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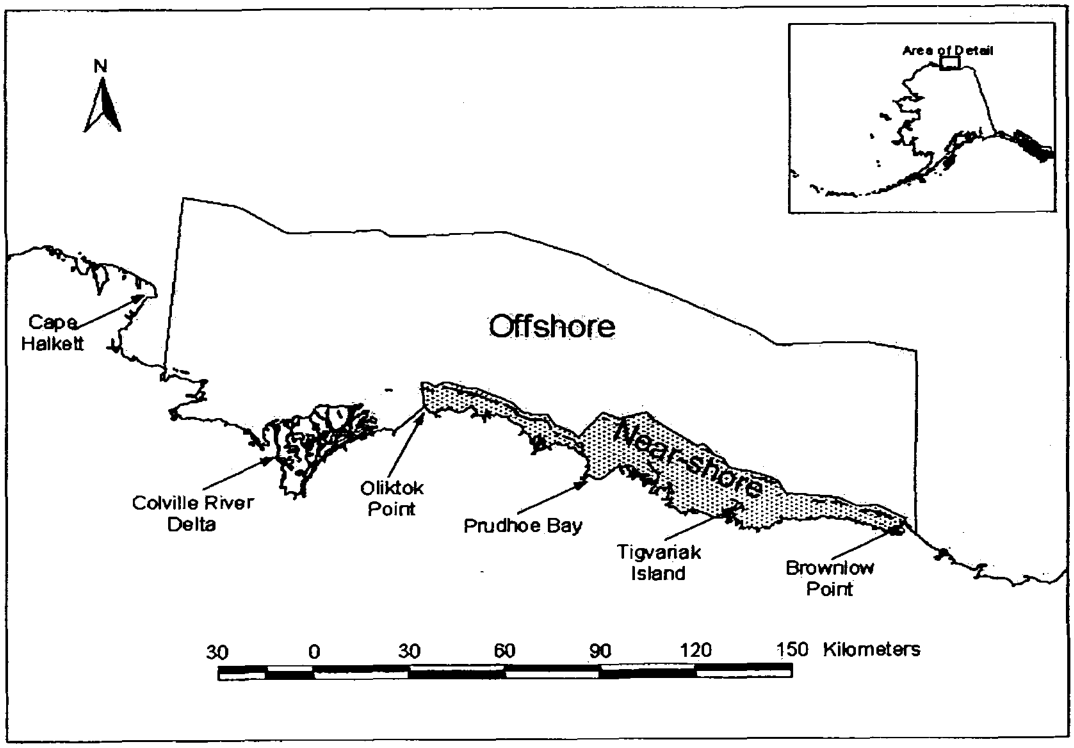
MMS 2002-002

Monitoring Beaufort Sea Waterfowl and Marine Birds Aerial Survey Component



Prepared for
U.S. Department of Interior
Mineral Management Service
Alaska OCS Region
949 East 36th Street
Anchorage, Alaska 99508

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Monitoring Beaufort Sea Waterfowl and Marine Birds Aerial Survey Component

By

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ABSTRACT

The U.S. Department of Interior investigated potential disturbance effects of human activities on the distribution and density of Long-tailed Ducks (*Clangula hyemalis*), and eiders (*Somateria spp.*) in lagoons and offshore waters of the south-central Beaufort Sea. The primary objectives of this study were to compare Long-tailed Duck population trends between "industrial" and "control" areas, describe the relationship between bird density and human activities, and document distribution patterns of eiders and other marine birds in the south-central Beaufort Sea. We used existing protocol (OCS-MMS 92-0060) to conduct 12 replicate Near-shore aerial surveys in Beaufort Sea lagoons between Oliktok Point and Brownlow Point. These data were collected in 1999 and 2000 and were compared with historic data collected in 1990-1991. We also modified the survey protocol to conduct 6 Offshore aerial surveys between Cape Halkett and Brownlow Point, Alaska.

We observed 33 marine bird taxa on Near-shore and Offshore surveys combined. A comparison between 1990 and 2000 revealed a significant negative trend in density of Long-tailed Ducks within the Near-shore survey area. Although densities decreased overall, trends in density were the same among "Industrial" and "Control" transects. Similarly, distribution patterns were not significantly related to sources of potential disturbance such as boat traffic, low-level aircraft over-flights, or human activities on shore adjacent to survey transects. Statistical tests may fail to detect effects of human activities on bird densities even if they exist due to inherent stochasticity in sea duck populations, high standard errors associated with aerial survey techniques, long-term changes in barrier island habitat, intrusion of human activities into the "Control" site, and unidentified components of variation.

We identified several areas that appear to be important to marine birds. King (*Somateria spectabilis*) and Spectacled Eiders (*S. fischeri*) were concentrated in Harrison Bay, where high densities of Scoters (*Melanitta spp.*), and Red-throated (*Gavia stellata*) and Yellow-billed Loons (*G. adamsii*) were also observed. High densities of Common Eiders (*S. mollissima*) and Long-tailed Ducks were found in Barrier Island Habitat, particularly among the Stockton Islands. Finally, Scoters were concentrated in Mid-lagoon habitat in western Simpson Lagoon.

As an alternative to aerial surveys for evaluating effects of human activities, we suggest measuring behavioral responses of individual birds to disturbances of known size and duration. This direct measure could document immediate changes in distribution in a controlled setting. This approach may also identify what activities have measurable effects and predict the potential duration of these effects. Further, we suggest future surveys employ a sampling design that includes systematic transects with random starting points to provide an unbiased sample of multi-species distribution, abundance, and habitat preference.

KEY WORDS: Beaufort Sea; marine birds; sea ducks; lagoons; Long-tailed Duck; *Clangula hyemalis*; Common Eider; *Somateria mollissima*; King Eider; *Somateria spectabilis*; Spectacled Eider; *Somateria fischeri*; Northstar; aerial survey; OCS, offshore.

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INTRODUCTION

Since the discovery of oil and gas on the Alaskan Arctic Coastal Plain, interest in maintaining healthy wildlife populations has accompanied industrialization of the region. Recent expansion of oil and gas development from on-shore sites into the near-shore waters of the Beaufort Sea raised concerns that wildlife using these waters may be at risk to disturbance and oil spills (US Army Corps of Engineers 1999). Wildlife species of particular concern to managers are more than one hundred thousand sea ducks and other marine birds that use the Beaufort Sea each summer (Johnson and Herter 1989, USFWS 1999). Despite high abundance of sea ducks in the Beaufort Sea, recent declines in some sea duck species have been documented state-wide and along the Arctic Coastal Plain (Goudie et al. 1994, Suydam et al. 2000, US Fish and Wildlife Service 1999). One potential threat to these birds in the Beaufort Sea is disturbance resulting from human presence on barrier islands and increased boat and air traffic in near-shore and offshore waters (Gollop et al. 1974; Johnson 1982, 1984; Schamel 1974). These potential disturbances are expected to increase within the Northstar unit where development of offshore oil and gas reserves is underway.

To address the potential threats to these wildlife resources, the Outer Continental Shelf Lands Act and its amendments include provisions for post-lease monitoring studies to identify environmental changes, establish trends in marine bird populations, and design experiments to identify the causes of any changes (Johnson and Gazey 1992). Accordingly, the Minerals Management Service and the USGS Biological Resources Division signed an Intra-agency Agreement in 1999 to assess impacts of human activities on distribution and density of Long-tailed Ducks in Beaufort Sea lagoons. To accomplish this, the USGS-BRD subcontracted the Waterfowl Branch of the USFWS Migratory Bird Management Division to conduct a Near-shore aerial survey in 1999 and 2000 using existing MMS protocol (OCS- MMS 92-0060). This protocol was designed to measure effects of near-shore industrialization on marine bird abundance and distribution (Johnson and Gazey 1992). Rather than test for industry effects on all species, the protocol identified the Long-tailed Duck (*Clangula hyemalis*) as a focal species to test for industry effects due to its relative abundance within the area of interest. We used this protocol to collect density and distribution data on Long-tailed Ducks in 1999-2000 to compare relative densities between an "industrial" and "contol" area. These areas were delineated in the early 1990s at a time when human activity was concentrated in the "industrial" area (Johnson and Gazey 1992). In addition, we sought to identify the relationship between bird density and human activity.

Although human disturbance may have indirect effects on marine birds, an oil spill could directly expose birds to oil and cause mortality in some individuals of these species (Stehn and Platte 2000). The probability and relative severity of oil spill impacts on population status depends on the temporal and spatial distribution of marine birds in the region. To understand marine bird distribution in the region we expanded aerial surveys throughout the near-shore environment between Oliktok Point and Brownlow Point.

The Near-shore aerial survey protocol provides a means to monitor trends and distribution patterns of bird populations close to shore, but bird use of offshore waters is poorly documented. Previous studies demonstrated that Spectacled Eiders (*Somateria fischeri*), a threatened species, use offshore waters extensively (Petersen et al. 1999). Surveys in the Canadian Beaufort Sea revealed that eiders used waters as far as 115 km from shore (Searing et al. 1975). Thus, we designed an Offshore survey to delineate concentrations of eiders and other marine birds that use waters within and beyond the barrier island lagoons between Cape Halkett and Brownlow Point. In contrast to the Near-shore survey that was designed to detect small-scale distribution patterns within the barrier island lagoons, the Offshore survey covered a much larger area. Consequently, inferences drawn from the Offshore survey are not limited to small-scale localized patterns of distribution.

The specific objectives of this study were to:

1. Monitor Long-tailed Ducks and other species within and among "industrial" and "control" areas using existing protocol (OCS-MMS 92-0060).
2. Use data from 1999-2000 and data collected by Johnson and Gazey (1992) in 1990-1991 to compare Long-tailed Duck population trends between "industrial" and "control" areas, and to describe the relationship between distribution patterns and human activities.
3. Expand the Near-shore survey area to encompass habitats between the original "industrial" and "control" areas, and sample Near-shore Marine habitat from Oliktok Point to Brownlow Point to delineate small-scale distribution patterns of marine birds throughout the expanded study area.
4. Correlate variation in marine bird populations with environmental factors, human activities, and temporal and spatial variables.
5. Implement an Offshore survey that targets Spectacled (*Somateria fischeri*), Common (*S. mollisima*) and King Eiders (*S. spectabilis*).
6. Document distribution patterns of marine birds within the Offshore survey area.

METHODS

U.S. Fish and Wildlife personnel completed a series of 12 Near-shore and 6 Offshore aerial surveys between Cape Halkett and Brownlow Point, Alaska in 1999-2000 (Fig. 1). These efforts replicated historical Long-tailed Duck surveys, expanded the geographical extent of sampling, and widened the breadth of analysis to include all marine birds in Central Beaufort Sea waters. To accomplish these tasks, we conducted separate Near-shore and Offshore surveys.

Near-shore Survey Methods

We completed 12 Near-shore aerial surveys from 1999-2000 using a standard protocol (OCS-MMS 92-0060) developed by Johnson and Gazey (1992) based on nine years of aerial survey data (1977-1984, 1989). They tested this protocol using two additional years of data (1990-1991) and recommended the technique be applied for subsequent comparable data collection and analysis. Thus, we collected comparable data in 1999-2000, combined these data with those collected by Johnson and Gazey in 1990-1991, and used the combined data set to compare trends in Long-tailed Duck density between an "industrial" and "control" site, and to identify a relationship between density and human activities.

We surveyed 24 established transects that passed through three habitats in two areas (Fig. 2). Habitats sampled included Barrier Island (lee side of the barrier islands), Mid-Lagoon (midway between barrier islands and mainland shoreline), and Mainland Shoreline (mainland coast). These habitats were sampled in two separate regions that represented an "Industrial" area between Oliktok Point and Prudhoe Bay, and a "Control" area between Tigvariak Island and Brownlow Point.

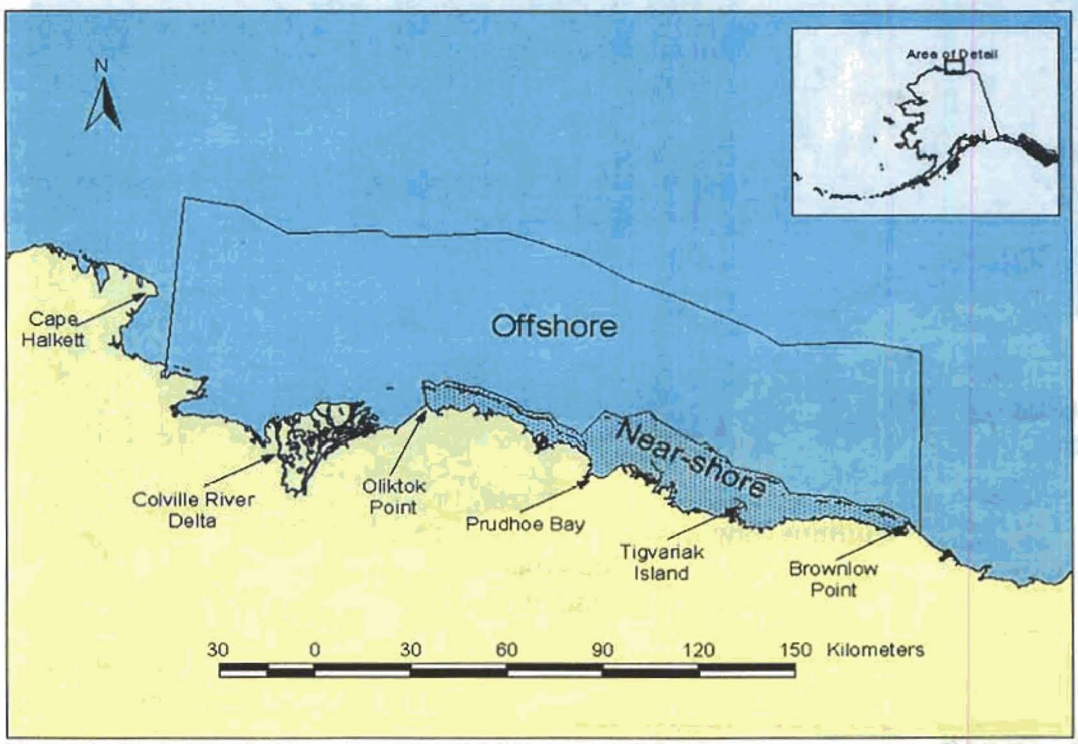

Figure 1. Study area for Near-shore and Offshore marine bird surveys, Beaufort Sea, Alaska, 1999-2000.

In addition to monitoring Long-tailed Ducks in these two regions, we recorded all marine birds in an expanded survey area that included a fourth habitat called Near-shore Marine (1.5 km north of Barrier Islands). We sampled these four habitats in the "Industrial" and "Control" areas, and in the "Central" area between Prudhoe Bay and Tigvariak Island (Fig. 3). The resulting 44 transects spanned 723 km and sampled 289 sq. km of near-shore waters (Table 1).

We completed 6 Near-shore surveys between mid-July and early September in both 1999 and 2000. This period corresponded with the Long-tailed Duck flightless molt when populations are relatively stable (Johnson and Gazey 1992). To sample this period evenly, we attempted to space our replicates approximately 1 week apart, although occasional poor weather precluded strict adherence to the 7-day sampling interval.

We used a single-engine Cessna as the survey sample platform for 10 of the 12 replicates (Table 2). Mechanical difficulties in 1999, however, required us to use a twin-engine Aero Commander to complete 2 replicates. We maintained survey altitude and speed at 30-45 m and 160-180 km/hr, respectively. While on transect, we recorded all birds within 200 m of either side of the aircraft. In addition to recording bird observations, we estimated wind speed, wave height, and ice cover associated with each transect.

Prior to conducting surveys, observers were trained in flock size estimation using computer simulation software. The simulation software, "Counting Wildlife", is a tool for estimating wildlife populations from the air (Hodges 1993). Designed specifically for aerial surveys of waterbirds, the program simulates realistic flocks of birds in clumped, non-normal distributions. At the end of a series of random test trials, results are displayed showing the observer's estimate and the percent error. By providing scores by trial, this program helps

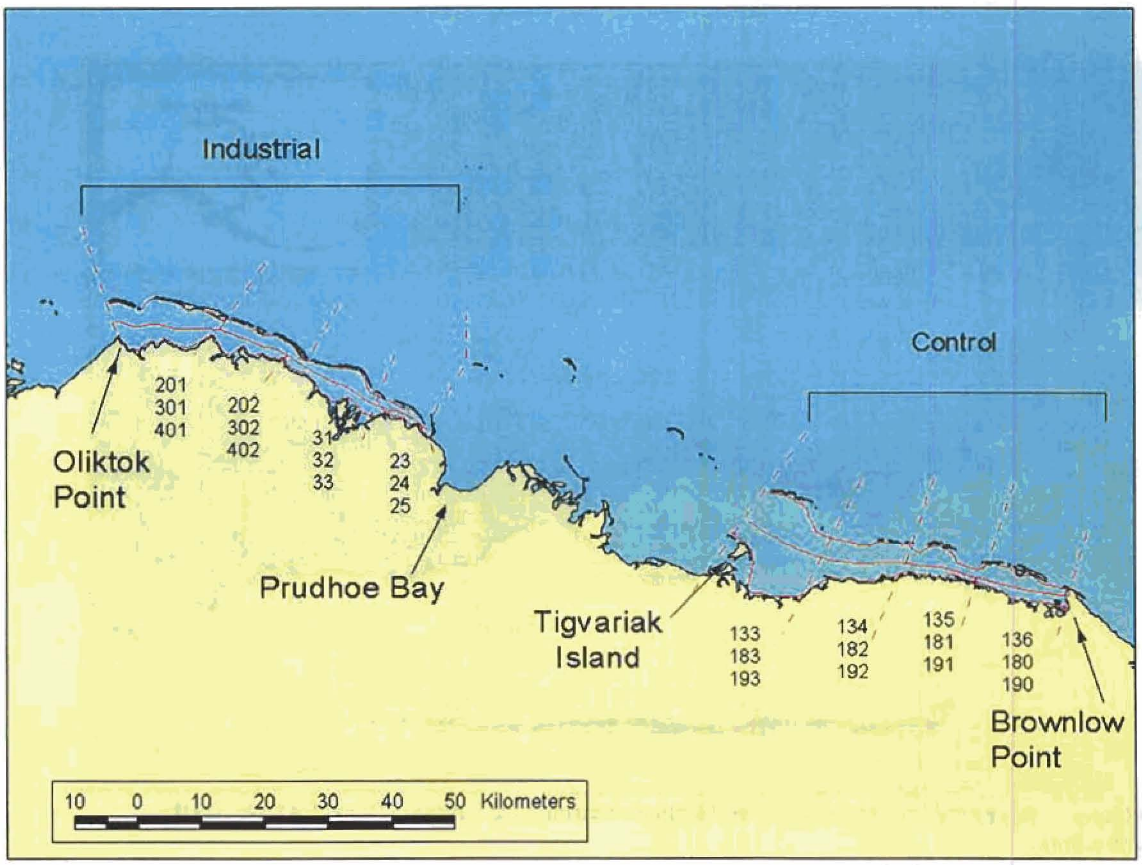

Figure 2. Aerial survey transects in Industrial and Control areas, Beaufort Sea, Alaska.

observers identify inherent bias in counts prior to actual aerial surveys, promotes improvement in accuracy, and helps standardize flock size estimation among observers. To aid in accurate transect width estimation, we used markings on the aircraft wing struts that were calibrated with clinometers. Similarly, prior to conducting surveys observers practiced estimating transect width by flying over markers at varying survey altitudes. All individuals who participated in this study had prior experience in aerial surveys of waterbirds in Alaska.

We improved the data recording protocol described by Johnson and Gazey (1992) by implementing standard aerial survey procedures used by USFWS Division of Migratory Bird Management. This method combines direct voice input data with position data continuously received from the aircraft's Global Positioning System (GPS). This provides position coordinates and time of day for all bird observations. Rather than recording data during 30-second intervals, as described by Johnson and Gazey (1992), we recorded continuously along transects, enabling greater accuracy in mapping of bird distribution. Moreover, we used the system's Moving Map function to display and navigate along fixed "electronic" transects for more precise replication of survey lines.

Following each survey, we transcribed digital voice recordings using customized software. In this process, bird observations were linked to position data, covariates and weather variables. We then checked all entries for accuracy. Next, we subjected the data files to a customized computer check program that identified missing or miscoded data, interpolated positions where latitude and longitude data were missing, calculated distance and area surveyed, and performed a datum shift on position data to adjust GPS data collected in NAD83 to correspond with USGS NAD27 maps. After completing these steps, we generated ArcInfo coverages from bird location files. Finally, these coverages were imported into ArcView to produce distribution maps.

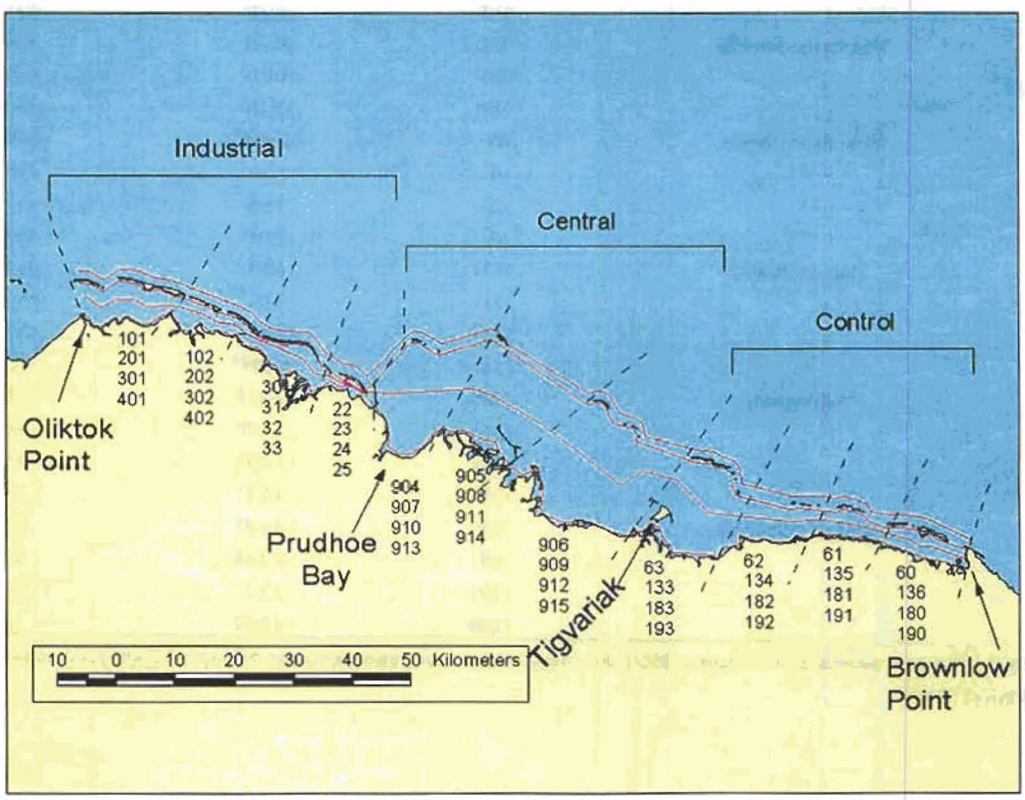

Figure 3. Aerial survey transects in an expanded Near-shore survey. Sampling occurred in four habitats among three areas.

Table 1. Transect length and area surveyed during 12 Near-shore aerial surveys, Beaufort Sea, Alaska, 1999-2000.

Area	Habitat	Transect	Length (km)	Km^2 Surveyed
Industrial	Near-shore Marine	22	17.53	7.01
		30	13.53	5.41
		101	22.08	8.83
		102	16.25	6.50
	Barrier Island	23	10.83	4.33
		31	13.98	5.59
		201	21.80	8.72
		202	15.38	6.15
	Mid-lagoon	24	9.83	3.93
		32	15.33	6.13
		301	18.23	7.29
		302	13.25	5.30
	Mainland-Shoreline	25	11.88	4.75
		33	19.73	7.89
		401	18.93	7.57
		402	14.73	5.89
Central	Near-shore Marine	904	16.55	6.62
		905	21.48	8.59
		906	20.68	8.27
	Barrier Island	907	25.10	10.04
		908	21.35	8.54
		909	20.90	8.36
	Mid-lagoon	910	15.53	6.21
		911	17.03	6.81
		912	24.68	9.87
	Mainland-Shoreline	913	19.28	7.71
		914	14.10	5.64
		915	32.30	12.92
Control	Near-shore Marine	60	13.63*	5.45*
		61	12.43	4.97
		62	12.83	5.13
		63	14.38	5.75
	Barrier Island	133	16.73	6.69
		134	13.85	5.54
		135	14.35	5.74
		136	15.90*	6.36*
	Mid-lagoon	180	14.58	5.83
		181	11.70	4.68
		182	13.55	5.42
		183	14.35	5.74
	Mainland-Shoreline	190	16.45	6.58
		191	13.48	5.39
		192	17.33	6.93
		193	18.90	7.56

* Transects 60 and 136 were truncated on 15 August 2000, due to fog. On that day, transect 60 was 5.75 km (2.3 km^2) and transect 136 was 6.43 km (2.57 km^2).

Table 2. Aerial survey flight specifications.

Survey Type	Year	Date	Aircraft	Altitude (m)	Speed (km/hr)	Survey Crew
Near-shore	1999	July 22	Cessna-185	30-45	160-180	T.J. Tiplady, W.W. Larned
		July 30	Aero Commander			T.J. Tiplady, R.M. Platte
		Aug. 11	Cessna-185			T.J. Tiplady, E. Taylor
		Aug. 26	Cessna-185			T.J. Tiplady, C.P. Dau
		Sept. 2	Aero Commander			T.J. Tiplady, S. Kendall
		Sept. 8	Cessna-185			T.J. Tiplady, E.J. Mallek
	2000	July 21				J.B. Fischer, E.J. Mallek
		Aug. 1				J.B. Fischer, E.J. Mallek
		Aug. 7				J.B. Fischer, E.J. Mallek
		Aug. 15				J.B. Fischer, E.J. Mallek
		Aug. 24				J.B. Fischer, E.J. Mallek
		Aug. 31				J.B. Fischer, E.J. Mallek
Offshore	1999	June 28-30	Aero Commander	90	200	T.J. Tiplady, D.K. Marks
		July 27-31		45	180	T.J. Tiplady, R.M. Platte
		Aug. 31-Sept. 3				W.W. Larned, J. Stich
	2000	June 24-27				J.B. Fischer, A. Brackney
		July 25-28				J.B. Fischer, D.K. Marks
		Aug. 25-30		90	200	J.B. Fischer, D.K. Marks

Near-shore Survey Data Analysis

EFFECTS OF HUMAN ACTIVITIES ON LONG-TAILED DUCKS

We used the general linear models designed by Johnson and Gazey (1992) to identify the effects of human activities on Long-tailed Ducks. We limited data analysis to 24 transects in Barrier Island, Mid-lagoon, and Mainland Shoreline Habitats within "Industrial" and "Control" areas. We combined data collected by LGL Ltd. in 1990-1991 with data collected by USFWS in 1999-2000. We first calculated Long-tailed Duck density for each transect on each survey day. We calculated density as the number of individuals per transect divided by transect area (transect length*400m). We then log transformed these density estimates (Ln [density+1]) to better meet the assumptions of normality required by parametric statistics (Johnson and Gazey 1992). Next, we subjected the dependent variable (log density) to a mixed-effects nested ANOVA and ANCOVA (Table 3) as specified by Johnson and Gazey (1992). These models were considered "mixed" because they incorporated both fixed and random factors. For example, Disturbance, Year, and Area were fixed factors, while Habitats and Transects were considered random factors. Unlike a factorial ANOVA that uses the residual error for calculation of the test statistic, a mixed-effects model uses specific error terms appropriate for particular tests (Table 3).

Table 3. Factors and error terms used to calculate F-statistic in ANOVA and ANCOVA models.

Term	Code	Error Term
Disturbance	D	Residual Error
Area	A	H(A)
Year	Y	YH(A)
Area*Year	AY	YH(A)
Habitat(Area)	H(A)	TH(A)
Year*Habitat(Area)	YH(A)	YT(H(A))
Transect(Habitat(Area))	T(H(A))	Residual Error
Year*Transect(Habitat(Area))	YT(H(A))	Residual Error
Ln (Wave+1)	W	Residual Error

Anova Model: Ln(Density+1) = Constant + D + A + AY + H(A) +YH(A) + T(H(A)) + YT(H(A))

Ancova Model: Ln(Density+1) = Constant + D + A + AY + H(A) +YH(A) + T(H(A)) + YT(H(A)) + W

In addition to having fixed and random factors in these models, some factors were nested. For example, Habitat was nested within Area. That is, a given Habitat was considered within the context of a given Area. Constructing the model in this fashion provided a means for comparing Area-Habitat strata. For example, if Long-tailed Duck densities in Mainland Shoreline habitat were not the same in the Industrial and Control areas, then the nested Habitat(Area) term would be significant. Similarly, Transects were nested within Habitat and Area; thus, transects were considered within the context of a particular Habitat in a specific Area.

To compare Long-tailed Duck population trends among the "Industrial" and "Control" areas, we examined the p-value associated with the Area*Year term. A significant Area*Year term would indicate that trends in density estimates were different between the "Industrial" and "Control" areas.

To determine if Long-tailed Duck densities were significantly related to human activities, we examined the p-value of the Disturbance term in the ANOVA model. The Disturbance term was based on human activities that we recorded on transect (boat traffic, low-level aircraft overflights [< 150 m], and land-based human activities [workers on land adjacent to transect]). We then applied an ordinal Disturbance code to each transect for each survey (1= 0 occurrences, 2= 1-5 occurrences, 3= 5-10 occurrences, 4= >10 occurrences; Johnson and Gazey 1992).

In accordance to MMS protocol (Johnson and Gazey 1992), these tests were re-assessed using ANCOVA. The process was identical to the ANOVA, with the exception that the covariate term Wave height was included in the model (Table 3). Wave height was calculated as Ln(Wave height in inches+1), and was estimated for each transect during all surveys (Johnson and Gazey 1992). Introduction of this covariate provided a control for lower sightability of Long-tailed Ducks due to high waves.

DISTRIBUTION IN THE NEAR-SHORE ENVIRONMENT

To assess distribution patterns of marine birds in 1999 and 2000, we log transformed (Ln[density+1]) densities of all taxa recorded on 44 transects in Near-shore Marine, Barrier Island, Mid-lagoon, and Mainland Shoreline Habitats, within "Industrial", "Central" and "Control" areas. We then subjected these data to an ANCOVA model to assess how densities varied both among and within 12 Area-Habitat strata (4 Habitats nested in 3 Areas) while controlling for Year, Time of Day (morning, midday, afternoon, evening), and Wave Height (Ln[Wave height in inches+1]). To identify differences among strata we assessed the significance of the Habitat(Area) term. Similarly, to identify differences within strata we assessed the significance of the Transect(Habitat(Area)) term. We then used Sheffe multiple comparison methods to identify where differences occurred when terms were significant (Kleinbaum et al. 1988).

ASSESSING BIAS IN NEAR-SHORE SURVEYS

Mechanical difficulties in the single-engine survey aircraft in 1999 forced USFWS survey crews to use a twin-engine aircraft as an alternate survey platform during two replicates of the Near-shore survey. Because this change may have influenced density estimates of marine birds, we tested the effect of Survey Platform on density of Long-tailed Ducks in two ways. First, we used an independent two-tailed *t*-test to compare Long-tailed Duck log densities estimated from the single-engine platform with those estimated from the twin-engine platform. This test used Long-tailed Duck density as the independent variable and Survey Platform (single engine, twin engine) as the grouping variable. Second, we included a Platform factor (single-engine, twin-engine) in the ANOVA and ANCOVA models developed by Johnson and Gazey (1992) and re-evaluated the inter-area trend comparisons.

Offshore Survey Methods

The Offshore survey was designed specifically to monitor Spectacled Eider use of near-shore and offshore waters. Accordingly, transects were established in 1999 within areas of known Spectacled Eider presence as determined from telemetry studies (Petersen et al. 1999). This area included 36 transects spanning from Cape Halkett to Bullen Point (Fig. 4, transects 1-36). Given the need, however, to obtain distribution and abundance data for marine birds within range of a potential oil spill (Stehn and Platte 2000), we extended coverage east to Brownlow Point in 2000 with the addition of 7 transects (Fig. 4, transects 37-43). Unlike the Near-shore survey, offshore transect lines ran perpendicular to shore for approximately 60 km. Due to persistent fog on transects, we were unable to survey the northern extent of all transects during every flight; thus, the area (km^2) surveyed varied between replicates (Tables 4, 5). While on transect we recorded bird observations within 200m of both sides of the aircraft. Transects were spaced 5.4 km apart providing a 7.4% sample of the study area.

We completed 3 Offshore surveys in both 1999 and 2000. The surveys were conducted at the end of June, July, and August in each year. This timing was planned to coincide with estimated peaks of offshore abundance for local breeding Spectacled Eiders (i.e., exodus of breeding males [late June], failed or non-breeding females [late July], and successful breeding females with broods [late August]). Appropriate dates for surveying King (*Somateria spectabilis*) and Common Eiders (*S. mollisima*) were expected to be similar.

We contracted a twin-engine Aero Commander as a survey platform for the Offshore survey. Most surveys were flown at 45m and 180km/hr. Due to safety concerns, however, surveys in June 1999 and August 2000 were flown at approximately 90m and 200km/hr. Data recording methods were similar to the Near-shore survey. Specifically, we recorded bird observations directly as voice inputs into onboard computer systems interfaced with GPS; used a computerized moving map to navigate along fixed "electronic" transects for precise replication; and recorded wind speed, wave height, and percent ice cover on each transect within a strata.

As in the Near-shore surveys, individuals who participated in the Offshore surveys had prior experience in aerial surveys of waterbirds in Alaska. Similarly, observers were trained in flock size estimation using computer simulation software. Unlike the single-engine aircraft that were used for Near-shore surveys, twin-engine aircraft used in Offshore surveys do not have visible wing struts to provide a surface for outer-transect boundary markers; thus, observers relied on pre-survey training to practice distance estimation whereupon they flew over marked outer-transect boundaries at varying altitudes. Further, all observers that participated in Offshore surveys also completed surveys in the near-shore Beaufort Sea lagoons and in other locations in Alaska from single-engine aircraft. During surveys from single-engine aircraft, observers practiced transect width estimation using clinometer-calibrated wing-strut markings.

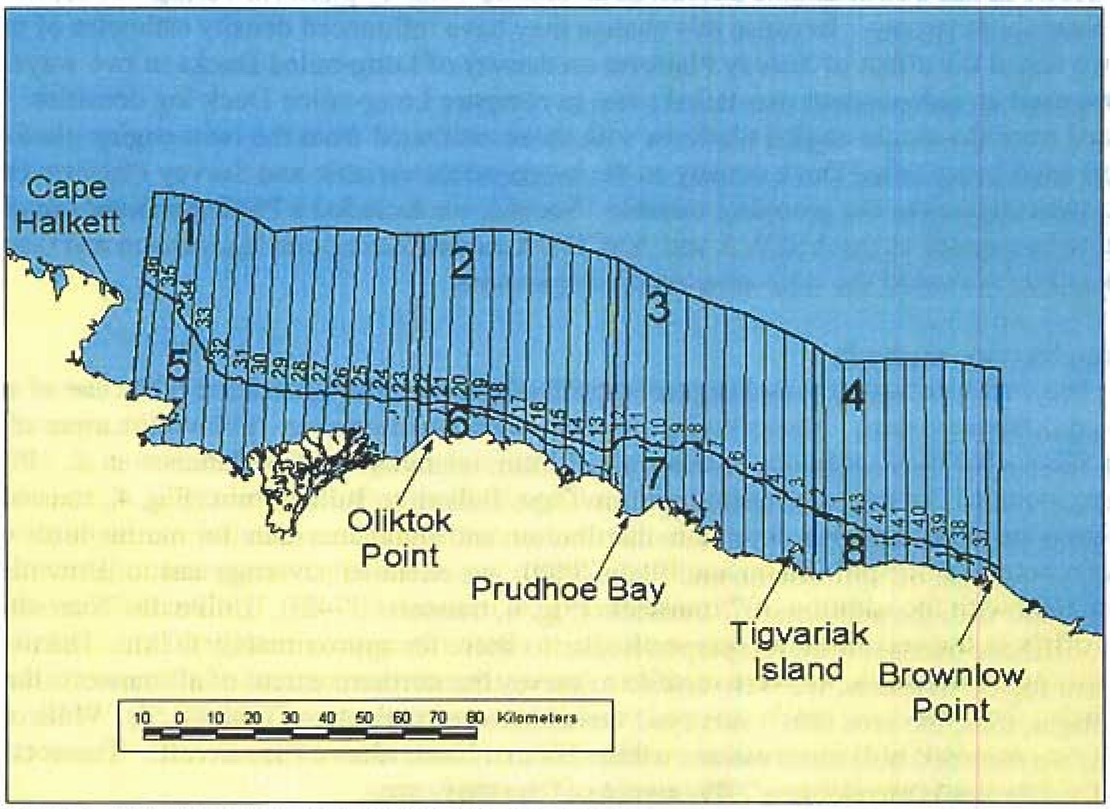

Figure 4. Offshore survey transects and strata, Beaufort Sea, Alaska, 1999-2000. Strata are indicated with bold numbers. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Offshore Survey Data Analysis

Unlike the Near-shore survey that was designed to assess effects of human activites on marine birds, the Offshore survey was initiated to delineate general distribution patterns of eiders and other marine birds. Prior to analysis, therefore, we divided the study area into 8 strata composed of four areas divided into deep (>10m) and shallow (<10m) zones (Fig. 4). The western area, located in Harrison Bay, extended from the mouth of the Kogru River, near Cape Halkett to Oliktok Point (transects 23-36). The remaining three areas corresponded to the Near-shore survey areas. For example, the Industrial area was bounded by Oliktok Point and Prudhoe Bay (transects 13-22), the Central area spanned from Prudhoe Bay to Tigvariak Island (transects 3-12), and the Control area was defined by Tigvariak Island and Brownlow Point (transects 1-2, 37-43).

To identify the components of variation in density (#birds/transect area) estimates, we used log density (Ln [density+1]) of a given taxa as the dependent variable in an ANCOVA. Using a saturated model of all factors, interaction terms and covariates (Table 6), we sequentially removed non-significant independent variables in a backward stepwise selection process (Kleinbaum et al. 1988) until only significant terms remained in a "final model". This process provided a means for detecting differences in density of each marine bird taxa among strata, years, and months after controlling for significant interaction effects and confounding covariates.

We included three parameters in the ANOVA and ANCOVA models for Offshore survey analysis that were not included in the Near-shore models. Ice cover, and Wind speed were found to be unimportant in explaining variation of Long-tailed Ducks in the Near-shore area (Johnson and Gazey 1992), but these covariates had not been assessed in the Offshore survey area, thus we included them in our analyses. In addition, we included a Month factor in Offshore survey analysis because unlike the Nearshore survey that is conducted during a period of assumed stable density (Johnson and Gazey 1992), Offshore surveys were conducted over three months when it was assumed that distribution patterns would change.

ASSESSING BIAS IN OFFSHORE SURVEYS

We assessed potential bias introduced from fluctuating altitude during Offshore surveys in two ways. First we conducted a two-tailed *t*-test with Long-tailed Duck log density as the independent variable and Altitude (45 m vs. 90 m) as a grouping variable. Second, we tested the significance of an altitude term (45 m vs. 90 m) while controlling for all variables and covariates in the "final model". This step provided a means to ask, given variability in density estimates associated with temporal and spatial factors (Year, Month, Strata, etc.), did Survey Altitude explain a significant proportion of variation?

Analysis and Presentation

Presentation of density estimates in figures and tables are reported in log transformed format (Ln [density+1]) to correspond with existing MMS protocol (OCS-MMS 92-0060, Johnson and Gazey 1992). This format allows the reader to distinguish the degree of statistical significance of inter-area comparisons and distribution differences. Because these surveys were aimed at detecting trends rather than abundance estimates, transformed density estimates provide a reliable indicator of statistical differences. Readers can find actual counts and standard densities for each survey in Appendices 1, 2 and 4.

We used SYSTAT 7.0 (SYSTAT 1997) for statistical analysis in this report.

Table 4. Area (sq. km) surveyed by subtransect and stratum during each of six Offshore surveys, Beaufort Sea, Alaska, 1999-2000. Subtransect suffix refer to depth class (d = deep, s = shallow). See Figure 4 for location of strata.

		1999			2000		
STRATUM	SUBTRANSECT	June	July	August	June	July	August
Harrison Bay Deep (1)	23d	18.6	17.7	17.6	18.7	18.8	18.7
	24d	19.7	18.1	17.9	19.7	19.7	19.8
	25d	25.8	20.2	20.6	19.4	19.6	19.6
	26d	24.2	20.3	20.3	24.0	24.1	24.0
	27d	21.5	14.2	19.5	21.6	21.8	21.6
	28d	20.8	14.2	19.5	21.1	21.2	21.1
	29d	19.1	17.5	16.9	18.7	19.1	18.9
	30d	18.3	17.1	16.9	18.5	18.2	18.4
	31d	14.9	12.9	15.7	17.5	16.7	16.4
	32d	16.9	14.8	16.1	16.8	17.1	16.8
	33d	16.7	14.0	14.2	16.2	16.6	16.6
	34d	12.1	10.6	10.7	12.1	12.1	12.0
	35d	13.5	8.8	12.1	10.9	10.9	10.6
	36d	9.7	9.6	10.9	11.2	11.0	11.0
	Stratum Total	**251.8**	**209.9**	**228.8**	**246.5**	**246.9**	**245.5**
Industrial Deep (2)	13d	20.3	8.2	17.5	20.1	8.7	20.2
	14d	18.9	19.0	16.7	19.9	10.7	19.9
	15d	20.1	18.4	16.4	20.7	17.3	20.4
	16d	19.5	13.3	16.2	21.1	20.1	21.0
	17d	20.7	12.6	22.7	21.1	21.2	20.7
	18d	19.9	5.2	21.6	20.5	20.6	18.1
	19d	21.0	18.2	21.3	21.0	21.1	7.0
	20d	20.6	17.8	20.5	20.8	20.7	10.3
	21d	17.1	20.4	20.5	20.5	20.5	20.7
	22d	18.2	21.2	21.4	21.4	21.5	21.8
	Stratum Total	**196.3**	**154.3**	**194.8**	**207.2**	**182.3**	**180.0**
Central Deep (3)	10d	-	17.8	17.7	18.2	18.0	17.7
	11d	12.5	17.1	15.2	16.8	16.9	16.9
	12d	12.7	8.5	15.0	17.6	17.1	18.7
	3d	18.6	20.1	17.3	17.8	6.5	18.0
	4d	15.5	14.4	16.0	17.2	4.8	16.3
	5d	8.4	15.1	14.2	15.1	4.4	15.1
	6d	9.3	10.8	14.0	14.3	3.8	13.9
	7d	5.2	12.5	16.9	13.6	2.4	13.4
	8d	2.3	13.5	16.4	14.6	1.9	14.5
	9d	0.6	12.1	16.7	17.4	17.6	17.3
	Stratum Total	**84.9**	**141.9**	**159.4**	**162.8**	**93.5**	**161.9**
Control Deep (4)	1d	24.2	18.9	18.6	19.9	7.6	19.4
	2d	22.9	18.3	17.8	18.6	7.2	18.6
	37d	-	-	-	23.0	11.2	7.9
	38d	-	-	-	20.5	12.2	20.4
	39d	-	-	-	21.2	11.0	21.3
	40d	-	-	-	20.9	10.2	21.1
	41d	-	-	-	20.9	9.5	21.1
	42d	-	-	-	19.7	10.2	20.1
	43d	-	-	-	19.6	8.9	19.5
	Stratum Total	**47.1**	**37.3**	**36.3**	**184.4**	**88.0**	**169.5**

STRATUM	SUBTRANSECT	1999 June	1999 July	1999 August	2000 June	2000 July	2000 August
Harrison Bay Shallow (5)	23s	6.6	6.6	6.6	6.6	6.6	6.6
	24s	6.7	6.7	6.7	6.7	6.7	6.7
	25s	4.5	4.5	4.5	4.5	4.5	4.5
	26s	4.1	4.1	4.1	4.1	4.1	4.1
	27s	4.3	4.3	4.3	4.3	4.3	4.3
	28s	5.4	5.4	5.4	5.4	5.4	5.4
	29s	6.2	6.2	6.2	6.2	6.2	6.2
	30s	7.5	7.5	7.5	7.5	7.5	7.5
	31s	11.2	11.2	11.2	11.2	11.2	11.2
	32s	9.1	9.1	9.1	9.1	9.1	9.1
	33s	10.2	10.2	10.2	10.2	10.2	10.2
	34s	13.7	13.7	13.7	13.7	13.7	13.7
	35s	14.0	14.0	14.0	14.0	14.0	14.0
	36s	12.2	12.2	12.2	12.2	12.2	12.2
	Stratum Total	**115.5**	**115.5**	**115.5**	**115.5**	**115.5**	**115.5**
Industrial Shallow (6)	13s	3.6	3.6	3.6	3.6	3.6	3.6
	14s	3.9	3.9	3.9	3.9	3.9	3.9
	15s	3.4	3.4	3.4	3.4	3.4	3.4
	16s	2.7	2.7	2.7	2.7	2.7	2.7
	17s	2.5	2.5	2.5	2.5	2.5	2.5
	18s	2.9	2.9	2.9	2.9	2.9	2.9
	19s	2.6	2.6	2.6	2.6	2.6	2.6
	20s	3.5	3.5	3.5	3.5	3.5	3.5
	21s	4.4	4.4	4.4	4.4	4.4	4.4
	22s	3.7	3.7	3.7	3.7	3.7	3.7
	Stratum Total	**33.0**	**33.0**	**33.0**	**33.0**	**33.0**	**33.0**
Central Shallow (7)	10s	5.8	6.5	6.5	6.5	6.5	6.5
	11s	8.3	8.3	8.3	8.3	8.3	8.3
	12s	6.6	6.6	6.6	6.6	6.6	6.6
	3s	8.0	8.0	8.0	8.0	8.0	8.0
	4s	8.1	8.1	8.1	8.1	8.1	8.1
	5s	9.3	9.3	9.3	9.3	9.3	9.3
	6s	9.7	9.7	9.7	9.7	9.7	9.7
	7s	10.6	10.6	10.6	10.6	10.6	10.6
	8s	8.6	8.6	8.6	8.6	8.6	8.6
	9s	8.4	8.4	8.4	8.4	8.4	8.4
	Stratum Total	**83.4**	**84.2**	**84.2**	**84.2**	**84.2**	**84.2**
Control Shallow (8)	1s	5.5	5.5	5.5	5.5	5.5	5.5
	2s	7.1	7.1	7.1	7.1	7.1	7.1
	37s	-	-	-	0.9	0.9	0.9
	38s	-	-	-	2.8	2.8	2.8
	39s	-	-	-	2.7	2.7	2.7
	40s	-	-	-	2.7	2.7	2.7
	41s	-	-	-	2.9	2.9	2.9
	42s	-	-	-	3.2	3.2	3.2
	43s	-	-	-	4.1	4.1	4.1
	Stratum Total	**12.6**	**12.6**	**12.6**	**31.8**	**31.8**	**31.8**

Table 5. Area (km²) surveyed per stratum during each of six replicates, Beaufort Sea, Alaska, 1999-2000.

Year	Month	Stratum[a] 1	2	3	4	5	6	7	8
1999	June	251.8	196.3	84.9	47.1	115.5	33.0	83.4	12.6
	July	209.9	154.3	141.9	37.3	115.5	33.0	84.2	12.6
	August	228.8	194.8	159.4	36.3	115.5	33.0	84.2	12.6
2000	June	246.5	207.2	162.8	184.4	115.5	33.0	84.2	31.8
	July	246.9	182.3	93.5	88.0	115.5	33.0	84.2	31.8
	August	245.5	180.0	161.9	169.5	115.5	33.0	84.2	31.8

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Table 6. Independent variables incorporated into ANOVA and ANCOVA models to explain variability in marine bird log densities (Ln[density+1]) during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

Independent Variable	Variable Code	Variable Type
Stratum	S	Factor (1-8)
Year	Y	Factor (1999, 2000)
Month	M	Factor (June, July, August)
Altitude	A	Factor (45 m, 90 m)
Stratum*Year	SY	Interaction term
Stratum*Month	SM	Interaction term
Year*Month	YM	Interaction term
Stratum*Year*Month	SYM	Interaction term
Percent ice cover	I	Covariate (Arc-sine transformed)
Wave height (ft.)	Wa	Covariate (Ln transformed)
Wind speed (mph)	Wi	Covariate

RESULTS

Near-shore Survey Results

Effects of Human Activities on Long-tailed Ducks

We compared Long-tailed Duck population trends in "Industrial" and "Control" areas. We applied the combined LGL (1990-1991) and USFWS (1999-2000) data sets to ANOVA and ANCOVA models and found no significant interaction between Area and Year (ANOVA: $F_{3,12} = 1.798$, $P = 0.201$; ANCOVA: $F_{3,12} = 1.557$, $P = 0.251$; Fig. 5, Table 7). While we did not detect a disproportionate change between the areas, we did detect a significant decline in densities of Long-tailed Ducks within the study area as a whole (ANOVA: $F_{3,12} = 7.664$, $P = 0.004$; ANCOVA: $F_{3,12} = 8.716$, $P = 0.002$; Fig. 6).

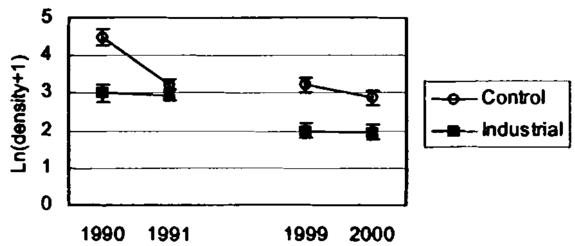

Figure 5. Comparison of trends in Long-tailed Duck log density (± 95% CI) in Control and Industrial transects. While density decreased overall, the interaction between Year and Area was not significant.

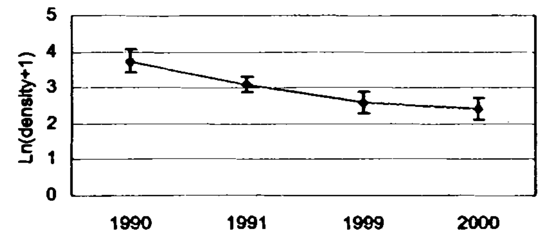

Figure 6. Long-tailed Duck log density (± 95% CI) decreased significantly within near-shore transects between 1990 and 2000.

Next, we examined the relationship between Long-tailed Duck densities and human activities by assessing the significance of the Disturbance term that indicated the degree of human activity on survey transects. We found no significant effect of Disturbance on Long-tailed Duck densities (ANOVA: $F_{2,550} = 0.812$, $P = 0.445$; ANCOVA: $F_{2,549} = 1.104$, $P = 0.332$; Table 7). A total of 171 potential disturbances in the form of boat, aerial, and land-based human activities were recorded in 1990-1991 and 1999-2000 (Table 8, Fig. 7, 8). Within the 24 transects used for analysis, potential disturbances occurred at a rate of 2.5 in Industrial transects to every 1 on Control transects.

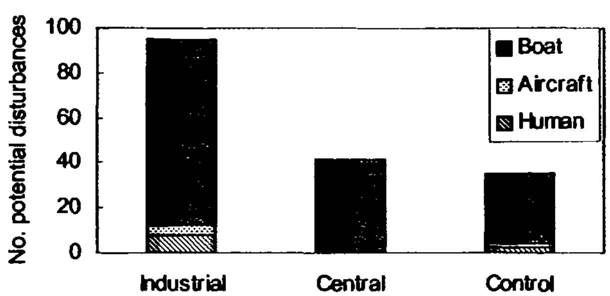

Figure 7. Total number of potential disturbances on transects during Near-shore surveys, 1990-1991, 1999-2000. Potential disturbances included boats (all marine vessels), aircraft (overflights <150 m), and humans (workers on land adjacent to transects).

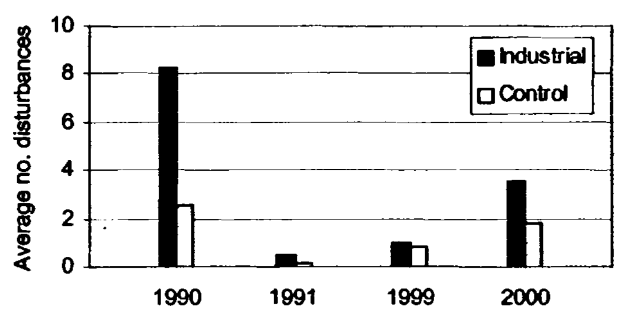

Figure 8. Average number of potential disturbances each year on Industrial and Control transects. Potential disturbances occurred at a higher rate in the Industrial area during each year of the study.

Table 7. Results of ANOVA (A) and ANCOVA (B) tests on Long-tailed Duck log density (Ln[Density+1]), collected on Near-shore surveys in 1990-1991 and 1999-2000.

(A) ANOVA: $R^2 = 0.74$

Term	df	MS	F[1]	P
Disturbance	2	0.868	0.812	0.445
Area	1	154.224	0.702	0.449
Year	3	51.478	7.664	0.004
Area*Year	3	12.076	1.798	0.201
Habitat(Area)	4	219.690	15.749	$\leq$0.001
Year*Habitat(Area)	12	6.717	6.559	$\leq$0.001
Transect(Habitat*Area)	18	13.949	13.053	$\leq$0.001
Year*Transect(Habitat*Area)	54	1.024	0.959	0.561
Residual Error	550	1.069		

(B) ANCOVA: $R^2 = 0.75$, one covariate- Ln(Wave+1)

Term	df	MS	F	P
Disturbance	2	1.107	1.104	0.332
Area	1	142.416	0.679	0.456
Year	3	60.149	8.716	0.002
Area*Year	3	10.748	1.557	0.251
Habitat(Area)	4	209.851	15.212	$\leq$0.001
Year*Habitat(Area)	12	6.901	6.547	$\leq$0.001
Transect(Habitat*Area)	18	13.795	13.753	$\leq$0.001
Year*Transect(Habitat*Area)	54	1.054	1.051	0.381
Ln(Wave+1)	1	37.001	36.893	$\leq$0.001
Residual Error	549	1.003		

[1] See table 2 for error terms used to derive F- statistic

Components of Variation

Five components explained 74% and 75% (ANOVA and ANCOVA, respectively) of the variation in Long-tailed Duck densities (Table 7). First, the significant wave covariate indicated that as wave height increased, density decreased. Second, the significant Year term suggested that Long-tailed Duck densities decreased area-wide from 1990-2000. Scheffe pair-wise comparisons show that 1990 log densities were significantly higher than 1999 ($P = 0.018$) and 2000 ($P = 0.005$; Fig. 6). Third, while Long-tailed Duck densities were the same in the Industrial and Control areas as a whole (ANOVA: $F_{1,4} = 0.702$, $P = 0.449$; ANCOVA: $F_{1,4} = 0.679$, $P = 0.456$), the importance of specific habitats differed between the two areas as shown in a significant Habitat(Area) term. For example, log densities in Mainland Coastline habitat differed significantly ($P = 0.002$) between the Control Area ($\bar{x} = 3.76 \pm 0.27$ 95% CI) and the Industrial area ($\bar{x} = 0.91 \pm 0.19$ 95% CI). Fourth, the significant interaction term Year*Habitat(Area), indicated that the Habitats within Areas varied significantly between Years. For example, density of Long-tailed Ducks was relatively high in Barrier Island habitat in the Control area during the summer of 1990 but decreased significantly in subsequent years (Fig. 9). Fifth, while densities of Long-tailed Ducks varied among Area-Habitat strata, the significant term Transect(Habitat*Area) demonstrated that density varied within these strata as well. Thus, Long-tailed Duck density in some transects was consistently high relative to other transects in the same Area-Habitat strata. These fine-scale

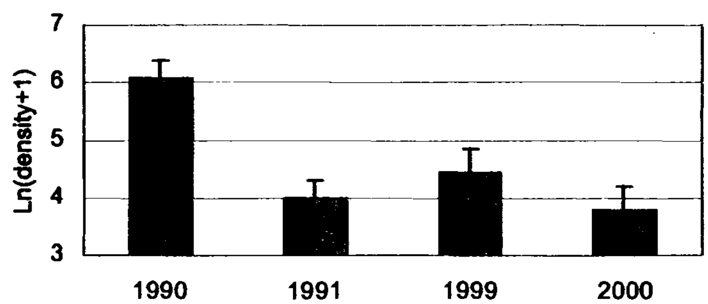

Figure 9. Mean log density (± 95% CI) of Long-tailed Ducks in Barrier Island habitat within the Control area was variable among years.

differences within given Habitats and Areas were consistent over the four year sampling period, as seen in the non-significant interaction term Year*Transect(Area*Habitat).

Table 8. Potential disturbances recorded on Industrial, Central, and Control transects. Potential disturbances included boats (all marine vessels), aircraft (overflights <150 m), and humans (workers on land adjacent to transects).

		Potential Disturbance			
Area	Transect	Boat	Aircraft	Human	Total
Industrial	22	7	0	0	7
Industrial	23	8	0	1	9
Industrial	24	17	2	0	19
Industrial	25	18	0	3	21
Industrial	30	2	0	0	2
Industrial	31	0	0	1	1
Industrial	32	8	2	0	10
Industrial	33	6	0	1	7
Industrial	202	0	0	2	2
Industrial	301	3	0	0	3
Industrial	401	9	0	0	9
Industrial	402	5	0	0	5
Central	904	5	0	0	5
Central	905	2	0	0	2
Central	907	25	0	0	25
Central	908	2	0	0	2
Central	910	5	0	0	5
Central	911	1	0	0	1
Central	915	0	0	1	1
Control	133	5	0	0	5
Control	135	1	0	1	2
Control	136	1	1	0	2
Control	182	2	0	0	2
Control	183	5	0	0	5
Control	190	2	0	0	2
Control	191	1	0	0	1
Control	192	7	0	2	9
Control	193	7	0	0	7

Near-shore Species Composition and Distribution

In 1999, we increased the range of marine bird sampling beyond transects sampled in 1990-1991 (Fig. 3). Unlike the previous section that reported results of a model designed specifically to identify human related effects on Long-tailed Ducks, here we use data from the expanded sampling area to describe the distribution of a suite of marine birds observed during 12 replicate surveys from 1999-2000.

We recorded 30 avian taxa during Near-shore surveys in 1999-2000 (Tables 9,10; Appendices 1a-k). Among this diverse avifauna, Long-tailed Ducks comprised nearly 80% of all birds counted in the Near-shore study area (Table 10, Fig. 10). Moreover, Long-tailed Ducks were the predominant species in all four habitats sampled: Near-shore Marine- 58%, Barrier Island- 83%, Mid-lagoon- 77%, Mainland Shoreline- 72%. When combined with Long-tailed Ducks, other marine species such as Common Eiders (6%), Shorebirds (*Charadriidae spp.* and

Scolopacidae spp.; 5%), and Glaucous Gulls (*Larus hyperboreus*; 4%) comprised 95% of all species seen in the near-shore environment. The remaining 5% of birds was made up by 26 avian taxa.

In the subsequent sections we report on the distribution patterns of 11 focal species/species groups that together comprised 99% of all observations. These include: Long-tailed Duck, Common Eider, King Eider, Scoter (*Melanitta* spp.), Pacific Loon (*Gavia pacifica*), Red-throated Loon (*Gavia stellata*), Yellow-billed Loon (*Gavia adamsii*), Glaucous Gull, Northern Pintail (*Anas acuta*), Geese and Swans (*Anserinae* spp.), and Shorebirds (*Charadriidae* and *Scolopacidae* spp.). Incidental observations of ten additional taxa seen in the near-shore environment occurred in densities so low that generalizations regarding their distribution patterns are difficult, and thus are not discussed here. These include: Grebe (*Podiceps* spp.), Northern Shoveler (*Anas clypeata*), Scaup (*Aythya spp.*), Red-breasted Merganser (*Mergus serrator*), Jaeger (*Stercorarius spp.*), Sabine's Gull (*Xema sabini*), Arctic Tern (*Sterna paradisaea*), Black Guillemot (*Cepphus grylle*), Gyrfalcon (*Falco rusticolus*), and Common Raven (*Corvus corax*).

Table 9. Counts of all birds observed during 12 Near-shore aerial surveys, Beaufort Sea, Alaska, 1999-2000.

	1999						2000					
Species	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Yellow-billed Loon	6	10	13	2	0	2	12	9	5	4	3	1
Pacific Loon	60	105	50	55	54	58	39	40	72	17	93	72
Red-throated Loon	11	26	18	9	8	26	1	17	13	6	26	4
Unidentified Loon *spp.*	0	0	0	0	0	5	0	0	0	0	0	0
Grebe *spp.*	0	0	0	0	1	0	0	0	0	0	0	0
Tundra Swan	0	12	0	4	3	2	2	2	8	0	2	18
White-fronted Goose	100	101	55	33	0	4	147	192	213	79	114	107
Snow Goose	1	1	41	0	20	0	80	20	110	67	25	0
Canada Goose	64	0	0	50	15	0	110	235	33	161	15	83
Black Brant	56	5	77	45	26	0	12	20	86	0	0	0
Northern Pintail	10	483	39	29	62	36	346	153	53	95	6	140
Northern Shoveler	0	0	0	0	0	0	0	1	0	0	0	0
Scaup *spp.*	90	1	0	0	0	61	0	0	12	1	5	0
Common Eider	452	667	510	1330	1089	1173	200	272	444	191	178	211
King Eider	41	97	50	2	3	0	1	0	0	0	0	0
Eider *spp.*	29	0	88	0	0	46	5	8	26	71	172	15
Black Scoter	0	0	0	0	0	57	15	2	20	8	0	0
White-winged Scoter	2	0	0	2	0	0	72	0	8	0	10	2
Surf Scoter	148	311	0	52	11	2	30	36	4	63	246	116
Unidentified Scoter *spp.*	0	0	105	113	0	1	0	2	29	25	5	23
Long-tailed Duck	10492	13721	7726	3720	18317	2879	7298	2437	8763	2326	9726	4978
Red-breasted Merganser	5	10	2	44	25	338	0	8	3	0	4	1
Shorebird *spp.*	0	33	694	623	1794	135	86	1071	74	113	54	633
Jaeger *spp.*	0	0	6	6	9	0	0	0	1	0	0	0
Glaucous Gull	311	251	223	375	633	269	642	463	130	359	446	306
Sabine's Gull	0	1	42	0	0	0	2	1	0	12	4	0
Arctic Tern	6	5	8	5	5	15	2	3	1	2	2	1
Black Guillemot	0	0	1	0	0	0	0	0	0	0	0	0
Gyrfalcon	0	0	0	0	0	0	0	0	0	0	0	1
Common Raven	20	0	0	0	0	0	0	0	0	0	0	0
Birds/survey	11904	15840	9748	6499	22075	5109	9102	4992	10108	3600	11136	6712

LONG-TAILED DUCK— Long-tailed Ducks were ubiquitous in the near-shore environment with a total 2,726 flocks sighted in 1999-2000 (median flock size = 10, range 1-999; Table 11). Significant variation in densities occurred both among ($F_{9,32} = 20.652$, $P < 0.001$) and within ($F_{32,482} = 4.071$, $P < 0.001$) Area-Habitat strata. In general, Long-tailed Duck densities were highest in barrier island habitat throughout the study area, and along the eastern coastline (Figs. 11, 12). In contrast, transects throughout Near-shore Marine, Central Mid-lagoon, and Industrial and Central Mainland Coastline habitats had low densities of Long-tailed Ducks. Among these strata, it is noteworthy that Mainland Coastline transects in the Industrial and Central areas had low densities relative to the Control area.

Table 10. Total count and percent composition of bird species observed during 12 replicate Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

Species	Total observed	% of total
Yellow-billed Loon	67	0.057
Pacific Loon	715	0.649
Red-throated Loon	165	0.141
Unidentified Loon *Spp.*	5	0.004
Grebe *Spp.*	1	0.001
Tundra Swan	53	0.045
White-fronted Goose	1145	0.980
Snow Goose	365	0.312
Canada Goose	766	0.655
Black Brant	327	0.280
Northern Pintail	1452	1.242
Northern Shoveler	1	0.001
Scaup *Spp.*	170	0.145
Common Eider	6717	5.748
King Eider	194	0.166
Eider *Spp.*	460	0.394
Black Scoter	102	0.087
White-winged Scoter	96	0.082
Surf Scoter	1019	0.872
Unidentified Scoter *Spp.*	303	0.259
Long-tailed Duck	92383	79.049
Red-breasted Merganser	440	0.376
Shorebird *Spp.*	5310	4.544
Jaeger *Spp.*	22	0.019
Glaucous Gull	4408	3.772
Sabine's Gull	62	0.053
Arctic Tern	55	0.047
Black Guillemot	1	0.001
Gyrfalcon	1	0.001
Common Raven	20	0.017
Total	116868	100.00

Table 11. Flock size of birds observed during 12 Near-shore aerial surveys, Beaufort Sea, Alaska, 1999-2000. Species with fewer than 10 flock sightings are not presented.

Species	n	Median	Range	Mean	SE
Yellow-billed Loon	55	1.0	1-3	1.22	0.06
Pacific Loon	514	1.0	1-30	1.39	0.07
Red-throated Loon	109	1.0	1-5	1.51	0.09
Tundra Swan	11	3.0	1-14	4.82	1.36
White-fronted Goose	71	11.0	1-60	16.13	1.78
Snow Goose	12	22.5	1-110	30.42	9.26
Canada Goose	25	18.0	2-125	30.64	6.22
Black Brant	17	10.0	2-60	19.24	4.61
Northern Pintail	102	6.5	1-150	14.24	2.03
Scaup *Spp.*	17	5.0	1-40	10.00	2.90
Common Eider	610	3.0	1-350	11.01	1.20
King Eider	16	6.0	1-90	12.13	5.99
Surf Scoter	97	4.0	1-100	10.51	1.71
Unidentified Scoter *Spp.*	20	4.0	1-100	15.15	5.94
Long-tailed Duck	2726	10.0	1-999	33.89	1.37
Red-breasted Merganser	31	4.0	1-130	14.19	4.94
Shorebird	182	10.0	1-400	29.18	4.02
Jaegar *Spp.*	15	1.0	1-3	1.47	0.17
Glaucous Gull	1509	1.0	1-80	2.92	0.16
Sabine's Gull	11	1.2	1-40	5.64	3.47
Arctic Tern	29	1.0	1-15	1.90	0.48

While Long-tailed Ducks were distributed differently among Area-Habitat strata, densities varied among transects within strata (Table 12) suggesting subtle differences in distribution irrespective of Habitat and Area. For example, densities were significantly greater in transect 31 ($\bar{x} = 4.04$, ± 0.83 95% CI) than in the adjoining transect 23 ($\bar{x} = 2.51$, ± 0.68 95% CI) despite similar habitat, and location. These small-scale differences may reflect microhabitat differences such as prey availability, protection from poor weather, or possibly reduced disturbance from human activities.

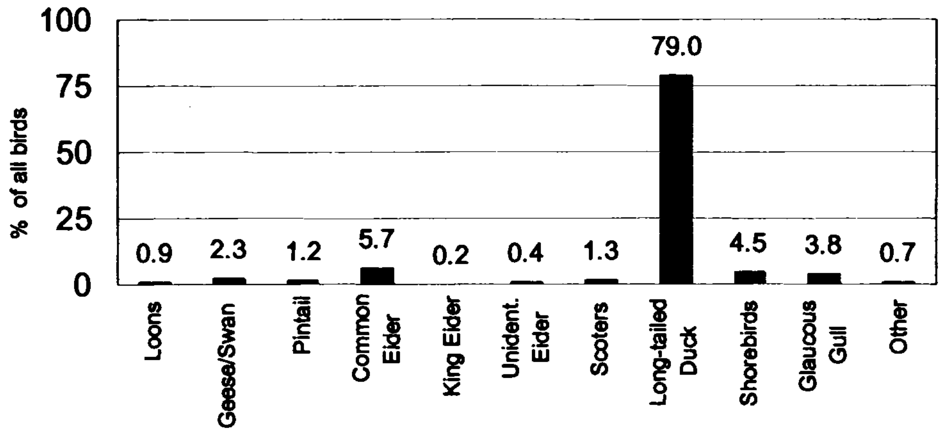

Figure 10. Percent composition of species observed during Near-shore surveys, 1999-2000. Long-tailed Ducks were ubiquitous among all habitats surveyed.

Table 12. Mean log density (Ln[den+1]) of Long-tailed Ducks in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	3.92				25	0.36	
		202	3.17				33	0.45	
		23	2.51				401	1.14	
		31	4.04				402	1.05	
				3.41					**0.75**
	Central					Central			
		907	2.15				913	0.84	
		908	3.30				914	0.25	
		909	3.55				915	1.46	
				3.00					**0.85**
	Control					Control			
		133	4.31				190	2.95	
		134	3.73				191	4.30	
		135	4.18				192	4.06	
		136	4.20				193	2.27	
				4.11					**3.40**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.65				101	0.54	
		301	2.17				102	0.21	
		302	1.80				22	0.34	
		32	2.36				30	0.27	
				1.74					**0.34**
	Central					Central			
		910	0.60				904	0.04	
		911	0.13				905	0.76	
		912	0.41				906	0.51	
				0.38					**0.44**
	Control					Control			
		180	2.44				60	0.73	
		181	1.78				61	0.73	
		182	1.82				62	0.84	
		183	0.50				63	0.68	
				1.64					**0.75**

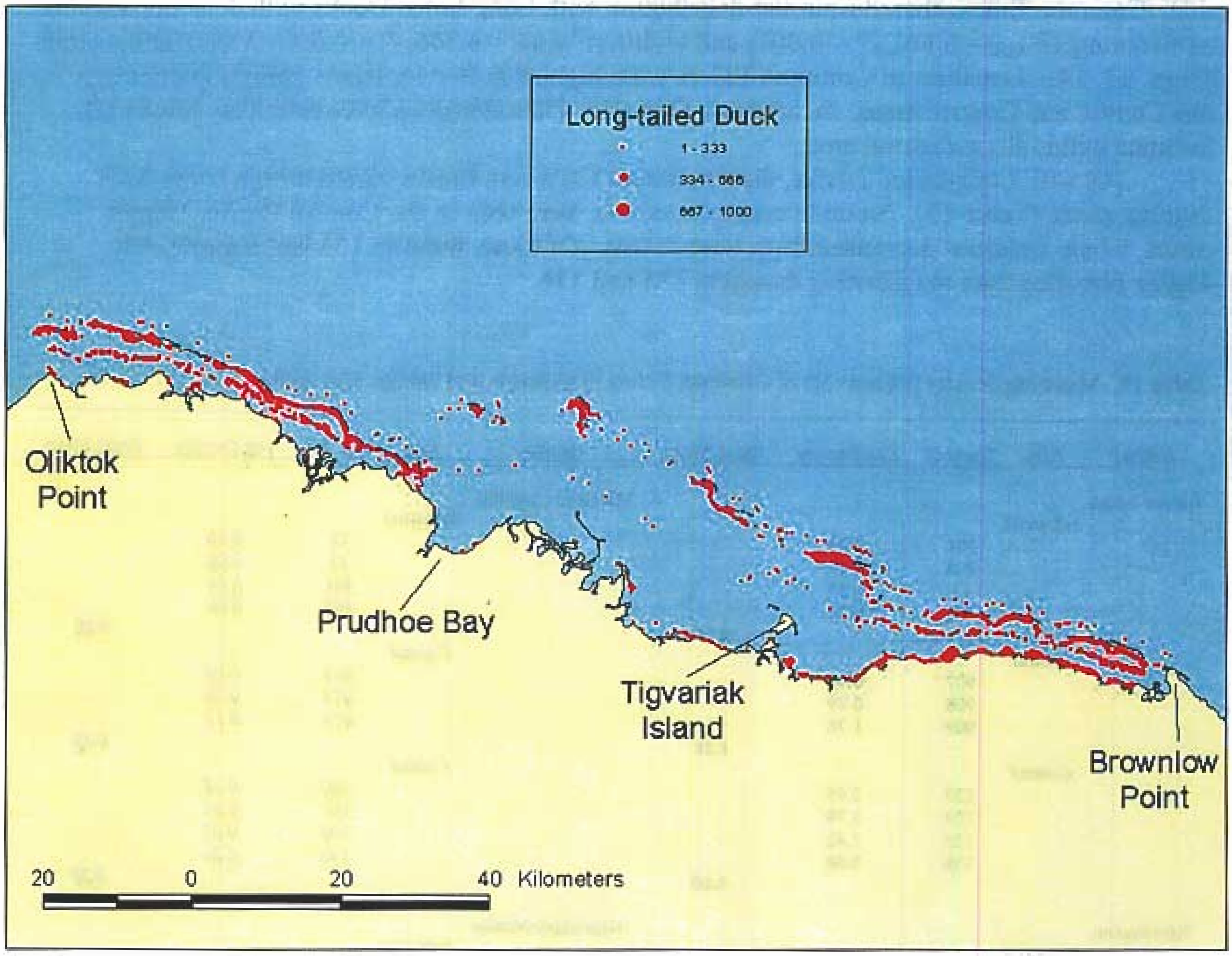

Figure 11. Locations of Long-tailed Ducks during 12 Near-shore surveys, 1999-2000.

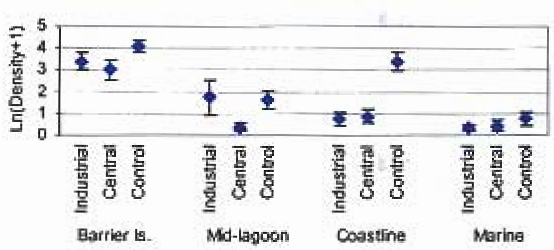

Figure 12. Mean log density (±95% CI) of Long-tailed Ducks among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

COMMON EIDER—As with Long-tailed Ducks, Common Eider flocks were seen regularly throughout the near-shore environment (median flock size = 3, range 1-350; Table 11). Common Eiders shared a similar distribution with Long-tailed Ducks with densities varying both among ($F_{9,32} = 6.601$, $P < 0.001$) and within ($F_{32,482} = 4.366$, $P < 0.001$) Area-Habitat strata (Figs. 13, 14). Densities of Common Eiders were highest in Barrier Island habitat, particularly in the Central and Control areas. In contrast, Common Eider densities were relatively low in all habitats within the Industrial area.

As with Long-tailed Ducks, distribution of Common Eiders varied within some Area-Habitat strata (Table 13). Notable examples of this were seen in the Control Barrier Islands strata, where densities decreased from west to east. Of these, transect 133 had significantly higher densities than neighboring transects 135 and 136.

Table 13. Mean log density (ln[den+1]) of Common Eiders in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.23				25	0.00	
		202	0.47				33	0.00	
		23	0.37				401	0.00	
		31	0.34				402	0.00	
				0.35					**0.00**
	Central					Central			
		907	0.96				913	0.06	
		908	0.89				914	0.30	
		909	1.78				915	0.13	
				1.21					**0.16**
	Control					Control			
		133	2.95				190	0.28	
		134	1.79				191	0.51	
		135	1.41				192	0.37	
		136	0.44				193	0.36	
				1.65					**0.38**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.09				101	0.28	
		301	0.00				102	0.00	
		302	0.00				22	0.34	
		32	0.12				30	0.27	
				0.05					**0.22**
	Central					Central			
		910	0.14				904	0.15	
		911	0.01				905	0.01	
		912	0.38				906	0.01	
				0.18					**0.06**
	Control					Control			
		180	0.06				60	0.48	
		181	0.21				61	0.57	
		182	0.54				62	0.17	
		183	0.45				63	0.00	
				0.31					**0.30**

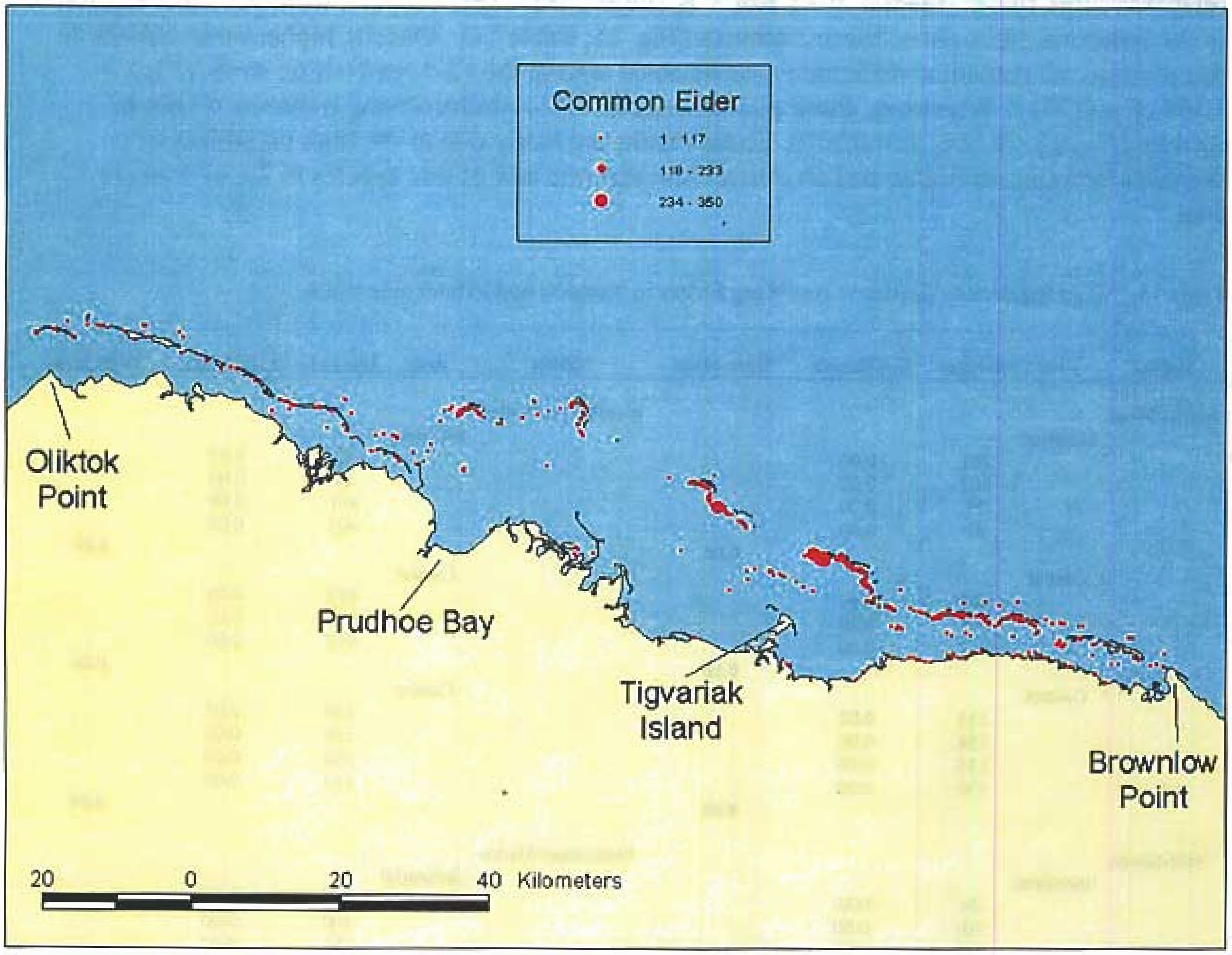

Figure 13. Locations of Common Eiders during 12 Near-shore surveys, 1999-2000.

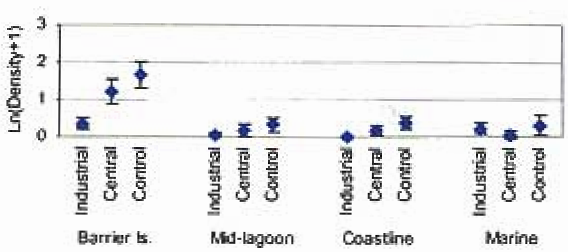

Figure 14. Mean log density (±95% CI) of Common Eiders among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

KING EIDER—While Common Eiders were seen regularly in the near-shore environment, King Eiders were rarely observed. Those that were observed, however, occurred in relatively large flocks (median flock size = 6, range 1-90; Table 11); and were generally sighted in the Industrial Near-shore Marine stratum (Fig. 15, Table 14). Despite higher mean density in this stratum, no statistical difference was detected among the 12 Area-Habitat strata ($F_{9,32}$ = 1.196, P = 0.331). Moreover, there was no detectable variability among transects within a stratum ($F_{32,482}$ = 1.106, P = 0.320). These results are likely due to the high variability of densities between replicates and an overall low sighting rate of this species in the near-shore area.

Table 14. Mean log density (ln[den+1]) of King Eiders in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.00				25	0.00	
		202	0.00				33	0.00	
		23	0.00				401	0.00	
		31	0.00				402	0.00	
				0.00					**0.00**
	Central					Central			
		907	0.09				913	0.00	
		908	0.20				914	0.00	
		909	0.00				915	0.00	
				0.10					**0.00**
	Control					Control			
		133	0.02				190	0.01	
		134	0.00				191	0.00	
		135	0.00				192	0.00	
		136	0.00				193	0.00	
				0.01					**0.00**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.00				101	0.02	
		301	0.00				102	0.00	
		302	0.00				22	0.00	
		32	0.00				30	0.28	
				0.00					**0.08**
	Central					Central			
		910	0.00				904	0.05	
		911	0.00				905	0.06	
		912	0.02				906	0.00	
				0.01					**0.04**
	East					East			
		180	0.00				60	0.00	
		181	0.05				61	0.02	
		182	0.00				62	0.00	
		183	0.00				63	0.00	
				0.01					**0.00**

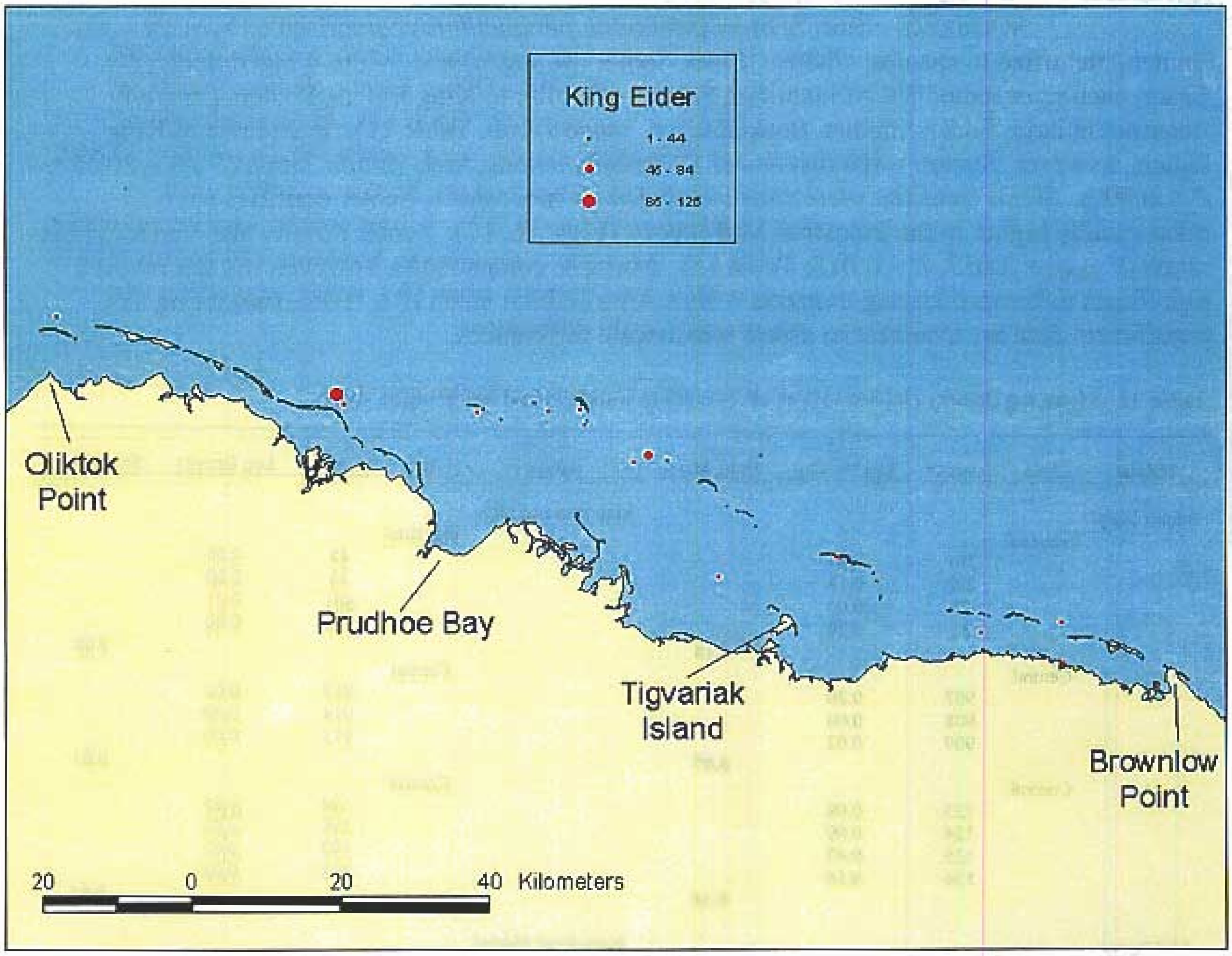

Figure 15. Locations of King Eiders during 12 Near-shore surveys, 1999-2000.

SCOTERS—Surf Scoters (*Melanitta perspicillata*) comprised 84% of all Scoters identified to species, whereas Black Scoter (*M. nigra*) and White-winged Scoter (*M. fusca*) each represented 8% of identified Scoters. Similar to King Eiders, Scoters generally occurred in large flocks (median flock size = 4, range 1-100; Table 11). In contrast to King Eiders, however, Scoters were distributed differently among Area-Habitat strata ($F_{9,32} = 20.652$, $P < 0.001$). While densities were consistently low in most strata, Scoter densities were substantially higher in the Industrial Mid-lagoon (Figs. 16, 17). Scoter density also varied within strata ($F_{32,482} = 1.653$, $P < 0.015$; Table 15). Multiple comparisons, however, did not reveal a significant difference among transects within Area-Habitat strata (P > 0.05), suggesting that insufficient data are available to assess small-scale differences.

Table 15. Mean log density (ln[den+1]) of all Scoters in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.24				25	0.00	
		202	0.18				33	0.00	
		23	0.00				401	0.01	
		31	0.29				402	0.00	
				0.18					**0.00**
	Central					Central			
		907	0.20				913	0.02	
		908	0.00				914	0.00	
		909	0.02				915	0.00	
				0.07					**0.01**
	Control					Control			
		133	0.08				190	0.05	
		134	0.00				191	0.05	
		135	0.47				192	0.01	
		136	0.16				193	0.03	
				0.18					**0.03**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.23				101	0.03	
		301	1.02				102	0.00	
		302	0.91				22	0.26	
		32	1.08				30	0.00	
				0.81					**0.07**
	Central					Central			
		910	0.04				904	0.02	
		911	0.08				905	0.00	
		912	0.01				906	0.28	
				0.04					**0.10**
	Control					Control			
		180	0.00				60	0.00	
		181	0.07				61	0.00	
		182	0.16				62	0.03	
		183	0.00				63	0.00	
				0.06					**0.01**

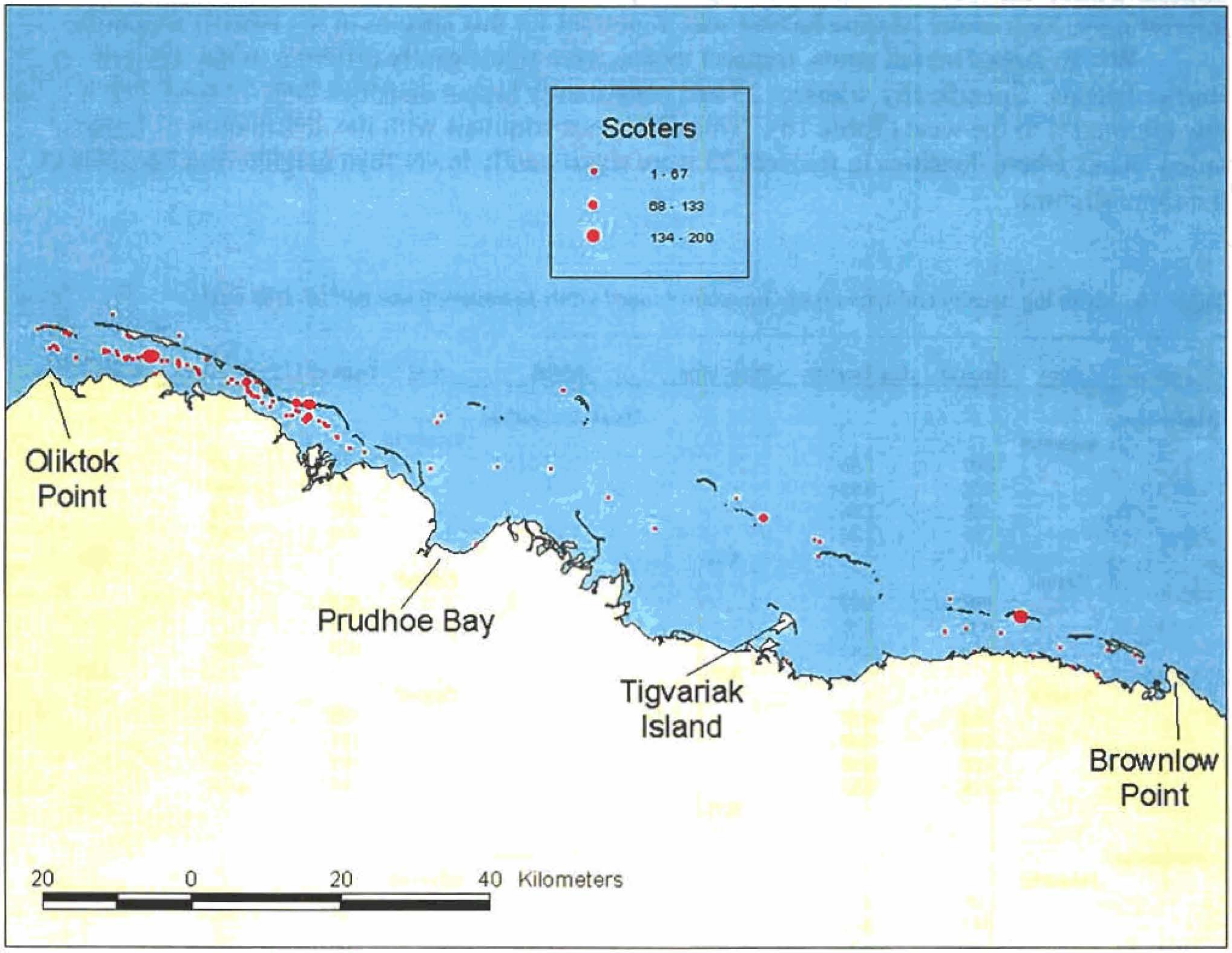

Figure 16. Locations of Scoters during 12 Near-shore surveys, 1999-2000.

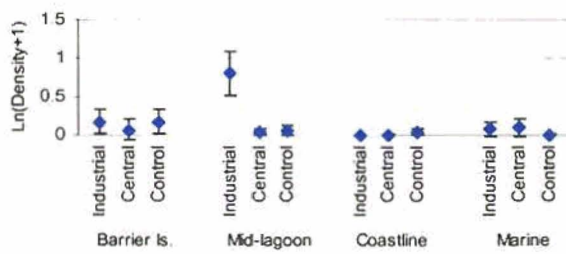

Figure 17. Mean log density (±95% CI) of Scoters among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

GLAUCOUS GULL—In contrast to Scoters, Glaucous Gulls occurred as individuals or in small flocks (median flock size = 1, range 1-80; Table 11). The distribution of Glaucous Gulls varied among ($F_{9,32} = 19.537, P < 0.001$) and within ($F_{32,482} = 2.352, P < 0.001$) Area-Habitat strata. In general, Glaucous Gull densities were highest along Barrier Island and Mainland Shoreline habitat, while Mid-lagoon appeared less important (Figs. 18, 19). Interestingly, Near-shore Marine habitat was important for this species in the eastern area only.

Within Area-Habitat strata, transect means were significantly different in the western Barrier Islands. Specifically, transect 23 had consistently higher densities than transect 202, a few kilometers to the west (Table 16). This difference contrasts with the distribution of Long-tailed Ducks where densities in transect 23 were significantly lower than neighboring transects in the same stratum.

Table 16. Mean log density (ln[den+1]) of Glaucous-winged Gulls in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	1.36				25	0.49	
		202	0.95				33	0.66	
		23	1.86				401	0.92	
		31	1.22				402	0.44	
				1.35					**0.63**
	Central					Central			
		907	0.77				913	1.07	
		908	1.33				914	1.17	
		909	0.62				915	0.83	
				0.91					**1.03**
	Control					Control			
		133	0.55				190	0.81	
		134	0.69				191	0.66	
		135	0.95				192	0.68	
		136	0.83				193	0.65	
				0.76					**0.70**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.12				101	0.40	
		301	0.01				102	0.08	
		302	0.04				22	0.08	
		32	0.05				30	0.07	
				0.06					**0.16**
	Central					Central			
		910	0.14				904	0.14	
		911	0.15				905	0.15	
		912	0.03				906	0.04	
				0.11					**0.11**
	Control					Control			
		180	0.65				60	0.15	
		181	0.14				61	0.05	
		182	0.08				62	0.09	
		183	0.06				63	0.01	
				0.23					**0.08**

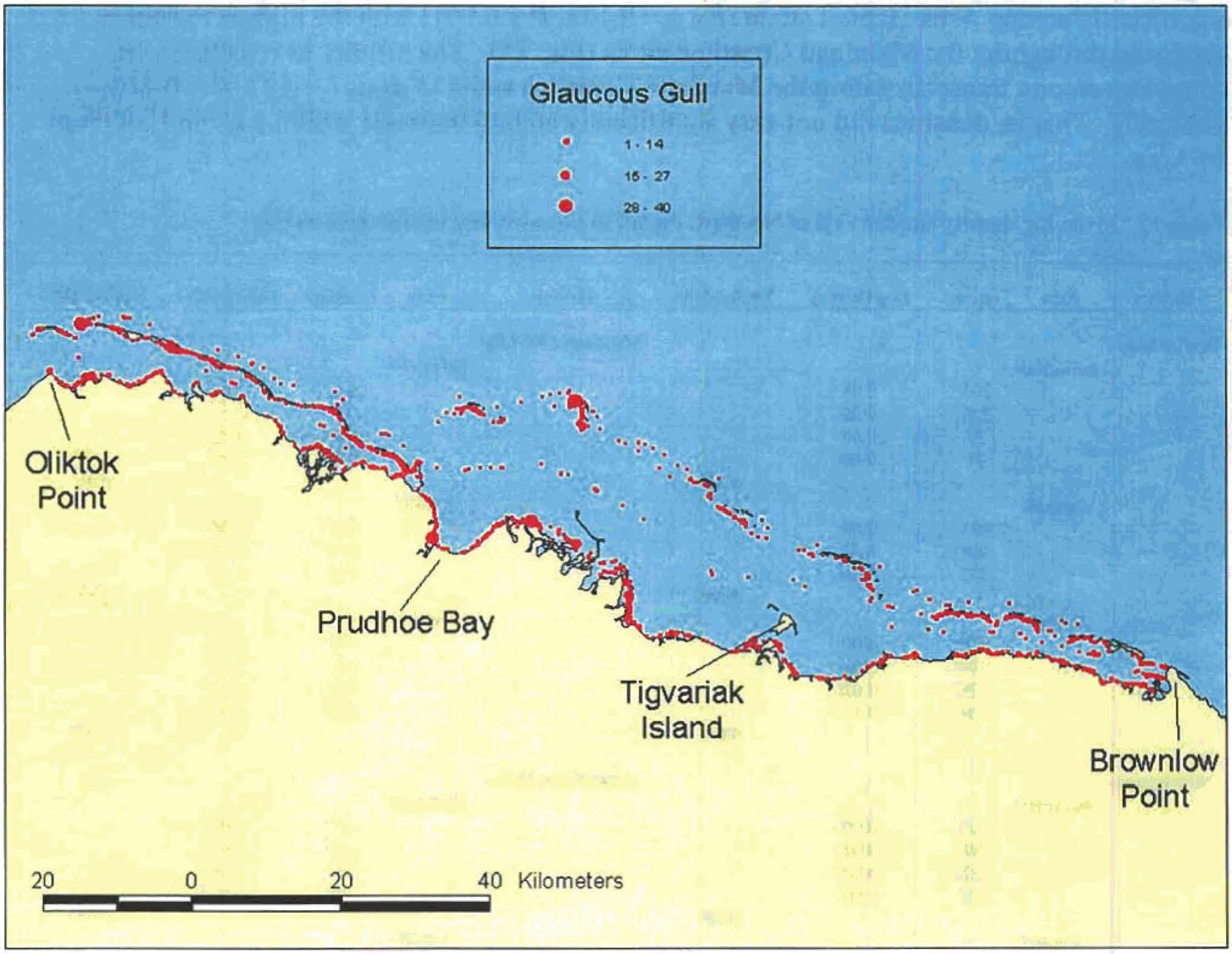

Figure 18. Locations of Glaucous Gulls during 12 Near-shore surveys, 1999-2000.

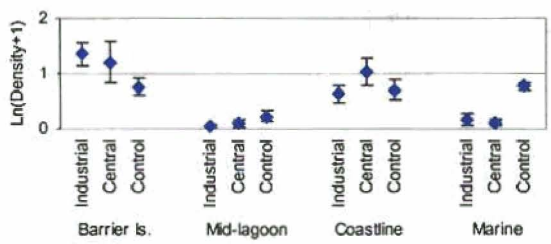

Figure 19. Mean log density (±95% CI) of Glaucous Gulls among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

NORTHERN PINTAIL—In contrast to the marine birds previously discussed, Northern Pintails were distributed almost exclusively along the coastline (Fig. 20) in relatively large flocks (median flock size = 6.5, range 1-150; Table 11). Thus, Pintail distribution varied significantly among Area-Habitat strata ($F_{9,32} = 9.132$, $P < 0.001$) with the highest densities occurring throughout the Mainland Coastline strata (Fig. 21). The affinity to coastline was consistent among transects within the Mainland Coastline strata ($F_{32,482} = 1.193$, $P = 0.219$, Table 17). That is, densities did not vary significantly among transects within a given Habitat in an Area.

Table 17. Mean log density (ln[den+1]) of Northern Pintail in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.08				25	0.26	
		202	0.00				33	0.24	
		23	0.03				401	0.42	
		31	0.00				402	0.23	
				0.03					**0.29**
	Central					Central			
		907	0.00				913	0.00	
		908	0.01				914	0.80	
		909	0.00				915	0.30	
				0.00					**0.37**
	Control					Control			
		133	0.00				190	0.72	
		134	0.01				191	0.70	
		135	0.02				192	0.23	
		136	0.13				193	0.57	
				0.04					**0.56**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.00				101	0.02	
		301	0.00				102	0.01	
		302	0.00				22	0.00	
		32	0.00				30	0.00	
				0.00					**0.01**
	Central					Central			
		910	0.00				904	0.04	
		911	0.00				905	0.01	
		912	0.00				906	0.00	
				0.00					**0.02**
	Control					Control			
		180	0.00				60	0.00	
		181	0.00				61	0.00	
		182	0.00				62	0.00	
		183	0.00				63	0.00	
				0.00					**0.00**

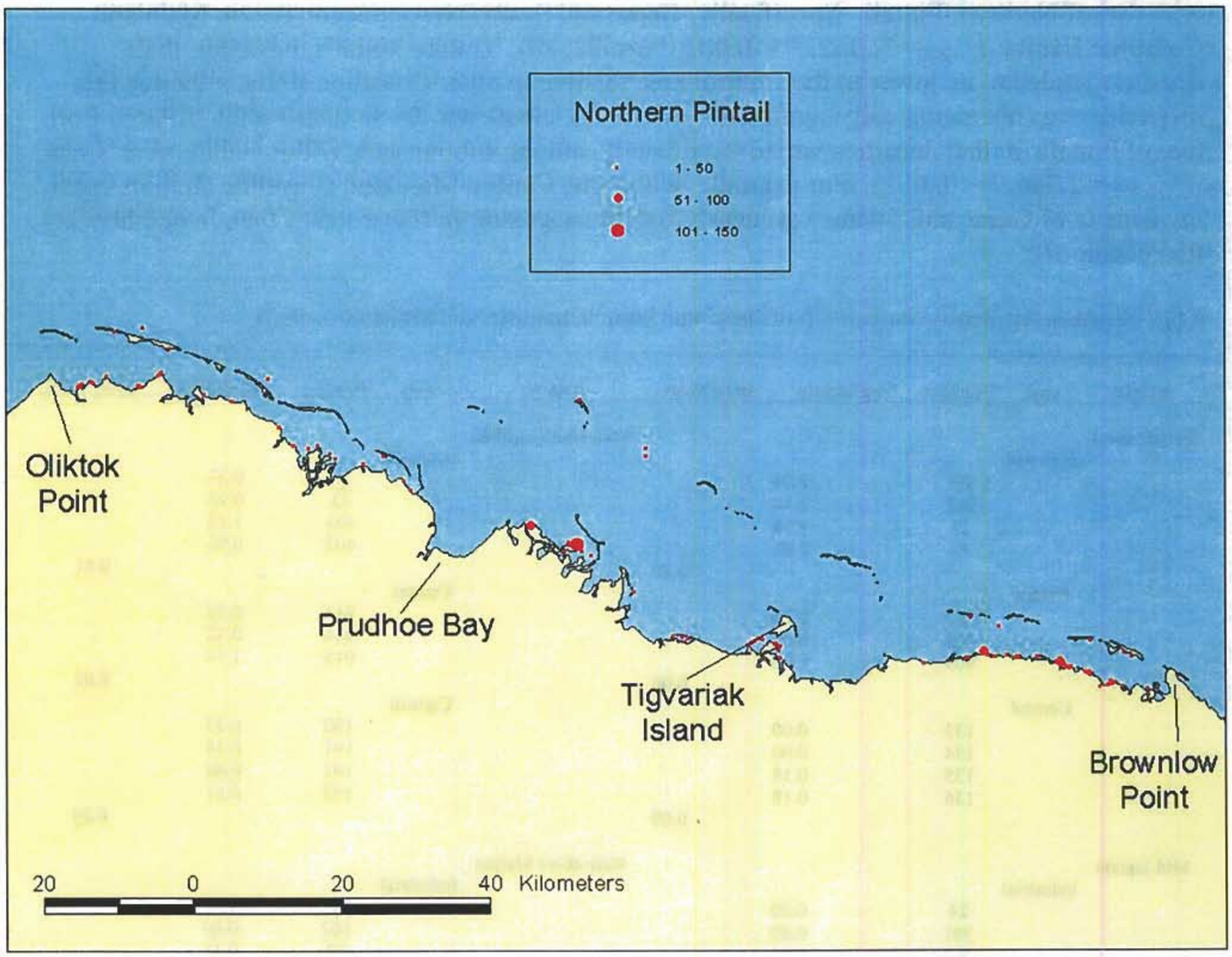

Figure 20. Locations of Northern Pintails during 12 Near-shore surveys, 1999-2000.

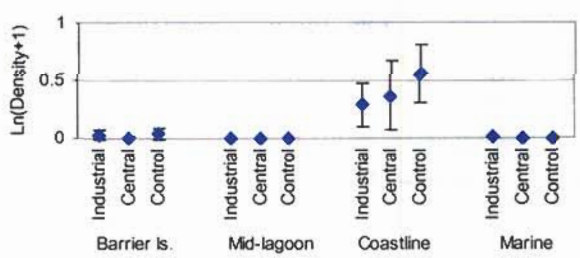

Figure 21. Mean log density (±95% CI) of Northern Pintails among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

GEEESE AND SWANS— The Geese and Swan group was composed of White-fronted Geese (*Anser albifrons*), Canada Geese (*Branta canadensis*), Black Brant (*Branta bernicla*), and Tundra Swans (*Cygnus columbianus*). These birds shared a similar distribution with that of Northern Pintail. Specifically, Geese and Swans were concentrated in Mainland Coastline Habitat ($F_{9,32} = 7.382$, $P < 0.001$; Figs. 22, 23). Unlike Pintails, however, their densities tended to be lower in the Control area relative to other Coastline strata, although this difference was not statistically significant. Similarly, Geese and Swan distribution differed from that of Pintails in that densities varied significantly among subtransects within habitat-area strata ($F_{32,482} = 2.786$, $P < 0.001$). For example, within the Central Mainland Coastline stratum, mean log density of Geese and Swans was nearly five times greater in transect 915 than in neighboring 914 (Table 18).

Table 18. Mean log density (ln[den+1]) of Geese and Swan in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.36				25	0.27	
		202	0.14				33	0.92	
		23	0.18				401	1.10	
		31	0.00				402	0.96	
				0.17					0.81
	Central					Central			
		907	0.00				913	0.50	
		908	0.00				914	0.32	
		909	0.00				915	1.57	
				0.00					0.80
	Control					Control			
		133	0.00				190	0.33	
		134	0.00				191	0.34	
		135	0.18				192	0.08	
		136	0.18				193	0.61	
				0.09					0.34
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.00				101	0.00	
		301	0.00				102	0.00	
		302	0.00				22	0.11	
		32	0.00				30	0.00	
				0.00					0.03
	Central					Central			
		910	0.00				904	0.00	
		911	0.00				905	0.00	
		912	0.00				906	0.00	
				0.00					0.00
	Control					Control			
		180	0.00				60	0.11	
		181	0.00				61	0.00	
		182	0.00				62	0.00	
		183	0.00				63	0.00	
				0.00					0.03

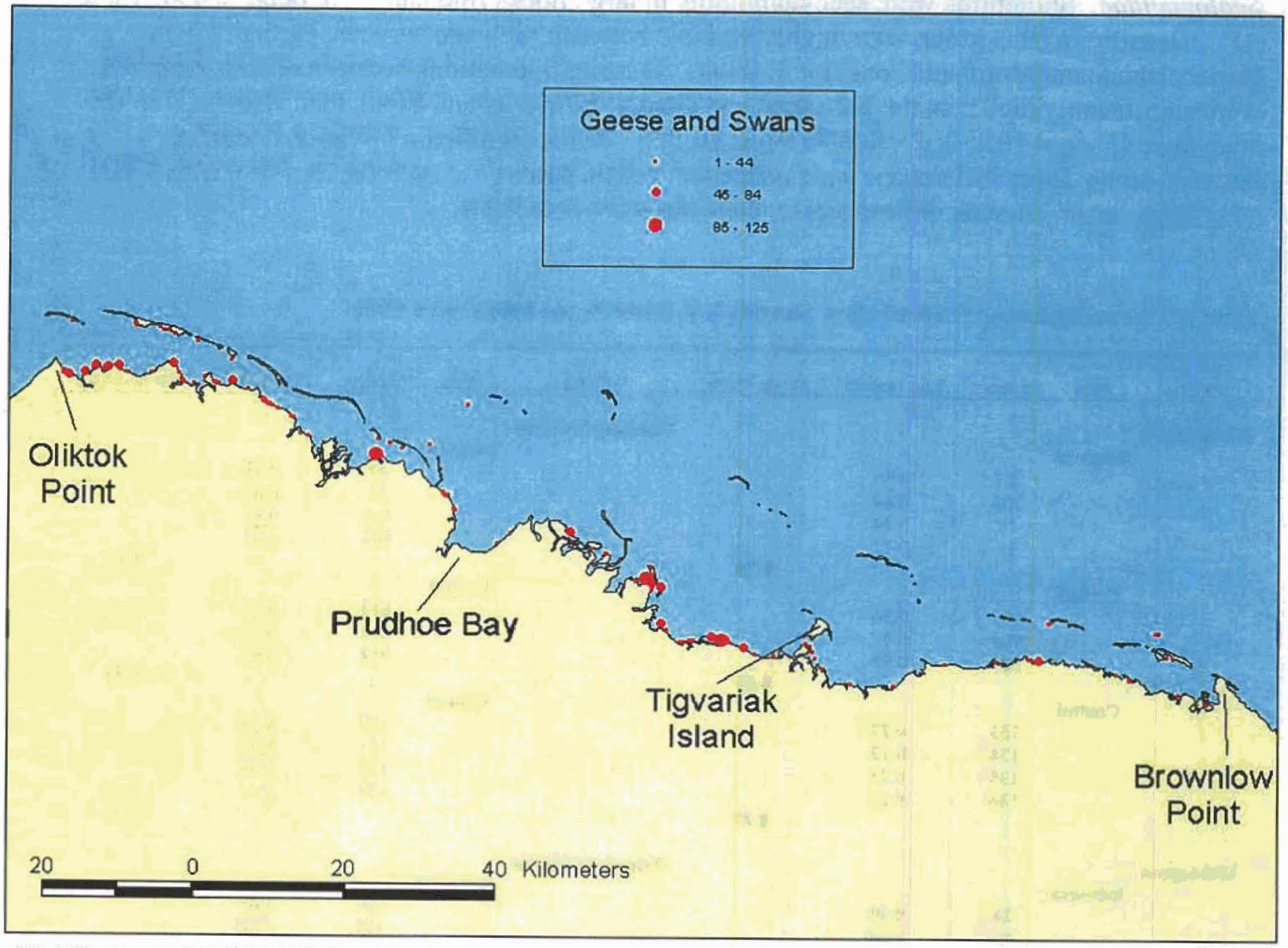

Figure 22. Locations of Geese and Swans during 12 Near-shore surveys, 1999-2000.

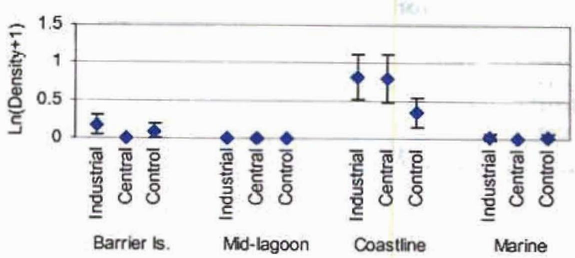

Figure 23. Mean log density (±95% CI) of Geese and Swans among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

SHOREBIRDS— Due to their small size, identification of shorebirds to species was difficult. Thus, in this survey we lumped all observations into the broad classification of "Shorebirds" which represented any species belonging to the families *Charadriidae* or *Scolopacidae*. Shorebirds were seen commonly in large flocks (median = 10, range 1-400; Table 11). Densities of this group were highly variable between replicate surveys, particularly in Barrier Island and Mainland Coastline Habitats. Despite fluctuations between counts, densities were significantly higher in the Industrial and Central Barrier Island Strata than elsewhere in the study area ($F_{9,32} = 10.313$, $P < 0.001$; Figs. 24, 25). While significant variation occurred between strata, these differences were consistent within strata ($F_{32,482} = 0.873$, $P = 0.670$; Table 19). Thus, no small-scale differences in densities were detectable.

Table 19. Mean log density (ln[den+1]) of Shorebirds in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.66				25	0.15	
		202	0.84				33	0.63	
		23	0.74				401	0.21	
		31	0.77				402	0.04	
				0.75					**0.26**
	Central					Central			
		907	0.36				913	0.33	
		908	0.77				914	0.56	
		909	0.95				915	0.56	
				0.69					**0.48**
	Control					Control			
		133	0.77				190	0.19	
		134	0.12				191	0.16	
		135	0.75				192	0.07	
		136	0.25				193	0.41	
				0.47					**0.21**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.00				101	0.07	
		301	0.00				102	0.05	
		302	0.09				22	0.00	
		32	0.00				30	0.00	
				0.02					**0.03**
	Central					Central			
		910	0.00				904	0.03	
		911	0.00				905	0.00	
		912	0.02				906	0.00	
				0.01					**0.01**
	Control					Control			
		180	0.49				60	0.03	
		181	0.00				61	0.00	
		182	0.05				62	0.00	
		183	0.00				63	0.00	
				0.13					**0.01**

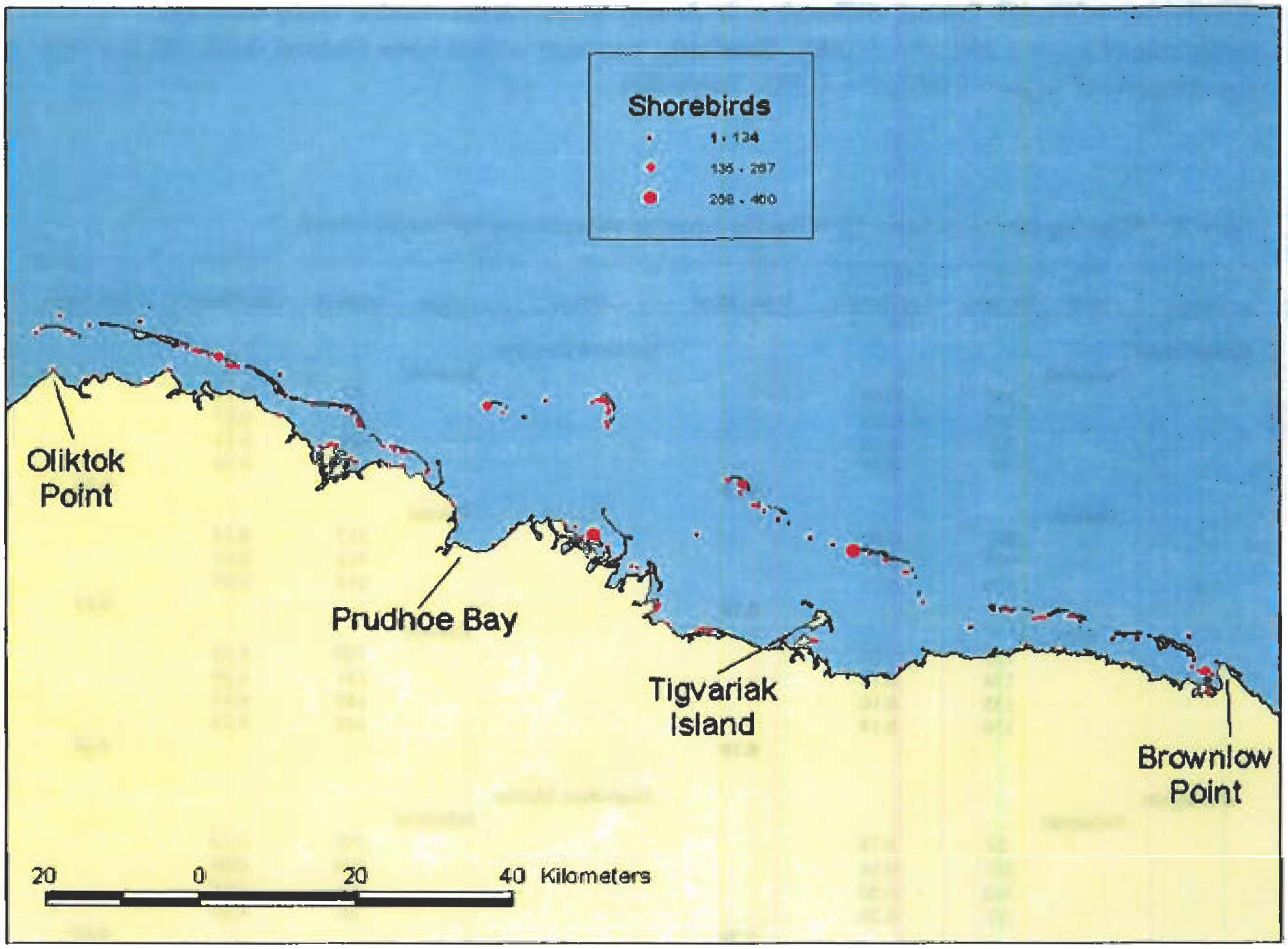

Figure 24. Locations of Shorebirds during 12 Near-shore surveys, 1999-2000.

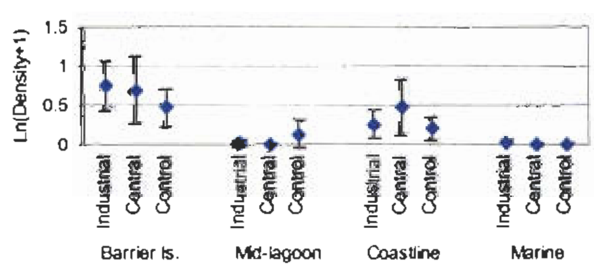

Figure 25. Mean log density (±95% CI) of Shorebirds among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

PACIFIC LOON—Pacific Loons were the most common loon species observed during Near-shore surveys. They occurred alone, in pairs, and in small flocks (median flock size = 1, range 1-30; Table 11) throughout all habitats (Fig. 26). Given the broad-scale distribution of Pacific Loons, differences in density among Area-Habitat strata were not detectable ($F_{9,32} = 1.891$, $P = 0.090$). Similarly, transects within Area-Habitat strata did not vary significantly ($F_{32,482} = 1.057$, $P = 0.385$; Table 20).

Table 20. Mean log density (ln[den+1]) of Pacific Loons in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.20				25	0.23	
		202	0.05				33	0.27	
		23	0.16				401	0.31	
		31	0.35				402	0.30	
				0.19					**0.28**
	Central					Central			
		907	0.09				913	0.14	
		908	0.11				914	0.05	
		909	0.11				915	0.20	
				0.10					**0.13**
	Control					Control			
		133	0.05				190	0.16	
		134	0.12				191	0.30	
		135	0.10				192	0.15	
		136	0.14				193	0.18	
				0.10					**0.20**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.18				101	0.14	
		301	0.14				102	0.08	
		302	0.20				22	0.04	
		32	0.26				30	0.09	
				0.20					**0.09**
	Central					Central			
		910	0.20				904	0.08	
		911	0.10				905	0.21	
		912	0.08				906	0.13	
				0.13					**0.14**
	Control					Control			
		180	0.25				60	0.11	
		181	0.09				61	0.16	
		182	0.10				62	0.15	
		183	0.13				63	0.10	
				0.14					**0.13**

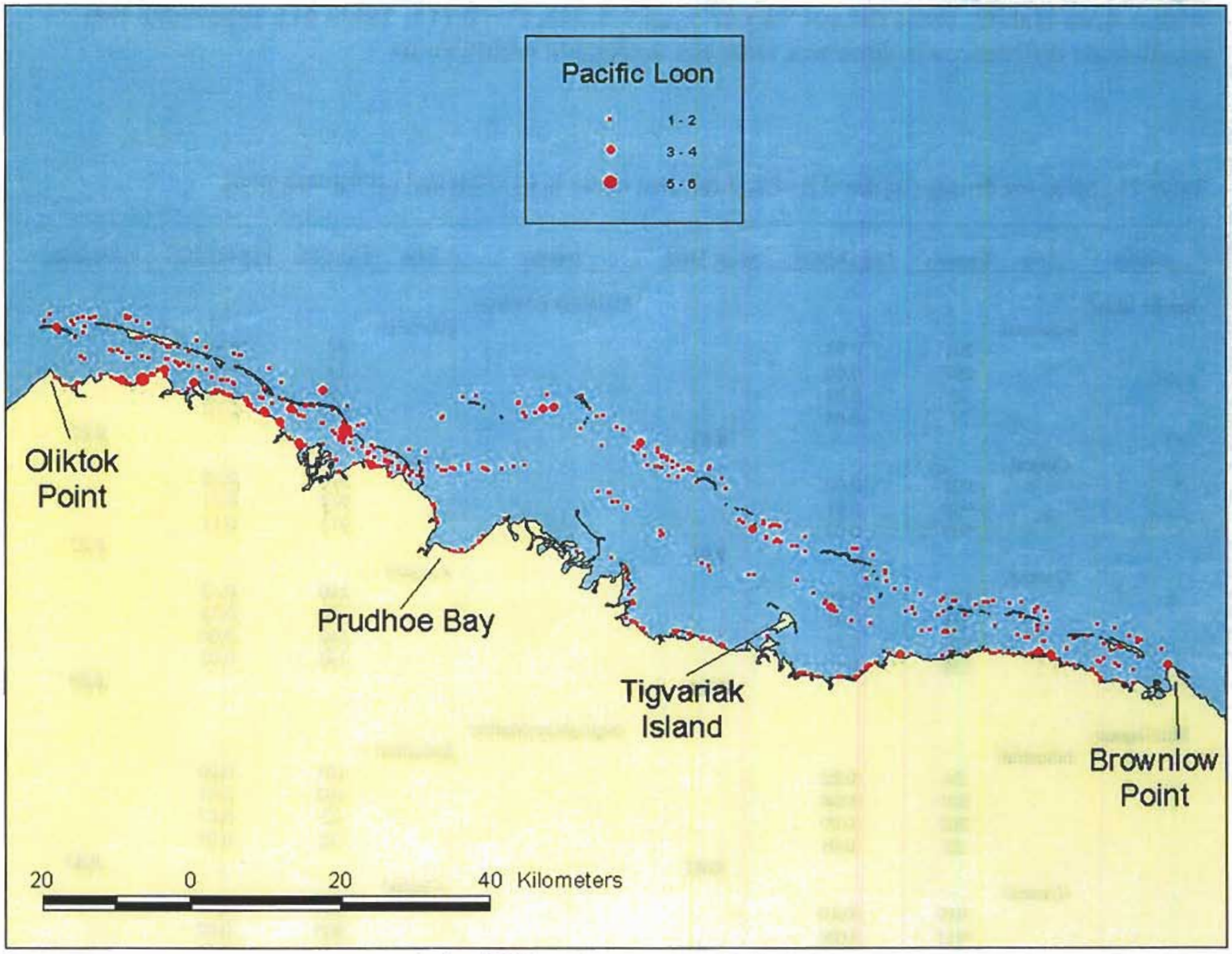

Figure 26. Locations of Pacific Loons during 12 Near-shore surveys, 1999-2000.

RED-THROATED LOON—Unlike Pacific Loons, Red-throated Loons were relatively uncommon in the near-shore environment and occurred in small flocks (median flock size = 1, range 1-5; Table 11). Red-throated Loons tended to occur in Mainland Coastline Habitat with greater frequency than in other habitats, yet this difference was not statistically significant at the alpha = 0.05 level ($F_{9,32} = 2.338$, $P = 0.057$; Fig. 27). Moreover, transects within Area-Habitat strata did not vary ($F_{32,482} = 1.325$, $P = 0.113$; Table 21), suggesting that small-scale differences in densities were not detectable within strata.

Table 21. Mean log density (ln[den+1]) of Red-throated Loons in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.05				25	0.05	
		202	0.00				33	0.05	
		23	0.03				401	0.09	
		31	0.04				402	0.10	
				0.03					**0.07**
	Central					Central			
		907	0.00				913	0.08	
		908	0.01				914	0.01	
		909	0.02				915	0.11	
				0.01					**0.07**
	Control					Control			
		133	0.06				190	0.13	
		134	0.01				191	0.13	
		135	0.01				192	0.06	
		136	0.10				193	0.02	
				0.05					**0.09**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.02				101	0.00	
		301	0.04				102	0.01	
		302	0.00				22	0.07	
		32	0.01				30	0.05	
				0.02					**0.03**
	Central					Central			
		910	0.10				904	0.00	
		911	0.00				905	0.02	
		912	0.01				906	0.02	
				0.04					**0.01**
	Control					Control			
		180	0.06				60	0.04	
		181	0.00				61	0.00	
		182	0.00				62	0.03	
		183	0.00				63	0.00	
				0.02					**0.02**

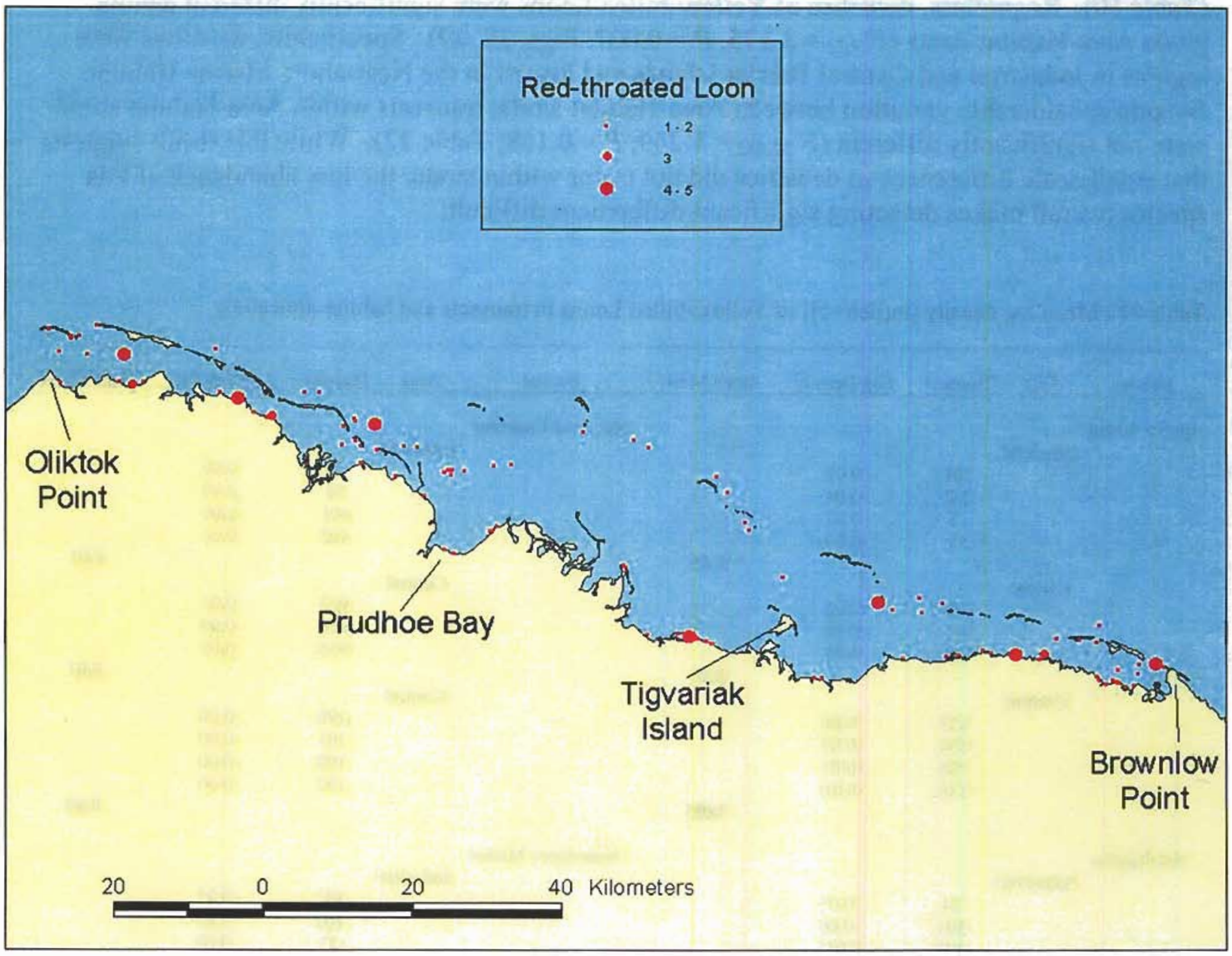

Figure 27. Locations of Red-throated Loons during 12 Near-shore surveys, 1999-2000.

YELLOW-BILLED LOON—As with Red-throated Loons, Yellow-billed Loons were uncommon in the near-shore environment. Mean flock size was the lowest of all marine birds recorded during the surveys (median flock size = 1, range 1-3; Table 11) and overall counts were lower than other taxa groups whose distribution is described in this report (Table 10). Regardless, densities of Yellow-billed Loons were significantly different among given Area-Habitat strata ($F_{9,32} = 3.175$, $P = 0.007$; Figs. 28, 29). Specifically, densities were highest in Industrial and Control Barrier Islands and lowest in the Near-shore Marine Habitat. Despite considerable variation between Area-Habitat strata, transects within Area-Habitat strata were not significantly different ($F_{32,482} = 1.249$, $P = 0.168$; Table 22). While this result suggests that small-scale differences in densities did not occur within strata, the low abundance of this species overall makes detecting significant differences difficult.

Table 22. Mean log density (ln[den+1]) of Yellow-billed Loons in transects and habitat-area strata.

Habitat	Area	Transect	Log Density	Strata Mean	Habitat	Area	Transect	Log Density	Strata Mean
Barrier Island					Mainland Coastline				
	Industrial					Industrial			
		201	0.07				25	0.00	
		202	0.04				33	0.00	
		23	0.02				401	0.00	
		31	0.09				402	0.06	
				0.05					**0.01**
	Central					Central			
		907	0.02				913	0.01	
		908	0.00				914	0.00	
		909	0.03				915	0.02	
				0.01					**0.01**
	Control					Control			
		133	0.06				190	0.00	
		134	0.03				191	0.00	
		135	0.01				192	0.00	
		136	0.10				193	0.00	
				0.05					**0.00**
Mid-lagoon					Near-shore Marine				
	Industrial					Industrial			
		24	0.05				101	0.01	
		301	0.00				102	0.00	
		302	0.04				22	0.00	
		32	0.01				30	0.00	
				0.03					**0.00**
	Central					Central			
		910	0.01				904	0.00	
		911	0.01				905	0.00	
		912	0.00				906	0.00	
				0.01					**0.00**
	Control					Control			
		180	0.01				60	0.00	
		181	0.00				61	0.00	
		182	0.03				62	0.00	
		183	0.00				63	0.02	
				0.01					**0.01**

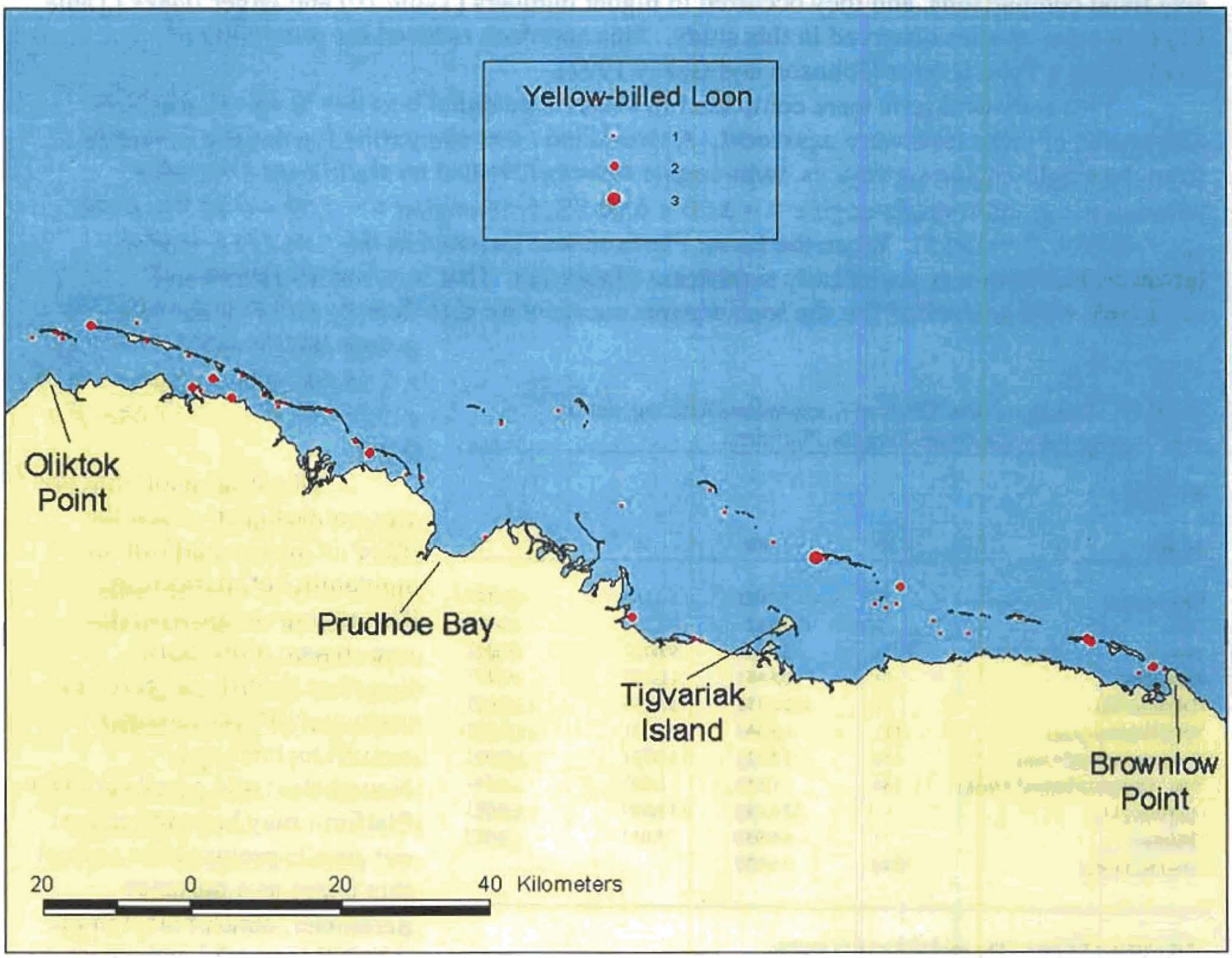

Figure 28. Locations of Yellow-billed Loons during 12 Near-shore surveys, 1999-2000.

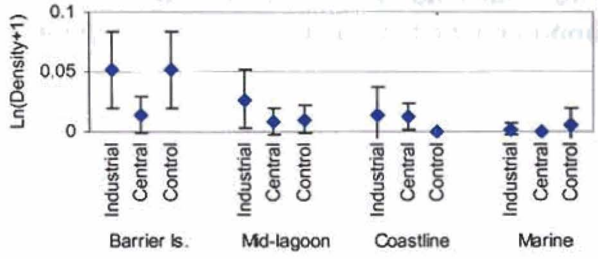

Figure 29. Mean log density (±95% CI) of Yellow-billed Loons among four near-shore habitats in Control, Central, and Industrial areas, 1999-2000.

Bias Due to Changes in Survey Platform

Due to concerns that aircraft type may influence density estimates of marine birds, we tested the effect of survey platform (single-engine, twin-engine) on the log density of Long-tailed Ducks. We chose to examine Long-tailed Ducks because they were the focal species of inter-area trend comparisons, and they occurred in higher numbers (Table 10) and larger flocks (Table 11) than other species observed in this study. This approach reduced the possibility of committing a Type II error (Johnson and Gazey 1992).

Two statistical tests were completed to measure potential bias due to survey platform. The results of these tests were equivocal. A two-tailed t-test comparing log density estimates from the single-engine surveys vs. twin-engine surveys revealed no significant difference between the groups (single-engine $\bar{x} = 3.00 \pm 0.08$ SE, twin-engine $\bar{x} = 3.02 \pm 0.28$ SE; t-test: $t_{646} = -0.059$, $P = 0.953$). When the factor Platform was included in the ANCOVA model, however, Platform was statistically significant (Table 23). That is, when all factors and covariates were controlled for, the least squares means were significantly different between the groups (single-engine $\bar{x} = 3.12 \pm 0.14$ SE, twin-engine $\bar{x} = 3.59 \pm 0.22$ SE; $F_{1,549} = 11.954$, $P = 0.008$.

Table 23. Results of ANCOVA on Long-tailed Duck log density (Ln[Density+1]) while controlling for Platform.

$R^2 = 0.76$

Term	df	MS	F^1	P
Disturbance	2	1.105	1.114	0.329
Area	1	143.212	0.681	0.456
Year	3	62.454	9.072	0.002
Area*Year	3	10.844	1.575	0.247
Habitat(Area)	4	210.332	15.216	$\leq$0.001
Year*Habitat(Area)	12	6.884	6.531	$\leq$0.001
Transect(Habitat*Area)	18	13.823	13.931	$\leq$0.001
Year*Transect(Habitat*Area)	54	1.054	1.062	0.361
Ln(Wave+1)	1	31.443	31.689	$\leq$0.001
Platform	1	6.959	7.013	0.008
Residual Error	548	0.992		

[1] See table 2 for error terms used to derive F- statistic

The Near-shore Survey was not designed to test the effect of survey platform on sightability of marine birds. The attempt to ascertain the importance of Platform, therefore, is difficult given the restriction of a twin-engine aircraft to 1999 only. Nonetheless, the possibility that Platform may have influenced our results prompted us to treat this factor as a nuisance parameter, control for it in the ANCOVA model and reassess the hypotheses that were designed to test for industry effects. When we did this, the results of our inter-area trend comparisons and correlation between human activity and bird distribution remained unchanged (Tables 7, 23) indicating that type of aircraft used was unimportant when evaluating the effects of human activities on Long-tailed Ducks.

Offshore Survey Results

Components of Variation in Offshore Distribution—As with the Near-shore survey data, variation in offshore marine bird density was quantified using ANOVA and ANCOVA models. Although similar analysis techniques were used, far less variation was explained in the offshore area compared to the near-shore area. For example, only 40% of the variation in Long-tailed Duck density in the offshore area was explained by ANOVA and ANCOVA models (Tables 24) compared with 75% in the near-shore area.

Table 24. Final analysis of variance (ANOVA) and analysis of covariance (ANCOVA) models that explain variation in log density (ln[density+1]) of waterfowl and marine birds on Offshore surveys, Beaufort Sea, Alaska, 1999-2000. Non-significant factors and covariates were removed following backward stepwise removal procedures.

	ANOVA		ANCOVA	
Species Group	Model[a]	R^2	Model	R^2
All Eider	S+Y+R+SR	0.23	S+Y+R+SR	0.23
Common Eider	Y+S+R+SY	0.16	S+Wa+SY	0.15
King Eider	S+Y+R+SR+YR	0.32	S+Y+R+SR+YR	0.32
Spectacled Eider	SYR[b]	0.05	SYR[a]	0.05
Long-tailed Duck	S+R+Y+SR+SY	0.40	S+R+Y+SR+SY	0.40
All Scoters	S+Y+SR+YR	0.21	S+Y+SR+YR	0.21
Glaucous Gulls	S+R+SR	0.28	S+ R+ I+SR	0.29
All Loons	S+SR+YR+SYR	0.23	S+Wa+Wi+I+SY	0.21
Pacific Loon	S+SR	0.15	R+Wi+I+SY+SR	0.20
Red-throated Loon	S+SY+SR+YR+SYR	0.21	Y+Wa+I+SY+SR+YR+SYR	0.21
Yellow-billed Loon	S+R+YR+SYR	0.17	S+R+Wi+YR+SYR	0.18

[a] See table 5 for term abbreviations
[b] P=0.058

Densities of marine birds in the offshore environment varied across time and space. Thus, generalizations regarding bird distribution must take into account both the time of year and general area. To illustrate, while Month (June, July, August) and Strata explained a significant portion of variation in density for most focal taxa (Table 25), a significant Strata*Month term was detected among King Eiders, Long-tailed Ducks, Scoters, Glaucous Gulls, Pacific Loons, and Red-throated Loons ($P < 0.05$), revealing that local distribution patterns varied by stage of the summer.

Although the stage of summer impacted distribution patterns of many marine birds, its effect varied between years. For example, the Year*Month term was significant among King Eiders, Scoters, and Red-throated and Yellow-billed Loons. Thus for these species, densities varied by Month to varying extents in 1999 versus 2000. Similarly, the Year*Strata term was significant among Common Eiders, Long-tailed Ducks, and Red-throated Loons ($P < 0.05$) suggesting that these birds used strata differently between 1999-2000.

To better explain variability in density estimates in the offshore area, three covariates were included in an ANCOVA model (Table 6). These covariates included Percent Ice Cover (Arc-sine transformed), Wave Height (Log transformed), and Wind Speed. These covariates were negatively correlated with density of several species (Table 26). Thus, as Ice Cover, Wave Height, and Wind Speed increased, bird density decreased. While these covariates explained a significant portion of variability in density estimates of several taxa, their contribution was relatively small. This is demonstrated by the similarity in R^2 estimates (representing the proportion of variability explained in a given model) in the ANOVA and ANCOVA models (Table 24). For example, among Red-throated Loons, an equal proportion of variability was accounted for in the two models. Similarly, among Glaucous Gulls and Yellow-billed Loons, just 1% more of the variance was explained when covariates were introduced. Thus, with the exception of models describing Pacific Loon density, whose R^2 increased by 5% when covariates were included, Ice Cover, Wave Height and Wind Speed had little effect on density estimates of marine birds.

Several important considerations regarding these covariates should be considered when interpreting these results. First, wind and waves are correlated; thus it is possible that while wind speed may be significant in an ANCOVA model, its inclusion prevents the wave height parameter from appearing significant. Second, it is likely that wave height and wind speed affect the sightability rather than density of marine birds. For this reason, standard protocol requires that surveys be conducted under specific weather conditions. For example, surveys were initiated only when surface winds were less than 15 knots. Similarly, observations were suspended if winds exceeded 20 knots during the course of the survey. Thus, we do not have a random sample of weather conditions to test the effect of wind and waves. It is likely that under severe weather conditions wind speed and wave height could significantly alter the distribution of all marine birds. Given our restricted sampling conditions, however, we could not report the full range of responses to weather conditions that is characteristic of the Beaufort Sea.

Offshore Species Composition and Distribution

We observed 19,924 birds among 28 taxa during Offshore surveys in 1999-2000 (Table 27, Appendix 4). Long-tailed Ducks comprised the largest proportion of these birds (44%) followed by King Eiders (28%), Scoters (10%) Common Eiders (5%), and Glaucous Gulls (5%; Fig. 30). These five groups made up over 90% of the avifauna in the Offshore survey area. When combined with Pacific, Red-throated and Yellow-billed Loons, Spectacled Eiders and unidentified *Somateria* Eider species, these groups represented over 95% of all birds sighted. These "focal" taxa are discussed in this report, whereas Northern Pintail, Geese, Swans, Shearwaters (*Puffinus spp.*), Scaup, Red-breasted Mergansers, Shorebirds, Jaegers, Arctic Terns, Black Guillemots, and Auklets (*Aethia spp.*) were incidental sightings; thus inferences regarding their distribution and density are difficult and not reported here.

Species composition varied among the 8 strata (2 depth classes across 4 west-east regions; Fig. 4), reflecting differences in distribution among depth and regional classes (Table 28). For example, while Long-tailed Ducks represented the majority of birds overall, King Eiders comprised over 84% of the Central Deep-water stratum (Fig. 31). Similarly, while Common Eiders only represented 5% of all birds seen during the Offshore survey as a whole, they represented 33% of birds in the Industrial Deep-water stratum.

Table 25. Results of ANCOVA models that explain variation of marine bird log density (ln [density +1]) in offshore waters, Beaufort Sea, 1999-2000. Non-significant factors and covariates were removed following backward stepwise removal procedures.

Species	Source of Variation	df	F	P-value	R^2
All Eiders	Stratum	7	4.39	< 0.01	
	Month	2	10.94	< 0.01	
	Year	1	6.27	0.01	
	Stratum*Month	14	4.24	< 0.01	
	Error	448			0.23
Common Eider	Stratum	7	9.42	< 0.01	
	Ln (wave ht +1)	1	15.11	< 0.01	
	Stratum*Year	7	3.73	< 0.01	
	Error	457			0.15
King Eider	Stratum	7	8.28	< 0.01	
	Month	2	18.58	< 0.01	
	Year	1	14.59	< 0.01	
	Stratum*Month	14	4.76	< 0.01	
	Year*Month	2	3.53	0.03	
	Error	446			0.32
Spectacled Eider	Stratum*Year*Month	14	1.67	0.06	
	Error	458			0.05
Long-tailed Duck	Stratum	7	24.18	< 0.01	
	Month	2	24.81	< 0.01	
	Year	1	12.21	< 0.01	
	Stratum*Month	14	4.73	< 0.01	
	Stratum*Year	7	2.81	< 0.01	
	Error	441			0.40
All Scoters	Stratum	7	7.92	< 0.01	
	Year	1	5.26	0.02	
	Stratum*Month	14	3.59	< 0.01	
	Year*Month	2	7.68	< 0.01	
	Error	448			0.21
Glaucous Gull	Stratum	7	9.21	< 0.01	
	Month	2	6.56	< 0.01	
	Arc sine %ice	1	6.50	0.01	
	Stratum*Month	14	1.90	0.03	
	Error	448			0.29
All Loons	Stratum	7	3.68	< 0.01	
	Ln (wave ht +1)	1	7.14	< 0.01	
	Wind speed	1	10.32	< 0.01	
	Arc sine %ice	1	18.56	< 0.01	
	Stratum*Year	7	2.40	0.02	
	Error	455			0.21
Pacific Loon	Month	2	10.17	< 0.01	
	Wind speed	1	8.96	< 0.01	
	Arc sine %ice	1	55.42	< 0.01	
	Stratum*Month	14	3.08	< 0.01	
	Stratum*Year	7	2.54	0.01	
	Error	447			0.20
Red-throated Loon	Year	1	5.30	0.02	
	Ln (wave ht +1)	1	7.69	< 0.01	
	Arc sine %ice	1	22.81	< 0.01	
	Stratum*Month	14	1.90	0.02	
	Stratum*Year	7	3.10	< 0.01	
	Year*Month	2	5.31	< 0.01	
	Stratum*Year*Month	14	2.44	< 0.01	
	Error	432			0.21
Yellow-billed Loon	Stratum	7	3.91	< 0.01	
	Month	2	3.41	0.03	
	Wind speed	1	6.27	0.01	
	Year*Month	2	5.76	< 0.01	
	Stratum*Year*Month	14	2.11	0.01	
	Error	446			0.18

Table 26. Results of ANCOVA models that explain variation of marine bird log density (ln [density +1]) in offshore waters, Beaufort Sea, 1999-2000. Non-significant factors and covariates were removed following backward stepwise removal procedures.

Species	Source of Variation	df	F	P-value	R^2
All Elders	Stratum	7	4.39	< 0.01	
	Month	2	10.94	< 0.01	
	Year	1	6.27	0.01	
	Stratum*Month	14	4.24	< 0.01	
	Error	448			0.23
Common Elder	Stratum	7	9.42	< 0.01	
	Ln (wave ht +1)	1	15.11	< 0.01	
	Stratum*Year	7	3.73	< 0.01	
	Error	457			0.15
King Elder	Stratum	7	8.28	< 0.01	
	Month	2	18.58	< 0.01	
	Year	1	14.59	< 0.01	
	Stratum*Month	14	4.76	< 0.01	
	Year*Month	2	3.53	0.03	
	Error	446			0.32
Spectacled Elder	Stratum*Year*Month	14	1.67	0.06	
	Error	458			0.05
Long-tailed Duck	Stratum	7	24.18	< 0.01	
	Month	2	24.81	< 0.01	
	Year	1	12.21	< 0.01	
	Stratum*Month	14	4.73	< 0.01	
	Stratum*Year	7	2.81	< 0.01	
	Error	441			0.40
All Scoters	Stratum	7	7.92	< 0.01	
	Year	1	5.26	0.02	
	Stratum*Month	14	3.59	< 0.01	
	Year*Month	2	7.68	< 0.01	
	Error	448			0.21
Glaucous Gull	Stratum	7	9.21	< 0.01	
	Month	2	6.56	< 0.01	
	Arc sine %ice	1	6.50	0.01	
	Stratum*Month	14	1.90	0.03	
	Error	448			0.29
All Loons	Stratum	7	3.68	< 0.01	
	Ln (wave ht +1)	1	7.14	< 0.01	
	Wind speed	1	10.32	< 0.01	
	Arc sine %ice	1	18.56	< 0.01	
	Stratum*Year	7	2.40	0.02	
	Error	455			0.21
Pacific Loon	Month	2	10.17	< 0.01	
	Wind speed	1	8.96	< 0.01	
	Arc sine %ice	1	55.42	< 0.01	
	Stratum*Month	14	3.08	< 0.01	
	Stratum*Year	7	2.54	0.01	
	Error	447			0.20
Red-throated Loon	Year	1	5.30	0.02	
	Ln (wave ht +1)	1	7.69	< 0.01	
	Arc sine %ice	1	22.81	< 0.01	
	Stratum*Month	14	1.90	0.02	
	Stratum*Year	7	3.10	< 0.01	
	Year*Month	2	5.31	< 0.01	
	Stratum*Year*Month	14	2.44	< 0.01	
	Error	432			0.21
Yellow-billed Loon	Stratum	7	3.91	< 0.01	
	Month	2	3.41	0.03	
	Wind speed	1	6.27	0.01	
	Year*Month	2	5.76	< 0.01	
	Stratum*Year*Month	14	2.11	0.01	
	Error	446			0.18

Table 27. Bird species observed during six Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

Species	Species Code	Total Count	% of Total
Yellow-billed Loon	YBLO	27	0.14
Pacific Loon	PALO	282	1.42
Red-throated Loon	RTLO	65	0.33
Unidentified Loon *spp.*	UNLO	1	0.01
Shearwater *spp.*	SHWA	37	0.19
Tundra Swan	TUSW	21	0.11
White-fronted Goose	WFGO	155	0.78
Snow Goose	SNGO	25	0.13
Canada Goose	CAGO	25	0.13
Black Brant	BLBR	85	0.43
Northern Pintail	NOPI	173	0.87
Scaup *spp.*	SCAU	154	0.77
Common Eider	COEI	926	4.65
King Eider	KIEI	5493	27.57
Spectacled Eider	SPEI	148	0.74
Unidentified Eider *spp.*	UNEI	333	1.67
Black Scoter	BLSC	46	0.23
White-winged Scoter	WWSC	204	1.02
Surf Scoter	SUSC	1112	5.58
Unidentified Scoter *spp.*	UNSC	542	2.72
Long-tailed Duck	LTDU	8797	44.15
Red-breasted Merganser	RBME	25	0.13
Shorebird *spp.*	SHSP	249	1.25
Jaeger *spp.*	JAEG	52	0.26
Glaucous Gull	GLGU	891	4.47
Arctic Tern	ARTE	51	0.26
Black Guillemot	BLGU	2	0.01
Auklet *spp.*	AUKL	3	0.02
Total		19924	100.00

Table 28. Number observed and percent composition of focal taxa among Offshore survey strata.

	Strata															
	1 Harrison Bay Deep		2 Industrial Deep		3 Central Deep		4 Control Deep		5 Harrison Bay Shallow		6 Industrial Shallow		7 Central Shallow		8 Control Shallow	
Species	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
YBLO[a]	1	0.0	2	0.2	1	0.1	0	0.0	18	0.4	0	0.0	5	0.2	0	0.0
PALO	55	1.4	28	2.6	24	2.1	17	7.9	91	2.0	30	2.5	32	1.0	5	0.1
RTLO	6	0.2	2	0.2	7	0.6	4	1.9	22	0.5	7	0.6	16	0.5	1	0.0
UNLO	1	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
COEI	7	0.2	58	5.3	25	2.2	68	31.6	276	6.1	161	13.5	184	5.6	147	4.2
KIEI	3051	78.4	542	49.4	956	84.2	21	9.8	708	15.7	47	3.9	138	4.2	30	0.9
SPEI	147	3.8	0	0.0	0	0.0	0	0.0	1	0.0	0	0.0	0	0.0	0	0.0
UNEI	204	5.2	43	3.9	33	2.9	8	3.7	19	0.4	4	0.3	9	0.3	13	0.4
All Scoters	71	1.8	113	10.3	14	1.2	40	18.6	1257	27.9	186	15.6	203	6.1	20	0.6
LTDU	312	8.0	284	25.9	63	5.6	55	25.6	1894	42.1	568	47.7	2371	71.7	3250	92.1
GLGU	36	0.9	25	2.3	12	1.1	2	0.9	216	4.8	187	15.7	351	10.6	62	1.8
Total	3891		1097		1135		215		4502		1190		3309		3528	

[a] See table 26 for species abbreviations

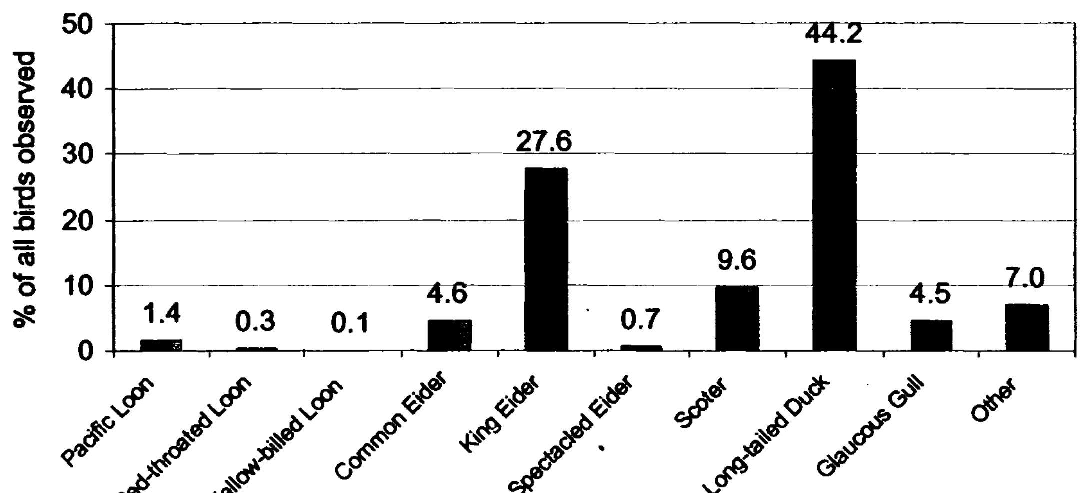

Figure 30. Percent composition of focal taxa observed during Offshore surveys, 1999-2000.

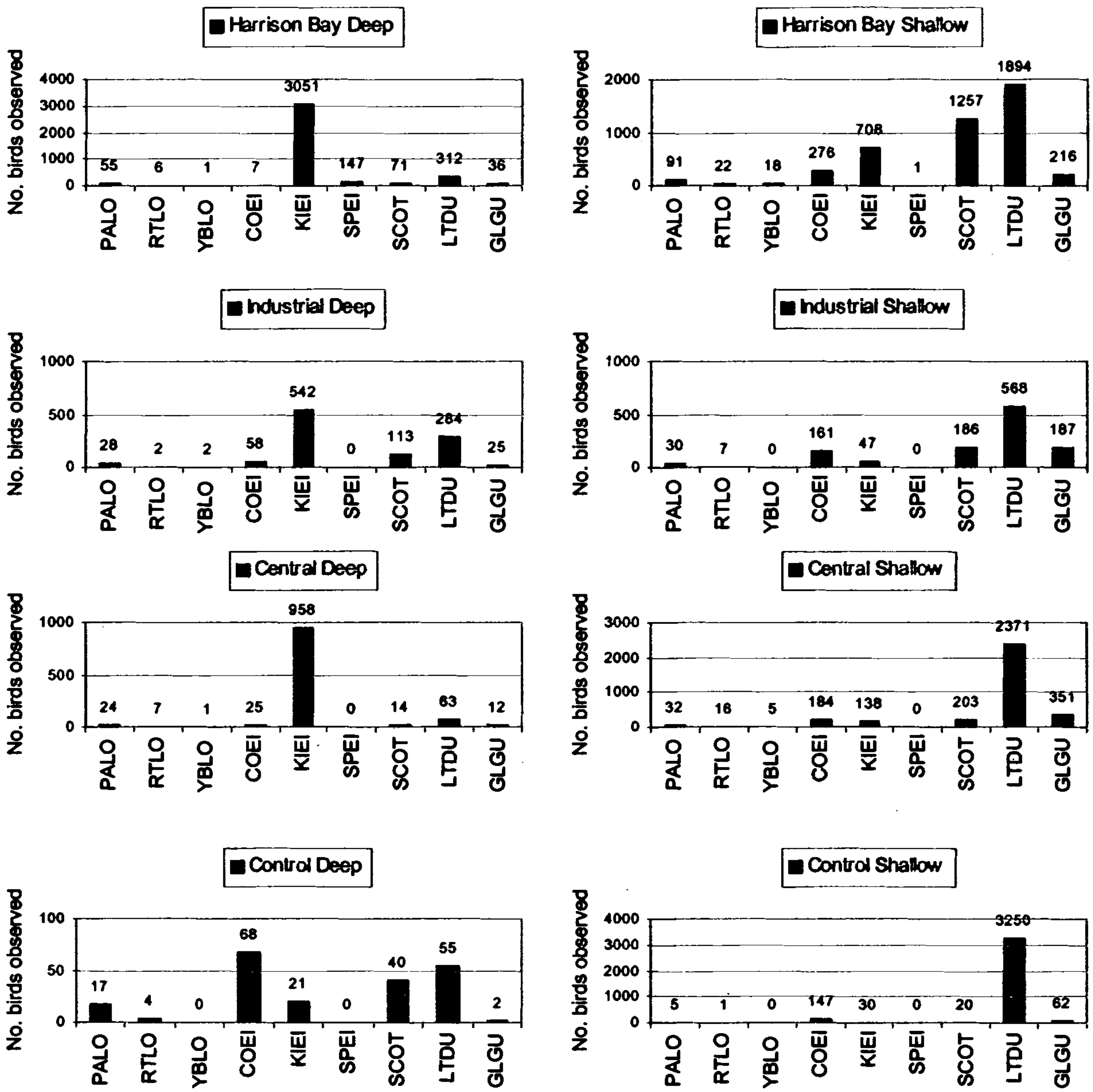

Figure 31. Number of individuals per taxa seen in each strata. Eiders comprised the majority of sightings in deep-water strata, while Long-tailed Ducks dominated the shallow-water strata. PALO- Pacific Loon, RTLO- Red-throated Loon, YBLO- Yellow-billed Loon, COEI- Common Eider, KIEI- King Eider, SPEI- Spectacled Eider, SCOT- Scoter, LTDU- Long-tailed Duck, GLGU- Glaucous Gull.

LONG-TAILED DUCK— The Long-tailed Duck was the most abundant marine bird observed on the Offshore survey, representing 44% of all birds recorded. While Long-tailed Ducks were seen in relatively large groups in near-shore areas (Table 11), flock size in offshore areas was smaller (Table 29).

Densities of Long-tailed Ducks varied by Stratum ($F_{7,441} = 24.184$, $P < 0.001$). In general, densities were greater in shallow-water than in deep-water strata (Fig. 32); however, distribution among these strata varied through the summer ($F_{14,441} = 4.728$, $P < 0.001$; Fig. 33). That is, Long-tailed Ducks moved from deep-water strata in June to shallow-water strata in the July post-breeding molt period. By the end of August, ducks began to move back into offshore waters. Moreover, the Control Shallow-water stratum was used to a greater extent in 1999 than in 2000, whereas use of other strata was consistent between years ($F_{7,441} = 2.807$, $P = 0.007$; Fig. 34).

COMMON EIDER— Common Eiders were found in relatively small flocks in the Offshore survey compared to the Near-shore survey (Tables 29, 11). As with Long-tailed Ducks, Common Eider densities varied between strata ($F_{7,457} = 9.415$, $P < 0.001$; Fig. 35) but densities also varied among strata between years ($F_{7,457} = 3.727$, $P < 0.001$; Fig. 36). In general, high densities were observed in shallow-water areas (Fig. 37) but density in the Control Shallow-water stratum was greater in 1999 than in 2000, whereas density within other strata was consistent between years. Additionally, we found that as Wave Height increased, density estimates of Common Eiders decreased ($F_{1,457} = 15.107$, $P < 0.001$). Although Wave Height proved to be a significant covariate in the ANCOVA model, it provided little additional explanation of variation than the ANOVA model (Table 24).

Table 29. Flock size of marine birds detected in Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

Species	n	Median	Range	Mean	SE
Scoter *spp.*	180	3	1-200	10.6	1.7
Common Eider	144	2	1-120	6.4	1.2
Glaucous Gull	405	1	1-40	2.2	0.2
King Eider	250	7	1-450	22.0	2.6
Long-tailed Duck	570	3	1-800	15.4	2.0
Pacific Loon	246	1	1-4	1.1	0.0
Red-throated Loon	50	1	1-4	1.3	0.1
Spectacled Eider	7	3	1-100	21.1	13.7
Yellow-billed Loon	22	1	1-3	1.2	0.1

KING EIDER— King Eiders were abundant in the Offshore survey. They were generally found in large flocks (Table 29). King Eiders were concentrated differently among the 8 strata with significantly higher densities in the Deep-water Harrison Bay stratum ($F_{7,446} = 8.284$, $P < 0.001$). Like other species, however, strata were used differently in each month ($F_{14,446} = 4.757$, $P < 0.001$; Fig. 38). For example, densities in the Deep-water Harrison Bay stratum were disproportionately high in July, a period when abundance of this species was elevated in all strata ($F_{2,446} = 18.576$, $P < 0.001$; Fig. 39). Moreover, although densities were highest during July of both years of the study, the magnitude of the difference was significantly greater in 1999 than 2000 ($F_{2,446} = 3.531$, $P = 0.03$; Fig. 40).

SPECTACLED EIDER— Spectacled Eiders were uncommon in the Offshore survey. Sightings were limited to seven flocks in 1999-2000. When seen, however, they occurred in relatively large flocks (Table 29). Owing to the limited sightings of Spectacled Eiders, little variation in density was explained using general linear models (R^2=0.05). Regardless, the interaction term Stratum*Month*Replicate was marginally significant ($F_{14,458} = 1.673$, $P = 0.058$; Fig. 41) indicating that density of this species among strata was dependent upon both Month and Year. Specifically, densities were highest in the Deep- and Shallow-water Harrison Bay strata in July 2000 and August 2000, respectively.

SCOTERS— Scoters were seen in medium-sized flocks throughout the offshore study area. Average flock size was nearly identical in the offshore and near-shore study (Table 29, 11). Similar to other taxa, Scoter density varied among strata ($F_{7,448} = 8.595$, $P < 0.001$), but distribution among these strata depended upon Month ($F_{14,448} = 3.438$, $P < 0.001$; Figs. 42, 44). For example, Scoters were generally distributed within shallow-water strata through the summer, but densities increased between Prudhoe Bay and Harrison Bay in July and August. A significant Month*Year term ($F_{2,448} = 7.962$, $P < 0.001$) indicated that an apparent peak in densities during mid-summer was unique to 2000, whereas densities remained constant throughout the summer months in 1999 (Fig. 43).

GLAUCOUS GULLS— Glaucous Gulls were common in Shallow-water strata. There they were typically seen in singles, pairs, or small flocks (Table 29). Although Glaucous Gulls were occasionally seen in Deep-water strata, densities there were significantly lower than strata closer to shore ($F_{7,448} = 9.213$, $P < 0.001$; Fig. 45). While Glaucous Gull density was relatively constant between years ($P > 0.05$), distribution among strata showed a general westward shift in concentrations with progression of the season ($F_{14,448} = 1.871$, $P = 0.027$; Fig. 46). Finally, Percent Ice Cover was negatively related to density estimates of Glaucous Gulls ($F_{1,448} = 6.499$, $P = 0.011$). That is, as ice cover increased, density decreased. While Percent Ice Cover was a significant covariate, it explained only 1% of the variation in density of this species (Table 26).

PACIFIC LOON— Pacific Loons were ubiquitous throughout the offshore survey where they were seen in singles or pairs (Table 29). Analysis of distribution data indicated a significant seasonal shift ($F_{14,447} = 3.077$, $P < 0.001$) highlighted by a scarcity of Pacific Loons in the Industrial Shallow-water stratum between Oliktok Point and Prudhoe Bay during July surveys (Figs. 47, 48). While Pacific Loon densities as a whole remained relatively stable between 1999-2000 ($P > 0.05$), a small-scale shift in distribution was noted between years ($F_{7,447} = 2.538$, $P = 0.014$). Specifically, densities of Pacific Loons in the Control Shallow-water stratum were significantly lower in 2000 than in the preceding year (Fig. 49). Two covariates explained 5% of the variation in Pacific Loon density. Percent Ice Cover ($F_{1,447} = 55.42$, $P < 0.001$) and Wind Speed ($F_{1,447} = 8.959$, $P = 0.003$) were both negatively related to density. That is, Pacific Loon density increased when less ice was present and as winds decreased.

RED-THROATED LOON— Similar to Pacific Loons, Red-throated Loons were seen as singles, pairs or in small groups (Table 29). Although Red-throated Loons occurred in all strata, overall densities were low. Densities within specific strata varied both by Month ($F_{14,432} = 1.902$, $P = 0.024$) and by Year ($F_{7,432} = 3.098$, $P = 0.003$). For example, densities were highest in the Deep-water strata during August surveys, whereas a greater proportion of Red-throated Loons were closer to shore in July (Figs. 50, 51). Similarly, Red-throated Loons used the Control Shallow-water stratum to a far greater extent in 1999 than in 2000, whereas use of other strata was consistent between years (Fig. 52). Two covariates helped explain variance in Red-throated Loon densities. As with Pacific Loons, Red-throated Loons densities were lower in areas with greater ice cover ($F_{1,432} = 22.81$, $P < 0.001$). Moreover, as Wave Height increased, density estimates of Red-throated Loons decreased ($F_{1,432} = 7.687$, $P = 0.006$). While these covariates were statistically significant, they only explained 1% of the variance.

YELLOW-BILLED LOON— Yellow-billed Loons were the least common of the Loon species seen. They occurred in singles, pairs or small groups (Table 29). Densities were significantly higher in the Shallow-water stratum in Harrison Bay than elsewhere in the study area ($F_{7,446} = 3.912$, $P < 0.001$; Figs. 53, 54). Yellow-billed densities were significantly higher in July than other months ($F_{2,446} = 3.408$, $P = 0.034$); however this pattern was apparent in 1999 only ($F_{2,446} = 5.762$, $P = 0.003$, Fig. 55). Finally, Yellow-billed Loon densities tended to decrease as Wind Speed increased ($F_{1,446} = 6.268$, $P = 0.013$) although this additional component added only 1% to the R^2 value of the overall model.

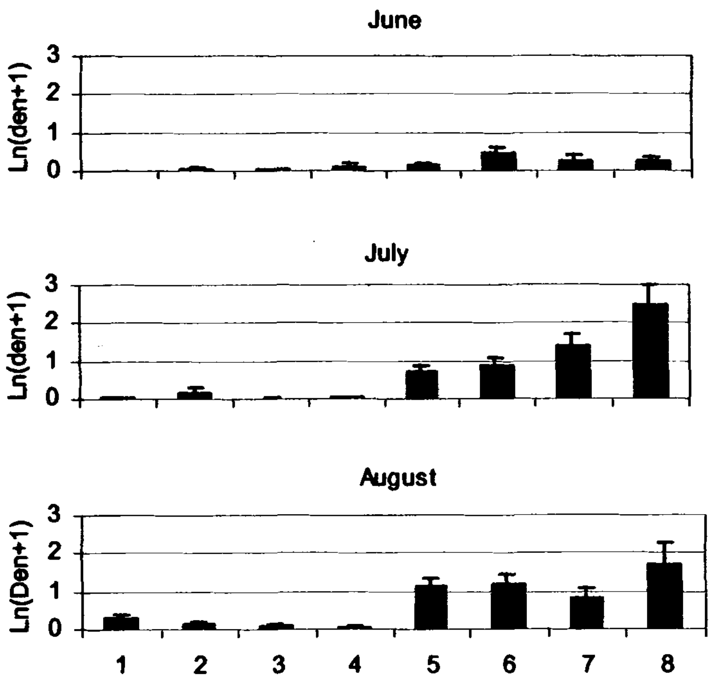

Figure 32. Mean log density (±SE) of Long-tailed Ducks among 8 strata during June, July, and August, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

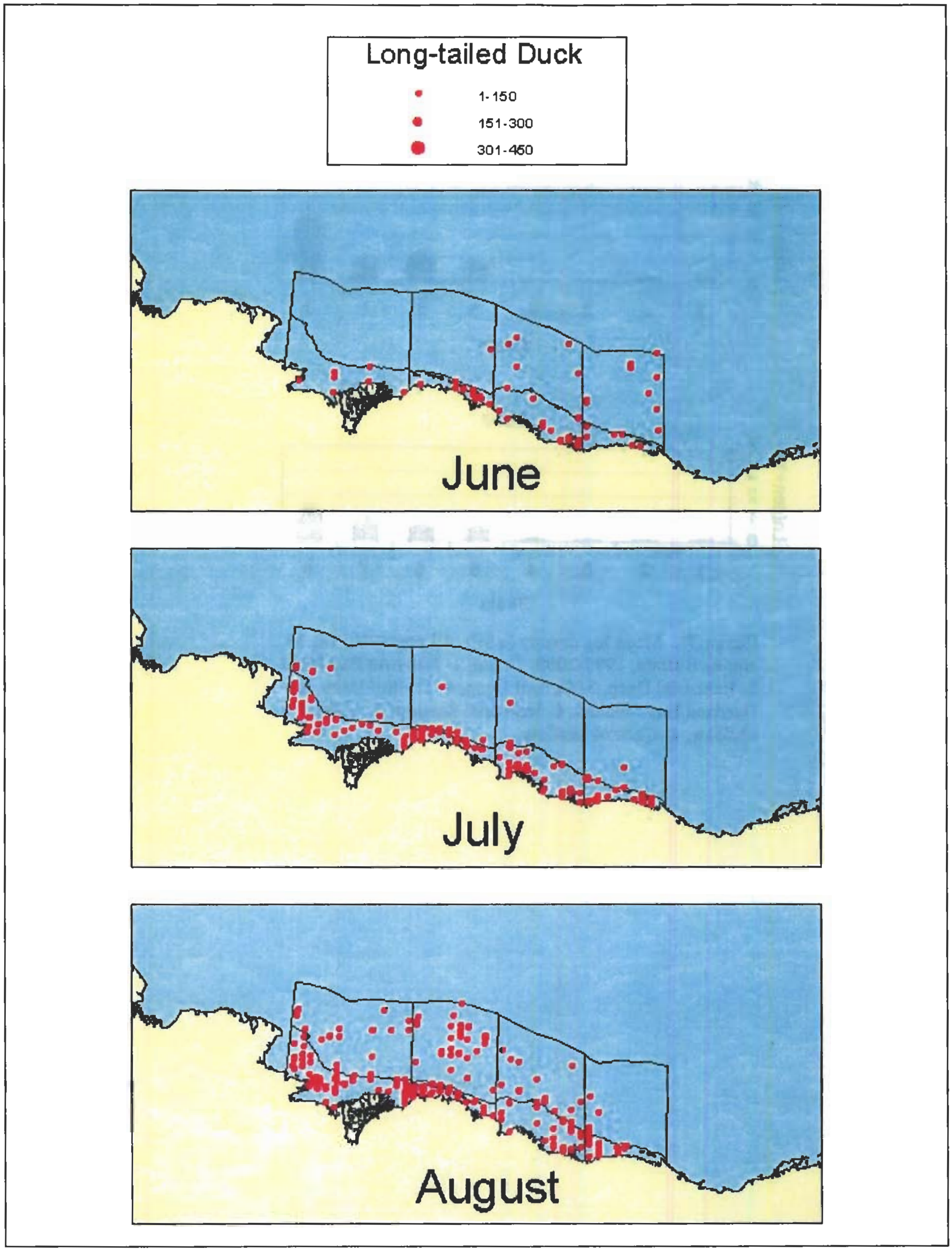

Figure 33. Inter-seasonal distribution patterns of Long-tailed Ducks during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

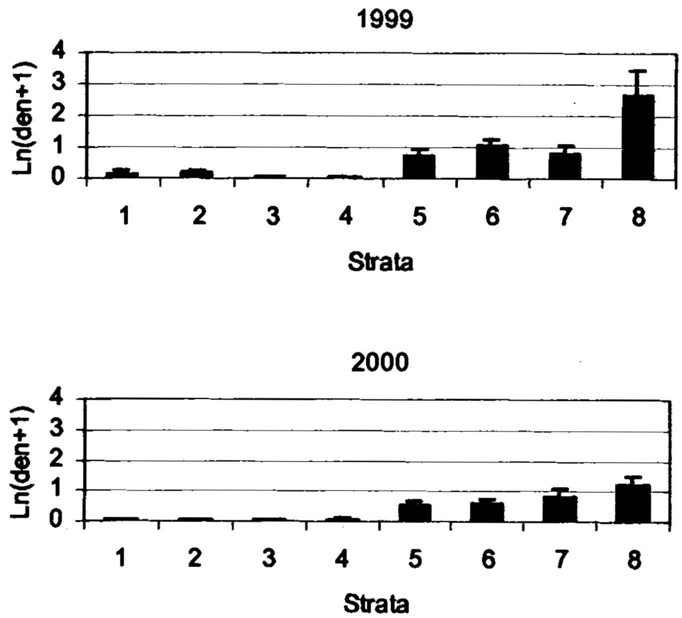

Figure 34. Mean log density (±SE) of Long-tailed Ducks among 8 strata, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

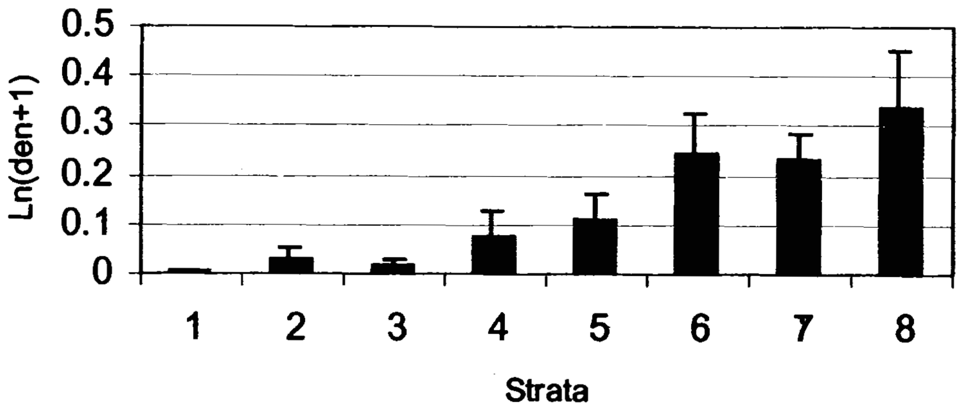

Figure 35. Mean log density (±SE) of Common Eiders among 8 strata. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

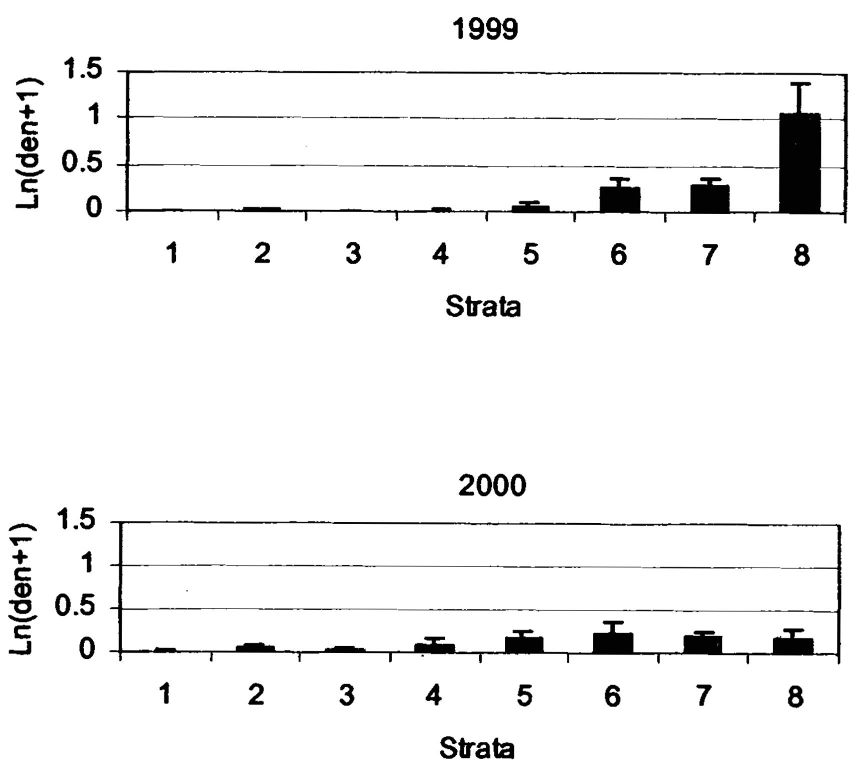

Figure 36. Mean log density (±SE) of Common Eiders among 8 strata, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

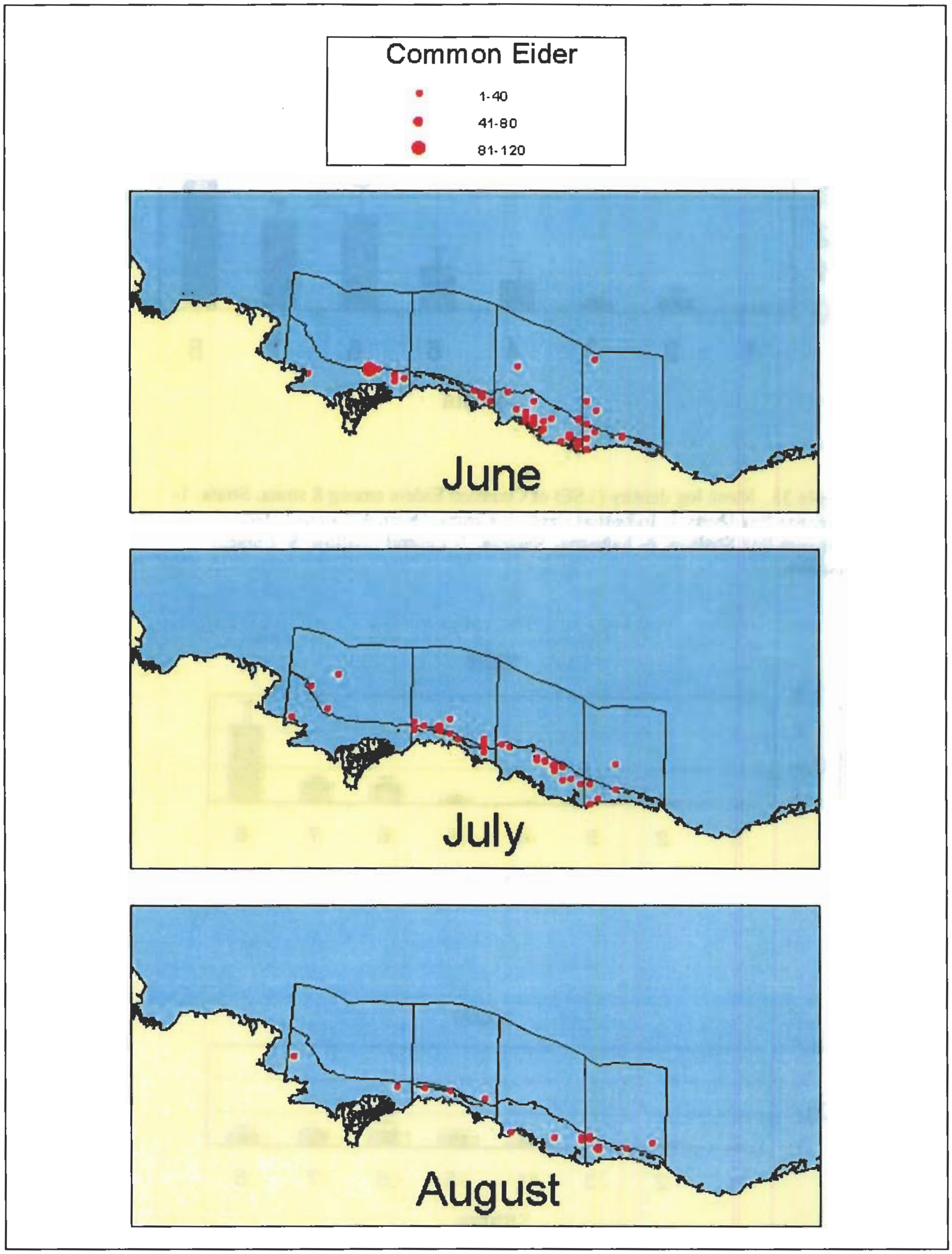

Figure 37. Inter-seasonal distribution patterns of Common Eiders during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

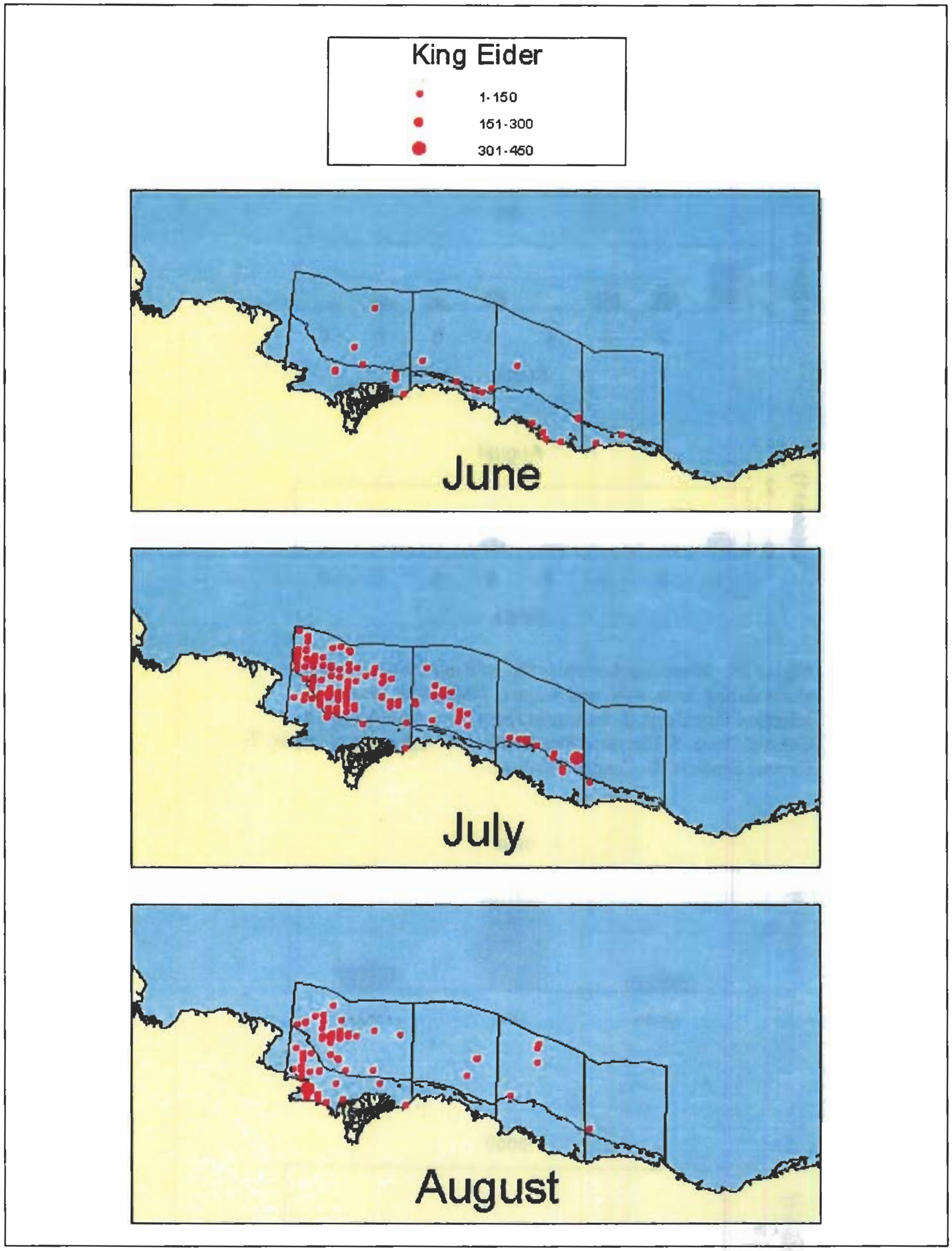

Figure 38. Inter-seasonal distribution patterns of King Eiders during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

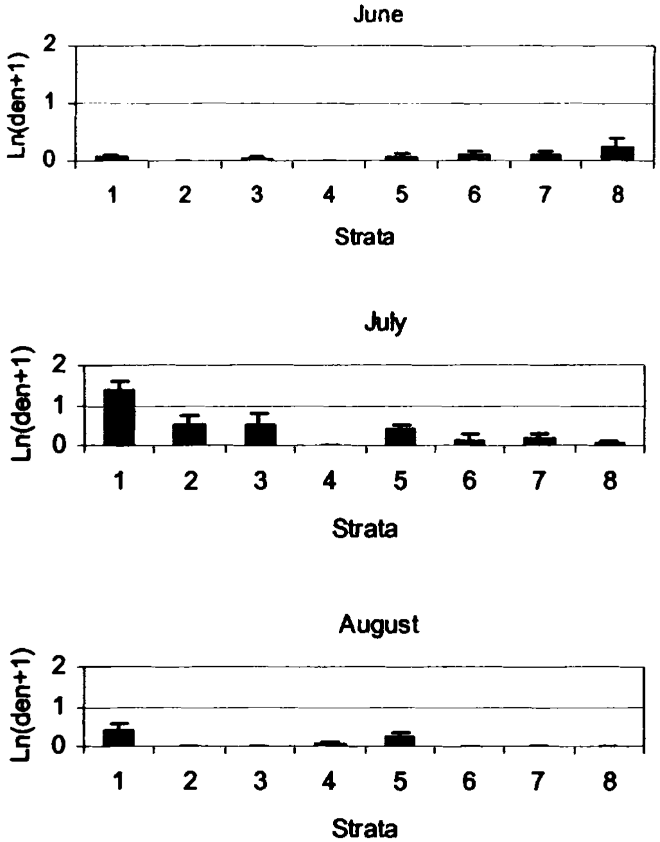

Figure 39. Mean log density (±SE) of King Eiders among 8 strata during June, July, and August, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

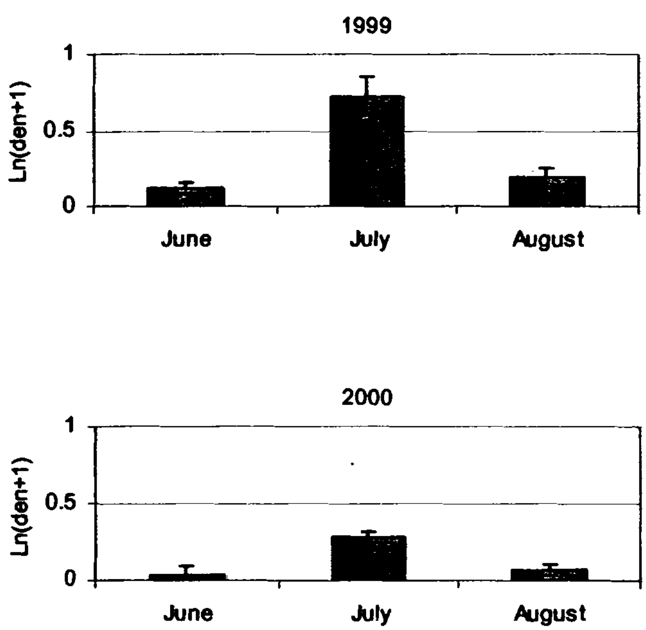

Figure 40. Inter-seasonal differences in mean log density (±SE) of King Eiders in 1999 and 2000.

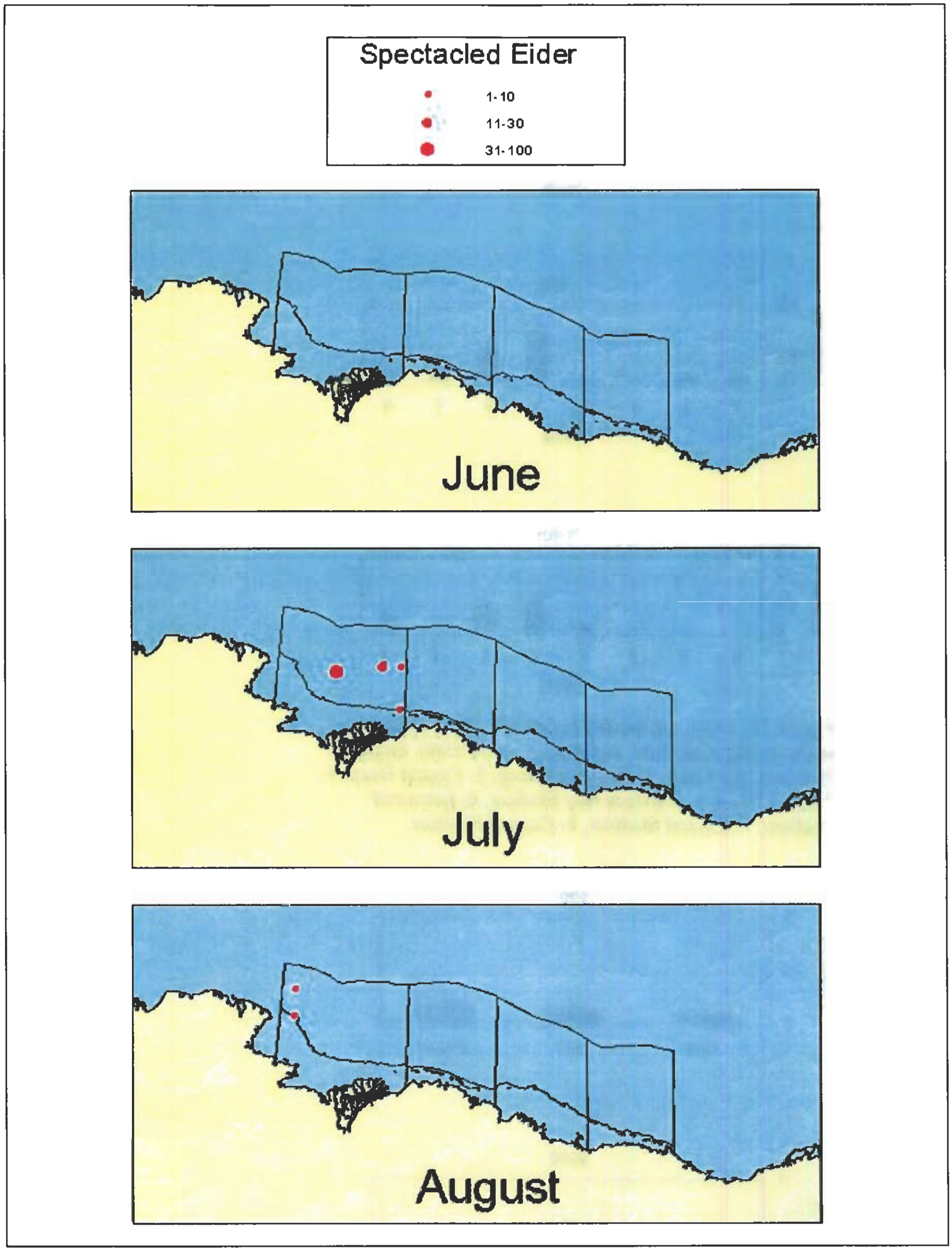

Figure 41. Inter-seasonal distribution patterns of Spectacled Eiders during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

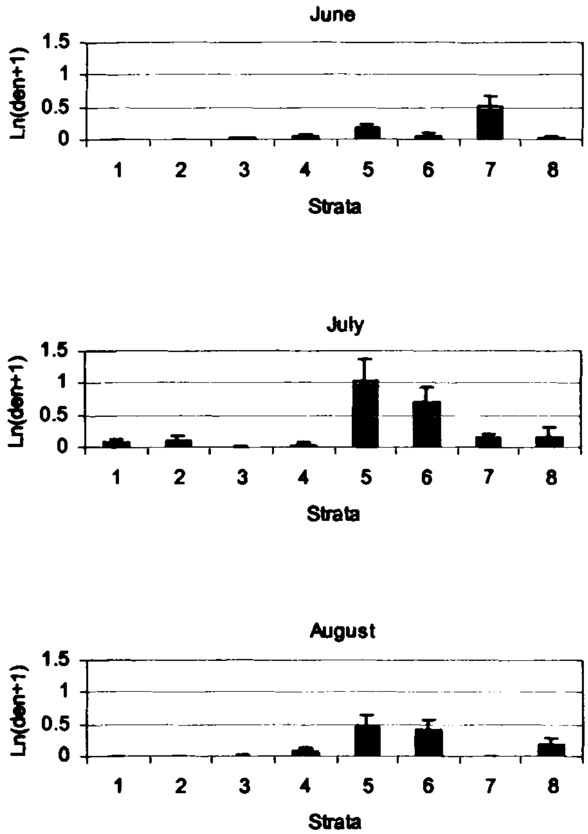

Figure 42. Mean log density (±SE) of Scoters among 8 strata during June, July, and August, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

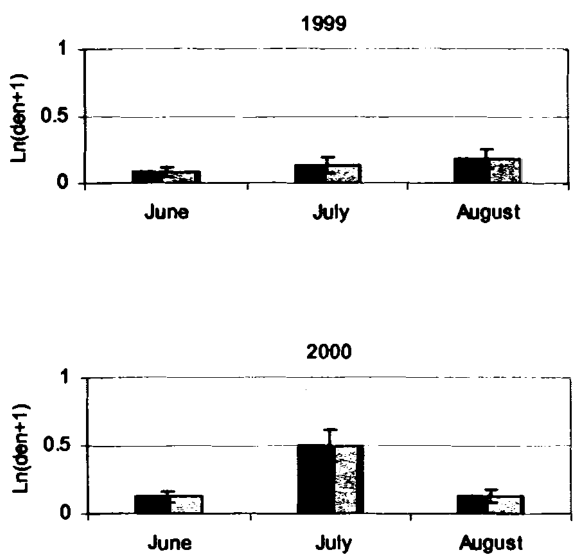

Figure 43. Inter-seasonal differences in mean log density (±SE) of Scoters in 1999 and 2000.

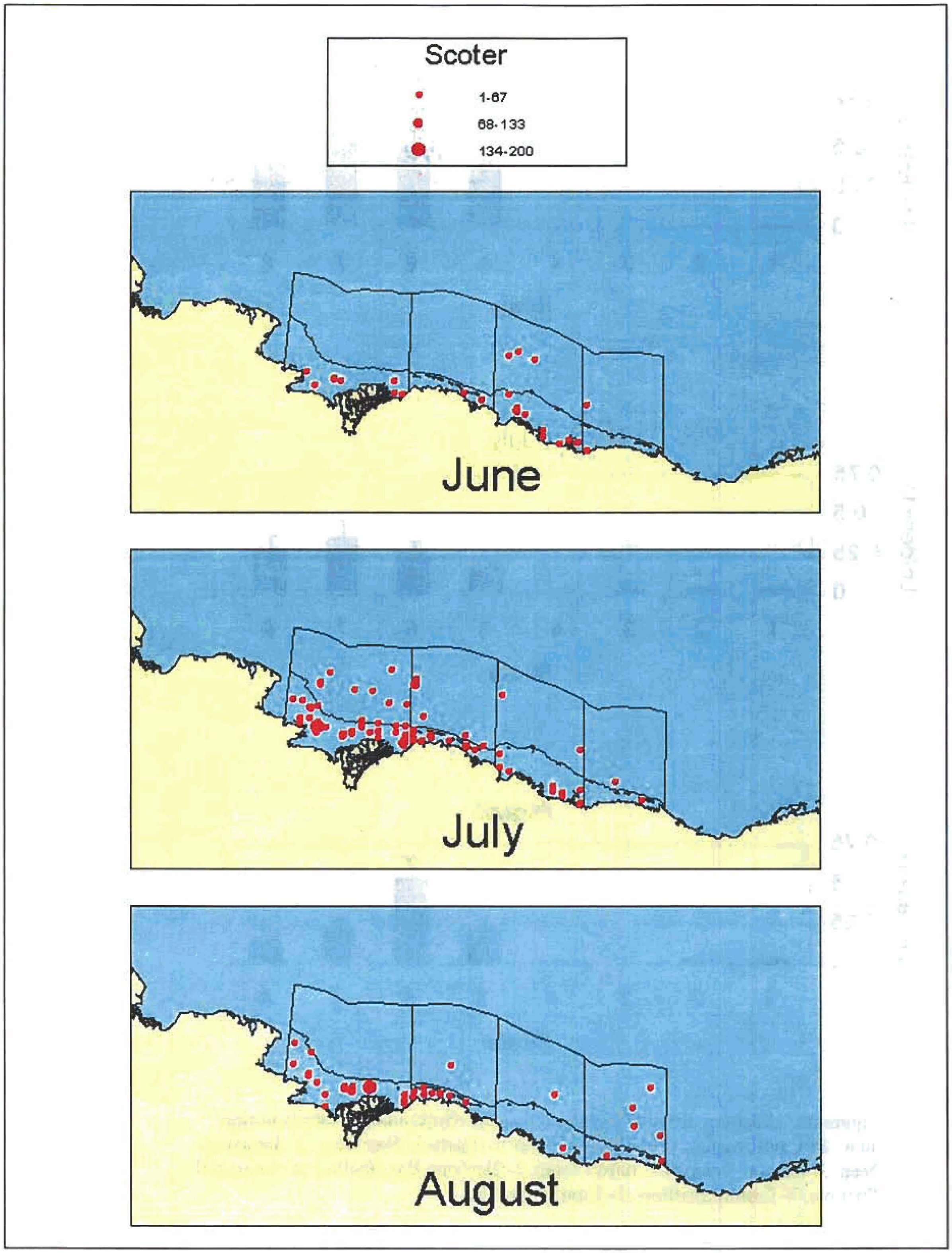

Figure 44. Inter-seasonal distribution patterns of Scoters during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

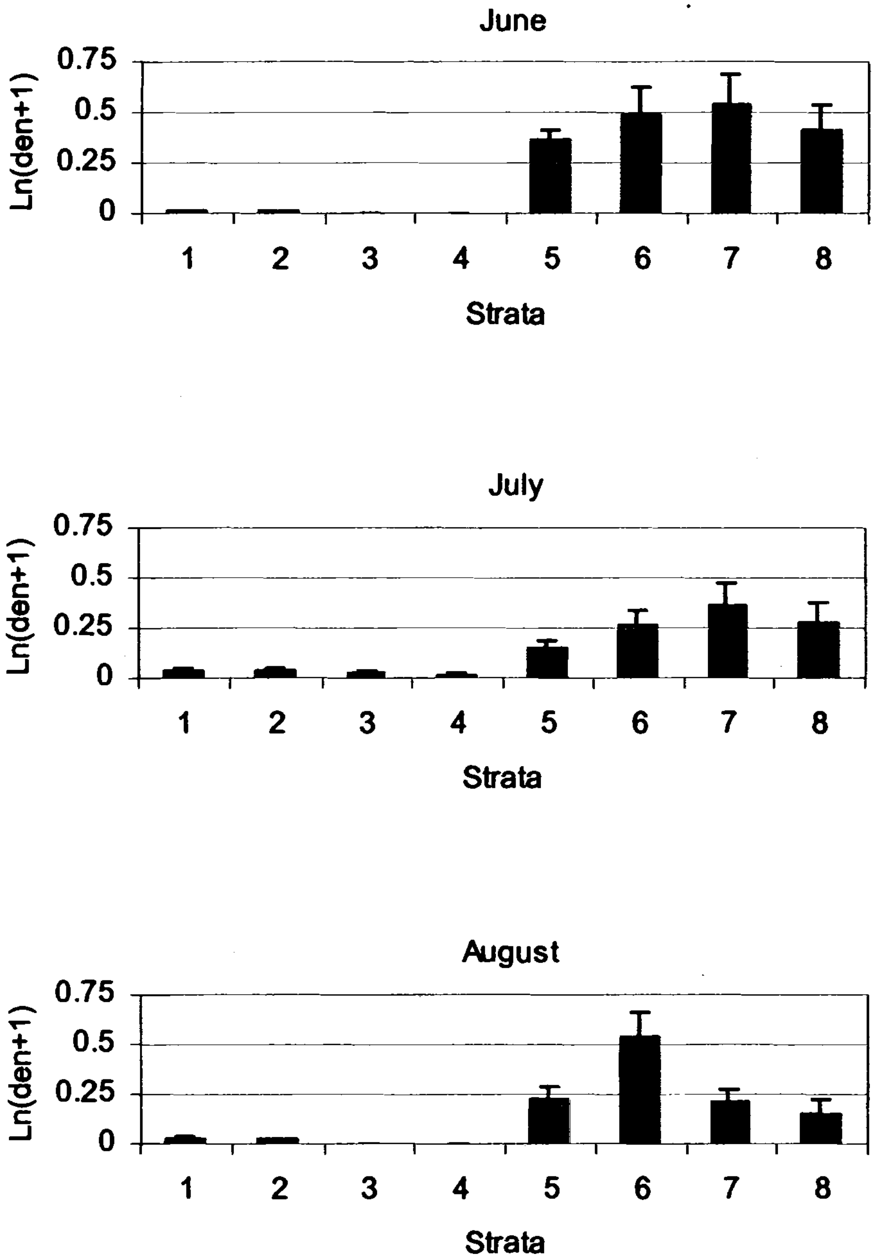

Figure 45. Mean log density (±SE) of Glaucous Gulls among 8 strata during June, July, and August, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

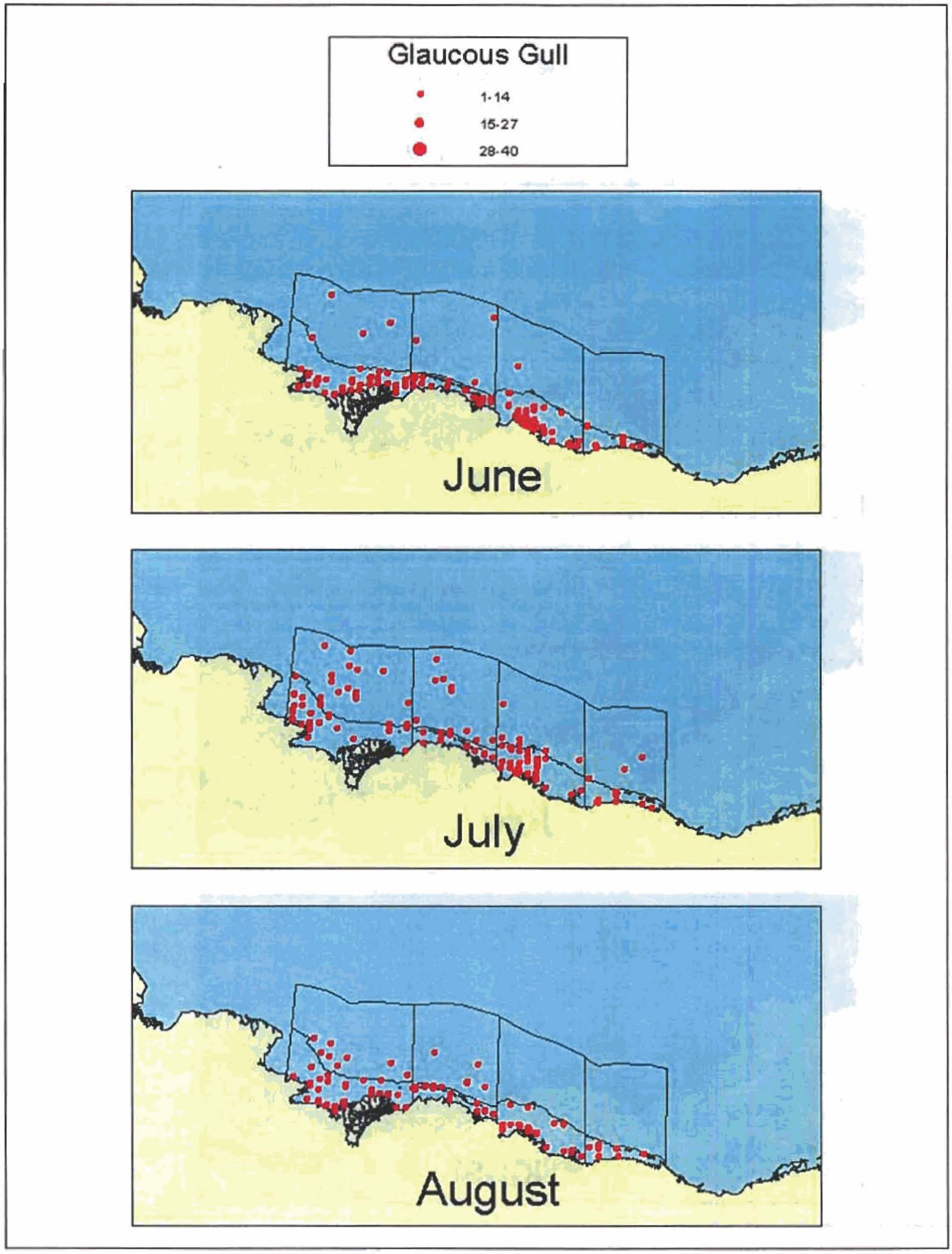

Figure 46. Inter-seasonal distribution patterns of Glaucous Gulls during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

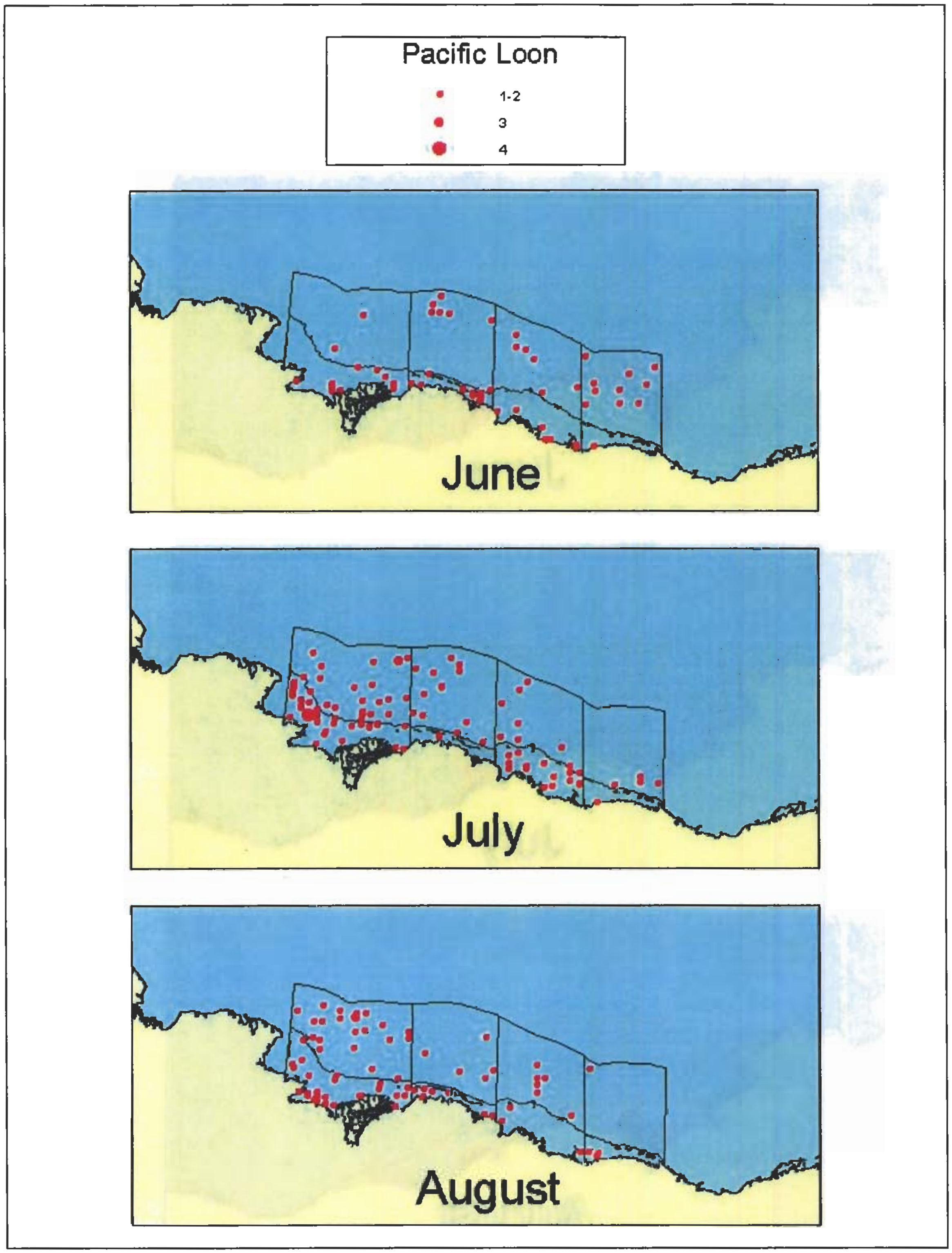

Figure 47. Inter-seasonal distribution patterns of Pacific Loons during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

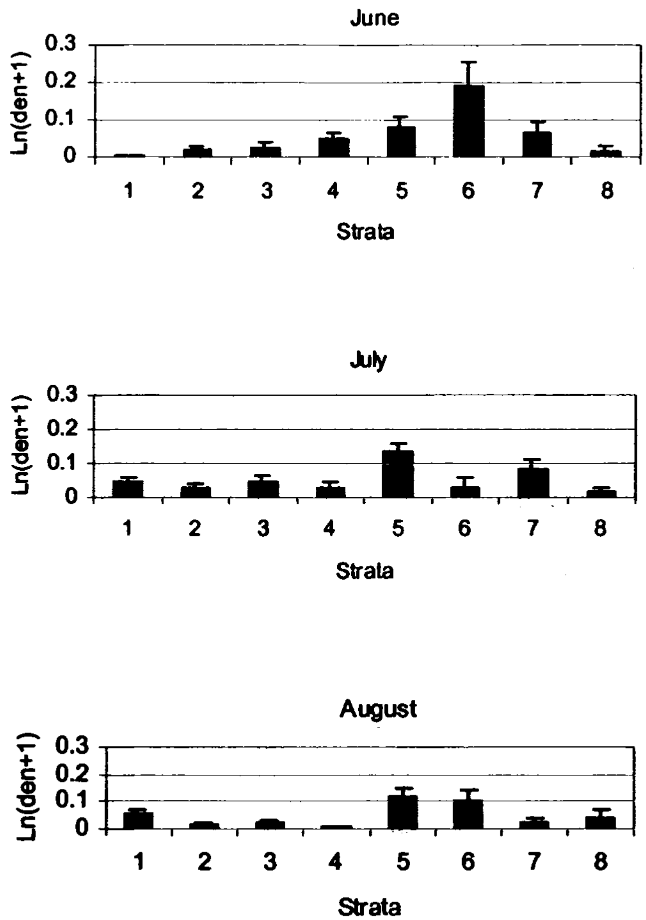

Figure 48. Mean log density (±SE) of Pacific Loons among 8 strata during June, July, and August, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow. 6- Industrial Shallow. 7- Central Shallow. 8- Control Shallow.

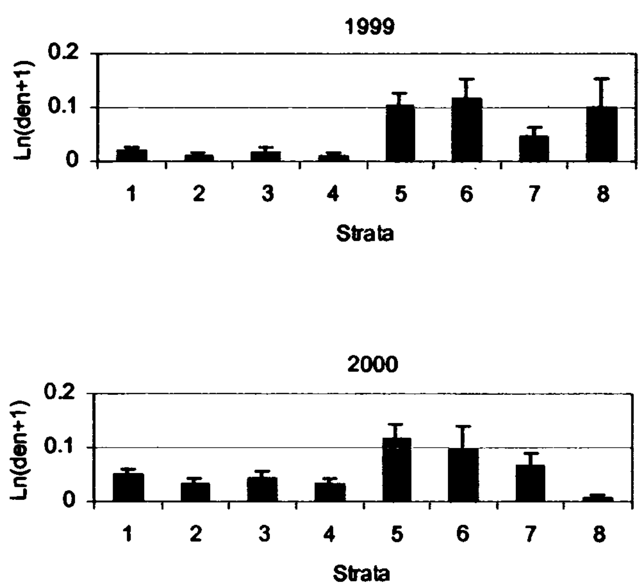

Figure 49. Mean log density (±SE) of Pacific Loons among 8 strata, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

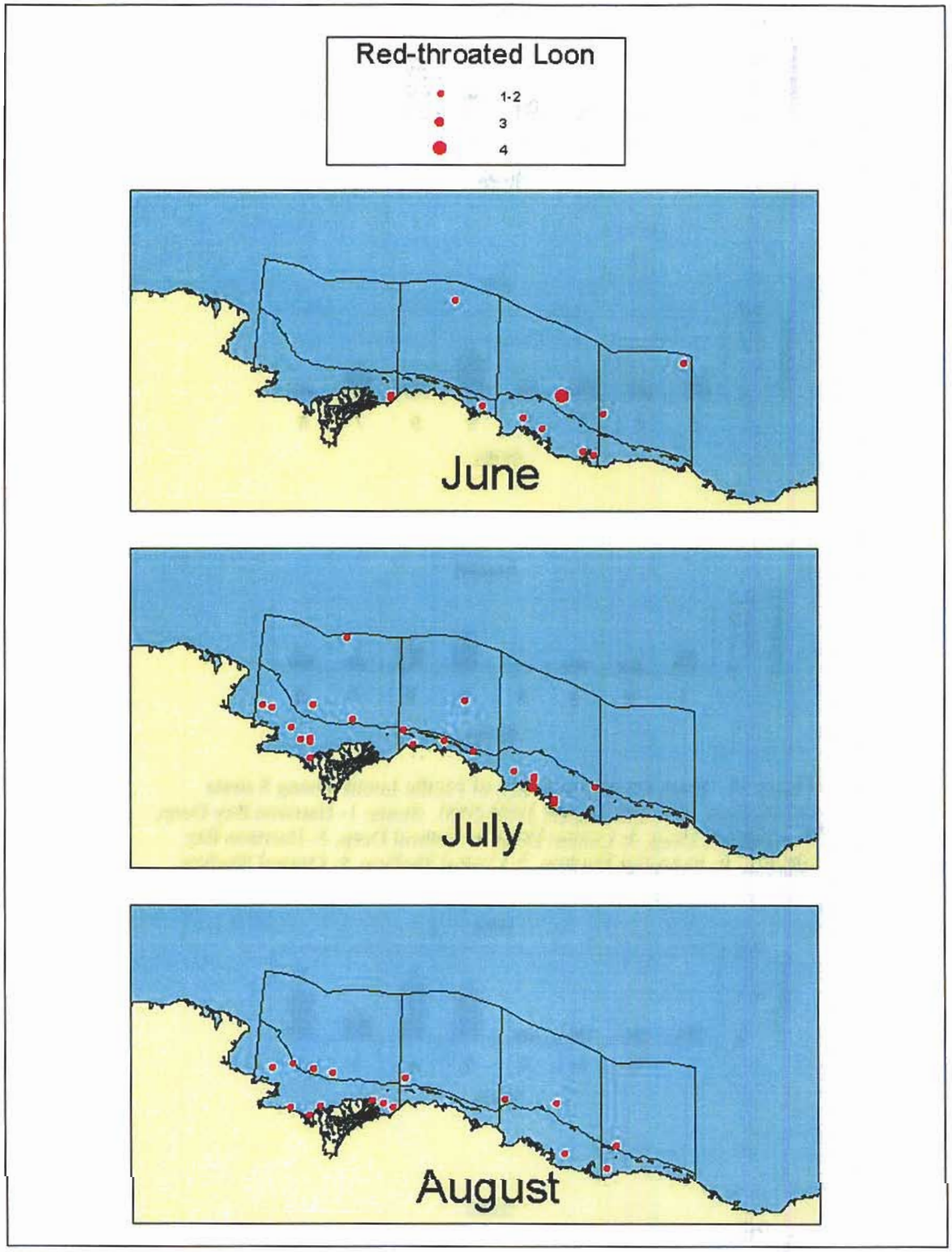

Figure 50. Inter-seasonal distribution patterns of Red-throated Loons during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

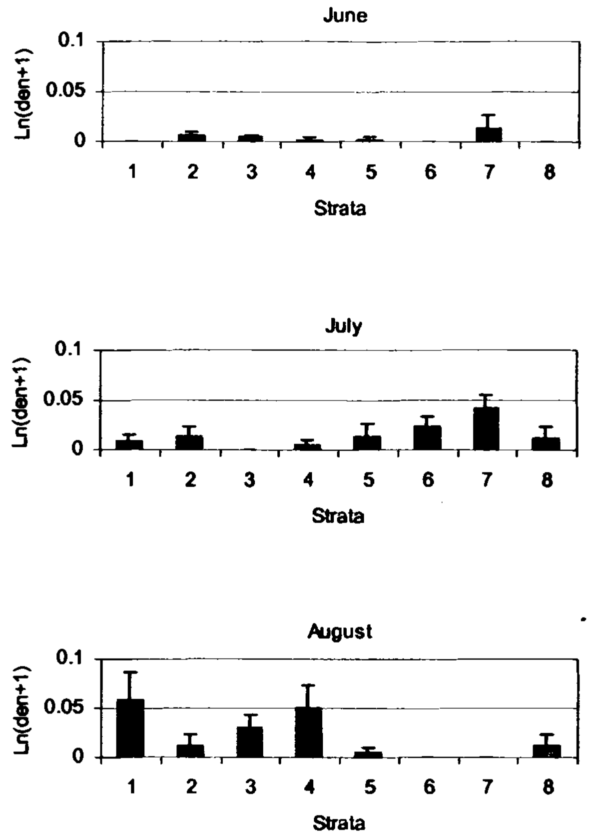

Figure 51. Mean log density (±SE) of Red-throated Loons among 8 strata during June, July, and August, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

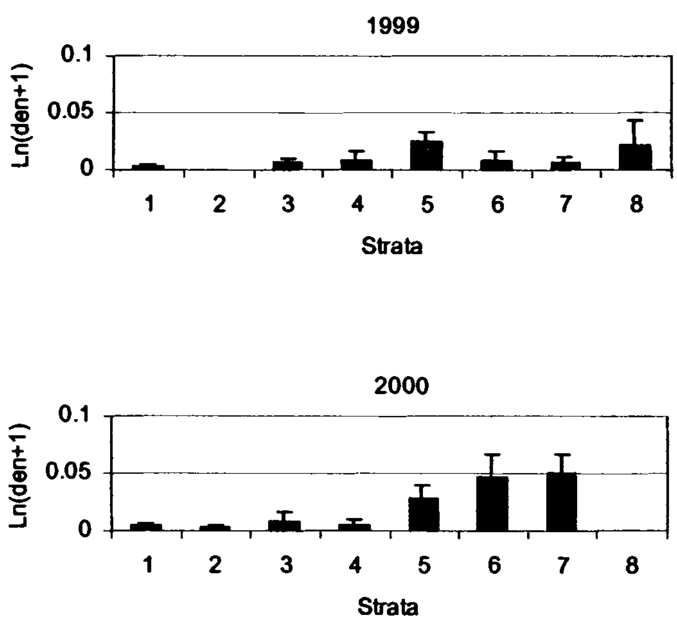

Figure 52. Mean log density (±SE) of Red-throated Loons among 8 strata, 1999-2000. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

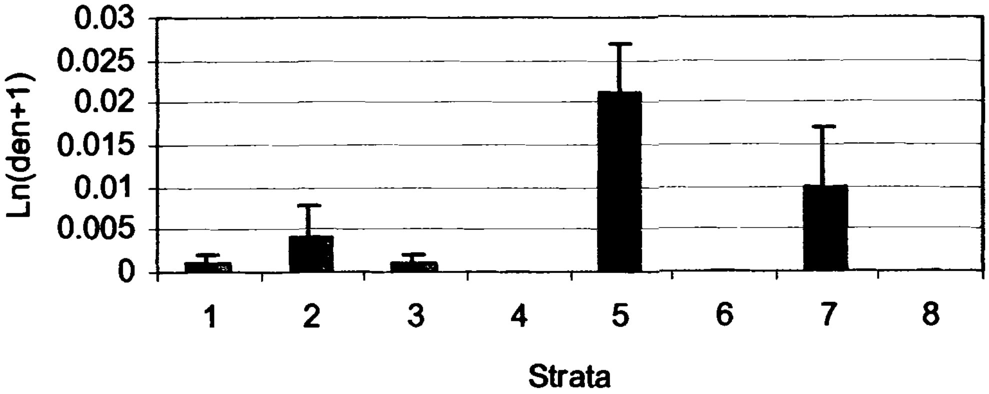

Figure 53. Mean log density (±SE) of Yellow-billed Loons among 8 strata. Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

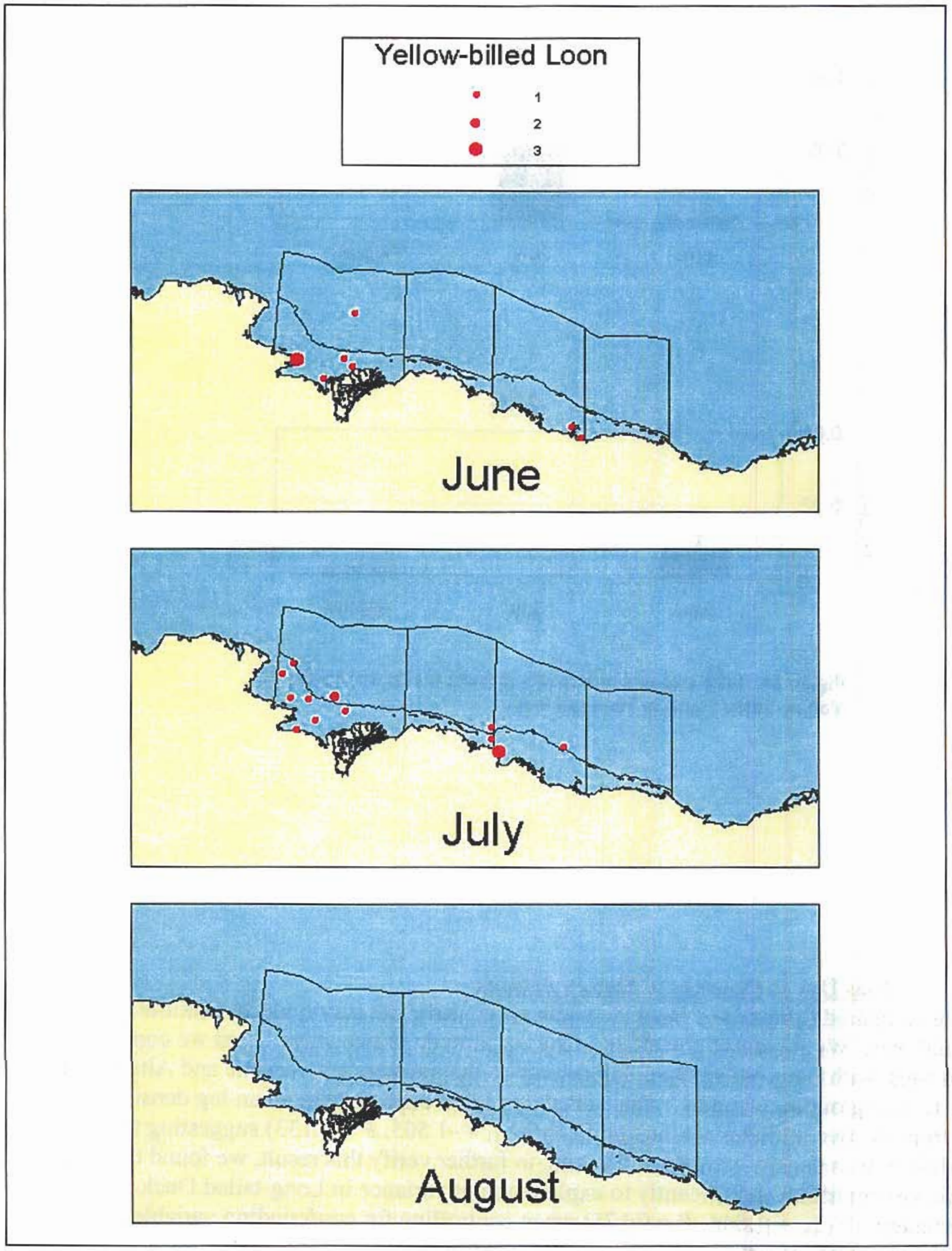

Figure 54. Inter-seasonal distribution patterns of Yellow-billed Loons during Offshore surveys, Beaufort Sea, Alaska, 1999-2000.

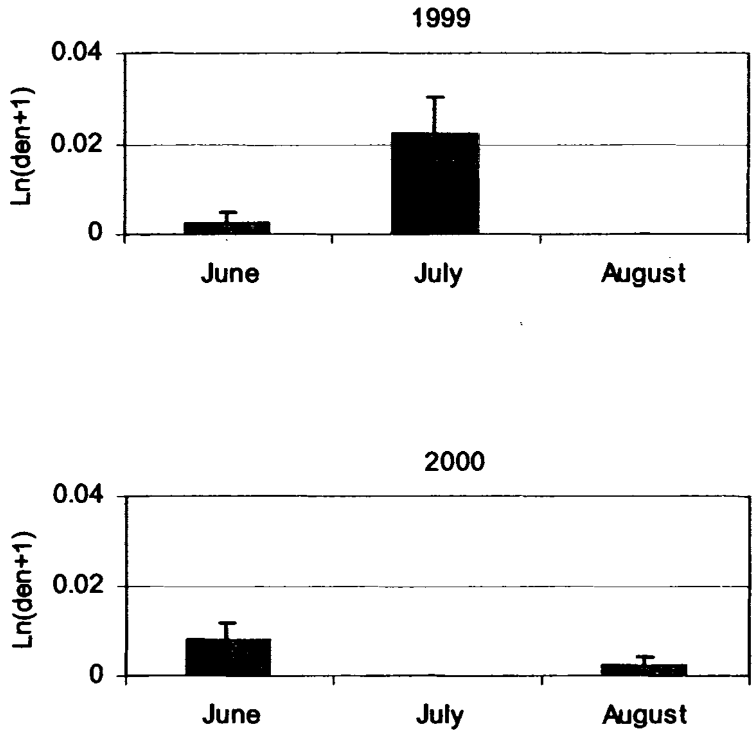

Figure 55. Inter-seasonal differences in mean log density (±SE) of Yellow-billed Loons in 1999 and 2000.

Bias Due to Changes in Survey Altitude

We compared Long-tailed Duck densities estimated from surveys at two altitudes to test for potential bias. We measured the effect of survey altitude in two ways. First we conducted a two-tailed *t*-test with Long-tailed Duck log density as the independent variable and Altitude (300 ft vs. 150 ft) as a grouping variable. This test showed that difference in mean log density obtained from the two altitudes was insignificant ($t_{471} = -1.505$, $P = 0.133$) suggesting that Altitude did not bias density estimates. Second, to further verify this result, we found that altitude did not contribute significantly to explanation of variance in Long-tailed Duck log density estimates ($F_{1,440} = 1.844$, $P = 0.175$) when controlling for confounding variables. In other words, the effect of survey altitude on density estimation was insignificant given the variation that can be attributed to Stratum, Month, Year, Stratum*Month, and Year*Stratum.

DISCUSSION

Near-shore Survey

Effects of Human Activities on Long-tailed Ducks

We measured the effects of human activities on Long-tailed Ducks by comparing population trends between "Industrial" and "Control" areas, and by assessing the correlation between density and human activities. In neither case was there sufficient evidence, based on models developed by Johnson and Gazey (1992), to suggest that change in density and distribution resulted from human activities. These results concur with those reported by Johnson and Gazey (1992). For example, both studies found that densities changed at similar rates between the "Industrial" and "Control" area, and that Long-tailed Duck density was not significantly related to the frequency of disturbances such as boats, low-altitude aircraft over-flights (<500 ft) or land-based human activities.

While disturbance effects on marine birds were not detected in this study, previous research has shown otherwise. For example, Common Eiders nesting on barrier islands were sensitive to low-level aircraft (Schamel 1974). Similarly, Long-tailed Ducks in Beaufort Sea lagoons showed behavioral responses (Gollop et al. 1974) and changes in distribution (Johnson 1982) resulting from human disturbances. Moreover, Johnson and Gazey (1992) reported a tendency for lower Long-tailed Duck densities on aerial transects with human activities, although this effect was not statistically significant.

Given that other studies indicate that human disturbance may impact marine birds in central Beaufort Sea lagoons, we should scrutinize the negative results in this study. Trends in sea duck populations are difficult to detect because of inherent stochasticity in populations and high standard errors in aerial survey techniques (Goudie et al. 1994). Recognizing these limitations, Johnson and Gazey (1992) cautioned that the power to detect a disproportionate change in Long-tailed Duck density is low, even if an effect actually exists. In fact, they reported that 11-12 years of monitoring would be required to detect a 12% change in relative density of Long-tailed Ducks.

A second reason why human impacts may be difficult to detect is long-term changes in habitat. Changes in availability of preferred habitat may influence shifts in Long-tailed Duck distribution. Configuration of lagoons between 1906 and 1972 suggest a net landward migration of barrier islands (Naidu et al. 1984). Moreover, some changes in barrier island structure can occur in relatively short periods of time. For example, a severe arctic storm hit the islands on 10 August, 2000 influencing distribution of marine birds and altering the size of some barrier islands (Flint et al. 2000).

Finally, human induced effects may not have been detected due to encroachment of human activities throughout the "Control" area. Thus, this area is not truly a scientific control because some limited development has occurred there. Seasonal camps in the "Control" area have served as a base for biological studies in the Maguire Islands since 1999 (Flint et al. 2000). A similar camp, however, was located in the "Industrial" area as well, thus these camps have not caused a disproportionate increase of human activity in the "Control" area during the study period.

Correlation between human activities and bird density is difficult to detect even if strong effects exist, due to low power of the ANOVA and ANCOVA models (Johnson and Gazey 1992).

Detecting human disturbance effects on birds is difficult because density and distribution is influenced by many variables, such as weather, season and locality. Moreover, disturbance events in this study were not controlled in a rigid experimental design. Absence of a controlled experiment can complicate attempts to identify the cause of change. For example, in an investigation of disturbance effects on Long-tailed Ducks, Johnson (1982) found that movements coincided with an increase in human-induced disturbances. This period, however, occurred during a change in wind and wave patterns, making it difficult to isolate the causes of distribution change.

For these reasons, an alternative to the current test of industry effects could be a controlled experiment of disturbance on distribution patterns. Experiments of this nature were initiated in 2000 (Flint et al. 2000) and expanded in 2001 using disturbed and multiple control study sites (Lanctot et al. 2001).

Components of Variation

Many results from this study matched those reported by Johnson and Gazey (1992) suggesting that the components of variation in density have not changed substantially since 1991. For example, both studies found no difference in Long-tailed Duck density between the "Industrial" and "Control" areas overall. Both studies, however, did find differences among habitats in specific areas. For instance, Mainland Coastline was important to Long-tailed Ducks in the "Control" area, but not in the "Industrial" area. This result reaffirms findings from previous studies (Bartels and Zellhoefer 1982, Johnson 1982) suggesting that Long-tailed Ducks are not randomly distributed throughout the Beaufort Sea lagoons. Further, both this study and Johnson and Gazey (1992) showed that densities varied among habitats between years. On a smaller scale, densities of ducks seen on transects within habitats varied in both studies. That is, there were specific transects with consistently high densities of Long-tailed Ducks. For example, transect 191, a mainland coastal habitat transect in the "Control" area, consistently had higher densities than other transects in the same habitat and area. Finally, both studies found that wave height was negatively correlated with densities. Thus, as wave height increased, densities decreased. This relationship may be due to Long-tailed Ducks seeking shelter during periods of heavy wave action; or alternatively, could be due to waves reducing the ability of observers to see birds on the water. Although Wave height was a significant variable, it explained little of the variation in density, as seen in the nearly identical R^2 estimates generated by the ANOVA (0.74) and ANCOVA (0.75) models.

Possible Long-term Decline in Long-tailed Ducks

While results from this study concurred with nearly all terms and covariates reported by Johnson and Gazey (1992), one important difference was a significant Year term, indicating that Long-tailed Duck density in both the Industrial and Control areas declined significantly between 1990 and 2000. Johnson and Gazey (1992) noted an apparent downward trend in 1991, but the change was not significant at the alpha = 0.05 level. Although the downward trend after 1991 was less pronounced than between 1990 and 1991, densities continued to decline in 1999 and 2000. This trend resulted in a significant Year term in this study, presumably due to the expanded sampling period (four years) and relatively low intra-year variance.

Concurrent with this downward trend in Long-tailed Duck density was an apparent shift in species composition within the near-shore study area. For example, Johnson and Gazey (1992) reported that Long-tailed Ducks made up over 91%, on average, of the marine birds sighted in the study area during the years 1977-1982, 1984, 1989-1991. The percentage, however, began decreasing in 1984, when 97% of the birds detected were Long-tailed Ducks. By 1991, the percentage had dropped to 87% (Johnson and Gazey 1992). Additional surveys in 1999 conducted by LGL Ltd. showed this percentage had dropped further to 84.5% (Noel et al. 2000). In this study we found slightly lower proportions of Long-tailed Ducks (1999- 80%, 2000- 79%). While the statistical and biological significance of these numbers has not been assessed, this downward trend may be important in light of decreased densities of Long-tailed Ducks in lagoons and Alaskan coastal plain breeding population estimates (Mallek 2001).

Several alternatives may explain the reduction of density estimates in central Beaufort Sea lagoons. First, populations of Long-tailed Ducks on the Alaskan Arctic Coastal Plain have been monitored annually since 1986 (Brackney and King 1993, 1994, 1995, 1996; King and Brackney 1997; Mallek and King 2000; Mallek 2001) and are showing signs of a long-term downward trend. Population estimates in 2000 were the lowest in the 15-year history of the survey (Mallek 2001), and were significantly lower than the preceding 14-year mean. The central Beaufort Sea lagoons likely support many molting birds that breed locally (Johnson and Richardson 1982). Decreased density in Beaufort Sea lagoons, therefore, may reflect a general downward trend of this species along the Alaskan Arctic Coastal Plain. Second, decreased density estimates of molting Long-tailed Ducks could be due to reduced numbers of a non-local breeding population that molts in Beaufort Sea lagoons. Sea duck breeding sites may be hundreds or even thousands of kilometers from molting areas (Salomonsen 1968). For example, many Canadian breeding Long-tailed Ducks presumably join Alaskan birds to molt in the Central Beaufort Sea lagoons (Salter et al. 1980, Johnson and Herter 1989). Third, Long-tailed Ducks that historically used central Beaufort Sea lagoons may have shifted their molting grounds out of the study area altogether. Fourth, the reduction of birds seen in lagoons may be related to breeding propensity rather than a decrease in population size. For example, in years with poor reproductive success, failed breeding females may have molted in July and August in conjunction with males rather than in September after raising broods. In this circumstance, density estimates in lagoons would be elevated due to a larger proportion of birds molting during the survey period. If this alternative were true it would indicate an increase in breeding propensity between 1990 and 2000. Fifth, observed decreases of Long-tailed Duck density may reflect a shift in diurnal patterns of lagoon use. For example, if birds required more time feeding in recent years relative to 1990 (resulting from disturbance, viruses, decrease in available prey, etc.), then birds would have spent more time in the mid-lagoon where Long-tailed Ducks generally feed. This situation would result in lower density estimates because Long- tailed Ducks dive for their food where they cannot be seen by survey crews, and because they would be spread out throughout the mid-lagoon rather than concentrated along the barrier island transect where they generally roost.

The difficulty in separating these various alternatives highlights the importance of identifying the breeding locations of Long-tailed Ducks that molt in the central Beaufort Sea lagoons. Plans are in place to put satellite radios on molting Long-tailed Ducks in 2002 to help answer this question. Additionally, it is important to gain a better understanding of the effects of breeding propensity on summer molting populations, and detect long-term shifts in activity budgets.

Distribution Patterns in the Near-shore Survey

Long-tailed Ducks densities were high in Barrier Island habitat relative to other habitats in the study area. The elevated density in this habitat, however, is likely influenced by the study design and diurnal patterns of marine birds. For example, given the objective to monitor trends in density between years, the study protocol specifies the importance of conducting surveys as late in the day as possible in order to control for diurnal movement patterns (Johnson and Gazey 1992). Long-tailed Ducks have been shown to congregate in the lee of barrier islands in evening (Johnson 1982, Flint and Lanctot, pers obs.) whereas they feed primarily on invertebrates in mid-lagoon habitat during midday (Johnson 1982, Craig et al. 1984). Thus, high densities of Long-tailed Ducks detected in Barrier Island transects is likely a result of time of day rather than habitat preference.

While differences occurred between habitats as a whole, density also varied among Habitat-Area strata. These differences, may be related to the varying protection each Habitat-Area stratum affords. For example, Long-tailed Duck density in Mainland Coastline habitat was highest in the "Control" area. This difference may be partly due to differences in habitat between the "Industrial" and "Control" areas (Johnson and Gazey 1992). Alternatively, differences among Habitat-Area strata may be due to food availability. Marine birds in central Beaufort Sea lagoons commonly utilize mysids and amphipods (Griffiths and Dillinger 1980). Abundance of these invertebrates, however, can vary considerably between years (Griffiths and Dillinger 1980). Fluctuations of these food sources may govern strategies birds use to distribute themselves within the lagoons.

Like Long-tailed Ducks, Common Eider concentrations were highest in Barrier Island habitat. This result is not surprising, because barrier islands are preferred nesting habitat for Common Eiders on the North Slope (Johnson 2000). Densities of this species were higher in the "Control" vs. "Industrial" areas, closely paralleling results from recent aerial surveys conducted by Noel et al. (2000). This distribution pattern is noteworthy given that the number of nests built, and nesting success parameters were essentially equal in the "Industrial" and "Control" areas (Flint et al. 2000). One explanation of this pattern is that a greater proportion of non-breeding Common Eiders use lagoons east of Prudhoe Bay, thereby increasing overall density estimates in the "Control" area.

Unlike Common Eiders, Scoters are not known to breed on the Alaskan Coastal Plain (Johnson and Herter 1989). Scoters do, however, migrate to Alaskan Beaufort Sea lagoons to molt. There we found that Scoters (predominantly Surf Scoters) were present consistently in Mid-lagoon habitat between Oliktok Point and Egg Island in the "Industrial" area. This finding, as well, was consistent with those reported by Noel et al. (2000). The affinity of Scoters to this particular stratum is striking, especially given that no other species discussed in this report used that area extensively. It is not clear why this area is favored, but bivalve mollusks are common to the diets of the three species of scoters (Savard et al. 1998, Brown and Fredrickson 1997, Bordage and Savard 1995) and may influence the unique distribution of these species.

In contrast to the sea ducks, loons were distributed throughout all near-shore habitats. Unlike sea ducks, Loons do not use Beaufort lagoons as molting sites. Rather, near-shore waters serve as important feeding locations during the critical chick-rearing period (Andres 1993). Loons that were observed in lagoons, therefore, were likely foraging for fish to deliver to chicks at inland sites. Our results matched those reported by Noel et al. (2000) who found that densities of Pacific and Red-throated Loons were not significantly different between habitats. Yellow-billed Loon density, however, was slightly higher along barrier islands than in other habitats. These differences in distribution patterns may reflect varying prey preferences of these three Loon species.

Other species varied widely in their use of near-shore waters. For example, Glaucous Gulls were ubiquitous along the Mainland Coastline and Barrier Islands. In these habitats, Glaucous Gulls were generally roosting on the water's edge. Interestingly, Near-shore Marine habitat was used to a relatively high extent in the "Control" area. In contrast, Glaucous Gulls were conspicuously absent from Mid-lagoon habitat throughout the study area. Shorebirds too, shared the barrier islands and mainland coastline. Shorebird sightings were variable, but when detected, these birds were generally found in relatively large flocks along mudflats. Rarely were Shorebirds seen in Mid-lagoon habitat. Similarly, Northern Pintails, and Geese and Swans also avoided mid-lagoon habitat. Instead, both groups used the mainland shoreline almost exclusively. There they were seen feeding and flying over the narrow strip of coastal salt marsh.

Offshore Survey

Components of Variation in Marine Bird Offshore Distribution

A lower proportion of variation in Long-tailed Duck density was explained by ANOVA and ANCOVA models in the Offshore surveys than in the Near-shore. This is likely due to intrinsic differences between the two surveys. For example, near-shore transects were selected in areas where birds occur in consistently high densities (Johnson and Gazey 1992), whereas offshore transects were systematically placed across a large study area. Moreover, the Offshore survey attempted to sample waters during three distinct phases of the summer, whereas the Near-shore survey concentrated on a six-week molt period when relatively stable populations of birds were present. Additionally, fewer replicates were conducted in the Offshore survey relative to the Near-shore survey. The differences in design of these surveys is due to the objectives that directed their implementation. For instance, the Near-shore survey was originally designed to measure human activity effects on densities of Long-tailed Ducks along index transects whereas the Offshore survey intended to monitor eider distribution through summer in offshore waters, an area with little prior information.

Distribution of marine birds as a whole cannot be broadly generalized. Densities varied by species and by when and where we looked. One example of this regional and temporal variability was seen in distribution patterns of Long-tailed Ducks. Long-tailed Ducks moved from deep offshore waters into protected near-shore waters at the onset of post-breeding molt in both years of the study. Movement of Long-tailed Ducks into near-shore waters during the molting period has been documented by others (Bartels et al. 1983, Bartels and Doyle 1984, Harrison 1977), and is likely due to the importance of near-shore lagoons affording protection from poor weather, and proximity to abundant prey (Johnson 1982). These characteristics can be critical to molting birds when nutritional requirements and susceptibility to predation are high (Hohman et al. 1992).

Another factor that explained some variation in distribution was the presence of ice. In particular, densities of Pacific and Red-throated Loons, and Glaucous Gulls decreased as ice cover increased. In contrast, densities of other species did not vary significantly with changes in ice cover. Other researchers found that presence of ice was not helpful in explaining variability in marine bird offshore distribution (Divoky 1979). Presumably, other components of variation in this study were more important to distribution patterns, thus the effect of ice was not detected. In this study, summer ice conditions varied between years, thus consistent patterns were difficult to detect.

Offshore Migration Corridor

While densities of most marine birds were generally higher in near-shore areas, offshore waters may provide an important migration corridor for eiders. In this study, densities of King Eiders were greatest offshore during the July surveys, coinciding with the peak of post-breeding molt migration (Johnson and Herter 1989). Johnson and Richardson (1982) using a combination of aerial surveys, ground observations, and radar found that eiders may bypass the south-central portion of the Beaufort Sea by migrating westward, north of the barrier islands. Similarly, Peterson et al. (1999) found that post-breeding Spectacled Eiders migrated west, seaward of the Beaufort Sea barrier islands. Finally, an aerial survey of the Canadian Beaufort Sea showed eiders used waters as far as 115 km from shore in July (Searing et al. 1975).

Long-tailed Ducks, too, may migrate from their breeding sites to molt locations using offshore waters. Johnson and Richardson (1982) reported that coastal observations of migrating Long-tailed Ducks in the Yukon were too low to account for the numbers of birds that entered Alaskan Beaufort Sea lagoons. Thus, they suggested that the many birds were migrating over deep waters, out of sight from land. Similarly, Harrison (1977) found Long-tailed Ducks scattered throughout Beaufort Sea offshore waters up to 160 km from shore. In this study we found that Long-tailed Duck densities increased in offshore strata by late August. Presumably these birds had completed post-breeding molt and were en route to wintering areas. This assessment, however, is speculative given the "snapshot" nature of these surveys. This highlights the need for a migration study designed specifically to detect routes, turnover rates and timing of marine birds in the Central Beaufort Sea.

Important Areas

The Near-shore and Offshore surveys revealed four locations in the Central Beaufort Sea important to marine birds. Harrison Bay is one area that showed relatively high densities for Scoters, King and Spectacled Eiders, and Yellow-billed and Red-throated Loons. Relatively high densities of Yellow-billed Loons and Spectacled Eiders seen in Harrison Bay may be related to the nesting distribution of these species. In general, these species nest closer to Harrison Bay than other areas in the Offshore survey area (Larned et al. 2001). Previous studies noted the importance of Harrison Bay for marine birds. For example, Harrison (1977) conducted offshore aerial surveys and found high densities of eiders in offshore waters within Harrison Bay in August. Moreover, Petersen et al. (1999) documented post-breeding Spectacled Eider concentrations in Harrison Bay. Similarly, Divoky (1984) noted that Loons were more common in the near-shore waters of Harrison Bay than in similar habitat to the east. Further, Andres (1993) showed that this area provided important feeding grounds for Loons. From his study site in the Colville River Delta, he noted regular foraging flights of Red-throated and Pacific Loons to Harrison Bay. From there they returned to nest sites bearing fish to deliver to chicks at inland nesting sites.

In contrast, our results indicate Harrison Bay had low densities of Long-tailed Ducks and Common Eiders. By chance, survey transects in Harrison Bay did not intersect Thetis Island, the single barrier island in Harrison Bay that has high concentrations of Long-tailed Ducks and Common Eiders (Johnson 1984, Schamel 1974, Johnson 2000). Thus, our density estimates of these two species are probably low in the Harrison Bay Shallow-water stratum.

Barrier Islands also had high marine bird densities, presumably because they provide important habitat for many species. These results agree with previous studies that have shown the affinity of Long-tailed Ducks and other marine birds to barrier island habitat (Johnson 1982, 1984; Johnson and Gazey 1992). The benefit this habitat provides includes protection from wind and rough water, and close proximity to abundant prey (Johnson 1982).

On a fine scale, several locations within the Beaufort lagoons stand out as particularly important. The Barrier Island habitat adjacent to the Stockton Islands had consistently high densities of Long-tailed Ducks and Common Eiders. Similarly, the Mainland Coastline between Bullen Point and Point Thomson had surprisingly high densities of Long-tailed Ducks. Finally Scoters showed a strong affinity to Mid-lagoon habitat throughout most of Simpson Lagoon. Similar patterns were reported in these three areas by Noel et al. (2000) who conducted comparable aerial surveys in 1999.

These four locations (Harrison Bay, Stockton Islands, Control Mainland Coastline, and Simpson Mid-lagoon) appear to have consistently high concentrations of select marine birds. Accordingly, care should be taken to minimize impacts of human activities in these areas.

Recommendations For Future Monitoring Efforts

Continuation of the current protocol in subsequent years will help detect relative change in Long-tailed Duck densities between the "Control" and "Industrial" areas if differences truly exist. Although data on Long-tailed Duck density were collected between 1977 and 1984 within the general study area, they were not collected using a comparable protocol (Johnson and Gazey 1992) and thus cannot be used for this analysis. For example, sampling prior to 1990 did not occur in four transects within each Habitat-Area stratum. Such a design is required by the analysis protocol to test for industry effects. Johnson and Gazey (1992) recommended that industrial effects be assessed using data collected in 1990-1991 as a baseline. Comparing these results to those collected in 1999 and 2000 provided the first opportunity for detecting a relative change in density. Given the low statistical power of these tests (Johnson and Gazey 1992), however, additional data should be collected.

A long-term data set, will be beneficial only if the conditions within the study area remain constant. For example, to attribute changes in density to industrialization requires that a disproportionate level of human disturbance occur in the "Industrial" area. As mentioned earlier, the "Control" area is not a true control in that it has become exposed to human activities since 1990. In the course of this study the "Industrial" transects were exposed to 2.5 times the level of potential disturbances as were transects in the "Control" area. If human encroachment into the "Control" area increases appreciably in future years, then alternative ways to assess disturbance effects should be sought.

One alternative is to examine immediate effects of disturbance of known extent and duration on behavior and distribution of Long-tailed Ducks in a controlled experiment. An opportunity to measure disturbance effects in a relatively controlled setting will occur in August 2001 when Western Geco conducts 3D seismic tests near Spy and Leavitt Islands. The Alaska Science Center will monitor local movements of Long-tailed Ducks in response to seismic tests using radio-equipped birds and remote data collection computers (Lanctot et al. 2001).

The current Near-shore study design may be an effective way to monitor trends of Long-tailed Duck density among specific areas, but it does not provide unbiased estimates of abundance or habitat preference. For example, Mid-lagoon habitat is under-represented in the current design (Noel et al. 2000), preventing reliable expansion of density estimates throughout this habitat. Moreover, the northern edge of barrier islands is not sampled at all in the current protocol. In addition, Near-shore survey results should not be misconstrued as demonstrating habitat preference because timing and locations of sampling were not random.

If abundance estimates and a better understanding of habitat preference are deemed important and necessary for multiple species using the Beaufort Sea, then a randomized sampling design may be better suited than the current approach. Purely random transects, however, are neither safe, logistically feasible, nor economical using an aerial platform. A better alternative may be a stratified systematic survey with random starting points. With this approach, habitats would be sampled in proportion to their size regardless of predetermined concentrations of marine birds. This would provide researchers an unbiased estimate of population size.

Ideally, aerial survey protocols should standardize observers, conditions, survey platform, and altitude. Standardization, however, is difficult due to uncontrolled weather, geography, and logistics. For those reasons our aerial surveys were imperfect. While it is accepted that aerial surveys, like any sampling method, include problems of bias and precision, the aerial platform does provide an acceptable level of sampling for many management questions (Caughley 1977). Certainly it is important to minimize potential sources of bias. In this study, the use of two types of aircraft in the Near-shore survey, and variable altitude during the Offshore survey may have increased variation. As discussed in the results section, however, these potential sources of bias are unimportant relative to other components of variation. Regardless, to obtain the best estimates of marine bird densities, special effort should be exercised to standardize data collection.

Towards that end, USFWS-Migratory Bird Management, USFWS- Regional Aviation Management, and the Office of Aircraft Services developed safe standardized operating procedures for Offshore aerial surveys in March 2001. In general, this agreement approved the continued use of twin-engine aircraft at an altitude of 45 m and speed of 180 km\hr for future Offshore survey efforts. The standard operating procedure increased the margin of safety for survey crews by implementing guidelines including specialized tests for contract pilots prior to surveys, use of primary and secondary pilots, and use of turbine engine aircraft. The continued use of a twin-engine platform at 45 m and 180 km\hr will enable future survey efforts to produce comparable data to those collected in this study.

SUMMARY AND CONCLUSIONS

Hundreds of thousands of marine birds use the Beaufort Sea each year. Previous studies have shown that the south-central Beaufort Sea satisfies important functions for marine birds, including feeding and molting habitat, and a migratory pathway. Concerned that these functions may be compromised by progression of oil and gas development into the near-shore waters of the Beaufort Sea, MMS and USGS-BRD signed an Intra-agency Agreement to assess impacts of human activities on distribution and density of Long-tailed Ducks in Beaufort Sea lagoons. To accomplish this, USGS-BRD subcontracted the USFWS, Waterfowl Branch of Migratory Bird Management, to conduct Near-shore aerial surveys in 1999 and 2000 using existing MMS protocol (OCS- MMS 92-0060), and to compare these results with historical data in "industrial" and "control" areas. We used these data to compare relative densities between "industrial" and "control" areas and to describe the relationship between bird density and human activities.

In addition to monitoring "industrial" and "control" areas, we surveyed near-shore waters between these sites. Accordingly, we mapped distribution patterns of Long-tailed Ducks and other marine birds in an expanded near-shore area among 4 habitats from Oliktok Point to Brownlow Point.

Although Long-tailed Ducks are abundant in the Beaufort Sea, Spectacled, King and Common Eiders also comprise an important proportion of marine avifauna in the region. A poor understanding of Eider distribution in the south-central Beaufort Sea prompted us to conduct an Offshore survey in 1999 and 2000. This survey supplemented the existing protocol to sample near- and off-shore waters for Eiders between Cape Halkett and Brownlow Point up to 60 km offshore.

The specific objectives of this study were to:

1. Monitor Long-tailed Ducks and other species within and among "industrial" and "control" areas using existing protocol (OCS-MMS 92-0060).
2. Use data from 1999-2000 and data collected by Johnson and Gazey (1992) in 1990-1991 to compare Long-tailed Duck population trends between "industrial" and "control" areas, and to describe the relationship between distribution patterns and human activities.
3. Expand the Near-shore survey area to encompass habitats between the original "industrial" and "control" areas, and sample Near-shore Marine habitat from Oliktok Point to Brownlow Point to delineate small-scale distribution patterns of marine birds throughout the expanded study area.
4. Correlate variation in marine bird populations with environmental factors, human activities, and temporal and spatial variables.

5. Implement an Offshore survey that targets Spectacled (*Somateria fischeri*), Common (*S. mollisima*) and King Eiders (*S. spectabilis*).
6. Document distribution patterns of marine birds within the Offshore survey area.

Using the analysis procedures outlined by Johnson and Gazey (1992), we detected a region-wide decrease in Long-tailed Duck density within the study area between 1990-2000. This finding substantiated concerns expressed by Johnson and Gazey (1992) who detected a non-significant downward trend in Long-tailed Duck densities between 1989-1991. While densities region-wide decreased, we did not find a disproportionate decline in the "industrial" area. Similarly, survey data suggested that local disturbance events, such as boat traffic, low-level aircraft, and land-based human activities did not alter the distribution patterns of Long-tailed Ducks.

These tests may have failed to detect human effects on bird densities even if they do indeed occur. Reasons for low power of these tests include inherent stochasticity in sea duck populations, high standard errors associated with aerial survey techniques, localized short- and long-term changes in barrier island habitat, intrusion of human activities into the "Control" area, and unidentified components of variation.

The expanded Near-shore survey indicated that Long-tailed Ducks were the most abundant species in the near-shore environment. Within this area, Long-tailed Ducks densities were highest in Barrier Island habitat, particularly among the Stockton Islands. The survey protocol, however, was designed to test hypotheses of disturbance effects, not to test habitat preferences. Thus, although Long-tailed Ducks were seen in the highest densities in Barrier Island habitat, this finding should not diminish the importance of Mid-lagoon habitat where Long-tailed Ducks feed in midday. Thus, distribution patterns reported here must take into account the location of transect lines and when surveys were conducted.

In the Offshore survey, patterns of marine bird distribution were more variable than in the Near-shore survey. The greater variability in the Offshore survey can be attributed to a larger and more varied study area, a broader sampling period (early, mid, and late summer) and fewer replicates. Nonetheless, general patterns of marine bird distribution were documented. For example, Common Eider densities were highest in shallow-water areas throughout the study area, whereas King Eiders were generally found in large flocks in the deep waters of Harrison Bay. Similarly, Spectacled Eiders were seen in large flocks in Harrison Bay. Unlike King Eiders, however, Spectacled Eiders were uncommon. Offshore survey data also indicated that Common Eider densities remained relatively stable through summer, while King and Spectacled Eider densities peaked in July. The timing and location of King and Spectacled Eider concentrations supports the idea that offshore waters provide a migration corridor for post-breeding Eiders. However, given the Offshore survey is limited to two years of data, it is difficult to predict timing or routes of migrating birds.

The Near-shore and Offshore surveys indicated several areas that appear to be important to marine birds. Harrison Bay, particularly the deep-water strata, supported the highest concentrations of King and Spectacled Eiders. Moreover, this region was relatively important for Scoters, and Red-throated and Yellow-billed Loons. Barrier Island habitat, too, had the highest concentrations of Long-tailed Ducks and Common Eiders. In particular, Barrier Island Habitat among the Stockton Islands had consistently high densities of these species. Although Mainland Shoreline habitat typically had lower densities than Barrier Island habitat, the shoreline between Bullen Point and Point Thomson supported high densities of Long-tailed Ducks relative to other areas in this habitat. Finally, Scoters showed a strong affinity to Mid-lagoon habitat in western Simpson Lagoon.

The Near-shore survey protocol provides a means to monitor trends in molting Long-tailed Duck densities among specific areas and can establish relationships between distribution patterns and human activities; however, this approach is limited. For example, the protocol cannot be used to measure population abundance or habitat preference and is inappropriate to apply to other marine bird species in the near-shore environment.

One alternative that may provide a better assessment of the effects of human activity on marine birds is to measure behavioral responses to disturbances of known size and duration. Direct observations could document immediate changes in distribution within a controlled setting. Additionally, this approach may help identify what specific activities have measurable effects on birds and predict the duration of these responses. An opportunity to measure disturbance effects in a relatively controlled setting occurred in August 2001 when Western Geco conducted 3D seismic tests near Spy and Leavitt Islands.

If multi-species abundance and habitat preference information is of interest, then monitoring efforts should use a sampling design that includes systematic transects with random starting points. This approach would provide an unbiased sample marine bird density in the study area of interest.

As oil and gas development shift from on-shore to offshore sites, potential for oil spills in marine waters will increase. Modeling efforts that predict the impact of oil spills on marine birds are dependent upon an understanding of distribution patterns of these species. These models can be important tools that minimize risk to wildlife by guiding development plans and prepare for cleanup in the event of an actual spill.

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APPENDICES

Appendix 1a. Total Long-tailed Ducks counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	1	9	0	21	6	4	0	45	0	0	0	41
	102	0	25	10	0	0	0	0	0	0	0	0	0
	30	4	0	0	2	0	0	4	0	0	0	0	26
	22	13	1	12	2	0	0	0	0	8	0	0	10
	201	1427	409	950	150	356	74	705	139	636	252	2930	342
	202	902	25	1079	12	21	11	455	88	218	132	982	266
	31	1500	392	1717	162	105	53	482	25	718	290	1597	183
	23	31	23	110	30	17	139	37	95	156	1	240	48
	301	69	465	183	14	0	11	3	187	290	57	41	118
	302	62	700	0	60	0	25	14	50	95	7	2	40
	32	75	483	50	118	97	66	20	125	70	1	13	71
	24	3	139	0	39	1	0	0	0	1	0	0	5
	401	101	126	20	0	25	1	25	0	62	0	8	10
	402	2	157	0	0	45	7	0	10	0	20	197	0
	33	0	1	0	0	0	3	50	0	0	6	3	53
	25	0	0	0	0	20	20	6	0	0	0	1	0
Central													
	904	0	0	0	0	1	0	0	0	1	0	0	1
	905	4	0	0	2	6	8	0	43	19	50	0	97
	906	1	0	0	0	29	0	4	0	10	0	96	9
	907	226	735	185	38	156	11	125	25	42	6	210	23
	908	280	263	557	391	451	132	420	99	293	0	396	415
	909	522	845	315	760	2092	234	510	83	376	40	444	8
	910	17	8	23	0	0	0	6	0	0	14	28	0
	911	0	0	1	0	0	0	8	0	2	0	3	0
	912	19	0	0	0	1	41	8	0	0	0	0	34
	913	28	88	0	0	0	15	40	0	0	25	34	0
	914	0	0	0	0	0	7	20	5	0	0	0	0
	915	37	294	95	0	28	3	45	35	210	14	74	31
Control													
	63	0	18	0	0	7	0	0	0	0	0	100	121
	62	26	0	0	4	13	35	3	0	0	0	0	245
	61	45	4	0	32	0	3	0	0	0	0	0	144
	60	28	0	0	61	0	2	4	0	0	0	0	200
	133	710	746	388	235	8587	246	727	485	565	112	254	314
	134	368	1230	95	141	2452	217	521	15	515	10	261	253
	135	572	1176	677	287	818	335	318	101	697	229	182	189
	136	853	582	307	206	504	356	750	144	943	118	366	466
	183	13	0	0	0	15	83	0	0	0	0	7	0
	182	16	21	0	30	61	253	0	80	0	89	12	263
	181	24	30	0	476	73	18	0	0	8	49	59	50
	180	74	219	147	59	0	238	86	25	227	149	0	49
	193	143	629	60	2	13	24	440	5	185	58	124	57
	192	1099	1194	150	175	1427	49	913	349	573	98	738	371
	191	887	1584	595	170	580	105	411	90	1342	332	249	352
	190	310	1100	0	41	310	50	138	89	501	167	75	73
	Total	10492	13721	7726	3720	18317	2879	7298	2437	8763	2326	9726	4978

Appendix 1b. Total Common Eiders counted per transect during 12 near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0	5	8	0	0	0	32	8	1	0	0	0
	102	0	0	0	0	0	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0	0	30	0	0	15
	22	0	14	0	1	1	30	5	0	5	0	0	0
	201	1	0	2	0	0	2	0	9	2	1	5	9
	202	3	0	8	16	15	0	0	0	5	0	0	16
	31	29	0	0	8	0	1	0	1	2	6	0	0
	23	1	2	0	0	20	0	3	0	3	0	0	9
	301	0	0	0	0	0	0	0	0	0	0	0	0
	302	0	0	0	0	0	0	0	0	0	0	0	0
	32	2	0	5	0	0	0	0	0	0	4	0	0
	24	0	0	0	8	0	0	0	0	0	0	0	0
	401	0	0	0	0	0	0	0	0	0	0	0	0
	402	0	0	0	0	0	0	0	0	0	0	0	0
	33	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0
Central													
	904	0	0	0	0	0	0	0	34	0	0	0	0
	905	0	1	0	0	0	0	0	0	0	0	0	0
	906	0	1	0	0	0	0	0	0	0	0	0	0
	907	58	44	40	0	70	0	13	1	62	4	3	11
	908	16	17	10	82	101	41	0	5	0	3	3	0
	909	9	95	0	137	282	373	47	14	45	12	69	0
	910	0	0	2	0	0	0	0	2	12	0	0	0
	911	0	0	0	0	0	0	0	0	0	1	0	0
	912	2	37	5	0	0	98	0	0	0	0	0	0
	913	0	1	4	0	0	0	2	0	0	0	0	0
	914	0	1	0	0	0	0	3	15	0	0	0	25
	915	10	0	0	0	0	0	12	0	0	0	0	5
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	7	0	0	0	0	0	0	0	0	12	0
	61	0	112	0	0	0	0	0	80	6	0	0	0
	60	0	100	0	0	0	0	0	25	4	0	0	4
	133	72	82	374	877	388	578	52	38	106	116	21	30
	134	170	38	14	130	110	9	4	2	52	37	4	26
	135	31	33	8	42	49	23	2	16	13	1	43	13
	136	1	8	0	10	12	6	0	11	2	0	3	0
	183	0	45	10	6	0	0	20	0	0	0	0	0
	182	0	6	20	0	0	1	0	0	28	6	0	18
	181	0	0	0	12	0	11	0	0	0	0	0	0
	180	3	2	0	0	0	0	0	0	0	0	0	0
	193	20	0	0	0	30	0	1	6	0	0	8	0
	192	8	0	0	0	0	0	4	4	43	0	0	9
	191	13	6	0	0	10	0	0	1	9	0	3	20
	190	3	10	0	1	1	0	0	0	14	0	4	1
	Total	452	667	510	1330	1089	1173	200	272	444	191	178	211

Appendix 1c. Total King Eider counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0	0	0	0	3	0	0	0	0	0	0	0
	102	0	0	0	0	0	0	0	0	0	0	0	0
	30	3	90	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	0	0	0	0	0
	201	0	0	0	0	0	0	0	0	0	0	0	0
	202	0	0	0	0	0	0	0	0	0	0	0	0
	31	0	0	0	0	0	0	0	0	0	0	0	0
	23	0	0	0	0	0	0	0	0	0	0	0	0
	301	0	0	0	0	0	0	0	0	0	0	0	0
	302	0	0	0	0	0	0	0	0	0	0	0	0
	32	0	0	0	0	0	0	0	0	0	0	0	0
	24	0	0	0	0	0	0	0	0	0	0	0	0
	401	0	0	0	0	0	0	0	0	0	0	0	0
	402	0	0	0	0	0	0	0	0	0	0	0	0
	33	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0
Central													
	904	6	0	0	0	0	0	0	0	0	0	0	0
	905	10	0	0	0	0	0	0	0	0	0	0	0
	906	0	0	0	0	0	0	0	0	0	0	0	0
	907	18	0	0	0	0	0	0	0	0	0	0	0
	908	0	4	50	0	0	0	1	0	0	0	0	0
	909	0	0	0	0	0	0	0	0	0	0	0	0
	910	0	0	0	0	0	0	0	0	0	0	0	0
	911	0	0	0	0	0	0	0	0	0	0	0	0
	912	2	0	0	0	0	0	0	0	0	0	0	0
	913	0	0	0	0	0	0	0	0	0	0	0	0
	914	0	0	0	0	0	0	0	0	0	0	0	0
	915	0	0	0	0	0	0	0	0	0	0	0	0
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	0	0	0	0	0	0	0	0	0	0	0
	61	0	1	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	0	0	0	0	0	0	0	0
	133	0	2	0	0	0	0	0	0	0	0	0	0
	134	0	0	0	0	0	0	0	0	0	0	0	0
	135	0	0	0	0	0	0	0	0	0	0	0	0
	136	0	0	0	0	0	0	0	0	0	0	0	0
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	0	0	0	0	0	0	0	0	0	0	0	0
	181	1	0	0	2	0	0	0	0	0	0	0	0
	180	0	0	0	0	0	0	0	0	0	0	0	0
	193	0	0	0	0	0	0	0	0	0	0	0	0
	192	0	0	0	0	0	0	0	0	0	0	0	0
	191	0	0	0	0	0	0	0	0	0	0	0	0
	190	1	0	0	0	0	0	0	0	0	0	0	0
	Total	41	97	50	2	3	0	1	0	0	0	0	0

Appendix 1d. Total Scoters counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	3	0	0	0	0	0	0	0	0	0	0	1
	102	0	0	0	0	0	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	27	0	0	25	0	0
	201	11	0	0	5	0	1	0	0	0	0	18	4
	202	0	0	0	0	0	0	15	0	0	0	3	4
	31	0	0	0	0	0	0	0	0	0	0	180	0
	23	0	0	0	0	0	0	0	0	0	0	0	0
	301	43	230	0	0	0	0	30	0	45	28	9	9
	302	25	40	0	30	1	0	0	1	4	20	2	50
	32	23	40	0	24	0	2	0	35	0	21	33	51
	24	0	0	0	30	0	0	0	0	0	0	0	3
	401	0	0	0	0	0	0	0	0	0	0	1	0
	402	0	0	0	0	0	0	0	0	0	0	0	0
	33	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0
Central													
	904	0	0	0	0	0	0	0	0	0	0	0	2
	905	0	0	0	0	0	0	0	0	0	0	0	0
	906	0	0	0	0	0	45	0	2	0	0	5	10
	907	0	0	100	0	0	0	0	0	0	0	0	0
	908	0	0	0	0	0	0	0	0	0	0	10	0
	909	0	0	0	2	0	0	0	0	0	0	0	0
	910	0	1	0	0	0	0	0	0	0	2	0	0
	911	0	0	0	0	0	0	0	0	8	0	0	1
	912	0	0	0	0	0	0	0	0	1	0	0	0
	913	0	0	0	0	0	2	0	0	0	0	0	0
	914	0	0	0	0	0	0	0	0	0	0	0	0
	915	0	0	0	0	0	0	0	0	0	0	0	0
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	0	0	0	0	0	0	2	0	0	0	0
	61	0	0	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	0	0	0	0	0	0	0	0
	133	0	0	0	0	0	0	0	0	0	0	0	0
	134	0	0	0	0	0	0	0	0	0	0	0	0
	135	0	0	5	75	0	55	0	0	0	0	0	0
	136	26	0	0	0	0	0	0	0	0	0	0	2
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	8	0	0	0	10	0	0	0	0	0	0	0
	181	2	0	0	0	0	0	0	0	3	0	0	0
	180	0	0	0	0	0	0	0	0	0	0	0	0
	193	3	0	0	0	0	0	0	0	0	0	0	0
	192	0	0	0	1	0	0	0	0	0	0	0	0
	191	0	0	0	0	0	0	0	0	0	0	0	4
	190	6	0	0	0	0	0	0	0	0	0	0	0
	Total	150	311	105	167	11	60	117	40	86	96	261	141

Appendix 1e. Total Glaucous Gulls counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	1	3	20	1	82	0	0	0	0	0	0	10
	102	2	1	0	1	0	0	0	0	0	0	0	3
	30	0	0	0	1	1	0	1	0	1	1	0	0
	22	0	1	0	0	0	0	1	2	0	0	1	3
	201	36	68	94	38	14	29	2	36	3	9	59	16
	202	30	3	0	6	8	4	3	12	1	19	81	22
	31	6	6	12	15	9	17	27	20	26	30	7	6
	23	27	24	4	12	43	23	35	27	31	20	36	29
	301	0	0	0	0	0	0	0	0	0	1	0	0
	302	0	0	0	0	0	0	0	0	0	0	2	1
	32	0	0	0	0	0	0	1	1	2	0	0	0
	24	0	3	0	1	1	1	0	0	0	1	0	0
	401	36	26	1	0	4	12	16	5	0	134	26	2
	402	0	4	2	2	2	11	4	8	5	2	2	2
	33	9	8	3	4	4	12	8	28	0	5	5	19
	25	3	3	2	0	4	2	14	1	2	2	4	5
Central													
	904	2	0	6	0	0	0	0	0	2	1	3	0
	905	3	2	3	0	0	0	1	0	1	9	0	0
	906	0	3	1	0	0	1	0	0	0	0	0	0
	907	0	2	9	12	61	32	14	9	4	5	32	7
	908	1	8	9	128	29	21	81	62	3	4	99	24
	909	4	2	4	12	47	14	11	2	2	6	3	6
	910	1	1	1	0	0	1	0	1	0	0	4	3
	911	0	0	0	0	0	0	4	0	0	12	0	3
	912	1	0	1	0	0	0	0	0	1	0	0	1
	913	12	4	5	11	122	13	8	17	2	35	24	15
	914	9	18	2	18	5	7	138	99	3	4	6	5
	915	14	5	9	5	29	11	60	44	14	18	11	18
Control													
	63	0	0	0	0	0	0	0	1	0	0	0	0
	62	1	0	4	0	0	1	0	0	0	1	0	0
	61	0	3	0	0	0	0	0	0	0	0	0	1
	60	0	0	0	13	0	4	0	0	0	0	0	0
	133	1	7	1	31	22	9	1	4	1	1	0	7
	134	6	10	4	5	5	3	5	12	2	3	2	18
	135	6	5	5	31	21	10	8	5	2	14	3	21
	136	13	7	6	4	33	23	9	1	4	0	4	24
	183	0	0	0	0	0	0	0	0	0	0	6	0
	182	0	0	0	1	0	0	0	0	0	3	1	1
	181	1	0	0	3	1	1	0	0	0	2	1	0
	180	7	6	10	2	16	0	6	14	0	1	8	7
	193	4	12	4	7	13	1	37	9	0	4	2	13
	192	8	3	0	5	52	5	31	7	3	2	4	3
	191	57	0	1	2	2	0	22	19	6	2	2	1
	190	10	3	0	4	3	1	94	17	9	8	8	10
	Total	311	251	223	375	633	269	642	463	130	359	446	306

Appendix 1f. Total Northern Pintail counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0	0	2	0	0	0	0	0	0	0	0	0
	102	0	0	1	0	0	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	0	0	0	0	0
	201	0	0	14	0	0	0	0	0	0	0	0	0
	202	0	0	0	0	0	0	0	0	0	0	0	0
	31	0	0	0	0	0	0	0	0	0	0	0	0
	23	0	0	2	0	0	0	0	0	0	0	0	0
	301	0	0	0	0	0	0	0	0	0	0	0	0
	302	0	0	0	0	0	0	0	0	0	0	0	0
	32	0	0	0	0	0	0	0	0	0	0	0	0
	24	0	0	0	0	0	0	0	0	0	0	0	0
	401	0	0	0	0	0	2	9	0	25	86	0	0
	402	0	0	0	0	34	0	8	0	0	0	0	0
	33	0	64	0	0	0	0	0	0	0	0	0	7
	25	0	31	0	0	0	0	0	0	0	0	0	9
Central													
	904	0	0	4	0	0	0	0	0	0	0	0	0
	905	0	0	1	0	0	0	0	0	0	0	0	0
	906	0	0	0	0	0	0	0	0	0	0	0	0
	907	0	0	0	0	0	0	0	0	0	0	0	0
	908	0	0	1	0	0	0	0	0	0	0	0	0
	909	0	0	0	0	0	0	0	0	0	0	0	0
	910	0	0	0	0	0	0	0	0	0	0	0	0
	911	0	0	0	0	0	0	0	0	0	0	0	0
	912	0	0	0	0	0	0	0	0	0	0	0	0
	913	0	0	0	0	0	0	0	0	0	0	0	0
	914	0	220	0	4	0	0	0	80	0	0	0	75
	915	0	5	0	25	0	0	27	6	0	0	0	12
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	0	0	0	0	0	0	0	0	0	0	0
	61	0	0	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	0	0	0	0	0	0	0	0
	133	0	0	0	0	0	0	0	0	0	0	0	0
	134	0	0	1	0	0	0	0	0	0	0	0	0
	135	0	0	2	0	0	0	0	0	0	0	0	0
	136	10	0	5	0	0	0	0	0	0	0	0	0
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	0	0	0	0	0	0	0	0	0	0	0	0
	181	0	0	0	0	0	0	0	0	0	0	0	0
	180	0	0	0	0	0	0	0	0	0	0	0	0
	193	0	156	0	0	12	0	0	12	0	1	0	35
	192	0	0	0	0	8	16	0	8	0	0	0	0
	191	0	5	2	0	8	18	165	6	0	3	3	0
	190	0	2	4	0	0	0	137	41	28	5	3	2
	Total	10	483	39	29	62	36	346	153	53	95	6	140

Appendix 1g. Total Geese and Swans counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0	0	0	0	0	0	0	0	0	0	0	0
	102	0	0	0	0	0	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	9	0	0	0	4
	201	12	0	0	0	0	0	0	0	19	20	0	17
	202	0	0	0	0	20	0	0	0	0	0	0	2
	31	0	0	0	0	0	0	0	0	0	0	0	0
	23	6	0	0	0	0	0	12	0	0	0	0	0
	301	0	0	0	0	0	0	0	0	0	0	0	0
	302	0	0	0	0	0	0	0	0	0	0	0	0
	32	0	0	0	0	0	0	0	0	0	0	0	0
	24	0	0	0	0	0	0	0	0	0	0	0	0
	401	50	0	0	0	0	0	27	47	170	72	49	1
	402	21	47	65	0	0	0	82	0	28	8	0	0
	33	46	33	56	25	0	0	0	43	0	0	45	2
	25	2	0	0	0	0	0	85	0	0	0	0	0
Central													
	904	0	0	0	0	0	0	0	0	0	0	0	0
	905	0	0	0	0	0	0	0	0	0	0	0	0
	906	0	0	0	0	0	0	0	0	0	0	0	0
	907	0	0	0	0	0	0	0	0	0	0	0	0
	908	0	0	0	0	0	0	0	0	0	0	0	0
	909	0	0	0	0	0	0	0	0	0	0	0	0
	910	0	0	0	0	0	0	0	0	0	0	0	0
	911	0	0	0	0	0	0	0	0	0	0	0	0
	912	0	0	0	0	0	0	0	0	0	0	0	0
	913	0	9	0	30	3	0	0	0	22	0	20	8
	914	0	0	12	0	0	2	0	0	60	0	0	0
	915	64	23	40	30	0	0	105	340	133	202	25	47
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	0	0	0	0	0	0	0	0	0	0	0
	61	0	0	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	16	0	0	0	0	0	0	0
	133	0	0	0	0	0	0	0	0	0	0	0	0
	134	0	0	0	0	0	0	0	0	0	0	0	0
	135	0	0	0	20	0	0	0	0	0	0	0	6
	136	0	0	0	27	0	4	0	0	0	0	0	0
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	0	0	0	0	0	0	0	0	0	0	0	0
	181	0	0	0	0	0	0	0	0	0	0	0	0
	180	0	0	0	0	0	0	0	0	0	0	0	0
	193	0	0	0	0	0	0	40	22	18	0	17	35
	192	0	4	0	0	0	0	0	0	0	5	0	0
	191	0	3	0	0	0	0	0	8	0	0	0	75
	190	20	0	0	0	25	0	0	0	0	0	0	11
	Total	221	119	173	132	64	6	351	469	450	307	156	208

Appendix 1h. Total Shorebirds counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0	0	0	0	0	0	1	0	10	0	0	0
	102	0	0	5	0	0	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	0	0	0	0	0
	201	0	0	170	0	80	20	0	25	0	0	0	0
	202	0	0	200	28	11	2	0	14	2	0	5	22
	31	0	0	230	0	23	0	0	25	0	5	0	20
	23	0	0	70	0	0	0	0	42	5	0	10	20
	301	0	0	0	0	0	0	0	0	0	0	0	0
	302	0	0	0	10	0	0	0	0	0	0	0	0
	32	0	0	0	0	0	0	0	0	0	0	0	0
	24	0	0	0	0	0	0	0	0	0	0	0	0
	401	0	0	0	0	4	0	0	0	0	53	0	0
	402	0	0	4	0	0	0	0	0	0	0	0	0
	33	0	30	0	0	41	0	0	35	0	8	0	40
	25	0	0	5	0	10	0	0	0	0	0	0	0
Central													
	904	0	0	0	0	0	0	0	0	0	0	0	0
	905	0	0	0	0	0	0	0	0	0	0	0	0
	906	0	0	0	0	0	0	0	0	0	0	0	0
	907	0	0	0	0	280	0	0	0	0	0	0	15
	908	0	0	5	50	561	95	0	0	0	2	0	0
	909	0	0	1	260	373	15	0	0	2	10	0	50
	910	0	0	0	0	0	0	0	0	0	0	0	0
	911	0	0	0	0	0	0	0	0	0	0	0	0
	912	0	0	0	0	0	0	0	0	0	2	0	0
	913	0	0	0	0	0	0	75	12	0	1	0	5
	914	0	0	0	0	4	0	0	730	0	0	0	15
	915	0	0	2	215	6	1	0	94	0	2	8	8
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	0	0	0	0	0	0	0	0	0	0	0
	61	0	0	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	0	0	0	0	2	0	0	0
	133	0	0	0	0	360	0	0	0	15	10	20	33
	134	0	0	0	5	0	0	0	0	0	7	0	0
	135	0	0	0	52	13	0	0	15	10	13	10	10
	136	0	0	0	0	25	0	0	0	20	0	0	0
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	0	0	0	0	0	0	0	0	4	0	0	0
	181	0	0	0	0	0	0	0	0	0	0	0	0
	180	0	0	1	0	0	0	3	8	3	0	1	285
	193	0	3	1	0	0	0	4	20	1	0	0	100
	192	0	0	0	0	0	0	0	0	0	0	0	10
	191	0	0	0	3	0	0	3	10	0	0	0	0
	190	0	0	0	0	0	2	0	41	0	0	0	0
	Total	0	33	694	623	1791	135	86	1071	74	113	54	633

Appendix 1i. Total Pacific Loons counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	4	3	1	1	0	1	0	3	1	0	1	2
	102	0	0	1	0	0	2	0	1	2	0	0	1
	30	1	2	1	0	0	0	0	3	0	0	0	0
	22	0	2	0	2	0	0	0	0	0	0	0	0
	201	6	3	2	4	1	4	0	0	1	0	3	1
	202	0	0	0	0	1	0	1	0	0	0	2	0
	31	0	1	1	21	0	8	0	0	0	1	7	3
	23	0	0	1	0	2	2	1	0	3	0	0	1
	301	0	0	0	0	0	2	0	0	7	0	1	6
	302	0	0	5	1	0	0	0	0	2	0	4	5
	32	0	3	7	1	0	1	1	2	2	1	6	1
	24	1	1	0	0	1	0	0	0	0	1	3	4
	401	1	10	0	0	1	4	1	4	1	0	10	7
	402	2	5	4	1	0	0	1	4	1	0	8	2
	33	4	3	0	0	0	4	0	2	0	0	22	5
	25	0	5	0	2	1	0	0	1	0	0	4	5
Central													
	904	1	2	1	0	0	0	0	2	1	0	0	0
	905	11	2	2	1	2	3	2	1	3	0	0	0
	906	0	2	0	1	0	1	6	1	4	0	1	0
	907	1	0	0	0	0	4	0	0	9	0	0	0
	908	1	7	1	0	0	0	3	1	0	0	0	1
	909	0	1	1	0	0	1	2	1	6	1	0	0
	910	1	4	3	0	0	0	2	1	0	0	5	3
	911	4	0	3	0	0	0	1	0	0	0	2	0
	912	2	0	0	2	0	2	0	0	2	0	2	0
	913	1	10	0	0	1	0	0	0	2	0	0	3
	914	0	0	0	2	0	2	0	0	0	0	0	0
	915	4	9	1	0	3	3	2	0	5	2	3	4
Control													
	63	0	3	1	2	0	0	0	1	1	0	0	0
	62	0	1	0	1	2	3	7	0	1	0	0	1
	61	2	1	0	2	2	0	0	1	2	0	0	1
	60	1	2	0	1	2	0	0	0	2	0	0	0
	133	0	3	0	1	0	1	0	0	0	0	0	0
	134	0	2	1	0	0	3	0	2	1	0	0	0
	135	0	3	1	1	2	1	0	0	0	0	0	0
	136	1	0	2	4	0	3	0	0	0	0	2	1
	183	5	0	2	0	0	1	1	0	0	1	1	0
	182	0	1	0	0	0	0	0	0	4	0	0	3
	181	2	2	0	0	0	0	0	0	2	0	0	0
	180	0	0	3	0	31	0	1	2	0	1	1	0
	193	1	8	1	0	0	1	0	2	2	3	0	2
	192	1	1	0	0	0	0	0	1	1	2	2	7
	191	1	0	3	2	2	1	3	4	3	1	3	1
	190	1	3	1	2	0	0	2	0	1	3	0	2
	Total	60	105	50	55	54	58	39	40	72	17	93	72

Appendix 1j. Total Red-throated Loon counted per transect during 12 near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0	0	0	0	0	0	0	0	0	0	0	0
	102	0	0	0	0	1	0	0	0	0	0	0	0
	30	2	0	0	0	2	0	0	0	0	0	0	0
	22	1	0	0	0	2	0	0	0	4	0	0	0
	201	1	0	0	0	0	3	0	0	1	0	0	1
	202	0	0	0	0	0	0	0	0	0	0	0	0
	31	0	0	0	0	0	3	0	0	0	0	0	0
	23	0	0	0	1	0	0	0	0	1	0	0	0
	301	0	0	0	0	0	0	0	0	0	0	5	0
	302	0	0	0	0	0	0	0	0	0	0	0	0
	32	0	0	1	0	0	0	0	0	0	0	0	0
	24	0	0	0	1	0	0	0	0	0	0	0	0
	401	0	5	0	0	0	2	1	1	0	0	1	0
	402	0	2	0	0	0	0	0	0	1	0	6	0
	33	0	0	0	0	0	0	0	1	0	0	5	0
	25	0	2	0	0	0	0	0	0	0	0	1	0
Central													
	904	0	0	0	0	0	0	0	0	0	0	0	0
	905	1	0	0	0	0	1	0	0	0	0	0	0
	906	1	0	0	0	1	0	0	0	0	0	0	0
	907	0	0	0	0	0	0	0	0	0	0	0	0
	908	0	0	1	0	0	0	0	0	0	0	0	0
	909	0	0	0	0	0	2	0	0	0	0	0	0
	910	1	0	4	0	0	2	0	1	0	0	1	0
	911	0	0	0	0	0	0	0	0	0	0	0	0
	912	0	1	0	0	0	0	0	0	0	0	0	0
	913	1	0	1	2	0	0	0	1	0	0	3	0
	914	0	0	0	1	0	0	0	0	0	0	0	0
	915	0	8	0	1	0	0	0	4	3	1	2	1
Control													
	63	0	0	0	0	0	0	0	0	0	0	0	0
	62	0	0	0	0	1	1	0	0	0	0	0	0
	61	0	0	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	2	0	0	0	1	0	0	0	0
	133	0	1	0	0	0	5	0	0	0	0	0	0
	134	0	0	1	0	0	0	0	0	0	0	0	0
	135	0	0	1	0	0	0	0	0	0	0	0	0
	136	0	0	7	0	0	4	0	0	0	0	0	0
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	0	0	0	0	0	0	0	0	0	0	0	0
	181	0	0	0	0	0	0	0	0	0	0	0	0
	180	0	0	2	0	0	0	0	1	0	2	0	0
	193	2	0	0	0	0	0	0	0	0	0	0	0
	192	1	0	0	1	0	2	0	0	0	2	0	0
	191	0	1	0	0	0	1	0	5	3	1	0	0
	190	0	6	0	0	1	0	0	2	0	0	2	2
	Total	11	26	18	9	8	26	1	17	13	6	26	4

Appendix 1k. Total Yellow-billed Loons counted per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	1	0	0	0	0	0	0	0	0	0	0	0
	102	0	0	0	0	0	0	0	0	0	0	0	0
	30	0	0	0	0	0	0	0	0	0	0	0	0
	22	0	0	0	0	0	0	0	0	0	0	0	0
	201	3	1	3	0	0	0	0	0	0	0	1	0
	202	0	0	1	1	0	0	1	0	0	0	0	0
	31	0	0	1	0	0	0	0	0	3	3	0	0
	23	0	0	0	0	0	0	0	0	1	0	0	0
	301	0	0	0	0	0	0	0	0	0	0	0	0
	302	0	1	0	0	0	0	2	0	0	0	0	0
	32	0	1	0	0	0	0	0	0	0	0	0	0
	24	1	0	0	0	0	2	0	0	0	0	0	0
	401	0	0	0	0	0	0	0	0	0	0	0	0
	402	0	4	0	0	0	0	0	1	0	0	0	0
	33	0	0	0	0	0	0	0	0	0	0	0	0
	25	0	0	0	0	0	0	0	0	0	0	0	0
Central													
	904	0	0	0	0	0	0	0	0	0	0	0	0
	905	0	0	0	0	0	0	0	0	0	0	0	0
	906	0	0	0	0	0	0	0	0	0	0	0	0
	907	0	0	1	0	0	0	0	1	0	0	0	0
	908	0	0	0	0	0	0	0	0	0	0	0	0
	909	0	0	1	0	0	0	2	0	0	0	0	0
	910	0	0	1	0	0	0	0	0	0	0	0	0
	911	1	0	0	0	0	0	0	0	0	0	0	0
	912	0	0	0	0	0	0	0	0	0	0	0	0
	913	0	1	0	0	0	0	0	0	0	0	0	0
	914	0	0	0	0	0	0	0	0	0	0	0	0
	915	0	2	0	0	0	0	0	1	0	0	0	1
Control													
	63	0	0	0	0	0	0	2	0	0	0	0	0
	62	0	0	0	0	0	0	0	0	0	0	0	0
	61	0	0	0	0	0	0	0	0	0	0	0	0
	60	0	0	0	0	0	0	0	0	0	0	0	0
	133	0	0	3	0	0	0	0	3	0	0	0	0
	134	0	0	1	0	0	0	1	0	0	0	0	0
	135	0	0	1	0	0	0	0	0	0	0	0	0
	136	0	0	0	1	0	0	2	3	1	0	2	0
	183	0	0	0	0	0	0	0	0	0	0	0	0
	182	0	0	0	0	0	0	1	0	0	1	0	0
	181	0	0	0	0	0	0	0	0	0	0	0	0
	180	0	0	0	0	0	0	1	0	0	0	0	0
	193	0	0	0	0	0	0	0	0	0	0	0	0
	192	0	0	0	0	0	0	0	0	0	0	0	0
	191	0	0	0	0	0	0	0	0	0	0	0	0
	190	0	0	0	0	0	0	0	0	0	0	0	0
	Total	6	10	13	2	0	2	12	9	5	4	3	1

Appendix 2a. Long-tailed Duck density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.11	1.02	0.00	2.38	0.68	0.45	0.00	5.10	0.00	0.00	0.00	4.64
	102	0.00	3.85	1.54	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.74	0.00	0.00	0.37	0.00	0.00	0.74	0.00	0.00	0.00	0.00	4.81
	22	1.85	0.14	1.71	0.29	0.00	0.00	0.00	0.00	1.14	0.00	0.00	1.43
	201	163.65	46.90	108.94	17.20	40.83	8.49	80.85	15.94	72.94	28.90	336.01	39.22
	202	146.67	4.07	175.45	1.95	3.41	1.79	73.98	14.31	35.45	21.46	159.67	43.25
	31	268.34	70.13	307.16	28.98	18.78	9.48	86.23	4.47	128.44	51.88	285.69	32.74
	23	7.16	5.31	25.40	6.93	3.93	32.10	8.55	21.94	36.03	0.23	55.43	11.09
	301	9.47	63.79	25.10	1.92	0.00	1.51	0.41	25.65	39.78	7.82	5.62	16.19
	302	11.70	132.08	0.00	11.32	0.00	4.72	2.64	9.43	17.92	1.32	0.38	7.55
	32	19.08	122.90	12.72	30.03	24.68	16.79	5.09	31.81	17.81	0.25	3.31	18.07
	24	0.49	22.68	0.00	6.36	0.16	0.00	0.00	0.00	0.16	0.00	0.00	0.82
	401	13.34	16.64	2.64	0.00	3.30	0.13	3.30	0.00	8.19	0.00	1.06	1.32
	402	0.34	26.66	0.00	0.00	7.64	1.19	0.00	1.70	0.00	3.40	33.45	0.00
	33	0.00	0.13	0.00	0.00	0.00	0.38	6.34	0.00	0.00	0.76	0.38	6.72
	25	0.00	0.00	0.00	0.00	4.21	4.21	1.26	0.00	0.00	0.00	0.21	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.15	0.00	0.00	0.15
	905	0.47	0.00	0.00	0.23	0.70	0.93	0.00	5.01	2.21	5.82	0.00	11.29
	906	0.12	0.00	0.00	0.00	3.51	0.00	0.48	0.00	1.21	0.00	11.61	1.09
	907	22.51	73.21	18.43	3.78	15.54	1.10	12.45	2.49	4.18	0.60	20.92	2.29
	908	32.79	30.80	65.22	45.78	52.81	15.46	49.18	11.59	34.31	0.00	46.37	48.59
	909	62.44	101.08	37.68	90.91	250.24	27.99	61.00	9.93	44.98	4.78	53.11	0.96
	910	2.74	1.29	3.70	0.00	0.00	0.00	0.97	0.00	0.00	2.25	4.51	0.00
	911	0.00	0.00	0.15	0.00	0.00	0.00	1.17	0.00	0.29	0.00	0.44	0.00
	912	1.93	0.00	0.00	0.00	0.10	4.15	0.81	0.00	0.00	0.00	0.00	3.44
	913	3.63	11.41	0.00	0.00	0.00	1.95	5.19	0.00	0.00	3.24	4.41	0.00
	914	0.00	0.00	0.00	0.00	0.00	1.24	3.55	0.89	0.00	0.00	0.00	0.00
	915	2.86	22.76	7.35	0.00	2.17	0.23	3.48	2.71	16.25	1.08	5.73	2.40
Control													
	63	0.00	3.13	0.00	0.00	1.22	0.00	0.00	0.00	0.00	0.00	17.39	21.04
	62	5.07	0.00	0.00	0.78	2.53	6.82	0.58	0.00	0.00	0.00	0.00	47.76
	61	9.05	0.80	0.00	6.44	0.00	0.60	0.00	0.00	0.00	0.00	0.00	28.97
	60	5.14	0.00	0.00	11.19	0.00	0.37	0.73	0.00	0.00	0.00	0.00	36.70
	133	106.13	111.51	58.00	35.13	1283.56	36.77	108.67	72.50	84.45	16.74	37.97	46.94
	134	66.43	222.02	17.15	25.45	442.60	39.17	94.04	2.71	92.96	1.81	47.11	45.67
	135	99.65	204.88	117.94	50.00	142.51	58.36	55.40	17.60	121.43	39.90	31.71	32.93
	136	134.12	91.51	48.27	32.39	79.25	55.97	117.92	22.64	148.27	45.91	57.55	73.27
	183	2.26	0.00	0.00	0.00	2.61	14.46	0.00	0.00	0.00	0.00	1.22	0.00
	182	2.95	3.87	0.00	5.54	11.25	46.68	0.00	14.76	0.00	16.42	2.21	48.52
	181	5.13	6.41	0.00	101.71	15.60	3.85	0.00	0.00	1.71	10.47	12.61	10.68
	180	12.69	37.56	25.21	10.12	0.00	40.82	14.75	4.29	38.94	25.56	0.00	8.40
	193	18.92	83.20	7.94	0.26	1.72	3.17	58.20	0.66	24.47	7.67	16.40	7.54
	192	158.59	172.29	21.65	25.25	205.92	7.07	131.75	50.36	82.68	14.14	106.49	53.54
	191	164.56	293.88	110.39	31.54	107.61	19.48	76.25	16.70	248.98	61.60	46.20	65.31
	190	47.11	167.17	0.00	6.23	47.11	7.60	20.97	13.53	76.14	25.38	11.40	11.09

Appendix 2b. Common Eider density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.57	0.91	0.00	0.00	0.00	3.62	0.91	0.11	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.55	0.00	0.00	2.77
	22	0.00	2.00	0.00	0.14	0.14	4.28	0.71	0.00	0.71	0.00	0.00	0.00
	201	0.11	0.00	0.23	0.00	0.00	0.23	0.00	1.03	0.23	0.11	0.57	1.03
	202	0.49	0.00	1.30	2.60	2.44	0.00	0.00	0.00	0.81	0.00	0.00	2.60
	31	5.19	0.00	0.00	1.43	0.00	0.18	0.00	0.18	0.36	1.07	0.00	0.00
	23	0.23	0.46	0.00	0.00	4.62	0.00	0.69	0.00	0.69	0.00	0.00	2.08
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.51	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	1.02	0.00	0.00
	24	0.00	0.00	0.00	1.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	402	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.14	0.00	0.00	0.00	0.00
	905	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	5.78	4.38	3.98	0.00	6.97	0.00	1.29	0.10	6.18	0.40	0.30	1.10
	908	1.87	1.99	1.17	9.60	11.83	4.80	0.00	0.59	0.00	0.35	0.35	0.00
	909	1.08	11.36	0.00	16.39	33.73	44.62	5.62	1.67	5.38	1.44	8.25	0.00
	910	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.32	1.93	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.00	0.00
	912	0.20	3.75	0.51	0.00	0.00	9.93	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.13	0.52	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.18	0.00	0.00	0.00	0.00	0.53	2.66	0.00	0.00	0.00	4.43
	915	0.77	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.39
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	1.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.34	0.00
	61	0.00	22.54	0.00	0.00	0.00	0.00	0.00	16.10	1.21	0.00	0.00	0.00
	60	0.00	18.35	0.00	0.00	0.00	0.00	0.00	4.59	0.73	0.00	0.00	0.73
	133	10.76	12.26	55.90	131.09	58.00	86.40	7.77	5.68	15.84	17.34	3.14	4.48
	134	30.69	6.86	2.53	23.47	19.86	1.62	0.72	0.36	9.39	6.68	0.72	4.69
	135	5.40	5.75	1.39	7.32	8.54	4.01	0.35	2.79	2.26	0.17	7.49	2.26
	136	0.16	1.26	0.00	1.57	1.89	0.94	0.00	1.73	0.31	0.00	0.47	0.00
	183	0.00	7.84	1.74	1.05	0.00	0.00	3.48	0.00	0.00	0.00	0.00	0.00
	182	0.00	1.11	3.69	0.00	0.00	0.18	0.00	0.00	5.17	1.11	0.00	3.32
	181	0.00	0.00	0.00	2.56	0.00	2.35	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.51	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	2.65	0.00	0.00	0.00	3.97	0.00	0.13	0.79	0.00	0.00	1.06	0.00
	192	1.15	0.00	0.00	0.00	0.00	0.00	0.58	0.58	6.20	0.00	0.00	1.30
	191	2.41	1.11	0.00	0.00	1.86	0.00	0.00	0.19	1.67	0.00	0.56	3.71
	190	0.46	1.52	0.00	0.15	0.15	0.00	0.00	0.00	2.13	0.00	0.61	0.15

Appendix 2c. King Eider density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.55	16.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	402	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	1.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.47	5.85	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.21	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	190	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 2d. Scoter density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	3.85	0.00	0.00	3.57	0.00	0.00
	201	1.26	0.00	0.00	0.57	0.00	0.11	0.00	0.00	0.00	0.00	2.06	0.46
	202	0.00	0.00	0.00	0.00	0.00	0.00	2.44	0.00	0.00	0.00	0.49	0.65
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	32.20	0.00
	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	301	5.90	31.55	0.00	0.00	0.00	0.00	4.12	0.00	6.17	3.84	1.23	1.23
	302	4.72	7.55	0.00	5.66	0.19	0.00	0.00	0.19	0.75	3.77	0.38	9.43
	32	5.85	10.18	0.00	6.11	0.00	0.51	0.00	8.91	0.00	5.34	8.40	12.98
	24	0.00	0.00	0.00	4.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.49
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00
	402	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	5.44	0.00	0.24	0.00	0.00	0.60	1.21
	907	0.00	0.00	9.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00
	909	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.15
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.87	13.07	0.00	9.58	0.00	0.00	0.00	0.00	0.00	0.00
	136	4.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	1.48	0.00	0.00	0.00	1.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74
	190	0.91	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 2e. Glaucous Gull density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.11	0.34	2.27	0.11	9.29	0.00	0.00	0.00	0.00	0.00	0.00	1.13
	102	0.31	0.15	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46
	30	0.00	0.00	0.00	0.18	0.18	0.00	0.18	0.00	0.18	0.18	0.00	0.00
	22	0.00	0.14	0.00	0.00	0.00	0.00	0.14	0.29	0.00	0.00	0.14	0.43
	201	4.13	7.80	10.78	4.36	1.61	3.33	0.23	4.13	0.34	1.03	6.77	1.83
	202	4.88	0.49	0.00	0.98	1.30	0.65	0.49	1.95	0.16	3.09	13.17	3.58
	31	1.07	1.07	2.15	2.68	1.61	3.04	4.83	3.58	4.65	5.37	1.25	1.07
	23	6.24	5.54	0.92	2.77	9.93	5.31	8.08	6.24	7.16	4.62	8.31	6.70
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38	0.19
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.25	0.51	0.00	0.00	0.00
	24	0.00	0.49	0.00	0.16	0.16	0.16	0.00	0.00	0.00	0.16	0.00	0.00
	401	4.76	3.43	0.13	0.00	0.53	1.59	2.11	0.66	0.00	17.70	3.43	0.26
	402	0.00	0.68	0.34	0.34	0.34	1.87	0.68	1.36	0.85	0.34	0.34	0.34
	33	1.14	1.01	0.38	0.51	0.51	1.52	1.01	3.55	0.00	0.63	0.63	2.41
	25	0.63	0.63	0.42	0.00	0.84	0.42	2.95	0.21	0.42	0.42	0.84	1.05
Central													
	904	0.30	0.00	0.91	0.00	0.00	0.00	0.00	0.00	0.30	0.15	0.45	0.00
	905	0.35	0.23	0.35	0.00	0.00	0.00	0.12	0.00	0.12	1.05	0.00	0.00
	906	0.00	0.36	0.12	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.20	0.90	1.20	6.08	3.19	1.39	0.90	0.40	0.50	3.19	0.70
	908	0.12	0.94	1.05	14.99	3.40	2.46	9.48	7.26	0.35	0.47	11.59	2.81
	909	0.48	0.24	0.48	1.44	5.62	1.67	1.32	0.24	0.24	0.72	0.36	0.72
	910	0.16	0.16	0.16	0.00	0.00	0.16	0.00	0.16	0.00	0.00	0.64	0.48
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	1.76	0.00	0.44
	912	0.10	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10
	913	1.56	0.52	0.65	1.43	15.82	1.69	1.04	2.20	0.26	4.54	3.11	1.95
	914	1.60	3.19	0.35	3.19	0.89	1.24	24.47	17.55	0.53	0.71	1.06	0.89
	915	1.08	0.39	0.70	0.39	2.24	0.85	4.64	3.41	1.08	1.39	0.85	1.39
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
	62	0.19	0.00	0.78	0.00	0.00	0.19	0.00	0.00	0.00	0.19	0.00	0.00
	61	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20
	60	0.00	0.00	0.00	2.39	0.00	0.73	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.15	1.05	0.15	4.63	3.29	1.35	0.15	0.60	0.15	0.15	0.00	1.05
	134	1.08	1.81	0.72	0.90	0.90	0.54	0.90	2.17	0.36	0.54	0.36	3.25
	135	1.05	0.87	0.87	5.40	3.66	1.74	1.39	0.87	0.35	2.44	0.52	3.66
	136	2.04	1.10	0.94	0.63	5.19	3.62	1.42	0.16	0.63	0.00	0.63	3.77
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.05	0.00
	182	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.55	0.18	0.18
	181	0.21	0.00	0.00	0.64	0.21	0.21	0.00	0.00	0.00	0.43	0.21	0.00
	180	1.20	1.03	1.72	0.34	2.74	0.00	1.03	2.40	0.00	0.17	1.37	1.20
	193	0.53	1.59	0.53	0.93	1.72	0.13	4.89	1.19	0.00	0.53	0.26	1.72
	192	1.15	0.43	0.00	0.72	7.50	0.72	4.47	1.01	0.43	0.29	0.58	0.43
	191	10.58	0.00	0.19	0.37	0.37	0.00	4.08	3.53	1.11	0.37	0.37	0.19
	190	1.52	0.46	0.00	0.61	0.46	0.15	14.29	2.58	1.37	1.22	1.22	1.52

Appendix 2f. Northern Pintail density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.00	0.00	1.61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.00	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.26	1.19	0.00	3.30	11.36	0.00	0.00
	402	0.00	0.00	0.00	0.00	5.77	0.00	1.36	0.00	0.00	0.00	0.00	0.00
	33	0.00	8.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
	25	0.00	6.53	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.89
Central													
	904	0.00	0.00	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	39.01	0.00	0.71	0.00	0.00	0.00	14.18	0.00	0.00	0.00	13.30
	915	0.00	0.39	0.00	1.93	0.00	0.00	2.09	0.46	0.00	0.00	0.00	0.93
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	1.57	0.00	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.00	20.63	0.00	0.00	1.59	0.00	0.00	1.59	0.00	0.13	0.00	4.63
	192	0.00	0.00	0.00	0.00	1.15	2.31	0.00	1.15	0.00	0.00	0.00	0.00
	191	0.00	0.93	0.37	0.00	1.48	3.34	30.61	1.11	0.00	0.56	0.56	0.00
	190	0.00	0.30	0.61	0.00	0.00	0.00	20.82	6.23	4.26	0.76	0.46	0.30

Appendix 2g. Geese and Swan density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28	0.00	0.00	0.00	0.57
	201	1.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.18	2.29	0.00	1.95
	202	0.00	0.00	0.00	0.00	3.25	0.00	0.00	0.00	0.00	0.00	0.00	0.33
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	23	1.39	0.00	0.00	0.00	0.00	0.00	2.77	0.00	0.00	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	6.61	0.00	0.00	0.00	0.00	0.00	3.57	6.21	22.46	9.51	6.47	0.13
	402	3.57	7.98	11.04	0.00	0.00	0.00	13.92	0.00	4.75	1.36	0.00	0.00
	33	5.83	4.18	7.10	3.17	0.00	0.00	0.00	5.45	0.00	0.00	5.70	0.25
	25	0.42	0.00	0.00	0.00	0.00	0.00	17.89	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	1.17	0.00	3.89	0.39	0.00	0.00	0.00	2.85	0.00	2.59	1.04
	914	0.00	0.00	2.13	0.00	0.00	0.35	0.00	0.00	10.64	0.00	0.00	0.00
	915	4.95	1.78	3.10	2.32	0.00	0.00	8.13	26.32	10.29	15.63	1.93	3.64
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	2.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.00	3.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.05
	136	0.00	0.00	0.00	4.25	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.00	0.00	0.00	0.00	0.00	0.00	5.29	2.91	2.38	0.00	2.25	4.63
	192	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.00	0.00
	191	0.00	0.56	0.00	0.00	0.00	0.00	0.00	1.48	0.00	0.00	0.00	13.91
	190	3.04	0.00	0.00	0.00	3.80	0.00	0.00	0.00	0.00	0.00	0.00	1.67

Appendix 2h. Shorebird density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	1.13	0.00	0.00	0.00
	102	0.00	0.00	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.00	0.00	19.50	0.00	9.17	2.29	0.00	2.87	0.00	0.00	0.00	0.00
	202	0.00	0.00	32.52	4.55	1.79	0.33	0.00	2.28	0.33	0.00	0.81	3.58
	31	0.00	0.00	41.14	0.00	4.11	0.00	0.00	4.47	0.00	0.89	0.00	3.58
	23	0.00	0.00	16.17	0.00	0.00	0.00	0.00	9.70	1.15	0.00	2.31	4.62
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	1.89	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.53	0.00	0.00	0.00	0.00	7.00	0.00	0.00
	402	0.00	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	3.80	0.00	0.00	5.20	0.00	0.00	4.44	0.00	1.01	0.00	5.07
	25	0.00	0.00	1.05	0.00	2.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	27.89	0.00	0.00	0.00	0.00	0.00	0.00	1.49
	908	0.00	0.00	0.59	5.85	65.69	11.12	0.00	0.00	0.00	0.23	0.00	0.00
	909	0.00	0.00	0.12	31.10	44.62	1.79	0.00	0.00	0.24	1.20	0.00	5.98
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.00	9.73	1.56	0.00	0.13	0.00	0.65
	914	0.00	0.00	0.00	0.00	0.71	0.00	0.00	129.43	0.00	0.00	0.00	2.66
	915	0.00	0.00	0.15	16.64	0.46	0.08	0.00	7.28	0.00	0.15	0.62	0.62
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	53.81	0.00	0.00	0.00	2.24	1.49	2.99	4.93
	134	0.00	0.00	0.00	0.90	0.00	0.00	0.00	0.00	0.00	1.26	0.00	0.00
	135	0.00	0.00	0.00	9.06	2.26	0.00	0.00	2.61	1.74	2.26	1.74	1.74
	136	0.00	0.00	0.00	0.00	3.93	0.00	0.00	0.00	3.14	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.17	0.00	0.00	0.00	0.51	1.37	0.51	0.00	0.17	48.89
	193	0.00	0.40	0.13	0.00	0.00	0.00	0.53	2.65	0.13	0.00	0.00	13.23
	192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.44
	191	0.00	0.00	0.00	0.56	0.00	0.00	0.56	1.86	0.00	0.00	0.00	0.00
	190	0.00	0.00	0.00	0.00	0.00	0.30	0.00	6.23	0.00	0.00	0.00	0.00

Appendix 2i. Pacific Loon density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.45	0.34	0.11	0.11	0.00	0.11	0.00	0.34	0.11	0.00	0.11	0.23
	102	0.00	0.00	0.15	0.00	0.00	0.31	0.00	0.15	0.31	0.00	0.00	0.15
	30	0.18	0.37	0.18	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00	0.00
	22	0.00	0.29	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.69	0.34	0.23	0.46	0.11	0.46	0.00	0.00	0.11	0.00	0.34	0.11
	202	0.00	0.00	0.00	0.00	0.16	0.00	0.16	0.00	0.00	0.00	0.33	0.00
	31	0.00	0.18	0.18	3.76	0.00	1.43	0.00	0.00	0.00	0.18	1.25	0.54
	23	0.00	0.00	0.23	0.00	0.46	0.46	0.23	0.00	0.69	0.00	0.00	0.23
	301	0.00	0.00	0.00	0.00	0.00	0.27	0.00	0.00	0.96	0.00	0.14	0.82
	302	0.00	0.00	0.94	0.19	0.00	0.00	0.00	0.00	0.38	0.00	0.75	0.94
	32	0.00	0.76	1.78	0.25	0.00	0.25	0.25	0.51	0.51	0.25	1.53	0.25
	24	0.16	0.16	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.16	0.49	0.65
	401	0.13	1.32	0.00	0.00	0.13	0.53	0.13	0.53	0.13	0.00	1.32	0.92
	402	0.34	0.85	0.68	0.17	0.00	0.00	0.17	0.68	0.17	0.00	1.36	0.34
	33	0.51	0.38	0.00	0.00	0.00	0.51	0.00	0.25	0.00	0.00	2.79	0.63
	25	0.00	1.05	0.00	0.42	0.21	0.00	0.00	0.21	0.00	0.00	0.84	1.05
Central													
	904	0.15	0.30	0.15	0.00	0.00	0.00	0.00	0.30	0.15	0.00	0.00	0.00
	905	1.28	0.23	0.23	0.12	0.23	0.35	0.23	0.12	0.35	0.00	0.00	0.00
	906	0.00	0.24	0.00	0.12	0.00	0.12	0.73	0.12	0.48	0.00	0.12	0.00
	907	0.10	0.00	0.00	0.00	0.00	0.40	0.00	0.00	0.90	0.00	0.00	0.00
	908	0.12	0.82	0.12	0.00	0.00	0.00	0.35	0.12	0.00	0.00	0.00	0.12
	909	0.00	0.12	0.12	0.00	0.00	0.12	0.24	0.12	0.72	0.12	0.00	0.00
	910	0.16	0.64	0.48	0.00	0.00	0.00	0.32	0.16	0.00	0.00	0.81	0.48
	911	0.59	0.00	0.44	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.29	0.00
	912	0.20	0.00	0.00	0.20	0.00	0.20	0.00	0.00	0.20	0.00	0.20	0.00
	913	0.13	1.30	0.00	0.00	0.13	0.00	0.00	0.00	0.26	0.00	0.00	0.39
	914	0.00	0.00	0.00	0.35	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.31	0.70	0.08	0.00	0.23	0.23	0.15	0.00	0.39	0.15	0.23	0.31
Control													
	63	0.00	0.52	0.17	0.35	0.00	0.00	0.00	0.17	0.17	0.00	0.00	0.00
	62	0.00	0.19	0.00	0.19	0.39	0.58	1.36	0.00	0.19	0.00	0.00	0.19
	61	0.40	0.20	0.00	0.40	0.40	0.00	0.00	0.20	0.40	0.00	0.00	0.20
	60	0.18	0.37	0.00	0.18	0.37	0.00	0.00	0.00	0.37	0.00	0.00	0.00
	133	0.00	0.45	0.00	0.15	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.36	0.18	0.00	0.00	0.54	0.00	0.36	0.18	0.00	0.00	0.00
	135	0.00	0.52	0.17	0.17	0.35	0.17	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.16	0.00	0.31	0.63	0.00	0.47	0.00	0.00	0.00	0.00	0.31	0.16
	183	0.87	0.00	0.35	0.00	0.00	0.17	0.17	0.00	0.00	0.17	0.17	0.00
	182	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.00	0.00	0.55
	181	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00
	180	0.00	0.00	0.51	0.00	5.32	0.00	0.17	0.34	0.00	0.17	0.17	0.00
	193	0.13	1.06	0.13	0.00	0.00	0.13	0.00	0.26	0.26	0.40	0.00	0.26
	192	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.14	0.14	0.29	0.29	1.01
	191	0.19	0.00	0.56	0.37	0.37	0.19	0.56	0.74	0.56	0.19	0.56	0.19
	190	0.15	0.46	0.15	0.30	0.00	0.00	0.30	0.00	0.15	0.46	0.00	0.30

Appendix 2j. Red-throated Loon density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.37	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.14	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.57	0.00	0.00	0.00
	201	0.11	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.11	0.00	0.00	0.11
	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.66	0.00	0.00	0.00	0.26	0.13	0.13	0.00	0.00	0.13	0.00
	402	0.00	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	1.02	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00	0.63	0.00
	25	0.00	0.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.12	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.12	0.00	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.16	0.00	0.64	0.00	0.00	0.32	0.00	0.16	0.00	0.00	0.16	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.13	0.00	0.13	0.26	0.00	0.00	0.00	0.13	0.00	0.00	0.39	0.00
	914	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.62	0.00	0.08	0.00	0.00	0.00	0.31	0.23	0.08	0.15	0.08
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00
	133	0.00	0.15	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.00	0.00	1.10	0.00	0.00	0.63	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.34	0.00	0.00	0.00	0.00	0.17	0.00	0.34	0.00	0.00
	193	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.14	0.00	0.00	0.14	0.00	0.29	0.00	0.00	0.00	0.29	0.00	0.00
	191	0.00	0.19	0.00	0.00	0.00	0.19	0.00	0.93	0.56	0.19	0.00	0.00
	190	0.00	0.91	0.00	0.00	0.15	0.00	0.00	0.30	0.00	0.00	0.30	0.30

Appendix 2k. Yellow-billed Loon density (individuals/sq. km) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.34	0.11	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00
	202	0.00	0.00	0.16	0.16	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.54	0.54	0.00	0.00
	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.19	0.00	0.00	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.16	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	402	0.00	0.68	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.12	0.00	0.00	0.00	0.24	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.08
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.45	0.00	0.00	0.00	0.00	0.45	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.18	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.00	0.00	0.00	0.16	0.00	0.00	0.31	0.47	0.16	0.00	0.31	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.18	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00
	193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 3a. Long-tailed Duck log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.11	0.70	0.00	1.22	0.52	0.37	0.00	1.81	0.00	0.00	0.00	1.73
	102	0.00	1.58	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.55	0.00	0.00	0.31	0.00	0.00	0.55	0.00	0.00	0.00	0.00	1.76
	22	1.05	0.13	1.00	0.25	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.89
	201	5.10	3.87	4.70	2.90	3.73	2.25	4.40	2.83	4.30	3.40	5.82	3.69
	202	4.99	1.62	5.17	1.08	1.48	1.03	4.32	2.73	3.60	3.11	5.08	3.79
	31	5.60	4.26	5.73	3.40	2.98	2.35	4.47	1.70	4.86	3.97	5.66	3.52
	23	2.10	1.84	3.27	2.07	1.59	3.50	2.26	3.13	3.61	0.21	4.03	2.49
	301	2.35	4.17	3.26	1.07	0.00	0.92	0.34	3.28	3.71	2.18	1.89	2.84
	302	2.54	4.89	0.00	2.51	0.00	1.74	1.29	2.35	2.94	0.84	0.32	2.15
	32	3.00	4.82	2.62	3.43	3.25	2.88	1.81	3.49	2.93	0.23	1.46	2.95
	24	0.40	3.16	0.00	2.00	0.15	0.00	0.00	0.00	0.15	0.00	0.00	0.60
	401	2.66	2.87	1.29	0.00	1.46	0.12	1.46	0.00	2.22	0.00	0.72	0.84
	402	0.29	3.32	0.00	0.00	2.16	0.78	0.00	0.99	0.00	1.48	3.54	0.00
	33	0.00	0.12	0.00	0.00	0.00	0.32	1.99	0.00	0.00	0.57	0.32	2.04
	25	0.00	0.00	0.00	0.00	1.65	1.65	0.82	0.00	0.00	0.00	0.19	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.14	0.00	0.00	0.14
	905	0.38	0.00	0.00	0.21	0.53	0.66	0.00	1.79	1.17	1.92	0.00	2.51
	906	0.11	0.00	0.00	0.00	1.51	0.00	0.39	0.00	0.79	0.00	2.53	0.74
	907	3.16	4.31	2.97	1.57	2.81	0.74	2.60	1.25	1.65	0.47	3.09	1.19
	908	3.52	3.46	4.19	3.85	3.99	2.80	3.92	2.53	3.56	0.00	3.86	3.90
	909	4.15	4.63	3.66	4.52	5.53	3.37	4.13	2.39	3.83	1.76	3.99	0.67
	910	1.32	0.83	1.55	0.00	0.00	0.00	0.68	0.00	0.00	1.18	1.71	0.00
	911	0.00	0.00	0.14	0.00	0.00	0.00	0.78	0.00	0.26	0.00	0.37	0.00
	912	1.07	0.00	0.00	0.00	0.10	1.64	0.59	0.00	0.00	0.00	0.00	1.49
	913	1.53	2.52	0.00	0.00	0.00	1.08	1.82	0.00	0.00	1.45	1.69	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.81	1.51	0.63	0.00	0.00	0.00	0.00
	915	1.35	3.17	2.12	0.00	1.15	0.21	1.50	1.31	2.85	0.73	1.91	1.22
Control													
	63	0.00	1.42	0.00	0.00	0.80	0.00	0.00	0.00	0.00	0.00	2.91	3.09
	62	1.80	0.00	0.00	0.58	1.26	2.06	0.46	0.00	0.00	0.00	0.00	3.89
	61	2.31	0.59	0.00	2.01	0.00	0.47	0.00	0.00	0.00	0.00	0.00	3.40
	60	1.81	0.00	0.00	2.50	0.00	0.31	0.55	0.00	0.00	0.00	0.00	3.63
	133	4.67	4.72	4.08	3.59	7.16	3.63	4.70	4.30	4.45	2.88	3.66	3.87
	134	4.21	5.41	2.90	3.28	6.09	3.69	4.55	1.31	4.54	1.03	3.87	3.84
	135	4.61	5.33	4.78	3.93	4.97	4.08	4.03	2.92	4.81	3.71	3.49	3.52
	136	4.91	4.53	3.90	3.51	4.39	4.04	4.78	3.16	5.01	3.85	4.07	4.31
	183	1.18	0.00	0.00	0.00	1.28	2.74	0.00	0.00	0.00	0.00	0.80	0.00
	182	1.37	1.58	0.00	1.88	2.51	3.86	0.00	2.76	0.00	2.86	1.17	3.90
	181	1.81	2.00	0.00	4.63	2.81	1.58	0.00	0.00	1.00	2.44	2.61	2.46
	180	2.62	3.65	3.27	2.41	0.00	3.73	2.76	1.67	3.69	3.28	0.00	2.24
	193	2.99	4.43	2.19	0.23	1.00	1.43	4.08	0.51	3.24	2.16	2.86	2.14
	192	5.07	5.15	3.12	3.27	5.33	2.09	4.89	3.94	4.43	2.72	4.68	4.00
	191	5.11	5.69	4.71	3.48	4.69	3.02	4.35	2.87	5.52	4.14	3.85	4.19
	190	3.87	5.12	0.00	1.98	3.87	2.15	3.09	2.68	4.35	3.27	2.52	2.49

Appendix 3b. Common Eider log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.45	0.65	0.00	0.00	0.00	1.53	0.65	0.11	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.88	0.00	0.00	1.33
	22	0.00	1.10	0.00	0.13	0.13	1.66	0.54	0.00	0.54	0.00	0.00	0.00
	201	0.11	0.00	0.21	0.00	0.00	0.21	0.00	0.71	0.21	0.11	0.45	0.71
	202	0.40	0.00	0.83	1.28	1.24	0.00	0.00	0.00	0.59	0.00	0.00	1.28
	31	1.82	0.00	0.00	0.89	0.00	0.16	0.00	0.16	0.31	0.73	0.00	0.00
	23	0.21	0.38	0.00	0.00	1.73	0.00	0.53	0.00	0.53	0.00	0.00	1.12
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.41	0.00	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.70	0.00	0.00
	24	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	402	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.81	0.00	0.00	0.00	0.00
	905	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	1.91	1.68	1.61	0.00	2.08	0.00	0.83	0.09	1.97	0.34	0.26	0.74
	908	1.06	1.10	0.78	2.36	2.55	1.76	0.00	0.46	0.00	0.30	0.30	0.00
	909	0.73	2.51	0.00	2.86	3.55	3.82	1.89	0.98	1.85	0.89	2.23	0.00
	910	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.28	1.08	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00
	912	0.18	1.56	0.41	0.00	0.00	2.39	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.12	0.42	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.16	0.00	0.00	0.00	0.00	0.43	1.30	0.00	0.00	0.00	1.69
	915	0.57	0.00	0.00	0.00	0.00	0.00	0.66	0.00	0.00	0.00	0.00	0.33
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.21	0.00
	61	0.00	3.16	0.00	0.00	0.00	0.00	0.00	2.84	0.79	0.00	0.00	0.00
	60	0.00	2.96	0.00	0.00	0.00	0.00	0.00	1.72	0.55	0.00	0.00	0.55
	133	2.46	2.58	4.04	4.88	4.08	4.47	2.17	1.90	2.82	2.91	1.42	1.70
	134	3.46	2.06	1.26	3.20	3.04	0.96	0.54	0.31	2.34	2.04	0.54	1.74
	135	1.86	1.91	0.87	2.12	2.26	1.61	0.30	1.33	1.18	0.16	2.14	1.18
	136	0.15	0.81	0.00	0.94	1.06	0.66	0.00	1.00	0.27	0.00	0.39	0.00
	183	0.00	2.18	1.01	0.72	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.75	1.55	0.00	0.00	0.17	0.00	0.00	1.82	0.75	0.00	1.46
	181	0.00	0.00	0.00	1.27	0.00	1.21	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.42	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	1.29	0.00	0.00	0.00	1.60	0.00	0.12	0.58	0.00	0.00	0.72	0.00
	192	0.77	0.00	0.00	0.00	0.00	0.00	0.46	0.46	1.97	0.00	0.00	0.83
	191	1.23	0.75	0.00	0.00	1.05	0.00	0.00	0.17	0.98	0.00	0.44	1.55
	190	0.38	0.92	0.00	0.14	0.14	0.00	0.00	0.00	1.14	0.00	0.47	0.14

Appendix 3c. King Eider Ln density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.44	2.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	402	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	1.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.38	1.92	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.19	0.00	0.00	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	190	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 3d. Scoter log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	1.58	0.00	0.00	1.52	0.00	0.00
	201	0.82	0.00	0.00	0.45	0.00	0.11	0.00	0.00	0.00	0.00	1.12	0.38
	202	0.00	0.00	0.00	0.00	0.00	0.00	1.24	0.00	0.00	0.00	0.40	0.50
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	0.00
	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	301	1.93	3.48	0.00	0.00	0.00	0.00	1.63	0.00	1.97	1.58	0.80	0.80
	302	1.74	2.15	0.00	1.90	0.17	0.00	0.00	0.17	0.56	1.56	0.32	2.35
	32	1.92	2.41	0.00	1.96	0.00	0.41	0.00	2.29	0.00	1.85	2.24	2.64
	24	0.00	0.00	0.00	1.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00
	402	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.26
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	1.86	0.00	0.22	0.00	0.00	0.47	0.79
	907	0.00	0.00	2.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00
	909	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.14
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.63	2.64	0.00	2.36	0.00	0.00	0.00	0.00	0.00	0.00
	136	1.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.91	0.00	0.00	0.00	1.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.00	0.00	0.00	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.56
	190	0.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 3e. Glaucous Gull log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.11	0.29	1.18	0.11	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.76
	102	0.27	0.14	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.38
	30	0.00	0.00	0.00	0.17	0.17	0.00	0.17	0.00	0.17	0.17	0.00	0.00
	22	0.00	0.13	0.00	0.00	0.00	0.00	0.13	0.25	0.00	0.00	0.13	0.36
	201	1.63	2.17	2.47	1.68	0.96	1.46	0.21	1.63	0.30	0.71	2.05	1.04
	202	1.77	0.40	0.00	0.68	0.83	0.50	0.40	1.08	0.15	1.41	2.65	1.52
	31	0.73	0.73	1.15	1.30	0.96	1.40	1.76	1.52	1.73	1.85	0.81	0.73
	23	1.98	1.88	0.65	1.33	2.39	1.84	2.21	1.98	2.10	1.73	2.23	2.04
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.17
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.23	0.23	0.41	0.00	0.00	0.00
	24	0.00	0.40	0.00	0.15	0.15	0.15	0.00	0.00	0.00	0.15	0.00	0.00
	401	1.75	1.49	0.12	0.00	0.42	0.95	1.14	0.51	0.00	2.93	1.49	0.23
	402	0.00	0.52	0.29	0.29	0.29	1.05	0.52	0.86	0.61	0.29	0.29	0.29
	33	0.76	0.70	0.32	0.41	0.41	0.92	0.70	1.51	0.00	0.49	0.49	1.23
	25	0.49	0.49	0.35	0.00	0.61	0.35	1.37	0.19	0.35	0.35	0.61	0.72
Central													
	904	0.26	0.00	0.65	0.00	0.00	0.00	0.00	0.00	0.26	0.14	0.37	0.00
	905	0.30	0.21	0.30	0.00	0.00	0.00	0.11	0.00	0.11	0.72	0.00	0.00
	906	0.00	0.31	0.11	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.18	0.64	0.79	1.96	1.43	0.87	0.64	0.34	0.40	1.43	0.53
	908	0.11	0.66	0.72	2.77	1.48	1.24	2.35	2.11	0.30	0.38	2.53	1.34
	909	0.39	0.21	0.39	0.89	1.89	0.98	0.84	0.21	0.21	0.54	0.31	0.54
	910	0.15	0.15	0.15	0.00	0.00	0.15	0.00	0.15	0.00	0.00	0.50	0.39
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.46	0.00	0.00	1.02	0.00	0.37
	912	0.10	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10
	913	0.94	0.42	0.50	0.89	2.82	0.99	0.71	1.16	0.23	1.71	1.41	1.08
	914	0.95	1.43	0.30	1.43	0.63	0.81	3.24	2.92	0.43	0.54	0.72	0.63
	915	0.73	0.33	0.53	0.33	1.18	0.62	1.73	1.48	0.73	0.87	0.62	0.87
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00
	62	0.18	0.00	0.58	0.00	0.00	0.18	0.00	0.00	0.00	0.18	0.00	0.00
	61	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18
	60	0.00	0.00	0.00	1.22	0.00	0.55	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.14	0.72	0.14	1.73	1.46	0.85	0.14	0.47	0.14	0.14	0.00	0.72
	134	0.73	1.03	0.54	0.64	0.64	0.43	0.64	1.15	0.31	0.43	0.31	1.45
	135	0.72	0.63	0.63	1.86	1.54	1.01	0.87	0.63	0.30	1.24	0.42	1.54
	136	1.11	0.74	0.66	0.49	1.82	1.53	0.88	0.15	0.49	0.00	0.49	1.56
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72	0.00
	182	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.44	0.17	0.17
	181	0.19	0.00	0.00	0.50	0.19	0.19	0.00	0.00	0.00	0.36	0.19	0.00
	180	0.79	0.71	1.00	0.29	1.32	0.00	0.71	1.22	0.00	0.16	0.86	0.79
	193	0.42	0.95	0.42	0.66	1.00	0.12	1.77	0.78	0.00	0.42	0.23	1.00
	192	0.77	0.36	0.00	0.54	2.14	0.54	1.70	0.70	0.36	0.25	0.46	0.36
	191	2.45	0.00	0.17	0.32	0.32	0.00	1.63	1.51	0.75	0.32	0.32	0.17
	190	0.92	0.38	0.00	0.47	0.38	0.14	2.73	1.28	0.86	0.80	0.80	0.92

Appendix 3f. Northern Pintail log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.00	0.00	0.96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.00	0.00	0.38	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.23	0.78	0.00	1.46	2.51	0.00	0.00
	402	0.00	0.00	0.00	0.00	1.91	0.00	0.86	0.00	0.00	0.00	0.00	0.00
	33	0.00	2.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64
	25	0.00	2.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.06
Central													
	904	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	3.69	0.00	0.54	0.00	0.00	0.00	2.72	0.00	0.00	0.00	2.66
	915	0.00	0.33	0.00	1.08	0.00	0.00	1.13	0.38	0.00	0.00	0.00	0.66
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.94	0.00	0.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.00	3.07	0.00	0.00	0.95	0.00	0.00	0.95	0.00	0.12	0.00	1.73
	192	0.00	0.00	0.00	0.00	0.77	1.20	0.00	0.77	0.00	0.00	0.00	0.00
	191	0.00	0.66	0.32	0.00	0.91	1.47	3.45	0.75	0.00	0.44	0.44	0.00
	190	0.00	0.27	0.47	0.00	0.00	0.00	3.08	1.98	1.66	0.57	0.38	0.27

Appendix 3g. Geese and Swan log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.45
	201	0.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.16	1.19	0.00	1.08
	202	0.00	0.00	0.00	0.00	1.45	0.00	0.00	0.00	0.00	0.00	0.00	0.28
	31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.87	0.00	0.00	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	2.03	0.00	0.00	0.00	0.00	0.00	1.52	1.98	3.16	2.35	2.01	0.12
	402	1.52	2.19	2.49	0.00	0.00	0.00	2.70	0.00	1.75	0.86	0.00	0.00
	33	1.92	1.65	2.09	1.43	0.00	0.00	0.00	1.86	0.00	0.00	1.90	0.23
	25	0.35	0.00	0.00	0.00	0.00	0.00	2.94	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.77	0.00	1.59	0.33	0.00	0.00	0.00	1.35	0.00	1.28	0.71
	914	0.00	0.00	1.14	0.00	0.00	0.30	0.00	0.00	2.45	0.00	0.00	0.00
	915	1.78	1.02	1.41	1.20	0.00	0.00	2.21	3.31	2.42	2.81	1.08	1.53
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	1.37	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.72
	136	0.00	0.00	0.00	1.66	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	193	0.00	0.00	0.00	0.00	0.00	0.00	1.84	1.36	1.22	0.00	1.18	1.73
	192	0.00	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.00	0.00
	191	0.00	0.44	0.00	0.00	0.00	0.00	0.00	0.91	0.00	0.00	0.00	2.70
	190	1.40	0.00	0.00	0.00	1.57	0.00	0.00	0.00	0.00	0.00	0.00	0.98

Appendix 3h. Shorebird log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.76	0.00	0.00	0.00
	102	0.00	0.00	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.00	0.00	3.02	0.00	2.32	1.19	0.00	1.35	0.00	0.00	0.00	0.00
	202	0.00	0.00	3.51	1.71	1.03	0.28	0.00	1.19	0.28	0.00	0.59	1.52
	31	0.00	0.00	3.74	0.00	1.63	0.00	0.00	1.70	0.00	0.64	0.00	1.52
	23	0.00	0.00	2.84	0.00	0.00	0.00	0.00	2.37	0.77	0.00	1.20	1.73
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.00	0.00	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.42	0.00	0.00	0.00	0.00	2.08	0.00	0.00
	402	0.00	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	33	0.00	1.57	0.00	0.00	1.82	0.00	0.00	1.69	0.00	0.70	0.00	1.80
	25	0.00	0.00	0.72	0.00	1.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	3.36	0.00	0.00	0.00	0.00	0.00	0.00	0.91
	908	0.00	0.00	0.46	1.92	4.20	2.50	0.00	0.00	0.00	0.21	0.00	0.00
	909	0.00	0.00	0.11	3.47	3.82	1.03	0.00	0.00	0.21	0.79	0.00	1.94
	910	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00
	913	0.00	0.00	0.00	0.00	0.00	0.00	2.37	0.94	0.00	0.12	0.00	0.50
	914	0.00	0.00	0.00	0.00	0.54	0.00	0.00	4.87	0.00	0.00	0.00	1.30
	915	0.00	0.00	0.14	2.87	0.38	0.07	0.00	2.11	0.00	0.14	0.48	0.48
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00
	133	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.00	1.18	0.91	1.38	1.78
	134	0.00	0.00	0.00	0.64	0.00	0.00	0.00	0.00	0.00	0.82	0.00	0.00
	135	0.00	0.00	0.00	2.31	1.18	0.00	0.00	1.28	1.01	1.18	1.01	1.01
	136	0.00	0.00	0.00	0.00	1.60	0.00	0.00	0.00	1.42	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.16	0.00	0.00	0.00	0.42	0.86	0.42	0.00	0.16	3.91
	193	0.00	0.33	0.12	0.00	0.00	0.00	0.42	1.29	0.12	0.00	0.00	2.66
	192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.89
	191	0.00	0.00	0.00	0.44	0.00	0.00	0.44	1.05	0.00	0.00	0.00	0.00
	190	0.00	0.00	0.00	0.00	0.00	0.27	0.00	1.98	0.00	0.00	0.00	0.00

Appendix 3i. Pacific Loon log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.37	0.29	0.11	0.11	0.00	0.11	0.00	0.29	0.11	0.00	0.11	0.20
	102	0.00	0.00	0.14	0.00	0.00	0.27	0.00	0.14	0.27	0.00	0.00	0.14
	30	0.17	0.31	0.17	0.00	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.00
	22	0.00	0.25	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.52	0.30	0.21	0.38	0.11	0.38	0.00	0.00	0.11	0.00	0.30	0.11
	202	0.00	0.00	0.00	0.00	0.15	0.00	0.15	0.00	0.00	0.00	0.28	0.00
	31	0.00	0.16	0.16	1.56	0.00	0.89	0.00	0.00	0.00	0.16	0.81	0.43
	23	0.00	0.00	0.21	0.00	0.38	0.38	0.21	0.00	0.53	0.00	0.00	0.21
	301	0.00	0.00	0.00	0.00	0.00	0.24	0.00	0.00	0.67	0.00	0.13	0.60
	302	0.00	0.00	0.66	0.17	0.00	0.00	0.00	0.00	0.32	0.00	0.56	0.66
	32	0.00	0.57	1.02	0.23	0.00	0.23	0.23	0.41	0.41	0.23	0.93	0.23
	24	0.15	0.15	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.15	0.40	0.50
	401	0.12	0.84	0.00	0.00	0.12	0.42	0.12	0.42	0.12	0.00	0.84	0.65
	402	0.29	0.61	0.52	0.16	0.00	0.00	0.16	0.52	0.16	0.00	0.86	0.29
	33	0.41	0.32	0.00	0.00	0.00	0.41	0.00	0.23	0.00	0.00	1.33	0.49
	25	0.00	0.72	0.00	0.35	0.19	0.00	0.00	0.19	0.00	0.00	0.61	0.72
Central													
	904	0.14	0.26	0.14	0.00	0.00	0.00	0.00	0.26	0.14	0.00	0.00	0.00
	905	0.82	0.21	0.21	0.11	0.21	0.30	0.21	0.11	0.30	0.00	0.00	0.00
	906	0.00	0.22	0.00	0.11	0.00	0.11	0.55	0.11	0.39	0.00	0.11	0.00
	907	0.09	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.64	0.00	0.00	0.00
	908	0.11	0.60	0.11	0.00	0.00	0.00	0.30	0.11	0.00	0.00	0.00	0.11
	909	0.00	0.11	0.11	0.00	0.00	0.11	0.21	0.11	0.54	0.11	0.00	0.00
	910	0.15	0.50	0.39	0.00	0.00	0.00	0.28	0.15	0.00	0.00	0.59	0.39
	911	0.46	0.00	0.37	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.26	0.00
	912	0.18	0.00	0.00	0.18	0.00	0.18	0.00	0.00	0.18	0.00	0.18	0.00
	913	0.12	0.83	0.00	0.00	0.12	0.00	0.00	0.00	0.23	0.00	0.00	0.33
	914	0.00	0.00	0.00	0.30	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.27	0.53	0.07	0.00	0.21	0.21	0.14	0.00	0.33	0.14	0.21	0.27
Control													
	63	0.00	0.42	0.16	0.30	0.00	0.00	0.00	0.16	0.16	0.00	0.00	0.00
	62	0.00	0.18	0.00	0.18	0.33	0.46	0.86	0.00	0.18	0.00	0.00	0.18
	61	0.34	0.18	0.00	0.34	0.34	0.00	0.00	0.18	0.34	0.00	0.00	0.18
	60	0.17	0.31	0.00	0.17	0.31	0.00	0.00	0.00	0.31	0.00	0.00	0.00
	133	0.00	0.37	0.00	0.14	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.31	0.17	0.00	0.00	0.43	0.00	0.31	0.17	0.00	0.00	0.00
	135	0.00	0.42	0.16	0.16	0.30	0.16	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.15	0.00	0.27	0.49	0.00	0.39	0.00	0.00	0.00	0.00	0.27	0.15
	183	0.63	0.00	0.30	0.00	0.00	0.16	0.16	0.00	0.00	0.16	0.16	0.00
	182	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.55	0.00	0.00	0.44
	181	0.36	0.36	0.00	0.00	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00
	180	0.00	0.00	0.42	0.00	1.84	0.00	0.16	0.29	0.00	0.16	0.16	0.00
	193	0.12	0.72	0.12	0.00	0.00	0.12	0.00	0.23	0.23	0.33	0.00	0.23
	192	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.25	0.25	0.70
	191	0.17	0.00	0.44	0.32	0.32	0.17	0.44	0.56	0.44	0.17	0.44	0.17
	190	0.14	0.38	0.14	0.27	0.00	0.00	0.27	0.00	0.14	0.38	0.00	0.27

Appendix 3j. Red-throated Loon log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.31	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.13	0.00	0.00	0.00	0.25	0.00	0.00	0.00	0.45	0.00	0.00	0.00
	201	0.11	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.11	0.00	0.00	0.11
	202	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.00	0.00	0.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00
	23	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00
	302	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.51	0.00	0.00	0.00	0.23	0.12	0.12	0.00	0.00	0.12	0.00
	402	0.00	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.70	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.00	0.00	0.49	0.00
	25	0.00	0.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.11	0.00	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.11	0.00	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.00
	910	0.15	0.00	0.50	0.00	0.00	0.28	0.00	0.15	0.00	0.00	0.15	0.00
	911	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.12	0.00	0.12	0.23	0.00	0.00	0.00	0.12	0.00	0.00	0.33	0.00
	914	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.48	0.00	0.07	0.00	0.00	0.00	0.27	0.21	0.07	0.14	0.07
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00
	133	0.00	0.14	0.00	0.00	0.00	0.56	0.00	0.00	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.00	0.00	0.74	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.29	0.00	0.00	0.00	0.00	0.16	0.00	0.29	0.00	0.00
	193	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.13	0.00	0.00	0.13	0.00	0.25	0.00	0.00	0.00	0.25	0.00	0.00
	191	0.00	0.17	0.00	0.00	0.00	0.17	0.00	0.66	0.44	0.17	0.00	0.00
	190	0.00	0.65	0.00	0.00	0.14	0.00	0.00	0.27	0.00	0.00	0.27	0.27

Appendix 3k. Yellow-billed Loon log density (Ln[den+1]) per transect during 12 Near-shore surveys, Beaufort Sea, Alaska, 1999-2000.

		1999						2000					
Area	Transect	22-Jul	30-Jul	11-Aug	26-Aug	2-3-Sep	8-Sep	21-Jul	1-Aug	7-Aug	15-Aug	24-Aug	31-Aug
Industrial													
	101	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	102	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	201	0.30	0.11	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00
	202	0.00	0.00	0.15	0.15	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00
	31	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.43	0.43	0.00	0.00
	23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00
	301	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	302	0.00	0.17	0.00	0.00	0.00	0.00	0.32	0.00	0.00	0.00	0.00	0.00
	32	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	24	0.15	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00	0.00	0.00	0.00
	401	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	402	0.00	0.52	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00
	33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Central													
	904	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	905	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	906	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	907	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00
	908	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	909	0.00	0.00	0.11	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00
	910	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	911	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	912	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	913	0.00	0.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	914	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	915	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.07	0.00	0.00	0.00	0.07
Control													
	63	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	0.00	0.00	0.00	0.00
	62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	61	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	133	0.00	0.00	0.37	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00
	134	0.00	0.00	0.17	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00
	135	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	136	0.00	0.00	0.00	0.15	0.00	0.00	0.27	0.39	0.15	0.00	0.27	0.00
	183	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	182	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.17	0.00	0.00
	181	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	180	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00
	193	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	192	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	191	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	190	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Appendix 4a. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Long-tailed Ducks on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	5	0.28	0.25	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	3	0.15	0.14	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26d	0	0.00	0.00	5	0.25	0.22	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	6	0.25	0.22
	27d	0	0.00	0.00	0	0.00	0.00	5	0.26	0.23	0	0.00	0.00	0	0.00	0.00	43	1.99	1.10
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	7	0.45	0.37	0	0.00	0.00	0	0.00	0.00	10	0.61	0.48
	32d	0	0.00	0.00	0	0.00	0.00	71	4.41	1.69	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	40	2.82	1.34	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.25	0.22	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	5	0.41	0.35	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	98	8.97	2.30	0	0.00	0.00	9	0.82	0.60	0	0.00	0.00
2	13d	30	1.48	0.91	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05
	14d	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	7	0.35	0.30
	15d	0	0.00	0.00	0	0.00	0.00	2	0.12	0.12	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	11	0.68	0.52	0	0.00	0.00	0	0.00	0.00	9	0.43	0.36
	17d	0	0.00	0.00	156	12.37	2.59	20	0.88	0.63	0	0.00	0.00	7	0.33	0.28	2	0.10	0.09
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	13	0.72	0.54
	19d	0	0.00	0.00	0	0.00	0.00	4	0.19	0.17	0	0.00	0.00	3	0.14	0.13	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	17	0.79	0.58	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	21	1.19	0.78	3	0.16	0.15	0	0.00	0.00	4	0.23	0.20
	11d	2	0.16	0.15	0	0.00	0.00	2	0.13	0.12	1	0.06	0.06	5	0.30	0.26	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	1	0.07	0.06	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05
	3d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	1	0.06	0.05	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.17	0.16	0	0.00	0.00	11	0.67	0.51
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00	0	0.00	0.00	3	0.22	0.20
	8d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	2	0.11	0.10	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	2	0.11	0.11	24	1.29	0.83	0	0.00	0.00	11	0.59	0.46
	37d	-	-	-	-	-	-	-	-	-	8	0.35	0.30	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	2	0.10	0.09	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	5	0.52	0.42	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	2	0.30	0.26	109	16.51	2.86	80	12.12	2.57	0	0.00	0.00	38	5.76	1.91	40	6.06	1.95
	24s	0	0.00	0.00	2	0.30	0.26	1	0.15	0.14	0	0.00	0.00	0	0.00	0.00	68	10.08	2.40
	25s	0	0.00	0.00	0	0.00	0.00	2	0.45	0.37	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.74	0.55	2	0.49	0.40
	27s	15	3.52	1.51	0	0.00	0.00	22	5.16	1.82	9	2.11	1.13	3	0.70	0.53	0	0.00	0.00
	28s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.37	0.32	0	0.00	0.00
	29s	0	0.00	0.00	110	17.87	2.94	134	21.77	3.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30s	0	0.00	0.00	15	2.01	1.10	27	3.62	1.53	0	0.00	0.00	0	0.00	0.00	35	4.69	1.74
	31s	0	0.00	0.00	6	0.54	0.43	72	6.45	2.01	11	0.99	0.69	12	1.08	0.73	37	3.32	1.46
	32s	0	0.00	0.00	10	1.10	0.74	15	1.65	0.97	0	0.00	0.00	1	0.11	0.10	64	7.02	2.08
	33s	0	0.00	0.00	1	0.10	0.09	2	0.20	0.18	0	0.00	0.00	1	0.10	0.09	462	45.35	3.84
	34s	0	0.00	0.00	179	13.05	2.64	48	3.50	1.50	0	0.00	0.00	11	0.80	0.59	16	1.17	0.77
	35s	0	0.00	0.00	155	11.10	2.49	17	1.22	0.80	1	0.07	0.07	3	0.21	0.19	0	0.00	0.00
	36s	0	0.00	0.00	11	0.90	0.64	8	0.65	0.50	0	0.00	0.00	7	0.57	0.45	25	2.04	1.11

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	10	2.81	1.34	0	0.00	0.00	1	0.28	0.25	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	7	1.81	1.03	0	0.00	0.00	5	1.30	0.83	2	0.52	0.42	35	9.07	2.31	25	6.48	2.01
	15s	9	2.68	1.30	20	5.95	1.94	17	5.06	1.80	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16s	4	1.49	0.91	7	2.60	1.28	4	1.49	0.91	0	0.00	0.00	11	4.09	1.63	0	0.00	0.00
	17s	25	9.86	2.38	0	0.00	0.00	47	18.53	2.97	1	0.39	0.33	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	43	15.01	2.77	0	0.00	0.00	1	0.35	0.30	3	1.05	0.72
	19s	0	0.00	0.00	5	1.96	1.08	1	0.39	0.33	0	0.00	0.00	4	1.56	0.94	36	14.08	2.71
	20s	0	0.00	0.00	10	2.86	1.35	16	4.58	1.72	0	0.00	0.00	5	1.43	0.89	0	0.00	0.00
	21s	10	2.27	1.19	0	0.00	0.00	74	16.81	2.88	0	0.00	0.00	60	13.63	2.68	13	2.95	1.37
	22s	0	0.00	0.00	19	5.16	1.82	26	7.06	2.09	0	0.00	0.00	8	2.17	1.15	4	1.09	0.74
7	10s	0	0.00	0.00	275	42.10	3.76	0	0.00	0.00	0	0.00	0.00	333	50.98	3.95	0	0.00	0.00
	11s	0	0.00	0.00	3	0.36	0.31	47	5.63	1.89	1	0.12	0.11	135	16.18	2.84	4	0.48	0.39
	12s	0	0.00	0.00	0	0.00	0.00	6	0.91	0.65	3	0.45	0.37	6	0.91	0.65	0	0.00	0.00
	3s	40	5.01	1.79	0	0.00	0.00	86	10.76	2.46	57	7.13	2.10	75	9.39	2.34	0	0.00	0.00
	4s	0	0.00	0.00	3	0.37	0.31	22	2.71	1.31	3	0.37	0.31	3	0.37	0.31	45	5.55	1.88
	5s	0	0.00	0.00	174	18.67	2.98	156	16.74	2.88	2	0.21	0.19	222	23.83	3.21	31	3.33	1.46
	6s	1	0.10	0.10	5	0.52	0.42	4	0.41	0.35	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7s	4	0.38	0.32	0	0.00	0.00	1	0.09	0.09	2	0.19	0.17	46	4.33	1.67	0	0.00	0.00
	8s	1	0.12	0.11	20	2.32	1.20	1	0.12	0.11	0	0.00	0.00	0	0.00	0.00	240	27.90	3.36
	9s	0	0.00	0.00	314	37.48	3.65	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
8	1s	0	0.00	0.00	528	95.24	4.57	55	9.92	2.39	0	0.00	0.00	135	24.35	3.23	75	13.53	2.68
	2s	24	3.39	1.48	70	9.88	2.39	1355	191.25	5.26	0	0.00	0.00	363	51.24	3.96	180	25.41	3.27
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	82	29.32	3.41	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	1	0.38	0.32	228	85.71	4.46	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	1	0.38	0.32	7	2.64	1.29	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	1	0.35	0.30	29	10.08	2.41	89	30.94	3.46
	42s	-	-	-	-	-	-	-	-	-	1	0.32	0.28	10	3.17	1.43	14	4.44	1.69
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	2	0.49	0.40	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4b. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Common Eiders on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00
	32d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.25	0.22	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
2	13d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	2	0.11	0.10	2	0.12	0.11	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17d	0	0.00	0.00	1	0.08	0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	1	0.19	0.18	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	50	2.37	1.22	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.09	0.09	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	25	1.37	0.86	0	0.00	0.00	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	1	0.04	0.04	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	35	1.88	1.06	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	30	2.94	1.37	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	4	0.61	0.47	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24s	17	2.52	1.26	0	0.00	0.00	2	0.30	0.26	12	1.78	1.02	0	0.00	0.00	0	0.00	0.00
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	14	3.44	1.49	0	0.00	0.00	0	0.00	0.00
	27s	2	0.47	0.38	0	0.00	0.00	0	0.00	0.00	220	51.57	3.96	0	0.00	0.00	0	0.00	0.00
	28s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	32s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34s	1	0.07	0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36s	0	0.00	0.00	3	0.24	0.22	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.08	0.08

Stratum[a]	Transect	Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	5	1.40	0.88	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	21	5.44	1.86	11	2.85	1.35	0	0.00	0.00	59	15.29	2.79	0	0.00	0.00	0	0.00	0.00
	15s	3	0.89	0.64	0	0.00	0.00	0	0.00	0.00	1	0.30	0.26	0	0.00	0.00	0	0.00	0.00
	16s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	8	2.79	1.33	3	1.05	0.72	0	0.00	0.00	1	0.35	0.30	0	0.00	0.00
	19s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	38	14.86	2.76	0	0.00	0.00
	20s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.45	0.37	1	0.23	0.20
	22s	0	0.00	0.00	8	2.17	1.15	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
7	10s	2	0.35	0.30	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11s	0	0.00	0.00	20	2.40	1.22	3	0.36	0.31	1	0.12	0.11	0	0.00	0.00	0	0.00	0.00
	12s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	10	1.51	0.92	0	0.00	0.00
	3s	15	1.88	1.06	25	3.13	1.42	4	0.50	0.41	16	2.00	1.10	0	0.00	0.00	0	0.00	0.00
	4s	8	0.99	0.69	0	0.00	0.00	0	0.00	0.00	2	0.25	0.22	3	0.37	0.31	0	0.00	0.00
	5s	0	0.00	0.00	2	0.21	0.19	0	0.00	0.00	2	0.21	0.19	0	0.00	0.00	0	0.00	0.00
	6s	8	0.83	0.60	5	0.52	0.42	1	0.10	0.10	0	0.00	0.00	2	0.21	0.19	0	0.00	0.00
	7s	2	0.19	0.17	3	0.28	0.25	0	0.00	0.00	6	0.57	0.45	0	0.00	0.00	0	0.00	0.00
	8s	12	1.39	0.87	2	0.23	0.21	0	0.00	0.00	6	0.70	0.53	15	1.74	1.01	0	0.00	0.00
	9s	4	0.48	0.39	0	0.00	0.00	0	0.00	0.00	5	0.60	0.47	0	0.00	0.00	0	0.00	0.00
8	1s	2	0.36	0.31	1	0.18	0.17	44	7.94	2.19	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2s	13	1.83	1.04	35	4.94	1.78	10	1.41	0.88	10	1.41	0.88	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	19	6.60	2.03	0	0.00	0.00	1	0.35	0.30
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	12	3.81	1.57	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4c. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of King Eiders on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24d	0	0.00	0.00	90	4.97	1.79	21	1.17	0.78	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	48	2.37	1.22	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26d	0	0.00	0.00	73	3.60	1.53	0	0.00	0.00	0	0.00	0.00	90	3.73	1.55	0	0.00	0.00
	27d	15	0.70	0.53	0	0.00	0.00	47	2.42	1.23	0	0.00	0.00	70	3.21	1.44	0	0.00	0.00
	28d	8	0.38	0.32	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	8	0.38	0.32	0	0.00	0.00
	29d	25	1.31	0.84	180	10.28	2.42	12	0.71	0.54	0	0.00	0.00	12	0.63	0.49	0	0.00	0.00
	30d	0	0.00	0.00	256	14.97	2.77	16	0.95	0.67	0	0.00	0.00	276	15.15	2.78	2	0.11	0.10
	31d	0	0.00	0.00	418	32.43	3.51	98	6.26	1.98	0	0.00	0.00	54	3.24	1.44	6	0.36	0.31
	32d	0	0.00	0.00	112	7.59	2.15	410	25.45	3.28	0	0.00	0.00	97	5.69	1.90	5	0.30	0.26
	33d	0	0.00	0.00	36	2.57	1.27	52	3.66	1.54	0	0.00	0.00	22	1.33	0.84	3	0.18	0.17
	34d	0	0.00	0.00	119	11.28	2.51	1	0.09	0.09	0	0.00	0.00	12	0.99	0.69	0	0.00	0.00
	35d	0	0.00	0.00	19	2.15	1.15	0	0.00	0.00	0	0.00	0.00	97	8.86	2.29	3	0.28	0.25
	36d	0	0.00	0.00	45	4.70	1.74	0	0.00	0.00	0	0.00	0.00	192	17.40	2.91	1	0.09	0.09
2	13d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.15	0.14
	16d	0	0.00	0.00	2	0.15	0.14	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	0.19	0.17
	17d	0	0.00	0.00	120	9.52	2.35	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	19	0.92	0.65	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	73	3.47	1.50	0	0.00	0.00
	20d	0	0.00	0.00	85	4.78	1.75	0	0.00	0.00	0	0.00	0.00	100	4.82	1.76	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	25	1.22	0.80	0	0.00	0.00
	22d	0	0.00	0.00	110	5.18	1.82	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	10d	-	-	-	12	0.67	0.52	0	0.00	0.00	15	0.82	0.60	0	0.00	0.00	0	0.00	0.00
	11d	0	0.00	0.00	70	4.09	1.63	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3d	0	0.00	0.00	452	22.52	3.16	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	55	5.08	1.80	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	3	0.22	0.20	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.21	0.19
	9d	0	0.00	0.00	345	28.44	3.38	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	21	1.18	0.78	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.15	0.14	4	0.61	0.47	2	0.30	0.26
	24s	33	4.89	1.77	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.25	0.22
	27s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	10	1.86	1.05	0	0.00	0.00
	29s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.13	0.13
	31s	5	0.45	0.37	0	0.00	0.00	60	5.38	1.85	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	32s	0	0.00	0.00	337	36.98	3.64	0	0.00	0.00	0	0.00	0.00	37	4.06	1.62	2	0.22	0.20
	33s	0	0.00	0.00	15	1.47	0.91	13	1.28	0.82	0	0.00	0.00	0	0.00	0.00	7	0.69	0.52
	34s	0	0.00	0.00	12	0.87	0.63	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	83	6.05	1.95
	35s	0	0.00	0.00	55	3.94	1.60	0	0.00	0.00	0	0.00	0.00	4	0.29	0.25	18	1.29	0.83
	36s	0	0.00	0.00	6	0.49	0.40	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.16	0.15

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	7	1.97	1.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	2	0.52	0.42	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15s	2	0.59	0.47	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16s	0	0.00	0.00	35	13.00	2.64	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17s	1	0.39	0.33	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
7	10s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3s	13	1.63	0.97	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5s	0	0.00	0.00	8	0.86	0.62	0	0.00	0.00	4	0.43	0.36	0	0.00	0.00	0	0.00	0.00
	6s	10	1.03	0.71	100	10.34	2.43	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7s	1	0.09	0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.23	0.21	0	0.00	0.00	0	0.00	0.00
	9s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
8	1s	2	0.36	0.31	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2s	0	0.00	0.00	7	0.99	0.69	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	21	7.30	2.12	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4d. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Spectacled Eiders on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.16	0.15	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	40	2.04	1.11	0	0.00	0.00
	26d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	100	5.49	1.87	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	32d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	4	0.33	0.29	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
2	13d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.15	0.14	0	0.00	0.00
	24s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	32s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

Stratum[a]	Transect	Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
7	10s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
8	1s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4e. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Scoters on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

Stratum[a]	Transect	Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	0.20	0.19	0	0.00	0.00
	26d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	5	0.23	0.21	0	0.00	0.00
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	35	1.65	0.97	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	32d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	23	1.39	0.87	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
2	13d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	17d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.06	0.05
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	110	5.13	1.81	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	5	0.30	0.26	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00
	3d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.15	0.14	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	0.29	0.25
	7d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	12	0.64	0.50	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	1	0.13	0.12
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	21	1.00	0.69
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	5	0.49	0.40	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	0	0.00	0.00	50	7.57	2.15	2	0.30	0.26	3	0.45	0.37	155	23.48	5.20	28	4.24	1.94
	24s	2	0.30	0.26	0	0.00	0.00	0	0.00	0.00	7	1.04	0.71	8	1.19	0.92	0	0.00	0.00
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	12	2.95	1.37	0	0.00	0.00	0	0.00	0.00	2	0.49	0.40	0	0.00	0.00
	27s	0	0.00	0.00	0	0.00	0.00	200	46.88	3.87	0	0.00	0.00	3	0.70	0.53	0	0.00	0.00
	28s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	6	1.12	0.75	0	0.00	0.00
	29s	0	0.00	0.00	95	15.44	2.80	133	21.61	3.12	0	0.00	0.00	169	27.46	6.11	0	0.00	0.00
	30s	6	0.80	0.59	4	0.54	0.43	12	1.61	0.96	0	0.00	0.00	46	6.16	2.64	0	0.00	0.00
	31s	30	2.69	1.31	0	0.00	0.00	0	0.00	0.00	5	0.45	0.37	0	0.00	0.00	0	0.00	0.00
	32s	0	0.00	0.00	0	0.00	0.00	4	0.44	0.36	0	0.00	0.00	1	0.11	0.10	1	0.11	0.10
	33s	20	1.96	1.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	194	19.04	4.63	20	1.96	1.09
	34s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07	8	0.58	0.50	20	1.46	1.09
	35s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	0.29	0.27	0	0.00	0.00
	36s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	0.33	0.28	2	0.16	0.15

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	1.04	0.71	2	0.52	0.42	0	0.00	0.00
	15s	0	0.00	0.00	30	8.92	2.29	0	0.00	0.00	0	0.00	0.00	18	5.35	2.34	0	0.00	0.00
	16s	2	0.74	0.56	0	0.00	0.00	2	0.74	0.56	0	0.00	0.00	12	4.46	2.18	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	3	1.05	0.72	0	0.00	0.00	2	0.70	0.53	0	0.00	0.00
	19s	0	0.00	0.00	0	0.00	0.00	3	1.17	0.78	0	0.00	0.00	0	0.00	0.00	18	7.04	2.08
	20s	0	0.00	0.00	1	0.29	0.25	0	0.00	0.00	0	0.00	0.00	35	10.03	3.36	1	0.29	0.25
	21s	0	0.00	0.00	0	0.00	0.00	8	1.82	1.04	0	0.00	0.00	11	2.50	1.56	20	4.54	1.71
	22s	0	0.00	0.00	0	0.00	0.00	9	2.44	1.24	0	0.00	0.00	5	1.36	1.03	0	0.00	0.00
7	10s	21	3.63	1.53	0	0.00	0.00	0	0.00	0.00	31	4.75	2.23	0	0.00	0.00	0	0.00	0.00
	11s	0	0.00	0.00	5	0.60	0.47	0	0.00	0.00	3	0.36	0.31	8	0.96	0.67	0	0.00	0.00
	12s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	7	1.06	0.88	0	0.00	0.00
	3s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	55	6.88	2.06	5	0.63	0.54	0	0.00	0.00
	4s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	19	2.34	1.21	0	0.00	0.00	0	0.00	0.00
	5s	0	0.00	0.00	0	0.00	0.00	1	0.11	0.10	1	0.11	0.10	3	0.32	0.30	0	0.00	0.00
	6s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.21	0.19	0	0.00	0.00
	7s	15	1.41	0.88	0	0.00	0.00	0	0.00	0.00	6	0.57	0.45	0	0.00	0.00	0	0.00	0.00
	8s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	21	2.51	1.33	0	0.00	0.00	0	0.00	0.00
8	1s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.28	0.25	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	2	2.28	1.19
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	12	4.51	1.71	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	4	0.97	0.68

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4f. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Glaucous Gulls on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	1	0.06	0.05	1	0.06	0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	3	0.12	0.11	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05
	26d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.08	0.08	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	5	0.26	0.23	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	4	0.22	0.20	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00
	32d	0	0.00	0.00	1	0.07	0.07	5	0.31	0.27	1	0.06	0.06	1	0.06	0.06	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07	0	0.00	0.00	5	0.30	0.26	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	1	0.09	0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
2	13d	2	0.10	0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.23	0.21	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05
	15d	0	0.00	0.00	0	0.00	0.00	3	0.18	0.17	2	0.10	0.09	1	0.06	0.06	0	0.00	0.00
	16d	0	0.00	0.00	1	0.08	0.07	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.10	0.09
	17d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	5	0.24	0.22	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.10	0.09	1	0.10	0.09
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22d	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	3	0.17	0.15	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.18	0.16	0	0.00	0.00
	3d	0	0.00	0.00	4	0.20	0.18	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	1	0.08	0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	1	0.09	0.09	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	1	0.10	0.10	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	4	0.61	0.47	4	0.61	0.47	0	0.00	0.00	6	0.91	0.65	3	0.45	0.37	1	0.15	0.14
	24s	2	0.30	0.26	0	0.00	0.00	1	0.15	0.14	5	0.74	0.55	0	0.00	0.00	1	0.15	0.14
	25s	2	0.45	0.37	0	0.00	0.00	2	0.45	0.37	1	0.22	0.20	2	0.45	0.37	0	0.00	0.00
	26s	4	0.98	0.68	0	0.00	0.00	0	0.00	0.00	2	0.49	0.40	0	0.00	0.00	9	2.21	1.17
	27s	2	0.47	0.38	0	0.00	0.00	0	0.00	0.00	10	2.34	1.21	0	0.00	0.00	4	0.94	0.66
	28s	5	0.93	0.66	0	0.00	0.00	3	0.56	0.44	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29s	2	0.32	0.28	0	0.00	0.00	0	0.00	0.00	1	0.16	0.15	1	0.16	0.15	0	0.00	0.00
	30s	4	0.54	0.43	0	0.00	0.00	14	1.87	1.06	1	0.13	0.13	0	0.00	0.00	2	0.27	0.24
	31s	0	0.00	0.00	0	0.00	0.00	1	0.09	0.09	2	0.18	0.16	2	0.18	0.16	3	0.27	0.24
	32s	0	0.00	0.00	2	0.22	0.20	2	0.22	0.20	4	0.44	0.36	2	0.22	0.20	3	0.33	0.28
	33s	9	0.88	0.63	0	0.00	0.00	2	0.20	0.18	11	1.08	0.73	5	0.49	0.40	2	0.20	0.18
	34s	3	0.22	0.20	5	0.36	0.31	8	0.58	0.46	6	0.44	0.36	3	0.22	0.20	4	0.29	0.26
	35s	0	0.00	0.00	2	0.14	0.13	0	0.00	0.00	15	1.07	0.73	1	0.07	0.07	0	0.00	0.00
	36s	0	0.00	0.00	9	0.73	0.55	0	0.00	0.00	0	0.00	0.00	11	0.90	0.64	1	0.08	0.08

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	5	1.40	0.88	5	1.40	0.88	2	0.56	0.45	0	0.00	0.00	1	0.28	0.25	1	0.28	0.25
	14s	5	1.30	0.83	8	2.07	1.12	9	2.33	1.20	24	6.22	1.98	1	0.26	0.23	6	1.56	0.94
	15s	1	0.30	0.26	0	0.00	0.00	2	0.59	0.47	2	0.59	0.47	1	0.30	0.26	2	0.59	0.47
	16s	2	0.74	0.56	2	0.74	0.56	0	0.00	0.00	4	1.49	0.91	0	0.00	0.00	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	1	0.35	0.30	1	0.35	0.30	2	0.70	0.53	1	0.35	0.30	1	0.35	0.30
	19s	0	0.00	0.00	4	1.56	0.94	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.39	0.33
	20s	1	0.29	0.25	0	0.00	0.00	8	2.29	1.19	0	0.00	0.00	0	0.00	0.00	2	0.57	0.45
	21s	2	0.45	0.37	1	0.23	0.20	22	5.00	1.79	2	0.45	0.37	1	0.23	0.20	1	0.23	0.20
	22s	2	0.54	0.43	0	0.00	0.00	1	0.27	0.24	24	6.51	2.02	0	0.00	0.00	26	7.06	2.09
7	10s	16	2.77	1.33	8	1.22	0.80	1	0.15	0.14	1	0.15	0.14	51	7.81	2.18	3	0.46	0.38
	11s	3	0.36	0.31	1	0.12	0.11	3	0.36	0.31	8	0.96	0.67	6	0.72	0.54	0	0.00	0.00
	12s	0	0.00	0.00	1	0.15	0.14	1	0.15	0.14	0	0.00	0.00	8	1.21	0.79	5	0.76	0.56
	3s	4	0.50	0.41	2	0.25	0.22	1	0.13	0.12	1	0.13	0.12	0	0.00	0.00	0	0.00	0.00
	4s	1	0.12	0.12	0	0.00	0.00	0	0.00	0.00	15	1.85	1.05	1	0.12	0.12	4	0.49	0.40
	5s	0	0.00	0.00	0	0.00	0.00	4	0.43	0.36	1	0.11	0.10	0	0.00	0.00	1	0.11	0.10
	6s	1	0.10	0.10	0	0.00	0.00	0	0.00	0.00	1	0.10	0.10	0	0.00	0.00	1	0.10	0.10
	7s	5	0.47	0.39	2	0.19	0.17	1	0.09	0.09	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8s	6	0.70	0.53	4	0.46	0.38	2	0.23	0.21	33	3.84	1.58	5	0.58	0.46	1	0.12	0.11
	9s	31	3.70	1.55	1	0.12	0.11	4	0.48	0.39	71	8.47	2.25	18	2.15	1.15	13	1.55	0.94
8	1s	1	0.18	0.17	7	1.26	0.82	6	1.08	0.73	5	0.90	0.64	2	0.36	0.31	0	0.00	0.00
	2s	2	0.28	0.25	1	0.14	0.13	1	0.14	0.13	17	2.40	1.22	1	0.14	0.13	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	1	0.36	0.31	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	3	1.13	0.76	1	0.38	0.32	1	0.38	0.32
	40s	-	-	-	-	-	-	-	-	-	2	0.75	0.56	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	4	1.39	0.87	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	5	1.59	0.95	2	0.63	0.49
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4g. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Pacific Loons on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	3	0.17	0.16	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.05	0	0.00	0.00	3	0.15	0.14	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.10	0.10	1	0.05	0.05
	26d	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	4	0.17	0.15	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	4	0.18	0.17	0	0.00	0.00
	28d	1	0.05	0.05	1	0.07	0.07	1	0.05	0.05	0	0.00	0.00	5	0.24	0.21	1	0.05	0.05
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	7	0.37	0.31
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31d	1	0.07	0.06	0	0.00	0.00	2	0.13	0.12	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00
	32d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	4	0.24	0.22
	34d	0	0.00	0.00	0	0.00	0.00	2	0.19	0.17	0	0.00	0.00	1	0.08	0.08	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.09	0.09	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.18	0.17
2	13d	2	0.10	0.09	0	0.00	0.00	1	0.06	0.06	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	1	0.09	0.09	1	0.05	0.05
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	17d	0	0.00	0.00	0	0.00	0.00	1	0.04	0.04	0	0.00	0.00	3	0.14	0.13	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	1	0.05	0.05	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.14	0.13	2	0.09	0.09	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.10	0.09	1	0.05	0.05	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	2	0.10	0.09	0	0.00	0.00	2	0.10	0.09	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.09	0.09	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	2	0.11	0.10	4	0.22	0.20	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00
	3d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.11	0.11	1	0.15	0.14	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	1	0.21	0.19	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.23	0.20	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	1	0.19	0.18	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07
	8d	0	0.00	0.00	0	0.00	0.00	5	0.30	0.27	1	0.07	0.07	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	1	0.06	0.06	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.10	0.10	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.05	3	0.16	0.15	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	1	0.04	0.04	1	0.09	0.09	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	1	0.05	0.05	2	0.18	0.17	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	2	0.10	0.09	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	2	0.10	0.09	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	1	0.10	0.09	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	0	0.00	0.00	1	0.15	0.14	3	0.45	0.37	0	0.00	0.00	1	0.15	0.14	0	0.00	0.00
	24s	3	0.44	0.37	0	0.00	0.00	4	0.59	0.47	1	0.15	0.14	1	0.15	0.14	1	0.15	0.14
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.45	0.37	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.25	0.22	2	0.49	0.40	2	0.49	0.40
	27s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.47	0.38	0	0.00	0.00
	28s	3	0.56	0.44	1	0.19	0.17	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	3	0.56	0.44
	29s	0	0.00	0.00	1	0.16	0.15	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30s	1	0.13	0.13	1	0.13	0.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31s	1	0.09	0.09	1	0.09	0.09	1	0.09	0.09	6	0.54	0.43	1	0.09	0.09	2	0.18	0.16
	32s	0	0.00	0.00	2	0.22	0.20	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.22	0.20
	33s	0	0.00	0.00	3	0.29	0.26	0	0.00	0.00	0	0.00	0.00	1	0.10	0.09	6	0.59	0.46
	34s	0	0.00	0.00	7	0.51	0.41	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07	4	0.29	0.26
	35s	1	0.07	0.07	4	0.29	0.25	1	0.07	0.07	0	0.00	0.00	0	0.00	0.00	2	0.14	0.13
	36s	0	0.00	0.00	6	0.49	0.40	1	0.08	0.08	0	0.00	0.00	3	0.24	0.22	1	0.08	0.08

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	0	0.00	0.00	0	0.00	0.00	1	0.28	0.25	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	4	1.04	0.71	0	0.00	0.00	1	0.26	0.23	7	1.81	1.03	0	0.00	0.00	0	0.00	0.00
	15s	1	0.30	0.26	0	0.00	0.00	0	0.00	0.00	2	0.59	0.47	0	0.00	0.00	0	0.00	0.00
	16s	1	0.37	0.32	0	0.00	0.00	0	0.00	0.00	1	0.37	0.32	0	0.00	0.00	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	1	0.35	0.30	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19s	0	0.00	0.00	2	0.78	0.58	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.29	0.25	0	0.00	0.00	2	0.57	0.45
	21s	0	0.00	0.00	0	0.00	0.00	1	0.23	0.20	1	0.23	0.20	0	0.00	0.00	1	0.23	0.20
	22s	1	0.27	0.24	0	0.00	0.00	2	0.54	0.43	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
7	10s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.31	0.27	1	0.15	0.14	0	0.00	0.00
	11s	0	0.00	0.00	3	0.36	0.31	1	0.12	0.11	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12s	1	0.15	0.14	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.30	0.26
	3s	0	0.00	0.00	3	0.38	0.32	1	0.13	0.12	6	0.75	0.56	0	0.00	0.00	0	0.00	0.00
	4s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.25	0.22	0	0.00	0.00
	5s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6s	1	0.10	0.10	0	0.00	0.00	0	0.00	0.00	1	0.10	0.10	2	0.21	0.19	0	0.00	0.00
	7s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.09	0.09	2	0.19	0.17	0	0.00	0.00
	8s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9s	0	0.00	0.00	3	0.36	0.31	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
8	1s	0	0.00	0.00	1	0.18	0.17	2	0.36	0.31	1	0.18	0.17	0	0.00	0.00	0	0.00	0.00
	2s	0	0.00	0.00	0	0.00	0.00	1	0.14	0.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4h. Numbers, densities (individuals/sq. km), and log densities (Ln[den+1]) of Red-throated Loons on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.09	0.09	0	0.00	0.00
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00	1	0.06	0.06	0	0.00	0.00
	32d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
2	13d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00
	17d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	1	0.07	0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	4	0.28	0.25	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	0	0.00	0.00	2	0.12	0.11	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.11	0.10	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	1	0.04	0.04	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	0	0.00	0.00	0	0.00	0.00	1	0.15	0.14	3	0.45	0.37	0	0.00	0.00	0	0.00	0.00
	24s	0	0.00	0.00	0	0.00	0.00	1	0.15	0.14	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.22	0.20
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.13	0.13
	31s	0	0.00	0.00	2	0.18	0.16	1	0.09	0.09	0	0.00	0.00	1	0.09	0.09	0	0.00	0.00
	32s	0	0.00	0.00	1	0.11	0.10	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33s	0	0.00	0.00	1	0.10	0.09	2	0.20	0.18	0	0.00	0.00	0	0.00	0.00	2	0.20	0.18
	34s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.07	0.07	2	0.14	0.13
	36s	0	0.00	0.00	2	0.16	0.15	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.26	0.23	0	0.00	0.00	0	0.00	0.00
	15s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.30	0.26	0	0.00	0.00
	16s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.35	0.30	0	0.00	0.00
	19s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.45	0.37	0	0.00	0.00
	22s	0	0.00	0.00	0	0.00	0.00	1	0.27	0.24	0	0.00	0.00	1	0.27	0.24	0	0.00	0.00
7	10s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.15	0.14	0	0.00	0.00	0	0.00	0.00
	11s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.12	0.11	0	0.00	0.00
	12s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.13	0.12	2	0.25	0.22	0	0.00	0.00
	4s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.12	0.12	0	0.00	0.00	0	0.00	0.00
	5s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6s	0	0.00	0.00	0	0.00	0.00	1	0.10	0.10	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.19	0.17	0	0.00	0.00
	8s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	2	0.23	0.21	0	0.00	0.00	0	0.00	0.00
	9s	0	0.00	0.00	1	0.12	0.11	0	0.00	0.00	0	0.00	0.00	4	0.48	0.39	0	0.00	0.00
8	1s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2s	0	0.00	0.00	0	0.00	0.00	1	0.14	0.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.

Appendix 4i. Numbers, densities (individuals/sq. km), and log densities (Ln(den+1)) of Yellow-billed Loons on subtransects per replicate offshore survey, Beaufort Sea, Alaska, 1999-2000.

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
1	23d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.05	0.05	0	0.00	0.00	0	0.00	0.00
	29d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	30d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	32d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	35d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
2	13d	0	0.00	0.00	2	0.24	0.22	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
3	10d	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	4d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	5d	0	0.00	0.00	1	0.07	0.06	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
4	1d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2d	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43d	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
5	23s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	24s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	25s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	26s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	27s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	28s	1	0.19	0.17	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	29s	0	0.00	0.00	1	0.16	0.15	0	0.00	0.00	1	0.16	0.15	0	0.00	0.00	1	0.16	0.15
	30s	0	0.00	0.00	2	0.27	0.24	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	31s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.09	0.09	0	0.00	0.00	0	0.00	0.00
	32s	0	0.00	0.00	1	0.11	0.10	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	33s	0	0.00	0.00	2	0.20	0.18	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	34s	0	0.00	0.00	1	0.07	0.07	0	0.00	0.00	3	0.22	0.20	0	0.00	0.00	1	0.07	0.07
	35s	0	0.00	0.00	2	0.14	0.13	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	36s	0	0.00	0.00	1	0.08	0.08	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

		Jun-99			Jul-99			Aug-99			Jun-00			Jul-00			Aug-00		
Stratum[a]	Transect	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density		Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)	Indiv	Density	Ln(den+1)
6	13s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	14s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	15s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	16s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	17s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	18s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	19s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	20s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	21s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	22s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
7	10s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	11s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	12s	0	0.00	0.00	3	0.45	0.37	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	3s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.13	0.12	0	0.00	0.00	0	0.00	0.00
	4s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	1	0.12	0.12	0	0.00	0.00	0	0.00	0.00
	5s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	6s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	7s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	8s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	9s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
8	1s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	2s	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	37s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	38s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	39s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	40s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	41s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	42s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00
	43s	-	-	-	-	-	-	-	-	-	0	0.00	0.00	0	0.00	0.00	0	0.00	0.00

[a] Strata: 1- Harrison Bay Deep, 2- Industrial Deep, 3- Central Deep, 4- Control Deep, 5- Harrison Bay Shallow, 6- Industrial Shallow, 7- Central Shallow, 8- Control Shallow.