ASSESSMENT OF CHARTER BOAT AND HEAD BOAT ANGLER PERCEPTION OF FISHERY REGULATIONS AND STOCK HEALTH IN THE RECREATIONAL RED SNAPPER (*LUTJANUS CAMPECHANUS*) FISHERY IN THE UPPER TEXAS COAST

A Thesis

by

SARAH A. NORMAN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF MARINE RESOURCES MANAGEMENT

August 2011

Major Subject: Marine Resources Management

Assessment of Charter Boat and Head Boat Angler Perception of Fishery Regulations and Stock Health in the Recreational Red Snapper (*Lutjanus campechanus*) Fishery in the Upper Texas Coast

ASSESSMENT OF CHARTER BOAT AND HEAD BOAT ANGLER PERCEPTION OF FISHERY REGULATIONS AND STOCK HEALTH IN THE RECREATIONAL RED SNAPPER (*LUTJANUS CAMPECHANUS*) FISHERY IN THE UPPER TEXAS COAST

A Thesis

by

SARAH A. NORMAN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF MARINE RESOURCES MANAGEMENT

Approved by:

Chair of Committee,	Wyndylyn M. von Zharen
Committee Members,	Samuel D. Brody
	Thomas La Rue Linton
Head of Department,	Patrick Louchouarn

August 2011

Major Subject: Marine Resources Management

ABSTRACT

Assessment of Charter Boat and Head Boat Angler Perception of Fishery Regulations and Stock Health in the Recreational Red Snapper (*Lutjanus campechanus*) Fishery in the Upper Texas Coast.

(August 2011)

Sarah A. Norman, B.A., Wittenberg University

Chair of Advisory Committee: Dr. Wyndylyn M. von Zharen

In 1988, the red snapper fishery in the Gulf of Mexico was declared severely overfished. Since then, the daily bag limit has been reduced from 7 to 2, the minimum size limit has increased from 13 to 16 inches, and the year-round recreational season has been reduced to one lasting 53 days. Despite NOAA's recommendations that the Gulf States match these regulations, Texas has enforced a 4 bag limit and no seasonal restrictions. In 2009 alone, the total recreational catch exceeded the allocated quota by 1.7 million pounds. The lack of consistency between state and federal regulations and the drastic changes in management schemes have affected anglers' confidence in management, and limited the ability of the fishery to successfully adapt. This study provides an innovative assessment that measures fishers' knowledge and determines their support for current fishery regulations and for the scientific rationale behind the regulatory system. Over 150 interviews of red snapper anglers at charter and head boat docks were conducted along the Texas coast. The majority of respondents were 20-50 year old (74.5%), male (89.3%), four-year college graduates (34.9%), who resided near the coast (65.3%), and were targeting red snapper (92.5%). Results showed that 72.5 percent of respondents agree with the science behind red snapper management, 63.4 percent believe that the stock has improved since 2008, 89.5 percent agree that a bag limit in general is an appropriate management tool, and 78.2 percent agree with the Texas state management of red snapper. However, 51.7 percent of respondents disagree with the federal management of red snapper, and 90.1 percent of all respondents did not know that red snapper live to be 41-60 years old. The lack of support for the federal management may be due to the lack of knowledge of red snapper life span. Applications of this research will be imperative for managers – who already address biological, ecological, and economic aspects of a fishery – to expand their multi-disciplinary approach to include social analysis for the successful evolution of recreational fisheries management. Future research should explore improved management approaches that involve greater communication between the stakeholders and managers.

DEDICATION

To my parents, my sister, and my better half. Their sacrifice, selflessness, and motivation have enabled me to pursue my dreams.

ACKNOWLEDGEMENTS

This research was supported by the Erma Lee and Luke Mooney Travel Grant, the Erma Lee and Luke Mooney Graduate Student Research Excellence Award, the Galveston Graduate Student Association Micro Grant, and the Galveston Graduate Student Association/Texas Sea Grant Mini Travel Grant. I am especially grateful to the Southeast Texas Sports Fishing Association, which has not only helped to fund my research but has been a wonderful support group from the first time I was invited into one of their meetings. Special thanks to Mr. Dutch Kueteman for his support, guidance, and motivation to do my best.

I would like to thank my committee chair, Dr. von Zharen, for her amazing persistence, passion for teaching, and dedication to her students. Our weekly discussions have helped to shape my understanding about the impact I can make through my research and beyond. I would also like to thank my committee members, Dr. Brody and Dr. Linton for their guidance, support, and motivation throughout the course of this research. I am so privileged to have had the pleasure of learning from all of them and I truly appreciate their mentorship. Thank you to Dr. Elizabeth Scott-Denton, for her guidance early on that helped in my search for where my research was most needed.

Thanks also to my friends and colleagues and the department faculty and staff for making my time at Texas A&M University a great experience. I especially want to thank Alyson Azzara, Michelle Cortez, Laurissa Noack, Sarah Piwetz, Katie St. Clair, and Thomas Riddle. It is a joy to have met and worked with all of them, and their support in school and in life has been invaluable. I also want to extend my gratitude to the charter and head boat captains in Galveston, Freeport, and Port Aransas, who enabled my site sampling, and to all the anglers who were willing to participate in the study.

Finally, a huge thanks goes to Peg Herwerden, Eric Norman, Marcella Norman, Laura Norman, and Steven Orlando. They are the motivation behind my success; this work is for them. Their encouragement has helped me push through the hard times and celebrate in the good times. I cannot thank them enough for all they have done; I love them so very much.

NOMENCLATURE

FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OSY	Optimum Sustainable Yield
SEDAR	SouthEast Data, Assessment, and Review
TAC	Total Allowable Catch
TPWD	Texas Parks and Wildlife Department
USFWS	United States Fish and Wildlife Service

TABLE OF CONTENTS

Page

LIST OF FIGURES

Page

Page

LIST OF TABLES

Page

Page

CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

Background of the Study

Red snapper, *Lutjanus campechanus*, is arguably the most important offshore fin-fish fishery in the northern Gulf of Mexico (GOM), both commercially and recreationally (Fischer, Baker, & Wilson, 2004; Cowan et al., 2010). The commercial fishery began in 1870, and recreational interest began to grow in the 1960s (Moseley, 1965). In 1988, the red snapper fishery in the GOM was declared severely overfished. (Cowan et al., 2010) Federal agencies have had to make annual adjustments of federal size and bag limit, as well as changes in season length, in attempts to end overfishing of red snapper by 2010 and rebuild the stock by 2032, as required by the Gulf of Mexico Fishery Management Council (GMFMC) (Strelcheck & Hood, 2007). However, a major inhibitor of progress in red snapper recovery has been the recreational sector. The Total Allowable Catch (TAC), a quota assigned to each sector to control how much of the species is removed each year, is often exceeded by recreational fishers, whereas commercial fishers generally abide by their TAC (Sutinen & Johnston, 2003).

In 2008, federal red snapper regulations including a recreational 2 bag daily limit and a closed season were implemented to reduce overfishing (GMFMC, 2006). Despite NOAA's recommendations that Texas match these regulations, Texas enforced a 4 bag

---

This thesis follows the style of *Human Dimensions of Wildlife*.

daily limit and no closed season (TPWD, 2010). In 2009 alone, the recreational catch exceeded the quota by an estimated 1.7 million pounds (Griggs, 2010). Current regulations, then, are ineffective in reducing overfishing in the recreational sector and alternative methods for management must be developed. Managers stress the importance of a healthy, diversified age/size structure of fish stocks whereas anglers argue that the fisheries are stable, creating conflict and confusion among all stakeholders involved (M. Clark, personal communication, November 14, 2009). Thus, a gap in knowledge of the regulations and the science behind those regulations has contributed to the overfishing in the recreational red snapper fishery.

For the purpose of this research, *anglers* refers to people who fish recreationally rather than commercially, *charter boats* refers to “a boat available for hire, normally by a group of anglers for a short period of time” and *head boats* represents “a fishing boat that takes recreational fishermen out for a fee per person,” or “per head” (Brusher & Palko, 1987; Ditton, Gill, & MacGregor, 1991; Sutton , Ditton, Stoll, & Milon, 1999). Within the anglers group, “captains” will represent those respondents that declared themselves as either a charter or head boat captain. “Non-captains” will refer to those respondents who did not identify themselves as a captain. This study provides an innovative snapshot of the assessment of the anglers’ perspective on the 2008 red snapper regulations. Over 150 interviews at charter and head boat docks were conducted at Galveston, Freeport, and Port Aransas, Texas. Analysis of the results of the interviews: 1) target gaps in angler knowledge of state versus federal regulations; 2) identify what scientific information anglers understand about the red snapper stock in the

GOM; 3) quantify the support for current management and stock assessment practices; and 4) assess recreational red snapper anglers' demographics. Stakeholders such as regulatory and non-regulatory agencies, as well as boat captains and anglers themselves, may use this study as one prediction of the future of the red snapper fishery in Texas.

Red Snapper Life History

Red snapper, a member of the family Lutjanidae, inhabits the waters from North Carolina to the Yucatan Peninsula, including the GOM but not the Caribbean Sea (Hoese & Moore, 1998) (Figure 1). Though rare, red snapper has been found as far north as Massachusetts (Rogers, 1999).

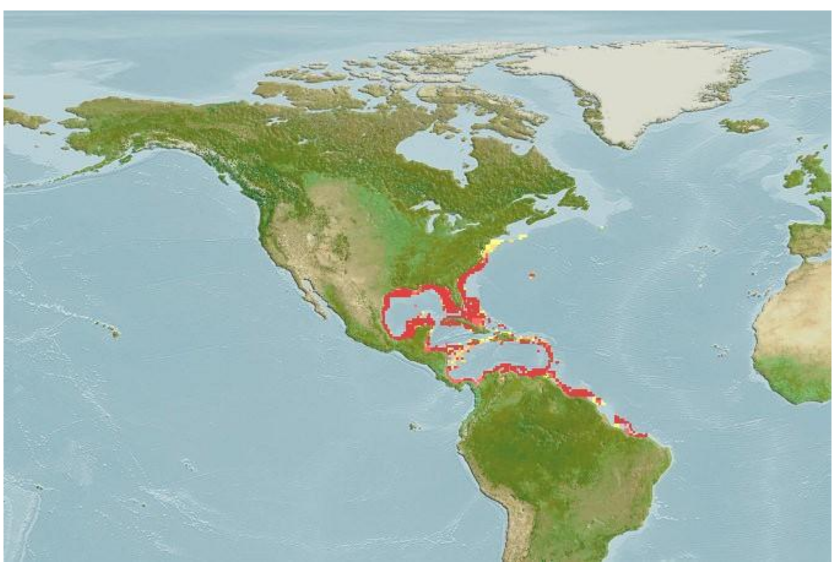

Figure 1 Native distribution map of red snapper, *Lutjanus campechanus* (Global Biodiversity Information Network and Ocean Biogeographic Information System, 2011).

Red snapper is a demersal reef fish, living on or near the bottom of the ocean along the continental shelf out to the shelf edge. The GOM continental shelf has little or no vertical relief, and is composed mainly of silt, sand, and mud (Ludwick 1964; Kennicutt, Schroeder, & Brooks, 1995). Typical adult habitat includes hard substrate such as coral reefs, sunken ships, oil and gas platforms, and rocky outcroppings (Gallaway, Cole, Meyer, & Roscigno, 1999). Open bottom areas such as shell and inshore and offshore mud habitats associated with natural banks act as settlement habitats for red snapper (Geary, Mikulas, Rooker, Landry, & Dellapenna, 2007). The larvae remain in the plankton stage for about 26 days until settling over the smooth bottom (Szedlmayer & Conti, 1999). According to the SouthEast Data, Assessment, and Review, a cooperative Fishery Management Council process for improved stock assessments, these habitat types are important nursery areas for age-0 red snapper, and juvenile red snapper have demonstrated associations with structured habitat, such as rock outcroppings, shell ridges, and artificial reefs (SEDAR7, 2005; Szedlmayer & Conti, 1999; Masuda et al., 2003; Geary et al., 2007). Wells and Cowan (2007) have also demonstrated that red snapper showed significantly higher abundance and larger size in habitats that are located over reefs.

There is some discrepancy as to whether red snapper move off reef to feed or if they feed on both organisms associated with reef and open-water habitat (Gallaway, 1984; McCawley, 2003). The presence of artificial platforms may have altered the distribution of many fish species, including red snapper (Bohnsack, 1989). In 1984, platforms alone contributed to 28 percent of red snapper habitat in the western GOM

(Gallaway, 1984). Consequently, the availability of red snapper to fishers has been heavily influenced by the presence of artificial reefs. Dugas, Guillory, and Fischer (1979) state that the construction of platforms was the largest contributor to the growth of the now lucrative offshore sportfishing industry, and “fishing the oil rigs” is common. There is speculation that the larger size and older age red snapper that are now more accessible will be harvested in higher proportions than the rest of the population (Nieland & Wilson, 2002). It is a critical time for anglers to understand the life history of red snapper and how the pressure being exerted by the fishery may influence the evolution of red snapper in the future (Heino & Dieckmann, 2009).

Red snapper are opportunistic feeders, varying their prey seasonally and with changes in size (McCawley & Cowan , 2007). Juvenile red snapper feed upon shrimp, crabs, other crustaceans and epifaunal benthic organisms (Moran, 1988; Cowan et al., 2010). As the individual increases in size, the incorporation of fish into the diet increases as well (Bradley and Bryan, 1975; Gallaway, 1984). Initially, red snapper grow quickly at about 25 mm/month in the first year, and about 60 to 75 mm/year from age 1 to age 5. Growth slows steadily as they age, and asymptotes by about age 10 (Moran, 1988).

Red snapper are a long living species that require proper management to ensure a sustainable, self-sufficient stock is achieved. Prior to the wave of regulations involving this species, it was believed that red snapper only lived to a maximum of 15 years (Hood, Strelcheck, & Steele, 2007; Cowan et al., 2010). As research and concern with red snapper grew, scientists discovered that this species can live up to 40 to 50 years on average (Wilson & Nieland, 2001; Hood et al., 2007). Recently however, it is rare to find an older red snapper, as most of the snapper sampled from recreational and commercial fisheries are 2 to 6 years old (Figure 2) (Louisiana Sea Grant, 2010).

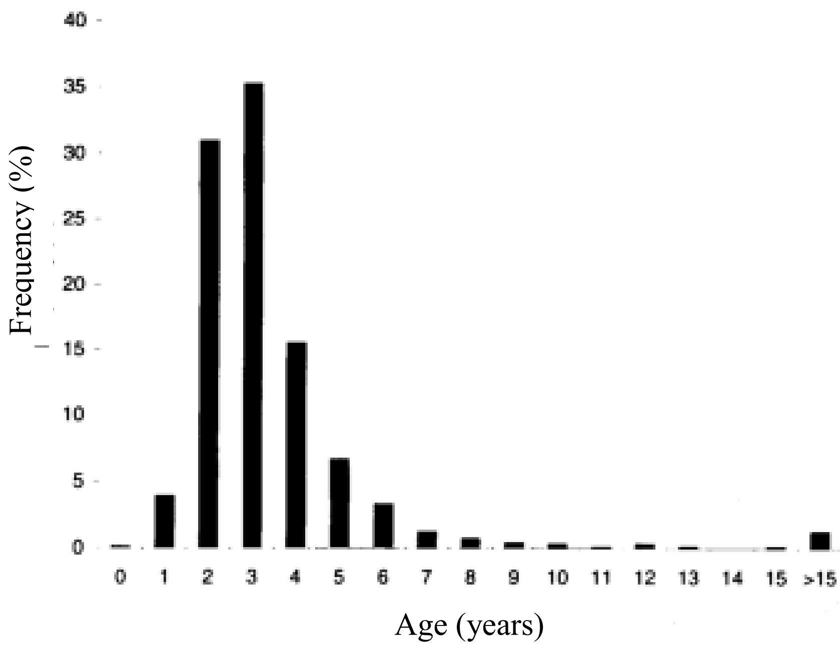

Figure 2 Age-frequency histogram (n=3791) for red snapper collected from Northern GOM, from 1989-1992 and 1995-1998 (Wilson & Nieland, 2001).

With most individuals reaching 13 to 30 inches by age 5, red snapper grow quickly in the first decade of their life. Often, there is not a correlation between age and size, as growth rate slows around age 10, and a 5 year-old snapper may be the same size as a 30 year-old (Figure 3) (Wilson & Nieland, 2001).

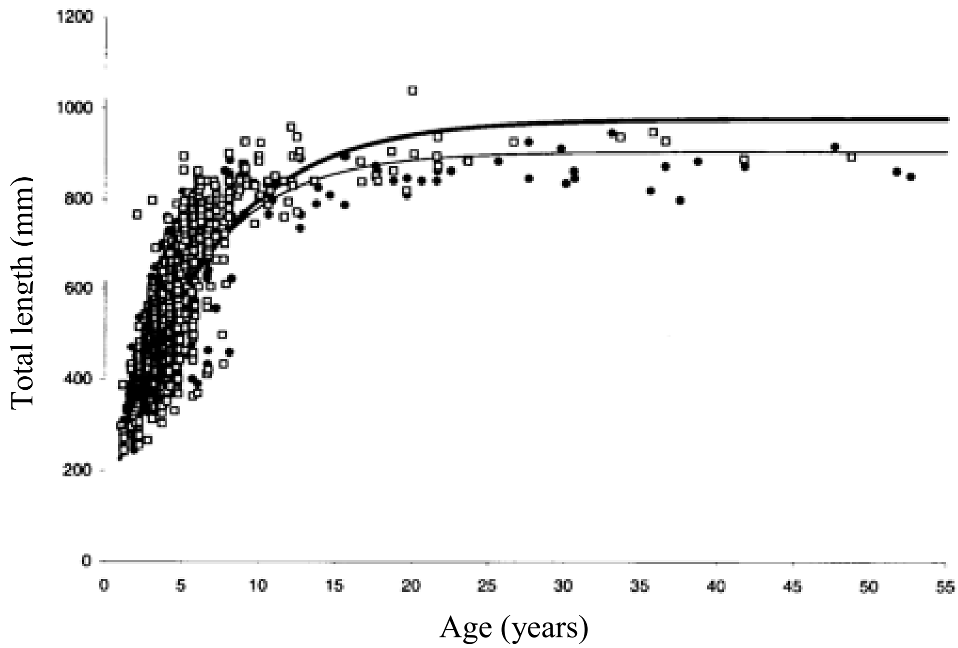

Figure 3 Total length (mm) at age and relationship of age to total length predicted from the von Bertalanffy growth models for male (closed circles, narrow line) and female(open squares, thick line) red snapper from the northern GOM (Wilson & Nieland, 2001).

Although numbers of red snapper are in fact increasing, the increase in numbers is mostly comprised of 3-7 year old fish (Dance, 2008; SEDAR Red Snapper Update, 2009). As Cowan et al. (2010) emphasize, "the bottom line is that if carrying capacity for adults has increased, yet escapement to older ages is still too low, we would now have a much larger and longer row to hoe to recover the red snapper stock to B_{OFL}," or biomass at overfishing levels.

Continuous spawning of red snapper occurs within the April-May and September-October spawning seasons in the GOM. Spawning occurs away from reefs at depths of 18-37 m over open water and sandy bottom habitat (Beaumariage &Bullock,

1976). Findings also suggest that red snapper spawn over a wide depth range, as a consistent presence of red snapper larvae was found in samples from 100 to 200 m along the western and eastern Gulf (Lyczkowski-Shultz & Hanisko, 2007; Collins et al., 2001). Red snapper are partially sexually mature at age 1 and most reach full maturity at age 2, or at about 375 mm in fork length (FL) (Moran, 1988). A female age 3, or 386 mm, produces around 0.2 million eggs per spawning period, while a 12 year old female, about 754 mm, produces nearly 9.3 million (Collins, Finucane, & Brusher, 1987). Number of eggs produced varies depending on the size and age of the female, with most females reaching peak fecundity around age 15 (Collins, Johnson, & Keim, 1996). Unfortunately, many females are harvested after only a few spawning periods and well before they reach their full potential for reproduction (Louisiana Sea Grant, 2010). A red snapper female's ability to reach peak fecundity, between the ages of 10 and 15, is imperative for the health of the stock. While red snapper do reach maturity at age two, their reproductive potential is negligible compared to those of highly fecund individuals. Thus it has been noted that regulations should act to preserve a significant proportion of red snapper females to allow them to reach age 10 or older (Wilson & Nieland, 2001).

The decline of red snapper in the GOM can be attributed to: commercial fishing; recreational fishing; and shrimp trawl by-catch (Patterson, Cowan, Fitzhugh, & Nieland, 2007) In addition to the regulation of the red snapper fishery, the commercial shrimp fishery has also undergone management changes. Juvenile red snapper are often taken incidentally by the shrimp fishery in the GOM (Gazey et al., 2008) With juvenile red snapper habitats being over the smooth bottom, shrimp trawlers have been noted as a significant source of mortality for the red snapper fishery (GMFMC, 2001).

Scientific data collection methods for red snapper are accepted to be “state-of-the-art” (Patterson et al., 2007; University of Miami, 2005). SEAMAP, the Southeast Area Monitoring and Assessment Program, functions to produce a long-term early life stage database of fishes in the GOM. Since 1982, this program has collaborated with scientists in Florida, Alabama, Mississippi, and Louisiana to collect plankton samples in a systematic approach across the Exclusive Economic Zone in the U.S. GOM (Lyczkowski-Shultz & Hanisko, 2007). In recent SEDAR workshops, larval indices based on the SEAMAP data have been examined for use in stock assessments of red snapper. All snapper larvae are examined and identified by ichthyoplankton specialists. In SEAMAP surveys, plankton sampling “is conducted around the clock at predetermined stations arranged in a fixed, systematic grid across the U.S, Exclusive Economic Zone of the GOM” (Hanisko, Lyczkowski-Shultz, & Ingram, 2007). This research has enabled managers to receive “information about the biology and ecology of [red snapper] that…have withstood numerous internal and external reviews over the period of record” (Patterson et al., 2007). While the scientific community may accept the scientific methods used for red snapper stock assessment, many fishers do not (Anderson, 2009, Lelis, 2009). Thus, a goal of red snapper managers must be to “encourage anglers and their representatives to form more positive attitudes toward NMFS so that they will…support management decisions based on these results, and put more trust in the agency” (National Research Council, 2006).

Fisheries Policy and Management

In 1976, the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) was passed by Congress to "provide for the conservation and management of the fisheries" of the United States" (MSFCMA, 1996). To protect red snapper and other reef fish, the Gulf of Mexico Reef Fish Fisheries Management Plan was developed in 1984 by the GMFMC under the National Marine Fisheries Service (NMFS) to "manage the reef fish fishery…to attain the greatest overall benefit to the Nation" (Keithly, 2001). As many marine fisheries, both commercial and recreational, have only had a few decades of management history, the recognition that the red snapper fishery was being overfished was not realized until the first stock assessment in 1988, four years after implementation of the Reef Fish Fishery Management Plan. The GMFMC established federal regulations such as recreational bag limits and commercial quotas for reef fish. The original regulations included a 13-inch Total Length (TL) minimum size limit, a 7-fish bag limit, and an allocated quota of 1.96 Million Pounds (MP) for the recreational fishery (Table 1). Since its implementation, the Reef Fish Fishery Management Plan has implemented 30 amendments to the plan addressing both the commercial and recreational sectors including Amendment 1 that set a target for stabilizing long-term population levels of all reef fish species by January 1, 2000 (GMFMC, 2010c). In 2005, a red snapper rebuilding plan was generated by the GMFMC; this extended the Amendment 1 (1990) goal of red snapper stocks being rebuilt by the year 2000 to 2032 (GMFMC, 2010c) (Table 1). A summary of legal provisions may be found in Appendix B.

Table 1 Recreational and commercial regulation changes for Gulf of Mexico red snapper fishery from 1991-2011. (Adapted from SEDAR Red Snapper Update, 2009. 2010-2011 data obtained from Wildlife and Fisheries, 50 C.F.R. § 6 (2011)). For detailed regulatory information see Appendix B.

	Recreational					Commercial			
YEAR	**Size Limit (in TL)**	**Daily Bag Limit**	**Season (days)**	**Quota (MP)**	**Harvest (MP)**	**Size Limit (in TL)**	**Season (days)**	**Quota (MP)**	**Harvest (MP)**
1991	**13**	**7**	**365**	**1.96**	2.1	**13**	**236**	**2.04**	2.21
1992	13	7	365	1.96	3.62	13	95	2.04	3.11
1993	13	7	365	2.94	5.57	13	94	3.06	3.37
1994	14	7	365	2.94	4.53	14	77	3.06	3.22
1995	15	5	365	2.94	3.69	15	52	3.06	2.93
1996	15	5	365	4.47	3.47	15	87	4.65	4.31
1997	15	5	330	4.47	4.37	15	73	4.65	4.81
1998	15	4	272	4.47	4.35	15	72	4.65	4.68
1999	15	4	240	4.47	3.33	15	70	4.65	4.88
2000	16	4	194	4.47	3.56	15	66	4.65	4.84
2001	16	4	194	4.47	4.87	15	79	4.65	4.63
2002	16	4	194	4.47	4.6	15	91	4.65	4.78
2003	16	4	194	4.47	5.02	15	94	4.65	4.41

Table 1 Continued.

	Recreational					Commercial			
YEAR	**Size Limit (in TL)**	**Daily Bag Limit**	**Season (days)**	**Quota (MP)**	**Harvest (MP)**	**Size Limit (in TL)**	**Season (days)**	**Quota (MP)**	**Harvest (MP)**
2006	16	4	194	4.47	**	15	126	4.65	4.65
2007	16	2	194	3.185	**	13	365	3.315	3.18
2008	16	2	65	2.45	**	13	365	2.55	2.48
2009	16	2	75	2.45	4.27	13	365	2.55	2.55
2010	16	2	53*	3.403	2.23	13	365	3.542	**
2011	**16**	**2**	**48**	**3.525**	**	**13**	**365**	**3.66**	**

***In the year 2010, a supplemental season was established on Fridays, Saturdays, and Sundays from October 1, 2010 to November 21, 2010, due to the closures caused by the BP Deepwater Horizon oil spill.**

**** Data not available.**

The shrimp trawl by-catch has been addressed since 1997 through the federal mandated for By-catch Reduction Devices (BRDs) for most shrimp boats in the Gulf (GMFMC, 2010c). However, the SEDAR7 stock assessment determined that “red snapper remained overfished, mainly because (1) the BRDs had failed to achieve the target mortality reduction and (2) the TAC had been maintained throughout the 1998-2003 period at a level that assumed the by-catch mortality reduction was being met" (SEDAR7, 2005, Gazey et al., 2008). This gives cause for recreational anglers to believe that they are not the ones responsible, nor should they be regulated, due to the commercial snapper and shrimp fisheries (Wilson, 2009).

State Versus Federal Regulations

During the time of this research, in the year 2010, federal regulations for recreationally caught red snapper in the GOM were not consistent with state management regulations. The federal regulations, implemented by the GMFMC, included a 53-day season from June 1st, 2010 until July 24th at 12:01 am local time (GMFMC, 2010b). The regulations also required a 16 inch minimum size limit for snapper and a 2 bag daily limit (GMFMC, 2010b). The federal season has declined significantly since the late 1990s, as has the daily bag limit (Figure 4) (GMFMC, 2010b).

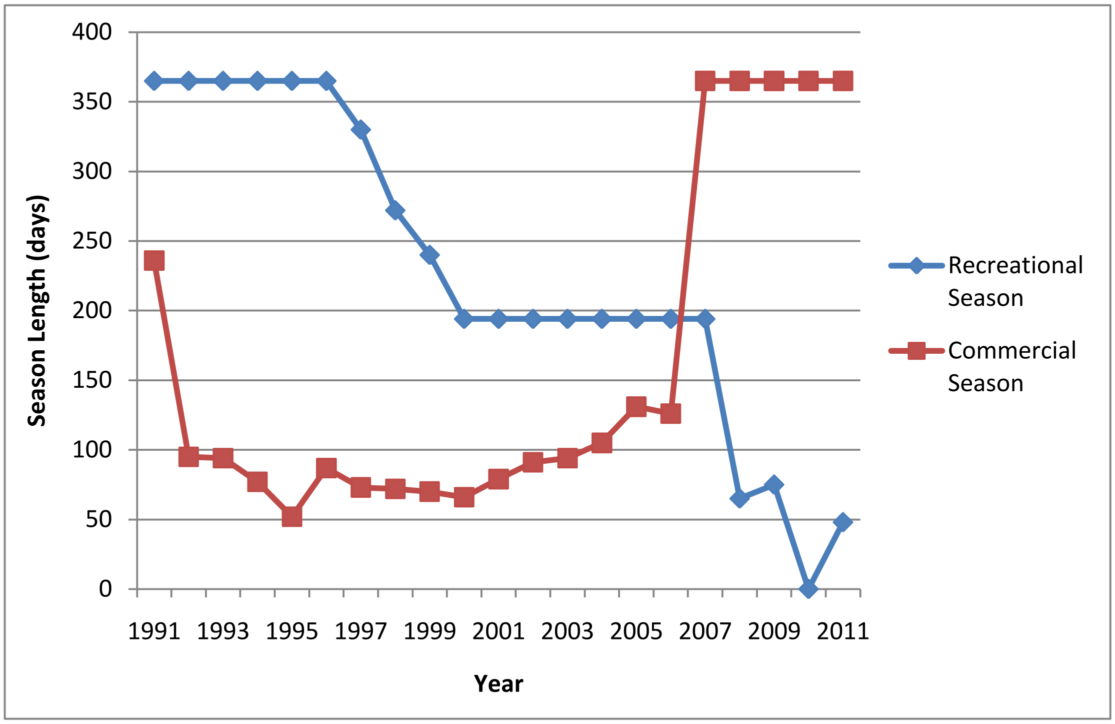

Figure 4 Days open for commercial and recreational sectors in the GOM red snapper fishery (GMFMC, 2001).

The state regulations, implemented by the Texas Parks and Wildlife Department (TPWD), did not have a season during 2010, and had a minimum size limit of 15 inches with a daily bag limit of 4 (TPWD, 2010). The inconsistency between state and federal regulations has generated tension between the agencies and between managers, state or federal, and the fishers (Wilson, 2009).

Commercial Fishery

During the 2006 season, over 4.5 million pounds of red snapper, valued at over $13 million, were caught commercially in the United States (NOAA, 2008). GOM commercial red snapper landings peaked in the 1950s at about 14 million pounds annually, and since then have declined to recent annual landings of less than 3 million pounds (Keithly, 2001). As of 2010, the commercial quota for red snapper was 3.542 million pounds (Table 1) (GMFMC, 2010a). Commercial fishing for the GOM remains a significant source of revenue for the Gulf States; red snapper nation-wide is one of the most sought-after fish in the commercial fishing sector, bringing in $7,963,814 in 2008 landings in alone (NMFS, 2002).

In 1996, the Gulf Council recommended a catch share management strategy called an Individual Transferrable Quota program (ITQ) to be implemented for the commercial fishery. In January of 2007, a similar Individual Fishing Quota (IFQ) catch share program was implemented through Amendment 26 to the Reef Fish Fishery Management Plan (Appendix B) (GMFMC, 2006). The IFQ program for the red snapper fishery establishes a catch share program where participants receive percentages of the total allowable catch (TAC) for the red snapper commercial sector. In the 17 years prior to the IFQ program, the GOM commercial red snapper annual quota was exceeded nine times, while in the first two years of the IFQ program, landings have been below set quotas (Table 1) (NMFS, 2008). While keeping the annual landings below the quota is not directly related to the recovery of red snapper, this evidence supports the argument that commercial overfishing of the GOM red snapper fishery is ending. This is likely due to the shift in management schemes to the GOM Individual Fishing Quota system (Keithly, 2001).

The primary problem that caused managers to consider initiating the IFQ program was the derby-style fishing induced by the limited access fishing permits, trip limits, and closed seasons (NMFS, 2008). Factors contributing to the derby style fishing were a fleet larger than necessary to harvest red snapper, set seasons that forced fishers to go out in unsafe conditions, and market gluts that would generate lower ex-vessel values for the fish followed by shortages of snapper when the season was closed (Keithly, 2001). The IFQ program was designed and implemented by NMFS to address these problems and eventually, to reach the optimum yield for the fishery. However, multiple agencies are still faced with the challenge of sustaining the commercial fishery while satisfying recreational fishers who claim that the IFQ system "grants exclusive rights" to commercial fishers through allocating a portion of the stock to them (Tresaugue, 2009).

Recreational Fishery

In 2001, an estimated 34 million anglers ages 16 and older, nearly 16 percent of the population, fished an average of 16 days each (Sutinen & Johnston, 2003). Recreational fishing plays a vital role in the Texas economy, bringing in $3.2 billion in fisheries related expenses in 2006 (USFWS, 2006). Also in 2006, the GOM accounted for 40 percent of all U.S. marine recreational fishing catch (NOAA, 2008). The 5th highest recreationally caught species during that year was also red snapper, making it one of the most economically significant species in the GOM both recreationally and commercially (NOAA, 2008).

In retail sales, recreational fishing accounts for about $365 million for fishing related expenditures each year in Texas (FEMA, 2008). The recreational fishing sector has been contributing significantly to fishing activity, with marine recreational fishing activity (harvest) increasing by 20 percent from 1996 to 2000 (Figure 5) (GMFMC, 2001).

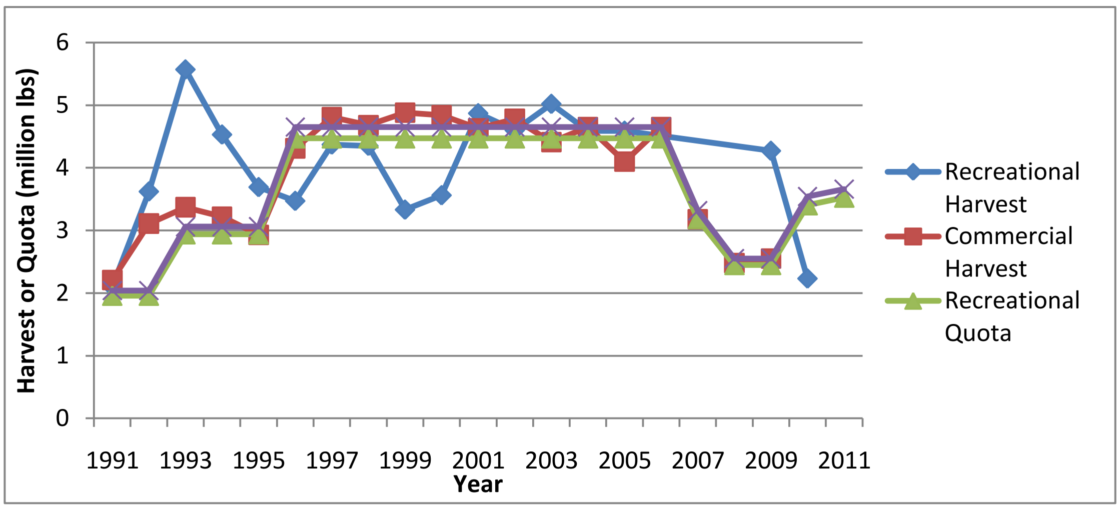

Figure 5 Commercial and recreational harvest and quotas for GOM red snapper from 1988-2000 (GMFMC, 2001)**.**

A significant factor in this increase has been the charter and head boats that have made the ability to catch red snapper more affordable and accessible (Holland, Ditton, & Gill, 1992; Sutton et al., 1999). The number of charter boats studied by Sutton , Ditton, Stoll, and Milon (1999) increased from 210 in 1987 to 430 in 1997, and the number of trips taken by passengers has increased three-fold. The recreational fishing sector is increasingly welcoming new members without limiting the number of people utilizing this resource, jeopardizing the sustainability of the fishery (Sutinen & Johnston, 2003).

While the mortality of red snapper in the commercial sector and the shrimp by-catch sector have been controlled through the introduction of catch shares and by-catch-reduction devices (BRDs), and have since retained a constant mortality rate, that is not the case with recreational fishing. In the recreational sector, there has been an increasing trend of red snapper mortality (GMFMC, 2001). This may be due to a number of factors including failure to comply with regulations, the lack of success of the catch and release management of the fishery, and the inability to limit the number of anglers removing red snapper from the waters in the GOM (Render & Wilson, 1994; Rummer, 2007). Historically, fish have been caught recreationally for domestic consumption; however there is a growing trend in recreational fisheries to release the fish caught (Cowx, 2002). The tension between the commercial and recreational fishery combined with the strict season and bag limits for red snapper make it all the more likely that anglers will catch-and-release red snapper until they get their ideal fish for their bag limit. The regulations since 1990 have “increased the proportion of red snapper caught that are subsequently released in the recreational fishery to over 50%, a 10-fold increase since the early 1980s” (Rummer, 2007). Catch and release mortality rates for red snapper released from 20-40 m may be below 20 percent, but for snapper retrieved from deeper depths, mortality rates may be greater than 70 percent (Burns, Koenig, & Coleman, 2002).

Another complication in the management of the recreational sector involves the accessibility of artificial reefs for fishing. A study on the Artificial Reef Permit Zone off of Alabama showed that as the number of artificial reefs had increased since 1986, so had the landings of red snapper (Patterson, 1999; Bailey, Cowan, & Shipp, 2001). Cowan et al. (2010) contended, that "this [was] a spurious relationship created by knowledge and law" and as such was a "curious juxtaposition of new scientific knowledge about red snapper and fortuitous changes in statutes governing fisheries management." Consequently, in the 1980's, it became apparent that a management strategy was necessary for red snapper; and a management plan was introduced that included reducing harvest of adults and reducing juvenile by-catch (Hood et al., 2007). A result of the management was an increase in the demand for a greater scientific understanding of red snapper (Cowan et al., 2010). The result of the scientific research on red snapper was "a progression of red snapper age estimates that extended estimated longevity from 15 years in the early 1980s to 55 years, as we know today" (Cowan et al., 2010). This knowledge was imperative for management in determining how to regulate the fishery (Cowan et al., 2010). The presence of artificial reefs, combined with the rapid advances in technology available to commercial and recreational fishers --such as synthetic fibers for monofilament fishing line, global positioning systems, and powerful motors - and the affordability of charter and head boats, has contributed immensely to the pressure exerted by the recreational sector on the red snapper fishery (Cooke & Cowx, 2006; Cowen et al., 2010).

Alternative Management Strategies

Recent trends in recreational fisheries management are the concepts of co-management and rights-based management. *Co-management* is "the collaboration of government and stakeholders in decision-making processes" (Kosaka, 2005). The theme of co-management is that self-involvement in the management of the resource will lead to a stronger commitment to comply with the management strategy and sustainable resource use (Sutinen & Johnston, 2003). More specifically, co-management involves fishermen's organizations taking a more active part in "designing, implementing, and enforcing fisheries regulations" (Jentoft, 1989). A fishery's implementation of co-management can range from "a high degree of government control with a limited role for user groups to participate by providing information to government representatives, to exclusive community control over the resource" (Beem, 2007). In some cases, co-management may be simply a formal recognition of informal and customary community-based system of fisheries management which already exists. Currently, the Maine lobster fishery, Norway's Lofoten fishery, and the Atlantic surf clam fisheries practice this management strategy (Beem, 2007).

Advocates for co-management argue that it "leads to greater procedural legitimacy and enhances the quality of regulations" by improving the information available about the resource and the consequences of regulations (Pinkerton, 1989; Jentoft, 1989). Opposing arguments to co-management claim that participants in a co-management process may have an unrealistic view of what their role should be relative to the government's role. The handing over of management responsibility to an "unauthorized group" may seem to some like an "abdication of federal authority" (Bryan, 2004). Furthermore, argument can be made that the current Regional Fishery Management Councils in the United States, with members from government agencies and stakeholder groups, is a form of fisheries co-management that has not led to more sustainable fisheries (Kosaka, 2005).

While co-management is meant to address the lack of participation and reduce conflicts associated with centralized management, *rights-based management*, is meant to "reduce excess competition, stimulate investment and provide incentives for greater economic efficiency" (Pomeroy, 1999). Also known as "market-tradeable user rights," and "transferable user rights," among other terms, rights-based management requires collaboration between all sectors of the fishery as well as legislation that defines recreational rights for fishing organizations, empowering them to exclude nonmembers from designated fishing areas (Leal & Maharaj, 2009). Proponents for this strategy claim that rights-based management allows for better enjoyment of the sport for anglers, increased profits and flexibility for the for-hire sector, and more cost-effective, better control of the catch for managers (Leal & Maharaj, 2009). Others caution that in order to succeed in marine recreational fisheries, rights-based management must be easily monitored and enforced, controlling fish mortality "while generating sufficient information for managers to gauge the impacts of fishing, the number of participants, and the extent of their fishing efforts" (Griffin, Woodward, & Kim, 2009). While examples of rights-based management can be found in the commercial fisheries, such as the GOM reef fish fishery, and the Pacific halibut and sablefish fishery, a recreational fishery in the U.S. has yet to adopt a rights-based management strategy (Leal & Maharaj, 2009).

Leal and Maharah (2009) note several problems with the current recreational fishery management strategy. They explain, "while recreational fishing is an activity carried out for sport and personal use, it is still susceptible to what Garret Hardin calls the 'tragedy of the commons'" (Leal & Maharah, 2009). What generally occurs first is that a conflict among users arises when the collective recreational catch exceeds safe target levels or takes a growing share of the catch. Secondly, the management approaches such as seasons, size limits and bag limits, traditional for the recreational fishery, not only are "often not enough to prevent overfishing," but they also create "angler discontent and lower economic benefits for those who service anglers" (Leal & Maharaj, 2009). Finally, the tendency of recreational management to use a "one size-fits-all set of restrictions over a large geographic area ignores widely varying preferences among angler populations and environmental conditions," which only exacerbates angler discontent and financial losses to the sector (Leal & Maharah, 2009). Holland, Ditton, and Gill (1992) recognized that the tragedy of a common property resource "unfolded with dramatic increases in commercial and recreational harvest, electronic fish finders that enhance fish targeting capabilities, and increasing number of anglers."

The case for the shift to a new management strategy is based on claims, such as those stated previously, that many recreational sectors are not well regulated, and thus "unintegrated" in fisheries management (Sutinen & Johnston, 2003). An example of an unintegrated recreational sector would be where the management approach allows one sector to take away an amount of catch to which the other sector is entitled:

> The recreational sector of a fishery is fully integrated into the fishery's management program when management measures applied to the recreational sector are sufficient to enable managers to achieve the goals of the fishery management plan, and achieve the agreed upon allocation of catches among recreational, commercial, and other user groups.
>
> -Sutinen & Johnston 2003

In order for fisheries management to be successful and sustainable, fishing mortality must be controlled in all sectors (Sutinen & Johnston, 2003). One approach to community-based fisheries management is AMOs, or angling management organizations. This concept combines "three of the more pervasive and promising trends in fishery management worldwide – management devolution, strengthened harvest rights, and co-management" (Sutinen & Johnston, 2003). Approaches such as AMOs offer a solution to fully integrating the recreational sector into fisheries management. These strategies may offer an alternative to fisheries such as the red snapper fishery in the GOM. The goals of this approach are to "strengthen resource stewardship, reduce enforcement and monitoring costs, alleviate management conflicts, and produce greater long-term net economic benefits in recreational fisheries" (Sutinen & Johnston, 2003).

In the case of the red snapper fishery, rights-based management is being considered by the GMFMC as an option to better regulate the recreational sector

(GMFMC, 2011). There is much controversy over this consideration however, as recreational anglers view the new management approach as a violation of public rights to the resource (Leal & Maharaj, 2009). However, if action is not taken now to prevent further exploitation of the fishery, traditional management may not be enough to ensure proper control of the resource for the future (Pomeroy, 1999).

Significant Prior Research and Justification for Study

In 1948, F.W. King established the significance of human factors in fisheries management and the demand for including these factors in management decisions (King, 1948). A year later, G.N. Hunter conducted the first use of personal interview techniques to obtain information regarding state natural resource management (Hunter, 1949). His research expanded fisheries management to include human dimensions studies. Most of the past surveys of residential recreational fishers in Texas were conducted by the Texas A&M University Human Dimensions Lab over an 18 year time span, published in peer-reviewed journals, and utilized by TPWD (Anderson & Ditton, 2004). These surveys have been conducted on demographic and attitudinal shifts of Texas anglers since 1989. In 2000, a survey was conducted on 463 participants of a saltwater fishing tournament in Texas, identifying characteristics, attitudes, and expenditures of the tournament angler sub-population (Ditton , Anderson, Bohnsack, & Sutton, 2000). The last of these individual angler surveys was published in 2006, prior to the red snapper regulations of 2008 that reduced the federal bag limit to 2 per day.

The above mentioned surveys have standardized methods that have produced measurable results with each survey. Of the surveys conducted on in-state recreational anglers in Texas, those in 2004 included questions addressing “demographics; participation and experience; species preferences; motivations and attitudes; ‘typical’ fishing trip characteristics; satisfaction with fishing in Texas; and constraints to fishing participation” (Anderson and Ditton, 2004). Demographics, economic impact, motivations and attitudes, fishing trip characteristics, and satisfaction with fishing in Texas were the topics chosen for this research as variables to measure influences on angler knowledge and perception of science and management. Questions from these surveys pertaining to recreational saltwater anglers were influential in developing the interview questionnaire.

TPWD also conducts creel surveys that intercept anglers at the docks; these surveys address strictly biological data with the exception of one question regarding the demographics or social dimension of the anglers (L. Robinson, personal communication, February 18, 2010). According to the National Research Council, improved fishing statistics are still needed for the recreational fishing sector, and “human dimensions addressed in [recreational fishing sector] surveys would help to target where management and education is needed” (National Research Council, 2006). Benefits to human dimensions studies in natural resource management include “better, more informed decisions, durable and sustainable solutions, and [encouraged] compliance with management decisions” (Krishnaswamy, 2010). Citizen involvement through interviews may also reduce the “values clash” that may occur when wild-life focus of the citizen participant creates a negative interaction with other people, such as managers (Decker & Chase, 1997). As Anderson and Ditton (2004) contend, advantages to incorporating human dimensions into fisheries management include "a reduction of conflict over fishery resources and a more rational understanding of the various interests involved in fisheries management."

TPWD has expressed a significant interest in the human dimensions aspect of fisheries management, more so than any other state in the southeast region (Anderson & Ditton, 2004). As aforementioned, the agency performs a survey on resident anglers every few years through the Human Dimensions Lab at Texas A&M University (Anderson & Ditton, 2004). However, this current research on the assessment of recreational red snapper anglers focused on a single species that is significant to both commercial and recreational fishers, and was conducted only a few years after the controversial regulation promulgated in 2008. Furthermore, the value of observing the effects of regulatory change on a fishery soon after its implementation makes this research all the more urgent. As noted by the National Research Council (2006), the infrequent, inconsistent timing of current socioeconomic surveys "does not provide the ongoing monitoring of the recreational sector that is needed to better inform management decisions." Managers are not only concerned with the status of the fishery itself but also with whether fishers will choose to target another species, and thus, the number of recreational red snapper fishery participants diminish due to dissatisfaction with regulations (T. Wiley, personal communication, January 19, 2010): The results of the interviews provide managers with information necessary to make effective management decisions to ensure recovery of red snapper, and reduce conflict with anglers despite the strict regulations.

Many human dimensions studies have focused on angler demographics and attitudes; however, few, if any, have sought to assess anglers' opinions about a particular species including allowing them to speak in a non-regulatory setting regarding their suggestions for the fishery (Ditton & Fedler, 1983; Ditton, Gill, & MacGregor, 1991; Anderson & Ditton, 2004). An important limitation of past research is the lack of assessment of anglers' scientific knowledge about the fishery they are targeting (National Research Council, 2006). By utilizing interviews to determine perspectives of the anglers and to target their knowledge of the regulations and science involving red snapper, an important component for implementing an effective fishery management strategy will be obtained. Paired with catch and biomass data, economic and sociocultural data are used to "accurately illustrate the impact of management policies" (NOAA, 2010a).Therefore, this type of research will be imperative for managers to enhance their data collection efforts to include social foundations for managing valuable marine resources in the GOM (Anderson & Ditton, 2004).

Research Purpose and Objectives

With tighter red snapper regulations, both regulatory and non-regulatory agencies are faced with the task of ensuring angler participation while meeting the demand to rebuild the red snapper stock by 2032. To properly manage the red snapper recreational fishing sector along the Texas coast, an assessment of the current values and opinions of the anglers regarding their knowledge and acceptance of the red snapper regulations and scientific research is necessary. Also, a demographic survey analyzing the state of the fishery after the red snapper regulations of 2008 will assist in enabling managers to create effective management strategies for the recreational red snapper fishing sector. The specific objectives of this research, therefore, are:

1. To assess anglers' scientific knowledge about red snapper through their knowledge of certain life history traits of red snapper
2. To assess angler knowledge of state and federal regulations regarding red snapper by quantifying their knowledge of the bag limit and season regulations
3. To assess angler perception of red snapper management and science through quantifying angler attitudes regarding these topics
4. To determine whether angler perception of red snapper science and management is dependent upon the scientific and regulatory knowledge of the anglers
5. To determine if anglers have similar opinions in open ended responses as to how the red snapper fishery should be managed

Research Hypotheses

Hypothesis 1: A majority of respondents do not know the state regulations for red snapper.

The population sampled in this study is charter and head boat anglers; it may be that this demographic is composed of participants who are not familiar with the regulations of offshore species. The participants will have likely received some education on the federal regulations during their offshore fishing trip due to the requirement of charter and head boats to abide by the federal regulations (GMFMC, 2010b). It is less likely that they will be aware of the state regulations as they fish in federal water during the charter or head boat trip, and do not have to know or abide by state regulations should they be stopped by a federal regulatory agent.

Hypothesis 2: There is no significant ($p<.05$) difference between the respondents' knowledge of red snapper life span and the actual population mean of 50 years old.

Only since the late 1980s have scientists known that red snapper live to an average of 50 years old (Fischer, 2007). The probability is unlikely that the respondents - charter and head boat anglers and captains - know this information as well. Anglers have noted that there are "plenty of red snapper," and in some cases claim that the fishery is better now than it was 20 years ago (Wilson, 2009, Lelis, 2009). This discrepancy in knowledge could result in dissatisfaction with the federal government for placing strict regulations on the red snapper fishery.

Hypothesis 3: There is no significant ($p<.05$) relationship between respondents who reside near the coast (coastal county) and knowledge of red snapper life span.

Hypothesis 4: There is no significant ($p<.05$) relationship between respondents who primarily fish in saltwater bodies and knowledge of federal regulations for red snapper.

Past studies have demonstrated that angler residency has contributed to awareness of and compliance to fishery regulations (Page & Radomski, 2006). Respondents residing near the coast or who frequently fish in saltwater areas may be more likely to understand the regulations and science about the species that are present there.

Hypothesis 5: There is no difference between captain angler and non-captain angler perception and knowledge of red snapper management.

Hypothesis 6: There is no difference between captain angler and non-captain angler perception and knowledge of science related to red snapper management.

A charter or head boat business depends on the health of the fishery and compliance with regulations to conduct a successful business operation (Sutton et al., 1999). Thus, anglers who are captains are more likely to understand the management and be more educated about red snapper life history, as they have a vested interest in the species.

CHAPTER II

RESEARCH FRAMEWORK

The following section outlines the concepts necessary to assess charter and head boat angler and captain perceptions and knowledge of science and management in relation to the GOM red snapper fishery. The variables listed will be utilized to measure the relationship between independent variables and the knowledge and perception of the respondents. A conceptual model will be presented to clarify the objectives of the study (Figure 6).

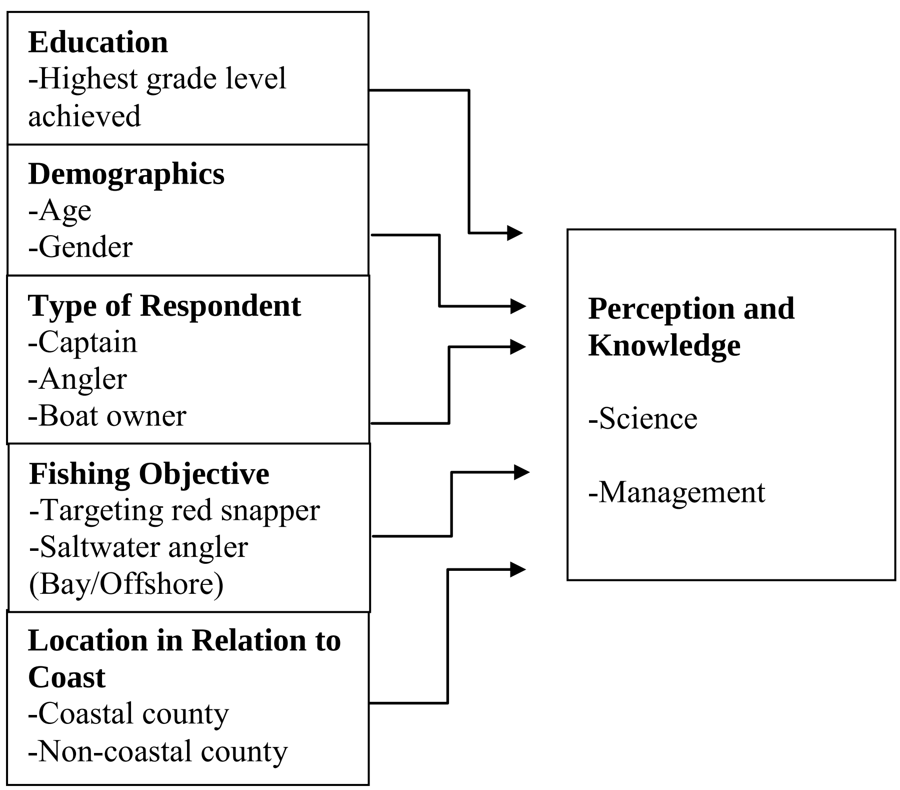

Figure 6 Conceptual research framework.

Dependent Variables

The dependent variables for this study were 1) the knowledge of science related to red snapper; 2) perceptions of science related to red snapper; 3) knowledge of red snapper management; and 4) management perceptions of the respondents. Red snapper age and life span were used to assess angler knowledge of science; state and federal bag limit regulations and seasons were used to assess angler knowledge of regulations. Questions about science and management, including specific management tools, regarding red snapper were used to assess angler attitudes on these topics (Appendix A). The open-ended questions provided additional insight to angler knowledge and perception of the science and management. While not included in the explanatory analyses, these measurements may be used by managers to supplement the results obtained within the dependent and independent variables.

Independent Variables

Age and level of education, along with gender, type of angler (captain or non-captain), boat ownership, species targeted, location in a coastal or non-coastal county, and amount spent offshore fishing before and after 2008, were the independent variables. The offshore expenditure variables were excluded from analysis due to ineffectiveness of the income scale in the instrument. Respondents noted that the initial measure, UNDER $10,000, was considerably higher than their annual offshore expenditure. This was determined to be an inaccurate independent variable and was thus removed from the data.

CHAPTER III

RESEARCH METHODS

Study Area

A series of on-site interviews were conducted at frequented access site locations for charter and head boats in Galveston (77550), Freeport (77541), and Port Aransas (78401), Texas (Figure 7).

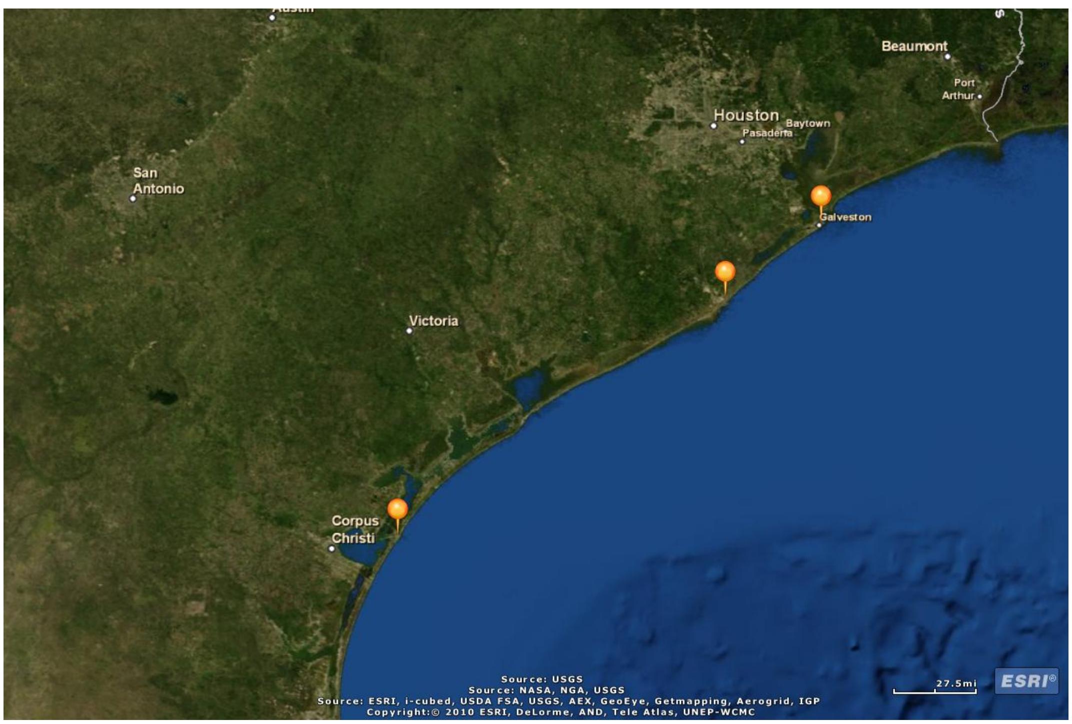

Figure 7 Location of sample sites in Galveston, Freeport, and Port Aransas, Texas. (ESRI ArcGIS Explorer, 2011).

These sampling locations along the Texas coast were chosen based on their proximity to the greatest concentration of charter and head boats in each region in order to reach a large number and variety of anglers for a sample population (Sutton et al., 1999). South Padre Island, Port Aransas, and Galveston-Freeport are the major activity centers for both charter boats and party (head) boats in Texas (Sutton et al., 1999). According to Ditton, Holland, and Gill, there were 97 party (head) boats in the five states adjacent to the U.S. GOM in 1992. At the time, of the 20 boats in Texas, the majority were located in the Galveston-Freeport area. Ten boats were operated between Port Aransas to Port Isabel, and ten were operated between Rockport and Port Arthur (Ditton, Holland, & Gill, 1992). Due to this historical concentration of head boats, and the reinforced activity of charter and head boats in 1999, Galveston, Freeport, and Port Aransas were chosen as sample sites. Location of charter and head boat businesses was obtained from personal communication with local agencies and anglers, charter boat and head boat lists maintained by NMFS, and web-based searches.

The state of Texas was selected to assess the impact of the United States regulations involving red snapper in the Gulf of Mexico due to the contrast of regulations that allowed for comparisons of knowledge of state versus federal regulations, and the number of charter and head boats that are operated in that state. Florida was not selected because of the two councils (Gulf of Mexico Fishery Management Council and South Atlantic Fishery Management Council) that regulate the waters surrounding Florida. Texas provided the largest potential participant size with a single set of federal and regulations covering red snapper.

The first site, Galveston, TX, is one of the most popular locations for tourists along the Texas coast. As of 2000 it had a population of 57,247 on 46.2 square miles of land, with a population density of 1240.0 people per square mile (U.S. Census Bureau, 2010). Galveston occupies 162.2 square miles of water, or 77.85% of the city (U.S. Census Bureau, 2010). In 2007, the city's economy received $808 million from 5.4 million tourists, visiting the location for beachfront hotels and condominiums, a downtown historic neighborhood, and a cruise terminal (Galveston Chamber of Commerce, 2009).

Freeport, Texas was the second site for interviews; the city lies within Brazoria County, occupying 11.9 square miles of land and 1.4 square miles of water (U.S. Census Bureau, 2010). A population of 12,708 resided in Freeport in the year 2000, with a density of 1,069.6 people per square mile (U.S. Census Bureau, 2010). Freeport is most well known for the Dow Chemical Company, a major employer for the area that helped to develop the Port of Freeport (Dow Chemical Company, 2011).

Port Aransas was the third site chosen, with a population of 3,371 in the year 2000. (U.S. Census Bureau, 2011). Port Aransas consists of 8.8 sq mi of land and 3.3 sq mi of water (U.S. Census Bureau, 2011). It is currently known for fishing, its beaches, and its resort beaches. The population during the summer can reach 60,000 or more; tourism is the largest contributor to Port Aransas' economy (City of Port Aransas, 2010). Fishing is a main part of the economy as well, as over 600 species of saltwater fish can be found in the waters near Port Aransas (City of Port Aransas, 2010).

Sampling and Questionnaire Design

Survey and interview questionnaire recommendations from Backstrom and Hursh (1963), Anderson and Ditton (2004), Ditton and Felder (1983), and Ditton et. al. (2000) provided essential references in the initial development of research and interview design. These authors are well-respected for their contributions to human dimensions studies and their research aided in many aspects of research design including interview costs; proper sample size and response rates; random sampling techniques; interview design, content, and conduct; and data analysis (Arlinghaus, Mehner, & Cowx, 2002; Cooke & Schramm, 2007; Prior & Beckley, 2007, Rea & Parker, 1997). While the surveys conducted by the Human Dimensions Lab at Texas A&M University reached a greater number of recreational anglers through 10,000 mail out surveys, only 3,124 usable surveys were returned with a response rate of 40 percent (Anderson & Ditton, 2004). The goal of the recreational red snapper angler interviews was to improve accuracy and achieve a better response rate through executing an alternative approach to human dimensions research. In person interviews were chosen because of the greater response rate seen in personal interviews (74.2% – 84%) as opposed to phone (59% – 72%) and mail (40% – 70.3%) surveys (Yu & Cooper, 1983; Anderson & Ditton, 2004; Siemiatycki, 1979; and Groves, 1979). Interviews were designed to target gaps in angler knowledge of state and federal regulations involving red snapper, as well as to determine what scientific information they have about the red snapper stock in the GOM such as implications of taking red snapper at a young age, the proper age of red snapper for reproduction, and average life span of a red snapper (see Appendix A).

Prior to the start of the interview process, procedural measures were undertaken for research with human subjects, and approval for the research was obtained from the Office of Research Compliance at Texas A&M University. Partnership with the Southeast Texas Sports Fishing Association (SETSFA) was undertaken for a pilot test to determine the effectiveness of different interview designs, to troubleshoot for weaknesses in a draft questionnaire, and to obtain an estimate of the population demographics that the interview would generate (Backstrom & Hursh, 1963; Fink & Kosecoff, 1998). Pilot test surveys were administered to 10-15 members of the sample group and anglers provided feedback about the survey. Results of pilot test surveys estimated the perception of current red snapper recreational anglers in Texas and their satisfaction with both state and federal management. Following the pilot test, a four-page questionnaire was finalized with improvements from the original draft.

Sampling using the final questionnaire was initiated at charter and head boat docks during the open season for red snapper in Texas, June 1st to July 24th during the year 2010. Interviews were consistently conducted during the time periods of 7:00 and 9:00 pm CST to eliminate bias of the type of anglers who fish at different times of the day. The exception to this method was during the trips to Freeport and Port Aransas, in which the limited duration of the trip necessitated sampling the entire day. Anglers were approached at the end of an offshore fishing trip and asked if they would participate in the research study. Due to time and funding constraints, clusters of anglers were interviewed at the three study site locations, in accordance with standard simple random cluster sampling methods (Fink & Kosecoff, 1998; Fowler, 2002). As many interviews as possible were conducted with the group of anglers in the cluster at each site. Due to the fact that the respondents were from a variety of locations and not necessarily from the surrounding neighborhood, all respondents were considered to be a part of one sample of the population of charter and head boat anglers along the central and lower Texas coast.

Due to the Deepwater Horizon Oil Spill in 2010 that caused a decline in offshore fishing activity, an emergency rule allowed for the re-opening of the red snapper season on Fridays, Saturdays, and Sundays from October 1st through November 22nd (NOAA, 2010b). Additional sampling was not conducted during this time due to the possibility that anglers fishing for red snapper in this typically off-season time would not be representative of those anglers that had been fishing during the summer open season for red snapper. Also, this was the first time the season had been closed, and then re-opened since the regulation changed in 2008, and anglers surveyed during the year 2010 may have had biased opinions from having additional time to fish.

An information sheet outlining the purpose and requirements of the study, emphasis of voluntary participation, and contact information for the researcher was provided to each subject at the start of the interview. Each interview took 5 -10 minutes per person. Respondents were kept anonymous and their questionnaires were given a unique identification number. Subjects were handed a visual aid for any questions that involved more than four possible answers to look at during the interview (Figure 8). The same researcher interviewed each angler to avoid errors between interviews, and to ensure the same interview approach was used with every subject.

10. How old does an average red snapper get in the wild? (show card)			
a	0-10	f	51-60
b	11-20	g	61-70
c	21-30	h	71-80
d	31-40	i	81-90
e	41-50	j	91-100

Figure 8 Example of visual aid provided to the respondent.

Several close-ended questions in the interview were developed using a Likert-type scale as utilized by Ditton et. al. (2000) and Leitz and Grubs (2008). Demographic questions regarding age, gender, education level, and zip code were included in the interview for comparison with U.S. Census data; this was also performed by Anderson and Ditton in their studies (2004). Additional demographic questions including amount of money spent annually on offshore fishing were included to assess the economic impact of the fishers. Studying the demographics of the charter and head boat anglers will provide resource management agencies with an understanding of any observed attitudinal or participant changes post-2008 red snapper regulations. Open-ended questions were conducted by asking the question and recording any comments made by the subject. These questions, regarding angler opinion on red snapper regulations and management, were provided to regulatory agencies as a record of angler comments for consideration in future management. This type of questioning has been used in previous demographic and attitudinal surveys conducted by Ditton for the same purpose (Anderson & Ditton, 2004).

Interviews were included in the study only if the angler had fished for red snapper in the past five years, before and after the implementation of the 2008 regulations. This was to ensure that anglers' opinions about red snapper management were only included if they had experienced the fishery before and after the changes in bag limit and season length. Minors ages 17 and younger were not interviewed in compliance with the IRB. Captain and non-captain interview results were initially analyzed together as a single sample population of charter and head boat anglers. Due to their anticipated knowledge of and experience with the fishery, results from captains interviews were also analyzed separately from non-captains, to examine differences in responses to variables related to knowledge and perception of science and management. A total of 152 interviews were completed, with 12 captain interviews, and 140 charter and head boat angler interviews.

Concept Measurement

Dependent Variables

Angler knowledge of state and federal management was measured by the respondent's knowledge of Texas state and U.S. federal bag limits and season for red snapper during the year 2010. Questions on awareness of state and federal regulations included "yes" or "no" answers for bag limit and season. Angler knowledge of the science behind the management was measured by questions on "the average age of a red snapper caught recreationally," and "how old an average red snapper gets in the wild" (Appendix A). For life span, or "how old an average red snapper gets in the wild," respondents were shown a scale from age 0 – age 100, in 10 year increments, and were asked to choose the increment that best represented what they believed was the average life span of a red snapper (Appendix A). A question about the largest red snapper the subject ever caught was included mid-way through the survey to improve subject morale. Angler perception of red snapper management and science was measured by a series of Likert-type questions that ranked the respondent's satisfaction with the science, with specific state and federal regulations, and with state and federal management overall (Appendix A). The anglers were asked to answer with a scale ranging from "Strongly Agree" to "Strongly Disagree" (Anderson & Ditton, 2004). The concept measurement table details each variable utilized in the questionnaire (Table 2). Open-ended questions were placed in the final section of the questionnaire, prior to demographic questions including age, gender, yearly offshore fishing expenditures, and zip code (Appendix A). The respondent was asked for additional comments regarding Texas state and U.S. federal management of red snapper.

Independent Variables

Interviews included close-ended questions identifying the angler type (non-captain/captain), species targeted, whether they owned a boat, and where they fished. Boat ownership and where the respondent fished were used as indicators of the anglers' interaction with and location in relation to the coast. This variable may have influenced both angler perception and knowledge. Gender was measured by the interviewer upon initiation of the interview. The respondent declared themselves as either captain or non-captain at the initiation of the interview; the label, “angler” was assigned to non-captains and “captain” was assigned for captains. Boat owner and species targeted were measured by a “yes” or “no” response when the respondent was asked whether they owned a boat or what type of species they were targeting from a list provided. This included mahi-mahi, king mackerel, red snapper, amberjack, and ling (cobia), and “other” (Appendix A). Area fished was measured by a “yes” or “no” response to a list of four types of water bodies: lakes, rivers, bays, and offshore. A “yes” denoted that the respondent fished this area frequently, and respondents were allowed to provide more than one response. These questions were included to maintain consistency with past surveys conducted for TPWD to allow for comparative studies in future research endeavors. Age was measured by asking the respondent their age in years. This variable may influence angler knowledge of red snapper life history, as the scientific knowledge of this species has advanced considerably in the past few decades. Education was measured by the respondent choosing a level from a list provided indicating their highest level of education received. This variable may affect the angler’s perception of science, as the respondent may have a greater understanding of the scientific study of red snapper and the strategies used in fisheries management, thus influencing their opinion on these topics.

Table 2 Concept measurement.

Variable Name	Abbreviation	Description	Mean	Std. Dev.	Min*	Max*
Type of Angler	FISH_TYPE	Type of respondent; either captain of a charter/head boat or an angler on a charter/head boat.	0.08	0.271	0	1
Targeting a Species	TARGET	Whether the respondent was targeting a specific species of fish on the day interviewed.	0.27	0.444	0	1
Species Targeted	MAHI MAHI	Whether the respondent was targeting Mahi Mahi.	0.93	0.264	0	1
Species Targeted	KG_MACK	Whether the respondent was targeting King Mackerel.	0.86	0.349	0	1
Species Targeted	REDSNAPP	Whether the respondent was targeting Red Snapper.	0.07	0.264	0	1
Species Targeted	AMBRJACK	Whether the respondent was targeting Amberjack.	0.95	0.212	0	1
Species Targeted	LING	Whether the respondent was targeting Ling.	0.91	0.292	0	1
Species Targeted	OTHER	Whether the respondent was targeting a species of fish not given.	0.95	0.212	0	1
Fished for RS in Past 5 Years	SNAPP_5	Had the respondent fished for red snapper (RS) in the past five years. This was a requirement in order to proceed with the interview.	0	0	0	1
Body of Water Primarily Fished	FISH_WHR	The type of body of water in which the respondent primarily fishes; either lakes, rivers, bays, or offshore, or a combination of any of these.	N/A	N/A	0	3

Table 2, continued.

Variable Name	Abbreviation	Description	Mean	Std. Dev.	Min*	Max*
Fished Lakes	LAKES	Whether the respondent primarily fishes lakes.	0.57	0.497	0	1
Fished Rivers	RIVERS	Whether the respondent primarily fishes rivers.	0.93	0.264	0	1
Fished Bays	BAYS	Whether the respondent primarily fishes bays.	0.78	0.419	0	1
Knowledge of State Bag Limit	BAGLM_ST	Respondent's knowledge of the Texas state bag limits for red snapper.	0.4	0.491	0	1
Knowledge of Federal Bag Limit	BAGLM_FD	Respondent's knowledge of the GOM federal bag limits for red snapper.	0.13	0.342	0	1
Knowledge of State Season	SEASN_ST	Respondent's knowledge of the Texas state season for red snapper.	0.44	0.498	0	1
Knowledge of Federal Season	SEASN_FD	Respondent's knowledge of the GOM federal season for red snapper.	0.21	0.407	0	1
Knowledge of RS Avg Age	AVG_AGE	Respondent's knowledge of average age of red snapper (RS) caught recreationally (in years).	5.17	9.784	1	100
Knowledge of RS Life Span	AVG_OLD	Respondent's knowledge of average life span of red snapper in the wild (in years).	2.45	1.703	0	10
Knowledge of RS Life Span	KNOW_LS	Respondent's knowledge of average life span of red snapper in the wild.	0.9013	0.299	0	1
Largest RS Caught	BIG_SNAP	Largest red snapper (RS) caught by respondent (in pounds).	19.2	10.432	4	67
Support for Science	SPRT_SCI	Support for scientific information being used to determine red snapper management.	0.22	0.414	0	1
Perception of Stock Improvement	STK_IMPV	Support for whether the GOM red snapper stock has improved since January of 2008.	0.27	0.448	0	1

Table 2, continued.

Variable Name	Abbreviation	Description	Mean	Std. Dev.	Min*	Max*
Overall Satisfaction	OV_SATIS	Overall satisfaction with the offshore fishing experience from Texas.	0.05	0.209	0	1
Satisfaction with State RS Regulations	ST_SATIS	Satisfaction with state red snapper regulations in Texas.	0.18	0.384	0	1
Satisfaction with Federal RS Regulations	FD_SATIS	Satisfaction with federal red snapper regulations in the Gulf of Mexico.	0.56	0.498	0	1
Support for Min Size Limit	MIN_SIZE	Measurement of support for minimum size limit as a management tool for red snapper.	0.13	0.335	0	1
Support for Max Size Limit	MAX_SIZE	Measurement of support for maximum size limit as a management tool for red snapper.	0.74	0.438	0	1
Support for Daily Bag Limit	DLY_BAG	Measurement of support for daily bag limit as a management tool for red snapper.	0.07	0.26	0	1
Support for Trophy Tag	TPHY_TAG	Measurement of support for a tag to retain a trophy fish as a management tool for red snapper.	0.39	0.489	0	1
Support for Annual Season	SEASN_CL	Measurement of support for an annual season closure as a management tool for red snapper.	0.25	0.437	0	1
Support for Closure of Fishery	FSHRY_CL	Measurement of support for closre of fishery as a management tool for red snapper.	0.75	0.437	0	1
Respondent Age	AGE	Age in years of respondents.	41.86	12.954	20	74
Respondent Gender	GENDER	Gender of respondents.	0.11	0.311	0	1

Table 2, continued.

Variable Name	Abbreviation	Description	Mean	Std. Dev.	Min*	Max*
Offshore Fishing Spending Before 2008	SPEND_BE	Amount spent by respondent (in U.S.D.) annually on offshore fishing before 2008.	1.28	1.053	1	11
Offshore Fishing Spending After 2008	SPEND_AF	Amount spent by respondent (in U.S.D.) annually on offshore fishing after 2008.	1.31	1.127	1	11
Respondent Grade Level	GRADE	Education of respondents by highest grade level achieved.	4.34	1.731	1	7
Respondent Zip Code	ZIP	Location of respondent's residence by 5-digit zip code.	76983	2168.8	71106	92058
Residence Inside/Outside Coastal County	COASTAL	Location of respondent's residence by coastal or non-coastal county.	0.347	0.478	711	920

*For variables with a value of "0" for Min and "1" for Max: "0" = "YES/SUPPORT/AGREE/ MALE /NON-CAPTAIN", "1" = "NO/OPPOSE/DISAGREE/FEMALE/CAPTAIN"

Data Analysis

The two phases of data analysis used for this study were descriptive and explanatory in nature. The descriptive analysis summarizes the characteristics of the respondents and patterns in the results. Explanatory analysis included correlations,, cross-tabulations and t-tests conducted with SPSS statistical software Version 17.0 (SPSS Inc., 2010). Despite the small sample size of captains, statistical tests were conducted on this group due to the nature of the sample in relation to the population being studied. Along the Upper Texas Coast, there were an estimated 150 charter boat captains and 14 head boat captains, for a total estimated population of 164 captains in

1999 (Sutton, et al., 1999). As 12 captains were surveyed in this study, an arguably representative sample has been taken of this population. An estimated 1,147,000 saltwater anglers participated in fishing in Texas in the year 2006 (USFWS, 2006). Of these, 267,000 anglers were fishing for “other saltwater fish” that may have included red snapper (USFWS, 2006). While this is a large population, the number of anglers from this population that were targeting red snapper on charter and head boats along the Upper Texas Coast is the specific target population for this study, and would have consisted of less participants. Thus, the sample size of 150 non-captain anglers is also a representative sample of the population of recreational red snapper charter and head boat anglers along the Upper Texas Coast. Statistical testing of these sample populations was conducted, with supplemental descriptive analyses to support the statistical findings. When comparing the means of the two groups in an independent samples t-test, unequal variances was assumed to account for the differences in sample size of each group. This assumption allows for a less rigorous test that incorporates the number of observations and variances of the two independent samples. This test, in conjunction with supplemental descriptive analyses enables conclusions to be drawn between these two groups despite their respective sample sizes.

Pearson’s product-moment correlations were used to study whether a relationship was present between the measurements of knowledge and perception. This specific correlation was used due to the assumptions and limitations that made it a more rigorous statistical test. The correlation was based on the individuals being sampled at random from a population of recreational red snapper charter and head boat anglers along the

Upper Texas Coast. (Townend, 2002). One-sample t-tests were used to test for differences between the population mean and the expected value of red snapper life span, and an independent samples t-test was used to test for differences between the captain and non-captain groups. Cross-tabulations were also conducted between independent and dependent variables to examine additional trends not identified by the statistical tests. A correlation matrix was developed for all variables (Appendix F). Captain and non-captain interviews were analyzed both as collective and separate data sets. All data sets were analyzed using methods similar to those incorporated in Ditton's surveys (Ditton & Felder, 1983; Donaldson, Osborn, Faulkner, Ditton, & Matlock, 1987; Ditton, Anderson, Bohnsack, & Sutton, 2000; Anderson & Ditton, 2004). Open-ended questions were grouped by similar content and evaluated for similarities between interviews on these topics. Results with exact or nearly exact comments were compiled into negative response and positive response categories.

Collaboration with TPWD and Sea Grant Extension Agents ensured that the results of the interviews would meet the needs of these agencies for implementation in fisheries management and outreach to anglers. Results will be presented to both regulatory and non-regulatory agencies with summary angler demographics and evaluation of current fisheries management statistics. Results will also identify the extent to which anglers targeting red snapper understand regulations and science. This aspect is included in the survey to measure the need for clarification of federal and state regulations for anglers, information specifically needed by TPWD (T. Wiley, personal communication, January 19, 2010).

CHAPTER IV

DATA ANALYSIS

Descriptive Analysis

A total of 152 interviews of red snapper anglers at charter and head boat docks were conducted along the Texas coast during the sample period. Captains comprised 7.9 percent of the sample, while 92.1 percent of the sample population was non-captains (Table 3). While the sample size for captains, n=12, was small, there are only about 157 known captains in the region sampled (Sutton et al., 1999). For non-captains, n=140, there are an estimated 1,099,000 residents with a saltwater license in the state of Texas (USFWS, 2006). Thus, variables for these groups will be compared under the assumption that 12 captain respondents is a sufficient sample size for that population. Male anglers comprised 89.3 percent of the sample, and females comprised 10.7 percent (Appendix C).

Table 3 Frequency and percent of charter and head boat anglers and captains who were interviewed.

Type of Angler

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NON-CAPTAIN	140	92.1	92.1	92.1
	CAPTAIN	12	7.9	7.9	100.0
	Total	152	100.0	100.0	

For all respondents, the majority had some college education or more, with 13.7 percent having some college, 10.27 percent having a two-year or technical degree, 34.93 percent having a four-year college degree, and 18.49 percent having a graduate degree (Figure 9).

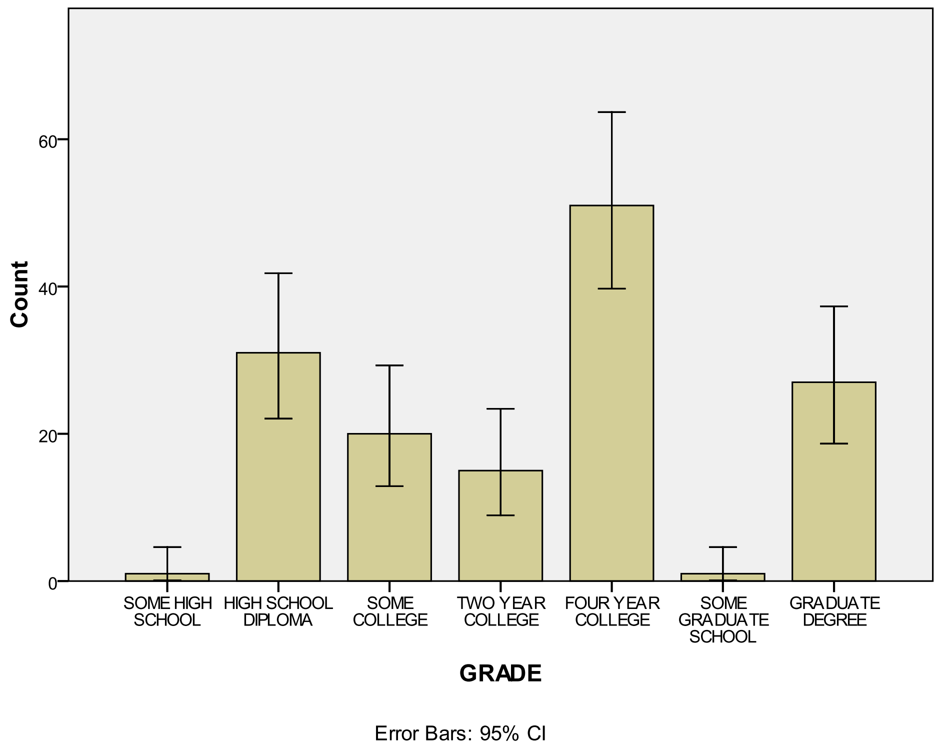

Figure 9 Angler distribution by level of education.

For all respondents, 34.25 percent were non-captains with a four-year college degree. For respondents that were also captains, the majority had either a high school diploma (2.74%), or some college (2.05%) (Table 4).

Table 4 Level of education by gender and type of angler.

HIGHEST GRADE LEVEL	Some High School	High School Diploma	Some College	Two-Year or Tech	Four-Year College	Some Grad School	Graduate Degree
MALE	0.68	19.18	13.70	8.22	31.51	0.68	15.07
FEMALE	0.00	2.05	0.00	2.05	3.42	0.00	3.42
CAPTAINS	0.00	2.74	2.05	0.68	0.68	0.00	0.00
NON-CAPTAINS	0.68	18.49	11.64	9.59	34.25	0.68	18.49
TOTAL	**0.68**	**21.23**	**13.70**	**10.27**	**34.93**	**0.68**	**18.49**

The largest percent of anglers (31.7%) were ages 40-49, with the smallest proportion of anglers ages 60 and older (11%) (Figure 10). For males, 31 percent were 40-49 years old, and 37.5 percent of females were 40-49 years old. A greater proportion of females (18.75%) were over 60 years old (Appendix C).

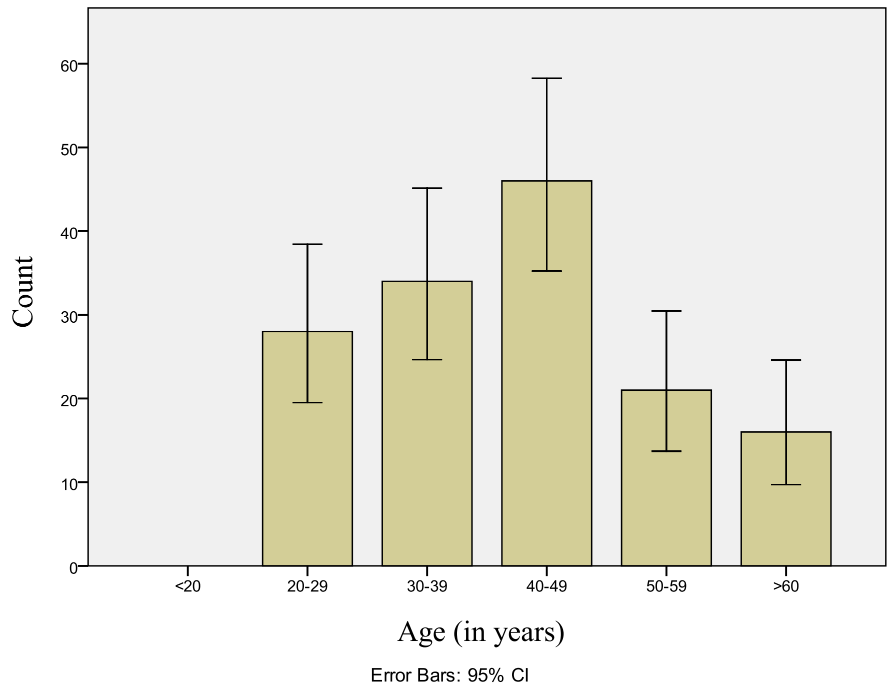

Figure 10 Distribution of respondent age by 10-year increments.

Anglers were allowed to provide more than one answer for body of water primarily fished, and species of fish targeted. For all respondents, most fish offshore (57.1%), or in lakes (42.9%), followed by bays (22.4%), and rivers (7.5%) (Figure 11, Appendix C). The distribution was nearly the same for anglers who own a boat (49.7%), and those who do not (50.3%) (Table 5).

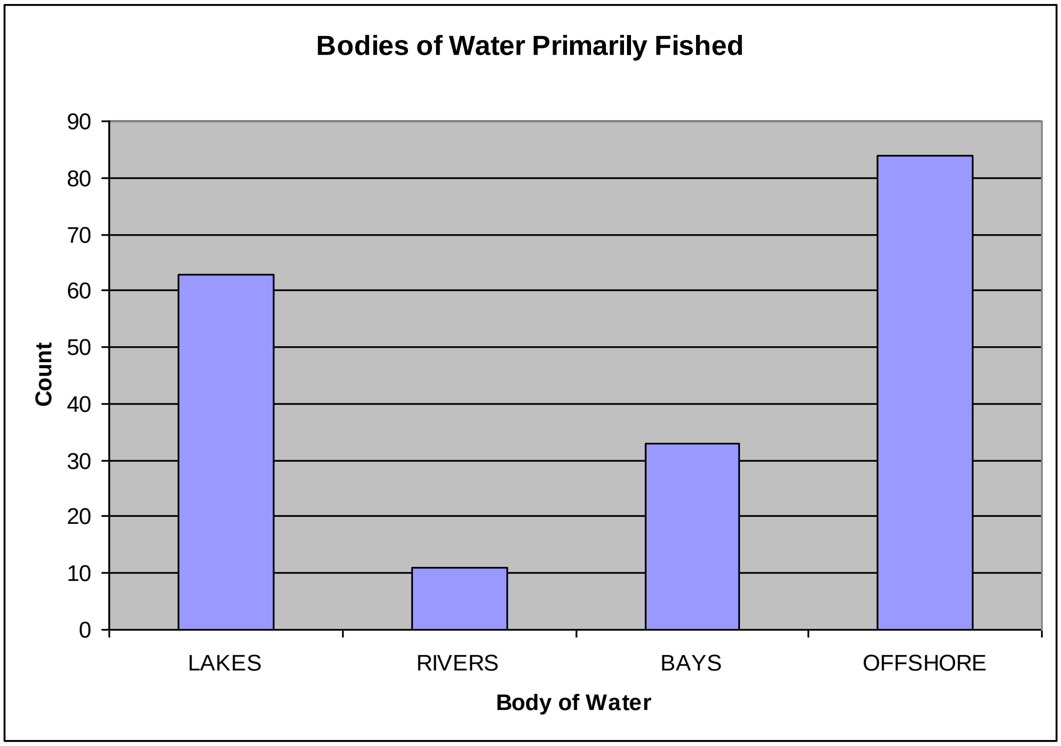

Figure 11 Percent of bodies of water primarily fished by respondents.

Table 5 Frequency and percent of anglers who own a boat.

ANGLER'S RESPONSE TO: DO YOU OWN A BOAT?

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	73	48.0	49.7	49.7
	NO	74	48.7	50.3	100.0
	Total	147	96.7	100.0	
Missing	System	5	3.3		
Total		152	100.0		

For all respondents, most were targeting red snapper (92.5%), followed by king mackerel (14%), ling (9.3%), mahi-mahi (7.5%), and amberjack (4.7%) (Figure 12, Appendix C). Some respondents (4.7%) were targeting species other than those previously mentioned.

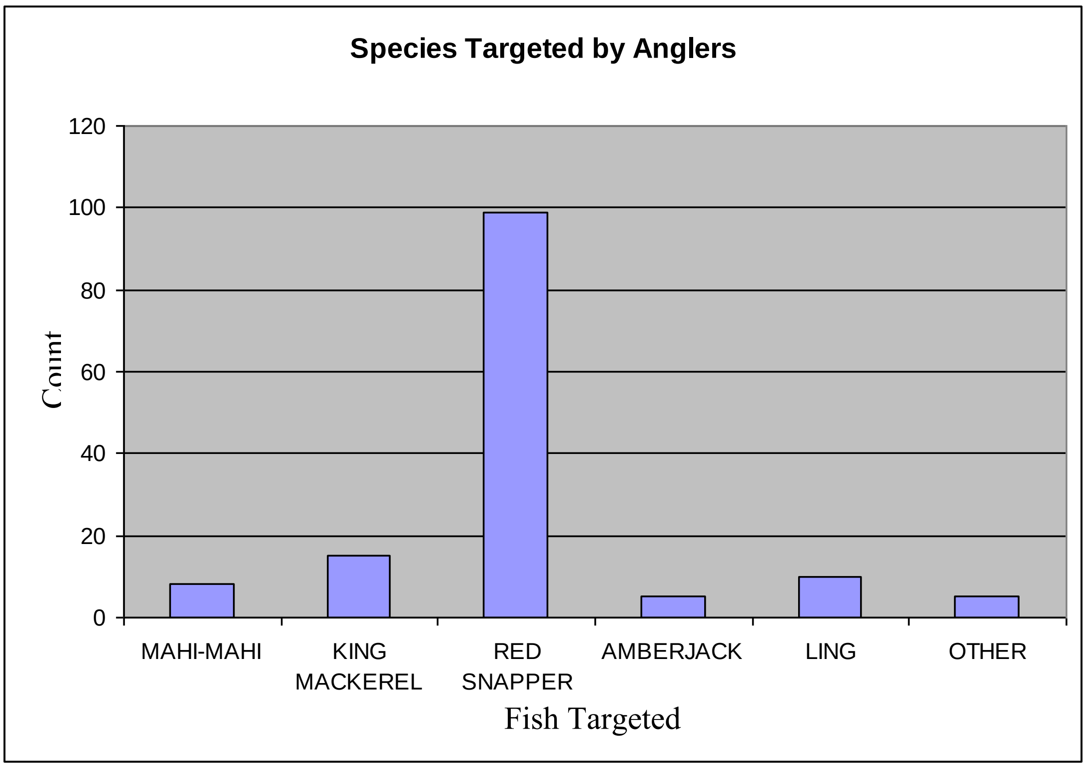

Figure 12 Distribution of species targeted, if any, by respondents.

For all respondents, 60.1 percent knew the 2010 state bag limit for red snapper, or 4 per day (Table 6). There was no season for red snapper in state waters; 55.7 percent of all anglers knew the lack of season that year (Table 7). *Hypothesis 1*, greater than 75 percent of respondents will not know the state regulations for red snapper, is not supported by this data. Respondents have a greater than expected knowledge of state regulations. However, it should be noted that nearly 40 percent of all anglers interviewed did not know the state bag limit and season.

Table 6 Frequency and percent of anglers that know the state bag limit.

RESPONDENT'S KNOWLEDGE OF STATE BAG LIMIT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	89	58.6	60.1	60.1
	NO	59	38.8	39.9	100.0
	Total	148	97.4	100.0	
Missing	System	4	2.6		
Total		152	100.0		

Table 7 Frequency and percent of anglers that know the state season.

RESPONDENT'S KNOWLEDGE OF STATE SEASON

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	83	54.6	55.7	55.7
	NO	66	43.4	44.3	100.0
	Total	149	98.0	100.0	
Missing	System	3	2.0		
Total		152	100.0		

In 2010, the federal bag limit for red snapper was 4 fish per day; 86.6 percent of anglers knew this (Table 8). Also, 79.2 percent of anglers knew that the season for red snapper in the year 2010 was from June 1st – July 24th (Table 9).

Table 8 Frequency and percent of anglers that know the federal bag limit.

RESPONDENT KNOWLEDGE OF FEDERAL BAG LIMIT

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	129	84.9	86.6	86.6
	NO	20	13.2	13.4	100.0
	Total	149	98.0	100.0	
Missing	System	3	2.0		
Total		152	100.0		

Table 9 Frequency and percent of anglers that know the federal season.

RESPONDENT KNOWLEDGE OF FEDERAL SEASON

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	118	77.6	79.2	79.2
	NO	31	20.4	20.8	100.0
	Total	149	98.0	100.0	
Missing	System	3	2.0		
Total		152	100.0		

Only 109 of the 152 anglers interviewed responded to the question measuring their knowledge of the average age of a red snapper caught recreationally. Responses ranged from age 1 (5.5%) to age 100 (0.9%) (Table 10). The most frequent responses were age 2 (22%), age 3 (22%), and age 5 (21.1%). These responses are fairly accurate, as studies have shown that red snapper landed range from age 2 to age 6 (Allman & Fitzhugh, 2007). Also, 85.3 percent of responses are represented by answers age 1 through age 5 for average age of red snapper, showing that the majority of anglers interviewed know the average age of a recreationally caught red snapper.

Table 10 Distribution of angler responses for average age of red snapper caught recreationally.

RESPONDENT KNOWLEDGE OF AVERAGE AGE OF RED SNAPPER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.0	6	3.9	5.5	5.5
	1.5	1	.7	.9	6.4
	2.0	24	15.8	22.0	28.4
	2.5	1	.7	.9	29.4
	3.0	24	15.8	22.0	51.4
	3.5	2	1.3	1.8	53.2
	4.0	12	7.9	11.0	64.2
	5.0	23	15.1	21.1	85.3
	6.0	2	1.3	1.8	87.2
	7.0	2	1.3	1.8	89.0
	8.0	2	1.3	1.8	90.8
	8.5	1	.7	.9	91.7
	10.0	1	.7	.9	92.7
	11.0	3	2.0	2.8	95.4
	15.0	3	2.0	2.8	98.2
	25.0	1	.7	.9	99.1
	100.0	1	.7	.9	100.0
	Total	109	71.7	100.0	
Missing	System	43	28.3		
Total		152	100.0		

The average red snapper life span is about 40 to 50 years old, with the oldest red snapper being aged at about 53 years old (Wilson & Nieland, 2001). For this study, answers ranging from age 40 to age 60 were considered a "knowledgeable" response. Most of the anglers believe red snapper life span to be from 0-10 years (35.5%) or 11-20 years (29.8%) (Figure 13, Appendix C). Only 9.9 percent of anglers knew red snapper life span, while 90.1 percent did not. *Hypothesis 2*, that there is no significant relationship between the respondents' knowledge of red snapper life span and the actual population mean of 50 years old, is supported by this data. The majority of charter and head boat anglers interviewed do not know the average life span of red snapper.

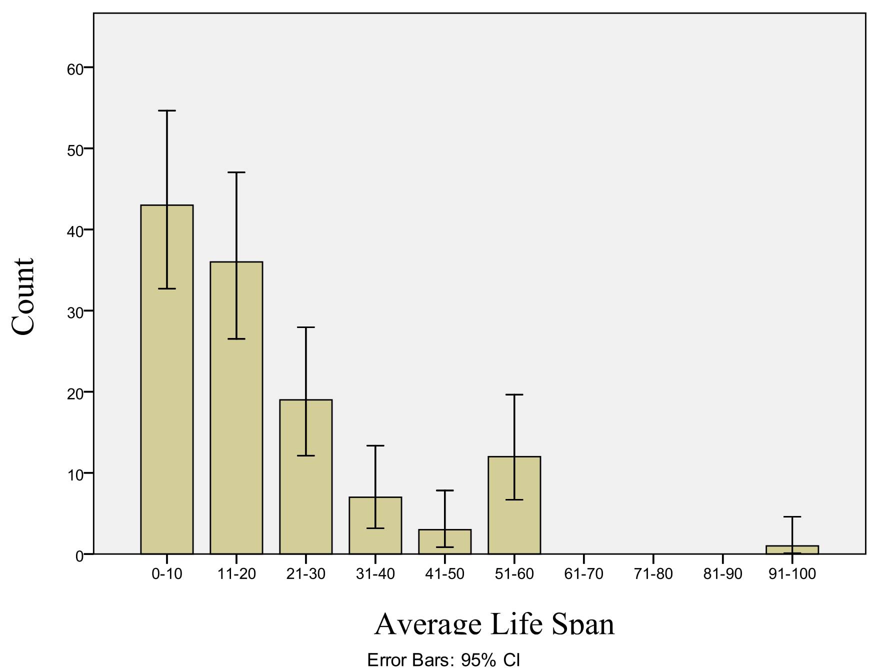

Figure 13 Angler knowledge of red snapper life span.

Anglers were asked to recall the biggest red snapper they ever caught, in pounds. Responses ranged from 4 pounds to 67 pounds, with a mean of 19.2 pounds (Figure 14, Appendix C).

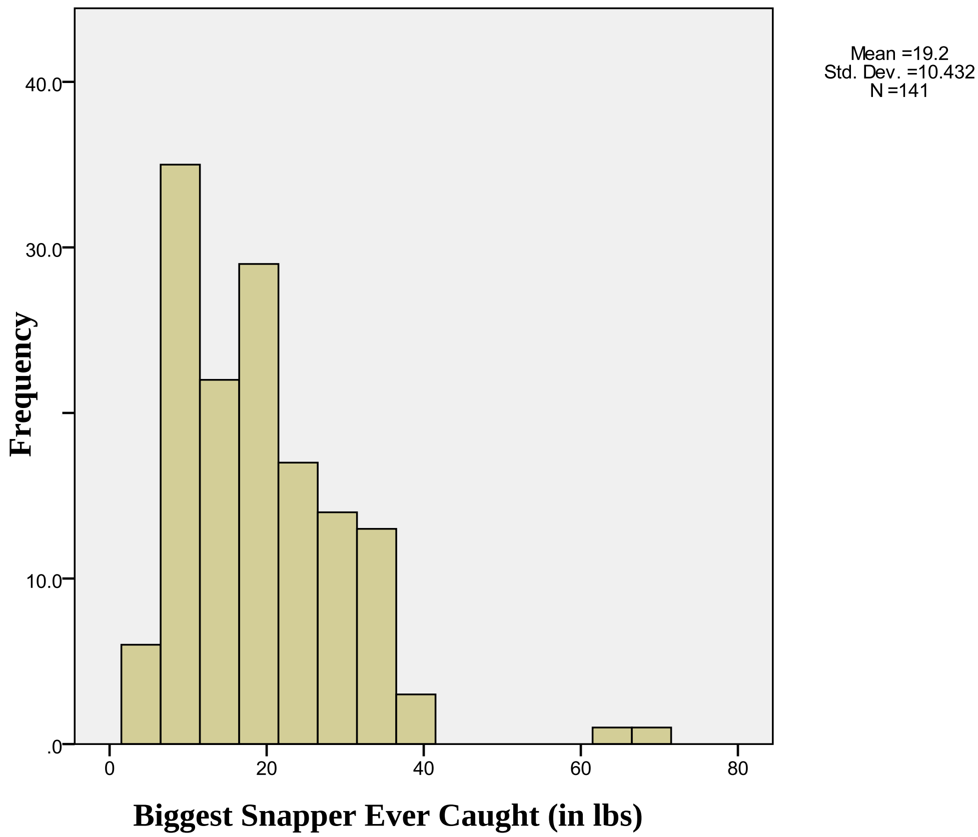

Figure 14 Frequency of responses to "What size was the biggest red snapper you ever caught?" in pounds.

Regarding science behind the management of red snapper, 72.5 percent of anglers agreed, and 20 percent disagreed with the current science (Table 11). When asked whether they believed that the stock had improved since the 2008 regulation changes (2-bag limit and 5 MP TAC), 63.4 percent agreed and 23.8 percent disagreed. For 66.7 percent of anglers, the 2-bag limit did not affect how often they went fishing. While 78.2 percent of anglers were satisfied with the 2010 state recreational red snapper regulations, only 40.7 percent were satisfied with the federal regulations that same year.

When asked about their support for specific management tools that may or may not have been implemented at the time, 85.4 percent of anglers said they supported the minimum size limit as a management tool for red snapper (Table 11). About 70 percent of anglers opposed the maximum size limit, and 89.5 percent stated that they support the daily bag limit as a tool for managing the fishery; 57.5 percent of anglers asserted that they support the trophy tag as a management tool, possibly due to the success of the red drum, or redfish, fishery (Campbell, McEachron, & Choucair 1997). Despite the mixed perception of federal regulations overall (51.7% disagree), 68.8 percent of anglers stated that they support having an annual season closure for the management of red snapper; on the other hand, 66.4 percent opposed a full closure of the fishery, such as a moratorium.

Table 11 Respondent perceptions of recreational state and federal science and management for red snapper.

STATEMENT OF FEELINGS	AGREE[1]	UNSURE	DISAGREE[2]	N
Support scientific information being used to determine GOM red snapper stock management	72.50	7.50	20.00	120
GOM red snapper stock has improved since the 2008 2-bag limit and the 5 million lb TAC	63.37	12.87	23.76	101
Satisfied with the offshore saltwater fishing experience from Texas	86.90	8.97	4.14	145
Federal 2-bag limit change has had an effect on how often I've gone offshore fishing since 2008	29.71	3.62	66.67	138
Satisfied with the current Texas STATE red snapper regulations	78.17	4.93	16.90	142
Satisfied with the current Texas FEDERAL red snapper regulations	40.69	7.59	51.72	145
MANAGEMENT TOOL	**SUPPORT[1]**	**UNSURE**	**OPPOSE[2]**	**N**
Minimum size limit	85.42	2.08	12.50	144
Maximum size limit	24.09	5.84	70.07	137
Daily bag limit	89.51	3.50	6.99	143
Trophy tag	57.46	5.97	36.57	134
Annual season closure	68.79	7.80	23.40	141
Closure of fishery, resume fishery when it is "recovered"	22.63	10.95	66.42	137

[1] Includes individuals who reported they "Strongly Agree/Support" or "Somewhat Agree/Support"

[2] Includes individuals who reported they "Strongly Disagree/Oppose" or "Somewhat Disagree/Oppose"

Subjects of this research were from a total of 30 cities, and 6 states (Figure 15, Appendix D). Non-resident anglers were from Oklahoma, Louisiana, New Mexico, Arizona, and California. The majority of anglers were from North Houston or Houston (57.33%), followed by North Texas or Fort Worth (10%).

Figure 15 Distribution of respondents by U.S. Zip Code. (ESRI ArcMap 10.0, 2010).

When categorized by 3-digit zip code, 65.3 percent of anglers resided in a coastal county in Texas, 25.3 percent resided in Texas but not in a coastal county, and 9.3 percent resided out-of-state (Table 12).

Table 12 Distribution of respondents by location in a coastal county, non-coastal county, or out of state.

ZIP CODE	N	%
Coastal counties[1]	98	65.33
Non-coastal counties	38	25.33
Outside of Texas	14	9.33
Total	150	100

[1] Includes the Texas coastal counties as defined by NOAA (2011).

In the open ended questions, 110 anglers made a total of 249 comments in relation to selected topics on red snapper science and management. These comments were grouped by topic and measured by their positive or negative connotation. Notable topics included anglers' opinions on state and federal management and regulations, science, conflicting state and federal regulations, catch-and-release, venting, the status of the stock, conserving the fish, the commercial and shrimp fisheries, and other management recommendations (Table 13).

Table 13 Distribution of selected angler responses to open ended questions.

Response	Total		Positive Response		Negative Response	
	N	%	N	%	N	%
Related to state management	20	8.03	17	85.00	3	15.00
Related to federal management	14	5.62	7	50.00	7	50.00
Related to federal bag limit	37	14.9	3	8.11	34	91.89
Related to federal season	19	7.63	2	10.53	17	89.47
Related to minimum size limit	19	7.63	5	26.32	14	73.68
Related to science behind management	8	3.21	0	0.00	8	100.00
Related to managers utilizing angler input	8	3.21	8	100.00	0	0.00
Related to having same state and federal regulations	8	3.21	8	100.00	0	0.00
Related to dividing GOM into regions for management	5	2.01	5	100.00	0	0.00
Related to catch and release	14	5.62	4	28.57	10	71.43
Related to venting	10	4.02	5	50.00	5	50.00
Related to more education needed on venting	7	2.81	7	100.00	0	0.00
Related to state fishing license	5	2.01	0	0.00	5	100.00
Related to year-round season	6	2.41	6	100.00	0	0.00
Related to weekend season	2	0.8	2	100.00	0	0.00
Related to "stock is healthy/recovered"	17	6.83	15	88.24	2	11.76
Related to "keep what you catch" or "keep 1st…"	17	6.83	16	94.12	1	5.88
Related to conserving the fish	16	6.43	16	100.00	0	0.00
Related to commercial & shrimp fisheries	17	6.83	1	5.88	16	94.12
Total	249	100				

***Each angler could speak to state or federal management, or any other comments they wished to add. Comments were made by 110 anglers.**

Twenty anglers spoke about state management; 85 percent of the twenty anglers had a positive comment, such as "state does a fairly good job" the other 15 percent had negative comments, such as "everything accessible in state waters is overfished." Regarding federal management, 14 anglers expressed their opinion; 50 percent of these had negative claims, such as "grossly mismanaged," while the other 50 percent claimed that the federal managers are "doing good regulating, letting fish catch up." Thirty-seven anglers commented on the federal bag limit, 91.9 percent of whom had a negative opinion about the current limit. The majority of the comments included the word "increase;" those comments that were positive included comments such as, "limit has helped."

Eight anglers commented on the science behind the management; those who had negative opinions such as "need to count rigs not just reefs on data collection," were part of the 100% negative responses in this category. Alternatively, eight anglers spoke positively about managers utilizing angler input. They stated, "talk to fishermen more to get science," and that managers have "never taken an active survey of recreational fishermen on red snapper." Regarding having the same state and federal regulations, 100 percent of respondents (n=8) spoke positively; making statements such as, "the state should comply with federal." Seventeen anglers commented relating to stock health, 88.2 percent believe the "fishery has improved," or "gotten bigger and bigger," while 11.7% were weary of the future of the fishery, stating "technology is ahead of red snapper – fish don't stand a chance," and "it is a limited resource." Seventeen anglers also commented on a phrase, "keep first 2/4/6;" 94.1 percent of the 17 comments were positive, such as "keep 1st… you're killing more fish than you're saving." The one negative comment stated, "if you keep first 4, certain people will go and wipe out a spot." Sixteen anglers commented positively related to conserving the fish, such as "need to conserve," and "teach fishers to be good stewards." Finally, seventeen anglers commented on either the commercial red snapper or shrimp fishery, or both. Negative comments such as "commercial and shrimp boats are the problem," and "commercial fishers are overtaking the quota," were made by 94.1 percent of the seventeen responders, and one positive response noted, "many people think that catch shares give rights to someone; before IFQ, there were 130 licensed red snapper commercial fishers in GOM, very limited access fishery. Used to throw out thousands of fish, now throw out zero with IFQ."

Explanatory Analysis

Further measure of angler knowledge and perception of red snapper science and management was accomplished through explanatory analysis. Due to the inability to conduct correlations between the scaled variables (“Strongly Agree” – “Strongly Disagree”) and the nominal variables (“Yes/No”), the Likert-scale responses were transformed into nominal variables of “Agree” and “Disagree”, or “Support” and “Oppose.” “Strongly Agree” and “Strongly Disagree” were the most frequent responses, and histograms of all scale variables were analyzed for scale distribution to ensure confidence in the data would be maintained (Figure 16).

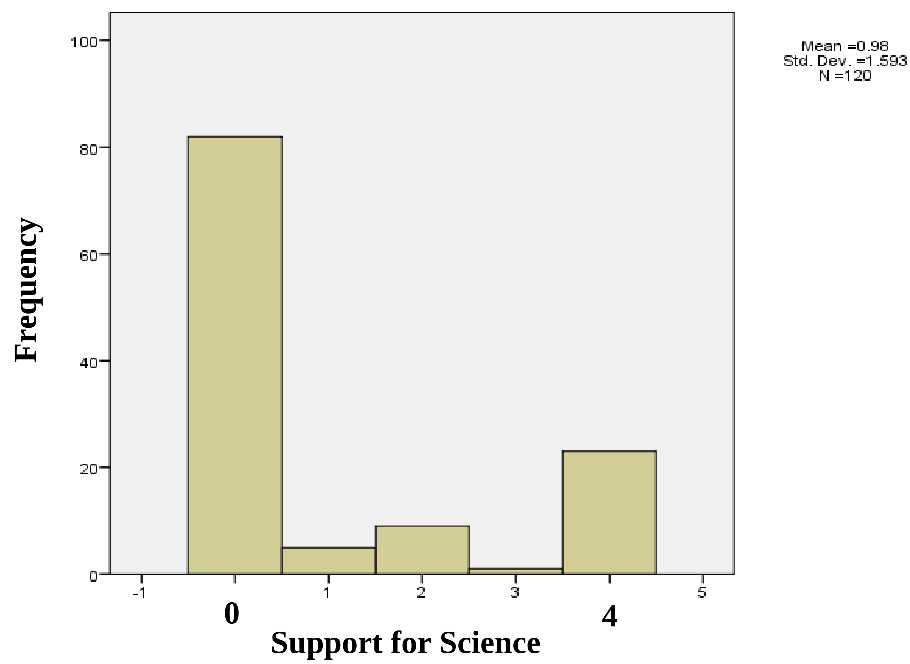

Figure 16 Histogram example of Likert-scale distribution. Respondents’ perception of the science behind the management from “Strongly Agree” (“0”) to “Strongly Disagree” (“4”).

Of the 12 ranked variables, only two had more than 10 percent of responses labeled as “Unsure” (Table 11). To further compare these variables with the “Yes/No” variables, the “Unsure” responses were discarded for explanatory analysis. While the integrity of the data must be considered, this re-coding allowed for comparisons between variables that otherwise would not have been possible.

Selected indicators of scientific and regulatory knowledge and perception were chosen and examined for relationships with independent variables. Variables chosen that were relevant to the objectives included knowledge and perception of state and federal regulations, knowledge and perception of science, residence near the coast, fishing objective (saltwater angler – bay or offshore), and type of respondent (captain/non-captain).For the Pearson’s product-moment correlation analyses, coefficient values from $\pm$ 0.0 to $\pm$ 0.6 signified little or no relationship between the variables; values from $\pm$ 0.6 to $\pm$ 0.9 signified a weak relationship; and values from $\pm$ 0.9 to $\pm$ 1.0 indicated that a strong relationship was present between the variables (Townend, 2002). A value of $p \leq 0.05$ was used to indicate statistical significance for all analyses.

To test respondent knowledge of red snapper life span, a one-sample t-test was used to compare the mean knowledge of life span from the sample population to the actual life span (Townend 2002). As the variable, average life span, was a scale variable (a=0-10, b=11-20, etc.), the test value of 5 and the test value of 6 were used to test the scale values that represented age 41-60 for red snapper (see Appendix A, Question 10). For the one-sample t-test with a test value of 5, there was a significant ($p<0.000$) difference between the sample mean, and the actual mean (Table 14).

Table 14 One-sample t-test comparing the sample mean to the actual mean value of 5, representing red snapper life span of 41-50 years old.

One-Sample Test for Red Snapper Life Span of 41-51 years

	Test Value = 5					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
AVG_OLD	-16.442	120	.000	-2.545	-2.85	-2.24

For the one-sample t-test with a test value of 6, there was a significant ($p<0.000$) difference between the sample mean, and the actual mean (Table 15).

Table 15 One-sample t-test comparing the sample mean to the actual mean value of 6, representing red snapper life span of 51-60 years old.

One-Sample Test for Red Snapper Life Span of 51-60 years

	Test Value = 6					
	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
AVG_OLD	-22.902	120	.000	-3.545	-3.85	-3.24

For both tests, the sample mean, 2.45, was significantly lower than 5 and 6, both measures for actual red snapper life span (Table 16). The anglers had a significantly different knowledge of red snapper life span than what is in the scientific literature.

Thus, *Hypothesis 2*, there is no significant difference between the respondents' knowledge of red snapper life span and the actual population mean of 50 years old, is not supported.

Table 16 One-sample t-test statistics regarding knowledge of red snapper life span (red snapper aged 41-50).

One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Knowledge of Red Snapper Life Span	121	2.45	1.703	.155

To examine the relationship between respondents who resided in a coastal county and knowledge of red snapper life span, a Pearson's correlation was conducted, along with a cross-tabulation. There was a significant ($p<0.05$), negative, but very weak correlation between residing in a coastal county and knowledge of red snapper life span (Table 17). Thus there is insufficient evidence to conclude that there is a correlation between location near the coast and knowledge about red snapper.

Table 17 Pearson's product-moment correlation for examining the relationship between residence in a coastal county and knowledge of science related to red snapper management.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.224	.084	-2.798	.006[c]
Ordinal by Ordinal	Spearman Correlation	-.224	.084	-2.798	.006[c]
N of Valid Cases		150			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

The cross-tabulations for coastal county and knowledge of life span show ed19.2 percent of non-coastal county residents as knowing the average life span of red snapper, as opposed to 5.1 percent of coastal county residents that know red snapper live to be about 50 (Appendix E). Overall, however, only 15 respondents of 150 knew the average life span of red snapper. Therefore, this analysis does not provide enough evidence to support *Hypothesis 3*, that there is no significant relationship between respondents who reside near the coast and knowledge of red snapper life span.

To examine the relationship between respondents who are saltwater anglers (bay and offshore fishers) and knowledge of management (state and federal bag limit/season), a Pearson's correlation was conducted, along with a a cross-tabulation for all six variables. There was a significant ($p<0.05$), positive, but very weak correlation between frequently fishing offshore and knowledge of federal bag limit (Table 18).

Table 18 Pearson's product-moment correlation for examining the relationship between fishing offshore and knowledge of federal bag limit.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.256	.077	3.181	.002[c]
Ordinal by Ordinal	Spearman Correlation	.256	.077	3.181	.002[c]
N of Valid Cases		146			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Further analysis with cross-tabulations shows that 94 percent of anglers who frequently fish offshore know the federal bag limit, as opposed to 76.2 percent for non-offshore anglers that know federal bag limit (Appendix E.). There seems to be a pattern, but not a significant relationship, between the two variables. Thus, there is insufficient evidence to conclude that there is a correlation between frequently fishing offshore and knowledge of federal regulations.

There was a significant ($p<0.05$), positive, but very weak correlation between frequently fishing offshore and knowledge of federal season (Table 19).

Table 19 Pearson's product-moment correlation for examining the relationship between fishing offshore and knowledge of federal season.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.224	.081	2.758	.007[c]
Ordinal by Ordinal	Spearman Correlation	.224	.081	2.758	.007[c]
N of Valid Cases		146			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Cross-tabulations shows that 86.7 percent of anglers who frequently fish offshore know the federal season, as opposed to 68.3 percent for non-offshore anglers that know federal season (Appendix E.). There seems to be a pattern, but not a significant relationship, between the two variables. Thus, there is insufficient evidence to conclude that there is a correlation between frequently fishing offshore and knowledge of federal season. Part of *Hypothesis4*, there is no significant relationship between respondents who primarily fish in saltwater bodies (offshore) and knowledge of federal regulations for red snapper, is thus supported by these analyses.

There was not a significant ($p>0.05$), correlation between frequently fishing bays and knowledge of federal season (Table 20).

Table 20 Pearson's product-moment correlation for examining the relationship between fishing in bays and knowledge of federal season.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.154	.065	1.866	.064[c]
Ordinal by Ordinal	Spearman Correlation	.154	.065	1.866	.064[c]
N of Valid Cases		146			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Cross-tabulations shows that 90.6 percent of anglers who frequently fish bays know the federal season, as opposed to 75.4 percent for non-bay anglers that know federal season (Appendix E.). Therefore, there is no significant relationship between the two variables. Thus, there is insufficient evidence to conclude that there is a correlation between frequently fishing bays and knowledge of federal season.

There was a significant ($p<0.05$), positive, very weak correlation between frequently fishing bays and knowledge of federal bag limit (Table 21).

Table 21 Pearson’s product-moment correlation for examining the relationship between fishing in bays and knowledge of federal bag limit.

Symmetric Measures

		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	.163	.051	1.982	.049[c]
Ordinal by Ordinal	Spearman Correlation	.163	.051	1.982	.049[c]
N of Valid Cases		146			

a. Not assuming the null hypothesis.

b. Using the asymptotic standard error assuming the null hypothesis.

c. Based on normal approximation.

Cross-tabulations shows that 96.9 percent of anglers who frequently fish bays know the federal bag limit, as opposed to 83.3 percent for non-bay anglers that know federal bag limit (Appendix E.). While there is evidence that an association between the variables exists, there is no strong, significant correlation between the two variables. Combined with the previous conclusion that there is no correlation between fishing bays and knowing federal season, there is insufficient evidence to conclude that there is a correlation between frequently fishing bays and knowledge of federal regulations for red snapper. Part of *Hypothesis 4*, that there is no significant relationship between respondents who primarily fish in saltwater bodies (bays) and knowledge of federal regulations for red snapper, is thus supported by these conclusions.

Overall, there is enough evidence in relationships between by and/or offshore anglers and knowledge of federal regulations to support *Hypothesis 4*. There is no significant relationship between fishing in saltwater bodies and knowledge of federal regulations for red snapper.

To test whether captain and non-captain respondents differed in perception and knowledge of red snapper management, an independent samples t-test was conducted between type of angler and state bag limit/season and federal bag limit/season. As the variables were coded, “0” for “Yes,” and “1” for “No,” a higher mean is to be interpreted as the group having a greater frequency of “no” or “wrong” answers to knowledge of regulations. Assuming unequal variances, there was a significant ($p<0.005$) difference between captain and non-captain respondents for all four measurements of knowledge: state bag limit, state season, federal bag limit, and federal season (Table 22). The numerical mean for non-captains was significantly higher than for captains, as the non-captains had a significantly lower score for knowledge of state and federal regulations

Table 22 Independent samples t-test, testing for significant differences between means of captain and non-captain groups when measuring knowledge of state and federal management.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Knowledge of State Bag Limit	Equal variances assumed	459.801	.000	2.714	146	.007	.428	.158	.116	.739
	Equal variances not assumed			10.115	137.000	.000	.428	.042	.344	.511
Knowledge of Federal Bag Limit	Equal variances assumed	9.583	.002	1.288	147	.200	.144	.112	-.077	.365
	Equal variances not assumed			4.816	138.000	.000	.144	.030	.085	.203
Knowledge of State Season	Equal variances assumed	192.202	.000	2.285	147	.024	.368	.161	.050	.686
	Equal variances not assumed			3.384	12.514	.005	.368	.109	.132	.603
Knowledge of Federal Season	Equal variances assumed	22.284	.000	1.683	147	.095	.223	.133	-.039	.485
	Equal variances not assumed			6.294	138.000	.000	.223	.035	.153	.293

Table 23 Group statistics for measuring influence of type of angler on knowledge of state and federal management (0=yes/know, 1=no/don't know).

Group Statistics

	FISH_TPE	N	Mean	Std. Deviation	Std. Error Mean
Knowledge of State Bag Limit	NON-CAPTAIN	138	.43	.497	.042
	CAPTAIN	10	.00	.000	.000
Knowledge of Federal Bag Limit	NON-CAPTAIN	139	.14	.352	.030
	CAPTAIN	10	.00	.000	.000
Knowledge of State Season	NON-CAPTAIN	139	.47	.501	.042
	CAPTAIN	10	.10	.316	.100
Knowledge of Federal Season	NON-CAPTAIN	139	.22	.418	.035
	CAPTAIN	10	.00	.000	.000

(more “Yes/Correct” responses) (Table 23). Consequently, part of *Hypothesis 5*, that there is no difference between captain and non-captain *knowledge* of red snapper management, cannot be supported from this analysis.

To test captain versus non-captain perception of red snapper management, another independent samples t-test was conducted between type of angler and satisfaction with state and federal management. Assuming unequal variances, there was no significant difference between the means (captains and non-captains) for satisfaction with state management ($p>0.05$) (Table 24).

However, there was a significant difference between the means of the two groups regarding satisfaction with federal management ($p<0.00$). This does not support the second half of *Hypothesis 5*, that there is no difference between captain and non-captain *perception* of red snapper management. The mean score for satisfaction with federal management was significantly higher for captains than for non-captains (Table 25). Again, as a high score (“1”) correlates to a “No” or “Disagree” response; captains were more dissatisfied with the federal management than non-captains.

Table 24 Independent samples t-test, testing for significant differences between means of captain and non-captain groups when measuring perception of state and federal management.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Satisfaction with State Management	Equal variances assumed	3.879	.051	-1.262	133	.209	-.167	.132	-.428	.095
	Equal variances not assumed			-.981	8.652	.353	-.167	.170	-.554	.220
Satisfaction with Federal Management	Equal variances assumed	2818.198	.000	-2.815	132	.006	-.472	.168	-.804	-.140
	Equal variances not assumed			-10.528	124.000	.000	-.472	.045	-.561	-.383

Table 25 Group statistics for measuring influence of type of angler on perception of state and federal management (0 =agree, 1=disagree).

Group Statistics

	FISH_TPE	N	Mean	Std. Deviation	Std. Error Mean
Satisfaction with State Management	NON-CAPTAIN	126	.17	.374	.033
	CAPTAIN	9	.33	.500	.167
Satisfaction with Federal Management	NON-CAPTAIN	125	.53	.501	.045
	CAPTAIN	9	1.00	.000	.000

To test for differences between group means of captains and non-captains regarding knowledge of science, an independent samples t-test was used to compare type of angler to average life span of red snapper. Assuming unequal variances, there was no significant difference ($P>0.05$) between captain and non-captain knowledge of red snapper life span (Table 26). Both captain (2.41) and non-captain (3.13) respondents had means differing from the actual mean value of 5/6, representing red snapper life span of 41-60 (Table 27). It appears that experience with the fishery does not affect knowledge of red snapper science as measured by average life span. Therefore, part of *Hypothesis 6*, there is no difference between captain and non-captain *knowledge* of science related to red snapper management, is supported.

Table 26 Independent samples t-test, testing for significant differences between means of captain and non-captain groups when measuring knowledge of state and federal management.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Knowledge of Average Red Snapper Life Span	Equal variances assumed	.928	.337	-1.154	119	.251	-.718	.622	-1.950	.514
	Equal variances not assumed			-1.010	7.749	.343	-.718	.711	-2.366	.930

Table 27 Group statistics for measuring influence of type of angler on knowledge of state and federal management (1=0-10 years, 10=91-100 years).

Group Statistics

	FISH_TPE	N	Mean	Std. Deviation	Std. Error Mean
AVG_OLD	NON-CAPTAIN	113	2.41	1.683	.158
	CAPTAIN	8	3.13	1.959	.693

To test for differences between captain and non-captain perception of science related to red snapper management, another independent samples t-test was used, pairing type of angler with support for the science and stock improvement variables. Assuming unequal variance, there was no significant difference ($p>0.05$) in the mean support for science for captains and non-captains. However, there was a significant difference ($p<0.05$) in the mean support for the statement that the red snapper stock has improved since the implementation of the 2008 regulations (Table 28). The mean for non-captain respondents is significantly greater than the mean for captains regarding stock improvement; non-captains have a significantly greater opposition to the perception that the stock has improved (Table 29). Therefore, the rest of *Hypothesis 6*, that there is no difference between captain and non-captain *perception* of science related to red snapper management, is not supported, in such that there is a difference in the perception of the success of the science through an improved stock.

Table 28 Independent samples t-test, testing for significant differences between means of captain and non-captain groups when measuring perception of science related to red snapper management.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Support for Science Behind the Management of Red Snapper	Equal variances assumed	.587	.445	-5.796	109	.000	-.732	.126	-.982	-.482
	Equal variances not assumed			-6.264	9.778	.000	-.732	.117	-.993	-.471
Support for Statement that Red Snapper Stock has Improved Since 2008	Equal variances assumed	12.826	.001	1.300	86	.197	.195	.150	-.103	.493
	Equal variances not assumed			1.729	14.394	.105	.195	.113	-.046	.436

Table 29 Group statistics for measuring influence of type of angler on perception of science related to red snapper management (0=support, 1=oppose).

Group Statistics

	FISH_TPE	N	Mean	Std. Deviation	Std. Error Mean
SPRT_SCI	NON-CAPTAIN	102	.16	.365	.036
	CAPTAIN	9	.89	.333	.111
STK_IMPV	NON-CAPTAIN	78	.29	.459	.052
	CAPTAIN	10	.10	.316	.100

CHAPTER V

CONCLUSIONS

The purpose of this study was to assess the knowledge and perception of recreational red snapper management and science behind the management, in a sample population of charter and head boat anglers in Texas. Additional objectives included examining potential connections between angler knowledge and perception, and analyzing open ended questions to identify patterns in the data that may indicate common themes amongst the sample population.

Discussion of Descriptive Analysis

The majority of respondents were 20-50 year old (74.5%), male (89.3%), four-year college graduates (34.9%), who resided near the coast (65.3%), and were targeting red snapper (92.5%). The captain population had a lower mean education level overall, with most of its participants (4.79%) of total population having either a high school diploma or some college. Offshore (57.1%) and lakes (42.9%) are the most common bodies of water fished by the respondents; this may be due to the large concentration of anglers located near Houston, close to offshore fishing access, and Dallas/Ft. Worth, surrounded by a large lake system (Figure 15).

Anglers are generally accepting of minimum size limit (85.4%), daily bag limit (89.5%), a trophy tag (57.5%), and an annual season closure (68.7%). Results also showed that 72.5 percent of respondents agree with the science behind red snapper management, 63.4 percent believe that the stock has improved since 2008, 89.5 percent agree that a bag limit in general is an appropriate management tool, and 78.2 percent agree with the Texas state management of red snapper. In general, respondents seem satisfied with the current science, and state management strategy. They also are noticing the results of the 2008 regulation changes on the GOM red snapper stock. However, 51.7 percent of respondents disagree with the federal management of red snapper, and 90.1 percent of all respondents did not know that red snapper live to be 41-60 years old. This implies not only that most charter and head boat anglers have negative perceptions of the federal management of red snapper, but that a potential explanation for their discontent may be that anglers do not understand why the federal managers are requiring a 2-bag limit. The 2-bag limit regulation, combined with the minimum size limit restriction, is meant to cause a fisheries-induced shift towards catching larger fish, allowing more of the juveniles to reach their peak reproductive age, and ultimately, rebuild the stock more quickly (Hood et al., 2007). The relationship between education and perception is explored further in the explanatory analysis.

Anglers responded mostly age 1 to age 5 (85.3%) when asked the average age of red snapper caught recreationally; this is nearly exactly the age as cited in the literature, 2 to 6 years old (Allman & Fitzhugh, 2007). However, while anglers were knowledgeable on this life history trait, very few (9.9%) anglers knew the life span of a red snapper, or how old they reach in the wild. This represents a gap in the knowledge of anglers about red snapper, as it appears they are educated only on certain characteristics of the species. This knowledge may be anecdotal and passed down by generation.

Open ended responses were most frequent on topics related to state management, federal regulations (bag limit and season), and suggestions for improving the fishery. Of 20 respondents, 85 percent had a positive perception of the state management; of 14 responses, 50 percent had a positive opinion about federal management. The difference in perception of state and federal management may be due to the majority of opinions against the federal 2-bag limit (91.9%), or against the federal season (89.5%). All of 16 comments were supportive of “conserving the fish,” which may be related to the pattern of comments (n=17) suggesting and supporting (94.1%) a management strategy, “keep what you catch,” that would result, in their opinion, in less mortality for the fishery. These open ended questions and the consequential responses are examples of how communication can be facilitated between managers and stakeholders through an avenue - other than council meetings - to improve relations and offer the exchange of knowledge.

Discussion of Explanatory Analysis

For all respondents, knowledge of how old red snapper live was significantly lower than the literature value of about age 50 (Tables 14, 15). This supports previous speculation that there is a lack of knowledge about this characteristic in the angler community. The relationship between an angler’s location along the coast or participation in saltwater activities and its effect on their knowledge and perception about red snapper was examined.

Angler's residence in a coastal county does not correlate with their knowledge of red snapper life span (Table 17). Also, an angler's frequency with which they interact with the coast through saltwater fishing in bays or offshore does not correlate with a greater knowledge of federal regulations (Tables 18-21). Thus, it should not be assumed that proximity and interaction with the coast does not result in a greater knowledge about saltwater species life history – such as red snapper life span - and knowledge of federal regulations. It is up to members of the outreach community and managers to ensure all anglers receive education about why the species is being managed a certain way.

Finally, differences between angler groups, captains and non-captains, were examined. As captains interact more with and have a vested interest in the resource, it is expected, as was shown, that captains have a greater knowledge of red snapper state and federal management (Table 22). Captains had a significantly lower mean score on knowledge of management, implying that they received a greater frequency of "correct" responses to the questions regarding state and federal regulations. Also, there was a significant difference between captain and non-captain responses regarding satisfaction with federal management; captains were more dissatisfied with the federal management than non-captains. This may be because the captains have experienced the management changes more directly than non-captains, through financial and other means, and are thus not in agreement with how the management is being conducted.

The results showed that there is not a difference between captain and non-captain knowledge of science related to red snapper management. This, along with the previous finding that location in relation to the coast and saltwater anglers do not know the science, supports the argument that regardless of the angler's frequency with which they interact with the red snapper fishery, there is a lack of education about the science. Moreover, the lack of education is regarding life span, upon which the management regulations are based. This study also found that there is a difference between captain and non-captain perception of science in relation to stock management; non-captains have a greater opposition to the statement that the red snapper stock has improved since 2008. This may be due to the lack of interaction with the resource by the anglers, as compared to that of the captains.

Recommendations and Challenges for Management

Regardless of the fisheries sector, commercial or recreational, decision makers should strive to familiarize themselves with the perspective of fishers, namely, "what they want in the way of rules and allocations, why they feel the way they do, how their use of fishery resources benefits the state and themselves, and what they will and will not support" (Anderson & Ditton, 2004). Conflicts between managers and the fishers, as well as between the sectors of fishers themselves, are frequent in the red snapper fishery (Anderson, 2009; Sikes, 2008) Often, disputes between commercial and recreational sectors in the United States focus on the open-ended reallocation of harvest from one sector to the other, or on the use of different management measures to manage the recreational versus the commercial sector (Sutinen & Johnston, 2003). For example, despite extensive research that demonstrates the increase in pressure from the recreational sector on red snapper populations, recreational fishers feel that they are being punished for the actions of the commercial red snapper fishery and the shrimp fishery (Anderson, 2009). Authorities such as the GOM and South Atlantic Fishery Management Councils believe “a 44% reduction in juvenile red snapper shrimp trawl mortality is necessary for the recovery of the red snapper fishery” (Parsons & Foster, 2007). These conclusions are known to the recreational fishing community and have since generated tension between the sectors (Wilson, 2009). Enabling recreational fishers to better understand their role in the red snapper fishery decline, through such methods as education about the catch-and-release mortality rate, may help to reduce the negative opinions toward the commercial sector.

Yet another area on which to focus improvement is the science behind the regulation. This study has examined the relationship between angler knowledge and their opinions about the management of red snapper. Not only is additional research needed, but more importantly, the dissemination of scientific findings is imperative for improving compliance and acceptance concerning the management (NOAA, 2010a). Scientists and managers should assess whether increased education involving science directly related to management decisions will reduce the frequency of negative opinions towards the management of red snapper. Although fisheries are managed through a combination of social, economical, and biological understanding, the scientific knowledge about the stock is the foundation upon which all management is based (National Research Council, 2006).

For example, in the red snapper fishery, the science has concluded that in the GOM, the abundance of the red snapper population is young in age, at most being between 2 and 6 years old (Nieland et al., 2007; Allman & Fitzhugh, 2007). As previously stated, red snapper are a long-living species however, with an average life span of 50 years (Nieland et al., 2007). Managers are making regulatory decisions based on the goal of restoring the stock to a "healthy" level, with the average red snapper reaching 15-25 years old (Allman & Fitzhugh, 2007). Anglers may disagree with management because they do not understand why red snapper are being managed. If anglers do not know that red snapper live to be about 50 years old, they may not realize the reason to have daily bag limits and size limits. By measuring angler knowledge of the longevity of red snapper, managers may be able to target where education is needed to reduce angler dissatisfaction with management. Education can be achieved through public postings personal communication with anglers and other means of disseminating knowledge about why red snapper need to be managed. Public postings of stock assessments and conclusions can be presented in fish reports online and in periodicals, for example. Also, utilizing non-regulatory associated persons - such as already established Sea Grant extension agents and academic faculty - to conduct outreach about red snapper science in fishing communities, would allow for the distribution of anecdotal accounts that support the need for the regulation. Through having a greater understanding of angler demographics, decision makers will be able to generate management tailored for recreational red snapper anglers.

A historical preference has been established for red snapper; they have been commercially sought after since the 1800s in the GOM, and both commercial and recreational fishing pressure has increased as technology has advanced and the demand for the fish has grown (Cooke & Cowx, 2006). Advances in diesel engines, depth finders, fish finders, reels, and synthetic fibers have increased the ability to exploit red snapper in both commercial and recreational fisheries (Porch, 2007). Additionally, ethical consideration should be made regarding the practice of catching fish for recreational use. While some anglers do fish recreationally to provide food for their families, others do so as a catch and release sport. The potential repetitive injuries made to fish through a catch and release fishery should be communicated to anglers to limit the impact of humans on this natural resource.

On the other hand, technological advances have also allowed for improvements in conservation by "reducing selectivity, by-catch, and habitat degradation" (MacLennan, 1990). For example, modifications to gear such as circle hooks, used in both recreational and commercial fisheries, have resulted in reduced injury and mortality of discarded or released fish (Cooke & Suski, 2004). Consequently, managers must remain informed of all technological advancements and their potential to help or harm the GOM red snapper fishery, in order to develop management strategies that utilize and respond to these advances (Cooke & Cowx, 2006).

Currently, the GOM is recognized as a single stock for assessment purposes (Nieland et al., 2007). Sutinen and Johnston (2003) stated that the nature of the current red snapper recreational season regulations alone "may not provide optimal benefits to anglers in all geographic areas" of the GOM. The application of the GMFMC's management regulations across a wide spatial scale is something that was noted by anglers. Five respondents made a point to comment positively in the open ended section about the GOM being divided into management regions. Several scientific studies have already demonstrated that “local [red snapper] populations may be behaving differently to the selective regimes, including extent of overfishing” (Nieland et al., 2007). Dividing the Gulf into multiple management regions may aid managers in developing the best possible management regimes for their area. Research should be conducted on the feasibility of the division of the GOM management region, and on the exact locations where differences in red snapper population demographics may be occurring (Jackson, Cowan, & Nieland 2007). Furthermore, utilizing angler interviews to demonstrate support for the change may improve political support for implementation. Managers could incorporate more open-ended questions into already established intercept surveys to allow for stakeholder opinion and suggestions.

Trends in fisheries management have “threatened…the sustainability and long-term social value of recreational fisheries”; the process of fisheries management has become “cumbersome and inflexible,” resulting in “regulations that fishers view as overly complex and inappropriate for their fishery” (Sutinen & Johnston, 2003). Recreational fishers are losing their trust in the management strategies (National Research Council, 2006). It has been noted that the GOM red snapper fishery is “a good example of a mixed recreational-commercial fishery that is poorly served by existing management arrangements” (Sutinen & Johnston , 2003). Therefore, studies such as this one that includes input from citizens who have a vested interest in the future of the red snapper fishery, may aid scientists and managers in coming to a decision on how management can be more effective.

The way in which anglers received this interview, willing and determined to share their perceptions and suggestions for the fishery, suggest that a form of co-management may be appropriate for the GOM recreational red snapper fishery. The recommendation of this research is to focus on incremental change that supplements the current management strategies of bag limits and season restrictions. While council meetings already offer an avenue for angler comment, a goal of co-management is that “fishers [exercise] more than simply providing information that is more typical in government/stakeholder relations” (Beem, 2007). Having a non-council-related outlet for recreational fishers may reduce the conflict between the recreational and commercial sector, and the disagreement with federal regulations (Sutinen & Johnston, 2003). Alternatively, the adoption of any innovative management strategy should be fully considered, as researchers warn against “seeing co-management as a panacea, as problems with legitimacy and regulatory capture have emerged in some arenas” (Jentoft, 2000). Through interviews such as the one conducted in this study, an initial co-management approach could be implemented by utilizing angler input in management decisions, and directly involving these stakeholders in the management of their resource (Pomeroy, 1999).

Limitations and Suggestions for Future Research

Limitations to this research involve time available to conduct in person interviews, availability of funding to cover interview costs, and the time constraints of the federal open season for red snapper. The open season for red snapper began on June

1st, 2010, and was open for 53 days thereafter (Griggs, 2010). This provided only a small window of opportunity to interview anglers actively targeting red snapper.

The assumption was made that the majority of red snapper anglers were on charter boats or head boats because of the expenses involved in targeting an offshore species: the cost of a boat, the expenses involved in maintaining the boat, and the cost of bait and tackle. Additionally, the limited 2 bag limit for red snapper in federal waters makes the prospect of spending the time and money to take a boat offshore less likely. This assumption has been supported by evidence that most red snapper anglers are charter and head boat anglers, and that a number of anglers sport fish in tournaments for red snapper (M. Clark, personal communication, November 14, 2009; A. Reisinger, personal communication, March 25, 2010). For these reasons, only charter and head boat anglers were studied in this research. Future studies should seek to encompass all participants of the recreational fishing sector.

Due to the limited amount of time and resources, only two trips were made to sites outside of Galveston, Texas. An extended weekend was spent in Port Aransas, TX, and an 8-hour day was spent in Freeport, TX. Due to the restriction of time at each location, areas of greatest concentration of for-hire recreational businesses were sampled. In Freeport, a local bait shop and boat ramp site was used. This was due to the limited number of boat access sites in this region and the popularity of this location for anglers. TPWD uses the site for creel surveys. Future research should address the entire Texas coast population of charter and head boat anglers, and should include more intensive sampling along the lower Texas coast.

While considerable efforts were made to eliminate bias in this research, inevitably the conditions under which the interviews were conducted must be acknowledged as sources of error. Interviews were conducted at the same time of day, but anglers present during the week may have been of a different population than anglers on the weekend. This sampling error may have affected the quality of the interview (Fowler, 2002). Additionally, as most interviews were conducted after a long trip offshore, respondents may have been tired and thus may have answered questions in haste, when otherwise they would have taken longer to consider their response. In order to persuade anglers to engage in the interview, and in accordance with the requirements of the IRB, the surveyor explained that they were not associated with a regulatory agency and that they were conducting research as a graduate student at Texas A&M University. This information may have made an initial impression that unintentionally biased the factual reporting of the interview, as respondents may have altered their answers according to what they perceived was the best answer in the presence of someone associated with academia (Oppenheim, 1992). Respondents also may have assumed that the data collected would be utilized by a regulatory agency nonetheless, and may have responded according to what they perceived would have produced the most, or least, regulatory change.

One of the groups that need additional attention in research is the non-resident angler population if management agencies wish to attract more revenue from that sector to Texas (Anderson & Ditton, 2004). Only two studies have been conducted on non-resident licensed anglers who fish in Texas. Of these two, both were completed prior to the implementation of many regulations affecting recreational anglers today, and one focused strictly on the largemouth bass industry (Donaldson, Osborn, Faulkner, Ditton, & Matlock, 1987; and Hunt & Ditton 1996). These studies provide baseline data and methods to obtain an understanding of the non-resident angler population. Through the additional recreational angler interviews, the potential exists to identify the demographics, recreational and scientific knowledge, and attitudes of anglers participating in the charter and head boat sector that prior recreational mail-out, telephone, and in-person surveys have not addressed. A second group that needs further research is the charter and head boat captains. An attempt should be made to interview all head boat captains, and a significant sample of charter boat captains, in Texas. This would be necessary to expand the understanding of captains' perception and knowledge of science and management. A larger sample size would allow for a more conclusive assessment of this population. The recent consideration of rights-based management in the GMFMC for recreational quota management is suggestive of a major management shift in the red snapper fishery. Having significant documentation of the captains who may be affected by this management shift could help to determine if and how they will be affected by the changes.

REFERENCES

Allman, R.J., & Fitzhugh, G.R. (2007). Temporal age progressions and relative year-class strength of Gulf of Mexico red snapper. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 311-328). Bethesda, MD: American Fisheries Society.

Anderson, D.K., & Ditton, R.B. (2004). *Demographics, participation, attitudes, and management preferences of Texas anglers.* HD-624. Texas A&M University, College Station, TX: Human Dimensions of Fisheries Research Laboratory.

Anderson, P. (2009). Speaking out: red snapper outrage. *Florida Sportsman*. Retrieved September 5, 2009, from http://www.floridasportsman.com.

Arlinghaus, R., Mehner, T., & Cowx, I.G. (2002). Reconciling traditional inland fisheries management and sustainability in industrialized countries, with emphasis on Europe. *Fish and Fisheries, 3*, 261-316.

Backstrom, C. H., & Hursh, G. D. (1963). *Survey Research*. Evanston, IL: Northwestern University Press.

Bailey, H.K., Cowan, J.H. Jr., & Shipp R.L. (2001). Experimental evaluation of potential effects of habitat size and presence of conspecifics on habitat association by young-of-the-year red snapper. *Gulf of Mexico Science, 2*, 119-131.

Beaumariage, D.S., & Bullock, L.H. (1976). Biological research on snappers and groupers as related to fishery management requirements. In H.R. Bullis, Jr., & A.C.

Jones (Eds.). *Proceedings: Colloquium on Snapper-Grouper Fishery Resources of the Western Central Atlantic Ocean*, *17*, 86-94.

Beem, B. (2007). Co-management from the top? The roles of policy entrepreneurs and distributive conflict in developing co-management arrangements. *Marine Policy, 31*, 540-549.

Bohnsack, J. A. (1989). Are high densities of fishes at artificial reefs the result of habitat limitation or behavioral preference? *Bulletin of Marine Science, 44(2),* 631-645.

Bradley, E., & Bryan, C.E. (1975). Life history and fishery of the red snapper (*Lutjanus campechanus*) in the northwestern Gulf of Mexico: 1970-1974. *Proceedings of the Gulf and Caribbean Fisheries Institute, 27*, 77-106.

Brusher, H.A., & Palko, B.J. (1987). Results from the 1984 and 1985 surveys in Southeastern U.S. waters and the U.S. Caribbean Sea. *Marine Fisheries Review, 49* (2), 109-117.

Bryan, T.A. (2004). Tragedy averted: the promise of collaboration. *Society and Natural Resources, 17*, 881-896.

Burns, K.M., Koenig, C.C., & Coleman, F.C. (2002). *Evaluation of multiple factors involved in release mortality of undersized red grouper, gag, red snapper, and vermillion snapper.* Technical Report No. 814. Sarasota, FL: Mote Marine Laboratory.

Campbell, R.P., McEachron, L.W., & Choucair, P. (1997). *Red drum and spotted seatrout size limits: they work*. Paper presented at Southern Division of the American Fisheries Society Midyear Meeting: San Antonio, TX.

City of Port Aransas. (2010). *Our history*. Retrieved March 15, 2010, from http://www.cityofportaransas.org.

Collins, L.A., Finucane, J.H., & Brusher, H.A. (1987). Reproductive biology of the red snapper, *Lutjanus campechanus* (Poey), from three areas along the southeastern coast of the United States. Unpublished Manuscript, National Marine Fisheries Service, Panama City, FL.

Collins, L.A., Johnson, A.G., & Keim, C.P. (1996). Spawning and annual fecundity of the red snapper (*Lutjanus campechanus*) from the northeastern Gulf of Mexico. In F. Arreguin-Sanchez, J.L. Munro, M.C. Balgos, and D. Pauly (Eds.). Biology, fisheries and culture of tropical groupers and snappers. *Proceedings of the International Center for Living Aquatic Resources Management Conference, 48*, 174-188.

Collins, L.A., Fitzhugh, G.R., Mourand, L., Lombardi, L.A., Wlling, W.T.Jr., Fable, W.A., Burnett, M.R., & Allman, R.J. (2001). Preliminary results from a continuing study of spawning and fecundity in the red snapper (Lutjanidae: *Lutjanus campechanus*) from the Gulf of Mexico, 1988-1999. *Proceedings of the 52nd Annual Gulf and Caribbean Fisheries Institute, 52,* 34-47.

Cooke, S.J., & Suski, C.D. (2004). Are circle hooks effective tools for conserving freshwater and marine recreational catch-and-release fisheries? *Aquatic Conservation: Marine and Freshwater Ecosystems, 14*, 299-326.

Cooke, S.J., & Cowx, I.G. (2006). Contrasting recreational and commercial fishing: searching for common issues to promote unified conservation of fisheries resources and aquatic environments. *Biological Conservation, 128*, 93-108.

Cooke, S.J., & Schramm, H.L. (2007). Catch-and-release science and its application to conservation and management of recreational fisheries. *Fisheries Management and Ecology, 14,* 73-79.

Cowan, J.H., Grimes, C.B., Patterson, C.J., Walters, A.C., Jones, W.J., Lindberg, D.J., Sheehy, W.E., Powers, J.E., & Campbell, M.D., et al. (2010). Red snapper management in the Gulf of Mexico: science- or faith-based? *Reviews in Fish Biology and Fisheries*. doi:10.1007/s11160-010-9165-7.

Cowx, I.G. (2002). Recreational fisheries. In: P. Hart & J. Reynolds (Eds.), *The Fisheries Handbook, Vol. II* (pp. 367-390). Oxford, UK: Blackwell Science.

Dance, M.A. (2008). *Reef fish community structure at unpublished artificial reef sites of northwest Florida: implications for no-harvest refugia*. (Master's Thesis). University of West Florida, Pensacola, FL.

Decker, D.J., & Chase, L.C. (1997). Human dimensions of living with wildlife – a management challenge for the 21st century. *Wildlife Society Bulletin, 25*, 788-795.

Ditton, R. B., & Fedler, A. J. (1983). *A statewide survey of boatowners in Texas and their saltwater fishing activity*. TAMU-SG-83-205. Texas A&M University, College Station, TX: Sea Grant College Program.

Ditton, R.B., Gill, D.A., & MacGregor, C.L. (1991). Understanding the market for charter and headboat fishing services. *Marine Fisheries Review, 53*, 19-26.

Ditton, R.B., Holland, S.M., & Gill, D.A. (1992). The U.S. Gulf of Mexico party boat industry: activity centers, species targeted and fisheries management options. *Marine Fisheries Review, 54* (2): 15-20.

Ditton, R.B., Anderson, D.K., Bohnsack, B.L., & Sutton, S.G. (2000). *1999 Texas International Fishing Tournament: Participants' Characteristics, Participation in Fishing, Attitudes, Expenditures, and Economic Impacts*. HD-614. Texas A&M University, College Station, TX: Human Dimensions of Fisheries Research Laboratory.

Donaldson, D. M., Osborn, M. F., Faulkner, K., Ditton, R. B., & Matlock, G.C. (1987). *Demographics, participation, expenditures, and management preferences of Texas non-resident anglers, 1987*. Management Data Series 81. Austin, TX: Texas Parks and Wildlife Department.

Dow Chemical Company. (2011). *Texas Operation – Freeport, Texas*. Retrieved January 9, 2011, from http://www.dow.com/facilities/namerica/texops/pdfs/Dow_Fact_Sheet_05-18-10.pdf.

Dugas, R., Guillory, V., & Fischer, M. (1979). Oil rigs and offshore sport fishing in Louisiana. *Fisheries, 4(6),* 2-10.

ESRI. (2011). ArcGIS Explorer.

FEMA. (2008). *Hurricane Ike Impact Report.* Retrieved January 29, 2011, from http://www.fema.gov/pdf/hazard/hurricane/2008/ike/impact_report.pdf.

Fink, A., & Kosecoff, J (1998). *How to Conduct Surveys* (2nd ed). Thousand Oaks, CA: SAGE Publications.

Fischer, A.J., Baker, S.M. Jr., & Wilson, C.A. (2004). Red snapper (*Lutjanus campechanus*) demographic structure in the northern Gulf of Mexico based on spatial patterns in growth rates and morphometrics. *Fisheries Bulletin, 102*, 593-603.

Fischer, A.J. (2007). An overview of age and growth of red snapper in the Gulf of Mexico. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 189-200). Bethesda, MD: American Fisheries Society.

Fowler, F.J. (2002). *Survey research methods* (3rd ed) Thousand Oaks, CA: Sage Publications.

Gallaway, B. J. (1984). Assessment of platform effects on snapper populations and fisheries. In *Fifth Annual Gulf of Mexico Information Transfer Meeting.* (pp. 130-137). New Orleans, LA: OCS Study MMS 85-0008.

Gallaway, B. J., Cole, J. G., Meyer, R., & Roscigno, P. (1999). Delineation of essential habitat for juvenile red snapper in the northwestern Gulf of Mexico. *Transactions of the American Fisheries Society, 128,* 713-726.

Galveston Chamber of Commerce. (2009). *History*. Retrieved November 20, 2009, from http://www.galvestonchamber.com.

Gazey, W.J., Gallaway, B.J., Cole, J.G., & Fournier, D.A. (2008). Age composition, growth, and density-dependent mortality in juvenile red snapper estimated from observer data from the Gulf of Mexico penaeid shrimp fishery. *North American Journal of Fisheries Management, 28*, 1828-1842.

Geary, B.W., Mikulas, J.J.Jr., Rooker, J.R., Landry, A.M.Jr., & Dellapenna, T.M. (2007). Patterns of habitat use by newly settled red snapper in the Northwestern Gulf of Mexico. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 25-38). Bethesda, MD: American Fisheries Society.

Global Biodiversity Information Network and Ocean Biogeographic Information System. (2011). *Lutjanus campechanus*: *Northern red snapper*. Retrieved March 6, 2011, from www.fishbase.org.

GMFMC. (2001). *Regulatory amendment to the reef fish fishery management plan to set a red snapper rebuilding plan through 2032*.Tampa, FL: Gulf of Mexico Fisheries Management Council.

GMFMC. (2006). *Amendment 26 to the fishery management plan for reef fish fishery of the Gulf of Mexico*. Tampa, FL: Gulf of Mexico Fisheries Management Council.

GMFMC. (2010a). *2010 Commercial Fishing Regulations for Gulf of Mexico Federal Waters.* Tampa, FL: Gulf of Mexico Fisheries Management Council.

GMFMC. (2010b) *2010-11 Recreational Fishing Regulations of Gulf of Mexico Federal Waters*. Tampa, FL: Gulf of Mexico Fisheries Management Council.

GMFMC. (2010c). *Fishery management plan for reef fish fishery of the Gulf of Mexico.* Tampa, FL: Gulf of Mexico Fisheries Management Council.

GMFMC. (2011). *Gulf of Mexico Fishery Management Council seeks applicants to serve on ad hoc head boat individual fishing quota advisory panel*. Tampa, FL: Gulf of Mexico Fisheries Management Council.

Griffin, W.L., Woodward, R.T., & Kim, H.N. (2009). *Bioeconomic analysis of the red snapper rebuilding plan and transferable rights policies in the Gulf of Mexico*. Grant No. NA17FF2873. Washington, D.C.: National Oceanographic and Atmospheric Administration.

Griggs, T. (2010). Snapper season could be shortest ever: catch going up, but shorter season could be next. *Pensacola News Journal*. Retrieved February 15, 2010, from http://www.thedestinlog.com/articles/season-12778-snapper-shortest.html.

Groves, R.M. (1979). Actors and questions in telephone and personal interview surveys. *Public Opinion Quarterly, 43*, 190-205.

Hanisko, D.S., Lyczkowski-Shultz, J., & Ingram, G.W. (2007). Indices of larval red snapper occurrence and abundance for use in stock assessment. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 285-300). Bethesda, MD: American Fisheries Society.

Heino, M., & Dieckmann, U. (2009). Fisheries-induced evolution. In: *Encyclopedia of Life Sciences*. Chichester, UK: John Wiley & Sons, Ltd.

Hoese, H.D., & Moore, R.H. (1998*). Fishes of the Gulf of Mexico* (2nd ed). College Station, TX: Texas A&M Press.

Holland, S.M., Ditton, R.B., & Gill, D.A. (1992). The U.S. Gulf of Mexico charter boat industry: activity centers, species targeted, and fisheries management options. *Marine Fisheries Review, 54*, 21-27.

Hood, P.B., Strelcheck, A.J., & Steele, P. (2007). A history of red snapper management in the Gulf of Mexico. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 267-284). Bethesda, MD: American Fisheries Society.

Hunt, K. M., & Ditton, R.B. (1996). *A social and economic study of the Lake Fork Reservoir recreational fishery*. HD-608. Texas A&M University, College Station, TX: Human Dimensions of Fisheries Research Laboratory.

Hunter, G.N. (1949). The utility of personal interviews in obtaining information on game and fish resources. *Transactions of the 14th North American Wildlife Conference, 14*, 239-252.

Jackson, M.W., Cowan, J.H., & Nieland, D.L. (2007). Demographic differences in Northern Gulf of Mexico red snapper reproductive maturation: implications for the unit stock hypothesis. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 217-227). Bethesda, MD: American Fisheries Society.

Jentoft, S. (1989). Fisheries co-management: delegating government responsibility to fishermen's organizations. *Marine Policy, 13*, 137-54.

Jentoft, S. (2000). Legitimacy and disappointment in fisheries management. *Marine Policy, 24*, 141-148.

Keithly, W.R. Jr. (2001). *Initial allocation of ITQs in the Gulf of Mexico red snapper fishery*. FAO. Retrieved March 21, 2011 from http://www.fao.org/DOCREP/005/Y2684E/y2684e11.htm.

Kennicutt, M.C., Schroeder, W.W., & Brooks, J.M. (1995).Temporal and spatial variations in sediment characteristics on the Mississippi-Alabama continental shelf. *Continental Shelf Research, 15*, 1-18.

King, F.W. (1948). The management of man. *Wisconsin Conservation Bulletin, 13 (9),* 9-11.

Kosaka, R. (2005). Fisheries co-management: the spectrum and the challenges. *Proceedings of the 14th Biennial Coastal Zone Conference, New Orleans, LA.* Retrieved August 8, 2011, from http://www.csc.noaa.gov/cz/CZ05_Proceedings/pdf%20files/Kosaka.pdf.

Krishnaswamy, A. (2010). Strategies and tools for effective public participation in natural resource management. *Human Dimensions of Natural Resource Management: Columbia Mountains Institute of Applied Ecology, 19*, 144-158.

Leal, D. R., & Maharaj, V. (Eds.). (2009). *Evolving Approaches to Managing Marine Recreational Fisheries*. Lanham, MD: Lexington Books.

Leitz, J., & Grubs, F. (2008). *Survey of Redfish Bay and Nine-Mile Hole anglers: to assess attitudes and opinions towards boating restrictions intended to conserve seagrass beds*. Austin, TX: Texas Parks and Wildlife, Coastal Fisheries Division.

Lelis, L. (2009). Anglers to feds: Bone up on red-snapper facts. *Orlando Sentinel*. Retrieved September 15, 2010, from http://articles.orlandosentinel.com.

Louisiana Sea Grant. (2010). *Red Snapper FAQs.: Biology and Life History*. Retrieved September 20, 2010, from http://www.seagrantfish.lsu.edu/faqs/biology.htm.

Ludwick, J.C. (1964). Sediments in the northeastern Gulf of Mexico. In R.L. Miller (Ed.), *Papers in Geology: Shepard Commemorative Volume* (pp. 204-240). New York: MacMillan.

Lyczkowski-Shultz, J., & Hanisko, D. S. (2007). A time series of observations on red snapper larvae from SEAMAP surveys, 1982-2003: Seasonal occurrence, distribution, abundance, and size. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 3-23). Bethesda, MD: American Fisheries Society.

MacLennan, D.N. (1990). Fish harvesting technology and profitability. *Advances in Fisheries Technology and Biotechnology for Increased Profitability, 1990*, 7-21.

Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), 16 U.S.C. §1801 *et seq.* (1996).

Masuda, R., Keller, K., Ziemann, D.A., & Ogle, J. (2003). Association with underwater structures in hatchery-reared and wild red snapper *Lutjanus campechanus* juveniles. *Journal of the World Aquaculture Society, 34*, 140-146.

McCawley, J.R. (2003). *Diet and prey demand of red snapper,* Lutjanus campechanus*, on Alabama artificial reefs*. (Master's Thesis). University of South Alabama, Mobile, AL. Retrieved from ProQuest Dissertations and Theses. (Accession Order No. 1412878).

McCawley, J.R., & Cowan, J.H. Jr. (2007). Seasonal size specific diet and prey demand of red snapper on Alabama artificial reefs. In W. F. Patterson, III, J. H. Cowan Jr., G.

R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 77-104). Bethesda, MD: American Fisheries Society.

Moran, D. (1988). Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Gulf of Mexico)-red snapper. *U.S. Fish and Wildlife Service Biological Report, 82*, 11.83.

Moseley, F. N. (1965). *Biology of the red snapper,* Lutjanus aya *Bloch, of the Northwestern Gulf of Mexico*. (Master's Thesis). University of Texas, Austin, TX.

National Research Council. (2006). *Review of Recreational Fisheries Survey Methods*. Washington, D.C.: The National Academies Press.

Neiland, D.L., Fischer, A.J., Baker, M.S. Jr., & Wilson, C.A. III. (2007). Red snapper in the northern Gulf of Mexico: age and size composition of the commercial harvest and mortality of regulatory discards. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 301-310). Bethesda, MD: American Fisheries Society.

Nieland, D. L., & Wilson, C. A. (2002). Red snapper recruitment to and disappearance from oil and gas platforms in the northern Gulf of Mexico. In J. McKay, J. Nides, and D. Vigil (Eds.), *Gulf of Mexico fish and fisheries: bringing together new and recent research* (pp. 270-279). New Orleans, LA: U.S. Dept. of the Interior, Minerals Managment Service, Gulf of Mexico OCS Region.

NMFS. (1998). *Fishermen urged to observe red snapper closures*. NMFS Southeast Regional News. Retrieved August 9, 2011 from http://www.publicaffairs.noaa.gov/pr98/oct98/seronr98-056.html.

NMFS. (2002). *Marine Recreational Fishery Statistics Survey* (MRFSS). Retrieved February 22, 2010, from http://www.st.nmfs.gov/st1/recreational/index.html.

NMFS. (2008). *Gulf of Mexico Red Snapper Individual Fishing Quota Annual Report*. Saint Petersburg, FL: NMFS Southeast Regional News.

NOAA. (2008). *The Gulf of Mexico at a Glance*. Retrieved March 31, 2010, from http://gulfofmexicoalliance.org/pdfs/gulf_glance_1008.pdf.

NOAA. (2010a). A vision for marine recreational fisheries. *Recreational Fisheries Strategic Plan: FY2005-FY2010*. Washington, D.C.: National Oceanographic and Atmospheric Administration.

NOAA. (2010b). *Fishery Disaster Assistance*. Retrieved January 29, 2011, from http://www.nmfs.noaa.gov/mb/financial_services/disaster.htm.

Oppenheim, A.N. (1992). *Questionnaire design, interviewing, and attitude measurement* (2nd ed). London, UK: Pinter Publishers.

Page, K.S., & Radomski, P. (2006). Compliance with sport fishery regulations in Minnesota as related to regulation awareness. *Fisheries, 31*, 166-178.

Parsons, G.R., & Foster, D.G. (2007). Swimming performance and behavior of red snapper: Its application to by-catch reduction. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 59-75). Bethesda, MD: American Fisheries Society.

Patterson, W. F. III, Cowan, J. H. Jr., Fitzhugh, G. R., & Nieland, D. L. (Eds.). (2007). *Red snapper ecology and fisheries in the U.S. Gulf of Mexico*. Bethesda, MD: American Fisheries Society.

Patterson, W.F.III. (1999). *Aspects of the population ecology of red snapper* Lutjanus campechanus *in an artificial reef area off Alabama*. (Doctoral Dissertation). University of South Alabama, Mobile, AL.

Pinkerton, E. (1989). *Co-operative management of local fisheries: New directions for improved management and community development*. Vancouver, BC: University of British Columbia Press.

Pomeroy, R.S. (1999). Devolution and fisheries co-management. In: Meinzen-Dick, R., Knox, A., Di Gregorio, M. (Eds.), Collective action, property rights and devolution of natural resource management: exchange of knowledge and implications for policy. *Proceedings of the International Center for Living Aquatic Resource Management Conference Penang, Malaysia, 59*, 111-46.

Porch, C.E. (2007). An assessment of the red snapper fishery in the U.S. Gulf of Mexico using a spatially-explicit age-structured model. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 355-384). Bethesda, MD: American Fisheries Society.

Prior, S.P., & Beckley, L.E. (2007). Characteristics of recreational anglers in the Blackwood Estuary, a popular tourist destination in Southwestern Australia. *Tourism in Marine Environments, 4*, 15-28.

Rea, L.M., & Parker, R.A. (1997). *Designing and conducting survey research: A comprehensive guide*. San Francisco, CA: Jossey-Bass Publishers.

Render, J.H., & Wilson, C.A. (1994). Hook-and-line mortality of caught and released red snapper around oil and gas platform structural habitat. *Bulletin of Marine Science, 55*, 1106-1111.

Rogers, D.R. (1998). *Behavior of red snapper,* Lutjanus campechanus*, in relation to trawl modifications to reduce shrimp trawl bycatch*. (Doctoral Dissertation). Louisiana State University, Baton Rouge, LA. Retrieved from ProQuest Dissertations and Theses. (Accession Order No. 9902659).

Rummer, J.L. (2007). Factors affecting catch and release (CAR) mortality in fish: insight into CAR mortality in red snapper and the influence of catastrophic decompression. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 123-144). Bethesda, MD: American Fisheries Society.

SEDAR 7. (2005). *Stock Assessment report of SEDAR 7 Gulf of Mexico red snapper*. Charleston, SC: SouthEast Data, Assessment, and Review.

SEDAR Red Snapper Update. (2009). *Stock assessment of red snapper in the Gulf of Mexico: Report of the update assessment workshop*. Miami, FL: SouthEast Data, Assessment, and Review.

Siemiatycki, J. (1979). A comparison of mail, telephone, and home interview strategies for household health surveys. *American Journal of Public Health, 69*, 238-245.

Sikes, D. (2008). Red snapper season is over, but battle is just beginning. *Corpus Christi Caller-Times*. Retrieved September 20, 2011, from http://www.caller.com/news/2008/aug/10/sikesoutdoors/

Strelcheck, A. J., & Hood, P. B. (2007). Rebuilding red snapper: Recent management activities and future management challenges. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 353–363). Bethesda, MD: American Fisheries Society.

Sutinen, J. G., & Johnston, R. J. (2003). Angling management organizations: Integrating the recreational sector into fishery management. *Marine Policy, 27*, 471-487.

Sutton, S. G., Ditton, R.B., Stoll, J.R., & Milon, J.W. (1999). *A cross-sectional study and longitudinal perspective on the social and economic characteristics of the charter and party boat fishing industry of Alabama, Mississippi, Louisiana, and Texas*. HD 612. Texas A&M University, College Station, TX: Human Dimensions of Fisheries Research Laboratory.

Szedlmayer S.T., & Conti, J. (1999). Nursery habitats, growth rates, and seasonality of age-0 red snapper, *Lutjanus campechanus*, in the northeast Gulf of Mexico. *Fisheries Bulletin, 97,* 626-635.

Townend, J. (2002). *Practical Statistics for Environmental and Biological Scientists*. West Sussex, UK: John Wiley & Sons, Ltd.

TPWD. (2010). *Bag and Length Limits for Saltwater Fish.* Retrieved January18, 2010, from http://www.tpwd.state.tx.us/publications/annual/fish/limits_saltwater/.

Tresaugue, M. (2009). Lawsuit challenges commercial fishing quotas in Gulf. *Houston Chronicle*. Retrieved September 25, 2009, from http://www.chron.com/disp/story.mpl/metropolitan/6643952.html.

U.S. Census Bureau. (2010). *American FactFinder*. Retrieved March 15, 2011, from http://factfinder.census.gov/.

U.S. Census Bureau. (2011). *NOAA's List of Coastal Counties*. Retrieved January 29, 2011, from http://www.census.gov/geo/landview/lv6help/coastal_cty.pdf.

University of Miami, Independent System for Peer Review. (2005). *Review of 2005 SEDAR panel for red snapper*. Contract C2327. University of Miami, Miami, FL: The Centre for Environment, Fisheries & Aquaculture Science.

USFWS. (2006). *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation: Texas*. Washington, D.C.: US Department of the Interior, Fish and Wildlife Service.

Wells, R.J.D., & Cowan, J.H.Jr. (2007). Video estimates of red snapper and associated fish assemblages on sand, shell, and natural reef habitats in the North-central Gulf of Mexico. In W. F. Patterson, III, J. H. Cowan Jr., G. R. Fitzhugh, & D. L. Nieland (Eds.), *Red snapper ecology and fisheries in the U.S. Gulf of Mexico* (pp. 39-57). Bethesda, MD: American Fisheries Society.

Wildlife and Fisheries, 50 C.F.R. § 6 (2011).

Wilson, C.A., & Nieland, D.L. (2001). Age and growth of red snapper, *Lutjanus campechanus*, from the northern Gulf of Mexico off Louisiana. *Fisheries Bulletin, 99*, 653-654.

Wilson, M. (2009, December 10). Gulf of Mexico red snapper recovering. For Shore Fishing [Web log comment]. Retrieved from http://forshorefishing.blogs.theledger.com/11381/gulf-of-mexico-red-snapper-recovering/.

Yu, J., & Cooper, H. (1983). A quantitative review of research design effects on response rates to questionnaires. *Journal of Marketing Research, 20*, 36-44.

APPENDIX A

SURVEY INSTRUMENT

_0_ Charter Boat/Head Boat Angler _1_ Captain (Charter OR Party Boat)

Assessment of Charter and Head Boat Angler Perception of Fishery Regulations and Stock Health in the Recreational Red Snapper (*Lutjanus campechanus*) Fishery in Texas

In the following questions, please tell me about your fishing activity. The information you provide will remain strictly confidential and you will not be identified with your answers.

1. Are you fishing for a particular species of fish today? 0 Yes 1 No

If yes, check the species: ___ 0 Dolphin (Mahi-Mahi) ___ 1 King Mackerel
___ 2 Red Snapper ___ 3 Amberjack
___ 4 Ling (Cobia) ___ 5 Other

2. Have you fished for red snapper in the past 5 years? (if no, reject the questionnaire)

0 YES
1 NO

3. Do you primarily fish LAKES, RIVERS, BAYS or OFFSHORE?

0 Lakes 1 Rivers 2 Bay 3 Offshore

4. Do you own a fishing boat? 0 Yes 1 No

5. Are you aware of the *bag limits* for recreational red snapper fishing in Texas STATE waters?
0 YES 1 NO Write if they provide bag limit ____________

6. Are you aware of the *bag limits* for recreational red snapper fishing in FEDERAL waters?

0 YES 1 NO Write if they provide bag limit ____________

7. Are you aware of a recreational *season* for red snapper in Texas STATE waters?

0 YES 1 NO Write if they provide season ____________

8. Are you aware of a recreational *season* for red snapper in FEDERAL waters?

0 YES 1 NO Write if they provide season ____________

The following are a few questions regarding angler knowledge of the Gulf of Mexico red snapper stock and life history. Please answer to the best of your knowledge.

9. What is the average age of a red snapper caught recreationally? _________

10. How old does an average red snapper get in the wild? (show card)

a	0-10	f	51-60
b	11-20	g	61-70
c	21-30	h	71-80
d	31-40	i	81-90
e	41-50	j	91-100

11. What size was the biggest red snapper you ever caught? (lbs)

____

For the following statements, please state your agreement on a scale of 1-5, 1 for strongly agree and 5 for strongly disagree: *(give laminated copy of paper)*

0 Strongly Agree
1 Somewhat Agree
2 Undecided/Unsure
3 Somewhat Disagree
4 Strongly Disagree
N/A Not Applicable

Agree→Unsure→Disagree

12. I support the scientific information being used to determine Gulf of Mexico (GOM) red snapper stock management.	0	1	2	3	4	N/A
13. The GOM red snapper stock has improved since January of 2008 (when the 2 bag limit was set and the overall TAC (total allowable catch) lowered to 5 million pounds).	0	1	2	3	4	N/A
14. Overall, I am satisfied with the offshore saltwater fishing experience from Texas.	0	1	2	3	4	N/A

Agree→Unsure→Disagree

The following focus on the impacts of the 2008 bag limit changes on your fishing activities. Please indicate whether you agree or disagree with these statements.						
15. The FEDERAL 2-bag limit change has had an effect on how often I've gone offshore fishing since January 2008.	0	1	2	3	4	N/A
16. I am satisfied with the current Texas STATE red snapper regulations.	0	1	2	3	4	N/A
17. I am satisfied with the current FEDERAL red snapper regulations.	0	1	2	3	4	N/A
The following is a list of tools for managing recreational saltwater fisheries. Some are used for managing red snapper, others are not. Please indicate whether you support or oppose these tools for red snapper management.						
18. Minimum size limit (releasing fish below a certain length)	0	1	2	3	4	N/A
19. Maximum size limit (releasing fish above a certain length)	0	1	2	3	4	N/A
20. Daily bag limit (being allowed to keep only a certain number of fish you catch in one day)	0	1	2	3	4	N/A
21. A tag to retain a "trophy" fish (i.e. for redfish)	0	1	2	3	4	N/A
22. Annual season closure	0	1	2	3	4	N/A
23. Closure of fishery, resume fishery when it is "recovered"	0	1	2	3	4	N/A

25. Do you have any comments regarding STATE management of red snapper in Texas?

____
____
____
____
____
____
____

26. Do you have any comments regarding FEDERAL management of red snapper in the U.S.?

____
____
____
____
____
____
____

The following questions will help me to know more about anglers. The information you provide will remain strictly confidential and anonymous.

27. What is your age? _________

28. Are you:

0 MALE
1 FEMALE

29. How much did you spend per year on offshore fishing prior to 2008? (show card)

1 UNDER $10,000
2 $10,000 - $19,999
3 $20,000 - $29,999
4 $30,000 - $39,999
5 $40,000 - $49,999
6 $50,000 - $59,999
7 $60,000 - $69,999
8 $70,000 - $79,999
9 $80,000 - $89,999
10 $90,000 - $99,999
11 $100,000 and ABOVE

30. How much have you spent per year on offshore fishing since 2008? (show card)

1 UNDER $10,000
2 $10,000 - $19,999
3 $20,000 - $29,999
4 $30,000 - $39,999
5 $40,000 - $49,999
6 $50,000 - $59,999
7 $60,000 - $69,999
8 $70,000 - $79,999
9 $80,000 - $89,999
10 $90,000 - $99,999
11 $100,000 and ABOVE

31. What is the highest grade level of school that you have completed? (show card)

1 Did not complete high school
2 High school diploma or equivalent
3 Some college, but no degree
4 Two-year college or technical school
5 Four-year college (B.A. or B.S.)
6 Some graduate work, but no degree
7 Graduate degree (M.A., M.S., Ph. D.)

32. What is your zip code? _____________

33. Is there anything else you would like to share with me?

____
____
____
____
____
____

Your contribution of time to this study is greatly appreciated. ThankYou

APPENDIX B

REGULATORY HISTORY

Year	Rule-making Vehicle	Action	Rationale
1984 Effective: 11/8/84	FMP[1]	• 13 inch minimum TL	• Estimated 18-25% increase in yield • Some at this size sexually mature and have spawned
1990 Effective: 2/21/90	Amendment 1[1]	• 7-fish bag limit • 3.1 mp commercial quota • Rebuilding goal 20% SSBR	• Actions estimated to achieve a 20 percent reduction in harvest.
1991 Effective: 7/29/91	Amendment 3[1]	• Revise TAC framework to be more flexible	• Improve the efficiency of the TAC setting process
1991 Effective: 8/23/91	Regulatory amendment[1]	• 2.04 mp commercial quota • 1.96 mp recreational allocation • Effect 50% bycatch reduction by 1994 in the shrimp fishery • Projected to achieve 20% SPR by 2007	• Reduces TAC an additional 20 percent • Should allow stock to rebuild to 20 percent SPR by 2007 • Further control F
1992 Effective: 4/3/92	Emergency rule[2]	• Open commercial red snapper fishery from April 3 – May 14 with 1,000 lbs trip limit due to the season closing in just 53 days	• Ameliorate adverse economic caused by a short season, an influx of non-traditional vessels in the fishery, and depressed ex-vessel prices
1992	Amendment 4[1]	• Moratorium on the issuance of new reef fish commercial permits for three years	• Limit participation in an overcapitalized fishery and allow time to develop a limited-access fishery
1992 Effective: 12/30/92-3/30/93	Emergency rule[2]	• Create commercial red snapper 2,000 lbs and 200 lbs endorsement for 1993	• Limit effort primarily to those with a historical dependence in the fishery • Allow a bycatch provision • Extend the fishing year
1992	Emergency rule[2]	• Close the commercial fishery from December 30, 1992 to February 15, 1993	• Provide time to implement trip limit endorsement system
1993 Effective: 3/23/93	Regulatory amendment[1]	• 3.06 mp commercial quota • 2.94 mp recreational allocation • Projected to achieve 20% SPR by 2009 • Change opening day of the 1994 commercial season to February 10 • Restrict commercial vessels to landing no more than one trip limit per day	• Continue rebuilding plan • Facilitate enforcement of the trip limits • Minimize fishing during hazardous winter weather • Ensure the commercial red snapper fishery is open during Lent
1993 Effective: 6/29/93-12/31/94	Amendment 6[1]	• Extended commercial red snapper endorsements	• Limit effort primarily to those with a historical dependence in the fishery • Allow a bycatch provision • Extend the fishing year
1994 Effective: 2/7/94	Amendment 5[1]	• Raise minimum size limit incrementally from 14 to 16 inches TL over a 5-year period • Establish Class 1 and Class 2 licenses • Create Alabama SMZs	• Increase yield per recruit and help rebuild the stock • Limit pulse and derby commercial fishery • Limit fishing on artificial reefs off Alabama
1994 Effective: 1/1/95	Regulatory amendment[1]	• Change opening day of the commercial season to February 24, 1995 • Retain 6 million pound red snapper TAC and commercial trip limits • Reduced the daily bag limit from 7 fish to 5 fish • Increase the minimum size limit for recreational fishing from 14 inches to 15 inches a year ahead of the scheduled automatic increase.	• Ensure the commercial red snapper fishery is open during Lent • Continue rebuilding plan • Because the recreational sector exceeded its 2.94 million pound red snapper allocation each year since 1992, further restrict recreational F

Year	Rule-making Vehicle	Action	Rationale
1994	Amendment 7[1]	• Establish dealer reporting	• Improve accountability for landings
1994 Effective: 7/27/94	Amendment 9[1]	• Allow collection of commercial landings 1990-92 for ITQ • Extend the moratorium on the issuance of new reef fish permits	• Need for historical red snapper landings for commercial fishermen to establish baseline information for an IFQ program • Allow time for evaluation and development of a more comprehensive controlled access system
1995 12/95	Regulatory amendment[1]	• Raise TAC from 6 mp to 9.12 mp • Start commercial season February 28	• Revise rebuilding plan taking into account new information • Ensure the commercial red snapper fishery is open during Lent
1995	Amendment 8[1]	• Attempted to establish ITQ system (Congress repealed it)	• Reduce overcapitalization of commercial fishery • End derby fishery • Reduce user conflicts
1996 Effective: 10/16/96	Regulatory amendment[1]	• Increase TAC to 9.12 mp • Extend recovery date to 20% SPR to 2019 • Split commercial quota in a spring and fall season	• TAC recommendations based on a new stock assessment and recovery plan range from 6 to 10 mp • Provide commercial fishermen an income going into the fall holiday season
1996 Effective: 9/15/96	Amendment 13[1]	• Extend the red snapper endorsement system through the remainder of 1996 and, if necessary, through 1997, in order to give the Council time to develop a permanent limited access system	• Continue permit limitations to avoid open access to red snapper by all commercially permitted vessels
1997 Effective 1/15/97	Amendment 12[1]	• NMFS disapproved proposed provisions to cancel the automatic comm. red snapper size limit increases to 15 inches total length in 1996 and 16 inches total length in 1998	• Minimum size limit increase assumes a 33 % discard mortality rate, a rate thought to be too high.
1997 Effective 10/6/97	Regulatory amendment[1]	• Change start of fall season from 9/15 to 9/2 • Fall season first 15 days of each month until the quota is filled. • Change the recreational red snapper allocation to a quota • RA close recreational fishery in EEZ when landings projected to exceed its allocation	• Earlier opening of the season avoids bad weather and Labor Day weekend conflicts with anglers • Helps extend the season • Quota will better control angler harvest • Quota allows for quicker action by RA to close the fishery when needed
1997 Effective 1/1/98	Regulatory amendment[1]	• Cancel planned increase in the red snapper minimum size limit to 16 inches TL	• Gains to the fishery from size limit increase offset by decreases in yield per recruit
1998 Effective 1/29/98	Amendment 15[1]	• Establish a permanent two-tier red snapper license limitation system (Class 1 and Class 2) • The comm. season was split in two, with two thirds of the quota allocated to a February 1 opening and the remaining quota to a September 1 opening.	• Without transferability, the previous system was a closed-access system • Spread out landings over a longer period of time and give fishermen more options about when to fish
1998 1/98	Regulatory amendment[1]	• Maintain 9.12 mp TAC • Zero bag limit for the captain and crew of for-hire recreational vessels (not implemented)	• Rebuilding projected to continue to 20% SPR with current TAC • Zero bag limit for captain and crew projected to extend recreational season 1-2 weeks

Year	Rule-making Vehicle	Action	Rationale
1998 Effective 10/1/99	Regulatory amendment[1]	• 6 mp TAC, with release of all or part of the remaining 3.12 mp contingent upon the capability of BRDs to achieve better than a 50 percent reduction in juvenile red snapper shrimp trawl mortality • Reduce the bag limit to 4 fish and zero fish for captain and crew of for-hire vessels • Set the opening date of the rec fishing season to March 1 • Reduce the minimum size limit for red snapper to 14 inches total length for both directed fisheries • Change the opening of the fall fishing season from the first 15 days to the first 10 days of each month beginning September 1	• A 1998 NMFS study suggested BRDs could achieve bycatch mortality reductions of Age-0 and Age-1 red snapper by over 60 percent • Reduce recreational catch to avoid quota closures • Close the recreational fishery during the least favorable months for fishing to reduce effort • Previous size limits were based on a release mortality of less than 33%. New information suggested release mortality of greater than 33%
1998 Effective: 6/29/99-12/26/99	Emergency rule[2]	• Reduce the recreational bag limit for red snapper from 5 to 4 fish per person • Reopen the recreational fishing season in January 1999	• Reduce recreational F to prevent the fishery from exceeding its quota
1999 Effective: 6/4/99-8/29/99	Interim rule[2]	• Increase the minimum size of recreationally caught red snapper to 18 inches • Close the recreational red snapper fishery in the EEZ on August 29, 1999	• Extend the recreational season by 2 weeks
1999 Effective 1/19/00-12/16/00	Interim rule[2]	• Change 2000 recreational season from April 24 to October 31 • Reinstate 4-fish bag limit for captain and crew • Reduce opening of spring commercial seasons from 15 to 10 days	• Allow for a fall recreational fishery • Allow flexibility for charter fishermen to manage their catch • Extend the spring commercial season
2000 Effective 8/2/00	Amendment 17[1]	• Extend the reef fish permit moratorium for another five years, from the existing expiration date of December 31, 2000 to December 31, 2005, unless replaced sooner by a comprehensive controlled access system.	• Provide a stable environment for the fishery • Prevent the fishery from further overcapitalization • Allow time for evaluation and development of a more comprehensive controlled access system
2000 Effective 9/18/00	Regulatory amendment[1]	• Maintain the TAC at 9.12 mp for the next two years • Increase the recreational minimum size limit from 15 inches to 16 inches TL • Set the red snapper recreational bag limit at 4 fish • Reinstate the for-hire captain and crew bag limit • Set the recreational red snapper season from April 15 to October 31, subject to revision by the RA to accommodate reinstating the bag limit for captain and crew • Set the commercial red snapper Spring season to open on February 1 and be open from noon on the 1st to noon on the 10th of each month until the Spring sub-quota is reached • Set the commercial red snapper Fall season to open on October 1 and be open from noon on the 1st to noon on the 10th of each month until the remaining	• Maintain stability in the fishery by maintaining TAC • Reduce the recreational F • Extend the recreational season • Extend the commercial season • Maintain price stability for the commercial fishery • Delay the fall season to increase red snapper prices • Allow more flexibility in assigning the commercial spring and fall quotas should TAC change

Year	Rule-making Vehicle	Action	Rationale
		commercial quota is reached • Retain the red snapper commercial minimum size limit at 15 inches TL • Allocate the red snapper commercial season sub-quota at 2/3 of the commercial quota, with the Fall season sub-quota as	
2003 Effective: 7/29/02	Amendment 20[1]	• Establish a 3-year moratorium on the issuance of any additional charter vessel/headboat permits for vessels fishing the EEZ of the Gulf of Mexico (Gulf) for Reef Fish or CMP fishes • Allow permits (except those issued to historical captains) to be transferable to other persons • Require vessel captains or vessel owners to participate in data collection surveys as a permit condition.	• Cap effort in the for-hire fishery
2005 Effective: 7/5/05	Amendment 22[1]	• Establish status determination criteria and biological reference points • Establish red snapper rebuilding plan • Establish additional reef fish bycatch reporting methodologies	• Bring the red snapper fishery into compliance with requirements added to the MSFCMA through the SFA • Establish a schedule for rebuilding the overfished 1red snapper stock meets MSFCMA requirements • Document and reduce red snapper bycatch
2005 Effective: 8/17/05	Amendment 24[1]	• Extend the commercial reef fish permit moratorium indefinitely from the existing expiration date of December 31, 2005, unless replaced by a comprehensive controlled access system.	• Provide a stable environment for the fishery • Prevent the fishery from further overcapitalization • Allow time for evaluation and development of a more comprehensive controlled access system
2006	Amendment 25[1]	• Extend the recreational for-hire reef fish permit moratorium indefinitely from the expiration date of June 16, 2006 and create a limited access system.	• Cap effort in the for-hire fishery
2006 Effective: 1/1/07	Amendment 26[1]	• Establish an individual fishing quota program for the commercial red snapper fishery	• Reduce overcapacity in the commercial red snapper fishery • Eliminate, to the extent possible, the problems associated with derby fishing
2007 effective 5/2/07	Interim Rule	• Reduced catch quota to 6.5 mp (commercial 3.315 mp and recreational 3.185 mp) (effective 5/2/07) • Reduced recreational bag limit from 4 to 2 fish, and prohibits captain and crew on for hire vessels from retaining the recreational bag limit. (effective 5/2/07) • Reduced size limit for commercial from 15" to 13" TL (Effective 4/2/07) • Established a target for the reduction of red snapper bycatch mortality in the shrimp fishery (effective 5/2/07)	•

Year	Rule-making Vehicle	Action	Rationale
2008 effective 2/28/08	Amendment 27/14	• Requires non-stainless steel circle hooks with use of natural baits, dehooking device required to dislodge hooks from reef fish, and venting tools required for deflating the swim bladders.(effective 6/1/08) • Size limits: recreational = 16", commercial = 13" (effective 2/28/08) • Recreational bag limit 2 fish, prohibits captain and crew on for hire vessels from retaining the recreational bag limit. (effective 2/28/08) • Recreational season June 1- September 30 (effective 2/28/08) • Established a target for the reduction of red snapper bycatch mortality in the shrimp fishery (effective 2/28/08)	• Decrease release mortality of reef fish • The June 1- September 30 recreational season was shortened to 65 days based on a projected quota overage and inconsistent state regulations.

[1]Copies of the FMP/amendment can be obtained from the Gulf of Mexico Fishery Management Council, 2203 N. Lois Ave., Tampa, FL 33607
[2]Copies of the rule can be obtained from the Southeast Regional Office, 263 13th Avenue South, St. Petersburg, FL 33701

APPENDIX C

FREQUENCY TABLES

Table 30 Distribution of respondents by gender.

GENDER OF RESPONDENTS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	MALE	133	87.5	89.3	89.3
	FEMALE	16	10.5	10.7	100.0
	Total	149	98.0	100.0	
Missing	System	3	2.0		
Total		152	100.0		

Table 31 Distribution of respondents by age and gender.

AGE CATEGORY (years)	Male		Female		Total	
	N	%	N	%	N	%
<20	0	0.00	0	0.00	0	0.00
20-29	26	20.16	2	12.50	28	19.31
30-39	30	23.26	4	25.00	34	23.45
40-49	40	31.01	6	37.50	46	31.72
50-59	20	15.50	1	6.25	21	14.48
>60	13	10.08	3	18.75	16	11.03
Total	129	100.00	16	100.00	145	100.00

Table 32 Distribution of respondents by frequency of fishing lakes.

RESPONDENTS WHO FREQUENTLY FISHED LAKES

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	63	41.4	42.9	42.9
	NO	84	55.3	57.1	100.0
	Total	147	96.7	100.0	
Missing	System	5	3.3		
Total		152	100.0		

Table 33 Distribution of respondents by frequency of fishing rivers.

RESPONDENTS WHO FREQUENTLY FISHED RIVERS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	11	7.2	7.5	7.5
	NO	136	89.5	92.5	100.0
	Total	147	96.7	100.0	
Missing	System	5	3.3		
Total		152	100.0		

Table 34 Distribution of respondents by frequency of fishing bays.

RESPONDENTS WHO FREQUENTLY FISHED BAYS

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	33	21.7	22.4	22.4
	NO	114	75.0	77.6	100.0
	Total	147	96.7	100.0	
Missing	System	5	3.3		
Total		152	100.0		

Table 35 Distribution of respondents by frequency of fishing offshore.

RESPONDENTS WHO FREQUENTLY FISHED OFFSHORE

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	84	55.3	57.1	57.1
	NO	63	41.4	42.9	100.0
	Total	147	96.7	100.0	
Missing	System	5	3.3		
Total		152	100.0		

Table 36 Distribution of respondents who were targeting mahi mahi.

RESPONDENTS WHO WERE TARGETING MAHIMAHI

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	8	5.3	7.5	7.5
	NO	99	65.1	92.5	100.0
	Total	107	70.4	100.0	
Missing	System	45	29.6		
Total		152	100.0		

Table 37 Distribution of respondents who were targeting king mackerel.

RESPONDENTS WHO WERE TARGETING KING MACKEREL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	15	9.9	14.0	14.0
	NO	92	60.5	86.0	100.0
	Total	107	70.4	100.0	
Missing	System	45	29.6		
Total		152	100.0		

Table 38 Distribution of respondents who were targeting red snapper.

RESPONDENTS WHO WERE TARGETING RED SNAPPER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	99	65.1	92.5	92.5
	NO	8	5.3	7.5	100.0
	Total	107	70.4	100.0	
Missing	System	45	29.6		
Total		152	100.0		

Table 39 Distribution of respondents who were targeting amberjack.

RESPONDENTS WHO WERE TARGETING AMBERJACK

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	5	3.3	4.7	4.7
	NO	102	67.1	95.3	100.0
	Total	107	70.4	100.0	
Missing	System	45	29.6		
Total		152	100.0		

Table 40 Distribution of respondents who were targeting ling.

RESPONDENTS WHO WERE TARGETING LING

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	10	6.6	9.3	9.3
	NO	97	63.8	90.7	100.0
	Total	107	70.4	100.0	
Missing	System	45	29.6		
Total		152	100.0		

Table 41 Distribution of respondents who were targeting other species.

RESPONDENTS WHO WERE TARGING "OTHER" FISH

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	YES	5	3.3	4.7	4.7
	NO	102	67.1	95.3	100.0
	Total	107	70.4	100.0	
Missing	System	45	29.6		
Total		152	100.0		

Table 42 Distribution of respondents' knowledge of the average age of a red snapper.

RESPONDENTS' KNOWLEDGE OF AVERAGE AGE OF RED SNAPPER

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-10	43	28.3	35.5	35.5
	11-20	36	23.7	29.8	65.3
	21-30	19	12.5	15.7	81.0
	31-40	7	4.6	5.8	86.8
	41-50	3	2.0	2.5	89.3
	51-60	12	7.9	9.9	99.2
	91-100	1	.7	.8	100.0
	Total	121	79.6	100.0	
Missing	System	31	20.4		
Total		152	100.0		

Table 43 Distribution of responses that were correct for knowledge of average red snapper life span.

RESPONDENTS' KNOWLEDGE OF RED SNAPPER LIFE SPAN AS 41-60 YRS OLD

		Frequency	Percent	Valid Percent	Cumulative Percent
Knew Red Snapper Life Span?	YES	15	9.9	9.9	9.9
	NO	137	90.1	90.1	100.0
	Total	152	100.0	100.0	

Table 44 Distribution of the largest red snapper ever caught by respondents.

LARGEST RED SNAPPER EVER CAUGHT (IN LBS)

SIZE (IN LBS)		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	4	1	.7	.7	.7
	5	3	2.0	2.1	2.8
	6	2	1.3	1.4	4.3
	7	2	1.3	1.4	5.7
	8	9	5.9	6.4	12.1
	9	8	5.3	5.7	17.7
	10	15	9.9	10.6	28.4
	11	1	.7	.7	29.1
	12	7	4.6	5.0	34.0
	14	6	3.9	4.3	38.3
	15	6	3.9	4.3	42.6
	16	3	2.0	2.1	44.7
	17	4	2.6	2.8	47.5
	18	9	5.9	6.4	53.9
	19	1	.7	.7	54.6
	20	11	7.2	7.8	62.4
	21	4	2.6	2.8	65.2
	22	2	1.3	1.4	66.7
	23	3	2.0	2.1	68.8
	24	2	1.3	1.4	70.2
	25	9	5.9	6.4	76.6
	26	1	.7	.7	77.3

Table 44 Continued.

LARGEST RED SNAPPER EVER CAUGHT (IN LBS)

SIZE (IN LBS)		Frequency	Percent	Valid Percent	Cumulative Percent
27		2	1.3	1.4	78.7
28		3	2.0	2.1	80.9
29		1	.7	.7	81.6
30		7	4.6	5.0	86.5
31		1	.7	.7	87.2
32		6	3.9	4.3	91.5
33		1	.7	.7	92.2
34		4	2.6	2.8	95.0
35		1	.7	.7	95.7
36		1	.7	.7	96.5
37		1	.7	.7	97.2
40		2	1.3	1.4	98.6
62		1	.7	.7	99.3
67		1	.7	.7	100.0
Total		141	92.8	100.0	
Missing	System	11	7.2		
Total		152	100.0		

APPENDIX D

RESPONDENT ZIP CODES

Table 45 Distribution of anglers by 3-digit zip code, city, and county.

3-DIGIT	CITY	COUNTY	COUNT	PERCENT
775	NORTH HOUSTON	HARRIS	29	19.33
770	HOUSTON	HARRIS	24	16.00
773	NORTH HOUSTON	HARRIS	20	13.33
774	NORTH HOUSTON	HARRIS	13	8.67
750	NORTH TEXAS	DALLAS	9	6.00
760	FT WORTH	DENTON	6	4.00
776	BEAUMONT	JEFFERSON	5	3.33
783	CORPUS CHRISTI	NUECES	5	3.33
730	OKLAHOMA CITY (OK)	OKLAHOMA	4	2.67
751	DALLAS	DALLAS	4	2.67
757	EAST TEXAS	HENDERSON	3	2.00
761	FT WORTH	TARRANT	3	2.00
762	FT WORTH	DENTON	3	2.00
711	SHREVEPORT (LA)	CADDO	2	1.33
731	OKLAHOMA CITY (OK)	OKLAHOMA	2	1.33
754	NORTH TEXAS	HUNT	2	1.33
765	WACO	MCLENNAN	2	1.33

Table 45 Continued.

3-DIGIT	**CITY**	**COUNTY**	**COUNT**	**PERCENT**
778	BRYAN	BRAZOS	2	1.33
740	TULSA (OK)	TULSA	1	0.67
746	PONCA CITY (OK)	KAY	1	0.67
747	DURANT (OK)	CHOCTAW	1	0.67
763	WICHITA FALLS	WICHITA	1	0.67
777	BEAUMONT	JEFFERSON	1	0.67
779	VICTORIA	VICTORIA	1	0.67
782	SAN ANTONIO	BEXAR	1	0.67
786	AUSTIN	WILLIAMSON	1	0.67
788	SAN ANTONIO	REAL	1	0.67
864	KINGMAN (AZ)	MOHAVE	1	0.67
870	ALBUQUERQUE (NM)	BERNALILLO	1	0.67
920	SAN DIEGO (CA)	SAN DIEGO	1	0.67
Total			150	**100.00**

*** 3-Digit code information from the USPS 3-Digit ZIP Code Prefix Matrix**

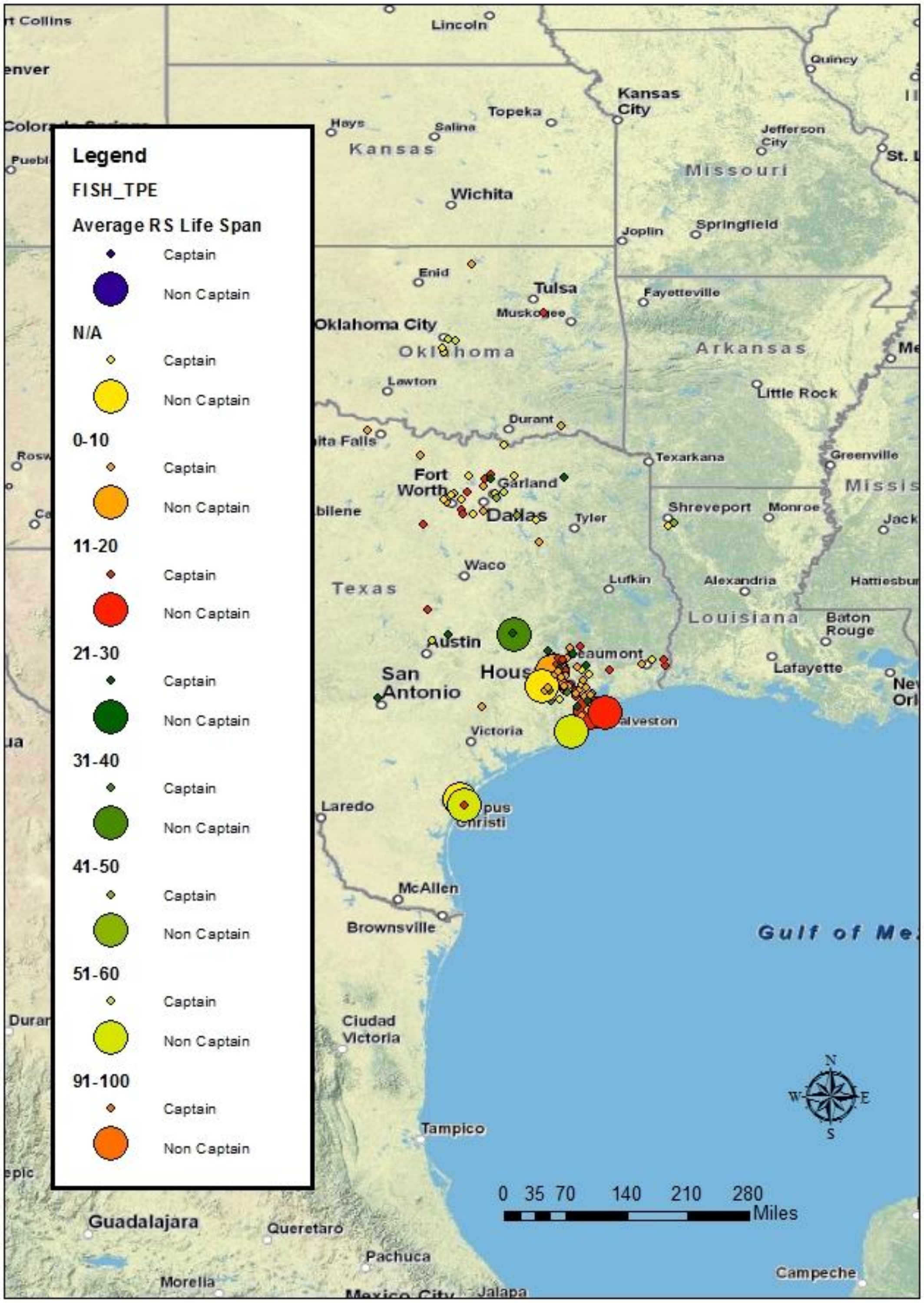

Figure 17 Distribution of captain and non-captain anglers by zip code and knowledge of average life span of red snapper.

APPENDIX E

SUPPLEMENTAL CROSS-TABULATIONS

Table 46 Percentage of offshore fishers that knew the federal bag limit.

Crosstab

			OFFSHORE FISHER		
			YES	NO	Total
Knowledge of Federal Bag Limit	YES	Count	78	48	126
		% within OFFSHORE	94.0%	76.2%	86.3%
	NO	Count	5	15	20
		% within OFFSHORE	6.0%	23.8%	13.7%
Total		Count	83	63	146
		% within OFFSHORE	100.0%	100.0%	100.0%

Table 47 Percentage of offshore fishers that knew the federal season.

Crosstab

			OFFSHORE FISHER		
			YES	NO	Total
Knowledge of Federal Season	YES	Count	72	43	115
		% within OFFSHORE	86.7%	68.3%	78.8%
	NO	Count	11	20	31
		% within OFFSHORE	13.3%	31.7%	21.2%
Total		Count	83	63	146
		% within OFFSHORE	100.0%	100.0%	100.0%

Table 48 Percentage of bay fishers that knew the federal bag limit.

Crosstab

			BAY FISHER		
			YES	NO	Total
Knowledge of Federal Bag Limit	YES	Count	31	95	126
		% within BAY	96.9%	83.3%	86.3%
	NO	Count	1	19	20
		% within BAY	3.1%	16.7%	13.7%
Total		Count	32	114	146
		% within BAY	100.0%	100.0%	100.0%

Table 49 Percentage of bay fishers that knew the federal season.

Crosstab

			BAY FISHER		
			YES	NO	Total
Knowledge of Federal Season	YES	Count	29	86	115
		% within BAY	90.6%	75.4%	78.8%
	NO	Count	3	28	31
		% within BAY	9.4%	24.6%	21.2%
Total		Count	32	114	146
		% within BAY	100.0%	100.0%	100.0%

Table 50 Percentage of coastal residents that knew the federal bag limit.

Crosstab

			LIVES IN A COASTAL COUNTY		
			YES	NO	Total
Knowledge of Federal Bag Limit	YES	Count	85	42	127
		% within COASTAL	89.5%	80.8%	86.4%
	NO	Count	10	10	20
		% within COASTAL	10.5%	19.2%	13.6%
Total		Count	95	52	147
		% within COASTAL	100.0%	100.0%	100.0%

Table 51 Percentage of coastal residents that knew the federal season.

Crosstab

			LIVES IN A COASTAL COUNTY		
			YES	NO	Total
Knowledge of Federal Season	YES	Count	82	34	116
		% within COASTAL	86.3%	65.4%	78.9%
	NO	Count	13	18	31
		% within COASTAL	13.7%	34.6%	21.1%
Total		Count	95	52	147
		% within COASTAL	100.0%	100.0%	100.0%

Table 52 Percentage of boat owners that knew the state bag limit.

Crosstab

			BOAT_OWNER		Total
			YES	NO	
Knowledge of State Bag Limit	YES	Count	49	38	87
		% within BOAT_OWN	68.1%	51.4%	59.6%
	NO	Count	23	36	59
		% within BOAT_OWN	31.9%	48.6%	40.4%
Total		Count	72	74	146
		% within BOAT_OWN	100.0%	100.0%	100.0%

Table 53 Percentage of offshore fishers that knew the state bag limit.

Crosstab

			OFFSHORE FISHER		Total
			YES	NO	
Knowledge of State Bag Limit	YES	Count	58	28	86
		% within OFFSHORE	70.7%	44.4%	59.3%
	NO	Count	24	35	59
		% within OFFSHORE	29.3%	55.6%	40.7%
Total		Count	82	63	145
		% within OFFSHORE	100.0%	100.0%	100.0%

Table 54 Percentage of coastal residents that knew the state bag limit.

Crosstab

			LIVES IN A COASTAL COUNTY		
			YES	NO	Total
Knowledge of State Bag Limit	YES	Count	61	26	87
		% within COASTAL	64.9%	50.0%	59.6%
	NO	Count	33	26	59
		% within COASTAL	35.1%	50.0%	40.4%
Total		Count	94	52	146
		% within COASTAL	100.0%	100.0%	100.0%

APPENDIX F

PEARSON'S PRODUCT-MOMENT CORRELATION MATRIX

Table 55 Correlations matrix for first set of independent and dependent variables.

Correlations																	
		FISH_TPE	TARGET	MAHI MAHI	KG_MACK	RED SNAPP	AMBR JACK	LING	LAKES	RIVERS	BAY	OFF SHORE	BOAT_OWN	BAGLM_ST	BAGLM_FD	SEASN_ST	SEASN_FD
FISH_TPE	Pearson Correlation	1	-.029	-.131	-.062	-.056	.044	.063	.179*	-.026	.081	-.234**	-.272**	-.219**	-.106	-.185*	-.137
	Sig. (2-tailed)		.730	.178	.524	.567	.655	.517	.030	.756	.332	.004	.001	.007	.200	.024	.095
	N	152	142	107	107	107	107	107	147	147	147	147	147	148	149	149	149
TARGET	Pearson Correlation	-.029	1	.048	.069	.382**	.038	.055	-.158	-.061	-.012	.232**	.126	.130	.165	.112	.179*
	Sig. (2-tailed)	.730		.621	.483	.000	.701	.577	.062	.477	.888	.006	.138	.127	.050	.187	.033
	N	142	142	107	107	107	107	107	140	140	140	140	140	140	141	141	141
MAHI MAHI	Pearson Correlation	-.131	.048	1	.397**	.081	.442**	.397**	-.067	-.071	.043	.131	.041	-.026	.090	.075	.120
	Sig. (2-tailed)	.178	.621		.000	.408	.000	.000	.495	.469	.663	.183	.680	.791	.356	.447	.219
	N	107	107	107	107	107	107	107	105	105	105	105	105	105	106	106	106
KG_MACK	Pearson Correlation	-.062	.069	.397**	1	-.090	.166	.425**	-.119	.109	-.019	.264**	.172	.019	.133	.166	.102
	Sig. (2-tailed)	.524	.483	.000		.357	.088	.000	.228	.268	.849	.006	.080	.846	.175	.089	.297
	N	107	107	107	107	107	107	107	105	105	105	105	105	105	106	106	106

Table 55, continued.

Correlations																	
		FISH_ TPE	TAR GET	MAHI MAHI	KG_ MACK	RED SNAPP	AMBR JACK	LING	LAKES	RIVERS	BAY	OFF SHORE	BOAT _OWN	BAGLM _ST	BAGLM _FD	SEASN _ST	SEASN _FD
RED SNAPP	Pearson Correlation	-.056	.382**	.081	-.090	1	.063	.091	-.053	.077	.065	-.004	-.075	.070	-.097	.188	.156
	Sig. (2-tailed)	.567	.000	.408	.357		.520	.350	.592	.436	.508	.972	.450	.475	.321	.053	.110
	N	107	107	107	107	107	107	107	105	105	105	105	105	105	106	106	106
AMBR JACK	Pearson Correlation	.044	.038	.442**	.166	.063	1	.385**	-.166	-.053	.255**	.054	.002	-.049	.067	-.030	.090
	Sig. (2-tailed)	.655	.701	.000	.088	.520		.000	.091	.590	.009	.587	.985	.621	.493	.758	.361
	N	107	107	107	107	107	107	107	105	105	105	105	105	105	106	106	106
LING	Pearson Correlation	.063	.055	.397**	.425**	.091	.385**	1	-.204*	.173	.064	.188	-.099	-.040	.104	.056	.138
	Sig. (2-tailed)	.517	.577	.000	.000	.350	.000		.037	.077	.520	.055	.314	.685	.290	.567	.159
	N	107	107	107	107	107	107	107	105	105	105	105	105	105	106	106	106
LAKES	Pearson Correlation	.179*	-.158	-.067	-.119	-.053	-.166	-.204*	1	.224**	-.235**	-.639**	-.030	-.294**	-.216**	-.181*	-.156
	Sig. (2-tailed)	.030	.062	.495	.228	.592	.091	.037		.006	.004	.000	.723	.000	.009	.029	.060
	N	147	140	105	105	105	105	105	147	147	147	147	146	145	146	146	146
RIVERS	Pearson Correlation	-.026	-.061	-.071	.109	.077	-.053	.173	.224**	1	.281**	.090	.030	-.028	.038	-.001	.021
	Sig. (2-tailed)	.756	.477	.469	.268	.436	.590	.077	.006		.001	.281	.720	.740	.647	.986	.799
	N	147	140	105	105	105	105	105	147	147	147	147	146	145	146	146	146

Table 55, continued.

Correlations																	
		FISH_ TPE	TAR GET	MAHI MAHI	KG_ MACK	RED SNAPP	AMBR JACK	LING	LAKES	RIVERS	BAY	OFF SHORE	BOAT _OWN	BAGLM _ST	BAGLM _FD	SEASN_ ST	SEASN _FD
BAY	Pearson Correlation	.081	-.012	.043	-.019	.065	.255**	.064	-.235**	.281**	1	.038	.007	.035	.163*	.049	.154
	Sig. (2-tailed)	.332	.888	.663	.849	.508	.009	.520	.004	.001		.651	.931	.680	.049	.559	.064
	N	147	140	105	105	105	105	105	147	147	147	147	146	145	146	146	146
OFF SHORE	Pearson Correlation	-.234**	.232**	.131	.264**	-.004	.054	.188	-.639**	.090	.038	1	.113	.265**	.256**	.181*	.224**
	Sig. (2-tailed)	.004	.006	.183	.006	.972	.587	.055	.000	.281	.651		.176	.001	.002	.029	.007
	N	147	140	105	105	105	105	105	147	147	147	147	146	145	146	146	146
BOAT_ OWN	Pearson Correlation	-.272**	.126	.041	.172	-.075	.002	-.099	-.030	.030	.007	.113	1	.170*	.077	.158	.180*
	Sig. (2-tailed)	.001	.138	.680	.080	.450	.985	.314	.723	.720	.931	.176		.040	.356	.056	.029
	N	147	140	105	105	105	105	105	146	146	146	146	147	146	147	147	147
BAGLM_ ST	Pearson Correlation	-.219**	.130	-.026	.019	.070	-.049	-.040	-.294**	-.028	.035	.265**	.170*	1	.163*	.519**	.191*
	Sig. (2-tailed)	.007	.127	.791	.846	.475	.621	.685	.000	.740	.680	.001	.040		.048	.000	.020
	N	148	140	105	105	105	105	105	145	145	145	145	146	148	148	148	148
BAGLM_ FD	Pearson Correlation	-.106	.165	.090	.133	-.097	.067	.104	-.216**	.038	.163*	.256**	.077	.163*	1	.164*	.477**
	Sig. (2-tailed)	.200	.050	.356	.175	.321	.493	.290	.009	.647	.049	.002	.356	.048		.045	.000
	N	149	141	106	106	106	106	106	146	146	146	146	147	148	149	149	149

Table 55, continued.

Correlations		FISH_TPE	TARGET	MAHIMAHI	KG_MACK	REDSNAPP	AMBRJACK	LING	LAKES	RIVERS	BAY	OFFSHORE	BOAT_OWN	BAGLM_ST	BAGLM_FD	SEASN_ST	SEASN_FD
SEASN_ST	Pearson Correlation	-.185*	.112	.075	.166	.188	-.030	.056	-.181*	-.001	.049	.181*	.158	.519**	.164*	1	.375**
	Sig. (2-tailed)	.024	.187	.447	.089	.053	.758	.567	.029	.986	.559	.029	.056	.000	.045		.000
	N	149	141	106	106	106	106	106	146	146	146	146	147	148	149	149	149
SEASN_FD	Pearson Correlation	-.137	.179*	.120	.102	.156	.090	.138	-.156	.021	.154	.224**	.180*	.191*	.477**	.375**	1
	Sig. (2-tailed)	.095	.033	.219	.297	.110	.361	.159	.060	.799	.064	.007	.029	.020	.000	.000	
	N	149	141	106	106	106	106	106	146	146	146	146	147	148	149	149	149
KNOW_LS	Pearson Correlation	-.067	-.067	.153	.055	-.153	.081	.007	-.019	-.010	-.020	.110	-.044	.027	-.076	.056	-.118
	Sig. (2-tailed)	.414	.429	.116	.571	.116	.407	.941	.815	.900	.812	.184	.595	.741	.359	.500	.151
	N	152	142	107	107	107	107	107	147	147	147	147	147	148	149	149	149
SPRT_SCI	Pearson Correlation	.485**	-.224*	-.114	-.051	-.140	.013	-.024	.072	.030	.148	-.145	-.195*	-.202*	-.082	-.129	-.217*
	Sig. (2-tailed)	.000	.021	.324	.659	.224	.909	.836	.455	.756	.123	.131	.041	.035	.397	.181	.022
	N	111	105	77	77	77	77	77	110	110	110	110	110	109	110	110	110
STK_IMPV	Pearson Correlation	-.139	.012	.088	-.017	.068	-.020	-.029	.083	-.071	-.172	.180	-.009	-.165	-.180	-.158	-.090
	Sig. (2-tailed)	.197	.918	.485	.894	.588	.875	.820	.443	.516	.112	.095	.931	.128	.093	.141	.403
	N	88	81	65	65	65	65	65	87	87	87	87	88	87	88	88	88

Table 55, continued.

Correlations																	
		FISH_ TPE	TAR GET	MAHI MAHI	KG_ MACK	RED SNAPP	AMBR JACK	LING	LAKES	RIVERS	BAY	OFF SHORE	BOAT _OWN	BAGLM _ST	BAGLM _FD	SEASN_ ST	SEASN _FD
OV_SATIS	Pearson Correlation	-.055	-.054	-.133	-.062	-.071	-.227*	.066	.183*	.051	.097	-.183*	-.152	-.183*	-.092	-.117	-.118
	Sig. (2-tailed)	.528	.544	.200	.550	.491	.027	.522	.036	.564	.272	.036	.082	.036	.293	.182	.177
	N	132	127	95	95	95	95	95	131	131	131	131	132	131	132	132	132
IKE_EFCT	Pearson Correlation	.010	-.097	-.012	-.102	-.103	.163	-.028	.027	.054	.058	-.005	.085	-.024	.109	-.082	.060
	Sig. (2-tailed)	.918	.305	.914	.342	.337	.128	.795	.775	.569	.538	.958	.371	.798	.249	.388	.524
	N	115	114	89	89	89	89	89	114	114	114	114	114	114	114	114	114
BAG_EFCT	Pearson Correlation	-.118	.240**	.133	-.054	.221*	.067	.066	-.059	.159	.140	.093	.109	.139	.047	.160	.135
	Sig. (2-tailed)	.175	.006	.200	.604	.031	.518	.525	.499	.069	.109	.289	.212	.112	.594	.065	.123
	N	133	127	95	95	95	95	95	132	132	132	132	133	132	133	133	133
ST_SATIS	Pearson Correlation	.109	.030	-.058	-.101	.040	-.014	.069	-.031	.048	-.076	.103	.064	.010	.132	.166	.133
	Sig. (2-tailed)	.209	.732	.577	.328	.700	.892	.505	.721	.585	.383	.238	.463	.907	.128	.055	.127
	N	135	129	96	96	96	96	96	134	134	134	134	134	133	134	134	134
FD_SATIS	Pearson Correlation	.238**	-.209*	-.093	-.217*	-.051	-.096	-.262**	.144	-.078	-.034	-.130	-.160	-.150	-.068	-.133	-.206*
	Sig. (2-tailed)	.006	.018	.365	.033	.618	.349	.009	.098	.371	.699	.135	.066	.087	.437	.126	.017
	N	134	128	97	97	97	97	97	133	133	133	133	133	132	133	133	133

Table 55, continued.

Correlations																	
		FISH_ TPE	TAR GET	MAHI MAHI	KG_ MACK	RED SNAPP	AMBR JACK	LING	LAKES	RIVERS	BAY	OFF SHORE	BOAT _OWN	BAGLM _ST	BAGLM _FD	SEASN_ ST	SEASN _FD
MIN_SIZE	Pearson Correlation	.225**	.025	-.250*	-.042	.014	-.213*	-.001	.204*	-.054	-.065	-.155	-.120	-.049	.098	-.029	-.034
	Sig. (2-tailed)	.007	.771	.012	.676	.889	.034	.991	.015	.526	.445	.067	.158	.569	.248	.738	.688
	N	141	135	100	100	100	100	100	140	140	140	140	140	139	140	140	140
MAX_SIZE	Pearson Correlation	.091	-.006	-.095	-.128	.170	-.033	-.048	.039	-.038	.034	-.048	-.035	.087	.115	.079	.155
	Sig. (2-tailed)	.306	.944	.365	.223	.104	.753	.647	.662	.666	.705	.587	.693	.328	.197	.378	.080
	N	129	123	92	92	92	92	92	128	128	128	128	128	127	128	128	128
DLY_BAG	Pearson Correlation	.030	-.038	.087	.124	-.081	.068	.098	-.027	.079	.081	.027	.118	.222**	.202*	.092	.214*
	Sig. (2-tailed)	.730	.668	.390	.219	.424	.504	.331	.756	.360	.348	.756	.168	.009	.018	.287	.012
	N	138	132	100	100	100	100	100	137	137	137	137	137	136	137	137	137
TPHY_TAG	Pearson Correlation	-.114	.095	-.123	.002	-.049	-.060	-.005	-.088	-.054	-.010	.049	.154	.047	.019	.119	.152
	Sig. (2-tailed)	.205	.301	.247	.982	.648	.576	.960	.328	.553	.914	.584	.085	.600	.837	.186	.089
	N	126	120	90	90	90	90	90	125	125	125	125	126	125	126	126	126
SEASN_CL	Pearson Correlation	.230**	-.050	-.126	.043	.057	-.129	-.097	-.046	.000	.097	-.009	-.037	.133	.155	.080	.196*
	Sig. (2-tailed)	.009	.580	.234	.683	.593	.222	.362	.610	1.000	.276	.919	.678	.137	.081	.369	.027
	N	130	124	91	91	91	91	91	128	128	128	128	128	127	128	128	128

Table 55, continued.

Correlations																	
		FISH_ TPE	TAR GET	MAHI MAHI	KG_ MACK	RED SNAPP	AMBR JACK	LING	LAKES	RIVERS	BAY	OFF SHORE	BOAT _OWN	BAGLM _ST	BAGLM _FD	SEASN _ST	SEASN_ FD
FSHRY_CL	Pearson Correlation	.021	-.115	-.044	-.095	.064	-.021	-.186	.062	.078	.003	-.216*	.052	.137	-.050	.098	-.004
	Sig. (2-tailed)	.821	.221	.683	.377	.551	.848	.080	.499	.393	.977	.017	.571	.137	.583	.283	.967
	N	122	116	89	89	89	89	89	121	121	121	121	121	120	121	121	121
GENDER	Pearson Correlation	-.093	.187*	.086	.122	.042	.067	.097	-.181*	.017	.085	.137	.039	.070	.117	-.001	-.072
	Sig. (2-tailed)	.259	.026	.378	.209	.668	.492	.319	.029	.838	.309	.099	.640	.397	.157	.989	.383
	N	149	142	107	107	107	107	107	146	146	146	146	146	147	148	148	148
COASTAL	Pearson Correlation	-.151	.179*	.118	.218*	.188	.151	.219*	-.215**	.051	.166*	.157	.215**	.145	.121	.086	.245**
	Sig. (2-tailed)	.065	.034	.227	.024	.053	.120	.023	.009	.540	.046	.060	.010	.080	.143	.300	.003
	N	150	141	107	107	107	107	107	145	145	145	145	145	146	147	147	147
AGE	Pearson Correlation	.067	-.017	.068	.046	-.140	.037	-.010	.091	-.104	-.164	-.165	-.100	-.092	-.072	-.157	-.167*
	Sig. (2-tailed)	.423	.847	.492	.645	.160	.710	.917	.282	.219	.051	.050	.235	.271	.390	.060	.045
	N	145	138	103	103	103	103	103	142	142	142	142	143	144	145	145	145
GRADE	Pearson Correlation	-.215**	.042	.082	-.062	.076	.015	-.033	.089	.046	-.007	-.073	.164	-.069	-.124	.007	.045
	Sig. (2-tailed)	.009	.627	.407	.529	.440	.882	.741	.289	.587	.932	.387	.050	.408	.137	.934	.593
	N	146	139	104	104	104	104	104	143	143	143	143	144	145	146	146	146

Table 56 Correlations matrix for second set of independent and dependent variables.

Correlations																	
		KNOW_LS	SPRT_SCI	STK_IMPV	OV_SATIS	IKE_EFCT	BAG_EFCT	ST_SATIS	FD_SATIS	MIN_SIZE	MAX_SIZE	DLY_BAG	TPHY_TAG	SEASN_CL	FSHRY_CL	GENDER	COASTAL
FISH_TPE	Pearson Correlation	-.067	.485**	-.139	-.055	.010	-.118	.109	.238**	.225**	.091	.030	-.114	.230**	.021	-.093	-.151
	Sig. (2-tailed)	.414	.000	.197	.528	.918	.175	.209	.006	.007	.306	.730	.205	.009	.821	.259	.065
	N	152	111	88	132	115	133	135	134	141	129	138	126	130	122	149	150
TARGET	Pearson Correlation	-.067	-.224*	.012	-.054	-.097	.240**	.030	-.209*	.025	-.006	-.038	.095	-.050	-.115	.187*	.179*
	Sig. (2-tailed)	.429	.021	.918	.544	.305	.006	.732	.018	.771	.944	.668	.301	.580	.221	.026	.034
	N	142	105	81	127	114	127	129	128	135	123	132	120	124	116	142	141
MAHIMAHI	Pearson Correlation	.153	-.114	.088	-.133	-.012	.133	-.058	-.093	-.250*	-.095	.087	-.123	-.126	-.044	.086	.118
	Sig. (2-tailed)	.116	.324	.485	.200	.914	.200	.577	.365	.012	.365	.390	.247	.234	.683	.378	.227
	N	107	77	65	95	89	95	96	97	100	92	100	90	91	89	107	107
KG_MACK	Pearson Correlation	.055	-.051	-.017	-.062	-.102	-.054	-.101	-.217*	-.042	-.128	.124	.002	.043	-.095	.122	.218*
	Sig. (2-tailed)	.571	.659	.894	.550	.342	.604	.328	.033	.676	.223	.219	.982	.683	.377	.209	.024
	N	107	77	65	95	89	95	96	97	100	92	100	90	91	89	107	107
REDSNAPP	Pearson Correlation	-.153	-.140	.068	-.071	-.103	.221*	.040	-.051	.014	.170	-.081	-.049	.057	.064	.042	.188
	Sig. (2-tailed)	.116	.224	.588	.491	.337	.031	.700	.618	.889	.104	.424	.648	.593	.551	.668	.053
	N	107	77	65	95	89	95	96	97	100	92	100	90	91	89	107	107
AMBRJACK	Pearson Correlation	.081	.013	-.020	-.227*	.163	.067	-.014	-.096	-.213*	-.033	.068	-.060	-.129	-.021	.067	.151
	Sig. (2-tailed)	.407	.909	.875	.027	.128	.518	.892	.349	.034	.753	.504	.576	.222	.848	.492	.120
	N	107	77	65	95	89	95	96	97	100	92	100	90	91	89	107	107

Table 56, continued.

Correlations																	
		KNOW_LS	SPRT_SCI	STK_IMPV	OV_SATIS	IKE_EFCT	BAG_EFCT	ST_SATIS	FD_SATIS	MIN_SIZE	MAX_SIZE	DLY_BAG	TPHY_TAG	SEASN_CL	FSHRY_CL	GENDER	COASTAL
LING	Pearson Correlation	.007	-.024	-.029	.066	-.028	.066	.069	-.262**	-.001	-.048	.098	-.005	-.097	-.186	.097	.219*
	Sig. (2-tailed)	.941	.836	.820	.522	.795	.525	.505	.009	.991	.647	.331	.960	.362	.080	.319	.023
	N	107	77	65	95	89	95	96	97	100	92	100	90	91	89	107	107
LAKES	Pearson Correlation	-.019	.072	.083	.183*	.027	-.059	-.031	.144	.204*	.039	-.027	-.088	-.046	.062	-.181*	-.215**
	Sig. (2-tailed)	.815	.455	.443	.036	.775	.499	.721	.098	.015	.662	.756	.328	.610	.499	.029	.009
	N	147	110	87	131	114	132	134	133	140	128	137	125	128	121	146	145
RIVERS	Pearson Correlation	-.010	.030	-.071	.051	.054	.159	.048	-.078	-.054	-.038	.079	-.054	.000	.078	.017	.051
	Sig. (2-tailed)	.900	.756	.516	.564	.569	.069	.585	.371	.526	.666	.360	.553	1.000	.393	.838	.540
	N	147	110	87	131	114	132	134	133	140	128	137	125	128	121	146	145
BAY	Pearson Correlation	-.020	.148	-.172	.097	.058	.140	-.076	-.034	-.065	.034	.081	-.010	.097	.003	.085	.166*
	Sig. (2-tailed)	.812	.123	.112	.272	.538	.109	.383	.699	.445	.705	.348	.914	.276	.977	.309	.046
	N	147	110	87	131	114	132	134	133	140	128	137	125	128	121	146	145
OFFSHORE	Pearson Correlation	.110	-.145	.180	-.183*	-.005	.093	.103	-.130	-.155	-.048	.027	.049	-.009	-.216*	.137	.157
	Sig. (2-tailed)	.184	.131	.095	.036	.958	.289	.238	.135	.067	.587	.756	.584	.919	.017	.099	.060
	N	147	110	87	131	114	132	134	133	140	128	137	125	128	121	146	145
BOAT_OWN	Pearson Correlation	-.044	-.195*	-.009	-.152	.085	.109	.064	-.160	-.120	-.035	.118	.154	-.037	.052	.039	.215**
	Sig. (2-tailed)	.595	.041	.931	.082	.371	.212	.463	.066	.158	.693	.168	.085	.678	.571	.640	.010
	N	147	110	88	132	114	133	134	133	140	128	137	126	128	121	146	145

Table 56, continued.

Correlations																	
		KNOW_LS	SPRT_SCI	STK_IMPV	OV_SATIS	IKE_EFCT	BAG_EFCT	ST_SATIS	FD_SATIS	MIN_SIZE	MAX_SIZE	DLY_BAG	TPHY_TAG	SEASN_CL	FSHRY_CL	GENDER	COASTAL
BAGLM_ST	Pearson Correlation	.027	-.202*	-.165	-.183*	-.024	.139	.010	-.150	-.049	.087	.222**	.047	.133	.137	.070	.145
	Sig. (2-tailed)	.741	.035	.128	.036	.798	.112	.907	.087	.569	.328	.009	.600	.137	.137	.397	.080
	N	148	109	87	131	114	132	133	132	139	127	136	125	127	120	147	146
BAGLM_FD	Pearson Correlation	-.076	-.082	-.180	-.092	.109	.047	.132	-.068	.098	.115	.202*	.019	.155	-.050	.117	.121
	Sig. (2-tailed)	.359	.397	.093	.293	.249	.594	.128	.437	.248	.197	.018	.837	.081	.583	.157	.143
	N	149	110	88	132	114	133	134	133	140	128	137	126	128	121	148	147
SEASN_ST	Pearson Correlation	.056	-.129	-.158	-.117	-.082	.160	.166	-.133	-.029	.079	.092	.119	.080	.098	-.001	.086
	Sig. (2-tailed)	.500	.181	.141	.182	.388	.065	.055	.126	.738	.378	.287	.186	.369	.283	.989	.300
	N	149	110	88	132	114	133	134	133	140	128	137	126	128	121	148	147
SEASN_FD	Pearson Correlation	-.118	-.217*	-.090	-.118	.060	.135	.133	-.206*	-.034	.155	.214*	.152	.196*	-.004	-.072	.245**
	Sig. (2-tailed)	.151	.022	.403	.177	.524	.123	.127	.017	.688	.080	.012	.089	.027	.967	.383	.003
	N	149	110	88	132	114	133	134	133	140	128	137	126	128	121	148	147
KNOW_LS	Pearson Correlation	1	.028	.166	.072	-.154	-.153	-.032	.116	-.015	-.065	-.101	.037	.064	.051	-.028	-.224**
	Sig. (2-tailed)		.773	.123	.411	.101	.078	.708	.183	.859	.461	.237	.681	.470	.574	.734	.006
	N	152	111	88	132	115	133	135	134	141	129	138	126	130	122	149	150
SPRT_SCI	Pearson Correlation	.028	1	-.071	-.106	.183	-.305**	.163	.454**	.274**	.025	.136	.091	.289**	.258*	.071	-.086
	Sig. (2-tailed)	.773		.564	.294	.085	.002	.099	.000	.005	.806	.165	.367	.004	.011	.463	.375
	N	111	111	69	99	89	100	103	103	106	97	106	100	100	96	110	109

Table 56, continued.

Correlations																	
		KNOW_LS	SPRT_SCI	STK_IMPV	OV_SATIS	IKE_EFCT	BAG_EFCT	ST_SATIS	FD_SATIS	MIN_SIZE	MAX_SIZE	DLY_BAG	TPHY_TAG	SEASN_CL	FSHRY_CL	GENDER	COASTAL
STK_IMPV	Pearson Correlation	.166	-.071	1	.084	.045	-.172	-.031	.229*	.046	-.067	.039	.125	.060	-.014	.136	-.005
	Sig. (2-tailed)	.123	.564		.466	.708	.118	.786	.040	.676	.550	.728	.287	.600	.904	.207	.963
	N	88	69	88	77	71	84	81	81	84	81	81	74	80	75	87	86
OV_SATIS	Pearson Correlation	.072	-.106	.084	1	-.047	-.121	-.090	.116	.034	.046	-.056	.086	.058	-.217*	-.078	-.097
	Sig. (2-tailed)	.411	.294	.466		.637	.188	.328	.205	.708	.624	.531	.364	.536	.023	.373	.271
	N	132	99	77	132	104	120	121	121	127	115	126	114	118	110	132	131
IKE_EFCT	Pearson Correlation	-.154	.183	.045	-.047	1	.013	-.051	.012	-.092	.024	.144	.007	.147	.089	-.099	.194*
	Sig. (2-tailed)	.101	.085	.708	.637		.893	.606	.906	.338	.808	.138	.946	.137	.386	.291	.038
	N	115	89	71	104	115	109	106	105	110	102	108	101	104	97	115	114
BAG_EFCT	Pearson Correlation	-.153	-.305**	-.172	-.121	.013	1	-.069	-.510**	-.177*	.053	-.040	-.176	-.207*	-.055	.032	.172*
	Sig. (2-tailed)	.078	.002	.118	.188	.893		.450	.000	.045	.563	.655	.058	.024	.567	.714	.049
	N	133	100	84	120	109	133	122	121	129	120	125	116	119	111	133	132
ST_SATIS	Pearson Correlation	-.032	.163	-.031	-.090	-.051	-.069	1	.352**	.109	.082	.175*	.143	.252**	.007	-.031	.004
	Sig. (2-tailed)	.708	.099	.786	.328	.606	.450		.000	.215	.376	.049	.125	.005	.941	.721	.960
	N	135	103	81	121	106	122	135	125	130	119	127	117	120	113	135	134
FD_SATIS	Pearson Correlation	.116	.454**	.229*	.116	.012	-.510**	.352**	1	.162	.199*	.024	.131	.384**	.174	-.019	-.199*
	Sig. (2-tailed)	.183	.000	.040	.205	.906	.000	.000		.067	.030	.788	.162	.000	.064	.829	.021
	N	134	103	81	121	105	121	125	134	129	119	127	115	118	114	134	134

Table 56, continued.

Correlations		KNOW_ LS	SPRT_ SCI	STK_ IMPV	OV_ SATIS	IKE_ EFCT	BAG_ EFCT	ST_ SATIS	FD_ SATIS	MIN_ SIZE	MAX_ SIZE	DLY_ BAG	TPHY_ TAG	SEASN _CL	FSHRY _CL	GEN DER	COAS TAL
MIN_SIZE	Pearson Correlation	-.015	.274**	.046	.034	-.092	-.177*	.109	.162	1	.119	.063	.089	.161	.096	-.070	-.095
	Sig. (2-tailed)	.859	.005	.676	.708	.338	.045	.215	.067		.185	.467	.324	.072	.298	.410	.267
	N	141	106	84	127	110	129	130	129	141	126	135	124	126	120	141	140
MAX_SIZE	Pearson Correlation	-.065	.025	-.067	.046	.024	.053	.082	.199*	.119	1	.109	.246**	.195*	.027	-.099	.075
	Sig. (2-tailed)	.461	.806	.550	.624	.808	.563	.376	.030	.185		.232	.008	.036	.785	.265	.396
	N	129	97	81	115	102	120	119	119	126	129	123	114	117	108	129	129
DLY_BAG	Pearson Correlation	-.101	.136	.039	-.056	.144	-.040	.175*	.024	.063	.109	1	.132	.213*	.156	.073	.147
	Sig. (2-tailed)	.237	.165	.728	.531	.138	.655	.049	.788	.467	.232		.148	.018	.091	.392	.087
	N	138	106	81	126	108	125	127	127	135	123	138	122	124	119	138	137
TPHY_TAG	Pearson Correlation	.037	.091	.125	.086	.007	-.176	.143	.131	.089	.246**	.132	1	.120	.189	-.042	.123
	Sig. (2-tailed)	.681	.367	.287	.364	.946	.058	.125	.162	.324	.008	.148		.204	.052	.641	.173
	N	126	100	74	114	101	116	117	115	124	114	122	126	114	107	126	125
SEASN_CL	Pearson Correlation	.064	.289**	.060	.058	.147	-.207*	.252**	.384**	.161	.195*	.213*	.120	1	.246**	-.096	-.019
	Sig. (2-tailed)	.470	.004	.600	.536	.137	.024	.005	.000	.072	.036	.018	.204		.010	.277	.830
	N	130	100	80	118	104	119	120	118	126	117	124	114	130	110	129	129
FSHRY_CL	Pearson Correlation	.051	.258*	-.014	-.217*	.089	-.055	.007	.174	.096	.027	.156	.189	.246**	1	.019	-.166
	Sig. (2-tailed)	.574	.011	.904	.023	.386	.567	.941	.064	.298	.785	.091	.052	.010		.840	.069
	N	122	96	75	110	97	111	113	114	120	108	119	107	110	122	122	121

Table 56, continued.

Correlations																	
		KNOW_LS	SPRT_SCI	STK_IMPV	OV_SATIS	IKE_EFCT	BAG_EFCT	ST_SATIS	FD_SATIS	MIN_SIZE	MAX_SIZE	DLY_BAG	TPHY_TAG	SEASN_CL	FSHRY_CL	GENDER	COASTAL
GENDER	Pearson Correlation	-.028	.071	.136	-.078	-.099	.032	-.031	-.019	-.070	-.099	.073	-.042	-.096	.019	1	.017
	Sig. (2-tailed)	.734	.463	.207	.373	.291	.714	.721	.829	.410	.265	.392	.641	.277	.840		.835
	N	149	110	87	132	115	133	135	134	141	129	138	126	129	122	149	148
COASTAL	Pearson Correlation	-.224**	-.086	-.005	-.097	.194*	.172*	.004	-.199*	-.095	.075	.147	.123	-.019	-.166	.017	1
	Sig. (2-tailed)	.006	.375	.963	.271	.038	.049	.960	.021	.267	.396	.087	.173	.830	.069	.835	
	N	150	109	86	131	114	132	134	134	140	129	137	125	129	121	148	150
AGE	Pearson Correlation	.146	.265**	-.042	-.099	-.113	-.048	.045	.233**	.088	.006	-.052	.011	.097	.002	.076	-.155
	Sig. (2-tailed)	.079	.006	.700	.265	.234	.588	.606	.008	.309	.946	.547	.906	.284	.980	.366	.063
	N	145	106	86	129	112	131	131	130	137	125	134	123	125	119	145	144
GRADE	Pearson Correlation	-.058	-.113	.068	.000	-.046	.108	.057	-.018	-.187*	.011	-.036	-.167	-.042	-.131	.110	.034
	Sig. (2-tailed)	.487	.247	.536	.997	.631	.217	.513	.842	.028	.901	.675	.064	.638	.155	.188	.684
	N	146	107	85	130	112	131	133	131	138	126	135	124	126	119	146	145

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

VITA

Sarah A. Norman received her Bachelor of Arts degree in biology with minors in marine science and English from Wittenberg University in 2008. She entered the Marine Resources Management program at Texas A&M University in August 2009. Her research interests include human dimensions, fisheries, and ecosystem based management. She plans to pursue a career working in human dimensions to achieve sustainable natural resources management.

Ms. Norman may be reached at Texas A&M University at Galveston, Department of Marine Sciences, c/o Dr. W.M. von Zharen, P.O. Box 1675, Galveston, TX, 77553. Her email is sarah.a.norman@gmail.com.