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Ecosystem Services Valuation of the Central Georgia Coast, including Sapelo Island National Estuarine Research Reserve and Gray's Reef National Marine Sanctuary

NOAA National Centers for Coastal Ocean Science
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LIST OF ACRONYMS

ANOVA	Analysis of Variance
AUC	Area Under the Curve
C-CAP	Coastal Change Analysis Program
CITI	Collaborative Institutional Training Initiative
CSR	Completely Spatially Random
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
FET	Fisher's Exact Test
GA	Georgia
GDNR-CRD	Georgia Department of Natural Resources – Coastal Resources Division
GED	General Education Degree
GRNMS	Gray's Reef National Marine Sanctuary
GIS	Geographic Information Systems
HTML	Hypertext Markup Language
MaxEnt	Maximum Entropy
NCCOS	National Centers for Coastal Ocean Science
NERR	National Estuarine Research Reserve
NERRS	National Estuarine Research Reserve System
NMS	National Marine Sanctuary
NMSS	National Marine Sanctuary System
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
ONMS	Office of National Marine Sanctuaries
PHP	Hypertext Preprocessor
PPGI	Public Participatory Geographic Information
ROC	Receiver Operating Characteristic
SCUBA	Self-Contained Underwater Breathing Apparatus
SINERR	Sapelo Island National Estuarine Research Reserve
SolVES	Social Values of Ecosystem Services
UNEP	United Nations Environmental Programme
URL	Uniform Resource Locator
VI	Value Index
ZCTA	ZIP Code Tabulation Area
ZIP	Zone Improvement Plan

Executive Summary

Tybee Lighthouse

This report details the results of a survey effort conducted by the National Centers for Coastal Ocean Science, Hollings Marine Laboratory for coastal Georgia, which included the Sapelo Island National Estuarine Research Reserve and the Gray's Reef National Marine Sanctuary. The survey instrument was designed in collaboration with management staff to analyze the knowledge, attitudes, and preferences of social values associated with the area's ecosystem services for three distinct user groups of the Georgia coast: permanent residents, seasonal residents, and visitors. Components of the survey instrument addressed observed changes in abundance of key resources, and prioritization of management goals, among others. A participatory mapping component was included during which respondents allocated weights to any of 13 social value types and placed points on a map corresponding with those values. We received a total of 348 usable responses. We highlight interesting findings for each group, and offer two potential uses of this information for the Sapelo Island National Estuarine Research Reserve and the Gray's Reef National Marine Sanctuary.

Findings from the survey include, among other things, that aesthetics, recreation, and biodiversity are the social values most frequently cited by residents as their reason for using the study area. Survey respondents exhibited high levels of place attachment to coastal Georgia, and most feel that there are adequate levels of public access to coastal Georgia's resources, including boat ramps, boat slips, scenic viewpoints, wildlife viewing, and educational opportunities. Further, most residents felt that the various management options proposed in the survey, such as improving coastal water quality, restoring live bottom reef habitat, and wetland restoration, are "priority" items. An analysis of resident status indicates that:

Permanent Residents (47% of total respondents):

- Exhibited the most place attachment of all groups
- Allocated more pennies to the Economic social value
- Placed more points on the map

Seasonal Residents (21% of total respondents):

- Were the most knowledgeable about management dimensions
- Placed fewer points on the map
- Understood more about the local environmental effects of sea level rise than visitors
- Had more understanding of opportunities for public involvement in the decision-making process

Visitors (32% of total respondents):

- Were not dependent upon the Georgia coast for their income
- Had less understanding of management decisions
- Exhibited less place attachment

We also found that:

- There is recreation connectivity between the Gray's Reef National Marine Sanctuary and the Sapelo Island National Estuarine Research Reserve
- The environmental variable used in the SolVES analysis, Distance to Wrecks, had significant influence over both Aesthetics and Recreation values. This is likely due to the wrecks being visible in some cases (for Aesthetics) and the submerged wrecks acting as fish aggregating devices (for Recreation)

These findings can be used for advocating for increased connectivity between the Sapelo Island National Estuarine Research Reserve and the Gray's Reef National Marine Sanctuary. The findings may also provide a foundation for the development of a "scenic trail" connecting and/or informing visitors and residents of the various protected areas along the Georgia coast.

Chapter 1
Introduction

Black Seabass on sparsely colonized livebottom at Gray's Reef. Photo credit: NOAA Gray's Reef NMS

1.1. SOCIAL VALUATION BACKGROUND

Natural areas provide important ecosystem-related services to surrounding communities. These services can be grouped into four categories that include provisioning services, such as providing food or water; regulating services, such as providing flood or disease control; cultural services, by providing spiritual, recreational or cultural benefits; and, supporting services, such as nutrient and water cycling (UNEP, 2009). These ecosystem services play an important role in the continued use and conservation of the nation's coastlines and coastal communities, and as a result, these environments must be thoughtfully managed. Ecological and economic valuation are often used to define high-priority areas for decision making, but the inclusion of social valuation is increasingly considered a necessary step to more fully understanding stakeholder views (van Riper et al., 2012; Felipe-Lucia et al., 2015). Social surveys that aim to understand public values, attitudes, and preferences towards natural areas are an effective way to generate this type of information (Clement and Cheng, 2011). Surveys can be designed to ask respondents to rank or prioritize values against one another, encouraging respondents to consider management trade-offs (Costanza, 2000; Farber et al., 2002).

In addition to this, social valuation surveys can include participatory mapping to collect spatially explicit value attribution and place attachment information. Respondents can be asked to identify specific points on a map, and assign a specific value to each point (Emmel, 2008; Brown et al., 2014; Clement, 2006; Clement and Cheng, 2011). In this way, respondents can make trade-offs among an infinite number of placement options and among a set of social values, therefore prioritizing certain values and locations over others. After this information is collected, it can be analyzed using a Geographic Information Systems (GIS) framework. This collection uses public participatory geographic information (PPGI), a method commonly used to capture non-expert spatial information (Brown and Kyttä, 2014) that can then help determine public opinion through both an attitudinal and a spatial lens.

As public opinion often results in public support for, or opposition to, proposed management changes, social surveying can help inform officials to manage natural places more effectively. This report highlights public knowledge, attitudes and perceptions along the Georgia coast, which includes two National Ocean Service (NOS) protected places: the Sapelo Island National Estuarine Research Reserve and the Gray's Reef National Marine Sanctuary.

1.2. COASTAL GEORGIA AND THE STUDY AREA

The Georgia coast delivers a unique combination of history, culture, tourism, and ecological function. While smaller than many states, Georgia offers roughly 100 miles of irregular, dynamic coastline that varies between tides by as much as seven feet. Located along this coastline are fourteen barrier islands and 400,000 acres of saltwater marshes. These marshes are, acre-by-acre, the most protective land in Georgia, are home to insects, birds, fish, shrimp, and crabs, and also provide the important ecological functions of storm surge buffering and natural filtration of upstream river pollutants. Georgia's barrier islands are supported by these saltwater marshes, and have beaches on their seaward side (GeorgiaInfo, 2015). Historically accessible only by the wealthy, this changed once many of these islands came under state and federal jurisdiction (Guthrie, 2015). Government control was accompanied by the ability to increase protection for some of Georgia's coastal areas. Many islands became national wildlife refuges or protected wilderness areas, and Cumberland Island became a national seashore (GeorgiaInfo, 2015).

Today, these islands are enjoyed by large numbers of tourists and locals, alike. In 2013, the State of Georgia was ranked 13th in number of international travelers (0.74 million), and in 2011, the Georgia Department of Economic Development estimated that there was a total of 122.5 million combined day and over-night person-trips annually. Of those travel and tourism expenditures and taxes within the state, 6.3% came from coastal counties (Fleming et al., 2014).

While tourism is often a steady stream of revenue for the Georgia coast, other economic sectors play a large role. Coastal counties held 9.8% (945,436) of Georgia's total population in the 2010 census, and 2.2% ($7.7 billion) of the state's personal income. In addition to tourism, fisheries and port activities contribute to those

shares. In 2012 Georgia contributed roughly 9.5% of the South Atlantic's total commercial fisheries landings both by weight and by value.[1] In recreational fisheries, Georgia caught 4.1% of the South Atlantic's 2012 reported catch, and 88.1% of this was from private or rental boats. Within the maritime transportation sector, the port of Savannah, GA was ranked the 2012 top South Atlantic port by cargo volume (20th in the nation), 2010 top South Atlantic port by port call (8th in the nation), and 2010 top South Atlantic port by container traffic (4th in the nation) (Fleming et al., 2014).

Georgia's coast holds not only economic importance, but also has strong historical and cultural significance, in part because Georgia's earliest settlements were coastal (GeorgiaInfo, 2015). For example, the Gullah/Geechee Cultural Heritage Corridor that spans from Wilmington, NC to Jacksonville, FL, encompasses the entire Georgia coast, and is home to the Gullah people in the Carolinas and the Geechee in Georgia and Florida. These cultural groups descended from enslaved peoples from west and central Africa, and share similar linguistic, artistic, and societal traits that have remained relatively intact for several centuries due to geographic isolation. In coastal Georgia, the Sapelo Island Cultural and Revitalization Society hosts a "Culture Day" to educate the public about their culture, and the Geechee Kunda Museum and Community Education Center in Riceboro, GA has exhibits, galleries, classes, and events highlighting Geechee culture (National Park Service, 2015). Furthermore, a study by Blount and Kitner (2007) demonstrates the importance of the Georgian coast to a community of African Americans who harvest shellfish not only as an individual economic strategy, but also as a way of life.

1.2.1. Sapelo Island National Estuarine Research Reserve

The Sapelo Island National Estuarine Research Reserve (Reserve) is one of 28 sites in the United States that compose the National Estuarine Research Reserve System (NERRS). The NERRS was "created to practice and promote stewardship of coasts and estuaries through innovative research, education and training using a place-based system of protected areas" (NERRS, 2011). It was established by the Coastal Zone Management Act (CZMA) of 1972 as part of the Federal Coastal Zone Management (CZM) program "dedicated to comprehensive, sustainable management of the nation's coasts" (SINERR, 2008). The NERRS network is directed and guided by the Office for Coastal Management within NOAA's National Ocean Service. The Sapelo Reserve was designated as a NERRS site in 1976 with the mission to "perpetuate the protection of the Sapelo Island National Estuarine Research Reserve and to provide a platform for conservation-based research, education, and stewardship through the Reserve" (SINERR, 2008). The lead state agency for the Reserve is the Georgia Department of Natural Resources, and it serves to protect the Reserve for long-term research, water-quality monitoring, education, and coastal stewardship (NERRS, 2015). Located 7.5 miles northeast of Darien, Georgia, the Reserve is utilized by various user-groups including non-profit institutions, local residents, visitors, students, and teachers (SINERR, 2008). The terrestrial and aquatic landscapes of Sapelo Island and the Reserve itself offer many ecosystem services to the inhabitants and visitors of the site (SINERR, 2008).

Sapelo Island is located at about the midway point along the Georgia coast, and its estuary system is defined by the convergence of the currents of Doboy Sound and the Duplin River. The Reserve encompasses estuarine ecosystems characteristic of the Carolinian biogeographic region, which features tidal salt marshes protected by a series of barrier islands. The Reserve's mean tidal range is 6.8 feet. Roughly 10,900 acres of Sapelo Island is high ground, while the rest is salt marsh, and an additional 4.5 miles of salt marsh and estuarine systems separate the island from the mainland. Historically, Sapelo Island has had many economic uses, including agriculture of cotton, corn, cane sugar, and dairy cattle, as well as timbering and sawmilling, boat building, and commercial fishing. Since the late 1960s, however, Sapelo Island has experienced relatively little human modification and development due to the sale of the island to both the State of Georgia and the federal government (SINERR, 2008). These conditions provide an ideal habitat for species such as pelicans, herons, and osprey, as well as estuarine flora and fauna including marsh grasses, otter, crabs, and jellyfish (SINERR, 2008). Today, the island provides an environment for residences, research by the

[1]South Atlantic is defined by the U.S. states of North Carolina, South Carolina, Georgia, and Florida (Fleming, Tonioli, and Agar 2014).

University of Georgia Marine Institute and Georgia Department of Natural Resources, commercial fishing, and recreation, including public tours, boating, swimming, hunting, and fishing (SINERR, 2008). These user groups result in a variety of stakeholders visiting or utilizing Sapelo Island and the Reserve.

1.2.2. Gray's Reef National Marine Sanctuary

The Gray's Reef National Marine Sanctuary (Sanctuary) is one of 14 marine protected areas in the U.S. that compose the National Marine Sanctuary System (NMSS). The NMSS was established by the Marine Protection, Research and Sanctuaries Act of 1972, which allows the Secretary of the Department of Commerce "to dedicate discrete areas of the marine environment as national marine sanctuaries to promote comprehensive management of their special conservation, recreational, ecological, historical, research, educational, or aesthetic resources" (NMS, 2015). The Sanctuary was designated as an NMSS site in 1981 to "protect the quality of [the] unique and fragile ecological community" of "one of the largest nearshore, live-bottom reefs of the southeastern United States" (NMS, 2014). The Office of National Marine Sanctuaries (ONMS) serves to protect the Sanctuary's mission "to identify, protect, conserve, and enhance the natural and cultural resources, values, and qualities of the sanctuary for current and future generations" (NMS, 2014). Located 16 miles offshore from Sapelo Island, the 22-square-mile natural marine habitat is recognized nationally and internationally (NMS, 2014). Since the Sanctuary was also designated to promote scientific understanding, the lower one third of the reef serves as a "sentinel site," where ongoing research and observations take place to detect change in the ecosystem, and also provides early warning signs of impending problems (NMS, 2014).

The Sanctuary is a "live bottom" reef, referring to the hard or rocky seafloor that supports the high numbers of invertebrates that live there. The reef attracts over 200 fish species, including both temperate and tropical fishes that fluctuate seasonally (NMS, 2014). The Sanctuary substrate is composed of four basic bottom types, including flat sand, rippled sand, sparsely colonized live bottom, and densely colonized live bottom (ledges). A 2007 biogeographic study found that median total percent biotic cover on ledges was 97.6%, 75.1%, and 17.7% on tall, medium, and short ledges, respectively; indicating that the taller the ledge, the more hard and soft corals and other biotic life are found. These conditions provide an ideal habitat for fish communities that corresponded closely with the various benthic habitats (Kendall et al., 2007) and larger migrating marine animals, including the threatened loggerhead sea turtle and the highly endangered North Atlantic right whale (NMS, 2014). Recreational fishers show an interest in black sea bass, as well as gag and scamp grouper along Gray's Reef (Kendall et al., 2007), and another study estimated that the economic impact at a Sanctuary research area may be between 0.11% and 0.86% of statewide saltwater fishing expenditures (NOAA, 2008). Because of its seaward location, the types of user groups that travel to the Sanctuary are fairly limited, but include boaters and divers (NMS, 2014b).

Pair of Black Seabass at Gray's Reef. Photo credit: NOAA Gray's Reef NMS

1.2.3. Liberty County, McIntosh County, and Glynn County

Due to the study area's location on the Georgia coast, this study will also consider three adjacent coastal counties: Liberty County, McIntosh County, and Glynn County. Together these counties measure over 1,700 square miles in land and water area (University of Georgia, 2015), are home to over 160,000 people, and exhibit county-level median household incomes ranging from $39,000 to $46,000. Across the three counties, the majority of the population identifies as white, the largest minority identifies as black or African American, and between 15% and 26% of residents hold a Bachelor's degree or higher (U.S. Census Bureau, 2015). This tri-county area hosts many cultural events and festivals, and has a series of historic sites including museums, churches, and historic forts, as well as wildlife refuges, natural areas, and an operational army installation (GDNR-CRD, 2015a-c). For a full tri-county profile, please see Appendix B.

It is portions of these three counties, Sapelo Island, the Sapelo Reserve, and the Gray's Reef Sanctuary that comprise this project's study area (Figure 1.1).

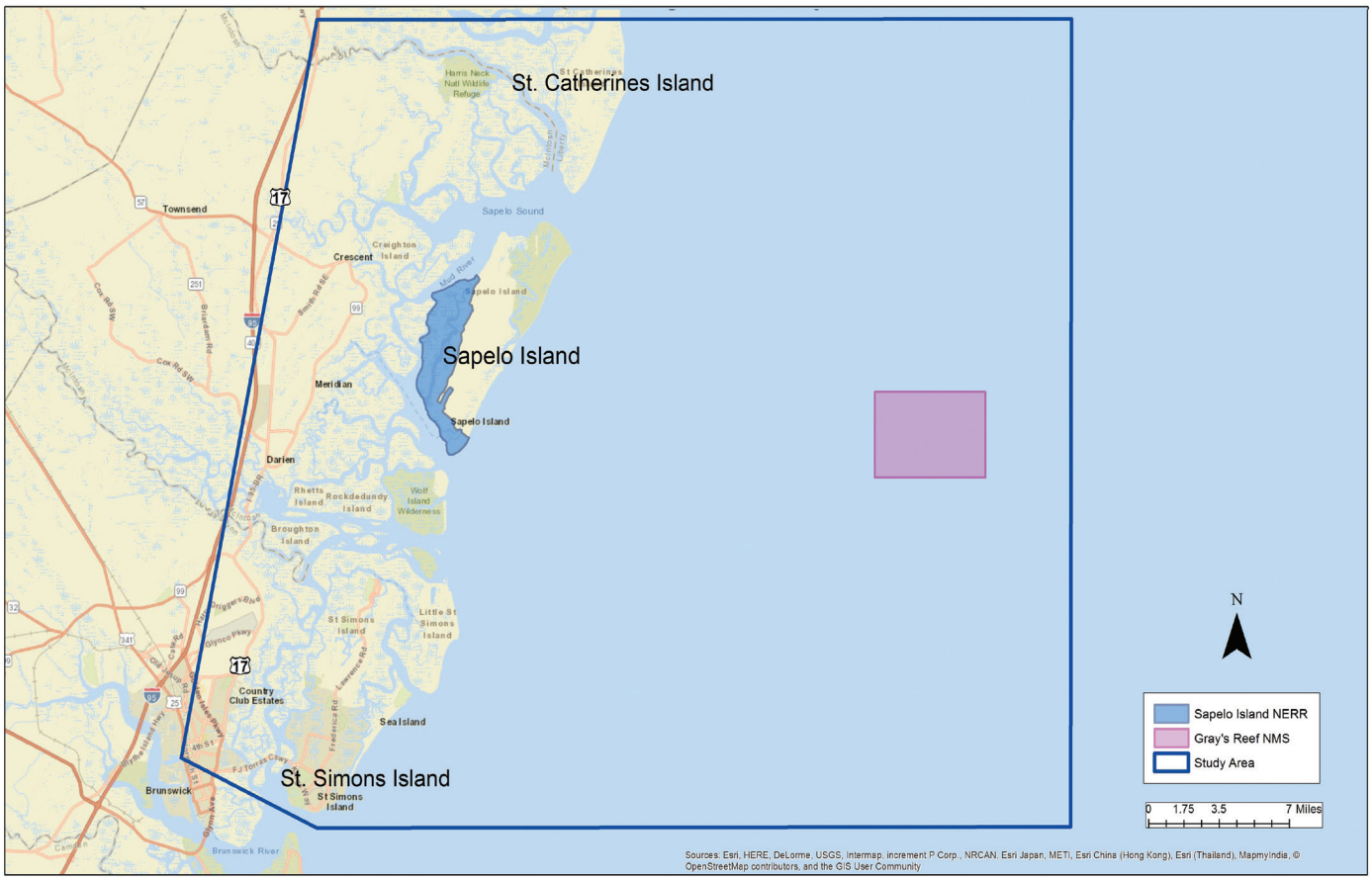

Figure 1.1. Coastal Georgia study area, including the Sapelo Island Reserve and Gray's Reef Sanctuary.

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Chapter 2
Methods

Surveying at Forsyth Park in Savannah, GA. Photo credit: Alison Scott

2.1. SURVEY INSTRUMENT

The survey instrument (Appendix A) was designed in modular format with a set of core questions and a set of supplementary questions labeled "management modules." Management staff members at the Reserve and Sanctuary were invited to select from a number of management modules and suggest questions for those modules. The questions selected involved current legislative and management issues such as motorized watercraft limitations, commercial and recreational harvest restrictions, and the incorporation of local knowledge and cultural heritage into management decision, among others.

The survey instrument was organized into nine sections, the first of which asked introductory residence and visitation questions. The second section asked respondents about their perceptions concerning changes along the Georgia coast since living in or visiting the area. We framed the questions as "Change in Condition" issues, in that we asked the respondents if they felt that resource condition had increased or decreased for eight biological, geophysical, and manmade factors. The factors included shellfish, fish, visitors and boaters, marsh vegetation, marine mammals, birds, public access to land and water resources, and frequency of adverse conditions, such as red tides, jellyfish, marine debris, and trash.

Section 3 obtained respondent attitudes towards the idea of "place attachment" within the study area. Place attachment statements included satisfying outdoor recreation needs, representing of a way of life, providing habitat for fish and other wildlife, economic dependence on natural resources, and contributing to community character.

The fourth and fifth sections were comprised of value allocation and value mapping exercises. We asked respondents to distribute 100 "pennies" across thirteen different social value types according to their perceived importance when they think of the study area. These values were adapted and expanded from Rolston and Coufal's (1991) original ten values to include Aesthetic, Biodiversity, Economic, Legacy, In and of Itself, Learning, Human Needs, Recreation, Spiritual, Therapeutic, Wilderness, Inspiration, and Socializing. Socializing value had not been used in past value allocation for ecosystem services studies, but was included after discussions with fellow researchers (Lovelace pers. comm., 2015). After values were allocated, section 5 asked respondents to consider specific locations that they associate with the social values they selected in the previous section. We asked them to mark those locations on a map we provided.

Section 6 asked respondents to provide their opinions on adequacy of existing public access in the study area. Respondents were asked to rank quality of access to the Sanctuary, the Reserve, boat ramps, boat slips, scenic viewpoints, environmental educational opportunities, wildlife viewing sites, diving sites, and birding sites. Respondents were also able to write in and rank additional conservation areas on the Georgia coast.

To better understand what respondents knew about certain management dimensions and other characteristics of the study area, section 7 asked them to rate their level of knowledge on ecology, history/culture, local environmental effects of sea level rise, recreational opportunities, volunteer opportunities, educational opportunities, and public involvement in decision making within the study area.

Section 8 asked respondents about a number of management goals. The goals posed to the respondents were selected through collaboration with Reserve and Sanctuary management staff, in which active or future goals were discussed and chosen. These management goals included the improvement of coastal water quality, elimination of damage to coral reefs, research to enhance the understanding of coastal processes, restoration and sustainability of fish stocks and other marine resources, increased resilience of coastal communities to coastal hazards, increased public understanding of how natural coastal ecosystems help protect communities from these hazards, increased public understanding of how human use and development impact the long-term sustainability of coastal ecosystems, creation of areas where commercial and recreational harvest is restricted, established areas where motorized watercraft use is limited or restricted, and the incorporation of local cultural heritage into resource management decision making.

The final section of the survey asked general demographic questions. The researchers were careful to articulate that the answers provided would in no way be associated with individual respondents. Income categories were arranged loosely around U.S. Census categories, and ethnicity and race were modeled after U.S. Census guidelines. The age question was posed to the respondents in an open-ended "what year were you born" format, with the thinking that respondents would be more comfortable revealing their birth year, rather than report their age.

Two forms of the same survey were developed: a paper-based instrument and an online instrument. Both instruments contained a mapping element. The paper-based survey was arranged in portrait layout on 8.5"X11" paper with the map printed in landscape layout on a sheet of 11"X17" paper. The paper map was set to a 1:300,000 scale, and was marked with major island and city locations so that users could orient themselves, but did not include boundaries of the Reserve or Sanctuary so as not to bias results. The online version was coded with the assistance of National Centers for Coastal Ocean Science (NCCOS) IT support specialists using a combination of HTML, PHP, JavaScript, and MySQL programming languages and hosted on a secure NCCOS web server. The mapping component of the online version was developed using Google Maps as a user interface both for its broad familiarity and ease of programmatic manipulation. For example, the Google Map allowed the user to "zoom in" or "out" – as is typical with the Google Map interface – as well as switch from a street view to a satellite view of the study area.

2.2. SURVEY DEPLOYMENT

Surveying was conducted from August-November 2015, and again from March-June 2016. Surveying ceased during the winter months due to infrequent coastal visitation. Managers of the Reserve and Sanctuary were consulted to determine the targeted sample populations, and it was suggested that data be collected from residents and non-residents, alike. This influenced the sample methodology, and resulted in intercept surveying at random locations within or nearby the study area. The sample size goal was 385, as this number would adequately provide population estimates for resource users of the Georgia coast (within +/- 5 percentage points at a 95% confidence level).

The data collection efforts involved paper-based and online tablet-based surveys given to respondents intercepted at a variety of locations in and around the study area. Alternatively, for those respondents not wishing to complete the survey at the time, a business card containing the URL for the online survey was provided. Upon completing the survey, the respondents were allowed to choose from a selection of computer wallpapers made from award winning underwater photos taken at the Sanctuary.

2.2.1. Volunteer Training

We relied on the volunteer networks at the Reserve and Sanctuary. For the second leg of surveying, one of these volunteers was temporarily hired to dedicate more time to this effort. A team member from each of the volunteer groups was provided with webinar-based training on the ethics of surveying and human research in general. The objective of this effort was to teach the volunteers how to conduct intercept surveys and certify them in the ethics of human subject research. As part of the training, we provided the history and rationale for protecting human research participants; suggested appropriate attire and attitude needed to be a successful intercept surveyor; how to properly greet potential respondents; getting permission to interview; and, what to do if someone does not want to participate in the survey.

We also instructed the volunteers in how to select potential survey respondents depending upon the number of people in a given location. For example, if a small number of people (e.g., less than 10) were present, the volunteer was instructed to ask all present if they would like to complete the survey. If a larger number of people (e.g., more than 10) were present, however, the volunteer was instructed to ask every third person.
At the end of the training presentation, the volunteers were directed to a website hosted by the National Institute of Health, Office of Extramural Research to take a test on "Protecting Human Research Participants." Following successful completion of the training and a satisfactory score on the test, each volunteer was issued a certificate.

2.2.2. Intercept Site Selection

In order to capture respondents' immediate impressions of their social and natural values, surveys were conducted immediately before, during, or after a respondent interacted with the environment through intercept surveying. At the beginning of the intercept site selection process, 145 potential intercept sites were identified using information obtained from the Georgia Department of Natural Resources. The potential intercept site types included parks, wildlife management areas, marinas and boat ramps, fishing piers, and beaches. The sites were located at various points within the study area. After consultation with people familiar with the area, the original 145 sites were then refined to 96, and grouped according to location (n=10) to focus on: their variation in types of users (i.e., beach goers, boaters, fishermen, etc.); the site's location within the study area; the likelihood of the site to draw high traffic flow; ease of access for the surveyor; and, the probability of intercepting people willing to take the survey. During the second leg of surveying, intercept sites were refined further to include only 20 individual sites based on previous surveying success rates. Surveying at local events was also implemented to increase survey completion rates. The six primary intercept site types are outlined below in Figure 2.1. For a full list of all intercept sites used in this study and their attributes/ conditions, please see Appendix C.

Figure 2.1. Final survey intercept site types and examples.

2.3. THE SOCIAL VALUES FOR ECOSYSTEM SERVICES (SolVES) TOOL

2.3.1. SolVES Background

We define social values of ecosystem services as attributes of the environment that provide additional benefit to human life beyond material needs. Social values such as recreation, spiritual fulfillment, and aesthetic beauty, for example, provide support for human well-being and contribute to the fulfillment of human life (Millennium Ecosystem Assessment, 2005). Because many socially important ecosystem services are not consumed in markets, they are often difficult to quantify (Daniel et al., 2012). In large part, this is because the disciplines of ecology and economics have yet to standardize both the measurement and definition of ecosystem services in their respective techniques (Boyd and Banzhaf 2007). Nevertheless, it is important that social values do not go unrecognized in ecosystem service valuation efforts. Fortunately, tools are available that enable researchers to gain a sense of the social values placed on ecosystem services by various constituent groups. One such tool is described below.

The Social Values for Ecosystem Services (SolVES) GIS tool[2] was developed by researchers at the United States Geological Survey to allow users to assess, map, and quantify social values of ecosystem services (Sherrouse and Semmens, 2015). SolVES is a result of the gaps revealed and the lessons learned from past social values mapping research; research which is itself based on the values typology of Rolston and Coufal (1991) and Brown and Reed (2000). For this reason, SolVES is especially useful when analyzing aesthetics and recreation, two components of the cultural category of ecosystem services (Sherrouse, Clement, and Semmens, 2011; Sherrouse et al., 2014).[3] In an effort to extend the usefulness of the tool, SolVES now incorporates the functionality found in the Maximum Entropy (MaxEnt) modeling software, version 3.3k (Phillips et al., 2006).

2.3.2. SolVES Setup

As noted previously, our survey incorporated a two-part mapping exercise: the first asked respondents to distribute 100 “pennies” across 13 value types that are typically associated with ecosystem service categories (thereby weighting the value types by respondent preference). The second exercise asked respondents to situate these weighted values on a paper or online map of the coastal Georgia study area. The end result was a spatial representation of weighted value types based on respondent preference within the study area landscape. This information provides the foundation upon which SolVES runs.

The locations to which respondents assigned values on the paper maps were digitized as point feature classes, and placed in a geodatabase using ArcGIS 10.3.1 software. Because some respondents placed points outside of the study area boundary, a 5 mile (8,047 m) buffer around the study area was used to include as many value points in the analysis as possible. The locations of assigned value entered using the Google Maps interface were transformed to the WGS 1984 Geographic Coordinate System, and then projected to the North American Datum 1983, Universal Transverse Mercator 17N (NAD83 UTM17N) for inclusion into the working geodatabase.

Also included in the geodatabase was a variety of potential explanatory environmental feature layers for SolVES and MaxEnt analysis. The selection of these environmental variables was based on past iterations of the SolVES tool (Sherrouse, Clement, and Semmens, 2011; Cole, 2012; van Riper and Kyle, 2014a; van Riper and Kyle, 2014b) and the belief that they may have an influential role in the perceived values of the study area. The environmental variables were divided into two groups based upon the relationship to the Reserve and the Sanctuary. The Reserve group was primarily land-based shapefiles, while the latter were primarily ocean-based shapefiles. The Reserve group of environmental variables included nine continuous and/or categorical rasters: a National Wetlands Inventory of the study area; a 2009-era Vegetation cover file; distance to rivers; distance to underwater obstructions; distance to underwater wrecks; distance to protected areas; Landsat 8 – Band 1; distance to artificial reefs; and, bathymetry. The Sanctuary group of environmental variables included six continuous and/or categorical raster files: bathymetry; distance to artificial reefs; distance to wrecks; distance to protected areas; distance to underwater obstructions; and,

[2]For more information on the SolVES tool, visit http://solves.cr.usgs.gov.
[3]For a more detailed explanation of the SolVES application, see Sherrouse and Semmens (2015).

Landsat 8 – Band 1. The Euclidean Distance tool in the ArcGIS 10.3.1 Spatial Analyst extension was used to create continuous raster-based files from files not already in raster format (e.g., point- and line-based shapefiles). In the SolVES analysis, all environmental feature layers were treated as 30 m resolution rasters (with the exception of the distance to rivers, which was 15m). See Appendix D for more details concerning the environmental variables used in the analyses.

For this study, SolVES was configured to run at a 350 m output cell size and a 3,500 m search radius. These parameters were chosen based on the recommendations outlined in the SolVES User Manual. For example, the 350 m output cell size is based on the scale of the map used for the survey, where the output cell size is approximately 1/1,000th of the scale used for the survey map. The average scale used for the survey map was 1:296,000, hence the 350 m output cell size. The 3,500 m search radius was used since the search radius is suggested to be 10 times the output cell size. Next, the data were loaded into the SolVES tool where kernel density estimations and average nearest neighbor distances were applied for all mapped social value types to assess spatial clustering. SolVES then used MaxEnt to analyze the interaction between the survey point data and the environmental-feature layers.

2.3.3. SolVES Modeling and Interpretation

The results from both SolVES and MaxEnt were used to create a "Value Index" (VI) (Sherrouse and Semmens, 2015). The Value Index is "a spatial, non-monetary metric statistically related to characteristics of the underlying physical environment" and then normalized, transformed, and standardized on a 10-point "Value Index" (Sherrouse and Semmens, 2015). The maximum VI for each value category was then multiplied by a logistic surface layer calculated in MaxEnt, which employed a machine learning program to estimate the probability distribution of points given the constraints imposed by a suite of explanatory environmental variables. Using the point data reflecting the distribution and intensity of respondent-valued landscapes as well as the continuous and categorical aspects of the explanatory environmental features that were selected for analysis, logistic surface layers were generated in MaxEnt to indicate the probability – cell-wise – that the survey respondents would associate assigned values with other places in the study area.

In summary, the objectives of spatial analysis using the SolVES tool were to determine if there is any statistically significant clustering of the spatially assigned social values as well as to understand the interaction of those values with environmental features using spatial statistics.

Fishing off a bridge. Credit: Tripp McElwee

After the models were run, the "View Results" dialog box was initiated in the SolVES tool to generate map layouts. The map layouts were then displayed in the ArcGIS interface (see section 3.2 in Chapter 3). The user was shown, from left to right, top to bottom: 1) a rasterized map depicting the distribution of the Value Index across the study area (at 350m cell size) and the Value Index scale, indicating Value Indices ranging from 0-10 from blue (low) to red (high); 2) line graphs of the environmental variables used in the model depicting the relationship of the environmental variable to the Value Index; 3) orientation map, scale bar, and compass rose; 4) details as to the Area Under the Curve (AUC) of the Receiver Operating Characteristic (ROC) curve from the model data; 5) text instructing the user to refer to the details of the categorical dataset to determine what the numbers represent on the x-axis of any categorical environmental variables used in the model.

2.4. STATISTICAL ANALYSES

The three user groups surveyed were analyzed to generate user profiles based on their knowledge, attitudes, and perceptions of the Sanctuary and Reserve. Analysis was completed through the use of a Pearson correlation matrix as well as one-way ANOVA tests. Before the analysis could take place, a few assumptions and data manipulations were necessary. Firstly, all answers of "unsure" were coded as missing values. Additionally, dummy variables were created for the following variables to satisfy the assumptions of Pearson correlation analysis:

- Permanent Residency (1 if the respondent is a permanent resident, 0 otherwise)
- Seasonal Residency (1 if the respondent is a seasonal resident, 0 otherwise)
- Visitor Status (1 if the respondent is a visitor, 0 otherwise)
- Visitation of the Sanctuary and Reserve (1 if the respondent has ever visited coastal Georgia, 0 otherwise)
- Visitation Frequency (1 if the respondent visits coastal Georgia once per month or more, 0 otherwise)
- Income Dependency (1 if the respondent's income is dependent upon coastal Georgia, 0 otherwise)
- Race (1 if the respondent is white, 0 otherwise; 1 if the respondent is black, 0 otherwise; 1 if the respondent is multi-racial, 0 otherwise)
- Ethnicity (1 if the respondent is Hispanic, 0 otherwise)
- Education (1 if the respondent completed college, 0 otherwise)

Additive indices were also created for the following groups of questions and normalized on a scale of 0-100 to satisfy the assumptions of Pearson correlation analysis:

1. Agreement with statements of value concerning place attachment to the Sanctuary and Reserve
2. Priority of management goals
3. Public knowledge of management dimensions
4. Perceptions concerning public access to the Sanctuary and Reserve
5. Changes in the conditions of the Sanctuary and Reserve

A few other stipulations apply to the "conditions index." This index only includes perceptions related to shellfish, fish, marsh vegetation, marine mammals, and birds. We excluded visitors/boaters, public access to land and water resources, and frequency of adverse conditions from the index because increases in these attributes can have an ambiguous interpretation (visitors, public access) or be negative (adverse conditions); whereas increases in shellfish, fish, marsh vegetation, marine mammals, and birds are interpreted as beneficial.

Therefore, the index value increases as positive perception concerning changes in attributes increases.

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Chapter 3
Results

Harbor in Darien, GA during annual Blessing of the Fleet festival. Photo credit: Alison Scott

3.1. SURVEY RESULTS

Our survey efforts yielded 348 complete responses. Complete responses (hereafter referred to as "responses" or "surveys") included surveys where the respondent had at least completed the mapping component, value allocation section, and management goals section. Of the completed surveys, 271 (78%) were completed in person, and 77 (22%) were completed online. Nevertheless, the 348 completed surveys represents a confidence level of 94.66% and a 5% margin of error. The surveys were then grouped according to the respondent being a permanent resident, seasonal resident, or visitor to the Georgia coast.

3.1.1. Residency and Visitation

Of the completed surveys, 47% of respondents were permanent residents, 21% were seasonal residents, and 32% were visitors. Four respondents chose not to answer this question. The most commonly recorded ZIP Code was 31312 (Guyton, GA) with 37, followed by 31401 (Savannah, GA) with a count of 21 respondents. The next most commonly recorded ZIP Codes were 31419 (Georgetown, GA), 31522 (Saint Simons Island, GA), and 31523 (Brunswick, GA), with a count of 16 each. Following these were 31407 (Port Wentworth, GA), 31510 (Alma, GA), and 31533 (Douglas, GA), each with a count of 15 respondents. No respondents recorded a ZIP Code that corresponded to Sapelo Island itself. On average, respondents had lived within their recorded ZIP Code for 17.8 years.

Of our sample, 161 respondents were permanent residents, and 22% of permanent residents lived in ZIP code 31305 (Darien, GA). Table 3.1 illustrates residency ZIP Codes of permanent residents. For further ZIP Code analyses, please see sections 3.3 and 3.6 in this Chapter.

When asked about the frequency of visitation to the Georgia coast study area, 18 respondents did not answer. Of those that did provide a response, 34% reported visiting the area daily, 14% visited once a week, and 15% visited once a month. Twenty-two percent of respondents visited the area twice a year or more, 15% visited once a year, and only 1% reported this being their first visit to the study area.

Beach crowd at Jekyll Island, GA. Credit: Alison Scott

Table 3.1. ZIP Codes of Permanent Residents.

ZIP Codes of Permanent Residents	Frequency of Occurrence
31305	36
31331	19
31520	13
31525	12
31523	8
31419	8
31522	6
31406	5
31404	4
31410	4
31411	3
31324	3
31320	3
30307	2
31319	2
31405	2
31401	2
31326	2
31322	2
31329	2
30525	2
31521	1
32210	1
24060	1
77396	1
31311	1
31553	1
48640	1
31794	1
30309	1
31545	1
31569	1
30427	1
40525	1
31533	1
31548	1
30446	1
30436	1
31524	1
31516	1
51323	1
31425	1

3.1.2. Change in Condition

Forty percent of respondents were unsure or did not know if shellfish conditions had changed while they had lived in or had been visiting the area. Twenty-four percent responded neutrally, 19% reported a decrease in shellfish, and 10% reported an increase. Only 3% responded that there had been a large increase or decrease, respectively. Five respondents did not answer this question (Figure 3.1).

Six people chose not to give their opinion in regards to changes in fish. Of those that did respond, Figure 3.2 indicates that 33% reported they were unsure or did not know about any change in fish, followed by 27%, who recorded a neutral response. Nineteen percent reported a decrease in fish and 3% reported a large decrease, whereas 16% reported an increase in fish and 1% reported a large increase.

Figure 3.3 shows that 49% of respondents perceived an increase in visitors and boaters, and 17% perceived a large increase. Conversely, only 3% reported a decrease and 1% large decrease. Twenty-one percent of respondents reported neutrally, 10% reported that they were unsure or did not know, and 8 respondents did not provide their opinion as to change in visitors and boaters.

Figure 3.4 indicates that 40% of respondents perceived no change in the condition of marsh vegetation, and 23% were unsure or did not know if marsh vegetation had changed. Eighteen percent and 3% of respondents reported an increase or large increase, respectively, in marsh vegetation, whereas 16% and 1% reported a decrease or large decrease, respectively. Six individuals chose not to respond.

Figure 3.5 shows that 38% of respondents perceived no change in marine mammals along the Georgia coast, and 30% of respondents were unsure or did not know. While 15% and 2% of respondents reported an increase or large increase, respectively, 14% and 1% reported a decrease or large decrease, respectively, in marine mammals. Seven respondents did not answer.

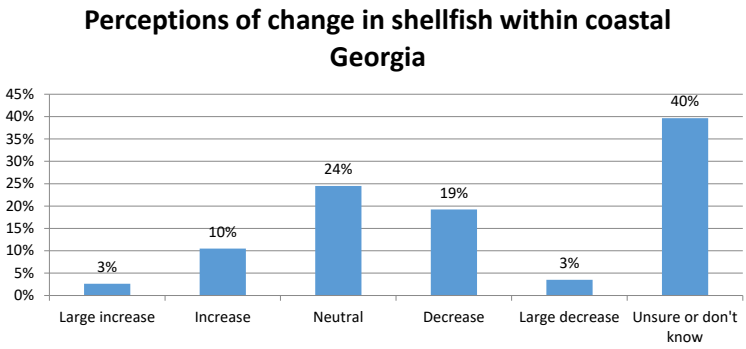

Figure 3.1. Change in shellfish.

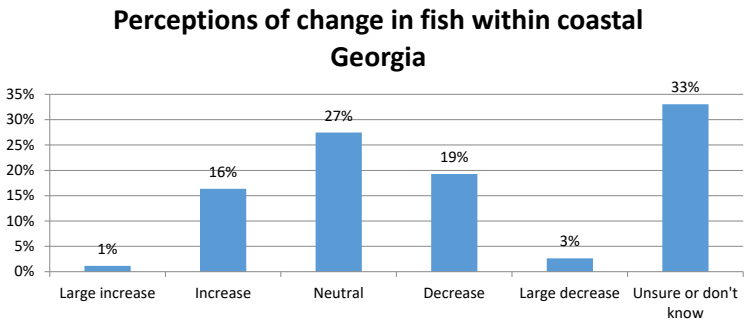

Figure 3.2. Change in fish.

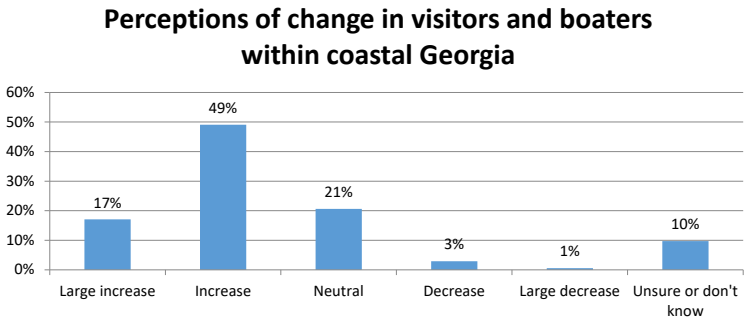

Figure 3.3. Change in visitors and boaters.

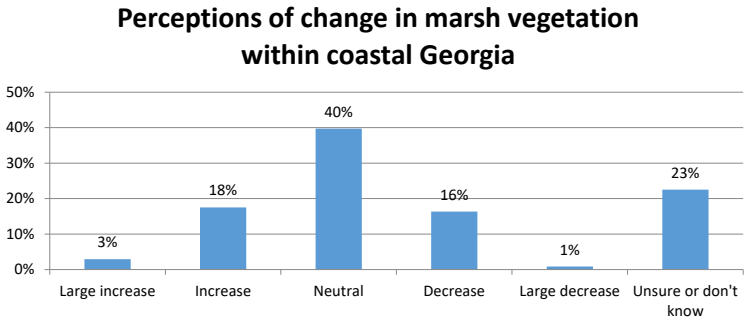

Figure 3.4. Change in marsh vegetation.

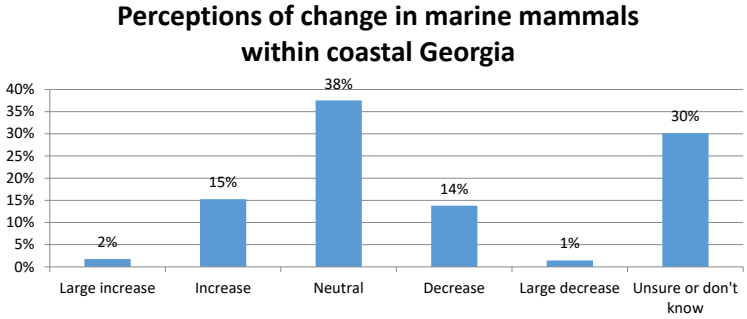

Figure 3.5. Change in marine mammals.

Ten respondents chose not to report their perception of change in birds along the Georgia coast. Of those that did respond, 40% perceived no change (Figure 3.6). Twenty-eight percent of respondents reported an increase and 7% reported a large increase in birds, while 10% of respondents reported a decrease and 0% reported a large decrease in birds within coastal Georgia. Fifteen percent were unsure or did not know of any change.

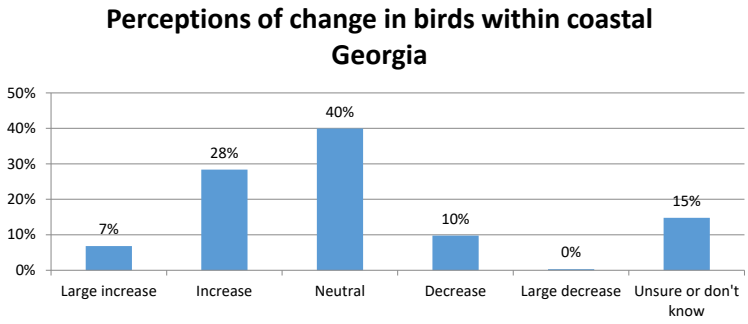

Figure 3.6. Change in birds.

Figure 3.7 shows that 41% of respondents perceived no change in public access to land and water resources along Georgia's coast, but 31% and 4% of respondents reported an increase or large increase, respectively. Twelve percent were unsure or did not know of any change, 11% reported a decrease in public access, and 1% reported a large decrease. Seven individuals did not respond.

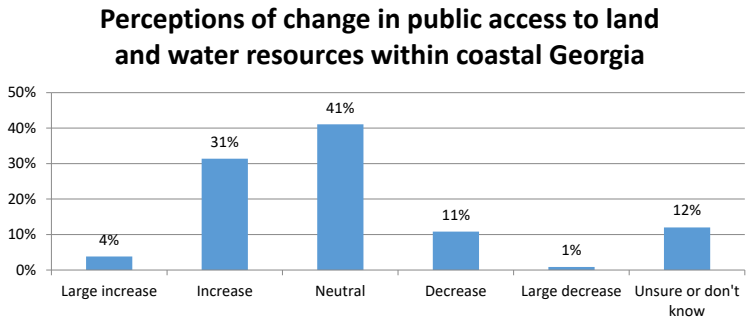

Figure 3.7. Change in public access to land and water resources.

Figure 3.8 indicates that 39% of respondents perceived no change in the frequency of adverse conditions such as red tides, jellyfish, marine debris, or trash. The second majority (26%) of respondents reported an increase in the frequency of adverse conditions, and 9% reported a large increase. Conversely, 8% of respondents reported a decrease and 1% reported a large decrease. Sixteen percent were unsure or did not know of any change, and 5 respondents chose not to answer.

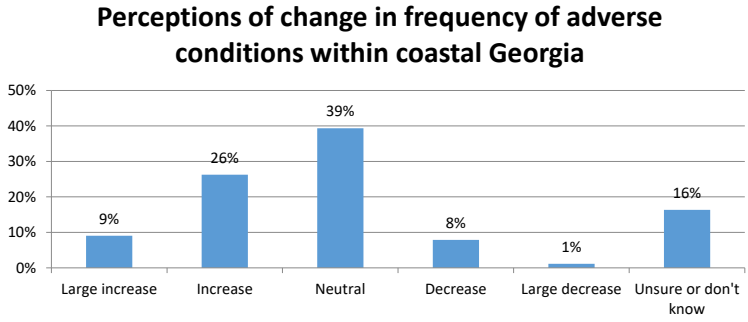

Figure 3.8. Change in the frequency of adverse conditions (i.e. red tides, jellyfish, marine debris, trash).

3.1.3. Place Attachment

Respondents generally felt that the study area is an important part of their lives and the surrounding community. Figure 3.9 shows that the majority of respondents agreed (46%) or strongly agreed (38%) that the study area is the best place to satisfy their outdoor recreation needs. Only 4% of respondents disagreed (3%) or strongly disagreed (1%) with this statement. The remaining 12% of respondents felt neutrally about this concept, and 0% was unsure or did not know. Three individuals did not respond.

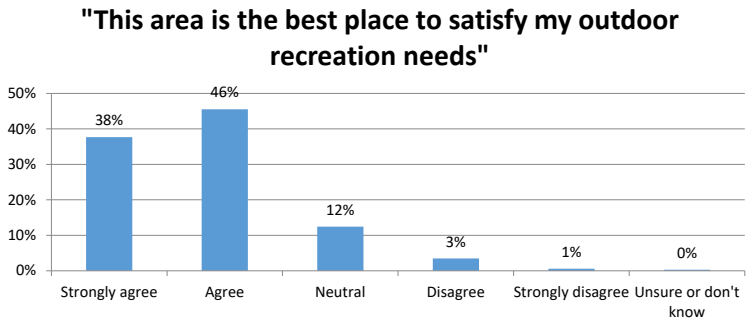

Figure 3.9. Is the study area the best place to satisfy my outdoor recreation needs?

Figure 3.10 indicates that the majority of respondents agreed (48%) or strongly agreed (38%) that the study area represents a way of life in their community. Seven percent disagreed (6%) or strongly disagreed (1%) with this statement. Nine percent of respondents were neutral to this statement, and 4% were unsure of their response to this statement or did not know.

Figure 3.11 shows that respondents overwhelmingly agreed (29%) or strongly agreed (68%) that the study area is important for providing habitat for fish and other wildlife. Only 1% disagreed, no respondents strongly disagreed, 2% felt neutrally about this statement, and 1% were unsure or did not know. Four people chose not to answer this question.

Figure 3.12 indicates that the majority of respondents agreed (34%) or strongly agreed (44%) that their community's economy depends on the natural resources of coastal Georgia. Ten percent of respondents held neutral opinions in regards to this topic, and 13% disagreed (7%) or strongly disagreed (1%) with this statement. Four percent were unsure or did not know, and 5 respondents did not answer.

Figure 3.13 shows that the majority of respondents agreed (32%) or strongly agreed (53%) that the study area contributes to the character of their community. Only 4% of respondents disagreed with this statement, and only 1% of respondents strongly disagreed. Eight percent felt neutrally about this topic, and 2% were unsure or did not know. Six people did not respond to this question.

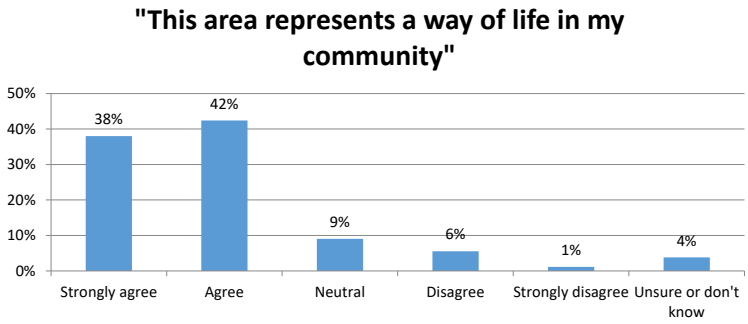

Figure 3.10. Does the study area represent a way of life in my community?

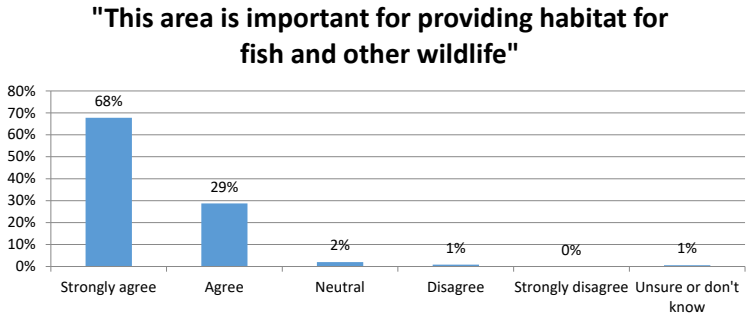

Figure 3.11. Is the study area important for providing habitat for fish and wildlife?

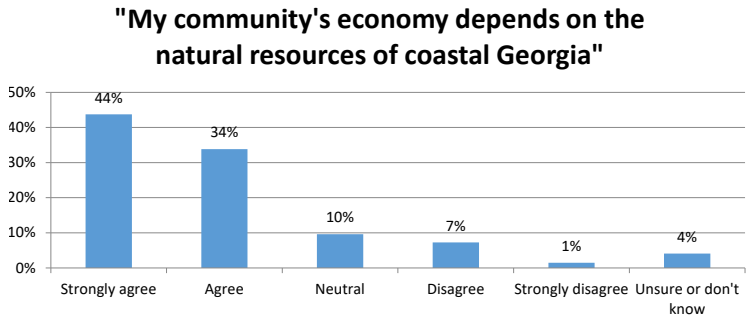

Figure 3.12. Does my community's economy depend on the natural resources of Coastal Georgia?.

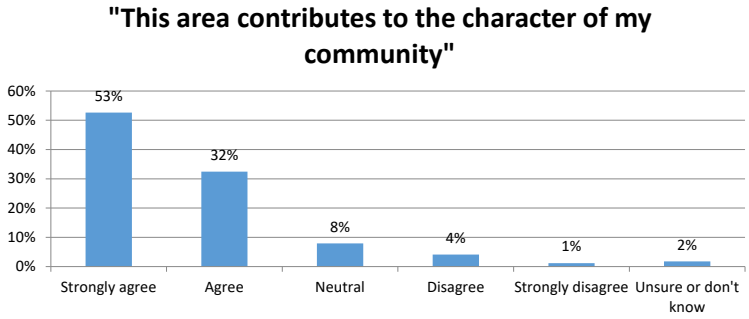

Figure 3.13. Does the study area contribute to the character of my community?

3.1.4. Value Allocation Exercise

In total, there were 34,516.4 "pennies" "spent" on all social values by 348 respondents. Aesthetics, Recreation, Biodiversity, and Wilderness were the top four social values in terms of allocated "pennies" (Table 3.2).

3.1.5. Value Mapping Exercise

In total, there were 3,223 points from all mapping efforts (Figure 3.14 and Table 3.3). The top four mapped social values were Recreation, Aesthetics, Biodiversity, and Wilderness (Table 3.3). Although the same top four value types appear here as in the value allocation exercise, the order differs, with Recreation value displacing Aesthetics value as the number one choice. Of note here is the order placement of Socializing value, which was placed on the map more frequently than three other value types, including Human Needs value. This, too, differs from the value allocation exercise, in which Socializing value was ranked 12th overall. A comparison of results from the value allocation and value mapping exercises is displayed in Figure 3.15.

Table 3.2. Results from the Valuation Allocation exercise.

	Total Pennies	Percent	Rank
Aesthetics	4,511.9	13%	1
Recreation	4,293.5	12%	2
Biodiversity	3,854.3	11%	3
Wilderness	3,523.2	10%	4
Legacy	2,728.8	8%	5
Human Needs	2,663.0	8%	6
Learning	2,464.9	7%	7
Therapeutic	2,258.1	7%	8
Economic	2,205.1	6%	9
In and of Itself	2,042.9	6%	10
Spiritual	1,532.9	4%	11
Socializing	1,445.8	4%	12
Inspiration	991.9	3%	13
	34,516.4	100%	

Table 3.3. Results from the Value Mapping exercise.

	Total Points	Percent	Rank
Recreation	448	14%	1
Aesthetics	392	12%	2
Biodiversity	337	10%	3
Wilderness	279	9%	4
Economic	246	8%	5
Learning	246	8%	6
Legacy	221	7%	7
Therapeutic	217	7%	8
In and of Itself	194	6%	9
Socializing	185	6%	10
Human Needs	174	5%	11
Spiritual	160	5%	12
Inspiration	124	4%	13
	3,223	100%	

Sapelo Island NERR sign. Credit: Jarrod Loerzel, NOAA NCCOS

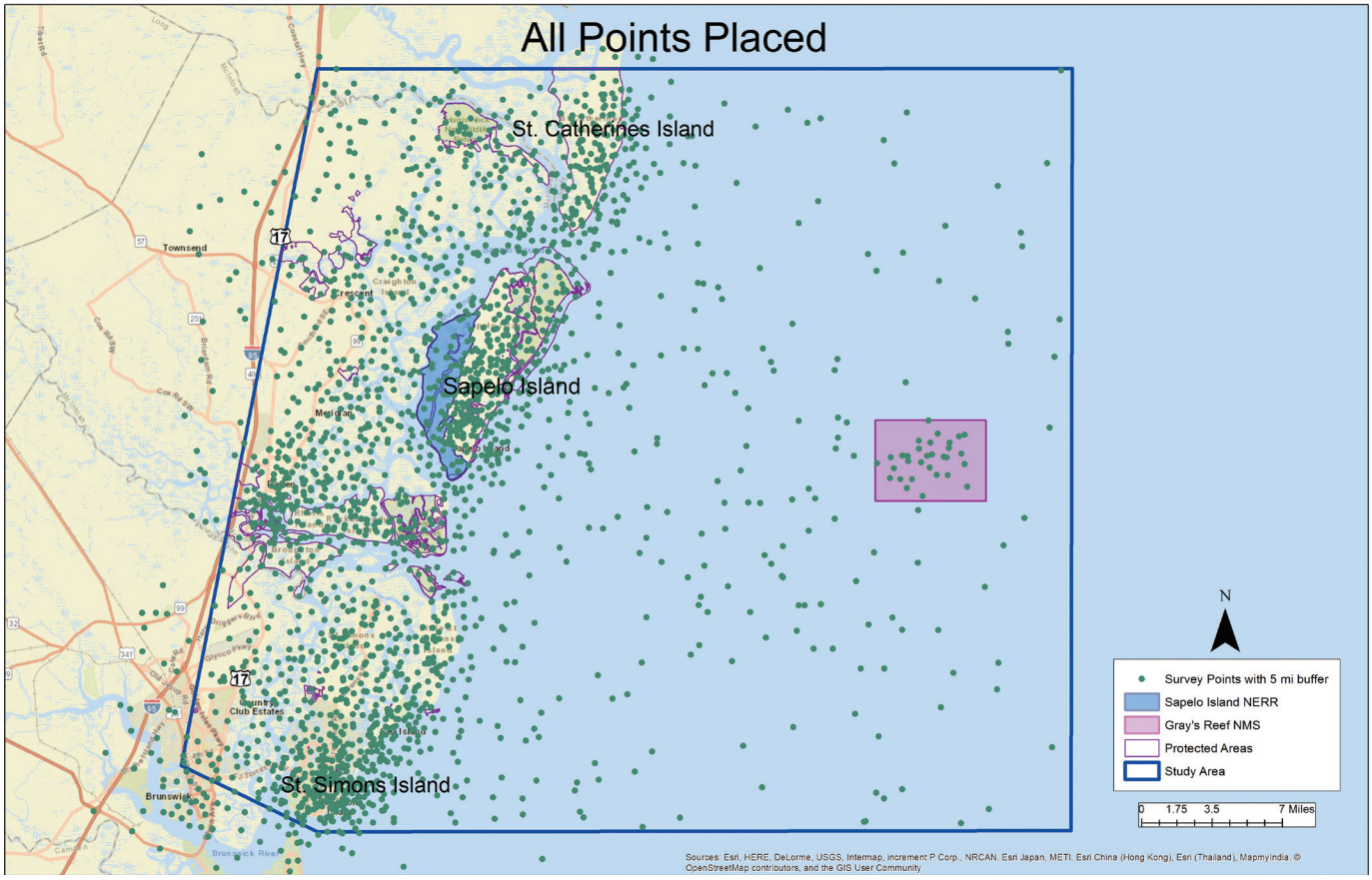

Figure 3.14. Total points placed for all values.

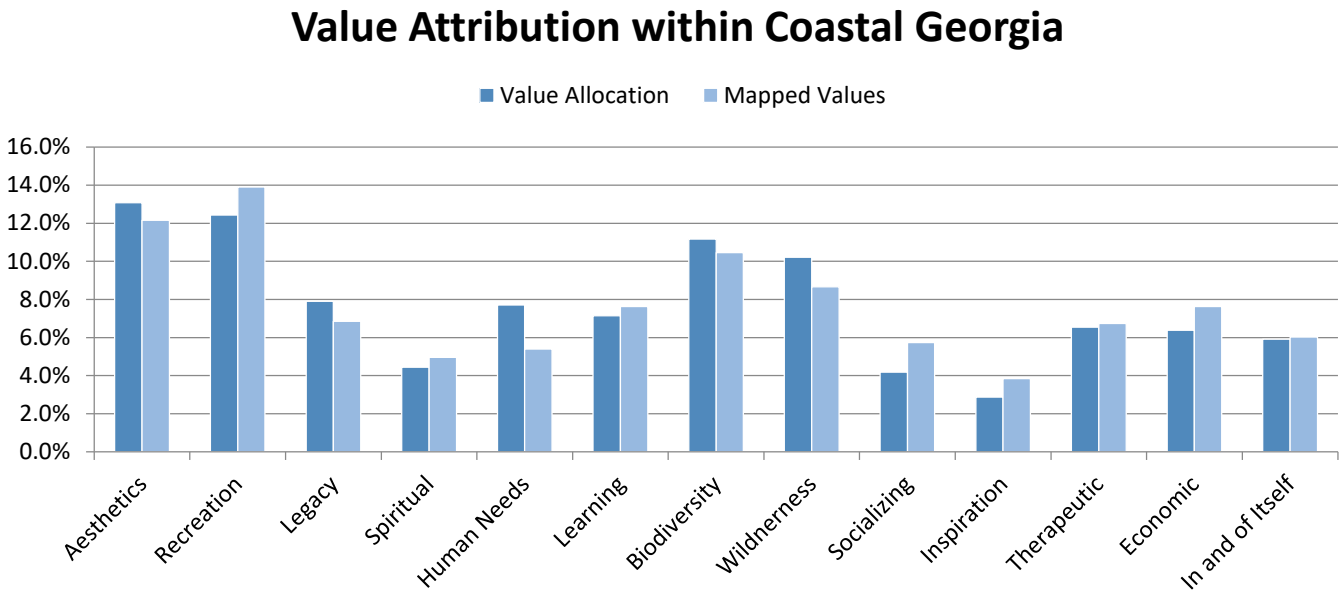

Figure 3.15. Comparison between Value Allocation and Value Mapping exercises.

On average, respondents placed 10 points each. Density mapping of the placed points shows "hotspots" at the south end of St. Simons Island, on Sapelo Island, and near Darien, with a smaller hotspot on St. Catherine's Island (Figure 3.16). Figures 3.17-24 show total points placed and point densities for each of the top four mapped values: Recreation, Aesthetics, Biodiversity, and Wilderness.

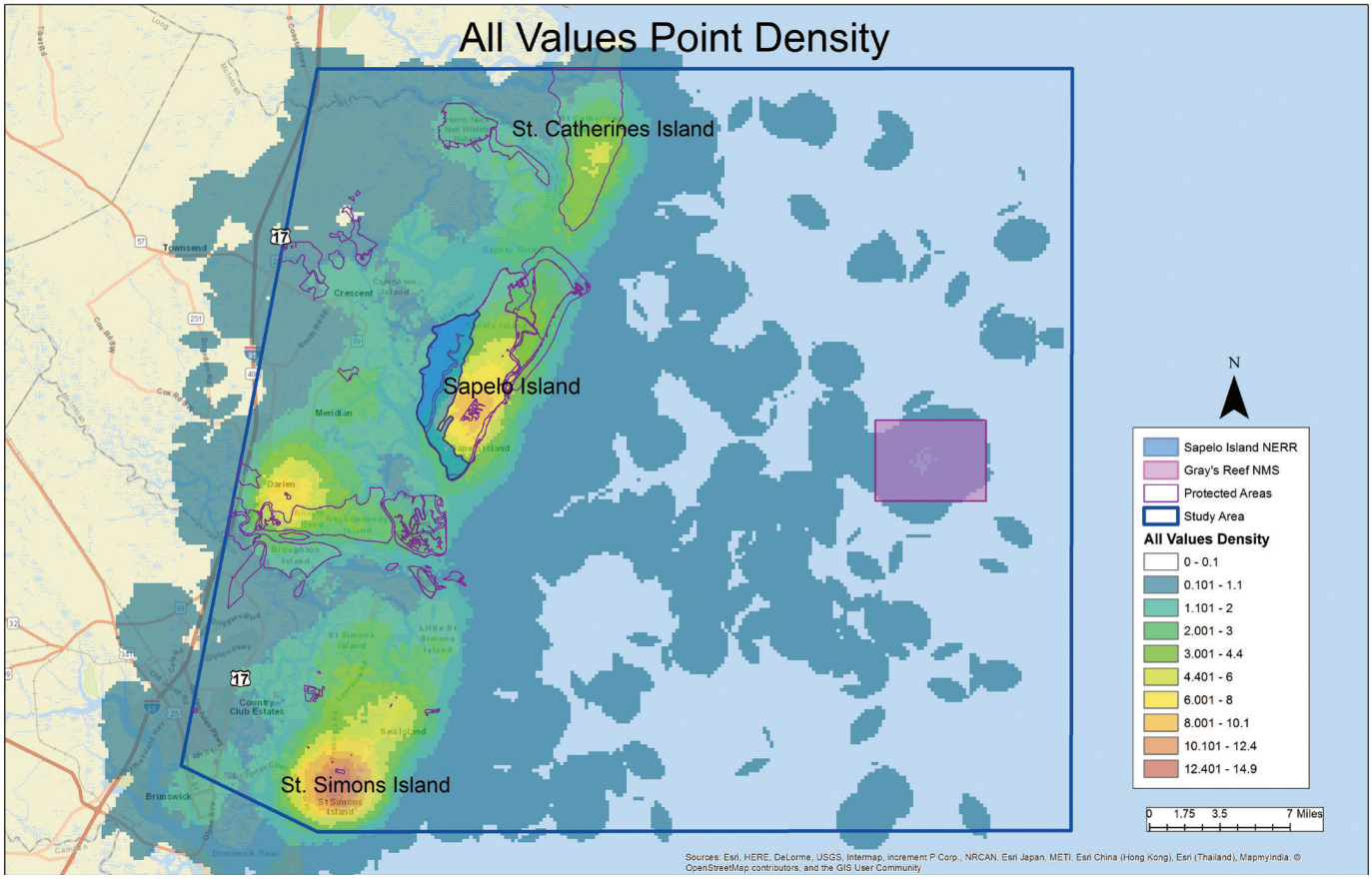

Figure 3.16. Total point density for all values.

Gray's Reef NMS sign. Photo credit: Jarrod Loerzel, NOAA NCCOS

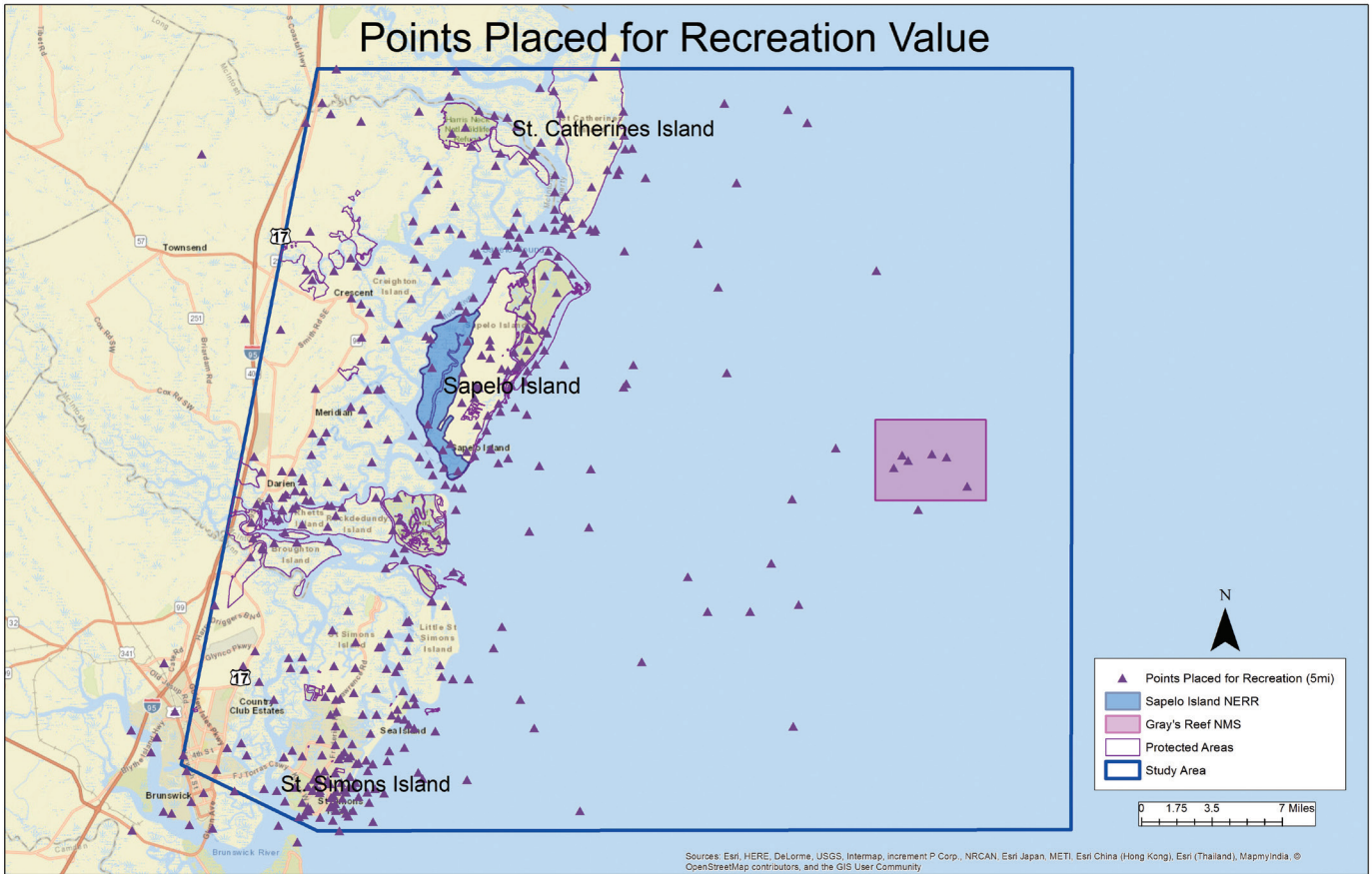

Figure 3.17. Total points placed for Recreation value.

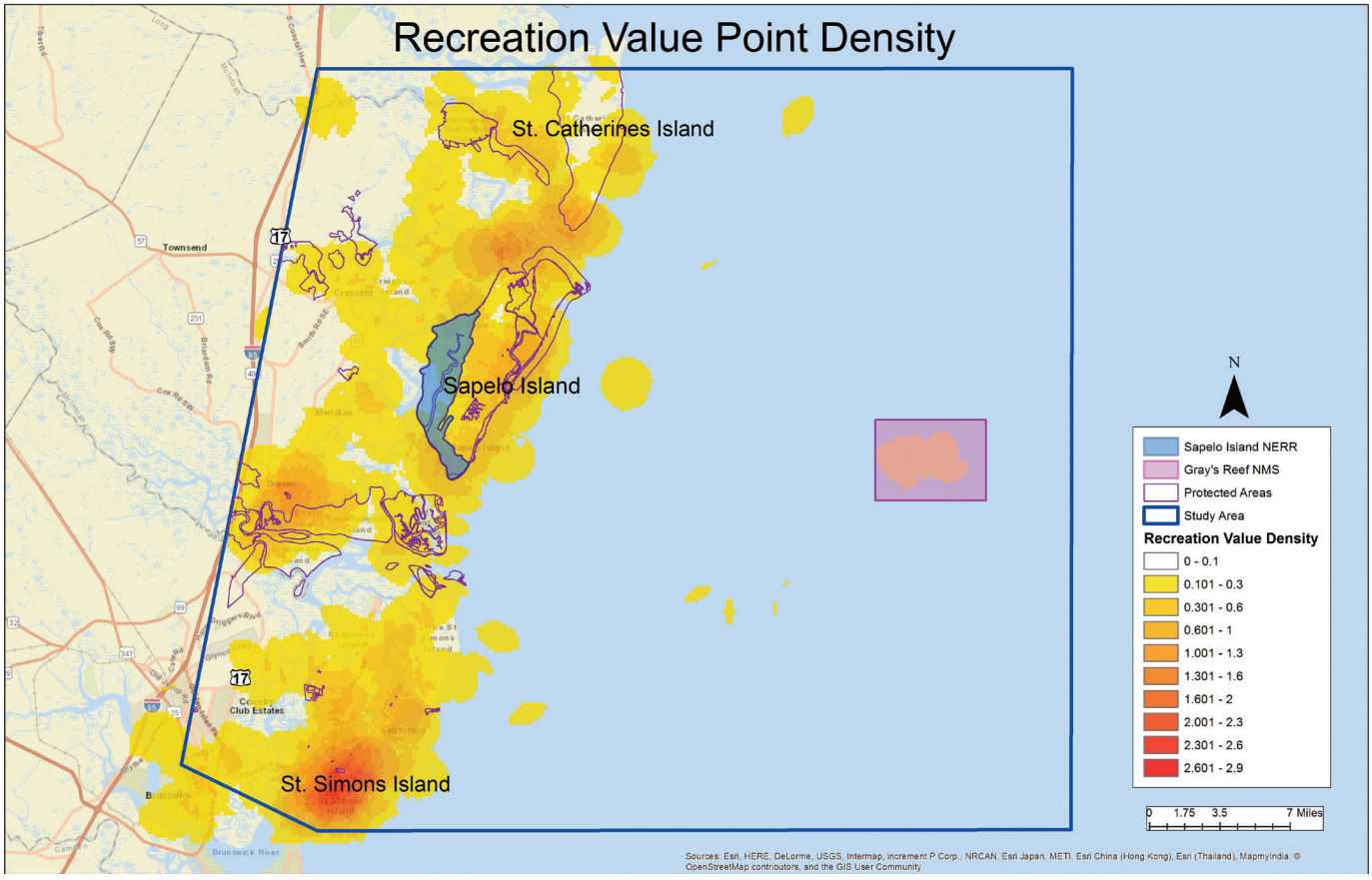

Figure 3.18. Recreation value point density.

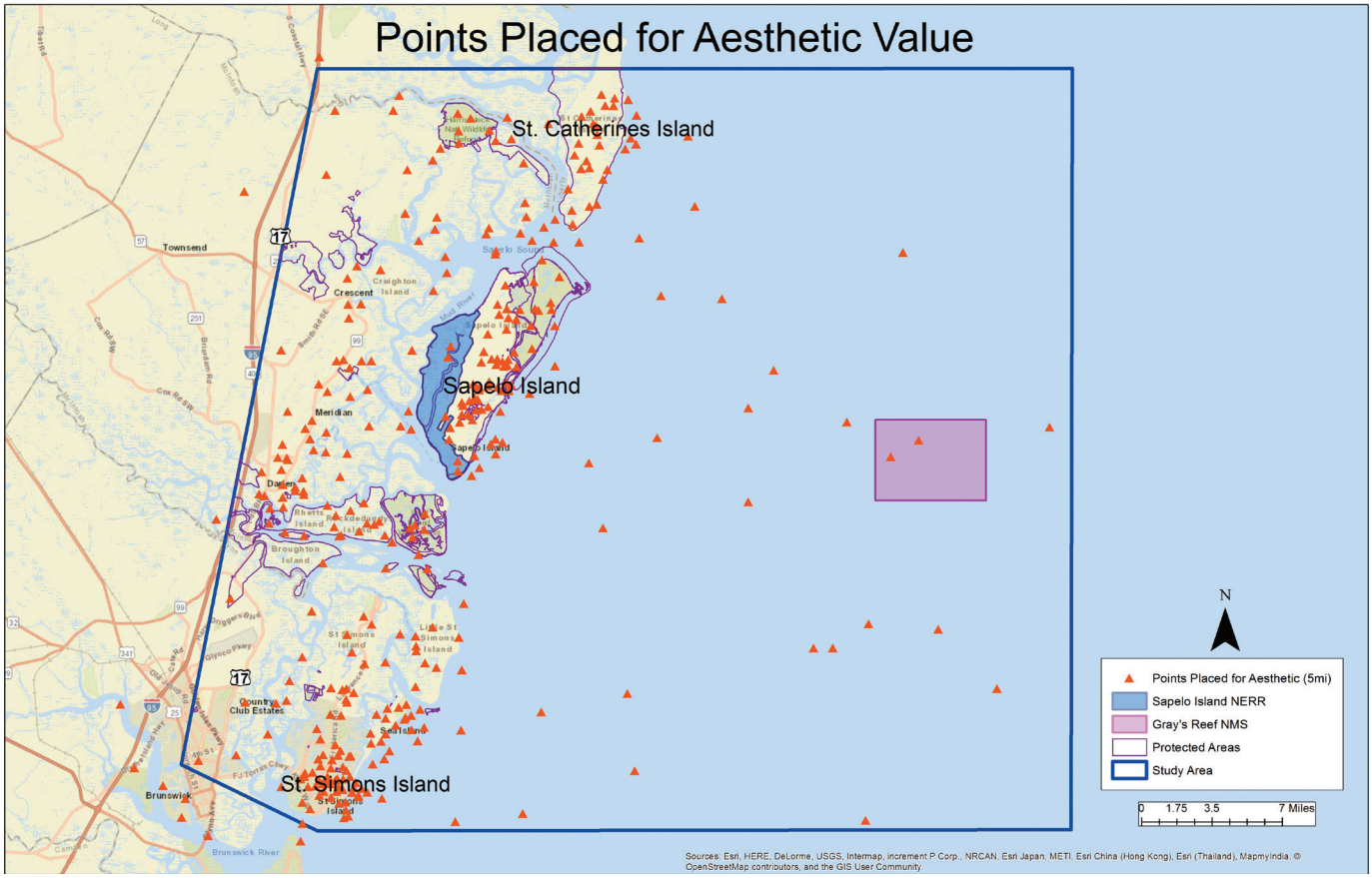

Figure 3.19. Total points placed for Aesthetics value.

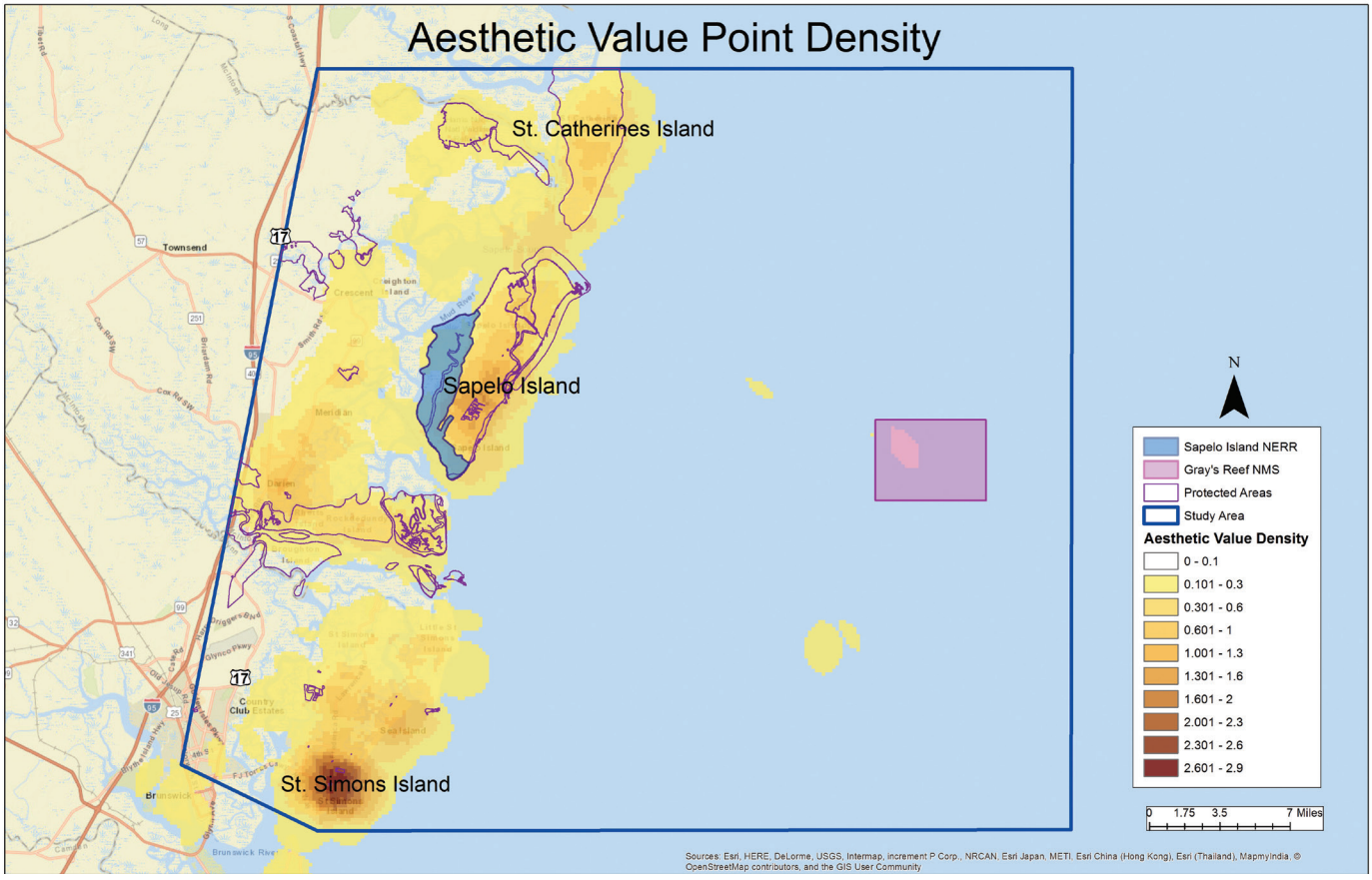

Figure 3.20. Aesthetic value point density.

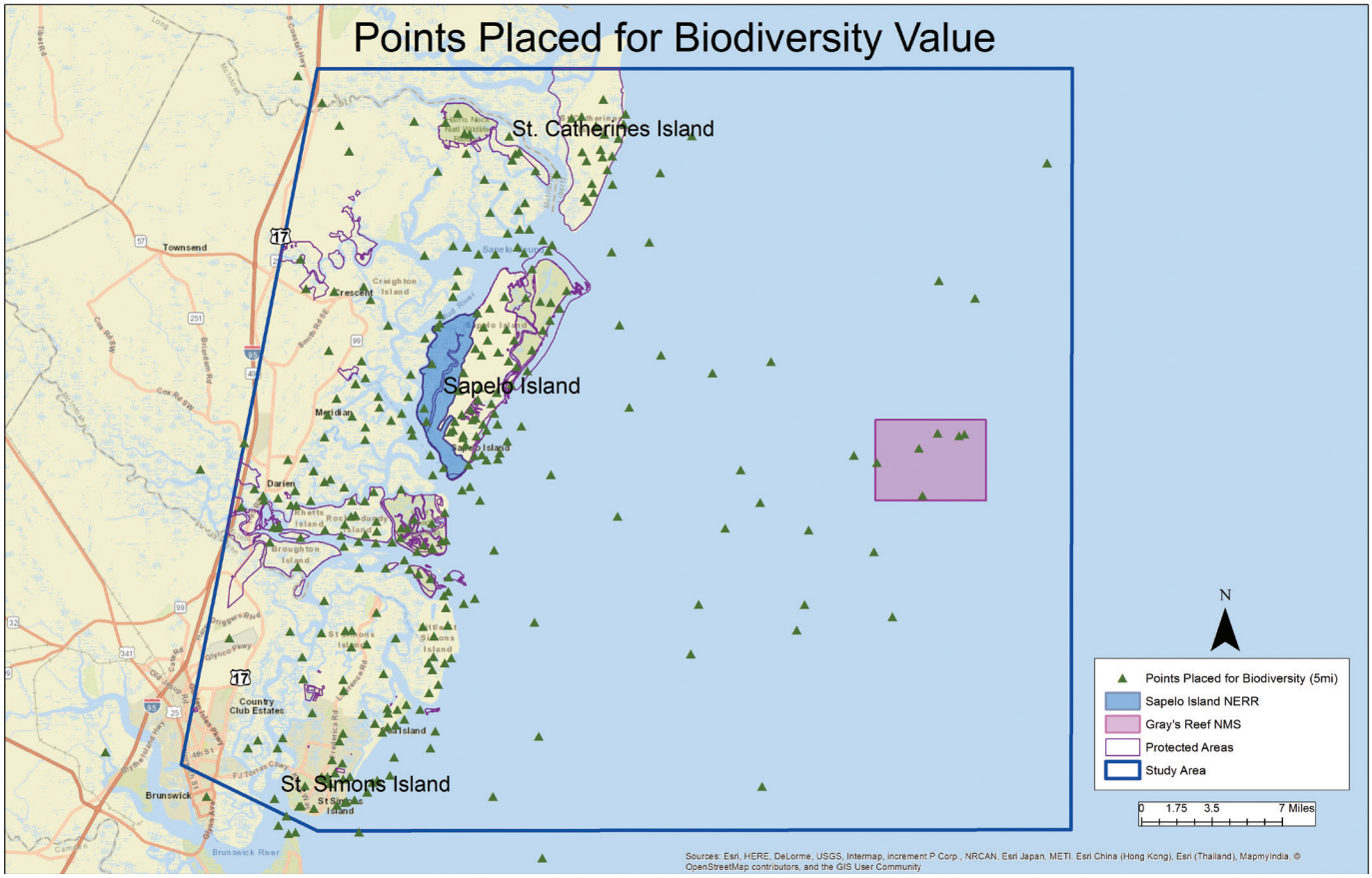

Figure 3.21. Total points placed for Biodiversity value.

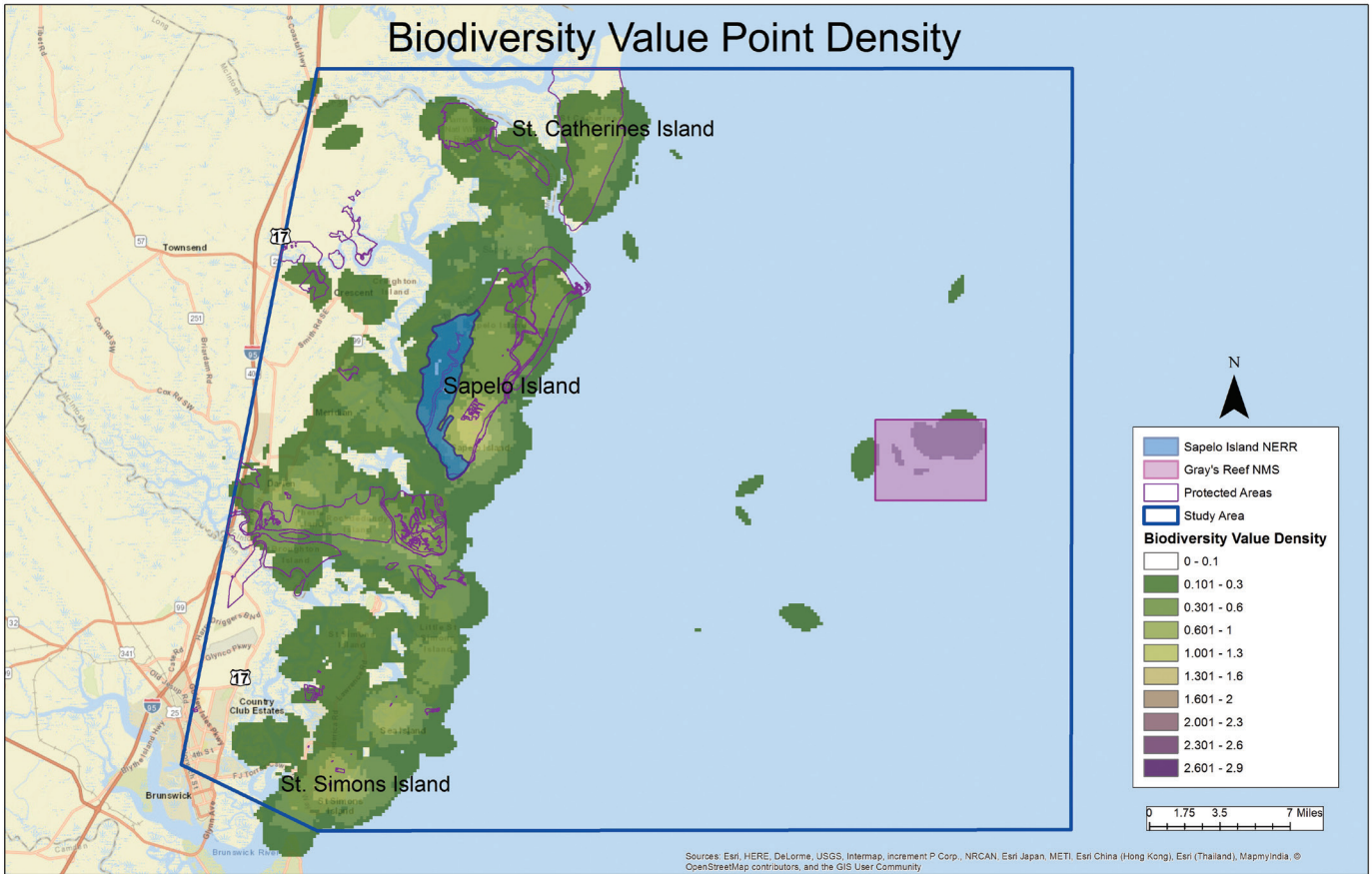

Figure 3.22. Biodiversity value point density.

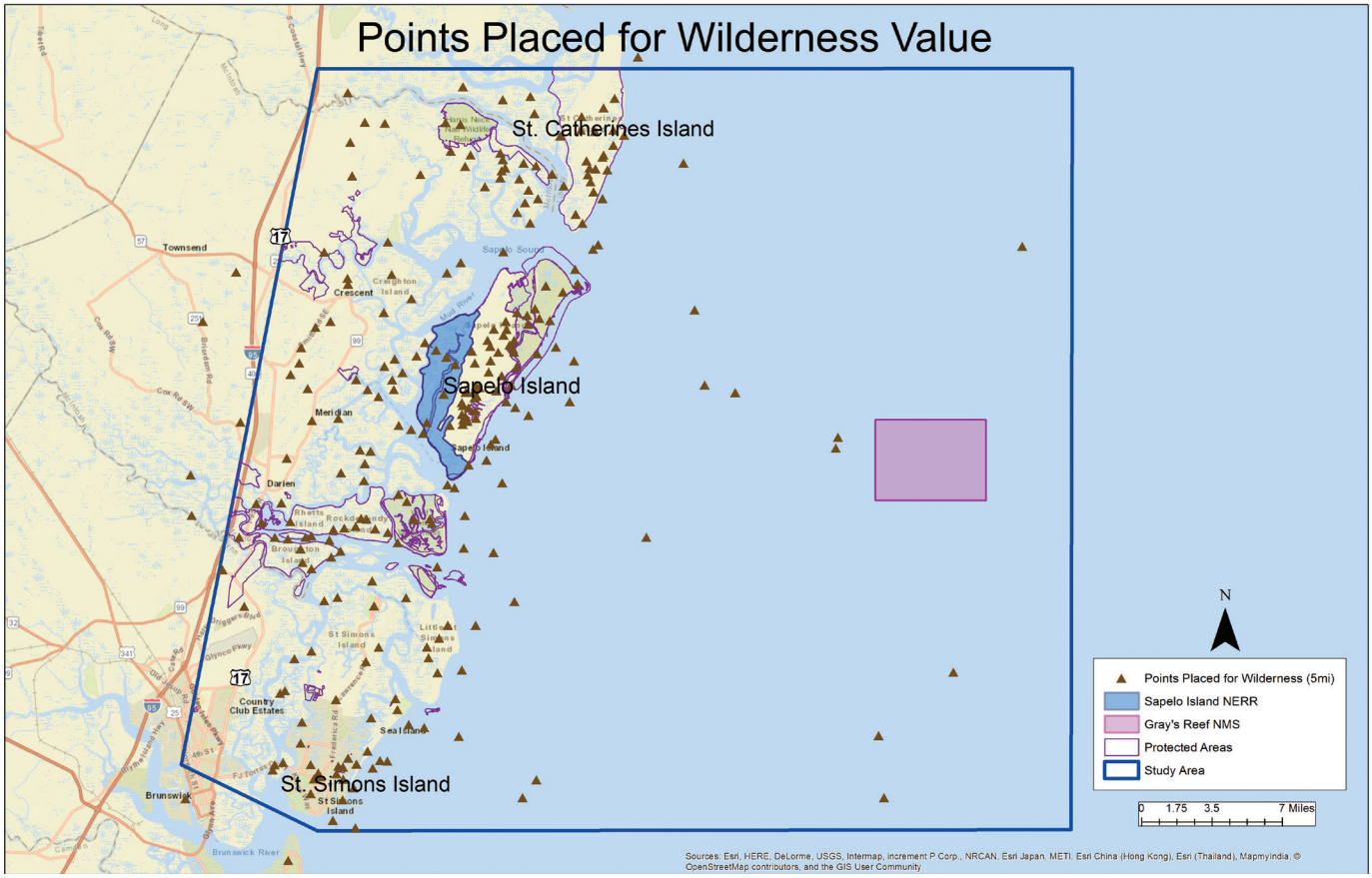

Figure 3.23. Total points placed for Wilderness value.

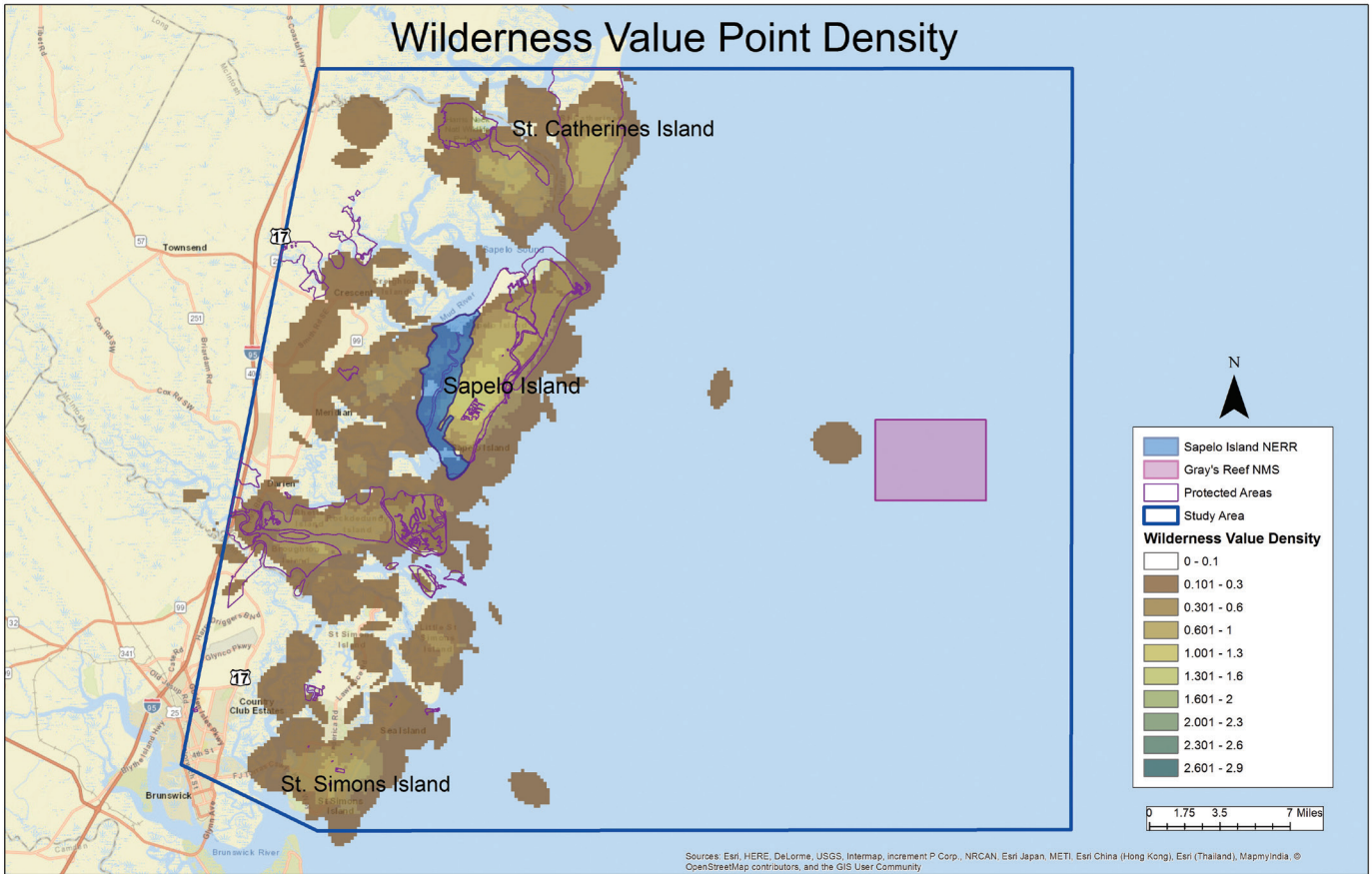

Figure 3.24. Wilderness value point density.

3.1.6. Public Access

Forty-two percent of respondents do not know about public access to the Sanctuary. An additional 11% of respondents reported that the adequacy of public access to the Sanctuary is neutral. Thirty-six percent of respondents reported that there is adequate access (28%) or more than adequate access (8%), whereas 5% felt that there is inadequate access, and 6% felt that there is little to no access to the Sanctuary. Seven people did not respond (Figure 3.25).

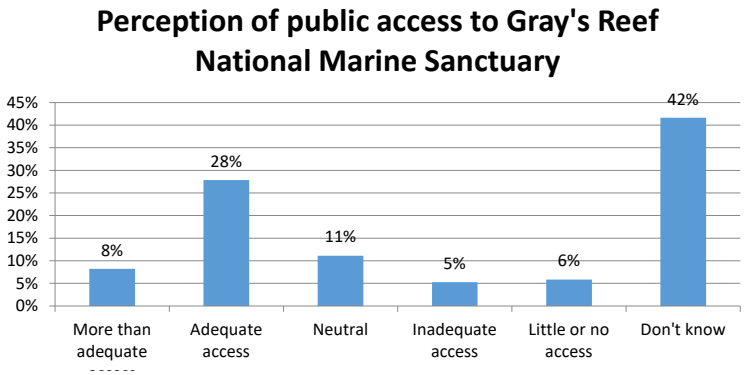

Figure 3.25. Public access to Gray's Reef Sanctuary.

Thirty-six percent of respondents perceived adequate existing public access to the Reserve, and 8% perceived more than adequate access. Conversely, 12% of respondents reported inadequate access (10%) or little to no access (2%), to the Reserve. An additional 29% of respondents did not know, and the remaining 14% of respondents felt neutrally about this issue. Five individuals did not answer this question (Figure 3.26).

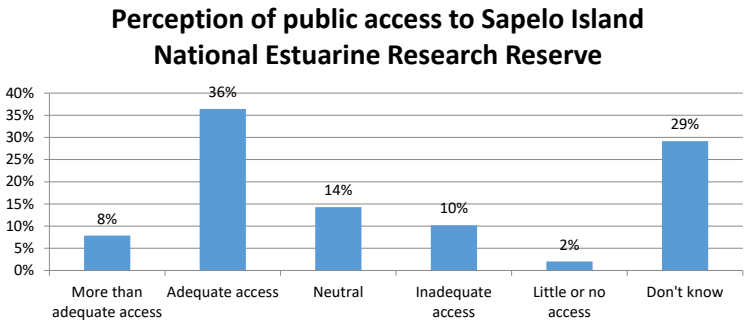

Figure 3.26. Public access to Sapelo Island Reserve.

The majority of respondents felt that there is adequate access (45%) or more than adequate access (16%) to public boat ramps within the study area. Eleven percent of respondents reported inadequate access and only 1% perceived little to no access to boat ramps. Eleven percent felt neutrally about this access type, and 14% did not know. Seven respondents did not answer (Figure 3.27).

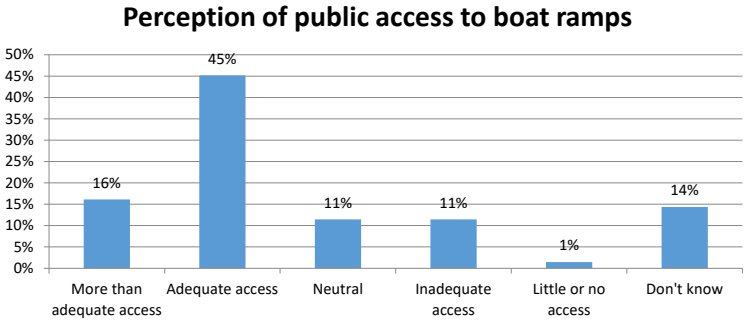

Figure 3.27. Public access to boat ramps.

Forty-six percent of respondents perceived adequate access (36%) or more than adequate access (10%) to boat slips within coastal Georgia. Eleven percent reported inadequate access to boat slips, 2% reported little to no access, and 24% did not know. Seventeen percent of respondents felt that boat slip access was neutral, and twelve people did not respond to this question (Figure 3.28).

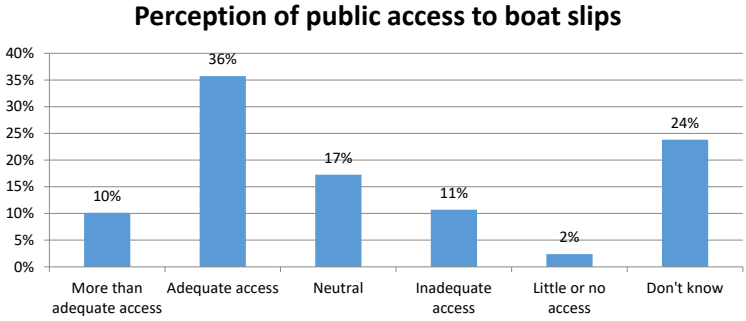

Figure 3.28. Public access to boat slips.

The majority of respondents perceived adequate (50%) or more than adequate (24%) public access to scenic viewpoints in coastal Georgia, while 13% of respondents perceived inadequate access (11%) or little or no public access (2%) to scenic viewpoints. Eleven percent felt that public access to viewpoints is neutral, and 3% did not know. Nine individuals did not answer this question (Figure 3.29).

Fifty-one percent of respondents felt that the Georgia coast provides adequate public access (41%) or more than adequate public access (10%) to environmental educational opportunities. Conversely, 22% of respondents perceived that there is inadequate access (19%) or little to no public access (3%) to these opportunities. An additional 17% reported neutrally, and 10% did not know. Twelve people did not respond to this question (Figure 3.30).

The majority of respondents reported adequate (51%) or more than adequate (15%) public access to wildlife viewing sites along the Georgia coast study area. Fifteen percent reported inadequate access, and only 1% perceived little to no access to wildlife viewing sites. The remaining respondents replied neutrally (11%) or did not know (6%). Seven individuals did not respond (Figure 3.31).

Just over half of respondents (53%) did not know about public access to diving sites, either SCUBA or freediving, in coastal Georgia. Another 16% of respondents felt neutrally about public access to dive sites. The remaining respondents were relatively split, with 16% reporting adequate (12%) or more than adequate (4%) public access, and 14% reporting inadequate (11%) or little to no public access (3%). Fourteen respondents did not answer this question (Figure 3.32).

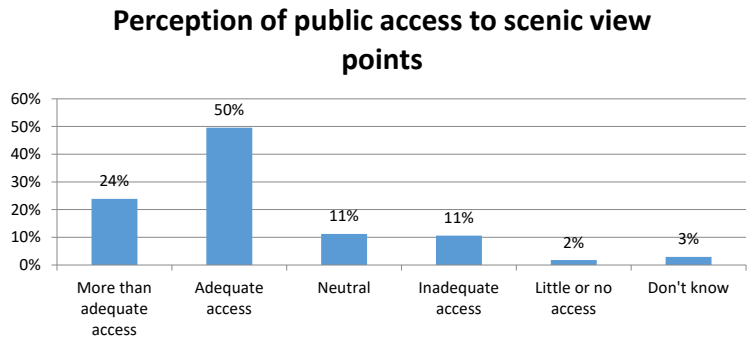

Figure 3.29. Public access to scenic viewpoints.

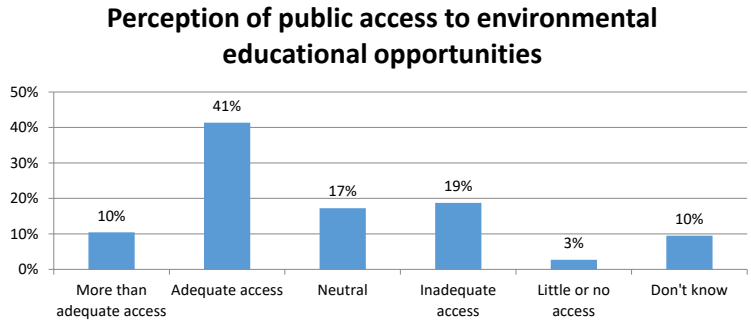

Figure 3.30. Public access to environmental educational opportunities.

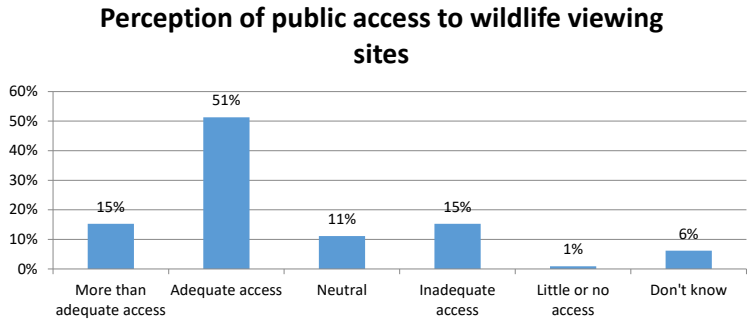

Figure 3.31. Public access to wildlife viewing sites.

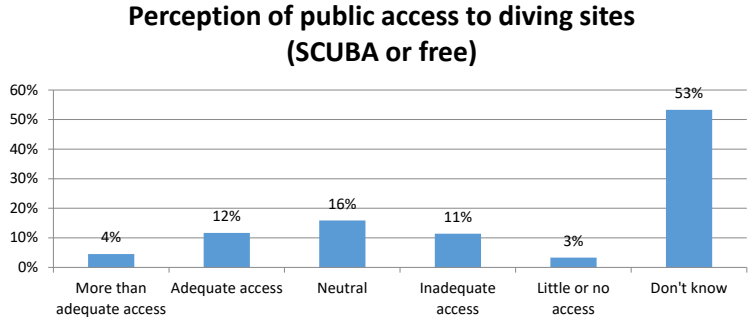

Figure 3.32. Public access to diving sites.

Forty-two percent of respondents perceived existing public access to birding sites within the study area to be adequate, and an additional 15% perceived access to be more than adequate. Only 8% of respondents found access to birding sites inadequate, and 1% felt that there is little to no access. Fourteen percent of respondents replied neutrally, and 20% did not know. Five people did not respond (Figure 3.33).

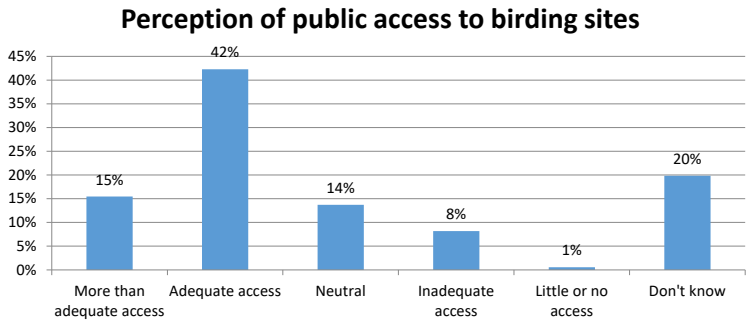

Figure 3.33. Public access to birding sites.

Respondents were also able to write in and rank additional conservation areas on the Georgia coast. This exercise found that public access to Harris Neck National Wildlife Refuge, to Cumberland Island, and to Skidaway Island State Park was "adequate." The majority of respondents (89%) who completed surveys did not offer additional conservation areas on the Georgia coast, and as a result did not record their perception of public access to these areas. Of the 39 respondents who did write in additional conservation areas, however, Figure 3.34 indicates that over half (56%) of the write-in conservation areas were perceived to have adequate access, with an additional 18% perceived to have more than adequate access. Eighteen percent of the write-in conservation areas were reported to have inadequate access (13%) or little or no public access (5%). The last 3% of these other areas were perceived neutrally.

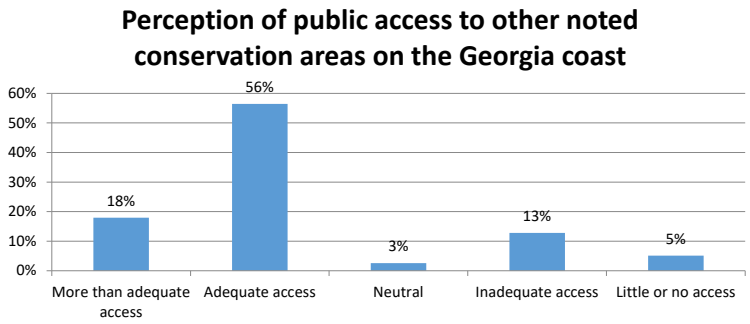

Figure 3.34. Public access to other conservation areas.

3.1.7. Public Knowledge of Management Dimensions

Figure 3.35 shows that 41% of respondents reported a good understanding or awareness of ecology management decisions along the Georgia coast, and 19% reported an excellent understanding or awareness. Twenty-two percent reported a fair understanding or awareness, 10% reported a poor understanding or awareness, and 6% were unsure. Six respondents did not answer this question.

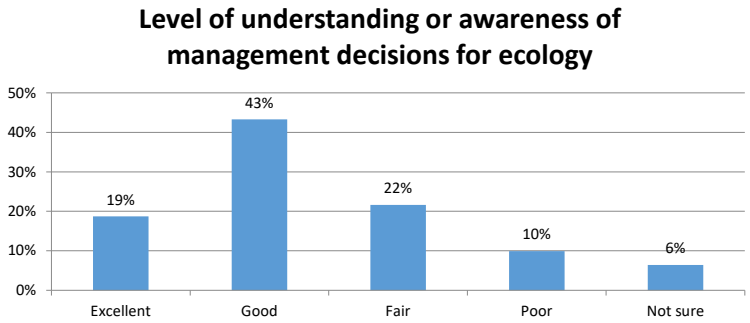

Figure 3.35. Knowledge of management decisions with ecology dimensions.

Figure 3.36 indicates that 69% of respondents reported a good (48%) or excellent (21%) understanding or awareness of management decisions with historic or cultural dimensions within the study area. Conversely, 23% of respondents reported a fair understanding or awareness, 6% had a poor understanding or awareness, and the remaining 3% were unsure. Six individuals did not respond.

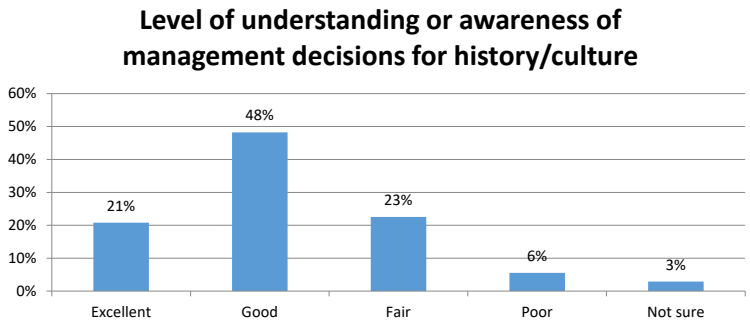

Figure 3.36. Knowledge of management decisions with historic/cultural dimensions.

Figure 3.37 shows that 30% of respondents had a good level of understanding or awareness of management decisions for local environmental effects of sea level rise, and 17% had an excellent understanding or awareness. Twenty-seven percent of respondents reported a fair understanding or awareness of this issue, and 15% had a poor understanding or awareness. Eleven percent was unsure, and 6 people did not respond.

Figure 3.38 shows that the majority of respondents (77%) had a good (55%) or excellent (22%) understanding or awareness of management decisions for recreational opportunities within the study area. In contrast, 15% had a fair understanding or awareness, and 4% had a poor understanding or awareness. The remaining 4% were unsure, and 6 respondents did not answer.

Eight respondents did not provide their level of understanding or awareness of management decisions for volunteer opportunities along the Georgia coast. Of those who provided an answer, Figure 3.39 shows that 38% of respondents reported a good understanding or awareness, 24% reported a fair understanding or awareness, 15% reported an excellent understanding or awareness, and 13% reported a poor understanding or awareness of management decisions for volunteer opportunities. The remaining 11% of respondents were unsure.

Figure 3.40 indicates that 42% of respondents held a good understanding or awareness of management of educational opportunities within coastal Georgia, and 14% of respondents held an excellent understanding or awareness. Conversely, 25% and 10% of respondents reported a fair or poor understanding or awareness of educational opportunities, respectively. Eight percent were unsure, and 6 people did not respond.

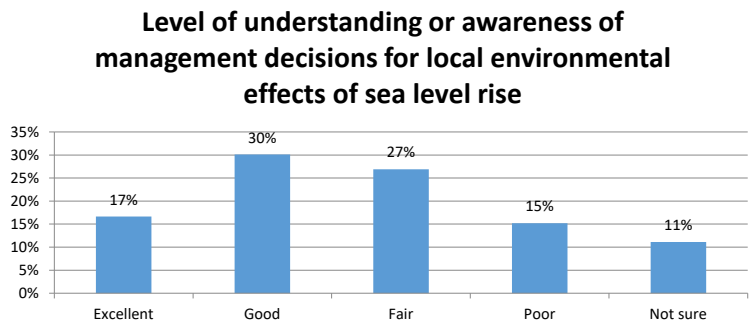

Figure 3.37. Knowledge of management decisions for effects of sea level rise.

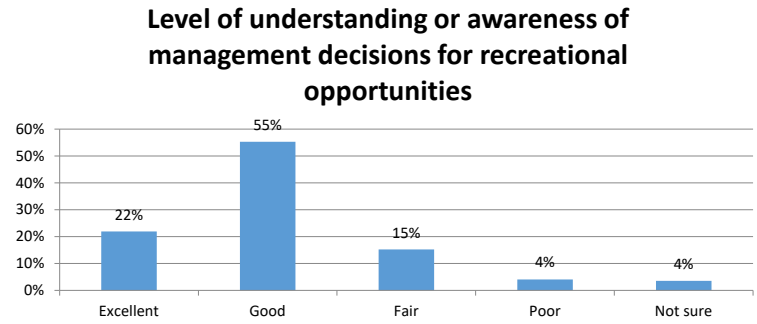

Figure 3.38. Knowledge of management decisions for recreational opportunities.

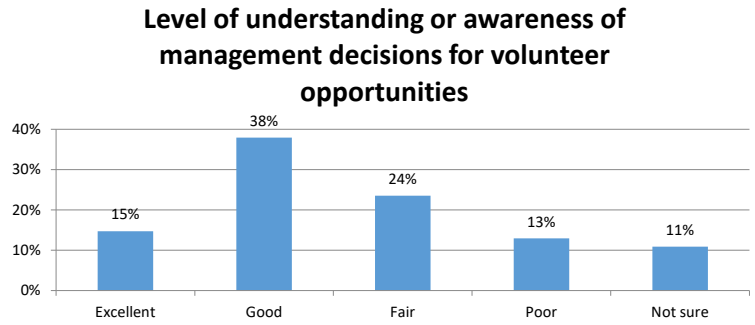

Figure 3.39. Knowledge of management decisions for volunteer opportunities.

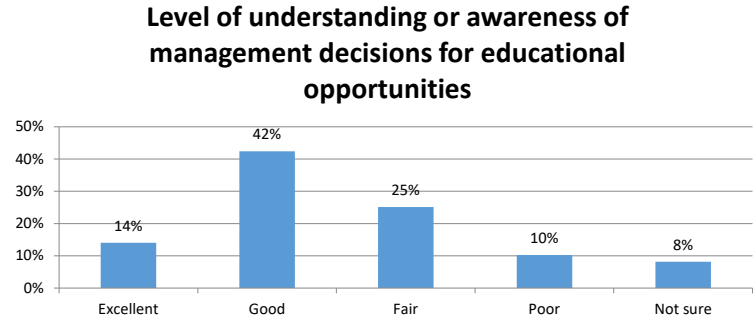

Figure 3.40. Knowledge of management decisions for educational opportunities.

Seven respondents did not report their level of understanding or awareness of public involvement in decision making along Georgia's coast. Of those who answered this question, the majority of respondents reported their understanding or awareness on the lower side of the scale: 32% held a fair understanding or awareness, 25% held a poor understanding or awareness, and 16% did not know. Conversely, 22% and 4% reported a good or excellent understanding or awareness, respectively, of this management dimension (Figure 3.41).

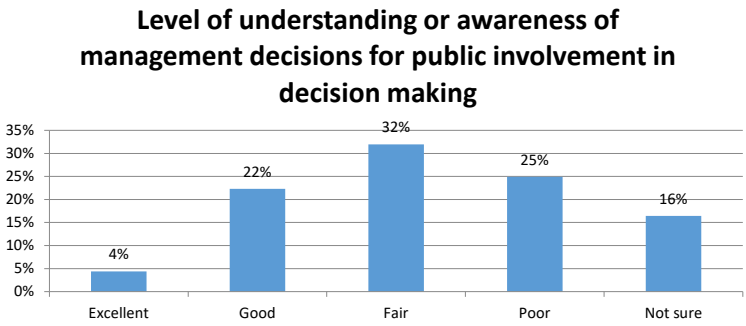

Figure 3.41. Knowledge of management decisions for public involvement in decision making.

3.1.8. Management Goals

Figure 3.42 shows that 88% of respondents felt that improving coastal water quality along the Georgia coast is a priority (34%) or high priority (54%). Six percent of respondents responded neutrally to this management goal, and only 4% felt that this is a low priority (3%) or not a priority (1%). The remaining 2% were unsure or did not know. Thirty-five people (10% of completed survey respondents) did not answer this question, although this is likely due to placement on the paper survey instrument.

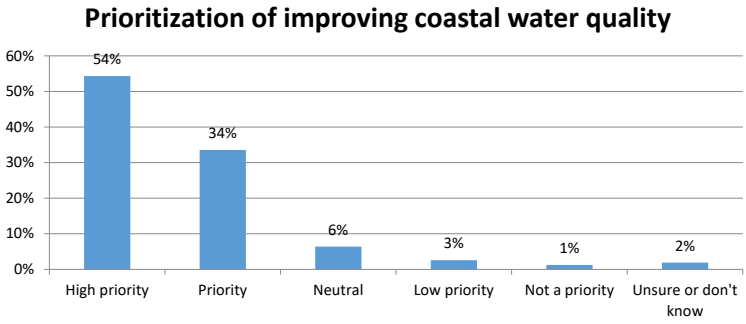

Figure 3.42. Prioritization of improving coastal water quality.

Figure 3.43 indicates that 87% of respondents reported that eliminating the further damage of and restoring natural live bottom reef habitats within the study area is a priority (32%) or high priority (55%). Only 5% of respondents felt that this is a low priority (3%) or not a priority (2%). Five percent thought this was a neutral issue, and 3% were unsure or did not know. Four people did not respond.

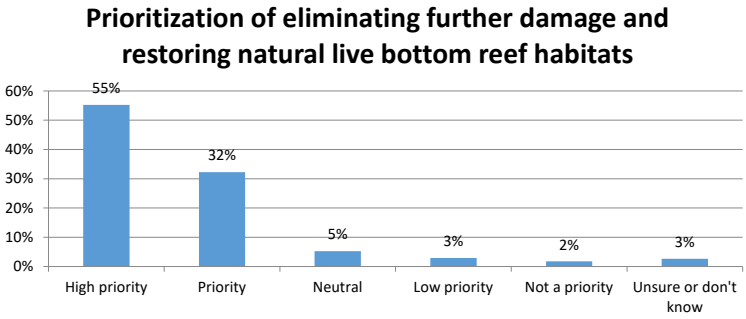

Figure 3.43. Prioritization of eliminating further damage and restoring natural live bottom reef habitats.

Figure 3.44 shows that 86% of respondents reported that eliminating the further loss of and restoring shoreline and wetland habitats along coastal Georgia is a priority (33%) or high priority (53%). Only 4% of respondents perceived this to be a low priority (3%) or not a priority (1%). Seven percent of respondents replied neutrally, and 3% were unsure or did not know. Two people did not answer this question.

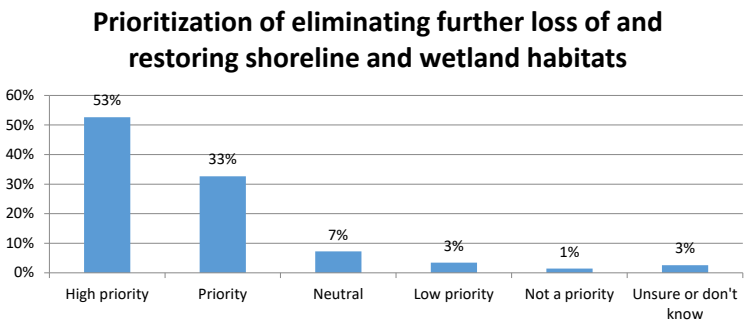

Figure 3.44. Prioritization of eliminating further loss of and restoring shoreline and wetland habitats.

Figure 3.45 shows that the majority of respondents (82%) felt that conducting scientific research and long term monitoring to enhance the understanding of coastal processes is a priority (45%) or high priority (37%) management goal. Eleven percent of respondents felt that this is a neutral management issue, and only 4% felt that this is a low priority (3%) or not a priority (1%). The remaining 2% of respondents were unsure or did not know, and 3 people did not respond.

Figure 3.46 indicates that the large majority (88%) of respondents reported that restoring and sustaining fish stocks and other living marine resources is a priority (44%) or high priority (44%) management goal. Conversely, only 3% reported that this was a low priority (2%) or not a priority (1%). Seven percent of respondents were neutral about this management issue, and 4% were unsure or did not know. Only 2 respondents did not answer.

Figure 3.47 shows that the majority of respondents (74%) reported that increasing the resilience of coastal communities to future coastal hazards within the study area is a priority (38%) or high priority (36%). Conversely, 6% of respondents reported that this is a low priority, and 2% reported that this is not a priority. The remaining 18% were neutral (13%) or were unsure or did not know (5%). Five people did not answer.

Figure 3.48 shows that 84% of respondents felt that increasing the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards along Georgia's coast is a priority (42%) or high priority (42%). Only 5% of respondents felt that this was a low priority (4%) or not a priority (1%). Ten percent of respondents felt that this management goal was neutrally aligned, and 1% was unsure or did not know. All respondents answered this question.

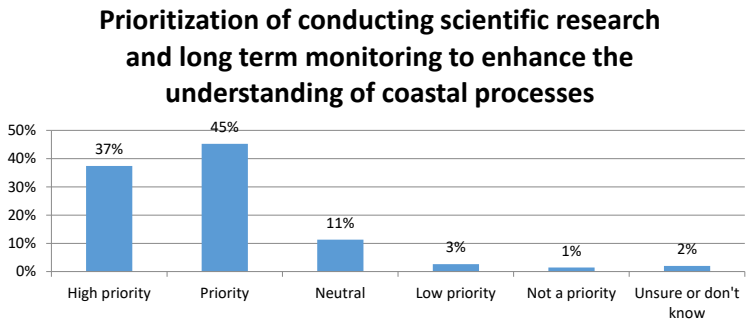

Figure 3.45. Prioritization of conducting scientific research and long term monitoring to enhance the understanding of coastal processes.

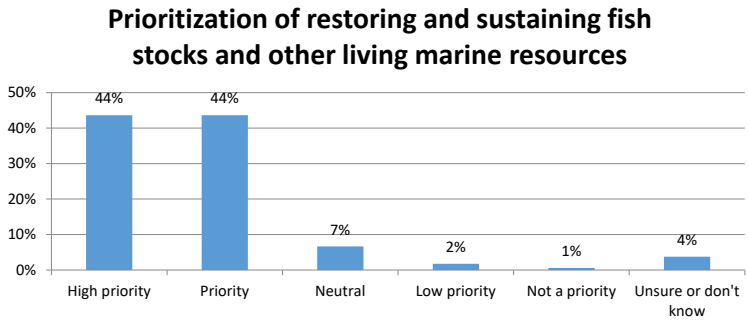

Figure 3.46. Prioritization of restoring and sustaining fish stocks and other living marine resources.

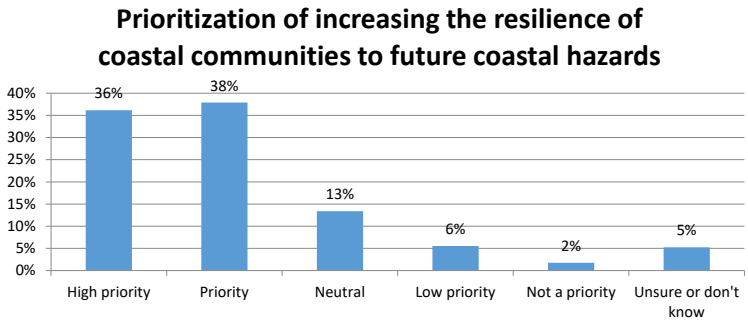

Figure 3.47. Prioritization of increasing the resilience of coastal communities to future coastal hazards.

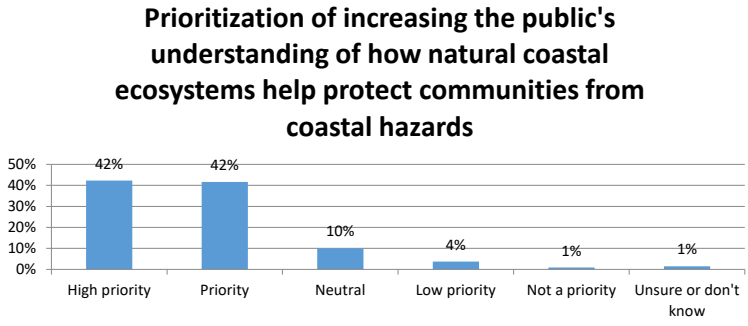

Figure 3.48. Prioritization of increasing the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards.

Figure 3.49 shows that 83% of respondents felt that increasing the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes within coastal Georgia is a priority (39%) or high priority (44%). Only 4% of respondents felt that this was a low priority management goal (3%) or not a priority (1%). Twelve percent of respondents felt neutrally, and 2% were unsure or did not know. Only 1 person did not respond to this question.

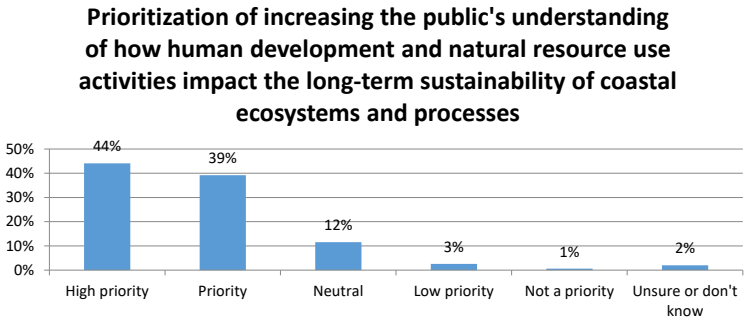

Figure 3.49. Prioritization of increasing the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes.

Figure 3.50 shows that only 53% of respondents felt that creating or increasing areas where commercial and recreational harvest is restricted along Georgia's coast is a priority (29%) or high priority (24%) management goal. This management goal has the lowest level of support amongst respondents, although only 15% of respondents felt that this is a low priority (8%) or not a priority (7%). The main reason for this lower level of support is due to the 24% of respondents who replied that this was a neutral management goal. The remaining 7% of respondents were unsure or did not know, and 3 people did not answer this question.

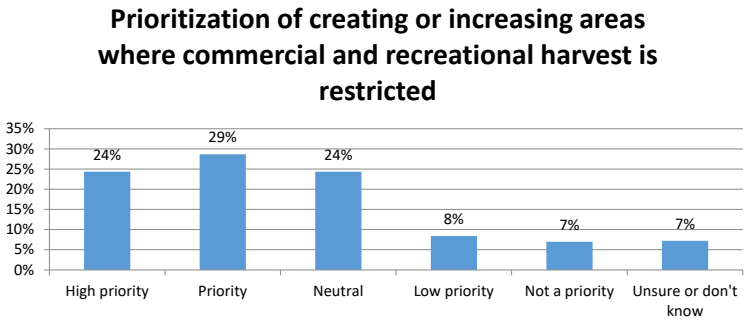

Figure 3.50. Prioritization of creating, or increasing, areas where commercial and recreational harvest is restricted.

Figure 3.51 indicates that only 63% of respondents felt that establishing areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged should be a priority (35%) or high priority (28%) management goal. Seventeen percent of respondents replied neutrally to this question, and 16% felt that this is a low priority (10%) or not a priority (6%). Four percent were unsure or did not know, and 1 individual did not answer.

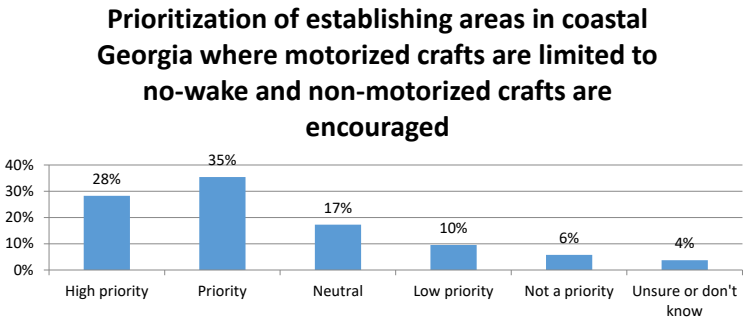

Figure 3.51. Prioritization of establishing areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged.

Figure 3.52 shows that 67% of respondents felt that incorporating local social and cultural heritage into resource management decision making, such as public input and community advisory boards, should be a priority (42%) or high priority (25%) management goal. Similar to other anthropocentric management goal responses, the number of neutral responses was relatively high (20%), and 10% of respondents felt that this is a low priority (6%) goal or not a priority (4%) goal. Three percent were unsure or did not know, and 3 people did not respond.

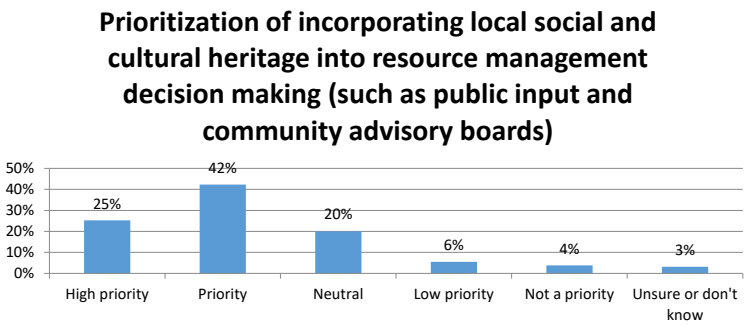

Figure 3.52. Prioritization of incorporating local social and cultural heritage into resource management decision making.

3.1.9. Demographics

Our first question in this section asked the respondents if any of their household income was dependent upon the products or services related to coastal Georgia resources. Figure 5.53 shows that 71% of respondents claimed that their income was not dependent upon these coastal resources, a total of 9% were unsure or provided no response, and only 20% said their income hinged upon available coastal Georgia resources. We then asked those who depended upon coastal Georgia resources to describe the source of their income, and 11% reported that fish was the primary source of income, 18% reported tourism, 11% reported real estate, and only 4% reported shellfish. Thirty-nine percent reported "other" as their dependent source of income, and 18% claimed multiple sources of income derived from coastal Georgia resources. Common "other" sources of income included marinas, boating, forestry, research, and education.

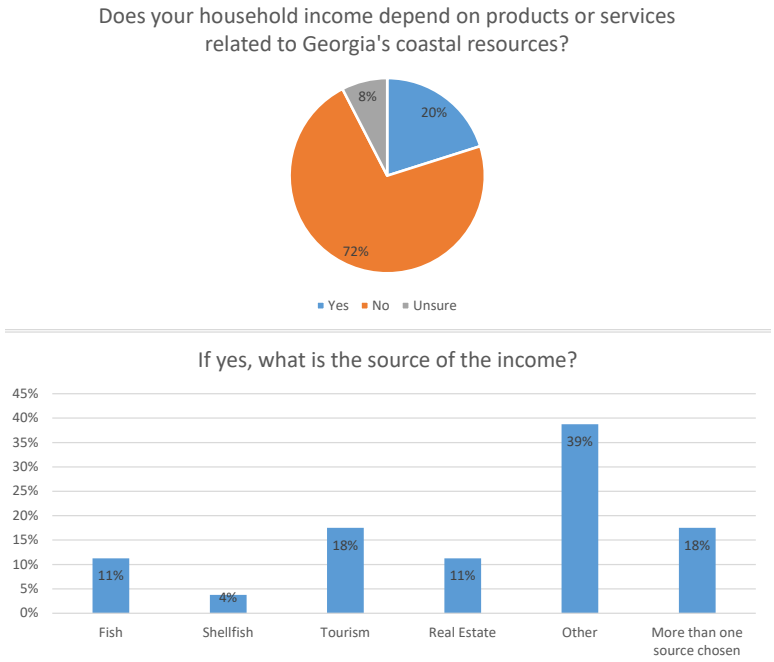

Figure 3.53. Household income dependence on coastal Georgia resources and corresponding income source.

The average birth year for respondents was 1965, making the average age of respondents 51. Sixty-two percent of respondents were male, and 38% were female. A college education, technical degree, or graduate degree was claimed by 75% of respondents, 23% claimed a high school diploma or GED, and 3% had less than a high school diploma. Six individuals did not respond.

In terms of yearly household income levels, 25% of the respondents earned over $100,000 or more a year, 18% earned between $70,000 and $99,999 a year, 26% earned between $40,000 and $69,999 a year, 11% earned between $20,000 and $39,000 a year, 7% earned $19,000 or below a year, and 13% did not respond to the inquiry. Respondents were asked an open-ended question in relation to their occupation. These responses spanned a relatively wide range, but the most commonly referenced occupation was "Retired" (94 responses). Often, respondents listed "Retired," followed by their former profession. Following Retired, the next most common responses were Manager (21 responses), Teacher or Professor (17 responses), and student (16 responses).

The ethnicity question found that 92% of respondents were not Hispanic or Latino, only 1% were Hispanic or Latino, and the remainder did not answer the question (7%). Coupled with this question was another asking with which racial categories the respondent most identified. An overwhelming majority reported being Caucasian (80%), 7% answered Black or African American, 1% answered Native American, and less than 1% answered Asian, Alaskan Native, or Native Hawaiian or Other Pacific Islander. Two percent chose the "other" category, and 5% claimed multiple racial identities. Four percent of respondents did not answer.

Fort McAllister State Park. Credit: Alison Scott

3.2. SolVES RESULTS

The objectives of the spatial analysis using the SolVES tool were to determine if there were any statistically significant clustering of the spatially assigned social values as well as to understand the interaction of those values with environmental features using spatial statistics. In terms of spatial clustering, all of the social values in the typology clustered to a statistically significant degree (Table 3.4).

Table 3.4. Clustering of social values points.

Social Value	Count	R2	Z Score	p-Value
Aesthetic	392	0.597	-15.283	0
Biodiversity	337	0.628	-13.080	0
Economic	246	0.575	-12.767	0
Legacy	221	0.594	-11.547	0
In and of Itself	194	0.583	-11.106	0
Learning	246	0.593	-12.223	0
Human Needs	174	0.737	-6.631	0
Recreation	448	0.603	-16.063	0
Spiritual	160	0.666	-8.090	0
Therapeutic	217	0.649	-9.905	0
Wilderness	279	0.567	-13.823	0
Inspiration	124	0.555	-9.480	0
Socializing	185	0.622	-9.833	0

The MaxEnt portion of the SolVES process that incorporates the environmental variables into the analysis can be a time consuming process. This is because each environmental feature interacts with every social value differently. Nevertheless, within the results of the MaxEnt and SolVES analysis, files are created that make the process of understanding the influence of each environmental variable on each social value somewhat easier. Table 3.5 shows the percent contribution of each environmental variable for the social value models Recreation, Aesthetics, Biodiversity, and Wilderness for both the SINERR and the GRNMS. The results that follow present the influence of the top four contributing variables (highlighted) for the SINERR and the top three variables (highlighted) for the GRNMS for the social values of Recreation and Aesthetics, respectively (Figures 3.54-3.57(56-59).

Table 3.5. Top contributing environmental variables for the Reserve and Sanctuary.

TOP CONTRIBUTING ENVIRONMENTAL VARIABLES - SINERR				
Variable	Percent Contribution			
	Recreation	Aesthetics	Biodiversity	Wilderness
Distance to Wrecks	32.9	31.1	36.1	23.5
Distance to Protected Areas	14.3	19.7	22.3	10.9
Vegetation	10.6	11.5	9.3	16.6
Landsat 8 – Band1	10.5	5.7	2.0	2.0
Nat. Wet. Inv.	10.1	15.1	9.0	13.3
Distance to Obstructions	6.7	7.3	4.9	21.7
Distance to Art. Reefs	5.7	2.1	6.6	6.6
Distance to Rivers	4.9	3.4	7.6	2.2
Bathymetry	4.3	4.0	2.1	3.2
TOP CONTRIBUTING ENVIRONMENTAL VARIABLES - GRNMS				
Variable	Percent Contribution			
	Recreation	Aesthetics	Biodiversity	Wilderness
Distance to Protected Areas	55.2	48.5	63.5	53.9
Distance to Wrecks	31.2	30.5	26.0	19.3
Bathymetry	5.7	15.9	3.7	14.0
Landsat 8 – Band 1	4.3	2.1	2.0	2.3
Distance to Art. Reefs	2.2	1.3	2.3	4.2
Distance to Obstructions	1.5	1.7	2.5	6.4

Depicted in the top left side of each map layout is a graphical representation of the Value Index across the study area landscape (Figures 3.54-3.57). As mentioned, Figures 3.54 and 3.55 are the results from the SINERR (Reserve) models for Recreation and Aesthetics, respectively, using the top four contributing environmental variables to those models as indicated in Table 3.5. In the Recreation results (Figure 3.54), the highest Value Index locations are centered on the Shellman's Bluff area, to the north of Blackbeard Island, and to the west of Sapelo Island. The Aesthetics results (Figure 3.55) indicate more locations of high Value Index spread across the study area.

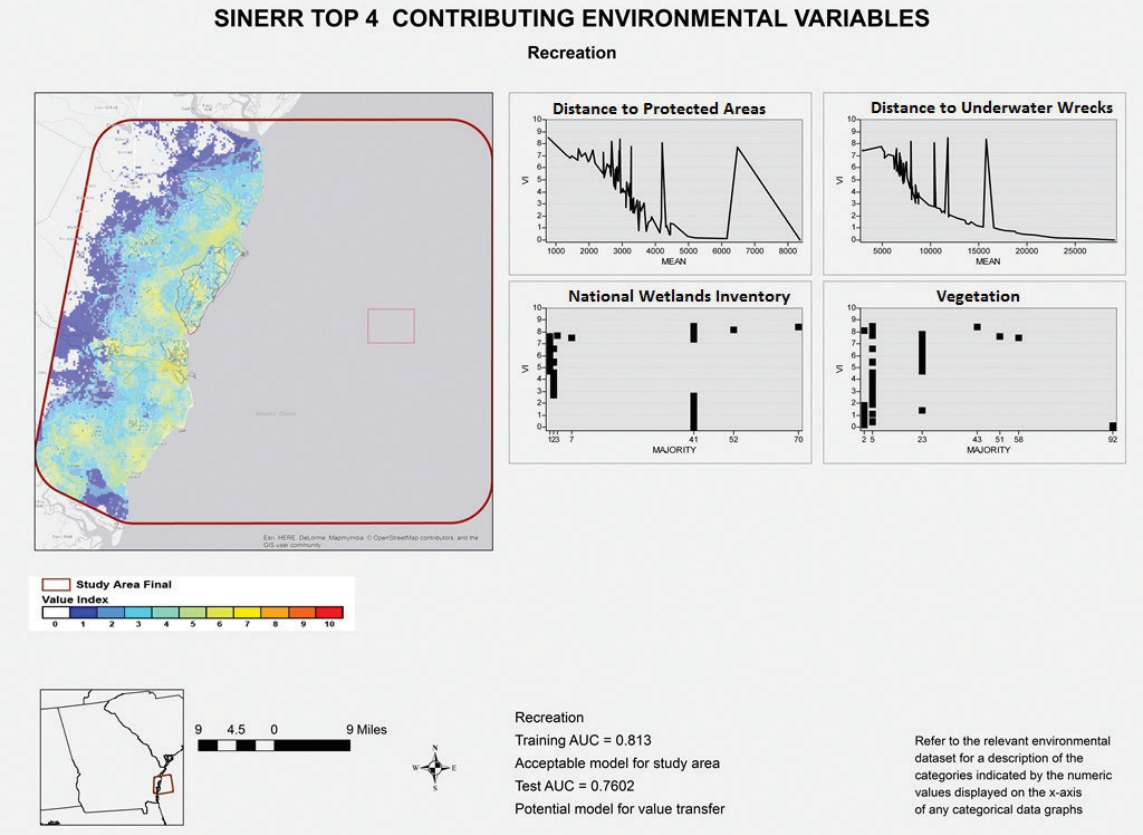

Figure 3.54. Results from the SolVES analysis of the top four contributing environmental variables influencing Recreation for the Reserve.

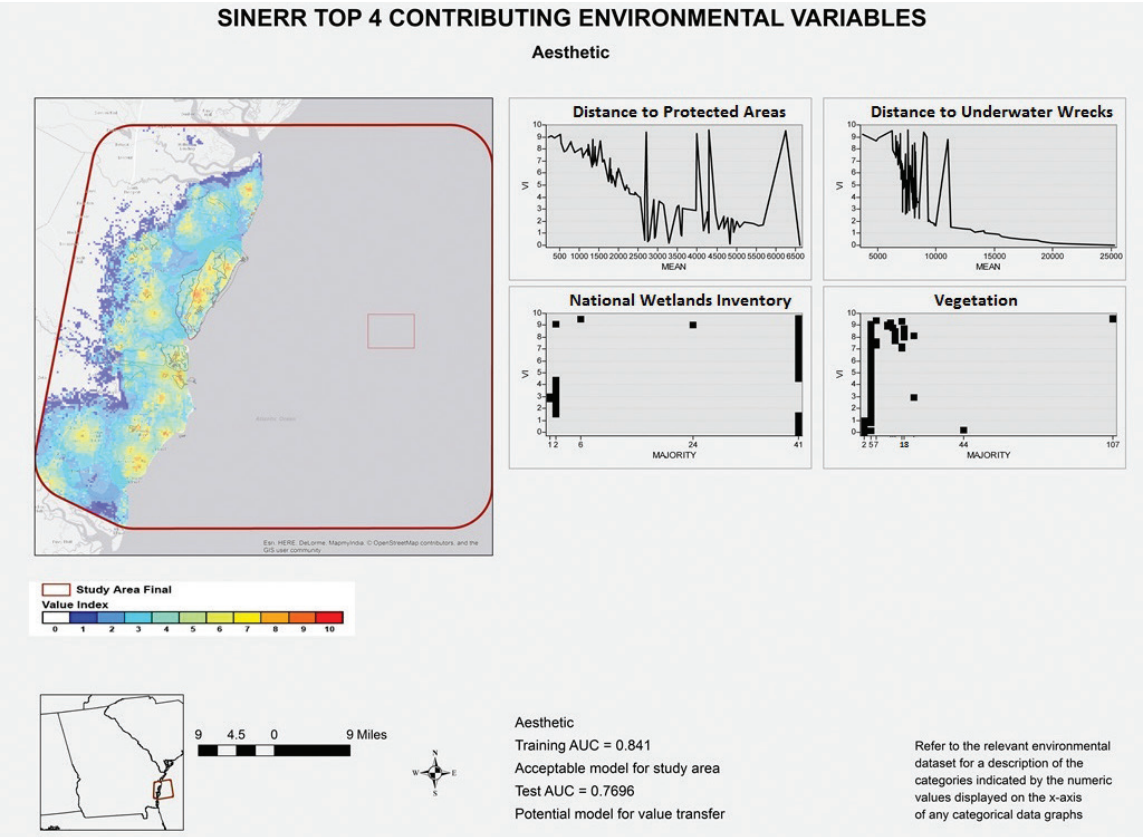

Figure 3.55. Results from the SolVES analysis of the top four contributing environmental variables influencing Aesthetics for the Reserve.

Figures 3.56 and 3.57 are the results from the GRNMS (Sanctuary) models for Recreation and Aesthetics, respectively. In the Recreation results (Figure 3.56), while low, there is an area of connectivity between the Sanctuary and the Reserve in terms of Value Index. Additionally, the higher Recreation Value Index locations extend from shore more so than for the Reserve model. The Value Index of 3 is concentrated around the Sanctuary boundary. The highest Value Index areas for the Aesthetic social value are centered on land-based locations; however, there is quite a large area of Value Index 2 and 3 in and around the Sanctuary boundary (Figure 3.57). It is also important to note that the connectivity between the Reserve and the Sanctuary seen in Figure 3.56 (the Recreation model) is not apparent in the Aesthetics model.

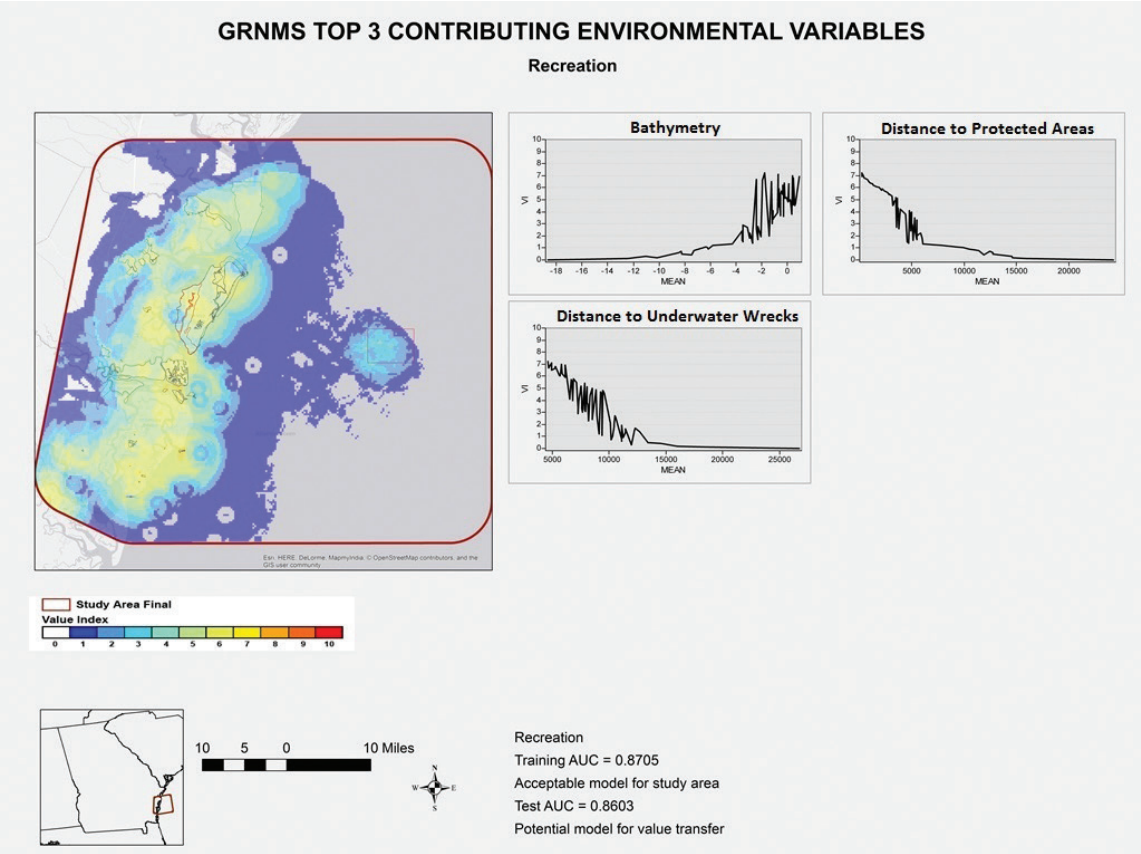

Figure 3.56. Results from the SolVES analysis of the top three contributing environmental variables influencing Recreation for the Sanctuary.

The line graphs on the SolVES output were drawn from the calculated spatial statistics files for each environmental layer used in the analysis. An example of a Distance to Wrecks spatial statistics file and the corresponding line graph is provided in Figure 3.58a and 3.58b, respectively. The "VI" (Value Index) column in the statistics file starts at the highest calculated Value Index for the model and goes to 0 (8.5 in the example) by increments of 0.1. At each one-tenth increment, the total number of 350m cells was determined, as was the area for the total number of cells ("COUNT" and "AREA," respectively). The lowest minimum and the highest maximum distances from Underwater Wrecks were also determined. From the maximum and minimum distances, the range, the mean, and the standard deviation for each one-tenth increment were calculated. The "SUM" column represents the "COUNT" field multiplied by the "MEAN" field for each increment. The results were then plotted in the line graph with the "MEAN" as the x-axis and the "VI" as the y-axis. While this example is of a continuous environmental layer, the process is very similar for a categorical environmental layer, with the exception that the MEAN distance value would be replaced by the MAXIMUM categorical value.

Using this information, we interpreted the graphs. The intensity of preferences for Recreation in the Sanctuary analysis decreased as the distance to protected areas and the distance to wrecks increased. Higher levels of Recreation value were associated with locations of Uplands; Palustrine, emergent, persistent, semi-permanently flooded, diked/impounded areas; and, Palustrine, forested, long-leafed evergreen, saturated,

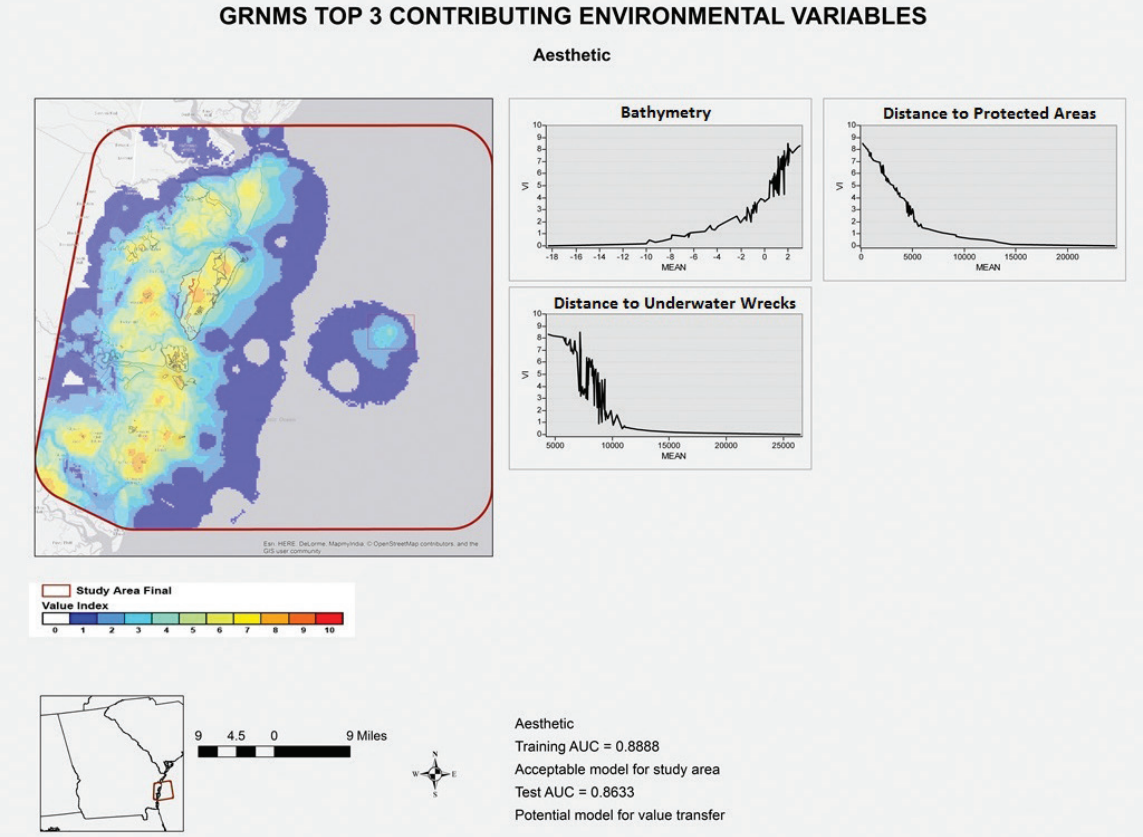

Figure 3.57. Results from the SolVES analysis of the top three contributing environmental variables influencing Aesthetics for the Sanctuary.

a.

Value	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD	SUM	VI
96	1	122500	7585.730	7585.730	0.000	7585.730	0.000	7585.72998047000	9.6
95	4	490000	5293.789	7283.083	1989.294	6225.225	807.847	24900.90185550000	9.5
94	3	367500	6402.382	11988.069	5585.687	8909.233	2315.938	26727.69970700000	9.4
93	2	245000	6580.403	7277.644	697.241	6929.023	348.621	13858.04687500000	9.3
92	1	122500	3703.755	3703.755	0.000	3703.755	0.000	3703.75488281000	9.2
91	2	245000	5967.587	7136.974	1169.387	6552.281	584.693	13104.56152340000	9.1
90	3	367500	4167.733	11795.228	7627.494	9169.857	3538.492	27509.57128910000	9.0
89	4	490000	3164.253	6837.104	3672.851	5036.077	1489.286	20144.30932620000	8.9
88	5	612500	7509.954	12257.671	4747.717	11004.241	1772.408	55021.20263670000	8.8
87	5	612500	3921.862	7060.269	3138.407	4869.364	1116.213	24346.82080080000	8.7
86	6	735000	3589.234	12239.302	8650.068	6685.954	3332.698	40115.72192380000	8.6
85	9	1102500	3838.594	14261.742	10423.149	8149.169	3523.287	73342.51806640000	8.5

b.

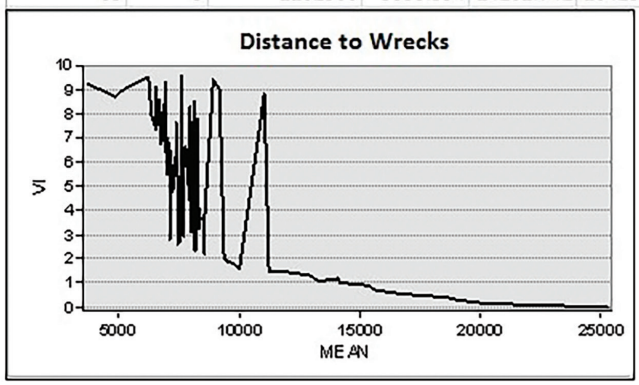

Figure 3.58. Example results from SolVES outputs. a) An example spatial statistics file for Distance to Wrecks influence on the Aesthetics social value model for the SINERR. b) The line graph corresponding to the spatial statistics file shown above.

drained areas. Vegetation cover receiving the highest intensity for Recreation value was Southern Atlantic Coastal Plain Salt and Brackish Tidal Marsh and Loblolly-bay Forest. The intensity of preferences for Aesthetics in the Reserve analysis decreased as the distance to protected areas and the distance to wrecks increased. Higher levels of Aesthetic values were associated with locations of Uplands; Estuarine, intertidal, unconsolidated shore, irregularly flooded areas; and, Palustrine, forested, long-leafed evergreen, saturated, drained areas. Vegetation cover receiving the highest intensity for Aesthetic value was Cabbage Palmetto Woodland; Developed; and, Longleaf pine – Pond Pine/Chapman Oak – Myrtle Oak – Sand Live Oak – Tree Lyonia Woodland.

The intensity of preferences for both Recreation and Aesthetics in the Sanctuary analysis decreased as the distance to protected areas and distance to wrecks increased; however, the intensity of both value preferences increased as water depth decreased.

Additional statistics describing the performance of each model are included; among these is the Area Under the Curve (AUC) of the Receiver Operating Characteristic (ROC) curve. The training AUC indicates how well the model fits the primary study area. Models with AUC values of 0.5 or less perform at the level of random prediction (Phillips et. al., 2006). Models with AUC values above 0.70 (Swets, 1988; Hosmer and Lemeshow, 2000; Elith et. al., 2006) are considered useful. In the four examples provided above (Figures 3.54-3.57), the training AUC values range from 0.813 to 0.888, indicating that the environmental variables chosen are key influencing factors on the placement of social values. Test AUC values indicate the predictive potential of the model. All models shown indicate a useful predictive potential: 0.7602, 0.7696, 0.8603, and 0.8633, respectively.

3.3. MANAGEMENT PRIORITIES AND ZCTA LOCATION

Respondents' ZCTAs were spread throughout the United States, ranging from New Jersey in the east, to Michigan in the north, California to the west, and Florida in the south (Figure 3.59). Most ZCTAs, however, were concentrated in Georgia, with a few in Florida, Alabama, and South Carolina. The highest concentrations of ZIP Codes occur within 100 miles of the study area, with even higher concentrations within 15 miles of the study area.

Management Priority responses were analyzed with respect to whether or not respondents lived within or beyond 15 miles from the study area (based on ZCTA). Respondents who lived within 15 miles of the study area were, on average, less supportive of conducting scientific research to enhance the understanding of coastal processes, the restriction of harvest, and the limitation of motorized watercrafts (Table 3.6).

Georgia boat ramp. Credit: Tripp McElwee

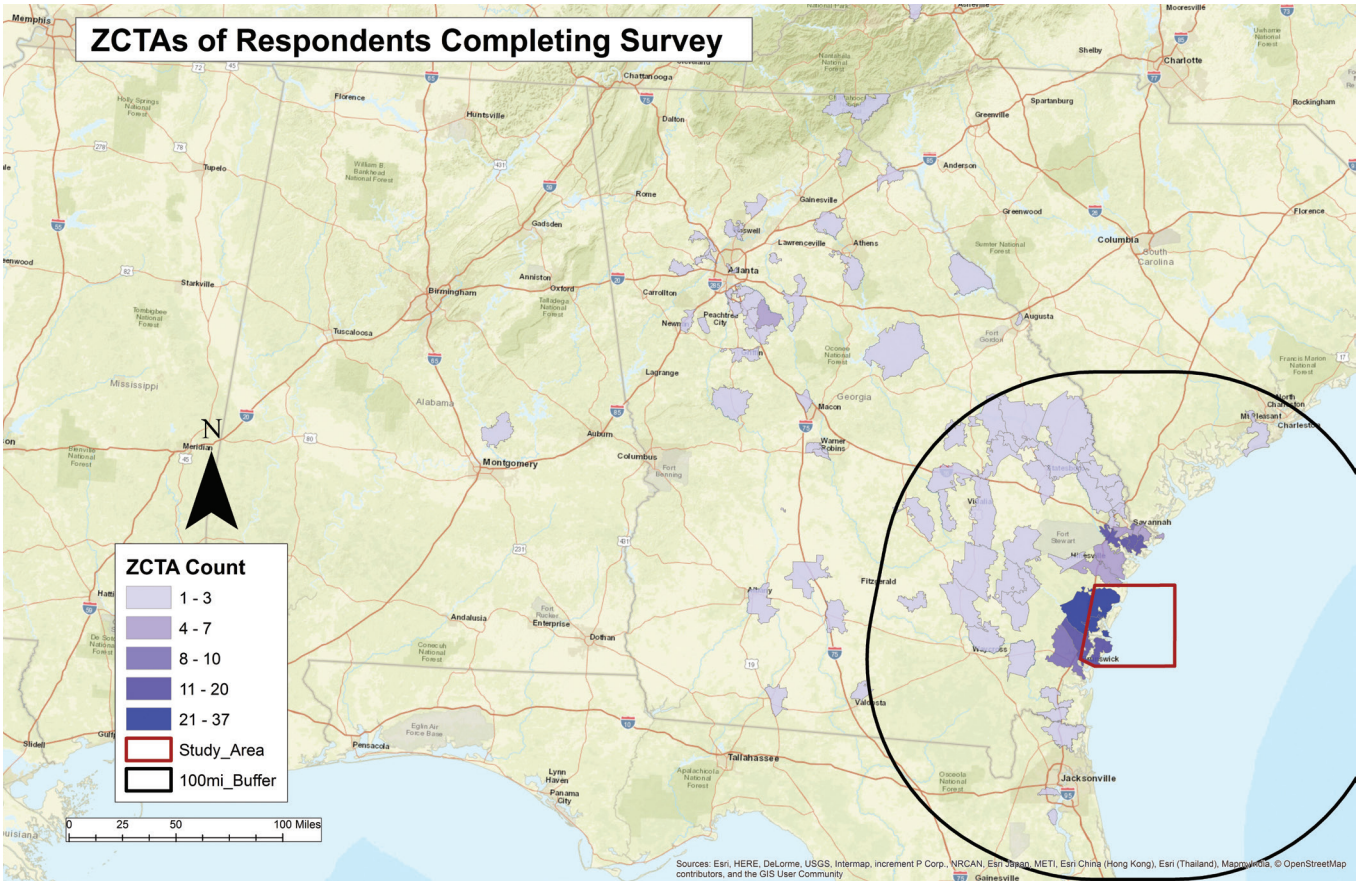

Figure 3.59. ZIP code tabulation areas (ZCTAs) of respondents completing the survey.

Table 3.6. Results from ZCTA and management priority analysis.

Management Priority	Lives in a ZCTA beyond 15 miles from the study area		Lives in a ZCTA within 15 miles from the study area		Statistical test for difference	
	n	Mean	n	Mean	t	p
Improve coastal water quality	177	4.39	130	4.41	-0.19	0.85
Eliminate further damage and restore natural live bottom reef habitats	189	4.44	146	4.35	0.95	0.35
Eliminate further loss of and restore shoreline and wetland habitats	191	4.34	146	4.36	-0.24	0.81
Conduct scientific research and long term monitoring to enhance the understanding of coastal processes	192	4.24	146	4.08	1.78*	0.08
Restore and sustain fish stocks and other living marine resources	190	4.31	143	4.36	-0.57	0.57
Increase the resilience of coastal communities to future coastal hazards	185	4.11	140	4.01	0.87	0.38
Increase the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards	195	4.29	148	4.14	1.58	0.12
Increase the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes	193	4.32	147	4.19	1.41	0.16
Create, or increase, areas where commercial and recreational harvest is restricted	185	3.74	135	3.40	2.52**	0.01
Establish areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged	191	3.85	143	3.59	2.02**	0.04
Incorporate local social and cultural heritage into resource management decision making (such as public input and community advisory boards)	189	3.87	145	3.77	0.92	0.36

Notes: * = significant at the 10% level; ** = significant at the 5% level

3.4. ANALYSIS OF RESIDENT STATUS

3.4.1. Pearson Correlation Analysis

Table 3.7 displays the results of a Pearson correlation analysis examining characteristics related each status of residency. Results indicate that respondents who were permanent residents tend to have more place attachment to Georgia's coast, allocate fewer "pennies" to Aesthetic value and allocate more to Economic value, place more points on the map, respond less favorably to management options, and be male. Seasonal residents tend to have more place attachment to Georgia's coast, allocate more "pennies" to Aesthetic value and fewer "pennies" to Economic value, place fewer points on the map, have a greater understanding of management dimensions, respond more favorably to management options, be dependent upon Georgia's coast for their income, be white, and not be black or African American. Lastly, this table shows that visitors tend to have less place attachment to Georgia's coast, place fewer points on the map, have less understanding of management decisions, and not be dependent upon Georgia's coast for their income.

Table 3.7. Correlation matrix of resident status.

	Permanent Resident	Seasonal Resident	Visitor
Nature Condition Index	0.089	-0.070	-0.031
Place Attachment Index	0.120**	0.160***	-0.281***
Aesthetic	-0.109**	0.200***	-0.058
Recreation	0.023	-0.059	0.027
Legacy	-0.009	-0.003	0.012
Spiritual	0.022	0.035	-0.054
Human needs	-0.041	0.049	0.001
Learning	-0.072	0.016	0.063
Biodiversity	0.023	-0.008	-0.017
Wilderness	-0.034	-0.001	0.037
Socializing	0.058	-0.032	-0.033
Inspiration	0.004	-0.059	0.048
Therapeutic	0.002	-0.011	0.008
Economic	0.173***	-0.200***	-0.010
In of itself	0.049	-0.010	-0.044
Number of points placed	0.262***	-0.193***	-0.118**
Access Index	-0.018	0.076	-0.066
Management Understanding Index	-0.024	0.169***	-0.130**
Management Priority Index	-0.146**	0.183***	-0.008
Income Dependence	0.083	0.099*	-0.175***
Age	-0.009	0.081	-0.060
Male Gender	0.096*	-0.043	-0.064
Completed College	-0.076	0.050	0.038
Annual Household Income	0.006	0.018	-0.022
Hispanic	-0.017	0.000	0.018
White	-0.046	0.126**	-0.060
Black	0.037	-0.092*	0.040
Multi Race	-0.042	-0.052	0.089

* = significant at the 10% level; ** = significant at the 5% level;*** = significant at the 1% level

3.4.2. One-Way ANOVA Analysis

The following analyses examine how the three different user groups differed in their knowledge, attitudes, and perceptions pertaining to the following groups of questions contained in the survey instrument:

- Agreement with statements of value concerning place attachment to coastal Georgia
- Public knowledge of management dimensions
- Priority of management goals

The Tukey's HSD post-hoc comparison procedure was used to test for statistically significant differences amongst each resident group. Only statistically significant findings are reported below. In the following tables, the number (1) corresponds to permanent residents, (2) corresponds to seasonal residents, and (3) corresponds to visitors. For example, if a table says that "3>2" for a given question, this means that the mean response for visitors is statistically significantly greater than the mean response for permanent residents for that particular question.

Table 3.8 shows that, on average, permanent residents exhibited the most place attachment to the Georgia coast; and, on average, seasonal residents exhibited more place attachment to Georgia's coast than did visitors. (Higher mean values indicate more agreement with the statement of place attachment.)

Table 3.8. Place attachment to coastal Georgia ANOVA results.

Place Attachment Statement	Permanent Resident (1)		Seasonal Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
This area is the best place to satisfy my outdoor recreation needs	159	4.13	71	4.30	110	4.14	N/A	N/A
This area represents a way of life in my community	155	4.32	71	4.44	99	3.69	1>3***	0.04
							2>3***	0.02
This area is important for providing habitat for fish and other wildlife	157	4.61	71	4.72	110	4.63	N/A	N/A
My community's economy depends on the natural resources of coastal Georgia	156	4.31	71	4.39	98	3.74	1>3***	<0.01
							2>3***	<0.01
This area contributes to the character of my community	158	4.54	69	4.64	105	3.84	1>3***	<0.01
							2>3***	<0.01

* = significant at the 10% level; ** = significant at the 5% level;*** = significant at the 1% level

Table 3.9 shows that, on average, seasonal residents were the generally the most knowledgeable of management dimensions when compared to permanent residents and visitors. (Higher mean values indicate more knowledge of the management dimension.)

Table 3.9. Public knowledge of management dimensions ANOVA results.

Management Dimension	Permanent Resident (1)		Seasonal Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
Ecology	149	2.67	69	2.99	98	2.71	2>1**	0.04
History/Culture	154	2.77	69	2.88	105	2.97	N/A	N/A
Local environmental effects of sea level rise	139	2.58	65	2.71	96	2.35	2>3*	0.07
Recreational Opportunities	154	2.94	68	3.15	104	2.95	N/A	N/A
Volunteer Opportunities	143	2.67	67	2.85	89	2.31	2>3***	<0.01
							1>3**	0.01
Educational Opportunities	149	2.60	68	2.91	93	2.53	2>1**	0.04
							2>3**	0.02
Public involvement in decision making	140	2.01	61	2.34	81	1.95	2>1**	0.04
							2>3**	0.02

* = significant at the 10% level; ** = significant at the 5% level;*** = significant at the 1% level

Table 3.10 shows that, on average, seasonal residents were the most supportive of management options when compared to permanent residents and visitors. (Higher mean values indicate higher prioritization of the management goal option.)

Similar analyses found that, on average, seasonal residents agreed more that there is adequate access to environmental education opportunities when compared to permanent residents** and visitors**, and that permanent residents, on average, had a more positive perception concerning the change in the condition of birds when compared to seasonal residents*** and visitors***. (These tables are not illustrated as these were the only additional significant findings of resident status.)

Table 3.10. Priorities of management goals ANOVA results.

Management Priority	Permanent Resident (1)		Seasonal Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
Improve coastal water quality	138	4.38	65	4.52	100	4.34	N/A	N/A
Eliminate further damage and restore natural live bottom reef habitats	155	4.30	69	4.58	107	4.43	2>1*	0.07
Eliminate further loss of and restore shoreline and wetland habitats	155	4.23	70	4.66	108	4.31	2>1***	<0.01
							2>3**	0.03
Conduct scientific research and long term monitoring to enhance the understanding of coastal processes	158	4.07	69	4.32	107	4.21	N/A	N/A
Restore and sustain fish stocks and other living marine resources	152	4.29	69	4.46	108	4.30	N/A	N/A
Increase the resilience of coastal communities to future coastal hazards	151	4.06	69	4.37	108	3.89	2>1*	0.07
							2>3***	<0.01
Increase the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards	158	4.09	70	4.44	111	4.28	2>1**	0.01
Increase the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes	157	4.14	70	4.47	109	4.30	2>1**	0.01
Create, or increase, areas where commercial and recreational harvest is restricted	145	3.46	69	3.86	102	3.62	2>1*	0.06
Establish areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged	154	3.73	68	3.62	108	3.81	N/A	N/A
Incorporate local social and cultural heritage into resource management decision making (such as public input and community advisory boards)	156	3.81	70	3.77	104	3.88	N/A	N/A

* = significant at the 10% level; ** = significant at the 5% level;*** = significant at the 1% level

3.4.3. Analysis of Questions 1, 2, 3, and 5

Table 3.11 below shows survey question 1, 2, 3, and 5 combined by ZIP Code to illustrate the frequency of each ZIP Code, the average tenancy at each ZIP Code, coastal Georgia visitation, and percentages of residency category by ZIP Code.

Table 3.11. Combination of survey questions 1, 2, 3, and 5.

	Question 1	Question 2	Question 3	Question 5a	Question 5b	Question 5c
ZIP Code	Frequency of occurrence for ZIP	Average number of years spent at ZIP	Percent of people that have visited Coastal GA before by ZIP	Percent permanent resident by ZIP	Percent seasonal resident by ZIP	Percent visitor by ZIP
31305	37	16.93	100.0%	97.3%	2.7%	0.0%
31331	21	12.50	90.0%	90.5%	9.5%	0.0%
31411	20	9.70	47.4%	15.0%	35.0%	50.0%
31522	17	13.38	29.4%	35.3%	64.7%	0.0%
31520	17	19.24	82.4%	76.5%	23.5%	0.0%
31406	17	20.13	62.5%	31.3%	31.3%	37.5%
31419	16	11.00	81.3%	50.0%	31.3%	18.8%
31525	15	16.70	86.7%	80.0%	20.0%	0.0%
31523	10	20.35	90.0%	80.0%	10.0%	10.0%
31401	10	10.70	60.0%	20.0%	20.0%	60.0%
31410	7	11.79	57.1%	66.7%	33.3%	0.0%
31404	7	9.00	50.0%	57.1%	14.3%	28.6%
31328	7	31.29	14.3%	0.0%	71.4%	28.6%
31405	6	5.83	33.3%	33.3%	66.7%	0.0%
31324	5	13.50	100.0%	60.0%	0.0%	40.0%
31311	5	3.30	100.0%	25.0%	0.0%	75.0%
30252	5	33.60	60.0%	0.0%	20.0%	80.0%
31320	4	13.75	100.0%	75.0%	0.0%	25.0%
31545	3	36.00	100.0%	33.3%	0.0%	66.7%
31326	3	14.33	100.0%	66.7%	33.3%	0.0%
31322	3	12.00	100.0%	66.7%	0.0%	33.3%
31605	2	3.75	50.0%	0.0%	0.0%	100.0%
31510	2	23.5	50.0%	0.0%	50.0%	50.0%
31329	2	4.50	100.0%	100.0%	0.0%	0.0%
31319	2	39.00	100.0%	100.0%	0.0%	0.0%
31313	2	14.00	50.0%	0.0%	0.0%	100.0%
31312	2	18.50	100.0%	0.0%	100.0%	0.0%
30525	2	18.00	100.0%	100.0%	0.0%	0.0%
30458	2	31.50	50.0%	0.0%	0.0%	100.0%
30309	2	24.00	0.0%	50.0%	0.0%	50.0%
30307	2	17.00	50.0%	100.0%	0.0%	0.0%
30253	2	20.00	100.0%	0.0%	0.0%	100.0%
30248	2	50.00	100.0%	0.0%	0.0%	100.0%
30078	2	36.50	100.0%	0.0%	0.0%	100.0%
31331	1	2.00	0.0%	0.0%	100.0%	0.0%
31521	1	9.00	0.0%	0.0%	100.0%	0.0%
95616	1	1.00	0.0%	0.0%	0.0%	100.0%
80126	1	17.00	0.0%	0.0%	100.0%	0.0%
77396	1	12.00	100.0%	100.0%	0.0%	0.0%

Table 3.11. continued. Combination of survey questions 1, 2, 3, and 5.

	Question 1	Question 2	Question 3	Question 5a	Question 5b	Question 5c
ZIP Code	Frequency of occurrence for ZIP	Average number of years spent at ZIP	Percent of people that have visited Coastal GA before by ZIP	Percent permanent resident by ZIP	Percent seasonal resident by ZIP	Percent visitor by ZIP
60601	1	18.0	100.0%	0.0%	0.0%	100.0%
51323	1	62.0	100.0%	100.0%	0.0%	0.0%
50055	1	1.0	0.0%	0.0%	0.0%	100.0%
48640	1	50.0	0.0%	100.0%	0.0%	0.0%
48307	1	40.0	0.0%	0.0%	0.0%	100.0%
46561	1	5.0	0.0%	0.0%	0.0%	100.0%
46060	1	2.0	0.0%	0.0%	0.0%	100.0%
40525	1	40.0	100.0%	100.0%	0.0%	0.0%
37766	1	51.0	0.0%	0.0%	0.0%	100.0%
37664	1	40.0	100.0%	0.0%	100.0%	0.0%
36092	1	6.0	0.0%	0.0%	0.0%	100.0%
32821	1	5.0	0.0%	0.0%	0.0%	100.0%
32818	1	30.0	0.0%	0.0%	0.0%	100.0%
32210	1	5.0	100.0%	100.0%	0.0%	0.0%
32041	1	11.0	100.0%	0.0%	0.0%	100.0%
32003	1	12.0	100.0%	0.0%	0.0%	100.0%
31794	1	68.0	0.0%	100.0%	0.0%	0.0%
31757	1	3.0	0.0%	0.0%	0.0%	100.0%
31714	1	21.0	100.0%	0.0%	100.0%	0.0%
31705	1	1.0	0.0%	0.0%	0.0%	100.0%
31569	1	2.0	100.0%	100.0%	0.0%	0.0%
31560	1	16.0	100.0%	0.0%	0.0%	100.0%
31555	1	58.0	100.0%	0.0%	0.0%	100.0%
31553	1	61.0	0.0%	100.0%	0.0%	0.0%
31548	1	12.0	100.0%	100.0%	0.0%	0.0%
31533	1	12.0	100.0%	100.0%	0.0%	0.0%
31524	1	33.0	100.0%	100.0%	0.0%	0.0%
31521	1	2.0	100.0%	100.0%	0.0%	0.0%
31516	1	18.0	100.0%	100.0%	0.0%	0.0%
31513	1	50.0	100.0%	0.0%	0.0%	100.0%
31425	1	66.0	100.0%	100.0%	0.0%	0.0%
31407	1	21.0	100.0%	0.0%	0.0%	100.0%
31210	1	1.5	100.0%	0.0%	0.0%	100.0%
31088	1	35.0	100.0%	0.0%	100.0%	0.0%
31087	1	2.0	100.0%	0.0%	0.0%	100.0%
31051	1	66.0	100.0%	0.0%	0.0%	100.0%
31049	1	20.0	100.0%	0.0%	0.0%	100.0%
31005	1	4.0	100.0%	0.0%	0.0%	100.0%
30904	1	8.0	100.0%	0.0%	100.0%	0.0%
30817	1	20.0	100.0%	0.0%	0.0%	100.0%
30677	1	27.0	0.0%	0.0%	0.0%	100.0%
30563	1	70.0	100.0%	0.0%	100.0%	0.0%
30553	1	50.0	100.0%	0.0%	0.0%	100.0%

Table 3.11. continued. Combination of survey questions 1, 2, 3, and 5.

	Question 1	Question 2	Question 3	Question 5a	Question 5b	Question 5c
ZIP Code	Frequency of occurrence for ZIP	Average number of years spent at ZIP	Percent of people that have visited Coastal GA before by ZIP	Percent permanent resident by ZIP	Percent seasonal resident by ZIP	Percent visitor by ZIP
30549	1	25.0	100.0%	0.0%	0.0%	100.0%
30471	1	56.0	100.0%	0.0%	0.0%	100.0%
30467	1	46.0	100.0%	0.0%	100.0%	0.0%
30461	1	10.0	100.0%	0.0%	0.0%	0.0%
30457	1	23.0	0.0%	0.0%	0.0%	100.0%
30446	1	9.0	100.0%	100.0%	0.0%	0.0%
30445	1	20.0	100.0%	0.0%	0.0%	100.0%
30442	1	19.0	100.0%	0.0%	100.0%	0.0%
30441	1	17.0	0.0%	0.0%	0.0%	100.0%
30436	1	4.0	100.0%	100.0%	0.0%	0.0%
30427	1	10.0	100.0%	100.0%	0.0%	0.0%
30425	1	1.6	100.0%	0.0%	0.0%	100.0%
30411	1	15.0	0.0%	0.0%	0.0%	100.0%
30297	1	30.0	100.0%	0.0%	0.0%	100.0%
30294	1	2.0	100.0%	0.0%	0.0%	100.0%
30286	1	57.0	0.0%	0.0%	0.0%	100.0%
30281	1	7.0	100.0%	0.0%	0.0%	100.0%
30269	1	15.0	100.0%	0.0%	0.0%	100.0%
30265	1	5.0	0.0%	0.0%	0.0%	100.0%
30236	1	60.0	100.0%	0.0%	0.0%	100.0%
30224	1	24.0	100.0%	0.0%	100.0%	0.0%
30152	1	30.0	100.0%	0.0%	0.0%	100.0%
30134	1	8.0	100.0%	0.0%	0.0%	100.0%
30106	1	3.0	100.0%	0.0%	0.0%	100.0%
30082	1	12.0	100.0%	0.0%	0.0%	100.0%
30076	1	25.0	100.0%	0.0%	100.0%	0.0%
30075	1	2.0	0.0%	0.0%	0.0%	100.0%
30060	1	68.0	100.0%	0.0%	0.0%	100.0%
30040	1	6.0	100.0%	0.0%	100.0%	0.0%
30014	1	7.0	100.0%	0.0%	0.0%	100.0%
30009	1	26.0	100.0%	0.0%	100.0%	0.0%
29455	1	6.0	100.0%	0.0%	0.0%	100.0%
28721	1	43.0	100.0%	0.0%	0.0%	100.0%
24060	1	11.0	100.0%	100.0%	0.0%	0.0%
18704	1	22.0	0.0%	0.0%	0.0%	100.0%
18042	1	25.0	0.0%	0.0%	0.0%	100.0%
16735	1	40.0	100.0%	0.0%	0.0%	100.0%
64120	1	14.0	0.0%	0.0%	0.0%	100.0%
26679	1	18.0	100.0%	0.0%	0.0%	100.0%

3.5. ANALYSIS OF VALUE ALLOCATION

Table 3.12 displays the variables that correspond to the thirteen different value types based on respondents' value allocation. Those who allocated more "pennies" to Aesthetic value tend to have more place attachment, not be dependent upon Georgia's coast for their income, be older in age, have more annual household income, be white, and not be multi-racial. Those who allocated more "pennies" to Recreation value tend to not be dependent upon Georgia's coast for their income, and be male. Respondents who allocated more "pennies" to Legacy value tend to have a more positive perception concerning the change in the condition of resources, have more place attachment, and be older in age. Respondents who allocated more "pennies" to Spiritual value tend to be female, and respondents who allocated more to Human Needs tend to respond more favorably to management options, be black or African American, and not be white.

Those respondents who allocated more "pennies" to Learning value tend to be younger, have less annual household income, be multi-racial, and not be white. Those who allocated more to Wilderness value tend to have a more negative perception concerning the change in the condition of resources, and respond more favorably to management options. Respondents who allocated more "pennies" to Socializing value tend to have a more positive perception concerning the change in the condition of resources, be younger in age, be male, have not completed college, have less annual household income, and be black or African American. Those who allocated more to Inspiration value tend to place more point on the map, and have not completed college, and respondents who allocated more "pennies" to Therapeutic value tend to have less place attachment, and be female.

Table 3.12. Correlation matrix of value allocation.

	Aest	Rec	Legacy	Sprtul	Human Needs	Lrn	Biol	Wild	Social	Inspir	Ther	Econ	In and of Itself
Number of points placed	-0.090	-0.080	-0.028	0.030	-0.024	0.008	-0.007	-0.026	0.069	0.187***	0.011	0.107*	0.052
Visit Once a Month or More	-0.023	0.009	-0.025	-0.007	-0.051	-0.078	0.038	0.000	0.064	-0.004	0.001	0.126**	-0.034
Nature Condition Index	-0.047	0.011	0.183**	-0.012	-0.025	-0.092	0.068	-0.139*	0.165**	0.074	-0.015	0.176**	-0.207**
Place Attachment Index	0.095*	-0.069	0.099*	-0.077	-0.024	0.023	-0.005	0.021	-0.025	-0.025	-0.101*	0.107*	-0.021
Access Index	-0.084	0.047	-0.079	0.075	0.146	-0.116	-0.079	-0.028	0.025	0.049	-0.006	0.014	0.194*
Management Understanding Index	-0.025	-0.042	-0.004	-0.013	0.049	0.073	-0.042	0.032	0.083	0.058	-0.015	-0.013	0.019
Management Priority Index	-0.116*	-0.058	0.038	-0.066	0.110*	0.090	-0.016	0.140**	-0.067	0.070	-0.032	0.042	-0.031
Income Dependence	-0.097*	-0.128**	-0.075	-0.073	0.004	0.059	-0.002	0.090	0.083	0.038	0.032	0.105*	0.060
Age	0.220***	0.018	0.133**	-0.004	-0.018	-0.132**	-0.004	-0.035	-0.145***	-0.065	-0.083	-0.120**	0.052
Male Gender	-0.023	0.123**	0.024	-0.150***	-0.007	-0.023	0.089	0.036	0.093*	-0.080	-0.136**	0.017	-0.066
Completed College	0.087	0.006	0.000	0.044	-0.058	-0.007	0.059	0.016	-0.137**	-0.090*	0.027	-0.089	0.039
Annual Household Income	0.106*	0.083	0.037	0.008	-0.093	-0.140**	0.067	-0.047	-0.115**	-0.049	0.054	-0.030	0.059
Hispanic	-0.045	-0.043	-0.020	0.026	0.066	-0.022	0.014	0.038	-0.023	0.022	-0.023	0.055	-0.010
White	0.133**	0.040	-0.061	-0.026	-0.134**	-0.104*	0.075	-0.016	0.006	0.042	0.022	-0.076	0.032
Black	-0.072	-0.002	0.041	-0.049	0.140**	0.044	-0.083	-0.039	0.091*	-0.018	-0.014	0.085	-0.066
Multi Race	-0.131**	-0.082	0.054	-0.081	0.073	0.102*	0.010	0.040	-0.043	-0.022	0.043	0.108**	-0.026

* = significant at the 10% level; ** = significant at the 5% level;*** = significant at the 1% level

Those who allocated more to Economic value tend to place more points on the map, visit coastal Georgia once a month or more, have a more positive perception concerning the change in the condition of resources, have more place attachment, be dependent upon Georgia's coast for income, be younger in age, and be multi-racial. Respondents who allocated more "pennies" to In and of Itself value tend to have a more negative perception concerning the change in the condition of resources, and have a more positive perception concerning the level of access to coastal resources. Lastly, those who allocated more "pennies" to Biodiversity value did not exhibit any statistical relationships with the variables that were analyzed.

To determine if there were any significant findings within respondents who answered "Unsure or Do Not Know" frequently, a "Not Sure" proportion analysis was conducted. Those who answered "Unsure or Do Not Know" to questions concerning the change in resource condition, perceptions of public access, knowledge of management dimensions, and opinions on management priorities were counted and divided by the question total, 35, to create a "Not Sure proportion" variable.

Through a Pearson correlation analysis, it was found that those who answered "Not Sure" more frequently tend to: not be a seasonal resident (-0.169)* and be a visitor (0.230)***, visit coastal Georgia less than once a month (-0.308)***, have less place attachment (-0.219)***, allocate fewer "pennies" to Economic value (-0.103)* and more "pennies" to In and of Itself value (0.091)*, have a more positive perception concerning the level of access to coastal resources (0.182)*, have less knowledge of management decisions (-0.286)***, not be dependent upon Georgia's coast for their income (-0.187)***, and be female (-0.185)*** (* = significant at the 10% level; *** = significant at the 1% level).

3.6. OTHER COMPARATIVE ANALYSES

3.6.1. Visitation Frequency and Place Attachment

Respondents who visited the Georgia coast at least once per month, on average, exhibited higher levels of place attachment than those who visited less than once per month (Table 3.13).

Table 3.13. Place attachment and visitation frequency.

Place Attachment Statement	Visits Coastal Georgia less than Once a Month		Visits Coastal Georgia Once a Month or More		Statistical test for difference	
	n	Mean	n	Mean	t	p
This area is the best place to satisfy my outdoor recreation needs	124	3.93	204	4.32	-4.32***	<0.01
This area represents a way of life in my community	113	3.73	203	4.37	-5.74***	<0.01
This area is important for providing habitat for fish and other wildlife	123	4.63	202	4.65	-0.22	0.83
My community's economy depends on the natural resources of coastal Georgia	110	3.88	201	4.31	-3.50***	<0.01
This area contributes to the character of my community	119	3.96	201	4.55	-5.27***	<0.01

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more agreement with the statement.

Respondents who visited the Georgia coast at least once per month, on average, agreed more that there has been an increase in fish, marsh vegetation, and birds (Table 3.14). These same respondents, on average, agreed more that there has been a decrease in public access to land and water resources along Georgia's coast.

3.6.2. Perceptions of Those with Income Dependent upon Georgia's Coast

Respondents who depend upon Georgia's coast for income, on average, agreed more with increasing public understanding of how natural ecosystems protect communities and incorporating local heritage into decision making (Table 3.15). (Higher mean values indicate more agreement with the management option.)

Table 3.14. Resource condition perceptions and visitation frequency.

Change in Quantity of:	Visits Coastal Georgia less than Once a Month		Visits Coastal Georgia Once a Month or More		Statistical test for difference	
	n	Mean	n	Mean	t	p
Shellfish	61	2.74	134	2.87	-0.88	0.38
Fish	62	2.70	154	2.99	-1.69*	0.09
Visitors and Boaters	100	3.97	192	3.83	1.54	0.12
Marsh vegetation	80	2.91	171	3.13	-2.07**	0.04
Marine mammals	70	3.00	157	3.03	-0.28	0.78
Birds	95	3.25	180	3.47	-2.10**	0.04
Public access to land and water resources	98	3.41	188	3.24	1.75*	0.08
Frequency of adverse conditions (i.e. red tides, jellyfish, marine debris, trash)	90	3.47	184	3.38	0.82	0.41

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate the perception that the resource has increased.

Table 3.15. Management priorities and income dependence.

Management Priority	Does Not Depend on Georgia's Coast for Income		Does Depend on Georgia's Coast for Income		Statistical test for difference	
	n	Mean	n	Mean	t	p
Improve coastal water quality	219	4.41	61	4.46	-0.45	0.65
Eliminate further damage and restore natural live bottom reef habitats	238	4.42	66	4.41	0.09	0.93
Eliminate further loss of and restore shoreline and wetland habitats	239	4.36	67	4.39	-0.23	0.82
Conduct scientific research and long term monitoring to enhance the understanding of coastal processes	239	4.12	68	4.31	-1.62	0.11
Restore and sustain fish stocks and other living marine resources	238	4.35	65	4.32	0.25	0.80
Increase the resilience of coastal communities to future coastal hazards	232	4.03	65	4.18	-1.15	0.25
Increase the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards	244	4.19	68	4.41	-1.98**	0.05
Increase the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes	241	4.26	68	4.34	-0.70	0.48
Create, or increase, areas where commercial and recreational harvest is restricted	225	3.56	65	3.74	-1.10	0.27
Establish areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged	238	3.76	65	3.72	0.18	0.86
Incorporate local social and cultural heritage into resource management decision making (such as public input and community advisory boards)	236	3.77	68	4.04	-1.96*	0.05

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more agreement with the management option.

Respondents who depend upon Georgia's coast for their income are, on average, more knowledgeable about ecology, local environmental effects of sea level rise, and public involvement in decision-making (Table 3.16).

Table 3.16. Knowledge of management dimensions and income dependence.

Management Dimension	Does Not Depend on Georgia's Coast for Income		Does Depend on Georgia's Coast for Income		Statistical test for difference	
	n	Mean	n	Mean	t	p
Ecology	227	2.70	65	2.92	-1.74*	0.08
History/Culture	236	2.83	67	2.90	-0.57	0.57
Local environmental effects of sea level rise	213	2.48	64	2.75	-1.92*	0.06
Recreational Opportunities	234	2.96	67	3.06	-0.95	0.34
Volunteer Opportunities	211	2.56	65	2.74	-1.34	0.18
Educational Opportunities	218	2.65	67	2.66	-0.04	0.97
Public involvement in decision making	197	2.02	62	2.23	-1.67*	0.10

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more knowledge of the management dimension.

Respondents who depend on Georgia's coast for income exhibited more place attachment, on average, when compared to those who do not depend on coastal Georgia for their income (Table 3.17). (Higher mean values indicate more agreement with the statement.)

Table 3.17. Place attachment and income dependence.

Place Attachment Statement	Does Not Depend on Georgia's Coast for Income		Does Depend on Georgia's Coast for Income		Statistical test for difference	
	n	Mean	n	Mean	t	p
This area is the best place to satisfy my outdoor recreation needs	245	4.16	69	4.19	-0.30	0.77
This area represents a way of life in my community	232	4.07	68	4.49	-3.41***	<0.01
This area is important for providing habitat for fish and other wildlife	245	4.64	67	4.72	-1.14	0.26
My community's economy depends on the natural resources of coastal Georgia	234	4.07	67	4.51	-4.11***	<0.01
This area contributes to the character of my community	243	4.29	67	4.60	-3.34***	<0.01

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more agreement with the statement.

Respondents who depend upon Georgia's coast for their income, on average, agreed more that there has been an increase in marine mammals, and also an increase in the frequency of adverse conditions, such as red tides, jellyfish, marine debris, or trash (Table 3.18). (Higher mean values indicate the perception that the resource has increased.)

Table 3.18. Resource condition perceptions and income dependency.

Change in Quantity of:	Does Not Depend on Georgia's Coast for Income		Does Depend on Georgia's Coast for Income		Statistical test for difference	
	n	Mean	n	Mean	t	p
Shellfish	142	2.74	46	3.02	-1.56	0.12
Fish	155	2.84	54	3.07	-1.48	0.14
Visitors and Boaters	214	3.84	64	3.94	-0.96	0.34
Marsh vegetation	180	2.97	58	3.19	-1.58	0.12
Marine mammals	158	2.97	56	3.16	-1.67*	0.10
Birds	202	3.36	59	3.42	-0.56	0.58
Public access to land and water resources	210	3.30	62	3.32	-0.18	0.86
Frequency of adverse conditions (i.e. red tides, jellyfish, marine debris, trash)	198	3.36	62	3.61	-2.05**	0.04

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate the perception that the resource has increased.

3.6.3. Perceptions of Respondents with High Mapping Effort

Respondents who placed eight or more map points, on average, agree less with increasing the resilience of communities to future hazards, restricting harvest, and creating or increasing limited or no wake areas (Table 3.19). Eight mapped points was chosen as the cut-off point because it is the median number of points placed overall (this is the same for Table 3.20.).

Table 3.19. Management priorities and mapping participation.

Management Priority	Placed 8 or more Map Points		Placed less than 8 Map Points		Statistical test for difference	
	n	Mean	n	Mean	t	p
Improve coastal water quality	147	4.38	126	4.37	0.16	0.88
Eliminate further damage and restore natural live bottom reef habitats	166	4.33	134	4.43	-0.98	0.33
Eliminate further loss of and restore shoreline and wetland habitats	166	4.30	135	4.40	-0.99	0.33
Conduct scientific research and long term monitoring to enhance the understanding of coastal processes	169	4.16	135	4.15	0.12	0.91
Restore and sustain fish stocks and other living marine resources	165	4.32	135	4.35	-0.39	0.70
Increase the resilience of coastal communities to future coastal hazards	161	3.96	128	4.17	-1.84*	0.07
Increase the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards	170	4.20	137	4.17	0.33	0.74
Increase the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes	169	4.26	135	4.20	0.64	0.52
Create, or increase, areas where commercial and recreational harvest is restricted	158	3.46	128	3.74	-2.04**	0.04
Establish areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged	165	3.62	133	3.85	-1.73*	0.09
Incorporate local social and cultural heritage into resource management decision making (such as public input and community advisory boards)	167	3.81	132	3.78	0.29	0.78

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more agreement with the management priority.

Respondents who placed eight or more map points, on average, agreed more that coastal Georgia is the best place to satisfy their outdoor recreation needs and that the study area contributes to the character of their community (Table 3.20).

Table 3.20. Place attachment and mapping participation.

Place Attachment Statement	Placed 8 or more Map Points		Placed less than 8 Map Points		Statistical test for difference	
	n	Mean	n	Mean	t	p
This area is the best place to satisfy my outdoor recreation needs	173	4.29	135	4.11	2.10**	0.04
This area represents a way of life in my community	169	4.24	125	4.08	1.52	0.13
This area is important for providing habitat for fish and other wildlife	171	4.65	135	4.67	-0.31	0.76
My community's economy depends on the natural resources of coastal Georgia	163	4.28	133	4.14	1.34	0.18
This area contributes to the character of my community	169	4.47	131	4.29	1.89*	0.06

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more agreement with the place attachment statement.

Respondents who placed eight or more map points, on average, agreed more that there has been an increase in birds and marine mammals within the study area (Table 3.21). This table uses the same cut-off point as Tables 3.19 and 3.20.

Table 3.21. Resource condition perceptions and mapping participation.

Change in Quantity of:	Placed 8 or more Map Points		Placed less than 8 Map Points		Statistical test for difference	
	n	Mean	n	Mean	t	p
Shellfish	108	2.91	80	2.78	0.96	0.34
Fish	119	2.97	90	2.80	1.37	0.17
Visitors and Boaters	160	3.84	119	3.92	-0.92	0.36
Marsh vegetation	138	3.11	105	3.02	0.85	0.40
Marine mammals	121	3.14	94	2.89	2.27**	0.02
Birds	147	3.56	112	3.20	3.61***	<0.01
Public access to land and water resources	157	3.32	115	3.28	0.47	0.64
Frequency of adverse conditions (i.e. red tides, jellyfish, marine debris, trash)	148	3.35	114	3.49	-1.31	0.19

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate the perception that the resource has increased.

Lazaretto Creek. Photo credit: Alison Scott

3.6.4. Respondents and Management Attitudes

Respondents who favored management options at a higher rate are, on average, more knowledgeable about ecology, recreational opportunities, volunteer opportunities and educational opportunities (Table 3.22). The value of 77 was chosen as the cut-off point because it is the median of the sample.

Table 3.22. Knowledge of management dimensions and management priority index.

Management Dimension	Management Priority Index ≥ 77		Management Priority Index < 77		Statistical test for difference	
	n	Mean	n	Mean	t	p
Ecology	132	2.87	108	2.62	2.17**	0.03
History/Culture	134	2.87	113	2.84	0.31	0.75
Local environmental effects of sea level rise	132	2.61	104	2.49	0.97	0.33
Recreational Opportunities	135	3.06	111	2.85	2.21**	0.03
Volunteer Opportunities	128	2.66	104	2.41	1.96*	0.05
Educational Opportunities	130	2.73	111	2.45	2.45**	0.02
Public involvement in decision making	118	2.06	100	2.09	-0.26	0.80

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more knowledge with the management dimensions; high management priority index values indicate a more favorable disposition toward management options.

Respondents who favored management options at a higher rate exhibited more place attachment, on average, when compared to those who favored management options at a lower rate (Table 3.23). The value of 77 was chosen as the cut-off point because it is the median of the sample.

Table 3.23. Place attachment and management priority index.

Place Attachment Statement	Management Priority Index ≥ 77		Management Priority Index < 77		Statistical test for difference	
	n	Mean	n	Mean	t	p
This area is the best place to satisfy my outdoor recreation needs	137	4.27	118	4.01	2.59**	0.01
This area represents a way of life in my community	130	4.23	115	3.97	2.21**	0.03
This area is important for providing habitat for fish and other wildlife	136	4.71	117	4.58	1.88*	0.06
My community's economy depends on the natural resources of coastal Georgia	130	4.24	111	4.01	1.76*	0.08
This area contributes to the character of my community	132	4.40	116	4.17	1.98**	0.05

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate more place attachment; high management priority index values indicate a more favorable disposition toward management options.

Respondents who favored management options at a higher rate, on average agreed more that there has been a decrease in shellfish, fish, and marsh vegetation (Table 3.24). These same respondents, on average, agreed more that there has been an increase in visitors and boaters, and an increase in the frequency of adverse conditions. Here, too, the cut-off point of 77 was chosen because it is the median of the sample.

Table 3.24. Resource condition perceptions and management priority index.

Change in Quantity of:	Management Priority Index ≥ 77		Management Priority Index < 77		Statistical test for difference	
	n	Mean	n	Mean	t	p
Shellfish	87	2.64	71	3.10	-3.02***	<0.01
Fish	95	2.76	81	3.15	-3.01***	<0.01
Visitors and Boaters	127	3.98	100	3.74	2.32**	0.02
Marsh vegetation	111	2.91	87	3.29	-3.44***	<0.01
Marine mammals	100	3.00	79	3.16	-1.34	0.18
Birds	123	3.39	92	3.36	0.28	0.78
Public access to land and water resources	123	3.34	101	3.19	1.49	0.14
Frequency of adverse conditions (i.e. red tides, jellyfish, marine debris, trash)	120	3.61	98	3.19	3.73***	<0.01

* = significant at the 10% level; ** = significant at the 5% level; *** = significant at the 1% level
Note: Higher mean values indicate the perception that the resource has increased; high management priority index values indicate a more favorable disposition toward management options..

Art on the beach. Photo credit: Jarrod Loerzel, NOAA NCCOS

3.6.5. Analyses of Access Attitudes

Other analyses examined the number of respondents who believe that access to the Sanctuary and Reserve is inadequate. Forty-two people believe that access to the Reserve is inadequate (12.2% of those who answered), and 38 people believe that access to the Sanctuary is inadequate (11.1% of those who answered). Further, 11 people believe that access is inadequate to both locations (3.2%). Interestingly, those who feel there is inadequate access to the Reserve tend to depend on Georgia's coast for their income (r=0.115, p=0.042) and tend to have completed college (r=0.090, p=0.097). Similarly, those who feel there is inadequate access to the Sanctuary tend to answer "not sure" less often to questions concerning resource condition, level of access, and management (r=-0.184, p=0.001), and tend to have completed college (r=0.139, p=0.011).

Figure 3.60 shows additional analyses of respondents who believe that access to the Reserve and Sanctuary is inadequate. Of those who feel that access to The Reserve is inadequate (42), 35% depend on Georgia's coast for their income, 95% completed high school, 85% completed college, 85% are white, 10% are black or African American, and the average age is 47.5 years. The majority of these respondents have a household income of $40,000 or more a year, with 42% earning between $40,000 and $60,000, and 36% earning $100,000 or more. Of those who feel that access to The Sanctuary is inadequate (38), 31% depend on Georgia's coast for their income, 100% completed high school, 91% completed college, 86% are white, 11% are black or African American, 3% are multi-racial, and the average age is 48.4 years. The majority of these respondents have a household income of $40,000 or more a year, with 31% earning between $40,000 and $60,000, and 31% earning $100,000 or more.

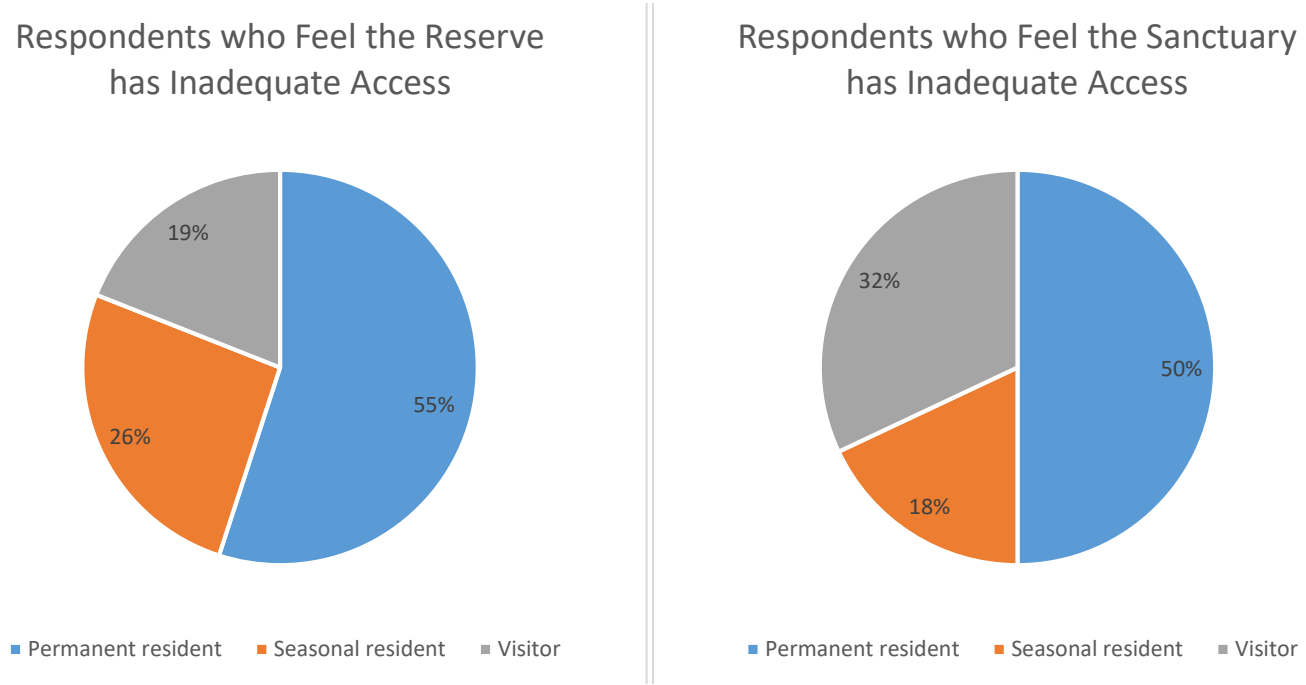

Figure 3.60. Residency of those claiming inadequate access to the Reserve and Sanctuary.

Figure 3.61 shows the differences in perceptions of public access to the Sanctuary and Reserve amongst permanent residents. There is higher perceived access to the Reserve, and a higher unknown adequacy of access to the Sanctuary.

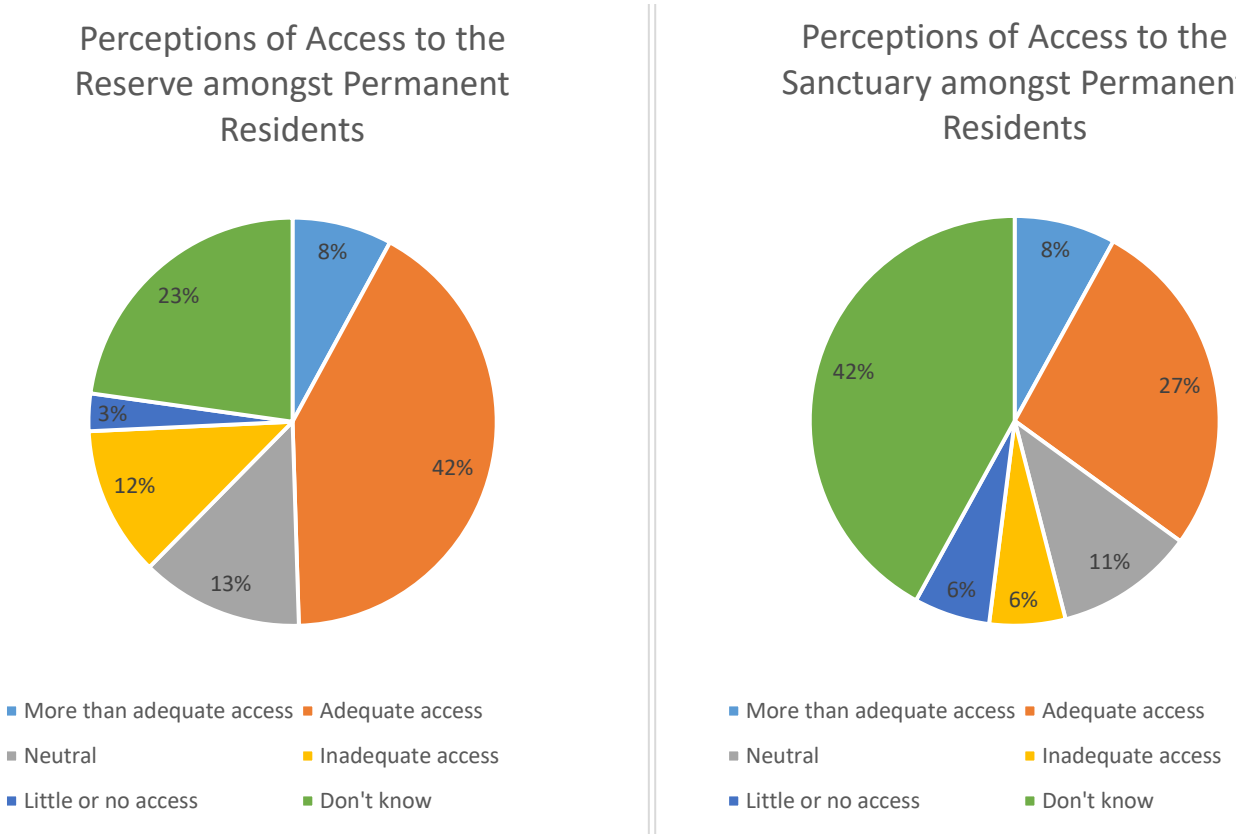

Figure 3.61. Permanent residency and access to the Sanctuary and Reserve.

Chapter 4
Discussion and Conclusions

Cockspur Island Lighthouse near Tybee Island, GA

This study has highlighted the knowledge, attitudes, and perceptions of permanent residents, seasonal residents, and visitors to the Georgia coast. We were able to determine resource user attitudes regarding management goals, resource condition, access to public lands, as well as why, how, and where they value the landscape of the Georgia coast.

In terms of management goals, we presented eleven different management goals to respondents, and asked them to indicate their level of support for each. We considered the first five management goals "bio-centric" in nature, meaning that the goals focus primarily on the biological condition of the coast. These "biocentric" goals received a high degree of support for prioritization from respondents. The last six management goals were more "anthropocentric" in nature, meaning they were more people oriented; for these management goals, we observed a slight shift downward in respondent support (Table 3.6). When the respondents were categorized into two groups – those living within 15 miles of the study area and those living beyond 15 miles of the study area – the results showed that those respondents living beyond 15 miles of the study area were, on average, generally more in favor of eight out of eleven proposed management options. Nevertheless, only three management options showed statistically significant differences between these groups. One was "biocentric" (conduct scientific research and long term monitoring to enhance the understanding of coastal processes), and two were "anthropocentric"(create, or increase, areas where commercial and recreational harvest is restricted; and, establish areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged). All three of these options were, on average, statistically significantly favored more by respondents living beyond 15 miles. The reasons for this disparity are somewhat intuitive: those respondents living beyond 15 miles from the study area likely feel that the implementation of these coastal-based management options would have little impact on their day-to-day lives, and are therefore more likely to support these options.

When asked about resource condition, respondents seemed more aware of human-oriented conditions rather than nature-based conditions. This is illustrated in the results, which show that the number of "Unsure /Don't Know" responses declined when the questions concerned increases, or decreases to human-based subject matter. When the questions concerned increases or decreases to nature-based subject matter, however, the number of "Unsure/Don't Know" responses increased dramatically. It is intuitive that people would be more aware of congestion at beaches, boat ramps, and the like and less aware of the landscape that surrounds them, both above and (especially) below the waterline. One example of this is a finding from O'Donnell and Shalles (2016) showing that over the last 27 years, marsh biomass (an above ground phenomenon) has decreased by an average of 36%. This would indicate that adult environmental education is needed in the study region.

Another instance of respondent uncertainty is reflected in the awareness of public access for both the Sanctuary and the Reserve. For example, 42% of respondents do not know about public access to the Sanctuary compared to only 29% for the Reserve. This is one of the highest percentages of public access uncertainty found in this study, and the results indicate that just under half of respondents did not know the location of the Sanctuary at the time this survey was administered.

By using spatial analysis and modeling, we were able to determine that the environmental variable Distance to Wrecks had a significant influence on the social values Recreation and Aesthetics for both the Sanctuary and Reserve. For the Aesthetic social value, this is likely because many of the boat wrecks are above water and visible to the observer. There are a number of photographic opportunities with these wrecked vessels, and the surrounding marsh provides a magnificent setting. In terms of the Recreational social value and the influence of the boat wrecks, it is likely due to the fact that a number of the wrecks are submerged and provide cover and structure for fish populations. Even if the wrecks are not completely submerged, they can still act as fish aggregating devices.

One interesting aspect of this project is the mixed method approach of offering both an online and paper-based option for the mapping application of the survey. Both have benefits and disadvantages. One advantage of the online mapping portal was that it required respondents to place location-specific values as a point on the map, thus allowing for more accurate and efficient spatial data collection from the respondent. By contrast, the paper map was unable to prevent respondents from drawing polygons, dots, stars, or writing "all values in this area." Another advantage of the online mapping portal is that it restricted respondents in the ability to map only the values

to which they had allocated “pennies” in the Value Allocation section. Nevertheless, while the online mapping portal is beneficial in these ways, the paper-based map has its own advantages. The paper map restricted the area to which respondents could place points to the study area region, whereas the online map application allowed points to be placed anywhere, which resulted in some respondents placing points well outside of the study area. Many respondents also found the paper-based map to be a more personalized experience, and this approach often achieved more points placed per respondent than through the online mapping application. By utilizing both mapping options in this survey, we hoped to balance the differences between the two approaches. When this study’s results are compared to a similar study conducted in the Mission-Aransas NERR, the differences are more apparent than the similarities. The sampling strategy for the Mission-Aransas NERR study utilized a mixed-mode of sampling (intercept and a paper-based mail-back), whereas this study utilized an entirely intercept based sampling approach. In terms of results, one major difference between this study and the one conducted in the Mission-Aransas NERR is that the majority of respondents in the Mission-Aransas project considered themselves permanent residents of the study region (65.7%), while for this effort slightly less than half (47%) considered themselves to be permanent residents. Another interesting difference, especially considering the residency responses, is that the respondents for this study were more likely to visit the study area daily or once a week (48%) when compared to the Mission-Aransas respondents (23.1%). A likely explanation for this finding is the fact that the sampling for this study was entirely intercept based.

Nevertheless, given a few constraints, we were able to determine resource user attitudes regarding management goals, resource condition, access to public lands, as well as why, how, and where they value the landscape of coastal Georgia. Coastal managers in Georgia, including those at state, county, and city offices, as well as at state and municipal parks and wildlife areas, can use these findings to better understand the preferences of their user groups. These findings can be used to advocate for increased connectivity between the Sapelo Island Reserve and the Gray’s Reef Sanctuary, as well as to inform education and outreach efforts for each of these locations. The findings may also provide a foundation for the development of a “scenic trail” connecting and/or informing visitors and residents of the various protected areas along the Georgia coast.

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Blenny at Gray's Reef. Photo credit: NOAA Gray's Reef NMS

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Appendix A
Survey Instrument

Fishing pier in Brunswick, GA. Photo credit: Tripp McElwee

NOAA NOS National Centers for Coastal Ocean Science

Hollings Marine Laboratory
Social Values of NERR and NMS Survey
OMB Control Number 0648-0687
Expiration Date: 01/31/2017

Hello. We are interested in learning about how you value the natural resources of the Georgia coast in general, and the Sapelo Island National Estuarine Research Reserve (NERR) and the Gray's Reef National Marine Sanctuary (NMS) in particular. Your participation is voluntary and will be kept strictly confidential. Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

Public reporting burden for this collection of information is estimated to average 20 minutes per response, including the time for reviewing instructions. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Jarrod Loerzel, National Oceanic and Atmospheric Agency, National Ocean Service, National Centers for Coastal Ocean Science, Hollings Marine Laboratory, 331 Ft. Johnson Road, Charleston, SC 29412 USA

Section 1. Participation

1. First, can you please tell us the ZIP Code of the place you call home? _____
2. How many years have you lived at the ZIP Code you provided in Question 1? _____
3. Have you ever visited this area of coastal Georgia?

   _____Yes _____No _____ Unsure/don't know

4. If you answered Yes or Unsure to Question 3, about how often?

   _____every day
   _____once a week
   _____once a month
   _____twice or more a year
   _____once a year
   _____first time here

5. Do you consider yourself _____visitor _____seasonal resident or _____ permanent resident to this area of the Georgia coast?

Section 2. Conditions of coastal Georgia

6. Below we ask for your opinion of the **change in conditions** along coastal Georgia while you have lived in or have been visiting the area. The possible responses range from "Large Increase" to "Large Decrease." You may also respond with "Unsure or Don't Know."

	Large Increase	Increase	Neutral	Decrease	Large Decrease	Unsure or Don't Know
Shellfish						
Fish						
Visitors and Boaters						
Marsh vegetation						
Marine mammals						
Birds						
Public access to land and water resources						
Frequency of adverse conditions (i.e. red tides, jellyfish, marine debris, trash)						

Section 3. Place Attachment

7. Below are five questions about your use of coastal Georgia and the role it plays in the life of your family and your community. The possible responses range from "Strongly Agree" to "Strongly Disagree." You may also respond with "Unsure or Don't Know." Please select the response that best represents your opinion of the statement.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure or Don't Know
This area is the best place to satisfy my outdoor recreation needs						
This area represents a way of life in my community						
This area is important for providing habitat for fish and other wildlife						
My community's economy depends on the natural resources of coastal Georgia						
This area contributes to the character of my community						

Section 4. Values

The natural environment holds different values for each person. We would like to know how important each of the following value types are to you when you think about this area of the Georgia coast. Later, we will ask you to mark places that you value on the map.

8. *Imagine that you could "spend" 100 pennies to ensure that the management entities along the Georgia coast are able to preserve or develop the characteristics that you most value. You may allocate or "spend" the 100 pennies in any way you like, but your total spending may not exceed 100. You might "spend" all 100 pennies on one value (and 0 on all others), or you might "spend" 50 pennies on one value, 25 on another value, and 25 on yet another value. Remember, the total pennies you "spend" should equal 100.* (The use of money for this exercise is **not meant to refer to actual money** - *your own or any agency's budget* - but just a convenient way to compare your choices). Begin by looking over all of the value types, and then decide what value each has for you.

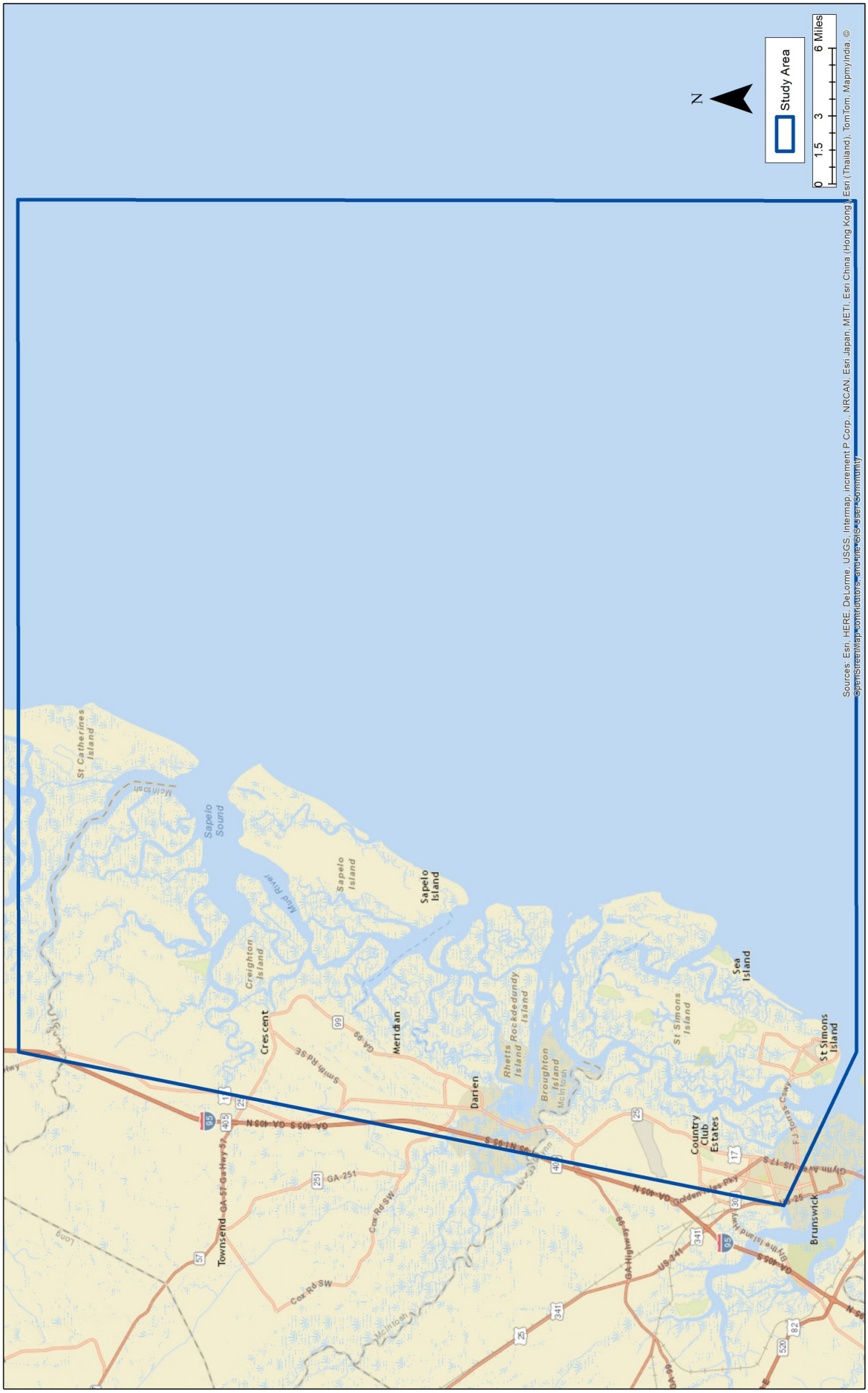
$____ **Aesthetic (A)** — I value the Georgia coast because I enjoy the beauty, sights, sounds, and smells.
$____ **Biodiversity (B)** — I value the Georgia coast because it provides a variety of fish, wildlife, plant life, etc.
$____ **Economic (E)** — I value the Georgia coast because it provides timber, fisheries, minerals, and/or tourism opportunities such as outfitting and guiding.
$_____**Legacy (Lg)** — I value the Georgia coast because it allows future generations to know and experience the area for its contribution to wisdom, knowledge, traditions and way of life.
$____ **In and of Itself (I)** — I value the Georgia coast in and of itself, whether people are present or not.
$____ **Learning (L)** — I value the Georgia coast because we can learn about the environment through scientific research and education.
$____ **Human Needs (H)** — I value the Georgia coast because it helps produce, preserve, clean, and renew air, soil, water and food.
$____ **Recreation (R)** — I value the Georgia coast because it provides a place for my favorite outdoor recreation activities.
$_____**Spiritual (S)** — I value the Georgia coast because there are sacred, religious, or spiritually special places for me or because I feel reverence and respect for nature there.
$_____**Therapeutic (T)** — I value the Georgia coast because it makes me feel better, physically and/or mentally. It is calming.
$_____**Wilderness (W)** I value the Georgia coast because it is undeveloped with minimal human impact,
$_____**Inspiration (Ip)** I value the Georgia coast because it motivates me to action or thought.
$_____**Socializing (So)** I value the Georgia coast because it allows me to comfortably interact with others.

Remember, the total of all your values should be 100.

Section 5. Mapping Values

9. This map identifies the various protected areas along the Georgia coast. We have also included city names and other general reference points to help you orient to places you may know. Please make a mark on the map at each place that you most associate with the value type. Next to each mark please put the abbreviation of the value (in red, for paper based maps), or use the drop-down menu to select the value type (for the on-line version) that represents the most important reason you value that place. You may select different values for different locations.
   For example, you may find Recreational value in areas of the Sapelo Sound. Place dots on the map where you recreate and place a letter "R" next to each one. Repeat for any other values.

   1. **Aesthetic (A)** — I value the Georgia coast because I enjoy the beauty, sights, sounds, and smells.
   2. **Biodiversity (B)** — I value the Georgia coast because it provides a variety of fish, wildlife, plant life, etc.
   3. **Economic (E)** — I value the Georgia coast because it provides timber, fisheries, minerals, and/or tourism opportunities such as outfitting and guiding.
   4. **Legacy (Lg)** — I value the Georgia coast because it allows future generations to know and experience the area for its contribution to wisdom, knowledge, traditions and way of life.
   5. **In and of itself (I)** — I value the Georgia coast in and of itself, whether people are present or not.
   6. **Learning (L)** — I value the Georgia coast because we can learn about the environment through scientific research and education.
   7. **Human Needs (H)** — I value the Georgia coast because it helps produce, preserve, clean, and renew air, soil, water and food.
   8. **Recreation (R)** — I value the Georgia coast because it provides a place for my favorite outdoor recreation activities.
   9. **Spiritual (S)** — I value the Georgia coast because there are sacred, religious, or spiritually special places for me or because I feel reverence and respect for nature there.
   10. **Therapeutic (T)** — I value the Georgia coast because it makes me feel better, physically and/or mentally. It is calming.
   11. **Wilderness (W)** I value the Georgia coast because it is undeveloped with minimal human impact,
   12. **Inspiration (Ip)** I value the Georgia coast because it motivates me to action or thought.
   13. **Socializing (So)** I value the Georgia coast because it allows me to comfortably interact with others.


N
Study Area
0 1.5 3 6 Miles
Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
St Catherines Island
Sapelo Sound
Sapelo Island
Mud River
Creighton Island
Crescent
Meridian
Darien
Rhetts Island
Rockdedundy Island
Broughton Island
McIntosh
St Simons Island
Sea Island
St Simons Island
Country Club Estates
Brunswick
Townsend
GA-99
GA-251
Cox Rd SW
Smith Rd SE
Golden Isles Pky
US-17 S
US-341
GA-Highway 99
Blythe Island Hwy
Glynn Ave
Long

Section 6. Public Opinions of Management

10. Public access to coastal waters and waterways has been identified as a priority management issue. From your perspective, how adequate is existing public access to the protected areas on the Georgia coast? For each access type please select the response that best represents your opinion. The possible responses range from "More than Adequate Access" to "Little or No Access." You may also respond with "Don't Know."

	More than Adequate Access	Adequate Access	Neutral	Inadequate Access	Little or No Access	Don't Know
Gray's Reef National Marine Sanctuary						
Sapelo Island National Estuarine Research Reserve						
Other conservation areas on the Georgia coast Specify:						
Boat Ramps						
Boat Slips						
Scenic view points						
Environmental educational opportunities						
Wildlife viewing sites						
Diving sites (SCUBA or Free)						
Birding sites						

Section 7. Knowledge / Awareness

11. To help us better understand how local residents understand the characteristics of coastal Georgia, please rate your level of understanding or awareness of the following management dimensions. Please select "Excellent," "Good," "Fair," "Poor," or "Not sure" for each of the dimensions.

	Excellent	Good	Fair	Poor	Not sure
Ecology					
History/Culture					
Local environmental effects of sea level rise					
Recreational Opportunities					
Volunteer Opportunities					
Educational Opportunities					
Public involvement in decision making					

Section 8. Management Goals

12. Managers and stakeholders have identified goals to guide management decisions that affect the numerous environmental areas along the Georgia coast. Please indicate the level of priority you would give to each of the potential goals listed below. The possible responses range from "High Priority" to "Not a Priority." You may also respond with "Unsure or don't know." Please select the response that best represents your opinion of the statement. You may also respond with "Unsure or don't know." Please select the response that best represents your opinion of the statement.

	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure or Don't Know
Improve coastal water quality						
Eliminate further damage and restore natural live bottom reef habitats						
Eliminate further loss of and restore shoreline and wetland habitats						
Conduct scientific research and long term monitoring to enhance the understanding of coastal processes						
Restore and sustain fish stocks and other living marine resources						
Increase the resilience of coastal communities to future coastal hazards						
Increase the public's understanding of how natural coastal ecosystems help protect communities from coastal hazards						
Increase the public's understanding of how human development and natural resource use activities impact the long-term sustainability of coastal ecosystems and processes						
Create, or increase, areas where commercial and recreational harvest is restricted						
Establish areas in coastal Georgia where motorized crafts are limited to no-wake and non-motorized crafts are encouraged						
Incorporate local social and cultural heritage into resource management decision making (such as public input and community advisory boards)						

Section 9. Demographics

Finally, we would like to ask just a few questions to help us understand your needs.

13. Does your household income depend on products or services related to Georgia's coastal resources?
_____Yes _____No _____Unsure

14. If yes, please describe the source of the income:
_____Fish
_____Shellfish
_____Tourism
_____Real estate
_____Other (please specify _____)

15. In what year were you born? 19_____

16. Are you _____male _____female?

17. What is your highest level of education?
_____Less than high school diploma
_____High school diploma or GED
_____College degree- 4-year or 2-year
_____Technical
_____Graduate degree

18. What is your average yearly **household** income?
_____$19,999 or below
_____$20,000-$39,999
_____$40,000-$69,999
_____$70,000-$99,999
_____$100,000 or more

19. What is your occupation? _____

20. What is your ethnicity?
_____ Hispanic or Latino
_____ Not Hispanic or Latino

21. With which racial group(s) do you most identify? (Choose one or more)
_____Alaska Native
_____Asian
_____Black or African American
_____Native American
_____Native Hawaiian or Other Pacific Islander
_____Caucasian
_____Other

1. This data collection request involves the gathering of value, use, and location information specific to ecosystem services as well as general socioeconomic information from those using NERR and NMS sites. This data collection ensures that NOAA's Office of National Marine Sanctuaries (ONMS) and National Estuarine Research Reserve System (NERRS) have available important social data to satisfy the legal requirements put forth by the National Environmental Policy Act (NEPA) (42 U.S.C. § 4321 *et seq.*), the National Marine Sanctuaries Act (NMSA) (16 U.S.C. § 1431 *et seq.*), the Coastal Zone Management Act (CZMA) (16 U.S.C. § 1451 *et seq.*), and Executive Order 12898 of 1994. The latter three mandates require federal agencies to establish conservation and management measures, which take into account the importance of marine and estuarine resources to local communities in order to provide sustained community participation and to minimize, to the extent possible, adverse economic impacts on such communities. Furthermore, all of these requirements mandate that NERR and NMS sites establish conservation and management plans and measures using the best available information.

The absence of up-to-date socio-economic information would limit the ability of NERR and NMS sites to estimate the social impacts of management proposals and examine the performance of existing regulations. Hence, the merits of management proposals would continue to be debated without the inclusion of social data. In addition, the availability of current information would minimize the likelihood of unforeseen impacts of existing regulations and court challenges on the grounds of deficient analysis. Lastly, the collection of detailed stakeholder data will allow NERR and NMS site managers to make timely and better-informed decisions by having the best information available.

Finally, if this data collection is not carried out, gaps in data relative to visitor attitudes, knowledge, perceptions, and resource use patterns in the NERR and NMS sites will persist and resource managers in the sites will not have the information to understand the nature of the resource users at the NERR and NMS sites.

2. This data collection may be used by resource managers in selected NERR and NMS sites to better understand the nature of stakeholder use patterns so as to inform management decisions. This information could be used by NERR and NMS resource managers to inform NERR and NMS management plans or programs, outreach/education activities, or policies related to the management of the NERR and NMS sites.

Public reporting burden for this collection of information is estimated to average 20 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Jarrod Loerzel, National Oceanic and Atmospheric Agency, National Ocean Service, National Centers for Coastal Ocean Science, Hollings Marine Laboratory 331 Ft. Johnson Road, Charleston, SC 29412 USA, or via the internet to jarrod.loerzel@noaa.gov.

Your participation is voluntary and will be kept strictly confidential. Notwithstanding any other provisions of the law, no person is required to respond to, nor shall any person be subjected to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless that collection of information displays a currently valid OMB Control Number.

Appendix B
Tri-County Profile

Harris Neck National Wildlife Refuge at dusk. Photo credit: Alison Scott

Due to the study areas's location on the Georgia coast, this study will also consider three coastal counties: Liberty County, McIntosh County and Glynn County. Liberty County measures 490.4 square miles in land area and 112.1 square miles in water area (University of Georgia, 2015). Its population per the 2014 estimate from the 2010 U.S. Census is 65,198, with 28.7% of those persons below the age of 18 and 7.5% of those persons 65 years or older. Fifty-one point one percent identified as white, 40.8% identified as black or African American, and 12.1% identified as Hispanic or Latino. Seventy-two point nine percent of this population had been living in the same house ≤ 1 year. Ten point nine percent spoke a language other than English in the home, 90.9% held a high school education or higher, and 20.2% held a Bachelor's degree or higher. In 2014 Liberty County had 27,198 housing units, 23,046 households, and median household income of $43,832 (U.S. Census Bureau, 2015).

Liberty County includes the communities of Allenhurst, Flemington, Gumbranch, Hinesville, Midway, Riceboro, Sunbury and Walthourville. Liberty was created in 1777 from the colonial parishes of St. Andrews, St. James and St. John on land that was originally held by the Creek Indians. Historic sites located within Liberty County include the Midway Museum, the Dorchester Church, the LeConte Botantical Gardens and Fort Morris. Additionally, almost half of the county's usable land is occupied by the U.S. Army installation Fort Stewart (GDNR-CRD, 2015a).

McIntosh County measures 424.3 square miles in land area and 149.6 square miles in water area (University of Georgia, 2015). Its population per the 2014 estimate from the 2010 U.S. Census is 14,214, much smaller than the other two study site counties, with 19.0% of its persons below the age of 18 and 21.7% of its persons 65 years or older, indicating that McIntosh has a larger retirement-age community than the other two counties. Sixty-two point eight percent identified as white, 34.9% identified as black or African American, and only 2.0% identified as Hispanic or Latino. Ninety-one point four percent of McIntosh County's population had been living in the same house ≤ 1 year, a higher percentage compare with the other two counties. Only 2.7% spoke a language other than English in the home, 80.5% held a high school education or higher, and 15.8% held a Bachelor's degree or higher. In 2014, McIntosh County had 9,299 housing units, 4,993 households, and median household income of $39,068, all of which were lower in comparison to the other two counties (U.S. Census Bureau, 2015).

McIntosh County is the state's 17th county, and includes the communities of Cox, Cresent, Darien, Eulonia, Pine Harbour, Ridgeville, Shellman Bluff, South Newport, Townsend and Valona. McIntosh is rich in historic sites, including Fort King George in Darien (the first English fort in Georgia); ruins of a Spanish fort and mission on Sapelo Island; St. Cyprians Episcopal Church, which was established in 1876 by freed slaves and in still in use today; St. Andrews Episcopal Church, which is on the national register of historic places; a late 16th century Franciscan mission; and, an American Indian village. McIntosh is also home to many protected natural areas, including Harris Neck National Wildlife Refuge, Blackbeard Island National Wildlife Refuge and Wilderness Area, Wolf Island National Wildlife Refuge, and Sapelo Island National Estuarine Research Reserve. Additionally, this county holds the annual Blessing of the Fleet in Darien every spring (GDNR-CRD, 2015b).

The last county included in this study is Glynn County, which measures 419.8 square miles in land area and 165.4 square miles in water area (University of Georgia, 2015). Its population per the 2014 estimate from the 2010 U.S. Census is 82,175, the largest of the three counties, with 23.1% of those persons below the age of 18 and 17.7% of those persons 65 years or older. Sixty-nine point five percent identified as white, 26.5% identified as black or African American, and 6.5% identified as Hispanic or Latino. Eighty point two percent of this population had been living in the same house ≤ 1 year. Nine point five percent spoke a language other than English in the home, 86.6% held a high school education or higher, and 26.1% held a Bachelor's degree or higher, making this county that with the highest education levels of the three counties. In 2014 Liberty County had 41,726 housing units, 31,547 households, and median household income of $46,407, all of which are higher in comparison to the other two counties (U.S. Census Bureau, 2015).

Glynn County was one of Georgia's original counties, established in 1777, and includes the communities of Brunswick, Jekyll Island, St. Simon's Island and Thalman. The municipality of Brunswick was one of the

fifteen cities that built Liberty Ships during World War II, and a twenty-three foot replica of the Liberty Ship now rests in Mary Ross Waterfront Park. Glynn county also holds Hofwyl-Broadfield Plantation, a state-run park, historic site and classic example of a 19th century rice plantation. Additionally, Glynn County holds many annual festivals, including the Old Town Tour of Homes, a King Fish tournament, Blessing of the Shrimp Fleet Festival, and an art festival, beach music festival and bluegrass festival on Jekyll Island (GDNR-CRD, 2015c).

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U.S. Census Bureau. 2015. "State and County QuickFacts." U.S. Department of Commerce. Accessed on Oct. 29, 2015 at https://www.census.gov/quickfacts/fact/table/US/PST045217

Georgia Department of Natural Resources: Coastal Resources Division (GDNR-CRD). 2015b. "McIntosh County." Accessed on Oct. 29, 2015.

Georgia Department of Natural Resources: Coastal Resources Division (GDNR-CRD). 2015c. "Glynn County." Accessed on Oct. 29, 2015.

Georgia Department of Natural Resources: Coastal Resources Division (GDNR-CRD). 2015a. "Liberty County." Accessed on Oct. 29, 2015.

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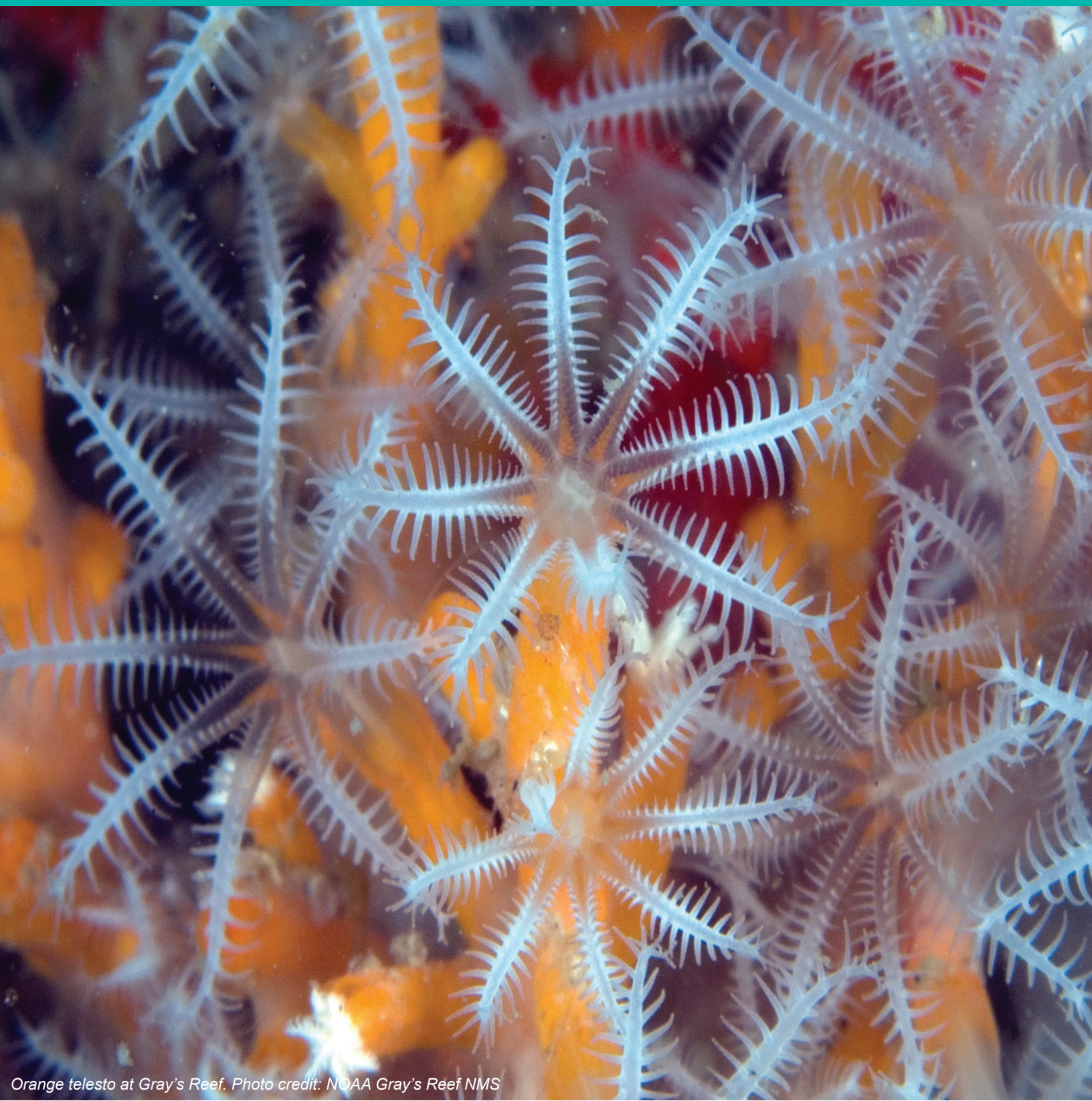
Appendix C
Intercept Sites and Surveyor Perspectives



Orange telesto at Gray's Reef. Photo credit: NOAA Gray's Reef NMS

Table C-1. Intercept Locations and Surveyor Perspectives within Chatham County, Georgia.

Intercept locations	Skidaway Island State Park	Coffee Bluff Marina	Isle of Hope Marina	Landings Harbor Marina	Lazaretto Creek	Morningstar Marinas-Bohia Blue	Rodney J Hall Boat Ramp	Frank Downing Fishing Pier	W.E. Honey Park Pier	Tybee Beach and Fishing Pier	Tybee Island Turtle Trot	Savannah Earth Day
Coordinates (Lat, Long)	31.9556232, -81.0536383	31.937301, -81.153198	31.9818802, -81.0609446	31.958113, -81.011707	32.0161067, -80.8907337	32.0314838, -81.0501014	31.9475406, -81.0669982	31.9509242, -81.0847664	32.036955, -81.047712	31.9920656, -80.8467998	--	--
County	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham	Chatham
Intercept Type	Park	Marina/Boat Ramp	Marina/Boat Ramp	Marina/ Boat Ramp	Marina/Boat Ramp	Marina/Boat Ramp	Marina/Boat Ramp	Fishing Pier	Fishing Pier	Beach and Fishing Pier	Event	Event
Ease of Physical Access for Surveyor	**Easy**- Easily located; excellent maps provided.	**Easy**- Easily located; at the end of White Bluff; ample parking.	**Easy**- Easily located; not permitted on the docks.	**Medium**- Gate pass required.	**Easy**- Located off of the causeway to Tybee; the pier is at the end of the street.	**Easy**- Easily located.	**Easy**- Located off of the Diamond Causeway to Skidaway Island; walkable.	**Medium**- Located off of the Diamond Causeway to Skidaway Island; fishing piers not connected; one is closed, but this does not deter fishers.	**Medium**- Confusing roads make this site difficult to find.	**Easy**- Large beach; parking can be difficult during prime time.	**Medium** - Difficult to find parking.	**Easy**- Easily located and accessed.
Cost	Parking Fee	Free	Free	Free	Free	Free	Free	Free	Free	Parking Fee	Parking Fee	Free
# of potential respondents	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**	**Low**	**High**	**High**	**High**
Willingness of Respondents to Complete Survey	**High**- Almost all willing; especially those leaving the trails.	**Medium**- Time dependent.	**High**- Leisurely area.	**High**- Almost all willing.	**Medium**- Leisurely fishing.	**Low**- Busy cleaning boats and wanting to go home or on the water.	**Low/Medium**- Boaters too busy or tired; beach goers and observers willing.	**High**- Almost all willing.	**Low**- Lack of interest.	**High**- Sitting down; relaxed environment.	**High**- Sitting down; leisurely; relaxed.	**High**- Many willing.
Amenities or Activities	Restrooms; picnic tables; grills; volleyball courts; camping grounds; walking trails; play ground; education center.	Restrooms; boat lift; overnight docking; shop; live bait; kayak launch; play ground.	Restrooms; boat lift; overnight docking; shop; fuel dock.	Restrooms; boat lift; overnight docking; shop; boat racks; live bait; fuel dock; kayak launch.	Fishing pier; boat ramp.	Restrooms; boat lift; overnight docking; shop; fuel dock; boat cleaning racks; nearby restaurants.	Boat ramp; fishing pier; beach; picnic pavilion; bait shop.	Fishing pier; access to tidal creek.	Fishing pier; playground.	Restrooms; restaurants; board walks; fishing pier; large pavilion with picnic tables; bait shop; Tybee Marine Science Center.	5km race; sea turtles released.	Earth day celebration; environmental education opportunities.
Maintenance of Site	**Excellent**- Trails and boardwalks well maintained; no trash.	**Excellent**- Recently rennovated; well maintained.	**Excellent**- Well maintained; little to no trash.	**Excellent**- Facility well maintained.	**Fair**- Pier maintained; lots of trash.	**Excellent**- Marina well maintained.	**Good**- Boat ramp and picnic areas maintained; limited trash debris.	**Poor**- Half of pier closed; lots of trash.	**Poor**- Restrooms closed due to misuse; trash on pier and in parking lot.	**Good**- Pavilion and board walks maintained; trash managed well; restrooms not clean.	--	--
Perceived Site Safety for Surveyor	**Safe**- High traffic area; park rangers present.	**Safe**- High traffic area; marina staff present.	**Safe**- Medium traffic area; open space.	**Safe**- High traffic area; marina staff present.	**Wary**- Low traffic area; isolated and secluded.	**Safe**- High traffic area; manager frequently present.	**Safe**- Medium traffic area; open space; shop frequently open.	**Safe**- Medium traffic area; open space.	**Wary**- Low traffic area.	**Safe**- High traffic area; police patrol.	--	--
When to Survey	All day weekend; pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; pm on weekdays.	All day weekend and weekday.	--	--

Table C-2. Intercept Locations and Surveyor Perspectives within McIntosh County, Georgia.

Intercept locations	Darien-Waterfront Park	Altamaha Wildlife Management Area	Harris Neck National Wildlife Refuge	Barbour Landing Boat Ramp	Blue N Hall	Champney River Boat Ramp	Shellman Bluff Fish Camp	Darien Blessing of the Fleets
Coordinates (Lat, Long)	31.367725, -81.435294	31.354938, -81.4518428	31.625376, -81.2896013	31.6217857, -81.2618995	31.4062403, -81.3916433	31.367725, -81.435294, 31.354938, -81.4518428	31.5684259, -81.3217449	--
County	McIntosh	McIntosh	McIntosh	McIntosh	McIntosh	McIntosh	McIntosh	McIntosh
Intercept Type	Park	Wildlife Management Area	Wildlife Management Area	Marina/Boat Ramp	Marina/Boat Ramp	Marina/Boat Ramp	Marina/Boat Ramp	Event
Ease of Physical Access for Surveyor	**Easy**- Easily accessible.	**Difficult**- Area is large; use of car on site is suggested; trail maps are difficult to read.	**Medium**- Refuge is large; use of car on site is suggested; some areas restrict vehicles.	**Easy**- Easily accessible; located down the street from the Wildlife refuge.	**Easy**- Easily accessible; ample parking.	**Easy**- Easily accessible; located south of the Altamaha Wildlife Management Area.	**Medium**- GPS use results in wrong turns; look for red and white sign; parking is limited.	**Easy**- Easily accessible.
Ease of Financial Access for Surveyor	Free	Free	Free	Free	Free	Free	Free	Entrance fee
# of potential respondents	**Medium**	**Low**	**Low**	**Low**	**Medium**	**Low**	**Medium**	**High**
Willingness of Respondents to Complete Survey	**Medium**- Many willing; time dependent.	**High**- Almost all willing.	**High**- Almost all willing.	**Medium**- Leisurely fishing.	**Low**- Time dependent.	**Medium**- Busy boaters; lesiurely fishing.	**High**- Many willing.	**High**- Many willing; nature of event encouraged respondents to be involved.
Amenities or Activities	Boat slips; picnic tables; playground; fishing spots; restrooms.	Fishing pier; lookout points; road trails.	Education center; walking and biking trails; car accessible trails; abandoned World War Two airship.	Fishing pier; boat ramp.	Fishing pier; boat ramp; boat lift.	Fishing pier; boat ramp.	Restrooms; boat lift; shop.	Blessing of the Fleet event; art festival; food and gift vendors; environmental education opportunities; live music.
Maintenance of Site	**Fair**- Docks well maintained and recently renovated; boat ramp in need of maintenance.	**Fair**- Trailed and signage not maintained; little to no trash.	**Fair**- No trash; trail closures not marked.	**Fair**- Not regularly serviced.	**Good**- Boat lift maintained; little to no trash; marina in need of renovations.	**Poor**- Signage not maintained; lots of trash.	**Good**- In need of renovation, but has rustic charm.	--
Perceived Site Safety for Surveyor	**Safe**- High traffic area; open space.	**Wary**- Low traffic area; isolated and secluded.	**Safe**- Park ranger offices frequently open.	**Wary**- Low traffic area; isolated and secluded.	**Safe**- Medium traffic area; staff present.	**Wary**- Low traffic area.	**Safe**- Medium traffic area; staff present.	--
When to Survey	All day weekend; pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	--

Table C-3. Intercept Locations and Surveyor Perspectives within Glynn County, Georgia.

Intercept locations	Blyth Island Regional State Park	Two Way Fish Camp	Fishing Bridges by St. Simons	St. Simons Beach	Jekyll Island Beach	Brunswick- First Friday	Brunswick- Blessing of the Fleets	St. Simons- Art in the Park	Jekyll Island Turtle Crawl
Coordinates (Lat, Long)	31.1561881, -81.5447545	31.3256866, -81.4486237	(31.1644876, -81.4476585), (31.1687105, -81.4374876), (31.1687105, -81.4374876)	31.1441414, -81.3709259	31.0521251, -81.4088912	--	--	--	--
County	Glynn	Glynn	Glynn	Glynn	Glynn	Glynn	Glynn	Glynn	Glynn
Intercept Type	Park	Marina/Boat Ramp	Fishing Pier	Beach	Beach	Event	Event	Event	Event
Ease of Physical Access for Surveyor	**Medium**- Easily accessible; walking required to find respondents.	**Easy**- Easily accessible; ample parking.	**Easy**- Easily accessible; located off the road adjacent to the Bridges to St. Simons.	**Medium**- Easily accessible; parking can be difficult.	**Easy**- Easily accessible; ample parking.	**Easy**	**Easy**	**Easy**	**Easy**
Ease of Financial Access for Surveyor	Free	Free	Free	Free	Fee to get onto the island	Free	Free	Free	Island entrance fee
# of potential respondents	**Medium**	**Medium**	**High**	**High**	**High**	**High**	**High**	**High**	**High**
Willingness of Respondents to Complete Survey	**High**- Many willing.	**High**- Many willing.	**High**- Almost all willing.	**High**- Many willing.	**High**- Many willing.	**High**- Sitting down; almost all willing.	**High**- Sitting down; many willing.	**Low**- Many willing, but low completion rates due to lack of familiarity with study area.	**High**- Many willing; relaxed and leisurely environment.
Amenities or Activities	Restrooms; picnic tables; grills; beach; camping grounds; walking trails; play ground; education center.	Restrooms; boat lift; boat slips; fuel dock; shop; large pavilion.	Fishing piers; bridges.	Restrooms; fishing pier; picnic benches; play grounds; board walks; restaurants; shops.	Restrooms; picnic benches; board walks; restaurants; shops. Adjacent nature trails; water park; golf course; environmental education centers.	Monthly community gathering in town center; live music; food vendors; social and political group advocates.	Blessing of the Fleet event; food and gift vendors; environmental education opportunities; live music.	Art festival adjacent to St. Simon's beach and fishing pier; art for sale; social group advocates.	Sea turtle festival; triathlon; sea turtle release; educational booths; live music.
Maintenance of Site	**Excellent**- Trails, beach, pavilions, and marina maintained; little to no trash.	**Excellent**- Well maintained; little to no trash.	**Poor**- Trash overwhelming.	**Excellent**- Well maintained; clean restrooms; little to no trash.	**Excellent**- Well maintained; new restrooms; little to no trash.	--	--	--	--
Perceived Site Safety for Surveyor	**Safe**- High traffic area; staff present.	**Safe**- High traffic area; restaurant staff present; nearby condos.	**Wary**- Time dependent; low-medium traffic area; secluded.	**Safe**- High traffic area; police patrol.	**Safe**- High traffic area; staff present.	--	--	--	--
When to Survey	All day weekend; pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.	All day weekend; pm on weekdays.	All day weekend; pm on weekdays.	All day weekend and weekday.	--	--	--	--

Table C-4. Intercept Locations and Surveyor Perspectives within Bryan and Liberty County, Georgia.

Intercept locations	Fort McAllister State Park	Half-Moon Marina
Coordinates (Lat, Long)	31.883652, -81.178883	31.6951089, -81.2715018
County	Bryan	Liberty
Intercept Type	Park	Marina/Boat Ramp
Ease of Physical Access for Surveyor	**Medium**- Gate code needed for access to camp sites; over an hour from Savannah.	**Medium**- GPS use results in wrong turns; located next to large condos.
Ease of Financial Access for Surveyor	Parking Fee	Free
# of potential respondents	**Medium**	**Low**
Willingness of Respondents to Complete Survey	**High**- Almost all willing.	**Low**- Lack of interest; busy.
Amenities or Activities	Restrooms; picnic tables; grills; boat ramp; fishing pier; camping grounds; walking trails; education center.	Restrooms; boat lift; boat slips; fuel dock; shop; sea tow.
Maintenance of Site	**Excellent**- Trails and fishing piers well maintained.	**Good**- Shop, marina, and docks well maintained.
Perceived Site Safety for Surveyor	**Safe**- High traffic area; park rangers present.	**Safe**- High traffic area; nearby condos.
When to Survey	All day weekend; pm on weekdays.	All day weekend; 2-6:00 pm on weekdays.

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Appendix D
Details of Environmental Data Sets

Fresh catch at Frank Downing Fishing Pier. Photo credit: Alison Scott

Table D-1. Details of Environmental Data Sets.

Environmental Data Layer	Description	Source	Categorical or Continuous	Used for: SINERR, GRNMS, or BOTH
National Wetlands Inventory	Raster based image file that provides detailed information on the abundance, characteristics, and distribution of wetlands for coastal Georgia	Derived from U.S. Fish & Wildlife Service spatial data	Categorical	SINERR
Vegetation Cover	Polygon file of 19 different ecological systems, converted to categorical raster based image file	Derived from the Georgia Department of Natural Resources using the U.S. National Vegetation Classification. Separate files for each of the four study area counties.	Categorical	SINERR
Distance to Rivers	Polyline file of the river, stream, and creek network in coastal Georgia	Derived from the U.S. Census Bureau's hydrography dataset and created using tools available in the Spatial Analyst extension of ArcGIS	Continuous	SINERR
Distance to Terrestrial Protected Areas	Polygon file of wildlife refuges, national parks, monuments, etc., converted to raster based image file	Derived from the U.S. National Park Service spatial data and created using tools available in the Spatial Analyst extension of ArcGIS	Continuous	BOTH
Distance to Underwater Obstructions	Point file containing information on the location of identified submerged wrecks and obstructions within the U.S. maritime boundaries	Derived from the National Oceanic and Atmospheric Administration's Office of Coast Survey Automated Wrecks and Obstructions Information System and created using tools available in the Spatial Analyst extension of ArcGIS	Continuous	BOTH
Distance to Wrecks	Point file containing information on the location of identified submerged wrecks and obstructions within the U.S. maritime boundaries	Derived from the National Oceanic and Atmospheric Administration's Office of Coast Survey, Automated Wrecks and Obstructions Information System and created using tools available in the Spatial Analyst extension of ArcGIS	Continuous	BOTH
Landsat 8 – Band 1	Satellite imagery of estuarine area of coastal Georgia, including the "aerosol band" depicting areas of shallow water more clearly	Derived from U.S. Geological Survey spatial data and clipped to study area using tools available in ArcGIS	Continuous	BOTH
Distance to Artificial Reefs	Point file depicting the locations of both inshore and offshore artificial reefs, converted to rater based image file	Derived from the Georgia Department of Natural Resources, Coastal Resources Division and created using tools available in the Spatial Analyst extension of ArcGIS	Continuous	BOTH
Bathymetry	Raster based image file depicting the water depths from the coast to 20 miles offshore	Derived from the NOAA/ NODC National Coastal Data Development Center (NCDDC)	Continuous	BOTH

U.S. Department of Commerce

Wilber L. Ross, Jr., *Secretary*

National Oceanic and Atmospheric Administration

Benjamin Friedman, *Deputy Under Secretary for Operations and Acting Administrator*

National Ocean Service

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