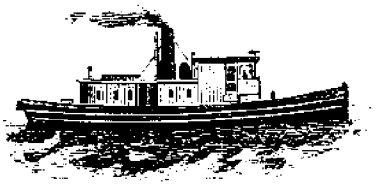
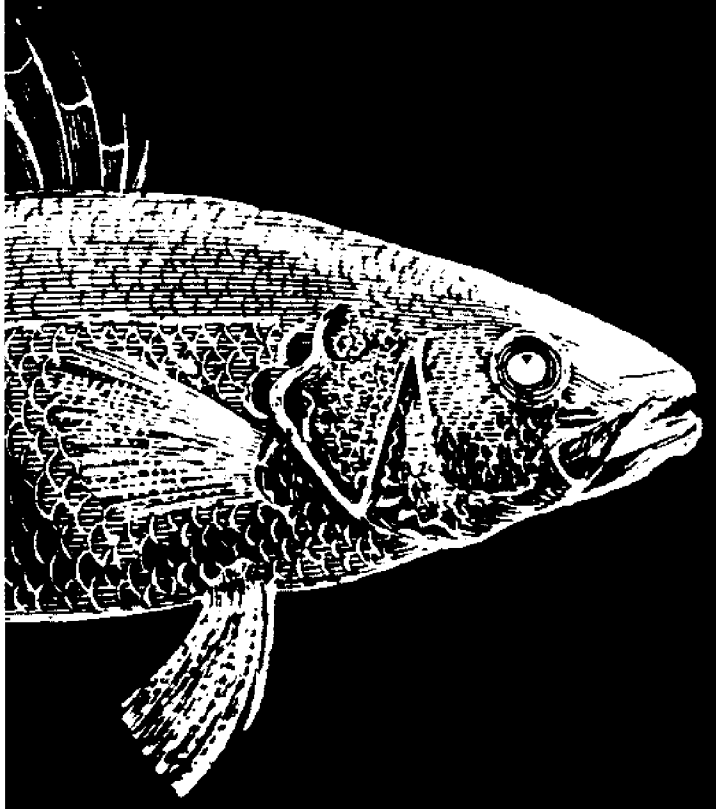


Characterization of the Commercial Dive Operator Industry in the Florida Keys National Marine Sanctuary



Florida Sea Grant Technical Paper
Number 103

D.O. Suman and M.P. Shivlani

Florida Sea Grant College is supported by award of the Office of Sea Grant, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, grant number NA 76RG-0120, under provisions of the National Sea Grant College and Programs Act of 1966. This paper is funded by a grant from The National Oceanic and Atmospheric Administration. The views expressed herein are those of the author(s) and do not necessarily reflect the views of NOAA or any of its sub-agencies. This information is published by the Sea Grant Extension Program which functions as a component of the Florida Cooperative Extension Service, Christine Waddill, Dean, in conducting Cooperative Extension work in Agriculture, Home Economics, and Marine Sciences, State of Florida, U.S. Department of Agriculture, U.S. Department of Commerce, and Boards of County Commissioners, cooperating. Printed and distributed in furtherance of the Acts of Congress of May 8 and June 14, 1914. The Florida Sea Grant College is an Equal Opportunity-Affirmative Action employer authorized to provide research, educational information and other services only to individuals and institutions that function without regard to race, color, sex, age, handicap or national origin. The information in this publication is available in alternate formats. Information about alternate formats is available from Educational Media and Services, University of Florida, PO Box 110810, Gainesville, FL 32611-0810. 10/99.

Characterization of the Commercial Dive Operator Industry in the Florida Keys National Marine Sanctuary

D. O. Suman
M. P. Shivlani
Division of Marine Affairs and Policy
Rosentiel School of Marine and Atmospheric Science
University of Miami
4600 Rickenbacker Causeway
Miami, FL 33149

October 1998

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ACKNOWLEDGEMENTS

Funding for this study was made through a grant from the U.S. Man and the Biosphere Program through the Marine and Coastal Ecosystems Directorate. We thank Dr. Michael Crosby, Ocean and Coastal Resources Management, Sanctuaries and Reserve Division at NOAA for his support.

We also thank Lisa Ziobro, Webb Smith, and Scott Thomas, graduate students at the Rosenstiel School of Marine and Atmospheric Science who assisted in the surveys. Finally, we extend our appreciation to the dive operators who took the time to participate in our survey efforts and provide us with the information that made this study possible.

EXECUTIVE SUMMARY

This report presents the results of a study conducted with commercial dive operators in Monroe County on their uses and perceptions of the Florida Keys National Marine Sanctuary (FKNMS). The FKNMS, designated in 1990 under the Florida Keys National Marine Sanctuary and Protection Act (Public Law 101-605), extends from lower Biscayne Bay to the Dry Tortugas, and it includes a variety of unique habitats within its 2,800 square nautical mile area. The National Oceanic and Atmospheric Agency (NOAA), in coordination with other government agencies and public advisory group assistance, released a Draft Management Plan in 1995 that included a zoning action plan. This zoning strategy designated 26 no-take, marine reserves that would have encompassed 5.3 percent of the FKNMS. Non-consumptive dive activities were allowed in all FKNMS zones, with the exception of 4 Special-use Areas (SUAs) which allowed no activities within their boundaries.

As part of the study, field surveys were conducted with 62 dive operators to determine the socioeconomic profile of the commercial dive industry in the FKNMS, including its economic investments, trip totals, participation within the FKNMS plan development process, and its views toward zoning in the Florida Keys.

Respondents invested an approximate average of $300,000 per operation, which included capital investments, annual operating costs, and trip-related expenses. On average, they took more than one trip per day and transported almost 10 divers per trip. In 1995, an average dive operator transported over 4,000 visitors in 420 trips.

Dive operators relied significantly on the zones designated in the Draft Management Plan. They took nearly 70 percent of 25,000 trips and 77 percent of their 450,000 visitors to one of the 26 zones in 1995. Zone use was highest in the Upper and Lower Keys, where most zones were designated. Special-use Areas, zones where diving would not be permitted, were not important dive destinations. Use totals from these zones suggested that dive operators would not be negatively affected by the FKNMS zoning strategy. Zones in pre-existing protected areas, tended to attract more trips and higher numbers of divers per trip.

Dive operators participated extensively in the FKNMS process. A majority of the respondents received information from NOAA, media, and interest group sources. Most dive operators read the Draft Management Plan, other FKNMS literature, and attended NOAA meetings. Less popular forms of participation included attending Sanctuary Advisory Council meetings and writing letters to NOAA, which only a third or less of the respondents reported doing.

Operators were divided in their perceptions on the FKNMS planning process. While most believed that the process had been conducted fairly, a majority still argued that individual citizen concerns were not heeded by NOAA. Dive operators were also concerned that the final regulations that the FKNMS adopts may not be fair, and that their opinions may not matter once these regulations are enacted.

Most of the respondents believed that the purpose of the zoning strategy is to increase stocks and conserve biodiversity within the reserves, and fewer individuals agreed with the replenishment purpose. Most dive operators perceived that zones will lead to better diving conditions, but they did not see the zones as an effective way to restore reefs. While the levels of agreement were highest for their group benefiting from the zoning strategy, most dive operators did not believe that zones can effectively reduce user conflicts.

A majority of the respondents were against the establishment of the zones as proposed in the Draft Management Plan, although over 75 percent favored some type of zoning strategy in the Florida Keys, and 65 percent favored the establishment of the FKNMS. As a user group that stands to benefit from the proposed zoning strategy, these results suggest that there may be socio-political perceptions that affect the group's acceptance of the FKNMS zones. Such perceptions may include: the dissatisfaction over the planning process; belief that the FKNMS zones will increase operating costs for dive operators (user fees, permits, etc.); and, a fear that the FKNMS will remove dive operators from within its boundaries.

The Final Management Plan, released in 1996, addressed public and user group concerns to the zoning plan. NOAA changed the term "replenishment reserve" with "ecological reserve" to highlight the preservation-based purpose of the zones, and it reduced the total percentage of zones from 5.3 percent of the FKNMS to less than 1 percent. The Final Management Plan also emphasized the socioeconomic benefits that the reserves would have on the diving industry, since they capture a majority of snorkelers and divers in the Florida Keys.

Important, follow-up research to this baseline study must include a determination of whether use profiles have shifted since the final zones have been implemented, the extent to which the dive industry has grown or contracted since the implementation of the FKNMS, and if dive operators more strongly favor the FKNMS and its zoning strategy over time.

I. INTRODUCTION

A. Diving and snorkeling in the Florida Keys

Containing the largest coral reef ecosystem in the continental United States, the Florida Keys hosts a variety of water-based activities (NOAA, 1996). Diving and snorkeling are prominent activities by which visitors and residents interact with and enjoy the reefs and their resources. In 1995-96, almost 30 percent of the three million visitors in the Florida Keys reported snorkeling as an activity, and 8 percent listed diving (Leeworthy and Wiley, 1996). During the same period, more than 45 percent of Monroe County's 79,830 residents reported snorkeling, and 16.7 percent listed diving as primary, recreational activities (Leeworthy and Wiley, 1997).

To accommodate visitor and resident demands, there are over a hundred operators that cater to water-based activities, such as diving, snorkeling, and glass-bottom boating. The diving industry, which includes snorkel and dive operators, is an important component of the tourism economy in the Florida Keys. Comprised of various sized operations, the industry transports visitors to dive locations extending from lower Biscayne Bay in Biscayne National Park to the Dry Tortugas National Park in the Gulf of Mexico. A majority of the commercial dive operators limit their trips to neighboring locations and predominantly frequent Atlantic reef sites. In recent years, however, various "eco-tourist" operators have started combination kayak/snorkel trips to Florida Bay.

Diving activities have increased in the Florida Keys as the region has attracted more visitors and tourists. Recreational use at Looe Key National Marine Sanctuary increased by 400 percent from 1985 to 1990 (Talge, 1992). Almost 30 percent of the tourists that visited the Florida Keys in 1992 reported either snorkeling or diving (Lott et al., 1996), and that percentage has remained consistent into the mid-1990's as tourist numbers have increased (Leeworthy and Wiley, 1996). The impacts of visitors on reefs are not completely determined, but recent studies indicate that increasing diver densities negatively impact coral-dominated sites (Harriot et al., 1997; Hawkins and Roberts, 1996). Diver-generated damage generally results from boating and diver impacts (Tisdell, 1987). Boating impacts include vessel groundings, anchor damage, and pollution. Diver impacts consist of coral breakage and smothering, as well as the disturbance of organisms. Secondary diver impacts include spearfishing and fish-collecting.

Several governmental and non-governmental entities have taken measures to minimize actual and potential diver impacts in the Florida Keys. The State of Florida established the John Pennekamp Coral Reef State Park in 1960 to protect 19,773 hectares of marine habitat off Key Largo, and the National Oceanic and Atmospheric Administration (NOAA) extended the park's boundaries in 1975 to protect another 25,900 hectares as part of the Key Largo National Marine Sanctuary (KLNMS) (Lott et al., 1996). Both the KLNMS and the Looe Key National Marine Sanctuary (LKNMS), established in 1981, have installed mooring buoy systems to minimize anchor damage on the sensitive benthic habitats (Halas, 1985). Reef Relief, a Florida Keys-based environmental group, has also advocated and maintained mooring buoys within popular reef sites in the Lower and Middle Keys (Quirolo, 1994). However, the cumulative impacts of increasing

use and the higher rates of vessel groundings in shallow-water reefs in the 1980's prompted the need for a more comprehensive management strategy that could protect the entire region and eventually led to the designation of the Florida Keys National Marine Sanctuary in 1990 (Suman, 1997).

B. The Florida Keys National Marine Sanctuary Plan: Regulations concerning the dive industry

The U.S. Congress passed the Florida Keys National Marine Sanctuary and Protection Act (Public Law 101-605) in November 1990, designating the Florida Keys National Marine Sanctuary (FKNMS). The Act required the Secretary of Commerce to develop a comprehensive management plan to protect the Sanctuary's resources and mandated that the plan: facilitate all public and private uses of the FKNMS consistent with the primary objective of resource protection; consider temporal and spatial zoning to protect FKNMS resources; develop and incorporate a water quality protection program in the FKNMS regulations; establish a long-term ecological monitoring program; ensure inter-agency coordination and cooperation in the implementation and management of the FKNMS; identify alternative funding sources to fully implement the FKNMS plan; promote education on navigational safety and coral reef conservation; and incorporate the region's existing sanctuaries, KLNMS and LKNMS, into the FKNMS (NOAA, 1995). NOAA released its Preferred Alternative/FKNMS Draft Management Plan (DMP) in March 1995, after it was developed by the Interagency Core Group, the Strategy Identification Work Group, the FKNMS Advisory Council, and a NOAA team (Suman, 1997).

The FKNMS addressed diver impacts and regulations in the DMP. The strategies contained in the plan included a mooring buoy system which the FKNMS intended to expand along various heavily impacted reefs, carrying capacity studies to determine the total allowable number of users per day per reef, and diver education. The DMP also addressed the use of zoning to control activities within individual reef sites and larger contiguous habitats (refer to Appendix I for the DMP zone map). The FKNMS designated 19 FKNMS Preservation Areas (SPAs), 3 Replenishment Reserves (RRs), and 4 Special-Use Areas (SUAs) as part of its zoning action plan (NOAA, 1995).

The zones encompassed 5.3 percent of the Sanctuary's total area. The SPAs were small zones ranging from 16 - 327 hectares in area that were designated in "discrete, biologically important areas" (NOAA, 1995, p. 264). The purpose of the SPAs was to protect species populations and habitats, reduce user conflicts, avoid concentration of uses, and to provide opportunities for scientific research. The RRs were larger FKNMS zones (greater than 3,000 hectares) that contained contiguous, diverse habitats. They were designed to minimize human influences on natural, biotic activities and to protect and preserve the representative habitats and species of the FKNMS.

Both the SPAs and RRs prohibited fishing or the taking of any marine organism within their boundaries, with the exception of the Key Largo RR in the Upper Keys, which allowed catch-and-release from the shoreline to a depth of 12 feet and lobster trap fishing in federal waters

on sand and seagrass bottom. The zones did allow diving activities that were non-consumptive, thereby excluding spearfishing, fish collecting, and lobster diving. Also, these zones required that vessels use mooring buoys or anchoring areas when such facilities are designated and available, and that anchors be placed away from live or dead coral and benthic organisms.

The SUAs were very small zones, ranging from 28 - 72 hectares, designated to set aside areas for research and monitoring activities. The FKNMS prohibited all uses in the SUAs except "passage without interruption" (NOAA, 1995, p. 129); research activities could only be conducted upon issuance of permits. Diving activities, whether consumptive or not, were not allowed in the SUAs.

After significant public input and extensive governmental review (Suman, 1997; Smith, 1996), the planning groups developed a modified version of the management strategy that NOAA released as the FKNMS Final Management Plan (FMP). The FMP, released in September 1996, contained 23 zones which encompassed less than 1 percent of the Sanctuary's total area (NOAA, 1996) (refer to Appendix II for the FMP zones). The Key Largo RR was eliminated from the FMP, and the Dry Tortugas RR was postponed. The name "replenishment reserve" was changed to "ecological reserve" to "reflect public concerns over the purpose of these areas" (NOAA, 1996, p. 31). Only one of the 19 SPAs was removed from the final plan, and the Carysfort SPA in the Upper Keys was enlarged by 0.5 square nautical miles to include more coral reef community and to compensate for the elimination of the Key Largo RR. The FMP included the same number of SUAs as did the DMP, but it replaced Pelican Shoal SUA in the Lower Keys with Eastern Sambos SUA. All regulations in the zones were unchanged from the DMP to the FMP with the exception of allowing catch-and-release fishing in Conch Reef, Alligator Reef, Sombrero Reef, and Sand Key SPAs, as well as permitting the limited use of nets for catching bait fish in all of the SPAs.

The FMP determined that the zones would have minimal negative impacts on the dive industry. The only expected loss in revenue from the zoning strategy would be as a result of curtailed spearfishing, fish collecting, and lobster diving activities. Recent research demonstrated that the SPAs may capture between 80-85 percent of all snorkelers and divers in the Florida Keys, and the FKNMS concluded that the protection of the SPAs would produce "positive socioeconomic benefits" to the dive industry (NOAA, 1996, p. 33). The dive industry would benefit from being one of the few commercial groups allowed to operate in the SPAs and ecological reserves, thereby reducing resource competition and inter-group conflicts. The dive industry would also benefit from areas that are less impacted and relatively undisturbed, which would attract more visitors (Bohnsack, 1993).

This study examined the dive industry in the Florida Keys, in terms of its economic impact to the region, its use of the various zones as proposed in the DMP, and its social perceptions and attitudes toward the FKNMS process, the zoning strategy, and overall goals. The study reached 83 percent of the dive operators in the region with a field-based survey that calculated dive operator economic impacts, categorized use patterns, and analyzed social perceptions.

II. METHODOLOGY

A. Estimation of dive operator population

In September 1995, we began our survey efforts by determining the Florida Keys dive operator population. Because there is no single, inclusive unit by which to identify the entire population, we used a variety of sources to compile a water operators' list that we later modified to include only dive operators. The sources were:

1. Florida Association of Dive Operators (FADO)
2. Florida Keys Association of Dive Operators (KADO)
3. Reef Relief
4. Media and advertisement sources (telephone directories, internet sites, chamber of commerce listings, and brochures)
5. Field research

FADO and KADO provided us with their member lists of dive operators, Reef Relief shared its water operators' database, and we obtained all other information through directory, internet, and field research to produce a complete water operators' list in the Florida Keys. In total, we identified 147 water operators in the region.

Water operators consist of dive/snorkel operators, general charter operators who offer mixed fishing and diving trips, seasonal operators, and operators who offer only glass-bottom boating. In order to target only those operators who offer year-round, exclusive dive/snorkel trips, we included only those operators that met the following criteria:

1. Specialize in diving and/or snorkeling trips/activities
2. Own or have access to a vessel(s) that is specifically and solely geared toward diving/snorkeling
3. Operate throughout the year
4. Own or lease a specific site (i.e. dive shop)
5. Have an investment in the dive industry, through capital investments in gear, vessel(s), and facilities
6. Advertise dive/snorkel trips in directories, chambers of commerce, brochures, internet, etc.

We identified a potential total of 89 dive operators using this criteria process and reduced the population to 75 operators after contacting each location and discovering that 14 of the 89 operations had since shut down.

B. Survey design and contents

Following the population determination, we developed a survey instrument from September to October 1995. The instrument contained the following sections:

1. General Information

We asked the respondents questions concerning their position in the dive operation (we limited the survey to owners and managers), the number of employees in the dive operation, demographic information, and the number of years the operation had been in business.

2. Economic Information

Respondents reported on the total investments in their operations, including capital investments such as gear and vessel costs, annual expenses such as dockage, gear and vessel maintenance, and mortgage payments. We did not include any questions on site/shop expenses, gear or equipment sales revenue, or advertisement overhead. All annual costs reported were related to the 1995 season.

3. Trip Information

In this section, we asked the dive operators to break down their 1995 trips into three distinct regions that we delineated. We also asked them the average number of divers/snorkelers they took per trip, the average number of persons who rented equipment per trip, and the estimated percentage of trips taken to FKNMS zones in 1995. The respondents reported on the individual zones they used, including the percentage of use per zone. In order to calculate trip costs, we asked operators to list the average amount spent on fuel, supplies, and crew per trip. Finally, we determined whether the operators allowed spearfishing on their trips, and if so, then what percentage of their customers engaged in that activity.

4. Perceptions

The perceptions section was broadly divided into six subsections: sources of FKNMS information; participation in FKNMS activities; perceptions on the FKNMS planning process; perceptions on the purpose and effects of the FKNMS zoning strategy; perceptions on the establishment of the FKNMS zoning strategy; and perceptions on dive-related programs within the FKNMS. The information and participation subsections determined whether dive operators had received information on the FKNMS from various sources and in which FKNMS activities they had participated. The remaining subsections, divided into 32 questions, related to the respondents' perceptions on the efficacy and fairness of the FKNMS designation process, the expected benefits and beneficiaries of the FKNMS zoning strategy, and the applicability of diver or dive-operator funded, maintenance programs in the FKNMS.

C. Survey activities, field research, and research completion

We completed the draft survey instrument in September 1995, and submitted draft copies of the instrument to Reef Relief and KADO representatives and researchers from the University of Miami and University of Florida for review and comment. We then conducted a two-day pilot session to test the survey instrument in the field. Upon completion of the final survey, we mailed the dive operator population cover letters describing our research objectives and solicited their participation in the survey effort.

The field surveys were conducted from October 1995 through the end of June 1996. We performed each survey in person with either the owner or manager of the dive shop.

TIMELINE

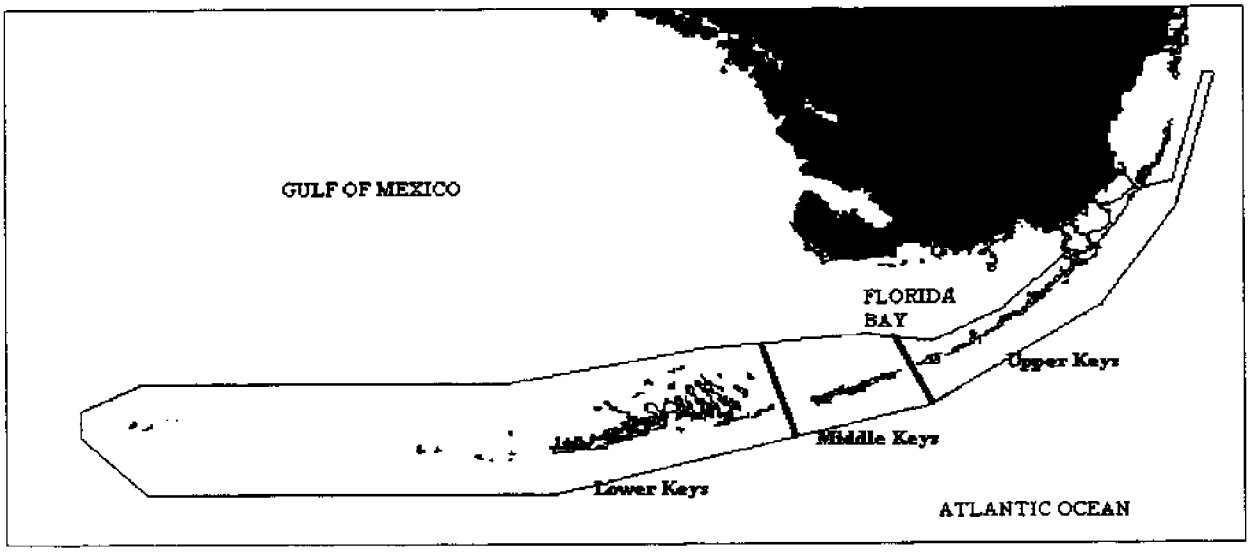
August - September 1995	Development of water operators and dive operators lists
September 1995	Development of draft survey instrument
	Review and comment period
	Pilot survey session
	Mailing of cover letters to the dive operator population
October 1995	Start of field surveys
June 1996	Completion of field surveys

We surveyed 62 of the 75 dive operators in the Florida Keys. The 13 operations that we did not survey were contacted but refused to participate in the study. The following tabulation summarizes the surveys performed by region.

REGION	DIVE SHOPS	SHOPS SURVEYED
Upper Keys	41	36
Middle Keys	12	7
Lower Keys	22	19
TOTAL	75	62

A majority of our surveys were conducted in the Upper Keys, the region that contains the greatest number of dive operators in the Keys. A map of the Florida Keys subregions within the FKNMS is presented in Figure 1.

Figure 1: Study Area.



III. RESULTS

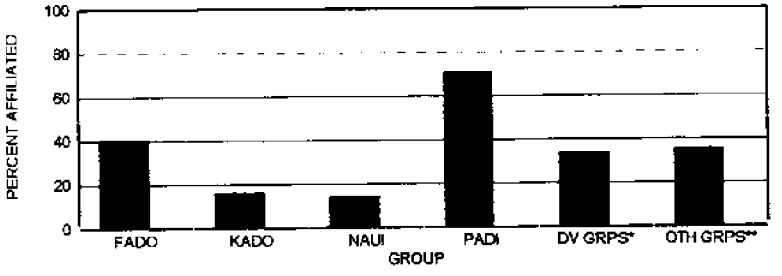
Results are presented in the following, four sections: General information; Economic information; Trip information; Perceptions.

A. General information

Of the 62 surveys we conducted with dive operators, 69 percent were conducted with dive operation owners and 31 percent with dive operation managers. The average age of the respondents was between 31-50 years, and over 48 percent were within the 41-50 year age group. Over 97 percent of the respondents listed themselves as Anglo-Americans. Dive operators support an average of 2.17 family members.

We asked dive operators about their affiliations with various dive, commercial, and environmental organizations. The dive organizations included the Florida Association of Dive Operators (FADO), Keys Association of Dive Operators (KADO), National Association of Underwater Instructors (NAUI), PADI (Professional Association of Dive Operators), and others. Figure 2 presents the percentage of group affiliation.

FIGURE 2: Dive operator affiliation.



* refers to other dive groups
** refers to all other, non-dive groups

The most popular dive organization listed by the respondents was PADI, with which 70.9 percent of the dive operators were affiliated; PADI is also the world's largest dive training organization (Davis and Tisdell, 1996), and it controls about 70 percent of the dive certification market (Padgett, 1997). NAUI, the other major, national dive certifying organization, was not as popular as PADI, and only 14.5 of the operators were affiliated with it. Within the regional dive organizations, FADO was more popular than KADO, although the latter group is composed exclusively of Key-based operators. Slightly over a third of the respondents were members of other dive groups and local organizations, such as chambers of commerce. Environmental group affiliation, not included in Figure 2, was low among dive operators. Only 14.5 percent of the respondents belonged to an environmental group.

Most dive operators (70.5 percent) had been involved in the dive industry for 10 years or less, and only 8.2 percent had operated a dive charter for over 20 years. This information, along

with the number of closed shops that we discovered during our population study, suggests that there is considerable turnover in the Florida Keys dive industry.

B. Economic information

Dive operators reported three types of costs in their industry: capital investments, or costs incurred in opening and operating a dive operation; maintenance costs, or costs that are expended annually for maintaining the operation, vessel(s), gear, and facilities; and trip costs, or costs incurred per trip in fuel, supplies, and crew. The average costs of operation for each type of expenditure and the total costs as determined from our survey sample are presented in Table 1.

TABLE 1: Average and totals costs incurred by the dive industry.

Costs	Average cost	Total cost
1. Vessel(s)	167,792	11,655,000
2. Dive gear	16,885	1,981,800
3. Other equipment	29,023	1,397,000
4. Vessel maintenance	12,372	581,500
5. Gear maintenance	2,365	176,000
6. Dockage	6,918	283,220
7. Trip-related expenses	61,811	3,428,904
TOTAL	297,166	19,503,424

Table 1 demonstrates that the highest costs for dive operators were their capital investments. Vessels, gear, and other equipment cost an average of over $210,000 per operator. Vessels represented the largest investment, costing operators an average of $167,792. Several operators in the Florida Keys used more than one vessel. Our sample reported operating an average of 1.7 vessels. Gear, which may include tanks, fins, masks, and snorkels, cost almost $17,000 per operator. Other equipment, such as compressors, cost an average of over $29,000.

The next highest expense incurred by dive operators was from their 1995 trip-related costs, averaging almost $62,000. We determined trip-related costs by multiplying the average fuel, supplies, and crew costs by the average number of trips reported by the respondents.

Maintenance costs, which include both vessel and gear maintenance (and replacement), averaged over $21,000 per operator. The most substantial maintenance cost was vessel maintenance. Other maintenance costs, such as shop rental or mortgage payments and shop inventory costs were not included in this total because, being land-based, they are not directly related to dive activity-related costs.

We also asked dive operators to report the number of trips they took in the 1995 season and the average total of divers and renters they took per trip. Based on that information, we calculated the average and total number of trips, divers, and renters that dive operators took in 1995.

TABLE 2: Trips and divers taken by dive operators in 1995.

	Average	Total
1. Trips	420.2	24,910
2. Divers per trip	9.6	
3. Divers in 1995	4,034	449,679
4. Renter per trip	5.8	
5. Renters in 1995	2,437	229,275

Table 2 shows that dive operators took an average total of 420.2 trips in 1995, or 1.15 trips per day. The trip total was greater than one trip per day because several operators used more than one vessel, and a majority of the respondents took multiple trips in a single day. Dive operators took almost 10 divers per trip, and over 60 percent of those divers rented equipment from the operators. We assigned a $30 value for each diver and a $5 value for each renter, and estimate that dive operators earned an average of $133,205 from their 1995 dive trips. Of that total, $121,020 was earned from divers and $12,185 from renters. The total survey sample earned almost $15 million from 1995 dive trips, of which almost $13.5 million was from diver fees and an additional $1.5 million from rental fees.

C. Trip information

The trip information section summarizes FKNMS zone use in the entire FKNMS, and it discusses diver and trip totals and percentages in each of the designated zones.

1. FKNMS zone use in 1995

The respondents listed their 1995 trips by subregion as shown in Figure 1, and they specified the percentage of their total trips taken to the 26 FKNMS zones. Using the percentages reported by each dive operator, we determined the total number of trips and divers that operators took to FKNMS zones in 1995. Table 3 shows the total use of FKNMS zones.

The data in Table 3 demonstrate that dive operators rely extensively on FKNMS zones. Almost 69 percent of the 24,910 trips and 77 percent of the 449,679 divers reported by our survey sample were taken to FKNMS zones in 1995. Upper Keys operators utilized the 13 FKNMS zones in their subregion extensively, for over 75 percent of their total trips and 83 percent of their divers. Middle Keys operators relied less on the three FKNMS zones in their subregion, taking less than a quarter of their divers and 35.1 percent of their trips there. Lower Keys operators, like their Upper Keys counterparts, depended considerably on the subregion's 10 FKNMS zones. They took almost two-thirds of their trips and divers to the zones.

In terms of consumptive activities, 40 percent of the respondents reported allowing spearfishing on their trips; however, almost all of these operators added that such trips were specially arranged that did not include other divers. In total, the dive operators who allowed spearfishing in their 1995 trips did so for only 6.1 percent of their total trips.

TABLE 3: Dive operator use of FKNMS zones by region.

Region	Total trips	Zone trips	% Zone trips	Total divers	Zone divers	% Zone divers
1. Upper Keys	16,020	12,131	75.7	349,604	290,572	83.1
2. Middle Keys	2,295	806	35.1	23,685	5,544	23.4
3. Lower Keys	6,595	4,164	63.1	76,390	50,301	65.8
TOTAL	24,910	17,101	68.7	449,679	346,417	77.0

2. Trips and divers to individual FKNMS zones

We calculated the extent of use for each of the 26 FKNMS zones as reported by the respondents, and determined the importance of the three zone types to dive operators, as well as the total and percentage trips and divers within each zone in 1995. Table 4 presents the trips and divers by zone type.

TABLE 4: Trips and divers by FKNMS zone type.

Zone type	Trips	Trip %	Divers	Diver %
1. Replenishment Reserve (RR)	273	1.6	6,233	1.8
2. Sanctuary Preservation Area (SPA)	16,364	95.7	334,166	96.5
3. Special-use Area (SUA)	464	2.7	6,018	1.7

Of the three types of no-take zones designated under the DMP, the SPAs are the most important to dive operators. SPAs captured over 95 percent of all trips and 96.5 percent of all divers bound for FKNMS zones in 1995. The larger Replenishment Reserves, which constitute 5.1 percent of the FKNMS, only hosted 1.6 percent of the zone-specific trips and 1.8 percent of the divers. Similarly, the smaller SUAs, where no diving would be permitted, only accounted for 2.7 percent of the zone-specific trips and 1.7 percent of the divers. These data, and particularly those for the SUAs, suggest that dive operators would not be negatively impacted by the FKNMS zoning strategy. Table 5 presents the relative importance of individual zones.

The most popular FKNMS zones in 1995 were Molasses Reef SPA, Grecian Rocks SPA, French Reef SPA, The Elbow SPA, and Dry Rocks SPA in the Upper Keys, and Western Sambo SPA and Looe Key SPA in the Lower Keys. Together, these SPAs captured almost 71 percent of zone-specific trips and 84 percent of the zone-specific divers. Molasses Reef SPA hosted the greatest number of trips (3,007 trips or 17.5 percent of all FKNMS zone-specific trips) as well as the highest number of total users (22) who reported using any zone in the FKNMS. Grecian Rocks SPA captured the most divers (68,326 divers, or 19.7 percent) of any zone in the FKNMS. Two of the zones, Dry Tortugas RR and Newfound Harbor Key SPA, had no reported trips in 1995; both zones are located in the Lower Keys subregion.

TABLE 5: Trips and divers to individual FKNMS zones.

ZONE	1995 trips	1995 % trips	1995 divers	1995 % divers	total users	divers/trip
1. Key Largo RR	116	0.7	4,257	1.3	2	36.7
2. Carysfort SPA	166	1	6,088	1.8	5	36.7
3. The Elbow SPA	1,433	8.4	25,313	7.3	13	17.7
4. Dry Rocks SPA	1,169	6.8	54,701	15.8	14	46.8
5. Grecian Rocks SPA	1,961	11.4	68,326	19.7	12	34.8
6. French Reef SPA	1,603	9.4	44, 609	12.9	16	27.8
7. Molasses Reef SPA	3,007	17.5	62,218	17.9	22	20.7
8. Conch Reef SUA	220	1.3	1,859	0.5	10	8.5
9. Conch Reef SPA	732	4.3	5,270	1.5	16	7.2
10. Cheeca Rocks SPA	164	1	1,945	0.6	3	11.9
11. Davis Reef SPA	860	5	6,406	1.8	13	7.4
12. Hen + Chickens SPA	225	1.3	2,355	0.7	10	10.5
13. Alligator Reef SPA	475	2.8	7,225	2.9	9	15.2
14. Tennessee Reef SUA	90	0.5	810	0.2	1	9
15. Coffins Patch SPA	230	1.3	1,399	0.4	6	6.1
16. Sombrero Key SPA	486	2.8	3,335	1	6	6.9
17. New found Harbor Key SPA	0	0	0	0	0	0
18. Looe Key SPA	1,331	7.8	22,936	6.6	4	17.2
19. Looe Key SUA	129	0.8	3,225	0.9	1	25
20. Pelican Shoal SUA	25	0.1	124	0.04	2	5
21. Sambos RR	157	0.9	1,976	0.6	7	12.6
22. Western Sambo SPA	1,639	9.8	12,324	3.6	12	7.5
23. Eastern Dry Rocks SPA	249	1.4	2,864	0.8	9	11.5
24. Rock Key SPA	324	1.9	3,114	0.9	9	9.6
25. Sand Key SPA	310	1.8	3,747	1.1	10	12.1
26. Dry Tortugas RR	0	0	0	0	0	0
TOTAL	17,101	100	346,417	100	-	-

The number of users, or dive operators, that reported using an FKNMS zone was not necessarily indicative of use intensity. For example, both Conch Reef SPA and Grecian Rocks SPA hosted 16 users, but the latter zone attracted over 13 times the amount of divers as the former. Also, the 16 dive operators who visited Grecian Rocks SPA did so almost three times more frequently than the 16 operators that visited Conch Reef SPA. Similarly, trip totals were not indicative of use intensity. Looe Key SPA hosted 308 fewer trips than Western Sambos SPA, but it attracted almost twice as many divers as did Western Sambos SPA. These disparities suggest that there are distinct user profiles within different FKNMS zones, and that dive operators utilize FKNMS zones disproportionately.

The number of divers per trip statistic provides important information on the user profiles within individual FKNMS zones. The five SPAs located in the KLNMS in the Upper Keys- Carysfort, The Elbow, Dry Rocks, Grecian Rocks, French Reef, and Molasses Reef- also hosted an average of 20 or more divers per trip. And in the Lower Keys, Looe Key SPA, which is located in the LKNMS, hosted over 17 divers per trip. The data indicates that operators benefit from these previously designated sites and can take a larger number of divers per trip to these already popular areas, while operators using the other FKNMS zones generally take smaller groups. The diver per trip statistic for all three FKNMS zones in the Middle Keys subregion is under 10, demonstrating that the dive operators there specialize in small-sized trips. Similarly, the

dive operators in the western end of the Lower Keys (Key West and Stock Island) take an average of no greater than 12.6 divers per trip. The data tentatively point to a trend within previously designated sites such as the SPAs within the KLNMS and LKNMS, which is that the designation (and subsequent advertisement) of such sites as "sanctuaries" or protected areas may increase diver usage and intensity of use as measured by total trips and divers, as well as the divers per trip statistic.

D. Perceptions

The survey instrument requested that dive operators list their sources of information of and their activities within the FKNMS process, and that they respond to statements concerning the FKNMS zoning strategy and designation. The results of their responses are presented in the following subsections:

1. Information sources on FKNMS zones
2. Levels of participation in FKNMS activities
3. Perceptions on the FKNMS process
4. Perceptions on the purpose and effects of the FKNMS zoning strategy
5. Perceptions on the establishment of the FKNMS zoning strategy and the FKNMS
6. Perceptions on dive-related activities and programs within the FKNMS

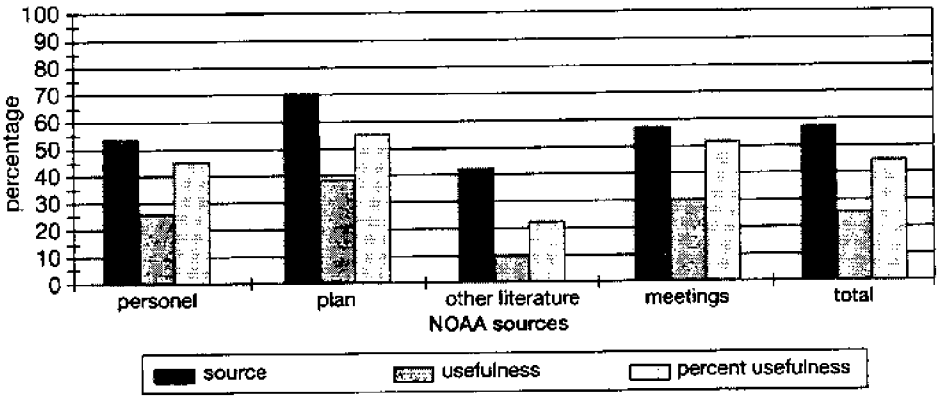
1. Information sources on FKNMS zones

We requested that dive operators reply whether or not they had received information on the FKNMS zoning strategy from a variety of sources and which source they believed was most "useful". We determined the percentage of dive operators that received information from each source, as well as the percentage that found the source "useful". We also determined the percent usefulness statistic for each source of information, by dividing the number of respondents who listed a source as "useful" by only the number of respondents who reported receiving information from that source. The results in this section relate to 95.2 percent of our survey sample, as 4.8 percent had no knowledge of the FKNMS zoning strategy.

a. NOAA sources

Dive operators reported whether or not they had received FKNMS zone information from four NOAA sources: NOAA personnel, including FKNMS personnel and NOAA officials; the DMP, which was released to the public in April 1995; other NOAA literature, consisting of brochures, pamphlets, mailers, and publications; and, NOAA meetings which were held throughout the FKNMS process at various venues in the Florida Keys. Figure 3 presents the percentage of respondents that reported receiving information from these sources, and the percentage that found the information useful.

FIGURE 3: NOAA information sources.



The most common source of NOAA information was the DMP, which 69.4 percent of the respondents reported having accessed. Information from NOAA personnel and meetings were also notable sources, reporting at 53.2 percent and 56.5 percent, respectively. Only the NOAA literature source was below 50 percent, at 43.5 percent. Overall, 55.7 percent of the dive operators reported receiving information from one of the four NOAA sources.

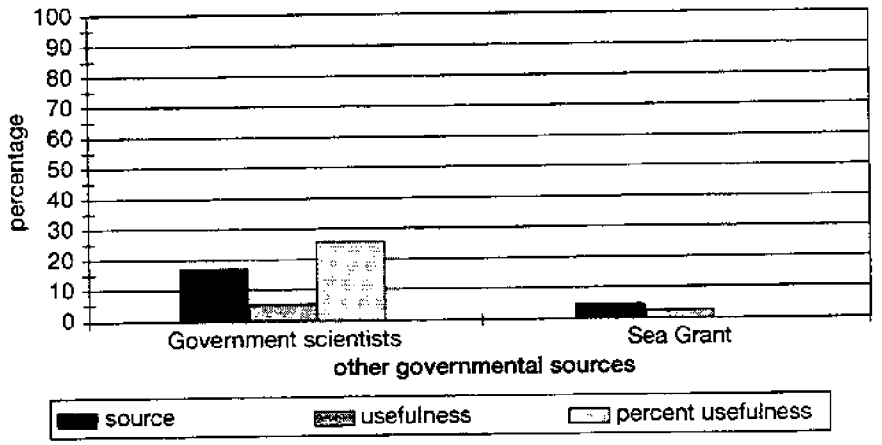
Dive operators listed the DMP as the most useful source of information, at 38.7 percent. NOAA personnel and meetings were not considered as useful, and less than 30 percent of the respondents reported them as such. The least useful source of information to dive operators was the NOAA literature, as only 9.7 percent found it useful. A quarter of the respondents found the total NOAA sources useful, less than half the percentage that reported receiving information from one of the four sources.

The percent usefulness statistic for the total NOAA sources was 45.6 percent, showing that just under half the respondents who did receive information from NOAA found it useful. Almost 56 percent of those that read the DMP found it useful, and percent usefulness statistics for NOAA personnel and meetings were 45.4 percent and 51.3 percent respectively. Dive operators did not perceive NOAA literature as favorably as they did the other NOAA sources. While the other sources had percent usefulness statistics of approximately 50 percent, only about 20 percent of the respondents who read NOAA literature found it useful.

b. Other governmental sources

These sources consist of government scientists and the Florida Sea Grant Extension Service (based in Key West). Both NOAA scientists and the Sea Grant extension officer were very active in the FKNMS process, presenting information at meetings with various organizations. Figure 4 shows the percentage of dive operators who received information from these sources, and the percentage that perceived that information as useful.

FIGURE 4: Governmental information sources.



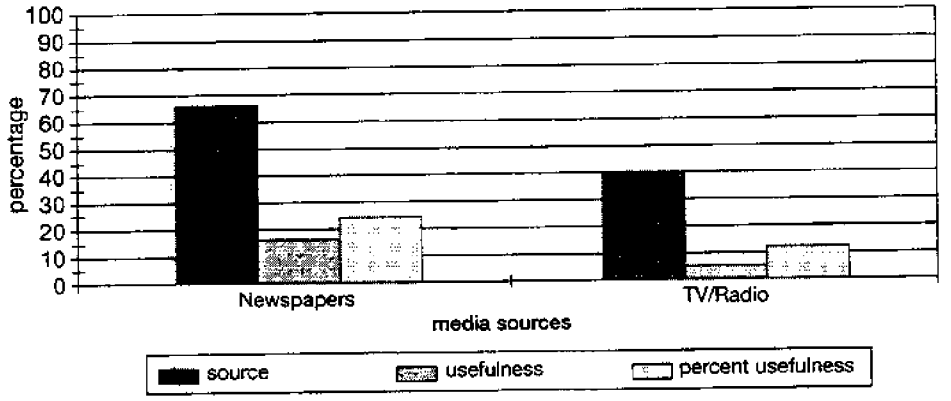
Government sources were not a popular source of information, and only 17.7 percent of the dive operators reported receiving information about the FKNMS zoning strategy from government scientists. Just over 3 percent received such information from Sea Grant. And less than 5 percent found the government scientists' information useful compared to 1.6 percent that perceived Sea Grant information as useful. The percent usefulness statistic for government scientists was 27 percent, showing that just over one in four operators who received information from this source found it useful. Because Sea Grant had such a minor response rate, its percent usefulness statistic is not considered.

c. Media sources

Several media sources in the Florida Keys provided information on the FKNMS zoning strategy. Each subregion in Monroe County has its own newspaper, there are several local radio stations, and there is a Florida Keys television station dedicated to regional programming. Other regional media sources include adjacent Dade County's newspapers and television programming. Figure 5 presents the percentages on the media sources of information and their perceived usefulness in the FKNMS process.

While newspapers (66.1 percent) and TV/radio (40.3 percent) were both popular sources of information to dive operators, they did not consider such information very useful. Only 16.1 percent of the respondents listed newspapers as a useful source, and less than 5 percent perceived either television or radio as useful. As percent usefulness statistics, less than a quarter of the dive operators that read about the zoning strategy in newspapers found that information useful, and only 11.9 percent who received similar information from TV/radio found it useful. These results suggest that, although they did receive much information from media sources, dive operators perceived them as prevalent, secondary sources that seldom provide useful information.

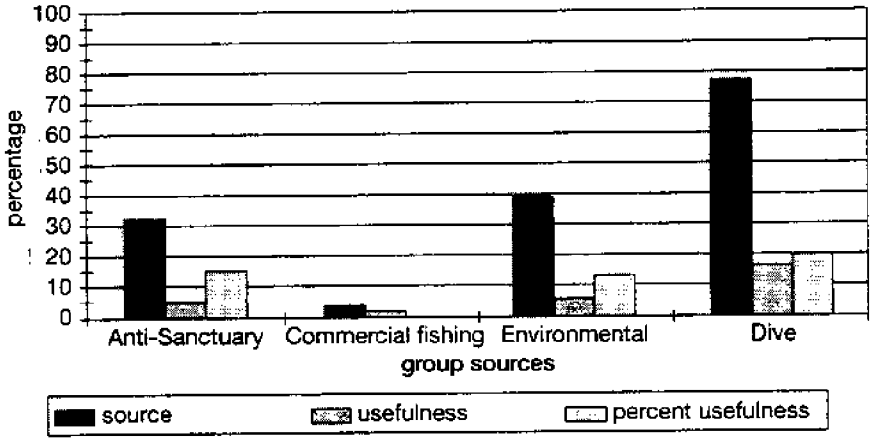
FIGURE 5: Media information sources.



d. Interest group sources

Various interest groups provided both pro-FKNMS and anti-FKNMS "information" during the FKNMS process. We asked dive operators if they had received information from opposition groups (Conch Coalition, Victims of NOAA), commercial fishing groups (Monroe County Commercial Fishermen, Inc., Organized Fishermen of Florida), environmental groups (The Nature Conservancy, Reef Relief, and others), and dive organizations (discussed earlier), and whether they found that information useful. The results are presented in Figure 6.

FIGURE 6: Interest group information sources.



The most popular source of interest group information on the FKNMS zoning strategy for dive operators was their own group, and 76.1 percent of the respondents reported receiving information from dive organizations. However, only 15.2 percent of the operators found this information useful. Almost 40 percent of the respondents received information from environmental groups, and over 30 percent from opposition groups. But only 4.8 percent found either source useful. Only 3.2 percent received information from commercial fishing groups.

With all interest group information sources, dive operators displayed low usefulness responses. The percent usefulness statistics for dive, environmental, and opposition groups were 20 percent or less, showing that only one out of every five dive operators that received information from such sources found it useful. As with the media sources, dive operators did perceive interest group sources as reliable sources of information.

To complete this section, we must add that rumors were a large source of information for dive operators. However, although 66.1 percent of the respondents listed rumors as a source, only 9.7 percent found that information useful. The percent usefulness statistic was 14.7 percent, showing that less than 15 percent of the dive operators who heard rumors on the FKNMS found them credible.

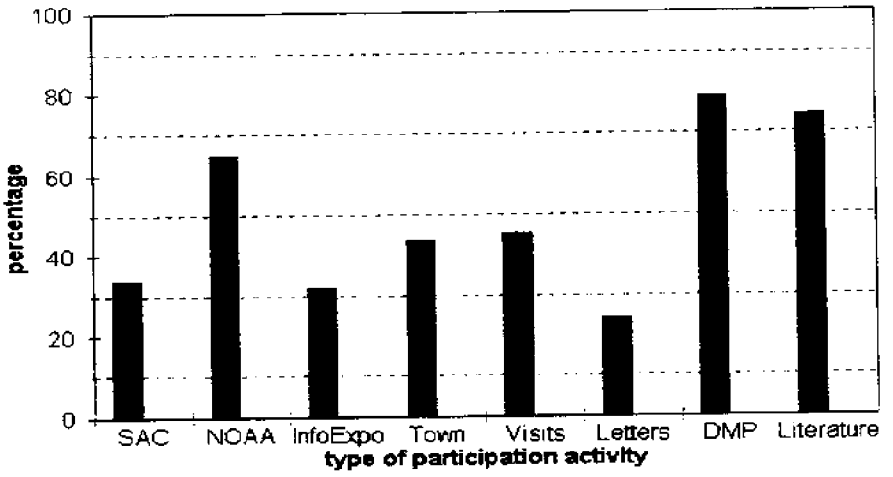
2. Levels of participation in FKNMS activities

We asked dive operators whether they participated in FKNMS activities---by attending various meetings, visiting FKNMS offices, reading the DMP and other FKNMS literature, or writing letters to the FKNMS or NOAA.

The meetings we considered were FKNMS Advisory Council (SAC) meetings, NOAA public meetings and hearings, Info Expos, and town meetings. The Florida Keys National Marine Sanctuary and Protection Act of 1990 established the SAC to "ensure public input into the Plan, and to advise and assist NOAA in its development and implementation" (NOAA, 1995, p. 3). Included in its member composition were representatives of user groups, and the SAC met periodically to consider FKNMS planning issues. NOAA also held a series of public meetings and hearings throughout the FKNMS, commencing with the scoping meetings held in 1991 through the six public hearings held in November 1995. The FKNMS also organized Info Expos, fora held in the Keys' three subregions in April and October 1995 in an informational booth-type framework where persons could discuss the FKNMS and its various action plans with officials in an informal setting. Finally, local, state, and federal representatives periodically held town meetings in which they considered and discussed the FKNMS process. We also considered visits to FKNMS offices as a participatory activity. Dive operators could visit one of the three offices located in Key Largo, Marathon, and Key West. Figure 7 presents the percentage of dive operators that participated in any of the 8 FKNMS activities.

The most popular participatory activities in the FKNMS process were reading the DMP, reading other FKNMS literature, and attending NOAA meetings and hearings. Over 60 percent of the respondents reported participating in these categories. The least popular modes of participation were attending SAC meetings and Info Expos, and writing letters to the FKNMS or NOAA. A third or less of the dive operators participated in these activities. It should be noted, however, that the FKNMS only held six Info Expos (three each in April and October 1995), and that SAC meetings usually ran over six hours and were held during weekdays. Thus, dive operators may not have had the opportunity to attend these fora, and their lower participation percentages may be related to the timing of the activities rather than the respondents' unwillingness to participate.

Figure 7: Participation in FKNMS activities.



3. Perceptions on the FKNMS process

For the remainder of the questionnaire, we used a Likert scale (Alreck and Settle, 1985), requesting that dive operators respond to various statements concerning the information they received from the FKNMS, the importance of the information they received, the relevance of the FKNMS process, and the outcome of FKNMS regulations. The scale used is summarized below:

1- Strongly agree	3- Neutral	5- Strongly disagree
2- Moderately agree	4- Moderately disagree	6- Don't know

We merged the moderate and strong responses (responses 1 and 2, and responses 4 and 5) as dive operators did not exhibit graded answers; instead, they either responded favorably or unfavorably. Thus, the percentages presented in Tables 6 through 10 summarize the results based on whether dive operators agreed or disagreed with the statements they were asked, as well as neutral and "don't know" responses.

The results concerning the FKNMS and zone implementation process presented in Table 6 suggest that dive operators, as a group, are divided in their support. There is lesser agreement about specific FKNMS processes and the results of the FKNMS process. For instance, in Question 4, exactly half the dive operators agreed that the NOAA process for regulation development has been open and fair to all groups. However, in Question 5, only 38.7 percent agreed that the NOAA boundary and regulation development process has been open and fair to all groups. Similarly, although 46.8 percent of the dive operators agreed in Question 2 that information that NOAA provided them on the zones contains everything they needed to know about the zones, only 37.1 percent agreed that the NOAA information informed them of all the positive and negative effects of the zones (distribution differences are not statistically significant). Dive operators, as a majority, also feel that they have been left out of the process. In Question 8, 58.1 percent agreed that NOAA has not given enough consideration to citizen concerns in the

FKNMS development process, which is significantly greater than the 33.9 percent who agreed in Question 7 that NOAA has not given enough consideration to local government concerns.

TABLE 6: FKNMS process perceptions.

QUESTION (responses in percentage)	AGREE	NEUTRAL	DISAGREE	DON'T KNOW
1. Information from NOAA about the DMP contains everything you needed to know about the plan.	37.1	14.5	33.9	14.5
2. Information from NOAA about the DMP zones contains everything you needed to know about the zones.	46.8	11.3	27.4	14.5
3. Information from NOAA about the DMP zones gave you the positive and negative effects of zones.	37.1	9.7	41.9	11.3
4. The NOAA workshop and meeting process for regulation development has been open and fair to all groups.	50	11.3	19.4	19.3
5. The NOAA boundary and regulations development process has been open and fair to all groups.	38.7	8.1	30.6	22.6
6. Average person participation does not matter in the FKNMS process because the average person cannot influence the decisions.	5.2	6.4	45.2	3.2
7. NOAA did not give consideration to the local government concerns in the development process.	33.9	12.9	30.6	22.6
8. NOAA did not give consideration to citizen concerns in the development process.	58.1	9.7	25.8	6.4
9. There will be no way for an average person to voice his/her opinions once the FKNMS regulations are enacted	61.3	4.8	29.1	4.8
10. NOAA procedures to deal with FKNMS regulations are or will be fair and just.	25.8	4.8	38.7	30.7

- Differences in the distributions between statements 7 and 8 are statistically significant ($p = 0.02$)

Finally, many dive operators remain wary of NOAA's future in the FKNMS. Over 61 percent perceived that the FKNMS regulations will be beyond their control in Question 9, and only 25.8 percent in Question 10 believed that the procedures that NOAA will establish to deal with FKNMS regulations will be fair and just (although it should be noted that there were 30.7 percent non-responses to that question).

4. Perceptions on the purpose and effects of the FKNMS zoning strategy

As demonstrated in Table 7, more dive operators agreed that the main purpose of the zones is to increase stocks and biodiversity inside the zones (83.9 percent) than outside the zones (59.7 percent). This point is further accentuated by the levels of disagreement. Only 9.7 percent of the dive operators disagreed that the main purpose of the zones is to increase stocks and biodiversity inside the zones, but 21 percent disagreed that the main purpose of the zones is to increase stocks outside the zones. These results suggest that dive operators, while supporting the purpose of the zones as replenishment areas for the Florida Keys, are more inclined to believe that the zones' purpose is to increase stocks inside the zones themselves while maximizing biodiversity.

In terms of user conflicts, dive operators as a majority did not perceive the zones are the most effective way to reduce user conflicts. Interestingly, only 32.3 percent agreed with Question 4, although the zoning strategy would effectively remove most competing uses from the zones. In Question 6, 54.8 percent of the dive operators agreed that the zones will lead to better diving conditions in the Keys, but in Question 5 a majority disagreed that the zones are the most effective way to restore the coral reefs in the Keys to what they used to be. Dive operators obviously perceived a difference between better diving conditions and coral restoration, as is suggested by the contrasting opinions in the questions. Finally, most dive operators agreed that the long-term effects of the zones on the economy of the Florida Keys will be positive.

TABLE 7: Dive operator perceptions on the FKNMS zoning strategy

QUESTION (responses in percentage)	AGREE	NEUTRAL	DISAGREE	DON'T KNOW
1. The main purpose of the zones is to increase stocks and biomass inside the zones.	83.9	1.6	9.7	4.8
2. The main purpose of the zones is to increase stocks and biomass outside the zones.	59.7	14.5	21	4.8
3. The main purpose of the zones is to conserve and protect biodiversity inside the zones.	83.9	4.8	9.7	1.6
4. Zones are the most effective way to reduce user conflicts.	32.3	14.5	50	3.2
5. Zones are the most effective way to restore coral reefs in the Florida Keys to what they used to be.	37.1	8.1	50	4.8
6. Zones will lead to better diving conditions in the Florida Keys.	54.8	6.5	37.1	1.6
7. The long-term effects of the zones on the economy of the Florida Keys will be positive.	51.6	17.7	24.2	6.5

a. Differences in the distributions between statements 1 and 2 are statistically significant ($p = 0.01$)
Differences in the distributions between statements 2 and 3 are statistically significant ($p = 0.01$)

Dive operators were asked who would benefit from the FKNMS zones, in terms of the user groups that most frequent the zones. The results are presented in Table 8.

TABLE 8: Dive operator perceptions on beneficiary groups.

QUESTION (responses in percentage)	AGREE	NEUTRAL	DISAGREE	DON'T KNOW
1. The primary group that will benefit from the zones is dive operators.	38.7	14.5	46.8	0
2. The primary group that will benefit from the zones is recreational fishermen.	35.5	11.3	53.2	0
3. The primary group that will benefit from the zones is commercial fishermen.	24.2	12.9	62.9	0

Dive operators agreed more strongly that their group will be the prime beneficiary of the zoning strategy than they did that recreational or commercial fishermen will benefit. Also, dive operators identified the commercial fishermen group to least benefit from the zones, as indicated by their low level of agreement in Question 3.

5. Perceptions on the establishment of the FKNMS zoning strategy and the FKNMS

Dive operators reported their support for FKNMS zones in various locations of the Florida Keys, support for specific types of FKNMS zones (including the Special-Use Areas, where diving is not allowed), the percentage of FKNMS zones they would designate in the FKNMS, and their support for the FKNMS as it was developed in the DMP. Table 9 presents the percentages of responses.

The support for FKNMS zones dropped significantly when dive operators were asked if they support establishing zones in the exact locations proposed in the DMP. Similarly, there was statistically less support for proposed Special-use Areas in the FKNMS than there was for zones somewhere in the Florida Keys. Most dive operators (51.6 percent) did agree that the Special-use Areas will have a positive impact on the FKNMS, but they were unwilling to have more Special-use Areas established. A majority of the respondents (64.5 percent) generally supported the establishment of the FKNMS. The support for the FKNMS was significantly greater than the support for the proposed FKNMS zones. In terms of FKNMS zone size, dive operators were asked if they favor greater than six percent of the FKNMS being designated as FKNMS zones. Only 22.6 percent of the dive operators agreed with this statement, and 56.5 percent disagreed. The average size that 35 dive operators preferred to have as FKNMS zones was 10.9 percent of the FKNMS; 27 dive operators refused to list a preferred FKNMS zone percentage.

TABLE 9: Dive operator perceptions on the FKNMS and FKNMS zoning strategy.

QUESTION (responses in percentage)	AGREE	NEUTRAL	DISAGREE	DON'T KNOW
1. I support the establishment of a FKNMS zone in the Upper Keys.	66.1	9.7	21	3.2
2. I support the establishment of a FKNMS zone in the Middle Keys.	64.5	9.7	21	4.8
3. I support the establishment of a FKNMS zone in the Lower Keys.	71	8.1	19.3	1.6
4. I support establishing FKNMS zones somewhere in the Florida Keys.	75.8	3.2	19.4	1.6
5. I support establishing FKNMS zones in the exact locations proposed in the DMP.	41	8.2	44.2	6.6
6. I support establishing the Special-use Areas proposed in the DMP.	53.2	4.8	41.9	0
7. The Special-use Areas will have a positive impact on the marine environment.	51.6	16.1	30.7	1.6
8. There should be additional Special-use Areas in the FKNMS.	22.6	14.5	56.4	6.5
9. I generally support the establishment of the FKNMS	64.5	16.1	19.4	0

a. Differences in the distributions between statements 4 and 5 are statistically significant ($p = 0.00$)
b. Differences in the distributions between statements 4 and 6 are statistically significant ($p = 0.04$)
c. Differences in the distributions between statements 7 and 8 are statistically significant ($p = 0.00$)
d. Differences in the distributions between statements 5 and 9 are statistically significant ($p = 0.01$)

6. Perceptions on dive-related activities and programs within the FKNMS

We requested that dive operators respond to statements concerning dive operations and their effects on the marine environment, mooring buoys, and the amount that they would be willing to pay for the maintenance of a zone implementation and management system. Table 10 presents the statements and associated percentages.

Dive operators generally agreed that their activities have impacts on marine areas and resources, and they also agreed that mooring buoys have positive effects on marine ecosystems. However, having acceded to those impacts and accepted mooring buoys as means to reduce the negative effects, a majority of dive operators were not in favor of either dive operator-funded or diver-funded mooring buoy plans in the FKNMS. There was more support for the latter plan, but the levels of disagreement represented a majority of the respondents (57.8 percent). In terms of

willingness-to-pay, only eight dive operators (12.9 percent) were willing to pay an annual fee to maintain a FKNMS zone and mooring buoy implementation and maintenance plan.

TABLE 10: Dive operator views on related programs.

QUESTION (responses in percentage)	AGREE	NEUTRAL	DISAGREE	DON'T KNOW
1. Activities such as snorkeling and diving have no effect on marine areas or resources.	21	8.1	70.9	0
2. Mooring buoys have a negative effect on marine ecosystems.	9.7	4.8	85.5	0
3. There should be a dive operator-funded mooring buoy plan in the FKNMS.	27.4	6.5	66.1	0
4. There should be a diver-funded mooring buoy plan in the FKNMS.	40	2.2	57.8	0

IV. DISCUSSION

Dive operators rely extensively on the FKNMS, and particularly the FKNMS zones, as determined by this study. We found that dive operators took almost 70 percent of their trips to FKNMS zones, a percentage similar to the 80-85 percent reported in the FMP (NOAA, 1996). SPAs constituted the most important zone type to dive operators, as they took over 95 percent of their zone-specific trips there. Of the estimated $14.6 million that the dive operator sample earned from dive trips and rental equipment in 1995, the FKNMS zones accounted for over $10 million of that income. Moreover, these estimates do not include the revenue dive operators generated within the local economy through investments and expenditures.

Dive operators generally understand that their group will be the prime beneficiary of the FKNMS Zoning Action Plan. More respondents (38.7 percent) agreed that dive operators will benefit from the FKNMS zones than recreational fishermen (35.5 percent) or commercial fishermen (24.2 percent). A majority of dive operators (54.8 percent) also believe that zoning will lead to better diving conditions in the Florida Keys. Within the sample, less than half of the operators reported allowing spearfishing, for an average of only 6.1 percent of their total trips. Because most dive operators either do not allow consumptive activities on their trips or only do so for a minority of their total trips, we expect that they would not be affected significantly by the zone regulations. Overall, the dive operator group stands to gain disproportionately, at least in the short term, from the FKNMS zoning strategy.

Research has shown that visitation rates have increased in previously designated MPAs (Talge, 1992), and "no-take" reserves may attract additional users (Bohnsack, 1993). Moreover, dive operators comprise the only major group that would be allowed to use FKNMS zones for commercial activities. However, despite all these expected benefits, a majority of the dive operators (44.2 percent) are against the establishment of the FKNMS zones as proposed in the DMP. Half of the operators also disagree that the zones are the most effective way by which to reduce user conflicts and to restore coral reefs in the region. Finally, most of the operators have generally negative views on the FKNMS planning process and its outcomes.

We suggest that the division in dive operator support for the FKNMS zones, views on the effectiveness of the zoning strategy, and opinions on the planning process and its outcomes are derived primarily from socio-political perceptions. These perceptions include that the FKNMS process does not allow for meaningful participation, that the FKNMS zoning strategy will increase operating costs and may remove commercial dive operators from the region, and that the FKNMS represents another unnecessary "layer of bureaucracy".

Over 45 percent of the dive operators believed that public participation in the FKNMS process does not matter, and 58.1 percent agreed that NOAA did not give consideration to individual citizen concerns in the development process. A significant proportion (38.7 percent) believed that the FKNMS procedures to deal with FKNMS regulations will not be fair or just. These opinions show that dive operators, who participated extensively in the FKNMS process, are dissatisfied with how it was conducted. Milon et al. (1997) reported similar dissatisfaction

with the FKNMS process among commercial fishers, another user group from the region.

Most of the dive operators we surveyed were against diver or dive operator-funded mooring buoy programs. Less than 13 percent were willing to pay for an annual fee for FKNMS zone maintenance. Because of the competitive nature of the business, several respondents argued that increased costs would limit customers. Although the DMP did not discuss user fees in detail, Strategy B.8 (User Fees) did outline the need for "boating fee assessment study", including "impact fees" (NOAA, 1995, p. 202). Other dive operators feared that the carrying capacity strategy (Strategy R.5) would limit their ability to use popular reef destinations. Another segment of the dive operators simply believed that the FKNMS would remove them from the region. They pointed to other user groups, including treasure salvors and commercial fishermen, and argued that the government planned to eventually extricate all commercial users from the FKNMS.

Finally, many dive operators felt that the FKNMS represents just another "layer of bureaucracy". Such respondents believed that there are sufficient government agencies to protect the Florida Keys environment without having to create a "master overlord agency" (Swift, 1996). They also argued that the FKNMS would divert funding away from more urgent causes, and that it may require the aforementioned user fees to fund its redundant operations. This portion of the population represents Florida Keys' residents who live there to "get away from it all". Thus, when the US Congress designated the Florida Keys as a national marine sanctuary in 1990, there were many such persons who perceived the designation as governmental encroachment and continue to oppose the FKNMS implementation.

REFERENCES

Alreck, P. L., and R. B. Settle. 1985. The survey research handbook. Richard D. Irwin, Inc., Homewood, IL. 429 pp.

Bohnsack, J. A. 1993. Marine reserves: They enhance fisheries, reduce conflicts, and protect resources. Oceanus 36: 63-71.

Davis, D., and C. Tisdell. 1996. Economic management of recreational scuba diving and environment. Journal of Environmental Management 48: 229-248.

Davis, D., and C. Tisdell. 1995. Recreational scuba-diving and carrying capacity in marine protected areas. Ocean and Coastal Management 26 (1): 19-40.

Harriot, V. J., D. Davis, and S. A. Banks. 1997. Recreational diving and its impact in marine protected areas in Eastern Australia. Ambio 26 (3): 173-179.

Hawkins, J. P., and C. M. Roberts. 1996. Estimating the carrying capacity of coral reefs for scuba diving. Pages 1923-1926 in H. A. Lessios (ed.) Proceedings of the 8th international coral reef symposium. Universidad de Panama, Panama City, Panama.

Leeworthy, V. R., and P. C. Wiley. 1997. A socioeconomic analysis of the recreation activities of Monroe County residents in the Florida Keys/Key West. NOAA, Silver Spring, MD. 49 pp.

Leeworthy, V. R., and P. C. Wiley. 1996. Visitor profiles: Florida Keys/Key West. NOAA, Silver Spring, MD. 159 pp.

Lott, C., R. Dye, and K. M. Sullivan. 1996. Site characterization for the Florida Keys National Marine Sanctuary and environs, Volume 3: Historical overview of development and natural history of the Florida Keys. The Preserver, Zenda, WI. 49pp.

Milon, J. W., D. O. Suman, M. Shivlani, and K. A. Cochran. 1997. Commercial fishers' perceptions of marine reserves for the Florida Keys National Marine Sanctuary. Technical Paper-89. Florida Sea Grant College Program, Gainesville, FL. 50 pp.

National Oceanic and Atmospheric Administration. 1996. Florida Keys National Marine Sanctuary Final Management Plan/Environmental Impact Statement. SRD/OCRM/NOS/NOAA, Silver Spring, MD. 3 volumes.

National Oceanic and Atmospheric Administration. 1995. Florida Keys National Marine Sanctuary Draft Management Plan/Environmental Impact Statement. SRD/OCRM/NOS/NOAA, Silver Spring, MD. 3 volumes.

Padgett, R. R. 1997. The U.S. National Marine Sanctuary Program: Effectiveness of diver

education in the Florida Keys. University of Rhode Island, Providence, RI. 87 pp.

Quirolo, D. 1994. Reef mooring buoys and reef conservation in the Florida Keys: A community and NGO approach. Pages 80-90 in A White, L. Hale, Y. Renard, and L Cortesi (eds.) Collaborative and community-based management of coral reefs: Lessons from Experience. Kumarian Press, West Hartford, CT.

Smith, R. L. 1996. The Florida Keys National Marine Sanctuary: Public information and public process. University of Miami, Coral Gables, FL. 74 pp.

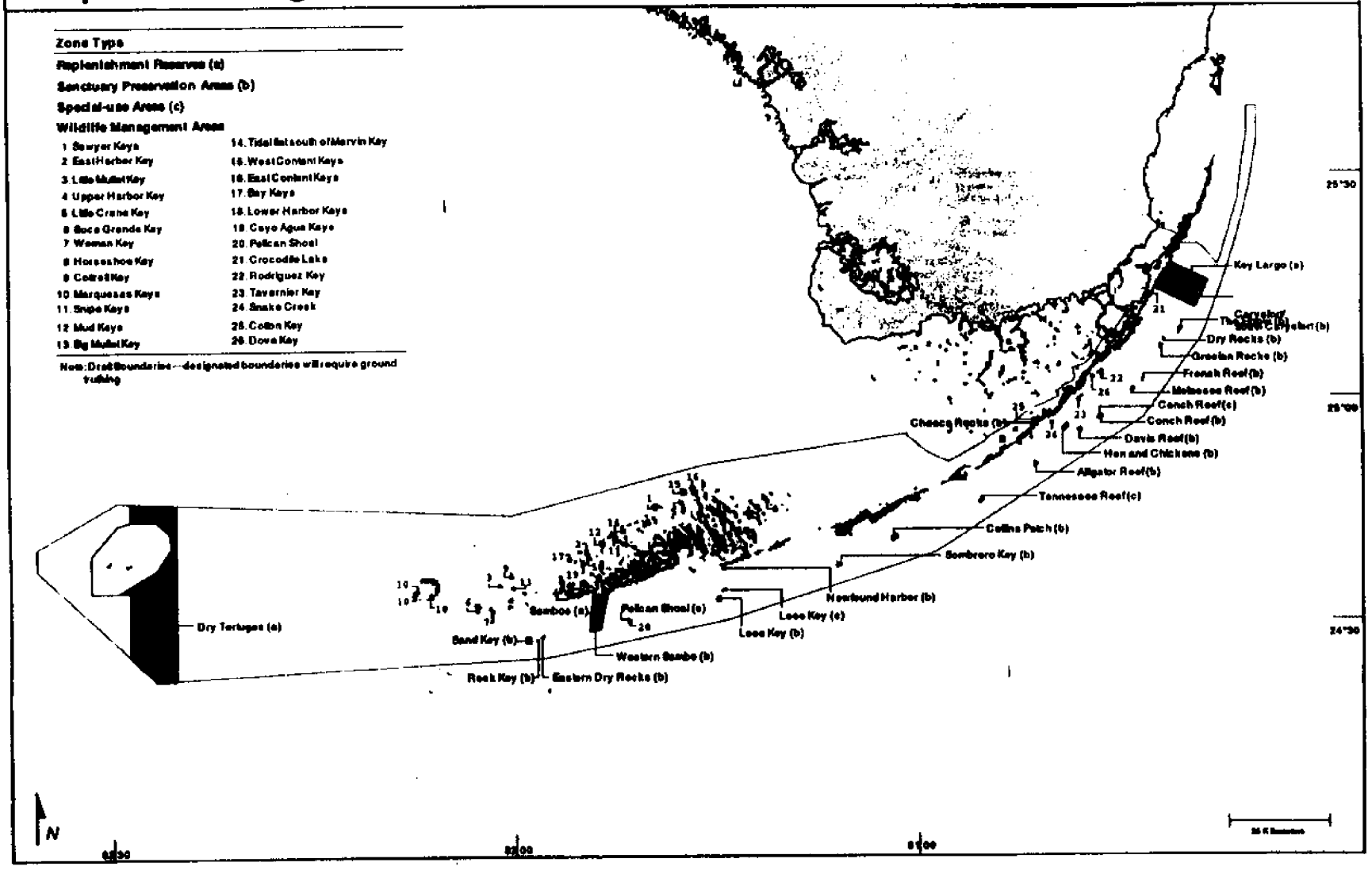
Swift, E. 1996. Common sense versus the proposed Florida Keys National Marine Sanctuary: The continuing failure of our government to control the bureaucracy. Environment, Yes! Bureaucracy No!, Key West, FL. 128 pp.

Suman, D. O. 1997. The Florida Keys National Marine Sanctuary: A case study of an innovative federal-state partnership in marine resource management. Coastal Management 25: 293-324.

Talge, H. 1992. Impact of recreational divers on scleratinian corals at Looe Key, Florida. Pages 1077-1082 in Proceedings of the 7th international coral reef symposium. University of Guam, Mangilao, Guam.

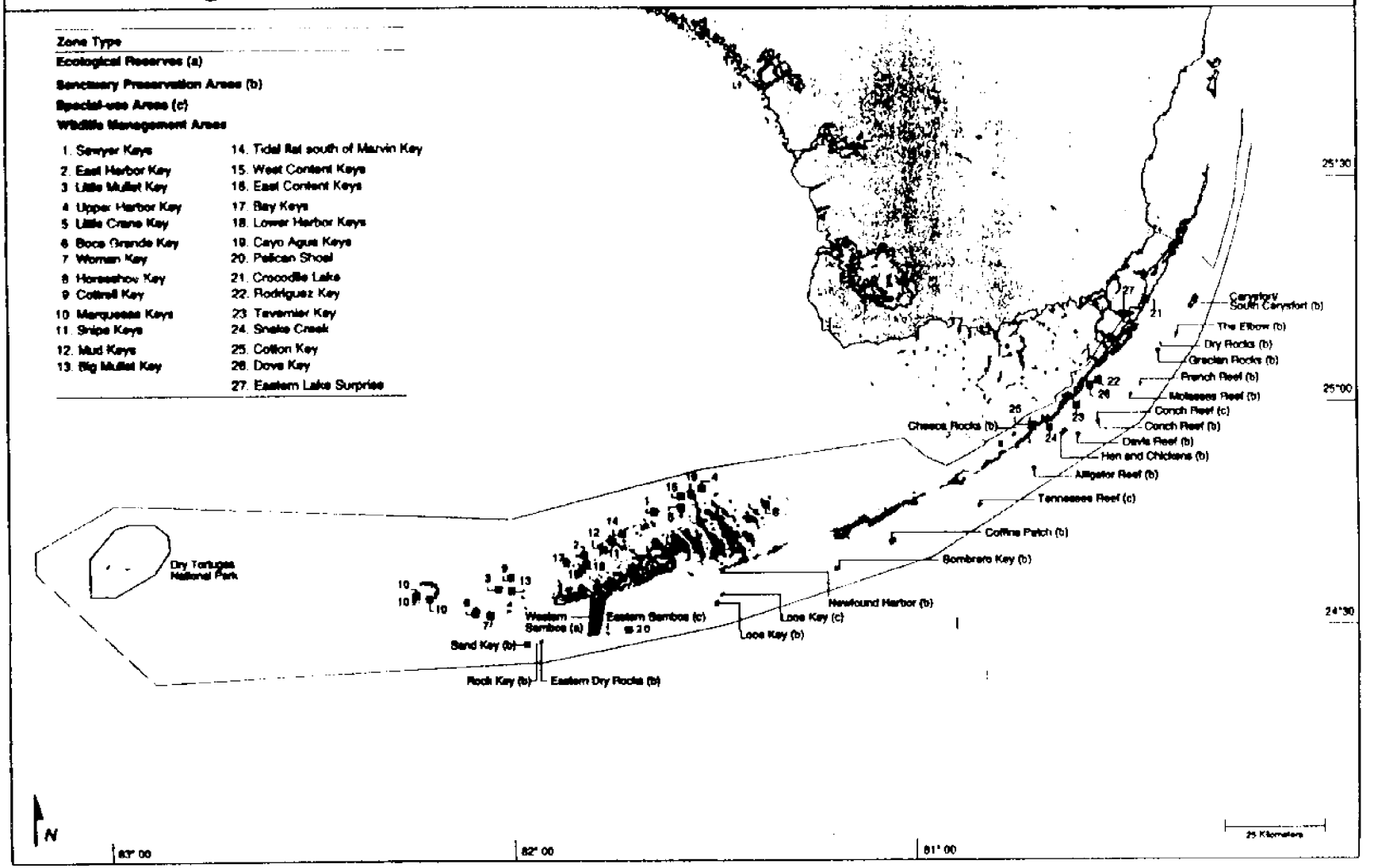
APPENDIX 1

Proposed Zoning Alternative III



APPENDIX 2

Final Zoning Plan



Florida Sea Grant College Program
University of Florida
P.O. Box 110409
Gainesville, FL 32611-0409
(352) 392-2801

www.FLSEAGRANT.ORG