

Attitudes, Behavior, and Management Preferences of Texas Artificial Reef Users



Michael A. Schuett
Gerard T. Kyle
Rebekka Dudensing
Chen Ding
Carena van Riper
Jihee Park

Department of Recreation, Park & Tourism Sciences
Texas A&M University
College Station, TX 77843-2261

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Michael A. Schuett
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Department of Recreation, Park & Tourism Sciences
Texas A&M University
College Station, TX 77843-2261

*Department of Agricultural Economics, Extension Agricultural Economics
Texas A&M University

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TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
TABLE OF CONTENTS.....	iv
LIST OF TABLES.....	v
LIST OF FIGURES.....	vi
EXECUTIVE SUMMARY	1
INTRODUCTION.....	4
STUDY OBJECTIVES.....	6
METHODS.....	6
Sampling Design.....	6
Questionnaire Development	7
Mailing Procedures.....	7
RESULTS	8
Response Rates.....	8
Respondents' Socio-demographic Profile, Use, and Experience with Artificial Reefs.....	8
TPWD Artificial Reefs	19
DISCUSSION.....	35
Respondents' Profile and Reef Behavior/Preferences	35
TPWD Artificial Reef Use.....	37
FUTURE RESEARCH.....	39
REFERENCES.....	41
APPENDICES A-D	43

LIST OF TABLES

Table 1. Overall response rates for the mail survey of artificial reef users	8
Table 2. Percent of participants distributed by socio-demographic variables	9
Table 3. Importance for various items when choosing artificial reef sites for fishing, diving, or boating (percentage).....	12
Table 4. Most important item when choosing artificial reef sites (percentage)	13
Table 5. Participants' level of agreement regarding the use of artificial reefs (percentage)	13
Table 6. Participants' level of agreement regarding the management of artificial reefs (percentage)	14
Table 7. Percentage of activities respondents participate in on their trips.....	17
Table 8. Level of importance of the activities respondents participate in on their trips (percentage).....	17
Table 9. Mean direct expenditures on most recent reef-related trips in the Gulf of Mexico	18
Table 10. Willingness to pay (WTP) among respondents who provided a WTP equal or larger than their current trip expenditures.....	19
Table 11. Distribution of participants' visits to artificial reef site(s) during their trips.....	22
Table 12. Percent of participants distributed by ZONE(s) for those who could not identify the specific TPWD artificial reef they last visited.....	24
Table 13. Percent of participants distributed by ZONE(s) and artificial reef site(s) where they spent most of their time	24
Table 14. Percent of participants distributed by the most preferred zones and artificial reef sites.....	26
Table 15. Level of importance for why people participate in marine recreation (percentage)	34

LIST OF FIGURES

Figure 1. Percent of participants who have taken a trip to the Gulf of Mexico in the last twelve months 10

Figure 2. Percent of participants who have taken trip(s) to the Gulf of Mexico in the last twelve months
by number of trips 10

Figure 3. Primary purpose of trips to the Gulf of Mexico (percentage) 11

Figure 4. Percent of participants that have made use of artificial reef structures during their trips to the
Gulf of Mexico..... 11

Figure 5. Mean percentage of trips to reefs by specific reef structures..... 12

Figure 6. Percent of participants who experienced problems at an artificial reef site by specific condition
which reduced the probability of their return to artificial reef sites..... 15

Figure 7. Participants’ difficulties caused by encounters at artificial reef sites (percentage)..... 15

Figure 8. Number of artificial reef trip(s) made in the Gulf of Mexico over the last twelve months
(percentage)..... 16

Figure 9. Number of hours participants stayed out on the reef (percentage) 16

Figure 10. Percent of additional people (by group size) that participants paid for on their most recent
reef-related trip in the Gulf of Mexico..... 17

Figure 11. Percent of participants who make use of TPWD artificial reefs 19

Figure 12. Percent of participants’ reasons for not making use of TPWD artificial reef sites 20

Figure 13. Mean number of trips by periods that participants made involving TPWD artificial reef sites 21

Figure 14. Percent of participants distributed by the mainland areas/ports that they have departed from
for their most recent reef trip to the Gulf 28

Figure 15. Percent of participants who have heard or seen information about the TPWD Artificial Reef
Program..... 29

Figure 16. Percent of participants distributed by sources from which they have heard or seen
information about the TPWD Artificial Reef Program 29

Figure 17. Participants’ preferences of distance (in miles) of artificial reefs from the shore (percentage)..... 30

Figure 18. Participants’ preferences of water depth (in feet) that artificial reef structures should be situated from the ocean surface to the ocean bottom (percentage)..... 30

Figure 19. Participants’ preferences of water height (in feet) from the ocean surface to the top of the artificial reef structures (percentage)..... 31

Figure 20. Participants’ preferences of materials and structures for future artificial reef sites (percentage)..... 31

Figure 21. Participants’ most preferred type of materials and structures for future artificial reef sites (percentage)..... 32

Figure 22. Percent of participants who object to the use of the materials or structures listed in Figure 20..... 32

Figure 23. Percent of participants who object to specific type of materials and structures for future artificial reef sites..... 33

Figure 24. Participants’ level of agreement toward the existence of artificial reefs in the Gulf of Mexico (percentage)..... 33

Figure 25. Participants’ level of awareness toward the practice of individuals placing their own fish attracting structures in the Gulf of Mexico (percentage)..... 34

EXECUTIVE SUMMARY

In order to provide the Texas Parks and Wildlife Department's (TPWD) Artificial Reef Program with updated information about individuals who use artificial reefs in the Gulf of Mexico for recreation, Texas A&M University conducted a mail survey of 7,000 registered boaters (boats >26' in hull length) and 7,000 licensed saltwater anglers (license year 9/1/12-8/31/13). The sample was randomly drawn from the saltwater angler and boat registration databases for coastal and adjacent counties as well as counties from selected metropolitan areas, i.e., Dallas (Tarrant), Austin (Travis) and San Antonio (Bexar) (31 counties in total). Respondents were sent a questionnaire by mail but were also given the option to complete the questionnaire online. The questionnaires were sent out starting on October 21, 2013. Respondents received four mail contacts. This survey provided the Artificial Reef Program with information on respondents' fishing and boating behavior, awareness and use of reefs as well as other management topics. An overall response rate of 18.3% was achieved for the study. The following bullets highlight the report findings:

- A socio-demographic profile of the respondents showed a group of artificial reef users (both TPWD reefs and other artificial structures) with a mean age of 56.9 years, predominantly male (86.8%), 93.1% white, with more than one-third (36.1%) reporting incomes of over \$160,000.
- Over half (61.7%) had taken a trip to the Gulf of Mexico in the last 12 months with the primary purpose of that trip focused on fishing (62.6%). Artificial reef use was reported by 54.9% of respondents with the most frequently visited type of reef being standing rigs and oil production structures (39.3%).
- Over 70.0% (72.7%) made use of TPWD artificial reefs. Of those that did not use TPWD artificial reefs (27.3%), the main reason reported was that they did not know where the reef sites were located (61.9%).
- The most important reasons for choosing artificial reefs for fishing, diving, or boating were presence of desired fish (58.7%) and distance from port (28.8%).
- Problems encountered which would reduce the probability of returning to the artificial reef sites were varied; 57.2% reported the presence of too many other boats as the most frequent response, followed by commercial fishing (41.1%).

- Respondents gave a range of responses for the number of trips they had taken to the Gulf of Mexico in the last 12 months with 60.8% reporting that they had taken between 1-5 trips, followed by 6-10 trips (22.4%). The amount of time they spent by hours out on the reef showed that almost half (49.3%) of respondents spent from 1-5 hours at the reef, followed by 30.1% who spent between 6-10 hours on the reef.
- Respondents spent an average of \$1,652.00 per person on their most recent reef-related trip with the highest average of \$775.00 spent on private auto/boat expenses (gas, repairs, rental), followed by \$217.00 on retail shopping (bait/tackle, clothing, groceries, ice, etc.).
- Artificial reef visitation was recorded by site and zone. The most frequently visited TPWD artificial reef sites were the GA-A-22-Freeport Liberty Ship (101 visits, 16.0%) and GA-189-Mitchell's (73 visits, 11.6%) in Zone One which are located off the coast of Galveston and Freeport. Zone One received the most visits at 631; the total for all four zones totaled 1691 visits. The MI-616-Matagorda Island Liberty Ship received the second most visits with 79 (14.5% in Zone Three). Respondents spent the most time at GA-A-22-Freeport Liberty Ship.
- The most frequent departure point was Galveston for 27.9% of the respondents, followed by Port Aransas at 25.9% and Freeport at 22.6%.
- Just over half (57.4%) had heard or seen information about the TPWD Artificial Reef Program. More than three-fourths of respondents had heard or seen information about the TPWD Artificial Reef Program primarily through two sources: magazines (43.8%) and the Internet (38.3%).
- The distance in miles respondents' felt artificial reefs should be located off-shore was approximately bi-modal with 30.2% reporting 1-10 miles and 30.0% above 30 miles. Overall, 32.9% of respondents preferred artificial reefs in waters deeper than 100 feet (from the ocean surface to ocean bottom), and the preferred height from the ocean surface to the top of the artificial reef structure was 21-40 feet (30.6%).
- Preferred materials and structures for future artificial reef sites were ships and barges (84.5%), followed by petroleum rig jackets, decks, and other oil production structures (81.8%). The *most preferred* materials and structures for future artificial reef sites were petroleum rig jackets, decks, and other oil production structures (47.2%).

- Very few (7.9%) reported objecting to the materials and structures currently being used for TPWD artificial reefs. Of those that did object, 37.8% objected to blocks made of concrete or fly ash.
- Just over one-third of respondents (38.0%) were unaware of the practice of individuals placing their own fish attracting structures in the Gulf of Mexico, while 31.7% had heard of it occasionally.
- Almost all of the respondents either agreed or strongly agreed (94.9%) that TPWD should place more artificial reefs in the Gulf; 31.8% agreed that all submerged artificial reefs should be identified with marker buoys.
- Motives that were rated highest in importance for participating in marine recreation were: to be close to water (46.9%), to be outdoors (45.4%), and for relaxation (45.4%). Other important reasons included: to experience unpolluted natural surroundings (41.3%), for family recreation (36.9%), to experience adventure and excitement (36.4%), and to get away from the regular routine (35.5%).

INTRODUCTION

The Texas Legislature passed the Artificial Reef Act in 1989. This legislation directs the Texas Parks and Wildlife Department (TPWD) to promote, develop, maintain, monitor, and enhance the artificial reef potential in state waters and federal waters adjacent to Texas. Artificial reefs are defined as a structure or system of structures constructed, placed, or permitted in the navigable water of Texas or water of the federal exclusive economic zone adjacent to Texas for the purpose of enhancing fishery resources and commercial and recreational fishing opportunities (TPWD Artificial Reef Plan, 1990). There are several types of artificial reefs in Texas and adjacent federal waters, ranging from nearshore reefs and ship reefs to petroleum platforms (rigs). The reefs are spread throughout a wide area of the Gulf of Mexico and are a popular fishing and diving destination.

Under the Coastal Fisheries Division of Texas Parks and Wildlife Department, the Texas Artificial Reef Program officially began in 1990 to “promote, maintain, monitor and enhance the artificial reef potential of Texas offshore waters” (TPWD Artificial Reef Program website, 2014). Before this, fishermen had discretely placed artificial reef materials on the ocean bottom off the Texas coast since at least the 1960s. Currently, there are 68 artificial reefs in the Gulf of Mexico that are managed by the Texas Artificial Reef Program.

The majority of research conducted on artificial reefs has been focused in several areas, including reef materials (Lukens & Selberg, 2004), biological effects on fish populations (Shiple & Cowan, 2011), and economic impacts to local communities (Maliki, Otero, & Casanove, 2010). One area of research that has not been examined in much recent detail is artificial reef use by recreation user groups, including anglers and boaters. Managers need to learn more about the use of artificial reefs by recreation user groups to be more effective in their outreach and education programs and to protect the marine resources.

Past research in the 1980s and 1990s examined the use of artificial reefs in Texas waters, concentrating on select recreation groups. In particular, these studies focused on scuba divers and charter boat operators. In one of the early reports on artificial reefs, Ditton and Graefe (1978) examined the fishing use at a particular type of artificial reef—Liberty ships. Liberty ships carried supplies and military personnel all over the world during World War II and were later intentionally sunk in the Gulf of Mexico to serve as artificial reefs. This study surveyed owners of two different boat categories (i.e., 26 feet or less and 26 feet or more) on fishing motivations and behavior. Anglers were motivated by escape from everyday routines, relaxation, and being outdoors; the majority of boat owners traveled

less than 30 miles offshore, and preferred fish species for harvesting were kingfish, cobia, and red snapper.

In a follow-up study, Ditton, Finkelstein, and Wilemon (1995) collected data from the Texas charter boat industry (fishing and diving). They examined frequency of use, number of trips offshore, and reef site selection. Charter fishing boats took 832 trips to TPWD artificial reefs and 3,300 trips involving artificial reefs in general. The average maximum reported distance to reefs for all boat captains was 63 miles; preferred reef materials for all boat types were oil production structures, ships, and barges. A few years later, Ditton and Baker (1999) focused on one specific user group, sport divers. They obtained a list of diving customers to examine their use of the Flower Garden Banks National Marine Sanctuary in the Gulf of Mexico, about 100 miles from the Galveston, Texas, jetties. Results showed that just over half took one or more trips involving artificial reefs in the last 12 months and most did not belong to a diving club. Respondents averaged 16 days diving in salt water and nine days in fresh water; large naval ships, petroleum rig jackets, decks, and other oil production structures were the preferred reef materials.

A few studies have focused specifically on the socioeconomic impacts of artificial reefs to local economies. In particular, Hiett and Milon (2002) found that divers, boaters, and anglers spend approximately \$119.00 per day on artificial reef diving trips in the Gulf of Mexico. Using a more in-depth approach focusing on labor income, taxes, and employment, Maliki et al. (2010) examined fishing and diving activities to the Texas Clipper ship artificial reef. Fishing the Texas Clipper generated just over \$935,000 in output, while divers generated almost \$1.5 million in output.

This body of research on artificial reefs has laid the groundwork for understanding user characteristics, participation patterns, benefits, and expenditures; however, given the age of some of these past data, more recent demographic, behavioral, and preference information is needed. Therefore, the purpose of this study was to examine the extent to which near and offshore artificial reef structures in Texas waters (e.g., Liberty ships, oil platforms, etc.) are used and experienced by two groups, saltwater anglers and boaters. The TPWD Artificial Reef Program (Program, hereafter) focuses its efforts in three areas: Rigs-to-Reefs, Nearshore Reefing, and Ships-to-Reefs. Even though the Program only manages 68 of the artificial reef sites that are present in the Gulf of Mexico, these study results reflect the use of both TPWD and other types of artificial reefs in the Gulf of Mexico.

The products of our research provide management staff with an updated database that they can query for information on reef use. The findings provide management staff with an understanding of issues underlying saltwater anglers and boaters in several areas: (a) boating and fishing participation in

the Gulf of Mexico; (b) awareness and knowledge of TPWD's artificial reefs and other artificial reefs in the Gulf; (c) trip expenditures on past trips; (d) management and reef preferences; and (e) socio-demographic characteristics. By understanding the diverse needs of saltwater anglers and boaters, managers are better situated to make informed decisions affecting their programs and rules and regulations and to understand how specific constituents will be impacted by policy.

STUDY OBJECTIVES

Three broad objectives guided this investigation:

1. Determine the recreational use of both TPWD and non-TPWD artificial reefs in the Gulf of Mexico by saltwater anglers and boaters.
2. Report current level of awareness and knowledge about artificial reefs in the Gulf of Mexico.
3. Identify motivations to use artificial reefs, locations/reefs visited, preferred materials, trip expenditures, and socio-demographic characteristics for saltwater anglers and boaters.

METHODS

Sampling Design

The sampling design for this study involved two recreational user groups: saltwater anglers and registered boaters. Overall, a total of 14,000 anglers and boaters were surveyed. A total of 7,000 names and addresses were randomly selected from the population of Texas saltwater anglers from the TPWD Point-of-Sale (POS) license files, specifically Saltwater Package and Senior counterpart, All-Water Package and Senior counterpart, and Year-From-Purchase All-Water Licenses. These names were drawn from Texas coastal and adjacent counties, and names were also drawn from three metropolitan counties: Tarrant (Dallas), Travis (Austin), and Bexar (San Antonio). Thirty-one counties were chosen to gather the sample (see Appendix A for the county list). These Texas residents purchased a fishing license in state fiscal year 2013 (September 1, 2012-August 31, 2013). An additional 7,000 names and addresses were also randomly selected from the population of registered boaters in the TPWD registration database. These names were drawn from the list of non-commercial registered boaters owning boats with a hull length of 26 feet or greater from the same list of 31 coastal, adjacent, and metropolitan counties used for the saltwater anglers. A hull length of 26 feet or greater was used because this size boat is more likely to be used for offshore saltwater fishing (Ditton & Graefe, 1978).

Questionnaire Development

A 10-page questionnaire was developed to assess information about anglers' and boaters' use and experience with artificial reefs in the Gulf of Mexico. Several of the study questions were similar to those used in previous research by Ditton and Graefe (1978); the vast majority of items were newly developed by Texas A&M University (TAMU) researchers and with representatives from TPWD's Artificial Reef Program and Coastal Fisheries Division. Topics included recreation activities in the Gulf of Mexico, number of trips, selection criteria for visiting artificial reefs, preferred reef materials, location of any artificial reefs visited (TPWD and others), reef-related trip expenditures, knowledge of the TPWD Artificial Reef Program, and socio-demographics (see Appendix B for the survey questionnaire).

Mailing Procedures

Following the procedures recommended by Dillman, Christian, and Smyth (2008), we employed a mixed-mode design that involved four contacts with respondents. For the mailings, cover letters were sent displaying the green TPWD letterhead and the maroon TAMU logo with the black/white TPWD logo on the envelope. The reminder/thank you postcard featured the maroon TAMU logo and black/white TPWD logo. The online questionnaire featured the TPWD and TAMU logos in color. The use of TAMU and TPWD logos together followed policies set forth by TAMU University Brand Guidelines. The initial contact letter was sent out on October 21, 2013, and followed the sequence below for three subsequent weeks:

- (1) A personalized contact letter was sent out introducing the study and inviting the respondent to complete the questionnaire online (www.tpwd-survey.org), or, if they preferred, a hard copy would arrive in the mail in a week (see Appendix C for the survey correspondence).
- (2) One week following the mailing of the first contact letter, a survey packet was sent to respondents containing a cover letter informing them of the study and inviting them to complete the survey questionnaire online or to complete the enclosed hard copy. In the survey packet, we included a postage-paid, self-addressed return envelope.
- (3) Two weeks following the initial contact, a reminder/thank you postcard was sent to respondents with an associated URL link again inviting them to complete the survey online if they preferred that option.
- (4) Three weeks following the initial contact, another survey packet was sent to respondents containing a cover letter informing them of the study and inviting them to complete the survey questionnaire online or use the enclosed hard copy.

Survey instruments were each identified with a unique ID number connecting each respondent to the mailed instrument. Each wave of survey materials was assembled and mailed to anglers and boaters on Monday of each week. The respondents' returned questionnaires were logged in and processed. Non-deliverables were removed from the database and did not receive any further mailings. Those who used the online system (Qualtrics software) entered a unique ID online to access the questionnaire.

RESULTS

Response Rates

From the 14,000 names pulled from the entire sample of licensed saltwater anglers and registered boaters for the mailing list, duplicates of people within and across lists, incomplete names, and company addresses were deleted, yielding a sample size of 13,817 (Table 1). Of the 13,817 questionnaires mailed out, completed questionnaires were received from 2,510, for a raw response rate of 18.1%. Respondents were given a choice of mailing their questionnaires back or using an online response format. Taking into account 132 names that were returned due to bad addresses, non-usable returns, nine deceased persons, and one boater who asked to be deleted from the mailing list, the effective response rate was 18.3% (2,510/13,685). Of the 2,510 returned usable questionnaires, 1,877 were paper copies and 633 were online. The following results section reports aggregated angler and boater data.

Table 1. Overall response rates for the mail survey of artificial reef users

Number Mailed	Returned Usable	Not Returned	Returned Non-Usable	Total Non-Deliverable/Deleted from sample	Raw Response Rate	Effective Response Rate
13,817	2,510	11,294	13	132	18.1%	18.3%

Respondents' Socio-demographic Profile, Use, and Experience with Artificial Reefs

The socio-demographic description of the sample showed a mean age of 56.9 years, with the largest age category being over 60 (41.3%) (Table 2). Respondents were mostly male (86.8%), with over one-third (36.1%) reporting incomes of \$160,000 and above. Race was dominated by those who were white at 93.1%, with a nominal percentage of Mexican, Mexican American, or Chicano (6.0%). Thus, even though this sample is not socio-demographically diverse, it is similar to past profiles found in other

Texas angler-related studies (Kyle et al., 2014). The largest percentage of respondents came from Harris County (26.6%). A breakdown of respondents by zip code can be found in Appendix D.

Table 2. Percent of participants distributed by socio-demographic variables

(Q.28) Age	Percent
UNDER 20	0.4
20-30	2.9
31-40	6.8
41-50	16.8
51-60	31.8
OVER 60	41.3
Total	100.0
Mean (SD)	56.9 (12.2)

(Q.29) Gender	Percent
Male	86.8
Female	13.2
Total	100.0

(Q.30) Income	Percent
Under \$20,000	3.1
\$20,000 - \$39,999	5.9
\$40,000 - \$59,999	8.2
\$60,000 - \$79,999	10.6
\$80,000 - \$99,999	9.9
\$100,000 - \$119,999	12.0
\$120,000 - \$139,999	8.0
\$140,000 - \$159,999	6.3
\$160,000 and ABOVE	36.1
Total	100.0

(Q.31) Ethnicity	Percent
a. NO, NOT SPANISH/HISPANIC	91.4
b. YES, MEXICAN, MEXICAN AMERICAN, CHICANO	6.0
c. YES, OTHER SPANISH/HISPANIC GROUP	2.6
Total	100.0

(Q.32) Race?	Percent
a. WHITE	93.1
b. BLACK OR AFRICAN AMERICAN	1.6
c. AMERICAN INDIAN OR ALASKAN NATIVE	0.7
d. ASIAN OR PACIFIC ISLANDER	1.3
e. SOME OTHER RACE	3.3
Total	100.0

(SD=Standard Deviation)

Initially, we asked respondents if they had taken a trip to the Gulf of Mexico in the last 12 months; 61.7% responded that they had (Figure 1). If they did not take a trip in the last 12 months, they

proceeded to the end of the questionnaire and filled out the socio-demographic section. Of those that did take a trip to the Gulf, over half (57.1%) had taken between 1-5 trips in the last 12 months, and over three-fourths (77.8%) had taken up to 10 trips (Figure 2). As for the primary purpose of the trips to the Gulf, 23.3% went boating, while 62.6% went fishing (Figure 3). Only a small percentage named snorkeling/diving as their primary trip purpose (3.5%). The top three activities of the “Other” category were beach activities, sailing, and vacation.

Figure 1. (Q.1) Percent of participants who have taken a trip to the Gulf of Mexico in the last twelve months

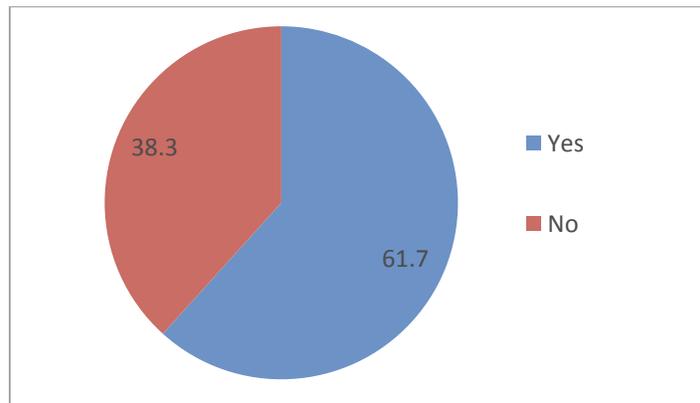


Figure 2. (Q.1.1) Percent of participants who have taken trip(s) to the Gulf of Mexico in the last twelve months by number of trips

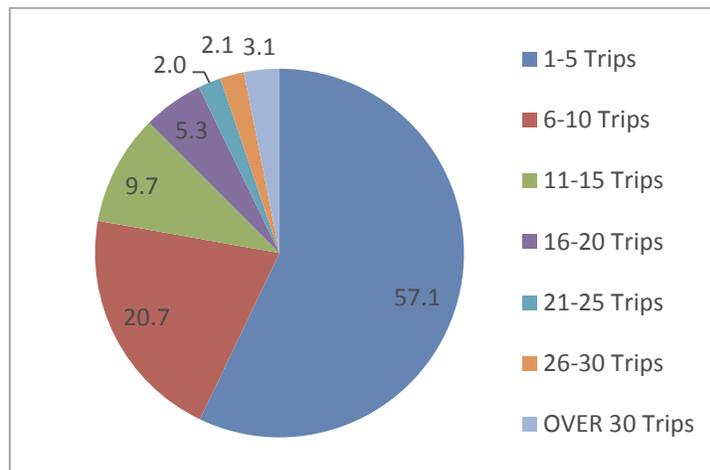
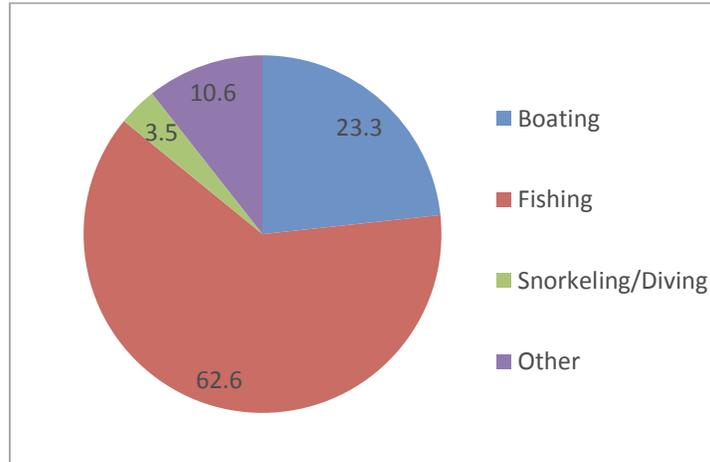


Figure 3. (Q.2) Primary purpose of trips to the Gulf of Mexico (percentage)



In terms of actually making use of artificial reef structures, respondents were about split, with just over half (54.9%) reporting that they did use them during their trips to the Gulf of Mexico, versus 45.1% that did not (Figure 4). Of those that did make use of artificial reefs during their trips, standing rigs and oil production structures were reported as being used most frequently (39.3%), followed by natural structures and topographical formations (20.8%); toppled, submerged rigs and oil production structures (12.0%); and Liberty ships and other submerged vessels (11.9%). The rest of the structures were used less frequently, with less than 10% use by the respondents (Figure 5).

Figure 4. (Q.3a) Percent of participants that have made use of artificial reef structures during their trips to the Gulf of Mexico

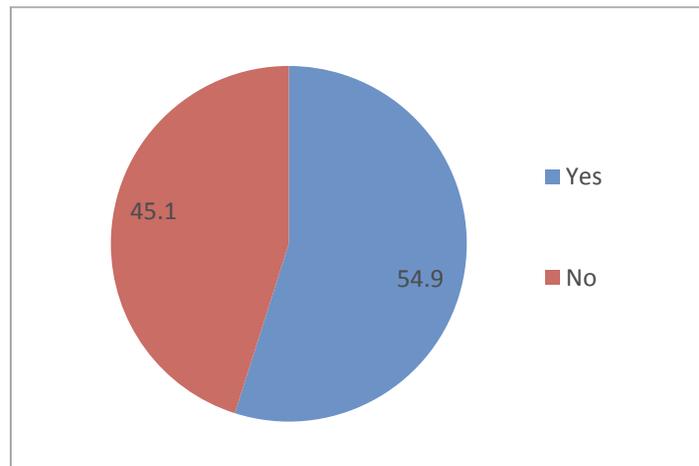
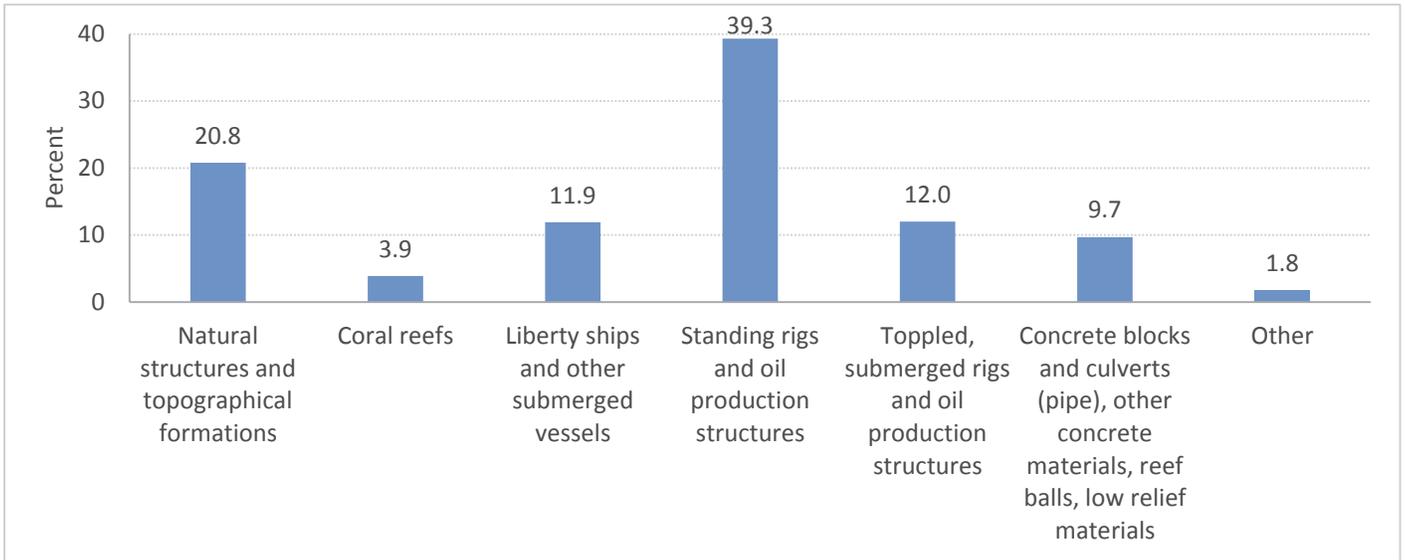


Figure 5. (Q.3b) Mean percentage of trips to reefs by specific reef structures



We explored various factors respondents considered in selecting artificial reef structures for fishing, diving, and boating. Results showed that the presence of fish was extremely important for 58.7% of respondents, followed by distance from port (28.8%), depth of water (24.1%), and diversity of marine life (23.1%) (Table 3). Regarding the importance of those previous choices for choosing artificial reef sites, presence of desired fish (35.0%) and distance from port (32.8%) were the most important (Table 4).

Table 3. Importance for various items when choosing artificial reef sites for fishing, diving, or boating (percentage)

(Q.4) Please rate the importance of the following when selecting ARTIFICIAL REEF sites for fishing, diving, or boating	Not At All Important	Slightly Important	Moderately Important	Very Important	Extremely Important
a. Distance from port	2.7	8.2	25.8	34.6	28.8
b. Type of reef material	19.1	25.3	32.3	15.7	7.7
c. Reef design/layout	16.5	24.9	32.2	18.0	8.4
d. Reef size	5.8	13.9	34.5	32.7	13.3
e. Depth of water	2.3	4.6	25.3	43.7	24.1
f. Water clarity	3.5	9.0	31.3	38.8	17.4
g. Strength of currents	4.7	15.7	37.0	26.7	16.0
h. Presence of desired fish	0.8	3.0	6.5	31.0	58.7
i. Presence of desired marine life other than fish	12.0	18.4	23.1	26.1	20.3
j. Diversity of marine life	5.5	11.9	27.2	32.3	23.1
k. Other	37.6	7.1	11.8	18.2	25.3

Table 4. Most important item when choosing artificial reef sites (percentage)

(Q.5) Of the considerations for reef site selection listed in question #4 (A-K), which are most important to you?	Most Important	Second Most Important
a. Distance from port	32.8	22.6
b. Type of reef material	1.4	2.3
c. Reef design/layout	2.6	2.4
d. Reef size	4.1	6.1
e. Depth of water	11.7	19.3
f. Water clarity	4.0	7.8
g. Strength of currents	1.0	3.5
h. Presence of desired fish	35.0	21.9
i. Presence of desired marine life other than fish	2.7	5.3
j. Diversity of marine life	2.6	7.8
k. Other	2.2	1.3
Total	100.0	100.0

Respondents were asked to state their level of agreement with a series of statements regarding the specific use of artificial reefs. The strongest agreement was shown for a better chance of catching fish (71.2%), followed by more variety of fish at 61.6% (Table 5).

Table 5. Participants' level of agreement regarding the use of artificial reefs (percentage)

(Q.6) Please circle the number that indicates your level of agreement with these statements about using ARTIFICIAL REEFS	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Not Applicable
a. Better chance of harvesting fish	0.4	1.2	3.8	22.6	71.2	0.8
b. Other recommended artificial reefs to me	2.8	5.9	27.0	39.2	19.9	5.2
c. I don't go out that far off shore	28.0	26.5	15.4	12.3	8.4	9.3
d. I like to go snorkeling in these areas	14.8	13.8	20.4	16.3	8.7	26.0
e. I like to go scuba diving in these areas	13.6	11.2	17.3	15.2	16.6	26.2
f. They provide more opportunities to observe fish	3.4	2.9	15.3	32.4	36.3	9.7
g. They degrade the natural ecosystem	72.1	19.0	5.1	1.2	1.0	1.7
h. They change the human use characteristics of the area	31.4	15.3	19.6	24.1	7.9	1.7
i. There is more variety of fish	0.4	0.6	6.3	29.6	61.6	1.6
j. The reef areas are too crowded	11.2	26.2	37.0	18.3	6.0	1.3
k. They bring in tourism to the local communities	1.5	3.7	20.9	38.3	33.3	2.3
l. They lead to overfishing in that area	24.6	35.8	26.3	9.7	2.7	0.8
m. There is recreation conflict with other users at the reef sites	18.2	34.4	30.2	11.9	3.3	1.9
n. More information should be made available about their benefits	1.8	2.3	14.6	35.6	43.8	2.0
o. They provide new areas to recreate	0.7	0.4	6.0	33.1	57.9	2.0

To obtain more detailed information, we explored additional statements regarding artificial reef preferences. The survey results showed that 65.9% of respondents would like to see more artificial reefs placed by TPWD in the Gulf; other items with comparatively high percentages of agreement included 31.8% who would like to have all submerged artificial reefs identified with marker buoys, closely followed by 30.6% who would like to have certain artificial reefs designed for specific uses, and 29.7% who would like to have mooring buoys (for tying off) provided by TPWD in the Gulf (Table 6). Interestingly, one-fifth of responses were split on whether individuals should be allowed to place their own underwater reef structures in the Gulf as long as they are in safe locations (21.9% strongly disagreeing and 20.1% strongly agreeing).

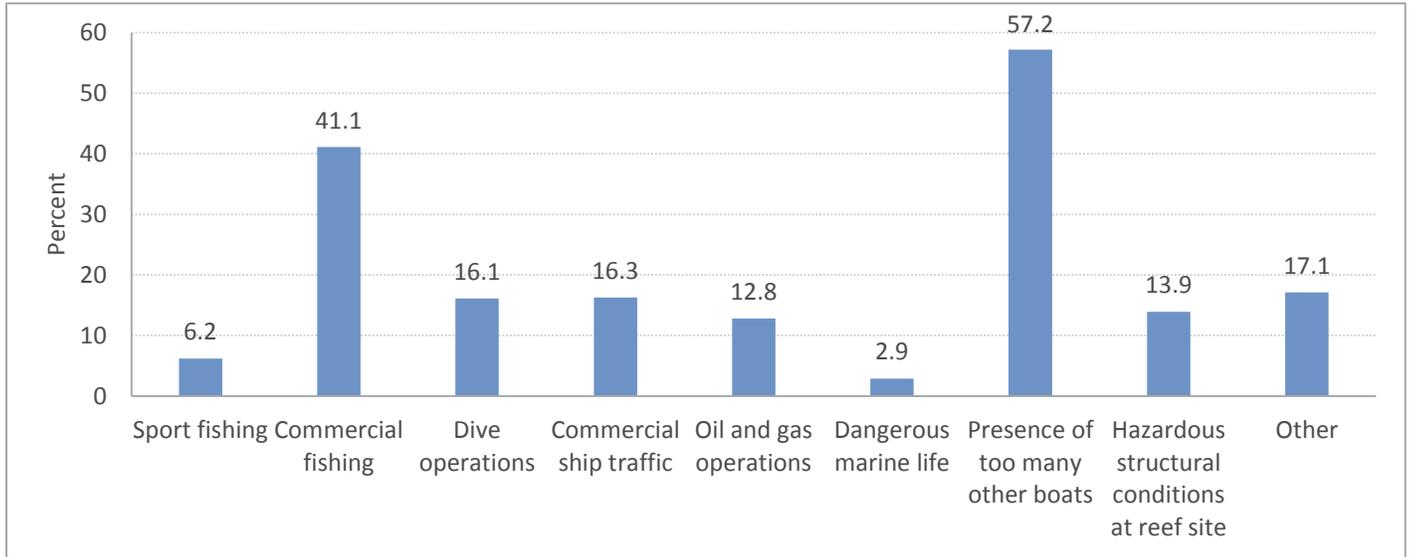
Table 6. Participants' level of agreement regarding the management of artificial reefs (percentage)

(Q.7) Please circle the number that corresponds with your level of agreement with each of the statements below about ARTIFICIAL REEFS	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a. I would like to have all submerged artificial reefs identified with marker buoys	11.0	21.0	19.2	31.8	17.0
b. Mooring buoys (for tying off) should be provided by TPWD in the Gulf	12.7	20.6	18.5	29.7	18.4
c. I want to see more artificial reefs placed by TPWD in the Gulf	0.6	0.4	4.1	29.0	65.9
d. Certain artificial reefs should be designed for specific uses (such as diving only or sport fishing only)	10.9	15.9	23.5	30.6	19.1
e. Certain artificial reefs should be designed for specific types of fishing gear (such as rod and reel only or spear gun only)	13.7	19.9	26.0	24.6	15.8
f. Individuals should be allowed to place their own underwater reef structures as long as they are in safe locations	21.9	18.5	18.1	21.3	20.1

When asked about encounters that caused the most problems for respondents and would reduce the probability of their returning to a particular reef site, over half (57.2%) reported that the presence of too many boats was a problem. Commercial fishing was also an issue, with 41.1% reporting it to be a problem (Figure 6). No other issues were rated as being problematic for reducing the probability of returning to artificial reef sites. A closer examination of the importance of these items again revealed that the presence of too many boats was ranked as *most important* by 38.1%, followed by commercial fishing at 26.4%. The presence of too many boats was also rated as *second most important* at 27.9% (Figure 7). Evidently, the issue of crowded areas with too many boats on the

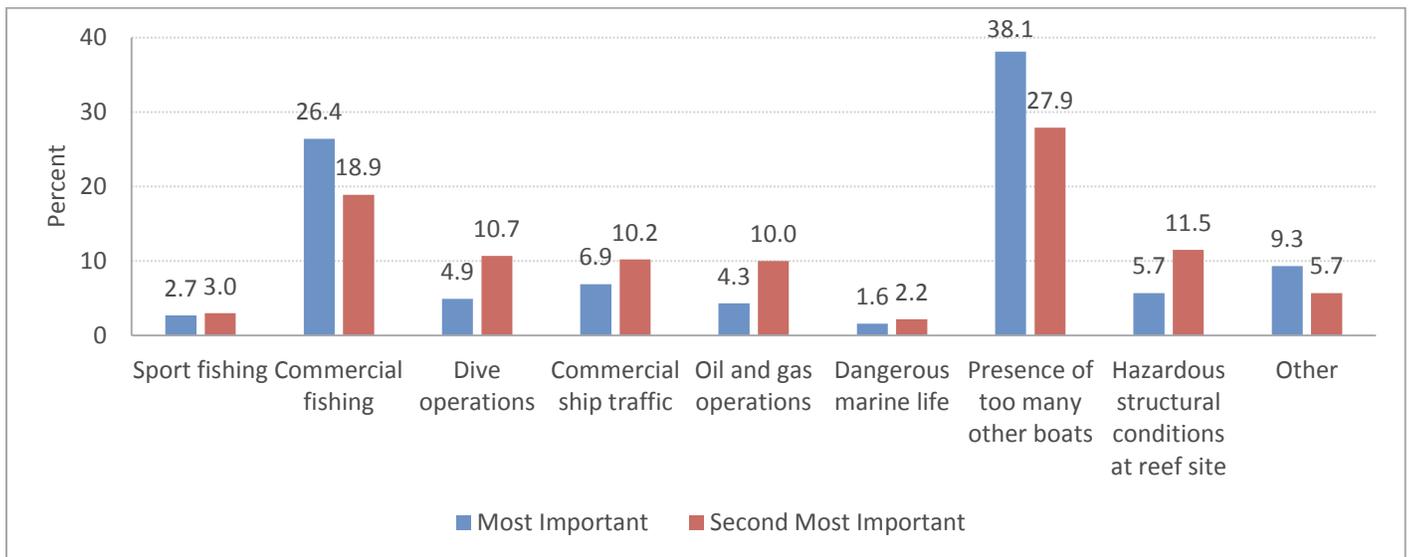
artificial reefs, whether the boats are commercial vessels or not, is a substantive concern for artificial reef users.

Figure 6. (Q.8a) Percent of participants who experienced problems at an artificial reef site by specific condition which reduced the probability of their return to artificial reef sites*



*over 100% due to multiple responses

Figure 7. (Q.8b) Participants' difficulties caused by encounters at artificial reef sites (percentage)



In order to gain some background on the frequency of use of the artificial reefs, we asked respondents about the number of trips they had taken to the Gulf of Mexico in the last 12 months. Respondents gave a range of responses, with 60.8% indicating that they had made between 1-5 trips, followed by 22.4% who indicated making 6-10 trips (Figure 8). The frequency dropped off sharply after 6-10 trips, with only a small percentage making over 20 trips in the last year (4.6%). In a closely related item, the amount of hours respondents spent on the reef on their most recent trip was also tabulated, with almost half (49.3%) spending from 1-5 hours offshore; the next longest time period out on the reef was from 6-10 hours at 30.1% (Figure 9). Thus, over three-fourths of respondents spent a day or less out on the reef on their most recent trip.

Figure 8. (Q.9) Number of artificial reef trip(s) made in the Gulf of Mexico over the last twelve months (percentage)

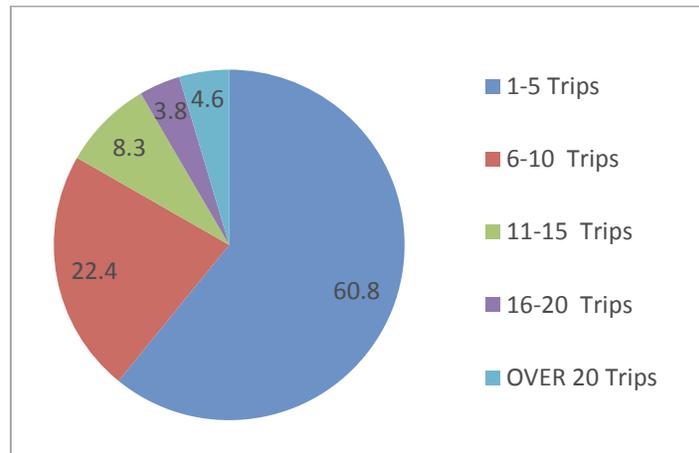
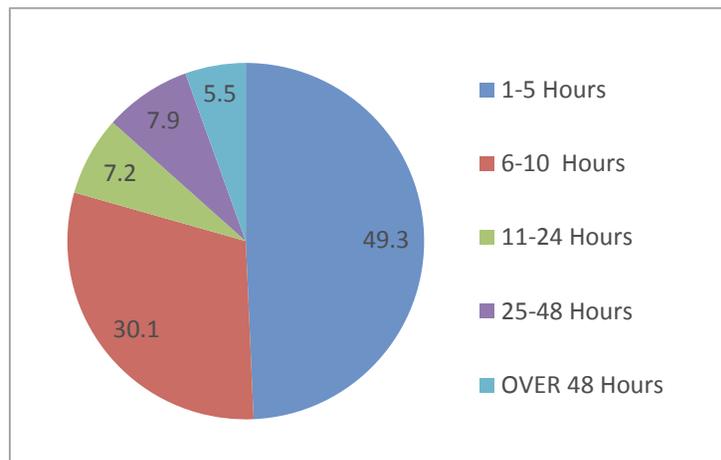
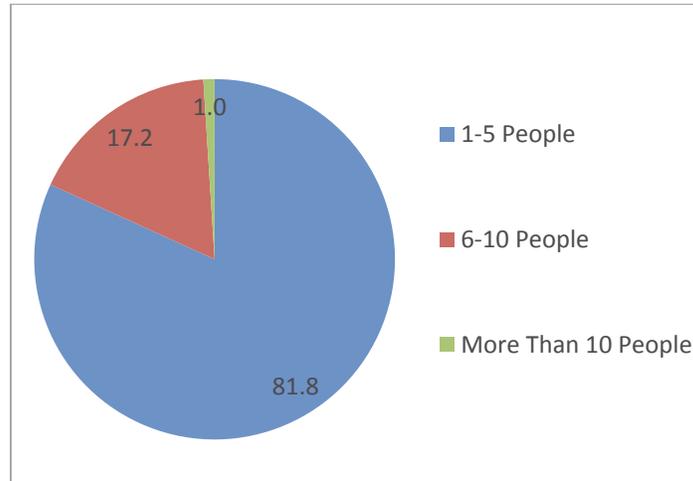


Figure 9. (Q.10) Number of hours participants stayed out on the reef (percentage)



Regarding other reef trip behaviors, 81.8% paid for between 1-5 people on their trips to the reef, with 17.2% paying for between 6-10 people (Figure 10).

Figure 10. (Q.11) Percent of additional people (by group size) that participants paid for on their most recent reef-related trip in the Gulf of Mexico



As for the activities they participate in on the trip, 94.0% went fishing, while a smaller percentage (19.6%) went snorkelling/diving (Table 7). In a follow-up to the activities that they participate in, fishing was considered as most important by 87.4%, followed by snorkeling/diving at 10.4% (Table 8).

Table 7. Percentage of activities respondents participate in on their trips*

(Q.12a) Which activities did you participate in on the trip? (Multiple choice)	Percent
a. Fishing	94.0
b. Snorkelling/Diving	19.6
c. Other	5.7

*over 100% due to multiple responses

Table 8. Level of importance of the activities respondents participate in on their trips (percentage)

(Q.12b) From the list above, which activity was most important to you?	Percent
a. Fishing	87.4
b. Snorkelling/Diving	10.4
c. Other	2.2
Total	100.0

In terms of the economic aspects of artificial reef use, respondents reported a spending average of \$1,652.00 per travel party (Table 9). Responses varied greatly, from no spending to thousands of dollars per category. The largest and most variable expenditure category was private auto/boat expenditures, including gasoline, repairs, and rental, which averaged \$775.00 (46.9% of all the expenditure items).

Table 9. Mean direct expenditures on most recent reef-related trips in the Gulf of Mexico

(Q. 13) How much did you and other members of your immediate group spend on this trip, including travel to and from your home?	Mean (SD)	Range
a. Access fees (entrance fees, parking fees, boat launch, etc.)	\$72 (\$393)	\$0-5,000
b. Restaurants & Bars	\$146 (\$293)	\$0-5,000
c. Private auto/boat expenses (gas, repairs, rental)	\$775 (\$1,693)	\$0-30,000
d. Charter/guide fees	\$171 (\$674)	\$0-10,000
e. Lodging (hotel, camping)	\$157 (\$485)	\$0-6,000
f. Retail shopping (bait & tackle, clothing, groceries, ice, etc.)	\$217 (\$540)	\$0-12,000
g. Other entertainment (movies, etc.)	\$26 (\$158)	\$0-3,000
h. Any other miscellaneous expenses (please list)	\$88 (\$610)	\$0-12,000
Mean Amount Spent Per Trip	\$1,652.00	--

(SD=Standard Deviation)

Respondents were asked how much their trip could have cost before they would have cancelled it. Among respondents who provided willingness-to-pay (WTP) estimates, just over one-fifth (21.2%) would have paid between \$1 to \$500, and just over a quarter (26.3%) would have paid between \$501 to \$1,000 more for the trip before cancelling it. Interestingly, only 1.3% were not willing to pay more for the trip and would have cancelled if costs were higher (Table 10). The average willingness-to-pay amount was \$1,821.00, which was \$641.00 above current expenditures. Both in regard to expenditures and willingness to pay, it is noteworthy that many respondents had relatively high incomes (Table 1). While 36.1% of respondents reported annual household incomes of \$160,000 and higher, only 9.1% of Texas households have annual incomes greater than \$150,000 (U.S. Census Bureau, 2014). This result demonstrates that the sample consisted of users with discretionary income capable of spending money on activities, which bodes well for tourism and marine recreation in coastal counties and communities.

Table 10. Willingness to pay (WTP) among respondents who provided a WTP equal or larger than their current trip expenditures

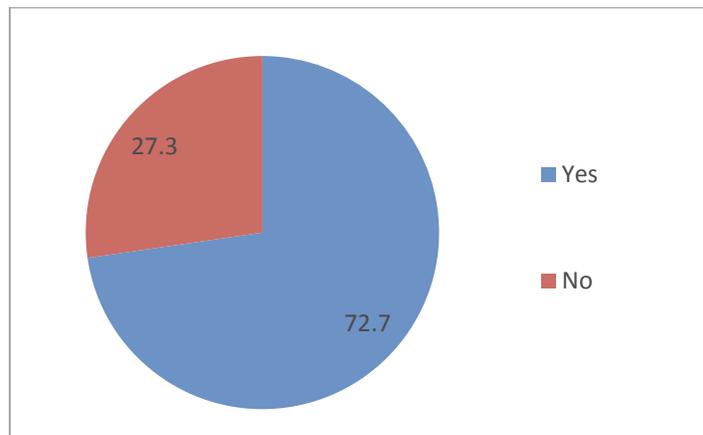
(Q. 14) What is the highest amount your trip could have cost in total (recall the trip costs you listed in Question #13) before you would have cancelled this trip in the Gulf of Mexico?	Percent
0	1.3
1~500	21.2
501~1,000	26.3
1,001~1,500	13.8
1,501~2,000	11.4
2,001~2,500	6.7
2,501~3,000	6.9
3,001~3,500	1.4
3,501~4,000	2.4
4,000~4,500	1.1
4,501~5,000	3.9
5,001~10,000	3.1
ABOVE 10,000	0.5
Total	100.0
Mean (SD)	\$1,821.00 (\$1,996.00)

(SD=Standard Deviation)

TPWD Artificial Reefs

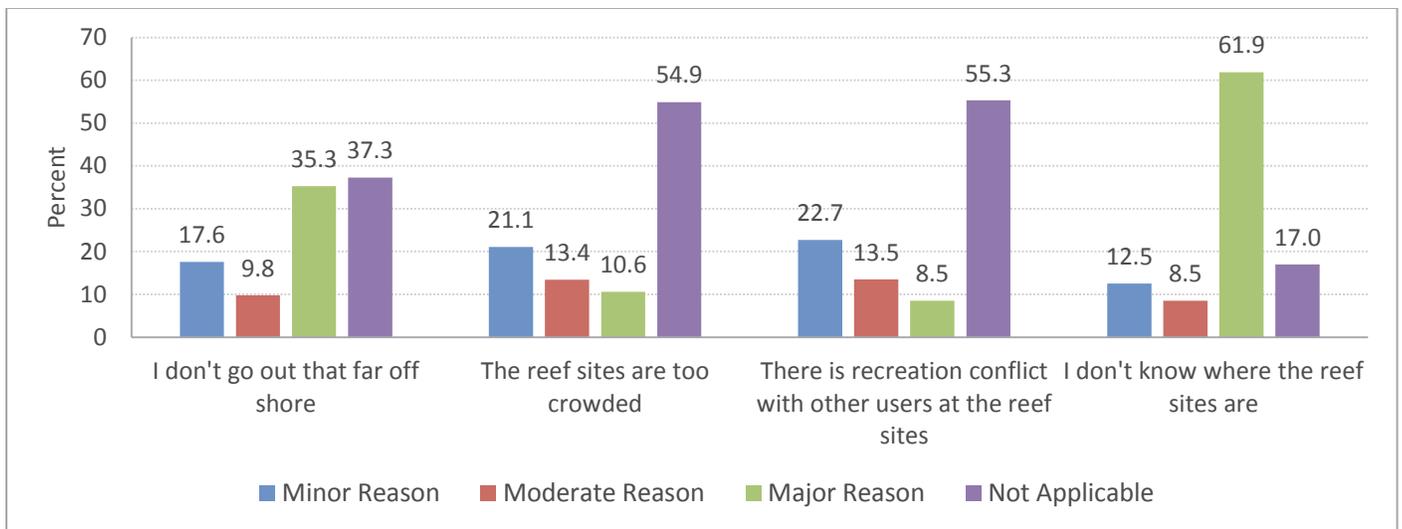
The next section of this report is specific to the use and experience with TPWD artificial reefs. Initially, when asked about the use of TPWD artificial reefs, 72.7% of participants responded that they made use of them, while slightly over one-fourth reported not using TPWD artificial reefs (27.3%) (Figure 11). Hence, the majority of respondents in this study appear to be TPWD artificial reef users.

Figure 11. (Q. 15) Percent of participants who make use of TPWD artificial reefs



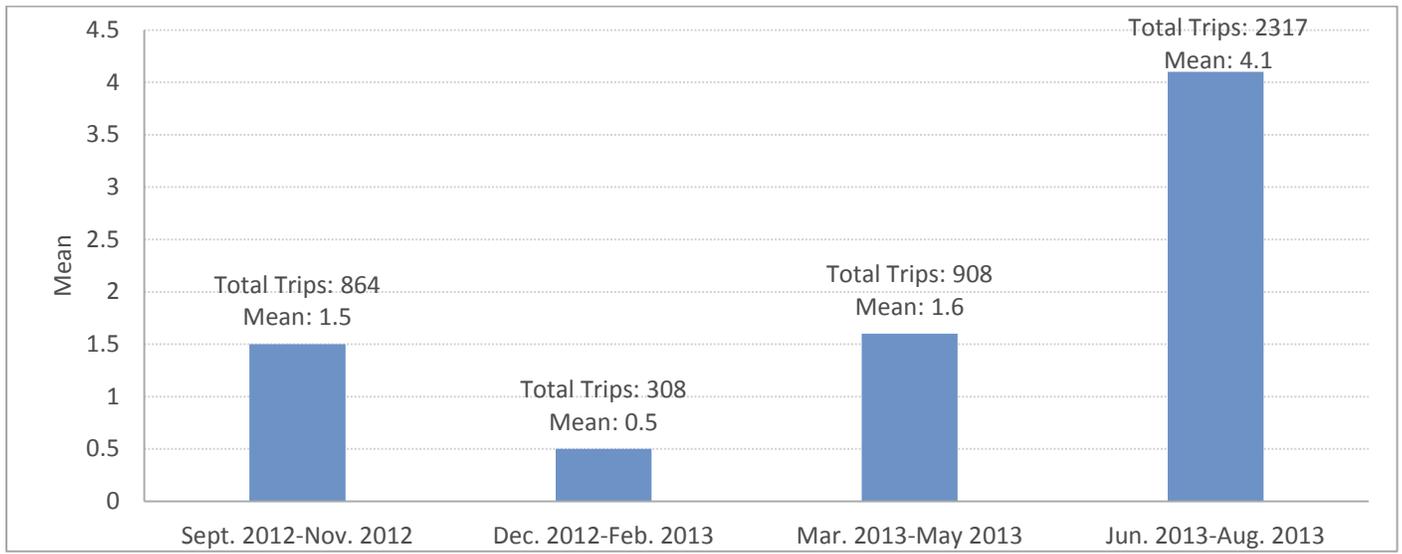
Regarding reasons for not making use of the TPWD artificial reef sites, the responses were varied. Of those that reported that they did not make use of TPWD artificial reefs, over half (61.9%) stated that they did not know where the sites were located (Figure 12). This finding is quite significant since it details a general lack of knowledge about TPWD artificial reef sites by a majority of the respondents who did not use them. Another major reason for not using TPWD artificial reefs sites, as reported by over one-third (35.3%) of respondents, was that they did not travel that far off shore. This response implies that participants took shorter trips out in the Gulf or had less time to spend in the water. As for moderate reasons for not making use of TPWD artificial reefs, 13.5% felt that there was recreation conflict with other users, and similarly, 13.4% felt reef sites were too crowded; this finding on crowding appears connected to the issue of too many boats at the reef sites, which was mentioned earlier.

Figure 12. (Q. 16) Percent of participants' reasons for not making use of TPWD artificial reef sites



We asked respondents a series of questions pertaining to the number of trips they took to TPWD artificial reefs sites over the last year, which sites they visited most often, and which sites they preferred. Over a 12-month period from September 2012 to August 2013 and using three-month increments, the total number of trips taken by all respondents in the study was 4,397. Visitation was highest from June 2013-August 2013, totaling 2,317 trips (52.7%) with an average of 4.1 trips (Figure 13). Visitation was next highest in spring from March 2013-May 2013, with 908 trips (20.7%) and an average of 1.6 trips; visitation in the fall (19.6%) was similar to the spring months. The winter time period activity was quite low (7.0%) compared to the summer time period in 2013, so trip numbers may not have been impacted by “Winter Texans.”

Figure 13. (Q.17) Mean number of trips by periods that participants made involving TPWD artificial reef sites



In order to measure the number of specific sites and areas visited, respondents were provided a map in the questionnaire showing a list of 66 TPWD artificial reef sites segregated into four zones (see questionnaire in Appendix B). They were asked to record which specific sites and zones they visited during their trips. Given the number of reef sites they could potentially visit, tabulated responses showed a wide range of sites listed by frequency and location throughout the Gulf. Zone One, which is located closest to the ports of Freeport and Galveston, has 12 artificial reef sites. Visitation was highest in Zone One with a total of 631 total visits (37.3% of all zone visits) (Table 11). The most popular site visited in Zone One was GA-A-22-Freeport Liberty Ship with 101 visits (16.0% of visits), followed by GA-189-Mitchell's with 73 visits (11.6%); the sites in Zone One with the lowest visitation were HI-85-S.A.L.T. and HI-17-Sabine (15 visits each, 2.4%).

Zone Two has the most artificial reef sites (35) but is located farther offshore than the other three zones. The most-visited site in Zone Two was HI-A-480 with 23 visits (5.7% of visits), followed by HI-A-571 with 20 visits (5.0%), and HI-A-447 with 19 visits (4.7%). Two sites were visited only five times each in Zone Two, HI-A-317 and HI-A-281. The total number of visits for this zone was 404 (23.8%). Zone Three, with 10 sites, is located near the ports of Port O'Connor, Port Aransas, and Corpus Christi, and received the second most visits at 543 (32.1%). The most frequently visited reef sites in this zone were MI-616-Matagorda Island Liberty Ship with 79 visits (14.5%) and MU-802-Mustang Liberty Ship with 68 visits (12.5%) (Table 11). Zone Four, which is located by Port Isabel, has the fewest number of artificial reef sites with nine. The total number of site visits in Zone Four was 113 (6.6%). The most-visited sites

in this area were the two ship reef sites, PS-1070-Port Mansfield Liberty Ship and PS-1122-Texas Clipper, each at 19 visits (16.8%).

Table 11. Distribution of participants' visits to artificial reef site(s) during their trips

(Q.18a) Artificial Reef Sites (Multiple choice)	Frequency	Percent
Zone One		
1: BA-336-George Vancouver Liberty Ship	62	9.8
2: BA-439-Matagorda	40	6.3
3: BA-A-28	57	9.0
4: GA-189-Barr's	45	7.1
5: GA-189-Mitchell's	73	11.6
6: GA-288-Buccaneer	63	10.0
7: GA-296-Buccaneer	58	9.2
8: GA-A-125	68	10.8
9: GA-A-22-Freeport Liberty Ship	101	16.0
10: HI-117-Basco's	34	5.4
11: HI-117-Sabine	15	2.4
12: HI-85-S.A.L.T.	15	2.4
Zone One Total:	631	100.0
Zone Two		
13: HI-A-270	6	1.5
14: HI-A-271	8	2.0
15: HI-A-281	5	1.2
16: HI-A-285	6	1.5
17: HI-A-286	9	2.2
18: HI-A-298	9	2.2
19: HI-A-302	8	2.0
20: HI-A-310	7	1.7
21: HI-A-313	9	2.2
22: HI-A-315	9	2.2
23: HI-A-317	5	1.2
24: HI-A-323	6	1.5
25: HI-A-327	9	2.2
26: HI-A-330	13	3.2
27: HI-A-341	7	1.7
28: HI-A-349	18	4.5
29: HI-A-355	14	3.5
30: HI-A-356	10	2.5
31: HI-A-447	19	4.7
32: HI-A-462	11	2.7
33: HI-A-466	12	3.0
34: HI-A-477	14	3.5
35: HI-A-480	23	5.7
36: HI-A-487	16	4.0
37: HI-A-492	10	2.5
38: HI-A-497	13	3.2
39: HI-A-515	8	2.0
40: HI-A-517	9	2.2
41: HI-A-520	8	2.0
42: HI-A-532	18	4.5

Table 11. Distribution of participants' visits to artificial reef site(s) during their trips (cont'd.)

(Q.18a) Artificial Reef Sites (Multiple choice)	Frequency	Percent
Zone Two		
43: HI-A-542	14	3.5
44: HI-A-555	16	4.0
45: HI-A-567	18	4.5
46: HI-A-570	17	4.2
47: HI-A-571	20	5.0
Zone Two Total:	404	100.0
Zone Three		
48: BA-A-132	57	10.5
49: MI-616-Matagorda Island Liberty Ship	79	14.5
50: MI-712	67	12.3
51: MI-A-7	64	11.8
52: MU-746L-Boatmen's	50	9.2
53: MU-770L-Lonestar	44	8.1
54: MU-775-Corpus Christi	38	7.0
55: MU-802-Mustang Island Liberty Ship	68	12.5
56: MU-828	36	6.6
57: MU-A-16	40	7.4
Zone Three Total:	543	100.0
Zone Four		
58: MU-A-85	7	6.2
59: PN-967	6	5.3
60: PN-A-58	12	10.6
61: PS-A-72	6	5.3
62: PS-1047-Port Mansfield	15	13.3
63: PS-1070-Port Mansfield Liberty Ship	19	16.8
64: PS-1122-Texas Clipper	19	16.8
65: PS-1169L-Port Isabel	15	13.3
66: PN-A-42	14	12.4
Zone Four Total:	113	100.0

We anticipated that respondents may not have been able to recall which specific reef site they visited on their last trip. Therefore, we asked a question about site visits to each *zone only*. In response to the item about number of trips to each zone, the results were as follows: Zone Two received the most visits with 58 (41.4%), followed by Zone One with 46 (32.9%), Zone Three with 29 (20.7%), and Zone Four with seven visits (5.0%) (Table 12). In general, these responses differed with the previous table (Table 11), which stated that the most popular area was Zone One.

Table 12. Percent of participants distributed by ZONE(s) for those who could not identify the specific TPWD artificial reef they last visited

(Q.18b) If you cannot identify the specific TPWD ARTIFICIAL REEF site that you last visited, please tell us which ZONE(s) you were in. (Multiple choice)	Frequency	Percent
Zone One	46	32.9
Zone Two	58	41.4
Zone Three	29	20.7
Zone Four	7	5.0
Total	140	100.0

In a closely related question, we asked respondents to identify which specific artificial reef site they spent the most time at if they visited *more than one* reef site. In Zone One, the most popular reef site was GA-A-22-Freeport Liberty Ship with 28 visits (17.8%) (Table 11). This finding is consistent with the earlier question (Table 9) for the sites visited, which showed the same reef site as the most visited. In Zone Two, the sites where people spent the most time were HI-A-570 and HI-A-571, both at seven times (8.8%); Zone Three’s site where people spent the most time was MU-802-Mustang Island Liberty Ship, at 24 times (20.7%); and in Zone Four, it was PS-1122-Texas Clipper and PS8-1070-Port Mansfield Liberty Ship, both at six times (23.1%).

Table 13. Percent of participants distributed by ZONE(s) and artificial reef site(s) where they spent most of their time

(Q.19a) If you visited more than one TPWD ARTIFICIAL REEF site, which site(s) did you spend the most time? (Multiple choice)	Frequency	Percent
Zone One		
1: BA-336-George Vancouver Liberty Ship	14	8.9
2: BA-439-Matagorda	7	4.5
3: BA-A-28	19	12.1
4: GA-189-Barr’s	12	7.6
5: GA-189-Mitchell’s	16	10.2
6: GA-288-Buccaneer	18	11.5
7: GA-296-Buccaneer	17	10.8
8: GA-A-125	11	7.0
9: GA-A-22-Freeport Liberty Ship	28	17.8
10: HI-117-Basco’s	6	3.8
11: HI-117-Sabine	3	1.9
12: HI-85-S.A.L.T.	6	3.8
Zone One Total:	157	100.0

Table 13. Percent of participants distributed by ZONE(s) and artificial reef site(s) where they spent most of their time (cont'd.)

(Q.19a) If you visited more than one TPWD ARTIFICIAL REEF site, which site(s) did you spend the most time? (Multiple choice)	Frequency	Percent
Zone Two		
13: HI-A-270	2	2.5
14: HI-A-271	1	1.3
15: HI-A-281	2	2.5
16: HI-A-285	1	1.3
17: HI-A-286	1	1.3
18: HI-A-298	3	3.8
19: HI-A-302	1	1.3
20: HI-A-310	2	2.5
21: HI-A-313	1	1.3
22: HI-A-315	2	2.5
23: HI-A-317	1	1.3
24: HI-A-323	1	1.3
25: HI-A-327	1	1.3
26: HI-A-330	2	2.5
27: HI-A-341	1	1.3
28: HI-A-349	2	2.5
29: HI-A-355	3	3.8
30: HI-A-356	2	2.5
31: HI-A-447	1	1.3
32: HI-A-462	1	1.3
33: HI-A-466	1	1.3
34: HI-A-477	1	1.3
35: HI-A-480	3	3.8
36: HI-A-487	4	5.0
37: HI-A-492	1	1.3
38: HI-A-497	5	6.3
39: HI-A-515	2	2.5
40: HI-A-517	2	2.5
41: HI-A-520	1	1.3
42: HI-A-532	1	1.3
43: HI-A-542	2	2.5
44: HI-A-555	6	7.5
45: HI-A-567	6	7.5
46: HI-A-570	7	8.8
47: HI-A-571	7	8.8
Zone Two Total:	80	100.0
Zone Three		
48: BA-A-132	11	9.5
49: MI-616-Matagorda Island Liberty Ship	16	13.8
50: MI-712	21	18.1
51: MI-A-7	9	7.8
52: MU-746L4-Boatmen's	11	9.5
53: MU-770L-Lonestar	4	3.4
54: MU-775-Corpus Christi	5	4.3
55: MU-802-Mustang Island Liberty Ship	24	20.7
56: MU-828	8	6.9
57: MU-A-16	7	6.0
Zone Three Total:	116	100.0

Table 13. Percent of participants distributed by ZONE(s) and artificial reef site(s) where they spent most of their time (cont'd.)

(Q.19a) If you visited more than one TPWD ARTIFICIAL REEF site, which site(s) did you spend the most time? (Multiple choice)	Frequency	Percent
Zone Four		
58: MU-A-85	1	3.8
59: PN-967	0	0.0
60: PN-A-58	2	7.7
61: PS-A-72	0	0.0
62: PS-1047-Port Mansfield	4	15.4
63: PS-1070-Port Mansfield Liberty Ship	6	23.1
64: PS-1122-Texas Clipper	6	23.1
65: PS-1169L-Port Isabel	4	15.4
66: PN-A-42	3	11.5
Zone Four Total:	26	100.0

We asked one last question in order to determine which reef site or zone was respondents' most preferred. Respondents could write in either a site or zone if they did not know or could not recall where they went. In brief, the most preferred site in Zone One was GA-A-22-Freeport Liberty Ship with a frequency of 22 (17.2%); Zone Two's preferred site was HI-A-570 with 11 visits (7.1%), Zone Three's was MI-712 with 28 visits (20.9%), and Zone Four's was PS-1122-Texas Clipper with 11 visits (35.5%) (Table 14). These results are somewhat consistent with the previous responses, but given the fact that respondents could write in a zone or site, it is difficult to directly compare frequencies.

Table 14. Percent of participants distributed by the most preferred zones and artificial reef sites

(Q.19b) Which is your most preferred ZONE OR ARTIFICIAL REEF? (Multiple choice)	Frequency	Percent
Zone One		
1: BA-336-George Vancouver Liberty Ship	17	13.3
2: BA-439-Matagorda	9	7.0
3: BA-A-28	14	10.9
4: GA-189-Barr's	6	4.7
5: GA-189-Mitchell's	11	8.6
6: GA-288-Buccaneer	13	10.2
7: GA-296-Buccaneer	10	7.8
8: GA-A-125	13	10.2
9: GA-A-22-Freeport Liberty Ship	22	17.2
10: HI-117-Basco's	8	6.3
11: HI-117-Sabine	2	1.6
12: HI-85-S.A.L.T.	3	2.3
Zone One Total:	128	100.0

Table 14. Percent of participants distributed by the most preferred zones and artificial reef sites (cont'd.)

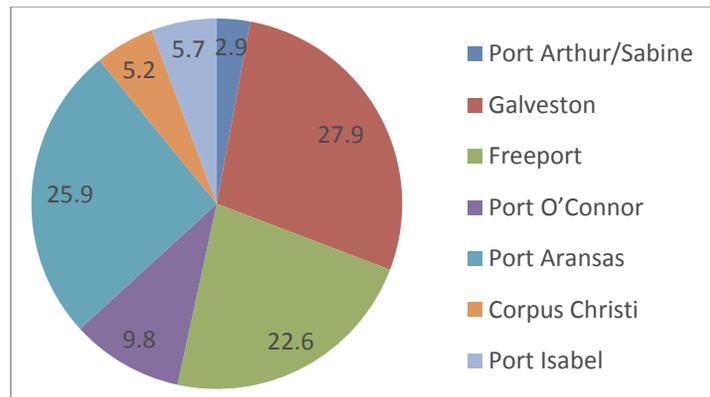
(Q.19b) Which is your most preferred ZONE OR ARTIFICIAL REEF? (Multiple choice)	Frequency	Percent
Zone Two		
13: HI-A-270	2	1.3
14: HI-A-271	2	1.3
15: HI-A-281	2	1.3
16: HI-A-285	2	1.3
17: HI-A-286	3	1.9
18: HI-A-298	3	1.9
19: HI-A-302	3	1.9
20: HI-A-310	5	3.2
21: HI-A-313	4	2.6
22: HI-A-315	5	3.2
23: HI-A-317	4	2.6
24: HI-A-323	5	3.2
25: HI-A-327	4	2.6
26: HI-A-330	4	2.6
27: HI-A-341	4	2.6
28: HI-A-349	5	3.2
29: HI-A-355	8	5.2
30: HI-A-356	5	3.2
31: HI-A-447	4	2.6
32: HI-A-462	4	2.6
33: HI-A-466	5	3.2
34: HI-A-477	4	2.6
35: HI-A-480	5	3.2
36: HI-A-487	4	2.6
37: HI-A-492	5	3.2
38: HI-A-497	5	3.2
39: HI-A-515	4	2.6
40: HI-A-517	5	3.2
41: HI-A-520	4	2.6
42: HI-A-532	3	1.9
43: HI-A-542	3	1.9
44: HI-A-555	5	3.2
45: HI-A-567	7	4.5
46: HI-A-570	11	7.1
47: HI-A-571	7	4.5
Zone Two Total:	155	100.0
Zone Three		
48: BA-A-132	13	9.7
49: MI-616-Matagorda Island Liberty Ship	19	14.2
50: MI-712	28	20.9
51: MI-A-7	8	6.0
52: MU-746L-Boatmen's	11	8.2
53: MU-770L-Lonestar	8	6.0
54: MU-775-Corpus Christi	5	3.7
55: MU-802-Mustang Island Liberty Ship	21	15.7
56: MU-828	11	8.2
57: MU-A-16	10	7.5
Zone Three Total:	134	100.0

Table 14. Percent of participants distributed by the most preferred zones and artificial reef sites (cont'd.)

(Q.19b) Which is your most preferred ZONE OR ARTIFICIAL REEF (Multiple choice)	Frequency	Percent
Zone Four		
58: MU-A-85	1	3.2
59: PN-967	0	0.0
60: PN-A-58	1	3.2
61: PS-A-72	0	0.0
62: PS-1047-Port Mansfield	6	19.4
63: PS-1070-Port Mansfield Liberty Ship	5	16.1
64: PS-1122-Texas Clipper	11	35.5
65: PS-1169L-Port Isabel	5	16.1
66: PN-A-42	2	6.5
Zone Four Total:	31	100.0

To identify the location where respondents departed from shore, we gave them a choice of seven major ports. The most frequent departure point was Galveston for 27.9% of the respondents, followed by Port Aransas at 25.9%, and Freeport at 22.6% (Figure 14). The fact that Galveston (first) and Freeport (third) were frequent points of departure and near the Houston metro area is one of the reasons that Zone One (closest) also had the highest frequencies for most time spent out on the reefs (Table 13).

Figure 14. (Q.20) Percent of participants distributed by the mainland areas/ports that they have departed from for their most recent reef trip to the Gulf



We asked if respondents had heard of or seen information about TPWD’s Artificial Reef Program, and 57.4% reported that they were familiar with it (Figure 15). This finding may be an indirect indicator of a lack of familiarity with TPWD artificial reef sites and their locations. Most respondents learned of the Program through either a magazine (43.8%), a web search/TPWD webpage (38.3%), or friends/family (28.8%) (Figure 16). The use of magazines as the number one source may be tied to the mean age of respondents (56.9).

Figure 15. (Q.21a) Percent of participants who have heard or seen information about the TPWD Artificial Reef Program

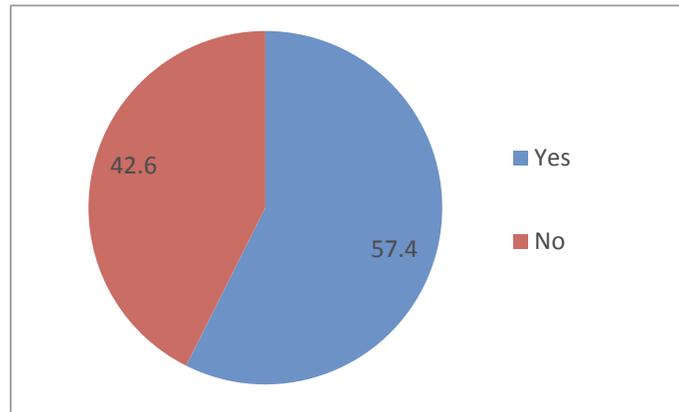
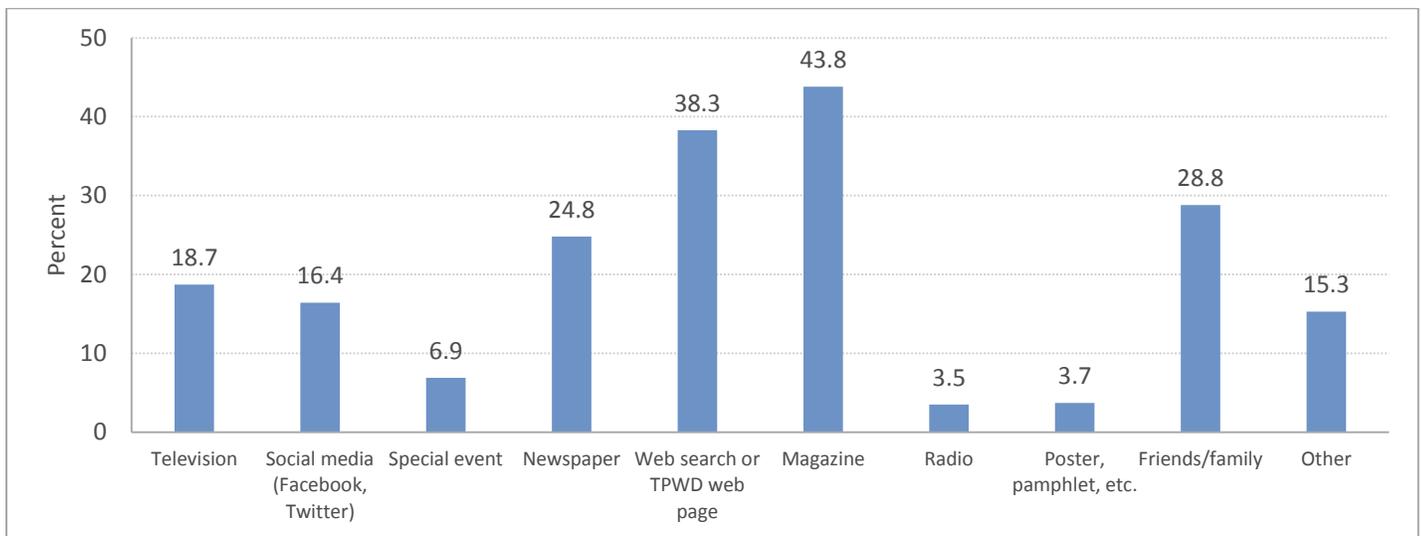


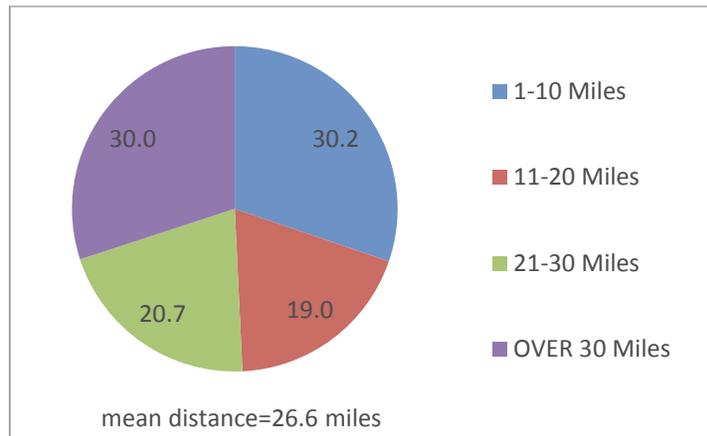
Figure 16. (Q.21b) Percent of participants distributed by sources from which they have heard or seen information about the TPWD Artificial Reef Program*



*over 100% due to multiple responses

We asked several questions about reef locations, water depth, materials/structures for future reefs, preferences for reef materials, and how respondents felt about artificial reefs being located in the Gulf of Mexico. When queried about the distance artificial reefs should be situated from the shore, respondents provided mixed results (Figure 17). Of those preferring closer reef locations, 30.2% were in favor of the artificial reefs being 1-10 miles from shore, 30.0% preferred that the reefs be farther than 30 miles, 20.7% felt they should be 21-30 miles, and the remaining percentage (19%) preferred 11-20 miles. The mean distance was 26.6 miles from shore.

Figure 17. (Q.22) Participants' preferences of distance (in miles) of artificial reefs from the shore (percentage)



Two questions were posed to respondents about the depth and height of the reefs. Responses for the best water depth for artificial reef structures (from the ocean surface to the ocean bottom) showed that the respondents wanted them to be deeper in the water (Figure 18). Deeper than 100 feet was the most frequent response (32.9%), followed by 81-100 feet (22.0%). The mean preferred depth was 109.9 feet from the ocean surface to the ocean bottom. As for the best height from the ocean surface to the top of the artificial reef structure, the most frequent response was 21-40 feet (30.6%), followed by 41-60 feet (22.6%) (Figure 19). The mean preferred height was 49.5 feet from the ocean surface to the top of the artificial reef structure.

Figure 18. (Q.23a) Participants' preferences of water depth (in feet) that artificial reef structures should be situated from the ocean surface to the ocean bottom (percentage)

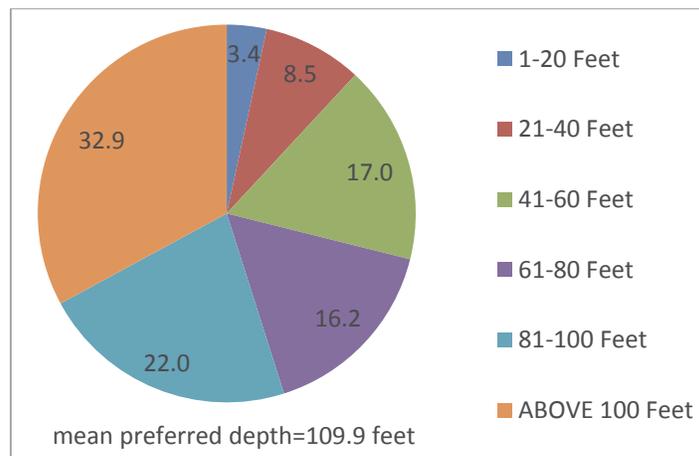
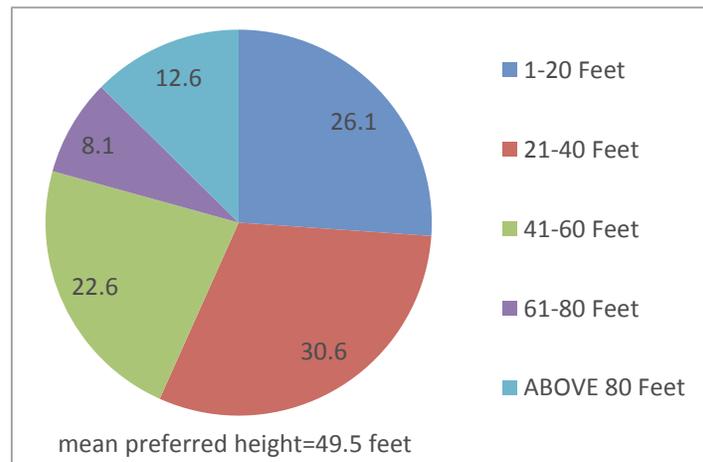
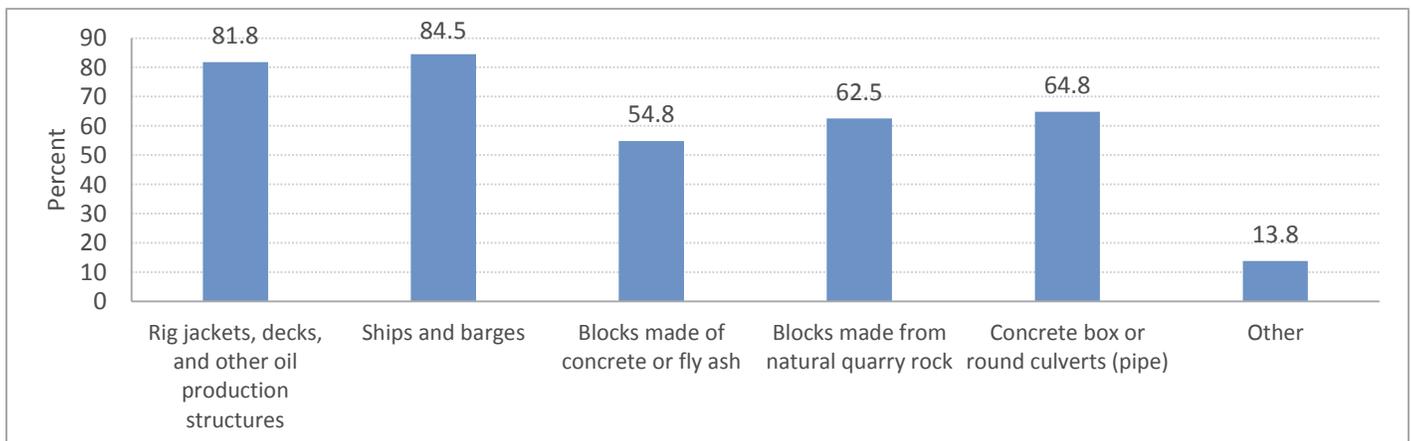


Figure 19. (Q.23b) Participants' preferences of water height (in feet) from the ocean surface to the top of the artificial reef structures (percentage)



Preferences for types of materials and structures for future reef sites varied. Ships and barges were preferred (84.5%), followed by rig jackets, decks, and other oil production structures (81.8%), and then by concrete boxes or round culverts (64.8%) (Figure 20). This finding is consistent with the earlier question on specific sites visited that showed the Liberty ships being very popular sites to experience. When asked to choose the *most preferred* structure/material for future sites, rig jackets, decks, and other oil production structures were chosen most often at 47.2% (Figure 21). Almost all of the respondents (92.1%) did not object to the use of any materials or structures listed in the previous question (Figure 22). Of the small percentage that did object, 37.8% of that group did not want blocks made of concrete or fly ash, followed by 31.1% who did not want rig jackets, decks, and other oil production structures (Figure 23).

Figure 20. (Q.24a) Participants' preferences of materials and structures for future artificial reef sites (percentage)*



*over 100% due to multiple responses

Figure 21. (Q.24b) Participants' most preferred type of materials and structures for future artificial reef sites (percentage)

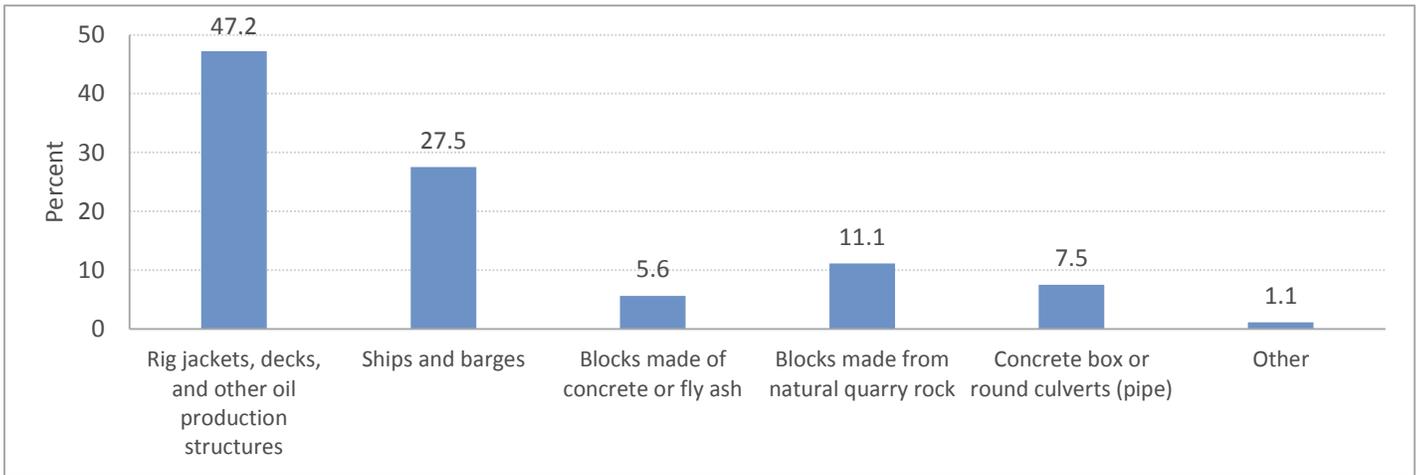


Figure 22. (Q.24c) Percent of participants who object to the use of the materials or structures listed in Figure 20

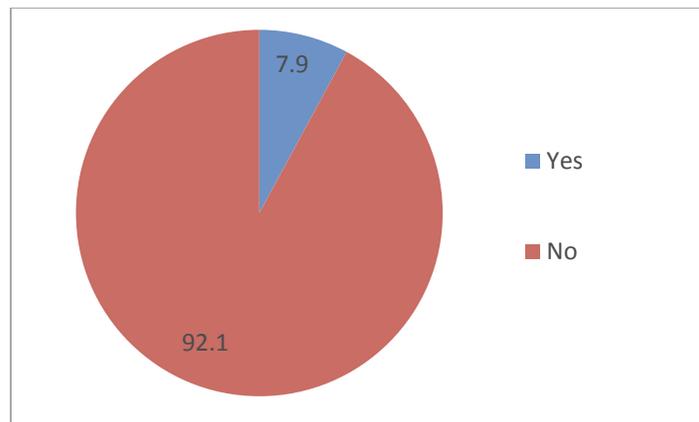
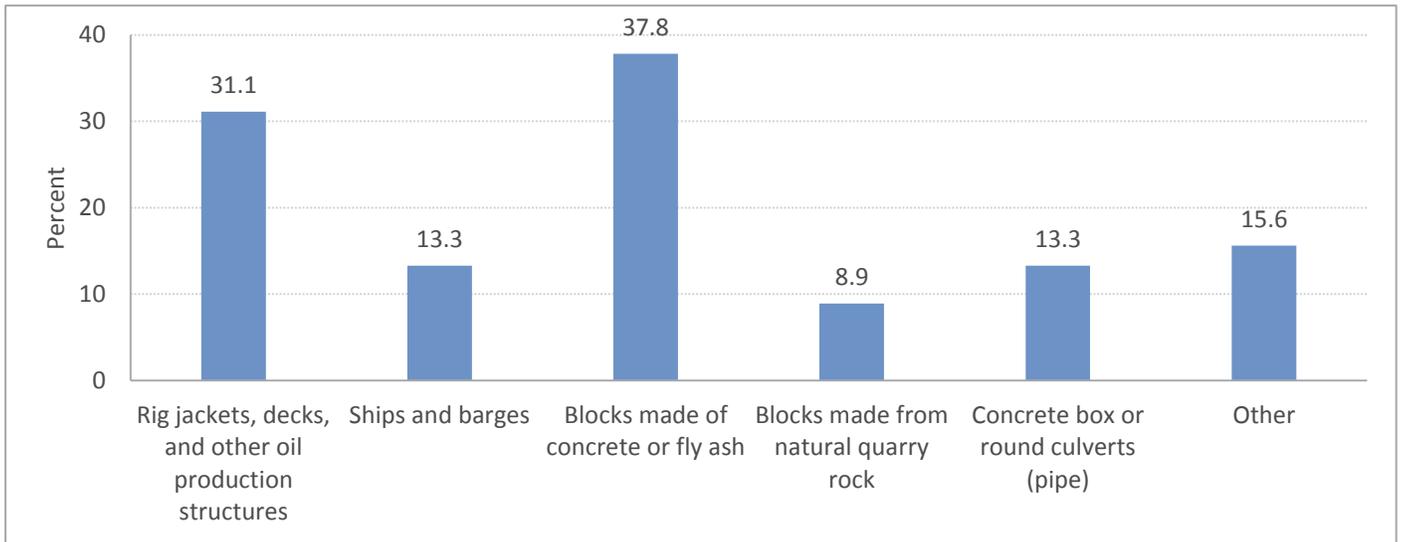


Figure 23. (Q.24d) Percent of participants who object to specific type of materials and structures for future artificial reef sites*



*over 100% due to multiple responses

Regarding respondents' attitudes toward artificial reefs, not surprisingly, 87.6% agreed that artificial reefs should be in the Gulf of Mexico (Figure 24) (item was reverse scored). Concerning the practice of individuals placing their own fish-attracting structures in the Gulf of Mexico, just over one-third (38.0%) were unaware of how extensive this practice was, and 31.7% thought this practice was done only occasionally. Very few felt it was done extensively (6.1%) (Figure 25).

Figure 24. (Q.25) Participants' level of agreement toward the existence of artificial reefs in the Gulf of Mexico (percentage)

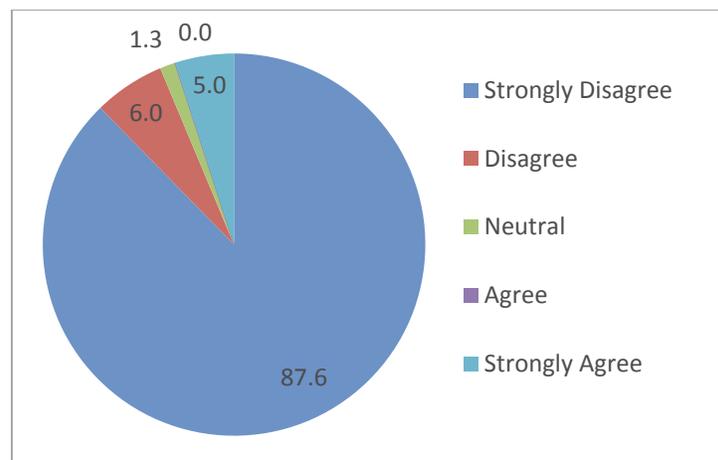
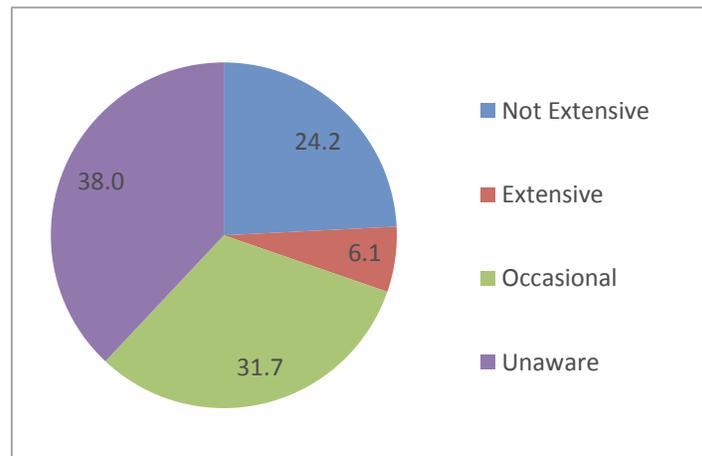


Figure 25. (Q.26) Participants' level of awareness toward the practice of individuals placing their own fish attracting structures in the Gulf of Mexico (percentage)



Finally, a question was posed to respondents about participating in marine recreation (Table 15). Three reasons scored the highest in importance for participating in marine recreation: to be close to water (46.9%), to be outdoors (45.4%), and for relaxation (45.4%). Other important reasons included the following: to experience unpolluted natural surroundings (41.3%), for family recreation (36.9%), to experience adventure and excitement (36.4%), and to get away from the regular routine (35.5%).

Table 15. Level of importance for why people participate in marine recreation (percentage)

(Q.27) Please circle the number that indicates your level of agreement with these statements about using artificial reefs	Not At All Important	Slightly Important	Moderately Important	Very Important	Extremely Important
a. To be outdoors	0.7	1.2	9.2	43.5	45.4
b. For family recreation	2.7	4.6	15.3	40.6	36.9
c. To experience new and different things	2.8	7.1	21.7	38.7	29.7
d. For relaxation	1.0	2.1	11.3	40.1	45.4
e. To be close to the water	1.0	2.8	11.5	37.8	46.9
f. To look at fish	10.0	19.2	27.3	25.0	18.5
g. To get away from the demands of other people	8.3	11.4	20.5	29.6	30.3
h. For the experience of the catch	16.4	9.9	17.8	25.7	30.2
i. To test my equipment	26.6	24.8	27.3	13.7	7.7
j. To be with friends	3.0	6.1	19.8	38.8	32.3
k. To experience unpolluted natural surroundings	2.3	4.5	15.6	36.4	41.3
l. To win a trophy or prize	65.1	16.5	10.2	4.4	3.8
m. To develop my skills	17.1	15.6	28.9	24.8	13.6
n. To get away from the regular routine	3.1	5.3	17.1	39.0	35.5
o. For the challenge or sport	12.3	10.4	21.5	30.7	25.1
p. To experience adventure and excitement	3.7	5.6	19.0	35.4	36.4

DISCUSSION

The purpose of this study was threefold: (1) to determine the recreational use of TPWD and non-TPWD artificial reefs in the Gulf of Mexico by boaters and saltwater anglers; (2) to report current level of awareness and knowledge about artificial reefs; and (3) to identify motivations for the use of artificial reefs, locations and reefs visited, preferred reef materials, trip expenditures, and user socio-demographic characteristics. The findings presented from this study provide current information on TPWD's Artificial Reef Program regarding artificial reef use and the behaviors and preferences of reef users. Past TPWD research studies conducted on artificial reef users from the 1980s and 1990s were dated; the findings from this research provide new data about contemporary artificial reef users for management of artificial reef resources in the Gulf of Mexico.

Respondents' Profile and Reef Behavior/Preferences

The socio-demographic profile of artificial reef users in this study reveals a male-dominated (87%), mostly white (93%), middle-aged reef user (56.9 years) with an income well above the average for most Texans. According to the 2010 Census (U.S. Census Bureau, 2014), Texas is one of the fastest-growing states in the nation, with its overall population expected to increase from 26 million in 2014 to 35 million by 2040—a 19% increase. A lack of diversity among this study's reef users opens the door for new markets in Texas, especially for Hispanic users, who only made up 6% of the study population. By 2040, the Hispanic population in Texas is expected to increase by almost 50%, particularly in some of the larger cities such as San Antonio and Austin. Given the current mean age of artificial reef users in this study, TPWD should consider the population dynamics of the next generation and determine how best to communicate and provide information about the Program to them. The current age of users, along with their racial and ethnic composition, may impact the intensity and frequency of reef use in the future and should be considered an opportunity to educate potential artificial reef users.

The findings in this study showed that just over two-thirds of respondents (67.1%) took trips to the Gulf of Mexico in the last 12 months. The primary purpose of trips was fishing (62.6%). Of those that did take a trip to the Gulf, just over half (54.9%) made use of artificial reefs on their trips. Over half of the reef users in this study took between 1-5 trips in the last 12 months, mostly during the summer months. Over three-fourths of the respondents (79.4%) spent between 1-10 hours out on the reef. The visitation frequency and amount of time spent out on the reef can be based on many factors, including boat type, distance from port, weather conditions, and activity, and was beyond the scope of this study.

In terms of the types of reef structures respondents preferred, more than one-third (39.3%) visited standing rigs and oil production structures. Motives behind why they chose artificial reef sites were largely “fish/fishing-centric,” with 58.7% rating the presence of desired fish as extremely important. Additional information regarding their feelings about artificial reefs was also related to fish species and fishing. Almost three-fourths of respondents strongly agreed that artificial reefs provide a better chance of harvesting fish (71.2%), and 61.6% strongly agreed that these structures have more variety of fish. Respondents were very interested in going out to reefs to go fishing, which is reasonable given the fact that half the sample was made up of saltwater anglers. Other attitudes about artificial reefs showed that more than three-fourths of respondents either agreed or strongly agreed that they wanted to see more artificial reefs placed by TPWD in the Gulf.

There are issues, however, that impact reef use, with 38.1% reporting the presence of too many boats and 26.4% reporting the presence of commercial fishing vessels as the most important reasons causing difficulties with where the artificial reefs are located. Although challenging to project, continued use of these areas by many types of boats may hinder the fishing experience and lead to enhanced recreation conflict for those seeking to experience artificial reef areas. The issue of crowding is nothing new for managing water recreation experiences in Texas, but further monitoring is needed to determine the extent of the problem of too many boats around artificial reef sites. If increased recreational boat usage or commercial fishing vessels are impacting the recreation experience, there may be safety-related issues to investigate. Given the fact that the problems mentioned by artificial reef users also referenced commercial fishing vessels, it would be prudent to obtain information from the commercial fishing industry about this issue as well. A need to closely monitor the effect of artificial reef use on marine resource management, including fish populations and species diversity in the Gulf of Mexico, is another area that will continue to be a concern over time.

Respondents reported spending an average of \$1,652.00 on their most recent reef-related trip. Examination of these data by key categories revealed that respondents averaged \$775.00 on private auto/boat expenses (gas, repairs, rental) and \$217.00 on retail shopping (bait/tackle, clothing, groceries, ice). Respondents generally indicated that they were willing to pay more for their trips. Given that access fees comprised less than 10% of average trip expenditures, TPWD may be able to evaluate related fees and potential revenue without greatly restricting access to reefs.

The travel party expenditures reported by this sample suggest that reef trip spending is substantial. However, we do not know how many people actually visited the reefs, so total expenditures cannot be extrapolated. This is potentially an avenue for additional research and would allow for the

calculation of economic impacts related to the artificial reefs. Such a study would also describe how other industries on the coast and in the remainder of the state are affected by reef-related tourism. These data are important from a tourism and economic development perspective and should be highlighted by coastal counties and communities. This information needs to be shared among convention and visitor bureaus and other tourism-related businesses and organizations.

TPWD Artificial Reef Use

Results showed that respondents did not appear to be very well informed about TPWD artificial reef sites or TPWD's Artificial Reef Program. However, users want more artificial reefs out in the Gulf to explore and use and would like all submerged reefs marked with buoys; this issue could be problematic given navigational concerns and may require more discussion with boaters. While respondents may not have been that well informed about reef locations, they did want to know more about access to artificial reef sites. Just over half (57.4%) had heard about the Program. Almost half (43.8%) learned about it through magazines, and just over one-third (38.3%) used a web search or the TPWD webpage. Given the average age of the users in this study (56.9 years, with 41.3% over 60), this finding is not surprising. Making artificial reef information available to more mature reef users may need to be reexamined by TPWD because these individuals appear to rely on print media. Since Galveston, Port Aransas, and Freeport were the most frequented points of departure, the Program may consider providing more printed information about artificial reefs in these locations and monitor its effectiveness in reaching this age group. For example, the Program may want to partner with local convention and visitor bureaus or related businesses in making its printed material available.

For reaching future (possibly younger) users, the Program may need to revisit its Internet and social media presence. To its credit, the Program is continually monitoring its 68 reef sites and posts this information on its website: http://www.tpwd.state.tx.us/landwater/water/habitats/artificial_reef/. The Program provides explicit detail to reef users about all TPWD artificial reef sites, locations, and depth, so current and potential reef users can be easily informed about various types of reef sites and structures in the Gulf of Mexico. The Program's monitoring team posts new information on its website regularly, e.g., sea conditions, fish populations, etc., which is an exceptional resource for anyone interested in artificial reefs. The Program makes an easy-to-use interactive map available on its website as well. The map integrates various layers to illustrate the coordinates of reef locations, names, materials, distances, and images. However, from the results in this study, it appears that respondents were not using the Program website as their first choice for learning about artificial reefs in the Gulf; this

may be related to the average age of study participants. Thus, the map on the Program's website might not be the prime source used for locating the reef sites. Targeted feedback on the website and its usage would be beneficial in order to keep it user friendly and up to date, and to meet the needs of current and/or future reef users, e.g., divers. One observation from the researchers is that the Program's website is not easy to find from the TPWD website. To get to the Program website, potential users need to type in the Program name or key words into the search option on the TPWD webpage or their own browser. A link to "Artificial Reefs" is listed on the webpage in the Fishing tab, specifically under "Where to Fish in Texas Public Waters," but it is still a challenge to find the Program website. Future discussions about the location of the Program's webpage on the TPWD webpage should be considered.

In communicating with its customers in other ways, the Program uses social media outlets, e.g., Facebook. This social media tool enables reef users to ask questions, post comments on stories, and obtain the latest information on the artificial reef sites. Program staff should investigate how Facebook is being used and determine how beneficial it is to the Program. In regard to other online communication strategies, TPWD has recently introduced an official app for hunting and fishing. This app provides a plethora of information on various topics, e.g., bag limits and weekly fishing reports. The Program may want to consider getting its own mobile app. The app can be added to the Program website and include interactive features so that users can obtain current information and obtain updates via notifications through their smartphone, e.g., iPhone, Android, etc. If it is not feasible to get its own app, the Program could work in conjunction with other fishing or boating related programs at TPWD to disseminate its information out. With over 56% of the U.S. population owning a smartphone (Pew Research Center, 2013), the potential to reach new artificial reef users could be enhanced.

Even though respondents appeared to be somewhat uninformed about the Program or about artificial reef locations, many individuals explored artificial reef sites. Respondents reported over 4,000 trips taken to TPWD artificial reef sites from September 2012-August 2013, primarily in the summer months. Study participants were given a map in the study questionnaire to assist them in identifying sites they had visited. Some of the most-visited TPWD artificial reef sites included the Freeport and Matagorda Island Liberty ships. The choice of this type of structure is also tied to where respondents wanted to visit in the future. When asked their preference of choices of structure and materials for future artificial reefs, most preferred two main categories: rigs, decks, and other oil production structures, *and* ships and barges. These results are consistent with the findings from previous artificial reef studies with charter boat owners and anglers in the Gulf (Ditton & Graefe, 1978; Ditton, Finkelstein & Wilemon, 1999).

Other reef use behavior and preferences showed that about one-third of reef users liked to stay closer to shore (1-10 miles), while about another one-third preferred to go more than 30 miles offshore. These findings portray a diverse group of users, some of whom prefer to stay closer to shore, but many others who are able to go much farther out into the Gulf of Mexico, thereby spending more travel time and resources to get to their preferred reef sites. This finding may also be related to boat characteristics, navigation equipment, and fuel capacity, but those variables were not investigated.

As for water depth preferences of artificial reefs, about one-third preferred the artificial reef structures to be deeper than 100 feet from the ocean surface to the ocean bottom. Regarding the best height of artificial reefs, one-third preferred structures to be 21-40 feet from the ocean surface to the highest point on the reef. Past research has examined the phenomenon that specific reef sites attract and develop particular fish communities (Lindberg, 1997; Miller, 2002); hence, anglers prefer and seek certain types of reef structures to fulfill their angling objectives (Graefe & Ditton, 1978). Given the fact that the majority of reef users went on their trips for fishing-related activities, updated behavioral data that relate to preferences for fish species, reef sites, locations, and structural choices should be obtained.

This study provides current information on artificial reef use in the Gulf of Mexico, but more in-depth data on the preferences and behaviors of artificial reef users are needed. Those who purchase fishing licenses and/or register their boats should be provided with more information about the Program and its website in order to become more familiar with its purpose and goals. It is in the state's best interest to continue to support the Program in order to make sure that artificial reef users are provided with satisfying experiences, as well as to maintain and protect the marine resources in the Gulf of Mexico. Learning more about the importance of artificial reefs for ecosystem restoration, water quality, and fisheries production (Miller, 2002), as well as recreation, is an important aspect of TPWD's Artificial Reef Program.

FUTURE RESEARCH

This study surveyed licensed saltwater anglers and registered boat owners (n=31) in coastal counties and three metro counties: Tarrant (Dallas), Travis (Austin), and Bexar (San Antonio). Through the use of a mail survey and following the tailored design method (Dillman et al., 2008), respondents were given an opportunity to respond by mail or online. The effective response rate for this study was 18.3%, and although this response rate may appear low, it is similar to the TPWD's Statewide 2012

Angler Survey (Kyle et al., 2014). Unfortunately, increasingly lower response rates appear to be a trend in survey research and are compounded by giving respondents a choice to respond by mail or online (Vaske, Jacobs, Sijtsma, & Beamon, 2011). Given these survey research issues, consistent procedures in conducting mail surveys, i.e., tailored design method, are even more important in order to minimize response bias and ensure representative samples. Due to the fact that only licensed saltwater anglers and registered boaters were queried, there may be a need to obtain additional data from other individuals that take trips to the Gulf for other activities, e.g., diving or sailing.

Another factor to consider is the socio-demographic composition of this sample. Over half of the respondents were middle-aged, predominantly white males, with more than one-third of them reporting incomes over \$160,000. There is a need to determine if the results from this study represent reef users who do not own a boat or have a fishing license. Additional data could be collected onsite at various coastal ports to obtain input from more diverse individuals, which may broaden the socio-demographic composition of artificial reef users. Finally, it is recommended that a study of artificial reef users be conducted every few years to develop a database that can be used to identify and monitor trends over time.

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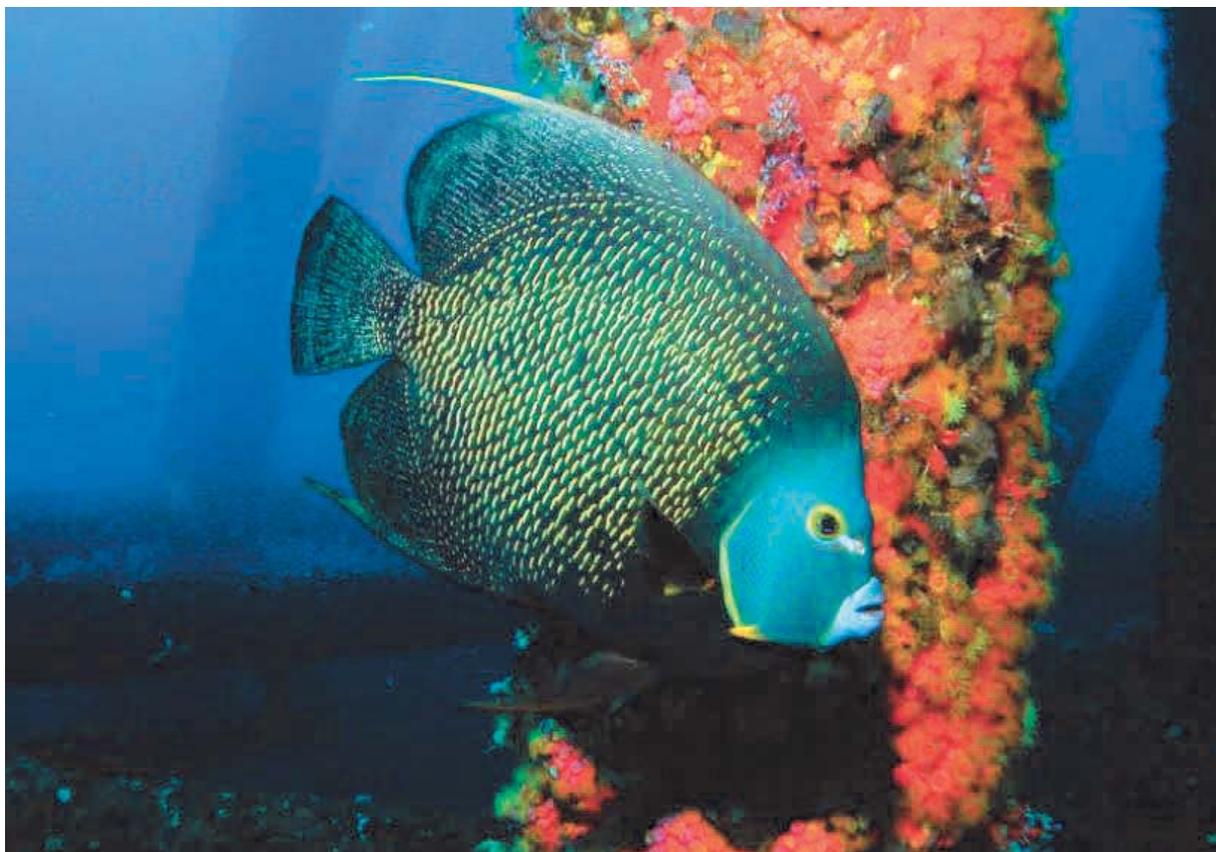
Appendix A. List of counties for study sample

Aransas
Bee
Bexar
Brazoria
Brooks
Calhoun
Cameron
Chambers
Dallas
Fort Bend
Galveston
Hardin
Harris
Hidalgo
Jackson
Jefferson
Jim Wells
Kenedy
Kleberg
Liberty
Live Oak
Matagorda
Nueces
Orange
Refugio
San Patricio
Tarrant
Travis
Victoria
Willacy
Wharton
(n=31)

Appendix B. Questionnaire

SURVEY INSTRUMENT

TEXAS ARTIFICIAL REEF SURVEY



Conducted for

TEXAS PARKS & WILDLIFE DEPARTMENT

By

TEXAS A&M UNIVERSITY

COLLEGE STATION, TX 77843-2261

ARTIFICIAL REEF USE IN THE GULF OF MEXICO

In the following questions, please tell us about your use and experience with ARTIFICIAL REEFS IN THE GULF OF MEXICO.

1. Have you taken a trip to the Gulf of Mexico in the last twelve months?

1. YES *If YES, how many?* _____
2. NO *(If answered NO, please skip to question #27)*

2. In thinking about your trip(s) to the Gulf of Mexico in the last twelve months, what was the primary purpose of your trip(s)?

1. Boating
2. Fishing
3. Snorkeling/Diving
4. Other _____

3a. Do you make use of artificial reef structures during your trips to the Gulf of Mexico?

1. YES
2. NO *(If answered NO, please skip to question #27)*

3b. If **YES**, what percentage of your trips to reefs takes place at each of the following types of reef structures? ***(Please enter zero (0) for any that do not apply).***

- _____ % natural structures and topographical formations
- _____ % coral reefs
- _____ % Liberty ships and other submerged vessels
- _____ % standing rigs and oil production structures
- _____ % toppled, submerged rigs and oil production structures
- _____ % concrete blocks and culverts (pipe), other concrete materials, reef balls, low relief materials
- _____ % other (please specify _____)
- _____ % **TOTAL (should equal 100%)**

4. Please rate the importance of the following when selecting ARTIFICIAL REEF sites for fishing, diving or boating.

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
a) Distance from port	1	2	3	4	5
b) Type of reef material	1	2	3	4	5
c) Reef design/layout	1	2	3	4	5
d) Reef size	1	2	3	4	5
e) Depth of water	1	2	3	4	5
f) Water clarity	1	2	3	4	5
g) Strength of currents	1	2	3	4	5
h) Presence of desired fish	1	2	3	4	5
i) Presence of desired marine life other than fish	1	2	3	4	5
j) Diversity of marine life	1	2	3	4	5
k) Other (list):	1	2	3	4	5

5. Of the considerations for reef site selection listed in question #4 (A-K), which are most important to you?

_____ Most important for site selection (*write letter only, e.g., a, b*)

_____ Second most important for site selection (*write letter only*)

6. Please circle the number that indicates your level of agreement with these statements about using ARTIFICIAL REEFS.

	STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	NOT APPLICABLE
a) Better chance of harvesting fish	1	2	3	4	5	NA
b) Others recommended artificial reefs to me	1	2	3	4	5	NA
c) I don't go out that far off shore	1	2	3	4	5	NA
d) I like to go snorkeling in these areas	1	2	3	4	5	NA
e) I like to go scuba diving in these areas	1	2	3	4	5	NA
f) There are more opportunities to observe fish	1	2	3	4	5	NA
g) They degrade the natural ecosystem	1	2	3	4	5	NA
h) They change the human use characteristics of the area	1	2	3	4	5	NA
i) There is more variety of fish	1	2	3	4	5	NA
j) The reef areas are too crowded	1	2	3	4	5	NA
k) They bring in tourism to the local communities	1	2	3	4	5	NA
l) Leads to overfishing in that area	1	2	3	4	5	NA
m) There is recreation conflict with other users at the reef sites	1	2	3	4	5	NA
n) More information should be made available about their benefits	1	2	3	4	5	NA
o) They provide new areas to recreate	1	2	3	4	5	NA

7. Please circle the number that corresponds with your level of agreement with each of the statements below about ARTIFICIAL REEFS.

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
a) I would like to have all submerged artificial reefs identified with marker buoys	1	2	3	4	5
b) Mooring buoys (for tying off) should be provided by TPWD in the Gulf	1	2	3	4	5
c) I want to see more artificial reefs placed by TPWD in the Gulf	1	2	3	4	5
d) Certain artificial reefs should be designed for specific uses (such as diving only or sport fishing only)	1	2	3	4	5
e) Certain artificial reefs should be designed for specific types of fishing gear (Such as rod and reel only or spear gun only)	1	2	3	4	5
f) Individuals should be allowed to place their own underwater reef structures as long as they are in safe locations	1	2	3	4	5

8a. From the list of encounters below, which, if any, have caused you the most problems during your trips and reduced the probability of your return to a particular ARTIFICIAL REEF site? **(Please circle all that apply).**

- a. Sport fishing
- b. Commercial fishing
- c. Dive operations
- d. Commercial ship traffic
- e. Oil and gas operations
- f. Dangerous marine life
- g. Presence of too many other boats
- h. Hazardous structural conditions at reef site.
- i. Other (Please explain: _____)

8b. From the list above, which is the most problematic?

- _____ Most important problem **(write letter only, e.g., a, b)**
- _____ Second most important problem **(write letter only)**

9. How many ARTIFICIAL REEF trips did you make in Texas over the last twelve months? _____

For questions #10-#15, please think back to your most recent REEF-RELATED trip.

10. How long did you stay out on the reef?

_____ Hours

_____ Days

11. How many people (including yourself) in your immediate group did you pay for on this trip? _____

12a. What activities did you participate in on the trip? **(Circle all that apply)**

- a. Fishing
- b. Snorkeling/Diving
- c. Other _____

12b. From the list above, which activity was most important to you _____ **(write letter only, e.g., a, b)**

13. How much did you and other members of your immediate group spend **on this trip**, including travel to and from your home? We understand this is a difficult question, but your responses are very important to estimate the economic impact to our region.

TYPE OF EXPENDITURE	Amount spent <u>IN TEXAS</u>
a. Access fees (entrance fees, parking fees, boat launch, etc.)	\$ _____
b. Restaurants & Bars	\$ _____
c. Private Auto/Boat Expenses (gas, repairs, rental)	\$ _____
d. Charter/guide fees	\$ _____
e. Lodging (hotel, camping)	\$ _____
f. Retail Shopping (bait & tackle, clothing, groceries, ice, etc.)	\$ _____
g. Other entertainment (movies, etc.)	\$ _____
h. Any other miscellaneous expenses (please list and explain below)	\$ _____

14. What is the highest amount your trip could have cost (**recall the trip costs you listed in Question #13 above**) before you would have cancelled this trip in the Gulf of Mexico?

\$_____ HIGHEST TRIP COST

For questions #15 to #17, please tell us about your use of TPWD ARTIFICIAL REEFS only.

15. When you are out in the Gulf of Mexico, do you make use of **TPWD artificial reefs**?

1. YES (***If answered YES, skip to question #17***)

2. NO (***If answered NO, answer #16 and then skip to question #27***)

16. What are your reasons for not making use of TPWD ARTIFICIAL REEF sites?

	MINOR REASON	MODERATE REASON	MAJOR REASON	NOT APPLICABLE
a) I don't go out that far off shore	1	2	3	NA
b) The reef areas are too crowded	1	2	3	NA
c) There is recreation conflict with other users at the reef sites	1	2	3	NA
d) I don't know where they are	1	2	3	NA

17. During each of the following three month periods, approximately how many trips did you make involving TPWD ARTIFICIAL REEF sites?

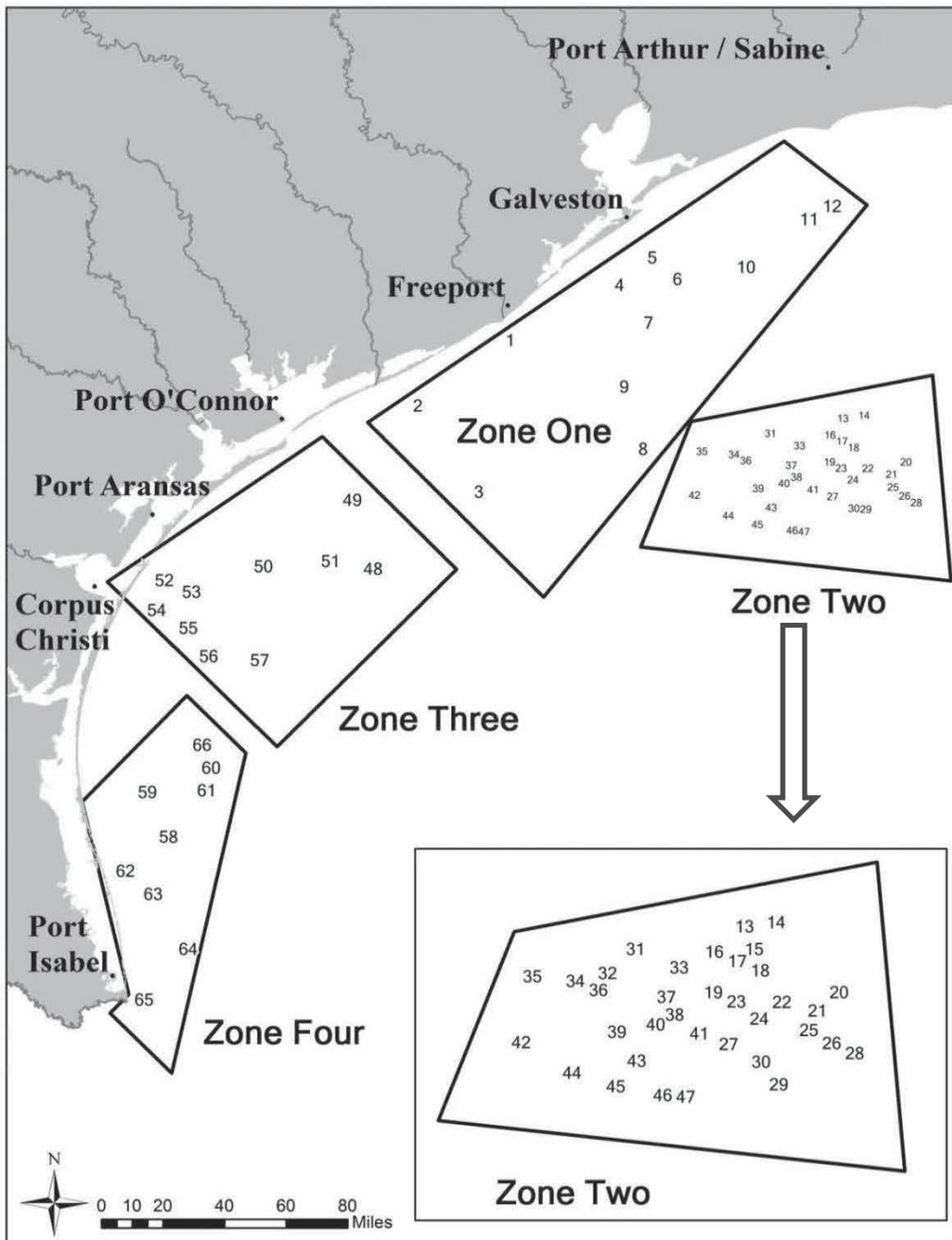
- _____ Trips involving TPWD artificial reefs (Jun. 2013-Aug.2013)
- _____ Trips involving TPWD artificial reefs (Mar. 2013-May 2013)
- _____ Trips involving TPWD artificial reefs (Dec. 2012-Feb. 2013)
- _____ Trips involving TPWD artificial reefs (Sept. 2012-Nov. 2012)

For questions #18 to #20, please consider your most recent reef trip to the Gulf.

18a. Please identify the ZONE(S) (1-4) and TPWD ARTIFICIAL REEF(S) you visited using the map on page 7. Use numbers to identify ZONE and ARTIFICIAL REEF (e.g., ZONE #3, REEF #59). If you visited more than one ZONE or REEF, please list in the space provided. Do not count zones or artificial reefs passed on your travel enroute to your destination reef site(s).

ZONE/REEF
 ZONE # _____

ARTIFICIAL REEF # _____



Reef Number	Reef Site
ZONE TWO	
13	HI-A-270
14	HI-A-271
15	HI-A-281
16	HI-A-285
17	HI-A-286
18	HI-A-298
19	HI-A-302
20	HI-A-310
21	HI-A-313
22	HI-A-315
23	HI-A-317
24	HI-A-323
25	HI-A-327
26	HI-A-330
27	HI-A-341
28	HI-A-349
29	HI-A-355
30	HI-A-356
31	HI-A-447
32	HI-A-462
33	HI-A-466
34	HI-A-477
35	HI-A-480
36	HI-A-487
37	HI-A-492
38	HI-A-497
39	HI-A-515
40	HI-A-517
41	HI-A-520
42	HI-A-532
43	HI-A-542
44	HI-A-555
45	HI-A-567
46	HI-A-570
47	HI-A-571

Reef Number	Reef Site	Reef Number	Reef Site	Reef Number	Reef Site
ZONE ONE		ZONE THREE		ZONE FOUR	
1	BA-336 - George Vancouver Liberty Ship	48	BA-A-132	58	MU-A-85
2	BA-439 - Matagorda	49	MI-616 - Matagorda Island Liberty Ship	59	PN-967
3	BA-A-28	50	MI-712	60	PN-A-58
4	GA-189 - Barr's	51	MI-A-7	61	PN-A-72
5	GA-189 - Mitchell's	52	MU-746L - Boatmen's	62	PS-1047 - Port Mansfield
6	GA-288 - Buccaneer	53	MU-770L - Lonestar	63	PS-1070 -Port Mansfield
7	GA-296 - Buccaneer	54	MU-775 - Corpus Christi		Liberty Ship
8	GA-A-125	55	MU-802 - Mustang Island Liberty Ship	64	PS-1122 - Texas Clipper
9	GA-A-22 - Freeport Liberty Ship	56	MU-828	65	PS-1169L - Port Isabel
10	HI-117 - Basco's	57	MU-A-16	66	PN-A-42
11	HI-117 - Sabine				
12	HI-85 - S.A.L.T.				

18b. If you cannot identify the specific TPWD ARTIFICIAL REEF that you last visited, please tell us which ZONE(s) you were in.

ZONE(S) # _____

19a. If you visited more than one TPWD ARTIFICIAL REEF site, which site(s) did you spend the most time? (Again, please use the reef site numbers in the list with the map.)

ZONE(S)

ARTIFICIAL REEF # _____

19b. Which is your most preferred ZONE OR ARTIFICIAL REEF?

ZONE # _____

ARTIFICIAL REEF # _____

20. From the mainland areas/ports identified on the map, what is the closest port you departed from on your most recent reef trip to the Gulf? (***Please circle one***)

- a. Port Arthur/Sabine
- b. Galveston
- c. Freeport
- d. Port O'Connor
- e. Port Aransas
- f. Corpus Christi
- g. Port Isabel

21a. In the previous twelve months, have you heard or seen information about the **TPWD Artificial Reef Program ("Rigs to Reefs, Ships-to-Reefs, Nearshore Reefs")**?

- 1. YES
- 2. NO

21b. If **YES**, was this from: (***Please circle all that apply***)

- a. Television
- b. Social media (Facebook, Twitter)
- c. Special event
- d. Newspaper
- e. Magazine
- f. Radio
- g. Poster, pamphlet, etc.
- h. Friends/family
- i. Other (Please explain: _____)

22a. Ideally, how many miles from shore should ARTIFICIAL REEFS be situated? _____ miles

23a. Ideally, what is the best water depth for ARTIFICIAL REEF structures (as measured in feet) from the ocean surface to the ocean bottom? _____ feet

23b. Ideally, what are the best water depths (measured by feet) from the ocean surface to the top of ARTIFICIAL REEF structures (as measured from the ocean surface to the highest point off the bottom of the ARTIFICIAL REEF material)? _____ feet

24a. What types of materials and structures would you prefer for future ARTIFICIAL REEF sites? ***(Please circle all that would be acceptable)***

1. Rig jackets, decks, and other oil production structures
2. Ships and barges
3. Blocks made of concrete or fly ash
4. Blocks made from natural quarry rock
5. Concrete box or round culverts (pipe)
6. Other (Please explain:_____)

24b. Of the materials and structures listed above, which one would you prefer most for future artificial reefs? ***(Please circle one answer only)***

1 2 3 4 5 6

24c. Do you object to the use of any of the materials or structures listed above?

1. YES
2. NO

24d. If **YES**, which one(s) and why?

25. I do not feel there should be any ARTIFICIAL REEFS in the Gulf of Mexico. ***(Circle one)***

STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE
1	2	3	4	5

26. On a scale of 1 to 4, how extensive would you say the practice of individuals placing their own fish attracting structures in the Gulf of Mexico? ***(Please circle one that apply)***

- 1=NOT EXTENSIVE
- 2=EXTENSIVE
- 3=OCCASIONAL
- 4=UNAWARE

27. Below is a list of reasons why people participate in marine recreation. Please circle the number that indicates how important each item is to you

	NOT AT ALL IMPORTANT	SLIGHTLY IMPORTANT	MODERATELY IMPORTANT	VERY IMPORTANT	EXTREMELY IMPORTANT
a) To be outdoors	1	2	3	4	5
b) For family recreation	1	2	3	4	5
c) To experience new and different things	1	2	3	4	5
d) For relaxation	1	2	3	4	5
e) To be close to the water	1	2	3	4	5
f) To look at fish	1	2	3	4	5
g) To get away from the demands of other people	1	2	3	4	5
h) For the experience of the catch	1	2	3	4	5
i) To test my equipment	1	2	3	4	5
j) To be with friends	1	2	3	4	5
k) To experience unpolluted natural surroundings	1	2	3	4	5
l) To win a trophy or prize	1	2	3	4	5
m) To develop my skills	1	2	3	4	5
n) To get away from the regular routine	1	2	3	4	5
o) For the challenge or sport	1	2	3	4	5
p) To experience adventure and excitement	1	2	3	4	5

In the following questions, we would like to know some personal information about you so that we may further distinguish artificial reef users and non-reef users. Your responses will be confidential and you will not be identified with your answers.

28. What is your age?

_____Years

29. Are you: 1 MALE 2 FEMALE

30. What is your approximate annual household income before taxes?

- | | | |
|------------------------|--------------------------|--------------------------|
| 1. Under \$20,000 | 4. \$60,000 - \$79,999 | 7. \$120,000 - \$139,999 |
| 2. \$20,000 - \$39,999 | 5. \$80,000 - \$99,999 | 8. \$140,000 - \$159,999 |
| 3. \$40,000 - \$59,999 | 6. \$100,000 - \$119,999 | 9. \$160,000 and ABOVE |

31. Are you of Spanish/Hispanic origin?

- a. NO, NOT SPANISH/HISPANIC

- b. YES, MEXICAN, MEXICAN AMERICAN, CHICANO
- c. YES, OTHER SPANISH/HISPANIC GROUP (Please specify) _____

32. What is your race? Please indicate one or more races for what you consider yourself to be:

- a. WHITE
- b. BLACK OR AFRICAN AMERICAN
- c. AMERICAN INDIAN OR ALASKAN NATIVE
- d. ASIAN OR PACIFIC ISLANDER
- e. SOME OTHER RACE (Please specify) _____

33. What is the ZIP code of your primary residence?

34. Was this survey completed by the person whom it was addressed to?

- 1. YES
- 2. NO

35. Is there anything else you would like to share with us?

Thank you!! Your contribution of time to this study is greatly appreciated. Please return your completed questionnaire in the business reply envelope as soon as possible.

Appendix C. Survey correspondence

ID#

Date

First and Last Name
Street Address
City, State Zip

Dear First Name,

The Artificial Reef Program of the Texas Parks and Wildlife Department (TPWD) has created and maintained over 4,000 acres of artificial reef structures within Texas Gulf waters. Artificial reefs are structures or a system of structures constructed, placed, or permitted (e.g., oil platforms) in the navigable water of Texas for the purpose of enhancing fishery resources and commercial/recreational fishing opportunities. The use of reefs can be direct (fishing over or diving nearby) or indirect (trolling near reefs).

Texas Parks and Wildlife would like to learn more about your use and preferences of artificial reefs in the Gulf of Mexico. To gather information on your opinions, we are conducting a survey of registered boaters and licensed salt water anglers who may have used artificial reefs in the past. The survey is being conducted by researchers from Texas A&M University on behalf of TPWD's Artificial Reef Program. The information gathered will provide data in support of fishery resources, habitat, and marine recreation in Texas Gulf waters.

Your responses to the survey will help to inform us as to where you stand on these important issues concerning artificial reefs. YOU are one of a small number of participants that were chosen to participate in this study. Your response to this survey is completely voluntary. You are in no way obligated to participate if you do not feel comfortable doing so. However, we would appreciate you taking a few minutes to complete the questionnaire. Your answers will remain anonymous and completely confidential. Only aggregated results will be reported. Once the study is complete, all names and addresses will be destroyed. We WILL NOT sell or distribute your name and address to any other party. The questionnaire should take approximately 20 minutes to complete. You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. The number is used so we can check your name off the mailing list when your questionnaire is returned, ensuring we do not send you a second questionnaire. Your name will never be placed on the questionnaire itself. Please answer all of the questions to the best of your ability (if applicable). You will not be identified with your answers, and your responses will be confidential.

If you would prefer you can access the questionnaire online, please type in website into the address bar:

www.tpwd-survey.org



If you would prefer a hard-copy version of the questionnaire, a survey packet will be sent to you in about a week. For questions or clarification about the survey, please call Dale Shively with the Texas Parks and Wildlife Department at (512) 389-4686. Thank you in advance for your help.

Sincerely,

J. Dale Shively, Leader
Artificial Reef Program
Texas Parks and Wildlife Department
ID#

Date

First and Last Name
Street Address
City, State Zip

Dear First Name,

Several weeks ago we sent you a letter requesting your participation in a survey concerning artificial reef use in Texas Gulf waters. Texas Parks and Wildlife (TPWD) would like to learn more about your use and preferences of artificial reefs in the Gulf of Mexico. To gather information on your opinions, we are conducting a survey of registered boaters and licensed salt water anglers who may have used artificial reefs in the past. The survey is being conducted by researchers from Texas A&M University on behalf of TPWD's Artificial Reef Program. The information gathered will provide data in support of fishery resources, habitat, and marine recreation in Texas Gulf waters.

Your responses to the survey will help to inform us as to where you stand on these important issues concerning artificial reefs. YOU are one of a small number of participants that were chosen to participate in this study. Your response to this survey is completely voluntary. You are in no way obligated to participate if you do not feel comfortable doing so. However, we would appreciate you taking a few minutes to complete the questionnaire. Your answers will remain anonymous and completely confidential. Only aggregated results will be reported. Once the study is complete, all names and addresses will be destroyed. We WILL NOT sell or distribute your name and address to any other party. The questionnaire should take approximately 20 minutes to complete.

You may be assured of complete confidentiality. The questionnaire has an identification number for mailing purposes only. The number is used so we can check your name off the mailing list when your questionnaire is returned, ensuring we do not send you a second questionnaire. Your name will never be placed on the questionnaire itself. Please answer all of the questions to the best of your ability (if applicable). You will not be identified with your answers, and your responses will be confidential. Please fill out the enclosed hard-copy version of the questionnaire and place it in the business reply envelope and drop it in any U.S. mailbox, postage is guaranteed. If you would prefer to access the questionnaire online, please type this website into the address bar:

www.tpwd-survey.org



For questions or clarification about the survey, please call Dale Shively with the Texas Parks and Wildlife Department at (512) 389-4686. Thank you in advance for your help.

Sincerely,

J. Dale Shively, Leader
Artificial Reef Program
Texas Parks and Wildlife Department



Texas Parks and Wildlife Department
4200 Smith School Road
Austin, TX 78744

Life's better outside.®

ID#

Date

Dear First Name,

Recently, we mailed you a letter and questionnaire inviting you to participate in a survey regarding the use of artificial reefs in Texas Gulf waters. If you have already completed the questionnaire, please accept our thanks. If you haven't, please do so at your earliest convenience. We understand that you are busy and may not have had a chance to complete the questionnaire. We are looking forward to your feedback. If you would like to fill out a hard-copy version of the questionnaire, another survey packet containing the questionnaire will be arriving in a week. If you would like to access the questionnaire online, please type this website into the address bar:

www.tpwd-survey.org



Your response to this survey is completely voluntary. You are in no way obligated to participate if you do not feel comfortable doing so. However, we would appreciate your taking the few minutes necessary to complete the questionnaire. Thank you for your assistance.

Sincerely,

J. Dale Shively, Leader
Artificial Reef Program
Texas Parks and Wildlife Department

ID#

Date

First and Last Name

Street Address

City, State Zip

Dear First Name,

Several weeks ago we sent you a letter requesting your participation in a survey concerning artificial reefs in Texas Gulf waters. As of today we have not yet received your completed questionnaire. If you have recently completed the questionnaire, please accept our thanks.

The success and accuracy of our survey depends on you and the others who have not yet responded. You and other individuals who have not responded may have different opinions and may represent a completely different segment of those who use artificial reefs and have sent in their questionnaire. **We need to hear from you!**

This survey is being conducted so Texas Parks and Wildlife can learn more about your use and preferences about artificial reefs in the Gulf of Mexico. The information gathered will provide data in support of fishery resources, habitat, and marine recreation in Texas Gulf waters. Your responses to our questionnaire are as important to you as they are to us because of their impact on future management decisions.

We are writing to you again because of the importance each questionnaire has to the usefulness of this survey. You are one of a small number of individuals being randomly sampled. In order for survey results to be representative of boaters and licensed saltwater anglers in Texas, it is **essential** that **you complete the questionnaire**. Whether you went out to the Gulf waters one day or ten days, we need to hear from **YOU**. Your response to this survey is completely voluntary; you are in no way obligated to participate if you do not feel comfortable doing so. However, we would appreciate you taking a few minutes to complete the questionnaire. Your answers will remain anonymous and completely confidential. Only aggregated results will be reported. Once the study is complete, all names and addresses will be destroyed. We **WILL NOT** sell or distribute your name and address to any other party. The questionnaire should take approximately 20 minutes to complete. Please fill out the enclosed hard-copy version of the questionnaire and place it in the business reply envelope and drop it in any U.S. mailbox, postage is guaranteed. If you would prefer to access the questionnaire online, please type this website into the address bar:

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For questions or clarification about the survey, please call Dale Shively with the Texas Parks and Wildlife Department at (512) 389-4686. Thank you in advance for your help.

Sincerely,

J. Dale Shively, Leader
Artificial Reef Program
Texas Parks and Wildlife Department

Appendix D. Percent distribution of participants in Texas by zip code

(Q35) What is the ZIP code of your primary residence?	County	Frequency	Percent
520, 521, 401, 532, 429, 433, 536, 562, 001, 002, 003, 004, 005, 006, 007, 008, 009, 013, 015, 016, 017, 018, 019, 020, 021, 023, 024, 025, 027, 030, 032, 034, 035, 036, 039, 040, 041, 042, 043, 044, 046, 047, 048, 049, 051, 052, 055, 056, 057, 058, 059, 060, 061, 062, 063, 064, 065, 066, 067, 068, 069, 070, 071, 072, 073, 074, 075, 077, 079, 080, 081, 082, 083, 084, 086, 087, 088, 089, 090, 092, 094, 095, 096, 098, 099, 207, 292, 336, 338, 339, 346, 396, 449, 450, 493, 571, 503, 504, 505, 508, 586, 373, 379, 388, 389, 375, 377, 484, 598	Harris	643	26.6
518, 539, 546, 550, 551, 552, 553, 554, 623, 563, 565, 568, 573, 650, 510, 517, 590, 591	Galveston	261	10.8
002, 015, 023, 069, 109, 112, 148, 207, 209, 210, 212, 213, 214, 215, 216, 217, 220, 221, 222, 225, 226, 227, 228, 229, 230, 231, 232, 233, 238, 240, 242, 244, 245, 247, 248, 249, 250, 251, 253, 254, 255, 256, 257, 258, 259, 260, 261, 264	Bexar	173	7.2
401, 402, 403, 404, 406, 410, 411, 412, 413, 414, 415, 416, 417, 418, 463, 469, 373, 380	Nueces	169	7.0
701, 703, 704, 705, 708, 717, 721, 723, 725, 726, 727, 728, 730, 731, 732, 733, 734, 735, 736, 738, 739, 744, 745, 746, 747, 748, 749, 750, 752, 753, 756, 757, 758, 759, 768, 645, 660, 669	Travis	169	7.0
001, 006, 011, 012, 015, 016, 017, 018, 020, 022, 034, 036, 039, 040, 051, 052, 053, 054, 063, 092, 099, 102, 107, 108, 109, 112, 114, 116, 120, 123, 126, 132, 133, 135, 140, 148, 179, 180, 182, 244, 248	Tarrant	153	6.3
422, 430, 480, 486, 511, 515, 531, 534, 541, 566, 577, 578, 581, 583, 584	Brazoria	141	5.8
406, 407, 441, 451, 459, 461, 469, 471, 477, 478, 479, 489, 494, 497, 498	Fort Bend	107	4.4
006, 019, 030, 038, 041, 042, 043, 044, 048, 050, 052, 060, 061, 062, 063, 080, 081, 088, 089, 104, 106, 137, 146, 150, 181, 201, 204, 208, 219, 220, 224, 225, 229, 231, 234, 236, 243, 244, 248, 252, 339	Dallas	95	3.9
619, 627, 629, 640, 642, 651, 701, 705, 706, 708, 713	Jefferson	62	2.6
520, 521, 526, 550, 552, 559, 566, 575, 578, 583, 586, 593, 597	Cameron	60	2.5
358, 382	Aransas	46	1.9
335, 336, 362, 368, 374, 387, 390	San Patricio	41	1.7
501, 504, 516, 539, 541, 563, 570, 572, 573, 574, 577, 596	Hidalgo	29	1.2
414, 419, 456, 457, 465, 482, 483	Matagorda	27	1.1
901, 902, 904, 905, 968, 976	Victoria	26	1.1
303, 304, 306, 356, 365, 380, 381, 382, 386	Montgomery	23	1.0
611, 630, 632, 662	Orange	23	1.0
978, 979, 982, 983	Calhoun	22	0.9
514, 523, 580, 597, 661, 665	Chambers	19	0.8
345, 340, 358	Walker	16	0.7
535, 538, 564, 575	Liberty	13	0.5
007, 010, 068, 262	Denton	12	0.5
420, 437, 455, 488	Wharton	12	0.5
729, 613, 641, 665, 681	Williamson	12	0.5
625, 657, 656, 659, 663	Hardin	11	0.5
332, 383	Jim Wells	6	0.2
737, 620	Hays	5	0.2
962, 957	Jackson	5	0.2
102	Bee	3	0.1
340, 377	Refugio	3	0.1
598, 580	Willacy	3	0.1
028	Johnson	2	0.1
363	Kleberg	2	0.1
022	Live Oak	2	0.1
All other Zip Codes	Other	21	0.9