CA, December 1989. 81 pp.

Young, G.A. 1991. Concise Methods of Predicting the Effects of Underwater Explosions on Marine Life. NTIS AD A241310. Silver Spring, MD: Naval Weapons Center, White Oak.. 22 pp.

Zembal, R., and S.M. Hoffman. 1999. Light-Footed Clapper Rail Management and Study, 1999. Report to USDOI/FWS and California Department of Fish and Game. 8 p

APPENDIX G: COMMENT LETTERS

Federal Government

JEFF MILLER
1st District, Florida

Armed Services
Committee

Veterans Affairs
Committee

Congress of the United States

House of Representatives
Washington, DC 20515

Comments on the 2002-2007 OCS Oil and Gas Program Draft EIS
United States Representative Jeff Miner (R, FL-0l)

Thank you for the opportunity to present comments on behalf of the citizens of the State of Florida regarding (the Mineral Management Service's *Proposed Outer Continental Shelf Oil and Gas Leaaing Program:* 2002-2007.

Florida's west coast is a unique environment, with an array of marine and coastal habitats from the offshore fishing grounds and bountiful estuaries to the sandy white beaches and barrier islands. including the Gulf Islands National Seashore. The marshes and coastal areas provide a unique habitat for a variety of wildlife. including many threatened and endangered species.

The economy of Florida's northwest coast, and indeed the entire state, is directly tied to our warm climate, clean waters and unspoiled natural resources. Recreation, tourism. retirement and commercial and recreational fishing arc the major economic activities of the area and bring in billions of dollars annually to the State and local economics. Nationally, Florida trails only California in tourism expenditures. Visitors to our state cite preserves and natural areas the second major attraction bringing them to Florida. Before the recent downturn in the economy, the western counties of the Florida panhandle that I represent brought in billions of dollars in tourism and recreation taxable sales each year.

Florida is making a very simple and specific request. As the residents of the State of Alaska spoke overwhelmingly in support of drilling in the Arctic Wildlife Refuge, Floridians have with one voice let it be known that they do not want drilling off their shores. In my home district, we do not want exploration less than 20 miles off of our coast. The sovereign right of each State should be heard, and all factors, including environmental and economic impact, national interest, and local will must be considered in the process of such a decision. We hear from the oil producing states that Florida must share the burden of oil and natural gas production, yet Florida is saying that the potential reward does not come close to validate taking the risk to our economy and the very foundation of our state. An overwhelming majority of the people of the State of Florida, the entire Congressional delegation, as well as the past two Governors of our State; have all expressed their strong opposition to OCS drilling.

Floridians oppose offshore drilling because of the threat it presents to the state's greatest natural and economic resource, our coastal environment. The tourism industry, the State's largest, attracts millions of people from around the globe every year, supporting

millions of jobs across the state and generating billions of dollars in revenue. It is simply too great a risk to threaten the shallow, clean water marine communities found on the Florida outer continental shelf that serve as the cornerstone to our economy. our life, and our livelihood.

Another important concern for Northwest Florida, and the reason why each decision is unique is the possible encroachment on the Eglin Air Force Base Water Range. This range is used for coastal training and is vital to the overall training done at the base. It would be in poor judgment to jeopardize or reduce the effectiveness of a facility that is so important to our military .

For the past 17 years, Congress, with the unanimous support from the Florida Delegation, has annually enacted moratoriums on oil and gas activities in the eastern Gulf of Mexico as part of the Interior Appropriations bill. The delegation and indeed the entire United Slates Congress has sent a strong message that the moratorium on offshore drilling should be maintained and that we should not be forced to sacrifice our marine ecosystem in an attempt to satisfy our energy demands.

I thank you for taking the views of the people of the First District of Florida into consideration while :considering the draft environmental impact statement for the *Proposed Outer Continental Shelf Oil and Gas Leasing Program:* 2002-2007.

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for Oceans and Atmosphere
Washington, D.C. 20230

JAN 28 2002

JAN 24 2002

Richard Wildermann
US Department of Interior
Minerals Management Service
Branch of Environmental Assessment
381 Elden St
Herndon, VA 20170-4817

Dear Mr. Wildermann:

Thank you for the opportunity to review the draft Environmental Impact Statement (DEIS) for the proposed Outer Continental Shelf (OCS) Oil and Gas Leasing Program: 2002-2007. The National Oceanic and Atmospheric Administration (NOAA) circulated the DEIS among its line offices for review and comment. Provided here is a synopsis of comments provided by the National Marine Fisheries Service (NMFS) Office of Habitat Conservation. No additional comments are expected at this time from the NMFS Office of Protected Resources or the National Ocean Service.

The document offers an analysis of the environmental consequences associated with proposed lease sales in eight of the OCS planning areas in the Gulf of Mexico and offshore Alaska. NOAA's comments focus on issues related to transportation of OCS oil from Alaska to California ports; alternatives considered in this analysis; and concerns with respect to environmental justice issues.

While no leasing offshore California is proposed in this action, the potential for impact on resources along California's coast remains. That threat stems from the transportation of OCS oil from Valdez to California ports. Three major consequences of these tanker operations are: 1) discharge of treated effluents from transiting tankers; 2) accidental release/spill of crude oil; and, 3) introduction of invasive species. These topics were addressed in different portions of the document, and the assessments by Minerals Management Service (MMS) of the adverse affects of discharged effluents and oil spills are sufficient. However, the potential impacts of invasive species were not discussed. The NMFS Southwest region's Essential Fish Habitat (EFH) Conservation Recommendations for the discharge of treated effluent is that tankers comply with existing international, Federal, and state discharge regulations. For oil spills, the EFH Conservation Recommendations include compliance with the requirement for double hulled vessels, and that the use of dispersants be consistent with the dispersant use planning process of the RRT Region IX Regional Contingency Planning Area. For invasive species, it is recommended that OCS take precautions and comply with programs to minimize introduction of invasives. Lastly, a document entitled "Southwest Fishery Management Council, 2000" is referenced several times (p. 3-131; 132). However, without a list of references, it is not clear what document they are referencing.

The action for which MMS has prepared this National Environmental Policy Act (NEPA) analysis is described as "a plan to offer areas of the Federal OCS for oil and natural gas exploration and development." Specifically, MMS proposes to conduct 20 sales in 8 of the 26 planning areas of the U.S. OCS. Of these, 8 sales would occur in waters off the Alaska coast. The rest of the 5-year OCS leasing program would occur in the Gulf of Mexico. No sale is proposed for the remainder of the Nation's OCS.

The selection process MMS has employed in preparing the proposed 5-year program incorrectly identifies the pertinent action and fails to offer a reasonable set of alternatives as required by NEPA. MMS does not appear to recognize that the decision to limit the suite of OCS planning areas available for consideration in this 5-year plan is itself a Federal action subject to NEPA. There is a need to assess and compare the impacts of leasing among all these planning areas. By restricting options to only the Gulf of Mexico, MMS allows no consideration for other planning areas which may be environmentally preferable to their proposed action. In this matter, there appear to be gaping inconsistencies between the stated intent of the OCS Lands Act on page 1-1 and the proposed action. Where other planning areas are excluded due to Administration policy, the document should note so in explanation.

NEPA identification and consideration of alternatives should not be preempted or constricted by the existence of state or Federal laws which would otherwise prohibit OCS leasing. Also, please refer to page 2-18 of the DEIS concerning Environmental Justice (Executive Order 12898) which correctly notes "Disproportionately adverse effects on Alaskan Natives could result from the proposed activities in all regions." This point, and the intent of this Executive Order, have been rendered moot by the pre-selection of OCS leasing areas. All the alternatives, except "no action", would include some Alaska sales. MMS, therefore, seems undeterred by the stated impact to environmental justice. Similarly, the sale areas which MMS has selected may, in fact, have much worse consequence to marine mammals, marine habitats, endangered species, protected marine resources, or marine fisheries than other areas of the U.S. OCS. Thus, NMFS is not able to fully discharge its responsibility to advise MMS on a National OCS leasing program from the standpoint of living marine resources.

Questions remain why this major issue was not identified during scoping, or if it was discussed, how it was resolved. MMS should note that marine waters off the Alaskan coast are among the Nation's most important. Indeed, they support the Nation's largest and most valuable commercial fisheries, are the most undeveloped and unpolluted, among the most, if not the most, scenic, provide habitat for many species of threatened or endangered birds, fish, and mammals, and are inextricably linked to the cultural and subsistence needs of Alaskan Natives, many of whom are wholly dependent on the sea and its resources. Oil spills, which have the capability for large-scale environmental harm, are problematic anywhere OCS exploration and production occur. In the Alaskan Arctic, however, industry has demonstrated an inability to recover oil spilled into a broken-ice environment. This is an example of just one planning consideration that might lead to a selection of non-Arctic OCS planning areas.

Should you have questions regarding regional issues, NMFS staff are available to discuss further. Ramona Schreiber of my office can be reached at 202-482-5181 to coordinate your needs.

Sincerely,

Ramona Schreiber

for Margaret R. McCalla
Acting Director
Office of Policy and Strategic Planning

FEB - 1 2002

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

JAN 24 2002

OFFICE OF
ENFORCEMENT AND
COMPLIANCE ASSURANCE

Richard Wildermann, Chief
Environmental Assessment Branch
Minerals Management Service
381 Elden Street
Herndon, Virginia 20170-4817

Dear Mr. Wildermann:

The Environmental Protection Agency (EPA), in accordance with its responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, has reviewed the Minerals Management Service's (MMS) Draft Environmental Impact Statement (EIS) on the Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007 (CEQ # 010400).

In general, we believe that this draft EIS provides much of the programmatic level information necessary to assess the environmental impacts associated with the leasing program and possible future exploration and development activities. We do have some concerns that the air quality non-attainment and environmental justice sections, as currently written, do not fully address process/assessment issues and possible mitigation measures that might be used in future exploration and development activities.

We recommend that the non-attainment discussions located in section 4.3.2.2 include additional information on the Gulf Coast ozone non-attainment areas and the likelihood that future exploration and development activities could cause air conformity problems. While the current EIS discussion states that if modeled concentrations (future site specific EISs) exceed certain significant levels in non-attainment areas, emissions offsets would be required, there is no discussion regarding the likelihood that this issue will arise from leasing associated with this EIS, and if it does arise, where offsets are likely to be obtained. We also believe it would be helpful to include information relating to any past exploration/development activities where this was an issue.

While the draft EIS addresses environmental justice issues, there is an expressed acknowledged need for "additional information," (EIS 3-48), which must be addressed prior to site specific exploration and development activities. While this need applies to both of the regions under review, it is clearly most significant in the Alaska region. Baseline information relating to subsistence patterns is not adequately understood at present. Without additional study it will not be possible to document the effects of multiple and cumulative impacts on subsistence

populations and the resources upon which they rely. Because multiple leases tend to be developed around successful finds and single pipelines this is of special concern. Moreover, significant time in advance of development may be required to work with the potentially affected populations who have a unique understanding of their patterns of consumption, and the resources upon which they rely. For these reasons, we believe that a comprehensive environmental justice study would be useful to provide base level information prior to any future site specific exploration and development activities. Such a study would best be accomplished with the participation of all relevant federal agencies, including EPA. We would be pleased to discuss the possibility of such a study with you.

As background for the reader and to help support the proposed action (20 sales in 8 of the 26 OCS planning areas), EPA recommends that the EIS provide leasing information from previous 5-year leasing EISs that discusses the selected action (proposed number of lease sales) and follow-up information on the number of lease sales that actually took place during the applicable period. Since it is clear that MMS has great expertise in establishing the number of lease sales that is appropriate for any particular 5-year lease sale period, it would be most useful if the EIS would provide greater detail on the underlying assumptions that are used to develop the proposed action. Similarly, we believe it would be worthwhile to generally assess the environmental impacts of previous 5-year lease sale periods and to compare them with projections in the EISs.

In view of the issues above, EPA has rated this EIS as EC-2 (Environmental Concerns/Insufficient Information). EPA's review has identified air quality and environmental justice issues that need additional information and possible mitigation in order to adequately protect the environment. Enclosed is a summary of EPA's ratings system definitions..

Thank you for the opportunity to review the draft EIS. If you have any questions regarding our comments, please contact me at 202-564-2400 or contact Joe Montgomery at 202-564-7157.

Sincerely,

Anne Norton Miller
Director
Office of Federal Activities

Enclosure

State Government

OFFICE OF THE GOVERNOR

DON SIEGELMAN
GOVERNOR

STATE OF ALABAMA

STATE CAPITOL
600 DEXTER AVENUE, ROOM N-104
MONTGOMERY, ALABAMA 36130

(334) 242-7100
FAX: (334) 242-0937

January 2, 2002

Mr. Thomas R. Kitsos
Acting Director
Minerals Management Service
U.S. Department of the Interior
1849 C Street Northwest
Washington, D.C. 20240-0001

Dear Mr. Kitsos:

With respect to your letter of October 25, 2001, concerning the Draft Environmental Impact Statement for the Proposed Outer Continental Shelf Oil and Gas Leasing Program for 2002-2007, the state of Alabama offers the following comments.

As you are aware, Alabama consistently has supported protection for environmentally sensitive areas that might be impacted by oil and gas exploration and development activities in the OCS. In particular, the state requests that the Minerals Management Service provide adequate protection for the live bottom areas, pinnacle reefs and chemosynthetic communities offshore Alabama throughout the new five-year program.

The state of Alabama continues to oppose the offering for lease blocks south and within 15 miles of the Baldwin County coast, including the Central Gulf of Mexico Planning Area. Our desire is to minimize the visual impact of new natural gas structures within the area. We believe that the state's position on minimizing the visual impact of new natural gas structures is consistent with the proper development of offshore Alabama. We request that the MMS exclude these blocks from consideration for leasing throughout the proposed five-year OCS oil and gas leasing program for 2002-2007.

We appreciate the information provided in the DEIS concerning the potential impacts of OCS production to onshore air quality in Mobile County. This remains an issue with which we have concerns and regarding which we intend to seek additional information from the MMS.

We believe the state of Alabama has received significant impacts to its coastal area from oil and gas activities in the OCS. Some of these impacts have been adverse, and the new program undoubtedly will result in additional adverse impacts to coastal Alabama. We do not believe that Alabama has been compensated fairly and equitably for these impacts, and we will be seeking your assistance in determining the proper mechanisms for addressing these inequities.

The state of Alabama supports a balanced and reasonable OCS leasing program that leads to exploration, development and production, with the stipulation that all OCS activities be carried

out in full compliance with relevant Alabama laws, rules and regulations, and be consistent with the state's Coastal Zone Management Program.

We appreciate the opportunity to comment on the DEIS for the Proposed Outer Continental Shelf Oil and Gas Leasing Program for 2002-2007. We look forward to working cooperatively with the MMS in the successful and safe development of the hydrocarbon resources located offshore Alabama and in sharing in the benefits of OCS leasing and production activities.

Sincerely,

Don Siegelman
Governor

DS/lb/me

cc: Minerals Management Service
Dr. Donald F. Oltz
Commissioner Riley Boykin Smith
Mr. James Warr
Mr. Lance Brown

STATE OF ALASKA *TONY KNOWLES, GOVERNOR*

OFFICE OF THE GOVERNOR

OFFICE OF MANAGEMENT AND BUDGET
DIVISION OF GOVERNMENTAL COORDINATION

Southcentral Regional Office
550 W. 7th Avenue, Suite 1660
Anchorage Alaska 99501
PH: (907) 269-7470/FAX@907) 269-3981

Central Office
PO BOX 11003'0
Juneau, Alaska 99811-0030
PH: (907) 465-3562/FAX: (907) 465-3075

Pipeline Coordinator's Office
11 West 4th Avenue, Suite 2C
Anchorage, Alaska 99501-2343
PH: (907) 271-4317/FAX: (907) 272-3829

January 24, 2002

Mr. Ralph Ainger
Minerals Management Service
MS-4010. Room 2324
381 Elden Street
Herndon, VA 20170

Dear Mr. Ainger;

This letter provides the State of Alaska response to the *Proposed Outer Continental Shelf Oil and Gas Leasing Program.- 2002-2007.* The state continues to support the five-year planning process of the Minerals Management Service (MMS). This planning process results in selection of planning areas for inclusion in the next five-year program and develops an initial lease sale schedule.

The State of Alaska appreciates the MMS response to our recommendations to defer leasing in the five-year program. These areas include deferral of the entire North Aleutian Basin Planning Area; deferral of Shelikof Strait in the Cook Inlet Planning Area; and a coastal deferral within the Chukchi Sea Planning Area encompassing the Chukchi polyna. Because there will be no sales planned for the Gulf of Alaska and St. George Basin planning areas, important areas will be excluded from the leasing program including thc area between Cross Sound and Dry Bay, the Fairweather fishing grounds; and tracks around the Pribilof Islands and Unimak Pass.

In the draft Environmental Impact Statement (EIS) for the five-year program, MMS indicates that it will consider deletion of additional blocks from individual sale areas when more current environmental and technical data will be available. As a result of this approach, the draft EIS does not exclude areas from this five-year program that have been deleted or deferred in previous lease sales, such as the Barter Island Deferral in Beaufort Sea Planning Area and the Yukon Delta deferral in Norton Basin Planning Area. We note with appreciation that the recent call for information on the Norton Basin Planning Area excluded the area within 12 miles of the Yukon Delta. The state will provide more specific comments on these areas during review of individual lease sales.

Efforts by the MMS to solicit comments from industry about their interest in lease sales in the current five-year program are also appreciated. For planning areas where industry did not indicate much interest, it may be useful to check with industry again during the Call for Information to ensure there is adequate interest to proceed with a sale.

As we pointed out in previous comments, field tests conducted over the past few years clearly demonstrate critical limitations of mechanical response equipment to successfully recover oil in spring and fall ice conditions. In order to mitigate the possibility of an oil spill during these conditions, the State of Alaska reiterates its request that MMS require mitigation of spin risk during seasonal ice periods. Future lease sale planning decisions should be based upon these response limitations, and lease sale mitigation measures should require appropriate spill prevention measures.

We look forward to working closely with the MMS and other stakeholders during review of each proposed lease sale. Sale-specific comments will be offered during those reviews under authority of the Coastal Zone Management Act, the OCS Lands Act, and the National Environmental Policy Act.

For the proposed lease sales in Cook Inlet, the state recommends the MMS consider the December 2001 resolution by the Kenai Peninsula Borough that supports the Tri-Borough Position Paper for OCS lease sales. This position paper addresses five issues: 1) Offshore loading of tankers, 2) Fishing gear conflicts. 3) Oil spill response capability. 4) Critical habitat areas, and 5) Local government revenue sharing. This resolution is included with this letter as Attachment A and the position paper is included as Attachment B.

For planning areas with multiple sales, the state looks forward to reviewing a new consistency determination for each lease sale. As stated in our November I, 2001 letter to Alaska Region Director John Goll, we disagree with the approach proposed in the September 19,2001 *Federal Register* notice for the proposed Beaufort Sea Lease Sale 186. This notice states that consistency determinations for subsequent lease sales "will focus primarily on new issues or changes in a State's federally-approved coastal management plan." Because of the potential for significant effects to coastal resources and uses, we believe MMS should take a fresh look at issues for each lease sale when more current environmental and technical data will be available.

Page-specific comments on the draft Environmental Impact Statement are included with this response as Attachment C. Should you have any questions about this response to the proposed five-year program, please call me at (907) 465-8800.

Sincerely,

Patrick Galvin

Director

cc:

Michelle Brown, Commissioner, Department of Environmental Conservation
Frank Rue, Commissioner. Department of Fish and Game
Pat Pourchot, Commissioner. Department of Natural Resources
John Katz, Office of the Governor
John Goll, Director, Alaska Region Minerals Management Service

State of Alaska Response to the Proposed Outer Continental Shelf Oil and Gas Leasing Program 2002 - 2007
January 24, 2002
Attachment A

KENAI PENINSULA BOROUGH

RESOLUTION 2001-127

A RESOLUTION APPROVING THE TRI-BOROUGH POSITION PAPER FOR FEDERAL OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM, 2002-2007

WHEREAS, the Federal Government has advertised its intent to offer the Outer Continental Shelf Oil & Gas Leasing Program, 2002-2007; and

WHEREAS, this proposed program will encompass the southern portion of the Cook Inlet, excluding the Shelikof Straits; and

WHEREAS, leasing in areas proposed in the program could have an impact on the Kenai Peninsula Borough, the Kodiak Island Borough, and the Lake and Peninsula Borough; and

WHEREAS, representatives of these three boroughs have met and agreed to work together in reviewing and presenting comments on this proposed Outer Continental Shelf Leasing Program, 2002-2007; and

WHEREAS, it is the intent of the three boroughs to be involved early in the process of leasing in the described area; and

WHEREAS, the Tri-Borough Position Paper was developed so that our concerns could be considered while the Environmental Impact Study for this leasing program is still being formulated and

WHEREAS, the draft position paper was reviewed by representatives of the three boroughs at a meeting on December 11, 2001, who recommended;

NOW, THEREFORE, BE IT RESOLVED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH:

SECTION 1. That the Kenai Peninsula Borough Assembly adopt the Tri-Borough Position Paper on the Federal Oil & Gas Leasing Program, 2002-2007 as presented.

SECTION 2: That this resolution takes effect immediately upon its enactment.

ADOPTED BY THE ASSEMBLY OF THE KENAI PENINSULA BOROUGH THIS 11TH DAY OF DECEMBER. 2001.

Attachment C

Page-Specific Comments on the
Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007: Draft Environmental Impact Statement

The State of Alaska submits the following comments on the draft Environmental Impact Statement (EIS) for the 2002-2007 Outer Continental Shelf (OCS) oil and gas leasing program. These comments focus on Sections 3 and 4 of the draft EIS.

1. Page 3-70. Cetaceans: Recent research by the National Marine Fisheries Service indicates that winter distribution of Cook Inlet belugas extends into the upper inlet. The information would support the assumption that belugas are found year round in Cook Inlet and consequently are subject to impacts from oil and gas activities at any time of the year. ADF&G recommends that the DEIS discussion on distribution and potential regional effects on Cook Inlet belugas be revised to incorporate this information.

2. Page 3-74, Sea Otters: This section suggests that Alaskan sea otter populations have declined 70% over the last eight years. However, research indicates that this drastic decline is limited to the Aleutian Islands population, with smaller declines occurring in some other areas. It is our understanding that the U.S. Fish and Wildlife Service (FWS) does not have sufficient data to determine the current status of lower Cook Inlet and Kachemak Bay stocks.

3. Page 3-75, Terrestrial Mammals: The discussion on management responsibilities (third paragraph) does not accurately paraphrase state and federal authorities for terrestrial mammals and fish. The state recommends the text be revised as follows:

> Some special management agreements exist for transnational populations such as the Porcupine Caribou Herd (PCU) under a co-management agreement with federal and state agencies. Management of all fish and wildlife is the responsibility of the State of Alaska except where specifically reassigned by Congress (e.g., Marine Mammal Protection Act, Endangered Species Act, Eagle Protection Act). Under a federal court decision, the Department of the Interior and Department of Agriculture are responsible for assuring a federal subsistence priority on federal lands and waters. The state regulates harvest with a preference for subsistence use on all lands. The Federal Subsistence Board acts to regulate the subsistence priority on federal lands under the Alaskan National Interest Lands Conservation Act (ANILCA), rather than the MMPA. Alaska Natives are heavily represented on the 10 regional advisory subsistence councils (RAC) that advise the Board. The state's local advisory committees and the RAC meetings generate a great deal of local knowledge applicable to wildlife management issues...

4. Page 3-80, Steller's Eider: The discussion states that small numbers of Steller's eiders may occur in Kachemak Bay. The FWS has documented Steller's eiders in Kachemak Bay and north along the east side of Lower Cook Inlet to Deep Creek. ADF&G recommends that the DEIS be revised to include this information.

5. Page 3-80, Aleutian Canada Goose: The Aleutian Canada goose also breed in the eastern Aleutians (e.g. Chagulak Island). This subspecies was also removed from the Endangered Species List on March 20, 2001.

6. Page 3-83, Shorebirds: Studies by the U.S. Geological Survey have documented what may be the entire population of Pribilof Islands rock sandpiper wintering along the tide flats along western Cook Inlet, primarily from the Susitna Flats south to Redoubt Bay. An oil spill could significantly impact the subspecies. The DEIS discussion on distribution and potential regional effects on shorebirds should be revised to address this concern.

7. Page 3-84, Seabirds: This section should be revised to include nesting marbled and Kittlitz's murrelets in Kachemak Bay.

8. Page 3-92. Areas of Special Concern: The discussion of Alaskan areas of special concern fails to include coastal areas designated by the state as critical habitat areas, game refuges, and sanctuaries. These areas were given special status by the State legislature because of their high value to fish and wildlife. These areas should be included in the DEIS and decision document, and taken into consideration when calculating regional environmental sensitivities.

9. Page 3-103, Fisheries, Gulf of Alaska: The discussion implies that blocks offshore of Yakutat within the Gulf of Alaska planning area are on the 5-year schedule. This is contrary to the decision document, which does not include the Gulf of Alaska. The department recommends this section be clarified.

10. Page 4-99, Fissipeds, Accidents: The discussion fails to include potential spill impacts to sea otters. Otters were significantly impacted during the Exxon Valdez oil spill (EVOS). The EVOS Trustee Council considers the population recovering, but the recovery objectives have not been met. Additionally, sea otter numbers in southwest Alaska are in decline. The DEIS should be revised to address this concern.

11- Page 4-103, Grizzly and Black Bears: The discussion should be expanded to address potential impacts of routine operations on seasonal concentrations of bears along the west side of Cook Inlet (e.g., McNeil River, Tuxedni Bay and Chinitna Bay) and on the Kenai Peninsula. Large numbers of bears congregate in the spring along the coast to feed on emerging sedges. Clams and marine mammal carcasses. Bears also concentrate along salmon streams during late summer and fall to feed on returning fish. The Kenai

Peninsula brown bears, which are considered an isolated population, have been designated as a Species of Special Concern by ADF&G. Onshore infrastructure placement could significantly affect the local bear populations. The department also recommends that the DETS be revised to expand on potential oil spill impacts to seasonal concentrations of bears. If, for example, a spill significantly impacted salmon stocks in an important bear feeding stream, sublethal effects to coastal and inland bears, particularly maternal female bears, could result in an impact on the local population.

12. Page 4-109. Marine and Coastal Birds: The discussion suggests that seabird colonies in Lower Cook Inlet would not be subject to routine operations (e.g.. aircraft). In addition to large seabird colonies on the Barren Islands, there are important seabird colonies on Duck and Chisik Islands that may be significantly affected. Concentrations of seabirds also forage in waters adjacent to Kachemak Bay, a state legislatively designated critical habitat area. Kachemak Bay has also been designated as a National Estuarine Research Reserve by the National Oceanic and Atmospheric Administration. The previous 5-year sale identified a coastal deferral adjacent to Kachemak Bay to protect significant fish and wildlife resources within and near the Bay. The DEIS should be revised to address these concerns.

13. Page 4-127, Areas of Special Concern: The discussion should include a description of potential impacts from exploration, development, and transportation on state game refuges, critical habitat areas, and sanctuaries. The proposed Cook Inlet planning area lays adjacent several legislatively designated "'special areas", including the Kachemak Bay Critical Habitat Area.

II. Decision Document Proposed Program

The department notes the following deficiencies in the Summary and Decision document.

1. Page 17, Beaufort Sea, Environmental Impacts: Steller sea lions, harbor seals, and northern fur seals do not generally occur in the Beaufort Sea planning area. Pinnepeds in this area would include the spotted seal, ringed seal, bearded seal, and walrus. In addition, Pacific salmon are not generally found in the Beaufort Sea.

2. Page 25, Chukchi Sea/Hope Basin, Environmental Impacts: The northern fur seal and harbor seal do not generally occur in the Chukchi Sea.

3. Pages 31 and 32, Norton Basin, Environmental Impacts: This section should summarize the potential impacts from oil spills on fish resources and fisheries.

4. Page 32. Cook Inlet. Key Comparative Results: This document characterizes the Cook Inlet area as the lower range of environmental sensitivity. ADF&G believes the system for ranking the environmental sensitivity of Alaskan lease sale areas is inadequate

because it does not consider the fact that both sub-Arctic and Arctic ecosystems are characterized by brief but often intense periods of biological activity during the spring and summer. If a large oil spill occurred during this highly sensitive and compressed period, an entire season's worth of biological production would be severely impacted. The department recommends that the rankings of the Alaskan sale areas be adjusted to better reflect the sensitivity of these areas (see comment 7).

5. Pages 34 through 377 Cook Inlet, Environmental Impacts: The ringed seal, bearded seal, spotted seal, and ribbon seal do not generally occur in the Cook Inlet planning area. This section should also address potential affects to sea otters, particularly oil spill effects.

In addition, this section states that potential impacts on commercial and recreational fisheries would be negligible to moderate. Closures due to the Exxon Valdez oil spill were considered a major impact on the commercial salmon fisheries. ADF&G recommends that MMS re-evaluate potential effects to fisheries.

6. Page 75, Relative Environmental Sensitivity: The department does not believe the system for ranking environmental sensitivity accurately reflects the Arctic and sub-Arctic ecosystems. It appears that the major component in the ranking system is the Environmental Sensitivity Index (ESI). This index weighs heavily on the ability to clean up oil on a particular shoreline habitat. The sensitivity *of* fish and wildlife sources is not well represented in the ESI rankings. In addition, a considerable amount of Alaskan shoreline habitat has not been categorized. A prediction of impacts using the Natural Resource Damage Assessment Model for Coastal and Marine Environments does not function as well in Alaska as it does for other coastal areas in the United States. Consequently, Table 12 should be adjusted to better characterize the Alaskan planning areas.

7. Page 83, Other Areas of Special Concern: The discussion should include designated special areas as established by the State of Alaska (see DEIS comment 8).

This concludes the State of Alaska page-specific comments on the draft EIS for the Proposed OCS Oil and Gas Leasing Program for 2002-2007.

GOVERNOR GRAY DAVIS

January 24. 2002

Honorable Gale Norton
Secretary
United States Department of the Interior
1849 C Street. NW, Room 6156
Washington, DC 20240

RE: Comments on the Proposed 5-Year Oil and Gas Leasing Program for 2002.2007

Dear Secretary Norton:

Thank you for the opportunity to comment on the second draft of the new Five-Year Oil and Gas Leasing Program (5-Year Program). I remain firmly opposed to any additional leasing for offshore oil and gas development off the California coast.

I support the continued prohibition of leasing within the three Outer Continental Shelf planning areas (northern. central and southern) off California in this upcoming 5-Year Program because I believe that the impacts from new oil and gas operations would be unacceptable. These impacts have been documented extensively in past comments from California. Key concerns include the cumulative impacts of future leasing on air and water quality, commercial and span fisheries. scenic and marine resources, vessel traffic safety, and on land resources. In addition, substantial data gaps exist for understanding the full extent of these impacts as noted by the National Research Council *(The Adequacy of Information for Outer Continental Shelf Oil and Gas Decisions: Florida and California.* 1989). To our knowledge. the Department of the Interior has yet 10 fully address these information gaps, or to provide a thorough cumulative impact analysis of the impacts of existing, approved, proposed, and projected developments in the Outer Continental Shelf off California.

STATE CAPITOL. SACRAMENTO. CALIFORNIA 95814. (916) 445-2841

Moreover, in his comments on the first phase of the new 5-Year Program dated January 26, 2001, California Department or Conservation Director Darrell Young noted that all three planning areas off the California coast had been withdrawn from consideration during the period under consideration in this 5-Year Program (July 2002 to July 2007). This action is the result of the prohibitions originally set in place by former President Bush (1990 through 2001) and then extended by President Clinton until June 30, 2012. In addition. Director Young observed that the West Coast planning areas also (all within the area included in the leasing moratoria imposed by the U.S. Congress on the Interior Appropriations budgets on an annual basis since 1991.

Thank you for the opportunity to comment on the second phase of the Proposed 5-Year Outer Continental Shelf Leasing program for 2002-2007.

Sincerely.

GRAY DAVIS

cc: Lucy Querques Denett, Acting Director
U.S. Department of the Interior

Ralph Ainger, 5-Year Program Manager
U.S. Department of the Interior

STATE OF CALIFORNIA-THE RESOURCES AGENCY GRAY DAVIS, GOVERNOR
CALIFORNIA COASTAL COMMISSION
45 FREMONT, SUITE 2000
SAN FRANCISCO, CA 94105-
VOICE AND TDD (415) 904-5200
FAX (415) 904-5400

January 24, 2002

Ralph Ainger
Minerals Management Service
MS.4010, Room 2324
381 Elden Street
Herndon, Virginia 20170

RE: **Comments on the Draft Environmental Impact Statement for the Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007**

Dear Mr. Ainger:

Thank you for the opportunity to comment on the draft environmental impact statement ("DEIS") for the U.S. Department of the Interior's proposed *Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007.* The OCS leasing program for 2002-2007 proposes a total of 20 OCS lease sales in five areas offshore Alaska and three in the Gulf of Mexico. The California Coastal Commission strongly supports the continued prohibition of any new leasing off the coast of California.

The Coastal Commission regulates oil and gas development in accordance with the policies of the Coastal Act, which addresses a range of activities and potential environmental impacts associated with offshore oil and gas development. In addition, the Coastal Commission exercises federal consistency review of federal activities and federal permitted activities under the provisions of the Coastal Zone Management Act.

Based on the Coastal Commission's experience to date in regulating offshore oil and gas development, our concerns are broad-ranging. including impacts to coastal wetlands and marine resources from potential oil spins; marine water quality impacts from discharges associated with offshore drilling, production, and oil transportation; effects on commercial and recreational fishing; adverse impacts on visual, recreational, and archaeological resources; vessel traffic safety concerns; air quality impacts; impacts to environmentally sensitive habitat areas; and impacts from on-shore production and support infrastructure on other coastal land uses. The Coastal Commission has consistently opposed new lease sales in frontier areas with no facilities because of concerns about individual and cumulative adverse impacts to coastal resources. We therefore reiterate our support of the continued prohibition of new lease sales off the coast of California.

We also are very concerned that leasing and developing Alaskan OCS planning areas, as proposed in the 2002-2007 leasing program, may cause adverse individual and cumulative impacts to California's coastal resources. The DEIS states that oil from the Beaufort Sea and Chukchi Sea Planning Areas would be loaded onto tankers at Valdez and shipped primarily

to west coast ports. Beaufort Sea and Chukchi Sea oil transported by tanker along the California coast, and to California ports, may increase the risk of a major oil spill. The DEIS fails to describe and evaluate adequately the potential significant effects of additional tanker traffic on California's coastal resources. Our specific comments on the DEIS, and requests for additional analyses to be included a final EIS, are attached for your consideration.

Thank you for the opportunity to comment,

Sincerely,

PETER M. DOUGLAS
Executive Director

SPECIFIC COMMENTS ON
THE DRAFT ENVIRONMENTAL IMPACT STATEMENT ("DEIS")
FOR THE OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM:
2002-2007

1. The DEIS estimates futuree oil production volumes (Vol. II, pg. 81), but there is no discussion of how many additional annual tank transits along and into California ports this represents. Please include this information in the final EIS. The production volumes should be expressed as barrels per year from both the Beaufort and Chukchi Sea Planning Areas, with an extrapolated estimate of additional tanker trips (above 2002 levels) expected per year per California port (San Francisco, Los Angeles/Long Beach).

2. The DEIS assumes a "large spill" volume for tankers to be 7,800 barrels (Vol. i.pg. 4-26). Derivation of this value, based on historic spills, seems to represent a "reasonable worst-case spill volume". For planning purposes (including spill trajectory modeling), worst-case spill volumes should also be estimated. This would represent the entire volume of a tank vessel. Average or median total tank vessel volumes (for each major operator expected to be involved in crude oil transport along the west coast) could be used in deriving worst-case spill volume estimates. No information is given on oil spill trajectories, although Vol. I, pg. 3-122 offer some information on climate and meteorology that can be useful in trajectory modeling. Vol. I, pg. 158 states that routine tanker vessel traffic and associated discharges are not expected to produce impacts to southern sea otters, as discharges will occur while tankers are in transit well offshore in deep water." However, tankers routinely operate much closer to shore when entering the port of San Francisco, and when approaching the ports of Long Beach/Los Angeles via the Santa Barbara Channel. Oil spill trajectory modeling conducted for the southern sea otter recovery plan indicates that spills off California's San Mateo coast would be expected in many circumstances to contact the coastal waters, habitats and sensitive and/or listed organisms of the California central coast (Draft Revised Recovery Plan for the Southern Sea Otter *(Enhydra lutris nereis),* January 2000, U.S. Fish and Wildlife Service Region I). New NOAA and Minerals Management Service trajectory models (TAPS and GNOME, respectively) have been developed, and their applicability should be evaluated here. The final EIS should include new oil spill trajectory modeling, especially for oil spills that could occur in the approach to the port of San Francisco and in the Santa Barbara Channel.

3. The DEIS underestimates both the potential for an oil spill, and the impact of spilled oil on sea otters. birds. fish and coastal habitats (Vol. I, pg. 4-159, 3-128,3-130.3-134). The DEIS states "Although the spill size under the proposed action is relatively small (7.800 barrels), impact... along the central California coast would be unavoidable. ..." In the particular case of sea otters, the DEIS states (pg. 4-159) that "following oil exposure. sea otters would be expected to recover completely. ..." This is not the case for sea otters, nor would it be for many other sensitive species also occurring in the same coastal habitat. Recent California experience (e.g., 1997 Central Coast vegetable/fish oil spill, 1997-98 Point Reyes spills, 1999 TN Command spill, 2001/02 San Mateo Mystery spill) in the central coast area, *or* in the approach to San Francisco, shows that relatively small spills can impact large numbers of coastal birds (e.g., common murres, marbled murrelets, pelicans, loons, grebes, scoters) as well as putting sea otters and pinniped populations at risk. At a minimum. the final EIS needs to:

   - Acknowledge recent California spill events;
   - Realistically evaluate the potential spills due to any increased transportation of crude via tanker;
   - Estimate spill impacts using both worst case spill volumes (entire tanker volume) and reasonable worst case spill volume (volume of largest cargo cell);
   - Use updated trajectory models of worst case and reasonable worst case spill volumes;
   - Construct spill scenarios from routinely-used near-shore transit and traffic separation areas off San Francisco, the northern Santa Barbara channel and both offshore and near-shore southern California lightering areas; and
   - Estimate natural resource damage from worst case and reasonable worst case spills, using the scenarios and trajectory information from the above.

4. The DEIS lists "Marine Resources of Concern in California" (Vol. n, pg. 78) and National Marine Sanctuaries (Vol. I, pg. 3-137). The final EIS should also identify and evaluate:

   -). National Marine Sanctuary concerns regarding the anticipated additional tanker traffic through each of the California Sanctuaries;
   -)- The effect of California's Marine Life Protection Act;
   -). The effect of Offshore Rocks National Monument status; and
   -). Recent developments in the designations of California Marine Protected Areas.

5. The discussion of invasive species in the DEIS is very broad and incomplete (Vol. I, pg.4-12). No mention is made of West Coast ballast water exchange initiatives implemented to help address introduction of invasive species (these vary by state and for British Columbia), nor how and whether the tankers transporting new Alaskan crude will obligate themselves to observe invasive species control measures *(e.g.,* ballast water exchange). Please address these issues in the final EIS.

6. Reference to noise impacts (Vol. I. pg. 3-123) in the DEIS is very general, and does not inform us of the new noise levels expected from the increased tanker traffic. Reference to the ability of cetaceans to avoid tank vessels (Vol. I, pg. 4-155) is predicated on the expectation that "tankers produce considerable noise" and cetaceans are expected to "recognize that a tanker is approaching and initiate avoidance behavior .... The final EIS needs to treat both these subjects - additional underwater noise, and increased potential of vessel strikes on cetaceans - in the context of cumulative impacts.

7. In Vol. I, pg. 4-25, the DEIS states that .. Alaska OCS oil transported by tanker to West Coast ports would be handled by existing onshore facilities." There is, however, no discussion of whether existing facilities can accommodate additional volumes of Alaska crude oil, or if infrastructure improvements or expansions are needed. Please address these issues in the final EIS.

8. If the Alaskan crude is to be lightered offshore California, please evaluate in the final EIS the cumulative impacts of additional offshore California lightering operations.

9. The DEIS does not address whether the Alaskan crude will be transported primarily along the west coast by vessels owned or operated by member companies of the Western States Petroleum Association ("WSPA"). WSPA tank vessels generally observe a voluntary agreement to keep laden vessels in transit at least 50 miles offshore. There is no similar voluntary agreement in place for non- WSP A vessels. The final EIS should discuss the proportion of crude oil tank vessels expected to operate under the voluntary WSPA agreement.

10. The final EIS should discuss, state-by-state, and for British Columbia recent (within the last decade) regulatory and policy advances in oil spill *prevention.* For example, the final EIS should discuss the recommendations *(e.g.,* collision hazards risk, tug availability) historic casualty, minimum distance from shore) developed on behalf of the Pacific States/British Columbia Task Force by the Offshore Vessel Traffic Risk Management Workgroup. These findings and recommendations, currently in draft form, can be found at the Pacific States/British Columbia web site (http://wlapwww.gov.bc.loc.ca/eeeb/taskforc/tfhome.htm).

11. The final EIS should discuss, state-by-state, and for British Columbia, recent (within the last decade) regulatory and policy advances in oil spill *response.* These should cover both mechanical *(e.g.,* booming, skimming) and alternative *(e.g., in situ* bum, chemical dispersant) response technologies. This analysis also should include the dispersants use policy currently being revised for application in California.

Jeb Bush
Governor

Department of Environmental Protection

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

David B. Struhs
Secretary

JAN 24 2002

January 23, 2002

Ms. Lucy Querques Dennett
Acting Director
Minerals Management Service
Department of the Interior
1849 C Street, Northwest
Washington, D.C. 20240

Dear Ms. Dennett:

On behalf of Governor Jeb Bush, the Florida Department of Environmental Protection has coordinated a statewide review of the Proposed Outer Continental Shelf Oil and Gas Leasing Program for 2002-2007 (Program) and the accompanying Draft Environmental Impact Statement (DEIS). While the DEIS analyzes alternatives for varying numbers of lease sales (zero, one, two or three) in the Eastern Gulf of Mexico Planning Area, the Program proposes two lease sales, one each in 2003 and 2005, in the modified Lease Sale 181 area. The two proposed eastern Gulf sales are located more than one hundred (100) miles offshore Florida and Alabama and no lease sales are proposed for the Straits of Florida and South Atlantic Planning Areas.

The proposed Program does not differ from the Draft Proposed Program, for which the state provided comments in September 2001. The state will carefully review the individual sale proposals and make recommendations appropriate at that time. We continue to encourage MMS to develop sound environmental and technological information for accurately assessing the environmental impacts of OCS activities, especially in the deep water environment of the eastern Gulf.

Discussions with MMS staff have indicated that the Service proposes a modified NEPA process for the eastern Gulf sales included in the 2002-2007 Program. We understand that an Environmental Impact Statement (EIS) will be developed for the first eastern Gulf lease sale under the Program, but any subsequent sales would be evaluated through either Environmental Assessments (EA) or supplemental EISs. If the initial EIS provides a sufficiently detailed and comprehensive analysis of environmental impacts throughout the eastern Gulf *and* only limited new information is applicable to a subsequent sale, that process should be acceptable. Regardless, however, Florida does want to review all draft NEPA documents prepared for subsequent sales – whether an EA or a supplemental EIS.

Florida appreciates the opportunity to comment on the Proposed 5-year leasing Program and the DEIS, as well as your agency's efforts to address concerns and issues raised in our comments on the Draft Proposed Program. In addition to those remarks, the state offers the technical and general document-specific comments enclosed. We also enclose a separate comment letter from Pinellas County for your review. Should you have any questions regarding the state's comments, please call me at (850) 488-2960.

Sincerely,

Lisa Polak Edgar

Lisa Polak Edgar
Deputy Secretary

LPE/dt
Enclosures

cc: Secretary David Struhs, DEP
Secretary Steve Seibert, DCA
Carolita Kalluar, MMS
Brian Yablonski, EOG
Frank Jimenez, EOG
Chris Oynes, MMS
Richard Wilderman, MMS

Ms. Lucy Querques Dennett
January 23, 2002
Page Two

Florida appreciates the opportunity to comment on the Proposed 5-year leasing Program and the DEIS, as well as your agency's efforts to address concerns and issues raised in our comments on the Draft Proposed Program. In addition to those remarks, the state offers the technical and general document-specific comments enclosed. We also enclose a separate comment letter from Pinellas County for your review. Should you have any questions regarding the state's comments, please call me at (850) 488-2960.

State of Florida
Comments on the Draft Environmental Impact Statement
for the Proposed 5-Year OCS Leasing Program (2002-2007)

Background:

Eastern Planning Area (EPA) lease sales evaluated in this DEIS (2002-2007) are proposed within the revised boundaries of eastern Gulf Lease Sale 181, greater than 100 miles from Florida beaches and off the coast of Alabama. The Proposed Action evaluated in the DEIS (Alternative 1) includes two lease sales in the Eastern Planning Area of the Gulf of Mexico in 2003 and 2005. In addition to the proposed action, four alternative actions were evaluated, including Alternative 2: slow the pace of leasing by having one sale in the EPA; Alternative 3: excluding some planning areas from leasing by having no sales in the EPA; Alternative 4: accelerating leasing by holding three sales in the EPA; and Alternative 5: A No Action alternative in which no lease sales would be conducted from 2002 through 2007.

Impacts from activities resulting from the proposed eastern Gulf lease sales are expected to occur over a period up to 40 years after each sale. Activities include 17-26 exploration and delineation wells and 30-52 development wells that can discharge up to 505,960 barrels of drilling muds and 154,460 barrels of drill cuttings. Between 200 and 350 miles of pipelines are expected to be installed.

General Comments:

Florida remains concerned about the effects of OCS oil and gas activities conducted in the eastern Gulf of Mexico on marine and coastal environments and the sensitive biological resources and critical habitats associated with them. A significant amount of activity over several decades is expected to result from the approval of the proposed program. While the DEIS provides an adequate description of expected activities, affected resources and impact analyses for a programmatic document, it is imperative that environmental analyses for individual sales and drilling proposals carried out under this 5-Year Program be more detailed and thorough. We will continue to carefully review the environmental analyses for individual proposals at the appropriate time.

Increased efforts by MMS to support environmental and oceanographic studies in the Eastern Gulf of Mexico, particularly in deeper waters, has helped to increase our knowledge of the area's natural diversity and oceanographic influences on the Florida shelf. We continue to encourage MMS to develop sound environmental and technological information for accurately assessing the environmental impacts of all OCS activities, especially in this deep water environment.

The most recent environmental impact statement (EIS) for a lease in this area, however, clearly shows that information is often limited. The Lease Sale 181 EIS notes that the knowledge of deepwater benthic resources in the proposed sale area is based on limited studies conducted many years ago. While MMS is funding more detailed benthic studies, these must be

completed to broaden our current understanding of the presence and function of deepwater benthic resources in the Eastern Gulf.

Strong deepwater bottom currents and intermittent subsurface currents are often poorly understood. The environmental analyses for individual sales should adequately address how these currents could affect operational activities resulting in impacts on the environment. In addition, analyses should include discussions of whether currents may move either permitted or accidentally discharged materials out of the immediate area and onto the Florida shelf. Operational discharges from the use of synthetic drilling muds and large volumes of industrial chemicals used in deepwater drilling operations should be analyzed to better understand their potential impacts on marine and coastal resources.

An assessment of the short and long term environmental impacts to be analyzed for OCS activities conducted under the Proposed Program should document emergency response capabilities, worst-case accidental discharges, both deepwater blowouts and pipeline ruptures from representative locations should be analyzed, including spill trajectory models; fates and effects of discharges, including the potential for bioaccumulation; the increased use of new and unusual technologies; the potential of OCS facilities to become vectors for exotic species; the amount of trash and debris generated by OCS activities; threatened and endangered species; fisheries; benthic habitats; and socioeconomic and tourism issues.

Other uses of the OCS that should be analyzed for individual proposals resulting from this proposal include military operations; recreational activities; marine protected areas; commercial and recreational fishing; methane hydrates; cruise ships and other vessel traffic; and aquaculture.

Lease sale specific EISs should also thoroughly address the cumulative, long-term impacts from not only large spills, but also from small spills, the discharge of drilling muds and cuttings, debris, pipeline placement and rig construction, all of which have the potential to degrade water quality and result in deleterious effects to marine and coastal habitats. The impacts of drilling muds and cuttings, including synthetic based drilling fluids, in this deep water environment, should be thoroughly addressed in the environmental evaluations of individual sales, including the potential for persistence in the area.

Concerns about the potential for and the impacts of both permitted and accidental discharges, including synthetic based drilling fluids, should be adequately addressed. The impact of spills on coastal communities would have direct implications not only to the environment, but to tourism and the state's economy. Because hydrocarbon releases can range from single or episodic spill events to prolonged seepage, understanding how far and where hydrocarbons may migrate beyond the immediate site is critical to assessing potential impacts. This is especially important in Florida since materials entrained in the Loop Current may be rapidly carried to Florida's west coast, well outside of the proposed sale area. These issues must be adequately addressed for individual sales and plans resulting from this proposed 5-Year Program.

In addition to adequately evaluating the potential for and types of impacts which may occur from OCS activities, specific sale and plan analyses must include complete descriptions of areas impacted by these activities. These areas include live bottom habitat, seagrass beds, mangroves, coastal marshes and other critical habitat for species that are important to Florida, including threatened and endangered species.

Page Specific Comments

Page iv - Summary: The statement is made that "If no sales were held in the Eastern Gulf of Mexico between 2002 and 2007 (alternative 3) impacts could still occur in the Eastern Gulf due to oil and gas activities in the Central Gulf of Mexico Planning Area." This statement clearly acknowledges the potential for activities occurring in the Central Planning Area (CPA) to impact habitats and resources which occur in the Eastern Gulf of Mexico. Cumulative analyses for activities resulting from the proposed Program should include the additive effects of central Gulf activities.

Page 1-3 Impact Producing Factors: Floating Production, Storage and Offloading Systems (FPSOs) are included in this DEIS as an impact-producing factor. While these systems have been evaluated for use in the Central and Western Gulf of Mexico Planning Areas, no evaluations have been conducted for using these systems in the Eastern Planning Area. If such systems are proposed in the EPA, a separate NEPA evaluation will be required, including review by affected states under the CZMA.

Page 1-13 Zero Discharge in Water: Re-injection of drilling wastes or produced water into underground reservoirs was suggested as a means to avoid impacts to receiving waters from these discharges. This measure was considered by MMS to be more appropriately evaluated at the lease sale stage rather than at the programmatic stage. Information presented at the 2001 Offshore Technology Conference shows that zero discharge is technically feasible and can be cost effective. Evaluation of this technology should be conducted for future activities in this area.

Page 2-16 Impacts on Tourism and Recreation: The MMS considers large oil spills to have minor to moderate impacts to travel tourism and recreation. Given the current challenges faced by the travel and tourism industries, additional impacts to these industries in Florida could have severe ramifications both locally and statewide. It is imperative that Florida protects its natural resources and the tourism industries they support. Minimizing negative impacts to natural resources in the Eastern Gulf of Mexico is of the utmost importance to Florida's economic future.

Page 2-20 Comparison of Impacts: Since knowledge of this deepwater region of the Gulf of Mexico is limited, a cautious approach to development in this area is warranted. The Environmental Studies Program is collecting valuable data which will provide managers with information that could reduce negative environmental impacts of future activities

Page 3-7 Water Quality: The discussion of water quality in the Gulf of Mexico is based on studies conducted in the early and mid 1990s. Are more recent data, especially concerning hypoxic conditions in the Gulf, available for use in this analysis?

Page 3-8 Water Quality: The DEIS acknowledges that "there has been relatively little evaluation of anthropogenic inputs to the Gulf of Mexico slope area (depths > 200 m)" and limited data are "available regarding trace element concentrations in the deepwater Gulf of Mexico." These statements reiterate the need to better understand this environment.

Page 3-22 Nonendangered Species: The DEIS notes that an estimated 94 percent of natural hard bottom exists on the west Florida shelf from the Dry Tortugas to Pensacola. These hard bottom areas, with associated flora and fauna, are essential fish habitat for many species critical to Florida's recreational and commercial fishing industries. Because of their importance, they should be afforded maximum protection.

Page 3-31 Live Bottom Areas: The discussion of the live bottom communities found in the Gulf of Mexico should be updated to include important live bottom resources located at depths greater than 100m in the eastern Gulf. These resources were clearly seen in the video surveys conducted for the Gulfstream Pipeline project. The USEPA, in commenting on proposed Lease Sale 181, requested MMS to extend the Eastern Gulf of Mexico Planning Area Live Bottom Stipulation to 200m to provide protection to these resources.

Page 3-35 Areas of Special Concern: Discussions under this section do no include any state owned and managed lands which could be impacted by OCS oil and gas activities. Individual proposals conducted under the proposed program should describe these and discuss potential effects.

Pages 3-38 and 3-39 National Estuarine Research Reserves: The descriptions of the Rookery Bay National Estuarine Research Reserve (NERR) and the Apalachicola NERR should be reversed. Rookery Bay NERR is located south of Naples, Florida and the Apalachicola NERR is located southeast of Panama City.

Page 3-41 The Structure of Regional Population and Demographics: The summarizing paragraph states that "these broad summaries suggest that the three Gulf of Mexico Planning Areas (Western, Central and Eastern) exhibit a mix of similar and distinctive demographic and employment characteristics." While this may be true in a very broad sense, the DEIS acknowledges that employment in the EPA in the service, wholesale, and retail sectors is greater than anywhere else along the coast. It is imperative that the analyses for individual actions conducted under the proposed sale discuss the differences observed in the EPA regarding tourism based employment versus industrial development observed in the CPA and WPA, the age of the population in the EPA; and Florida's reliance on living marine resources and a pristine environment for its tourism-based economy.

Page 3-46 Recreational Fisheries: The statement is made that "...during 1999 there were 2.2 million oil and gas structure visits associated with recreational fishing and diving..." The

DEIS should discuss implications to personnel and rig safety resulting from such a large number of vessel visiting oil and gas structures.

Page 4-1 Department of Defense Use Areas: In the discussion of the Department of Defense use area, the statement is made that "The Eastern Gulf of Mexico Planning Area also has a potential for conflicts" and that "intensive use of the planning area by the Air Force and the Navy tends to limit where oil and gas operations may take place without very close cooperation between USDOI and USDOD." Florida supports measures to minimize conflicts between the Department of Defense and oil and gas operations for both safety and to continue allowing the military access to important training areas critical to their mission.

Page 4 -19 Definitions of Impact Levels: A minor impact level is defined as "most impacts to the affected resource could be avoided with proper mitigation." However, mitigation does not "avoid" impacts. It is simply an action taken to offset negative impacts to resources. Avoidance is the preferred method of resource protection. Where avoidance cannot be accomplished, efforts should be made to minimize impacts. Only when avoidance and minimization have been maximized, does mitigation become prudent. Because of questions regarding success of mitigation, it is the last choice, not the first choice in resource protection.

Page 4 -188 Replacements for OCS Oil and NGL's - Gulf of Mexico Region: The statement is made that in "the proposed region, the primary spill source was pipelines (66%) followed by platforms (25%) with tanker spills playing a minor role (6%)." The sale specific EISs should describe specific proposals being considered to improve safety and reduce spills.

Section 4 – Environmental Consequences: In general, impacts to natural resources, recreational fisheries, tourism and recreation from oil spills are described as moderate. Minimizing these negative impacts is critical to protecting the eastern Gulf ecosystems on which Florida's tourism and fishing industries depend. Florida supports efforts to increase protection and provide adequate emergency response capability to assure that oil spills are cleaned up before they contact important resources.

Figure 2 – 2 – Program Area: It would be helpful if the geographic coordinates for the area under consideration for lease in the EPA were provided.

Appendix C: Probabilistic modeling of oil spills does not provide information on spill trajectories or the potential for specific areas of shoreline impact. This information is important for spill planning. Under certain conditions in the Gulf, a shoreline impact in Florida is possible for a large offshore spill in the planning area. Effective response using mechanical recovery, dispersants, and/or in-situ burning can reduce shoreline impacts from a large spill.

Page C-26: This discussion does not include the planning efforts of Region IV for dispersant and in-situ burning preauthorization. Region IV has been active in these efforts and have granted pre-authorization to the FOSC in offshore waters.

Page C-26: We disagree with the first sentence of the last paragraph. Dispersant use in the Gulf of Mexico has gained state acceptance as reflected by the pre-authorizations in both USEPA Regions IV and VI. Florida has led the effort to grant this authority to the FOSCs with resonsibility within the state.

PINELLAS COUNTY
BOARD OF COUNTY COMMISSIONERS
PHONE (727) 464-3365 • FAX (727) 464-3022 • 315 COURT STREET • CLEARWATER, FLORIDA 33756

BARBARA SHEEN TODD
CHAIRMAN

January 8, 2002

Debby Tucker
Florida Department of Environmental Protection
Office of Intergovernmental Programs
Mail Station 47
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Dear Ms. Tucker:

Pinellas County has received the Proposed 5-Year Schedule for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program, 2002-2007, and the corresponding Draft Environmental Impact Statement (EIS) for review.

The 5-Year Schedule includes proposed lease sales within the western, central and eastern portions of the Gulf of Mexico. Of particular interest to Pinellas County are the proposed sales in the eastern Gulf of Mexico in areas 189 and 197, scheduled for 2003 and 2005, respectively. Possible activities identified that would occur in the leased areas over a period of 25 to 40 years are: (1) drilling and natural gas exploration, (2) installing and operating offshore platforms/pipelines/support facilities, and (3) transporting oil via ships or pipelines. We understand that the proposal does not address the issuance of specific leases in the OCS, but establishes a schedule for considering where and when leasing might be appropriate over the 5 year period.

The EIS is not specific, but is based on assumptions about the likely impact of oil and gas exploration, development activities and the consequences of accidental events (e.g., oil spills) associated with eventual leases. The EIS also considers 4 Alternatives to the proposed Schedule (pages i and ii of the Draft EIS). Of those Alternatives, Alternative 3 and Alternative 5 both exclude the eastern Gulf of Mexico from consideration for new oil and gas exploration and development leases. Alternative 3 would still, however, allow exploration in the western and central Gulf.

Pinellas County has, during all previous opportunities to review Outer Continental Shelf Oil and Gas Leasing Program proposals, consistently opposed the leasing of any portion of the eastern Gulf of Mexico for oil and gas exploration and recovery. Pinellas County continues to strongly oppose the leasing of any portion of the eastern Gulf for this purpose, and therefore opposes the inclusion at this time of areas 189 and 197 in the proposed 5-Year Lease Schedule.

Pinellas County believes that the potential for local environmental degradation and consequent economic loss due to impacts on commercial and recreational fishing, tourism and related activities precludes support for any alternative that includes leases within the eastern Gulf of Mexico. Therefore, Pinellas County considers the currently proposed 2002 - 2007 Schedule, as well as Alternatives 2 and 4 (see pages i and ii of the Draft EIS) to be unacceptable.

Although areas 189 and 197 are located in a relatively small area roughly 300 miles west of Pinellas County beaches, there is still the probability of a large oil spill impacting coastal Pinellas County. Given the known circulation patterns in the Gulf of Mexico, oil released into Gulf waters - particularly the eastern Gulf - can, under the influence of the "Loop Current," easily travel several hundred miles east to be deposited along Pinellas County's shorelines. In addition, the effects of chronic spills and routine operations can have a long term negative impact on live bottom communities, marine animals, and coastal habitats. Chronic exposure to oil, and other residues related to oil and gas exploration and drilling, can negatively impact the life cycle and food chain of, and for, commercial and recreational fish and other marine animals.

Seagrass protection and restoration is a priority in Pinellas County and the Tampa Bay region. In addition, our waters are designated as Outstanding Florida Waters and are part of the Tampa Bay National Estuary, and are thereby afforded special protection status. The EIS recognizes (page iv) that it would be difficult to clean up an oil spill that reached shallow and coastal waters, including seagrass beds, and that affected resources may not fully recover. The EIS acknowledges that seagrass beds can entrap oil and flocculates associated with oil dispersants, and oil residues can persist in the vegetation and surrounding sediments. The EIS speculates that seagrass beds would recover, even without mitigation, from small spills. However, with the Tampa Bay Estuary being an area of extensive research into the successes and failures of seagrass recovery and long term viability, and considering the significance of seagrasses to the

economic vitality of the commercial and recreational fishing industry, Pinellas County would not support conclusions that most impacts from small and large oil spills would be short-lived.

The EIS also recognizes that "moderate impacts" to the tourism industry could occur from a large spill (page iv). Much of Pinellas County's economy is based on tourism, and is dependent upon the County's natural coastal resources and habitats. "Minor" or "moderate" impacts to the local economy are, therefore, not acceptable or justifiable. The impact of any spill or related environmental degradation would be very significant to a substantial portion of this County's workforce. Pinellas County currently enjoys an international reputation for high quality beaches - meeting the Clean Beach Council's "Blue Wave" standards for public safety and environmental quality. These standards are recognized throughout the world and actively promoted by Pinellas County. In addition, three of Pinellas County's beaches consistently appear on the "top ten" list of best beaches in the United States compiled annually by Dr. Stephen Leatherman. Clearly, the results of even one spill would seriously tarnish public perception regarding Pinellas County beaches, greatly affecting the desirability of the area as a tourist destination, and seriously impacting the economy built around this County's greatest asset.

In regard to impacts on marine mammals (e.g., the endangered sperm whale, the west indian manatee, and the several dolphin species), potential impacts are classified in the EIS as ranging from "minor" to "moderate." Impacts to waterfowl and seabirds are described as potentially "moderate" to "major" in the event of a large oil spill. Sea turtles may be impacted by seismic/pressure and noise-related activities, ingestion of solid debris, and contact with spilled oil. Impacts to sea turtles are described as potentially ranging from "minor" to "moderate." Following review of the EIS, Pinellas County believes that too many uncertainties remain regarding the potential for harm to marine-dependent species. Because Pinellas County's connection to surrounding Gulf waters and their dependent inhabitants is inextricable, and the living resources of the eastern Gulf are part of the landscape and character of coastal Florida, their continued viability is essential to the environmental and economic vitality of Florida's Gulf coast.

In summary, due to the potential for environmental and economic degradation and loss, Pinellas County opposes the inclusion of the eastern Gulf of Mexico (i.e., areas 189 and 197) in the 2002 - 2007 Schedule for the OCS Oil and Gas Leasing Program. Specifically, Pinellas County is opposed to the Schedule as proposed (which includes areas 189 and 197), and to Alternatives 2 and 4.

Thank you for this opportunity to comment, and please do not hesitate to contact my office should you have any questions regarding the County's expressed comments and concerns.

Sincerely,

Barbara Sheen Todd

Barbara Sheen Todd
Chairman

cc: Members of the Board of County Commissioners
Stephen Spratt, Pinellas County Administrator

letter oil and gas lease sales 1-8-02

State of Louisiana

M.J. "MIKE" FOSTER, JR.
GOVERNOR

JACK C. CALDWELL
SECRETARY

DEPARTMENT OF NATURAL RESOURCES

December 3, 2001

Richard Wildermann
5-Year Program Manager
Minerals Management Service
381 Elden Street, MS 4042
Herndon Virginia 20170-4817

RE: **C20010516**, Coastal Zone Consistency
Minerals Management Service
Direct Federal Action
Draft Environmental Impact Statement (DEIS) for the Proposed 5-Year Outer Continental Shelf (OCS) Leasing Program: 2002-2007

Dear Mr. Wildermann :

We have reviewed the above referenced DEIS for the proposed 5-Year OCS Leasing Program and offer the following preliminary comments for your consideration in meeting Louisiana's Coastal Zone Consistency requirements and in developing the Final 5-Year OCS Leasing Program for the nation for 2002-2007. A final Consistency concurrence by this State, however, must await your agency submitting a Consistency Determination as discussed below.

For the previous 5-Year OCS Leasing Program, MMS did not submit a Consistency Determination to this State, claiming instead, that this was a planning document, not subject to Consistency requirements. Since then, the National Oceanic and Atmospheric Administration (NOAA) has issued final rules (Federal Register: Dec. 8, 2000, Vol. 65, Number 237, Rules and Regulations, p. 11) which make it clear that the 5-Year OCS Leasing Program is a Direct Federal Action subject to State Coastal Zone Consistency requirements. Thus, pursuant to these new rules, we request that MMS submit a Consistency Determination for the proposed 5-Year Leasing Program, so that we can make our final determination on this proposal.

We are pleased to see that the Proposed Action (Alternative 1) includes two proposed Lease Sales in the westernmost portion of the Eastern Gulf of Mexico Planning Area in addition to the normal ten Lease Sales proposed for the Central and Western Gulf of Mexico. We favor including this area in the Leasing Program, as it is adjacent to existing oil and gas infrastructure in the Central Gulf of Mexico off Louisiana, and its development would serve to stimulate employment and the oil and gas economy of Louisiana. Alternatives 2 and 3 would slow the pace of leasing or exclude some areas from future lease sales that currently have periodic lease sales. These alternatives would adversely impact employment and the economy of Louisiana,

COASTAL MANAGEMENT DIVISION P.O. BOX 44487 BATON ROUGE, LOUISIANA 70804-4487
TELEPHONE (225) 342-7591 FAX (225) 342-9439
AN EQUAL OPPORTUNITY EMPLOYER

and should be rejected, especially in this time period (2002-2007) when National Energy Policy stresses an increase in national energy self- sufficiency and leasing expansion. Alternative 4 expands leasing slightly in the Gulf of Mexico Region, by including a third lease sale in the Eastern Gulf of Mexico Planning Area. We are not opposed to Alternative 4, since it would benefit the employment and economy of Louisiana.

Louisiana's primary concerns with the OCS Leasing Program directly relate to our extensive coastal wetlands, and the fisheries and wildlife resources therein, and the close geographical proximity of the OCS leasing areas and the extensive production, transportation and onshore development activities resulting from these leasing actions. Of particular concern is the strain and cost these activities place on our existing infrastructure coupled with the development pressure on our coastal wetlands. Unlike other OCS Planning areas, the Central and Western Gulf of Mexico Planning Areas have been subject to a long-running MMS policy of annual areawide leasing, and account for 97 % of all OCS oil and gas leasing and production in the United States, with the bulk of the onshore activity focused in coastal Louisiana.

Loss of wetlands in Louisiana results in part from such diverse OCS-generated activities as waterborne traffic along navigation canals and coastal bays; pipeline construction and subsequent pipeline canal widening; water pollution degradation of marshes, canals and valuable estuarine water bodies; overuse and unsustainable over development of onshore infrastructure at the expense of wetlands and often at a high financial cost for the state to maintain; and environmental contamination associated with hazardous wastes produced in these two Planning Areas and often stored or disposed of in the Louisiana Coastal Zone. While wetland losses may sometimes be attributed to specific petroleum activities, it is usually not possible to identify the specific companies responsible for each wetland loss because many of these losses result along waterways traveled in common by all users, and from a multitude of indirect and secondary effects of petroleum development activities. Hence, Louisiana views the Federal agency responsible for promoting and benefitting from the development and exploration of energy resources these activities produce as responsible for the wetland impacts arising from them. An issue your agency should address in the development of the new 5-Year Leasing Program is the program/process MMS should implement to adequately compensate Louisiana for these secondary and cumulative impacts, as required by the LCRP and 15 CFR 930.36.

Another issue we would appreciate having addressed, is a review of the impacts predicted in earlier 5-Year Programs and OCS lease sale documents, as compared to the actual impacts which resulted. We are not aware of any monitoring data supporting either the methodology or conclusions of these predictions as espoused in previous plans. This is particularly true of wetland impacts. If MMS does not have the data with which to make this analysis, we strongly recommend this 5-Year Program include provisions for obtaining such information for the 2008-2013 5-year plan.

Section 18 of the Outer Continental Shelf Lands Act requires that the 5-Year Program be prepared in a manner consistent with the attainment of a proper balance among potential for environmental damage, discovery of oil and gas, and adverse impacts on the coastal zone, as well

as, consideration of laws, goals and policies of affected states, relative environmental sensitivity and marine productivity, and relevant environmental and predictive information. The development and maintenance of the transportation, petroleum service, and other infrastructure necessary to support continued offshore exploration and development, which benefits the entire nation, has had tremendous detrimental impacts to Louisiana's vulnerable wetlands and consequently to our valuable commercial seafood industry, hurricane and storm surge protection, and scenic values. Louisiana has a policy of no net wetland loss, in which the entity responsible must mitigate or otherwise provide adequate compensation for the loss of wetland functions and values. It is also noteworthy that Executive Order 1190 establishes that each Federal agency shall provide leadership and take action to minimize the destruction, loss or degradation of wetland, and to preserve and enhance the values of wetland. Therefore, it is our recommendation that MMS take a leadership role in finding methods to adequately compensate Louisiana, which has borne the brunt of OCS development impacts.

The enactment by Congress of the Outer Continental Shelf Deep Water Royalty Relief Act has resulted in a rapid increase in deepwater development in the Gulf of Mexico and in and around shore bases in the Louisiana Coastal Zone. This legislation and recent technological advances in the petroleum industry have resulted in an oil boom that has severely stressed Louisiana's onshore infrastructure and coastal communities. All the workers, equipment, supplies, transportation facilities, etc., which have accompanied the explosive growth in deepwater development depend on land based facilities and community infrastructure, located primarily in Louisiana. Highways, housing, water, acreage for new business locations and expansions of existing businesses, waste disposal facilities, and other infrastructure facilities are needed in localized areas such as southern Lafourche Parish, where the bulk of land based deepwater activity is occurring. Compounding the magnitude of impacts from the new development is the fact that the existing land based infrastructure is already heavily overburdened and in need of expansion and improvement which requires extensive financial infusions from state and local government. We submit that some of the financial responsibility for maintaining the vast and complex infrastructure for OCS development and should come from the proceeds of United States government sales of these potentially highly productive leases.

Impacts to community infrastructure from OCS activity are to be expected, including impacts to local provision of education, police, fire, sewage, solid waste disposal, water, recreation facilities, transportation systems, health care, utility service and housing. The Department of Natural Resources is encouraged by action on the part of MMS to study deepwater activity impacts to the infrastructure of Port Fourchon and Lafourche Parish and hopes to see similar studies coastwide. We am pleased and encouraged that the State of Louisiana was the recipient of a grant from the Historic Preservation Fund as reported by MMS in the Consistency Determination for Lease Sale 181. We encourage MMS to continue these financial assistance efforts and grants and also, to help the concerned states to effect legislative changes so that the more heavily impacted states receive a more appropriate proportion of these funds. MMS should also initiate studies and provide assistance to impacted communities to help plan

and implement procedures to diversify their local economies and to develop efficient growth measures that minimize disruption from the social and environmental impacts of OCS activity.

We strongly support initiatives such as The Coastal Impact Assistance Program recently passed by Congress for one-time revenue sharing by states and local governments affected by OCS development activities. We do recognize, however, that this one-time appropriation, while evincing that Congress acknowledges OCS's myriad impacts, does not provide the steady stream of funding needed to fully address a continuing problem. This legislation has promise for offsetting some of the infrastructure costs and wetland and socioeconomic impacts suffered by the State of Louisiana and its coastal communities. To this end we fully support OCS legislation which provides for such a revenue stream.

Finally, it must be noted that Louisiana has enjoyed many benefits from OCS exploration and development in the Gulf of Mexico. We are grateful for the opportunity to comment on and coordinate with MMS in the preparation of the upcoming 5-Year OCS Leasing Program. It is our hoped that our concerns are adequately addressed and incorporated into the requested Consistency Determination for the Leasing Program. If you should have questions with regards any of these matters, please feel free to contact me at (225) 342-7591.

Sincerely,

Terry W. Howey

Terry W. Howey
Administrator, CMD

TWH/JH/bgm

cc: Jack C. Caldwell, Secretary, DNR
Chris C. Oynes, Regional Director, MMS

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

January 16, 2002

Mr. Richard Wildermann
Branch of Environmental Assessment
Minerals Management Service
381 Elden Street
Herndon, VA 20170-4817

Re: Outer Continental Shelf Drilling Leases, Gulf of Mexico

Dear Mr. Wildermann:

The Texas Natural Resource Conservation Commission (TNRCC) has reviewed the above-referenced project and offers the following comments:

The Policy and Regulations Division has reviewed the above-referenced project and does not anticipate significant long-term environmental impacts from this project as long as construction and waste disposal activities associated with it are completed in accordance with applicable local, state, and federal environmental permits and regulations. We recommend that the applicants take necessary steps to insure that best management practices are utilized to control runoff from construction sites to prevent detrimental impact to surface and groundwater.

The Strategic Assessment Division has reviewed the information submitted and has no comments on this project at this time.

Thank you for the opportunity to review this project. If you have any questions, please call Mr. Dan Burke, Policy and Regulations Division, at (512) 239-1543.

Sincerely,

Jim Muse

Jim Muse, Director
Policy and Regulations Division

Local Government

City of Nuiqsut

Administration Office
Post Office Box 148 Nuiqsut, Alaska 99789
Phone: 907-480-6727 or 907-480-6429
Fax: 907-480-6928

October 9, 2001

Minerals Management Service
Mr. Ralph Ainger, 5-Year Program Manager
Room 2324 Elden Street
Herndon, Virginia 20170

Re: Comments on Preparation of the Beaufort Sea OCS Lease Sales 5-Year Program for 2002-2007

Dear Mr. Ainger:

As the Mayor and City Council members for the community of Nuiqsut, we are honored to officially comment on behalf of the City office of Nuiqsut, and the community. This comment letter is in response to the 5-Year OCS Leasing Program that is currently in Nominations Notice of Intent to prepare an EIS and Call for Information. The areas off Alaska's shores are what we would like to concentrate our input on, and specifically the areas of Alaska's northernmost shoreline and offshore regions - the Chuckchi Sea and the Beaufort Sea. In context, these waters have significant value to the marine mammal and human environments co-existing contiguously.

Throughout the shorelines of the Beaufort Sea is a human environment of Alaskan native and non-native Alaskans who depend on the various subsistence resources flourishing in this region. The co-existence of the human environment and the marine mammal environment is maintained with our utmost care. The native Alaskan population on the shoreline regions of the Beaufort Sea shares a common responsibility to ensure sustenance between the two environments. As a result, our people exist with great pride in our abilities to effectively manage the marine mammal and wildlife resources for generations to come.

The Beaufort Sea and the Chuckchi Sea supports plenty of activity in terms of subsistence hunting and fishing. The native people who traverse the open seas and the ice packs have a perspicuous knowledge of the ever-changing climate of these offshore areas, and in having that knowledge, the people know when it is safe to hunt and how best to challenge the elements for a successful hunt. Traditional laws and rules are another aspect of Inuit knowledge our people have followed for generations, laws and rules, which are observed and honored among the Inuit environment. Today, the indigenous population maintains these laws and rules in order to sustain the cleanliness of the waters, the providence of its natural habitats, the wildlife it supports, and the human environment who are dependent on its providences ("it" being the waters).

The climate is predominantly cold and icy throughout the Beaufort Sea and Chuckchi Sea, and for a period of time, the sea ice gives way to very strong ocean water currents. The Inuit people know the power of this expanse, and when it moves - it moves without any regard to anyone or anything. Whether it is natural shoreline or a manmade installation, be assured that this movement will damage and destroy it when contacted. It is evident that placing unnatural material into/onto the sea does not hold too well when the ice is on the move unpredictably. The people who live their lives from this expanse are a testament to this, and we advise you to take this into account when considering oil and gas prospects off these shores.

During the long, cold winter months on the arctic slope, wildlife is still present and surviving the elements. The Inuit people of Alaska's arctic slope customarily face each winter and summer on hunts in accordance to the ever-changing elements, and to the traditional laws and rules ordained by our ancestors. As for the short summers of Alaska's arctic slope, the Inuit people's subsistence hunting is

heightened to take advantage of this time of year across the region of the Beaufort Sea. Summer in this region is significant for wildlife, whether they are land-bearing mammals or sea-bearing mammals or waterfowl, the ecosystem of the summer arctic climate supplements the different species of animals with dietary needs particular to each species.

The Inuit people of arctic Alaska take every opportunity they have to fill their winter caches during the short summer months. As winter approaches, the Inuit people work diligently, to ensure that their caches are full enough to last for most of the winter. In the arctic summer climate, wildlife is flourishing offshore, and inland of the Beaufort Sea and the Chuckchi Sea. Wildlife such as waterfowl, caribou, brown bear, moose, musk ox, reindeer, ground squirrel, fox, seal, walrus, wolverine, wolf, beluga whale, Orcas, polar bear, fish of various sorts, clams, crab, shrimp, plankton, krill, the bowhead whale, and a number of other species of wildlife. The Inuit people of Alaska, and the whole of the circumpolar Inuit of Canada, Greenland and Russia depend on all the animals mentioned here. The animals and their habitat provide food to sustain our diet during the long, cold winter seasons. Co-existence of the marine and non-marine mammals, and the human environment is evidently vital to each, as we are dependent on them; they are dependent on the care that we provide for them and their habitat. It has always been the Inuit Eskimo's duty to ensure a replenished environment for mankind and for wildlife. A clean, natural manner of maintaining this environment is the Inuit Eskimo's foremost approach. A clean and natural manner is the only infallible way the Inuit believes is effective. This kind of environmental practice has proven to be a sure process, in which, all living beings are benefited without unnatural causes of discomfort.

The marine mammals of the Beaufort Sea and the Chuckchi Sea are especially important, not only in their own habitat, but also to the Inuit Eskimo population. For as long as it can be recalled, the Inuit Eskimo have hunted for whales, seals, polar bear, fish, walrus and other oceanic creatures since the people's first journey over the land bridge of the Bering Strait. All marine mammals and their habitat are valuable to the Inuit. The northern Inuit of Alaska especially esteems the bowhead whale. The bowhead whale (with its size) when it's harvested provides for a community the food necessary to sustain the people's traditional diet and nourishments. Before the arrival of spring ice-break-up of the Beaufort Sea and the Chukchi Sea, the Inuit ready themselves, and all their traditional hunting tools for the harvest of this mighty creature. The careful work to prepare for such an endeavor is a combination of community cooperation and an unselfish desire to move forward for the health of the community.

The allowance of oil and gas industrial development of these waters will undoubtedly disrupt the present cycle of each environment mentioned here. Even though this letter shares more on subsistence and ecology based on our traditional knowledge and lifestyle, we encourage you to continue listening to the Inuit people who exist here and keep in account these environments of the far north when doing the EIS for the proposed lease sales. So, as is evident, we are not in favor of the lease sales proposed for the Beaufort Sea 2002 – 2007. Permitting oil and gas activity in these waters will only cause intense friction between the industry and the residents of arctic Alaska.

We want to thank you for this opportunity to comment and we look forward to further information and involvement on all aspects of these proposed leases.

Sincerely,

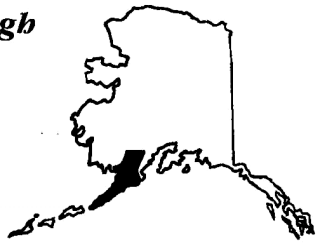
Eli Nukapigak
City Mayor
Council Members:

1. Rosemary Ahtuangaruak
2. Mac Masuleak
3. Rhoda Bennett
4. Thomas Nukapigak
5. Lorraine Akpik
6. Erna Brown

Cc: Isaac Nukapigak, President, Kuukpik Corporation
Leonard Lampe, President, Nuiqsut Tribal Council
Thomas Napageak, Chairman, Alaska Eskimo Whaling Commission
George Ahmaogak, Mayor, North Slope Borough
Maggie Ahmaogak, Executive Director, Alaska Eskimo Whaling Commission
Charlie Brower, Director, North Slope Borough Wildlife Department
Tom Albert, North Slope Borough, Senior Scientist
Arnold Brower Jr., President, Inupiat Community of the Arctic Slope

Lake and Peninsula Borough
P.O. Box 495
King Salmon, Alaska 99613

Telephone: (907) 246-3421
Fax: (907) 246-6602
E-mail: lpboro@bristolbay.com



January 16, 2002

Alaska OCS Region
Minerals Management Service
949 East 36th Avenue, Room 300
Anchorage, AK 99508-4363

Subject: Proposed Outer Continental Shelf Oil & Gas Leasing Program 2002-2007

Dear Ms. Robin Casey:

The purpose of this letter is to provide comment to the Alaska OCS Region Mineral Management Service on the Proposed Outer Continental Shelf Oil & Gas Leasing Program 2002-2007.

Attached is a resolution and Tri Borough Position Paper the Lake and Peninsula Borough Assembly has endorsed for you consideration on this proposed lease.

Thank you for the opportunity to comment on this project. If you have any questions please do not hesitate to contact Walt Wrede or me at 907-246-3421.

Sincerely,

Marvin R. Smith
Community Development Coordinator

Attachments: Resolution and Position Paper

cc: Kenai Peninsula Borough
Kodiak Island Borough

LAKE AND PENINSULA BOROUGH
RESOLUTION 02-06

A RESOLUTION EXPRESSING SUPPORT FOR THE "TRI-BOROUGH POSITION PAPER" REGARDING THE 2002-2007 OCS FEDERAL OIL AND GAS LEASING PROGRAM FOR LOWER COOK INLET.

WHEREAS, the United States Department of the Interior has advertised its intent to offer the Outer Continental Shelf Oil and Gas Leasing Program for 2002 through 2007, and

WHEREAS, this proposed sale will encompass the southern portion of the Cook Inlet, and

WHEREAS, leasing in areas proposed in this program could have social, economic, and environmental impacts in the Kenai Peninsula Borough, the Kodiak Island Borough, and the Lake and Peninsula Borough, and

WHEREAS, representatives of these three boroughs have met and agreed to work together in reviewing and presenting comments on this proposed leasing program, and

WHEREAS, it is the intent of the three boroughs to be involved early in the leasing process, and

WHEREAS, the Tri-Borough Position Paper was developed so that our concerns could be considered while the Environmental Impact Study for this leasing program is still being formulated, and

WHEREAS, the draft position paper was reviewed by representatives of the three boroughs on several occasions, endorsed by the Lake and Peninsula Borough Planning Commission at its meeting on January 7, 2002, and reviewed by the Borough Assembly at its regular meeting on January 15, 2002.

NOW THEREFORE BE IT RESOLVED, that the Lake and Peninsula Borough Assembly hereby approves and adopts the Tri-Borough Position Paper on the 2002-2007 OCS Oil and Gas Leasing Program, a copy of which is attached and incorporated herein, and

BE IT FURTHER RESOLVED, that the Assembly urges the Department of Interior to specifically address the five prominent issues identified in the Tri-Borough Position Paper as part of the scoping, environmental, and leasing process. These issues are:

1. No Off-Shore Loading of Tankers
2. Specific Plans to Minimize and Avoid Commercial Fishing Gear Conflicts
3. Adequate Spill Prevention and Response Capability
4. Identification of Critical Habitat Areas
5. Provisions for Local Government Revenue Sharing

PASSED AND APPROVED by a duly constituted quorum of the Lake and Peninsula Borough Assembly this 15th day of January, 2002.

IN WITNESS THERETO:

Glen Alsworth Sr., Mayor

ATTEST:

Sheila Bergey, Borough Clerk

TRI-BOROUGH POSITION PAPER
FEDERAL OUTER CONTINENTAL SHELF
OIL & GAS LEASING PROGRAM
2002-2007

The United States Department of Interior is preparing for offshore oil and gas leasing program, which includes waters of the Lower Cook Inlet (but excluding Shelikoff Strait) planning area of offshore Alaska. The proposed lease sale area is included in or contiguous with the boundaries of Kenai Peninsula Borough, Kodiak Island Borough, and Lake and Peninsula Borough. The three boroughs have met together to discuss the proposed leasing program and have jointly agreed to the following position with regard to the Federal Outer Continental Shelf (OCS) Oil and Gas Leasing Program, 2002-2007.

The Tri-Borough position is that five critical issues must be included in the leasing program's environmental impact statement, and specifically addressed in the terms and conditions in any future Notice of Sale in federal waters adjacent to Tri-Borough boundaries. If the five issues are not addressed in the leasing program environmental impact statement review process, the Tri-Boroughs have grave reservations about supporting future lease sales. These five items are in addition to any other issues that might surface in the federal government's environmental impact statement process. The Tri-Boroughs reserve the right to identify any additional concerns, which may need to be addressed as an outcome of the environmental impact statement process. Following is a summary of the Tri-Boroughs' position on each of the five issues.

1. **No Off-shore Loading of Tankers**

The lower Cook Inlet and particularly the Shelikoff Strait area comprise some of the most dangerous navigable waters in the entire world. The seas in this area are highly unpredictable and subject to extreme weather changes, unusual currents, rogue tides and waves. This feature of contiguous Shelikoff Strait waters makes off-shore loading of tankers particularly dangerous, posing an extremely high risk of an oil spill while attempting to load a tanker in these waters. The position of the Tri-Boroughs is that any recoverable oil must be pumped to an onshore facility where adequate protected dockage can be provided to allow the safe loading of tankers and to minimize the possibility of a spill during the loading process from the oil generated by this sale.

2. **Specific Plans to Minimize and Avoid Commercial Fishing Gear Conflicts with the Exploration and Development of Oil**

The avoidance of conflicts with the commercial fishing fleet and their gear is absolutely mandatory in these waters. The Lower Cook Inlet and contiguous Shelikoff Strait support an extremely rich fishery resource, which generates a great deal of fishing activity on a year-round basis. These year-round fisheries are the primary economic base of the entire region and therefore must be protected to the greatest extent possible, including an absolute minimum of disruption. The Tri-Boroughs require that any oil exploration or development proposed in the region have up front plans to eliminate

conflicts with the fishing industry in order to minimize any negative impact on the fishing industry. This includes critical time periods when no drilling activity would be allowed to occur due to spawning activity and crab molting in the areas in and around the drilling platforms. This information must be clearly identified and published on a regular basis so that the fishing industry will be fully aware of the location of this equipment and can, therefore, avoid any possible conflicts. It is in the best interest of the oil industry as well as the fishing industry to avoid negative impacts from drill rigs and/or development platforms on fishing gear and resources.

3. **The Oil Exploration Company must have Adequate Spill Prevention and Response Capability**

Based on the experience of the Exxon-Valdez oil spill, the Tri-Boroughs are determined that adequate spill prevention and response capabilities be specifically identified in exploration and development proposals for any sales which may occur under the Federal OCS leasing program. Input from the Cook Inlet Regional Citizens Advisory Council could be used to help determine the adequacy of spill prevention and response capability. At a minimum, a vessel with adequate amounts of boom and response capability should be on site during the exploratory and pre-development phases. Upon completion of exploratory drilling, and during the production of any successful well, prevention and response capability should include readily available response equipment and labor, which can be deployed on site in a matter of minutes.

4. **Identification of Critical Habitat Areas**

As a precursor to spill prevention and response that may be needed in the future, the Tri-Boroughs require that critical habitat areas be identified during the environmental impact statement phase of the lease sale process at a minimum before any actual exploration occurs in the OCS lease sale area. This habitat identification process must involve the land owners and users, the managers of fish, game and wildlife resources, such as the Alaska Department of Fish and Game, and the Federal Fish & Wildlife Service, as well as representatives of the fishing industry and local governments. Identification of critical habitat should include a prioritization for habitat protection, given the location of a particular spill, as well as identification of critical habitat that cannot practically be protected in the event of a spill. Further, the identification of critical habitat areas must be a public process that allows residents of the region to have input into and an opportunity to review and critique the proposed critical habitat protection priority prior to final adoption. Once identified, critical habitat and known coastal resources must become part of the municipalities GIS systems for easy map retrieval and updating.

5. **Provision for Local Government Revenue Sharing**

The Tri-Boroughs have extensively discussed and agree that a mandatory requirement for moving ahead with the OCS leasing program is the continued provision for revenue sharing back to the borough from OCS impact assistance revenues collected by the federal government. These funds are necessary because the three boroughs will have impacts from an influx of population demanding additional municipal services such as police, fire, road service, parks and recreation, education, solid waste disposal, etc. The history of municipal service provision shows that revenues always lag behind the demand for services. The only reasonable way to approach this problem without placing an undue burden on the existing tax base is to provide for revenue sharing within two hundred miles of any exploration site. Although the three boroughs recognize that there is a potential for federal revenues to be shared with the State of Alaska, it is clear that revenue sharing to the state does not necessarily assure that these funds are shared with local governments. Therefore, it is mandatory that legislation be introduced and passed in Congress that allows for revenue sharing with the three boroughs in order to provide the financial resources needed to deal with the impact of sales under the OCS leasing program.

Conclusion/Summary

The position of the Tri-Boroughs is that all five of these items must be addressed in the EIS, and subsequent sales for the described waters in the proposed OCS leasing program. We look forward to the opportunity to discuss and further develop these concepts with organizations and individuals interested in the Federal OCS Oil and Gas Leasing Program.

North Slope Borough
OFFICE OF THE MAYOR

P.O. BOX 69
BARROW, ALASKA 99723
☎ 907 852-2611 or 0200
Fax: 907 852-0337
email: gahmaogak@co.north-slope.ak.us

George N. Ahmaogak, Sr., Mayor

January 24, 2002

Richard Wildermann
Minerals Management Service
Branch of Environmental Assessment
381 Elden Street
Mail Stop 4042
Herndon, VA 20170-4817

Phone: (703) 787-1670
Fax: (703) 787-1026
E-Mail: MMS5-year.eis@mms.gov

Re: DRAFT ENVIRONMENTAL IMPACT STATEMENT OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM: 2002-2007

Dear Mr. Wildermann:

The North Slope Borough appreciates this opportunity to comment to the Minerals Management Service (MMS) on its 2002-2007 Outer Continental Shelf Oil and Gas Leasing Program Draft Environmental Impact Statement (EIS). We provided comments on the proposed 5-Year Program and scoping comments on the proposed EIS in February 2001, comments on the Draft Proposed Program (DPP) in September 2001, and additional November 2001 scoping comments on the proposal to prepare a single EIS for three Beaufort Sea lease sales under the 2002-2007 Program. We also provided comments at every stage during the development of the 5-year program now in place, and have a long and consistent history of commenting on all matters relating to the Arctic OCS, including all OCS lease sales, exploration projects, and development projects proposed prior to and during implementation of the current *1997-2002 Leasing Program.*

Beyond our consistency in participating in public processes concerning the Arctic OCS, the content of the Borough's comments, like those of the Alaska Eskimo Whaling Commission (AEWC), other North Slope organizations, communities, and individuals,

has been remarkably consistent as well. As stated in our earlier comments during development of this DEIS, the Borough's general opposition to and specific concerns over offshore oil and gas leasing, exploration, and development should be well known to your agency by this time. We were hopeful that the development of this 5-year program would allow us the opportunity to step back from reviews of specific lease sales and projects to highlight broader issues and draw renewed attention to ongoing concerns. We are disappointed that much of the substance of our earlier comments has yet to be meaningfully addressed in the planning documents, including the DEIS, produced so far in the process.

These comments will be in three parts. They will first revisit our earlier February and September 2001 comments and consider the extent to which they have been adequately addressed in the DEIS. Next, we will address specific sections and language within the DEIS. Finally, we will make some recommendations regarding future planning processes under the proposed 2002-2007 Leasing Program.

COMMENTS ON THE TREATMENT OF EARLIER COMMENTS

Most of the scoping comments we submitted in February 2001 were apparently ignored in preparation of the DPP. Our September 2001 comments on the DPP now appear to have been ignored or addressed only superficially in the DEIS. We asked that the 5-Year Program EIS reiterate MMS' commitment to the mitigation measures developed with respect to recent Beaufort Sea lease sales. The DEIS does not assume all such measures. We stated that the document must contain a comprehensive analysis of the ongoing and potential cumulative impacts of leasing, exploration, and development on the physical, biological, and human environment of the Alaskan Arctic. It does not adequately do so. We maintained that the EIS must incorporate in a meaningful way the traditional and contemporary knowledge of the residents of the North Slope in describing the affected environment and the ongoing and potential impacts of industrial activities. The DEIS may present some Native knowledge, but the conclusions reached throughout the document do not seem affected by it. We asked that the EIS appropriately describe the level of ongoing costs borne by the Borough and other local entities as a direct or indirect result of OCS leasing, exploration, and development as a means of identifying an appropriate level of impact assistance which should accompany any continued leasing under the proposed 5-Year Program. We also asked MMS to support the North Slope Borough in working to ensure that our local communities, who must bear the risks associated with OCS lease sales, also have the opportunity to share in the financial benefits of those lease sales. The true and complete costs borne by North Slope governments and other organizations are not adequately described in the DEIS, and MMS does not clearly state its support for appropriate impact assistance and revenue sharing. We suggested that it simply made good sense and was the responsible way to proceed to coordinate development of the 5-Year Program with other ongoing planning efforts, including the study by the National Research Council (NRC) of the cumulative effects of oil and gas activities on the North Slope, and to accept the conclusions and recommendations of both the current and past relevant NRC studies. There is no

suggestion in the DEIS that these sensible recommendations have been followed. Some of these points are discussed in more detail below.

DEFERRAL OF ARCTIC PLANNING AREAS

We expressed frustration in our earlier comments over being told that most OCS planning areas offshore of the lower-48 states will remain withdrawn or under Congressional moratorium from consideration for leasing under the 2002-2007 leasing program, as they have been under the current program. We were not advocating that these areas be made available for leasing, but questioning why they are off-limits while the Beaufort and Chukchi Sea planning areas are not. We surmised that the areas withdrawn have been pulled from leasing for oil and gas exploration and development either because they contain other resources of great sensitivity and value, and/or because the prevailing conditions within those planning areas somehow limit the ability to mitigate the potential risks of oil and gas operations. We continue to maintain that the biological and cultural resources of the Beaufort and Chukchi Seas, including the endangered bowhead whale and unique Inupiat traditional subsistence culture, are as valuable and as sensitive to disruption as the resources contained within any of the withdrawn planning areas. There also can be no question that the prevailing environmental conditions of the arctic OCS present a greater challenge for both planned industrial operations, and for crisis response. Continuing to aggressively lease in the remote, highly sensitive, unique, valuable, and undeniably vulnerable arctic OCS, while withdrawing or deferring from leasing all other OCS planning areas except certain areas within the Gulf of Mexico raise significant questions of fundamental fairness and environmental justice. We have yet to see in any MMS document a direct response to this clear inequity. Like the DPP before it, the DEIS does not deal with that larger and legitimate issue, and excludes from its discussion of the equitable sharing of developmental benefits and environmental risks the vast areas withdrawn from leasing. It would be useful and fair to include all OCS planning areas in this discussion. Again, as we have stated before, to not compare the potential benefits and environmental and socio-cultural risks associated with potential development of all OCS regions raises serious environmental justice issues. It is also ironic that States under moratorium receive 8(g) payments from Outer Continental Shelf Lands Act and nothing for local governments who are experiencing the greatest impact from exploration and development impact.

There are, of course, active federal OCS and State of Alaska leases in the Beaufort Sea. British Petroleum began production at its Northstar facility in October 2001. Start-up at the Northstar production island occurred several years later than originally planned, and cost several times initial projections. After several years of planning, British Petroleum recently withdrew its proposal to develop its Liberty Prospect in the Beaufort Sea, noting that the project was not economical to pursue. It is reasonable to view this move as an indication of failing industry interest in pursuing costly arctic OCS development. These extreme costs and flagging interest, as well as the inherent risks we discussed in our earlier comments, only lend strength to our recommendation that leasing in both the Beaufort and Chukchi Sea planning areas be halted until it is shown that operations at the

Northstar facility and associated support activities can be conducted safely and without significant impacts to area resources and subsistence harvests.

We have argued that if OCS leasing in the Arctic does occur, it is appropriate to defer from leasing the entire Chukchi Sea planning area, and those portions of the Beaufort Sea planning area which have been deferred from recent lease sales. MMS offers an inadequate response to this recommendation in the DEIS. The Chukchi Sea presents deeper waters, more extreme ice conditions, stronger currents, and greater distances from existing infrastructure than tracts in the Beaufort Sea. Little is known about vast areas of the region's environment, including the interaction between the resources of U.S. and Russian waters. Sound leasing decisions should be based on a far more comprehensive understanding of the potentially affected environment than now exists with respect to the Chukchi Sea. The DEIS has not sufficiently responded to these concerns or our conclusion that leasing should not occur in the Chukchi Sea under the proposed 2002-2007 OCS leasing program.

The discussion on page 1-10 of alternatives not analyzed in the DEIS, and specifically of exclusion of portions of planning areas, focuses primarily on the suggested deferral of the area offshore and adjacent to the Alaska[sic] National Wildlife Refuge in the Beaufort Sea. It seems to have completely missed the point of our earlier comments. The discussion essentially asserts that it is best to leave the Secretary's options for leasing open until the later stage of individual lease sales analysis. That may make sense where MMS can reasonably conclude that there is a strong likelihood that unacceptable potential impacts on resources can be avoided by imposition of appropriate mitigation measures. It is our challenge to MMS, however, to define any combination of mitigation measures which will sufficiently minimize potential impacts on resources and subsistence activities in the three areas of the Beaufort Sea which we suggested be deferred from leasing. In other words, if you cannot now foresee a scenario which would permit construction and operation of permanent production facilities in a particular area (the Barrow spring lead system, the extreme eastern Alaskan Beaufort Sea, and the waters in the vicinity of Cross Island) because unacceptable potential impacts to resources or subsistence activities cannot be avoided, then the area should not be leased. Deferral of these three areas within the Beaufort Sea planning area, discussed in more detail below, should have been analyzed as an alternative within the DEIS.

The area which encompasses the spring lead system around Pt. Barrow concentrates and renders highly vulnerable a variety of arctic marine resources. It is the focus of Barrow's spring subsistence bowhead whale hunt, and is intensively utilized for the harvest of a variety of marine resources throughout the year. Neither Beaufort Sea Lease Sale 170, nor the State's most recent Beaufort Sea Areawide lease sale offered the waters around Barrow for lease. As we have repeatedly stated, this area should never be leased, and the Borough will oppose the siting of any permanent industrial facilities in the vicinity of the spring lead system which distinguishes the region. The authorization of any permanent facility siting or non-winter exploratory operations in this area would be inconsistent with

the Borough's Land Management Regulations and federally approved Coastal Management Program.

The eastern Alaskan Beaufort Sea is a feeding area for bowhead whales migrating westward in the fall. The level of industrial activity in the waters east of Barter Island is also of critical importance to the success or failure of subsistence hunters from our community of Kaktovik. The area is "upstream" of the harvest zone of Kaktovik subsistence whalers. Kaktovik hunters take whales as they move westward through the waters offshore of their community. Fall exploratory drilling operations occurring to the east of that harvest zone in the past have deflected whales beyond the reach of subsistence hunters. The community suffered great hardship, deprivation, stress, anxiety, and depression as no whales were taken for two consecutive seasons. If leasing occurs within Kaktovik's traditional harvest zone or within that upstream area, you should expect the Borough and the Alaska Eskimo Whaling Commission (AEWC) to act aggressively to prevent fall exploratory operations from occurring again. Past experiences would strongly support our claim that a drilling operation active during the fall whaling season would be inconsistent with those provisions of the North Slope Borough Coastal Management Program which explicitly prohibit development that prevents subsistence user access to a subsistence resource. More of a concern even than exploratory drilling operations, which can be conducted seasonally, production facilities would have year-round cumulative impacts. It is doubtful that a permanent offshore production facility east of Barter Island, and in the fall migratory path of bowhead whales, could ever be operated without continuing significant interference with Kaktovik's subsistence bowhead hunt.

The importance and sensitivity of the Barrow-area spring lead system and the eastern Beaufort Sea has been recognized in recent OCS lease sales, and the areas have been deferred from leasing. No new information has been generated which would indicate that these areas are less important or vulnerable than has been thought. No new technology has been developed which would render industrial operations in these areas safe or mitigate the potential impacts of those operations on resources or critical subsistence activities. The spring lead system and eastern Beaufort Sea should be deferred from leasing under the proposed 2002-2007 OCS leasing program.

In addition, we have recommended that a deferral zone be created around Cross Island, the subsistence whaling base for the community of Nuiqsut. There is a current stipulation prohibiting permanent facilities within a 10-mile zone around Cross Island unless the lessee can demonstrate that placement of facilities in the zone will not have a significant impact on the subsistence harvest of bowhead whales. This mitigation measure has been included in recent federal and State of Alaska lease sales, but inexplicably has not been included in the DEIS' Appendix D which defines *Assumed Mitigation Measures*. We believe that an area deferral is necessary to protect the Nuiqsut subsistence bowhead harvest, but accepted the stipulation as an interim measure until a deferral zone of appropriate size could be identified. Absent an outright deferral, MMS must continue to include the Cross Island mitigation measure in upcoming Beaufort Sea lease sales, and

must work to identify the true area within which the siting of permanent facilities could impact Nuiqsut's bowhead harvest. The 10-mile zone was chosen arbitrarily and clearly is too small. The zone should be expanded to include a larger area based on a combined analysis of 1) the true area utilized by Nuiqsut in the traditional pursuit, harvest, retrieval, and processing of bowhead whales, as well as the areas utilized for transportation and storage of the products of the bowhead whale hunt, and 2) the effects of production noise on bowhead whales. The goal should be to add protection for the area not only directly utilized by subsistence whalers, but also to the area "upstream" in the fall bowhead migration, or east of that use area, within which the noise from permanent industrial facilities would have the potential to deflect whales out of the reach of waiting subsistence hunters. For example, one or more production islands 15 miles directly east of Cross Island in the path of the fall whale migration would certainly impact the success of Nuiqsut's hunt. The new zone should be defined in consultation with the AEWC, Nuiqsut, and the National Marine Fisheries Service, and refined as monitoring studies, including those associated with British Petroleum's Northstar Development Project, produce more accurate information regarding noise impacts on whales.

CUMULATIVE EFFECTS

The DEIS fails to note or address several significant Borough comments with respect to the mounting cumulative effects of oil and gas leasing and operations onshore and offshore in arctic Alaska, as well as non-oil and gas activities. The analysis of ongoing and potential cumulative effects on the arctic ecosystem and the socio-cultural systems of North Slope communities must become a more prominent component of planning efforts, including the proposed 5-Year Program EIS. As we noted in our earlier comments, a National Research Council (NRC) Committee is currently studying the cumulative effects of North Slope oil and gas activities. It is our hope and expectation that this Committee's efforts will be of the highest quality, and that its report will significantly impact and guide the work of the governmental agencies that regulate oil and gas activities on the North Slope. We hope that the Committee will be solution-oriented in its work. We would like to see the oil and gas industry, and responsible state and federal agencies and officials, including those at MMS, acknowledge the importance of the Committee's work, and agree to put forth appropriate effort and funds to see that any recommendations offered in its final report are acted upon and followed up. Provision should be made in the 2002-2007 Leasing Program for appropriate action in response to recommendations contained within the final report of the NRC study.

Despite our submission of extensive comments on the subject, little mention is made of the current, ongoing, socio-cultural effects of OCS leasing, exploration, and now, development. Significant environmental justice issues exist with respect to the ability of our sparsely populated, largely Inupiat Eskimo, broader North Slope community to meaningfully impact leasing decisions. We have explained that the vast majority of adult Native Alaskan residents of our communities already must assume the dual roles of wage earner and subsistence provider. The demands of this life leave little time and energy for careful attention to decisions made far away which have the potential to effect individual

and community health and cultural and economic stability. Yet, with daunting frequency, community leaders and individual residents are faced with the challenge of reviewing an ever-increasing number of oil and gas related leasing, exploration, and development proposals. Attendance at oil and gas related public meetings, typically held in the evening, demands time away from families and other pursuits. In our village of Nuiqsut, for example, it has not been uncommon in recent years to have multiple oil-related meetings in a single week, a dozen or more in a month, and several dozen in a year.

Our residents will tell you that stress and anxiety over increasing offshore and onshore oil and gas activity is widespread in North Slope communities. Hunters worry about not being able to provide for their families, or the added risk and expense of doing so if game is more difficult to find and harvest. Elders who can no longer provide for themselves worry about the challenges facing younger hunters who will go to great lengths to provide them with their essential and traditional foods. Families worry about the safety of hunters who must travel farther and more often if game is not easily accessible. We all worry about contamination of the traditional foods we consume, but know that our health would suffer if we were unable to eat as we and our ancestors always have. We worry that the bowhead harvest quota we have worked so hard to secure will be reduced if the International Whaling Commission perceives a heightened threat to the population resulting from the expansion of oil development facilities into the whales' Beaufort or Bering Sea habitat. Today, the Borough alone bears the costs of social stresses tearing at the fabric of our culture. We provide substance abuse treatment, counseling, public assistance, crisis lines and shelters, and other social service programs. We provide the search and rescue services which must respond when hunters put themselves at risk in the pursuit of scarce or less accessible game due to the deflection of normal migration paths. We provide the police force which must respond to all of the kinds of unfortunate situations which arise when people and entire communities are subjected to long-term and persistent stress. We provide the biologists, planners, and other specialists who review and offer recommendations on the staggering volume of lease sale, exploration plan, and development project documents which are produced and distributed each year. We must absorb the ever-increasing expense of travel to Fairbanks, Anchorage, Juneau, Seattle, and Washington, D.C. and including our own seven villages, where the agencies with authority over oil and gas leasing, exploration, and development, and the subsistence resources we depend upon, conduct most of their work and make most of their decisions. All of these ongoing effects must be adequately described and analyzed in this EIS.

We believe it is critical that the EIS utilize a cumulative effects definition which includes not only effects caused by actions occurring over multiple seasons or years (e.g., the loss of onshore waterfowl or caribou habitat to industrial facilities associated with multiple projects), but also multiple actions occurring within a single season or year (e.g., multiple offshore industrial noise sources within the migratory path of the bowhead whale during a single fall migration). The Borough and AEWC have long stressed that several industrial activities in a given season, such as two seismic boats operating at the same time along the bowhead's fall migratory path, can have a cumulative effect far more serious than the effect a single activity would have in that season or year.

Our concern with multiple effects-causing activities occurring in a single season or year is particularly relevant in the Beaufort Sea, with production at Northstar underway. The production island, with its associated noise, will be a fixture in the ocean for the next 15-20 years or more. The effect of the noise it generates must not be considered only in combination with other simultaneous noise impact activities in its immediate vicinity, but also in terms of the heightened reactions it may cause in migratory species at a later time and in a distant location following exposure. A bowhead whale exposed first to seismic noise in the eastern Beaufort Sea, and then perhaps to Northstar noise in the central Beaufort Sea, might be expected to react more dramatically than it otherwise would to an additional noise source (like a Barrow-based subsistence hunting boat) to the west and "downstream" in its migratory path. This increased "skittishness" of whales has been observed by our hunters, commented on repeatedly in the past, yet is only mentioned in passing in the DEIS. There is no suggestion of how MMS expects that this effect could be mitigated, why and there is certainly no basis for the conclusion of the second paragraph on page 4-294 that such potential effects have been effectively mitigated for exploration and development activities in the past, or could be for production activities in the future.

The community-wide stress and anxiety associated social ills resulting from these mounting pressures already take their toll on our people and institutions. The aggressive arctic OCS leasing schedule described within the DEIS will undeniably add to increasing anxieties already at critical levels. The mounting demands on individuals' time, the prevailing sense of helplessness in the face of relentless and expanding oil and gas leasing, exploration, and development, increasing non-oil and gas influences, including an expansion of sport hunting, opening of the Dalton Highway to public travel, and recreational uses, and community-wide stress and anxiety over the potential effect of multiple influences on the future health of the Inupiat culture, are all real and significant effects which must be analyzed in a far more comprehensive manner in the EIS. The EIS must also appropriately describe the level of ongoing costs borne by the Borough and other local entities in dealing with these effects.

We have noted that the Outer Continental Shelf Lands Act (OCSLA) requires MMS to study and manage the effects of OCS activities on the human, marine and coastal environments. OCSLA defines the human environment broadly, to include the physical, social, and economic components, conditions, and factors which interactively determine the state, condition, and quality of living conditions, employment, and health of those affected directly or indirectly, by activities occurring on the OCS. (43 U.S. C. Section 1331(i)) We have supported the AEWC in its comments concerning the recommendations of the OCS Policy Committee, its Legislative Working Group, and the Committee to Review Alaskan Outer Continental Shelf Environmental Information established by the National Research Council. The OCS Working Group published its report, "From Conflict to Consensus," in 1993, and the NRC Committee published the report on its work in 1994. It was the conclusion of both groups that OCS oil and gas operations create real and verifiable environmental, cultural, and economic risks. They

likewise found that northern Alaskan communities are at particular risk relative to other communities because of the traditional subsistence lifestyle of our residents and their dependence on the ocean for subsistence food and cultural identity. Both groups found that the approach historically taken by MMS to manage these risks was inadequate and non responsive as called for under 43 U.S. C. Section 1331(i). In part in response to these reports, the OCS Policy Committee developed a series of recommendations outlining efforts which MMS should undertake in the present five-year OCS leasing plan to begin to address the burdens borne by local communities stemming from OCS oil and gas development – with specific recommendations for addressing those burdens in Alaska. We have joined the AEWC in its strong encouragement that MMS adopt these recommendations of the OCS Policy Committee and reflect that commitment in this EIS.

COMMENTS ON SPECIFIC SECTIONS AND LANGUAGE OF DEIS

Section 3: Affected Environment

The bowhead whale segment of Section 3 represents a major step backwards from recent MMS documents in terms of sophistication, use of current and relevant literature, understanding of bowhead biology, toxicology, and the current thinking about the industrial effects to migrating bowheads. We find this disturbing. Scientific advances made over the last 10 years have resulted in a broadly accepted and balanced description of relevant biological issues regarding bowhead whales. They have essentially been ignored or overlooked here. The authors should familiarize themselves with the marine mammal literature on noise disturbance and detection thresholds, and oil spill effects. Many of these are listed in the Reference Section of these comments, though in particular the writers should review:

Albert, T. 1981b. Some thoughts regarding the possible effects of oil contamination on the bowhead whale, Balaena mysticetus. pp. 945-953. In: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea. T. Albert (ed.). Report to the Bureau of Land Management, Department of the Interior, Anchorage, AK from the Department of Veterinary Science, University of Maryland, College Park, MD 20742. 953 pp.

LGL Limited and Greeneridge Sciences, Inc. 1987. Responses of bowhead whales to an offshore drilling operation in the Alaskan Beaufort Sea, Autumn 1986. Report from LGL Limited, King City, Ontario Canada and Greeneridge Sciences, Inc., Santa Barbara, CA for Shell Western E&P Inc., Anchorage, AK.

Loughlin, T.R. (ed.) 1994. Marine Mammals and the Exxon Valdez. 395 pages, Academic Press. (Chapters on pathology e.g., Lipscomb, T.P., R.K. Harris, A.H. Rebar, B.E. Ballachey, and R.J. Haebler. 1994. Pathology of sea otters. Pages 265-279.)

Richardson, W.J. (ed.) 1999. Marine mammal and acoustical monitoring of Western Geophysical's open water seismic program in the Alaskan Beaufort Sea, 1998.

LGL Report 2230-3. Report from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and National Marine Fisheries Service, Anchorage, AK, and Silver Spring, MD.390 p.

If we were to apply independent peer review standards for scientific literature, this entire section would likely be rejected without major revision. The section must be rewritten to reflect the current state of literature and knowledge. To assist in the re-writing process, we have provided specific comments and a detailed reference list. We also suggest that the authors refer to the bowhead sections in the Lease Sale 170 Final EIS. It is a better example of a synthesis of current scientific literature and traditional and contemporary local knowledge.

Page 3-65, Bowhead Whale:
First paragraph, 1st sentence, with regard to bowhead whale distribution, refer to Moore and Reeves, 1993.

1. First paragraph, 3rd sentence. "In the fall bowheads return along this route to the Bering Sea..." This is not true. The MMS aerial surveys indicate that there is a major difference in these routes, with the fall migration much further south along the Alaskan Beaufort Sea coast. See Moore and Reeves, 1993; Tracey, 1997.
2. Second paragraph, 1st sentence. Why was a minimum population estimate given? The current best estimate of 8,200 is reported in Raftery and Zeh, 1998.
3. Second paragraph, 4th sentence. We know of no records indicating a harvest of 72 whales being harvested in a single year. What is the source of that figure?
4. Third paragraph. A new and good reference regarding bowhead whale breeding is Reese *et al.*, 2001.
5. Third paragraph. Feeding at Cross Island has now been documented. (Lowry and Sheffield, *In Preparation*; G. Sheffield pers. comm., 2000)
6. Page 3-117, Environmental Justice: In the first paragraph, it is unclear how MMS studies and public meetings have "dealt with" the Inupiat concerns and fears centered around the possibility that oil and gas development may displace subsistence resources, thus displacing their culture."

Page 4-87, Marine Mammals: Cetaceans

7. First paragraph. Humpback whales are routinely seen in the Bering Strait region by Russian scientists (Melnikov et al., 1999). During summer feeding, humpbacks are generally very nearshore in Alaska. They are pelagic during migration.
8. p. 4-88, 2nd paragraph. This paragraph is grossly out of date and in error. The most profound error is the omission of the recent information of deflections of bowhead whales by seismic disturbance. Careful impact studies (LGL Limited and Greeneridge Sciences, Inc. 1987; Richardson 1998; and 1996 and 1997 and 1998 monitoring reports of seismic operations) have confirmed long-reported subsistence hunter knowledge and provide good information regarding bowhead impacts due to noise from a drill ship and from seismic boats. In view of the rather clear data from these studies it is wrong to say that in relation to industrial noise "bowhead whales do not appear to deflect more that a few kilometers in responding to a single noise disturbance....". It is known that industrial noise does

impact bowheads. For certain types of industrial noise (drill ship and seismic) the extent of impact is known at least to some degree. Studies from the Corona-Hammerhead project and the Kuvlum project clearly showed long-range deflection of whales. It is known that many do change their swim direction at considerable distances.

9. p. 4-89 1st sentence. "Sound produced by seismic exploration may also disturb bowhead whales". For the reasons stated in the preceding paragraph, replace "may" with "have been shown to" and then list the appropriate studies. (i.e., LGL and Richardson) To say "may" in this context is contrary to accepted science and insulting to subsistence hunters who have observed and consistently reported the disturbance for many years.
10. p. 4-89 last paragraph. One of the most disturbing omissions in this Draft EIS is found in the section on reactions to seismic vessels. The literature cited essentially ends in the late 1980s and important current research that shows profound changes is omitted. From the draft monitoring report of the 1997 open water seismic season (Richardson, 1998), one can see that the fall migrating whales stayed at last 20 km (12 miles) from the active seismic vessel (see Figure 5.28 on page 5-62 of Richardson, 1998). The received seismic noise levels at the edge of the "zone of avoidance" (20 km or 12 miles from the active seismic vessel) appeared to be about 100-135 dB (see Figure 3.14 on page 3-25 of the draft report by Richardson, 1998). Richardson 1999 further documents the 20 km (12 miles) exclusion zone around an active seismic vessel. They also give good evidence that the northward deflection of approaching whales may begin at 35 km (21 miles) (see pages 5-59, 5-60, 5-101 of their report) and that deflected whales remain deflected until they are at least 40-50 km (24-30 miles) past the seismic boat (see pages 5-59 and 5-60 of Richardson, 1999).
11. p. 4-89 last paragraph. Reference is made to the study by Ljungblad *et al.* (1988) regarding bowhead responses to an approaching seismic vessel indicating no avoidance at distances >7.5 km. Though this experiment did not have a good "control" since all of the studied whales were in ensonified waters, it is often cited by industry and MMS. In its time it was an interesting study but had severe limitations and was hamstrung by its design. Its limitations should be recognized and it should be noted that its findings have been superceded by the more recent work by Richardson 1998 and 1999 showing far greater avoidance ranges.
12. p. 4-89 last paragraph. It is important to note that the 20 km (12 miles) radius of avoidance is the distance at which even the most "noise tolerant" bowheads deflect. What is not mentioned is that if nearly all avoid by 20 km, then the "average" bowhead avoids the noise by an even greater distance. A basic question is "what is the mean distance by which members of the herd avoid the noise?" To overly focus upon the avoidance distance of the most noise tolerant whales is misleading. It is reasonable to expect that the average bowhead avoids the noise by an even greater distance than 20 km (12 miles).
13. p. 4-89 last paragraph. Whale hunters tried to agree upon actual distances in response to continued requests by MMS personnel conducting this meeting in Barrow. At that time the hunters estimated that the whales began to divert from

their normal migratory path at 35 miles from an active seismic boat and that the diversion could be as much as 30 miles from their normal path. In using these hunter statements it is important to remember; 1) these are estimated distances by hunters on the water, 2) the 35 miles is the distance where the diversion is estimated to begin (that is, some begin to divert here and other continue further before diverting), 3) the 35 miles is not the point at which all are estimated to divert at once, 4) the 30 miles is the estimate as to how great the diversion can be ("as much as 30 miles"), 5) sometimes the diversion estimate is much less than 30 miles (10 miles, 15 miles, etc.), and 6) most of the Barrow hunters gained their "experience" with seismic boats during the 1980's when industry says that the noise sources were louder than those used in recent years.

14. p. 4-91. This is a very elementary discussion of oil effects on cetaceans, and continues on for pinnipeds and fissipeds. This text is quite shocking in the number of assumptions made regarding cetaceans and oil, contradictory comments, and outright inaccuracies. This would not pass any type of peer review process and many of the stated facts lack citations. The use of "pulmonary stress" or "pulmonary distress" is confusing and essentially is misleading. Pulmonary exposure to volatile oil components is very lethal in all air breathing animals and the target organs include lung but this is not the only system affected (i.e., oral cavity, eyes, trachea, central nervous system) by volatile components and other irritants in oil. One can expect severe effects and lesions from pulmonary (and other routes) exposure to these volatile components as documented in other mammalian species.
15. p. 4-91 and 4-92. It should be noted that whales are not just migrating through the Chukchi and Beaufort Seas (Barrow to Kaktovik), but that the whales are feeding as well. Much evidence has accumulated indicating this feeding activity and thus oral exposure is a serious consideration as well as effects of oil on prey. Considering the feeding and migrating importance of this region oil spill response activities (noise and visual disturbances) and the oil spill itself will likely deflect whales from this habitat. The introduction of hydrocarbons (acute or chronic releases) into this area could have a long-term effect on avoidance, not to mention direct effects (ship collisions, entanglements, the oil, etc.). This could impact the health of the whale (decreased feeding) but would certainly affect the hunt of these whales in the fall for 3 communities. Gray whales are well known to migrate along the coast of northern Alaska and to feed benthically. This should be more directly addressed as they are moving through an area that is at risk from oil spills and feed differently than bowheads. They would be susceptible to oil spill components that have sunk (i.e., epibenthic).
16. p.4-92, 5th paragraph. Comments related to oil exposure in belugas being brief in lead systems is absurd. Where does this information come from? If the animals are confined by both ice and oil then exposure times could be very long and avoidance impossible as the animals try to breathe in open water. Thus surfacing in the spill with direct exposure externally and via the lungs as they breathe close to the surface could be devastating. The entire concept that "healthy" animals are less susceptible to oil exposure is unfounded and likely not true when one

considers the massive acute nature of oil spills and that acute mortality is due to very severe affects. Chronic subtle changes induced by oil may affect animals disproportionately based on health status, but certainly many healthy mammals have succumbed to massive acute exposure. This section is simply loose (wild) speculation with no basis in fact.

17. p.4-92, last paragraph. The concept that ingested oil is "most dangerous" in killer whales and that these "toxins" bioaccumulate indicates a severe lack of knowledge concerning the environmental behavior, toxicity and toxicodisposition of these hydrocarbons in mammals by the authors. The fact that the Exxon Valdez Oil Spill (EVOS) was not linked with loss of killer whales was not the lack of effect, but the extreme lack of power in the studies/surveys conducted. This is a very disappointing section, and riddled with many inaccuracies.
    a. In the conclusions for cetaceans the concept that oil spill impacts would be negligible for many of the cetaceans shows the bias of this work. The truth is that the proper studies have not been conducted and that little effort has made to review or study the interactions of cetaceans (especially arctic species) with oil.
    b. There is no discussion of background data related to levels of hydrocarbons in the whales or the monitoring of background effects. In the face of an oil spill the agencies will be crippled in making a diagnosis without these data. This is an enormous data gap.
    c. There have been relatively few surveys for petroleum constituents in marine mammals. Low concentrations of PAHs (0.1 to 0.6 ppm wet weight chrysene equivalents) were detected in muscle of 26 harbor porpoises from the United Kingdom (Law and Whinnett, 1992). Low concentrations of 2-4 ring compounds, but not higher weight PAHs, were detected in blubber of seven sperm whales stranded in the southern North Sea (Holsbeek et al., 1999). Low concentrations of PAHs (0.1 to 1.2 ppm dry weight chrysene equivalents) with a preponderance of low molecular weight compounds were also reported in small numbers of muscle samples from five species of cetaceans and four species of seals from the Northwest Atlantic (Hellou et al., 1990). Varanasi et al. (1994) found large variation in PAH concentrations in stomach contents of gray whales (7 to 2100 ppb). Are these data available for arctic cetaceans, if not, this seems to be a large data gap.
    d. It has been speculated that PAHs were responsible for tumors in belugas of the St. Lawrence River estuary through the formation of DNA adducts (Martineau et al., 1988). However, DNA adducts occur at similar levels in livers of beluga whales from remote locations without significant PAH contamination (Ray et al., 1992), and thus complicates the impacts of oil exposure and effects assessment. How does MMS plan on monitoring low level chronic effects such as DNA adducts, cancer, etc.?
    e. Pinnipeds have been studied with respect to impacts of oil spills and based on the obvious pathology documented in these species similar exposures will very likely result in similar effects in cetaceans. As discussed below,

one should consider these effects that are outlined for arctic species (cetaceans and pinnipeds). These are known effects of oil; they should not be disregarded for any mammal that could be potentially exposed.

    f. Skin and blubber biopsies of southern sea lions from the polluted Mar del Plata harbor in Argentina had elevated concentrations (2785 ng/gm dry weight) of total PAHs in comparison with individuals from a less polluted area (578 ng/g); predominant compounds in biopsies and blood were phenanthrene, naphthalene, and acenaphthene (Marsili et al., 1997). This indicates that chronic releases or natural sources can result in increased levels; the current studies are very inadequate in northern Alaska to make this determination.
    g. Oiled harbor seals exposed to the Exxon Valdez spill had higher concentrations of PAHs in blubber than various reference samples, mostly compounds of low molecular weight (2- to 3-ring aromatics, napthalenes, and phenanthrenes). PAHs in milk and mammary tissue were variable, but the highest PAH concentration (1142 ng/g) detected in any sample of any harbor seal was in milk from the stomach of a pup with an oiled mother. Among aliphatic compounds, phytane was relatively high in brain of oiled seals (1228-7839 ppb ww) (Frost et al., 1994). However, it is thought that inhalation of volatile, short-chain aromatic hydrocarbons had the greatest impact on harbor seals, with levels immediately after the spill speculated to be sufficient to cause respiratory or cardiac arrest or to interfere with breathing (Frost et al., 1994), and this is a very like course of events for cetaceans as well. Visibly oiled seals collected by shooting several weeks after the Exxon Valdez spill had mild acanthosis and orthokeratotic hyperkeratosis of the epidermis, and mild, reversible hepatocellular necrosis and swelling with mild bile inspissation within canaliculi (Spraker et al., 1994). The most significant lesions, however, were intramyelinic edema of the large myelinated axons of the mid-brain, neuronal swelling, neuronal necrosis, and axonal swelling and degeneration. These lesions were most severe in the thalamic nuclei, and were consistent with nervous system damage caused by highly volatile hydrocarbons (Spraker et al, 1994). Variability among concentrations of hydrocarbons in tissues and presence of nervous system lesions in these studies were probably related to variability in exposure histories of individual animals (Frost et al., 1994).
    h. In other instances ringed seals immersed in an experimental oil slick for 24 h had transient eye irritation (profuse lacrimation, severe conjunctivitis, and corneal abrasions and ulcers that disappeared after being returned to clear water) and detectable hydrocarbons in tissues, but few consistent patterns in hematology and biochemistry other than elevated serum liver enzymes and lesions in kidney and liver (Geraci and Smith, 1976; St. Aubin, 1990). Epidermal acanthosis and hyperkeratosis, excessive lacrimation, conjunctivitis, and corneal abrasions and ulcers occur in seals

from contact with oil (Geraci and Smith, 1976; Spraker et al., 1994; St. Aubin, 1990).

i. For the fissipeds on should consider the following. Three captive polar bears were induced to swim through a pool covered with a 1 cm slick of crude oil. Ingestion of oil during intensive grooming the first few days after fouling resulted in vomiting, diarrhea, and biochemical lesions indicative of liver and kidney damage. Three ringed seals died acutely after exposure to crude oil in a tank, but these deaths were also complicated by stress (Geraci and Smith, 1976).

18. p.4-92, 4th paragraph. With respect to sperm whales the entire paragraph is extremely speculative and disregards the fact that certain components of oil do sink, and some type of avoidance behavior is indicated in this species with no reference cited.
19. p. 4-92, 3rd paragraph. The statement is made that, "...intermittent contact with oil would probably not result in any deaths of healthy [bowhead] whales..." There is little if any data to support this statement, and we suggest it be deleted. Bowhead whales have the mostly highly developed baleen feeding apparatus of any cetacean with long (to 32 cm) filamentous hairs. It is highly likely that contact with oil could be quite devastating to bowheads (Albert 1981a; Albert 1981b; Lambertson, 1989).
20. p.4-99, 2nd paragraph. The potential for a large number of polar bears, and particularly females with cubs, to suffer fatal or lesser serious effects while carcass feeding following an oil spill is not adequately considered in the DEIS.
21. p.4-143, 3rd paragraph. To say that "rural Alaska is quite dependent upon the State of Alaska for the provision of services, especially for funding public education" is terribly misleading. The North Slope is no more dependent upon the State for educational funding than other school districts in Alaska, both rural and urban, and the North Slope Borough provides the great bulk of essential services to our communities and residents. In fact, state educational funding, other state funding, the Borough's appropriate share of revenues from federal payments to the State from OCS funds and NPR-A leasing, and most recently, our ability to incur bonded indebtedness are increasingly under attack by the Alaska Legislature.
22. p.4-144, 2nd paragraph. It is inaccurate to state or even imply that noise and disturbance effects of single actions "can be, and have been, effectively mitigated." Some seismic programs have been conditioned to avoid areas of active subsistence whaling, but the conditioning of whales to become more "skittish", and therefore more difficult and dangerous to harvest, has never been addressed through mitigation measures. Likewise, exploratory drilling operations "upstream" in the bowhead migration from traditional village harvest areas have on several occasions disrupted or prevented subsistence whaling in the past.
23. p.4-183. The discussion of Alternative 4, Accelerated Leasing, raises the key point that activities occurring in deeper waters of the Beaufort Sea planning area may affect migrating bowhead whales. The document states that "additional sales in the Beaufort Sea are likely to extend exploration, development, and production

activities into deeper waters." As a result, migrating bowhead whales may be affected by an increase in noise disturbance associated with routine activities at platforms further from shore. The section concludes that impacts of the accelerated leasing alternative to the bowhead whale are expected to be moderate. That means that impacts to the affected resource are unavoidable, the viability of the affected resource is not threatened although some impacts may be irreversible, or that the affected resource would recover completely if proper mitigation were applied during the life of the project or proper remedial action were taken once the impacting agent was eliminated." See p.4-19. If one accepts the reasoning that more sales would necessarily produce operations further offshore in the Beaufort Sea, then one should also accept that other factors, like an increased price of oil, could also produce that result and the associated intensified impacts on bowheads with the three lease sale scenario. The EIS should acknowledge that if such a scenario plays out, both the bowhead population and subsistence users would likely suffer at least moderate impacts. Taking into account resulting effects like increased skittishness of whales which have not been sufficiently analyzed in the DEIS, the conclusion should be reached that impacts to subsistence could be major.

24. p.4-185. The discussion of the No Action Alternative is deficient in several respects. In the 3rd paragraph of the section, it grossly overstates the resulting impacts and economic losses to the "regional economies involved". The claim is made that a 5-year interruption in the leasing process would lead to a "disruption in the normal development sequence." We challenge any claim that there is a "normal development sequence" with respect to the Arctic OCS. Despite two decades of leasing, there is a single OCS production facility in the Beaufort Sea, and the company that operates it just cancelled plans for a second OCS facility in the latter stages of several years of planning for the project. There cannot be an economic "bust" if there has never been an economic "boom" in either the regional North Slope economy, or the economy of Alaska associated with OCS development. Secondly, the EIS cannot properly assess the costs and benefits of selecting the no action alternative if all of the potential impacts of moving ahead with leasing have not been adequately described. As we have discussed above, significant ongoing and potential impacts associated with arctic OCS leasing and operations have not been adequately addressed in this document. The widespread anxiety and stress associated with continued OCS leasing and operations which permeates our communities is a significant impact which the Borough alone now struggles to deal with on financial, social, and cultural levels. MMS also has yet to address the limited potential for mitigation of impacts on migrating whales and subsistence harvests as operations are projected to expand further offshore with continued leasing. Finally, the EIS does not adequately consider the potential that opening of the Arctic National Wildlife Refuge (ANWR) to oil and gas leasing would offset any loss of resource projected from continued arctic OCS leasing. For better or worse, it is the United States Congress, and not MMS, that is the arbiter of whether domestic oil production should increase, and if so, what the source of that oil should be. If the need for domestic oil were as great as MMS

implies, the Congress would open ANWR, with its vast potential reserves, to oil and gas leasing, exploration, and development.

25. p. 4-257, 1st paragraph. We are not aware of any records of 72 whales per year being harvested. We suggest a more in-depth survey of the socio-anthropological literature that Stoker and Krupnik (1993) compiled since this chapter provides only an overview and has many omissions.
26. p. 4-257, 6th paragraph. Fishing Mortality. There are five documented cases of bowhead whales entangled in crab fishing gear. In two cases the entanglement was likely the cause of death. These data were reported to the U.S. Marine Mammal Commission in November 2001 (by J.C. George).
27. p. 4-259, 3rd full paragraph. MMS should use the most current literature regarding noise effects on migrating bowheads (see comment #8). Richardson and Malme (1993) is not the appropriate reference for the 20 km deflection from seismic operations; cite Richardson (1999). Last sentence; change "could" to "would". Note that an offshore migratory deflection would (not could) affect whale-hunting success. This effect has been documented by local hunters whereby years with heavy seismic operation either precluded hunting success or pushed whales offshore. Over the years, many subsistence hunters have reported such deflections in personal communications, as well as in formal testimony. The DEIS cites one example of such testimony, offered at the January 6, 2000 meeting of the MMS Regional Offshore Advisory Committee by Eugene Brower, President of the Barrow Whaling Captains' Association. See page 4-293.
28. p. 4-261, 4th full para. "...belugas would be most sensitive to oil contamination during spring migration through open leads." In our opinion, bowheads would be at least as susceptible to an oil spill due, in part, to their long filamentous baleen. Bowheads are known to feed during spring migration (Lowry, 1993).
29. Appendix C, p. C-15. The bulleted percentages given for the effectiveness of oil removal by various response countermeasures are meaningless without identifying the range of environmental conditions to which they apply. Dispersants, for example, have been shown to be largely ineffective or their deployment has been determined to be problematical under arctic conditions.
30. p.C-21. MMS seems overly enthusiastic about the effectiveness of in situ burning as a spill response measure given the difficulties of initiating the process under frequently occurring arctic conditions, including broken and shifting ice, high winds, high sea states, extreme cold, poor visibility, and prolonged darkness.
31. p.C-26. There is no mention of the identified ineffectiveness of dispersant delivery systems under arctic conditions.
32. p.C-30, 2nd full paragraph. The DEIS states that the "MMS evaluation of the July 2000 trials concluded that BPXA and Alaska Clean Seas demonstrated the capability to mount an oil-spill response in broken-ice conditions." Significantly, the document does not indicate whether BPXA and Alaska Clean Seas were able to mount an effective oil-spill response in broken-ice conditions, only that they could mount a response.
33. p.C-33, last sentence, through C-34, 1st paragraph. This paragraph contains several unsubstantiated statements concerning leak detection capability (i.e., leaks

should be detected "within a few hours to a day or two" and "would be discovered within a matter of hours") which should be removed from the document or supported by appropriate data.

PROPOSED BEAUFORT SEA SALES UNDER 2002-2007 PROGRAM

Under a new process, MMS is proposing that it prepare a single Environmental Impact Statement (EIS) covering three proposed Beaufort Sea lease sales under the 2002-2007 Leasing program, with an Environmental Assessment (EA) or Supplemental EIS to be prepared for each of the second and third sales. A Consistency Determination would also be prepared for each sale, with the determinations for the latter two sales focussing "primarily on new issues or changes in a State's federally-approved coastal management plan." This suggested change in the established process for reviewing proposed OCS lease sales would be counter to the trend of the steadily, if only incrementally, more open and responsive public review we have seen since OCS leasing began in the Beaufort Sea. Our comments opposing the single-EIS proposal were submitted to the Alaska Region MMS office on November 5, 2001, and are incorporated here fully by reference.

Thank you for considering these comments.

Sincerely,

George N. Ahmaogak, Sr.
Mayor

cc: Honorable Governor Tony Knowles, State of Alaska
Honorable Gale A. Norton, Secretary of the Interior
Donald Oltz, Chair, OCS Policy Committee
John Goll, Director MMS Alaska Region
George Tagarook, Mayor Kaktovik
Eli Nukapigak, Mayor Nuiqsut
Edith Vorderstrasse, Mayor Barrow
Martin Oktollik, Mayor Point Hope
Willard Neakok, Sr., Mayor Point Lay
Isabel Nashookpuk, Vice Mayor Wainwright
Thomas Napageak, Chairman AEWC
Maggie Ahmaogak, Executive Director AEWC
Eugene Brower, President BWCA
Charlie Brower, Director NSB Wildlife
Tom Lohman, NSB Wildlife

Rex Okakok, Director NSB Planning
Dennis Roper, NSB Government Affairs
NSB Planning Commission
Brad Smith, NMFS Anchorage
Glenn Gray, State of Alaska DGC
Senator Ted Stevens, Washington, D.C.
Senator Frank Murkowski, Washington, D.C.
Representative Don Young, Washington, D.C.
Senator Donny Olson
Representative Reggie Joule
Arnold Brower, Jr., President, ICAS
Ross Schaeffer, Mayor, NWAB

References

Albert, T. (ed.). 1981a. Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea. Report to the Bureau of Land Management, Department of the Interior, Anchorage, AK from the Department of Veterinary Science, University of Maryland, College Park, MD 20742. 953 pp.

Albert, T. 1981b. Some thoughts regarding the possible effects of oil contamination on the bowhead whale, Balaena mysticetus. pp. 945-953. In: Tissue Structural Studies and Other Investigations on the Biology of Endangered Whales in the Beaufort Sea. T. Albert (ed.). Report to the Bureau of Land Management, Department of the Interior, Anchorage, AK from the Department of Veterinary Science, University of Maryland, College Park, MD 20742. 953 pp.

Frost, K.J., Lowry, L.F., Sinclair, E.H., Hoef, J.V., and McAllister, D.C., 1994, Impacts on distribution, abundance, and productivity of harbor seals, Loughlin, T.R. (ed.), 1994, Marine Mammals and the Exxon Valdez, Academic Press, San Diego, CA.

Geraci, J.R. and Smith, T.G., 1976, Direct and indirect effects of oil on ringed seals of the Beaufort Sea, Journal of the Fisheries Research Board, Canada 33, 1976-1984

Hellou, J., Stenson, G., Ni. I-H, and Payne, J.F., 1990, Polycyclic aromatic hydrocarbons in muscle tissue of marine mammals from the Northwest Atlantic, Marine Pollution Bulletin 21, 469-473.

Holsbeek, L., Joiris, C.R., Debacker, V., Ali, I. B., Roose, P., Nellissen, J.-P., Gobert, S., Bouquegneau, J.-M., and Bossicart, M., 1999, Heavy metals, organochlorines and polycyclic aromatic hydrocarbons in sperm whales stranded in the southern North Sea during the 1994/1995 winter. Mar. Pollut. Bull., 38, 304-313.

Lambertsen, R., R. Hintz, W. Lancaster, A. Hirons, K. Kreiton and C. Moor. 1989. Characterization of the Functional Morphology of the Mouth of the Bowhead Whale, Balaena mysticetus, With Special Emphasis on Feeding and Filtration Mechanisms. Report to the Department of Wildlife Management, North Slope Borough, Box 69, Barrow, AK from Ecosystems, Inc., Institute for Environmental

Medicine, University of Pennsylvania Medical Center, Philadelphia, PA 19104. 134 pp.

Law, R.J. and Whinnet, J.A., 1992, Polycyclic aromatic hydrocarbons in muscle tissue of harbor porpoises from UK waters, Marine Pollution Bulletin 24, 550-553.

LGL Limited and Greeneridge Sciences, Inc. 1987. Responses of bowhead whales to an offshore drilling operation in the Alaskan Beaufort Sea, Autumn 1986. Report from LGL Limited, King City, Ontario Canada and Greeneridge Sciences, Inc., Santa Barbara, CA for Shell Western E&P Inc., Anchorage, AK.

Lowry, L. 1993. Foods and Feed Ecology. Pp. 201-238. In: The Bowhead Whale. J. Burns, J. Montague and C. Crowles (eds.). Society for Marine Mammalogy, Allen Press, Inc., Lawrence, KS 66044. pp. 787.

Marsili, L., and Focardi, S., 1997, Chlorinated hydrocarbon (HCB, DDTs and PCBs) levels in cetaceans stranded along the Italian coasts: an overview, Environ. Monitor. Assess. 45,129-180.

Martineau, D., A. Lagace, P. Beland, R. Higgins, D. Armstrong, and L. R. Shugart, 1988, Pathology of stranded beluga whales from the St. Lawrence Estuary, Quebec, Canadian Journal of Comparative Pathology 98, 287-311.

Melnikov V.V., Zelensky M.A., Aynana L.I. 1999. Humpback Whales (Megaptera novaeangliae) in waters off the Chukotka Peninsula. Rep. Int. Whal. Commision, SC/51/CAWS23. 10 pp

Raftery, A.E. and Zeh, J.E. 1998. Estimating the bowhead whale population size and rate of increase from the 1993 census. Journal of the American Statistical Association, 1998;93:1-13.

Ray, S., Dunn, B.P., Payne, J.F., Fancey, L., Helbig, R., and Beland, P., 1992, Aromatic DNA-carcinogen adducts in beluga whales from the Canadian Arctic and Gulf of St. Lawrence, Marine Pollution Bulletin 22, 392-396.

Reese, S., Calvin, J.A., George, J.C., and Tarpley, R.J. 2001. Estimation of fetal growth and gestation in bowhead whales. Journal of the American Statistical Association.

Richardson, J. 1996. Acoustic effects on bowhead whales: overview. pp. 107-110. In: Proceedings of the 1995 Arctic Synthesis Meeting. MMS document # OCS Study MMS 95-0065. pp. 206 plus appendices. (Available from; MMS OCS Region, Anchorage, AK 99508)

Richardson, W.J. (ed.) 1998. Marine mammal and acoustical monitoring of BPXA's seismic program in the Alaskan Beaufort Sea, 1997. Report from LGL Ltd. King City, Ontario, Canada, and Greeneridge Sciences Inc., Santa Barbara, CA for BP Exploration (Alaska) Inc., Anchorage, AK and National Marine Fisheries Service, Anchorage, AK and Silver Spring, MD.

Richardson, W.J. (ed.) 1999. Marine mammal and acoustical monitoring of Western Geophysical's open water seismic program in the Alaskan Beaufort Sea, 1998. LGL Report 2230-3. Report from LGL Ltd., King City, Ont., and Greeneridge Sciences Inc., Santa Barbara, CA, for Western Geophysical, Houston, TX, and National Marine Fisheries Service, Anchorage, AK, and Silver Spring, MD. 390 p.

Spraker, T.R., Lowry, L.F., and Frost, K.J., 1994, Gross necropsy and histopathologic lesions found in harbor seals, Loughlin, T.R. (ed.), Marine Mammals and the Exxon Valdez, Academic Press, San Diego, CA. p. 281-312.

St. Aubin, D. J., 1990, Physiologic and toxic effects on pinnipeds, Chapter 4, in Sea mammals and oil: confronting the risks. Geraci, J. R. and St. Aubin, D. J. (eds), Academic Press, New York, 103-127.

Stoker, S.W., Krupnik I. I. 1993. Subsistence whaling. *In:* J.J. Burns, J.J Montague and C.J. Cowles (eds.). *The Bowhead Whale*. 787 pp.

Tracey, S. D. Aerial surveys of endangered whales in the Beaufort Sea. Fall 1996. OCS study MMS, 97-0016. Anchorage, AK: USDOI, MMS, Alaska OCS Region, 115 pp.

Varanasi, U., Stein, J.E., Tilbury, K.L., Meador, J.P., Sloan, C.A., Clark, R.C., and Chan S.-L., 1994, Chemical contaminants in gray whales stranded along the west coast of North America. The Science of the Total Environment 145, 29-53.

IÑUPIAT COMMUNITY of the ARCTIC SLOPE
an IRA Regional Tribal Government

P.O. Box 934 • Barrow, Alaska 99723
Ph: (907)852-4227 1-888-788-4227 Fax: (907) 852-4246

January 24, 2002

RICHARD WILDERMANN
Minerals Management Service, Mail Stop 4042
Branch of Environmental Assessment
381 Elden Street
Herndon, Virginia 20170-4817

RE: ICAS Comments on the EIS on All Offshore Exploratory Proposals in the Arctic Ocean and the Beaufort Sea and the Five Year Plan.

Dear Mr. Wildermann:

The Inupiat Community of the Arctic Slope recognizes, understands and supports the Testimony and Comments the Alaska Eskimo Whaling Commission (AEWC) provided on January 10, 2002 to the Alaska Department of Environmental Conservation on the applications by BP Exploration, Alaska for renewal of the Oil Discharge Prevention and Contingency Plans for its Milne Point, Endicott, Greater Prudhoe Bay and Northstar facilities. The Inupiat Community of the Arctic Slope resubmits those comments as our concerns relative to any Environmental Impact Statement the U.S. Department of the Interior, thru the Minerals Management Service, may consider as part of the Public Process.

Sincerely,

EDITH TEGOSEAK
Environmental Director

Cc: Arnold Brower, Jr., President, Inupiat Community of the Arctic Slope
Maggie Ahmaogak, Executive Director, Alaska Eskimo Whaling Commission

ENCL: AEWC Testimony, January 10, 2002.

TESTIMONY
OF
THE ALASKA ESKIMO WHALING COMMISSION
BEFORE THE
ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ON THE
APPLICATIONS BY BP EXPLORATION, ALASKA FOR RENEWAL OF THE OIL DISCHARGE PREVENTION AND CONTINGENCY PLANS FOR ITS MILNE POINT, ENDICOTT, GREATER PRUDHOE BAY, AND NORTHSTAR FACILITIES

January 10, 2002

The Alaska Eskimo Whaling Commission (AEWC) appreciates the opportunity to submit testimony on the applications by BP Exploration, Alaska (BP) for renewal of its Oil Discharge Prevention and Contingency Plans for the Milne Point, Endicott, Greater Prudhoe Bay, and Northstar facilities.

Comments on BP's Renewal Application

The AEWC is aware that BP has sought and received, from both the State of Alaska and the North Slope Borough, permission to reduce its three-barge oil spill response system to a two-barge system. This change in BP's mechanical response capability apparently has been granted in light of the seasonal drilling restrictions imposed on BP for its exploratory and initial production well drilling. However, the AEWC has very serious reservations about the adequacy of BP's oil spill response capabilities for OCS oil production, where seasonal drilling restrictions are not relevant.

The Oil Discharge Prevention and Contingency Plans currently under review are all for operations that involve oil production, and in the case of Northstar, the first OCS production platform and the first subsea pipeline ever in the Arctic Ocean. The holder of a contingency plan approved under Alaska state law is required to:

> "maintain, or have available under contract, in its region of operation or in another region of operation approved by the [Alaska Department of Environmental Conservation], singly or in conjunction with other operators, sufficient oil discharge containment, storage, transfer, and cleanup equipment, personnel, and resources to . . . be able to contain or control, and clean up the realistic maximum oil discharge . . . from an exploration or production facility or a pipeline . . . within 72 hours." (AS 46.04.030 (k))

During oil spill response capability demonstrations conducted by BP in 1999 and 2000, BP very clearly demonstrated the inadequacy of its mechanical response system. Based on these demonstrations, it is clear that BP cannot clean up oil spilled in the Beaufort Sea under broken ice conditions within 72 hours or any other amount of time. Furthermore, BP has yet to demonstrate that it can clean up oil spilled in the Beaufort under any conditions. To date, as far as the AEWC is aware, BP has not implemented any measures that address the demonstrated inadequacy of its mechanical response system. It is our whaling captains' view that an oil spill contingency plan cannot be considered adequate until it has been satisfactorily proven to work. Furthermore, BP has yet to create the trust account promised under the BP Good Neighbor Policy to provide mitigation for our community in the event of adverse impacts to our subsistence hunting from an oil discharge at Northstar.

Conclusion Regarding BP's Renewal Application

In light of the above, it is the AEWC's position that BP's present Oil Discharge Prevention and Contingency Plans for the Milne Point, Endicott, Greater Prudhoe Bay, and Northstar facilities are inadequate as a matter of state law. Furthermore, BP has not fully provided oil spill mitigation measures required under the U.S. Marine Mammal Protection Act. Therefore these plans should not be renewed. Instead, the North Slope Borough and the State of Alaska should work with BP to develop an oil spill response system that meets the containment and clean up requirements of Alaska law. In addition, the AEWC believes that the North Slope Borough's duty to protect the subsistence of its people prohibits it from approving a new oil discharge and contingency plan for BP until BP finalizes the oil spill mitigation trust agreement for Northstar that it promised our community it would implement over three months ago.

Additional Comments on DEC Environmental Review

Finally, the AEWC would like to express its appreciation for the very good working relationship that we have developed over the years with the staff at DEC. In the AEWC's view, the DEC's staff has come to understand and share our community's desire to have the laws and regulations that apply to oil and gas operations properly applied and enforced. Proper enforcement of these laws is especially important to our people since we must live with the adverse impacts of the oil development which funds the services and programs enjoyed by all Alaska residents.

Recently, it was reported in the news that two of the DEC staffers with whom our community has worked, Susan Harvey and Robert Watkins, have been demoted, and their authority to issue or enforce North Slope permits has been revoked. Apparently, that authority was transferred to a political appointee at DEC. The AEWC was extremely disappointed to learn of this action. With all of us in Alaska feeling the pressure of declining revenues from Prudhoe Bay, there is a great temptation to look for "quick fixes" to try to get more oil into the pipeline as fast as possible. However, in

the long run, the best way to preserve Alaska's oil future is to stick with sound environmental management.

Finding a way to expedite oil company permit applications by a few weeks offers no long term benefit to Alaska's oil revenues. To the contrary, reducing environmental standards for the sake of some small reduction in the time required for environmental review can seriously threaten Alaska's oil future. If DEC bends under pressure to loosen its environmental standards, it only increases the risk of adverse environmental damage from oil development, with the resulting risk of law suits and added regulatory burdens that would ultimately make Alaska more expensive and less attractive to developers. While our subsistence hunters would not miss the risks and fears that oil has brought to our community, we would rather be in the position of living with the impacts of well managed development than having to face the potentially devastating adverse impacts of poorly managed offshore oil development.

TESTIMONY BY TED M. FALGOUT
EXECUTIVE DIRECTOR
GREATER LAFOURCHE PORT COMMISSION

I thank you for the opportunity to comment on the draft EIS for the OCS Leasing Program: 2002 – 2007.

As you know we are no stranger to making our views known on the impacts of the Federal OCS Leasing Program

I believe our past comments have helped in the recognition of the stresses placed on certain focal point staging areas such as Port Fourchon.

Again in the document we are here commenting on today, you recognize that some episodic stress on public infrastructure can be expected and the few areas equipped to support deepwater development activities may experience more sustained stress on infrastructure and you cite Port Fourchon as a case in point which I most certainly agree is most appropriate.

You go on to say, "without mediating efforts at infrastructure restoration, the impact in these isolated cases could be moderate."

It is these "isolated cases" that I am most concerned about since my port is the premiere example.

Webster defines moderate as "within reasonable limits." My evaluation of the impacts upon Port Fourchon and Lafourche Parish clearly points towards being described as severe rather than moderate.

Since I came before you 5 years ago to comment on the previous 5 year program, Port Fourchon has experienced phenomenal growth primarily as a result of Deepwater OCS hydrocarbon activities.

Simply put there's no better place geographically environmentally, and economically to access the deepwater activity in the Central Gulf of Mexico. The options are few, less efficient and the environmental impacts utilizing more inland options have not been properly assessed.

This fact has resulted in a huge impact to Port Fourchon in these last 5 years. Lease property has increased 300% in this short span from just over 200 to 600 acres. This is Not Moderate! And the only reason this increase isn't greater is because we cannot physically build any faster. We have a waiting list of tenants.

Port tonnage has increased over 300% in 5 years. From 9 million to 35 million tons. Find me another port in the nation with this growth. This is Not Moderate!

Truck traffic to the Port this year alone has increased 25%. This is Not Moderate! I could go on and on.

The point I am trying to make here is, when you spread impacts out across the coast which MMS always does in these documents, the impacts seem minimal. But is it truly reflective of the real situation? Especially in deepwater where the impacts are focused on one or two areas on the coast.

The stresses placed on these few focal point areas are truly severe and MMS must accurately document this and play a leading role in developing an impact assistance program that will relieve these stresses.

It is truly a federal responsibility. Its easy to state in an EIS that LA 1 will be stressed or one new land fill will be needed on the coast, but where is the leadership and funding mechanism to remedy these OCS related problems. It has yet to surface and we continue with the program. How can this state or far less a Parish go through the extremely expensive process of planning a highway or a landfill when the major beneficiary is not leading or even funding the effort.

This must change if focal point areas of activity such as Port Fourchon, are going to continue to be able to accommodate the proposed leasing program.

Special Interest Groups

Alaska Eskimo Whaling Commission
P.O. Box 570 • Barrow, Alaska 99723

January 24, 2002

Via Facsimile (703/ 787-1026) and U.S. Mail
Richard Wildermann
Minerals Management Service
Branch of Environmental Assessment
381 Elden Street
Mail Stop 4042
Herndon, VA 20170-4817

Phone: (703) 787-1670
Fax: (703) 787-1026
E-Mail:

Re: U.S. Minerals Management Service Draft Environmental Impact Statement for Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007

Dear Mr. Wildermann:

Enclosed are the comments of the Alaska Eskimo Whaling Commission on the Minerals Management Service's Draft Environmental Impact Statement for its 5-Year Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007.

Thank you for your attention to this matter. Please call my office if you have any questions.

Yours truly,

Maggie Ahmaogak
Executive Director

cc: Thomas Napageak, Chairman
Mayor George Ahmaogak
Secretary Gale A. Norton
Senator Ted Stevens
Senator Frank Murkowski

Congressman Don Young
Governor Tony Knowles
Donald F. Oltz, Jr., Chairman of OCS Policy Committee
Patsy Aamodt, President of Native Village of Barrow
Arnold Brower Jr., President of Inupiat Community of the Arctic Slope
Mayor Ross Schaeffer, Northwest Arctic Borough

ALASKA ESKIMO WHALING COMMISSION

COMMENTS
on
U.S. MINERALS MANAGEMENT SERVICE
DRAFT ENVIRONMENTAL IMPACT STATEMENT
for
OUTER CONTINENTAL SHELF OIL AND GAS LEASING PROGRAM: 2002-2007

January 24, 2002

INTRODUCTION

The Alaska Eskimo Whaling Commission (AEWC) appreciates the opportunity to submit these comments. On the U.S. Minerals Management Service's Draft Environmental Impact Statement for Its Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007.

The AEWC hereby endorses and incorporates by reference the comments submitted on this matter by the North Slope Borough.

SUMMARY

The Draft Environmental Impact Statement (DEIS) prepared by the U.S. Minerals Management Service (MMS) for its proposed 5-Year OCS Leasing Program falls far short of the standards of review and analysis set under the National Environmental Policy Act (NEPA). Important research results and other information is disregarded throughout the document. The document is entirely lacking in analytical content. The document as a whole and individual sections within the document are internally inconsistent. One of the most important components of the DEIS, the cumulative impacts analysis, contains only conclusory statements and entirely neglects any discussion of past, present, or reasonably foreseeable future activities whose impacts might interact with those of the proposed action, include state as well as federal activities.

The lack of a well-developed cumulative effects analysis is especially disappointing to the AEWC. For several years now, we have worked with MMS and the National Marine Fisheries Service on the identification of cumulative impacts from OCS development. In recent years, this work has focused heavily on cumulative sociocultural impacts. Throughout this time, we have been told repeatedly by representatives of both agencies that the NEPA process is the place where these impacts are analyzed and proper mitigation measures developed. MMS is now engaged in "the NEPA process" that will govern OCS activity in our waters for the next five years, and it has completely dropped the ball on the cumulative effects analysis.

In addition, the DEIS contains no oil spill risk analysis. It merely sets forth conclusory assumptions about the probability of oil spill with no discussion of the relevance of the data base and no attempt to analyze potential impacts in any concrete fashion.

MMS needs to revise this document and it needs to prepare a Supplemental EIS, or at a minimum to provide interested parties the opportunity to review and comment on an interim draft prior to preparation of the Final EIS.

COMMENTS

1. The Discussion in Section 1.2. "The Scope of the EIS" Is Inaccurate and Misleading.

In the paragraph preceding Section 1.2.1. on page 1-3, MMS states that "none of the mitigation measures identified during scoping are analyzed in this EIS." This statement should be explained.

Section 1.2.1. "Issues Analyzed in this EIS" is misleading in its title since it implies that the DEIS provides an "analysis" of the issues listed. In fact, as is discussed in detail below, there is very little analysis of any issues in this document.

Section 1.2.5. "Mitigation Measures" contains a misleading discussion of the current status of "revenue sharing" measures. The position of the North Slope Community is summarized in the first paragraph of the section. The second paragraph, however, seems to indicate that there is an ongoing program to provide "compensation or impact assistance." This is not the case. As the authors note in the fourth paragraph of this section, the "Coastal Impact Assistance Program" was funded by Congress through the 2001 Fiscal Year Appropriations for the Departments of Commerce, State and Justice. This was a one-time appropriation. It is over and there is no ongoing program to provide compensation or impact assistance.

In the third paragraph, MMS notes that the "Oil Pollution Act of 1990 (P.L. 101-380) includes comprehensive provisions pertaining to liability and compensation for both onshore and offshore oil spills." However, these statutory provisions are not adequate to meet the needs of a subsistence community since they provide only for monetary compensation for demonstrated monetary loss. The loss of subsistence resources and activities cannot be compensated through monetary damages. There are no statutes, federal or state, that address the unique needs of subsistence communities in this regard. Moreover, subsistence communities are not in a position to undertake the paperwork and potential legal claims envisioned in a scheme such as the one created under the Oil Pollution Act of 1990.

The fifth paragraph of this section, on page 1-13 is extremely misleading since it represents an attempt to suggest that adverse impacts to subsistence uses can somehow be offset by "increased employment" with the oil and gas industry. Employment of North Slope Natives by oil and gas companies is extremely rare and when it does occur is usually temporary. The more permanent job employment positions come from Urban Cities, for example Anchorage and lower 48. Furthermore, suggesting that current impacts might somehow be offset by actions that could occur in the future, depending on decisions to be made by an independent third party (as MMS does in this paragraph) is an abdication of MMS's responsibility to, itself, provide mitigation measures that address the impacts of its proposed actions.

Finally, in the last paragraph of this section, MMS attempts to suggest that the "Conservation and Reinvestment Act" might somehow become a source of mitigation by providing impact assistance. Congress has been considering the core provisions of this act for more than 10 years and has yet to pass them. MMS cannot rely on the possibility of passage of the Conservation and Reinvestment Act at some undetermined future date to mitigate the impacts of actions it currently is proposing.

2. The Information Presented in Sections 3.2 and 4.3.3.3 Fails To Meet the Standards of Professional and Scientific Integrity Set By the Council on Environmental Quality, Rendering the Conclusions in the DEIS Regarding Impacts To Marine Mammals Invalid.

The AEWC Requests That MMS Prepare a Revised Draft of These Sections with Updated and Supportable Conclusions.

The Council on Environmental Quality requires that MMS ensure the "professional integrity, including scientific integrity" of the discussions and analyses in the DEIS. The discussions of the "Biological Environment" in Section 3.2.2. and "Marine Mammals" in Section 4.3.3.3. of the DEIS fail to meet this regulatory criterion.

As discussed in detail in the North Slope Borough's comments on Sections 3.2.2. and 4.3.3.3., prepared by representatives of the North Slope Borough's Department of Wildlife Management, MMS's analysis in this section "represents a major step backwards from recent MMS documents in terms of sophistication, use of current and relevant literature, understanding of bowhead biology, toxicology, and the current thinking about the industrial effects to migrating bowheads."

The poor quality of this work is very disturbing to the AEWC, especially in light of the substantial time and resources invested by the AEWC and the North Slope Borough in recent years in working with MMS representatives on these very issues.

Beaufort Sea OCS-related notices issued by MMS and other federal and Alaska State agencies; and we have attended and participated with MMS in numerous meetings where recent research results have been presented and peer reviewed, and where the significance of these research results have been discussed at length.

MMS's failure to acknowledge these recent research results and the understanding of industrial impacts that they have fostered, especially given the participation of MMS representatives in hearings and meetings addressing these matters, is extremely disappointing. The AEWC insists that MMS revise this entire section and its conclusions prior to publication of the Final EIS. Furthermore, given the vital importance of this analysis to an understanding of the potential impacts to our community from OCS industrial activity in the Arctic, the AEWC insists that MMS make the revised draft of this section available for review by the AEWC, the North Slope Borough, and consulting agencies including the National Marine Fisheries Service, the Environmental Protection Agency and the Marine Mammal Commission.

3. The Discussion of the "Socioeconomic Environment" of the Beaufort and Chukchi Seas in Section 3.2.3.1.1. Is Incomplete and Misleading.

Under the heading "Beaufort and Chukchi Seas" in Section 3.2.3.1.1., at pages 3-96 and 3-97, MMS cites recent economic statistics indicating that the "1990 median household income" in the North Slope Borough was "$50,000 and the 1990 poverty rate was 8.6 percent." This section also notes that "most NSB revenues (about $39,000 per resident, highest in the State) are derived from property taxes imposed on oil and gas facilities." Thus, decisionmakers reading this section will be led to believe that OCS oil and gas development is conferring an economic boon on residents of the North Slope.

However, the reality is far different. The "property taxes imposed on oil and gas facilities" have come primarily from onshore development at the Prudhoe Bay complex, where tax-generating activities are in sharp decline. Future OCS activity may help to marginally dampen this decline, but will not offset it. In addition, the tax revenues that have been collected by the North Slope Borough since its inception have gone to finance capital improvements such as the construction of village sewage systems and schools. Far from conferring the level of wealth that might be expected based on MMS's presentation of data in this section, these investments have enabled North Slope residents, for the first time, to enjoy such modern amenities as indoor plumbing, secondary education for their children, and access to health care.

Furthermore, while the period of capital improvement undertaken by the North Slope Borough resulted in large numbers of jobs for local residents, the majority of those jobs were temporary construction-related jobs. The men who filled them now have become

the largest unemployed sector of the North Slope population.[1] Nor has the presence of the oil and gas industry offered any significant source of employment for North Slope Natives.[2] In fact, as noted by MMS much later in the DEIS – almost 200 pages later at page 4-150 – "analysis of the two most recent NSB population surveys demonstrates that . . . a good number of Inupiat households are living below the poverty line . . . Thus, any effects from the proposed action for . . . the NSB . . . will disproportionately affect populations living in poverty."

Omission of this information from the description of the "Socioeconomic Environment" is misleading at best. The impression conveyed by the description in this section is one of a community enjoying group and individual wealth. However, this does not reflect the reality of life for the majority of Native people on the North Slope, many of whom are unemployed, live in poverty, and rely heavily on subsistence hunting to feed their families. It is extremely significant that the potential environmental impacts of the proposed actions go to subsistence resources, which are most important to those living in poverty. Therefore, the level of poverty among Native people on the North Slope and the substantial reliance of these people on subsistence resources for their physical existence is a crucial component of the "Socioeconomic Environment."

Furthermore, the current economic status of the North Slope Borough municipal government, which must provide all public services necessitated by the proposed OCS activities, is a highly relevant fact. According to the Alaska Department of Community and Economic Development, the North Slope Borough is currently running an operating account deficit of approximately $50 million per year. (See www.dced.state.ak.us.) On a per capita basis, the North Slope Borough is running an operating deficit of $5,156 per year, compared with revenues of approximately $39,000 per person per year as noted by MMS. (See Id.)

In a document of this size, describing impacts with the potential to threaten the future physical and cultural well-being of a segment of our society, decisionmakers should be given all information relevant to a specific topic in one place, or should be provided with clear cross references. MMS's failure to provide a realistic picture of the socioeconomic environment surrounding Native people on the North Slope, again, is extremely disappointing to the AEWC. The presentation in the DEIS gives the impression of an agency that sees itself as tasked with serving one segment of society irrespective of the

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[1] See Worl, R., and C.W. Smythe, 1986, "Barrow: A Decade of Modernization (The Barrow Case Study)," OCS Study MMS 86-0088, cited in "Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska," National Research Council, 1994, p. 143.

[2] Id.

costs to other segments. This view of MMS has lead coastal communities throughout the United States to close their shores to oil and gas development, as noted by the agency's own advisory body, the OCS Policy Committee.[3] Representatives of MMS complain when the AEWC points this out, yet the agency continues to operate in the same mode.

4. MMS's Discussions of Sociocultural Systems and Environmental Justice in Sections 3.2.3., 4.3.3., and 4.8.3. Fail to Meet the Standards of the National Environmental Policy Act and Fail to Provide for the "Management of Environmental Impacts" Required of the Secretary Under the Outer Continental Shelf Lands Act.

The AEWC Requests That MMS Prepare a Revised Discussion of Sociocultural Impacts and Environmental Justice, Including a Balanced Account of the "Socioeconomic Environment" for the North Slope with a Reasoned Discussion of Mitigation Measures.

The Outer Continental Shelf Lands Act requires that the Secretary of the Interior provide "information needed for assessment and management of environmental impacts on the human, marine, and coastal environments of the outer Continental Shelf and the coastal areas which may be affected by oil and gas development." and that the Secretary make use of this information in decisionmaking.[4] Furthermore, as noted above, The Council on Environmental Quality requires that MMS ensure the "professional integrity, including scientific integrity" of the discussions and analyses in the DEIS. The present DEIS falls substantially short of these statutory and regulatory requirements.

A. Section 3.2.3. Fails Analytically Since the Conclusions Set Forth in Section 3.2.3.6. Do Not Follow From the Discussion Presented in Sections 3.2.3.5.3. and 3.2.3.5.4.

The AEWC appreciates the attempt made by the authors of sections 3.2.3.5.3. and 3.2.3.5.4. to convey the centrality of "subsistence" to the social organization and the cultural identity of the North Slope subsistence community. To the very good points made in these sections, the AEWC would like to add the critical role that subsistence

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[3] "The Outer Continental Shelf Oil and Gas Program – Moving Beyond Conflict to Consensus," Report of the OCS Policy Committee's Subcommittee on OCS Legislation, October 1993.

[4] 43 U.S.C. 1346.

plays in the individual identity of the members of our community. It is a characteristic of our people that we define ourselves, as individuals, first and foremost in relation to our subsistence hunting activities – especially in relation to the bowhead subsistence hunt. Thus, one's status as a whaling captain, a whaling captain's wife, a crew member, or a member of a whaling captain's family, is the most fundamental social attribute by which we each define who we are and what our role is in our community. This status also dominates the decisions by which we organize our time and activities throughout the year.

The AEWC would like to encourage the social scientists who work with MMS to try to develop a deeper appreciation of the importance of subsistence to our identity as individuals. Without a thorough understanding of this component of our self-identity, it is not possible to envision the depth of meaning that subsistence has for us as a people. Similarly, it is not possible to appreciate the utter devastation our people would suffer if we were to lose our subsistence way of life. This way of life is not an abstract concept from a text book or a research paper. It is as central to how we each know and think of ourselves as is our name, the color of our eyes, the color of our skin, or the memory of our loved ones. Therefore, the loss of this way of life would be experienced by each of us as a profound loss at the most fundamental level of self-identity.

While the authors of section 3.2.3.5. have made a notable effort to convey the centrality of "subsistence" to the social organization and the cultural identity of the North Slope subsistence community, the conclusions set forth in Section 3.2.3.6. "Environmental Justice" do not follow from the preceding discussion. In the opening paragraph of Section 3.2.3.5., at page 3-105, the authors note that

> For most Alaska Natives, if not all, subsistence (and the relationship between people, on the one hand, and the land and water and its resources, on the other hand) is the idiom of cultural identity.

The authors go on to discuss the importance of considering the cultural identity of Native people in terms of the sociological concept of "place." They note that "place" contains spiritual, social, and geographical components, including "an engulfing ideology" and a geographic location where "daily 'social action' occurs."

Consistent with this theoretical discussion, in the first paragraph of Section 3.2.3.5.3. "Sociocultural Significance of Subsistence," at page 3-112, the authors note that subsistence is a "central focus of North Slope personal and group cultural identity in addition to its primary economic role." Similarly, after noting the "substantial nutritional benefits" of subsistence foods in the last full paragraph on page 3-113, the authors go on to note that "social, emotional, spiritual, and cultural benefits are other important aspects of subsistence food harvesting and sharing that contribute to personal and community health."

Therefore, MMS's conclusion in Section 3.2.3.6. that "the most likely effects [of oil and gas development to Native people] would occur through the dietary intake of subsistence resources" is not supported by the preceding discussion. In fact, what follows from the preceding discussion is that a loss of subsistence resources would affect not only "dietary intake," it would affect the daily activities and the social, cultural, and individual identities of the Native people of the North Slope – potentially in a very profound way.

MMS goes on to note here and elsewhere in the DEIS that numerous studies of indigenous people have been undertaken in Alaska and that MMS continues to conduct studies and meetings to address problems raised by North Slope residents. In 1994, the National Research Council published a review of MMS's Environmental Studies Program in Alaska.[5] The AEWC has pointed MMS to the conclusions and recommendations of this review on numerous occasions in recent years. These conclusions and recommendations remain relevant as MMS has yet to incorporate or otherwise address them. Notably, the NRC Committee conducting the 1994 review pointed out that, just as it does in the current DEIS, MMS in the past has devoted considerable attention to the "amount and kind of subsistence activities, the importance of these subsistence activities for the maintenance of traditional cultures, and at least the potential for these activities to be disrupted in the case of catastrophic damage to the physical environment."[6]

However, the following comment from the NRC Committee is as true today as it was in 1994:

> Less attention has been devoted to the ways in which subsistence activities, and the broader cultural significance of given environmental settings, might be disturbed or affected by OCS oil and gas activities even in the absences of major spills. This weakness, in turn, leads to neglect of the pragmatic steps that might be available for avoiding or mitigating such effects, examples of which range from the outright loss of certain areas for subsistence purposes because of their conversion to industrial use to the loss of areas for pipelines and processing facilities.[7]

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[5] "Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska," National Research Council, 1994.

[6] Id., at pp. 141-142.

[7] Id., at p. 142.

Furthermore, the current DEIS continues to reflect MMS's ongoing failure to analyze the potential impacts to our subsistence community from the specific actions reviewed in the DEIS. Just as the NRC Committee found in 1994, it remains true today that:

> The studies focusing on mixed cash-subsistence economies provide an adequate description of baseline conditions. However, they fall short of providing a full analysis of potential impacts. For example, many studies describe subsistence activities and their cultural importance, but they do not attempt to analyze, quantify, and draw conclusions about the significance of possible changes in subsistence activities caused by specific scenarios for potential development.[8] (Emphasis added.)

B. Section 4.3.3.14. Presents Confused, Inconsistent, and Misleading Information and Fails Analytically Since It Does Not Provide the Reasoned Discussion Required by NEPA, Does Not Adequately Identify Environmental Consequences of the Proposed Action, and Does Not Provide Sufficient Detail to Ensure That the Environmental Consequences Have Been Fairly Evaluated.

This section contains a discussion of both physical and sociocultural impacts.

i) *Physical Impacts*

The discussion of physical impacts in the first full paragraph on page 4-144 and the paragraph following suffers from the same deficiencies as those noted for Sections 3.2.2. and 4.3.3.3. The statement in the opening sentence of the second full paragraph on page 4-144 is especially shocking. According to the authors, "that marine mammals are sensitive to noise disturbance is clear, although thresholds in terms of signal characteristics and distance for each species have not been established." Representatives of MMS participate in the annual "Open Water Season Monitoring Plan Peer Review" meetings held at the National Marine Mammal Laboratory. In recent years, these meetings have devoted substantial time to precisely these questions – signal characteristics and distance – especially for bowhead whales. MMS failure to even acknowledge these meetings and the data presented in them is inexplicable.

In the first paragraph on page 4-145, beginning at the top of the page, the authors state that "offshore pipeline effects on subsistence will . . . be mitigated through lease sale stipulations." MMS should give a more detailed description of what lease sale stipulations would be used here.

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[8] Id., at p. 151.

The discussion of "Accidents" on pages 4-147 to 4-149 again ignores relevant literature on the observed and potential impacts of oil to marine mammals. (See comments of the North Slope Borough, discussion under the heading " Comments on Specific Sections and Language of DEIS" beginning at page 9 of those comments.) The discussion in this section also appears to seriously de-emphasize the adverse effects of the Exxon Valdez spill on the marine life and the coastal communities in and around Prince William Sound.

It is now 12 years since the Exxon Valdez spilled 11 millions gallons of North Slope crude oil into Prince William Sound. New studies undertaken by the Exxon Valdez Oil Spill (EVOS) Trustee Council have found that oil still fouls some beaches in the area in amounts greater than had been anticipated, and that the oil remains toxic. (EVOS executive director Molly McCammon, "Scientists to review spill impact," *Anchorage Daily News*, January 21, 2002.) Since 1999, the council has listed eight species as not recovering at all, including killer whales, and four species whose recovery is unknown. Only bald eagles and river otters have been listed as restored. (EVOS Trustee Council web site, www.oilspill.state.ak.us/injury.)

It is especially troubling to note that despite the intense research conducted in the Prince William Sound area since the Exxon Valdez spill, the marine ecosystem of that area remains so poorly understood that even today scientists cannot predict how natural cycles and fluctuations will affect the ability of marine species to recover over time. (EVOS Trustee Council web site, Id.) Nonetheless, MMS continues to make unsupported assertions about the potential impacts of oil spill on arctic marine species and the ability of these species to recover, despite the fact that far less is known about the marine ecosystem of the Arctic than that of Prince William Sound.

ii) *Sociocultural Impacts*

Turning to sociocultural impacts, in the last paragraph beginning on page 4-143, the authors state that "for the arctic region, the potential direct and indirect effects of routine OCS operations derive from noise, visual, and traffic disturbances as a result of offshore operations, and disturbances from the construction and operation of pipelines and other shore-based facilities." Why, in this section which purports to analyze the environmental impacts of the preferred alternative, is there no reference back to the discussion of "Regional Communities, Beaufort and Chukchi Seas (North Slope Communities)" in Section 3.2.3.5.1. on pages 3-106 to 3-109? As MMS notes in that earlier discussion, the Native people of the North Slope are concerned not only about physical disturbances, they are also extremely concerned about what many of them feel is the overwhelming pace of social change occurring in their communities. And in recent years they have become very vocal about the need for MMS to address issues *related to the pace of change*.

At page 4-146, in the first full paragraph, the authors note that "in other arctic Alaskan areas without petroleum development but with other resources, such as the Northwest Arctic Borough, the same dynamics are present, although at a much reduced scope." This is a very significant statement which completely undermines attempts throughout this DEIS to argue that the adverse effects of social change on the North Slope are due to "more general agents of change."

While it is obvious that change is an element of all societies, any credible sociological analysis of impacts to the human environment of the North Slope from OCS oil and gas development must take account of the pace of change. It must account for the external forces of change and their relative importance – especially their relative importance from the perspective of the people experiencing the change. In addition, it must analyze the community's ability to adapt to change at the pace at which it is occurring, without the loss of cultural continuity and the severe damage to social systems and individual identity that can result when the pace of change overwhelms a community's and its members' ability to adapt. This analysis is especially important where the forces of change are largely external and even more so, as in this case, where they are driven by decisions that are largely beyond the influence of the members of the community. Ghetto communities provide a textbook example of the community and individual results of social change that occurs at a pace greater than the community's and the individuals' ability to adapt.

It appears, initially, that beginning at page 4-146, the authors are going to provide an analysis of this critical issue. However, no such analysis is ever developed. The three sentences following the reference to the differential in social change between the North Slope Borough and the North West Arctic Borough in the first full paragraph on page 4-146 add nothing to the discussion since their meaning is incomprehensible. The following paragraphs address certain literature on social change, but offer no analysis.

The complete absence of any discussion on this issue is severely disappointing. The AEWC and the North Slope Borough have devoted significant resources and time to working with representatives of MMS and the oil and gas industry on this very issue over the past two and one half years, including numerous in-person meetings. Reading this DEIS, it is as though none of those meetings ever took place. Even had they not taken place, however, MMS still bears the burden of providing a credible analysis of impacts to the human environment from its proposed actions. This DEIS provides no analysis of the very critical question of the effects of the pace of social change, credible or otherwise.

The discussion in the paragraphs under the heading "Accidents" beginning on page 4-147, also fail to provide any analysis of the potential sociocultural impacts of an oil spill. Here the authors make only summary reference to the Exxon Valdez spill with no attempt to draw parallels between the effects of that spill on the communities in and

around Prince William Sound and the potential affects to North Slope Communities from an oil spill in arctic waters.

Information on the continuing recovery by the Prince William communities is readily available from the EVOS Trustee Council, including the Council's website at www.oilspill.state.ak.us. According to information posted at that website, in 1998, follow-up interviews were conducted in the 15 coastal villages affected by the oil spill. The results of these interviews indicated that, while subsistence was improving, it has not fully recovered. In addition, more than 50 percent of subsistence users stated that their traditional way of life has not recovered since the spill. They continue to be concerned over a scarcity of some important resources. They also noted that increases in their harvest levels reflected greater harvest effort. In other words, hunters in the Prince William Sound area are traveling farther and spending more time and money to be successful. They also are relying more heavily on wildlife that previously constituted a smaller portion of their diet. For example, Chenega Bay residents indicated a drop in reliance on harbor seals from an average of 140 pounds per person per year before the spill to 15 pounds in 1998. The corresponding levels of salmon usage went from 70 pounds pre-spill to 225 pounds in 1998. The DEIS should include this type of information and provide an analysis of how these types of impacts would affect North Slope communities and wildlife. The lack of this analysis is a serious omission which greatly weakens the conclusions of the DEIS regarding impacts to North Slope communities from an oil spill.

Similarly, there is no support for the conclusions drawn in the last full paragraph on page 4-147. Here, the authors state, first, that "most communities are ethnically diverse, with Caucasian majority population." It is not clear to which communities the authors are referring; however, this should be clarified since the statement is not true for North Slope communities. In the following sentence, the authors state that "Native communities tend to be more remote and more difficult to access than do non-Native communities, and they would be somewhat buffered from the proposed actions effects." Again, this statement is patently false for North Slope communities and therefore should be qualified.

Finally, the concluding sentence of this paragraph states that "overall, impacts of routine operations on sociocultural systems are expected to be minor." Given the discussion in Sections 3.2.3.5.3. and 3.2.3.5.4., the additional information noted in these comments, and the complete lack of analysis of sociocultural impacts – most notably the lack of analysis of the pace of social change – there is no support in the DEIS or elsewhere for this conclusion.

iii) *Conclusion*

The first full paragraph on page 4-149, headed "Conclusion" contains a series of unsupported conclusory statements. As noted above, the discussions on which these conclusions purportedly are based contain inadequate and in some cases inaccurate information. In addition, those discussions offer little or no analysis from which to draw conclusions of any kind. Finally, the use of the words "minor," "moderate," and "major" in bold type here and elsewhere in the DEIS is highly misleading. These words are specifically defined previously in the DEIS (page 4-20) to include "mitigation measures." However, nowhere in the preceding discussions does MMS identify the specific mitigation measures that would enable it to draw any conclusions regarding the possibility that impacts might be "minor" or "moderate."

C. Section 4.3.3.15. Does Not Adequately Identify Mitigation Measures Necessary To Address the Environmental Justice Concerns Raised By the Proposed Action.

In the first paragraph of Section 4.3.3.15. "Environmental Justice," the authors note that Executive Order 12898 calls for the development of mitigation measures to address "all identified effects." Agencies also are instructed, in the Executive Order, to integrate those mitigation measures into the level of NEPA review required, in this case, into the Environmental Impact Statement.

As noted above, MMS has failed to identify all of the effects likely to result from the proposed action. Thus, it is not in a position to identify adequate mitigation measures. Furthermore, the attempt to address mitigation with the summary list of very general categories found in the next-to-last paragraph of this section, on page 4-151, does not constitute the reasoned discussion required by NEPA, nor does it provide sufficient detail to ensure that the environmental consequences have been fairly evaluated.

D. Section 4.8.3. Fails To Meet the Requirements of NEPA With Respect To the Analysis of Cumulative Impacts.

For purposes of an analysis of environmental impacts under NEPA, a "cumulative impact" is the "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. . . . " 40 C.F.R. 1508.7. In Section 4.8.3. and throughout each of its subsections, MMS fails to provide any reasoned analysis of the incremental impacts of the proposed action in light of other federal or state actions in the waters of the Arctic Ocean. The biological discussions are entirely inadequate, as is the discussion of "Sociocultural Systems" in Section 4.8.3.14., beginning at page 4-293. Moreover, the conclusions stated at the end of this discussion are contradicted by the discussion itself.

In the paragraph beginning at the top of page 4-294, the authors state that "OCS activities would affect subsistence (and thus sociocultural systems) in a potentially

major way." In the last sentence of the third paragraph on this page, the authors state that "Significant cumulative effects upon subsistence resource use are possible and likely." In the last sentence of the paragraph that begins at the end of page 4-294 and continues on page 4-295, the authors state that "potential cumulative effects of OCS activities would have the potential to be major, due to spill events." In the third full paragraph on page 4-295, the authors state that "the potential cumulative effects of spill events . . . [in arctic Alaska] . . . could be major." The authors then conclude – in the very next paragraph – that "the cumulative effects of OCS activities on general sociocultural systems should be **minor**." Nowhere in the discussion does MMS identify mitigation measures sufficient to overcome the substantial impacts cited, nor does it offer any reasoned analysis of how mitigation measures might be applied to enable the agency to conclude that the cited impacts, ultimately, would be minor.

It also should be noted that British Petroleum has commenced oil production at Northstar. Therefore, MMS must update the DEIS to take account of the existence of this ongoing activity. In the last sentence of the second paragraph on page 4-294, the authors state that "it is likely that . . . potential effects [of OCS production] can be effectively mitigated." The Supplemental EIS should identify mitigation measures that address the existence of production, and should describe how those mitigation measures will be applied.

In the discussion of "Environmental Justice" in Section 4.8.3.15., on pages 4-296 and 4-297, MMS again offers conclusory statements, basing its conclusions on the use of "mitigation measures." However, as in the previous sections, these mitigation measures are not clearly identified, nor does MMS provide any description of how they might be applied or to which specific impacts. MMS appears to rely heavily on its summary list of general mitigation categories in Section 4.3.3.15. The inadequacy of that section is discussed above. Furthermore, in the "Conclusion" paragraph of that section, MMS states that "mitigation measures should be developed. Since they clearly have not been developed, MMS cannot rely on them to address the cumulative impacts of the proposed action.

In the second paragraph of this section, on page 4-296, MMS tries to make the case that the economic benefits of employment opportunities created by OCS oil and gas development might offset the adverse impacts of this development. This argument does not hold for the Native population of the North Slope Borough, however, since regular employment of Native people by the oil and gas industry is rare. Furthermore, by trying to make this argument, MMS undermines the argument it attempts to make in other sections (e.g. 4.3.3.14.) that the "enclave" development used by the oil and gas industry in Alaska will protect Native communities.

5. In the DEIS, MMS Has Ignored the May 2001 Recommendations of the OCS Policy Committee, Including the Need To Restructure Its Decisionmaking Process.

As representatives of the AEWC and North Slope Borough have discussed with representatives of MMS's Anchorage office throughout the past year, we have had very high hopes that the 5-Year OCS Leasing Plan would provide an opportunity to address issues arising from North Slope OCS oil and gas activity that fall within MMS's jurisdiction. We had especially hoped that, given the Secretary's mandate under the OCS Lands Act to manage the environmental impacts to the human, as well as the marine and coastal environments of the outer Continental Shelf, this 5-Year Plan would provide an opportunity to address the cumulative sociocultural impacts that have been the subject of so many meetings between representatives of our community and federal agencies in recent years. Unfortunately, based on the discussion in this DEIS, it appears that MMS in fact has not intention of addressing these issues, unless forced to do so. As in the past, the agency continues to seek to place the blame elsewhere for what are clearly OCS-related sociocultural impacts.

A. MMS Cannot Continue To Ignore the Fiscal Crisis Its Ongoing Actions Are Creating for North Slope Communities.

It is especially telling in this regard that MMS chose not to even refer to the May 2001 resolution of its advisory body, the OCS Policy Committee. (See attached.) As noted by the Policy Committee, it is incumbent upon MMS, at a minimum, to recognize the irreconcilable fiscal dilemma faced by our community given the steep decline in North Slope Borough revenues and the sharp increase in resources required to address ongoing OCS actions proposed by MMS. Whether or not MMS has the resources or the authority to address this dilemma, itself, it certainly has the ability to make note of it honestly and fairly in the EIS for the 5-Year OCS Leasing Plan, as recommended by the Policy Committee.

Again, the AEWC must point to the 1993 conclusions of the OCS Policy Committee's Subcommittee on OCS Legislation. Of particular relevance here is the Subcommittee's observation, on page 51 of its report, that

> the congressional moratoria [on OCS leasing] have been the stats' and localities' weapon of last resort for preventing impacts to them under a legal regime that gives them very limited decisionmaking authority and little financial assistance for dealing with those impacts. (Emphasis added.)

The fiscal dilemma currently faced by North Slope communities has been one of the important factors leading all other coastal communities of the U.S., with the exception of

Alaska and the Gulf of Mexico, to use the annual federal appropriations process to close their shores to MMS.

B. The AEWC Encourages MMS To Incorporate a Process Similar To the Annual Open Water Season Peer Review Process as Part of Its Own Decisionmaking Processes.

The AEWC continues to encourage MMS to heed the advice of the OCS Policy Committee, not only with respect to the need to address the fiscal issues faced by our community, but also with respect to the need to update MMS's decisionmaking process. In this regard, the AEWC suggests that MMS consider incorporating a process similar to the peer review process, used for the open water season noise monitoring plans, into its decisionmaking processes. This model might provide a means of providing more opportunity for local input, while helping to ensure "value free" outcomes since the peer review process multi-party and is strongly influenced by scientific integrity.

CONCLUSION

The AEWC strongly encourages MMS to prepare a revised DEIS or a Supplemental EIS to address the issues raised in these comments and in the comments submitted by the North Slope Borough. As part of this process, the AEWC encourages MMS to take account of the May 2001 recommendations of the OCS Policy Committee.

OCS Policy Committee Meeting (May 24, 2001)

The OCS Policy Committee is an independent advisory committee chartered under the Federal Advisory Committee Act to give the Secretary of the Interior advice on discretionary issues related to implementation of the OCS Lands Act. The members represent Governors of coastal States, local government, environmental interests, and the offshore oil and gas, minerals and fishing industries.

In October 2000, the OCS Policy Committee established a Natural Gas Subcommittee to independently review and evaluate information on natural gas, and then provide an assessment of the contribution the OCS can make to meeting the short term and long term natural gas needs of the United States within the framework of a national energy policy. The subcommittee forwarded its report with accompanying recommendations for consideration of the OCS Policy Committee on April 20, 2001.

Action Taken: The OCS Policy Committee on May 24, 2001, amended the Subcommittee recommendations and adopted the resolution to forward its amended recommendations to the Secretary of the Interior.

OCS POLICY COMMITTEE
Resolution of the OCS Policy Committee on Recommendations based on The Report from the Subcommittee on Natural Gas

In consideration of the duty of the Outer Continental Shelf (OCS) Policy Committee to provide policy guidance to the Secretary of the Interior on issues related to the management, protection, and development of mineral resources on the OCS, the following resolution is hereby adopted in Alexandria, Virginia on this 24th day of May, 2001;

WHEREAS, growth of U.S. consumptive demand for natural gas is currently of national interest, with projections as high as 30 trillion cubic feet (Tcf) of natural gas annually by the year 2015, representing a 50 percent increase over current national consumption;

NOTING that if the offshore is expected to maintain the same percentage contribution towards future U.S. gas consumption, the annual gas production from Federal waters will have to be increased to reach about 7 to 8 Tcf from its current level of 5 Tcf;

WHEREAS, the OCS Policy Committee established a Subcommittee to independently review and evaluate information on natural gas, and then provide an assessment of the contribution the OCS can make to meeting the short term and long term natural gas needs of the United States within the framework of a national energy policy; and

WHEREAS, the Subcommittee on Natural Gas, after careful review and due consideration of significant factors including resource, production, and demand projections; infrastructure; alternatives; the environmental safety record of, and current technologies and procedures used by, the offshore industry; leasing moratoria; safety and operational considerations unique to natural gas; and social impacts; has prepared a report that documents its review and offers recommendations; but does not evaluate energy, fuel, or building efficiencies and the roles these may play in the nation's energy needs over the next several decades; and

WHEREAS, the report of the Subcommittee will help guide the Secretary of the Interior and the Minerals Management Service (MMS) in identifying the role of the OCS in addressing the natural gas needs of the nation by identifying potential issues and policy options;

NOW, THEREFORE BE IT RESOLVED by the OCS Policy Committee that the attached recommendations based on the Report of the Subcommittee on Natural Gas are approved and adopted by the OCS Policy Committee; and

Further, Be It Resolved, that the Secretary of the Interior is urged by the OCS Policy Committee to take timely action to implement the recommendations of this Committee.

OCS Policy Committee Recommendations Based On the Report from the Subcommittee on Natural Gas May 24, 2001

After consideration of the available information concerning the supply and demand for energy in the U.S., the Policy Committee finds that natural gas should be considered as a significant part of an energy base, which includes alternatives and conservation programs. Recognizing that natural gas is only a portion of a national energy policy, the Policy Committee makes the following recommendations:

6. The Outer Continental Shelf (OCS) should be viewed as a significant source for increased supply of natural gas to meet the national demand for the long term.

7. Congressional funding to MMS and other critical agencies such as Fish and Wildlife Service, National Marine Fisheries Service, DOE, and EPA, should be assured to allow staff to accomplish the work necessary to increase production of natural gas in an environmentally sound manner from the OCS.

8. Future production will have technical and economic challenges; therefore, following on the success of the deep water royalty relief program, MMS should develop economic incentives to encourage new drilling for natural gas in an environmentally sound manner in deep formations, subsalt formations, and in deep water. Such incentives should be considered for both new leases and existing leases to maximize the use of the existing natural gas infrastructure on the OCS.

9. The MMS, in cooperation with industry, should encourage increased natural gas production in an environmentally sound manner from existing OCS leases.

10. The Policy Committee supports the existing 5-year leasing program. However, the leasing process can be improved with increased congressional funding for mitigation, including impact assistance funds, revenue sharing, and local participation in the decisionmaking process.

11. Encourage congressional funding for additional education and outreach regarding the leasing program.

12. With regard to improving the leasing process, the Policy Committee also recommends that MMS:

    - Include the mitigation of local social, cultural, and economic impacts within its policy determinations and recommendations.

    - Consider how the Bureau can restructure its decisionmaking process to provide for greater input from local communities, including the opportunity for MMS, the industry, and local residents to attempt to reach agreement on controversial matters and how they should be adjusted, remedied, or mitigated—at specific times and places that various activities occur.

    - Conduct a comparative assessment of environmental risk between offshore and onshore production, where onshore reserves exist in the same area as offshore reserves.

    - Encourage operators to provide natural gas to the local communities in all areas.

13. Specifically in Alaska,

    - Give special consideration to local, social, cultural, and economic impacts in northern Alaskan communities, in light of the unique subsistence culture in, and the remoteness of, these communities.

    - Adopt as a resource tool the 1994 NRC Committee report entitled "Environmental Information for Outer Continental Shelf Oil and Gas Decisions in Alaska" (National Academy Press, 1994).

14. The MMS, partnering with DOE, should expand cooperative research with other agencies and industry seeking technical solutions to leading edge issues such as seismic imaging of subsalt areas and drilling in deep formations.

15. The MMS, in cooperation with DOE, should encourage international cooperation in development of gas hydrates in an environmentally sound manner, with a goal of a pilot program in place within 10 years.

16. A gas pipeline from Alaska to the lower 48 States would favorably encourage an increase in natural gas production by creating favorable economics for Federal OCS production in Alaska. The Policy Committee recommends that DOI work with other agencies to expedite all appropriate permit reviews for such a pipeline.

17. To help develop information and enhance an informed public debate on whether or not there are grounds and support for a limited lifting of moratoria in existing moratoria areas, the MMS in consultation with industry and affected states, should identify the 5 top geologic plays in the moratoria areas, and if possible, the most prospective areas for natural gas in the plays that industry would likely explore if allowed. The following process would be used:

- Encourage congressional funding to MMS for the acquisition of seismic data to assist in narrowing down prospective areas. It is important that these data be non-proprietary, which would be the case if acquired exclusively by MMS.

- Encourage congressional funding for environment and social/human impacts studies for broad based or specific to 5 prospective geological plays.

  Establish a site-specific stakeholder consultation process that would permit a sharing of information and discussion of concerns regarding the pilot areas.

18. Although the following are not under the purview of the MMS and the Policy Committee, it is recommended that a national energy policy consider:

- Continuing to expand and develop the national pipeline infrastructure, looking at corridor access, environmental, safety and regulatory issues, and capacity.

- Encouraging duel fuel capacity for new electricity generating plants.

- Encouraging the review by the Administration of cost-effective tax incentives to increase the production of natural gas.

- Encouraging conservation and increasing efficiency in the use of natural gas, as a part of a national energy policy portfolio.

Alaska Marine Conservation Council
Box 101145 . Anchorage, Alaska 99510
(907) 277-5357 . (fax) 277-5975
amcc@akmarine.org . www .akmarine. org

Mr. Ralph V. Ainger
Minerals Management Service (MS-4400)
Room 2324
381 Elden Street
Herndon, VA 20170

RE: Comments on Outer Continental Shelf Oil & Gas Leasing program for 2002- 2007: Draft Environmental Impact Statement

"Oil spills typically result in the closure of fishing grounds and reduced harvest. Even if harvest continues, the perception of a tainted product can reduce the economic value of fish harvested after an oil spill" MMS DEIS 4-141.

Dear Mr. Ralph Ainger:

The Alaska Marine Conservation Council (AMCC) is pleased to have the opportunity to comment on the OCS leasing program, Draft Environmental Impact Statement for 2002~ 2007. AMCC is dedicated to protecting the health and diversity of our marine ecosystem. We work with federal and state fisheries managers, fishermen and coastal Alaska residents to protect marine habitat, prevent overfishing and promote a clean ocean environment that will ensure productive and healthy marine ecosystems. Our membership is predominantly fishermen and other residents of Alaska's coastal communities, whose lifestyles are intimately connected to the North Pacific.

Proposed oil and gas lease sales - by the Department of the Interior; Minerals Management Service (MMS) - endanger fragile marine ecosystems off the coast of Alaska. Productive fisheries, marine mammals, sea birds, and coastal communities are all at risk by potential blowouts and pipeline oil spills. Additionally, marine life is threatened by toxic sediments and cuttings disposed at sea during exploratory drilling, noise pollution generated by platform work and seismic testing, and the laying of miles of pipelines in or on the seafloor. Even small amounts of oil can negatively affect marine life. Oil pollution increases susceptibility to diseases in fishes, inhibits phytoplankton productivity, and interferes with reproduction, development, growth and behavior of many species.

The Outer Continental Shelf (OCS) Oil & Gas Leasing Program for 2002-2007 proposes three lease sales in the Beaufort Sea, one in Norton Sound, two in the Chukchi Seal Hope Basin and two in lower Cook Inlet, as far south as Afognak Island. AMCC is concerned about the inability to adequately respond to small leaks or major spills in these sensitive marine environments. We are also greatly concerned that the MMS OCS Oil and Gas Leasing Program does not adequately protect valuable commercial, sport and subsistence

fisheries. The OCS program does not sufficiently address concerns for marine mammal breeding and nursery grounds, seabird nesting areas, habitat, and wetland productivity.

AMCC is greatly concerned of the lack of knowledge for how to successfully contain and cleanup an oil spill under prevailing Arctic weather including high winds, dense fog, and heavy sea ice. Yupik and Inupiat Eskimos of Northwestern Alaska depend heavily on coastal waters and the creatures that inhabit them for subsistence. The lease sales in the Beaufort, Chukchi and Bering Sea regions ignore concerns about offshore oil and gas exploration, particularly the potential for spills, and impacts from discharged drilling muds. Coastal communities in the Arctic carry the burden of risk for impacts that might occur as a result of offshore oil and gas development activities.

Lower Cook Inlet and Shelikof Strait contain some of the richest fisheries in the United States. These waters surround endangered Steller sea lion critical habitat and boarder refuges and wilderness including Lake Clark National Park and Preserve, Katmai National Park and Preserve, Kenai Fjords National Park. Kachemak Bay National Estuarine Research Reserve, and many other highly valued lands. Oil and gas development in Cook Inlet is contrary to plans for sustaining fisheries, subsistence tradition, and safeguarding the sensitive ecosystems we rely on. The Cook Inletl/Shelikof Strait area is also home to the Cook Inlet stock of Beluga whales, which was listed as depleted last year by the National Marine Fisheries Service after the population crashed 50% in the past five years. Oil and gas leaks, drilling, and low frequency acoustics may adversely affect beluga whales.

Alaska's marine ecosystems are at great risk by offshore drilling. Coastal residents who rely on healthy marine environments for subsistence, commercial, and recreational fishing face threats to their lifestyle and culture from the impacts of oil and gas development. Until these concerns are met, the Alaska Marine Conservation Council urges you to remove the proposed lease sales in the Beaufort Sea, Norton Sound, Chukchi Seal Hope Basin and lower Cook Inlet from the OCS Oil and Gas Leasing Program for 2002-2007. Furthermore, we request the rejection of recommendations made by the OCS Policy Committee that seismic testing and other damaging exploration activities be permitted within congressional moratorium areas. The Alaska moratorium area includes the North Aleutian Basin (encompassing Bristol Bay), which was withdrawn from lease sales until 2012.

Thank you for the opportunity to comment at this time.

Sincerely,

Benjamin Enticknap
Fisheries Project Coordinator
Alaska Marine Conservation Council

American Petroleum Institute
Anthony

General Manager

1220 L Street. Northwest
Washington. DC 2OOOS—4070

Tel 202/682-8116
Fax 202/682-8426
E-mail anthonyb@api.org

Betty
Upstream

January 24. 2002

Mr. Ralph Ainger
5-Year Program Manager
Minerals Management Service (MS-4010) Room 2324
381 Elden Street
Herndon, Virginia 20170

American Petroleum Institute's Comments on Proposed 5.Year OCS Oil and Gas Program for 2002-2007; 66 FR 54279 (October 26, 2001)

Dear Mr. Ainger:

The American Petroleum Institute (API) appreciates the opportunity to comment on the preparation of the new 5-year Outer Continental Shelf (OCS) leasing program. API is a national trade association representing over 400 member companies engaged in all aspects of the oil and natural gas industry in the United States, including exploration and production, refining. transportation and marketing. A significant percentage of domestic oil and gas produced by API members comes from the Gulf of Mexico and other offshore areas. Accordingly, API's members have a direct and substantial interest in the Minerals Management Service's (MMS) preparation of the next 5-year program.

Recent events emphasize the need for secure domestic sources of Oil and natural gas. One way of addressing this need is through a flexible and expansive 6-year program. Having a more inclusive 5-year program will allow MMS to more readily alter leasing plans to adapt to changing energy needs and public concerns. Industry needs access to promising new areas and continued access to traditional areas if it is to provide the oil and gas resources the nation needs. Whie access to the Central and Western Gulf of Mexico must be maintained, access to these areas alone is not sufficient to meet the increasing energy demands of the nation. MMS need look no further than its own natural gas production statistics to see why increased access to frontier areas, and in particular the Eastern Gulf of Mexico, is vital.

The Proposed Plan Fails to Meet the Nation's Energy Needs
In July, MMS requested comments on its Draft Proposed 5-year plan. API's comments delineated ways in which the Draft Proposed plan was too limited and described how it would not meet the nation's energy needs. (We request that those earlier comments be incorporated by reference here. A copy is attached for your convenience.) In order to address the nation's future need for oil and gas and to address declining US oil production and flat US natural gas production, API urged MMS to increase the area available in the Eastern Gulf of Mexico, conduct 3 sales in the Eastern Gulf of Mexico, and conduct 5 sales in the Beaufort Sea

Unfortunately, MMS's Proposed Plan moves in the opposite direction. Instead of encouraging investment in future U.S. energy supplies, the limited sales envisioned in the Proposed Plan will do little to reduce U.S, reliance on imported oil. The Proposed Plan does not provide industry with enough acreage nor enough sales to meet the nation's energy needs. The Proposed Plan

eliminates one sale in the small portion of the Eastern Gulf of Mexico that is open for leasing and eliminates two sales in the Beaufort Sea. This will hardly help close the gap between domestic production and consumption.

Even more troubling is the fact that these limited sales may not occur. As Sale 181 made clear, no sale is guaranteed until it occurs. By starting with a meager sale schedule, additional constraints and changes would be devastating. API recommends that MMS modify the Proposed Plan by adopting Option 4 for the Beaufort Sea and the Eastern Gulf of Mexico (what the draft EIS calls Alternative 4 - Accelerated Leasing). This would increase the amount of oil anticipated to be produced as a result of the five year plan by approximately one billion barrels. This is enough oil to fuel over 1.5 million automobiles for 20 years.

MMS should also expand the acreage offered in the Eastern Gulf of Mexico. A report by Resource Data International (RDI) estimates that between 2000 and 2020 Florida's demand for natural gas will grow by 142 percent. A new regional supply of natural gas will be required to satisfy this expected demand growth in Florida and the Eastern Gulf of Mexico is the most logical source for this new supply. While the current offering in the Eastern Gulf of Mexico will help meet this demand, expanding the Eastern Gulf of Mexico offering to include all of the lands in the Eastern Gulf of Mexico that are not under moratoria is a more appropriate action.

Another concern is MMS's use of a flawed Market Simulation Model. The MMS uses its Market Simulation Model to estimate the amount and percentage of alternative sources of energy the economy would have to adopt if the 5-year program were not implemented and its proposed lease sales were not held in the future. MMS States that the market simulation model deals with the oil and gas markets separately. In other words, it appears that the model estimates what would happen to the oil and gas markets if OCS oil production were curtailed and then what would happen to the oil and gas markets if OCS gas production were curtailed. The model would be more realistic if it estimated what would happen to oil and gas markets if OCS oil and gas production were curtailed simultaneously. As it is, the model does not give an accurate portrayal of what might occur and therefore could distort policy choices and incorrectly estimate the impact on U.S. energy supplies.

API appreciates the opportunity to provide comments on the preparation of the 5-year program. If you have any questions, please call either Linda Bauch of API's Upstream Department (202- 682-8170) or me.

Sincerely,

Betty Anthony
Upstream General Manager

Attachment

EcoSlo
ENVIRONMENTAL CENTER
OF SAN LUIS OBISPO COUNTY
P.O. Box 1014 San Luis Obispo, CA 93406
Tel. (805) 544-1777
Fax: (805) 544-1871
ecoslo@slonet.org

JAN 25 2002

January 14, 2002

U.S. Department of the Interior
Minerals Management Service
381 Elden Street
Herndon, VA 20170-4817

Re: Outer Continental Shelf Oil & Gas leasing Program: 2002-2007 DEIS

Thank you for this opportunity to comment on the 2002-2007 DEIS. My comments on behalf of the Environmental Center of San Luis Obispo (ECOSLO) will mainly address some important missing data in the DEIS.

The Pacific coastal area of San Luis Obispo California is situated between two National Marine Sanctuaries, the Channel Islands National Marine Sanctuary to the south and the Monterey Bay National Marine Sanctuary to the north. It must be noted that the Monterey Bay National Marine Sanctuary dips into Cambria, which is located in San Luis Obispo County. Nestled within the County is the Morro Bay National Estuary. Your DEIS fails to recognize this important Estuary.

Also missing in **Section 3.3.** is any mention of the Los Padres National Forest, or the many State and County Park areas dotted along the coastal areas from San Simeon to the Nipomo Dunes. These "natural" tourist activities account for a significant part of San Luis Obispo's tourist population. These must be noted in any DEIS as an oil spill would be detrimental to the tourist dollars we depend upon.

There are many State and, or Federal endangered or threatened species located in San Luis Obispo County. The coastal terraces along much of our coastline are home to a significant number of endangered plant species. There is no reference to coastal flora in the DEIS.

No where is there mention of: the Santa Lucia Bank, a major off-shore bank; the five fingered mile deep Arguello Canyon; or the three major upwelling' s, including one that is persistent between Pt. Conception and Pt. Sal, which form the basis for the basin's lush web of life that provides nutrients to the entire Northern Pacific Basin. Neither the world class benthic community, supported by the permanent upwelling, nor the Chumash archeological sites, some of which were continuously occupied for 9,000 or more years are mentioned in the DEIS.

All of the above features located within the San Luis Obispo coastal region clearly illustrate the significance of the area. Please adjust **Section 3.3** to reflect this important information.

Sincerely,

Pamela Marshall Heatherington
Executive Director

January 22, 2002

5-Year Program Manager
Minerals Management Service (MS-4400)
Room 2324
381 Elden Street
Herndon, VA 20170

Also via fax to: 703 787-1165

RE: Comments on the Proposed 5-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Program for 2002-2007 and the Environmental Impact Statement (EIS) for the Proposed 5–Year OCS Program

Dear Sir/Madam:

We are hereby submitting the comments of Environmental Defense on the Proposed 5-Year Outer Continental Shelf (OCS) Oil and Gas Leasing Program (the Program) for 2002-2007 and the Environmental Impact Statement (EIS) for the Proposed 5–Year OCS Program for 2002-2007, pursuant to Section 18 of the OCS Lands Act (43 USC 1344), which requires the Department of Interior (the Department) to solicit information from interested and affected parties during the preparation of a 5-Year OCS oil and gas leasing program.

Although these comments are being submitted within the deadline for the original comment period as initially noticed by your agency, we must formally request an extension of the official deadline for comments as a result of the inability of many of our members to provide MMS with their own individual views as a result of your agency's internet servers being inoperative. The failure of MMS to renotice the expiration date and target fax number for the comment period in the Federal Register makes it obvious that additional time needs to be granted for comments to be directed to MMS. As your agency is aware, the call for comments, as originally noticed, called for interested parties to provide comments via email directed to either MMS5-yr.document@mms.gov or to MMS5-year.eis@mms.gov. Since these email addresses have not been functioning for most of the duration of the comment cycle, the comment period needs to be substantially extended or the public input phase shall be deemed inadequate.

Our range of technical comments at this time fall into these general areas of concern:

1) We applaud the fact that the 5-Year OCS Program (the Program) and the accompanying EIS do appear to respect the *congressional OCS moratorium* provisions. We strongly encourage the Department to continue to abide by the OCS moratorium.

2) We further support the Department's compliance, in preparing the OCS Program and the accompanying EIS, with the "Presidential OCS Deferrals" initiated by former President George Herbert Walker Bush in 1991 and extended in duration by former President Bill Clinton in 1998 until the year 2012.

3) We urge the Department to comply fully with all provisions of the Coastal Zone Management Act (CZMA) and the consistency determinations provided by affected states pursuant to each states' federal-approved Coastal Zone Management Plan.

4) We urge the Department, in preparing the OCS Program and the accompanying EIS, not to rely on a cursory Environmental Assessment (EA) in preparing for any sale in the Eastern Gulf of Mexico OCS Planning Area, including OCS Sales promulgated in the new Proposed 5-Year Outer Continental Shelf OCS Leasing Program. A full sale-specific EIS each Eastern Gulf sale must be conducted to ensure that sound science and all necessary lease stipulations are applied to leasing decisions in this region. The previous EIS prepared for proposed Lease Sale #181 under the previous Program did not consider the geographic parameters of Lease Sale #181 as ultimately configured, and failed to consider newly-acquired information about seismic survey and other industry impacts on Sperm Whales nor did it conduct the required Section 7 consultation with the U.S. Fish and Wildlife Service (USFWS) under the Endangered Species Act (ESA). The previous EIS prepared for proposed area-wide Lease Sale #181 under the previous OCS Program also failed to consider the concentration of OCS activities within a smaller geographic area now identified for repeated leasing action in the Eastern Gulf of Mexico OCS Planning Area, and failed to consider newly-emerging information about the concentration of hazardous levels of mercury around existing drilling operations in the Gulf of Mexico. The new OCS Program and the accompanying EIS must evaluate the substantial cumulative effects of concentrating the impacts of a number of successive sales within the limited 1.5-million-acre footprint in the Eastern Gulf, and the cumulative effects of elevated mercury discharges from the anticipated number of new drilling activities likely to result from the OCS Leasing Program on fisheries as well as ecosystem and human health.

5) We further urge the Department, in preparing the OCS Program and the accompanying EIS, to avoid violation of the clear legislative intent of the Congress by consideration of the proposals advanced this year by the OCS Policy Committee with regard to allowing seismic survey activities associated with the evaluation of natural gas potential within the congressional OCS moratorium. Such activities would be illegal.

6) The 5-Year OCS Program (The Program) and the accompanying EIS fail to address *the need for specialized* OCS lease stipulations that will be necessary to accommodate the new engineering and environmental challenges encountered in the severe meteorological conditions of the Alaskan OCS frontier basins, the lack of oil spill cleanup capability in broken sea-ice conditions in the Arctic and the current technological inability of industry to respond to the "deep spill scenario" in any of the Gulf of Mexico OCS Planning Areas.

7) The 5-Year OCS Program (The Program) and the accompanying EIS fail to adequately consider the cumulative impacts of the proposed leasing actions in combination with previous leasing actions and with other uses of the sea and seabed to disclose the combined adverse impacts of all such activities on marine mammals, fish stocks, water quality, coastal ecosystems, and human communities. The 5-Year OCS Program and the accompanying EIS must evaluate the direct and indirect implications of the proposed OCS-related activities on local and regional economic, social, and environmental resources. Failure to evaluate cumulative impacts of the project in conjunction with other impacts on the regional marine environment will result in an inadequate EIS which fails to comply with the National Environmental Policy Act (NEPA).

8) The 5-Year OCS Program and the accompanying EIS fail to quantify the direct and indirect effects of activities anticipated to occur as a result of the Program on the land and water uses in the coastal zone of all impacted states. The EIS fails to explain how the Program intends to ensure full compliance with the Coastal Zone Management Act (CZMA). Shoreline and wetland impacts of proposed expansion of OCS activities must be delineated and mitigations evaluated. It should be noted that OCS pipelines crossing coastal wetlands in the Gulf of Mexico are estimated to have destroyed more coastal salt marsh than exists in New Jersey through Maine (Boesch and Rabalais, eds. The Long-Term Effects of Offshore Oil and Gas Development: An assessment and a research strategy. A Report to NOAA, National Marine Pollution Program Office at 13-11).

9) The 5-Year OCS Program and the accompanying EIS fail to explain how activities conducted as a result of the Program will fully comply with relevant sections of the Clean Water Act (CWA). Fates and effects of mercury, lead, cadmium, and, in some locations, radioactive materials, which are associated with discharges of muds and cuttings from OCS operations must be evaluated. In addition, the 5-Year OCS Program and the accompanying EIS fails to include an evaluation of recent data derived from studies of the Exxon-Valdez oil spill, in which very low levels of PAH compounds in Alaskan waters have been found to cause life cycle mutagenic effects on the eggs of Pink Salmon. Produced water impacts resulting from the discharge of toxic pollutants including benzene, arsenic, lead, naphthalene, zinc, toluene and radium downcurrent from the discharge must be quantified and mitigations identified. Fates and effects of NOx, carbon monoxide, sulfur dioxide, and all volatile organic hydrocarbons must be evaluated pursuant to the likelihood of compliance of OCS activities with the federal Clean Air Act, as well as with regional air quality standards in affected coastal regions.

10) The 5-Year OCS Program and the accompanying EIS fail to explain how activities conducted as a result of the Program will comply with the Magnuson-Stevens Fishery Conservation and Management Act. The Program and EIS must quantify and identify

the locations of biological resources comprising Essential Fish Habitat (EFH) within all project impact areas. EFH in the project areas must be delineated as to specific locations. Effective mitigation measures for project-induced EFH impacts must be incorporated in the NEPA process. Existing fishery closures and other fishery management measures affecting portions of the OCS are indicative that specific species may be under stress at this time, thus the additional new range of adverse impacts resulting from OCS activities dictates that a cumulative impact analysis must be done.

11) The 5-Year OCS Program and the accompanying EIS fail to fully comply with the federal Endangered Species Act (ESA), including the provision of Section 7 consultations relative to all potentially impacted species subject to ESA listing.

12) The 5-Year OCS Program and the accompanying EIS fail to adequately consider a range of alternative approaches to long-term energy planning, in order to minimize environmental impacts on ocean resources. The Program and EIS must evaluate alternative energy sources to fossil fuels, including hydrogen fuels and fuel cell technologies, the economic advantages of energy conservation and energy efficiency relative to offshore drilling, and potential terrestrial sources of hydrocarbons and the relative risks associated with drilling and transportation utilized to develop such land-based sources.

13) The 5-Year OCS Program and the accompanying EIS fail to adequately identify and evaluate the probable efficacy of specific mitigation measures, including oil spill cleanup technologies, air quality controls, and marine discharges from drilling operations.

14) The 5-Year OCS Program and the accompanying EIS fail to evaluate the implications of additional hydrocarbon development expected to occur as a result of the Program on global climate change, on the need to dispose of or sequester carbon dioxide in the ocean environment, and on public health.

15) In preparing the 5-Year OCS Program and the accompanying EIS, the Department and the Minerals Management Service are encouraged to fully respect all applicable Presidential directives, designation documents, and Sanctuary management plans which permanently preclude OCS leasing within National Marine Sanctuaries as the 5-Year OCS Program and the accompanying EIS are prepared.

16) The 5-Year OCS Program and the accompanying EIS fail to fully disclose the implications of OCS activities on coastal jurisdictions, including adverse impacts on air and water quality, shoreline industrialization and land use issues within the coastal zone, and public safety and wildlife damage risks associated with the current state of OCS technologies and the limitations of current oil spill cleanup capabilities.

17) The 5-Year OCS Program and the accompanying EIS fail to consider the lack of availability of adequate scientific information needed to support reasoned leasing decisions, and must disclose the anticipated impacts derived from the proposed action on existing uses of the sea and seabed.

18) The 5-Year OCS Program and the accompanying EIS fail to consider the present inadequacy of oil spill cleanup and containment technology, particularly as this inadequacy relates to the lack of effective oil spill cleanup in Alaskan frontier OCS regions. The 5-Year OCS Program and the accompanying EIS must quantify the minimum and maximum percentages of anticipated oil recovery for spills in various sea states, meteorological conditions, and sea ice conditions.

19) Because the U.S. Department of Interior is presently promoting, as part of a separate decisionmaking process, the adoption of additional fiscal incentives to the oil industry for deepwater drilling activities and is also considering broad utilization of risky floating storage and processing vessels in some OCS planning areas, the implications of these initiatives must be fully considered in the 5-Year Outer Continental Shelf Oil and Gas Leasing Program and EIS. In addition, the cumulative impacts associated with probable barging and tankering of produced OCS oil from proposed leasing areas must be quantified and evaluated, with adequate mitigation measures provided and their success rate assessed.

20) Because the drilling of delineation wells on active OCS leases offshore Central California is presently the focus of a separate and concurrent MMS Environmental Impact Statement process, and because these OCS leases have been the subject to a legal challenge by the State of California and co-plaintiffs and a subsequent Court decision, the cumulative regionwide implications of OCS delineation and production activities in this area should be fully evaluated in the proposed 5-Year Outer Continental Shelf Oil and Gas Leasing Program and EIS.

21) Since key environmental studies identified as necessary for safely proceeding with additional OCS leasing by the National Research Council have not been completed, such studies must be completed, peer-reviewed, and evaluated in preparing the 5-Year Outer Continental Shelf Oil and Gas Leasing Program and EIS.

22) The proposed 5-Year OCS Program and the accompanying EIS fail to provide detailed information about the probable implications of OCS oil and gas development on the fragile and productive Arctic environment in Alaskan waters and along Alaska's coastline. In particular, the cumulative impacts of new and existing federal OCS activities and state tidelands oil activities in Alaska must be evaluated and effective mitigations identified. As a result of the activities proposed in the 5-Year OCS Program, the Alaskan OCS is likely to be subjected to drilling impacts from hundreds of exploration, delineation, development, and production wells, construction impacts from many miles of pipelines, impacts from the construction of causeways, docks, and pipeline landfalls, wildlife disturbance resulting from hundreds of aerial overflights, and fisheries impacts derived from the conduct of thousands of miles of seismic surveys. Statewide, the fishing industry in Alaska provides more private sector jobs than does any other source. Subsistence use of fish and other marine

animals is both an established economy of Native coastal communities as well as being central to the survival of Alaska's indigenous cultures. Recent evaluations by MMS and the Alaska Department of Environmental Conservation have revealed the oil industry's inability to clean up oil spills in broken ice conditions. In addition to fully evaluating each of these areas of concern, the 5-Year OCS Program and the accompanying EIS must evaluate the threats posed by OCS activities in Alaska to wilderness values represented by the many national parks, wildlife refuges, national monuments, and national forests that line the Alaskan coastline.

23) The proposed 5-Year OCS Program and the accompanying final EIS must provide a full cost-benefit analysis which compares the actual costs (including transportation to markets, losses incurred in energy conversion, and one-time social and environmental costs, such as the Exxon Valdez oil spill, plus ongoing day-to-day costs incurred by the environment) and benefits of OCS oil and gas leasing to an equivalent level of energy benefits generated by secure diversified renewable energy sources located closer to markets, including commercial wind electric generation, biofuels, alcohol fuels, photovoltaics and energy conservation.

24) The Secretary's preliminary decision to consider three sales in the Beaufort Sea planning area in the Proposed OCS Oil and Gas Leasing Program for 2002-2007 (DPP) provides for the first sale to be held in 2003, with subsequent sales in 2005 and 2007. The September 19, 2001 publication of the call for information and comments indicates that a single EIS is anticipated for all three of these sales. In light of the fact that the final decision on the 2002-2007 5-year program has not yet been made and final delineation of the program areas and number of sales has not been accomplished, this call for information and comments on the Beaufort Sea planning area is clearly premature. In addition, the cumulative impacts of three lease sales within this area, the severe meteorological and sea-state conditions encountered, and the lack of oil spill cleanup technology are among the evidence that separate NEPA processes are necessary for each subsequent lease sale in the 2002-2007 Program.

Thank you for this opportunity to provide comments on the proposed 5-Year OCS Program and the accompanying EIS. We look forward to a full written response to each of these issues, pursuant to federal law.

Sincerely,

Richard Charter

Richard Charter
Marine Conservation Advocate
Environmental Defense
5655 College Avenue
Oakland, CA 94618

ipaa
America's Oil & Gas Producers

January 24, 2002

Minerals Management Service
Branch of Environmental Assessment
Attention: Mr. Richard Wildermann
381 Elden Street Mail Stop 4042
Herndon, Virginia 20170-4817

RE: 2002-2007 Oil and Gas Program Draft EIS

Dear Mr. Wildermann:

The Independent Petroleum Association of America (IPAA) submits the following comments on the Draft Environmental Impact Statement (EIS) for the Proposed OCS Oil and Gas Leasing Program for 2002-2007. We appreciate the opportunity to provide our views on this important program as we consider it to be a vital component of the nation's energy policy.

The IPAA is a national trade association representing approximately 5,000 independent oil and natural gas producers and service companies who are active in both the domestic and international arenas. In the Gulf of Mexico (GOM) portion of the OCS, independent producers own nearly 60 percent of the total acreage, including approximately 80 percent of the Shelf area and almost one-half in the deep-water portion. Independents produced a majority of the oil and natural gas in the Shelf portion of the GOM and participated in nearly half the wells drilled in the OCS in the calendar year 2000. In the December 2001 Sale 181 in the Eastern GOM, independents submitted bids on and obtained a majority of the acreage offered.

IPAA was represented at the MMS's December 10, 2001 Public Hearing on the EIS in Houston, Texas by Mr. Earl R. Sims. We have attached the statement delivered by Mr. Sims and ask that it be included in the public record.

Independents believe the OCS oil and gas program is a critical element of the nation's overall energy strategy. But, we believe its success will only be fully realized if it is executed in an environmentally sound manner. We are impressed that the five-year plan's EIS clearly concludes that not only can the program be executed with only minimal impacts on the environment, but that the program offers a number of positive benefits. These benefits, discussed more completely in the attached statement, include the creation of a high number of quality jobs for the nation's workers and substantial improvements in the nation's energy security equation. The program will also result in

substantial federal revenues directly in the form of bonuses, rentals, and royalties and indirectly from taxes on the incremental business activity generated.

We remain disappointed the MMS has failed to include more acreage in the Eastern GOM lease sales scheduled for 2002-2007. Our review of the EIS reveals no environmentally justifiable reason for limiting the area to the 256-tract area proposed under the 5-year plan. Indeed, we believe the final EIS should consider an alternative to offer more Eastern GOM acreage, up to the 1033-tracts originally considered for Sale 181. We are confident that such an environmental analysis would reveal no scientifically justifiable reason to limit the size of sale in the Easter GOM planning area during the plan period. This recommendation is included in the attached comments.

Thank you for the opportunity to provide our views on this important program and thank you for the high quality work we have come to take for granted from the MMS.

Sincerely,

Charles D. Davidson
Chairman
IPAA Offshore Committee

Enclosure

NATIONAL PARKS CONSERVATION ASSOCIATION
Protecting Parks for Future Generation

JAN 29

January 7, 2002

5-Year Program Manager
Minerals Management Service (MS-4430)
381 Elden St.
Herndon, VA 20170-4817

RE: Comments on Proposed Outer Continental Shelf Oil & Gas Leasing Program for Alaska's Oceans - Draft EIS

Thank you for this opportunity to comment on the Minerals Management Service's Draft Environmental Impact Statement on the Proposed Outer Continental Shelf Oil and Gas Leasing Program. The mission of The National Parks Conservation Association is to protect and enhance America's National Park System for present and future generations. Today NPCA has over 450,000 members, of which over 1,000 are in Alaska.

NPCA opposes any additional oil and gas leasing off the coast of Alaska. Seven national parks, preserves and monuments are susceptible to direct impacts from OCS oil and gas development. These units are: Cape Krusenstem National Monument, Bering Land Bridge National Preserve, Katmai National Park and Preserve, Lake Clark National Park and Preserve, Kenai Fjords National Park, Wrangell-St. Elias National Park and Preserve, and Glacier Bay National Park and Preserve. MMS asserts that any impacts to these units due to routine operations would be "negligible", and impacts due to accidents would only range from "minor to moderate". NPCA strongly disagrees with this assertion and finds it inconceivable that MMS could come to this conclusion. Any impacts to natural resources such as air and water quality and wildlife, subsistence harvests, and archaeological and cultural sites, in a national park unit due to OCS oil and gas development would be significant and must be avoided.

Oil spills in particular would have detrimental impacts to the coastal areas of many units. We only need to look at the Exxon Valdez oil spill to see the catastrophic effects on natural resources. Large marine spills cannot be contained, they cannot be completely recovered from the sea surface, and they cannot be completely cleaned from the shores. Oil development should not be allowed near such protected and sensitive units such as national parks, preserves, and monuments. To put these areas in potential risk of an oil spill is simply unacceptable.

Examples of potential significant impacts due to an oil spill include, among others: adverse affects to coastal fauna and subsistence hunting and fishing in Lake Clark and northwest park units, and contaminated shorelines and negative affects on coastal fauna in Katmai. Of special note, the vast area encompassed by the program in the draft EIS opens potential oil and gas leasing and development in subarctic and artic, near shore marine waters - closer to highly sensitive coastal resources than areas

ALASKA REGIONAL OFFICE
329 F Street, Suite 208 . Anchorage. AK 99501
(907) 277-6722 . Fax (907) 277-6723
alaska@npca.org . www.npca.org

NATIONAL OFFICE
1300 19th Street. N.W. . Washington. D.C. 20036
(202) 223-NPCA(6722) . Fax (202) 659-0650
npca@npca.org • www.npca.org

previously proposed. This alone raises the level of risk and defeats any claim that impacts from potential accidents would only be "minor to moderate".

Sincerely,

Joan Frankevich
Acting Regional Director

**THE OCEAN CONSERVANCY ** SIERRA CLUB ** GREENPEACE, INC. ** ARCTIC CONNECTIONS ** TRUSTEES FOR ALASKA ** ALASKA WILDERNESS LEAGUE ** NATURAL RESOURCES DEFENSE COUNCIL ** THE WILDERNESS SOCIETY ** EARTHJUSTICE LEGAL DEFENSE FUND INC. ** NATIONAL ENVIRONMENTAL TRUST ** NORTHERN ALASKA ENVIRONMENTAL CENTER ** ALASKA COMMUNITY ACTION ON TOXICS ** ALASKA CENTER FOR THE ENVIRONMENT **

January 25, 2002

Mr. Ralph V. Ainger
Minerals Management Service (MS-4010)
Room 2324
381 Elden Street
Herndon, VA 20170

RE: Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007 Draft Environmental Impact Statement

Dear Mr. Ainger,

Thank you for the opportunity to comment on the Outer Continental Shelf (OCS) Oil and Gas Leasing Program for 2002-2007 Draft Environmental Impact Statement (DEIS). (66 FR 54279-54282). These comments are offered on behalf of our organizations and the numerous members of: The Ocean Conservancy, Sierra Club, Greenpeace, Inc., Arctic Connections, Trustees for Alaska, Natural Resources Defense Council, The Wilderness Society, Northern Alaska Environmental Center, Earth Justice Legal Defense Fund, Alaska Wilderness League, Alaska Community Action on Toxics, National Environmental Trust, and Alaska Center for the Environment.

Alaska's OCS waters host endangered species, productive marine life and rich fishing grounds. The proposed leasing would occur along spectacular national parks, wildlife refuges, forests and wilderness areas. Statewide, the fishing industry provides more private sector jobs than any other source and a large portion of coastal residents rely on marine resources for subsistence. And unlike oil and gas, if managed properly Alaska's fisheries have the potential to be a perpetually sustainable asset to Alaska's economy. The proposed lease sales threaten these sensitive marine and coastal environments.

This proposed leasing program is a "major federal action" requiring the preparation of an EIS, as mandated by the National Environmental Policy Act (NEPA), 42 U.S.C. Sec. 4321-4370d. NEPA's purpose is to promote efforts "which will prevent or eliminate

damage to the environment," 42 U.S.C. Sec. 4321, to inform the public of environmental consequences, 40 C.F.R. Sec. 1500.1(b), and to "help public officials...take actions that protect, restore, and enhance the environment." 40 C.F.R. Sec. 1500.1(c). To be sufficient under the law, an EIS must assess the direct, indirect and cumulative impacts of the project and its alternatives. 40 C.F.R. Sec. 1508.7, 1508.8, 1508.9(b), 1508.25(c)(1)-(3).

MMS has produced a five-year leasing plan and attendant draft EIS for large areas of Alaska's marine waters that fails to satisfy the above-listed requirements of NEPA. Among other flaws, the proposed 5-Year Plan fails to consider a reasonable range of alternatives regarding the geographic extent of planning areas, and number and size of lease sale areas considered for Alaska. While eight sales are currently proposed for Alaska (DEIS p. 2-1), this sharply contrasts with the fact that MMS held only one lease sale in Alaska from its last 5-Year Plan, due to local, regional and national public objections. Information gained since that time regarding lack of oil spill response capability, cumulative impacts, climate change, wildlife values, and other issues further substantiates our concerns.

The proposed oil and gas lease sales endanger the fragile marine environment off the coast of Alaska. Productive marine ecosystems, marine mammals, sea birds, and coastal communities are all at risk from potential blowouts and pipeline oil spills. Additionally, marine life is threatened by toxic sediments and cuttings disposed at sea during exploratory drilling, noise pollution generated by vessel traffic, drilling, platform work and seismic testing, and the laying of miles of pipelines in or on the seafloor. Even small amounts of oil can negatively affect marine life. Oil pollution increases susceptibility to diseases in fishes, inhibits phytoplankton productivity, and interferes with reproduction, development, growth, and behavior of many species.

The inclusion of most of the Alaskan areas *prominently* ignores the inability to respond to an oil spill in ice conditions. Fierce climatic conditions, high winds and seas, sea ice, and cold temperatures challenge offshore technologies and spill cleanup far beyond present capabilities. Recent oil-spill drills by both oil companies and contractors have confirmed their inability to effectively respond to a spill in broken ice and open water conditions that prevail for most of the year in the Beaufort and Chukchi Seas, Hope Basin, Norton Sound and Cook Inlet. The Exxon Valdez oil spill of 1989 taught Alaskans and the world harsh lessons about the ability to clean up a significant oil spill. Scientific studies of the Exxon Valdez oil spill show long-lasting and significant damage to fish, wildlife, and subsistence.

A single large spill based on the number of proposed exploration and development wells and percentage risks given in the DEIS can be regarded as likely to happen. (DEIS Tables 4.1e, 4.6c). However, irrespective of this, smaller persistent spills can have a dramatic impact to the marine environment. For example, based on current sub-sea buried pipeline technology, persistent leaks of up to100 barrels a day could go unnoticed, particularly if under ice where sheening wouldn't be noticed (U.S. Army Corps of

Engineers, 1999. Final EIS, Beaufort Sea Oil and Gas Development/ Northstar Project, page 8-37).

MMS makes assertions throughout the DEIS about the impacts of oil spills on the offshore environment, the animals that live there, and the people who depend on those animals for subsistence. Yet MMS makes these assumptions in the absence of any clearly stated information on the amount of oil that will be produced as a result of the various leasing alternatives in this plan, compared with the existing situation without the new sales, and the resulting spill risks.

The DEIS asserts that this offshore drilling is necessary to satisfy US energy demands and to reduce reliance on oil imports. However, MMS fails to mention that the US has only three percent of global oil reserves. Therefore, the US will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska. A true "No Action" alternative would present a comprehensive view of energy efficiency and alternative renewable fuels.

The DEIS's analysis of the no action alternative does a woefully inadequate job of analyzing the various pros and cons of alternative fuels that would replace oil under this scenario. An example of this inadequate analysis is section 4.7.3.2 where nuclear power and wind power are examined. The DEIS blithely dismisses the potentially devastating impacts of nuclear power, whereas it paints a dismal picture of wind power. This sort of analysis appears throughout the DEIS, is deficient and misleading, and should be rewritten or struck from the FEIS.

Oil development off the coast of the Arctic National Wildlife Refuge poses risks to the Porcupine caribou herd, bowhead whales, fish, polar bears, and migratory birds using the refuge coastline, lagoons, and barrier islands. Offshore exploration and development would cause pollution, aircraft and vessel noise and related industrial activity, and oil spills degrading the Refuge, even if there were no construction of infrastructure within its boundaries. In the future, there would be intense pressure to construct sprawling onshore airports, pipelines, roads, docks, and other support facilities in the Refuge. In light of these threats to our national treasure, MMS should exclude the entire OCS area offshore of the Arctic Refuge from the Beaufort Planning Area.

Internationally significant brant molting areas are located along the Beaufort Sea coast in the Teshekpuk Lake area of the National Petroleum Reserve-Alaska. This area is sensitive to aircraft and other disturbances caused by industrial activities and infrastructure, as well as oil spills. We strongly support the exclusion of tracts in the spring bowhead lead zone around Barrow, but because of the above-listed concerns, we also urge the MMS to pursue the "no sale" alternative for the entire Beaufort Sea planning area.

The Norton Basin is a rich part of the Bering Sea ecosystem with among the highest (unacknowledged by MMS) primary productivity rates in the world. It is a major migratory zone for millions of seabirds and thousands of marine mammals, spawning

grounds for king crabs, feeding areas for Pacific salmon, herring and other fish, and provides critical habitats for the threatened spectacled eider. We strongly oppose the Norton Sound "special sale" as currently proposed, particularly because MMS views the sale as a precedent that could be followed in other frontier areas. We outlined our specific concerns with this approach in our September 20, 2001 letters on the draft 5-Year Program.

Oil leasing in the arctic waters of the Chukchi Sea/Hope Basin threatens critical spring bowhead and beluga whale migration routes, staging and molting areas for migratory birds, polar bear and walrus habitats including in Russian waters, and Cape Krusenstern National Preserve. We support the deletions proposed in the Chukchi polynya in the Chukchi Sea Planning Area, and the tracts in the vicinity of Barrow in the Beaufort Sea Planning Area, but these actions are not adequate to protect sensitive coastal resources.

We strongly support the exclusion of the Gulf of Alaska area from the plan because leasing in this area threatens the wildlife and wilderness values of Glacier Bay and Wrangell-St. Elias National Parks, Tongass and Chugach National Forests, and the rich fishery and migratory birds in the world-class wetlands of the nearby Copper River Delta. The final 5-Year Program also appropriately excludes lease sales in the rich fishery area of Bristol Bay (N. Aleutian Basin), and the contiguous United States areas that are subject to the nation-wide leasing moratoria.

The proposed Cook Inlet lease sales still pose oil spill and other risks to rich fisheries, declining populations of sea otters, depleted population of beluga whales, and critical habitat for endangered Steller sea lions, as well as the coastlines of Chugach National Forest, Lake Clark and Katmai National Park and Preserves, and the Becharoff, Alaska Peninsula, Kenai, and Alaska Maritime National Wildlife Refuges. We find that the proposed plan still encompasses Shelikof Strait within the Cook Inlet Planning Area (Map 6), and although leasing is not currently proposed, we urge that Sheilikof Strait be totally removed as a Planning Area in light of the major importance of this area to the State's economy from fisheries and the marine ecosystem.

The eight proposed enormous sale areas have the potential for dramatic and lasting impacts to the waters of and adjacent to the State of Alaska, to the fish and wildlife, and to the people of Alaska who depend upon healthy ocean ecosystems for economic and cultural survival. We do not find that the environmental impacts of past, present, and future offshore exploration and development on fish, wildlife, wilderness and subsistence are adequately analyzed by the DEIS. In particular, the DEIS underestimates the potential for major significant effects to the environment from pollution, noise disturbance, oil spills, greenhouse gas emissions, and support structures on coastlines.

The DEIS failed to evaluate alternatives and lease sale stipulations for seasonal drilling restrictions for exploratory and production drilling, noise buffers from vessels, aircraft, etc., or double-walled pipeline technology for the buried sub-sea pipelines. The DEIS fails to analyze the environmental impacts of any mitigation measures, including lease sale stipulations.

The Ocean Conservancy et al.
Comments on MMS 5-Year Program and DEIS

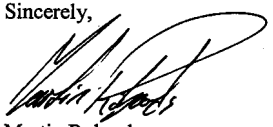
We provide detailed comments in the attached document on inadequate environmental impact analysis for the following issues:

I. Oil Spill Information
- ***a. Lack of oil spill response capabilities***
- ***b. Disconnect between data and conclusions***
- ***c. Impacts to marine and coastal environment from spilled oil***
- ***d. In-situ burning of spilled oil***
- **e. *Lessons from the Exxon Valdez oil spill***

II. Additional Impacts to Fish, Wildlife and Habitats
III. Impacts of Infrastructure
IV. Impacts to Alaska Native Communities
V. Cumulative Impacts
VI. Air Emissions and Global Warming
VII. No action alternative not sufficiently developed
VIII. Environmental assessment of Lower Cook Inlet
IX. Wilderness impacts
X. Supporting information in maps and figures in Vol. II.
XI. Conclusions

Thank you for this opportunity to comment. These comments supplement prior letters and testimony we submitted on the 5-Year Program (Natural Resources Defense Council et al. February 1, 2001 and September 20, 2001), on three Beaufort Sea Sales (Sierra Club et al. November 5, 2001), and during the DEIS public hearing (Anchorage, Alaska (12/3/01)) which are hereby incorporated by reference.

Sincerely,



Martin Robards
Alaska MPA and Ocean
Wilderness Manager
The Ocean Conservancy
coho@acsalaska.net

On Behalf of:

Sara Callaghan Chapell
Alaska Representative
Sierra Club
sara@sierraclubalaska.org

Melanie Duchin
Climate Campaigner
Greenpeace Inc.
melanie.duchin@dialb.greenpeace.org

Pamela A. Miller
Arctic Connections
pammiller@alaska.com

Jenna App
Staff Attorney
Trustees for Alaska
japp@trustees.org

Cindy Shogun
Executive Director
Alaska Wilderness League
cindy@alaskawild.org

Lisa Speer
Senior Policy Analyst
Natural Resources Defense Council
Lspeer@nrdc.org

Eric Jorgensen
Managing Attorney
Earthjustice Legal Defense Fund Inc.
ericj@earthjustice.org

Gerald B. Leape
Marine Program Director
National Environmental Trust

Eleanor Huffines
Alaska Regional Director
The Wilderness Society
eleanor_huffines@tws.org

Deb Moore
Arctic Coordinator
Northern Alaska Environmental Center
deb@northern.org

Randy Virgin
Executive Director
Alaska Center for the Environment
Randy@akcenter.org

Pamela K. Miller
Executive Director
Alaska Community Action on Toxics
pkmiller@akaction.net

Detailed Comments Regarding Outer Continental Shelf Oil & Gas Leasing Program: 2002-2007 and Draft Environmental Impact Statement

I. Oil Spill Information not Adequately Addressed in the DEIS

Lack of Oil-Spill Response Capabilities

MMS should consider recent information about the difficulties faced by the oil industry to clean up oil spills during seasonal ice conditions. Even under perfect conditions, a maximum of 10 to 15 percent of spilled oil is ever "cleaned up." MMS must paint a much more realistic picture of the impacts of oil spills so that the public can accurately judge the risks associated with oil leasing, exploration, and development.

Seasonal ice conditions affect offshore areas in Cook Inlet, Norton Sound, and in the Beaufort and Chukchi Seas and Hope Basin. This is the primary area of concern for the signatories to this letter and major concern to local communities. While Appendix B describes the ineffectiveness of oil spill cleanup response measures in the Beaufort Sea, it

failed to reference key documents related to recent tests and evaluations (Robertson, T.L. and Elise DeCola, *Joint agency evaluation of the spring and fall 2000 North Slope broken ice exercises*, December 18, 2000; Alaska Department of Environmental Conservation (ADEC) and Minerals Management Service, *Joint Evaluation*, January 18, 2000; ADEC, *North Slope Drills and Exercises Response Tactics for BP Exploration's Northstar, Prudhoe Bay Western Operating Area and Endicott Operations and ARCO's Prudhoe Bay Unit and Greater Point McIntyre Area*, Fall 1999).

After the failed tests of response equipment in 1999 and 2000, the State required a seasonal drilling restriction as part of oil spill plan compliance for Northstar and other offshore and coastal wells where oil spill response measures are infeasible due to open water and broken sea ice conditions (ADEC, *Northstar Operations Oil Discharge Prevention and Contingency Plan Compliance Order by Consent*, May 11, 2000; ADEC, *Amendment to Northstar ODPCP, Seasonal Drilling restrictions,* August 9, 2001). MMS must incorporate this scientific information into its environmental impact analysis, determination of alternatives, and/or design of reasonable stipulations. For example, MMS needs to include an analysis of prospective longevity of an oil spill cleanup in summer. Without this, it is impossible to establish if oil will still be on the water at freeze-up.

The DEIS at page 4-84 states that the estimated probability of a large spill (500 bbl [21,000 gallons] or greater) in the Beaufort Sea is 81-94 percent and 98 percent in the Chukchi Sea. While the DEIS states that "if large accidental oil spills were to occur, they would likely result in minor impacts to marine and coastal water quality. However, moderate impacts are also possible in situations where the oil would persist without cleanup." This falsely implies that a cleanup could effectively remove oil. It is nonsensical that the DEIS at once acknowledges the impossibility of cleaning up oil in most of the Alaskan sale areas during much of the year and also asserts that minor impacts are "likely."

The DEIS (page 4-85) states that the volatile organic compounds associated with crude oil spill "emissions do not appear to be hazardous to human health." The DEIS fails to mention the high levels of benzene present in North Slope crude oil. Recent information from workers in the Exxon Valdez oil spill suggests that oil spill clean up produced harmful vapors harmful to workers, and this information should be included in the FEIS.

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failed to reference key documents related to recent tests and evaluations (Robertson, T.L. and Elise DeCola, *Joint agency evaluation of the spring and fall 2000 North Slope broken ice exercises*, December 18, 2000; Alaska Department of Environmental Conservation (ADEC) and Minerals Management Service, *Joint Evaluation*, January 18, 2000; ADEC, *North Slope Drills and Exercises Response Tactics for BP Exploration's Northstar, Prudhoe Bay Western Operating Area and Endicott Operations and ARCO's Prudhoe Bay Unit and Greater Point McIntyre Area*, Fall 1999).

After the failed tests of response equipment in 1999 and 2000, the State required a seasonal drilling restriction as part of oil spill plan compliance for Northstar and other offshore and coastal wells where oil spill response measures are infeasible due to open water and broken sea ice conditions (ADEC, *Northstar Operations Oil Discharge*

The obvious conclusion that MMS has made, however, is that such degradation is acceptable. This is a tragic abrogation of their trust responsibility to act in the highest and best interest of the public at large and the residents of the affected communities. The agency seems to be acting solely on behalf of the oil industry, not the public. The public does not accept such serious degradation in our common coastal and marine ecosystems as a necessary trade-off for short term, non-renewable energy supplies.

At DEIS pages 2-3 and 4-83, MMS repeatedly asserts that the impacts from spilled oil in the lease areas would be minor to moderate. This is something that we would all hope. However, spills such as those from the *Exxon Valdez* have show that long-term impacts are likely. MMS indicates on page 4-83 that persistence of oil slicks would generally be less than one year. In an area of limited cleanup or even response capability, this is a ludicrous assumption. MMS needs to fully integrate experiences of spills such as the Exxon Valdez into this EIS; for instance, toxic oil still lurks in Prince William Sound beaches 13 years after being spilled. MMS indicates (at page 4-84) that "the probabilities for such as large spill [500bbl or larger] occurring are estimated as 16-18 percent (Cook Inlet), 81-94 percent (Beaufort Sea), and up to 98 percent (Chukchi Sea). We find it irreconcilable that MMS is considering leasing in areas such as the Beaufort and Chukchi, areas critical to local inhabitants and wildlife, with such a high possibility of a large spill, and with such low potential for response.

Analysis of Potential Spread of Spilled Oil

Appendix B presents misleading information about "containment" of oil by ocean sea ice. The statement that "under-ice currents in the coastal Beaufort Sea will not spread beyond the initial point of contact with the ice under surface" (p. C-32) ignores the Beaufort Gyre, and the fact that the pack ice moves a tremendous amount, as the recent voyage of the icebreaker SHEBA showed. The example of the Karluk is also fitting. This scientific research vessel shipwrecked near the coast at Flaxman Island near the western boundary of the current Arctic National Wildlife Refuge on August 12, 1913 and drifted hundreds of miles west to end its journey four months later at Wrangel Island, Russia in the Chukchi Sea on January 10, 1914 (McKinley, W.L. 1976. *The last voyage of the Karluk*, pp. 25, 64). MMS should recognize that these examples indicate that a major oil spill could spread rapidly within sea ice across the Beaufort or Chukchi Seas.

At DEIS page 4-91, MMS also asserts as fact much of speculation about how oil would behave when spilled in ice. The bottom line, which MMS needs to acknowledge, is that they cannot respond to a spill in ice, and that they do not fully understand the impacts of such a spill. There are scenarios from minor spills where wildlife would miraculously avoid all oiled breathing holes and the ice edges, to devastation in these areas. MMS optimistically embraces the idea of little impact – it wrote, for example, that "bowheads are well adapted to traveling under the ice and could possibly avoid contaminated areas." MMS must provide a realistic, balanced and scientific analysis that recognize the fact that oil would be found in leads, breathing holes, polynyas, and potentially the ice edge – the most important areas for wildlife.

Analysis of Impacts from Spilled Oil

The DEIS's treatment of oil spills is wholly inadequate and very misleading. The DEIS claims that for Alternative 1, MMS's preferred option, two large spills are likely to occur in the Beaufort and three large spills are likely to occur in the Chukchi over a 35- to 40-year period. These are catastrophic events in and of themselves, yet the bias throughout the DEIS is that the impact of large oil spills upon wildlife will be negligible, minor or moderate. One can look to the document's analysis of the impacts of oil spills on cetaceans to get a feel for the bias that runs throughout the analysis.

On page 4-93, the DEIS states with the exception of possible major impact to Cook Inlet beluga whales, the impacts to all other whale species will be "negligible to minor." This assumption runs counter to a huge body of knowledge about the persistence and toxicity of oil in the environment, as well as the impacts of oil spills on wildlife, and needs to be changed.

The DEIS also fails to properly analyze the amount and cumulative impact of oil spills. For example, the DEIS states that up to seven large spills are assumed to occur from OCS activities in the Beaufort and Chukchi Seas, but fails to explain how these multiple spills will cumulatively impact resources or provide a detailed analysis of how it arrived at that number of possible spills. There is no information on the likelihood of other large platform spills, large pipeline spills, blowouts and other catastrophic events occurring as a result of past or future oil and gas activities.

Even if we are to accept the assumption that up to seven large oil spills will occur in the Beaufort and Chukchi Seas, the DEIS goes on to state that the overall cumulative impact of oil spills on wildlife is expected to be negligible to minor. We believe this is incorrect. The DEIS fails to draws a conclusion at all regarding impact levels of oil spills on endangered bowhead whales – one of the most important resources to local residents. The DEIS merely said "individuals may be killed or injured if they were to contact freshly spilled oil. Unless there are multiple spills in a single year, only a few fatalities are expected to occur; however only one large platform spill and pipeline spill are assumed likely to occur in the Beaufort Sea." (p. 4-93). MMS should provide scientific evidence to support this conclusion along with a trajectory overlay of potential sources of blowout spills or pipeline spills, migratory routes, etc. Furthermore, on page 4-261 of the DEIS, MMS concludes that the cumulative impact of oil spills on bowhead whales are expected to be minor. Yet the preceding paragraph contains the effectively ignored traditional knowledge from Inupiat Eskimos attesting to the devastation that would occur to bowhead whales and other marine life if an oil spill were to occur. The case is the same on page 4-96 for risks to ringed seals during winter from oiling at their breathing holes. MMS needs to provide scientific evidence for its conclusions that are directly contrary to the well-being of this environment and the people who have traditionally relied on it for subsistence and cultural survival.

Given the lessons learned from the Exxon Valdez spill, MMS's treatment of oil spills in the DEIS does not give the public accurate information on which to base its comments. The Exxon Valdez oil spill shows categorically that spills cannot be contained, spilled oil

cannot be recovered from the sea or the shoreline, and that the environment cannot be restored once a spill has occurred. The issue is compounded in Arctic waters by the fact that it is impossible to respond to an oil spill for much of the year in the ice-infested waters of the Beaufort, Chukchi and Northern Bering Seas.

MMS must provide a much more detailed and factually justified analysis of the risks and impacts of oil spills on the full array of fish, wildlife and their habitats, subsistence resources, and wilderness before the public or any other agency can judge the environmental impact of any of the alternatives in the DEIS.

Analysis for *In-situ* Burning of Spilled Oil

While *in-situ* burning as an oil spill response method is given in Appendix B, MMS fails to analyze its environmental impacts in the DEIS. The description exaggerates the potential success and applicability of this technique -- which must occur within 24-hours of the spill -- during formidable weather conditions that occur over most of the year (sub-zero cold, high winds, fog, broken ice, and darkness inhibiting ability to reach the spill site). Furthermore, MMS does not recognize the inability of responders to place the proper fire-booms in difficult broken ice or open water conditions as shown by the 1999 and 2000 field exercises in the Beaufort Sea.

Appendix B (p. C-29) still holds up small, unsuccessful spill exercises from 1983 as demonstrations of industry in-situ burn capability. In 1983, two burn tests were conducted in onshore pits with scattered ice. In the first, a helicopter ignited a ten-foot wide pool of fresh oil, but only half the oil – 5.8 barrels – burned. In the next, oil escaped when the fire containment boom was submerged by the wind. In a third test, 500 feet of fire containment boom were deployed in the lee of an offshore drilling island and survived a mere 24 hours of moving, broken ice (Jason, N. H., ed. 1988. Alaska Arctic Offshore Oil Spill Response Technology Workshop Proceedings, Anchorage, Alaska, November 29 - December 1, 1988. Gaithersberg, MD: National Institute of Standards and Technology: 53.)

Lessons from the Exxon Valdez Oil Spill not adequately addressed

According to MMS statistics, some *three million gallons* of oil spilled from OCS oil and gas operations in 73 incidents between 1980 and 1999.[1] Oil is extremely toxic to a wide variety of marine species, including marine birds, mammals, and commercially important species of fish. In the wake of the devastating *Exxon Valdez* oil spill, scientists at the National Marine Fisheries Service's Auke Bay Lab found that concentrations of polycyclic aromatic hydrocarbons (PAH), the most toxic component of oil, in as low as 1 part per billion, were toxic to juvenile pink salmon.

Given the lessons learned from the Exxon Valdez spill such as the surprising toxicity of oil to juvenile salmonids, MMS's treatment of oil spills does not give the public accurate information on which to base its comments. The lack of effective oil spill response for

[1] MMS, 2000. Gulf of Mexico OCS Oil and Gas Lease Sale 181, Draft Environmental Impact Statement (DEIS), p. IV-50.

much of the year in the ice-infested waters of the Beaufort, Chukchi and Northern Bering Seas only increases the potential for persistent oil in these marine environments.

The 1989 Exxon Valdez Oil Spill was a human-caused ecological disaster of unprecedented magnitude. Over $400 million in scientific research to date clearly documents that, 13 years later, the ecological damage continues to be severe and is manifest in many ways not anticipated at the time of the spill. That the issue of long-term, "unanticipated damage" from the Exxon Valdez spill was not addressed at all in the Draft MMS OCS 5-year plan, is a glaring oversight, indeed a fatal flaw. There exists at present great concern for the continued lack of recovery for most of the biological resources and services injured by the Exxon Valdez Oil Spill. Although some long-term effects may have been anticipated in 1989, the precise detail, severity, and extent of such continued damage clearly wasn't understood, and was ignored in the MMS plan. As the Exxon Valdez spill is the foremost example of the potential effects of Alaska North Slope crude oil on Alaska's coastal ecosystems, the fact that the vast amount of scientific information gathered during the government EVOS research program was not brought into full consideration by the MMS 5-year plan should be sufficient grounds to postpone further consideration of the plan in its present form. In particular, the plan ignores the important new information demonstrating long-term, unanticipated injury from the 1989 oil spill, as discussed briefly below.

Background

The March 24, 1989 grounding of the Exxon Valdez spilled over 11 million gallons of Alaska North Slope crude oil into Alaska's Prince William Sound, becoming one of the most significant man-made environmental disasters in human history. The resulting spill covered over 10,000 square miles of Alaska's coastal ocean, and oiled some 1,500 miles of some of the nation's most productive and ecologically sensitive shoreline - three national parks, four national wildlife refuges, a national forest, five state parks, four state critical habitat areas, one state game sanctuary, and many ancestral lands for Alaska Natives. The spill killed more marine organisms than any other spill on record. Hundreds of thousands of seabirds, marine mammals, fish, intertidal and subtidal invertebrates and plants in the coastal ecosystem were killed by the acute effects of the oil, and chronic injury was and continues to be serious as well. Human communities dependent on the marine ecosystem for their livelihood were seriously impacted, showing increased indices of stress, substance abuse, domestic problems, and other anxiety related illnesses, giving rise to what sociologists described as "corrosive communities" in the spill region. The economic disruption caused by the spill was enormous as well. Ecologically, socially, and economically, the Exxon Valdez Oil Spill was an enormous catastrophe. Time magazine listed the Exxon Valdez as one of its "Great Events of the 20th Century." Beyond the actual acute and chronic damage caused, the spill became a powerful symbol across the world for the potentially tragic environmental consequences of corporate recklessness. As such, the Exxon Valdez has an indelible place in history, alongside other totemic industrial disasters such as Chernobyl and Bhopal.

As to the magnitude of the ecological damage caused by the spill, presiding U.S. District Court Judge H. Russel Holland stated in approving the 1991 settlement:

The Exxon Valdez oil spill was a complete, utter disaster, which I previously characterized as being 'off-the-chart.'

Judge Holland's statement was corroborated by the massive Natural Resource Damage Assessment (NRDA) research program that had been conducted prior to his approval of the settlement. Even at the time of settlement, the research proved the Exxon Valdez spill to be a devastating ecological tragedy, although the full extent wouldn't become apparent until many years later.

Unanticipated, Long-term Injury from EVOS

Subsequent to the October, 1991 settlement, government agencies have spent over $200 million on additional scientific research and monitoring (in addition to approximately $150 million spent on NRDA studies pre-settlement) - making this perhaps the single largest marine research effort in history. This enormous research program has shown that the spill damage has *continued to manifest in severe and often unanticipated ways*. The demographic effects of massive initial Exxon Valdez oil-induced mortalities, and the interaction of those impacts with other natural perturbations (such as oceanographic regime shifts or the 1998 El Nino) continue to surprise the scientific community. Further, the lingering toxicological effects of the large amount of Exxon Valdez oil remaining in beach sediments were unanticipated. In fact, the extent of the continuing damage is so severe that some scientists now suggest that the ecosystem *may never recover*.

This information is lacking from the Draft MMS OCS 5-year plan for Alaska. And, as such information fundamentally alters the understanding and discussion of ecological risk of oil spills on the Alaska OCS, it is incumbent upon the MMS OCS 5-year plan to fully incorporate and address this information on the unanticipated long-term effects of oil in the Alaska marine environment. In fact, the primary rationale used by government Trustee agencies to justify the massive research expenditure on Exxon Valdez science was that such information would be essential in conducting future oil spill risk analyses and lease planning processes. That this research information was not adequately incorporated into the Draft OCS plan is unacceptable. There is a glaring lack of reference to the extensive and detailed scientific studies that have been carried out since the spill (just one example is the synopsis of results by C.H. Peterson, 2001, The "Exxon Valdez" oil spill in Alaska: acute, indirect and chronic effects on the ecosystem, Advances in marine Biology, Vol. 39:1-62).

The "Status of Injured Resources and Services" in the 2001 EVOS Trustee Council Status Report lists only two injured species as *Recovered* - bald eagles and river otters. Listed as *Not Recovering* are loons, three species of cormorants, harbor seals, killer whales, and pigeon guillemots; listed as *Recovering (Not Recovered)* are black oystercatchers, murres, marbled murrelets, mussels, herring, pink salmon, red salmon, sea otter, intertidal habitat, subtidal habitat, and archeological sites. Resource services listed as having not recovered

include subsistence, passive uses, recreation and tourism, and commercial fishing. In fact, some scientists have recently suggested that the Prince William Sound ecosystem *may never recover* to pre-spill conditions.

Some of the most notable post-settlement manifestations of Exxon Valdez oil spill injury that were not known nor anticipated with precision from information available to the governments ten years ago are as follows:

Marine Mammals

1. *Sea otters* - recovery on northern Knight Island was "grossly delayed" at least through 1997, P450 detoxification enzyme (indicating continued oil toxicity) remained elevated in sea otters from oiled areas at least through 1998, populations have not yet returned to pre-spill levels, beach-cast carcasses include an abnormally high proportion of prime-aged animals, evidence of continued contamination through ingestion of oiled prey from mussel beds many years after the settlement.

2. *Harbor seals* - populations in spill area have failed to initiate convergence between oiled and un-oiled trajectories at least through 1997, due primarily to reduced prey availability.

3. *Killer whales* - AT1 and AB pods suffered significant losses after the spill far in excess of mortality rates of other well-studied populations elsewhere. The governments admit that AB pod "may or may not regain its former size." Since 1991, some 10 individuals from AT1 pod are missing and presumed to be dead, and there has been no recruitment of calves into this group of transient whales. Some killer whales have shifted their distribution out of the Sound. It is suspected that reduced prey availability, coupled with high contaminant loads unrelated to the spill may be acting in unanticipated ways to retard recovery. Further, as stated in one scientific paper, "unanticipated changes in killer whale feeding behavior in the Aleutian Islands suggest possible future indirect and chronic effects of the Exxon Valdez oil spill in Prince William Sound." This unanticipated change in foraging behavior is that of prey-switching, from feeding on declining populations of harbor seals and sea lions, to feeding on sea otters and other prey items. The authors of this study go on to predict that: "*if declines in harbor seals and Steller sea lions continue in Prince William Sound, this switch in killer whale diet may occur there, with potentially dramatic implications for indirect ecosystem changes. Such a switch in diet would be partly in response to the oil spill because of the failure of harbor seals to recover from losses after the spill*" (Oky and Pauly. 1999. Trophic mass balance model of Alaska Prince William Sound ecosystem for the post-spill period 1994-1996. EVOS Restoration Project 99330-1).

Fish

1. *Pacific herring* - one of the more dramatic and unanticipated injuries occurred as the herring population in PWS collapsed after the settlement. As stated by the Trustee

Council: "in 1993 there was an unprecedented crash of the adult herring population" in PWS. The outbreak of viral hemorrhagic septicemia (VHS) disease and a fungus in the PWS herring population, which is thought to have resulted from depressed immune response, didn't occur until 1993, and no matching outbreak occurred elsewhere in Alaska. Through 1999, the PWS herring population had not recruited a successful year class, an injury entirely unanticipated at the time of settlement. As herring are a critical prey item for many birds, mammals, and fish in the ecosystem, this loss has been particularly devastating ecologically.

2. *Pink salmon* - showed increased egg mortality in oiled stream gravel at least through 1997, and possible genetic damage affecting their productivity continuing indefinitely. After showing some signs of recovery, the increase in egg mortality in oiled streams reappeared quite unexpectedly in 1997. Laboratory studies demonstrated lethal effects on developing pink salmon embryos by small concentrations of relatively weathered Exxon Valdez oil. And, laboratory studies have shown that increased egg mortality may be the result of genetic damage caused by oil. Oil spill induced declines of pink salmon in PWS "have affected both their pelagic prey and their predators."

3. *Pricklebacks and crescent gunnels* - these intertidal fishes were not reported as impacted prior to the 1991 settlement. Subsequently, liver and spleen tissues from individuals collected at oiled eelgrass beds in Herring Bay in 1993 showed hemosiderosis *in all individuals,* where as no samples from un-oiled locations showed such impairment. Hemosiderosis is known to last only about 6 weeks after removal of pollutants, leading to the conclusion that these fish were still being exposed to oil.

4. *Masked greenling* - this intertidal fish was also not known to have been impacted at the time of settlement. It showed induction of cytochrome P450 in liver tissue in 1996 from oiled sites in Herring Bay, while levels from un-oiled sites were relatively low, indicating continued oil-exposure and impact.

5. *Capelin and sand lance* - these two fish species are extremely important as prey in the spill ecosystem as they were present in large numbers, they have shallow schooling behavior that may enhance their availability to predators, and they have a high lipid content making them very nutritious prey. Although they were not investigated after the spill and have not been listed as injured resources, several subsequent scientific papers have concluded that, due to their use of shallow nearshore substrates for egg deposition, there was "a high likelihood of extensive exposure to oil" (Oky and Pauly. 1999). Their sensitivity to oil contamination is well documented elsewhere, and thus "makes the probability high that both of these forage fishes suffered some decreases in abundance following the oil spill." This reduction could well be adding an additional element in the delayed recovery of a number of their predators.

Birds

1. *Harlequin ducks* - show P450 induction (indicating continued contamination) at least through 1998, winter population counts show declining numbers in western PWS as compared to eastern PWS.

2. *Cormorants, black-legged kittiwakes, murres and mergansers* - show continued depression in population numbers from oiled areas vs. the expected numbers at least through 1998.

3. *Pigeon guillemots* - show continued population depression in oiled vs. expected, lower productivity of young, lighter fledgling weights at oiled Naked Island area, at least through 1998.

4. *Marbled murrelets* - although numbers increased initially after acute mortality following the spill, population numbers declined unexpectedly in 1996 and 1998.

Nearshore Habitat

1. *Intertidal communities* - the intertidal communities within the spill zone showed continued impact into at least 1997, showing lower abundances and diversity of many invertebrate organisms. After an expected convergence in cover of the common intertidal popweed *Fucus gardneri* by 1992, this important algae exhibited an entirely unexpected "massive mortality" in 1994 and 1995, likely as a result of the establishment of a single-aged stand on rocky shores denuded by initial oiling and then simultaneous senescence years later. This continued at least through 1997. As *Fucus* cover is an important determinant of intertidal community structure and function, this unanticipated impact has had important consequences in the ecosystem. Furthermore, twelve years later, there are pockets of relatively unweathered and toxic Exxon Valdez oil in surface beach sediments of Prince William Sound. One recent scientific paper attests to the probable longevity of this problem, suggesting that hydrocarbon concentrations in mussels and sediments in the Sound "should reach background levels within *three decades* of the spill in most beds (emphasis added)" (M.G. Carls et al. 2001. Persistence of oiling in mussel beds after the Exxon Valdez Oil Spill. Marine Environmental Research 51: 167-190). The other significant unanticipated injury in the intertidal zone is the extent to which the high-pressure, hot water treatment of oiled beaches impacted community structure and recovery.

2. *Subtidal communities* - the extent of subtidal oiling was not known conclusively until well after the settlement. By 1994, it was estimated that from 8% - 16% of the total volume of spilled oil (or at least 5,000 tons of oil) was deposited into shallow subtidal sediments less than 20 meters in depth. Elevated chrysene levels in subtidal sediments, indicative of crude oil contamination, continued at least through 1995. Later studies revealed a "taxonomic complexity of response to oiling" (Oky and Pauly 1999) in shallow subtidal habitats that could not have been known nor anticipated at the time of settlement. Densities of isaeid and phoxocephalid amphipods and montacutid, thyasarid,

and tellinid bivalves remained significantly reduced in oiled subtidal habitats at least through 1995. The classic ecosystem cascade effect - reduced sea otter numbers (due to oil mortality) causing an explosion in numbers of their sea urchin prey and the consequent overgrazing of kelp forests and other macroalgae by the urchins - was detected in PWS, but as this is a well-known top-down ecological cascade effect, it cannot reasonably be considered to constitute an injury that was "unanticipated" at the time of settlement.

It is clear from the limited overview above, that there have been extensive long-term injuries from oil that were not anticipated. The 2001 EVOS Trustee Council report- the government's official position - states:

Twelve years after the spill, it is clear that many species injured by the spill have not fully recovered.

The lingering effects of this residual oil (particularly on early life stages of pink salmon and herring), together with the extraordinary and unanticipated lack of recovery of virtually all injured resources and services, brings the magnitude of the disaster into sharp focus. Although not the largest in terms of volume spilled, *it is now clear that the Exxon Valdez Oil Spill has been the most damaging oil spill in history, anywhere in the world.*

Again, as this information fundamentally alters the discussion and understanding of oil spill ecological risk on the Alaska OCS, the MMS OCS 5-year plan for Alaska simply must do a more complete and credible job of incorporating this fundamental understanding of the long-term effects of oil in Alaska's marine environment. The MMS needs to include a full, credible, and comprehensive analysis of the issue of long-term, unanticipated ecological, (and socioeconomic) damage from the Exxon Valdez Oil Spill into the present OCS 5-year plan.

II. Additional Impacts to Fish, Wildlife and Habitat not Adequately Addressed in the DEIS

Definition of Impact Levels

The impact levels on DEIS pages 4-19 and 4-20 do not take into account the effects on habitats (except coastal and seafloor habitats and essential fish habitats) but stress population effects for fish and wildlife species. As defined, in order to be called a Major impact, the "viability of the affected resource may be threatened," is necessary. The ways impact levels are defined vastly underestimate impacts and are different from other classifications used on federal lands and waters in Alaska. Under this definition of impact levels, coastal resources of Alaska would not be adequately protected as required by the Alaska Coastal Management Program.

Graphical Presentation of Data in DEIS

The DEIS needs to provide maps showing areas of wildlife concentrations, including bowhead whale migratory routes, migratory bird staging and nesting areas, anadromous

fish migration areas, seal, sea lion, and Pacific walrus haul out areas, and other sensitive wildlife habitats. While the DEIS lists infrastructure assumptions, such as 18-30 more exploratory wells, 190-325 development and production wells, and two new pipeline landfalls (Table 4-1b), these are not mapped. This lack of geographic information in the DEIS to indicate which areas of the Beaufort and Chukchi Sea will be explored or developed makes it impossible to overlay with critical wildlife areas throughout the huge leases sale areas and to determine whether these standards from the North Slope Borough Coastal Management Plan are met (e.g. NSB CMP Policy 2.4.4(a) Required Features for Applicable Development provides that "vehicles, vessels, and aircraft that are likely to cause significant disturbance must avoid areas where species that are sensitive to noise or movement are concentrated at times when such species are concentrated").

Analysis of Noise Disturbance

The Draft EIS underestimates the potential for major significant effects to the environment from noise disturbance and oil spills in the Beaufort and Chukchi Seas. The information on bowhead whales and noise disturbance needs to incorporate all current scientific and traditional knowledge (pp. 4-87 to 4-93). There is no evidence that MMS conducted any scientific analysis to assess potential noise or oil spill damage or disturbance to migrating bowhead or beluga whales (p. 4-93), Pacific walrus (4-97), polar bears (p. 4-99), migratory birds (4-48), endangered and threatened species, subsistence uses (p. 4-149), or coast lines of national and state conservation units (p. 4-133,134). Trajectory overlays and other methods should be used to evaluate potential risks and potential impacts to sensitive habitats, migratory corridors, and concentration areas. This is necessary in order to comply with fish and wildlife protection standards contained in the North Slope Borough Coastal Management Plan (NSB Policies 2.4.3(b)(c); 2.4.4(a); 2.4.4(I); 2.4.5.2(b)(g); 2./4.6(b)(c)(e)(f); 6AAC 80.130;140). Further, oil and gas activities violate the habitat standard, 6 AAC 80.130. The DEIS fails to include sufficient information to conclude that there is a significant need for the sales and that there are no feasible and prudent alternatives to the sales.

As Cook Inlet belugas are at such low levels we do not understand how MMS can assert that disturbances, which could reduce fitness, could have only "minor to moderate" impacts on this at-risk depleted population.

Analysis of Impacts to Fish

At page 2-9, in Impacts to Fish Resources, MMS says that impacts to fish resources from oil spills are variable and could range from minor to moderate. The Prince William Sound herring fishery is still in a state of collapse as a likely consequence of the Exxon Valdez oil spill 13 years earlier; it provides a stark reminder that impacts could be at least moderate and possibly major.

MMS notes "the approaching noise source probably scares mobile fishes away before the airgun comes within range". This is speculation. With the research resources available to MMS, questions such as this should not be left to speculative hope, they should be answered definitively in science.

At DEIS page 3-87, MMS needs to add a full analysis of other key forage fishes in the Alaskan fish sections. For example, capelin, sand lance, lanternfish, and numerous benthic fish such as pricklebacks and blennies are of critical importance to the local marine food webs. MMS focuses on notable commercial fish and omits to give full credit to keystone ecological species. Ironically, it is many of these species that are the most vulnerable to oil spills.

Analysis of Impacts to Polar Bears

The analysis of potential impacts of oil spills to polar bears (page 4-99) states that "over a 35-40 year period, two large spills are assumed likely to occur in the Beaufort Sea Planning Area, and three Chukchi Planning Area." (Table 4-1e). This contradicts the assumption of one large spill given in the bowhead whale section (p. 4-93). A trajectory analysis should be done for the direct and cumulative effects of these three proposed lease sales, along with existing federal and state offshore activity oil spill risks. For Northstar alone, up to 60 bears could be oiled by a major spill, according to modeling by the U.S. Geological Survey. The EIS fails to analyze the potential risks of oil spills in the Beaufort Sea or Chukchi Sea to the concentrations of denning polar bears in Wrangell Island National Park and other important polar bears habitats where oil may spread in the ice.

We are particularly concerned about potential impacts to polar bear denning, feeding, and migratory areas, including due to oil spill impacts, and disturbance from seismic, drilling, production and other activities to support offshore development (whether located offshore or on land). We are concerned about long-term degradation of important polar bear habitats, as defined by the U.S. Fish and Wildlife Service (1995) in the Habitat Conservation Strategy for Polar Bears in Alaska, including the Arctic National Wildlife Refuge.

On page 2-5 MMS asserts, "Polar bears may abandon dens, which could reduce cub survival". Polar bear cubs are dependent on their mothers for the first years of life. This statement needs to be changed to reflect the fact that cubs will die if the dens are abandoned.

Analysis of Impacts to the Biologically Important Boulder Patch

At page 4-125, MMS indicates that the boulder patch would probably recover quickly from minor changes in turbidity and sedimentation. However, no evidence is provided to justify this statement. MMS should provide supporting scientific evidence.

Analysis of Offshore Discharges and its Impacts on Fish and Wildlife

At DEIS page 1-13, MMS should analyze the measure to prohibit in-water discharge. Numerous justifiable concerns have been raised about this issue. The public needs to know if this type of pollution is being considered as part of this lease program. Further, at page 4-82, MMS needs to include the information about localized drilling-mud related pollution surrounding Gulf of Mexico platforms, and what impacts that pollution may have on the marine environment. We recommend a zero discharge standard for drilling

muds, produced waters, and other wastes discharged be evaluated as a mitigation measure.

III. Impacts of Infrastructure not Adequately Analyzed in the DEIS

Infrastructure Associated with Proposed Development

The DEIS fails to consider the effects of offshore structures including gravel causeways, docks, gravel islands and the direct and cumulative effects of key onshore activities needed to support offshore operations including: (1) effects on anadromous and other fish and waterfowl habitats from withdrawals of freshwater from lakes and rivers needed for ice roads to reach offshore drilling islands and production sites; and (2) impacts to fish and migratory birds habitats from gravel mines in river floodplains and wetlands. Ice roads, gravel mines, and offshore docks and causeways can impact coastal processes and wildlife dependent upon these coastal processes, yet were not sufficiently analyzed in the DEIS. However, there has been no demonstration that the location of these facilities would be proposed in a manner that prevents significant adverse impacts to fish and wildlife, as required by North Slope Borough Coastal Management Plan requires (NSB CMP 2.4.5.2(b)).

There has been inadequate analysis of how development activities such as land clearing, construction of roadways and utility corridors, floodplain sand and gravel removal, coal mining, oil and gas development, and seismic activities near streams can cause adverse disturbances to aquatic systems supporting anadromous fish, waterfowl and other wildlife. The primary goal in the Alaska Coastal Zone Management Plan is that anadromous fish streams and their tributaries are not subjected to adverse impacts from incompatible activities. Analysis of how the proposed Beaufort Sea lease sales, in combination with existing leasing activities and development will individually and cumulatively impact the aquatic resources, fisheries, caribou and other coastal resources need to be addressed. Potential impacts to biological resources from resource development activities such as disturbance of marine mammals and their habitat, disturbance of fish migration patterns along the coastline, impacts on caribou migration and habitat, and potential disturbance and resulting reduction in avian populations particularly seabirds and marine waterfowl in the coastal zone are also inadequately analyzed.

At DEIS page 2-10, section 2.1.2.9, and page 4-122, section 4.3.3.7, the MMS mentions the disturbance of coastal habitats from pipeline landfalls and vertical support members, onshore pipelines, on shore bases, and roads. The impacts to coastal habitats from the proposed action, MMS asserts, will be minor. The EIS needs to identify the extent of proposed "shore bases." It is impossible for the public to establish if impacts are minor with no indication of scope. Furthermore, in cumulative impacts, the DEIS does not recognize the concurrent interest in the NPRA Northwest area. The pressure to expand into these areas highlights the need for new and sizeable infrastructure in northwestern Alaska, which should be acknowledged.

All the production alternatives for OCS oil and gas in northern Alaska do not adequately address the potential need for transportation of produced oil at the development stage. We are particularly concerned about the potential direct, indirect and cumulative effects of a "new overland pipeline to TAPS [Trans-Alaska Pipeline System]" from the Chukchi Sea sale leases (p. 4-201). No maps are provided describing that route. The MMS should clarify if they assume this could be built without a road alongside it as no details are provided. There is no evidence that impacts to fish and wildlife and their habitats and subsistence uses caused by this new pipeline route were analyzed in the DEIS. As pipelines such as this are a direct consequence of the proposed action, they need to be addressed at this stage.

Onshore oil and gas activities in Prudhoe Bay and Cook Inlet increasingly suffer from persistent spills and leaks, many in relation to aging infrastructure. MMS needs to explain how it will address the fact that the TAPS was never intended to still be operational decades into the 21st century. MMS needs to assess the associated increasing risk of using existing aging infrastructure to move and process future OCS oil.

Analysis of Subsea Pipelines

In the Beaufort Sea, Chukchi Sea, and Hope Basin area, the DEIS failed to evaluate lease sale stipulations for seasonal drilling restrictions for exploratory and production drilling, noise buffers from vessels, aircraft, etc., leak detection systems, or double-walled pipeline technology for the buried sub-seabed pipelines. Given that the proposed alternative assumes drilling 208- 355 exploratory and production wells on the new leases and construction of 125 – 160 miles of offshore pipelines in Alaska (Vol. II, Table 4-1b), the technical feasibility of construction and maintenance of such pipelines, as well as the economic feasibility, and means of reducing risks associated with these pipelines at the shoreline transition zone from the effects of shoreline erosion, permafrost, and ice gouging should be addressed. NSB Policies on energy facilities and geophysical hazards (2.4.4(b)(g)(h); 2.4.6(f); 2.4.3(b); 6AAC 80.050-070) necessitate a full consideration by the MMS of such alternatives and whether oil spill risks and other impacts can be reduced in light of these features of the harsh arctic environment

IV. Impacts to Alaska Native Communities not Adequately Analyzed in the DEIS

The impacts to access to subsistence resources to date have not been "minor" (page 4-149). There have already been significant impacts from open water seismic exploration and exploratory drilling on the bowhead whale migration and availability for subsistence (although these studies were inadequately evaluated in the EIS). Furthermore, such an assessment ignores years of public comment, expert testimony by whaling communities, and scientific information. The fact that North Slope residents have to attend meeting after meeting just to voice their concerns is a major impact, as it is an unavoidable and a permanent change in the fabric of social life on the North Slope.

The DEIS is inadequate in its analysis of potential impacts to coastal resources used for subsistence (p. 4-149). These are identified as important to be protected by the Alaska Coastal Management Program. For example, the EIS fails to provide analysis to determine compliance with NSB CMP section 2.4.3(a) Standards for Development provides that "development shall not deplete subsistence resources below the subsistence needs of local residents of the borough." NSB CMP section 2.4.3(d) provides that development "shall not preclude reasonable subsistence user access to a subsistence resource."

MMS should consider more carefully the traditional knowledge of the Inupiat people concerning the dangers of broken ice, the changing climatic conditions, and the habits of the fish and wildlife of the Arctic Ocean. Too often in the DEIS, MMS states a piece of traditional wisdom and then concludes the opposite, without sufficient support to justify a disregard for the Inupiat people's 4000 years of experience.

On page 3-69, MMS needs to clarify what it means in the final paragraph by the statement "The relationship between the two is not clear, but the two dynamics may well be related." The implication is that Natives may be part of the cause for Steller Sea Lion declines, yet MMS provides no data to support this suggestion.

V. Cumulative Impacts not Adequately Analyzed in the DEIS

The assessment of cumulative impacts is unsatisfactory. Cumulative impacts from sources such as seismic testing are known to displace cetaceans including the bowhead whale; however, the consequences of more widespread and/or frequent perturbations go unaddressed. Such cumulative impacts are particularly problematic if exploration takes place concurrently in several of the proposed lease areas that share migratory populations.

Cumulative impacts can occur – even in the absence of a major spill – from the many chronic impacts of "routine" oil and gas operations, and could seriously impact the productivity of coastal ecosystems. Cumulatively, things such as increased turbidity, underwater noise, drilling mud/cuttings discharges, produced water discharges, habitat alteration, seabed pipelines and rigs and vessels, infrastructure, fresh water use for ice roads, seismic activities, minor spills and leaks, and so forth, have not been adequately considered by the EIS. Additionally, the impacts of the 5-yr plan were not considered in context with all the activity ongoing in the adjacent on-shore ecosystem, nor with other important changes offshore, such as the effects of climate change on the ecosystem. Taken together over time, all such cumulative impacts could cause the ecosystems to "die a death of a thousand cuts." Many of our concerns about cumulative impacts of Beaufort Sea offshore exploration and development are detailed in our concerns on the Northstar Draft and Final EIS by Greenpeace (please incorporate by reference).

The analysis of oil spill assumptions for the "no action" alternative is clearly flawed since it does not consider the cumulative risks of oil spills from existing OCS leased areas in the Beaufort Sea from exploratory drilling, or from the existing Northstar development

project, or the proposed Liberty project. Table (4-5d) indicates no oil spills risk from no action (no new leasing program). This ignores the reality of cumulative offshore oil development.

VI. Analysis of Emissions/Global Warming is Inadequate in the DEIS

The DEIS fails to adequately analyze the direct and cumulative effects of new sources of air emissions (in addition to all the existing ones), including greenhouse gases, to the offshore and coastal environments. The piecemeal approach to air pollution is inconsistent with NEPA and the NSB CMP policy 2.4.3 (h).

Section 4.1.2.3 of the DEIS only quantifies emissions that are a direct result of production activities within the OCS lease sale area such as diesel engines used to drill wells, installation of production facilities, support vessels, tankers that will transport oil, etc. While these emissions are not insignificant, they are dwarfed by the vast majority of greenhouse gas emissions that will result when oil produced from the 5-year lease sale is burned.

On page 4-3 MMS recognizes the IPCC workgroup and its finding that "there is strong evidence that most of the warming observed over the last 50 years is attributed to human activities." MMS then goes on (4-4): "the reduction in greenhouse gas emissions would have some other direct benefits, such as improved air quality." We cannot emphasize enough that MMS need to more fully weigh the prospect of alternative and cleaner forms of energy against environmental risky offshore oil production in Alaska, as well as the long-term health issues. MMS highlights their cursory dismissal of the impacts of oil on our environment in their paragraph (page 4-8) discussing how a warmer climate would bring the benefits of safer OCS activities in the northern regions of Alaska. The negative impacts of climate change on the ecosystem, including polar bears, ringed seals, other fish and wildlife, and subsistence and Arctic communities should be discussed. Furthermore, the effects of warming on environmental features such as beach erosion and permafrost that may affect the safety and integrity of offshore infrastructure needs to be analyzed.

The DEIS fails to quantify or analyze the impacts of burned OCS oil emissions, which is a significant gap in the section on the contribution of OCS activities to greenhouse gas emissions. Oil produced within the OCS planning area – even though it is transported and burned in a different area – contributes to greenhouse gas emissions produced from the lease sale. As such, they must be included in the agency's calculations to provide the public with an accurate picture of the lease sale's contribution to global warming. This omission is highlighted in the statement "At the refinery stage, OCS oil is mixed with oil from other sources such that the OCS contribution to subsequent environmental impacts is not discernable" (page 1-8). MMS must more accurately note that OCS oil is responsible for impacts, directly proportional to its percent component of domestic oil refined, and then provide an analysis based on those impacts.

The DEIS relies on misleading calculations and comparisons to provide a context for the lease sale's contribution of greenhouse gas emissions. On page 4-9, the DEIS states, "[t]he CO_2 emissions from the proposed 5-year program are about 0.04-0.07 percent of nationwide CO_2 emissions.... The CO_2 emissions from the proposed 5-year program would be about 0.01 to 0.02 percent of the global total." This portrays the greenhouse gas contribution from the 5-year plan as negligible.

First, the calculation is misleading because it does not include the greenhouse gases that will be produced when the oil and gas from the lease sale are eventually burned. Second, it portrays the lease sale as contributing an almost trivial amount of emissions to the national and global emission scenarios. Given the U.S. is the largest global emitter of greenhouse gas emissions, the federal government should not be downplaying or seeking to minimize any aspect of this country's exploration, production or burning of fossil fuels. Third, MMS seeks to have it both ways – the volume of oil from the lease sales is both large enough to significantly reduce our dependence on foreign oil and small enough not to impact greenhouse gases. This conclusion is overly convenient and nonsensical.

The FEIS should not include any calculations implying that the lease sale will contribute an infinitesimal or insignificant amount of greenhouse gases to the atmosphere. We recommend these figures be deleted from the FEIS. Likewise, the DEIS states that atmospheric concentrations of CO_2 are currently 370 parts per million, which could rise to as much as 970 ppm by 2100 (page 4-2). However, the DEIS fails to include the range of consequences that could occur with this near tripling of atmospheric CO_2, and the analysis of impacts in the DEIS is limited to the Gulf of Mexico and Alaska.

The FEIS should identify and discuss the range of global impacts, including worse case scenarios. These include the impacts that are identified in the Intergovernmental Panel on Climate Change's latest report, "Climate Change 2001: Impacts, Adaptation and Vulnerability," which can be found at http://www.ipcc.ch/pub/reports.htm. Since the United States is the largest contributor of greenhouse gases in the world (the U.S. has three percent of the worlds population yet is responsible for 25 percent of global greenhouse gas emissions), MMS must include a more in-depth and global description and analysis of the impacts of global warming to provide the public with a complete picture of the impacts of this lease sale.

VII. The "No Action" Alternative was not Sufficiently Developed in the DEIS

Issues Involving the No Action Alternative

The DEIS erroneously implies that without these new lease sales, there would not be on-going activity on existing federal leases in a large areas of the Beaufort Sea. One example of the flawed analysis is seen in the oil spill assumptions for No Action (Table 4-5d). Its analysis is clearly flawed since it does not consider the risks of oil spills from existing OCS leased areas in the Beaufort Sea from exploratory drilling or from the

existing Northstar development project or the proposed Liberty project. It shows no oil spill risk whatsoever.

Faulty analysis of changes in tanker spill risks is given. At DEIS page 4-190, MMS indicated that additional oil would need to be imported. It then indicates that the risk of a tanker spill occurring in the Pacific Region is much greater for the no action alternative compared to the proposed action. This is a preposterous case of misleading information that is prevalent in this DEIS. Most of the oil produced in Alaska will either find its way to TAPS and hence out of Valdez by tanker, or to Cook Inlet and then tanker. Either, by the Proposed Alternative or by No Action (based on the assumption that imported oil is the alternative in No Action), tanker transport of oil in the Pacific Region would be much the same, and not more. Furthermore, No Action highlights that conservation and alternative energy are also alternatives that could, in the long-term, reduce transport of oil by tanker.

At page 4-201 MMS notes that the export ban on Alaskan crude oil has led to some shipments to East Asia. As much justification for the need to drill is based on reducing dependence on foreign oil, this is a critical point. MMS says that "Our understanding is that these shipments are infrequent and generally of limited quantities" is not enough. MMS needs to provide at least the actual figures for what has been exported. Furthermore, a detailed analysis of the potential for increased oil exports with projections needs to be included.

There are a number of significant omissions and errors in the DEIS's analysis of the no action alternative that show the agency's clear bias toward its preferred alternative and its overarching bias toward drilling for more oil while downplaying and ignoring other alternatives. For example, on page vi, MMS reveals its cursory recognition of Alternative 5 by ignoring this alternative completely in the principle conclusions.

The MMS justifies selling off huge tracts of Alaskan waters by assuming huge increases in domestic energy consumption, such as a 33 percent rise in oil consumption in the next 20 years. Clearly, this doesn't have to be the case. Conservation and a greater reliance on renewable energy sources such as solar and wind can reduce this country's dependence on oil, be it imported or domestic.

The DEIS asserts that domestic drilling is necessary to satisfy US energy demands and to reduce reliance on oil imports. However, MMS fails to mention that the US has only three percent of global oil reserves. Therefore, the US will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska

Page 4-185 of the DEIS describes the "boom and bust" effect that would occur if the no action alternative were to be adopted and the lease sale were to be cancelled. However, the analysis fails to mention that the "boom and bust" effect is inevitable since oil is a finite resource and the U.S. has just three percent of global oil reserves. The DEIS describes the situation as if a "boom and bust" effect will occur only if the lease sale is

cancelled, which is neither fair nor accurate. The FEIS should be changed to correct this inaccuracy.

The renewal application for the Trans-Alaska pipeline states, "(m)ore than sufficient economically recoverable oil is available to support operation of the pipeline beyond 30 years. The estimates do not include the assumption that any oil will be produced from new major discoveries or from areas that are currently closed to exploration."[2] Given the TAPS can be supported for 30 years by known oil reserves, the "boom and bust" effect will not occur as a result of the no action alternative. Likewise, the proposed lease sale is not necessary to keep oil flowing at current rates.

Page 4-187 of the DEIS states that if the lease sale were to be cancelled, then 86 percent of lost OCS production would be made up by importing oil. This is an assumption that is stated as fact with little information beyond the name of the model that was used to generate it. The only assumption provided for the 86 percent figure is that, "basic economic decisions in the U.S. economy will continue to be made through the free market system." This assumption is too broad to be meaningful for the public's analysis and comment, and should be discussed in detail if included in the FEIS.

Specifically, it is not clear whether "free market system" means the current system where fossil fuel industries receive approximately $10 billion per year from the federal government in the form of subsidies and tax breaks. A 1995 report, "Fueling Global Warming: Federal Subsidies to Oil in the United States" produced by Industrial Economics for Greenpeace, revealed that the US government provided up to $11.9 billion in subsidies to the US oil industry in 1995 alone. Solar, wind and renewable forms of energy receive little more than lip service from the federal government. If economic incentives were removed from the oil and gas industry, then renewable forms of energy would look much more attractive when compared to importing or even domestic production of oil. The DEIS includes no such analysis.

Page 4-188 of the DEIS includes the statements that "additional crude oil imports associated with the no action alternative increase the risk of large oil spills," and "[c]itizens are concerned about the oil spills associated with imports." This is yet another example of the agency providing biased information that supports its own preferred alternative. The only way to prevent oil spills is to reduce and eventually eliminate U.S. reliance on oil, be it imported or domestic. It is unfair and misleading for the DEIS's analysis of the no action alternative to include statements that not drilling in the OCS will result in an increase in large oil spills. The DEIS's assertion that the no action alternative will lead to an increased risk of oil spills is particularly egregious given that much of the oil produced from the proposed lease sale would be shipped to markets on the U.S. west coast and Asia via oil spill-prone tankers.

[2] Section 5.3 Economic Life, TAPS Owners' Right of Way Renewal Application

Analysis of Current Energy Needs

One cannot readily discern from this document what predicted oil quantity will meet our "national need." Furthermore, the amounts projected to be found in the Central and Western Gulf of Mexico should be compared with those expected to be found in Alaska.

Analysis of Alternative Energy Options

The DEIS's analysis of the no action alternative is a huge fossil fuel shell game. It assumes that any oil left underground by not moving forward with the lease sale will be replaced, for the most part, by fossil fuels from elsewhere. The DEIS lacks any meaningful or proactive analysis of the role that energy efficiency, conservation and renewable forms of energy can play in reducing the need for domestic and foreign oil. The problem is the oil, not whether it's produced domestically or imported.

The US must break its dependence on oil – be it foreign or domestic – if we are to achieve true energy independence and national security. The no action alternative is a first step in this direction. The no action alternative could have an even more profound impact on this country's energy landscape if coupled with a re-direction of billions of dollars in federal subsidies, tax breaks and incentives away from fossil fuels and toward renewable energy sources, energy efficiency and conservation. One recent example of relevant information outlining alternative energy and efficiency steps for the nation is "Dangerous Addiction: Ending America's Oil Dependence," a report from Natural Resources Defense Council and the Union of Concerned Scientists (2002) www.nrdc.org, The DEIS fails to include any analysis of these issues which are key benefits of the no action alternative. This analysis should be included in the FEIS.

The DEIS's analysis of the no action alternative does a woefully inadequate job of analyzing the various pros and cons of alternative fuels that would replace oil under this scenario. An example of this inadequate analysis is section 4.7.3.2 where nuclear power and wind power are examined. The DEIS blithely dismisses the potentially devastating impacts of nuclear power, whereas it paints a dismal picture of wind power. This sort of analysis appears throughout the DEIS, is deficient and misleading, and should be rewritten or struck from the FEIS.

Specifically, the DEIS says without support that, "Compared with other forms of large-scale electricity, **nuclear power has relatively minor environmental impacts** (emphasis ours)...without a doubt, the main environmental problem associated with nuclear power is finding socially acceptable, long-term repositories for the spent fuel rods that are removed from these plants" (page 4-195).

Although the DEIS also mentions that nuclear power plants can lead to temperature rises in water used for cooling the reactors and that containment vessels can cause "visual aesthetic degradation," the DEIS fails to include the fact that that the federal government's attempts to dispose of "low level" waste have been an abysmal failure and have created an environmental problem as well. The government has licensed seven sites in the United States to bury low-level radioactive wastes. However, only three of these low-level waste dumps are in operation. They are located in Hanford, Washington;

Clive, Utah; and Barnwell, South Carolina. The four closed dumps located in West Valley, New York; Maxey Flats, Kentucky; Beatty, Nevada and Sheffield Illinois have all leaked radiation in to the surrounding environment.

The DEIS also fails to mention that the U.S. government has acknowledged that reactors in the U.S. can have accidents with radioactive releases to the environment comparable to those that occurred at Chernobyl. In the wake of the accident at Chernobyl in Ukraine, the U.S. Nuclear Regulatory Commission was asked to testify before Congress concerning the potential for severe accident at a U.S. reactor. The NRC acknowledged that there was a 45 percent chance of a meltdown in the next 20 years. NRC Commissioner James Asselstine stated:

> While we hope that their occurrence is unlikely, there are accident sequences for U.S. plants that can lead to rupture or bypassing of containment in U.S. reactors which would result in the off-site release of fission products comparable or worse than the releases estimated by the NRC staff to have taken place during the Chernobyl accident (Testimony of NRC Commissioner James K. Asselstine before the Energy Conservation and Power Sub-committee of the House Committee on Energy and Commerce, May 22, 1986; Also Letter from NRC Commissioner James K. Asselstine to Carl Walske, President, Atomic Industrial Forum, Inc., July 15, 1986, p. 1.).

This is why the Commission told Congress recently that it could not rule out a commercial nuclear power plant accident in the United States resulting in tens of billions of dollars of property losses and injuries to the public (U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Conservation and Power, Hearing on Nuclear Reactor Safety, 99th Cong., 2nd Session, May 22 and July 16, 1986, p. 38.).

In 1990, The Wall Street Journal reported on a study conducted by a Soviet nuclear industry economist on the continuing economic disaster of the Chernobyl accident. The study found that the cost of the disaster had originally been underestimated; the accident may cost 20 times more than Moscow's original estimates. The accident contaminated approximately 12,400 square miles. The Wall Street Journal article concluded that, "The total bill suggests that the Soviet Union may have been better off if they had never begun building nuclear reactors in the first place." (Richard L. Hudson, Cost of Chernobyl Nuclear Disaster Soars in New Study, Wall Street Journal, March 29, 1990, p. A-8.)

The DEIS also ignores the enormous cost of nuclear power. In 1986, the U.S. Department of Energy compared nuclear construction cost estimates to the actual final costs for 75 reactors. The original cost estimate was $45 billion. The actual cost was $145 billion (U.S. Department of Energy, Energy information Administration, Analysis of Nuclear Power Plant Construction Costs, DOE/EIA - 0485, 1986). Forbes magazine recognized that this "failure of the U.S. nuclear power program ranks as the largest managerial disaster in business history, a disaster of monumental scale." According to Forbes, "only the blind, or the biased, can now think the money has been well spent" (James Cook, "Nuclear Follies", Forbes, Feb. 11, 1985).

In contrast, the DEIS painted a very grim picture of wind power, a renewable resource that is much more environmentally friendly than oil, natural gas, coal and nuclear energy. The DEIS says, "[w]ind power has not turned out to be the environmental panacea that some expected," and goes on to describe how wind farms lead to siltation in nearby streams, high raptor mortality, degrade visual aesthetics, interfere with transmission of electromagnetic signals and cause noise pollution (page 4-196). The two paragraphs devoted to wind power in the analysis of the no action alternative mention nothing about the gains made in the wind sector in the U.S. and Europe, the potential for wind and other renewable energy sources such as solar to revolutionize energy production in the U.S., and the significant environmental and social benefits that would result as wind (and solar) displace oil.

One source of more complete information on the status and potential of wind energy can be found in Fortune magazine. The November issue of Fortune contains a special section called "Beyond Oil" that includes an article called, "The Coming Hydrogen Economy." The article can be found at http://www.fortune.com/indexw.jhtml?channel=artcol.jhtml&doc_id=204821. What follows are a few excerpts that directly contradict the information presented in the DEIS:

> Hydrogen-powered fuel cells promise to solve just about every energy problem on the horizon. In homes and offices, fuel cells would keep the lights on when the grid can't. Cars propelled by the cells wouldn't foul the air. Hydrogen-based energy would mean less global warming as we shift away from fossil fuels....
>
> None of this is as pie-in-the-sky as it sounds. Potent commercial forces are bringing the hydrogen economy along faster than anyone thought possible only a few years ago. In the next two years, the first wave of products based on hydrogen-powered fuel cells is expected to hit the market, including cars and buses powered by fuel cells, and compact electric generators for commercial buildings and houses. Technology for generating hydrogen is ready now: "reformers" that extract hydrogen from natural gas, and "electrolyzers," Jules Vernian devices that extract hydrogen from plain water. Those electrolyzers, if powered by so-called renewable-energy technologies like wind turbines and solar panels, could truly put an end to oil. Wind turbines and solar panels are emerging fast; after long decades of development, they have entered a Moore's law-like pattern of rapidly falling costs. All these advances add up to a startling reality. Major oil companies have begun to bet quietly but heavily on a hydrogen future. So have many of the largest manufacturers, including United Technologies, General Electric, Du Pont--and every major car company.
>
> Around the industrialized world, the seeds of oil displacement are already visible. Next year, for instance, three major energy companies in Scandinavia plan to build a pilot plant to make hydrogen from wind power. While it's only a start, the implications are huge: Denmark, the world wind-power leader, already gets nearly 15% of its electricity from the wind. Use that electricity to produce

> hydrogen, and the Danes would have the energy equivalent of the euro: an energy currency that can be efficiently swapped for heat or locomotion, or turned back into electricity. And while electricity is hard to store in large quantities, hydrogen is easy. The Scandinavians plan to use it in fuel-cell-equipped buildings and vehicles--such as the hydrogen-powered buses that Daimler/Chrysler expects to roll out in Europe next year....
>
> The U.S. is rich with similar prospects. The windy Dakotas, if studded with twirling wind turbines, could become the Saudi Arabia of hydrogen. Spare megawatts from the 55 major dams along the Columbia River and its tributaries in the Pacific Northwest could be fed into electrolyzers, turning them into the equivalent of inexhaustible oil gushers. Hawaii could help too: its volcanically abundant geothermal energy could be tapped to generate electricity for churning out hydrogen....
>
> Europe's wind capacity could reach a staggering 60 billion watts by 2010, enough to serve 75 million people, according to the European Wind Energy Association. (By comparison, a large nuclear plant has a capacity of about one billion watts.) The U.S. lags behind Europe in developing wind power, but America's wind-generating capacity is ramping up fast--it's expected to increase by a whopping 60% this year, or 1.5 billion watts...
>
> Renewable energy, excluding hydropower, which currently dwarfs other renewables, provides only 2% of U.S. electricity today. But its potential is huge. The harnessable wind power in Midwestern and Western states alone could supply as much electricity during a 15-year period as all of Saudi Arabia's vast oil reserves if they were burned in power plants, according to a federal study....
>
> Like all gases, however, hydrogen can be compressed, so one proposed solution calls for cars to carry special tanks filled with pressurized hydrogen. Such tanks already exist, but more work is needed to establish safety standards for their widespread use in vehicles. (If hydrogen makes you think of the Hindenburg, think again: A 1997 report showed that the famous Zeppelin's skin was painted with chemicals used in rocket fuel. Ignited by static electricity, the chemicals probably were the main cause of its fiery 1937 demise, not the hydrogen inside. In fact, hydrogen dissipates so rapidly outside buildings that the risk of an explosion while gassing up a fuel-cell car with the stuff is practically nil.)...
>
> Uncle Sam's hydrogen to-do list might include:
>
> • Creating incentives to install methane reformers at 10% of the nation's service stations--the minimum deemed necessary to support initial mass commercialization of fuel-cell cars. The installations would cost a total of $4.1 billion, according to a study last year jointly funded by the DOE and Ford Motor.

> • Earmarking, say, $500 million a year through mid-decade to hurry wind, solar, and other renewable-energy technology. Tax incentives would help erect wind turbines; R&D grants might speed development of advanced "multilayer" solar cells, capable of cutting the cost of solar power in half.
>
> • Providing $500 million to ramp up fuel-cell manufacturing. The money would fund federal R&D matching grants for labs working on fuel-cell manufacturing processes. It would also pay for shifting federal vehicle fleets to fuel-cell technology, helping fuel-cell makers more quickly achieve economies of scale....

In addition to the information in Fortune, the FEIS's analysis of the no action alternative should include information from the Rocky Mountain Institute (www.rmi.org), the American Wind Energy Association (www.awea.org), the Renewable Energy Policy Project (www.repp.org), and other organizations that provide current information on renewable energy sources that paint a much more realistic picture of the potential of these cleaner, environmentally-friendlier forms of energy.

Our groups, our supporters and other members of the public have submitted similar comments to MMS in the past, and the agency has responded by saying that it's in the business of oil and gas drilling, and that it is not up to MMS to implement programs of energy efficiency, conservation or renewable energy. However, the world changed on September 11 and issues of national security are – for very good reason – at the forefront of the national agenda. Energy security is a crucial underpinning of national security, and this country will never have either so long as we are dependent upon oil. That's because the United States has only three percent of global oil reserves, meaning there is no way we will ever be able to drill ourselves to energy independence and security, even if we drill every last drop of oil out of Alaska. In this new, post-September 11 world, MMS must begin to look at its remit within the big picture of moving the US toward true energy security. That means undertaking a full-blown analysis of the no action alternative in the FEIS.

VIII. The Environmental Assessment of Lower Cook Inlet is Inadequate

MMS provides inadequate data on the important productivity at the entrance to Cook Inlet in the vicinity of the Barren Islands, Kennedy Entrance, and the Chugach Islands. This information needs to be included in the FEIS. U.S. Fish and Wildlife Service's Alaska Maritime National Wildlife Refuge and Exxon Valdez Trustee Council APEX project scientists have numerous years of data for this important region.

On Page 3-59, MMS needs to add to Physical Oceanography a full description of the pronounced productivity at Kennedy Entrance and in Kachemak Bay of Lower Cook Inlet. The upwelling, and resultant elevated productivity is the reason this area is a thriving commercial fishing area, home of some of the nations premier sea bird colonies, and supports numerous populations of marine mammals. Furthermore, Alaska Maritime National Wildlife Refuge staffs as well as Exxon Valdez Oil Spill Trustee Council

researchers have regularly observed high concentrations of humpback whales in lower Cook Inlet. MMS needs to recognize that humpbacks can be found in large concentrations in these areas and are not always in low density and distributed sparsely (page 2-5). Impacts to these whales if a spill affected the region are quite likely, and not improbable (page 3-66 and page 4-92).

The area of lower Cook Inlet and upper Shelikof Strait is also critical spawning habitat for walleye Pollock. MMS needs to recognize and highlight the potential impacts in this region for one of Alaska's preeminent commercial fish species (page 4-129).

IX. DEIS Analysis of Impacts to Wilderness is Inadequate

The DEIS fails to address impacts to wilderness values (pages 4-132 and 4-133), as well as to designated wilderness areas (other than a cursory look at air quality issues at Tuxedni National Wilderness Area along Cook Inlet) caused by oil spills, support infrastructure, noise from vehicles and buildings, air pollution, and habitat loss caused by the leasing program. For example, there is designated wilderness along the coastline in the northeast area of the Arctic National Wildlife Refuge. The DEIS fails to address potential impacts of a blowout or subsea pipeline spill from a well located offshore of the Arctic Refuge to its coastlines, lagoons, river delta wetlands, and barrier islands. The effects of a spill on the wilderness character of the Refuge would certainly be considered major.

On page 4-141, the section fails to adequately describe the wilderness recreation and hunting that takes place in the Arctic Refuge each year, including in the coastal lagoons and shorelines. As well as hiking or rafting down rivers to the coast, other visitors camp along its shorelines and boat to reach the area. The existence of ARCO's Warthog drill rig (the "CIDS") degraded the wilderness experience for many visitors while it was planted just 3 miles off the Arctic Refuge coastline in Camden Bay. Noisy development operations would also certainly degrade the natural quiet and natural qualities of the refuge. The effects to wilderness tourism and recreation from oil spills and industrialization of the ocean areas would be major, not minor to moderate.

X. Comments on Supporting Information Contained in Volume II

- Figure 3-28. The range map for the Porcupine herd is wrong. The range extends all the way west to the Canning/ Staines River (it overlaps with the Central Arctic Herd in this area; Clough, N.K., et al. 1987. Arctic National Wildlife Refuge, Alaska, coastal plain resources assessment – Report and recommendation to the Congress of the United States and final legislative environmental impact statement. Washington, DC. Fig. II-4, p. 21. See also Garner, G.W. and P.E. Reynolds. 1986. Final Report, Baseline study of the fish, wildlife, and their habitats. Section 1002C. U.S. Fish and Wildlife Service. Anchorage. Fig. 1, pp. 212.)

-Figures 3-31 and 3-32. These maps of conservation system units should also depict the designated wilderness areas in both regions.

-Table 4-2b indicates there would be MORE miles of offshore pipeline if the pace of leasing were "slowed" to 2 sales instead of 3, as shown in Table 4-1b. This is illogical and needs to be addressed.

-Table 4.1.e. We question the applicability of using the spill statistics based on Alaska North Slope onshore and TAPS spill rates, as these are not offshore facilities. Most importantly, they do not take into account the unique risks of buried subsea pipelines.

-A "large spill" was considered 4,600 bbl [193,200 gallons] for pipeline spill, and 1,500 bbl [63,000 gallons] for platform. However, neither of these are worst case spills. In particular, the 30-day blowout spill should be analyzed. The EIS should analyze the effects of a "worst-case discharge scenario", as required by 30 CFR 254 for oil spill response plans.

-Table 4-5d. Oil spill assumptions for No action. This analysis is clearly flawed since it does not consider the risks of oil spills from existing OCS leased areas in the Beaufort Sea from exploratory drilling or from the existing Northstar development project or the proposed Liberty project.

- In Appendix C. Oil-Spill Response Capabilities for offshore oil and gas operations, Section 6. Regional conditions affecting OCS Oil-Spill Planning and Response on page C-12. Alaska OCS Region. "Because of the remoteness, relatively short drilling season, and other logistical considerations, the MMS Alaska OCS Region does not require unannounced oil-spill drills for exploration drilling. Unannounced drills may be conducted in the future if production or other long-duration operations exist in the region." This statement is clearly outdated. Production has begun at the Northstar offshore field. Due to the short exploratory season, it would seem logical that MMS could find a way to schedule some unannounced visits. This explanation is a red herring.

-In Appendix D. Assumed mitigation measures. This EIS should analyze additional mitigation measures as lease sale stipulations, not merely Information to Lessees, including seasonal drilling restrictions and production restrictions for the open-water and broken ice period to reduce risks of oil spill impacts, oil spill response field drills, leak detection systems and double-walled pipelines, and measures to reduce potential effects on migrating bowhead whales during spring and fall migrations. We are concerned that this DEIS fails to analyze the environmental impacts of any mitigation measures, including lease sale stipulations, as it concedes: "None of the mitigation measures that were identified during scoping are analyzed in the DEIS." (p.1-3). The simple statement of status quo practices in Appendix D does not constitute the level of analysis required to meet the NEPA and ACMP requirements, especially when the public has found the existing stipulations to be inadequate for protecting the coastal environment. Many mitigating measures related to critical habitats for endangered species, monitoring

program requirements, and oil spill clean-up plan requirements are listed as non-binding "Information to Lessees" not as required lease stipulations.

-References Section. This should be included as part of the printed document. It is not ancillary.

XI. CONCLUSIONS

The Draft EIS fails to consider reasonable alternatives for limiting the geographic scope of the planning areas and lease sales in Alaska despite such requests from local communities and the public for the Beaufort Sea and other areas (pp. 1-10). For example, even though the one sale held in the last 5-Year Plan was dramatically scaled back to the area north of the existing State oil field and leased region (Beaufort Sea Sale 170), MMS rationalizes that the current planning areas (and therefore proposed lease sale areas) are largely similar to what was proposed in the prior 5-Year Plan. MMS should provide serious consideration of the substantial scientific and public concerns that shaped the decisions during the past five years. The MMS should also address scoping comments from local communities that opposed leasing and requested additional specific deferral areas for the three new proposed Beaufort Sea lease sales and the 5-Year Plan.

Alaska's seas are too productive and sensitive to threaten with OCS oil and gas development. Alaska's seas and coasts are by far the most biologically productive and sensitive of any in the entire nation, and among the most productive in the world. Alaska has the most abundant populations of fish, shellfish, marine mammals, and seabirds in the nation. Alaska's seas are economically important, sustaining over 100,000 jobs. Alaska is the only state in the nation where large portions of coastal residents depend on marine resources for subsistence. The fierce climatic conditions, high winds and seas, sea ice, and cold temperatures challenge offshore technologies far beyond their capabilities at present. These conditions make ecosystems more vulnerable and less resilient to disturbance and perturbations. Because of the inhospitable climate, challenging spill response and extreme productivity/sensitivity of the marine ecosystems off Alaska, this is the *last* place in the world that OCS exploration and development should be allowed. If moratoria are in place along the remainder of the U.S. coastline (except the Gulf of Mexico) then logic would dictate that at very least Alaska should be similarly exempted from leasing. Under the proposed alternative, Alaska shoulders more risk than any other state in the U.S., and the Alaska sale areas constitute the vast majority of acreage proposed for leasing. This is both unacceptable and dangerous to Alaska's unique environment.

Private Citizens

December 6, 2001

Austin Ahmasuk
P.O. Box 1292
Nome, AK 99762

Richard Wildermann
Branch of Environmental Assessment
Minerals Management Service
381 Elden Street
Herndon, VA 20170-4817

Dear Mr. Wildermann,

I am writing you in regards to the DRAFT Environmental Impact Statement for the OCS Oil and Gas Leasing Program: 2002-2007 Volumes 1 & 2.

I am an Inupiaq Eskimo born and raised in Nome, Alaska. I am a subsistence user, I live out of town, I am married and have three children. I feel that being a subsistence user depends a great deal on pristine waters, lands and air. The OCS Oil & Gas leasing program threatens the very existence of the subsistence livelihood that I have come to know. Throughout history my people have had to deal with development on many levels. Development for western peoples has usually meant destruction of Native ways. It has been long thought that the gold rush of 1899 to Nome was the death of many Native people. I believe that to be true. According to censuses done during that time there was a marked decrease to the Nome Native population and is likely to have been totally wiped out due to disease (*ADF&G, Subsistence Land Use in Nome, A Northwest Alaska Regional Center, J. Magdanz, A. Olanna, 1986*). I strongly believe the various waves of development that have swept through this town are decimating Native cultures to this day. For the first time in my life outsiders who have come to live in this community are asking that Subsistence be shut down. It is outside influences that I fear will have impacts on my life as a Native person, the proposed Oil & Gas Leasing program will bring in many outside influences. I see from the December 5, 2001 public hearing that Sitnasuak Native Corporation spoke for development in the OCS. I would like to strongly urge your organization to consider the following: Alaska Native Claims Settlement Act (ANCSA) Corporations are institutions that only a few Native people believe are representative of Native interests. I do not believe that ANCSA Corporations are synonymous with Native interests. You must recognize that ANCSA Corporations have one agenda and that is to make money. I have strongly spoken out against Sitnasuak for not representing Native people and subsistence issues, I know many shareholders feel the same way I do.

In the Nome sub-district salmon numbers are so low that a TIER II fishing scheme has been in place for the last three years, the only such TIER II fishery in the state of Alaska. Many scientists believe that ocean survival is a major factor in the health of our salmon streams. The EIS only lightly touches on impacts associated with fish productivity. Additionally, the EIS only lightly touches on impacts to marine mammals, birds and terrestrial mammals. In recent years the moose population has been very low and with competing interests vying to hunt from a

resource that is popularly thought to be healthy, has put Seward Peninsula moose in the situation we have today whereby bull to cow ratios are so low that seasons have been dramatically shortened. I believe the reason for the low moose are sport hunting interests, something that the EIS does not even consider a likely impact. Certainly outsiders will find that living and working in this area of Alaska may not be all that it is cracked up to be and will find ways to spend their recreation time such as hunting. And then there are the marine mammal impacts, the whale is the most highly sought after game animal in the ocean and great amounts of time and work are devoted to hunting the whale. Saint Lawrence Island hunters have told me that they do not want any noise producing boats or ships in the area when they are hunting. The EIS mistakenly portrays the Subsistence hunt as one that produces high frequency noises such as outboard motor use in the pursuit of the whale. Being a subsistence hunter I know that a great deal depends on how quiet your hunting activities are in order for success.

I do not favor Oil & Gas Leasing in the Norton Basin and Hope Basin, and you should not for one second think that you have support of Native people just because an ANCSA Native Corporation gives support. If and when you hear from Tribes or tribally authorized agencies in the near future only then can you say that you have heard what Native people have to say about this issue. Thank you for your time and consideration.

Sincerely,

Austin Ahmasuk

Minerals Management Service
381 Elden Street
MS 4320
Herndon, Virginia 20170-4817,

January 21, 2002

Dear Minerals Management Service-

I oppose leasing and drilling for oil in Alaska's waters as described in the 5-year leasing program Draft environmental Impact Statement (DEIS). The risk of oil spills, global warming and other environmental impacts of oil exploration, drilling, production and transportation are too great to justify moving forward *with new lease sales in Alaska's waters.* Lessons of the Exxon Valdez Oil Spill (EVOS) show categorically that: catastrophic marine spills are to be expected because they can be caused by extremely simple errors, mechanical or human. Furthermore, large marine spills cannot be contained; they cannot *be recovered from the sea surface;* and they cannot be cleaned from beaches. The ecological, economic, and social impacts can be enormous because oil spills cannot be effectively mitigated or restored. The overall lesson of this is that we simply shouldn't be messing with oil in productive and sensitive marine *environments – either drilling it or shipping it.*

The DEIS for the 5-year federal leasing plan asserts that domestic drilling is necessary to satisfy US *energy demands and to reduce reliance on oil imports.* The document fails to mention that the US has only three percent of global oil reserves. The US will never drill its way to energy security and independence, even if every last drop of oil is drilled from federal waters off the coast of Alaska.

The federal government has a responsibility to implement cleaner, climate-friendly forms of energy such as solar and wind in order to protect the environment and move this country toward energy security and *independence.*

Moving forward with this lease sale is a step in the wrong direction. Please choose the "no action" *alternative to drilling,* and instead, shift resources toward the development of renewable forms of energy such as solar and wind.

Sincerely,

Melissa Pici
10232-F Manassas Mill RD
Manassas, VA 20110

202-234-6049

Don Hall
712 Compton Rd. , Murfreesboro, TN 37130

January 15, 2002

5-Year Program Manager Minerals Management Service (MS-4400)
381 Elden Street, Room 2324
Herndon, VA 20170

Subject: Oppose New Offshore Oil Drilling Plans

Dear 5-Year Program Manager Minerals Management Service (MS-4400):

I write to comment on your agency's preparation of the nationwide Five-Year Offshore Oil and Gas Leasing Program for 2002-2007.

I urge you to drop plans for additional offshore drilling in sensitive Alaskan waters. Oil drilling in these fragile areas will result in unwarranted environmental risks, due to well-documented failures of oil spill cleanup equipment in severe weather and where sea ice is present. Expanding drilling in Alaska's Cook Inlet would ignore recent pipeline leaks and discharges which have plagued this area. Drilling in undeveloped "frontier" waters offshore Alaska threatens important fisheries and can be expected to increase oil spills as additional "Exxon-Valdez" types of tanker accidents occur as a result of petroleum transport.

I also request that you suspend plans to initiate drilling operations and permit risky floating oil storage vessels in the Lease Sale #181 area of the Eastern Gulf of Mexico. Serious oil spill threats associated with planned deepwater drilling, as well as seismic survey noise impacts on endangered Sperm whales, must be resolved prior to drilling in this area.

The Interior Department should fully respect the bipartisan congressional offshore drilling moratorium, and abide by the presidential "2012" drilling deferrals previously issued by Presidents George Bush, Sr. and Bill Clinton, both of whom concluded that available scientific data does not support a decision to allow new rigs within the moratorium areas.

Thank you for your attention to these concerns, and please enter this letter into the legal record on the Five-Year Leasing Program and the Program's Environmental Impact Statement. I look forward to your agency's comprehensive written response to each of the issues I have raised, as required by law.

It is about time we starting working towards conservation to reduce our dependency on drilling.

Sincerely,

Don Hall

202-234-6049

Bela Johnson
PO Box 1127 , Holden, ME 04429

January 18, 2002

5-Year Program Manager Minerals Management Service (MS-4400)
381 Elden Street, Room 2324
Herndon, VA 20170

Subject: Oppose New Offshore Oil Drilling Plans

Dear 5-Year Program Manager Minerals Management Service (MS-4400):

I write to comment on your agency's preparation of the nationwide Five-Year Offshore Oil and Gas Leasing Program for 2002-2007.

I urge you to SUPPORT plans for additional offshore drilling in Alaskan waters. Oil drilling in these areas will result in NO environmental risks, VERY FEW if any oil spills are due to drilling. Expanding drilling in Alaska's Cook Inlet would ignore recent pipeline leaks and discharges which have DO VERY LITTLE DAMAGE to this area. Drilling in undeveloped "frontier" waters offshore Alaska WILL NOT EFFECT fisheries. "Exxon-Valdez" types of tanker accidents,NOT DRILLING,are the main problem.

I also request that you SUPPORT plans to initiate drilling operations and permit floating oil storage vessels in the Lease Sale #181 area of the Eastern Gulf of Mexico. Serious oil spill in the gulf have never been a problem,deep water drilling, as well as seismic survey noise have NOT BEEN PROVEN TO have an impacts on endangered Sperm whales.

The Interior Department should fully IGNORE the ILL imformed congressional offshore drilling moratorium.

Thank you for your attention to these concerns, and please enter this letter into the legal record on the Five-Year Leasing Program and the Program's Environmental Impact Statement. I look forward to your agency's comprehensive written response to each of the issues I have raised, as required by law.

Sincerely,

Bela Johnson

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.

20 Years of Service to America
MMS
Minerals Management Service