

**The Debate between Federal and State Agencies on Recreational Red Snapper
Fisheries Management in the Gulf of Mexico**

by

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Abstract

Red snapper is a pelagic species and one of the most popular recreational species in the GOM (Gulf of Mexico). The population of red snapper in the GOM has been in an overfished condition since 1988. In recent years, the federal government has been decreasing the number of open season days as well as bag limits to promote conservation. The recreational red snapper season in federal waters of the GOM was only 9 days in 2014 compared to 46 days in 2013, which led the Alabama state government to argue that the federal government underestimated stock population. Alabama favored a longer season to promote economic growth. Thus there is a controversy in the management of red snapper in the GOM, with government agencies using different approaches to achieve different goals. For this study, secondary data from papers, documents and government policies is analyzed to provide background information on recreational red snapper management and to describe the management systems used in the GOM. In addition, through conducting interviews with federal and state agency administrators and scientists whose research is related to red snapper, the current debate between federal and state levels can be placed into three areas: allocation of annual red snapper harvest pounds among commercial recreation boats and individual recreational anglers, recreational limit measures (total length, bag limit, season length) and state water boundary (3 or 9 miles). Policy recommendations are made for federal and state agencies for future recreational red snapper management.

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List of Abbreviations

EEZ	Exclusive Economic Zone
FMP	Fisheries Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
GSMFC	Gulf State Marine Fisheries Commission
MRD	Alabama Marine Resource Division
MRIP	Marine Recreational Information Program
NOAA	National Oceanic and Atmospheric Administration
SEAMAP	Southeast Area Monitoring and Assessment Program
SEDAR	Southeast Data, Assessment, and Review
SEFSC	Southeast Region Science Centre
TAC	Total Allowable Catch or Total Allowance Catch

Chapter 1. Introduction

1.1 Fishery in Gulf of Mexico

The Gulf of Mexico (GOM) is located at the southeastern corner of North America and is bordered by the states of Florida, Alabama, Mississippi, Louisiana, and Texas, as well as the Mexican states of Tamaulipas, Veracruz, Tabasco, Campeche, Yucatán, and the northernmost tip of Quintana Roo. The fisheries of the GOM may be one of the most pivotal resources in the economic world of the southeastern US because it can provide food and jobs to local people (McCrea-Strub et al. 2011). For example, in 2012, NOAA Fisheries conducted a Gulf of Mexico Regional Summary and stated commercial fish harvest was 1.7 billion pounds of finfish and shellfish, bringing \$763 million in landings revenue. This regional summary found that the seafood industry generated \$461 million in sales impacts in Alabama, \$1.9 billion in Louisiana, \$377 million in Mississippi, \$2.5 billion in Texas, and \$17 billion in Florida. The GOM recreational fishery impact is large with over 3.1 million recreational anglers taking over 23 million fishing trips in 2012. Over 91% of these anglers were residents of regional coastal counties (NOAA Fisheries 2012). Recreational fishing not only brings joy to anglers, it also generates economic impacts at the state level (employment, sales, and income) through fishing trip expenditures and equipment purchases (NOAA Fisheries 2011). Overall total recreational fishing trip and equipment expenditures in GOM states were \$10 billion in 2012 (NOAA Fisheries 2012).

1.2 Recreational Red Snapper in the GOM

Several key species are especially important to the GOM fishery, such as the Atlantic croaker, sand/silver seatrout, red drum and red snapper. Red snapper, *Lutjanus campechanus*, is one of the most economically important fisheries in the GOM and supports commercial and recreational fisheries. Red snapper is a reef-associated marine species that can grow up to 40 inches long and weigh as much as 50 pounds (SEDAR 2005, 2009; Fischer 2007). This species matures as early as two years at a length of approximately 39 cm (15 inch), has high fecundity, and may live for over 50 years (Gallaway et al. 2009). This species inhabits water ranging from 10-190 m deep, usually in the 30-130 m range. Red snapper are common in the Gulf of Mexico and eastern Atlantic coast (Froese and Pauly 2013) and can extend northward as far as Massachusetts. Small red snapper spend time in shallow water with sand or muddy bottoms and as they grow tend to move to deeper rocky sea floor areas.

Red snapper have been harvested from the GOM since the 1840s. The price of red snapper is higher than any other snapper species (Huang et al. 1995), which makes them attractive to the commercial sector. However, the status of red snapper was declared to be overfished by the National Marine Fisheries Service in 1988 through the first red snapper stock assessment and fishery management to restore stocks to sustainable levels was required.

When one thinks about red snapper management, one should understand the necessity for recreational and commercial management needs. Recreational fishing has a long history dating back to the 16th and 17th centuries. There is also an increasing commercial landing value (Pitcher and Hollingworth 2008; Coleman et al. 2004). Recreational fisheries create value through the landing of fish as a food, but can also create value through development of a fishing tourism industry. From the 2013 economic report of fisheries (American Sportfishing Association 2013), the total landings of all recreational species was about 0.2 billion pounds, while the commercial sector was about 8.5 billion pounds. However,

recreational anglers' spending generated \$70 billion in sales, supported 0.4 million jobs with \$20 billion in income. The commercial sector created \$2 billion in sales, brought 0.3 million jobs with only \$9 billion in income (Table 1).

Until recently, fisheries managers did not pay much attention to recreational fisheries (Schroeder and Love. 2002; National Research Council 2002). Seventy-one percent of marine fisheries in the U.S. had shown an increasing proportion of total harvest from the recreational sector (Ihde et al. 2011). As red snapper is one of the most valuable fisheries in the GOM (Goodyear 1995), management strategies for recreational red snapper are a topic of interest to all commercial and recreational fishers as well as managers and policy makers.

1.3 Basic Fisheries Management Steps

Even though it is hard to develop a perfect red snapper fisheries management plan, there are several basic steps (Figure 1). A good fisheries management plan should be supported by scientifically-sound information on the red snapper population. The first step for red snapper management agencies is to describe the current status of red snapper. There should be several goals and objectives focusing on what are to be achieved through fisheries management. With detailed and specific objectives, decision-makers can design and implement a focused fisheries management strategy toward red snapper sustainability. Continuous monitoring and evaluation of the effects of implemented management strategies feed back to the original planning and helps to modify the current goals and objectives. As a whole, it is a complex process with many tasks needing to be considered by the fisheries manager.

1.4 Objectives and Methods

Since recreational and commercial fishing are big business in the GOM, it comes as no surprise that federal and state agencies may have different management approaches based on different interests. However, red snapper is a very tasty fish and its value has attracted both commercial and recreational fishermen. Compared to commercial red snapper, recreational

red snapper can not only create economic value, but also social value. Each GOM state would like to obtain maximum benefits in catching more red snapper with longer open season lengths, but the federal government has been decreasing the number of open season days in recent years. The current controversy in recreational red snapper management seems to be based on federally proposed restricted rules in favor of fish species conservation and the state sponsors of less restrictive management to promote economic activity. Even with additional literature on the new management approaches toward red snapper recreational fisheries management, it is still important to research this debate and propose suggestions for finding a balance between recreational and commercial demands for red snapper. The purpose of this thesis is to contribute to this debate.

Objective 1: Describe basic information on the red snapper fisheries in the Gulf of Mexico.

Task 1.1. Using various sources, describe basic information on the importance of the GOM red snapper fishery.

Task 1.2. Describe the importance of recreational red snapper in the GOM in social and economic terms.

Task 1.3. Provide basic information on fisheries management for the following analyses.

Method: Review literature and federal/state reports.

Objective 2: Describe recreational red snapper management and the roles of different agencies in the Gulf of Mexico.

Task 2.1. Describe the roles of federal/regional/interstate/state agencies relative to recreational red snapper management in the GOM.

Task 2.2. Describe the current red snapper management system in the GOM.

Method: Analyze secondary data through documents, policy and official websites.

Objective 3: Describe recreational red snapper fisheries management in the GOM.

Task 3.1. Address stock assessment methods that are used by policy-makers to predict

red snapper status for managing recreational red snapper in the federal and state agencies.

Task 3.2. Analyze current management strategies.

Task 3.3. Using various sources, focusing on governmental documents, policies, describe the changes of recreational red snapper fisheries management in the Gulf of Mexico.

Method: Review and analyze secondary data.

Objective 4: *Describe and evaluate reasons behind differences in federal and state approaches to managing red snapper in the GOM.*

Task 4.1. Summarize the current debate by stating the kinds of conflicts federal and state agencies have in this issue.

Task 4.2. From the debate analysis, discuss the reasons behind the controversy.

Method: Secondary data from newspaper and online statements will be collected and interviews with fisheries managers from federal and state agencies will be conducted for background understanding of the issue. Interviews will be conducted with officers from federal agencies, state agencies and scientists whose work is related to red snapper. The question outline will be sent to the interviewee before the interview and developed notes will be sent to the interviewee afterwards to check for mistakes, misunderstandings and/or missing points. All the interviewees will be asked to sign the informed consent letter approved by the IRB at Auburn University. Interviewee names and titles will not be shown in the research findings. Interviews will provide background information and understanding of red snapper management in the GOM. Notes from interviews used in this thesis will be anonymously cited simply as an officer from a federal or state agency or from a scientist in this field.

Objective 5: *State conclusions drawn from the prior objectives and provide suggestions for*

improving recreational red snapper management in Alabama and Federal waters.

Task 5.1. Develop the reasoning behind the state and federal positions on recreational red snapper management.

Task 5.2. Provide suggestions for future recreational red snapper management for federal and state agencies.

Chapter 2. Agencies Involved in Recreational Red Snapper Management in the GOM

According to The Technical Guidelines (Food and Agriculture Organization 1997), the fisheries management institutions should have two basic components: the fisheries management authority and the interested parties. For this thesis, the management authority is the main focus. The term fishery manager does not refer to one person but includes the larger management authority, including technical experts, scientists, administrative units, and so on. It could be a national or provincial ministry or an agency that could be governmental, parastatal or private (Cochrane 2002). For a better understanding of recreational red snapper fisheries management in the GOM, it is essential to define what constitutes the management authority in this area.

2.1 Federal Authority in the GOM

The National Oceanic and Atmospheric Administration (NOAA), within the Department of Commerce, is the federal agency responsible for fisheries management. NOAA Fisheries, formally known as the National Marine Fisheries Service (NMFS), was founded in 1871. NOAA Fisheries is responsible for stewardship of the nation's ocean resources and their habitat within the United States Exclusive Economic Zone (3 to 200 mile offshore) (NOAA Website http://www.nmfs.noaa.gov/aboutus/our_mission.html). They work closely with their partners, the Regional Fishery Management Council and Interstate Marine Fisheries Commissions to accomplish the responsibly of management, conservation, and protection of fisheries resources.

NOAA Fisheries is the direct descendant of the U.S. Commission of Fish and Fisheries, the nation's first federal conservation agency. NOAA Fisheries administers its research and management responsibilities at regional science centers located in five regions throughout the United States. Alabama is covered by the Southeast Region that is located in Miami, Florida. The Southeast Region Science Center (SEFSC) conducts various programs to provide data support for federal and regional red snapper management. NOAA Fisheries also has six regional science centers and Alabama is covered by the Southeast Fisheries Science Center. There are three divisions in this center: Fisheries Statistics Division (divided into the Fisheries Sampling Branch and the Fisheries Monitoring Branch), Protected Resources Division (includes Marine Protected Areas, Coral Reef Ecosystems, Habitat Restoration, Biological Research and Fishery-independent assessments), and Sustainable Fisheries Division (to determine the abundance and distribution of marine resources). Since 1979, the Southeast Regions Science Center conducted the Marine Recreational Fisheries Survey (MRFSS) to estimate the impact on marine species from recreational fishing.

NOAA Fisheries also have eight programs: Sustainable Fisheries; Science and Technology; Protected Resources (conserve, protect and recover endangered species); Habitat Conservation; International Affairs (manage fisheries beyond national jurisdiction); Law Enforcement (Enforce Law); Aquaculture (work on marine aquaculture) and Seafood Inspection (keep product safe). All the programs work with each other to ensure fisheries management. In terms of recreational red snapper management in the GOM, the Sustainable Fisheries and Science Program is much more important than others. Sustainable Fisheries is a headquarters program whose work is mainly to (Sustainable Fisheries website <http://www.nmfs.noaa.gov/sfa>):

- Coordinate preparation of an annual report to Congress on the status of U.S. fisheries

- Develop guidance about economic and social impacts of management programs and assessments of regulatory processes
- Coordinate regional offices and regional fishery management councils
- Oversee all document processing, such as proposed and final regulations

The Science and Technology branch can provide statistical data information from fishermen about when, where, how and how many fish are caught through fishing surveys and a newly created program called Marine Recreational Information Program (MRIP) (Science and Technology <http://www.st.nmfs.noaa.gov/recreational-fisheries/index>). This program plays a very important role in recreational fisheries management since it can collect information on angler's catch and effort (number of trips). Better data is a foundation for better fisheries management. Catch per trip can be estimated through in-person intercepts that require NOAA Fisheries and state agencies working together to interview anglers about their trip and catch. Furthermore, NOAA Fisheries conducts telephone interviews with charter boat and headboat captains to get information about their fishing effort and catch. The total catch is calculated by multiplying catch per effort (catch per trip) by the amount of effort (number of trips).

2.2 Regional Fishery Management Councils

Under the Magnuson-Steven Act, NOAA Fisheries works with Regional Fishery Management Councils to assess and predict the status of fish stocks, set catch limits, ensure compliance with fisheries regulations, and reduce bycatch. Alabama is under the Gulf of Mexico Fishery Management Council (GMFMC) which is one of eight regional Fishery Management Councils and manages fisheries resource in the Gulf region (GMFMC website). In accordance with the requirements of the Act, the Council shall:

- prepare/submit plans to the Secretary of Commerce ;
- review Fisheries Management Plans (FMPs) on a continuing basis;

- comment on foreign fishing applications;
- comment on FMPs prepared by the Secretary;
- prepare reports to the Secretary;
- determine the statement of its organization, practices, and procedures (SOPPs);
and
- conduct other appropriate activities in federal waters.

The GMFMC has a total of 17 voting members and four nonvoting members, appointed for three-year terms with a maximum of three consecutive terms. Eleven voting members shall be nominated by the state governors and appointed by the Secretary of Commerce. The remaining six voting members include the Southeast Regional Administrator of NMFS (or his designee), and directors of the five Gulf state marine resource management agencies (or their designees) (GMFMC SOPPs 2012). There are also four nonvoting members representing the U.S. Coast Guard, U.S. Fish and Wildlife Service, Department of State, and the Gulf State Marine Fisheries Commission (Figure 2). There are four representatives from recreational sector and four from commercial sector that appointed by the Secretary of Commerce for now. The Council meets five times every year. Public testimony is also heard during the meeting at which time final action is scheduled.

2.3 Interstate Authority

The Gulf State Marine Fisheries Commission (GSMFC) is an organization of the five states (Texas, Louisiana, Mississippi, Alabama and Florida), whose coastal waters are the Gulf of Mexico. This authority was established on July 16, 1949 at Mobile, Alabama. It aims at conservation, development and full utilization of shared coastal fisheries within the first three miles of the nation's coastline (<http://www.gsmfc.org/>). It has seven programs: Aquatic Nuisance Species Program; Fisheries Information Network; Habitat Program; Interjurisdictional Fishery Program; Oil Disaster Recovery Program; Southeast Area

Monitoring and Assessment Program; and Sport Fish Restoration Administrative Program. They have a Fisheries Information Network that is similar to the Science office in NOAA Fisheries, whose work is to collect and manage statistical data in the Gulf region. For the recreational sector, they coordinate with NOAA Fisheries in the conduct of the recreational information survey by providing additional information which can be combined with MRIP effort data using MRIP methodology. Furthermore, states also conduct their own telephone interview surveys to estimate fishing effort.

Fishery-independent data and information is collected by the Southeast Area Monitoring and Assessment Program, or SEAMAP using multiple surveys, including a shrimp survey and a reef fish survey. It is a program that requires state, federal and university personnel to work with each other and includes three components: SEAMAP-Gulf of Mexico, SEAMAP-South Atlantic and SEAMAP-Caribbean.

2.4 State Authority in the GOM

There are five states surrounding the GOM and Alabama was the selected state chosen for this in-depth study. The Alabama Marine Resource Division (MRD) manages Alabama's marine fisheries resources with assessment and monitoring, applied research, and enforcement programs in state waters (zero to three miles). They use several biological sampling tools (such as trawl sampling, gillnet sampling and shoreline sampling) to get recreational and commercial fisheries data. The data are analyzed and used to make recommendations for management regulations. A voluntary, no-cost angler registry license was implemented to obtain better catch and harvest data from people fishing in saltwater environments. MRD collects recreational fisheries data as required under a sub-award administered by the Gulf States Marine Fisheries Commission (Alabama Department of Conservation and Natural Resource 2011). They cooperate with the NMFS in near shore federal waters within the GOM and with other GOM state agencies to develop cooperative

fisheries management programs. Beyond this, MRD conducts Red Snapper Mandatory Reporting that require recreational vessels with red snapper on board to report vessel number, number of anglers, total harvest, and trip type mainly through a smartphone app (Alabama Marine Resource Division website <http://www.outdooralabama.com/red-snapper-data-and-mandatory-reporting-faqs>). Also, telephone and paper reports are available. In terms of organization, MRD offices are located at Dauphin Island and Gulf Shores, with one director, one chief enforcement officer and one captain.

2.5 Conclusion

As a whole, there are four large agencies involved in red snapper management in the GOM. NOAA Fisheries works with GMFMC to manage red snapper in federal waters. At the same time, GSMFC manages and conserves shared coastal fisheries in state waters in cooperation with state agencies (Figure 3).

2.5.1 Federal-State Jurisdiction

From what was stated above, we can know the lead authority for fisheries management in the GOM is determined by distance from the shore. Alabama has lead authority from the zero to three miles (4.8 km) off shore in the GOM. Meantime, the Gulf State Marine Fisheries Commission also plays a part in the fisheries management to deal with the overlap of multiple states jurisdictions. Federal government has lead authority from three to 200 miles (4.8 to 321.8 km) offshore what is called EEZ (Exclusive Economic Zone). However, red snapper is a marine fish where adults inhabit and are mainly caught in federal waters. In Figure 4, it is apparent that adults of red snapper live in federal waters. Red snapper are rarely caught in state waters. Thus, the fundamental reason why there is a debate between federal and state authorities on the management of red snapper is that recreational fishers come mainly from local communities and want to catch more red snapper in waters under

federal jurisdiction. Simply speaking, state fishermen want to catch more red snapper in federal waters where the federal agency sets a lot of regulations to limit their access. The detail of the regulations and reasons will be discussed in more detail in Chapter 5 (Conclusions and Suggestions).

2.5.2 Fisheries Management of Federal Waters in the GOM

Since red snapper are mainly caught in federal waters, it is necessary to know how federal agencies manage fishery populations in the GOM. As was stated above, from 3 to 200 miles from shore, NOAA Fisheries has lead authority. NOAA Fisheries have five regional offices, six science centers and also lots of laboratories around the U.S. They have different responsibilities and work with each other. The Southeast Region covers all the states along the Gulf. It was administered by NOAA Fisheries to manage fisheries in the GOM region. Additionally, the Southeast Fisheries Science Center conducts fisheries research and provides scientist support for fisheries management. The Gulf of Mexico Fishery Management Council develops management measures. NOAA Fisheries reviews all fishery management plans, evaluates the plans, and give advices for future plans. In addition, NOAA Fisheries implements and enforces fishery regulations recommended by the Gulf Council and approved by the Secretary of Commerce (Gulf of Mexico Fishery Management Council 2012).

Based on Figure 5, in terms of red snapper, the GMFMC should submit red snapper management plans to the Department of Commerce. During this process, NOAA Fisheries will review and give some advice on these Plans. The Department of Commerce will need several days to consider all these plans. Sometimes, the Department of Commerce disapproves the Plans so that the GMFMC has to modify and resubmit them. Once they approve red snapper management plans and public red snapper regulations, NOAA Fisheries will implement and enforce these regulations. The Southeast Regional Office manages red snapper in the GOM that is administered by NOAA Fisheries. Since data is the foundation

of red snapper management, the Southeast Fisheries Science Center provides data-support to Regional Office, also NOAA Fisheries.

Chapter 3. Recreational Red Snapper Management in the GOM

Red snapper supports the most important recreational and commercial offshore fishery in the GOM (Fishcher et al. 2007), which is closely associated with artificial habitats such as artificial reefs and oil drilling platforms (Szedlmayer and Lee 2004). The first complete description of the red snapper fishery was written by Carpenter (1965) who described the red snapper fishery through vessels used, fishing grounds, fishing methods, handling and production. The red snapper fishery has been in existence in the GOM since the 1840s (Hood et al. 2007) but may have started around 1850 off Pensacola, Florida (Carpenter 1965). After several years, the red snapper fishery expanded south into Tampa Bay, west into the Texas Lumps, and southwest to the Campeche Banks off Mexico (Camber 1955; Carpenter 1965). There were no reliable estimates of recreational red snapper harvest before 1981 (Hood et al. 2007). In this chapter, the status of red snapper, recreational management strategies and regulation changes in recreational red snapper management are presented.

The most important data resource to understand red snapper management is from the Southeast Data, Assessment, and Review (SEDAR) program which is under the management of the Caribbean, Gulf of Mexico, and South Atlantic Regional Fishery Management Councils, and also in coordination with NOAA Fisheries to estimate red snapper stock status in federal water in the GOM. SEDAR is a cooperative Fishery Management Council process started in 2002 to

improve the quality and reliability of fishery stock assessments in the South Atlantic, Gulf of Mexico, and US Caribbean. SEDAR was expanded in 2003 to do stock assessment for all three Fishery Management Councils in the Southeast Region (South Atlantic, Gulf of Mexico, and Caribbean). It is organized around three workshops, namely the data workshop, the assessment workshop and the review workshop (SEDAR 2005). SEDAR conducts different species stock assessment based on different regions in different years and names it using a continuous numbering system from one to 46. For the red snapper fishery in the GOM, data, stock assessment and management plans can be found mainly through SEDAR 07-Gulf of Mexico Red Snapper 2004, SEDAR 31-Gulf of Mexico Red Snapper 2012.

The other important data resources are the reef fish management plans. The original plan was initiated in 1984 through Amendment 27 and was proposed by GMFMC (Appendix 1). The NOAA Fisheries Service Red Snapper website can provides information, such as a red snapper historical overview and future management options. The Alabama Department of Conservation and Natural Resources-Marine Resources Division also offers a red snapper informational report from the state level perspective.

3.1 Status of Red Snapper

Describing the status of the red snapper fishery is the first step of management. Fishery managers use stock assessment analyses to estimate the red snapper population, which can provide useful information in the regulation of a fish stock (Cowan 2011). Through stock assessment, the current status of the red snapper stock can be described and it can be used in predicting the of the fish population.

A vast array of information on both fish population (fishery-dependent data) and biological data (fishery-independent data) are collected for a complete stock assessment. Fish population data are related to fishery management, e.g., the landing quantity removed, gears used to catch the fish and the type of fisherman. Biological data includes the size-age

structure of the species, fecundity, natural mortality and size-age distribution of the stock. Then, assessment models are used to estimate stock size by managers based on different reference points. Using fishery-dependent and fishery-independent information, the current fish population could be defined by managers. To achieve fishery management goals, managers must predict future stock size based on this assessment. It is impossible to know exactly how many fish are in the marine environment with the commercial and recreational activities occurring, but a reasonable range can be predicted to make effective regulations. Detailed red snapper stock assessment will be discussed in the next section.

3.1.1 Stock Assessment for Red Snapper

Stock assessment can provide red snapper fishery managers a technical basis for setting annual fishery harvest levels, such as allocation and catch limits, which should have reliable fisheries data and an appropriate stock model underlying them.

3.1.1.1 Data Resource. Stock assessment can rely on two primary data sources. The first one is fishery-dependent data. Data is gathered on the total amount of fish removed from the ocean and the level of fishing effort. Fishing effort is defined as “The amount of fishing gear of a specific type used on the fishing grounds over a given unit of time e.g. hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day” (CWP Handbook of Fishery Statistical Standards 2002). Additionally, it can be collected from the fishing trip itself and biological information. For the red snapper fishery, data is also gathered on fishing gear, bycatch and discards. Fishery-dependent data can be obtained from commercial and recreational fisheries in a number of ways, such as fishermen and dealer reports, observer programs, and broad surveys of the recreational sector. Recreational fishery data in the U.S. are gathered by the NOAA Fisheries, Marine Recreational Information Program (MRIP), providing recreational catch and effort via angler surveys.

The second source of data is fishery-independent. Data are collected by scientists conducting long term surveys (e.g., trawl surveys) like the Southeast Area Monitoring Assessment Program (SEAMAP). These data are not influenced by specific management measures, such as size and bag limits, season closure and mesh size in recreational management. When combined with fishery-dependent data, fishery-independent data provides fisheries managers a more accurate picture of a fish stock's status.

3.1.1.2 Assessment Models. There are several models, such as age-structured assessment program (ASAP), virtual population analysis (VPA), yield per recruit analysis (YPR), stock reduction analysis (SRA), and the CATCHEM model used by Southeast Data, Assessment, and Review (SEDAR) to estimate the red snapper's stock status in the GOM. Stock assessment models are very complex since different models have different input data and assumptions driving computer simulations. Below is the basic information about these models.

- a) Age Structured Assessment Program (ASAP) - this assessment can use forward computations to estimate population sizes with given observed catches, catch-at-age, and indices of abundance and typically are used by managers to help set levels of fishing mortality (F).
- b) Virtual Population Analysis (VPA) - this assessment work backwards, year by year to get annual estimates of cohort abundances and mortality rates. Sometimes, it is referred to as "cohort analysis."
- c) Stock Reduction Analysis (SRA) - this model runs very fast and can compute Maximum Sustainable Yield (MSY) reference points.
- d) CATCHEM - this model is in many ways a generalization of the ASAP approach. It can be used to simultaneously model multiple fleets and multiple stocks.

According to SEDAR 31 (2013) there is a new approach to red snapper stock assessment,

known as Stock Synthesis (Methot 2000) version 3.24p. It is an integrated catch-at-age model. It can be used for data weak situations to complex situations during biological and environmental processes. Detailed descriptions of Stock Synthesis are available at the NOAA Fisheries Toolbox website (<http://nft.nefsc.noaa.gov/>). Stock Synthesis is a highly flexible model using age and size structure data with multiple stock sub-areas. In red snapper stock assessment, landings, discards, age composition and indices of abundance were used as input data. Model results can provide information on catch trends, fishing mortality trends, stock abundance and biomass trends (SEDAR 2013).

3.1.2 Status Result from Stock Assessment

Under the Fishery Management Council's preferred definition (discussed in 3.2.1-f) for Maximum Fishing Mortality Threshold (MFMT), the current red snapper status in the GOM is not undergoing overfishing, but is overfished (SEDAR 2013). These results are based on different stock assessment models in Table 2. Red snapper managers can make recommendations for management strategies based on the results of stock assessment. In general, if a stock assessment indicates that a recreational fishery is at a healthy level, managers will increase catch limits and allow longer fishing seasons. Otherwise, managers will do the opposite, e.g., if a stock assessment indicates that a fishery is declining and management actions are needed. In the case of red snapper, the current management plan is to hold fishing effort in check in order to rebuild red snapper stocks by increasing spawning biomass. In short, red snapper stocks are considered to be overfished even though current fishing effort is being kept low to rebuild stocks.

3.2 Strategies for Red Snapper Management in the GOM

From stock assessment, management strategies for recreational red snapper can also be analyzed. Simply speaking, the goal of stock assessment is to estimate the size of a fish population. The population size is constantly changing and is determined by the growth,

recruitment and mortality of the fish species. Growth will occur when red snapper increases in length and weight. Red snapper may live for over 50 years and can grow up to 40 inches long and weigh as much as 50 pounds (SEDAR 2005, 2009; Fischer 2007; Gallaway et al. 2009). This species matures as early as two years and has a high fecundity (Gallaway et al. 2009). The number of fish born and survive to the juvenile stage is termed recruitment. Growth and recruitment will increase the population while mortality will decrease it. Mortality is the number fish lost from a fish population. It can be separated into fishing mortality and natural mortality. Fishing mortality (F) refers to fish deaths stemming from fishing activities. Natural mortality is the number of fish dying from all causes other than fishing. The detailed analysis will be stated in this part for a better understanding of red snapper management.

3.2.1 Red Snapper Management Reference Points and Management Criteria

When talking about fisheries management, certain basic reference points and management criteria should be understood, such as:

- a) Spawning Stock Biomass (SSB) - the stock population that is capable of reproducing. And when it is divided by the number of recruits to the stock, we use SSBR (spawning stock biomass per recruit). SSBR can also mean the spawning biomass an average recruit would be expected to produce.
- b) Spawning Potential Ratio (SPR) - an estimate of the reproductive potential of a fished stock relative to its unfished condition. The reference points generally used are $F_{x\%}$, where X was defined as the percent reduction of maximum spawning potential caused by fishing.

$$SPR = \frac{SSBR \text{ fished}}{SSBR \text{ unfished}} \quad (1)$$

- c) Maximum Sustainable Yield (MSY) - a level of harvest that a population can sustain over time. When we use F_{MSY} , it means the fishing rate that can maximize the yield of each individual in the population. Within the GMFMC, red snapper managers set F_{MSY} equal to $F_{26\%SPR}$ (GMFMC 2007).
- d) Optimum Yield (OY) - this is based on MSY, but will be reduced with economic, social or ecological factors. For red snapper, “It is any harvest level for each species which maintains, or is expected to maintain, over time a survival rate of biomass into the stock of spawning age to achieve at least a 20 percent spawning stock biomass per recruit (SSBR) population level relative to the SSBR that would occur with no fishing” (GMFMC 1989). The normally level used is 20 percent spawning potential ratio (20% SPR) after Amendment 3 in 1991 was initiated to determine OY (Appendix 1). For red snapper in the GOM, F_{OY} is equal to 75% of F_{MSY} (GMFMC 2007).
- e) Minimum Stock Size Threshold (MSST) - the minimum size of the stock that is required to produce MSY, the size under MSST is determined to be overfished. Applied to red snapper stock, this proxy is equal to $(1-M)*SSB_{MSY}$ with the estimation of $M=0.1$ (Shirripa and Legault, 1999).
- f) Maximum Fishing Mortality Threshold (MFMT) - the level of fishing mortality that if exceeded indicates overfishing of a stock is occurring. It is equal to F_{MSY} for red snapper (GMFMC 2007).

Based on these management criteria, fishery biologists can have a better understanding of how to determine the status of the red snapper fishery. The stock size below MSST is determined to overfish. If the level of fishing mortality is higher than MFMT, overfishing is occurring (Figure 6).

3.2.2 Current Recreational Red Snapper Management Strategies

The directed recreational fishery in the GOM has been managed with size limits, bag limits, and season closures (Coleman et al. 2004).

- a) Size limit - for recreational red snapper, minimum size limits are set which can protect small sized fish and allow juvenile fish to survive long enough to reproduce.
- b) Bag limit - a maximum number of fish allowed to be harvested per day to reduce harvest.
- c) Season closure - before 1997, the recreational red snapper fishery was mainly managed with size and bag limits (GMFMC. 2007). In 1997, recreational red snapper managers adapted the season closure strategy when the actual recreational harvests in pounds of fish exceeded the allocation amount.

3.3 Change in Regulations for Recreational Red Snapper Fisheries Management

Regulation of GOM red snapper began in 1984 (Cowan et al. 2010) with the implementation of the Reef Fish Fisheries Management Plan (Hood et al. 2007). Current recreational red snapper strategies include size limit, bag limit, and season closure. Also, managers allot 49 percent of the total allowance catch (TAC) to the recreational fishery in the GOM. In Table 3, an historical list of recreational red snapper management measures are presented. A complete history of management for recreational red snapper management can be found in Appendix 1. Currently, the recreational sector fishing for red snapper in the GOM is regulated by a 16-inch length minimum size and two fish/ person/day, and a limited season.

Recreational red snapper limit entry measures: the original rule for fish length was effective in 1984 with a 12-inch fork length, "...refers to the length of a fish measured from the tip of the snout to the end of the middle caudal fin rays" (Term: fork length definition 2004). Amendment 1 specified a new framework for setting a 13-inch total length, "...refers to the length of a fish measured from the tip of the snout to the tip of the longer

lobe of the caudal fin” (Term: total length definition 2004). It remained in effect for four years until 1995 when a new regulation changed this to a 14-inch total length. Meanwhile, the bag limit decreased from seven fish to five fish. Two years later (1997), the daily bag limit decreased to four fish. A further regulatory amendment in 2000 put in place the current 16-inch total length limit and the current two fish daily limit which has been in effect since 2008. Prior to 1996, the recreational fishing season for red snapper in the GOM was open year-round. Beginning in 1997, it was set for in-season closures. From 1998 to 2008, recreational red snapper fishing season was decreased in length. Even though the fishing season increased in length during 2009 and 2010, it has been shorter and shorter since 2011 despite the increasing quota for the recreational sector.

Figure 7 shows the changes in recreational allocation over the period from 1990 to 2013. It rapidly increased in 1990-1995 and was steady during the next 9 years, then dropped sharply after 2005 but has since climbed back up to historic highs in 2012. Regarding season length, it dropped from 356 days in 1996 to only 9 days in 2014. Figure 8 shows the rise in total length from 13-inch to 16-inch from 1994 to 2000 where it has remained stable after 2000 at the 16-inch level. However, the daily bag limit declined gradually from seven fish per day in 1994 to the current limit of two fish per day since 2008.

From this chapter, we can see the red snapper stock assessment is conducted by federal agencies and federal agencies have proposed specific strategies to rebuild the GOM red snapper population levels based on their assessment results. This can especially be seen by their actions in more recent years when managers have increased the limits through setting of higher minimum length, reducing the fish/person/day catch rate, and imposing a much shorter open season. Reducing the open season to 9 days in 2014 was the decision that has elevated the conflict to its present high level between federal and state agencies in how to manage the red snapper stock. According to the results from stock assessment, red snapper is not

undergoing overfishing but is overfished. Overfished means the size of current red snapper is below to the MSST. The current goal of NOAA Fisheries management is to rebuild stocks and thus allow a higher level of harvest in the future. To obtain this goal, the decision of reducing open season days was made to reduce fishing mortality in the short term. The next chapter will discuss this conflict in greater detail.

Chapter 4. Current Debate

In recent years, recreational anglers have had shorter red snapper fishing seasons. In 2014, local fishermen only had nine days to fish for red snapper in federal waters. Many local fishermen as well as political leaders and government officers from state agencies, have felt that the federal fisheries management system is not working. There is a debate on recreational red snapper management in the GOM. In this chapter, a description of the current conflicts between NOAA Fisheries and Alabama is presented in order to understand the issue. The debate on recreational red snapper management between NOAA Fisheries and Alabama could be put into three areas: allocation, recreational limit measures and state water boundary.

4.1 Allocation Controversy

The allocation controversy related to recreational red snapper fishery in the GOM can be divided into two parts: 1) the allocation of red snapper between commercial and recreational fishing, and 2) the allocation of red snapper within the recreational allocation.

4.1.1 Allocation Controversy Between Commercial and Recreational Sector

The current red snapper allocation between recreational and commercial fishing was established in the Reef Fish Amendment 1 in 1990 (Appendix 1). Amendment 1 set 51 percent for commercial fishermen and 49 percent for recreational for red snapper in the GOM based on the historical landing data from 1979 to 1987. However, the allocation did not change over the

years even though landings data has been changing. People may think it is not a conflict between NOAA Fisheries and the state level, but state agencies and political leaders have asked for an increase in the recreational allocation because of the huge value it brings into the state.

People from the commercial fishery have argued that, "...the data over the last five years shows that many years the commercial sector underharvested the red snapper resource, leaving hundreds of thousands of pounds of red snapper in the Gulf for the next year's season. Clearly that has had a positive impact on the abundance of red snapper that we are seeing today" (Archer 2013). With this argument, commercial fishermen would like to have a greater percent of the allocation than before. They believe that the commercial fishery can not only have a positive impact on the red snapper population, but also bring lots of red snapper to restaurants for public consumption instead of recreational fishermen catching red snapper for themselves.

Recreational fishermen also want to have more red fish to catch. They believe the recreational fishery has a greater economic value than the commercial sector. As Table 1 showed, recreational landings (205 million pounds) are about one twentieth of all commercial finfish species (8.5 billion pounds). However, the recreational fishery is shown to have brought in ten times more economic value than the commercial sector. The recreational fishery has a large multiplier effects on sales. Expenditures for people who would like to catch red snapper recreationally pay for gas, hotel, restaurant, fishing gears and other related industries that promote their economic impacts on local development.

For now, the Gulf of Mexico Fishery Management Council has proposed Amendment 28 to reallocate the quota between the commercial and recreational sectors, but it is still in the public hearing phase and may be voted on later this year. There are nine different alternatives in Amendment 28: alternative one states there should be no changes in

allocations and all the other alternatives propose increasing the recreational sector allocation. Implementation could take place in 2016.

4.1.2 Allocation Controversy in Recreational Sector

The allocation of recreational red snapper between for-hire boats and private anglers was established in 2015. As discussed in prior chapters, red snapper in the GOM is overfished and is under a rebuilding plan that goes another 17 years, until 2032. To manage the recreational red snapper sector, the GMFMC has submitted Amendment 40 to NOAA Fisheries. Amendment 40 heated up the debate as it separated the recreational red snapper allocation and season closure into two components, the “for-hire” charter boat sector and the private recreational sector. It was passed by a 10-7 vote in October, 2014 in Mobile, Alabama. Under Amendment 40, the red snapper season in the GOM’s federal waters will open at 12:01 a.m. June 1. The for-hire/charter sector will have 44 days with about 42 percent of the total allowable recreational catch. Private fishermen will be allowed 10 days and have 58 percent of the recreational red snapper quota. Amendment 40 was proposed mainly to allow federal for-hire vessels to have more opportunities for catching red snapper in federal water since for-hire vessels cannot access red snapper in state water. The Amendment has a three year sunset measure, meaning that it would expire after 3 years unless the GOM Fisheries Management Council takes additional action. Using secondary data, a better understanding of how the debate is presented below.

4.1.2.1 Arguments Supporting Amendment 40

The first argument that people supporting Amendment 40 make is that they believe it can increase red snapper management flexibility, especially in the for-hire/charter sector. As one editor (Editor 2015) of “In the Bite” said, “Amendment 40 would provide a basis for increased flexibility in future management of the entire recreational sector, and reduce the chance for recreational quota overruns, which could jeopardize the rebuilding of the red

snapper stock.” And he added, “Those who aren't lucky enough to own a boat get their access to the fishery through charter fishing boats and local seafood markets. Today's approval of a separate charter sector protects their ability to keep fishing and will help us captains continue to support our families doing what we love.” Since charter trips are always affected by weather and flexibility to attract customers, "We want to be held accountable for staying within a set limit of fish, but we need the flexibility to go out on the water when it makes sense for our customers," said Susan Boggs of Reel Surprise Charters in Orange Beach, Alabama (Magill 2015).

One officer with NOAA Fisheries also says that “Amendment 40 would allow charter captains to choose the days they fish when conditions and customer demand are favorable, rather than restricted them to the traditional short summer season ” (Sikes 2014).

Also, Amendment 40 can bring much more equal and fair access to recreational red snapper fishery. As the following arguments say, “We want everybody to have equal and fair access to the fishery,” said Jarvis, who also serves as president of the Destin Charter Boat Association (Harbuck 2015). In this same newspaper article, Staples, who also serves as a board member for the Destin Fishing Rodeo also says: “It’s not my access, but it’s their access. No one is sticking up for the ones who do not have boats. It’s going to help us, help them.” Chris Dorsett, Vice President for Policy and Programs at Ocean Conservancy, also voiced support for Amendment 40, saying “This decision enables a much more tailored approach to ensuring that red snapper populations in the Gulf are healthy for generations to come” (Gulf Council Staff and Ed Lallo 2014).

Keith Magill (2015), executive editor from Houmatoday.com, also says, “The measure will make it easier for charter captains to operate their business. It will allow federal regulators to develop a management plan meeting their needs, which are often different than those of private anglers.” This approach is a potential new management plan that could be

developed for the charter-for-hire sector.

4.1.2.2 Arguments Against Amendment 40

First, people argued for individual States to manage red snapper fishing.

Opponents believe “red snapper management would be better left to the individual Gulf states, which could then set bag and size limits, as well as seasons. State officials could also set closed areas so the recreational anglers could stay within their quota”, which could privatize recreational fishing (Tomalin 2014).

“A growing number of other states have reacted to this by adopting liberal state-water rules to skirt the federal regulations. This, federal fisheries managers say, has resulted in reaching the gulfwide catch quota more and more quickly. In turn, the hasty harvest has resulted in an ever-shortening federal season for all recreational anglers” (Sikes 2014).

Secondly, they distrust the current data.

“Recreational fishing arguments included rejection of federal management and general distrust of the data,” said in a public hearing on the red snapper amendment, which mentioned the data (Lacy 2014). Fisheries management is based on scientifically-sound data. Now people can’t trust the data showed by NOAA Fisheries. For Alabama, “The numbers showed 418 thousand pounds of red snapper through the month of June and the federal reporting program showed a million, 41 thousand, and 121 pounds.” Director of Alabama Marine Resources Division Chris Blankenship says that discrepancy underlines the problem they have been battling for years, bad science (Williams 2014). There is huge difference now.

4.2 Recreational Limit Measures Controversy

Red snapper in the GOM are managed with size limit, bag limits and opening days. The current size limit is 16 inches and a bag limit of 2 fish per trip. In short, the controversy in the recreational sector concluded that the state would like to catch more red snapper in federal water with longer opening season days. NOAA Fisheries tried to change size or bag

limits several years ago, but people prefer less fishing days instead of catching one fish per day when they spend lots of money on gas and other items. Besides, NOAA Fisheries tried to increase size limit to 18 inches two years ago, which resulted in the increase of discard mortality. So the current conflict of management measures focuses on the open fishing days instead of size and bag limits.

For now, the state would like to say the red snapper population is in good condition and they would ask for a longer open season. However, red snapper stock is no longer undergoing overfishing, but is still overfished and in a rebuilding program through 2032. It is the first year that we did not exceed total allowance catch (TAC) in 2014 which means the current management works (Officers from NOAA Fisheries). Quotas of red snapper are established as weights. With effective management measures in recent years, as state agencies have said, red snapper have become much bigger than before, and they are more abundant. Thus, more and bigger fish are caught, which fills the quota more quickly. NOAA Fisheries will need to more restrictive rules to make sure that the TAC is not exceeded (Officers from NOAA Fisheries).

4.3 State Water Boundary Conflict

GOM States have tried to extend their boundary to nine miles off shore to have much more water area to catch red snapper. The state waters in Alabama are recognized by the state as being nine miles out from shore. Fishermen can catch red snapper within these 9 miles of state water from June 1 to 31. However, catching red snapper within the 3 to 9 mile zone is risky because federal authorities do not recognize the 3 - 9 miles as being state waters. Thus, federal enforcement officers may issue a citation to fishermen in federal waters beyond 3 miles from the shore. Fishermen who want to catch red snapper in the 3 to 9 mile offshore zone must fish at their own risk. There is a conflict about state water boundary between federal government and Alabama. Besides, Florida and Texas already

have expanded state waters in 9 miles in gulf with recognition from federal authority.

Louisiana extended state water to 9 miles in 2012 and Mississippi also extended it to 9 miles in 2014. But for now, they didn't get the recognition of federal government. There are five states in Gulf of Mexico. We should have same state water boundary.

Chapter 5. Conclusions and Suggestions

The most important part of this research is finding the reasons for the differences in recreational red snapper management between federal and state agencies. Based on a review of the structure and process of fisheries policy, a review of news accounts and public statements of various stakeholders reported in the media, and interviews with senior researchers and policy makers at the state (Alabama) and federal levels, the issues involved reflect fundamentally different underlying values associated with the red snapper resource. Simply put, the federal government is interested in the long-term re-establishment of red snapper stocks and has put in place a plan extending into the 2030s to accomplish this goal. The state government sees red snapper resources as an engine of economic growth and wants to utilize this resource immediately.

5.1 Potential Reasons for the Debate

First, based on the collection of information for this research, I would like to say that the reasons behind the debate are complex. Each side wants to maximize their benefit in recreational red snapper fisheries. Simply put, federal agencies want to promote sustainable fisheries and state agencies are in favor of economic increases. The reasons are not this simple though and boiling it down to one or a few sentences is difficult.

5.1.1 Basic Reasons

As stated in chapter 1, people have great interests in recreational red snapper fishing in the GOM, not only because red snapper are delicious to eat but it means “money.” In 2013, the landings of recreational species were less than in the commercial sector, but they brought

in three times more sales value than commercial landing values. Recreational fishing trips mean expenditures for gas, travel, hotel, restaurant, gear, etc., which means recreational fisheries are big business and bring in money, jobs and income to areas close to the fishery. Recreational fishing in the U.S. resulted in \$20.5 billion in income, which is twice that of income attributed to all U.S. commercial finfish fishing. Meanwhile, recreational fishing offers more job opportunities (Table 1). For the Alabama state level, the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation showed more detailed information (U.S. Fish and Wildlife Service, 2011). In 2011, there were approximately 683 thousand anglers (72 percent of all sportsperson) in Alabama resulting in over 10 million fishing days, which means fishing is very popular in Alabama. Total fishing expenditures in Alabama in 2011 was over \$456 million including over \$317 million from trip related expenditures, including food and lodging, transportation and other expenses. Anglers in Alabama spent another \$128 million on equipment (Table 4). There is no doubt that Alabama politicians, including politicians representing Alabama in the Senate and House of Representatives in Washington, D.C., want to promote development of recreational fishing for its huge value impact. These political leaders in turn set the tone for state agencies responsible for fisheries management. For the author, that seems to be the basic reason behind raising this issue on how to manage red snapper in the GOM.

Red snapper have been harvested in the GOM since the 1840s. Red snapper is a pelagic fish and adult red snapper inhabit offshore waters which are under federal agency jurisdiction. Red snapper are mainly caught in the 3 - 200 mile zone that is federal water (Table 5). In terms of total red snapper weight caught, more than 80% are landed in federal waters (Figure 9). By counting total number of red snapper caught, about 75% are caught in federal waters (Figure 10). That is another reason of the current debate. Since red snapper are mainly caught in federal water, local fishermen have to comply with restricted regulations

that were developed by NOAA Fisheries to increase red snapper stocks through imposing limits on fishing mortality. These federal policies, especially the reduced open fishing season length in federal waters, have made local recreational fishermen and the state's political leaders dissatisfied. Under these restrictive rules fewer days are allowed to catch fewer red snapper.

5.1.2 The “Reasons” Based on the Fisheries Management Process

Based on the fisheries management steps in chapter 1, the sheer complexity of the fisheries management process contributes to the current conflict.

5.1.2.1 Multiple Data Collection Programs Without a Single Standard

Precise data is the foundation for fisheries management. Actually, there is no single specific data collection program for red snapper through NOAA Fisheries. All data collection programs are designed for all the fisheries and not just for the red snapper. NOAA Fisheries conducted a Southeast Area Monitoring and Assessment program (SEAMAP) for fishery-dependent data and a Marine Recreational Information Program (MRIP) for fishery-independent data. For fishery-independent data, SEAMAP-Gulf, one of the components of SEAMPA, mainly operates red snapper collection activities in the southeast region. It is a cooperative state/federal/university data collection program that started in 1981. Fishery-independent data can be used to determine the abundance and distribution of red snapper populations. There are several different tools at their disposal such as trawl surveys, bottom line surveys and video surveying. MRIP can provide fishery-dependent data through dockside survey intercepts of fishermen to estimate landings and phone surveys of fishermen to obtain effort data.

In the meantime, the state has its own data collection program. The Alabama Department of Conservation and Natural Resources, Marine Resource Division conducted its own Red Snapper Report program. The NOAA Fisheries and the Alabama MRD work side

by side on this program. NOAA Fisheries will ask the state to cooperate on federal programs to obtain more data and GOM state data programs provide additional data to NOAA Fisheries.

However, there are multiple programs and there is not a single standard to control, which is one reason for the current conflict and debate. Different programs conduct their own surveys using different methodologies that produce different results and policy makers at the federal and state levels may select those data and methodologies that most fit their underlying values and interests.

As one report (CITE) states, “The Alabama Red Snapper Reporting Program estimates that 417,526 pounds of Red snapper were landed through June. The federal MRIP Program estimates that 1,041,121 pounds of red snapper were landed in Alabama through June.”

This is a huge difference with the federal results at almost twice the Alabama estimate. People feel angry with the larger federal results that are the foundation for the current restrictive fishing rules. For the author it is hard to say which one is right or wrong. The data mainly comes from dockside and phone interviews of private anglers and headboat surveys of others conducted by MRIP. The smartphone app was the primary method used for the red snapper report in Alabama. While the smartphone survey was easy to conduct and effective in obtaining data, the smartphone program has several limitations, including:

- No real time data; fishermen may not submit data in a timely fashion.
- Hard to evaluate the validity of self-reported data. There would need to be a ground-truthing effort of dockside intercepts to cross check against what is reported via smartphone.
- Take time to compile and quality control incoming data.

Without a standard method to collect data, NOAA Fisheries and Alabama do not fully trust the data from each other.

5.1.2.2 Goals and Objectives are Different

Based on A Fishery Manager's Guidebook-Management Measures and Their Application (Cochrane 2002), the goals in fisheries management can be divided into four subsets: biological; ecological; economic and social (social includes political and cultural goals). Biological or ecological objectives means maintaining sustainable stocks of fish species while biological goals always try to maintain the specific target species and ecological goals aim to minimize the impact to non-target species (by-catch) and the environment. Economic goals mean increasing the incomes of the fishers and the larger coastal economy by creating more jobs to local people.

Of course, NOAA Fisheries and the state both want to keep sustainable red snapper fisheries. But the federal agency has a longer term goal for the conservation and state has a shorter term goal for economic increase. As stated previously in earlier chapters, federal agencies have conducted several research studies to determine the status of red snapper and reducing open seasons. They are in favor of biological and ecological goals while GOM states, such as Alabama, would like to have longer seasons and more access to red snapper fisheries because of the huge value the red snapper industry can have toward increasing the local economy, promoting local tourism and bringing jobs to the area.

5.1.2.3 Inconsistent Management Strategies in State Waters Aggravate Restrictive Catch Rules in Federal Waters

As previous chapters state, the main conflict of management strategies focuses on the open fishing season days between NOAA Fisheries and the state of Alabama. Even though NOAA Fisheries manages red snapper in federal waters through various restrictions, state governments are also able to implement regulations and they are often inconsistent with federal regulations. For instance in state waters Alabama can set more open days than the federal authorities do federal waters. Alabama has a one-month red snapper fishing season

from July 1 to 31 in 2015, but this is when federal waters are closed. Thus, state waters are still open which can lead to more landings from state waters. It can result in a data bias during red snapper stock assessment conducted by the federal agency and compel the federal government to implement much more restricted regulations. The problem is compounded by state management policies which encourage Alabama fishers to operate in the 3 to 9 mile zone, which NOAA Fisheries claim is federal jurisdiction (3 to 200 miles). In this manner, there could be a vicious circle of mismanagement of recreational red snapper.

In recent years, GOM states have set state red snapper harvest regulations inconsistent with rules set for federal waters (Table 6). Texas has set a limit of 4 fish per harvester per day, a 15-inch size limit and year-round open season (365 days) in state waters. Other GOM states implemented the same number of open season days in state waters as did the federal agencies, at least until 2012. There were 28 open days in federal GOM waters in 2013, but Florida set 44 open days and Louisiana set 88 open days to catch red snapper in their state waters. The situation varied more in 2014 when there were only 9 open days for recreational red snapper fishing in federal water but Florida set 51 open days, Louisiana set 111 open days and Mississippi set 21 open days in their state waters, while Alabama had the same number of days as the federal regulations. Less open season days in federal waters caused most GOM state to increase their number of open days in state waters. In 2015, Alabama set 41 open season days to let fishermen catch more red snapper. Florida also set more open days in state waters (51 days). As of the writing of this thesis (July 2015) people still had an “open” season for red snapper fishing in Louisiana and Mississippi state waters until further notice (Table 6).

Since states would like to catch more red snapper which could result in the federal agency reducing the open season, this could result in states further extending their own season to accommodate the demands of local fishers. Considering the data inaccuracy and

more juvenile red snapper being caught in state waters, federal agencies would have to limit access to the red snapper fishery. Simply put, if NOAA Fisheries is reducing the season length, it will simulate GOM states to be non-compliant and inconsistent with federal fishery managers. This escalating decrease/increase of open days by federal/state agencies could be a cause for less consistent management of the fishery. In fact, it has led to Alabama setting forth a claim that their state jurisdiction should extend to 9 miles off their coast and is an example of how this conflict can create additional management problems.

5.1.2.4 Cannot Monitor Resource and Evaluate the Effects of Management Strategies in a Timely Manner

The author thinks both federal and state agencies have the same problem with monitoring and evaluating their implemented management strategies. For NOAA Fisheries, in the case of a red snapper recession, they would prefer precautionary measures. Even though red snapper is no longer undergoing overfishing they still want to rebuild the breeding population through restrictive catch rules. Actually, no one can know quickly or exactly how red snapper populations will change in response to management strategies. What NOAA Fisheries can do now is to predict its status, stock size and age structure. Because the effects of strategies are hard to evaluate in a timely manner, state agencies and fishers may lose their faith in NOAA Fisheries.

5.2 Suggestions for Future Recreational Red Snapper Management

The lead authority for red snapper management in federal waters of the GOM is NOAA Fisheries. Meantime, Alabama manages red snapper in state waters. To find an effective way for future management, the author thinks both agencies should make an effort to work together.

5.2.1 Federal Level Should Have a More Accurate Data System and Enhance Public Awareness

As was discussed in previous chapters, there is a controversy about data collection because of the lack of specific standards and methods. Alabama now has its own data reporting system and shows a big difference compared to federal results. NOAA Fisheries may distrust the result, but they do need to pay attention to the difference. This author thinks a more accurate data collection system should be developed through effective data collection and comprehensive data analysis.

Improving data collection for red snapper mainly means improving fishery-dependent data since the federal and state agencies have different collection methods as laid out in chapter 4. It seems it would be possible to require all agencies to use the same methods to collect data. It is understood that different research situations and even different government budgets would provide difficulties in adopting standard procedures, but establishing a data collection standard to guide different programs could provide consistent results. It would likely be easier to reduce data bias if they could combine their data collection efforts. A standard survey guidance should have three basic parts:

- Have the same landing survey frequencies. Use monthly data collection out of open seasons, and weekly data collection during the open days.
- Have the same survey form. A standard survey design form for telephone, online and random daily surveys should be developed and suggest all programs use the same form. In this way, it would be easy to compare differences and similarities in in-shore and EEZ waters.

Other methods of data collection, such as the smartphone survey would be an effective future way to collect data. This approach would use fishermen to input their catch data and entered data would go directly to state and federal agencies. Even though this approach still has limitations now it is a promising solution for the future.

Furthermore, attention should be paid to reviewing data. Each federal and state level

could have several weeks to review the data before it would be published publically. This would allow for professional consultation between federal and state agency personnel to address differences in interpretation. There is no guarantee that all differences would be addressed, but this would increase transparency between the agencies.

The federal government has put forth a lot of effort to enhance the public's awareness of red snapper management. NOAA Fisheries has done a lot to publicize its information about red snapper management. The council process has substantial public input through public testimony, comment period, etc. All SEADAR workshops are open to the public and webcast so people can listen to them. NOAA Fisheries also distributes a Fishery Bulletin via email. The public is welcome to enroll on their email list to receive up-to-date information on regulatory changes. What NOAA Fisheries now needs to do is make their science simple to understand and disseminate it broadly.

For example, let's make a simple calculation. We only have 10 fishing days and two fish per person allowed, but we have millions of fishermen (assume 3 million according to Gulf of Mexico Region Summary).

$$10 \text{ days} * 2 \text{ fish per day} * 3 \text{ million fishers} = 60 \text{ million fish caught}$$

Assuming 5 pounds average weight per fish caught and the total harvest will be 300 million pounds of red snapper caught. How huge is this catch? It exceeds the annual allocation for the recreational sector (for 2013, the recreational red snapper TAC is 3.96 million pounds). Fishermen concentrate more on the seasonal number of angling days and the bag limits or number of fish they can harvest per day. With the limited days, they catch red snapper day by day. With the great fishing effort and so many fishermen, fishing mortality is very high. That is one of the reasons restrictive fishing rules are still needed to prevent the red snapper fishery from being overfished again. There is no doubt that restrictive regulations have positive impacts on red snapper populations.

Local fishermen have argued with federal regulations saying lots of red snapper can be seen in the water so there should be more open days to catch them. They do believe there are enough fish even for so many fishermen. However, for the red snapper species, it is not only the number of individuals present that is very important to a healthy population, but it also requires maintaining their age-size structure. This is equally important for a sustainable red snapper fishery and many recreational fishermen do not understand this. If fishermen catch too many adult fish, there will not be enough adult fish to reproduce enough small fish to sustain the population and if fishermen catch too many small or juvenile red snapper, there will not be enough small fish to grow up to sexual maturity. The federal agency should tell the public why the season is short instead of implementing it without local fishermen's support. Just like the simple example calculation above, the federal agency should try to make science simple to understand for the people who do not have any experience in how to manage a red snapper fishery. It may not be able to manage red snapper directly, but it will bring positive impacts on implementing regulations and strong support between federal and state agencies.

5.2.2 State Should Be Involved in Submitting Fisheries Management Plan

Some people argue that NOAA Fisheries should let individual states manage their own fisheries. Bob Shipp, a professor emeritus in the Department of Marine Sciences at the University of South Alabama, chaired that department for 20 years and also served on the Gulf of Mexico Fishery Management Council for 18 years is an expert. His expressed opinion provided in a newspaper article stated that transferring management of red snapper to GOM states is one solution for the current situation (Shipp 2014). But fisheries management is a tough issue. On one side, NOAA Fisheries has much more experience than the state level to manage reef fisheries including red snapper. Additionally, NOAA Fisheries also has a responsibility to the general public of the nation, and has a unique voice

representing all stakeholders, not just recreational fishery interests. On the other side, as stated in chapter 3, stock assessments are very important for red snapper management. However, stock assessment is a huge undertaking and requires a large effort, much funding and time. So it does not seem effective to let the state alone manage red snapper. In addition, if the federal government were to transfer management authority to the state, it could hurt commercial red snapper fishing since the wealthy people with power will ask much more access to private recreational red snapper. Last but not least, it will aggravate the conflicts between the states.

This does not mean that individual states could not submit management plans to regional councils for review during council meetings. Red snapper management systems are very complex, but it is certainly true that each state has been involved in the policy-making process for a long time. For now, states could present their data report during the council meeting. NOAA Fisheries could ask the state to be involved in the red snapper fisheries management process through representation in the NOAA Fisheries offices. And the state could provide feedback through numerous public comments and review processes.

In my opinion from this research, I suggest that GOM states can also have a red snapper fisheries management plan and they can be submitted to regional councils. Based on individual state level of red snapper management knowledge, they may know red snapper better than federal agencies and they may consider social and economic aspects in their fisheries management plan. Once they submit their Plan to the regional council, there would be a much more comprehensive analysis of all management aspects. The combination of state plans would decrease the discontent from state agencies and be good for implementation. It is suggested that these plans should have three parts. First, a data report. Each state should submit their own results from their own data collection program using the same standard methodologies set out by NOAA Fisheries. Instead of presenting plans only during

council meetings, the reports could state much more detailed information about how they collect and interpret the data. Second, each state should submit a red snapper measurement plan. Since the current conflict exists in both the commercial and recreational sectors, plans should be proposed for each side, unless they agree with the regulations from NOAA Fisheries. For recreational red snapper, each state could submit their plans of open season days, size limit and bag limits. But the most important thing in the second part is that they must provide data reports or other strong evidence to support their plans. Third, each state must submit the analysis of advantages and disadvantages of their plans, which would be a good way to make states understand that there is no perfect management plan and realize that finding a balance between economic, social and biological aspects of the red snapper fishery is needed in the management plan. In this process, states could have their chance to express their views and NOAA Fisheries would gain a more comprehensive consideration of all aspects involved in the management of the GOM red snapper fishery.

Table 1. Economic impacts of recreational and commercial fishing in the United States, 2011.

U.S.		
Impacts	All recreational species	All commercial finfish species
Landings (billion pounds)	0.205	8.481
Value of commercial landings (\$ billions)		2
Expenditures, recreational (\$ billions)	26	
Sales, total multiplier effect (\$ billions)	70	25
Jobs	454,542	380,513
Income (\$ billions)	20	9
Value added (\$ billions)	32	13

(Source: American Sportfishing Association 2013)

Table 2. Assessment results of red snapper in the GOM.

Time		Method	Results
In 1980s		Red snapper management started in the GOM	
In 1990s		VPA, ASAP	Overfished and undergoing overfishing
In the beginning of 1900s	2005	CATCHEM, SRA	Now plan to rebuild red snapper stock
	2009	CATCHEM	Overfishing end
2013		SS	Stock was still overfished but rebuilding

ASAP- Age Structured Assessment Program

VPA-Virtual population analysis

SRA-Stock Reduction Analysis

SS-Stock Synthesis

(Source: SEDAR 2005; 2009; 2013)

Table 3. Changes in red snapper recreational management measures, e.g., total length, daily bag limit, season and recreational allocation.

Year	Total Length (inches)	Daily Bag Limit	Season Length (days)	Recreational Allocation (Million Pounds)
1990	13	7	365	NA
1991	13	7	365	1.96
1993	13	7	365	2.94
1994	13	7	365	2.94
1995	14	5	365	2.94
1996	15	5	365	4.47
1997	15	5	330	4.47
1998	15	4	272	4.47
1999	15	4	240	4.47
2000	16	4	194	4.47
2001	16	4	194	4.47
2002	16	4	194	4.47
2003	16	4	194	4.47
2004	16	4	194	4.47
2005	16	4	194	4.47
2006	16	4	194	4.47
2007	16	4	194	3.185
2008	16	2	65	2.45
2009	16	2	75	2.45
2010	16	2	77	3.403
2011	16	2	48	3.866
2012	16	2	46	3.959
2013	16	2	28	5.39

(Source: SEDAR 2013)

Table 4. 2011 national survey of fishing – Alabama.

Anglers in Alabama, thousand	683	Expenditures, \$ millions	456
Days of Fishing, millions	10.2	Food and Lodging, \$ millions	122
Average Days Per Angler	16	Transportation, \$ millions	79
Percent of All Alabama Sportspersons	72	Fishing Equipment, \$ millions	107
Percent Fishing in Saltwater	20	Average Per Angler, \$	635

(Source: U.S. Fish and Wildlife Service 2011)

Table 5. Recreational landings of red snapper by distance caught off US shores.

Year	0-3 miles (State Waters)		3-200 miles (Federal Waters)	
	Pounds (thousands)	Total Number (thousands)	Pounds (thousands)	Total Number (thousands)
2013	1,520	345	7,673	930
2012	666	131	3,672	477
2009	488	143	3,933	721
2010	601	147	1,031	190
2011	568	141	2,901	412
Average	769	181.4	3,842	546

(NOAA National Marine Fisheries Service 2010; 2011; 2012; 2013)

Table 6. Management regulations of recreational red snapper in federal and state waters of the GOM, 2011 - 2015.

Year s	Waters	Bag limit (per harvester per day)	Size limit (inch total length)	Total open days	State water boundary(miles)
2011	Federal	2	16	48	EEZ¹
	Alabama	same	same	same	0-3
	Texas	4	15	365	0-9 ²
	Florida	same	same	same	0-9 ²
	Louisiana	same	same	same	0-3
	Mississippi	same	same	same	0-3
2012	Federal	2	16	46	EEZ¹
	Alabama	same	same	same	0-3
	Texas	4	15	365	0-9 ²
	Florida	same	same	same	0-9 ²
	Louisiana	same	same	same	state:0-9 ³
	Mississippi	same	same	same	0-3
2013	Federal	2	16	28	EEZ¹
	Alabama	same	same	same	0-3
	Texas	4	15	365	0-9 ²
	Florida	same	same	44	0-9 ²
	Louisiana	3	same	88	state:0-9 ³
	Mississippi	same	same	same	state:0-9 ³
2014	Federal	2	16	9	EEZ¹
	Alabama	same	same	same	0-3
	Texas	4	15	365	0-9 ²
	Florida	same	same	51	0-9 ²
	Louisiana	same	same	111	state:0-9 ³
	Mississippi	same	same	21	state:0-9 ³

	Federal	2	16	Private Anglers:40	EEZ ¹
				"For-hire" vessels:44	
2015	Alabama	same	same	41	state:0-9 ³
	Texas	4	15	365	0-9 ²
	Florida	same	same	51	0-9 ²
	Louisiana	same	same	still open ⁴	state:0-9 ³
	Mississippi	same	same	still open ⁴	state:0-9 ³

Note:

¹ EEZ (Exclusive Economic Zone) = water from 3 to 200 mile offshore)

² Expand state water from 3 to 9 miles and with recognition by federal government

³ Expand state water from 3 to 9 miles and without recognition of federal government

⁴ This table was made on July 10, 2015

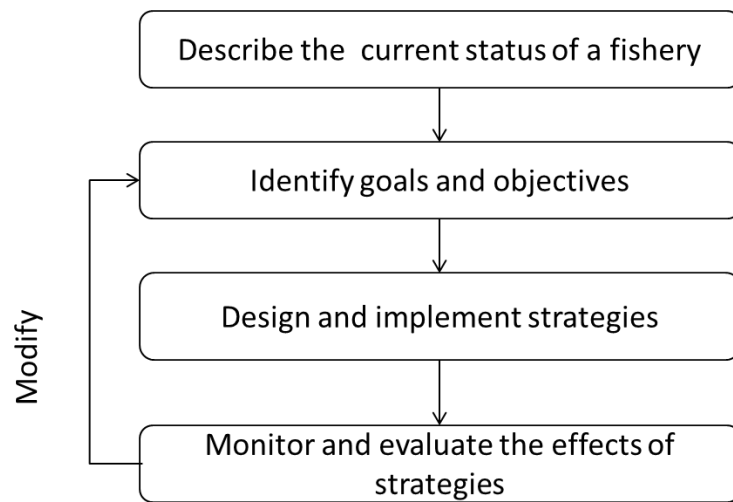


Figure 1. General steps of fisheries management

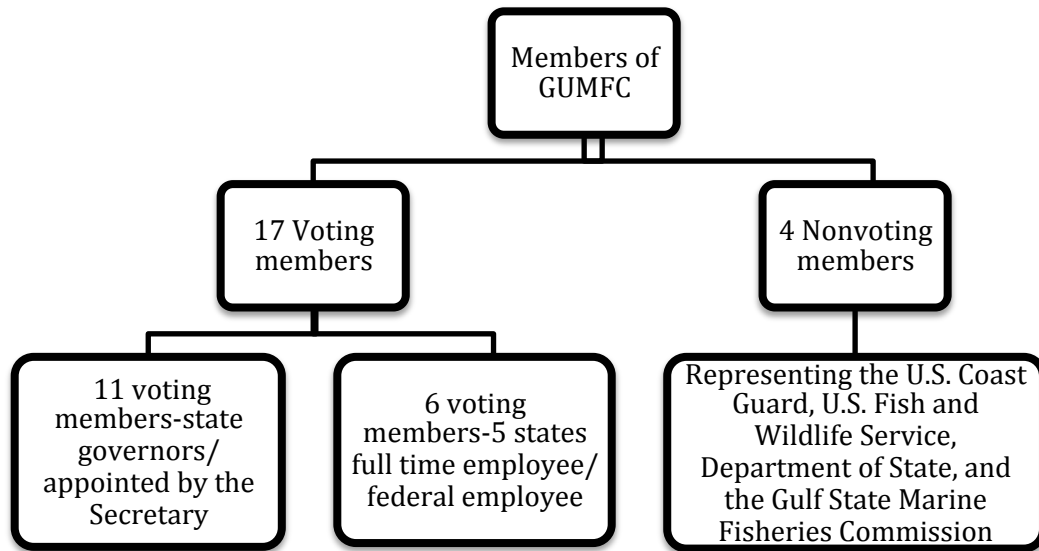


Figure 2. Members of the Gulf of Mexico Fishery Management Council.

(Source: Gulf of Mexico Fishery Management Council website

<http://www.gulfcouncil.org/about/index.php>)

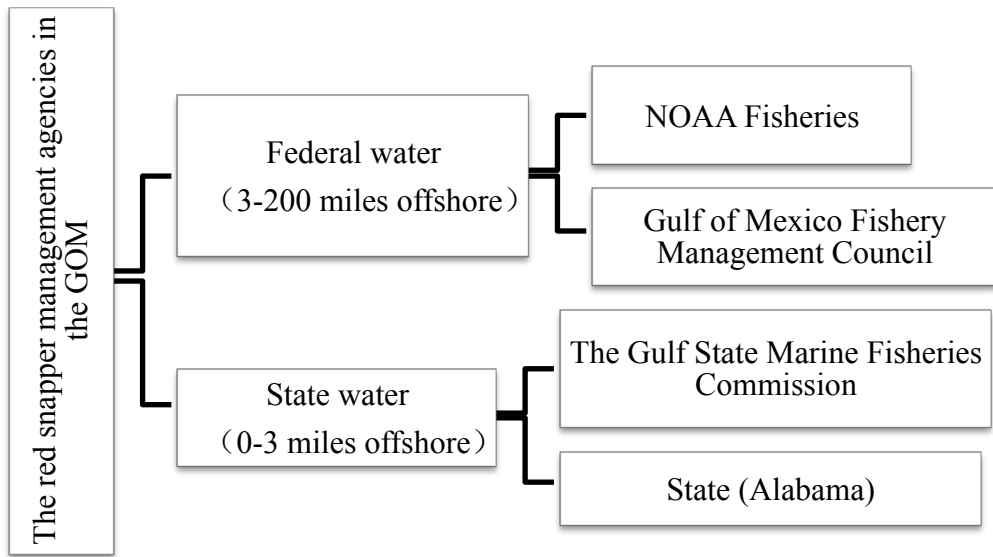
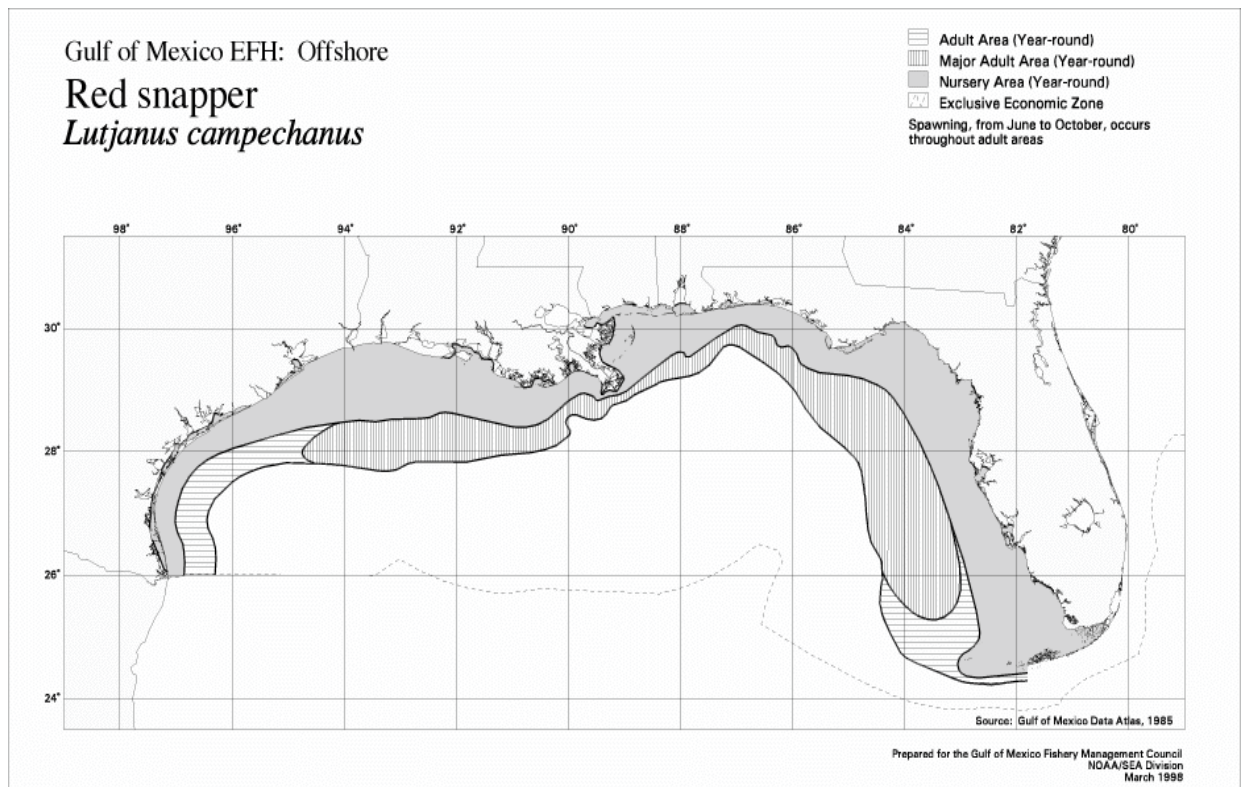


Figure 3. Red snapper management agencies in the GOM.



Note: 1°latitude \approx 111km \approx 69 miles

State water is no more than 9 miles offshore

Figure 4. Distribution of red snapper in the GOM.

(Source: Fish and Fisheries 2009)

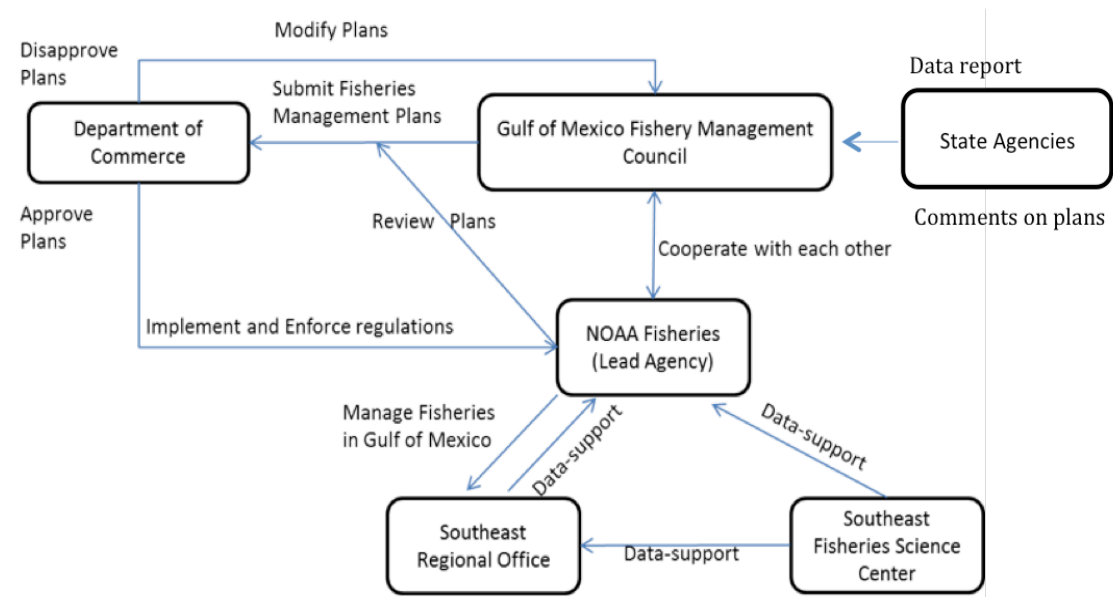


Figure 5. Fisheries management system of federal water in the GOM.

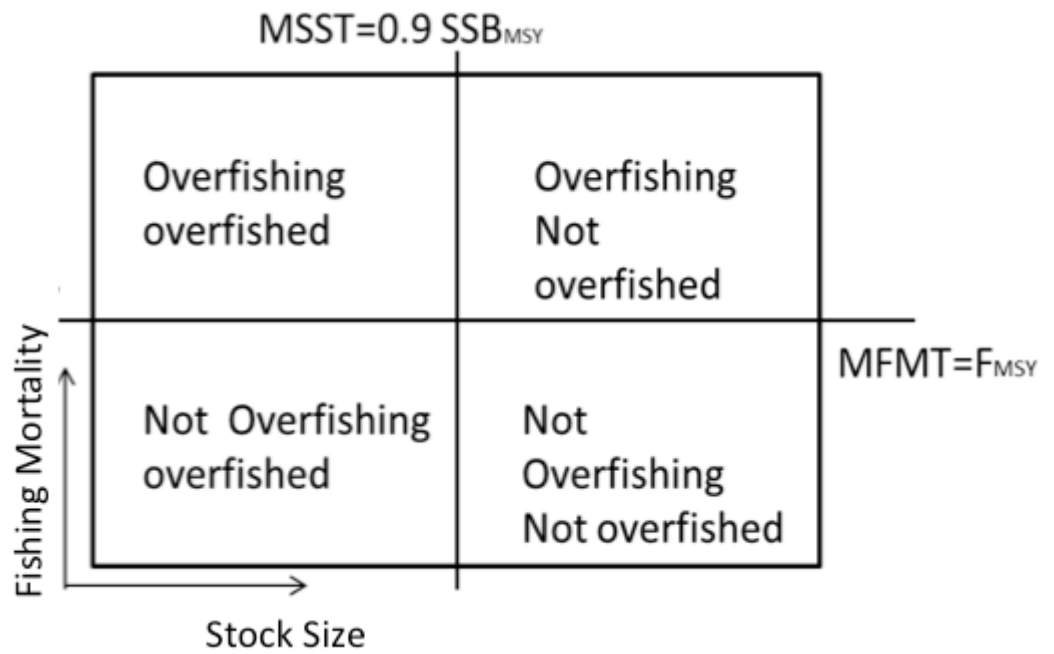


Figure 6. Framework of determining the status of red snapper.

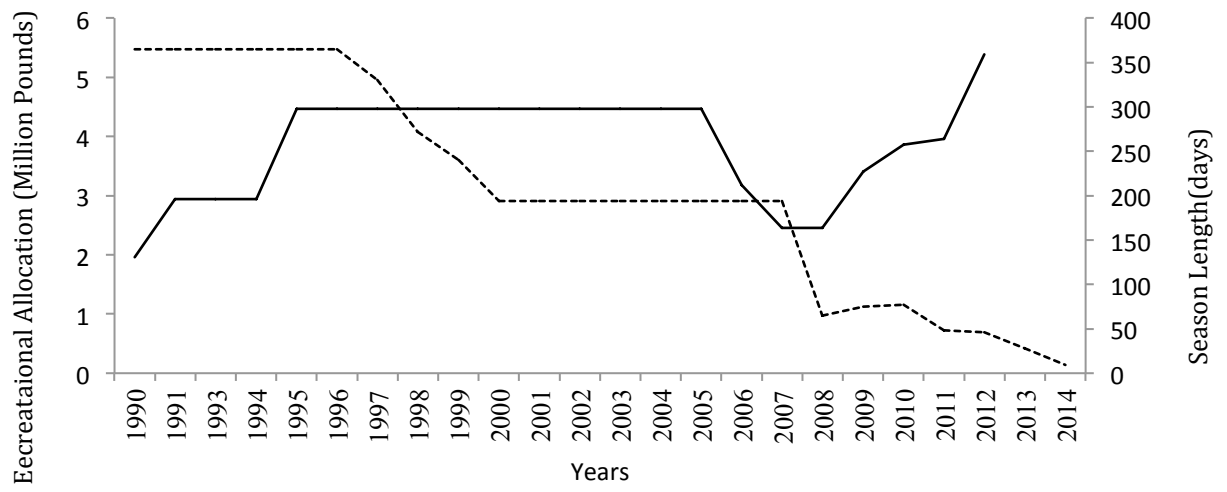


Figure 7. Changes of recreational allocation quota and season length in different years.

(Data source: SEDAR 2013)

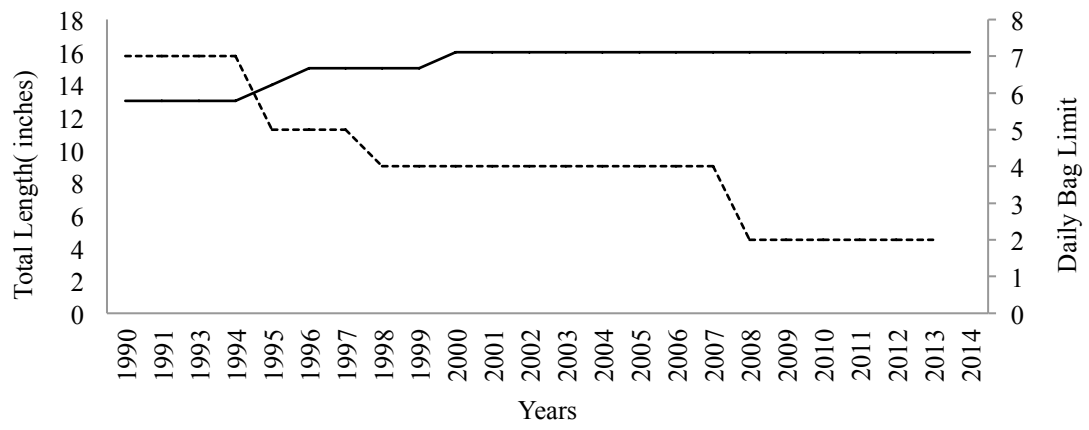


Figure 8. Changes of total length and daily bag limit in different years.

(Data source: SEDAR 2013)

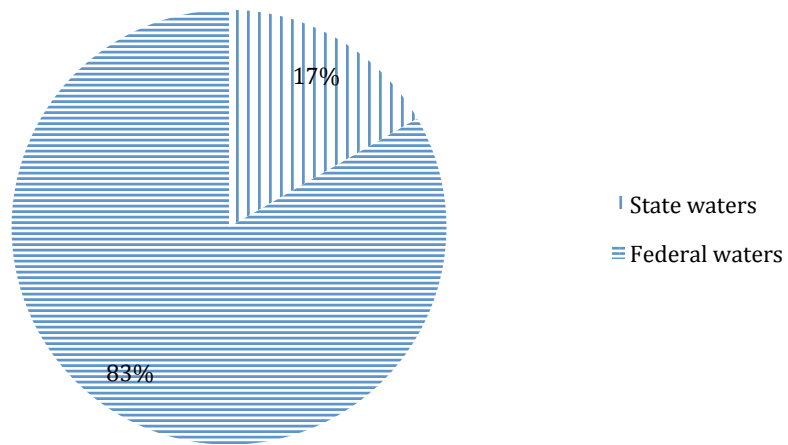


Figure 9. Recreational landings of red snapper by distance caught off US shores, by weights.

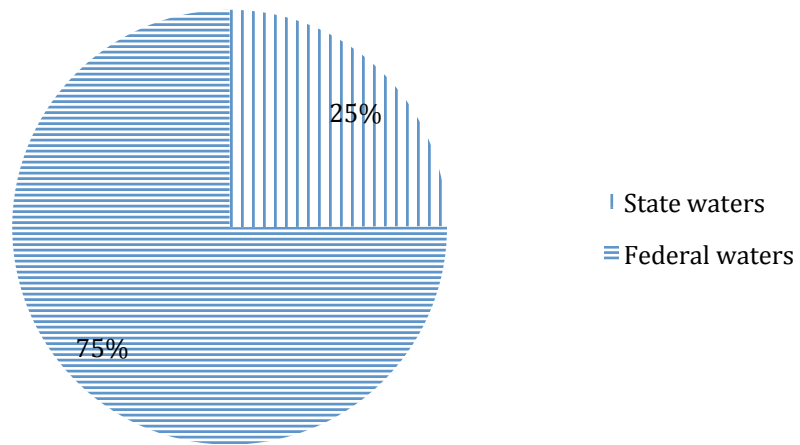


Figure 10. Recreational landings of red snapper by distance caught off US shores, by total number.

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Appendix 1. Recreational red snapper management plans and regulatory amendments.

Management Plans And Amendments	Implemented Data	Action (Parts of actions)
Reef Fish FMP	Nov/8/1984	<ul style="list-style-type: none"> • 12 inches Fork Length • For-Hire Boat Can Keep 5 Undersize Fish
Amendment 1	Feb/21/1990	<ul style="list-style-type: none"> • 13 Inches TL • 7-Fish Bag Limit • Begin Rebuilding Program • 20 Percent SSBR Goal was set at Jan/1/2000
Amendment 2	Mar/11/1991	<ul style="list-style-type: none"> • 7 Fish Daily Bag Limit (1.96MP recreational allocation) • Achieve 20 percent SPR goal by the year 2007
Amendment 3	July/29/1991	Replacing the 20 percent SSBR Target with 20 percent SPR
Regulatory Amendment	Mar/23/1993	<ul style="list-style-type: none"> • Total Available Catch from 4.0 MP to 6.0 MP (2.94MP recreational allocation) • 7 Fish Daily Bag Limit • The target tear to Achieve %₂₀ SPR from 2007 to 2009
Amendment 5	Feb/7/1994	Restrictions of the use of fish gear
Amendment 7	Feb/7/1994	Establish Reef Fish dealer permitting and record keeping requirement
Regulatory Amendment	Jan/1/1995	<ul style="list-style-type: none"> • Minimum Size Limit from 14 to 15 inches • Daily Bag Limit From 7 fish/person/day to 5 • Recreational Sector exceeded its 2.94 MP Allocation Each Year Since 1992
Amendment 8	Nov/ 29/1995	Individual Transfer Quota System
Regulatory Amendment	Oct/16/1996	<ul style="list-style-type: none"> • 5 Fish daily permit • 15 inches TL • TAC From 6MP to 9.12 MP (Recreational 4.47 MP) • Target date to achieve %₂₀ spr was extended to 2019
Amendment 12	Jan/15/1997	Disapproved proposed provisions to cancel the automatic red snapper size limit increase to 15 inches tl in 1996 and 16 inches in 1998

Regulatory Amendment	March/17/1997	<ul style="list-style-type: none"> • Authorizing the NOAA fisheries regional administrator to close the recreational fishery in the EEZ • Filled its 1997 quota of 4.47 mp and was closed on November 27, 1997
Regulatory Amendment	Jan/1/1998	Cancel a planned increase mini size to 16 retain 15
Amendment 14	March/25 and April/24/1997	Reopen a fishery prematurely closed before the allocation was reached
Amendment 15	Jan 29 1998	Two-tier red snapper license
Regulatory Amendment (NOAA Fisheries Implement An Interim Rule)	Effective April 14 1998	<ul style="list-style-type: none"> • Reduced bag limit from 5 to 4 for the Jan 1 to augh 30 1998 • Set a zero bag limits for the captain and crew of for-hire recreational vessels in order to extend the recreational red snapper quota season/not approved
Interim Rule	Jan/1999	<ul style="list-style-type: none"> • Reduce bag limit 5 to 4 • Retain 15 inch TL • Reopening of recreational fishing season Jan 1999
Regulatory Amendment	Oct/1/1999	<ul style="list-style-type: none"> • Opening data for recreational at march 1 • Reduce to 14 inches TL
Regulatory Amendment	Sep/18/2000	<ul style="list-style-type: none"> • Increase recreational minimum size from 15 to 16 • Season: April 15 through Oct 31
Amendment 19	Aug/19/2002	• Establish two marine reserve areas prohibit fishing
Amendment 20	July 29 2002	• Limit future expansion in the recreational for-hire fishery
Amendment 21	Mar/2004	• Extend marine reserves closures for an additional six years
Amendment 22	Submit In June 2004 Under View Now	<ul style="list-style-type: none"> • Set biological reference points and status determination criteria • Maintain TAC at 9.12 MP • End overfishing between 2009 and 2010 • Rebuild red snapper by 2032
Amendment 26	2007	• Established an individual fishing quota (IFO) system for the

		commercial red snapper fishery
Amendment 27	2008	<ul style="list-style-type: none"> • TAC at 5.0 MP between 2008 and 2010, with recreational sector of 2.45mp • 2 bag limits • 16 inch TL • Recreational season from June 1- September 30 • Non-stainless steel circle hooks
Regulatory Amendment	2010	<ul style="list-style-type: none"> • Increased TAL from 5 MP to 6.945 MP • Recreational sector from 2.45 MP to 3.403 MP
Regulatory Amendment	2011	<ul style="list-style-type: none"> • Increased TAL from 6.945 to 7.185MP • Recreational sector from 3.403 MP to 3.525 MP
Regulatory Amendment	2012	<ul style="list-style-type: none"> • Recreational sector from 3.25 MP to 3.959 MP • For 2013, increased from 3.959 MP to 4.258 MP

(Data from: SEDAR 2013)