**Tab D, No. 5**
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# Shrimp Permit Moratorium

# Final Draft for Amendment 17A
## 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 17A

**Responsible Agencies:**

National Marine Fisheries Service
(Lead Agency)
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701
727-824-5305
727-824-5308 (fax)
http://sero.nmfs.noaa.gov
Contact: Susan Gerhart
Susan.Gerhart@noaa.gov

Gulf of Mexico Fishery Management Council
2203 North Lois Avenue, Suite 1100
Tampa, Florida 33607
813-348-1630
813-348-1711 (fax)
http://www.gulfcouncil.org
Contact: Morgan Kilgour
Morgan.Kilgour@gulfcouncil.org

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# ABBREVIATIONS USED IN THIS DOCUMENT

| | |
|---|---|
| ACL | annual catch limit |
| ALF | annual landings form |
| AM | accountability measure |
| BECI | bio-economic conditions index |
| BRD | bycatch reduction device |
| CPUE | catch per unit effort |
| Council | Gulf of Mexico Fishery Management Council |
| DWH | Deepwater Horizon MC 252 |
| EA | Environmental Assessment |
| EEZ | exclusive economic zone |
| EFH | essential fish habitat |
| EIS | Environmental Impact Statement |
| EJ | environmental justice |
| ELB | electronic logbook |
| ESA | Endangered Species Act |
| FMP | fishery management plan |
| GMFMC | Gulf of Mexico Fishery Management Council |
| GSS | Gulf Shrimp System |
| Gulf | Gulf of Mexico |
| HAPC | habitat area of particular concern |
| Magnuson-Stevens Act | Magnuson-Stevens Fishery Conservation and Management Act |
| mp | million pounds |
| MSY | maximum sustainable yield |
| NEPA | National Environmental Policy Act |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRC | National Research Council |
| OY | optimum yield |
| PBR | potential biological removal |
| RA | Regional Administrator |
| RQ | regional quotient |
| Secretary | Secretary of Commerce |
| SEFSC | Southeast Fisheries Science Center |
| SEIS | Supplemental Environmental Impact Statement |
| SERO | Southeast Regional Office of NMFS |
| SPGM | federal Gulf commercial shrimp permit |
| TEDs | turtle excluder device |
| USCG | United States Coast Guard |
| VOOP | vessel of opportunity program |

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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. The Fishery Management Plan (FMP) for the Shrimp Fishery of the Gulf of Mexico, U.S. Waters includes four species: brown shrimp, *Farfantepenaeus aztecus*; pink shrimp, *Farfantepenaeus duorarum*; white shrimp, *Litopenaeus setiferus*; and royal red shrimp, *Pleoticus robustus*.

In 2001, the Council established a federal commercial permit for all vessels harvesting shrimp from federal waters of the Gulf through Amendment 11 (GMFMC 2001). Approximately 2,951 vessels had been issued these permits by 2006. After the establishment of the permit, the shrimp fishery experienced economic losses, primarily because of high fuel costs and reduced shrimp prices caused by competition from imports. These economic losses resulted in the exodus of vessels from the fishery, and consequently, reduction of effort. 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. That additional effort could negate, or at least lessen, profitability for the fleet as a whole. Consequently, the Council established a 10-year moratorium on the issuance of new federal commercial shrimp vessel permits through Amendment 13 (GMFMC 2005a). The final rule implementing the moratorium was effective October 26, 2006; permits became effective in March 2007.

To be eligible for a commercial shrimp vessel permit under the moratorium, vessels must have been issued a valid permit by NMFS prior to and including December 6, 2003. An exception was made for owners who lost use of a qualified vessel, but obtained a valid commercial shrimp vessel permit for the same vessel or another vessel prior to the date of publication of the final rule. NMFS estimated 285 of the 2,951 vessels would not meet the control date; thus, the number of permitted vessels under the moratorium would be 2,666. Of those 285 ineligible vessels, 126 were inactive during 2002 (the last year of data available during the time the Council deliberated on this issue). Of the remaining 159 active vessels, only 72 operated in federal waters and were excluded under the moratorium. Of those 72 vessels, 45 were large and 27 were small. The large vessels were expected to be the most affected because the small vessels could continue to fish in state waters, where a federal permit is not required.

Vessel owners had one year to obtain the new permit; NMFS issued 1,933 moratorium permits in that time. As of September 21, 2015, 1,464 moratorium permits were valid or renewable (within one year of expiration); therefore, the number of permits has decreased by 469 since the moratorium began (Table 1.1.1). These permits have been permanently removed and are no longer available to the fishery. A permit is valid if it has been renewed; a permit is renewable one year from its expiration. After a year with no renewal, a permit is terminated and permanently removed from the permit pool.

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

| Year | Number of Valid Permits Each Year | Number of Surrendered Permits Each Year | Number of Permits Terminated Each Year* | Cumulative Number of Permits Lost from the Fishery |
|---|---|---|---|---|
| 2007 | 1,933 | 0 | NA | NA |
| 2008 | 1,907 | 0 | 26 | 26 |
| 2009 | 1,722 | 1 | 184 | 211 |
| 2010 | 1,633 | 1 | 88 | 300 |
| 2011 | 1,582 | 0 | 51 | 351 |
| 2012 | 1,534 | 0 | 48 | 399 |
| 2013 | 1,501 | 0 | 33 | 432 |
| 2014 | 1,470 | 0 | 31 | 463 |

Source: NMFS Southeast Regional Office (SERO) Permits Database

The moratorium on federal commercial shrimp permits will expire October 26, 2016. The Council may: 1) allow the moratorium to expire and revert all federal shrimp permits to open access; 2) extend the moratorium for another period of time; or 3) establish a limited access system for Gulf shrimp permits that would not have an expiration date.

Royal red shrimp can only be harvested with a royal red shrimp endorsement. Anyone with a federal commercial shrimp permit is eligible to obtain a royal red shrimp endorsement for an additional fee. The establishment of the royal red shrimp endorsement was intended to help identify the universe of royal red shrimp fishermen for analytical purposes. The Council may eliminate the royal red shrimp endorsement if they determine it is not accomplishing its purpose. As of September 21, 2015, 298 royal red shrimp permits were valid.

Compliance with the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act)

Section 303 (b) (6) of the Magnuson-Stevens Act requires the Council to consider several factors when establishing a limited access system. These factors were discussed in Amendment 13 (GMFMC 2005a), which originally established the federal shrimp permit moratorium, and are discussed in detail in various sections of this amendment, especially in Chapters 2.0, 4.0, and 5.0. Below is a summary of those details.

**(a) Present participation in the fishery**

Prior to the implementation of the federal commercial shrimp vessel permit in Amendment 11 (GMFMC 2001), approximately 4,000 vessels fished in federal waters at least some portion of the year. An estimated 2,951 vessels obtained a permit sometime within the period from implementation of Amendment 11 (December 2002) and May 5, 2005. NMFS estimated 2,666 vessels were eligible for a permit when the moratorium was implemented through Amendment

13 (GMFMC 2005a); 1,933 vessels applied for and were issued permits by March 2007. As of September 21, 2015, 1,464 vessels had federal shrimp permits.

At the time of the implementation of the moratorium, economic projections indicated that the number of vessels participating in the Gulf shrimp fishery would continue to decline until at least 2012, primarily due to high fuel costs and competition with imports. Therefore, the decrease in participation is likely the result of the economic climate of the fishery. Furthermore, shrimp permits under the moratorium are fully transferable. Consequently, persons wishing to enter the fishery can freely do so by finding a willing seller from whom they can purchase a permit.

**(b) Historical fishing practices and the dependence on the fishery**

Competition with imports has impacted historical fishing practices and dependence on the shrimp fishery. This competition has escalated substantially since approximately 2001 with prices so low that many vessels have been forced out of the fishery. As stated in (a) above, these impacts have resulted from economic conditions within the fishery that would not be changed as a result of continuation of a moratorium.

**(c) Economics of the fishery**

The dynamics of the shrimp fishery and resulting economic conditions are primarily determined by factors largely beyond the control of shrimp harvesters and fishery managers in the Gulf. Primary determinants of the economic conditions in the industry are environmental conditions, shrimp prices, and fuel prices. For penaeid shrimp, abundance, and therefore catch per unit effort, are primarily dependent on environmental conditions. Fuel prices constitute a key factor in the economic conditions in the fishery because they typically account for a significant portion of shrimp harvesters' total costs. Imports have resulted in very low prices for shrimp that have been good for consumers but have forced many vessels in the commercial fishery to cease operations due to not being profitable. Shrimp imports have fallen in recent years because of early mortality syndrome that affected cultured shrimp in some major exporting countries; however, imports are again on the rise as countries take measures to prevent the disease. Again, these impacts have resulted from factors not related to the imposition of a moratorium, and continuing the moratorium is not likely to change the economic climate in the near future.

**(d) Capability of vessels in the fishery to engage in other fisheries**

Most of the vessels in the offshore shrimp fishery in the Gulf are large (from 60 to 90 feet in length). Consequently, they would probably not be able to operate profitably in other fisheries in the Gulf with the possible exception of the pelagic longline fishery that is also under a permit moratorium. The other major species in the reef fish and coastal migratory pelagics fisheries are less profitable than shrimp and they are governed by trip limits, hard quotas, and permit moratoria that could preclude these large vessels from entering these fisheries. As a result of the economic conditions in the shrimp fishery, some vessels have been sold or otherwise left the shrimp fishery and entered other fisheries on the east coast of the U.S. and other countries. On the other hand many vessels remain idle because they cannot operate profitably under the present price structure. It is currently unknown as to whether and to what extent these vessels will be able to reenter the shrimp fishery if profitability improves.

**(e) Cultural and social framework relevant to the fishery and any affected fishing communities**

Fishing communities that rely on shrimp have been heavily impacted by high fuel costs and competition from imports. The institution of a moratorium has provided some protection for the individuals and communities still involved in the fishery against a return to unprofitable conditions as a result of new entrants. Without the permit moratorium, negative effects would be expected for the shrimp industry as some of the identified problems that warranted the moratorium could be expected to return should the permits become open access. For existing shrimp permit holders and communities, this may result in some direct negative effects from increased competition.

**(f) Other relevant considerations**

Effort in the shrimp fishery is closely monitored to not exceed bycatch limits. Amendment 14 (GMFMC 2007) established a target effort level in specific areas of the western Gulf to protect juvenile red snapper. This target was originally set at 74% less than the effort in the benchmark years of 2001-2003. That 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. Also, in the 2014 biological opinion (NMFS 2014), analyses of the effects of the Southeast shrimp fishery on sea turtles were based on 2009 effort levels. If effort exceeds that level, NMFS will infer that the incidental take allowance has been exceeded and that effects on sea turtles were greater than analyzed. If sea turtle effects exceed those in the opinion, then NMFS must consider management measures to reduce effort. The moratorium on permits indirectly controls shrimping effort in federal waters and thereby bycatch levels. Allowing the moratorium to expire would remove this control.

## 1.2 Purpose and Need

### *Purpose for Action*

The purpose is to determine if limiting access to federal permits is necessary on a temporary or permanent basis to maintain the biological, social, and economic benefits to the shrimp fishery achieved under the moratorium, and to determine if the endorsement to harvest royal red shrimp is still necessary to monitor participation and activity in that component of the fishery.

### *Need for Action*

The need is to protect federally managed Gulf shrimp stocks while promoting catch efficiency, economic efficiency and stability, and obtain the best available information with which to manage the fishery.

## 1.3 History of Management

The 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 have since been removed from the FMP. The actions implemented through the FMP and its 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 Council with the shrimp management programs of the Gulf 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 the NMFS Southeast Regional Office (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 after Louisiana provided for that bycatch.

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 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 became available. A total allowable level of foreign fishing for royal red shrimp was eliminated; however, a redefinition of overfishing for royal red shrimp 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 maximum sustainable yield (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 optimum yield (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. 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 were 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 of 72% 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.

A **Framework Action** (2008) made revisions to BRD specifications and testing protocols, including lowering the needed bycatch reduction for BRDs in the western Gulf from 44% to 30% to be consistent with the eastern Gulf and the South Atlantic.

A **Framework Action** (2009) decertified three BRDs.

A **Framework Action** (2010) provisionally certified two BRDs.

**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.

A **Framework Action** certified two BRDs that were provisionally certified in 2010. It also lowered the effort reduction threshold established in Amendment 14 from 72% to 67%.

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

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

## 2.1 Action 1 – Address the Expiration of the Federal Shrimp Permit Moratorium in the Gulf of Mexico

**Alternative 1:** No Action. The moratorium on the issuance of new Gulf of Mexico (Gulf) federal commercial shrimp vessel permits expires on October 26, 2016. With expiration of the federal Gulf commercial shrimp permit moratorium, the commercial shrimp vessel permits will become open access permits, as they were prior to the moratorium, and therefore be available to any eligible applicants.

**Preferred Alternative 2:** Extend the moratorium on the issuance of federal Gulf commercial shrimp vessel permits; the moratorium will be extended for:

**Option a.** 5 years

**Preferred Option b.** 10 years

**Alternative 3:** Create a federal limited access permit for commercial shrimp vessels in the Gulf. To be eligible for a commercial shrimp vessel permit under the limited access system, vessels must have a valid or renewable federal Gulf commercial shrimp vessel permit on October 26, 2016. Federal Gulf commercial shrimp vessel permits will need to be renewed every year and all previous renewal, transfer, and reporting requirements would still be in effect.

**Discussion:** The moratorium on the issuance of federal Gulf commercial shrimp permits was established in Shrimp Amendment 13 (GMFMC 2005a). The purpose of the amendment was to help stabilize the shrimp fishery. Increasing fuel costs, decreasing shrimp prices, and increasing foreign shrimp imports all contributed to the overcapitalization of the commercial shrimp fleet. Since the implementation of the moratorium, the number of permits has decreased each year with terminations highest in 2009, when initially issued permits were terminated due to non-renewal (Table 1.1.1). Vessels were expected to continue to exit the fishery until the reduced number of permits allowed the resource to be harvested profitably (GMFMC 2005a). Effort in the offshore fishery has decreased, and landings have slightly declined (Figure 2.1.1). Additionally, the catch per unit effort (CPUE) for the offshore fishery has remained relatively constant since implementation of the moratorium (Figure 2.1.1).

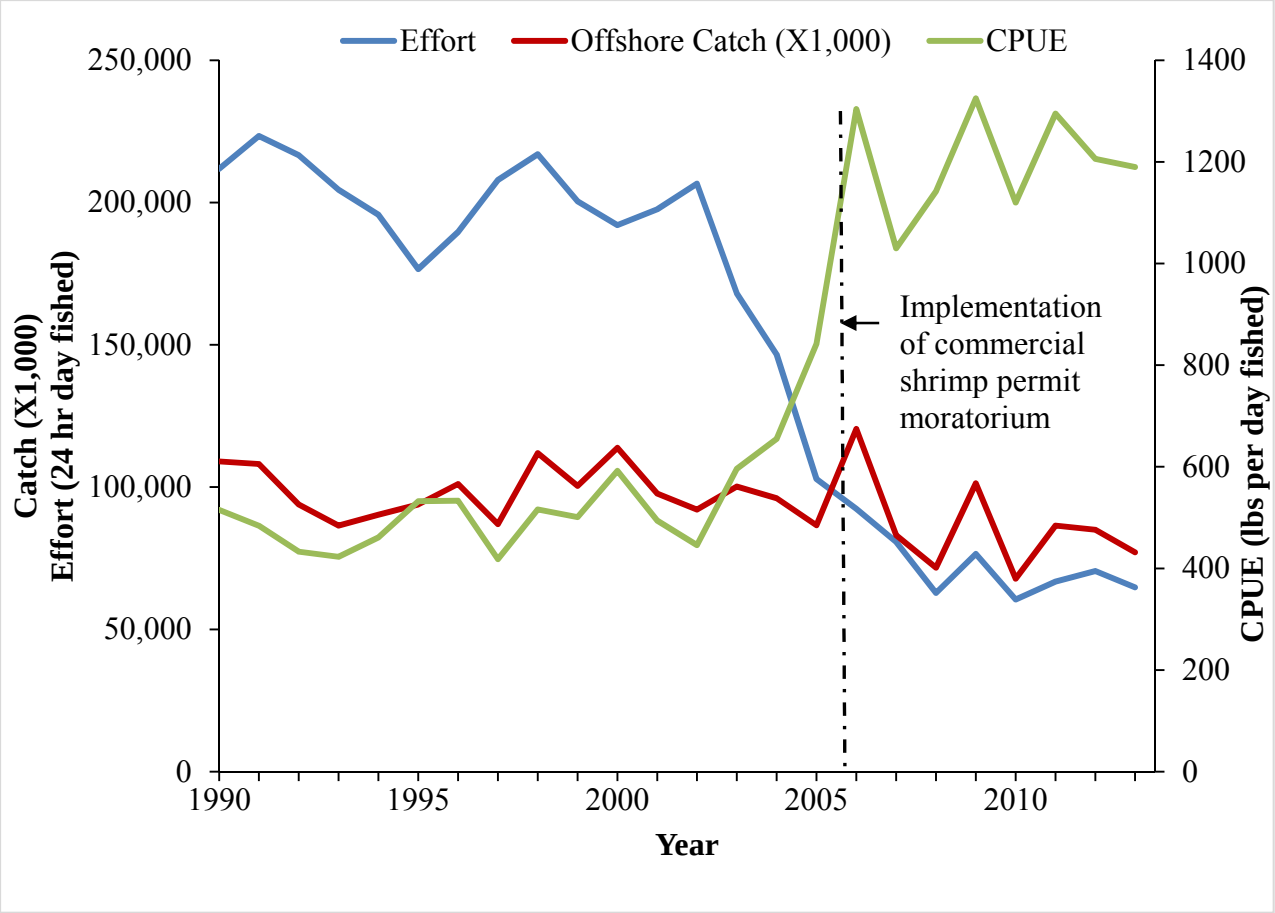


**Figure 2.1.1.** Catch, effort and CPUE from 1990-2013 for all shrimp caught in offshore waters[1] and landed in Gulf ports.[2]

**Alternative 1** would allow the moratorium to expire and federal Gulf shrimp permits would become open access. This would allow new entrants into the commercial shrimp fishery and could have negative effects if the fishery became overcapitalized. Overcapitalization and/or effort increases could lead to increases in protected resources and red snapper bycatch and potentially result in additional requirements for bycatch reduction or closures. Notably, the effort level in 2014 was just 0.1% below the target level that would trigger closures to protect juvenile red snapper (R. Hart, presentation to the Council, October 2015).

[1] Offshore waters 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.

[2] Although landings information can be obtained from both the Gulf Shrimp System (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, landings estimates are based solely on GSS data, and only shrimp landed at Gulf ports are taken into account. Further, because separate permits are not required to harvest each of the penaeid species, and multiple species of shrimp may be harvested simultaneously, these estimates include all shrimp harvested from offshore waters, regardless of whether they are federally managed.

**Alternative 1** would return the fishery back to an open access fishery and thus could undo any positive effects of the moratorium. Under this alternative, permits would no longer be transferrable because they would be freely available from the National Marine Fisheries Service (NMFS) and therefore, would have no market value.

**Preferred Alternative 2** would extend the permit moratorium for a specified number of years. This could reduce the number of federal permits if additional permits are terminated. Extending the moratorium for an additional 5 years (**Option a**) would require the Council to review the status of the fishery sooner than if the 10 year option (**Preferred Option b**) was selected. **Option a** gives less flexibility as the time required to produce an amendment to address an additional expiration date would be between 18 and 24 months, thus not allowing for more than 3 or 4 years of data to be incorporated before re-evaluating the expiration of the federal Gulf commercial shrimp permit (SPGM) extension. The recent/current instability of shrimp and fuel prices and the resulting uncertainty regarding future profitability would require more years of data collection to be properly evaluated. **Preferred Option b** would allow for more data collection and may result in a stable number of permits if fewer fishermen exit the fishery. The number of permits that have terminated has declined from 2010 until 2014, but the number of permits has not yet reached a minimum as the number of terminated permits per year has not reached zero.

**Alternative 3** would create a federal limited access permit for commercial shrimp vessels in the Gulf, which is similar to a moratorium, but without an expiration date. Current permit holders would receive the limited access permit if their vessel has a valid or renewable federal Gulf commercial shrimp permit on October 26, 2016. The new Federal Gulf commercial shrimp vessel permits would still need to be renewed every year and all previous renewal, transfer, and reporting requirements would still be in effect. This alternative would make the federal commercial shrimp fishery a limited access fishery until the Council took action to change that status, unlike a permit moratorium which has an expiration date. Additionally, the number of permits could continue to decline due to non-renewal of permits unless the Council implements other measures. For both **Preferred Alternative 2** and **Alternative 3**, persons wishing to enter the fishery could purchase a valid permit from another permit holder. A permit must be valid to be transferred; permits that have expired but are still renewable cannot be transferred unless and until they are renewed prior to termination.

## 2.2 Action 2 – Royal Red Shrimp Endorsement

**Alternative 1:** No Action. Continue to require a royal red shrimp endorsement to the federal Gulf shrimp vessel permit to harvest royal red shrimp from the Gulf EEZ. Endorsements are open access for entities with a federal Gulf shrimp vessel permit.

**Alternative 2:** Discontinue the royal red shrimp endorsement. Only the federal Gulf shrimp vessel permit is required to harvest royal red shrimp from the Gulf EEZ.

**Discussion:** Through Shrimp Amendment 13 (GMFMC 2005a), an endorsement for royal red shrimp was required to conduct commercial harvest of royal red shrimp. The purpose was to help inform data collectors about who the royal red shrimpers were and collect better information about the fishery. Royal red shrimp are primarily harvested from deep waters requiring greater capital investment; therefore, historically only a small number of boats have been engaged in harvesting royal red shrimp. Information for the fishery was lacking, particularly for catch, effort, operating costs, and maximum sustainable yield estimates. With the extensive number of endorsements and the small number of active royal red shrimping vessels (Table 2.2.1), it does not appear that the establishment of the endorsement has helped with collecting the desired data outlined in Shrimp Amendment 13.

**Table 2.2.1.** Number of royal red shrimp endorsements and the number of vessels actively landing royal red shrimp (as of May 26, 2015).

| Year | Number of Royal Red Shrimp Endorsements | Number of Unique Vessels Actively Landing Royal Red Shrimp |
|---|---|---|
| 2003 | | 17 |
| 2004 | | 17 |
| 2005 | | 12 |
| 2006 | | 6 |
| 2007 | 369 | 8 |
| 2008 | 388 | 8 |
| 2009 | 339 | 6 |
| 2010 | 325 | 7 |
| 2011 | 331 | 8 |
| 2012 | 351 | 7 |
| 2013 | 332 | 15 |
| 2014 | 323 | 7 |

Source: NMFS Southeast Fisheries Science Center (SEFSC).

**Alternative 1** would continue the royal red shrimp endorsement requirement. Anyone with a federal Gulf commercial shrimp permit would also need a royal red shrimp endorsement to harvest royal red shrimp. These endorsements are available to anyone with a federal Gulf commercial shrimp permit. This alternative would continue to provide a readily accessible royal red shrimp database, although its usefulness is limited. Additionally, the Council is considering

new areas closed to bottom tending gear to protect deepwater corals. The Council is in the early stages of exploring potential deepwater coral areas that could become coral habitat areas of particular concern (HAPC) and determine if specific fishing regulations would or would not be applied to these proposed areas. If the Council proceeds with closing some deepwater coral areas and limiting various gear types, some royal red shrimpers would be affected as they have stated they currently fish around some of the proposed coral HAPCs and often enter some of the areas when retrieving their nets. However, the nets are not on the bottom during these operations. Some royal red shrimp fishers have requested their vessels be considered for an exemption from the potential coral HAPC closures due to their fishing practices and knowledge of the areas. If the royal red shrimp endorsement is maintained and the Council decides to accommodate these fishermen, it could allow law enforcement to determine which shrimping vessels are allowed in the areas.

**Alternative 2** would eliminate the requirement for a royal red shrimp endorsement; however, a federal Gulf commercial shrimp permit would still be required to harvest royal red shrimp. This would decrease administrative costs to NMFS and be a minor cost savings of ten dollars to applicants.[3] Additionally, an economic database specific to royal red shrimp would not be maintained, although royal red shrimp landings data are still collected. Further, many more royal red shrimp endorsements are issued than the number of vessels actually harvesting royal red shrimp.

[3] To purchase or renew a commercial permit costs $25 for the first permit and $10 for each additional permit or endorsement.

# 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 2013 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 Shrimp 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 2013, annual commercial landings have ranged from approximately 55 to 87 mp of tails (Table 3.1.1). The MSY established in Shrimp 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 the Florida Keys. Annual commercial landings in 2003 through 2013 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 Shrimp 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 2013 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.

| Year | All Species | Brown | White | Pink | Royal Red |
|---|---|---|---|---|---|
| 2003 | 155,242,184 | 83,949,224 | 60,996,687 | 9,943,414 | 352,859 |
| 2004 | 157,739,916 | 74,430,438 | 72,873,648 | 10,133,819 | 302,011 |
| 2005 | 132,780,625 | 58,574,505 | 65,314,218 | 8,722,912 | 168,990 |
| 2006 | 181,475,558 | 87,441,817 | 86,216,341 | 7,654,077 | 163,323 |
| 2007 | 138,509,322 | 70,560,173 | 64,305,379 | 3,414,746 | 229,024 |
| 2008 | 118,991,711 | 50,236,551 | 63,728,659 | 4,888,385 | 138,116 |
| 2009 | 155,591,111 | 75,500,221 | 75,296,070 | 4,621,755 | 173,065 |
| 2010 | 110,757,364 | 45,236,923 | 59,596,612 | 5,796,471 | 127,358 |
| 2011 | 136,277,325 | 73,107,015 | 58,265,392 | 4,709,564 | 195,354 |
| 2012 | 136,041,709 | 65,204,529 | 67,246,784 | 3,412,738 | 177,658 |
| 2013 | 126,048,427 | 66,305,319 | 56,360,746 | 3,182,863 | 199,499 |
| Average | 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 September 21, 2015, there were 1,464 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.

Commercial shrimp vessels are classified by NMFS as part of either a nearshore or an offshore fleet. 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 federal shrimp vessel permits, NMFS maintains three types of databases/files, two of which are largely dependent on port agent records. One, the shrimp landings file or GSS 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 reports as 24-hour days fished;

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 state 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 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. Gulf water temperatures range from 12º C to 29º C (54º F to 84º F) depending on depth and season. In the Gulf, adult penaeid shrimp are found in 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 areas associated with them (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 butterfish. Although red snapper comprise a very small percentage (0.3% by weight) of overall bycatch, the mortality associated with this bycatch affects the recruitment of older fish (age 2 and above) to the directed fishery and ultimately the recovery of the red snapper stock.

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

If the Council were to select Action 1, Alternative 1, there may be an increase in bycatch in the shrimp fishery if the number of permits were to increase. Bycatch levels and associated implications will continue to be monitored and issues will be addressed based on new information. More details about bycatch in Gulf shrimp fishery can be found in the bycatch practicability analysis in Appendix B.

### 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 most recent biological opinion evaluated 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 Gulf shrimp fishery was considered specifically as part of this larger consultation. 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 GMFMC'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 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.[4]

### 3.3.4 Status of the Shrimp Stocks

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

## 3.4 Description of the Economic Environment

Descriptions of the Gulf shrimp fishery are contained in previous amendments and NMFS regulatory actions and are incorporated herein by reference [see Shrimp Amendment 13 (GMFMC 2005a); Shrimp Amendment 14/Reef Fish Amendment 27 (GMFMC 2007); Regulatory Impact Review and Regulatory Flexibility Act Analysis for Making Technical Changes to TEDs to Enhance Turtle Protection in the Southeastern United States Under Sea Turtle Conservation Regulations (NMFS 2002); Regulatory Impact Review and Regulatory Flexibility Act Analysis, and Social Impact Assessment for the Proposed Rule to Revise the

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

Gulf/South Atlantic Bycatch Reduction Device Testing Manual and Modify the Bycatch Reduction Criterion for Bycatch Reduction Devices Used in the Penaeid Shrimp Fishery West of Cape San Blas, Florida (NMFS 2006), Framework Action to Establish Funding Responsibilities for the Electronic Logbook Program in the Shrimp Fishery of the Gulf of Mexico (GMFMC 2013), Shrimp Amendment 16 (GMFMC 2014)]. The following discusses certain key characteristics of the Gulf shrimp fishery.

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

The harvesting sector is composed of two types of fleets: 1) an inshore segment, mostly active in state waters and very diverse; and 2) an offshore segment, largely active in federal waters and almost always using trawl gear. In 2003, a federal shrimp permit was instituted requiring vessels to possess the permit when fishing for penaeid shrimp in the Gulf EEZ. A moratorium on the issuance of new federal shrimp permits was established in 2006. Currently, vessels must possess a shrimp moratorium permit (SPGM) when fishing for penaeid shrimp in the Gulf EEZ. In addition, a royal red shrimp endorsement, which is an open access permit for those holding a SPGM, is required for harvesting royal red shrimp in the Gulf.

**Selected Characteristics of Participating Vessels in the Shrimp Fishery**

Selected characteristics of participation in the Gulf shrimp fishery in 2003 through 2013 are summarized in Table 3.4.1. Estimates of the total number of active shrimp vessels are based on the number of unique vessels landing shrimp as recorded in the Gulf Shrimp System (GSS) database. The number of active permitted vessels was generated by cross referencing GSS landings data with the NMFS permit database. The number of active vessels (permitted and non-permitted) is likely to be an underestimate of the "actual" number of active vessels/permits based on other research (Travis 2010). However, this determination of active vessels provides a means of standardizing active participation in the Gulf shrimp fishery over a longer time frame.

**Table 3.4.1.** Selected characteristics of participation in the Gulf shrimp fishery, 2003-2013.

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of active vessels* | 7,136 | 6,481 | 5,467 | 4,871 | 4,717 | 4,152 | 4,640 | 4,510 | 5,285 | 5,191 | 4,669 |
| Percent of active vessels with a federal permit | 31 | 33 | 36 | 34 | 33 | 30 | 27 | 25 | 22 | 22 | 24 |
| Number of active vessels with federal permits | 2,226 | 2,120 | 1,951 | 1,644 | 1,553 | 1,237 | 1,232 | 1,132 | 1,187 | 1,148 | 1,110 |
| Percent of active vessels without a federal permit | 69 | 67 | 64 | 66 | 67 | 70 | 73 | 75 | 78 | 78 | 76 |
| Number of active vessels without a federal permit | 4,910 | 4,361 | 3,516 | 3,227 | 3,164 | 2,915 | 3,408 | 3,378 | 4,098 | 4,043 | 3,559 |
| | | | | | | | | | | | |
| Number of federally permitted vessels** | 2,688 | 2,791 | 2,713 | 2,578 | 2,514 | 1,930 | 1,764 | 1,685 | 1,641 | 1,587 | 1,544 |
| Percent Active | 83 | 76 | 72 | 64 | 62 | 64 | 70 | 67 | 72 | 72 | 72 |
| Percent Inactive | 17 | 24 | 28 | 36 | 38 | 36 | 30 | 33 | 28 | 28 | 28 |
| | | | | | | | | | | | |
| Landings (million lbs, heads off) | 161 | 162 | 135 | 183 | 140 | 120 | 155 | 111 | 137 | 134 | 128 |
| Gross revenues (million 2001 dollars) | 347 | 341 | 320 | 348 | 306 | 304 | 261 | 270 | 346 | 314 | 389 |
| Percent of landings by Federally permitted vessels | 65 | 65 | 69 | 71 | 68 | 66 | 69 | 63 | 67 | 63 | 60 |
| Percent of gross revenues by Federally permitted vessels | 76 | 77 | 78 | 79 | 78 | 77 | 76 | 74 | 78 | 72 | 72 |

*****Active means a vessel had at least 1 lb of Gulf shrimp landings in a year based on GSS data provided by J. Primrose, July 27, 2015. ******The number of federally permitted vessels each year was based on permit counts in the year the survey was undertaken. These numbers would slightly differ from what is currently known about the number of permits issued for those survey years. "Active" vessels are those landing shrimp as recorded in the GSS database. Source: Liese, 2011, 2013, 2014; Liese and Travis, 2010; Liese et al., 2009a, 2009b. The Annual Economic Survey of Federal Gulf Shrimp Permit Holders, NMFS-SEFSC.

The number of permitted and non-permitted active vessels (i.e., vessels reporting landings in the Gulf shrimp fishery) has generally been above 4,000 (Table 3.4.1). Approximately 22% to 36% of active vessels are federally permitted vessels (vessels with SPGM permit). Despite being fewer in number, federally permitted vessels have accounted for the majority of shrimp landings (60% to 71%) and revenues (72% to 79%) by all active vessels.

**Vessels with Royal Red Shrimp Endorsements**

The royal red shrimp sector is a relatively small segment of the Gulf shrimp fishery. As of September 21, 2015, there were 1,464 valid or renewable SPGM permits and 298 valid GRRS endorsements. On average (2006-2013), royal red shrimp accounted for less than 1% of total Gulf shrimp landings and dockside revenues. The deep-water nature of the fishery, the limited geographic location of known fishing grounds, and the equipment needed to fish for royal red shrimp may have contributed to the relatively low share of the royal red shrimp landings and revenues to the overall shrimp landings and revenues in the Gulf. A detailed discussion of vessels participating in the royal red shrimp fishery is provided in Shrimp Amendment 16 (GMFMC, 2015).

**Key Economic and Financial Characteristics of Federally Permitted Shrimp Vessels**

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

The type of economic data the survey collects is based on an accounting framework of money flows and values associated with the productive activity of commercial shrimping. With these data, three financial statements (the balance sheet, the cash flow statement, and the income statement) are prepared to give a comprehensive overview of the financial and economic situation of the offshore shrimp fishery.[5] Table 3.4.2 shows a summary of these financial statements. In this table, financial statements for 2010 and onward include costs and revenues related to the Deepwater Horizon MC 252 (DWH) oil spill. Dollar values are averages in 2012 dollars.

The year 2010 was unique for the operations of many shrimp vessels in the Gulf because of the DWH oil spill. This oil spill and BP's responses had a confounding effect on the economics of the Gulf shrimp fishery in 2010 and onward. In 2010, the majority of vessels (66%) reported receiving oil spill-related revenues. The two primary sources of this revenue were damage claims (passive income) and revenue generated by participation in BP's vessel of opportunity program (VOOP) where vessels were hired to clean up oil. Of the surveyed vessels in 2010, 28% participated in the VOOP. Both sources provided substantial revenue for participating vessels, thereby obscuring the economics of the Gulf shrimp fishery. Further, vessels

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

participating in VOOP incurred non-negligible costs unrelated to commercial fishing. For more details on DWH-related revenues, see Liese (2011, 2013, and 2014). It is noted that some shrimp vessels continued to receive DWH-related revenues after 2010, but the amounts in these later years were small relative to that received in 2010. The average vessel shows a fair amount of equity that rose through the years (Table 3.4.2). This resulted from a combination of an increasing market value of the assets (vessel being the main asset) and declining liabilities (mainly loans), except for a dip in asset value in 2008.

Except for 2007, the average vessel shows positive net cash flows. The absolute amount of net cash flows may be relatively low in general, but it does indicate a certain level of solvency for continued operation in the shrimp fishery, at least in the short term. Cognizant of the importance of the DWH-related revenues, the three years after the DWH oil spill recorded the three highest net cash flows for the years 2006 through 2013. Revenues from shrimp were the major source of cash inflows while fuel and labor (crew and hired captain) costs were the top sources of cash outflows.

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

Table 3.4.3 provides a summary of the financial statements for active vessels. Active vessels are defined as vessels with at least one pound of Gulf shrimp landings in a year (based on GSS data provided by J. Primrose, July 27, 2015). Similar to averages for all federally permitted vessels, average equity for active vessels have been increasing. However, averages focusing on active vessels highlight the fragile economic state of shrimp harvesters, as illustrated by average net cash flows and economic returns for active vessels (Table 3.4.3).

The future economic and financial prospects for the shrimp industry could revert to those of the previous years as DWH-related activities dwindle. It may only be noted that shrimp imports have fallen in recent years as a result of diseases (early mortality syndrome) that affected cultured shrimp in some major exporting countries, allowing domestic prices for shrimp to temporarily increase. In addition, fuel prices, a major cost item for shrimp vessel operation, have fallen in recent months, but it is not known if prices would rebound to their previous high levels in the near future.

Table 3.4.4 provides a summary of the 2012 financial statements for federally permitted vessels with a royal red endorsement. Compared to active vessels without a royal red endorsement, vessels with a royal red endorsement had more equity in 2012. However, for 2012, the return on equity for royal red vessels was approximately equal to 50% of the return for active vessels in 2012.

**Table 3.4.2.** Economic and financial characteristics of an average vessel with federal Gulf commercial shrimp permit (SPGM), 2006-2013. Parentheses indicate negative values and all dollar values are averages in 2001 dollars.

| Year | 2006 | 2007 | 2008 | 2009 | 2010*** | 2011 | 2012 | 2013* |
|---|---|---|---|---|---|---|---|---|
| Number of observations | 484 | 505 | 497 | 427 | 429 | 456 | 442 | 380 |
| **Balance Sheet** | | | | | | | | |
| Assets | 156,942 | 173,087 | 172,811 | 175,304 | 190,512 | 237,108 | 230,995 | 223,251 |
| Liabilities | 81,757 | 73,436 | 60,033 | 51,274 | 41,262 | 33,417 | 39,517 | 33,119 |
| Equity | 75,185 | 99,650 | 112,778 | 124,030 | 149,250 | 203,691 | 191,478 | 190,132 |
| **Cash Flow** | | | | | | | | |
| Inflow | 203,272 | 168,514 | 181,179 | 177,680 | 278,245 | 256,532 | 298,446 | 284,819 |
| Outflow | 187,800 | 173,488 | 177,520 | 170,755 | 199,234 | 227,930 | 243,243 | 241,767 |
| Net cash flow | 15,472 | (4,975) | 3,659 | 6,925 | 79,011 | 28,602 | 55,203 | 43,052 |
| **Income Statement** | | | | | | | | |
| Revenue (commercial fishing operations) | 193,062 | 162,678 | 178,967 | 174,033 | *** | 244,382 | 247,594 | 248,626 |
| Expenses | 195,347 | 177,693 | 183,046 | 173,427 | 199,970 | 233,190 | 244,465 | 244,059 |
| *Variable costs – Non-labor* | 50.6% | 49.5% | 53.7% | 50.1% | 42.4% | 47.8% | 52.0% | 48.0% |
| *Variable costs – Labor* | 25.9% | 25.2% | 25.3% | 27.1% | 32.6% | 32.0% | 28.2% | 30.5% |
| *Fixed costs* | 23.5% | 25.4% | 21.0% | 22.8% | 25.0% | 20.2% | 19.8% | 21.5% |
| Net revenue from operations | (2,285) | (15,015) | (4,079) | 606 | *** | 11,192 | 3,129 | 4,567 |
| Net receipts from non-operating activities | 4,630 | 682 | (1,715) | 383 | *** | 10,067 | 48,458 | 33,575 |
| Net revenue before tax (profit or loss) | 2,345 | (14,333) | (5,794) | 989 | 75,625 | 21,259 | 51,587 | 38,141 |
| **Returns** | | | | | | | | |
| Economic Return | (1.5%) | (8.7%) | (2.4%) | 0.3% | *** | 4.7% | 1.4% | 2.0% |
| Return on Equity | 3.1% | (14.4%) | (5.1%) | 0.8% | 50.7% | 10.4% | 26.9% | 20.1% |

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

**Table 3.4.3.** Economic and financial characteristics of an average Gulf-shrimp-ACTIVE vessel with federal shrimp permit (SPGM), 2006-2013. Parentheses indicate negative values and all dollar values are averages in 2001 dollars.

| Year | 2006 | 2007 | 2008 | 2009 | 2010*** | 2011 | 2012 | 2013* |
|---|---|---|---|---|---|---|---|---|
| Number of observations | 386 | 388 | 383 | 348 | 332 | 368 | 370 | 293 |
| **Balance Sheet** | | | | | | | | |
| Assets | 170,433 | 160,065 | 154,965 | 162,908 | 173,344 | 181,805 | 189,456 | 192,927 |
| Liabilities | 92,397 | 80,867 | 58,054 | 55,116 | 41,974 | 33,216 | 39,645 | 28,695 |
| Equity | 78,036 | 79,198 | 96,911 | 107,792 | 131,370 | 148,589 | 149,811 | 164,231 |
| **Cash Flow** | | | | | | | | |
| Inflow | 229,355 | 191,673 | 202,512 | 193,210 | 194,157 | 255,777 | 309,291 | 323,066 |
| Outflow | 215,023 | 196,807 | 199,527 | 188,222 | 194,785 | 234,828 | 257,267 | 273,576 |
| Net cash flow | 14,333 | (5,135) | 2,985 | 4,988 | (628) | 20,950 | 52,023 | 49,490 |
| **Income Statement** | | | | | | | | |
| Revenue (commercial fishing operations) | 217,287 | 184,749 | 199,817 | 188,807 | 192,428 | 241,463 | 251,068 | 279,436 |
| Expenses | 223,849 | 201,642 | 207,130 | 191,630 | 196,086 | 240,350 | 258,924 | 278,224 |
| *Variable costs – Non-labor* | 51.6% | 53.0% | 56.6% | 52.4% | 50.8% | 52.4% | 55.6% | 49.8% |
| *Variable costs – Labor* | 25.3% | 23.9% | 24.2% | 25.4% | 27.2% | 27.7% | 25.1% | 29.2% |
| *Fixed costs* | 23.1% | 23.0% | 19.2% | 22.2% | 21.9% | 19.9% | 19.2% | 20.9% |
| Net revenue from operations | (6,562) | (16,893) | (7,313) | (2,823) | (3,657) | 1,113 | (7,856) | 1,212 |
| Net receipts from non-operating activities | 5,761 | 994 | (1,154) | 859 | (565) | 12,248 | 55,690 | 40,969 |
| Net revenue before tax (profit or loss) | (801) | (15,899) | (8,467) | (1,964) | (4,222) | 13,362 | 47,834 | 42,181 |
| **Returns** | | | | | | | | |
| Economic Return | (3.9%) | (10.6%) | (4.7%) | (1.7%) | (2.1%) | 0.6% | (4.1%) | 0.6% |
| Return on Equity | (1.0%) | (20.1%) | (8.7%) | (1.8%) | (3.2%) | 9.0% | 31.9% | 25.7% |

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

**Table 3.4.4.** Economic and financial characteristics of an average Gulf-shrimp-active vessel with federal shrimp permit (SPGM) and a royal red endorsement, 2012. Dollar values are averages in 2001 dollars.

| | |
|---|---|
| Year | 2012 |
| Number of observations | 70 |
| **Balance Sheet** | |
| Assets | $298,303 |
| Liabilities | $30,324 |
| Equity | $267,980 |
| **Cash Flow** | |
| Inflow | $369,366 |
| Outflow | $317,028 |
| Net cash flow | $52,339 |
| **Income Statement** | |
| Revenue (commercial fishing operations) | $327,903 |
| Expenses | $323,740 |
| *Variable costs – Non-labor* | 47.0% |
| *Variable costs – Labor* | 29.3% |
| *Fixed costs* | 23.7% |
| Net revenue from operations | $4,162 |
| Net receipts from non-operating activities | $39,433 |
| Net revenue before tax (profit or loss) | $43,595 |
| **Returns** | |
| Economic Return | 1.4% |
| Return on Equity | 16.3% |

Source: Personal communication, Christopher Liese (NMFS-SEFSC), September 4, 2015

### Dealers and Processors

Between 2003 and 2013, the number of shrimp dealers ranged from 558 (2008) to 839 (2003). In 2013, there were 600 dealers. Table 3.4.5 provides selected characteristics for Gulf shrimp dealers. As illustrated by the percentage of the value of shrimp purchases relative to total seafood purchases, shrimp dealers in the Gulf are very specialized. Between 2003 and 2013, annual shrimp purchases account for more than 75% of their total annual seafood purchases. Between 2003 and 2013, shrimp dealers in the Gulf annual shrimp purchases by dealers averaged $320.2 million (in 2001 dollars).

Selected characteristics for Gulf shrimp processors are provided in Table 3.4.6. Between 2003 and 2013, the annual number of shrimp processors averaged 54, approximately. During the same time period, the annual value of processed shrimp averaged $501.2 million (in 2001 dollars).

Shrimp processors are also very specialized. Shrimp products accounted for more than 90 % of the total value processed between 2003 and 2013.

**Imports**

On average, between 2003 and 2013 the United States has imported more than 1.2 billion pounds (product weight) of shrimp products annually. The value of imported shrimp products averaged 3.6 billion (2001 dollars) annually. Table 3.4.7 provides annual pounds and value of shrimp imports and the share of imports by country of origin. Although Thailand continues to be the primary country of origin for shrimp products imported into the United States, several countries have increased their market share in recent years. For example, India's share of the imports rose from 10.9% in 2003 to 19.1% in 2013. Other countries that have significantly increased their market share include Ecuador and Indonesia. Conversely, imports from China have decreased form 11.8% in 2003 to 4.5% in 2013.

**Table 3.4.5.** Selected characteristics of Gulf shrimp dealers, 2003-2013. Dollar values are in 2001 dollars.

| Years | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of Dealers** | 839 | 850 | 688 | 682 | 663 | 558 | 593 | 726 | 896 | 808 | 600 |
| **Million Pounds of shrimp purchased (whole weight)*** | 258.47 | 261.01 | 209.99 | 287.57 | 222.59 | 186.19 | 228.64 | 175.06 | 184.86 | 201.65 | 202.36 |
| **Average price per pound (mean, whole weight)** | $1.36 | $1.33 | $1.50 | $1.20 | $1.38 | $1.62 | $1.09 | $1.56 | $1.85 | $1.49 | $1.93 |
| **Value of purchased shrimp (Million 2001$)** | $352.76 | $346.30 | $314.57 | $345.04 | $307.50 | $300.86 | $248.41 | $273.81 | $341.40 | $301.27 | $389.69 |
| **Total Value of all products purchased by Gulf shrimp dealers (Million 2001$)** | $414.88 | $408.88 | $354.84 | $394.04 | $346.96 | $343.16 | $291.04 | $317.28 | $400.22 | $358.62 | $448.83 |
| **Average pounds of shrimp purchased per dealer (median, whole weight)** | 4,110 | 3,532 | 4,102 | 4,477 | 3,929 | 5,141 | 4,938 | 4,018 | 3,738 | 4,500 | 4,059 |
| **Average value of shrimp purchased per dealer (median, 2001$)** | $7,933 | $6,601 | $7,583 | $8,144 | $6,556 | $10,313 | $7,616 | $7,429 | $7,831 | $9,763 | $8,337 |
| **Average total value of all products purchased by Gulf shrimp dealers, per dealer (median, 2001$)** | $17,721 | $14,319 | $14,449 | $12,503 | $10,399 | $15,241 | $11,464 | $9,888 | $14,399 | $16,200 | $18,197 |
| **Average percent of total seafood purchased value is shrimp, per dealer (mean)** | 77 | 78 | 83 | 84 | 85 | 83 | 83 | 86 | 84 | 83 | 81 |

Source: NMFS-SERO, ALS 2003-2013. *Only shrimp species included in the GSS database are included in these estimates. A Gulf shrimp dealer is a dealer located in Gulf that purchased shrimp regardless of where shrimp harvested. Most averages are reported in terms of medians rather than means because the data distributions are highly skewed.

**Table 3.4.6.** Selected characteristics of the GULF shrimp processing industry, 2003-2013. Dollar values are in 2001 dollars.

| Years | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Number of Processors** | 62 | 56 | 54 | 52 | 47 | 50 | 51 | 54 | 50 | 67 | 55 |
| **Million Pounds of shrimp processed (whole weight)*** | 343.99 | 338.91 | 297.67 | 354.74 | 273.01 | 260.82 | 335.02 | 271.12 | 294.43 | 355.60 | 283.78 |
| **Average processed price per pound (mean, whole weight)** | $1.71 | $1.60 | $1.57 | $1.51 | $1.35 | $1.56 | $1.34 | $2.18 | $1.52 | $1.53 | $2.02 |
| **Value of processed shrimp (Million 2001$)** | $589.03 | $542.04 | $466.80 | $535.07 | $369.27 | $406.00 | $448.99 | $591.44 | $447.10 | $543.23 | $574.14 |
| **Total Value of all products processed by Gulf shrimp processors (Million 2001$)** | $643.26 | $585.78 | $509.85 | $555.51 | $374.42 | $430.92 | $483.94 | $632.87 | $481.73 | $580.92 | $636.35 |
| **Average pounds of shrimp processed per processor (median, Million pounds whole weight)** | 2.22 | 2.71 | 3.36 | 4.80 | 3.98 | 2.56 | 2.87 | 1.87 | 3.06 | 2.35 | 1.80 |
| **Average value of processed shrimp per processor (median, Million 2001$)** | $3.85 | $4.37 | $3.38 | $5.97 | $3.64 | $2.84 | $3.05 | $2.15 | $3.03 | $3.12 | $3.54 |
| **Average total value of all products processed by shrimp processors, per processor (median, Million 2001$)** | $4.55 | $6.77 | $4.87 | $6.50 | $4.21 | $3.33 | $4.02 | $2.56 | $3.91 | $3.44 | $5.05 |
| **Average percent of total processed value is shrimp, per processor (mean)** | 86 | 88 | 91 | 96 | 96 | 94 | 94 | 88 | 90 | 93 | 87 |
| **Average number of employees per processor (median)** | 36 | 40 | 36 | 36 | 38 | 28 | 35 | 28 | 34 | 31 | 35 |

*Only includes shrimp processed for human consumption and thus excludes shrimp processed for bait or shrimp meal. Most averages are reported in terms of medians rather than means because the data distributions are highly skewed. Source: personal communication, Office of Science and Technology, Sept 8, 2015.

**Table 3.4.7.** Annual pounds and value of shrimp imports and share of imports by country, 2003-2013. Dollar values are in 2001 dollars.

| | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pounds of Shrimp Imports (product weight, Million pounds) | 1,012.9 | 1,112.2 | 1,165.9 | 1,301.4 | 1,227.8 | 1,243.9 | 1,209.3 | 1,231.5 | 1,267.9 | 1,176.6 | 1,118.6 |
| Value of Shrimp Imports (Million 2001$) | $3,634.2 | $3,464.4 | $3,344.4 | $3,654.1 | $3,368.5 | $3,464.5 | $3,164.3 | $3,555.2 | $4,188.3 | $3,554.7 | $4,141.1 |
| | | | | | | | | | | | |
| **Share of Imports by Country** | | | | | | | | | | | |
| THAILAND | 26.5 | 23.7 | 26.8 | 30.9 | 31.7 | 31.4 | 35.8 | 35.3 | 33.3 | 26.9 | 17.1 |
| VIET NAM | 15.8 | 10.5 | 12.0 | 10.4 | 11.8 | 11.7 | 10.1 | 11.9 | 10.1 | 10.0 | 13.8 |
| CHINA* | 11.8 | 9.2 | 5.6 | 8.0 | 6.0 | 6.1 | 6.2 | 6.4 | 5.6 | 5.1 | 4.5 |
| INDIA | 10.9 | 9.8 | 8.6 | 6.1 | 5.0 | 3.5 | 4.4 | 7.2 | 10.2 | 12.9 | 19.1 |
| MEXICO | 7.8 | 8.9 | 8.7 | 7.8 | 9.2 | 8.3 | 8.8 | 5.3 | 5.6 | 5.7 | 5.0 |
| ECUADOR | 5.6 | 5.8 | 7.4 | 7.8 | 7.9 | 8.3 | 8.7 | 9.5 | 10.3 | 12.5 | 12.4 |
| INDONESIA | 4.5 | 9.2 | 10.2 | 10.4 | 11.4 | 15.4 | 13.0 | 11.5 | 13.5 | 14.8 | 17.2 |
| BANGLADESH | 2.2 | 4.7 | 3.7 | 4.6 | 3.9 | 3.1 | 2.4 | 2.1 | 1.2 | 0.9 | 1.0 |
| MALAYSIA | 0.2 | 3.3 | 3.2 | 3.3 | 3.9 | 4.5 | 3.0 | 3.5 | 4.1 | 3.8 | 1.5 |
| ALL OTHERS | 14.7 | 15.0 | 13.8 | 10.6 | 9.2 | 7.7 | 7.5 | 7.4 | 6.2 | 7.3 | 8.2 |

* Does not include imports from Hong Kong, Taipei, or Macao. Source: Pounds of Shrimp Imports (personal communication, GOM Data Management, Sept. 17, 2015 http://www.st.nmfs.noaa.gov/commercial-fisheries/market-news/related-links/market-news-archives/index). Values and market share by country (personal communication, Office of Science and Technology, Sept. 15, 2015.

## 3.5 Description of the Social Environment

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

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

**Regional Quotients by Community**

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

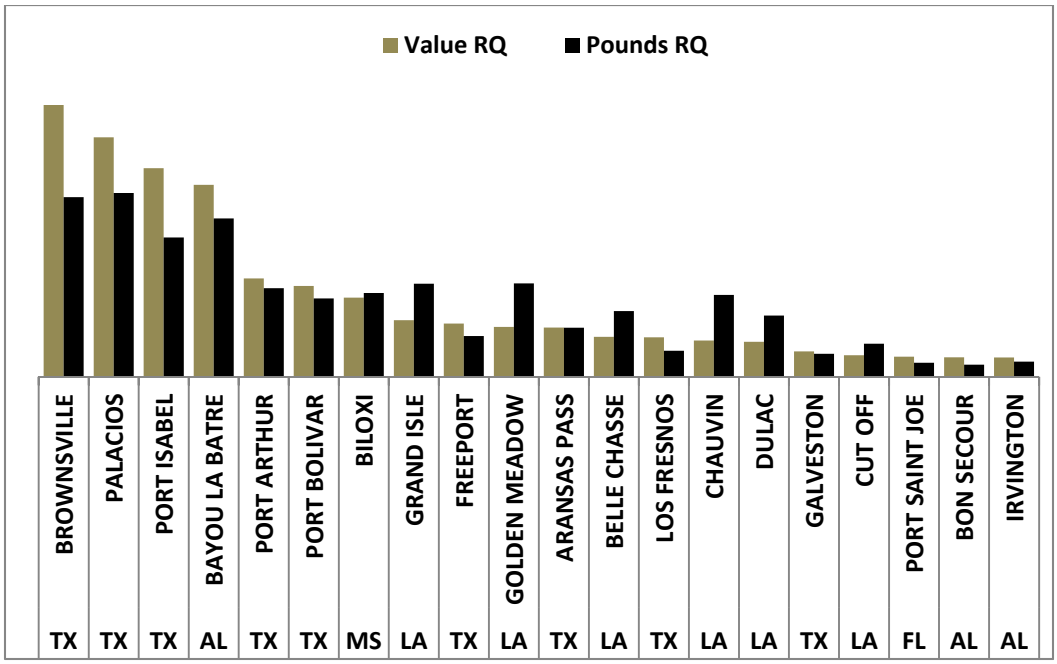


**Figure 3.5.1.** Top twenty communities ranked on value regional quotient (RQ) for brown shrimp in the Gulf.
Source: SERO ALS 2013

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

Pink shrimp landings are primarily in Florida with the majority of landings in Fort Myers Beach (Figure 3.5.2). Tampa, Tarpon Springs, and Key West follow with Bayou La Batre, Alabama fifth in ranking. There are several Texas communities within the top twenty, although pink shrimp landed in Texas may have been harvested elsewhere since the majority of pink shrimp are harvested off the west coast of Florida. Mislabeling of brown shrimp in Texas may account for some pink shrimp landings in that state.

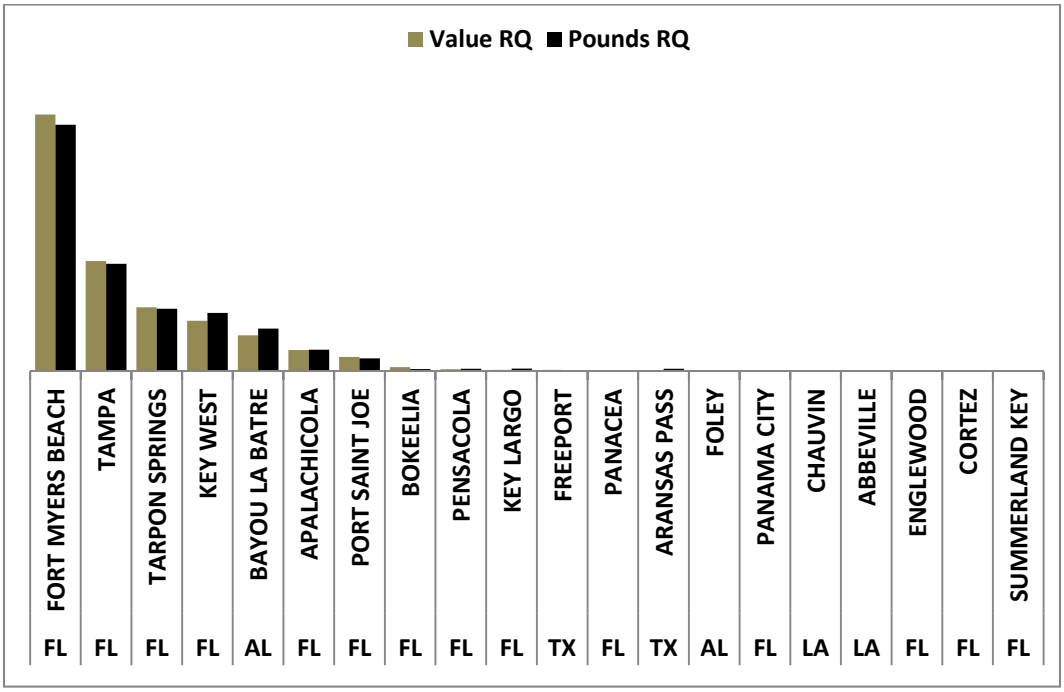


**Figure 3.5.2.** Top twenty communities ranked on value regional quotient (RQ) for pink shrimp in the Gulf.
Source: SERO ALS 2013

White shrimp landings (Figure 3.5.3) are primarily in the northern and western Gulf with Port Arthur, Texas having the highest RQ in terms of pounds and value. Other communities have comparable RQs with regard to pounds landed but are not near the value quotient found in Port Arthur.

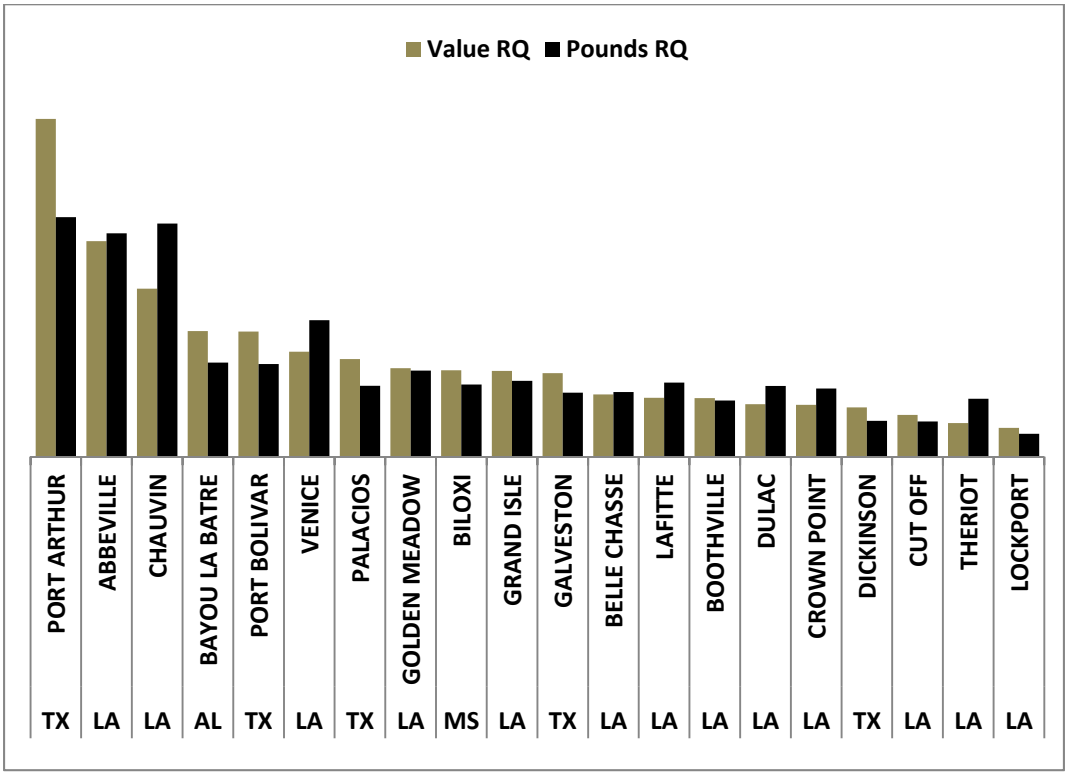


**Figure 3.5.3.** Top twenty communities based upon pounds and value regional quotient (RQ) for white shrimp in the Gulf.
Source: SERO ALS 2013

Royal red shrimp landings are primarily in Alabama and were documented in GMFMC 2014. The communities of Bon Secour and Coden, AL were the primary ports of landings.

When the combined landings of shrimp are compared in Figure 3.5.4, the landings are dominated by Texas communities with Bayou La Batre, AL third in terms of value. Overall, communities from Texas and Louisiana dominate the top twenty communities in terms of RQ of value for overall shrimp landings (brown, white, pink, royal red, rock, seabob). Again, many Louisiana communities have a higher RQ for pounds as displayed for some single species which indicates lower prices for smaller shrimp in most cases.

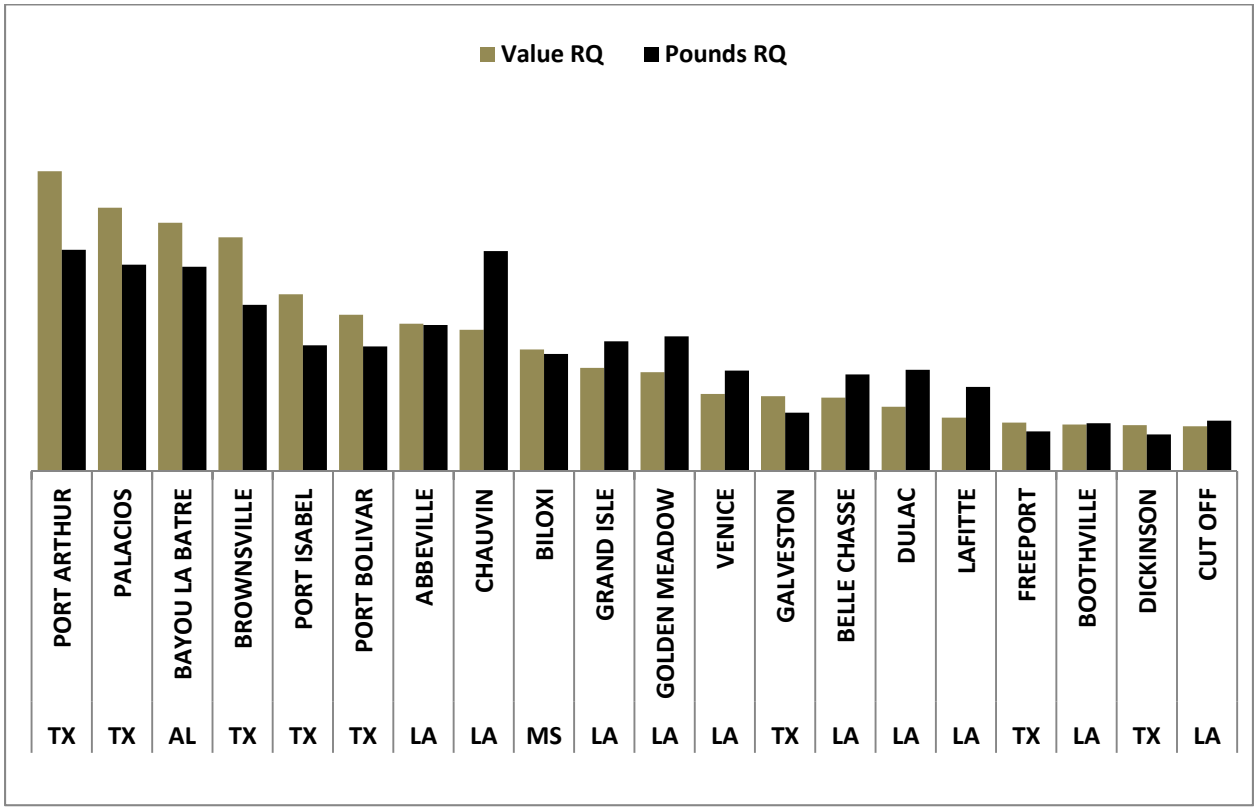


**Figure 3.5.4.** Top twenty communities ranked upon value regional quotient (RQ) for total shrimp in the Gulf.
Source: SERO ALS 2013

**Demographics and Fleet Characteristics**

Vessel Permits

As stated, as of September 21, 2015, there were 1,464 valid Gulf commercial shrimp permits, with 469 permits terminated since the inception of the moratorium. Figure 3.5.5 displays the distribution of all Gulf shrimp permits by homeport community as of 2014. The majority of permits were in the Western Gulf with New Orleans, Louisiana, Brownsville, Texas, and Bayou La Batre, Alabama having more permit holders than other communities.

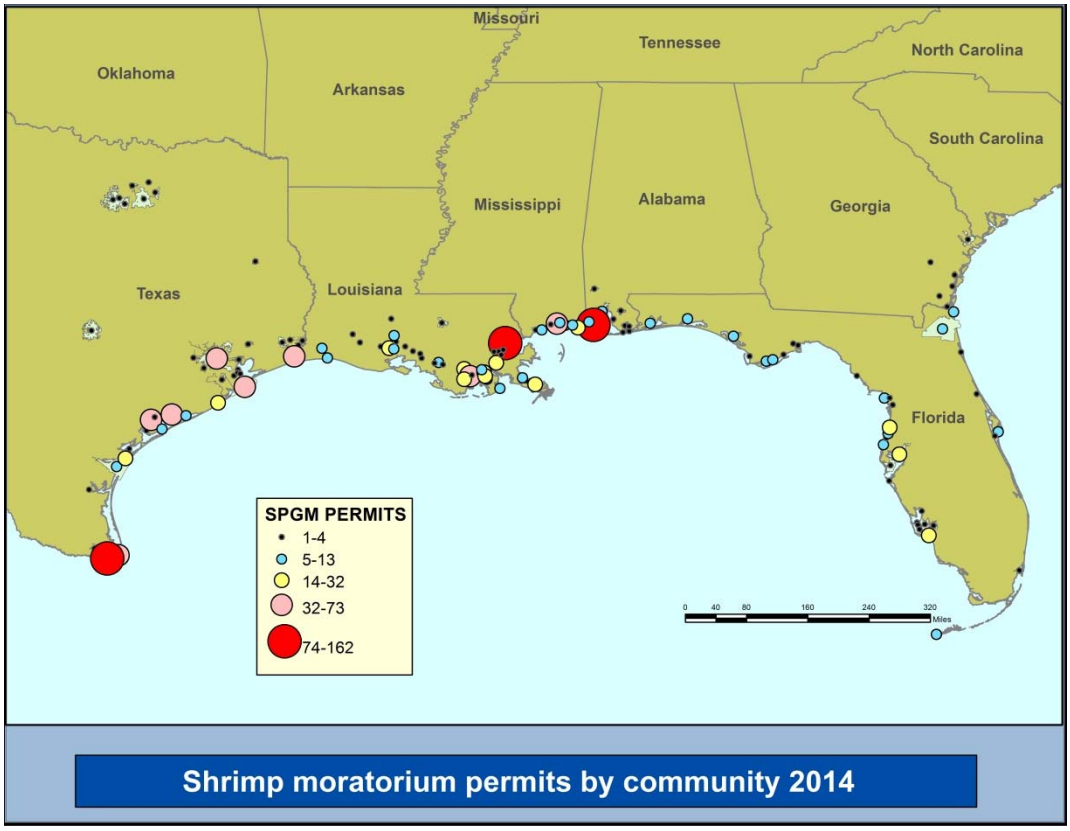


**Figure 3.5.5.** Number of Gulf shrimp permits by homeport communities.
Source: NMFS SERO Permits Database

As shown in Table 3.5.1, the three above mentioned communities have considerably more Gulf shrimp permits held by vessels homeported[6] in those communities. It should be mentioned that while the designated homeport may not be where a vessel is docked most of the time, it is the best approximation given the data available to be able to co-locate people and infrastructure in a port. These three aforementioned communities also have the largest number of terminated permits since the inception of the moratorium. However, several communities have had a larger portion of permits terminated over the years. The states of Texas and Louisiana have the largest share of Gulf shrimp permits and terminated permits.

[6] It should be noted that vessel homeport is derived from the permit application label hailing port. This term may be interpreted by permit applicants differently and therefore does not always represent the dock where a vessel can be located. In some cases a permittee may use their home address. Therefore, some locations may have inflated numbers for vessel homeport.

It should be noted that the reason for termination of a shrimp permit can vary and there is no information as to why each terminated permit was not renewed. Most terminated permits were voluntary and due to non-renewal. Of course, this may also be a result of economic conditions referenced. There has been considerable latent effort in the shrimp fishery which can be of some concern, especially with regard to the possibility of increased bycatch for some key species with an influx of new effort. The following tables and figures offer different perspectives on the geographical distribution of terminated permits; they do not infer any benefit or detriment as a result of the termination.

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

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

Source: NMFS Southeast Fisheries Science Center (SEFSC).

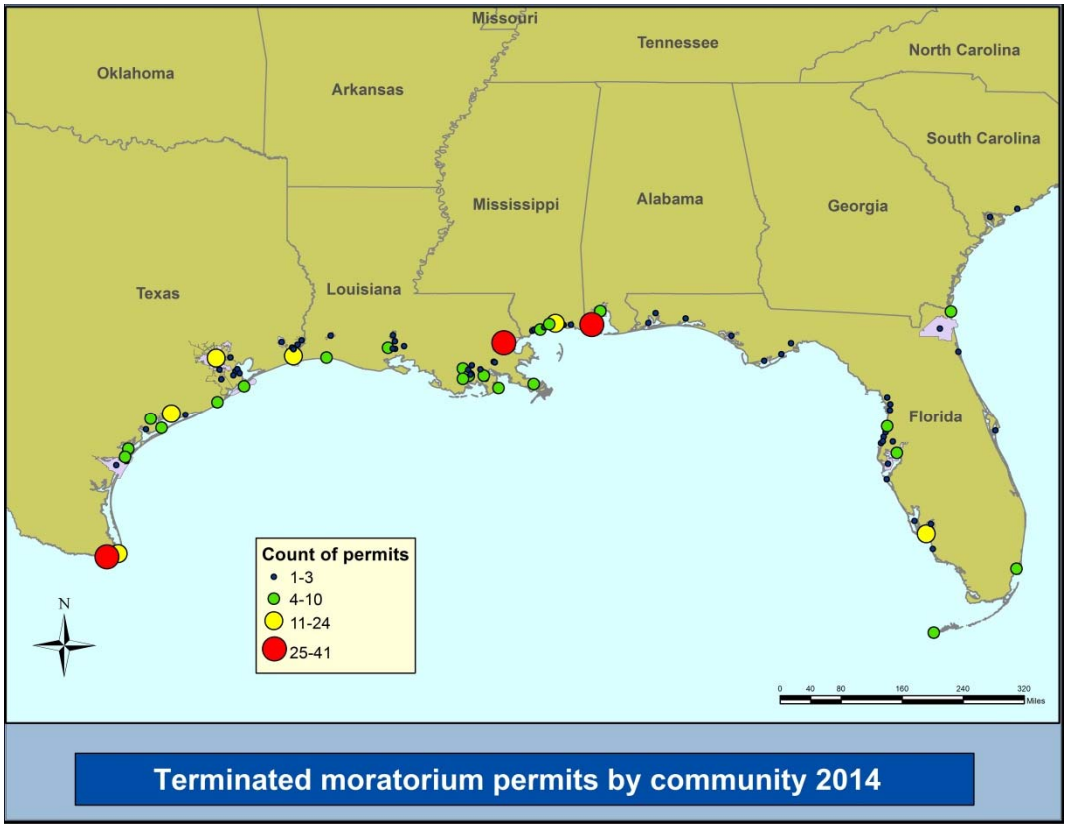


**Figure 3.5.6.** Terminated Gulf shrimp permits by community since moratorium.
Source: NMFS SERO Permits Database

A geographical breakdown of the percent of all terminated permits out of total permits by homeport community is displayed in Figure 3.5.6. Whereas Table 3.5.1 has only the top 35 communities listed, Figure 3.5.7 has the location of all terminated permits. Several locations within Texas have seen a large percentage of permits terminated. However, in some cases these communities may have had few permits to begin with. Several communities in Texas, like Seabrook, Beaumont, and Seadrift, each had only three permits total and had two terminated each; therefore, the percentage lost is large, but the actual number of permits lost is small. Other communities, like Brownsville, Texas, Bayou La Batre, Alabama, and New Orleans, Louisiana had greater numbers of terminated permits as mentioned earlier.

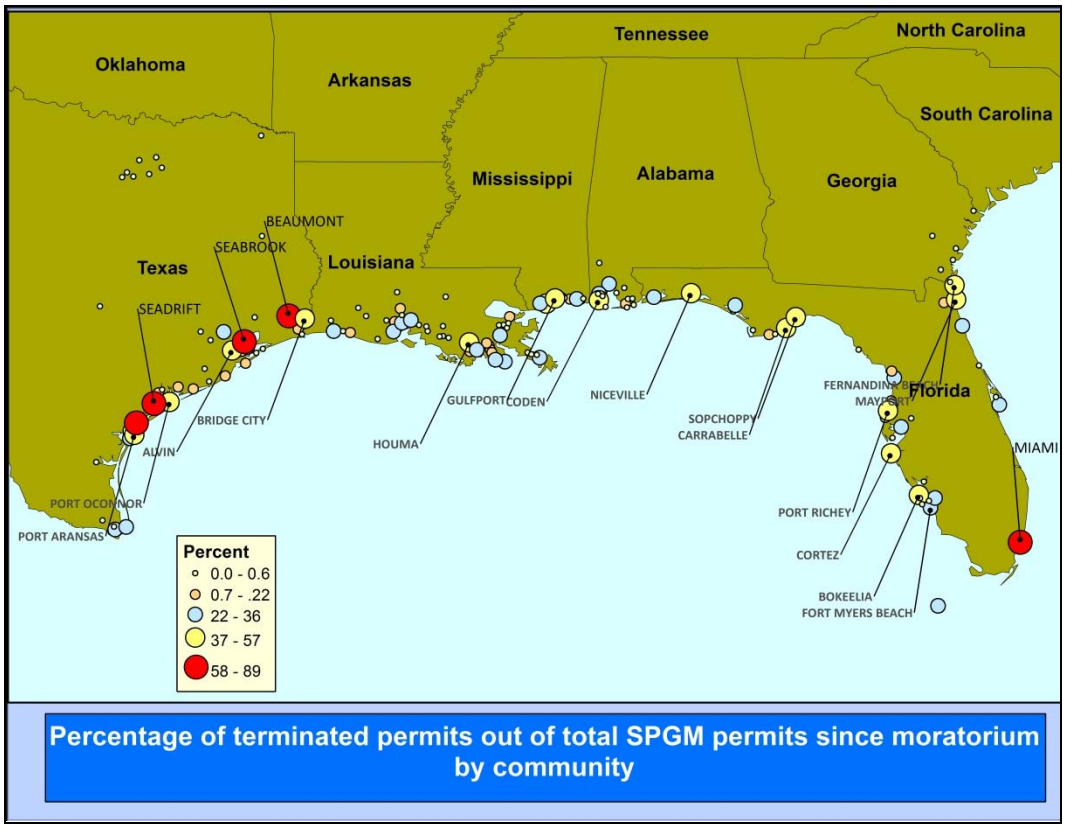


**Figure 3.5.7.** Percent of terminated Gulf shrimp permits by homeport communities.
Source: NMFS SERO Permits Database

Figure 3.5.8 provides the geographical distribution of shrimp processors in the Gulf and Florida east coast. Shrimp processors are distributed fairly evenly among the Gulf States with 16 in Louisiana, 15 in Texas, 15 in Alabama-Mississippi, and 10 in Florida. While some processors may also be a wholesale dealer, some processors deal with product landed outside the state and may also process imported shrimp.

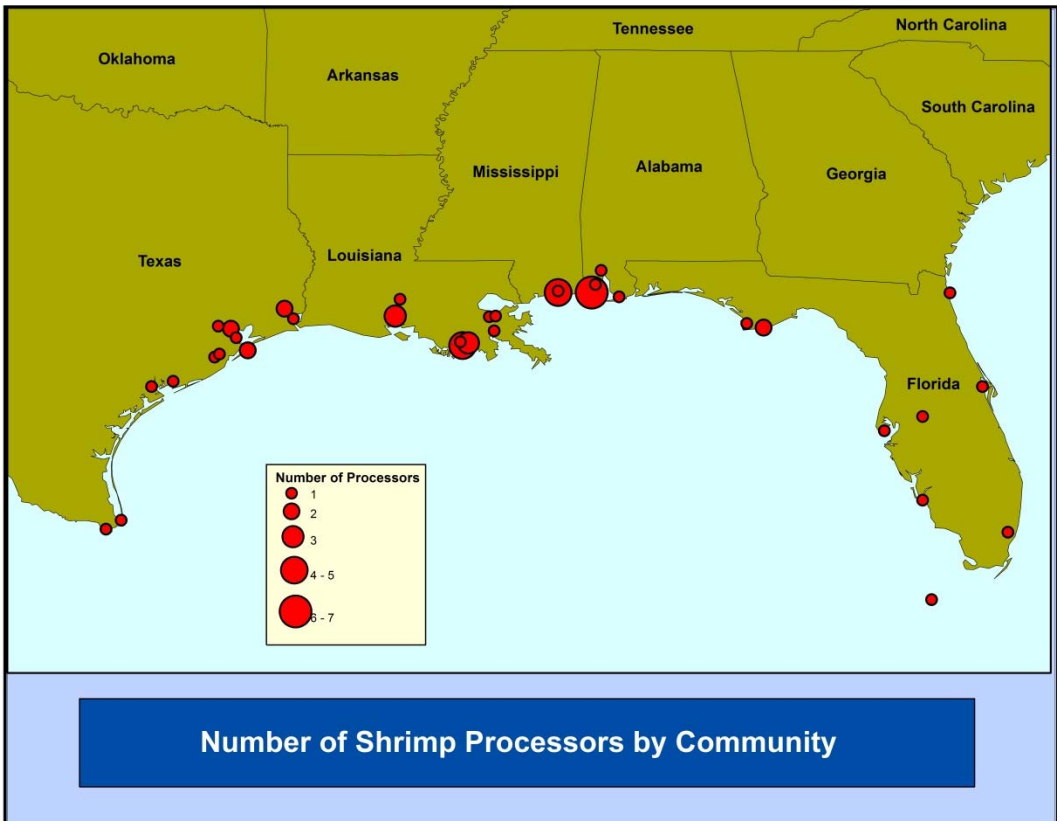


**Figure 3.5.8.** Number of Gulf shrimp processors by community.
Source: Personal Communication, Office of Science and Technology, Sept. 8, 2015.

While the number of processors may be evenly distributed throughout the Gulf States, the volume and value of shrimp processed is not. Figure 3.5.9 provides a geographical illustration of the real value of processed shrimp by community across the Gulf. Louisiana processors have the highest value of total shrimp processed followed by Texas, Mississippi, Florida, and Alabama. Actual values are not presented to avoid revealing confidential information.

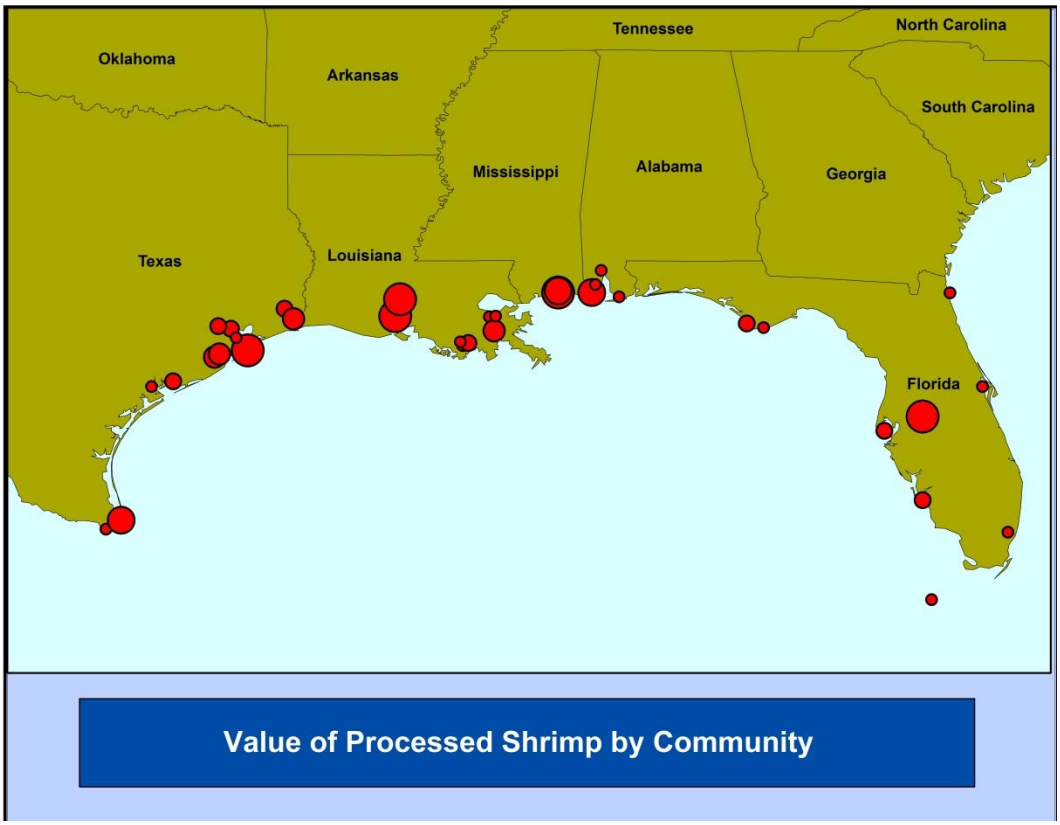


**Figure 3.5.9.** Value of processed shrimp by community.
Source: Personal Communication, Office of Science and Technology, Sept. 8, 2015.

## Overall Fishing Engagement and Reliance

While it is possible to characterize the fleet landings with regard to those communities that have high RQs for landings and value, it is more difficult to characterize the fleet and its labor force regarding demographics and residence for captains and crew of vessels. There is little to no information on captains and crew including demographic makeup as NMFS does not collect these data.

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

Using principal component and single solution factor analysis, each community receives a factor score for each index to compare to other communities. Factor scores of both engagement and reliance on commercial fishing for the top 20 communities (Figure 3.5.4) were plotted onto graphs in Figure 3.5.10. For some communities data were not available to calculate a factor score and do not appear on the chart. Each community's factor score is located on the Y axis, the higher the score, the more engaged or reliant. Factor scores are standardized; therefore, the

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

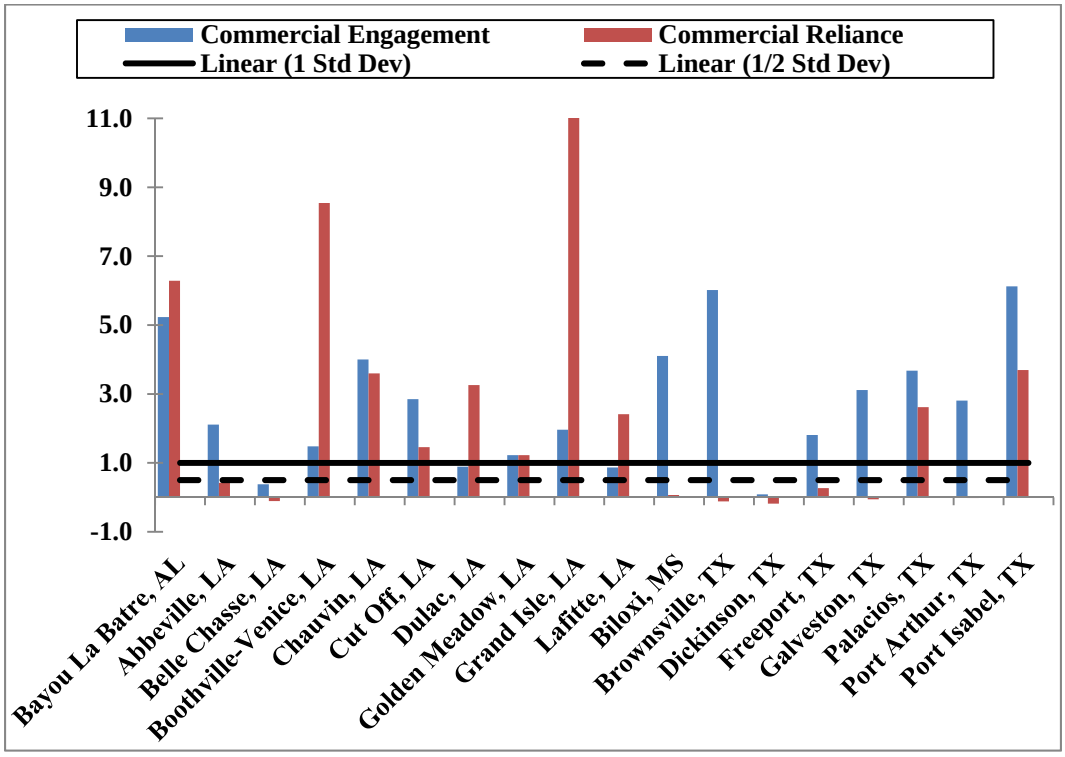


**Figure 3.5.10.** Commercial fishing engagement and reliance indices for top twenty communities in terms of pounds and value regional quotient for total shrimp in the Gulf.
Source: SERO Social Indicator Database

In Figure 3.5.10, all communities exceed either one or both of the thresholds of ½ or 1 standard deviation, which means they are highly engaged or reliant on commercial fishing. Those that exceed thresholds for both indices have a substantial component of their local economy dependent upon commercial fishing. The ten communities that exceed both thresholds are: Bayou LaBatre, Alabama; Fort Myers Beach, Florida; Chauvin, Cut Off, Dulac, Golden Meadow, Grand Isle, Laftite, and Bootheville-Venice, Louisiana; and Port Isabel and Palacios, Texas. More in-depth profiles of some of these communities appear in previous amendments (GMFMC 2005a, 2007).

There have been relatively few, if any, recent descriptions of the Gulf shrimp fishery from both a social and economic perspective. Liese et al. (various years) have provided the most recent economic analysis of fleet-wide economic performance, but there is little information concerning the demographic makeup or characterization of the fleet. While demographic information for captains and crew is not available, a proxy can be used to examine the number of vessels that may have minorities associated with the vessel by looking at surnames from the permit file and

counting those owners that have Southeast Asian surnames. This technique was first utilized in a memorandum from Council Director Wayne Swingle to the Council's Shrimp Management Committee dated March 28, 2003. In that memorandum, Dr. Swingle indicated that of the 1,836 federally permitted shrimp vessels, 524 (or 28.7%) had owners with Southeast Asian surnames or corporate names. A similar count conducted by SERO in 2009 resulted in 484 out of 1853[7] (or 26.1%) of permit owners with Southeast Asian surnames. Unfortunately, we do not know if these are active vessels and whether the crew is also of Southeast Asian ethnicity. However, this does give a rough indication of the participation rate of Southeast Asians within the Gulf shrimp fishery.

Examining terminated permits using this same methodology, approximately 28% of terminated permits had owners or lessees with Southeast Asian surnames. Thus, the proportion of terminated permits held by those of Southeast Asian descent appears to be approximately the same as their participation in the shrimp fishery overall.

This methodology has not been attempted for other minority groups. It has been suggested that Hispanics make up a large portion of the crew on Gulf shrimp vessels in Texas and possibly other states in the western Gulf (Gary Graham, Texas A&M Sea Grant, pers. comm.). Unfortunately, data on crew are unavailable and thus it is not possible to calculate a credible number for that participation.

### 3.5.1 Environmental Justice Considerations

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

In order to assess whether a community may be experiencing EJ issues, a suite of indices created to examine the social vulnerability of coastal communities (Colburn and Jepson 2012; Jacob et al. 2012) is presented in Figure 3.5.11 for those same communities in Figure 3.5.10. The three indices are poverty, population composition, and personal disruptions. The variables included in each of these indices have been identified as important components that contribute to a community's vulnerability. Indicators such as increased poverty rates for different groups, more single female-headed households and children under the age of 5, disruptions such as higher separation rates, higher crime rates, and unemployment, all are signs of vulnerable populations. These indicators are closely aligned to previously used measures of EJ which used thresholds for the number of minorities and those in poverty. For those communities that exceed the threshold,

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

it is expected that they would exhibit vulnerabilities to sudden changes or social disruption that might accrue from regulatory change.

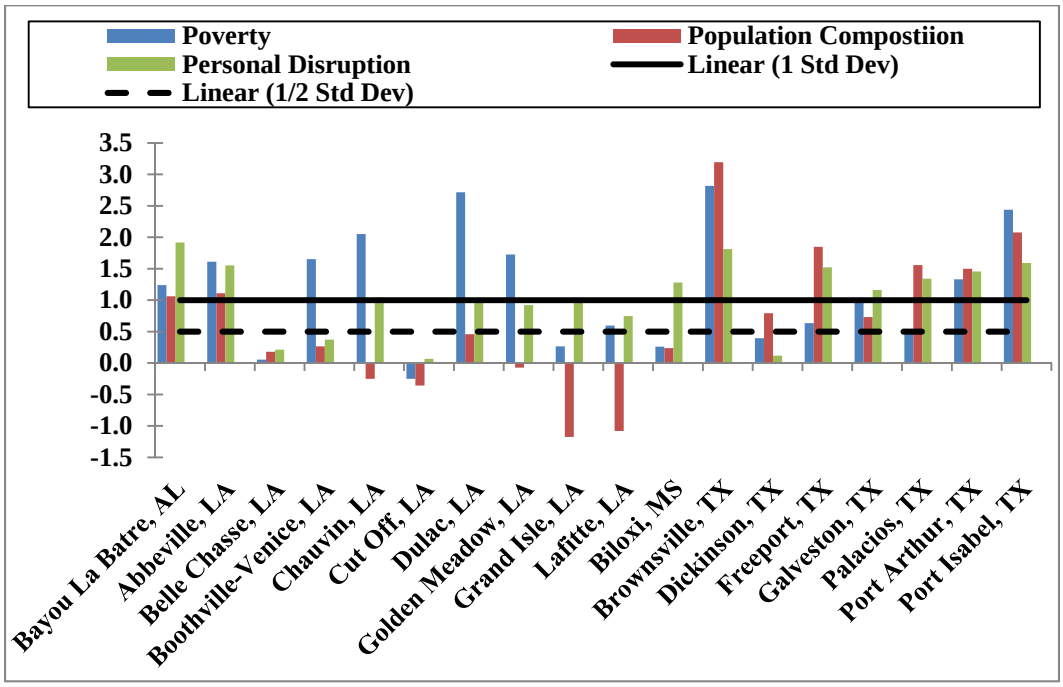


**Figure 3.5.11.** Social vulnerability indices for top twenty communities in terms of pounds and value regional quotient for total shrimp in the Gulf.
Source: SERO Social Indicator Database

In terms of social vulnerabilities, several of the top shrimp fishing communities exhibit medium to high vulnerabilities. In fact, only six communities are below the thresholds for two or more indices and do not exhibit vulnerabilities. Those that exceed both thresholds for two or more indices are: Bayou LaBatre, Alabama; Abbeville, Chauvin, and Dulac, in Louisiana; Brownsville, Freeport, Galveston, Palacios, Port Arthur and Port Isabel, in Texas (Figure 3.5.11). It is expected that these communities would be especially vulnerable to any social or economic disruption because of regulatory change, depending upon their engagement and reliance upon commercial fisheries. Because most of these communities are either highly engaged or reliant on commercial fishing, it is likely that any negative social effects from regulatory changes will have an impact. Whether that impact will be long-term or short-term would depend upon the regulatory change.

These indicators of vulnerability have been developed using secondary data at the community level. Because these types of data are not collected at the individual level by NMFS or other agencies, it is difficult to understand the social vulnerabilities that might exist on either a household or individual level. It is hard to recognize or attribute impacts that will directly affect individuals who are fishermen or work in a related business because we do not know what those specific vulnerabilities may be. Therefore, our measure of vulnerability is a broader measure at the community level and not specific to fishermen or the related businesses and their employees. Furthermore, there has been little research and relatively no data collected on subsistence fishing patterns of fishermen in the Southeast. Impacts on subsistence fishing within the Gulf shrimp

fishery cannot be assessed, other than to say we know very little and it is unlikely to be affected because it is an offshore fishery.

## 3.6 Description of the Administrative Environment

### 3.6.1 Federal Fishery Management

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.

### 3.6.2 State Fishery Management

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

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

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

# CHAPTER 4. ENVIRONMENTAL CONSEQUENCES

## 4.1 Action 1 – Address the Expiration of the Federal Shrimp Permit Moratorium in the Gulf of Mexico

**Alternative 1:** No Action. The moratorium on the issuance of new Gulf of Mexico (Gulf) federal commercial shrimp vessel permits expires on October 26, 2016. With expiration of the federal Gulf commercial shrimp permit moratorium, the commercial shrimp vessel permits will become open access permits, as they were prior to the moratorium, and therefore be available to any eligible applicants.

**Preferred Alternative 2:** Extend the moratorium on the issuance of federal Gulf commercial shrimp vessel permits; the moratorium will be extended for:

**Option a.** 5 years

**Preferred Option b.** 10 years

**Alternative 3:** Create a federal limited access permit for commercial shrimp vessels in the Gulf. To be eligible for a commercial shrimp vessel permit under the limited access system, vessels must have a valid or renewable federal Gulf commercial shrimp vessel permit on October 26, 2016. Federal Gulf commercial shrimp vessel permits will need to be renewed every year and all previous renewal, transfer, and reporting requirements would still be in effect.

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

**Alternative 1** would allow the permit moratorium to expire; therefore, both effort and shrimp landings could increase. This can have negative effects on the physical environment as it may increase trawling effort. Trawling is recognized for its impacts to benthic environments because the heavy doors drag along the bottom and the tickler chains scrape along the sea floor. The shrimp fishery is prosecuted primarily over soft substrates such as mud or silt that are more resilient to disturbance than other bottom types. Areas that have been closed to shrimp trawling seasonally, such as the Texas closure, are not physically different than areas continuously open to shrimp trawling, and longer term parameters, such as currents and storms, may have more effects on the physical characteristics of an area (Sheridan and Doerr 2005).

The proposed action may modify the way the fishery is prosecuted, but most likely negative effects will only result if effort increases above threshold levels; this is only likely if **Alternative 1** is selected. **Preferred Alternative 2** and **Alternative 3** would likely maintain the fishery at current or, at most, high moratorium levels, and more likely lower levels. Therefore, these alternatives would be expected to have less effects on the physical environment as shrimp permit numbers and active shrimping vessels may decrease over time. The effects would be greatest with **Alternative 1** because shrimping could increase; therefore, bottom contact with gear could increase.

### 4.1.2 Direct and Indirect Effects on the Biological Environment

Effort in the shrimp fishery is closely monitored to not exceed bycatch limits, so if the number of permits were to change, this monitoring could effectively limit how the fishery is prosecuted to keep bycatch to acceptable levels. Amendment 14 (GMFMC 2007) established a target effort level in specific areas of the western Gulf ((statistical zones 10-21, 10-30 fathoms (60 to 180 feet)) to protect juvenile red snapper. This target was originally set at 74% less than the effort in the benchmark years of 2001-2003, but 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 the exclusive economic zone (EEZ) must be closed to shrimp fishing. 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. Any increase in effort over that level would exceed the target and trigger closures. In 2014, the effort level was just 0.1% below the target level that would trigger closures (R. Hart, presentation to the Council, October 2015).

In the 2014 biological opinion (NMFS 2014), the effects analyses were based on 2009 effort levels. If effort exceeds that level, the National Marine Fisheries Service (NMFS) will infer that take has been exceeded and that effects on sea turtles were greater than analyzed. If sea turtle effects exceed those in the opinion for any given year, then NMFS must decide whether it must reinitiate consultation, and whether rule-making to address the activities leading to the greater effects is warranted.

**Alternative 1** is the most likely to result in changes in the fishery, such as increases in effort and bycatch, as it would allow unlimited number of participants to enter the fishery. If the permit moratorium is allowed to expire in 2016, red snapper and other protected species (as described in Section 3.3) may be affected if the expiration of the permit moratorium results in the issuance of more permits and an expansion in the shrimping industry. However, because trends such as effort and fishing mortality have decreased over time and the number of permit renewals has been decreasing since the institution of the permit moratorium, it is unlikely that effort will resume to historical pre-moratorium levels.

**Preferred Alternative 2** would maintain the permit moratorium. Currently, with the moratorium in place, shrimping effort has decreased and the number of permit holders has decreased. The effects on the biological environment would change minimally, or decrease if effort decreased. The same effects would be observed with **Alternative 3**.

### 4.1.3 Direct and Indirect Effects on the Economic Environment

**Alternative 1** would let the moratorium on federal commercial shrimp permits expire in October 2016. Therefore, **Alternative 1** would revert the commercial shrimp fishery to open access and would establish a management environment that could curtail the potential economic benefits of the moratorium.

Potential benefits expected to result from a moratorium on the issuance of new federal shrimp permits include a reduction in overcapitalization in the fishery and improvements in the economic profitability of shrimp harvesters. However, the dynamics of the shrimp fishery and

resulting bio-economic conditions are primarily determined by factors largely beyond the control of shrimp harvesters and fishery managers in the Gulf.

Primary determinants of the economic conditions in the industry are environmental conditions, shrimp prices, and fuel prices. For annual species such as shrimp, abundance and therefore catch per unit effort are primarily dependent on environmental conditions. Fuel prices constitute a key factor in the economic conditions in the fishery because they typically account for a significant portion of shrimp harvesters' total costs. Liese (personal communication, February 18, 2015) estimated that between 2006 and 2012 fuel costs accounted for more than 42% of total costs. Finally, because shrimp prices are determined within a global integrated market, disruptions in the domestic market are mitigated by adjustments in the quantity of imports (and vice versa) without much changes in prices. The market integration between the domestic wild-caught shrimp and farmed-raised imported shrimp is discussed in Aasche et al (2012). The integration between the domestic, European, and Japanese shrimp markets is discussed in Vinuya (2007).

The overall economic climate faced by shrimp harvesters has been characterized by a bio-economic conditions index (BECI) based on three factors: environmental conditions (shrimp abundance), fuel, and shrimp prices (Jones, 2012). The BECI provides the average shrimp revenue generated per dollar spent on fuel. Therefore, larger BECI values correspond to more favorable bio-economic conditions for shrimp harvesters. Between 2006 and 2012, BECI estimates provided by Liese (personal communication, February 18, 2015) range from 2.26 to 2.03. In other terms, in 2012, shrimp harvesters in the Gulf generated $2.03 in shrimp revenues per dollar spent on fuel. The decrease in estimated BECI between 2006 and 2012 suggests that bio-economic conditions have deteriorated since the establishment of the moratorium. However, precarious bio-economic conditions have long prevailed in the shrimp industry and have resulted in a significant contraction of the fleet before the establishment of the moratorium. For example, Ran et al. (2014) reported that the number of vessels in the shrimp fleet decreased by 18% between 2001 and 2004. Therefore, it is not a forgone conclusion that the implementation of a moratorium on shrimp permits is primarily responsible for the ongoing attrition in the number of permits. It could only be suggested that, in conjunction with changing bio-economic conditions, the moratorium may have contributed, probably to a very limited extent, to the observed decrease in the number of shrimp permits.

Based on the preceding discussion, economic effects expected to result from the expiration of the moratorium on the issuance of new shrimp permits (**Alternative 1**) would depend on the evolution of bio-economic conditions, as measured by the BECI or comparable indices, faced by shrimp harvesters. If the conditions improve (BECI increases) as a result of increases in shrimp abundance, decreases in fuel prices, or increases in shrimp prices (or as a result of a combination of these factors) then **Alternative 1** would be expected to result in adverse economic effects because it would prevent harvesters currently active in the fishery from fully benefiting from the more favorable bio-economic conditions. Under this scenario, **Alternative 1** would curtail opportunities to potentially improve the economic profitability of currently permitted shrimp harvesters and possibly lessen the economic returns of the entire fleet, new entrants included. If bio-economic conditions worsen (BECI decreases) as a result of decreases in shrimp abundance, increases in fuel prices, or decreases in shrimp prices (or as a result of a combination of these

factors), **Alternative 1** would be expected to result in limited, if any, economic effects because deteriorating conditions would be expected to hasten the exit of some of the harvesters.

In addition to these effects, **Alternative 1** could result in adverse economic effects stemming from the detrimental effects of increased sea turtle takes and juvenile red snapper bycatch if effort increases following the expiration of the moratorium. If they occurred, both of these increases would be expected to result in corrective measures that would likely place additional restrictions on shrimp effort, thereby resulting in adverse economic effects for the fleet. In summary, plausible scenarios under which the expiration of the moratorium (**Alternative 1**) would be expected to result in economic benefits for the shrimpers or for the Nation do not appear likely.

**Preferred Alternative 2** would extend the moratorium for 5 years (**Option a**) or 10 years (**Preferred Option b**). If bio-economic conditions for the shrimp fleet improve (BECI increases), **Preferred Alternative 2** would be expected to result in economic benefits. The extension of the moratorium would shield existing shrimpers from previously discussed detrimental effects that could result from possible increases in the size of the fleet, thereby allowing potential economic benefits from improved conditions to materialize. **Preferred Option b**, which would provide a longer extension to the moratorium would offer greater protection than **Option a**. If bio-economic conditions worsen (BECI decreases), **Preferred Alternative 2** would not be expected to result in noticeable economic effects because deteriorating conditions would be expected to continue to foster reductions in the size of the shrimp fleet. In effect, **Preferred Alternative 2** would serve as a safeguard to protect the current fleet, if needed, from the potentially detrimental economic effects of open access. It is also noted that if changes in bio-economic conditions result in drastic reductions in the number of permits over time, **Preferred Alternative 2** could potentially adversely affect onshore operations (dealers and processors) by decreasing their access to shrimp harvested in the Gulf.

**Alternative 3** would establish a permanent moratorium on permits (unless changed by subsequent Council action) by creating a limited access shrimp permit. Although they would be longer lasting, economic effects expected to result from **Alternative 3** are expected to be comparable to effects discussed under **Preferred Alternative 2.** However, as opposed to **Preferred Alternative 2**, **Alternative 3** would not require a re-examination of the moratorium in 5 or 10 years if the Council wants to extend it further.

### 4.1.4 Direct and Indirect Effects on the Social Environment

In 2012, there were approximately 4,000 shrimp permits for state waters in Texas, Louisiana, and Mississippi, with over 75% of these sold in Louisiana. These state water permits are open access. In Alabama and Florida, an estimated 3,500 small boats are shrimping under state licenses (Section 3.1). As of September 21, 2015, there were 1,464 federal shrimp permits, which are under a moratorium but renewable for $25 per year.[8] The federal shrimp permits were put under a moratorium to help stabilize the fishery, which was negatively affected by increasing fuel prices, decreasing shrimp prices, and increased competition with foreign imports.

[8] To buy or renew federal permits costs $25 for the first permit, and $10 for each subsequent permit, including the royal red shrimp endorsement.

**Alternative 1** would allow the shrimp vessel permits to become open access permits on October 27, 2016. From that date, anyone would be able to purchase a federal shrimp permit for $25. This would allow an unspecified number of new entrants to the fishery. Negative effects would be expected for the shrimp industry, as some of the identified problems that warranted the permit moratorium could be expected to return should the permits increase. For existing shrimp permit holders, this may result in some direct negative effects from increased competition with other vessels. Some indirect negative effects could potentially result if an increase in effort corresponds with an increase in bycatch that negatively affects other species or fisheries. Such indirect effects would be long-term.

**Preferred Alternative 2** would extend the moratorium for 5 years (**Option a**) or 10 years (**Preferred Option b**). Extending the moratorium would be expected to forestall the potential for negative effects from allowing open access to the fishery. Greater benefits would be expected from **Preferred Option b** than **Option a**, as the moratorium extension would be twice as long.

Among the alternatives, the greatest benefits to the industry and existing shrimp permit holders would result from **Alternative 3**, which would make the moratorium permanent (unless changed by subsequent Council action) by creating a limited access permit. Existing permits would remain renewable and transferable, thereby allowing for new entrants to replace shrimpers exiting the fishery. The Council could take action in the future to address the number of permits should it be determined that increased participation would be desirable.

### 4.1.5 Direct and Indirect Effects on the Administrative Environment

**Alternative 1** would have the greatest effect on the administrative environment. The fishery would become open access after the moratorium expires, so there could be additional permit holders. NMFS would need to increase the effort required to verify landings, file notifications in case of closures, and enforce closures if the number of permits increased significantly. There would likely be more in-season adjustments if effort were to increase above current levels, which is more likely if the number of permits are not restricted (as they are with the permit moratorium).

**Preferred Alternative 2** would not likely have any immediate effect on the administrative environment. The fishery would continue to be under the same moratorium, and monitoring would continue as it has been. It would maintain the same effort required from NMFS to verify landings, file notifications in case of closures, and enforce closures. **Preferred Alternative 2** would require the Council to re-address the expiration of the moratorium in 5 (**Option a**) or 10 (**Option b**) years, which would involve development of another plan amendment. Both **Option a** and **Preferred Option b** would have similar effects of the administrative environment, though **Option a** would be more immediate in initiating further Council and NMFS action than **Option b** would.

**Alternative 3** would have the least effect on the administrative environment as it would maintain the state of the fishery how it is now but would not require re-examination of the moratorium in

either five or ten years as both options in **Preferred Alternative 2** would, because the moratorium would not have an expiration date. However, NMFS would need to convert moratorium permits to limited access permits.

## 4.2 Action 2 – Royal red shrimp endorsement

**Alternative 1** – No Action. Continue to require a royal red shrimp endorsement to the federal Gulf shrimp vessel permit to harvest royal red shrimp from the Gulf EEZ. Endorsements are open access for entities with a federal Gulf shrimp vessel permit.

**Alternative 2** – Discontinue the royal red shrimp endorsement. Only the federal Gulf shrimp vessel permit is required to harvest royal red shrimp from the Gulf EEZ.

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

The royal red shrimp endorsement was established in Amendment 13 (GMFMC 2005a). The purpose of the royal red shrimp endorsement was to establish a "universe" of permit holders that fish for royal red shrimp. Since the implementation, the number of royal red shrimp endorsements has exceeded the number of those landing royal red shrimp by about two orders of magnitude (Table 2.2.1). It is unlikely that either **Alternative 1** or **Alternative 2** will result in significant effects on the physical or biological environment because whether or not an endorsement is required will likely not affect how the fishery is currently prosecuted. Additionally, landings data for royal red shrimp will continue to be collected. Discontinuance of the royal red shrimp endorsement could limit the ability to take some future actions that may benefit endorsement holders, such as the establishment of habitat areas of particular concern (HAPCs) in areas where royal red shrimping occurs. It may be possible to provide exemptions for vessels with royal red shrimp endorsements to fish in these areas if the permit holder has the royal red shrimp endorsement, as many of the areas being explored for HAPCs are "pick up" areas and not where the trawl net is actively on the ground. This would require that the Council choose **Alternative 1** as its preferred alternative; however, any HAPC regulations that are ultimately implemented could simply exempt vessels fishing for royal red shrimp rather than those holding the endorsement.

### 4.2.2 Direct and Indirect Effects on the Economic Environment

**Alternative 1** would continue to require a royal red shrimp endorsement to the federal shrimp permit to harvest royal red shrimp in federal waters. **Alternative 1** would not be expected to result in economic effects because it would neither impact the segment of the shrimp fleet prosecuting royal red shrimp nor affect the harvest of royal red shrimp in the EEZ.

**Alternative 2** would discontinue the royal red shrimp endorsement. Royal red shrimp landings would continue to be recorded. Although the endorsement was expected to provide a means to conveniently define the universe of shrimpers harvesting royal red shrimp, it has not fulfilled this expectation. Endorsements are issued to any federally permitted shrimp harvester who submit a complete application. However, a minute proportion of shrimpers with endorsements actively

harvest royal red shrimp. Between 2007 and 2014, the annual proportion of endorsement holders who harvested royal red shrimp averaged 2.4% (Table 2.2.1). As a result, the endorsements alone are not sufficient to identify the shrimpers who harvest royal red. Because royal red shrimp landings would continue to be recorded in the same manner, the elimination of the endorsement would not be expected to result in adverse effects. However, **Alternative 2** would be expected to result in economic benefits stemming from time and cost savings to NMFS and to shrimpers who would no longer have to acquire an endorsement for $10 each year.

### 4.2.3 Direct and Indirect Effects on the Social Environment

The harvest of royal red shrimp requires a federal shrimp permit and a royal red shrimp endorsement. While the federal shrimp permit is under a moratorium, the endorsement remains open access. The moratorium on the federal shrimp permit was intended to restrict effort in the federal shrimp fishery, while the royal red shrimp endorsement was created as a data collection tool, to identify royal red shrimpers.

The number of royal red shrimp endorsements bought or renewed each year has remained above 300 since the endorsement was put in place, although the number of unique vessels that land royal red shrimp has remained low (Table 2.2.1). Since 2007, eight vessels a year on average have made royal red shrimp landings. In 2013, 15 unique vessels landed royal red shrimp, the greatest number of vessels since 2004 when 17 vessels landed royal red shrimp. The 15 vessels landing royal red shrimp in 2013 represented 4.5% of all royal red shrimp endorsements.

Additional effects would not be expected from retaining the royal red shrimp endorsement (**Alternative 1**). Given the low number of permits with landings and the fact that royal red shrimp landings data are collected separate from the endorsement, the endorsement may not be necessary. Further, a federal shrimp permit would continue to be required for the harvest of royal red shrimp, whether or not the endorsement exists. These federal shrimp permits are currently limited access, which functions to constrain entry and effort in the fishery. With the utility of the endorsement uncertain, some positive effects could be expected from eliminating the endorsement for royal red shrimp (**Alternative 2**), by reducing the permitting requirements of those who harvest royal red shrimp. These effects would be minimal, as it would still be required to renew a vessel's federal shrimp permit.

### 4.2.4 Direct and Indirect Effects on the Administrative Environment

**Alternative 1** would be the most administratively burdensome of the alternatives being considered because it would require the continuation of the royal red shrimp endorsement and all of the processing requirements that are associated with that endorsement. **Alternative 2** would eliminate the administrative burden of the endorsement process for royal red shrimp.

## 4.3 Cumulative Effects Analysis

As directed by the National Environmental Policy Act (NEPA), federal agencies are mandated to assess not only the indirect and direct impacts, but cumulative impacts of actions as well. The

NEPA defines a cumulative impact as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 CFR 1508.7). Cumulative effects can either be additive or synergistic. A synergistic effect occurs when the combined effects are greater than the sum of the individual effects. The following are some past, present, and future actions that could impact the environment in the area where the Gulf shrimp fishery is prosecuted.

**Past Actions**

In 2003, regulations were instituted requiring vessels to possess a federal shrimp permit when fishing for shrimp in the Gulf EEZ. Subsequently, a moratorium on the issuance of new federal shrimp permit was established in 2007. During 2006 through 2010, an average of 4,582 vessels fished for shrimp in the Gulf, of which 20% were federally permitted vessels and the rest, non-permitted vessels. Despite being fewer in number, federally permitted vessels accounted for an average of 67% of total shrimp landings and 77% of total ex-vessel revenues. As of September 21, 2015, there were 1,464 valid or renewable Gulf shrimp permits, which is a significant decline from 1,933 that received a permit when the moratorium was implemented. As of the same date, there were 298 valid or renewable endorsements for royal red shrimp. The actions in this amendment may or may not change the rate of decline in number of permits.

Joint Reef Fish Amendment 27/Shrimp Amendment 14 (GMFC 2007) established a target effort-reduction goal of 74% less than the benchmark years of 2001-2003 as a proxy for juvenile red snapper mortality reduction. The amendment established a closure procedure for the northern and western Gulf within the 10- to 30-fathom zone in conjunction with the beginning of the annual Texas closure if fishing effort does not meet the reduction target. NMFS was able to relax the effort restrictions in 2012 to a 67% reduction because the red snapper stock was rebuilding on schedule. If the shrimp permit becomes an open access permit, effort could increase and exceed this threshold.

In April 2010, an explosion occurred on the Deepwater Horizon MC 252 (DWH) oil rig, resulting in the release of millions of barrels of oil into the Gulf. In addition, over a million gallons of Corexit 9500A dispersant were applied as part of the effort to constrain the spill. The cumulative effects from the oil spill and response may not be known for years. The oil spill affected more than one-third of the Gulf area from western Louisiana east to the Panhandle of Florida and south to the Campeche Bank in Mexico. The impacts of the DWH oil spill on the physical environment are expected to be significant and may be long-term. Oil was dispersed on the surface, and because of the heavy use of dispersants, oil was also documented as being suspended within the water column, some even deeper than the location of the broken well head. Floating and suspended oil washed onto shore in several areas of the Gulf as well as non-floating tar balls. Whereas suspended and floating oil degrades over time, tar balls persist in the environment and can be transported hundreds of miles.

In a study by Murawski et al. (2014), researchers found a higher frequency of skin lesions on fish in the northern Gulf in the area of the 2010 oil spill compared to other areas. Studies are

continuing to check whether the sick fish suffer from immune system and fertility problems. Indirect and inter-related effects on the biological and ecological environment of the shrimp fishery in concert with the DWH oil spill are not well understood. Changes in the population size structure could result from shifting fishing effort to specific geographic segments of populations, combined with any anthropogenically induced mortality that may occur from the impacts of the oil spill.

### ***Deepwater Horizon*** **MC252 Oil Spill**

*Overview*

On April 20, 2010 an explosion occurred on the *Deepwater Horizon* semi-submersible oil rig approximately 36 nautical miles (41 statute miles) off the Louisiana coast. Two days later the rig sank. An uncontrolled oil leak from the damaged well continued for 87 days until the well was successfully capped by British Petroleum on July 15, 2010. The *Deepwater Horizon* MC252 oil spill affected at least one-third of the Gulf area from western Louisiana east to the Florida Panhandle and south to the Campeche Bank in Mexico (Figure 4.3.1).

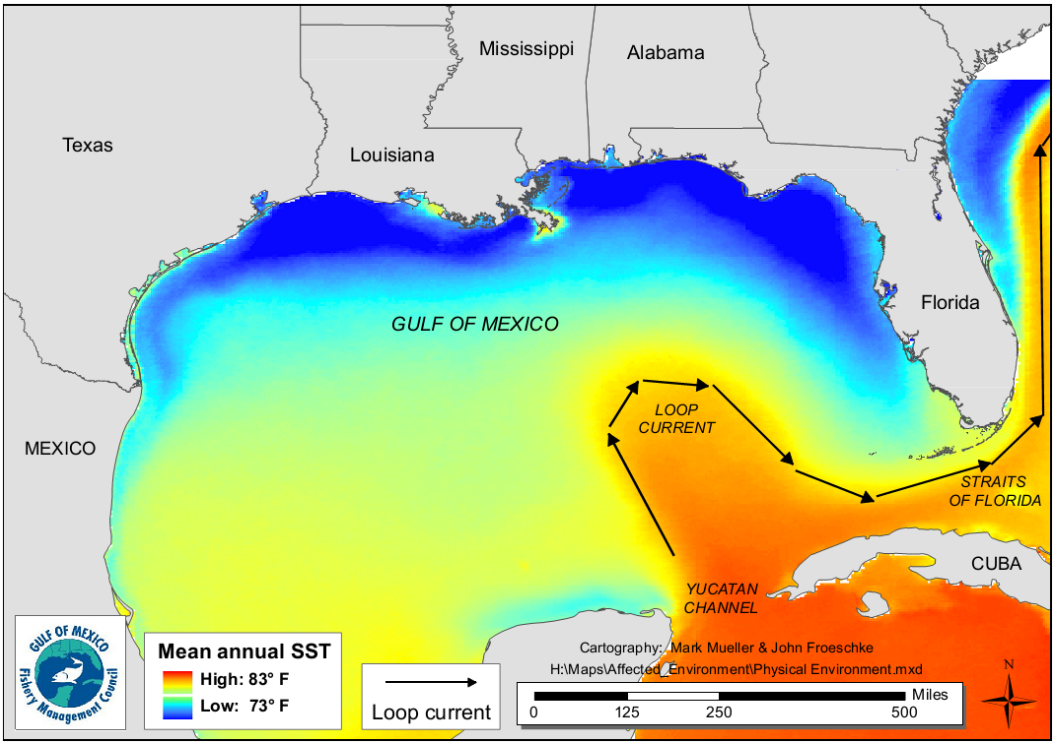


**Figure 4.3.1.** Mean annual sea surface temperature derived from the Advanced Very High Resolution Radiometer Pathfinder Version 5 sea surface temperature data set. (http://pathfinder.nodc.noaa.gov).

As reported by the National Oceanic and Atmospheric Administration Office of Response and Restoration (NOAA 2010), the oil from the *Deepwater Horizon* MC252 oil spill is relatively high in alkanes which can readily be used by microorganisms as a food source. As a result, the

oil from this spill is likely to biodegrade more readily than crude oil in general. The *Deepwater Horizon* MC252 oil is also relatively much lower in polycyclic aromatic hydrocarbons. Polycyclic aromatic hydrocarbons are highly toxic chemicals that tend to persist in the environment for long periods of time, especially if the spilled oil penetrates into the substrate on beaches or shorelines. Like all crude oils, *Deepwater Horizon* MC252 oil contains volatile organic compounds (VOCs) such as benzene, toluene, and xylene. Some VOCs are acutely toxic, but because they evaporate readily, they are generally a concern only when oil is fresh.[3]

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

In addition to the crude oil, over one million gallons of the dispersant, Corexit 9500A®, was applied to the ocean surface and an additional hundreds of thousands of gallons of dispersant was pumped to the mile-deep well head (National Commission 2010). No large-scale applications of dispersants in deep water had been conducted prior to the *Deepwater Horizon* MC252 oil spill.

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

*General Impacts on Fishery Resources*

The presence of PAHs in marine environments can have detrimental impacts on marine finfish, especially during the more vulnerable larval stage of development (Whitehead et al. 2011). When exposed to realistic yet toxic levels of PAHs (1–15 µg/L), greater amberjack (*Seriola dumerili*) larvae develop cardiac abnormalities and physiological defects (Incardona et al. 2014). The future reproductive success of long-lived species, including red drum (*Sciaenops ocellatus*) and many reef fish species, may be negatively affected by episodic events resulting in high-mortality years or low recruitment. These episodic events could leave gaps in the age structure of the population, thereby affecting future reproductive output (Mendelssohn et al. 2012). Other studies have described the vulnerabilities of various marine finfish species, with morphological and/or life history characteristics similar to species found in the Gulf, to oil spills and dispersants (Hose et al. 1996; Carls et al. 1999; Heintz et al. 1999; Short 2003).

An increase in histopathological lesions were found in red snapper (*Lutjanus campechanus*) in the area affected by the oil, but Murawski et al. (2014) found that the incidence of lesions had declined between 2011 and 2012. The occurrence of such lesions in marine fish is not uncommon (Sindermann 1979; Haensly et al. 1982; Solangi and Overstreet 1982; Khan and Kiceniuk 1984, 1988; Kiceniuk and Khan 1987; Khan 1990). Red snapper diet was also affected after the spill. A decrease in zooplankton consumed, especially by adults (>400 mm TL) over natural and artificial substrates may have contributed to an increase in the consumption of fish and invertebrate prey- more so at artificial reefs than natural reefs (Tarnecki and Patterson 2015).

The effect of oil, dispersants, and the combination of oil and dispersants on fishes of the Gulf remains an area of concern. Marine fish species typically concentrate PAHs in the digestive tract, making stomach bile an appropriate testing medium. A study by Synder et al. (2015) assessed bile samples from golden tilefish (*Lopholatilus chamaeleonticeps*), king snake eel (*Ophichthus rex*), and red snapper for PAH accumulation over time, and reported concentrations were highest in golden tilefish during the same time period when compared to king snake eel, and red snapper. These results suggest that the more highly associated an organism is with the sediment in an oil spill area, the higher the likelihood of toxic PAH accumulation. Twenty-first century dispersant applications are thought to be less harmful than their predecessors. However, the combination of oil and dispersants have proven to be more toxic to marine fishes than either dispersants or crude oil alone. Marine fish which are more active (e.g., a pelagic species versus a demersal species) appear to be more susceptible to negative effects from interactions with weathered oil/dispersant emulsions. These effects can include mobility impairment and inhibited respiration (Swedmark et al. 1973). Another study found that while Corexit 9500A® and oil are similar in their toxicity, when Corexit 9500A® and oil were mixed in lab tests, toxicity to microscopic rotifers increased up to 52-fold (Rico-Martínez et al. 2013). These studies suggest that the toxicity of the oil and dispersant combined may be greater than anticipated. The impacts on the food web from phytoplankton, to zooplankton, to mollusks, to top predators may be significant in the future. Effects on shrimp from the oil spill may affect other species that prey upon shrimp.

Sections of the Gulf were closed to all fishing during the oil spill event. These areas were opened after the well was capped and testing determined seafood from each area was safe for human consumption. In November 2010, a fisherman reported tarballs in his net while trawling for royal red shrimp in an area that opened five days before. NMFS reclosed the area and conducted additional seafood sampling. NMFS re-opened the area in February after testing shrimp and finfish from the area and finding that all seafood samples passed both sensory and chemical testing.

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

*Deepwater Coral Communities*

Deepwater corals are particularly vulnerable to episodic mortality events such as oil spills, since corals are immobile. Severe health declines have been observed in three deepwater corals in response to dispersant alone (2.3–3.4 fold) and the oil–dispersant mixtures (1.1–4.4 fold) compared to oil-only treatments (DeLeo et al. 2015). Increased dispersant concentrations appeared to exacerbate these results. As hundreds of thousands of gallons of dispersant were applied near the wellhead during the *Deepwater Horizon* MC252 oil spill, the possibility exists

that deepwater corals may have been negatively impacted by the oil spill and subsequent spill remediation activities.

Several studies have documented declines in coral health or coral death in the presence of oil from the *Deepwater Horizon* MC252 oil spill (White et al. 2011; Hsing et al. 2013; Fisher et al. 2014). Sites as far as 11 km southwest of the spill were documented to have >45% of the coral colonies affected by oil (White et al. 2011; Hsing et al. 2013), and, though less affected, a site 22 km in 1900 m of water had coral damage caused by oil (Fisher et al. 2014). Coral colonies from several areas around the wellhead had damage to colonies that seemed to be representative of microdroplets as all colonies were not affected, and colonies that were affected had patchy distributions of damaged areas (Fisher et al. 2014). Because locations of deep-sea corals are still being discovered, it is likely that the extent of damage to deep-sea communities will remain undefined.

*Outstanding Effects*

As a result of the *Deepwater Horizon* MC252 oil spill, a consultation pursuant to ESA Section 7(a)(2) was reinitiated. As discussed above, on September 30, 2011, the Protected Resources Division released a biological opinion, which after analyzing best available data, the current status of the species, environmental baseline (including the impacts of the recent *Deepwater Horizon* MC252 oil spill in the northern Gulf), effects of the proposed action, and cumulative effects, concluded that the continued operation of the Gulf reef fish fishery is not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, leatherback, or loggerhead sea turtles, nor the continued existence of smalltooth sawfish (NMFS 2011). For additional information on the *Deepwater Horizon* MC252 oil spill and associated closures, see: http://sero.nmfs.noaa.gov/deepwater_horizon_oil_spill.htm.
The impacts on the food web from phytoplankton, to zooplankton, to mollusks, to top predators may be significant in the future. Effects on shrimp from the oil spill may affect other species that prey upon shrimp.

Sections of the Gulf were closed to all fishing during the oil spill event. These areas were opened after the well was capped and testing determined seafood from each area was safe for human consumption. In November 2010, a fisherman reported tarballs in his net while trawling for royal red shrimp in an area that opened five days before. NMFS reclosed the area and conducted additional seafood sampling. NMFS re-opened the area in February after testing shrimp and finfish from the area and finding that all seafood samples passed both sensory and chemical testing.

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Bycatch reduction devices (BRDs) have been required for use since 1998 in the western Gulf and since 2004 in the eastern Gulf. Since 2010, some new BRDs were certified, while others were decertified. The intent of these modifications to BRD regulations was to provide additional flexibility to the fishery. BRDs may have different capabilities according to different fishing conditions, and having a wider variety of BRDs for use in the fisheries allows fishermen greater flexibility to choose the most effective BRD for the specific local fishing conditions.

To address sea turtle bycatch and associated mortality, NMFS implemented regulations requiring turtle excluder devices (TEDs) in 1987, which were phased in over 20 months. Originally, TEDs were required on a seasonal basis, and no TEDs were required if the fisherman followed restricted tow times. Subsequent rulemaking in 1992 required TEDs in all shrimp trawls from North Carolina to Texas, but phased in these requirements to the inshore fishery over a two-year period. Over time, TED regulations have been modified to change the allowable configurations with the intent of improving turtle exclusion. TEDs are required in both state and federal waters. Royal red shrimp trawls are not required to have TEDs if the catch is 90% or more royal red shrimp because the fishery is prosecuted in depths that are unlikely to capture sea turtles.

Since 2001, there has been a decrease in effort in southeast U.S. shrimp fishery. The decline has been attributed to low shrimp prices, rising fuel costs, competition with imported products, and the impacts of 2005 and 2006 hurricanes in the Gulf. This was exacerbated by the financial meltdown and consequent recession in the U.S. economy in 2007-2008. The economy has started to recover, though slowly, in the last few years. In addition, shrimp prices have increased in the last two years, partly due to reductions in shrimp imports as shrimp farms in some of the major exporting countries were hit with diseases. However, reductions in shrimp imports may be just temporary and imports could recover to their previous high levels in the future. Given that the shrimp fishery still faces many of the challenges that contributed to the effort declines, effort is not expected to increase substantially in the near future.

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

In a 2014 biological opinion (NMFS 2014), NMFS analyzed the impacts of the southeast shrimp fisheries based on 2009 effort levels. If effort exceeds that level, NMFS will infer that take has been exceeded and that effects on sea turtles were greater than analyzed. If effects exceed those in the opinion for any given year, then NMFS would reinitiate Endangered Species Act consultation and may need to implement stricter management measures. If the shrimp permit becomes an open access permit, effort could increase and trigger a new biological opinion.

**Present Actions**

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

**Reasonably Foreseeable Future Actions**

The Council has one other action in development relative to the shrimp fishery. Amendment 17B will address: 1) establishing aggregate maximum sustainable and optimum yields; 2) establishing a target number of shrimp permits and a potential reserve shrimp permit pool; and 3) allowing vessels without a federal permit to transit federal waters with shrimp on board. These actions would not remove any permits or impact any current federal shrimp permit holders. However, if access to the Gulf shrimp permit remains limited, some actions in Amendment 17B could halt the decline of permits, or even allow the number of permits to increase. This in turn could allow an increase in effort that could potentially exceed the red snapper or sea turtle thresholds and trigger stricter management measures.

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

In the southeast, general impacts of climate change have been predicted through modeling with few studies on species specific effects. Warming sea temperature trends in the southeast have been documented, and animals must migrate to cooler waters, if possible, if water temperatures exceed survivable ranges (Needham et al. 2012). Higher water temperatures may also allow invasive species to establish communities in areas they may not have been able to survive previously. An area of low oxygen, known as the dead zone, forms in the northern Gulf each summer. Climate change may contribute to this dead zone by increasing rainfall that in turn increases nutrient input from rivers. This increased nutrient load causes algal blooms that, when

decomposing, reduce oxygen in the water (Kennedy et al. 2002; Needham et al. 2012). Other potential effects of climate change in the southeast include increases in hurricanes, decreases in salinity, altered circulation patterns, and sea level rise. The combination of warmer water and expansion of salt marshes inland with sea-level rise may increase productivity of estuarine-dependent species in the short term. However, in the long term, this increased productivity may be temporary because of loss of fishery habitats due to wetland loss (Kennedy et al. 2002). Actions from this amendment are not expected to significantly contribute to climate change through the increase or decrease in the carbon footprint from fishing.

Hurricane season is from June 1 to November 30, and accounts for 97% of all tropical activity affecting the Atlantic Basin. These storms, although unpredictable in their annual occurrence, can devastate areas when they occur. However, while these effects may be temporary, those fishing-related businesses whose profitability is marginal may go out of business if a hurricane strikes.

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

**Monitoring**

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

The proposed action relates to the harvest of an indigenous species in the Gulf, and the activity being altered does not itself introduce non-indigenous species, and is not reasonably expected to facilitate the spread of such species through depressing the populations of native species. Additionally, it does not propose any activity, such as increased ballast water discharge from foreign vessels, which is associated with the introduction or spread on non-indigenous species.

# CHAPTER 5. LIST OF PREPARERS

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

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

# CHAPTER 6. LIST OF AGENCIES, ORGANIZATIONS AND PERSONS CONSULTED

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

NOAA General Counsel

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

# CHAPTER 7. REFERENCES


Aasche, F., L.S. Bennear, A. Oglend and M.D. Smith. 2012. U.S. Shrimp Market Integration. Marine Resource Economics. 27(2) 181-192.

Carls, M.G., S.D. Rice, and J.E. Hose. 1999. Sensitivity of Fish Embryos to Weathered Crude Oil: Part I. Low-level Exposure during Incubation Causes Malformations, Genetic Damage, and Mortality in Larval Pacific Herring (*Clupea pallasi*). Environmental Toxicology and Chemistry 18(3): 481–493.

Colburn, L. L. and M. Jepson. 2012. Social indicators of gentrification pressure in fishing communities: a context for social impact assessment. Coastal Management 40 (3): 289-300.

DeLeo, D.M., D.V. Ruiz-Ramos, I.B. Baums, and E.E. Cordes. 2015. Response of deep-water corals to oil and chemical dispersant exposure. Deep-Sea Research II. In press.

Fisher, C.R., P. Hsing, C.L. Kaiser, D.R., Yoerger, H.H. Roberts, W.W. Shedd, E.E. Cordes, T.M. Shank, S.P. Berlet, M.G. Saunders, E.A. Larcom, J.M. Brooks. 2014. Footprint of *Deepwater Horizon* blowout impact to deep-water coral communities. Proceedings of the National Academy of Sciences 111: 11744-11749. doi: 10.1073/pnas.1403492111

GMFMC. 1981. Fishery management plan for the shrimp fishery of the Gulf of Mexico, United States waters. Gulf of Mexico Fishery Management Council, Tampa, FL, 246 pp. http://www.gulfcouncil.org/docs/amendments/SHRIMP%20FMP%20Final%201981-11.pdf

GMFMC. 1997. Amendment 9 to the fishery management plan for the shrimp fishery of the Gulf of Mexico, U.S. Waters. Gulf of Mexico Fishery Management Council, 2203 North Lois Avenue, Suite 1100, Tampa, FL 33607. 153 pp. http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/SHRIMP%20Amend-09%20Final%201997-02.pdf

GMFMC. 2001. Amendment 11 to the fishery management plan for the shrimp fishery of the Gulf. Gulf Fishery Management Council, 2203 N. Lois Ave, Tampa, Florida 33607. http://gulfcouncil.org/Beta/GMFMCWeb/downloads/SHRIMP%20Amend-11%20Final%202001-04.pdf

GMFMC. 2002. Amendment 10 to the fishery management plan for the shrimp fishery of the Gulf of Mexico, U.S. Waters. Gulf of Mexico Fishery Management Council, 2203 North Lois Avenue, Suite 1100, Tampa, FL 33607. 153 pp. http://gulfcouncil.org/Beta/GMFMCWeb/downloads/SHRIMP%20Amend-10%20Final%202002-07.pdf

GMFMC. 2005a. Amendment 13 to the fishery management plan for the shrimp fishery of the Gulf. Gulf Fishery Management Council, 2203 N. Lois Ave, Tampa, Florida 33607. http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Shrimp%20Amend%2013%20Final%20805.pdf

GMFMC. 2005b. Generic amendment 3 for addressing essential fish habitat requirements, habitat areas of particular concern, and adverse effects of fishing in the following fishery management plans of the Gulf of Mexico: shrimp fishery of the Gulf of Mexico, United States Waters, red drum fishery of the Gulf of Mexico, reef fish fishery of the Gulf of Mexico, coastal migratory pelagic resources (mackerels) in the Gulf of Mexico and South Atlantic, stone crab fishery of the Gulf of Mexico, spiny lobster in the Gulf of Mexico and South Atlantic, and coral and coral reefs of the Gulf of Mexico.
http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/FINAL3_EFH_Amendment.pdf

GMFMC. 2007. Amendment 27 to the reef fish fishery management plan and Amendment 14 to the shrimp fishery management plan. Gulf Fishery Management Council, 2203 N. Lois Ave, Tampa, Florida 33607. http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Final%20RF%20Amend%2027-%20Shrimp%20Amend%2014.pdf

GMFMC. 2013. Framework action to establish funding responsibilities for the electronic logbook program in the shrimp fishery of the Gulf of Mexico. Gulf of Mexico Fishery Management Council, Tampa, FL, 39 pp.
http://www.gulfcouncil.org/docs/amendments/Final%20Shrimp%20ELB%20Abbreviated%20Framework.pdf

GMFMC. 2014. Amendment 16 to the fishery management plan for the shrimp fishery of the Gulf of Mexico, U.S. Waters. Gulf of Mexico Fishery Management Council, 2203 N. Lois Ave, Tampa, Florida 33607.
http://gulfcouncil.org/docs/amendments/Shrimp%20Amendment%2016.pdf

GMFMC. 2015. Amendment 15 to the fishery management plan for the shrimp fishery of the Gulf of Mexico, U.S. Waters. Gulf of Mexico Fishery Management Council, 2203 N. Lois Ave, Tampa, Florida 33607.
http://gulfcouncil.org/docs/amendments/Shrimp%20Amendment%2015%20FINAL.pdf

Gore, R. H. 1992. The Gulf of Mexico: a treasury of resources in the American Mediterranean. Pineapple Press. Sarasota, Florida.

Haensly, W.E., J.M. Neff, J.R. Sharp, A.C. Morris, M.F. Bedgood, and P.D. Beom 1982. Histopathology of *Pleuronectes platessa* from Aber Wrac'h and Aber Benoit, Brittany, France: long-term effects of the Amoco Cadiz crude oil spill. Journal of Fish Disease 5: 365-391.

Hart, R. A. 2013. Review of the status and health of the Gulf of Mexico shrimp stocks for 2012. Report to the Gulf of Mexico Fisheries Management Council. 13 pp.

Heintz, R.A., J.W. Short, and S.D. Rice. 1999. Sensitivity of fish embryos to weathered crude oil: Part II. Increased mortality of pink salmon (*Oncorhynchus gorbuscha*) embryos incubating downstream from weathered Exxon *Valdez* crude oil. Environmental Toxicology and Chemistry 18(3): 494–503.

Hose, J.E., M.D. McGurk, G.D. Marty, D.E. Hinton, E.D Brown, and T.T. Baker. 1996. Sublethal effects of the (Exxon *Valdez*) oil spill on herring embryos and larvae: morphological, cytogenetic, and histopathological assessments, 1989–1991. Canadian Journal of Fisheries and Aquatic Sciences 53: 2355-2365.

Hsing, P., B. Fu, E.A. Larcom, S.P. Berlet, T.M. Shank, A.F. Govindarajan, A.J. Lukasiewicz, P.M. Dixon, C.R. Fisher. 2013. Evidence of lasting impact of the *Deepwater Horizon* oil spill on a deep Gulf of Mexico coral community Elementa: Science of the Anthropocene 1: 1-15.

Incardona, J.P, L.D. Gardner, T.L. Linbo, T.L. Brown, A.J. Esbaugh, E.M. Mager, J.D. Stieglitz, B.L. French, J.S. Labenia, C.A. Laetz, M. Tagal, C.A. Sloan, A. Elizur, D.D. Benetti, M. Grosell, B.A. Block, and N.L. Scholz. 2014. *Deepwater Horizon* crude oil impacts the developing hearts of large predatory pelagic fish. Proceedings of the National Academy of Sciences 111(15): E1510–E1518.

IPCC. 2013. Climate Change 2013: The physical science basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Stocker, T. F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

IPCC. 2014. Climate Change 2014: impacts, adaptation, and vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Field, C. B., V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, and L. L. White (eds.). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

Jacob, S., P. Weeks, B. Blount, and M. Jepson. 2012. Development and evaluation of social indicators of vulnerability and resiliency for fishing communities in the Gulf of Mexico. Marine Policy 26 (10): 16-22.

Jepson, M. and L.L. Colburn 2013. Development of social indicators of fishing community vulnerability and resilience in the U.S. Southeast and Northeast Regions. U.S. Dept. of Commerce, NOAA Technical Memorandum NMFS-F/SPO-129, 64 p.

Jones, R.C., 2012 "Big Shrimpin': Changing Bio-economic Conditions, Vessel Responses, and Financial Outcomes in the Federal Gulf of Mexico Shrimp Fishery; a 2006 through 2009 Comparison of Annual Vessel-Level Data" (2012). *Open Access Theses.* Paper 385.

Kennedy, V. S., R. R. Twilley, J. A. Kleypas, J. H. Cowan, and S. R. Hare. 2002. Coastal and marine ecosystems and global climate change. Report prepared for the Pew Center on Global Climate Change, 52 pp. http://www.c2es.org/docUploads/marine_ecosystems.pdf

Khan, R.A. and J.W. Kiceniuk. 1984. Histopathological effects of crude oil on Atlantic cod following chronic exposure. Canadian Journal of Zoology 62: 2038-2043.

Khan R.A. and J.W. Kiceniuk. 1988. Effect of petroleum aromatic hydrocarbons on monogeneids parasitizing Atlantic cod, *Gadus morhua*. Bulletin of Environmental Contamination and Toxicology 41: 94-100.

Khan, R.A. 1990. Parasitism in Marine Fish after Chronic Exposure to Petroleum Hydrocarbons in the Laboratory and to the Exxon *Valdez* Oil Spill. Bulletin of Environmental Contamination and Toxicology 44: 759-763.

Kiceniuk J.W. and R.A. Khan. 1987. Effect of petroleum hydrocarbons on Atlantic cod, *Gadus morhua*, following chronic exposure. Canadian Journal of Zoology 65: 490-494.

Liese, C. 2011. 2009 Economics of the federal Gulf shrimp fishery annual report. NOAA Fisheries, Southeast Fisheries Science Center, Miami Laboratory, 75 Virginia Beach Drive, Miami, Florida 33149.

Liese, C. 2013. 2010 Economics of the federal Gulf shrimp fishery annual report. NOAA Fisheries, Southeast Fisheries Science Center, Miami Laboratory, 75 Virginia Beach Drive, Miami, Florida 33149.

Liese, C. 2014. Economics of the federal Gulf shrimp fishery -- 2012. NOAA Technical Memorandum NMFS-SEFSC-668, 26 p.

Liese, C., and M. D. Travis. 2010. The annual economic survey of federal Gulf shrimp permit holders: implementation and descriptive results for 2008. NOAA Technical Memorandum NMFS-SEFSC-601.

Liese, C., M. D. Travis, D. Pina, and J.R. Waters. 2009a. The annual economic survey of federal Gulf shrimp permit holders: report on the design, implementation, and descriptive results for 2006. NOAA Technical Memorandum NMFS-SEFSC-584.

Liese, C., M. D. Travis, and J. R. Waters. 2009b. The annual economic survey of federal Gulf shrimp permit holders: implementation and descriptive results for 2007. NOAA Technical Memorandum NMFS-SEFSC-590.

Mendelssohn, I.A., G.L. Andersen, D.M. Baltz, R.H. Caffey, K.R. Carman, J.W. Fleeger, S.B. Joye, Q. Lin, E. Maltby, E.B. Overton, and L.P. Rozas. 2012. Oil Impacts on Coastal Wetlands: Implications for the Mississippi River Delta Ecosystem after the *Deepwater Horizon* Oil Spill. BioScience 62: 562–574.

Murawski, S. A., W. T. Hogarth, E. B. Peebles and L. Barbieri. 2014. Prevalence of external skin lesions and polycyclic aromatic hydrocarbon concentrations in Gulf of Mexico fishes, post-Deepwater Horizon. Transactions of the American Fisheries Society 143(4):1084-1097.

National Commission. 2010. The use of surface and subsea dispersants during the BP *Deepwater Horizon* oil spill. National Commission on the BP *Deepwater Horizon* Oil Spill and Offshore Drilling (National Commission). Staff Working Paper No. 4. http://www.oilspillcommission.gov/sites/default/files/documents/Updated%20Dispersants%20Working%20Paper.pdf

Needham, H., D. Brown, and L. Carter. 2012. Impacts and adaptation options in the Gulf coast. Report prepared for the Center for Climate and Energy Solutions, 38 pp. http://www.c2es.org/docUploads/gulf-coast-impacts-adaptation.pdf

Nelson, D. M. (ed.). 1992. Distribution and abundance of fishes and invertebrates in Gulf of Mexico Estuaries, Volume I: data summaries. ELMR Report No. 10. NOAA/NOS Strategic Environmental Assessments Division, Rockville, Maryland. 273 pp.

NMFS. 2002. Regulatory impact review and Regulatory Flexibility Act analysis for making technical changes to TEDs to enhance turtle protection in the southeastern United States under sea turtle conservation regulations. National Marine Fisheries Service, 9721 Executive Center Drive North, St. Petersburg, FL 33702.

NMFS. 2006. Regulatory impact review, Regulatory Flexibility Act analysis, and social impact assessment for the proposed rule to revise the Gulf/South Atlantic bycatch reduction device testing manual and modify the bycatch reduction criterion for bycatch reduction devices used in the penaeid shrimp fishery west of Cape San Blas, Florida

NMFS. 2011. Biological opinion on the continued authorization of Reef Fish fishing under the Gulf of Mexico Reef Fish Fishery Management Plan. September 30, 2011. Available at: http://sero.nmfs.noaa.gov/pr/esa/Fishery%20Biops/03584%20GOM%20Reef%20Fish%20BiOp%202011%20final.pdf

NMFS. 2014. Endangered Species Act section 7 consultation biological opinion: reinitiation of Endangered Species Act (ESA) Section 7 consultation 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 under the Magnuson-Stevens Fishery Management and Conservation Act (MSFMCA). Consultation No. SER-2-13-1225. 346 pp. http://sero.nmfs.noaa.gov/protected_resources/sea_turtles/documents/shrimp_biological_opinion_2014.pdf

NMFS and USFWS. 1991. Recovery plan for U.S. population of Atlantic green turtle (Chelonia mydas). National Marine Fisheries Service, Washington, D.C., 59 pp. http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_green_atlantic.pdf

NMFS and USFWS. 1992a. Recovery plan for leatherback turtles in the U.S. Caribbean, Atlantic and Gulf of Mexico. National Marine Fisheries Service, Washington D.C., 69 pp. http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_leatherback_atlantic.pdf

NMFS and USFWS. 1992b. Recovery plan for the Kemp's Ridley sea turtle (*Lepidochelys*

*kempii*). National Marine Fisheries Service, St. Petersburg, FL, 47 pp. http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_kempsridley.pdf

NMFS and USFWS. 2008. Recovery plan for the northwest Atlantic population of the loggerhead sea turtle (*Caretta caretta*), second revision. National Marine Fisheries Service, Silver Spring, MD, 325 pp. http://www.nmfs.noaa.gov/pr/pdfs/recovery/turtle_loggerhead_atlantic.pdf

NMFS, USFWS, and SEMARNAT. 2011. Bi-national recovery plan for the Kemp's Ridley sea turtle (*Lepidochelys kempii*), second revision. National Marine Fisheries Service, Silver Spring, MD, 156 pp. http://ecos.fws.gov/docs/recovery_plan/kempsridley_revision2_with%20signature.pdf

Paramo, J. and U. Saint-Paul. 2011. Deep-sea shrimps *Aristaeomorpha foliacea* and *Pleoticus robustus* (Crustacea: Penaeoidea) in the Colombian Caribbean Sea as a new potential fishing resource. Journal of the Marine Biological Association of the United Kingdom 92:811-818.

Pattillo, M. E., T. E. Czapla, D. M. Nelson, and M. E. Monaco. 1997. Distribution and abundance of fishes and invertebrates in Gulf of Mexico estuaries. Volume II: species life history summaries. ELMR Report No. 11. NOAA/NOS Strategic Environmental Assessment Division, Silver Spring, Maryland. 377 pp.

Ran, T., W.R. Keithly and C. Yue. 2014. Reference-Dependent Preferences in the Gulf of Mexico Shrimpers' Fishing Effort Decisions. Marine Resource Economics 39(1) 19-33.

Reed, J. and S. Farrington. 2010. Distribution of deep-water commercial fisheries species-golden crab, tilefish, royal red shrimp- in deep-water habitats off eastern Florida from submersible and ROV dives. Report to the South Atlantic Fishery Management Council Contract No. SA(08-09)16, 163 pp. http://www.safmc.net/managed-areas/pdf/2010%20SAFMC%20NMFS%20Golden%20Crab%20Tilefish%20REPORT.pdf

Rico-Martinez, R., T.W. Snell, and T.L. Shearer. 2013. Synergistic toxicity of Macondo crude oil and dispersant Corexit 9500A ((R)) to the *Brachionus plicatilis* species complex (Rotifera). Environmental Pollution 173: 5–10.

Scott-Denton, E., P. F. Cryer, M. R. Duffy, J. P. Gocke, M. R. Harrelson, D. L. Kinsella, J. M. Nance, J. R. Pulver, R. C. Smith, and J. A. Williams. 2012. Characterization of the U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on observer data. Marine Fisheries Review 74(4):1-26. http://www.galvestonlab.sefsc.noaa.gov/publications/pdf/938.pdf

SEDAR 31. 2013. Stock Assessment Report for Gulf of Mexico Red Snapper. Southeast Data, Assessment and Review. North Charleston, South Carolina. 1103 pp.

Sheridan, P. and J. Doerr. 2005. Short-term effects of the cessation of shrimp trawling on Texas benthic habitats. American Fisheries Society Symposium 41:571-578.

Short, J. 2003. Long-Term Effects of Crude Oil on Developing Fish: Lessons from the Exxon *Valdez* Oil Spill. Energy Sources 25(6): 509-517.

Sindermann, C.J. 1979. Pollution-associated diseases and abnormalities of fish and shellfish: a review. Fisheries Bulletin 76: 717-749.

Solangi, M.A. and R.M. Overstreet. 1982. Histopathological changes in two estuarine fishes, Menidia beryllina (Cope) and Trinectes maculatus (Bloch and Schneider), exposed to crude oil and its water-soluble fractions. Journal of Fish Disease 5: 13-35.

Swedmark, M., A. Granmo, and S. Kollberg. 1973. Effects of oil dispersants and oil emulsions on marine animals. Water Research 7(11): 1649-1672.

Tarnecki, J.H. and W.F. Patterson III. 2015. Changes in Red Snapper Diet and Trophic Ecology. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science 7: 135–147.

Tavares, M. 2002. Shrimps *in* K.E. Carpenter, editor. The living marine resources of the western central Atlantic, species identification guide for fisheries purposes. FAO, Rome, pp. 251- 291.

Travis, M. 2010. Analysis of Gulf Shrimp Moratorium Permits. SERO-NMFS, 22 p.

Vinuya, F.D. 2007. Testing for Market Integration and the Law of One Price in World Shrimp Markets. Aquaculture Economics & Management. Volume 11, Issue 3 (243-265).

White, H.K., P. Hsing, W. Cho, T.M. Shank, E.E. Cordes, A.M. Quattrini, R.K. Nelson, R. Camili, A.W.J. Demopoulos, C.R. German, J.M. Brooks, H.H. Roberst, W. Shedd, C.M. Reddy, C.R. Fisher. 2012. Impact of the *Deepwater Horizon* oil spill on a deep-water coral community in the Gulf of Mexico. Proceedings of the National Academy of Sciences 109:20303-20308.

# APPENDIX A. ALTERNATIVES CONSIDERED BUT REJECTED

REMOVED AT JUNE 2015 COUNCIL MEETING

One alternative from Action 2 – Royal red shrimp endorsement
**Alternative 3** – To renew a royal red shrimp endorsement, the applicant must have had a minimum royal red shrimp landings during one of the three calendar years preceding the application

Option a: 300 lbs
Option b: 1,000 lbs
Option c: 10,000 lbs

**Alternative 3** would require landings to be eligible to be issued a royal red shrimp endorsement. **Option a** is the minimum landings that have been recorded from a vessel in the past 5 years. **Options b** and **c** are larger values that indicate that the fisher is targeting royal red shrimp at least sometime during the year. In 2013, the landings for royal red shrimp were below 200,000 lbs of tails (GMFMC 2014). The maximum landings recorded for royal red shrimp (from the years 1962-2013) was 336,710 lbs of tails in 1994. **Alternative 3** would prevent new entrants into the fishery from gaining a royal red endorsement and would eliminate latent endorsements. However, because the number of vessels fishing for royal red shrimp is much lower than the number of endorsements, the Council saw no need to limit access at this time.

# APPENDIX B. BYCATCH PRACTICABILITY ANALYSIS

**Overview**

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

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

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

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

**Background**

Bycatch practicability for the Gulf of Mexico (Gulf) shrimp fishery was first addressed in the Generic Sustainable Fisheries Act Amendment (GMFMC 1999). That amendment contained a bycatch practicability analysis and evaluated the biological, ecological, social, economic, and administrative impacts associated with a wide range of alternatives, including those required for

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

Amendment 17A considers allowing the permit moratorium to expire, continue the moratorium, or implement a limited access permit. The amendment also considers eliminating the royal red shrimp endorsement; however, removing the royal red shrimp endorsement would have no impact on bycatch because it does not limit participation in the fishery. Therefore, bycatch issues related to the moratorium action are reviewed below.

**1. Population effects for the bycatch species**

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

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

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

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

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

Source: SEFSC, Pascagoula

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

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

TEDs approved for use have had to demonstrate 97% effectiveness in excluding sea turtles from trawls in controlled testing. TEDs are required in both state and federal waters. Royal red shrimp trawls are not required to have TEDs if the catch is 90% or greater royal red shrimp because the fishery is prosecuted in depths where sea turtles are unlikely to be caught. Over time, TED regulations have been modified to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), flotation, and more widespread use.

In addition to improvements in TED designs, interactions between sea turtles and shrimp fisheries were thought to be declining because of reductions of fishing effort unrelated to fisheries management actions. Since 2001, low shrimp prices, rising fuel costs, competition with

imported products, and the impacts of hurricanes in the Gulf have all impacted shrimp fleets, in some cases reducing fishing effort by as much as 50% in offshore waters of the Gulf (GMFMC 2007). However, in August 2010, reinitiation of consultation on sea turtle effects was triggered by based on elevated strandings in the northern Gulf suspected to be attributable to shrimp trawling, compliance concerns with TED and tow-time regulations, and elevated nearshore sea turtle abundance trawl catch per unit of effort (CPUE). These factors collectively indicated that sea turtles may be affected by shrimp trawling, under the sea turtle conservation regulations and federal FMPs, to an extent not considered in the 2002 opinion, despite lower fishing effort levels.

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

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

The population effects of bycatch mortality are the same as fishing mortality from directed fishing efforts. If not properly managed and accounted for, either form of mortality could potentially reduce stock biomass to an unsustainable level. Bycatch mortality is incorporated in assessments of finfish stocks if estimates are available. Little is known about the status of many finfish (e.g., croaker, porgies) and invertebrate (e.g., mantis shrimp) species that are bycatch in shrimp trawls. These species have not undergone (or are likely to undergo) formal stock assessments, because most are not targeted in commercial or recreational fisheries. However, anecdotal information indicates that some of these species may have benefited from reduced effort in the shrimp fishery.

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

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

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

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

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

**4. Effects on marine mammals and birds**

The shrimp fishery in the Southeast (Gulf and South Atlantic) is classified in the 2015 List of Fisheries as a Category II fishery (79 FR 77919; January 28, 2015). This classification indicates the annual mortality and serious injury of a marine mammal stock from a fishery is greater than 1% but less than 50 % of the stock's potential biological removal (PBR) (i.e., sustainable levels). This fishery was elevated to Category II from Category III (mortality or serious injury to <1% of the PBR) in 2011 based on increased interactions reported by observers, strandings, and fisheries research data.

In February 2015, NMFS published the first estimates of total annual bycatch mortality and serious injury of Gulf common bottlenose dolphin (Tursiops truncates) and Atlantic spotted dolphin (Stenella frontalis) incidental to the Gulf shrimp otter trawl fishery (Soldevilla et al. 2015). Annual mortality estimates are calculated for the years 1997-2011 from annual fishery effort and bycatch rates. Results indicate that bottlenose dolphins in the Gulf are interacting with the Gulf shrimp otter trawl fishery. Soldevilla et al. (2015) states that shrimp bycatch mortality estimates exceed 10% of PBR for Western and Northern coastal stocks of bottlenose dolphins and may exceed sustainable levels for some estuarine stocks. Dolphin bycatch most commonly occurred as entanglements in TED nets and lazy lines. Soldevilla et al (2015) outlined several data limitations with potential biases based on inadequate knowledge of both the fishery and marine mammal stocks, particularly in the inshore bays, sounds, and estuaries. Therefore, additional data on estuarine stocks of bottlenose dolphins in the Gulf and overlapping shrimp trawl fishery effort are needed to determine the extent of mortality and serious injury on these stocks.

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

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

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

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

Regulatory measures implemented to reduce bycatch have direct costs related to purchasing and installing new technology or limiting where and/or when a vessel could operate. Benefits of increased bycatch reduction to the directed red snapper fishery would depend on whether and to what extent the reductions affect the rate of recovery in the red snapper fishery and thus the level of allowable yields in the fishery over time.

**6. Changes in fishing practices and behavior of fishermen**

The preferred alternative is to continue the moratorium, in which case no change in fishing practices or behavior would be expected. Even if the moratorium is allowed to expire and the permits become open access, a large influx of new shrimpers would not be expected due to the costs of vessels, gear, etc. However, with expiration of the moratorium, a new group of

fishermen could enter the fishery. These fishermen would need to comply with the BRD and TED rules and would not have the experience that led to the current acceptance of these devices.

When TEDs were first introduced in the Gulf, fishermen complained that these devices resulted in significant shrimp loss, malfunctioned and caused extra drag on trawlers, and were cumbersome and difficult to operate. They also contested the claims about the efficiency of TEDs, citing the poor performance of the devices under commercial conditions. Another problem was that many shrimpers did not believe that the fishery was contributing to high sea turtle mortality, and thus did not appreciate the need for TEDs (Cox et al. 2007, and references therein). Similar issues were encountered when BRDs were first required. Over time, fishermen learned how to use these devices in such a way as to reduce the negative impacts while comply with regulations. New shrimpers that have not gone through this process may experience the same initial problems and have a disincentive to use BRDs and TEDs properly.

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

Proposed actions that will affect bycatch are not expected to significantly impact research costs. Administrative and enforcement costs would be expected to increase if the moratorium is allowed to expire, because any new entrants would need to be educated about BRDs and TEDs and their proper installation.

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

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

**9. Changes in the distribution of benefits and costs**

When the moratorium was established in Amendment 13 (GMFMC 2005), the shrimp fishery in the Gulf was believed to have enough effort such that an initial reduction in effort due to the moratorium would not result in a reduction in catch. This statement was thought to be true for bycatch as well. In other words, there was excess capacity in the fishery and fewer vessels could harvest the available shrimp resources at a more profitable level. The problem under an open access permit was the potential for new vessels to enter the fishery by obtaining federal permits, which could reduce the benefits to current participants. Under the economic conditions, the vast

majority of new entry would likely be purely speculative. Increases in the number of active participants in the fishery would not have been sustainable under the economic conditions at that time. However, the global market is unpredictable, and the potential existed for external factors to improve long-term market conditions (i.e. shrimp and fuel prices). Should the moratorium expire, the number of vessels in the fishery could increase and reach excess capacity again. This situation would reverse the benefits obtained by historical fishermen during the moratorium.

Furthermore, current fishery participants have been exerting considerable effort to improve their economic condition through a variety of approaches, including attempts to improve product quality via a product certification program and aggressive marketing campaigns. Should those efforts be successful, the demand and thus the prices for domestic, wild shrimp would increase. The same result may occur if industry participants are successful in their attempts to have tariffs imposed on farmed, foreign shrimp, which they assert have been "dumped" into the U.S. market. The point is that, from the perspective of current industry participants, since they have borne the hardships and expended the resources in an attempt to reverse the industry's economic fortunes, then, under any reasonable concept of what is equitable, they should be the ones to benefit from their efforts.

**10. Social effects**

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

**Conclusion**

This section evaluates the practicability of taking additional action to minimize bycatch and bycatch mortality in the Gulf shrimp fishery by using the ten factors provided at 50 CFR 600.350(d)(3)(i). In summary, if the moratorium is allowed to expire, bycatch could increase substantially; however, continuing the moratorium or creating a limited access permit would not be expected to change the level of bycatch. Therefore, if the preferred alternative to continue the moratorium is implemented, no increase in bycatch would be expected. Bycatch is currently considered to be reduced to the extent practicable in the Gulf shrimp fishery through the use of BRDs and TEDs and reduced effort. Further, bycatch levels and associated implications will continue to be monitored in the future and issues will be addressed based on new information. Therefore, the Council concluded that current management measures minimize bycatch and bycatch mortality to the extent practicable in the Gulf shrimp fishery.

**References**

Campbell, L. M. and M. L. Cornwell. 2008. Human dimensions of bycatch reduction technology: Current assumptions and directions for future research. Endangered Species Research 5: 325-334.

Cook, R. 2003. The magnitude and impact of by-catch mortality by fishing gear. *In*: Sinclair, M. and G. Valdimarsson (eds.). Responsible Fisheries in the Marine Ecosystem. CABI Publishing, United Kingdom.

Cox, T. M., R. L. Lewison, R. Zydelis, L. B. Crowder, C. Safina, and A. J. Read. 2007. Comparing effectiveness of experimental and implemented bycatch reduction measures: The ideal and the real. Conservation Biology 21(5):1155-1164.

GMFMC. 1999. Generic sustainable fisheries act amendment. Gulf of Mexico Fishery Management Council, Tampa, FL 33607. 318 pp. http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Generic%20SFA%20amendment%201999.pdf

GMFMC. 2005. Amendment 13 to the fishery management plan for the shrimp fishery of the Gulf. Gulf Fishery Management Council, 2203 N. Lois Ave, Tampa, Florida 33607. http://www.gulfcouncil.org/Beta/GMFMCWeb/downloads/Shrimp%20Amend%2013%20Final%20805.pdf

GMFMC. 2007. Amendment 27 to the Reef Fish FMP and Amendment 14 to the Shrimp FMP to end overfishing and rebuild the red snapper stock. Gulf of Mexico Fishery Management Council, Tampa.

Henwood, T. A., and W. E. Stunz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. Fishery Bulletin 85:813-817.

Kelleher, K. 2005. Discards in the world's marine fisheries: An update. FAO Fisheries Technical Paper No. 470. Rome, FAO. 131p.

Nance, J. M. (Ed.). 1998. Report to congress. Southeastern United States shrimp trawl bycatch program. National Marine Fisheries Service, Southeast Fisheries Science Center Galveston Laboratory, 154 p.

NMFS. 2002. Endangered Species Act Section 7 consultation on shrimp trawling in the southeastern United States, under the sea turtle conservation regulations and as managed by the fishery management plans for shrimp in the South Atlantic and Gulf of Mexico. Southeast Regional Office, Saint Petersburg, Florida.

NMFS. 2012. Re-initiation of Endangered Species Act (ESA) Section 7 consultation on the continued implementation of the sea turtle conservation regulations and the continued

authorization of the southeast U.S. shrimp fisheries in federal waters under the Magnuson-Stevens Act. Southeast Regional Office, Saint Petersburg, Florida.

NMFS. 2014. Endangered Species Act section 7 consultation 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. Southeast Regional Office, St. Petersburg, FL.

NMFS-SEFSC. 2010. Data analysis request: Update of turtle bycatch in the Gulf of Mexico and southeastern Atlantic shrimp fisheries. Memorandum dated December 22, 2010. National Marine Fisheries Service. Southeast Fisheries Science Center, Miami, FL.

NMFS-SEFSC. 2011. Estimated incidental take of smalltooth sawfish (Pristis pectinata) and an assessment of observer coverage required in the South Atlantic and Gulf of Mexico shrimp trawl fishery. National Marine Fisheries Service. Southeast Fisheries Science Center, Miami, FL.

NRC. 1990. Decline of the sea turtles: Causes and prevention. National Research Council, Washington, D. C.

Scott-Denton, E., P. F. Cryer, M. R. Duffy, J. P. Gocke, M. R. Harrelson, D. L. Kinsella, J. M. Nance, J. R. Pulver, R. C. Smith, and J. A. Williams. 2012. Characterization of the U.S. Gulf of Mexico and South Atlantic penaeid and rock shrimp fisheries based on observer data. Marine Fisheries Review 74(4): 1-26. http://www.galvestonlab.sefsc.noaa.gov/publications/pdf/938.pdf

Soldevilla, Melissa S., Garrison, Lance P., Scott-Denton, Elizabeth, Nance, James M. 2015. Estimation of marine mammal bycatch mortality in the Gulf of Mexico shrimp otter trawl fishery. NOAA Technical Memorandum NMFS-SEFSC-672, 70 p.

# APPENDIX C. OTHER APPLICABLE LAW

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1801 et seq.) provides the authority for fishery management in federal waters of the Exclusive Economic Zone. However, fishery management decision-making is also affected by a number of other federal statutes designed to protect the biological and human components of U.S. fisheries, as well as the ecosystems that support those fisheries. Major laws affecting federal fishery management decision-making include the Endangered Species Act (Section 3.3 and 4.3), E.O. 12866 (Regulatory Planning and Review, Chapter 5) and E.O. 12898 (Environmental Justice, Section 3.5). Other applicable laws are summarized below.

**Administrative Procedures Act**

All federal rulemaking is governed under the provisions of the Administrative Procedure Act (APA) (5 U.S.C. Subchapter II), which establishes a "notice and comment" procedure to enable public participation in the rulemaking process. Under the APA, the National Marine Fisheries Service (NMFS) is required to publish notification of proposed rules in the *Federal Register* and to solicit, consider, and respond to public comment on those rules before they are finalized. The APA also establishes a 30-day waiting period from the time a final rule is published until it takes effect. Proposed and final rules will be published before implementing the actions in this amendment.

**Coastal Zone Management Act**

Section 307(c)(1) of the federal Coastal Zone Management Act of 1972 (CZMA), as amended, requires federal activities that affect any land or water use or natural resource of a state's coastal zone be conducted in a manner consistent, to the maximum extent practicable, with approved state coastal management programs. The requirements for such a consistency determination are set forth in NOAA regulations at 15 CF.R. part 930, subpart C. According to these regulations and CZMA Section 307(c)(1), when taking an action that affects any land or water use or natural resource of a state's coastal zone, NMFS is required to provide a consistency determination to the relevant state agency at least 90 days before taking final action.

Upon submission to the Secretary, NMFS will determine if this plan amendment is consistent with the Coastal Zone Management programs of the states of Alabama, Florida, Louisiana, Mississippi, and Texas to the maximum extent possible. The determination will then be submitted to the responsible state agencies under Section 307 of the CZMA administering approved Coastal Zone Management programs for these states.

**Data Quality Act**

The Data Quality Act (DQA) (Public Law 106-443) effective October 1, 2002, requires the government to set standards for the quality of scientific information and statistics used and disseminated by federal agencies. Information includes any communication or representation of knowledge such as facts or data, in any medium or form, including textual, numerical, cartographic, narrative, or audiovisual forms (includes web dissemination, but not hyperlinks to information that others disseminate; does not include clearly stated opinions).

Specifically, the Act directs the Office of Management and Budget (OMB) to issue government wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility, and integrity of information disseminated by federal agencies." Such guidelines have been issued, directing all federal agencies to create and disseminate agency-specific standards to: 1) ensure information quality and develop a pre-dissemination review process; 2) establish administrative mechanisms allowing affected persons to seek and obtain correction of information; and 3) report periodically to OMB on the number and nature of complaints received.

Scientific information and data are key components of fishery management plans (FMPs) and amendments and the use of best available information is the second national standard under the Magnuson-Stevens Act. To be consistent with the Magnuson-Stevens Act, FMPs and amendments must be based on the best information available. They should also properly reference all supporting materials and data, and be reviewed by technically competent individuals. With respect to original data generated for FMPs and amendments, it is important to ensure that the data are collected according to documented procedures or in a manner that reflects standard practices accepted by the relevant scientific and technical communities. Data presented in this amendment has undergone quality control prior to being used by the agency and will be subject to a pre-dissemination review.

**National Historic Preservation Act**

The National Historic Preservation Act (NHPA) of 1966, (Public Law 89-665; 16 U.S.C. 470 *et seq.*) is intended to preserve historical and archaeological sites in the United States of America. Section 106 of the NHPA requires federal agencies to evaluate the impact of all federally funded or permitted projects for sites on listed on, or eligible for listing on, the National Register of Historic Places and aims to minimize damage to such places.
Historical research indicates that over 2,000 ships have sunk on the Federal Outer Continental Shelf between 1625 to 1951; thousands more have sunk closer to shore in state waters during the same period. Only a handful of these have been scientifically excavated by archaeologists for the benefit of generations to come. Further information can be found at:
http://www.boem.gov/Environmental-Stewardship/Archaeology/Shipwrecks.aspx

The proposed action does not adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places nor is it expected to cause loss or destruction of significant scientific, cultural, or historical resources. In the Gulf, the *U.S.S. Hatteras*, located in federal waters off Texas, is listed in the National Register of Historic Places. Fishing activity already occurs in the vicinity of this site, but the proposed action would have no additional adverse impacts on listed historic resources, nor would they alter any regulations intended to protect them.

**Executive Orders**

**E.O. 12630: Takings**
The Executive Order on Government Actions and Interference with Constitutionally Protected Property Rights that became effective March 18, 1988, requires each federal agency prepare a

Takings Implication Assessment for any of its administrative, regulatory, and legislative policies and actions that affect, or may affect, the use of any real or personal property. Clearance of a regulatory action must include a takings statement and, if appropriate, a Takings Implication Assessment. The NOAA Office of General Counsel will determine whether a Taking Implication Assessment is necessary for this amendment.

**E.O. 13089: Coral Reef Protection**

The Executive Order on Coral Reef Protection requires federal agencies whose actions may affect U.S. coral reef ecosystems to identify those actions, utilize their programs and authorities to protect and enhance the conditions of such ecosystems, and, to the extent permitted by law, ensure actions that they authorize, fund, or carry out do not degrade the condition of that ecosystem. By definition, a U.S. coral reef ecosystem means those species, habitats, and other national resources associated with coral reefs in all maritime areas and zones subject to the jurisdiction or control of the United States (e.g., federal, state, territorial, or commonwealth waters).

Regulations are already in place to limit or reduce habitat impacts within the Flower Garden Banks National Marine Sanctuary. Additionally, NMFS approved and implemented Generic Amendment 3 for Essential Fish Habitat, which established additional HAPCs and gear restrictions to protect corals throughout the Gulf of Mexico. There are no implications to coral reefs by the actions proposed in this amendment.

**E.O. 13132: Federalism**

The Executive Order on Federalism requires agencies in formulating and implementing policies, to be guided by the fundamental Federalism principles. The Order serves to guarantee the division of governmental responsibilities between the national government and the states that was intended by the framers of the Constitution. Federalism is rooted in the belief that issues not national in scope or significance are most appropriately addressed by the level of government closest to the people. This Order is relevant to FMPs and amendments given the overlapping authorities of NMFS, the states, and local authorities in managing coastal resources, including fisheries, and the need for a clear definition of responsibilities. It is important to recognize those components of the ecosystem over which fishery managers have no direct control and to develop strategies to address them in conjunction with appropriate state, tribes and local entities (international too). No Federalism issues have been identified relative to the action proposed in this amendment. Therefore, consultation with state officials under Executive Order 12612 is not necessary.