Gauging the Social Values of Ecosystem Services in the Mission-Aransas National Estuarine Research Reserve

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Executive Summary

Photo credit: Ben Horstman, 2012 Mission-Aransas NERR Photography Contest Winner

This report presents the findings of a survey initiative conducted to gauge the social values of ecosystem services of the visitors, seasonal residents, and permanent residents of the Mission-Aransas National Estuarine Research Reserve (Reserve). Located 30 miles northeast of Corpus Christi, the Reserve is utilized by multiple user-groups including commercial entities, non-profit institutions, local residents, visitors, students and teachers. In order to gauge the perceived values of ecosystem services these user groups hold for the site, a survey instrument was designed in collaboration with the management staff of the Reserve to analyze the knowledge, attitudes, and preferences of respondents. Components of the survey instrument addressed a range of topics such as observed changes in abundance for key Reserve wildlife and prioritization of management goals, among others.

Three different sampling techniques were employed to gather results from the main groups utilizing Reserve resources. Seasonal residents and summer visitors were sampled using intercept surveys at targeted sites across the study area. Intercept surveys of seasonal residents were conducted by Reserve volunteers from February 1-March 12, 2014, while surveys of summer visitors were conducted by a graduate student from June 25-August 1, 2014. Residents in the five counties surrounding the Reserve were randomly sampled via a mail-back survey between April 15 and July 16, 2014. Finally, snowball sampling was conducted by contacting members of the Reserve Volunteer Coordinator's mailing list as well as meeting with members of the Coastal Bend Guide Association (CBGA) and occurred from August 14-September 15, 2014. These sampling efforts yielded a cumulative 251 completed surveys of which seasonal residents, permanent residents, summer visitors, and snowball sampling accounted for 59, 53, 87, and 52 of the respondents respectively.

Of the 247 respondents that provided a ZIP Code which could be geolocated, 87.9% provided a residential ZIP Code within Texas, while 12.0% of the respondents provided a residential ZIP Code outside of the state including a Hawaiian and Canadian area. When asked about perceived changes in the Reserve the majority of respondents believed that the abundance of fish and blue crabs has decreased, while the abundance of jellyfish has increased. A majority of respondents felt there has been no change to the abundance of oysters, seagrass, erosion, wildlife, red tide occurrences, birds, or public access to land and water resources. The section of the survey analyzing individuals' place attachment to the Reserve revealed that a vast majority of respondents agreed that the bays of the Reserve are an important part of their lives and their communities.

Another component of the survey asked respondents how high or low of a priority they considered various goals that were identified by Reserve managers as either being active or future goals. Goals which were "bio-centric" (biologically focused) were all considered a priority by over 75% of respondents, with the majority of respondents considering each a high priority. Alternatively, a higher level of ambiguity was present in the responses to "anthropocentric" (human focused) goals. The majority of respondents still believed that these goals were a priority; however, there were much smaller proportions of respondents who believed they were high priorities and much larger proportions that were neutral about these goals comparatively. Continuing this pattern, the majority of respondents believed that access types to the bays were adequate. The only exception was public oyster sites where over half of the respondents were unsure or felt neutral about access likely due to the high specificity of this access type. In another section, respondents were asked to rate their understanding of several management dimensions. Most participants believed they had a sound understanding of those dimensions with the majority of respondents ranking their knowledge of ecology, recreational aspects, and educational opportunities as good. For the dimensions of policy, history, and public involvement opportunities, the two major categories for respondents were good and excellent with almost an equal number of respondents choosing each.

A participatory mapping component was included on the survey instrument during which respondents allocated weights to any of 13 social value types and placed points on a map corresponding with those values. Respondents mapped a total of 1,962 points in this exercise with an average of 8 points mapped per individual. The value types with the most points mapped were Recreation, Aesthetics, and Wilderness receiving 388, 275, and 162 points respectively. Spatial data from this exercise along with environmental variables for the study area were used during analysis to power the Social Values for Ecosystem Services

(SolVES) GIS application. Results of SolVES analysis showed that each of the 13 value types clustered significantly except that of Spiritual. The values of Biodiversity, Recreation, Aesthetics, and Economics received the highest weighting allocation by respondents. Relationships between the locations mapped for these top four values and the environmental attributes used to power the analysis are discussed in further detail in the SolVES Analysis section. This section also shows heat maps generated for the entirety of the study area showing areas of highest and lowest social value for each of these value types.

Place attachment for the Reserve was determined by analyzing the relationship between the distances respondents reside from the Reserve and their level of agreement for a set of 7 prompts related to place attachment. The results showed that a significant reduction in place attachment occurs the further respondents reside from the Reserve site. Finally, a Pearson correlation matrix was created and One-Way ANOVA tests were performed to analyze the effect resident status has on respondents' knowledge, attitudes, and perceptions of the Reserve. Results of these analyses are presented with interpretations in the Analysis of Resident Status section of the report. The findings of this report indicate that management efforts based on preserving, conserving, or improving the resource conditions of the Reserve would be supported by the respondents of this survey.

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Chapter 1
Introduction

Photo credit: Jarrod Loerzel, NOAA

The Mission-Aransas National Estuarine Research Reserve (Reserve) is one of 28 sites in the U.S. that compose the National Estuarine Research Reserve System (NERRS), which was "created to promote the responsible use and management of the nation's estuaries through a program combining scientific research, education, and stewardship" (Reserve, 2012). The NERRS 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" (Reserve, 2012). The Mission-Aransas Reserve was designated as a NERR site in 2006 with the mission "to develop and facilitate partnerships that enhance coastal decision making through an integrated program of research, education, and stewardship" (UTMSI, 2006). The lead state agency for the Reserve is the University of Texas Marine Science Institute, which, along with reserve staff, provides vast opportunity for research of the area (Reserve, 2012). Located 30 miles northeast of Corpus Christi, the Reserve is utilized by various user-groups including non-profit institutions, local residents, visitors, students and teachers (Reserve 2012). The diverse terrestrial and aquatic landscapes of the Reserve offer a bounty of ecosystem services to the inhabitants and visitors of the site, providing not only economic but social value to these individuals (AFS, 2005; Reserve, 2012). Several groups rely on the area for economic gain including commercial and recreational fisherman as well as those involved in hydrocarbon production in the Bays (Reserve, 2012).

The Mission-Aransas Estuary system is composed of primary (Aransas, Redfish, Mesquite), secondary (Copano, Port, St. Charles), and tertiary (Mission) bays (Figure 1.1). The mean low water of this shallow bay system ranges from 0.6 m in Mission Bay up to 3 m in Aransas Bay (Reserve, 2012). Wetlands, terrestrial, and marine environments are all encompassed within the approximately 185,708 acre Reserve with habitats ranging from riparian woodlands to seagrass meadows (Reserve, 2012). These conditions provide an ideal

View of Port Aransas Beach Park. Photo credit: Susan Lovelace, NOAA

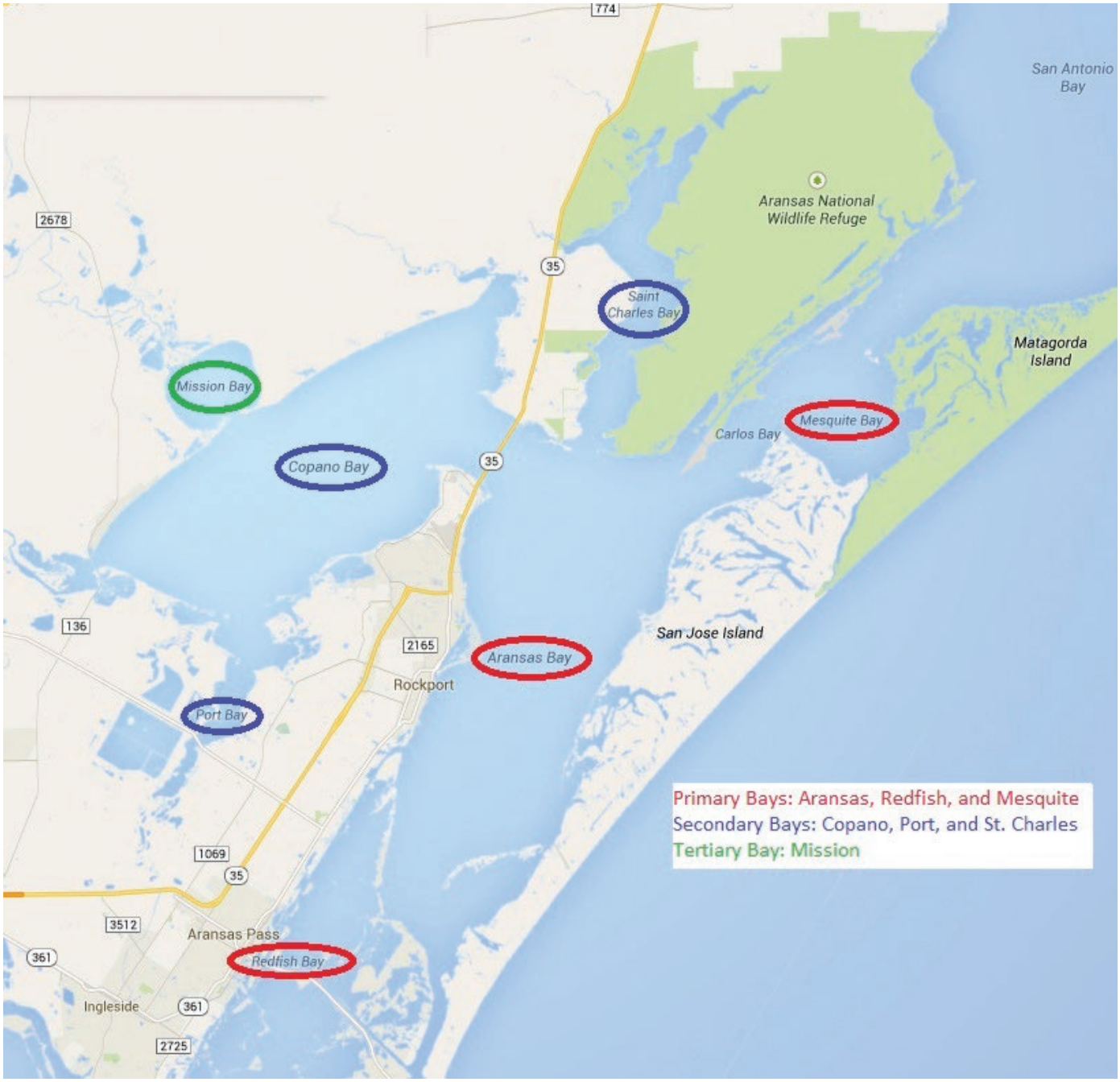

Figure 1.1. The Bay complex of the Reserve.

habitat for both terrestrial species such as the endangered piping plover and whooping crane as well as estuarine flora and fauna characterized by oyster reef, seagrass, and mangrove communities (Reserve 2012). The diversity of terrestrial and aquatic species found at the site attracts a wide range of user groups to the site including recreational fishers, commercial fisherman/crabbers, nature groups, wilderness clubs, and general daily users (Palmer pers. comm. 2013). Other user groups of the Reserve include oil/gas industry workers, business leaders, and residents of the area surrounding the site (Palmer pers. comm. 2013). Visitors to the Reserve follow seasonal patterns with a group of seniors/retirees known as “Winter Texans” staying in the area around the site from January-March each year and families from central Texas staying from May-August each year (Palmer pers. comm. 2013). These seasonal visitors were sampled separately in order to determine demographic differences between these user groups. Further analyses between these groups will be performed by a graduate student researcher as part of their thesis dissertation.

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Chapter 2
Methods

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The survey instrument was designed in modular format with a set of core questions – needed to drive the SolVES GIS application – and a set of supplementary questions labeled "management modules." Management staff at the Reserve were invited to select up to three modules and the questions they were to contain. The questions selected involved current legislative and management issues such as freshwater inflows to the Reserve, red tides, abundance of jellyfish, and stormwater runoff among others.

Two versions of the survey were developed: one a paper-based instrument (see Appendix A) and the other an online instrument. Both instruments contained a mapping element. The paper-based survey was arranged in landscape layout on 8.5"X11" paper with the map printed in landscape layout on a sheet of 11"X17" paper. 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 an 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.

Over the seven month period from February 1, 2014 to September 15, 2014, four stakeholder groups were targeted for sampling. The data collection efforts involved paper-based surveys either mailed to residents or given to respondents intercepted at a variety of locations in and around the Reserve. 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 one of four computer wallpapers made from award winning photos taken in the Reserve. The intercept site selection process, volunteer training, and the methods and timeframe for interacting with each stakeholder group are outlined below.

2.1. INTERCEPT SITE SELECTION

A two mile buffer around the Reserve site boundary was created and sites selected from locations that fell within that buffered area from the Texas Beach and Bay Access Guide (Patterson 2003). This process returned a total of 48 sites. For each of those 48 sites, the number of amenities was counted (excluding ADA compliance, wheelchair access, bay access, and river/bay access) and a cluster analysis was then performed. The top 14 results of that analysis were selected as the intercept survey sites for the study. Those 14 sites were then cross-referenced with the 25 creel survey sampling sites of the Texas Parks and Wildlife Department (TPWD) in order to verify that selection methods used in this study produced sites consistent with those of another study (Green pers. comm. 2013). Additionally, this allowed for coordination of sampling efforts that did not overlap with those of TPWD in order to increase response rate and decrease survey fatigue for both intercept survey efforts.

2.2. VOLUNTEER TRAINING

We relied on volunteers to conduct the intercept surveys of the "Winter Texans" stakeholder group. Fifteen volunteers assisted with the surveying of that group, representing about half of the usual contingent of volunteers. Each of the volunteers was provided with a webinar 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. During the training, we provided a demonstration of the survey as well as an introduction to the basics of intercept surveying. We suggested appropriate attire and attitude needed to be a successful intercept surveyor. We also covered such things as how to properly greet potential respondents, getting permission to interview, and what to do if someone doesn't want to answer. At the end of the presentation, the volunteers were directed to an online testing site where the CITI module "Ethics Training for the Protection of Human Participants in Research" was administered with the assistance of the College of Charleston. Following successful completion of the training each volunteer was given a certificate.

2.3. "WINTER TEXANS"

"Winter Texans" is the title used to describe a stakeholder group of annual visitors to coastal Texas towns during the winter months of each year. In Port Aransas, "Winter Texans" are typically characterized by individuals who have reached the age of retirement, composed of approximately 4,000 visitors staying for an average of 74 days annually (Mathis et al., 2008). In towns such as Port Aransas, this influx of seasonal

residents accounts for a greater number of individuals than the permanent residents, bringing with them a significant economic contribution (Mathis et al., 2008). For these reasons, the Reserve reserve managers chose this group as one of particular interest for this study.

Sampling dates of February 1 – March 12 were selected to survey this stakeholder group, with sampling efforts in both AM (designated as 6am-12pm) and PM (designated as 12pm-6pm) segments for each of the 14 intercept survey sites. Sampling was conducted on 14 days within the selected date range with 28 sampling events in order to obtain both an AM and PM sampling time for each site. This was accomplished by randomizing each of the 14 intercept sites for both AM and PM times across each of the sample days. The trained volunteer group totaling 15 individuals was assigned the randomly chosen intercept sites and times on each sample day to conduct intercept surveys. All surveys of the "Winter Texan" stakeholder group were administered in paper-based format. However, those not wishing to take the survey at the time of the request were provided a business card with the URL of the online survey instrument. In total, 59 useable surveys were obtained by the volunteer intercept surveyors during the sampling time frame.

2.4. RESIDENTIAL MAIL-OUTS

A randomized list of 5,000 name/address pairs encompassing the five counties surrounding the Reserve site was purchased from Peachtree Data. In ArcGIS 10.2.1, a 20-mile buffer was constructed around the Reserve boundary file, the list of addresses was geo-coded to give it a spatial context, and locations that fell within the buffer were entered into an Excel spreadsheet. Those addresses were then randomized and the first 750 were mailed a post card informing the recipient that they would be receiving a survey packet within the next 7-10 days. After ~100 of those post cards were returned due to invalid name/address pair, the remaining ~650 addresses were sent a survey packet that contained the survey instrument and a stamped, self-addressed return envelope. Due to the large number of invalid addresses contained within the original list of addresses which fell within a 20-mile buffer of the Reserve boundary, a 25-mile buffer was developed to obtain addresses from. All addresses that fell between the outer boundary of the 20-mile buffer and the outer boundary of the 25-mile buffer were then entered into a new Excel spreadsheet. A set of 750 addresses were selected out via the same method listed above and were mailed post cards, ~150 of which were returned.

View of Port Aransas Beach Park. Photo credit: Jarrod Loerzel, NOAA

The remaining ~600 addresses were mailed a survey packet within 7-10 days of post card mailing. In order to replace the ~250 returned post cards, an equivalent number of addresses were selected from the newest Excel spreadsheet and mailed a post card and subsequent survey packet via the same methods listed above. The overall sampling effort consisted of ~1,750 survey post card requests and ~1,500 survey packets mailed to the residents of the 5 counties surrounding the Reserve site between April 15, 2014 and July 16, 2014. The residential mail-out sampling yielded a total of 77 returned surveys in various states of suitability and completeness. Of those seventy-seven, 53 contained all of the information required for this analysis and were subsequently included in the results.

2.5. SUMMER VISITORS

Intercept surveys of summertime visitors were conducted from June 25, 2014 – August 1, 2014 using the same 14 intercept sites as those of the "Winter Texans" sampling effort. Sampling was conducted by a graduate student and their assistant for a total of 14 sample days and administered using a tablet and the online survey instrument. In total, 87 usable surveys were returned from this sampling effort.

2.6. SNOWBALL SAMPLING

Between the dates of August 14, 2014 and September 15, 2014 contacts associated with a number of environmentally conscious user groups were informed through their organization of our survey effort and invited to take the survey. Initial contact was made via the Reserve Volunteer Coordinator, Colleen McCue, through an emailed survey invitation sent out to her contact list of over 1,000 email addresses of individuals interested in the Reserve. That email also invited individuals to send the invitation to others who they felt might have an interest in participating in the survey. Members of the Coastal Bend Guide Association (CBGA), a regional angler guide association, were also included in a separate snowball sampling effort. The project lead and another member of the project team attended the monthly meeting of the CBGA to introduce the survey to its members in attendance. The researchers then invited them to complete the survey and invite other members of the association they felt would be interested. A total of 52 usable surveys were returned from this sampling effort.

Chapter 3
Results

Photo credit: Jarrod Loerzel, NOAA

3.1. SURVEY RESULTS

Our survey efforts yielded a total of 251 complete responses. The "Winter Texan" intercept surveys had 59 completed surveys, equating to 24.4% of all respondents. The residential mail-outs received a total of 53 completed responses, 22.4% of the total. The summer intercepts brought 87 completed surveys into the analysis, 36.7% of the total. And our snowball surveying approach yielded 52 completed responses, or 20.7% of the total number of surveys. It is assumed that the vast difference between the "Winter" and "Summer Texan" intercept totals is attributable to the inclement weather experienced during the Winter sampling period. The volunteer network reported a number of cold, rainy, and otherwise dreary days that had a negative effect on visitation rates.

Despite the fact that we attempted to contact a wide variety of users of the Bays, we found that 65.7% of the respondents identified themselves a permanent resident of the area. Whereas 24.7% claimed to be a visitor to the area and 9.5% claimed to be a seasonal resident. While difficulties arose when we attempted to align ZIP Codes listed by respondents to U.S. Census Department ZIP Code Tabulation Areas, or ZCTAs, it was determined that approximately 217 respondents lived in 95 ZCTAs located within Texas, and 30 respondents lived in 29 ZCTAs located outside of the state. One respondent reported living in Hawaii and another responded that they resided in Canada. The average length of residency was 19.3 years; however, two respondents did not answer that particular question.

A resounding 96.4% of the respondents claimed to visit the Bays on a regular basis, and 2.8% said they did not visit the Bays with any sort of regularity. Of those visiting the Bays on a regular basis, 23.1% reported visiting the Bays daily or once a week. Another 25.9% said they visited the Bays twice or more a year and 23.5% reported visiting the Bays at least once a year. Finally, only 6.8% said that they visited the Bays less than once a year.

3.1.1. Abundance of Biological and Geophysical Features

Following the introductory residence and visitation questions, we asked respondents about their perceptions concerning changes in the Bays that they may have witnessed since living in or visiting the area. We framed the questions as "Abundance" issues, in that we asked the respondents their perceptions regarding the increased or decreased abundance of ten biological and geophysical factors. The factors included oysters, fish, blue crabs, seagrass, shoreline erosion, wildlife, public access to land and water resources, red tide, jellyfish, and birds.

For the question about the abundance of oysters, 16.3% of respondents felt that there was an overall decrease in their abundance, 18.3% felt there was no change, and 8.8% felt there has been an increase in the oyster population in the Bays. A majority (53%) was unsure as to the abundance of the oyster population, and 3.6% did not respond (Figure 3.1). Tabulation of all survey questions can be found in Appendix B.

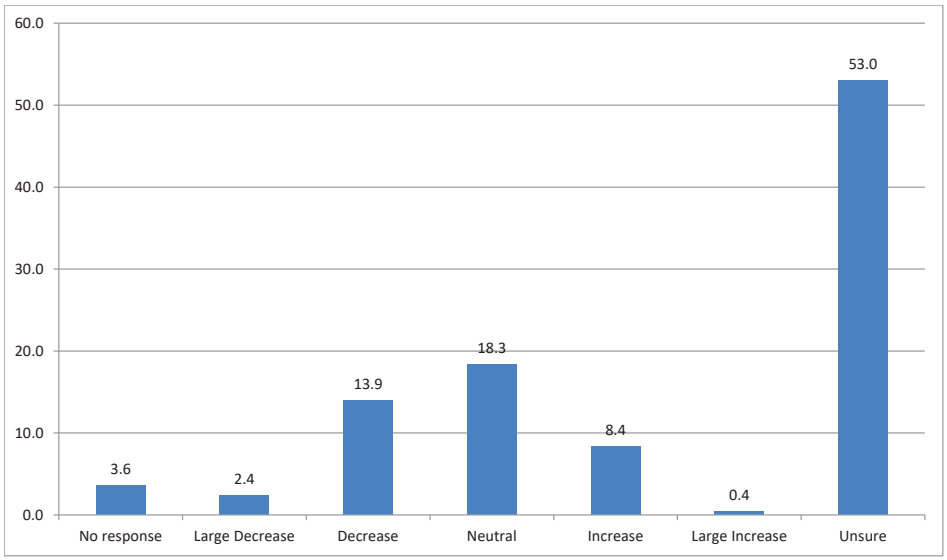

Figure 3.1. Opinions as to the abundance of oysters in the Reserve.

In terms of the abundance of fish, 30.7% felt there has been a decrease in the fish population. Twenty-six point seven percent felt there has been no change in fish numbers, while 10.8% felt there has been an increase in the fish population. The percentage of respondents saying they were unsure as to the level of fish abundance came in at 29.5%, and 2.4% did not provide their opinion (Figure 3.2).

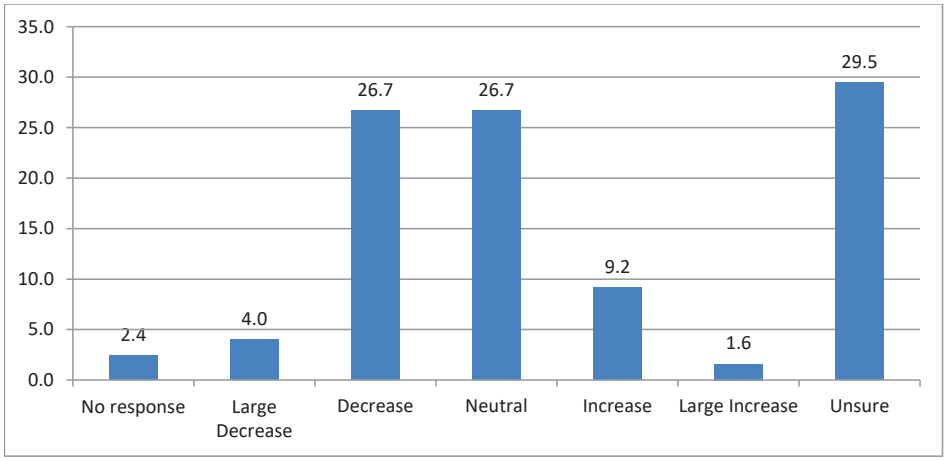

Figure 3.2. Opinions as to the abundance of fish in the Reserve.

Thirty-one point one percent of respondents felt there has been a decrease in the abundance of blue crabs in the Bays. Fifteen point five percent believed there to be no change in blue crab abundance, whereas 5.6% felt there has been an overall increase in the blue crab population (Figure 3.3).

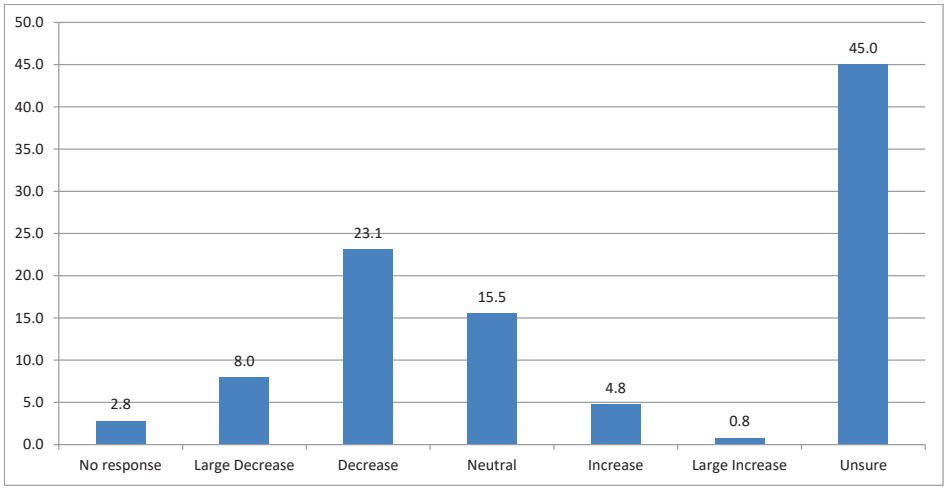

Figure 3.3. Opinions as to the abundance of blue crabs in the Reserve.

The abundance of seagrass question illustrates the politically contentious nature of the recent prop-scarring legislation in that 15.9% of respondents felt there has been an overall decrease in the amount of seagrass, while 20.3% felt there has been an overall increase in the amount of seagrass. Almost 36% (35.9%) were unsure, 2% did not respond, and 25.9% felt the amount of seagrass has not changed (Figure 3.4).

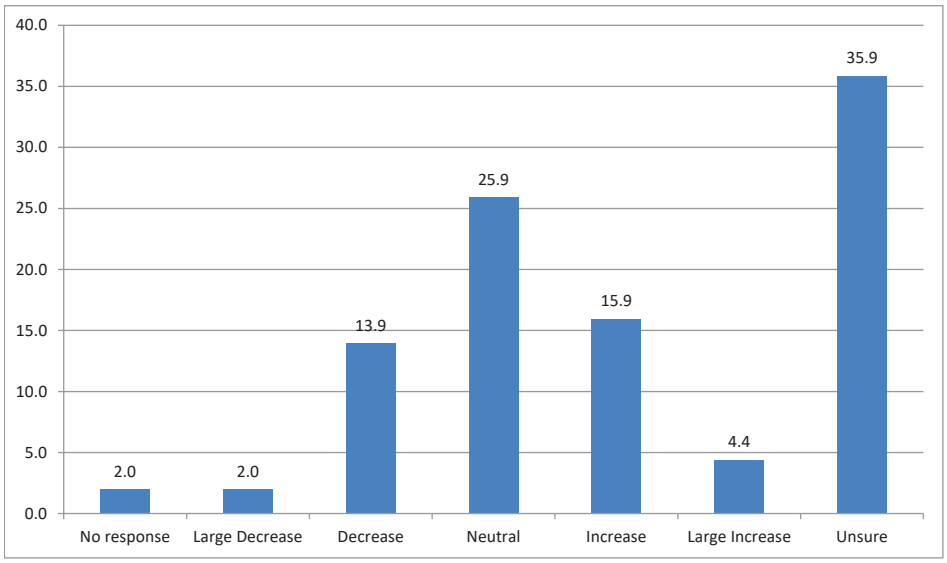

Figure 3.4. Opinions as to the abundance of seagrass in the Reserve.

When it comes to shoreline erosion, however, 30.7% of respondents felt that there has been an increase in shoreline erosion. This is an interesting finding in that seagrass is considered to be a mitigating factor in the loss of coastal shorelines due to erosion (TPWD, 1999). At the same time, 31.1% of the respondents felt there has been no change, 33.1% were unsure, and 1.2% did not provide an answer (Figure 3.5).

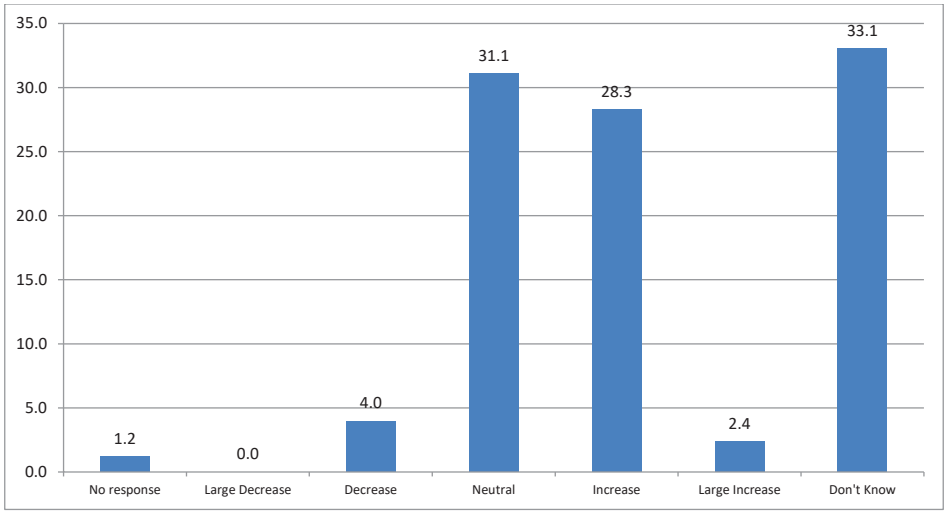

Figure 3.5. Opinions as to shoreline erosion in the Reserve.

Regarding the abundance of wildlife in general, 21.5% of respondents felt there has been an increase, 14% felt there has been an overall decrease and 34.3% felt there has been no change. Approximately 28% were unsure, and 2.4% did not express their opinion (Figure 3.6).

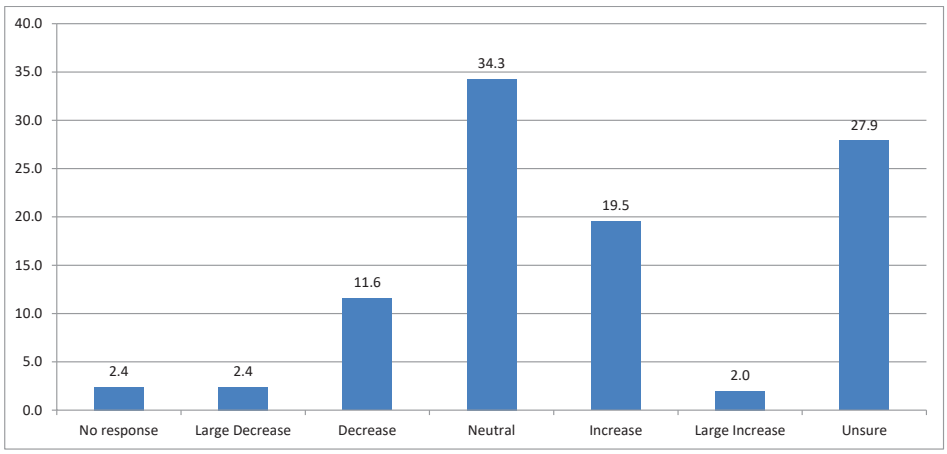

Figure 3.6. Opinions as to the abundance of wildlife in the Reserve.

The respondents' attitude toward public access to land and water resources in the Bays trended toward no change at 37.8% of respondents. Twenty-one point five percent felt there has been an increase in Bay accessibility, 14% reported seeing a decrease, 24.7% were unsure, and 2.0% did not provide a response (Figure 3.7).

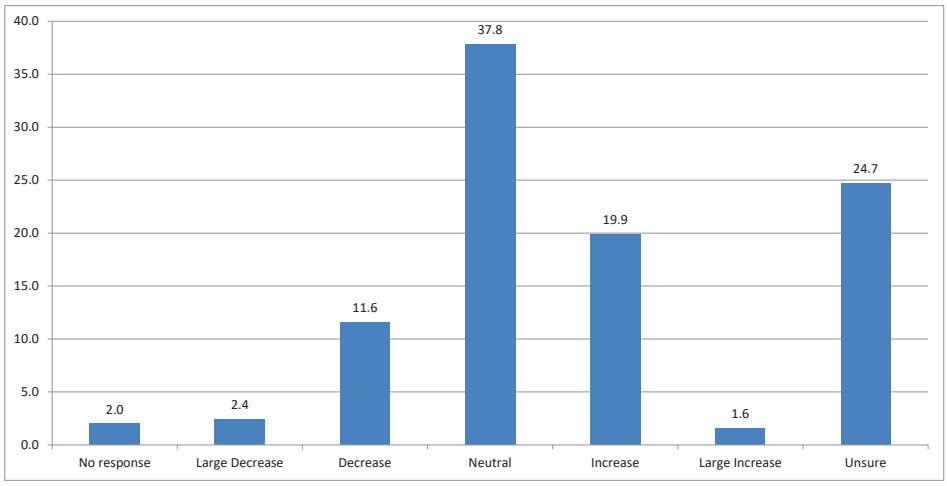

Figure 3.7. Opinions as to the abundance of public access in the Reserve.

An increase in red tide occurrences was perceived by 13.9% of respondents, 8.8% felt there has been a decrease in red tides, 31.5% felt there has been no change in their frequency, 43% were unsure, and 2.8% did not leave a response (Figure 3.8).

The abundance of jellyfish in the Bays was perceived to have increased by 31.1% of the respondents; 15.1% thought there had been an overall decrease in jellyfish numbers, 25.9% felt there has been no change, 25.9% were unsure, and 2% did not answer (Figure 3.9).

The bird population has increased according to 21.9% of survey responses; however, 17.5% felt that there has been a decrease in the number of birds in the Bays. Twenty-four point seven percent were unsure, 34.7% felt there has been no change, and 1.2% did not answer the question (Figure 3.10).

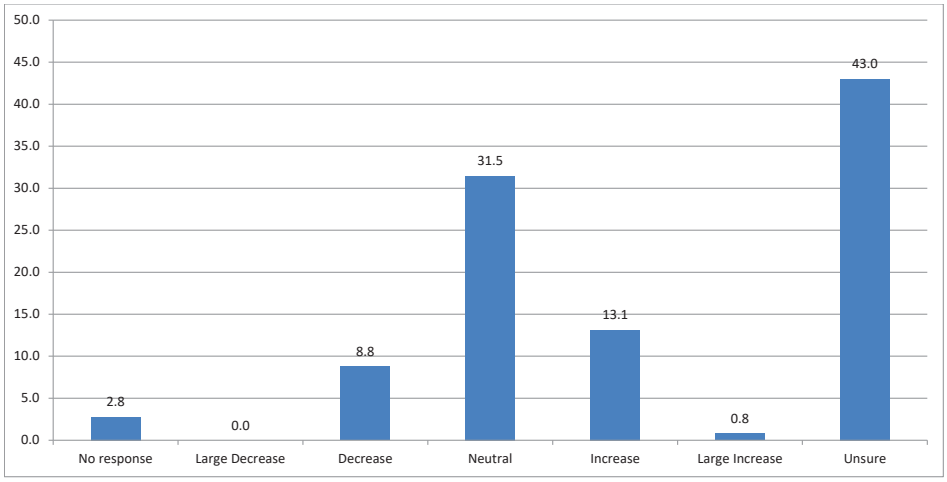

Figure 3.8. Opinions as to the abundance of red tide occurrences in the Reserve.

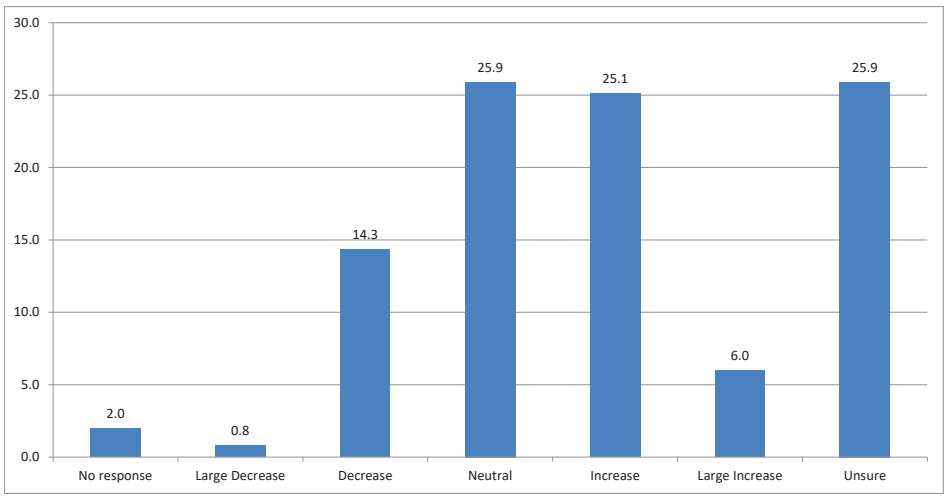

Figure 3.9. Opinions as to the abundance of jellyfish in the Reserve.

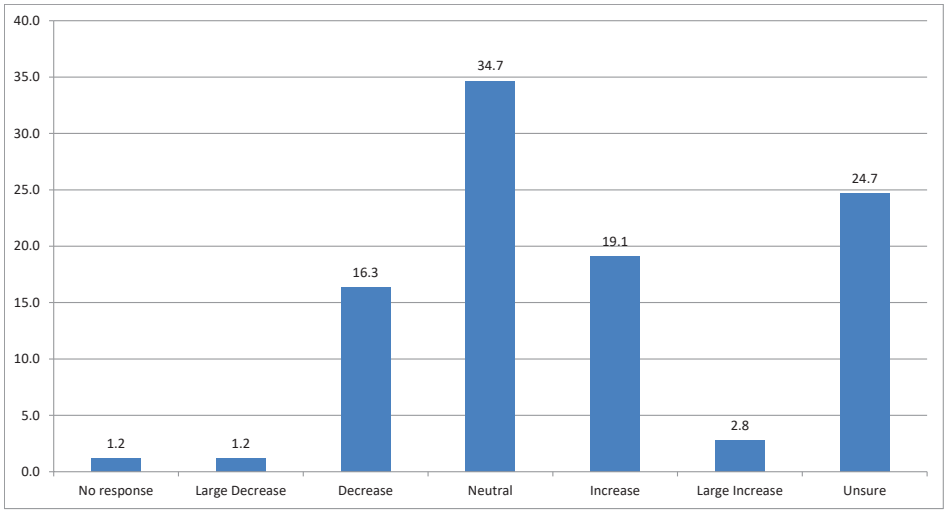

Figure 3.10. Opinions as to the abundance of birds in the Reserve.

3.1.2. Place Attachment Questions

The section of the survey dealing with respondent attitudes toward the idea of "place attachment" and the Bays indicates that those responding felt that the Bays are very much an important part of their lives and the surrounding community.

For example, in response to the prompt, "The Bays are the best place to satisfy my recreation needs," 83.7% of respondents agreed or strongly agreed. Only 4% disagreed or strongly disagreed with the statement, 2.8% did not respond, 8.8% were neutral and 0.8% were unsure (Figure 3.11).

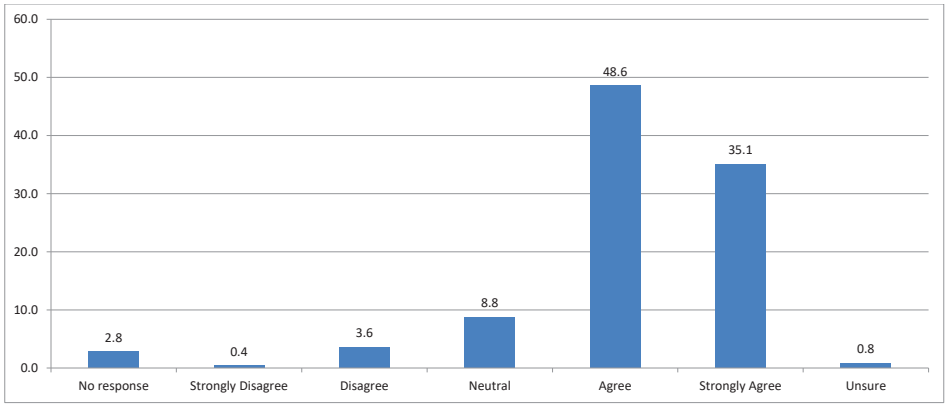

Figure 3.11. Are the Bays the best place for satisfying recreation needs?

In response to the prompt, "The Bays represent a way of life in my community," the results were similar: seventy-three point three percent agreed or strongly agreed, 9.6% disagreed or strongly disagreed, 10.8% were neutral on the topic, 3.2% were unsure, and 3.2% did not respond (Figure 3.12).

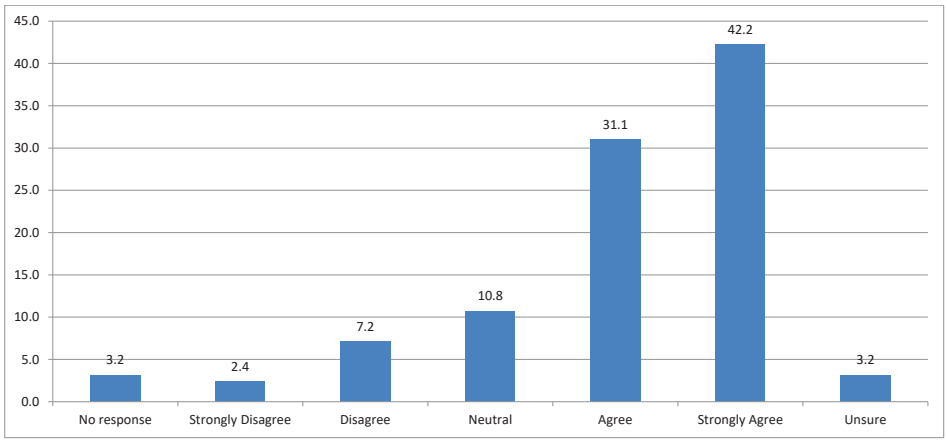

Figure 3.12. Do the Bays represent a way of life in the community?

When it comes to knowing the importance the Bays in terms of habitat for fish and other wildlife, the respondents expressed an overwhelming appreciation with 97.6% agreeing with the prompt. Only 0.8% were neutral, and 1.6% did not answer. No one was unsure as to the importance of the Bays in this regard, and no one disagreed with their importance in this area either (Figure 3.13).

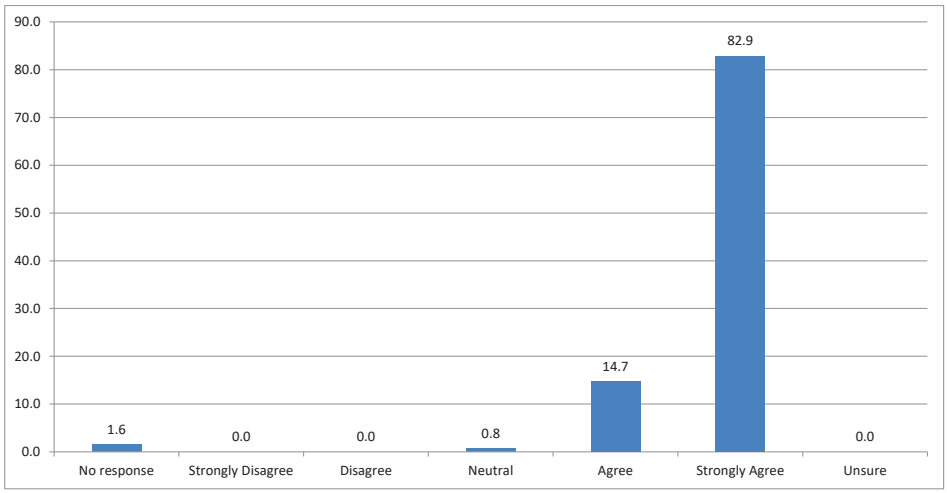

Figure 3.13. The perceived importance of the Bays to fish and wildlife habit.

Eighty-five point seven percent of the respondents agreed or strongly agreed that they are very attached to the Bays, 1.6% disagreed with the statement, 10% were neutral, 0.8% were unsure, and 2% did not respond (Figure 3.14).

Sixty-four point five percent of respondents agreed or strongly agreed that they get more satisfaction out of visiting the Bays than any other place. Ten point eight percent disagreed or strongly disagreed with the statement, while 21.5% were neutral, 0.4% were unsure, and 2.8% did not respond (Figure 3.15).

When it comes to the importance of the Bay's natural resources vis-à-vis their community's economy, 68.1% of the respondents felt that the natural resources of the Bays are vital to their community's economy. Fourteen point four percent disagreed or strongly disagreed with the statement, 11.6% were neutral, 3.2% were unsure, and 2.8% did not respond to the prompt (Figure 3.16).

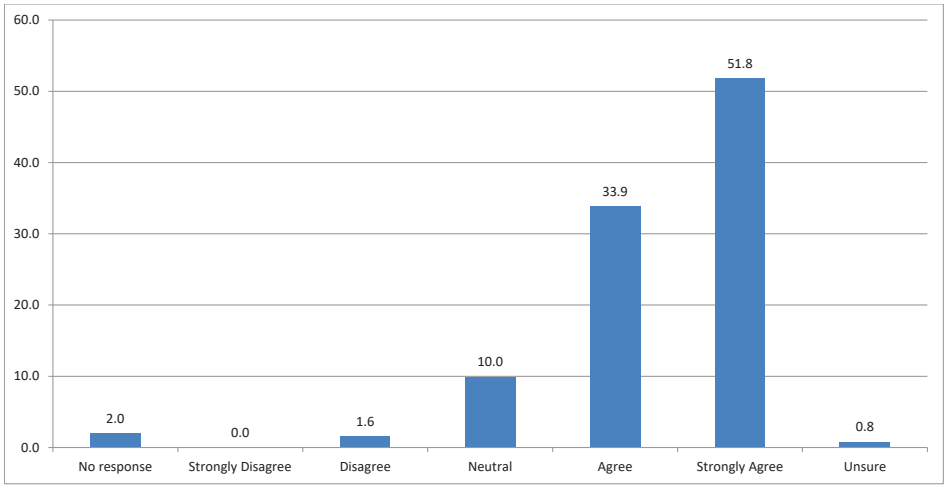

Figure 3.14. How attached to the Bays are the respondents?

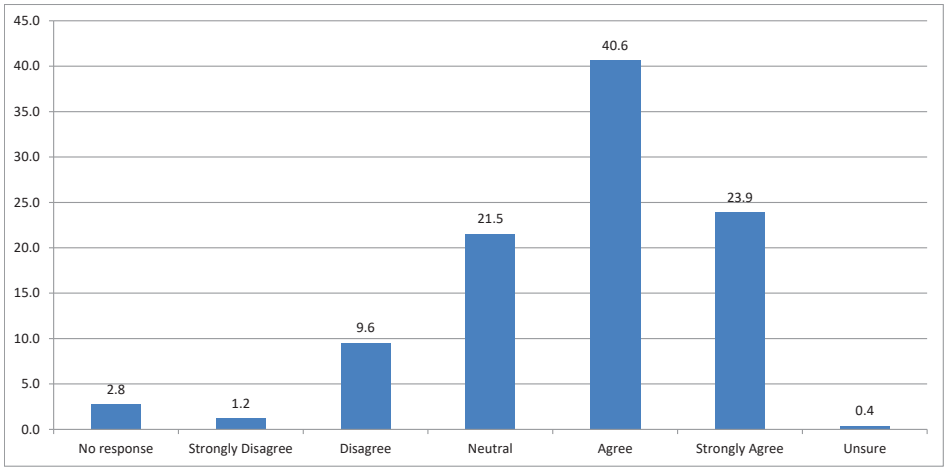

Figure 3.15. Respondent's opinion on whether they get more satisfaction out of visiting the Bays than any other place.

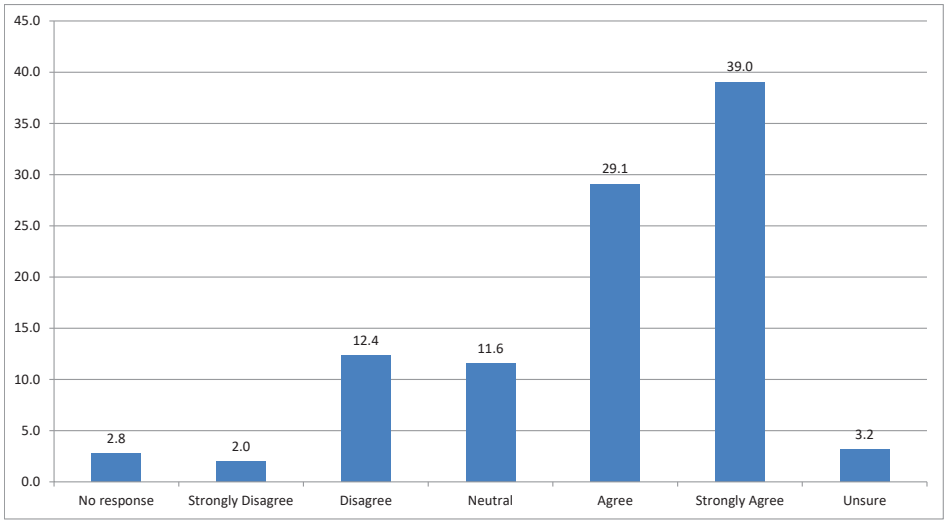

Figure 3.16. Are the Bay's natural resources important to the community's economy?

Seventy-eight point nine percent of respondents agreed that the Bays contribute to the character of their community. Ten point eight percent did not agree with the statement, 6% were neutral, 1.6% were unsure and 2.8% did not respond (Figure 3.17).

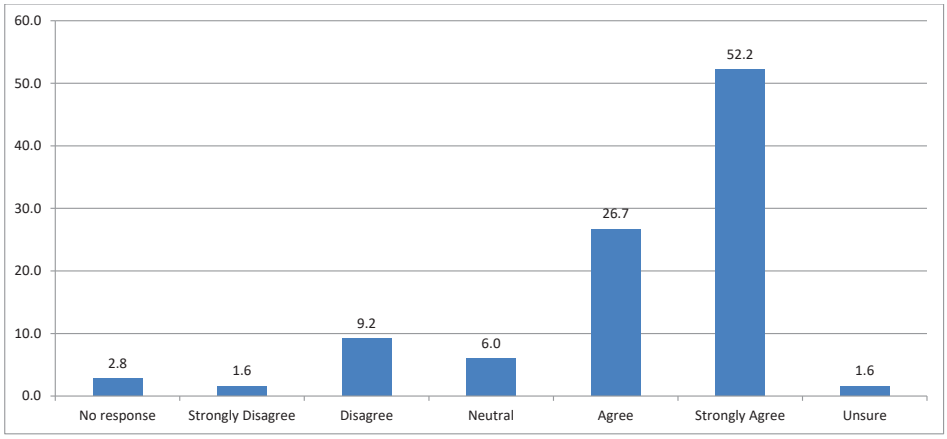

Figure 3.17. Percentage of respondents that say the Bays contribute to the character of the local community.

3.1.3. Value Allocation Exercise

In this section of the survey, we asked respondents to distribute 100 "pennies" across 13 different social value types according to their perceived importance when they think of the Bays. As Table 3.1 shows, Biodiversity (3,600), Recreation (3,054), and Aesthetic (2,855) were the top three social values in terms of allocated "pennies." In total, there were 25,060 "pennies" "spent" on all the social values. In relation to other studies of this type, this breakdown is not unusual. What is interesting in this particular implementation of the survey is that Economic value appears at number four; this is the first time that Economic value rising this high has been witnessed by the project lead for the valuation exercises of similar studies.

Table 3.1. Results from the Valuation Allocation exercise.

Social Value Type	Amount
Biodiversity	3,600
Recreation	3,054
Aesthetic	2,855
Economic	2,557
Human Needs	2,134
Wilderness	2,004
In and of Itself	1,704
Learning	1,663
Legacy	1,495
Socializing	1,203
Therapeutic	1,170
Spiritual	814
Inspiration	807
Total	**25,060**

Perched shore bird. Photo credit: Jarrod Loerzel, NOAA

3.1.4. Mapping Exercise

The next section of the survey asked respondents what places they think of when they reflect on the social values to which they allocated "pennies." We asked them to mark those locations on the map we provided. We provided an 11"x17" paper map for the paper-based surveys and used a Google Maps user interface for the online survey instrument. The paper map was set to a 1:250,000 scale, and was marked with six locations so that users could orient themselves. 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. See the screenshot of the Google survey map in Figure 3.18 below or Appendix A to see the paper-based version of the map.

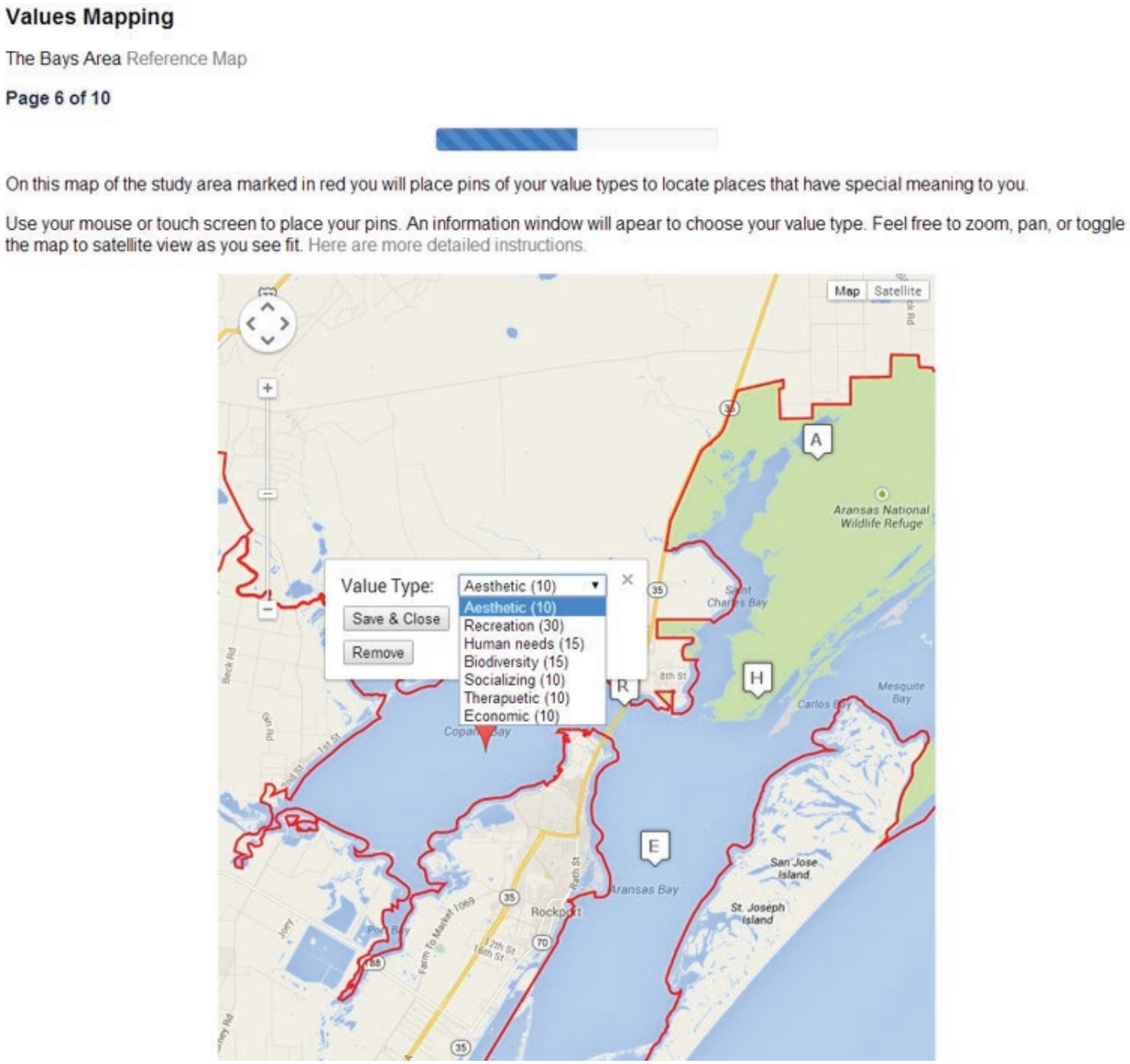

Figure 3.18. A screenshot of the online version of the Values Mapping exercise.

On average, there were 8 points placed per respondent, for a total of 1,962 points being placed on the map. Recreation received 388 markers, Aesthetics received 275, Wilderness received 162 and Economics received 152 markers. Table 3.2 summarizes the total markers per social value type, with Figures 3.19-3.23 showing the spatial allocation of all markers as well as those of the top 4 value types.

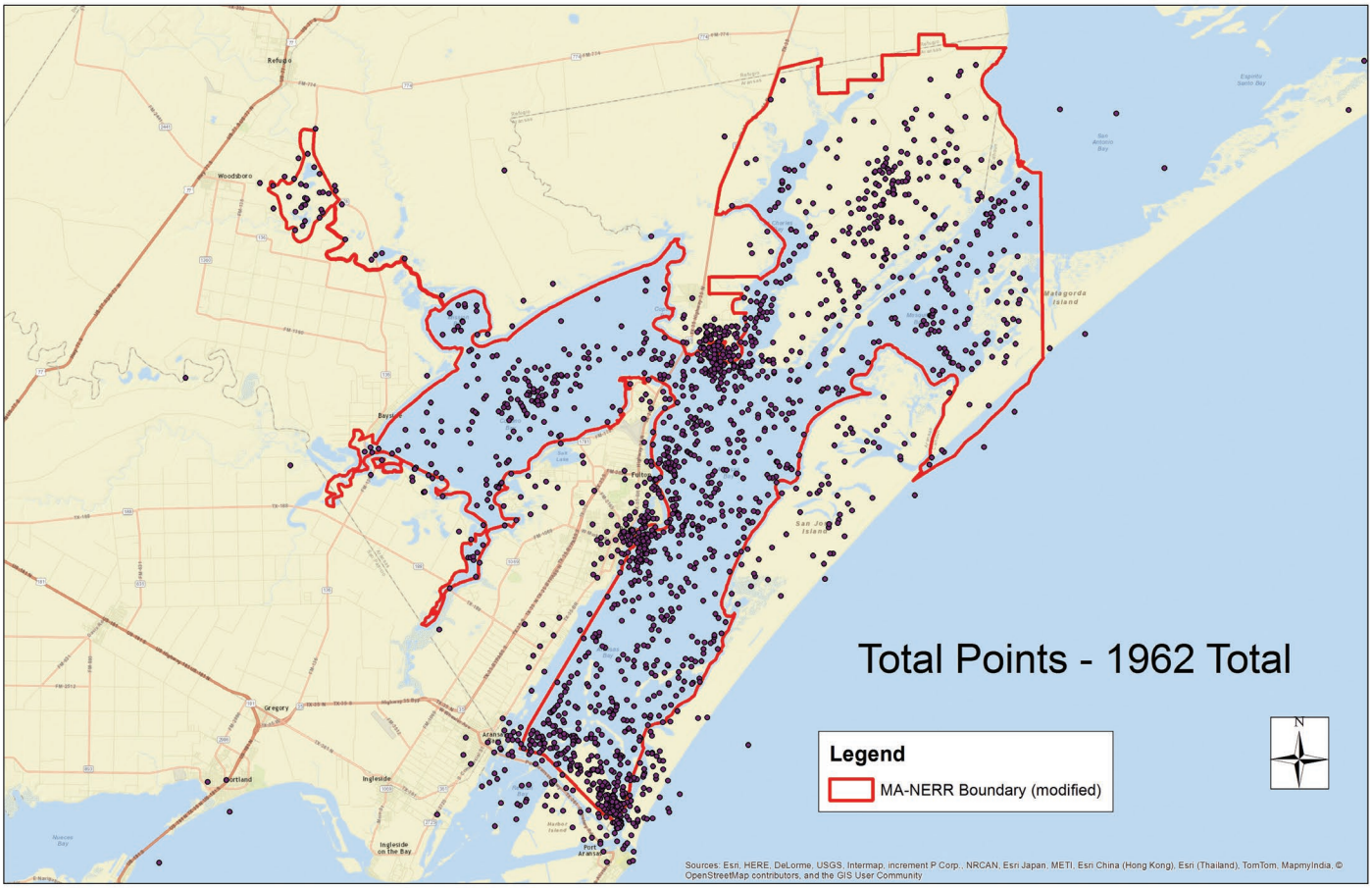

Figure 3.19. Total points placed for all values during the Values Mapping exercise.

Aransas Wildlife Refuge. Photo credit: Jarrod Loerzel, NOAA

Table 3.2. Results from the Valuation Mapping exercise.

Social Value Type	Markers
Recreation	418
Aesthetics	296
Wilderness	175
Biodiversity	162
Economic	160
Learning	122
In and of Itself	120
Human Needs	113
Therapeutic	110
Legacy	97
Spiritual	66
Socializing	62
Inspiration	61
Total	**1,962**

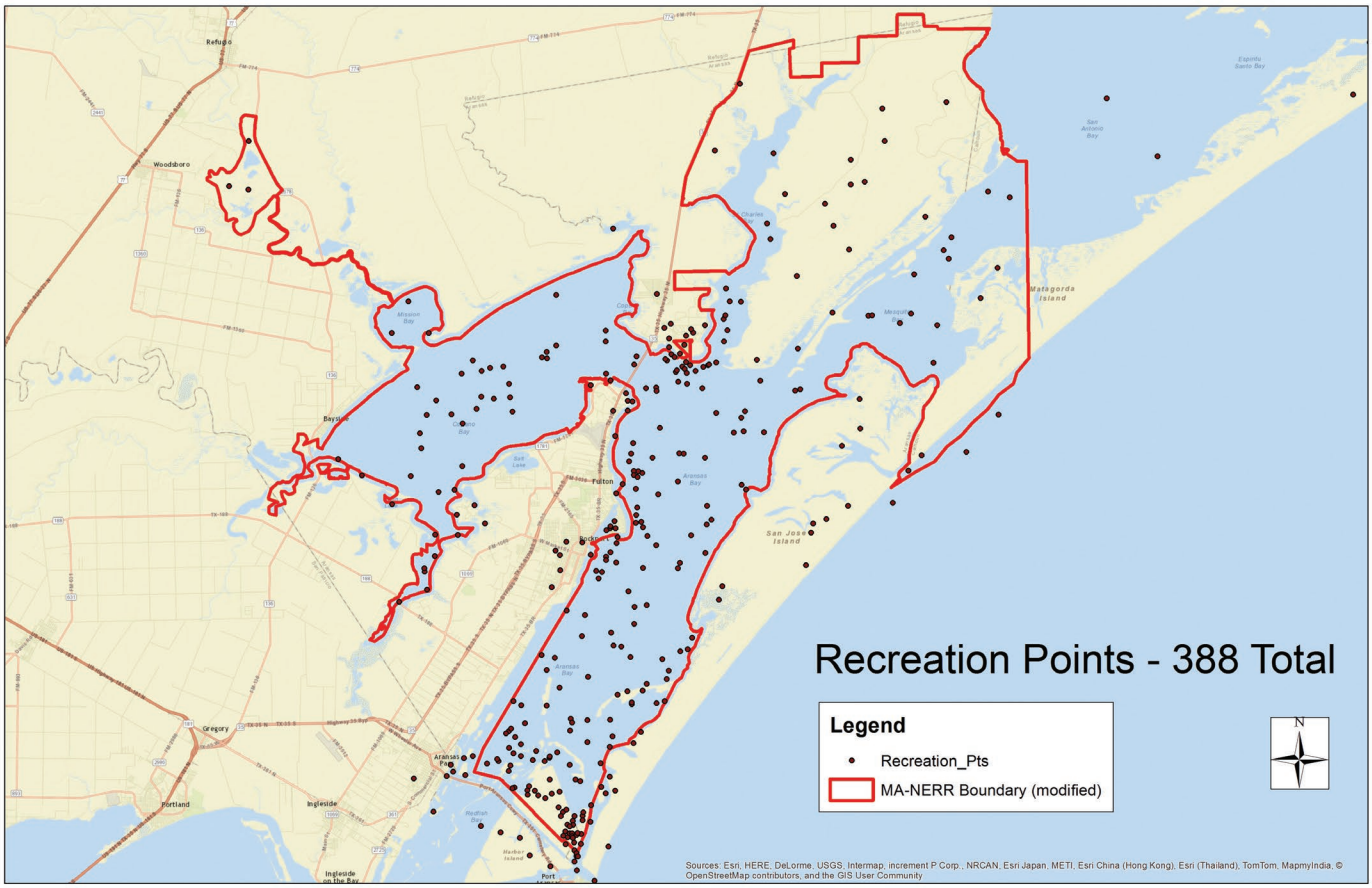

Figure 3.20. Total points placed for Recreation during the Values Mapping exercise.

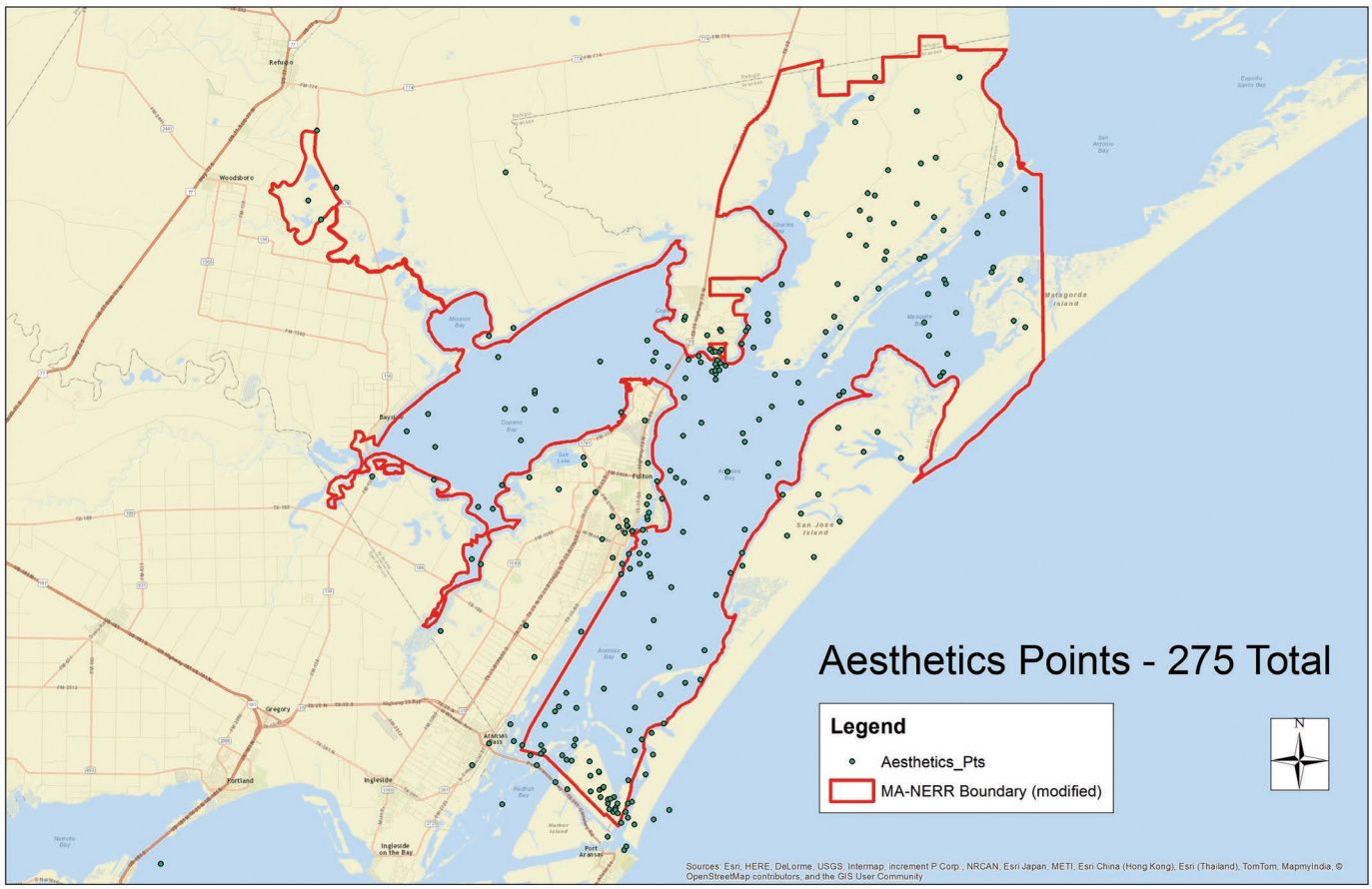

Figure 3.21. Total points placed for Aesthetics during the Values Mapping exercise.

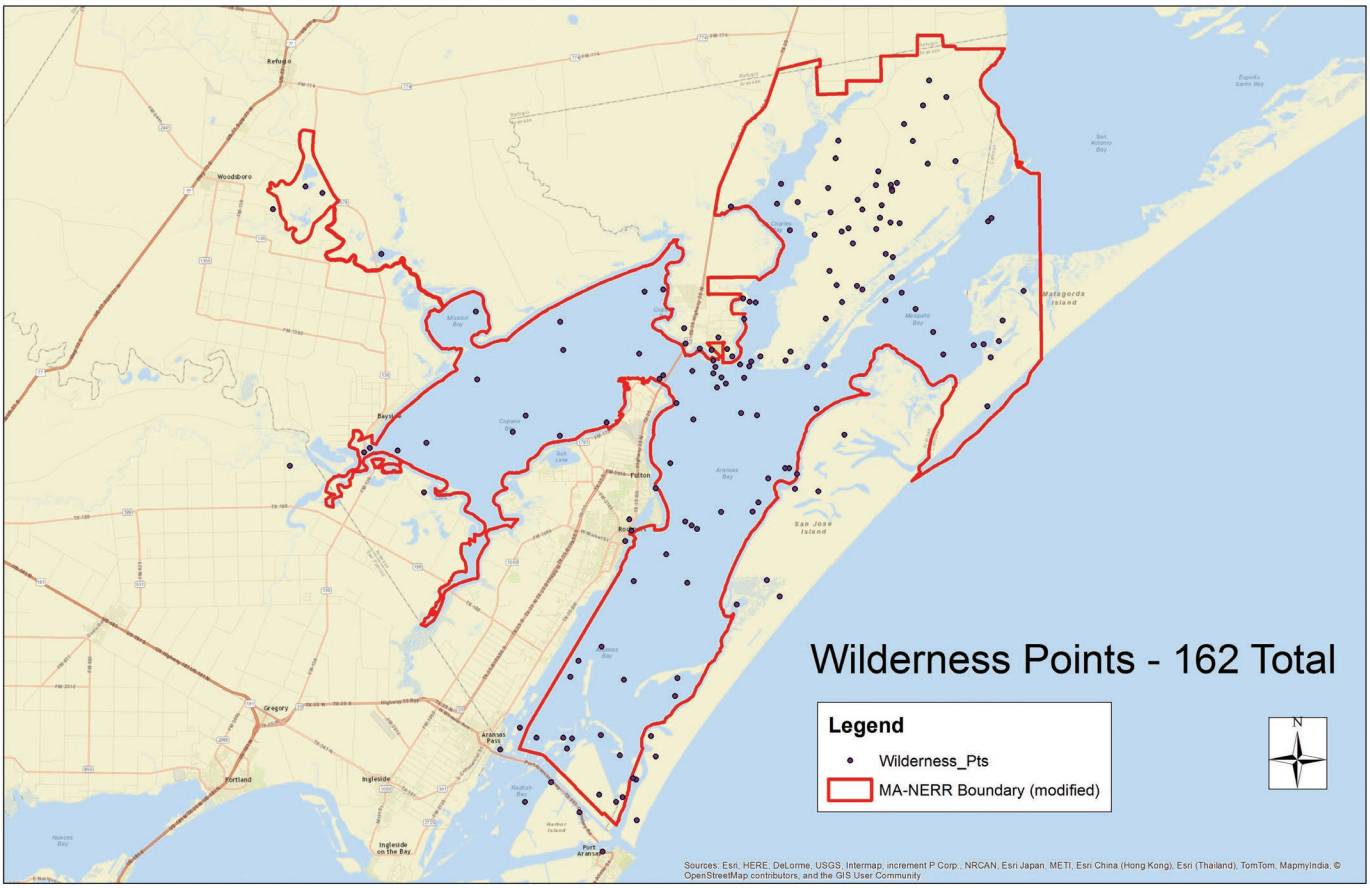

Figure 3.22. Total points placed for Wilderness during the Values Mapping exercise.

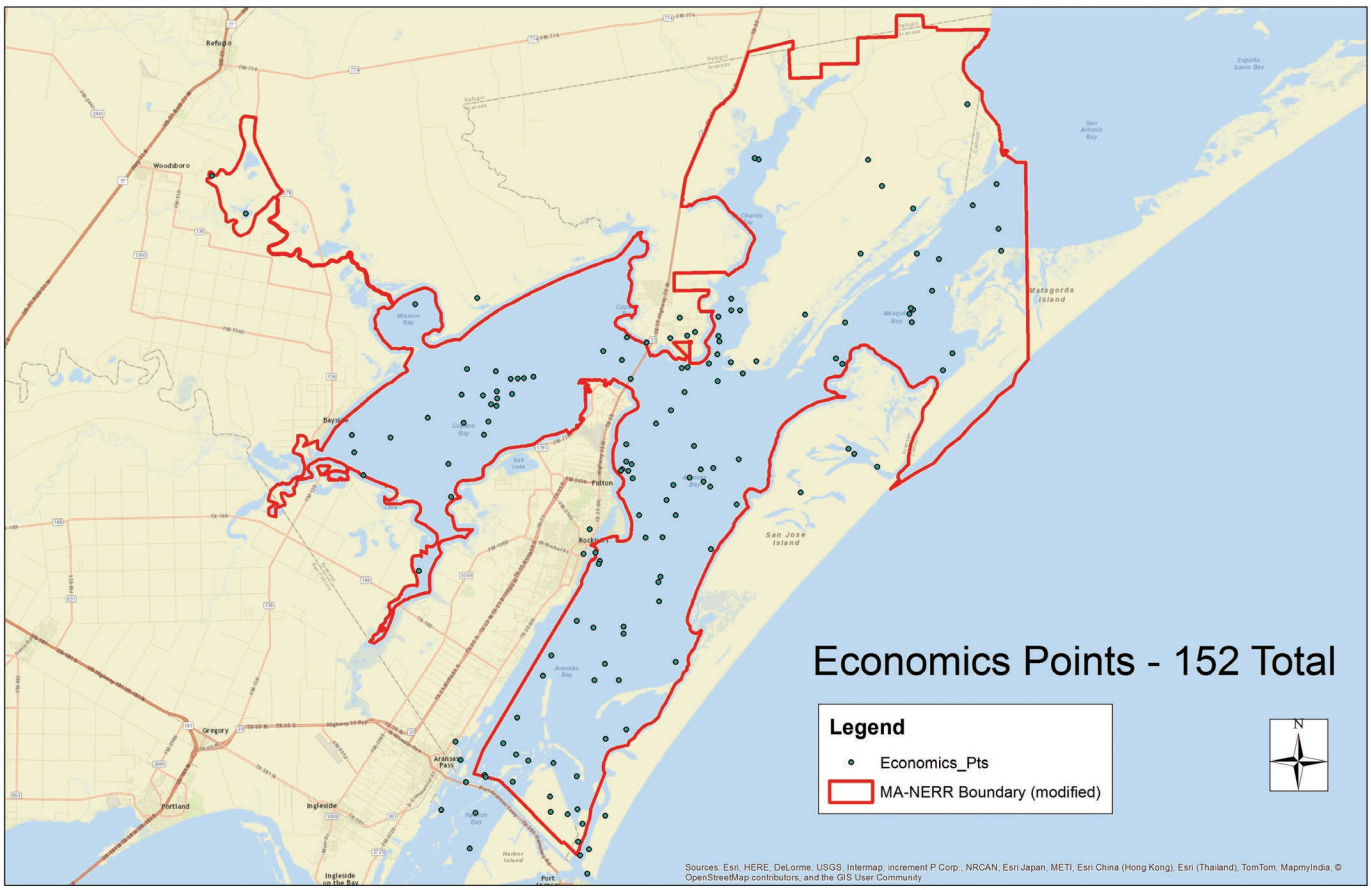

Figure 3.23. Total points placed for Economics during the Values Mapping exercise.

3.1.5. Management Goals

In this section of the survey we asked respondents about a number of management goals. The goals posed to the respondents were selected by the Reserve management staff as either active goals or goals that were being discussed for future implementation. Nevertheless, the opinions of respondents are very important to the success or failure of any management goal. For the most part, respondents agreed that the goals listed were priority goals.

One such management goal is to improve the water quality in the Bays. Eighty-eight point nine percent of the respondents believed this to be a priority or a high priority for management. Only 1.6% felt it was a low priority goal, 5.2% were neutral on the subject, 1.6% were unsure, and 2.8% provided no response (Figure 3.24).

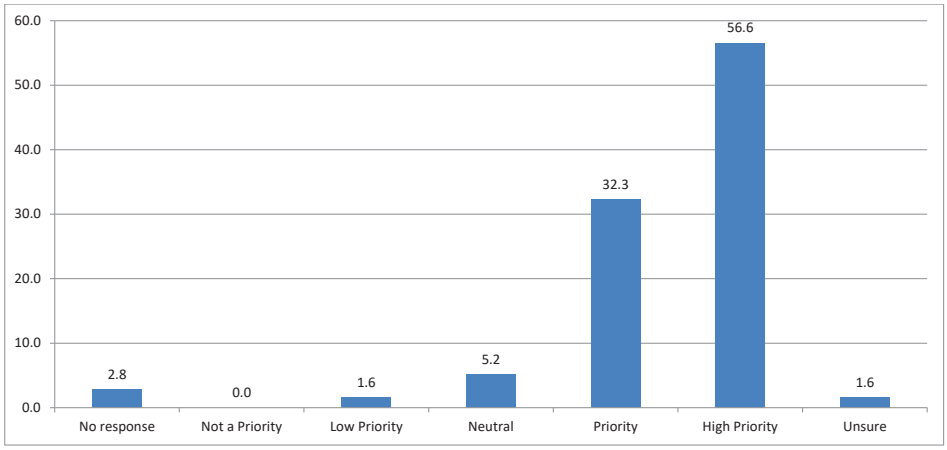

Figure 3.24. Level of priority assigned to the management goal of improving water quality in the local Bays.

On the subject of improving freshwater inflows to the Bays, the respondents were less enthusiastic, but 76.5% of the respondents still felt that freshwater inflows were a priority or a high priority management goal. Ten percent remained neutral, while 2.8% felt freshwater inflows were not a priority. Seven point two percent were unsure, and 3.6% did not provide a response (Figure 3.25).

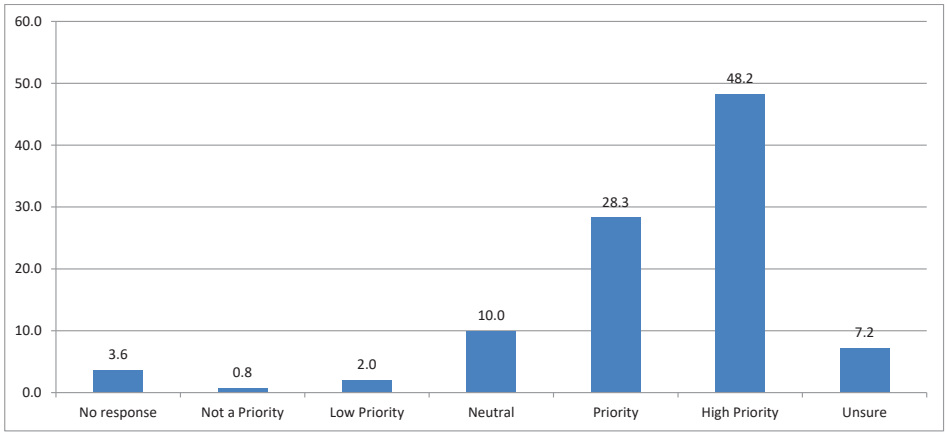

Figure 3.25. Level of priority assigned to the management goal of improving freshwater inflows to the Bays.

Similar results were found regarding the goal of managing the quantity and quality of storm water runoff to the Bays in that 78.9% of the respondents felt that this goal should receive priority or high priority status, 12% remained neutral, 2.4% believed it to be a low priority or not a priority at all, 4% were unsure, and 2.8% did not respond (Figure 3.26).

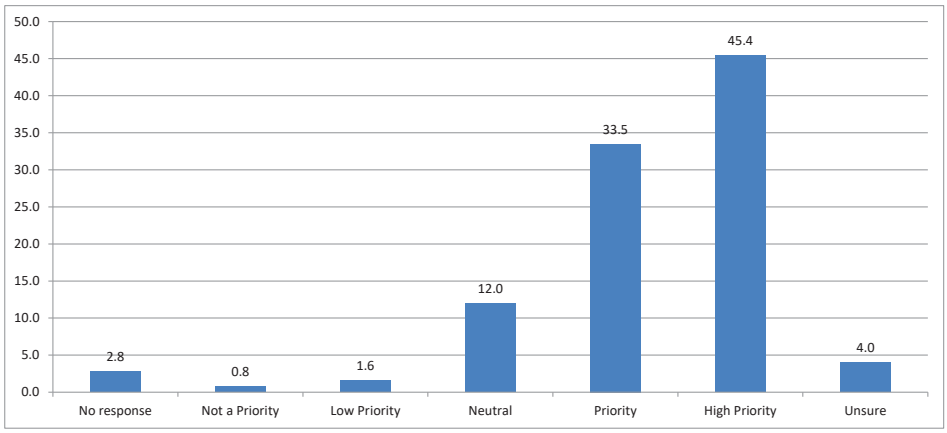

Figure 3.26. Level of priority assigned to the management goal of managing the quantity and improving the quality of storm water runoff to the Bays.

When it comes to the restoration of shoreline and wetland habitats, 80.5% of respondents said it should receive priority or a high priority status; 4% believed it to be a low priority goal or that it shouldn't be a priority goal at all. Only 1.2% were unsure, 10.8% were neutral, and 3.6% did not provide any opinion as to the priority level of the goal (Figure 3.27).

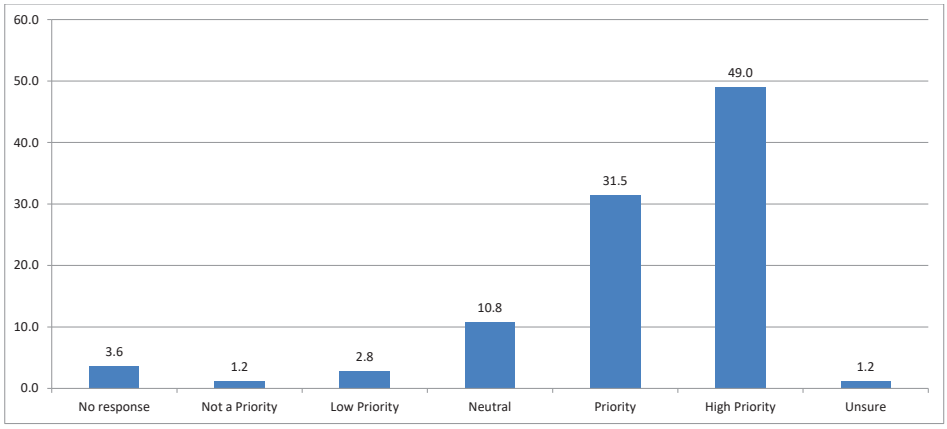

Figure 3.27. Level of priority assigned to the management goal of restoring shoreline and wetland habitats.

A very similar goal – to eliminate further loss of shoreline, seagrass and wetland habitats – received elevated priority status from the respondents, with 89.3% declaring this a priority or a high priority management goal. A mere 2.8% felt this was not a priority or should receive low priority status, only 0.4% were unsure, 4.8% were neutral, and 2.8% did not provide a response (Figure 3.28).

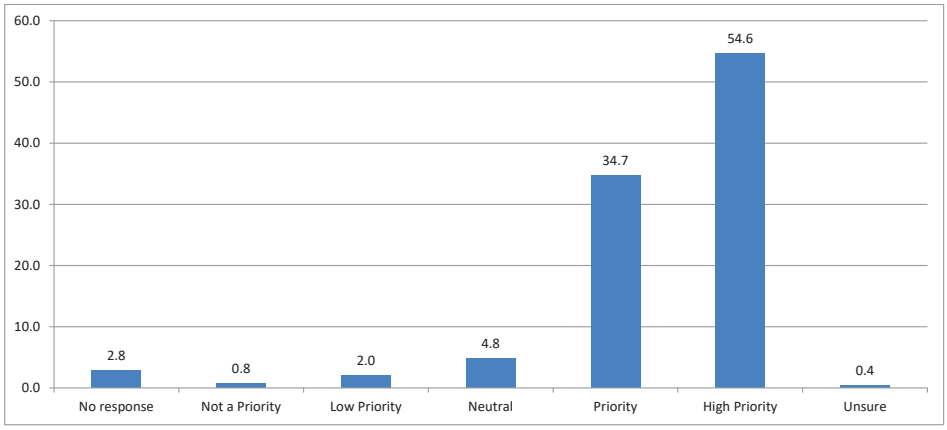

Figure 3.28. Level of priority assigned to the management goal of eliminating further loss of shoreline, seagrass and wetland habitats.

The management goal of restoring and sustaining fish stocks and other living marine resources in the Bays was another goal that respondents believed should receive elevated priority status: Eighty-nine point seven percent said it was a priority or a high priority goal, 2% said it was a low priority or not a priority at all, 4.8% were neutral on the priority status, 0.8% were unsure, and 2.8% did not provide a response to the significance of the goal (Figure 3.29).

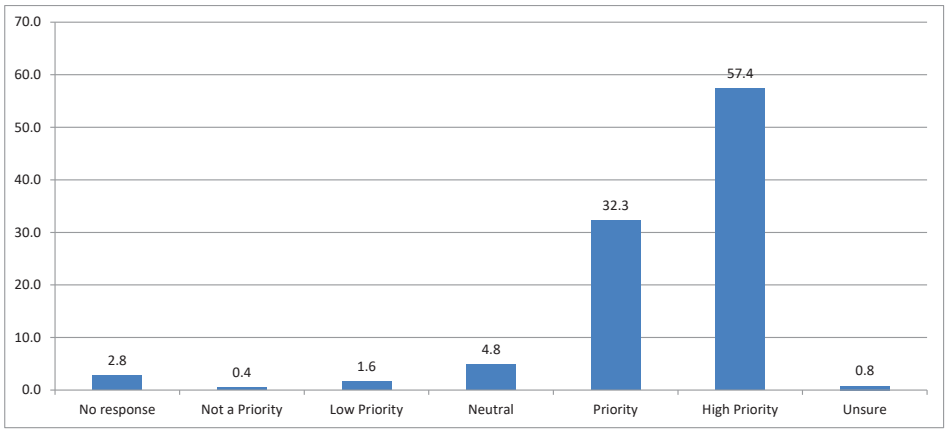

Figure 3.29. Level of priority assigned to the management goal of restoring and sustaining fish stocks and other living marine resources in the Bays.

Up to this point the management goals could be considered "bio-centric" in nature, meaning that the goals focus primarily on the biological condition of the Bays. When the goals began to focus on a more "anthropocentric" attitude, the respondent opinions changed – in some cases significantly.

For example, the goal of providing increased levels of public access to the Bays and its resources could be considered an anthropocentric goal. For this particular issue, the respondents' answers resembled a more symmetrical distribution rather than the left skewed distribution found in the results of the more bio-centric management goals. The results indicate that only 39% of respondents felt this is a high priority or a priority worthy goal. Twenty-eight point three percent felt it is a low priority or not a priority goal, 28.3% were neutral, 4% did not provide a response, and 0.4% were unsure (Figure 3.30).

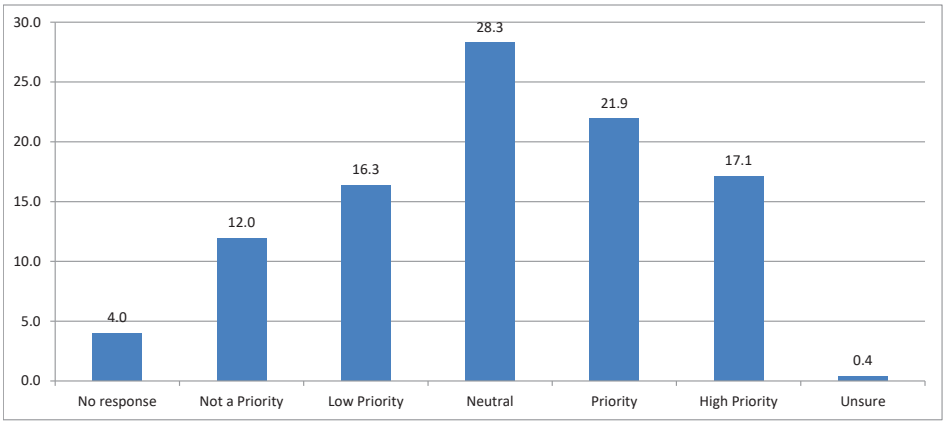

Figure 3.30. Level of priority assigned to the management goal of providing increased levels of public access to the Bays and its resources.

While the public access goal is the most symmetrical of all goal responses, the remaining anthropocentric results indicate only a slightly left skewed graph, and not nearly as left skewed as the previous graphs of the bio-centric goals. Indeed, the bio-centric management goals all have "High Priority" as the median response category, whereas the anthropocentric goals have the "Priority" category as their median response.

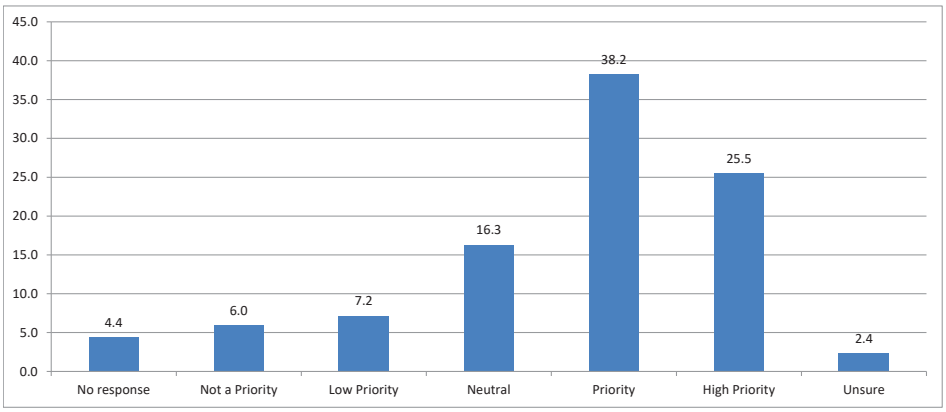

Figure 3.31. Level of priority assigned to the management goal of increasing the resilience of coastal communities in the face of natural and human-induced disasters (such as hurricanes and rising seas).

In the first example of a slightly left skewed graph - and another more anthropocentric goal - is increasing the resilience of coastal communities in the face of natural and human induced disasters. The results indicate that 63.7% of the respondents felt this to be a priority or a high priority worthy goal, and 13.2% felt it to be a low priority or not a priority at all. Sixteen point three percent were neutral, 2.4% were unsure, and 4.4% did not respond (Figure 3.31).

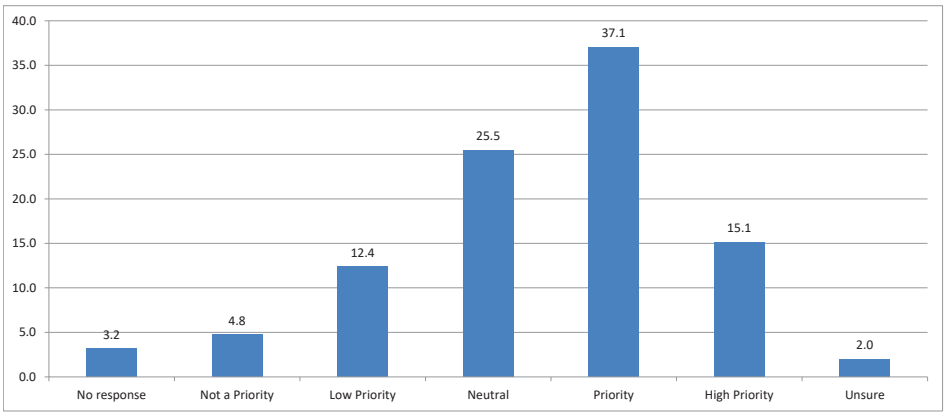

Figure 3.32. Level of priority assigned to the management goal of incorporating local social and cultural heritage into management of the Bays resources (such as public input and community advisory boards).

When it comes to the goal of incorporating local social and cultural heritage into the management of the Bays, 52.2% of respondents felt this is a priority or a high priority goal. Twenty-five point five percent were neutral, 17.2% suggested that this goal was low priority or not apriority at all, 3.2% did not provide a response, and 2% were unsure (Figure 3.32).

Increasing the awareness of human-use patterns that influence resource sustainability had 78.1% of the respondents agreeing that this is a priority or a high priority level goal. Six percent thought it was a low priority or not a priority, 3.6% did not respond, 11.2% remained neutral, and 1.2% were unsure about the priority level of this goal (Figure 3.33).

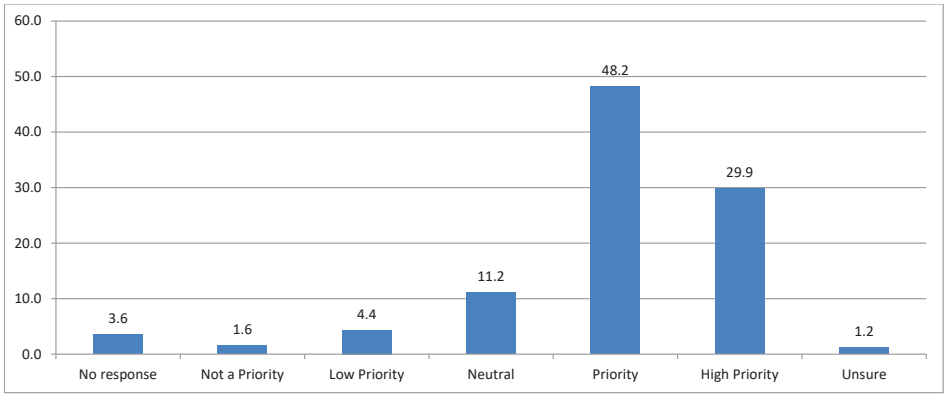

Figure 3.33. Level of priority assigned to the management goal of increasing the awareness of human-use patterns that influence resource sustainability.

Another more anthropocentric goal is integrating an understanding of human uses with the knowledge of natural processes. This goal had 67.7% of respondents believing it to be a priority or a high priority, and 4.8% thinking it a low priority or not a priority. Nineteen point nine percent were neutral, 5.2% did not respond, and 2.4% were unsure as to the level of priority (Figure 3.34).

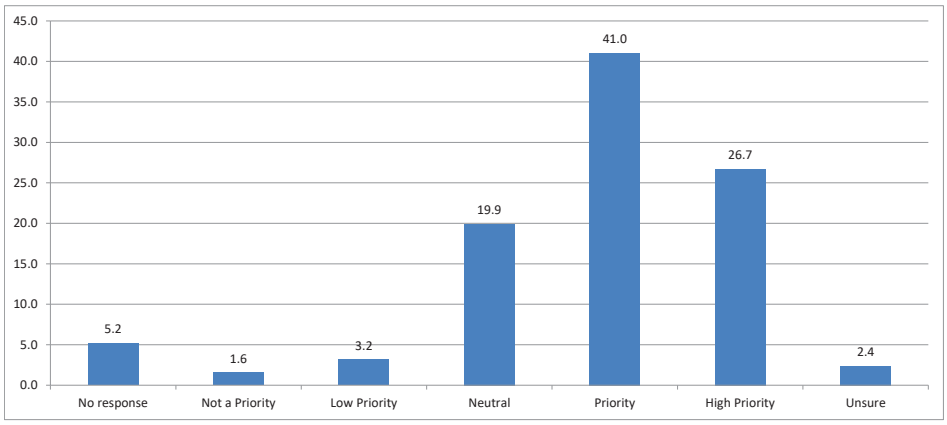

Figure 3.34. Level of priority assigned to the management goal of integrating understanding of human uses with knowledge of natural processes.

When the goal is purchasing additional non-wetland areas to add to the publically owned lands within or adjacent to the Bays, the respondents seem slightly more cautious: Fifty-one point eight percent thought it is a priority or a high priority, 17.2% felt it to be a low priority or not a priority at all, 22.7% were neutral, 4.8% did not respond, and 3.6% were unsure (Figure 3.35).

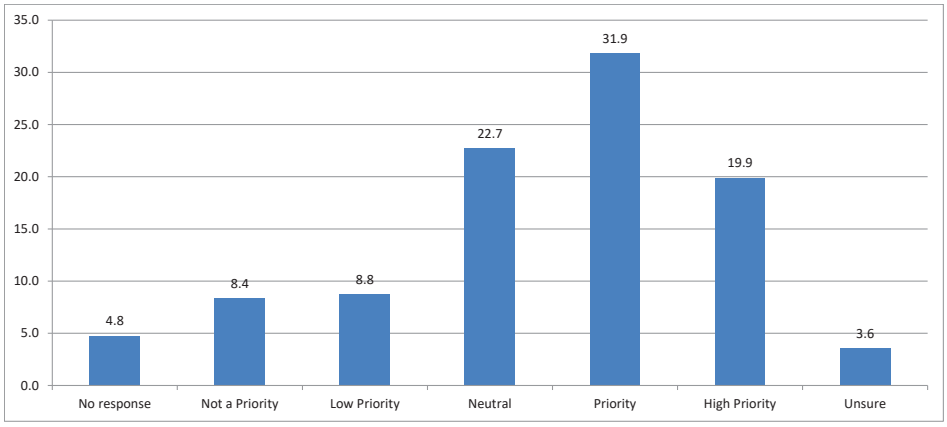

Figure 3.35. Level of priority assigned to the management goal of purchasing additional non-wetland areas to add to publically owned lands within or adjacent to the Bays.

3.1.6. Public Knowledge of Management Dimensions

To better understand what respondents knew about certain management dimensions and other characteristics of the Bays, we asked them to rate their level of knowledge on policy, the ecology, the history, recreational aspects, public involvement opportunities, and educational opportunities in and around the Bays.

In terms of their knowledge of the policy aspect of Bay management, 51.4% of the respondents felt they had a good to excellent understanding, 28.6% felt their level of understanding was fair or poor, 14.3% were unsure, and 5.6% did not provide an answer (Figure 3.36).

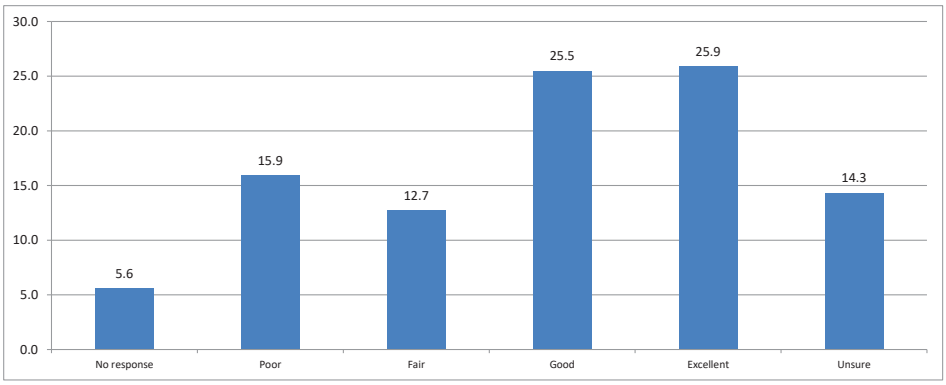

Figure 3.36. Level of understanding of the policy dimension of Bay management.

Fifty-seven point four percent of the respondents felt they had an excellent to good understanding of the ecology of the Bays, 29.1% thought they had a fair to poor understanding, 8.4% were unsure, and 5.2% provided no response (Figure 3.37).

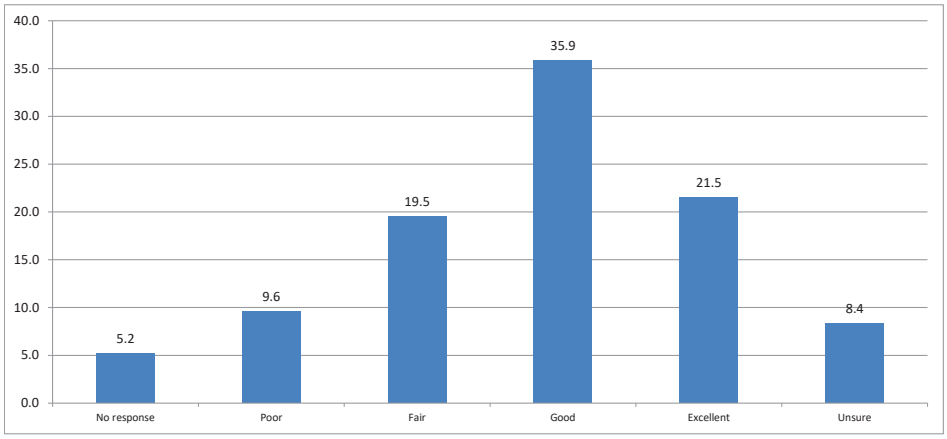

Figure 3.37. Level of understanding of the ecological dimension of Bay management.

When it came to the history of the Bays, 60.6% of respondents felt they had an excellent to good level of knowledge, 22.3% felt they had a fair to poor understanding, 12% were unsure, and 5.2% did not answer (Figure 3.38).

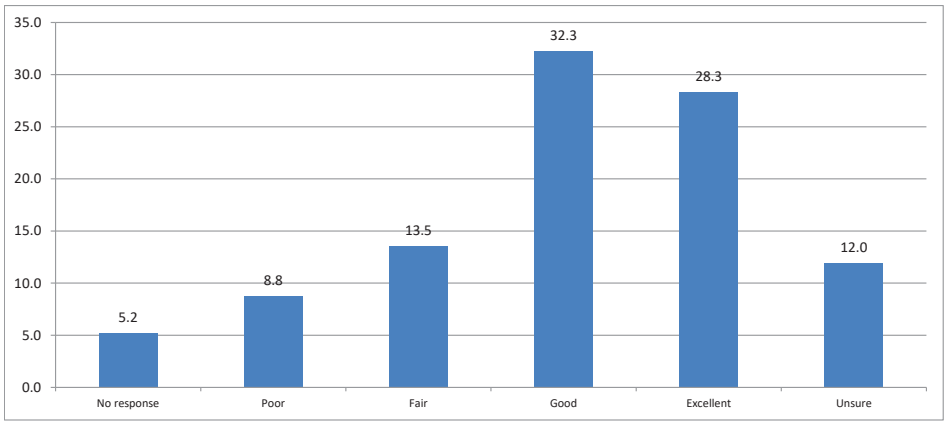

Figure 3.38. Level of understanding of the historic dimension of Bay management.

Knowledge of the recreational aspects of the Bays had the highest percentage of respondents in the good to excellent level of understanding category at 62.1%. Twenty-five point five percent had a fair to poor level of understanding, 6% did not answer, and 6.4% were unsure as to their level of understanding (Figure 3.39).

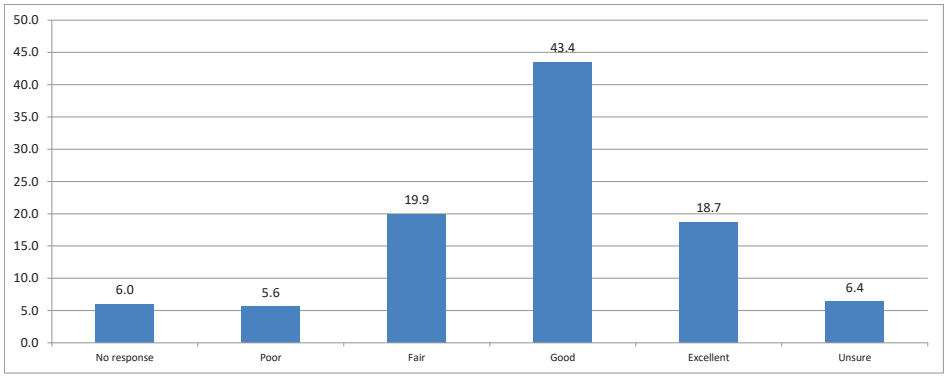

Figure 3.39. Level of understanding of the recreational aspects of Bay management.

Fifty-two point six percent of respondents felt their level of knowledge of public involvement opportunities is good to excellent. Twenty-two point four percent thought they had a fair to poor level of knowledge, 19.1% were unsure, and 6% did not answer. This would seem to indicate that informing the public of opportunities for involvement needs to be circulated more broadly, perhaps through the wider distribution of announcements in newspapers, on the radio, and via social media and the internet (Figure 3.40).

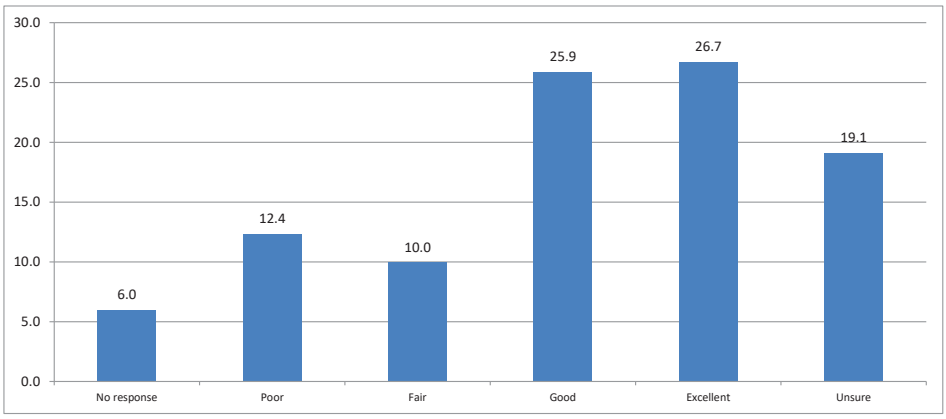

Figure 3.40. Level of understanding of the public involvement opportunities available.

In terms of being aware of educational opportunities, 53% of respondents felt they had a good to excellent level of understanding, 27.9% felt they had a fair to poor understanding of the availability of educational opportunities, 13.5% were unsure, and 5.6% did not provide a response (Figure 3.41).

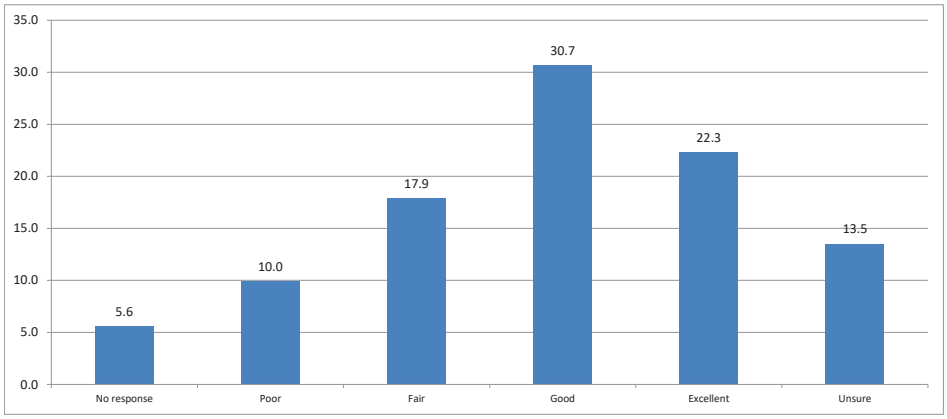

Figure 3.41. Level of understanding of the educational opportunities available.

3.1.7. Public Access

In this section, respondents were asked to provide their opinion on the adequacy of existing public access within the Bays. Public access to coastal waters and waterways has been identified as an Adequate Access management issue. Responses to this section of the survey should help managers determine which types of access have sufficient access and which areas the access is inadequate.

The majority of respondents believed that there was adequate access to boat ramps in the Bays, with 61.7% of individuals choosing either adequate or more than adequate access for this waterway access type. Only 11.2% of respondents believed that access to boat ramps was inadequate or that there was little or no access to this access type. The other 27.2% of respondents answered either neutral (9.6%), unsure (12.4%), or didn't provide a response (5.2%) to this question (Figure 3.42).

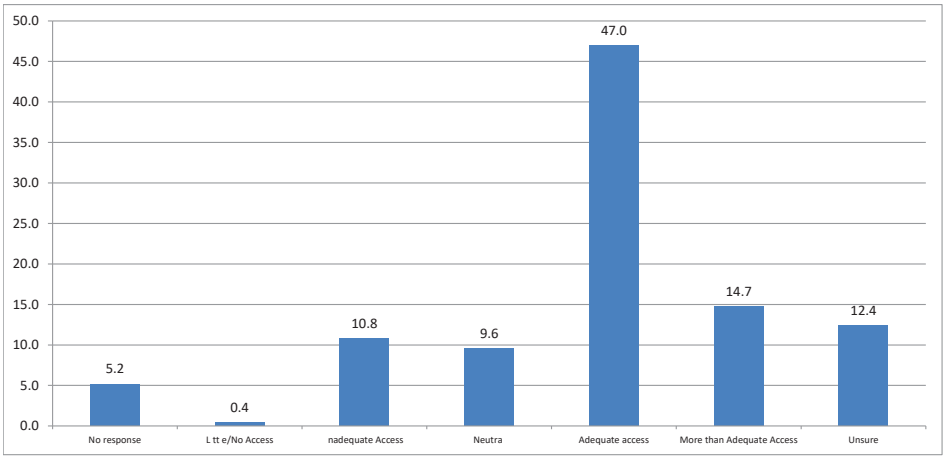

Figure 3.42. Level of adequacy of existing public access to boat ramps on the Bays.

There was a slightly stronger response among respondents that beach access was adequate in the Bays, with 71.3% of individuals choosing either adequate or more than adequate access for this waterway access type. Ten point eight percent of respondents believed there was inadequate access or little or no access to beaches in the Bays. Once again, 9.6% of respondents felt neutral about this question, while 3.2% were unsure, and 5.2% did not respond to the question, which accounted for a cumulative 18% of respondents (Figure 3.43).

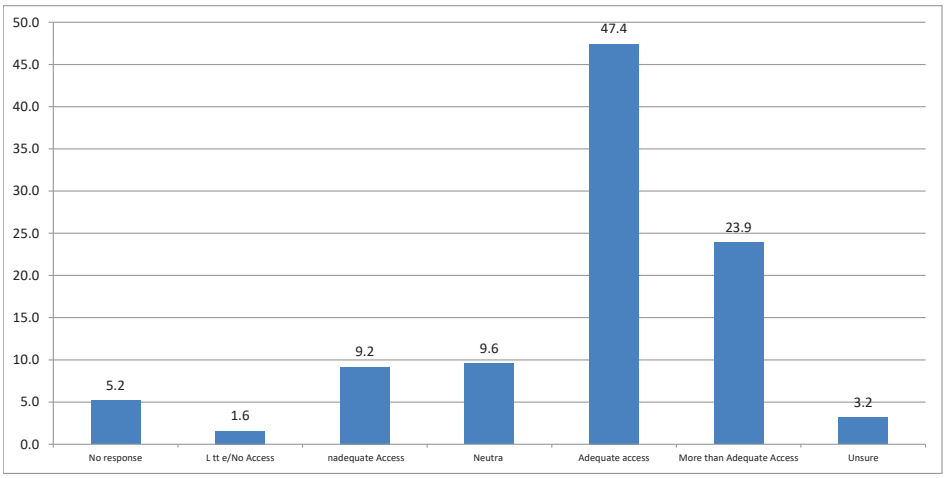

Figure 3.43. Level of adequacy of existing public access to beaches on the Bays.

A much greater proportion of respondents felt unsure (22.3%), neutral (15.5%), or didn't respond (7.6%) to the adequacy of access to boat slips, representing almost half of the respondents (45.4%). This figure represents almost double the amount of respondents who did not provide a response of adequate or inadequate for their opinion of boat ramps (27.2%). This could be due to the fact that boat slips are a more specialized access type than boat ramps, causing fewer individuals to be knowledgeable and opinionated about their level of access. Forty-five point eight percent of respondents felt that this type of access had adequate or more than adequate access in the Bays compared to just 8.8% of respondents who felt boat slips had inadequate access or little or no access (Figure 3.44).

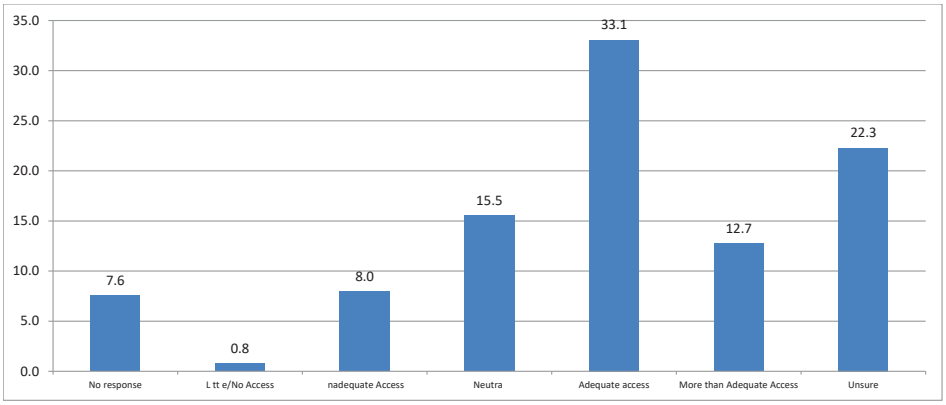

Figure 3.44. Level of adequacy of existing public access to boat slips on the Bays.

About half of respondents (55.3%) felt that access to restaurants and restaurant dockage was adequate or more than adequate, with 14.4% feeling that access was inadequate or that there was little or no access to these types. A high number of individuals felt neutral about this type of access (17.9%), while another

6.0% and 6.4% were unsure or did not respond to this question, respectively, for a total of 30.3% of respondents (Figure 3.45).

A slightly larger proportion of respondents felt that there was adequate or more than adequate access to scenic viewpoints in the Bays, accounting for 61.3% of respondents. A larger proportion of respondents (17.1%) also felt that there was inadequate access or little or no access to these viewpoints. This can be attributed to the fact that only 2% of respondents felt unsure about access to scenic viewpoints, while only 4.4% did not respond. Those who felt neutral about this type of access represented 15.1% of the respondents (Figure 3.46).

A large proportion of respondents felt unsure (16.7%), neutral (15.5%), or didn't respond (6%) to how adequate access to waterway nature trails (e.g. kayak trails) was, representing a large proportion of respondents (38.2%). This could once again be due to the specialized nature of this type of access. A total of 41.7% of respondents thought there was adequate or more than adequate access to waterway nature trails, while 19.1% of respondents thought there was inadequate access or little or no access to this in the Bays (Figure 3.47).

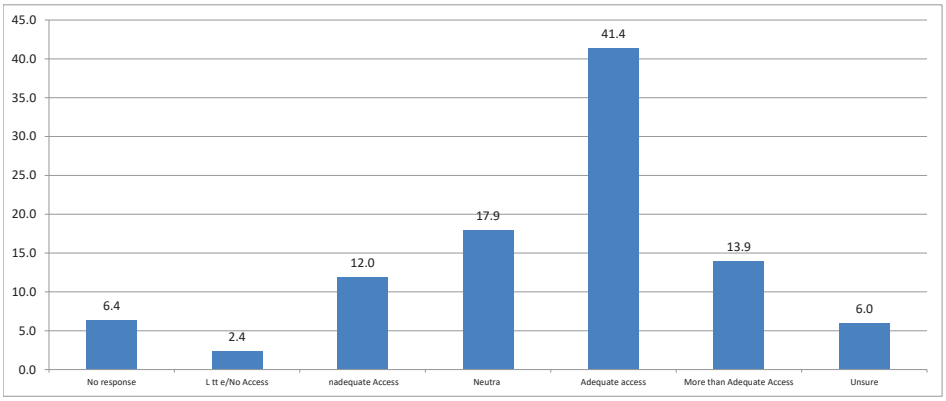

Figure 3.45. Level of adequacy of existing public access to restaurants and restaurant dockage on the Bays.

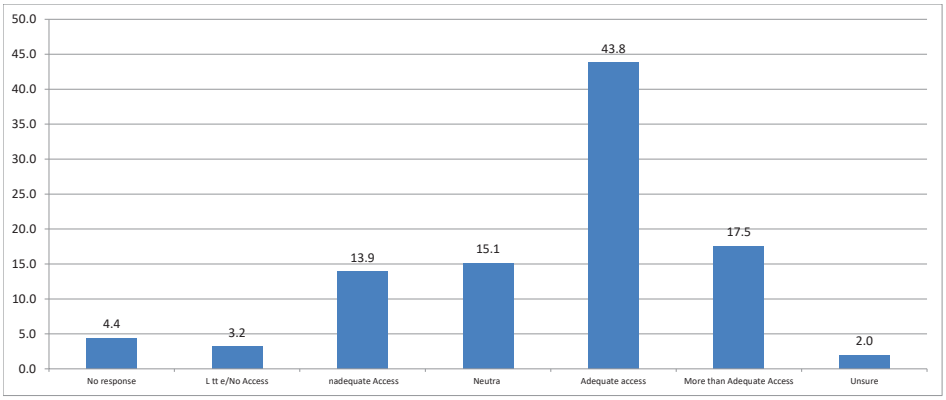

Figure 3.46. Level of adequacy of existing public access to scenic viewpoints on the Bays.

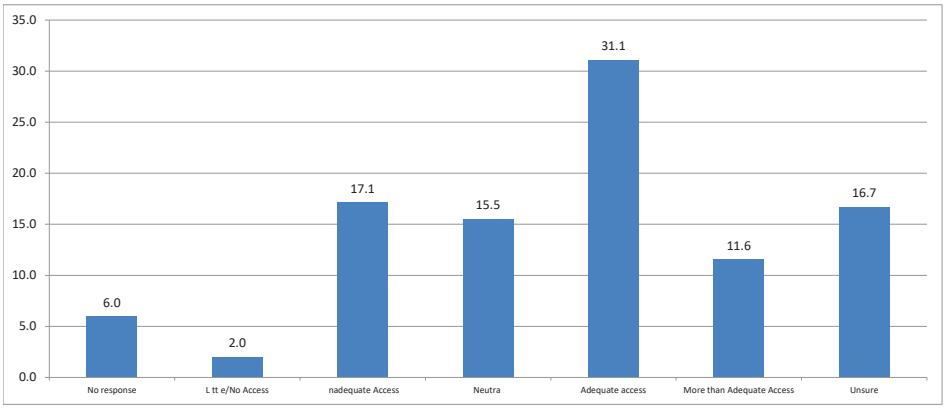

Figure 3.47. Level of adequacy of existing public access to waterway nature trails (e.g. kayak trails) on the Bays.

Alternatively, nature trails adjacent to water had a much higher proportion of respondents who felt there was inadequate access or little or no access for the Bays, representing 29.5% of respondents. Only 30.7% of respondents felt that there was adequate or more than adequate access to nature trails adjacent to water for the Bays. This makes nature trails adjacent to water almost evenly split between those who feel access is adequate and those who feel access is inadequate, separating it from the other access types that are mostly considered adequate access. A high number of respondents also felt neutral about this access type (21.1%), while 12.4% were unsure, and 6.4% did not answer the question, accounting for cumulative 39.9% of respondents (Figure 3.48).

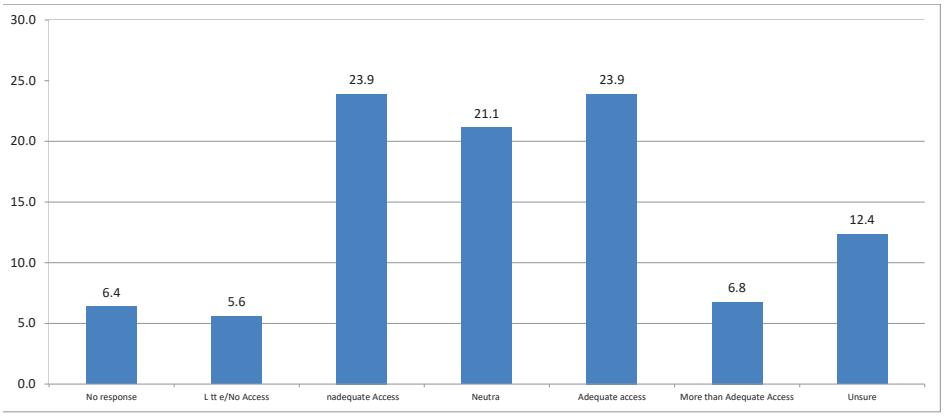

Figure 3.48. Level of adequacy of existing public access to nature trails adjacent to waters of the Bays.

A total of 44.7% of respondents felt that there was adequate or more than adequate access to natural swimming areas in the Bays, compared to 22.7% who felt there was inadequate access or little or no access. The other 32.7% of respondents answered either neutral (15.9%), unsure (11.2%), or didn't provide a response (5.6%) to the question (Figure 3.49).

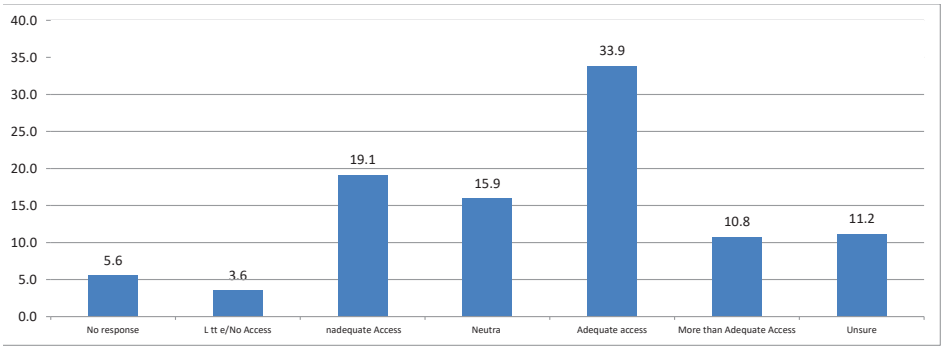

Figure 3.49. Level of adequacy of existing public access to natural swimming areas in the Bays.

A relatively high proportion (25.5%) of respondents thought there was inadequate access or little or no access to boardwalks around the Bays compared to 37.5% of respondents who thought there was adequate or more than adequate access. Individuals who felt neutral about boardwalk access represented a high proportion of respondents (23.5%), while those who were unsure or didn't respond represented 7.6% and 6.0% of respondents, respectively (Figure 3.50).

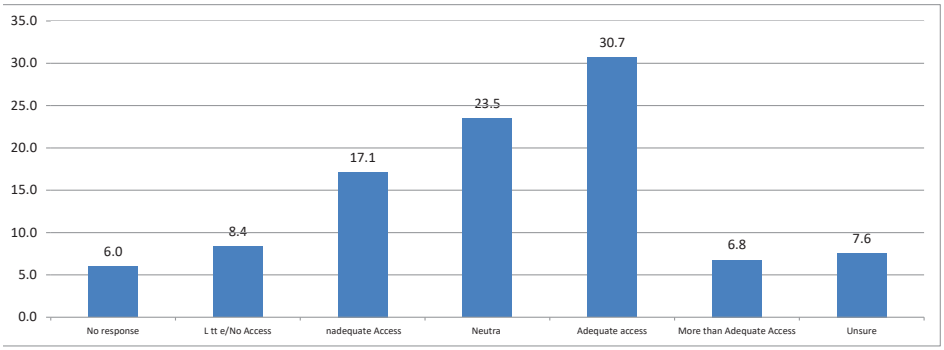

Figure 3.50. Level of adequacy of existing public access to boardwalks on the Bays.

Access to dune walkovers had the highest proportion of individuals who felt neutral about access (26.3%), with an additional large proportion of respondents who were unsure (15.9%). When combined with the proportion of those who did not respond to the question (7.2%), these individuals represent almost half of all respondents (49.5%). Of the remaining respondents, 31.5% felt that access to dune walkovers was adequate or more than adequate, while 19.1% felt that there was inadequate access or little or no access (Figure 3.51).

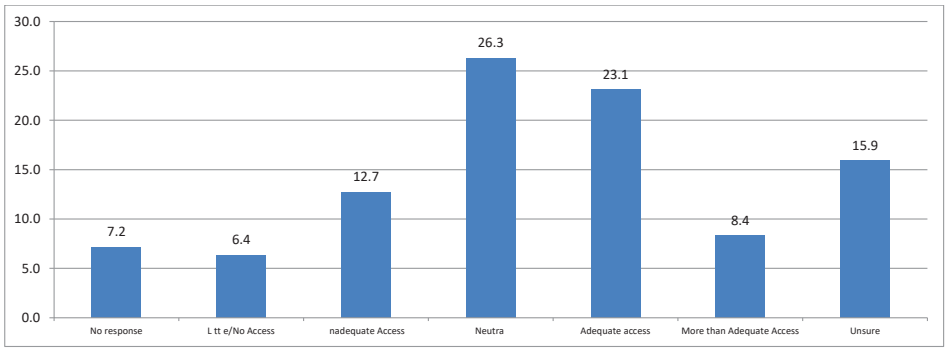

Figure 3.51. Level of adequacy of existing public access to dune walkovers of the Bays.

Over half of the respondents (52.5%) thought that access to camping was adequate or more than adequate compared to only 15.5% who thought there was inadequate access or little or no access. Those that felt neutral about camping access accounted for 15.1% of respondents, while 10.8% were unsure, and 6.0% did not respond to the question (Figure 3.52).

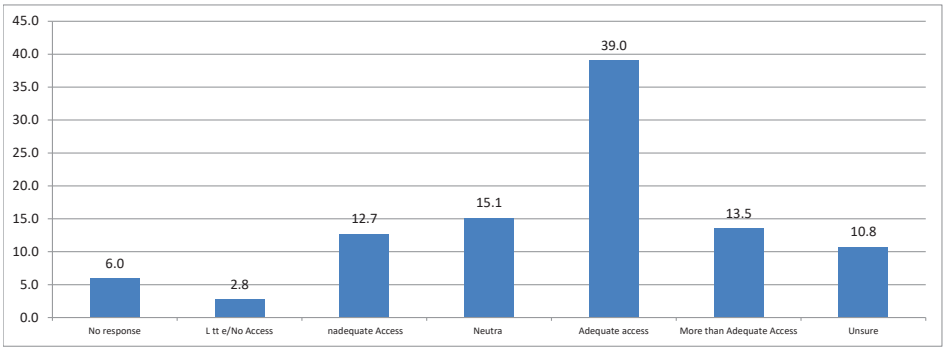

Figure 3.52. Level of adequacy of existing public access to camping on the Bays.

Access to wind/kite surfing also had a high proportion of respondents who felt neutral about access (25.9%), and also had a large proportion of individuals who were unsure (19.9%). Combined with the proportion of those who did not respond to the question (7.2%), these individuals represent over half of respondents (53%). This could be attributed to the specialized nature of this access and recreation type. A total of 39.9% of respondents felt that there was adequate or more than adequate access to wind/kite surfing, compared to only 7.6% of respondents who believed there was inadequate access or little or no access. Those 7.6% of respondents gave wind/kite surfing access the lowest proportion of individuals who believed there was inadequate access or little or no access out of any of the access types in the Bays (Figure 3.53).

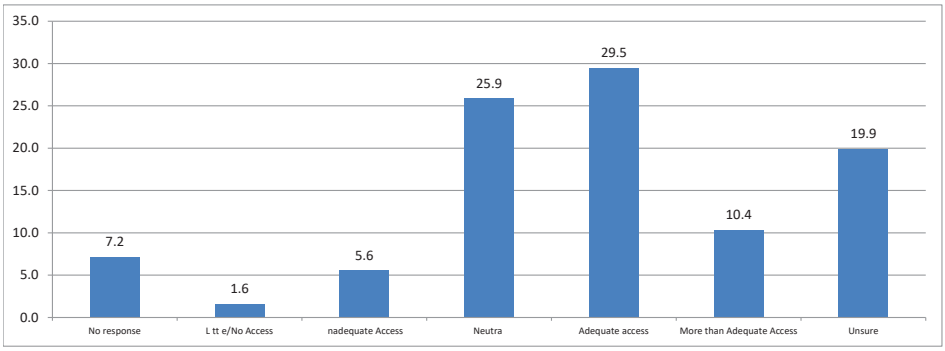

Figure 3.53. Level of adequacy of existing public access to wind/kite surfing on the Bays.

The proportion of those who felt access to kayaking sites was adequate or more than adequate (55.0%) was much greater than those who felt there was inadequate access or little or no access (12.0%). Those who felt neutral about access to kayaking sites and those who were unsure both represented 13.1% of respondents. A total of 6.8% of individuals did not provide a response to the question (Figure 3.54).

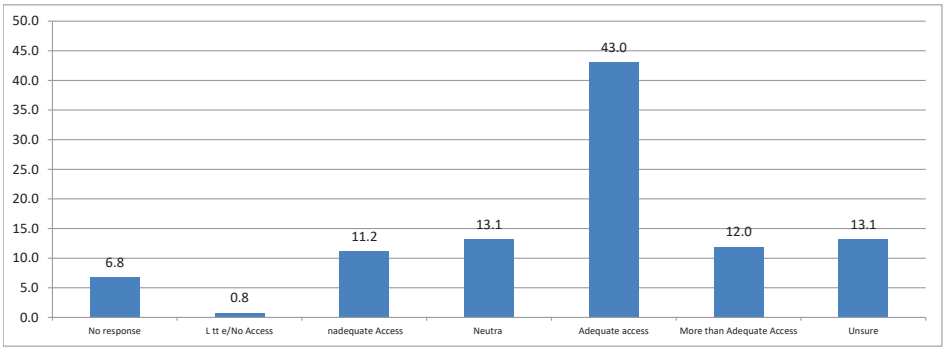

Figure 3.54. Level of adequacy of existing public access to kayaking sites on the Bays.

Access to rod-and-reel fishing sites was considered adequate or more than adequate by 63.7% of respondents. This was greater than those who felt that there was inadequate or little to no access (13.2%). The respondents that were unsure or provided no answer comprised 13.2% of the total. Only 10% of respondents were neutral on the topic of rod-and-reel fishing access (Figure 3.55).

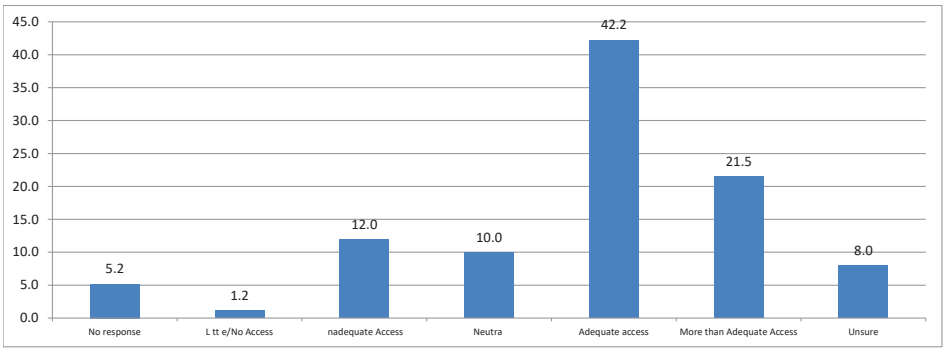

Figure 3.55. Level of adequacy of existing public access to rod-and-reel fishing sites of the Bays.

Perhaps reflecting the obscurity of fly fishing, 56.6% of respondents were either unsure, were neutral, or did not provide a response as to the level of access for fly fishing sites in and around the Bays. Whereas 30.3% felt that there was adequate or more than adequate access to fly fishing locations, and 13.2% felt that there was inadequate or little to no access for fly fishing in the Mission-Aransas Bay complex (Figure 3.56).

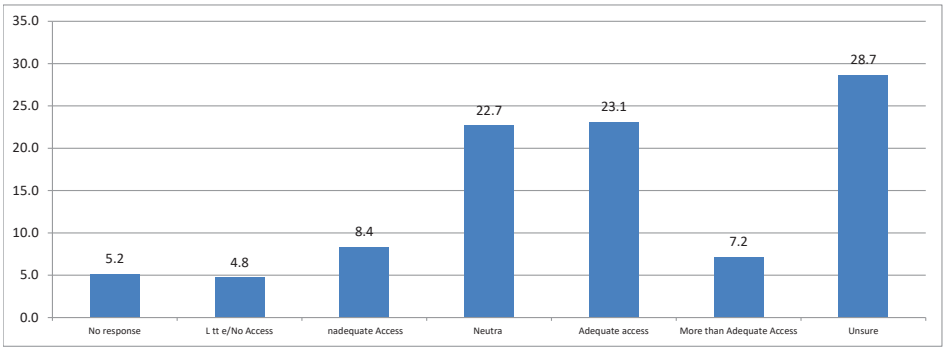

Figure 3.56. Level of adequacy of existing public access to fly fishing sites of the Bays.

Respondent attitudes toward access to public oyster sites also seemed to reflect limited public involvement in the activity with a total of 64.5% of respondents either not responding (8.0%), unsure (40.6%), or neutral (16.3%) on the subject of access to public oyster sites. Only 16.7% thought there was adequate or more than adequate access, and 18.4% thought there to be little to no access or inadequate levels of access to public oyster sites (Figure 3.57).

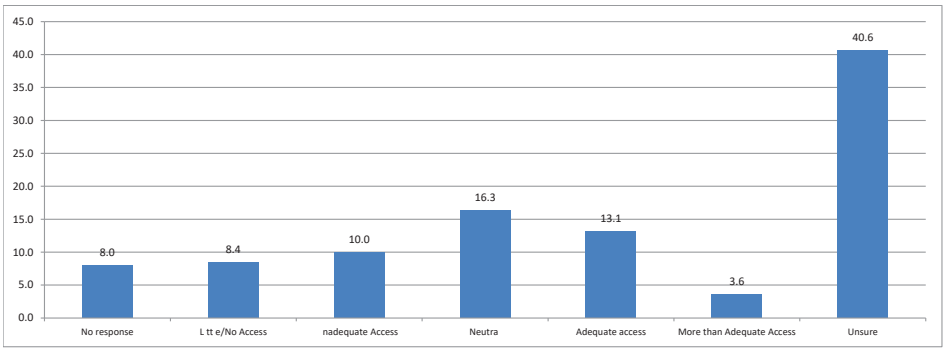

Figure 3.57. Level of adequacy of existing public access to public oyster sites in the Bays.

3.1.8. Demographics

The final section of the survey asked some general demographic questions of the respondents. 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, however 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 rather than have to give an age, respondents would be more comfortable revealing their birth year.

Our first question asked the respondents if any of their household income dependent upon the products or services related to Bay resources. Interestingly, 76.9% of respondents claimed that their income was not dependent upon Bay resources, a total of 5.2% were unsure or provided no response, and 17.9% said their income hinged upon available Bay resources. We then asked those that said their income depended upon Bay resources to describe the source of their income. Twenty-nine point eight percent said tourism was the primary source of income, 38.3% said "other," 10.6% said oil and gas, 8.5% said commercial fishing, 2.1% said commercial oystering, and 10.6% claimed multiple source of income derived from Bay resources.

The average birth year for respondents was 1957, making the average age of respondents 57. Males and females were fairly evenly divided, at 53.4% and 45%, respectively. A college education or graduate degree was claimed by 71.7% of respondents, with 22.3% claiming a high school diploma or GED, 1.2% had less than a high school diploma, and 4.8% did not respond.

In terms of income level, 60.2% of the respondents earned over $40,000 a year, 16.7% earned less than $40,000/year, and 23.1% did not respond to the inquiry. While a list of occupations derived from respondents would overwhelming, it is possible to say that a good portion of the respondents were retired (31.2%).

The ethnicity question found that 75.7% of respondents were not Hispanic or Latino, 15.1% were Hispanic or Latino, and 9.2% did not answer the question. Coupled with the ethnicity question was a question asking which racial categories the respondent identified with the most. An overwhelming majority reported being Caucasian (80.5%), 13.1% did not respond, 4% answered Native American/American Indian/Alaskan Native, and less than 1% answered Asian, Black (or African American), or Native Hawaiian or Other Pacific Islander. Only 0.4% claimed multiple racial identities.

3.2. SolVES ANALYSIS

While the low response rates for this survey effort preclude the suggestion of any representativeness to the general population of the area, other analyses can be undertaken; specifically spatial analysis. Our survey incorporated a two-part mapping exercise: the first asked respondents to distribute 100 "pennies" across 13 value categories typically associated with ecosystem services, and the second asked respondents to situate these values on an 11" by 17" map of the Reserve study area (for the paper-based survey) or within the Google user interface if they chose to complete the online version of the survey. We asked respondents to place markers or dots on the maps they believed reflected the values they selected in the allocation exercise. We accepted only the results from respondents completing both parts of the mapping exercise for this analysis.

The survey data were analyzed using version 2.0 of the SolVES (http://solves.cr.usgs.gov) GIS application developed by researchers at the United States Geological Survey (Sherrouse et al., 2014). This particular version of the SolVES application included the functionality found in the Maximum Entropy (MaxEnt) modeling software (Phillips et al., 2006). The locations to which respondents assigned values on paper maps were digitized using ArcGIS 10.2.1 software and placed as a point feature class in a geodatabase. The locations of assigned value entered using the Google maps interface were transformed to the WGS 1984 geographic coordinate system, then into the State Plane Coordinate System for inclusion into the working geodatabase. In total there were 1,962 points from all mapping efforts (Figure 3.19, Table 3.2). Next, weighted kernel density surface layers were generated for each of the assigned value categories and then normalized, transformed, and standardized on a 10-point "Value Index" (VI) using SolVES (Sherrouse et al., 2014). 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 we 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.

We used a variety of explanatory environmental feature layers for MaxEnt analysis based on past iterations of the application (Cole, 2012; Sherrouse et al., 2012; van Riper and Kyle, 2014a and 2014b) and the belief that they may have an influential role in the perceived values of the Reserve. The first environmental feature layer was the 2006-era land use-land cover - a 24 class categorical raster dataset for the Reserve developed by the NOAA Coastal Services Center Coastal Change Analysis Program (C-CAP). The second feature layer was a combination of the Coastal Bend Texas Benthic Habitat Mapping Redfish Bay, the Coastal Bend Texas Benthic Habitat Mapping Copano Bay, and the Coastal Bend Texas Benthic Habitat Mapping Aransas Bay. The three, 8-class categorical vector files were merged using ArcGIS 10.2.1 into one vector shapefile, converted to a raster image and stored in the working geodatabase. The third, fourth, and fifth layer files were distance to water treatment plant outfalls, distance to rookeries, and distance to access points in the Reserve. The Euclidean Distance tool in the ArcGIS 10.2.1 Spatial Analyst extension was used to create these raster based files. In the SolVES analysis, all environmental feature layers were treated as 25 m resolution raster images and the results generated reflected a 250 m output cell size. Because some respondents placed points outside of the study area boundary, we used a 3,219 m buffer around the Reserve study area so as to include as many value points in the analysis as possible. The final VI maps generated using SolVES and MaxEnt allowed for the analysis of the clustering, randomness, and dispersion of the assigned value points using completely spatially random (CSR) hypothesis testing to determine the average nearest neighbor statistic (Brown et al., 2002; Sherrouse et al., 2012). For a more detailed explanation of the SolVES application see Sherrouse et al. (2012, 2014).

The objectives of spatial analysis using the SolVES application are to determine the social values that are most favored by the respondents, understand the location and interaction of those values with environmental features, and examine the spatial statistics to determine if there is any clustering, randomness, and/or dispersion of the spatially assigned social values. We were able to determine that biodiversity, recreation, aesthetics, and economics received the most "pennies" in the allocation exercise, respectively, leading us to conclude that the Reserve Bay complex is valued most for those reasons (Table 3.1). We found that all but three of the social values in the typology clustered to a statistically significant degree. In other words, nearest neighbor statistics indicated a grouping together across the study area of those places assigned value in ten of the thirteen value types (Table 3.3).

Table 3.3. Clustering of social values points.

Value Type	N	R-ratio	Z-score	Clustered
Aesthetic	240	0.813926	-5.51472	Y
Biodiversity	136	0.807417	-4.29653	Y
Economic	138	0.795811	-4.58884	Y
Legacy	85	0.722451	-4.8953	Y
In and of Itself	95	0.906969	-1.73468	Y
Learning	100	0.683068	-6.06313	Y
Human Needs	95	0.842433	-2.93804	Y
Recreation	327	0.763659	-8.17604	Y
Spiritual	58	0.955868	-0.64299	N
Therapeutic	89	0.84265	-2.83982	Y
Wilderness	151	0.878842	-2.8482	Y
Inspiration	52	0.999737	-0.00363	N
Socializing	58	0.893315	-1.55435	N

At the time of this writing, the C-CAP codes used in this analysis were being "cross-walked" to a new land-cover classification system, the "Coastal and Marine Ecological Classification Standard" (CMECS) which should provide much greater detail at the scale needed for this type of analysis; until that is complete the broader C-CAP landscape categories must be used. Nevertheless, spatial analysis can still be undertaken.

The clustering found in the four most allocated social values indicates that the highest Values Indices are associated with landscape features one would expect. For example, the social value Biodiversity (as shown in Figure 3.58) had the “Scrub/Shrub” and “Estuarine Aquatic Bed” landscape categories as the categories containing the majority of the highest Values Indices when compared to other landscape categories. Redfish Bay is the largest area in the Bay complex exhibiting the type “Scrub/Shrub” and is considered by many to be very biodiverse (Tremblay et al., 2008). Estuarine Aquatic Bed classification contains a number of sub-categories such as “Rooted Algal,” “Drift Algal,” “Rooted Vascular,” Floating Vascular,” and “Faunal” all of which describe the types of vegetation found in this land-cover type.

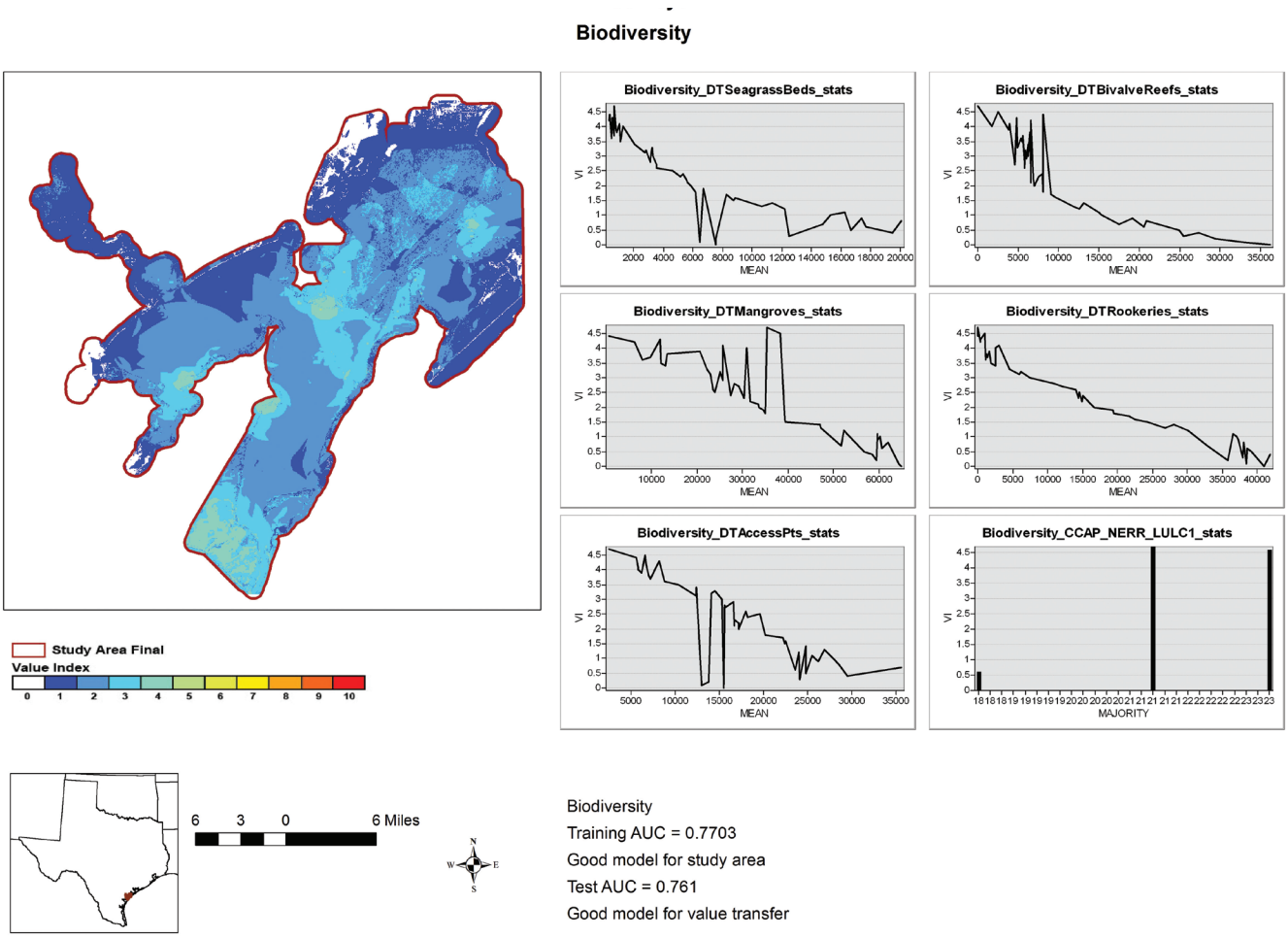

Figure 3.58. Results from the SolVES model run for Biodiversity.

The social value of Recreation (as shown in Figure 3.59) had "Estuarine Emergent Wetlands" and "Water" landscape categories associated with the majority of top level Value Indices. Estuarine Emergent Wetlands are those that "[include] all tidal wetlands dominated by erect, rooted, herbaceous hydrophytes (excluding mosses and lichens). Wetlands that occur in tidal areas in which salinity due to ocean-derived salts is equal to or greater than 0.5 percent and that are present for most of the growing season in most years. Perennial plants usually dominate these wetlands. Total vegetation cover is greater than 80 percent" (HARC, 2011). Species commonly found in Estuarine Emergent Wetlands include the following: "Cordgrass (*Spartina* spp.), needlerush (*Juncus roemerianus*), narrow leaved cattail (*Typha angustifolia*), southern wild rice (*Zizaniopsis miliacea*), common pickleweed (*Salicornia virginica*), sea blite (*Suaeda californica*), and arrow grass (*Triglochin martimum*)" (HARC 2011). Many species of wildlife take refuge in or are reared in this setting as well, including many species of fish, shrimp, and crab. The Water landscape type, one could naturally assume in a coastal setting, would be a landscape category that is readily associated with Recreation.

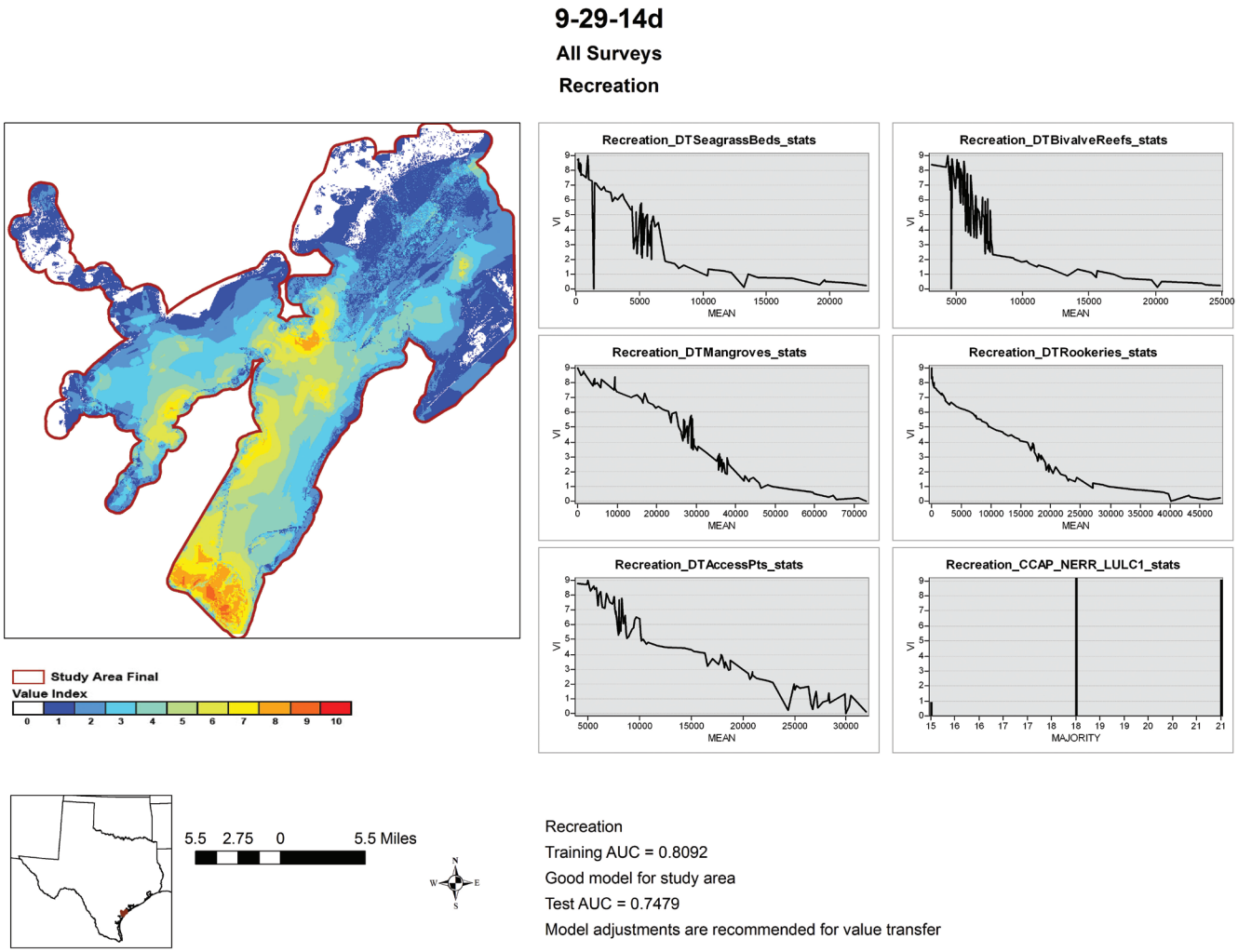

Figure 3.59. Results from the SolVES model run for Recreation.

For the Aesthetic social value (as shown in Figure 3.60), the only landscape category that had a majority of the highest Value Indices appear were in the "Water" category. This, too, makes sense intuitively, as some of the best views in the Bays occur when one is looking out over the water.

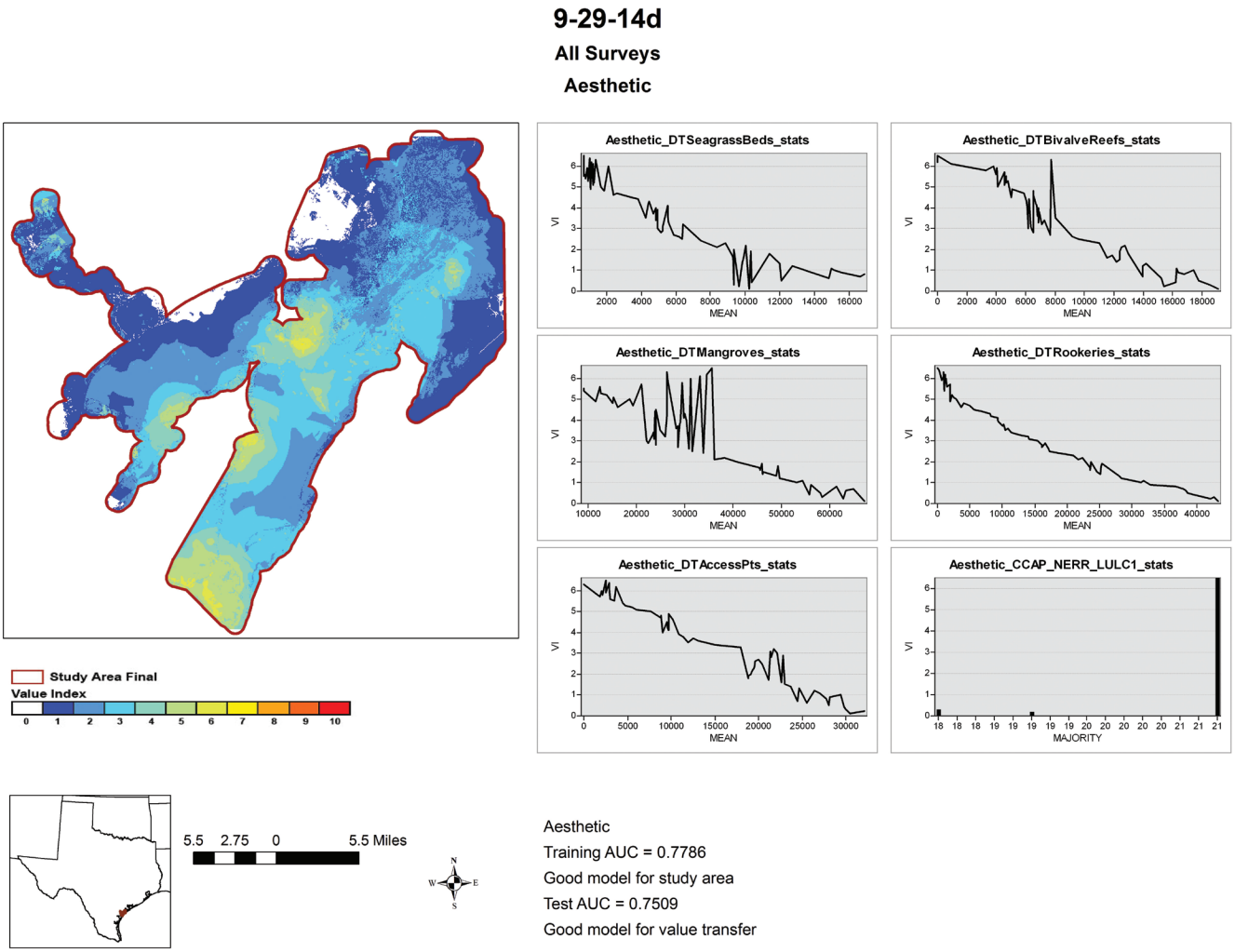

Figure 3.60. Results from the SolVES model run for Aesthetic.

Surfers at Port Aransas Beach Park. Photo credit: Susan Lovelace, NOAA

The fourth highest rated social value type was Economic (shown in Figure 3.61) and the landscape categories most associated with the social value were "High Intensity Developed" and "Water," again, landscape categories that one would think would be linked closely to this region's economy. High Intensity Developed landscapes are areas that are urban in nature and would include places of business, housing, and community. The Water landscape would also be very economically important given the region's coastal orientation and heavy dependence upon the resources contained in, float upon (e.g. shipping), or are found under water.

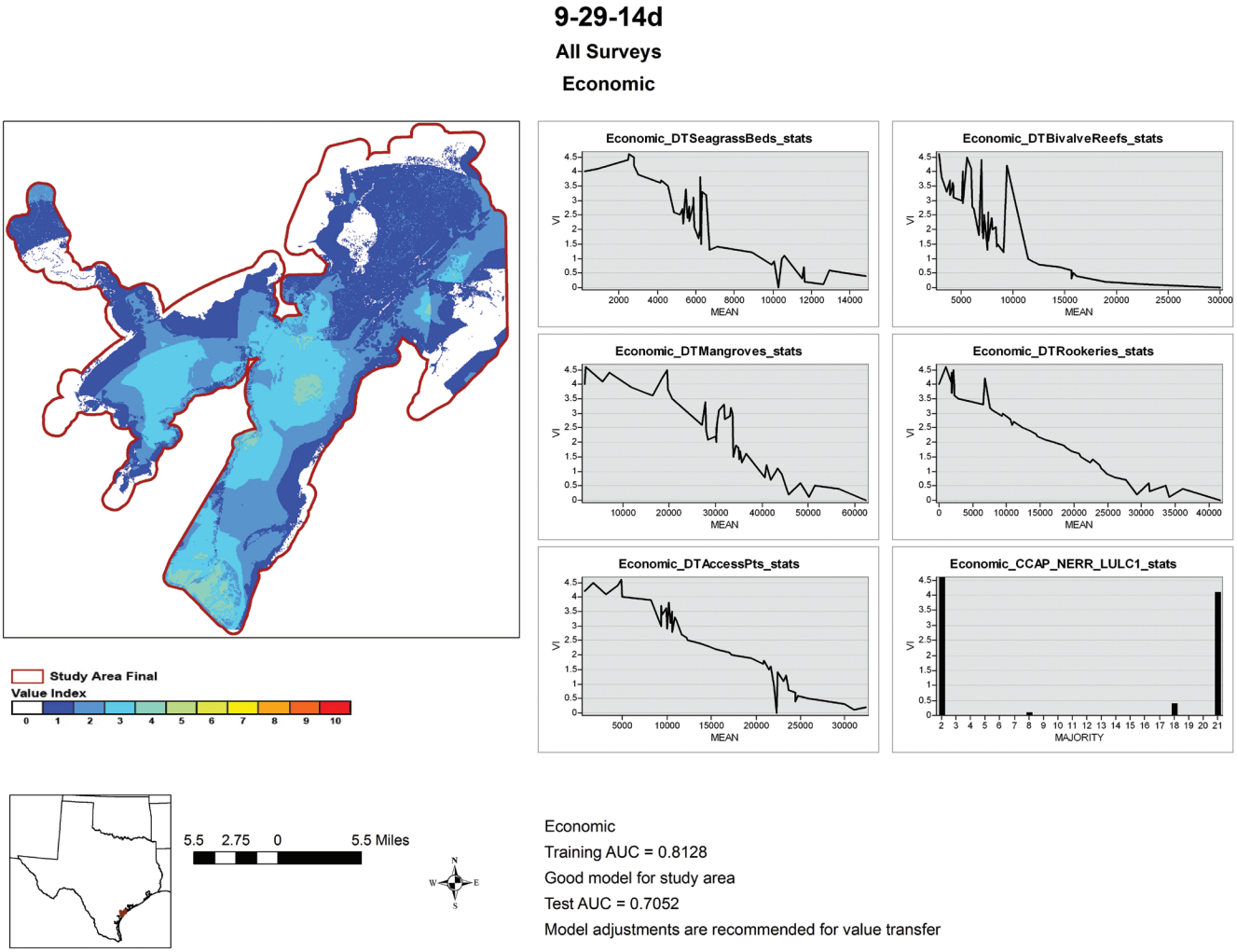

Figure 3.61. Results from the SolVES model run for Economic.

3.3. PLACE ATTACHMENT AND ZCTA LOCATION

The 20-mi buffer is labeled as group 1, the 120-mi buffer is group 2, and so on up to group 6. For analysis purposes, we combined groups 1, 2, and 3 into one overarching group and combined groups 4, 5, and 6 into another. These two groups represent respondents residing within 240 miles of the Reserve and those living outside the 240 mile buffer, respectively (Figure 3.62). We then examined responses to seven prompts related to the idea of Place Attachment and their relationship to the groups. Setting up the contingency table alerted us to the fact that a Chi-Square test might not be a valid test given that some cells in the 2 X 6 matrices had expected counts less than five. Therefore, we elected to use Fisher's Exact Test (F.E.T.). In the final analysis, we found significant relationships in four cases (Table 3.4). The four prompts having a significant relationship are: "The Bays represent a way of life for my community", "The Bays are important for providing habitat for fish and other wildlife", "My community's economy depends on the natural resources of the Bays", and "The Bays contribute to the character of my community." Then using the Somers' D statistic we found statistically significant negative direction in every case (Table 3.4). Because the Somers' D statistic is a proportional reduction of error (PRE) measure of strength, the value -0.5150, for example, tells us we can improve our prediction by 51.5% if we know the respondents' proximity to the Reserve. Additionally, the negative directionality of the Somers' D

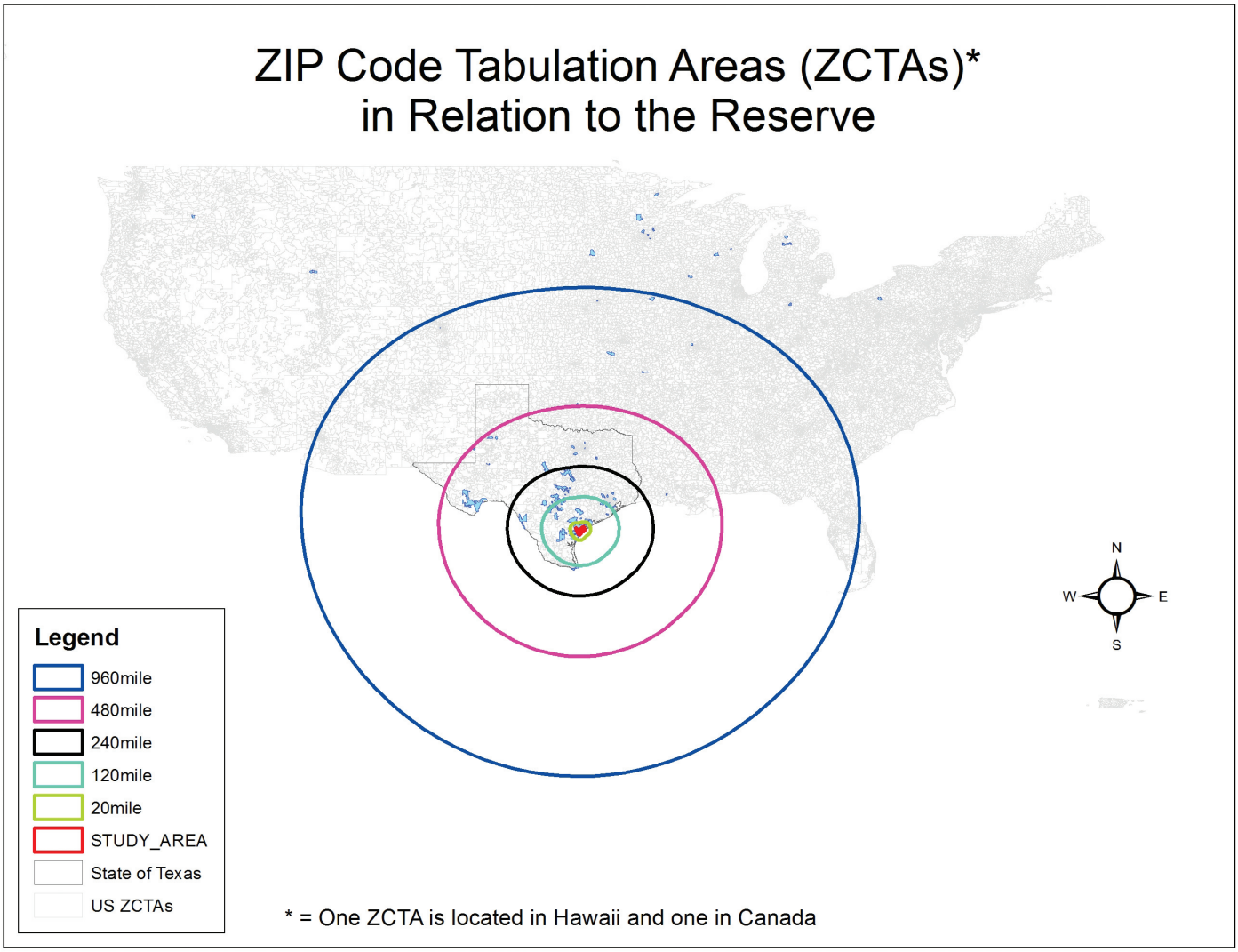

Figure 3.62. ZIP Code Tabulation Areas (ZCTAs) with buffer rings indicating their distance from the Reserve.

statistic tells us that as the value for the independent variable (the ZCTA Group) increases, values for the dependent variable (Place Attachment agreement) decreases. In other words, the farther a respondent resides from the Reserve, the less likely they are to agree with the place attachment prompts.

In terms of the overall relationship of ZCTA proximity to the Reserve and the average of place attachment answers for respondents (Figure 3.62), we see more of the same: the farther from the Reserve that the respondent resides, the less their overall place attachment becomes.

*Table 3.4. Results from place attachment statistical analyses. * significant*

Prompt	F.E.T. Pr <= P	Somers' *D* R|C	ASE	Clustered
The Bays are the best place to satisfy my outdoor recreation needs	0.143	-0.1491	0.0824	Y
The Bays represent a way of life in my community*	9.82E-07	-0.5105	0.0797	Y
The Bays are important for providing habitat for fish and other wildlife*	0.0446	-0.1527	0.0768	Y
I am very attached to the Bays	0.1662	-0.136	0.0914	Y
I get more satisfaction out of visiting the Bays than any other place	0.4519	0.0697	0.0855	Y
My community's economy depends on the natural resources of the Bays*	3.08E-05	-0.4494	0.0912	Y
The Bays contribute to the character of my community*	3.54E-07	-0.5176	0.0852	Y
Place Attachment Average	**5.97E-04**	**-0.3489**	**0.0943**	**Y**

3.4. ANALYSIS OF RESIDENT STATUS

The three user groups surveyed consisting of permanent residents, seasonal residents ("Winter Texans"), and visitors were analyzed to differentiate user type based on their knowledge, attitudes, and perceptions of the Bays. 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:

1. Permanent Residency (1 if the respondent was a permanent resident, 0 otherwise)
2. Seasonal Residency (1 if the respondent was a seasonal resident, 0 otherwise)
3. Visitor Status (1 if the respondent was a visitor, 0 otherwise)
4. Visitation of the Bays (1 if the respondent has ever visited the Bays or areas nearby, 0 otherwise)
5. Visitation Frequency (1 if the respondent visits the Bays once per month or more, 0 otherwise)
6. Income Dependency (1 if the respondent's income is dependent upon the Bays, 0 otherwise)
7. Race (1 if the respondent was white, 0 otherwise)
8. Ethnicity (1 if the respondent was Hispanic, 0 otherwise)
9. Education (1 if the respondent completed college, 0 otherwise)

Additive indices were also created for the following groups of questions to satisfy the assumptions of Pearson correlation analysis:

1. Agreement with statements of value concerning place attachment to the Bays
2. Priority of management goals
3. Public knowledge of management dimensions
4. Perceptions concerning public access to the Bays
5. Changes in the biological and geophysical attributes of the Bays
   - A few other stipulations apply to this "attributes index":
     a. For the questions concerning erosion, red tide occurrences, and jellyfish; respondents' choices were flipped (i.e. 1=5, 2=4, 3=3, 4=2, 5=1).
     b. This was done only for the purpose of creating the index for the correlation analysis; choices were not flipped for the ANOVA analyses.
     c. Since these above variables are usually interpreted as consequences (not benefits), we wanted the index measure to reflect this.
     d. An increase in these above variables is bad, whereas an increase in the other variables in the index (oysters, blue crabs, fish, sea grass, birds, wildlife, access) is good; hence the "flipping" of the responses for erosion, red tide, and jellyfish.
     e. An example of a "positive perception" would be the perception of an increase in oysters and a decrease in erosion.
     f. Therefore, this index value increases as positive perception concerning changes in attributes increases.

3.4.1. Pearson Correlation Analysis

Table 3.5 displays what variables correspond to the three different statuses of residency. Results indicate that respondents who were permanent residents were more likely to visit the Bays once per month or more, believe there has been a decrease in the positive attributes of the Bays, agree more with statements concerning the value of the Bays, allocate more of their budget of "100 pennies" to economic value, place more points of value on the map, have their income dependent on the Bays, have more knowledge concerning the various dimensions of Bays' management, and to have completed college. Seasonal residents were more likely to believe there has been an increase in the positive attributes of the Bays and allocate more of their budget of "100 pennies" to socializing value. Visitors were more likely to not visit the Bays once per month or more, agree less with statements concerning the value of the Bays, allocate more of their budget of "100 pennies" to "in and of itself" value, allocate less of their budget of "100 pennies" to therapeutic value, place less points of value on the map, not have their income dependent on the Bays, and to have not completed college.

*Table 3.5. Correlation Matrix. *= significant at 10% level, **= significant at 5% level, ***= significant at 1% level*

Access Type	Seasonal Resident	Permanent Resident	Visitor
Seasonal Resident	1		
Permanent Resident	-0.450***	1	
Visitor	-0.186***	-0.793***	1
Visit Bays or areas nearby	-.010	.041	-.039
Visit Bays at least once a month or more	--.055	0.457***	-0.467***
Positive Change in Attributes Index	0.236**	-0.238**	.136
Agree With Statement Index	-.009	0.367***	-0.467***
Aesthetic Value	0.32	-.044	.027
Biodiversity Value	-.010	-.033	.043
Economic Value	-.065	0.132**	-.101
Legacy Value	.025	.030	-.050
In And Of Itself Value	-.042	-.075	0.111*
Learning Value	-.029	-.014	.034
Human Needs Value	-0.40	.032	-.008
Recreation Value	.043	.066	-.102
Spiritual Value	-.044	-.035	.068
Therapeutic Value	.035	.100	-0.134**
Wilderness Value	-.050	-.028	.065
Inspiration Value	.079	-.072	.026
Socializing Value	0.115*	-.081	.010
Number of Map Points	.058	0.140**	-0.193
Management Priority Index	-.108	.112	-.053
Management Knowledge Index	-.116	0.163**	-.104
Access Index	.104	.082	-.150
Income Depends on Bays	-.080	0.237***	-0.206***
Age	.060	-.046	.011
Male	-.069	.087	-.049
Completed College	-.019	0.164**	-0.167***
Income ≤39k	-.027	.084	-.075
Income 40k-69.9k	-.035	.060	-.043
Income≥70k	-.001	-.096	.107
Hispanic	-.055	-.066	.107
White	.025	-.093	.085

3.4.2. One-Way ANOVA Analysis

The following analysis examines how the three different groups of residents differed in their knowledge, attitudes, and perceptions pertaining to the following groups of questions contained in the survey instrument:

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

The Tukey's HSD post-hoc comparison procedure was used to test for statistically significant differences amongst each resident group. Only statistically significant findings will be reported below. In the following tables, the number (1) will correspond to seasonal residents, (2) will correspond to permanent residents, and (3) will correspond 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.

3.4.2.1. Changes in the biological and geophysical attributes of the Bays

Higher mean values indicate the perception of an increase in that particular attribute (an increase in erosion is considered negative). Permanent residents were more pessimistic as it pertains to the changes in abundance of fish and blue crabs when compared to visitors. Permanent residents were also more pessimistic as it pertains to the change in shoreline erosion when compared to seasonal residents as well as visitors (Table 3.6).

*Table 3.6. Attribute ANOVA Results. *= significant at 10% level, **= significant at 5% level, ***= significant at 1% level*

Change in Attributes	Seasonal Resident (1)		Permanent Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
Abundance of fish	18	2.67	106	2.57	47	2.91	3>2*	0.06
Abundance of blue crabs	11	2.55	90	2.24	30	2.70	3>2**	0.04
Shoreline erosion	15	3.13	107	3.55	43	3.28	2>1*, 2>3*	0.06, 0.06

3.4.2.2. Agreement with statements of value concerning place attachment to the Bays

Higher mean values indicate higher agreeability with the statement. Permanent and seasonal residents were overall more likely to agree with the statements and place a higher value on the Bays when compared to visitors. In some cases (way of life and community character), permanent residents were more likely to place a higher value on the Bays when compared to seasonal residents. Permanent residents had the greatest mean values across all variables for this group of questions (Table 3.7).

*Table 3.7. Place Attachment ANOVA Results. *= significant at 10% level, **= significant at 5% level, ***= significant at 1% level*

Access Type	Seasonal Resident (1)		Permanent Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
The Bays represent a way of life in my community	22	3.82	163	4.44	50	3.16	2>1***, 2>3***, 1>3**	<0.01, <0.01, 0.014
The Bays are important for providing habitat for fish and other wildlife	24	4.87	165	4.89	58	4.66	1>3**, 2>3***	0.05, <0.01
I am very attached to the Bays	23	4.26	165	4.47	56	4.23	2>3***	0.09
My community's economy depends on the natural resources of the Bays	24	3.96	161	4.27	51	3.02	1>3***, 2>3***	<0.01, <0.01
The Bays contirbute to the character of my community	24	4.04	165	4.56	51	3.31	1>3***, 2>3***, 2>1**	<0.01, <0.01, 0.03

3.4.2.3. Priority of management goals

Higher mean values indicate the perception of higher priority. Permanent residents placed a higher priority on improving freshwater inflows, managing the quantity/improving the quality of storm water runoff, and restoring wetland habitats when compared to seasonal residents. A higher priority on providing increased

levels of public access was placed by visitors when compared to permanent residents. Visitors also placed a higher priority on managing the quantity/improving the quality of storm water runoff and restoring wetland habitats when compared to seasonal residents (Table 3.8).

*Table 3.8. Management Goals ANOVA Results. *= significant at 10% level, **= significant at 5% level, ***= significant at 1% level*

Management Goal	Seasonal Resident (1)		Permanent Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
Improve freshwater inflows into the Bays	21	4.05	153	4.44	50	4.22	2>1*	0.10
Manage the quantity and improve the quality of stormwater runoff to the bays	23	3.83	154	4.38	57	4.26	2>1***, 3>1*	<0.01, 0.08
Restore shoreline and wetland habitats	24	3.92	157	4.33	58	4.40	2>1*, 3>1*	0.08, 0.06
Provide increased levels of public access to the Bays and its resources	24	3.38	158	2.99	58	3.55	3>2**	0.011

3.4.2.4. Public knowledge of management dimensions

Higher mean values indicate more knowledge of that particular dimension. The only significant finding in this analysis corresponds to the management dimension of history. Permanent residents had more knowledge concerning the management dimension of history when compared to visitors and seasonal residents (Table 3.9).

*Table 3.9. Management Knowledge ANOVA Results. *= significant at 10% level, **= significant at 5% level, ***= significant at 1% level*

Management Dimension	Seasonal Resident (1)		Permanent Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
History	20	2.00	152	2.68	44	2.34	2>3*, 2>1***	0.07, <0.01

3.4.2.5. Perceptions concerning public access to the Bays

Higher mean values indicate the perception of adequate access to the particular entity. Visitors were more likely to believe that there is adequate access to restaurants/restaurant dockage and boardwalks when compared to permanent residents (Table 3.10).

*Table 3.10. Public Access ANOVA Results. *= significant at 10% level, **= significant at 5% level, ***= significant at 1% level*

Access Type	Seasonal Resident (1)		Permanent Resident (2)		Visitor (3)		One-Way ANOVA (Tukey post-hoc) difference	
	n	Mean	n	Mean	n	Mean	Groups	p
Restaurants and restaurant dockage	20	3.60	147	3.49	53	3.91	3>2**	0.03
Boardwalks	20	3.20	143	3.00	54	3.41	3>2*	0.06

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Photo credit: Susan Lovelace, NOAA

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Appendix A
Survey Instrument

Photo credit: Jane Willard, 2012 Mission-Aransas NERR Photography Contest Winner

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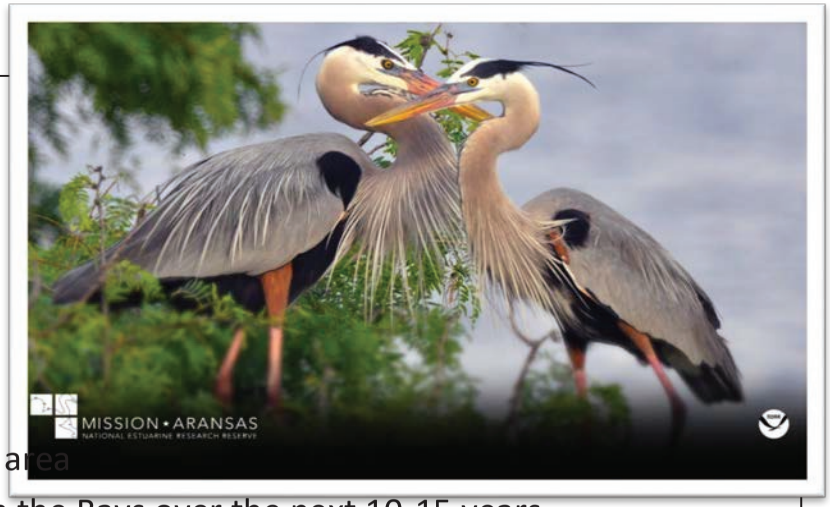
Mission-Aransas Bays Area Survey



How do you value the Bays of the Mission-Aransas area and its natural resources?

We invite you to participate in this confidential and very brief survey (estimated 20 minutes).
The purpose of this survey is to:

- Discover ways you value the Bays
- Map where those values are represented in the study area
- Gather your opinion regarding important topics within the Bays over the next 10-15 years
- Explore your familiarity with the Bays

This survey asks questions related to the Bays and the Reserve; this includes areas around the Copano and Aransas Bays. The University of Texas manages the Reserve as a non-regulatory research and education program. Thank you in advance for your participation and thoughtful responses to our questionnaire.

You also have the option of completing this survey online by using the following URL:

http://products.coastalscience.noaa.gov/nerr_survey/

I have read this consent form, and I agree to participate in this research study and certify that I am at least 18 years old ____ (CHECK HERE)

The United States Office of Management and Budget has approved this research study.

OMB Code: 0648-0687

Comments or questions concerning this research study or survey please contact Jarrod Loerzel at jarrod.loerzel@noaa.gov (or by phone 843.762.8864).

1. First, can you please tell us the ZIP code for the area that you live in? _____

2. How many years have you lived in or nearby this location? _____

3. Do you consider yourself a:
_____ seasonal resident
_____ permanent resident, or a
_____ visitor

4. Have you ever visited the Bays or areas nearby?
_____Yes _____No _____ Unsure/don't know

5. If you answered yes or unsure to question 4, about how often?
_____every day
_____once a week
_____once a month
_____twice or more a year
_____once a year

Next, we would like to ask for your opinion of the changes you have seen in the Bays while you have lived in or have been visiting the area. Please tell us if you have seen a "Large Increase", "Increase", "No Change", "Decrease", "Large Decrease", or "Unsure or Don't Know." Please place an "X" in the category that best describes your opinion for each attribute.

Attributes	Large Increase	Increase	No Change	Decrease	Large Decrease	Unsure or Don't Know
Abundance of oysters						
Abundance of fish						
Abundance of blue crabs						
Abundance of seagrass						
Shoreline erosion						
Abundance of wildlife						
Public access to land and water resources						
Red tide occurrences						
Abundance of jellyfish						
Abundance of birds						

Next, we have several statements about the use of the Bays and the role they play in the lives of families and communities. Please mark whether you "Strongly Agree", "Agree", "Neutral", "Disagree", "Strongly Disagree", or "Unsure or Don't Know" for each statement.

Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Unsure or Don't Know
The Bays are the best place to satisfy my outdoor recreation needs						
The Bays represent a way of life in my community						
The Bays are important for providing habitat for fish and other wildlife						
I am very attached to the Bays						
I get more satisfaction out of visiting the Bays than any other place						
My community's economy depends on the natural resources of the Bays						
The Bays contribute to the character of my community						

Now I would like to ask you about how you value the Bays. We are interested in the 13 values that are listed below. Definitions for each value are on the next page.

1. Aesthetic _____
2. Biodiversity _____
3. Economic _____
4. Legacy _____
5. In and of itself _____
6. Learning _____
7. Human Needs _____
8. Recreation _____
9. Spiritual _____
10. Therapeutic _____
11. Wilderness _____
12. Inspiration _____
13. Socializing _____

First, We would like to know how important each of the following value types are to you when you think about the Bays. Later, we will ask you to mark places that you value on the map.

To do this imagine that you could "spend" 100 pennies to ensure that the Bays 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 (this is not money… just an easy way for the researcher to compare).

After you complete this exercise, please continue to the next page to review the mapping instructions.

1. **Aesthetic (A)** I value Bays because I enjoy the beauty, sights, sounds, and smells.
2. **Biodiversity (B)** I value Bays because they provide a variety of fish, wildlife, plant life, etc.
3. **Economic (E)** I value Bays because they provide fisheries, minerals, and/or tourism opportunities such as outfitting and guiding.
4. **Legacy (Lg)** I value Bays because they allow 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 Bays in and of themselves, whether people are present or not.
6. **Learning (L)** I value Bays because we can learn about the environment through scientific research and education.
7. **Human Needs (H)** I value Bays because they help produce, preserve, clean, and renew air, soil, water, and food.
8. **Recreation (R)** I value Bays because they provide a place for my favorite outdoor recreation activities.
9. **Spiritual (S)** I value Bays because they are sacred, religious, or spiritually special places for me or because I feel reverence and respect for nature there.
10. **Therapeutic (T)** I value Bays because they make me feel better, physically and/or mentally. They are calming.
11. **Wilderness (W)** I value Bays because they are undeveloped with minimal human impact.
12. **Inspiration (Ip)** I value Bays because they motivate me to action or thought.
13. **Socializing (So)** I value Bays because they allow me to comfortably interact with others.

Mapping Instructions

What places within the Bays do you think of when you reflect on each of the values to which you allocated pennies on the last page? We want you to mark these places on the map provided. For each value, we ask that you mark places on the map using the following procedure:

1. Familiarize yourself with the included map of the area. You may also want to refer to the previous page to recall the values to which you assigned pennies.

2. Now, place a small dot or circle on the map that best represents one of the values to which you assigned pennies and put the corresponding red letter next to the dot (or circle). For example, say you gave 10 pennies to Aesthetics, locate on the map a place that represents Aesthetics, place a dot or a circle on the map and write the letter “A” next to the dot.

3. Repeat steps 1 and 2 as many times as you’d like for each of your important values.

For example, you indicated Recreation on the last page as one of your important values related to the Bays by allocating it a portion of your 100 pennies. When you think of Recreation, one of the places you might think of is "Crab Creek." Find the spot on the map where you think "Crab Creek" is located. Then place a dot or a circle on the map at that location, and next to the dot write the letter “R” for "Recreation". Repeat as many times as you would like for each of your selected values.

Fennessey Ranch
Refugio
Rooke Field
Woodsboro
Devils Run
US-77
Hwy 774
Chocolate Swale
Mullens Bayou
Mission Lake
Mission Bay
Melon Creek
REFUGIO
ARANSAS
Copano Creek
Big Lake
Aransas River
Bayside
Copano Bay
Aransas County Airport
Salt Lake
Fulton
TX-188
ARANSAS
SAN PATRICIO
Taft
US-181
Gregory
TX-35
TX-361
Aransas Pass
Aransas Bay
Traylor Island
Quarantine Shore
Stedman Island
Harbor Island
Ingleside
Portland
Spoil Banks
Redfish Bay

REFUGIO ARANSAS
Aransas National Wildlife Refuge
CALHOUN
San Antonio Bay
Espiritu Santo Bay
Matagorda Island
Big Boundary Lake
Mesquite Bay
Goose Island State Park
Cedar Bayou
ARANSAS
Aransas Bay
San Jose Island
Bay Education Center
Mud Island
Harbor Island Lighthouse
University of Texas Marine Science Institute
HOLLINGS MARINE LABORATORY
MUSC
COLLEGE of CHARLESTON
NIST
MISSION ★ ARANSAS
NATIONAL ESTUARINE RESEARCH RESERVE

Next, we would like to discuss management goals. Local communities have identified goals to guide decisions that affect the Bays and its watersheds. Please indicate whether you consider each of these goals a "High Priority", "Priority", Neutral", "Low Priority", "Not a Priority", or "Unsure or Don't Know."

Goals	High Priority	Priority	Neutral	Low Priority	Not a Priority	Unsure or Don't know
Improve water quality in the local Bays						
Improve freshwater inflows to the Bays						
Manage the quantity and improve the quality of storm water runoff to the Bays						
Restore shoreline and wetland habitats						
Eliminate further loss of shoreline, seagrass and wetland habitats						
Restore and sustain fish stocks and other living marine resources in the Bays						
Provide increased levels of public access to the Bays and its resources						
Increase the resilience of coastal communities in the face of natural and human-induced disasters (such as hurricanes and rising seas)						
Incorporate local social and cultural heritage into management of the Bays resources (such as public input and community advisory boards)						
Increase awareness of human-use patterns that influence resource sustainability						
Integrate understanding of human uses with knowledge of natural processes						
Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays						

To help us better understand what residents know about the characteristics of the Bays, please rate your level of understanding 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
Policy					
Ecology					
History					
Recreational Aspects					
Public Involvement Opportunities					
Educational Opportunities					

Public access to coastal waters and waterways has been identified as an Adequate Access management issue. From your perspective, how adequate is existing public access to the Bays? For each access type please select the response that best represents your opinion. Your choices are “More than Adequate Access”, “Adequate Access”, “Neutral”, “Inadequate Access”, “Little or No Access”, or “Don’t Know”.

	More than Adequate Access	Adequate Access	Neutral	Inadequate Access	Little or No Access	Don't Know
Boat Ramps						
Beaches						
Boat Slips						
Restaurants and restaurant dockage						
Scenic view points						
Waterway nature trails (e.g. kayak trails)						
Nature trails adjacent to water						
Natural swimming areas						
Boardwalks						
Dune walkovers						
Camping						
Wind/Kite surfing						
Kayaking sites						
Rod-and-reel fishing sites						
Fly fishing sites						
Public oyster sites						

Finally, we would like to ask just a few more questions to help us understand your needs.
The answers you provide here will in no way be linked to you.

Does your household income depend on products or services related to the Bay's resources?
_____Yes _____No _____Unsure

If yes, please describe the source of the income:
_____Commercial Fishing _____Commercial Oystering _____Tourism _____Oil and gas _____Other

In what year were you born? _____

Are you _____male _____female?

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

In which of these categories does your income fall into?
_____ $39,000 or below _____$40,000-$69,999 _____$70,000 or more

What is your occupation? _____

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

With which racial group(s) do you most identify?
_____American Indian or Alaska Native
_____Asian
_____Black or African American
_____Native Hawaiian or Other Pacific Islander
_____Caucasian

Thank you very much for sharing your thoughts about the Bays. Your thoughtful responses will help inform the resource management decision-making process.

As a small token of our appreciation for your efforts, we would like to offer you access to special "Bays" digital wallpapers from the Mission-Aransas Reserve for your home computer. The wallpapers come from award winning photographs taken within the Reserve. Please use the following link to download your choice of four wallpapers:

http://products.coastalscience.noaa.gov/nerr_survey/finish.php

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

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 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 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 NERR 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 sites.

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

Public reporting burden for this collection of information is estimated to average 20 minutes per response, including the time for reviewing instructions and completing both the mapping component and survey. All of the information you provide will be considered private and will be treated as confidential and protected by the NOAA National Ocean Service, National Centers for Coastal Ocean consistent with NOAA standards for confidentiality, privacy, and electronic information. Any information provided will be accessible only by those in need of such information and only group averages or group totals will be presented in any reports, publications, or presentations of the study's results. Send comments regarding this burden estimate or any other suggestions for reducing this burden to Susan Lovelace, 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.

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. NOAA National Ocean Service, National Centers for Coastal Ocean Science will retain control over the information and safeguard it from improper access, modification, and destruction, consistent with NOAA standards for confidentiality, privacy, and electronic information. Any information provided will be accessible only by those in need of such information and will be stored in a password protected database. Only group averages or group totals will be presented in any reports, publications, or oral presentations of the study's results; in no case will individual responses be used.

Appendix B
Tabulations of Survey Questions

Photo credit: Sherry Halbrook, 2012 Mission-Aransas NERR Photography Contest Winner

We would like to ask for your opinion of the changes you have seen in the Bays while you have lived in or have been visiting the area.

Abundance of Oysters

Response	Frequency	Proportion
Large Increase	1	0.41%
Increase	21	8.68%
Neutral	46	19.01%
Decrease	35	14.46%
Large Decrease	6	2.48%
Unsure	133	54.96%

Abundance of Fish

Response	Frequency	Proportion
Large Increase	4	1.63%
Increase	23	9.39%
Neutral	67	27.35%
Decrease	67	27.35%
Large Decrease	10	4.08%
Unsure	74	30.20%

Abundance of Blue Crabs

Response	Frequency	Proportion
Large Increase	2	0.82%
Increase	12	4.92%
Neutral	39	15.98%
Decrease	58	23.77%
Large Decrease	20	8.20%
Unsure	113	46.31%

Abundance of Seagrass

Response	Frequency	Proportion
Large Increase	11	4.47%
Increase	40	16.26%
Neutral	65	26.42%
Decrease	35	14.23%
Large Decrease	5	2.03%
Unsure	90	36.59%

Shoreline Erosion

Response	Frequency	Proportion
Large Increase	6	2.42%
Increase	71	28.63%
Neutral	78	31.45%
Decrease	10	4.03%
Large Decrease	0	0.00%
Unsure	83	33.47%

Abundance of Wildlife

Response	Frequency	Proportion
Large Increase	5	2.04%
Increase	49	20.00%
Neutral	86	35.10%
Decrease	29	11.84%
Large Decrease	6	2.45%
Unsure	70	28.57%

Public Access to Land and Water Resources

Response	Frequency	Proportion
Large Increase	4	1.63%
Increase	50	20.33%
Neutral	95	38.62%
Decrease	29	11.79%
Large Decrease	6	2.44%
Unsure	62	25.20%

Red Tide Occurrences

Response	Frequency	Proportion
Large Increase	2	0.82%
Increase	33	13.52%
Neutral	79	32.38%
Decrease	22	9.02%
Large Decrease	0	0.00%
Unsure	108	44.26%

Abundance of Jellyfish

Response	Frequency	Proportion
Large Increase	15	6.10%
Increase	63	25.61%
Neutral	65	26.42%
Decrease	36	14.63%
Large Decrease	2	0.81%
Unsure	65	26.42%

Abundance of Birds

Response	Frequency	Proportion
Large Increase	7	2.82%
Increase	48	19.35%
Neutral	87	35.08%
Decrease	41	16.53%
Large Decrease	3	1.21%
Unsure	62	25.00%

We have several statements about the use of the Bays and the role they play in the lives of families and communities. What is your level of agreement with each of the following statements?

The Bays are the best place to satisfy my outdoor recreation needs

Response	Frequency	Proportion
Strongly Agree	88	36.07%
Agree	122	50.00%
Neutral	22	9.02%
Disagree	9	3.69%
Strongly Disagree	1	0.41%
Unsure	2	0.82%

The Bays represent a way of life in my community

Response	Frequency	Proportion
Strongly Agree	106	43.62%
Agree	78	32.10%
Neutral	27	11.11%
Disagree	18	7.41%
Strongly Disagree	6	2.47%
Unsure	8	3.29%

The Bays are important for providing habitat for fish and other wildlife

Response	Frequency	Proportion
Strongly Agree	208	84.21%
Agree	37	14.98%
Neutral	2	0.81%
Disagree	0	0.00%
Strongly Disagree	0	0.00%
Unsure	0	0.00%

I am very attached to the Bays

Response	Frequency	Proportion
Strongly Agree	130	52.85%
Agree	85	34.55%
Neutral	25	10.16%
Disagree	4	1.63%
Strongly Disagree	0	0.00%
Unsure	2	0.81%

I get more satisfaction out of visiting the Bays than any other place

Response	Frequency	Proportion
Strongly Agree	60	24.59%
Agree	102	41.80%
Neutral	54	22.13%
Disagree	24	9.84%
Strongly Disagree	3	1.23%
Unsure	1	0.41%

My community's economy depends on the natural resources of the Bays

Response	Frequency	Proportion
Strongly Agree	98	40.16%
Agree	73	29.92%
Neutral	29	11.89%
Disagree	31	12.70%
Strongly Disagree	5	2.05%
Unsure	8	3.28%

The Bays contribute to the character of my community

Response	Frequency	Proportion
Strongly Agree	131	53.69%
Agree	67	27.46%
Neutral	15	6.15%
Disagree	23	9.43%
Strongly Disagree	4	1.64%
Unsure	4	1.64%

Next, we would like to discuss management goals. Local communities have identified goals to guide decisions that affect the Bays and its watersheds. Please indicate how much of a priority you consider each of these goals.

Improve water quality in the local Bays

Response	Frequency	Proportion
High Priority	142	58.20%
Priority	81	33.20%
Neutral	13	5.33%
Low Priority	4	1.64%
Not a Priority	0	0.00%
Unsure	4	1.64%

Improve freshwater inflows to the Bays

Response	Frequency	Proportion
High Priority	121	50.00%
Priority	71	29.34%
Neutral	25	10.33%
Low Priority	5	2.07%
Not a Priority	2	0.83%
Unsure	18	7.44%

Manage the quantity and improve the quality of storm water runoff to the Bays

Response	Frequency	Proportion
High Priority	114	46.72%
Priority	84	34.43%
Neutral	30	12.30%
Low Priority	4	1.64%
Not a Priority	2	0.82%
Unsure	10	4.10%

Restore shoreline and wetland habitats

Response	Frequency	Proportion
High Priority	123	50.83%
Priority	79	32.64%
Neutral	27	11.16%
Low Priority	7	2.89%
Not a Priority	3	1.24%
Unsure	3	1.24%

Eliminate further loss of shoreline, seagrass and wetland habitats

Response	Frequency	Proportion
High Priority	137	56.15%
Priority	87	35.66%
Neutral	12	4.92%
Low Priority	5	2.05%
Not a Priority	2	0.82%
Unsure	1	0.41%

Restore and sustain fish stocks and other living marine resources in the Bays

Response	Frequency	Proportion
High Priority	144	59.02%
Priority	81	33.20%
Neutral	12	4.92%
Low Priority	4	1.64%
Not a Priority	1	0.41%
Unsure	2	0.82%

Provide increased levels of public access to the Bays and its resources

Response	Frequency	Proportion
High Priority	43	17.84%
Priority	55	22.82%
Neutral	71	29.46%
Low Priority	41	17.01%
Not a Priority	30	12.45%
Unsure	1	0.41%

Increase the resilience of coastal communities in the face of natural and human-induced disasters (such as hurricanes and rising seas)

Response	Frequency	Proportion
High Priority	64	26.67%
Priority	96	40.00%
Neutral	41	17.08%
Low Priority	18	7.50%
Not a Priority	15	6.25%
Unsure	6	2.50%

Incorporate local social and cultural heritage into management of the Bays resources (such as public input and community advisory boards)

Response	Frequency	Proportion
High Priority	38	15.64%
Priority	93	38.27%
Neutral	64	26.34%
Low Priority	31	12.76%
Not a Priority	12	4.94%
Unsure	5	2.06%

Increase awareness of human-use patterns that influence resource sustainability

Response	Frequency	Proportion
High Priority	75	30.99%
Priority	121	50.00%
Neutral	28	11.57%
Low Priority	11	4.55%
Not a Priority	4	1.65%
Unsure	3	1.24%

Integrate understanding of human uses with knowledge of natural processes

Response	Frequency	Proportion
High Priority	67	28.15%
Priority	103	43.28%
Neutral	50	21.01%
Low Priority	8	3.36%
Not a Priority	4	1.68%
Unsure	6	2.52%

Purchase additional non-wetland areas to add to publically owned lands within or adjacent to the Bays

Response	Frequency	Proportion
High Priority	50	20.92%
Priority	80	33.47%
Neutral	57	23.85%
Low Priority	22	9.21%
Not a Priority	21	8.79%
Unsure	9	3.77%

To help us better understand what residents know about the characteristics of the Bays, please rate your level of understanding of the following management dimensions.

Policy

Response	Frequency	Proportion
Excellent	32	13.50%
Good	64	27.00%
Fair	65	27.43%
Poor	36	15.19%
Not Sure	40	16.88%

Ecology

Response	Frequency	Proportion
Excellent	49	20.59%
Good	90	37.82%
Fair	54	22.69%
Poor	21	8.82%
Not Sure	24	10.08%

History

Response	Frequency	Proportion
Excellent	34	14.29%
Good	81	34.03%
Fair	71	29.83%
Poor	30	12.61%
Not Sure	22	9.24%

Recreational Aspects

Response	Frequency	Proportion
Excellent	50	21.19%
Good	109	46.19%
Fair	47	19.92%
Poor	16	6.78%
Not Sure	14	5.93%

Public Involvement Opportunities

Response	Frequency	Proportion
Excellent	25	10.59%
Good	65	27.54%
Fair	67	28.39%
Poor	48	20.34%
Not Sure	31	13.14%

Educational Opportunities

Response	Frequency	Proportion
Excellent	45	18.99%
Good	77	32.49%
Fair	56	23.63%
Poor	34	14.35%
Not Sure	25	10.55%

From your perspective, how adequate is existing public access to the Bays?

Boat Ramps

Response	Frequency	Proportion
More than adequate access	37	15.55%
Adequate Access	118	49.58%
Neutral	24	10.08%
Inadequate Access	27	11.34%
Little or No Access	1	0.42%
Unsure	31	13.03%

Beaches

Response	Frequency	Proportion
More than adequate access	60	25.21%
Adequate Access	119	50.00%
Neutral	24	10.08%
Inadequate Access	23	9.66%
Little or No Access	4	1.68%
Unsure	8	3.36%

Boat Slips

Response	Frequency	Proportion
More than adequate access	32	13.79%
Adequate Access	83	35.78%
Neutral	39	16.81%
Inadequate Access	20	8.62%
Little or No Access	2	0.86%
Unsure	56	24.14%

Restaurants and Restaurant Dockage

Response	Frequency	Proportion
More than adequate access	35	14.89%
Adequate Access	104	44.26%
Neutral	45	19.15%
Inadequate Access	30	12.77%
Little or No Access	6	2.55%
Unsure	15	6.38%

Scenic Viewpoints

Response	Frequency	Proportion
More than adequate access	44	18.33%
Adequate Access	110	45.83%
Neutral	38	15.83%
Inadequate Access	35	14.58%
Little or No Access	8	3.33%
Unsure	5	2.08%

Waterway Nature Trails (e.g. kayak trails)

Response	Frequency	Proportion
More than adequate access	29	12.29%
Adequate Access	78	33.05%
Neutral	39	16.53%
Inadequate Access	43	18.22%
Little or No Access	5	2.12%
Unsure	42	17.80%

Nature Trails Adjacent to Water

Response	Frequency	Proportion
More than adequate access	17	7.23%
Adequate Access	60	25.53%
Neutral	53	22.55%
Inadequate Access	60	25.53%
Little or No Access	14	5.96%
Unsure	31	13.19%

Natural Swimming Areas

Response	Frequency	Proportion
More than adequate access	27	11.39%
Adequate Access	85	35.86%
Neutral	40	16.88%
Inadequate Access	48	20.25%
Little or No Access	9	3.80%
Unsure	28	11.81%

Boardwalks

Response	Frequency	Proportion
More than adequate access	17	7.20%
Adequate Access	77	32.63%
Neutral	59	25.00%
Inadequate Access	43	18.22%
Little or No Access	21	8.90%
Unsure	19	8.05%

Dune Walkovers

Response	Frequency	Proportion
More than adequate access	21	9.01%
Adequate Access	58	24.89%
Neutral	66	28.33%
Inadequate Access	32	13.73%
Little or No Access	16	6.87%
Unsure	40	17.17%

Camping

Response	Frequency	Proportion
More than adequate access	34	14.41%
Adequate Access	98	41.53%
Neutral	38	16.10%
Inadequate Access	32	13.56%
Little or No Access	7	2.97%
Unsure	27	11.44%

Wind/Kite Surfing

Response	Frequency	Proportion
More than adequate access	26	11.16%
Adequate Access	74	31.76%
Neutral	65	27.90%
Inadequate Access	14	6.01%
Little or No Access	4	1.72%
Unsure	50	21.46%

Kayaking Sites

Response	Frequency	Proportion
More than adequate access	30	12.82%
Adequate Access	108	46.15%
Neutral	33	14.10%
Inadequate Access	28	11.97%
Little or No Access	2	0.85%
Unsure	33	14.10%

Rod-and-Reel Fishing Sites

Response	Frequency	Proportion
More than adequate access	54	22.69%
Adequate Access	106	44.54%
Neutral	25	10.50%
Inadequate Access	30	12.61%
Little or No Access	3	1.26%
Unsure	20	8.40%

Fly Fishing Sites

Response	Frequency	Proportion
More than adequate access	18	7.56%
Adequate Access	58	24.37%
Neutral	57	23.95%
Inadequate Access	21	8.82%
Little or No Access	12	5.04%
Unsure	72	30.25%

Public Oyster Sites

Response	Frequency	Proportion
More than adequate access	9	3.90%
Adequate Access	33	14.29%
Neutral	41	17.75%
Inadequate Access	25	10.82%
Little or No Access	21	9.09%
Unsure	102	44.16%

U.S. Department of Commerce

Wilbur L. Ross, Jr., ***Secretary of Commerce***

National Oceanic and Atmospheric Administration

Timothy Gallaudet, ***Acting Under Secretary for Oceans and Atmosphere***

National Ocean Service

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The mission of the National Centers for Coastal Ocean Science is to provide managers with scientific information and tools needed to balance society's environmental, social and economic goals. For more information, visit: **http://www.coastalscience.noaa.gov/.**