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AMENDMENT NUMBER 10

TO

FISHERY MANAGEMENT PLAN FOR THE SHRIMP FISHERY

OF THE GULF OF MEXICO, U.S. WATERS

WITH

ENVIRONMENTAL ASSESSMENT

REGULATORY IMPACT REVIEW

INITIAL REGULATORY FLEXIBILITY ANALYSIS

AND SOCIAL IMPACT ASSESSMENT

JULY 2001



GULF OF MEXICO FISHERY MANAGEMENT COUNCIL
THE COMMONS AT RIVERGATE
3018 U.S. HIGHWAY 301 NORTH, SUITE 1000
TAMPA, FLORIDA 33619-2266
813-228-2815
FAX: 813-225-7015

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ABBREVIATIONS AND ACRONYMS USED IN THIS DOCUMENT

AP	Shrimp Advisory Panel
BO	Biological Opinion
BRD	Bycatch Reduction Device
CPUE	Catch Per Unit of Effort
DOC	Department of Commerce
SEIS	Supplemental Environmental Impact Statement
ESA	Endangered Species Act
EEZ	Exclusive Economic Zone
FEIS	Final Environmental Impact Statement
F	Fishing Mortality
FMP	Fishery Management Plan
GMFMC	Gulf of Mexico Fishery Management Council
GSAFF	Gulf and South Atlantic Fishery Foundation
IRFA	Initial Regulatory Flexibility Analysis
ITQ	Individual Transferrable Quota
LTPY	Long-Term Potential Yield
M	Natural Mortality
MMS	Minerals Management Service (DOI)
MRFSS	Marine Recreational Fishery Statistics Survey
MSY	Maximum Sustainable Yield
NAS	National Academy of Sciences
NMFS	National Marine Fisheries Service
NMFS-SEFSC	National Marine Fisheries Service, Southeast Fisheries Science Center
NOAA	National Oceanic and Atmospheric Administration
OY	Optimum Yield

RFSAP	Reef Fish Stock Assessment Panel
RA	Regional Administrator of NMFS
RIR	Regulatory Impact Review
SEP	Socioeconomic Assessment Panel
SIA	Social Impact Assessment
SEFSC	Southeast Fisheries Science Center
SLF	Shrimp Landings File
SPR	Spawning Potential Ratio
SSC	Scientific and Statistical Committee
TAC	Total Allowable Catch
TALFF	Total Allowable Level of Foreign Fishing
TED	Turtle Excluder Device
TL	Total Length
TAMU	Texas A & M University
TPWD	Texas Parks and Wildlife Department
TSA	Texas Shrimp Association
USCG	United States Coast Guard
VOUF	Vessel Operating Units File
YPR	Yield Per Recruit

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1.0 INTRODUCTION

General Information:

The species of shrimp managed under the FMP are as follows:

Brown shrimp	<i>Farfantepenaeus aztecus</i>
White shrimp	<i>Litopenaeus setiferus</i>
Pink shrimp	<i>Farfantepenaeus duorarum</i>
Royal Red shrimp	<i>Hymenopenaeus robustus</i>

The three species of penaeid shrimp comprise more than 99% of the landings in the Gulf of Mexico. In recent years, average annual landings have been approximately 150 million pounds (MP) (tails). Brown shrimp provide the largest portion of annual shrimp landings in the northern Gulf with average landings in the 1990's of approximately 80 MP. This species is distributed from the Mexican border through Apalachicola Bay, Florida (GMFMC 1981). Brown shrimp are caught out to at least 50 fathoms, though most catches are from less than 30 fathoms. White shrimp are the second most abundant species with 1998 and 1999 landings of approximately 55 MP. They are distributed from the Mexican border through Apalachee Bay (Figure 11, GMFMC 1998). Typically, white shrimp are caught inshore of 15 fathoms. Pink shrimp landings were approximately 17 MP in 1995, but dropped to only about 11 MP in 1999. This species is distributed across the northern Gulf from the Florida Keys to Mexico; however, they are most common in the Tortugas and Sanibel areas off Florida (GMFMC 1980). Pink shrimp are usually taken from waters less than 25 fathoms with the majority of catch being harvested in 11 to 15 fathoms. Maximum annual production of royal red shrimp has been on the order of 350,000 pounds (tails); however, landings in recent years have only been around 200,000 to 250,000 pounds. Royal red shrimp are a deep-water shrimp occurring primarily in depths of 140 to 300 fathoms.

Status of the Stocks

The Gulf of Mexico Fishery Management Council (Council or GMFMC) has established an overfished level for each of the 3 penaeid species in terms of a parent stock level as follows:

Brown Shrimp - 125 million individuals, age 7+ months during the November through February period.

White Shrimp - 330 million individuals, age 7+ months during the May through August period.

Pink Shrimp - 100 million individuals, age 5+ months during the July through June year.

The National Marine Fisheries Service (NMFS) has monitored the parent stock levels for all 3 penaeid species since 1970. Since 1991, NMFS has monitored the status of the shrimp stocks using the methodology of Nance et al. (1989), and Klima et al. (1990), as modified by the Shrimp Stock Assessment Panel (SSAP 1993) for white shrimp. The parent stock numbers for all 3 species have

remained above the maximum sustainable yield (MSY) parent stock minimum throughout this monitoring period. Additionally, the yield from the royal red shrimp fishery has remained below the MSY yield level of 392,000 pounds throughout the history of that fishery. Consequently, the shrimp stocks of the Gulf of Mexico are not considered to be overfished or approaching an overfished state.

2.0 HISTORY OF MANAGEMENT

A fishery management plan (FMP) for the shrimp fishery in the Gulf of Mexico was prepared by the Gulf of Mexico Fishery Management Council (GMFMC) and implemented as federal regulation on May 15, 1981. The principal thrust of the plan was to enhance yield in volume and value by deferring harvest of small shrimp to provide for growth. Principle action included: (1) establishing a cooperative Tortugas Shrimp Sanctuary with the state of 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 the state of Texas to protect small brown shrimp emigrating from bay nursery areas; and (3) seasonal zoning of an area of Florida Bay for either shrimp or stone crab fishing to avoid gear conflict.

Amendment 1, approved later that year, provided the Regional Administrator (RA) of the NMFS with the authority (after conferring with the GMFMC) 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 (1983) updated catch and economic data in the FMP, and Amendment 3 (1984) resolved another shrimp-stone crab gear conflict on the west-central coast of Florida.

Amendment 4, partially approved in 1988 and finalized in 1989, 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 GMFMC's and RA's review for the Texas closure was extended to February 1st. Disapproved was a provision that white shrimp taken in the EEZ be landed in accordance with a state's size/possession regulations to provide consistency and facilitate enforcement with the state of Louisiana. This latter action 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 proposed action was disapproved by the NMFS with the recommendation that it be resubmitted under the expedited 60-day Secretarial review schedule after Louisiana provided for a bycatch of undersized white shrimp in the directed fishery for seabobs. This resubmission was made in February of 1990 and applied to white shrimp taken in the exclusive economic zone (EEZ) and landed in Louisiana. It was approved and implemented in May of 1990.

In July 1989, the NMFS published revised guidelines for FMPs that interpretatively addressed the Magnuson Act National Standards (50 CFR Part 602). These guidelines required each FMP to

include a scientifically measurable definition of overfishing and an action plan to arrest overfishing should it occur.

In 1990, Texas revised the period of its seasonal closure in Gulf waters from June 1 to July 15 to May 15 to July 15. The FMP did not have enough flexibility to adjust the cooperative closure of federal waters to accommodate this change, thus an amendment was required.

Amendment 5, approved in 1991, defined overfishing for Gulf brown, pink, and royal red shrimp and provided for 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 deleted from the management unit. The duration of the seasonal closure to shrimping off Texas was adjusted to conform with the changes in state regulations.

Amendment 6 (1993) 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 continued to open seasonally, without need for annual action. A proposed definition of overfishing of white shrimp was rejected by the NMFS as not being based on the best available data.

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

Amendment 8, submitted in 1995 and implemented in early 1996, addressed management of royal red shrimp. It established a procedure that would allow total allowable catch (TAC) for royal red shrimp to be set up to 30% above MSY for no more than two consecutive years so that a better estimate of MSY could be determined. This proposal was subsequently rejected by NMFS because the Sustainable Fisheries Act (SFA) defined exceeding MSY as overfishing.

Amendment 9, approved in May 1998, required the use of a NMFS certified bycatch reduction devices in shrimp trawls used in the EEZ from Cape San Blas, Florida (85°30' W. Longitude) to the Texas/Mexico border and provided for the certification of the Fisheye BRD in the 30 mesh position. The purpose of this action was to reduce the bycatch mortality of juvenile red snapper by 44% from the average mortality for the years 1984-89. This amendment exempted shrimp trawls fishing for royal red shrimp outside of 100 fathoms, as well as groundfish and butterfish trawls. It also excluded small try nets and no more than two ridged frame roller trawls that do not exceed 16 feet. Amendment 9 also provided mechanisms to change the bycatch reduction criterion and to certify additional BRDs.

3.0 PROBLEMS REQUIRING A PLAN AMENDMENT

The Magnuson-Stevens Fishery Conservation and Management Act (M-SFCMA) requires that all FMPs, amendments, and regulations be consistent with the 10 National Standards. National Standard 9 states that “conservation and management measures shall to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.” Amendment 9 to the Shrimp FMP addressed bycatch reduction of red snapper in the Gulf EEZ west of Cape San Blas, Florida (85°30' W. Longitude) through the requirement of bycatch reduction devices (BRDs) in all shrimp trawls with the exception of: (1) royal red shrimp trawls that are being used in depths greater than 100 fathoms, (2) groundfish and butterfish trawls, (3) a single try net with a head rope measurement of 16 feet or less, and (4) no more than 2 rigid-frame roller trawls that are 16 feet or less (see 50 CFR, Part 622 for more specific definitions of exempted vessels, boats, and gear). These exemptions were determined to have no or little impact of red snapper bycatch. Although BRDs are also effective in reducing bycatch of other species (primarily finfish), Amendment 9 did not include measures applicable in waters of the exclusive economic zone (EEZ) east of Cape San Blas, Florida. Consequently, the Council is proposing this amendment to address the question of whether it has reduced bycatch and/or the mortality from bycatch to the extent practicable as required by the M-SFCMA.

4.0 PURPOSE AND NEED FOR ACTION

This amendment addresses the need for reducing bycatch from the shrimp trawl fishery in the EEZ off the west coast of Florida, specifically in the Gulf EEZ south and east of Cape San Blas (85°30' W. Longitude). As noted above, Amendment 9 to the Shrimp FMP addressed bycatch reduction of red snapper in the Gulf EEZ west of Cape San Blas, Florida; and the method that was approved was the requirement of bycatch reduction devices (BRDs) that would reduce the mortality from shrimp trawls on age 0 and age 1 red snapper by at least 44% from the average level of mortality during the period 1984-89. Because Amendment 9 did not address bycatch reduction on the west coast of Florida, east of Cape San Blas, this amendment considers the need and practicability of various alternatives for reducing bycatch from shrimp trawling in this area, including the requirement of BRDs. It also reviews the effectiveness and potential impacts of these alternatives.

5.0 PROPOSED ACTIONS

To be completed following final action by the Council on proposed alternatives

6.0 MANAGEMENT ALTERNATIVES

6.1 Area Closures

- 6.1.1 Increase the size of presently closed areas in the Gulf of Mexico EEZ east and south of Cape San Blas, Florida (85°30' W. Longitude) by 20% or (30%, 40%, or 50%)**
- 6.1.2 Permanently close the present boundaries of the Southwest Florida Seasonal Trawl Closure and the Tortugas Shrimp Sanctuary in the EEZ**
- 6.1.3 Enact additional area closures in areas of high bycatch, particularly Statistical Subareas 4-5 and 6-8 where there is a higher incidence of finfish bycatch**
- 6.1.4 Status Quo - do not increase the size or seasonal extent of presently closed areas and do not close additional areas in the Gulf of Mexico EEZ east and south of Cape San Blas, Florida (85°30' W. Longitude)**

Discussion: The state of Florida has established various permanently closed areas to the commercial harvest of shrimp. These areas are described in Titles 68B-31.016, 68B-31.017, 68B-31.018, and 68B-38, Florida Administrative Code (Figure 1) (Appendix A). These areas are primarily nursery areas for pink shrimp; however, they also include known habitat for many of the bycatch species in the shrimp trawl fishery. There are also several areas in the EEZ off the west coast of Florida that are permanently closed to shrimp trawling, including the Madison and Swanson sites and the Steam Boat Lumps implemented through the Reef Fish FMP framework procedure in June 2000 and the Florida Middle Grounds. Other areas in federal waters of south Florida are expected to be closed through the future implementation of a generic amendment to establish the Tortugas Ecological Reserve and/or expansion of the Florida Keys National Marine Sanctuary boundaries. Although closures exist and additional ones are proposed in state and federal waters, closures in state waters are much more extensive (Figure 1). There are also numerous, but unmapped, areas of hard bottom off the west coast of Florida in both state and federal waters that are not trawlable due to the potential for gear loss or damage. The biological, ecological, economic, and social effects of these closures that include areas of trawlable bottom on reducing bycatch is unknown. However, for species that typically do not migrate from these areas and those that do migrate but change habitat so as to become less vulnerable to trawl gear, a reduction in their bycatch would be expected. Increasing the size of these areas and/or enacting additional permanent closures of areas that are being trawled would be expected to further reduce bycatch; however, the amount of reduction and which species would be affected would depend on the extent and location of any additional closures.

Another factor that could influence the effect of additional closures is the potential relocation of fishing effort to open areas or cessation of trawling activities. If additional closed areas are relatively small

and or disjunct, shrimpers might increase efforts in nearby open areas. This activity would likely cause a localized increase in bycatch and possibly the mortality of bycatch. However, if these areas are sufficiently large, they might cause a broader relocation of shrimpers to other areas resulting in positive impacts with regard to bycatch reduction in such areas, but there would still be the possibility of increased bycatch in areas to which shrimpers relocate. Very large closed areas could cause some, particularly local operators, to exit the fishery, which could also have a positive impact on bycatch reduction. Smaller closed areas would be more difficult and costly to enforce, and larger closed areas would probably have more significant negative social and economic impacts to the shrimping industry due to the more substantial loss of trawlable bottoms.

Figure 2 shows the percentage of shrimp catch to total bycatch and to finfish bycatch for 3 statistical subareas off the west coast of Florida (Statistical Subareas 1-3, 4-5, and 6-8). These groupings closely correspond to the area of the EEZ off the west coast of Florida in which additional bycatch reduction measures were not implemented through Amendment 9. Figure 2 also shows that the shrimp to bycatch ratios, in terms of both finfish and total bycatch, is much higher in Statistical Subareas 1-3 as compared to 4-5 and 6-8. Additionally, approximately 59% of the total shrimp landings for Statistical Subareas 1-8 comes from subareas 1-3 (Table 1). Consequently, the impact on shrimp production of closing additional areas in Statistical Subareas 1-3 would be much greater than additional closures in the other subarea groupings, and larger areas would have to be closed to gain approximately the same amount of bycatch reduction when compared with the other subarea groupings. These inferences are supported by the fact that the square nautical miles (NM²) for each of the 3 statistical subarea groupings (1-3, 4-5, and 6-8) are about the same at between 24,000 and 28,000 NM² (Table 2). Area closures in Statistical Subareas 4-5 would be expected to have the least impact to shrimp harvest because only about 7% of the total shrimp harvest comes from this subarea grouping. Area closures in Statistical Subareas 6-8 would be expected to have about the same percentage effect on bycatch reduction since the percentages of shrimp and bycatch are the same in both subarea groupings (Figure 2); however, because approximately 34% of the shrimp catch comes from Statistical Subareas 6-8, the impacts of additional area closures here on shrimp catch would be much greater.

Figure 1 shows there are over 3,000,000 acres (approximately 4,700 NM²) that are permanently closed to commercial shrimping in Statistical Subareas 1-3. This amounts to approximately 16% of the total area. Permanently closed areas in Statistical Subareas 6-8 amount to approximately 550,000 acres (1,300 NM²), or about 2% of the total area here. As shown in Figure 1, there are other, small seasonally closed areas in Statistical Subareas 1-3 and 6-8. Closed areas in Statistical Subareas 4-5 have not been calculated, but are exceedingly small compared to the other statistical subarea groupings. Assuming an equal distribution of effort and bycatch, it could be assumed that the percentages noted above represent bycatch reduction that has currently been accomplished through management, and perhaps a little more from seasonally closed areas discussed in the following section. As shown in Tables 1 and 3, the majority of shrimp catch and effort occurs in Statistical Subareas 1-3. As discussed above, this area grouping currently has the largest amount

of closed acreage and as shown in Figure 2 additional closures here would have the greatest negative impact to shrimp production.

Additional closed areas could be developed to meet bycatch reduction goals; however, the impacts to shrimp production and the type and amount of bycatch reduction cannot be determined until the location and size of any proposed closures are known. Even with this information, additional research would be required to quantify the impacts.

Biological Impacts: The biological impacts of extending the time and/or extent of area closures or enacting additional closures cannot be attempted until the location and magnitude of any increases are known. Even with this information, the life histories of many finfish stocks that are caught in shrimp trawls off the west coast of Florida are largely unknown. Additionally, as discussed in Section 6.3, there are great differences in the species diversity of shrimp trawl bycatch by area, depth, and season along the west coast of Florida south and east of Cape San Blas. Furthermore, the biological and ecological impacts of shrimp trawling on most bycatch species on the west coast of Florida are also lacking (see discussion under Section 6.3). A thorough literature search would likely discover some life history data on some bycatch species that have been identified in bycatch characterization studies off the west coast of Florida and in Florida's Ecopath Programs, but probably not all species. Analyses could then be developed regarding the biological and ecological impacts from trawling on these species; however, any additional analyses of impacts due to present or additional closed areas would require, as previously discussed, an assumption of an even distribution of such species over these closed areas and equal trawlability of open areas. Such assumptions are likely to be highly erroneous based on present, limited knowledge. When coupled with the other unknowns and uncertainties noted above, such biological and ecological analyses would have little, if any scientific credence.

Economic Impacts: Since the intent of any area closure is to reduce shrimp trawl bycatch, it only stands to reason that the particular areas considered for closure should be characterized by at least two features, namely, areas where shrimping actually occurs (preferably intensively) and where bycatch is relatively highest. Alternative 6.1.3 directly addresses these two features while Alternative 6.1.1 may do so depending on the areas chosen for closure. Alternative 6.1.2 specifies a shrimping area but the level of bycatch in the area needs to be determined.

A likely effect of any area closure for shrimping is to reduce the harvest of shrimp. Considering that most trawlable areas are now being exploited, displaced vessels may not be able to offset their harvest reduction by shifting effort to other areas. Any effort shift is also likely to increase the cost of fishing, since vessels may either have to travel farther or fish harder. A reduction in vessel profitability can then be expected from any effective area closure.

Figure 2 shows the ratio of shrimp catch to bycatch in various statistical subarea groupings west of Cape San Blas. Regardless of whether only finfish bycatch or total bycatch is considered, it appears

that Statistical Subareas 4-5 and 6-8 are the two sub-areas where bycatch is relatively high compared to shrimp catch. On the other hand, Table 1 and Table 3 indicate that the greatest amount of shrimp catch and effort in terms of trips and hours fished occurs in Statistical Subareas 1-3 and 6-8. Consequently, it would be expected that bycatch would be higher in these two subarea groupings than in Statistical Subareas 4-5, thus additional area closures in Statistical Subareas 1-3 or 6-8 would be expected to yield greater bycatch reduction than in Statistical Subareas 4-5. Shrimping areas then in these two subareas may be considered prime candidates for closure in order to reduce bycatch in a more effective way.

It is likely that of the two prime subareas for closure the cost of closure, in terms of revenue reductions to shrimp vessels, would be higher if the closed areas were in Statistical Subareas 1-3 than if they were in Statistical Subareas 6-8 because shrimp harvest is greater in Statistical Subareas 1-3 (59% as opposed to 34%). Additionally, the shrimp to bycatch ratio is higher in Statistical Subareas 1-3 than in Statistical Subareas 6-8, implying that for given amount of shrimp reduction the bycatch reduction in Statistical Subareas 6-8 would be higher than that in the other area. This contention, of course, assumes that the shrimp to bycatch ratio indicated in Figure 2 uniformly holds throughout each of the subareas for the entire fishing season.

Although the assumption of uniform shrimp to bycatch ratio throughout each subarea grouping may be questionable, it can be used as a starting point for estimating the economic effects of any area closure. The data in Table 1 may be interpreted as the potential maximum loss in harvest and value if any additional areas in the three subarea groupings is closed to shrimping. For example, if under Alternative 6.1.3 the entire area comprising Statistical Subareas 6-8 were closed to shrimping, the resulting loss to shrimp vessels would be about 4.2 million pounds of shrimp valued at \$13.7 million. Considering that the number of shrimp vessel trips in this area totaled about 3,610, a total closure of this subarea is unlikely to result in effectively shifting effort to other areas. A partial closure of this subarea would force a shift in effort most likely to open locations within this same subarea, but the resulting shrimp harvest from such effort shift may be expected to not fully offset the loss from the closed area.

Closure of areas in Statistical Subareas 6-8, as in Alternative 6.1.3, would affect fishing ports in 10 of 14 counties in the west coast of Florida where shrimp caught in the subarea are landed. Of these 10 counties, 4 would be hit hardest, namely, Franklin, Gulf, Hillsborough, and Pinellas, based on the total value of shrimp landings from Statistical Subareas 6-8 landed in these counties. About 97 percent of the total value of shrimp landings in Franklin County, or \$1.93 million, came from this subarea. The corresponding numbers for the other counties are: 100 percent, or \$0.63 million, in Gulf County; 54 percent, or \$2.7 million, in Hillsborough County; and, about 55 percent, or \$1.54 million, in Pinellas County.

The Tortugas Shrimp Sanctuary is located in Statistical Subareas 1, 2 and 3. In 1999, these areas generated about 6.2 million pounds of pink shrimp (landed in Florida) valued at \$28.1 million.

Previous estimates on the effects of the sanctuary indicated that it enabled an increase in the yield of pink shrimp by about 1 million pounds (GMFMC 1981). Three small areas in the EEZ portion of the sanctuary totaling 63 square miles are open for shrimping on a seasonal basis. These areas comprise about 5 percent of the federal portion and 1 percent of the total area of the sanctuary (GMFMC 1992). In the absence of information on the amount of catch from the three small areas, the economic impact of the closure as in Alternative 6.1.2 cannot be ascertained. However, certain general insights of the economic consequences of such closure may be made.

Permanently closing the now seasonally open three areas in the Tortugas Shrimp Sanctuary would negatively affect vessels that, according to available information, fish in Statistical Subareas 1 and 2. In 1999, there were approximately 390 fishing craft that fished in these areas. Most of the catches from these two areas were landed in 6 counties in Florida, namely, Escambia, Hillsborough, Lee, Monroe, Pasco, and Pinellas. Of these counties, Hillsborough, Lee and Monroe would likely shoulder most of the negative economic effects based on landings in these counties from shrimp catches in Statistical Subareas 1 and 2 (see Table 3). The magnitude of impacts would depend on how much of the shrimp landings for these counties come from the three subject areas in the sanctuary. In terms of bycatch reduction, it appears that closing these three areas would not reduce bycatch by any significant amount. As can be inferred from Figure 2 showing the shrimp to finfish bycatch ratio, a 1-pound reduction in shrimp catch would reduce finfish bycatch by only 1.14 pounds. Hence, unless a very large amount of landings come from the subject three areas in the sanctuary, the resulting bycatch reduction would be very small.

One other point worth noting with Alternative 6.1.2 is that the main reason for opening the three areas in the sanctuary starting in 1988 was to alleviate the plight of those fishing around the area who suffered economically due to the reduced productivity of the Tortugas pink shrimp fishery. This fishery produced an average of 10 million pounds until 1985, but thereafter pink shrimp production in the Tortugas fishery dropped dramatically and in the last few years has hovered around 6 to 7 million pounds. Clearly, the rationale used to open the three small areas in the sanctuary still holds at present, and thus permanently closing these areas would only worsen the economic conditions of fishermen in the area, especially when taking into account the newly proposed closed area in Statistical Subarea 2 under the auspices of the Tortugas marine reserves. Closure of this area has been estimated to reduce shrimp harvests in Statistical Subarea 2 by about 45 thousand pounds, with the possibility of offsetting this reduction by shifting effort to other areas determined to be unlikely.

Another area specified under Alternative 6.1.2 for permanent closure is the Southwest Florida Seasonal Trawl Closure. This area is located in Statistical Subareas 1, 3, and 4 and its seaward boundary generally straddles between the 5- and 10-fathom contour lines. The area is closed to shrimping from January 1 through May 20. Data from the Shrimp Landings File indicates that in 1999 shrimp harvest in Statistical Subareas 1, 3, and 4 for depths below 10 fathoms totaled 107 thousand pounds valued at \$429 thousand during the months of June through December. Most of the catch were from Statistical Subarea 4 from depths of 6 to 10 fathoms and thus most likely would

not be from the subject area. In a sense then, these numbers may represent the maximum loss if a year round closure of the subject area is effected as in Alternative 6.1.2.

There are several combinations of closed areas that can be done under Alternative 6.1.1 or 6.1.3. In order to reduce bycatch by a significant amount, but with lesser reduction in shrimp catch, most of the closed areas would have to be in Statistical Subareas 4-5 and 6-8. Again, the numbers in Table 1 may be considered the potential maximum reduction in shrimp landings and values if a total closure of these areas is imposed. Any percentage of these areas closed to shrimping would possibly translate to an equivalent reduction in shrimp landings and values.

6.2 Seasonal Closures

6.2.1 Extend the Southwest Florida Seasonal Trawl Closure by one month before and one month after (or some lesser period) the present closed period (currently January 1 to May 20)

6.2.2 Extend the present seasonal closures of the three small areas of the Tortugas Shrimp Sanctuary by one month before and one month after (or some lesser period) the present closed periods (current closures vary by area between April 11 and September 30)

6.2.3 Enact additional seasonal closures in areas of high bycatch, particularly Statistical Subareas 4-5 and 6-8 where there is a higher incidence of finfish bycatch

6.2.4 Status Quo - do not extend the present closed seasons and do not enact additional closed seasons.

Discussion: As discussed below, seasonal closures to shrimp trawling off the west coast of Florida, particularly in the EEZ, have mainly been adopted to prevent or ameliorate conflicts with other fisheries and their gear. Other seasonal closures, particularly in state waters, have been implemented to allow shrimp to grow to a more optimum harvest size.

The Southwest Florida Seasonal Trawl Closure (Figure 2) was implemented to resolve a violent gear conflict between stone crab and shrimp fishermen that occurred in 1978. The conflict arose as a result of shrimp vessels that fished at night for pink shrimp during such time, they harvested, moved, and destroyed stone crab traps set by fishermen who fished in daylight. The concrete-weighted traps frequently damaged shrimp trawls. The shrimp vessels involved in the conflict were not locally based vessels and most were from out-of-state. Therefore, they had no prior knowledge of where stone crab fishermen set their traps. When violence between vessels began to occur the U.S. Coast Guard intervened and negotiated a temporary line of separation shoreward of which shrimp fishing was

prohibited. Having resolved the armed conflict, the U.S. Coast Guard reported that they lacked authority to implement a permanent solution. Therefore, the Council rapidly developed an FMP to provide such authority and in that development period the Council convened the Stone Crab and Shrimp APs to negotiate a permanent solution that was presented at public hearings and implemented in 1979.

As with the temporary U.S. Coast Guard line, the shrimp vessels were prohibited from fishing inshore of the line of separation (Figure 2) from January 1 through May 20. However, stone crab fishermen were not prohibited from setting traps seaward of the line, but would be subject to loss of traps if they did so.

At the request of the shrimp industry based in the Florida Keys, the Council allowed vessels to fish in three small areas within the Tortugas Shrimp Sanctuary during the late spring and summer. Resource assessment information on the sanctuary indicated that pink shrimp were usually above the 36 count standard that maximizes YPR during that period. The three small areas are depicted as areas 1, 2, and 3 on Figure 3. Area 1 (25 square miles) is open April 11 through September 30, Area 2 (5 square miles) is open April 11 through July 31, and Area 3 (33 square miles) is open May 26 through July 31. The opening dates are related to the closure dates for spiny lobster (March 31) and stone crab (May 15) fisheries because traps are also fished in these small shrimping areas.

As with area closures, additional seasonal closures or extensions of present closures could be adopted to potentially reduce bycatch. As discussed in Amendment 9, juvenile red snapper are distributed over shrimping grounds for approximately 14 months; consequently, seasonal closures would have little effect on bycatch reduction for this species or for other species with similar life histories. For other species, the effectiveness of closed seasons would depend on whether these bycatch species are only seasonally available to shrimp trawl gear during a chosen closed season. Where this is the case, some reduction in bycatch from the existing seasonal closures would be expected, and further reductions could occur with additional or extended seasonal closures under the same assumed circumstances. On the other hand, short-lived species tend to have higher natural mortality rates. Consequently, any perceived biological benefits from seasonal closures may be offset by natural mortality. As discussed under area closures, there are limited data to evaluate the effect of existing or additional closures on bycatch. The effect of additional seasonal closures on bycatch reduction would depend on the area, the length of the closed season, and species involved. As previously discussed, the evaluation of any such effects based on the paucity of data available would have little scientific validity.

Although the effects of additional or extended seasonal closures cannot be evaluated at this time, it is probable that their impact on reducing bycatch would be less than with area closures, unless the seasonal closure occurred at a time when shrimping was not occurring in a given area. In such case, there would be no impact to shrimp and no additional bycatch reduction. In areas that have a high but seasonal bycatch, a corresponding seasonal closure could have a similar or perhaps slightly

reduced impact on bycatch as a closed area with a reduced impact on shrimp production. Currently, such areas have not been identified and they could vary annually based on environmental conditions.

Biological Impacts: The biological impacts of existing seasonal closures and possible additional seasonal closures on various bycatch stocks have not been evaluated. As discussed above, very little is known about the life histories of many bycatch species, and attempts to estimate biological impacts based on such a paucity of data would be of questionable scientific credibility. Also, as discussed in Section 6.3, the effect of any reduction in bycatch on the health and size of a given stock or species group has not been determined. Intuitively, seasonal closures would be expected to have a lesser impact on bycatch reduction than permanent closures because some species are likely to remain in a given area after the seasonal closure ends, thus only delaying their being subject to trawling.

Economic Impacts: Previous discussions noted that the area currently subject to Southwest Florida Seasonal Trawl Closure generated about 107 thousand pounds of shrimp valued at \$429 thousand during the months of June through December. Of this amount, about 34 thousand pounds valued at \$152 thousand are accounted for by the months of June and December. These would be the potential losses to the shrimp vessels if the seasonal closure is extended by one month before (December) and one month after (June) the closure, as proposed under Alternative 6.2.1.

Since even the total catch, much less the seasonal catch, from the three small areas considered under Alternative 6.2.2 is not known, the economic impacts of this alternative cannot be determined. It may only be worthwhile recalling that in an earlier discussion the most likely negative impacts of closing these three areas would fall on vessels fishing in Statistical Subareas 1 and 2. In 1999, there were approximately 390 fishing craft that fished in these areas. Most of the catches from these two areas were landed in 6 counties in Florida, namely, Escambia, Hillsborough, Lee, Monroe, Pasco, and Pinellas. Of these counties, Hillsborough, Lee and Monroe would likely shoulder most of the negative economic effects based on landings in these counties from shrimp catches in Statistical Subareas 1 and 2 (see Table 3). The magnitude of impacts would depend on how much of the shrimp landings for these counties come from the three subject areas in the sanctuary during the two months proposed to be closed. In terms of bycatch reduction, it appears that closing these three areas by an additional two months would not reduce bycatch by any significant amount. As can be inferred from Figure 2 showing the shrimp to finfish bycatch ratio, a 1-pound reduction in shrimp catch would reduce finfish bycatch by only 1.14 pounds. Hence, unless a very large amount of landings come from the subject three areas in the sanctuary, the resulting bycatch reduction would be very small.

Alternative 6.2.3 presents several combinations for seasonal closures of the two sub-areas. Some general insights into the potential economic impacts of additional seasonal closures in Statistical Subareas 4-5 and Statistical Subareas 6-8 may be gained from an examination of the seasonal distribution of catches from these two sub-areas. The table below shows the 1999 monthly distribution of catches and values by areas (Statistical Subareas 4-5 and Statistical Subareas 6-8).

In Statistical Subareas 4-5, the concentration of shrimp catches occur in the months of January through June. On the other hand, catches in Statistical Subareas 6-8 are about evenly distributed throughout the year although there are months, such as January-February, May-July, and November, when catches exceed one million pounds. If bycatch in both sub-areas were about evenly distributed throughout the year, it would appear that for Statistical Subareas 4-5 larger negative economic impacts would occur if closure were for any months January through June. For Statistical Subareas 6-8, the choice for closed months that would generate relatively smaller (or larger) negative economic impacts is not as clear. It would appear though that relatively smaller negative economic impacts would ensue if the months chosen for closure were either March-April or August-October. The negative economic impacts can be alleviated if effort can be successfully shifted to the open months, but then harvesters would have to contend with potentially lower prices and/or would incur higher costs.

Monthly catches and values from two sub-areas, 1999.

Month	Statistical Subareas 4-5				Statistical Subareas 6-8			
	Pounds	Percent	Values	Percent	Pounds	Percent	Values	Percent
January	73,594	9.5	344,907	9.6	312,366	9.0	1,320,335	10.2
February	117,368	15.2	547,237	15.3	313,565	9.0	1,296,732	10.0
March	104,585	13.5	532,588	14.9	229,073	6.6	901,919	6.9
April	99,405	12.9	515,733	14.4	254,916	7.3	984,498	7.6
May	73,484	9.5	371,565	10.4	358,688	10.3	1,286,663	9.9
June	76,612	9.9	280,628	7.8	372,191	10.7	1,257,726	9.7
July	43,862	5.7	150,451	4.2	318,044	9.1	1,048,451	8.1
August	50,196	6.5	203,271	5.7	248,878	7.1	726,909	5.6
Sept.	25,340	3.3	124,523	3.5	175,078	5.0	476,245	3.7
Oct.	30,617	4.0	129,644	3.6	282,085	8.1	902,579	6.9
Nov.	31,642	4.1	132,714	3.7	406,605	11.7	1,599,430	12.3
Dec.	46,744	6.0	252,395	7.0	210,174	6.0	894,556	6.9
Total	773,449		3,585,656		3,481,663		12,696,043	

6.3 Bycatch Reduction Devices

- 6.3.1** Require the installation of BRDs in each net used aboard vessels trawling for shrimp in the Gulf of Mexico EEZ east and south of Cape San Blas, Florida (85°30' W. Longitude) that meet the criteria specified in Rule 46-31.0045, Florida Administrative Code under authority of Section 370.027(2), Florida Statutes (or as amended). Exempted are vessels trawling for royal red shrimp beyond the 100-fathom contour and vessels trawling for groundfish or butterfish. A single try net with a headrope length of 16 feet or less per vessel and no more than two rigid-frame roller trawls limited to 16 feet or less, such as those used in the Big Bend area of Florida are also exempted.
- 6.3.2** Require the installation of NMFS-certified BRDs that meet or exceed the bycatch reduction criteria established by the Council in each net used aboard vessels trawling for shrimp in the Gulf of Mexico EEZ east and south of Cape San Blas, Florida (85°30' W. Longitude). Exempted are vessels trawling for royal red shrimp beyond the 100-fathom contour and vessels trawling for groundfish or butterfish. A single try net with a headrope length of 16 feet or less per vessel and no more than two rigid-frame roller trawls limited to 16 feet or less, such as those used in the Big Bend area of Florida are also exempted. Bycatch reduction criteria shall be as follows:
- Option a. BRDs must reduce the bycatch of finfish (by number or weight) by 20% or (30%, 40%, or 50%)
- Option b. BRDs must reduce the bycatch of all species (by number or weight) by 20% or (30%, 40%, or 50%)
- Option c. No bycatch reduction criteria are specified
- 6.3.3** Require the use of BRDs as specified in Sections 6.3.1 or 6.3.2 above, only in areas of the EEZ north of 26° N. Latitude (the dividing line between Statistical Grids 3 and 4)
- 6.3.4** Require the use of BRDs as specified in Sections 6.3.1 or 6.3.2 above, only in areas of the EEZ north of 28° N. Latitude (the dividing line between Statistical Grids 5 and 6)
- 6.3.5** Status Quo - do not require BRDs in shrimp trawls used aboard vessels trawling for shrimp in the Gulf of Mexico EEZ east and south of Cape San Blas, Florida (85°30' W. Longitude)

6.4 Status Quo - do not implement further bycatch reduction requirements on the west coast of Florida

Discussion: Currently, there are various areas along the west coast of Florida from Cape San Blas to the Florida Keys that are closed either permanently or seasonally (see discussions above). As noted, the effects of these closed areas on bycatch reduction have not been determined, and data on the species involved are very limited. In addition to closed areas and seasons, the state of Florida enacted additional restrictions on the shrimp fishery in 1996. These restrictions include a reduction in the amount and type of allowable gear in various areas and the requirement of BRDs in state waters. Although the effects of these changes in gear on bycatch reduction have not been adequately evaluated, several research efforts have been conducted in both inshore bay areas and Florida state waters to determine the effects of BRDs and to characterize bycatch. Coleman et al. (1992) tested various BRDs using small otter trawls in Pensacola Bay, Choctawhatchee Bay, Apalachicola Bay, St Andrews Bay, St. Johns River, Tampa Bay, and Charlotte Harbor. The results of these studies were highly variable (bycatch ranging from a 2% increase to over a 75% reduction, and shrimp catch ranging from a 17% increase to about a 47% reduction). The variation in these results is probably due to the small sample sizes and using different BRDs.

Steele et al. (2001, in press) tested the efficiency of the Florida Fisheye and Large Mesh Extended Funnel BRDs in small otter trawls in Tampa Bay. They concluded that these BRDs significantly reduced bycatch of finfish with no significant shrimp loss. The top 10 species encountered (by number) included: leopard searobin, silver jenny, gafftopsail catfish, hardhead catfish, tonguefish, southern kingfish, sand seatrout, silver perch, pinfish, and spadefish. Interestingly, the number of leopard searobin and tonguefish increased in most nets equipped with either of these BRDs when compared to control nets with only a turtle excluder device (TED), and results were also highly variable.

Table 4 shows possible shrimp loss and finfish bycatch reduction estimates for 5 different BRDs used in tests covering Statistical Subareas 1-8 (NMFS unpublished data). As shown, shrimp loss ranged from 0% to 10%, and bycatch reduction ranged from 7% to 40%. Table 5 shows possible shrimp loss and finfish bycatch reduction estimates from BRD studies in other areas of the Gulf and South Atlantic.

Bycatch of crustaceans and other invertebrates is not effectively reduced by BRDs. This fact is significant in that a large portion of the bycatch in terms of numbers and weight for Statistical Subareas 1-3 are made up of invertebrates (Tables 6 and 7, Figure 2).

Table 6 shows the top 10 species caught in shrimp trawls in numbers stratified by area, depth, and season (where data are available) (NMFS unpublished data). Table 7 provides this information based on weight in kilograms.

Based on these studies, the potential reduction in bycatch from requiring BRDs in the EEZ south and east of Cape San Blas, Florida would vary depending on the type of BRD used; the type of shrimp-trawl gear used; the species involved; and the season, area, and depth of fishing. It would also be contingent on the amount of shrimping effort over statistical subareas and in the EEZ versus state waters. These data are currently unknown.

To estimate the effects of requiring BRDs in the EEZ south and east of Cape San Blas, the effects of current requirements must first be evaluated. As previously stated, Florida currently requires the use of BRDs in state waters. Table 8 shows average shrimp catches, trips, and effort in days fished by depth for 1991-2000 from Statistical Subareas 1-8 with subgroupings of 1-3, 4-5, and 6-8 and percentages of the total. Table 2 shows the average depth along the Florida state-federal boundary, and Table 1 shows shrimp catches by individual statistical subarea. As shown in these tables, the majority of catch, trips, and effort (88%, 95%, and 86%, respectively) from statistical subarea grouping 1-3 comes for the 11-20 fathom depth range. Table 1 shows that the majority of the catch, trips, and effort in Statistical Subarea grouping 1-3 (75%, 79%, and 71%, respectively) come from Statistical Subarea 2. Table 2 shows that the average depth along the state-federal boundary of Statistical Subarea 2 is 20.5 fathoms. Consequently, the majority, approximately 70%, of the catch and trawling effort from Statistical Subareas 1-3 comes from state waters. Based on these and other data, the requirement of BRDs in Statistical Subareas 1-3 would have a minimal effect on bycatch reduction because: (1) only 41% of the bycatch from this area is finfish (Figure 2), and invertebrates are not effectively excluded by BRDs; (2) only about 30% of the trawling effort occurs in the EEZ of this area, consequently only about 12% of the finfish bycatch is currently not effected by a BRD requirement; (3) BRDs are only about 50% effective in reducing finfish bycatch, consequently there would only be about a 6% reduction in finfish bycatch from requiring BRDs in the EEZ of Statistical Subareas 1-3.

For Statistical Subareas 4-5, only approximately 1.5% of the shrimp catch and effort occur in state waters. There is also a larger finfish component of the bycatch (66%). As such, BRDs would probably be effective in the EEZ of this area; however, this statistical subarea grouping has only about 9% of the total shrimping effort for Statistical Subareas 1-8. Consequently, the BRD requirement would have a minimal effect.

In Statistical Subareas 6-8, the finfish component of the bycatch is also 66% (Figure 2). Additionally, only about 11% of the shrimp catch and effort occurs in state waters of Statistical Subareas 6 and 7. In Statistical Subarea 8, average depth along the state-federal boundary is about 11.5 fathoms, and about 28% of the shrimping effort for Statistical Subareas 6-8 occurs here. Also, approximately 37% of the effort and 32% of the catch occurs in depths of 6-10 fathoms. Assuming that 28% of the effort occurs in Statistical Subarea 8 and 48% of the total effort for Statistical Subareas 6-8 occurs inside of 10 fathoms, then approximately 13% of the total effort for Statistical Subareas 6-8 occurs inside state waters of Statistical Subarea 8. Although BRDs are currently required in part of Statistical Subarea 8, the effectiveness of BRDs in the EEZ of Statistical Subareas

6-8 would be expected to be greater than in the other Statistical Subareas on the west coast of Florida, assuming that there is a similar distribution of bycatch species that would be susceptible to catch in shrimp trawls and effectively excluded by BRDs.

As shown in Tables 6 and 7, there are very few shrimp trawl encounters with managed species, particularly mackerels and reef fish, off the west coast of Florida; and the amount of their catch in either pounds or numbers is also small. Additionally, most such catches occur in water depths >20 fathoms. The amount of shrimping effort in depths >20 fathoms ranges between 1.5% and 5% for the 3 statistical subarea groupings (Table 8). Consequently, the potential catch is minimal.

Personal communication with some commercial shrimpers with larger vessels indicated that they no longer fish in Florida state waters, primarily due to the 500 square feet gear restriction on trawls inside of 3 miles. Based on available data, shrimp trawl encounters with managed species primarily occurs in the EEZ because state waters typically extend only to approximately 4 to 8 fathoms in Statistical Subareas 1-8, with the exception of Statistical Subareas 2 and 8 where the EEZ begins at approximately 20.5 and 11.5 fathoms, respectively (Table 2). These shrimpers also indicated that most of these vessels were currently using BRDs. To the extent that BRDs are not being used in the EEZ, the requirement of BRDs would probably reduce the bycatch of both managed and unmanaged species, as discussed above. Possible percentages are presented in Tables 4 and 5, assuming that the reduction rates are applicable to all finfish catch. If most trawlers in the EEZ off Florida are already using BRDs, there would be only minor benefits to bycatch reduction from requiring these devices; however, there would be an enforcement implication.

As previously stated, the data on percent bycatch reduction for most species by BRDs that have been tested are sparse for the west coast of Florida. Furthermore, the data are insufficient to determine whether the bycatch of managed species, particularly reef fish and mackerels, is sufficiently large that the requirement of BRDs would effect total mortality, recruitment, or stock size. Available data indicate that it is not. It is, however, likely that many of the BRD designs reported in Tables 4 and 5 would reduce bycatch of finfish. Additionally, to accomplish a given reduction in bycatch (e.g. 20%), the shrimp loss from requiring BRDs would probably be less than through the use of area closures or seasonal closures as discussed in Sections 6.1 and 6.2. As previously mentioned, the determination of the amount of bycatch reduction achievable from the requirement of BRDs in this area would require additional study and would vary depending on the type of BRD used; the type of shrimp-trawl gear used; the species involved; and the season, area, and depth of fishing. The biological, ecological, economic, and social effects of requiring BRDs are largely unknown, but some possible implications are considered in the following sections.

Biological Impacts: The biological impacts of requiring BRDs in the EEZ south and east of Cape San Blas, Florida are largely unknown, primarily because very little is known about the biology (life histories) of most species involved. For species such as most of the invertebrates that are not effectively excluded by BRDs there would be little if any effects, positive or negative. For finfish

stocks that are excluded, there may be positive benefits to these stocks provided that the mortality presently encountered by trawls is not merely offset by natural mortality. There may also be unknown, but highly variable, ecological impacts. The state of Florida is currently involved with an Ecopath Modeling effort to identify ecological relationships in some areas off the west coast of Florida. To date, this effort has not included scenarios for ecological impacts of bycatch reduction. Martinez et al. (1996) (Appendix B) reviewed scenarios for ecological impacts of bycatch reduction in the northern Gulf of Mexico. It is unknown whether these results would be applicable off the west coast of Florida, south and east of Cape San Blas. The following is an excerpt from Amendment 9 to the Shrimp FMP that contains a discussion of potential ecological impacts based on Martinez et al. (1996):

Although the requirement for using BRD's is expected to have positive biological impacts of increasing the biomass of numerous finfish species, their ecological effects may have a negative impact on shrimp biomass. The following is a summary of these ecological effects. Appendix B provides a more detailed discussion.

The SEFSC examined the food habits of 161 species of bottomfish, reef fish, and pelagic fish. Of these, only 14 species were identified as predators on shrimp at some time in their life. Table 1 (of Appendix B) lists these in order of their importance as predators. The top three were sand seatrout, spotted seatrout, and Atlantic croaker.

Mandating the use of BRDs could have a negative effect on the shrimp population based on results of the NMFS ecological modeling of bycatch reduction. Martinez, et al. (1996) projected that the effect of requiring BRDs could be a reduction in the biomass of shrimp by as much as 11%, but more likely between 5.9 and 8.2%. These estimates are based on increased predation that could result from an increase in abundance of bottomfish predators and decreased recycling of nutrients if finfish bycatch biomass is reduced by 50% (see Appendix B). Their model examined the effects of predation and recycling of organic nitrogen resulting from the reduction of bycatch. Four types of scenarios were examined. The first of these was the general effect of various levels of reduction in biomass of bottomfish (principally groundfish) on the biomass of shrimp from increased predation and reduced organic nitrogen. This scenario provided a standard by which probable effects could be evaluated depending on the reduction of bottomfish biomass achieved by various BRD designs that might be certified in the future. The model predicted that a 10% reduction in bycatch of finfish would result in a 0.8% decline in shrimp stock biomass, and declines of 5.5% and 10.7% were predicted for reductions in bycatch of 25 and 50%, respectively. The predicted reduction in shrimp stock biomass resulted from predation as the bottomfish nitrogen pool increased due to bycatch reduction. With the current BRD designs being considered, the reduction of bycatch biomass would be approximately 25% with a resultant reduction in shrimp stock biomass of 5.8% (see following discussion on BRDs). The scenario, however, assumed all finfish were released at equivalent rates.

The second scenario examined the reduction in bycatch by ... three BRD models and used data on the selective release of finfishes by each model recognizing the fact that BRDs do not release all finfish at equivalent rates. (Some finfish are released at higher rates and some are not released at all.) The reductions in catch-per-unit-of-effort (CPUE) (by weight of all fish excluded) averaged 30.6% for the 30 mesh position fisheye BRD, 29.6% for the 45 mesh position fisheye BRD, and 34% for the extended funnel BRD). The model estimated these BRDs would reduce the shrimp stock biomass by 6.7, 5.9, and 8.2%, respectively. Factors that would affect these estimates include the areas where BRDs are used and seasonal closures This scenario is probably more accurate because finfish are probably not excluded at an equivalent rate for all species.

The two other scenarios examined (Appendix B) assumed that as finfish biomass increased through the use of BRDs, the size and age structure of these excluded stocks could also change. Additionally, as these fish attain a larger size, and predation rates and prey may change for species that feed on shrimp. These scenarios examined assumptions that: (1) Larger fish would consume more shrimp, and some fish that are currently too small to prey on shrimp might grow large enough to utilize shrimp; and (2) Larger fish would target prey larger than shrimp (e.g., other fish), and predation rates on shrimp may decline. There is currently insufficient data available to predict the effects on predation through growth in size of fish for the populations of predator species through use of the model. A sensitivity analysis, however, showed that the shrimp stock could be reduced by as much as 16.7% from an increase in predation by 50%. A reduction in predation had smaller effects on the shrimp stock biomass; however, a 50% reduction showed an increase in shrimp stock biomass of 4.7%. Figure 7 of Appendix B presents these relationships in terms of predation rates and increases or decreases in shrimp biomass (expressed as organic nitrogen).

Sufficient information to utilize the model to examine effects of bycatch reduction on other predators, such as birds and marine mammals is not available. Large numbers of birds prey on the discarded bycatch while it floats on the surface, and there is some conjecture that they may have developed a dependence on this source of food. Earlier versions of a trophic ecological model (Browder 1983 and Sheridan et al. 1984, Appendix B) indicated that if 50% bycatch was removed from the ocean (e.g., landed and utilized on shore) the shrimp biomass would decline by 25%. If birds were harvesting a significant percentage of the bycatch biomass, a similar effect should have occurred, but it would be smaller in magnitude because bird guano and the tissues of dead birds would be recycled and contribute to the organic nitrogen pool. Whether bycatch reduction will have an adverse impact on bird populations is unknown (see discussion under section 6).

Martinez, et al., (1996) (Appendix B) pointed out that the model predicted the effects on the shrimp stock biomass and not yield from the fishery. Information to assess the relation between

the model results and catch by fishermen is not available, and any negative effects of increased predation could be "masked" by annual fluctuations in recruitment and landings.

In summary, there is currently insufficient information to determine the ecological impacts of requiring BRDs on the west coast of Florida south and east of Cape San Blas. Positive impacts to one species that may accrue due to exclusion may result in negative impacts to other species. Additionally as discussed above, the impacts to shrimp biomass could be either positive or negative; however, ecological modeling has not been attempted in this area.

Economic Impacts: Tables 4 and 5 show the shrimp and bycatch reduction from various types of BRDs. Data in Table 4 has particular relevance as this table contains results of BRD tests that were conducted in Statistical Subareas 1-8. This table shows that BRDs would effect a bycatch reduction from 7 to 40 percent and shrimp losses from 0 to 10 percent. Of the BRDs tested in Statistical Subareas 1-8, the Kiffe Version 4 BRD performed the best in terms of shrimp loss but it only reduced bycatch by 17 percent. The highest shrimp loss of 10 percent was recorded for the 12x5 Fisheye BRD, with only a slight improvement in bycatch reduction (22 percent) over the Kiffe Version 4. In terms of balancing shrimp loss and bycatch reduction, both the New Extended Funnel and the 3/5 Extended Funnel BRDs appear to be the best among the BRDs tested in Statistical Subareas 1-8, with the proportion of bycatch reduction significantly higher relative to shrimp loss.

Since the percent loss in shrimp through the use of a BRD may not necessarily translate to an actual reduction in shrimp catch as overall effort may increase, the percentages in shrimp loss found in Table 4 may be considered near the maximum potential loss in shrimp catch. On this basis and assuming the use of the 12x5 Fisheye BRD (worst case scenario), Alternative 6.3.1 would result in shrimp loss by as much as 1.3 million pounds valued at \$4.4 million. The shrimp loss under Alternative 6.3.3 would be as much as 500 thousand pounds valued at \$1.8 million. The corresponding shrimp loss for Alternative 6.3.4 would be as much as 423 thousand pounds valued at \$1.4 million.

If under Alternative 6.3.2 the minimum bycatch reduction required is 20 percent, either the New Extended Funnel or the 3/5 Extended Funnel BRD would provide significantly lower shrimp loss and higher bycatch reduction than the 12x5 Fisheye BRD. For the New Extended Funnel BRD, shrimp loss would be about 500 thousand pounds valued at \$1.8 million, and for the 3/5 Extended Funnel BRD, shrimp loss would be 126 thousand pounds valued at \$445 thousand. The corresponding losses for the 12x5 Fisheye BRD would be equal to the maximum loss under the worst case scenario of Alternative 6.3.1 (1.3 million pounds valued at \$4.4 million).

Among the counties in Florida, the top five with the most negative impacts under either Alternative 6.3.1 or Alternative 6.3.2 would be Lee, Hillsborough, Monroe, Pinellas and Franklin as these areas account for most of the landings of shrimp caught in Statistical Subareas 1-8. Under Alternative 6.3.3, which requires the use of BRDs only in Statistical Subareas 4 through 8, the counties likely to experience the most negative impacts would be Franklin, Gulf, Pinellas, and Hillsborough, since most

of the shrimp landings in these counties are caught in Statistical Subareas 4-8. Lee County also derives a substantial amount of shrimp landings from Statistical Subareas 4-8, but this amount is only 37 percent of all shrimp landings in the county. Under Alternative 6.3.4, which requires BRDs in Statistical Subareas 6 through 8, the counties most likely to incur the most negative impacts would be Franklin, Gulf, Hillsborough and Pinellas. All other counties have either relatively less shrimp landings overall or less landings of shrimp caught in Statistical 6-8.

One other cost item that accompanies the BRD requirement is the cost of the BRD itself and of the required maintenance. The cost of the equipment would increase the fixed cost of operation, and while this cost may not be significant relative to the potential shrimp revenue forgone, it could be substantial relative to the fixed cost of operating smaller fishing crafts.

7.0 REGULATORY IMPACT REVIEW

7.1 Introduction

The National Marine Fisheries Service (NMFS) requires a Regulatory Impact Review (RIR) for all regulatory actions that are of public interest. The RIR does three things: (1) it provides a comprehensive review of the level and incidence of impacts associated with a proposed or final regulatory action; (2) it provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problem; and, (3) it ensures that the regulatory agency systematically and comprehensively considers all available alternatives so that the public welfare can be enhanced in the most efficient and cost-effective way.

The RIR also serves as the basis for determining whether the proposed regulations are a "significant regulatory action" under the criteria provided in Executive Order 12866, and whether the proposed regulations will have a significant economic impact on a substantial number of small entities in compliance with the Regulatory Flexibility Act of 1980 (RFA). The primary purpose of the RFA is to relieve small businesses, small organizations, and small governmental jurisdictions (collectively: "small entities") of burdensome regulatory and recordkeeping requirements. The RFA requires that if regulatory and recordkeeping requirements are not burdensome, then the head of a federal agency must certify that the requirement, if promulgated, will not have a significant effect on a substantial number of small entities.

This RIR analyzes the probable impacts that the alternatives in this plan amendment to the Shrimp FMP would have on the commercial shrimp industry.

7.2 Problems and Issues in the Fishery

The specific problems addressed by this proposed plan amendment are enumerated and discussed in Section 3 and are incorporated here by reference. The major issues identified for this plan amendment in order to reduce shrimp trawl bycatch are: (1) area closures; (2) seasonal closures; and, (3) bycatch reduction devices.

7.3 Objectives

Section 4 of this document discusses the specific need for this plan amendment and is incorporated here by reference.

7.4 Impacts of Management Measures

The discussions under the “Economic Impacts” sub-heading in Section 6 comprise the bulk of the impact analysis for RIR purposes and are incorporated here by reference..

7.5 Private and Public Costs

The preparation, implementation, enforcement, and monitoring of this or any federal action involves the expenditure of public and private resources that can be expressed as costs associated with the regulations. Costs associated with this specific action include:

Council costs of document preparation, meetings, public hearings, and information dissemination	\$45,000
NMFS administrative costs of document preparation, meetings, and review	30,000
Industry cost of BRDs	340,000
Law enforcement costs	none
TOTAL	\$415,000

The Council and NMFS costs of document preparation will be based on staff time, travel, printing, and any other relevant items where funds would be expended directly for this specific action. Industry BRD cost refers only to the cost of the equipment. The total industry cost is estimated using BRD cost of \$50 (from Amendment 9) and assuming 4 trawls per vessel of the 850 fishing craft that may be affected by this amendment. Recent information indicates BRD costs may be around the range of \$25 for Fisheye, \$50 for Extended Funnel and \$200 for Kiffe (Jamir, pers. comm., 2001).

There are expected to be no additional law enforcement and data collection costs at the federal level with this plan amendment. Enforcing closures or BRD use would be part of the routine enforcement tasks, although this would mean some reallocation of enforcement activities. It should be recalled here that, in their review of Amendment 10 to the Shrimp FMP, the Council's Law Enforcement Advisory Panel advised that there are undetermined enforcement costs associated with any additional regulations that reduce efficiency and contacts. A more in-depth study is thus needed to determine these costs.

7.6 Determination of a Significant Regulatory Action

Pursuant to E.O. 12866, a regulation is considered a "significant regulatory action" if it is likely to result in a rule that may: (1) have an annual effect on the economy of \$100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of the recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in E.O. 12866.

Any of the alternatives considered in this amendment would affect the business operations related to the harvest of shrimp in Statistical Subareas 1 through 8. As shown in Table 3, the total value of landings of shrimp caught in these areas is \$12.6 million. Since the ex-vessel value of shrimp caught in the subject areas is substantially less than the \$100 million threshold and in addition any of the closure or BRD alternatives would reduce only a certain percentage of shrimp harvest and value, any of the alternatives considered in this amendment would not meet the \$100 million impact criterion.

The costs to federal government agencies of formulating and implementing closures or BRD requirements are estimated to be about \$75,000. If BRDs are required, industry costs may total about \$340,000 for the equipment alone. There are no expected cost increases to be borne by state and other local governments from implementing any of the alternatives in this amendment, since the measures considered would likely affect only vessel operations in the EEZ. It is likely that if a relatively high percentage reduction in shrimp landings is effected, the price of shrimp may increase in certain areas highly dependent on shrimp caught in the subject area. To the extent that the shrimp market is essentially dominated by imports, a significant increase in price may be deemed unlikely. It is not known whether some shrimp vessel/boat would exit the fishery as a result of adopting certain measures in this amendment. In the event that a substantial number of vessels/boats exit the fishery, there would ensue some adverse effects on competition, investment, productivity, and innovation, or on the competitive status of the domestic fishery, vis-a-vis its foreign rivals. The significance of this effect cannot be determined.

Any of the closure or BRD alternatives considered in this amendment would not create a serious inconsistency or otherwise interfere with an action taken or planned by another agency. In fact, the BRD alternatives would complement the state's BRD requirement in state waters and the current BRD requirement west of Cape San Blas, Florida.

Any of the alternatives considered in this amendment is not expected to impact entitlements, grants, user fees, or loan programs or the rights and obligations of the recipients thereof. These items would continue to be in effect whether or not any of the alternatives in this amendment is implemented. Closures or BRDs are not novel in the Gulf fishery management, considering that there are now in effect various closures for shrimping and BRD requirements.

It is, therefore, determined that any of the alternatives considered in this amendment, or any combination thereof, would not constitute a major regulatory action as stipulated under E.O. 12866.

7.7 Initial Regulatory Flexibility Analysis

Introduction

The purpose of the Regulatory Flexibility Act (RFA) is to establish a principle of regulatory issuance that agencies shall endeavor, consistent with the objectives of the rule and of applicable statutes, to fit regulatory and informational requirements to the scale of businesses, organizations, and governmental jurisdictions subject to regulation. To achieve this principle, agencies are required to solicit and consider flexible regulatory proposals and to explain the rationale for their actions to assure that such proposals are given serious consideration. The RFA does not contain any decision criteria; instead the purpose of the RFA is to inform the agency, as well as the public, of the expected economic impacts of various alternatives contained in the FMP or amendment (including framework management measures and other regulatory actions) and to ensure that the agency considers alternatives that minimize the expected impacts while meeting the goals and objectives of the FMP and applicable statutes.

With certain exceptions, the RFA requires agencies to conduct an Initial Regulatory Flexibility Analysis (IRFA) for each proposed rule. The IRFA is designed to assess the impacts various regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those impacts. An IRFA is conducted to primarily determine whether the proposed action would have a "significant economic impact on a substantial number of small entities." In addition to analyses conducted for the Regulatory Impact Review (RIR), the IRFA provides: (1) a description of the reasons why action by the agency is being considered; (2) a succinct statement of the objectives of, and legal basis for, the proposed rule; (3) a description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply; (4) a description of the projected reporting, record-keeping, and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirements of the

report or record; and, (5) an identification, to the extent practicable, of all relevant Federal rules, which may duplicate, overlap, or conflict with the proposed rule.

Description of the reasons why action by the agency is being considered: The need and purpose of the actions are set forth in Section 4 of this document. This particular section is included herein by reference.

Statement of the objectives of, and legal basis for, the proposed rule: The specific objectives of this action are enumerated in Section 4 of this document. This section is included herein by reference. The Magnuson-Stevens Fishery Conservation and Management Act, as amended, provides the legal basis for the rule.

Description and estimate of the number of small entities to which the proposed rule will apply: There are about 3,500 to 5,000 shrimp vessels and 13,000 shrimp boats in the Gulf, of which about 850 fishing craft may be affected to the extent that they fish in Statistical Areas 1 through 8. For the 1991-2000 period, these vessels/boats made an annual average of 6,761 trips totaling about 26 thousand hours in Statistical Subareas 1-8. Additional descriptions are noted below in the discussion of the substantial number of small entities criterion.

Description of the projected reporting, record-keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities which will be subject to the requirement and the type of professional skills necessary for the preparation of the report or records: This amendment does not require additional reporting requirements.

Identification of all relevant Federal rules which may duplicate, overlap or conflict with the proposed rule: No duplicative, overlapping, or conflicting Federal rules have been identified. In fact the actions in this amendment related to BRD requirements would place the shrimp fishery in the subject area on par with the shrimp fishery in state waters of Florida and the shrimp fishery in the EEZ west of Cape San Blas, Florida.

Substantial Number of Small Entities Criterion

Generally, a fish-harvesting business is considered a small business if it is independently owned and operated and not dominant in its field operation, and if it has annual receipts not in excess of \$3.0 million. Although there are several fleet operations in the shrimp fishery, their actual number is not known. Considering the low likelihood that these operations are dominant in the harvesting sector of the shrimp fishery, the gross receipts criterion may be used to define small business in the shrimp fishery.

Of the possible 3,500 vessels and 13,163 boats fishing for shrimp in the Gulf, about 850 fishing craft would be directly affected by some measures in this amendment. Of the 850 fishing craft, 687 are homeported in Florida and 163 in other Gulf states

Ward et al. (1995) reported that the average gross revenues for shrimp vessels are around \$82,000 (converted to 1999 prices using producer price index for all commodities). One standard deviation from this average provides a range of \$16,000 to \$425,000. Considering that even the upper limit of the revenue range is well below the \$3.0 million threshold, all shrimp vessel operations, and expectedly also all shrimp boat operations, may be considered small business entities. Thus, the substantial number criterion would be met.

Significant Economic Impact Criterion

The outcome of "significant economic impact" can be ascertained by examining two issues: disproportionality and profitability.

Disproportionality: Do the regulations place a substantial number of small entities at a significant competitive disadvantage to large entities?

All the commercial entities potentially affected by the proposed rule are considered small entities so that the issue of disproportionality does not arise in the present case. Within these small entities, there are significant variations among fishing operations in terms of revenues by size of vessels and revenues by homeport state. Ward et al. (1995) estimated that average annual revenues of shrimp vessels in the Gulf by length of vessel are: \$4,000 for vessels less than 25 feet, \$23,000 for vessels between 25 and 50 feet and, \$198,000 for vessels greater than 50 feet. Broken down by homeport state, the average annual revenues of shrimp vessels are: \$112,000 for Alabama, \$106,000 for Florida, \$9,000 for Louisiana, \$45,000 for Mississippi, and \$192,000 for Texas.

Profitability: Do the regulations significantly reduce profit for a substantial number of small entities?

Ward et al. (1995) estimated the profits (total revenues less total costs) of shrimp vessels in the Gulf. Revenues were defined as revenues from the sale of shrimp plus revenues from sale of other fish. Total costs included fuel cost, supplies, maintenance, overhead, interest, depreciation, insurance, and crew shares. The average revenues for a shrimp vessel in the Gulf are approximately \$12,000. Average profit for vessels by vessel length are: \$1,598 for vessels less than 25 feet, \$7,949 for vessels between 25 and 50 feet, and \$8,457 for vessels greater than 50 feet. Broken down by homeport state, average profits are: \$4,769 for Alabama, \$29,832 for Florida, \$3,286 for Louisiana, \$13,876 for Mississippi, and \$11,452 for Texas.

Some of the alternatives in this amendment (e.g., a BRD requirement that would reduce shrimp catch by 10 percent or area closure that would increase the areas closed to shrimping by 20 percent or more) result in a fair amount of reduction in shrimp landings, and thus would likely significantly reduce the profitability of some fishing craft particularly the smaller fishing craft.

Description of significant alternatives to the proposed rule and discussion of how the alternatives attempt to minimize economic impacts on small entities:

[This section will be completed once the Council selects preferred alternatives]

Conclusion

Some of the alternatives considered in this amendment would possibly result in a significant economic impact on a substantial number of small entities. One such alternative is the use of a BRD that would effect a 10 percent reduction in shrimp catch. Another would be an area closure that would effect an increase in shrimp area closures by 20 percent or more.

8.0 DESCRIPTION OF FISHERY

The Final Environmental Impact Statement (FEIS) for the original FMP and the FMP as revised in 1981 contain a description of the Gulf shrimp fishery. In its appendix, the FEIS of February 1981 includes the Habits, Distribution, and Incidental Capture of Sea Turtles. This material is incorporated by reference and is not repeated here in detail.

As an overview, 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 fishery with principal catches made from June through October. Annual commercial landings in recent years range from 70 to 100 million pounds of tails depending on environmental factors that influence natural mortality. The fishery extends offshore to about 40 fathoms.

White shrimp, second in value, are found in nearshore waters to about 20 fathoms from Texas through Alabama. There is a small spring and summer fishery for overwintering individuals, but the majority are taken from August through December. Recent annual commercial landings are about 50 million pounds of tails.

Pink shrimp are found off all Gulf states but are most abundant off Florida's west coast and particularly in the Tortugas grounds off the Florida Keys. Most landings are made from October through May with annual commercial landings of about 10 million pounds. In the western Gulf states, pink shrimp are landed mixed with browns. Most catches are made within 30 fathoms.

The commercial fishery for royal red shrimp has expanded in recent years with the development of local markets. This deep-water species is most abundant on the continental shelf from about 140 to 275 fathoms east of the Mississippi River. Thus far, landings have not reached the MSY, optimum yield (OY), and TAC estimate of 392,000 pounds of tails in any year.

The three principal species (penaeids) are short-lived and provide annual crops; however, royal red shrimp live longer, and several year classes may occur on the grounds at one time. The condition of each shrimp stock is monitored annually, and none has been classified as being overfished.

Brown, white, and pink shrimp are subjected to fishing from inland waters and estuaries, through the state-regulated territorial seas, and into federal waters of the EEZ. Royal red shrimp occur only in the EEZ. Management measures implemented under the M-SFCMA apply only to federal waters in the EEZ. Cooperative management occurs when state and federal regulations are consistent. Examples are the seasonal closure off Texas, the Tortugas Shrimp Sanctuary, and the shrimp/stone crab seasonally closed zones off Florida.

The NMFS has classified commercial shrimp vessels comprising the nearshore and offshore fleet into size categories from under 25 feet to over 85 feet. More than half fall into a size range from 56 to 75 feet.

Federal permits for shrimp vessels are currently not required, and state license requirements vary. Many vessels maintain licenses in several states because of their migratory fishing strategy. The number of vessels in the fishery at any one time varies due to economic factors such as the price and availability of shrimp and cost of fuel. The NMFS maintains two types of vessel files, both of which are largely dependent on port agent records. One is for vessels that are recorded as landing shrimp; the other is the VOUF that lists vessels observed at ports. The number of commercial vessels participating in the Gulf shrimp fishery is not known but is believed to be between about 3,500 and 4,500.

The NMFS estimates fishing effort independently from the number of vessels fishing. The NMFS uses the number of hours actually spent fishing from interview data with vessel captains to develop reports as 24-hour days fished. These estimates have been controversial and not well understood because the effort reported does not necessarily reflect the number of active vessels in the fleet.

A recreational shrimp trawl fishery occurs seasonally and almost entirely in the inside waters of the states. There are about 8,000 small boats participating using trawls up to 16 feet in width. About half the boats are licensed in Louisiana.

Bait landings of juvenile brown, pink, and white shrimp, occur in all states and are not routinely included in the NMFS statistics. Estimates from the original FMP suggest landings of about 5 million pounds (whole weight) in 1980.

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. A basic otter trawl consists of a heavy mesh bag with wings on each side designed to funnel the shrimp into the codend or tail. A pair of otter boards or trawl doors positioned at the end of each wing hold the mouth of the net open by exerting a downward and outward force at towing speed.

The two basic otter-trawl designs used by the Gulf shrimp fleet are the flat and the semi-balloon trawls (Klima and Ford 1970). The mouth of the flat trawl is rectangular in shape, whereas the mouth of the semi-balloon design forms a pronounced arch when in operation.

Try nets are small otter trawls about 12 to 16 feet in width that are used to test areas for shrimp concentrations. These nets are towed during regular trawling operations and lifted periodically to allow the fishermen to assess the amount of shrimp and other fish and shellfish being caught. These

amounts in turn determine the length of time the large trawls will remain set or whether more favorable locations will be selected.

Until the late 1950s, most shrimp vessels pulled single otter trawls ranging from 80 to 100 feet in width (Idyll, 1963). Double-rig trawling was introduced into the shrimp fleet during the late 1950s. The single large trawl was replaced by two smaller trawls, each 40 to 50 feet in width, towed simultaneously from stoutly constructed outriggers located on the port and starboard sides of the vessels. The port trawl was towed about 150 feet in back of the starboard trawl to prevent fouling. The advantages of double-rig trawling include: (1) increased catch per unit of effort, (2) fewer handling problems with the smaller nets, (3) lower initial gear costs, (4) a reduction in costs associated with damage or loss of the nets, and (5) greater crew safety (Idyll, 1963).

In 1972, the quad rig was introduced in the shrimp fishery, and by 1976 it became widely used in the western Gulf. The quad rig consists of a twin trawl pulled from each outrigger. One twin trawl typically consists of two 40-foot trawls connected to a center sled and spread by two outside trawl doors. Thus, the quad rig with two twin trawls has a total spread of 160 feet versus the total spread of 110 feet in the old double rig of two 55-foot trawls. The quad rig has less drag and is more fuel efficient. For some designs, a lower opening reduces fish bycatch (David Harrington, personal communication).

9.0 ENVIRONMENTAL ASSESSMENT

This section reviews and discusses the biological, physical, and human environment of the shrimp fishery of the Gulf of Mexico.

9.1 Biological Environment

The Shrimp FMP (with FEIS), Amendment 9 (with Supplemental Environmental Impact Statement [SEIS]), and the Generic Essential Fish Habitat (EFH) Amendment provide a review of the biology and habitat of shrimp, and they are incorporated here by reference. No new information that would appreciably change these discussions is available. The biological effects, of the proposed actions are discussed immediately following each section herein. As discussed, these impacts are presently unknown and they would likely vary depending on the preferred options chosen.

9.2 Physical Environment

The alternatives proposed in this amendment will not have a negative impact on the physical environment. A BRD requirement for additional bycatch reduction from shrimp vessels in the shrimp fishery would have no effect. To the extent that additional areas are closed permanently or seasonally, some positive benefits to the bottom environment might occur. Any such benefits could

not be quantified without further research. Continuing studies have provided no new information beyond that already contained in the FMP, as amended, that would change this determination. The relationship between shrimp stocks and their habitats, including the physical requirements, are contained in the Shrimp FMP, as amended, the original EIS and SEIS in Amendment 9, and in the Councils' Generic EFH Amendment. Additionally, subsequent studies have not provided new or different information that could be used to further define relationships or alter the aforementioned conclusions. These documents, accompanying discussions, and conclusions are incorporated here by reference.

9.2.1 Effect on Wetlands: Based on the review of documents listed in Section 9.2, it has been determined that the proposed action to reduce shrimp trawl bycatch will have no effect on flood plains, rivers, creeks, or other streams and tributaries to the marine environment or their associated wetlands.

9.2.2 Effect on Essential Fish Habitat: Based on the review of documents listed in Section 9.2, it has been determined that the proposed action will have no effect on EFH. The alternatives proposed in this amendment will not have a negative impact on the physical environment. A BRD requirement for additional bycatch reduction from shrimp in the shrimp fishery would have no effect. To the extent that additional areas are closed permanently or seasonally, some positive benefits to the bottom environment might occur. Any such benefit could not be quantified without further research.

9.2.3 Mitigating Measures: Based on the review of documents listed in Section 9.2, it has been determined that no mitigating measures related to the proposed action are necessary because there are no harmful impacts on the environment.

9.2.4 Unavoidable Adverse Affects: Based on the review of documents listed in Section 9.2, it has been determined that the proposed action does not create unavoidable adverse affects on the environment.

9.2.5 Irreversible and Irretrievable Commitments of Resources: There are no irreversible commitments of resources other than costs of administering and enforcing the proposed rule resulting from implementation of this amendment.

9.2.6 Relationship Between Short-Term Uses and Long-Term Productivity: These relationships cannot be determined at this time. Depending on the method of additional bycatch reduction that is chosen, there could be some benefits to the long-term productivity. None of these fisheries are overfished or undergoing overfishing, and there are no allocations of the resources involved.

9.2.7 Impacts on Other Fisheries: Based on a review of the alternatives proposed in this amendment as compared with other fisheries, the effect on other fisheries cannot be determined. There should be very little if any impacts to managed species because they are seldom encountered in trawls. Ecological relationships among other forage species and fishery species are unknown..

9.3 Human Environment

9.3.1 Description of the Fishery: The original FMP and subsequent Amendments 1 through 9, including accompanying Environmental Impact Statements or Environmental Assessments along with Section 8.0 herein describe the shrimp fishery in the Gulf. They are incorporated here by reference.

9.3.2 History of Management: The management history is described in Section 2.0, and incorporated here by reference.

9.3.3 Economic and Social Assessment: The economic and social effects of this amendment are discussed in detail in the discussions following each set of alternatives in Sections 6.0, 7.0, and 9.0, and incorporated here by reference.

9.4 Finding of No Significant Environmental Impact

I have reviewed the environmental assessment and determined that the proposed action will not significantly affect the physical or human environment, including EFH, and that preparation of an environmental impact statement is not required.

Assistant Administrator for Fisheries

Date

10.0 OTHER APPLICABLE LAW

10.1 Vessel Safety

The proposed alternatives do not impose requirements for use of unsafe (or other) gear nor do they direct fishing effort to periods of adverse weather conditions.

10.2 Paperwork Reduction Act

The purpose of the Paperwork Reduction Act is to control paperwork requirements imposed on the public by the Federal Government. The authority to manage information, its collection, and record keeping is vested with the Director of the Office of Management and Budget. This authority encompasses establishment of guidelines and policies, approval of information collection requests, and reduction of paperwork burdens and duplications. The proposed action is expected to increase paperwork requirements.

10.3 Coastal Zone Management Consistency

The Council have determined that actions to reduce bycatch on the west coast of Florida would not have any impact on the coastal zone management programs of the 5 Gulf states. Consequently, the proposed actions will be implemented in a manner that is consistent to the maximum extent practicable with the approved coastal zone management programs of the Gulf states. This determination has been submitted for review and concurrence by the Gulf states under Section 307 of the Coastal Zone Management Act (CZMA).

10.4 Effect on Endangered Species and Marine Mammals

Amendment 9 contains a list of endangered and threatened species in the Gulf, as well as a detailed account of the Section 7 consultations and biological opinions that have been issued for the shrimp fishery in the Gulf since 1980. These consultations and opinions generally concluded that the management actions that have effected the shrimp fishery were not likely to jeopardize the continued existence of any endangered species, and they are incorporated here by reference. Amendment 9 provided additional protection for endangered and threatened sea turtles by requiring BRDs in shrimp trawls. Bycatch reduction requirements would not have any impact on marine mammals or threatened and endangered species.

10.5 Scientific Data Needs

The actions proposed do not directly create the need for additional data collection efforts. There continues to be a need to study the impacts of bycatch reduction on managed species and ecological relationships. Furthermore, if additional closed areas are imposed, there is an opportunity to compare biodiversity between closed and open shrimp trawling areas. Additional study of the effectiveness of various BRDs is also needed and could be accomplished if BRDs are required.

10.6 Federalism

This proposed amendment does not contain policies with federalism implications sufficient to warrant preparation of a federalism assessment under E.O. 12612.

11.0 LIST OF PREPARERS

Dr. Richard L. Leard, Senior Fishery Biologist

Dr. Antonio Lamberte, Economist

12.0 LIST OF AGENCIES, ORGANIZATIONS, AND PERSONS TO WHOM COPIES OF THE AMENDMENT/ENVIRONMENTAL ASSESSMENT ARE SENT

Gulf of Mexico Fishery Management Council

Law Enforcement Advisory Panel

Shrimp Advisory Panel

Standing Scientific and Statistical Committee (SSC) and Special Shrimp SSC

Coastal Zone Management Offices

Alabama, Mississippi, Louisiana, Florida, Texas

Other Agencies, Organizations, and Persons

Alabama Cooperative Extension Service

Alabama Department of Conservation and Natural Resources, Marine Resources Division

Center for Marine Conservation

Coastal Conservation Association

Environmental Defense Fund

Florida Department of Environmental Protection

Florida Fish and Wildlife Conservation Commission

Florida Sea Grant

Gulf Restoration Network

Gulf and South Atlantic Fisheries Foundation, Inc.

Louisiana Cooperative Extension Service

Louisiana Department of Wildlife and Fisheries

Mississippi Cooperative Extension Service

Mississippi Department of Marine Resources

Monroe County Commercial Fishermen's Association

Monroe County Cooperative Extension Service

National Marine Fisheries Service Southeast Regional Office

National Marine Fisheries Service Southeast Fisheries Center

National Marine Fisheries Service Washington Office

National Marine Fisheries Service Law Enforcement

National Fisheries Institute

Organized Fishermen of Florida
Recreational Fishing Alliance
ReefKeeper International
Southeastern Fisheries Association
Southern Offshore Fishermen's Association
Texas America Vietnamese Association
Texas Cooperative Extension Service
Texas Parks and Wildlife Department
Texas Shrimp Association
United States Fish & Wildlife Service
United States Coast Guard

13.0 PUBLIC HEARING LOCATIONS AND DATES

The following public hearings will be held beginning at 7:00 p.m. In addition, public testimony will be accepted at the Council meeting in New Orleans, Louisiana, on September 12, 2001.

Monday, August 20, 2001

Holiday Inn Beachside
3841 North Roosevelt Boulevard
Key West, FL 33040

Thursday, August 23, 2001

Ramada Hotel & Conference Center
5303 West Kennedy Boulevard
Tampa, FL 33609

Tuesday, August 21, 2001

Edison Community College
Lee Campus
Corbin Auditorium, Room J-103
8099 College Parkway
Fort Myers, FL 33919

Tuesday, August 28, 2001

Franklin County Courthouse
33 Market Street
Apalachicola, FL 32320

14.0 REFERENCES

Brown, S. 2001. Unpublished data on depths at the state-federal boundary off the west coast of Florida. Florida Marine Research Institute, Florida Fish and Wildlife Conservation Commission, 100 Eighth Avenue, Southeast, St. Petersburg, Florida 33701.

Coleman, F. C., C. C. Koenig, and W. F. Herrnkind. 1992. Survey of Florida inshore shrimp trawling bycatch and preliminary tests of bycatch reduction devices. Annual Report Florida Department of Natural Resources Contract C-6959. 28 pp.

GMFMC, 1997. Amendment 9 to the fishery management plan for the shrimp fishery of the Gulf of Mexico, U.S. Waters with supplemental environmental impact statement, regulatory impact review,

initial regulatory flexibility analysis, and social impact assessment. Gulf of Mexico Fishery Management Council, 3018 U.S. Highway 301 North, Suite 1000, Tampa, Florida 33619-2266. 153 pp. +figures and attachments.

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Table 1. Average annual shrimp catch (all species) and value by statistical subareas and subarea groupings for 1991 through 2000.

STATISTICAL SUBAREA (SS)	POUNDS	VALUE
1	383,372	1,272,149
2	5,619,096	19,974,495
3	1,455,258	5,730,226
SS SUBTOTAL	7,457,726	26,976,870
4	427,706	1,836,331
5	454,350	1,955,658
SS SUBTOTAL	882,056	3,791,989
6	1,416,478	4,484,858
7	1,734,326	5,760,776
8	1,075,543	3,484,747
SS SUBTOTAL	4,226,347	13,730,381
TOTALS	12,566,129	44,499,240

Table 2. Square nautical mile (nm²) calculations for statistical subareas off the west coast of Florida from Key West to Panama City, Florida and average depth in fathoms (fm) along the state-federal boundary.

Area	Description	State nm ²	Federal nm ²	Total nm ²	Avg. Depth (fm)
1	Key West (middle-lower Keys; Gulf waters)	300	960	1,260	7.5
2	Dry Tortugas	250	9,950	10,200	20.5
3	Everglades (Naples-Florida Bay)	864	17,466	18,330	4
4	Fort Myers (Charlotte Harbor-Naples)	650	13,960	14,610	8
5	Tampa Bay (to N. of Charlotte Harbor)	610	9,770	10,380	6
6	Crystal River-Tarpon Springs	560	7,540	8,100	4
7	Apalachee Bay (Apalachicola-Crystal River)	1,341	4,739	6,080	5
8	Panama City-Apalachicola	540	9,030	9,570	11.5

Table 3. Average annual trips and effort (days fished) by statistical subareas and subarea groupings for 1991 through 2000.

STATISTICAL SUBAREA (SS)	TRIPS	EFFORT
1	95	1,289.3
2	2,078	10,772.6
3	467	3,171.0
SS SUBTOTAL	2,640	15,232.9
4	322	1,285.6
5	189	1,060.2
SS SUBTOTAL	511	2,345.8
6	1,993	2,764.8
7	1,266	3,512.6
8	351	2,395.1
SS SUBTOTAL	3,610	8,672.5
TOTALS	6,761	26,251.3

Table 4. Reduction rate estimates of various BRDs on the west coast of Florida (Statistical Subareas 1-8).

Species	n	Reduction Rate (%)	P - Value	95% C.I. (%)
New Extended Funnel BRD				
Shrimp (wt)	22	4	0.25	-3 to 10
Total Fish (wt)	22	40	0	32 to 48
3/5 Extended Funnel BRD				
Shrimp (wt)	72	1	0.54	-2 to 4
Total Fish (wt)	68	33	0.01	15 to 52
12x5 Fisheye BRD				
Shrimp (wt)	20	10	0.06	0 to 19
Total Fish (wt)	19	22	0.05	6 to 38
4x7 Fisheye BRD				
Shrimp (wt)	21	0	0.91	-8 to 7
Total Fish (wt)	21	7	0.23	-4 to 18
Kiffe Version 4 BRD				
Shrimp (wt)	24	0	0.90	-5 to 4
Total Fish (wt)	24	17	0	9 to 24

Table 5. Reduction rate estimates of various BRDs and one TED for the Gulf of Mexico and South Atlantic.

Species	n	Reduction Rate (%)	P - Value	95% C.I. (%)
12x5 Fisheye BRD				
Shrimp (wt)	157	4	0.16	--
Total Fish (wt)	141	35	0	30 to 39
12x5 Fisheye BRD in the 2.6 Meter Position				
Shrimp (wt)	105	4	0.17	--
Total Fish (wt)	98	44	0	38 to 49
12x5 Fisheye BRD in the 3.8 Meter Position				
Shrimp (wt)	35	-1*	0.78	--
Total Fish (wt)	35	31	0	24 to 37
Extended Funnel Device				
Shrimp (wt)	299	0	0.74	--
Total Fish (wt)	280	38	0	32 to 44
Jones/Davis BRD				
Shrimp (wt)	33	4	0.07	0 to 9
Total Fish (wt)	31	58	0	53 to 63
Parker TED				
Shrimp (wt)	68	7	0.00	4 to 10
Total Fish (wt)	67	32	0.00	28 to 36

*Negative values represent a nominal increase.

Table 6. Most frequently caught species by area, depth, and season for the Florida west coast (numbers per hour).

StatGr	DepthGr	SeasonGr	Scientific Name	Common Name	NCPUE	Percent
Area 1-3	0-10 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	918.92	70.94
Area 1-3	0-10 fm	Pre-Summer	<i>Solenocera sp</i>	Shrimp, Humpback	48.66	3.76
Area 1-3	0-10 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	36.01	2.78
Area 1-3	0-10 fm	Pre-Summer	<i>Trachypenaeus sp</i>	Shrimp, Sugar/Blood	31.70	2.45
Area 1-3	0-10 fm	Pre-Summer	<i>Eucinostomus gula</i>	Jenny, Silver	29.51	2.28
Area 1-3	0-10 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	27.46	2.12
Area 1-3	0-10 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	26.86	2.07
Area 1-3	0-10 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	19.09	1.47
Area 1-3	0-10 fm	Pre-Summer	<i>Eucinostomus argenteus</i>	Mojarra, Spotfin	16.95	1.31
Area 1-3	0-10 fm	Pre-Summer	<i>Eucinostomus sp</i>	Mojarra sp	13.70	1.06
Area 1-3	0-10 fm	Pre-Summer		Other Species	126.54	9.77
Area 1-3	11-20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	430.48	45.97
Area 1-3	11-20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	81.72	8.73
Area 1-3	11-20 fm	Pre-Summer	<i>Portunus sp</i>	Crab, Portunus	75.62	8.07
Area 1-3	11-20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	56.05	5.98
Area 1-3	11-20 fm	Pre-Summer	<i>Scorpaena sp</i>	Scorpionfish	47.10	5.03
Area 1-3	11-20 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	29.32	3.13
Area 1-3	11-20 fm	Pre-Summer	<i>Trachypenaeus sp</i>	Shrimp, Sugar/Blood	24.03	2.57
Area 1-3	11-20 fm	Pre-Summer	<i>Eucinostomus sp</i>	Mojarra sp	15.20	1.62
Area 1-3	11-20 fm	Pre-Summer	<i>Loligo pealeii</i>	Squid, Longfin	14.77	1.58
Area 1-3	11-20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	10.94	1.17
Area 1-3	11-20 fm	Pre-Summer		Other Species	151.28	16.15
Area 1-3	11-20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	100.09	22.73
Area 1-3	11-20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	98.28	22.31
Area 1-3	11-20 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	48.35	10.98
Area 1-3	11-20 fm	Summer	<i>Squilla sp</i>	Shrimp, Mantis	23.29	5.29
Area 1-3	11-20 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	22.24	5.05
Area 1-3	11-20 fm	Summer	<i>Bothus sp</i>	Flounder	20.58	4.67
Area 1-3	11-20 fm	Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothhead	14.77	3.35
Area 1-3	11-20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	12.17	2.76
Area 1-3	11-20 fm	Summer	<i>Loligo pealeii</i>	Squid, Longfin	10.47	2.38
Area 1-3	11-20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	10.38	2.36
Area 1-3	11-20 fm	Summer		Other Species	79.79	18.12

Table 6 continued.

Area 1-3	>20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	271.51	32.97
Area 1-3	>20 fm	Pre-Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	92.72	11.26
Area 1-3	>20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	78.27	9.50
Area 1-3	>20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	74.19	9.01
Area 1-3	>20 fm	Pre-Summer	<i>Bothus robinsi</i>	Flounder, Twospot	49.35	5.99
Area 1-3	>20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	24.08	2.92
Area 1-3	>20 fm	Pre-Summer	<i>Loligo pealeii</i>	Squid, Longfin	22.61	2.75
Area 1-3	>20 fm	Pre-Summer	<i>Sphoeroides spengleri</i>	Pufferfish, Bandtail	21.02	2.55
Area 1-3	>20 fm	Pre-Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothead	19.86	2.41
Area 1-3	>20 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	19.41	2.36
Area 1-3	>20 fm	Pre-Summer		Other Species	150.57	18.28
Area 1-3	>20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	164.89	29.65
Area 1-3	>20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	116.41	20.93
Area 1-3	>20 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	34.51	6.21
Area 1-3	>20 fm	Summer	<i>Squilla sp</i>	Shrimp, Mantis	26.43	4.75
Area 1-3	>20 fm	Summer	<i>Bothus sp</i>	Flounder	26.36	4.74
Area 1-3	>20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	21.97	3.95
Area 1-3	>20 fm	Summer	<i>Sphoeroides nephelus</i>	Pufferfish, Southern	20.69	3.72
Area 1-3	>20 fm	Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothead	19.31	3.47
Area 1-3	>20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	17.13	3.08
Area 1-3	>20 fm	Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	13.57	2.44
Area 1-3	>20 fm	Summer		Other Species	94.86	17.06
Area 4-5	0-10 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	256.81	21.66
Area 4-5	0-10 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	184.67	15.57
Area 4-5	0-10 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	156.12	13.17
Area 4-5	0-10 fm	Pre-Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	115.60	9.75
Area 4-5	0-10 fm	Pre-Summer	<i>Eucinostomus havana</i>	Mojarra, Big Eye	103.58	8.74
Area 4-5	0-10 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	59.76	5.04
Area 4-5	0-10 fm	Pre-Summer	<i>Citharichthys macrops</i>	Whiff, Spotted	55.02	4.64
Area 4-5	0-10 fm	Pre-Summer	<i>Haemulon sciurus</i>	Grunt, Bluestriped	42.26	3.56
Area 4-5	0-10 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	25.46	2.15
Area 4-5	0-10 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	17.40	1.47
Area 4-5	0-10 fm	Pre-Summer		Other Species	169.12	14.26
Area 4-5	0-10 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	495.12	36.75
Area 4-5	0-10 fm	Summer	<i>Eucinostomus havana</i>	Mojarra, Big Eye	238.12	17.67
Area 4-5	0-10 fm	Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	146.80	10.90

Table 6 continued.

Area 4-5	0-10 fm	Summer	<i>Squilla sp</i>	Shrimp, Mantis	130.40	9.68
Area 4-5	0-10 fm	Summer	<i>Citharichthys macrops</i>	Whiff, Spotted	58.44	4.34
Area 4-5	0-10 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	53.15	3.94
Area 4-5	0-10 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	35.56	2.64
Area 4-5	0-10 fm	Summer	<i>Diplectrum formosum</i>	Perch, Sand	27.09	2.01
Area 4-5	0-10 fm	Summer	<i>Haemulon plumieri</i>	Grunt, White	17.72	1.31
Area 4-5	0-10 fm	Summer	<i>Etropus crossotus</i>	Flounder, Fringed	16.13	1.20
Area 4-5	0-10 fm	Summer		Other Species	128.85	9.56
Area 4-5	11-20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	127.21	24.38
Area 4-5	11-20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	67.59	12.96
Area 4-5	11-20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	34.76	6.66
Area 4-5	11-20 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	32.03	6.14
Area 4-5	11-20 fm	Pre-Summer	<i>Loligo pealeii</i>	Squid, Longfin	28.34	5.43
Area 4-5	11-20 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	26.47	5.07
Area 4-5	11-20 fm	Pre-Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothead	21.89	4.20
Area 4-5	11-20 fm	Pre-Summer	<i>Eucinostomus sp</i>	Mojarra sp	19.10	3.66
Area 4-5	11-20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	16.70	3.20
Area 4-5	11-20 fm	Pre-Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	13.97	2.68
Area 4-5	11-20 fm	Pre-Summer		Other Species	133.66	25.62
Area 4-5	11-20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	163.42	22.68
Area 4-5	11-20 fm	Summer	<i>Syacium gunteri</i>	Flounder, Shoal	60.73	8.43
Area 4-5	11-20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	46.47	6.45
Area 4-5	11-20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	43.80	6.08
Area 4-5	11-20 fm	Summer	<i>Etropus sp</i>	Flounder sp	43.27	6.00
Area 4-5	11-20 fm	Summer	<i>Loligo pealeii</i>	Squid, Longfin	36.79	5.10
Area 4-5	11-20 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	36.62	5.08
Area 4-5	11-20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	27.50	3.82
Area 4-5	11-20 fm	Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	27.24	3.78
Area 4-5	11-20 fm	Summer	<i>Squilla sp</i>	Shrimp, Mantis	24.43	3.39
Area 4-5	11-20 fm	Summer		Other Species	210.39	29.19
Area 4-5	>20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	430.81	47.00
Area 4-5	>20 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	111.36	12.15
Area 4-5	>20 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	49.66	5.42
Area 4-5	>20 fm	Pre-Summer	<i>Haemulon aurolineatum</i>	Tomtate	42.55	4.64
Area 4-5	>20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	31.30	3.41

Table 6 continued.

Area 4-5	>20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	22.06	2.41
Area 4-5	>20 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	16.42	1.79
Area 4-5	>20 fm	Pre-Summer	<i>Rhomboplites aurorubens</i>	Snapper, Vermilion	14.18	1.55
Area 4-5	>20 fm	Pre-Summer	<i>Etropus sp</i>	Flounder sp	13.66	1.49
Area 4-5	>20 fm	Pre-Summer	<i>Loligo pealeii</i>	Squid, Longfin	13.66	1.49
Area 4-5	>20 fm	Pre-Summer		Other Species	171.04	18.66
Area 4-5	>20 fm	Summer	<i>Etropus sp</i>	Flounder sp	498.13	32.51
Area 4-5	>20 fm	Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothhead	185.03	12.07
Area 4-5	>20 fm	Summer	<i>Etropus crossotus</i>	Flounder, Fringed	113.31	7.39
Area 4-5	>20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	102.30	6.68
Area 4-5	>20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	93.65	6.11
Area 4-5	>20 fm	Summer	<i>Syacium gunteri</i>	Flounder, Shoal	68.15	4.45
Area 4-5	>20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	67.61	4.41
Area 4-5	>20 fm	Summer	<i>Bellator militaris</i>	Searobin, Horned	61.85	4.04
Area 4-5	>20 fm	Summer	<i>Loligo pealeii</i>	Squid, Longfin	56.59	3.69
Area 4-5	>20 fm	Summer	<i>Haemulon aurolineatum</i>	Tomtate	38.36	2.50
Area 4-5	>20 fm	Summer		Other Species	247.49	16.15
Area 6-8	0-10 fm	Pre-Summer	<i>Peprilus burti</i>	Butterfish, Gulf	228.58	19.27
Area 6-8	0-10 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	88.24	7.44
Area 6-8	0-10 fm	Pre-Summer	<i>Stellifer lanceolatus</i>	Drum, Star	80.91	6.82
Area 6-8	0-10 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	70.22	5.92
Area 6-8	0-10 fm	Pre-Summer	<i>Ovalipes ocellatus</i>	Crab, Lady (w/specks)	65.93	5.56
Area 6-8	0-10 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	61.71	5.20
Area 6-8	0-10 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	60.68	5.12
Area 6-8	0-10 fm	Pre-Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	42.63	3.59
Area 6-8	0-10 fm	Pre-Summer	<i>Leiostomus xanthurus</i>	Spot (Flat Croaker)	36.99	3.12
Area 6-8	0-10 fm	Pre-Summer	<i>Prionotus tribulus</i>	Searobin, Bighead	33.86	2.86
Area 6-8	0-10 fm	Pre-Summer		Other Species	416.17	35.09
Area 6-8	0-10 fm	Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	283.44	17.83
Area 6-8	0-10 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	226.89	14.27
Area 6-8	0-10 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	211.07	13.27
Area 6-8	0-10 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	132.60	8.34
Area 6-8	0-10 fm	Summer	<i>Stenotomus caprinus</i>	Porgy, Longspine	73.59	4.63
Area 6-8	0-10 fm	Summer	<i>Echinoidea</i>	Echinoderm (Class)	73.53	4.62
Area 6-8	0-10 fm	Summer	<i>Lolliguncula brevis</i>	Squid, Atlantic Brief	64.53	4.06
Area 6-8	0-10 fm	Summer	<i>Ovalipes floridanus</i>	Crab, Florida Lady	48.70	3.06

Table 6 continued.

Area 6-8	0-10 fm	Summer	<i>Diplectrum formosum</i>	Perch, Sand	39.20	2.47
Area 6-8	0-10 fm	Summer	<i>Trachypenaeus sp</i>	Shrimp, Sugar/Blood	38.23	2.40
Area 6-8	0-10 fm	Summer		Other Species	398.21	25.04
Area 6-8	11-20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	145.82	31.82
Area 6-8	11-20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	54.07	11.80
Area 6-8	11-20 fm	Pre-Summer	<i>Loligo pealeii</i>	Squid, Longfin	51.94	11.33
Area 6-8	11-20 fm	Pre-Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	37.14	8.10
Area 6-8	11-20 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	20.28	4.43
Area 6-8	11-20 fm	Pre-Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	16.77	3.66
Area 6-8	11-20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	15.82	3.45
Area 6-8	11-20 fm	Pre-Summer	<i>Raja eglanteria</i>	Skate, Clearnose	12.91	2.82
Area 6-8	11-20 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	12.46	2.72
Area 6-8	11-20 fm	Pre-Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothhead	11.86	2.59
Area 6-8	11-20 fm	Pre-Summer		Other Species	79.19	17.28
Area 6-8	11-20 fm	Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	512.72	25.73
Area 6-8	11-20 fm	Summer	<i>Etropus crossotus</i>	Flounder, Fringed	280.96	14.10
Area 6-8	11-20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	217.84	10.93
Area 6-8	11-20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	214.38	10.76
Area 6-8	11-20 fm	Summer	<i>Etropus sp</i>	Flounder sp	155.88	7.82
Area 6-8	11-20 fm	Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothhead	57.60	2.89
Area 6-8	11-20 fm	Summer	<i>Syacium gunteri</i>	Flounder, Shoal	50.22	2.52
Area 6-8	11-20 fm	Summer	<i>Lolliguncula brevis</i>	Squid, Atlantic Brief	46.93	2.35
Area 6-8	11-20 fm	Summer	<i>Loligo pealeii</i>	Squid, Longfin	40.49	2.03
Area 6-8	11-20 fm	Summer	<i>Synodus poeyi</i>	Lizardfish, Offshore	40.29	2.02
Area 6-8	11-20 fm	Summer		Other Species	375.52	18.84
Area 6-8	>20 fm	Post-Summer	<i>Stenotomus caprinus</i>	Porgy, Longspine	759.12	34.99
Area 6-8	>20 fm	Post-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	548.01	25.26
Area 6-8	>20 fm	Post-Summer	<i>Etropus crossotus</i>	Flounder, Fringed	305.45	14.08
Area 6-8	>20 fm	Post-Summer	<i>Syacium papillosum</i>	Flounder, Dusky	157.21	7.25
Area 6-8	>20 fm	Post-Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	62.88	2.90
Area 6-8	>20 fm	Post-Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	49.41	2.28
Area 6-8	>20 fm	Post-Summer	<i>Loligo pealeii</i>	Squid, Longfin	44.91	2.07
Area 6-8	>20 fm	Post-Summer	<i>Micropogonias undulatus</i>	Croaker, Atlantic	40.43	1.86
Area 6-8	>20 fm	Post-Summer	<i>Bellator militaris</i>	Searobin, Horned	31.44	1.45
Area 6-8	>20 fm	Post-Summer	<i>Haliutichthys aculeatus</i>	Batfish, Pancake	26.95	1.24

Table 6 continued.

Area 6-8	>20 fm	Post-Summer		Other Species	143.69	6.62
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Table 7. Most frequently caught species by area, depth, and season for the Florida west coast (kilograms per hour).

StatGr	DepthGr	SeasonGr	Scientific Name	Common Name	WCPUE	Percent
Area 1-3	0-10 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	8.55	43.06
Area 1-3	0-10 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	1.55	7.79
Area 1-3	0-10 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	0.94	4.73
Area 1-3	0-10 fm	Pre-Summer	<i>Eucinostomus gula</i>	Jenny, Silver	0.91	4.59
Area 1-3	0-10 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	0.74	3.74
Area 1-3	0-10 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	0.45	2.27
Area 1-3	0-10 fm	Pre-Summer	<i>Eucinostomus sp</i>	Mojarra sp	0.44	2.23
Area 1-3	0-10 fm	Pre-Summer	<i>Eucinostomus argenteus</i>	Mojarra, Spotfin	0.44	2.19
Area 1-3	0-10 fm	Pre-Summer	<i>Etropus crossotus</i>	Flounder, Fringed	0.36	1.83
Area 1-3	0-10 fm	Pre-Summer	<i>Porifera</i>	Sponge (Phylum)	0.36	1.83
Area 1-3	0-10 fm	Pre-Summer		Other Species	5.11	25.74
Area 1-3	11-20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	5.10	28.70
Area 1-3	11-20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	2.39	13.46
Area 1-3	11-20 fm	Pre-Summer	<i>Portunus sp</i>	Crab, Portunus	1.91	10.77
Area 1-3	11-20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	1.49	8.36
Area 1-3	11-20 fm	Pre-Summer	<i>Scorpaena sp</i>	Scorpionfish	0.60	3.36
Area 1-3	11-20 fm	Pre-Summer	<i>Sphoeroides spengleri</i>	Pufferfish, Bandtail	0.49	2.77
Area 1-3	11-20 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	0.49	2.74
Area 1-3	11-20 fm	Pre-Summer	<i>Eucinostomus sp</i>	Mojarra sp	0.47	2.63
Area 1-3	11-20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	0.38	2.15
Area 1-3	11-20 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	0.31	1.75
Area 1-3	11-20 fm	Pre-Summer		Other Species	4.14	23.31
Area 1-3	11-20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	2.45	19.53
Area 1-3	11-20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	2.36	18.78
Area 1-3	11-20 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	1.89	15.07
Area 1-3	11-20 fm	Summer	<i>Lactophrys quadricornis</i>	Cowfish, Scrawled	0.72	5.74
Area 1-3	11-20 fm	Summer	<i>Lutjanus synagris</i>	Snapper, Lane	0.61	4.84
Area 1-3	11-20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	0.56	4.45
Area 1-3	11-20 fm	Summer	<i>Bothus sp</i>	Flounder	0.36	2.85
Area 1-3	11-20 fm	Summer	<i>Diplectrum bivittatum</i>	Perch, Dwarf Sand	0.33	2.60
Area 1-3	11-20 fm	Summer	<i>Sphoeroides spengleri</i>	Pufferfish, Bandtail	0.31	2.46
Area 1-3	11-20 fm	Summer	<i>Sphoeroides nephelus</i>	Pufferfish, Southern	0.30	2.39
Area 1-3	11-20 fm	Summer		Other Species	2.67	21.29
Area 1-3	>20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	3.52	16.91
Area 1-3	>20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	3.35	16.11
Area 1-3	>20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	2.20	10.59
Area 1-3	>20 fm	Pre-Summer	<i>Syacium papillosum</i>	Flounder, Dusky	1.08	5.18

Table 7 continued.

Area 1-3	>20 fm	Pre-Summer	<i>Sphoeroides spengleri</i>	Pufferfish, Bandtail	1.07	5.16
Area 1-3	>20 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	1.04	4.97
Area 1-3	>20 fm	Pre-Summer	<i>Bothus robinsi</i>	Flounder, Twospot	0.95	4.55
Area 1-3	>20 fm	Pre-Summer	<i>Upeneus parvus</i>	Goatfish, Dwarf	0.68	3.28
Area 1-3	>20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	0.60	2.86
Area 1-3	>20 fm	Pre-Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	0.53	2.57
Area 1-3	>20 fm	Pre-Summer		Other Species	5.79	27.81
Area 1-3	>20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	3.06	21.98
Area 1-3	>20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	2.50	18.00
Area 1-3	>20 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	1.73	12.43
Area 1-3	>20 fm	Summer	<i>Sphoeroides nephelus</i>	Pufferfish, Southern	0.90	6.44
Area 1-3	>20 fm	Summer	<i>Lactophrys quadricornis</i>	Cowfish, Scrawled	0.80	5.76
Area 1-3	>20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	0.62	4.46
Area 1-3	>20 fm	Summer	<i>Bothus sp</i>	Flounder	0.47	3.36
Area 1-3	>20 fm	Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothead	0.42	3.00
Area 1-3	>20 fm	Summer	<i>Lutjanus synagris</i>	Snapper, Lane	0.33	2.37
Area 1-3	>20 fm	Summer	<i>Sphoeroides spengleri</i>	Pufferfish, Bandtail	0.31	2.23
Area 1-3	>20 fm	Summer		Other Species	2.78	19.97
Area 4-5	0-10 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	5.04	16.29
Area 4-5	0-10 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	4.52	14.59
Area 4-5	0-10 fm	Pre-Summer	<i>Eucinostomus havana</i>	Mojarra, Big Eye	2.61	8.43
Area 4-5	0-10 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	2.44	7.89
Area 4-5	0-10 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	1.89	6.11
Area 4-5	0-10 fm	Pre-Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	1.69	5.47
Area 4-5	0-10 fm	Pre-Summer	<i>Haemulon sciurus</i>	Grunt, Bluestriped	1.39	4.48
Area 4-5	0-10 fm	Pre-Summer	<i>Lactophrys quadricornis</i>	Cowfish, Scrawled	0.96	3.10
Area 4-5	0-10 fm	Pre-Summer	<i>Citharichthys macrops</i>	Whiff, Spotted	0.91	2.93
Area 4-5	0-10 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	0.76	2.46
Area 4-5	0-10 fm	Pre-Summer		Other Species	8.74	28.23
Area 4-5	0-10 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	9.38	30.35
Area 4-5	0-10 fm	Summer	<i>Eucinostomus havana</i>	Mojarra, Big Eye	5.42	17.54
Area 4-5	0-10 fm	Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	2.07	6.70
Area 4-5	0-10 fm	Summer	<i>Squilla sp</i>	Shrimp, Mantis	1.77	5.72
Area 4-5	0-10 fm	Summer	<i>Diplectrum formosum</i>	Perch, Sand	1.49	4.81
Area 4-5	0-10 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	1.08	3.50
Area 4-5	0-10 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	0.97	3.13
Area 4-5	0-10 fm	Summer	<i>Citharichthys macrops</i>	Whiff, Spotted	0.94	3.03
Area 4-5	0-10 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	0.81	2.63

Table 7 continued.

Area 4-5	0-10 fm	Summer	<i>Lactophrys quadricornis</i>	Cowfish, Scrawled	0.70	2.26
Area 4-5	0-10 fm	Summer		Other Species	6.29	20.34
Area 4-5	11-20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	2.85	14.66
Area 4-5	11-20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	1.94	9.97
Area 4-5	11-20 fm	Pre-Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	1.48	7.62
Area 4-5	11-20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	1.23	6.31
Area 4-5	11-20 fm	Pre-Summer	<i>Lactophrys quadricornis</i>	Cowfish, Scrawled	1.02	5.27
Area 4-5	11-20 fm	Pre-Summer	<i>Lutjanus synagris</i>	Snapper, Lane	0.86	4.40
Area 4-5	11-20 fm	Pre-Summer	<i>Eucinostomus sp</i>	Mojarra sp	0.73	3.78
Area 4-5	11-20 fm	Pre-Summer	<i>Haemulon aurolineatum</i>	Tomtate	0.69	3.55
Area 4-5	11-20 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	0.63	3.25
Area 4-5	11-20 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	0.60	3.09
Area 4-5	11-20 fm	Pre-Summer		Other Species	7.41	38.11
Area 4-5	11-20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	3.35	15.96
Area 4-5	11-20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	1.86	8.85
Area 4-5	11-20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	1.86	8.84
Area 4-5	11-20 fm	Summer	<i>Syacium gunteri</i>	Flounder, Shoal	1.73	8.26
Area 4-5	11-20 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	1.00	4.77
Area 4-5	11-20 fm	Summer	<i>Lactophrys quadricornis</i>	Cowfish, Scrawled	0.96	4.57
Area 4-5	11-20 fm	Summer	<i>Raja eglanteria</i>	Skate, Clearnose	0.71	3.39
Area 4-5	11-20 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	0.67	3.18
Area 4-5	11-20 fm	Summer	<i>Diplectrum formosum</i>	Perch, Sand	0.63	3.00
Area 4-5	11-20 fm	Summer	<i>Haemulon aurolineatum</i>	Tomtate	0.62	2.94
Area 4-5	11-20 fm	Summer		Other Species	7.61	36.24
Area 4-5	>20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	7.56	24.73
Area 4-5	>20 fm	Pre-Summer	<i>Haemulon aurolineatum</i>	Tomtate	3.85	12.62
Area 4-5	>20 fm	Pre-Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	2.04	6.69
Area 4-5	>20 fm	Pre-Summer	<i>Lutjanus synagris</i>	Snapper, Lane	2.02	6.62
Area 4-5	>20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	1.44	4.71
Area 4-5	>20 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	1.42	4.66
Area 4-5	>20 fm	Pre-Summer	<i>Rhomboplites aurorubens</i>	Snapper, Vermilion	0.99	3.25
Area 4-5	>20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	0.96	3.13
Area 4-5	>20 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	0.89	2.90
Area 4-5	>20 fm	Pre-Summer	<i>Lagodon rhomboides</i>	Pinfish	0.87	2.84
Area 4-5	>20 fm	Pre-Summer		Other Species	8.51	27.86
Area 4-5	>20 fm	Summer	<i>Etropus sp</i>	Flounder sp	7.52	20.16
Area 4-5	>20 fm	Summer	<i>Syacium papillosum</i>	Flounder, Dusky	4.60	12.33

Table 7 continued.

Area 4-5	>20 fm	Summer	<i>Scorpaena calcarata</i>	Scorpionfish, Smoothhead	3.36	9.02
Area 4-5	>20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	2.38	6.39
Area 4-5	>20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	2.24	6.02
Area 4-5	>20 fm	Summer	<i>Syacium gunteri</i>	Flounder, Shoal	1.70	4.57
Area 4-5	>20 fm	Summer	<i>Etropus crossotus</i>	Flounder, Fringed	1.65	4.42
Area 4-5	>20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	1.53	4.10
Area 4-5	>20 fm	Summer	<i>Portunus spinimanus</i>	Crab, Blotched Swimming	1.38	3.69
Area 4-5	>20 fm	Summer	<i>Loligo pealeii</i>	Squid, Longfin	1.00	2.67
Area 4-5	>20 fm	Summer		Other Species	9.94	26.64
Area 6-8	0-10 fm	Pre-Summer	<i>Peprilus burti</i>	Butterfish, Gulf	4.62	11.90
Area 6-8	0-10 fm	Pre-Summer	<i>Leiostomus xanthurus</i>	Spot (Flat Croaker)	2.53	6.52
Area 6-8	0-10 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	2.21	5.69
Area 6-8	0-10 fm	Pre-Summer	<i>Archosargus probatocephalus</i>	Sheepshead	2.15	5.54
Area 6-8	0-10 fm	Pre-Summer	<i>Stellifer lanceolatus</i>	Drum, Star	2.14	5.51
Area 6-8	0-10 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	2.00	5.15
Area 6-8	0-10 fm	Pre-Summer	<i>Gymnura micrura</i>	Ray, Smooth Butterfly	1.34	3.46
Area 6-8	0-10 fm	Pre-Summer	<i>Menticirrhus americanus</i>	Kingfish, Southern	1.33	3.42
Area 6-8	0-10 fm	Pre-Summer	<i>Dasyatis americana</i>	Stingray, Southern	1.11	2.87
Area 6-8	0-10 fm	Pre-Summer	<i>Squilla sp</i>	Shrimp, Mantis	0.97	2.50
Area 6-8	0-10 fm	Pre-Summer		Other Species	18.42	47.43
Area 6-8	0-10 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	5.21	15.16
Area 6-8	0-10 fm	Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	3.38	9.84
Area 6-8	0-10 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	2.90	8.44
Area 6-8	0-10 fm	Summer	<i>Aluterus schoepfi</i>	Filefish, Orange	2.07	6.03
Area 6-8	0-10 fm	Summer	<i>Portunus gibbesii</i>	Crab, Iridescent Swimming	1.96	5.70
Area 6-8	0-10 fm	Summer	<i>Diplectrum formosum</i>	Perch, Sand	1.82	5.28
Area 6-8	0-10 fm	Summer	<i>Porifera</i>	Sponge (Phylum)	1.31	3.80
Area 6-8	0-10 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	0.80	2.33
Area 6-8	0-10 fm	Summer	<i>Ogcocephalus radiatus</i>	Batfish, Polkadot	0.76	2.22
Area 6-8	0-10 fm	Summer	<i>Lolliguncula brevis</i>	Squid, Atlantic Brief	0.74	2.16
Area 6-8	0-10 fm	Summer		Other Species	13.42	39.05
Area 6-8	11-20 fm	Pre-Summer	<i>Raja eglanteria</i>	Skate, Clearnose	10.95	35.90
Area 6-8	11-20 fm	Pre-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	2.44	7.99
Area 6-8	11-20 fm	Pre-Summer	<i>Aluterus schoepfi</i>	Filefish, Orange	2.03	6.64
Area 6-8	11-20 fm	Pre-Summer	<i>Syacium gunteri</i>	Flounder, Shoal	1.89	6.19
Area 6-8	11-20 fm	Pre-Summer	<i>Diplectrum formosum</i>	Perch, Sand	1.76	5.78
Area 6-8	11-20 fm	Pre-Summer	<i>Raja texana</i>	Skate, Roundel	1.58	5.18

Table 7 continued.

Area 6-8	11-20 fm	Pre-Summer	<i>Syacium papillosum</i>	Flounder, Dusky	1.14	3.74
Area 6-8	11-20 fm	Pre-Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	1.10	3.60
Area 6-8	11-20 fm	Pre-Summer	<i>Paralichthys albigutta</i>	Flounder, Gulf	1.06	3.47
Area 6-8	11-20 fm	Pre-Summer	<i>Ogcocephalus radiatus</i>	Batfish, Polkadot	1.04	3.40
Area 6-8	11-20 fm	Pre-Summer		Other Species	5.52	18.11
Area 6-8	11-20 fm	Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	5.01	13.97
Area 6-8	11-20 fm	Summer	<i>Sicyonia brevirostris</i>	Shrimp, Brown Rock	2.40	6.70
Area 6-8	11-20 fm	Summer	<i>Raja eglantera</i>	Skate, Clearnose	2.39	6.67
Area 6-8	11-20 fm	Summer	<i>Portunus spinicarpus</i>	Crab, Longspine Swimming	2.07	5.77
Area 6-8	11-20 fm	Summer	<i>Synodus foetens</i>	Lizardfish, Inshore	1.89	5.26
Area 6-8	11-20 fm	Summer	<i>Etropus crossotus</i>	Flounder, Fringed	1.59	4.44
Area 6-8	11-20 fm	Summer	<i>Syacium gunteri</i>	Flounder, Shoal	1.36	3.79
Area 6-8	11-20 fm	Summer	<i>Diplectrum formosum</i>	Perch, Sand	1.29	3.60
Area 6-8	11-20 fm	Summer	<i>Etropus sp</i>	Flounder sp	1.19	3.33
Area 6-8	11-20 fm	Summer	<i>Aluterus schoepfi</i>	Filefish, Orange	1.19	3.31
Area 6-8	11-20 fm	Summer		Other Species	15.49	43.18
Area 6-8	>20 fm	Post-Summer	<i>Stenotomus caprinus</i>	Porgy, Longspine	41.80	45.38
Area 6-8	>20 fm	Post-Summer	<i>Farfantepenaeus duorarum</i>	Shrimp, Pink	12.23	13.28
Area 6-8	>20 fm	Post-Summer	<i>Syacium papillosum</i>	Flounder, Dusky	6.88	7.47
Area 6-8	>20 fm	Post-Summer	<i>Etropus crossotus</i>	Flounder, Fringed	5.61	6.09
Area 6-8	>20 fm	Post-Summer	<i>Raja eglantera</i>	Skate, Clearnose	5.09	5.53
Area 6-8	>20 fm	Post-Summer	<i>Micropogonias undulatus</i>	Croaker, Atlantic	3.95	4.28
Area 6-8	>20 fm	Post-Summer	<i>Prionotus scitulus</i>	Searobin, Leopard	2.80	3.04
Area 6-8	>20 fm	Post-Summer	<i>Leiostomus xanthurus</i>	Spot (Flat Croaker)	2.29	2.49
Area 6-8	>20 fm	Post-Summer	<i>Mellita quinquiesperforata</i>	Urchin, Keyhole (sanddollar)	2.03	2.21
Area 6-8	>20 fm	Post-Summer	<i>Diplectrum formosum</i>	Perch, Sand	1.53	1.66
Area 6-8	>20 fm	Post-Summer		Other Species	7.91	8.58

Table 8. Average annual shrimp catch (all species), value, trips, and effort (days fished) by depth for three statistical subarea groupings, 1991-2000, and percent of total.

Subgroup	FMGroup	Pounds	Percent	Value	Percent	Trips	Percent	Effort	Percent
1-3	0-5	171,822	2.3	370,586	1.4	14	0.5	880.128	5.8
1-3	6-10	642,809	8.6	1,920,912	7.1	85	3.2	1,113.180	7.3
1-3	11-20	6,577,292	88.2	24,410,355	90.5	2,518	95.4	13,033.241	85.6
1-3	> 20	65,804	0.9	275,017	1.0	23	0.9	206.394	1.4
SS Subtotal		7,457,727	100.0	26,976,870	100.0	2,640	100.0	15,232.943	100.0
4-5	0-5	13,585	1.5	39,568	1.0	31	6.0	27.165	1.2
4-5	6-10	365,524	41.3	1,532,661	40.3	274	53.1	1,038.431	44.3
4-5	11-20	501,808	56.6	2,213,172	58.1	209	40.5	1,160.081	49.5
4-5	> 20	4,996	0.6	21,091	0.6	2	0.4	120.182	5.1
SS Subtotal		885,913	100.0	3,806,492	100.0	516	100.0	2,345.859	100.0
6-8	0-5	484,835	11.4	1,493,781	10.9	1,146	31.7	986.227	11.4
6-8	6-10	1,369,003	32.3	4,497,479	32.7	1,676	46.4	3,197.786	36.9
6-8	11-20	2,262,260	53.4	7,423,274	53.9	772	21.4	4,283.859	49.4
6-8	> 20	122,498	2.9	350,941	2.5	17	0.5	204.677	2.4
SS Subtotal		4,238,596	100.0	13,765,475	100.0	3,611	100.0	8,672.549	100.0
		12,582,236		44,548,837		6,767		26,251.351	

Figure 1. Permanent and seasonally closed areas to the commercial harvest of shrimp on the west coast of Florida.

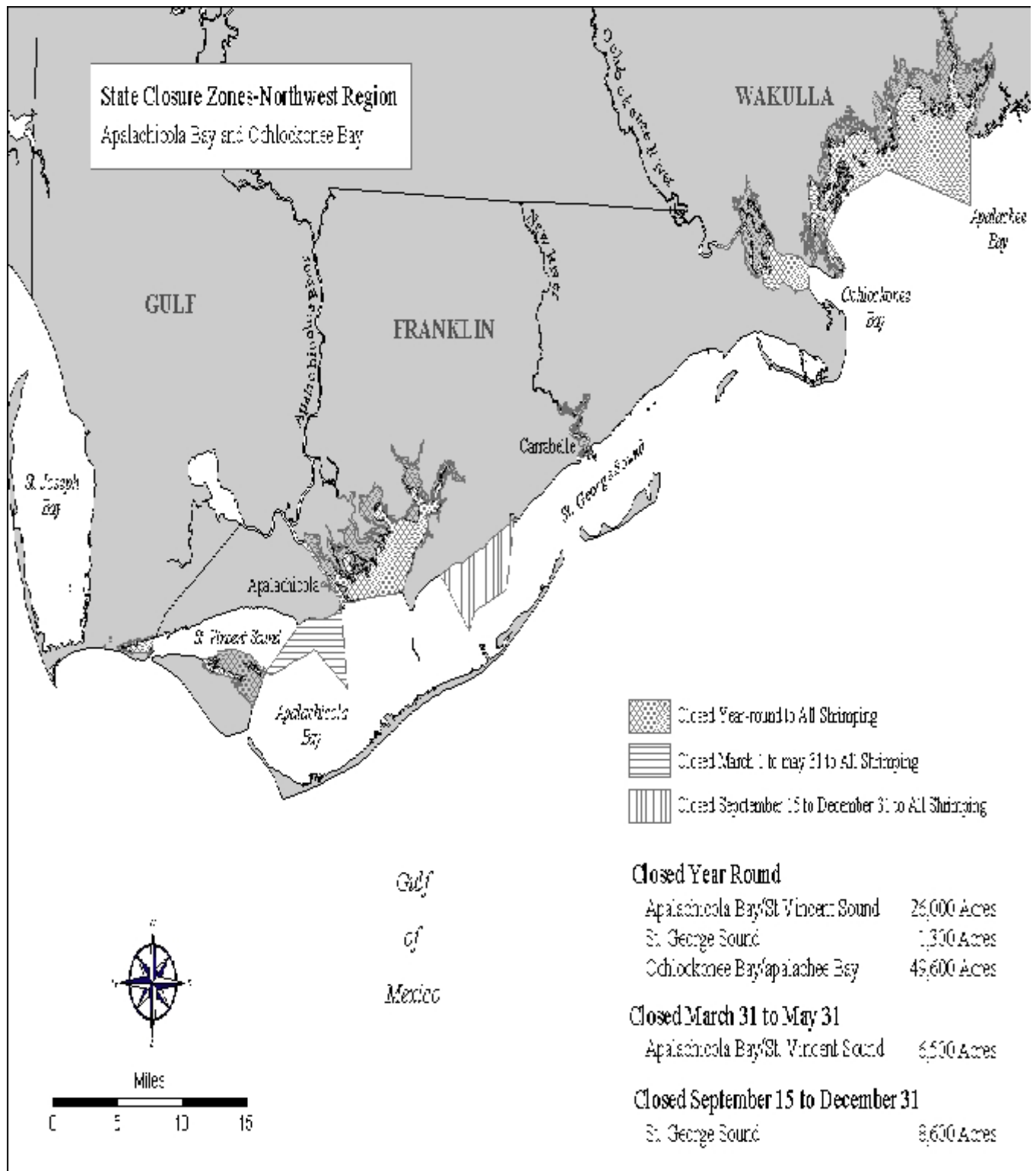


Figure 1. Continued.

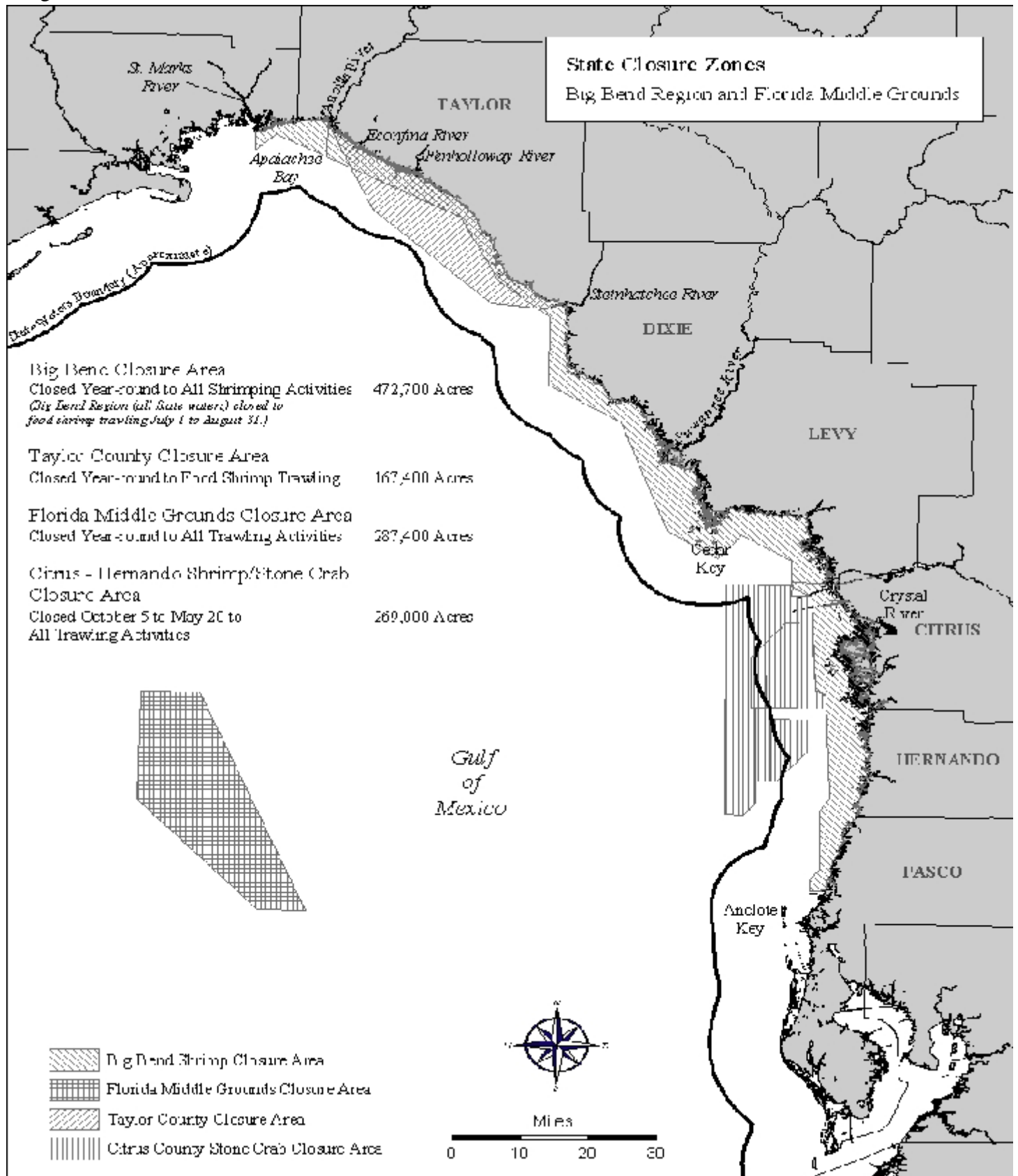


Figure 1. Continued.

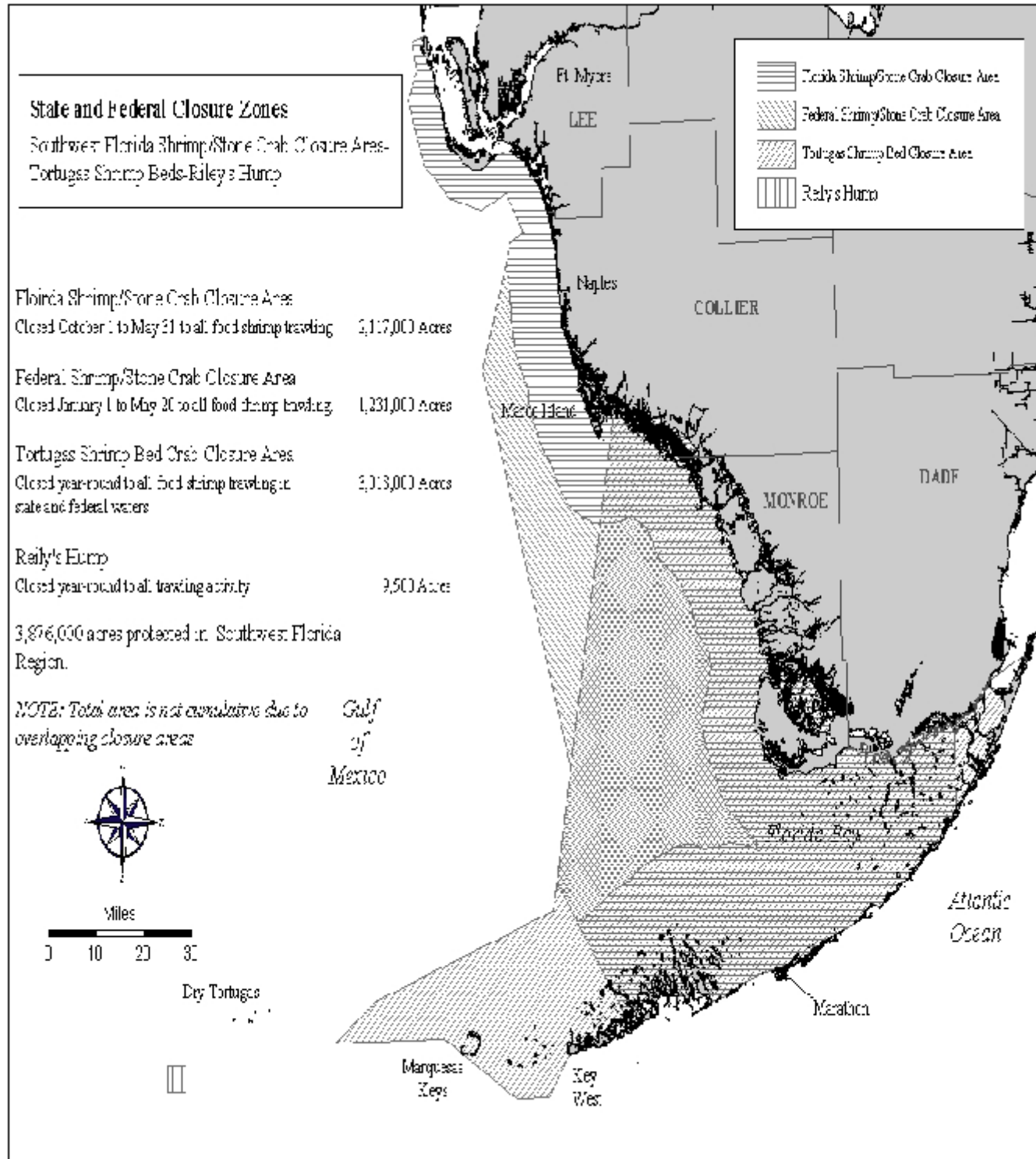


Figure 2. Percentage of catch weights (kilograms per hour) for shrimp to all bycatch and shrimp to finfish bycatch in 3 subareas off the west coast of Florida.

