

## Assessment of the Potential Costs and Benefits of the Final Management Plan Regulations

Appendix M is part of the Florida Keys National Marine Sanctuary (Sanctuary) Final Management Plan/ Environmental Impact Statement (FMP/EIS). Appendix M is the EIS assessment of the socioeconomic impacts of the FMP, including its implementing regulations and alternatives. Appendix M is supplemented by the socioeconomic assessment of the management alternatives in the draft management plan (DMP) set forth in Volume II. Volume I, *The Preferred Alternative-Management Plan* is the heart of the EIS and describes the process and reasoning by which the preferred alternative was chosen - by balancing public comments on the DMP, Sanctuary Advisory Council (SAC) recommendations and the goals and requirements of the National Marine Sanctuaries Act (NMSA), the Florida Keys National Marine Sanctuary and Protection Act (FKNMSPA) and the National Environmental Policy Act (NEPA). Volume I provides a narrative explanation of the way in which resource protection and the public welfare were considered together in building the FMP. The final socioeconomic assessment in Appendix M and Volume II, together with the analysis of the environmental consequences in Volume II, provide the basis for the analysis in Volume I.

The Preferred Alternative/Management Plan summarily explains the factors considered in developing the final management plan and regulations. These factors include the need for resource protection, for facilitating compatible multiple uses, and for balancing the related environmental and socioeconomic impacts of the alternatives. Public comments on the DMP, particularly those from the SAC, comprised of representatives of local user groups, were also carefully considered in development of the FMP.

NOAA's assessment of the potential socioeconomic impacts on various user groups in the EIS has been designed to also satisfy the Regulatory Impact Review (RIR) requirements of Executive Order 12866.

Under Executive Order 12866, if the regulations are "significant" as defined in section 3(f) of the Order, an assessment of the potential costs and benefits of the regulatory action must be prepared and submitted to the Office of Information and Regulatory Affairs (OIRA) of the Office of Management and Budget (OMB). The Administrator of NOAA has determined that although the regulatory action is not expected to "have an annual effect on the economy of \$100 million or more," or otherwise meet the definition of a significant regulation under section 3(f) (1), (2), or (3), certain controversial and innovative aspects of the regulations may meet the definition under section 4, "Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in [the] Executive Order."

Appendix M constitutes the primary socioeconomic impact of both the RIR and NOAA's FMP/EIS. Appendix M reviews the problems and policy objectives prompting the regulatory proposals and evaluates the major alternatives that were considered. It demonstrates that NOAA systematically and comprehensively considered a reasonable range of alternatives in order to ensure that the resource protection objectives would be achieved in such a way that national and local interests would be enhanced while costs and benefits would be duly taken into consideration.

NOAA's socioeconomic assessment places special emphasis on the regulations governing the establishment of marine zones and the conduct of activities in those zones. Particular attention is paid to the Ecological Reserves (ERs) and Sanctuary Preservation areas (SPAs), since the concept of no-take zones or reserves is the most innovative and controversial element of the FMP, and has aroused significant public interest and debate. NOAA has concluded that the Sanctuary regulations will have broad benefits to most users of the Florida Keys, and especially to the tourist industry which is very significant from a local and statewide perspective. No significant adverse socioeconomic impacts are anticipated to non-consumptive users. Among consumptive users, most will not be affected greatly by the Sanctuary-wide regulations nor the restrictions applicable to various zones, but a small percentage will undergo some costs due to displacement from no-take areas. These costs are expected to be offset with time as better habitat protection and protection of biodiversity within the zones improves the ecological health of the area.

Regulations which received considerable public scrutiny include those affecting the operation of vessels, particularly personal watercraft (PWC) (e.g., jet-skis); and to a lesser extent the Submerged Cultural Resources (SCR) permit system regulation of commercial treasure salvage. NOAA's approach to the PWC issue was multi-pronged and resulted in regulations that apply to PWCs as well as other vessels; and in non-regulatory management strategies which specifically apply to PWCs. NOAA took public input into account, as in its approach to all the regulations. The final preferred alternative attempts to address user conflicts and environmental concerns while avoiding regulatory impacts as much as possible consistent with the major



objectives of the Sanctuary. The process is described in Vol. 1, pp. 16-17, in Appendix L (Comments Received on the DEIS/MP and NOAA's Response), and in Appendix M.

NOAA also considered public comments, particularly those from the commercial treasure salvage community, in revising the SCR permit system to make it more pragmatic from the perspective of commercial salvors while maintaining the primary objective of protecting the natural and submerged cultural resources of the Sanctuary. (See Vol. 1, pp. 20-24, and the relevant sections in Appendix L and Appendix M.)

NOAA's preferred alternative in the FMP for marine zoning, PWCs, the SCR permit system and other issues took all comments received from the public into full account and represents a considerable alteration from the DMP so as to disrupt users as little as possible, without compromising the objectives of NMSA or the FKNMSPA.

### **Socioeconomic Impacts of Sanctuary Regulations**

Drawing upon 20 years of management experience in Key Largo, Looe Key and other National Marine Sanctuaries, NOAA has developed regulations that protect the natural and historic resources of the Sanctuary. Along with education and research, regulations are an integral tool for managing human activities in National Marine Sanctuaries. The revisions to these regulations from those proposed in the DMP/EIS are primarily based on the comments made on the draft plan during the public review process. Other changes are refinements on the draft which came about through interagency review. The FMP/EIS is the result of a careful balancing of the goals of protecting the resources and facilitating compatible multiple uses of the Sanctuary.

In greater detail, the goals and objectives of FKNMSPA and NMSA which the regulations were designed to meet are as follows:

- to protect and preserve the living and other resources of the Sanctuary (FKNMSPA §3(b));
- to educate and interpret for the public the Florida Keys marine environment (FKNMSPA §3(b));
- to manage human uses of the Sanctuary consistent with FKNMSPA (FKNMSPA §3(b));
- to facilitate all public and private uses of the Sanctuary that are compatible with the primary objective of resource protection (NMSA §301(b)(5));
- to support, promote, and coordinate scientific research on, and monitoring of Sanctuary resources, especially long-term monitoring and research (NMSA §301(b)(3));
- to enhance public awareness, understanding, appreciation, and wise use of the marine environment (NMSA §301(b)(4));
- to maintain, restore, and enhance living resources by providing places for species that depend upon marine areas to survive and propagate (NMSA §301(b)(9));
- to create models of, and incentives for, ways to conserve and manage the area (NMSA §301(b)(7));
- to implement coordinated plans for the protection and management of the Sanctuary with appropriate federal agencies, state and local governments, Native American tribes and organizations, international organizations, and other public and private interests concerned with the continuing health and resilience of the Sanctuary (NMSA §301(b)(6)).

Because coordination with existing authorities is an important component of comprehensive ecosystem management, the Sanctuary regulations supplement, rather than replace, existing authorities.

The regulations ensure the protection and use of Sanctuary resources in a manner that:

- complements existing regulatory authorities;
- utilizes a system of temporal and geographic zoning to ensure effective site-specific resource



protection and use management;

- ensures coordination and cooperation between Sanctuary management and other federal, state, and local authorities with jurisdiction within or adjacent to the Sanctuary;
- achieves simplicity in the regulatory process and promotes ease of compliance with Sanctuary regulations;
- promotes mechanisms for making informed regulatory decisions based on the best available research and analysis, taking into account information about the environmental, economic, and social impacts of Sanctuary regulations; and
- complements coordination among appropriate federal, state, and local authorities to enforce existing laws that fulfill Sanctuary goals.

The Sanctuary regulations are found in the Regulatory Action Plan. The heart of the regulations is the restriction or prohibition of certain activities throughout the Sanctuary or in specified parts of it. The Sanctuary-wide regulations prohibit hydrocarbon and mineral exploration, development and production; injury or removal of coral or live rock; alteration or construction on the seabed; discharging materials such as pollutants; operating vessels in a dangerous or destructive manner; diving without a flag; releasing exotic species; tampering with markers; removing or injuring Sanctuary historical resources; taking or possessing protected wildlife; possessing or using explosives or electrical charges; and interfering with law enforcement officers. The regulations also incorporate state regulations on collecting tropical fish marine life and make them applicable to federal waters.

This section includes a description of the revisions. Also included is a discussion of the expected environmental and socioeconomic consequences of the regulations. A longer discussion of the environmental consequences is contained in Volume II.

This assessment attempts to identify the potential impacts (costs and benefits) to society that can be expected from the regulations. Net socioeconomic benefits include: (1) potential changes in consumer surplus (the difference between the price the consumer is willing to pay and what he has to pay) derived from non-consumptive activities such as recreational diving and viewing; (2) potential changes in consumer surplus from recreational fishing; (3) potential changes in producer surplus and consumer surplus from landings from the commercial fishery; and (4) potential changes in management costs.

The determination of benefits depends on values derived from non-consumptive and consumptive uses of the Sanctuary. The effect of the regulations on the integrity of the habitat and the balance and population of marine species will tend to increase values derived from non-consumptive use. Values deriving from consumptive use can be affected in both directions, because short-term costs from complying with the regulations may be partially or totally offset by a long-term improvement in habitat.

The assessment is primarily qualitative, but values and impacts have been quantified where possible given the administrative record. Where there is no numerical valuation, an attempt has been made to predict the direction of benefits and costs. Data on the complex ecosystems of the Florida Keys are limited, as are landings data from both commercial and recreational harvest. NOAA and the University of Miami are currently conducting studies on tourist visitation and on non-market valuations of the Sanctuary, and the Florida Marine Research Institute is studying landings in the commercial fisheries. A University of Miami-University of Florida study is examining changing perceptions of the reserve concept by different user groups. These ongoing studies will help in understanding the socioeconomic dynamics of the area and may be of use in the continuing management process.

Based on NOAA's experience in the Looe Key and Key Largo National Marine Sanctuaries, and elsewhere, the assumption is made that the level of compliance with the regulations will be high and that therefore the potential benefits (to the extent that they exist) can be achieved. There are administrative costs to the government in obtaining voluntary compliance and in the enforcement of the regulations. There are costs to the private sector for compliance and additional costs to those subject to enforcement actions. Overall, the benefits to the Sanctuary users, the state and the nation are expected to exceed the costs.

The assessment describes the existing management regime, discusses the problems which the plan is



designed to address, discusses the benefits and costs associated with coral reefs and related habitats, describes the Monroe County regional economy, and reviews the regulations and their expected impacts on users of the Sanctuary.

## **Existing Management Regime**

The Final Management Plan is designed to complement an already-existing management regime of considerable complexity. Key Largo and Looe Key National Marine Sanctuaries have had management plans and regulations in place since 1975 and 1981, respectively. Additionally, the United States Fish and Wildlife Service (USFWS) has had a system of refuges in the Keys since the early 1900s, and John Pennekamp Coral Reef State Park was established in 1960.

Various federal laws, including the Endangered Species Act, the Marine Mammal Protection Act, the Magnuson Fishery Conservation and Management Act (Magnuson Act), the Abandoned Shipwreck Act of 1987, the Coastal Barrier Resources Act of 1982, the Coastal Zone Management Act of 1972, the Migratory Bird Treaty Act, the National Historic Preservation Act and the Lacey Act, all affect the Florida Keys. Various state statutes also affect Sanctuary resources, and authorities often overlap. The relevant statutes are described in Appendix C of Volume III.

Commercial and recreational fishing in the Exclusive Economic Zone (EEZ) adjacent to the Florida Keys are managed by regional fishery management councils which were established by the Magnuson Act to manage fishery resources in the United States' EEZ. The councils prepare fishery management plans for domestic and foreign fishing of species within their areas of authority.

Federal jurisdiction extends out 200 nautical miles, which is the limit of the EEZ, but waters up to three nautical miles from shore on the Atlantic side, or nine on the Gulf side, are considered state waters, and under the jurisdiction of the Florida Marine Fisheries Commission. Some differences exist between state and federal regulations. A protocol for a consistent set of federal-state regulations has been drafted, and is expected to lead to greater compliance and to reduce fishermen's confusion over such things as size limits and bag limits.

The marine zoning plan was developed in consultation with the South Atlantic Fishery Management Council, the Gulf of Mexico Fishery Management Council, and the Florida Marine Fisheries Commission. A protocol for continuing cooperative management has been developed and is described in the regulatory section of Volume I.

For further information about fishery management in the Florida Keys, including a description of fishery management plan preparation by the councils, the national standards used in development of fishery management plans, and a list of fishery management plans governing fisheries within the Sanctuary and their implementing regulations, see Appendix D, Volume III.

## **Problem Statement**

The problems that were considered in the development of the regulations in the FMP/EIS are grouped into the following four categories:

### **Habitat Loss and Degradation**

Outbreaks of serious coral disease, a general pattern of environmental decline, and three major ship groundings on the Keys' reef tract in 1989 are major factors that led to the enactment of the FKNMSPA in November of 1990. The loss of coral reef and seagrass habitats directly affects a wide range of species that are heavily dependent on reef habitats for food and shelter. The habitat degradation is caused primarily by human activities, both legal and illegal. Some of the more important causes are ship groundings, small boat groundings, anchor damage, dredging and dumping, and careless collection by scientists and commercial collectors. Another cause is injury by divers. Currently in Key Largo and Looe Key National Marine Sanctuaries and in state-protected areas, divers are prohibited from physically impacting corals, but are not prohibited from doing so elsewhere.

### **Increased Pressure from Harvest of Resources**

Recreational and commercial fishing have been, and continue to be, major activities throughout the Keys. Fishing occurs in the Keys year-round, with peaks during the winter tourist season and during the summer.



The situation in the Keys is complicated because of the large number of species and the variety of fishing gear used. Since the 1960s, gear such as styrofoam floats and polypropylene line have placed additional pressures on the fishery. Technological advances such as lorans, Global Positioning Systems, and depth recorders have changed the way fishermen work and increased their efficiency.

These technological advances, along with an increase in the numbers of participants, has meant that, like so many open-access fisheries worldwide, basically all of the Florida Keys fisheries are overcapitalized, including the commercial fisheries and the for-hire recreational fisheries.<sup>1</sup> Overcapitalized fisheries are, by definition, economically inefficient fisheries, in which more and bigger vessels and more gear is being used to catch a given number of fish than are needed to produce the most profit for the fishery.

In Monroe County, the finfish and shellfish catch has remained relatively stable over the past 25 years. In 1971, the finfish catch was 6.5 million lbs, and the shellfish catch was 16.8 million lbs. In 1995, Monroe County landings of finfish were 7.8 million lbs, and of shellfish 15.1 million lbs.

Overcapitalization is most easy to see in the lobster fishery. The number of traps used on the Florida west coast, which includes the Florida Keys, tripled from 55,000 in 1960-61 to 150,000 in 1970-71, nearly quadrupled again over the following ten years to 570,000 in 1980-81, and continued to rise until a peak of 857,000 traps was reached in the 1991-92 season. Meanwhile the catch per unit effort, after fluctuating over a range of 35 lbs per trap to 56 lbs per trap in the years 1960-1970, began declining precipitously, reaching a low of 6.1 lbs per trap in 1992-93. The overcapitalization problem was addressed in Florida in 1992 by a Florida State trap certificate program designed to gradually reduce the number of traps by 50 percent. Catch per unit effort has been gradually increasing again and reached 10.2 in the 1994-95 season (Harper 1995).

Overcapitalization does not necessarily lead to overfishing in the presence of effective regulations, but it often does put pressure on fish populations. Many of the Florida Keys fisheries are still in a healthy condition, but some are not. King mackerel, black grouper and other grouper species, sharks, mutton snapper, amberjack, spiny lobster, stone crabs, some aquarium species, and soft corals have all been placed under strict management plans because of declining stocks. Other marine species including jewfish and nassau grouper, queen conch, five species of sea turtles, live rock and coral have declined to the point of being closed to all harvest.

A broader issue concerns the alteration of species composition through removal of target species. In particular, the removal of a large proportion of top finfish predators and adult lobsters may allow such species as sea urchins and damselfish to multiply, which in turn has consequences for algal biomass, coral reef growth rates, bioerosion rates and other aspects of the ecosystem.

### **User Conflicts**

Conflicts among users have increased as overall demand on the marine resources of the Sanctuary has risen. Conflicts range in severity from annoying situations to very serious, even life-threatening ones.

Commercial fishermen and recreational fishermen in many areas of the world are involved in a competition over scarce resources. Normally, the allocation issue is dealt with through fishery management decisions. Sometimes, however, the competition may not be over who gets to take a fish which both want, but over available space within the fishing grounds. Anglers may complain about commercial lobster fishermen setting traps in high concentrations, thereby impeding recreational trolling grounds. On the other hand, severe losses occur annually from recreational fishermen molesting commercial traps. The most frequent complaint from both commercial and recreational fishermen involves their trap buoys being run over, both by other fishermen and by charter dive boats, which results in entanglement and loss of fishing gear.

Conflicts between recreational fishermen usually involve some invasion of perceived territory. Many recreational fishermen place a high priority on solitude, which can be disrupted if an area becomes a popular fishing spot.

Conflicts between fishermen and other users of the Sanctuary are the most relevant to the new zoning regulations. Swimmers and divers frequently have problems with fishermen's lost gear. Occasionally, they are injured by fishing gear. More often, they are annoyed by the sight of fishing line and sinkers wrapped around coral, or hooks embedded in fishes' mouths.

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<sup>1</sup>Richard Raulerson, NMFS, pers. comm., May 6, 1996.



A more recent problem is the conflict between operators of personal watercraft (e.g., jet skis) and other vessels, fishermen, swimmers, and nearby residents who are disturbed by the increased activity level, manner of operation and noise.

### **Inadequate Information Base**

The interaction of reef community species and the roles of the various species are not thoroughly understood, although these associations are crucial to the long-term health and productivity of the reef system. Insufficient scientific and fishery information exists on reefs, reef-associated invertebrates, fish, and plants—on growth rates, life span, colonization patterns, distribution, abundance, landings, catch, effort and mortality. Changes in consumptive and non-consumptive use patterns affect the habitat and the ecosystem in ways which are complex and do not lend themselves to a simple accounting process.

One problem in evaluating the effect of increased fishing on the marine ecosystem is that data on individual species in a multi-species fishery is often insufficient for a stock assessment (Roberts et al. 1995). Even if such statistics were more complete, data on individual species catch give only clues on the overall health of the reef system.

Information on landings locations is also inadequate. Fishermen fill out landings data as part of the Florida trip ticket information system established in 1984 by the Florida Department of Environmental Protection. The information on catch is in 60-mile grids, which is not sufficiently detailed for assessing many biological and socioeconomic questions.

A subsidiary problem is that when data does exist, it is sometimes difficult to evaluate because of diverse reporting systems and units of measure. Commercial fisheries traditionally report landings by weight, while recreational and marine life fisheries report catch by numbers of individuals, which can make some fisheries hard to compare.

The regulations do not address this data problem as the Sanctuary is primarily focused on habitat and ecosystem protection and management and leaves fisheries management to existing authorities. However, under the Protocol for Sanctuary Fishing Regulations, a cooperative process has been established for the development of uniform fishing regulations in the Sanctuary under existing laws or, if there is consensus among the existing fisheries management authorities and NOAA, under the Sanctuary regulations. Under the Protocol, the Florida Marine Fisheries Commission would generally take the lead in development of the administrative record, which would include data collection. The strategy for uniform fishing regulations could thus also address standardized data collection.

### **Coral Reef Costs and Benefits**

The coral reefs in the Florida Keys are the only extensive reefs in the continental United States and the third largest fringing-barrier reef system in the world. Quantification of the value of a natural resource like a coral reef is somewhat akin to putting a dollar figure on the value of a human life. Both are considered priceless. Regardless, economists and others quantify the value on human lives, or at least on lost earning power; and similarly quantify the value of natural assets such as coral reefs, for purposes of assessing damages in litigation or for the development of policies, and management choices about the best use of increasingly scarce resources. The valuation may vary depending on the intended use, and purpose of valuation.

James Spurgeon (1992) uses coral reefs as an example for valuing environmental resources. Three categories make up what he calls the "Total Economic Value" of a habitat: direct values, indirect values, and non-use values. The following discussion summarizes Spurgeon's system of valuation. It relates to the ensuing assessment of zoning in that zoning represents an effort to protect coral reef habitat. The benefit of a zoned area could be considered as the difference between its value with increased protection and the value it would have without that protection.

Most of these uses are capable of being valued numerically if data are available. Unfortunately, most of the needed data are not available for coral reefs worldwide, and it is possible that for some categories of use the cost of collecting all the relevant data could be excessive.

### **Direct Uses**

These include tourism, research and education, and the harvesting of resources for both consumptive and



non-consumptive uses. The tourist industry derives the greatest direct economic benefit from coral reefs. Tourism generates revenue for the local economy through such things as boat tours and charters, boat rentals, diving and fishing equipment rental and nature tours; and indirectly through hotel accommodations, transportation, food and other purchases.

The benefits deriving from tourist visitation also include tourist consumer surplus value, which is the satisfaction derived by tourists in excess of payment. For example, tourists may visit reefs for free or receive value greater than the market price and hence receive a consumer surplus benefit. The travel cost method is one way of evaluating consumer surplus; the value of a site is estimated by using travel costs from different distances and imputing consumer surplus based on the willingness to undergo different travel costs. Consumer surplus for use of the Florida Keys resources for selected tourist and resident activities was estimated using the travel cost method at \$653 million annually in 1990 (Leeworthy et al. 1993).

Another major direct use of coral reefs is in recreational and commercial fisheries. In 1984, potential harvests of reef fish were estimated at nine million tons per year, an eighth of the world fish harvest at that time (Munro 1984, cited in Spurgeon); the most recent available worldwide commercial fish harvest figure is 101 mt in 1993 (FAO 1994). For commercial fisheries, the harvest has a measurable financial value. Fish and other organisms which are taken for subsistence use provide additional social benefit which is not measured by any market but does represent consumer surplus.

Scientific research generates revenues for the local economy in two ways, from the budgets of marine researchers and from research findings. For example, coral reef research might result in biomedical discoveries or might have important consequences for environmental and climate change monitoring. The value of pure research would be harder to quantify. Similarly difficult to quantify are educational efforts involving the coral reefs, which add social benefits in the form of a better informed public which in turn has a greater appreciation of the marine environment.

Finally, coral reef organisms have potential for pharmaceutical and other industrial applications. Coral skeletons have been used in bone grafts, and corals, gorgonians and sponges contain many biological compounds of potential value. However, these values cannot be measured for substances which have not yet been shown to be of commercial value, and which often face competition from synthetic products.

### **Indirect Uses**

These may be lumped under the heading "biological services." Coral reefs and their ecosystem support other species and related ecosystems. Juveniles of many species drift on currents to other ecosystems where, upon maturation, they may become a target for fishermen or food for commercially valuable fish. Mature fish of some species commute between reefs and other ecosystems. Reef fish are a food source for seabirds and turtles, and thus provide an indirect benefit for tourists interested in viewing sea life.

Reefs also provide physical protection to coastlines. They produce emergent reef structures which form a barrier that dissipates wave energy. They produce beach material. They provide calm conditions, allowing seagrass beds, lagoons and mangroves to thrive. These habitat types are of great economic benefit to commercial fisheries.

Coral reefs have a role in global life support as well. The reefs affect world calcium and carbon balances. Calcification from coral reefs delivers much of the  $\text{CaCO}_3$  delivered to the sea each year. The reefs also act as a sink for about 111 million tons of carbon per year. This is about two percent of the current output of  $\text{CO}_2$ , and may rise to 4 percent within 100 years. This carbon sink role may be economically significant in that it may mitigate the effects of global warming. On the other hand, reef calcification could lead to initially increased concentrations of  $\text{CO}_2$ , which would exacerbate global warming (Kinsey & Hopley 1991).

The importance of the coral reef and the various species as components of the ecosystem is not well understood. It is therefore difficult, if not impossible, to quantify the value of the coral reef and ecosystem components to various users and society as a whole.

### **Non-Use Values**

Non-use values encompass existence value, the value of simply knowing that a place such as a wilderness area or coral reef exists; option value, the value of being able to use a resource at a future date; "social value," which accrues to local communities in the form of traditions and customs, aesthetic and cultural benefits



associated with natural areas; and intrinsic value, which can be interpreted as the worth of natural areas and of other species, apart from their valuation by people.

Attempting calculations of existence and option values for a coral reef system would require an extensive contingent valuation survey of people living near the reef and people from other areas, which would ask for their willingness to pay for the resource to be preserved in its current state. The answer would likely depend on the quality, extent, accessibility and uniqueness of the reef system, and on the educational level, income level, and attitude of the people surveyed. Numerical conclusions about existence value tend to be open to debate; what is clear is that assets such as coral reefs, which are highly productive and have a strong fascination for tourists, do have high existence and option values for society, and that their value decreases when they are subject to degradation and increases with scarcity.

The intrinsic value of the reefs and their organisms is difficult, if not impossible, to measure monetarily, but some consensus exists that the value of other species extends beyond their utilitarian value to humans (Spurgeon 1992).

### **Costs**

Coral reefs also entail some costs to society. They pose hazards to navigation. In addition to damaging the reef and related system, ship groundings also cause loss of life, limb and property. Besides the direct costs associated with groundings, costs are associated with the avoidance of reefs, including extra time and fuel, and the purchase of navigational aids to warn shipping traffic of reef location. Thus, some of the costs of the regulations are already inherent costs to users of reef areas for the prevention of the destruction of their ships, cargo, and other property. Some of the regulations, particularly regarding vessels and their operation, are somewhat of a codification of existing practices by the more careful and prudent users of the reef area.

### **Overview of Regional Economy**

The population and economy of Monroe County grew rapidly in the 1980s and early 1990s. The population increased from 63,188 to 80,968 or 28.1 percent from 1980 to 1992, and gross sales increased from \$720 million to \$1747 million or 143 percent, in the same period (Bureau of Economic and Business Research 1992). The regional economy is driven by three important components: recreation and tourism; commercial fishing; and retirement communities. Bell (1991) estimates that these three provide over 80 percent of the export base of the local economy. The U.S. military and state government make up the remaining portion of the local export base. The rest of the local economy depends upon these basic industries.<sup>2</sup>

### **Tourism**

In 1990, about 2 million tourists visited the Florida Keys for about 13 million days and spent almost \$800 million, about half the total \$1.6 billion in gross sales for the Florida Keys (A.T. Kearney, Inc. 1990). It is estimated that tourism accounts directly for half the expenditures, earnings, and employment in the retail trade and services sectors, which together account for over a half of total Monroe County gross earnings (Gorte 1994).

Leeworthy et al. (1993) estimated the nonmarket user value of water-based recreation activity in 1990 to be worth about \$660 million per year to both the residents and tourists of the Florida Keys. Using extremely conservative assumptions, including no growth in total recreational activity and constant value per activity day, and using a real rate of interest (interest net of inflation) of three percent, the calculated asset value of the Florida Keys for water-based recreation was estimated to be about \$22 billion.<sup>3</sup>

Since 1990 tourism has grown. A study in progress (Leeworthy & Wiley 1995) counted 854,000 visitors in July and August of 1995 alone. The preliminary results show that 79 percent of visitors participate in beach activities, 27 percent in recreational fishing, 28 percent in wildlife viewing on land and water, and 48 percent in snorkeling and scuba diving. Some overlap is expected in these figures as individuals may participate in more than one activity per visit.

The most recent estimate of economic benefits arising from visitor expenditures in the Sanctuary was done by the Florida Atlantic University/Florida International University Joint Center for Environmental and Urban

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<sup>2</sup>The ensuing discussion is largely based on Bell and Sorensen 1993.

<sup>3</sup>These values are all stated in 1990 dollars.



Problems. Using 1994 data from the Monroe County Convention and Visitors Bureau showing 2.6 million visitors to the county, they estimated that 34.7 percent took part in water recreational activities including visiting beaches, boating, fishing, snorkeling and diving, with about \$241 million in visitor sales expenditures, \$16 million in tax expenditures, and over 7,000 new jobs created (Correia 1995).

### **Commercial Fishing**

The commercial fishing industry is vital to Monroe County, which ranks first in all Florida counties in poundage and dockside value. In 1995, the ex-vessel value of commercial fishing in Monroe County was at a high of \$68.9 million; the aquarium trade added \$2.7 million to that. This represented a sharp rise after a seven-year decline from \$63 million in 1986 to \$47.7 million in 1993 (not corrected for inflation).<sup>4</sup> Shellfish has historically been the most important component of the fishing industry in Monroe County, accounting for 65.6 percent of the ex-vessel value in 1995; finfish was next with 15.8 percent, and the rest was accounted for by food shrimp and bait shrimp.

In 1991, gross earnings for the forestry/fisheries industry, of which fishing represents about 90 percent in Monroe County, were \$20.2 million, or 2.37 percent of Monroe County gross earnings (U.S. Dept. of Commerce 1994). Chuck Adams (1992) estimated out-of-county wholesale sales by the commercial fishing industry in Monroe County in 1990 as generating between \$87 million and \$94 million in total economic activity, between \$29 million and \$36 million in local earnings, and providing the equivalent of between 1,968 and 2,492 full-time jobs.<sup>5</sup>

### **Retirement Community**

Probably the most significant aspect of the Monroe County/Florida Keys economy is what can be termed the "retirement community." Florida is generally considered a mecca for retirees because of the climate, low taxes and cost-of-living, and the variety of natural resources to support leisure activities. In economic accounting, this shows up most clearly when income by place of work is compared with income by place of residence. In 1988, total income by place of work in Monroe County was about \$803.4 million, whereas total personal income by place of residence was about \$1.4 billion. The nearly 43 percent difference is mostly explained by transfer payments (\$154 million) and dividends, interest and rents (\$333.4 million) (Bell & Sorensen 1993). These two sources of income are mostly accounted for by people that are retired and living in Monroe County but receiving social security, pensions and return from investments outside the county. An important, but unanswered, question is to what extent the retirement community is dependent on the environmental quality of the Sanctuary. It seems a reasonable assumption that a good portion of the retirement community chose the Florida Keys because of the rich abundance of high quality resources.

## **Socioeconomic Assessment of Zoning Regulations**

In accordance with the requirements of the FKNMSPA, marine zoning was considered as a means of establishing differing levels of management of Sanctuary resources. The final regulations establish zones in five categories—Wildlife Management Areas (WMAs), ERs, SPAs, Existing Management Areas (EMAs), and Special-use Areas.

The only ER, the Western Sambos ER, is approximately nine square nautical miles (snm) in area. The largest of the 18 SPAs is Carysfort, which is about 1.5 snm in area. The other 17 SPAs are each well under one snm as follows: Alligator Reef (0.2 snm), Coffins Patch ((0.4 snm), Cheeca Rocks (0.05 snm), Davis Reef ((0.2 snm), Conch Reef (0.7 snm), Sand Key (0.5 snm), Rock Key (0.1 snm), Eastern Dry Rocks (0.1 snm), Dry Rocks (0.05 snm), Grecian Rocks (0.3 snm), Hen and Chickens (0.2 snm), French Reef (0.1 snm), Molasses Reef (0.3 snm), Looe Key (0.3 snm), Sombrero Key (0.2 snm), the Elbow (0.3 snm) and Newfound Harbor Key (0.1 snm). The four Special-use Areas are: Conch Reef (Research Only) (0.2 snm), Eastern Sambos (Research Only) (0.15 snm), Looe Key (Research Only) (0.1 snm), and Tennessee Reef (Research Only) (0.2 snm).

The four EMAs are the Key Largo Management Area (105 snm), the Looe Key Management Area (5.3 snm), the Great White Heron National Wildlife Refuge (246 snm), and the Key West National Wildlife Refuge (247 snm). There are 27 WMAs. For more details about the Zoning Action Plan and these areas, see Volume I of the FMP/EIS.

<sup>4</sup>Data supplied by Florida Department of Environmental Protection Fisheries Statistics Dept.

<sup>5</sup>The lower figures are based on the assumption that 75 percent of fishery products are exported out of Monroe County, and the higher estimate assumes that 95 percent of the fishery products are exported. Adams cautions that his figures are estimates, based on available secondary data and some anecdotal observations, and should not be taken as precise measurements.



Each of the zones is designed to reduce damage to resources and threats to environmental quality, while allowing uses that are compatible with resource protection. Marine zoning is one of the most practical tools available to management for achieving the primary objective of the FKNMSPA of ensuring the viability of the Florida Keys ecosystem by safeguarding its system of coral reefs and associated habitats.

A sixth category, Areas to be Avoided (ATBAs), was established by the FKNMSPA. The statute prohibits the operation of tank vessels or vessels greater than fifty meters in registered length. The regulations merely set forth the boundaries of these areas as established by the statute and repeat the statutory prohibition.

Although the use of no-take areas has a long history worldwide as a tool for protecting sensitive habitat or enhancing fishery production, marine zoning is an innovative approach for the United States that has aroused considerable public interest.

The overriding purpose of the marine zoning action plan is to protect habitats and species by limiting consumptive activities. The objectives are to reduce habitat damage in sensitive areas, protect rare and endangered species, reduce conflicts among users, and allow the ecosystem to change and evolve with minimal human influence.

Protection of the resources in the Florida Keys implies protection of the regional economy as well, which depends on the preservation of the Keys' outstanding natural resources. The discussion will center on the ERs and SPAs because these are expected to have the largest socioeconomic impacts. WMAs and Special-use Areas are expected to have only small or negligible socioeconomic impacts due to their size and location. Existing Management Areas are expected to have little additional socioeconomic impact, since these areas, and their protections (with minimal exceptions), are already in place. There may be adverse socioeconomic impacts on the operators of tankers and vessels in excess of 50 Meters in rerouting around the ATBAs, however, since the ATBAs were previously established by the USCG, approved by the International Maritime Organization (IMO), and codified by statute (FKNMSPA), the impacts to these operators have already been addressed and no additional impacts from the regulations are expected.

### **Wildlife Management Areas**

The FMP Preferred Alternative establishes 27 WMAs. WMAs are the marine portion of areas which were established for the management, protection, and preservation of Sanctuary wildlife resources. Twenty-one of these are the marine portions of, or the marine waters surrounding, Bay Key, Boca Grande Key, Woman Key, Cayo Agua Keys, Cottrell Key, Little Mullet Key, Big Mullet Key, Crocodile Lake, East Harbor Key, Lower Harbor Keys, Horseshoe Key, Marquesas Keys, the tidal flat south of Marvin Key, Mud Keys, Pelican Shoal, Sawyer Keys, Snipe Keys, Upper Harbor Key, East Content Keys, West Content Keys, and Little Crane Key. Nineteen of these WMAs are part of the U.S. Fish and Wildlife Service (USFWS) management of the backcountry portions of the existing National Wildlife Refuges in or surrounded by Sanctuary waters and already subject to special restrictions. One is the USFWS refuge area Crocodile Lake and the other is Pelican Shoal which is closed by the Florida Game and Freshwater Fish Commission between April 1 and August 31 of each year.

Six other areas were identified by the SAC, USFWS, and members of the public as wildlife habitats with marine portions and surrounding waters in need of protection by the Sanctuary. The six new areas are Rodriguez Key, Tavernier Key, Snake Creek, Cotton Key, Dove Key, and Eastern Lake Surprise.

The USFWS refuge regulations already restrict access partially or entirely to the 19 existing USFWS National Wildlife Refuges and Crocodile Lake in order to protect sensitive nesting habitats of endangered, threatened and other species. The Sanctuary regulations complement those USFWS restrictions by restricting access to the marine portions of those areas and surrounding waters. Beach areas below mean high water are closed where the USFWS has closed the beach areas above mean high water. For Pelican Shoal, the regulations complement the state's seasonal closure with a 50 meter seasonal no-access buffer zone.

In the six new areas, the regulations impose idle speed only/no wake restrictions, no motor restrictions, no access buffer zones, and closures. Except for closures, other activities such as fishing and diving are allowed.

### **Costs**

Socioeconomic costs of the WMA regulations are expected to be negligible for 21 of the 27 areas since the



regulations only affect the marine portions of land already subject to similar USFWS and state restrictions or provide a small marine buffer area for the land. For example, most of the Sanctuary regulations for WMAs apply only to the waters within 300 feet of land already subject to restrictions established by USFWS or within 50 meters of land subject to state restrictions. Some of the existing USFWS restrictions already apply to certain marine waters, based on agreements with the state. However, these restrictions also have been incorporated into the Sanctuary regulations to fortify the federal authority, and to add a potential civil penalty component (violations of the USFWS restrictions are subject to criminal sanctions only), as well as apply the interpretive enforcement approach. In many circumstances, civil penalties are less severe and more appropriate than criminal penalties. They are also easier to apply because there is no need to prove criminal intent.

The increased enforcement and administrative costs for the government are set forth below and in the FMP/EIS. Corresponding increased costs are also expected for violators of the Sanctuary regulations, although voluntary compliance is expected to be high.

The Pelican Shoal WMA is closed out to 50 meters between April 1 and August 31. The shoal itself is closed during this time by the Florida Game and Freshwater Fish Commission. Therefore, displacement costs for users during this time period are not expected.

With regard to the six WMAs not already controlled by the USFWS or the Florida Game and Freshwater Fish Commission, there may be some additional incremental costs to users of these areas, but they are not expected to be significant. The only restriction imposed on five of these WMAs is a no-motor zone on tidal flats. Because the rule only applies in the shallow tidal flats, it should have little or no adverse economic impact on fishing and other recreational activities currently conducted in these areas. Users of PWCs may suffer some dislocation costs. However, these areas are only a small portion of the waters in which PWCs can be operated, and the dislocation would be more of a inconvenience than an out-of-pocket expense.

Lake Surprise is a new WMA where an idle speed only/no wake zone is established east of US 1 highway where it crosses Lake Surprise. The western portion has higher levels of use for fishing and other recreation than the eastern portion. Regardless, the rule will not halt the public's current use for fishing. There may be some additional time delays, but, once again, this is expected to be more of an inconvenience than a significant cost. If PWCs are operated here, they may relocate to areas where there are no speed or wake restrictions and thus incur only minor relocation costs.

In the Dove Keys WMA, a no-access buffer area is created around two small islands. While there may be some displacement costs for users, there is no data or public comments indicating that will be the case.

Rodriguez Key is a big flat fishing area. The rule will not halt the public's current fishing activities, but there may be some additional time delays. Again, this is expected to be more of an inconvenience than a significant cost. If PWCs are operated here, they may relocate to areas where there are no speed or wake restrictions, and thus incur only minor relocation costs.

### **Benefits**

The primary benefit of the WMAs will be the additional protection afforded to the Sanctuary's wildlife and habitat. People engaged in viewing, studying or photographing wildlife will benefit, along with the tourist industry. In the new idle-speed only/no wake areas, the use for fishermen and other recreational users may be enhanced by minimizing some user conflicts. This in turn may result in some incremental socioeconomic benefits to users. For example, the Florida Keys Fishing Guides Association estimated that 30 fishing guides currently take clients to the WMAs. The Association estimates that banning jet skis from the refuges would make these areas more desirable fishing destinations. The Association estimated that each of the 30 fishing guides would get an additional 30 days of fishing charters with a total of approximately \$315,000 in direct positive impacts. Then, using a multiplier of 3.25, the Association estimated that would be an additional \$1,000,000 to the local economy.<sup>6</sup> It is unclear to NOAA how objective or accurate these estimates are, and whether the accuracy, scope and scale of areas and activities is directly applicable to all of the WMAs. However, the estimates do support public comments indicating there are socioeconomic benefits to existing users from the rule, particularly the flat fishing guides and related industries and users.

Minimizing user conflicts may also result in fewer accidents. In 1995, there were 503 personal watercraft (e.g., jet-ski) accidents involving 856 vessels in Florida waters. Of the 503 jet-ski accidents, 325 involved a collision

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<sup>6</sup>Communication with Capt. Mike Collins, Florida Keys Fishing Guides Association. The multiplier used by the Association was the same one used in the 1986 study by David Rockwell, PhD, for the Sportfishing Institute.



with another vessel. There were over 66 accidents in the Sanctuary waters off Monroe County. Of these 66 accidents, 48 resulted in injuries, and damages were estimated to be \$79,477.00.<sup>7</sup> It is difficult to predict how many accidents will be avoided or minimized by these rules, which apply in portions of the Sanctuary; however, it is clear that there should be some reduction in accidents, injuries, and damages, which is a socioeconomic benefit.

As stated above, the new status of the marine portions of the USFWS wildlife management areas as Sanctuary-protected areas allows enforcement agents to apply civil penalties. The potential exists for sharing of human resources by the Sanctuary and USFWS to educate the public and manage these special areas. This will allow a more comprehensive interpretive effort as well as increased enforcement options. It is also likely that education efforts by the Sanctuary staff will result in increased awareness of the wildlife areas and appreciation of their function, which in turn will cut down on behavior that could disrupt sensitive areas. Thus, voluntary compliance should increase, which should in turn result in significant resource protection benefits. And those users who voluntarily comply with the rules may have better experiences, which is in effect a socioeconomic benefit.

#### **Net Benefits or Costs**

While it is not possible to quantify net benefits or costs for the WMAs on the available record, some incremental costs in operation and relocation in complying with the WMA restrictions is expected. However, such impacts are not expected to be significant. The restrictions will increase protection for wildlife and habitat and, in turn, increase enjoyment or instruction for the people using them, as well as for industries catering to tourism and recreation, including recreational fishing. Overall, the benefits to society are expected to be greater than the incremental costs for complying with the regulations.

#### **Ecological Reserves**

The most important purpose of an ER is to protect critical habitat areas in the Florida Keys from further degradation from consumptive uses. The primary protection afforded an ER is the prohibition on taking, moving or disturbing fish, invertebrates, shells, coral, seagrass, bottom formations, or any other living or dead organisms. Other regulations include prohibitions on discharging any material other than cooling water or engine exhaust, touching coral, or on placing an anchor so that it touches living or dead coral. The chief consideration in establishing ERs in the Sanctuary is to protect a diverse portion of coral reef habitat and the related species in that habitat ecosystem, particularly in areas which are in good biological condition. Another consideration is the area's suitability as a control for monitoring and better understanding the biology of exploited species.

Much of the literature on marine reserves has stressed fishery management aspects. While fishery management is not the objective of establishing reserves in the Sanctuary, some of the beneficial effects to fish stocks that have been seen in marine reserves elsewhere can be expected in Florida. For example, marine reserves can afford some protection to species which are not managed under existing federal and state regulations. Marine reserves also offer a method of protecting a multispecies assemblage and can benefit surrounding areas to the extent that larvae, juveniles, and adults are exported to surrounding fisheries.

A panel of biologists and social scientists who attended a symposium in Tampa, Florida, in 1995 to review the use of marine fishery reserves in the U.S. Southeastern Atlantic wrote in a summary statement that marine reserves offer the "best option" for protecting reef fishes. They issued a statement encouraging the creation of reserves in suitable areas (Roberts et al. 1995):

there is overwhelming evidence from both temperate and tropical areas that exploited populations in protected areas will recover following cessation of fishing and that spawning biomass will be rebuilt. Also, there is widespread recognition throughout the world that loss of biodiversity is largely driven by ecosystem modifications and the habitat loss that ensues. Hence preserving biodiversity implies the maintenance or re-establishment of the natural ecosystems as in marine reserves in which no extractive anthropogenic effects are allowed or are minimized.

Some of the benefits to fish stocks which may be provided by larger reserves are not expected to occur to any great extent in the Florida Keys. Large reserves may provide insurance against stock collapse resulting from

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<sup>7</sup>1995 Boating Accidents Report by the Florida Department of Environmental Protection, Division of Law Enforcement.



the possible failure of traditional management methods which target individual species. They may also offer protection of genetic diversity against the risk of genetic selection by fishing gears; especially, fish stock characteristics associated with long life spans can be preserved. However, if the reserves are small, and if fish are exposed to fishing during part of their life cycles, then not much genetic protection can be expected.

Marine reserves have a history in parts of the United States and in Australia, Bermuda, New Zealand, the Cayman Islands, the Philippines, and other places. Studies of reserves in these areas indicate that they have generally been effective in raising the average density of most protected species and the average size of individuals. A survey of 31 study areas around the world concluded that species size and diversity increased under reserve protection in all but three or four of the cases in which results were available. Species that benefited most were nearshore coastal species with sedentary habits and relatively long lives (Dugan & Davis 1993).

Direct evidence of the effects of reserves on larval export is limited, but strong reasons exist to believe that larval export occurs. Studies in the Philippines and elsewhere show that substantially increased local catches more than made up for the reduction in fishable area caused by the establishment of reserves (Rowley 1992). A model of the red snapper fishery in the Gulf of Mexico, which assumed 20 percent of habitat protected by reserves, showed that total egg production was potentially 1200 percent greater than under the status quo, and that the increased fecundity and subsequent fish availability more than compensated for an assumed 25 percent greater fishing effort caused by displacement of fishermen moving to open areas (Bohnsack 1994).

Of particular relevance to the Sanctuary is the experience of three marine protected areas within Florida waters. The regulations implementing the designation of the Looe Key National Marine Sanctuary, established in 1981, ban spearfishing and the use of wire fish traps, among other activities. After two years in reserve status, total predator abundance had increased exponentially. Snapper stocks increased by 93 percent, grunts by 439 percent, and hogfish by 1900 percent; all 15 of the examined target species increased in abundance, and five potential target species not observed before the spearfishing ban were observed after the ban (Clark et al. 1989).

Portions of the estuary surrounding the Kennedy Space Center have been restricted since 1967 and have been used to test the effectiveness of the reserve concept. Studies conducted between 1986 and 1988 showed a statistically significant increase in catch per unit effort in closed areas as compared to similar open areas, after accounting for all other factors. Fish tagging studies also showed that fish routinely moved from non-fished areas to fished areas (Funicelli 1988).

Finally, the Oculina Banks area off Ft. Pierce, Florida was established in June, 1994, as an experimental marine reserve. This experiment has not yet shown results.

#### **Proposed Reserve Plan**

In the Draft Management Plan, three alternatives for Replenishment Reserves (RRs)(renamed ERs in the FMP) were proposed. The preferred alternative would have established three RR's totaling 485.7 km<sup>2</sup> (141.6 nm<sup>2</sup>), including a 77.6 km<sup>2</sup> area at Key Largo, a 29.9 km<sup>2</sup> area at Sambos, and a 378.2 km<sup>2</sup> area at the Dry Tortugas.

Criteria were developed by the SAC and the constituent groups they represent for use in identifying potential RR's and SPAs in the DMP/EIS. These criteria for selection zones were also considered in developing the Final Preferred Alternative (ERs and SPAs) are as follows:

- Consider areas of high habitat and species diversity representative of the Florida Keys marine ecosystem.
- Consider environmental and socioeconomic impacts on other areas resulting from displacing existing uses.
- Consider long-term impacts from establishing RR's in areas of critical economic value.
- Consider areas with good water quality.
- Consider socioeconomic impacts on displaced user groups.
- Consider ownership of nearby waterfront property.
- Consider sufficient size to include range of habitats.
- Consider other areas within and adjacent to the Sanctuary with existing or proposed restrictions.
- Consider existing managed areas.



***Appendix M. Assessment of the Potential Costs and Benefits of the Final Management Plan Regulations***

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The process involved collecting data on where significant coral was located, on water quality, and on where significant commercial and recreational fishing and diving activities were conducted. The areas were chosen primarily for purposes of habitat protection, not fishery management. The goal was to minimize adverse impacts on user groups while extending needed protection to the coral reefs.

A series of zoning workshops were held and maps were drawn to identify resources, user group activities, areas of conflict, and zone criteria to determine where zone boundaries should be for each alternative. The public process to elicit the problems, concerns and information about various strategies and plans is extensive and has been summarized in Volume I, Overview of the Planning Process, p.4. Unfortunately, but perhaps understandably, the fishing community is often reluctant to provide information about where it fishes and how much is caught. Some of the information about fishing in the reserves and the potential impacts, particularly in the Dry Tortugas were not raised by members of the fishing community until after the draft plan had been published.

Based on the information received, the FMP and implementing regulations dropped the Key Largo RR, partly because it would have duplicated the protection provided by the John Pennekamp Coral Reef State Park and the Key Largo Existing Management Area. Because of the potential impact on fishermen, the lack of detailed information on the precise boundary to minimize such impacts, and SAC recommendations, the Dry Tortugas RR was also dropped. Creation of a Dry Tortugas ER is still planned. Over the next two years, NOAA and others will gather data and obtain additional public input on boundary alternatives and relative impacts for the Dry Tortugas ER. NOAA will bring all interested parties including managers, scientists, environmental groups, fishermen and other affected groups together to develop these boundary alternatives. After this process has been completed, NOAA will propose a Dry Tortugas ER through a notice and opportunity-for-comment rulemaking and Supplemental EIS.

Based on this FMP/EIS, including public comments, the new boundary of the Dry Tortugas ER likely will be further to the west as opposed to the north-south configuration in the draft MP, which will likely be dropped from further consideration. Such realignment of the preferred alternative boundary should still afford a high level of protection to coral reef habitat while minimizing adverse socioeconomic impacts to shrimpers, lobster fishermen, and others who identified these as areas of high use. Changes to the original boundary proposed will be consistent with the objectives of protecting as much coral reef, as opposed to barren substrate, as possible, while avoiding or minimizing the displacement of fishermen. NOAA also will be working with the National Park Service to develop regulations for the Dry Tortugas National Park so that the park and adjoining areas will have compatible rules. Currently, commercial fishing is banned in the park, while recreational fishing is allowed.

Upon the establishment of an ER, scientific studies will be initiated in order to determine whether it is succeeding in protecting biological diversity and increasing the productivity of important marine life species. The ERs will also serve as control areas for research into the impacts of water quality, pollution, and different human user groups on the Keys ecosystem. Based on the results of these studies, the five-year update of the MP will consider expanding, modifying, or eliminating the ERs.

The expected costs, benefits and net benefits of the Preferred Alternative in the FMP will be examined below for the habitat, non-consumptive users, commercial fishermen, recreational fishermen, and the larger economy, followed by a shorter discussion of the costs and benefits of the rejected alternatives.

***1. Habitat Costs***

The primary purpose of establishing an ER is to protect habitats and maintain the biodiversity of the Sanctuary. No adverse effects or costs to the habitats of the Western Sambos ER are expected to result from the regulations protecting that ER. However, there may be some costs to non-protected habitats outside the ER from the displacement of users. The habitat areas outside the ER for relocation are vast. The displacement impacts are expected to be spread out through different areas as opposed to more confined habitat areas. This should spread the adverse impacts out over different areas sufficient so the impacts are short term and negligible over the long-term.

The regulations include curtailing consumptive use and monitoring non-consumptive use carefully. There will be some management costs for administration and enforcement. Estimates of the management and enforcement costs for Zoning and other regulations is provided at the end of this assessment.



### **Benefits**

Protection of the habitat within the reserve boundaries entails the benefits discussed in the preceding "background" section and in the list of benefits on p.7 in the section "Coral Reefs Costs and Benefits."

The primary benefit is the protection to sensitive habitat from further degradation. The protected reefs are expected to return to a more natural mix of species with more large predators. Establishment of marine reserves elsewhere has proven effective for protection of the coral reef habitat and for restoring the natural mix of species, the natural mix of ages, and for increasing populations of fish and other organisms. For example, in Mombasa Marine National Park, Kenya, the coral increased, fish populations and numbers of species present increased, and many sea urchin populations declined. (McClanahan & Obura 1995).

Preserving the natural mix of species is expected to benefit the coral reefs in many ways. The ecosystem balance is changed in areas that are heavily fished. For example, bicolor damselfish, which essentially clear areas of coral so that they can "farm" algae, tend to increase greatly in the absence of large predators. Sea urchins display high population numbers on unprotected reefs and low numbers on protected reefs. Sea urchins affect benthic algal biomass, bioerosion rates, and coral reef growth rates.

Another important benefit to the coral reef system is increased resistance to environmental stresses. Work with Kenyan coral reefs has shown that unfished, relatively intact reefs are more resistant to stresses such as eutrophication and sedimentation, than fished reefs (McClanahan & Obura 1995).

The more healthy and productive the coral reefs are, the greater the direct, indirect, and non-use values that can be derived from them. Their increased value for snorkelers and divers is apparent. If the coral reefs are in good condition, they can more ably fulfill their role of biological support of other ecosystems such as seagrass communities. Clearly, too, if the habitat is in good condition, whatever existence and option values the reefs have will be concomitantly higher. If the coral reefs are productive, they will positively affect stock levels in neighboring areas. Finally, protection of the habitat, particularly coral, is the primary goal of the Sanctuary and the underlying legislation.

### **Net Benefits**

The benefits to habitat and biological diversity overall are expected to exceed the costs to areas where consumptive users have relocated. This is because the costs to habitat are expected to be spread out over a vast area where recovery is expected to be reasonably accomplished over time. The number of species is expected to increase over time because the restrictions will prevent further degradation of some of the most significant habitat areas. This is expected to assist in the recovery of these habitat areas which is expected to have secondary or indirect benefits for the production of species which utilize the habitat. To the extent that the relocation activities are localized just outside the zones, these secondary benefits to species may be less than expected.

## **2. Non-consumptive Users**

### **Costs**

Some costs are predicted for non-consumptive users, but they are not expected to be significant because this class of users will not be excluded from using the reserves. The restrictions put on their use of the reserves, such as prohibiting discharge of marine sanitation devices, touching coral, and anchoring so as to avoid coral may have some incremental costs to users, but many non-consumptive users already voluntarily conduct their activities accordingly. The costs to charter boat operations and private users of the ER to avoid touching the coral involve some additional time and care, but are not expected to be significant. Additional expenditures for equipment are not expected, as marine sanitation devices can be discharged outside the zones consistent with other laws. There may be some additional costs for personnel to dive down and inspect the anchor to avoid touching coral, but they are not expected to be significant, as most dive charters already have personnel employed able to conduct the task. There may be some delays in getting the divers into the water, but the delay time should be minimal.

Costs to the tourist industry and divers are expected for those who violate the regulations and are subjected to civil penalties. However, based on public comments as well as NOAA's experience at Looe Key, Key Largo and elsewhere, compliance with the regulations from divers and charter operators is expected to be high.

### **Benefits**

The reserves are expected to be beneficial to non-consumptive users, who represent a substantial portion of visitors to the area. A NMFS aerial survey (McClellan 1996) discovered that approximately half the vessels in



the area proposed for designation as the Western Sambos ER over a four-year study period were diving or cruise vessels, and the other half were recreational or commercial fishing boats. The surveys were conducted on Fridays however, and probably underestimated the numbers of both recreational dive vessels and recreational fishing vessels present on weekends.<sup>8</sup>

The habitat quality will be improved because the absence of such things as fishing gear and anchors means those items will not be caught in the coral. In the areas where fish are allowed to reproduce naturally, the populations of many species is expected to rise. These areas, with higher-quality habitat and larger numbers of diverse fishes, will improve the quality of experience for non-consumptive users. This implies an increase in consumer surplus as, in a sense, each individual user is getting an experience which is worth more, without paying an additional price. The number of non-consumptive users should also rise, which will in turn increase expenditures for transportation, food, lodging, services, and local purchases. The Monroe County economy will benefit from increased tourism. The national economy should also benefit, as many of the tourists are seeking a recreational experience which they might otherwise look for in marine areas outside the United States.

Another benefit for non-consumptive users is that they will no longer experience conflicts with consumptive users. In the absence of zoning, non-consumptive users pay a cost: an implicit decision is imposed which favors consumptive over non-consumptive users automatically. All consumptive uses of the Sanctuary impose some costs on non-consumptive users because of ecological damage and sometimes direct conflicts.

#### **Net Benefits**

There will be some costs to non-consumptive users in complying with the restrictions in an ER. There will be an increase in numbers of flora and fauna and an improvement in habitat quality, all of which will benefit the experience for non-consumptive users. There should be an increase in trips as well as increased consumer surplus from individual trips. The local economy will benefit and there should be a net socioeconomic benefit for society as a whole.

### **3. Consumptive Users—Commercial Fishermen**

#### **Costs**

Some short-term costs resulting from increases in operations and reductions in fish catch are foreseen for commercial fishermen. Fishermen who presently use the Western Sambos ER area to catch spiny lobster, reef fish, coastal pelagics, and stone crab, and to collect tropical fish, will be displaced. Fishermen will be able to continue to fish outside the ER, but may incur some dislocation costs in moving to other fishing grounds. There may also be increased competition in existing fishing grounds from the displacement and therefore, depending on the availability of stock, some reduction in catch could occur. Also, trap fishermen who know the bottom areas through years of experience may find it difficult to learn new grounds and may accordingly have some learning curve costs incurred in additional travel and time to get the same level of catch. The potential costs to lobster fisherman from not being able to set traps in the Western Sambos ER may be mitigated by potential secondary benefits to lobster stocks by protecting the coral habitat areas from fishing and other consumptive activities.

These potential costs should also be placed in the larger context of the open-access fishery with declining catch per unit effort. The potential costs to lobster fisherman from the Western Sambos ER may also be mitigated by Florida's trap certificate program, which is designed to reduce crowding and should make it easier for neighboring fishing areas to absorb displaced fishermen.

The Florida trap certificate program has been in place in the spiny lobster fishery since August of 1993. The lobster fishermen received allocations for traps, one certificate per trap, based on their historical catch. The certificates are transferable. An annual reduction in certificates has been imposed; in 1993 there were 825,000; in 1995 there were 600,000. There will be no reduction in 1996, but the eventual goal is to arrive at a level which will maximize catch per unit effort while substantially reducing environmental impacts.<sup>9</sup> The purpose has not been to reduce harvest, which has increased over the past three years, but to reduce the overcapitalization in the industry by putting a cap on the number of traps in use, while reducing environmental damage caused by an overcrowded fishery.

The potential loss to fishermen cannot be readily quantified based on existing data. Landings data is taken in

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<sup>8</sup>This survey is discussed at greater length in following section, "Costs to Commercial Fishermen."  
<sup>9</sup>Pers. comm., John Hunt, Florida DEP, Florida Marine Research Institute, April 3, 1995.



60-square mile grids, which do not allow examination of the impact on smaller areas. Furthermore, the majority of fishermen do not fill out landings information on their fish tickets. A lobster study in which amount and location of take is being recorded by independent observers on vessels is currently in progress.<sup>10</sup>

A survey developed by the University of South Florida for the Monroe County Commercial Fishermen, Inc. (CEMR 1995) attempted to discover the answer to this question for two of the three proposed Replenishment Reserves: the Dry Tortugas and Western Sambos RRs. The grid zones used in the survey were larger than the boundaries for the two proposed RRs.

The survey was conducted by representatives of the Monroe County Commercial Fishermen and the sample was chosen by surveyors asking for names of interested fishermen at fish houses and by distributing surveys at a meeting. No steps were taken to ensure a random sample.<sup>11</sup> Out of 1875 restricted species license holders countywide, 1148 held lobster permits. Of the 41 captains who completed the survey, 29 were spiny lobster fishing vessel operations.

The fishermen were asked how much of their catch came from the two proposed areas, and how much they expected to lose if forced to go to other fishing grounds. It is unclear how the fishermen estimated their potential loss from establishing the RRs, upon which the report bases its estimates of impact to the fishing industry and county.

In the case of spiny lobsters, 12 indicated they fished in the area of the Sambos RR included in the data for estimated catch and loss.<sup>12</sup> They estimated that they would lose on average 102.6 percent of their estimated current catch in the draft Preferred Alternative Dry Tortugas RR. Thus, there is no accounting for their ability to make up some of the lost catch by fishing in other areas. For the Sambos ER, they estimated a 95 percent loss from their current estimated catch.

The report assumes that the majority of fishermen (ranging from 63 percent for spiny lobster to 83 percent for coastal pelagics) who did not fill out "area fished" information on their trip tickets fish the relevant statistical zones in the same ratio as the minority who did report collection area. That assumption is debatable.

The CEMR analysis estimates total primary economic impact of landed shellfish and finfish for 1995 using a multiplier of 1.7; Adams (1992) used a multiplier of 1.49, stating that would be an extreme upper limit since it was originally estimated for the Lee County, Florida commercial fishing industry, which likely has a more diverse economy. The report also assumes that all landings are exported out of Monroe County; Adams assumes a range between 75 percent and 95 percent.

Because of the problems both with collection of data and use of that data, NOAA does not agree with the quantitative conclusions of this report. The costs are expected to be lower than this report concluded, as indicated by the two aerial surveys discussed below. However, the CEMR report has been considered as part of the public comments on the socioeconomic impacts of zoning on fishermen. The report is valuable in that it highlights the concern of the fishermen surveyed about the effects of zoning. In their written responses, fishermen using the proposed reserve areas were concerned about the costs of displacement, and other fishermen who did not fish within the proposed boundaries expressed anxiety over increased crowding. It was largely as a result of these concerns that the SAC recommended the deletion of the Key Largo RR and further study before establishing a Dry Tortugas ER. NOAA in its selection of the Preferred Alternative in the FMP largely followed the SAC recommendations.

As previously indicated, the criteria for the draft and final zoning criteria included consideration of the socioeconomic impacts upon fishermen. The balancing of these criteria and statutory considerations is set forth in the selection of the preferred alternative. The only ER established by the FMP is the Western Sambos ER. It is a small area, nine snm, or 0.3 percent of the total Sanctuary area of 2800 snm. Because of its small size, most fishermen are expected to be able to incur relocation costs and only short term reductions in catch which should be minimal. Local fishermen who favor the area will experience some loss of revenue in moving, although the loss will be substantially smaller than the value of their current catch in the Western Sambos ER, since presumably they will be able to make up the majority of their catch in neighboring areas. Two studies involving aerial surveys of the SPAs and ERs proposed in the Draft Management Plan did not discover an extraordinary level of fishing activity in the Western Sambos ER. These include a year-long study run by the

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<sup>10</sup>Report is being conducted by Florida Marine Research Institute, Florida Dept. of Environmental Protection.

<sup>11</sup>Pers. comm. John Sanchez, Director, Monroe County Commercial Fishermen, April 29, 1996.

<sup>12</sup>Figures based on data supplied by Monroe County Commercial Fishermen to the University of South Florida Business Center.



**Appendix M. Assessment of the Potential Costs and Benefits of the Final Management Plan Regulations**

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Florida Marine Institute<sup>13</sup> of the Department of Environmental Protection from June 3, 1992 through May 29, 1993 (FMI 1996) and a survey run by NMFS, Southeast Fisheries Science Center, from September 1992-December 1996 (McClellan 1996) The Florida Marine Institute study will be discussed below under "Costs to Recreational Fishermen."

The NMFS survey was conducted randomly through the first year, with up to two surveys per month. Beginning in January 1994, the surveys were attempted once a week, barring bad weather, on Fridays, generally from about noon to 2 pm. All flights were aboard United States Coast Guard aircraft based at the Miami Air Station. Vessels were listed as recreational, commercial/lobster, charter/yacht, or unknown.

Of 158 fishing, dive and cruise vessels observed in 30 surveys in the area designated as the Western Sambos ER, 15, or 9.5 percent, were commercial fishing boats (two were lobster boats and the other 13 were classified as "unknown" in type). This translates to an average of 0.5 commercial vessels per survey, and an average of 5 vessels of all types per survey. The sum of all boats per survey (the sum of the averages) for zones 10 through 14 of the report, taking in the Florida Keys from Carysfort Reef in the east to Sand Key in the west, is 187; the sum of the averages for commercial fishing boats is 11.2. Thus, the Western Sambos ER area had on average 2.8 percent of all vessels in the portion of the Florida Keys which was included in the survey, and 4.4 percent of commercial vessels.

It is important to note that the flight path through zones 10-14 covered 132 nautical miles, and observers were able to count for a mile in each direction, so were able to survey a total of 264 square nautical miles, approximately one-tenth of the total Sanctuary area of 2800 square nautical miles.<sup>14</sup> The average number of vessels in the Western Sambos ER per snm was 59 percent lower than the average for zones 10-14, and the average number of commercial vessels was 31 percent higher than the average in those zones. The NMFS study did not include important fishing areas to the west of Sand Key, including Sand Key West, the Marquesas and the Dry Tortugas.

It seems fair from this data to assume that substantially less than 4.4 percent of all commercial fishing in the Florida Keys takes place in the Western Sambos ER. Since fishermen will be able to make up some of their catch by fishing elsewhere, the percentage of overall catch that will be lost by ER designation will be minimal. Without an accurate random survey of the fishermen in the area it is impossible to do more than make a qualitative estimation of probable loss.

But given the small percentage of commercial fishing which takes place in the Western Sambos ER area relative to the entire Florida Keys area, the costs of displacement to commercial fishermen overall should not disrupt the industry in a significant way. The boundary of the Dry Tortugas ER when it is proposed will be drawn to minimize the displacement of fishermen. However, the area of that ER could be as much as ten times larger than that of the Western Sambos ER, and more fishermen will likely be displaced.

**Benefits**

There are expected long-term benefits to commercial fishermen. As productivity increases within the reserves, some spillover of adults and juveniles will occur, from the highly productive reserves into the less productive fished areas, as was observed during a ten-year marine reserve experiment off Sumilon Island in the Philippines (Alcala 1966). The size of the spillover depends on individual species behavior and mobility, and the location and size of the protected areas. Fishermen can often be found along the edges of reserves where the fishing tends to be very productive.

The enhanced biomass in a reserve leads to enhanced egg production. Marine reserves have a larger percentage of large fish than fished areas, and this is important because egg production is a geometrical function of size. A 24 inch red snapper, for example, produces the same number of eggs as 212 16.5 inch red snappers (Norse 1993). Some of the fish eggs and other marine life may be dispersed to adjoining areas. This will have a major or minor effect on the total stock, depending on the species, the size and location of the reserves, and the circulation of water within the area.

A related benefit is the protection of some of the hundreds of species which are not covered by fishery management plans. The major targeted species are covered by fishery management plans, but other species may be fished or taken as bycatch, and these will generally be the same species for which information on

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<sup>13</sup>The survey is discussed further under following section, "Costs to Recreational Fishermen".

<sup>14</sup>David McClellan pers. comm. 7/29/96.



status is inadequate. ERs to some extent offer these species an insurance policy, although the strength of that policy is dependent on the size of the reserves; the Western Sambos ER and the Dry Tortugas ER still in the planning stage may not be of sufficient size to be effective, particularly in the case of species with a wide range which may swim into areas which allow fishing.

All of the potential benefits to commercial fishermen may not be realized. One major reason is that reserves are most helpful as a management tool if carried out as a part of an overall plan of stock protection for the entire South Atlantic fishery. In the absence of overall effort controls in the fisheries, the displacement from reserve to other areas of the Sanctuary may undermine the expected benefits. The other reason, again, is that the size and number of the reserves will affect the amount of benefits to be expected. The Western Sambos ER is a small reserve and will therefore only have limited benefits in terms of increased production, biodiversity, etc. The Dry Tortugas ER, to be proposed in the future, will probably be substantially larger and may offer more of these benefits.

#### **Net Benefits**

The long-term effect of the Western Sambos ER on commercial fishermen is predicted to be neutral to positive. Again, this is a small reserve, and according to the NMFS aerial study only 4.4 percent of commercial fishermen in the zones surveyed, and therefore a considerably smaller proportion in the entire Florida Keys, have fished there on average over the past five years. Furthermore, the increased productivity expected within the reserve should produce an "edge effect" which will benefit nearby areas.

#### **4. Consumptive Users—Recreational Fishermen Costs**

The short-term costs are expected to include some displacement, and possibly some crowding as displaced fishermen move to other areas. For the Western Sambos ER, these effects are not expected to be major since the area is so small. The Florida Marine Institute's aerial study conducted from June 3, 1992 through May 29, 1993 (FMI 1995) found fishing boats, including recreational and commercial boats, present on only 20 out of 51 surveys; an average of 0.9 fishing boats per survey were counted. Excluding the proposed Western Sambos SPA from the grid, an average of 0.46 boats were present in the ER at any given time.

The NMFS study, which was conducted over a longer time frame, recorded a higher average of three recreational and commercial fishing vessels in the Western Sambos ER in 30 surveys over the period September 1992–March 1996, out of a total average per survey of 115 fishing vessels for the area of the Florida Keys covered (Carysfort Reef to Sand Key). This is an average of 2.6 percent of fishing vessels (about 90 percent are recreational) in the Florida Keys area surveyed by NMFS, which did not take in the major recreational area around Key West.

Given these small numbers, the cost to recreational fishermen of establishing the Western Sambos ER will be minor.

#### **Benefits**

In the Marine Institute survey discussed above, an average of 0.43 boats were found in the nine mile-square grids to the east, and 1.24 boats in the nine mile-square grids to the west of the area proposed for designation as the Western Sambos ER. It seems reasonable that these areas can absorb the fishermen from the proposed ER. Fishermen in the adjacent areas are expected to benefit from increased productivity in the ER, spilling over to adjacent areas through larval dispersal and movements of adult fish. An additional benefit for recreational fishermen is that the expected effects of a reserve strategy would be to produce larger, more abundant "trophy" catches for recreational users. The edge effect of reserves, which produces excellent sport fishing at the boundary of the reserve, will also be a benefit.

#### **5. Consumptive Users—Commercial Treasure Salvors**

This group of small businesses are likely to be adversely impacted but it is difficult to quantify the amount as there is little or no data in the record as to the amount of treasure in these zoned areas or in other areas of coral, seagrass beds and other significant habitat. However, NOAA and state efforts to mitigate the adverse impacts on this group have been addressed in permits for research/recovery and deaccession/transfer of Sanctuary resources discussed below.

#### **Net Benefits**

The logic of the case for recreational fishermen is similar to that for commercial fishermen. Again, since the final boundaries of the Dry Tortugas ER are still open to a public process, and data is still being collected, it



seems prudent to be cautious in making a prediction. However, the most reasonable prediction is that the net effect will be positive, and more so than for commercial fishermen since territoriality is less of an issue and sport fishing benefits from the increase in numbers of large fish produced by the reserves.

#### **6. Larger Economy**

##### **Costs**

There will be some short-term costs to the regional economy in Monroe County from the short-term loss in catch due to the Western Sambos ER. As stated previously, NOAA has taken costs to commercial fishermen and the regional economy into account in writing the FMP. Dropping the Key Largo and the Dry Tortugas ERs will result in a much lower cost to the regional economy from short-term commercial fishing loss than the Preferred Alternative from the DMP.

##### **Benefits**

The zoning plan is expected to provide the benefit of helping to maintain the quality of the resources in the Florida Keys, which in turn will maintain all the benefits currently associated with tourism, fishing, and other uses.<sup>15</sup> If the habitat is allowed to deteriorate, most of the associated benefits to the regional economy, regardless of their size, will tend to disappear over time.

The added consumer surplus from the added value derived from ER status, even if that added value were quite small for each tourist, would be quite substantial in light of the enormous importance of tourism in the area. The same can be said for the value added by the ERs to existence and option values for the nation.

##### **Net Benefits**

Benefits to the regional economy from establishing the reserves are expected to be strongly positive. Tourism and recreation represents the largest industry in Monroe County, and it is clear that zoning will benefit tourism, even if the effect on commercial fishing is negative, against expectations.

#### **Sanctuary Preservation Areas**

SPAs protect shallow reefs where concentrated visitor activity has been leading to resource degradation. In designating the SPAs care was taken to protect areas identified as most in need while minimizing the cost to fishermen by avoiding areas with high fishing use wherever possible. Criteria which were used in selecting the SPAs, and again were reconsidered in drawing up the Final Preferred Alternative, included:

- Protect representative locations of the most rare habitats.
- Consider long-term impacts on areas of critical economic value.
- Protect areas that are buffered from poor water quality.
- Consider the accessibility of areas to fishermen and other user groups.
- Minimize conflicts.
- Provide geographic spread.
- Maintain sufficient size to ensure viability.
- Consider potential for research and use as control areas.

The concept of SPAs has been less controversial than the concept of ERs because the areas proposed for designation as SPAs are experiencing significant population or habitat declines as a result of human impacts, and the SPA strategy addresses this immediate and obvious issue of overuse and observed environmental degradation. Most of the SPAs are not heavily used by fishermen, and fishermen's groups agreed with the establishment of the SPAs early in the planning process.

In consideration of public comment on the draft plan and SAC recommendations, the FMP allows catch and release fishing by trolling in four SPAs-Conch Reef, Alligator Reef, Sombrero Key, and Sand Key. These four were selected using information gathered through aerial census data and from public comments. These four areas will give NOAA the ability to compare and contrast SPAs where catch and release fishing is allowed and not allowed in order to determine its short and long-range impact.

The DMP/EIS proposed prohibition against all consumptive activities, would include baitfishing in the SPAs. The public comments, particularly from small baitfishing businesses, indicated that certain SPAs would adversely impact their operations and that relocation of their operations was not practicable in the providing of live bait for offshore, pelagic fishing in certain areas. The SAC reiterated these concerns in their

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<sup>15</sup>See discussion on page 8 under "Monroe County Economy"



recommendations. Consequently, to mitigate the impacts on these small business entities, the final regulations allow ballyhoo fishing by net in the SPAs pursuant to a Sanctuary permit.

### **Costs**

Recreational diving, dive charter operators and other non-consumptive users may incur some incremental costs in complying with the increased restrictions to protect the habitat from further degradation. The restrictions put on their use of the SPAs, such as prohibiting discharge of marine sanitation devices, touching coral, and anchoring so as to avoid coral may have some incremental costs to users, but these costs are expected to be negligible. Additional expenditures for equipment are not expected, as marine sanitation devices can be discharged outside the zones consistent with other laws. There may be some additional costs for personnel to dive down and inspect the anchor to avoid touching coral, but they are not expected to be significant, as most dive charters already have personnel employed able to conduct the task. There may be some delays in getting the divers into the water, but the delay time should be minimal.

Costs to the tourist industry and divers are expected for those who violate the regulations and are subjected to civil penalties. However, based on public comments as well as NOAA's experience at Looe Key and Key Largo National Marine Sanctuaries and elsewhere, compliance with the regulations from divers and charter operators is expected to be high.

Tropical fish collectors, lobster fishermen, recreational fishermen, and spearfishermen displaced from these areas are expected to incur relocation costs and may be negatively impacted in their catch overall, at least in the short-term. These adverse impacts are not expected to be significant in the long term.

There is very little commercial fishing in the SPAs. As mentioned previously, two studies have surveyed vessel use in the SPAs. The NMFS survey (McClellan 1996) over a four-year period from September 1992 through December 1996, found that fishing activity was almost even between SPAs; Alligator reef, Davis reef, and Sand Key were the most popular, with 4.6, 4.5 and 3.9 fishing boats per survey. The great majority of these were recreational boats: nine out of ten boats in Alligator reef, twenty-nine out of thirty in Davis reef, and five out of six in Sand Key. The percentage of recreational fishermen is probably even higher than reflected by these numbers, since the surveys were conducted on Fridays, and more recreational fishing takes place on weekends.

The Florida Marine Institute study (1995) found a lower amount of fishing than the NMFS study. It found that what fishing does occur in the SPAs is inconsistent, with occasional higher usage, often coinciding with holidays.

Allowing catch and release fishing in four SPAs will significantly reduce the costs to charter boat operators who rely on these SPAs for fishing during inclement weather.

Allowing baitfishing by permit in the SPAs will significantly reduce the costs to small commercial baitfishing companies and recreational offshore fishermen. Although there may be some incremental costs for management and fishermen for the permit process, they are expected to be minimal. The permit process will be along standardized lines as opposed to requiring a more rigorous case by case analysis.

### **Benefits**

Groups that will benefit are those that value an abundance and diversity of marine wildlife, especially divers and snorkelers. Dive vessels were found by the NMFS survey (McClellan 1996) to be slightly more abundant than fishing vessels: adding up the averages for all the SPAs, the study found 43 dive vessels and 40.7 fishing vessels in the SPAs per aerial survey. Again, the flights were on Fridays, generally between noon and two, and missed some of the weekend traffic.

The habitat protection and reduction of habitat degradation in the SPAs is expected to have some secondary benefit for species which use the habitat, including species which are subject to recreational and commercial fishing. Thus, the habitat protection may in the long term provide benefits for such fisherman or at least mitigate the short term adverse impacts. Based on experiences in other protected areas, more fishing near the SPAs by recreational and commercial fishermen is expected.

### **Net Benefits**

SPAs are expected to have little cost since they are small in area and displaced recreational and commercial fishermen can easily move to nearby areas at little cost. The benefits of allowing these stressed habitat areas



to rejuvenate clearly justify the displacement costs to small numbers of recreational and commercial fishermen.

### **Existing Management Areas**

Consistent with the FKNMSPA, the regulatory protections for the Looe Key and Key Largo National Marine Sanctuaries (which became part of the Florida Keys National Marine Sanctuary) have been incorporated into Sanctuary regulations. The regulatory protections applicable to these areas are found in the Sanctuary-wide prohibitions and in the Existing Management Areas restrictions. The prohibitions and restrictions applicable to Looe Key and Key Largo Sanctuaries are substantially the same as before. The Key Largo/Looe Key NMS regulations and NOAA's corresponding experience at these sanctuaries provided a basis or model for the general Sanctuary wide-prohibitions and zoning restrictions for the entire FKNMS. The impact analysis for the Sanctuary-wide restrictions appears later, below. The analysis here is limited to the four prohibitions applicable to Key Largo and Looe Key set forth in the EMA regulations: (i) removing coral or marine invertebrate, or any plant, soil, rock, or other material, except commercial taking of spiny lobster by hand or gear; (ii) taking tropical fish; (iii) fishing with wire traps, bottom trawls, dredges, fish sleds, or similar vessel-towed or anchored bottom fishing gear or nets; and (iv) fishing with, carrying or possessing pole spears, air rifles, bows and arrows, slings, rubber powered arbalates, pneumatic and spring loaded guns or similar devices known as spearguns.

These restrictions are presently applicable to the Looe Key and Key Largo NMSs and accordingly their continuance imposes no new cost on any entity. It would be inconsistent with the NMSA under which these sanctuaries were originally designated and protected to lessen the protections afforded them. Maintaining the protections here without substantial change involves the least amount of disruption to users of these and other Sanctuary areas. If the protections were lessened here, then protections in other areas may need to be added. Thus, maintaining the status quo for these areas was considered to be the best alternative from a socioeconomic impact perspective.

Also designated Existing Management Areas are the Great White Heron and Key West National Wildlife Refuge Management Areas. Sanctuary regulations incorporate existing U.S. Fish and Wildlife Service restrictions which prohibit waterskiing, operating personal watercraft, and operating airboats within the Great White Heron and Key West National Wildlife Refuge Management Areas. By incorporating these provisions into the Sanctuary regulations, civil penalties can be sought for violations of Sanctuary regulations. Currently, only criminal sanctions, which are more difficult to prove and not always the best means of obtaining compliance, are available. To address water quality concerns and complement the Florida Clean Vessel Act, this section also sets forth a prohibition against the discharging or depositing of any material or other matter except cooling water or engine exhaust in these areas.

The costs to users of the Wildlife Refuge Management Areas are not expected to be significant. Additional costs are expected to be limited to civil penalty enforcement. This may mitigate some costs because the remedy under USFWS regulations is criminal sanctions, which require greater costs to management as well as to violators.

### **Special-use Areas**

Only four small research only Special-use Areas are established under these regulations. The places chosen are coral reef habitats which will serve as control areas for studying environmental, biological and human impact issues in the Sanctuary. Academic and scientific communities will be the primary initial beneficiaries of this zone type. Some comments indicated that one of the areas identified in the DMP would impact recreation use by local residents. The FMP was modified to avoid such impacts. Based on the zoning process for the DMP, and the public comments, no adverse impacts are expected upon fisherman or the tourist industry because these areas not generally used by those businesses. Later, additional areas may be established to address restoration needs, high-impact activities or user conflicts.

Except for passage without interruption through the area or for law enforcement purposes, no other person may enter the research only Special-use Areas except to conduct or cause to be conducted scientific research or educational use specifically authorized by and conducted in accordance with the scope, purpose, terms and conditions of a valid National Marine Sanctuary General or Historical Resources permit. The socioeconomic impacts of the four Special-use Areas are not expected to be significant because they are not areas traditionally used by commercial and recreational fishermen. Some local users and some tourists may be displaced but not to any great degree; these areas are small and located apart in discrete portions of the Sanctuary.



### **Conclusion: Net Benefit of Zoning Plan to All Users**

The overall net benefit of the zoning plan is expected to be strongly positive. Most sectors, including the habitat itself, non-consumptive users, and recreational fishermen, are expected to benefit. Recreational fishing is expected to benefit from increased productivity due to the reserves, with in particular increased numbers of large fish. Consumer surplus from non-consumptive activities will increase. It is expected that long-term producer surplus and consumer surplus for the commercial fishing industry will not change much or possibly increase. The worst case scenario is that the net benefit to that one sector will be mildly negative. However, this assessment has considered benefits across the board and the cost in that case would be justified by the benefits to all other sectors of society.

It should be emphasized again that although the non-consumptive use zones impose a short-term cost on commercial fishermen, the failure to adequately protect resources and ameliorate conflicts imposes a cost on non-consumptive users of the Sanctuary. In areas which allow both, an implicit decision is imposed which favors consumptive over non-consumptive users. Both consumptive and non-consumptive uses are important for the regional and national economy. Most of the Sanctuary, over 96 percent, will remain open to fishing. SPAs and ERs are areas of critical habitat where it seems most reasonable to favor non-consumptive uses.

### **COMPARATIVE IMPACTS OF ZONING ALTERNATIVES**

The above discussion centers on the FMP Preferred Alternative. The following is an assessment of the socioeconomic impacts of the zoning plan for each of the five zones for the three mid-range alternatives in the DMP.

#### **Wildlife Management Areas**

Only minor changes were made to the WMAs from Alternative III to the Final Preferred Alternative. The FMP and regulations allow transit through Jewfish Creek and Steamboat Creek. Alternative III restricts access. Also, an idle speed only/no wake zone in the area of Lake Surprise east of US Highway 1 was added to the final plan to protect endangered American Crocodiles and West Indian Manatees.

Alternative III, then, would basically provide all the benefits and costs outlined in the assessment of the Final Preferred Alternative. Alternative III would add certain additional habitat protection for the two creeks, and the slight additional socioeconomic cost of incrementally greater restricted access. The overall net benefit of Alternative III would be strongly positive, to nearly the same degree as the FMP Preferred Alternative.

Alternative IV includes fewer WMAs (19) than Alternative III (26) and would therefore entail fewer benefits to habitat and values deriving from benefits to habitat, as well as slightly lower costs to those whose access would be limited; enforcement costs would be concomitantly lower. Alternative II includes more WMAs (37) than Alternative III (26) and would have relatively concomitantly more benefits to habitat and values deriving from benefits to habitat, including enjoyment by non-consumptive users and higher existence and option values. However, there would also be higher costs for Sanctuary users desiring free access to as much of the Sanctuary as possible, and higher enforcement costs.

#### **Ecological Reserves**

This is the zoning type which underwent the greatest changes from Alternative III to the FMP Preferred Alternative. The proposed Key Largo and Dry Tortugas Ecological Reserves were dropped. The Western Sambos ER was maintained with the same boundary.

The categories of costs and benefits of the Alternative III ER plan are similar to those of the FMP Preferred Alternative, but different in magnitude. The inclusion of the Key Largo and Dry Tortugas ERs in Alternative III would have involved greater protection of the habitat and species biodiversity within the Sanctuary, and therefore more of the benefits of such protection for non-consumptive users, and higher benefits deriving from existence and option values. The short-term costs from displacement of some fishermen will be lower in the FMP Preferred Alternative than they would have been with the DMP Preferred Alternative, because of the inclusion of only one ER instead of three. The Dry Tortugas ER in its Alternative III configuration in particular contained some shrimping grounds which were identified in public comment on the draft plan. Alternative III would also involve higher administrative and enforcement costs, from having to manage two additional ERs.

Alternative IV establishes the same three ERs as Alternative III but all are smaller. This alternative was rejected as not providing enough habitat protection. Alternative II establishes eight ERs, including the three in



Alternative III, with roughly the same boundaries as in Alternative III.

The socioeconomic implications of these alternatives, clearly, are that the short-term costs to fishermen will rise, and the costs to management will rise, the more area is declared off-limits to fishing. The benefits foreseen for ERs, including protection of habitat and of biodiversity, maintaining control areas for scientific research, providing areas rich in marine life for high-quality viewing and enjoyment, and increasing stocks of species which will improve neighboring fishing areas, should also rise as greater area is placed in reserve status. Since the net benefits to users and the environment from ERs are expected to be strongly positive, the net benefits of Alternative IV would be higher, and the net benefits of Alternative II would be lower, than for Alternative III.

### **Sanctuary Preservation Areas**

Little change was made to the SPAs in developing the FMP Preferred Alternative from the DMP Preferred Alternative. One SPA, Western Sambos, was dropped because that area was made an ER, with the same protections provided the SPAs. The Carysfort Reef SPA was slightly enlarged to provided need protection that would have been supplied by designation of the Key Largo ER which was dropped from the FMP. The socioeconomic assessment for Alternative III is therefore identical to the assessment of the FMP Preferred Alternative.

Alternative IV contains the same 19 SPAs as Alternative III, but generally with each SPA being larger in area, and Alternative II contains 12 SPAs with roughly the same boundaries as in Alternative III. Alternative II was rejected for not providing sufficient habitat protection. The qualitative assessment of costs and benefits for each SPA is the same as for all SPAs together, so that the net benefits of Alternative IV would be expected to be higher, and the net benefits of Alternative II lower, than the net benefits for Alternative III.

### **Existing Management Areas**

The Existing Management Areas are the same in all alternatives in the DMP and in the FMP Preferred Alternative, so the assessment of benefits and costs is the same. No environmental or socioeconomic impacts are anticipated across the alternatives since these zones are currently managed by other agencies, except that costs may be lower due to interagency cooperation.

### **Special-use Areas**

The four research only Special-use Areas included in Alternative III are the same as in the FMP Preferred Alternative except that Alternative III includes Pelican Shoal, which was eliminated in the FMP and replaced with the Eastern Sambos (Research Only) Special-use Area. Alternative III would have a higher socioeconomic cost to the public because of the limited access to Pelican Shoal, and a higher research benefit, if NOAA's judgment that the Eastern Sambos area is a better research and monitoring site is correct. Alternatives IV and II were identical to Alternative III in the draft plan.

The conclusion that net benefits of the DMP Preferred Alternative III would be positive for all user groups is supported by the Florida Department of Commerce, which conducted a consistency review of the DMP/EIS. Their conclusion was:

the proposed plans and actions are consistent with criteria in Chapter 288, Florida Statutes: positive net impacts on income and employment; social benefits outweigh identifiable social costs; no adverse effects on any key Florida industry; and official local agency support for the project.<sup>16</sup>

## **Socioeconomic Assessment of Sanctuary-wide Regulations**

### **§ 922.163 Prohibited Activities - Sanctuary-wide.**

#### **(1) Mineral and hydrocarbon exploration, development and production**

Section 6(b) of the FKNMSPA states that "[n]o leasing, exploration, development, or production of minerals or hydrocarbons shall be permitted within the Sanctuary." The regulations merely codify this statutory prohibition, which became effective in November 1990 when the statute was enacted, rather than expanding upon it. Potential lost revenues from the statutory prohibition on the oil and gas industry and on the local

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<sup>16</sup>Letter from Wynnelle Wilson, Economic Development Policy Coordinator, Bureau of Economic Analysis, to Suzanne Traub-Mettay, Director, State Clearinghouse, Office of Planning and Budgeting, Executive Office of the Governor, August 7, 1995.



economy which could provide support services for this industry; and the potential adverse impact on the energy self-sufficiency of the United States, and on energy costs, have not been thoroughly researched and quantified by NOAA.

The Minerals Management Service (MMS) has indicated that the hydrocarbon potential is poorly known in the South Florida Basin because few exploratory wells have been drilled in the geochemically mature offshore portions of the basin. While MMS indicates that the South Florida Basin is a promising, frontier for oil and gas exploration, in the context of the nation's overall oil consumption, MMS hydrocarbon resource estimates for South Florida are modest. MMS states that the most favorable location for commercial hydrocarbons in South Florida are in the Eastern Gulf of Mexico Planning Area because of the location of the depocenter of the South Florida Basin. The Straits of Florida Planning Area which includes the Florida Keys has the lowest relative economic interest for commercial development for the South Florida Basin. The Marginal probability of commercial hydrocarbons is estimated by MMS to be 0.18 for the Straits of Florida Planning Area and 1.00 for the Eastern Gulf of Mexico Planning Area.

MMS has estimated the potential existence of hydrocarbons in the Straits of Florida to range from 180 to 680 million barrels of oil and 0.21 to 0.79 trillion cubic feet of gas. The mean estimated reserves 350 million barrels of oil and 0.44 trillion cubic feet of gas equate to about 27 days of total U.S. oil consumption at the 1988 rate (13 million barrels per day). Several exploratory wells drilled in the Florida Keys area had shows of oil, but were considered not economically viable. Two wells drilled in the vicinity of the Marquesas Keys in 1959 and 1960 were determined to be possible low-volume oil producers. While the mean reserves estimated by MMS for the Straits of Florida Planning Area appear too low to generate much industry interest because of the low potential return on investment, companies that want to drill in a frontier area could be hoping to discover new reserves that might be considerably greater than those estimated by MMS.

The lost revenues and costs to the hydrocarbon industry and related industries is considered to be moderate to low, depending on the resource potential. Whatever the costs, they were evidently deemed acceptable, particularly when considered with other societal concerns. These costs are reduced by removing the potential for damaging the resources of the Sanctuary that the conduct of such activities presents (e.g., oil spills fouling reefs and beaches, decreasing tourism, and making valueless fishery resources spoiled by a spill). There are also potential benefits to the tourism industry of preserving aesthetic views not spoiled by oil production platforms. It is not possible here to reach a conclusion as to whether the economic costs would be offset entirely by the expected benefits.

***(2) Removal of, injury to, or possession of coral or live rock***

The purpose of this regulation is to protect and preserve an important and slow to regenerate resource of the Sanctuary—live rock and coral. The damage to the resources of the Keys caused by the removal for resale of coral and live rock, from damage due to divers touching same, and from vessels running aground are well documented and was a primary reason for the designation of the Sanctuary by the FKNMSPA. If divers comply with this restriction, the restriction itself should have no economic impact on them. The same is true for vessels. As the collection of coral or live rock is already regulated by other federal and state authorities, there should be no adverse impacts from this restriction, except to the extent that these other authorities incorporate Sanctuary concerns into their permits. The state of Florida already prohibits the taking of coral and live rock, as does the South Atlantic Fishery Management Council. The Gulf Council will have its prohibition phased in by the end of the year. Live rock aquaculture may be conducted pursuant to a permit. Presently there are approximately 12 permits in the Gulf and 12 in the Atlantic; none of these permits are in Sanctuary waters.

The benefits of preserving the remaining coral and live rock in the Sanctuary from environmental damage through dive tourism will offset either partly or completely the adverse economic impacts on consumptive users. Failing to impose this prohibition would be inconsistent with obtaining the objectives of the NMSA and the FKNMSPA. No alternative which would lessen the impact on consumptive users would be consistent with the statutes.

***(3) Alteration of, or construction on, the seabed***

The purpose of this regulation is to protect the seabed and to act as a type of safety net for activities not covered by existing federal and state permit regimes. Certain activities have been expressly exempted in order to lessen the prohibitions costs on users of the Sanctuary. The exempted activities include anchoring, traditional fishing, installation of navigational aids, harbor maintenance, and the construction and repair of docks, seawalls, piers and marinas with less than ten slips. Other activities, not exempted, can still be



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conducted if authorized by a US Army Corps of Engineers and/or state DEP permit through the Sanctuary certification and authorization procedures (§§ 922.167 & 922.168) and further delineated in the Permit Memorandum of Agreement with the Florida Department of Environmental protection (DEP). The Sanctuary certification/authorization process avoids duplication, but also ensures that other federal and state authorities address Sanctuary concerns comprehensively and holistically. There may be some socioeconomic impacts from this process to the government agencies involved, as well as permittees. However, the process has been set up to avoid time delays and ensure that additional terms and conditions are justified.

The regulation also acts as a safety net to ensure that some future activity which disturbs the seabed and is not covered by other agency federal or state permits cannot be conducted without a Sanctuary permit.

While commercial salvors will continue to be required to obtain DEP permits in state waters, the Sanctuary permit process will govern salvage in Sanctuary waters. While the permitting process is rigorous for treasure hunters and may remove much of the financial incentive to conduct such operations, the potential profit for treasure hunters appears currently to be diminishing because of environmental and historic preservation laws, and a diminishing resource base. Historical resources in the Sanctuary are a public resource which should be preserved for present and future generations. Treasure that is not historically significant will be allowed to be transferred to permittees.

**(4) Discharge or deposit of materials or other matter**

This prohibition acts as a safety net for Sanctuary water quality and living resources. Costs on users have been substantially ameliorated by exempting common activities which do little harm: fish, fish parts, chumming material, bait produced or used incidental to traditional fishing activities, biodegradable effluents discharges incidental to vessel use and generated by USCG approved marine sanitation devices, water generated by routine vessel operations (gray water, cooling water), and vessel engine exhaust. Where an exempted activity has a greater potential for harm such as in the SPAs and ERs, the exemption has been withdrawn. Most of the significant discharges and deposits subject to this prohibition, such as sewage outfalls, will be subject to other federal and state agency permits, and Sanctuary concerns will be addressed through the permit certification and authorization process. Additional costs for addressing Sanctuary concerns are expected, but the processing costs are expected to be minimal, as are the impacts to permittees.

Like the prohibition on alteration of the seabed, the prohibition on discharges acts as a safety net. For example, some sponge fishermen pour used oil on the surface to make it easier to see sponges, or bleach to get fish to move out of hiding. This prohibition have have significant impacts on such fishermen, who use non-traditional fishing practices which are potentially harmful to the coral reef, habitat, and ecosystem.

**(5) Operation of vessels, including anchoring**

The final regulation prohibits operating a vessel at a speed greater than idle speed only/no-wake:

- in areas designated idle speed only/no wake zones;
- within 100 yards of navigational aids indicating emergent or shallow reefs (international diamond warning symbol);
- within 100 feet of the red and white "divers down" flag (or the blue and white "alpha" flag in federal waters);
- within 100 yards of residential shorelines; or
- within 100 yards of stationary vessels.

These restrictions apply to the operation of all vessels, including personal watercraft. Vessel operators may incur some time delays in going slower or in steering their course, but the adverse impacts are expected to be minimal and reasonable to avoid adverse impacts arising from conflicting uses of areas. Socioeconomic benefits are expected from compliance with these rules through reduction in the harm to Sanctuary resources, life and property from collisions.

In idle-speed only/no wake areas, the rule may enhance the use for fisherman and other recreational uses, by minimizing some user conflicts which harm those use experiences. This in turn may result in some incremental socioeconomic benefits to users such as fisherman, divers, charter operators and others. The aforementioned example of the Florida Keys Fishing Guides Association estimated benefits from such vessel restrictions to the 30 fishing guides currently utilizing the WMAs is somewhat analogous the these restrictions.

As these restrictions minimize user conflicts they will also result in fewer accidents. As previously indicated, in  
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1995, there were 503 personal watercraft (e.g., jet-ski) accidents involving 856 vessels in Florida waters. Of the 503 jet-ski accidents, 325 involved a collision with another vessel. There were over 66 accidents in the Sanctuary waters off Monroe County. Of these 66 accidents, 48 resulted in injuries, and damages were estimated to be \$79,477.00.<sup>17</sup> It is difficult to predict how many accidents will be avoided or minimized by these rules, which apply in portions of the Sanctuary; however, it is clear that there should be some reduction in accidents, injuries, and damages, which is a socioeconomic benefit. Adverse socioeconomic impacts from these restrictions are expected to be greatest upon PWC users.

Fifty-five percent of the public comments on the DMP/EIS addressed the issue of personal watercraft (e.g., jet-skis). The majority of them requested that NOAA not single out personal watercraft in its final regulations. Many of the public comments reminded NOAA that personal watercraft owners and users should act responsibly. Others asked that NOAA severely restrict or even prohibit the operation of personal watercraft within the Sanctuary. NOAA also received comments noting frequent environmental nuisance and safety issues associated with the operation of personal watercraft. These included: reckless operating behavior, harassment of endangered species such as the East Indian manatee, harassment of other boaters (including disruption of fishing on flats), and noisy operation in canals and adjacent to residential shorelines. These reviewers requested limiting and restricting or banning the use of personal watercraft within the Sanctuary.

NOAA has developed a multi-pronged approach to address the public's concern over this issue. NOAA has accepted the SAC's recommendation to add a new section to the final regulations, which prohibits reckless operation of watercraft. Additionally, the regulations have been modified to prohibit operating a vessel at greater than idle speed only/no wake within 100 yards from residential shorelines, from stationary vessels (except in marked channels), and from navigational aids marking emerging or shallow reefs. NOAA has also incorporated into its regulations the authority to enforce all idle speed only/no wake zones established throughout the Sanctuary. NOAA will use the existing county and state process for designating these zones, and it is likely that these personal watercraft will be restricted in certain residential areas and other places where they continue to be a nuisance or safety problem. The industry has indicated it is seriously committed to "self regulation" and is willing to work with NOAA to develop educational efforts geared toward changing user behavior. In particular, the PWC industry agreed to work with Sanctuary staff to establish criteria for the management of commercial PWC rental operations. The final component of NOAA's approach to PWCs is a modification of the SAC's recommendations. If initial efforts are not successful at significantly reducing or eliminating the nuisance and safety problems, NOAA will consider implementing broad zoning restrictions consistent with SAC recommendations. Restrictions of this type have been implemented successfully in the Monterey Bay National Marine Sanctuary.

The PWC industry, operators and others provided comments raising concerns about restricting only PWCs under the regulations. The PWC rental operators are small business entities and their comments were given due consideration. Despite pressure from other commentors, these restrictions do not single out PWCs, but apply uniformly to all vessels. The focus is not on the type of vessel, but the manner of operation. The restrictions are expected to have some adverse socioeconomic impacts on PWC users, but no such impacts are expected upon PWC rental operations. In addition, the adverse impacts on PWC users should be limited to relocation costs.

Additional regulations on the operation of vessels include a prohibition on: (1) operating a vessel in such a manner as to injure, take, or cause disturbance to wading, roosting, or nesting birds or marine mammals; and (2) operating a vessel in a manner which unreasonably or unnecessarily endangers life, limb, property or marine resources, including but not limited to weaving through congested vessel traffic, jumping the wake of another vessel unnecessarily closely or when visibility around the other vessel is obstructed, and swerving at the last possible moment to avoid a collision.

To a certain extent, these activities are already prohibited by existing laws. These activities may trigger the ESA and MMPA for certain Sanctuary resources. The restriction on reckless operation of vessels is based primarily on existing restrictions in state law, and therefore the incremental impacts are likely limited to users in the federal waters portion of the Sanctuary. As with the other vessel operation restrictions, some adverse socioeconomic impacts are expected, but primarily on PWC users. Overall the socioeconomic impacts are expected to be positive because vessels are restricted to operating in a manner which does not harm other recreational and commercial users of the Sanctuary, including fishermen and divers; but does not prevent them from carrying on with their own recreational or

<sup>17</sup>1995 Boating Accidents Report by the Florida Department of Environmental Protection, Division of Law Enforcement.



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business pursuits.

Also specifically prohibited is anchoring a vessel on coral other than hardbottom in less than 40 feet of water when visibility is such that the seabed can be seen. This prohibition does not apply to anchoring on hardbottom.

Anchoring on corals is a threat to the health of coral reefs in the Florida Keys. This is especially true in areas of concentrated vessel use. Mooring buoys have been installed on some heavily used reefs to prevent anchor damage (see Mooring Buoy Action Plan, Volume I). This is not a practical solution for all the areas where fishing occurs, especially over some of the deeper reef habitats. The problem of anchoring on corals can be addressed areas where the water clarity and depth are such that boat operators should reasonably be expected to see the bottom.

The alternative of prohibiting anchoring on corals throughout the Sanctuary was rejected as being overly restrictive and having unacceptable adverse socioeconomic impacts on users.

The proposed regulations would have prohibited anchoring a vessel on coral in depths less than 50 feet. Visibility in Sanctuary waters has been declining, particularly in the last decade. Reviewers of the proposed regulations, including the SAC, stated that the proposed prohibition was too restrictive, especially in the Lower Keys where visibility often prevents a boat operator from being able to see the bottom at such depths. While there would be greater environmental benefits from prohibiting anchoring a vessel on coral in all waters shallower than 50 feet, the inconvenience to fishermen and others who regularly use areas where they can't see the bottom would not appear to be justified.

The SAC recommended the anchoring restriction adopted in the final regulations in its comments to NOAA. Other groups favored the proposed regulation, requested an anchoring on coral ban throughout the Sanctuary, or objected to any prohibition on anchoring. The alternative chosen will help prevent anchor damage to coral reefs. The restriction will not have any direct economic impact on users. While impossible to quantify, the overall, long-term economic benefit to society from protecting coral reefs from anchor damage should far outweigh the inconvenience people face of having to be careful when they anchor.

**(6) Conduct of diving/snorkeling without flag**

This prohibition is designed to prevent user conflicts and to protect the health and safety of divers/snorkelers from being damaged inadvertently by other Sanctuary users. The cost of a flag is insignificant and is more than offset by the potential benefit of using one.

**(7) Release of exotic species**

The damage to the Florida environment and to other areas of the United States from the inadvertent or deliberate release of exotic species is public knowledge. The cost of the potential damage to the ecology of the Keys dwarfs the cost of a user complying with this requirement. The cost of compliance should be minimal.

**(8) Damage or removal of markers**

The overall cost of markers, their placement, and upgrade is not insignificant but is necessary for the safety of Sanctuary users and for the protection of fragile ecological areas. There is no cost associated with a prohibition on removing or damaging a marker. If a Sanctuary user damages a marker, that user should bear the costs of repair or replacement.

**(9) Movement of, removal of, injury to, or possession of Sanctuary historical resources**

Also included under this prohibition is a discussion of the § 922.166 permit system under which this prohibited activity could be conducted.

The regulations prohibit the removal or injury of Sanctuary historical resources. Three types of permits may be issued under § 922.166 to allow this activity: Survey/inventory, Research/Recovery, and Deaccession/Transfer permits. However, permits will not be issued for recovery of shipwrecks in any of the WMAs, EMAs, SPAs, ERs, or Special-use Areas or in any areas where coral or significant amounts of seagrass or other significant natural resources would be injured by recovery of submerged cultural resources (SCRs). Further, permits will not be issued for shipwrecks which are relatively intact and are of high historical significance. However, for shipwrecks of low to moderate historical significance where recovery will not injure significant natural Sanctuary resources, permits for the recovery of SCRs will be considered pursuant to these



regulations and the SCR Agreement, which is a Programmatic Agreement consistent with section 106 of the National Historic Preservation Act.

This regulation and the SCR Agreement will adversely affect commercial treasure salvors. Commercial treasure salvors generally run small business operations. Treasure salvors may be grouped into three categories: 1) professional treasure salvors whose search, recovery, sale, and/or display of recovered items is a full-time endeavor and primary source of income; 2) paraprofessionals who hunt for treasure regularly on a part-time basis, but for whom treasure salvage is not their primary source of income nor a full-time job; and 3) souvenir collectors/hobbyists, who combine the search for treasure with their recreational diving activities.

The discovery of the 1715 Spanish fleet off Vero Beach in the early 1960s resulted in a treasure hunting boom (Throckmorton 1990). In the mid-1980s another surge of treasure salvage activities occurred in South Florida. From 1985 to 1987, for example, Mel Fishers Salvors, Inc. dove the ATOCHA and the MARGARITA with up to six boats in the water at once. The operation employed over 100 people as divers, crew, and support staff for office, laboratory, and museum work. In addition to these activities, it was estimated that 40 to 50 people were actively conducting commercial treasure salvage during the 1980s at sites in the Florida, mostly outside the Keys. Thus the government has estimated that a total of 150 people were directly involved in treasure hunting at its peak. Treasure salvors have stated that 25 companies and over 100 people worked the 1715 Fleet and have asserted that 1,000 to 2,000 people were directly or indirectly involved with treasure operations in Florida in the heyday of operations in the 1980s.

While the potential for commercial treasure salvage operations is provided for in the plan, the number of companies and individuals involved directly and indirectly is not expected to reach those of the peak years in the 1980s because other finds like that of the ATOCHA are unlikely.

Since the enactment of the ASA in 1988, and perhaps due to the improbability of significant new finds, professional treasure salvors appear to have shifted their efforts to the Caribbean and other areas. Most professional treasure salvage in Florida is currently conducted by Salvors, Inc., which has federal Admiralty claims to the 1715 Fleet (outside the Sanctuary) as well as to the ATOCHA and the MARGARITA (inside the Sanctuary). The company employs approximately 50 to 100 people, but this varies with the number of expeditions planned and financed. Some treasure hunters have estimated that there are numerous companies employing hundreds of workers in the Keys (Arnold, 1991; Haskins, pers. comm.; Chapman, pers. comm.). While it is difficult to precisely estimate the number of commercial treasure salvors in the Keys, commercial treasure salvors have been considered as a small business enterprise in developing the plan and permit system.

To the extent that there are rich treasures to be found in the areas and shipwrecks which have been closed to recovery. It is impossible to quantify those impacts. While the government asserts that most of the gold and other treasure has been discovered, the commercial salvors argue there are hundreds of millions of dollars worth of treasure yet to be recovered. The records indicate that the industry finds peaked in the 1980s, and the likelihood of the discovery of shipwrecks with millions of dollars of treasure is not supported by a review of the state contracts or the admiralty court salvage records.

Regardless of whether there are millions to be found or not, a permit system was developed to accommodate commercial treasure salvors. The permit system will significantly increase the costs of treasure hunting in the Sanctuary because of the increased costs in hiring a professional marine archaeologist to supervise the research and recovery of the historic resources. There are also additional costs for compliance with the research and reporting requirements of the Federal Archaeological Program (FAP). These requirements are not new. Rather, they are new to this industry and the requirements are more rigorous than those that have been required in the past under state contracts and Admiralty law.

Some professional commercial treasure salvors have indicated that they have professional staff and comply with standard archaeological practices. For those, the adverse impacts should only be incremental. For the paraprofessional who conducts only amateur archaeology, the costs will be significantly more.

Another change involves ownership of the recovered treasure. In state contracts, the treasure salvor is guaranteed 80 percent of what is recovered, and the state gets the other 20 percent. Under these regulations, the commercial treasure salvor gets possession of everything recovered; however, the permittee must conserve and make available for public display all unique or highly significant historical resources. Through a Special-use permit, the permittee would be able to sell or transfer duplicative jewels, coins, bullion



and other valuable objects whose historical and/or archaeological significance has been determined to be diminished because the information about those artifacts has been preserved in final reports, photographs, drawings, videotapes and representative samples for future research. The economic costs to commercial treasure salvors are significantly greater than under the existing system, but there are also socioeconomic benefits from preserving certain historic shipwrecks in the Sanctuary, as well as in the more rigorous research, reporting and conservation requirements. Some of the costs to commercial treasure salvors should be mitigated by charging admission fees to museums for the viewing of conserved artifacts, as Mel Fisher does through his museum.

In response to comments from commercial treasure salvors and others, the permit requirements were revised to make the permit management system more pragmatic from the perspective of the commercial salvors without compromising the primary objectives of protecting the submerged cultural resources. Increased costs are expected in complying with permit requirements for liability insurance and performance bonds.

After consultation with the state of Florida, NOAA deleted the regulatory provisions requiring a performance bond for all applicants, although it still may be required in certain instances where the financial ability of the applicant to carry out the potentially harmful work is in question. At the suggestion of commercial treasure salvors, NOAA also modified the regulations to clarify that other security instruments may be utilized in lieu of insurance policies. Similarly, in response to these small businessmen concerned about having to get policies for millions of dollars of liability insurance, NOAA modified regulatory language to clarify that the scope of insurance coverage required is for potential claims for damages to Sanctuary resources arising out of permitted activities and to clarify that the amount of insurance or security should be reasonably equivalent to an estimated value of the Sanctuary resources in the vicinity of the permitted area and activities. These changes should make the requirement more flexible and thereby lessen some of the potential adverse socioeconomic consequences to these small businessmen as compared to the consequences of the draft plan.

**(10) Take or possession of protected wildlife**

Taking or possessing protected wildlife is prohibited, except pursuant to permits, under a variety of statutes such as the Marine Mammal Protection Act and the Endangered Species Act. Accordingly, this prohibition should impose no additional costs on Sanctuary users. However, civil penalties available under the NMSA and the FKNMSPA will make a violation easier to address. Enforcement costs should not increase since Sanctuary enforcement officers would enforce these statutes anyway.

**(11) Possession or use of explosive or electrical charges**

This restriction is primarily to protect Sanctuary resources from non-selective destructive fishing practices that have occurred on occasion in the past. It similarly would restrict the unauthorized use of such materials and practices in new activities. Use of explosives or electrical charges to fish or collect marine species already is prohibited in state waters by the state of Florida and by the National Marine Fisheries Service in federal waters. While significant construction and development activities requiring the use of explosives are not expected in the Sanctuary, should explosives need to be used in connection with some activity to be conducted in the Sanctuary, the permit provisions of § 922.166, the certification provisions of § 922.167, and the notification requirements of § 922.168 could be used to allow the activity. Costs of certifications would be incremental to the total costs of obtaining any needed federal or state permits.

**(12) Harvest or possession of marine life species**

The Florida State marine life species rule (which governs the taking of tropical fish and plants in state waters) has been incorporated by reference into the Sanctuary regulations and made applicable to all Sanctuary waters, including federal waters. Thus, the socioeconomic costs of this incorporation are limited to those currently collecting those species in federal waters where the state rule does not currently apply. Generally, the state rule imposes general requirements for landing various species, and therefore the incremental administrative costs should be minimal. As Sanctuary users are already familiar with the state rule, the adverse impacts upon marine live species collectors should be limited to those taking species inconsistent with the existing state law. There are approximately 70 full-time marine life collectors in the Keys. A number of those collectors already comply with the state rules when in federal waters.

NOAA does not have data on the number of marine life collectors in federal waters who comply with the state rules, but does not expect any significant adverse socioeconomic impacts from this regulation. In the public comment process, including the SAC process, some tropical fish collectors indicated that compliance with



uniform rules throughout the Sanctuary would have positive socioeconomic benefits to the industry as a whole because minimizing destructive collecting practices increases the stocks for future harvest.

**(13) Interference with law enforcement**

This regulation, which essentially codifies the NMSA statutory prohibition, is intended to protect enforcement officers and the integrity of the enforcement process, including the collection of evidence, and is therefore expected to have socioeconomic benefits from the administrative perspective and well as to society overall. This regulation should have no adverse socioeconomic impacts on users.

**§ 922.165 Emergency Regulations**

There was some concern raised by the SAC and members of the public about the ability of the director or his or her designee to close SPAs to public access for a period of time, which it was felt could have serious socioeconomic impacts on user activities. The comments requested establishing some kind of time limit or process to close areas to public access for emergency reasons. NOAA has agreed and has revised the regulation to read as follows:

The Director or designee will provide public notice of the limited access designation or temporary area closure by publishing a notice in the Federal Register, and through such other means as the Director or designee may deem appropriate. With respect to a temporary area closure, the Director or designee may only close and/or limit access to an area for a period of 60 days, with one additional 60-day renewal. Continued closure and/or limited access of an area will be established pursuant to notice and comment rulemaking under the Administrative Procedure Act. Such closures and/or limited access will be kept to the minimum amount of area necessary to achieve their purposes.

**Overall Costs for Implementing Sanctuary Regulations**

**Costs to Federal Government for Implementing and Enforcing Regulations**

**Zoning Regulations**

Establishing zones (startup costs)

Installing boundary buoys:

SPAs- 18 @ 4 buoys each @ \$400 /buoy = \$28800

WMAs- 7 new @ 4 buoys each @ \$300 /buoy = \$2100

ERs- 1 @ 8 buoys @ \$400 /buoy = \$3200

Administering zones (annual costs)

Maintaining zone boundary buoys

SPAs- 18 @ 4 buoys each @ \$500 /buoy = \$36000

WMAs- 7 new @ 4 buoys each @ \$200 /buoy = \$5600

ERs- 1 @ 8 buoys @ \$500 /buoy = \$4000

Enforcing all zones = \$800K

Monitoring zones = \$800K

Total Annual Costs for Administering Zones = \$1,645,600

**Boating Regulations**

Enforcement = \$600K

Administering Permits

General Permits:

140 permits x 1.0 hours x \$13/hr = \$1820

Historical Resource Permits (including 3 subtypes):

18 permits x 3.0 hours x \$13/hr = \$702

Special Use Permits:

10 permits x 6.0 hours x \$13/hr = \$780

Voluntary Research Registry



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15 registrations x 1.0 hours x \$13/hr = \$195

Certifications:

40 certifications x 1.0 hours x \$13/hr = \$520

Notifications:

40 notifications x 1.0 hours x \$13/hr = \$520

Total Annual Costs for Administering Permits = \$4537

Total Annual Costs for Administering Regulations = \$2.25 million

**Costs to Businesses to Comply with Regulations**

**Permitting**

General Permits:

140 requests x 1.5 hours x \$12/hr = \$2520

Historical Resource Permits (including 3 subtypes):

18 requests x 6 hours x \$12/hr = \$1296

Special Use Permits:

10 requests x 6 hours x \$12/hr = \$720

Voluntary Research Registry

15 requests x 0.5 hours x \$12/hr = \$90

Certifications:

40 requests x 0.5 hours x \$12/hr = \$240

Notifications:

40 requests x 0.5 hours x \$12/hr = \$240

Total Annual Costs for Obtaining Permits = \$5106

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