

# **Yield, Threshold Number of Permits, and Transit Provisions**



## **Draft Options for Amendment 17B to the Fishery Management Plan for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters**

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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.

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## Type of Action

Administrative  
 Draft

Legislative  
 Final

## ABBREVIATIONS USED IN THIS DOCUMENT

ACL	annual catch limit
AM	accountability measure
bi op	biological opinion
BRD	bycatch reduction device
CPUE	catch per unit effort
Council	Gulf of Mexico Fishery Management Council
EA	Environmental Assessment
EEZ	exclusive economic zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ELB	electronic logbook
ESA	Endangered Species Act
FMP	Fishery Management Plan
F <sub>MSY</sub>	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
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
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

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# 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: 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 notice of availability and proposed rule for Shrimp Amendment 17A published in April 2016.

During the development of Shrimp 17A several issues were identified (GMFMC 2016). 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. In Amendment 17A, the Council considered whether to let the permit moratorium expire, extend the moratorium, or to create a limited access system. As the preferred alternative is to extend the moratorium 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 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 2015) and a threshold for juvenile red snapper bycatch in a specific area of the Gulf (Amendment 14, GMFMC 2007). These thresholds should be considered when establishing a threshold number of permits for the federal commercial Gulf shrimp fishery.

Currently, any federal Gulf shrimp moratorium permit issued by the NMFS Southeast Regional Office (SERO) is valid for one year and is renewable within one year of expiring. As of April 20, 2016, 1,452 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.

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

Source: NMFS Southeast Regional Office (SERO) Permits Database

Transit with shrimping gear and shrimp on board through federal waters 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 to either transit through federal waters without a federal commercial Gulf shrimp moratorium permit or to be able to obtain said permit. The Council will consider a transit provision to address these concerns from the community, or the Council may choose to increase the number or available federal commercial Gulf shrimp permits to allow for these state participants to have access to a permit so that they can legally transit through federal waters.

## 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 by the 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.

**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), if implemented, would redefine stock status criteria for the three penaeid species of shrimp, including species-specific MSY values and overfished/overfishing thresholds. The general framework procedure would also be 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.

## CHAPTER 2. MANAGEMENT ALTERNATIVES

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

**Note:** Aggregate means for all federally managed 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**

#### **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 is appropriate for management of the shrimp fishery in federal waters as it 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 ad hoc shrimp effort working group (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 due to data limitations. Catch and effort in offshore waters<sup>1</sup> were determined to be the best available proxies for catch and effort in federal waters. The Gulf of Mexico (Gulf) shrimp fishery can be partitioned into three components or areas. 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 EEZ, which is the portion of the offshore area that is under U.S. federal government management. 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 3 or 9 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

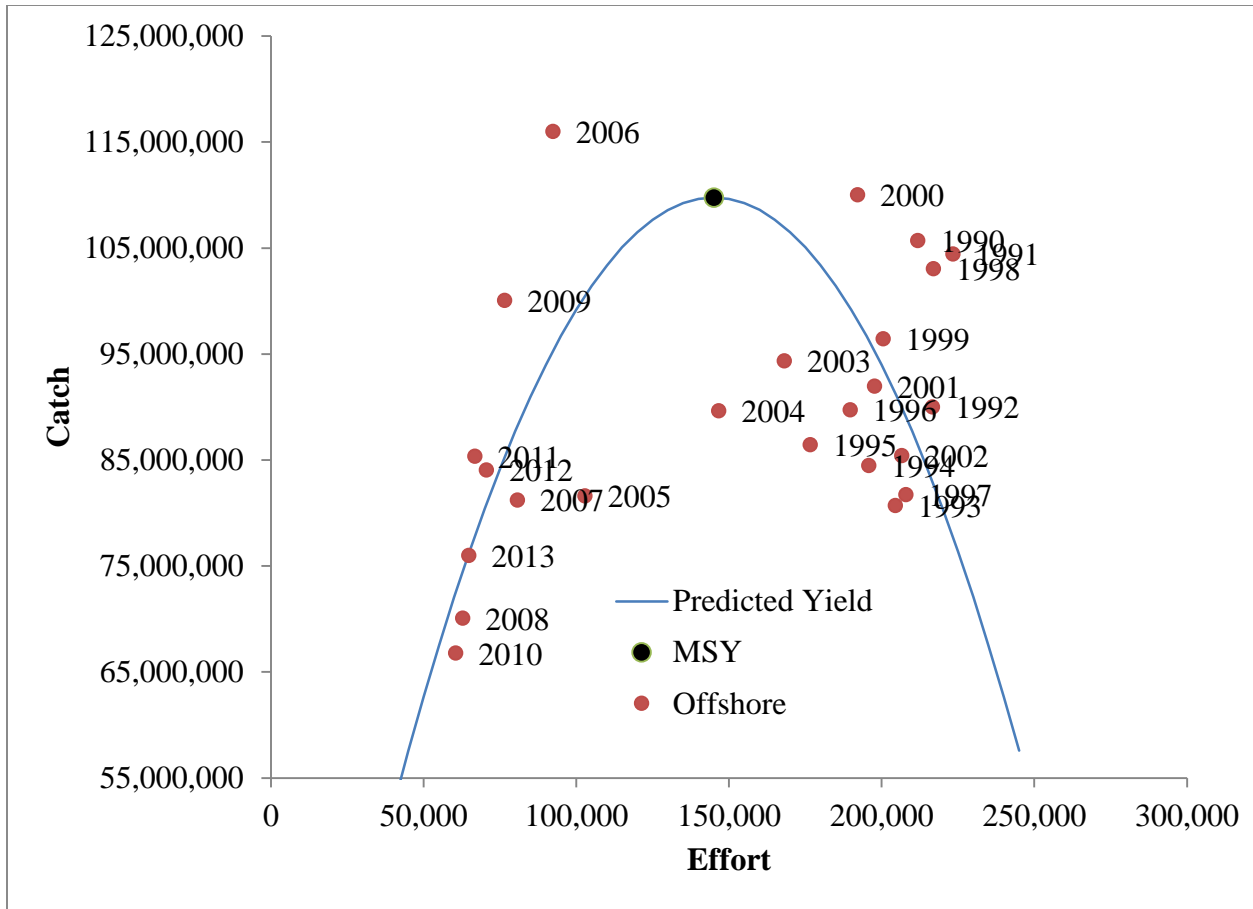
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<sup>1</sup> Gulf offshore waters include some state waters, as well as federal waters. Though most of these vessels had federal permits, a federal permit is not required to harvest shrimp in state offshore waters. Thus, the number of active vessels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

agencies, and the fisheries prosecuted in the EEZ are managed by the NMFS and the Council (Nance et al. 2008). In the 2006 report, effort and aggregate MSY for the federal shrimp fishery were calculated by the SEWG 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 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 (1990-2013), 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 109,237,618 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- so 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 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 in order 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 2.1.1.** Graham Schaeffer production model used to estimate aggregate maximum sustainable yield (MSY) for the offshore component of the Gulf shrimp fishery showing model estimate and actual data points, 1990-2013.

Source: Fm, Galveston



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

**Note:** Aggregate means for all federally managed 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.

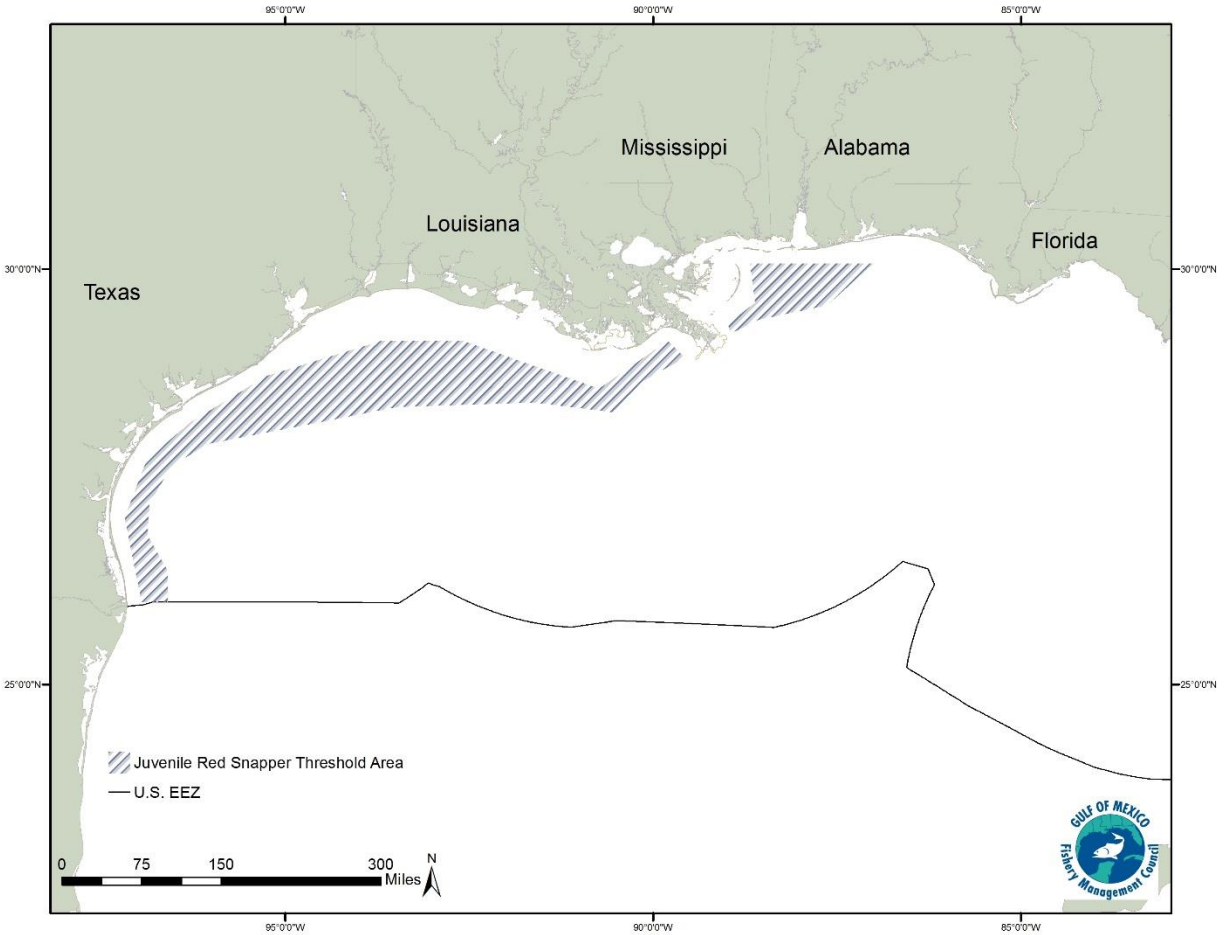
**Alternative 2.** For the federal shrimp fishery, aggregate OY = 85,368,059 lbs of tails which is aggregate MSY reduced for certain biological, social, and economic factors. **AP Preferred**

### Discussion:

The OY is the amount of fish 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 National Standard 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 is equal to 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. A working group was convened in March, 2016, to determine the appropriate aggregate OY for the shrimp fishery. The working group determined that there were four important factors to consider when establishing aggregate OY: high landings, high catch per unit effort (CPUE), effort levels below the sea turtle bycatch threshold, and effort levels below the juvenile red snapper bycatch threshold. The working group concluded that the effort and associated predicted landings balanced all of these criteria in 2009 relative to 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 status of the shrimp fishery, the working group determined that an aggregate OY equal to the aggregate MSY is not appropriate. Similarly, setting aggregate OY as some percentage below aggregate MSY would need scientific rationale.



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

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: 1,074 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)

**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:**

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 any 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.

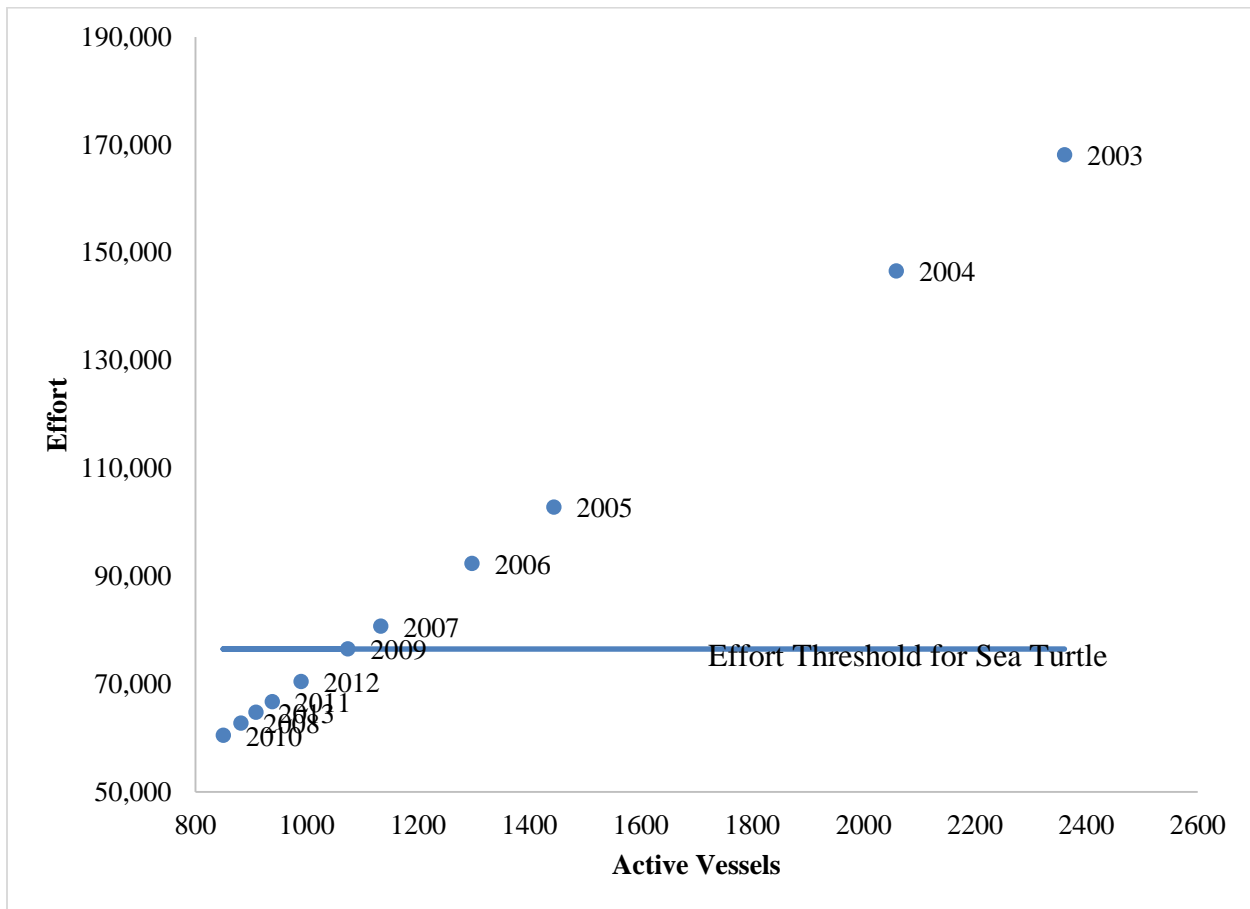
**Alternative 1** would not set a minimum threshold number of permits, and permits that were not renewed within one year of the expiration date would continue to be terminated. This is the practice for all other limited access permits issued by SERO. The number of Gulf shrimp permits would be expected 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.

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 looked at 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. 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 active federally permitted vessels and offshore effort found a strong relationship (Appendix A). A vessel is considered to be active in a particular year if it had shrimp landings from Gulf offshore<sup>2</sup> 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. 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 A, 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.

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<sup>2</sup> 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 A 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	94,372,801	561	106,975,942	640	2,361
2004	146,624	89,637,517	611	109,753,463	751	2,059
2005	102,840	81,611,212	794	100,483,450	979	1,444
2006	92,372	115,991,846	1,256	95,303,048	1,034	1,297
2007	80,733	81,228,888	1,006	88,199,291	1,094	1,133
2008	62,797	70,084,487	1,116	74,484,336	1,187	882
2009	76,508	100,070,591	1,308	85,271,120	1,116	1,074
2010	60,518	66,782,194	1,104	72,501,053	1,199	850
2011	66,777	85,357,173	1,278	77,817,764	1,167	938
2012	70,505	84,071,805	1,192	80,789,736	1,147	990
2013	64,764	75,992,480	1,173	76,152,288	1,177	909

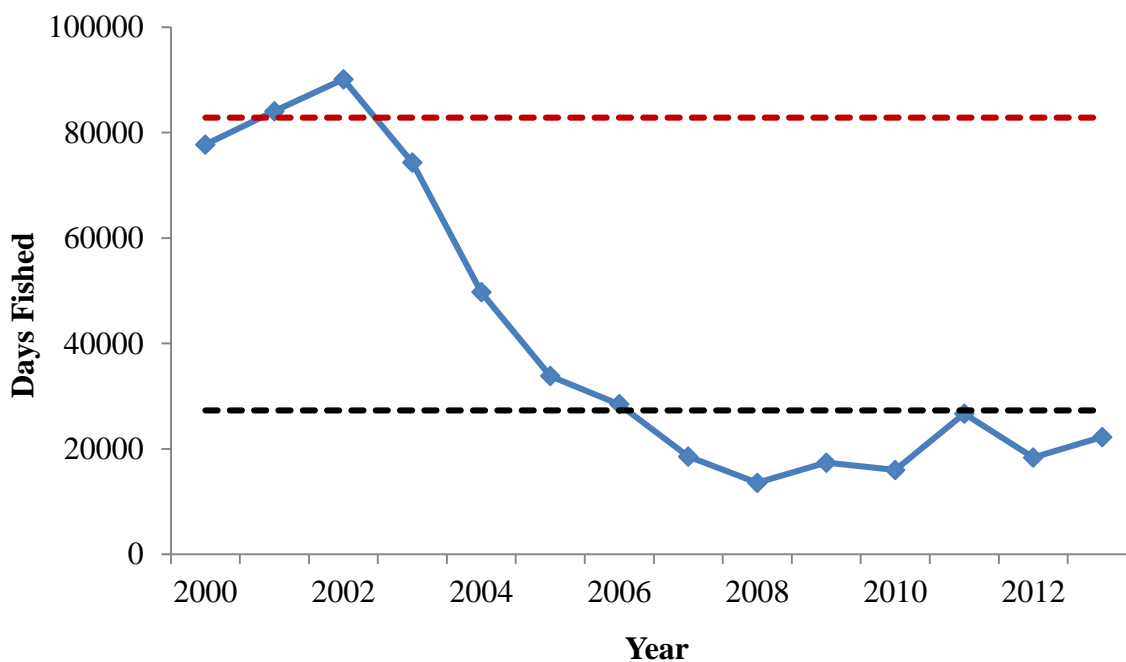
Source: Landings are based on GSS data, J. Primrose, SEFSC Galveston, 7/10/15; effort and CPUE estimates, R. Hart, SEFSC Galveston, 7/15/15; predicted values, M. Travis, NMFS SERO, 7/17/15.

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. National Standard 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 is 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, and thereby risking 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 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 2001-2003 effort levels; the lower (black) line shows the target effort level of 67% reduction from the baseline.

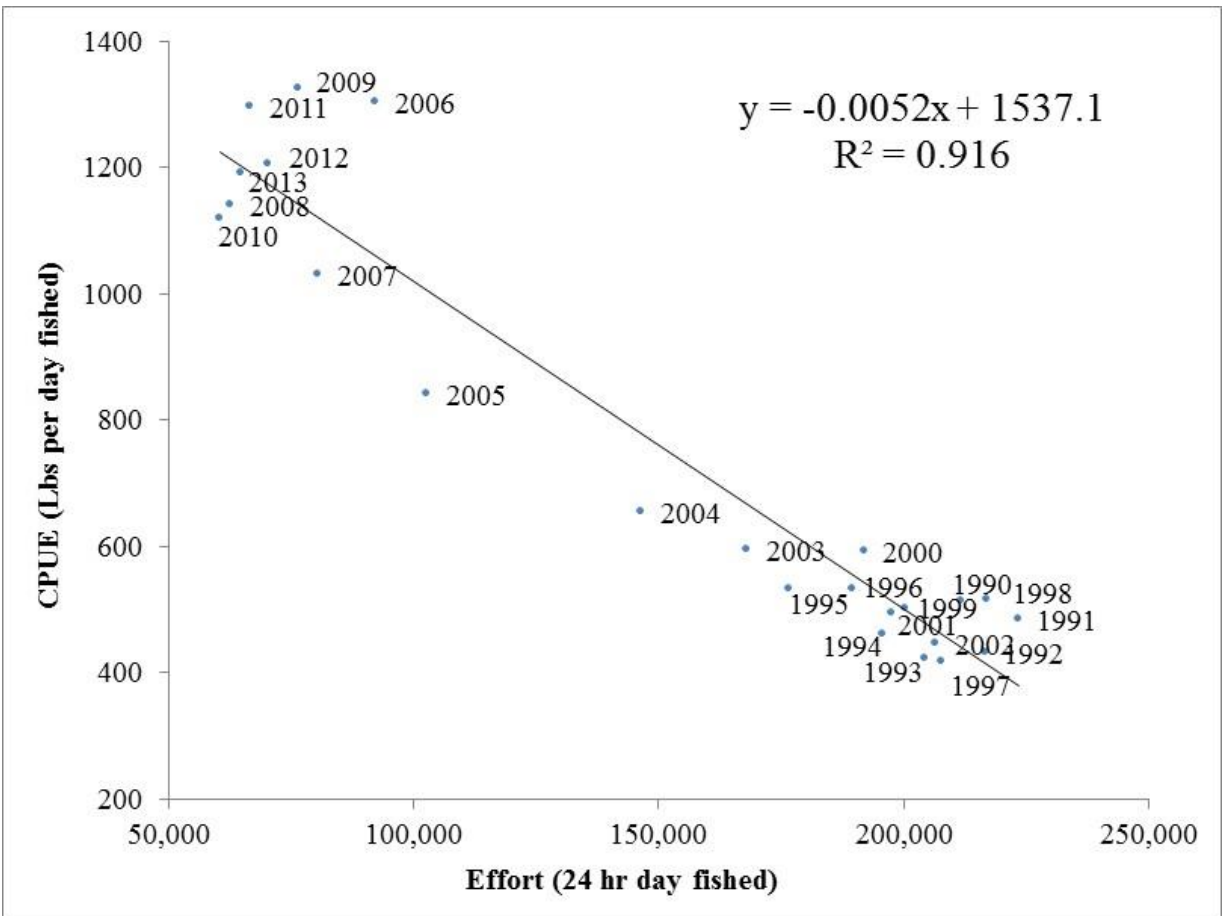
Source: SEFSC, Galveston.



**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. 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 A) 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 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 (2006-2013), 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 A). 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 stated in Amendment 13 (GMFMC 2005a).

Observed CPUE was highest when effort 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, 1990-2013.

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 mp) were 22% less than average predicted landings in 2004-2006 (101.80 mp) (Table 2.3.1). **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.

**Alternative 6, Options a-c** base the minimum threshold number of permits on the valid number of 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 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.

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. What 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.

**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.

**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.

### 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 benefit. 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.

**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.

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.

## 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**

### Discussion:

Action 3 would set a threshold number of permits that represents the smallest number of permits the Council currently believes can support the Gulf shrimp fishery. Because the permit reduction is passive (permits are only lost due to non-renewal by the permit holder), the threshold could be reached relatively quickly, after many years, or not at all. If the threshold is reached, the Council may want to respond with new management measures or re-evaluate the threshold.

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, revoked, or surrendered 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. Action 5 addresses the potential issuance of Gulf shrimp permits from the Reserve Pool, if created.

When the Reserve Pool would be created depends on the threshold set in Action 3. In Action 3, Alternatives 2-5 would set a threshold number of permits below the current number of permits, which would delay the creation of the Reserve Pool until the threshold is reached. If Alternative 6 is chosen in Action 3, the threshold number of permits would be above the number expected to be valid or renewable when measures in this amendment would be implemented and would require NMFS to create new permits for the Reserve Pool as part of the implementation. Any permit in the Reserve Pool would not have a landings history associated with it, regardless of whether it was newly created or transformed from a regular permit; in other words, permits in the Reserve Pool 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 Statistical and Scientific Committee (SSC) members, Shrimp AP members, NMFS and Council staff. The panel would determine if action was needed in response to permits reaching the threshold; that action could be to create a reserve permit pool, to reset the threshold, or establish any other management measure. 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 analysis based on the current situation. If one of the options for Alternative 6 in Action 3 is chosen, **Alternative 3** in Action 4 would not be valid, as the target number of permits in those alternatives has already passed. In other words, the trigger for Council review would be immediate; because this amendment actually is a Council review, the decision made here would fulfill the terms in **Alternative 3** and no additional action beyond this amendment would be warranted.

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 lower than the number of valid permits at the end of 2015. If the rate of permit terminations continues at the rate seen in 2013 and 2014 (approximately 30 permits terminated per year), the review panel would not meet for another 5 years. In 2015, only 15 permits were terminated, so the time to the review panel could be even longer.



## Action 5. Issuance 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 that is of at least **X** length on the application

**Option d** – assign the permit to a vessel with a United States Coast Guard (USCG)

Dockside Safety Exam for fishing activity beyond 3 miles

**Option e** – 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 issuance of the permit or the permit will not be renewed

*Note: For any of the options, the Council should discuss the type of proof required for meeting eligibility requirements.*

**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 that is of at least **X** length on the application

**Option d** – assign the permit to a vessel with a United States Coast Guard (USCG)

Dockside Safety Exam for fishing activity beyond 3 miles



**Option e** – 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 issuance of the permit or the permit will not be renewed

**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 that is of at least **X** length on the application

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

**Option e** – 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 issuance of the permit or the permit will not be renewed

*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.*

### **Discussion:**

If a Reserve Pool for Gulf shrimp permits is created through Action 4, distribution of those permits should also be considered. 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 eligibility requirements be established, such as a minimum vessel size (**Options c and d**). Establishing this type of restriction would set a new precedent for Gulf fisheries.

The Shrimp AP considered various minimum vessel lengths, but deferred making a recommendation. Two methods of classifying vessels by length are presented in Table 2.5.1. Method 1 is based on a longstanding distinction between large and small vessels in historical economic analyses as a proxy between vessels used to harvest shrimp in offshore versus inshore waters. Method 2 separates vessels into four classes by 25-foot lengths to allow a finer distinction. **The Council should choose which method and size threshold to use for Option c.** A more detailed break out of active vessels by size can be found in Appendix X.

**Table 2.5.1.** Proportion of vessels with valid or renewable Gulf shrimp permits in each size class (as of January 6, 2015). Methods are explained in the text.

	<b>Method 1</b>			
<b>Vessel Length</b>	<b>&lt; 60 ft</b>		<b>≥ 60 ft</b>	
<b>Proportion of Vessels</b>	24.3%		75.7%	
	<b>Method 2</b>			
<b>Vessel Length</b>	<b>&lt;25 ft</b>	<b>25 - &lt;50 ft</b>	<b>50 - &lt;75 ft</b>	<b>≥75 ft</b>
<b>Proportion of Vessels</b>	2.8%	13.6%	42.8%	40.8%

Source: NMFS SERO permits database.

The Shrimp AP also discussed USCG regulations which require certification of five net tons or larger. Vessel documentation (**Option d**) 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. Currently, federally permitted vessels can be registered with either the USCG or a state, and owners of state-registered vessels are not required to submit the tonnage of their vessel; therefore, the number of current federally permitted vessels below five net tons cannot be determined.

## Action 6. 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. **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 may remain on deck, but trawl doors (if present) must be disconnected from the trawl gear and must be secured.

**Alternative 4.** 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 may remain on deck, but the bag straps must be removed from the net.

### Discussion:

At its August, 2015 Council meeting it was brought to the Council's attention that there are some areas where state licensed shrimpers need to transit from state waters through federal waters in order to return to state waters and their 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 weren't 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 spend money to buy a federal permit even though they do not fish in federal waters or spend increased time at sea that may require additional fuel costs due to a longer transit time.

In this amendment the alternatives have two different definitions of stowed gear. **Alternative 2** is based on a recent regulation decision for South Atlantic rock shrimp and would allow transit through federal vessels of non-federally permitted vessels as long as shrimp nets are out of the water. 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.

The regulations state that transit of the closed EEZ with less than 4 inch stretch mesh aboard while in possession of penaeid species will be allowed 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 their 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 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” as in **Alternative 2**. 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.

**Alternative 3** is based on the current Gulf regulations and requires more gear restrictions, with the trawl doors needing 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.

**Alternative 4** is a much less cumbersome requirement than detaching the trawl doors. A bag strap is woven through the cod end of the net to close off the end of the net thereby catching 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 the fisherman than detaching trawl doors, but still keeps the net in an easily identifiable unfishable state by law enforcement.

## 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, 2003-2013.

<b>Year</b>	<b>All Species</b>	<b>Brown</b>	<b>White</b>	<b>Pink</b>	<b>Royal Red</b>
<b>2003</b>	155,242,184	83,949,224	60,996,687	9,943,414	352,859
<b>2004</b>	157,739,916	74,430,438	72,873,648	10,133,819	302,011
<b>2005</b>	132,780,625	58,574,505	65,314,218	8,722,912	168,990
<b>2006</b>	181,475,558	87,441,817	86,216,341	7,654,077	163,323
<b>2007</b>	138,509,322	70,560,173	64,305,379	3,414,746	229,024
<b>2008</b>	118,991,711	50,236,551	63,728,659	4,888,385	138,116
<b>2009</b>	155,591,111	75,500,221	75,296,070	4,621,755	173,065
<b>2010</b>	110,757,364	45,236,923	59,596,612	5,796,471	127,358
<b>2011</b>	136,277,325	73,107,015	58,265,392	4,709,564	195,354
<b>2012</b>	136,041,709	65,204,529	67,246,784	3,412,738	177,658
<b>2013</b>	126,048,427	66,305,319	56,360,746	3,182,863	199,499
<b>Average</b>	140,859,568	68,231,520	66,381,867	6,043,704	202,478

Source: NMFS SEFSC Rick Hart, pers. comm. 2015.

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 April 20, 2016, there were 1,452 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 the 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; it should be noted that 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. It should be noted that 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 commercially shrimping 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 for the Gulf overall 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, searobins, and Gulf butterflyfish. 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 more than what is currently in the fishery, it could increase the bycatch associated with the fishery.

### **3.3.3 Protected Species**

Species in the Gulf protected under the Endangered Species Act (ESA) include: five marine mammal species (sei, fin, humpback, sperm whales, and manatees); five sea turtles (Kemp's ridley, loggerhead, green, leatherback, and hawksbill); two fish species (Gulf sturgeon and smalltooth sawfish); and four 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 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 biological opinion, 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 biological opinion implemented measures to minimize the impacts of incidental take to sea turtle or smalltooth sawfish. After the completion of the biological opinion, 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 Gulf 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.

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.<sup>3</sup>

### 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.

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<sup>3</sup> [http://www.nmfs.noaa.gov/pr/pdfs/fisheries/lof2012/southeastern\\_us\\_atlantic\\_gulf\\_shrimp\\_trawl.pdf](http://www.nmfs.noaa.gov/pr/pdfs/fisheries/lof2012/southeastern_us_atlantic_gulf_shrimp_trawl.pdf)

## 3.4 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 C. 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.

### 3.4.2 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>



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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 Member**

Leann Bosarge

**NMFS-SERO Staff**

Susan Gerhart

**Others present**

John Williams  
James Primrose

**Council Staff**

Morgan Kilgour  
Phyllis Miranda

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). 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 profit 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). 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.

### Analysis of the Gulf of Mexico Shrimp Offshore Fishery - Preliminary 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. The permit and endorsement are not needed to harvest the same species in state waters. However, it is not possible to estimate effort<sup>4</sup> and catch (landings)<sup>5</sup> 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<sup>6</sup>) 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 of what is actually occurring 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.<sup>7</sup> 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.<sup>8</sup> 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

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<sup>4</sup> Effort is measured in “days fished,” where a day fished equals 24 hours of trawling time.

<sup>5</sup> Catch and landings are used interchangeably as discarding of shrimp is insignificant.

<sup>6</sup> 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.

<sup>7</sup> 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.

<sup>8</sup> A minor if not trivial amount of shrimp harvested from Gulf waters is landed in South Atlantic ports each year.

was 1990. Because GSS data for 2014 was not complete at the time this analysis was conducted, the analysis only used data through 2013.

Although the analyses conducted so far are scientifically acceptable for use in this amendment, additional research is being conducted to provide additional guidance and support to the Council as it continues developing this amendment. The following constitutes some of the key findings of the research that has been completed to date that relate to the Council's current set of actions and alternatives.

First, according to Figure 2.1, the estimated yield curve for the offshore fishery indicates that aggregate MSY is 109,237,618 pounds (tails) and effort at MSY is 143,756 days fished.<sup>9</sup> 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 2.1, the level of effort needed to achieve aggregate MSY in the offshore fishery was most closely observed in 2004. Based on effort observed in 2013, effort would need to increase by more than 126% from current levels to achieve aggregate MSY.

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<sup>9</sup> Personal Communication, Rick Hart, NMFS Galveston Laboratory, July 15, 2015.



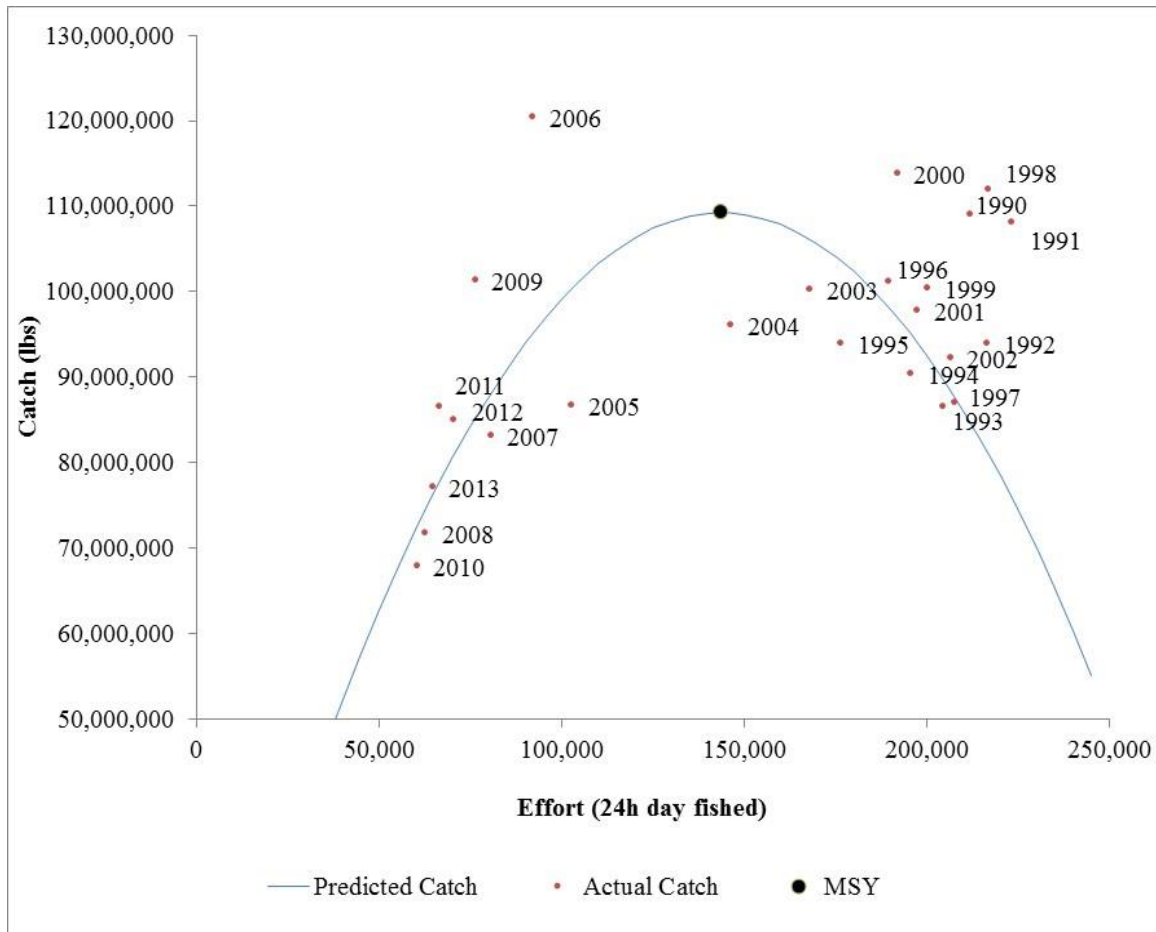


Figure 2.1. Yield curve for the offshore Gulf shrimp fishery. Estimates are based on catch and effort data for all shrimp species caught in offshore Gulf waters and landed in Gulf ports, 1990-2013.<sup>10</sup>  $Catch = 1519.7665 * effort + -0.00528 * effort^2$

Figure 2.2 illustrates the trends in observed landings, effort, and catch per unit effort (CPUE).<sup>11</sup> The most noticeable trends are with respect to observed effort and CPUE, with observed effort 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 appear to have declined slightly in recent years.

<sup>10</sup> Rick Hart, personal communication, July 15, 2015. 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).

<sup>11</sup> Personal Communication, Rick Hart, NMFS Galveston Laboratory, July 15, 2015.

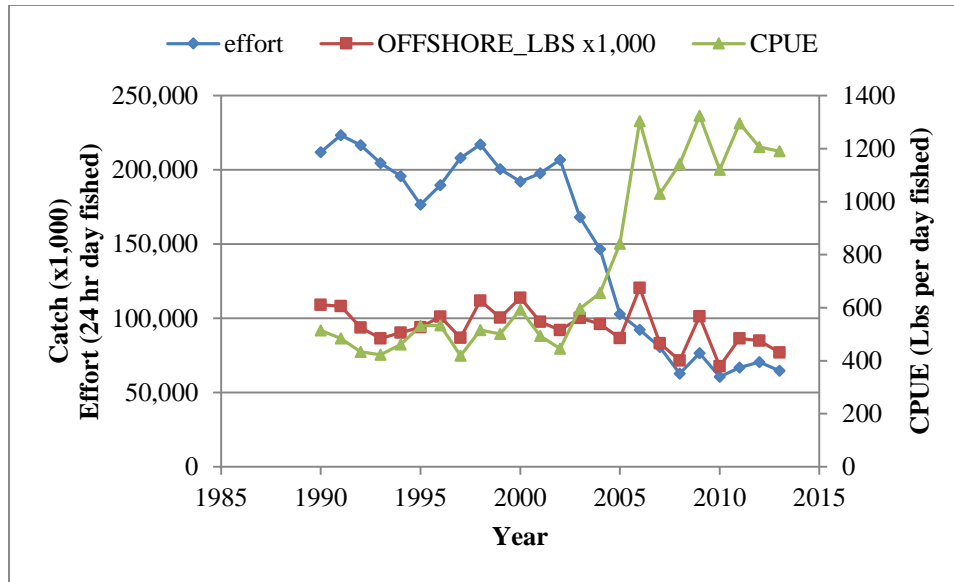


Figure 2.2. Catch, effort and CPUE for the offshore Gulf shrimp fishery. Estimates are based on catch and effort data for all shrimp species caught in offshore Gulf waters and landed in Gulf ports, 1990-2013.

Figure 2.3 illustrates a very strong, inverse relationship between effort and CPUE in the offshore fishery.<sup>12</sup> 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 2.1), 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 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.

<sup>12</sup> Personal Communication, Rick Hart, NMFS Galveston Laboratory, July 15, 2015.

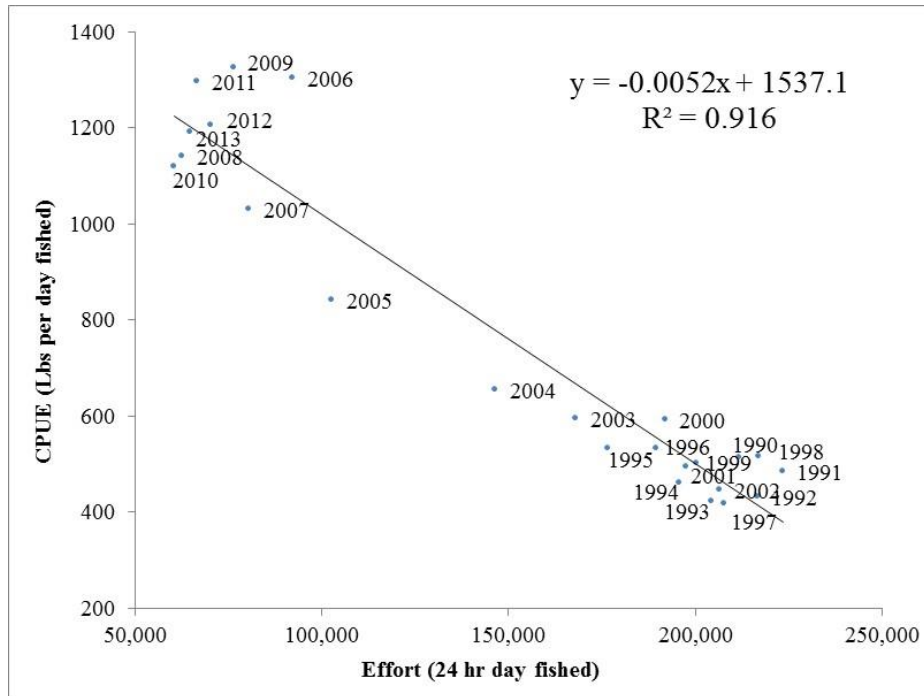


Figure 2.3. Relationship between CPUE and Effort in the offshore Gulf shrimp fishery, 1990-2013.

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.<sup>13</sup> According to the information in Table 2.1, 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 maximum in 2008. These results suggest that additional increases in CPUE from further effort reductions are likely to be minor.

The predicted values also better illustrate that landings have indeed been on a downward trend since 2006. Under the moratorium, although the highest level of observed landings was in 2009, this result was driven by above average abundance in that year. The highest level of landings under the moratorium would have been expected under effort levels seen in 2007, the first year of the moratorium.

<sup>13</sup> However, these estimates do not account for changes in technology that have likely occurred over time and caused effort to become more efficient.

Table 2.1. Effort, Landings, CPUE, Predicted CPUE, and Predicted Landings in the Offshore Gulf Shrimp Fishery, 1990-2013.

<u>Year</u>	<u>Effort</u>	<u>Landings (tails)</u>	<u>CPUE</u>	<u>Predicted Landings (tails)</u>	<u>Predicted CPUE</u>	<u>Predicted Active Permitted Vessels</u>
1990	211,860	109,017,807	515	84,986,857	435	N/A
1991	223,388	108,127,144	484	76,013,621	375	N/A
1992	216,669	93,878,905	433	81,414,352	410	N/A
1993	204,482	86,465,838	423	89,992,830	474	N/A
1994	195,742	90,292,943	461	95,179,257	519	N/A
1995	176,589	93,907,727	532	103,724,402	619	N/A
1996	189,653	101,091,922	533	98,315,856	551	N/A
1997	207,912	86,992,070	418	87,736,988	456	N/A
1998	216,999	111,930,612	516	81,160,530	409	N/A
1999	200,475	100,419,269	501	92,470,953	495	N/A
2000	192,073	113,783,105	592	97,116,225	538	N/A
2001	197,644	97,706,647	494	94,119,050	509	N/A
2002	206,621	92,119,199	446	88,600,977	463	N/A
2003	168,135	100,203,686	596	106,263,503	663	2,361
2004 <sup>14</sup>	146,624	96,079,478	655	109,321,652	775	2,059
2005	102,840	86,571,515	842	100,451,078	1,002	1,444
2006	92,372	120,437,081	1304	95,332,055	1,057	1,297
2007	80,733	83,126,655	1030	88,281,093	1,117	1,133
2008	62,797	71,689,314	1142	74,615,625	1,211	882
2009	76,508	101,339,883	1325	85,368,059	1,139	1,074
2010 <sup>15</sup>	60,518	67,790,473	1120	72,635,863	1,222	850
2011	66,777	86,482,240	1295	77,941,409	1,190	938
2012	70,505	85,004,590	1206	80,904,495	1,170	990
2013	64,764	77,063,083	1190	76,280,038	1,200	909

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 shrimp prices (e.g., increased imports and a

<sup>14</sup> Most closely approximates MSY conditions.

<sup>15</sup> DWH event

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 and to a level not seen since 2001 (see Table 2.2). Although gross revenue did not increase as much (22%) in 2013, because landings fell by more than 9%, it was still at its highest level since 2001. Preliminary data suggests ex-vessel shrimp prices continued to increase in 2014, likely resulting in increased gross revenue as well, and fuel price decreased somewhat as well. However, preliminary data also suggests ex-vessel prices have abruptly turned downward in 2015, potentially erasing the increases from the two previous years. Thus, the economic turnaround in 2013-2014 may be short-lived with 2013 economic conditions likely representing 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 2013 being the highest observed in the 1990-2013 time series. Net revenue per vessel estimates are only available for 2006-2013, and only apply to permitted vessels, but reflect a similar trend.

Recent analysis demonstrates the importance of maintaining a relatively high CPUE with respect to profitability in the offshore fishery. Although other factors may play a minor role, theory suggests net revenue per vessel should be primarily a function of CPUE, ex-vessel shrimp price, and fuel price. Based on limited data (2006-2013), a linear regression model determined that net revenue is primarily driven by CPUE, with ex-vessel shrimp price also being important though slightly less so, and fuel price of less significance.<sup>16</sup> As expected, CPUE and ex-vessel shrimp price are positively related to net revenue per vessel (i.e. net revenue will increase as a result of an increase in CPUE and/or ex-vessel shrimp price), while fuel price is inversely related to net revenue (i.e., an increase in fuel price will decrease net revenue). More specifically, for every one pound increase in CPUE, net revenue per vessel is expected to increase by \$55. A \$1 increase in ex-vessel shrimp price would increase net revenue by almost \$11,200, while a \$1 increase in fuel price would decrease net revenue by \$6,486. Of these three factors, management can only affect CPUE, and only indirectly by using direct or indirect controls on effort.

However, 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 be expected to cause adverse economic impacts in the onshore sector (i.e.,

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<sup>16</sup> The regression equation is as follows: net revenue per vessel=-87654.299+(54.874\*CPUE)+(11197.63\*ex-vessel price)+(-6486.055\*fuel price). All dollar values in real terms; n=8; R<sup>2</sup>=.875. CPUE and ex-vessel price are statistically significant at .05 confidence level. Fuel price was not statistically significant but the model's explanatory power was noticeably higher with its inclusion.

dealers and processors) as profitability in that sector is mainly determined by physical volume and gross revenue from the harvesting sector. Thus, landings reductions would be expected to reduce employment, income, sales, and value-added in the onshore sector and thus in associated communities, states, and the Gulf region. Though not strong, Figure 2.4 illustrates a statistically significant inverse relationship between landings and CPUE. Specifically, the model suggests that an increase in landings of 1 million pounds would only reduce CPUE by 8.2 pounds per day fished, resulting in a decrease in net revenue per vessel of about \$450.

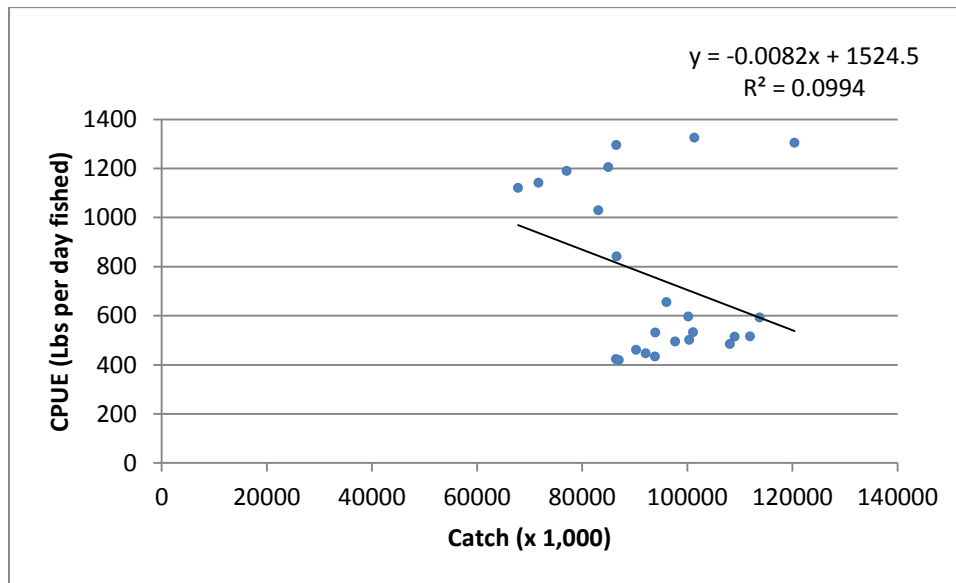


Figure 2.4. Relationship between Catch and CPUE in the offshore Gulf shrimp fishery, 1990-2013.

In general, the Council does not directly control effort in the offshore fishery, although 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 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 precisely target some desired level of effort in the offshore fishery that would lead to an acceptable level of landings and CPUE, 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 effort needs to be determined. That is, it would be helpful to know how many permits/vessels are needed to achieve alternative levels of effort that may be desired by the Council. Information on permitted and active vessels in the offshore fishery is provided in Table 2.3 and should be considered in conjunction with effort information in Table 2.1.

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 2.3 in this document. 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 effort indicates 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 effort, it also consistently overestimated observed effort and thus is not considered reliable for policy purposes. Further, in theory, effort should be more closely related to the number of active vessels rather than the number of permitted vessels in the fishery. Thus, a model that examines the relationship between active vessels and effort is expected to yield better results (i.e., it will explain as much if not more of the variability in effort, but also generate more accurate predictions of 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 1990-2013. 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 2.3, “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. Though most of these vessels had federal permits between 2003 and 2013, 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. 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 2.2. Gross Revenue, Ex-Vessel Price, Fuel Price, and Net Revenue per Active Permitted Vessel in the Offshore Gulf Shrimp Fishery, 1990-2013.

<u>Year</u>	<u>Gross Revenue (Nominal)</u> <sup>17</sup>	<u>Gross Revenue (Real)</u> <sup>18</sup>	<u>Ex-Vessel Price (Nominal)</u>	<u>Ex-Vessel Price (Real)</u>	<u>Fuel Price (Nominal)</u> <sup>19</sup>	<u>Fuel Price (Real)</u>	<u>Gross Revenue per Vessel (Real)</u>	<u>Net Revenue per Vessel (Real)</u> <sup>20</sup>
1990	\$314,929,509	\$395,009,857	\$2.89	\$3.62	N/A	N/A	\$115,130	N/A
1991	\$347,842,006	\$422,256,220	\$3.22	\$3.91	N/A	N/A	\$125,113	N/A
1992	\$285,251,679	\$338,565,605	\$3.04	\$3.61	N/A	N/A	\$103,474	N/A
1993	\$259,664,115	\$301,031,922	\$3.00	\$3.48	N/A	N/A	\$93,256	N/A
1994	\$353,105,982	\$400,828,640	\$3.91	\$4.44	N/A	N/A	\$115,846	N/A
1995	\$349,558,754	\$388,692,294	\$3.72	\$4.14	N/A	N/A	\$116,935	N/A
1996	\$332,150,302	\$362,716,414	\$3.29	\$3.59	N/A	N/A	\$106,964	N/A
1997	\$340,213,595	\$365,263,356	\$3.91	\$4.20	N/A	N/A	\$112,493	N/A
1998	\$380,646,267	\$404,289,093	\$3.40	\$3.61	N/A	N/A	\$129,001	N/A
1999	\$373,675,269	\$390,906,424	\$3.72	\$3.89	N/A	N/A	\$126,058	N/A
2000	\$485,387,192	\$496,473,444	\$4.27	\$4.36	N/A	N/A	\$166,100	N/A
2001	\$355,064,936	\$355,064,936	\$3.63	\$3.63	N/A	N/A	\$117,923	N/A
2002	\$281,472,047	\$277,219,500	\$3.06	\$3.01	N/A	N/A	\$82,826	N/A
2003	\$270,635,465	\$261,349,710	\$2.70	\$2.61	N/A	N/A	\$84,964	N/A
2004	\$268,840,649	\$252,667,408	\$2.80	\$2.63	N/A	N/A	\$87,640	N/A
2005	\$262,002,593	\$238,565,881	\$3.03	\$2.76	N/A	N/A	\$98,297	N/A
2006	\$297,644,024	\$262,927,126	\$2.47	\$2.18	\$2.06	\$1.82	\$117,221	-\$6,562
2007	\$252,184,090	\$216,996,016	\$3.03	\$2.61	\$2.39	\$2.05	\$112,317	-\$16,893
2008	\$255,638,060	\$215,722,859	\$3.57	\$3.01	\$3.08	\$2.60	\$126,228	-\$7,313
2009	\$228,596,619	\$191,456,058	\$2.26	\$1.89	\$2.05	\$1.72	\$101,730	-\$2,823

<sup>17</sup> Nominal gross revenue and ex-vessel price estimates are based on GSS data, James Primrose, personal communication, July 10, 2015.

<sup>18</sup> All real estimates have been adjusted for inflation into 2001 dollars using the GDP deflator.

<sup>19</sup> 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, 2015 (forthcoming); Liese and Travis, 2010; Liese et al., 2009a, 2009b. The Annual Economic Survey of Federal Gulf Shrimp Permit Holders, NMFS-SEFSC.

<sup>20</sup> Net revenue estimates are for permitted vessels with landings from the Gulf shrimp fishery in general as opposed to the offshore fishery because net revenue estimates have not been estimated for permitted vessels that were active in the offshore fishery.

2010	\$237,689,580	\$196,678,235	\$3.51	\$2.90	\$2.46	\$2.03	\$144,192	-\$3,657
2011	\$320,788,313	\$260,069,814	\$3.71	\$3.01	\$3.17	\$2.57	\$159,552	\$1,113
2012	\$291,314,188	\$232,004,546	\$3.43	\$2.73	\$3.24	\$2.58	\$135,517	-\$7,856
2013	\$359,631,710	\$282,212,386	\$4.67	\$3.66	\$3.19	\$2.51	\$171,662	\$1,212

Table 2.3. Number of Permitted and Active Vessels by Size Category in the Offshore Gulf Shrimp Fishery, 1990-2014.

<u>Year</u>	<u>Active Vessels</u>	<u>Large Active Vessels</u>	<u>Small Active Vessels</u>	<u>Permitted Vessels</u>	<u>Active Permitted Vessels</u>	<u>Large Active Permitted Vessels</u>	<u>Small Active Permitted Vessels</u>
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 <sup>21</sup>	N/A	N/A	N/A	N/A
2003	3,085	1,810	1,275	2,688	1,953	1,656	297
2004 <sup>22</sup>	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 <sup>23</sup>	1,940	1,137	803	2,514	1,283	1,084	199
2008 <sup>24</sup>	1,714	994	720	1,930	1,059	942	117
2009	1,891	1,001	890	1,764	1,075	959	116
2010 <sup>25</sup>	1,365	902	463	1,685	951	865	86

<sup>21</sup> 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.

<sup>22</sup> MSY

<sup>23</sup> Max predicted landings under moratorium and high predicted CPUE.

<sup>24</sup> Max predicted CPUE but significantly lower predicted landings.

2011 <sup>26</sup>	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 <sup>27</sup>	N/A	N/A	N/A	1,515	N/A	N/A	N/A

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<sup>25</sup> DWH event

<sup>26</sup> Effort in juvenile red snapper areas at highest level during moratorium without triggering a closure

<sup>27</sup> GSS data for 2014 was not finalized when this analysis was conducted.

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.<sup>28</sup> For state registered vessels with federal permits, length is what permit holders provide on their applications. NMFS does not possess length data for non-permitted vessels. Since 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. 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 2013 (11.5%) 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 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 active vessels 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 since permitted vessels only account for a percentage of 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 relationships were found between active permitted vessels and offshore effort<sup>29</sup> and between large active vessels and offshore effort.<sup>30</sup> The relationship between large active permitted vessels and offshore effort<sup>31</sup> is somewhat stronger than the relationship between all active vessels and offshore effort.<sup>32</sup>

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<sup>28</sup> 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.

<sup>29</sup> Model is offshore effort=71.225\*number of active permitted vessels. R<sup>2</sup> is .982.

<sup>30</sup> Model is offshore effort=97.283\*number of large active vessels. R<sup>2</sup> is .982.

<sup>31</sup> Model is offshore effort=83.03\*number of large active permitted vessels. R<sup>2</sup> is .980.

<sup>32</sup> Model is offshore effort=57.773\*number of active vessels. R<sup>2</sup> is .976.

These results suggest the Council can indirectly control or at least limit offshore effort by controlling the number of vessels with federal permits. 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 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 71.2 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 57.8 days. That said, this predicted value is based on data from 1990-2013 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 2.4. Table 2.4 combines information on offshore effort from Table 2.1 and the number of active vessels in offshore waters from Table 2.3. Between 1990 and 2001, the average annual days fished per vessel was about 63 days fished. Although the decline in the average days fished 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 effort per vessel has been relatively stable since 2005, and has averaged around 41 days between 2006 and 2013.

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 number of active permitted vessels needed to achieve MSY would be 2,018, 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.

The predicted number of active permitted vessels needed to attain levels of actual offshore effort in each year between 2003 and 2013 is provided in Table 2.1. 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 882. 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 1,134. The number of active permitted vessels needed to achieve effort in 2009 is 1,074, 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., due to repairs or damage from a storm), poor economic conditions in the offshore fishery, a decision to temporarily use the permitted vessel in another fishery (including the inshore fishery), etc. This is an issue for the Council to consider when potentially establishing a threshold level of permits in Amendment 17B.

Table 2.4. Effort, Active Vessels, and Average Effort per Vessel in the Offshore Gulf Shrimp Fishery, 1990-2013.

<u>Year</u>	<u>Effort</u>	<u>Active Vessels</u>	<u>Average Effort per Vessel</u>
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