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# Department of Commerce

## National Oceanic and Atmospheric Administration

## 15 CFR Part 922

## Florida Keys National Marine Sanctuary Regulations; Final Rule

**DEPARTMENT OF COMMERCE**

**National Oceanic and Atmospheric Administration**

**15 CFR Part 922**

**[Docket No. 000510129–1004–02]**

**RIN 0648–A018**

## Florida Keys National Marine Sanctuary Regulations

**AGENCY:** National Marine Sanctuary Program (NMSP), National Ocean Service (NOS), National Oceanic and Atmospheric Administration (NOAA), Department of Commerce (DOC).

**ACTION:** Final rule; notice of boundary expansion; supplemental management plan.

**SUMMARY:** By this document, NOAA expands the boundary of the Florida Keys National Marine Sanctuary (FKNMS or Sanctuary) in the remote westernmost portion of the Sanctuary by 96 square nautical miles ($nm^2$) and establishes the Tortugas Ecological Reserve (Ecological Reserve or Reserve) (a 151 $nm^2$ no-take zone) in the expanded area and in 55 $nm^2$ of the existing Sanctuary, to protect important coral reef resources. This document publishes the boundary coordinates for the expansion area and for the Reserve, announces the availability of the Supplemental Management Plan (SMP) for the Reserve, and publishes the text of the Revised Designation Document for the Sanctuary. The SMP details the goals and objectives, management responsibilities, research activities, interpretive and educational programs, and enforcement, including surveillance activities, for the Reserve. By this document, NOAA also issues regulations to implement the boundary expansion and the establishment of the Reserve and to regulate activities in the Reserve consistent with the purposes of its establishment and to make minor revisions to the existing Sanctuary boundary and to the boundaries of various zoned areas within that boundary to correct errors, provide clarification, and reflect more accurate data. This action is necessary to comprehensively protect some of the healthiest and most diverse coral reefs in the Florida Keys. The intended effect of this rule is to protect the deep water coral reef community in this area from being degraded by human activities.

**DATE:** Pursuant to Section 304(b) of the National Marine Sanctuaries Act (NMSA) 16 U.S.C. 1434(b), the Revised Designation and regulations shall take effect and become final after the close of a review period of 45 days of continuous session of Congress, beginning on the day on which this document is published in the **Federal Register**, unless the Governor of the State of Florida certifies to the Secretary of Commerce that the Revised Designation or any of its terms is unacceptable, in which case the Revised Designation or any unacceptable term shall not take effect. Announcement of the effective date of the Final Regulations will be published in the **Federal Register**.

**ADDRESSES:** Copies of the Final Supplemental Environmental Impact Statement/Supplemental Management Plan (FSEIS/SMP) and the Record of Decision for the Tortugas Ecological Reserve are available upon request to the Office of National Marine Sanctuaries, National Ocean Service, National Oceanic and Atmospheric Administration, 1305 East-West Highway, 11th Floor, Silver Spring, MD, 20910, (301) 713–3125. The FSEIS/SMP is also available on the Internet at: http://www.fknms.nos.noaa.gov. Comments regarding the collection-of-information requirements contained in this rule should be sent to the Office of Information and Regulatory Affairs, Office of Management and Budget, Washington, DC, 20503 (Attention: Desk Officer for NOAA) and to Richard Roberts, NOAA, Work Station 8118, 1305 East-West Highway, 8th Floor, Silver Spring, MD, 20910.

**FOR FURTHER INFORMATION CONTACT:** Billy Causey, Sanctuary Superintendent, (305) 743–2437.

**SUPPLEMENTARY INFORMATION:**

### I. Introduction

NOAA establishes the Tortugas Ecological Reserve (a no-take zone) in the Tortugas region (Tortugas or region) of the Florida Keys to protect nationally significant coral reef resources and to protect an area that serves as a source of biodiversity for the Sanctuary as well as for the southwest shelf of Florida. Establishment of the Reserve includes expansion of the Sanctuary boundary to ensure that the Reserve protects sensitive coral habitats lying outside the existing boundary of the Sanctuary.

With this expansion, the FKNMS, which was designated by the Florida Keys National Marine Sanctuary and Protection Act (FKNMSPA, Pub. L. 101–605) on November 16, 1990, consists of approximately 2900 $nm^2$ (9660 square kilometers) of coastal and oceanic waters, and the submerged lands thereunder, surrounding the Florida Keys and the Dry Tortugas.

NOAA expands the boundary of the FKNMS and establishes the Tortugas Ecological Reserve to protect the nationally significant coral reef resources of the Tortugas region. This action furthers the objectives of the National Marine Sanctuaries Act (NMSA, 16 U.S.C. 1431 *et seq.*) and the FKNMSPA and meets the objectives of E.O. 13089, Coral Reef Protection. With the addition of the Tortugas Ecological Reserve, the network of no-take zones in the FKNMS is increased to 24, two of which are ecological reserves (Western Sambo and Tortugas Ecological Reserves).

### II. Background

The Tortugas region is located in the westernmost portion of the FKNMS approximately 70 miles west of Key West, a very strategic position oceanographically that makes it an ideal location for an ecological reserve. It contains the healthiest coral reefs found in the Sanctuary. Coral pinnacles as high as forty feet with the highest coral cover (>30%) found in the Keys jut up from the ocean floor. These coral formations are bathed by some of the clearest and cleanest waters found in the Florida Keys. This occurs where the tropical waters of the Caribbean mingle with the more temperate waters of the Gulf of Mexico.

Recent studies reveal that the Tortugas region is unique in its location and the extent to which oceanographic processes impact the area. The Tortugas plays a dynamic role in supporting marine ecosystems throughout south Florida and the Florida Keys. Larvae that are spawned from adult populations in the Tortugas are spread throughout the Keys and south and southwest Florida by a persistent system of currents and eddies that provide the retention and current pathways necessary for successful recruitment of both local and foreign spawned juveniles with larval stages remaining from hours for some coral species up to one year for spiny lobster. In addition, the upwellings and convergences of the current systems provide the necessary food supplies in concentrated frontal regions to support larval growth stages.

The Tortugas is located at the transition between the Gulf of Mexico and the Atlantic and is strongly impacted by two major current systems, the Loop Current in the eastern Gulf of Mexico and the Florida Current in the Straits of Florida, as well as by the system of eddies that form and travel along the boundary of these currents. Of particular importance to the marine communities of the Tortugas and Florida Keys is the formation of a large

counterclockwise rotating gyre (large eddy) that forms just south of the Tortugas where the Loop Current turns abruptly into the Straits of Florida. This gyre can persist for several months before it is forced downstream along the Keys decreasing in size and increasing in forward speed until its demise in the middle Keys. This gyre serves as a retention mechanism for local recruits and as a pathway to inshore habitats for foreign recruits. It may also serve as a potential food provider through plankton production and concentration.

The Tortugas is also located adjacent to two coastal current systems, including the wind-driven currents of both the Florida Keys coastal zone and the west Florida Shelf.

Persistent westward winds over the Keys create a downwelling system that drives a westward coastal countercurrent along the lower Keys to the Tortugas. The countercurrent provides a return route to the Tortugas and its gyre-dominated circulation, and onshore surface Ekman transport (a process whereby wind-driven upwelling bottom water is transported 45 degrees to the left of the actual wind direction in the northern hemisphere) provide a mechanism for larval entry into coastal habitats. Circulation on the west Florida shelf is strongly influenced by wind forcing, but there also appears to be a significant southward mean flow, possibly due to the Loop Current. The effect of these currents on the Tortugas is to provide a larval return mechanism to the Florida Bay nursery grounds during periods of southeast winds, as well as the transport mechanism for low-salinity shelf waters from the north when the mean southward flow is strong.

The combination of downstream transport in the Florida Current, onshore Ekman transport along the downwelling coast, upstream flow in the coastal countercurrent and recirculation in the Tortugas gyre forms a recirculating recruitment pathway stretching from the Dry Tortugas to the middle Keys that enhances larval retention and recruitment into the Keys coastal waters of larvae spawned locally or foreign larvae from remote upstream areas of the Gulf of Mexico and Caribbean Sea. Convergences between the Florida Current front and coastal gyres provide a mechanism to concentrate foreign and local larvae, as well as their planktonic food supply. Onshore Ekman transport and horizontal mixing from frontal instabilities enhance export from the oceanic waters into the coastal zone. A wind- and gyre-driven countercurrent provides a return leg to aid larval retention in local waters. Seasonal cycles of the winds, countercurrent and Florida Current favor recruitment to the coastal waters during the fall when the countercurrent can extend the length of the Keys from the Dry Tortugas to Key Largo, onshore Ekman transport is maximum and downstream flow in the Florida Current is minimum. The mix and variability of the different processes forming the recruitment conveyor provide ample opportunity for local recruitment of species with larval stages ranging from days to several months. For species with longer larval stages, such as the spiny lobster, which has a six to 12-month larval period, a local recruitment pathway exists that utilizes retention in the Tortugas gyre and southwest Florida shelf and return via the Loop Current and the Keys conveyor system. Return from the southwest Florida shelf could also occur through western Florida Bay and the Keys coastal countercurrent, due to a net southeastward flow recently observed connecting the Gulf of Mexico to the Atlantic through the Keys.

The Tortugas North portion of the Tortugas Ecological Reserve consists of coral reef communities that are unparalleled in the Florida Keys in their diversity and composition. Several carbonate banks of varying size and depth (30 feet to 75 feet) and low relief hardbottom habitats with patches of sand and rubble characterize Tortugas North. The most prominent features in the Tortugas North portion of the Reserve are Tortugas Bank and Sherwood Forest. Tortugas Bank crests at 66 feet and supports abundant attached reef organisms such as sponges, corals, and soft corals. North of Tortugas Bank, in an area previously believed to be composed only of sand, are several pinnacles covered with hard and soft corals and reef fish.

Sherwood Forest is an ancient stony coral forest exhibiting 30% or more bottom cover located along the western flank of Tortugas Bank (compared to 10% for the rest of the Florida Keys). The area's name was inspired by the bizarre mushroom-shaped coral heads that are an adaptation to the low light conditions. There seem to be indications that the mushroom shape is the result of a composite of two coral species. The coral reef is so well developed, that it forms a veneer over the true bottom approximately three feet below the reef. It is an area of low relief but high coral cover that rises to a depth of about 65 feet and covers an area of many acres. The area exhibits a complex habitat with various rock ledges, holes, and caves, providing hiding places for marine life. Unusual coral formations and previously unidentified coral species associations have been observed in this location. Gorgonians and black corals (Antipathies sp.), which are not common elsewhere in the Florida Keys, are also prolific. An abundance of groupers has been documented in Sherwood Forest as have sightings of uncommon and rare fish species such as jewfish, white-eyed goby, and orangeback bass.

The Tortugas South portion of the Reserve includes a wide range of deep water coral reef habitats that will protect and conserve many rare and unusual reef species, and incorporates sufficient area to provide a buffer to the critical coral reef community. The upper portion of Tortugas South includes the relatively shallow Riley's Hump area in less than 100 feet of water. Riley's Hump consists of attached algae, scattered small coral colonies, sand, and hardbottom habitats. It is also a known fish aggregating and spawning site for several snapper-grouper species.

Deep reef habitats with numerous soft corals but few stony corals are found in Tortugas South in depths from 200 to 400 feet. A series of small pinnacles that surround a larger seamount have been identified as part of an east-west running ledge that begins around 250 feet and drops to close to 400 feet in a nearly vertical profile. This is unlike any other coral reef habitat discovered within Sanctuary waters. These complex habitats support numerous fish species including streamer bass, yellowmouth grouper, snowy grouper, scamp, speckled hind, creole fish, bank butterflyfish, amberjack, and almaco.

The deepest portions (1,600 to 1,800 feet) of Tortugas South encompass limestone ledges where unusual deep-dwelling sea life such as lantern fish (myctophids), tilefish, golden crabs, and giant isopods have been observed. The sand bottom habitat has been observed to be teeming with unique deep sea species of shrimp, fish, sea cucumbers, anemones, and crabs.

These critical deep water communities of Tortugas South are vulnerable to a wide range of impacts from fishing gear including deep water trawls and traps, and impacts from anchoring. Fishing gear impacts have been observed on sand and limestone substrates in some deep water areas.

In order for the Reserve to be biologically effective and to ensure protection and conservation of the full range of coral reef habitats and species in the Tortugas region, it is critical that all of the various benthic habitats and their associated marine communities, from the shallowest to the greatest

depths, be included within the boundary of the Reserve.

Despite its beauty and productivity, the Tortugas has been exploited for decades, greatly diminishing its potential as a source of larval recruits to the downstream portion of the Florida Keys and to itself. Fish and lobster populations have been significantly depleted thus threatening the integrity and natural dynamics of the ecosystem. Large freighters have been using Riley's Hump as a secure place to anchor between port visits. The several-ton anchors and chains of these ships have devastated large areas of fragile coral reef habitat that provide the foundation for economically important fisheries.

Visitation to the Tortugas region has increased dramatically over the past 10 years. Visitation in the DRTO increased 300% from 1984 through 1998. The population of South Florida is projected to increase from the current 6.3 million people to more than 12 million by 2050. With continued technological innovations such as global positioning systems (GPS), electronic fish finders, better and faster vessels, this increase in population will translate to more pressure on the resources in the Tortugas. By designating this area an ecological reserve, NOAA hopes to create a seascape of promise—a place where the ecosystem's full potential can be realized and a place that humans can experience, learn from and respect. This goal is consistent with E.O. 13089, Coral Reef Protection, and the U.S. Coral Reef Task Force's recommendations.

The FSEIS/SMP supplements the Final Environmental Impact Statement/ Final Management Plan (FEIS/MP) for the Sanctuary and fulfills the requirements of the National Environmental Policy Act of 1969 (NEPA) for the Sanctuary boundary expansion, the establishment of the Reserve, and the issuance of the regulations implementing the boundary expansion and the Reserve. Because establishment of the Tortugas Ecological Reserve includes a Sanctuary boundary expansion NOAA has followed the procedures and has complied with the requirements of section 304(a) of the NMSA, 16 U.S.C. 1434(a).

Other actions by various other jurisdictions are underway to ensure comprehensive protection of the unique resources of the Tortugas region:

- The National Park Service (NPS) is revising the General Management Plan for the Dry Tortugas National Park (DRTO) that will include as the preferred alternative a proposal to create a Research/Natural Area (RNA) within the Park. The proposed boundary and regulations for the RNA will be compatible with the establishment of the Tortugas Ecological Reserve.
- Under the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the Gulf of Mexico Fishery Management Council (GMFMC) has primary federal responsibility and expertise for the development of fishery management plans (FMPs) throughout the Gulf of Mexico. The GMFMC has developed an amendment for addressing Essential Fish Habitat requirements for the various Gulf of Mexico Fishery Management Plans (GMFMPs) which cover the area of the Tortugas Ecological Reserve. The GMFMPs are implemented by regulations promulgated by the National Marine Fisheries Service (NMFS) (50 CFR part 622). At the GMFMC's meeting on November 9, 1999, the NOS and NMFS requested that the GMFMC take steps to prohibit fishing, consistent with the purpose of the Tortugas Ecological Reserve. The GMFMC accepted this request and at its July 10–13, 2000 meeting, adopted the Generic Amendment for Addressing Essential Fish Habitat Requirements for Fishery Management Plans of the Gulf of Mexico. That amendment to the GMFMPs is consistent with the Tortugas Ecological Reserve and the regulations governing ecological reserves within the FKNMS, at 15 CFR 922.164(d).
- NMFS intends to issue regulations consistent with the no-take status of the Tortugas Ecological Reserve for the species covered by the GMFMPs and for Atlantic tunas, Swordfish, sharks, and Atlantic billfishes.
- The State of Florida is drafting regulations to prohibit fishing in those portions of Tortugas North that lie within State waters.

Combined with the establishment of the Tortugas Ecological Reserve, these actions would result in comprehensive protection for the nationally significant coral reef habitats from shallow to deep water extending from the DRTO into Sanctuary and GMFMC waters.

The process by which NOAA arrived at its proposal to establish the Tortugas Ecological Reserve is described in the preamble to the Proposed Rule published on May 18, 2000 (65 FR 31634). The five boundary alternatives and the four regulatory alternatives considered by NOAA are also set forth and described in the preamble to the Proposed Rule and in the FSEIS.

Consistent with the proposal, NOAA has selected Boundary Alternative III (the Preferred Boundary Alternative) (Figure 1) and expands the boundary of the Sanctuary by approximately 96 $nm^2$ to include two significant coral reef areas known as Sherwood Forest and Riley's Hump. The boundary of the Sanctuary in its northwesternmost corner is expanded by approximately 36 $nm^2$ to include Sherwood Forest and in its southwesternmost corner is expanded by adding a noncontiguous area of approximately 60 $nm^2$ to include Riley's Hump. By the final regulations issued with this document, NOAA establishes a Tortugas Ecological Reserve of approximately 151 $nm^2$. The Tortugas Ecological Reserve incorporates the expanded area and approximately 55 $nm^2$ of the existing Sanctuary in its northwest corner. The area of the Reserve surrounding Sherwood Forest encompasses approximately 91 $nm^2$ and is called Tortugas North; the area surrounding Riley's Hump is called Tortugas South.

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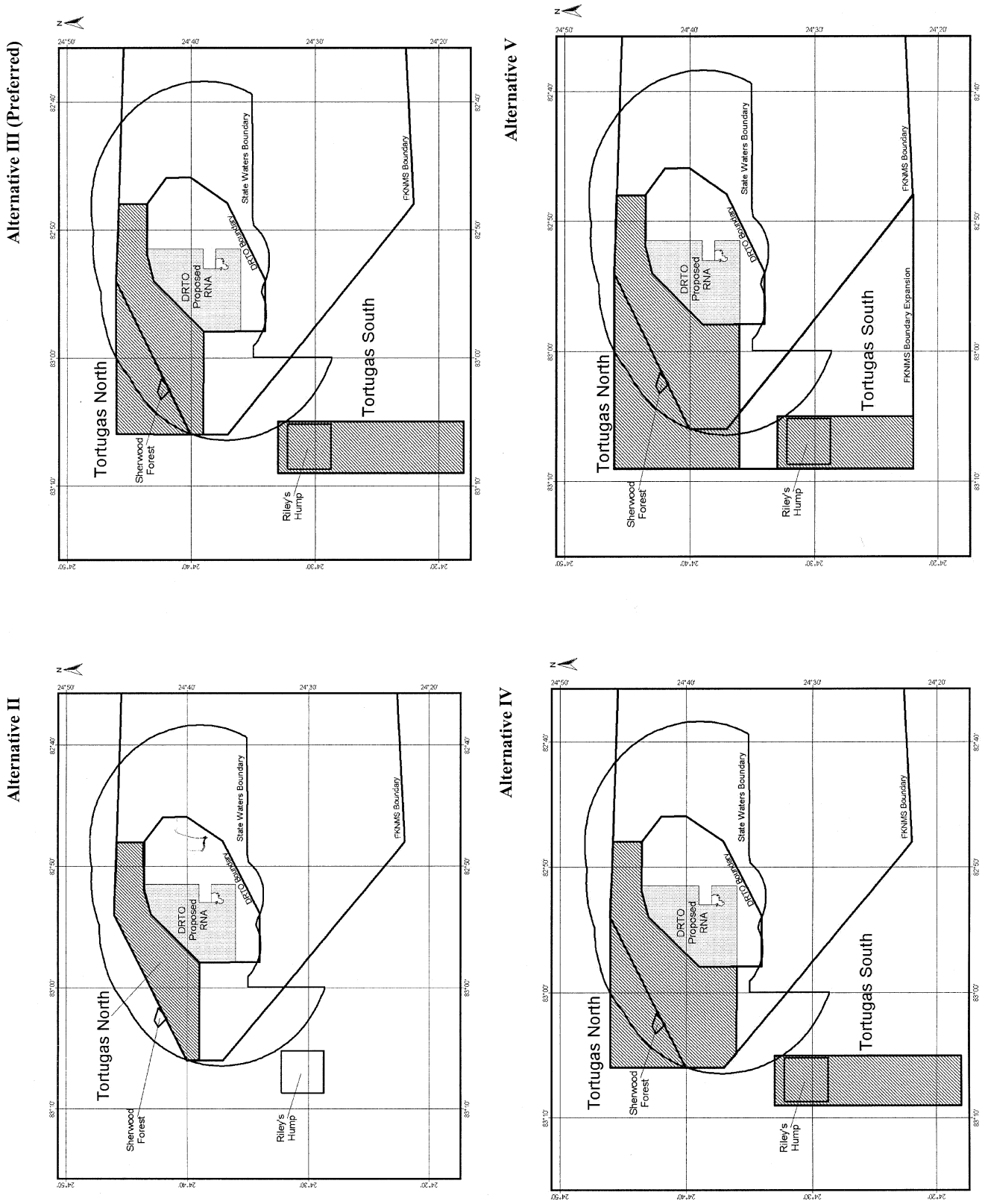


*Figure 1. Boundary Alternatives II - V.*

While NOAA proposed Regulatory Alternative C as its Preferred Regulatory Alternative, NOAA has selected Regulatory Alternative D and implements it by the final regulations issued with this document. The

difference between Regulatory Alternatives C and D is that Regulatory Alternative D prohibits access in Tortugas South except for continuous transit, law enforcement, or for scientific research or educational activities pursuant to a sanctuary permit. Under Alternative C, which is less restrictive, access to Tortugas South would have been allowed and, except for continuous transit and law enforcement purposes, would have required a simple, no-cost permit and call-in for entering and leaving.

The GMFMC, at its July 10–13, 2000, meeting, took final action on its Generic Amendment Addressing the Establishment of Tortugas Marine Reserves, which would create the Council's own 60 $nm^2$ marine reserve in the same location as Tortugas South and in the 13 $nm^2$ portion of Tortugas North that is within the Council's jurisdiction. The GMFMC has proposed a prohibition on any fishing (consumptive activity) or anchoring by fishing vessels. The Council also requested that NOAA prohibit anchoring by all vessels in the reserve and that NOAA prohibit all diving in the areas of Tortugas North and Tortugas South that are subject to Council jurisdiction.

The GMFMC expressed concern that non-consumptive diving would make the no-take prohibitions difficult to enforce, particularly with regard to diving for lobsters and spearfishing. The Council believes that eliminating all diving activities would greatly simplify enforcement. In addition, the GMFMC stated that non-consumptive diving can impact and damage bottom habitat through the inadvertent contact with coral or by stirring up sand and silt on the bottom. The Council also expressed concern about the biological impact of diving on the behavior of reef fish populations. Tortugas South is a known spawning area for many fish including red snapper, yellow tail snapper, mutton snapper, mangrove snapper, snowy grouper, black grouper, red grouper, red hind, and rock hind. The Council believes that the potential for diver impact on fish spawning would be eliminated by the closure. In addition, other commentors expressed concern over the effects of non-consumptive diving on sensitive coral reef resources.

Based on the comments received, NOAA revised the Preferred Alternative in the FSEIS from the Preferred Alternative in the DSEIS to prohibit all diving in Tortugas South except for research or educational activities pursuant to a Sanctuary permit. Non-consumptive diving will still be allowed in Tortugas North. The resources of Tortugas North are not as sensitive to diver impacts as those in Tortugas South and permitting non-consumptive diving in Tortugas North with careful monitoring of the impacts of such diving will provide exceptional resource appreciation and public education benefits. Also, prohibiting diving in Tortugas South will provide a reference for assessing the impact of diving activities in Tortugas North.

Socio-economic impacts, determined by analyzing the costs and benefits of no-take regulations on various industries, indicate moderate impacts on fishermen, mostly lobster and handline fishermen, and some recreational charter operators, and minimal or small impacts on recreational fishermen, commercial shippers, and treasure salvors. The potential for benefits to non-consumptive users and the scientific community is high due to the educational and research value of a no-take ecological reserve. Positive effects to surrounding areas through long-term fisheries replenishment are also likely.

The action taken today adequately protects the nationally significant coral reef resources of the Tortugas region and fulfills the objectives of the FKNMSPA and the National Marine Sanctuaries Act (NMSA). The Tortugas Ecological Reserve established by this action is of sufficient size and the regulations impose adequate protective measures to achieve the goals and objectives of the FKNMSPA and the NMSA while not unduly impacting user groups.

## III. Revised Designation Document

The Designation Document for the Sanctuary is revised to incorporate the coordinates for the expanded boundary of the Sanctuary, to authorize the regulation of entering or leaving specified areas of the Sanctuary, and to make necessary technical and editorial corrections of the Designation Document. The text of the Revised Designation Document follows:

REVISED DESIGNATION DOCUMENT FOR THE FLORIDA KEYS NATIONAL MARINE SANCTUARY

*Article I. Designation and Effect*

On November 16, 1990, the Florida Keys National Marine Sanctuary and Protection Act, Pub. L. 101–605 (16 U.S.C. 1433 note), became law. That Act designated an area of waters and submerged lands, including the living and nonliving resources within those waters, as described therein, as the Florida Keys National Marine Sanctuary (Sanctuary). By this revised Designation Document, the boundary of the Sanctuary is expanded to include important coral reef resources and resources in two areas known as Sherwood Forest and Riley's Hump, just beyond the westernmost portion of the statutory Sanctuary boundary.

Section 304 of the National Marine Sanctuaries Act (NMSA), 16 U.S.C. 1431 *et seq.,* authorizes the Secretary of Commerce to issue such regulations as are necessary and reasonable to implement the designation, including managing and protecting the conservation, recreational, ecological, historical, scientific, educational, cultural, archaeological or aesthetic resources and qualities of a national marine sanctuary. Section 1 of Article IV of this Designation Document lists activities of the type that are presently being regulated or may have to be regulated in the future, in order to protect Sanctuary resources and qualities. Listing in section 1 does not mean that a type of activity will be regulated in the future, however, if a type of activity is not listed, it may not be regulated, except on an emergency basis, unless section 1 is amended, following the procedures for designation of a sanctuary set forth in paragraphs (a) and (b) of section 304 of the NMSA, to include the type of activity.

Nothing in this Designation Document is intended to restrict activities that do not cause an adverse effect on the resources or qualities of the Sanctuary or on Sanctuary property or that do not pose a threat of harm to users of the Sanctuary.

*Article II. Description of the Area*

The Florida Keys National Marine Sanctuary boundary encompasses approximately 2900 $nm^2$ (9,800 square kilometers) of coastal and ocean waters, and the submerged lands thereunder, surrounding the Florida Keys in Florida. The easternmost point of the Sanctuary is the northeasternmost point of Biscayne National Park and the westernmost point is approximately 15 kilometers to the west of the western boundary of Dry Tortugas National Park, a linear distance of approximately 335 kilometers. The contiguous area boundary on the Atlantic Ocean side of the Florida Keys runs south from Biscayne National Park generally following the 300-foot isobath, curving in a southwesterly direction along the Florida Keys archipelago until south of the Dry Tortugas. The contiguous area boundary on the Gulf of Mexico side of the Florida Keys runs from this southern point in a straight line to the northwest and then when directly west of the Dry Tortugas in a straight line to the north. The boundary then turns to the east and slightly south and follows a straight line to just west of Key West and then turns to the northeast and follows a straight line parallel to the Florida Keys approximately five miles to the south, and then follows the Everglades National Park boundary until Division Point where the boundary then follows the western shore of Manatee Bay, Barnes Sound, and Card Sound. The boundary then follows the southern boundary of Biscayne National Park and up its eastern boundary until its northeasternmost point. Starting just to the east of the most western boundary line of the contiguous portion of the Sanctuary there is a vertical rectangular shape area of 60 $nm^2$ just to the south.

The shoreward boundary of the Sanctuary is the mean high-water mark except around

the Dry Tortugas where it is the boundary of the Dry Tortugas National Park. The Sanctuary boundary encompasses the entire Florida coral reef tract, all of the mangrove islands of the Florida Keys, and some of the sea grass meadows of the Florida Keys. The precise boundary of the Sanctuary is set forth at the end of this Designation Document.

*Article III. Characteristics of the Area That Give it Particular Value*

The Florida Keys extend approximately 223 miles southwest from the southern tip of the Florida peninsula. Adjacent to the Florida Keys land mass are located spectacular unique, nationally significant marine environments, including sea grass meadows, mangrove islands, and extensive living coral reefs. These marine environments support rich biological communities possessing extensive conservation, recreational, commercial, ecological, historical, research, educational, and aesthetic values which give this area special national significance. These environments are the marine equivalent of tropical rain forests in that they support high levels of biodiversity, are fragile and easily susceptible to damage from human activities, and possess high value to humans if properly conserved. These marine environments are subject to damage and loss of their ecological integrity from a variety of sources of disturbance.

The Florida Keys are a limestone island archipelago. The Keys are located at the southern edge of the Florida Plateau, a large carbonate platform made of a depth of up to 7000 meters of marine sediments, which have been accumulating for 150 million years and which have been structurally modified by subsidence and sea level fluctuation. The Keys region is generally divided into five distinct areas: the Florida reef tract, one of the world's largest coral reef tracts and the only barrier reef in the United States; Florida Bay, described as an active lime-mud factory because of the high carbonate content of its silts and muds; the Southwest Continental Shelf; the Straits of Florida; and the Keys themselves.

The 2.5 million-acre Sanctuary contains one of North America's most diverse assemblages of terrestrial, estuarine, and marine fauna and flora, including, in addition to the Florida reef tract, thousands of patch reefs, one of the world's largest sea grass communities covering 1.4 million acres, mangrove fringed shorelines, mangrove islands, and various hardbottom habitats. These diverse habitats provide shelter and food for thousands of species of marine plants and animals, including more than 50 species of animals identified under Federal or State law, as endangered or threatened. The Keys were at one time a major seafaring center for European and American trade routes to the Caribbean, and the submerged cultural and historic resources (*i.e.,* shipwrecks) abound in the surrounding waters. In addition, the Sanctuary may contain substantial archaeological resources of pre-European cultures.

The uniqueness of the marine environment draws multitudes of visitors to the Keys. The major industry in the Florida Keys is tourism, including activities related to the Keys' marine resources, such as dive shops, charter fishing and dive boats and marinas, as well as hotels and restaurants. The abundance of the resources also supports a large commercial fishing employment sector.

The number of visitors to the Keys grows each year, with a concomitant increase in the number of residents, homes, jobs, and businesses. As population grows and the Keys accommodate ever-increasing resource-use pressures, the quality and quantity of Sanctuary resources are increasingly threatened. These pressures require coordinated and comprehensive monitoring and researching of the Florida Keys' region.

*Article IV. Scope of Regulations*

*Section 1. Activities Subject to Regulation*

The following activities are subject to regulation under the NMSA, either throughout the entire Sanctuary or within identified portions of it or, as indicated, in areas beyond the boundary of the Sanctuary, to the extent necessary and reasonable. Such regulation may include prohibitions to ensure the protection and management of the conservation, recreational, ecological, historical, scientific, educational, cultural, archaeological or aesthetic resources and qualities of the area. Because an activity is listed here does not mean that such activity is being or will be regulated. All listing means is that the activity can be regulated, after compliance with all applicable regulatory laws, without going through the designation procedures required by paragraphs (a) and (b) of section 304 of the NMSA, 16 U.S.C. 1434(a) and (b). Further, no regulation issued under the authority of the NMSA except an emergency regulation issued with the approval of the Governor of the State of Florida may take effect in the area of the Sanctuary lying within the seaward boundary of the State of Florida if the Governor of the State of Florida certifies to the Secretary of Commerce that such regulation is unacceptable within the forty-five-day review period specified in NMSA. Detailed definitions and explanations of the following ''activities subject to regulation'' appear in the Sanctuary Management Plan:

1. Exploring for, developing, or producing oil, gas, and/or minerals (*e.g.,* clay, stone, sand, gravel, metalliferous ores, nonmetalliferous ores) in the Sanctuary;

2. Touching, climbing on, taking, removing, moving, collecting, harvesting, injuring, destroying or causing the loss of, or attempting to take, remove, move, collect, harvest, injure, destroy or cause the loss of, coral in the Sanctuary;

3. Drilling into, dredging or otherwise altering the seabed of the Sanctuary, except incidental to allowed fishing and boating practices or construction activities permitted by county, state or federal regulatory agencies; or constructing, placing or abandoning any structure, material or other matter on the seabed of the Sanctuary, except as authorized by appropriate permits or incidental to allowed fishing practices;

4. Discharging or depositing, within or beyond the boundary of the Sanctuary, any material that subsequently enters the Sanctuary and injures a Sanctuary resource or quality;

5. Operating water craft in the Sanctuary

(a) in a manner that could injure coral, hardbottoms, seagrass, mangroves, or any other immobile organism attached to the seabed,

(b) in a manner that could injure or endanger the life of divers, fishermen, boaters or other users of the Sanctuary,

(c) in a manner that could disturb marine mammals, marine reptiles, or bird rookeries;

6. Diving or boating activities in the Sanctuary including anchoring that could harm Sanctuary resources, Sanctuary property, or other users of the Sanctuary;

7. Stocking within the Sanctuary or releasing within the Sanctuary or from beyond the boundary of the Sanctuary, native or exotic species of plant, invertebrate, fish, amphibian or mammals;

8. Defacing, marking, or damaging in any way or displacing, removing, or tampering with any markers, signs, notices, placards, navigational aids, monuments, stakes, posts, mooring buoys, boundary buoys, trap buoys, or scientific equipment in the Sanctuary;

9. Removing, injuring, preserving, curating, and managing historic resources within the Sanctuary without all required state and/or federal permits;

10. Taking, removing, moving, catching, collecting, harvesting, feeding, injuring, destroying, or causing the loss of, or attempting to take, remove, move, catch, collect, harvest, feed, injure, destroy or cause the loss of any marine mammal, marine reptile, or bird within the Sanctuary, without all required state and/or federal permits;

11. Possessing, moving, harvesting, removing, taking, damaging, disturbing, breaking, cutting, spearing, or otherwise injuring any marine invertebrate, fish, bottom formation, algae, seagrass or other living or dead organism, including shells, or attempting any of these activities in any area of the Sanctuary designated as an Existing Management Area, Wildlife Management Area, Ecological Reserve, Sanctuary Preservation Area, or Special-Use Area;

12. Carrying or possessing specified fishing gear in any area of the Sanctuary designated as an Existing Management Area, Wildlife Management Area, Ecological Reserve, Sanctuary Preservation Area, or Special-Use Area except for passage through without interruption;

13. Entering and leaving any Wildlife Management Area, Ecological Reserve, Sanctuary Preservation Area, or Special-Use Area except for passage through without interruption or for law enforcement purposes;

14. Harvesting marine life as defined and regulated by the State of Florida under its marine life rule;

15. Mariculture;

16. Possessing or using explosives or releasing electrical charges or substances poisonous or toxic to fish and other living marine resources within the Sanctuary or beyond the boundary of the Sanctuary (possession of ammunition shall not be considered possession of explosives);

17. Removing and disposing of lost, out-of-season, or illegal gear discovered within the Sanctuary; removing of vessels grounded, lodged, stuck or otherwise perched on coral

reefs, hardbottom, or seagrasses within the Sanctuary; and removing and disposing of derelict or abandoned vessels or other vessels within the Sanctuary for which ownership cannot be determined or for which the owner takes no action for removal or disposal; and salvaging and towing of vessels abandoned or disabled within the Sanctuary vessels or of vessels within the Sanctuary otherwise needing salvaging or towing; and

18. Interfering with, obstructing, delaying or preventing an investigation, search, seizure or deposition of seized property in connection with enforcement of the NMSA or any regulation or permit issued under the NMSA.

*Section 2. Emergency Regulation*

Where necessary to prevent or minimize the destruction of, loss of, or injury to a Sanctuary resource or quality; or to minimize the imminent risk of such destruction, loss or injury, any activity, including any not listed in Section 1 of this article, is subject to immediate temporary regulation, including prohibition. However, no such regulation may take effect in any area of the Sanctuary lying within the seaward boundary of the State of Florida without the approval of the Governor of the State of Florida.

*Article V. Effect on Leases, Permits, Licenses, and Rights*

Pursuant to paragraph (c)(1) of section 304 of the NMSA, 16 U.S.C. 1434(c)(1), no valid lease, permit, license, approval or other authorization issued by any federal, State, or local authority of competent jurisdiction, or any right of subsistence use or access, may be terminated by the Secretary of Commerce, or his or her designee, as a result of a designation, or as a result of any sanctuary regulation, if such authorization or right was in effect on the effective date of the designation (November 16, 1990 with respect to the statutory Sanctuary boundary; _____, 2001 with respect to the revision to the Sanctuary boundary expansion made by this Revised Designation Document).

In no event may the Secretary of Commerce or his or her designee issue a permit authorizing, or otherwise approving: (1) the exploration for, development of, or production of oil, gas, or minerals within the Sanctuary; or (2) the disposal of dredged materials within the Sanctuary (except by certification in accordance with applicable National Marine Sanctuary Program regulations of valid authorizations in existence on the effective date of Sanctuary designation). Any purported authorizations issued by other authorities after the effective date of Sanctuary designation for any of these activities within the Sanctuary shall be invalid.

*Article VI. Alteration of this Designation*

The terms of designation, as defined in paragraph (a) of section 304 of the NMSA, 16 U.S.C. 1434(a), may be modified only by the procedures outlined in paragraphs (a) and (b) of section 304 of the NMSA, 16 U.S.C. 1434(a) and (b), including public hearings, consultation with interested federal, state, and local government agencies, review by the appropriate Congressional committees, review by the Governor of the State of Florida, and approval by the Secretary of Commerce, or his or her designee. No designation, term of designation, or implementing regulation may take effect in the area of the Sanctuary lying within the seaward boundary of the State of Florida if the Governor of the State of Florida certifies to the Secretary of Commerce that such designation or term of designation regulation is unacceptable within the forty-five-day review period specified in NMSA.

*Florida Keys National Marine Sanctuary Boundary Coordinates (based on North American datum of 1983)*

The boundary of the Florida Keys National Marine Sanctuary—

(a) begins at the northeasternmost point of Biscayne National Park located at a point approximately 25 degrees 39 minutes north latitude, 80 degrees 05 minutes west longitude, then runs eastward to the point located at 25 degrees 39 minutes north latitude, 80 degrees 04 minutes west longitude; and

(b) then runs southward and connects in succession the points at the following coordinates:

(i) 25 degrees 34 minutes north latitude, 80 degrees 04 minutes west longitude,

(ii) 25 degrees 28 minutes north latitude, 80 degrees 05 minutes west longitude,

(iii) 25 degrees 21 minutes north latitude, 80 degrees 07 minutes west longitude, and

(iv) 25 degrees 16 minutes north latitude, 80 degrees 08 minutes west longitude;

(c) then runs southwesterly and connects in succession the points at the following coordinates:

(i) 25 degrees 07 minutes north latitude, 80 degrees 13 minutes west longitude,

(ii) 24 degrees 57 minutes north latitude, 80 degrees 21 minutes west longitude,

(iii) 24 degrees 39 minutes north latitude, 80 degrees 52 minutes west longitude,

(iv) 24 degrees 30 minutes north latitude, 81 degrees 23 minutes west longitude,

(v) 24 degrees 25 minutes north latitude, 81 degrees 50 minutes west longitude,

(vi) 24 degrees 22 minutes north latitude, 82 degrees 48 minutes west longitude,

(vii) 24 degrees 37 minutes north latitude, 83 degrees 06 minutes west longitude,

(viii) 24 degrees 46 minutes north latitude, 83 degrees 06 minutes west longitude,

(ix) 24 degrees 46 minutes north latitude, 82 degrees 54 minutes west longitude,

(x) 24 degrees 44 minutes north latitude, 81 degrees 55 minutes west longitude,

(xi) 24 degrees 51 minutes north latitude, 81 degrees 26 minutes west longitude, and

(xii) 24 degrees 55 minutes north latitude, 80 degrees 56 minutes west longitude;

(d) then follows the boundary of Everglades National Park in a southerly then northeasterly direction through Florida Bay, Buttonwood Sound, Tarpon Basin, and Blackwater Sound;

(e) after Division Point, then departs from the boundary of Everglades National Park and follows the western shoreline of Manatee Bay, Barnes Sound, and Card Sound;

(f) then follows the southern boundary of Biscayne National Park to the southeasternmost point of Biscayne National Park; and

(g) then follows the eastern boundary of Biscayne National Park to the beginning point specified in paragraph (a).

The shoreward boundary of the Florida Keys National Marine Sanctuary is the mean high-water mark except around the Dry Tortugas where the boundary is conterminous with that of the Dry Tortugas National Park, formed by connecting in succession the points at the following coordinates:

(i) 24 degrees 34 minutes 0 seconds north latitude, 82 degrees 54 minutes 0 seconds west longitude;

(ii) 24 degrees 34 minutes 0 seconds north latitude, 82 degrees 58 minutes 0 seconds west longitude;

(iii) 24 degrees 39 minutes 0 seconds north latitude, 82 degrees 58 minutes 0 seconds west longitude;

(iv) 24 degrees 43 minutes 0 seconds north latitude, 82 degrees 54 minutes 0 seconds west longitude;

(v) 24 degrees 43 minutes 32 seconds north latitude, 82 degrees 52 minutes 0 seconds west longitude;

(vi) 24 degrees 43 minutes 32 seconds north latitude, 82 degrees 48 minutes 0 seconds west longitude;

(vii) 24 degrees 42 minutes 0 seconds north latitude, 82 degrees 46 minutes 0 seconds west longitude;

(viii) 24 degrees 40 minutes 0 seconds north latitude, 82 degrees 46 minutes 0 seconds west longitude;

(ix) 24 degrees 37 minutes 0 seconds north latitude, 82 degrees 48 minutes 0 seconds west longitude; and

(x) 24 degrees 34 minutes 0 seconds north latitude, 82 degrees 54 minutes 0 seconds west longitude.

The Florida Keys National Marine Sanctuary also includes the area located within the boundary formed by connecting in succession the points at the following coordinates;

(i) 24 degrees 33 minutes north latitude, 83 degrees 09 minutes west longitude,

(ii) 24 degrees 33 minutes north latitude, 83 degrees 05 minutes west longitude,

(iii) 24 degrees 18 minutes north latitude, 83 degrees 05 minutes west longitude,

(iv) 24 degrees 18 minutes north latitude, 83 degrees 09 minutes west longitude, and

(v) 24 degrees 33 minutes north latitude, 83 degrees 09 minute west longitude.

(End of Revised Designation Document.)

## IV. Supplemental Management Plan

The Supplemental Management Plan (SMP) complements the existing Sanctuary Management Plan (MP) in several respects. Many of the strategies described in the MP that are now being implemented in the Sanctuary will be applied to the Tortugas Ecological Reserve. However, due to the unique characteristics of the Tortugas region (remoteness, deep water) some new strategies have been developed and will be implemented. Some of these strategies are described below. The SMP adds strategies to the Education and Outreach Action Plan, Enforcement

Action Plan, Mooring and Boundary Buoy Action Plan, Research Monitoring Action Plan and adds an Administrative Action Plan.

*Administrative Action Plan*

The SMP adds an Administrative Action Plan to the Management Plan. It targets the development of a Memorandum of Understanding (MOU) to clearly define the roles and responsibilities of the various agencies responsible for resource management in the Tortugas region. The MOU will cover, at a minimum, the following activities: cooperative enforcement, research, and sharing of facilities. Management of the Reserve necessitates a high degree of coordination and cooperation between the affected agencies, particularly NOAA and the NPS. Both agencies have similar missions and responsibilities. Consequently, cooperation will not only save money but will also improve resource protection. The NPS has a variety of assets such as land, housing, and dockage that, under a workable agreement, could potentially be used to support management of the Reserve. An agreement on the use of these lands and facilities will be pursued by NOAA and NPS.

The State of Florida is the co-trustee for a significant portion of the waters and marine resources within the Reserve and will co-manage these resources with the NOAA.

NOAA's National Marine Fisheries Service (NMFS) has considerable expertise and some assets that could be utilized in managing the reserve, particularly in the areas of research and monitoring. The NMFS Office of Law Enforcement has responsibility for enforcing fishing regulations and has assets and technology that could potentially be used for enforcement.

The U.S. Coast Guard has responsibility for enforcing fishing regulations in federal waters of the Reserve. They have several large offshore patrol vessels based in Key West that could be used, in conjunction with Sanctuary patrol vessels, for enforcement of the reserve areas.

Strategy 1: Memorandum of Understanding (MOU)

Develop and enter into an MOU that clearly defines the roles and responsibilities of the various agencies responsible for resource management in the Tortugas region. The MOU should cover, at a minimum, the following activities: cooperative enforcement, research, and sharing of facilities and assets.

*Education and Outreach Action Plan*

The SMP supplements the Education and Outreach Plan in the MP by adding education and outreach strategies for the Reserve. These strategies are expected to have a significant effect on protecting and preserving the natural resources found in the Tortugas by enhancing the general public's understanding of this unique region and the regulations applicable to the reserve. These strategies were developed according to the Sanctuary Education and Outreach goals and outcomes identified in the MP.

Strategy E.13: Tortugas Site Brochure

To a large extent, marine reserves rely on visitor compliance and understanding in order for their regulations to be effective. This is even more critical when reserves like the Tortugas Ecological Reserve are remotely located or large in size. NOAA has learned from experience that an important tactic for increasing regulatory compliance is to provide appropriate educational products and information to visitors of protected areas. This strategy is to produce a site brochure which details the regulations and boundaries for the Reserve, how to obtain a permit to enter and visit Tortugas North area, the locations and numbers of mooring buoys, and the unique ecological features of the area. This product will complement the existing Sanctuary regional site brochures, and will interpret an area of the Sanctuary that is not currently covered in any existing products.

Activity 1—Design layout and content of brochure;

Activity 2—Identify partners to assist with brochure costs;

Activity 3—Print and distribute brochure.

Strategy E.14: Tortugas Ecological Reserve Exhibit, Garden Key

Most visitors to the Tortugas Ecological Reserve will stop at Fort Jefferson on Garden Key in the DRTO at some point during their visit. Garden Key provides a convenient anchorage for private pleasure boats, commercial fishing vessels, live-aboard dive vessels, recreational fishing guides, and ferries and seaplanes that bring campers and day visitors from Key West. This strategy involves the development and construction of an information kiosk at Fort Jefferson that will take advantage of this contact point to educate visitors about the Reserve. The exhibit will include practical information on reserve boundaries and regulations, as well as information on the habitats and marine life found in the reserve and the reasons for designating the Reserve. The exhibit will be visually appealing, educational and interesting for the general public, while still conveying necessary regulatory information for those visitors who may be entering the reserve.

Activity 1—Consult with National Park Service staff to determine size and location of kiosk. Review construction designs and materials of similar kiosks;

Activity 2—Design content and layout for kiosk;

Activity 3—Produce and install kiosk.

Strategy E.15: Interagency Visitor Center, Key West

Due to the geographical remoteness of the Tortugas area and considerable depths at which unique coral reef resources are located, it is important to provide educational opportunities for the over 2.5 million visitors to the Keys that will not see these special features first-hand. NOAA, working in conjunction with the NPS and the United States Fish and Wildlife Service, is establishing an interagency visitor center in Key West. This strategy will develop an exhibit for the visitor center in which the natural characteristics and habitats of the Tortugas region are featured. This exhibit will educate the visitor about natural resources while interpreting the multi-agency jurisdiction of the region. The development and designation of the Tortugas Ecological Reserve and the DRTO's Research Natural Area will also be explained.

Activity 1—Consult with National Park Service staff to determine content, design, and layout of exhibit;

Activity 2—Identify other possible agency or private partners for exhibit production;

Activity 3—Produce and install exhibit.

Strategy E.16: Tortugas Site Characterization

Several years ago a comprehensive site characterization of the FKNMS was produced. This 10 volume series is rich in biological, oceanographic, chemical, geological, and other scientific information. A similar, though less voluminous, site characterization of the Tortugas region was produced as a component of the Tortugas Ecological Reserve planning process. In order to heighten the Reserve users' awareness of the oceanographic and biological uniqueness of the Tortugas resources, a layperson's summary of the site characterization will be developed under this strategy. NOAA will seek to create a product in cooperation with the National Park Service that takes an

ecosystem approach to interpretation, starting at the islands of the Park, and progressing through the deep-water environments of the Reserve. This product will be produced in both electronic and printed format to increase accessibility and reduce printing costs. The web site document will contain hyperlinks to the full site characterization document and to research data from the region, including GIS maps.

Activity 1—Obtain electronic versions of Tortugas Site Characterization document and upload to Sanctuary web site;

Activity 2—Write summary of Site Characterization and conduct review of summary by original authors;

Activity 3—Produce printed version of summary and post electronic version to web site;

Activity 4—Improve web site page by identifying and creating relevant links to data, photos, and GIS maps.

Strategy E.17: Tortugas Ecological Reserve Documentary

This strategy will produce a video documentary on the Tortugas Ecological Reserve to interpret the unique ecological resources of the reserve, explain the necessity of protection, summarize the use of marine zoning as an effective management tool, and explain the process by which the Reserve was created. NOAA has received and continues to receive multiple requests from national and international sources on the process used to create the Reserve. This documentary will convey the breadth of information associated with the reserve and its creation. The documentary will also be duplicated for use by the many agencies that have undertaken action within the Tortugas area relative to reserve designation (e.g., National Park Service, regional fishery management councils, the State of Florida).

Activity 1—Contract with videographer to produce documentary;

Activity 2—Produce duplicate copies of documentary and distribute as needed.

Strategy E.18: Traveling Exhibit on Marine Zoning

Sanctuary Education and Outreach staff participate in more than twenty-five community fairs, trade shows, scientific and management conferences, and related events annually. A variety of traveling exhibits and display materials are used to interpret Sanctuary resources, regulations, and special projects. This strategy involves the development and production of a traveling exhibit on marine zoning in the Sanctuary, including the Tortugas Ecological Reserve. Components of the exhibit will be interchangeable, focusing on a variety of topics such as zone designation, resources protected by various zone types, regulations, research and monitoring of zone performance, and the use of marine zoning in other national and international arenas.

Activity 1—Design content and layout for traveling exhibit;

Activity 2—Produce exhibit components.

Strategy E.19: Interpretive Wayside Exhibits on the Tortugas Ecological Reserve

Of the 2.5 million visitors to the Florida Keys annually, 14.4% participate in boating activities using private vessels. In recent years, visitation to the DRTO has increased from 18,000 visitors in 1984 to 72,000 in 1998. This strategy aims to educate private boaters traveling to the Tortugas by developing and installing interpretive wayside exhibits such as information signs at boat ramps, chambers of commerce, and other strategic locations. Exhibits will provide important information about the Tortugas waters, natural resources, and regulations for the new reserve. The signs will also display information on minimal impact usage and safety considerations for traveling to this remote area.

Activity 1—Identify number of exhibits needed and appropriate locations for exhibits. Prioritize exhibit placement;

Activity 2—Investigate production costs and possible partners for funding exhibits;

Activity 3—Design content and layout for wayside exhibits;

Activity 4—Produce and install exhibits by priority area as funding permits.

*Enforcement Action Plan*

The SMP supplements the Enforcement Action Plan in the MP by adding the goals of gaining the highest level of compliance by the public who enter and visit the Tortugas Ecological Reserve. This compliance can be achieved through several management actions including education and outreach and on the water presence of Sanctuary staff in programs such as Team OCEAN, where Sanctuary information is distributed along the waterfront or boat to boat by Sanctuary staff and volunteers.

The most effective management action that can be used to achieve compliance with Sanctuary regulations is an effective law enforcement program. Currently, the primary enforcement of Sanctuary regulations is accomplished through an enforcement agreement between NOAA/Office of National Marine Sanctuaries and the State of Florida Fish and Wildlife Conservation Commission. The enforcement efforts are consistent with the goals and objectives for enforcement described in the MP. The MP also calls for cross-deputization of other agency law enforcement personnel (*e.g.,* National Park Service Rangers) to accomplish law enforcement responsibilities within the Sanctuary. This approach to enforcement continues to remain an option.

The success of the Reserve will depend to a large extent on the level of enforcement resources dedicated to the Reserve. Several enforcement options are presently available and are being evaluated for deployment in the Reserve. These options include:

- Installation and monitoring of a long-range radar unit at the Dry Tortugas National Park. This would allow remote monitoring of vessels entering and leaving the Reserve.
- Place two 82' vessels into service for patrolling the Ecological Reserve.
- Cross-deputize and fund National Park Service Rangers to assist in enforcement in the Tortugas Ecological Reserve.

The SMP commits substantial enforcement resources for the Reserve. The SMP sets forth the law enforcement budget as follows:

Personnel

Law Enforcement Officers (4–6) $50,000 per position

General Support $50,000

Vessels

82' Patrol Vessels (2) No Cost—Agency Property Transfer

NOAA will work with the FWC and other enforcement agencies to develop the enforcement resources that are necessary to assure the success of the Reserve.

Other Enforcement Factors

Because vessels are prohibited from stopping within the Tortugas South portion of the Tortugas Ecological Reserve, except for law enforcement or for scientific research or educational activities pursuant to a sanctuary permit, it will be possible to monitor vessel traffic remotely by radar and response will only be necessary when vessels without a permit stop within Tortugas South. Additionally, access to Tortugas North will be allowed only by permit. This will help Sanctuary managers monitor the level of visitor

use in the reserve and will facilitate enforcement efforts.

*Mooring and Boundary Buoy Action Plan*

The SMP supplements the MP by revising the title to the Mooring Buoy Action to read Mooring and Boundary Buoy Action Plan and by adding several strategies specific to the Tortugas Ecological Reserve.

Tortugas Ecological Reserve Supplement

Strategy 1. Install and maintain boundary buoys for Tortugas North.

Strategy 2. Install and maintain an adequate number of mooring buoys in Tortugas North in appropriate locations.

Strategy 3. Determine whether buoys are appropriate for Tortugas South and, if so, determine the number, type, and locations of buoys.

*Regulatory Action Plan*

The SMP supplements the Regulatory Action Plan in the MP by calling for extensive coordination with other governmental entities, particularly the State of Florida, to ensure that all required regulations are put in place. The Plan calls for publication on NOAA nautical charts of the new boundaries for the Sanctuary and the reserve.

*Research and Monitoring Action Plan*

The SMP supplements the Regulatory Action Plan in the MP by identifying and describing research and monitoring strategies for the Tortugas Ecological Reserve. These strategies are expected to have significant effects on Sanctuary resources by providing the knowledge necessary to make informed decisions about protecting the biological diversity and natural ecosystem processes of the Tortugas region. These strategies were developed according to the Sanctuary Research and Monitoring goals and objectives identified in the MP.

Strategy T.1: Ecological Reserve Support Staff

This strategy involves hiring support staff to assist with regulatory implementation and interpretation of the Tortugas Ecological Reserve. This staff member will establish a permit issuance and tracking system for entrance into Tortugas North, answer inquiries from the general public while on-site at the reserve, and assist with research and other reserve issues as needed.

Activity 1—Review support staff logistics (office space, communications, lodging) with National Park Service personnel.

Activity 2—Advertise for and hire support staff.

Strategy T.2: Design and Implement Long-term Ecological Monitoring to Test the Efficacy and Ecological Integrity of the Tortugas Ecological Reserve

Ecological reserves are established within the Sanctuary to protect and enhance biodiversity and to provide natural spawning, nursery, and permanent residence areas for marine life. This strategy establishes monitoring activities that compare reserve areas before and after designation, as well as monitoring which captures changes occurring inside and outside the protected area, which is critical to gauge the effectiveness of ecological reserves as a management tool. This monitoring will also assist Sanctuary management in determining if the area's biodiversity, productivity, and ecological integrity are being adequately protected by the regulations in place.

Consistent with the existing Zone Monitoring Program, indicators for assessing ecosystem function and ecological integrity (such as changes in coral and fish diversity, trophic structure, and water quality) will be monitored. An important element will be monitoring diving impacts by comparing changes in gross habitat morphology in Tortugas South and Tortugas North, particularly around mooring buoys.

Activity 1—Assess existing Tortugas monitoring activities. Prioritize baseline monitoring data needs and provide support to existing monitoring programs to gather necessary data. Contract with additional researchers as needed to fill baseline data gaps.

Activity 2—Develop post-implementation monitoring plan for the Tortugas Ecological Reserve and adjacent areas of varying protection levels.

Activity 3—Convene annual or biannual meeting of Tortugas researchers to share monitoring data with Sanctuary management and review monitoring schedule.

Strategy T.3: Dry Tortugas Marine Laboratory and Research Support Feasibility Study

Historically, the Dry Tortugas have been a place of marine research, supporting early pioneers in the fields of coral reef biology, ecology, oceanography, and underwater photography. A remote marine research station supported by the Carnegie Institution existed in the late 1800's and early 1900's on Loggerhead Key. The Carnegie facility was closed and dismantled decades ago, and since that time research efforts in the region have been sporadic. This strategy undertakes a feasibility study for the re-establishment of this laboratory or a similar facility. Such a facility would address the growing interest in Tortugas research and support the collection of much-needed data to assist National Park Service and Sanctuary managers in future decisions about Tortugas resources. Additionally, the feasibility study will consider other logistical needs to support researchers working in the Dry Tortugas area, such as shore-based lodging.

Activity 1—Meet with NPS personnel to plan feasibility study and desired conditions of research station. Discuss funding options for feasibility study.

Activity 2—Conduct feasibility study and discuss results with NPS. Implement next steps as appropriate.

Strategy T.4: Wireless Data Transfer

This strategy will establish wireless data transfer capabilities using the existing Motorola two-way radio network.

Activity 1—Contact Motorola to determine wireless data transfer capabilities using the existing two way radio network.

Activity 2—If the existing network can be used to transfer data, procure needed software and hardware.

Activity 3—Train staff on wireless data transfer.

Activity 4—Maintain and upgrade system as needed.

Activity 5—If existing two way radio network will not permit data transfer, research additional options.

Strategy T.5: Automated Oceanographic Data Collection

Throughout the Sanctuary a series of automated, continuously functioning sensors mounted on remote platforms or structures (C–MAN Stations) collect physical oceanographic data and report this information real-time to the Internet. This strategy will expand the C–MAN network to include similar data collection at a remote location in the Tortugas. Additionally, instruments that continuously collect data on biological parameters will also be installed.

Activity 1—Assess existing remote data collection activities in the Dry Tortugas.

Activity 2—Contract with current C–MAN Station research team to install a new station in the Tortugas area. Develop maintenance plan.

Activity 3—Investigate instrument capabilities and costs to expand data collection to include biological parameters. Purchase and install necessary instrumentation.

Strategy T.6: Tortugas Region Non-Use Valuation Study

In the development of the Sanctuary Final Management Plan, user attitude and economic values of the Sanctuary were established through a comprehensive socio-economic study. This strategy will complement the existing socio-economic studies of the Sanctuary by specifically identifying the non-use values that exist within the Tortugas region. Establishing these non-use values is critical for managers to accurately estimate the economic benefits and costs of newly designated reserve areas.

Activity 1—Discuss non-use valuation study requirements with Sanctuary economist.

Activity 2—Contract with economist to conduct study and publish results.

**V. Summary of Final Regulations**

The regulations applicable to the Reserve start with the current Sanctuary-wide regulations (15 CFR part 922, subpart P, in particular, § 922.163) and those additional regulations applicable to ecological reserves (15 CFR 922.164(d)). The Sanctuary-wide regulations prohibit mineral and hydrocarbon exploration; removal of, injury to, or possession of coral or live rock; alteration of, or construction on, the seabed; discharge or deposit of materials or other matter; operation of vessels in a manner that injures or endangers life, marine resources, or property; diving or snorkeling without flying a diver's down flag; releasing exotic species; damaging or removing markers; moving, removing, injuring, or possessing Sanctuary historical resources; taking or possessing protected wildlife; possessing or using explosives or electrical charges; harvesting or possessing marine life species not in accordance with the Florida Administrative Code; and interfering with law enforcement authorities.

The ecological reserve regulations prohibit the discharge or deposit of any material except cooling water or engine exhaust; taking, disturbing or injuring any dead or living organism; fishing; touching living or dead coral; and anchoring when a mooring buoy is available or on living or dead coral. Transit by vessels is allowed provided that all fishing gear is stowed away.

In addition to the Sanctuary-wide and ecological reserve regulations, the regulations for the Tortugas Ecological Reserve:

- Prohibit anchoring in, prohibit mooring by vessels more than 100 ft in length overall (LOA), and control access to Tortugas North, other than for continuous transit or for law enforcement purposes, via access permit and require permitted vessels to call-in prior to entering or when leaving.
- Prohibit anchoring in, prohibit mooring by vessels more than 100 ft in length overall (LOA), and restrict access to Tortugas South, other than for continuous transit with fishing gear stowed away or for law enforcement purposes, to research or educational purposes. A National Marine Sanctuary General Permit (see 15 CFR 922.166(a)) would be required for all research or educational activities.

The access permit for Tortugas North is free, no paperwork is required, and Sanctuary staff will be available year-round to handle requests. Applicants must call the Key West or Marathon Sanctuary office to request a permit and must radio into the Sanctuary staff person at Fort Jefferson (DRTO) prior to entering and upon leaving the reserve.

Applicants must furnish the following information:

1. Names, addresses, and telephone numbers of owner, captain, and applicant.
2. Vessel name and home port.
3. USCG documentation number, state license, or boat registration number.
4. Length of vessel and primary propulsion type (*i.e.,* motor or sail).
5. Number of divers.
6. Requested effective date and duration of permit.

The permit will be valid for the time the vessel is in the area, not to exceed two weeks. Vessels longer than 100 ft LOA exceed the capacity of the mooring buoys and are therefore prohibited from using them. Advance reservations will not be accepted more than one month in advance. Doubling-up on mooring buoys is permitted and leave and return privileges (dive during the day, stay at the park overnight) are allowed within the time period covered by the permit. Permit holders must notify FKNMS staff at Fort Jefferson by radio no less than 30 minutes and no more than six hours before entering the reserve and upon leaving.

The regulations issued today implement Regulatory Alternative D and amend 15 CFR 922.161 to expand the boundary of the FKNMS to be consistent with Boundary Alternative III. The revised Sanctuary boundary coordinates are set forth in Appendix I to Part 922 which is also revised to make minor revisions in the existing boundary to correct errors, provide clarification, and reflect more accurate data and, in the area of Biscayne National Park, to provide a fixed enforceable boundary. Appendix IV to Part 922 is also revised to make the area within the coordinates for Boundary Alternative III an ecological reserve, to provide clarification, and to remove no longer needed introductory text. Appendices II, V, VI, and VII are revised to correct errors, provide clarification, and reflect more accurate data.

The regulations prohibit anchoring in the Tortugas Ecological Reserve; entering the Tortugas North area of the Ecological Reserve without a valid access permit (except for continuous transit or law enforcement purposes); entering the Tortugas South area of the Ecological Reserve except for continuous transit or law enforcement, or for scientific research or educational activities pursuant to a sanctuary permit; or tying a vessel greater than 100 ft (30.48 meters) LOA to a mooring buoy in the Tortugas Ecological Reserve or tying more than one vessel (other than vessels carried on board a vessel), if the combined lengths would exceed 100 feet (30.48 meters) in length overall (LOA), to a mooring buoy or to a vessel tied to a mooring buoy in the ecological reserve. The reason for the length restriction is to prevent a buoy from being ripped off its mooring.

Because all anchoring is prohibited in the northern portion of the Tortugas Bank no-anchoring zone established by 15 CFR 922.164(g), the regulations revise the zone to be consistent. The existing zone is an area within the Sanctuary boundary where vessels 50 meters or greater in LOA are prohibited from anchoring. The northern portion of the zone overlaps the reserve.

The regulations add a new section to provide for permits for access to the Tortugas North area of the Ecological Reserve. A person with a valid access permit is allowed to enter the Tortugas North area of the Ecological Reserve. Access permits do not require written applications or the payment of any fee. Access permits must be requested at least 72 hours but no longer than one month before the date the permit would be effective. Permits may be requested via telephone or radio by contacting FKNMS at the Sanctuary offices at Key West or Marathon. Permit applicants must provide, as applicable, the following information: vessel name; the names, addresses, and telephone number of the owner, operator and applicant; USCG documentation, state license, or registration number; home port; length of vessel and propulsion type (*i.e.,* motor or sail); number of divers; and the requested effective date and duration of permit (two weeks, maximum). The Sanctuary Superintendent will issue a permit to the owner or to the owner's

representative for the vessel when all applicable information has been provided. FKNMS will provide a permit number to the applicant and confirm the effective date and duration period of the permit. Written confirmation of permit issuance will be provided upon request. Permit holders must notify FKNMS staff at the Dry Tortugas National Park office by telephone or radio no less than 30 minutes and no more than six hours, before entering and upon leaving the Tortugas Ecological Reserve. Permit holders may leave and return to the Tortugas North area of the ecological reserve during the time their permit is effective.

Finally, the regulations add a new definition to 15 CFR 922.162, to define ''length overall (LOA) or length of a vessel.''

## VI. Differences Between the Proposed and Final Regulations

There are two primary differences between the proposed and final regulations. The first is a prohibition on all activities in Tortugas South, including non-consumptive diving. The proposed regulations would have allowed non-consumptive activities in Tortugas South including diving. The second is that the prohibition on fishing does not exclude fishing in the Tortugas Ecological Reserve that might be authorized by NMFS under 50 CFR parts 622 and 635. The final regulation applies the existing ecological reserve regulations at § 922.164(d)(iii) to prohibit fishing in the Reserve. This is consistent with the Gulf of Mexico Fishery Management Council's recommendation for a total ban on all fishing in the Reserve. As discussed in the preamble, no-take protection for the critically important coral reef ecosystem of the Tortugas is necessary to preserve the richness of species and help the fish stocks in the Tortugas and throughout the Florida Keys. Preservation of the full biodiversity of the area cannot be accomplished if exceptions are made to the no-take prohibition. Additional changes to the regulations have been made to correct errors, provide clarification and reflect more accurate boundary coordinate data.

## VII. Summary of Comments and Responses

More than 4,000 comments were received on the DSEIS/SMP and the proposed implementing regulations for the proposed Tortugas Ecological Reserve. All comments received were treated as being directed to both the DSEIS/SMP and the proposed regulations. Almost 3000 of the comments were form letters expressing general support for the creation of the Tortugas Ecological Reserve. Two hundred and forty-five persons commented by signing a petition. The substantive comments received are summarized below followed by the agency's responses. Multiple but similar comments have been treated as one comment for purposes of response. Comments merely stating personal support or opposition to the establishment of the proposed Tortugas Ecological Reserve and comments supporting the process employed or complimenting the many individuals who participated in that process, while certainly appreciated, do not require responses. Comments beyond the scope of the proposed action, such as establishment of an ecological reserve within the Dry Tortugas National Park, establishing more ecological reserves in the Sanctuary, or making the entire Sanctuary a ''no-take'' zone, are neither summarized nor responded to. No comments were received on the Initial Regulatory Flexibility Act Analysis (IFRA) per se. However, a number of the comments requested changes to the Preferred Alternative because of impacts on users, all of which are considered small entities for purposes of the Regulatory Flexibility Act. Comments 1, 3, 4, 9, 13, 16–19, 21–23, 36, 41–43, and 50 and the responses thereto summarize the significant issues raised by those comments and the assessment of the agency of such issues. Although changes were made to the proposed regulations, no changes were made as a result of those comments.

*Comment 1:* A commentor wrote on behalf of over 100 commercial fishermen who are opposed to ecological reserves in the Sanctuary. They believe that ecological reserves are unnecessary for stock or environmental preservation and that reserves are a ''back-door'' approach to the eventual elimination of all commercial fishing within the Sanctuary. They believe that the statement in the DSEIS that the Tortugas process was a joint effort with the commercial fishing industry is misleading and highly offensive to the rank and file fishermen who oppose the reserve. The commentor stated that he did not participate in the process because he believed that establishment of the Tortugas Ecological Reserve was a ''done deal'' from the beginning. He requested that the FSEIS not state that establishment of the Reserve was supported by the commercial fishing industry.

*Response:* NOAA disagrees. NOAA recognizes that some individual fishermen oppose reserves in the Sanctuary. However, NOAA worked with leaders in the commercial fishing industry who served on the Sanctuary Advisory Council, as well as the Tortugas 2000 Working Group. The commercial fishing representatives contacted other commercial fishermen for their input into the Tortugas 2000 process. Dozens of commercial fishermen participated in the process to draft the boundary alternatives for the proposed Tortugas Ecological Reserve. NOAA also worked cooperatively with the Gulf of Mexico Fishery Management Council in the development of the Reserve.

The successful use of ecological reserves or marine reserves as management tools to conserve, protect, and preserve stocks and marine environments is documented in the scientific literature. NOAA has its own positive experiences with the use of ''no-take'' reserves in the FKNMS since July 1997, as data from scientific research and monitoring of these areas supports the positive benefits of reserves. The Tortugas Ecological Reserve is proposed to protect remote areas that include varied habitats, exceptional coral reefs, and excellent water quality.

NOAA strongly disagrees that reserves are a ''back-door'' approach to the eventual elimination of commercial fishing in the Sanctuary. The proposal in no way represents an effort to eliminate commercial fishing from the rest of the Sanctuary. Including the Tortugas Reserve, approximately 6% of the total geographical area of the Sanctuary will be closed to fishing.

NOAA recognizes that some of the commercial fishing that formerly occurred in the Reserve will relocate to other areas within and outside the Sanctuary.

*Comment 2:* NOAA should select Boundary Alternative III (Preferred Boundary Alternative). This alternative provides distinct longitudinal and latitudinal boundary lines for both compliance and enforcement purposes; incorporates important benthic communities that serve as critical foraging areas for coral reef species; provides important buffer areas to the critical coral reef community; protects Riley's Hump, a known fish aggregating and fish spawning site; and protects a wide range of deep water coral reef habitats.

*Response:* NOAA agrees. Boundary Alternative III remains the Preferred Boundary Alternative. The protection of the diverse and productive benthic communities of the Tortugas region is consistent with the FKNMSPA and NMSA, and it is therefore critical that the full extent of coral reef and related

habitats lying within Boundary Alternative III be included in the Tortugas Ecological Reserve. Expansion of the Sanctuary boundary as proposed in the Preferred Boundary Alternative is necessary to include unique coral structures and significant habitats lying outside the present boundary, such as Sherwood Forest and Riley's Hump. The on-going and immediate threat of anchor damage and other direct human impacts to the coral reef community outside the existing Sanctuary boundary further supports the Preferred Alternative.

The provision of buffer areas within the design of the Tortugas Ecological Reserve is necessary for several reasons. NOAA has learned from the Western Sambo Ecological Reserve and the Sanctuary Preservation Areas that fishermen will fish along the boundaries of these areas due to the success of no-take areas in increasing fish and other marine life abundance. Without an adequate buffer, traps and other fishing gear could become entangled in coral, threatening the effectiveness of the Ecological Reserve. Several different groups of scientists over the past two years have documented shrimp nets entangled on sensitive coral reef habitat in the proposed Tortugas North portion of the Reserve.

Scientists conducting research in the area of the proposed Tortugas Ecological Reserve have found that benthic primary production provides the base for the food web on this portion of the west Florida shelf. They also found that high levels of fishery production associated with the live bottom habitats are in fact directly supported by the surrounding open sand, algae and seagrass communities in the area. Buffer areas that include these habitat types will contribute to the overall functionality of the Ecological Reserve.

The Tortugas North portion of the Ecological Reserve as contained in Boundary Alternative III (Preferred Boundary Alternative) consists of coral reef communities that are unparalleled in the Florida Keys in their diversity and composition. Several carbonate banks of varying size and depth (30 feet to 75 feet) and low relief hardbottom habitats with patches of sand and rubble characterize Tortugas North. The most prominent features in the Tortugas North reserve are Tortugas Bank and Sherwood Forest. Tortugas Bank crests at 66 feet and supports abundant attached reef organisms such as sponges, corals, and soft corals. North of Tortugas Bank, in an area previously believed to be composed only of sand, are several pinnacles covered with hard and soft corals and reef fish.

Sherwood Forest is an ancient stony coral forest exhibiting 30% or more bottom cover located along the western flank of Tortugas Bank. The top of Sherwood Forest rises to a depth of about 65 feet and covers an area of many acres. The area exhibits a complex habitat with various rock ledges, holes, and caves, providing hiding places for marine life. Unusual coral formations and previously unidentified coral species associations have been observed in this location. Gorgonians and black corals (Antipathies sp.), which are not common elsewhere in the Florida Keys, are also prolific. An abundance of groupers has been documented in Sherwood Forest as have sightings of uncommon and rare fish species such as jewfish, white-eyed goby, and orangeback bass.

The Tortugas South portion of the Ecological Reserve as contained in Boundary Alternative III (Preferred Boundary Alternative) includes a wide range of deep water coral reef habitats that will protect and conserve many rare and unusual reef species, and incorporates sufficient area to provide a buffer to the critical coral reef community. The upper portion of Tortugas South includes the relatively shallow Riley's Hump area in less than 100 feet of water. Riley's Hump consists of attached algae, scattered small coral colonies, sand, and hardbottom habitats. It is also a known fish aggregating and spawning site for several snapper-grouper species.

During the 2000 Sustainable Seas Expedition (SSE), submersible pilots explored the lower (southern) portions of Tortugas South. Deep reef habitats with numerous soft corals but few stony corals were found in depths from 200 to 400 feet. A series of small pinnacles that surround a larger seamount were identified as part of an east-west running ledge that begins around 250 feet and drops to close to 400 feet in a nearly vertical profile. This is unlike any other coral reef habitat discovered within Sanctuary waters. These complex habitats support numerous fish species including streamer bass, yellowmouth grouper, snowy grouper, scamp, speckled hind, creole fish, bank butterflyfish, amberjack, and almaco.

The deepest portions (1,600 to 1,800 feet) of Tortugas South encompass limestone ledges where unusual deep-dwelling sea life such as lantern fish (myctophids), tilefish, golden crabs, and giant isopods have been observed by submersible pilots. Contrary to some opinions that these depths were devoid of life, the sand bottom habitat was observed to be teeming with unique deep sea species of shrimp, fish, sea cucumbers, anemones, and crabs.

These critical deep water communities of Tortugas South are vulnerable to a wide range of impacts from fishing gear including deep water trawls and traps, and impacts from anchoring. Fishing gear impacts have been observed on sand and limestone substrates in some deep water areas.

In order for the Ecological Reserve to be biologically effective and to ensure protection and conservation of the full range of coral reef habitats and species in the Tortugas region, it is critical that all of the various benthic habitats and their associated marine communities, from the shallowest to the greatest depths, be included within the boundary of the Tortugas Ecological Reserve.

*Comment 3:* NOAA should select the No-Action Alternative I. NOAA should not expand the FKNMS boundary or create an ecological reserve. The reserve ''punishes the general public for the sins of commercial interests.''

*Response:* NOAA disagrees. If the no-action alternative is selected and the Sanctuary boundary is not expanded to create the Tortugas Ecological Reserve as contained in the Preferred Alternative, significant coral reef resources would be left at risk to physical destruction by ship and boat anchors and other human impacts including fishing. If the Sanctuary boundary is not expanded to include the geographical extent of the Tortugas Ecological Reserve as proposed in the Preferred Boundary Alternative (III), some of this nation's most significant coral reef resources would be left vulnerable (see environmental description contained in Response to Comment 2).

The Sanctuary boundary established by Congress in the FKNMSPA in 1990 was based upon the very best information available at the time related to the coral reef resources located to the far-western extent of the Florida Keys. Over the last decade scientists and managers have learned and documented a considerable amount about the existence of extensive and unique coral reef resources that are located outside the boundary of the FKNMS. This new information regarding those significant coral reef resources and the threats to them emphasizes the critical need to take action and protect them.

The Tortugas Ecological Reserve is intended to preserve for all, including future generations, the critical coral reef ecosystem of the Tortugas and the extraordinary resources and qualities that are found there. Consumptive recreational activities have resource

impacts that are inconsistent with the protection needed for these resources. All consumptive commercial and recreational activities are being prohibited in the Reserve. Most of the data used in the analysis of the environmental consequences and socio-economic impacts in the DSEIS/SMP refer to commercial activities because commercial activities represent the majority of use of the Tortugas area and because commercial data are more readily available.

*Comment 4:* NOAA should adopt Boundary Alternative II.

*Response:* NOAA disagrees. The benthic community contained within the boundary of Alternative II does not include the significant and biologically diverse coral community known as Sherwood Forest. Unless this area is included within the Ecological Reserve, some of this nation's most significant coral reef resources will not be adequately protected for future generations. These unique coral reefs comprise some of the most biologically diverse coral reef communities and best water quality in the Florida Keys. Failure to protect these unique coral reefs will result in their decline from a variety of human impacts.

Additionally, Boundary Alternative II does not contain Riley's Hump, a known fish aggregating and spawning site, or its adjacent deep water shelf communities. Boundary Alternative II would not offer protection and preservation of these unique deep water habitats and their associated fish and invertebrate species (see description contained in Response to Comment 2).

*Comment 5:* NOAA should adopt Boundary Alternative IV.

*Response:* NOAA disagrees. While this alternative would protect a larger area than the Preferred Alternative and provide greater ecological benefits, the adverse socio-economic impacts of this alternative on various fishing activities such as recreational charter fishing, commercial fishing, and spearfishing, would be significantly greater because all of Tortugas Bank would be closed to consumptive activities. On balance, the benefits of the increased area protected would be outweighed by the greater socio-economic costs.

*Comment 6:* NOAA should adopt Boundary Alternative V.

*Response:* NOAA disagrees. While Alternative V would protect an even larger area than Alternative IV, it would not protect the full range of critical deep water habitat at the southern end of Tortugas South that would be protected by Alternatives III and IV (see description contained in Response to Comment 2). While it would expand protection to the west, the majority of the benthic communities located there are not as threatened from direct impact as those located within the boundary of the Preferred Alternative. Alternative V would not result in significant increased protection to coral reef communities located outside Alternative III, yet would have increased socio-economic costs.

*Comment 7:* Alternatives IV and V are more consistent than Alternative III with the goals that the Sanctuary has set for the ecological reserve, in addition to being more consistent with Executive Order 13089 by protecting nationally significant coral reef resources.

*Response:* NOAA disagrees. See Responses to Comments 2, 5 and 6. Boundary Alternative III is the Preferred Boundary Alternative because it will protect ecosystem integrity; protect biodiversity; enhance scientific understanding of marine ecosystems; facilitate human uses to the extent consistent with the other objectives; minimize socio-economic impacts to the extent consistent with the other objectives; and facilitate enforcement and compliance. The Preferred Alternative is of sufficient size, together with the Dry Tortugas National Park, to protect all known nationally significant coral reef resources of the Tortugas region and fulfill the objectives of the FKNMSPA and the NMSA, while not unduly impacting user groups, and is consistent with Executive Order 13089.

The Preferred Boundary Alternative (Alternative III) provides an appropriate balance of significant resource protection while leaving other areas of Tortugas Bank available for consumptive uses, including commercial and recreational fishing, and spearfishing. A detailed comparison of the alternatives and an explanation for the selection of the Preferred Alternative is set forth in the FSEIS. The Preferred Boundary Alternative is consistent with the criteria and objectives established for selecting a Preferred Alternative.

*Comment 8:* NOAA should adopt Regulatory Alternative D (Preferred Regulatory Alternative).

*Response:* NOAA agrees. Regulatory Alternative D (Preferred Regulatory Alternative) differs from Regulatory Alternative C (the Preferred Regulatory Alternative in the DSEIS) by prohibiting all activities in Tortugas South except for continuous transit, law enforcement, and, pursuant to a sanctuary permit, scientific research and educational activities. Both Regulatory Alternatives C and D would prohibit any take. The reasons that Alternative D is now the Preferred Regulatory Alternative are to more fully protect fish spawning aggregations found on Riley's Hump, to permit effective enforcement of Tortugas South, the most remote region of the Sanctuary, and to provide a reference area for comparison to gauge the impacts of non-consumptive activities in Tortugas North. Riley's Hump is a known fish spawning aggregation site for at least five species of snapper and several species of grouper. Riley's Hump is also one of the only known spawning aggregation sites for mutton snapper, a highly targeted species for commercial fisheries.

*Comment 9:* NOAA should adopt Regulatory Alternative C.

*Response:* NOAA disagrees. See Response to Comment 8.

*Comment 10:* The resources in the Tortugas area are in good shape overall and do not need the protection of an ecological reserve. The size and number of recreationally and commercially important species of fish remain healthy.

*Response:* The importance of the resources of the Tortugas region to the rest of the Florida Keys is documented throughout the DSEIS and FSEIS. Over the past few decades the Florida Keys have experienced a significant increase in visitation, particularly at Dry Tortugas National Park where visitation increased 300% from 1984 to 1998 (18,000 to 72,000 visitors). The current population of South Florida of approximately 6 million is expected to double by 2050. It is likely that population pressures, increase in tourism, and improved boating and fishing technology making it easier for more people to regularly visit the same remote sites, located well offshore, will result in greater visitation and pressure on the resources of the Tortugas area. By protecting the resources of the Tortugas area now, NOAA will be able to maintain them in a nearly pristine state, for the benefit of present and future generations. The protection of areas of the marine environment of special national significance due to their resource or human use values, such as the Tortugas region, is consistent with the FKNMSPA and NMSA.

Fisheries biologists have documented alarming declines in the size and abundance of commercially and recreationally important species of snapper, grouper, and grunts throughout the Florida Keys including the Tortugas region.

*Comment 11:* NOAA must provide an adequate number of mooring buoys in the Reserve. One commentor suggested that NOAA place at least 25 buoys in Tortugas North and a lesser number in

Tortugas South. Several commentors suggested rotation of mooring buoys.

*Response:* NOAA agrees that an adequate number of mooring buoys will have to be provided in Tortugas North. It is not now known how many mooring buoys will be needed and where they should be installed. Some buoys will be installed at the more popular dive locations in Tortugas North prior to the effective date of the regulations. Non-consumptive users, such as dive charter operators, will be consulted to determine a desirable number and appropriate locations for buoys. The rotation of mooring buoys will be considered.

It has not yet been determined whether buoys will be installed in Tortugas South because, under the Preferred Alternative, diving will only be allowed for scientific research and educational purposes. Submerged moorings (*i.e.,* moorings located beneath the surface) are being considered as a means to facilitate scientific research activities in this portion of the Ecological Reserve.

*Comment 12:* Non-consumptive diving should be prohibited throughout the Reserve to prevent any disturbance to the ecosystem. Even non-consumptive diving activity can cause substantial damage to corals.

*Response:* Prohibiting non-consumptive diving in Tortugas North is not needed to protect the resources or their ecosystem. One of the basic tenets of the FKNMSPA, the NMSA and indeed the Designation Document for the FKNMS, is to allow activities in the Sanctuary that do not cause an adverse effect on the resources or qualities of the Sanctuary, or that do not pose a threat of harm to users of the Sanctuary. However, the resources of Tortugas South, particularly the spawning aggregation areas, are unique and warrant the additional protection of prohibiting diving. Enforcement surveillance in this remote part of the Reserve would be facilitated by prohibiting all activities in Tortugas South except for continuous transit, law enforcement, and, pursuant to a sanctuary permit, scientific research and educational activities. Additionally, prohibiting diving in Tortugas South will provide a baseline to gauge the effects of non-consumptive activities on the resources in Tortugas North.

Tortugas North is less remote and protection and conservation can be more easily afforded to it than to Tortugas South. Allowing non-consumptive diving that is carefully monitored in Tortugas North will provide significant educational and resource appreciation benefits. Further, prohibiting non-consumptive diving in Tortugas North would unnecessarily increase adverse socio-economic impacts on charter dive operators without providing corresponding resource protection. The permit system for Tortugas North will allow the level of diving activity to be monitored, and combined with the reference of Tortugas South, will allow the effects of non-consumptive diving on resources in Tortugas North to be determined.

Education and outreach programs are being implemented that will continue to raise the awareness of divers about the potential impact from their activity on coral reefs. The presence of ''no-take'' divers in the Reserve is viewed by marine reserve experts as important to help convey the message of the benefits of marine reserves.

*Comment 13:* NOAA should prohibit commercial fishing in the Tortugas Ecological Reserve but allow recreational fishing, especially catch-and-release fishing. Recreational spearfishing should be allowed in the Reserve because it has little impact on the fish populations of the Tortugas region.

*Response:* NOAA disagrees. No-take protection for the critically important coral reef ecosystem of the Tortugas is necessary to preserve the richness of species and health of fish stocks in the Tortugas and throughout the Florida Keys. Preservation of the full biodiversity of the area cannot be accomplished if exceptions are made to the ''no-take'' prohibition.

Even catch-and-release fishing can result in direct and indirect mortality. According to biologists, release mortality can be a significant contribution to total mortality depending on the intensity of fishing. Reef fishes are particularly vulnerable to catch-and-release mortality because of their behavior, long lives, and ecology. Fisheries biologists have reported mortalities ranging from 15–30% of fish that are caught and released. One study suggests high mortality for Barracuda that fight for an extended period.

Spearfishers tend to target the largest members of particular species. Scientists have demonstrated the impact spearfishing activities have of removing top predators in the food chain. The selective removal of the largest individuals of a fish species by spearfishing affects the over-all trophic structure of coral reef communities. Spearfishing charters in the Tortugas region, in particular, often target ''trophy'' fish for their customers. Research at the Looe Key National Marine Sanctuary between 1983 and 1985 demonstrated a marked increase in fish populations after spearfishing was prohibited. Continued spearfishing in the Tortugas Reserve would adversely affect fish populations and undermine the ecological integrity of the Reserve.

Impacts from commercial and recreational fishing activities are occurring in the Tortugas, where the average size of black grouper has decreased from 22.5 pounds to 9 pounds. The scientific literature as well as NOAA's own experience in the Sanctuary have shown that prohibiting fishing in select areas directly benefits species abundance, size and diversity. Prohibiting all consumptive activities, including commercial and recreational fishing, will greatly help the species within the Reserve achieve greater ecological and demographic potential. As described in the FSEIS, this should result in benefits to some fish populations outside the Reserve. Prohibiting all forms of take will also yield significant scientific benefits because the Reserve will more accurately reflect a natural system against which the effects of extractive human activities can be compared.

In addition, enforcement of the remote Tortugas Ecological Reserve would be complicated significantly if limited extractive activities such as catch and release fishing or spearfishing were not prohibited. NOAA's experience with the existing Sanctuary Preservation Areas is that no-take regulations are more easily enforced and gain more compliance and acceptance from visitors than areas that allow varying extractive activities.

*Comment 14:* Adequate law enforcement cannot be provided for the Tortugas Ecological Reserve. The 90+ square mile Oculina Marine Reserve off Fort Pierce is unenforceable and the Tortugas Reserve will be, also.

*Response:* NOAA disagrees. The proposed Tortugas Ecological Reserve is substantially different with respect to enforcement than the Oculina Marine Reserve. The Oculina Reserve is located in a remote area, well offshore of the east coast of Florida. It is not associated with an existing marine protected area and does not have the benefits of all the management programs that help increase the public's awareness of the reserve and the regulations with which they must comply. Education and outreach are important tools that help to gain the compliance of the general public, the majority of which are law-abiding citizens. The Management Plan commits substantial enforcement resources for the Reserve.

As set forth in the Enforcement Action Plan of the Supplemental Management Plan, one of the goals of

Sanctuary management is to gain the highest level of compliance by the public who enter and visit the Tortugas Ecological Reserve. This compliance can be achieved through several management actions including education and outreach and on-the-water presence of Sanctuary staff in programs such as Team OCEAN, where Sanctuary information is distributed along the waterfront or boat to boat by Sanctuary staff and volunteers.

The most effective management action that can be used to achieve compliance to Sanctuary regulations is an effective law enforcement program. Currently, the primary enforcement of Sanctuary regulations is accomplished through an enforcement agreement between NOAA/National Marine Sanctuary Program and the State of Florida Fish and Wildlife Conservation Commission. The enforcement efforts are consistent with the goals and objectives for enforcement described in the Final Management Plan for the FKNMS (July 1997). The Final Management Plan for the Sanctuary also calls for cross-deputization of other agency law enforcement personnel (*e.g.,* National Park Service Rangers) to accomplish law enforcement responsibilities within the Sanctuary. This approach to enforcement continues to remain an option.

A successful Ecological Reserve will depend to a large extent on the level of enforcement resources dedicated to the Reserve. Several enforcement options are presently available and are being evaluated for deployment in the Reserve. These options include:

- Installation and monitoring of a long-range radar unit at the Dry Tortugas National Park. This would allow remote monitoring of vessels entering and leaving the Reserve.
- Place two 82' vessels into service for patrolling the Ecological Reserve.
- Cross-deputize and fund National Park Service Rangers to assist in enforcement in the Tortugas Ecological Reserve.

Prohibiting vessels from stopping within Tortugas South except pursuant to a valid sanctuary permit for scientific research or educational activities will facilitate enforcement. This will make it possible to monitor vessel traffic remotely by radar and response will only be necessary when vessels without a permit stop within the reserve.

The permit system for Tortugas North will help Sanctuary managers monitor the level of visitor use in the reserve and facilitate enforcement efforts.

As set forth in the Management Plan for the Reserve, the law enforcement budget is as follows:

Personnel

Law Enforcement Officers (4–6) $50,000 per position
General Support $50,000

Vessels

82' Patrol Vessels (2) No Cost—Agency Property Transfer

*Comment 15:* The economic analysis contained in the DSEIS/SMP did not adequately consider activities of fishing clubs in the Tortugas Ecological Reserve Study Area. In public testimony, one fishing club estimated that its membership had 673 person-days of fishing in the Dry Tortugas National Park area in 1998 and was not contacted for input for the socio-economic analyses.

*Response:* The recreational use of the Tortugas region has been adjusted in the socio-economic impact analysis in the FSEIS/SMP to reflect this comment. In preparing the DSEIS/SMP, NOAA staff relied on directory assistance search to locate private fishing clubs. Only one was found, and that was in Miami. The president of that club indicated that very few if any of its members went to the Dry Tortugas region. He provided names of a few members who were knowledgeable of the region's fishing patterns. Phone calls to these contacts produced no new information and their names were not kept. Additionally, commercial operators who work in the Tortugas area were asked if they saw other boats in the Tortugas but outside the boundaries of the Dry Tortugas National Park. They consistently said that they did not. Some members of the club said they fished in the National Park, but not in the Tortugas Ecological Reserve Study Area (TERSA). NOAA was not able to identify any private households that did any activity in the TERSA.

*Comment 16:* Representatives of shrimping activities criticized the socio-economic impact analyses on the shrimp industry provided in Leeworthy and Wiley (October 1999). First, they claim that the total catch estimate of 58,374 pounds of shrimp from the area within the Preferred Boundary Alternative should be one million pounds instead. Second, they claim the prices for shrimp used were incorrect and a higher price should have been used. Third, they claim that the assumption that shrimp lost from the no-take areas could be caught elsewhere is incorrect.

*Response:* The use of the total catch estimate of 58,374 pounds of shrimp caught in the area within the Preferred Boundary Alternative is valid. The commentors offered no quantitative support to justify their assertion that the estimate should be one million pounds. The only information they offered was boat tracking data. No quantities of catch were offered, only that 30 percent of their fishing time was spent in the Tortugas North area. The sample of shrimp fishermen used in the socio-economic impact analysis accounted for 90 percent of the 58,374 pounds that was estimated. Non-sampled fishermen, including those that landed shrimp in counties other than Monroe and Lee (*i.e.,* Hillsborough, Pinellas and Franklin) accounted for the other 10 percent. If all the shrimp catch from the non-sampled population estimated in the TERSA were caught in the area within the Preferred Boundary Alternative, this would only amount to 71,500 pounds. If 30 percent of all the shrimp caught in the Florida Marine Research Institute (FMRI) areas 2.0 and 2.9 and landed in Hillsborough, Pinellas and Franklin counties (183,319 pounds) were caught from the area within the Preferred Boundary Alternative, this would only amount to 54,996 pounds. None of these estimates support an estimate of one million pounds. Not even all the shrimp catch estimated in the TERSA (715,500 pounds) is close to the one million pound estimate and the economists' sample accounted for 90 percent of all the shrimp caught in FMRI areas 2.0 and 2.9.

NOAA economists used an average price per pound at the ex-vessel level of $2.40. This estimate was derived from the NMFS landings and ex-vessel value reported for Monroe County for the year 1997. The landings for Monroe County were reported in a mix of heads-on and heads-off (tails). NOAA economists converted all weights to heads-on before deriving the price per pound (price per pound is equal to total ex-vessel value divided by total pounds of heads-on weight). Data provided by the commentors included a table showing pounds and ex-vessel value from the National Marine Fisheries Service (NMFS) and yields an average price of $4.31 per pound. Both of these prices are correct, however the commentors did not specify the geographic region or the species mix of the sample with which they calculated their price. Furthermore, the NMFS weights cited by the commentors are heads-off weight, whereas the socio-economic analysis used heads-on weight. Most of the shrimp caught in the TERSA was landed in either Monroe County (Stock Island) or in Lee County (Ft. Myers Beach). NOAA economists concluded that the Monroe County landings price per

pound was the appropriate price to use in the analysis.

The commentors stated that lost catch cannot be replaced by catch from other areas. This presumes that they are fishing all areas as intensely as they can be fished. This is why the socio-economic study uses 58,374 pounds of shrimp as the upper bound estimate of maximum potential loss of from the Preferred Boundary Alternative.

*Comment 17:* Shrimping should not be prohibited in areas outside the 20 fathom contour at the western end of the Tortugas North because these are not areas of high environmental value or special ecological sensitivity. The eastern boundary of Tortugas North, above the DRTO, should be moved to the west from 82E 47′ to 82E 57′ to accommodate shrimping. Shrimpers are already prohibited from fishing within a 3 million acre Tortugas Shrimp Nursery year-round in State waters and seasonally in EEZ waters. Shrimpers cannot afford to be excluded from any additional areas in the Tortugas region.

*Response:* A substantial sand buffer area around the coral reef community is needed to provide foraging areas for reef inhabitants without the potential of capture by shrimp trawling. Additionally, the bycatch of shrimping activities is well-known and documented. Trawling outside the 20 fathom contour at the western end of Tortugas North or moving the eastern boundary of Tortugas North to the west would result in mortality of reef fish species and other reef inhabitants through bycatch. Other shrimp fishermen have questioned the need to move the eastern boundary of Tortugas North in light of the bathymetric profile in this area.

Scientists have discovered and documented the remains of shrimp nets entangled around living corals in the proposed Tortugas Ecological Reserve. It is well known and stated by shrimp trawlers that they do not trawl on coral reefs. However, they do trawl off the reefs. Prohibiting shrimping in the Reserve will eliminate the incidental impact of shrimping gear to the living coral reefs.

Preservation of the richness of the species and health of the fish stocks in the Tortugas region and throughout the Florida Keys, and indeed preservation of the biodiversity of the Tortugas region, cannot be accomplished if only the coral reefs are protected. The protection of diverse habitats including sand and other benthic habitats is essential. A recent scientific study has substantiated the importance of sand and other ''barren'' habitats to the ecology of the west shelf of Florida. Scientists conducting research in the proposed Tortugas Ecological Reserve have found that benthic primary production provides the base for the food web on this portion of the west Florida shelf. They also found that high levels of fishery production associated with the live bottom habitats are in fact directly supported by the surrounding open sand, algae and seagrass communities in the area.

*Comment 18:* Shrimpers were not, but should have been, represented on the Tortugas 2000 Working Group.

*Response:* Prior to the establishment of the Working Group, shrimpers stated that the 110 square mile area to the east of the Dry Tortugas National Park originally proposed for the ecological reserve should not be established because it would have an adverse economic impact on their shrimping. In response to them and to other fishers, NOAA did not include this area in the proposed ecological reserve.

Commercial fishing representatives on the Tortugas 2000 Working Group communicated with and received input from shrimpers regarding the proposal and reported this information back to the Working Group. Shrimpers, when shown the proposed boundaries, expressed no concern over the proposed Tortugas Ecological Reserve boundaries. No shrimper expressed an interest in participating in the Tortugas Working Group.

Additionally, 18 of the 28 shrimp operations known to fish in the area were interviewed by NOAA economists. These operations accounted for 65 of the 75 shrimp vessels and 193 of the 213 captains or crew that fish in the TERSA.

*Comment 19:* The following comments were provided by a charter spearfishing operation:

1. The majority of the reefs where the company takes passengers spearfishing are in the proposed Reserve area. Areas south of Fort Jefferson (not on Tortugas Bank) are not suitable for spearfishing because they are too deep and therefore unsafe, and have poor visibility. The Tortugas Bank area south of the proposed Reserve (south of 24E 30′) is mostly sand and low patch reef, with poor conditions for spearfishing.

2. The company provided detailed information to NOAA regarding the number of trips, days, and passengers the company takes. The survey that was done on the company in 1988 indicates 60 trips per year, 180 days with 550 divers. The information on pages 46 and 47 of the DSEIS is incorrect. The DSEIS does not reflect the company's information and it appears that deliberately falsified information was provided to the Working Group. The Working Group was provided incorrect information regarding the socio-economic impact on small businesses creating a false impression that small businesses would not be negatively impacted.

3. The commentor questioned the data attributed to one of the other two operators. The commentor requested the identity of the operator.

4. The company will go out of business and its employees will lose their jobs if it cannot conduct spearfishing charters in the area of the proposed Reserve, because 90% of the company's business is on the reefs north of latitude 24E 39′. South of that area are sandy patch reefs. A permit should be issued to the company allowing it to continue its business or the southern boundary of Tortugas North should be moved to 24E 40′ 50″N.

5. The DSEIS does not reflect that the company conducts approximately 30 spearfishing trips per year on Riley's Hump.

6. The commentor challenged specific conclusions regarding his business at pages 46, 47, and 123 of the DSEIS, which indicate a maximum potential loss of $13,700.00 of lost revenue and $5,580.00 of lost profits. The commentor claims that his business has grown significantly and that he now operates in the Tortugas more than 260 days per year. He states that he would lose $288,000.00 in revenues and experience a potential profit loss of $144,000.00. The real potential loss could be $460,000.

7. The figures on the Nitrox membrane system are not accurate. The amount should be increased by $10,000.

8. Statements about increased visits to Dry Tortugas National Park are misleading because most visitors only go to Garden Key because of the daily ferry boat service from Key West. These visitors never leave the island and do not impact the reefs.

*Response:* The DSEIS reports a total maximum potential adverse impact on spearfishing revenues of $66,816 for Boundary Alternatives II and III, $196,944 for Alternative IV, and $230,380 for Alternative V. The analysis and estimates of impacts were based upon survey data collected in 1998 and included information provided by three spearfishing operators. Data provided by the company submitting the above comment indicated that it operated in 48 one square nautical mile grid cells identified in the study area. Boundary Alternatives II and III would exclude the company from only 8 of those grid cells (16.67%). Alternative IV would exclude the company from 26 grid cells (54.17%) and Alternative V would

exclude the company from 29 of the 48 grid cells (60.42%). The DSEIS and information provided to the Working Group accurately reflect the information that was reported by the three operators in response to the survey.

The impact estimates in the DSEIS are the maximum losses from displacement of the consumptive recreational activities. Based on the existing patterns of use provided by each of the three operators, it was concluded that they could relocate to other sites in the study area that they indicated they are using and completely offset their losses. While monitoring would be required to verify this conclusion, the estimates of maximum potential loss in the DSEIS represent the upper bound of potential losses based on the data collected in 1998. The FSEIS has been revised based on the assumed validity of the more recent data provided by the commentor. While it is hoped that the spearfishing operators will be able to shift to different locations and to different economic activities (such as non-consumptive dive charters), the need to protect the ecosystem of the Tortugas Ecological Reserve from the impacts of spearfishing justifies the adverse economic impacts on the operators. See also the Response to Comment 13.

NOAA accurately forwarded information to the Working Group. No information was falsified.

The laws governing the collection of business information by the government prevent the disclosure of proprietary information.

The cost estimate for the Nitrox system has been revised.

The overall trend in tourism at Dry Tortugas National Park suggests increased visitor use in the Tortugas area, particularly with the ability of larger, faster vessels from Key West to reach the Park and reef areas beyond the Park. See Response to Comment 10. One company has indicated that its business has increased in the Tortugas area in the last two years.

*Comment 20:* The National Marine Fisheries Service (NMFS) commented that it is incorrect to state, ''the National Marine Fisheries Service (NMFS) is amending the Final Fishery Management Plan for Atlantic Tunas, Swordfish and Sharks (FMP) and its implementing regulations to be consistent with the no-take status of the proposed reserve.''

*Response:* The FSEIS/SMP has been corrected to reflect this, as it is not necessary under that FMP's framework provision to amend the FMP.

*Comment 21:* NMFS stated that there is a lack of analyses of impacts on commercial and other fishermen and businesses from other counties who may be displaced by the proposed Reserve.

*Response:* The socio-economic analyses includes catch landed in Monroe, Collier and Lee Counties from each boundary alternative. Catch from the Tortugas that was landed in other counties was insignificant. The quantities and values cited by NMFS are irrelevant as far as impact, since the numbers referred to measure the total catch from FMRI areas 2.0 and 2.9. In Leeworthy and Wiley (October 1999), a set of steps are described showing how they estimated the proportion of this catch from the Tortugas Ecological Reserve Study Area (TERSA). The TERSA is a 1,020 $nm^2$ area and is a sub-set of the larger FMRI Areas 2.0 and 2.9. They estimated how much of the TERSA catch was caught in each boundary alternative. These are the relevant numbers for potential impact. They included all catch landed in all counties but only reported estimates of impact for Monroe, Collier and Lee counties because the catch in all other counties impacted was not significant. Below are summarized the steps used in estimating the impacts from shrimp catch since it was the most valuable portion of total catch, but the same procedures were followed for all species.

*Steps in Estimating Economic Impact*

*Step 1.* Examine Landings Data in FMRI Areas 2.0 and 2.9 FMRI areas 2.0 and 2.9 represent a large area generally referred to as the Tortugas, but also include the Marquesas. FMRI keeps landings and value information for this large statistical grid from Florida's trip ticket. The landings cited by NMFS for FMRI areas 2.0 and 2.9 are correct. But these values do not represent impact by the proposed Tortugas Ecological Reserve. Only a small portion of these landings are impacted by any of the proposed boundary alternatives.

*Step 2.* Examine Landings from the Tortugas Ecological Reserve Study Area (TERSA). Leeworthy and Wiley selected a portion of FMRI Areas 2.0 and 2.9 for the study area and a 1,020 nautical square mile area, called the Tortugas Ecological Reserve Study Area (TERSA). NOAA attempted to collect information on catch from all commercial fishermen that reported catch from FMRI areas 2.0 and 2.9. Thomas Murray and Associates limited the sample to those in Monroe, Dade, Collier and Lee counties for cost reasons and because the catch from FMRI areas 2.0 and 2.9 landed outside Monroe, Collier and Lee counties was only a small proportion of total catch. For example, 97.21 percent of the shrimp caught in FMRI areas 2.0 and 2.9 was landed in Monroe and Lee counties. The other 2.79 percent was landed in Hillsborough, Pinellas and Franklin counties which amounted to 183,319 pounds valued at $450,021.

The sample of shrimp fishermen included 18 of the 28 shrimp operations known to fish in FMRI areas 2.0 and 2.9. These 18 operations accounted for 65 of the 75 shrimp vessels and 193 of the 213 captain or crew shrimping in the area. The sample accounted for over 90 percent of the shrimp catch in FMRI areas 2.0 and 2.9.

The sample indicated they caught only 10 percent of all their catch from FMRI areas 2.0 and 2.9 in the TERSA. Using an average of 1997–1998 catch in FMRI areas 2.0 and 2.9, Leeworthy and Wiley estimated that 715,500 pounds of shrimp were caught from the TERSA. This amount includes those amounts landed in all counties of Florida, not just Monroe and Lee counties. NOAA used a factor of 1.10 to account for the non-sampled shrimp catch. This factor was applied to each one square mile grid cell to extrapolate sampled shrimp catch to the total population estimate of shrimp catch. See Leeworthy and Wiley (October 1999). The 715,000 pounds of shrimp caught in the TERSA still do not represent impacted catch, it simply represents the total amount estimated for the study area.

*Step 3.* Examine Landings Potentially Impacted by a Particular Boundary Alternative for the No-Take Area.

The spatial distribution of shrimp catch from our sample of shrimpers was used to derive the distribution of all shrimp catch for the TERSA. The Leeworthy and Wiley sample accounted for 665,500 pounds of the total of 715,500 pounds of shrimp catch estimated for the TERSA. The key assumption used was that the non-sampled catch had the same distribution as the sampled catch.

Catch within a boundary alternative was labeled maximum potential loss under the assumption that all catch within the no-take area could not be replaced. For the Preferred Boundary Alternative, they estimated the maximum potential loss of 58,374 pounds of shrimp. This amount includes catch landed in all counties of Florida including Monroe, Lee, Hillsborough, Pinellas and Franklin counties. Since 2.79 percent of the total shrimp catch from FMRI areas 2.0 and 2.9 was landed in Hillsborough, Pinellas and Franklin counties, this would imply that only 1,629 pounds of shrimp (.0279 times 58,374) valued at $3,910 would be lost from the three counties. Given the insignificance of this amount, they did not present separate estimates of this

impact in Leeworthy and Wiley (October 1999). Actually, Leeworthy and Wiley included the amounts in the impacts for Monroe, Collier and Lee counties, thus slightly overstating the impacts in these counties. But again, these amounts are insignificant.

The same procedures were followed for finfish and all other species and are documented in Leeworthy and Wiley (October 1999). The document Proposed Tortugas 2000 Ecological Reserve, Draft Socio-economic Impact Analysis of Alternatives, October 1999 by Dr. Vernon R. (Bob) Leeworthy and Peter C. Wiley can be found at http://www-orca.nos.noaa.gov/projects/econkeys.econkeys.html.

*Comment 22:* NMFS stated that ''the economic outcomes relative to private recreational fishing and diving do not appear to be addressed.''

*Response:* Leeworthy and Wiley (October 1999) and the DSEIS documented that no information could be found to support private household use for any recreational activity in the TERSA. Leeworthy and Wiley identified the known population of charter/party operators in the TERSA. The Rod and Reel Club, Inc. in Miami, Florida, provided other contacts and which also reported no activity in the TERSA. Leeworthy and Wiley found that although some members of the club occasionally went to the Dry Tortugas National Park, they did not fish in the TERSA. In addition, each of the commercial operators that operated in the TERSA was asked whether s/he had seen any private household boats in the TERSA and all reported seeing each other, but no private household boats. Leeworthy and Wiley concluded that the private household boat usage, if it existed at all, was insignificant. In this case, usage was close enough to zero to be treated as zero.

*Comment 23:* NMFS stated that the DSEIS lacks an analysis of community impacts and should be analyzed at the City or Census Designated Place level.

*Response:* Leeworthy and Wiley had Thomas Murray and Associates go back to the data and assign FIPSCODES for City and Census Designated Places for where commercial fishermen live and where they landed their catch. They did the same for recreational charter boat operations.

*Comment 24:* The United States Environmental Protection Agency (EPA) rated the DSEIS as ''EC–2'' which means EPA has environmental concerns regarding the proposed Reserve, and believes more information is needed to fully assess the impacts. In particular, EPA stated further details are needed regarding measurable activities that could be used to manage natural resources in the Reserve, such as the number of permits NOAA plans to issue and the amount of visitor education/communication expected. Information should also be given regarding the frequency of ecological monitoring activities. It would also be helpful if the FSEIS included a map that showed the formerly proposed area that was in the Draft EIS and DMP for the FKNMS (1997) but that was later rejected, as compared to the Preferred Alternative in the DSEIS (2000), explaining how the Preferred Alternative protects the environment and prevents adverse economic impacts, as contrasted with the former proposal.

*Response:* At this time, there are no plans to limit the number of access permits for Tortugas North. However, as described in the Final Supplemental Management Plan, it will be possible to use the access permit system to determine the number of divers visiting Tortugas North annually and the areas in the vicinity of mooring buoys will be examined as primary sites for diver impact. This will enable sites to be monitored for impacts from diving. This information can then be used to determine whether it is necessary to limit the number of access permits for those who visit Tortugas North. The questions regarding public education and outreach and the frequency of ecological monitoring have also been addressed in the Education and Outreach Action Plan and Research and Monitoring Action Plan of the FSEIS/SMP. A map showing the previously considered site for the Reserve has not been added to the FSEIS because NOAA believes it would confuse the public with regards to the current Ecological Reserve proposal.

*Comment 25:* The United States Department of the Interior, Fish and Wildlife Service, commented that the importance of the Tortugas area as a spawning site and as a ''source'' reef for the fish communities found in the Key West and Great White Heron National Wildlife Refuges is just beginning to be understood scientifically. The ability of the Refuges to maintain a healthy ecosystem for the wildlife that inhabit them is directly dependent upon a healthy marine component. The avian resources of the Refuges feed upon the fish communities of the Refuges. Those fish communities depend upon a healthy ''upstream'' ecosystem, which includes the Tortugas region. Marine reserves are a viable tool for resource protection. The protection of marine resources in the Tortugas region will benefit the Refuges. Because of this, the USFWS endorses the Tortugas 2000 Preferred Alternative and proposed rules.

*Response:* The FSEIS has been revised to reflect the importance of the Tortugas area to the Key West and Great White Heron National Wildlife Refuges. It is recognized that the Tortugas Ecological Reserve will serve as important feeding grounds for many bird species that frequent the Key West and Great White Heron National Wildlife Refuges. Additionally, several threatened and endangered sea turtles that nest in the Key West National Wildlife Refuge spend a portion of their life cycle in the Tortugas Ecological Reserve region.

*Comment 26:* The Florida Fish and Wildlife Conservation Commission (FWC) was concerned that no limits were being placed on the level of non-consumptive diving that would be allowed. The FWC stated that non-consumptive diving results in some morbidity and mortality to coral reef habitat and asked that controls be placed on the number of divers and dive trips to assure minimal acceptable damage to the habitat. The FWC was also concerned over the adequacy of the enforcement resources. The FWC believes that the minimal enforcement resources needed to enforce the Reserve would be two vessels 50 feet or greater in length with a Lieutenant and two officers for each vessel. The FWC encourages NOAA to work with it to develop these enforcement resources in order to assure the success of the reserve.

*Response:* Regulatory Alternative D allowing non-consumptive diving in Tortugas North but closing Tortugas South to all diving except for scientific research or educational purposes, pursuant to a valid sanctuary permit, provides an appropriate degree of public access. See Response to Comment 12 regarding non-consumptive diving in the Reserve. If the monitoring of impacts from non-consumptive diving in Tortugas North demonstrates that its carrying capacity is being exceeded, limits can be imposed. See Response to Comment 14 regarding the Enforcement Action Plan for the Tortugas Reserve. NOAA will work with the FWC and its other enforcement partners to develop the enforcement resources that all agree are necessary to assure the success of the Reserve.

*Comment 27:* The Gulf of Mexico Fishery Management Council (GMFMC) requested that the Sanctuary Program use its authority to prohibit anchoring and all diving within the portions of Tortugas North and Tortugas South that are within the Council's jurisdiction (all of Tortugas South and 13 $nm^2$ of Tortugas North). Non-consumptive

diving can impact and damage bottom habitat through the inadvertent touching of corals or the stirring up of sand and silt on the bottom. Non-consumptive diving can adversely affect sensitive habitats, the normal behavior of fish, and spawning activity. Anchoring and non-consumptive diving could also adversely affect essential fish habitat in the Reserve. In addition, if non-consumptive diving is allowed, it will be difficult to enforce prohibitions against spearfishing and the taking of lobster.

*Response:* Under the Preferred Alternative, all anchoring in Tortugas North and South would be prohibited as well as all activities in Tortugas South except for continuous transit, law enforcement, and, pursuant to a sanctuary permit, scientific research and educational activities. Non-consumptive diving will be allowed in all of Tortugas North. See Responses to Comments 8 and 12. NOAA does not anticipate that there will be significant non-consumptive diving in the area of Tortugas North within the GMFMC's jurisdiction because of the lack of coral reef formations.

*Comment 28:* Monroe County commented that the socio-economic section of the DSEIS seems to have been inserted out of context. This rather lengthy section should be reduced to some simpler explanations, tables and conclusions, then attach the larger document as an appendix.

*Response:* NOAA has retained the socio-economic section in the main body of the FSEIS/SMP but has revised it to make it clearer.

*Comment 29:* Monroe County commented that the FSEIS should provide some additional explanation concerning the table of benthic habitats in the DSEIS. It is not clear whether the 59% of unmapped acreage is a less significant area within the overall total (it should be noted if so). If it is not, then this area needs significant additional exploration.

*Response:* The benthic habitats categorized in Table 1 of the FSEIS represent those identified as the result of one mapping project based on aerial photographs and limited groundtruthing in the Tortugas region. Extensive characterization of the benthic communities within Dry Tortugas National Park has been completed (Agassiz 1883, Davis 1982, and Jaap 1998). Also, scientific exploration of benthic habitats within the proposed Tortugas Ecological Reserve area has occurred since the completion of the DSEIS (Miller, unpubl. data). However, NOAA agrees that additional mapping and exploration are needed to accurately assess the full extent of marine resources throughout the Tortugas region.

*Comment 30:* Monroe County commented that the FSEIS should include a table summarizing the regulatory alternatives.

*Response:* A table summarizing the regulatory alternatives has been added to the FSEIS.

*Comment 31:* The management plan should be designed to: (1) Protect ecosystem structure, function, and integrity; (2) improve fishery yields; (3) expand knowledge and understanding of marine systems; and (4) enhance non-consumptive opportunities.

*Response:* The regulations implementing the designation of the reserve are designed to protect ecosystem structure, function and integrity and should improve fishery yields outside of the closed areas. The management plan has been redesigned with many objectives including better understanding of marine systems as well as providing better opportunities for non-consumptive activities within the Tortugas North area of the Reserve.

*Comment 32:* The regulations concerning fishing in the Reserve should be issued pursuant to the National Marine Sanctuaries Act and the exception clause that would authorize fishing pursuant to regulations issued pursuant to the Magnuson-Stevens Fishery Conservation and Management Act at 50 CFR Parts 622 and 635 should be eliminated from the fishing prohibition.

*Response:* The fishing regulations will be issued under the National Marine Sanctuaries Act and have been revised to prohibit all fishing in the reserve without exception.

*Comment 33:* Fishing and other consumptive activities should be prohibited in the Reserve, including all forms of diving-related extraction. Carefully regulated non-consumptive diving should be allowed to continue to the extent consistent with resource protection.

*Response:* See Response to Comment 12. All consumptive activities are prohibited within the Reserve. As described in the FSEIS/SMP, the permit system for Tortugas North will allow NOAA to monitor the level of non-consumptive diving activity and its effect on resources in Tortugas North.

*Comment 34:* The Reserve should be permanent and should not be subject to sunset provisions.

*Response:* The only portion of the Tortugas Reserve that would be subject to termination would be the areas located in State waters. Pursuant to NOAA's Memorandum of Agreement with the State of Florida, the State has the right to review the portions of the Sanctuary located in State waters and the applicable regulations after 5 years. Based on its review, the Governor of the State may object to the designation of any portion of the Sanctuary in State waters and the continued application of the regulations.

*Comment 35:* NOAA should implement the Tortugas Reserve with strong enforcement, research and monitoring, education and outreach programs, and interagency cooperation to maximize the value of the Reserve.

*Response:* The Final Supplemental Management Plan so provides. See Response to Comment 14.

*Comment 36:* The economic analysis contains a bias toward hypothetical, short-term economic losses to a handful of consumptive users. Such losses are highly speculative in real-world terms and the quantitative analysis provided in the DSEIS lends them more weight than appears appropriate. The economic analysis also does not appear to account adequately for likely future migration of fishing economic activity to other economic sectors. The likelihood of continuing future reductions in fishing activities as a result of overfishing do not appear to be incorporated into the DSEIS' discussion.

*Response:* NOAA staff primarily analyzed data from users engaged in activities within the Tortugas Ecological Reserve Study Area. To assess maximum economic impacts, they assumed that the users could not replace their losses if the Tortugas Reserve were closed to consumptive activities. This is a very conservative assumption because, as stated in the DSEIS, many users will likely be able to relocate their activities outside of the Reserve. The protections afforded to the habitats in the Tortugas Reserve will also benefit displaced users by increasing production in areas outside of the Reserve. However, there is no hard data indicating the extent of mitigation or the likely future migration of fishing economic activity to other economic sectors.

*Comment 37:* The DSEIS does not describe clearly defined and scientifically justifiable goals. In particular, there are five fundamental objectives that are consistent with the overarching goal of maintaining the native biodiversity of a region in perpetuity: (1) represent all ecosystem types across their natural range or variation; (2) maintain or restore viable populations of all native species in natural patterns of abundance and distribution; (3) sustain ecological and evolutionary processes within their

natural ranges of variability; (4) build a conservation network that is adaptable and resilient to short-term and long-term environmental change; and (5) regulate human uses that are consistent with conservation of native biodiversity, and eliminate those that are not.

The Plan should also consider additional criteria in order to protect endangered, threatened, rare or imperiled species, small populations, species with limited vitality, species with very specific habitat requirements, areas of high endemism, areas of productivity, areas of high diversity, and movement and migration corridors.

*Response:* Most of the five biodiversity goals are contained within the criteria for choosing the location and protection measures for the Ecological Reserve (see Part VI of this FSEIS). Specific subcriteria have been added to clarify what is contained in each criterion. Likewise, protecting endangered, threatened, rare, or imperiled species is included within the criterion ''Protecting biodiversity, including the maintenance or restoration of viable populations of native species.''

Part II of the FSEIS includes clear objectives for the Reserve. As stated, the goal for the Sanctuary zoning plan is to protect areas representing diverse Sanctuary habitats and areas important for maintaining natural resources and ecosystem functions. The objectives of the Reserve are to: protect ecosystem integrity; protect biodiversity including the maintenance or restoration of viable populations of native species; enhance scientific understanding of marine ecosystems; and facilitate human uses to the extent consistent with the other objectives. These are scientifically justifiable goals and objectives.

The goals listed by the commentor are essentially the goals and objectives that the establishment of the Reserve and issuance of the implementing regulations are designed to achieve. Likewise, the Supplemental Management Plan is designed to achieve the goals and objectives for which the reserve is being established and regulated.

*Comment 38:* The DSEIS does not define or identify indicators for assessing ecological integrity.

*Response:* Indicators for assessing ecological integrity have been incorporated in the Research and Monitoring Action Plan. These indicators include: changes in fish and coral diversity, changes in predation, herbivory and trophic structure, changes in water quality (nutrients and transmissivity), and changes in user activities.

*Comment 39:* The Draft Supplemental Management Plan is inadequate and needs to be more comprehensive. It should include:

- Specific goals and objectives;
- Performance measures with an implementation schedule;
- An estimate of management costs for implementing and maintaining the reserve;
- An expanded education plan;
- An expanded enforcement plan;
- A description of the permitting system with defined criteria and capacity limits;
- A mooring and boundary buoy component that includes criteria for placement and costs for placement and maintenance; and
- An expanded research and monitoring plan that includes a resource inventory, monitoring of ecological performance measures, cooperative research agreements, and database of research.

*Response:* See Response to Comment 37. The FSEIS/SMP includes:

- Specific goals and objectives;
- Estimate of management costs for implementing and maintaining the reserve;
- An expanded education plan;
- An expanded enforcement plan;
- A description of the permitting system;
- A mooring and boundary buoy component that includes costs for placement and maintenance; and
- An expanded research and monitoring plan that includes a resource inventory, monitoring of ecological performance measures for assessing ecological integrity, and cooperative research agreements.

*Comment 40:* NOAA should develop a broader research initiative including, at a minimum:

- Further identification and study of spawning aggregations including grouper, snapper and jewfish;
- Further studies of patterns of short- and long-distance larval dispersal;
- Complete inventories of biodiversity and habitat structure in the Reserve and Sanctuary waters in the region;
- Further documentation of the distribution and abundance of threatened, endangered, and rare species in the Reserve; and,
- Field experiments and comparative studies to test hypotheses generated by these studies.

*Response:* The Research and Monitoring Action Plan has been expanded to include long-term ecological monitoring to test the efficacy of the Reserve. As modified, the Plan will compare reserve areas before and after designation, as well as monitor changes occurring inside and outside the protected areas, in order to determine the overall effectiveness of the reserve. Over time, these efforts will examine larval dispersion and spawning aggregations. There should also be complete inventories of biodiversity and habitat structure in the Reserve, which would include more complete descriptions of the presence of endangered, threatened and rare species. Also the Plan has been expanded to monitor the effects of non-consumptive diving activities on the resources in Tortugas North using the reference provided by Tortugas South.

*Comment 41:* Scuba diving and underwater exploration in the Reserve should be permitted only in the company of a qualified guide.

*Response:* NOAA disagrees. It is not necessary to require that diving in the Reserve be conducted with a guide to adequately protect coral reef resources. As explained elsewhere (see Response to Comment 12) diving effects will be monitored to determine whether the Reserve's resources are being impacted. Also, a sufficient enforcement presence will be maintained to deter and detect violations of the no-take provisions.

*Comment 42:* Neither the Everglades National Park nor the Dry Tortugas National Park prohibit recreational fishing and they have the best fishery management system in the world. NOAA should not prohibit recreational fishing in the Tortugas Reserve.

*Response:* NOAA disagrees. See Responses to Comments 3 and 13. The Dry Tortugas National Park is proposing changes to its management plan that would prohibit recreational fishing in approximately 40% of the Park that would be adjacent to the Tortugas Reserve.

*Comment 43:* The United States Government does not have jurisdiction over the area that would be included in the proposed reserve.

*Response:* NOAA disagrees. The Tortugas Reserve is within the Exclusive Economic Zone and the authority of the United States to establish and manage the Reserve is well-established and consistent with international law. In 1983, President Ronald Reagan declared a 200 nautical mile Exclusive Economic Zone, in which the United States may conserve and manage natural resources, consistent with international law (Presidential Proclamation 5030, March 10, 1983). The NMSA expressly applies to the EEZ. In 1989, President Reagan extended the territorial sea to twelve nm (Presidential Proclamation 5928, December 27, 1988). In 1999, President William J. Clinton extended the

contiguous zone from twelve to twenty-four nm, extending the jurisdiction of the United States over customs, fiscal, immigration, and sanitary laws (Presidential Proclamation 7219, August 2, 1999).

*Comment 44:* Sanctuary staff working at Dry Tortugas National Park should live and work aboard ships rather than increase environmental pressure on existing facilities at the Park.

*Response:* NOAA will work with the National Park Service so that Sanctuary personnel will be stationed at the Park in a manner that is consistent with environmental protection of the islands and waters in the Park.

*Comment 45:* NOAA's plan for a visitor center in Key West is redundant and would detract from other visitor centers in Key West dedicated to interpretation of the marine environment.

*Response:* NOAA disagrees. The creation of the visitor facility in Key West is not a part of this action. The facility has already been established and is located within the existing Dr. Nancy Foster Environmental Center at the Truman Annex. The visitor center complements existing interpretive centers in Key West. Among other things, the facility will present information derived from research conducted within the Sanctuary (including the Reserve) as well as describe ongoing research projects and other various activities related to the Sanctuary.

*Comment 46:* A nominal charge should be assessed for access permits to the Reserve.

*Response:* NOAA disagrees. As proposed, the access permit system will require minimal effort by users and will be relatively inexpensive for NOAA to operate. The system will be simple and reduce the time imposed on permit applicants. The cost to NOAA of administering the access permit system is expected to be small. If a fee were charged to offset the cost, the system would increase in complexity, increasing the cost that would need to be offset as well as increasing the burden on users applying for permits. In the interest of administrative efficiency and of not placing a burden on permit applicants, a permit fee is not being imposed.

*Comment 47:* The greatest threat to the marine resources of the area is pollution and degradation of water quality. Vessel discharges should not be permitted in the Reserve.

*Response:* Pollution and degradation of water quality is a serious threat to Sanctuary resources. Under the regulations applicable to ecological reserves, only engine cooling water and exhaust can be discharged in the Reserve.

*Comment 48:* Select a Preferred Alternative for the reserve that allows for fishing to the northwest of Loggerhead Key.

*Response:* The only alternative that would allow fishing to the northwest of Loggerhead Key is the No-Action Alternative (see Response to Comment 3).

*Comment 49:* Prohibit the use of motorized Personal Watercraft in the Ecological Reserve.

*Response:* While the use of Personal Watercraft has not been documented in the TERSA, Regulatory Alternative D will prohibit all activities in Tortugas South except for continuous transit, law enforcement, and pursuant to a Sanctuary permit, scientific research and educational activities. Should the use of motorized Personal Watercraft in Tortugas North be documented as a problem, NOAA will consider initiating appropriate rulemaking.

*Comment 50:* The Tortugas 2000 Working Group did not have a representative of the tourism industry and did not consider non-consumptive activities.

*Response:* Among its membership, the Tortugas 2000 Working Group had two non-consumptive diving representatives and one citizen-at-large representative. Additionally, the Working Group's proposal was recommended to Sanctuary managers by the Sanctuary Advisory Council which, among its members, has representatives of the tourism industry and other non-consumptive interests.

*Comment 51:* Several commentors addressed vessel discharge restrictions, pumpout facilities, and other public access issues related to the DRTO and surrounding Sanctuary waters. One commentor suggested that NOAA charts be updated to reflect any new regulatory changes in the Tortugas area.

*Response:* The NPS General Management Plan revisions are taking into consideration pressures and limitations on infrastructure and other Park resources. Sanctuary regulations will prohibit vessel discharges in the Tortugas Ecological Reserve, with the exception of engine cooling water and exhaust. NOAA nautical charts will be updated to include relevant information once regulations to implement the Ecological Reserve are issued and effective.

*Comment 52:* A number of commentors suggested various education, mooring buoy, research and monitoring, and enforcement programs for the Tortugas Ecological Reserve.

*Response:* The Final Supplemental Management Plan has been updated to reflect these comments and suggestions.

*Comment 53:* A commentor stated that it appeared that several disparate agency processes were going on with regard to an appropriate fishing regime for the Tortugas area and that no proposal should be adopted until all disparate processes are concluded.

*Response:* Providing comprehensive protection to the critical coral reef resources of the Tortugas must take precedence over awaiting the completion of the many other agency processes. However, NOAA has gathered input from the seven resource management agencies with jurisdiction in the TERSA with the ultimate goal of achieving a consensus to the extent consistent with requirements of the FKNMSPA, NMSA, and other applicable law. The Tortugas 2000 Working Group process, boundary and regulatory alternative development, and subsequent public hearings effectively brought all resource management entities to the table and ensured that federal and state regulations will be thoroughly integrated. This process has served as a model for interagency and stakeholder collaboration.

## VIII. Miscellaneous Rulemaking Requirements

### *Marine Protection, Research, and Sanctuaries Act*

Paragraph (b)(1) of section 304 of the NMSA, 16 U.S.C. 1434(b)(1), requires the Secretary, in designating a national marine sanctuary, to publish in the **Federal Register** a notice of the designation together with final regulations to implement the designation and any other matters required by law, and submit such notice to the Congress. The Secretary also is required to advise the public of the availability of the final management plan and the final environmental impact statement with respect to the Sanctuary. While this action does not designate a new national marine sanctuary, it revises the boundary and changes the terms of designation of an existing sanctuary, the FKNMS, and therefore must satisfy the requirements of section 304. In accordance with section 304, the public was advised on December 1, 2000 (65 FR 75285) of the availability of the FSEIS/SMP and this notice is being submitted to the Congress for its review.

### *Executive Order 12866*

This action has been determined to be significant for purposes of E.O. 12866. That Order requires that the draft text of the final regulations, a reasonably

detailed description of the need for the action, an explanation of how the action will meet that need, and an assessment of the potential costs and benefits, including an explanation of the manner in which the action is consistent with statutory mandates, and, to the extent permitted by law, promotes the President's priorities and avoids undue interference with State, local, and tribal governments in the exercise of their governmental functions (referred to as a Regulatory Impact Review (RIR)) be prepared and be submitted to the Office of Management and Budget for review. In accordance with the requirements of the Executive Order, NOAA has prepared a RIR for this action and has submitted it to OMB for review. The RIR is contained in part V of the FSEIS/SMP.

*Regulatory Flexibility Act*

In accordance with the requirements of section 603(a) of the Regulatory Flexibility Act (5 U.S.C. 603(a)), NOAA prepared an initial regulatory flexibility analysis (IFRA) describing the impact of the proposed action on small entities. No comments were received on the Initial Regulatory Flexibility Act Analysis (IFRA) per se. However, a number of the comments requested changes to the Preferred Alternative because of impacts on users, all of which are considered small entities for purposes of the Regulatory Flexibility Act. Comments 1, 3, 4, 9, 13, 16–19, 21–23, 36, 41–43, and 50 and the responses thereto summarize the significant issues raised by those comments and the assessment of the agency of such issues. Although changes were made to the proposed regulations, no changes were made as a result of those comments.

Section 604(b) (5 U.S.C. 604(b)) requires that NOAA prepare a final regulatory flexibility analysis (FRFA) for this action. The FRFA is required to contain: (1) A succinct statement of the need for and objectives of the rule; (2) a summary of the significant issues raised by the public comments in response to the IRFA, a summary of the assessment of the agency of such issues, a statement of any changes made to the proposed rule as a result of such comments; (3) a description of and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available; (4) a description of the projected reporting, record keeping and other compliance requirements of the regulations, including an estimate of the classes of small entities that will be subject to these requirements and the type of professional skills necessary to prepare any required report or record; and (5) a description of the steps the agency has taken to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual policy and legal reasons for selecting the alternative adopted in the final rule and why each of the other significant alternatives to the rule considered by the agency which affect the impact on small entities was rejected.

NOAA has prepared the required FRFA. The complete FRFA is contained in Parts I, IV, V, VI and Appendix H of the FSEIS/SMP. The following is a summary of the FRFA.

*Statement of Need*

As previously set forth in this regulatory preamble.

*Goals, Objectives and Legal Basis*

As previously set forth in this regulatory preamble.

*Summary of the Significant Issues Raised by the Public Comments in Response to the IRFA, a Summary of the Assessment of the Agency of Such Issues, a Statement of Any Changes Made to the Proposed Rule as a Result of Such Comments*

No comments were received on the IFRA per se. However, a number of the comments requested changes to the Preferred Alternative because of impacts on users, all of which are considered small entities for purposes of the Regulatory Flexibility Act. Comments 1, 3, 4, 9, 13, 16–19, 21–23, 36, 41–43, and 50 and the responses thereto appearing in Section VI Summary of Comments and Responses, above, summarizing the significant issues raised by those comments and the assessment of the agency of such issues. Although changes were made to the proposed regulations, no changes were made as a result of those comments.

*Discussion of All Relevant State and Federal Rules Which May Duplicate, Overlap or Conflict with the Regulations*

Under the Magnuson-Stevens Act, the GMFMC has primary federal responsibility and expertise for the development of FMPs throughout the Gulf of Mexico and has developed an Essential Fish Habitat Amendment for the various GMFMPs, which includes the area of the proposed Tortugas Ecological Reserve. The GMFMPs are implemented by regulations promulgated by the NMFS (50 CFR 622). At the GMFMC's meeting on November 9, 1999, the NOS and NMFS requested that the GMFMC take steps to prohibit fishing, consistent with the purpose of the proposed ecological reserve. The GMFMC accepted this request and at its July 10–13, 2000 meeting, adopted a Generic Amendment Addressing the Establishment of Tortugas Marine Reserves. That amendment to the GMFMPs is consistent with the no-take Tortugas Ecological Reserve proposed by NOAA and NOAA's regulations for ecological reserves in the FKNMS, at 15 CFR 922.164(d).

NMFS intends to issue regulations under the Magnuson-Stevens Act consistent with the no-take status of the Tortugas Ecological Reserve for the species covered by the GMFMPs and for Atlantic tunas, swordfish, sharks, and billfish. In federal waters, these regulations will duplicate and overlap, but not conflict, with the Sanctuary regulations prohibiting fishing in the Tortugas Ecological Reserve. Regulations issued under the Magnuson-Stevens Act must satisfy the requirements of that Act including the National Standards set forth in that Act. Sanctuary regulations including those governing fishing are issued under the NMSA. While some of the goals and objectives of the two Acts are similar, many of the goals and objectives of the two statutes are different.

The State of Florida may implement a no-fishing rule for the area of Tortugas North within State waters. In State waters, this rule could duplicate and overlap with the Sanctuary, but not conflict with the Sanctuary no-take rule for the Reserve. The State of Florida is co-manager of the Reserve with NOAA and Sanctuary regulations affecting State waters must have the approval of the State.

*Description of the Projected Reporting, Record Keeping and Other Compliance Requirements of the Regulations, Including an Estimate of the Classes of Small Entities that Will be Subject to These Requirements and the Type of Professional Skills Necessary to Prepare Any Required Report or Record*

The access permit application and call in requirements are described in the Summary of Final Regulations, above. Any entity desiring to enter Tortugas North for other than continuous transit or for law enforcement purposes will be subject to these requirements. It is anticipated that dive charters operators and individuals wishing to dive from private vessels will be the primary class of small entity subject to this requirement. No special skills will be necessary to comply with the permitting or call-in requirements.

Any entity desiring to conduct educational or scientific research activities in Tortugas South will be

required to apply for a National Marine Sanctuary General Permit. Each permit applicant will be required to provide a detailed description of the proposed activity, including a timetable for completion of the activity and the equipment, personnel and methodology to be employed; the qualifications and experience of all personnel; a statement of the financial resources available to the applicant to conduct and complete the proposed activity; a statement as to why it is necessary to conduct the activity within the Sanctuary; a statement of the potential impacts of the activity, if any, on Sanctuary resources and qualities; and a statement of the benefit to be derived from the activity; and such other information as the Director may request. Copies of all other required licenses, permits, approvals, or other authorizations must be attached to the application. The application requirements for such a permit are set forth in 15 CFR 922.166(e). There will be additional reporting and record keeping requirements associated with a Sanctuary permit. These will include submitting interim reports on the status of the activity and final reports including relevant research findings.

It is anticipated that marine scientists affiliated with public and private research institutions, universities, and conservation organizations, and associated graduate students or assistants, will be the primary class of small entity subject to this requirement.

The skills necessary for preparing a permit application and subsequent reports are the same as those that are required to prepare research proposals, grant applications, and their associated activity reporting requirements.

*A Description of the Steps the Agency has Taken to Minimize the Significant Economic Impact on Small Entities Consistent With the Stated Objectives of Applicable Statutes, Including a Statement of the Factual Policy and Legal Reasons for Selecting the Alternative Adopted in the Final Rule and Why Each of the Other Significant Alternatives to the Rule Considered by the Agency Which Affect the Impact on Small Entities was Rejected*

In the DEIS/MP for the FKNMS, NOAA proposed a boundary for a 110 $nm^2$ Replenishment Reserve (Ecological Reserve) in the Tortugas area to protect significant coral resources while minimizing or avoiding adverse impacts to users. NOAA postponed establishing a reserve in part because public comment identified serious adverse economic impacts on commercial fishers from the proposed boundary and the proposed no-take regulations. Accepting these comments, NOAA went back to the drawing board by convening an ad hoc 25 member Working Group (WG) of the Sanctuary Advisory Council (SAC), that included key stakeholder representatives from the fishing, diving, and recreation industries, as well as eight SAC members, and government agency representatives with resource management authority in the Tortugas area to recommend a ''Preferred Boundary Alternative'' for the reserve.

The WG held five meetings in 1998 and 1999. In addition to ecological information, socio-economic data were gathered from the commercial and recreational users of the area. This was an unprecedented data collection effort spearheaded by Dr. Vernon R. (Bob) Leeworthy of NOAA. His contractors first determined that approximately 105–110 commercial fishermen used the area. They then collected information on catch, costs, and trips from 90 of the fishermen. These 90 fishermen caught over 90% of the total harvest from the Tortugas. The entire population of recreational charter users was interviewed and data on trips and costs were obtained. Through the help of the Florida Marine Research Institute, the commercial and recreational data were input into a GIS format and maps were produced showing intensity of use.

A critical aspect of this GIS data was the creation of maps at a consistent scale using the same grid cell framework so comparisons could be made between maps. The study area was partitioned into one minute by one minute (approximately one square nautical mile) grid cells which facilitated the collection and analysis of data and the creation of boundary alternatives.

In February 1999, the WG developed criteria for the ecological reserve that addressed ecological and socio-economic concerns. One of the objectives of these criteria was to try to choose an area and craft recommendations that would serve to minimize adverse socio-economic impacts on established users of resources in the area. The preferred alternative recommended by the WG (and that subsequently was selected by NOAA as its Preferred Alternative in the DSEIS/SMP) was selected, in part, because it provided environmental protection while leaving open significant fishing grounds for lobster and reef fish such as the southern half of Tortugas Bank, which is an important fishing area in the winter, and leaves open fishing areas for King mackerel.

The SAC unanimously adopted the WG's recommendation, recognizing that the WG's proposal for an ecological reserve would protect biodiversity and minimize impacts to users. The SAC that adopted the WG's recommendation included members from the fishing, diving, boating, and tourism industries. The geographical area for an ecological reserve and application of no-take regulations recommended by the SAC have been adopted by NOAA as the Preferred Alternative.

NOAA encouraged the public to comment on the alternatives contained in the DSEIS and held a series of public hearings throughout South Florida to accept comments. More than 4,000 comments were received and considered.

*Approach to the Analysis of Alternatives*

The analysis of the alternatives focuses on market economic impacts as measured by direct revenue, costs, and profits of the business firms directly affected by the ''no-take'' regulations. These impacts are then translated into the secondary or multiplier impacts on the local economy. For the recreational industry, the impact area is defined as Monroe County, Florida and, for the commercial fisheries the impact areas are Monroe County and Lee/Collier counties. For the commercial fisheries, the results presented here are an aggregation of the impacts on both Monroe and Lee/Collier Counties. The market economic impacts include estimates of output/sales, income and employment. The details by impacted area can be found in Leeworthy and Wiley (2000). Although the results are only presented for impacts on Monroe and Lee/Collier Counties, the impacts are based on catch landed in all counties. The results for Monroe and Lee/Collier counties are slightly overstated because they include the amounts landed in other counties, but for the boundary alternatives, these amounts are insignificant.

The approach begins by first analyzing the affects of the ''no-take'' regulation for each boundary alternative. Analyses are presented for the recreation industry (broken down into consumptive and non-consumptive), the commercial fisheries, commercial shipping, treasure salvors and then other benefits (non-users, scientific and education values). The next step is to analyze other regulations. Other regulations include the no anchoring/required mooring buoy use regulation, access restrictions, and sanctuary-wide regulations (for boundary alternatives that include areas outside current Sanctuary boundary). For most of the sanctuary-wide regulations, there is no additional or

incremental impact over the ''no-take'' regulation.

The approach proceeds in two basic steps for the recreation industry and the commercial fisheries. First, the impacts are estimated under the assumption that all the activities displaced result in complete loss. This is done by summing all the activities within the geographic area defined by an ecological reserve boundary (i.e., the no-take area) and applying the appropriate economic parameters. Second, whether the results from step 1 are likely to occur is assessed by using a qualitative analysis. Mitigating and offsetting factors are taken into account and whether net benefits or costs exist in the short and longer terms is assessed. Over the long term, the ecological reserve is expected to generate replenishment effects to the fisheries. In the commercial reef fisheries, there may be some short term losses, however over the longer term, the expectation is that there would be long-term benefits even to commercial reef fishermen and related dependent businesses.

Results are presented in four sections. The first section addresses the recreation industry. Consumptive recreation is separated from non-consumptive recreation since consumptive recreation activities are displaced from the ''no-take'' areas and may potentially be negatively impacted, while non-consumptive activities would be beneficiaries of the ''no-take'' area in Tortugas North. The second section addresses the commercial fisheries which would all be displaced from the ''no-take'' areas and thus potentially negatively impacted. The third section addresses other potential benefits of the ''no-take'' areas including non-use economic values, scientific values, and education values. The fourth section addresses the costs of the management action to create the reserve. This analysis assumes that all entities impacted are small entities within the meaning of the Regulatory Flexibility Act.

*Analysis of Alternatives*

Definition of the Study Area

For purposes of this analysis, NOS examined a 1,020 $nm^2$ area called the Tortugas Ecological Reserve Study Area (TERSA) (Figure 2). All socio-economic information was collected and organized for the TERSA at a geographical resolution of one $nm^2$. Detailed descriptions of the data are included for the recreation industry and for the commercial fisheries. Four separate boundary alternatives were identified within the TERSA and analyzed using the information collected for the TERSA.

*Boundary Alternatives (Figure 1)*

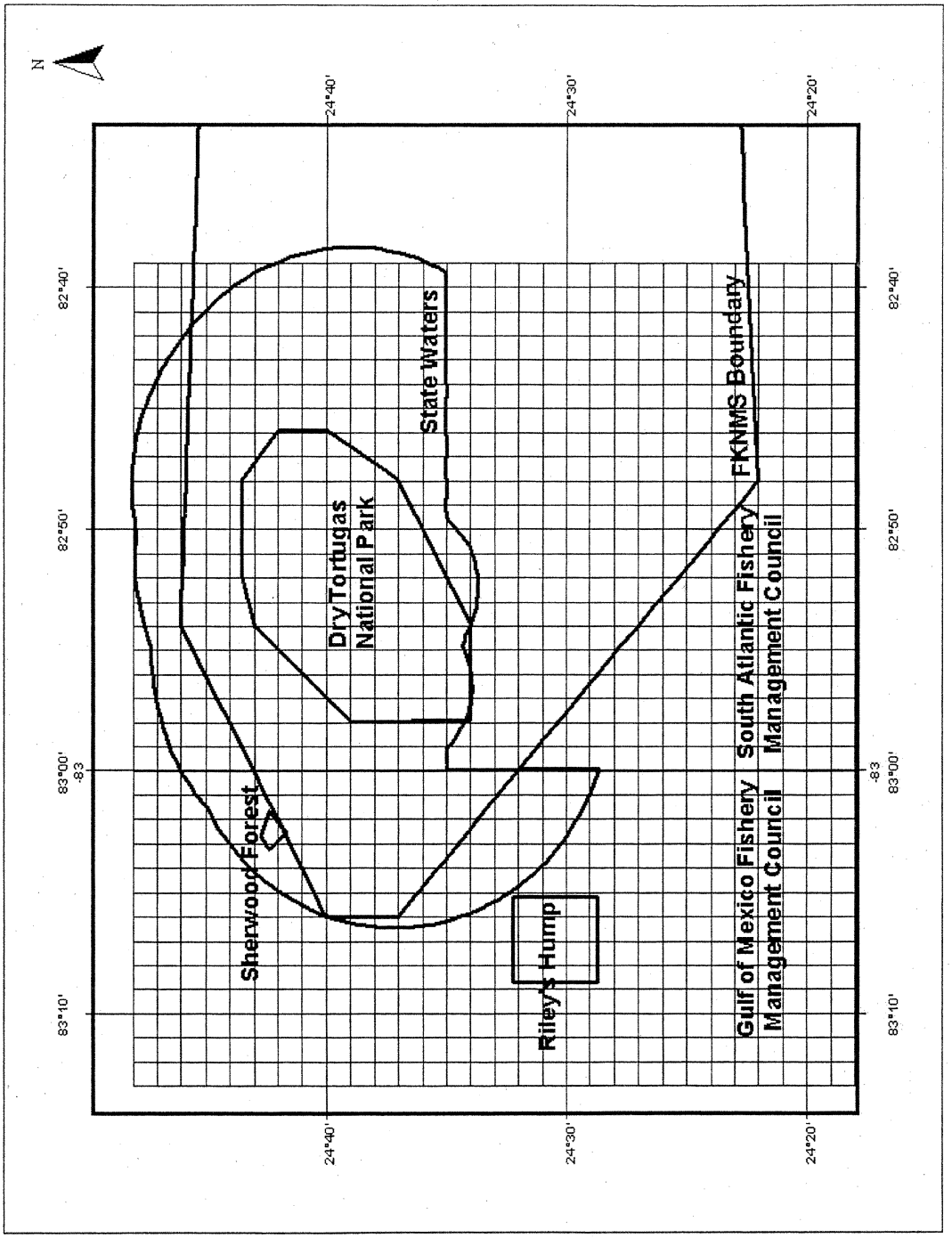


*Figure 2. Tortugas Ecological Reserve Study Area (TERSA)*

*Boundary Alternative I.* This alternative would be taking no-action, that is, not expanding the Sanctuary boundary and not establishing a Tortugas Ecological Reserve.

*Boundary Alternative II.* This alternative would limit the reserve to the existing Sanctuary boundary for a total area of approximately 55 $nm^2$. This alternative includes a portion of Sherwood Forest and the coral pinnacles north of Tortugas Bank; it does not include Riley's Hump. It includes some coral and hardbottom habitat north of the DRTO.

*Boundary Alternative III (Preferred Boundary Alternative).* This alternative would expand the boundary of the Sanctuary and its westernmost corner by approximately 36 $nm^2$ to include Sherwood Forest. In addition, this alternative would expand the boundary by adding a non-contiguous area of approximately 60 $nm^2$ to include Riley's Hump. The Reserve would also incorporate approximately 55 $nm^2$ of the existing Sanctuary in its northern section, for a total area of approximately 151 $nm^2$. The area of the Reserve surrounding Sherwood Forest would be called Tortugas North and encompass approximately 91 $nm^2$; the area surrounding Riley's Hump would be called Tortugas South and encompass approximately 60 $nm^2$.

*Boundary Alternative IV.* This alternative would increase the area of Tortugas North over that in Alternative III by an additional 23 $nm^2$ to make it conterminous with the DRTO's proposed Research/Natural Area for a total area of approximately 175 $nm^2$. It would involve the same boundary expansion as in Alternative III. The Tortugas South area would be the same as in Alternative III.

*Boundary Alternative V.* This alternative would expand the Sanctuary boundary to the west by 3 nm over Alternatives III and IV to make the boundary extend as far west as the western boundary of Tortugas South. The area of Tortugas North would be expanded over Alternatives III and IV to include the three nm boundary expansion. The area of Tortugas North would be approximately 145 $nm^2$. The area of Tortugas South would be approximately 45 $nm^2$, by reducing its southern extent over alternatives III and IV. Under Alternative V the overall area of the Reserve would be approximately 190 $nm^2$.

*No-take Regulations*

Recreation Industry

*Boundary Analysis.* The estimates from the geographic information system (GIS) analysis for the different boundary alternatives are the sum of each measurement within the boundaries of each alternative. The estimates therefore represent the maximum total potential loss from displacement of the consumptive recreational activities. This analysis ignores possible mitigating factors and the possibility of net benefits that might be derived if the proposed ecological reserve has replenishment effects. Although the extent of the mitigating factors or the potential benefits from replenishment is unknown, this analysis discusses these as well as other potential benefits of the proposed ecological reserve after the maximum potential losses from displacement of the current consumptive recreational uses are presented and discussed.

There are two types of potential losses identified and quantified in the analysis, non-market economic values and market economic values.

*Non-Market Economic Values.* There are two types of non-market economic values. The first is consumer's surplus, which is the amount an individual is willing to pay for a good or service over and above what he or she is required to pay for the good or service. It is a net benefit to the consumer and in the context of recreation use of natural resources, where the natural resources go unpriced in markets, this value is often referred to as the net user value of the natural resource. The second type of non-market economic value is one received by producers or owners of the businesses providing goods or services to the users of the natural resources. This is commonly referred to as producer's surplus. The concept is similar to consumer's surplus in that the businesses do not pay a price for the use of natural resources when providing goods or services to users of the resources. However, this concept is a little more complicated because, in ''welfare economics'', not all producer's surplus is considered a proper indicator in the improvement of welfare. Only that portion of producer's surplus called ''economic rent'' is appropriate for inclusion. Economic rent is the amount of profit a business receives over and above a normal return on investment (*i.e.*, the amount of return on investment that could be earned by switching to some alternative activity). Again, because businesses that depend on natural resources in the Tortugas do not have to pay for the use of them, there exists the possibility of earning above normal rates of return on investment or ''economic rent''. This like consumer's surplus, would be additional economic value attributable to the natural resources (*i.e.*, another user value).

Economic rents are different from consumer's surplus in that supply and demand conditions are often likely to lead to dissipation of the economic rents. This is generally true for most open access situations. As new firms enter the industry because of the lure of higher than normal returns on investment, the net effect is to eliminate most if not all of the economic rent. However, given the remoteness of the TERSA, it is likely that all economic rents would not be eliminated. Accounting profits are used as a proxy for economic rents in the analysis. The absolute levels of accounting profits are not a good proxy for economic rents, however, they are used here as an index for assessing the relative impacts across the different boundary alternatives.

The estimates for consumer's surplus were derived by combining estimates of person-days from all the operators in the TERSA with estimates of consumer's surplus per person-day from Leeworthy and Bowker (1997). The estimates were derived separately by season (see Leeworthy and Wiley 2000).

*Market Economic Values.* Revenues from the charter boat operations that provided service to the consumptive recreational users provide the basis for this portion of the analysis. Total output/sales, income and employment impacts on the Monroe County economy are then derived from these estimates. These impacts include the ripple or multiplier impacts. Total output/sales is equal to business revenue times the total output multiplier of 1.12 from English et al 1996. Income is then derived by taking the total output/sales impact and dividing by the total output-to-income ratio (2.63) from English et al. Total employment was derived by dividing the total income impact by the total income-to-employment ratio ($23,160) from English et al.

*Boundary Alternative I: No Action*

The no-action alternative is not establishing a reserve and not issuing the implementing regulations. The costs of imposing the no-take regulations, for any given alternative with no-take regulations, would be the benefits of the no-action alternative. That is, by not adopting the no-take regulations, the costs are avoided. Similarly, any benefits from imposing the no-take regulations, for any given alternative with no-take regulations, would be the costs of the no-action alternative. That is, by not adopting the no-take regulations, the costs are the benefits lost by not adopting the no-take regulations. Said another way, the costs are the opportunities lost. The impacts of the no-action alternative can only be understood by comparing it to one of the alternatives. Thus the impacts of the no-action alternative can be obtained by reading the impacts from any of the alternatives in reverse (Tables 1–8). Table 1 shows the 1997 baseline conditions.

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Table 1. Boundary Analysis Summary: TERSA - Consumptive Recreation

| | Diving for Lobsters | Fishing | Spearfishing | Total |
|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | |
| Person-Days | 1,442 | 12,215 | 1,569 | 15,226 |
| Revenue | $ 99,282 | $ 579,143 | $ 291,898 | $ 970,323 |
| Cost | $ 68,372 | $ 471,657 | $ 149,503 | $ 689,532 |
| Profit | $ 30,909 | $ 107,497 | $ 142,395 | $ 280,801 |
| Number of Firms | 2 | 10 | 3 | 12 [1] |
| Consumer Surplus | $ 131,222 | $ 996,744 | $ 144,034 | $ 1,272,000 |
| **Outside FKNMS Boundary** | | | | |
| Person-Days | 288 | 4,163 | 303 | 4,754 |
| Revenue | $ 19,868 | $ 267,597 | $ 41,795 | $ 329,260 |
| Cost | $ 13,680 | $ 217,794 | $ 22,926 | $ 254,400 |
| Profit | $ 6,188 | $ 49,804 | $ 18,869 | $ 74,861 |
| Number of Firms | 2 | 4 | 2 | 5 [1] |
| Consumer Surplus | $ 26,208 | $ 339,619 | $ 27,815 | $ 393,642 |
| **Total** | | | | |
| Person-Days | 1,730 | 16,378 | 1,872 | 19,980 |
| Revenue | $ 119,150 | $ 846,740 | $ 333,693 | $ 1,299,583 |
| Cost | $ 82,052 | $ 689,451 | $ 172,429 | $ 943,932 |
| Profit | $ 37,097 | $ 157,301 | $ 161,264 | $ 355,662 |
| Number of Firms | 2 | 10 | 3 | 12 [1] |
| Consumer Surplus | $ 157,430 | $ 1,336,363 | $ 171,850 | $ 1,665,643 |

1. Number of firms does not add up to the total because individual firms may engage in more than one activity.

*Table 2. Boundary Analysis Summary: Alternative II/ Regulatory alternative D - Consumptive Recreation*

| Charter/Party Boat Operators | Diving for Lobsters[2] | | Fishing[2] | | Spearfishing[2] | | Total[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | | | | | | |
| Person-Days | 461 | (31.97%) | 200 | (1.64%) | 485 | (30.91%) | 1,146 | (7.53%) | |
| Revenue | $ 31,732 | (31.96%) | $ 24,691 | (4.26%) | $ 66,816 | (22.89%) | $ 123,239 | (12.70%) | |
| Cost | $ 21,862 | (31.98%) | $ 14,496 | (3.07%) | $ 36,656 | (24.52%) | $ 73,014 | (10.59%) | |
| Profit | $ 9,870 | (31.93%) | $ 10,195 | (9.48%) | $ 30,160 | (21.18%) | $ 50,225 | (17.89%) | |
| Number of Firms | 2 | (100.00%) | 8 | (80.00%) | 3 | (100.00%) | 9 | (75.00%) | 1 |
| Consumer Surplus | $ 41,977 | (31.99%) | $ 15,859 | (1.59%) | $ 44,548 | (30.93%) | $ 102,384 | (8.05%) | |
| **Outside FKNMS Boundary** | | | | | | | | | |
| Person-Days | - | (0.00%) | - | (0.00%) | - | (0.00%) | - | (0.00%) | |
| Revenue | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | |
| Cost | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | |
| Profit | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | |
| Number of Firms | - | (0.00%) | - | (0.00%) | - | (0.00%) | - | (0.00%) | 1 |
| Consumer Surplus | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | |
| **Total** | | | | | | | | | |
| Person-Days | 461 | (26.65%) | 200 | (1.22%) | 485 | (25.91%) | 1,146 | (5.74%) | |
| Revenue | $ 31,732 | (26.63%) | $ 24,691 | (2.92%) | $ 66,816 | (20.02%) | $ 123,239 | (9.48%) | |
| Cost | $ 21,862 | (26.64%) | $ 14,496 | (2.10%) | $ 36,656 | (21.26%) | $ 73,014 | (7.74%) | |
| Profit | $ 9,870 | (26.61%) | $ 10,195 | (6.48%) | $ 30,160 | (18.70%) | $ 50,225 | (14.12%) | |
| Number of Firms | 2 | (100.00%) | 8 | (80.00%) | 3 | (100.00%) | 9 | (75.00%) | 1 |
| Consumer Surplus | $ 41,977 | (26.66%) | $ 15,859 | (1.19%) | $ 44,548 | (25.92%) | $ 102,384 | (6.15%) | |
| **Private Boats[3]** | | | | | | | | | |
| Person-Days | - | n/a | 673 | (100.00%) | - | n/a | 673 | (100.00%) | |
| Consumer's surplus | $ - | n/a | $ 53,392 | (100.00%) | $ - | n/a | $ 53,392 | (100.00%) | |

1. Number of firms does not add up to the total because individual firms may engage in more than one activity.
2. Percent of TERSA (See Table 1) by activity and total in parentheses.
3. Private boat activity does not involve losses to commercial recreation operators, therefore the only impacts are in loss of person-days of activity and in consumer's surplus. Lacking any information with regard to the distribution of the activity, the assumption was made that all of the activity takes place within the boundary alternative.

*Boundary Alternative II*

*Non-Market Economic Values.* This alternative would displace over 26% of the total person-days of diving for lobsters, about 26% of the spearfishing, and just over 1% of the fishing. Across all three consumptive recreational activities just under 6% of the person-days would be displaced (Table 2). This alternative is entirely within the FKNMS boundary. Because of the way in which consumer's surpluses are calculated, they generally mirror the patterns in displaced use. Minor differences would be due to the distributions across activities by season. Only in the case of diving for lobsters are the impacts on person-days and profits equal. For spearfishing, the impacts on profits are lower than the affect on person-days (18.7% versus 25.9%), while for fishing the affect is greater on profits than on person-days (6.5% versus 1.2%). The GIS generated maps show why diving for lobsters and spearfishing are relatively more affected than fishing. The reason is that diving for lobsters and spearfishing are concentrated on Tortugas Bank, while relatively little fishing currently takes place on the Tortugas Bank. Private boat usage does not impact commercial recreational fishing operations, therefore the only impacts are the loss of person days and the non-market value (consumer's surplus) of the activity. During the public comment period it was noted that there were 673 person days of activity taking place in the TERSA. This translates to a maximum potential loss of $53,392 in consumer's surplus.

*Market Economic Values.* Presently, there are 12 charter boats operating within the TERSA, nine of which would be potentially affected by this alternative. Direct business revenue would include potential losses of 26.6% for diving for lobsters, 20% for spearfishing, and 3% for fishing. Across all three consumptive recreational activities, 9.5% of revenue would be potentially affected (Table 2).

Through the ripple or multiplier effects, 11–13% of output/sales, income and employment associated with all the consumptive recreational activities in the TERSA could potentially be lost (Table 7). Although these costs could have an effect on the nine firms operating in the TERSA, the effect would not likely be noticed in the Monroe County economy because the effect would amount to only a fraction of a percent of the total economy supported by recreating visitors to the Florida Keys (Table 8).

*Boundary Alternative III (Preferred Boundary Alternative)*

*Non-Market Economic Values.* Because the portion of this alternative that is within the FKNMS boundary is exactly the same as Alternative II, the analysis for these two activities is exactly the same for the two alternatives. This alternative would displace over 26% of the total person-days of diving for lobsters, about 26% of the spearfishing, and just over 3% of the fishing. Across all three consumptive recreational activities over 7% of the person-days would be displaced (Table 3). For fishing, 40% of the displaced activity would be from within the FKNMS boundary. Consumer's surpluses generally mirror patterns of displaced use. Again, minor differences would be due to the distributions across activities by season. Only in the case of diving for lobsters are the effects on person-days and profits equal. For spearfishing, the effects on profits is lower than the effect on person-days (18.7% versus 25.9%), while for fishing the effect is greater on profits than on person-days (10.02% versus 3.0%).

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*Table 3. Boundary Analysis Summary: Alternative III/ Regulatory alternative D - Consumptive Recreation*

| Charter/Party Boat Operators | Diving for Lobsters[2] | | Fishing[2] | | Spearfishing[2] | | Total[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | | | | | | |
| Person-Days | 461 | (31.97%) | 200 | (1.64%) | 485 | (30.91%) | 1,146 | (7.53%) | |
| Revenue | $ 31,732 | (31.96%) | $ 24,691 | (4.26%) | $ 66,816 | (22.89%) | $ 123,239 | (12.70%) | |
| Cost | $ 21,862 | (31.98%) | $ 14,496 | (3.07%) | $ 36,656 | (24.52%) | $ 73,014 | (10.59%) | |
| Profit | $ 9,870 | (31.93%) | $ 10,195 | (9.48%) | $ 30,160 | (21.18%) | $ 50,225 | (17.89%) | |
| Number of Firms | 2 | (100.00%) | 8 | (80.00%) | 3 | (100.00%) | 9 | (75.00%) | [1] |
| Consumer Surplus | $ 41,976 | (31.99%) | $ 15,859 | (1.59%) | $ 44,548 | (30.93%) | $ 102,383 | (8.05%) | |
| **Outside FKNMS Boundary** | | | | | | | | | |
| Person-Days | - | (0.00%) | 297 | (7.13%) | - | (0.00%) | 297 | (6.25%) | |
| Revenue | $ - | (0.00%) | $ 28,815 | (10.77%) | $ - | (0.00%) | $ 28,815 | (8.75%) | |
| Cost | $ - | (0.00%) | $ 23,254 | (10.68%) | $ - | (0.00%) | $ 23,254 | (9.14%) | |
| Profit | $ - | (0.00%) | $ 5,561 | (11.17%) | $ - | (0.00%) | $ 5,561 | (7.43%) | |
| Number of Firms | - | (0.00%) | 2 | (50.00%) | - | (0.00%) | 2 | (40.00%) | [1] |
| Consumer Surplus | $ - | (0.00%) | $ 23,570 | (6.94%) | $ - | (0.00%) | $ 23,570 | (5.99%) | |
| **Total** | | | | | | | | | |
| Person-Days | 461 | (26.65%) | 497 | (3.03%) | 485 | (25.91%) | 1,443 | (7.22%) | |
| Revenue | $ 31,732 | (26.63%) | $ 53,506 | (6.32%) | $ 66,816 | (20.02%) | $ 152,054 | (11.70%) | |
| Cost | $ 21,862 | (26.64%) | $ 37,750 | (5.48%) | $ 36,656 | (21.26%) | $ 96,268 | (10.20%) | |
| Profit | $ 9,870 | (26.61%) | $ 15,756 | (10.02%) | $ 30,160 | (18.70%) | $ 55,786 | (15.69%) | |
| Number of Firms | 2 | (100.00%) | 8 | (80.00%) | 3 | (100.00%) | 9 | (75.00%) | [1] |
| Consumer Surplus | $ 41,976 | (26.66%) | $ 39,429 | (2.95%) | $ 44,548 | (25.92%) | $ 125,953 | (7.56%) | |
| **Private Boats[3]** | | | | | | | | | |
| Person-Days | - | n/a | 673 | (100.00%) | - | n/a | 673 | (100.00%) | |
| Consumer's surplus | $ - | n/a | $ 53,392 | (100.00%) | $ - | n/a | $ 53,392 | (100.00%) | |

1. Number of firms does not add up to the total because individual firms may engage in more than one activity.

2. Percent of TERSA (See Table 1) by activity and total in parentheses.

3. Private boat activity does not involve losses to commercial recreation operators, therefore the only impacts are in loss of person-days of activity and in consumer's surplus. Lacking any information with regard to the distribution of the activity, the assumption was made that all of the activity takes place within the boundary alternative.

Private boat usage does not impact commercial recreational fishing operations, therefore the only impacts are the loss of person days and the non-market value (consumer's surplus) of the activity. A total of 673 person days of private boat use takes place in the TERSA. This translates to a maximum potential loss of $53,392 in consumer's surplus.

*Market Economic Values.* Nine of the twelve charter boats operating within the TERSA would be potentially affected by this alternative. Direct business revenue would include potential losses of 26.6% for diving for lobsters, 20.0% for spearfishing, and 6.3% for fishing. Across all three consumptive recreational activities, 11.7% of revenue would be potentially affected (Table 3).

Through the ripple or multiplier effects, 16–17% of output/sales, income and employment associated with all the consumptive recreational activities in the TERSA could potentially be lost (Table 7). Although these costs could have an effect on the nine firms operating in the TERSA, the effect would not likely be noticed in the Monroe County economy because it would amount to only a fraction of a percent of the total economy supported by recreating visitors to the Florida Keys (Table 8).

*Boundary Alternative IV*

*Non-Market Economic Values.* This alternative would displace over 73% of the total person-days of diving for lobsters, just under 72% of the spearfishing, and over 6% of the fishing. Across all three consumptive recreational activities over 18% of the person-days would be displaced (Table 4). All the diving for lobsters and spearfishing activity displaced would be from within the FKNMS boundary. For fishing, 71% of the displaced activity would be from within the FKNMS boundary. Similarly to the other alternatives, consumer's surpluses mirror the patterns in displaced use because of the way in which they are calculated. Minor differences would be due to the distributions across activities by season. Again, profits are only equal to the effect on person-days for diving for lobsters. For spearfishing, the effects on profits is lower than the effect on person-days (56.2% versus 71.7%), while for fishing the effect is greater on profits than on person-days (17.6% versus 6.3%).

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*Table 4. Boundary Analysis Summary: Alternative IV/ Regulatory alternative D - Consumptive Recreation*

| Charter/Party Boat Operators | Diving for Lobsters[2] | | Fishing[2] | | Spearfishing[2] | | Total[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | | | | | | |
| Person-Days | 1,269 | (88.00%) | 736 | (6.03%) | 1,343 | (85.60%) | 3,348 | (21.99%) | |
| Revenue | $ 87,361 | (87.99%) | $ 60,261 | (10.41%) | $ 196,944 | (67.47%) | $ 344,566 | (35.51%) | |
| Cost | $ 60,165 | (88.00%) | $ 38,093 | (8.08%) | $ 106,360 | (71.14%) | $ 204,618 | (29.67%) | |
| Profit | $ 27,196 | (87.99%) | $ 22,168 | (20.62%) | $ 90,584 | (63.61%) | $ 139,948 | (49.84%) | |
| Number of Firms | 2 | (100.00%) | 8 | (80.00%) | 3 | (100.00%) | 10 | (83.33%) | 1 |
| Consumer Surplus | $ 115,449 | (87.98%) | $ 58,501 | (5.87%) | $ 123,271 | (85.58%) | $ 297,221 | (23.37%) | |
| **Outside FKNMS Boundary** | | | | | | | | | |
| Person-Days | - | (0.00%) | 297 | (7.13%) | - | (0.00%) | 297 | (6.25%) | |
| Revenue | $ - | (0.00%) | $ 28,815 | (10.77%) | $ - | (0.00%) | $ 28,815 | (8.75%) | |
| Cost | $ - | (0.00%) | $ 23,254 | (10.68%) | $ - | (0.00%) | $ 23,254 | (9.14%) | |
| Profit | $ - | (0.00%) | $ 5,561 | (11.17%) | $ - | (0.00%) | $ 5,561 | (7.43%) | |
| Number of Firms | - | (0.00%) | 2 | (50.00%) | - | (0.00%) | 2 | (40.00%) | 1 |
| Consumer Surplus | $ - | (0.00%) | $ 23,570 | (6.94%) | $ - | (0.00%) | $ 23,570 | (5.99%) | |
| **Total** | | | | | | | | | |
| Person-Days | 1,269 | (73.35%) | 1,033 | (6.31%) | 1,343 | (71.74%) | 3,645 | (18.24%) | |
| Revenue | $ 87,361 | (73.32%) | $ 89,076 | (10.52%) | $ 196,944 | (59.02%) | $ 373,381 | (28.73%) | |
| Cost | $ 60,165 | (73.33%) | $ 61,347 | (8.90%) | $ 106,360 | (61.68%) | $ 227,872 | (24.14%) | |
| Profit | $ 27,196 | (73.31%) | $ 27,729 | (17.63%) | $ 90,584 | (56.17%) | $ 145,509 | (40.91%) | |
| Number of Firms | 2 | (100.00%) | 8 | (80.00%) | 3 | (100.00%) | 10 | (83.33%) | 1 |
| Consumer Surplus | $ 115,449 | (73.33%) | $ 82,071 | (6.14%) | $ 123,271 | (71.73%) | $ 320,791 | (19.26%) | |
| **Private Boats[3]** | | | | | | | | | |
| Person-Days | - | n/a | 673 | (100.00%) | - | n/a | 673 | (100.00%) | |
| Consumer's surplus | $ - | n/a | $ 53,392 | (100.00%) | $ - | n/a | $ 53,392 | (100.00%) | |

1. Number of firms does not add up to the total because individual firms may engage in more than one activity.
2. Percent of TERSA (See Table 1) by activity and total in parentheses.
3. Private boat activity does not involve losses to commercial recreation operators, therefore the only impacts are in loss of person-days of activity and in consumer's surplus. Lacking any information with regard to the distribution of the activity, the assumption was made that all of the activity takes place within the boundary alternative.

Private boat usage does not impact commercial recreational fishing operations, therefore the only impacts are the loss of person days and the non-market value (consumer's surplus) of the activity. A total of 673 person days of private boat use takes place in the TERSA. This translates to a maximum potential loss of $53,392 in consumer's surplus.

*Market Economic Values.* Ten of the twelve charter boats operating within the TERSA would be potentially affected by this alternative. Direct business revenue would include potential losses of 73.4% for diving for lobsters, 59.0% for spearfishing, and 10.5% for fishing. Across all three consumptive recreational activities, 28.7% of revenue would be potentially affected (Table 4).

Through the ripple or multiplier effects, 38–39% of output/sales, income and employment associated with all the consumptive recreational activities in the TERSA could potentially be lost (Table 7). Although these impacts could have significant effect on the ten firms operating in the TERSA, the effect would not likely be noticed in the Monroe County economy because the effect would amount to only a fraction of a percent of the total economy supported by recreating visitors to the Florida Keys (Table 8).

*Boundary Alternative V*

*Non-Market Economic Values.* This alternative would displace over 86% of the total person-days of diving for lobsters, over 84% of the spearfishing, and over 7% of the fishing. Across all three consumptive recreational activities over 21% of the person-days would be displaced (Table 5). For diving for lobsters 85% of the displaced activity would be from within the FKNMS boundary, 59% of the fishing, and 85% of the spearfishing. Because of the way in which consumer's surpluses are calculated, they generally mirror the patterns in displaced use. Minor differences would be due to the distributions across activities by season. Profits are only equal to the affect on person-days for diving for lobsters. For spearfishing, the effects on profits are lower than the affect on person-days (65.5% versus 84.7%), while for fishing the affect is greater on profits than on person-days (21.9% versus 7.6%).

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*Table 5. Boundary Analysis Summary: Alternative V/Regulatory alternative D - Consumptive Recreation*

| Charter/Party Boat Operators | Diving for Lobsters[2] | | Fishing[2] | | Spearfishing[2] | | Total[2] | | |
|---|---|---|---|---|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | | | | | | |
| Person-Days | $ 1,269 | (88.00%) | 736 | (6.03%) | 1,343 | (85.60%) | 3,348 | (21.99%) | |
| Revenue | $ 87,361 | (87.99%) | $ 60,261 | (10.41%) | $ 196,944 | (67.47%) | $ 344,566 | (35.51%) | |
| Cost | $ 60,165 | (88.00%) | $ 38,093 | (8.08%) | $ 106,360 | (71.14%) | $ 204,618 | (29.67%) | |
| Profit | $ 27,196 | (87.99%) | $ 22,168 | (20.62%) | $ 90,584 | (63.61%) | $ 139,948 | (49.84%) | |
| Number of Firms | 2 | (100.00%) | 10 | (100.00%) | 3 | (100.00%) | 10 | (83.33%) | 1 |
| Consumer Surplus | $ 115,449 | (87.98%) | $ 58,501 | (5.87%) | $ 123,271 | (85.58%) | $ 297,221 | (23.37%) | |
| **Outside FKNMS Boundary** | | | | | | | | | |
| Person-Days | 231 | (80.21%) | 511 | (12.27%) | 243 | (80.20%) | 985 | (20.72%) | |
| Revenue | $ 15,894 | (80.00%) | $ 48,832 | (18.25%) | $ 33,436 | (80.00%) | $ 98,162 | (29.81%) | |
| Cost | $ 10,944 | (80.00%) | $ 36,495 | (16.76%) | $ 18,341 | (80.00%) | $ 65,780 | (25.86%) | |
| Profit | $ 4,950 | (79.99%) | $ 12,337 | (24.77%) | $ 15,095 | (80.00%) | $ 32,382 | (43.26%) | |
| Number of Firms | 2 | (100.00%) | 3 | (75.00%) | 2 | (100.00%) | 3 | (60.00%) | 1 |
| Consumer Surplus | $ 20,992 | (80.10%) | $ 40,617 | (11.96%) | $ 22,277 | (80.09%) | $ 83,886 | (21.31%) | |
| **Total** | | | | | | | | | |
| Person-Days | 1,500 | (86.71%) | 1,247 | (7.61%) | 1,586 | (84.72%) | 4,333 | (21.69%) | |
| Revenue | $ 103,255 | (86.66%) | $ 109,093 | (12.88%) | $ 230,380 | (69.04%) | $ 442,728 | (34.07%) | |
| Cost | $ 71,109 | (86.66%) | $ 74,588 | (10.82%) | $ 124,701 | (72.32%) | $ 270,398 | (28.65%) | |
| Profit | $ 32,146 | (86.65%) | $ 34,505 | (21.94%) | $ 105,679 | (65.53%) | $ 172,330 | (48.45%) | |
| Number of Firms | 2 | (100.00%) | 10 | (100.00%) | 3 | (100.00%) | 11 | (91.67%) | 1 |
| Consumer Surplus | $ 136,441 | (86.67%) | $ 99,118 | (7.42%) | $ 145,548 | (84.69%) | $ 381,108 | (22.88%) | |
| **Private Boats[3]** | | | | | | | | | |
| Person-Days | - | n/a | 673 | (100.00%) | - | n/a | 673 | (100.00%) | |
| Consumer's surplus | $ - | n/a | $ 53,392 | (100.00%) | $ - | n/a | $ 53,392 | (100.00%) | |

1. Number of firms does not add up to the total because individual firms may engage in more than one activity.
2. Percent of TERSA (See Table 1) by activity and total in parentheses.
3. Private boat activity does not involve losses to commercial recreation operators, therefore the only impacts are in loss of person-days of activity and in consumer's surplus. Lacking any information with regard to the distribution of the activity, the assumption was made that all of the activity takes place within the boundary alternative.

Private boat usage does not impact commercial recreational fishing operations, therefore the only impacts are the loss of person days and the non-market value (consumer's surplus) of the activity. A total of 673 person days of private boat use takes place in the TERSA. This translates to a maximum potential loss of $53,392 in consumer's surplus.

*Market Economic Values.* Eleven of the twelve charter boats operating within the TERSA would be potentially affected by this alternative. Direct business revenue would include potential losses of 86.7% for diving for lobsters, 69.0% for spearfishing, and 12.9% for fishing. Across all three consumptive recreational activities, 34.1% of revenue would be potentially affected (Table 5).

Through the ripple or multiplier effects, 45% of output/sales, income and employment associated with all the consumptive recreational activities in the TERSA could potentially be lost (Table 7). Although these effects could have significant affect on the ten firms operating in the TERSA, the affect would not likely be noticed in the Monroe County economy because the affect would amount to only a fraction of a percent of the total economy supported by recreating visitors to the Florida Keys (Table 8).

Table 6. Calculation of Maximum Potential Market Economic Losses: Consumptive Recreation

| | TERSA | Alternative II | | III Preferred Alternative | | Alternative IV | | Alternative V | |
|---|---|---|---|---|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | | | | | | |
| Revenue[1] | $ 970,323 | $ 123,239 | (12.70%) | $ 123,239 | (12.70%) | $ 344,566 | (35.51%) | $ 344,566 | (35.51%) |
| Output/Sales[2,5] | $ 1,086,762 | $ 138,028 | (12.70%) | $ 138,028 | (12.70%) | $ 385,914 | (35.51%) | $ 385,914 | (35.51%) |
| Income[3,5] | $ 413,217 | $ 52,482 | (12.70%) | $ 52,482 | (12.70%) | $ 146,735 | (35.51%) | $ 146,735 | (35.51%) |
| Employment[4,5] | 18 | 2 | (12.70%) | 2 | (12.70%) | 6 | (35.51%) | 6 | (35.51%) |
| **Outside FKNMS Boundary** | | | | | | | | | |
| Revenue[1] | $ 329,260 | $ - | (0.00%) | $ 28,815 | (8.75%) | $ 28,815 | (8.75%) | $ 98,162 | (29.81%) |
| Output/Sales[2,5] | $ 368,771 | $ - | (0.00%) | $ 32,273 | (8.75%) | $ 32,273 | (8.75%) | $ 109,941 | (29.81%) |
| Income[3,5] | $ 140,217 | $ - | (0.00%) | $ 12,271 | (8.75%) | $ 12,271 | (8.75%) | $ 41,803 | (29.81%) |
| Employment[4,5] | 6 | 0 | (0.00%) | 1 | (8.75%) | 1 | (8.75%) | 2 | (29.81%) |
| **Total** | | | | | | | | | |
| Revenue[1] | $ 1,299,583 | $ 123,239 | (9.48%) | $ 152,054 | (11.70%) | $ 373,381 | (28.73%) | $ 442,728 | (34.07%) |
| Output/Sales[2,5] | $ 1,455,533 | $ 138,028 | (9.48%) | $ 170,300 | (11.70%) | $ 418,187 | (28.73%) | $ 495,855 | (34.07%) |
| Income[3,5] | $ 553,435 | $ 52,482 | (9.48%) | $ 64,753 | (11.70%) | $ 159,006 | (28.73%) | $ 188,538 | (34.07%) |
| Employment[4,5] | 24 | 2 | (9.48%) | 3 | (11.70%) | 7 | (28.73%) | 8 | (34.07%) |

1. Total Revenue from Tables 2-5.

2. Output is derived by multiplying Revenue by a multiplier of 1.12.

3. Income is calculated by dividing total output by the total output to total income ratio for Monroe County (2.63).

4. Employment is calculated by dividing total income by the total income to jobs ratio for Monroe County (23,160).

5. The multiplier, total output to total income ratio, and total income to jobs ratio are taken from English, et. al. 1996

Table 7. Summary of Maximum Total Potential Loss from Displacement: Summary: Consumptive Recreation

| | TERSA | Alternative II | | III Preferred Alternative[1] | | Alternative IV | | Alternative V | |
|---|---|---|---|---|---|---|---|---|---|
| Market Impacts | | | | | | | | | |
| Output/Sales | $ 1,455,533 | $ 138,028 | (9.48%) | $ 170,300 | (11.70%) | $418,187 | (28.73%) | $ 495,855 | (34.07%) |
| Income | $ 553,435 | $ 52,482 | (9.48%) | $ 64,753 | (11.70%) | $159,006 | (28.73%) | $ 188,538 | (34.07%) |
| Employment | 24 | 2 | (8.37%) | 3 | (12.55%) | 7 | (29.29%) | 8 | (33.48%) |
| Non-market Impacts | | | | | | | | | |
| Consumer's Surplus | $ 1,665,643 | $ 102,965 | (6.18%) | $ 127,029 | (7.63%) | $320,791 | (19.26%) | $ 381,108 | (22.88%) |
| Producer's Surplus (profit) | $ 355,662 | $ 50,225 | (14.12%) | $ 55,786 | (15.69%) | $145,509 | (40.91%) | $ 172,330 | (48.45%) |

1. Percent of TERSA in parentheses.

Table 8. Comparison to the Economic Contribution of Visitors to Florida Keys to Monroe County

| | Monroe County | Alternative II | III Preferred Alternative[1] | Alternative IV | Alternative V |
|---|---|---|---|---|---|
| Output/Sales | $1,548,762,097 | 0.009% | 0.011% | 0.027% | 0.032% |
| Income | $ 573,566,049 | 0.009% | 0.011% | 0.028% | 0.033% |
| Employment | 18,892 | 0.011% | 0.016% | 0.037% | 0.042% |

1. For year June 1997 - May 1998. Represents total impact of spending by recreating visitors (non-residents of Monroe County) on economy of Monroe County. See Leeworthy and Vanasse, 1999.

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*Addendum to Economic Impact Estimates Based on One Commentor's Revised Input*

*Economic Impact Estimates Based on Commentor's Revised Input.* In the course of the public comment period, several pieces of correspondence were received from a charter spearfishing operator indicating information and data that differ from that which he provided to us during our initial interview with him conducted on December 10, 1998. The following are the impact estimates based on the revised information received. These estimates are based on the assumption of a constant rate of profit, where no revised profit is indicated and a constant relationship between revenue and person-days of activity. The first column is the company's revised estimates, the second is the revised estimates for Spearfishing and the third is the revised estimates for Total Consumptive Recreational Activities.

The revised estimates indicate maximum potential impact on spearfishing and total consumptive recreational use based on the commentor's revised estimates. These estimates were submitted after the analysis based upon the alternative boundaries, including the Preferred Alternative, was complete.

*Data from original survey—Revised Assumption:* All activity takes place within Preferred Boundary Alternative (based on comments received in June 2000).

| | Commentor | Spearfishing total | Total consumptive |
|---|---|---|---|
| Revenue | $214,000 | $245,142 | $301,565 |
| Profit | $124,000 | $130,160 | $150,225 |
| Person-days of activity | 1,650 | 1,860 | 3,194 |
| Total Output/Sales Impact | $239,680 | $274,519 | $337,713 |
| Total Income Impact | $91,133 | $104,395 | $128,423 |
| Total Employment Impact | 4 | 4 | 5 |
| Consumer's Surplus | $151,465 | $170,743 | $284,812 |

*Revised Assumption:* Revenue $288,000, Profit $144,000 and all activity takes place within Preferred Boundary Alternative (based on comments submitted in June 2000).

| | Commentor | Spearfishing total | Total consumptive |
|---|---|---|---|
| Revenue | $288,000 | $319,142 | $375,565 |
| Profit | $144,000 | $150,160 | $170,225 |
| Person-days of activity | 2,221 | 2,431 | 3,765 |
| Total Output/Sales Impact | $322,560 | $357,399 | $420,593 |
| Total Income Impact | $122,646 | $135,908 | $159,936 |
| Total Employment Impact | 5 | 5 | 6 |
| Consumer's Surplus | $203,841 | $223,119 | $337,188 |

*Revised Assumption:* Revenue $416,000 and all activity takes place within Preferred Boundary Alternative (based on comments submitted in June 2000).

| | Commentor | Spearfishing total | Total consumptive |
|---|---|---|---|
| Revenue | $416,000 | $447,142 | $503,565 |
| Profit | $241,047 | $247,207 | $267,272 |
| Person-days of activity | 3,207 | 3,417 | 4,751 |
| Total Output/Sales Impact | $465,920 | $500,759 | $563,953 |
| Total Income Impact | $177,156 | $190,418 | $214,446 |
| Total Employment Impact | 8 | 8 | 9 |
| Consumer's Surplus | $294,437 | $313,715 | $427,784 |

*Revised Assumption:* Revenue $460,000 and all activity takes place within Preferred Boundary Alternative (based on comments submitted in May 2000).

| | Commentor | Spearfishing total | Total consumptive |
|---|---|---|---|
| Revenue | $460,000 | $491,142 | $547,565 |
| Profit | $266,542 | $272,702 | $292,767 |
| Person-days of activity | 3,547 | 3,757 | 5,091 |
| Total Output/Sales Impact | $515,200 | $550,039 | $613,233 |
| Total Income Impact | $195,894 | $209,156 | $233,184 |
| Total Employment Impact | 8 | 8 | 9 |
| Consumer's Surplus | $325,579 | $344,857 | $458,926 |

*Mitigating Factors—Are the Potential Losses Likely?*

In the above GIS-based analysis, effects are referred to as ''potential losses.'' The reason is that there are several factors that could mitigate these potential losses and further there is a possibility that there might not be any losses at all. It is quite possible that there might be actual benefits to even the current displaced users. These factors are referred to only in qualitative terms because it is not possible to quantify them. Below two possible mitigating factors, how likely they might mitigate the potential losses from displacement, and further how this might differ for each of the three alternatives, are discussed.

*Substitution.* If displaced users are simply able to relocate their activities, they may be able to fully or partially mitigate their losses. This of course depends on the availability of substitute sites and further depends on the substitute site qualities. Several scenarios are possible. Even when total activity remains constant (i.e., person-days remain the same as they simply go to other sites), if the quality of the site is lower there could be some loss in consumer's surplus. If it costs more to get to the substitute sites, there could still be increases in costs and thus lower profits. If there is not a completely adequate supply of substitute sites, then there could be losses in total activity and in all the non-market and market economic measures referenced in our above analysis of displaced use. The possibilities for substitution vary by alternative.

*Long-term benefits from Replenishment Effects.* Ecological reserves or marine reserves may have beneficial effects beyond the direct ecological protection for the sites themselves. That is, both the size and number of fish, lobster and other invertebrates both inside and outside the reserves may increase. The following quote from Davis (1998) summarizes the replenishment effect of reserves:

> [W]e found 31 studies that tested whether protected areas had an effect on the size, reproductive output, diversity, and recruitment of fish in adjacent areas. Fisheries targeted species were two to 25 times more abundant in no-take areas than in surrounding areas for fish, crustaceans, and mollusks on coral and temperate reefs in Australia, New Zealand, the Philippines, Japan, Kenya, South Africa, the Mediterranean Sea, Venezuela, Chile, and the United States (California, Florida and Rhode Island). Mean sizes of fished species protected in no-take zones were 12 to 200 percent larger than those in surrounding areas for all fishes studied and in 75 to 78 percent of the invertebrates. Eighty-six percent of the studies that tested fishery yields found that catches within three kilometers of the marine protected areas were 46 to 50 percent higher than before no-take zones were created. It is clear that fishers all over the world believe no-take zones increase yields because they fish as close to the boundaries as possible.

The long-term benefits from the reserve could offset any losses from displacement and may also result in long-term benefits and no costs to recreational users that are displaced by the proposed Tortugas Ecological Reserve. Again, this conclusion may still vary by alternative.

*Boundary Alternative II*

*Substitution.* Complete mitigation by substituting to alternative sites has a high probability for this alternative because over half of the Tortugas Bank would still be available for all consumptive recreation activities. Given the equal distribution of use for diving for lobsters and spearfishing on the Tortugas Bank, it is not likely that increased costs of relocation would occur or that there would be losses from users forced to go to sites of lower quality. Crowding effects, by pushing all the use currently spread over the whole Tortugas Bank onto half the bank, would also be unlikely given the small absolute amounts of activity. For fishing, only 1% of the activity would be displaced, so for this activity it would also be expected there would be no crowding effects and recreational fishermen would not likely suffer any losses.

*Long-term Benefits from Replenishment Effects.* Eight fish spawning areas have been identified in the western portion of the TERSA. One of these spawning areas is in the Alternative II boundary area. Alternative II is the portion of the Preferred Alternative that lies within the existing boundary of the Sanctuary. Therefore the long-term benefits to stocks derived from the portion of the Preferred Alternative that lies outside of the FKNMS boundary would not be realized. This alternative has the smallest area of those analyzed here and so the potential long-term benefits to stocks outside the protected area would be smaller than the other alternatives. But by the same token, the displaced activity to be mitigated is also much smaller and thus on net there is a high likelihood that there would be long-term benefits to all the consumptive recreational users in the TERSA.

*Boundary Alternative III (Preferred Boundary Alternative)*

*Substitution.* As with Alternative II, complete mitigation by substituting to alternative sites has a high probability for this alternative because of the small proportion of the Tortugas Bank included in the alternative. Given the equal distribution of use for diving for lobsters and spearfishing on the Tortugas Bank, it is not likely that increased costs of relocation would occur or that there would be losses from users forced to go to sites of lower quality. Crowding effects, again, would be unlikely given the small absolute amounts of activity. For fishing, only 3% of the activity would be displaced, so recreational fishermen would not likely suffer any losses.

*Long-term Benefits from Replenishment Effects.* Five of the eight fish spawning sites in the western portion of the TERSA are located within the boundary of this alternative. Because this alternative includes areas outside the Sanctuary, the potential long-term benefits to stocks outside the protected area would be comparatively larger than it would be for Alternative II. The mitigating effort required on the part of operators in the boundary alternative would also be comparatively larger, but as mentioned above, because of the small percentage of the active recreational area included in the

alternative, the effect is likely to be very small. Therefore, there is a high likelihood that there would be long-term benefits to all the consumptive recreational users in the TERSA.

*Boundary Alternative IV*

*Substitution.* Under this alternative, about 73% of the diving for lobsters and 72% of the spearfishing would be displaced. The potential for substituting to other sites is greatly reduced as compared with Alternatives II and III. The reason is that under this alternative all of the Tortugas Bank falls within this boundary alternative. Some substitution is possible, but the probability of crowding effects rises considerably for diving for lobsters and spearfishing.

For fishing, substitution mitigating all the losses is still highly probable since only about 6% of the fishing activity would be displaced. This represents a relatively low amount of activity and given the wide distribution of this activity in the study area, crowding effects are still a low probability under this alternative.

*Long-term Benefits from Replenishment Effects.* Seven of the eight fish spawning sites in the western portion of the TERSA are located within the boundary of this alternative. For diving for lobsters and spearfishing, it is not clear whether there would be significant benefits offsite given that most of this activity currently takes place on the Tortugas Bank and none of the bank is available for the activity. Not much is currently known about other areas which might benefit from the stock effect and where they could relocate to reap these benefits. Whether those doing the activities displaced could find alternative sites where both the quantity and quality of activity could be maintained or enhanced seems less likely given the extent of displacement.

For fishing, however, the small amount of displacement relative to the entire area plus the wider distribution of fishing activity still makes it highly likely that the long-term benefits of replenishment would more than offset the potential losses from displacement resulting in net benefits to this group.

*Boundary Alternative V*

*Substitution.* This alternative displaces about 87% of the diving for lobsters and 85% of the spearfishing. Substitution possibilities for these activities are reduced even more, meaning that losses given in Table 7 are more likely to actually occur.

For fishing, mitigating all the losses through substitution is still highly probable since only about 8% of the fishing activity would be displaced. This again, represents a relatively low amount of activity and given the wide distribution of this activity in the study area, crowding effects are still a low probability under this alternative.

*Long-term Benefits from Stock Effects.* Seven of the eight fish spawning sites identified in the western portion of the TERSA are located within the boundary of this alternative. However, because the entire Tortugas Bank would be closed to diving for lobsters and spearfishing and the additionally large area encompassed by the proposed reserve, it is highly unlikely that these two user groups would benefit from the enhanced stocks of lobster and fish. Therefore, under this alternative, the maximum potential losses listed in Table 7 are highly likely to occur.

For fishing, however, the stock effects for the reserve could be substantial. Whether the benefits would be large enough to offset the displacement cannot immediately be determined. But given the past experience with reserves, it is still somewhat likely that the long-term benefits would offset the displacement costs yielding net benefits.

*Benefits of the Tortugas Ecological Reserve to Recreational Users*

*Recreational Users on Entire Florida Keys Reef Tract.* The possibility that consumptive recreational users could possibly benefit if there were long-term offsite impacts was discussed above. Given the work by Ault et al. (1998), Bohnsack and Ault (1996), Bohnsack and McClellan (1998), and Lee et al. (1994 and 1999), there is also the possibility that a protected area in the Tortugas could yield beneficial stock effects to a wide variety of species all along the entire Florida Keys reef tract and to species such as sailfish that are primarily offshore species. Even small increases in recreational tourist activities along the entire Florida Keys reef tract could more than offset the total displacements from the most extreme alternative analyzed here. Table 8 shows the total effects for each alternative relative to the total Florida Keys recreational visitor economic contribution. They are only fractions of a percent of the total recreational visitor economic contribution. One-tenth of one percent increase in the total recreational visitor contribution along the entire Florida Keys reef tract would more than offset the maximum potential losses from Alternative V (Table 7).

*Non-consumptive Users (Divers) in Tortugas.* Currently there is one operator that brings divers to the TERSA for non-consumptive diving. There were 1,048 person-days of non-consumptive diving which account for 4.98% of the total recreational activity in the TERSA (excluding the National Park). Of the total non-consumptive diving, 83.3% is currently done within the FKNMS boundary. Table 9 summarizes the information for non-consumptive divers. It is expected that this group would be benefited by Tortugas North. As the site improves in quality, it is expected that the demand for this site would increase and person-days, consumer's surplus, business revenues and profits would all increase. This would be expected to vary by alternative with the more protective alternatives having greater benefits.

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Table 9. Non-consumptive Diving

| | TERSA | Alternative II | | III Preferred Alternative | | Alternative IV | | Alternative V | |
|---|---|---|---|---|---|---|---|---|---|
| **Within FKNMS Boundary** | | | | | | | | | |
| Person-Days | 873 | 279 | (31.96%) | 279 | (31.96%) | 768 | (87.97%) | 768 | (87.97%) |
| Revenue | $ 95,123 | $ 30,439 | (32.00%) | $ 30,439 | (32.00%) | $ 83,708 | (88.00%) | $ 83,708 | (88.00%) |
| Cost | $ 58,157 | $ 18,610 | (32.00%) | $ 18,610 | (32.00%) | $ 51,178 | (88.00%) | $ 51,178 | (88.00%) |
| Profit | $ 36,966 | $ 11,829 | (32.00%) | $ 11,829 | (32.00%) | $ 32,530 | (88.00%) | $ 32,530 | (88.00%) |
| Number of Firms | 1 | 1 | (100.00%) | 1 | (100.00%) | 1 | (100.00%) | 1 | (100.00%) |
| Consumer Surplus | $ 77,198 | $ 24,710 | (32.01%) | $ 24,710 | (32.01%) | $ 67,954 | (88.03%) | $ 67,954 | (88.03%) |
| **Outside FKNMS Boundary** | | | | | | | | | |
| Person-Days | 175 | - | (0.00%) | - | (0.00%) | - | (0.00%) | 140 | (80.00%) |
| Revenue | $ 19,025 | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ 15,220 | (80.00%) |
| Cost | $ 11,631 | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ 9,305 | (80.00%) |
| Profit | $ 7,393 | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ 5,915 | (80.01%) |
| Number of Firms | 1 | - | (0.00%) | - | (0.00%) | - | (0.00%) | 1 | (100.00%) |
| Consumer Surplus | $ 15,475 | $ - | (0.00%) | $ - | (0.00%) | $ - | (0.00%) | $ 12,355 | (79.84%) |
| **Total** | | | | | | | | | |
| Person-Days | 1,048 | 279 | (26.62%) | 279 | (26.62%) | 768 | (73.28%) | 908 | (86.64%) |
| Revenue | $ 114,148 | $ 30,439 | (26.67%) | $ 30,439 | (26.67%) | $ 83,708 | (73.33%) | $ 98,928 | (86.67%) |
| Cost | $ 69,788 | $ 18,610 | (26.67%) | $ 18,610 | (26.67%) | $ 51,178 | (73.33%) | $ 60,483 | (86.67%) |
| Profit | $ 44,359 | $ 11,829 | (26.67%) | $ 11,829 | (26.67%) | $ 32,530 | (73.33%) | $ 38,445 | (86.67%) |
| Number of Firms | 1 | 1 | (100.00%) | 1 | (100.00%) | 1 | (100.00%) | 1 | (100.00%) |
| Consumer Surplus | $ 92,673 | $ 24,710 | (26.66%) | $ 24,710 | (26.66%) | $ 67,954 | (73.33%) | $ 80,309 | (86.66%) |

*Commercial Fishery*

Boundary Analysis

*Boundary Analysis Methodology.* In performing the boundary analysis, for the each alternative, the impact estimates are broken out by ''within the FKNMS boundary'' and ''outside the FKNMS boundary.''

Commercial fishing is prohibited in the DRTO so these grid cells are ''true'' zeroes in the analysis. Before breaking out the impact, the status of each grid cell (i.e., inside or outside of the boundary) had to be determined. Two methods were considered to carry out this task: the ''centroid method'' and the ''intersection method.'' The centroid method characterizes a grid cell as within a boundary if the center point of the cell is within the boundary. The intersection method characterizes a grid cell as within a boundary if any part of the cell is intersected by the boundary. The centroid method was selected because it was more consistent with how the data were collected (i.e., 1 $nm^2$ grid cells was the finest resolution).

The estimates from the geographic information system (GIS) analysis for the different boundary alternatives are the sum of each measurement within the boundary for each alternative. The estimates therefore represent the maximum total potential loss from displacement of the commercial fishing activities. This analysis ignores possible mitigating factors and the possibility of net benefits that might be derived if the proposed ecological reserve has replenishment effect. Although the extent of the mitigating factors or the potential benefits from replenishment cannot be quantified, these as well as other potential benefits of the proposed ecological reserve are discussed after presenting and discussing the maximum potential losses from displacement of the current commercial fisheries.

The boundary analysis is driven by the catch summed across grid cells within each boundary alternative. The set of relationships, measures and methods described in Leeworthy and Wiley (1999) are then used to translate catch into estimates of market and non-market economic values potentially affected. These estimates are broken-down by area both inside and outside FKNMS boundary and are done by species. Table 10 shows the results for catch for each alternative. Catch for the total TERSA is also presented to allow assessment of the proportion of the TERSA fishery potentially affected by each alternative.

Table 10. TERSA Catch Potentially Lost from Displacement, 1997

| Alternative/Area | Species/Species Group (Pounds)/Percent | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | King Mackerel | | Lobster | | Reef Fish | | Shrimp | |
| **TERSA** | **96,346** | | **937,952** | | **574,642** | | **715,500** | |
| Inside FKNMS | 77,285 | (80.22%) | 568,399 | (60.60%) | 293,374 | (51.05%) | 183,262 | (25.61%) |
| Outside FKNMS | 19,061 | (19.78%) | 369,553 | (39.40%) | 281,268 | (48.95%) | 532,238 | (74.39%) |
| **Alternative II** | **4,057** | | **56,625** | | **74,494** | | **7,940** | |
| Inside FKNMS | 4,057 | (100.00%) | 56,625 | (100.00%) | 74,494 | (100.00%) | 7,940 | (100.00%) |
| Outside FKNMS | - | (0.00%) | - | (0.00%) | - | (0.00%) | - | (0.00%) |
| **Preferred Alternative** | **13,489** | | **108,639** | | **116,642** | | **58,374** | |
| Inside FKNMS | 4,057 | (30.08%) | 56,802 | (52.29%) | 74,494 | (63.87%) | 7,940 | (13.60%) |
| Outside FKNMS | 9,432 | (69.92%) | 51,837 | (47.71%) | 42,148 | (36.13%) | 50,434 | (86.40%) |
| **Alternative IV** | **14,999** | | **153,778** | | **161,997** | | **58,374** | |
| Inside FKNMS | 5,568 | (37.12%) | 101,940 | (66.29%) | 119,849 | (73.98%) | 7,940 | (13.60%) |
| Outside FKNMS | 9,431 | (62.88%) | 51,838 | (33.71%) | 42,148 | (26.02%) | 50,434 | (86.40%) |
| **Alternative V** | **14,999** | | **164,908** | | **169,907** | | **73,427** | |
| Inside FKNMS | 5,568 | (37.12%) | 101,940 | (61.82%) | 119,849 | (70.54%) | 7,940 | (10.81%) |
| Outside FKNMS | 9,431 | (62.88%) | 62,968 | (38.18%) | 50,058 | (29.46%) | 65,487 | (89.19%) |

1. Percents of catch inside and outside FKNMS in parentheses.

The boundary alternatives are ordered according to size and potential impact. Alternative I is the ''No Action'' alternative and is the least protective alternative. Alternative III is the ''Preferred Alternative''. Alternatives IV and V are the largest and ''most protective'' alternatives. For catch, generally the higher the alternative number the greater the potential affect on catch, except for King mackerel and shrimp. Potential affect on King mackerel catch is the same for both alternatives IV and V and, the potential affect on shrimp catch is the same for the Preferred Alternative (III) and alternative IV.

Both the market and non-market economic values potentially lost from displacement for each alternative, except the ''No-action'' Alternative (Boundary Alternative I), are summarized in Leeworthy and Wiley (2000), includes greater detail by species/species groups, and for the market economic values, separate estimates for Monroe and Collier/Lee counties. Although the impacts on only Monroe and Collier/Lee counties are presented, the catch impacted that is landed in other counties is included in the analyses. The result is that the impacts in Monroe and Collier/Lee Counties are slightly overstated. However, in the boundary alternative analyses only a small amount of catch is landed in other counties and the amounts are insignificant.

*Table 11. Maximum Potential Losses to the Commercial Fisheries from Displacement*

| Area/Measure | Total TERSA | Alternatives: Alternative II | Preferred Alternative | Alternative IV | Alternative V |
|---|---|---|---|---|---|
| **Total TERSA** | | | | | |
| Market[1] | | | | | |
| Harvest Revenue | $ 6,884,992 | $ 411,632 | $ 843,583 | $ 1,126,237 | $ 1,224,849 |
| Total Output | $ 14,957,717 | $ 865,819 | $ 1,817,843 | $ 2,400,730 | $ 2,621,627 |
| Total Income | $ 9,273,785 | $ 536,808 | $ 1,127,063 | $ 1,488,453 | $ 1,625,409 |
| Total Employment | 404 | 23 | 49 | 65 | 71 |
| Non-market | | | | | |
| Consumer's Surplus [2] | $ 7,537,781 | $ 473,097 | $ 879,973 | $ 1,103,808 | $ 1,239,587 |
| Producer's Surplus [3] | $ - | $ - | $ - | $ - | $ - |
| Return to Labor & Capital [4] | $ 1,926,162 | $ 106,789 | $ 221,968 | $ 300,599 | $ 326,880 |
| **Inside FKNMS** | | | | | |
| Market | | | | | |
| Harvest Revenue | $ 3,476,456 | $ 411,632 | $ 411,632 | $ 694,284 | $ 694,284 |
| Total Output | $ 7,292,387 | $ 865,819 | $ 865,819 | $ 1,448,700 | $ 1,448,700 |
| Total Income | $ 4,521,280 | $ 536,808 | $ 536,808 | $ 898,194 | $ 898,194 |
| Total Employment | 197 | 23 | 23 | 39 | 39 |
| Non-market | | | | | |
| Consumer's Surplus | $ 3,890,933 | $ 473,097 | $ 473,097 | $ 696,932 | $ 696,932 |
| Producer's Surplus | $ - | $ - | $ - | $ - | $ - |
| Return to Labor & Capital | $ 1,029,118 | $ 106,789 | $ 106,789 | $ 185,420 | $ 185,420 |
| **Outside FKNMS** | | | | | |
| Market | | | | | |
| Harvest Revenue | $ 3,408,536 | $ - | $ 431,951 | $ 431,953 | $ 530,565 |
| Total Output | $ 7,665,330 | $ - | $ 952,024 | $ 952,030 | $ 1,172,927 |
| Total Income | $ 4,752,505 | $ - | $ 590,255 | $ 590,259 | $ 727,215 |
| Total Employment | 207 | - | 26 | 26 | 32 |
| Non-market | | | | | |
| Consumer's Surplus | $ 3,646,848 | $ - | $ 406,876 | $ 406,876 | $ 542,655 |
| Producer's Surplus | $ - | $ - | $ - | $ - | $ - |
| Return to Labor & Capital | $ 897,044 | $ - | $ 115,179 | $ 115,179 | $ 141,460 |

1. Market economic measures include impacts on Monroe County and Collier/Lee counties. See Appendix A, Tables A.6 – A.11 in Leeworthy and Wiley (1999) for details by species and counties.
2. Maximum values from each species were used when range of estimates was generated multiple demand equations. See Appendix B in Leeworthy and Wiley (1999) for detailed calculations by species and alternatives.
3. Producer's surplus or economic rents were assumed to be zero for two reasons. First, all fisheries, except spiny lobsters, are open access fisheries and therefore economic would be zero i.e., firms are earning only normal rates of return on investment. Second, even using total return to labor & capital, which overstates return on investment, does not yield rates of return on investment above normal rates of return.
4. Return to Labor & Capital is not a non-market value but would include rent if it existed.

*Boundary Alternative I: No Action*

The no-action alternative is not establishing a reserve and not issuing the implementing regulations. The costs of imposing the no-take regulations, for any given alternative with no-take regulations, would be the benefits of the no-action alternative. That is, by not adopting the no-take regulations, the costs are avoided. Similarly, any benefits from imposing the no-take regulations, for any given alternative with no-take regulations, would be the costs of the no-action alternative. That is, by not adopting the no-take regulations, the costs are the benefits lost by not adopting the no-take regulations. Said another way, the costs are the opportunities lost. The impacts of the no-action alternative can only be understood by comparing it to one of

the alternatives. Thus the effects of the no action alternative can be obtained by reading the effects from any of the proposed alternatives in reverse.

*Boundary Alternative II*

*Market Economic Values.* This alternative could potentially affect 4.2% of the catch of King mackerel, 6% of the lobster catch, 12.96% of the Reef Fish catch, and 1% of the shrimp catch in the TERSA. This would lead to a reduction in about $411 thousand in harvest revenue or 6% of the TERSA harvest revenue. This reduction in revenue would result in a reduction of 5.8% of total output, income and employment generated by the TERSA fishery. Since this alternative was restricted to reside within FKNMS current boundary, the effects are all inside FKNMS boundary. Although these effects may be significant to those firms that might potentially be affected, the overall affect on the local economies would be so small they would not be noticed. Harvest revenue potentially impacted was only 0.67% of all harvest revenue of catch landed in Monroe County. In addition, this lost revenue would translate (accounting for the multiplier effects) into only fractions of a percent of the total Monroe County economy; 0.035% of total output, 0.046% of total income and 0.045% of total employment.

*Non-market Economic Values.* For all species/species groups, this alternative could result in a potential loss of over $473 thousand in consumer's surplus. This is 6.28% of the consumer's surplus generated by the entire TERSA. Although producer's surplus or economic rents are estimated to be zero, about 5.54% of the return to labor and capital of the TERSA fishery is potentially affected by this alternative.

*Boundary Alternative III (Preferred Boundary Alternative)*

*Market Economic Values.* This alternative could potentially affect 14% of the catch of King mackerel, 11.58% of the lobster catch, 20.30% of the Reef Fish catch, and 8.16% of the shrimp catch in the TERSA. This would lead to a reduction in about $844,000 in harvest revenue or 12.26% of the TERSA harvest revenue. This reduction in revenue would result in a reduction of 12.16% of total output, income and employment generated by the TERSA fishery. The impacts are split almost evenly between the areas inside and outside the FKNMS boundary. Although these costs may be significant to those firms that might potentially be affected, the overall affect on the local economies would be so small they would not be noticed. Harvest revenue potentially affected was only 1.16% of all harvest revenue of catch landed in Monroe County. In addition, this lost revenue would translate (accounting for the multiplier effects) into only fractions of a percent of the total Monroe County economy; 0.0596% of total output, 0.0779% of total income and 0.0785% of total employment.

*Non-market Economic Values.* For all species/species groups, this alternative could result in a potential loss of about $880,000 in consumer's surplus. This was 11.7% of the consumer's surplus generated by the entire TERSA. Whereas the market economic values were almost evenly split inside and outside the FKNMS, 53.76% of the consumer's surplus potentially affected is from inside the FKNMS boundary. This is due to the distributions of lobster and reef fish catch where a higher proportion of the potentially affected catch come from inside the FKNMS boundary, whereas the distributions of shrimp and King mackerel come largely from outside the FKNMS boundary.

Although producer's surplus or economic rents are estimated to be zero, about 11.5% of the return to labor and capital of the TERSA fishery is potentially affected by this alternative. The distribution inside versus outside the FKNMS boundary follows that of the market economic values with 48% from catch inside the FKNMS boundary.

*Boundary Alternative IV*

*Market Economic Values.* This alternative could potentially affect 15.57% of the catch of King mackerel, 16.4% of the lobster catch, 28.19% of the Reef Fish catch, and 8.16% of the shrimp catch in the TERSA. This would lead to a reduction in about $1.126 million in harvest revenue or 16.45% of the TERSA harvest revenue. This reduction in revenue would result in a reduction of 16.05% of total output, income and employment generated by the TERSA fishery. About 61.65% of the harvest revenue and 60.34% of the output, income and employment impacts would come from catch displaced from within FKNMS boundary. Although the costs may be significant to those firms that might potentially be affected, the overall impact on the local economies would be so small they would not be noticed. Harvest revenue potentially affected was only 1.82% of all harvest revenue of catch landed in Monroe County. In addition, this lost revenue would translate (accounting for the multiplier effects) into only fractions of a percent of the total Monroe County economy; 0.0968% of total output, 0.127% of total income and 0.1281% of total employment.

*Non-market Economic Values.* For all species/species groups, this alternative could result in a potential loss of about $1.1 million in consumer's surplus. This is 14.64% of the consumer's surplus generated by the entire TERSA. Approximately 63.14% of the consumer's surplus potentially affected is from catch from inside the FKNMS boundary. This is due to the distributions of lobster and reef fish catch where a higher proportion of the potentially affected catch come from inside the FKNMS boundary, whereas the distributions of shrimp and King mackerel come largely from outside the FKNMS boundary.

Although producer's surplus or economic rents are estimated to be zero, about 15.6% of the return to labor and capital of the TERSA fishery is potentially affected by this alternative. The distribution inside versus outside the FKNMS boundary follows that of the market economic values with 61.68% from catch inside the FKNMS.

*Boundary Alternative V*

*Market Economic Values.* This alternative could potentially affect 15.57% of the catch of King mackerel, 17.58% of the lobster catch, 29.57% of the Reef Fish catch, and 10.26% of the shrimp catch in the TERSA. This would lead to a reduction in about $1.224 million in harvest revenue or 17.89% of the TERSA harvest revenue. This reduction in revenue would result in a reduction of 17.5% of total output, income and employment generated by the TERSA fishery. About 56.68% of the harvest revenue and 55.26% of the output, income and employment impacts would come from catch displaced from within the FKNMS boundary. Although the costs may be significant to those firms that might potentially be affected, the overall impact on the local economies would be so small they would not be noticed. Harvest revenue potentially affected was only 1.98% of all harvest revenue of catch landed in Monroe County. In addition, this lost revenue would translate (accounting for the multiplier effects) into only fractions of a percent of the total Monroe County economy; 0.106% of total output, 0.138% of total income and 0.1399% of total employment.

*Non-market Economic Values.* For all species/species groups, this alternative could result in a potential loss of about $1.24 million in consumer's surplus. This was 16.4% of the consumer's surplus generated by the entire TERSA. 56.2% of the consumer's surplus

potentially affected is from catch from inside the FKNMS boundary. This is due to the distributions of lobster and reef fish catch where a higher proportion of the potentially affected catch come from inside the FKNMS boundary, whereas the distributions of shrimp and King mackerel come largely from outside the FKNMS boundary.

Although producer's surplus or economic rents are estimated to be zero, about 16.97% of the return to labor and capital of the TERSA fishery is potentially affected by this alternative. The distribution inside versus outside the FKNMS boundary follows that of the market economic values with 56.7% from catch inside the FKNMS boundary.

*Profiles of Fishermen Potentially Affected*

A profile of the approximately 110 fishermen using TERSA based on a sample of 90 was completed with a comparison with other commercial fishermen in Monroe County. The profiles of those potentially affected by each alternative were compared. The profiles are summarized in Table 12. Statistical tests were performed comparing the sample distributions for the groups that fished within each boundary alternative as compared with TERSA fishermen as a whole. Except for the number of fishing operations potentially affected, the only significant differences for all alternatives were in membership in organizations and in fish house usage.

Fishermen potentially affected by Boundary Alternative II were the only group that was significantly different for any other characteristics listed in Table 12. These fishermen had less experience fishing in Monroe County than the general TERSA fishermen, however they were not significantly different with respect to years fishing in the TERSA. Fishermen potentially affected by Boundary Alternative II also earned a significantly lower proportion of their income from fishing than the general TERSA fishermen; however, they earned a significantly higher proportion of their income from fishing within the TERSA than the general TERSA fishermen.

Fishermen potentially affected by Boundary Alternative II were also significantly different from the general TERSA fishermen in the distribution of their primary hauling port. A significantly higher proportion of those potentially affected by this alternative used Key West/Stock Island and Tavenier than the general TERSA fishermen, and they used Big Pine Key, Marathon and Naples/Ft. Myers significantly less than the general TERSA fishermen.

Fifty-one (51) or 57% of the sampled fishing operations could be potentially affected by Boundary Alternative II followed by 64 operations or 71% for Alternative III, and 65 operations or 72% for both Alternatives IV and V. Twenty-four (24) of the 28 or 86% of all the lobster operations could be potentially affected by Boundary Alternative II, while 27 of the 28 lobster operations or 96% are potentially affected by Boundary Alternatives III, IV, and V. Six (6) of the 18 or 33.3% of the shrimp operations are potentially affected by Alternative II, while Alternative III could potentially affect 15 of 18 or 83% of the shrimp operations. Boundary Alternatives IV and V could potentially affect 14 of the 18 or 78% of the shrimp operations. Fifteen (15) of the 16 King mackerel operations could be potentially affected by Boundary Alternative II, while Boundary Alternatives III, IV and V could potentially affect all 16 of the King mackerel operations. Thirty-seven (37) of the 42 or 88% of the reef fish operations could be potentially affected by Alternative II, while 40 or 95% of the reef fish fishing operations could be potentially affected by Alternative III. Boundary Alternatives IV and V could potentially affect all 42 reef fish operations.

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