Yield, Threshold Number of Permits, and Transit Provisions

Public Hearing Draft for Amendment 17B

to the Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters

Including Environmental Assessment

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Gulf of Mexico Shrimp Amendment 17B

Shrimp Amendment 17B: Yield, Threshold Number of Permits, and Transit Provisions to the Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters Including Environmental Assessment

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ABBREVIATIONS USED IN THIS DOCUMENT

ACL	annual catch limit
ALS	accumulated landing system
AM	accountability measure
bi op	biological opinion
BRD	bycatch reduction device
CPUE	catch per unit effort
Council	Gulf of Mexico Fishery Management Council
DWH	Deepwater Horizon MC 252
DPS	distinct population segments
EA	Environmental Assessment
EEZ	exclusive economic zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EJ	environmental justice
ELB	electronic logbook
EMS	early mortality syndrome
ESA	Endangered Species Act
FMP	Fishery Management Plan
F_{MSY}	fishing mortality at MSY
GLM	General Linear Model
GMFMC	Gulf of Mexico Fishery Management Council
GSS	Gulf shrimp system
Gulf	Gulf of Mexico
HAPC	habitat area of particular concern
lbs	pounds
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
mp	million pounds
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OY	optimum yield
RA	Regional Administrator
Reserve Pool	Gulf Shrimp Vessel Permit Reserve Pool
RQ	regional quotient
Secretary	Secretary of Commerce
SEFSC	Southeast Fisheries Science Center
SEIS	Supplemental Environmental Impact Statement
SERO	Southeast Regional Office of NMFS
SEWG	Ad Hoc Shrimp Effort Working Group
SPGM	federal Gulf commercial shrimp permit
SSC	Statistical and Science Committee

Shrimp AP	Shrimp Advisory Panel
South Atlantic Council	South Atlantic Fishery Management Council
TED	turtle excluder device
USCG	United States Coast Guard
VMS	vessel monitoring systems
VOCs	volatile organic compounds
VOOP	vessel of opportunity program

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[This statement is completed after selection of all preferred alternatives.]

CHAPTER 1. INTRODUCTION

1.1 Background

The Gulf of Mexico Fishery Management Council (Council) and the National Marine Fisheries Service (NMFS) began managing the shrimp fishery in the Gulf of Mexico (Gulf) in 1981. Four species are included in the fishery management plan (FMP): brown shrimp, *Farfantepenaeus aztecus*; pink shrimp, *Farfantepenaeus duorarum*; white shrimp, *Litopenaeus setiferus*; and royal red shrimp, *Pleoticus robustus*.

After the establishment of the federal commercial Gulf shrimp moratorium permit in 2006, the shrimp fishery experienced economic losses, primarily due to high fuel costs and reduced prices caused by competition with imports. These economic losses resulted in the exodus of vessels from the fishery, and consequently, reduction of effort. In Amendment 13 (GMFMC 2005a), the Council determined that the number of vessels in the offshore shrimp fleet would likely decline to a point where the fishery again became profitable for the remaining participants, and new vessels might want to enter the fishery; thus, the Council established the federal Gulf shrimp permit moratorium to prevent overcapitalizing the fishery when it became profitable again. The final rule implementing the moratorium was effective October 26, 2006, and permits became effective in March 2007. The Council addressed the expiration of the permit moratorium in 2016 in Shrimp Amendment 17A and decided to extend the permit moratorium for an additional 10 years. The rule for Amendment 17A went into effect on August 22, 2016.

During the development of Amendment 17A (GMFMC 2016), several issues were identified. Namely, optimum yield (OY) is still defined as equal to maximum sustainable yield (MSY) and MSY is defined individually for the three penaeid species (not the whole fishery). The number of federal commercial Gulf shrimp moratorium permits has continued to decline, and there is fear that these declines will continue indefinitely. As the permit moratorium was extended for an additional 10-years, this is an opportune time for the Council to review OY and determine the appropriate number of permits necessary to achieve OY on a continuing basis in the shrimp fishery, without substantially increasing bycatch. The Gulf shrimp fishery currently has two effort thresholds directly related to bycatch that would affect the fishery if the thresholds are exceeded: the threshold for sea turtle bycatch (Shrimp Biological Opinion, NMFS 2014) and a threshold for juvenile red snapper bycatch in a specific area of the Gulf (Amendment 14, GMFMC 2007). These effort thresholds should be considered when establishing a threshold number of permits for the federal commercial Gulf shrimp fishery

Currently, a federal Gulf shrimp moratorium permit issued by the NMFS Southeast Regional Office (SERO) is generally valid for one year and is renewable within one year of expiring. It costs $25 to renew a federal permit; additional permits on the same vessel cost $10 each. As of December 8, 2016, 1,441 federal commercial Gulf shrimp moratorium permits were valid or renewable. After the expiration date, the holder of a permit has an additional year to renew the permit. If a permit is not renewed within one year of the expiration date, it is terminated (i.e., no longer renewable or transferable and effectively ceases to exist). Through non-renewal, 476

Gulf shrimp permits have been terminated during the moratorium; two permits have been surrendered by the permit holders (Table 1.1.1). The Council seeks to determine the appropriate number of permits for the fishery and what action to take if the number of permits dips below the specified threshold number. Other fisheries, such as the American Samoa longline fishery, have an established limited entry program that makes permits available when the number of permits falls below the threshold number. In this fishery, longline permits are redistributed and historical participation in the fishery is given priority for different class sized vessels (Class A gets first priority, followed by Class B, etc.); ties in priority are selected (from the tied individuals) by lottery.

Table 1.1.1. Number of valid, surrendered, and terminated Gulf commercial shrimp permits as of December 31 each year since implementation of the moratorium. Valid permits are those that were fishable at least one day each year. Surrendered permits are those that were voluntarily returned to NMFS by the permit holder – these permits were valid for part of the year, before being lost from the fishery. Terminated permits are those that were lost from the fishery due to non-renewal by the permit holder.

Year	Number of Valid Permits Each Year	Number of Surrendered Permits Each Year	Number of Permits Terminated Each Year	Cumulative Number of Permits Lost from the Fishery
2007	1,933	0	NA	NA
2008	1,907	0	26	26
2009	1,722	1	184	211
2010	1,633	1	88	300
2011	1,582	0	51	351
2012	1,534	0	48	399
2013	1,501	0	33	432
2014	1,471	0	30	462
2015	1,455	0	16	478
2016*	1,441	0	14	492

Source: NMFS Southeast Regional Office (SERO) Permits Database
*Preliminary

Transit through federal waters with shrimping gear and shrimp on board currently requires a federal commercial Gulf shrimp moratorium permit. At the August 2015 Council meeting, it was brought to the Council's attention that state-licensed shrimping vessels (lacking a federal Gulf shrimp permit) cannot transit through federal waters with shrimp on board. There are some federal waters (such as off the coast of Louisiana and Mississippi) that state-permitted shrimping vessels would like to transit through to return to state waters. There are members of the shrimping community that would like the opportunity either to transit through federal waters without a federal commercial Gulf shrimp moratorium permit or be able to obtain said permit. The Council is considering a transit provision to address these concerns from the community.

1.2 Purpose and Need

Purpose for Action

The purposes are to define the optimum yield, determine the appropriate number of permits to achieve optimum yield on a continuing basis, consider measures to maintain the appropriate number of permits for the federal Gulf shrimp fishery without increasing bycatch, and to develop provisions for non-federally permitted shrimping vessels to transit through federal waters while not actively shrimping.

Need for Action

The needs for this action are to ascertain the appropriate metric(s) to manage the shrimp fishery, maintain increases in catch efficiency without substantially reducing landings, promote economic efficiency and stability in the fishery, provide flexibility for state registered shrimp vessels, and protect federally managed Gulf shrimp stocks.

1.3 History of Management

The Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters (FMP), supported by an environmental impact statement (EIS), was implemented on May 15, 1981. The FMP defined the shrimp fishery management unit to include brown shrimp, white shrimp, pink shrimp, royal red shrimp, seabobs (*Xiphopenaeus kroyeri*), and brown rock shrimp (*Sicyonia brevirostris*). Seabobs and rock shrimp were subsequently removed from the FMP. The actions implemented through the FMP and its subsequent amendments have addressed the following objectives:

1. Optimize the yield from shrimp recruited to the fishery.
2. Encourage habitat protection measures to prevent undue loss of shrimp habitat.
3. Coordinate the development of shrimp management measures with the shrimp management programs of the several states, when feasible.
4. Promote consistency with the Endangered Species Act and the Marine Mammal Protection Act.
5. Minimize the incidental capture of finfish by shrimpers, when appropriate.
6. Minimize conflict between shrimp and stone crab fishermen.
7. Minimize adverse effects of obstructions to shrimp trawling.
8. Provide for a statistical reporting system.

The purpose of the plan was to enhance yield in volume and value by deferring harvest of small shrimp to provide for growth. The main actions included: 1) establishing a cooperative Tortugas Shrimp Sanctuary with Florida to close a shrimp trawling area where small pink shrimp comprise the majority of the population most of the time; 2) a cooperative 45-day seasonal closure with Texas to protect small brown shrimp emigrating from bay nursery areas; and 3) a seasonal closure of an area east of the Dry Tortugas to avoid gear conflicts with stone crab fishermen.

Amendment 1/environmental assessment (EA)(1981) provided the Regional Administrator (RA) of SERO with the authority (after conferring with the Council) to adjust by regulatory amendment the size of the Tortugas Sanctuary or the extent of the Texas closure, or to eliminate either closure for one year.

Amendment 2/EA (1983) updated catch and economic data in the FMP.

Amendment 3/EA (1984) resolved a shrimp-stone crab gear conflict on the west-central coast of Florida.

Amendment 4/EA (1988) identified problems that developed in the fishery and revised the objectives of the FMP accordingly. The annual review process for the Tortugas Sanctuary was simplified, and the Council and RA review for the Texas closure was extended to February 1. A provision that white shrimp taken in the exclusive economic zone (EEZ) be landed in accordance with a state's size/possession regulations to provide consistency and facilitate enforcement with Louisiana was to have been implemented at such time when Louisiana provided for an incidental catch of undersized white shrimp in the fishery for seabobs. This provision was disapproved by NMFS with the recommendation that it be resubmitted under the expedited 60-day Secretarial review schedule after Louisiana provided for a bycatch of undersized white shrimp in the directed fishery for seabobs. This resubmission was made in February of 1990 and applied to white shrimp taken in the EEZ and landed in Louisiana. It was approved and implemented in May of 1990.

In July 1989, NMFS published revised guidelines for FMPs that interpretatively addressed the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (then called the Magnuson Fishery Conservation and Management Act) National Standards (50 CFR 602). These guidelines required each FMP to include a scientifically measurable definition of overfishing and an action plan to arrest overfishing should it occur.

Amendment 5/EA (1991) defined overfishing for Gulf brown, pink, and royal red shrimp and provided measures to restore overfished stocks if overfishing should occur. Action on the definition of overfishing for white shrimp was deferred, and seabobs and rock shrimp were removed from the management unit. The duration of the seasonal closure to shrimping off Texas was adjusted to conform to the changes in state regulations.

Amendment 6/EA (1992) eliminated the annual reports and reviews of the Tortugas Shrimp Sanctuary in favor of monitoring and an annual stock assessment. Three seasonally opened areas within the sanctuary continue to open seasonally, without need for annual action. A proposed

definition of overfishing of white shrimp was rejected by NMFS because it was not based on the best available data.

Amendment 7/EA (1994) defined overfishing for white shrimp and provided for future updating of overfishing indices for brown, white, and pink shrimp as new data become available. A total allowable level of foreign fishing for royal red shrimp was eliminated; however, a redefinition of overfishing for this species was disapproved.

Amendment 8/EA (1995), implemented in early 1996, addressed management of royal red shrimp. It established a procedure that would allow total allowable catch for royal red shrimp to be set up to 30% above MSY for no more than two consecutive years so that a better estimate of MSY could be determined. This action was subsequently negated by the 1996 Sustainable Fisheries Act amendment to the Magnuson-Stevens Act that defined overfishing as a fishing level that jeopardizes the capacity of a stock to maintain MSY, and does not allow OY to exceed MSY.

Amendment 9/supplemental environmental impact statement (SEIS) (1997) required the use of a NMFS certified bycatch reduction device (BRD) in shrimp trawls used in the EEZ from Cape San Blas, Florida to the Texas/Mexico border, and provided for the certification of BRDs and specifications for the placement and construction. The purpose of this action was to reduce the bycatch mortality of juvenile red snapper by 44% from the average mortality for the years 1984 through 1989 (the required bycatch reduction was reduced to 30% in 2008 through a framework action). This amendment exempted shrimp trawls fishing for royal red shrimp seaward of the 100-fathom contour, as well as groundfish and butterfish trawls, from the BRD requirement. It also excluded small try nets and no more than two ridged frame roller trawls of limited size. Amendment 9 also provided mechanisms to change the bycatch reduction criterion and to certify additional BRDs.

Amendment 10/EA (2002) required BRDs in shrimp trawls used in the Gulf east of Cape San Blas, Florida. Certified BRDs for this area are required to demonstrate a 30% reduction by weight of finfish.

Amendment 11/EA (2001) required owners and operators of all vessels harvesting shrimp from the EEZ of the Gulf to obtain a federal commercial vessel permit. This amendment also prohibited the use of traps to harvest royal red shrimp from the Gulf and prohibited the transfer of royal red shrimp at sea.

Amendment 12/EA (2001) was included as part of the Generic Essential Fish Habitat (EFH) Amendment that established EFH for shrimp in the Gulf.

Amendment 13/EA (2005) established an endorsement to the federal shrimp vessel permit for vessels harvesting royal red shrimp; defined the overfishing and overfished thresholds for royal red shrimp; defined MSY and OY for the penaeid shrimp stocks in the Gulf; established bycatch reporting methodologies and improved collection of shrimping effort data in the EEZ; required completion of a Gulf Shrimp Vessel and Gear Characterization Form by vessels with federal

shrimp permits; established a moratorium on the issuance of federal commercial shrimp vessel permits; and required reporting and certification of landings during the moratorium.

August 2006 Regulatory Amendment (2006) changed the bycatch reduction certification criterion for red snapper from penaeid shrimp trawling in the EEZ. The BRD certification criterion addressed shrimp trawl bycatch more comprehensively and increased flexibility, promoted innovation, and allowed for a wider variety of BRDs which allowed fishermen to choose the most effective BRD for fishing conditions and therefore reduce overall finfish bycatch.

Amendment 14/EIS (2007) was a joint amendment with Reef Fish Amendment 27. It established a target red snapper bycatch mortality goal for the shrimp fishery in the western Gulf and defined seasonal closure restrictions that can be used to manage shrimp fishing efforts in relation to the target red snapper bycatch mortality reduction goal. It also established a framework procedure to streamline the management of shrimp fishing effort in the western Gulf.

The Generic Annual Catch Limit (ACL)/Accountability Measures (AMs) Amendment/EIS (2011) set an ACL and AM for royal red shrimp. Penaeid shrimp were exempt from the ACL/AM requirements because of their annual life cycle.

The Shrimp Electronic Logbook (ELB) Framework Action (2013) established a cost-sharing system for the ELB program, and described new equipment and procedures for the program.

Amendment 15/EA (2015) redefined stock status criteria for the three penaeid species of shrimp, including species-specific MSY values and overfished/overfishing thresholds. The general framework procedure was updated.

Amendment 16/SEIS (2015) eliminated duplicative AMs and the quota for royal red shrimp. The ACL was set equal to the acceptable biological catch and a post-season AM was established.

Amendment 17A/EA (2016) extended the Gulf shrimp permit moratorium for another 10 years until October 26, 2026.

CHAPTER 2. MANAGEMENT ALTERNATIVES

Action 1 – Aggregate Maximum Sustainable Yield (MSY) for the Gulf of Mexico (Gulf) Shrimp Fishery

Note: Aggregate means for all shrimp species combined. MSY for each species is already established. Aggregate MSY does not equal the sum of the individual species MSYs.

Alternative 1. No Action. Do not establish an aggregate MSY for the federal shrimp fishery.

Alternative 2. Establish aggregate MSY using the method developed by the Shrimp Effort Working Group (SEWG). For the federal commercial Gulf shrimp fishery, aggregate MSY = 112,531,374 lbs of tails. AP Preferred

Discussion:

In Amendment 15 to the Fishery Management Plan (FMP) for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters, the Gulf of Mexico Fishery Management Council (Council) determined species-specific MSYs for penaeid shrimp. However, an aggregate MSY for management of the shrimp fishery in federal waters includes all managed species (penaeid shrimp and royal red shrimp) and can be used as a reference point for the shrimp fishery as a whole. In March 2016, a working group was convened to determine the appropriate aggregate MSY for the shrimp fishery in federal waters. The working group decided to use the same general approach used by the SEWG (Nance et al. 2006) except that the group determined it was no longer possible to estimate catch and effort in federal waters with a reasonable degree of scientific certainty because of data limitations. Catch and effort in offshore waters[1] were determined to be the best available proxies for catch and effort in federal waters. The Gulf shrimp fishery can be partitioned by different components or boundaries. The shrimp fishery operates within the inshore area, which is defined as the area from the COLREGS line shoreward; the offshore area, which is designated as being from the COLREGS line seaward; and the exclusive economic zone (EEZ), which is the portion of the offshore area that is under U.S. federal government management (Figure 2.1.1). The COLREGS lines are the set of demarcation lines that have been established by the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (commonly called COLREGS). COLREGS define boundaries across harbor mouths and inlets for navigation purposes. The inner boundary of the EEZ begins either three or nine nautical miles offshore depending upon the area of the Gulf and extends 200 miles seaward from the inner boundary. Both inshore and offshore fisheries of the Gulf are managed by their respective state agencies, and the fisheries prosecuted in the EEZ are managed by National Marine Fisheries

[1] Gulf offshore waters include some state waters, as well as federal waters. Though most of these vessels had federal permits, a federal permit is not required to harvest shrimp in state offshore waters. Thus, the number of active vessels in the offshore fishery will generally exceed the number of permitted or active permitted vessels.

Service (NMFS) and the Council.

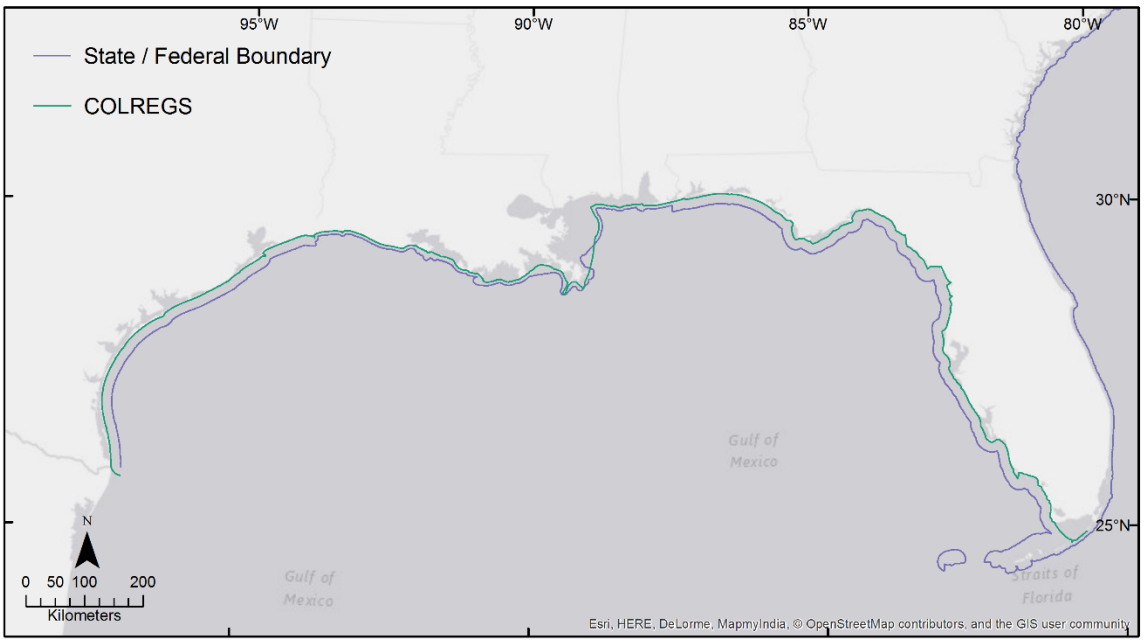

Figure 2.1.1. Depiction of COLREGS boundaries versus federal boundaries (EEZ). The blue line depicts the COLREGS boundary, separating "inshore" and "offshore" waters. The purple line depicts the boundary separating state and federal waters.

In the 2006 Ad Hoc Shrimp Effort Working Group (SEWG) report, effort and aggregate MSY for the federal shrimp fishery were calculated using two methods: the "pooled" approach used by the Galveston Lab and the General Linear Model (GLM) developed by Griffin et al. (1997). For current purposes, the 2016 Aggregate MSY-OY working group decided to use the pooled approach because that model is currently being used for shrimp stock assessment purposes, and the GLM model has not been used or updated in recent years. Using methods from the SEWG with the most recent years of catch and effort data included (1990-2014), the estimated yield curve (Figure 2.2.1) for the offshore fishery (a proxy for the federal shrimp fishery) produced by the model indicates that aggregate MSY is 112,531,374 lbs (tails) for managed shrimp species and effort at MSY is 143,756 days fished. The aggregate MSY for the offshore fishery (a proxy for the federal shrimp fishery) is less than the summation of all individual species' Gulf-wide MSYs because aggregate MSY only uses offshore landings, while the individual species' MSYs are based on the total fishery; the two are not comparable. Model results should only be used to estimate aggregate MSY based on observed data. These model results should not be used to predict what landings would be at effort levels above or below observed levels.

Aggregate MSY is needed to determine aggregate OY which is the yield that National Standard (NS) 1 requires the fishery achieve on a continuing basis and takes into account economic, social, and ecological factors. The level of effort needed to achieve aggregate MSY in the federal shrimp fishery was most closely observed in 2004 (Figure 2.2.1). Recent levels of effort

have been well below the level needed to achieve aggregate MSY in the offshore fishery though in 2006 landings were above MSY. Based on observed effort in 2013, effort would need to increase by more than 126% from current levels to achieve aggregate MSY. It is unlikely that the fishery needs to achieve aggregate MSY to attain aggregate OY. The Council may either choose to establish an aggregate MSY or not, but the Aggregate MSY-OY working group did not feel that there were viable alternatives to the aggregate MSY produced by the accepted model.

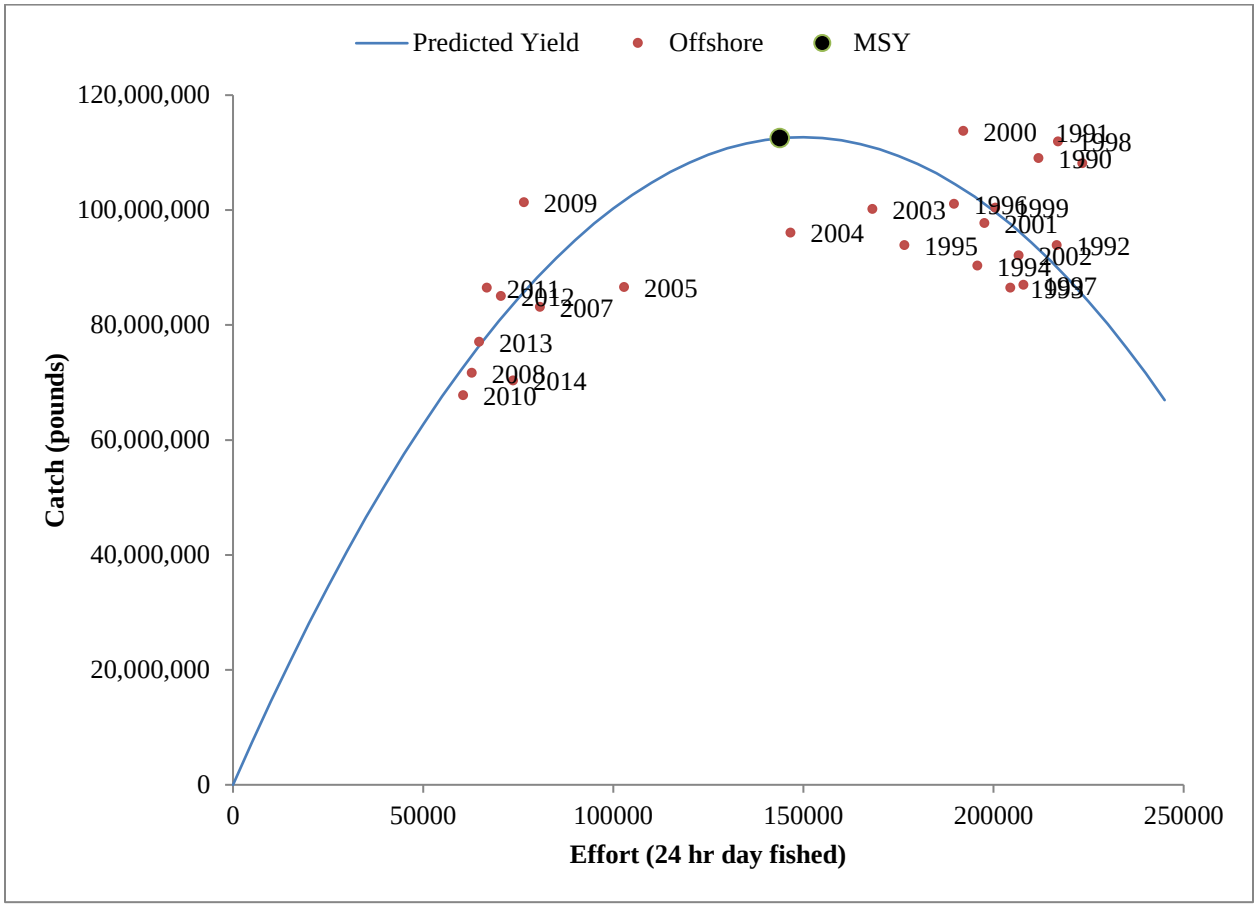

Figure 2.1.2. Graham Schaeffer production model used to estimate aggregate MSY for the offshore component of the Gulf shrimp fishery showing model estimate and actual data points, 1990-2014.
Source: SEFSC, Galveston

Action 2 – Aggregate Optimum Yield (OY) for the Gulf Shrimp Fishery

Note: Aggregate means for all shrimp species combined. OY for each species is already established. Aggregate OY does not equal the sum of the individual species OYs.

Alternative 1. No Action. Do not establish an aggregate OY for the federal commercial Gulf shrimp fishery.

Alternative 2. For the federal shrimp fishery, aggregate OY = 85,761,596 lbs of tails which is aggregate MSY reduced for certain ecological, social, and economic factors. AP Preferred

Discussion:

The OY is the amount of a managed species that will provide the greatest overall benefit to the nation with respect to food production and recreational opportunities and is prescribed on the basis of MSY as it may be reduced by any relevant social, economic, or ecological factor. The NS 1 guidelines for the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) state that OY cannot exceed, but may be equal to, MSY target levels. The guidelines continue to note that the Councils should adopt a precautionary approach and set OY levels safely below limit reference points so they are "explicitly" risk averse.

Other Gulf FMPs have set OY in terms of a percentage of MSY or fishing mortality at MSY (F_{MSY}) (e.g., king mackerel OY is 85% F_{MSY}). The current definition of OY for the individual shrimp stocks is OY equals MSY. Aggregate OY would be achieved by determining what the appropriate value would be for all stocks combined, not individual species.

Action 1 would determine the aggregate MSY for the federal shrimp fishery based on the SEWG methodology. The Aggregate MSY-OY working group was convened in March 2016 to determine the appropriate aggregate OY for the shrimp fishery. The Aggregate MSY-OY working group determined that there were four important factors to consider when establishing aggregate OY: landings, catch per unit effort (CPUE), sea turtle bycatch threshold, and juvenile red snapper bycatch. The Aggregate MSY-OY working group concluded that the effort and associated predicted landings in 2009 balanced all of these criteria relative to observed levels in other years. It should be noted that the juvenile red snapper bycatch threshold only pertains to effort exerted in the juvenile red snapper bycatch area (statistical zones 10-21, 10-30 fathoms; Figure 2.2.1) established in Shrimp Amendment 14, and the sea turtle bycatch effort threshold applies to all Gulf waters (i.e., inshore and offshore combined). Based on the definition of OY in the NS1 guidelines and the economics of the shrimp fishery, the Aggregate MSY-OY working group determined that an aggregate OY equal to the aggregate MSY is not appropriate.

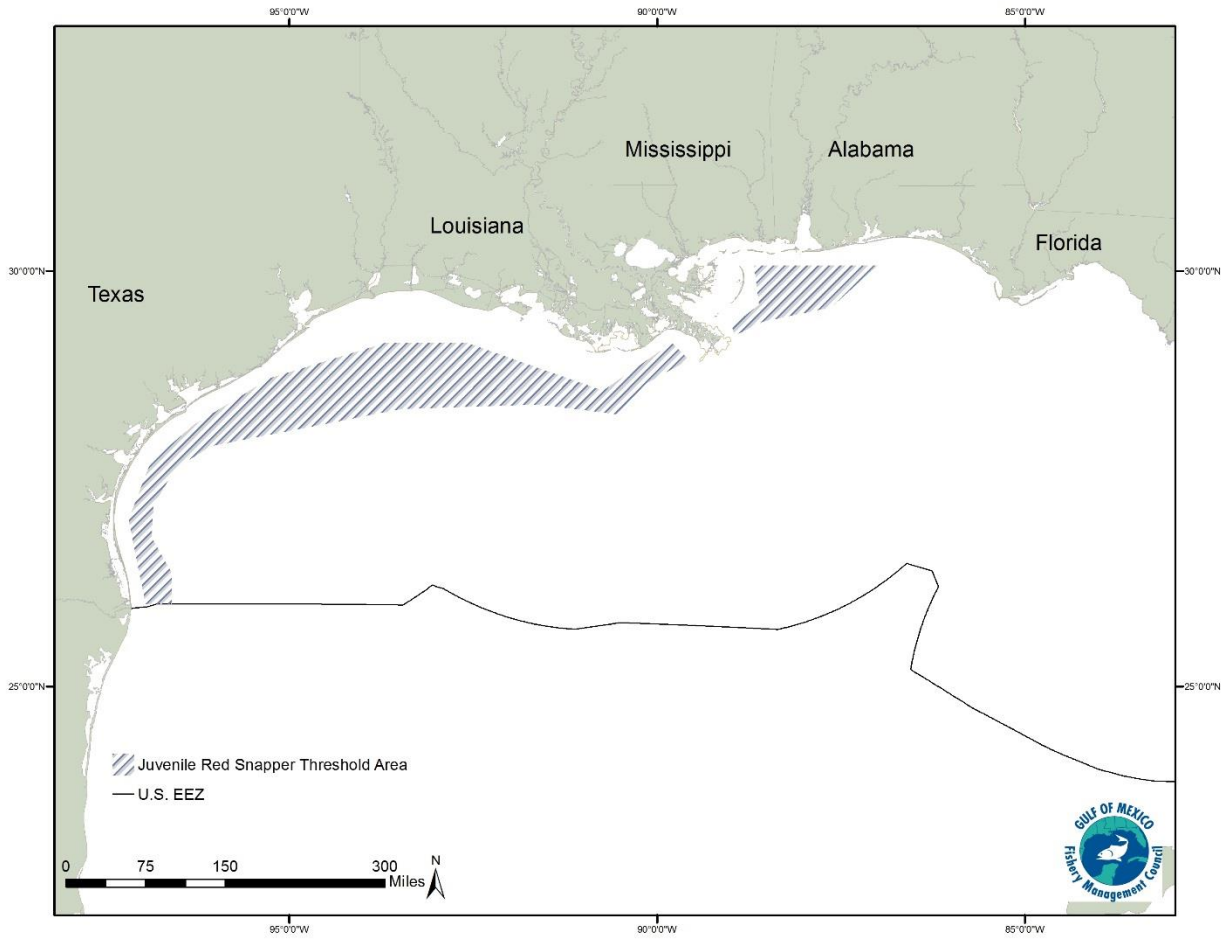

Figure 2.2.1. The juvenile red snapper bycatch threshold area in statistical zones 10-21, 10-30 fathoms.

Similarly, setting aggregate OY as some percentage below aggregate MSY would need scientific rationale. Setting OY in terms of a percentage of F_{MSY} would require that each time F_{MSY} is re-evaluated, so too, would OY. The Aggregate MSY-OY Working Group chose a point value based on the history of the fishery and felt that a complicated socio-bio-economic model would require explicit weighting of criteria, which would be subjective; additionally, the Council would need to direct the group as to how criteria should be weighted. The Aggregate MSY-OY Working Group felt that confidence intervals about the aggregate OY would be inappropriate because the confidence intervals would be based on the point estimate. The Aggregate MSY-OY Working Group also felt that any other alternative would be subjective; though the point estimate presented is qualitative, it is based on historical landings and effort data and a model that has been used for developing management benchmarks for shrimp.

Action 3 – Minimum Threshold Number of Gulf Shrimp Vessel Permits

NOTE: This action does not actively remove any Gulf shrimp permits. The minimum threshold is only for purposes of monitoring changes in fishery participation and determining if additional management measures should be established.

Alternative 1. No Action. Do not set a threshold number of Gulf shrimp vessel permits.

Alternative 2. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) needed to attain aggregate OY in the offshore fishery. Aggregate OY accounts for relatively high CPUE and landings while reducing the risk of exceeding sea turtle and juvenile red snapper bycatch (for Action 2 Alternative 2: 1,072 permits). AP Preferred

Alternative 3. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) during 2011 when effort was highest during the moratorium in the area monitored for red snapper juvenile mortality but without reaching the bycatch reduction threshold and triggering closures (935 permits).

Alternative 4. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) during 2008 when CPUE in the offshore fishery was highest during the moratorium (880 permits).

Alternative 5. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) in a year with relatively high CPUE in the offshore fishery without substantially reduced landings, and with effort that is close to the effort needed to achieve OY.

Option 5a. 2007 (1,131 permits)

Option 5b. 2012 (988 permits)

Discussion:

A passive decrease in the number of permits is an expected part of a moratorium or limited access permit. Permits are terminated if the holder does not renew the permit within one year of the expiration date. The federal Gulf commercial shrimp permit moratorium was based on the likelihood that, at some point in time, the number of vessels in the offshore shrimp fleet would decline to a point where the fishery again became profitable for the remaining participants. In Amendment 13, the Council determined that there was a need to prevent new effort in the fishery and thus negating, or at least lessening, profitability. Various members of the Council, the

Council's Shrimp Advisory Panel (Shrimp AP), and the public have suggested the fishery has reached that point, and the decline in permits should end; others have suggested the time is still in the future. In either case, the Council may decide to set a minimum threshold for the number of permits in the Gulf shrimp fishery. If so, when the threshold is reached, the Council would need to determine if the termination of permits should be stopped.

Alternative 1 would not set a minimum threshold number of permits, and permits that were not renewed within one year of the expiration date would continue to be terminated. This is the practice for all other limited access permits issued by NMFS Southeast Regional Office (SERO). The number of Gulf shrimp permits would be expected to continue to decrease over time, although the rate of decrease would be expected to slow as fewer inactive permits (permits with no landings) remain. The Shrimp AP was concerned that the fleet would also continue to shrink because of vessel age and the high cost of replacing those vessels. These factors could cause the rate of attrition to increase in the future. If the number of termination remains similar to that in 2015 (15 per year), the number of permits expected at the end of the 10-year moratorium would be around 1,295.

Through the end of 2015, 478 federal shrimp permits have been terminated or surrendered (Table 1.1.1). To understand if terminated permits were on active vessels prior to termination, we examined permits from the three most recent years with data (2012-2014). During that time, 129 permits were terminated. Of those 129 permits, 114 had been on the same vessel for at least three years. Looking at 2007-2014 offshore landings for those 114 vessel/permit combinations, 33% had no landings and an additional 14% had only one year of landings. Also of those 114 vessel/permit combinations, 57% had no offshore landings for at least three years immediately before termination, 64% had no landings for at least two years immediately before termination, and 89% had no landings for at least one year immediately before termination. Further, some vessels with offshore landings during these years may have only fished in state offshore waters and did not need the federal permit. Thus, the majority of permits that terminated in 2012-2014 due to non-renewal were not being used prior to termination.

Alternatives 2-5 would set the minimum threshold number of permits based on a level of effort and number of active vessels that leads to a particular management goal: achieving OY, remaining below the target effort level for juvenile red snapper bycatch, maintaining the highest CPUE, or balancing high CPUE and landings, respectively. Effort is for vessels fishing in offshore waters, which are waters outside the COLREGS lines (see Figure 2.1.1). The COLREGS lines are the set of demarcation lines that have been established by the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (commonly called COLREGS). COLREGS define boundaries across harbor mouths and inlets for navigation purposes.

In 2014, NMFS issued a biological opinion (bi op) on the continued authorization of the Southeast U.S. shrimp fisheries in federal waters on threatened and endangered species and designated critical habitat, in accordance with Section 7 of the Endangered Species Act (ESA).

The expectation in the bi op was that future total effort levels in the southeastern shrimp fisheries would remain at or below 2009 effort levels (Figure 2.3.1). Although the bi op allows for some annual fluctuation, any substantial increase in effort above the 2009 level would require re-initiation of consultation on the effect of the shrimp fishery on ESA-listed species. If captures of protected species increase, additional requirements for bycatch reduction could be imposed.

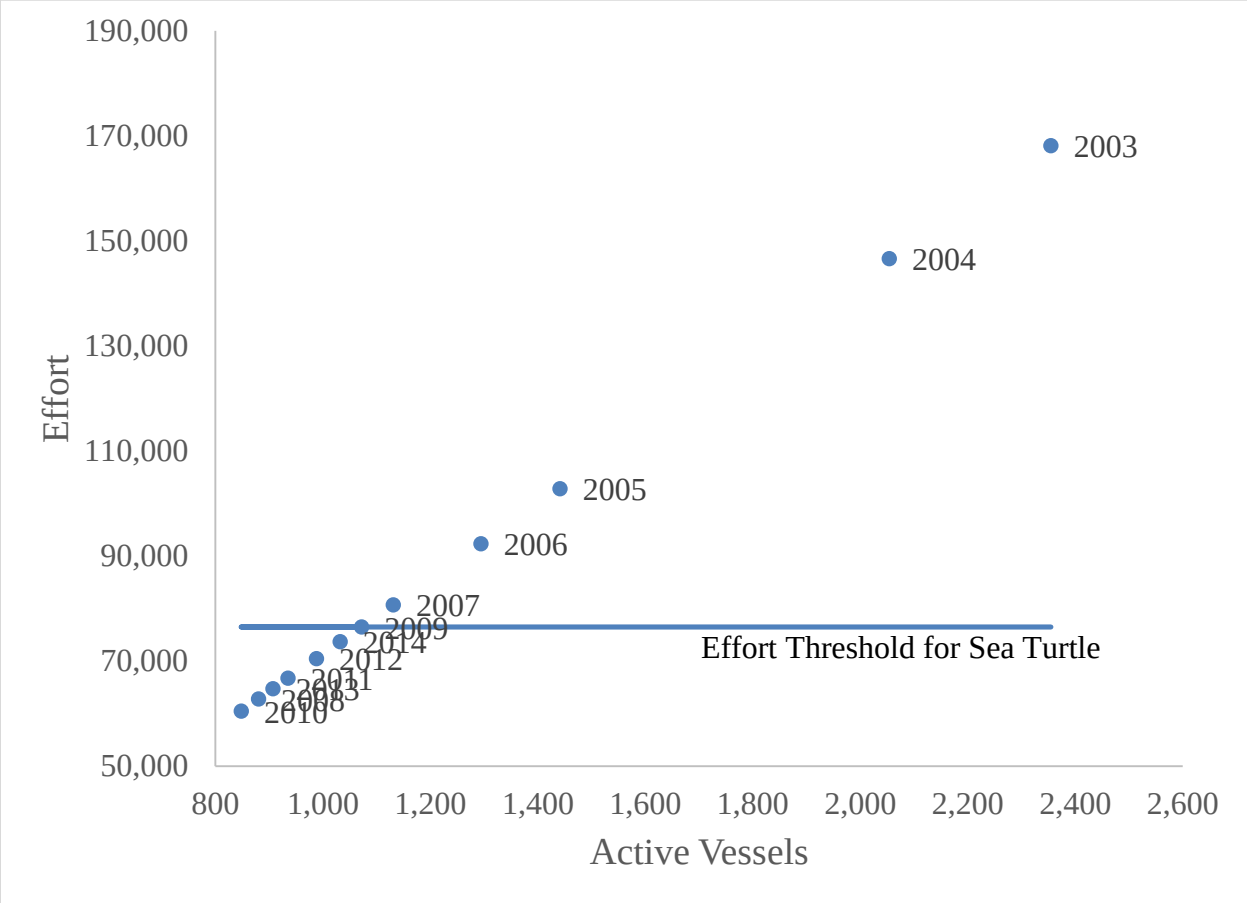

Figure 2.3.1. Number of active federally permitted shrimp vessels versus effort in days (24 hours) fishing. The blue line indicates the effort threshold set by the 2014 biological opinion based on 2009 effort levels; any effort above this level could result in an increase in sea turtle bycatch and would trigger a new consultation relative to the ESA.

Amendment 14 (GMFMC 2007) set a target shrimp effort level in specific areas of the western Gulf (statistical zones 10-21, 10-30 fathoms) to protect juvenile red snapper. This target was originally 74% less than the effort in the benchmark years of 2001-2003. The target was reduced in 2012 to 67% less than the benchmark years because the red snapper rebuilding plan was proceeding as planned. If effort in the area increases above this target, selected areas of federal waters must be closed to shrimp fishing.

An analysis of the relationship between the number of active federally permitted vessels and offshore effort found a strong relationship (Appendix B). A vessel is considered to be active in a particular year if it had shrimp landings from Gulf offshore[2] waters according to the most recent available Gulf Shrimp System (GSS) data. For example, if a vessel only had landings from inshore waters or another region (e.g., South Atlantic), it was not considered active in this analysis. Landings included all shrimp species caught.

Further, estimates of active permitted vessels in offshore waters are likely a very good proxy for estimates of active permitted vessels in federal waters (Appendix B). Because the number of federally permitted vessels is related to offshore effort, the Council can indirectly control or at least limit offshore effort by controlling the number of vessels with federal permits. By looking for the desired level of effort in past years, we can find the number of active vessels in the year that matches that effort threshold. However, the number of active vessels in any year is dependent on many factors, including abundance of shrimp. A model was used to predict the number of active permitted vessels needed to attain levels of effort observed in each year under average shrimp abundance (Appendix B, Table 2.3.1). Because the effort includes state offshore waters, the estimates are overestimates of what is actually occurring in federal waters.

The available data does not allow for separation of landings and effort from the EEZ versus those from state offshore waters. Thus, the estimates of offshore effort and number of active vessels in **Alternatives 2-5** are overestimates of those values for federal waters; therefore, the number of permits needed to achieve the target effort in federal waters only is some amount lower than the threshold set in each of those alternatives. The result is a de facto "buffer" between the threshold set by the alternative and the number of active permits needed. Because some federally permitted vessels are expected to be inactive each year, the threshold number of permits should be set somewhat higher than the actual number needed to achieve the target effort. Although we cannot quantify the actual size of these "buffers", the overestimates of the number of permits needed should account for any inactive vessels in a year. Reasons for not participating in the fishery in a year include, but are not limited to, illness of the vessel owner, temporary loss of the vessel, poor economic conditions in the offshore fishery, or a decision to temporarily use the permitted vessel in another fishery. Finally, only 1,568 permits were associated with at least one pound of landings during any of the eight years of the moratorium (2007-2014) and only 1,185 permits were associated with at least one pound of landings in three or more of the eight years.

[2] Gulf offshore waters includes some state waters, as well as federal waters. Though most of these vessels had federal permits, a federal permit is not required to harvest shrimp in state offshore waters. Thus, the number of active vessels in the offshore fishery will generally exceed the number of permitted or active permitted vessels.

Table 2.3.1. Observed landings and CPUE for the offshore component of the Gulf shrimp fishery, landings and CPUE predicted with the same effort under average shrimp abundance conditions, and the number of vessels predicted to produce those landings under average shrimp abundance. Effort is in days (24 hours) fished and landings are in pounds of tails. See the text and Appendix B for details on how effort and predicted numbers were calculated.

Year	Effort	Observed Landings	Observed CPUE	Predicted Landings under Average Abundance	Predicted CPUE under Average Abundance	Predicted Active Permitted Vessels under Average Abundance
2003	168,135	100,203,686	596	110,997,688	666	2,355
2004	146,624	96,079,478	655	112,661,609	773	2,054
2005	102,840	86,571,515	842	101,667,987	992	1,441
2006	92,372	120,437,081	1304	96,183,378	1,044	1,294
2007	80,733	83,126,655	1030	88,790,218	1,103	1,131
2008	62,797	71,689,314	1142	74,730,070	1,192	880
2009	76,508	101,339,883	1325	85,769,737	1,124	1,072
2010	60,518	67,790,473	1120	72,711,672	1,204	848
2011	66,777	86,482,240	1295	78,129,551	1,172	935
2012	70,505	85,004,590	1206	81,168,842	1,154	988
2013	64,764	77,063,083	1190	76,429,912	1,182	907
2014	73,683	70,341,587	955	83,649,665	1,138	1,032

Source: Landings are based on GSS data, J. Primrose, SEFSC Galveston, 7/10/15; effort and CPUE estimates, R. Hart, SEFSC Galveston, 7/15/15; predicted values, M. Travis, NMFS SERO, 7/17/15.
Note: A small percentage of the offshore landings in each year cannot be ascribed to a particular vessel because of missing or invalid vessel identifiers in the GSS data; this percentage has declined from 3% in 2003 to 0.6% in 2013. Because of missing or invalid vessel identifiers, the estimates of active vessels in Table 2.3.1 may be slightly underestimated.

Alternative 2 bases the minimum threshold number of permits on the predicted number of active permitted vessels that could harvest the aggregate OY in the offshore component of the shrimp fishery under average shrimp abundance. NS 1 of the Magnuson-Stevens Act says that management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery. Federal permits only apply to fishing in federal waters, but effort in only federal waters cannot be estimated with a high degree of scientific certainty because some state trip tickets do not require dealers to report whether landings come from federal or state waters. Therefore, the effort needed to harvest the aggregate OY for the offshore component is the best proxy to base the minimum threshold number of permits on to manage for OY. Because the effort includes state offshore waters, the estimates are most likely overestimates of what is actually occurring in federal waters. The actual number of permits set by this alternative depends on the aggregate OY chosen in Action 2. For example, Alternative 2 in Action 2 is the OY recommended by the working group based on predicted effort in 2009. As stated in Action

2, the 2009 effort maintained fairly high landings and CPUEs, while still remaining below the thresholds for sea turtle and juvenile red snapper bycatch; thus this level of effort balances these factors to produce a yield that is optimal for the fishery. The effort in 2009 was the threshold level of effort used to develop the sea turtle incidental take statement in the 2014 bi op (NMFS 2014). By setting the minimum threshold number of permits at the number of active vessels in 2009, the Council could indirectly control offshore effort and prevent exceeding the effort levels used in the bi op, thereby reducing the risk of fishery closures.

Alternative 3 bases the minimum threshold number of permits on the predicted number of active permitted vessels during 2011, when effort was highest during the moratorium in the area monitored for red snapper juvenile mortality, but without exceeding the effort associated with the bycatch reduction target of 67%. In 2011, the effort level for the area exceeded the original target effort level; however, it was just below the new target effort level, which was in the process of being implemented (Figure 2.3.2). Therefore, the predicted number of active permitted vessels in that year could be considered a reasonable minimum threshold for the number of permits in the shrimp fishery.

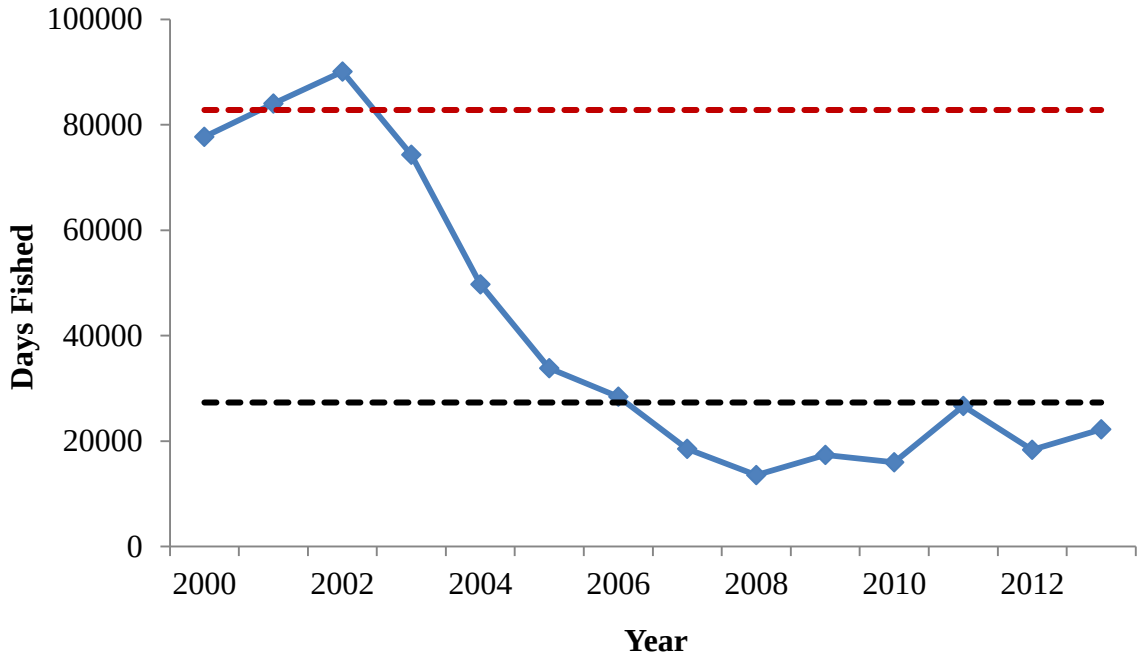

Figure 2.3.2. Offshore Gulf shrimp effort in statistical zones 10-21, 10-30 fathoms relative to target effort levels to reduce red snapper juvenile mortality. The upper (red) line shows the baseline 2001-2013 effort levels; the lower (black) line shows the target effort level of 67% reduction from the baseline.
Source: SEFSC, Galveston.

Alternatives 4 and **5** would base the minimum threshold on a level of effort that could maintain high CPUE and high landings (Table 2.3.1); however, effort and landings are affected by many factors, including varying abundance of shrimp. For example, although observed landings were highest in 2006, this was due to higher shrimp abundance that year than the long-term average abundance. The level of effort seen in 2006 would not be expected to generate that same level of landings under average levels of shrimp abundance. Thus, observed levels should not be used to predict landings under average abundance conditions in the future. The same caution applies to using observed levels of CPUE. Although observed CPUE was highest in 2009, this result was similarly driven by above average abundance of shrimp. It is not prudent to expect or rely on above average abundance conditions in the future. Instead, models for landings and CPUE can be used to generate values that would be expected under average shrimp abundance (see Appendix B) and thus are more reliable with respect to determining what to expect in the future (Table 2.3.1).

The minimum threshold in **Alternative 4** is based on the predicted number of active vessels when CPUE was highest during the original moratorium. Predicted CPUE was highest in 2010, but this finding must be viewed with caution given the effects of the Deepwater Horizon MC252 oil spill on fishing behavior in 2010. It would be safer to conclude that CPUE was at its maximum in 2008. Economic conditions have led to substantial consolidation in this industry creating significant efficiency gains for the remaining participants. Although based on limited data (2006-2014), a linear regression model determined that annual net revenue per vessel was primarily driven by CPUE; ex-vessel shrimp price was slightly less important and fuel price was even less important relative to CPUE (Appendix B). The consolidation and the resulting efficiency gains for fishermen would be locked in by maintaining the number of vessels that could harvest at a high CPUE. This was the objective of the moratorium as stated in Amendment 13 (GMFMC 2005a).

Observed CPUE was highest when effort (in days fished) was lowest (Figure 2.3.3). If 2010 is omitted, predicted CPUE was at its maximum in 2008. If the Council intends simply to maximize CPUE, the predicted number of active permitted vessels needed to attain effort observed in 2008 should be used to set the minimum threshold number of permits.

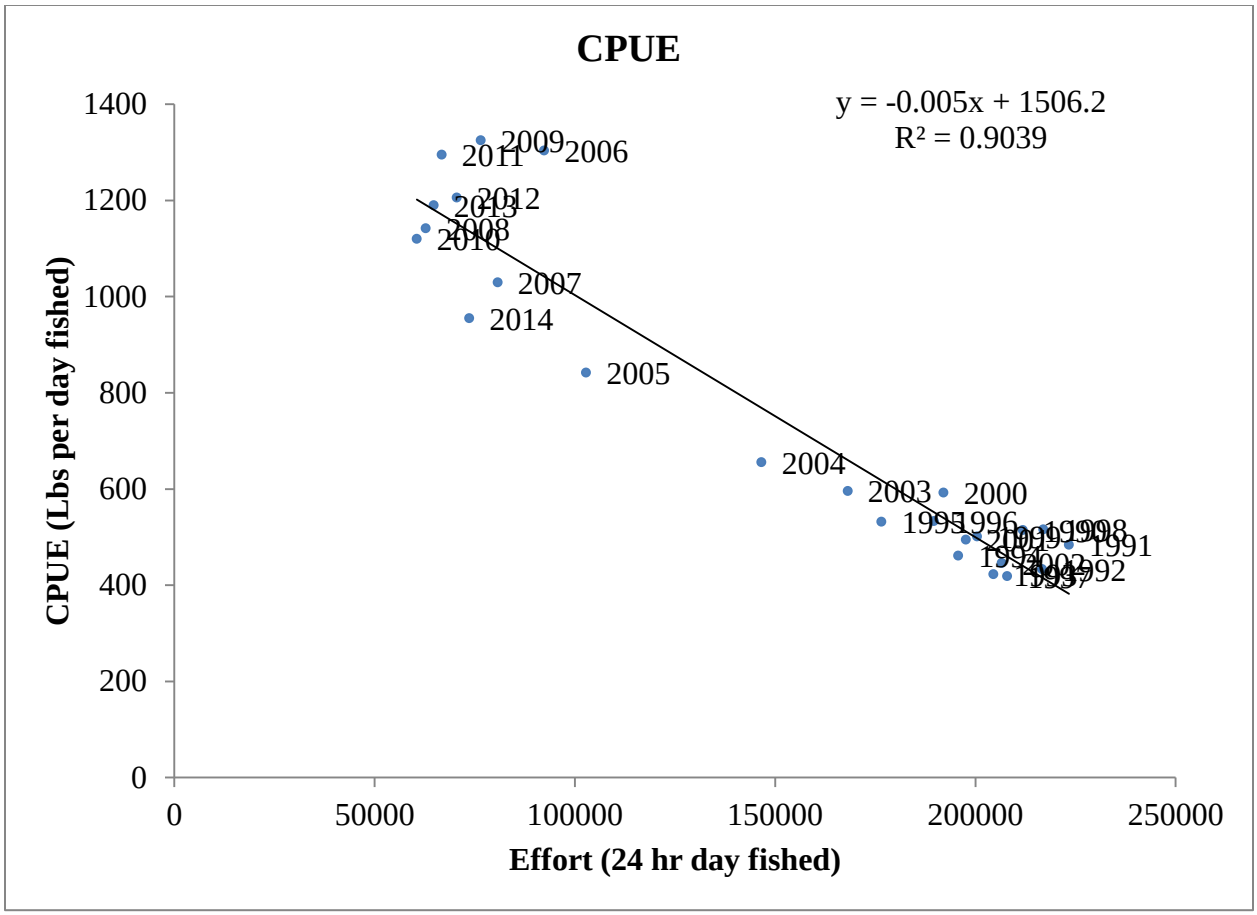

Figure 2.3.3. Relationship between CPUE and effort in the offshore component of the Gulf shrimp fishery, 1990-2014.
Source: SEFSC, Galveston

Reductions in observed effort and fleet size after implementation of the moratorium resulted in increased CPUE values, but substantial increases in CPUE were not seen after 2007. Conversely, reduced effort resulted in decreased landings after implementation of the moratorium. Average predicted landings during the moratorium (79.32 million pounds (mp)) were 22% less than average predicted landings in 2004-2006 (101.80 mp) (Table 2.3.1). Landings reductions would generally be expected to cause adverse economic impacts in the onshore sector (e.g., dealers and processors) as profitability in that sector is mainly determined by physical volume and gross revenue from the harvesting sector. However, even though landings decreased in 2013 and 2014, gross revenue from the offshore fishery increased because the increases in the price of shrimp more than offset the reductions in landings. Thus, the effect of further reductions in landings will depend on what happens to shrimp prices in the future. **Alternative 5** is an attempt to balance the number of permits needed to maintain relatively high CPUE values without allowing total landings to substantially decrease. Any year during the moratorium could be chosen to represent a balance between CPUE and landings; the years included in **Options 5a** and **5b** were requested by the Council because the effort in those years

was near the effort estimated to achieve OY. The effort in 2007 (**Option 5a**) was 6% higher than in 2009, and the effort in 2012 (**Option 5b**) was 8% lower than in 2009.

Table 2.3.2. Number of federally permitted active and inactive vessels in the offshore component of the Gulf shrimp fishery. Vessels are those that had a valid permit at any time during the year; because permits are transferable and thus more than one vessel can possess the same valid permit in a given year, the number of vessels with a valid permit in a year will be greater than the number of valid permits in that year, as demonstrated by the differences in permit and vessel counts in Table 1.1.1 and Table 2.3.1. Active vessels are those that had at least one pound of shrimp landings at any point in the year.

Year	Vessels with Valid Permits	Active Offshore Vessels with Valid Permits	Inactive Offshore Vessels with Valid Permits	Percent Inactive Vessels - Offshore	Percent Inactive Vessels – Offshore and Inshore
2007	2,514*	1,283	1,231	49%	38%
2008	1,930	1,059	871	45%	36%
2009	1,764	1,075	689	39%	30%
2010	1,685	951	734	44%	33%
2011	1,641	1,013	628	38%	28%
2012	1,587	1,014	573	36%	28%
2013	1,544	970	574	37%	28%
2014	1,515	987	528	35%	26%

Source: M. Travis, NMFS SERO, 4/29/16
*This count includes both open access and moratorium permits. Many open access permits were valid for part of the year.

Economic conditions improved somewhat in 2013 because the average, real (inflation adjusted) ex-vessel shrimp price increased by 34% compared to 2012. Economic conditions continued to improve in 2014, and in general appear to have been the most favorable conditions seen in the fishery since 2000. Preliminary data suggests ex-vessel prices have abruptly turned downward in 2015, potentially erasing the increases from the two previous years. Conversely, fuel prices appear to have decreased further as well, somewhat mitigating the sharp decline in shrimp prices. Thus, economic conditions in 2014 likely represent a best-case scenario in the reasonably foreseeable future. Given the relatively positive economic conditions in 2014, one would expect vessels that were inactive due to the previous poor economic conditions to begin fishing again in 2014. Yet the percent of inactive permitted vessels only decreased by 2%, equivalent to the decrease in the number of permits. This suggests is that the active permitted fleet has become fairly stable and changes in economic conditions are having little effect on the size of that core fleet.

Summary of Potential Impacts

Alternatives 2-5 would continue to allow a passive reduction in the number of permits over time. Fewer permits could result in a lower number of vessels actively fishing, decreasing

bycatch and impacts on the environment. If fewer vessels could maintain the same level of total landings, each remaining vessel would have more landings and greater benefits. However, vessels cannot continue to increase CPUE indefinitely, and landings have been declining as effort has decreased in recent years. If the number of vessels is severely limited, shrimp harvest may not be able to support the current level of shore-side infrastructure needed by the industry.

The expected effects of these alternatives are dependent on changes in fishing effort, which may or may not change based on the number of permits. Inactive permits during the moratorium years have provided an opportunity for increased effort, either by the owners of those vessels starting to fish or by transferring permits to new entrants that intend to fish. Yet effort has not increased because of economic and social factors (e.g., shrimp prices, fuel prices, vessel, and owner age). Reasons to maintain a permit that is not being used to harvest shrimp include waiting for fishing to be more economical, accounting for bycatch of shrimp when trawling for other purposes, or speculating that the value of the permit will increase in the future.

NMFS staff conducted a qualitative risk analysis to determine the relative risk of exceeding the sea turtle effort threshold for each of the alternatives (Appendix C). The assessment considered three different scenarios based on fishing effort observed over the last seven years that could also exist in the future: 1) average effort 2008-2014, 2) maximum annual effort (2008), and 3) effort in the most recent year (2014). First, effort was calculated in days fished (24 hours) per active offshore vessel. Next, the number of additional "average offshore" vessels that would need to become active to reach the effort threshold for sea turtles was calculated. Those totals were then compared to the number of permits associated with each alternative to determine if the risk was low, moderate, or high. For example, under Scenario 1, the average number of active permitted vessels in the offshore fishery was 1,010 and an additional 445 "average offshore" vessels would need to become active to reach the sea turtle effort threshold, meaning that any federal permit level above 1,455 could, mathematically, lead to the effort threshold being exceeded, with all else being equal. For an explanation of the other scenarios and the caveats associated with the analysis, please see Appendix C.

Table 2.3.3. Relative risk of exceeding the sea turtle effort threshold for each alternative under Action 3. For details of the analysis, see Appendix B (values in this table have been updated).

Alternative	Number of permits	Relative risk of exceeding sea turtle-related effort threshold
1	1,295*	Moderate/High
2	1,072	Moderate
3	935	Low
4	880	Low
5a	1,131	Moderate
5b	988	Low

*The number of permits if no threshold is set was estimated using a termination rate of 15 permits per year for the next 10 years.

Action 4 – Response When Threshold Number of Shrimp Moratorium Permits is Reached

Alternative 1. No action. No action will be triggered when the threshold number of valid or renewable shrimp moratorium permits is reached.

Alternative 2. If the number of valid or renewable shrimp moratorium permits reaches the threshold set in Action 3, any permits that are not renewed within one year of the expiration date on the permit will go into a Gulf Shrimp Vessel Permit Reserve Pool.

Alternative 3. If the number of valid or renewable shrimp moratorium permits reaches the threshold set in Action 3, the Council will form a review panel to review the threshold and determine if action is needed.

Alternative 4. When the number of valid or renewable shrimp moratorium permits reaches 1,300, the Council will form a review panel to review the details of a permit pool and other options. If the number of permits reaches the threshold set in Action 3, any permits that are not renewed within one year of the expiration date on the permit will go into a Gulf Shrimp Vessel Permit Reserve Pool. The panel would consist of Shrimp AP members, Science and Statistical Committee (SSC) members, NMFS and Council staff. AP Preferred

Discussion:

Action 3 would set a threshold number of shrimp permits that represents the smallest number of permits the Council currently believes can support the Gulf shrimp fishery. If the threshold is reached, the Council may want to respond with new management measures or re-evaluate the threshold. Because the permit reduction is passive (permits are only terminated due to non-renewal by the permit holder), the threshold could be reached relatively quickly, after many years, or not at all, depending on the rate of termination. For 2015, only 16 permits were terminated and as of December 31, 2016, only 14 permits had been terminated for 2016. Using a termination rate of 15 permits per year, the time for the thresholds to be reached with Alternatives 2-5 in Action 3 would range from 20 to 37 years, long after the current permit moratorium expires.

No specific action would be triggered with **Alternative 1**. The Council could still choose to take an action relative to Gulf shrimp permits when the threshold is reached, but what type of action would be determined at that time. The Council could also choose to take action related to permits before the threshold is reached.

Alternative 2 would create a Gulf Shrimp Vessel Permit Reserve Pool (Reserve Pool). If the number of valid or renewable permits reaches the threshold set in Action 3, permits that normally would be terminated would instead be transformed into Reserved Gulf Shrimp Vessel Permits

that could be re-issued. The NMFS Pacific Islands Regional Office maintains a similar pool for the American Samoa longline limited access permits, wherein if a permit is relinquished, revoked, or not renewed, the Regional Administrator makes that permit available for re-issuance. Royal red shrimp endorsements would also be available to Reserve Gulf Shrimp Vessel Permit holders. Any permit in the Reserve Pool would not have a catch history associated with it, regardless of whether it was newly created or transformed from an expired, non-renewed permit; in other words, Reserve Gulf Shrimp Vessel Permits would act as new permits without associated catch history.

With **Alternative 3**, if the threshold is reached, NMFS would notify the Council and then the Council would form and convene a review panel. The panel would consist of SSC members, Shrimp AP members, and NMFS and Council staff. The panel would determine if action was needed in response to permits reaching the threshold and make recommendations to the Council; that action could be to create a reserve permit pool, to modify the threshold, or establish any other management measure. Any recommended action would be developed through the Council process. Because the threshold might not be reached for many years, economic conditions, the health of the shrimp stocks, and other factors may have changed, and the threshold number of permits set in this amendment may no longer be appropriate for the fishery. Thus, **Alternative 3** allows the Council flexibility to tailor future management measures to the actual situation at that time, rather than relying on an analysis based on the current situation.

At their meeting in March 2016, the Shrimp AP recommended the Council add another alternative that combined the ideas of **Alternatives 2** and **3**. This alternative would have the Council form and convene a review panel *before* the threshold from Action 3 was reached, to review the threshold and details of the Reserve Pool or other management measures. The Shrimp AP continued to support the idea of the Reserve Pool for permits, but believed a review of the threshold should be conducted before implementation of the Reserve Pool is triggered. The Shrimp AP suggested the review panel should meet if only 1,300 valid and renewable permits remain, which is approximately 150 permits less than the number of valid permits at the end of 2015. The rate of permit terminations in 2015 and 2016 was around 15 permits per year, so the time to the formation of a review panel would be 10 years if the termination rate stays the same.

Action 5 – Transit Provisions for Shrimp Vessels without a Federal Permit

Alternative 1. No Action. For a person aboard a vessel to fish for shrimp or possess shrimp in Gulf federal waters, a federal vessel permit for Gulf shrimp must have been issued to the vessel and must be on board.

Alternative 2. A vessel possessing shrimp may transit Gulf federal waters without a federal vessel permit if fishing gear is appropriately stowed. Transit means non-stop progression through the area; fishing gear appropriately stowed means trawl doors and nets must be out of the water and the bag straps must be removed from the net. AP Preferred

Alternative 3. A vessel possessing shrimp may transit Gulf federal waters without a federal vessel permit if fishing gear is appropriately stowed. Transit means non-stop progression through the area; fishing gear appropriately stowed means a trawl net shall remain on deck, but trawl doors (if present) must be disconnected from the trawl gear and must be secured.

Discussion:

At the August 2015 Council meeting, it was brought to the Council's attention that there are some areas where state-licensed shrimpers would like to transit from state waters through federal waters in order to return to state waters and port. However, because these state-licensed shrimping vessels do not possess a federal permit, they cannot legally transit through federal waters. Because of this, the Council is investigating a provision for state-licensed shrimping vessels to transit through federal waters as long as these vessels are not actively fishing.

Alternative 1 would continue to prohibit transit through federal waters without a federal permit for vessels possessing shrimp. Vessels that are state-licensed must have a federal permit or travel extra distances to remain in state waters to return to port. Thus, shrimpers must buy a federal permit even if they do not fish in federal waters, or these shrimpers must spend increased time at sea that may require additional fuel costs because of a longer transit times.

In this action, **Alternatives 2** and **3** have two different definitions of stowed gear. The South Atlantic Fishery Management Council (South Atlantic Council) currently has transit provisions in its Shrimp FMP for vessels in possession of penaeid shrimp in closed areas of the EEZ. Those regulations state that transit of the closed EEZ with less than four inch stretch mesh aboard while in possession of penaeid species is allowable provided that the nets are in an unfishable condition, which is defined as stowed below deck (SAFMC 1993). Recently, the South Atlantic Council established a similar transit provision for rock shrimp vessels transiting through coral habitat areas of particular concern. These regulations define gear stowed as doors and nets out of water and either onboard the deck or below the deck of the vessel. However, at its September 2015 meeting, the South Atlantic Council reviewed concerns about bringing gear on board rock

shrimp vessels while at sea for safety reasons. The transit for rock shrimp vessels is a very short distance through a closed area, and rock shrimp vessels have vessel monitoring systems (VMS), so the South Atlantic Council approved changing the wording of the regulation to the more general "doors and nets out of water." The South Atlantic Council expressly stated that this was an exception to the penaeid transit provisions applicable only for rock shrimp vessels under these circumstances. Along these same lines, the Council developed **Alternative 2** to define stowed gear as shrimp nets out of the water and bag straps removed. **Alternative 2** entails a much less cumbersome requirement than detaching the trawl doors as in **Alternative 3**. A bag strap is woven through the cod end of the net to close off the end of the net to catch the shrimp. When the net is hauled on board the vessel, the bag strap is "tripped" or untied, and the net opens to release the catch. These straps are easily removed from the net and easily repositioned for the next trawl. This alternative is much less time consuming for fishermen than detaching trawl doors, but still keeps the net in an easily identifiable unfishable state by law enforcement.

Alternative 3 is based on the current Gulf regulations and requires more gear restrictions, as the trawl doors need to be on deck and secured. Regulations for closed areas to protect Gulf reef fish allow a trawl net to remain on deck, but the trawl doors must be disconnected from the trawl gear and must be secured. This alternative is easier to enforce because if gear is secured, it is not fishable. However, this alternative is cumbersome for fishermen as removing the trawl doors is a significant undertaking, and trawl doors are not easily placed back on the trawl net.

CHAPTER 3. AFFECTED ENVIRONMENT

3.1 Description of the Fishery

The Environmental Impact Statement (EIS) for the original shrimp fishery management plan (FMP) and the FMP as revised in 1981 contain a description of the Gulf of Mexico (Gulf) shrimp fishery. Amendment 9 (GMFMC 1997) with supplemental environmental impact statement (SEIS) updated this information. This material is incorporated by reference and is not repeated here in detail. The management unit of this FMP consists of brown, white, pink, and royal red shrimp. Seabobs and rock shrimp occur as incidental catch in the fishery.

Brown shrimp is the most important species in the U.S. Gulf shrimp fishery, with most catches made from June through October. Annual commercial landings in 2003 through 2014 have ranged from about 45 to 88 million pounds (mp) of tails (Table 3.1.1). The fishery is prosecuted to about 40 fathoms (240 feet) and is highly dependent on environmental factors such as temperature and salinity. The maximum sustainable yield (MSY) established in Amendment 15 is 146,923,100 lbs of tails (GMFMC 2015).

White shrimp are found in nearshore waters to about 20 fathoms (120 feet) from Texas through Alabama. The majority are taken from August through December, although there is a small spring and summer fishery. From 2003 through 2014, annual commercial landings have ranged from approximately 56 to 87 mp of tails (Table 3.1.1). The MSY established in Amendment 15 is 89,436,907 lbs of tails (GMFMC 2015).

Pink shrimp are found off all Gulf states but are most abundant off Florida's west coast, particularly in the Tortugas grounds off of the Florida Keys. Annual commercial landings in 2003 through 2014 have ranged from approximately 3 to 11 mp of tails (Table 3.1.1); most landings are made from October through May in 30 fathoms (180 feet) of water. In the northern and western Gulf states, pink shrimp are sometimes mistakenly counted as brown shrimp. The MSY established in Amendment 15 is 17,345,130 lbs of tails (GMFMC 2015).

Royal red shrimp occur only in federal waters. Commercial fishing for royal red shrimp is most common on the continental shelf from about 140 to 300 fathoms (840 to 1800 feet) and east of the Mississippi River (GMFMC 2005a). The peak fishing season is March through June. Royal red shrimp are available in other areas and at other times, but costs are generally too high to make fishing practical (GMFMC 2005a). Thus far, landings have not reached the current MSY estimate of 392,000 lbs of tails in the years 2003 through 2014 and have ranged from approximately 130,000 to 353,000 lbs of tails (Table 3.1.1). In 2013, 74% of landings were from federal waters off Alabama, 24% were from off Florida, and 2% were from off Louisiana.

The three species of penaeid shrimp (brown, white and pink) are short-lived and provide annual crops; royal red shrimp live longer, and several year classes may occur on the fishing grounds at

one time. The condition of each penaeid shrimp stock is monitored annually, and none has been overfished for more than 40 years.

Table 3.1.1. Landings (pounds of tails) of shrimp from the Gulf, 2003-2014.

Year	Brown	White	Pink	Royal Red	Four Species Total
2003	83,949,224	60,996,687	9,943,414	352,859	155,242,184
2004	74,430,438	72,873,648	10,133,819	302,011	157,739,916
2005	58,574,505	65,314,218	8,722,912	168,990	132,780,625
2006	87,441,817	86,216,341	7,654,077	163,323	181,475,558
2007	70,560,173	64,305,379	3,414,746	229,024	138,509,322
2008	50,236,551	63,728,659	4,888,385	138,116	118,991,711
2009	75,500,221	75,296,070	4,621,755	173,065	155,591,111
2010	45,236,923	59,596,612	5,796,471	127,358	110,757,364
2011	73,107,015	58,265,392	4,709,564	195,354	136,277,325
2012	65,204,529	67,246,784	3,412,738	177,658	136,041,709
2013	66,305,319	56,360,746	3,182,863	199,499	126,048,427
2014	62,295,521	58,472,474	3,800,713	96,702	124,665,410
Average	67,736,853	65,722,751	5,856,788	193,663	139,510,055

Source: NMFS SEFSC Rick Hart, pers. comm. 2016.

Cooperative management of penaeid shrimp species includes: simultaneous closure in both state and federal waters off the coast of Texas, the Tortugas Shrimp Sanctuary, and seasonally closed zones for the shrimp and stone crab fisheries off the coast of Florida. The royal red shrimp fishery is only prosecuted in deeper waters of the exclusive economic zone (EEZ). An endorsement to the federal permit is required for vessels engaging in royal red shrimp fishing.

As of December 31, 2016, there were 1,441 valid or renewable federal Gulf shrimp permits and 288 endorsements for royal red shrimp. There has been a moratorium on the issuance of new Gulf shrimp permits since 2007. Permits are fully transferrable, and renewal of the permit is contingent upon compliance with recordkeeping and reporting requirements. State licensing may vary and vessels may have more than one state license. If selected, a vessel with a Gulf shrimp permit must carry a National Marine Fisheries Service (NMFS) approved observer. The size of the shrimp industry and its total effort has been substantially reduced since the benchmark 2001-2003 time period established in Amendment 14 (GMFMC 2007). This effort reduction reflects both a reduction in the number of vessels estimated to be participating in the fishery, and a reduction in the level of activity for those vessels remaining in the fishery. Approximately 500 vessels with a federal Gulf commercial shrimp permit (SPGM) have electronic logbooks (ELBs) which help monitor shrimping effort in the Gulf.

More than half of the commercial shrimp vessels fall into a size range from 56 to 75 feet. The number of vessels prosecuting the fishery at any one time varies because of economic factors such as the price and availability of shrimp and cost of fuel. In addition to permit data, NMFS

maintains three types of databases/files, two of which are largely dependent on port agent records. One, the shrimp landings file or Gulf shrimp system (GSS) landings database, is based almost entirely on trip ticket data; another is the annual landings form which is submitted by the permit holders; the last is the vessel operating units file. In the past, NMFS estimated fishing effort independently from the number of vessels fishing. NMFS used the number of hours actually spent fishing from interview data with vessel captains to develop estimates of effort measured by the number of days fished, where a day fished is equal to 24 hours of towing time. NMFS currently uses the number of hours spent towing from the ELB program to calculate effort.

A recreational shrimp trawl fishery occurs seasonally inside state waters. However, not all states have a permitting system for recreational shrimping in state waters and not all states track the amount of bait shrimp landed. In 2014, there were more than 750 recreational shrimp permits for Texas, Louisiana, Mississippi, and Alabama; Florida and Alabama do not require special recreational shrimp permits for state waters. For state commercial shrimping licenses, there are approximately 9,500, more than half of which are licensed through Louisiana. The commercial licenses issued by the states include out of state licenses, and a commercial shrimp fisherman may have more than one license. Therefore, it is likely that there are less than 9,500 individual vessels shrimping commercially in state waters in the Gulf.

Bait landings of juvenile brown, pink, and white shrimp occur in all states. Estimates from 2014 suggest landings of at least 2.6 mp (whole weight). Total values for this component of the fishery cannot be calculated as not all states estimate values.

Various types of gear are used to capture shrimp, including but not limited to: cast nets, haul seines, stationary butterfly nets, wing nets, skimmer nets, traps, and beam trawls. The otter trawl, with various modifications, is the dominant gear used in offshore waters, and there has been a decline in the number of otter trawls in recent years (NMFS 2014). Details about the specifics of each gear type as well as the historical development of the fishery can be found in Amendments 13 and 14 (GMFMC 2007). Royal red shrimp have been a small component of Gulf shrimp landings since the early 1960s. A few vessels in the Gulf shrimp fishery have targeted royal red shrimp, but fishing effort has been variable and inconsistent. Participation in this fishery requires larger vessels and heavier gear than that used for shallow-water penaeid shrimp. Although the industry continuously works to develop more efficient gear designs and fishing methods, the quad rig is still the primary gear used in federal waters. In recent years, the skimmer trawl has become a major gear in the inshore shrimp fishery in the northern Gulf. All trawls used in federal waters are required to have bycatch reduction devices (BRDs) unless: the vessel is fishing for and catching more than 90% royal red shrimp; the vessel is using a try net; the trawl is a rigid frame roller trawl; or the vessel is testing the efficacy of a BRD under an authorization by NMFS.

3.2 Description of the Physical Environment

The EIS for the original Shrimp FMP and the FMP as revised in 1981 contains a description of the physical environment. The physical environment for penaeid shrimp is also detailed in the Generic Essential Fish Habitat (EFH) Amendment (GMFMC 2005b). This material is incorporated by reference and is not repeated here in detail.

The Gulf is a semi-enclosed oceanic basin of approximately 600,000 square miles (Gore 1992). It is connected to the Atlantic Ocean by the Straits of Florida and to the Caribbean Sea by the Yucatan Channel. Oceanic conditions are primarily influenced by the Loop Current, the discharge of freshwater into the northern Gulf, and a semi-permanent, anticyclonic gyre in the western Gulf. In the Gulf, adult penaeid shrimp are found nearshore and offshore on silt, mud, and sand bottoms; juveniles are found in estuaries. Primary fishing grounds for royal red shrimp are: the Desoto Canyon about 75 miles off Mobile, Alabama; offshore of Tampa Bay, Florida; and the Dry Tortugas northwest of the Florida Keys.

Several area closures, including gear restrictions, may affect targeted and incidental harvest of penaeid shrimp species in the Gulf. These are described in detail in Amendment 13 (GMFMC 2005a) and incorporated by reference. Areas such as the Flower Garden Banks and Tortugas North and South Reserves have either incorrect area measurements associated with them in the document (Flower Garden Banks) in Amendment 13 or incorporate state water closures in the total area (Tortugas North and South Reserves). The areas include:

- Cooperative Texas Shrimp Closure
- Tortugas Shrimp Sanctuary
- Southwest Florida Seasonal Closure
- Central Florida Seasonal Closure
- Longline/Buoy Gear Area Closure
- Madison-Swanson and Steamboat Lumps Marine Reserves
- The Edges Marine Reserve
- Tortugas North and South Marine Reserves
- Alabama Special Management Zone

Reef and bank areas designated as Habitat Areas of Particular Concern (HAPCs) in the northwestern Gulf include: East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil Bank, 29 Fathom, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, and Jakkula Bank, Florida Middle Grounds HAPC and Pulley Ridge HAPC.

Generic Amendment 3 addressed EFH requirements (GMFMC 2005b) and established that a weak link in the tickler chain is required on bottom trawls for all habitats throughout the Gulf EEZ. A weak link is defined as a length or section of the tickler chain that has a breaking strength less than the chain itself and is easily seen as such when visually inspected. The

amendment established an education program on the protection of coral reefs when using various fishing gears in coral reef areas for recreational and commercial fishermen.

3.3 Description of the Biological Environment

The EIS for the original Shrimp FMP and the FMP as revised in 1981 contains a description of the biology of the shrimp species. In its appendix, the EIS of February 1981 includes the habitats, distribution, and incidental capture of sea turtles. Amendment 9 (GMFMC 1997) updated this information, which has essentially remain unchanged, except with respect to protected species as discussed below. This material is incorporated by reference and is not repeated here in detail.

3.3.1 Target Species

Brown, white, and pink shrimp use a variety of habitats as they grow from planktonic larvae to spawning adults (GMFMC 1981). Brown shrimp eggs are demersal and occur offshore. Post-larvae migrate to estuaries through passes on flood tides at night mainly from February until April; there is another minor peak in the fall. Post-larvae and juveniles are common in all U.S. estuaries from Apalachicola Bay, Florida to the Mexican border. Brown shrimp post-larvae and juveniles are associated with shallow, vegetated, estuarine habitats, but may occur on silt, sand, and non-vegetated mud bottoms. Adult brown shrimp occur in marine waters extending from mean low tide to the edge of the continental shelf and are associated with silt, muddy sand, and sandy substrates. More detailed discussion on habitat associations of brown shrimp is provided in Nelson (1992) and Pattillo et al. (1997).

White shrimp eggs are demersal and larval stages are planktonic in nearshore marine waters. Post-larvae migrate through passes mainly from May until November with peaks in June and September. Juveniles are common in all Gulf estuaries from Texas to the Suwannee River in Florida. Post-larvae and juveniles commonly occur on bottoms with large quantities of decaying organic matter or vegetative cover such as mud or peat. Juvenile migration from estuaries occurs in late August and September and is related to juvenile size and environmental conditions (e.g., sharp temperature drops in fall and winter). Adult white shrimp are demersal and inhabit nearshore Gulf waters to depths of 16 fathoms (96 feet) on soft bottoms. More detailed information on habitat associations of white shrimp is available from Nelson (1992) and Pattillo et al. (1997).

Pink shrimp eggs are demersal, early larvae are planktonic, and post-larvae are demersal in marine waters. Juveniles inhabit almost every U.S. estuary in the Gulf but are most abundant in Florida. Juveniles are commonly found in estuarine areas with seagrass where they burrow into the substrate by day and emerge at night. Adults inhabit offshore marine waters, with the highest concentrations in depths of 5 to 25 fathoms (30 to 150 feet).

The life history of royal red shrimp is poorly known. Royal red shrimp occur exclusively in the EEZ, live longer than penaeid shrimp, and many year classes may be present on fishing grounds at one time. Royal red shrimp become mature at three years, do not fully recruit to the fishery until they are 2-3 years old, and many year classes may occur in the same location (Reed and Farrington 2010). Royal red shrimp decrease in size with depth; juveniles likely occur in deeper habitats (Paramo and Saint-Paul 2011), and females are larger than males (Tavares 2002; Paramo and Saint-Paul 2011).

3.3.2 Bycatch

Between 2007 and 2010, 185 species were observed as bycatch in the shrimp fishery (Scott-Denton et al. 2012). By weight, approximately 57% of the catch was finfish, 29% was commercial shrimp, and 12% was invertebrates. The species composition is spatially and bathymetrically dependent, but overall, for the Gulf, Atlantic croaker, sea trout, and longspine porgy are the dominant finfish species taken in trawls (approximately 26% of the total catch by weight). Other commonly occurring species include: portunid crabs, mantis shrimp, spot, inshore lizardfish, sea robins, and Gulf butterfish. Although red snapper comprise a very small percentage (0.3% by weight) of overall bycatch, the mortality associated with this bycatch affects the recruitment of older fish (age 2 and above) to the directed fishery and ultimately the recovery of the red snapper stock.

To address finfish bycatch issues, especially bycatch of red snapper, the Gulf of Mexico Fishery Management Council (Council) initially established regulations requiring BRDs specifically to reduce the bycatch of juvenile red snapper. In 1998, all shrimp trawlers operating in the EEZ, inshore of the 100-fathom contour, west of Cape San Blas, Florida were required to use BRDs; later BRDs were required in the eastern Gulf (GMFMC 2002). Only three Gulf states (Florida, Louisiana, and Texas) require the use of BRDs in state waters. Shrimp trawls fishing for royal red shrimp seaward of the 100-fathom contour are exempt from the requirement for BRDs. The shrimp fishery is also a source of bycatch mortality on sea turtles (see Section 3.3.3). Bycatch is currently considered to be reduced to the extent practicable in the Gulf shrimp fishery.

If a permit pool is created in Action 4, and an alternative is selected in Action 3 that sets the threshold number of permits at more than the number that is currently in the fishery, the bycatch associated with the fishery could increase.

3.3.3 Protected Species

Species in the Gulf protected under the Endangered Species Act (ESA) include: marine mammal species (sei, fin, humpback, sperm whales, and manatees); sea turtles (Kemp's ridley, loggerhead (North Atlantic distinct population segment (DPS)), green (North Atlantic and South Atlantic DPSs), leatherback, and hawksbill); fish species (Gulf sturgeon, smalltooth sawfish, and Nassau grouper); and coral species (elkhorn coral, lobed star coral, boulder star coral, and mountainous

star coral). Seven species of fish and invertebrates in the Gulf are currently listed as species of concern.

Otter trawls may directly affect smalltooth sawfish that are foraging within or moving through an active trawling location via direct contact with the gear. The long toothed rostrum of the smalltooth sawfish causes this species to be particularly vulnerable to entanglement in any type of netting gear, including the netting used in shrimp trawls.

Green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles are all highly migratory and are known to occur in areas subject to shrimp trawling. Bycatch of the species by commercial fisheries is a major contributor to past declines and a potential threat to future recovery (NMFS and USFWS 1991, 1992a, 1992b, 2008; NMFS et al. 2011). Historically, southeastern U.S. shrimp fisheries (both Gulf and South Atlantic) have been the largest threat to benthic sea turtles. Regulations requiring turtle excluder devices (TEDs) have reduced mortalities from trawl fisheries on sea turtles. During a four year study period, 55 sea turtles were captured in shrimp trawls; 80% were released alive and conscious (Scott-Denton et al. 2012).

The impacts of the Gulf shrimp fishery on ESA-listed species were evaluated in the most recent biological opinion (bi op) on the continued implementation of the sea turtle conservation regulations under the ESA and the continued authorization of the southeast U.S. shrimp fisheries in federal waters (NMFS 2014). The bi op, which was based on the best available commercial and scientific data, concluded the continued authorization of the southeast U.S. shrimp fisheries in federal waters (including the Gulf shrimp fishery) is not likely to jeopardize the continued existence of threatened or endangered species (NMFS 2014). The bi op implemented measures to minimize the impacts of incidental take to sea turtle or smalltooth sawfish. After the completion of the bi op, NMFS designated new critical habitat for the Northwestern Atlantic distinct population segment of loggerhead sea turtles defined by five specific habitat types. Two of those habitat types (nearshore reproductive and *Sargassum)* occur within the Council's jurisdiction. NMFS determined that all federal Gulf fisheries operate outside the nearshore reproductive habitat and will not affect it. Gulf fisheries (including the shrimp fishery) could overlap with the *Sargassum* habitat. However, NMFS determined any effects from those fisheries would be insignificant and, therefore, were not likely to adversely affect the *Sargassum* habitat unit. NMFS has also listed new species since the completion of the opinion (the North Atlantic and South Atlantic green sea turtle DPSs and Nassau grouper) and has proposed listing another species (the Bryde's whale). On July, 1, 2016, NMFS requested re-initiation of consultation.

The shrimp fishery is classified in the 2015 List of Fisheries as a Category II fishery (79 FR 77919; January 28, 2015). This classification indicates the annual mortality and serious injury of a marine mammal stock is greater than 1% but less than 50 % of the stocks potential biological removal (PBR), not including natural mortalities, which may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. This

fishery was elevated to Category II from Category III (mortality or serious injury to <1% of the PBR) in 2011 based on increased interactions reported by observers, strandings, and fisheries research data.[3]

3.3.4 Status of the Shrimp Stocks

The three species of penaeid shrimp harvested by the shrimp fishery are short-lived and provide annual crops; royal red shrimp live longer (2-5 years) and multiple year classes can be found on the same fishing grounds. The condition of each shrimp stock is monitored annually, and none has been classified as overfished or undergoing overfishing (Hart 2013). Specific landings and values are provided in Table 3.1.1.

3.4 Description of the Economic Environment

Descriptions of the Gulf shrimp fishery are contained in previous amendments and NMFS regulatory actions and are incorporated herein by reference [see Shrimp Amendment 13 (GMFMC 2005a); Shrimp Amendment 14/Reef Fish Amendment 27 (GMFMC 2007); Regulatory Impact Review and Regulatory Flexibility Act Analysis for Making Technical Changes to TEDs to Enhance Turtle Protection in the Southeastern United States Under Sea Turtle Conservation Regulations (NMFS 2002); Regulatory Impact Review and Regulatory Flexibility Act Analysis, and Social Impact Assessment for the Proposed Rule to Revise the Gulf/South Atlantic Bycatch Reduction Device Testing Manual and Modify the Bycatch Reduction Criterion for Bycatch Reduction Devices Used in the Penaeid Shrimp Fishery West of Cape San Blas, Florida (NMFS 2006), Framework Action to Establish Funding Responsibilities for the Electronic Logbook Program in the Shrimp Fishery of the Gulf of Mexico (GMFMC 2013), Shrimp Amendment 16 (GMFMC 2014) and Shrimp Amendment 17A (GMFMC 2016)]. The following discusses certain key characteristics of the Gulf shrimp fishery.

The Gulf shrimp fishery consists of three major sectors: harvesting sector, dealer/wholesaler sector, and processing sector. The following discussion provides summary statistics and selected characteristics for the harvesting sector (including royal red shrimp harvesters), shrimp dealers, and the processing sector. Imports are also presented.

The harvesting sector is composed of two types of fleets: 1) a small vessel fleet that is predominantly active in inshore and state offshore waters and very diverse with respect to gear and other operating characteristics; and 2) a large vessel fleet predominantly active in offshore waters, particularly the EEZ, and almost always using otter trawl gear. In 2003, a federal shrimp permit was instituted requiring vessels to possess the permit when fishing for penaeid shrimp in the Gulf EEZ. A moratorium on the issuance of new federal shrimp permits became effective in March 2007. Currently, vessels must possess a federal Gulf shrimp permit (SPGM) when fishing for penaeid shrimp in the Gulf EEZ. In addition, a royal red shrimp endorsement, which is an

[3] http://www.nmfs.noaa.gov/pr/pdfs/fisheries/lof2012/southeastern_us_atlantic_gulf_shrimp_trawl.pdf

open access permit for those holding a SPGM, is required for harvesting royal red shrimp in the Gulf.

Selected Characteristics of Participating Vessels in the Shrimp Fishery

Selected characteristics of participation in the Gulf shrimp fishery in 2003 through 2014 are summarized in Table 3.4.1. Estimates of the total number of active shrimp vessels are based on the number of unique vessels landing shrimp as recorded in the GSS database. The number of active permitted vessels was generated by cross referencing GSS landings data with the NMFS permit database. The number of active vessels (permitted and non-permitted) is likely to be an underestimate of the "actual" number of active vessels/permits based on other research (Travis 2010). However, this method for estimating active participation in the Gulf shrimp fishery allows standardized estimates to be generated over a longer time frame compared to other methods.

The number of permitted and non-permitted active vessels (i.e., vessels reporting landings in the Gulf shrimp fishery) has been above 4,000 and generally around 5,000 in the last 4 years (Table 3.4.1). Although approximately one-third of active vessels were federally permitted (vessels with SPGM) at the beginning of the moratorium, less than 25% of active vessels had federal permits in each of the last 4 years (i.e., vessels without a permit are representing an increasing percentage of active vessels in the fishery over time). Despite being fewer in number, federally permitted vessels generally accounted for about 67% of shrimp landings and 76% of shrimp revenues in the fishery between 2007 and 2011. However, the permitted vessels' shares of the fishery's landings and revenues have declined noticeably in the last three years, to only 56% and 68%, respectively. Thus, vessels without permits have been accounting for a greater percentage of the fishery's production and revenues in recent years.

Vessels with Royal Red Shrimp Endorsements

The royal red shrimp sector is a relatively small segment of the Gulf shrimp fishery. As of September 21, 2015, there were 1,464 valid or renewable SPGM permits and 298 valid Gulf royal red shrimp endorsements. On average (2006-2014), royal red shrimp accounted for less than 1% of total Gulf shrimp landings and ex-vessel revenues. The deep-water nature of the fishery, the limited geographic location of known fishing grounds, and the equipment needed to fish for royal red shrimp may have contributed to the relatively low share of the royal red shrimp landings and revenues to the overall shrimp landings and revenues in the Gulf. A more detailed discussion of vessels participating in the royal red shrimp fishery is provided in Shrimp Amendment 16 (GMFMC 2015) and Shrimp Amendment 17A (GMFMC 2016).

Table 3.4.1. Selected characteristics of participation in the Gulf shrimp fishery, 2007-2014.

	2007	2008	2009	2010	2011	2012	2013	2014
Number of active vessels*	4,717	4,152	4,640	4,510	5,285	5,191	4,669	4,916
Percent of active vessels with a federal permit	33	30	27	25	22	22	24	23
Number of active vessels with federal permits	1,553	1,237	1,232	1,132	1,187	1,148	1,110	1,116
Percent of active vessels without a federal permit	67	70	73	75	78	78	76	77
Number of active vessels without a federal permit	3,164	2,915	3,408	3,378	4,098	4,043	3,559	3,800
Number of federally permitted vessels	2,514	1,930	1,764	1,685	1,641	1,587	1,544	1,515
Percent active	62	64	70	67	72	72	72	74
Percent inactive	38	36	30	33	28	28	28	26
Landings (million lbs, heads off)	140	120	155	111	137	134	128	131
Gross revenues (million 2014 dollars)	398	389	321	354	441	389	504	557
Percent of landings by Federally permitted vessels	68	66	69	63	67	63	60	56
Percent of gross revenues by Federally permitted vessels	78	77	76	74	78	72	72	68

*****Active means a vessel had at least 1 lb of Gulf shrimp landings in a year based on GSS data provided by R.Hart, April 25, 2016.

Key Economic and Financial Characteristics of Federally Permitted Shrimp Vessels

The following descriptions are based on a series of annual reports on the economics of the federal Gulf shrimp fishery for the years 2006 through 2014 (Liese 2011, 2013a, 2013b, 2014, 2016 (forthcoming); Liese and Travis 2010; Liese et al. 2009a, 2009b). These reports present the results of the Annual Economic Survey of Federal Gulf Shrimp Permit Holders. The first survey, which was administered in 2007, collected data for the 2006 fishing year.

The type of economic data the survey collects is based on an accounting framework of money flows and values associated with the productive activity of commercial shrimping. With these data, three financial statements (the balance sheet, the cash flow statement, and the income statement) are prepared to give a comprehensive overview of the financial and economic situation of the offshore shrimp fishery.[4] Table 3.4.2 shows a summary of these financial statements. In this table, financial statements for 2010 and onward include costs and revenues related to the Deepwater Horizon MC 252 (DWH) oil spill. Dollar values are averages in 2014 dollars.

The year 2010 was unique for the operations of many shrimp vessels in the Gulf because of the DWH oil spill. This oil spill and BP's responses had a confounding effect on the economics of the Gulf shrimp fishery in 2010 and onward. In 2010, the majority of vessels (66%) reported receiving oil spill-related revenues. The two primary sources of this revenue were damage claims (passive income) and revenue generated by participation in BP's vessel of opportunity program (VOOP) where vessels were hired to clean up oil. Of the surveyed vessels in 2010, 28% participated in the VOOP. Both sources provided substantial revenue for participating vessels, thereby obscuring the economics of the Gulf shrimp fishery. Further, vessels participating in the VOOP incurred non-negligible costs unrelated to commercial fishing. For more details on DWH-related revenues, see Liese (2011, 2013a, 2013b, and 2014). It is noted that some shrimp vessels continued to receive DWH-related revenues after 2010, but the amounts in these later years were small relative to that received in 2010.

Except for a dip in asset value in 2008, the average vessel shows a fair amount of equity that rose through the years (Table 3.4.2). This resulted from a combination of an increasing market value of the assets (vessel and permits being the main assets) and declining liabilities (mainly loans). Because of vastly improved economic conditions in the Gulf shrimp and other fisheries these vessels participate in, asset value increased by 23% and, in turn, equity increased even more (34%) in 2014 relative to 2013.

Except for 2007, the average vessel shows positive net cash flows. The absolute amount of net cash flows was relatively low in 2008 and 2009, but it does indicate a certain level of solvency for continued operation in the shrimp fishery, at least in the short term. Since the moratorium

[4] For more detailed descriptions of these three financial statements, see Liese et al. 2009a. The Annual Economic Survey of Federal Gulf Shrimp Permit Holders: Report on the Design, Implementation, and Descriptive Results for 2006. NOAA Technical Memorandum NMFS-SEFSC-584.

was put in place, and cognizant of the importance of the DWH-related revenues in 2010, the years after the DWH oil spill recorded much higher net cash flows. Revenues from shrimp were the major source of cash inflows while fuel and labor (crew and hired captain) costs were the top sources of cash outflows.

The income statement generally reflects the relatively fragile financial condition of an average permitted shrimp vessel between 2007 and 2013. Before the occurrence of DWH-related activities, net revenues from fishing operations were generally negative, except for 2009. As is true of most averages, many shrimp vessels deviated from the average and were profitable. A very different financial scenario characterized the average shrimp vessel between 2010 and 2013 when including DWH-related activities. These activities materially affected the cash flow and income statement of the average vessel. Net cash flows were significantly positive for these years relative to those of the previous years. In addition, the bottom line profits (net revenue before tax) were also relatively high for these years. In 2014, even in the absence of cash flows from DWH-related activities, economic conditions in the Gulf shrimp fishery improved significantly as reflected by the significant increase in net revenues from fishing operations.

Table 3.4.3 provides a summary of the financial statements for active vessels. Active vessels are defined as vessels with at least one pound of Gulf shrimp landings in a year (based on GSS data provided by R. Hart, April 25, 2016). Similar to averages for all federally permitted vessels, average equity for active vessels has been increasing, particularly in 2014 when it increased by 19%. However, averages focusing on active vessels highlight the fragile economic state of shrimp harvesters between 2007 and 2013, as illustrated by average net revenue from operations and economic returns for active vessels (Table 3.4.3).

However, economic conditions for vessels active in the fishery improved dramatically in 2014. Ex-vessel shrimp prices increased significantly, most likely due to a decrease in shrimp imports caused by diseases (early mortality syndrome (EMS)) that affected cultured shrimp in some major exporting countries (e.g., Thailand). In addition, fuel prices, a major cost item for shrimp vessel operation, decreased in 2014. In fact, the difference between ex-vessel shrimp price and fuel price was greater in 2014 by far than in any other year during the moratorium, and likely since the early 2000s. Preliminary data for 2015 suggests fuel prices have continued to decline, but shrimp prices reverted to their lower levels before 2013 (see Appendix B for a more detailed discussion). Thus, economic conditions in 2014 likely reflect a "best case" scenario for the harvesting sector, with future economic conditions not being as favorable in the short-term.

Because of the difference in economic conditions and performance in the years before and after the DWH oil spill, as well as the year to year differences in the years after the oil spill, Table 3.4.4 provides an average of financial and economic conditions for active permitted vessels between 2011 and 2014. These estimates may best approximate expected financial and economic conditions for these vessels in the foreseeable future. Most importantly, average gross revenue from fishing operations was approximately $343,000 but net revenue from operations was only about $8,300.

Table 3.4.2. Economic and financial characteristics of an average vessel with a federal Gulf commercial shrimp permit (SPGM), 2007-2014. Parentheses indicate negative values and all dollar values are averages in 2014 dollars.

Year	2007	2008	2009	2010**	2011	2012	2013*	2014*
Number of observations	505	497	427	429	456	442	380	396
Balance Sheet								
Assets	223,750	223,393	226,617	246,276	306,511	298,608	288,598	356,141
Liabilities	94,932	77,605	66,283	53,339	43,198	51,083	42,813	27,205
Equity	128,818	145,789	160,334	192,936	263,313	247,525	245,785	328,936
Cash Flow								
Inflow	217,839	234,211	229,689	359,688	331,621	385,803	368,187	354,236
Outflow	224,269	229,481	220,736	257,550	294,647	314,442	312,533	303,035
Net cash flow	-6,431	4,729	8,952	102,138	36,974	71,361	55,654	51,201
Income Statement								
Revenue (commercial fishing operations)	210,295	231,352	224,973	**	315,914	320,066	321,400	351,585
Expenses	229,705	236,625	224,190	258,502	301,446	316,022	315,497	310,155
Variable costs – Non-labor	49.5%	53.7%	50.1%	42.4%	47.8%	52.0%	48.0%	47.4%
Variable costs – Labor	25.2%	25.3%	27.1%	32.6%	32.0%	28.2%	30.5%	33.7%
Fixed costs	25.4%	21.0%	22.8%	25.0%	20.2%	19.8%	21.5%	18.9%
Net revenue from operations	(19,410)	(5,273)	783	**	14,468	4,044	5,903	41,430
Net receipts from non-operating activities	882	(2,218)	495	**	13,013	62,642	43,402	449
Net revenue before tax (profit or loss)	(18,528)	(7,490)	1,278	97,761	27,482	66,686	49,306	41,879
Returns								
Economic return	(8.7%)	(2.4%)	0.3%	**	4.7%	1.4%	2.0%	11.6%
Return on equity	(14.4%)	(5.1%)	0.8%	50.7%	10.4%	26.9%	20.1%	12.7%

Source: Liese et al. various years. The Annual Economic Survey of Federal Gulf Shrimp Permit Holders, NMFS-SEFSC. *2013 and 2014 numbers are preliminary. **In 2010, many sampled vessels (28%) participated in BP's vessel of opportunity (VOOP) program. As a result, business operations and resulting cost reflect both fishing and VOOP activities. In other years, operations were strictly commercial fishing. The survey did not ask respondents to separate revenue from participation in VOOP and damage claims (passive income), hence we cannot determine 'Revenue from Operations' and calculate 'Net Revenue from Operations' or 'Economic Return'.

Table 3.4.3. Economic and financial characteristics of an average active vessel with a federal Gulf commercial shrimp permit (SPGM), 2007-2014. Parentheses indicate negative values and all dollar values are averages in 2014 dollars.

Year	2007	2008	2009	2010***	2011	2012	2013*	2014*
Number of observations	388	383	348	332	368	370	293	333
Balance Sheet								
Assets	206,917	200,324	210,593	224,083	235,021	244,911	249,398	272,193
Liabilities	104,537	75,047	71,249	54,259	42,939	51,250	37,095	19,825
Equity	102,380	125,277	139,344	169,823	192,082	193,661	212,303	252,368
Cash Flow								
Inflow	247,776	261,788	249,764	250,988	330,645	399,822	417,630	376,594
Outflow	254,414	257,930	243,316	251,799	303,563	332,571	353,654	321,793
Net cash flow	-6,638	3,859	6,448	-811	27,082	67,251	63,976	54,801
Income Statement								
Revenue (commercial fishing operations)	238,826	258,305	244,072	248,753	312,141	324,557	361,229	373,490
Expenses	260,664	267,759	247,722	253,481	310,702	334,713	359,662	333,314
Variable costs – Non-labor	53.0%	56.6%	52.4%	50.8%	52.4%	55.6%	49.8%	49.7%
Variable costs – Labor	23.9%	24.2%	25.4%	27.2%	27.7%	25.1%	29.2%	32.2%
Fixed costs	23.0%	19.2%	22.2%	21.9%	19.9%	19.2%	20.9%	18.1%
Net revenue from operations	(21,838)	(9,454)	(3,650)	(4,728)	1,439	(10,155)	1,567	40,176
Net receipts from non-operating activities	1,285	(1,492)	1,111	(730)	15,833	71,991	52,961	1,221
Net revenue before tax (profit or loss)	(20,553)	(10,945)	(2,539)	(5,458)	17,273	61,836	54,528	41,397
Returns								
Economic return	(10.6%)	(4.7%)	(1.7%)	(2.1%)	0.6%	(4.1%)	0.6%	14.8%
Return on equity	(20.1%)	(8.7%)	(1.8%)	(3.2%)	9.0%	31.9%	25.7%	16.4%

Source: Liese et al. Various years. The Annual Economic Survey of Federal Gulf Shrimp Permit Holders, NMFS-SEFSC.
*2013 and 2014 numbers are preliminary. ***2010 numbers are adjusted to remove payments and costs (cleanup activities) related to DWH.

Table 3.4.4. Average economic and financial characteristics for active vessels with a federal Gulf of Mexico commercial shrimp permit, 2011-2014. Dollar values are averages in 2014 dollars.

NUMBER OF OBSERVATIONS	1,364
BALANCE SHEET	
ASSETS	250,381
LIABILITIES	37,777
EQUITY	212,604
CASH FLOW	
INFLOW	381,172
FROM SHRIMP (ANY)	91.1%
OUTFLOW	327,895
NET CASH FLOW	53,277
INCOME STATEMENT	
REVENUE (COMMERCIAL FISHING OPERATIONS)	342,854
EXPENSES	334,597
VARIABLE COSTS: NON-LABOR	51.9%
VARIABLE COSTS: LABOR	28.6%
FIXED COSTS	19.5%
NET REVENUE FROM OPERATIONS	8,257
NET RECEIPTS FROM NON-OPERATING ACTIVITIES	35,501
NET REVENUE BEFORE TAX (PROFIT OR LOSS)	43,758
RETURNS	
ECONOMIC RETURN	3.0%
RETURN ON EQUITY	20.8%

Dealers and Processors

Between 2007 and 2014, the number of shrimp dealers ranged from 558 (2008) to 896 (2011) in a given year. In 2014, there were 627 dealers. Between 2011 and 2014, there were 1,427 dealers that purchased food shrimp at some point in time in the Gulf of Mexico.5 Table 3.4.5 provides selected characteristics for Gulf shrimp dealers. As illustrated by the percentage of the value of shrimp purchases relative to total seafood purchases, shrimp dealers in the Gulf are very specialized. Between 2007 and 2014, annual shrimp purchases account for around 83% of their total annual seafood purchases. Between 2007 and 2014, annual Gulf shrimp purchases by

[5] This figure could be a slight overestimate of the actual number of dealers. It is based on a compilation of unique dealer codes across the GSS and Accumulated Landings System (ALS) databases. Although most codes could be matched, there are some inconsistencies in the codes within and across these databases over time.

dealers averaged about $423 million per year (in 2014 dollars), while total seafood purchases by these dealers averaged almost $489 million. However, as in the harvesting sector, the value of these dealers' shrimp and total seafood purchases increased significantly in 2013 and 2014 as a result of the increases in shrimp prices, with the value of shrimp purchases increasing by more than 50% between 2012 and 2014. The value of shrimp purchases per dealer also increased by more than 50% during this time. Although the average value of shrimp and total seafood purchases per dealer appears relatively small, $24,000 and $50,000 in 2014 respectively based on the median, Gulf shrimp dealers are a very heterogeneous group. Many if not most "dealers" are actually vessel owners and fishermen who have chosen to act as their own dealers and bypass so-called "middlemen" so they can reduce costs and retain more of their net revenue (profit). A much smaller number of these dealers are also shrimp processors, and their operations generate much larger revenues on average (see below).

Selected characteristics for Gulf shrimp processors are provided in Table 3.4.6. Between 2007 and 2014, the number of Gulf shrimp processors was relatively stable (except for 2012), averaging 53 during this time. Thus, the consolidation seen in this sector in previous years appears to have largely abated. During the same time period, the annual value of processed shrimp averaged more than $639 million (in 2014 dollars). Like dealers, shrimp processors are also very specialized. Shrimp products accounted for more than 90% of the total value processed between 2007 and 2014. However, processors are much larger businesses on average than dealers, with the value of processed shrimp and all processed products averaging $4.46 million and $5.3 million per processor between 2007 and 2014.

Economic trends in the processing sector do not exactly mirror trends in the harvesting and dealer sectors. For example, for the sector as a whole, there were increases in the value of processed shrimp and all processed products by these processors in 2013 and 2014. But they were relatively minor in the aggregate, and those values were still below values seen in 2010. The reason for this difference is because processors process imported product as well as domestic product, whereas the dealer data only represents domestic production. A comparison of the dealer and processor data indicates that processors in the Gulf relied heavily on imported shrimp in 2010, and were able to increase the value of their processed products as a result. Conversely, in 2014, processors appear to have been much more dependent on domestic product. And although the value of the processed shrimp was somewhat less in 2014 relative to 2010, the average value of processed shrimp per processor was considerably greater in 2014 than in 2010, increasing by 189% from $2.8 million in 2010 to more than $8 million per processor in 2014. What this finding suggests is that, while imported product can and has been important for this sector as a whole, imports are important to a relatively small number of shrimp processors. Conversely, all Gulf shrimp processors are somewhat if not highly reliant on domestic production. Thus, when the value of domestic production increases, as it did in 2013 and 2014, such increases benefit all processors rather than only a relatively few.

Table 3.4.5. Selected characteristics of Gulf shrimp dealers, 2007-2014. Pounds are whole weight, Dollar values are in 2014 dollars.

Years	2007	2008	2009	2010	2011	2012	2013	2014
Number of dealers	663	558	593	726	896	808	600	627
Pounds of shrimp purchased (millions)*	222.59	186.19	228.64	175.06	184.86	201.65	202.36	206.61
Average price per pound (mean)	$1.79	$2.09	$1.40	$2.02	$2.39	$1.93	$2.49	$2.84
Value of purchased shrimp (millions)	$397.51	$388.93	$321.12	$353.96	$441.33	$389.45	$503.75	$585.91
Total value of all purchases by Gulf shrimp dealers (millions)	$448.51	$443.60	$376.23	$410.14	$517.36	$463.59	$580.20	$668.83
Average pounds of shrimp purchased per dealer (median)	3,929	5,141	4,938	4,018	3,738	4,500	4,059	6,862
Average value of shrimp purchased per dealer (median)	$8,475	$13,332	$9,846	$9,603	$10,123	$12,621	$10,777	$24,025
Average total value of all purchases by Gulf shrimp dealers, per dealer (median)	$13,443	$19,702	$14,820	$12,782	$18,613	$20,942	$23,523	$50,207
Average percent of purchases is shrimp, per dealer (mean)	85	83	83	86	84	83	81	78

Source: NMFS-SERO, ALS 2007-2017. * Only shrimp species included in the GSS database are included in these estimates, though landings of all such species are included regardless of where they were harvested. A Gulf shrimp dealer is a dealer located in Gulf that purchased shrimp regardless of where shrimp were harvested. Most averages are reported in terms of medians rather than means because the data distributions are highly skewed.

Table 3.4.6. Selected characteristics of the Gulf shrimp processing industry, 2007-2014. Pounds are whole weight, Dollar values are in 2014 dollars.

Years	2007	2008	2009	2010	2011	2012	2013	2014
Number of Processors	47	50	51	54	50	67	53	51
Million pounds of shrimp processed*	273.01	260.82	335.02	271.12	294.43	355.60	282.57	322.86
Average processed price per pound (mean)	$1.75	$2.01	$1.73	$2.82	$1.96	$1.97	$2.61	$2.32
Value of processed shrimp (millions)	$477.36	$524.84	$580.41	$764.56	$577.97	$702.23	$736.12	$749.98
Total value of all products processed by Gulf shrimp processors (millions)	$484.01	$557.05	$625.59	$818.11	$622.74	$750.96	$779.40	$798.89
Average pounds of shrimp processed per processor (median, millions)	3.98	2.56	2.87	1.87	3.06	2.35	2.02	3.18
Average value of processed shrimp per processor (median, millions)	$4.70	$3.67	$3.94	$2.78	$3.92	$4.04	$4.57	$8.05
Average total value of all products processed by shrimp processors, per processor (median, millions)	$5.44	$4.31	$5.20	$3.31	$5.05	$4.44	$6.52	$8.10
Average percent of total processed value is shrimp, per processor (mean)	96	94	94	88	90	93	89	92
Average number of employees per processor (median)	38	28	35	28	34	31	31	36

* Includes all shrimp regardless of where harvested, but only includes shrimp processed for human consumption (i.e., shrimp processed for bait or shrimp meal are excluded). Most averages are reported in terms of medians rather than means because the data distributions are highly skewed. Source: personal communication, Office of Science and Technology, Sept 8, 2016.

Imports

On average, between 2007 and 2014, the United States has imported more than 1.2 billion pounds (product weight) of shrimp products annually. Imports were relatively stable between 2007 and 2011, but decreased by about 7.2% in 2012 and an additional 5% in 2013. These decreases are likely part of the reason why domestic ex-vessel shrimp prices increased in 2013 and 2014. Imports subsequently increased by almost 12% in 2014, returning to previous levels, which in turn likely caused the apparent decrease in domestic ex-vessel shrimp prices in 2015. The value of imported shrimp products averaged $4.95 billion (2014 dollars) annually between 2007 and 2014. Table 3.4.6 provides annual pounds and value of shrimp imports and the share of imports by country of origin.

The distribution of shrimp imports into the U.S. across exporting countries has changed significantly. Thailand was the primary country of origin for shrimp products imported into the U.S. between 2007 and 2012, and typically accounted for about one-third of all imports during that time. Vietnam and Indonesia were the next largest exporting countries to the U.S., but still only accounted for about 20% of shrimp imports during that time. The decrease in imports from Thailand, which was primarily driven by EMS, led to the overall decrease in imports in 2012 and 2013. As imports of shrimp from Thailand decreased (down to just over 12% in 2014), other countries took advantage of the situation by increasing their exports of shrimp to the U.S. and, as a result, have increased their market share in recent years. For example, India's share of the imports quadrupled from 2007 to 2014, increasing from 5% to 20.5%. Other countries that have significantly increased their market share include Indonesia, whose share increased from 11.4% to 19.7%, and Ecuador, whose share increased from 7.9% to 13.5%. Unlike earlier years when Thailand dominated the market of shrimp imports into the U.S., market share was more evenly distributed by 2014, with India, Indonesia, Vietnam, Ecuador, and Thailand having between 12% and 20% of the market.

Economic Impacts of the Gulf Offshore Shrimp Fishery

The commercial harvest and subsequent sales and consumption of shrimp generates business activity as fishermen expend funds to harvest shrimp and consumers spend money on goods and services, such as shrimp purchased at a local seafood market and served during restaurant visits. These expenditures spur additional business activity in the region(s) where the harvest and purchases are made, such as jobs in local seafood markets, grocers, restaurants, and fishing supply establishments. In the absence of the availability of a given species for purchase, consumers would likely spend their money on substitute goods and services. As a result, the analysis presented below represents a distributional analysis only; that is, it only shows how economic impacts may be distributed through regional markets.

Table 3.4.7. Annual pounds and value of shrimp imports and share of imports by country, 2007-2014.

	2007	2008	2009	2010	2011	2012	2013	2014
Pounds of shrimp imports (product weight, million pounds)	1,227.8	1,243.9	1,209.3	1,231.5	1,267.9	1,176.6	1,118.6	1,251.2
Value of shrimp imports (millions, nominal)	$3,914	$4,105	$3,778	$4,296	$5,166	$4,463	$5,277	$6,696
Value of shrimp imports (millions, 2014$)	$4,354	$4,478	$4,090	$4,595	$5,414	$4,595	$5,353	$6,696
Share of Imports by Country								
THAILAND	31.7	31.4	35.8	35.3	33.3	26.9	17.1	12.2
VIET NAM	11.8	11.7	10.1	11.9	10.1	10.0	13.8	15.0
CHINA*****	6.0	6.1	6.2	6.4	5.6	5.1	4.5	4.1
INDIA	5.0	3.5	4.4	7.2	10.2	12.9	19.1	20.6
MEXICO	9.2	8.3	8.8	5.3	5.6	5.7	5.0	4.5
ECUADOR	7.9	8.3	8.7	9.5	10.3	12.5	12.4	13.5
INDONESIA	11.4	15.4	13.0	11.5	13.5	14.8	17.2	19.7
BANGLADESH	3.9	3.1	2.4	2.1	1.2	0.9	1.0	.4
MALAYSIA	3.9	4.5	3.0	3.5	4.1	3.8	1.5	2.7
ALL OTHERS	9.2	7.7	7.5	7.4	6.2	7.3	8.2	7.3

* Does not include imports from Hong Kong, Taipei, or Macao. Source: Pounds of Shrimp Imports (personal communication, GOM Data Management, Sept. 15, 2016 http://www.st.nmfs.noaa.gov/commercial-fisheries/market-news/related-links/market-news-archives/index). Values and market share by country (personal communication, Office of Science and Technology, Sept. 15, 2016.

Economic impacts are generally characterized in terms of the levels of output, employment, and income that accrue to the local, state, regional and the national economy as a result of expenditures or gross revenues. Economic impact models are used to determine the current economic impacts of an industry or sector, as reflected by these measures, as well as changes expected to occur if expenditures or gross revenues change in a particular industry or sector. Estimates of the average annual business activity associated with the commercial harvest of shrimp from Gulf offshore waters were derived using the model[6] developed for and applied in NMFS (2016). Average gross revenue from shrimp harvested in Gulf offshore waters averaged about $344.05 million between 2011 and 2014 (in 2014 dollars).[7] Estimates of the economic impacts generated as a result of this revenue are provided in Table 3.4.8. According to this information, the affected fisheries generate employment, income, and output impacts of 45,043 jobs, $1.17 billion, and $3.33 billion, respectively.

Table 3.4.8 Economic impacts of the Gulf Offshore Shrimp Fishery.

INDUSTRY SECTOR	DIRECT	INDIRECT	INDUCED	TOTAL
Harvesters				
Employment impacts (FTE jobs)	6,326	1,232	1,427	8,985
Income impacts (000 of dollars)	143,082	40,417	70,431	253,930
Output impacts (000 of dollars)	344,050	334,377	233,781	912,208
Primary dealers/processors				
Employment impacts (FTE jobs)	1,711	683	1,186	3,579
Income impacts (000 of dollars)	60,609	55,856	52,829	169,295
Output impacts (000 of dollars)	195,076	146,934	194,422	536,433
Secondary wholesalers/distributors				
Employment impacts (FTE jobs)	432	95	418	945
Income impacts (000 of dollars)	19,633	5,839	20,649	46,121
Output impacts (000 of dollars)	52,588	19,174	68,593	140,354
Grocers				
Employment impacts (FTE jobs)	2,661	300	588	3,549
Income impacts (000 of dollars)	58,135	19,186	28,982	106,303
Output impacts (000 of dollars)	99,358	50,213	96,329	245,900
Restaurants				
Employment impacts (FTE jobs)	22,802	1,503	3,681	27,985
Income impacts (000 of dollars)	320,649	96,090	181,482	598,220
Output impacts (000 of dollars)	624,979	268,783	603,386	1,497,147
Harvesters and seafood industry				
Employment impacts (FTE jobs)	33,931	3,812	7,299	45,043
Income impacts (000 of dollars)	602,109	217,388	354,372	1,173,869
Output impacts (000 of dollars)	1,316,051	819,480	1,196,510	3,332,042

[6] A detailed description of the input/output model is provided in NMFS (2011b).

[7] Given the actions in this Amendment, economic impacts associated with gross revenue from shrimp harvested in Gulf offshore waters are the most relevant. In other cases, it may be more appropriate to estimate the economic impacts associated with a particular group of vessels' gross revenues (e.g., gross revenues for all federally permitted vessels).

3.5 Description of the Social Environment

Descriptions of the social environment associated with the Gulf shrimp fishery have been provided in previous amendments and documents (GMFMC 2005a, 2007, 2013) and will be incorporated herein by reference as appropriate. However, recent descriptions of the Gulf shrimp fishery's social environment do not provide a historical trend related to the moratorium or recent landings; therefore, more recent data are presented that will update descriptions and focus on the moratorium and changes over time.

The shrimp fishery is one of the more economically important fisheries within the Gulf. Since implementation of the permit moratorium, the fishery has seen a decline in active vessels harvesting several species of shrimp, which has likely affected many coastal communities along the Gulf coast. The reasons for this decline are numerous and include competition with shrimp imports, fuel prices, and shrimp prices, all of which have affected shrimp fishing households (GMFMC 2014, 2015). The major sectors that have been affected by this decline include: the harvesting sector, dealer/wholesaler sector, and processing sector. The following description focuses on all three sectors at the community level.

Regional Quotients by Community

The regional quotient (RQ) is a way to measure the relative importance of a given species across all shrimp fishing communities in the region and represents the proportional distribution of commercial landings of a particular species by community. The graphical representation of this proportional measure does not provide the number of pounds or the value of the catch, data which might be confidential at the community level for some locations. The RQ is calculated by dividing the total pounds (or value) of a species landed in a given community by the total pounds (or value) for that species for all communities within the Gulf region with shrimp landings. This measure includes all landings of a particular species, but it does not distinguish where they may have been caught as the data is based on dealer address. It is important to note that for some communities, especially in the Florida Keys, catches from South Atlantic vessels that may not be affected by this amendment may be included in summary data for certain shrimp species and the communities where they are landed. It is also important to note that location of the dealer in the accumulated landing system (ALS) dataset may not always correspond to where seafood was initially landed. The landings associated with a dealer location within a community are derived from the reported address of that dealer. In some cases a dealer may have several locations, but landings are reported to one primary business address. These landings data are updated from Shrimp Amendment 17A to provide landings from 2014.

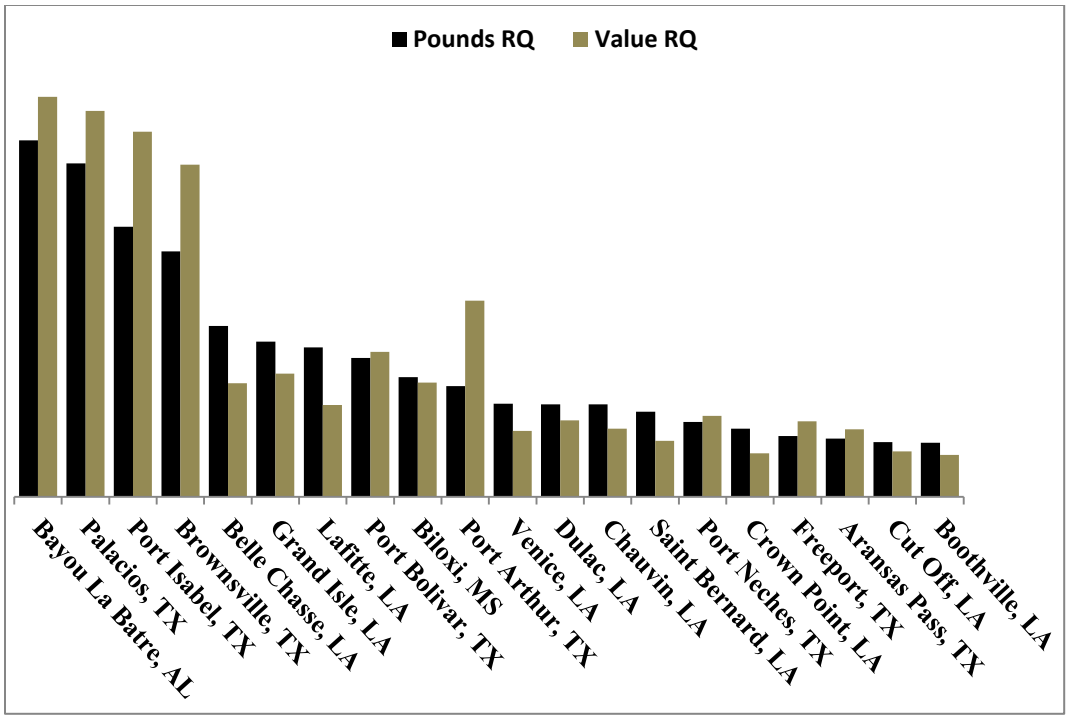

Figure 3.5.1. Top twenty communities' regional quotient (RQ) of pounds and value for brown shrimp in 2014.
Source: SERO ALS 2014.

Depending upon which shrimp species is being targeted, the volume and value for the RQ varies considerably by community. In Figure 3.5.1 which is for brown shrimp landings only, the top five communities are from three of the Gulf States. While Texas and Louisiana communities dominate brown shrimp landings with 18 out of the top 20 communities, Bayou La Batre, Alabama has the highest RQ for 2014. Louisiana communities tend to have higher landings but lower value compared to dealers in other states, which may be indicative of size differentiation in harvest, with smaller sizes being landed from inshore waters that bring lower prices than larger shrimp from offshore waters.

Pink shrimp landings occur primarily in Florida with 11 of the top 20 communities (Figure 3.5.2). The largest portion of landings is made in Fort Myers Beach, with Tampa and Tarpon Springs following. Bayou La Batre and Irvington, Alabama are the only communities outside of Florida that rank within the top ten communities for pink shrimp landings. There are several Texas communities within the top twenty, although pink shrimp landed in Texas may have been harvested elsewhere since the majority of pink shrimp are harvested off the west coast of Florida. There may also be mislabeling of brown shrimp in Texas that accounts for some pink shrimp landings in that state.

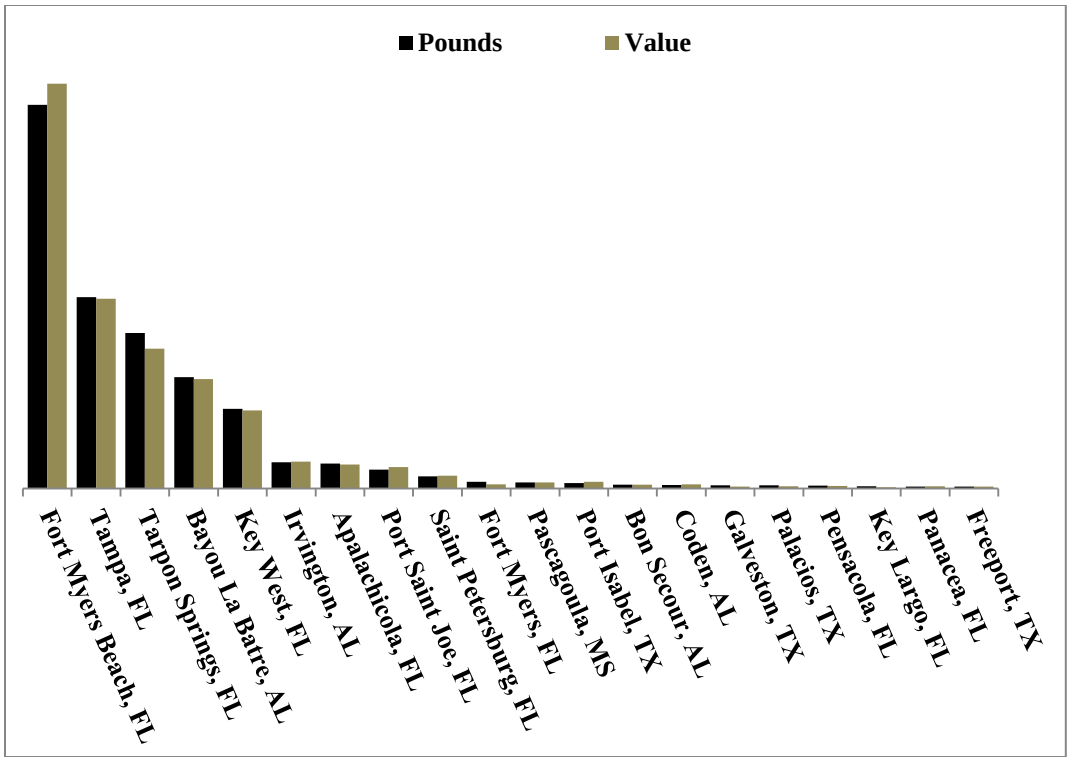

Figure 3.5.2. Top twenty communities' regional quotient (RQ) of pounds and value for pink shrimp in 2014.
Source: SERO ALS 2014.

White shrimp landings (Figure 3.5.3) occur primarily in the northern and western Gulf. The top six communities for pounds of white shrimp landings are located in Louisiana, where 13 of the top 20 communities are located. Port Arthur, Texas has the highest RQ in terms of value among all communities, but ranks seventh for pounds landed.

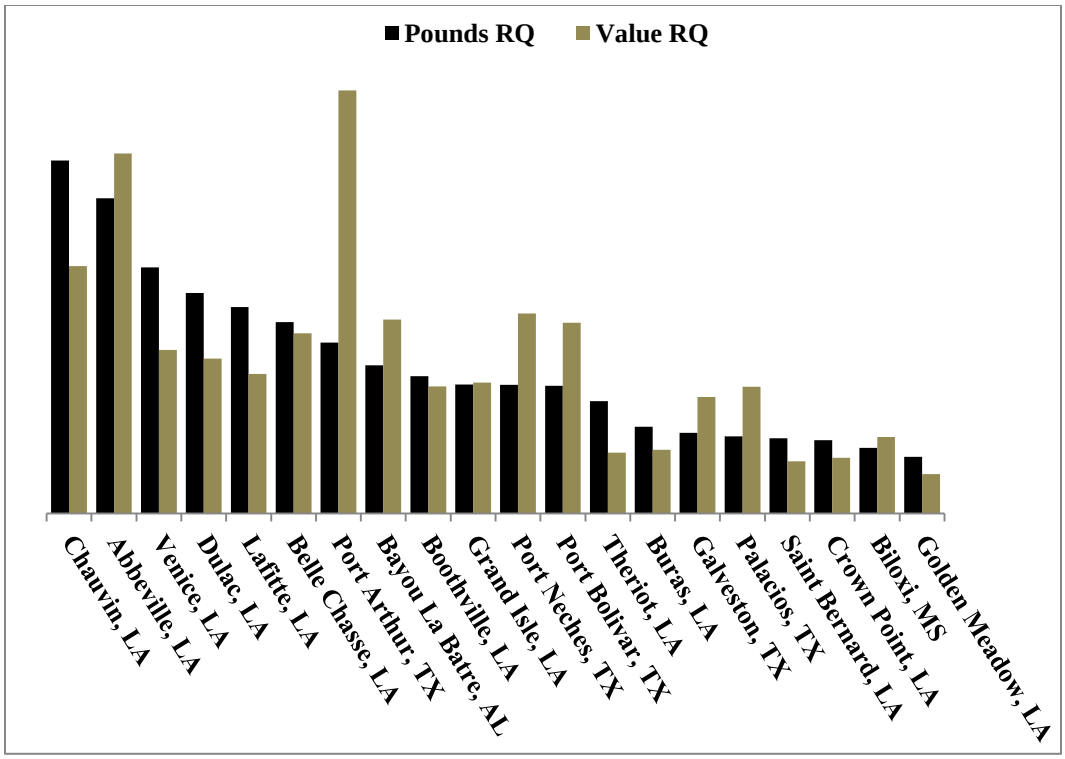

Figure 3.5.3. Top twenty communities' regional quotient (RQ) of pounds and value for white shrimp in 2014.
Source: SERO ALS 2014.

Royal red shrimp are landed primarily in Alabama and landings were documented in GMFMC 2014. The communities of Bon Secour and Coden, Alabama were the primary ports of landings. Rock shrimp landings are primarily in Florida communities, with Port St. Joe ranking first in RQ for both pounds and value. For most vessels, rock shrimp is a bycatch but can be a targeted fishery for some. Seabobs are also primarily caught incidentally.

Comparing the combined Gulf landings of shrimp (Figure 3.5.4), landings are dominated by Texas and Louisiana communities overall, with 18 out of the top 20 communities. Yet, Bayou La Batre, Alabama ranks first Gulf-wide in terms of pounds and value of total shrimp landings, including brown, white, pink, royal red, rock, and seabobs. Port Arthur, Texas ranks second in terms of RQ value for total shrimp, but ranks eleventh for pounds of landings. Again, many of the Louisiana communities have a lower RQ for value compared to pounds of landings, which in most cases indicates lower prices for smaller shrimp. These communities include Chauvin, Belle Chasse, Lafitte, and Venice, Louisiana, which rank third to sixth for greatest landings in pounds, respectively.

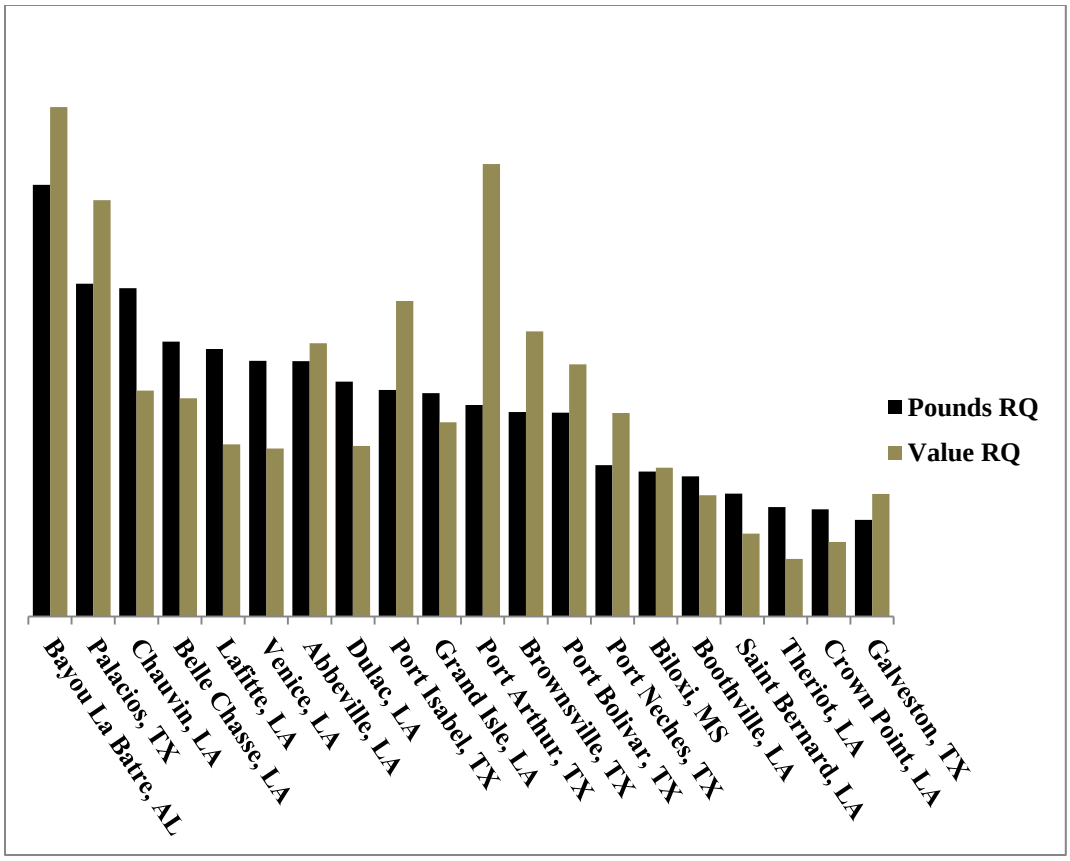

Figure 3.5.4. Top twenty communities' regional quotient (RQ) in pounds and value for the combined shrimp landings in 2014.
Source: SERO ALS 2014.

Demographics and Fleet Characteristics

Vessel Permits

As stated earlier, at the end of 2014, there were 1,470 valid Gulf commercial shrimp permits, with 463 permits terminated since the inception of the moratorium. Figure 3.5.5 displays the distribution of all Gulf shrimp permits by homeport community in 2014. The majority of permits are in the western Gulf with New Orleans, Louisiana, Brownsville, Texas, and Bayou La Batre, Alabama holding more permits than other communities.

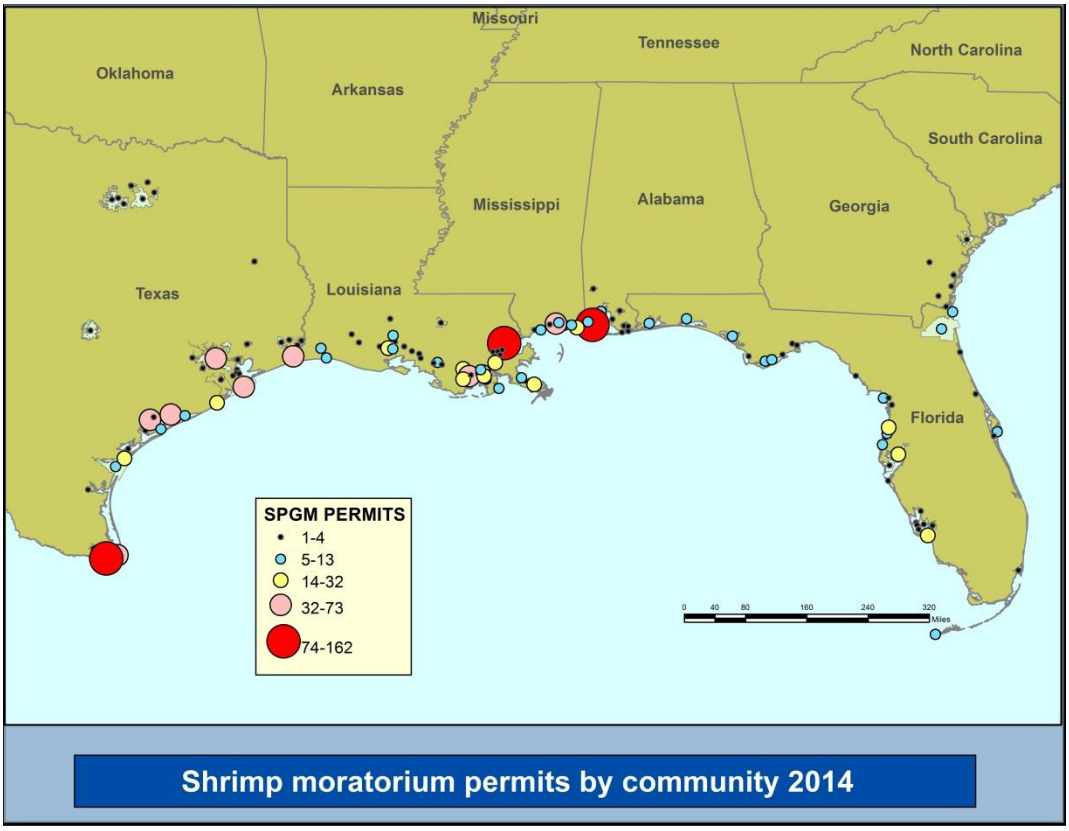

Figure 3.5.5. Number of Gulf shrimp moratorium permits by homeport communities in 2014.
Source: NMFS SERO Permits Database.

As shown in Table 3.5.1, the three above mentioned communities have considerably more Gulf shrimp permits on vessels homeported in those communities compared with other Gulf communities. It should be mentioned that while the designated homeport may not be where a vessel is docked most of the time, it is the best approximation given the data available to be able to collocate people and infrastructure in a port. These three aforementioned communities also have the largest number of terminated permits since the inception of the moratorium, but not the greatest proportion of terminated permits given the large number of permits held in each community. Several communities have had a larger portion of their permits terminated over the years. The states of Texas and Louisiana have the largest share of valid or renewable shrimp moratorium permits and terminated permits.

The reason for termination of a shrimp permit can vary. Most terminated permits were voluntary and likely due to non-renewal. A permit holder has one year following expiration of the permit during which the permit may be renewed before it is terminated. It costs $25 to renew a federal permit, and $10 for each additional federal permit held on the same vessel. Allowing a permit to expire and terminate may also be a result of economic conditions that were referenced earlier, but information from permit holders as to why a permit was not renewed is not available. There has been considerable latent effort in the shrimp fishery. This may be a concern, given the possibility of increased bycatch for some key species and decreasing profits for active shrimpers following an influx of new effort. The following tables and figures offer different perspectives

on the geographical distribution of terminated permits; they do not infer any benefit or detriment as a result of the termination.

Table 3.5.1. Gulf shrimp moratorium permits and terminated permits for top 35 homeport communities.

State	Community	Current SPGM Permits	Terminated	Percent Terminated	In Top 20
LA	HOUMA	14	9	39.1%	
TX	ARANSAS PASS	17	10	37.0%	*
FL	FORT MYERS BEACH	21	12	36.4%	*
FL	KEY WEST	11	6	35.3%	*
TX	HOUSTON	49	24	32.9%	
AL	MOBILE	10	4	28.6%	
TX	PORT ISABEL	53	21	28.4%	*
TX	BROWNSVILLE	109	41	27.3%	*
FL	TAMPA	16	6	27.3%	*
LA	INTRACOASTAL CITY	15	5	25.0%	
LA	VENICE	15	5	25.0%	*
LA	CAMERON	12	4	25.0%	
AL	BAYOU LA BATRE	91	29	24.2%	*
LA	GRAND ISLE	13	4	23.5%	*
TX	PALACIOS	51	14	21.5%	*
LA	DULAC	16	4	20.0%	*
TX	FREEPORT	16	4	20.0%	*
FL	APALACHICOLA	8	2	20.0%	*
LA	LAROSE	8	2	20.0%	
TX	PORT ARTHUR	49	12	19.7%	*
LA	NEW ORLEANS	162	35	17.8%	
MS	BILOXI	73	15	17.0%	*
LA	GALLIANO	25	5	16.7%	
LA	LAFAYETTE	10	2	16.7%	
LA	ABBEVILLE	21	4	16.0%	
TX	GALVESTON	37	7	15.9%	*
FL	HERNANDO BEACH	32	6	15.8%	
FL	JACKSONVILLE	12	2	14.3%	
LA	CHAUVIN	48	7	12.7%	*
TX	PORT LAVACA	53	6	10.2%	
LA	CUT OFF	27	3	10.0%	
LA	LAFITTE	14	1	6.7%	*
MS	PASCAGOULA	18	0	0.0%	*
FL	PANAMA CITY	12	0	0.0%	
TX	PORT BOLIVAR	12	0	0.0%	*

Note: The "Top 20" column identifies the communities that ranked within the top 20 communities for at least one shrimp species (Figures 3.5.1-3.5.4).

Figure 3.5.6 provides the geographical distribution of all terminated permits. Some vessels with terminated shrimp permits had designated homeports outside of the Southeast, and they may not appear in the map.

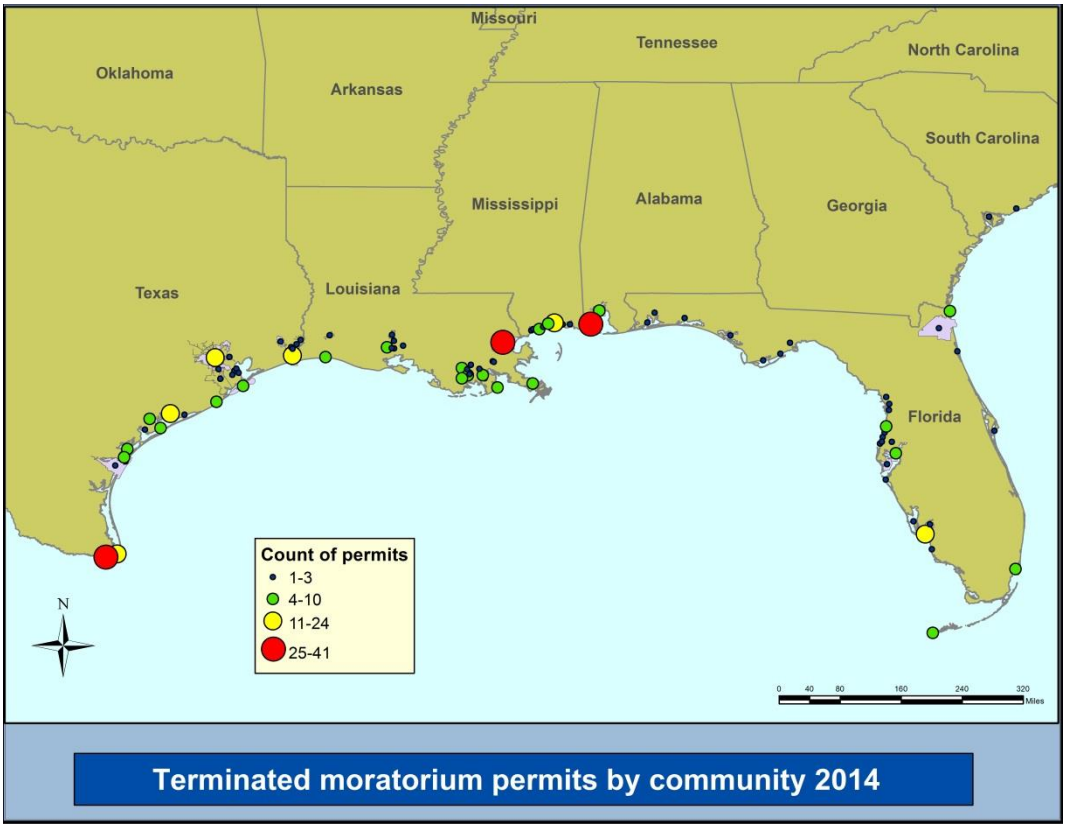

Figure 3.5.6. Locations of terminated Gulf shrimp permits by community since moratorium.
Source: NMFS SERO Permits Database.

A geographical breakdown of the percent of terminated permits out of all SPGM permits by homeport community is displayed in Figure 3.5.7. Whereas Table 3.5.1 includes only the top 35 communities in terms of number of permits, Figure 3.5.7 provides the location of all terminated permits. Several locations within Texas have seen a large percentage of permits terminated. However, in some cases these communities may have had few permits originally. Several communities in Texas, like Seabrook, Beaumont, and Seadrift, had only three permits per community and two were terminated in each. Therefore, the percentage lost is large, but the actual number of permits lost is small, which suggests that the community did not have high engagement or reliance on shrimping (see below). Other communities like Brownsville, Texas, Bayou La Batre, Alabama, and New Orleans, Louisiana had greater numbers of terminated permits as mentioned earlier. Bayou La Batre ranked number one for pounds and value RQ for all shrimp landings combined, and 24.2% of its permits have been lost since the moratorium, while Brownsville ranked twelfth, and 27.3% of its permits have been lost since the moratorium.

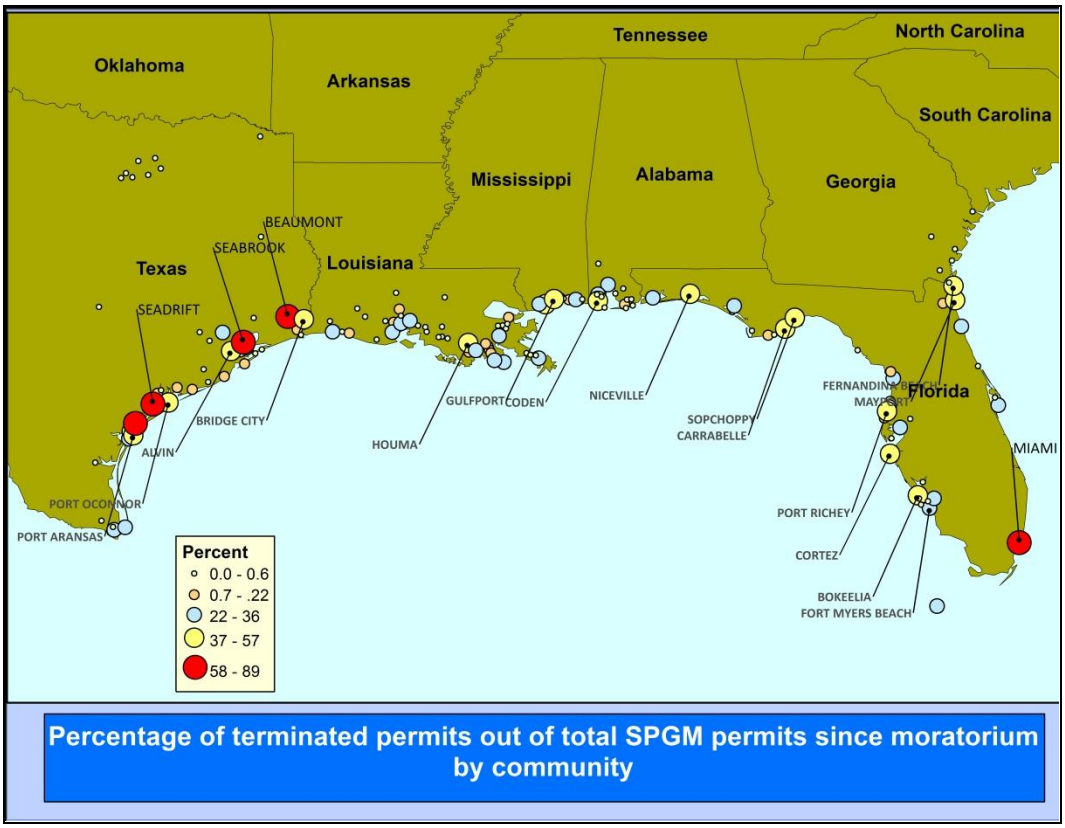

Figure 3.5.7. Percent of terminated Gulf shrimp permits by homeport communities.
Source: NMFS SERO Permits Database.

Figure 3.5.8 provides the geographical distribution of shrimp processors in the Gulf and Florida east coast. The processing sector is fairly evenly distributed between the Gulf States with 16 in Louisiana, 15 in Texas, 15 in Alabama-Mississippi, and 10 in Florida. While some processors may also be a wholesale dealer, other processors deal with product from outside the state where landings were located and may process imported shrimp as well.

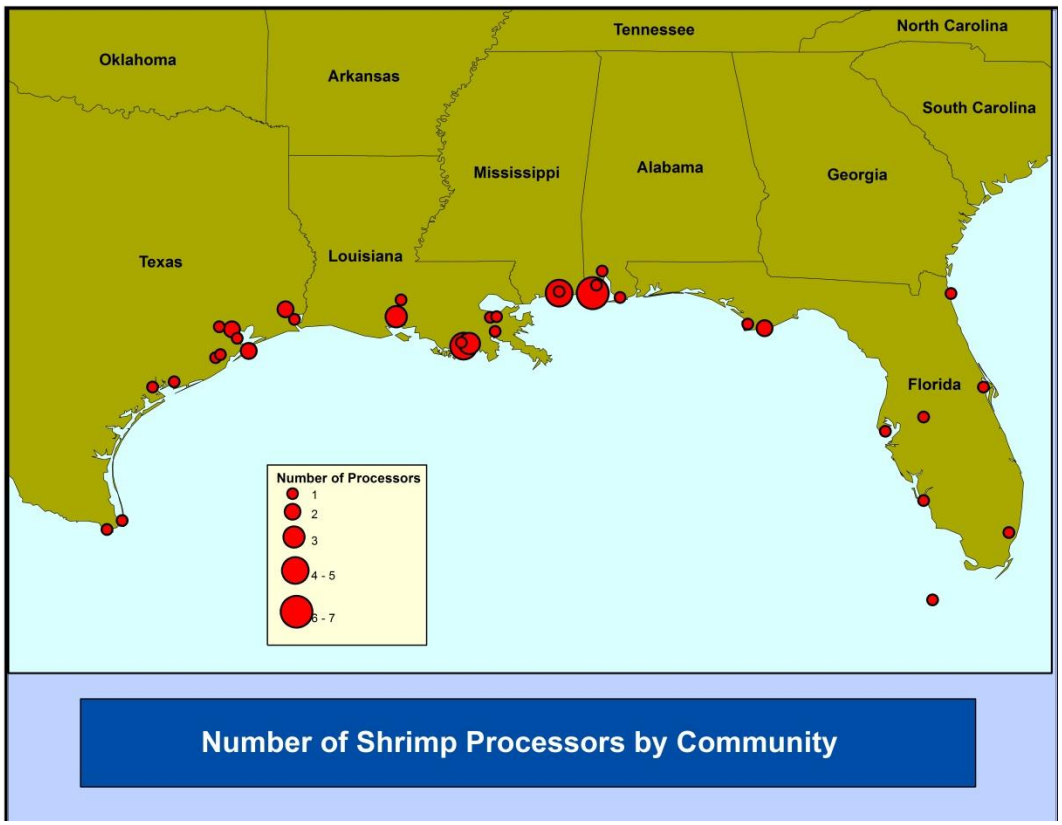

Figure 3.5.8. Number of Gulf shrimp processors by community.
Source: NMFS Processor Database.

Overall Fishing Engagement and Reliance

While it is possible to characterize landings with regard to communities that have high RQs for landings and value, it is more difficult to characterize the shrimp fleet and its labor force regarding demographics, including places of residence for captains and crew of vessels. There is little to no information on captains and crew including age, gender, race and ethnicity, and income status.

To better understand how Gulf shrimp fishing communities are engaged and reliant on fishing overall, several indices composed of existing permit and landings data were created to provide a more empirical measure of the communities' relationship to fishing dependence (Jepson and Colburn 2013; Colburn and Jepson 2012; Jacob et al. 2012). Fishing engagement uses the absolute numbers of permits, landings, and value, while fishing reliance includes many of the same variables as engagement, but divides by population to give an indication of the per capita impact of this activity.

Using a principal component and single solution factor analysis, each community receives a factor score for each index to compare to other communities. Factor scores of both engagement and reliance on commercial fishing for the top 20 communities from Figure 3.5.5 were plotted onto graphs in Figure 3.5.9. For some communities data were not available to calculate a factor score and do not appear on the chart. Each community's factor score is located on the Y axis;

the higher the score the more engaged or reliant. Factor scores are standardized, therefore the mean is zero. Two thresholds of 1 and ½ standard deviation above the mean are plotted onto the graphs to help determine a threshold for significance. Because the factor scores are standardized, a score above one is also above one standard deviation. Those communities with factor scores above the thresholds should be considered to have high engagement and reliance upon commercial fishing. Those that exceed both thresholds might be considered dependent upon commercial fishing.

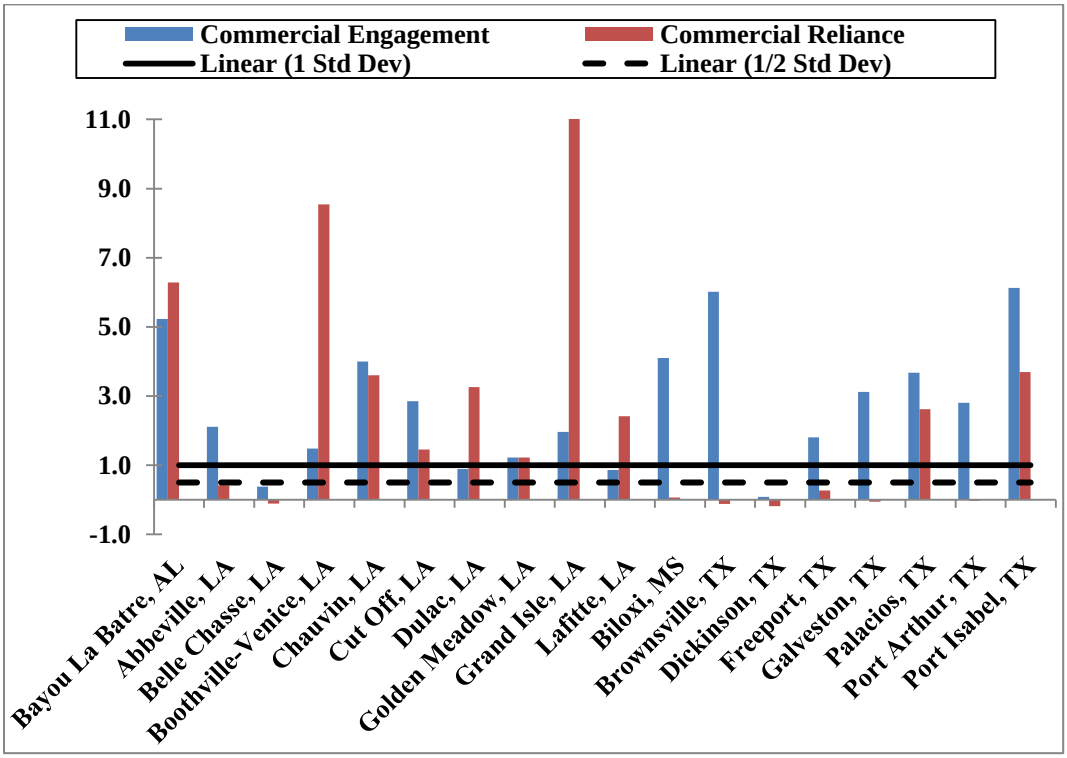

Figure 3.5.9. Commercial fishing engagement and reliance indices for top 20 communities in terms of pounds and value RQ for total shrimp landings in the Gulf 2014.
Source: SERO Social Indicator Database.

In Figure 3.5.9, all communities except Belle Chase, Louisiana and Dickenson, Texas exceed either one or both of the thresholds of ½ or 1 standard deviation, which means these are the least highly engaged or reliant on commercial fishing among the other communities. Those that exceed thresholds for both indices have a substantial component of their local economy dependent upon commercial fishing. The ten communities that exceed both thresholds are: Bayou LaBatre, Alabama; Fort Myers Beach, Florida; Chauvin, Cut Off, Dulac, Golden Meadow, Grand Isle, Lafitte, and Boothville-Venice, Louisiana; and Port Isabel and Palacios, Texas. More in-depth profiles of some of these communities are provided in previous amendments (GMFMC 2005a, 2007).

3.5.1 Environmental Justice Considerations

Executive Order 12898 requires that federal agencies conduct their programs, policies, and activities in a manner to ensure individuals or populations are not excluded from participation in, or denied the benefits of, or subjected to discrimination because of their race, color, or national origin. In addition, and specifically with respect to subsistence consumption of fish and wildlife, federal agencies are required to collect, maintain, and analyze information on the consumption patterns of populations who principally rely on fish and/or wildlife for subsistence. This executive order is generally referred to as environmental justice (EJ).

There have been relatively few if any recently published descriptions of the Gulf shrimp fishery from both a social and economic perspective. Liese et al. (2009b) and Liese and Travis (2010) have provided the most recent analysis of fleet-wide economic performance, but there is little information concerning the demographic makeup or characterization of the fleet. While we do not have demographics for captains and crew, we can identify a proxy for the number of vessels that may have certain minorities associated with the vessel by looking at surnames from the permit file and counting those that appear Southeast Asian in their origin. This technique was first utilized in a memorandum from Gulf Council Director Wayne Swingle to the Shrimp Management Committee dated March 28, 2003. In that memorandum Dr. Swingle indicated that of the 1,836 federally permitted shrimp vessels, 524 (or 28.7%) had owners with Southeast Asian surnames or corporate names. A similar count conducted by SERO in 2009 resulted in 484 out of 1853[8] (or 26.1%) of permit owners with Southeast Asian surnames. Unfortunately, we do not know if these are active vessels and whether the crew is also of Southeast Asian ethnicity. This measure also ascribes identity by surname; the individuals may nor may not self-identify as Southeast Asian, and the surnames may have been acquired through marriage or other relationships. However, this does give a rough indication of the participation rate of Southeast Asians within the Gulf shrimp fishery.

When we examine terminated permits using this same methodology, we also find that approximately 28% of those permits had owners or lessees with Southeast Asian surnames. Thus, the proportion of terminated permits for those owned by those of potential Southeast Asian descent is approximately the same as this proxy for participation in the shrimp fishery overall.

This methodology has not been attempted for other minority groups. It has been suggested that Latinos make up a large portion of the crew on Gulf shrimp vessels in Texas and possibly other states in the western Gulf (pers. comm., G. Graham). Especially in Brownsville and Port Isabel, many shrimp vessel owners or operators use the temporary guest worker visa (H2B visas) program to locate foreign crew, primarily Mexicans, for shrimp vessels.[9] It is estimated that 90% of the shrimp boats fishing off the Texas coast have at least one crew member holding a

[8] This is a snapshot of permits at one point in time and not exclusive to shrimp vessels, so numbers may vary at different points in time. This is a very rough estimate of the number of vessels with owners who may be of Southeast Asian background. It is not a precise count of persons involved in the fishery who may be of Southeast Asian descent or other minorities.

[9] http://www.brownsvilleherald.com/news/local/article_6e9d1973-0063-5729-a164-41223c22e858.html

H2B visa. Unfortunately, NMFS does not collect data on crew of shrimp vessels and it is not possible to calculate the number of temporary guest workers in the fishery.

Another measure to assess whether a community may be experiencing EJ issues has been developed using other secondary sources, a suite of indices created to examine the social vulnerability of coastal communities (Colburn and Jepson 2012; Jacob et al. 2012) is presented in Figure 3.5.10 for the same communities in Figure 3.5.9. The three indices used for social vulnerability are poverty, population composition, and personal disruptions. The variables included in each of these indices have been identified as important components that contribute to a community's vulnerability. Indicators such as increased poverty rates for different groups, more single female-headed households and children under the age of 5, disruptions such as higher separation rates, higher crime rates, and unemployment are all signs of vulnerable populations. These indicators are closely aligned to previously used measures of EJ which used thresholds for the number of minorities and those in poverty. For those communities that exceed the threshold, it is expected that they would exhibit vulnerabilities to sudden changes or social disruption that might accrue from regulatory change.

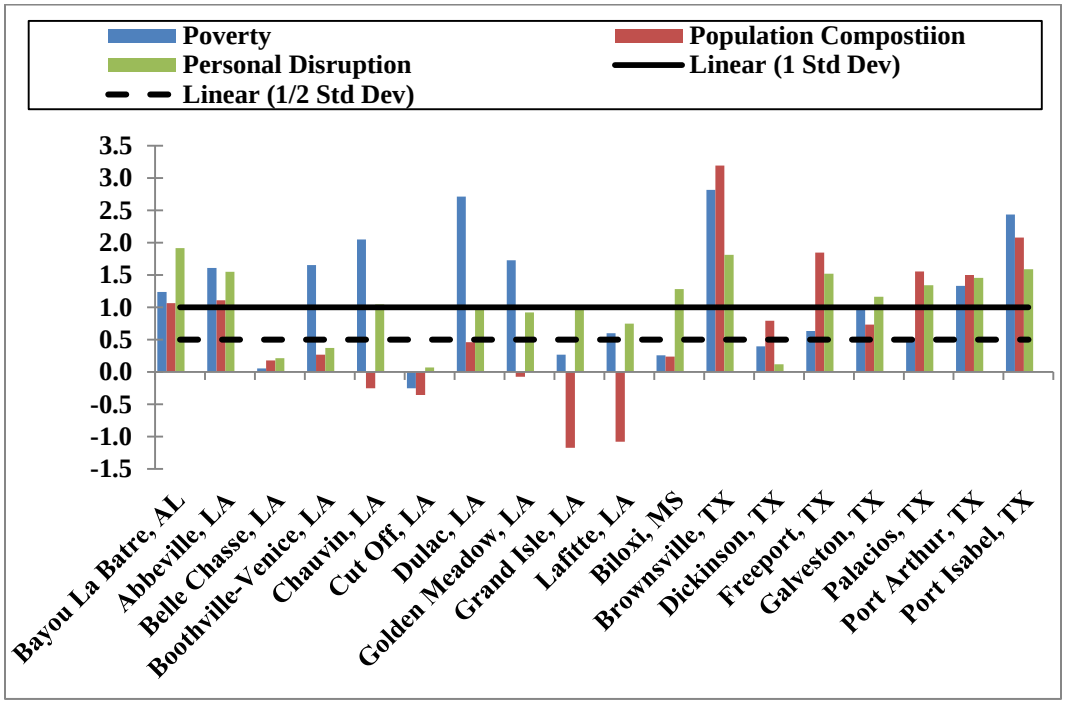

Figure 3.5.10. Social vulnerability indices for top shrimp fishing communities in the Gulf 2014.
Source: SERO Social Indicator Database.

In terms of social vulnerabilities, several of the top shrimp fishing communities exhibit medium to high vulnerabilities. In fact, only six communities are below the thresholds for two or more indices and do not exhibit vulnerabilities. Those that exceed thresholds for two or more indices are: Bayou LaBatre, Alabama; Abbeville, Chauvin, and Dulac, Louisiana; and Brownsville, Freeport, Galveston, Palacios, Port Arthur, and Port Isabel, Texas (Figure 3.5.10). It would be expected that these communities would be especially vulnerable to any negative social or

economic disruption because of regulatory change, depending upon the communities' engagement and reliance upon commercial fisheries. Because most of these communities are highly engaged and/or reliant on commercial fishing, it is likely that any negative social effects from regulatory changes would have an impact. Whether that impact will be long term or short term, and direct or indirect, would depend upon the regulatory change. These potential effects are discussed in Chapter 4.

These indicators of vulnerability have been developed using secondary data at the community level. Because these types of data are not collected at the individual level by NMFS or other agencies, it is difficult to understand the social vulnerabilities that might exist on either a household or individual level. It is hard to recognize or attribute impacts that will directly affect individuals who are fishermen or work in a related business, because we do not know what those specific vulnerabilities may be. Therefore, our measure of vulnerability is a broader measure at the community level and not specific to fishermen or the related businesses and their employees. Furthermore, there has been little research and relatively no data collected on subsistence fishing patterns and the customary use of marine resources by fishermen in the Southeast. Impacts on subsistence fishing within the Gulf shrimp fishery cannot be assessed, other than to say it is unlikely because it is an offshore fishery and there are no known claims for customary usage or subsistence consumption of federally managed shrimp species by any population including tribes or indigenous groups.

3.6 Description of the Administrative Environment

Federal fishery management is conducted under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.), originally enacted in 1976 as the Fishery Conservation and Management Act. The Magnuson-Stevens Act claims sovereign rights and exclusive fishery management authority over most fishery resources within the EEZ, an area extending 200 nautical miles from the seaward boundary of each of the coastal states, and authority over U.S. anadromous species and continental shelf resources that occur beyond the EEZ.

Responsibility for federal fishery management decision-making is divided between the Secretary of Commerce (Secretary) and eight regional fishery management councils that represent the expertise and interests of constituent states. Regional councils are responsible for preparing, monitoring, and revising management plans for fisheries needing management within their jurisdiction. The Secretary is responsible for promulgating regulations to implement proposed plans and amendments after ensuring that management measures are consistent with the Magnuson-Stevens Act and with other applicable laws summarized in Appendix E. In most cases, the Secretary has delegated this authority to NMFS.

The Council is responsible for fishery resources in federal waters of the Gulf. These waters extend to 200 nautical miles offshore from the nine-mile seaward boundary of the states of Florida and Texas, and the three-mile seaward boundary of the states of Alabama, Mississippi, and Louisiana. The Council consists of 17 voting members: 11 public members appointed by

the Secretary; one each from the fishery agencies of Texas, Louisiana, Mississippi, Alabama, and Florida; and one from NMFS. Non-voting members include representatives of the U.S. Fish and Wildlife Service, U.S. Coast Guard (USCG), and Gulf States Marine Fisheries Commission.

The Council uses its Science and Statistical Committee to review data and science used in assessments and fishery management plans/amendments. Regulations contained within FMPs are enforced through actions of the NMFS' Office for Law Enforcement, the USCG, and various state authorities.

The public is involved in the fishery management process through participation at public meetings, on advisory panels and through Council meetings that, with few exceptions for discussing personnel matters, are open to the public. The regulatory process is in accordance with the Administrative Procedures Act, in the form of "notice and comment" rulemaking, which provides extensive opportunity for public scrutiny and comment, and requires consideration of and response to those comments.

3.6.2 State Fishery Management

The purpose of state representation at the Council level is to ensure state participation in federal fishery management decision-making and to promote the development of compatible regulations in state and federal waters. The state governments have the authority to manage their respective state fisheries including enforcement of fishing regulations. Each of the five states exercises legislative and regulatory authority over its state's natural resources through discrete administrative units. Although each agency listed below is the primary administrative body with respect to the state's natural resources, all states cooperate with numerous state and federal regulatory agencies when managing marine resources. The states are also involved through the Gulf States Marine Fisheries Commission in management of marine fisheries. This commission was created to coordinate state regulations and develop management plans for interstate fisheries.

NMFS' State-Federal Fisheries Division is responsible for building cooperative partnerships to strengthen marine fisheries management and conservation at the state, inter-regional, and national levels. This division implements and oversees the distribution of grants for two national Acts (Inter-jurisdictional Fisheries Act and Anadromous Fish Conservation Act). Additionally, it works with the Gulf States Marine Fisheries Commission to develop and implement cooperative State-Federal fisheries regulations.

Texas Parks & Wildlife Department - http://www.tpwd.state.tx.us
Louisiana Department of Wildlife and Fisheries http://www.wlf.louisiana.gov/fishing
Mississippi Department of Marine Resources http://www.dmr.state.ms.us/
Alabama Department of Conservation and Natural Resources
http://www.outdooralabama.com/fishing-alabama
Florida Fish and Wildlife Conservation Commission http://www.myfwc.com

CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

4.1 Action 1 – Aggregate Maximum Sustainable Yield (MSY) for the Gulf of Mexico (Gulf) Shrimp Fishery

Note: Aggregate means for all shrimp species combined. MSY for each species is already established. Aggregate MSY does not equal the sum of the individual species MSYs.

Alternative 1. No Action. Do not establish an aggregate MSY for the federal shrimp fishery.

Alternative 2. Establish aggregate MSY using the method developed by the Shrimp Effort Working Group (SEWG). For the federal commercial Gulf shrimp fishery, aggregate MSY = 109,237,618 lbs of tails. AP Preferred

4.1.1 Direct and Indirect Effects on the Physical Environment and Biological Environment

This action will not change how the fishery is currently prosecuted; therefore, neither **Alternative 1** nor **Alternative 2** is likely to have any additional effects on the physical environment. The purpose of this Action is to establish an aggregate MSY to provide a metric to establish an aggregate optimum yield for the fishery as a whole (Action 2). There is currently a moratorium on the issuance of permits, so it is not possible for the fishery to expand beyond the existing number of permits. Conversely, the fishery is contracting in terms of permit numbers, losing between 15 and 30 permits per year for the past five years (Table 1.1.1). Thus, establishing an aggregate MSY will not change how the fishery is directed, though the sum of the individual species' MSYs would be more than the aggregate MSY and there will be no direct or indirect effects on the physical environment.

Similar to the effects on the physical environment, this action will have no additional effects on the biological environment. Establishing an aggregate MSY for the shrimp fishery will not change how the fishery is prosecuted. The purpose is to enable the determination of an aggregate OY. Thus, since this action will not change how shrimp fishermen fish, it will not have any effects on the biological environment. **Alternative 1** will not enable a whole fishery metric, which would prevent establishing an aggregate OY for the fishery. This could allow negative effects on the fishery to continue as there is no method to determine the appropriate number of permits for achieving OY, but the biological environment will not be affected as the moratorium prevents the fishery from expanding beyond the number of existing permits. **Alternative 2** would enable an aggregate OY to be established which can be used for determining the appropriate number of permits necessary for achieving OY, so it would benefit the fishery in that OY can be calculated for the fishery.

4.1.2 Direct and Indirect Effects on the Economic Environment

No direct or indirect economic effects are expected under **Alternative 1** or **Alternative 2**. The primary purpose of establishing an aggregate MSY for the federal fishery is to establish an aggregate OY, and thus **Action 1** is effectively an administrative action with respect to expected economic effects. Shrimp landings in the federal fishery are primarily dictated by environmental and economic conditions rather than regulations. In general, environmental conditions (e.g., salinity levels, water temperature, etc.) control the availability of shrimp in federal waters, though the harvest of shrimp in state waters also affects the recruitment of shrimp into federal waters. The availability of shrimp and economic conditions (e.g., shrimp and fuel prices) generally determine the level of effort and thus the actual harvest of shrimp in the federal fishery. Because there are no management restrictions that directly restrict the amount of shrimp harvested in federal waters, though catches may be reduced as a result of losses from BRDs and TEDs as well as from an assortment of time and area closures, fishermen can generally exert as much effort as they desire in catching the available supply of shrimp in any given year. Additionally, because the consumption of shrimp far exceeds the available domestic harvest, the price of domestically harvested shrimp appears to be influenced more by imports than domestic landings, though seasonal fluctuations still exist. Because neither **Alternative 1** nor **Alternative 2** are expected to alter domestic shrimp prices, landings, or the harvesting behavior of federally permitted vessels in general, no direct economic effects are expected under either alternative. Similarly, if domestic shrimp landings, prices, and therefore gross revenues in the harvesting sector are not affected, no indirect economic effects on onshore businesses (i.e., dealers and processors) are expected under either alternative.

4.1.3 Direct and Indirect Effects on the Social Environment

The action to establish an aggregate MSY will have no direct or indirect social effects because it is primarily an administrative action to establish an aggregate OY and would not change fishing behavior, affect costs of harvesting shrimp, or influence shrimp prices. By not establishing an aggregate MSY for the federal shrimp fishery in **Alternative 1**, there would be no change and therefore, no direct or indirect social effects. The establishment of an aggregate MSY in **Alternative 2** would similarly have no direct social effect as it would not change current fishing behaviors, costs of harvest, or shrimp prices. The aggregate MSY under **Alternative 2** is unlikely to be exceeded as there would need to be a significant increase in effort from recent years to reach landings of that magnitude. Because shrimp landings are primarily affected by either environmental or economic circumstances as discussed in section 4.1.3, it is unlikely that any negative social effects would occur from this action.

4.1.4 Direct and Indirect Effects on the Administrative Environment

As **Alternative 1** does not establish an aggregate MSY, it would have no effect on the administrative environment because nothing further would be required. The establishment of an aggregate MSY in **Alternative 2** will have minimal effects on the administrative environment.

This will just be updating an existing metric, and the only administrative burden would be associated with the implementation of the proposed and final rule which are required for all management actions.

4.2 Action 2 – Aggregate Optimum Yield (OY) for the Gulf Shrimp Fishery

Note: Aggregate means for all shrimp species combined. OY for each species is already established. Aggregate OY does not equal the sum of the individual species OYs.

Alternative 1. No Action. Do not establish an aggregate OY for the federal commercial Gulf shrimp fishery.

Alternative 2. For the federal shrimp fishery, aggregate OY = 85,368,059 lbs of tails which is aggregate MSY reduced for certain ecological, social, and economic factors. AP Preferred

4.2.1 Direct and Indirect Effects on the Physical and the Biological Environments

This action will not change how the fishery is prosecuted and will have no effect on the physical nor the biological environment. OY for each species was defined as equal to MSY in Amendment 13. If an aggregate MSY is defined in Action 1, then an aggregate OY is also defined (**Alternative 1**) unless changed by this action (**Alternative 2**). The aggregate MSY is slightly less than the sum of all individual species' MSYs; however, there is no punitive action if either MSY or the aggregate MSY is exceeded as the current overfishing and overfished definitions are determined by the maximum fishing mortality threshold and the minimum stock size threshold respectively. Effort in the shrimp fishery is primarily capped for two reasons, nearing the effort threshold for sea turtle bycatch and the effort threshold for juvenile red snapper bycatch. Keeping aggregate OY equal to the aggregate MSY would change the rationale and discussion for Action 3; **Alternative 1** would result in a number of permits to achieve OY that is more than the existing number of valid or renewable permits which could lead to indirect negative effects. A working group was convened in March 2016 to determine the best metric for establishing OY. Taking into account four metrics (high landings, high CPUE, effort levels below the sea turtle bycatch threshold, and effort levels below the juvenile red snapper bycatch), the working group recommended an aggregate OY be set at a level consistent with predicted landings in 2009 because all of the outlined criteria were balanced in this year. If **Alternative 2** is selected, the aggregate OY would be established that would have the least negative effects on the physical and biological environments as it would not be changing the fishery. **Alternative 2** would keep effort levels at or below levels that are consistent with those established by the biological opinion of the shrimp fishery that minimizes sea turtle bycatch. This low level would prevent expansion of the shrimp fishery, thereby having no effect on the fishery. **Alternative 1** would create an OY set at a level that would be more than the current number of *active* permits in the shrimp fishery are capable of producing. This could allow for more effort in the future should the Council choose to create a permit pool. More effort could lead to more trawling

which would have more negative effects on the physical environment. Shrimp trawling is typically conducted on soft substrate which recovers quickly from disturbance, but increases in effort would increase substrate disturbance. Increases in effort could also cause negative effects by increasing bycatch. The OY provided in this action will be used to calculate threshold values in Action 3 (which can potentially lead to the creation of a permit pool in Action 4), and there could be negative effects if the OY is not modified to take into consideration current thresholds placed on the fishery. **Alternative 2** is the least likely to have any negative effects on the physical or biological environment in that it maintains the OY at levels that are consistent with thresholds on the shrimp fishery. **Alternative 1** could allow for the immediate creation of a permit pool that could potentially create a situation, though unlikely in the current state of the fishery, where effort increases thereby causing an increase in bottom disturbance and bycatch.

4.2.2 Direct and Indirect Effects on the Economic Environment

No direct or indirect economic effects are expected under **Alternative 1** or **Alternative 2**. The primary purpose of establishing an aggregate OY for the federal fishery is to determine the level of harvest, and associated level of effort, that would generate the greatest overall (i.e., net) benefit to the Nation, consistent with the MSA and National Standard 1. Once aggregate OY is determined, the Council can determine how many federally permitted vessels are likely needed to achieve OY or other management objectives (see Action 3). Thus, Action 2 is effectively an administrative action with respect to expected economic effects.

The number of federally permitted vessels has steadily declined since the moratorium became effective in 2007, although the number of active federally permitted vessels has been relatively stable during that time. The Council has raised concerns regarding whether the current number of federally permitted vessels is consistent with achieving OY and other management goals. As discussed in the analysis of economic effects under Action 1, shrimp landings in the federal fishery are primarily dictated by environmental and economic conditions rather than regulations. In general, environmental conditions (e.g., salinity levels, water temperature, etc.) control the availability of shrimp in federal waters, though the harvest of shrimp in state waters also affects the recruitment of shrimp into federal waters. The availability of shrimp and economic conditions (e.g., shrimp and fuel prices) generally determine the level of effort and thus the actual harvest of shrimp in the federal fishery. Because there are no management restrictions that directly restrict the amount of shrimp harvested in federal waters, though catches may be reduced as a result of losses from BRDs and TEDs as well as from an assortment of time and area closures, fishermen can generally exert as much effort as they desire in catching the available supply of shrimp in any given year. Additionally, because the consumption of shrimp far exceeds the available domestic harvest, the price of domestically harvested shrimp appears to be influenced more by imports than domestic landings, though seasonal fluctuations still exist. Because neither **Alternative 1** nor **Alternative 2** are expected to alter domestic shrimp prices, landings, or the harvesting behavior of federally permitted vessels in general, no direct economic effects are expected under either alternative. Similarly, if domestic shrimp landings, prices, and therefore gross revenues in the harvesting sector are not affected, no indirect economic effects on onshore businesses (i.e., dealers and processors) are expected under either alternative.

4.2.3 Direct and Indirect Effects on the Social Environment

As in Action 1, the determination of an aggregate OY is an administrative action and direct social effects would not be expected. Because OY is a threshold to determine the net benefits to the nation, the indirect social effects should be beneficial as it is being used to determine how many viable shrimp permits are needed in the fishery to reach OY. The indirect social effects would result from subsequent actions if OY is selected to determine the number of permits. As in Action 1, not establishing an OY (**Alternative 1**) would not be expected to result in direct or indirect social effects because it would not affect or change fishing behaviors. Under **Alternative 2**, the aggregate OY of 85,368,059 lbs of tails would also have no direct social effects until it is used to determine criteria proposed in other actions within this amendment, such as the number of permits allowed to remain in the fishery. However, OY is based upon MSY as reduced by economic, social, or ecological factors. The information needed to consider social factors that help determine OY is limited. For that reason, the discussion of OY is often reliant on either economic or qualitative information about the fishery. In addition, because shrimp landings are often determined more by environmental or economic conditions, the determination of direct or indirect social effects from establishing OY is difficult. With **Alternative 2** preferred by the Shrimp Advisory Panel, the assumption is that the social effects should be positive.

4.2.4 Direct and Indirect Effects on the Administrative Environment

As **Alternative 1** does not establish an aggregate OY, it would have no effect on the administrative environment because nothing further would be required. The establishment of an aggregate OY in **Alternative 2** will have minimal effects on the administrative environment. This will just be updating an existing metric, and the only administrative burden would be associated with the implementation of the proposed and final rule which are required for all management actions.

4.3 Action 3 – Minimum Threshold Number of Gulf Shrimp Vessel Permits

NOTE: This action does not actively remove any Gulf shrimp permits. The minimum threshold is only for purposes of monitoring changes in fishery participation and determining if additional management measures should be established.

Alternative 1. No Action. Do not set a threshold number of Gulf shrimp vessel permits.

Alternative 2. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) needed to attain aggregate OY in the offshore fishery. Aggregate OY accounts for relatively high CPUE and landings while reducing the risk of exceeding sea turtle and juvenile red snapper bycatch (for Action 2 Alternative 2: 1,074 permits). AP Preferred

Alternative 3. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) during 2011 when effort was highest during the moratorium in the area monitored for red snapper juvenile mortality but without reaching the bycatch reduction threshold and triggering closures (938 permits).

Alternative 4. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) during 2008 when catch per unit effort (CPUE) in the offshore fishery was highest during the moratorium (882 permits).

Alternative 5. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the predicted number of active permitted vessels (those with landings from offshore waters) in a year with relatively high CPUE in the offshore fishery without substantially reduced landings, and with effort that is close to the effort needed to achieve OY.

Option 5a. 2007 (1,133 permits)

Option 5b. 2012 (990 permits)

4.3.1 Direct and Indirect Effects on the Physical and the Biological Environments

Trawling is recognized for its impacts to benthic environments because the heavy doors drag along the bottom and the tickler chains scrape along the sea floor. The shrimp fishery is prosecuted primarily over soft substrates such as mud or silt that are more resilient to disturbance than other bottom types. Shrimp fishing effort level is used to determine the extent of impacts to the physical and biological environments.

This action would establish a threshold number of Gulf shrimp vessel permits. The Gulf shrimp permit moratorium was renewed for an additional 10 years through Amendment 17A to the FMP. This action will not result in an expansion of the fishery; thus **Alternatives 1-5** would have no discernable direct negative physical or biological effects. The action does not actively remove any permits; however, a passive decrease in the number of permits is an expected part of the moratorium. Through the end of 2015, 478 federal shrimp permits have been terminated or surrendered. If current trends continue, the number of permits expected at the end of the 10-year moratorium would be around 1,295.

Specifically, **Alternative 1** would continue to allow a passive reduction in the number of permits over time without establishing a threshold. **Alternatives 2-5** would also continue to allow a passive reduction in number of permits over time until the number reaches the established threshold number based on a level of effort and number of active vessels that leads to a particular management goal: achieving OY, remaining below the target effort level for juvenile red snapper bycatch, maintaining the highest CPUE, or balancing high CPUE and landings, respectively. **Alternative 5a** would allow the smallest reduction in permits (highest threshold) and **Alternative 4** would allow the largest reduction (lowest threshold). The other alternatives

provide permit levels between the high and low thresholds. Fewer permits could result in indirect effects if a lower number of vessels actively fish, decreasing bycatch and impacts on the environment. Nevertheless, the majority of terminated permits have been inactive prior to termination.

The expected effects of these alternatives are dependent on changes in fishing effort, which may or may not change based on the number of permits. While there is a strong relationship between the number of actively fishing federally permitted vessels and offshore effort, effort is variable and is affected by environmental (shrimp size and abundance) and economic factors (shrimp and fuel prices). Currently, with the moratorium in place, shrimping effort has fluctuated below the recommended sea turtle and red snapper bycatch thresholds.

4.3.2 Direct and Indirect Effects on the Economic Environment

Because none of the alternatives would actively remove moratorium permits from the federal fishery, no direct economic effects are expected under any of the alternatives for Action 3. The primary purpose of this action is to ensure there are an appropriate number of permits in the federal fishery such that the level of effort and landings will meet one or more of the management objectives specified in this Amendment. All of the alternatives would continue to allow for some level of passive reduction in the number of permits as a result of permits not being renewed in a timely manner and therefore terminating.

The number of valid or renewable permits was 1,452 as of April 20, 2016. The risk assessment in Appendix B projects that the number of permits at the end of the moratorium and thus under **Alternative 1 (no action)** is expected to be 1,295. **Alternatives 2-5** would set a threshold number of permits below the expected number of permits under **Alternative 1 (no action)**. Specifically, the threshold number of permits under **Alternative 2**, **Alternative 3**, **Alternative 4**, **Alternative 5a**, and **Alternative 5b** are 1072, 935, 880, 1131, and 988. Thus, the highest threshold would be 1,131 under **Alternative 5a**. If the projected number of permits under **Alternative 1 (no action)** is accurate, or even relatively close to accurate, none of the thresholds established under **Alternatives 2-5** will be met before the end of the moratorium. If the threshold is not met, then Council action will not be triggered under Action 4. If Council action is not expected to be triggered under Action 4, then none of the alternatives under Action 3 would be expected to cause indirect economic effects in the harvesting sector. Conversely, if the projection is not accurate and permits terminate at a faster rate than assumed in the risk assessment, then it is possible for each of these alternatives to generate indirect economic effects in the harvesting sector in the future, particularly if Alternative 2 or Alternative 4 under Action 4 is selected as the preferred alternative as each would trigger the creation of a reserve pool of permits. Although it is not possible to determine whether those indirect economic effects would be positive or adverse at present because it is unknown what would happen with theses reserve pool permits or who might obtain them, the probability that such effects could occur in the future is the greatest under **Alternative 5a** and the least under **Alternative 4**, with the other alternatives being between these two.

4.3.3 Direct and Indirect Effects on the Social Environment

This action will determine an appropriate number of permits in the federal shrimp fishery by establishing a permit number threshold to ensure that the amount of effort and landings meets the specified management objectives. Thus, no direct effects would be expected from this action as it does not change the number of moratorium permits. All of the alternatives, including **Alternative 1** would allow the number of permits to continue to decrease in the event of non-renewal or voluntary surrender.

No additional effects would be expected from selecting **Alternative 1** and the number of permits would continue to decrease as some permits are either not renewed or surrendered. Permit holders likely have various reasons for allowing their permits to be terminated. As the cost of renewing the permit is $25 per year (or $10, if the shrimp permit is an additional federal permit assigned to the vessel), renewal cost is not likely the reason for not maintaining the permit. As discussed in Section 2.3, those permits that are not renewed or surrendered are generally latent; they are not being used. However, the loss of these permits means that fewer permits are available to others who may desire a permit, either at present or in the future.

Because the permits are limited access (i.e., under a moratorium), the value of the permit if transferred would be expected to be greater than the cost of renewing the permit. Thus, if a permit holder does not intend to retain and renew a permit, there is an economic incentive to attempt to transfer the permit to another vessel operator in need of a permit. That the number of permits continues to decline despite the ability to transfer permits suggests that 1) those desiring a permit are unable to locate another who would like to dispose of such permit, or that an agreement could not be reached for transferring the permit; or 2) there is insufficient demand for acquiring a limited access shrimp permit.

Reaching the threshold specified in **Alternatives 2-5** would result in indirect effects, triggering the action to be taken in Action 4. Although it is possible for the rate of permit attrition to increase in the future, indirect effects would not be expected in the short term. Since implementation of the permit moratorium, 24.7% of permits over 8 years have been terminated or surrendered (Table 1.1.1). The year with the greatest loss of permits was 2008-2009 with 9.64% (184 permits) terminated or surrendered. During the years 2012-2014, the majority of terminated permits were not being used (Section 2.3). It may be assumed that unused permits would more likely be allowed to terminate than those that are being used. Thus, going forward, it is more likely for the rate of permit loss to slow, rather than accelerate. This pattern is evident in the number of permits that have been terminated each year since inception of the permit moratorium (Table 1.1.1).

Assuming 5% of permits are terminated each year going forward (similar to the rate of permit loss projected in Appendix B until the end of the moratorium) beginning with the 1,452 permits as of April 20, 2016, it would take just under 5 years before triggering the highest threshold (1,131 permits; **Alternative 5, Option 5a**). It would be even more distant in the future to reach the other proposed thresholds beginning with **Alternative 2** (1,072 permits), **Alternative 5**, **Option 5b** (988 permits), **Alternative 3** (935 permits) and lastly, **Alternative 4** (880 permits).

Thus, any indirect effects resulting from this action would not occur in the short term. Finally, should the threshold number of permits be reached, the indirect effects may be positive for some entities, and negative for others, depending on the action to be taken upon triggering the threshold (see Section 4.4.3).

4.3.4 Direct and Indirect Effects on the Administrative Environment

None of the alternatives, including **Alternative 1**, would be expected to have any direct effects on the administrative environment. Indirect effects with **Alternatives 2-5** would only be expected if an alternative is chosen in Action 4 that requires the formation of a review panel or a permit pool; these potential effects are discussed in Section 4.4.4.

4.4 Action 4 – Response When Threshold Number of Shrimp Moratorium Permits is Reached

Alternative 1. No action. No action will be triggered when the threshold number of valid or renewable shrimp moratorium permits is reached.

Alternative 2. If the number of valid or renewable shrimp moratorium permits reaches the threshold set in Action 3, any permits that are not renewed within one year of the expiration date on the permit will go into a Gulf Shrimp Vessel Permit Reserve Pool.

Alternative 3. If the number of valid or renewable shrimp moratorium permits reaches the threshold set in Action 3, the Council will form a review panel to review the threshold and determine if action is needed.

Alternative 4. When the number of valid or renewable shrimp moratorium permits reaches 1,300, the Council will form a review panel to review the details of a permit pool and other options. If the number of permits reaches the threshold set in Action 3, any permits that are not renewed within one year of the expiration date on the permit will go into a Gulf Shrimp Vessel Permit Reserve Pool. The panel would consist of Shrimp AP members, SSC members, NMFS and Council staff. AP Preferred

4.4.1 Direct and Indirect Effects on the Physical and the Biological Environments

This action would establish a process to provide the shrimp industry with a means of maintaining participation at the level determined by Action 3. If the threshold is reached, the Council may respond with new management measures or re-evaluate the threshold. Because the permit reduction is passive (permits are only terminated due to non-renewal by the permit holder), the threshold could be reached relatively quickly, after many years, or not at all, depending on the rate of termination. The number of valid permits has declined by an average of 35 permits per year over the last five years. **Alternatives 2-4** are responses to the threshold being met at some future date.

Alternative 1 would result in no new management measures if and when the threshold is met. **Alternative 2** would maintain the number of permits determined by the threshold implemented by Action 3 through the creation of a Gulf Shrimp Vessel Permit Reserve Pool. Establishing a permit pool would prevent further passive decline in the total number of permits. Fewer permits could result in indirect effects due to a lower number of vessels actively fishing, decreasing bycatch and impacts on the environment. **Alternatives 3** and **4** would convene a review panel to discuss management options when the threshold established by Action 3 is reached (**Alternative 3**) or when the total permit number reaches 1,300 (**Alternative 4**). The review panel could recommend initiating development of a permit pool or decide that a permit pool is not an appropriate management measure at that time.

Essentially, Action 3 would set a lower limit on participation in the fishery at the established threshold and this action could allow effort to be expanded up to the cap if permit levels continue to fall below the threshold number. Thus, the creation of a permit pool may have effects on the physical and biological environment in that it may allow for an increase in effort in the fishery at some point in the future, though that effort will likely be less than the current effort in the fishery as the number of permits would be lower. The total number of federal permits is not linked to effort in the shrimp fishery, but increasing available permits via a permit pool could increase effort and therefore could have negative effects on the physical and biological environment by allowing more trawling and by increasing bycatch. However, as the proposed threshold levels are all below current permit numbers and are based on current thresholds for sea turtle bycatch and juvenile red snapper bycatch, or are based on high catch per unit effort (CPUE), it is unlikely that the effects of potential increased effort from the creation of a permit pool would be more than the effects already experienced from fishing activities of the shrimp fishery.

4.4.2 Direct and Indirect Effects on the Economic Environment

This action considers alternative courses of action the Council may take once the threshold number of federal shrimp permits is reached. Under **Alternative 1**, the Council would not take any action once the threshold number of permits is met. **Alternative 1** would not affect shrimp harvests and would not impede the continued attrition observed in the number of moratorium permits. Therefore, **Alternative 1** would not be expected to result in direct economic effects. Once the minimum number of permits, as determined in Action 3, is reached, **Alternative 2** would place permits that are not renewed within one year of the expiration date into a Gulf Shrimp Vessel Permit Reserve Pool. Because permits placed in the reserve pool could be reissued as Gulf Reserve permits, **Alternative 2** would stop the decline in the number of permits and set a minimum number of permits available to shrimpers in the Gulf. Direct economic effects would not be expected to result from **Alternative 2** because it does not affect the characteristics or harvest levels of the Gulf shrimp fishery. However, **Alternative 2** could result in indirect economic effects due to the artificial constraint placed on the uninhibited attrition in the number of permits. If the additional permits (permits that would have expired) resulting from this artificial constraint result in an unwarranted increase in shrimp effort, **Alternative 2** could be expected to result in adverse indirect economic effects stemming from potential increases in sea turtle encounters and in negative impacts on the profitability of shrimp operations. Conversely, if the additional permits provide an avenue for increases in shrimp effort warranted

by significant improvements in the bio-economic conditions of the fishery, then **Alternative 2** could result in indirect economic benefits associated due to the additional shrimp harvests. Under **Alternative 3**, once the threshold established in Action 3 is reached, the Council would appoint a panel to review the threshold and recommend a course of action, if needed. Following the review, if the Council establishes a permit reserve pool, **Alternative 3** would be expected to result in the same economic effects as **Alternative 2**. If the Council decides to reset the threshold, then **Alternative 3** would not be expected to result in economic effects as long as the Council does not reassess the threshold. Finally, the Council could elect to take a yet to be determined action with unknown expected economic effects that would be assessed once the course of action is defined.

Alternative 4 combines provisions in **Alternative 2** with an early initiation of the review of the provisions for a reserve pool once the number of permits reaches 1,300. Therefore, **Alternative 4** would be expected to result in economic effects commensurate with economic effects expected from **Alternative 2**. Relative to **Alternative 2**, **Alternative 4** could also be expected to result in additional economic benefits because it could afford managers additional time to design the reserve permit pool thereby fostering the design of a more effective permit pool. These additional economic benefits would be expected to increase as the difference between 1,300 and the threshold set in Action 3 widens.

4.4.3 Direct and Indirect Effects on the Social Environment

Should the threshold number of shrimp moratorium permits selected in Action 3 be reached, this action specifies the action to be taken. If **Alternative 1** is selected, neither direct effects would be expected from Action 4, nor would any indirect effects result from Action 3, as no response would occur when the threshold number of permits is met.

The effects from **Alternative 3** would be similar to **Alternative 1**, as the action of forming a review panel to review the threshold and determine whether action is needed does not result in any effects to the social environment. Any action the review panel may recommend is unknown at this time. Once determined, the recommended action would then need to be brought to the Council before going through the regulatory process to be implemented. Although specifying that a review panel would be convened (**Alternative 3**) provides the Council with flexibility to tailor future management measures to the actual situation at that time, the Council could select **Alternative 1** and decide to form a review panel by Council motion when the number of shrimp permits reaches the threshold of Action 3, or upon reaching any other number. Further, **Alternatives 1** and **3** continue the uncertainty for the social environment of whether the number of federal shrimp permits would be allowed to decline below the threshold. Thus, these alternatives would be less desirable than **Alternatives 2** and **4**, which specify the threshold (Action 3) as the minimum number of permits to exist in the fishery, and that terminated permits will become available to others.

Under **Alternatives 2** and **4**, the number of permits selected as the threshold in Action 3 would become the minimum number of federal shrimp permits for the fishery. Upon reaching the threshold, any additional permits that are surrendered or terminated would be placed in a permit

pool, and these permits could be reissued. The mechanism or selection process for deciding who would have access to the permits in this pool would need to be determined and some social effects could result depending on the means of access to these permits. Without knowing the distribution process and access provisions, the scope and extent of these direct effects, as well as the beneficiaries, remain unknown.

Although **Alternative 4** does not address these issues explicitly, compared with **Alternative 2**, it specifies the formation of the review panel in advance of reaching any of the thresholds provided in Action 3. Further, compared with **Alternative 3**, **Alternative 4** specifies that the review panel will address the details of the permit pool to be created for permits terminated or surrendered after the threshold number of permits is reached. Thus, among the alternatives, **Alternative 4** involves the least uncertainty to the social environment as it provides the most details about the action to be taken when the threshold number of permits is reached, and it establishes the threshold as the minimum number of permits for the fishery.

4.4.4 Direct and Indirect Effects on the Administrative Environment

No effects on the administrative environment would be expected with **Alternative 1** because permits would continue to terminate if not renewed within a year after they expire. **Alternatives 2** and **4** would require the formation of a permit pool. Any permits that were not renewed within one after they expired would be converted to Reserved Gulf Shrimp Vessel Permits and could be reissued. In this case, the number of permit applications to be processed could increase. **Alternatives 3** and **4** would require a review panel to be created. In addition to the direct administrative burden of convening the panel, indirect effects could occur as a result of the panel recommendation. Because any recommend action by the panel would need to go through the Council process, effects of those actions would be analyzed at that time.

4.5 Action 5 – Transit Provisions for Shrimp Vessels without a Federal Permit

Alternative 1. No Action. For a person aboard a vessel to fish for shrimp or possess shrimp in Gulf federal waters, a federal vessel permit for Gulf shrimp must have been issued to the vessel and must be on board.

Alternative 2. A vessel possessing shrimp may transit Gulf federal waters without a federal vessel permit if fishing gear is appropriately stowed. Transit means non-stop progression through the area; fishing gear appropriately stowed means trawl doors and nets must be out of the water and the bag straps must be removed from the net. AP Preferred

Alternative 3. A vessel possessing shrimp may transit Gulf federal waters without a federal vessel permit if fishing gear is appropriately stowed. Transit means non-stop progression through the area; fishing gear appropriately stowed means a trawl net shall remain on deck, but trawl doors (if present) must be disconnected from the trawl gear and must be secured.

4.5.1 Direct and Indirect Effects on the Physical and the Biological Environments

This action will mainly affect who can transit through federal waters while having shrimp on board. Currently, one must possess a federal Gulf shrimp moratorium permit to have shrimp on board a vessel with shrimp fishing gear in federal waters. **Alternative 1** would continue to prohibit fishermen without a federal permit from entering federal waters if they have shrimp fishing gear and shrimp on board a vessel. This alternative would have no additional effects from the current way that federal waters are enforced with regard to the shrimp fishery. **Alternatives 2** and **3** would have positive effects on the physical environment and indirect positive effects on the biological environment in that both would allow for a shorter transit from fishing grounds to port by not requiring vessels to travel farther distances to avoid federal waters. These positive effects would result from fewer emissions of greenhouse gases from vessels in transit, and would also decrease the amount of time a vessel spends transiting, thus decreasing noise pollution caused by engines. As **Alternatives 2** and **3** only differ in the definition of what stowed gear means, there is no difference between alternatives with regard to effects on the physical or biological environment.

4.5.2 Direct and Indirect Effects on the Economic Environment

This action considers the establishment of provisions to allow vessels possessing shrimp but without a valid federal shrimp permit to transit through federal waters. **Alternative 1** (no action) would continue to require all vessels possessing shrimp and transiting through federal waters to have a federal shrimp permit on board. Therefore, **Alternative 1** would be expected to result in adverse economic effects because shrimpers without a federal shrimp permit would be forced to take more circuitous routes to go back to port if they have shrimp on board. The magnitude of the negative economic effects expected to result from **Alternative 1** would be represented by the additional fuel costs incurred and by the lengthier transit times, quantitative estimates of which are unknown. **Alternatives 2** and **3** would allow vessels possessing shrimp to transit through federal waters without a federal shrimp permit provided that their gear is stowed. However, **Alternatives 2** and **3** differ in their definition for stowed gear. **Alternative 2** would define stowed gear as shrimp nets out of the water and bag straps removed. **Alternative 3** would be more taxing for shrimpers because it would also require trawl doors to be detached from the trawl gear and secured. Relative to **Alternative 1**, both **Alternatives 2** and **3** would be expected to result in direct economic benefits stemming from decreases in fuel expenditures and shorter travel times that would be associated with the opportunity to transit through federal waters. However, economic benefits that could result from **Alternative 3** are expected to be at least partially offset by increased safety challenges that could result from detaching trawl doors during inclement weather conditions.

4.5.3 Direct and Indirect Effects on the Social Environment

Establishing transit provisions through federal waters by vessels without a federal permit should have beneficial social effects as it will allow fishermen to reduce their transit time and costs.

Under **Alternative 1** there may be negative social effects occurring if fishermen must travel further to avoid transit through federal waters without a federal permit. The provisions under **Alternative 2** allow for transit and have gear stowing provisions that are less restrictive than **Alternative 3**, so would have the most positive social effects among the three alternatives. The provisions under **Alternative 3** require crew to disconnect more gear which can create a burden and possible issues of safety at sea if the vessel intends to fish once transit is completed.

Generally, there is a trade-off between the social impacts on fishermen and benefits for law enforcement, which is part of the administrative environment. **Alternative 1** would have the most negative social effects on fishermen, but may benefit law enforcement in determining violations. The provisions under **Alternative 3** would have fewer negative social effects on fishermen as it would allow transit, but could impose some burden on law enforcement who would have to board the vessel and ensure gear were stowed properly. **Alternative 2** would have the most beneficial social effects for fishermen and the social effects for law enforcement would be similar to **Alternative 3**.

4.5.4 Direct and Indirect Effects on the Administrative Environment

This action could have some effect on the administrative environment. **Alternative 1** would have no effect on the administrative environment as it would maintain the current status of the regulations. **Alternatives 2** and **3** would require changing the current regulations for providing a transit provision that currently does not exist. Neither **Alternative 2** nor **3** match the wording that exists in the regulations regarding transit provisions through closed areas and thus would require additional language for law enforcement to consider when enforcing a transit provision.

4.6 Cumulative Effects Analysis

As directed by the National Environmental Policy Act (NEPA), federal agencies are mandated to assess not only the indirect and direct impacts, but cumulative impacts of actions as well. The NEPA defines a cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). Cumulative effects can either be additive or synergistic. A synergistic effect occurs when the combined effects are greater than the sum of the individual effects. The following are some past, present, and future actions that could impact the environment in the area where the Gulf shrimp fishery is prosecuted.

Past Actions

In 2003, regulations were instituted requiring vessels to possess a federal shrimp permit when fishing for shrimp in the Gulf EEZ. Subsequently, a 10-year moratorium on the issuance of new

federal shrimp permits was established in 2006. Amendment 17A, implemented in 2016, extended the moratorium another 10 years until 2026. As of December 16, 2016, there were 1,441 valid or renewable Gulf shrimp permits, which is a significant decline from the 1,933 vessels that received a permit when the moratorium was implemented. Although approximately one-third of active vessels were federally permitted at the beginning of the moratorium, less than 25% of active vessels had federal permits in each of the last four years (i.e., vessels without a permit are representing an increasing percentage of active vessels in the fishery over time). Despite being fewer in number, federally permitted vessels generally accounted for about 67% of shrimp landings and 76% of shrimp revenues in the fishery between 2007 and 2011. However, the permitted vessels' shares of the fishery's landings and revenues have declined noticeably in the last three years, to only 56% and 68%, respectively. Thus, vessels without permits have been accounting for a greater percentage of the fishery's production and revenues in recent years. The actions in this amendment may or may not change the rate of decline in number of federal permits.

Joint Reef Fish Amendment 27/Shrimp Amendment 14 (GMFMC 2007) established a target effort-reduction goal of 74% less than the benchmark years of 2001-2003 as a proxy for juvenile red snapper mortality reduction. The amendment established a closure procedure for the northern and western Gulf within the 10- to 30-fathom zone in conjunction with the beginning of the annual Texas closure if fishing effort does not meet the reduction target. NMFS was able to relax the effort restrictions in 2012 to a 67% reduction because the red snapper stock was rebuilding on schedule. Actions in this amendment take into account the need to protect the red snapper stock and reduce the likelihood of potential closures by keeping effort below the threshold.

To address sea turtle bycatch and associated mortality, NMFS implemented regulations requiring turtle excluder devices (TEDs) in 1987, which were phased in over 20 months. Originally, TEDs were required on a seasonal basis, and no TEDs were required if the fisherman followed restricted tow times. Subsequent rulemaking in 1992 required TEDs in all shrimp trawls from North Carolina to Texas, but phased in these requirements to the inshore fishery over a two-year period. Over time, TED regulations have been modified to change the allowable configurations with the intent of improving turtle exclusion. TEDs are required in both state and federal waters. Royal red shrimp trawls are not required to have TEDs if the catch is 90% or more royal red shrimp because the fishery is prosecuted in depths that are unlikely to capture sea turtles. In a 2014 biological opinion (NMFS 2014), NMFS analyzed the impacts of the southeast shrimp fisheries based on 2009 effort levels. If effort exceeds that level, NMFS will infer that take has been exceeded and that effects on sea turtles were greater than analyzed. If effects exceed those in the opinion for any given year, then NMFS would close certain areas of the Gulf and reinitiate Endangered Species Act consultation. In 2014, the effort level was just 0.1% below the target level that would trigger closures.

Since 2001, there has been a decrease in effort in the southeast U.S. shrimp fishery. The decline has been attributed to low shrimp prices, rising fuel costs, competition with imported products, and the impacts of 2005 and 2006 hurricanes in the Gulf. This was exacerbated by the financial meltdown and consequent recession in the U.S. economy in 2007-2008. Given that the shrimp

fishery still faces many of the challenges that contributed to the effort declines, effort is not expected to increase substantially in the near future.

In December 2013, NMFS implemented a rule outlining a cost share plan between NMFS and shrimp vessel permit holders to support the electronic logbook (ELB) program. The ELB program provides data on Gulf shrimp fishing effort that is critical to both the Council and NMFS in performing annual assessments of the status of shrimp stocks, obtaining accurate estimates of juvenile red snapper mortality attributable to the shrimp fishery, and generating mortality estimates on a number of other species captured as bycatch in the shrimp fishery (see Section 3.3). The cost per vessel is approximately $240 per year. Because the average vessel in the Gulf shrimp fishery has been in poor financial condition, an additional cost item that does not improve the vessel's operations could have a material adverse impact on the operations and solvency of an average vessel.

Deepwater Horizon MC252 Oil Spill

On April 20, 2010, an explosion occurred on the Deepwater Horizon semi-submersible oil rig approximately 36 nautical miles (41 statute miles) off the Louisiana coast. Two days later the rig sank. An uncontrolled oil leak from the damaged well continued for 87 days until the well was successfully capped by British Petroleum on July 15, 2010. The Deepwater Horizon MC252 (DWH) oil spill affected at least one-third of the Gulf area from western Louisiana east to the Florida Panhandle and south to the Campeche Bank in Mexico.

As reported by the NOAA (National Oceanic and Atmospheric Administration) Office of Response and Restoration (NOAA 2010), the oil from the DWH oil spill is relatively high in alkanes which can readily be used by microorganisms as a food source. As a result, the oil from this spill is likely to biodegrade more readily than crude oil in general. The DWH is also relatively much lower in polycyclic aromatic hydrocarbons. Polycyclic aromatic hydrocarbons are highly toxic chemicals that tend to persist in the environment for long periods of time, especially if the spilled oil penetrates into the substrate on beaches or shorelines. Like all crude oils, DWH oil contains volatile organic compounds (VOCs) such as benzene, toluene, and xylene. Some VOCs are acutely toxic, but because they evaporate readily, they are generally a concern only when oil is fresh.[10]

Oil could exacerbate the development of the hypoxic "dead" zone in the Gulf, similar in effect as higher than normal input of water laden with fertilizer runoff from the Mississippi River basin. For example, oil on the surface of the water could restrict the normal process of atmospheric oxygen mixing into and replenishing oxygen concentrations in the water column. In addition, microbes in the water that break down oil and dispersant consume oxygen; this metabolic process further depletes oxygen in the adjacent waters.

In addition to the crude oil, over one million gallons of the dispersant, Corexit 9500A®, was applied to the ocean surface and an additional hundreds of thousands of gallons of dispersant was

[10] Source: http://sero.nmfs.noaa.gov/sf/deepwater_horizon/OilCharacteristics.pdf

pumped to the mile-deep well head (National Commission 2010). No large-scale applications of dispersants in deep water had been conducted prior to the DWH oil spill.

Twenty-first century dispersant applications are thought to be less harmful than their predecessors. However, the combination of oil and dispersants has proven to be more toxic to marine fishes than either dispersants or crude oil alone. Marine fish which are more active (e.g., a pelagic species versus a demersal species) appear to be more susceptible to negative effects from interactions with weathered oil/dispersant emulsions. These effects can include mobility impairment and inhibited respiration (Swedmark et al. 1973). Another study found that while Corexit 9500A® and oil are similar in their toxicity, when Corexit 9500A® and oil were mixed in lab tests, toxicity to microscopic rotifers increased up to 52-fold (Rico-Martínez et al. 2013). These studies suggest that the toxicity of the oil and dispersant combined may be greater than anticipated. The impacts on the food web from phytoplankton, to zooplankton, to mollusks, to top predators may be significant in the future. Effects on shrimp from the oil spill may affect other species that prey upon shrimp.

Sections of the Gulf were closed to all fishing during the oil spill event. These areas were opened after the well was capped and testing determined seafood from each area was safe for human consumption. In November 2010, a fisherman reported tarballs in his net while trawling for royal red shrimp in an area that opened five days before. NMFS reclosed the area and conducted additional seafood sampling. NMFS re-opened the area in February 2011 after testing shrimp and finfish from the area and finding that all seafood samples passed both sensory and chemical testing. For additional information on the Deepwater Horizon MC252 oil spill and associated closures, see: http://sero.nmfs.noaa.gov/deepwater_horizon_oil_spill.htm.

The DWH oil spill and BP's responses had a confounding effect on the economics of the Gulf shrimp fishery in 2010. The majority of vessels (66%) reported receiving oil spill-related revenue. The two primary sources of this revenue are damage claims (passive income) and revenue generated by participation in BP's vessel of opportunity program (VOOP) where vessels were hired to clean up oil. Of the surveyed vessels, 28% participated in the VOOP. Both sources provided substantial revenue for participating vessels, thereby obscuring the economics of the fishery. Further, vessels participating in VOOP incurred non-negligible costs unrelated to commercial fishing.

Present Actions

The shrimp fishery is closed annually in state waters off Texas to allow brown shrimp to reach a larger and more valuable size prior to harvest and to prevent waste of brown shrimp that might otherwise be discarded due to their small size. The closing and opening dates of the Texas closure are based on the results of biological sampling by the Texas Parks and Wildlife Department. Historically, the closure is from about May 15 to July 15. NMFS closes federal waters off Texas concurrent with this action each year, at the request of the Council.

The proposed action relates to the harvest of an indigenous species in the Gulf, and the activity being altered does not itself introduce non-indigenous species, and is not reasonably expected to

facilitate the spread of such species through depressing the populations of native species. Additionally, it does not propose any activity, such as increased ballast water discharge from foreign vessels, which is associated with the introduction or spread on non-indigenous species.

Reasonably Foreseeable Future Actions

NMFS is proposing to require all skimmer trawls, pusher-head trawls, and wing nets (butterfly trawls) rigged for fishing, with the exception of vessels participating in the Biscayne Bay wing net fishery prosecuted in Miami-Dade County, Florida, to use TEDs designed to exclude small turtles in their nets. Currently, vessels using these gears can use alternative tow times. The intent of this proposed rule is to reduce incidental bycatch and mortality of sea turtles, and to aid in the protection and recovery of listed sea turtle populations. An estimated 304 vessels that had a federal Gulf permit between 2011 and 2014 would be affected by this rule. Of these 304 vessels, 196 are considered "full-time" vessels (i.e., average annual gross revenues are at least $52,000 per year) and 108 are considered "part-time" vessels (i.e., average annual gross revenues are less than $52,000 per year) in the Gulf shrimp fishery. The adverse economic effects (combination of TED costs and revenue loss due to shrimp loss) would exceed 20% of the annual average gross revenues for 34 of these vessels, all of which are part-time vessels whose average annual gross revenues are less than $17,000 per year. Although the adverse effects on these vessels may be significant enough to prevent them from continuing in all inshore and offshore shrimp fisheries in the Gulf, these vessels predominantly operate in inshore waters and thus their exit from all fisheries would not be expected to affect harvest from federal waters and associated economic activity. If the rule is implemented, the termination rate for federal permits could temporarily increase relative to the rate in recent years used in the analysis for this amendment.

The Environmental Protection Agency's climate change webpage (http://www.epa.gov/climatechange/) provides basic background information on measured or anticipated effects from global climate change. A compilation of scientific information on climate change can be found in the United Nations Intergovernmental Panel on Climate Change's Fifth Assessment Report (IPCC 2013). Those findings are incorporated here by reference and are summarized. Global climate change can affect marine ecosystems through ocean warming by increased thermal stratification, reduced upwelling, sea level rise, and through increases in wave height and frequency, loss of sea ice, and increased risk of diseases in marine biota. Decreases in surface ocean pH due to absorption of anthropogenic carbon dioxide emissions may affect a wide range of organisms and ecosystems, particularly organisms that absorb calcium from surface waters, such as corals and crustaceans. These influences could affect biological factors such as migration, range, larval and juvenile survival, prey availability, and susceptibility to predators. These climate changes could have significant effects on southeastern fisheries; however, the extent of these effects is not known at this time (IPCC 2014).

In the southeast, general impacts of climate change have been predicted through modeling with few studies on species specific effects. Warming sea temperature trends in the southeast have been documented, and animals must migrate to cooler waters, if possible, if water temperatures

exceed survivable ranges (Needham et al. 2012). Higher water temperatures may also allow invasive species to establish communities in areas where they may not have been able to survive previously. An area of low oxygen, known as the dead zone, forms in the northern Gulf each summer. Climate change may contribute to this dead zone by increasing rainfall that in turn increases nutrient input from rivers. This increased nutrient load causes algal blooms that, when decomposing, reduce oxygen in the water (Kennedy et al. 2002; Needham et al. 2012). Other potential effects of climate change in the southeast include increases in hurricanes, decreases in salinity, altered circulation patterns, and sea level rise. The combination of warmer water and expansion of salt marshes inland with sea-level rise may increase productivity of estuarine-dependent species in the short term. However, in the long term, this increased productivity may be temporary because of loss of fishery habitats due to wetland loss (Kennedy et al. 2002). Actions from this amendment are not expected to significantly contribute to climate change through the increase or decrease in the carbon footprint from fishing.

Summary

The cumulative biological, social, and economic effects of past, present, and future actions as described above may be described as limiting fishing opportunities in the short-term, with some exceptions of actions that alleviate some negative social and economic impacts. The intent of this amendment is to improve prospects for sustained participation in the fishery over time by determining the appropriate number of permits for the fishery; however, the proposed actions in this amendment are not expected to significantly impact the environment. Effort has the potential to increase, but any increase should be minimal. The proposed changes in management for the Gulf shrimp fishery are not related to other actions with individually insignificant but cumulatively significant impacts.

The effects of the proposed action are, and will continue to be, monitored through collection of landings data by NMFS, annual stock assessments and stock assessment updates, life history studies, economic and social analyses, and other scientific observations.

CHAPTER 5. LIST OF PREPARERS

Name	Expertise	Responsibility	Agency
Morgan Kilgour	Fishery Biologist	Co-Team Lead - Amendment development, biological analyses	GMFMC
Susan Gerhart	Fishery Biologist	Co-Team Lead - Amendment development, biological analyses, cumulative effects analysis	SERO
Assane Diagne	Economist	Economic analyses	GMFMC
Mike Travis	Economist	Economic analyses	SERO
Christopher Liese	Economist	Economic review	SEFSC
Matt Freeman	Economist	Economic review	GMFMC
Ava Lasseter	Anthropologist	Social analyses	GMFMC
Mike Jepson	Anthropologist	Social environment and environmental justice	SERO
Carrie Simmons	Fishery biologist	Reviewer	GMFMC
Mara Levy	Attorney	Legal review	NOAA GC
Noah Silverman	Natural Resource Management Specialist	NEPA review	NMFS
Steve Branstetter	Fisheries Biologist	Reviewer	SERO
Rick Hart	Fisheries Biologist	Statistical analyses, reviewer	SEFSC

GMFMC = Gulf of Mexico Fishery Management Council; NMFS= National Marine Fisheries Service; NOAA GC= National Oceanic and Atmospheric Administration General Counsel; SEFSC= Southeast Fishery Science Center; SERO = Southeast Regional Office of the National Marine Fisheries Service

CHAPTER 8. LIST OF AGENCIES, ORGANIZATIONS AND PERSONS CONSULTED

National Marine Fisheries Service
- Southeast Fisheries Science Center
- Southeast Regional Office
- Office for Law Enforcement

NOAA General Counsel

Environmental Protection Agency
United States Coast Guard
United States Fish and Wildlife Services
Texas Parks and Wildlife Department
Alabama Department of Conservation and Natural Resources/Marine Resources Division
Louisiana Department of Wildlife and Fisheries
Mississippi Department of Marine Resources
Florida Fish and Wildlife Conservation Commission

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APPENDIX A

Shrimp Aggregate MSY and Aggregate OY Working Group Summary
Gulf Council Office
Tampa, FL
March 2, 2016
9:00 a.m. - 5:00 p.m.

Members Present:
Ben Blount
Benny Gallaway
Rick Hart
Christopher Liese
Jim Nance
Mike Travis

Council Staff
Morgan Kilgour
Phyllis Miranda

Council Member
Leann Bosarge

NMFS-SERO Staff
Susan Gerhart

Others present
John Williams
James Primrose

The shrimp aggregate maximum sustainable yield (MSY) and aggregate optimum yield (OY) working group met on March 2, 2016, at the Gulf Council office in Tampa, Florida. The group had been provided with the draft options paper for Shrimp Amendment 17B and was tasked with developing a method for determining an aggregate MSY and an aggregate OY for the Gulf shrimp fishery.

Rick Hart had used the methodology from the Ad Hoc Shrimp Effort Working Group (GMFMC Ad Hoc Shrimp Effort Working Group, 2006) to calculate aggregate MSY using data from 1990-2013 from offshore landings, and this information was provided to the working group. The working group approved using this methodology and approved the model outputs for an aggregate MSY of 109,237,618 pounds (tails); effort at this aggregate MSY is 143,756 days fished (Appendix B). It was clarified that the landings and effort estimates cover all activity in offshore waters (i.e., waters outside the COLREGS line), which means that it does include activity from non-federally permitted vessels, but it does not include landings from inshore waters by federally permitted vessels.

Because the offshore landings have not been at or near aggregate MSY for some time, and are not expected to be in the near future, there was discussion on the possibility of foreign vessels being able to harvest that portion of MSY that isn't harvested by the domestic fleet. However, it was clarified this is not allowable under Magnuson. Whether or not the juvenile red snapper bycatch reduction target should still be 67% or further reduced was discussed, but this issue is outside the scope of the working group. It was noted that it may be appropriate to reduce this target as the status of red snapper improves.

Aggregate OY was then discussed. Previously, OY had been set equal to MSY at the stock level for each of the federally managed shrimp stocks. The group discussed the two different sectors of the shrimp fishery: the harvesting sector and the onshore sector (dealers, processors, etc.).

While the objective of businesses in each sector is generally the same (i.e., to earn as much rofit as possible), profitability in these two sectors is primarily driven by different factors, at least with respect to factors that management can affect (i.e., excluding shrimp prices, fuel prices, and general macroeconomic conditions). Profitability for dealers and processors is primarily determined by volume (i.e., higher landings lead to higher profits), whereas profitability in the harvesting sector is primarily determined by catch per unit of effort (CPUE) (i.e., higher CPUE leads to higher profits). Thus, in general, the onshore sector prefers higher levels of effort and higher landings while the harvesting sector prefers lower levels of effort and a higher CPUE. CPUE was identified as one metric to help determine the appropriate aggregate OY. From the economic standpoint, revenue per vessel needs to be maintained to prevent the loss of more fishery participants. Right now, the economics are driving the fishery and keeping the effort low. In years prior to the moratorium, when effort was much higher, shrimp prices were much higher and fuel prices were much lower, and so it was possible for businesses in the harvesting sector to be profitably with a much lower CPUE. Under current conditions, businesses could not be profitable with a low CPUE. The group discussed that the CPUE observed in 2014 likely allowed businesses in the harvesting sector to be profitable because economic conditions were a little more favorable than some of the other recent years (e.g., shrimp prices increased significantly), but even this 2014 year CPUE was well above those observed prior to the moratorium. The group discussed that consistency as well as high volume in the pounds of shrimp landed would be preferable to dealers and processors from a planning/investment perspective.

Economic conditions are currently constraining effort by the harvesting sector in the shrimp fishery. From an economic perspective, the only condition that can be "controlled" is the CPUE, as shrimp and fuel prices are set by global markets beyond the control of the Gulf Council. CPUE increases with lower overall effort. On the other hand, high poundage (through more effort) and revenue help maintain dealers, shore-side infrastructure, and associated communities and helps build in some protection for the social sector. To quantitatively model OY, in light of competing interests possibly including distributional issues, would require a very complicated bio-socioeconomic model. Given available data, it is unlikely that such a model is feasible at this time. Yet even if a complex bi--socioeconomic model were built, the choice of objectives---and their relative weights/priorities with respect to each other---would be the central determinants driving the model results. Different value judgement may result in very different outcomes. For example, 1) prioritizing dealer/community interests above all else leads to OY equal MSY, i.e., the highest possible effort and landings; 2) prioritizing the harvesting sector's interest above all else would argue for lower effort, more likely to maximize CPUE; and 3) prioritizing turtle preservation above all else would possibly close the fishery.

After discussion, four competing goals were decided upon for determining aggregate OY for the Gulf shrimp fishery: high CPUE, high landings, and an effort target that is unlikely to result in a

closure for both juvenile red snapper bycatch and sea turtle bycatch. . In the absence of specific Council guidance on relative priorities among these goals, the work group decided to take a balanced approach, looking at recent years with actual data. These four goals are realized in a qualitative manner in 2009. Therefore, the group recommended that the aggregate OY be the predicted landings based on the model output from 2009 because the model takes into account variability among years (Appendix B). The observed landings in 2009 are higher than predicted because it was an above average shrimp abundance year. It was discussed that there is no action triggered if the fishery were to exceed the aggregate OY. Therefore, the recommended aggregate OY is 85,368,059 pounds of tails; effort for this aggregate OY is 76,508 days fished.

The group discussed a range for aggregate OY using confidence intervals around the point estimate for effort in 2009, but decided that this was not really an alternative as it is still using the same reference point. The confidence limits are based on the effort and it would be inappropriate because the recommendation is based on a point that meets the criteria that the group outlined. It was also discussed that the years used for input into the model to calculate aggregate MSY and aggregate OY should be 1990-2013. Incorporating one or two years of additional data would only be expected to result in trivial changes to the various models' parameters and the resulting estimates, but would create a significant amount of extra work that would not produce better or additional information for the Council. These years are also consistent with the years used in the model to establish the overfished and overfishing definitions outlined in Shrimp Amendment 15.

The meeting adjourned at 12:30 p.m.

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APPENDIX B

Analysis of the Gulf of Mexico Shrimp Offshore Fishery – Updated Results

The Gulf of Mexico (Gulf) shrimp moratorium permit and royal red shrimp endorsement manage the harvest of all federally managed shrimp species in Gulf federal waters (i.e., the Exclusive Economic Zone or EEZ). The permit and endorsement are not needed to harvest the same species in state waters. However, it is not possible to estimate effort[11] and catch (landings)[12] of shrimp in federal waters with a reasonable degree of scientific certainty due to data limitations. Specifically, some state trip tickets do not require dealers to report whether landings come from federal or state waters. Further, although ELB data can determine if effort is taking place in federal or state waters, not all permitted vessels have ELBs and only about 70% of ELB trips can be matched to trips and thus to landings in the Gulf Shrimp System (GSS) data. Conversely, it is possible to generate estimates of effort and landings in offshore waters (i.e., waters outside the COLREGS lines[13]) with a relatively high degree of scientific certainty. Thus, the National Marine Fisheries Service (NMFS) decided that estimates for the offshore fishery are the best available proxy for estimates in federal waters and thus most appropriate for Amendment 17B purposes. Hence, this analysis encompasses effort and landings in all offshore waters (i.e., the combination of federal waters and state waters out to 3 or 9 nm, depending on the state). Because the data used in this analysis includes effort and landings from state offshore waters, the estimates in this analysis are most likely overestimates effort and landings in federal waters.

Further, although landings information can be obtained from both the (GSS) and Annual Landings Form (ALF) databases, effort is not reported on the ALF and it is not possible to determine whether the reported landings on the ALF came from offshore or inshore waters. Thus, the results in the accompanying figures and tables only use GSS data.[14] GSS data is a combination of state trip ticket and port agent collected data from dealers in the Gulf. As such, only shrimp landed at Gulf ports is taken into account.[15] Landings from the GSS are always reported in terms of tail (i.e., heads-off) weight. Further, because separate permits are not required to harvest each of the penaeid species and multiple species of shrimp are harvested simultaneously or on the same trip, this analysis includes data for all shrimp harvested from offshore waters, regardless of whether or not they are federally managed. Consistent with the Ad-Hoc Shrimp Effort Working Group Report (2006), the first year of data used for this analysis

[11] Effort is measured in "days fished," where a day fished equals 24 hours of trawling time.
[12] Catch and landings are used interchangeably as discarding of shrimp is insignificant.
[13] The COLREGS lines are the set of demarcation lines that have been established by the Convention on the International Regulations for Preventing Collisions at Sea, 1972 (commonly called COLREGS). COLREGS define boundaries across harbor mouths and inlets for navigation purposes.
[14] Previous analyses (Travis, 2010) have shown that only using GSS data will likely underestimate the actual number of permitted vessels active in the Gulf shrimp fishery as a whole (i.e., in offshore and inshore waters combined) because, in a given year, some vessels report they had landings on the ALF form but do not have landings according to state trip ticket and port agent dealer reports. Whether the exclusion of ALF data would also result in an underestimate of the number of permitted vessels active in offshore waters cannot be determined because the ALF form does not indicate where the landings came from in the Gulf.
[15] A minor if not trivial of amount of shrimp harvested from Gulf waters is landed in South Atlantic ports each year.

was 1990. Because GSS data for 2015 was not complete at the time this analysis was conducted, the analysis only used data through 2014.

On the other hand, recent research indicates that estimates of active permitted vessels in offshore waters based on the GSS data are likely a very good proxy for estimates of active permitted vessels in federal waters. Estimates of permitted vessels active in the EEZ are based on vessel gear form data only or a combination of vessel gear form, ELB, and vessel monitoring system (VMS) data for Gulf vessels that also participate in the South Atlantic limited access rock shrimp fishery. Owners of vessels with federal Gulf shrimp permits have been required to submit vessel gear forms since 2005, and one question on that form asks owners whether their vessel harvested shrimp from the Gulf EEZ in the previous year. Reliable data from all three of these sources was available for 2007 through 2014.

According to the information in Table 2.1, there are some differences in the three estimates from year to year. However, the trends in these estimates over time are generally the same (i.e., they move in the same direction from year to year, with a few exceptions). Further, the statistics associated with these estimates are very similar as well. The range of estimates based on the minimum and maximum values are very similar and, most importantly, the median and particularly the (arithmetic) means are nearly identical and are not statistically different from each other. Based on these findings, the number of permitted vessels active in offshore waters based on the GSS data is a good proxy for the number of permitted vessels active in federal waters and therefore it is acceptable to use those estimates for other analytical purposes.

Table 2.1. Estimates of Active Permitted Vessels in Offshore Waters and Estimates of Active Permitted Vessels in Federal Waters, 2007-2014.

Year	Active EEZ VG form only	Active EEZ Any	Active Offshore GSS
2007	1,072	1,139	1,283
2008	974	1,047	1,059
2009	1,068	1,117	1,075
2010	1,000	1,052	951
2011	961	1,022	1,013
2012	952	973	1,014
2013	934	938	970
2014	962	992	987
Minimum	934	938	951
Maximum	1,072	1,139	1,283
Median	968	1,035	1,014
Arithmetic Mean	990	1,035	1,044
Standard Deviation	52.6	68.9	105.2

According to Figure 2.1, the estimated yield curve for the offshore fishery indicates that aggregate MSY is 112,531,374 pounds (tails) and effort at MSY is 143,756 days fished.[16] The model results should only be used within the range of the observed data, and thus should not be used to predict what landings would be at effort levels above or below observed levels. These results also indicate that recent levels of effort have been well below the level needed to achieve aggregate MSY in the offshore fishery. According to Figure 2.1 and Table 2.2, the level of effort needed to achieve aggregate MSY in the offshore fishery was most closely observed in 2004. Based on effort observed in 2014, effort would need to increase by more than 105% from current levels to achieve aggregate MSY.

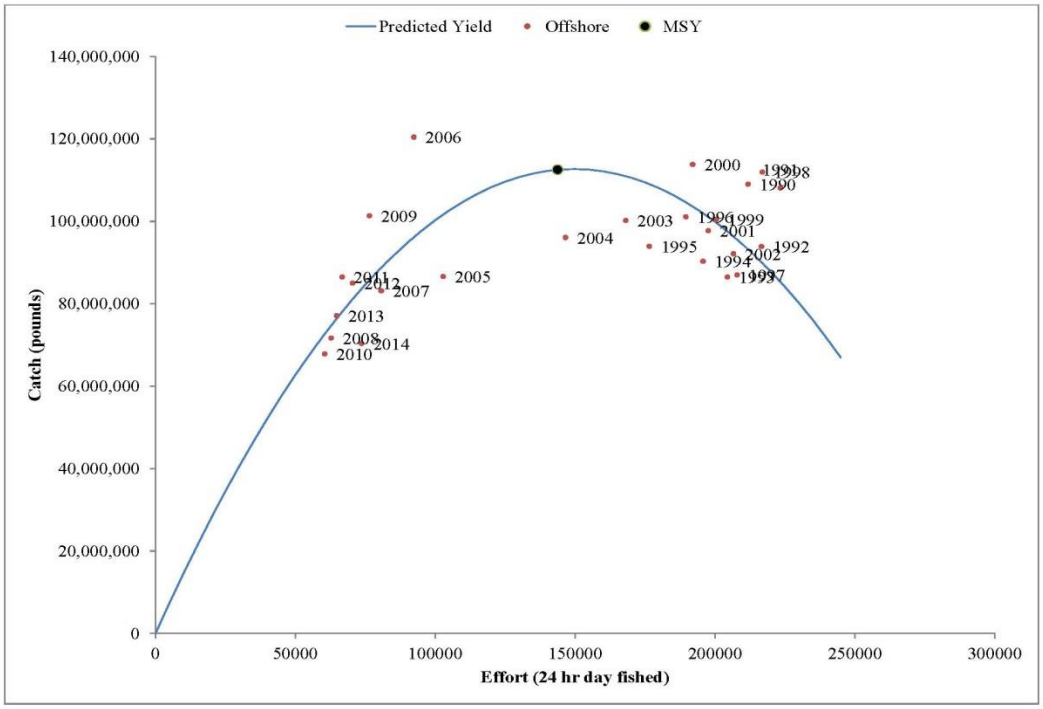

Figure 2.1. Yield curve for the offshore Gulf shrimp fishery. Estimates are based on catch and effort data for all shrimp species caught in offshore Gulf waters and landed in Gulf ports, 1990-2014.[17] Catch=1505.8896*effort+-0.00503*effort^2

Figure 2.2 illustrates the trends in observed landings, effort, and catch per unit effort (CPUE).[18] The most noticeable trends are with respect to observed effort and CPUE, with observed effort

[16] Personal Communication, Rick Hart, NMFS Galveston Laboratory, June 7, 2016.
[17] Rick Hart, personal communication, June 7, 2016. For current purposes, "Gulf waters" includes all areas of statistical zones 1 and 2, consistent with and for reasons explained in a previous analysis of latent permits (Travis, 2010).
[18] Personal Communication, Rick Hart, NMFS Galveston Laboratory, June 7, 2016.

decreasing significantly from 2002 until 2008 and CPUE increasing significantly from 2002 through 2006. Both have been relatively stable since 2008. Conversely, observed landings were relatively stable for many years, but have declined somewhat in recent years.

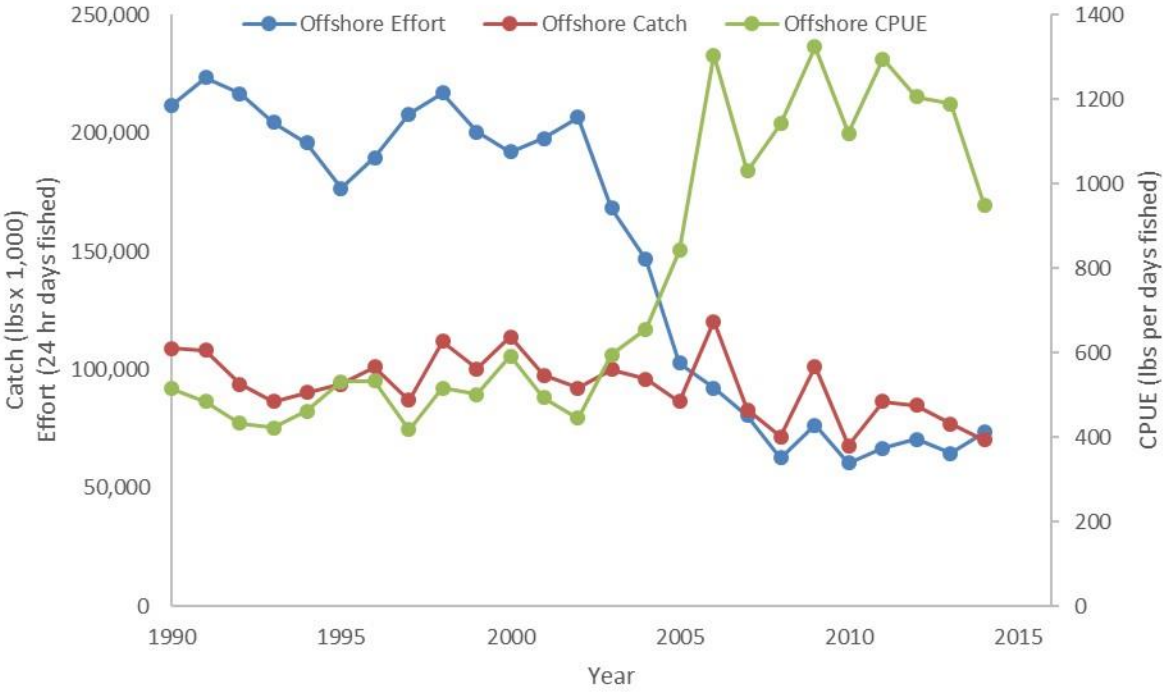

Figure 2.2. Catch, effort and CPUE for the offshore Gulf shrimp fishery. Estimates are based on catch and effort data for all shrimp species caught in offshore Gulf waters and landed in Gulf ports, 1990-2014.

Figure 2.3 illustrates a very strong, inverse relationship between effort and CPUE in the offshore fishery.[19] Thus, as effort decreased, CPUE increased. The regression model has an unusually high ability to explain variability in CPUE. As with the model for the yield curve, the model results should only be used within the range of the observed data, and thus should not be used to predict what CPUE would be at effort levels above or below observed levels. However, the clustering of data points in the upper left portion of the curve suggests a potential change in the relationship at lower levels of effort (i.e., CPUE may be approaching an asymptote).

For annual crop species like penaeid shrimp, care must be exercised in relying on trends in observed landings as they are subject to year to year variations in abundance. For example, although observed landings exceeded MSY in 2006 (Table 2.2), this was due to abundance being above the long-term average. The level of effort in 2006 would not be expected to generate that level of landings or MSY under long-term average levels of abundance. Thus, observed levels

[19] Personal Communication, Rick Hart, NMFS Galveston Laboratory, June 7, 2016.

should not be used to predict what would be expected under average abundance conditions in the future. The same caution applies to using observed levels of CPUE. Although observed CPUE was highest in 2009, this result was similarly driven by above average abundance. It is not prudent to expect or rely on above average abundance conditions in the future.

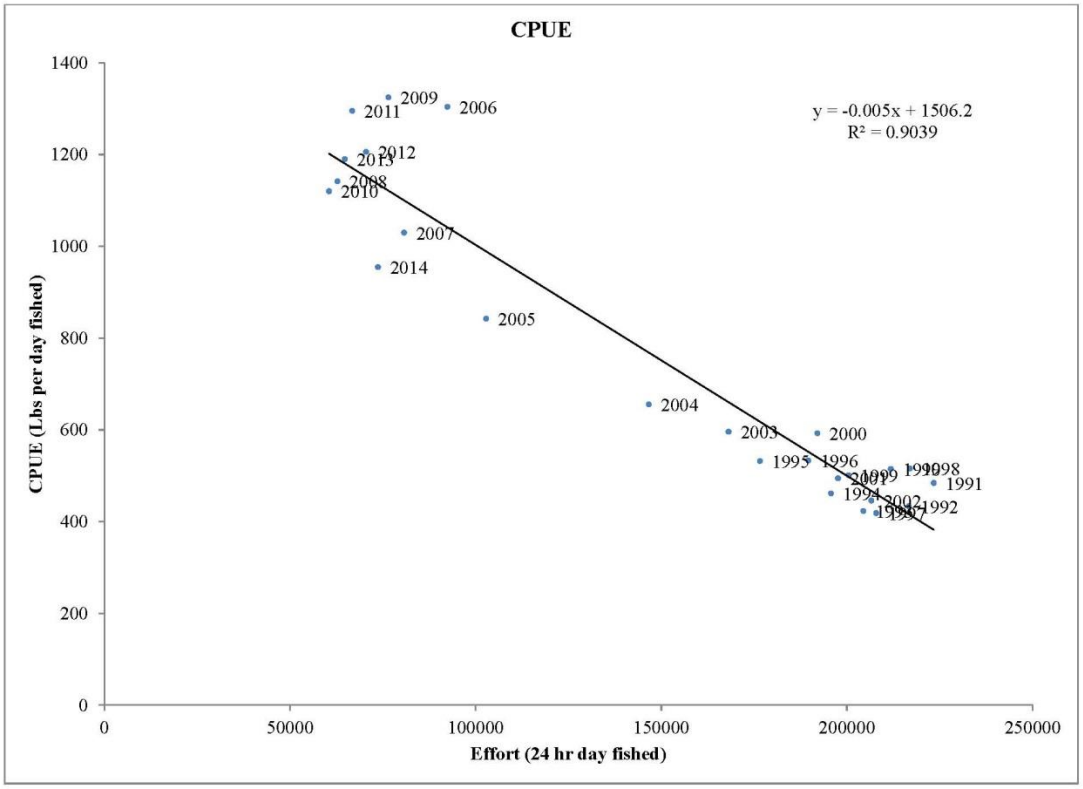

Figure 2.3. Relationship between CPUE and Effort in the offshore Gulf shrimp fishery, 1990-2014.

The models for landings and CPUE can be used to generate predicted values that correct for changes in abundance over time and thus are more reliable with respect to determining the actual trends in those values and expected values in the future.[20] According to the information in Table 2.2, these predicted values confirm that CPUE significantly increased from 2002 through at least 2006, and possibly 2007, but remained relatively stable thereafter. Predicted CPUE was at its highest level in 2010, but this finding must be viewed with caution given the effects of the DWH event on fishing behavior in 2010. It would be safer to conclude that predicted CPUE was at its

[20] However, these estimates do not account for changes in technology that have likely occurred over time and caused effort to become more efficient.

maximum in 2008. These results suggest that additional increases in CPUE from further effort reductions are likely to be minor.

Table 2.2. Effort, Landings, CPUE, Predicted CPUE, and Predicted Landings in the Offshore Gulf Shrimp Fishery, 1990-2014.

Year	Effort	Landings (tails)	CPUE	Predicted Landings (tails)[21]	Predicted CPUE[22]	Predicted Active Permitted Vessels[23]
1990	211,860	109,017,807	515	93,268,045	447	N/A
1991	223,388	108,127,144	484	85,389,281	389	N/A
1992	216,669	93,878,905	433	90,144,013	423	N/A
1993	204,482	86,465,838	423	97,608,478	484	N/A
1994	195,742	90,292,943	461	102,041,704	527	N/A
1995	176,589	93,907,727	532	109,069,778	623	N/A
1996	189,653	101,091,922	533	104,676,126	558	N/A
1997	207,912	86,992,070	418	95,658,669	467	N/A
1998	216,999	111,930,612	516	89,921,355	421	N/A
1999	200,475	100,419,269	501	99,736,515	504	N/A
2000	192,073	113,783,105	592	103,673,845	546	N/A
2001	197,644	97,706,647	494	101,142,188	518	N/A
2002	206,621	92,119,199	446	96,406,735	473	N/A
2003	168,135	100,203,686	596	110,997,688	666	2,355
2004[24]	146,624	96,079,478	655	112,661,609	773	2,054
2005	102,840	86,571,515	842	101,667,987	992	1,441
2006	92,372	120,437,081	1304	96,183,378	1,044	1,294
2007	80,733	83,126,655	1030	88,790,218	1,103	1,131
2008	62,797	71,689,314	1142	74,730,070	1,192	880
2009	76,508	101,339,883	1325	85,769,737	1,124	1,072
2010[25]	60,518	67,790,473	1120	72,711,672	1,204	848
2011	66,777	86,482,240	1295	78,129,551	1,172	935
2012	70,505	85,004,590	1206	81,168,842	1,154	988
2013	64,764	77,063,083	1190	76,429,912	1,182	907
2014	73,683	70,341,587	955	83,649,665	1,138	1,032

The predicted values also better illustrate that landings have been on a downward trend since 2006. Although the highest level of observed landings during the moratorium was in 2009, this

[21] Predicted landings are estimated using observed effort and the yield curve equation in Figure 2.1.
[22] Predicted CPUE is estimated using observed effort and the equation in Figure 2.3.
[23] Predicted number of active permitted vessels is estimated using observed effort and the average effort per active permitted vessel between 2003 and 2014 (see footnote 29).
[24] Most closely approximates MSY conditions.
[25] DWH event

result was driven by above average abundance in that year. The highest level of landings under the moratorium would have been expected in the year with the highest effort (2007).

These findings are consistent with what would be expected given where the fishery has been operating on the yield curve (see Figure 2.1). However, these findings should not be used to conclude the moratorium is the cause of the changes in observed or predicted CPUE and landings. In general, the effort reductions that have occurred during this time have been caused by poor economic conditions in the harvesting sector, particularly events that have caused increases in costs (e.g., fuel prices) and decreases in ex-vessel shrimp prices (e.g., increased imports and a recession).

These poor economic conditions changed somewhat in 2013 because the average, real (inflation adjusted) ex-vessel shrimp price increased by 34% compared to 2012. Gross revenue from the offshore fishery increased as well in 2013 but not by as much (22%) because landings fell by more than 9%. Economic conditions continued to improve in 2014, and in general appear to have been the most favorable conditions seen in the fishery since 2000. Specifically, ex-vessel shrimp prices increased again in 2014, by an additional 13% relative to 2013, and to a level not seen since 2000 (see Table 2.3). Gross revenue increased as well, though again not by as much (3% relative to 2013) because landings decreased further (by 9% relative to 2013). In addition, fuel price decreased by approximately 7% in 2014 relative to 2013. Most importantly, the difference between the inflation-adjusted ex-vessel shrimp price and fuel price was $2.36, which is significantly greater than the difference in any other year since NMFS began collecting fuel price data from owners of permitted vessels and is likely the greatest difference seen in the fishery since 2000. Preliminary data also suggests ex-vessel prices have abruptly turned downward in 2015, potentially erasing the increases from the two previous years. Conversely, fuel prices appear to have decreased further as well, somewhat mitigating the sharp decline in shrimp prices. Thus, economic conditions in 2014 likely represent a best-case scenario in the reasonably foreseeable future.

In general, it appears that observed reductions in effort from 2002 through at least 2004 and possibly 2006-07 were beneficial to the fishery due to the significant increase in CPUE without a noticeable and concomitant decrease in landings. Assuming other factors are constant (e.g., shrimp prices, fuel prices, etc.), increases in CPUE caused by a decrease in effort and the number of active vessels would be expected to economically benefit the harvesting sector of the fishery by increasing the average gross revenue and net revenue/profit per vessel. Although decreases in ex-vessel price between 2001 and 2003 caused gross revenue per vessel from the offshore shrimp fishery to decrease, the positive effect of the fleet reduction on gross revenue per vessel are evident thereafter, with the level in 2014 being the highest observed in the 1990-2014 time series. Net revenue per vessel estimates are only available for 2006-2014, and only apply to permitted vessels, but reflect a similar trend. Consistent with the changes in shrimp and fuel prices, net revenue per vessel was significantly greater in 2014 relative to previous years for which estimates are available.

Theory suggests that profitability will increase as the difference between the price of shrimp and price of fuel increases because an increase in the price of shrimp will increase gross revenue and a decrease in the price of fuel will decrease total costs, all else being equal. Based on limited data (2006-2014), a linear regression model determined that net revenue (profitability) is driven by the difference between the price of shrimp and the price of fuel.[26] This result is consistent with findings in a previous Ad-Hoc Effort Working Group Report (see Table 13, GMFMC 2006). More specifically, the model suggests that, for every $.10 increase in this price difference, net revenue per vessel is expected to increase by almost $2000. If there is no difference between the price of shrimp and the price of fuel, vessels would be expected to earn a loss in net revenue of approximately $18,581 per year, which is not economically sustainable.

Management cannot affect shrimp or fuel prices but it can affect CPUE. However, management can only indirectly affect CPUE through direct or indirect controls on effort. Previous analyses done in support of Amendments 17A and 17B suggested CPUE is also directly related to and can significantly affect profitability. Theory suggests that an increase in CPUE can increase a vessel's landings and/or decrease costs on a per unit basis, and can thereby increase profitability. Although the updated results suggest otherwise, the updated and previous analyses should be viewed with caution because of the limited time series of data. The addition of 2014 data to the model significantly changed the results, likely because the economic conditions in 2014 were very different from those seen between 2006 and 2013. But it is also the case that the significant changes (increases) in CPUE occurred before 2006 and CPUE has been relatively stable since 2006. Therefore, the effect of CPUE on profitability is likely not being accurately captured by the updated model. Additional data and triangulation with previous research is needed.

Reductions in observed effort and fleet size after 2007 have not caused any significant improvements in CPUE, but they have caused noticeable reductions in landings. Landings reductions would generally be expected to cause adverse economic impacts in the onshore sector (e.g., dealers and processors) as profitability in that sector is mainly determined by physical volume and gross revenue from the harvesting sector. However, even though landings decreased in 2013 and 2014, gross revenue from the offshore fishery increased because the increases in the price of shrimp more than offset the reductions in landings. Thus, further reductions in landings may reduce employment, income, sales, and value-added in the onshore sector, and thus in associated communities, states, and the Gulf region, but that will depend on what happens to shrimp prices in the future.

Although the Council does not directly control effort in the offshore fishery, the bycatch reduction target for juvenile red snapper places a limit on effort in certain areas of the offshore fishery. The moratorium permit is intended to restrict participation and thereby indirectly control or limit effort. By limiting the number of permits and thus vessels, the moratorium on permits is expected to have placed a limit on effort in the federal waters component of the offshore fishery. By establishing a target number of moratorium permits and thus vessels, the Council could more

[26] The regression equation is as follows: net revenue per vessel= -18581.27+(19822.18*pricedifference); n=9; R^2=.654. The variable representing the difference between shrimp and fuel prices is statistically significant at the .05 confidence level. Inclusion of other variables in the model did not improve and actually confounded the results.

precisely target some desired level of effort in the offshore fishery that would lead to an acceptable level of landings, CPUE, and bycatch, under certain economic conditions and given its management objectives for the fishery.

In order to establish such a target, the relationship between permits and/or vessels and offshore effort needs to be determined. That is, it would be helpful to know how many permits/vessels are needed to achieve alternative levels of offshore effort that may be desired by the Council. Information on permitted and active vessels in the offshore fishery is provided in Table 2.4 and should be considered in conjunction with offshore effort information in Table 2.2.

Because moratorium permits are transferable and thus more than one vessel can possess the same valid permit in a given year, the number of vessels with a valid permit in a year will be greater than the number of valid permits in that year, as demonstrated by the differences in permit and vessel counts in Table 1.1.1 in Amendment 17B and Table 2.4 in this document. Offshore effort should be more closely related to the number of vessels with permits than the number of permits. A preliminary model of the relationship between the number of permitted vessels and offshore effort indicated such a relationship does exist and, rather surprisingly, the relationship is not only positive but relatively strong. This finding was not expected because a previous analysis showed that all permits or permitted vessels were not active each year (i.e., some were "latent"), and some were not active in any of the first three years of the moratorium (SERO 2010).

However, even though the estimated model explained much of the variability in offshore effort, it also consistently overestimated observed effort and thus is not considered reliable for policy purposes. Further, in theory, offshore effort should be more closely related to the number of active vessels rather than the number of permitted vessels in the offshore fishery. Thus, a model that examines the relationship between active vessels and effort in the offshore fishery would be expected to yield better results (i.e., it will explain as much if not more of the variability in offshore effort, but also generate more accurate predictions of offshore effort).

For current purposes, a vessel is only considered to be "active" in a particular year if it had shrimp landings from Gulf offshore waters according to the most currently available GSS data for 1990-2014. Thus, for example, if a vessel only had landings from inshore waters or in another region (e.g., South Atlantic), it is not considered "active" in this analysis. In Table 2.4, "permitted vessels" refers to the number of vessels that held a valid open access or moratorium permit in each specific year from 2003 through 2014. The significant decrease in permitted vessels between 2007 and 2008 reflects the effect of the moratorium. As with the number of permits, the number of permitted vessels has continuously declined from the time permits were first required throughout the moratorium, though the rate of decline decreased in 2013 and 2014 as fewer permits terminated in those two years relative to previous years. Though most vessels active in the offshore fishery had federal permits between 2003 and 2014, a federal permit is not required to harvest shrimp in offshore waters managed by the states. Thus, the number of active vessels in the offshore fishery will generally exceed the number of permitted or active permitted vessels. The number of active vessels in the offshore fishery declined significantly (49%)

between 2002 and 2008, but has remained relatively stable since, with the notable exception of 2010 which was undoubtedly due to the DWH event.

Table 2.3. Gross Revenue and Ex-Vessel Prices from the Offshore Gulf Shrimp Fishery, Fuel Prices, and Net Revenue per Active Permitted Vessel, 1990-2014

Year	Nominal Gross Revenue[27]	Gross Revenue (Real)[28]	Ex-Vessel Price (Nominal)	Ex-Vessel Price (Real)	Fuel Price (Nominal)[29]	Fuel Price (Real)	Gross Revenue per Vessel (Real)	Net Revenue per Vessel (Real)[30]
1990	$314,929,509	$510,629,707	$2.89	$4.68	N/A	N/A	$115,130	N/A
1991	$347,842,006	$545,854,772	$3.22	$5.05	N/A	N/A	$125,113	N/A
1992	$285,251,679	$437,668,341	$3.04	$4.66	N/A	N/A	$103,474	N/A
1993	$259,664,115	$389,143,934	$3.00	$4.50	N/A	N/A	$93,256	N/A
1994	$353,105,982	$518,156,144	$3.91	$5.74	N/A	N/A	$115,846	N/A
1995	$349,558,754	$502,463,153	$3.72	$5.35	N/A	N/A	$116,935	N/A
1996	$332,150,302	$468,886,484	$3.29	$4.64	N/A	N/A	$106,964	N/A
1997	$340,213,595	$472,179,434	$3.91	$5.43	N/A	N/A	$112,493	N/A
1998	$380,646,267	$522,627,735	$3.40	$4.67	N/A	N/A	$129,001	N/A
1999	$373,675,269	$505,328,113	$3.72	$5.03	N/A	N/A	$126,058	N/A
2000	$485,387,192	$641,792,564	$4.27	$5.64	N/A	N/A	$166,100	N/A
2001	$355,064,936	$458,994,549	$3.63	$4.70	N/A	N/A	$117,923	N/A
2002	$281,472,047	$358,362,327	$3.06	$3.89	N/A	N/A	$82,580	N/A
2003	$270,635,465	$337,847,324	$2.70	$3.37	N/A	N/A	$84,716	N/A
2004	$268,840,649	$326,624,766	$2.80	$3.40	N/A	N/A	$87,489	N/A
2005	$262,002,593	$308,395,177	$3.03	$3.56	N/A	N/A	$98,297	N/A
2006	$297,644,024	$339,886,546	$2.47	$2.82	$2.06	$2.35	$116,857	-$8,483
2007	$252,184,090	$280,513,151	$3.03	$3.37	$2.39	$2.66	$111,854	-$21,838
2008	$255,638,060	$278,865,708	$3.57	$3.89	$3.08	$3.36	$125,859	-$9,454
2009	$228,596,619	$247,496,987	$2.26	$2.44	$2.05	$2.22	$101,246	-$3,650
2010	$237,689,580	$254,247,562	$3.51	$3.75	$2.46	$2.63	$144,087	-$4,728

[27] Nominal gross revenue and ex-vessel price estimates are based on GSS data, Rick Hart, personal communication, April 25, 2016.
[28] All real estimates have been adjusted for inflation into 2014 dollars using the GDP deflator.
[29] Fuel prices and net revenue per vessel estimates are only for active permitted vessels rather than all active offshore vessels and are based on Liese, 2011, 2013, 2014, 2016 (forthcoming); Liese and Travis, 2010; Liese et al., 2009a, 2009b. The Annual Economic Survey of Federal Gulf Shrimp Permit Holders, NMFS-SEFSC.
[30] Net revenue estimates are for permitted vessels with landings from the Gulf shrimp fishery in general, as opposed to having landings in the offshore fishery, and account for all revenue sources, not just revenue from shrimp harvested in offshore waters.

2011	$320,788,313	$336,193,182	$3.71	$3.89	$3.17	$3.32	$158,773	$1,439
2012	$291,314,188	$299,912,560	$3.43	$3.53	$3.24	$3.34	$134,573	-$10,155
2013	$359,631,710	$364,817,491	$4.67	$4.73	$3.19	$3.24	$171,142	$1,567
2014	$375,253,221	$375,253,221	$5.33	$5.33	$2.97	$2.97	$232,211	$40,176

Table 2.4. Number of Permitted and Active Vessels by Size Category in the Offshore Gulf Shrimp Fishery, 1990-2014.

Year	Active Vessels	Large Active Vessels	Small Active Vessels	Permitted Vessels	Active Permitted Vessels	Large Active Permitted Vessels	Small Active Permitted Vessels
1990	3,431	2,034	1,397	N/A	N/A	N/A	N/A
1991	3,375	1,954	1,421	N/A	N/A	N/A	N/A
1992	3,272	1,916	1,356	N/A	N/A	N/A	N/A
1993	3,228	1,894	1,334	N/A	N/A	N/A	N/A
1994	3,460	1,912	1,548	N/A	N/A	N/A	N/A
1995	3,324	1,929	1,395	N/A	N/A	N/A	N/A
1996	3,391	2,022	1,369	N/A	N/A	N/A	N/A
1997	3,247	2,011	1,236	N/A	N/A	N/A	N/A
1998	3,134	1,981	1,153	N/A	N/A	N/A	N/A
1999	3,101	1,920	1,181	N/A	N/A	N/A	N/A
2000	2,989	1,918	1,071	N/A	N/A	N/A	N/A
2001	3,011	2,032	979	N/A	N/A	N/A	N/A
2002	3,357	1,956	1,401[31]	N/A	N/A	N/A	N/A
2003	3,085	1,810	1,275	2,688	1,953	1,656	297
2004[32]	2,888	1,658	1,230	2,791	1,833	1,548	285
2005	2,427	1,493	934	2,713	1,676	1,405	271
2006	2,250	1,252	998	2,578	1,426	1,182	244
2007[33]	1,940	1,137	803	2,514	1,283	1,084	199
2008[34]	1,714	994	720	1,930	1,059	942	117
2009	1,891	1,001	890	1,764	1,075	959	116
2010[35]	1,365	902	463	1,685	951	865	86
2011[36]	1,638	929	709	1,641	1,013	898	115
2012	1,724	938	786	1,587	1,014	885	129
2013	1,649	904	745	1,544	970	858	112
2014	1,616	911	705	1,515	987	879	108

[31] Reflects artificial increase due to change in Gulf Shrimp System (GSS) data protocols wherein landings data came from LA and AL trip tickets, rather than port agents, which explicitly identified state registered boats. Florida trip ticket data was also incorporated over the next few years.
[32] MSY
[33] Max predicted landings under moratorium and high predicted CPUE.
[34] Max predicted CPUE but significantly lower predicted landings.
[35] DWH event
[36] Effort in juvenile red snapper areas at highest level during moratorium without triggering a closure

Historically, economic analyses of the Gulf shrimp fishery have separated vessels in the fishery by size category, where "large" vessels are those 60 ft or greater in length and "small" vessels are less than 60 ft in length. For Coast Guard documented vessels, length is the vessel's registered length.[37] For state registered vessels with federal permits, length is what permit holders provide on their applications. NMFS does not possess length data for all state registered vessels active in the Gulf shrimp fishery. Because vessels with a net tonnage greater than 5 net tons must be documented, and vessels less than 5 net tons are typically less than 60 ft in length, state registered vessels without permits are assumed to be small vessels in this analysis.[38]

As expected, large vessels represent the majority of vessels in the offshore fishery. The number of active large vessels declined from 2002-2008, but has remained relatively stable thereafter. Participation by small vessels has also declined over time, but is more variable and more susceptible to major events, such as the hurricanes in 2005 and the DWH event in 2010. Changes in active permitted vessels basically mimic the trends for all offshore vessels, with the same holding true for large and small vessels, though small permitted vessels represent a somewhat smaller percentage of active permitted vessels in 2014 (11%) than they did back in 2003 (15%). Small vessels can more effectively operate in inshore waters than large vessels, and have likely been more inclined to do so given economic conditions over most of the past decade.

An analysis of the relationship between the various estimates of active vessels in the offshore fishery (i.e., all active, large active, active permitted, and large active permitted) was conducted to see whether any had a strong, direct relationship with offshore effort. Though theory would suggest the strongest relationship should be between all vessels active in the offshore fishery and offshore effort, that relationship is likely confounded by a change in data protocols that affected the estimate of small active vessels as state registered vessels were not explicitly identified in the GSS data until 2002 and thus the number of small vessels was systematically underestimated in previous years. As such, the estimates of large active vessels are more reliable over the time period considered in this analysis. In addition, the relationship between all active vessels and offshore effort would be expected to be stronger than the relationship between active permitted vessels and offshore effort because permitted vessels do not account for all effort in offshore waters (i.e., non-permitted vessels account for some effort in offshore waters).

These hypotheses were only partly confirmed by the empirical findings. All models were statistically significant and found a strong, direct relationship between offshore effort and the specific number of active vessels under consideration. Though the models are essentially equivalent with respect to statistical significance, the strongest relationship was found between active permitted vessels and offshore effort.[39] The relationships between large active vessels and

[37] Length data was missing from the CG database for a small number of CG documented vessels that did not have permits, and thus this analysis assumed these vessels are large vessels.
[38] This assumption is supported by the fact that, based on a large sample of state registered vessels for which NMFS does possess length data, less than .3% of such vessels are greater than 60 ft.
[39] Model is offshore effort=71.385*number of active permitted vessels. R^2 is .983.

offshore effort and between large active permitted vessels and offshore effort[40] are somewhat stronger than the relationship between all active vessels and offshore effort.[41]

These results suggest the Council can only indirectly limit or control offshore effort by controlling the number of vessels with federal permits, and even that ability is limited because economic factors (i.e., the difference between shrimp and fuel prices) drives profitability and therefore effort in the fishery. If a particular level of offshore effort is desired based on various management objectives, these results are suggestive of what the target number of federally permitted vessels should be. However, these models were developed, and should generally only be used, for predictive purposes only and interpretation should be made with care.

For example, for the model that estimates the relationship between offshore effort and the number of active permitted vessels, it is not appropriate to conclude that the average number of days fished per active permitted vessel is 71.4 days because active permitted vessels are not solely responsible for all of the offshore effort (i.e., some unknown percentage of offshore effort comes from active non-permitted vessels).

On the other hand, according to the model that estimates the relationship between offshore effort and the number of active vessels (permitted and non-permitted) in offshore waters, it is accurate to conclude that the predicted number of days fished by active vessels (permitted and non-permitted) in offshore waters is approximately 57.6 days. That said, this predicted value is based on data from 1990-2014 and the average number of days fished in offshore waters per active vessel has changed significantly over that time period, as can be seen in Table 2.5. Table 2.5 combines information on offshore effort from Table 2.2 and the number of active vessels in offshore waters from Table 2.4.

Between 1990 and 2001, the average annual offshore effort (days fished) per vessel was about 63 days fished. Although the decline in the average effort per active vessel from 2001 to 2002 is likely an artifact of changes in data collection protocols, the declines from 2002 to 2005 are likely real changes caused by the same economic factors that led to the declines in effort and active vessels during that time. Average annual offshore effort per vessel was relatively stable between 2006 and 2013 and averaged around 41 days. However, offshore effort per vessel increased by 16% in 2014 relative to 2013, and to is highest level since 2004. This increase was likely caused by the significantly improved economic conditions in 2014. So, although the improved economic conditions did not increase the number of vessels active in the offshore fishery, they did increase the amount of effort by each active vessel.

Of greatest interest to management is the model that estimates the relationship between offshore effort and the number of active permitted vessels as it predicts the number of active permitted vessels that would be needed to achieve a specific level of offshore effort, such as the level of offshore effort associated with a particular management objective or in a given year. For example, because effort at MSY was estimated to be approximately 143,756 days fished, the

[40] Model is offshore effort=83.07*number of large active permitted vessels. R^2 is .981.
[41] Model is offshore effort=57.605*number of active vessels. R^2 is .976.

number of active permitted vessels needed to achieve MSY would be 2,014, somewhat higher than the number of permits initially issued at the beginning of the moratorium. If MSY is the management objective, the number of active permitted vessels and thus the number of valid permits would have to increase significantly from current levels.

Table 2.5. Effort, Active Vessels, and Average Effort per Vessel in the Offshore Gulf Shrimp Fishery, 1990-2014.

Year	Effort	Active Vessels	Average Effort per Vessel
1990	211,860	3,431	61.7
1991	223,388	3,375	66.2
1992	216,669	3,272	66.2
1993	204,482	3,228	63.3
1994	195,742	3,460	56.6
1995	176,589	3,324	53.1
1996	189,653	3,391	55.9
1997	207,912	3,247	64.0
1998	216,999	3,134	69.2
1999	200,475	3,101	64.6
2000	192,073	2,989	64.3
2001	197,644	3,011	65.6
2002	206,621	3,357	61.5
2003	168,135	3,085	54.5
2004	146,624	2,888	50.8
2005	102,840	2,427	42.4
2006	92,372	2,250	41.1
2007	80,733	1,940	41.6
2008	62,797	1,714	36.6
2009	76,508	1,891	40.5
2010	60,518	1,365	44.3
2011	66,777	1,638	40.8
2012	70,505	1,724	40.9
2013	64,764	1,649	39.3
2014	73,683	1,616	45.6

The predicted number of active permitted vessels needed to attain levels of actual offshore effort in each year between 2003 and 2014 is provided in Table 2.2. Predicted CPUE is maximized in 2008, but with significantly lower predicted landings compared to 2007. The number of active permitted vessels needed to achieve actual effort in 2008 is 880. Alternatively, predicted CPUE is relatively high in 2007, but with a significantly higher level of predicted landings. The number of active permitted vessels needed to achieve effort in 2007 is 1,131. The number of active permitted vessels needed to achieve effort in 2009 is 1,072, which may be important for management objectives other than a high CPUE or relatively high landings and is also almost

exactly the number of permitted vessels that were in fact active in offshore waters that year (1,075 vessels).

These potential targets presume all permitted vessels will in fact be active in the offshore fishery, which is consistent with a desire to not have any inactive or "latent" federally permitted vessels. In a given year, a federally permitted vessel may not be active in the offshore fishery for a number of potential reasons, including but not necessarily limited to: illness of the vessel owner, temporary loss of the vessel (e.g.oyThis is an issue for the Council to consider when potentially establishing a threshold level of permits in Amendment 17B.

APPENDIX C: CONSIDERED BUT REJECTED

Action 3

Alternative 6. Set a threshold number of valid or renewable Gulf shrimp vessel permits equal to the number of valid permits at:

Option 6a. the end of 2013 (1,501 permits)

Option 6b. the end of 2014 (1,470 permits)

Option 6c. the end of the initial moratorium, October 26, 2016 (number of permits unknown).

*Note: For **Alternative 6**, the number of valid or renewable permits has already decreased below the threshold, except **Option 6c**.*

Discussion:

Alternative 6, Options a-c base the minimum threshold number of permits on the number of valid permits at a certain period of time (Table 1.1.1). Choosing one of the options in **Alternative 6** would include inactive permits in the minimum threshold. In other words, the minimum permit threshold would be higher than the number of vessels needed to achieve the effort in each year. Because some permits are inactive each year due to vessel repairs, health issues, etc., a threshold somewhat higher than the absolute number of vessels needed to maintain effort could be useful. However, maintaining a high number of inactive permits could provide an opportunity for a dramatic increase in effort that would reduce CPUE and economic efficiency for each vessel and could possibly exceed sea turtle and red snapper bycatch thresholds. The options include years of the moratorium with high CPUEs and landings, except 2010.

Options 6a-c presume the number of permits at the end of one of the years during the moratorium, as selected by the Council, was the appropriate number of permits to maintain in the shrimp fishery. **Option 6a** (2013) represents a 22% decrease, and **Option 6b** (2014) represents a 24% decrease in the number of permits from the start of the moratorium in 2007. As mentioned above, these numbers include both active and inactive permits. During the time of the moratorium, the percentage of inactive permits in any one year has decreased and appears to be stabilizing (Table 2.3.2), probably because inactive permits were not renewed after expiration. Some of the permits listed as inactive in offshore waters are active in inshore waters; however, the percent of federal permits that are not active in the Gulf at all has followed a similar pattern. Also, although offshore *effort per vessel* increased by 16% in 2014 relative to 2013, and is at the highest level since 2004, the improved economic conditions did not increase *the number of vessels* active in the offshore fishery.

Option 6c presumes the number of permits at the end of the moratorium will be the appropriate number of permits to maintain in the shrimp fishery. This represents an unknown decrease from the number of permits at the beginning of the moratorium. The number of permits lost has decreased since 2009 and only 15 permits were terminated in 2015 (Table 1.1.1). If we assume a similar loss in 2016, the number of permits at the end of 2016 would be around 1,440, a decrease of 25% from the beginning of the moratorium in 2007.

Alternative 6 would set the threshold number of Gulf shrimp permits above where they are expected to be when the measures in this amendment are implemented. Increasing the number of permits could allow an increase in effort in the future, and increased effort increases the risk of exceeding the target bycatch mortality of juvenile red snapper and protected species in shrimp trawls. If target levels are reached, more restrictive management measures could be required.

Action 5 – Issuance and Maintenance of Reserved Gulf Shrimp Vessel Permits

NOTE: This action only considers eligibility requirements for Reserved Gulf Shrimp Vessel Permits, if established in Action 4. It does not affect federal Gulf shrimp moratorium permits.

Alternative 1. No action. Individuals must submit a completed application to NMFS to be issued a Reserved Gulf Shrimp Vessel Permit. Applicants with complete applications will receive a Gulf Shrimp Vessel Permit Reserve Pool permit if one is available.

Alternative 2. NMFS will maintain a waiting list for Reserved Gulf Shrimp Vessel Permits and notify individuals in the order in which they appear on the list when a Reserved Gulf Shrimp Vessel Permit becomes available. Once notified, the individual must submit a completed and up-to-date application to NMFS to be issued a Reserved Gulf Shrimp Vessel Permit. To be eligible for a Reserved Gulf Shrimp Vessel Permit the applicant must meet the requirements selected below. A Reserved Gulf Shrimp Vessel Permit may only be transferred to an individual who also meets the eligibility requirement. AP Preferred

Option a – no eligibility requirements

Option b – be a U.S. citizen or business

Option c – assign the permit to a vessel with a valid United States Coast Guard (USCG) Dockside Safety Exam for fishing activity beyond 3 miles

Option d – after receiving a Reserved Gulf Shrimp Vessel Permit, the permit holder must show proof of shrimp landings from the Gulf associated with the vessel through trip tickets or other applicable landings data programs within 12 months of the initial issuance of the permit or the permit will not be renewed or approved for transfer

Alternative 3. The Reserved Gulf Shrimp Vessel Permits will be available from NMFS *once per year* and will be issued to applicants in the order in which applications are received after the availability of permits is announced. Individuals must submit a completed application to NMFS to be eligible for a Reserved Gulf Shrimp Vessel Permit. To be eligible for a Reserved Gulf Shrimp Vessel Permit the applicant must meet the requirements selected below. A Reserved Gulf Shrimp Vessel Permit may only be transferred to an individual who also meets the eligibility requirement.

Option a – no eligibility requirements

Option b – be a U.S. citizen or business

Option c – assign the permit to a vessel with a valid United States Coast Guard (USCG) Dockside Safety Exam for fishing activity beyond 3 miles

Option d – after receiving a Reserved Gulf Shrimp Vessel Permit, the permit holder must show proof of shrimp landings from the Gulf associated with the vessel through trip tickets or other applicable landings data programs within 12 months of the initial issuance of the permit or the permit will not be renewed or approved for transfer

Alternative 4. The Reserved Gulf Shrimp Vessel Permits will be available from NMFS *once per year*. If the number of applicants is greater than the number of Reserved Gulf Shrimp Vessel Permit, NMFS will conduct a lottery to determine which individuals may be issued the available permits. Individuals must submit a completed application to NMFS by the published deadline to be eligible for the lottery. To be eligible for a Reserved Gulf Shrimp Vessel Permit, the applicant must meet the requirements selected below. A Reserved Gulf Shrimp Vessel Permit may only be transferred to an individual who also meets the eligibility requirement.

Option a – no eligibility requirements

Option b - be a U.S. citizen or business

Option c – assign the permit to a vessel with a valid United States Coast Guard (USCG) Dockside Safety Exam for fishing activity beyond 3 miles

Option d – after receiving a Reserved Gulf Shrimp Vessel Permit, the permit holder must show proof of shrimp landings from the Gulf associated with the vessel through trip tickets or other applicable landings data programs within 12 months of the initial issuance of the permit or the permit will not be renewed or approved for transfer

Note: *All current permit renewal/transferability and recordkeeping/reporting requirements would remain in place regardless of the alternative chosen. These requirements can be found in detail in 50 CFR 622.4 and 622.51. Royal red shrimp endorsements would also be available to Reserve Pool Permit holders.*

Discussion:

If a Reserve Pool for Gulf shrimp permits is created through Action 4, distribution of those permits should also be considered. However, the Reserve Pool would not be created until the threshold chosen in Action 3 is reached. If any of Alternatives 2-5 in Action 3 are chosen as a threshold, the estimate of when the Reserve Pool would be created ranges from 20 to 37 years.

Distribution could follow the regular permit application process with no additional restrictions with **Alternative 1**. A Reserved Gulf Shrimp Vessel Permit would be obtained by submitting a completed application and the appropriate application fee (currently $25 for the first permit, $10 for each additional permit on the application). If a Reserved Gulf Shrimp Vessel Permit is available, it would be assigned to the applicant. However, if a permit is not available, the application fee would be forfeited. To avoid submitting an application when no permits are available, the applicant would need to have some knowledge of permits that may have an upcoming termination date or of someone willing to surrender their permit. Reserved Gulf Shrimp Vessel Permits would be fully transferable; Reserved Gulf Shrimp Vessel Permits that are not renewed within one year of the expiration date would be returned to the Reserve Pool.

With **Alternative 2**, NMFS would create a waiting list for Reserved Gulf Shrimp Vessel Permits, which would be posted on the SERO website. Each person wishing to be on the waiting list would submit his/her name and contact information and be responsible for updating the information if it changes; not doing so would result in forfeiting his/her place on the list. If a Reserved Gulf Shrimp Vessel Permit becomes available, the first individual on the list would be contacted. If that individual does not submit a completed application and fee within the specified time or has inaccurate contact information, the next person on the list would be contacted. If any of **Options b-d** are selected, NMFS would only accept applications from individuals that meet the requirements. Reserved Gulf Shrimp Vessel Permits would only be transferrable to someone who meets the same eligibility requirements. Reserved Gulf Shrimp Vessel Permits that are not renewed within one year of the expiration date would be returned to the Reserve Pool.

With **Alternative 3**, NMFS would hold all Reserved Gulf Shrimp Vessel Permits in the Reserve Pool until a specific date, when a notice would be published in the *Federal Register* announcing the availability of those permits. NMFS would also distribute a Southeast Fisheries Bulletin. After the announcement, the permits would be distributed to entities submitting a completed application and the appropriate fee on a first come, first served basis, until no permits were left in the Reserve Pool. No applications would be accepted before the announcement of availability. If any of **Options b-d** are selected, NMFS would only accept applications from individuals who met the eligibility requirements. Reserved Gulf Shrimp Vessel Permits would only be transferrable to someone who meets the same eligibility requirements. Reserved Gulf Shrimp Vessel Permits that are not renewed within one year of the expiration date would be returned to the Reserve Pool.

Alternative 4 is similar to **Alternative 3** in that NMFS would hold all Reserved Gulf Shrimp Vessel Permits in the Reserve Pool until a specific date, when a notice would be published in the *Federal Register* announcing an application period for those permits. NMFS would also distribute a Southeast Fisheries Bulletin announcing the application period. Applications would be held until the end of the announced application period before being issued. If NMFS received more completed applications and fees than the number of available Reserved Gulf Shrimp Vessel Permits, a lottery would be conducted to determine which qualified applicants would receive a permit. No applications would be accepted before or after the availability period. If any of **Options b-d** are selected, NMFS would only accept applications from individuals who met the eligibility requirements. Reserved Gulf Shrimp Vessel Permits would only be transferrable to someone who meets the same eligibility requirements. Reserved Gulf Shrimp Vessel Permits that are not renewed within one year of the expiration date would be returned to the Reserve Pool.

Option a would not add any eligibility requirements to be issued a Reserved Gulf Shrimp Vessel Permit. **Option b** was suggested by the Shrimp AP. However, the Council cannot exclude permanent resident aliens, and they would need to articulate a good reason for wanting to limit to citizens and resident aliens in light of the fact that no other vessel permits have such a restriction.

The Shrimp AP was concerned that if Reserved Gulf Shrimp Vessel Permits were available to anyone for $25 from NMFS, some people might buy all available permits to control the cost of permits on the market. A permit must be attached to a vessel, but the vessel can be of any size, such as a canoe, if the vessel is state or USCG registered. To help ensure Reserved Gulf Shrimp Vessel Permits are only issued to entities intending to use them for shrimping, the Shrimp AP suggested an eligibility requirement that would ensure permits are on vessels that are capable of engaging in offshore shrimp fishing (**Option c**). Vessel documentation is a national form of vessel registration issued by the USCG. Vessels of less than five net tons are excluded from such documentation, but may still obtain it. However, certified vessels may not be actively engaged in commercial fishing or may be owned by foreign entities, so the Council could use this option in conjunction with another option. Establishing this type of restriction would set a new precedent for Gulf fisheries.

Another way to ensure Reserved Gulf Shrimp Vessel Permits are on vessels used for fishing would be to require proof of some level of landings associated with the permit within the first year (**Option d**). The permit would only be renewed if proof of landings was provided; if not, the permit would return to the pool. The Council should discuss what the landings level should be.

APPENDIX D. BYCATCH PRACTICABILITY ANALYSIS

Overview

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) Section 303(a)(11) requires Gulf of Mexico Fishery Management Council (Council) to establish a standardized bycatch reporting methodology for federal fisheries and to identify and implement conservation and management measures that, to the extent practicable and in the following order, a) minimize bycatch and b) minimize the mortality of bycatch that cannot be avoided. The Magnuson-Stevens Act defines bycatch as "fish which are harvested in a fishery, but which are not sold or kept for personal use, and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch-and-release fishery management program" (Section 3(2)). Economic discards are fish that are discarded because they are undesirable to the harvester. This category of discards generally includes certain species, sizes, and/or sexes with low or no market value. Regulatory discards are fish that are required by regulation to be discarded, but also include fish that may be retained but not sold.

Guidance provided at 50 CFR 600.350(d)(3) identifies ten factors to consider in determining whether a management measure minimizes bycatch or bycatch mortality to the extent practicable. These are:

1. Population effects for the bycatch species.
2. Ecological effects due to changes in the bycatch of that species (effects on other species in the ecosystem).
3. Changes in the bycatch of other species of fish and the resulting population and ecosystem effects.
4. Effects on marine mammals and birds.
5. Changes in fishing, processing, disposal, and marketing costs.
6. Changes in fishing practices and behavior of fishermen.
7. Changes in research, administration, and enforcement costs and management effectiveness.
8. Changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources.
9. Changes in the distribution of benefits and costs.
10. Social effects.

The Council is encouraged to adhere to the precautionary approach outlined in Article 6.5 of the Food and Agriculture Organization of the United Nations Code of Conduct for Responsible Fisheries when uncertain about these factors.

Background

Bycatch practicability for the Gulf of Mexico (Gulf) shrimp fishery was first addressed in the Generic Sustainable Fisheries Act Amendment (GMFMC 1999). That amendment contained a

bycatch practicability analysis and evaluated the biological, ecological, social, economic, and administrative impacts associated with a wide range of alternatives, including those required for achieving the bycatch mandates of the Magnuson-Stevens Act. In summary, four alternatives including a "No Action" alternative were presented and impacts were described regarding bycatch reporting and are included herein by reference. Also, measures were included to minimize bycatch and bycatch mortality to the extent practicable. The analysis of the practicability of these measures was provided in Section 7.0 of that amendment and is incorporated herein by reference.

Amendment 17B considers establishing an aggregate maximum sustainable yield (MSY), an aggregate OY (optimum yield), a threshold number of permits, a response to when a threshold is met, and transit provisions for non-federally permitted vessels. None of these actions would have an impact on bycatch because none limit participation in the fishery. Therefore, bycatch issues related to the response of when the threshold is met action (Action 4) are reviewed below.

1. Population effects for the bycatch species

In 2000, the Gulf shrimp fishery discarded more bycatch, by weight, than any fishery in the FAO database, and its discard rate was 57% (Kelleher 2005). In July 2007, a mandatory federal observer program was implemented to characterize the Gulf penaeid shrimp fishery. However, only 2% of days at sea are covered by the observer program (Scott-Denton et al. 2012). The following summary is for penaeid shrimp trips which make up the majority of trips in the fishery; the number of trips for royal red shrimp that are sampled each year is too small for reasonable conclusions.

Scott-Denton et al. (2012) summarized catch from 348 observer trips in the Gulf representing 4,763 days at sea in 2007-2010. They identified 185 species. By weight, approximately 57% of the catch was finfish, 29% was penaeid shrimp, and 12% was invertebrates. The species composition changes somewhat depending on the area and depth fished, but for the Gulf overall, Atlantic croaker, sea trout, and longspine porgy are the dominant finfish species taken in trawls, comprising approximately 26% of the total catch by weight. Other commonly occurring species include portunid crabs, mantis shrimp, spot, inshore lizardfish, searobins, and Gulf butterfish. Red snapper represent approximately 0.3% of the total catch by weight.

Although red snapper comprise a very small percentage of overall bycatch, the mortality associated with this bycatch impacts the recruitment of older fish (age 2 and above) to the directed fishery, and ultimately, the recovery of the red snapper stock. To address finfish bycatch issues, the Council initially established regulations requiring bycatch reduction devices (BRDs), specifically to reduce the bycatch of juvenile red snapper. In 1998, all shrimp trawlers operating in the exclusive economic zone (EEZ), inshore of the 100-fathom contour, west of Cape San Blas, Florida, were required to use BRDs. To be certified for use in the fishery, a BRD had to demonstrate a 44% reduction in fishing mortality for age 0 and age 1 red snapper from the baseline years of 1984-1989. Subsequently, in 2004, BRDs were required in the eastern Gulf (east of Cape San Blas, Florida). BRDs used in this area had to demonstrate a 30% reduction in the total finfish biomass. In 2008, the finfish biomass reduction needed for certification of BRDs

in all parts of the Gulf was set at 30%; currently certified BRDs are in Table 1. Only two Gulf states (Florida and Texas) require the use of BRDs in state waters. Shrimp trawls fishing for royal red shrimp seaward of the 100-fathom contour are exempt from the requirement for BRDs.

Appendix Table 1. Certified bycatch reduction devices (BRDs) for the Gulf of Mexico, with reduction in finfish bycatch (95% confidence interval).

BRD Type	Percent Reduction in Total Finfish Bycatch (by weight)	Shrimp loss percentage (by weight)
Fisheye	37.0 (30.6-43.3)	10.4 (6.2-14.6)
Jones Davis	58.0 (53 – 63)	4.0 (0.0 – 9.0)
Modified Jones Davis	33.1 (30.3-36)	3.2 (1.4-4.9)
Square Mesh Panel Composite Panel	49.9 (44.1-55.6)	To be added
Cone Fish Deflector Composite Panel	51.3 (45.0-57.7)	To be added

Source: SEFSC, Pascagoula

The shrimp fishery is also a substantial source of bycatch mortality on sea turtles. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom. Shrimp trawling increased dramatically in the action area between the 1940s and the 1960s. By the late 1970s, there was evidence thousands of sea turtles were being killed annually in the Southeast (Henwood and Stunz 1987). In 1990, the National Research Council (NRC) concluded that the Southeast shrimp trawl fisheries affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in the U.S. waters, in part due to the high reproductive value of turtles taken in this fishery (NRC 1990).

To address sea turtle bycatch and associated mortality, NMFS implemented regulations requiring turtle excluder devices (TEDs) in 1987, which were phased in over 20 months. Originally, TEDs were required on a seasonal basis, and no TEDs were required if the fisherman followed restricted tow times. Subsequent rulemaking in 1992 required TEDs in all shrimp trawls from North Carolina to Texas, but phased in these requirements to the inshore fishery over a two-year period. Thus, the level of annual mortality described in NRC (1990) is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use TEDs, allowing at least some sea turtles to escape nets before drowning (NMFS 2002).

TEDs approved for use have had to demonstrate 97% effectiveness in excluding sea turtles from trawls in controlled testing. TEDs are required in both state and federal waters. Royal red shrimp trawls are not required to have TEDs if the catch is 90% or greater royal red shrimp because the fishery is prosecuted in depths where sea turtles are unlikely to be caught.

Over time, TED regulations have been modified to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), flotation, and more widespread use.

In addition to improvements in TED designs, interactions between sea turtles and shrimp fisheries were thought to be declining because of reductions of fishing effort unrelated to fisheries management actions. Since 2001, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of hurricanes in the Gulf have all impacted shrimp fleets, in some cases reducing fishing effort by as much as 50% in offshore waters of the Gulf (GMFMC 2007). However, in August 2010, reinitiation of consultation on sea turtle effects was triggered based on elevated strandings in the northern Gulf suspected to be attributable to shrimp trawling, compliance concerns with TED and tow-time regulations, and elevated nearshore sea turtle abundance trawl catch per unit of effort (CPUE). These factors collectively indicated that sea turtles may be affected by shrimp trawling, under the sea turtle conservation regulations and federal FMPs, to an extent not considered in the 2002 opinion, despite lower fishing effort levels.

On May 9, 2012, NMFS completed a new biological opinion (NMFS 2012). Sea turtle interactions and captures were estimated to be significantly higher than estimated in the 2002 biological opinion due to increases in Kemp's ridley and green sea turtle population abundance, incorporation of the TED compliance data and the effect violations on expected sea turtle captures rates, and incorporation of interactions in shrimp trawl gear types previously not estimated (i.e. skimmer trawls and try nets). However, the new estimates were highly uncertain. Subsequently, NMFS withdrew a proposed regulation considered by the 2012 biological opinion, and consultation was reinitiated. A new biological opinion completed in November 2014 that determined the continued implementation of the sea turtle conservation regulations and the continued authorization of the Southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act was not likely jeopardize the continued existence of any sea turtle species (NMFS 2014).

Other protected species captured aboard shrimp trawlers in the Gulf and South Atlantic combined and recorded by observers in 2007-2010 included seven Atlantic sturgeon (Atlantic only), one Gulf sturgeon, seven small-tooth sawfish, two marine birds, and five dolphin (Scott-Denton et al. 2012). The 2014 biological opinion estimates that every three years, 288 smalltooth sawfish interact with shrimp otter trawls of which 105 are expected to be lethal. No smalltooth sawfish were observed captured in trawls in 2011 or 2012. In early January 2013, three smalltooth sawfish captures were observed on one shrimp trip in the Gulf approximately 45 miles northwest of Key West. In 2015, a smalltooth sawfish was observed caught in a commercial shrimp trawl in the Gulf. It was cut free from the net, and released at same location. The sawfish was alive and moving, but the final disposition could not be determined. This is the first sawfish take observed since completion of the 2014 biological opinion.

The population effects of bycatch mortality are the same as fishing mortality from directed fishing efforts. If not properly managed and accounted for, either form of mortality could potentially reduce stock biomass to an unsustainable level. Bycatch mortality is incorporated in assessments of finfish stocks if estimates are available. Little is known about the status of many

finfish (e.g., croaker, porgies) and invertebrate (e.g., mantis shrimp) species that are bycatch in shrimp trawls. These species have not undergone (or are likely to undergo) formal stock assessments, because most are not targeted in commercial or recreational fisheries. However, anecdotal information indicates that some of these species may have benefited from reduced effort in the shrimp fishery.

2. Ecological effects due to changes in bycatch of shrimp species

For the offshore shrimp fishery, almost all shrimp are of marketable size and discard of shrimp is minimal. As an annual stock, shrimp stocks are influenced primarily by recruitment, which is controlled by environmental factors especially in the estuaries, and is not dependent on fishing mortality. The life history of these species is presented in more detail in Chapter 3.

3. Changes in bycatch of other species and resulting population and ecosystem effects

If affected finfish are shrimp predators, reductions in finfish bycatch may result in increased predation on the shrimp population. Predator-prey relationships largely depend on the size structure of predator and prey populations. Juvenile fish that are too small to prey on large shrimp may be able to do so later if their exclusion from trawl gear allows them to grow larger. However, it is also possible some fish will reduce predation on shrimp as they grow and their dietary habits change (Nance 1998).

Changes in the bycatch of non-shrimp invertebrates (e.g., crustaceans and mollusks) also could have ecosystem effects. These species have ecological functions in addition to serving as prey for other invertebrates and fishes. For example, some species, like barnacles and hydrozoans, condition habitat for other organisms by providing a growing surface or by contributing to the bioturbation of bottom sediments.

4. Effects on marine mammals and birds

The shrimp fishery in the Southeast (Gulf and South Atlantic) is classified in the 2015 List of Fisheries as a Category II fishery (81 FR 20550; April 8, 2016). This classification indicates the annual mortality and serious injury of a marine mammal stock from a fishery is greater than 1% but less than 50 % of the stock's potential biological removal (PBR) (i.e., sustainable levels). This fishery was elevated to Category II from Category III (mortality or serious injury to <1% of the PBR) in 2011 based on increased interactions reported by observers, strandings, and fisheries research data.

In February 2015, NMFS published the first estimates of total annual bycatch mortality and serious injury of Gulf common bottlenose dolphin (*Tursiops truncatus*) and Atlantic spotted dolphin (*Stenella frontalis*) incidental to the Gulf shrimp otter trawl fishery (Soldevilla et al. 2015). Annual mortality estimates are calculated for the years 1997-2011 from annual fishery effort and bycatch rates. Results indicate that bottlenose dolphins in the Gulf are interacting with the Gulf shrimp otter trawl fishery. Soldevilla et al. (2015) states that shrimp bycatch mortality estimates exceed 10% of PBR for Western and Northern coastal stocks of bottlenose dolphins

and may exceed sustainable levels for some estuarine stocks. Dolphin bycatch most commonly occurred as entanglements in TED nets and lazy lines. Soldevilla et al (2015) outlined several data limitations with potential biases based on inadequate knowledge of both the fishery and marine mammal stocks, particularly in the inshore bays, sounds, and estuaries. Therefore, additional data on estuarine stocks of bottlenose dolphins in the Gulf and overlapping shrimp trawl fishery effort are needed to determine the extent of mortality and serious injury on these stocks.

The Marine Mammal Protection Act requires NMFS to develop and implement take reduction plans to help in the recovery or prevent the depletion of strategic marine mammal stocks that are frequently or occasionally interacting with commercial fisheries, like the Gulf shrimp otter trawl fishery. However, improving data limitations and biases noted in Soldevilla et al. (2015) is prudent to accurately inform whether and when bycatch reduction measures under the Marine Mammal Protection Act should be initiated.

There are minimal, if any, interactions between seabirds and shrimp trawl gear. Sea birds are a common predator behind shrimp boats, feeding on the discards or feeding on organisms that escape from the net as the gear is brought aboard. Whether bycatch reduction has an adverse impact on bird populations is unknown. However, the potentially high level of bycatch in the penaeid fishery could be affecting some seabird species. Cook (2003) notes the availability of discards and offal has been linked to population increases in a number of species.

5. Changes in fishing, processing, disposal, and marketing costs

The analysis in Amendment 17B already indicates significant reductions in effort have occurred in the shrimp fishery and these are likely to continue. Initially, such reductions are expected to have come from the "marginal" vessels in the fleet. Specifically, the vessels that would exit the fishery first would be those who are the least efficient in terms of their ability to generate profits and those who are least dependent on the fishery as a source of income (i.e. part-timers). Those who remain in the fishery would generally be able to compensate for the loss of these producers by increasing their own production, either via increases in effort (if economic conditions allow) or increases in catch rates (which increase their productivity and profitability). That is, production remains relatively constant. Thus, at first, the marginal costs of effort/bycatch reduction are relatively low. However, as effort and fleet size continue to decline, remaining producers find it increasingly more difficult to increase their production either because they cannot increase their effort more than they already have (i.e. time constraints), it is unprofitable to do so under prevailing economic conditions, and/or catch rates have reached their maximum. At such a point, the marginal cost of further effort/bycatch reductions will become relatively high and production will be lost, as will the economic benefits associated with that production. Allowing the moratorium to expire could reverse these effects. Thus, the creation of a permit pool below such a threshold as outlined in Actions 3 and 4 will prevent the cost from becoming too high to prevent the economic benefits.

Regulatory measures implemented to reduce bycatch have direct costs related to purchasing and installing new technology or limiting where and/or when a vessel could operate. Benefits of

increased bycatch reduction to the directed red snapper fishery would depend on whether and to what extent the reductions affect the rate of recovery in the red snapper fishery and thus the level of allowable yields in the fishery over time.

6. Changes in fishing practices and behavior of fishermen

There is currently no preferred alternative to discuss.

7. Changes in research, administration, and enforcement costs and management effectiveness

Proposed actions that will affect bycatch are not expected to significantly impact research costs. Administrative and enforcement costs would be expected to increase if the threshold is established and a permit pool is created because any new entrants would need to be educated about BRDs and TEDs and their proper installation.

8. Changes in the economic, social, or cultural value of fishing activities and non-consumptive uses of fishery resources

Bycatch is considered wasteful because it reduces overall yield obtained from the fishery. The U.S. Congress recognized the need to balance the costs of bycatch reduction with the social and economic benefits provided by the shrimp fishery when it mandated the study of shrimp trawl bycatch (and potential gear modifications) through the 1990 Magnuson-Stevens Act reauthorization. The resulting cooperative bycatch research program identified gear options that could reduce shrimp trawl bycatch with minimum loss of shrimp production. Decreases in bycatch mortality attributed to these technologies are believed to have contributed to the survival and recovery of at least some sea turtle populations and finfish stocks. The societal benefits associated with recovering these species are not easily quantified, but are believed to outweigh any short-term costs to penaeid shrimp fishermen related to the required bycatch reduction technology.

9. Changes in the distribution of benefits and costs

When the moratorium was established in Amendment 13 (GMFMC 2005), the shrimp fishery in the Gulf was believed to have enough effort such that an initial reduction in effort due to the moratorium would not result in a reduction in catch. This statement was thought to be true for bycatch as well. In other words, there was excess capacity in the fishery and fewer vessels could harvest the available shrimp resources at a more profitable level. The problem under an open access permit was the potential for new vessels to enter the fishery by obtaining federal permits, which could reduce the benefits to current participants. Under the economic conditions, the vast majority of new entry would likely be purely speculative. Increases in the number of active participants in the fishery would not have been sustainable under the economic conditions at that time. However, the global market is unpredictable, and the potential existed for external factors to improve long-term market conditions (i.e. shrimp and fuel prices). Should a threshold be reached and a permit pool created, the number of vessels in the fishery could increase and reach

excess capacity again. This situation would reverse the benefits obtained by historical fishermen during the moratorium but it is unlikely as all threshold values are well below the current number of permits.

Furthermore, current fishery participants have been exerting considerable effort to improve their economic condition through a variety of approaches, including attempts to improve product quality via a product certification program and aggressive marketing campaigns. Should those efforts be successful, the demand and thus the prices for domestic, wild shrimp would increase. The same result may occur if industry participants are successful in their attempts to have tariffs imposed on farmed, foreign shrimp, which they assert have been "dumped" into the U.S. market. Thus, improved conditions may increase effort in the shrimp fishery, and attract new participants, but any scenario presented in Actions 3 and 4 are unlikely to shift efforts above existing thresholds.

10. Social effects

Incentives to comply with requirements for BRDs and TEDs are linked to increased efficiency of fishing effort and higher catch values. Increased efficiency and higher catch values are believe to arise through the following factors: less time spent sorting unwanted catch, less damage to nets and catch from bycatch, higher value on catch because net space, lower fuel costs due to reduced net drag, decreased overall number of trips needed because more target catch has been captured, and potential for marketing of ecofriendly seafood to consumers (Campbell and Cornwell 2008). Measures that reduce bycatch to the extent practicable should also benefit stock recovery, thereby resulting in net social benefits. Further, the concerned public is likely to experience social benefits related to knowing that the organisms they value for aesthetic and existence reasons are better protected. However, some members of the public may believe bycatch is not sufficiently reduced through BRD and TED requirements.

Conclusion

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the Gulf shrimp fishery by using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, even if a threshold is set and a permit pool created, bycatch is unlikely to increase substantially from existing levels; similarly, allowing the passive reduction of the fleet as is the current status, there is likely only a reduction from the current level of bycatch. Therefore, no matter which alternative is implemented implemented, no increase in bycatch from current levels would be expected. Bycatch is currently considered to be reduced to the extent practicable in the Gulf shrimp fishery through the use of BRDs and TEDs and reduced effort. Further, bycatch levels and associated implications will continue to be monitored in the future and issues will be addressed based on new information. Therefore, the Council concluded that current management measures minimize bycatch and bycatch mortality to the extent practicable in the Gulf shrimp fishery.

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