OCS Study
BOEM 2019-054

Resident Perceptions of Local Offshore Wind Energy Development: Support Level and Intended Action in Coastal North and South Carolina

US Department of the Interior
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ABOUT THE COVER

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List of Abbreviations and Acronyms

ACS	American Community Survey
API	Application Programming Interface
AUC	Area Under the Curve
BOEM	Bureau of Ocean Energy Management
CA	Call Area
C-CAP	Coastal Change Analysis Program
CI	Confidence Interval
GED	General Education Degree
GIS	Geographic Information System
GW	Gigawatt
HH	Household
km	Kilometers
LRS	Low Response Score
mi	Miles
NA	Not Available
NC	North Carolina
NC DENR	NC Department of Environment and Natural Resources
NCCOS	National Centers for Coastal Ocean Science
NIMBY	Not In My Back Yard
nm	Nautical Miles
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
OCS	Outer Continental Shelf
Odum	H.W. Odum Institute for Research in Social Science at the University of North Carolina at Chapel Hill
OMB	Office of Management and Budget
OREP	Office of Renewable Energy Programs
PCA	Principle Components Analysis
RR	Response Rate
SC	South Carolina
SC DPRT	SC Department of Parks, Recreation, and Tourism
SCORP	Statewide Comprehension Outdoor Recreation Plan
SCUBA	Self-Contained Underwater Breathing Apparatus
sq mi	Square Miles
URL	Uniform Resource Locator
US	United States
UTM	Universal Transverse Mercator
WEA	Wind Energy Area

Executive Summary

Americans generally support wind energy, but opposition to local wind energy development is common, and action to oppose projects can hinder planning processes. Outside of official public engagement forums, preferences about offshore wind energy development generally remain unknown for members of the public as well as for groups who may not perceive themselves as stakeholders. Failure to gain the perspective of communities regarding potential benefits or impacts is problematic, particularly when latent stakeholders to local projects emerge late in the planning process. This research offers an approach for understanding what is important to communities, and how differing values and perceptions across communities influence local receptivity to proposed development.

The research goal was to document the relevance and importance of local contextual factors, including place attachment, proximity, and perception of impacts, on the possible reception of proposed local offshore wind energy development among residents in affected coastal communities. The objectives were to identify factors predictive of 1) support level and 2) intention to take future action to advance a position.

A geographically stratified, random household survey was conducted in 2018 in a pre-defined coastal region of North and South Carolina adjacent to offshore wind energy development areas. Residents 18 years of age and older were invited to take the survey, which contained questions on place attachment, recreational activities, social value of favorite places, awareness, perceived impact to important quality of life items, support level, past and future action, and demographic and household characteristics. A 33% response rate was achieved with a final sample size of 3,593.

A logistic regression model was used to examine factors influencing support level and intended action. Modelling suggests:

- household distance to the shoreline, awareness, certainty of impacts, importance of electricity costs, and importance of marine mammal and sea turtle habitat are predictive of support level;
- place attachment is not predictive of support level;
- importance of daytime views of the ocean is not predictive of support level;
- household distance to the nearest wind energy area or call area is not predictive of support level;
- residents are more likely to oppose local offshore wind energy development and engage in action the closer they live to the shoreline;
- awareness of local offshore wind energy development is more likely to lead to opposition;
- residents in the study region who are unsure about the impacts on their quality of life and those who are unaware of local offshore wind energy development efforts are more likely to support local efforts;
- support level may change as residents grow more sure of impacts and more aware of efforts;
- future intended action related to local offshore wind energy development is predicted by household distance to the shoreline, place attachment, and past action;
- strong place attachment is likely to precipitate action, especially for individuals who oppose local offshore wind energy development; and
- residents who have previously engaged in past action are more likely to intend future action related to local offshore wind energy development.

The most common forms of past action (e.g., signing a petition, contacting a public official) in an offshore wind energy context imply civic engagement and networks of individuals and organizations related to offshore wind energy development are key for mobilizing both support and opposition.

This research confirms the importance of local context when planning for offshore wind energy development. Findings from this research give voice to a plurality of potential stakeholders in a region identified for offshore wind energy development. It identifies the quality of life factors important to communities, how residents perceive potential impacts to these factors from offshore wind energy development projects, and how differing values and perceptions across the social landscape influence support level. Findings provide an enhanced understanding about perceived impacts to a broader range of stakeholders, which can be used in mitigation planning and to inform future public engagement activities.

1 Introduction

1.1 Project Background

The Bureau of Ocean Energy Management's (BOEM) Office of Renewable Energy Programs (OREP) oversees development of offshore renewable energy projects on the Outer Continental Shelf (OCS). BOEM is required to identify, monitor, and mitigate negative impacts that manifest from offshore renewable energy projects. The agency must determine and evaluate the effects of OCS activities on natural, historical, and human resources, and institute the appropriate monitoring and mitigation of those effects.

BOEM's process for identifying potential areas for offshore renewable energy projects includes public engagement activities, such as the issuance of public notices, solicitation of public comment, and convening of public informational meetings. BOEM uses these engagement activities to meet requirements for identifying and mitigating negative impacts. Outside of these processes, preferences regarding renewable energy development remain unknown for members of the public and, specifically, groups who may not perceive themselves as stakeholders. Failure to gain the perspective of communities regarding potential benefits or impacts is problematic, particularly when latent stakeholders to local projects emerge late in the planning process.

This research offers an approach for understanding what is important to communities, broadly, and how differing values and perceptions within communities influence support for offshore wind energy development in areas targeted for these projects.[1] To assist BOEM in documenting the importance of local context in targeted regions, the National Oceanic and Atmospheric Administration (NOAA) collected data on the perspectives of coastal residents regarding offshore wind energy development. Findings provide an enhanced understanding about factors influencing how local residents feel about offshore wind energy development near their communities, and the likelihood that they will engage in actions to support or oppose local projects.

1.2 Theoretical Foundation

According to Gallup, 72% of Americans support government investment into solar and wind powered energy production (Newport 2017). Similarly, the Pew Research Center (2017) found 83% of Americans agreed that increasing the use of renewable energy is an important priority for the United States (US) (Pew Research Center 2017). Pew (2017, 8) also found that 63% of Americans believe "wind power is very effective at minimizing air pollution." While Americans appear to support wind energy, federal agencies anticipate opposition in localities where wind energy development projects are proposed (US Department of Energy 2008). There is a support paradox in the public's position related to wind energy

[1] As of December 2018, BOEM has held 8 competitive lease sales and executed 15 offshore leases, with over 19 gigawatt (GW) total capacity. These include leases within identified Wind Energy Areas (WEAs) offshore Delaware, Rhode Island, Massachusetts, Virginia, Maryland, New Jersey, New York, and North Carolina. Additional WEAs have been identified or are in the process of being identified offshore South Carolina, California, and Hawaii.

development: people generally or theoretically support wind energy, but may still oppose specific projects.

Bell et al. (2013) theorized this social gap in public support occurs because there are two categories of wind energy development support positions. First, it could be the majority of people are "qualified supporters" who support wind energy development, but only under specific circumstances or with caveats (Bell et al. 2013, 129). For qualified supporters, plans for a local wind energy development project may still trigger opposition because of the specific conditions that influence their support. Second, the minority of people could be "unqualified opponents" who will oppose local wind energy development projects regardless of possible benefits or efforts to mitigate potential negative impacts. Bell et al. (2013) concluded these two groups may work together to oppose particular projects. The nature of planning processes enables "well-resourced local opponents with strong commitments, supported by well-networked and well-resourced national interest groups, to effectively oppose developments" (Bell et al. 2013, 130). There are certainly examples of localized opposition to offshore wind energy development projects.

Botetzagias et al. (2015) found that opposition to an offshore wind energy development project in Greece stemmed from personal cost-benefit-risk calculations. Those opposed to the project perceived no or low benefits, but did expect costs and risks. Perceived environmental harm and economic benefits shape public attitudes toward all electricity sources, including wind (Ansolabehere and Konisky 2009). While some public response to wind energy development may be based on exaggerated perceptions of impacts (Warren et al. 2005), the construction and operation of wind farms does impact local communities (Breukers and Wolsink 2007; Wüstenhagen et al. 2007). Not all anticipated effects are negative, however, with common expectations that wind energy development will improve environmental conditions, create jobs, and contribute to the tax base of communities (Jessup 2010). Yet, undesirable effects may receive more attention in a cost-benefit calculation, depending upon the public's expectations and awareness.

The relationship between public policy, public awareness, and support for utility development projects is inconclusive. Looking at the influence of proximity on public awareness and support for nuclear energy, Cale and Kromer (2015) found people living closer to a nuclear facility in North Carolina were more aware of the potential risks posed by nuclear energy, but this heightened awareness was not correlated with support level. Esaiasson (2014) reported the availability of information about siting of cell phone towers and recycling complexes increased the likelihood of opposition to local projects in Sweden. Conversely, related to offshore wind energy development in particular, Bidwell (2016) found residents of coastal Michigan were more likely to become supportive of wind farms generally after receiving information on wind farm basics, likely effects, associated development pressures, and siting processes.

Americans appear to have low knowledge about novel forms of energy production, such as wind energy and fracking (Clarke et al. 2016; Boudet et al. 2014; Klick and Smith 2010). When such projects are not local, people may not take a support position or, when doing so, may be more influenced by ideology or impressions (Clarke et al. 2016; Steel et al. 2015; Boudet et al. 2014). When issues become localized, however, people may begin to assess energy alternatives differently. Devine-Wright (2009) suggested awareness is a prerequisite to evaluation of potential changes to one's community that can result. Further, once people gain awareness at the local level, additional information about wind energy development projects may not result in support (Bidwell 2016; Devine-Wright 2009).

The most notable example of local opposition to offshore wind energy development in the US is the Cape Wind Project that was proposed for construction in Nantucket Sound, Massachusetts (Kimmell and Stalenhoef 2011; Dinnell and Russ 2007; Firestone and Kempton 2007; Kempton et al. 2005; Kaplan 2004). Documented objections to the Cape Wind Project were rooted in a variety of concerns, including:

visual impacts; negative effects on fishing, recreation, and tourism; declining property values; and threats to birds and marine life (Firestone et al. 2012; Kimmell and Stalenhoef 2011; Firestone and Kempton 2007). Kempton et al. (2005) also argued that opposition to the Cape Wind Project related to perceptions about the value and specialness of the ocean, and a belief that the ocean should be left untouched by development. This notion was exemplified by tribal nations who argued that Nantucket Sound be added to the National Register of Historic Places as traditional cultural property (Kimmell and Stalenhoef 2011).

Photograph 1: Demonstrators against the Cape Wind Project
Photo courtesy of John Romero, BOEM

When comparing public opinion in Cape Cod and Delaware, Firestone et al. (2012) found proximity to a proposed site was related to opposition in both states, as were concerns about recreational boating safety and commercial fishing. Conversely, the prospect of energy independence and price of energy produced led to support in both cases (Firestone et al. 2012). Interestingly, some factors were related to both support and opposition, such as electricity rates and fishing/boating (Firestone et al. 2012). Thus, factors influencing support and opposition likely depend on how people perceive the potential impacts from offshore wind energy development projects, as well as how they understand the costs relative to possible benefits. This conclusion is supported by Nash et al. (2010), who asserted social conflict over land use is best understood as a divergence of symbolic meanings attached to places and development activities, as held by stakeholders.

Because the reception of local wind energy development projects has not been consistent with national polling on public support for wind energy, several researchers have examined the relationship between opposition to wind energy development and geographic proximity to proposed sites. For offshore wind energy development, the question of proximity has largely been approached as a matter of aesthetics; specifically, the visibility of offshore wind turbines and public acceptability of seeing them (Knapp and Ladenburg 2015). Firestone et al. (2012) found that respondents with a self-reported view of a proposed offshore wind energy development project were more likely to oppose the project than those not claiming to have a view. Ladenburg and Dungaard (2009) concluded people using coastal areas were more likely to perceive severe negative impacts to the viewshed from offshore wind energy development. Similarly, public acceptance of wind farms has been positively correlated with increased siting distances from residences or the shore (Hevia-Koch et al. 2018; Vecchiato 2014). However, Krueger et al. (2011) evaluated households' willingness to pay for wind turbines at different distances from shore, and found public tolerance for seeing wind turbines within the viewshed.

The relevance of proximity is also captured in the context of "Not in My Back Yard" or NIMBY outcomes. The concept of NIMBY characterizes actions taken by people, residents, or citizens of an affected area, to stop objectionable development. NIMBY residents believe development is valuable to society, but should be further away from their individual properties or community (Bell et al. 2013; Schively 2007; Wolsink 2007; Devine-Wright 2005). The NIMBY construct initially described collective action associated with the anti-toxics and environmental justice movements (Szasz 1994). However, the connotation of NIMBY movements has grown derogatory (Botetagias et al. 2015). Critics and even some developers cast opponents of wind energy and other development projects as selfish and hypocritical, thwarting the public good to protect personal interests and corporate profits (Burningham et al. 2015; Esaiasson 2014; Feldman and Turner 2010; Meyer 2010).

Use of the concept in a disparaging way downplays the legitimacy of citizens to have a voice in the use of spaces relevant to them (Szasz 1994), and denies the existence of multiple "contradictory meanings and understandings" for the same physical space (Nash et al. 2009, 56). Additionally, in wind energy and tidal energy development contexts, there is evidence of an "inverse NIMBY" effect where residents near to proposed projects are strongly supportive and perceive gained benefits (Devine-Wright 2011b; Warren et al. 2005; Wolsink 2000). Not surprisingly, the usefulness of the NIMBY construct is doubted because it oversimplifies the social and contextual complexities of local action to oppose development (Feldman and Turner 2010; Meyer 2010; McClymont and O'Hare 2008; Szasz 1994; Devine-Wright 2005; Wolsink 2000). Eschewing NIMBY frameworks for understanding community responses to offshore wind energy development does not negate the relevance of proximity, particularly when combined with other context-specific factors that influence support or opposition (Avila 2018; Larson and Krannich 2016; Botetagias et al. 2015).

Embracing the complexity of social and contextual factors motivating local opposition to developments, rather than assuming opposition is NIMBY induced, is preferable. Information gained on the drivers of opposition can be used to understand and resolve differences before adversarial relationships are galvanized. Once adversarial relationships are formed, local opposition manifesting as action can occur, even if the number of people who actively oppose local wind energy development projects is small (Bell et al. 2013). Case studies indicate that people can and do shift from passive opponent to oppositional activist, at which time they engage in activities to protect their place from the proposed project, termed place-protective action (Devine-Wright 2009; Stedman 2002; Wolsink 2000). Place-protective action includes a range of actions on a continuum of personal investment and effort, such as giving money, signing petitions, attending meetings or protests, organizing meetings or protests, media activities or campaigns, letter-writing or lobbying, legal action, or administrative action (Wolsink 2000; Oliver and Marwell 1992; Bullard 1990).

Place attachment is an important driver of place-protective action. Attachment to place is described as the positive emotional bonds existing between individuals and a physical location or environment (Ardoin 2006; Moore and Graefe 1994; Altman and Low 1992; Williams et al. 1992). It is conceptualized in a few ways, including place identity, sense of place, and place dependence (Ardoin et al. 2012; Ardoin 2006). Place identity is a mixture of feelings about specific physical settings, and it forms in conjunction with physical space (Proshansky et al. 1983). As such, an individual's sense of self-worth, well-being, safety, and security are all, to some degree, tied to that individual's place identity (Devine-Wright 2009; Proshansky et al. 1983). Further, collective identities that bind people to each other, such as in the context of communities or interest groups, can also bind the collective to physical spaces in predictable ways (Otto and Leibenath 2014).

Similarly, sense of place refers to how individuals assign meaning or relate to a particular place (Altman and Low 1992). These meanings can depend on many factors, including how knowledgeable the individual is about the place (Cantrill 1998; Lutwack 1984), the characteristics of the place itself (Ardoin 2014; Ardoin et al. 2012), the amount of time the individual has spent in the place (Cantrill 1998; Cantrill and Masluk 1996; Kitayama and Markus 1994), and the activities the individual participates in (Haggard and Williams 1992; Fournier 1991; Vayda 1983; Steele 1981; Stokols and Shumaker 1981). For example, a particular beach may take on special meaning for a person because of childhood visits with family. Memories of special moments with loved ones become integrated with locational experiences, making the beach more than a place; the beach becomes interconnected with personal and family identity.

Related to sense of place, place dependence translates specifically to connections based on activities occurring in a setting, reflecting the importance of that place in providing the conditions that support an intended use (Schreyer et al. 1981), as well as the ability for the area to provide for that use (Jacob and Schreyer 1980). Place dependence might be economic in nature, such as commercial fishermen depending on a particular bank or reef for their livelihoods. It could be for subsistence reasons, such as depending on a bay or estuary to harvest food for one's family. Additionally, place dependence can be related to leisure or recreational use. For instance, kayakers may prize a particular river because of the technical challenge associated with running it. Birders may treasure a particular forest because it offers sightings of rare or unique species. A beach might be valued because it provides unique snorkeling, surfing, or other high quality recreational opportunities.

Finally, the importance of landscapes to people, based on the range of social values they hold for them, has been used by geographers as a predictor of place attachment and connection to place (Brown and Kyttä 2014; Clement and Cheng 2010; Clement 2008; Brown and Raymond 2007). People may hold a range of social values for landscapes, such as aesthetic, spiritual, heritage, etc. Brown and Raymond (2007, 96) found "aesthetic and wilderness/natural landscape features, along with recreation and therapeutic experiences in those landscapes" were important mediators of place attachment (Brown and Raymond 2007, 108). In a second study that assessed the relative importance of spaces around an individual's home, Brown et al. (2015) found that economic value for landscapes most often mediated the importance of spaces where people lived.

When asked to map social values, respondents tend to think of the logistics of the particular geography first and the abstract values second (Nahuelhal et al. 2016), especially in household surveys (Brown 2013); because of this, socially valued places are often associated with a location's amenities and attractions. Awareness of prominent social values held for physical spaces across a geographic area, in addition to the characteristics of the places themselves, are therefore useful for understanding how people attach to those places.

Photograph 2: Terrestrial wind turbines
Photo courtesy of Pixabay (copyright and royalty free)

In a wind energy context, strong place attachment in combination with other factors relating to a perceived threat to place appear to be important for mediating one's position on development efforts and motivating action (Devine-Wright 2009; Devine-Wright 2005). For example, people engaging in recreational activities, particularly when those activities cannot be undertaken in other places, tend to exhibit higher levels of place connection, mediated through place dependence (Haggard and Williams 1992; Fournier 1991; Steele 1981). As activity importance increases, place connection and dependence tend to increase as well (Schreyer et al. 1981; Jacob and Schreyer 1980). Past surveys related to offshore wind energy development have documented concern about negative impacts to coastal recreation (e.g., fishing, boating) and tourism (Firestone et al. 2012; Firestone and Kempton 2007; Johansson and Laike 2007). Previous research also suggests those using the coastal zone for recreational purposes are most likely to expect visual impacts (Ladenburg and Dungaard 2009). Brownlee et al. (2015) found that marine recreationists in South Carolina largely supported offshore wind energy development in the state. Thus, it is possible that place attachment mediates perception of impacts and intention to act.

Devine-Wright (2011a) suggested that strong attachment to a restorative place (like a coastal city) was correlated with negative attitudes toward an offshore wind energy development project. To help understand who might engage in place-protective action in such contexts, and at what time, Devine-Wright (2009) proposed a "framework of place change" (shown in Figure 1). The framework includes five stages: awareness, interpretation, evaluation, coping, and acting. After individuals become aware of proposed wind energy development projects in areas relevant to them, they develop a sense of the possible impacts, termed interpretation. In this stage, they evaluate what disruptions may result.

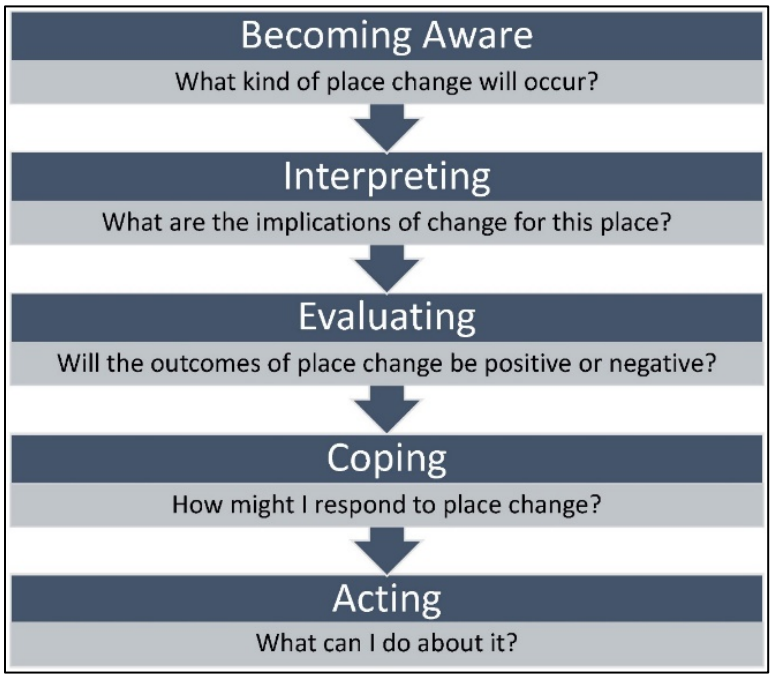

Figure 1: Devine-Wright's (2009) framework of place change

Following interpretation, they next evaluate the possible disruptions, drawing conclusions about the impacts associated with the project and how changes will influence the things most important to them, and to what degree. This is the risk assessment phase, when costs and benefits are calculated. After concluding what the likely costs will be, people decide whether potential mitigation of possible costs is acceptable. If perceived costs from probable disruption are not acceptable, particularly when place attachment is strong, some kind of action might be anticipated (Devine-Wright and Howes 2010; Nash et al. 2010; Cass and Walker 2009; Wolsink 2000).

Not all people join environmental movements, engage in significant environmental behaviors, or practice civic engagement to influence environmental policy (Corraliza and Berenguer 2000; Stern 2000). However, Bell et al. (2013) argued that opposition to local wind energy development projects is likely to be mobilized by vocal opponents concerned about negative outcomes. Indeed, previous research indicates perceived disruption to place and costs are strong predictors of intended protective action. Devine-Wright and Howes (2010) found that persons with strong place attachment perceived negative impacts from an offshore wind energy development project and, additionally, were more likely to actively oppose it through civic engagement, signing a petition or writing a letter. Similarly, Cass and Walker (2009) documented “emotional” oppositional action to a land-based wind energy development project in the United Kingdom, resulting from disruptions to place attachment and perceived procedural unfairness. Focused on a lake in Wisconsin, Stedman (2002) found that likelihood to engage in place-protective action, including voting for laws and joining an interest group, was positively correlated with strength of place identity in combination with the perceived degree of threat to the valued place. Finally, Wolsink (2000) found “perceived characteristics of wind power,” including scenic value of wind turbines, expected annoyance from the turbines, anticipated efficiency of energy production, possible environmental benefits, NIMBY sentiments, and attitudes toward wind power, were each predictive of resistance to local wind energy development. Resistance was expressed by signing a petition, writing a letter, attending a meeting, consulting with neighbors, or taking legal action (Wolsnik 2000).

1.3 Research Goals

Research on the factors influencing public support and opposition to offshore wind energy development collectively suggests that context matters tremendously. Building upon foundational studies, the goal of this research was to document the relevance and importance of local contextual factors on the possible reception of proposed local offshore wind energy development among residents in affected coastal communities. The primary objective was to identify factors predictive of 1) support level for local offshore wind energy development and 2) propensity to take future action to advance a position on local offshore wind energy development.

To accomplish these goals, data were collected on support level for local offshore wind energy development in two states, along with residents' intention to engage in related future action. Data were analyzed to evaluate the explanatory power of place attachment, perceived impacts on important quality of life items, and household distance to the shoreline and proposed offshore wind development areas. Additionally, data were collected on awareness and past action to understand the role of these factors in predicting support level and intended action.

Photograph 3: Offshore wind turbines at Block Island Wind Farm
Photo courtesy of BOEM (all rights reserved)

2 Methodology

2.1 Study Region

The region of interest for this research was coastal North and South Carolina, termed the "Carolina coast," as shown in Figure 2. For purposes of this research, the Carolina coast includes all land and water area in North Carolina (NC) and South Carolina (SC) from the OCS to the shoreline and from the shoreline inland for approximately 20 miles. Researchers chose this region because BOEM had processes underway in both states to identify offshore wind energy leasing areas.

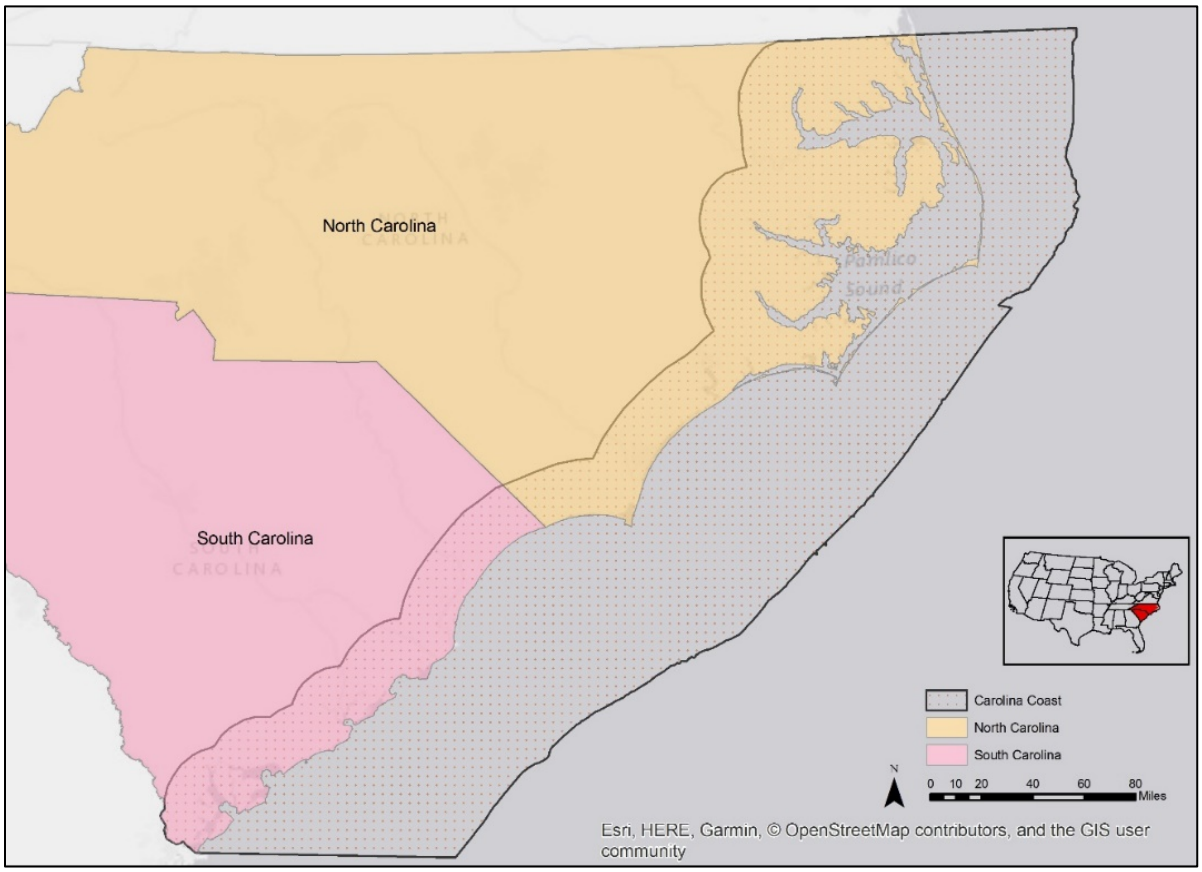

Figure 2: Study region, termed the Carolina coast

Discussion about the feasibility of offshore wind energy development began in NC at the state level in the 2000s (University of North Carolina at Chapel Hill 2009). In 2012, BOEM initiated an assessment of interest in commercial leasing for offshore wind energy development in the state. After completion of an Environmental Assessment, BOEM identified three wind energy areas (WEAs) on the OCS of NC (BOEM 2014), shown in Figure 3. The Kitty Hawk WEA, designated a Lease Area after sale at auction in 2017 (82 FR 5600), is located approximately 24 nautical miles (nm) offshore from Kitty Hawk, NC (BOEM 2014). The remaining two WEAs are in the vicinity of Wilmington, NC. The Wilmington West WEA is located about 10 nm offshore, while Wilmington East is located about 15 nm from Bald Head Island, NC (BOEM 2014). BOEM conducted a series of public informational meetings about offshore wind energy development in NC from August 2013 to September 2016.

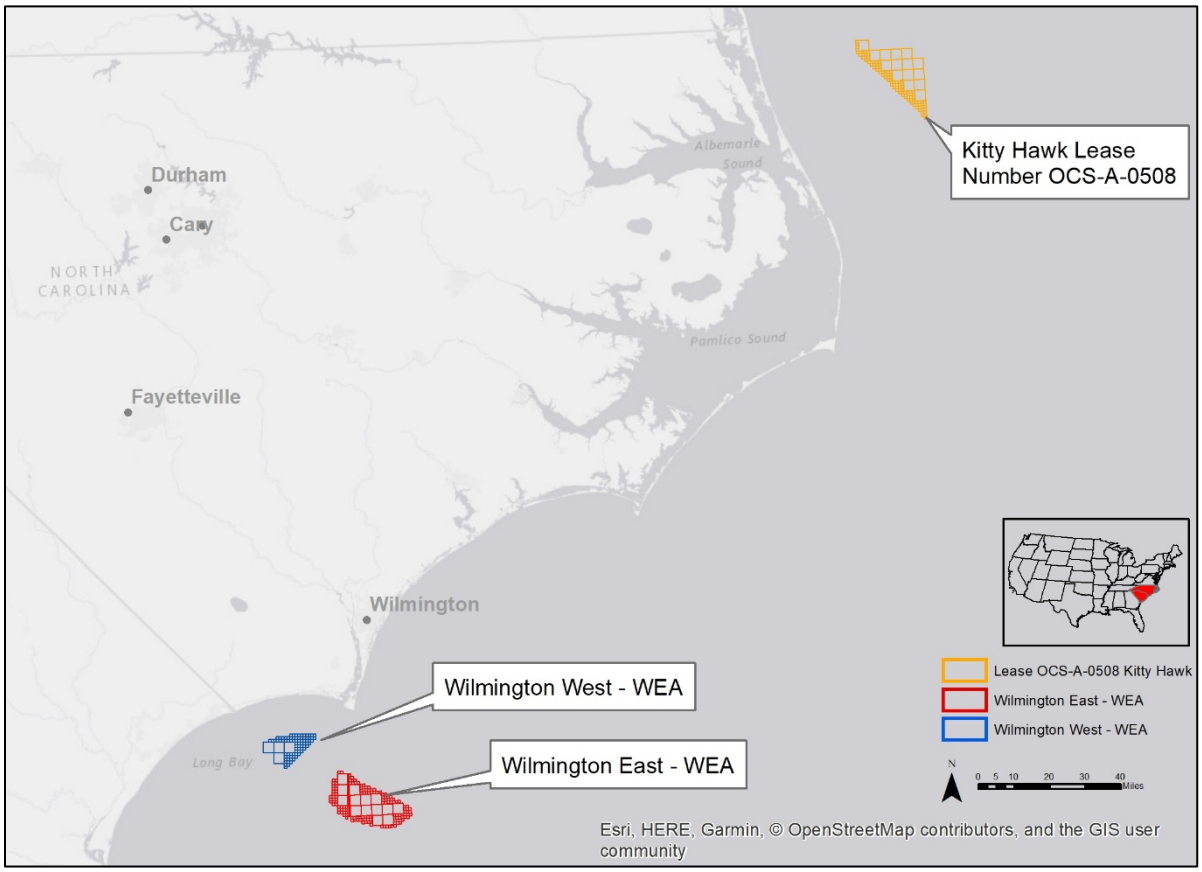

Figure 3: North Carolina Wind Energy Areas and Lease Area

Gauging from print news media, public views about offshore wind energy development in NC have been mixed. In 2015, NC Brunswick County residents expressed concern about the potential visibility of turbines, and how their presence might affect tourism (Bellamy 2015). To reduce the potential visibility of turbines, coastal municipalities in southeastern NC requested a minimum distance of 24 nm for placement of the structures offshore (Wagner 2017). As long as the turbines are not visible from the coast, some residents were in support of offshore wind energy development, especially given the perceived alternative of offshore drilling (Ouzts 2016). In contrast, some stated that turbine visibility would not deter their support for wind energy development, and referenced Jennette's Pier, a combined fishing pier and wind research station, as an example of how coastal wind can act as a tourist attraction (Ouzts 2016). Other citizens expressed concern about how the Wilmington WEAs could affect the North Atlantic right whale habitats and migration corridors (Wagner 2017).

In 2017, NC enacted a Session Law (2017 N.C. Sess. Laws 192) that, among other things, instituted an 18-month moratorium for permitting of both onshore and offshore wind projects. This moratorium allowed time for an independent study of the state's military operations, and the potential impact that wind farms could have on them (Oteri et al. 2018; Brown 2017). However, in a speech at the Outer Banks Chamber of Commerce 2018 Economic Summit, Governor Roy Cooper affirmed state support for wind and solar energy production (Kozak 2018).

In the same year that BOEM began investigation into offshore wind energy development in NC, BOEM also initiated scoping of interest for offshore SC. The agency issued a call for commercial leasing interest

in 2015 in four areas: Grand Strand, Cape Romain, Charleston, and Winyah (80 FR 73818). The call areas (CAs) began at 3 nm, 6 nm, 23 nm, and 35 nm from the shore, respectively. The total area covered by the CAs off SC was 1,007.56 square nautical miles (BOEM 2016). The CAs are shown in Figure 4.

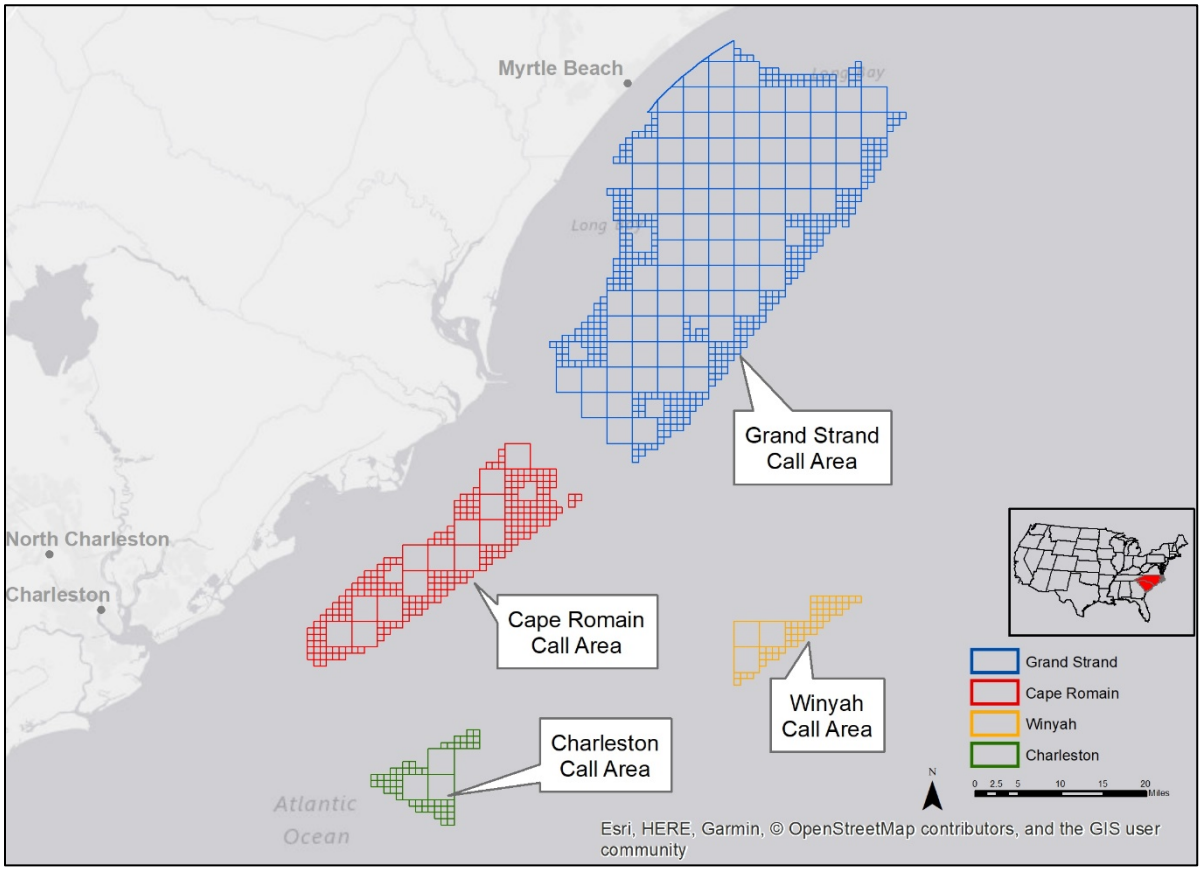

Figure 4: South Carolina Call Areas

While concerns were expressed about how offshore wind energy development projects would affect wildlife and the environment (Hudson 2016), judging from media coverage, attitudes toward potential offshore wind energy development in SC were largely positive (Harvey 2016). At least three cities in coastal SC passed resolutions supporting offshore wind energy development, including North Myrtle Beach (Carnevale 2012), City of Charleston (Carnevale 2013 Jun), and North Charleston (Carnevale 2013 Oct). The State of SC also passed a resolution in support of wind energy and another "to recognize the wind energy capabilities of South Carolina" (Carnevale 2014). *The Washington Post* suggested that SC's positive shift in accepting and encouraging wind energy development may "mirror evolving attitudes towards alternative energy in the country as a whole" (Harvey 2016).

While processes continued for wind energy development in the Carolinas, in early 2018 the Trump Administration announced its intent to open the majority of the Arctic, Pacific, and Atlantic OCS to new offshore oil and gas drilling (Carlisle 2018; Friedman 2018). A number of coastal states responded with opposition to the proposed program, including the governors of NC and SC (Friedman 2018). Some local politicians and community leaders echoed opposition to oil and gas development off the Carolinas (Carlisle 2018; Jarvis 2018).

2.2 Sampling

The potential respondent universe for this research included residents 18 years of age or older living in occupied housing units located in the sampling geography. Researchers chose a sampling geography capturing rural and urban populations in two states, each with an adjacent WEA or CA (Figure 5). The sampling geography included portions of four counties in NC (Brunswick, Columbus, New Hanover and Pender) and one county in SC (Horry).

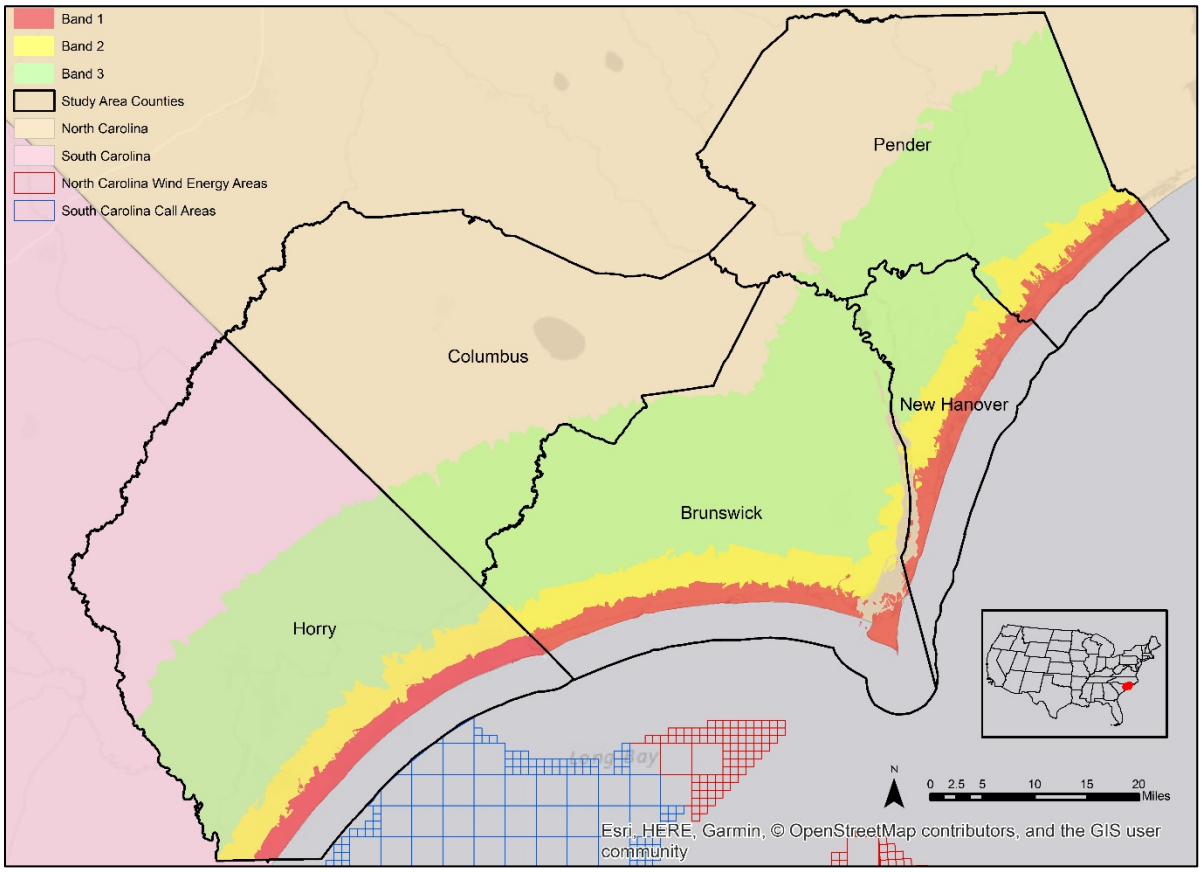

Figure 5: Sampling geography

To examine the influence of geographic proximity to the shoreline on dependent variables, researchers stratified the sampling geography by state and coastal band (Figure 5). The sampling geography was defined to ensure variation based on household distance to the shoreline where offshore wind energy development is proposed, specifically adjacent to a NC WEA (Wilmington West) and SC CA (Grand Strand). Using Block unit geographies from the 2010 US Census Bureau Decennial Census (hereafter, 2010 Census), the sampling region was divided into three coastal bands extending 20 miles (mi) inland from the shoreline. The inland distance was chosen to capture coastal residents, based on ease of access for frequent trips to the shoreline for beach-going and other activities (Bin et al. 2005; Sohngen et al. 1999). Band 1 included 2010 Census Blocks within 2 mi from the coast; Band 2 included 2010 Census Blocks between 2 and 5 mi from the coast; and Band 3 included 2010 Census Blocks between 5 and 20 mi from the coast. Residents in Band 3 are considered inland for purposes of this research, having the least potential for daily aesthetic or other shoreline-proximate impacts from their residence. However,

residents in this group are still likely to have connections to the ocean environment, although these connections may vary in strength or type from residents in Band 1 and Band 2.

To develop the coastal bands, researchers used satellite imagery and GIS software to draw a generalized shoreline shapefile. Researchers then calculated buffers from the generalized shoreline at the distances provided above. All 2010 Census Blocks in the sampling geography were assembled and their centroids calculated. The centroid of each Block was used to assign it to a coastal band. The bands were further delineated based on state geography. Thus, the sampling strata for the research was a combination of coastal band and state, hereafter referred to as strata.

The stratification process yielded three bands and six strata. Figure 6 shows the band and strata assignment for the sampling geography. Table 1 summarizes the characteristics of each strata. The estimated number of occupied housing units in the sampling geography, constituting the total sampling frame, was 327,747.

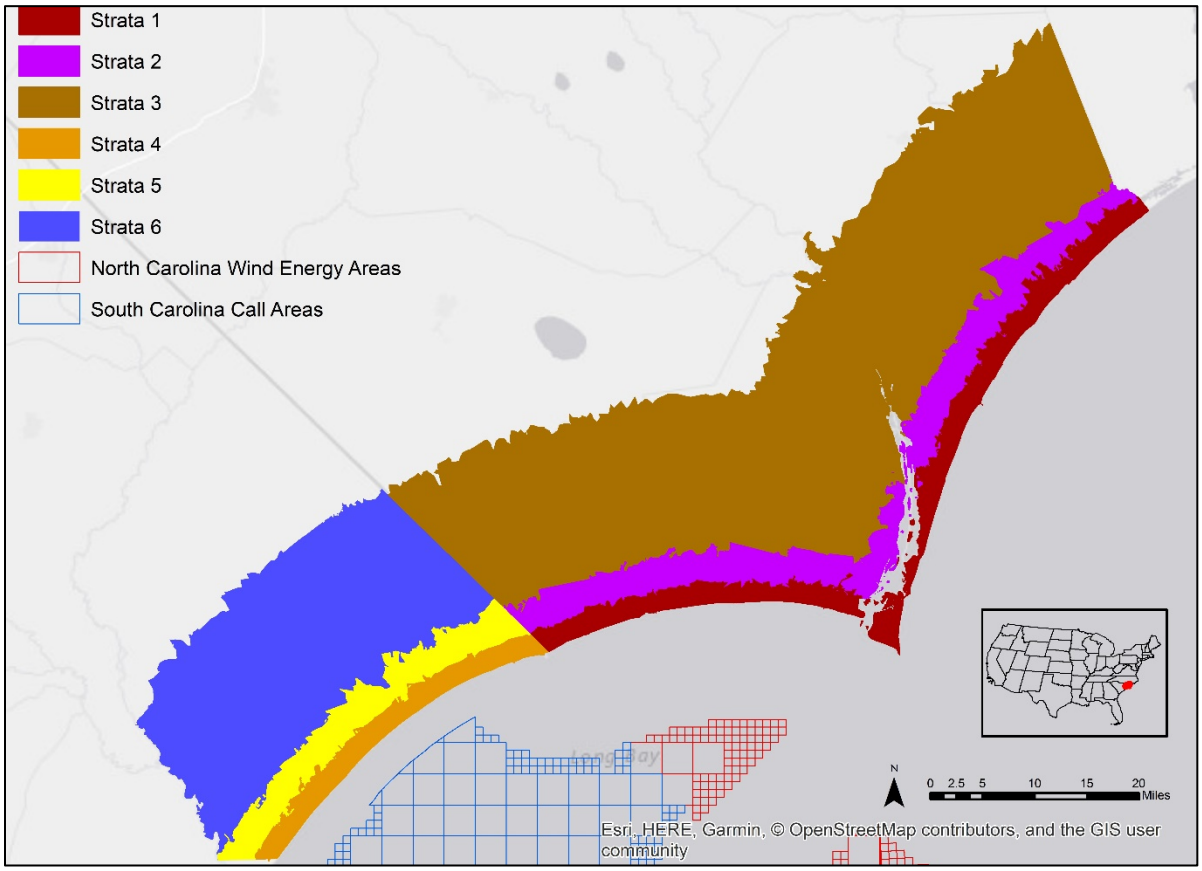

Figure 6: Band and strata assignment for the sampling geography

Table 1: Characteristics of each strata

State	Strata	Band	Width (mi)	Area (sq mi)	Number of Census Blocks	^Estimated Occupied Housing Units	*Estimated Population 18 Years and Over
North Carolina	1	1	2	85.86	3202	39881	49615
	2	2	3	174.77	3200	69009	98192
	3	3	15	866.39	5806	74114	118106
South Carolina	4	1	2	53.00	3394	46152	54231
	5	2	3	79.32	1380	45226	55402
	6	3	15	475.87	2883	53365	79684

*Areas calculated at North American Datum 1983 - UTM Zone 17N
*US Census Bureau, 2010 Decennial Census
^Based on US Postal Service Delivery Sequence File of mailing addresses, accessed via Virtual Genesys system compiled by Marketing Systems Group, pulled by H.W. Odum Institute for Research in Social Science at the University of North Carolina at Chapel Hill on December 6, 2017

The required sample size for each strata was calculated using Equation 1, which yielded a sample size of approximately 366 occupied housing units for each of the six strata, or a total sample of 2,196 occupied housing units for the sampling geography.

A pretest was conducted in spring 2017, during which 320 survey packets were mailed to 283 eligible mailing addresses. Fifty-nine completes were received during pretest, for a response rate of 21%. Based on pretest performance and in an effort to increase response rate by increasing the number of mail-outs per strata, the sampling geography was reduced from an eight county region to the geography described above for the final data collection. A final adjusted sample size of 12,198 occupied housing units was calculated to accommodate a pretest response rate of 21% and an estimated postal non-deliverable rate of 10%. For final collection, the adjusted sample size per strata was 2,033 occupied housing units for the final sampling geography.

Photograph 4: Residence on Fripp Island, South Carolina (south of sampling region)
Photo courtesy of Pixabay (copyright and royalty free)

Equation 1: Sample size calculation by sampling strata[2]

$$ss = \frac{X^2\, NP(1-P)}{d^2(N-1) + X^2P(1-P)}$$

where

ss = sample size
N = population size
P = population proportion (.40) [3]
d = .05 = ±5
X^2 = value of chi square for one degree of freedom relative to 95% level of confidence

Within each strata, eligible mailing addresses, representing occupied housing units, were randomly selected. To approximate random selection within each household, researchers invited the person in the housing unit over the age of 18 who had the next upcoming birthday to complete the survey.

Sample selection was conducted by the H.W. Odum Institute for Research in Social Science at the University of North Carolina at Chapel Hill (hereafter, Odum) on December 6, 2017. Odum identified mailing addresses using the Virtual Genesys system by Marketing Systems Group. Virtual Genesys is based on the US Postal Service Delivery Sequence File and contains all addresses that receive postal mail in the US. NOAA provided Odum with a list of all 2010 Census Blocks within the sampling geography. Using this list, Odum developed a sampling frame consisting of all addresses with a confirmed "USPS deliverable address" for each of the strata within the sampling geography. Odum then randomly selected 2,033 housing units per strata from the sample frame, excluding business addresses, vacant housing units, and post office boxes, unless the post office box was designated as being the "only way to get mail" for the household. The total master sample was 12,198 housing units.

2.3 Survey Instrument

In July 2016, a draft of the survey instrument was vetted via focus groups conducted in cooperation with the Center for Marine Science at the University of North Carolina-Wilmington. Two focus groups, comprised of five and four members, evaluated the survey for completion time, contextual appropriateness of language, presentation, and clarity of content. Based on feedback from the focus groups, adjustments were made to phrasing, the layout and presentation of the map question, survey content, and question order. Six reviewers then assessed the revised survey instrument and sampling design. Two reviewers were internal to NOAA, while four were experienced social science survey researchers from academic institutions. Three of these four had expertise on data collections directly related to wind energy issues in the US.

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[2] Krejcie RV, Morgan DW. 1970. Determining sample size for research activities. Educational and Psychological Measurements. 30:607–610.
[3] Based on approximate expected proportion of population reporting "firm support" for offshore wind energy development as found in: Firestone J, Kempton W, Lilley MB, Samoteskula K. 2012. Public acceptance of offshore wind power across regions and through time. Journal of Environmental Planning and Management. 55(10):1369–1386.

On September 19, 2016, the US Office of Management and Budget (OMB) cleared the project for pretest under the Paperwork Reduction Act (OMB 0648-0744). After the pretest, follow-up phone calls were attempted with 126 non-responding households with associated telephone numbers. Thirty-five percent of these non-responding households had disconnected phone service or the person associated with the phone number was no longer living at that address. Interviews were completed with fourteen percent of non-responding households successfully contacted. Of those commenting on why the survey was not returned, common reasons included a lack of requisite knowledge or interest in the issue. After pretest, changes were made to reduce the length of the survey, simplify survey language, and modify recruitment correspondence to emphasize that no knowledge of wind energy development was needed. Additionally, in final correspondence to potential respondents, an alternative web-based administration tool was proposed to encourage younger respondents. OMB cleared the final data collection on September 6, 2017 for full implementation.

A full color survey booklet (Appendix A) was designed to maximize response rate. The booklet was composed of three folded and saddle stitched 11 x 17 inch pages, resulting in ten 8.5 x 11 inch pages with a front and back cover. Each mailing address was also given a URL and assigned a unique code used to access the online version of the survey. The online survey was created using Qualtrics, and paralleled the paper version except for the mapping exercise. To add a mapping component to the online survey, the Google Maps Application Programming Interface (API) was used to display a map of the study area to the respondent. The respondent was then instructed to place a point on the map and, after clicking a confirmation button, was then prompted to select the social values associated with the point they had placed.

2.4 Survey Administration

Survey administration occurred from January to May 2018. Selected housing units received an initial survey packet in January, which included an introductory letter, survey booklet, and postage-paid business reply envelope. The outgoing envelopes were white and featured the NOAA logo to attract respondent interest. The cover letter was printed on US Department of Commerce/NOAA letterhead.

The final reminder postcard provided the URL for the online survey and a unique login code the household could use to complete its survey online. After the initial mailing, households received up to four additional mailings, summarized in Table 2.

Table 2: Mailing schedule

Mailing	Date
First survey mailing	January 5, 2018
First reminder postcard	January 15, 2018
Second survey mailing	February 9, 2018
Second reminder postcard with invitation to online survey	February 27, 2018

Surveys were mailed at a nonprofit postage rate using the University of North Carolina-Chapel Hill indicia printed on the envelope. Because the distance from origin to destination was less than 200 mi, a nonprofit postal rate provided the same speed of delivery as a first class postal rate, but at a lower cost. However, when a nonprofit postal rate is used, the US Postal Service does not return mail to sender when undeliverable. Therefore, researchers used returns of the reminder postcards, sent via first class mail, to identify vacant, undeliverable, and other ineligible household units in the sample. Using a unique

identifying code, households submitting a completed survey were removed from future mailings as were addresses having postcards returned as undeliverable.

No names were used or collected during the course of this research, nor were attempts made to learn the identity of residents at sampled addresses. Researchers used the name of the city wherein the housing unit was located in the outgoing address and for the salutation of correspondence. For example, envelopes and letters sent to residents with a Wilmington, NC address showed “Wilmington Area Resident” while those sent to Myrtle Beach, SC showed “Myrtle Beach Area Resident,” etc.

2.5 Data Entry

Upon receipt, completed surveys were logged into a control system for tracking and management. A research assistant then reviewed and edited each survey. Variable names and code values were established prior to data collection. During editing, the research assistant recorded code values onto the surveys in preparation for data entry. For the mapping exercise (Appendix A, Question 6, Page 4 of the survey), the research assistant coded the item using a grid overlay printed onto a clear transparency. The research assistant coded the endpoint of each Favorite Place line drawn by the respondent with two codes: grid cell number and county.

When responses on the surveys were ambiguous or multiple items were marked for a single-response question, the research assistant edited the survey using a colored pencil to indicate the response to be keyed during data entry. To ensure quality control in the editing and coding process, a sample of the edited and coded surveys was reviewed by senior staff at Odum throughout the collection period.

Data were entered utilizing the online survey interface developed for respondent use in Qualtrics. This platform ensured exact correspondence between the two modes of administration for most of the data fields. The only formatting exception in data capture between the two modes was for the mapping exercise. Fields for keying items related to the mapping exercise for mail surveys, meaning grid cell and county codes, were presented on the online interface for entry purposes only. However, these fields were not necessary for surveys completed online. The Google API interface captured exact latitude and longitude in an interactive fashion for respondents completing the online version. The grid cell and county codes for online surveys were later added by researchers using boundary overlays in ArcMap. All paper surveys were keyed twice for quality control purposes. The research assistant reconciled discrepancies between original and re-keyed values by retrieving and examining the paper survey.

At the conclusion of the data collection period, data were exported from Qualtrics. Keying errors detected in the quality control process were corrected, and missing values were assigned for items left blank by respondents completing the online survey.

2.6 Data Preparation

2.6.1 Overview of the Sample

Mailings were sent to 12,198 addresses in the sampling geography. The US Postal system returned mail for 1,198 addresses, indicating the unit addressed was vacant or undeliverable. The remaining 11,000 addresses were presumed eligible for the survey. Survey booklets were received from 3,547 households, and 46 households responded online. However, 10 survey booklets returned contained refusals and four surveys were dropped as incomplete. There were a total of 3,593 completed observations. A summary of the sample outcome is provided in Table 3.

Table 3: Summary of sample outcome

Status	Cases
Completed	3593
Incomplete – Dropped	4
Refused by Mail	10
Undeliverable/Returned – Ineligible	1198
No Response – Presumed Eligible	7393
Total	12198

A response rate of 33% was achieved for the entire sampling geography. The highest response rate was achieved in Coastal Band 1 (38%), which was the band located nearest to the shoreline, while the lowest response rate was achieved in Coastal Band 3 (27%), located furthest inland. A response rate of 35% was achieved for the NC portion of the sampling geography, while a response rate of 30% was achieved in SC. The highest response rate, at 44%, was achieved in Strata 1, which was the NC portion of Coastal Band 1. Frequencies and response rates for the sampling geography, by state and coastal band, are shown in Table 4.

Table 4: Frequencies (Freq) and response rate (RR%) by coastal band and state

Coastal Band	NC Freq	NC RR	SC Freq	SC RR	Total Freq	Total RR
1	769	44	543	32	1312	38
2	671	35	601	32	1272	34
3	512	27	497	26	1009	27
Total	1952	35	1641	30	3593	33

A response rate of 21% was achieved in the pretest for this study. Thus, there was an increase in response rate from pretest to final collection. There are many factors that could have contributed to the increase in response rate from pretest to the final collection. As discussed above, after follow-up with pretest non-responding households, the research team made changes to the survey and research design to increase the likelihood of achieving a higher response rate. It is probable that these efforts served to increase the response rate.

Photograph 5: Ocean view from Myrtle Beach, South Carolina
Photo courtesy of Pixabay (copyright and royalty free)

It is also possible that the political context at the time of data collection catalyzed individuals to participate in the survey. In April 2017, the Trump Administration issued Executive Order 13795, which expanded federal efforts to promote offshore oil and gas development. In January of 2018, as the survey was being deployed, the Trump Administration announced an unprecedented push to expand offshore oil and gas production in all US ocean waters, including offshore NC and SC (Fears 2018). Based on anecdotal evidence, such as hand written notes on survey booklets returned (for example, see Figure 7), as well as direct communications from sampled respondents, it is probable that this political context served as a focusing event that motivated response from some participants. However, it is not possible to discern influence of this phenomenon on the sample to know, for example, if those who oppose offshore oil and gas development were more or less likely to respond to the survey than those who support it. Stated differently, it is unknown if responses rates were different for people opposing offshore oil and gas development in NC or SC, as opposed to those supporting it.

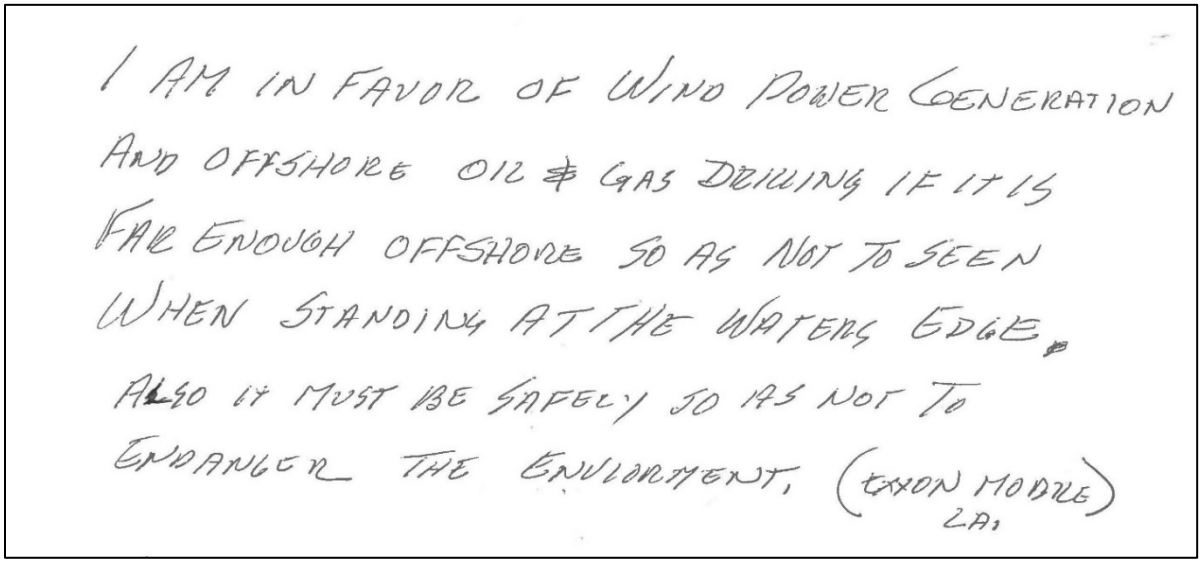


Figure 7: Handwritten note from survey respondent regarding offshore energy development

2.6.2 Coverage and Non-response

Figure 8 shows geographic coverage of the sample by Census Block. Similar to pretest, fewer Blocks located inland from the shoreline are represented, particularly in NC, which are predominately rural areas with lower population density. Responding Blocks are somewhat more dispersed in the SC portion of the study area than in NC. Responding Blocks are noticeably around population centers, such as Wilmington, NC and Myrtle Beach, SC. This is not surprising given the sampling design: strata closer to the shoreline are geographically smaller than inland strata and have higher population densities.

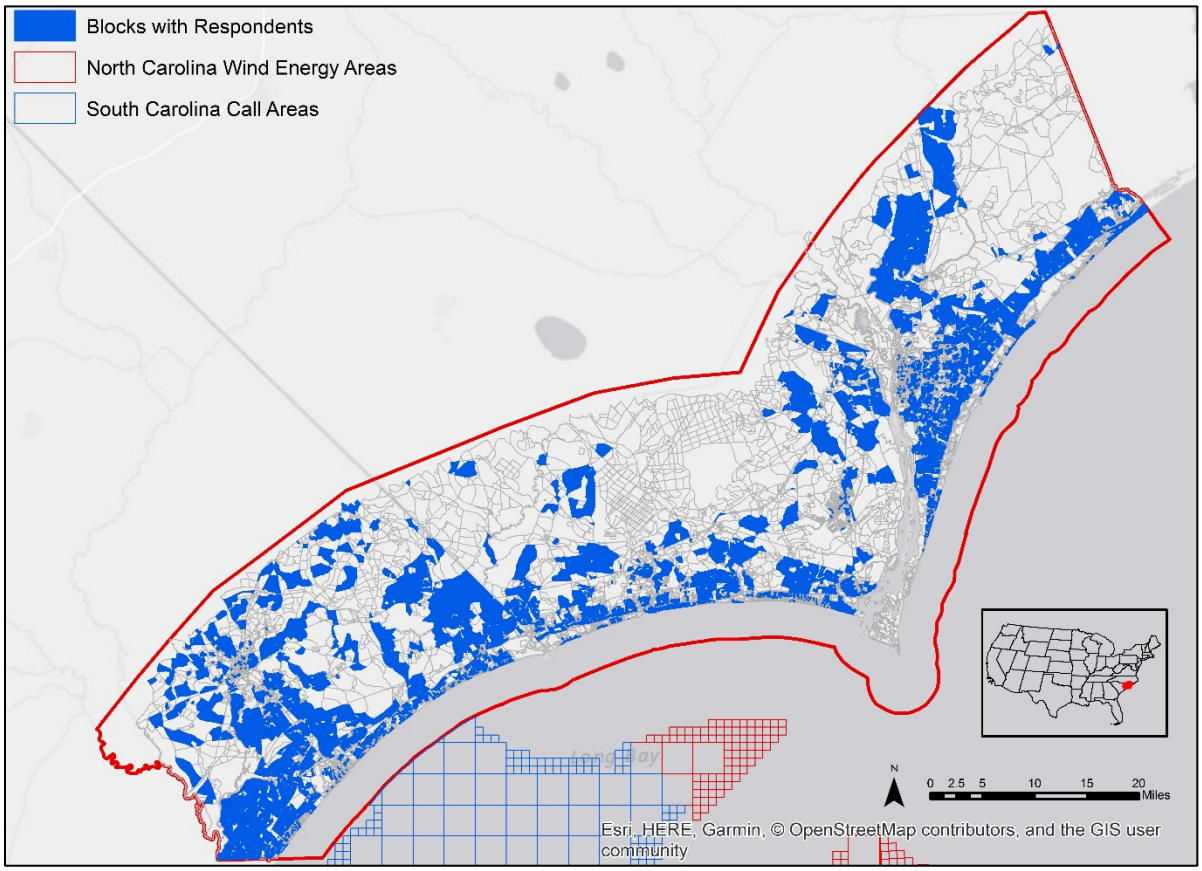


Figure 8: Distribution of respondents by Census Block

To determine the representativeness of the sample, using data from the 2010 Census, comparisons were made for key demographic variables between the sample and population in the study region for persons 18 years of age and older. Key variables included sex, race, ethnicity, and age. As indicated in Table 5, the sample was representative in terms of sex.

Table 5: Sample representativeness of the population (percent)

Variables	Sample	Population
Female	52	52
White	95	83
Black	4	12
Hispanic	1	5
Age Group		
18-24	1	12
25-34	5	16
35-44	8	16
45-54	13	17
55-64	24	18
65-74	32	13
75-84	14	6
85+	6	2

However, for race, the sample was skewed toward residents self-identifying as white compared to the general population, with 95% of the sample self-identifying as white compared to 83% in the general population. Other racial groups, the next most prominent being persons self-identifying as African-American, and persons self-identifying as Hispanic were under-represented in the sample compared with the general population. For age, the sample was heavily skewed toward residents aged 55 years and over, leaving younger age groups (18-44) under-represented in the sample compared to the population.

2.6.3 Weighting

To mitigate non-response bias the sample was weighted. The probability of selection, $P_{selection}$, for each strata, s, was calculated as follows in Equation 2.

Equation 2: Probability of selection for each strata

$$P_{selection,s} = \frac{HH_{sample,s}}{HH_{pop,s}}$$

where $HH_{sample,s}$ is the number of households within the sample within strata s and $HH_{pop,s}$ is the number of households within the population within strata s.

The inverse of the probability of selection was then multiplied by the number of adults living in the selected household, $hhsize_i$, to estimate the design weight, $Design\ Weight_{s,i}$, for each respondent, i, in Equation 3.

Equation 3: Design weight for each respondent

$$Design\ Weight_{s,i} = \frac{1}{P_{selection,s}} * hhsize_i$$

Table 6 shows the number of households within the sample and the population for each strata as well as mean household size and design weight for each strata (rounded to two decimal places each). Note that neither of the household counts include zero-occupied housing blocks and that the population counts come from the 2010 Census.

Table 6: Number of households, mean household size, and design weight by strata

Strata	$HH_{pop,s}$	$HH_{sample,s}$	Mean $hhsize_i$	Mean $Design\ Weight_{s,i}$
1	39881	2033	1.92	19.62
2	69009	2033	1.92	33.94
3	74114	2033	1.88	36.46
4	46152	2033	1.93	22.70
5	45226	2033	1.94	22.25
6	53365	2033	1.95	26.25

Population weights were derived using the raking command in STATA/SE 13.1. The following control variables were used as weighting factors: sex, race (white, black), and age group (18-34, 35-44, 45-54, 55-64, 65-74, and 75+).

A low response score (LRS)[4] was assigned to each Census Block in the sampling geography based on the LRS of corresponding Census Block Groups. LRS were used to create meaningful subgroups within strata by grouping blocks, as shown in Figure 9.

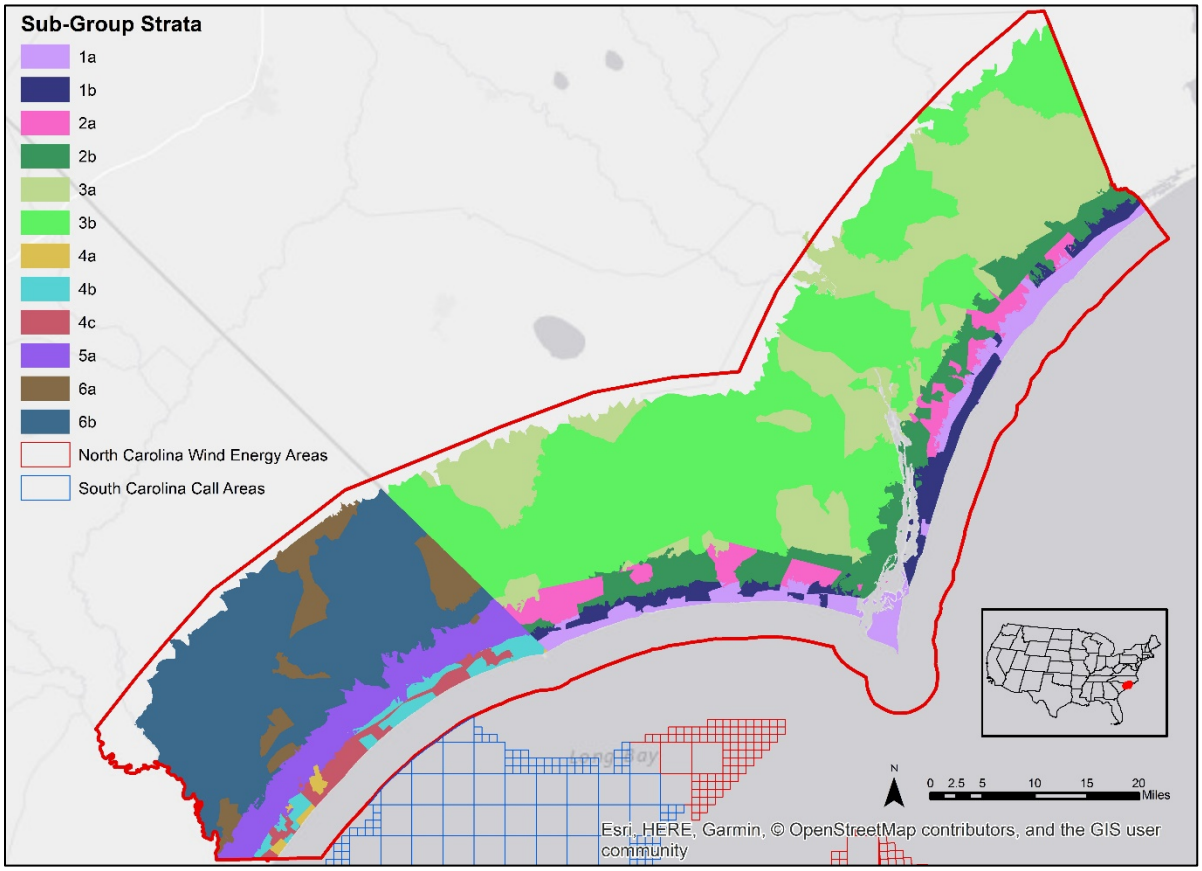


Figure 9: Groups of blocks created within strata for sample weighting

Two groups were created within strata 1, 2, 3, and 6 with the bottom 50% of low response respondents forming one subgroup and the top 50% forming a second. In Stratum 6, target tolerance of five percentage points could not be met for each subgroup regardless of how the subgroups were created, unless restrictions were removed on the maximum weight size. Therefore, the tolerance was removed when creating the second group, and the maximum weight size was capped at 5.00 after the fact (1.98% of weights were capped).

[4] U.S. Census Bureau. 2018 Planning Database. Available online: https://www.census.gov/research/data/planning_database/2018. Erdman C, Bates N. 2017. The low response score (LRS): a metric to locate, predict, and manage hard-to-survey populations. Public Opinion Quarterly. 81(1):144–156.

In Stratum 4, three subgroups were created through a systematic testing of potential subgroups. The first subgroup is comprised of respondents with an LRS equal to or less than 0.6 (6% of Stratum 4 respondents); the second is comprised of respondents with an LRS between 8.5 and 16.9 (42%); and the third is comprised of respondents with an LRS equal to or greater than 17.5 (52%). In Stratum 5, iterative raking performed worse with subgroups than with the stratum as a whole, so no subgroups were created.

The proportion of respondents self-identifying as black was removed as a weighting factor for Stratum 4's first two subgroups because there were no respondents self-identifying as black in these groups. Additionally, two age categories were combined (18-44) for the second subgroup due to a low proportion of respondents in those categories. Table 7 summarizes the final, normalized weights developed from the iterative ranking process.

Table 7: Final, normalized weights

Strata	Subgroup	Min Weight	Max Weight	Max Deviation	Iterations
1	1a	100.93	1003.75	2.03	2
	1b	62.69	619.054	3.83	3
2	2a	100.20	1002.06	2.20	2
	2b	99.56	854.74	4.18	3
3	3a	88.53	859.03	4.14	2
	3b	71.92	697.20	4.97	13
4	4a	40.58	402.62	4.45	3
	4b	66.99	669.00	2.71	3
	4c	50.82	505.83	4.32	4
5	5	165.84	1640.87	4.84	4
6	6a	100.97	999.68	4.93	4
	6b	114.22	1157.53	3.61	3

Photograph 6: North Carolina Beach
Photo courtesy of Sarah Ball Gonyo, NOAA

Table 8 shows a comparison of the key demographic variables for the sample, population, and weighted sample. Weighting improved the representation for race and ethnicity, but not to a large extent. Therefore, caution should be taken when interpreting or generalizing findings inclusive of race as an independent variable. With the exception of the 18-24 age group, the representativeness of age from the sample to the population improved after weighting. However, caution must be used when extrapolating results to the 18-24 age group, especially if there is evidence to suggest variables of interest are significantly different for this age group from older age groups.

Table 8: Comparison of key variables for sample, population, and weighted sample (percent)

Variables	Sample	Population	Weighted Sample
Female	52	52	53
White	95	83	90
Black	4	12	7
Hispanic	1	5	2
Age Group			
18-24	1	12	5
25-34	5	16	16
35-44	8	16	15
45-54	13	17	16
55-64	24	18	19
65-74	32	13	17
75-84	14	6	8
85+	6	2	4

2.6.4 Spatial Data Preparation

In preparation for the spatial analysis of the survey data, researchers created a line shapefile representing an approximation of the study area shoreline. The researchers also created a point shapefile of household locations using the latitude and longitude coordinates supplied by Odum. The latitude and longitude coordinates were rounded to two decimal places and joined with the survey data containing weights. Rounding the latitude and longitude coordinates to two decimal places allowed the researchers to conduct spatial analyses on the data while at the same time obscuring the location of households. Using the approximated shoreline shapefile, the researchers calculated the Euclidian distance from each household point location to the shoreline to determine household distance to the shoreline, the average household distance to the shoreline for all households, and the average household distance to the shoreline for all households in each coastal band.

In preparation for analysis of data gathered for Question 6, the Favorite Place mapping exercise (Appendix A), a point shapefile representing the centroids of the grid cells was developed. Each cell was assigned a unique identification number for spatial joins with tabular data. Researchers summed the total number and type of values associated with each grid cell, as well as calculated the distance from households to the centroid of the cell containing their identified Favorite Places. In addition, distances from the first Favorite Place grid cell centroid to 1) the nearest point on the shoreline and 2) the nearest WEA or CA were calculated.

Using the Spatial Join tool in ArcGIS, the household location point shapefile was aggregated to polygon shapefiles representing US Census Blocks, US Census Block Groups, and grid cells to get a count of

respondents for each geography. Using this information, for each geography, average weighted responses were calculated.

Finally, researchers calculated land cover metrics for each grid cell in the study region using data retrieved from the NOAA Office for Coastal Management's Coastal Change Analysis Program (C-CAP). In addition, amenities and attractions data were consolidated from available data on the locations of cultural and recreational places across the study region, as well as for the locations of infrastructure needed for the recreational activities reported by respondents. Centroids for large geographies, such as parks, greenways, and golf courses, were used. Attractions were defined as listings in the National Register of Historic Places, shipwrecks, parks and greenways, boat ramps and marinas, artificial reefs, and golf courses.

2.7 Data Analysis

Tabular data were analyzed using STATA/SE 15.1 and SPSS V22. Basic descriptive statistics were used to evaluate and summarize the data. Correlations and parametric tests of significance were used to assess relationships between variables and check model assumptions. Principal components analysis (PCA) and logistic regression were used to test hypotheses.

Spatial data were analyzed using ArcMap v10.5.1, ArcGIS Pro, R v3.5, and Microsoft Excel. A series of spatial correlations, Euclidean distance analyses, and Block Group statistics were produced to describe and analyze data. Where appropriate, data are visualized at the Census Block Group level (hereafter, block group).

Photograph 7: Offshore wind turbines in the distance at sunset, with ship silhouette in the foreground
Photo courtesy of Ian Dyball © 123RF.com

3 Results: Summary Findings

3.1 Overview of the Weighted Sample

Table 9 provides an overview of demographic variables for the weighted sample, as well as the target population[5] for comparison where data were available. The response rate for each survey item is also provided. Response rates for all demographic items were above 90%.

Females represent 53% of the weighted sample, while males represent 47%. In terms of race, 90% of respondents self-identify as white and 7% as black. Three percent of the weighted sample self-identified as other racial categories (i.e. American Indian/Alaska Native, Asian, and Native Hawaiian/Other Pacific Islander). For ethnicity, 3% of respondents self-identify as Hispanic or Latino. Forty-six percent are 55 years of age or older, while the remainder are under the age of 55.

Respondents in the weighted sample are likely to be married and have formal higher education, with 50% having a Bachelor's or other advanced degree. According to the US Census Bureau figures for 2013-2017, 30% of NC and 27% of SC adults aged 25 and over hold a Bachelors' degree or higher educational level.[6] Fifty-two percent of respondents are employed full-time or self-employed, while 31% are retired. Lastly, Figure 10 shows the spatial distribution of the sample by income level. Respondents, particularly those living along the shoreline in NC, have higher household incomes when compared with the average NC or SC resident, with 21% of the weighted sample having an income in the range of $50,000 to $74,999, and 47% having an income of $75,000 or greater. According to the US Census Bureau, derived from American Community Survey data collected from 2012 to 2016, the median household incomes for NC and SC are $48,256 and $46,898, respectively, in 2016 dollars.[7]

Photograph 8: Wave breaking along the Carolina coast
Photo courtesy of Pixabay (copyright and royalty free)

[5] Unless otherwise noted, population data is from US Census Bureau, 2010 Census Summary File 1. Population data were not available for all variables. Variables for which population data were not available are noted as such ("NA").
[6] US Census Bureau, American Community Survey (ACS), 5-Year Estimates. American FactFinder: Online @ https://www.census.gov/quickfacts
[7] US Census Bureau, QuickFacts (North Carolina, South Carolina): Online @ https://www.census.gov/quickfacts/fact/table/US/PST045217

Table 9: Comparison of demographic variables for population and weighted sample (percent)

Demographic Variables (RR=Item response rate)		Population	Weighted Sample
Sex (RR=96%)	Female	52	53
	Male	48	47
Race (RR=96%)	White	83	90
	Black	12	7
	Other	5	3
Ethnicity (RR=96%)	Hispanic	5	2
Age (RR=96%)	18-24	12	4
	25-34	16	17
	35-44	16	15
	45-54	17	16
	55-64	18	19
	65-74	13	18
	75-84	6	8
	85+	2	1
Marital Status (RR=98%)	Married	NA	65
	Widowed	NA	6
	Divorced	NA	10
	Separated	NA	1
	Never married	NA	17
Education (RR=98%)	No schooling completed	NA	0.33
	Some high school	NA	1
	High school or GED	NA	12
	Some college	NA	22
	Associate's	NA	14
	Bachelor's	NA	32
	Master's	NA	13
	Professional	NA	3
	Doctoral	NA	3
Income (RR=90%)	Less than $25,000	NA	9
	$25,000 to $34,999	NA	9
	$35,000 to $49,999	NA	13
	$50,000 to $74,999	NA	21
	$75,000 to $99,999	NA	17
	$100,000 to $149,999	NA	16
	$150,000 or more	NA	14
Employment (RR=98%)	Unemployed	NA	2
	Employed full-time	NA	41
	Employed part-time	NA	9
	Self-employed	NA	11
	Retired	NA	31
	Student	NA	2
	Homemaker	NA	3
	None of the above	NA	2

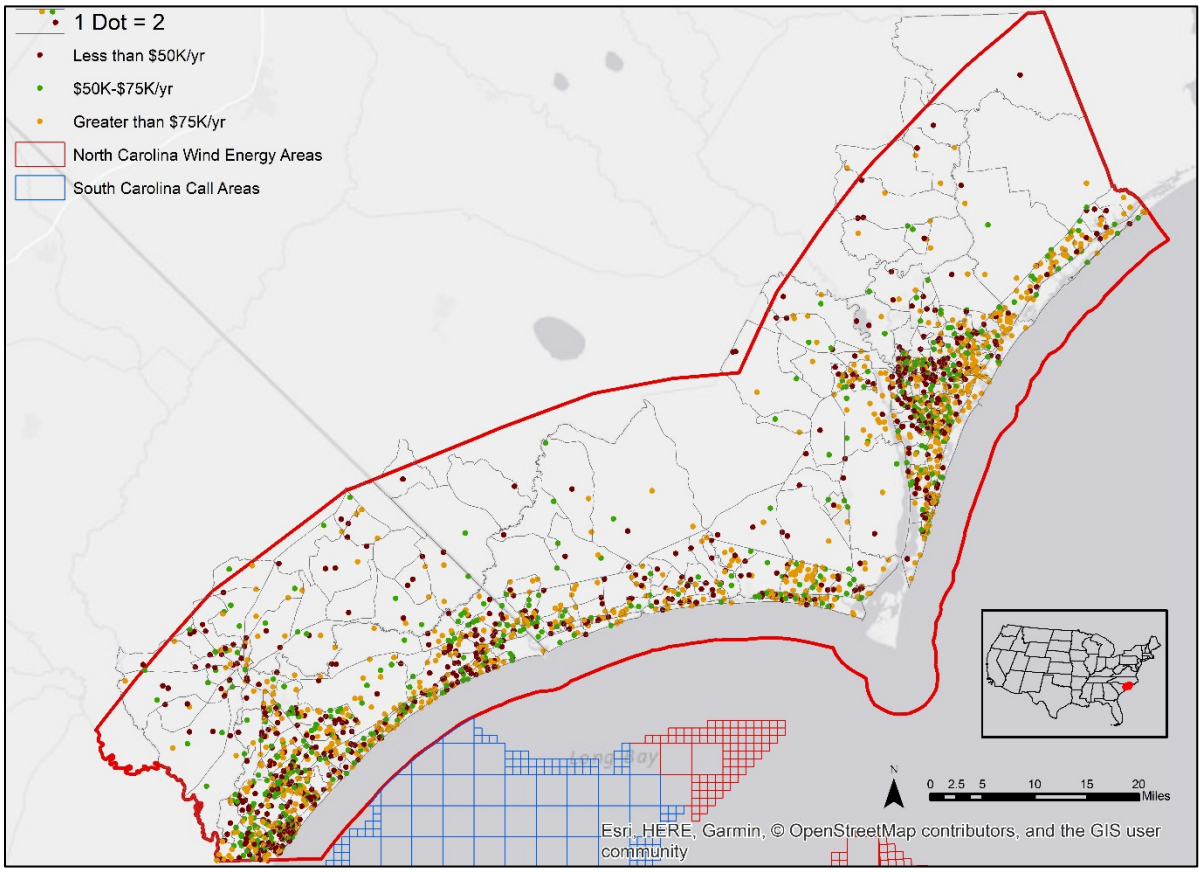


Figure 10: Distribution of households by level of income

Resident and household variables are summarized for the weighted sample in Table 10, along with figures for the population (where available) and item response rates. The weighted sample is largely composed of permanent residents to the region, as opposed to temporary or seasonal residents, over half of which have lived in the coastal Carolina region for 11 or more years. A majority of the weighted sample own the dwelling where their household resides. The average distance of households to the shoreline is 6.09 km for NC and 8.23 km for SC. The average household size is 2.65, and the average number of persons under the age of 18 is 0.55 per household for the weighted sample.

Photograph 9: Sunset on the Carolina coast
Photo courtesy of Pixabay (copyright and royalty free)

Table 10: Comparison of resident and household variables for population and weighted sample (percent)

Resident and Household Variables (RR=Item response rate)		Population	Weighted Sample
State of Residence (RR=NA)	North Carolina	58	48
	South Carolina	42	52
Coastal Band of Residence (RR=NA)	Band 1	23	26
	Band 2	34	47
	Band 3	44	26
Resident Type (RR=99%) *	Permanent	99	95
	Temporary/ Seasonal	1	5
Residential Tenure (RR=99%)	Less than 1 Year	NA	6
	1 to 2 years	NA	9
	3 to 5 years	NA	15
	6 to 10 years	NA	16
	11 to 20 years	NA	23
	More than 20 years	NA	31
Ownership Status (RR=98%)	Owner	67	81
	Renter/ Occupy, no rent	33	19
Average Household Distance from the Shoreline (km)	North Carolina	NA	6.09
	South Carolina	NA	8.23
Household Size (RR=97%)		1.34	2.65
Household Size – Under Age 18 (RR=97%)		0.26	0.55

* Population data source: US Postal Service Delivery Sequence File of mailing addresses, accessed via Virtual Genesys system compiled by Marketing Systems Group, pulled by H.W. Odum Institute for Research in Social Science at the University of North Carolina at Chapel Hill on December 6, 2017.

3.2 Connection to the Carolina Coast

Researchers measured the type and strength of connections held by residents in the study region in three ways: place attachment, importance of recreational activities, and the social values of favorite places identified across the study region.

3.2.1 Place Attachment

Place attachment studies include multiple dimensions of possible connection, including individual identity, family identity, self-expression, community identity, economic meaning, and self-efficacy (Smith et al. 2012; Smith et al. 2011; Davenport et al. 2010; Kruger and Shannon 2000; Proshansky et al. 1983). In an effort to improve measurement of attachment, Ardoin (2006; 2014) and Ardoin et al. (2012) refined the many theoretically driven dimensions used to capture sense of place and place attachment, aligning them to four dimensions: biophysical, sociocultural, psychological, and political-economic. In an effort to reduce survey length, two of the most applicable statements representing each of the four dimensions were adapted from Ardoin's (2006; 2014) model for use in this research. The eight statements are shown in Table 11, and variable names are provided.

Data were collected to assess strength of attachment to the Carolina coast using a five point Likert scale from Strongly Disagree to Strongly Agree relative to the connection statements, shown in Table 11. The survey item asked:

To what extent do you disagree or agree with the following statements about the Carolina coast?

Table 11: Dimensions of place attachment

Ardoin's (2006) Sense of Place Dimension	Survey Statement	Variable Name
Biophysical	I like the Carolina coast's mix of plants, animals, and landscapes.	LAND
	I think the natural parts of the Carolina coast are beautiful.	NATURE
Political-economic	I think the economy is strong on the Carolina coast.	ECON
	The Carolina coast is the best place for what I like to do.	DO
Psychological	The Carolina coast is a special place for me and/or my family.	FAMILY
	The Carolina coast says a lot about who I am.	ME
Sociocultural	I feel a strong sense of community on the Carolina coast.	COMM
	I feel connected to the other people who live on the Carolina coast.	CONN

Study area residents' level of agreement with each of the survey statements is shown in Table 12, where a mean value of 1 is Strongly Disagree, a mean value of 3 is Neutral, and a mean value of 5 is Strongly Agree. Although residents largely agree with each of the eight statements, they most strongly agree with biophysical/nature bonding connection statements (LAND=4.43; NATURE=4.70). In contrast, residents express their highest levels of disagreement to the ECON item (15% Disagree; mean of 3.58).

Table 12: Agreement levels with place attachment statements

Measure	Strongly Disagree (%)	Disagree (%)	Neutral (%)	Agree (%)	Strongly Agree (%)	Mean
LAND	2	2	9	25	62	4.43
NATURE	2	1	3	14	81	4.70
ECON	4	15	20	42	19	3.58
DO	4	6	17	34	40	4.00
FAMILY	2	2	11	26	59	4.36
ME	4	6	26	29	34	3.82
COMM	2	5	17	39	38	4.05
CONN	3	7	24	40	26	3.80

These findings suggest that place attachment is moderately high on the Carolina coast. However, the number of Neutral responses is noteworthy. More residents reported neutrality on all of the statements than disagreement.

PCA was used to identify the dimensions of attachment to place (Table 13). Because only eight statements were used in the survey item, a maximum of two components were possible. More components may have been possible if more statements had been included. The first component has positive associations with LAND, NATURE, DO, FAMILY and ME, which suggests this component measures individual connections, called Personal Connection. The second component has positive associations with COMM, ECON, and CONN, which suggests Social Connections. The relatively large Chronbach's alpha values (0.88 and 0.75, respectively) suggest reasonable internal consistency within the components. The place attachment components derived from the PCA were used in later modelling (see section 4).

Table 13: Final PCA results

Place Attachment Dimension	Chronbach's Alpha value	Survey Statement	Variable
Personal Connection (Component 1)	0.88	I like the Carolina coast's mix of plants, animals, and landscapes.	LAND
		I think the natural parts of the Carolina coast are beautiful.	NATURE
		The Carolina coast is the best place for what I like to do.	DO
		The Carolina coast is a special place for me and/or my family.	FAMILY
		The Carolina coast says a lot about who I am.	ME
Social Connection (Component 2)	0.75	I feel a strong sense of community on the Carolina coast.	COMM
		I think the economy is strong on the Carolina coast.	ECON
		I feel connected to the other people who live on the Carolina coast.	CONN

3.2.2 Importance of Recreational Activities

Data were gathered to document the recreational activities residents engaged in within the study region, as well as how important those activities were to them. Specifically, respondents were given a four point Likert scale from Not Important to Extremely Important relative to a series of recreational activities. Respondents marked Don't Engage for recreational activities they do not engage in along the Carolina coast. A reference period was not used, such as "in the past twelve months," because researchers were interested in any engagement, as opposed to recency or frequency of engagement. The item read:

> For only the recreational activities that you engage in along the Carolina coast, please indicate how important each is to you.

The activities list included: beach-going; nature or scenic photography; birdwatching, whale watching or viewing of other marine mammals; fishing; hunting; boating or sailing; and, SCUBA diving. An "Other; please specify" option was included as well.

Recreational activities were chosen because of their potential—or perceived potential—to be affected by offshore wind energy development, either directly (e.g., disruption to engagement) or indirectly (e.g., reduced aesthetic enjoyment). For example, the presence of offshore wind farms may restrict boating, sailing, fishing, and SCUBA diving activity through the potential implementation of updated zoning and access regulations (Ecology and Environment, Inc. 2014; Kimmell and Stalenhoef 2011). Beach-going and nature or scenic photography may be impacted due to a perceived decline in local aesthetics (Parsons

and Firestone 2018; Knapp and Ladenburg 2015). Further, marine mammal watching, birdwatching, and hunting participants may fear that offshore wind energy development projects could harm marine mammal and shore bird habitat, migration corridors, and flyways (Latham et al. 2017; Rein et al. 2013). Alternatively, offshore wind energy development projects may enhance some of these activities. Fishing and SCUBA diving quality may improve with the additional artificial fish and crustacean habitat provided by the bases and submerged portions of the wind turbine shafts (Keller et al. 2014; Voss et al. 2013). For some, beach-going and photography aesthetics may improve with the presence of offshore wind turbines (Parsons and Firestone 2018).

Table 14 shows that residents within the study region engage in all of the listed recreation activities along the Carolina coast. Beach-going is the most commonly reported activity, followed by nature or scenic photography and marine mammal watching. Several "other" recreational activities are also reported, including golf and water sports, such as swimming, surfing, kayaking, and paddle boarding. Table 14 shows the percentage of study area residents that engage in each activity by state of residence. NC residents in the study area have higher participation levels than their SC counterparts for all activity types, except hunting and SCUBA diving.

Photograph 10: Beach-goers flying a kite on a beach on the Outer Banks of North Carolina
Photo courtesy of Sherri Johnson © 123RF.com

Table 14: Engagement in recreational activities: comparison of sampling region and two statewide studies (percent)

Activity	Resident Engagement in Recreational Activities for Sampling Region			NC SCORP (2015)	SC SCORP (2008)
	Total	North Carolina	South Carolina	North Carolina Statewide	South Carolina Statewide
Beach-going	97	98	97		
Visiting a beach or lake				69	
Nature or scenic photography	84	85	84		
Nature photography				33	
Marine mammal watching	83	85	81		
Watching wildlife					33
Boating or sailing	79	82	77		
Boating - power, saltwater				31	
Boating - power, freshwater				46	
Motorboating					34
Sailing, Saltwater				6	
Sailing, Freshwater				5	
Sailing					3
Fishing	78	78	77		
Fishing - Freshwater, bank or pier				58	
Fishing - Freshwater, boat				50	
Freshwater fishing					37
Fishing - Saltwater, on-shore or pier				45	
Fishing - Saltwater, boat				37	
Saltwater fishing					19
Birdwatching	73	76	72	31	20
Hunting	55	53	58		12
Hunting, Gun				47	
Hunting, Bow				26	
SCUBA diving	51	50	52		
SCUBA/snorkeling				13	

Table 14 also compares engagement rates reported by residents in the sampling region to participation rates derived from two statewide recreational studies, one in NC and the other in SC. When compared to statewide figures, engagement rates for all activities in the study region are higher than rates reported for the general population in both states. The NC Department of Environment and Natural Resources (2015) reported 47% and 26% of NC residents engage in hunting by gun and bow, respectively, as compared to 57% of NC study region residents who report engaging in hunting. Statewide fishing participation rates for NC and SC vary from 19% to 58%, depending on the type of fishing (NC DENR 2015; SC DPRT 2008), compared with 78% of residents who report fishing in the current study. Residents in the current study report engagement in birdwatching (73%) at rates higher than statewide figures from NC (31%) or SC (20%). Similarly, SCUBA diving (51%) is reported by residents in the current study at a rate much higher than in the NC statewide study (13%).

There are several possible reasons for the differences in some recreation engagement figures in this research compared with statewide figures. First, data for the NC study were gathered via a convenience

sample and may not be representative of the population (NC DENR 2015). Additionally, the NC statewide study asked respondents to report only activities engaged in within the past five years, which restricts positive responses to engagement. Data for SC were collected in 2005 by SC Department of Parks, Recreation, and Tourism with a random sample of residents aged 12 years old or older (SC DPRT 2008), and respondents were asked to report participation in the past twelve months. It is unclear if or how data from either report were weighted to the populations of their respective states.

Assuming figures from both statewide studies were representative of their state populations, the population for the present research differs from a statewide sample. Foremost, residents in the study region live in a coastal area and likely engage in some of the listed activities at rates higher than residents who live inland further than 20 mi. Finally, it is possible that some respondents misunderstood this survey item, reporting importance for an activity they did not engage in, or reporting engagement/importance for others, such as friends or family. With these caveats, recreational engagement data gathered in this research are adequate for further modelling as the goal was to identify engagement in activities and their relative importance in the study region.

Figure 11 shows the importance levels for recreational activities. Beach-going is most important among residents in the study region with 74% reporting it is Extremely or Very Important to them. Hunting and SCUBA diving are least important with Not Important levels at 31% and 27%, respectively.

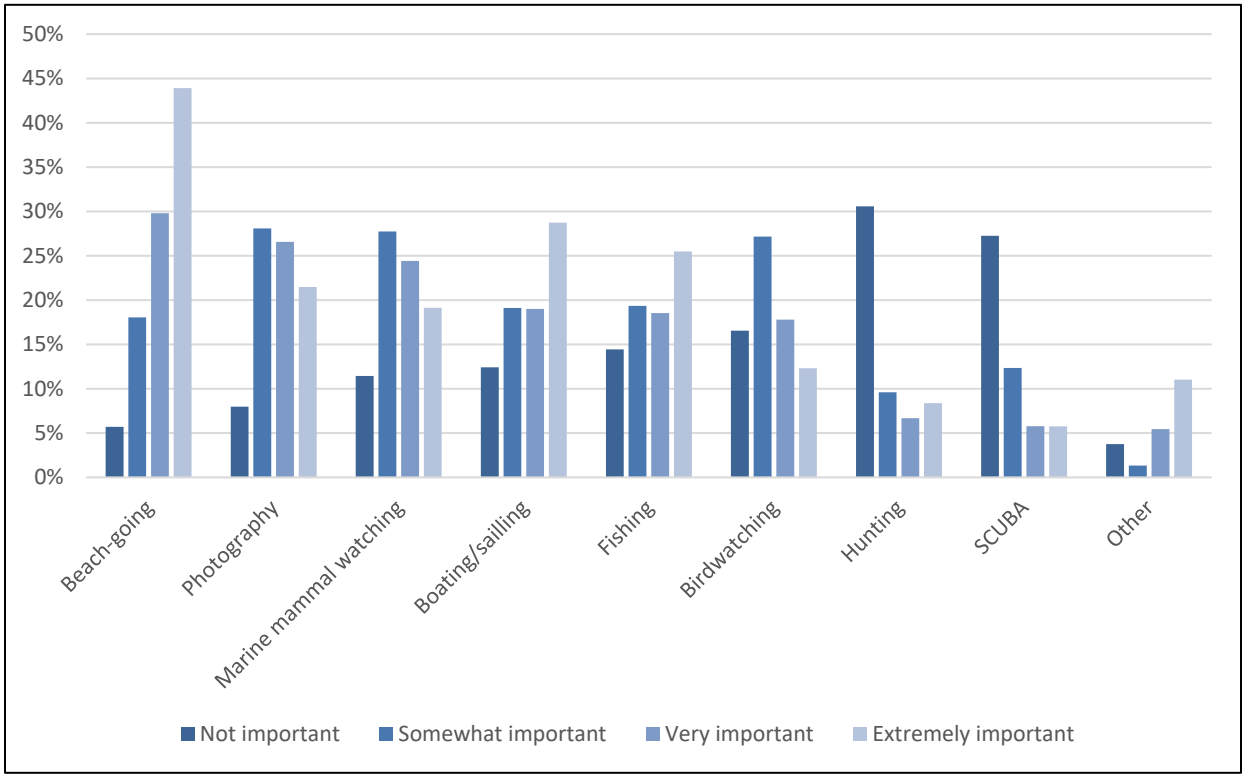


Figure 11: Level of recreational activity importance for entire study region (percent)

Table 15 shows average importance for each recreational activity by state of residence, with higher values corresponding to higher levels of importance. Residents of NC assign significantly more importance to each activity than do SC residents, with the exception of nature/scenic photography ($F=2.45$, $p=0.12$), hunting ($F=6.68$, $p=0.01$), and SCUBA diving ($F=0.00$, $p=0.96$).

Table 15: Average importance of recreational activities by state of residence (mean)

Activity	NC	SC	Mean
Beach-going	3.25	3.06	3.15
Nature/ Scenic Photography	2.77	2.69	2.73
Birdwatching	2.43	2.27	2.35
Marine Mammal Watching	2.69	2.55	2.62
Fishing	2.77	2.65	2.71
Hunting	1.76	1.96	1.87
Boating or Sailing	2.91	2.71	2.81
SCUBA Diving	1.81	1.80	1.80

Table 16 shows the average distance that activity participants live from the shoreline. On average, study area residents who engage in marine mammal watching, boating or sailing, beach-going, and SCUBA diving live closer to the shoreline. Residents who participate in birdwatching, fishing, and nature or scenic photography live farther away on average. Hunters appear to live the farthest from the shoreline on average (7.63km).

Table 16: Average distance of residents from the shoreline by recreational activity engagement (km)

Activity	Distance to Shoreline (km)
Beach-going	7.15
Nature/ Scenic Photography	7.34
Birdwatching	7.22
Marine Mammal Watching	7.09
Fishing	7.30
Hunting	7.63
Boating or Sailing	7.15
SCUBA Diving	7.19

Photograph 11: South Carolina beach at low tide
Photo courtesy of Catherine Ward, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/)

As beach-going is the most common and most important activity, this relationship was explored spatially. Figure 12 displays the percentage of people who go to the beach in each block group who find beach-going Extremely Important or Very Important. Red depicts areas that have a higher percentage of Extremely or Very Important beach-goers. The figure suggests that beach-going is relatively important regardless of household distance to the shoreline. In some cases, the percentage of residents who find this activity Extremely or Very Important is higher in areas further inland than in shoreline-adjacent areas. This indicates inland residents are connected to the Carolina coast through this activity.

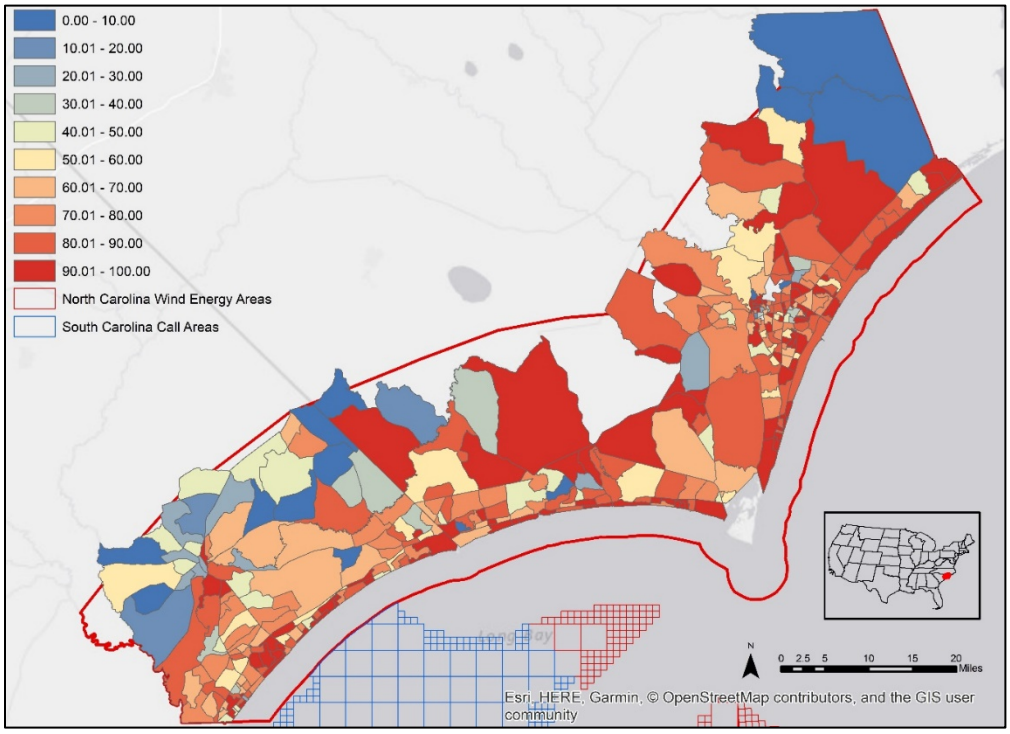


Figure 12: Distribution of residents rating beach-going as Extremely or Very Important (percent)

Figures 13 and 14 show the percentage per block group of birdwatching and marine mammal watching for study area residents who find each activity Extremely or Very Important. Block groups with a higher percentage of residents who find birdwatching Extremely or Very Important are found sporadically throughout the study area. A similar pattern is found for marine mammal watching, but the overall importance is greater.

Photograph 12: Coastal vegetation
Photo courtesy of Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/)

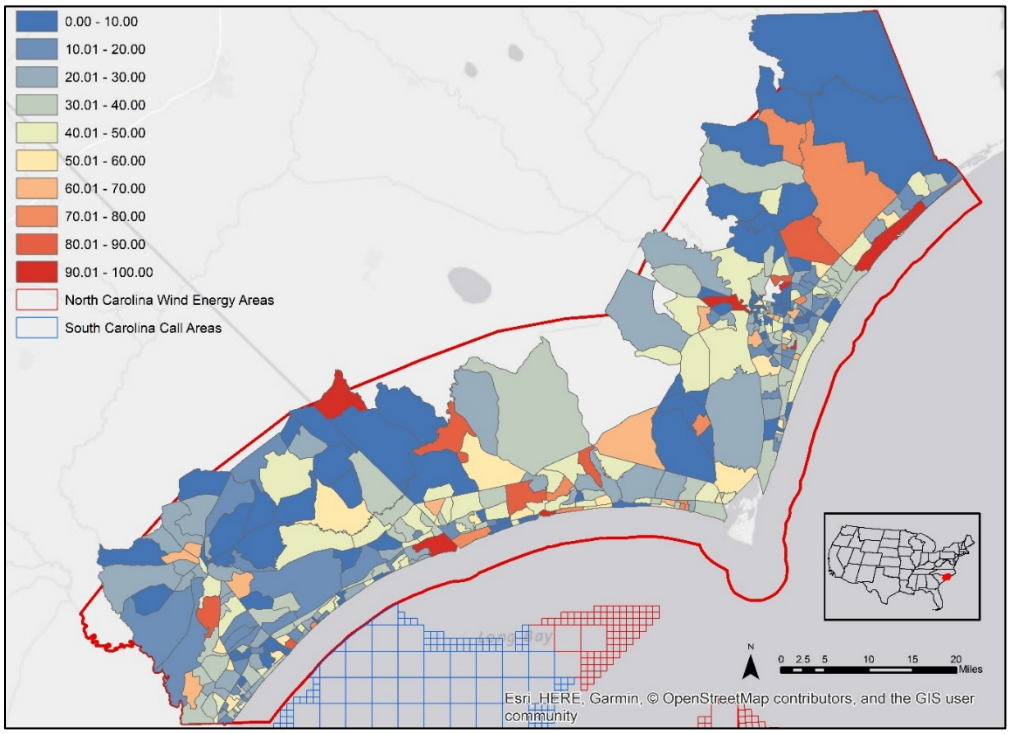


Figure 13: Distribution of residents rating birdwatching as Extremely or Very Important (percent)

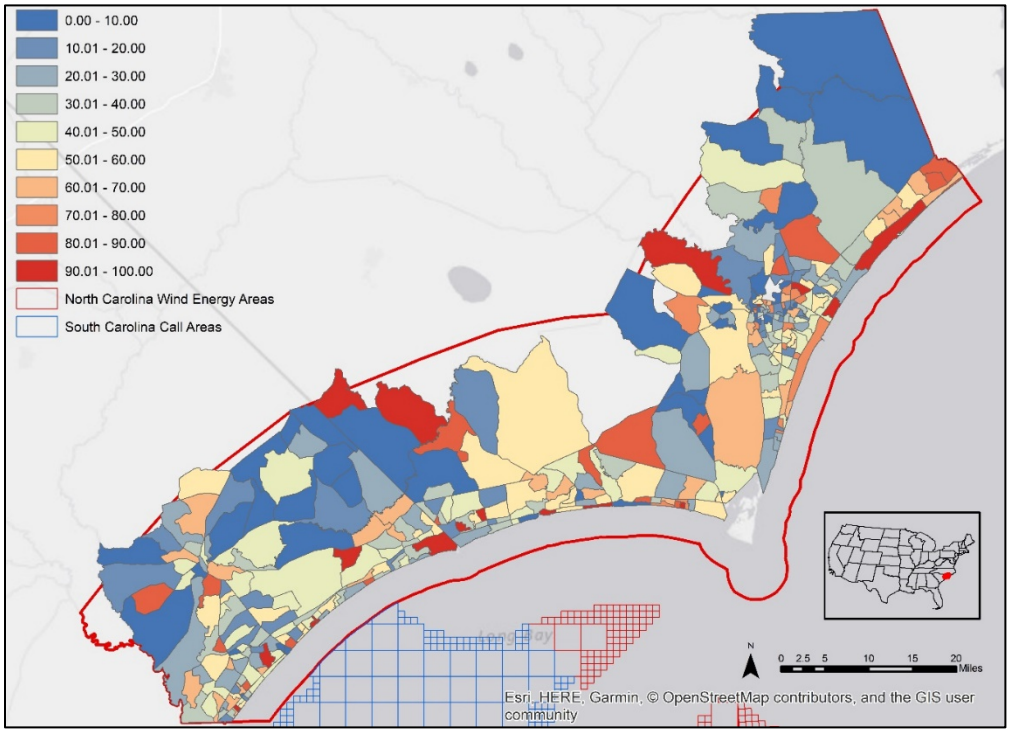


Figure 14: Distribution of residents rating marine mammal watching as Extremely or Very Important (percent)

Past studies predicted that participation in highly valued recreational activities strengthens one's connection to a place (Hammit et al. 2004; Moore and Graefe 1994; Stokols and Shumaker 1981). Residents in the study region are connected to the Carolina coast because of the importance placed on coastal and marine recreational activities.

3.2.3 Social Values and Favorite Places

Respondents were asked to identify three Favorite Places on a map of the Carolina coast specific to the area of the sampling geography, and select the social values they associate with each location identified. Six social values types were used in this research: Aesthetics, Economics, Historic, Naturalness, Recreation, and Relaxation. This list was narrowed from Rolston and Coufal's (1991) original ten social value types, employing the social values most frequently chosen by respondents in previous studies (Brown and Kyttä 2014; van Riper et al. 2012; Nielsen-Pincus 2011). An "Other, please specify" response was offered to capture additional social values beyond those listed. Respondents were allowed to select as many of the social value types from the list as they wished to associate with their Favorite Places. Social value definitions were provided to respondents. The respondent was instructed as follows (for full item, see Appendix A, Question 6, Page 4 of the survey):

> Please draw a line connecting each pencil to one of your favorite places inside the black boundary on this map. Then mark all the reasons that you value each place.
>
> **Aesthetics:** I value this area because I enjoy the beauty, sights, sounds, and smells found here.
> **Economic:** I value this area because it provides fisheries, minerals, and/or tourism opportunities such as outfitting and guiding.
> **Historic:** I value this area because of the historic significance to our culture and communities.
> **Naturalness:** I value this area because it is undeveloped with minimal human impact and it provides a variety of fish, wildlife, plant life, etc.
> **Recreation:** I value this area because it provides a place for my favorite outdoor recreation activities.
> **Relaxation:** I value this area because it makes me feel better, physically and/or mentally; it is calming.
> **Other:** I value this area because of a reason not listed above. Please specify in the blank provided.

"Other" responses were excluded from analysis due to the difficulty in deciphering the intention of the respondents in identifying social values versus specifying additional details. For example, respondents specified particular types of amenities (e.g., parking, shopping, golf course), activities (e.g., birdwatching), and locations (e.g., home, Myrtle Beach). In combination with the social value data, researchers examined the characteristics of favorite locations identified, in terms of proximity to amenities and attractions, along with land use.

Overall, the top three values reported for all Favorite Places by percentage of selection are: Relaxation, Recreation, and Aesthetics (Figure 15). These three values are also most common for each of the three Favorite Places, individually.

Respondents' chosen locations were assigned to 10 square km cells during the survey coding process for spatial analysis and to visualize the spatial distribution of Favorite Places. Figure 16 shows which cells hold the most Favorite Places as a percentage of the total recorded by residents in the study region. The

darker blue cells indicate the most important places identified across all social values. These cells cluster near the shoreline and in areas of high population density, especially around Wilmington, NC and Myrtle Beach, SC. Correlation analysis between the number of each value type reported in each cell shows that the values are correlated with each other geographically (Kendall tau ranging from .883 to .970), which means the same places are deemed favorites across a variety of value types.

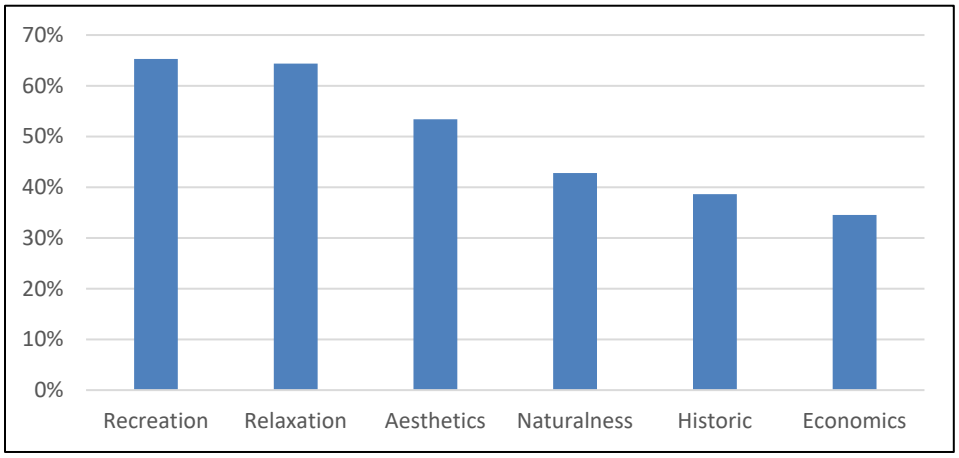


Figure 15: Percentage of social value counts by type for all Favorite Places

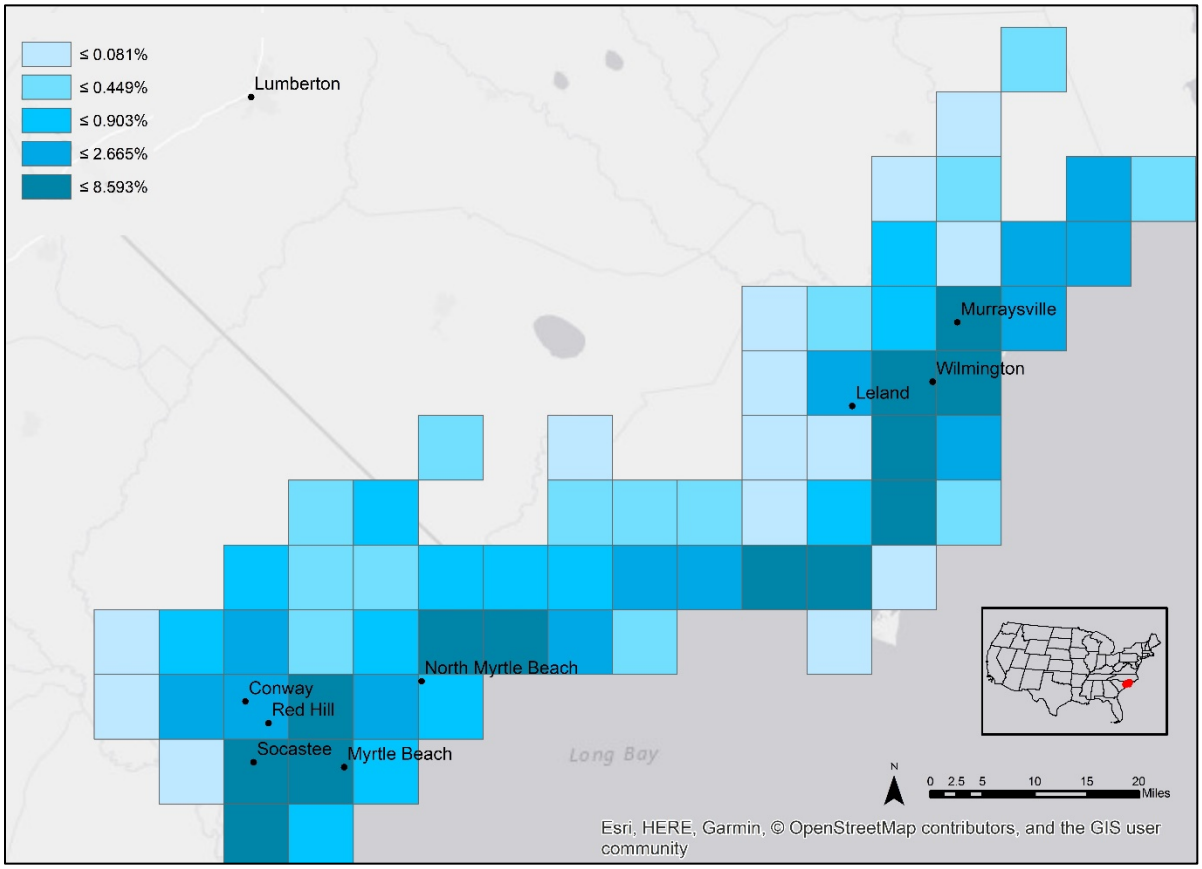


Figure 16: Distribution of residents' Favorite Places across the study region

Correlation analysis was run to explore the relationship between the number of Favorite Places in a cell to the number of natural and cultural attractions that might be driving the importance of these areas. There is a strong, positive correlation between the number of Favorite Places and the number of attractions in cells (Pearson correlation shows r=.697 and p<0.001), demonstrated by the darker purple color on the map shown in Figure 17. However, many of the attractions in the study region are churches, which are associated with spiritual values. Because the survey question did not specifically solicit spiritual values, researchers wanted to ensure the correlation was not driven by churches, so churches were removed to test how their presence was influencing the relationship. Results continue to show a moderately strong correlation (r=.609 and p<<.001) between the number of Favorite Places and attractions present in cells.

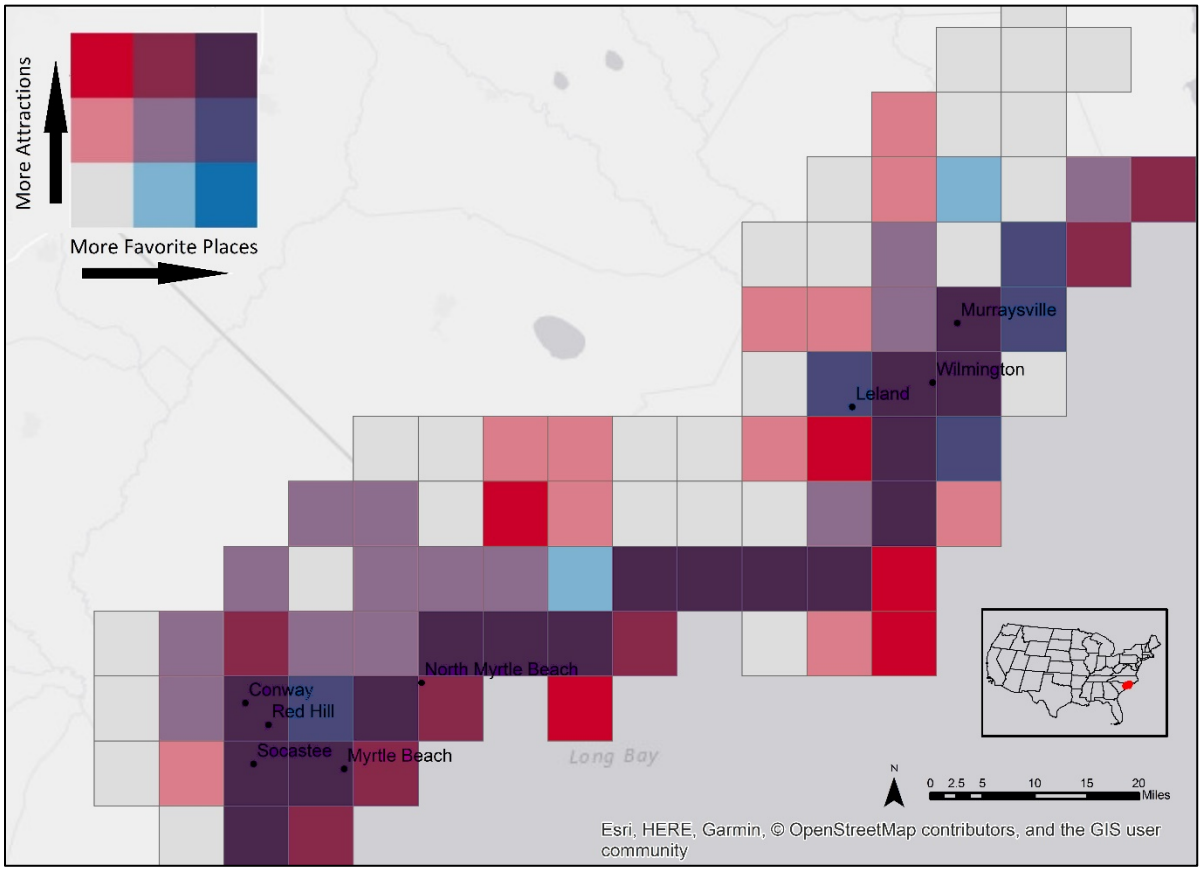


Figure 17: Attractions and Favorite Places per geographic cell

Results indicate that attractions and the locations of residents' Favorite Places are most commonly adjacent to the shoreline. This suggests residents are connected to the Carolina coast in their preference for favorite locations, perhaps in part driven by the coastal attractions found there, such as beaches. Alternatively, people may site attractions near favorite locations, such as along a waterfront (shoreline or riverfront).

Table 17 and Figure 18 show the tabular and spatial representation of respondents' first, second, and third Favorite Places. Cell #36, which encompasses Myrtle Beach, SC, is the most socially valued with four of the six values associated with it. For the second Favorite Place location, Cell #88, which contains several golf courses, the Oak Island Lighthouse, and the Intracoastal Waterway, is the most important, with three of the six value categories attached to this location (Table 17). For the third Favorite Place location, Cells

#88 and #147, which encompass Wilmington, NC, are equally most valued, each having three of the six values associated with them.

Table 17: Frequency count of social values for Favorite Places by cell

Favorite Place #1	
CELL NUMBER	VALUE
36	Aesthetics
36	Economics
147	Historical
107	Naturalness
36	Recreation
36	Relaxation

Favorite Place #2	
CELL NUMBER	VALUE
88	Aesthetics
147	Economics
147	Historical
88	Naturalness
36	Recreation
88	Relaxation

Favorite Place #3	
CELL NUMBER	VALUE
88	Aesthetics
147	Economics
147	Historical
88	Naturalness
147	Recreation
88	Relaxation

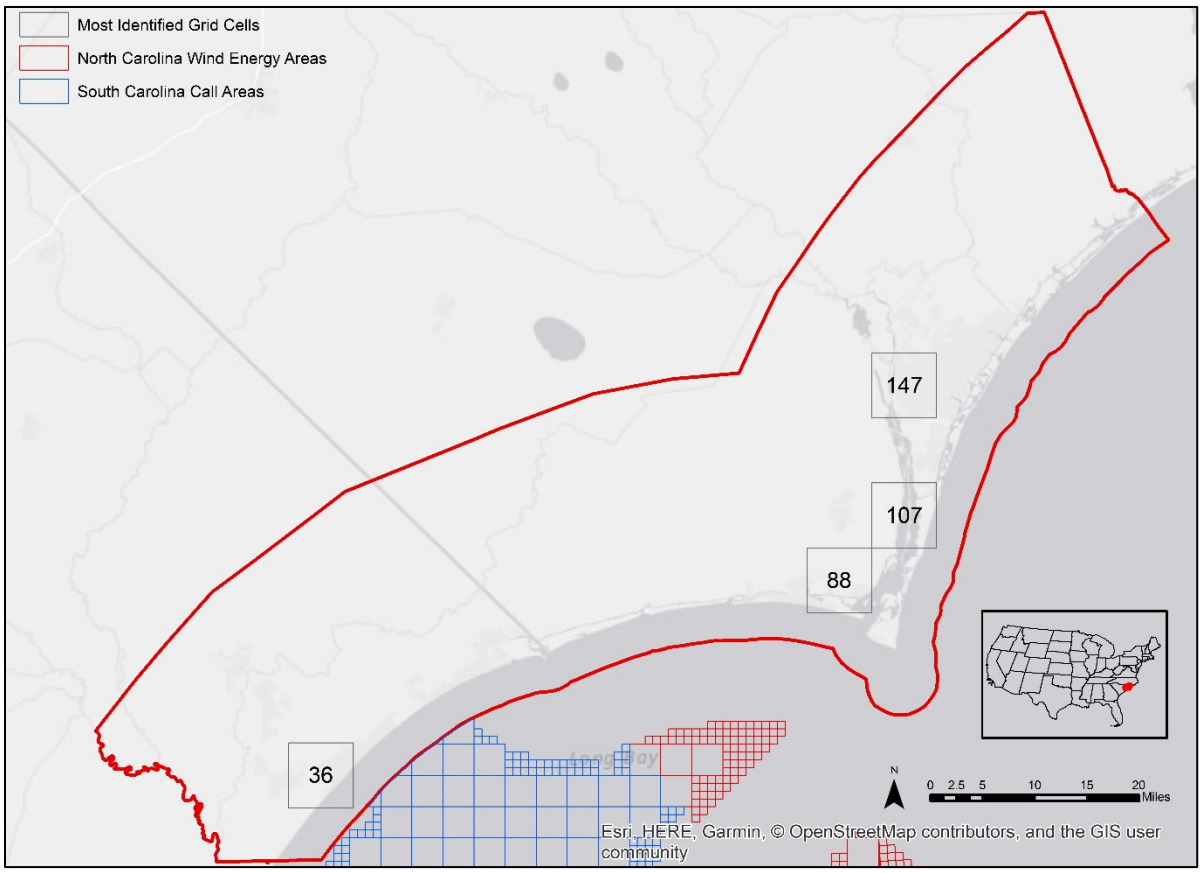


Figure 18: Top four cells having the majority of Favorite Places identified

To explore what might be driving the importance of these particular areas to respondents, land use/land cover characteristics (e.g., impervious surface) were examined, along with attractions. Cells #88 and #107 have high levels of undeveloped land area coverage, with 81% and 87% undeveloped land coverage, respectively, which may explain why respondents value these cells for Naturalness. Cell #88 is predominantly beachfront, where most attractions are related to beach access and associated infrastructure. Cell #107 includes Kure Beach and Carolina Beach State Park, a large park featuring noteworthy populations of carnivorous plant species and offering a number of outdoor recreational opportunities. On the other hand, Cells #36 and #147, which are part of the Myrtle Beach and Wilmington areas, each have over half of their land area covered by development, with 55% and 53% developed land

coverage, respectively. The presence of more development may explain why respondents value these cells for Economic (Brown 2013) and Historic values, but not Naturalness.

Findings indicate that the Carolina coast shoreline is highly valued by residents in the study region. The shoreline is particularly important for its Relaxation, Recreation, and Aesthetics values. Thus, place attachment in the region is likely to be strongly mediated by place dependence (Schreyer et al. 1981; Jacob and Schreyer 1980), in the form of recreational importance and restorative value (i.e., places important for comfort and relaxation) (Devine-Wright 2011a). These findings are consistent with results related to the importance of recreational activities in the region, of which beach-going is most important. Additionally, the high social value associated with the shoreline region, in combination with the importance of beach activities, is evidence of specialness of the ocean and coastal environments for residents in the region (Kempton et al. 2005).

3.3 Importance and Expectations of Impact

To understand the relationship between importance and perceived impact by wind energy development, data were collected on perceived importance and impact on select quality of life items.

Two coordinated survey item sets were served to obtain the necessary information for the importance-impact analysis:

> Item Set 1: For the items listed below, please tell us how important each item is to you in terms of your quality of life on the Carolina coast.
>
> Item Set 2: Based on the impressions you have at present time, and thinking about the Carolina coast as shown on page 1, please indicate the type of impact you think development of offshore wind would have for each of the items listed below.

The first set asked respondents to rate the importance of twelve items in terms of quality of life on the Carolina coast. Items listed include tax revenues, job opportunities, affordability of electricity, image of your community, shipwrecks and other submerged maritime heritage sites, local property values, view of ocean from the shore during the day, view of ocean from the shore at night, recreational fishing, habitat for birds, habitat for fish, and habitat for marine mammals and sea turtles. Items were chosen due to their likely or perceived impacts from offshore wind energy development given previous studies (Larson and Krannich 2016; Firestone et al. 2012; Kimmell and Stalenhoef 2011; Jessup 2010; Firestone and Kempton 2007), with the exception of shipwrecks and view of ocean from the shore at night. “Shipwrecks” was included at the suggestion of representatives from NOAA’s Office of National Marine Sanctuaries. “View of ocean from the shore at night” was included at the suggestion of local government officials in a city near the Wilmington West WEA in NC. Later in the survey, the second item set was asked with the same list provided in item set one.

Table 18 summarizes the results of these questions in order of item importance. The mean scores are reported along with the estimated standard errors of the mean, the response rate, and the rate at which respondents either did not know how important the item was to them or were unsure of the potential impacts of offshore wind energy development on the item. Neither economic nor environmental items appear to dominate in terms of importance; however, the expected impacts tend to be positive for economic items and negative for environmental items.

Importance and impact are often correlated. Residents feeling property values are important tend to also feel community image is important ($r=0.46$, $p=0.00$). Respondents who feel daytime views are important

also feel nighttime views are important (r=0.81, p=0.00). Respondents who feel one type of wildlife habitat is important tend to feel all wildlife habitats are important (fish/bird: r=0.80, p=0.00; fish/mammal: r=0.84, p=0.00; bird/mammal: r=0.76, p=0.00). These relationships hold for potential impacts as well (property values/community image: r=0.51, p=0.00; views: r=0.81, p=0.00; fish/bird: r=0.69, p=0.00; fish/mammal: r=0.78, p=0.00; bird/mammal: r=0.70, p=0.00).

Table 18: Importance and impact results by level of importance

Item			Mean	Standard Error	Response Rate (%)	Surety Rate (%)
A	**Local property values**	Importance	3.43	0.01	98	96
		Impact	0.09	0.02	62	27
B	**Electricity affordability**	Importance	3.35	0.01	99	98
		Impact	0.78	0.01	75	53
C	**Marine mammal and sea turtle habitat**	Importance	3.34	0.01	97	95
		Impact	-0.21	0.02	60	23
D	**Community image**	Importance	3.29	0.01	98	97
		Impact	0.09	0.02	67	36
E	**Fish habitat**	Importance	3.24	0.01	97	94
		Impact	-0.05	0.02	64	29
F	**Daytime ocean views**	Importance	3.18	0.02	97	96
		Impact	-0.46	0.01	70	42
G	**Bird habitat**	Importance	3.07	0.02	96	93
		Impact	-0.30	0.02	62	26
H	**Job opportunities**	Importance	3.05	0.02	97	94
		Impact	0.81	0.01	76	53
I	**Tax revenues**	Importance	2.99	0.02	89	81
		Impact	0.55	0.02	59	21
J	**Nighttime ocean views**	Importance	2.97	0.02	97	95
		Impact	-0.30	0.01	69	39
K	**Recreational fishing**	Importance	2.60	0.02	94	88
		Impact	-0.15	0.02	63	27
L	**Shipwrecks and other submerged maritime heritage sites**	Importance	2.43	0.02	89	78
		Impact	-0.34	0.01	59	21

In general, residents of the study region are more certain about the importance of quality of life items than the perceived impacts that offshore wind energy development might have on them. Additionally, response rates were much lower for impacts than for importance, possibly due to respondents not providing an answer when they were unsure of the impacts.

Figure 19 further explores the response rate and surety for impact responses. In general, residents seem more confident about impacts that could directly affect them. For example, residents are most sure of the impacts on electricity affordability and job opportunities, followed by ocean views. They are least sure about impacts on tax revenues and shipwrecks, followed by wildlife habitats. Overall, results suggest residents in the study region are relatively uncertain about the potential impacts of offshore wind energy development.

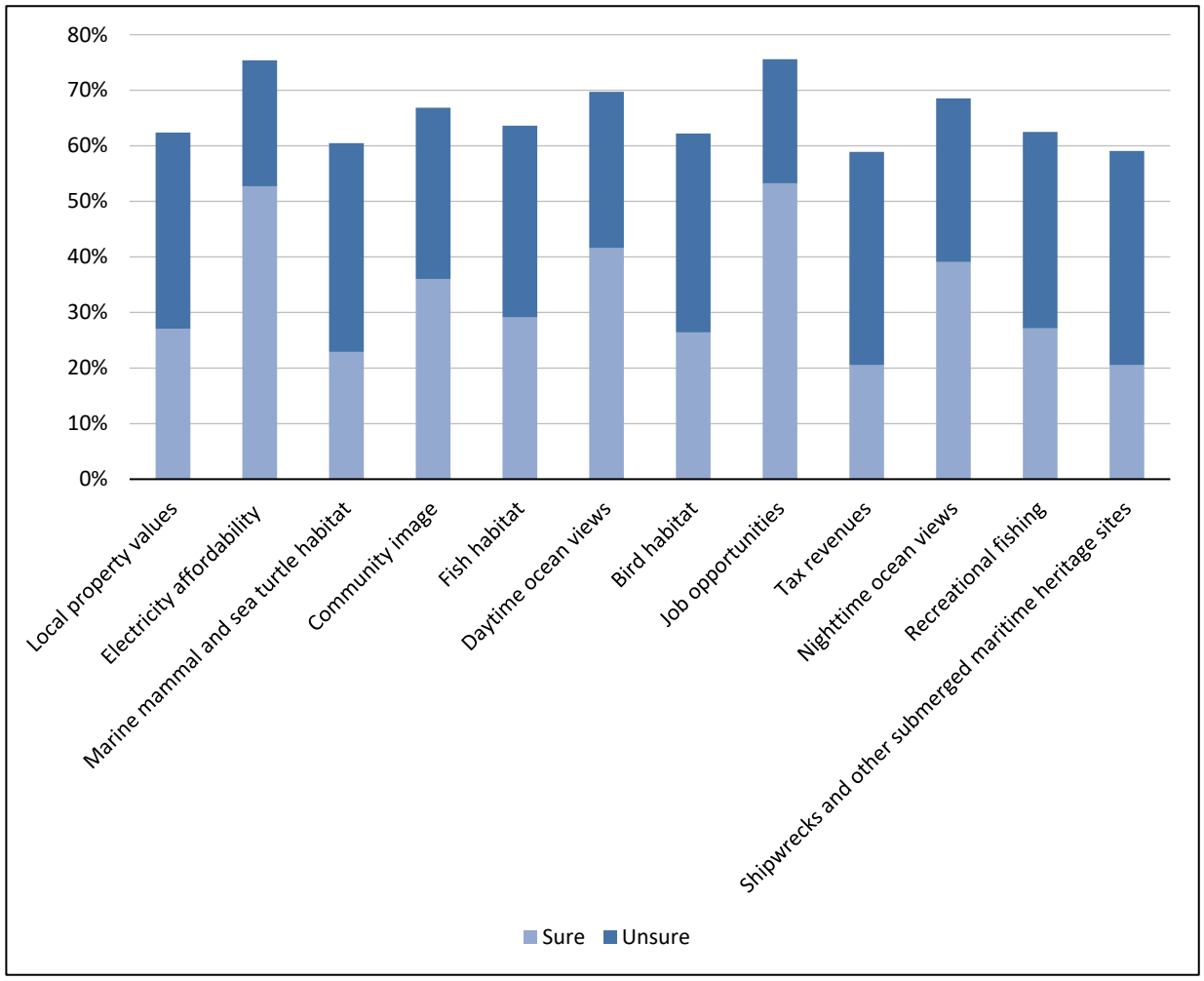


Figure 19: Surety rates for those completing the impact to quality of life items (percent)

Finally, Figure 20 displays the full results of the importance-impact analysis in a four-quadrant presentation. The four quadrants were formed by first placing the importance measurement on the vertical axis and the impact measurement on the horizontal axis. An additional vertical line was placed at zero on the impact scale (no impact) and an additional horizontal line was placed at the mean score for all twelve items on the importance scale. These two lines form a cross hair, which separates the area into four quadrants. This allows for interpretation to the "relative importance" and whether the impacts are perceived to be positive or negative. Scores falling in the upper left quadrant are relatively high on the importance scale and are perceived to be negatively impacted by offshore wind energy development. Scores falling in the upper right quadrant are also relatively high on the importance scale and are

perceived to be positively impacted by offshore wind energy development. Scores falling in the lower left quadrant are relatively low on the importance scale and are perceived to be negatively impacted by offshore wind energy development. Finally, scores falling in the upper right quadrant are also relatively low on the importance scale and are perceived to be positively impacted by offshore wind energy development.

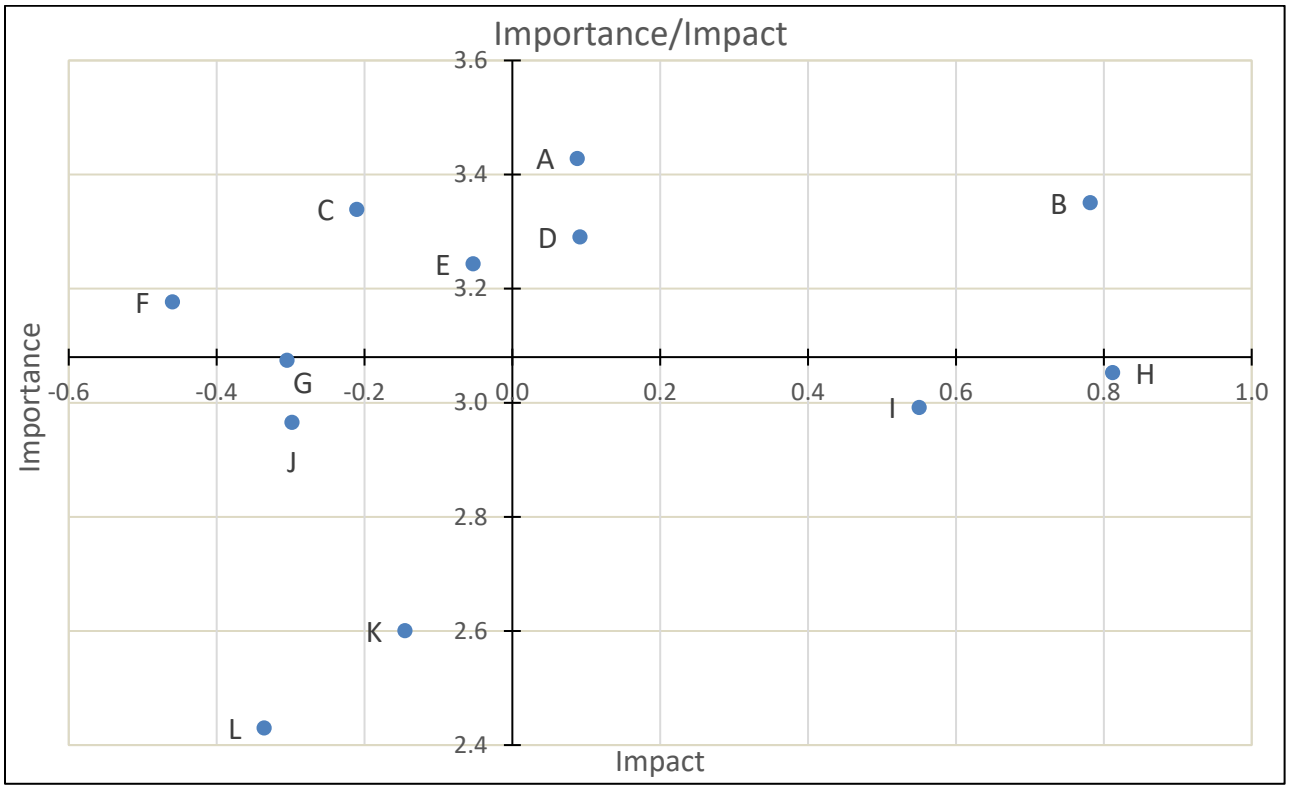


Figure 20: Importance-impact results in quadrants

Quality of life items of high importance and negative expected impact include marine mammal and sea turtle habitat (C), fish habitat (E), and daytime ocean views (F). Items of high importance and positive expected impact include local property values (A), electricity affordability (B), and community image (D). Items of low importance and negative expected impact include bird habitat (G), nighttime ocean views (J), recreational fishing (K), and shipwrecks and other submerged maritime heritage sites (L). Lastly, items of low importance and positive expected impact include job opportunities (H) and tax revenues (I).

These results suggest that when messaging about the benefits of offshore wind energy development to residents in the study region, policy-makers should focus on the positive impacts relative to local property values, electricity affordability, and community image. Alternatively, if assuaging public concerns about the risks and negative impacts of offshore wind energy development is the goal, policy-makers should ensure risks to marine mammal and sea turtle habitat, fish habitat, and daytime ocean views are mitigated, and the public is aware and understands the possible impacts on these items. Generally, this information can help policy-makers better understand the disconnect between what people in the study region think the impacts of offshore wind energy development will be versus what the actual impacts are likely to be.

3.4 Awareness of Offshore Wind Energy Development

From August 2013 to September 2016, BOEM hosted a series of public meetings about potential offshore wind energy development in NC. Additionally, local media covered public discourse about the possibility for offshore wind energy development in the state. Consequently, residents of the Carolinas had opportunities to gain awareness of offshore wind energy development efforts in the region prior to data collection for this study. However, during pretest a number of potential respondents communicated that they were not aware of the offshore wind energy issue and, therefore, felt unqualified to take the survey. Additionally, respondents expressed this concern during pretest follow-up inquiries. For this reason, care was taken to clarify in the survey instrument and related materials that awareness of offshore wind energy and local offshore wind energy development efforts were not required for completion of the survey or the support level item.

Respondents were asked to report their level of awareness about offshore wind energy development efforts in three geographies (US, NC, and SC) using a five point Likert scale from Not at All Aware to Extremely Aware with the following question:

> How aware are you of efforts to develop offshore wind energy in the following areas?

Item response rates for the awareness question were 98%, 97%, and 98% for each of the three geographies, US, NC, and SC, respectively.

As shown in Figure 21, 77% of residents in the sampling region have some level of awareness about offshore wind energy development in the US. However, of those reporting some level of awareness about offshore wind energy development in the Carolinas, most claim slight awareness for activities in both states. Just under half of residents report no awareness about efforts to develop offshore wind energy in the Carolinas.

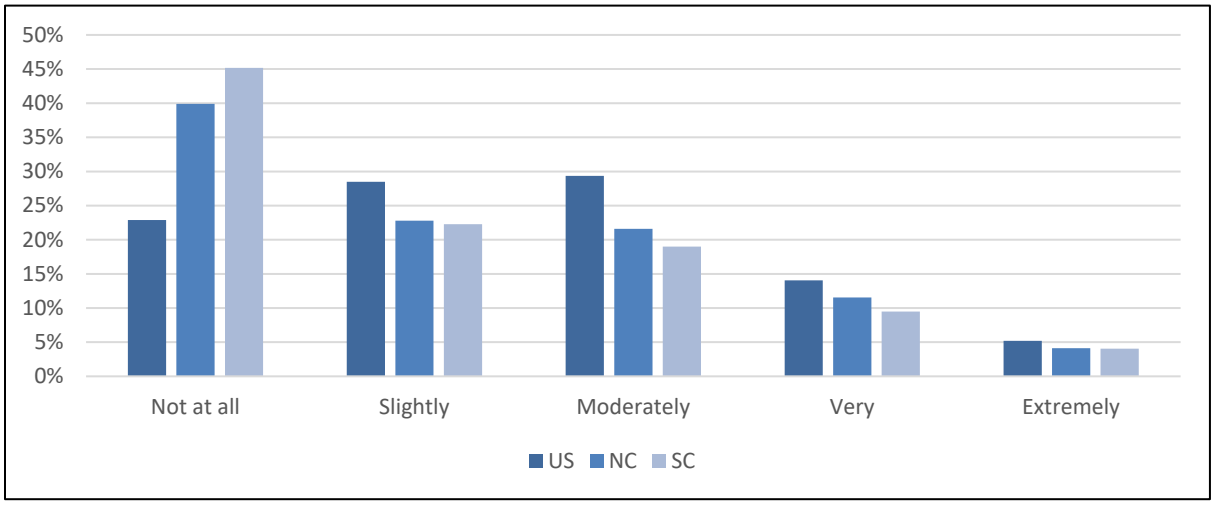


Figure 21: Awareness of offshore wind energy development in the US, NC, and SC (percent)

Table 19 highlights differing levels of awareness about offshore wind energy development in each of the three geographies by state of residence. Residents of NC are statistically more likely to report awareness of offshore wind energy development in NC (F=25.79, p=0.00) and the US (F=5.06, p=0.00) than SC residents. However, SC residents are statistically more likely to report awareness in SC (F=9.45, p=0.00).

Table 19: Awareness of offshore wind energy development by state of residence (percent)

Location of Efforts	State of Residence	Not at All	Slightly Aware	Moderately Aware	Very Aware	Extremely Aware
US	NC	20	26	33	16	6
	SC	25	31	26	13	4
NC	NC	29	25	24	16	6
	SC	50	21	20	7	2
SC	NC	52	22	16	7	3
	SC	39	22	22	12	5

As shown in Table 20, NC residents living near the shoreline report more awareness of offshore wind energy development in their own state than do their fellow residents living further inland. The opposite is true in SC. SC residents living further inland report more awareness of offshore wind energy development in their own state than do SC residents nearest the shoreline.

Table 20: Awareness of offshore wind energy development by mean distance of household to the shoreline (km)

State of Residence	Not at All	Slightly Aware	Moderately Aware	Very Aware	Extremely Aware
NC	6.92	6.48	5.69	6.06	6.34
SC	7.05	7.74	7.62	7.23	7.77

Results generally suggest there is no to slight awareness of local offshore wind energy development among residents of the Carolina coast, although NC residents are more likely to report some level of awareness of activities in their own state. This finding is logical because planning activities related to offshore wind energy development were well underway in NC when this research was initiated. NC residents had more time and opportunity for exposure to information about local planning. However, residents in both states are still more likely to be aware of national efforts than they are to be aware of activities in their own state.

3.5 Support Level for Offshore Wind Energy Development

After reporting level of awareness, respondents were asked to report their support level for efforts to develop offshore wind energy in three geographies (US, NC, and SC) using a five point Likert scale from 1 (Strongly Oppose) to 5 (Strongly Support) with an option to report a neutral position. The following question was posed:

> Regardless of how aware you are about efforts to develop offshore wind energy, and based on the impressions you have at the present time, what is your level of opposition to or support for the development of offshore wind energy in the following areas?

The item response rate was 98%, 97%, and 97% for the US, NC, and SC geographies, respectively.

Figure 22 displays support level by geography. Residents in the study region are statistically more likely to support offshore wind energy development in the US than in either NC ($F=267.24$, $p=0.00$) or SC ($F=222.44$, $p=0.00$). For each of the three geographies, residents in the study region report neutrality as often as support for offshore wind energy development.

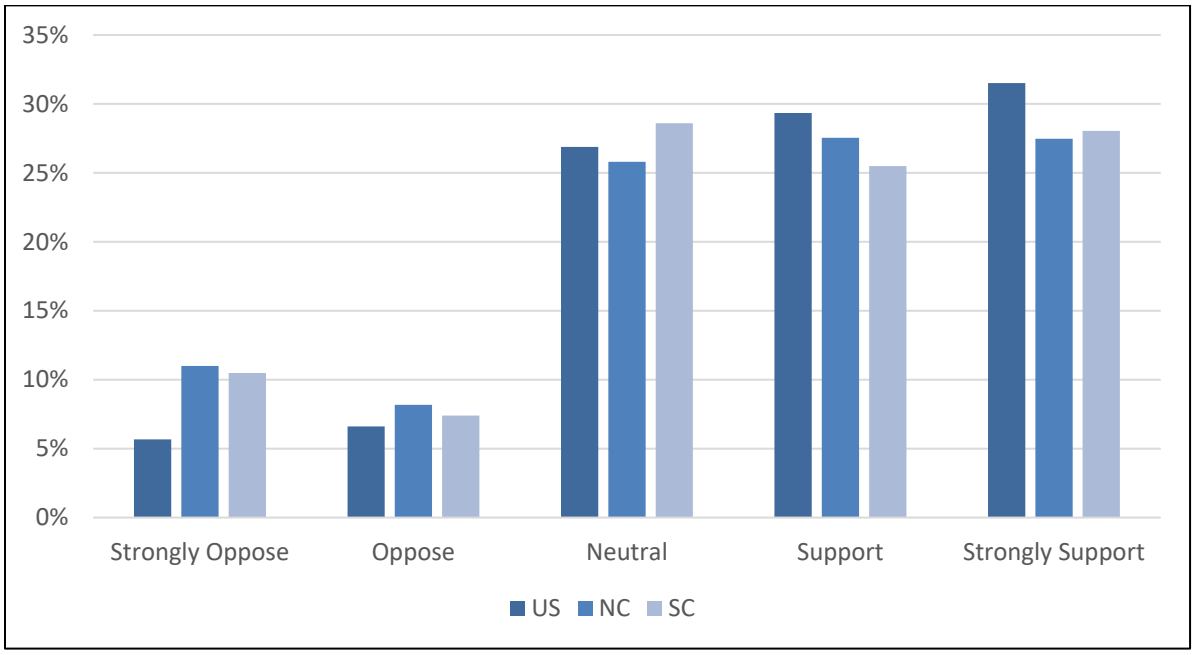


Figure 22: Support for offshore wind energy development in the US, NC, and SC (percent)

As shown in Table 21, 26% of residents from NC report a neutral position on US offshore wind energy development, and 28% of SC residents take a neutral stance. However, residents of NC are statistically less likely to support offshore wind energy development in NC (F=11.21, p=0.00), SC (F=5.21, p=0.00), and the US (F=4.33, p=0.00) than SC residents. Additionally, SC residents are more supportive of efforts in SC than are NC residents. SC residents report a neutral position more often for offshore wind energy development in NC.

Table 21: Support for offshore wind energy development in the US, NC, and SC by State of Residence (percent)

Location of Efforts	State of Residence	Strongly Oppose	Somewhat Oppose	Neutral	Somewhat Support	Strongly Support
US	NC	77	8	26	27	31
	SC	4	4	28	32	31
NC	NC	15	9	22	27	28
	SC	6	7	31	28	27
SC	NC	12	8	31	22	27
	SC	8	7	26	29	30

Figures 23, 24, and 25 display support level for offshore wind energy development efforts by resident's reported level of awareness. Generally, residents who Strongly Oppose or Strongly Support offshore wind energy development tend to report higher levels of awareness. Residents who are Very or Extremely Aware of development efforts tend to report an oppositional stance, or claim strong support. Residents with high awareness levels tend not to claim neutrality. By contrast, slight awareness generally equates to a neutral or somewhat supportive position, while moderate awareness equates to support with an equal tendency toward somewhat and strongly supportive positions.

However, for both NC and SC the polarized effect related to higher levels of awareness (Very and Extremely Aware) is more pronounced. These findings imply that the more awareness residents have

about offshore wind energy development, the more likely they are to report a strong position, whether for or against. At the same time, residents who report neutrality tend to be unaware at the local level. Residents who are supportive of offshore wind energy development or neutral on the issue at the national level, in addition to being Not at All Aware of local efforts, are significantly more likely to be neutral about local efforts (F=74.54, p=0.00). This finding suggests the neutral group claiming no awareness is potentially comprised of residents who have yet to make a decision on offshore wind energy development.

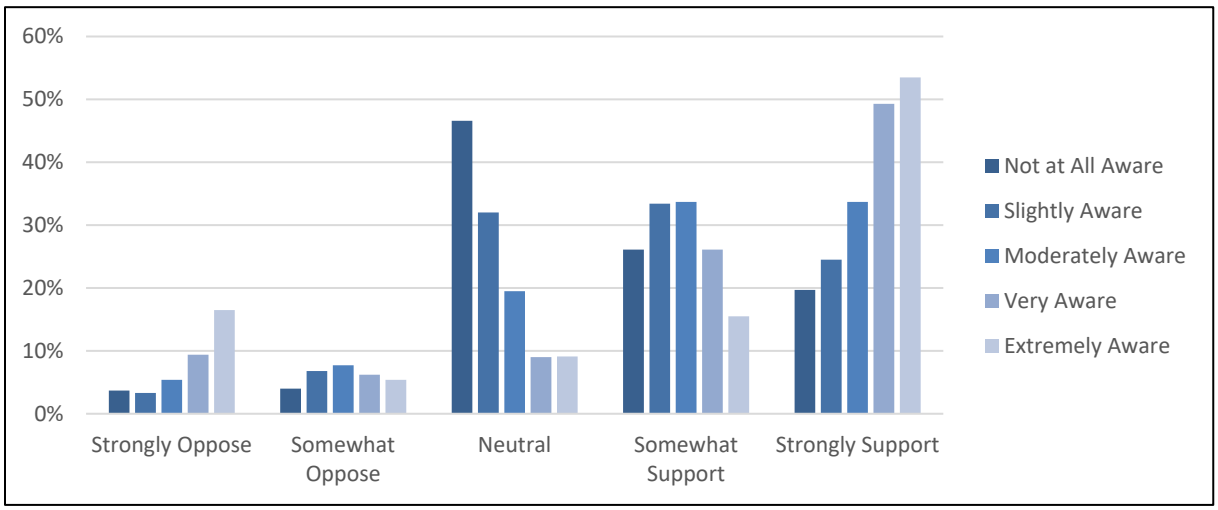


Figure 23: Support for offshore wind energy development in the US by awareness of offshore wind energy development in the US (percent)

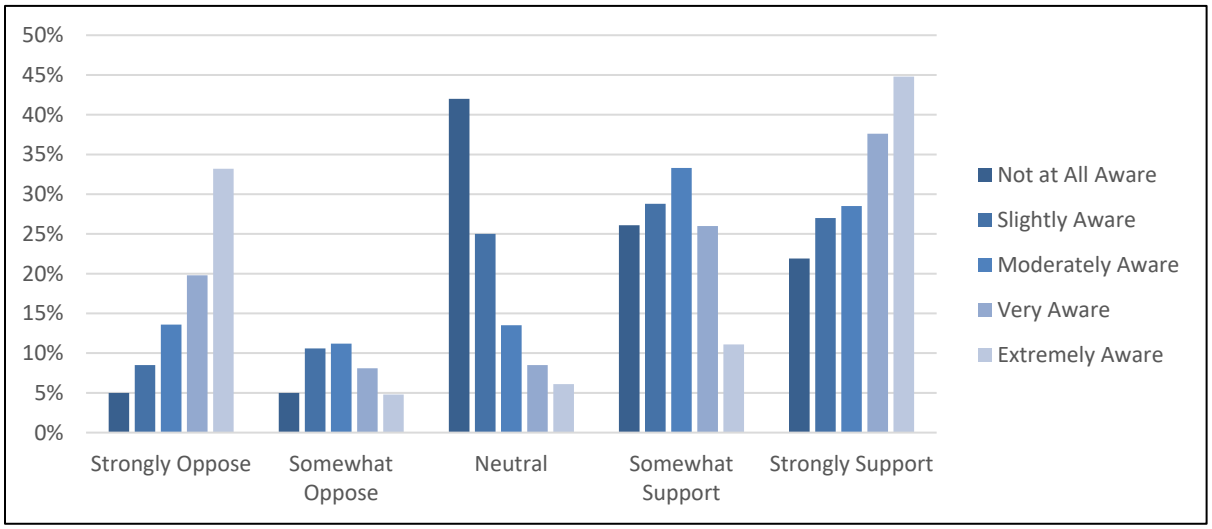


Figure 24: Support for offshore wind energy development in NC by awareness of offshore wind energy development in NC (percent)

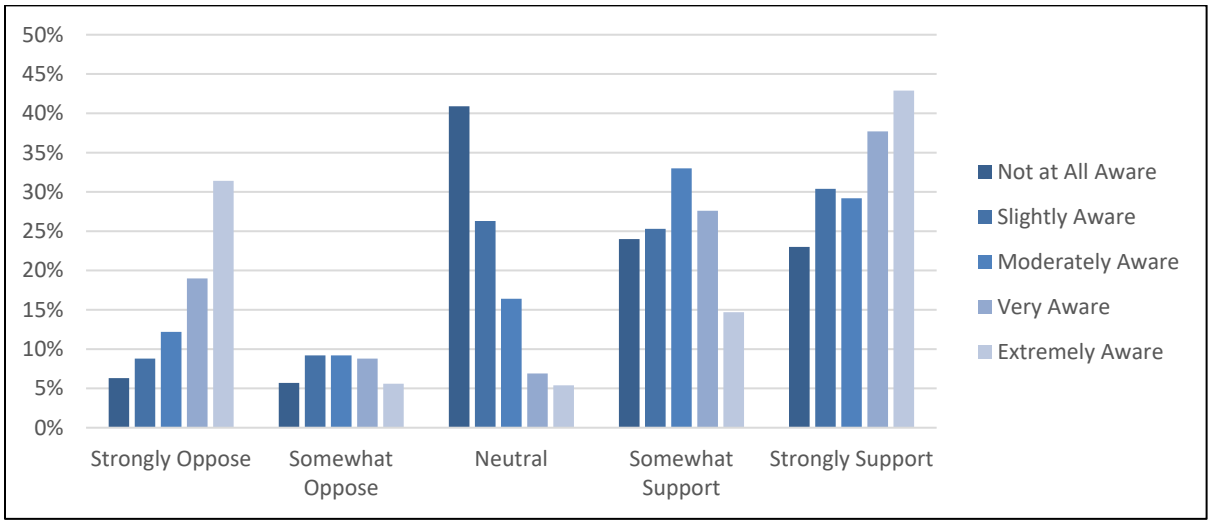


Figure 25: Support for offshore wind energy development in SC by awareness of offshore wind energy development in SC (percent)

Figures 26 and 27 provide the spatial distribution of the relationship between awareness of offshore wind energy development combined with support level for efforts in one's own state. For both maps, awareness is represented on a scale from 1 to 5, with 5 being the highest level of awareness. Support is also represented on a scale from 1 to 5, with 5 being the highest level of support. The areas in darker blue tone are block groups reporting the highest levels of awareness with the lowest levels of support. Conversely, the areas in the darker red-brown tone are block groups with the highest levels of awareness as well as the highest levels of support. Thus, these maps show the greatest ratio of awareness to support for each of the block group geographies across the study region.

Photograph 13: Offshore wind turbines in the distance, with birds flying in the foreground
Photo courtesy of Ian Dyball © 123RF.com.

The spatial distribution of level of awareness by level of support for offshore wind energy development in NC is shown in Figure 26. Within the NC portion of the study area, there is somewhat more awareness and less support for NC offshore wind energy development nearer to the shoreline, noted by predominance of the blue tones in this region. This interpretation is consistent with findings that NC residents who are in opposition (F=19.94, p=0.00) live closer to the shoreline than those who are neutral or in support (F=26.90, p=0.00). Pockets of support within NC, noted by the red tones, appear inland from the shoreline, and are characterized by higher levels of awareness. However, based on household distance to the shoreline, no significant differences are found for NC residents who are neutral, supportive, or strongly supportive (F=0.91, p=0.40). Finally, the figure highlights that residents in the SC portion of the study region support efforts in NC; however, SC residents who strongly oppose offshore wind energy development live significantly closer to the shoreline than all others (F=5.59, p=0.02).

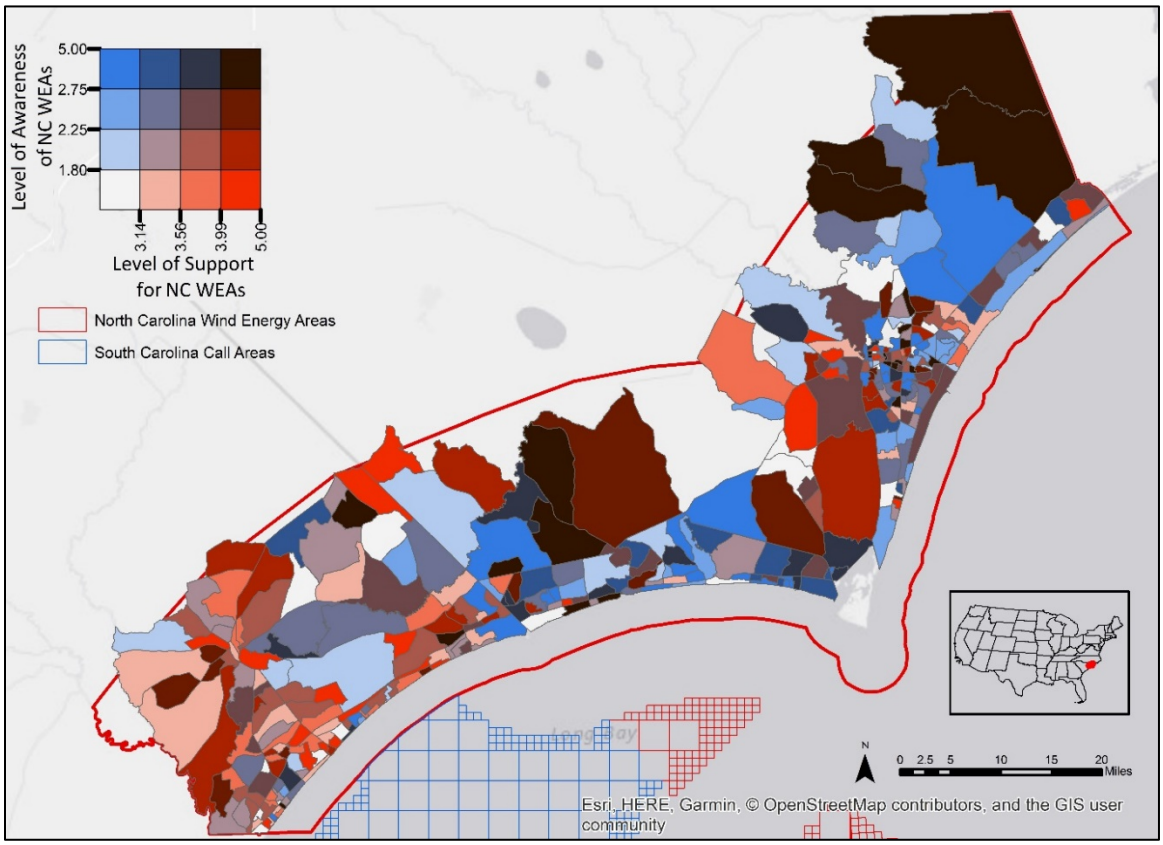


Figure 26: Awareness by support for offshore wind energy development in NC

Looking at support for offshore wind energy development in SC by awareness in SC (Figure 27), the map indicates strong support by residents living in the SC portion of the study area, but with varying levels of awareness. This trend is demonstrated by the patchy dark blue and dark red pattern across the SC portion of the map. In the NC portion of the study area, the color pattern indicates there is moderate support for offshore wind energy development in SC in some NC areas located inland and along the shoreline. In NC, support for SC efforts tends to be accompanied by slight to moderate levels of awareness in most locations.

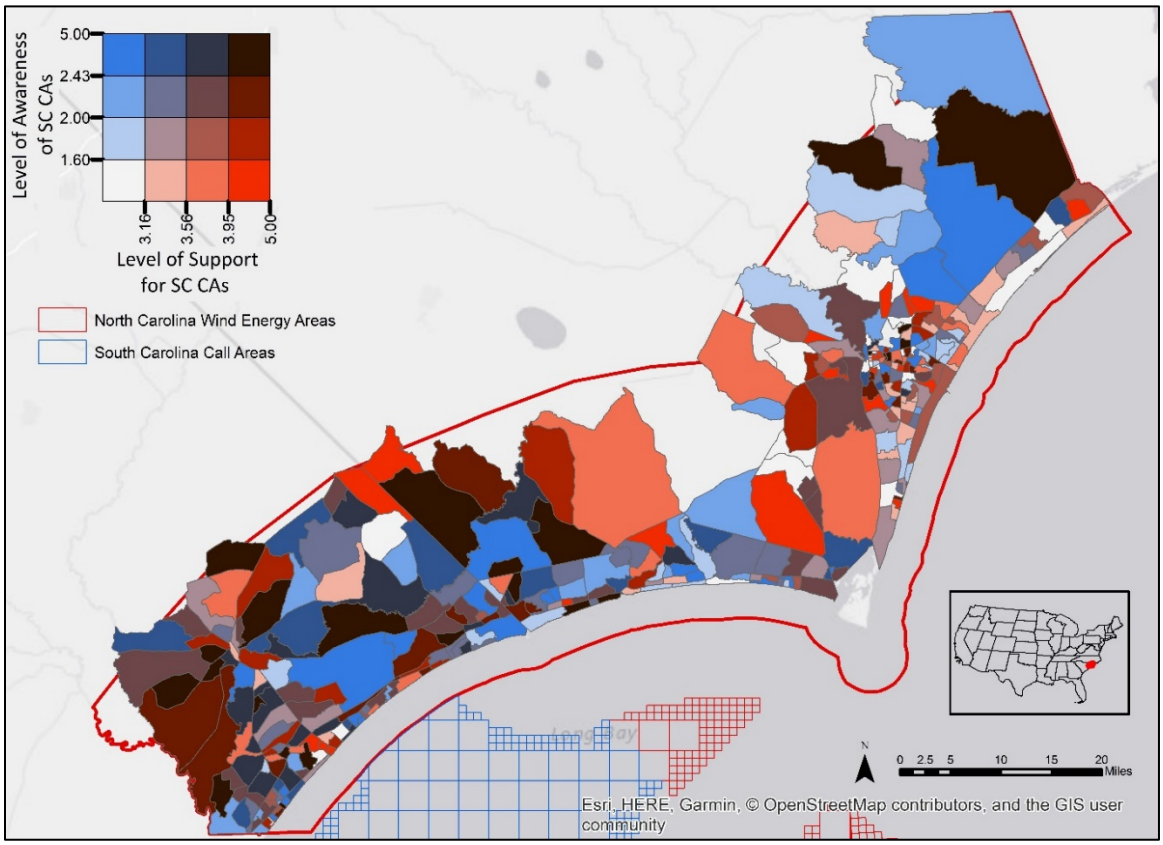


Figure 27: Awareness by support for offshore wind energy development in SC

3.6 Support Level for Offshore Wind Energy Development in Residents' Own State

Residents support offshore wind energy development efforts in the US, but are significantly less supportive of efforts in their own states (F=214.741, p=0.00). Figure 28 highlights the support level of residents in each state for their own state of residence. It is notable that NC residents are more likely than SC residents to oppose offshore wind energy development in their own state of residence (F=5.49, p=0.00). Residents in SC report more neutrality than opposition to offshore wind energy development in SC.

Looking at support level for offshore wind energy development in one's own state by demographic variables, relevant relationships are presented. Figure 29 shows support level by residents' age, although caution is advised when interpreting findings for residents aged 18-24 due to their underrepresentation relative to the population. There is no statistical difference in age between those who Oppose or Strongly Oppose offshore wind energy development in their own state (F=0.79, p=0.38), but those who Oppose or Strongly Oppose efforts are significantly older than those who are Neutral or supportive (F=40.04, p=0.00).

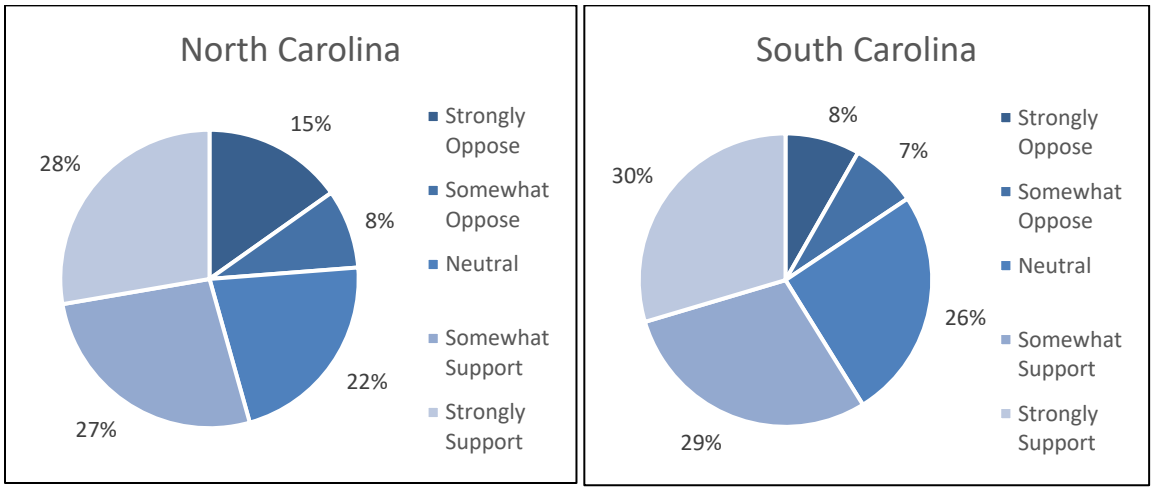


Figure 28: Support for offshore wind energy development in one's own state of residence (percent)

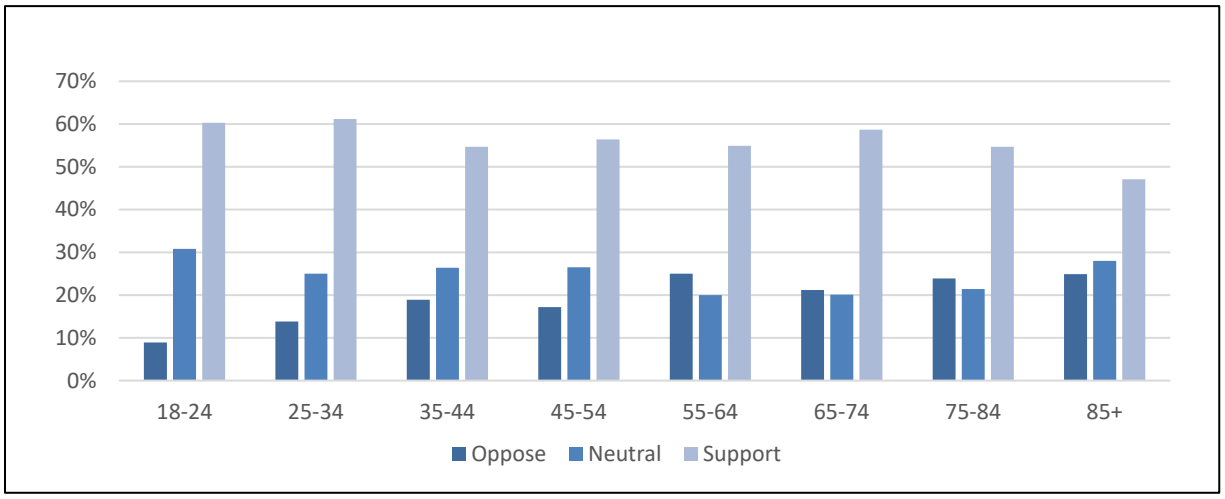


Figure 29: Support for offshore wind energy development in one's own state by age (percent)

Photograph 14: Dunes along North Carolina coast
Photo courtesy of Pixabay (copyright and royalty free)

Residents from all income levels report support more often than neutrality or opposition (Figure 30). Persons with income of $150,000 or greater report opposition more often than other income groups. Residents with income less than $75,000 tend to report neutrality more often than residents with higher incomes. However, statistically, there is no clear relationship between income and support level.

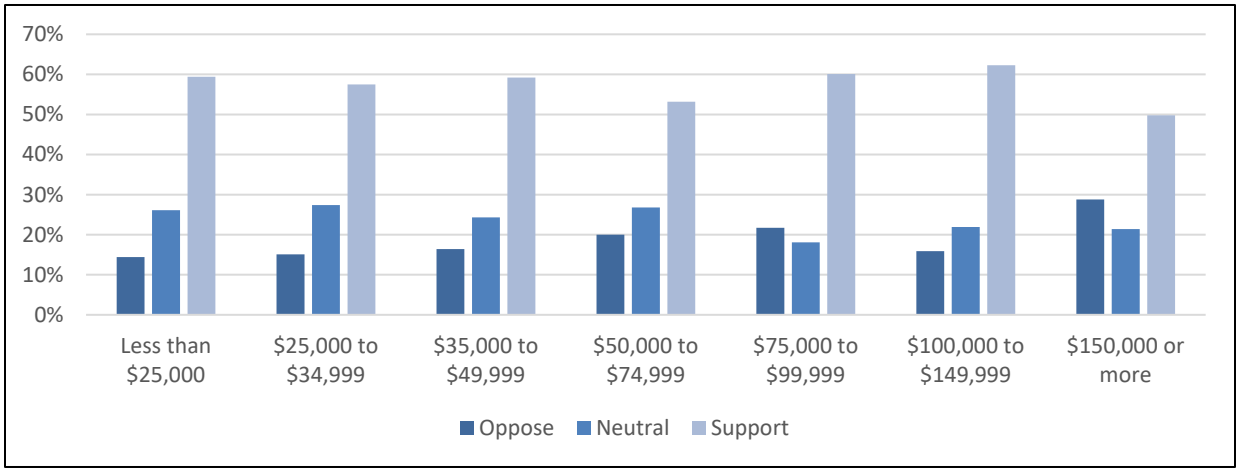


Figure 30: Support for offshore wind energy development in one's own state by income (percent)

No statistical differences are detected based on educational attainment either. However, residents in the study region from all educational attainment groups report support more often than neutrality or opposition, as shown in Figure 31. Note the sample is well-educated when compared to statewide figures.

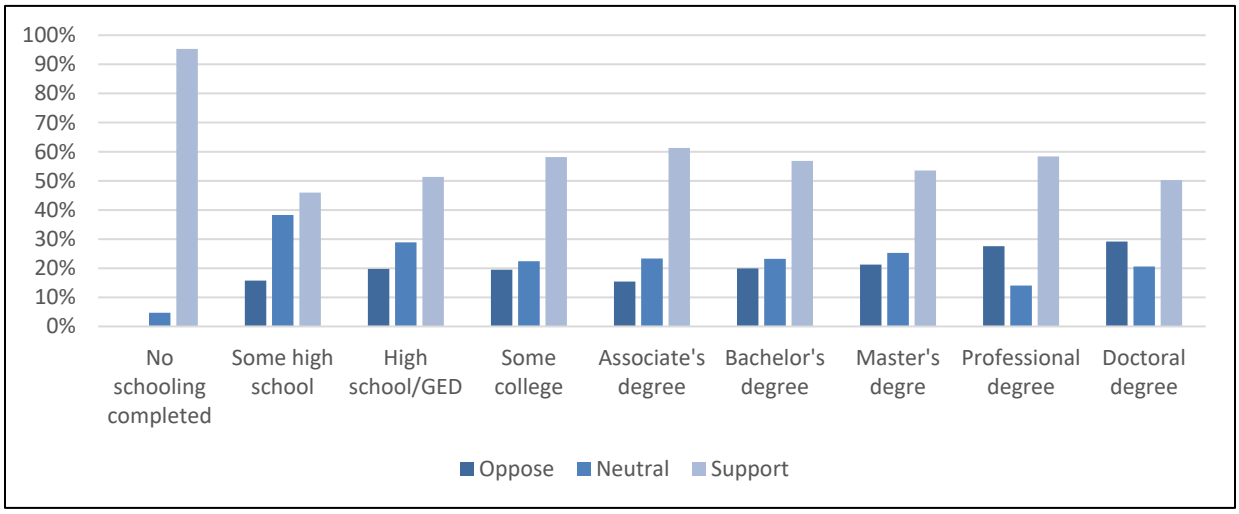


Figure 31: Support for offshore wind energy development in one's own state by educational attainment (percent)

Considering respondents' ownership status (Figure 32), persons who do not own their household at the time of survey are slightly more neutral and supportive of offshore wind energy development in their own state than owners. Relationships, however, are not statistically significant.

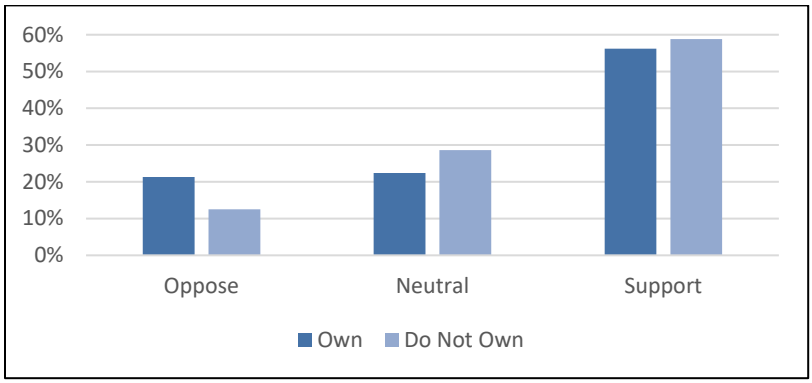
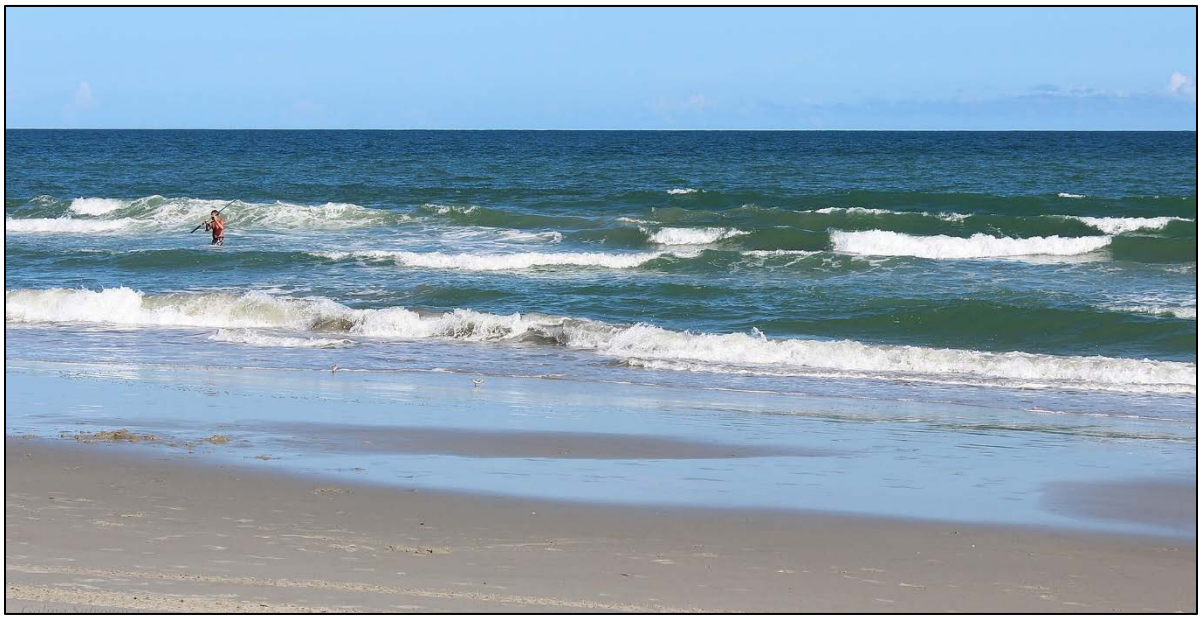


Figure 32: Support for offshore wind energy development in one's own state by housing unit ownership status (percent)

Turning to support level by type of recreational activities engaged in, level of support for offshore wind energy development in one's own state is weakly correlated with engagement in two reactional activities: birdwatching ($r = 0.08$, $p=0.00$) and marine mammal watching ($r =-0.05$, $p=0.00$). Residents reporting engagement in both of these wildlife-based activities are more likely to report an oppositional stance toward offshore wind energy development in their own state of residence when compared with residents who do not engage in these activities (Figure 33).

There is no statistically significant correlation between level of support and engagement in beach-going, boating or sailing, fishing, or SCUBA diving. However, as noted in the charts in Figure 33, beach-goers tend to support offshore wind energy development in their own state when compared to those who do not engage in the activity. Fishers and boaters/sailors report strong opposition and strong support for offshore wind energy development more than often those who do not engage in these activities. Residents who engage in SCUBA diving report being strongly opposed to offshore wind energy development in their own state more often than those not claiming to engage in diving.



Photograph 15: Myrtle Beach, South Carolina
Photo courtesy of Galina Safronova, Pixabay (copyright and royalty free)

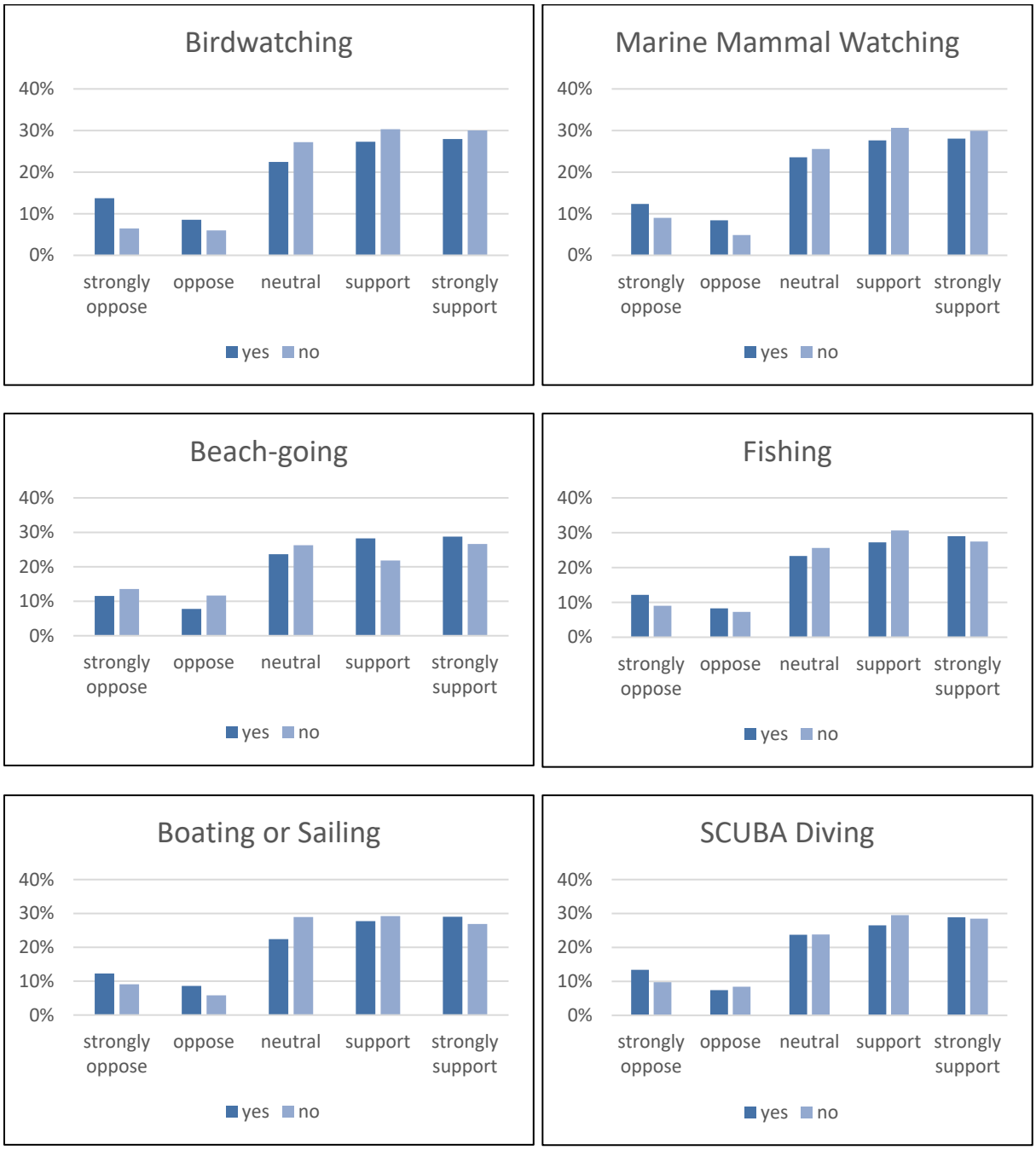


Figure 33: Support for offshore wind energy development in one's own state by recreational activity engagement (percent)

Figure 34 provides a summary of residents' support level related to offshore wind energy development efforts by their level of awareness about development efforts, both in their state of residence. Residents having awareness of efforts in their own state appear more likely to Strongly Oppose or Strongly Support development efforts. Residents that are Not at All Aware of development efforts in their state of residence are most likely to take a neutral stance (F=30.77, p=0.00).

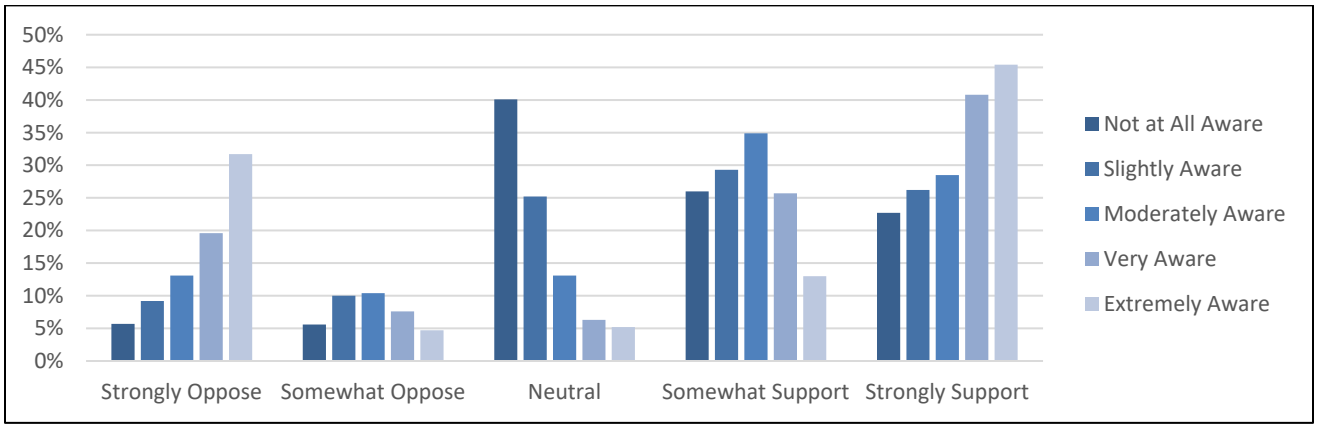


Figure 34: Support for offshore wind energy development by awareness in one's own state (percent)

The spatial distribution of support level by level of awareness for offshore wind energy development in one's own state is provided in Figure 35. Residents who are in strong opposition are significantly closer to the shoreline than all other residents (F=32.70, p=0.00). Awareness is indicated by the bright-red to pink tones across the shoreline region in this area. The blue toned areas are indicative of low awareness and opposition. However, there are some notable pockets of support for NC efforts, near the shoreline and inland, as indicated by the dark red and blue tones on the map.

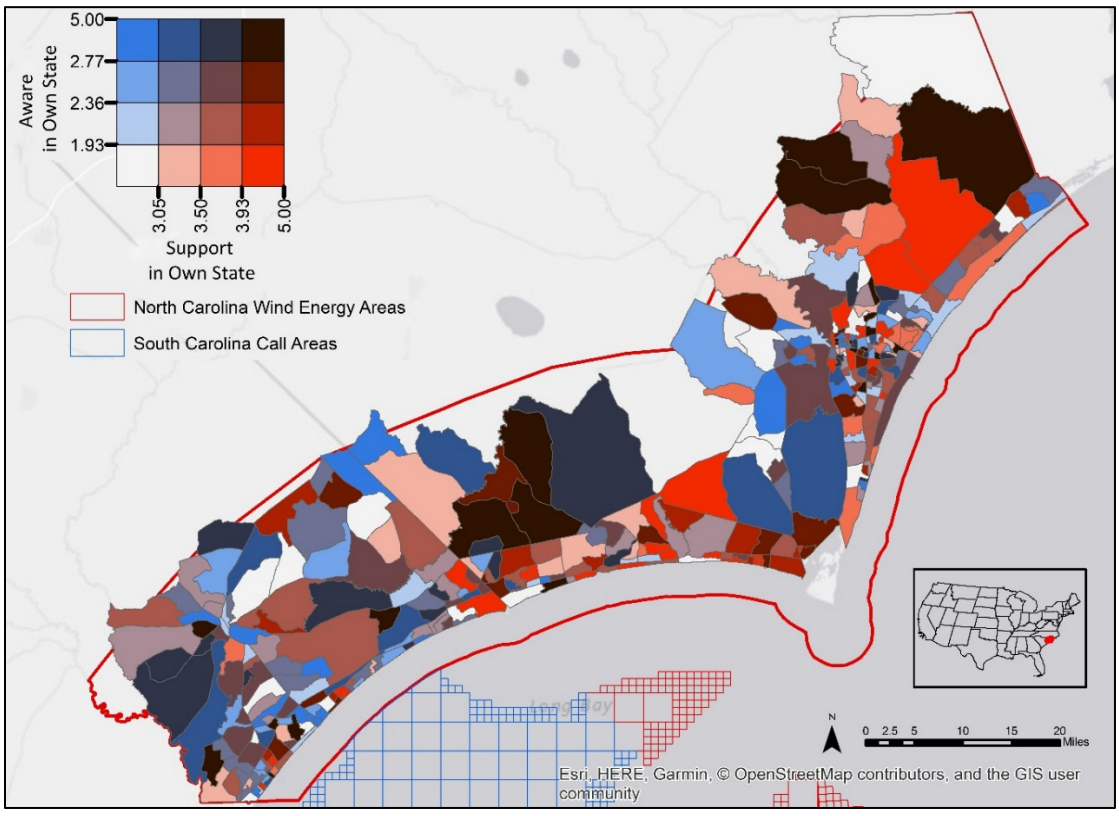


Figure 35: Distribution of support level by awareness for offshore wind energy development in one's own state of residence

In the SC region of the map, on the other hand, there is less of a contrasting color pattern across the area. This means that support and awareness levels for offshore wind energy development in SC by SC residents may be more diverse in terms of geographic distribution. However, the prominence of blue/dark blue and dark red tones indicates higher levels of support by SC residents for efforts in SC, regardless of awareness levels.

3.7 Action Engagement and Intent

Past action was measured using a multi-part item assessing if and how residents expressed support or opposition for: 1) any issue, 2) any environmental issue, and 3) the potential for offshore wind energy development. Place-protective action can include a range of political and civic engagement activities, such as giving money, signing petitions, attending meetings or protests, organizing meetings or protests, media activities or campaigns, letter-writing, lobbying, or some kind of legal action (Wolsink 2000; Oliver and Marwell 1992; Bullard 1990). For this research, respondents were asked:

> By selecting "Yes" or "No" for each item below, please indicate whether you have ever done any of the following activities to express your support for or opposition to:
>
> a. Any issue in a city, county, or state where you have lived
> b. Any environmental issue in a city, county, or state where you have lived
> c. The potential for offshore wind energy development in a city, county of state where you have lived

The six activities offered include:

- Signed a petition
- Written, emailed, or called a public official
- Joined a citizen-based advocacy group because of their position
- Attended public meetings sponsored by a government agency
- Attended public meetings, gatherings, or demonstrations sponsored by an advocacy group
- Contributed money to an organization or campaign

To capture the full range of possible activities, respondents were allowed to specify one "Other" activity. The majority of "Other" items specified by respondents provided more detailed information on activities already listed. For example, one respondent specified, "donations to help marine mammals from extinction." When "Other" activities corresponded to existing activity categories, and those activities were not already selected, they were assigned to the appropriate existing activity type. In some cases, respondents simply offered general comments about positions on issues, such as: "I care about a clean environment!" Finally, there were unique activities provided by respondents, such as Congressional meetings, debate among friends, organizing a group, recycling, research, volunteering, clean-up events, social media/online forums, posting yard signs, and voting. An "other" category was formed from these activities.

The response rate for each of the issue-activity item sub-parts ranged from 82% to 95%.

Shown in Figure 36, residents within the study region of both states report high levels of past action. Further, 61% of NC residents and just under half of SC residents report some form of past action specifically related to an environmental issue. Seventeen percent of NC residents and 14% of SC residents report engaging in activities to express support or opposition for offshore wind energy development at some point in the past.

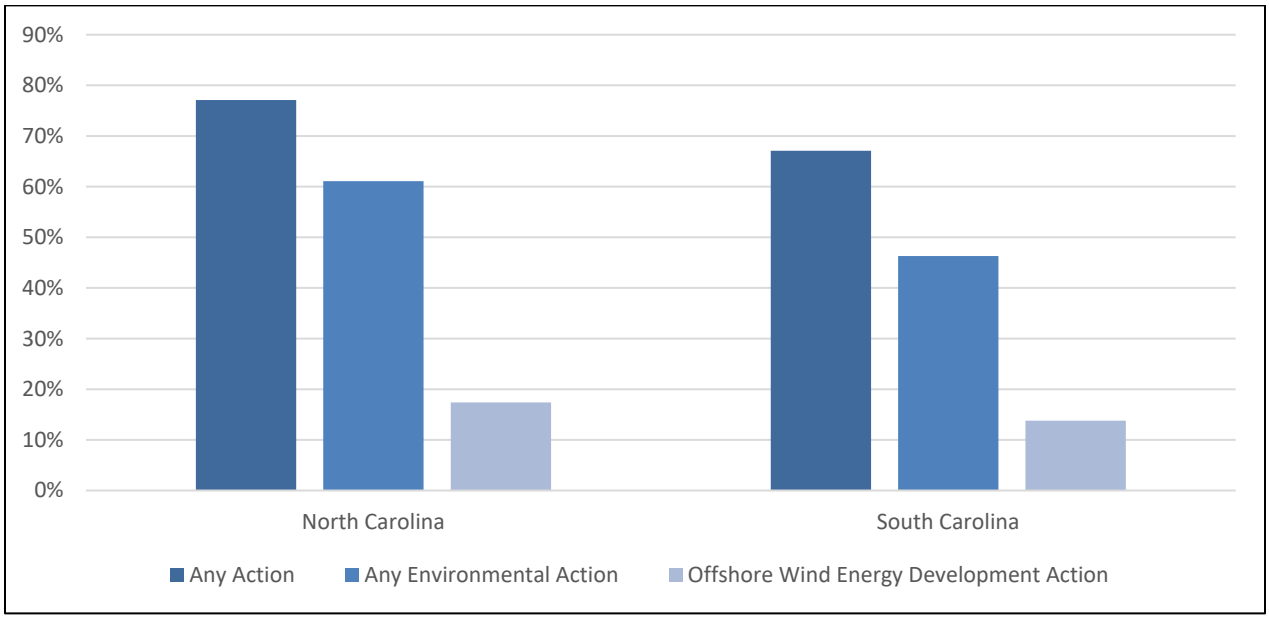


Figure 36: Participation in past action by type of issue and state of residence (percent)

Figure 37 displays the type of activity engaged in for any issue and any environmental issue. For residents of the study region in both states, signing a petition is the activity most often used to express support or opposition to issues. Contributing money to an organization or campaign of some kind is the next most popular way residents express support or opposition on issues, followed by contacting a public official and attending meetings sponsored by government agencies. Residents were least likely to report attendance at public meetings, gatherings, or demonstrations sponsored by an advocacy group or joining a citizen-based advocacy group based on their position relative to an issue.

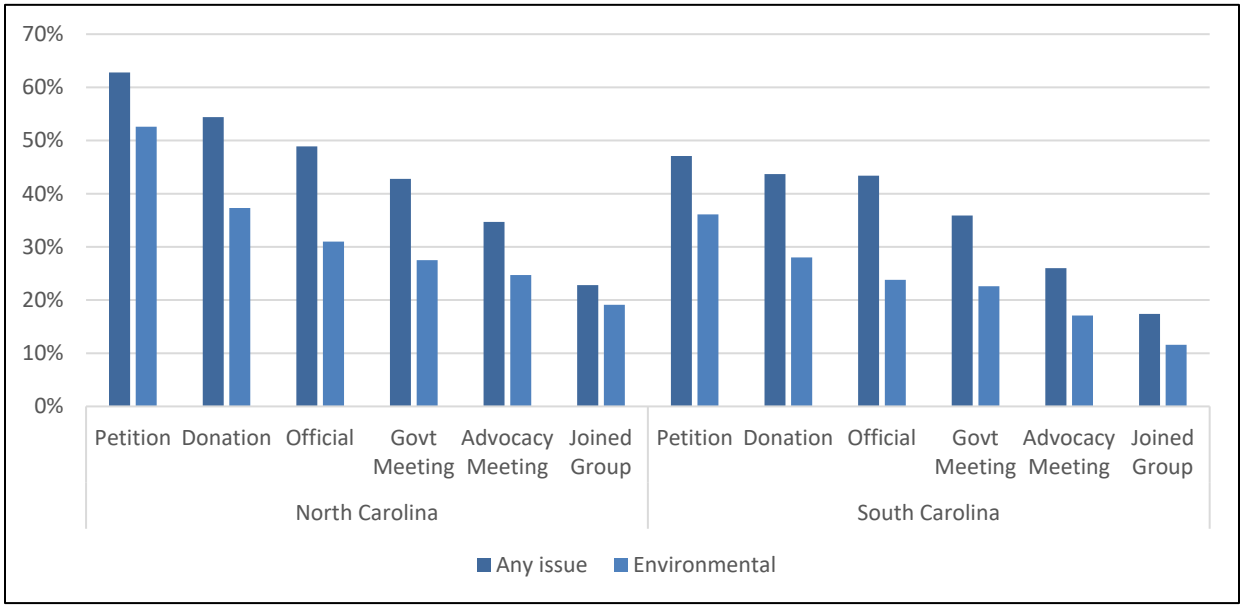


Figure 37: Activity type for past action on any and environmental issue by state of residence (percent)

Considering past action relative to offshore wind energy development, specifically, residents in study region from both states who report this type of action indicate signing petitions as the activity in which they most often engaged (Figure 38). In NC, the next most commonly reported activity is contacting a government official. In SC, residents also report contacting a government official roughly as often as attending public meetings sponsored by a government agency.

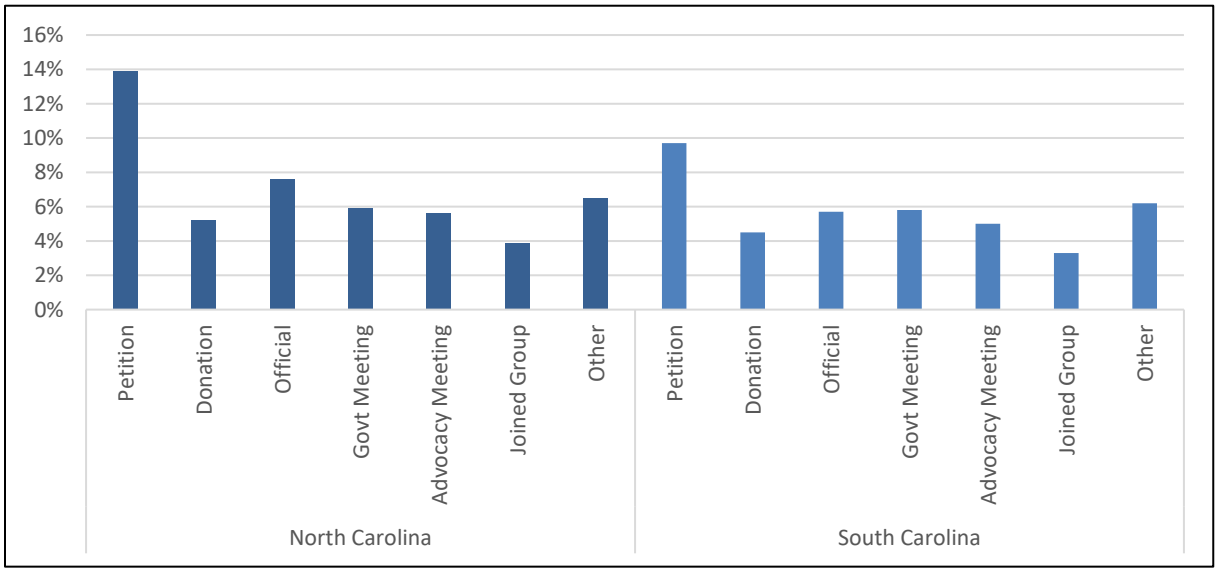


Figure 38: Activity type for past offshore wind energy development action and by state of residence (percent)

Researchers examined relationships between past action in an offshore wind energy development context and demographic and social value variables. Regardless of one's state of residence, those engaging in past action related to offshore wind energy development tend to have higher levels of formal education ($F=2.01$, $p=0.05$) and exhibit higher personal ($F=23.79$, $p=0.00$) and social ($F=33.64$, $p=0.00$) attachment to the Carolina coast. They also tend to espouse the importance of recreational fishing ($F=4.84$, $p=0.00$), habitat for birds ($F=4.12$, $p=0.00$), habitat for marine mammals and sea turtles ($F=3.92$, $p=0.00$), habitat for fish ($F=2.63$, $p=0.03$), shipwrecks and other submerged maritime heritage sites ($F=8.91$, $p=0.00$), and views of the ocean from the shore during the day ($F=7.35$, $p=0.00$) and at night ($F=6.71$, $p=0.00$).

Future wind action was determined with one question immediately following the past action survey item. The future action question stated:

> In the next 12 months, do you plan to do any of the activities listed above in Question 7 in response to the potential for offshore wind energy development in your current city, county, or state?

Respondents were asked to indicate "yes" or "no." The item response rate for this question was 97%.

While a majority of residents in the study region report no intention to engage in activities related to expressing their position for offshore wind energy development, some residents do express some intent toward future wind action. Within a twelve-month period, 35% of NC residents and 25% of SC residents state they will engage in one or more activities referenced in response to the potential for offshore wind energy development in their current city, county, or state.

Residents reporting past action related to offshore wind energy development (termed "activists" for simplicity) are significantly more likely to intend future action in their local context (F=187.84, p=0.00). Figure 39 provides a breakdown of the support stance relative to offshore wind energy development efforts in one's state of residence for future offshore wind energy development activists (hereafter, future activists) in the study region. Future activists in NC report more opposition to offshore wind energy development in their own state, whereas future activists in SC report more neutrality and support in their own state.

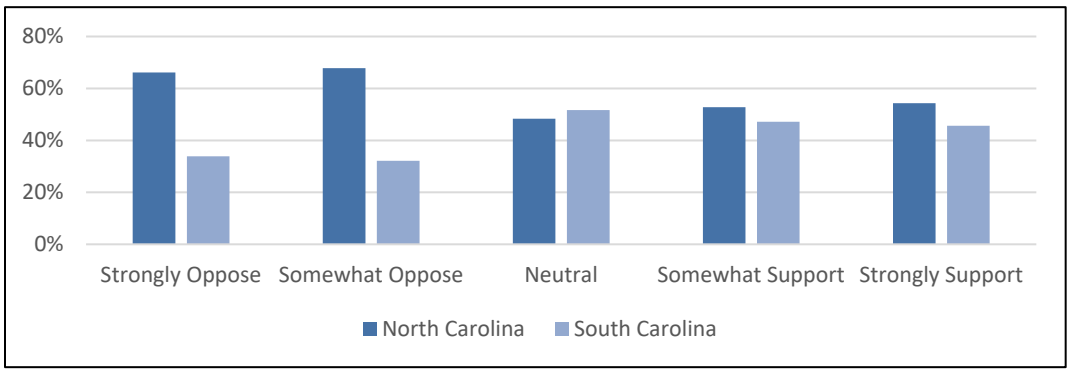


Figure 39: Support level in one's own state by state of residence for future activists only (percent)

Figure 40 shows the types of past action undertaken by support level for this group. In general, residents with a non-neutral position on offshore wind energy development – either support or opposition – report signing petitions and contacting public officials in the past. Future activists who Strongly Support efforts report signing petitions more so than other future activists. They also more often report attending meetings or other gatherings hosted by advocacy groups. Future activists who Strongly Oppose offshore wind energy development efforts in their state, and who also plan to engage in future action, are most likely to have signed a petition, contacted a public official, and attended a meeting sponsored by a government agency. Residents reporting a neutral position on local offshore wind energy development most often report having contacted a public official, followed by donating to an organization or campaign and attending a public meeting sponsored by a government agency.

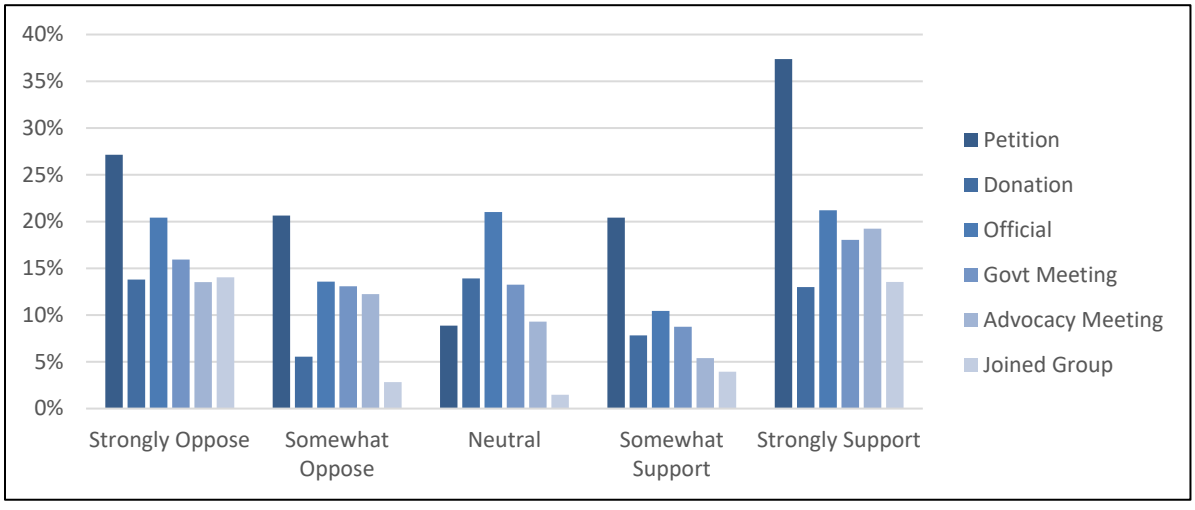


Figure 40: Activity type for past wind action by support level in one's own state for future activists only (percent)

Residents in the study region report engaging in past action on issues generally at relatively high proportions; however, residents of NC tend to be more socially proactive on issues than residents in SC, generally. Past action relative to offshore wind energy development is not widely reported in the study region. However, those who have engaged in past action most often report signing a petition to express their position. Related to future wind action, future activists opposed to offshore wind energy development are more likely to live in NC, and are more likely to have signed a petition or contacted an official to express their position. Of future activists who are supportive of offshore wind energy development, they are likely to live in SC, and are also more likely to express their position through signing petitions and contacting public officials.

Photograph 16: Protestors in the Peoples Climate Movement March, 2017
Photo courtesy of 3000ad © 123RF.com

4 Results: Statistical Modelling

Building on findings from past studies, a model was developed to understand 1) the factors that may be predictive of level of support for local offshore wind energy development and 2) the factors most likely to influence residents' potential for intended action on the Carolina coast. The dependent variables are:

- Support level—level of support (from Strongly Oppose to Strongly Support) for offshore wind energy development in one's own state; and
- Future action—likelihood of a resident to intend to take future action related to offshore wind energy development in their own state of residence.

Figure 41 depicts the conceptual model tested in this research. The model includes two interconnected components. The first component predicts support level, while the second predicts future action.

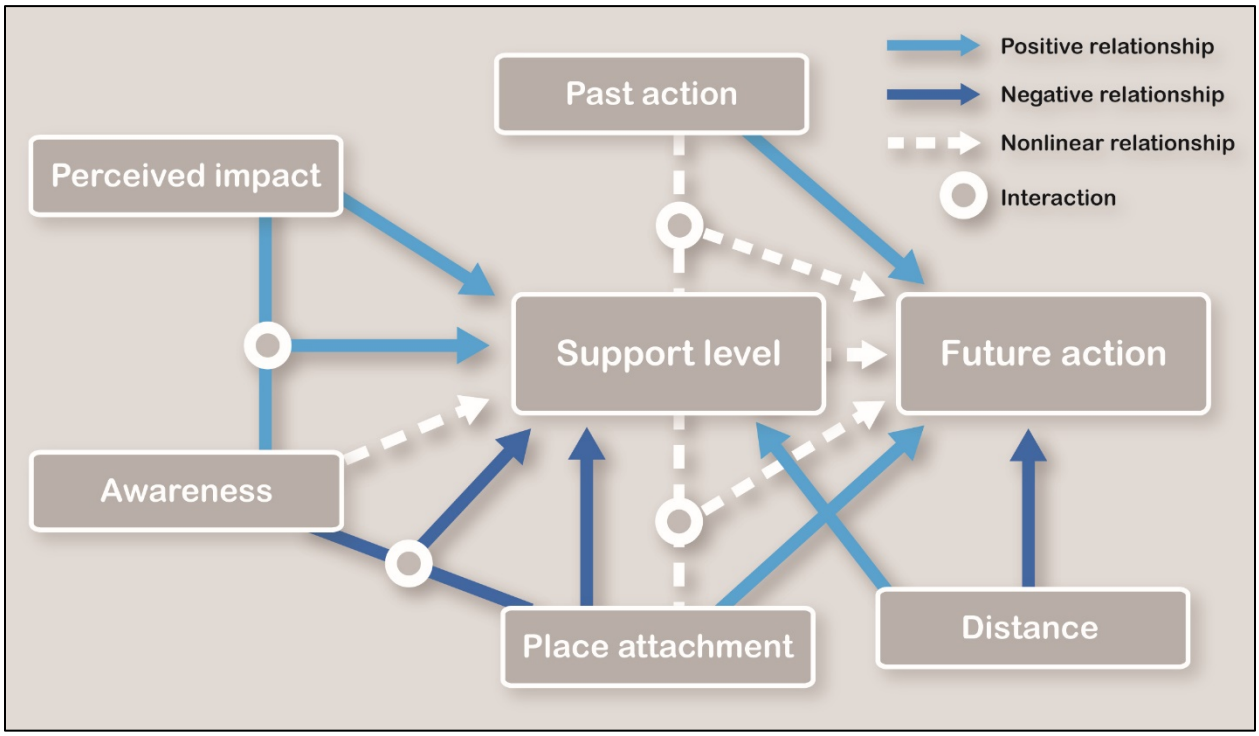


Figure 41: Conceptual model for support level and intention to take action

Support level for offshore wind energy development on the Carolina coast is predicted using perceived impact to quality of life items, awareness of local offshore wind energy development, place attachment, and distance of households to offshore wind development areas and to the shoreline. The following hypothesized relationships are depicted in Figure 41:

- Perceived impact has a positive relationship with support level.
- The interaction between perceived impact and awareness has a positive relationship with support level.
- Awareness has a nonlinear relationship with support level.
- Place attachment has a negative relationship with support level.

- The interaction between place attachment and awareness has a negative relationship with support level.
- Household distance has a positive relationship with support level.

The second component of the model predicts the potential of residents to intend to take future action related to local offshore wind energy development using support level (as predicted from component one), place attachment, distance of households, and past action. Related hypothesized relationships are depicted in Figure 41:

- Support level has a nonlinear relationship with future action.
- The interaction between support level and place attachment has a nonlinear relationship with future action.
- Place attachment has a positive relationship with future action.
- Household distance has a negative relationship with future action.
- Past action has a positive relationship with future action.
- The interaction between past action and support level has a nonlinear relationship with future action.

Model details and findings related to the components are provided below.

4.1 Factors Influencing Level of Support

Household distance to the proposed offshore WEA or CA and household distance to the shoreline were each used to examine the influence of proximity on support level. The first distance measure represents the Euclidean distance (km) from respondents' households to the nearest proposed offshore wind development area, either the nearest NC WEA (Wilmington West) or nearest SC CA (Grand Strand). The second measure represents Euclidean distance (km) from households to the nearest point on the shoreline.[8] Household distance was hypothesized to have a direct relationship with support, with residents being more supportive the farther away they reside from the WEA, CA, or the shoreline.

As the two place attachment dimensions are correlated ($r=0.74$, $p=0.00$), only the Personnel Connection component was used in the final model. Awareness of local offshore wind energy development is captured by level of awareness in one's own state of residence. Awareness and place attachment were hypothesized to have inverse relationships with support, with more aware or more attached residents being either less supportive or opposed. Further, researchers predicted the more aware and attached a resident is, the stronger the opposition would be.

For efficiency, importance of recreational activities was not included in the model because these measures were also inputs into quality of life importance. Further, importance of recreational activities were correlated with the importance of related quality of life items. For example, residents who indicated marine mammal watching is an important recreational activity were also likely to indicate marine mammal and sea turtle habitat is important for quality of life ($r=0.41$, $p=0.0$). Therefore, quality of life items were included instead of recreational activities.

As several of the high importance quality of life items were correlated (e.g., view of the ocean from the shore during the day, view of the ocean from the shore at night), only four were included in the final

[8] Distance from the shoreline to proposed offshore wind energy development was not analyzed in this study.

model: affordability of electricity, local property values, view of ocean from the shore during the day, and habitat for marine mammals and sea turtles.

Theory indicates perceived impacts on quality of life items will have a direct influence on level of support. However, as a large proportion of residents (47% to 79%) are unsure of the potential impacts of wind energy development projects on their quality of life, "surety of impacts on quality of life items" and "importance of quality of life items" were used. For example, if support for offshore wind energy development increases as the importance of a quality of life item increases, then it can be assumed that the specified item is perceived to be positively impacted by offshore wind energy development. It was hypothesized that more surety will lead to stronger levels of support or opposition, while less surety will relate to neutrality.

Photograph 17: Wind turbine construction at the Block Island Wind Farm
Photo courtesy of BOEM (all rights reserved)

A generalized ordered logistic model was used to model support level for offshore wind energy development. This model was chosen for two reasons. First, the dependent variable, support level, was measured as ordered categories. Second, not all coefficients met the parallel lines assumption, which states that the coefficients in the model are the same across all response categories. Coefficients that did meet this assumption are shown in the column labeled "Parallel Lines Assumption Met." Coefficients that did not meet this assumption are shown under the heading "Parallel Lines Assumption Not Met." Coefficients that did not meet this assumption have an estimated coefficient for each level of support with Strongly Opposed as the baseline and should be compared across columns. The results of the model using household distance to the nearest WEA or CA are shown in Table 22. Results for the model using household distance to the shoreline are shown in Table 23.

Table 22: Model A) Results of the support level model with household distance to WEA or CA

	Support Level				
	Parallel Lines Assumption Met	Parallel Lines Assumption Not Met			
		Somewhat Oppose	Neutral	Somewhat Support	Strongly Support
Household distance to WEA/ CA (100 km)	0.00 (0.00)				
Awareness (own)		**0.32** **(0.08)**	**0.21** **(0.06)**	0.02 (0.06)	**-0.14** **(0.07)**
Place Attachment (Individual)	-0.07 (0.06)				
Place Attachment (Individual) x Aware	0.00 (0.02)				
Unsure		**-2.51** **(0.79)**	**-1.37** **(0.34)**	**1.90** **(0.33)**	**1.49** **(0.45)**
Awareness x Unsure		0.23 (0.23)	0.08 (0.12)	**-0.57** **(0.13)**	**-0.28** **(0.16)**
Electricity Costs	**0.14** **(0.06)**				
Property Values	-0.02 (0.06)				
Daytime Views	-0.08 (0.05)				
Marine Mammal and Sea Turtle Habitat		**0.17** **(0.10)**	0.05 (0.07)	-0.07 (0.06)	**-0.12** **(0.07)**
Constant		**-2.95** **(0.44)**	**-1.72** **(0.35)**	-0.23 (0.32)	**1.48** **(0.35)**

Number of observations=3,025
F=23.14, p=0.00
P(correct)=0.38
Standard errors shown in parentheses
Significant values (90% CI) shown in bold

Photograph 18: Homes along the Carolina coast
Photo courtesy of Sarah Ball Gonyo, NOAA

Table 23: Model B) Results of the support level model with household distance to shoreline

	Support Level				
	Parallel Lines Assumption Met	Parallel Lines Assumption Not Met			
		Somewhat Oppose	Neutral	Somewhat Support	Strongly Support
Household distance to Shoreline (km)		**-0.04 (0.01)**	**-0.02 (0.01)**	-0.01 (0.01)	-0.01 (0.01)
Awareness (own)		**0.32 (0.08)**	**0.21 (0.06)**	0.02 (0.06)	**-0.14 (0.07)**
Place Attachment (Individual)	-0.07 (0.06)				
Place Attachment (Individual) x Aware	0.00 (0.02)				
Unsure		**-2.51 (0.77)**	**-1.35 (0.34)**	**1.89 (0.33)**	**1.48 (0.45)**
Awareness x Unsure		0.22 (0.23)	0.07 (0.12)	**-0.57 (0.13)**	**-0.28 (0.16)**
Electricity Costs	**0.15 (0.06)**				
Property Values	-0.02 (0.06)				
Daytime Views	-0.06 (0.05)				
Marine Mammal and Sea Turtle Habitats		**0.17 (0.10)**	0.06 (0.07)	-0.07 (0.06)	**-0.11 (0.07)**
Constant		**-2.54 0.42**	**-1.46 0.33**	-0.05 (0.31)	**1.63 (0.33)**
Number of observations=3,025 F=21.92, p=0.00 P(correct)=0.37 Standard errors shown in parentheses Significant values (90% CI) shown in bold					

Model A results suggest household distance to the nearest WEA or CA does not affect support level. However, Model B indicates residents are less likely to be supportive the closer to the shoreline they reside.

Place attachment does not influence support level, according to either model. However, the more aware residents are of local offshore wind energy development, the more likely they are to oppose it. With more certainty of potential impacts, residents who are very or extremely aware of local offshore wind energy development efforts are even more likely to oppose it. Conversely, with more certainty of potential impacts, residents who are less aware or unaware are more likely to support local offshore wind energy development, especially if they are unsure of the impacts on quality of life items. There is one exception: Residents who are Not at All Aware and are less certain of potential impacts are likely to be more supportive.

Results indicate that the more important electricity costs are to residents, the more likely they are to support offshore wind energy development efforts, suggesting residents expect electricity costs to improve after development. Results also indicate the more important marine mammal and sea turtle habitats are to residents, the more likely they are to oppose offshore wind energy development efforts,

suggesting residents expect these habitats to decline with development. No relationship was found with daytime views and property values, suggesting no (or uncertain) impacts to property values and daytime views of the ocean.

4.2 Intention to Engage in Future Wind Action

Future wind action represents residents' intention to engage in some form of action to advance a position on offshore wind energy development within the next 12 months in their own city, county, or state. Future wind action was predicted with four independent variables: distance of household to the shoreline (km); engagement in past action related to environmental issues and offshore wind energy development; strength of place attachment; and support level for offshore wind energy development in one's own state. Household distance to a WEA or CA was not used because of insignificant findings in the support level component of the model.

Distance of households to the shoreline was hypothesized to have a direct relationship with future wind action. Past action was included to capture qualities that activists possess, such as altruism, sense of obligation, empowerment, or activist identity (Schmitt et al. 2019; Steg et al. 2005; Polletta and Jasper 2001; Stern et al. 1999). These qualities may predispose people to future action, but were not captured in the survey questions. Residents who have engaged in past action and residents who are more strongly attached to place were hypothesized to be more likely to intend action, regardless of their support position (support or oppose). Finally, residents with strong levels of support or opposition were predicted to intend future action more so than those with moderate or neutral positions.

A logistic model was used to model intent to engage in future wind action. As past action towards any issue is highly correlated with action towards any environmental issue (r=0.68, p=0.00), past action towards any issue was not included in the model. The results of the future wind action model are shown in Table 24.

Photograph 19: Demonstrators in support of offshore wind energy development in Massachusetts
Photo courtesy of John Romero, BOEM

Table 24: Results of the future wind action model

	Coefficient
Distance to Shoreline (km)	**-0.02** **(0.01)**
Strong Support	**-0.86** **(0.27)**
Support	**-1.49** **(0.27)**
Neutral	**-1.86** **(0.30)**
Oppose	**-0.75** **(0.32)**
Place Attachment (Individual)	**0.32** **(0.11)**
Strong support x Place Attachment (Individual)	**-0.25** **(0.13)**
Support x Place Attachment (Individual)	**-0.30** **(0.13)**
Neutral x Place Attachment (Individual)	**-0.27** **(0.14)**
Oppose x Place Attachment (Individual)	-0.06 (0.20)
Environmental Action	0.11 (0.09)
Wind Action	**0.85** **(0.28)**
Strong Support x Environmental Action	**0.31** **(0.11)**
Support x Environmental Action	**0.30** **(0.11)**
Neutral x Environmental Action	**0.29** **(0.13)**
Oppose x Environmental Action	0.09 (0.13)
Strong Support x Wind Action	**-0.61** **(0.32)**
Support x Wind Action	-0.34 (0.33)
Neutral x Wind Action	-0.36 (0.42)
Oppose x Wind Action	-0.57 0.38
Constant	**-0.38** **(0.22)**
Number of observations=3,268 F=14.37, p=0.00 P(correct)=0.75 AUC=0.79 Standard errors shown in parentheses Significant values (90% CI) shown in bold	

Results suggest that residents living further inland from the shoreline are less likely to intend future wind action than residents living closer to the shoreline. Residents who are opposed to offshore wind energy development are most likely to intend future wind action. Residents reporting a neutral position are least likely to intend future action on the issue; however, the influence of support level on intention to act is affected by place attachment.

According to findings, residents who are more strongly attached to the Carolina coast are more likely to intend future action relative to offshore wind energy development, but the effect of place attachment decreases if residents are supportive. This reinforces the postulate that residents with strong place attachment are more likely to intend future wind action if they are in opposition than if they are in support. Finally, past action related to environmental issues is only a predictor of future wind action if residents are supportive or neutral toward local offshore wind energy development. Alternatively, past action related to the potential for offshore wind energy development is a predictor of future wind action regardless of support level, but those who strongly support local efforts are less likely to intend future wind action.

Photograph 20: Taking action through signing a petition
Photo courtesy of Malgorzata Pakula © 123RF.com

5 Discussion

Measuring and predicting resident expressions of support versus opposition for offshore wind energy development is pragmatic for two reasons. First, it is necessary for those responsible for mitigating potential negative impacts from this form of renewable energy to understand how it may affect local residents. In public forums focused on energy policy, a variety of stakeholder groups assert their perspective on policy alternatives and help articulate the potential costs and benefits. However, involving all stakeholders can be a difficult task, especially when there are latent stakeholders in a community. Latent stakeholders are people who, likely during early stages of the planning process, are unaware or perhaps do not fully recognize the potential impacts of wind energy projects on the places they care about, but who gain awareness or recognition at some point. The issue of latent stakeholders is problematic because the full scope of community impacts cannot be discerned without understanding the experiences, preferences, and concerns of all people who are connected to locations proposed for development. Without this information, a need for mitigation may not be recognized despite best efforts to engage stakeholders in planning processes.

Second, understanding the level and causes of support among residents in relevant communities is a precursor to identifying the possible opportunities and pitfalls in public engagement or planning processes. Evidence of local support for offshore wind energy development is encouraging for agencies as it may be indicative of how receptive a community is to alternative energy projects, as well as the presence of allies who will actively support local efforts. However, past research suggests that local opposition is more likely to require the attention of agencies because opponents are more likely to take action to advance their position (Devine-Wright and Howes 2010; Cass and Walker 2009; Wolsink 2000). Further, opposition need not be widespread among the populace to necessitate agency response (Bell et al. 2013). Therefore, advanced knowledge about the nature and level of support in relevant communities helps put public engagement in perspective.

With this in mind, the goal of the present research was to identify possible latent stakeholders in a region, particularly those most likely to take action to advance their position, as well as to document the quality of life items of most concern to coastal residents. Connection to place shows promise for predicting support level among affected people (Botetzagias et al. 2015; Brownlee et al. 2015; Firestone et al. 2012; Ladenburg 2010; Ansolabehere and Konisky 2009; Firestone and Kempton 2007). Past studies also suggest place attachment can be indicative of place-protective action when residents are opposed to changes that threaten places important to them (Devine-Wright 2011c; Cass and Walker 2009; Devine-Wright 2009; Devine-Wright 2005; Stedman 2002).

Photograph 21: Offshore wind turbine at Block Island Wind Farm on a low visibility day

5.1 Support and Opposition for Offshore Wind Energy Development on the Carolina Coast

People who support wind energy at the national level may be qualified supporters in that meaningful support decisions are likely made only when projects are relevant to them, such as at the local level (Bell et al. 2013). Results support this postulate. The majority of residents who are neutral or supportive of offshore wind energy development efforts at a national level are neutral towards local efforts if they are unaware of local efforts. Further, despite national acceptance of wind energy (Pew 2017), opposition to local projects is anticipated (US Department of Energy 2008). Results indicate most residents in the study region support offshore wind energy development at a national level, but are significantly less supportive at the local level.

Once individuals become aware of proposed local wind energy development projects, they are able to weigh the costs and benefits of such efforts to determine their level of support. Past studies are inconclusive about the influence of awareness and information availability on support for energy or environmental policy. Awareness may increase support for natural resource management activities, such as invasive species management (Novoa et al. 2017), and motivate positive environmental behaviors (Eom et al. 2018). Bidwell (2016) found residents of coastal Michigan were more likely to be supportive of offshore wind energy development after attending informational sessions, although he cautioned that informing residents may not translate to support for specific projects. Esaiasson (2014) reported availability of information about siting cell phone towers and recycling complexes increased the likelihood of local opposition. Further, Cale et al. (2015) found no correlation between awareness and support for nuclear energy. The present study suggests that greater awareness of local offshore wind energy development is more likely to lead to opposition on the Carolina coast.

Perceived costs and benefits of offshore wind energy development correspond with perceived directionality of the impacts to quality of life items. In the present research, important quality of life items might include views of the ocean, coastal and marine recreational activities, coastal property values, or different types of wildlife (Firestone et al. 2012; Kimmell and Stalenhoef 2011; Firestone et al. 2009; Ladenburg and Dungaard 2009; Firestone and Kempton 2007; Johansson and Laike 2007). Assuming that perceptions of impacts on quality of life will influence an individual's support level for local offshore wind energy development, importance and impact analysis found the quality of life items most likely to drive opposition are negative changes to ocean views and wildlife habitat. The items most likely to drive support are positive changes to local property values, electricity affordability, and community image.

Photograph 22: Sandpiper enjoying wildlife habitat along the Carolina coast
Photo courtesy of Pixabay (copyright and royalty free)

It is likely that those reporting greater awareness and opposition are focused on different issues than supporters, or they have prioritized the costs and benefits differently. Residents who expect new or increasing costs may be more likely to seek information on the matter, thereby selectively increasing their understanding of focal issues and increasing their concern and opposition. This phenomenon is termed confirmation or congeniality bias where individuals selectively expose themselves to information to defend their attitudes, beliefs, or behaviors, or improve the accuracy of their understanding for decision-making (Hart et al. 2009). Conversely, supporters satisfied with perceived benefits outweighing the potential costs may not investigate further. The present research suggests that perceived benefits of electricity affordability may drive support, and perceived negative impacts to wildlife habitat may drive opposition.

The economic cost of wind-generated power is a confounding issue for the American public (Klick and Smith 2010). Klick and Smith (2010) found less than 20% of Americans were aware that wind energy could be more expensive than conventional forms of energy production. Firestone et al. (2012) found electricity rates were the primary issue influencing both support and opposition to proposed offshore wind energy development, possibly due to residents' understanding or misunderstanding about how or whether local developments would influence local energy costs. As residents on the Carolina coast generally believe electricity will become more affordable with local offshore wind energy development, their support may decline if they learn otherwise (Klick and Smith 2010). Thus, this quality of life item could conceivably drive opposition rather than support at some point in the future, should related awareness increase.

Concerns about adverse impacts to wildlife from wind energy projects have been documented in a number of public opinion surveys (Knapp and Ladenburg 2015; Firestone et al. 2012; Kimmell and Stalenhoef 2011; Firestone and Kempton 2007). On the Carolina coast, there was public discourse on the possible impact of local offshore wind energy development on the habitat and migratory corridors of highly endangered North Atlantic right whales (Wagner 2017). Results of the importance-impact analysis suggest that marine mammal and sea turtle habitat along with fish habitat are important to quality of life. This importance could be related to strong place attachment to the natural aspects of the Carolina coast and important recreational activities, such as marine mammal watching, fishing, and birdwatching.

Daytime ocean views did not affect support level despite being important to quality of life and the expectation that views will be negatively impacted. However, investigation into concerns about the visibility of offshore wind turbines, and public acceptability of seeing them, has been generally conceptualized as a question of proximity to windfarms (Hevia-Koch et al. 2018; Knapp and Ladenburg 2015; Vecchiato 2014; Firestone et al. 2012; Ladenburg and Dungaard 2009). Studies have found that public acceptance of offshore wind energy development increases with increased siting distances from residences or the shore (Hevia-Koch et al. 2018; Vecchiato 2014). Where planned offshore wind farms will not be visible from shore, public concern about ocean views may abate.

This study's results suggest that household distance to a WEA or CA is not predictive of support level; however, this may be because residents do not know where proposed development areas are relative to where they live. Results do suggest that household distance from the shoreline is a predictor of support level, with those nearer to the shoreline being more opposed to local offshore wind energy development. Residents along the shoreline may anticipate greater negative impacts from an offshore wind energy development in waters near their residences, without knowing where actual projects are proposed. While daytime views was not a predictor in the models, it is important to note it was the least important of the six quality of life items rated important in the study region. It is also possible residents nearer to the shoreline are concerned about other issues not measured in the present study, such as boating access,

boating safety, tourism, or air quality (Firestone et al. 2012), which are captured in the household distance to the shoreline measure.

Proximity to wind energy development projects has also been investigated from the standpoint of property values, largely operating through negative impacts to scenery and views (Hoen et al. 2011). Results from the importance-impact analysis suggest that local property values are important to quality of life on the Carolina coast. Contrary to previous research (Hevia-Koch et al. 2018; Groth and Vogt 2014; Vecchiato 2014; Firestone et al. 2012; Swofford and Slattery 2010; Firestone and Kempton 2007), residents anticipate improvements to local property values due to local offshore wind energy development. Regardless, modelling results indicate the importance of property values does not influence support level on the Carolina coast. This is perhaps due to the low certainty associated with this item in the importance-impact analysis.

Many residents are unsure of the impacts of local offshore wind energy development on their quality of life, especially those who are unaware of local efforts. It is possible that residents are reluctant to form or express opinions on impacts if they do not understand the issues involved. Yet, this does not necessarily imply they are or will remain neutral in their assessments about impacts, particularly as familiarity with relevant issues increases (Edwards 2018; Devine-Wright 2009). Edwards (2018, 355) explored risk perception related to nuclear energy, the Keystone XL pipeline, and hydraulic fracking, and found "risk perception predictors of non-substantive responses more closely resemble the risk perception predictors of opposition rather than predictors of support." Consistent with Edwards (2018), the current study suggests that uncertainty about impacts does not imply neutrality. This finding, in light of past research indicating that support levels change over time (Firestone et al. 2012), implies that support level certainly could change on the Carolina coast in future years. It is dynamic, and not static.

Results indicate the more unsure Carolina coast residents are, the more likely they are to support offshore wind energy development efforts. This may suggest that residents give offshore wind energy development the benefit of the doubt when they have little or no familiarity with the impacts. However, results also indicate residents with more awareness of local offshore wind energy development efforts tend toward opposition, not support. While the current study did not test the effect of information exposure on changes to support level, these findings may corroborate Devine-Wright's (2005) assertion that familiarity and experience with wind energy development will not necessarily translate into positive perceptions. It is also consistent with studies suggesting while access to information may increase knowledge of environmental issues, increased knowledge does not necessarily translate into support or action (Petrova 2014; Kollmuss 2002).

Photograph 23: Wind farm in the Baltic Sea
Photo courtesy of vvoennyy © 123RF.com

5.2 Action and Offshore Wind Energy Development on the Carolina Coast

Information on public support for offshore wind energy development alone is not enough to determine how a project will be received in affected communities because not all people join social movements or engage in civic activities to influence environmental policy (Corraliza and Berenguer 2000; Stern 2000). For example, while the majority of Carolina coast residents have formed an opinion on local offshore wind energy development efforts, only 30% of residents report an intent to engage in action. Further, results suggest support level interacts with place attachment and previous action when predicting intended future action.

There are several examples of contexts where people have taken some kind of action to change or stop development projects locally (Devine-Wright 2009; Stedman 2002; Wolsink 2000). In an offshore wind energy development context, the most noteworthy example is the Cape Wind Project in Massachusetts (Kimmell and Stalenhoef 2011; Dinnell and Russ 2007; Firestone and Kempton 2007; Kempton et al. 2005; Kaplan 2004), where the developer eventually abandoned the project after over a decade of legal challenges and administrative issues (Seelye 2017; Kimmell and Stalenhoef 2011). Understanding the likelihood of local residents to take action to advance their position on offshore wind energy development may provide opportunities to preemptively engage and include action-oriented opponents in the planning process to better understand and address their concerns.

Past research suggests place attachment mediates engagement in place-protective action (Devine-Wright and Howes 2010; Cass and Walker 2009; Stedman 2002), and present results are consistent with these studies. As strength of place attachment increases, residents are more likely to intend to take future action to advance their position on offshore wind energy development, regardless of their support level. This effect is magnified for residents who are opposed.

Distance from residents' households to the shoreline is also a predictor of intended action. Findings suggest residents living closer to the shoreline are more likely to intend to take action. While researchers did not identify prior studies assessing propensity to take action regarding offshore wind energy development relative to proximity of potentially affected geographies, these connections conceptually make sense. Individuals living closer to the shoreline may be more motivated to engage in issues related to the coastal and marine environment, including offshore wind energy development. Alternatively, it is possible that related mobilization efforts and activities, such as public meetings or petition drives, are more convenient or common in neighborhoods nearest to wind development areas, making intended participation easier.

Previous research has shown that past behaviors are a predictor of future behaviors (Ouellette and Wood 1998), which suggests there may be a predisposition to continue engagement or take action on other social issues (Schmitt et al. 2019; Tindall 2004). Using Devine-Wright's (2009) place change framework, intended action can also be explained by the fact that these individuals have already progressed through the five stages, and are able to progress more rapidly to the point of action in future contexts. Of the almost 16% of residents in the study region who report having engaged in past activities to express support or opposition for offshore wind energy development, nearly two-thirds indicate an intent to engage in future action. Further, modelling results suggest that past action on environmental and offshore wind energy development issues is predictive of intent to engage in future action. Residents who support local offshore wind energy development are more likely to intend to take future action if they have engaged in past action related to general environmental issues as compared to issues specific to offshore wind energy. However, residents who are opposed to local offshore wind energy development are the most likely subgroup to intend future action, regardless of their past action.

Future activists who are strong supporters of offshore wind energy development most frequently report having signed petitions and, to a lesser degree, contacted public officials and attended meetings and gatherings sponsored by advocacy groups. This indicates those in strong support of offshore wind energy development projects may be relatively passive. In terms of public outreach, they perhaps may be best engaged through public meetings. Future activists who strongly oppose offshore wind energy development report having signed a petition, but they also report contacting public officials and attending meetings sponsored by government agencies relatively more often. Thus, similar to strong supporters, those who are strongly opposed appear inclined to access networks of individuals and organizations related to the issue. However, they may be more likely to express their opposition more directly to public officials perceived to be influential in the planning processes.

While all of these actions may seem passive in that they rely on others to politically engage with the issue, it is important to consider that social networks and robust financial resources are key for mobilizing opposition, even when the number of opponents is deemed small (Bell et al. 2013). In this light, it is noteworthy that neither group frequently reports giving donations to advance their position, but strong opponents to offshore wind energy development appear somewhat more inclined to engage with public officials through direct contact and public meetings.

Photograph 24: Wind turbine in the Wadden Sea
Photo courtesy of Pixabay (copyright and royalty free)

6 Conclusions

BOEM uses public engagement activities, such as public notices, solicitation of public comment, and informational meetings, to identify potential negative impacts from offshore wind energy development. The reason for gathering information on potential negative impacts is to inform mitigation strategies. Unfortunately, decision-makers cannot canvass the entirety of the public, nor identify latent stakeholders, using traditional public engagement activities alone. Thus, additional approaches for engaging the public and understanding stakeholder viewpoints are desirable, precipitating this research. Findings from this research give voice to a plurality of potential stakeholders in a region identified for offshore wind energy development. It identifies the quality of life factors important to communities, how residents perceive potential impacts to these factors from offshore wind energy development projects, and how differing values and perceptions across the social landscape influence support level. Findings provide an enhanced understanding about perceived impacts to a broader range of stakeholders, which can be used in mitigation planning and to inform future public engagement activities.

While there is moderate to strong support for offshore wind energy development in the study region, there is also low awareness. This is important because results indicate low awareness and uncertainty of impacts from local offshore wind energy development are predictive of support. Conversely, with heightened awareness of local efforts, increased opposition is likely. This implies greater efforts to inform the public about local efforts may not necessarily lead to increased support in targeted communities. Instead, it may result in increased opposition, depending upon the specific issues of concern to residents and their receptivity to non-congenial information. Efforts to gain a more nuanced understanding about the quality of life items important to residents and why opponents, especially, obtain information would be useful.

Of the quality of life items evaluated in this study, electricity affordability and wildlife habitat appear to be of particular interest from a policy standpoint. Knowing that concern about marine mammal and sea turtle habitat drives opposition when negative impacts are expected could help policy-makers anticipate issues relevant to future public discourse. Efforts to mitigate potential negative impacts to wildlife valued by residents would likely be necessary to win favor for offshore wind energy development in this region.

Conversely, electricity affordability drives support for local offshore wind energy development, suggesting that residents expect electricity to become less expensive with offshore wind energy development. If this expectation is erroneous, then this perception could pose problems for securing or maintaining future support in this region. If local electricity could conceivably become more expensive with offshore wind energy development, residents might be unpleasantly surprised. In this situation, greater awareness of the issue could lead a supportive public to become more oppositional.

This research indicates the importance of local context for planning offshore wind energy development projects. Findings suggest that residents who are more strongly attached to the Carolina coast are more likely to intend action to advance their position of support or opposition toward local offshore wind energy development. This finding is useful in that strongly attached residents who are supportive are likely to intend action, which presents opportunities for cultivating local support. However, results also suggest that strong place attachment is even more likely to lead opponents to intend action. Further, findings indicate that opponents to local offshore wind energy development are more likely to intend future action, regardless of having engaged in past action of some kind. This emphasizes a need for policy-makers to engage, if possible, the most strongly attached opponents to better understand the quality of life items of greatest concern to them.

Finally, the present research finds that residents in households located closer to the shoreline are more likely to oppose local offshore wind energy development than residents living farther inland. While views of the ocean by day or night do not appear to be singularly driving locational effects in support level, it is probable that residents closer to the shoreline are focusing on different quality of life items than those relatively inland, or they may be assessing the impacts of these items differently. Certainly, results indicate the shoreline-adjacent region is important to all residents in the study region, but for shoreline residents, local offshore wind energy development projects may be deemed more costly from a social standpoint.

This research offers an approach for identifying factors that influence how local residents feel about offshore wind energy development near their communities, and the likelihood they will get involved to advance their positon on local development efforts. Findings, however, apply only to residents in the study region, which is essentially a coastal zone. Future studies might explore these relationships with statewide samples and in different coastal geographies. Additional research to further document the range of impacts expected by residents, particularly residents in proximity to the shoreline and who are strongly place-attached, would also be desirable.

Photograph 25: Block Island Wind Farm
Photo courtesy of BOEM (all rights reserved)

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A Appendix: Survey Instrument

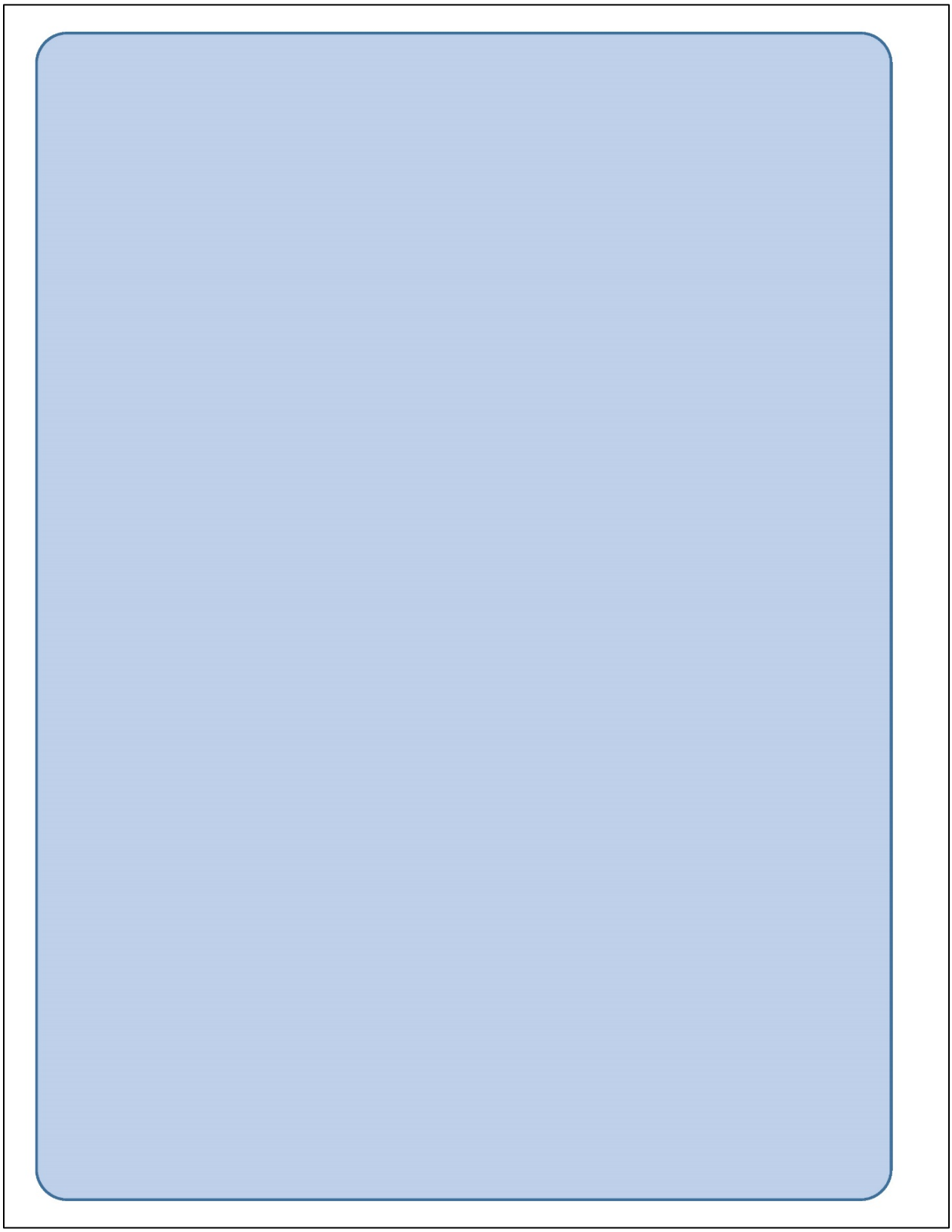
OMB CONTROL NO. 0648-0744 Exp Date: 9/30/2019

The Carolina Coast: What Does It Mean to You?

Photo Credit: Melissa Casper

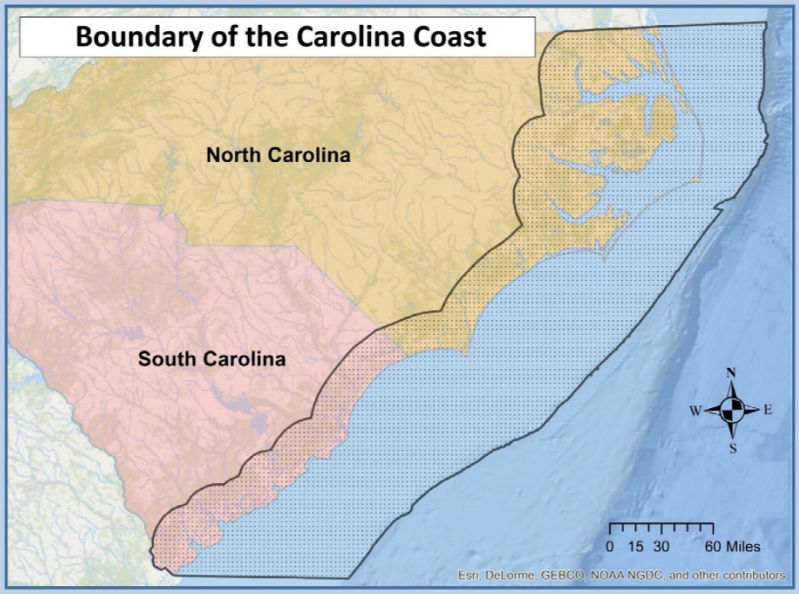
To be completed by the adult (age 18 and over) in your household who has the next upcoming birthday.

A survey by the National Oceanic and Atmospheric Administration



Importance of the Carolina Coast

Only households found on the Carolina coast received this survey. Please consider the term "Carolina coast" to mean the land and water area shown within the black boundary on the map below.



1. First, would you describe yourself as a permanent, temporary, or seasonal resident of the Carolina coast?

- ☐ Permanent (i.e., you reside here full time, permanently)
- ☐ Temporary (i.e., you reside here full time, but for a limited period only)
- ☐ Seasonal (i.e., you reside here for one to four months annually or periodically, such as for vacation)

2. How long have you resided on the Carolina coast as a permanent, temporary, or seasonal resident?

- ☐ Less than 1 year
- ☐ 1 to 2 years
- ☐ 3 to 5 years
- ☐ 6 to 10 years
- ☐ 11 to 20 years
- ☐ More than 20 years

3. To what extent do you disagree or agree with the following statements about the Carolina coast?

	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
I feel a strong sense of community on the Carolina coast.	☐	☐	☐	☐	☐
I think the economy is strong on the Carolina coast.	☐	☐	☐	☐	☐
I feel connected to the other people who live on the Carolina coast.	☐	☐	☐	☐	☐
The Carolina coast is a special place for me and/or my family.	☐	☐	☐	☐	☐
I think the natural parts of the Carolina coast are beautiful.	☐	☐	☐	☐	☐
The Carolina coast says a lot about who I am.	☐	☐	☐	☐	☐
The Carolina coast is the best place for what I like to do.	☐	☐	☐	☐	☐
I like the Carolina coast's mix of plants, animals, and landscapes.	☐	☐	☐	☐	☐

4. For only the recreational activities that you engage in along the Carolina coast, please indicate how important each is to you.

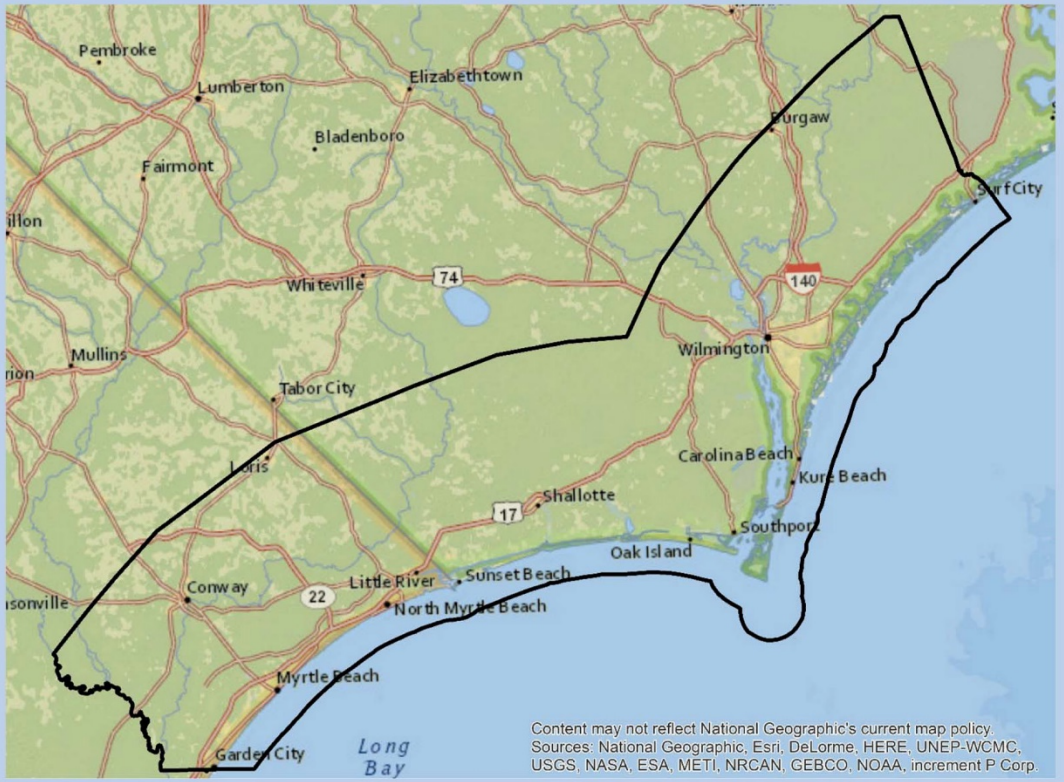
	Not Important	Somewhat Important	Very Important	Extremely Important	Don't Engage
Beach going	☐	☐	☐	☐	☐
Nature or scenic photography	☐	☐	☐	☐	☐
Birdwatching	☐	☐	☐	☐	☐
Whale watching or viewing of other marine mammals	☐	☐	☐	☐	☐
Fishing	☐	☐	☐	☐	☐
Hunting	☐	☐	☐	☐	☐
Boating or sailing	☐	☐	☐	☐	☐
SCUBA diving	☐	☐	☐	☐	☐
Other, please specify: _____	☐	☐	☐	☐	☐

5. For the items listed below, please tell us <u>how important</u> each item is to you in terms of your quality of life on the Carolina coast.

	Not Important	Somewhat Important	Very Important	Extremely Important	Don't Know
Tax revenues	☐	☐	☐	☐	☐
Job opportunities	☐	☐	☐	☐	☐
Affordability of electricity	☐	☐	☐	☐	☐
Image of your community	☐	☐	☐	☐	☐
Shipwrecks and other submerged maritime heritage sites	☐	☐	☐	☐	☐
Local property values	☐	☐	☐	☐	☐
View of ocean from the shore during the day	☐	☐	☐	☐	☐
View of ocean from the shore at night	☐	☐	☐	☐	☐
Recreational fishing	☐	☐	☐	☐	☐
Habitat for birds	☐	☐	☐	☐	☐
Habitat for fish	☐	☐	☐	☐	☐
Habitat for marine mammals and sea turtles	☐	☐	☐	☐	☐

6. Please <u>draw a line</u> connecting each pencil to one of your favorite places inside the black boundary on this map. Then <u>mark all the reasons</u> that you value each place. You may use either a pen or pencil. Types of reasons for valuing a place are defined below.

Aesthetics: I value this area because I enjoy the beauty, sights, sounds, and smells found here.
Economic: I value this area because it provides fisheries, minerals, and/or tourism opportunities such as outfitting and guiding.
Historic: I value this area because of the historic significance to our culture and communities.
Naturalness: I value this area because it is undeveloped with minimal human impact and it provides a variety of fish, wildlife, plant life, etc.
Recreation: I value this area because it provides a place for my favorite outdoor recreation activities.
Relaxation: I value this area because it makes me feel better, physically and/or mentally; it is calming.
Other: I value this area because of a reason not listed above. Please specify in the blank provided.



My 1st Favorite Place
I value this place for:
☐ Aesthetics ☐ Recreation
☐ Economics ☐ Relaxation
☐ Historic ☐ Other
☐ Naturalness

My 2nd Favorite Place
I value this place for:
☐ Aesthetics ☐ Recreation
☐ Economics ☐ Relaxation
☐ Historic ☐ Other
☐ Naturalness

My 3rd Favorite Place
I value this place for:
☐ Aesthetics ☐ Recreation
☐ Economics ☐ Relaxation
☐ Historic ☐ Other
☐ Naturalness

Expressions of Support or Opposition on Issues

The following questions will help us to understand how you express your support for or opposition to issues, including but not limited to offshore wind energy development.

7. By selecting "Yes" or "No" for each item below, please indicate whether you have ever done any of the following activities to express your support for or opposition to:

a. any issue in a city, county, or state where you have lived
b. any environmental issue in a city, county, or state where you have lived
c. the potential for offshore wind energy development in a city, county, or state where you have lived

	a. Any issue		b. Any environmental issue		c. The potential for offshore wind development	
	Yes	No	Yes	No	Yes	No
Signed a petition	☐	☐	☐	☐	☐	☐
Written, emailed, or called a public official	☐	☐	☐	☐	☐	☐
Joined a citizen-based advocacy group because of their position	☐	☐	☐	☐	☐	☐
Attended public meetings sponsored by a government agency	☐	☐	☐	☐	☐	☐
Attended public meetings, gatherings, or demonstrations sponsored by an advocacy group	☐	☐	☐	☐	☐	☐
Contributed money to an organization or campaign	☐	☐	☐	☐	☐	☐
Other, please specify: _____	☐	☐	☐	☐	☐	☐

8. In the next 12 months, do you plan to do any of the activities listed above in Question 7 in response to the potential for offshore wind energy development in your current city, county, or state?

☐ Yes
☐ No

Offshore Wind Energy Development

The following questions will help us to understand your views on offshore wind energy development, generally and in your region.

9. How aware are you of efforts to develop offshore wind energy in the following areas?

	Not at All Aware	Slightly Aware	Moderately Aware	Very Aware	Extremely Aware
The United States	☐	☐	☐	☐	☐
North Carolina	☐	☐	☐	☐	☐
South Carolina	☐	☐	☐	☐	☐

10. Regardless of how aware you are about efforts to develop offshore wind energy, and based on the impressions you have at the present time, what is your level of opposition to or support for the development of offshore wind energy in the following areas?

	Strongly Oppose	Somewhat Oppose	Neutral	Somewhat Support	Strongly Support
The United States	☐	☐	☐	☐	☐
North Carolina	☐	☐	☐	☐	☐
South Carolina	☐	☐	☐	☐	☐

11. Based on the impressions you have at the present time, and thinking about the Carolina coast as shown on Page 1, please indicate the type of impact you think development of offshore wind would have for each of the items listed below.

	Negative Impact	No Impact	Positive Impact	Unsure
Tax revenues	☐	☐	☐	☐
Job opportunities	☐	☐	☐	☐
Affordability of electricity	☐	☐	☐	☐
Image of your community	☐	☐	☐	☐
Shipwrecks and other submerged maritime heritage sites	☐	☐	☐	☐
Local property values	☐	☐	☐	☐
View of ocean from the shore during the day	☐	☐	☐	☐
View of ocean from the shore at night	☐	☐	☐	☐
Recreational fishing	☐	☐	☐	☐
Habitat for birds	☐	☐	☐	☐
Habitat for fish	☐	☐	☐	☐
Habitat for marine mammals and sea turtles	☐	☐	☐	☐

Background

To enable us to compare the responses of people with similar or different characteristics, in this final section we ask a few questions about you and your household. As with all answers, this information will be used for grouped analysis involving responses from all survey participants—your responses will remain completely confidential.

12. What is your sex?

☐ Male
☐ Female

13. In what year were you born?

☐☐☐☐

14. Which best describes your marital status?

- ☐ Married
- ☐ Widowed
- ☐ Divorced
- ☐ Separated
- ☐ Never married

15. Which best describes your ethnicity?

- ☐ Hispanic or Latino
- ☐ Not Hispanic or Latino

16. Which best describes your race? (Select one or more)

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White

17. What is the highest degree or level of school you have completed?

- ☐ No schooling completed
- ☐ Some high school (no diploma)
- ☐ High school diploma or GED
- ☐ Some college (no degree)
- ☐ Associate's degree
- ☐ Bachelor's degree
- ☐ Master's degree
- ☐ Professional degree (e.g., MD, DVM, JD)
- ☐ Doctoral degree (e.g., PhD, EdD)

18. Which best describes the ownership status of your residence in this county?

- ☐ Owned or being bought by you or someone in your household
- ☐ Rented or leased
- ☐ Occupied without payment of rent

19. How many people currently live in your household, including yourself?

☐☐

20. How many people under the age of 18 currently live in your household?

☐☐

21. What was the total income of your household during 2017 before taxes and other deductions?

- ☐ Less than $25,000
- ☐ $25,000 to $34,999
- ☐ $35,000 to $49,999
- ☐ $50,000 to $74,999
- ☐ $75,000 to $99,999
- ☐ $100,000 to $149,999
- ☐ $150,000 or more

22. Which best describes your current employment status?

- ☐ Unemployed
- ☐ Employed full-time
- ☐ Employed part-time
- ☐ Self-employed
- ☐ Retired
- ☐ Student
- ☐ Homemaker
- ☐ None of the above

Thank you for your participation in this important survey.
Please return it in the postage-paid envelope provided.

Department of the Interior (DOI)

The Department of the Interior protects and manages the Nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors the Nation’s trust responsibilities or special commitments to American Indians, Alaska Natives, and affiliated island communities.

Bureau of Ocean Energy Management (BOEM)

The mission of the Bureau of Ocean Energy Management is to manage development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.

BOEM Environmental Studies Program

The mission of the Environmental Studies Program 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. The proposal, selection, research, review, collaboration, production, and dissemination of each of BOEM’s Environmental Studies follows the DOI Code of Scientific and Scholarly Conduct, in support of a culture of scientific and professional integrity, as set out in the DOI Departmental Manual (305 DM 3).