OCS Study
BOEM 2013-210

Fishing, Diving, and Ecotourism Stakeholder Uses and Habitat Information for North Carolina Wind Energy Call Areas

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Office of Renewable Energy Programs

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Prepared under BOEM Award
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US Department of the Interior
Bureau of Ocean Energy Management
Office of Renewable Energy Programs
December 11, 2013

BOEM
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CITATION

Voss, C.M., C.H. Peterson, and S.R. Fegley. 2013. Fishing, Diving, and Ecotourism Stakeholder Uses and Habitat Information for North Carolina Wind Energy Call Areas. U.S. Department of the Interior, Bureau of Ocean Energy Management, Office of Renewable Energy Programs, Herndon, VA. OCS Study BOEM 2013-210. 23pp.

ACKNOWLEDGEMENTS

We wish to recognize and thank Jess Hawkins for sharing his networking skills and expertise in fisheries management. We also thank the participants of each stakeholders meeting and other individuals who shared their time and knowledge about the coastal waters and benthic habitats offshore of North Carolina.

Executive Summary

The development of offshore wind energy at commercial scales may provide North Carolina with the potential to become a net exporter of energy and to sustain well-paying jobs while combating the drivers of global climate change that particularly threaten its coasts. Such development will necessitate cooperation between current users of natural resources in the coastal waters offshore of the state, such as fishermen and divers, and those who seek to harvest the wind resource above those waters. By synthesizing information from regional stakeholders about the locations of natural resources and their existing uses within published wind energy Call Areas, researchers from the University of North Carolina Institute of Marine Sciences were able to create maps that integrate new stakeholder information with existing agency data, enabling BOEM to reduce potential user conflicts within leases for offshore wind development. Project objectives were to obtain and convey spatially explicit information indicating where wind energy development can avoid or minimize conflicts with fish, fish habitat, fishing, diving, and ecotourism in the three Call Areas published in December 2012: Wilmington-West, Wilmington-East, and Kitty Hawk on the Outer Continental Shelf (OCS) offshore of North Carolina.

By far the most important concern of all stakeholder groups was the potential for loss of access to areas of traditional use within the coastal ocean. While stakeholders realize that some restrictions may be inevitable during construction and installation of wind turbines and cable connections, such restrictions are expected to be limited in duration and extent. Participants were curious about turbine spacing; however, there was little concern that the anticipated ≥1-mi. spacing would negatively affect fishing and diving activities. Stakeholders shared both general and spatially explicit information about benthic features and existing human uses within and near the three Call Areas. Expected benefits and harms associated with offshore wind energy development were discussed during regional stakeholder meetings, leading to some suggested strategies to mitigate undesirable consequences of offshore wind development.

Contents

List of Figures

Abbreviations and Acronyms

AIS	Automated Information System
AOI	Wind Energy Area of Interest
BOEM	Bureau of Ocean Energy Management
EFH	Essential Fish Habitat
mi	statute mile
MOTSP	Military Ocean Terminal Sunny Point
nmi	nautical mile
NOAA	National Oceanic and Atmospheric Administration
OREP	Office of Renewable Energy Programs
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
RNA	Regulated Navigation Areas
SECOORA	Southeast Coastal Ocean Observing Regional Association
SEAMAP	Southeast Area Monitoring and Assessment Program
UNC-IMS	University of North Carolina Institute of Marine Sciences
USCG	United States Coast Guard

1. Introduction

At the request of the Governor of North Carolina, the Bureau of Ocean Energy Management (BOEM), Office of Renewable Energy Programs (OREP), established the North Carolina Intergovernmental Renewable Energy Task Force in 2011 to gather information from various stakeholders to help define those Outer Continental Shelf (OCS) lease blocks that may be most suitable for commercial wind energy development. Prior to offering OCS blocks for leasing, BOEM must satisfy the criteria of the Outer Continental Shelf Lands Act (OCSLA), of which Section 1346 mandates the conduct of environmental and socioeconomic studies needed for the assessment and management of environmental impacts on the human, marine, and coastal environments that may be affected by development. In December 2012, BOEM issued a Call for Information and Nominations (Call) for three of five North Carolina's Wind Energy Areas of Interest (AOIs): Call Area Wilmington-West (AOI #1), Call Area Wilmington-East (AOI #2), and Call Area Kitty Hawk (AOI #5). To benefit from local and traditional knowledge, BOEM-OREP entered into a cooperative agreement with the University of North Carolina Institute of Marine Sciences (UNC-IMS) to work with regional stakeholders to collect and synthesize spatially explicit data and information on the State's OCS resources and uses of these resources within the three Call Areas.

In January - April of 2012, the UNC-IMS team had successfully acquired valuable input working with an analogous group of stakeholders from the central region of North Carolina that identified leasable aliquots within AOIs #3 and #4 free from conflicts with known hard-bottom habitat of value to reef fishes (see Voss et al. 2012). The December 2012 Call issued by BOEM specified a need to obtain local stakeholder information of relevance to setting boundaries for the Wilmington-West and -East Call Areas and for the Kitty Hawk Call Area in the southern and northern regions of the state, respectively. In each region, the UNC-IMS team held meetings and worked with stakeholder groups comprised of key informants (Tremblay 1957, McKenna and Main 2013) from the commercial and recreational fishing communities, the diving community, and the ecotourism communities. The information and recommendations shared by these stakeholders are described in this report. Our objectives were to obtain and convey spatially explicit information indicating where wind energy development can avoid or minimize conflicts with fish, fish habitat, fishing, diving, and ecotourism in the Wilmington-West, Wilmington-East, and Kitty Hawk Call Areas on the OCS offshore of North Carolina.

2. Methods

2.1. Stakeholder Meetings

To streamline the process of collecting stakeholder information relevant to offshore wind energy development, the UNC-IMS team appointed a facilitator, Jess Hawkins, to: (1) identify the key community leaders and key informants within each stakeholder group; (2) contact each individual to encourage participation; and to (3) identify a meeting date on which a majority of the stakeholders in each region could meet with the UNC-IMS team. On May 14, 2013, a meeting for stakeholders in southern North Carolina and northeastern South Carolina was held in Shallotte, North Carolina; 18 stakeholders attended. On May 28, 2013,

a meeting for stakeholders in northeastern North Carolina was held in Manteo, North Carolina; 13 stakeholders attended. For each meeting, weather conditions enabled an excellent opportunity for fishing; thus, attendance by fishermen was limited. After each meeting, the UNC-IMS team contacted specific fishermen, who were recommended by their peers, to promote the transfer of information from those not able to attend the meetings. The ideal time frame for meeting with coastal-ocean stakeholders is during the winter when these groups generally spend more time in port than on the water. During each meeting, participants were briefed on the status of the offshore wind energy development planning process. Participants learned of the BOEM webpage that tracks wind energy progress in North Carolina and of the December 2012 Call, as well as the results of the Call. The UNC-IMS Team prepared maps of the Call Areas on photocopies of NOAA Charts showing navigation markings and bathymetry so that participants could place the Call Areas locations into a familiar context. Group and individual discussions followed involving UNC-IMS researchers and participating stakeholders. Some stakeholders shared data, sometimes including associated GPS coordinates, with the UNC-IMS researchers in subsequent communications. All comments, notes, data, and drawings pertinent to the project objective were collected and reviewed by UNC-IMS researchers: this information was subsequently incorporated into ArcMap files and synthesized for this report.

2.2. Map Creation

The information provided from each region's stakeholders was merged with relevant information retrieved from federal and state agency databases. Information from stakeholders was received in multiple types of formats: Global Positioning System datafiles, hand-drawn maps on photocopies of geo-referenced NOAA nautical charts, actual nautical charts with markings indicating important fishing features or areas, and verbally described areas that we sketched onto copies of geo-referenced nautical charts, which were later verified by the respective informant. Datafiles that we received in electronic format were converted to Excel.csv files and examined for completeness and consistency, then subsequently converted to ArcMap shapefiles DNRGPS® software (version 6.0.0.15). Information in non-electronic formats was carefully digitized by hand while verifying geo-reference points. Publically available data from surveys of hard-bottom in the region were available as ArcMap shapefiles from the Southeast Area Monitoring and Assessment Program (SEAMAP) and Southeast Coastal Ocean Observing Regional Association (SECOORA). SEAMAP is a state-federal-university program for the collection, management, and dissemination of fishery-independent data and information in the southeastern United States. The accuracy of SEAMAP data is variable and this variability is conveyed within the dataset on hard-bottom habitat. The SECOORA bottom mapping dataset represents the collective efforts of the South Atlantic Fisheries Management Council (SAFMC) Habitat Plan for the South Atlantic Region: Essential Fish Habitat Requirements. Much of the hard-bottom data received from stakeholders in the southern region overlapped spatially with agency data, which served to verify the accuracy of the information from both sources. Additional data on the location, extent, and topography of hard-bottom were furnished by Dr. J. Christopher Taylor and Paula Whitfield at NOAA's Center for Coastal Fisheries and Habitat Research. The locations of shipwrecks were obtained from the North Carolina Department of Cultural Resources Underwater Archaeology Branch, NOAA's Office of Coast Survey, and from stakeholders. Artificial reef locations were provided by the

North Carolina Division of Marine Fisheries and the Governors' South Atlantic Alliance. Specific coordinates for the locations of wrecks and artificial reefs were confirmed by information provided by commercial and recreational fishermen. Hard-bottom, shipwrecks, and artificial reefs are all types of Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act. Using ArcMap, we combined site-specific information on the locations of EFH from the multiple sources mentioned above. Within our maps, we note all aliquots (1/16 of an OCS lease block; the smallest leasable unit) that are known to contain EFH. The presence of EFH within a given aliquot does not preclude construction; however, EFH existence and extent will require careful site planning to accommodate the 500-m buffer planned for hard-bottom habitat and the 30-m buffer planned for wrecks and perhaps also artificial reefs. Current rules promulgated by the North Carolina Coastal Resources Commission [CRC Rule 15A NCAC 07H .0208(b)(12)(A)(iv)] and the recommendation from the North Carolina Division of Coastal Management's Ocean Policy Steering Committee (DCM 2009) specify that a 500-m buffer be established around any exposed hard-bottom habitat. It is generally assumed on the basis of invoking consistency provisions associated with the Coastal Zone Management Act of 1972, as subsequently amended, that this buffer distance established by North Carolina policy would also apply outside of State waters.

3. Results

3.1. Shallotte Stakeholders Meeting for the Southern Coastal Region: Commercial Fishermen, Recreational Fishermen, Diving Industry, and Ecotourism Practitioners

During planning for stakeholders meeting in the southern (Brunswick County) coastal region, the best candidates to provide well-informed input from each group of stakeholders were targeted. These candidates were identified through an extensive search by UNC-IMS principle investigators and our meeting facilitator, Jess Hawkins. Accordingly, the meeting was not a public hearing that anyone was welcome to attend, but instead represented a meeting of carefully chosen representatives, "key informants", of each stakeholder group. Both Mr. Hawkins, and Dr. Peterson had served on the North Carolina Marine Fisheries Commission for several years. The key informants were comprised of both commercial and recreational fishermen with extensive experience working offshore of North Carolina. One of Dr. Peterson's graduate students, Avery Paxton, has worked extensively as a dive guide and wreck researcher in Dare County, which introduced her to thoughtful and articulate representatives of the dive industry in this southern geographic region of the North Carolina coast. Mr. Jess Hawkins has been working for the past five years as an ecotourism guide in Carteret County (North Carolina central region), and thus knew who to include as representatives of the ecotourism business sector. We chose to hold our stakeholders meeting close to the South Carolina state line because both commercial and recreational fishermen travel from the Grand Strand area to fish in waters in and around the Wilmington-East and Wilmington-West Call Areas. Several stakeholders from South Carolina did attend the meeting and provided valuable information.

We held the stakeholders meeting in a room within the Carolina Wing Company restaurant in Shallotte from 6 – 9 pm on a Tuesday evening so as to minimize conflicts with

work during the daylight working hours. Because the weather on the day of our meeting was conducive to offshore fishing, and because the fishing season for important reef fishes had just reopened after several months of winter closure, many of the invited and interested participants were unable to attend. Nonetheless, a complete spectrum of stakeholder types was represented among the 18 people in attendance (Appendix I), with thoughtful and forthright comments provided by all in attendance.

The commercial, and especially the recreational, fishermen immediately recognized the potential value of the scour apron bases and submerged portions of the shafts of the wind turbines as reef fish and spiny lobster habitat. This southern region of the North Carolina continental shelf differs greatly from the northern region by possessing rocky seafloor substrates and very little modern sedimentary material. Consequently, the fishermen operating in Wilmington-East and Wilmington-West Call Areas are focused largely on reef fishes, realize that currently low stock sizes of several species limit allowable catches, and recognize that the substantial augmentation of rocky reef habitat associated with wind turbines represents a valuable potential benefit to their fishing. As sea surface temperatures in the southeast Atlantic Ocean continue to increase, fishermen have noticed an increase in Florida spiny lobsters, which they feel over time, and given the potential new habitat provided by offshore wind facilities, could result in a North Carolina spiny lobster fishery. The best possible area for promoting this new fishery coincides with relatively high hogfish abundances, namely in the southern portion of the Wilmington-East Call Area. In general, there is less stakeholder activity in the shallower Wilmington-West Call Area than in the deeper Wilmington-East Call Area.

Although fishing for reef fish dominates the commercial and recreational fishing in this southern region offshore of North Carolina, an important trawl fishery for brown shrimp also exists, largely in State waters immediately inshore of the first virtually continuous rocky ledge of hard-bottom habitat. This zone, historically from about 1 to 3 nmi. offshore from Brunswick County southward into Florida, is characterized by a depositional environment and muddier sediments in which shrimp prefer to feed. Our informants noted that in winter months, trawling for shrimp occasionally extends out to about 7 nmi. from the shoreline: even at this distance, trawling activity occurs inshore of the most landward boundary of Wilmington-West, the Call Area closest to shore. Because beach nourishment has escalated over the past 20-30 years in response to increased beach erosion, the sand used in beach nourishment has itself eroded off the ocean beaches and become deposited on top of this muddy material. Coincident with this consequent loss of muddy habitat, brown shrimp abundances have fallen dramatically and only about 30% of this historically important band of muddy sediments, the deeper portion away from the beach and the sand sources, now sustains shrimp in fishable abundances (Capt. Bill Hickman, pers. comm.). Therefore, trawling activity can be expected just shoreward of the Wilmington-West Call Area.

Many participants in our stakeholders meeting commented that hard bottom is nearly ubiquitous throughout both Wilmington-East and Wilmington-West. This dominance by hard bottom does not necessarily imply that usable ground for wind turbines does not exist; however, the areas described in the December 2012 Call, if offered for lease, may need to be fragmented at aliquot scales below the lease block (3 mi. x 3 mi.) to avoid inclusion of

substantial amounts of unsuitable area because of conflicts with potential Essential Fish Habitat (EFH). According to several fishermen, the majority of the fishing in this region (comprising perhaps 90% of the effort) occurs within the two advertised Wilmington Call Areas (East and West). Consequently, the chief recommendation from the collected stakeholders was to perpetuate provision of full access to all areas leased. Presuming that areas leased for wind energy development will remain open to all types of fishing, the stakeholders expressed broad support of wind power development in this region. Restrictions to access for fishing activities would likely transform these same supporters of offshore wind energy development into adversaries.

Several comments implied that redrafting of the Call Areas, especially Call Area Wilmington-East, may be appropriate before offering them up for lease bidding. Specifically, fishermen reported existence of a 5-mile-wide shipping lane running approximately NW-SE, used by large ships transporting ammunition to Military Ocean Terminal Sunny Point (MOTSP) (Fig. 1). This corridor is not evident in the 2009-2010 AIS data provided by the USCG. Eliminating this shipping lane from the Call Area would remove perhaps 10% of its total acreage. In addition, the stakeholders reported that the southeastern third of the Wilmington-East Call Area is characterized by abundant emergent hard-bottom reef fish habitat: this, in combination with bottom lying further to the east in deeper water, represents the best fishing ground on the OCS in this southern region of the state. The stakeholders also expressed interest in creation of local boat passage corridors for fishing and dive boats that emerge from navigable inlets; however, no further details to map such corridors were furnished.

Stakeholders provided suggestions about various processes involved in developing wind facilities on the OCS. Suggestions were made to consider using drilling instead of the noisy alternative of pile driving to install monopiles and to use cofferdams in sandy areas to minimize shock waves and turbidity. Others suggested that BOEM prohibit the use of demolitions and blasting in the lessee's decommissioning plan. Those activities have been reported to kill valuable fish and wildlife offshore of other U.S. coasts (NRC 1996; Schroeder and Love 2004). Also discussed were concerns about increased boat traffic and vessel collisions while wind facilities are being constructed.

We recognized the high level of confidence associated with the information from stakeholders on the locations of hard-bottom habitat. Consequently, we used this stakeholder information to enhance the information available on the GIS maps previously produced by SEAMAP and SECOORA. Sources of information on the locations of artificial reefs and wrecks are described in the methods section. Through combining site-specific information on locations of EFH from multiple sources, we mapped in red the aliquots that are known to contain EFH on the seafloor (Figs. 1 and 2). Our data synthesis revealed EFH in 31 aliquots from the Wilmington-East (Fig. 1) and 13 aliquots in the Wilmington-West (Fig. 2) Call Areas, respectively. The shipping corridor in Wilmington-East used by ships bringing ammunition to MOTSP is noted by hashed lines (Fig. 1).

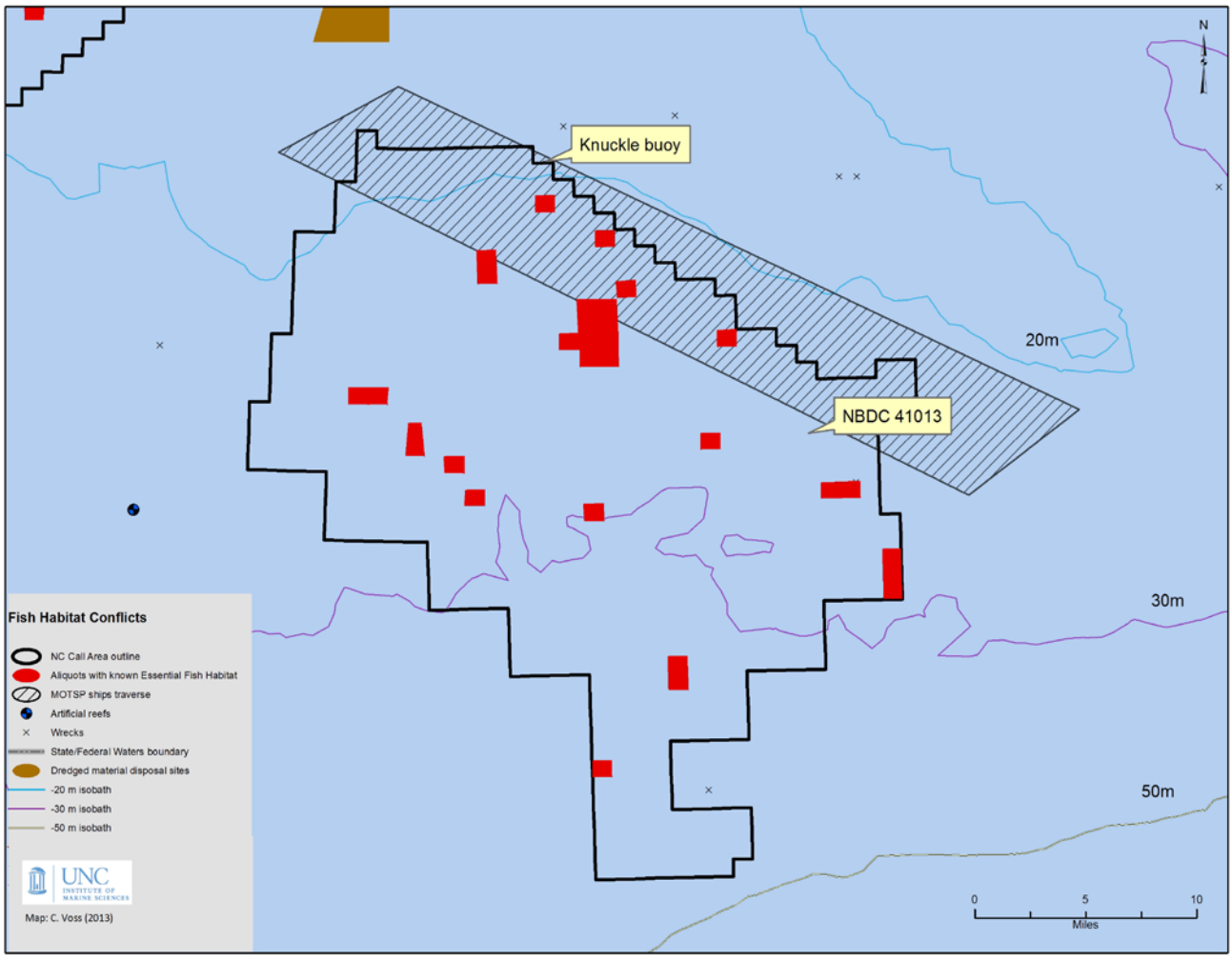

Figure 1. Wind energy development considerations in the Wilmington-East Call Area

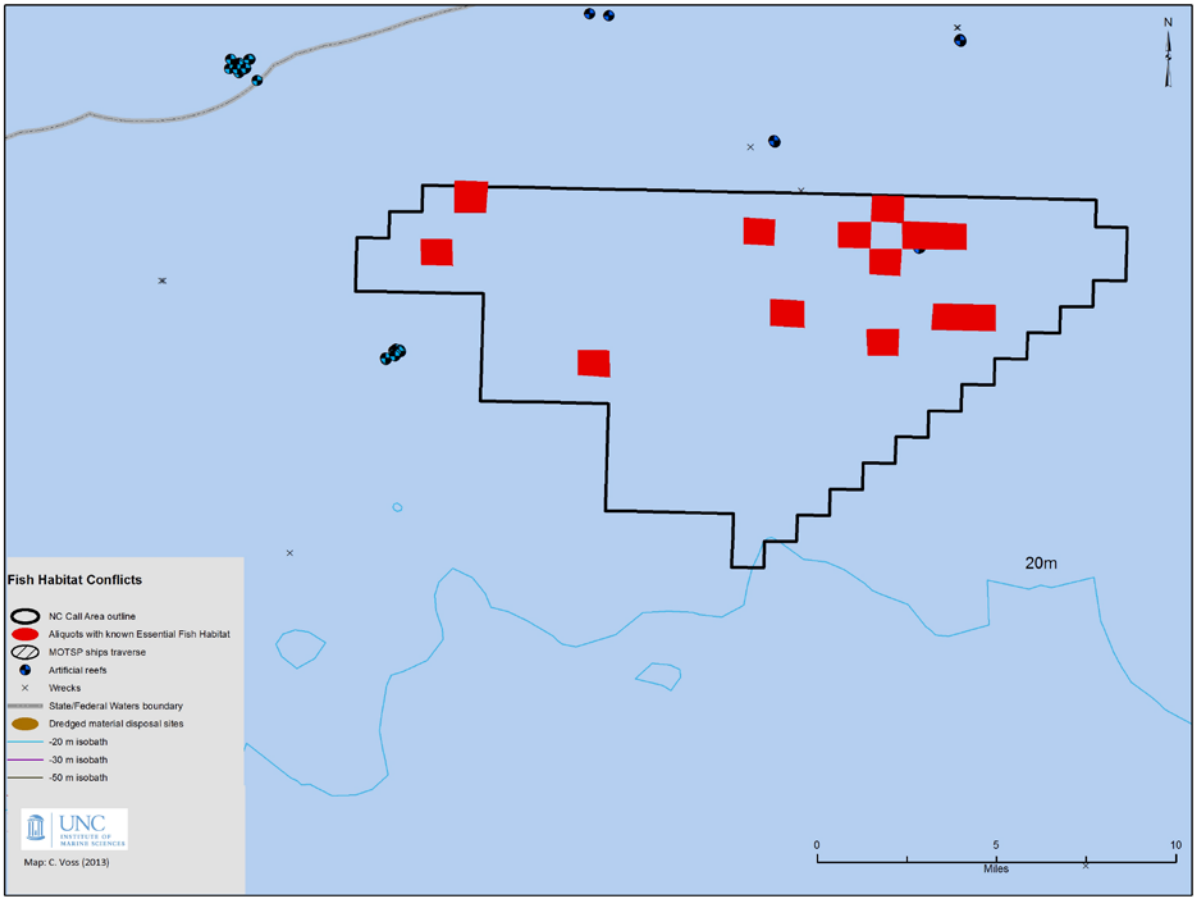

Figure 2. Wind energy development considerations in the Wilmington-West Call Area

3.2. Manteo Stakeholders Meeting for the Northern Coastal Region: Commercial Fishermen, Recreational Fishermen, Diving Industry, and Ecotourism Practitioners

Similar to the southern stakeholder meeting, UNC-IMS researchers and the meeting facilitator, Jess Hawkins, reached out to contacts within the fishing community and the dive industry to identify the best candidates among commercial and recreational fishermen to provide input at the northern (Dare County) coastal region meeting. Accordingly, the meeting was not a public hearing in which anyone was welcome to attend, but instead represented a meeting of carefully chosen representatives, "key informants", of each stakeholder group. Mr. Hawkins and Dr. Peterson had served on the North Carolina Marine Fisheries Commission for several years. The key informants were comprised of both commercial and recreational fishermen, who had extensive experience fishing offshore of North Carolina. One of Dr. Peterson's graduate students, Avery Paxton, has worked extensively as a dive guide and wreck researcher in Dare County, so she helped identify and ensure participation by the best representatives of the dive industry in this geographic region of the North Carolina coast. North Carolina is considered the best location in the U.S. for wreck diving, providing valuable support to a vibrant recreational and scientific dive

industry. Drs. Voss, Peterson, and Fegley have been working for the past 4-5 years with the seabird and marine mammal ecotourism industry in this northern coast of North Carolina and therefore had existing contacts with the most highly qualified spokespersons to represent the offshore ecotourism business sector.

The stakeholder meeting took place in the County Government Building in Manteo on Tuesday May 28, 2013 from 6 – 9 pm so as to minimize work conflicts during the daylight working hours. Because of ideal fishing conditions on the day of the meeting– warm and clear weather, with calm winds – many of the invited and interested participants were unable to attend because they were fishing or guiding clients on fishing or dive charters. Nonetheless, the 13 attendees represented a full spectrum of stakeholder types (Appendix II). In addition, Dr. Voss connected with the most prominent ecotourism stakeholders, who were unable to attend the meeting because of a scheduled tour out into the Gulf Stream off Hatteras, by going to sea with them and their clients on the day following the stakeholders meeting (May 29).

All stakeholders expressed a single and shared chief concern: the potential for loss of access to areas where they fish, dive, navigate, or carry clients because of wind energy development. Specifically, the stakeholders had questions for the USCG regarding what fishing practices (gears) may be restricted within offshore wind energy leases. Furthermore, stakeholders wanted information about the nature of any potential USCG restrictions, such as the width of any possible buffers established around the bases of turbine structures and the width of any possible trawl exclusion zones around buried underwater transmission cables. To date, the USCG has not indicated that there would be restricted access within wind energy facilities in the Atlantic. In addition, the stakeholders want assurance that insurance policies potentially purchased by the wind developers will not require access restrictions around wind turbines. It should be noted that safety zones (aka Restricted Navigation Areas) around offshore wind facilities must go through a proposed and final rulemaking process with the USCG: such rules are not simply established by edict from the lessee or the lessee's insurer (see Conclusion section below). Dive industry representatives foresee great potential interest among their clients in diving around the bases of the wind turbines in this northern region of North Carolina to observe associated fish and their interactions with wind facility structures as well as with the attached marine invertebrates and algae, but only if such diving is permitted.

Whereas commercial fishermen recognized and acknowledged the broad-scale benefits that could be associated with development of renewable wind power to replace power generated by combustion of fossil fuels, the fishermen were united in requesting some local benefits from any wind energy development in addition to these national-level services. Unlike commercial and recreational fishing in the central and southern regions of the North Carolina coast, fishing in this northern region involves more trawling and other types of net fishing over sedimentary bottom instead of relying heavily on the snapper-grouper complex of rocky reef species. Because the northern fishermen are not accustomed to targeting reef fishes, it is unclear to them whether the addition of more rocky reef habitat in the form of scour aprons around monopiles and gravity-based foundations would result in appreciably enhanced income. The commercial fishermen of this northern region of the North Carolina

coast have suffered economically for decades from high costs of fuel, growing foreign imports of low-priced fish and shellfish, greater regulation of their fishing activities, poor access to ocean fishing grounds because of dangerous shoaling of Oregon Inlet, and reductions in many fish stocks. Accordingly, these commercial (and recreational) fishermen of Dare County are unprepared to support wind power development until (1) they are assured that there will be no loss of access to fishing grounds and (2) they see reliable commitments to local benefits by the wind power developers. The most appropriate and desirable benefit mentioned by the assembled fishermen was a credible governmental or industry commitment to maintaining a reliably open, safe, and functional Oregon Inlet. For several years, shoaling has rendered Oregon Inlet unreliable and dangerous for passage of fishing boats from the harbors in the sounds to the ocean where they fish. The failure to maintain a safe and passable Oregon Inlet has also interfered with the capacity of the fish dealers at Manns Harbor and Wanchese to function by purchasing fish for distribution to the wholesale and retail markets. Consequently, the commercial (and recreational) fishermen of Dare County suggest that wind power development on the OCS in the northern region of North Carolina be tied to maintaining safe navigability of Oregon Inlet.

Synthesizing the concerns of stakeholders in this region, we offer a potential mitigation strategy that wind energy developers might use to win the support of Outer Banks watermen and residents. Currently, the fate of the channel(s) through Oregon Inlet is confounded by controversial questions related to the high costs of maintaining Highway 12, which connects the Outer Banks by land, and the Bonner Bridge at Oregon Inlet. The historical dynamics of changing shorelines, shoals, and channels in this area of extremely high physical energy where wave heights are greater than any other location along the U.S. Atlantic coast (NRC 1988) has always challenged the budget of the State of North Carolina. Over the past decade, these challenges have escalated with global climate change and the associated rises in sea level and increased frequencies of intense storms, including both hurricanes and northeasters. Alternative replacement plans for a new Oregon Inlet Bridge have been developed and debated (BTLB 2013; NCDOT 2013; RTBN 2013). Riggs et al. (2011) have developed an alternative management plan based on enhanced use of ferries to replace the Bonner Bridge entirely. Furthermore, many stakeholders in this northern coastal region of North Carolina have advocated installation of enhanced jetties to stabilize Oregon Inlet, an expensive proposition that conflicts with policies of the North Carolina Coastal Resources Commission. However, the continuous deployment of dredges at Oregon Inlet could in principle suffice to maintain a deep and safe boat channel while debate and litigation over alternative vehicular transportation solutions continue. Such a guarantee of a deep and safe shipping channel would not only serve the fishing and dive boat fleets of the northern coast of North Carolina, but it could also facilitate the maritime traffic required for the maintenance and operation of a wind facility. A reliable shipping channel in Oregon Inlet could make possible economic development of local manufacturing of wind turbines, bases, and other components. The declining local ship-building, dry-docking, and repair industries could be revitalized by needs from the wind power industry. Such economic development in coastal Dare County would restore a culture of maritime professions – a culture that while treasured by North Carolinians, is rapidly dying as the commercial fishing industry has faded. The assembled stakeholders in our meeting realized the potential local economic revitalization that could develop from the establishment of wind facilities off the Dare County coast. However, they

also recognized that these opportunities would likely benefit Tidewater Virginia with its accessible deep ports and not Dare County in North Carolina without a commitment to safe shipping channel for the industry, from which the fishing industry would also benefit. In summary, by helping to resolve a local problem, even temporarily, a large wind-energy developer could motivate stakeholders in this region to accept the challenges that offshore wind facilities may bring.

The process that we followed after the central coast stakeholders meeting of making a finer-scale (aliquot-level) patchwork of unsuitable vs. suitable habitat for directed fishing and diving on reefs does not work well for the OCS bottom off Dare County, where the nature of these activities differs greatly from the central coast. Trawling offshore of Dare County is conducted over relatively large expanses of sedimentary seafloor and vastly dominates over reef fishing. Because of uncertainty over retaining access after leases are granted and wind facilities are created and because of the numerous past restrictions on commercial fishing, the trawl fishermen were unwilling to endorse leasing for wind energy facilities in any area that they used for trawling. If trawling is not restricted within a lease, as BOEM cites as the default situation, then the wind turbines and trawl fishing would be compatible joint uses, but the commercial fishermen of this northern area were cautious in the absence of convincing assurance that the scope of their fishing activity would not be restricted. We explained that the distance between turbines increases with turbine capacity and that turbine capacities are increasing with technological advances. In general, the stakeholders were not concerned about their ability to fish in areas where turbine spacing is to be $\geq$1 mi, as expected for 5 MW turbines. Much of the Dare County diving activity is focused solely on shipwrecks due to diver interest and because natural, hard bottom reef habitat is so limited in this region. Several charter boat fishermen emerge from Oregon Inlet and head from due east to northeast to reach deeper water, the actual compass heading depending on where fish are expected to be most dense and on which heading minimizes wind and wave challenges to boat transit. The wide range in course headings makes identification of a narrow transport corridor impossible, but we have marked the boundaries of the preferred direct travel corridors (Fig. 3) to reflect input from fishermen concerned about continuing to be able to minimize travel time and fuel costs once a wind facility is constructed.

The information shared with us by stakeholders in the northern region of North Carolina is shown in Figure 3. This map has black hash lines to indicate the broad range of headings commonly used by boats entering the coastal ocean from Oregon Inlet: stakeholders plan to continue to traverse these areas regardless of offshore energy development. The salmon-colored cross-hatched area on this map indicates where shrimp trawling occurs within topographic lows (valleys) of the seafloor. The fishermen that use this area expect that wind-turbine monopiles would be best sited on the adjacent topographically high sand ridges that run generally parallel to the muddier valleys where shrimp are more abundant, making both trawling and wind facilities compatible in this area by applying careful spatially based planning. Stakeholders noted that valleys in other portions of the Kitty Hawk Call Area were also fished, but with less intensity. We received no data from stakeholders to confirm the presence and locations of the relatively small amount of hard-bottom EFH noted in the SEAMAP and SECOORA datasets. All known artificial reefs (sources noted above) are outside of the Kitty Hawk Call Area boundaries. Coordinates for the shipwrecks within this

Call Area are available to the general public through several sources, including NOAA's Office of Coast Survey.

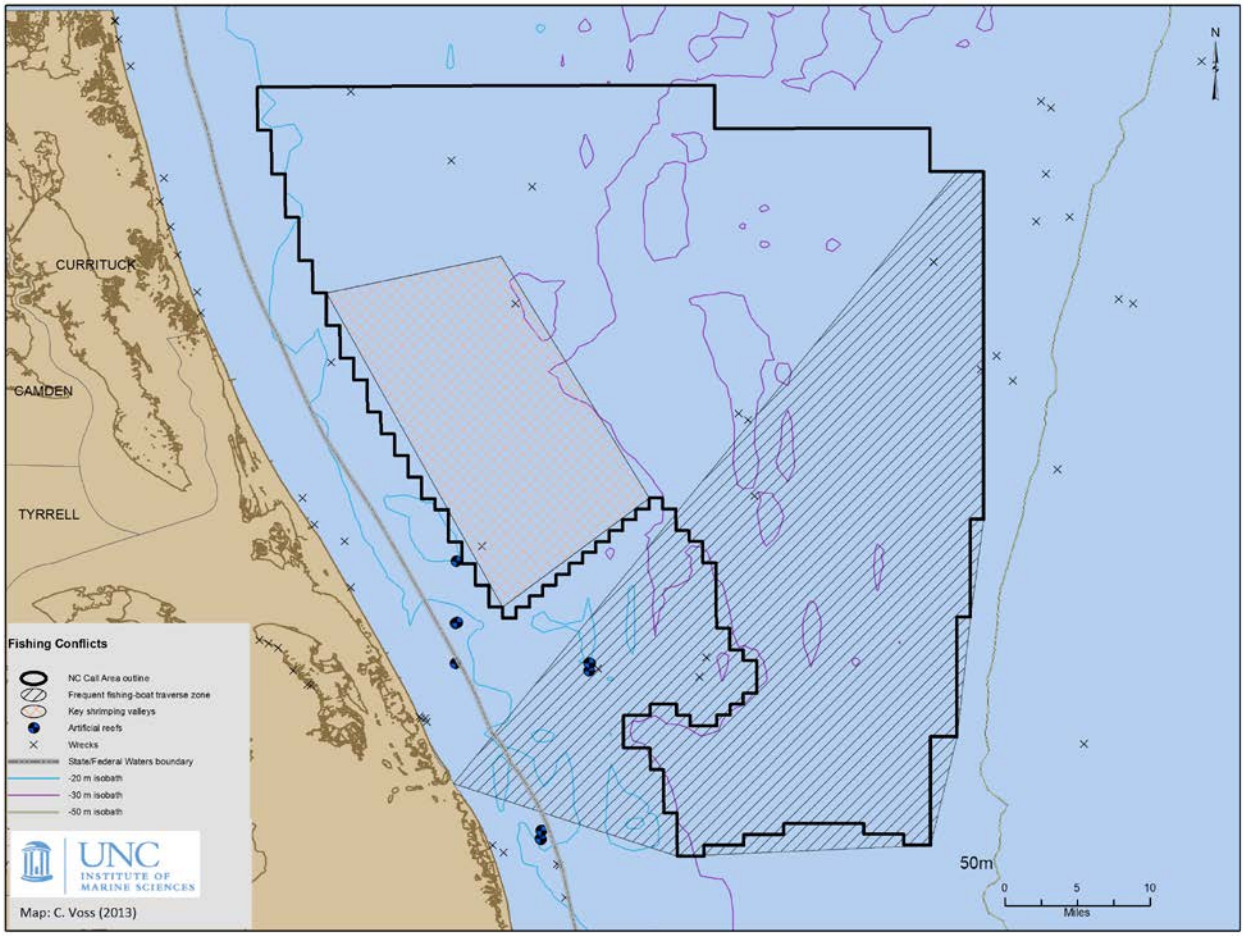

Figure 3. Wind energy development considerations in the Kitty Hawk Call Area

4. Conclusions and Recommendations

By far the most important concern of all stakeholder groups was the potential for loss of access to areas of traditional use within the coastal ocean. While stakeholders realize that some restrictions may be inevitable during construction and installation of wind turbines and cable connections, such restrictions are expected to be limited in duration and spatial extent. Nonetheless, concerns were raised about the consequences of broader ecosystem impacts, especially during wind facility construction, from increased ship traffic, turbidity and noise, as well as issues of impact duration and cumulative impacts. All stakeholder groups were cautiously optimistic about the benefits of the addition of new hard-substrate and emergent habitats; however, these additions were viewed more positively in the southern region where hard-bottom habitat is naturally widespread and serves to support the reef fishes that they harvest.

Widespread stakeholder concerns about potential access limitations within offshore wind facilities prompted us to review current regulations on this topic. BOEM is responsible for overseeing the safe and environmentally responsible development of energy and mineral resources on the Outer Continental Shelf. OCSLA (43 USC 1337) and the National Environmental Policy Act (NEPA) (42 USC 4321-4347) also can apply to offshore wind development in US federal waters. Currently, BOEM has no authority to restrict access within U.S. waters (B. Krevor pers. comm.). Logically, the USCG would probably be the agency restricting access, if deemed necessary, in support of their mission to provide safe and secure navigation as well as to protect natural resources within US waters. The USCG contributes to the siting of and planning for offshore renewable energy installations (OREIs) through two processes. First, as part of NEPA implementation, the USCG assesses the navigational impacts of proposed OREI projects and shares recommendations concerning anticipated impacts and mitigation with the appropriate permitting agency. The USCG published a Navigational and Vessel Inspection Circular (NVIC 02-07) (2007) to offer guidance on its roles and responsibilities for OREIs and to provide a framework describing the factors that the USCG will consider when reviewing an OREI permit in US navigable waters. Current USCG recommendations for siting Wind Energy Areas along the North Carolina OCS may be found in the Atlantic Coast Ports Access Routing Study Interim Report (USCG 2012). The second way in which the USCG may influence access within OREIs would be through a lengthy process, involving the Administrative Procedures Act, in which the USCG is authorized to designate Regulated Navigation Areas (RNAs) as outlined in 33 CFR 165. RNAs could be initiated based upon the USCG's assessment of navigational risk or by a lessee's request that the USCG establish a safety zone. Precedence for minimal USCG restrictive actions may be inferred from the lack of restricted access around oil rigs in the Gulf of Mexico; however, the density of turbines within an OREI is greater than that for oil rigs in the Gulf. To date, perhaps the best evidence upon which to infer whether the USCG will issue restrictions within OREIs can be derived from the Cape Wind project, where no RNAs have been deemed necessary despite concerns over turbines affecting radar performance (Cape Wind Energy Project FEIS Appendix M 2009). Similarly, instead of establishing a RNA for an underwater turbine and high voltage cables in Cobbscook Bay, ME, the USCG required surface buoys, notations on local nautical charts, and twice-daily VHF-FM safety marine information broadcasts advising mariners to avoid anchoring, diving, dredging, dumping, trawling, laying cable, or conducting salvage operations in the area (ME DMR 2012). Therefore, the USCG does have the ability to restrict access within OREIs through two possible administrative processes, NEPA or RNA designation; however, in previous cases it has not done so.

Few stakeholders were aware of the status of and the level of spatially explicit planning that had already occurred for wind energy development offshore of North Carolina. Local newspapers had minimal coverage of the Call for Information and Nominations posted to the Federal Register on December 13, 2012 and of the re-opening of this Call on February 5, 2013. The North Carolina chapter of the Sierra Club had publicized these Calls in the southern and central regions of the state. Most stakeholders learned details about the North Carolina Call Areas from UNC-IMS at our regional stakeholders meetings. It is clear that additional conduits are needed for disseminating information on the BOEM leasing process offshore of North Carolina. UNC-IMS recognizes that BOEM has made an active effort to

inform North Carolinians through the following efforts: (1) holding four Intergovernmental Task Force Meetings from January 2011 to August 2012; (2) conducting one of eight workshops to be held from Maine to North Carolina in Morehead City, North Carolina, intended to assemble individuals from the fishing and offshore wind energy sectors to develop best management practices and mitigation measures for offshore wind energy development; (3) conducting two public meetings in North Carolina to provide information and to solicit public comment on the planning, leasing, and environmental review processes; (4) conducting four "Open Houses" at separate locations along the northern and southern North Carolina coast, for citizens to review the results of BOEM's Offshore Wind Visualization Study for North Carolina; and (5) providing regular updates on wind development to the Mid-Atlantic Fisheries Management Council and the Atlantic States Marine Fisheries Commission. To disseminate relevant offshore wind energy information to and through key stakeholder groups, we recommend the following additional conduits: (1) fishing clubs and organizations; (2) hub marinas in which charter boats cluster; (3) state authorities that issue commercial and recreational fishing licenses; (4) SCUBA diving organizations such as National Association of Underwater Instructors (NAUI), Professional Association of Dive Instructors (PADI), Divers Alert Network (DAN), and SCUBA Schools International (SSI); (5) local SCUBA diving shops and charter operations; (6) groups such as the East Carolina Artificial Reef Association, who hold annual meetings; (7) periodicals specific to fishing, diving and ecotourism activities such as Alert Diver, Wreck Diving Magazine, Salt Water Sportsman, Sport Fishing, Flyfishing in Saltwater Magazine, National Fisherman, Fishermen's News, Commercial Fisheries News, and the International Ecotourism Society newsletter; and (8) a BOEM listserv to which interested parties can add their contact information to receive news pertaining to offshore wind energy based upon self-selected categories, such as 'agency'@service.govdelivery.com. An internet query using readily available search engines provides an efficient and effective means to acquire contact information on these organizations for specific geographic regions.

The existence of a corridor, not evident from the 2009-2010 AIS data, along the northern portion of Wilmington-East used by ships carrying large amounts of ammunition to MOTSP was a surprise. We recommend that BOEM contact the commanding officer of MOTSP and the Pentagon directly to learn pertinent details about these ships, their cargo, and recommendations for appropriate cautionary measures. The area traversed by these ships is noted in Figure 1, as described by a southern region fisherman and former longshoreman who had worked at MOTSP.

In addition to spatially explicit information for each Call Area, we have noted measures that have potential to mitigate some of the negative impacts associated with offshore wind energy development. Stakeholders in the southern region of North Carolina, where hard bottom is prominent, suggested that potential negative impacts of noise and vibration during monopile installation could be reduced by employing more costly drilling methods instead of the current practice of pile driving, by using cofferdams to decrease shockwaves, and by using explosion-free demolition in the decommissioning process. These measures could be applied throughout the OCS. In the northern region, where fishing activities are generally less spatially explicit than in the southern region, stakeholders suggested that negative impacts to fishing and fishing communities could be mitigated by maintaining navigable passage through Oregon Inlet.

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Appendix I. Stakeholders who attended the meeting concerning the Wilmington-West and Wilmington-East Call Areas on May 14, 2013 in Shallotte, North Carolina

Business Category	Last Name	First Name	Email
Charter boat	Logan	Keith	capt_keith@northmyrtlebeachfishingcharters.com
Charter boat/ Commercial fishing	McMullan	Brant	captbrant@oifc.com
Charter boat/ Commercial fishing	McMullan	Barrett	barrett@mcmullanproperties.com
Commercial fishing, Fish house owner	Buff	Scott	buffbuildersinc@yahoo.com
Commercial fishing	Fulford	Al	alfulford@yahoo.com
Commercial fishing	Hickman	Bill	bill.hickman1221@hotmail.com
Dive industry	Atack	Jim	jim.atack@adm.com
Dive industry	Sebastian	Cameron	cameron@coastalscuba.com
Dive industry	Strickland	Wayne	scubasouth@ec.rr.com
Recreational fishing/ Local outdoor writer	Dilsaver	Jerry	captjerry@captjerry.com
Recreational fishing	Fisher	Andy	agitatorfisher@bellsouth.net
Recreational fishing/ Owner recreational fishing center	McMullan	Rube	rubemc@att.net
Recreational fishing	Russ	Rusty	rustyruss@allstate.com
Recreational fishing	Robinson	Randy	fishmancst@gmail.com
Recreational fishing	Ridenhour	Jeremy	coastaloceanf@yahoo.com
Chair of Jim Caudle Reef Foundation	McManus	Ron	salemgmt@msn.com
Division of Marine Fisheries	Collier	Chip	chip.collier@nedenr.gov
North Strand Coastal Wind Team/ Municipal government	Baldwin	Monroe	monroe.baldwin@SC.RR.com

Appendix II. Stakeholders who attended the meeting concerning the Kitty Hawk Call Area on May 28, 2013 in Manteo, North Carolina

Business Category	Last Name	First Name	Email
Charter boat	Foreman	Allen	vcforeman@hotmail.com
Charter boat	Ross	Jeff	captjeff@mindspring.com
Charter boat	Smith	Bobby	bobby@fishnfoolcharters.com
Charter boat	Spencer	Duke	duke@captainduke.com
Commercial fishing	Craddock	James	
Commercial fishing	Craddock	Ralph	ralphcraddock@embergmail.com
Commercial fishing	Daniels	Mikey	nccroskenjoc@yahoo.com
Commercial fishing	Locke	Charlie	obxlocke@aol.com
Recreational fishing	Mann	Edward Lee	emann2276@centurylink.net
Fish house owner	O'Neal	Benny	oneilsseaharvest@Yahoo.com
Dive industry	Landrum	Pam	
Dive industry	Landrum	Matt	
Dive industry	McDermott	Bill	macd1@obxdive.com

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under US administration.

BOEM
Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management

As a bureau of the Department of the Interior, the Bureau of Ocean Energy Management (BOEM) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS) in an environmentally sound and safe manner.

The BOEM Environmental Studies Program

The mission of the Environmental Studies Program (ESP) is to provide the information needed to predict, assess, and manage impacts from offshore energy and marine mineral exploration, development, and production activities on human, marine, and coastal environments.