ENVIRONMENTAL ASSESSMENT
FOR THE
ISSUANCE OF AN EXEMPTED FISHING PERMIT
FOR A FEASIBILITY STUDY OF NET CAGE CULTURE OF FINFISH
IN THE EASTERN GULF OF MEXICO

Southeast Region
National Marine Fisheries Service
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

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1.0 PURPOSE AND NEED FOR ACTION

Aquaculture is the cultivation of aquatic animals and plants in controlled or selected environments for commercial, recreational or public purposes. Aquaculture supports a variety of commercial and non-commercial markets both in the United States and overseas, and the many and disparate sub-industries of aquaculture provide employment, trade and economic well-being, and recreation for a large number of American people (Draft Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone, National Marine Fisheries Service (NOAA Fisheries), 2003).

Farmed aquaculture production in the United States is about 400,000 metric tons annually, with a current value of $970 million. In addition, the United States imports about $7 billion of seafood annually. Because of the need to reduce seafood imports and the economic benefits of marine aquaculture, NOAA Fisheries is encouraging responsible aquaculture practices.

NOAA Fisheries received an application for an exempted fishing permit (EFP) from Mr. Jody Symons on behalf of Florida Offshore Aquaculture, Inc. of Maderia Beach, Florida. If granted, the EFP would authorize a feasibility study for 24 months of net cage culture of cobia, mahi-mahi, greater amberjack, Florida pompano, red snapper and cubera snapper at a site approximately 33 statute miles WSW of Johns Pass, Florida (Lat. 27 34 44; Long. 83 15 56)(See Figure 1). According to the applicant, the purpose of the proposed study is to determine whether it is feasible to grow commercial quantities of native fish species in the offshore environment of the eastern Gulf of Mexico using mariculture techniques. The applicant proposes to place hatchery-raised juvenile fish in net cages, feed them, allow them to grow for approximately 4 months, harvest each cage 3 times annually, land them in Florida, and sell them. Although most fish will be harvested and transported to shore in a processed state, some fish may be held alive and sold as “live” fish. No wild-caught fish will be involved in this study.

The proposed study involves activities otherwise prohibited by regulations implementing the joint South Atlantic and Gulf of Mexico Fishery Management Plan for the Coastal Migratory Pelagic Resources (Mackerels) (See 50 CFR 622.4(a)(iii); 622.32(c)(1); and 622.37(c). The applicant requires authorization to harvest, possess, and sell cobia (*Rachycentron canadum*) taken from Federal waters of the Gulf of Mexico. In addition, authorization is required to possess or sell cobia below the minimum size limit and to harvest or possess cobia in excess of the two fish per person possession limit.

The proposed study involves activities otherwise prohibited by regulations implementing the FMP for the Reef Fish Resources of the Gulf of Mexico (Reef Fish)(See 50 CFR 622.37(d)(iii)(iv)(v), and 622.39(b)(i)(iii)(iv)(v). The applicant intends to use greater amberjack (*Seriola dumerili)***,** red snapper (*Lutjanus campechanus),* and cubera snapper (*Lutjanus cyanopterus*) to test the feasibility of raising them in an offshore mariculture operation. The applicant requires authorization to harvest, possess and sell greater amberjack, red snapper and cubera snapper taken from Federal waters of the Gulf of Mexico. In addition, authorization is required to possess or sell these species below the minimum size limit and to harvest or possess these species in excess of the individual and ten fish aggregate snapper bag limit.

The applicant also intends to use dolphin (*Coryphaena hippurus*), in offshore mariculture operations; however, although dolphin fish are included in the fishery management plan for coastal migratory pelagic resources, there are no management measures to restrict possession, harvest, or sale of dolphin taken from Federal waters of the Gulf of Mexico. Similarly, the applicant would like to use Florida pompano. There are no management measures to restrict possession, harvest, or sale of Florida pompano taken from Federal waters of the Gulf of Mexico.

The EFP is requested under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq*.) and regulations at 50 CFR 600.745, concerning "Scientific research activity, exempted fishing permits, and exempted educational activity."

According to 50 CFR 600.745(b), a National Marine Fisheries Service (NMFS) Regional Administrator may authorize, for limited testing, public display, data collection, exploratory, health and safety, environmental cleanup, and/or hazard removal purposes, the target or incidental harvest of species managed under a fishery management plan or fishery regulations that would otherwise be prohibited. Exempted fishing may not be conducted unless authorized by an EFP issued by a Regional Administrator in accordance with certain criteria and procedures.

Grounds for denial of an EFP include, but are not limited to, the following: (A) The applicant has failed to disclose material information required, or has made false statements as to any material fact, in connection with his or her application; or (B) According to the best scientific information available, the harvest to be conducted under the permit would detrimentally affect the well-being of the wild stock of any regulated species of fish, marine mammal, or threatened or endangered species in a significant way; or (C) Issuance of the EFP would have economic allocation as its sole purpose; or (D) Activities to be conducted under the EFP could create a significant enforcement problem.

If granted, the EFP may contain terms and conditions consistent with the purpose of the exempted fishing, including, but not limited to: (A) The maximum amount of each regulated species that can be harvested and landed during the terms of the EFP, including trip limitations, where appropriate; (B) The number, size(s), name(s), and identification number(s) of the vessel(s) authorized to conduct fishing activities under the EFP; (C) The time(s) and place(s) where exempted fishing may be conducted; (D) The type, size, and amount of gear that may be used by each vessel operated under the EFP; (E) The condition that observers, a vessel monitoring system, or other electronic equipment be carried on board vessels operated under an EFP, and any necessary conditions, such as predeployment notification requirements; (F) Reasonable data reporting requirements; (G) Other conditions as may be necessary to assure compliance with the purposes of the EFP, consistent with the objectives of the fishery management plans and other applicable law; and (H) Provisions for public release of data obtained under the EFP that are consistent with NOAA confidentiality of statistics procedures. An applicant may be required to waive the right to confidentiality of information gathered while exempted fishing as a condition of an EFP.

Currently, the Department of Commerce strongly supports aquaculture initiatives, which are designed to create jobs in the public sector, revitalize coastal communities suffering from the collapse of traditional fisheries stocks and reduce the trade deficit in fishery products. This project should provide important information which can be used to evaluate the potential for aquaculture activities in the EEZ off the west coast of Florida. Also, information will be obtained from the project which will assist managers to develop environmentally friendly procedures for future aquaculture projects in this area.

Based on a review of the Florida Offshore Aquaculture application, NOAA Fisheries has made a preliminary determination that the application contains all of the required information and that it constitutes an activity appropriate for further consideration. Consequently, NOAA Fisheries will publish a notice of receipt of an application for an exempted fishing permit and a request for public comments.

It is expected that the U.S. Environmental Protection Agency (EPA), Region 4, will comment during the 30-day public comment period. EPA will note that the applicant is required to apply for a National Pollutant Discharge Elimination Systems (NPDES) permit. The applicant will apply for an NPDES permit. At the proper time, the applicant will obtain a permit from the U.S. Army Corps of Engineers for the proposed aquaculture activity at the site.

The Regional Administrator is also required to forward copies of the application to the Regional Fishery Management Council(s), the U.S. Coast Guard, and the appropriate fishery management and agricultural agencies of affected states, accompanied by the following information: (a) the effect of the proposed EFP on the target and incidental species, including the effect on any total allowable catch (TAC); (b) a citation of the regulations that, without the EFP, would prohibit the proposed activity; and (c) biological information relevant to the proposal, including appropriate statements of environmental impacts, including impacts on marine mammals and threatened or endangered species.

The Gulf of Mexico Fishery Management Council, the U.S. Coast Guard, the Environmental Protection Agency (Region 4), the Florida Department of Agriculture and Consumer Services, and the appropriate fishery management agencies of Florida will receive copies of the Environmental Assessment, which includes the EFP application.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

A. Issue the permit with certain conditions (Proposed Action)

The applicant proposes to place hatchery-raised juvenile fish (fingerlings) of species native to the eastern Gulf of Mexico in four to eight cages, located approximately 33 statute miles west-southwest of John's Pass, Florida (See FIGURE 1). The cages measure 53 feet (16 meters) tall and 83 feet (25 meters) in diameter and will contain a maximum fish biomass of 165,000 pounds (75,000 kg). The depth of water at the site is approximately 109 feet and is located over sandy bottom in a non-traditional fishing area.

The fish will be monitored and fed commercially-available fish pellets by a crew of technicians visiting the cages each day. Observations will be made of resident fish and invertebrate populations in the vicinity of the cages to assess the impact of the project. Additionally, the applicant intends to monitor disease occurrences, water and substrate quality, and possible endangered species interactions. Details of the draft EPA monitoring plan–a requirement to obtain the EPA National Pollutant Discharge Elimination Systems (NPDES) permit–are given in APPENDIX 2. The applicant will implement the monitoring program as required to obtain the NPDES permit.

The applicant requests a 24-month effective period for the EFP to accommodate several complete growout cycles, i.e., growouts from fingerlings to marketable products. Once preliminary results of the study are available, the applicant intends to ask the Gulf of Mexico Fishery Management Council to amend the Mackerel and Reef Fish FMPs to accommodate longterm or permanent uses of cobia, dolphin-fish (mahi-mahi), greater amberjack, red snapper and cubera snapper in commercial offshore aquaculture operations.

During the 30-day public comment period on the application, comments will be specifically requested on the scope of potential environmental impacts of the proposal on targeted species, such as genetic dilution, habitat alteration, or disease introductions, on protected species interactions, on sediment quality, and on water quality including possible accumulations of chemotherapeutants such as antibiotics. NOAA Fisheries believes that enforcement of existing prohibitions on taking of species subject to Federal regulation in the Gulf of Mexico may also be affected by the proposal and that the EFP will contain conditions needed to mitigate potential impacts on the targeted species and the habitats of the eastern Gulf of Mexico and measures to facilitate enforcement.

As discussed in Section 4.0, offshore siting of aquaculture operations reduces the potential for environmental impacts, especially water/sediment quality, entanglements, habitat alterations, diseases, and user conflicts (Siewicki, 1995). In addition, by siting facilities in areas that provide proper water exchange rates, nutrients are quickly and widely dispersed and waste products do not accumulate on the bottom under the cages or net-pens (Stickney, 2002). It is expected that the selected site in the EFP application, which is 33 miles offshore and located in 109 feet of water, will experience higher current velocities and an increased water volume that will flow through the site and result in a much-reduced buildup of waste products. It is anticipated that the increased current flow at the site (0.5 knots) should result in a rapid dispersion of excess food and waste products. This is supported by Helsley (Unpublished MS), who found that average current velocities of 0.2 knots were sufficient to carry waste products away from a aquaculture site. Further, he noted that at a current of 0.1 knots more than 217 million gallons of water would flow through a cage daily. Use of species native to the eastern Gulf of Mexico eliminates the possibility of introducing exotic species following escapements. The proposed action is not expected to result in any significant impacts on targeted or incidental species or any Total Allowable Catches for managed species. No wild-caught fish are involved in the project.

According to the application (Appendix 3), the cages utilize a net made of spectra fiber which is stretched tightly over the entire structure. This greatly reduces the possibility of entanglement by sea turtles and marine mammals. According to our consultation under Section 7 of the Endangered Species Act, we believe that this arrangement will reduce the risk of entanglement by marine mammals or endangered sea turtles. The probability of encountering these species is discussed in Section 3.0. In general, NOAA Fisheries believes that construction and operation of the proposed aquaculture facility would pose a low risk to protected species.

The applicant has contacted the Florida Department of Agriculture and Consumers Services (DACS) and stated they intend to apply for an Aquaculture Certificate of Registration. The department will not grant a Certificate until all applicable federal permits are acquired. As a Certificate holder, Florida Offshore Aquaculture, Inc. will be required to mark their packaging and invoices with a unique Aquaculture Number that distinguishes their product as being farm-raised. Their fish can then be sold in a manner similar to other agricultural products. This, plus the notification and reporting requirements in the EFP conditions will allow Florida to enforce its fishery regulations when fish are landed in Florida.

NOAA Fisheries intends to add the following conditions to any issuance of the EFP to ensure that there are no significant impacts on the environment, natural resources or on enforcement efforts regarding existing Florida and Federal regulations on the taking of these species. In addition, the proposed project will provide useful data that can be used to evaluate the impacts of future projects.

Proposed Conditions

1. Applicant must notify NOAA Fisheries of any changes to the list of hatcheries to be used and all fingerlings must be certified by the hatchery to be disease-free prior to placement in the cages.

2. The applicant will be required to implement the EPA monitoring program required for the NPDES permit. See Appendix 2 for draft EPA monitoring program.

3. Only Chemotherapeutants approved by FDA, the Florida Department of Agriculture and Consumer Services or prescribed by an USDA accredited veterinarian may be used.

4. Use of toxic chemicals as defined in 50 CFR 622.2 to control the fouling of nets is prohibited.

5. Immediate notification must be provided to NOAA Fisheries if any of the following events occur:

   a) damage to cages or malfunction of supporting structures
   b) large-scale escapement, i.e., loss of more than 20% of a cage population
   c) major disease outbreak resulting in mortalities exceeding 10%
   d) entanglements of marine mammals or endangered or threatened sea turtles

6. Quarterly reports are required on:

   a) any disease occurrences
   b) any use of chemotherapeutants approved by FDA or prescribed by a qualified veterinarian
   c) outcome of any events requiring immediate notification (see 5 above)
   d) changes in faunal composition of the area around the experimental site
   e) substrate and water quality monitoring
   f) landings of aquacultured fish species

7. The following samples/records must be maintained and made available for inspection:

   a) sources of feed including batch codes
   b) sources of each batch of fish including:

      1. total number of fish by species
      2. estimated size of fish
      3. date of each introduction/stocking
      4. name, address and phone number of supplier(s)
      5. disease status of supplier's facility including name, address, and phone number of analytical facilities assessing disease status.

c) samples of frozen specimens of each batch of fish including fish harvested from cages, and during any unusual morbidity or mortality events as per USDA standards.

c) phase one fry need to be tagged (satellite DNA or other appropriate technique) so that fish can be monitored throughout the process.

8. Fish must be maintained intact through offloading ashore. Fish will be placed in live haul containers located on the harvest vessels, brought to shore and loaded on live haul trucks for sale to traditional live markets. Any fish over the capacity of the live market will be processed in St. Petersburg, Florida and sold. Once harvested, the aquacultured fish must be reported in accordance with State and Federal reporting requirements. Sale of product is allowed only to dealers licensed by Florida to sell aquacultured fishery products landed in Florida.

9. Not less than 24 hours prior to harvest, provide the following information to the NOAA Fisheries Law Enforcement Office, Southeast Region, St. Petersburg, FL, (727-570-5344): date, port, and facility at which aquacultured product will be landed and name(s) and phone number(s) of licensed dealer(s) receiving the fish.

10. NOAA Fisheries retains the authority to make periodic inspections of aquaculture operations and records. If the applicant becomes a certified Florida aquaculturist, the applicant must notify NOAA Fisheries Law Enforcement of the annual unique serial number required on all aquaculture records, including sales, and the records must be made available for inspection by authorized officers and maintained for the duration of the EFP plus one year.

11. NOAA Fisheries has the authority to suspend or revoke the EFP if: the application is found to contain false, incomplete, or inaccurate information; the applicant fails to comply with its terms and conditions; significant new information becomes available indicating that one of the conditions for denial of the EFP application (See 50 CFR 600.745(b)(3)(iii)) is applicable.

12. The applicant must comply with the provisions in the NOAA Fisheries “A Code of Conduct for Responsible Aquaculture Development in the U.S. Exclusive Economic Zone.”

13. Issuance of the EFP does not eliminate the need for the applicant to obtain any other Federal, state, or local authorizations required by law.

B. Issue the permit as requested

Based on a review of the literature on offshore aquaculture (see section 4.0) and in consultation with its research staff, NOAA Fisheries does not believe that issuance of the permit as requested would result in any significant environmental impacts. However, conditions have been proposed to ensure that potential impacts are documented and that any unusual or emergency circumstances are promptly reported. The application includes a number of monitoring plans and a potential response to unforeseen conditions.

Physical and chemical water quality parameters will include dissolved oxygen, salinity, temperature, turbidity, total suspended solids, chlorophyll, ammonia-N, nitrite-N, nitrate-N and total phosphate. The above referenced water quality parameters are to be assessed at mid-water and one meter from the bottom at each of the water quality sampling sites (See Appendix 2). Current speed and direction will be measured at each sampling event. The frequency of sampling is given in Appendix 2.

The sampling programs to describe sediment characteristics and to determine possible changes in the benthic infauna community structure are described in Appendix 2 as are the programs to test for heavy metals and unforeseen contingencies. There are reporting requirements for all sampling programs and there is a procedure to modify sampling programs should that prove necessary.

Based on historical records (see Section 3.0), it is possible that a tropical or winter storm will enter the Gulf of Mexico during the proposed 24 month period of the EFP. Storm damage could result in escapements from and damage to the aquaculture cages. The applicant's contingency response is as follows: Once a hurricane or storm enters the Gulf of Mexico, the operating technicians will make a complete inspection of all cages and moorings. Cages, as always, will be secured with Danforth custom anchors (1,200 kg) at four points around each cage (See Figure 2). Cages will be secured and aids to navigation checked. Personnel will evacuate the site before wind and seas conditions reach dangerous levels. Given the low frequency of storms and hurricanes in the Tampa Bay region, it is anticipated that such events will be relatively rare.

Although the introduction of exotic or non-native species through escapement from the cages during a storm is a frequently-cited cause of concern for aquaculture operations, in this case, no such introduction is possible because all species are native to the eastern Gulf of Mexico. Fingerlings of dolphin, which are migratory, may be raised from broodstock taken off the east coast of Florida. Hatchery-reared fish are likely to have less genetic variability than resident fish and could affect the wild gene pool by interbreeding. However, as discussed in Section 4.0, no genetic impact has been detected following a decade of interbreeding of escaped salmonids in Norway. Also, the potential for any genetic impacts is considerably less when the cultured species is native to the area, as in this case.

C. <u>Deny the permit request (No Action Alternative).</u>

As discussed in Section 1.0 above, grounds for denial of the EFP include whether the harvest would detrimentally affect the well-being of the wild stock of any regulated species of fish, marine mammal, or endangered species in a significant way. Based on the best scientific information available, NOAA Fisheries does not believe that a significant impact on these species is likely. However, in order to reduce the risk even further, we have included a number of conditions on the EFP as the proposed action (See Alternative A). The potential for a significant enforcement problem is considerably reduced due to the requirement for a paper-trail from the site to the point of sale (See condition 9 above). Therefore the grounds for denial of the EFP under 50 CFR 600.745(b)(3)(iii) do not appear to have been met.

D. No Decision Alternative

Under 50 CFR 600.745(b)(3), NMFS does not have the discretion to fail to act once an EFP application is received containing all the information required in 50 CFR 600.745(b)(2). On [DATE] (68 FR), NOAA Fisheries found that the application warranted further consideration and indicated its intent to issue the permit.

3.0 AFFECTED ENVIRONMENT

Following is a summary of information regarding the environment of the eastern Gulf of Mexico taken primarily from Amendment 1 to the Atlantic Billfish Fishery Management Plan and recent reports from the Minerals Management Service of the U.S. Department of the Interior. Additional information on fishery resources may be found in Gulf of Mexico Fishery Management Council documents (1992, 1993, 1997, 1998), Minerals Management Service (1992, 1995, 1996 and 2001) and Goodyear (1996).

3.1 Physical Environment

3.1.1 Eastern Gulf Shelf Features

The northwest Florida shelf is dominated by sand-bottom assemblages with low-relief, low-diversity communities widely interspersed with carbonate outcroppings. These outcroppings occasionally serve as attractors for hard-bottom biota and large aggregations of small fishes.

Live bottoms are regions of high productivity characterized by a firm substrate supporting a high diversity of epibiota. These communities are scattered across the west Florida shelf in shallow waters with depth zonation apparent. The density of the epibiotal communities varies from sparse to 100 percent coverage of the bottom and largely depends on bottom types, current regimes, suspended sediments, habitat availability and anthropogenic perturbations. Sessile epibiota include seagrasses, algae, sponges, anemones, encrusting bryozoans, and associated communities. For purposes of this document, live bottoms also include rocky formations with rough, broken, or smooth topography.

A survey of the site was conducted with side-scan sonar which showed that there were no coral reefs in the site. However, one outcropping of rock about 60 ft long, 2 ft wide and one foot high was observed in the southeast corner of the site. The applicant has agreed not to locate any cages within 400 meters of the outcropping. This should ensure that biota on the outcropping will not be impacted by the project.

The southwest Florida shelf between 10 and 200 m (33-660 ft) in depth has been characterized as having several biological assemblages that are associated with particular substrates and depths. Although depth is probably not the decisive factor in determining the distribution of the biotic assemblages, three major biotic depth zones are evident: there appears to be an innershelf zone between 10 and 90 m (33-197 ft) water depths; a transitional zone between 60 and 90 m (197-297 ft); and an outer-shelf zone from 90 to 200 m (297-660 ft). A brief description of each assemblage can be found in the Gulf of Mexico Council's EFH amendment (GCFMC, 1998).

3.1.2 Physical Oceanography Water Movements and Marine Habitats

The Gulf receives large amounts of freshwater runoff from the Mississippi River as well as from a host of other drainage systems. This runoff mixes with the surface water of the Gulf, making the nearshore water chemistry quite different from that of the open ocean. Sea surface salinities along the northern Gulf vary seasonally. During months of low freshwater input, salinities near the coastline range between 29 to 32 parts per thousand (ppt). High freshwater input conditions during the spring and summer months result in strong horizontal gradients and inner shelf salinities less than 20 ppt. The mixed layer in the open Gulf, from the surface to a depth of approximately 100 to 150 m (330 to 495 ft), is characterized by salinities between 36.0 and 36.5 ppt.

Sharp discontinuities of temperature and/or salinity at the sea surface, such as the Loop Current front or fronts associated with eddies or river plumes, are dynamic features that may act to concentrate buoyant material such as spilled oil, detritus, plankton or eggs and larvae. These materials are transported, not by the front's movements or motion across the front, but mainly by lateral movement along the front. In addition to open ocean fronts, a coastal front, which separates turbid, lower salinity water from the open_shelf regime, is probably a permanent feature of the northern Gulf shelf. This front lies about 30 to 50 km offshore. In the Gulf these fronts are the most commonly utilized habitat of the pelagic billfish species.

The Loop Current is a highly variable current entering the Gulf through the Yucatan Straits and exiting through the Straits of Florida (as a component of the Gulf Stream) after tracing an arc that may intrude as far north as the Mississippi_Alabama shelf. This current has been detected down to about 1,000 m below the surface. Below that level there is evidence of a countercurrent. The "location" of the Loop Current is definable only in statistical terms, due to its great variability. Location probabilities during March, the month of greatest apparent intrusion, range from 100 percent in the core location at 25 N Lat., down to small probabilities (10 percent) near midshelf. Analysis has indicated an average northern intrusion to 26.6 N Lat., within a wide envelope.

When the Loop Current extends into or near shelf areas, instabilities, such as eddies, may develop that can push warm water onto the shelf or entrain cold water from the shelf. These eddies consist of warm water rotating in a clockwise fashion. Major Loop Current eddies have diameters on the order of 300 to 400 km (186_249 mi) and may extend to a depth of about 1,000 meters. Once these eddies are free from the Loop Current, they travel into the western Gulf along various paths to a region between 25 N Lat. to 28 N Lat. and 93 W Long. to 96 W Long. As eddies travel westward, a decrease in size occurs due to mixing with resident waters and friction with the slope and shelf bottoms. The life of an individual eddy, until its eventual assimilation by regional circulation in the western Gulf, is about one year. Along the

Louisiana/Texas slope, eddies are frequently observed to affect local current patterns, hydrographic properties, and possibly the biota of fixed oil and gas platforms or hard bottoms.

Once an eddy is shed, the Loop Current undergoes major dimensional adjustments and reorganizations. Small anticyclonic (clockwise) eddies are also generated by the Loop Current. They have diameters on the order of 100 km (62 mi), and the few data available indicate a shallow vertical extent (ca. 200 m or 660 ft). These smaller eddies have a tendency to move westward along the Louisiana/Texas slope. Also, cyclonic (counterclockwise) eddies associated with the larger scale eddy process have been observed in the eastern Gulf and the Louisiana/Texas slope. Their origin and role in the overall circulation are presently not well understood. A major eddy seems to be resident in the southwestern Gulf; however, recent evidence points toward a more complex and less homogeneous structure.

Shelf circulation is complicated because of the large number of forces and their variable seasonality. A northward current driven by prevailing winds and the semi_permanent anticyclonic eddy exists offshore south Texas. A strong east_northeasterly current along the remaining Texas and Louisiana slope has been explained partly by the effects of the semi_permanent anticyclonic eddy and a partner cyclonic eddy. West of Cameron, LA (93 W Long.), current measurements clearly show a strong response of the coastal current to the winds, whereby a large_scale anticyclonic gyre is set up. The inshore limb of this gyre is the westward or southwestward (downcoast) component that prevails along much of the coast, except in July_August. Because the coast is concave the shoreward prevailing wind results in a convergence of coastal currents. A prevailing countercurrent toward the northeast along the shelf edge constitutes the outer limb of the gyre. The convergence at the southwestern end of the gyre migrates seasonally with the direction of the prevailing wind, ranging from a point south of the Rio Grande in the fall to the Cameron area by July. The gyre is normally absent in July but reappears in August/September when a downcoast wind component develops.

The Mississippi/Alabama shelf circulation pattern is not well understood at present although there appears to be divergent flow near the delta region. Offshore Panama City, FL the prevailing flow is eastward, but reversals occur at the time of maximum westward wind components. Offshore Mobile, AL, currents are eastward on the average, and flow reversals coincide with eastward winds. Most current reversals occur during the summer or during Loop Current intrusion events. The inner shelf general circulation is a two_season event. During the winter the water column is homogeneous and surface circulation is mainly alongshore and westward with the cross_shelf component weaker and directed onshore. During spring_summer conditions, the surface flow is mostly eastward. Under winds with easterly components, the water tends to flow shoreward and accumulate against the shoreline, creating a pressure gradient that drives bottom water alongshore in the direction of the winds. However, Loop Current intrusions, when present, will completely dominate the shelf circulation.

The west Florida shelf circulation is dominated by tides, winds, eddy_like perturbations, and the Loop Current. The flow consists of three regimes: the outer shelf, the mid_shelf, and the coastal boundary layer. Also, the Loop Current and eddy_like perturbations are stronger in this region. During Loop Current intrusion events, upwelling of colder, nutrient_rich waters has been observed. In waters less than 30 m (98 ft) deep the wind_driven flow is mostly alongshore and parallel to the isobaths. A weak mean flow is directed southward in the surface layer. In the coastal boundary layer longshore currents driven by winds, tides, and density gradients predominate over the cross_shelf component. Common flow ranges from moderate to strong, and the tidal components are moderate. Longshore currents, due to winter northerlies, tropical storms, and hurricanes may range much higher, depending on local topography, fetch, and duration. Longshore currents consisting of tidal, wind_driven, and density_gradient components predominate over across_shelf components within a narrow band (10_20 km) close to the coast, referred to as the coastal boundary layer.

Sea_surface temperatures in the Gulf range from nearly constant throughout (isothermal) (29 to 30 C) in August to a sharp horizontal gradient in January, (from 25 C in the Loop Current core to 14_15 C along the northern shelves). Surface salinities along the northern Gulf are seasonal. During months of low freshwater input, salinities near the coastline range between 29 to 32 ppt. High freshwater inputs (spring_summer months) are characterized by strong horizontal salinity gradients and inner shelf values of less than 20 ppt. The vertical distribution of temperature reveals that in January the thermocline depth is about 30 to 61 m (98 to 200 ft) in the northeastern Gulf and 91 to107 m (298 to 350 ft) in the northwestern Gulf. In May, the thermocline depth is about 46 m (150 ft) throughout the entire Gulf.

Dissolved oxygen varies seasonally, with a slight lowering during the summer months. Very low oxygen levels (anoxia) have been found to occur in some areas of open Gulf bottom waters. A zone of hypoxia affecting up to 16,500 square kilometers of bottom waters during mid_summer on the inner continental shelf from the Mississippi River delta to the upper Texas coast has been identified, most likely the result of high summer temperatures combined with freshwater runoff carrying large nutrient loads from the Mississippi River.

3.1.3 Severe Storms

In the Gulf of Mexico, tropical cyclones generally occur in summer and fall but the Gulf also experiences winter storms or extratropical storms due to the contrast of warm air over Gulf waters and cold continental air. Winter storms can have wind speeds of up to 60 miles per hour (mph) and most storm activity generally occurs above 25EN in the western Gulf of Mexico.

Tropical storms have wind speeds in excess of 36 mph and those with wind speeds over 72 mph are called hurricanes. Tropical cyclones occur most frequently between June and November. Based on 42 years of data, there are about 10 storms per year and about 6 become major hurricanes in the Atlantic Ocean. Data from 1886-1986 show that 44.5% of the storms originating in the Atlantic, or 3.7 storms per year will affect the Gulf of Mexico. The number of storms directly hitting the Gulf States are as follows: Florida, 54; Alabama, 10, Mississippi, 8; Louisiana, 24; and Texas, 36. Tropical storms are likely to cause damage to physical, economic, biological, and social systems in the Gulf. The probability of storm occurrence is highest in South Florida and west of the Mississippi River Delta to Port Arthur, Texas. Conversely, the incidence of storms in the Tampa Region is relatively rare. Since 1960, there have been only five category 3-5 storms that could have adversely affected the proposed aquaculture site.

3.1.4 Water Quality

Degradation of offshore waters in the Gulf of Mexico is primarily associated with discharges from offshore operations and contamination from land-based inputs and nearshore waters. The major offshore operations include OCS oil and gas and sulfur exploitation, maritime transportation of oil and other commodities, dredged material disposal, and commercial fishing. Historically, the highest concentration of oil and gas activity in the Gulf has been south of Timbalier Bay, Louisiana, and eastward to an area 20 m east of the Mississippi River Delta.

Hypoxia (low dissolved oxygen levels) is a summer phenomenon in bottom waters off Louisiana’s inner continental shelf, occasionally extending as far west as Freeport, Texas. This event is linked to density stratification caused by high temperatures combined with river discharges and high organic nutrient inputs. Pollution carried in the rivers entering the Gulf and coastal waters may also contribute to this condition. There is no evidence that similar hypoxia occurs off the west coast of Florida.

Water quality on the continental shelf from the Mississippi River Delta to Tampa Bay is influenced by river discharge and run-off from the coast and eddies from the Loop Current. The Mississippi River accounts for 72 percent of the total river discharge in this area. The Loop Current intrudes in irregular intervals onto the shelf, and the water column can transition from well mixed to highly stratified very rapidly. The West Florida shelf has very little sediment input with primarily high-carbonate sands offshore and quartz sands nearshore. (MMS, 2001).

A three-year, large scale marine environmental baseline study conducted from 1974 to 1977 in the Eastern Gulf of Mexico, based on an analysis of water, sediments, and biota for hydrocarbons, concluded that waters offshore of the west coast of Florida were pristine (MMS, 2001). Also, it was noted that water clarity is higher off Florida than off Alabama and Mississippi.

The water quality off Tampa, as noted above, appears excellent; hence, should be suitable for aquaculture operations. The site is approximately one square mile in size; whereas, the EEZ off the west coast of Florida is about 150,000 square miles. The EFP authorizes the use of four to eight cages. Given the relative small area of the site compared to the size of the shelf on the west coast of Florida, the limited number of cages, the depth of water at the site and the currents at the site, which vary in direction seasonally, there is little reason to believe that the project will adversely impact the environment. Because the site is located over 30 miles from shore, there should be little or no impact on water quality of nearshore waters.

The Environmental Protection Agency (EPA) examined the potential impact of the project on water quality by modeling results of the proposed aquaculture project. The model used was the Multiple Dump FATE (MDFATE) developed by the U.S. Army Corps of Engineers Waterways Experimental Station. The results of the study are given in an EPA draft report dated November 4, 2002. The title of the report is “Evaluation of the Ocean Discharge Criteria,

Florida Offshore Aquaculture, Inc. Net Pen Fish Culture Platform Facility NPDES Permit OCS, Gulf of Mexico."
The main conclusion of the report follows: "It is expected that any impacts that would occur as a result of the proposed activities would reverse quickly if the discharge ceased. Therefore, it can be determined that "no-irreparable harm" would result if the permit is issued. A condition of the EPA NPDES permit issued under " no-irreparable harm" will require that an environmental monitoring plan, acceptable to EPA, be implemented if the facility is constructed." This EFP (condition 2) requires that the project implement the EPA monitoring program (See Appendix 2 for draft monitoring plan).

3.2 Biological Environment

3.2.1 Fishery Resources

Estuarine dependent species dominate the fisheries of the eastern and northwestern Gulf. The life history of estuarine dependent species involves spawning on the continental shelf, transporting eggs, larvae, or juveniles to the estuarine nursery grounds, growing and maturing in the estuary, and migration of the young adults back to the shelf for spawning. Estuarine species of importance in the Gulf include menhaden, shrimps, oyster, crabs, and sciaenids. Estuarine communities are found from east Texas through Louisiana, Mississippi, Alabama, and northwestern Florida. Density distributions of fishery resources in the Gulf is highest in nearshore waters of the central coast.

Estuaries and rivers of the Gulf of Mexico export considerable quantities of organic material to the adjacent continental shelf areas. Atlantic croaker, spot, drum, silver seatrout, southern kingfish, and Atlantic threadfin dominate the inshore shelf zone (7-14 m). Sciaenids and the longspine porgies dominate the middle shelf zone (27-46 m). The blackfin searobin, Mexican searobin, and shoal flounder dominate the outer shelf zone (64-110 m). Natural reefs and banks, located mainly between the middle and outer shelf zones support large numbers of grouper, snapper, gag, scamp, and seabass. Reef fish occur on the continental shelf wherever hard/live bottoms with rocks, holes, or crevices are available. In the Western and Central Gulf, natural reefs are scattered along the 200-m isobath.

Numerous offshore petroleum platforms are believed to act as artificial reefs and augment the availability of hard substrates in this area.

Hard substrates with some vertical relief act as important landmarks for pelagic species. Coastal pelagics, such as mackerels, cobia, bluefish, amberjack, and dolphin move seasonally within the Gulf of Mexico. In spring, king and Spanish mackerels leave their wintering grounds in the southeastern Gulf and move northward along the continental shelf to their spawning and summering areas in the northwestern Gulf. Oceanic species such as yellowfin tuna are found mainly beyond the continental shelf during the winter and spring, but move through the Florida Straits into the Atlantic after spawning. Billfishes spawn in the northeastern Gulf in areas beyond the continental shelf.

The degradation of inshore water quality and loss of Gulf wetlands as nursery areas are considered significant threats to fishery resources in the Gulf of Mexico. Loss of wetland nursery areas in the north-central Gulf is believed to be the result of channelization, river control, and subsidence of wetlands. Loss of wetland nursery areas in the far Western and Eastern Gulf is believed to be the result of urbanization and poor water management practices.

Many of the commercially important fish species in the Gulf of Mexico are believed to be declining due to overfishing. NOAA Fisheries considers the following species to be “overfished” (stock size below optimal size to replenish itself) according to definitions contained in current fishery management plans: Gulf red snapper, Nassau grouper, jewfish, and red drum.

3.2.1.1 <u>The red drum fishery</u> -- Members of the Sciaenidae family such as croaker, red and black drum, and spotted seatrout have similar life histories. Throughout the Gulf, sciaenids have a protracted spawning season over the spring and summer or fall and winter. The beginning of spawning is variable and dependent on rising or falling water temperatures. Large schools of spawning red drum congregate around major passes in relatively shallow water during late summer and fall. Planktonic larvae develop in nearshore areas and with the help of prevailing currents actively seek protected areas of estuaries and inshore bays with slightly muddy bottoms. Sciaenids move to deeper waters of bays during their first year. After the first year, there is a gradual movement of sciaenids into the Gulf during the cold weather and a pronounced movement back into bays and estuaries in early spring. When mature, older fish move offshore to assemble and spawn. Sciaenids are opportunistic carnivores whose food habits change with size. Larval sciaenids feed selectively on pelagic zooplankton. Juveniles feed on invertebrates, changing to a finfish diet as they mature.

3.2.1.2 <u>Reef fish fishery</u> -- Snappers and groupers are associated with natural reefs, hard bottom and artificial reefs of the mid-outer continental shelf. Gag grouper and grey snapper are common inhabitants of estuarine waters. Snappers remain close to underwater structures and exhibit little movement during the day but may forage away from the reefs at night. Snappers spawn offshore in groups over unobstructed bottoms adjacent to reef areas. Juvenile snappers form loose aggregates, while adults aggregate during the day and disperse at night. Snappers do not migrate or travel away from their reef environment and the surrounding areas. There is a tendency for larger, older snappers to occur in deeper water than juveniles. Seasonal spawning patterns vary among snapper species, but generally, once they attain sexual maturity, they have a protracted spawning period with seasonal peaks. There is a decline in spawning activity among snappers during the winter. Juveniles inhabit shallow nearshore and estuarine waters and are most abundant over sand or mud bottoms. Snappers feed along the bottom on fishes and benthic organisms such as crustaceans.

3.2.1.3 <u>Coastal pelagics</u> – Coastal pelagics are open-water fish widely distributed throughout the Gulf. Pelagic species such as king and Spanish mackerel move seasonally in response to water temperature and oceanographic conditions. Mackerels are found from the shore to 200-m depths. Spanish mackerel frequent the coastal areas, while king mackerel stay farther offshore. King mackerel move from the eastern to the north central and western Gulf in the spring. During the fall, they move back into the warmer waters of the southeastern Gulf. A contingent of large solitary adult king mackerel can be found in a localized area of the north-central Gulf during part of the winter. Spanish mackerel spread over the northern Gulf during the summer and are mainly found in southeastern coastal areas in the fall and winter. Mackerels spawn offshore over the continental shelf during the spring and summer. Spawning may occur more than once per season. Juvenile mackerel use nearshore areas of high salinity as nurseries. Mackerel feed throughout the water column on other fish, especially herrings, and on shrimp and squid. Mainly a schooling fish, larger king mackerel occur in small groups or singly.

3.2.1.4 Shrimp -- Up to 15 species of penaeid shrimp use the coastal and estuarine areas in the Gulf of Mexico. Brown, white, and pink are the most important. Pink shrimp have an almost continuous distribution throughout the Gulf but are most numerous on the shell, coral sand, and coral silt bottoms off southern Florida. Brown and white shrimp occur in both marine and estuarine habitats and have similar life histories. Adult shrimp spawn offshore in high salinity waters; the fertilized eggs become free-swimming larvae. After several molts they enter estuarine waters as postlarvae. Wetlands within the estuary offer both a concentrated food source and a refuge from predators. After growing into juveniles, the shrimp larvae leave the salt marsh to move offshore where they become adults. The timing of immigration and emigration, spatial use of a food-rich habitat, and physiological and evolutionary adaptations to tides, temperatures, and salinity differ between the 2 species.

Brown shrimp spawn in shallow offshore marine waters in spring and early summer. Postlarval brown shrimp move into estuaries from January through June with peaks in early spring. Four to 6 weeks after entering the estuarine nurseries, brown shrimp postlarvae transform into juveniles. Juveniles remain in shallow estuarine areas near the march-water interface, which provide both feeding habitat and protection from predators. When mature, they move into deeper salt marsh bays and finally to the outer continental shelf.

White shrimp spawn in shallow nearshore waters beginning in the spring. Spawning activity is probably correlated with a rapid change in water temperature. Recruitment of postlarval white shrimp occurs in early summer. Some young white shrimp move from estuaries to overwinter in nearshore waters during late fall and move back to estuaries in early spring when the water temperatures rise. In nursery grounds, juvenile white shrimp move further up waters courses than brown shrimp. White shrimp leave Gulf embayments as waters cool from fall through early winter.

3.2.1.5 Crab fisheries -- About 8 species of portunid crabs are found in the coastal and estuarine waters of the Gulf of Mexico. There is only one species, however, that is located throughout the Gulf and comprises a substantial fishery. Blue crabs occur on a variety of bottom types in fresh, estuarine, and shallow offshore waters. Spawning grounds are areas of high salinity such as salt marshes and nearshore waters. Spawning occurs from March to November in the northern Gulf and year-round in the warmer waters of the southern Gulf. Larval blue crabs occur throughout the water column. Movement during the larval stages is governed by tidal action and coastal currents. Female blue crabs move into areas of lower salinity to mate, then to higher salinities to spawn. Mature crabs usually remain in the same estuary until after mating, when males move into lower salinities and females head for the Gulf. During cold periods, blue crabs move into deeper water or burrow into the mud.

3.2.1.6 Oysters -- Large intertidal reefs constructed by oysters are prominent biologically and physically in estuaries of the Gulf of Mexico. Finfish, crabs, and shrimp use the intertidal reefs for refuge and also a source of food. Reefs, as they become established, modify tidal currents and this, in turn, affects sedimentary patterns. Further, the reefs contribute to the stability of bordering marsh. Oysters spawn from late spring through summer and fall in the Gulf of Mexico. A rapid change in water temperature triggers mass spawnings over localized areas of reefs. Oysters may spawn several times during a season. Oyster larvae are transported throughout the estuarine systems by tidal actions. After several weeks, free-swimming larvae attach in clusters to shell reefs, firm mud/shell bottoms, and other hard substrates.

3.2.2 Marine mammals and endangered species

3.2.2.1 Marine Mammals

Twenty-eight species of whales and dolphins have been sighted in the northern Gulf of Mexico. The West Indian manatee is only rarely seen as far west as the proposed aquaculture site. Seven species of baleen whales have been reported, including the northern right whale, blue whale, fin whale, sei whale, Bryde's whale, minke whale and humpback whale. The northern right whale is one of the worlds rarest whales due to extensive hunting pressure. Current populations within the North Atlantic seasonally migrate around 5 discrete areas along the eastern seaboard of the U.S. Historical records of northern right whales in the Gulf of Mexico consist of a single stranding record in Texas in 1974 and a sighting of 2 individuals off the west coast of Florida.

Records of blue whales in the Gulf consist of 2 strandings on the Texas coast. It is believed that the entire surviving population in the North Atlantic consists of only a few hundred individuals. It is thought that fin whales segregate into independent stocks in each hemisphere and that there may be a small population that inhabits the Gulf of Mexico or Caribbean Sea. Sightings in the Gulf have typically been in deeper waters in the north-central area.

Two sei whales were sighted off the Mississippi River Delta in 1956 and off Gulfport, Mississippi in 1973. Sightings and stranding records from the Gulf of Mexico, Caribbean Sea, and off eastern Florida suggest that there may be a resident population in the Gulf. The humpback occurs in all oceans and migrates seasonally from summer feeding grounds in higher latitudes to winter ranges over shallow tropical banks where they calve. Sightings in Gulf have been sporadic and have occurred in central Gulf, in the eastern Gulf off Florida, and most recently (1992) off Galveston Bay, Texas.

The minke whale is seasonally abundant in the North Atlantic, migrating southward during winter to the Florida Keys, Gulf of Mexico, and Caribbean Sea. Bryde's whales are not noted for lengthy migrations and tend to remain within tropical to temperate waters. It is believed a small, resident population of Bryde's whales may inhabit the Caribbean Sea or the Gulf of Mexico.

Twenty-one species of toothed whales and dolphins have been reported in the Gulf of Mexico, including sperm whales, pygmy and dwarf sperm whales, four species of beaked whales (Cuvier's, Gervais', Blainville's, and Sowerby's), killer whale, false and pygmy killer whales, short-finned pilot whale, grampus, melon-headed whale, and 8 dolphins (bottlenose, Atlantic spotted, pantropical spotted, spinner, clymene, striped, Fraser's and rough-toothed).

The sperm whale is the most abundant large whale observed in the Gulf of Mexico and has been sighted on most surveys in deeper waters. Congregations are most often seen off the shelf edge in the vicinity of the Mississippi River Delta. Dwarf and pygmy sperms are also found in deeper waters (the continental shelf edge and beyond). Information on beaked whales is sparse and data from stomach contents of stranded individuals indicated that they are deep-diving animals and probably feed on mesopelagic fish and deep-water benthic invertebrates.

Bottlenose dolphins are the most abundant on the continental shelf and nearshore waters of the Gulf. Many studies suggest the presence of morphologically discrete offshore and coastal stocks. Atlantic spotted dolphins frequent mid-shelf to outer-shelf waters and overlap to some degree with the bottlenose dolphins, especially the offshore stocks. Grampus are also frequently sighted along the shelf edge. All the other dolphins appear to prefer deeper slope waters. Knowledge of the spatial and temporal abundance of most deep-water marine mammals in the Gulf is sparse and limited to only a few surveys.

3.2.2.2 Marine Turtles

The green sea turtle (*Chelonia mydas*) population in the Gulf once supported a commercial fishery off Texas and Florida, but has not recovered since the collapse of the fishery around the turn of the century. Reports of nesting in the northern Gulf are isolated and infrequent, except on Santa Rosa Island, Florida. The closest significant nesting aggregations are on the Florida east coast and the Yucatan Peninsula. Green sea turtles prefer depths of less than 20 m, where seagrasses and algae are plentiful. In coastal Texas, green sea turtles demonstrate site fidelity, and remain in one location for several months.

Leatherbacks (*Dermochelys coriacea*) seasonally enter coastal and estuarine habitats where jellyfish are plentiful. Nesting is concentrated on coarse-grain beaches in the tropics, but there are occurrences on Florida's Panhandle and Flagler County beaches. The hawksbill (*Eretmochelys imbricata*) is the least commonly reported sea turtle in the Gulf. Stranded turtles are regularly reported in Texas and Louisiana; these tend to be either hatchlings or yearlings. Northerly currents may carry them away from their natal beaches in Mexico northward into Texas. The Kemp's ridley sea turtle (*Lepidochelys kempi*) is the most endangered of the world's sea turtles. The population of nesting females has declined from an estimated 47,000 in 1947 to less than 1,000 in 1990. An estimated 700-1000 nests are laid annually, primarily on a 17 km stretch of beach in Rancho Nuevo, Vera Cruz, Mexico. Nesting in the U.S. occurs infrequently on Padre and Mustang Islands in south Texas from May to August. The Kemp's ridley distribution is associated with the abundance of portunid and other crabs and seagrass ecosystems. In the Gulf, Kemp's ridley adults inhabit nearshore areas and have also been recorded off the mouth of the Mississippi River.

The loggerhead sea turtle (*Caretta caretta*) occurs worldwide in habitats ranging from estuaries to the continental shelf. The largest nesting concentration in the U.S. is on the southeast Florida coast from Volusia to Broward Counties. In the Gulf of Mexico, recent surveys indicate that the Florida Panhandle accounts for about 1/3 of the nesting on the Florida Gulf coast. In the central Gulf, loggerhead nesting has been reported on Gulf Shores and Dauphin Island, Alabama, Ship Island, Mississippi, and the Chandeleur Islands, Louisiana. Nesting in northern Texas occurs primarily on North and South Padre Islands, although occurrences are recorded throughout coastal Texas. Adults and juveniles are often found in association with concentrations of portunid and horsehoe crabs.

3.2.2.3 Gulf Sturgeon

The threatened Gulf sturgeon (*Acipenser oxyrinchus desotoi*) was listed September 30, 1991 (56 FR 49653), and is managed jointly by NOAA Fisheries and the U.S. Fish and Wildlife Service (FWS). Gulf sturgeon critical habitat was designated March 19, 2003 (68 FR 13370).

Areas designated as critical habitat include portions of the following Gulf of Mexico rivers, tributaries, estuarine and marine areas: Pearl and Bogue Chitto Rivers in Louisiana and Mississippi (Unit 1); Pascagoula, Leaf, Bowie, Big Black Creek and Chickasawhay Rivers in Mississippi (Unit 2); Escambia, Conecuh, and Sepulga Rivers in Alabama and Florida (Unit 3); Yellow, Blackwater, and Shoal Rivers in Alabama and Florida (Unit 4); Choctawhatchee and Pea Rivers in Florida and Alabama (Unit 5); Apalachicola and Brothers Rivers in Florida (Unit 6); and Suwannee and Withlacoochee River in Florida (Unit 7); . Lake Pontchartrain (east of causeway), Lake Catherine, Little Lake, the Rigolets, Lake Borgne, Pascagoula Bay and Mississippi Sound systems in Louisiana and Mississippi, and sections of the state waters within the Gulf of Mexico (Unit 8); the Pensacola Bay system in Florida (Unit 9); Santa Rosa Sound in Florida (Unit 10); Nearshore Gulf of Mexico in Florida (Unit 11); Choctawhatchee Bay system in Florida (Unit 12); Apalachicola Bay system in Florida (Unit 13); and Suwannee Sound in Florida (Unit 14). These 14 geographic areas (units) encompass approximately 2,783 river kilometers (km) (1,730 river miles [mi]) and 6,042 km^2 (2,333 mi^2) of estuarine and marine habitats.

The Gulf sturgeon (Acipenser oxyrinchus (=oxyrhynchus) desotoi), also known as the Gulf of Mexico sturgeon, is an anadromous fish (breeding in freshwater after migrating up rivers from marine and estuarine environments), inhabiting coastal rivers from Louisiana to Florida during the warmer months and overwintering in estuaries, bays, and the Gulf of Mexico. It is a nearly cylindrical primitive fish embedded with bony plates or scutes. The head ends in a hard, extended snout; the mouth is inferior and protrusible and is preceded by four conspicuous barbels. The tail (caudal fin) is distinctly asymmetrical, the upper lobe is longer than the lower lobe (heterocercal). Adults range from 1.2 to 2.4 meters (m) (4 to 8 feet (ft)) in length, with adult females larger than males.

Historically, the Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Its present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic occurrences have been recorded as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay (Wooley and Crateau, 1985; and Reynolds, 1993).

Mature active females range in age (as determined from fin rays) from 8 and 17 years, and active males from 7 to 21 years (Huff 1975). Female Gulf sturgeon spawn every 3 to 5 years, and males every 1 to 5 years (Smith 1985, Fox et al. 2000). Limited data indicate that although male Gulf sturgeon may be capable of annual spawning, females are probably not (Huff 1975, Fox et al. 2000).

Directed and incidental take in fisheries and habitat loss have been identified as the major threats to the recovery of Gulf sturgeon. Its present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi east to the Suwannee River in Florida. Sporadic occurrences have been recorded as far west as the Rio Grande River between Texas and Mexico, and as far east and south as Florida Bay (Wooley and Crateau 1985, Reynolds 1993). In the late 19th and early 20th century, the Gulf sturgeon supported an important commercial fishery, providing eggs for caviar, flesh for smoked fish, and swim bladders for isinglass (Carr 1983). Gulf sturgeon numbers declined due to overfishing during most of the 20th century. The decline was exacerbated with the construction of water control structures (e.g., dams and sills) that obstructed sturgeon access to historic migration routes and spawning areas (Boschung 1976, Wooley and Crateau 1985, McDowell 1988).

Gulf sturgeon populations from eight drainages along the Gulf of Mexico were analyzed for genetic diversity and five river-specific stocks have been identified: (1) Lake Pontchartrain and Pearl River, (2) Pascagoula River, (3) Escambia and Yellow rivers, (4) Choctawhatchee River, and (5) Apalachicola, Ochlockonee, and Suwannee rivers (Stabile et al.,1996). Tagging studies reveal both that Gulf sturgeon exhibit both a high degree of river fidelity, and that inter-river movements occur.

Migratory behavior of the Gulf sturgeon varies by sex, maturity, water temperature, and river flow. Male Gulf sturgeon generally enter the rivers earlier in the spring and move greater distances than females; ripe males and females enter the river earlier than nonripe fish (Fox et al. 2000). Adults and sub-adults begin moving from the estuaries, bays, and Gulf of Mexico into the coastal rivers in early spring (i.e., March through May) when river water temperatures range from 16 to 23EC (Huff 1975, Carr 1983, Wooley and Crateau 1985, Odenkirk 1989, Clugston et al. 1995, Foster and Clugston 1997, Fox and Hightower 1998, Sulak and Clugston 1999, Fox et al. 2000). Demersal eggs are deposited in hard-bottom areas (comprised of some limestone, cobble, gravel, sand matrix) where the eggs probably adhere to the substrate almost immediately after spawning (Marchant and Shutters 1996, Sulak and Clugston 1999, Fox et al. 2000). Fall downstream migration (both subadults and adults) begins in September (at water temperatures ca 23^{o}C) and continues through November when the sturgeon return to the estuary or Gulf of Mexico (Huff 1975, Wooley and Crateau 1985, Foster and Clugston 1997). Some young Gulf sturgeon are known to remain at the river mouth during the winter and spring (Clugston et al.

1995). Gulf sturgeon spring migration may or may not be coincide with lunar periodicity and river flow rates (Sulak and Clugston 1999, Fox et al. 2001).

Subadult and adult Gulf sturgeon spend cool months (October/November through March/April) in estuarine areas, bays, or in the Gulf of Mexico (Odenkirk 1989, Foster 1993, Clugston et al. 1995). Studies of subadult Gulf sturgeon (ages 4 to 7) in Choctawhatchee Bay found that 78% of tagged fish remained in the bay the entire winter, while 13% ventured into a connecting bay. Potentially 9% of the subadults spent some time in the Gulf of Mexico (FWS 1998). Adult Gulf sturgeon are more likely to overwinter in the Gulf of Mexico. Tagged adults absent from the rivers in the winter are presumed to have spent extended periods of time in either the nearshore waters or the Gulf of Mexico (Carr et. al. 1996, Fox and Hightower 1998, Edwards et al. in prep.).

Subadult and adult Gulf sturgeon have been found in brackish and marine habitats at depths thought to support their food items. They have been located on seagrass and sand in depths from 1.5 to 5.9 m (Fox and Hightower 1998, Craft et al. 2001, Parauka et al. in press) which supports .
a variety of potential prey items including estuarine crustaceans, small bivalve mollusks, and lancelets (Menzel 1971, Abele 1986, AFS 1989).

Ontogenetic changes in Gulf sturgeon diet and foraging area have been documented. Young-of-year forage in freshwater on aquatic invertebrates and detritus (Mason and Clugston 1993, Sulak and Clugston 1999); juveniles forage throughout the river on aquatic insects (e.g., mayflies and caddisflies), worms (oligochaetes), and bivalves (Huff 1975, Mason and Clugston 1993); and adults, which forage sparingly in freshwater and depend almost entirely on estuarine and marine prey for their growth (Gu et al 2001), rely mainly on benthic marine invertebrates including amphipods, lancelets, polychaetes, gastropods, shrimp, isopods, molluscs, and crustaceans (Huff 1975, Mason and Clugston 1993, Carr et al. 1996b, Fox et al. 2000, Fox et al. in press).

Once Gulf sturgeon leave the river having spent at least 6 months in the river fasting, it is presumed that they immediately begin feeding. Upon exiting the rivers, Gulf sturgeon concentrate around the mouths of their natal rivers in lakes and bays. These areas are very important for the Gulf sturgeon as they offer the first foraging opportunity for the Gulf sturgeon exiting the rivers. In addition, reproductive Gulf sturgeon require additional food resources to obtain sufficient energy necessary for reproduction (Fox et al. in press, Murie and Parkyn pers. comm. 2002).

Gulf sturgeon are easily sampled in rivers because they are in the lower reaches which are bordered (enclosed) by banks. The locations of Gulf sturgeon in the sea, however, are unknown because of the vast area where sampling would be required. However, there have been no reported catches of this species in Federal waters (USEPA 1993a), and their exposure to adverse effects associated with the proposed action would be primarily limited to onshore support activities occurring in inland waterways.

3.2.2.4 Smalltooth sawfish

The U.S. Distinct Population Segment (DPS) of smalltooth sawfish was listed as endangered on April 1, 2003 (68 FR 15674). All modern sawfish belong to the Suborder Pristoidea, Family Pristidae, Genus *Pristis*. Although they are rays, sawfish appear to be more shark_like than ray_like, with only the trunk and especially the head ventrally flattened. The snout of all sawfish is extended as a long narrow flattened rostral blade with a series of transverse teeth along either edge, hence the vernacular name. Species in the genus *Pristis* are separable into two groups according to whether the caudal fin has a distinct lower lobe or not. The smalltooth sawfish, *Pristis pectinata*, is the sole known representative on the western side of the Atlantic of the group lacking a defined lower caudal lobe. The group in which the caudal fin has a lower lobe is similarly represented in the western side of the Atlantic by a single known species, the largetooth sawfish, *P. perotteti*. The smalltooth sawfish is also distinguished from the largetooth sawfish by having the first dorsal fin origin located over the origin of the pelvic fins (which is positioned anterior of the pelvic fin the largetooth sawfish) and by having 24 to 32 rostral teeth on each side of the rostrum (not more than 19 or 20 in largetooth sawfish). The rostrum of the smalltooth sawfish is about 1/4 of the total length of an adult specimen, somewhat shorter than the rostrum of largetooth sawfish (Bigelow and Schroeder 1953).

There is no critical habitat listed for the smalltooth sawfish.

Very little empirical data are available on life history parameters for the smalltooth sawfish. Growth studies of largetooth sawfish suggest indicate sawfish are a K-strategist, having a slow growth rate, long life span (30 years), and late maturity (10 years) (Thorson 1982a, Simpfendorfer 2000). As in all elasmobranchs, fertilization is internal. Sawfish are ovoviviparous and gravid smalltooth sawfish females have been found with 15_20 embryos (Bigelow and Schroeder 1953). Studies of largetooth sawfish in Lake Nicaragua (Thorson 1976) report litter sizes of 1_13 individuals, with a mean of 7.3 individuals. The gestation period for largetooth sawfish was approximately 5 months and females likely produce litters every second year. Although there are no such studies on smalltooth sawfish, its similarity in size and habitat to the largetooth sawfish implies that their reproductive biology may be similar. Smalltooth sawfish are generally about 2 feet long at birth and may grow to a length of 18 feet or greater (Bigelow and Schroeder 1953). Individuals have been maintained in public aquaria for up to 20 years (Cerkleski pers. comm., 2000).

The smalltooth sawfish is generally a shallow warm-water fish of inshore bars, mangrove edges, and seagrass beds, but larger animals can be found in deeper coastal waters. They can be found very close to shore in muddy and sandy bottoms, seldom descending to depths greater than 10 meters. They are often found in sheltered bays, on shallow banks, and in estuaries or river mouths. Some species enter fresh water and ascend inland in large river systems. Bigelow and Schroeder (1953) report that sawfish in general subsist chiefly on whatever small schooling fish may be abundant locally, such as mullets and the smaller members of the herring family, and they also forage on crustacea and other benthic animals. The smalltooth sawfish is noted as often being seen “stirring the mud with its saw” to locate its prey, and has been reported to attack schools of small fishes by slashing sideways with its saw and then eating the impaired fish (Bigelow and Schroeder 1953).

The Mote Marine Laboratory sawfish reporting database contains 110 reports relating to 207 sawfish as of 2001, most of which have been reported between 1991 and 2001 (Simpfendorfer 2001). Historically, this species was reported as abundant and large numbers were caught as bycatch in the early part of this century. Because the smalltooth sawfish was not a commercially important food species, it is not a traditional sport fish, and its large size and toothed rostrum make it difficult to handle, this species was not well studied before incidental bycatch severely reduced its numbers. The U.S. DPS of smalltooth sawfish has been extirpated from ninety percent of its range and has experienced severe declines in abundance based on present and historical reports of the smalltooth sawfish. Due to the K-selected strategy of the smalltooth sawfish, recovery of the population will be very slow which makes the smalltooth sawfish vulnerable to even small changes to the population. Animals with low intrinsic rates of increase are particularly vulnerable to excessive mortalities and rapid stock collapse, after which recovery may take decades (Musick et al. 2000). For example, rapid stock collapses have been documented for many elasmobranchs shown to have low intrinsic rates of increase, particularly larger species (Musick et al. 2000)

Smalltooth sawfish are tropical marine and estuarine fish that have the northwestern terminus of their Atlantic range in the waters of the eastern United States. Historic capture records within the U.S. range from Texas to New York. However, quantitative data are not available to conduct a formal stock assessment for smalltooth sawfish. The present range of the smalltooth sawfish is now believed to be limited to the Florida coast from St. John’s County in the Atlantic, extending southward throughout the Florida Keys, and northward along the Gulf Coast to Pinellas County (Figure 3).

Smalltooth sawfish in the northern and western Gulf of Mexico (GOM) have become rare in the last 30 years. The smalltooth sawfish was said to be commonly found in shallow water throughout the northern GOM, especially near river mouths and in large bays and was common in peninsular Florida (Walls 1975). Historical records indicate that smalltooth sawfish have been found in the lower reaches of the Mississippi River. The smalltooth sawfish was first recorded in the lower Mississippi River upstream as far as the Red River, Arkansas (Rafinesque 1820). Baughman (1943) reported that smalltooth sawfish were “frequently taken” and “plentiful” in Texas waters. Bigelow and Schroeder (1953) later regarded smalltooth sawfish as“abundant” in Texas. As recently as the late 1950’s sawfish were characterized as being “not uncommon” in Alabama waters (Boschung 1957), and recreational fishers reportedly took “many sawfish” prior to the 1960’s in Texas (Caldwell 1990). Expansion of commercial fishing and an increase in scientific exploratory fishing in the Gulf of Mexico in the 1950’s and 1960’s produced many records of smalltooth sawfish, primarily from the northwestern Gulf in Texas, Louisiana, Mississippi, and Alabama. Since 1971, however, the only published or museum reports of smalltooth sawfish capture from this region have been three accounts from Texas (1978, 1979, and 1984).

Present threats to the smalltooth sawfish include loss of coastal habitat resulting from increased urbanization of the southeastern coastal states from development, commercial activities, dredge and fill operations, recreational boating, erosion, and diversions of freshwater run_off (SAFMC 1998). Loss and/or degradation of habitat has contributed to the decline of many marine species, and is unknown, but fully expected, to have impacted the distribution and abundance of smalltooth sawfish. Smalltooth sawfish may be especially vulnerable to coastal habitat degradation due to their affinity to shallow, estuarine systems.

Large_scale directed fisheries for smalltooth sawfish have not existed; however, smalltooth sawfish bycatch has been commercially landed in various regions, primarily in Louisiana. The majority of the smalltooth sawfish bycatch were from shrimp and fish. There were also landings from trammel nets, beach haul seines, and hand lines. Total Gulf of Mexico landings dropped continually from 1950 to 1978 from around 5 metric tons to less than 0.2 metric tons during this time period (Simpendorfer 200b). NOAA Fisheries has only a few records of landings since 1978.

Various fishing methods used in state fisheries, including trawling, pot fisheries, fly nets, and gillnets are known to cause interactions with sea turtles and the smalltooth sawfish. Florida has banned all but very small nets in state waters, as has Texas. Louisiana, Mississippi, and Alabama have also placed restrictions on gillnet fisheries within state waters such that very little commercial gillnetting takes place in southeast waters.

Today, recreational catches of sawfish are very rare, and poorly documented for the most part, except within the Everglades National Park. Between 1991 and 1999, during the June Gulf Coast Shark Census (operating out of Sarasota), only five smalltooth sawfish were captured (and released) in 20,000 line hours of recreational fishing effort. Two of the smalltooth sawfish were already missing their saws when the angler caught them, implying previous capture. All of these captures were from either inside the barrier islands or just offshore from the barrier islands, along the southwest Florida coast between Cape Romano and St. Petersburg. Surveys in the Everglades National Park indicate that a sustaining population still exists there, with consistent annual catches by private recreational anglers and guide boats. Over ten years (1989_1998), the U.S. Park Service recorded 76 smalltooth sawfish from their angler surveys and 133 smalltooth sawfish from their guide surveys of Everglades National Park (Appendix B). Possession of smalltooth sawfish has been prohibited in Florida since April 1992. Only one smalltooth sawfish according to the records in the angler survey database was kept; this record was from 1990. There were 14 smalltooth sawfish recorded as kept in the guide survey database; one in 1991, one 1992, and twelve in 1997. There are no studies on sawfish post_release mortality.

It is expected that there will be little or no interaction between the proposed aquaculture project and the smalltooth sawfish because they are extremely rare–only 3 have been reported to have been captured since 1971 and they were captured off Texas.

In April, NOAA Fisheries initiated a Section 7 consultation regarding the request for an EFP by Florida Offshore Aquaculture. The consultation was completed on July 2, 2003. The consultation determined that the proposed project will not likely adversely affect federally-listed species under NOAA Fisheries' purview.

3.3 Human Environment

The Gulf of Mexico provides nearly 20% of the commercial fish landings in the continental U.S. During 2001, commercial landings of all fisheries in the Gulf totaled 1.6 billion pounds, valued at $798 million. Menhaden, with landings of 1.2 billion pounds, valued at $72.4 million, was the most important Gulf species in quantity landed during 2001. Shrimp, with landings of 256.2 million pounds, valued at about $449 million, was the most important Gulf species in value landed during 2001. The 2001 Gulf oyster fishery accounted for 70 percent of the national total with landings of 23 million pounds of meats, valued at about $56 million. The Gulf blue crab fishery accounted for 35% of the national total landings of 151 million pounds, valued at about $46 million.

The west coast of Florida ranked fourth among Gulf states in total commercial fishery landings for 2001 with nearly 73.1 million pounds landed, valued at $143.8 million. In quantity and value, shrimp ranked first, with about 17.5 million pounds, valued at about $ 31 million. In addition, during 2001, the following species accounted for landings valued at over $500,000: king mackerel, red grouper, gag, vermilion snapper, sharks, swordfish, and yellowfin tuna,

The eastern Gulf of Mexico coastal zone is one of the major recreational regions of the U.S., particularly for marine fishing and beach activities. Gulf coast shorelines offer a diversity of natural and developed landscapes and seascapes. Major recreational resources include coastal beaches, barrier islands, estuarine bays and sounds, river deltas, and tidal marshes. Other resources include publicly owned and administered areas, such as national seashores, parks, beaches, and wildlife lands, as well as designated preservation areas, such as historic and natural sites and landmarks, wilderness areas, wildlife sanctuaries and scenic rivers.
There are about 4 million participants in marine recreational fishing and over 2 million tourists who fish for Gulf species. Over 40% of the nation's marine recreational fishing catch comes from the Gulf of Mexico, and marine fishermen in Florida through Louisiana made over 32 million fishing trips in 2001, exclusive of Texas. The site is located in a non-traditional fishing area which should result in minimal competition for space. Also, the site is not located on coral reefs, which should minimize any impact on reefs and associated fisheries.

4.0 ENVIRONMENTAL CONSEQUENCES

4.1. Environmental impact of proposed action.

Most discussions of environmental impacts of aquaculture are based on coastal sites where impacts are quite concentrated. The proposed action involves aquaculture in a site about 33 miles WSW of John's Pass, Florida. in about 109 feet of water. The site is not in a traditional fishing area and is located over sandy bottom. Side-scan sonar failed to reveal the presence of coral reefs. There is one rocky outcropping about 60 feet in length, two feet wide and one foot in height in the southeast corner of the site. Cages will be located at least 400 m from the outcropping. The currents in the area are about 0.5 knots which should be sufficient to disperse excess food and waste products. An EPA modeling study indicated that the proposed project would result in "no-irreparable harm." Further, one of the conditions of the EFP requires that an EPA approved environmental monitoring program be implemented to monitor results. Also, there are provisions to terminate the EFP should that become necessary.

Siewicki (1995) reported that the potential for adverse environmental impacts is reduced by moving aquaculture operations to the offshore environment Potential user-conflicts and impacts on the nearshore environment should be minimized by the location of the proposed site and there is no evidence to suggest that nearshore water quality will be adversely impacted by this project. Aquaculture as a pollution source has been a primary concern in the evaluation of the future of aquaculture in the United States (DeVoe 1997; Yokoyama 1997). According to Yokoyama (1997), fish farming in Japanese coastal waters has resulted in a steady rise in levels of water deoxygenation and the occurrence of red tides which have caused mortalities of cultured organisms. When discharged into coastal embayments, these organic wastes cause qualitative and quantitative changes in the surrounding macrofauna.

As noted earlier, Siewicki (1995 noted that impacts of offshore aquaculture sites are expected to be much less significant and NOAA Fisheries scientists have suggested that a close monitoring of sites for sediment and water quality parameters can prevent significant impacts. The project site is located 33 miles offshore and there will be a stringent monitoring program to check for possible impacts; hence, there appears to be a small likelihood that adverse impacts will be observed.

Maclean (1996) notes that in ponds and other systems with inadequate flushing, waste accumulates beneath cultured finfish and can lead to significant physical, chemical, and biological changes to the environment. Excrement and uneaten food can alter the sediments resulting in a fine silty consistency that is less likely to disperse than larger-grained material and lead to a decrease in diversity and abundance of benthic organisms. On the contrary, in well-flushed, less-intensive aquaculture systems, such as the proposed action, there may actually be a biostimulation of benthic species. Based on European studies (Gowen and Bradbury, 1987) and studies conducted on the west coast of the United States and Canada, it appears that feed wastage may be less than ten percent (Weston, 1986; Cross, 1988). These studies, together with the current velocities at the proposed site, suggest that there will be minimal accumulation of waste products. It should be noted that there is relatively little known about the impacts of aquaculture operations in the Gulf of Mexico. This project will provide valuable information via the monitoring program that can be shared by managers and other aquaculture firms.

Decomposition of organic wastes consumes oxygen and can lead to reversible anoxia and generation of hydrogen sulfide and methane gases. Local anoxia has been reported in Japan and under salmon net-pens in Europe, according to MacLean (1996). Since the proposed aquaculture site is in deep water over 33 miles offshore and since current velocities should lead to rapid dispersion of wastes, it appears that benthic effects of fish wastes will be minimal. Further, the EPA modeling study determined that any impacts resulting from the proposed project will likely be limited to the surrounding area, within 300-500 meters from the perimeter.

Also, the potential for impacts due to toxic effects from fish farm discharges appears minimal, and the EPA believes that operating discharges from the proposed project will have little adverse impact on species migrating to coastal or inland waters for spawning or breeding.

Diseases are of major concern in aquaculture because of their effects on production and potential impacts on wild populations. According to MacLean (1996), outbreaks of disease in finfish culture facilities typically are caused by opportunistic pathogens that are widely distributed in the natural environment and have a low prevalence and low intensity of infections in wild populations. Stress of confinement decreases resistance and high density of culture situations facilitates transmission of infectious agents. The small number of cages should minimize the possibility of disease.

Nakajima (1997) notes that viruses are the most devastating infectious agent affecting cultured finfish. These include lymphocystis disease, iridovirus infection of various marine fish, viralepidermal hyperplasia (VEH) of Japanese flounder *Paralichthys olivaceus*, herpesvirus infection of coho salmon *Onocorhynchus kisutch*, yellowtail ascites virus (YAV) and related infection of yellowtail and Japanese flounder, rhabdovirus infection of various marine fish, and viral nervous necrosis (VNN) of various marine fish VNN has been reported to cause high mortalities in hatchery-raised larvae and juveniles of Japanese parrotfish, redspotted grouper, striped jack, Japanese flounder, tiger puffer, kelp grouper and barfin flounder.

MacLean (1996) reports that antibiotics used to treat bacterial diseases of cultured finfish are of concern because of their persistence in the environment, the development of antibiotic-resistant strains of wild bacteria, and the presence of residues of antibiotics in the cultured food product. Extensive use of antibiotics associated with salmonid net-pen culture resulted in accumulation of drugs in the sediments near the site. After 30 days, however, oxytetracycline (the most commonly used drug) binds to the sediment in an inactive state. Antibiotic-resistant strains of bacteria have been isolated from sediments near fish culture facilities, but resistance may only last 9 days. Use of antibiotics in finfish culture is declining because of recent developments in inexpensive vaccines.

FDA regulates the use of drugs in animals cultured for human consumption and requires a period of nontreatment before marketing to allow drugs to dissipate from tissues. Several chemicals have been approved by the FDA for use in aquaculture to treat external fungal and parasitic infestations, including hydrogen peroxide and garlic (MacLean 1996). The project will comply fully with FDA guidelines and guidance obtained by the Florida Department of Agriculture and Consumer Services (DACS). The applicant intends to apply for an Aquaculture Certificate of Registration and agrees to identify and label all fish as farm-raised.

In addition to disease transmission, possible impacts on wild stocks from aquaculture operations include genetic interactions and dilution of the wild gene pool and competition or predation by escapees. According to MacLean (1996), escapees result from accidents and natural disasters, such as hurricanes. Hatchery-reared or cultured organisms tend toward limited genetic variability and may introduce “weak” genes into the wild gene pool through interbreeding. However, hundreds of thousands of cultured salmonids have escaped from net-pens in Norway over the past decade and no genetic impact has been reported. Reducing the potential for genetic impact could include increasing the number of broodstock to keep genetic variability high, using only sterile finfish in culture, and rearing local finfish. The proposed aquaculture operation will use only species native to the eastern Gulf of Mexico and all fingerlings will be obtained from hatcheries that certify that the fish are disease-free. One of the conditions of the EFP is that the applicant must notify NOAA Fisheries if a disease outbreak occurs. Diseased fish will be destroyed and properly disposed of.

Regarding water quality, MacLean (1996) notes that addition of nutrients, especially nitrogen and phosphorus to the environment is of concern because of the potential for these elements to trigger algal blooms. Intensive culture of finfish and shrimp can contribute to substantial amounts of nitrogen to the environment through addition of uneaten feed and metabolic waste in the form of ammonia. Algal blooms, however, are more likely in lake systems rather than in open well-flushed environments subject to dilution. Blooms of toxic algae can pose a human health risk. Correlations between toxic algal blooms and aquaculture were reported from Japan when mollusks were intensively culture in poorly flushed embayments. Such blooms have not been reported in association with finfish farms.

According to MacLean (1996), chemicals used as antifouling agents to treat equipment can have effects on cultured or wild marine organisms. Antifouling paint containing Tributyltin has been implicated as the cause of major reproductive failures and deformities in mollusks in Europe and the U.S. Copper-based antifouling agents have shown limited local effects. All cages, including mooring systems, will not use any antifouling agents including Tributyltin. Copper based paints will not be used by the applicant. The cages and mooring system will use sacrificial zincs.

One major concern of the aquaculture industry, states and Federal agencies, according to Mears (1992), is the chemicals employed in fish culture for disease treatment. The Food and Drug Administration (FDA) established a Work Group on Quality Assurance in Aquaculture to address proper use of drugs, avoidance of illegal residues in food fish, and the drug approval process. The project will comply fully with FDA guidelines and regulations. Also, the applicant will comply with guidance obtained from the Florida Department of Agriculture and Consumer Services concerning the use of drugs should any outbreaks of disease occur.

Exotic species are those that are nonindigenous to the eastern Gulf of Mexico. According to Mears (1992), the introduction of exotic species and frequent local transfer of such stocks create a potential for introductions of diseases, parasites, competitors and injurious genetic strains. Executive Order 11987 requires Federal agencies to restrict the introduction of exotic species into natural ecosystems. This project will not use any exotic species.

Regarding user conflicts, Brennan (1995) noted some standards for review of aquaculture permits: whether the proposed activity would unreasonably interfere with fishing or other uses of the area, considering such factors as the number of individuals that participate in recreational or commercial fishing, the amount and type of fishing gear utilized, the number of actual fishing days and the amount of fisheries resources harvested from the area. Also, one might consider the degree to which the use of the site will interfere with the ability of the area to support ecologically significant flora and fauna, such as the degree to which physical displacement of marine vegetation occurs, the amount of alteration of current flow, increased rates of sedimentation or sediment resuspension, and the degree to which disruption of fish migration will occur. Based on these criteria, the proposed action is not likely to affect other users of the resources in any significant way. The site is located in a non-traditional fishing area.

Any adverse environmental effects which cannot be avoided should the proposal be implemented.

The proposed action is limited in scope (four to eight cages) and the EFP would be valid only for two years. The action will be conducted in accordance with a strict monitoring plan and under the scrutiny and permits issued by the National Marine Fisheries Service, Southeast Region; the U.S. Environmental Protection Agency; the U.S. Army Corps of Engineers: and the State of Florida. Current velocities at the proposed site are strong enough to disperse whatever waste products may be released from the fish. The fingerlings will be certified disease free which should minimize the possibility of transmitting disease to native fish. Since the fingerlings are obtained from broodstock native to the eastern Gulf, the gene pool of native species should not be adversely affected should fish escape. There will be an extensive habitat monitoring program to monitor this project and project personnel will be on site daily. The scientific literature shows that should adverse consequences result, the affected habitat could recover quickly by terminating the project. The EFP is for two years and NOAA Fisheries has procedures to review and terminate the EFP should that be required. In conclusion, it does not appear that there would be any adverse environmental effects that could not be addressed quickly to correct whatever situation may arise. Finally, the EPA determined that "no-irreparable harm" would result if the permit is issued.

Any adverse environmental effects upon marine mammals and endangered species.

The location of the site and the limited number of cages (four to eight) should not result in many interactions between marine mammals and endangered species. The cages utilize a net made out of spectra fiber and are stretched tightly over the entire structure, which should reduce the possibility of entanglement by sea turtles and marine mammals. Cages will be inspected daily and appropriate action taken by project personnel should any interaction occur. In addition, project personnel will be required to report any entanglement of marine mammals or endangered and threatened sea turtles. An informal Section 7 consultation, conducted by the National Marine Fisheries Service, concluded that the project will not likely adversely affect federally-listed species under NOAA Fisheries' purview.

Relationships between local short-term uses of man's environment and maintenance and enhancement of long-term productivity.

According to a 1992 National Research Council (NRC) report, aquaculture is expected to produce: (1) high quality seafood to replace that supplied through the harvests of wild stocks in decline or at maximum sustainable yields; (2) products for export to help reduce the country's foreign trade deficit; (3) stock enhancement of important commercial and recreational fisheries species; (4) economic development opportunities for rural and suburban communities; and (5) new employment opportunities for skill workers. The proposed aquaculture operation is a feasibility study to determine whether or not the potential exists for offshore aquaculture to meet the expectations of the NRC. Information obtained from this project will improve the state of knowledge concerning such project in the eastern Gulf of Mexico. Such information will allow managers better insight concerning how to manage future activities should they occur.

Irreversible and irretrievable commitments of resources which would be involved in proposed action should it be implemented.

There are no expected irreversible or irretrievable commitments of resources involved in the proposed action which is a feasibility study of limited duration.

Direct effects and their significance.

The proposed action and its alternatives are not expected to result in any significant environmental impacts. The proposed action is not expected to affect public health or safety. The proposed site does not involve offshore oil and gas platforms and there are no unique characteristics to the area and it is not considered to be controversial. There is a paucity of information concerning aquaculture operations in the eastern Gulf. The information obtained from this project should prove useful to fishery managers as they plan for future operations in this area. There does not appear to be any highly uncertain or unique or unknown risks associated with the proposed action. Further, as mentioned one of the objectives of the project is to learn more about aquaculture in the exclusive economic zone. Should any unanticipated situation arise, project personnel are committed to notify NOAA Fisheries and resolve whatever problems are encountered in an environmentally friendly manner.

Indirect effects and their significance.

Finfish culture can decrease fishing pressure on wild stocks and potentially increase diversity in benthic communities beneath some net-pen systems. Densities of wild finfish and large crustaceans may be higher around cages than in surrounding areas. None of these indirect effects are likely to be significant in the case of this relatively small cage system operating for a limited period of time.

Cumulative impacts.

The proposed action is limited in scope (four to eight cages) and the EFP would be valid only for two years. The action will be conducted in accordance with a strict monitoring plan and under the scrutiny and permits issued by the National Marine Fisheries Service, Southeast Region; the U.S. Environmental Protection Agency; the U.S. Army Corps of Engineers: and the State of Florida. Current velocities at the proposed site are strong enough to disperse whatever waste products may be released from the fish. The fingerlings will be certified disease free which should minimize the possibility of transmitting disease to native fish. Since the fingerlings are obtained from broodstock native to the eastern Gulf, the gene pool of native species should not be adversely affected should fish escape. There will be an extensive habitat monitoring program to monitor this project and project personnel will be on site daily. The scientific literature shows that should adverse environmental impacts occur as a consequence of the project , the affected habitat could recover quickly by terminating the project.

The project will have minimal impacts upon commercial and recreational fisheries because it is not sited on traditional fishing grounds and the site does not contain coral reefs. There are no other mariculture sites near the project site and current velocities as well as the depth of the site appear sufficient to distribute food and waste products so that there will be little, if any accumulation. The EPA monitoring program will provide sufficient warning to minimize any potential cumulative impact, which appears unlikely to occur. The EPA conducted a modeling study of the project and concluded that any impacts that would occur as a result of the proposed activities would reverse quickly if the discharges ceased. One of the conditions of the EFP is to implement the EPA environmental monitoring program.

This project will provide information on aquaculture practices in the eastern Gulf of Mexico that can be used to predict the level of activity that might result in an unacceptable level of additional pollution in the eastern Gulf of Mexico. Such information would be very useful to fishery managers as they consider future impacts of increased aquaculture activity in this area. In summary, the small scale of the proposed project and the stringent monitoring and reporting requirements will not only provide valuable information to managers on aquaculture practices in the eastern Gulf of Mexico, but also minimize the possibility of any cumulative impacts.

If the EFP is authorized and subsequently demonstrates the viability of offshore aquaculture, the applicant intends to approach the Gulf of Mexico Fishery Management Council for a permanent authorization under its fishery management plans to continue the aquaculture operations indefinitely. Although offshore aquaculture on a large scale in the Gulf of Mexico may be cumulatively significant, this one project of limited duration does not appear to have any significant cumulative impacts. Further large scale development of offshore aquaculture will require additional analysis under NEPA. A Section 7 analysis, conducted by NOAA Fisheries on July 2, 2003, determined that the proposed action will not likely adversely affect federally-listed species under NOAA Fisheries' purview.

<u>Possible conflicts between proposed action and the objectives of Federal, State, and local land use plans, policies and controls for the area concerned.</u>

The Office of Environmental Services of the Florida Fish and Wildlife Conservation Commission raised a concern about an enforcement problem in trying to distinguish between aquacultured cobia and cobia harvested from wild stocks. However, given the limited scope of the proposed aquaculture activities, and based on the following considerations, an enforcement problem is unlikely. Cobia occur rather rarely, and the quantities that would be involved are much higher than could reasonably be expected to be harvested from wild stocks, both when stocking fingerlings and when harvesting for market. In addition, the economic viability of harvesting wild stocks for commercial purposes is unlikely. Only two vessels, which have been identified in the original application package and an amendment, would be involved and note that current regulations require any Exempted Fishing Permit to be aboard the vessel for which it was issued.

The applicant must receive a permit under the Rivers and Harbors Act of 1899 from the U.S. Army Corps of Engineers regarding possible interference with navigation. The applicant will apply to the U.S. EPA for a discharge permit. The State of Florida is expected to provide permits for landing and sale of aquacultured fish.

Environmental effects of alternatives.

Alternatives to the proposed action include denial of the EFP (No action alternative), no decision alternative and issuance of the EFP without conditions. Denial of the EFP application would be justified if significant environmental impacts were anticipated; however, none of the alternatives are likely to have significant impacts due to the small scale and limited duration of the feasibility study. Conditions placed on the EFP ensure that NOAA Fisheries is aware of any developments such as escapements or disease occurrences that could warrant revocation or reconsideration of the EFP. Extraordinary circumstances necessitating an "unusual incidence" report are considered unlikely based on a review of the current literature on offshore aquaculture activities. The "no decision" alternative is not a viable option because 50 CFR 600.745 requires action by the Regional Administrator in response to an EFP application that warrants further consideration.

Energy requirements and conservation potential of various alternatives and mitigation measures.

Transportation of the fingerlings to the offshore cages and transportation of the fish grown to marketable size to the dealer will require some expenditure of energy under Alternatives A and B. Also, possible inspections of the aquaculture facility could require a limited number of vessel trips and this would add energy requirements to Alternative A. However, energy use of the facility is not an issue in the permit decision.

Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.

Ultimately, if successful, offshore aquaculture could supply additional seafood to consumers at a reasonable price and provide alternative incomes for coastal residents. In addition, the present balance of trade deficit in seafood products could be reduced by U.S. aquaculture projects. Mitigation measures include reporting requirements for any "unusual occurrences" and quarterly reports on disease occurrence, water and sediment quality, and interactions with protected species. These are expected to reduce further the chances for any adverse effects of the feasibility study.

Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.

The proposed aquaculture site is 33 statute miles off Florida which should minimize any adverse impacts on Florida urban sites and cultural resources. As far as we know, there are no ancient shipwrecks in the proposed site. The proposed site is located over sandy bottom and does not include any coral reefs. There is one rock outcropping in the southeast corner of the site, however, cages will be located at least 400 meters from that outcropping. There is no ecologically sensitive area within the proposed site.

Federalism

No federalism issues have been identified relative to the proposed project. Florida and Federal agencies have been closely involved in the monitoring and evaluation of this request. Florida has not expressed federalism related opposition to the granting of the EFP.

Beneficial and Adverse Impacts

If the EFP is granted, valuable information will be provided to State and Federal agencies concerning aquaculture practices that can be employed in the eastern Gulf of Mexico with a minimum of environmental impacts. The EFP has stringent conditions to minimize any potential adverse environmental impacts and NOAA Fisheries has procedures to terminate the EFP should that be required.

Public Health or Safety

The proposed action is not expected to have any significant adverse impact on public health or safety because of the offshore location of the project and the limited scope of the operation which will involve few personnel. In addition, only chemotherapeutants approved by FDA, the Florida Department of Agriculture and Consumer Services or prescribed by an USDA accredited veterinarian may be used. Also, use of toxic chemicals to control the fouling of nets is prohibited.

Unique Characteristics

The proposed action is not unique, but it could be the first EFP issued by NOAA Fisheries for an aquaculture pilot project in the eastern Gulf of Mexico. Information gained from the project, should the EFP be granted, will provide valuable information to State and Federal agencies, including the Gulf of Mexico Fishery Management Council, which is in the process of developing a generic amendment to address aquaculture operations in the Gulf of Mexico.

Controversial Effects

A public notice announcing the receipt of the application has resulted in a number of individuals in environmental organizations opposing the granting of the EFP. Also, one shrimp vessel owner opposes the granting the EFP because he has conducted shrimp trawling in the general area of the proposed sites. NOAA Fisheries will consider all comments from individuals, organizations and State and Federal agencies who comment on this action. In summary, the action is controversial.

Uncertainty or Unique/Unknown Risks

The proposed action is not expected to have any significant effect on the human environment that are highly uncertain or involved unique or unknown risks. Benefits from the action can not be quantified but appear beneficial because the monitoring and reporting requirements specified in the EFP will provide new and additional information concerning aquaculture practices in the eastern Gulf of Mexico.

Precedent/Principle Setting

The proposed action is not expected to be a precedent because the procedures evaluating EFPs are already specified in Federal regulations and EFPs are routinely evaluated by NOAA Fisheries. In addition, marine aquaculture practices are well described in popular and scientific literature. Currently, the Gulf of Mexico Fishery Management Council is developing a generic amendment under the Magnuson-Stevens Act that will prescribe practices and regulations to manage future aquaculture projects in the EEZ in the Gulf of Mexico.

Historical/Cultural Impacts

The proposed action is not expected to have any significant effects on historical sites listed in the National Register of Historic Places and will not result in any significant impacts on significant scientific, cultural, or historical resources. No such resources are known to be in or near the area of the proposed activity.

Interaction with Existing Laws for Habitat Protection

The proposed action requires that the applicant implement the EPA habitat monitoring program required for the NPDES permit (See Appendix 2). This condition will enhance existing Federal regulations for the protection of the environment.

Impacts on Fishing Effort in Existing Fisheries

The project is prohibited from the harvest of wild fish. By increasing the supply of native fish for consumption purposes, the project will mitigate to a minor degree current overfishing problems in the Gulf of Mexico. This impact can not be quantified, but would be positive because it would tend to not only lessen fishing pressure, but also to offer the possibility of alternative employment to fishers, who otherwise would be totally dependent upon wild stocks of fish.

Bycatch

Because this project will not harvest wild fish and will obtain fingerlings only from approved hatcheries, there will be no bycatch.

Means to mitigate adverse environmental impacts.

No significant adverse impacts are anticipated as a result of any of the alternatives. Stringent conditions are proposed for the EFP to ensure that NOAA Fisheries and EPA are aware and in a position to correct any unusual occurrences, such as disease outbreaks or accidents, that might have the potential for adverse impacts on native stocks. Periodic inspections of the facilities, the EPA monitoring program, reporting of harvests to NOAA Fisheries, and extensive reporting requirements will document project activities and provide valuable information to NOAA Fisheries and other State and Federal agencies on the potential impacts of large-scale offshore aquaculture operations that may require future authorizations.

5.0 LIST OF PREPARERS

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APPENDIX 1 - FIGURES

APPENDIX 2 MONITORING PROGRAM

MONITORING PROGRAM - 40 CFR, Part 125, Subpart M, CWA SECTION 403(C)

The Environmental Monitoring Program will be documented in an approved Quality Assurance Project Plan (QAPP) (*USEPA. 1998.EPA guidance for quality assurance project plans. EPA QA/G-5. USEPA/ORD EPA/600/R-98/018*). Adaptive management provisions to improve sampling and analysis will be evaluated and supported within the QAPP.

<u>Sample types and location</u>

Benthic and water quality samples will be collected at intervals on two perpendicular transects passing through the center of the cluster of cages (the cage cluster is formed by a circle drawn around the outermost edges of cages in a group of cages). Each transect will be two kilometers in length and the two transects intersect at the center of the cage cluster. The first transect lies parallel to the predominate current direction and the second transect lies perpendicular to the first, or the predominate current. Control samples, water and benthos unaffected by cage operations, will be collected at the ends of each transect (one kilometer from the center of the cage cluster).

Water quality parameters will be measured at two depths, mid-water and a meter from the bottom, at 6 sampling sites located along each transect. The sampling sites, from the center of the cage cluster in both directions, include: 1) a point at the center of the cage cluster, 2) the edge of the cage cluster, 3) the edge plus 10 meters, 4) the edge plus 50 meters, 5) the edge plus 100 meters, and 6) the edge plus one kilometer (control). Benthic samples are to be collected from the same sample locations and distance intervals along each transect. Each benthic sample is to consist of sufficient surface and below surface materials to adequately determine the parameter of interest. Sufficient replicate samples or sample quantity should be collected to meet the QAPP.

During each sampling event, at the beginning and end of the period of active sampling, sea surface conditions (wind, wave amplitude and frequency, rain, cloud cover, air temperature and salinity) and tide stage or change in tidal stage should be recorded plus: current stocking density, feeding rate reported on a per cage and total farm basis and an analysis of feed contents (feed label information).

<u>Bathymetric and Topographic Description</u>

Prior to sample collection, a complete description of the bathymetric and topographic characteristics within an area that projects out two kilometers from the center of the edge of the cage cluster will be developed and documented.

<u>Water and Benthic Parameters</u>

Prior to the installation of the cages each transect will be sampled for the following:

Sediment Characteristics - A profile and description of the sediment to include particle size distribution, total solids, specific gravity, and settling rates. Sediment chemical composition will include total volatile solids, total organic carbon, total nitrogen, total phosphate, hydrogen sulfide, and interstitial dissolved oxygen[1].

Benthic Macro invertebrate Community Structure - Benthic macro invertebrates or infauna (organisms that are retained on a 0.5 mm sieve) will be collected at each benthic sample location for community structure analysis. Organisms will be identified to the lowest possible identification level and counted. Infauna community structure analysis will include species richness (calculated as Margaret's index: $d = (S-1)/log\ N$, where N is the total number of species in the sample), diversity (calculated as Shannon-Wiener diversity: $H' = -3_I\ p_i(log\ p_i)$).

Physical and chemical water quality parameters will include dissolved oxygen, salinity, temperature, turbidity, total suspended solids, chlorophyll, ammonia-N, nitrite-N, nitrate-N and total phosphate. The above referenced water quality parameters are to be assessed at mid-water and a meter from the bottom at each of the water quality sampling sites. Current speed and direction will be measured at each sampling event.

Sample Frequency

Water Quality – The following schedule is to be initiated following the initial introduction of animals or animal feed into cages and following any increase in animal stock density (abundance or biomass) or feeding rate 20% or higher. The listed water quality parameters will be measured monthly at each site for the first three months. If no significant changes in water quality parameters are detected over three consecutive months at a given stock density and feeding rate, water sampling will then be done quarterly until a 20% or greater increase in stock density or feeding rate occurs. In addition, a change in sampling frequency, sample location, or parameters measured may be directed by EPA based on detection or significant water quality degradation.

Sediment Characteristics – The following schedule is to be initiated following the initial introduction of animals or animal feed into cages and following any increase in animal stock density (abundance or biomass) or feeding rate 20% or higher. The listed sediment quality parameters will be measured monthly at each site for the first three months. If no significant changes in water quality parameters are detected over three consecutive months at a given stock density and feeding rate, sediment sampling and analysis will then be done quarterly until a 20% or greater increase in stock density or feeding rate occurs. In addition, a change in sampling frequency, sample location, or parameters measured may be directed by EPA based on detection or significant sediment quality degradation.

Benthic Infauna Community Structure – The purpose of infauna community analysis is to determine ecological impacts of significant changes to sediment quality and, therefore,

[1] Analytical methods to determine TOC or TVS may be hampered by sediment grain size as influenced by scouring currents. In the event one or both of these parameters cannot be determined the environmental monitoring management team must document such a failure.

scheduling should be tied to detected changes in sediment quality rather than on a predetermined frequency. Following the initial baseline (pre-stocking) sampling and analysis of benthic infauna, subsequent sampling and analysis will be done if significant sediment quality degradation is detected based on measured sediment characteristics.

Contingency Sampling

The presence or impact of certain chemicals and metals could occur depending upon structure maintenance or fish health management practices adopted to counter the negative impact of cage befalling or disease or parasites on the fish being cultured.

Therapeutic Compounds - If approved therapeutic compounds are used, then appropriate methodology to detect those chemicals and their breakdown products will be included in the water quality and benthic sampling. If antibiotics are administered, then indicator bacteria will be selected for resistance testing. Sampling for the indicator bacteria and resistance test will be completed during each transect sampling event.

In addition, during the treatment period and for a withdrawal period as directed by the USDA-accredited veterinarian, or as described in the label directions, a representative sample of fish and crustaceans in the immediate vicinity of the cage or cage cluster must be captured and analyzed for the presence of the disease or pathogen, the therapeutic compound and its breakdown products and/or antibiotic resistance by an associated bacterial indicator[2].

Heavy Metals

Cage materials requiring the application of anti-fouling coatings or attachments (i.e., sacrificial zincs) to the cage structure will require the addition of appropriate sampling methodology of the sediments to detect accumulation of heavy metals (zinc). Such chemical analyses are not required if such coating and attachments are not used.

Failure to Sample

Should conditions arise so that some or all of the sampling or analytical procedures prescribed in this Monitoring Program are not done or reporting cannot occur on schedule, the EPA must be notified in writing (email). The notification should include the nature of the problem and recommended solutions.

Submission of Monitoring Results

The results of each monthly monitoring event prescribed by this Monitoring Program as per 40 CFR, Part 125, Subpart M, will be submitted to the U.S. Environmental Protection Agency/Region 4 within 60 working days of sample collection. Results will include any

[2] Periodic sampling for the presence of diseases and parasites in wild fish and crustacean populations prior to and during the sea cage installation or operation may be beneficial to provide farm management with information regarding ambient disease/parasite presence.

narrative reporting in electronic format (.doc, .txt, etc.). All processed and raw data will be included in Excel (.xls) format.

Modifications to the Monitoring Program

The specifications in the monitoring program are subject to modification by the EPA if warranted, based on evaluation of physical, chemical and biological data or proposed changes. The permit applicant may request modifications of the monitoring program in writing to the EPA. The EPA will consider modification requests based on findings to date of the monitoring program, in consultation with the applicant.

APPENDIX 4 - REFERENCES

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