Marine Sanctuaries Conservation Series ONMS-08-06

Knowledge, Attitudes and Perceptions of Management Strategies and Regulations of the Florida Keys National Marine Sanctuary by Commercial Fishers, Dive Operators, and Environmental Group Members: A Baseline Characterization and 10-year Comparison

U.S. Department of Commerce
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COVER

Paige Gill. Commercial lobster vessel and dive boat.
Reef Relief. Reef Relief visitor booth.

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ABSTRACT

This research is part of the Socioeconomic Research & Monitoring Program for the Florida Keys National Marine Sanctuary (FKNMS), which was initiated in 1998. In 1995-96, a baseline study on the knowledge, attitudes and perceptions of proposed FKNMS management strategies and regulations of commercial fishers, dive operators and on selected environmental group members was conducted by researchers at the University of Florida and the University of Miami's Rosenstiel School of Atmospheric and Marine Science (RSMAS). The baseline study was funded by the U.S. Man and the Biosphere Program, and components of the study were published by Florida Sea Grant and in several peer reviewed journals. The study was accepted into the Socioeconomic Research & Monitoring Program at a workshop to design the program in 1998, and workshop participants recommended that the study be replicated every ten years. The 10-year replication was conducted in 2004-05 (commercial fishers) 2006 (dive operators) and 2007 (environmental group members) by the same researchers at RSMAS, while the University of Florida researchers were replaced by Thomas J. Murray & Associates, Inc., which conducted the commercial fishing panels in the FKNMS. The 10-year replication study was funded by NOAA's Coral Reef Conservation Program.

The study not only makes 10-year comparisons in the knowledge, attitudes and perceptions of FKNMS management strategies and regulations, but it also establishes new baselines for future monitoring efforts. Things change, and following the principles of "adaptive management", management has responded with changes in the management plan strategies and regulations. Some of the management strategies and regulations that were being proposed at the time of the baseline 1995-96 study were changed before the management plan and regulations went into effect in July 1997. This was especially true for the main focus of the study which was the various types of marine zones in the draft and final zoning action plan. Some of the zones proposed were changed significantly and subsequently new zones have been created.

This study includes 10-year comparisons of socioeconomic/demographic profiles of each user group; sources and usefulness of information; knowledge of purposes of FKNMS zones; perceived beneficiaries of the FKNMS zones; views on FKNMS processes to develop management strategies and regulations; views on FKNMS zone outcomes; views on FKNMS performance; and general support for FKNMS. In addition to new baseline information on FKNMS zones, new baseline information was developed for spatial use, investment and costs-and-earnings for commercial fishers and dive operators, and views on resource conditions for all three user groups. Statistical tests were done to detect significant changes in both the distribution of responses to questions and changes in mean scores for items replicated over the 10-year period.

Key findings:

- Over the 10-year period, there was the hypothesized convergence in stakeholder attitudes, perceptions and beliefs about FKNMS outcomes and support for the FKNMS.
- There exists greater support for FKNMS across a variety of aspects among the commercial fishing community, with a shift from a highly negative position to majority/plurality support or neutral position (approximately equal percentages of support and non-support).
- There is a need for greater outreach and education efforts to members of local environmental groups.
- There has been increased use of the FKNMS zones by dive operators, especially the Sanctuary Preservation Areas.
- Either a majority or plurality of each of the three user groups support the FKNMS zones as currently established, except commercial fishers for the Ecological Reserves (ERs). There has been a significant shift by commercial fishers over the 10-year period towards support for the FKNMS zones; however, a plurality still does not support the ERs.
- A majority or plurality of dive operators and environmental group members support more FKNMS zones of all types. An overwhelming majority of commercial fishers is against any more FKNMS zones of any type.
- Either a majority or plurality of all three user groups believes that the Florida Keys has benefited both the environment and economy of the Florida Keys.
- A majority of dive operators believes that the Sanctuary Preservation Areas (SPAs) have reduced conflicts between user groups. This was a significant change from expectations in the baseline.
- None of the user groups believe that the FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they use to be, but the user groups understand that the conditions of the coral reefs are driven by many factors outside the control of the FKNMS.
- Across all three user groups, only two of eight items assessed were rated as having improved in condition since the establishment of the FKNMS ("Mooring buoys" and "Vessel groundings"). The avoidance of vessel groundings was one of the main impetuses of creating the FKNMS.
- There was no resource condition rated as having gotten worse by any of the three user groups since establishment of the FKNMS. Most items received scores in the neutral or no change status.

KEY WORDS

Socioeconomic monitoring, knowledge, attitudes, perceptions, management strategies, regulations, commercial fishers, dive operators, environmental group members, marine zones, spatial use

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1 Introduction

Designated through an act of the US Congress in 1990 (Public Law 101-605), the Florida Keys National Marine Sanctuary (FKNMS) underwent an often contentious designation process from 1995 to 1996 before the National Oceanic and Atmospheric Administration (NOAA) and the State of Florida jointly implemented the 2,800 nautical square mile sanctuary in 2007 (NAPA, 2000; Suman et al., 1999). In 2001, the FKNMS extended its western boundary to include parts of the Tortugas Ecological Reserve, thereby increasing its overall size to its present 2,900 square nautical miles (NOAA, 2000).

An integral part of the FKNMS management strategy consisted of a zoning action plan, part of ten action plans developed to protect and manage FKNMS resources (NOAA, 1996; NOAA, 1995). In 1995, the FKNMS released its draft zoning action plan, as part of the Draft Management Plan (DMP), which called for the designation of five different zone types in the FKNMS: Existing management areas (EMAs); Replenishment Reserves (RRs); Sanctuary Preservation Areas (SPAs); Special-use Areas (SUAs); and Wildlife Management Areas (WMAs). The 21 EMAs included zones now subsumed under the FKNMS boundaries but which existed prior to the Sanctuary's designation and which would continue to be managed by parent agencies. Similarly, 20 of the 27 WMAs the FKNMS identified in its DMP were already managed by the US Fish and Wildlife Service; however, the FKNMS did designate seven new WMAs which would employ seasonal and/or use-specific restrictions to protect sensitive wildlife. The other three zone types, while espousing different purposes, restricted all extractive activities and were thus no-take (or no-fishing zones).

The DMP defined RRs as large areas created to provide spawning, nursery, and habitats for coral reef ecosystem dependent species and to foster ecosystem function in contiguous habitats. Due to the purpose of this zone type, the DMP designated three large RRs: the 38,000 ha Dry Tortugas RR in the western FKNMS; the 8,000 ha Key Largo RR in the northeastern FKNMS; and the 3,000 ha Sambos RR in the Lower Florida Keys section of the FKNMS (see Figure 1). Together, the RRs comprised over 3% of the FKNMS. The DMP also designated 19 smaller SPAs to protect heavily used, shallow-water coral reefs and reduce use conflicts (see Figure 1). These zones, whose area totaled less than 1% of the FKNMS, nevertheless attracted between 80-85% of all dive and snorkel use in the Florida Keys (NOAA, 1996). Finally, the DMP designated four, small SUAs as research-only areas, where use would be allowed for education, scientific, and monitoring purposes and only by permit. These zones comprised less than 0.1% of the FKNMS (see Figure 1).

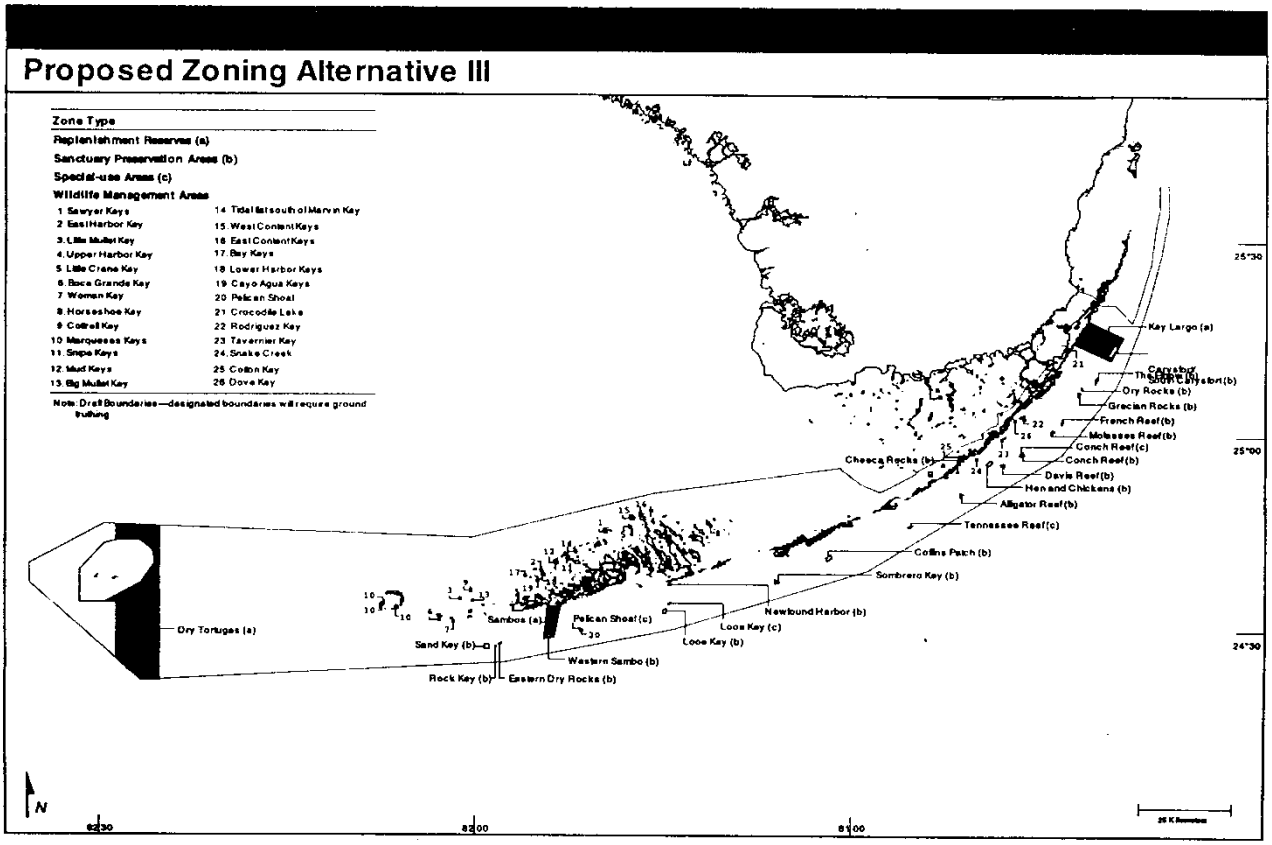

Figure 1: Draft Management Plan FKNMS zones

The Final Management Plan (FMP), published in 1996 following a highly charged public hearing session (Suman et al., 1999), revised the Sanctuary's zoning action plan. The FMP eliminated two of the three RRs, retaining only the Western Sambos reserve (see Figure 2); however, while the FMP argued that existing management areas could provide the benefits of a reserve in the Upper Florida Keys, the Sanctuary would nevertheless undertake a separate process in the future to best develop boundaries and regulations for a reserve in the Dry Tortugas (NOAA, 1996). The FMP also changed the term "Replenishment Reserve to "Ecological Reserve", to better reflect the primary purpose of the zones – that of setting aside diverse areas comprising a cross-section of the region's habitats so that the areas may provide natural spawning and nursery habitats with minimal human disturbance. The FMP also modified the SPAs identified in the DMP, subsuming Western Sambos SPA within Western Sambos ER and enlarging the Carysfort SPA in the Upper Florida Keys (see Figure 2). Furthermore, all SPAs would now permit limit bait fishing for ballyhoo, and four SPAs would allow catch-and-release fishing. The FMP did not change the total number of SUAs but did replace Pelican Shoal SUA with Eastern Sambos SUA (see Figure 2). The Federal Register published the final FKNMS regulations on June 12, 1997, which were implemented on July 1, 1997 (Federal Register, 1997).

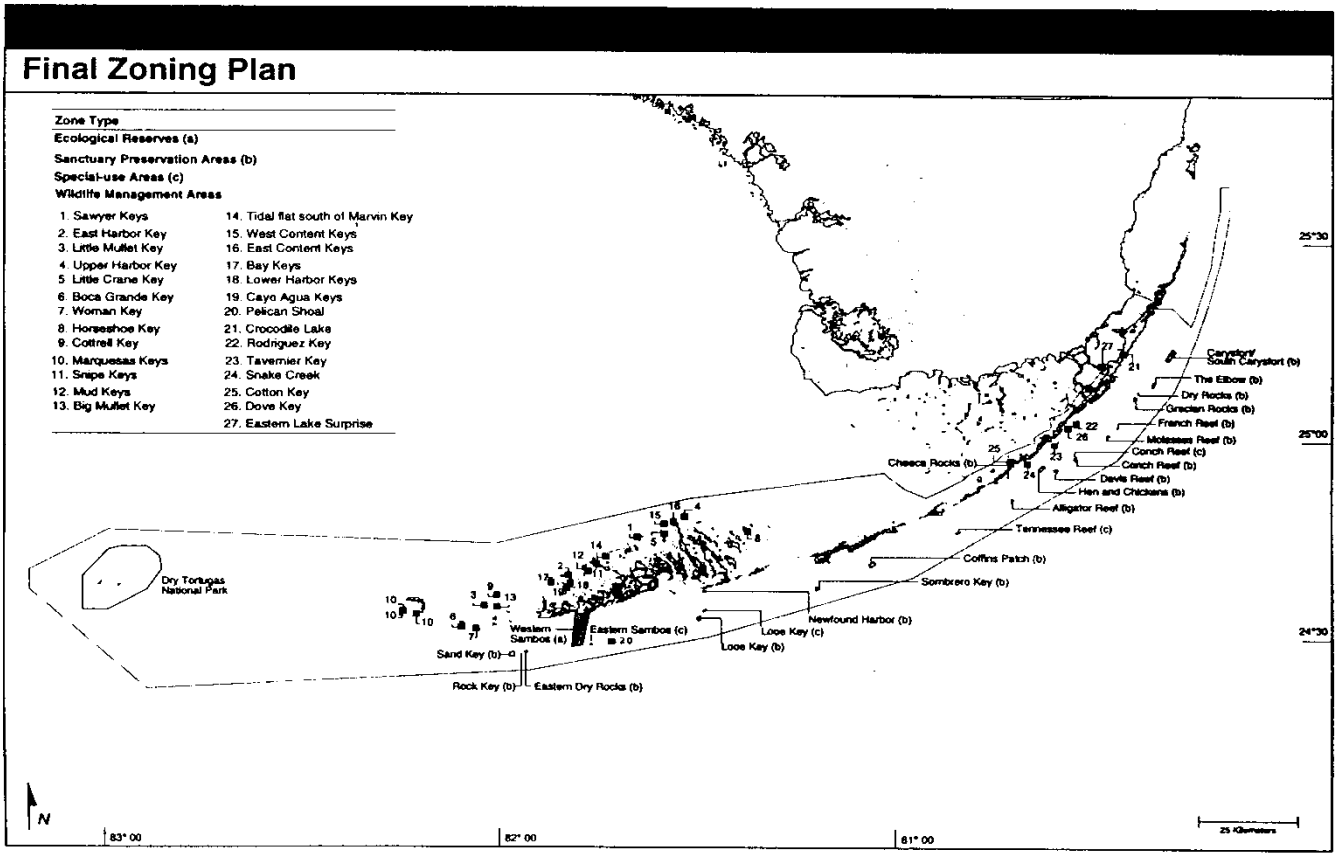

Figure 2: Final Management Plan FKNMS zones

The FKNMS commenced its Dry Tortugas Ecological Reserve designation process in 1998. Titled *Tortugas 2000*, the planning process included three phases: Design, solicitation of comments, and refinement and implementation (NOAA, 2000). Unlike the previous zoning action plan process where boundaries and regulations were developed prior to the public comment period, the FKNMS used the early phases of *Tortugas 2000* to characterize the biophysical and socioeconomic conditions in the so-called Tortugas Ecological Reserve Study Area (TERSA) (Delaney, 2003; Cowie-Haskell and Delaney, 2002; NOAA, 2000).

Also, the process involved the creation of a *Tortugas 2000* working group, comprised of stakeholder group' and governmental agencies' representatives, whose purpose it was to reach consensus on a preferred alternative for a Tortugas Ecological Reserve (TER), including its boundaries and regulations. Following a series of meetings that commenced in April 1998, the working group reached consensus on a preferred alternative on May 22, 1999, which it recommended to NOAA (NOAA, 2000). The working group agreed on a reserve that included two, discontinuous sections: TER North and TER South. The TER, as recommended by the working group, covered 151 square nautical miles. TER North encompassed 91 square nautical miles, a third larger than the 60 square nautical mile TER South. Over half of the reserve in state waters, and 22.2 square nautical miles

were in state waters outside of FKNMS jurisdiction. Another 73.8 square nautical miles were located in federal waters under the Gulf of Mexico Fishery Management Council, requiring an FKNMS boundary expansion of 96 square nautical miles. In a collaborative process that required agreements from the aforementioned agencies, NOAA published the final management plan/final supplemental environmental impact statement for the TER in November 2000, and the reserve came into effect in July 2001 (Federal Register, 2001). The boundary expansion increased the size of the FKNMS to its current area of 2,900 square nautical miles, of which no-take zones comprise more than 5%.

2 Stakeholder groups in the FKNMS

The FKNMS was the first national marine sanctuary to embrace ecosystem management (NOAA, 1996) and to implement a network of no-take zones. While these achievements were embraced by several stakeholder groups, others believed that the Sanctuary was part of a federal takeover, foisted on the Florida Keys' communities via governmental fiat (Suman, 1997). Part of the latter attitude is explained by the common view that Florida Keys' residents (the so-called "Conchs") are a fiercely independent group of individualists who, in a mock but yet telling gesture, had once even proclaimed their independence from the federal government, when Key West declared itself the "Conch Republic" (Williams, 1991). However, the opposition to the FKNMS can also be understood as the culmination of a longer, local struggle against marine protected area management, where several previous governmental attempts at implementing effective coastal and marine protection failed until the 1990 act of Congress that designated the FKNMS (NAPA, 2000; Suman, 1997).

By mid-1995, several groups had formed in the Florida Keys to protest against the FKNMS in general and the DMP and its various action plans (especially the zoning action plan) in particular. Members of the "Conch Coalition" and "Victims of NOAA" led protests at public hearings and other Sanctuary fora (Suman et al., 1999). Alternatively, conservation groups sided with and occasionally promoted the FKNMS and its management strategies. The Nature Conservancy, the Center for Marine Conservation, and the Izaak Walton League were among various national conservation groups that were in favor of the FKNMS. Other, local groups that also showed support were Reef Relief, Last Stand, and the Sanctuary Friends of the Florida Keys; the latter group formed specifically to promote support for the FKNMS. In a 1996 county-wide, non-binding referendum, 55% of the voters cast a ballot against the implementation of the FKNMS. While the result had no bearing on the implementation, and the FKNMS was implemented in 1997, it did reveal widespread disapproval of the Sanctuary. It was in part due to the acrimonious public hearing period and referendum that the FKNMS adopted a more open process that incorporated human dimensions in designating the TER (Delaney, 2003; NOAA, 1996).

As part of the initial socioeconomic baseline characterization conducted on stakeholder groups in the FKNMS in 1995-96, the research team headed by Dr. Daniel Suman of the University of Miami surveyed members of the commercial fishing industry, dive

operations, and local environmental groups (Shivlani and Suman, 2000; Suman et al., 1999; Suman and Shivlani, 1998; Milon et al., 1997). Each study evaluated stakeholder use patterns, sources of information on FKNMS regulations, views on the Sanctuary designation process, and perceptions on the expected effects of the FKNMS and its no-take zones. These stakeholder studies, conducted during the stages of DMP and FMP publication, provided an appropriate baseline against which future changes in stakeholder knowledge, attitudes, and perceptions could be measured (Bohnsack, 1993).

In comparing stakeholder views on the FKNMS, Suman et al. (1999) determined that commercial fishers displayed the highest levels of discontentment over the FKNMS process and its expected outcomes, and that their largely negative views may have been compounded by unrelated fishery regulatory effects on their activities. By contrast, environmental group members mostly supported the FKNMS process and its establishment. Dive operators were less sanguine than their environmental group counterparts in their support for the FKNMS but were nevertheless more optimistic than commercial fishers in the Sanctuary's expected outcome; the authors argued that this middle position was due to the dive operators' uncertainty over the outcome of the zoning action plan and its effects on their economic livelihoods.

A follow-up, monitoring study conducted with commercial fishing panels that operated in the FKNMS from 1998 to 2006 found that use patterns among commercial fishers concentrated mainly within the FKNMS and that the no-take zones had not resulted in significant economic impacts to the region's commercial fishing industry (Thomas J. Murray & Associates, 2007). However, a related study on the short-term impacts of the TER on the commercial fishing industry reported considerable impacts on commercial fishers in specific fishery sectors (especially reef fish fisheries), manifested mainly as displacement into other areas (Thomas J. Murray & Associates, 2005). While these and other studies (Shivlani et al., 2004; Shivlani et al., 1997) have considered the secondary effects of FKNMS no-take zones on stakeholder groups, no research until the present one has focused on the re-establishment of a socio-economic baseline for the FKNMS.

This project replicates the 1995-96 stakeholder group study to establish a ten-year baseline following the release of the DMP. By reassessing the same stakeholders' use patterns and knowledge, attitudes, and perceptions, it is expected that the findings can determine whether (a) stakeholder opinions have shifted in support of the FKNMS in the decade since its establishment, (b) stakeholder perceptions on FKNMS outcomes have converged over time, and (c) what areas of divergence concerning FKNMS performance have developed across stakeholders that may not have existed in the previous baseline.

3 Methodology

The project followed the 1995-96 stakeholder group study methodology, both in terms of the stakeholders selected for characterization and the approach used to survey the stakeholders. The previous methodology had proven effective in obtaining representative

samples of all three stakeholder groups, and a replication allowed for a direct comparison of baselines.

The survey instruments developed for the stakeholder surveys were each based on the 1995-96 questionnaires; however, the research team developed additional questions related to stakeholders' knowledge of different zone types and their effects and stakeholders' perceptions on FKNMS accomplishments and failures; thus, the questions were predicated on the stakeholders having a nuanced understanding of different FKNMS zones and familiarity with FKNMS activities. Please refer to appendices 1-3 for copies of the survey instruments.

In September 2005, the research team finalized the stakeholder survey instruments and respective work plans, which were then sent for approval from the Office of Management and Budget (OMB). The commercial fisher and dive operator surveys would be conducted as in-person, field surveys, whereas the environmental group survey would be sent as a mail-back survey (as per the 1995-96 study methodology). OMB approved the commercial fisher and dive operator survey instruments and respective work plans in January 2006 and the environmental group survey instrument and work plan (following revisions) in July 2006.

Also, the study area is described in regions that relate to historical distinctions within the Florida Keys. The Upper Keys run northeast from southern Miami-Dade County southwest to Long Key Bridge. The Middle Keys are located between Long Key Bridge and the Seven Mile Bridge and include the main island of Marathon. The Lower Keys commence on the western side of the Seven Mile Bridge and include all islands through the Dry Tortugas, with the main island being Key West. Please refer to Figure 3 for a map of the study area and the three regions.

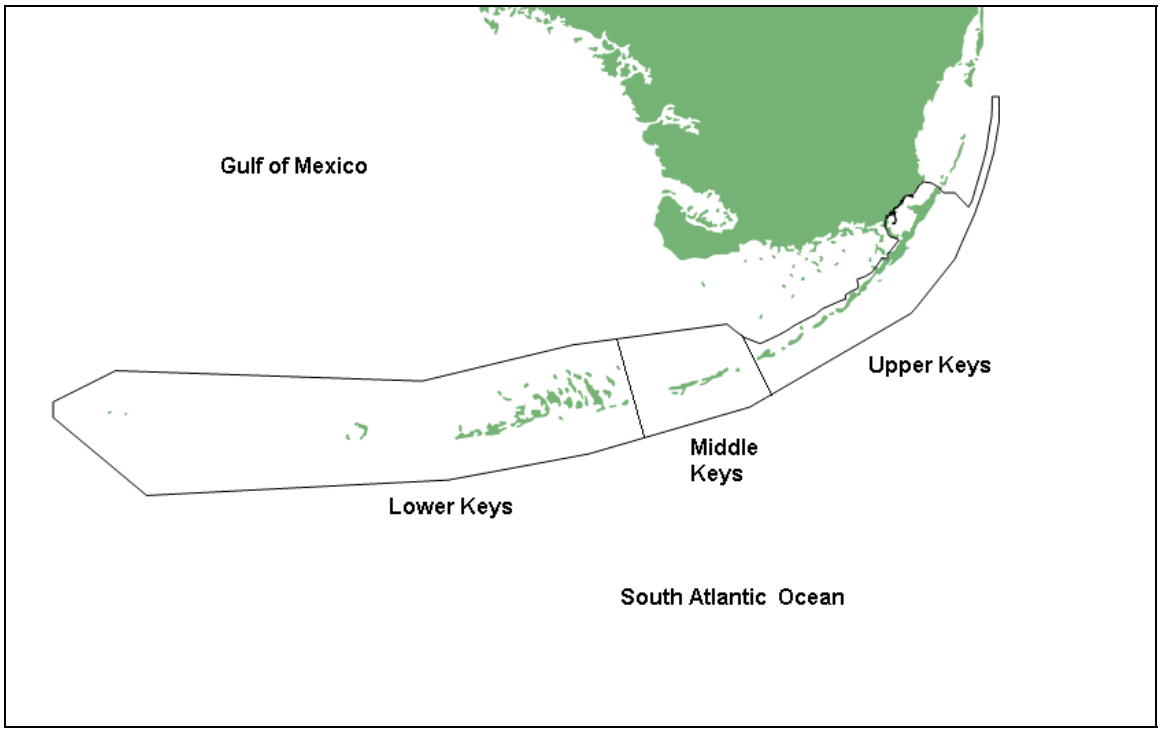

Figure 3: Study area and regions

3.1 Commercial fisher survey methodology

The research team obtained the 2005 list of Florida Saltwater Products License (SPL) holders for Monroe County, which served as the commercial fisher population. While the research team did contact and survey randomly selected fishers from this list, the field surveyors also utilized a field intercept (or 'snowball') approach to interview fishers they met at fish houses, docks, etc.

In April 2006, the research team mailed letters explaining the research project to all 1,268 commercial fishers who held an SPL in Monroe County. Because 138 of the letters were undeliverable, the population was revised to 1,138 commercial fishers.

The survey session commenced in May 2006 and ended in July 2006. The research team selected these months to conduct the commercial fisher surveys due to the fact that both the spiny lobster and stone crab fisheries are closed for most of those months. This allowed for surveyors to contact and interview trap fishers who would otherwise be fishing.

Table 1: Commercial fisher population and sample[1]

Region	*Number of fishers*	*Surveys required*	*Surveys completed*
1. Upper Keys	287	72	74
2. Middle Keys	297	75	75
3. Lower Keys	554	140	145
TOTAL	1,138	287	294

Table 2: Commercial fisher response rates

Region	*Fishers contacted*	*Fishers refused*	*Fishers unreachable*	*Fishers eligible*	*Surveys completed*	*Response rate (%)*
1. Upper Keys	116	18	23	93	74	79.6
2. Middle Keys	81	3	3	78	75	96.2
3. Lower Keys	227	28	57	170	145	85.3
TOTAL	424	49	83	341	294	86.2

Almost half (48.7%) of the fishers resided in the Lower Keys (from Big Pine Key to Key West), compared to 26.1% in the Middle Keys (Conch Key to Marathon), and 25.2% in the Upper Keys (Key Largo to Islamorada) (see Table 1). Based on a sample size of 287, the proportional total required per region were 140 surveys in the Lower Keys, 75 surveys in the Middle Keys, and 72 surveys in the Upper Keys.

In the Upper Keys, the research team contacted a total of 116 fishers, of whom 18 did not wish to participate and 23 who could not be reached (wrong number or disconnected phone) (see Table 2). In the Middle Keys, the research team contacted a total of 81 fishers, but three refused to participate and three could not be reached (for the Middle Keys, the team relied mainly on field intercept surveys). In the Lower Keys, the research team contacted 227 fishers, of whom 28 refused to participate and 57 who could not be contacted. Finally, it should be noted that the 294 fisher sample size represented 25.2% of the entire population, considerably higher than the 13.9% sampled in 1995-96 (or 337 out of 2,430 fishers).

3.2 Dive operator survey methodology

The research team used a variety of sources in determining the total population of dive, snorkel, glass-bottom, and kayak operators (in effect, all water operators) in the Florida Keys. The approach adopted was to first determine the population of all commercial

[1] The sample size represented a 95% confidence level with a +/-5% confidence interval, based on a total population of 1,138 fishers. Regional sample sizes were determined for the proportion of total fishers per region.

operators that take out or rent gear to visitors and then to refine that list by contacting the operators to determine whether they conduct any in-water activities (namely snorkeling and diving trips). Then, as conducted with the commercial fishers, the final step was to send an introductory letter to each operation to explain the project and to quantify the total number of active operations.

From a total of 105 water operators that was determined using the Keys Association of Dive Operators (KADO) internet list, other Florida Keys water operator internet lists, brochures, and the Florida Keys and Key West yellow pages, the research team identified a population of 89 active[2] dive and snorkel operations. The survey session commenced in June 2006 and ended in October 2006. The length of the survey session was in part due the research team's focus on the completion of commercial fisher surveys during the closed trap fishing months (see earlier in this section), after which the research team targeted dive operations.

The research team conducted a census survey of the 89 operations instead of selecting a random sample, a methodology similar to that used in the 1995-96 study. Research team members contacted each operation over the survey session period and requested that the operations participate in the study at a time of their convenience. Of the 89 operations contacted, 21 operations (23.3%) refused to participate. Table 3 shows the frequency of participating operations by region in the Florida Keys.

Table 3: Dive operation population and sample

Region	*Number of operations*	*Surveys completed*	*Participation rate (in %)*
1. Upper Keys	45	39	86.7
2. Middle Keys	11	10	90.9
3. Lower Keys	33	20	60.6
TOTAL	89	69	77.5

As shown in Table 3, Upper and Middle Keys operators participated more frequently than their Lower Keys counterparts. Participation rates were highest among Middle Keys operators, of whom greater than 90% completed surveys. It should be noted that the population total of 89 may have been slightly higher than the actual functioning population of dive and snorkel operators, in that a few operators may have closed while the study was being conducted (ex. two operations in the Lower Keys could not be reached, either by telephone or in the field). Overall, over three-quarters of the diver operator population participated in the study; this was slightly lower than the 82.7% of the 75 operations that participated in the 1995-96 study, but the present effort led to the completion of 69 surveys, or 11.3% more than the 62 surveys completed in the previous study.

[2] 'Active' refers to those operations that could be contacted (by telephone or email) and which offer scheduled trips (to be contrasted with those operations plan trips only when requested and which may specialize in other operations, ex. charter fishing).

3.3 Environmental group survey methodology

The research team contacted representatives from two of the three environmental groups used in the 1995-96 study to request mailing lists to conduct the environmental group survey. Reef Relief is a Key West-based environmental group with 3,442 members spread across the Keys, Florida, and the United States. Concerned primarily with the health of the Florida Keys reef ecosystem, Reef Relief has long advocated and maintained a mooring buoy program in the Lower Keys. In the FKNMS Final Management Plan, it is listed as one of the partners in the Sanctuary's mooring buoy action plan. Last Stand is a grass-roots conservation group. Its primary objectives concern the welfare of the Florida Keys' natural environment. With a 330 member base mostly located in the Florida Keys, this Key West-based group has been very active in the Sanctuary process by having its representatives and members attend Sanctuary meetings and advocating the implementation of the Sanctuary. Last Stand and Reef Relief representatives agreed to have their membership base be contacted as part of this effort and provided their mailing lists.

The research team developed a detailed work plan (see Appendix 4 for a copy of the work plan and related material) that it used to conduct environmental group surveys and which consisted of four steps (following Dillman, 1978):

Step 1: Letter promoting the study
Step 2: Survey questionnaire
Step 3: Reminder postcard
Step 4: Non-response bias postcard

As part of Step 1, the research team mailed 3,442 and 330 copies of a letter promoting the study to Reef Relief and Last Stand members, respectively. The letter described the objectives of the research and requested that recipients please complete and return the survey questionnaire to be sent within two weeks. The research team mailed copies of the letter on the first week of January 2007.

Step 2 involved the mailing of the eight-page survey questionnaire, including the introductory letter, to members of both environmental groups. In total, the research team mailed out 3,772 surveys over the third week of January 2007.

Step 3 consisted of mailing a reminder postcard to all members of both groups to promote survey returns. The postcard provided recipients with a telephone number and email address via which to request replacement copies of the survey and to answer any questions concerning the survey. The research team mailed the postcards over the second week of February 2007.

Finally, in Step 4, the research team sent out postcards containing two questions (the age group of the recipient and the level of support for the establishment of the Sanctuary) to all members to determine whether either factor affected participation rates, as had been

determined for the 1995-96 study. The research team mailed the postcards over the first week of March 2007.

A total of 438 members returned completed or partially completed surveys, resulting in a gross response rate of 11.6%. Also, another 577 members, or 15.3%, returned the non-response bias postcard mailed out as part of Step 4.

4 Results

The results from the project are presented separately for each of the three groups surveyed. Also, previous and present results are compared throughout each stakeholder group section. Finally, the results mainly follow the order in which the questions appear in the survey instruments.

4.1 Commercial fisher survey results

The research team completed a total of 294 commercial fisher surveys, representing over a quarter (25.2%) of Monroe County's Saltwater Products License (SPL) holder population. The survey results are divided into the following sections: General information; economic information; fishery information (including use patterns); sources of information and perceptions; and enforcement.

4.1.1 Commercial fisher survey general information

The sample provided general information on its socio-demographic characteristics, including the fishers' age groups, ethnicity, affiliations, primary and secondary ports, and tenure in the fishery.

A majority, or 79.3%, of the sample considered itself non-Hispanic (see Table 4). Among the 21.7% that was Hispanic, 88.5% was of Cuban origin. The percentage of Hispanic fishers increased from the Upper to the Lower Keys, consistent with the region's general ethnic distribution (US Census, 2007). Also, 94.9% of the sample identified itself as White/Caucasian, the dominant racial group in the fishery. While the 1995-96 sample did not provide information on both ethnicity and race, the percentage of respondents who identified themselves as Hispanic in the earlier study (or 18.2%) was consistent with the proportion of Hispanic fishers in the present sample (21.7%)

Over three quarters (77.9%) of the sample was 41 years or older. Fishers younger than 30 years old comprised less than 7% of the industry. The mean age of commercial fishers, on a scale from 1 to 5 (where 1 is 18-30 years old and 5 is over 60 years old), was significantly higher in the present sample than in the 1995-96 sample, suggesting both a graying of the fleet and decreased recruitment of younger fishers. In 1995-96, fishers 40 years old or younger comprised 29.1% of the fishery; in 2004-05, those age groups decreased to 22.1% of the fishery. Similarly, the number of fishers older than 60 years old increased from 17.1% of the fleet in 1995-96 to 27.9% in 2004-05. This shift in age

groups was in part reinforced by the changes reported for experience in fishing. Exactly two thirds (66.7%) of the sample had been fishing for over 20 years; by contrast, only 5.1% had been fishing for five years or less. In 1995-96, only 29.5% of the sample had fished for 20 or more years, and 17% had entered the fishery five or fewer years ago. The difference in fishing experience between the samples was statistically significant, suggesting a more experienced fleet in the present study[3]. However, when the age group and fishing experience results are considered together, the findings indicate a declining trend in the industry, as suggested by the age, tenure, and number of participants. In 1995-96, 2,430 Saltwater Products License (SPL) holders fished in Monroe County, a number that decreased by more than half (53.1%) in the ten years between the two studies[4]. Also, the results show that along with a decline in the total number of participants, there were changes in the age and experience distributions among commercial fishers such that younger entrants were no longer as common as they were a decade ago (Shivlani et al., 2004; Thomas J. Murray & Associates, 2005; Shivlani and Milon, 1998).

In terms of family members, commercial fishers supported an average of 2.64 family members, including themselves. This represents a slight decline in family support from the 1995-96 sample, in which fishers supported an average of 2.74 family members, including themselves.

Group affiliations showed that commercial fishers were mostly members of county (Monroe County Commercial Fishermen, Inc. (MCCF)) or state (Organized Fishermen of Florida (OFF)) commercial fishery organizations. Other organizations, such as Chambers of Commerce and environmental groups, attracted much lower rates of affiliation. Also, as had been found in the 1995-96 study, OFF affiliation was lowest in the Lower Keys. Interestingly, more respondents were members of MCCF and OFF than in the 1995-96 sample. The percentage of fishers who were MCCF members increased from 24.2% in 1995-96 to 34% in 2004-05. This increase is most likely a result of two factors: the first is that MCCF had only recently formed prior to the earlier study and thus may have increased its membership base over the next decade; the second is due to the increasing professionalization (i.e. exit of part-time fishers) in the industry and subsequent need for local representation (Shivlani et al., 2004).

While fishery organization increased in between the two studies, fish house affiliation dropped. Over 72% of the respondents belonged to a fish house in 1995-96, compared to 47.3% in 2004-05. Middle Keys fishers had the highest rates of fish house affiliation, contrasted with Upper Keys fishers, of whom less than a third belonged to a fish house. In the Lower Keys, fish house affiliation was reported by less than half the fishers interviewed (42.8%). In 1995-96, 74.6% of the 157 fishers interviewed in the Lower

[3] Since 87.4% of the sample had been fishing for 11 or more years, a large majority of the fishers interviewed had directly experienced the FKNMS (1995-1997) and TER (1998-2001) designation processes.

[4] By contrast, the total number of Saltwater Products Licenses declined by 38.4% in the State of Florida during the same time period, from 17,712 in 1996 to 11,535 in 2005 (Thomas J. Murray & Associates, 2007).

Keys belonged to one of 13 fish houses in the region. Since then, fish houses have mostly closed down throughout the Lower Keys (and elsewhere), and important commercial fishing ports have witnessed an often rapid gentrification and loss of commercial waterfront. For example, the study identified only two fish houses in Stock Island (the principal commercial fishing port in the Lower Keys), down from 11 in 1995-96.

Finally, the sample reported considerable reliance on commercial fishing, as measured as a percentage of total personal (86.3%) and household (80.3%) income. Fishers on average now gained over 25% more of their personal income from commercial fishing than they had in 1995-96, a significant increase attesting to the growing professionalization in the industry. In the Middle Keys, the percentage of personal income from commercial fishing was almost 92%, up from 61% in 1995-96.

Table 4: Commercial fisher socio-demographic information

Question	*1995-96 sample*	*Total sample*	*Upper Keys*	*Middle Keys*	*Lower Keys*
Age of fishers	n = 333	n = 290	n = 74	n = 73	n = 143
	3.18 (1.22)*	3.48 (1.24)*	3.49 (1.25)	3.41 (1.27)	3.51 (1.22)
1. 18-30 years	10.5	6.9	6.8	9.6	5.6
2. 31-40 years	18.6	15.2	13.5	13.7	16.8
3. 41-50 years	30.3	29.0	35.1	27.4	26.6
4. 51-60 years	23.4	21.0	13.5	24.7	23.1
5. Over 60 years	17.1	27.9	31.1	24.7	28.0
Hispanic/Latino	n = 336	n = 294	n = 74	n = 75	n = 145
	18.2	21.7	2.7	25.3	27.6
Number of family members	n = 329	n = 294	n = 74	n = 75	n = 145
	2.72 (1.55)	2.64 (1.64)	2.59 (1.63)	2.96 (1.74)	2.67 (1.42)
Affiliation in organizations	n = 331	n = 294	n = 74	n = 75	n = 145
1. MCCF	24.2	34.0	16.2	50.7	34.5
2. OFF	19.0	24.2	24.3	42.7	14.5
3. Chamber of Commerce	6.9	4.1	1.4	6.7	4.1
4. Environmental group	-	1.4	0.0	2.7	1.4
Member of fish house	n = 315	n = 294	n = 74	n = 75	n = 145
	72.4	47.3	32.4	70.7	42.8
Years fishing	n = 329	n = 294	n = 74	n = 75	n = 145
	2.73 (1.06)*	3.49 (0.84)*	3.31 (0.94)	3.49 (0.89)	3.58 (0.75)
1. 1-5 years	17	5.1	8.1	6.7	2.8
2. 6-10 years	22.5	7.5	8.1	6.7	7.6
3. 11-20 years	31.0	20.7	28.4	17.3	18.6
4. Over 20 years	29.5	66.7	55.4	69.3	71.0
Percent of personal income from fishing	n = 303	n = 290	n = 72	n = 74	n = 144
	61.0 (43.0)*	86.3 (26.7)*	77.3 (33.0)	91.6 (17.9)	88.1 (26.1)
Percent of household income from fishing	-	n = 289	n = 71	n = 74	n = 144
		80.3 (29.7)	70.1 (34.3)	86.5 (21.4)	82.2 (29.9)

* denotes responses that are statistically different at the 5% significance level.

4.1.2. Commercial fisher survey economic information

Respondents provided information on their economic activities for the 2004-05 (or 2005)[5] season, including capital investments such as vessel and gear costs and operating costs, including docking fees and repair and maintenance costs, among others.

[5] Depending on the species targeted, the time period for which commercial fishers provided economic information varied. For fin fish, marine life, and shrimp, the information concerned the most recent

Table 5: Commercial fisher vessel and gear costs

Item	*1995-96 sample*	*Total Sample*	*Upper Keys*	*Middle Keys*	*Lower Keys*
Vessel number	-	n = 223 1.21 (0.51)	n = 57 1.24 (0.61)	n = 55 1.20 (0.52)	n = 111 1.20 (0.44)
Vessel costs	n = 304 $124,722 (383,993)	n = 220 $119,250 (176,043)	n = 57 $125,893 (268,004)	n = 55 $106.964 (115,323)	n = 108 $122,000 (137,908)
Lobster traps	-	n = 139 1,723.4 (1,321.0)	n = 28 1,546.5 (1,808.5)	n = 48 2,212.3 (1,357.8)	n = 63 1,429.6 (880.7)
Lobster trap costs	-	n = 128 $47,049 (39,088)	n = 26 $47,154 (49,805)	n = 47 $56,276 (41,100)	n = 55 $39,117 (29,457)
Stone crab traps	-	n = 99 2,179.5 (2,,276.4)	n = 17 1,070.7 (1,782.7)	n = 38 3,600.3 (2,788.5)	n = 44 1,380.9 (1,006.9)
Stone crab trap costs	-	n = 94 $39,506 (47,894)	n = 16 $17,264 (36,672)	n = 36 $65,643 (61,450)	n = 42 $25,575 (22,152)
Total traps	n = 166 1,927.4* (2,178.3)	n = 148 3,076.6* (2,943.0)			
Total trap costs	n = 168 $46,044* (60,161)	n = 138 $70,550* (70,069)			
Nets costs	n = 57 $30,425 (53,979)	n = 24 $38,785 (96,235)	n = 9 $4,947.8 (6,977.9)	n = 5 $47,840 (49,238)	n = 10 $64,712 (143,560)
Other gear costs	-	n = 99 $8,581.7 (12,968)	n = 35 $8,713.2 (9,814.6)	n = 5 $7,170.0 (6,711.5)	n = 59 $8,728.8 (14,940)

As shown in Table 5, commercial fisher costs varied across the three regions, but traps dominated overall gear costs. Vessel values for the entire sample averaged $119,250, with the Upper Keys' respondents reporting the highest average values ($125,893) and the Middle Keys' respondents the lowest average values ($106,964). When compared to the 1995-96 sample, when the average cost of vessels was $97,325 (SD = 299,643; n = 204), vessel costs had increased by an average of almost $20,000.

calendar year (or 2005), but for spiny lobster and stone crab trap fisheries, the information concerned the previous fishing year (or 2004-05, as the seasons for both trap fisheries straddle two years).

In terms of gear costs, Middle Keys fishers reported the highest average totals and costs for trap gear. On average, respondents from the Middle Keys held more than 2,200 spiny lobster traps and 3,600 stone crab traps. As might be expected, Middle Keys' fishers generally did not participate in other fisheries, as shown by the few respondents reporting "other gear" costs. Other gear included handline equipment (for fin fish), dive gear, and long lines. Finally, the average cost of nets was highest among Lower Keys and Middle Keys fishers, both of whom used large gillnets to target king and Spanish mackerel. Upper Keys fishers reporting nets generally used the gear type for more shallow water activities (ex. cast and other bait-specific nets).

Table 6: Commercial fisher operating costs

Item	*1995-96 sample*	*Total Sample*	*Upper Keys*	*Middle Keys*	*Lower Keys*
Docking fees	n = 128 $4,592.1 (4,176.3)	n = 88 $5,362.2 (6,039.4)	n = 33 $4,806.1 (3,861.5)	n = 17 $2,889.6 (1,756.5)	n = 28 $8,441.3 (8,965.9)
P&I insurance	-	n = 63 $8,696.7 (16,973)	n = 22 $6,247.7 (5,085.2)	n = 13 $12,073 (28,080)	n = 28 $9,660.7 (16,727)
Vessel repair and maintenance	n = 287 $13,868 (22,124)	n = 209 $14,953 (19,431)	n = 54 $16,256 (23,569)	n = 50 $12,905 (15,962)	n = 105 $15,258 (18,624)
Spiny lobster trap repair and maintenance	-	n = 131 $19,910 (24,430)	n = 25 $17,808 (21,914)	n = 47 $14,625 (14,776)	n = 59 $25,011 (30,426)
Stone crab trap repair and maintenance	-	n = 89 $11,427 (14,331)	n = 17 $5,678.1 (6,683.2)	n = 35 $15,720 (18,624)	n = 37 $10,008 (10,907)
Net repair and maintenance	-	n = 17 $3,620.6 (3,311.5)	n = 5 $290.0 (124.2)	n = 4 $4,250.0 (2,986.1)	n = 8 $5,387.5 (3,084.7)
Other gear repair and maintenance	-	n = 59 $2,956.8 (4,386.5)	n = 22 $4,313.6 (6,217.9)	n = 8 $2,275.0 (2,319.3)	n = 29 $2,115.5 (2,684.1)
Total gear repair and maintenance	n = 168 $10,327* (13,757)	n = 177 $21,517* (28,865)			

As shown in Table 6, commercial fishers incurred high operating costs in 2005 compared to 1996, as related to total gear repair and maintenance costs. This was mostly likely due to consecutive active hurricane seasons (particularly for the trap fisheries), commencing with Hurricanes Charley and Ivan in 2004, followed by Hurricanes Dennis, Katrina, Rita, and Wilma in 2005. Trap fisheries were impacted considerably, with the spiny lobster

industry reporting damage to 300,000 traps (or 54% of all traps in the fishery) in 2005, leading to the lowest landings in the fishery in 30 years (Clark, 2006). The Lower Keys, from Key West to Big Pine Key, were especially affected due to several of the storms (Hurricanes Charley and Ivan in 2004 and Hurricanes Dennis, Katrina, and Wilma) brushing or going over the islands and adjacent waters. Consequently, Lower Keys fishers reported higher repair and maintenance costs for spiny lobster traps than Middle or Upper Keys fishers, even though this region reported the lowest average lobster trap total.

Other operating costs reported by the sample included docking fees, property and indemnity insurance, and vessel repair and maintenance costs. Only 19% and 22.7% of the Lower Keys and Middle Keys fishers, respectively, reported paying docking fees, compared to 44.6% of Upper Keys fishers. This finding is consistent with other research conducted with Florida Keys fishers (see Shivlani et al., 2004) and is related to the higher percentage of Middle and Lower Keys fishers who belong to fish houses, where they have an arrangement (ex. fish house fees) that covers dockage. A minority of fishers in each region reported paying for property and indemnity insurance, and the main reason given was the prohibitive cost of the insurance premium. Finally, apart from gear costs, the most common and among the highest of all operating costs reported were vessel repair and maintenance costs. Only a few fishers claimed that the vessel costs were in part related to hurricane damage, while a majority stated that the costs were routine maintenance and repair expenses. Altogether, the operating costs demonstrate the impacts of tropical storms on the regions' commercial fisheries and especially those fisheries that rely on fixed gear (i.e. traps) that are often in the water during the peak of the Atlantic hurricane season. The high costs in maintaining a commercial fishery operation may also explain in part why the participation in the fishery may have declined in the decade between studies[6].

4.1.3. Commercial fisher survey fishery information

Fishers provided their effort, landings, and costs (on a per trip) data on the species that they targeted and the areas that they fished. Landings were provided for two years (2004-05 or 2005 and 2003-04 or 2004[7], as the research team decided that landings may have been affected in the latter season/year due to the active hurricane season and may not be representative for the sample). Table 7 shows the effort by species in the three regions.

[6] It is not suggested that the operating costs comprise the *primary* or *sole* reason for a decline in participation in the commercial fishing industry in the Florida Keys. Clearly, fishery management regulations have played a role in reducing effort and/or landings, gentrification has increased land values, and tourism has intensified competition for resources and waterfront. However, in a county that has the highest cost of living in the State of Florida, high operating costs have added to the combination of factors that made commercial fishing less economically sustainable in the Florida Keys.

[7] The research team collected landings, effort, and cost information for the 2003-04 or 2004 season to compare landings from the 2004-05 or 2005 season to determine whether there were significant differences in fishing profiles. However, the report compares the 2004-05 or 2005 season with the 1995-96 season to discuss changes in fishing patterns, due to the fact that the 2004-05 or 2005 season represents the most current fishing season characterized is thus the most recent, complete data set collected.

Table 7: Commercial fisher 2004-05/2005 effort (trips)

Species	*1995-96 sample*	*Total sample*	*Upper Keys*	*Middle Keys*	*Lower Keys*
1. Stone crab	n = 99 59.1* (45.9)	n = 84 88.8* (67.8)	n = 16 55.9 (73.7)	n = 31 111.1 (69.0)	n = 37 84.5 (58.5)
2. Spiny lobster	n = 140 102.5 (123.4)	n = 123 108.3 (68.9)	n = 25 105.8 (70.7)	n = 37 140.5 (78.6)	n = 61 90.5 (54.9)
3. Shrimp	n = 17 152.6* (104.6)	n = 3 241.5* (93.8)	-	-	n = 3 241.5 (93.8)
4. Reef fish	n = 119 62.4 (58.5)	n = 49 88.7 (85.6)	n = 16 92.7 (83.9)	n = 3 98.7 (68.1)	n = 30 85.8 (90.2)
5. King mackerel	n = 66 32.0* (46.9)	n = 25 66.9* (77.4)	n = 9 86.1 (69.7)	n = 3 3.7 (2.9)	n = 13 68.2 (86.3)
6. Spanish mackerel	-	n = 8 36.5 (76.5)	n = 1 20.0	n = 4 8.5 (8.5)	n = 3 79.3 (126.3)
7. Bait fish	-	n = 14 90.9 (81.1)	n = 8 102.9 (86.4)	n = 3 36.7 (20.8)	n = 3 113.3 (102.1)
8. Pelagics	-	n = 33 135.2 (89.4)	n = 13 119.6 (85.3)	n = 2 125.0 (106.1)	n = 18 147.5 (94.3)
9. Marine life	n = 6 145.0 (106.0)	n = 9 173.7 (100.7)	n = 5 104.6 (72.4)	-	n = 4 260.0 (43.7)

As shown in Table 7, most fishers in the sample targeted spiny lobster or stone crab. Importantly, the effort data showed that unlike in the 1995-96 study, fishers now tended to focus more on trap fisheries, as determined by the number of trips reported for each fishery. The average number of stone crab trips increased by more than 30% from 1995-96 to 2004-05; lobster trips increased by over 37% in the same time period. In fact, effort in all 2004-05 fisheries, compared to the 1995-96 sample, increased while participation in the fishers (as a percentage of the total sample) remained similar or decreased.

Table 8: Commercial fisher 2004-05/2005 landings

Species	*1995-96 sample*	*Total sample*	*Upper Keys*	*Middle Keys*	*Lower Keys*
1. Stone crab	n = 101 6,263.2* (7,960.0)	n = 86 7,377.7* (8,793.2)	n = 14 3,777.5 (7,733.2)	n = 34 11,081 (10,110)	n = 38 5,468.7 (6,630.1)
2. Spiny lobster	n = 141 17,353* (17,981)	n = 120 19,616* (18,592)	n = 24 12,422 (10,818)	n = 41 21,052 (22,411)	n = 55 21,685 (17,633)
3. Shrimp	n = 17 67,012 (83,788)	n = 2 44,000 (22,627)	-	-	n = 2 44,000 (22,627)
4. Reef fish	n = 119 7,861.4* (12,551)	n = 44 18,065* (32,765)	n = 14 25,993 (52,437)	n = 3 20,667 (16,921)	n = 27 14,636 17,940
5. King mackerel	n = 65 8,764.6 (14,501)	n = 23 16,490 (22,615)	n = 8 5,832.8 (7,465.2)	n = 4 20,500 (17,059)	n = 11 22,782 (29,292)
6. Spanish mackerel	-	n = 9 42,222 (48,191)	n = 1 200.0	n = 5 44,560 (46,169)	n = 3 52,333 (63,058)
7. Bait fish	-	n = 15 22,144 (29,908)	n = 7 7,380.0 (8,631.0)	n = 5 27,100 (41,392)	n = 3 48,333 (27,538)
8. Pelagics	-	n = 33 13,094 (22,879)	n = 12 16,267 (33,333)	n = 3 4,333.3 (4,932.9)	n = 18 12,439 (15,569)

Landings in the fishery varied across species for the 2004-05 sample (see Table 8). In the two trap fisheries, participants averaged over 7,400 of stone crab claw pounds and almost 20,000 spiny lobster pounds. These totals were comparable to the amounts reported by the 1995-96 sample. In almost all fisheries, while the number of participants decreased, the average catch totals remained similar or increased. The effort and landings results support the earlier discussed view on the 'professionalization' of the fishery, where the part time and multi-species fishers have declined in the ten-year period in between studies. Highly capitalized, full-time (and mainly trap) participants have emerged as the new Florida Keys fishers.

Table 9: Commercial fisher 2004-05/2005 average trip costs

Species	*Sample*	*Fuel and oil*	*Ice*	*Bait*	*Food and supplies*	*Other costs*	*Total costs (except crew costs)*	*Total crew*
1. Stone crab	2004-05 n = 86	$237.0 (269.4)	$11.9 (63.3)	$184.2 (255.4)	$21.8 (45.1)	$1.14 (10.2)	$456.2* (437.5)	n = 62 2.42 (0.99)
	1995-96 n = 101	$74.0 (63.3)	$2.41 (8.89)	$129.4 (130.8)	$18.5 (17.1)	$0.48 (2.29)	$257.2* (189.4)	n = 98 2.23 (0.82)
2. Spiny lobster	2004-05 n = 128	$294.5 (394.3)	$29.4 (84.5)	$93.1 (199.1)	$69.9 (199.9)	$4.67 (44.9)	$487.0* (771.1)	n = 97 2.32 (0.97)
	1995-96 n = 140	$122.3 (196.7)	$20.3 (61.2)	$96.7 (259.4)	$45.5 (92.3)	$3.47 (22.4)	$288.3* (548.8)	n = 137 2.32 (0.84)
3. Shrimp	2004-05 n = 3	$4,033.3 (1,738.8)	$673.3 (502.1)	-	$600.0 (0.0)	-	$5,307 (2,185)	n = 3 2.67 (0.57)
	1995-96 n = 18	$2,232 (1,330)	$451.4 (441.6)	-	$1,043 (2,009)	$185.1 (607.8)	$3,912 (2,951)	n = 18 2.61 (0.70)
4. Reef fish	2004-05 n = 47	$220.3 (336.6)	$42.8 (100.1)	$110.0 (173.3)	$72.4 (225.0)	$0.63 (4.38)	$443.8 (608.4)	n = 27 1.52 (0.70)
	1995-96 n = 116	$188.4 (308.3)	$47.4 (87.5)	$125.1 (188.5)	$78.5 (113.1)	$12.0 (256.3)	$451.5 (622.3)	n = 112 2.18 (0.82)

5. King mackerel	2004-05 n = 24	$351.0 (375.9)	$55.4 (111.9)	$70.0 (185.6)	$152.5 (285.9)	$4.38 (12.5)	$632.7* (551.3)	n = 19 2.95 (1.43)
	1995-96 n = 65	$197.3 (300.0)	$60.8 (83.1)	$55.4 (93.3)	$69.0 (98.7)	$8.54 (24.1)	$391.0* (464.5)	n = 62 2.56 (1.36)
6. Spanish mackerel	2004-05 n = 9	$337.2 (368.7)	$20.6 (40.8)	$11.7 (23.2)	$256.1 (423.7)	$16.7 (5.56)	-	n = 9 1.78 (1.20)
7. Bait fish	2004-05 n = 13	$191.1 (187.2)	$4.62 (9.01)	$8.15 (16.1)	$198.1 (364.9)	$2.31 (8.32)	-	n = 10 1.80 (0.92)
8. Pelagics	2005-05 n = 31	$217.6 (222.6)	$94.2 (429.4)	$123.4 (314.6)	$21.7 (37.7)	$1.06 (5.40)	-	n = 17 1.96 (0.71)
9. Marine life	2004-05 n = 7	$52.0 (33.9)	-	-	$14.3 (13.7)	-	$66.3 (44.2)	n = 7 1.57 (0.53)
	1995-96 n = 6	$42.7 (19.7)	$2.78 (4.47)	-	$17.1 (12.6)	$20.9 (23.1)	$83.5 (32.6)	n = 6 2.17 (0.75)

The trip costs in Table 9 demonstrate the high costs of commercial fishing trips in the Florida Keys. Fuel costs generally dominated trip costs, with bait costs averaging as the second most expensive aspect of fishing for species such as stone crab, spiny lobster, and reef fish. Crew totals varied across fisheries, with species requiring additional labor for pulling traps and nets (i.e. the spiny lobster and stone crab trap fisheries and the shrimp and king mackerel net fisheries) reporting the highest average number of crew members.

The survey instrument utilized two maps to determine areas fished. The first map used was similar to that used in the 1995-96 study and in subsequent efforts (Thomas J. Murray & Associates, 2007; Thomas J. Murray & Associates, 2005), except that it included an additional area, Area 7, denoting the Tortugas Ecological Reserve Study Area (see Figure 4).

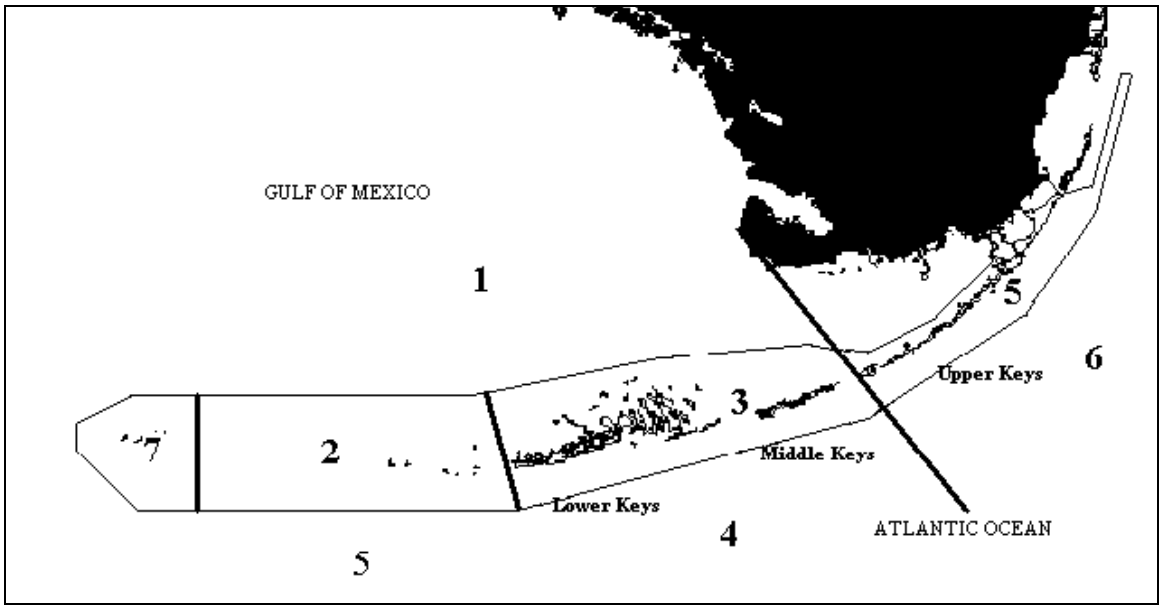

Figure 4: FKNMS fishing areas

As shown in Figure 4, the survey instrument divided up the Florida Keys into fishing areas within and outside the FKNMS. Areas 2, 3, 5, and 7 are within the FKNMS, and Areas 1, 4, 5, and 6 are outside the FKNMS. Tables 9-12 show the landings by area for the entire region, Upper Keys, Middle Keys, and Lower Keys, respectively.

Table 10 shows that landings varied considerably by area based on the species targeted. Fishers reported targeting stone crab mainly in areas 1, 2, and 3, in a triangle west of Florida Bay north to the Gulf of Mexico and west into the Marquesas Keys and east towards Key West. Spiny lobster was landed in many of the same areas as stone crab (namely areas 1, 2, and 3, which accounted for almost three quarters of the landings), but landings in areas 2 and 3 included catch from the South Atlantic side of those areas. Also, an important area for the spiny lobster fishery is the Dry Tortugas, included mostly in area 7, which accounted for 7.7% of the sample's total landings. Reef fish was targeted mainly within FKNMS waters, with areas 2, 3, 5, and 7 comprising almost two-

thirds of all landings. King and Spanish mackerel, important migratory coastal pelagics, were targeted by commercial fishers in the Lower Keys and the Gulf of Mexico, with areas 1 and 2 making up over 60% of king mackerel landings and 97.2% of Spanish mackerel catch (the latter being landed almost exclusively by nets). The other fin fish complex that was targeted by fishers across the region was that of pelagics (consisting primarily of cobia, dolphin, and wahoo), which were landed in offshore areas (areas 1, 4, and 6) and the western section of the FKNMS (area 2).

Table 10: Commercial fisher 2004-05/2005 season landings by area

Species group	*Area 1*	*Area 2*	*Area 3*	*Area 4*	*Area 5*	*Area 6*	*Area 7*
Stone crab (n = 86)	49.8	15.3	28.6	2.7	3.4	1.2	1.1
Spiny lobster (n = 120)	14.2	26.2	32.5	6.7	10.4	2.3	7.7
Shrimp (n = 2)	75.0	25.0	-	-	-	-	-
Reef fish (n = 45)	8.2	16.0	14.9	17.2	23.1	9.8	10.8
King mackerel (n = 23)	28.7	32.6	4.2	14.0	6.9	8.3	5.4
Spanish mackerel (n = 9)	41.9	55.3	-	2.6	-	0.1	0.1
Baitfish (n = 15)	6.0	66.7	9.9	3.0	11.4	3.0	-
Pelagics (n = 33)	19.7	23.2	5.3	25.5	4.4	20.7	1.1

As shown in Table 11, Upper Keys fishers generally targeted species in areas 5 and 6, the former of which is located in the Upper Keys section of the FKNMS and latter of which is the Upper Keys' South Atlantic offshore region. The only species that was mainly targeted outside those areas was stone crab, of which 62.2% was harvested from area 1 (Gulf of Mexico). This is partly due to the favorable fishing grounds in that area, as well as the lack of adequate stone crab fishing grounds in the Upper Keys (especially in the mid and lower Upper Keys). Other species, including spiny lobster, reef fish, king mackerel, bait fish, and pelagics, were all largely targeted in the Upper Keys. Species such as spiny lobster, reef fish, and bait fish, which are either very coastal or are reef-related, were landed within FKNMS waters (area 5), whereas more pelagic species were targeted in the offshore region of the Upper Keys.

Table 11: Commercial fisher 2004-05/2005 season landings by area - Upper Keys

Species group	*Area 1*	*Area 2*	*Area 3*	*Area 4*	*Area 5*	*Area 6*	*Area 7*
Stone crab (n = 14)	62.2	-	9.1	-	28.6	0.1	-
Spiny lobster (n = 24)	-	-	19.0	1.8	67.0	12.2	-
Reef fish (n = 15)	1.6	11.3	3.5	18.0	41.7	17.8	6.1
King mackerel (n = 8)	16.1	18.0	-	6.4	22.3	37.0	0.2
Spanish mackerel (n = 1)	-	-	-	-	20	80	-
Baitfish (n = 7)	-	7.7	-	-	72.9	19.4	-
Pelagics (n = 12)	20.3	-	0.2	24.3	9.5	45.7	-

Middle Keys fishers largely targeted areas 1 and 3 for the two main species, spiny lobster and stone crab, by the most of the region's sample (see Table 12). Fishers placed stone crab traps mainly in area 1 (Gulf of Mexico), followed by area 3. Together, these two areas contributed almost 95% of the Middle Keys respondents' total landings. Similarly, areas 1 and 3 provided over 81% of the regional sample's spiny lobster production, with less being landed in the deeper south Atlantic (area 4) and western FKNMS (area 2).

Table 12: Commercial fisher 2004-05/2005 season landings by area - Middle Keys

Species group	*Area 1*	*Area 2*	*Area 3*	*Area 4*	*Area 5*	*Area 6*	*Area 7*
Stone crab (n = 34)	59.6	0.6	35.0	3.1	1.6	-	-
Spiny lobster (n = 41)	28.8	3.7	52.6	9.3	5.2	0.3	-
Reef fish (n = 3)	-	20.2	56.4	3.2	-	-	20.2
King mackerel (n = 4)	54.9	43.9	-	-	-	-	1.2
Spanish mackerel (n = 5)	32.7	51.1	-	16.0	-	-	0.2
Bait fish (n = 5)	7.4	84.9	7.7	-	-	-	-
Pelagics (n = 3)	-	76.9	15.4	3.8	3.8	-	-

Lower Keys' fishers, like their counterparts in the Upper and Middle Keys, mostly fished in adjacent waters and targeted the two main trap fisheries; fewer targeted fin fish, including reef fish, pelagics, and king mackerel (see Table 13). Most of both trap fisheries were located in the western FKNMS (area 2), between Key West and Rebecca Shoal, and while an additional 14.7% of spiny lobster landings originated from the Dry Tortugas (area 7), the stone crab fishery did not extend further west beyond area 2. Reef fish was another fishery that had an important component in area 7, which comprised one-sixth of the sample's regional fishery landings. King mackerel landings were

skewed towards areas 1 and 2, fishing grounds for the net fishery; however, the hook and line segment of the fishery targeted various areas, including areas 4 and 7. The net fishing fleet accounted for the entire Spanish mackerel landings distribution, which was concentrated in areas 1 and 2. The regional sample consisted of several fishers who targeted pelagics, and the Lower Keys' pelagics fishing grounds consisted mainly of areas 1, 2, and 4; thus, pelagics fishers either fished north in the Gulf of Mexico (20.5%), south to the South Atlantic Ocean (27.8%), or west from Key West towards Rebecca Shoal (27.8%). Finally, it is important to discuss the declining shrimp fishery, which is located solely in Stock Island. In the 1995-96 study, the field research led to the identification of almost 20 shrimp fishers who docked in and fished out of Stock Island. In a recent study on the Tortugas Ecological Reserve, Thomas J. Murray & Associates (2005) determined that the Lower Keys shrimp fishery consisted of less than ten participants. The research team surveyed three of these remaining shrimp fishers.

Table 13: Commercial fisher 2004-05/2005 season landings by area - Lower Keys

Species group	*Area 1*	*Area 2*	*Area 3*	*Area 4*	*Area 5*	*Area 6*	*Area 7*
Stone crab (n = 38)	28.9	45.5	21.8	2.6	0.4	0.3	0.3
Spiny lobster (n = 55)	6.7	48.6	21.4	5.8	1.6	1.2	14.7
Shrimp (n = 2)	75.0	25.0	-	-	-	-	-
Reef fish (n = 27)	18.7	22.0	24.8	18.3	0.1	-	16.1
King mackerel (n = 11)	22.4	31.6	6.4	19.9	6.2	5.7	7.7
Spanish mackerel (n = 3)	49.3	50.7	-	-	-	-	-
Bait fish (n = 3)	6.9	70.7	15.5	6.9	-	-	-
Pelagics (n = 18)	20.5	40.4	9.2	27.8	-	-	2.1

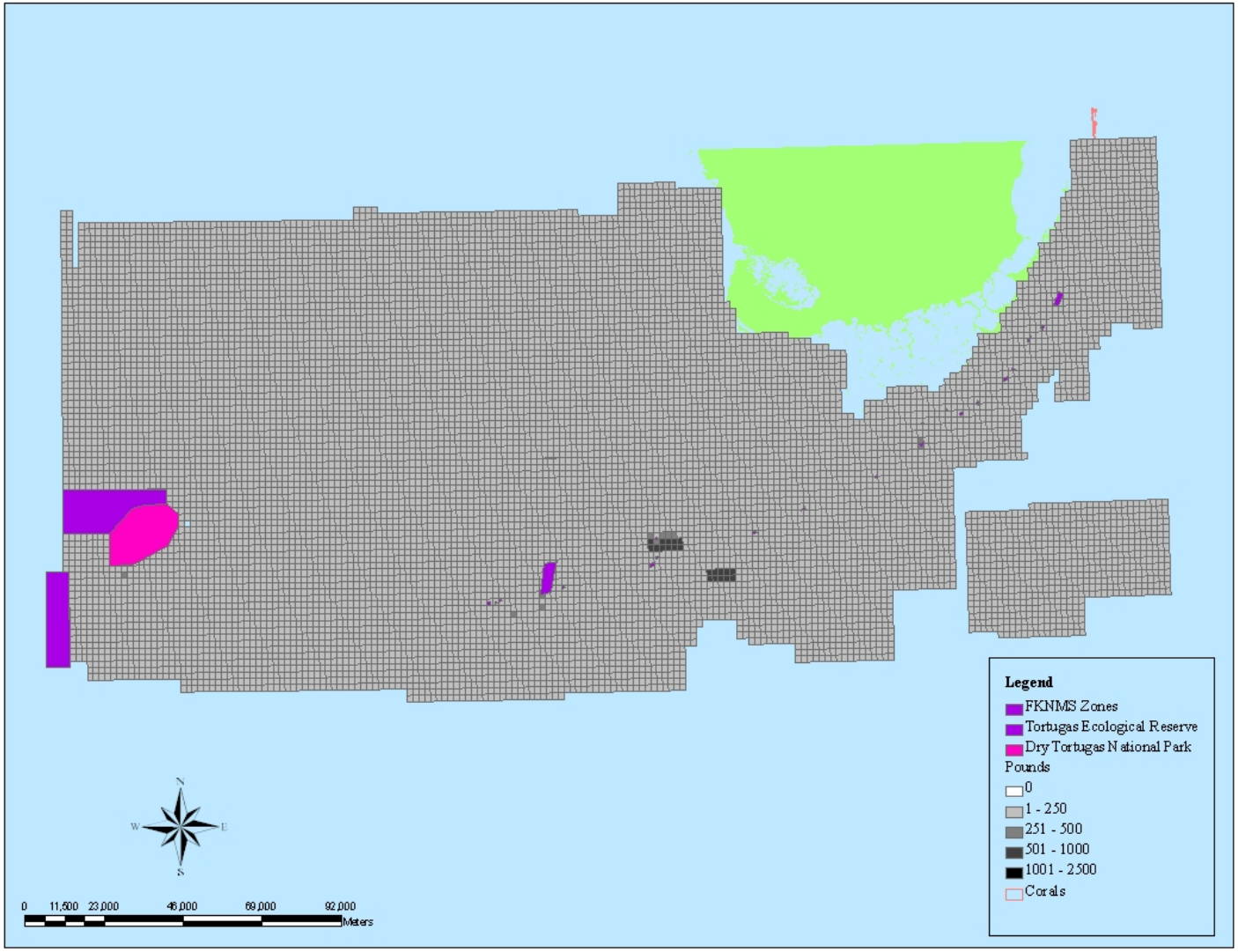

Figure 5: Commercial fisher spiny lobster landings

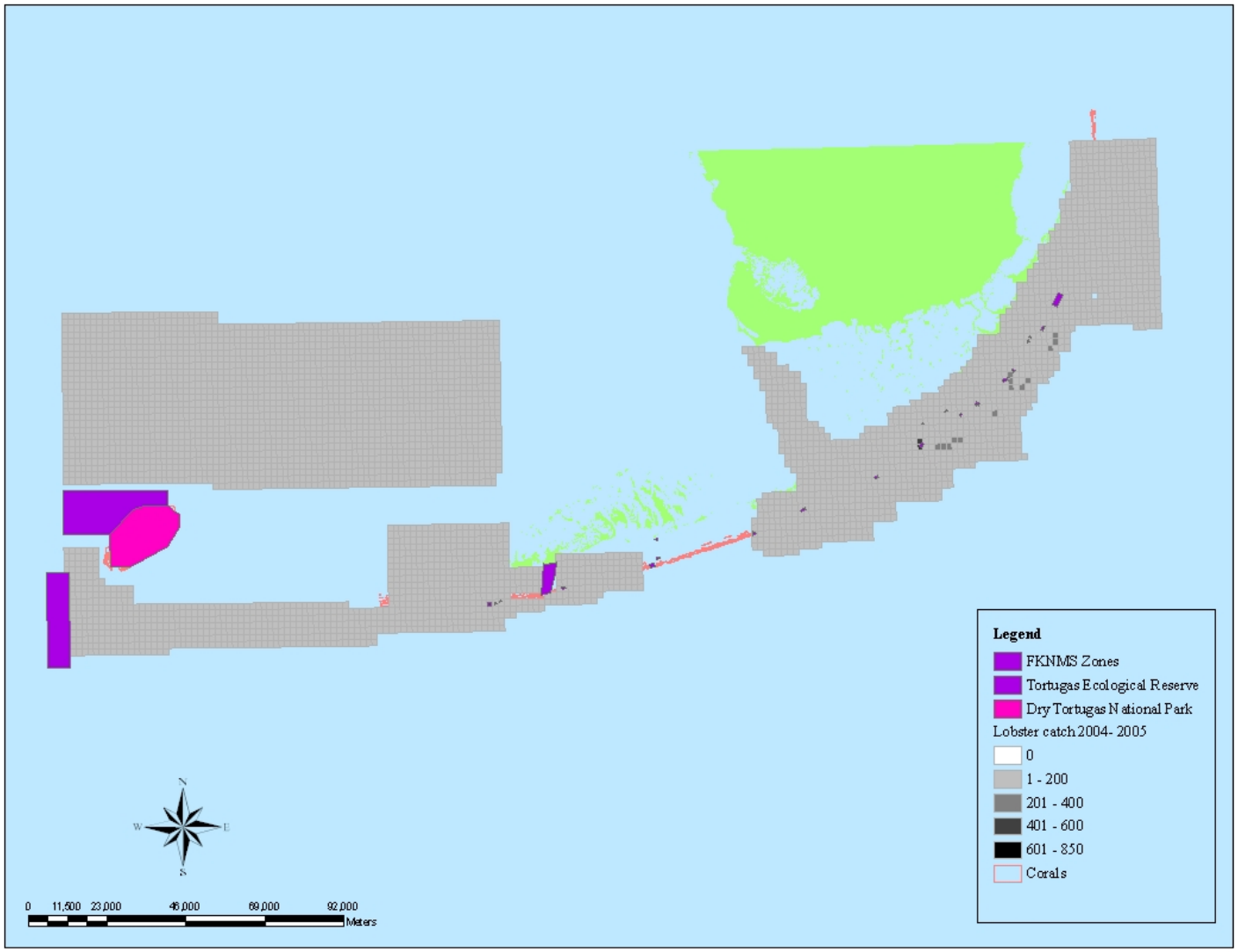

Figure 6: Commercial fisher spiny lobster landings - Upper Keys

Figure 7: Commercial fisher lobster landings - Middle Keys

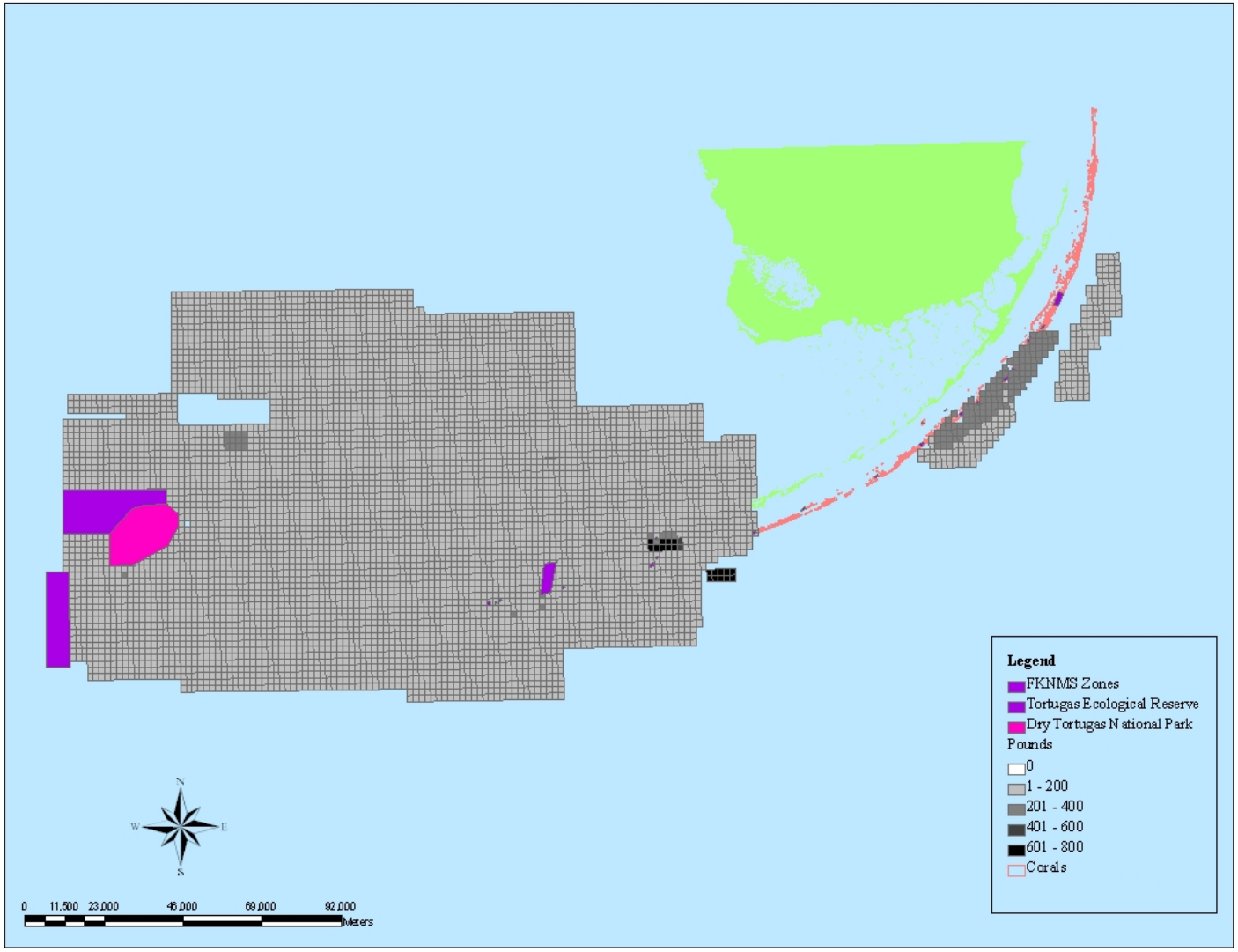

Figure 8: Commercial fisher spiny lobster landings - Lower Keys

Figures 5 to 8 show spiny lobster landings in the FKNMS, as reported by 120 fishers from the 2004-05 sample. Figure 5 shows landings across the Florida Keys for all fishers who reported spiny lobster landings, demonstrating that the fishery is spread across the entire region; however, the map also identifies 'hotspots' in the fishery, areas where landings are highest. In the Upper Keys, the South Atlantic side off Key Largo extending towards Islamorada represented an area of high landings. Similarly, the southwestern section of the Marquesas Keys in the western FKNMS produced high landings. It should also be noted that spiny lobster landings for the season largely occurred in the nearshore waters off either side of the Florida Keys, and that while landings extended well north into the Gulf of Mexico and south in the western parts of the archipelago, most of the landings were concentrated in areas closer to the islands and within the FKNMS.

The spiny lobster landings areas shown in Figure 6 were concentrated mainly along the Upper Keys reef tract, confirming the territorial nature of the region's (mainly) trap fishery. Fewer fishers targeted spiny lobster in the Middle Keys and fewer still in the Lower Keys. The Upper Keys fishery also extended into Biscayne Bay, reaching areas adjacent to Miami-Dade County.

Figure 7 shows that Middle Keys fishers took advantage of their geographical location by fishing both Lower and Upper Keys sections; however, the most concentrated landings originated from northern parts of the Middle Keys and northeast along the island chain. Few landings came from western parts of the Lower Keys, including the Dry Tortugas.

Figure 8 shows that Lower Keys fishers targeted the Lower Keys regions east and west of Key West, with most landings originating from either around the islands (Key West to the Content Keys) and north and south of the Marquesas. Use west of Key West extended considerably into the Gulf of Mexico and the Dry Tortugas, with lobster landings being reported for areas adjacent to the two sections of the Tortugas Ecological Reserve.

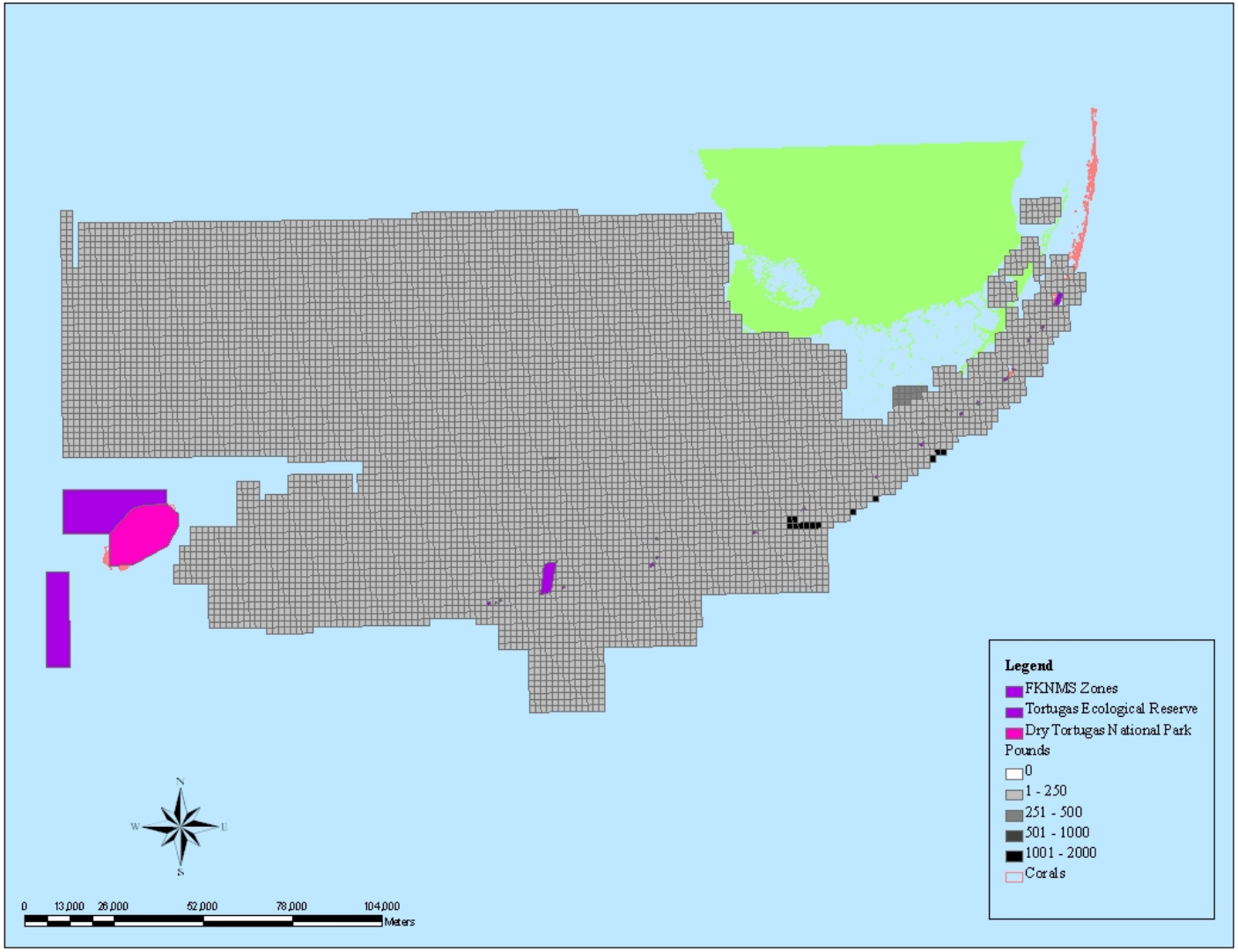

Figure 9: Commercial fisher stone crab landings

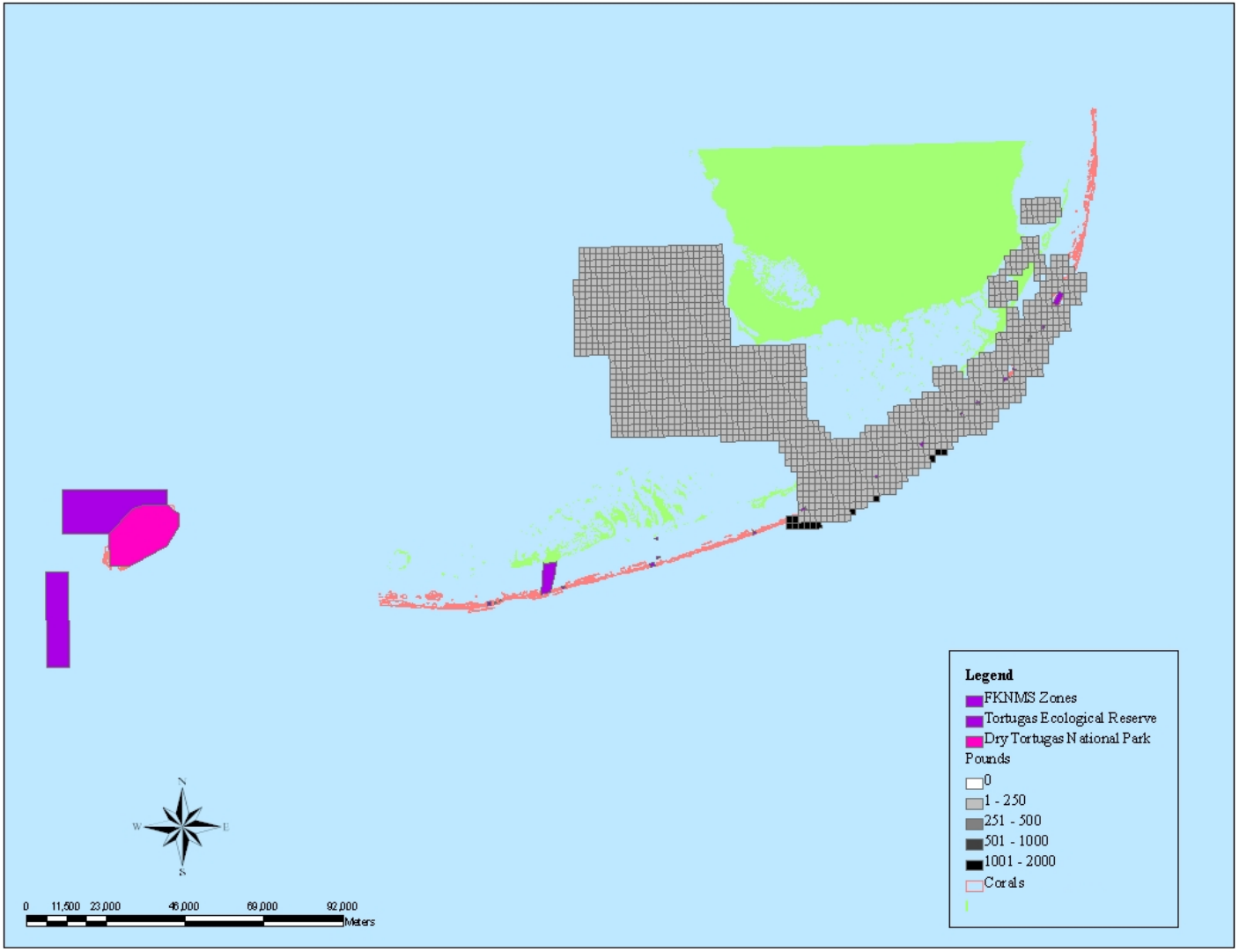

Figure 10: Commercial fisher stone crab landings - Upper Keys

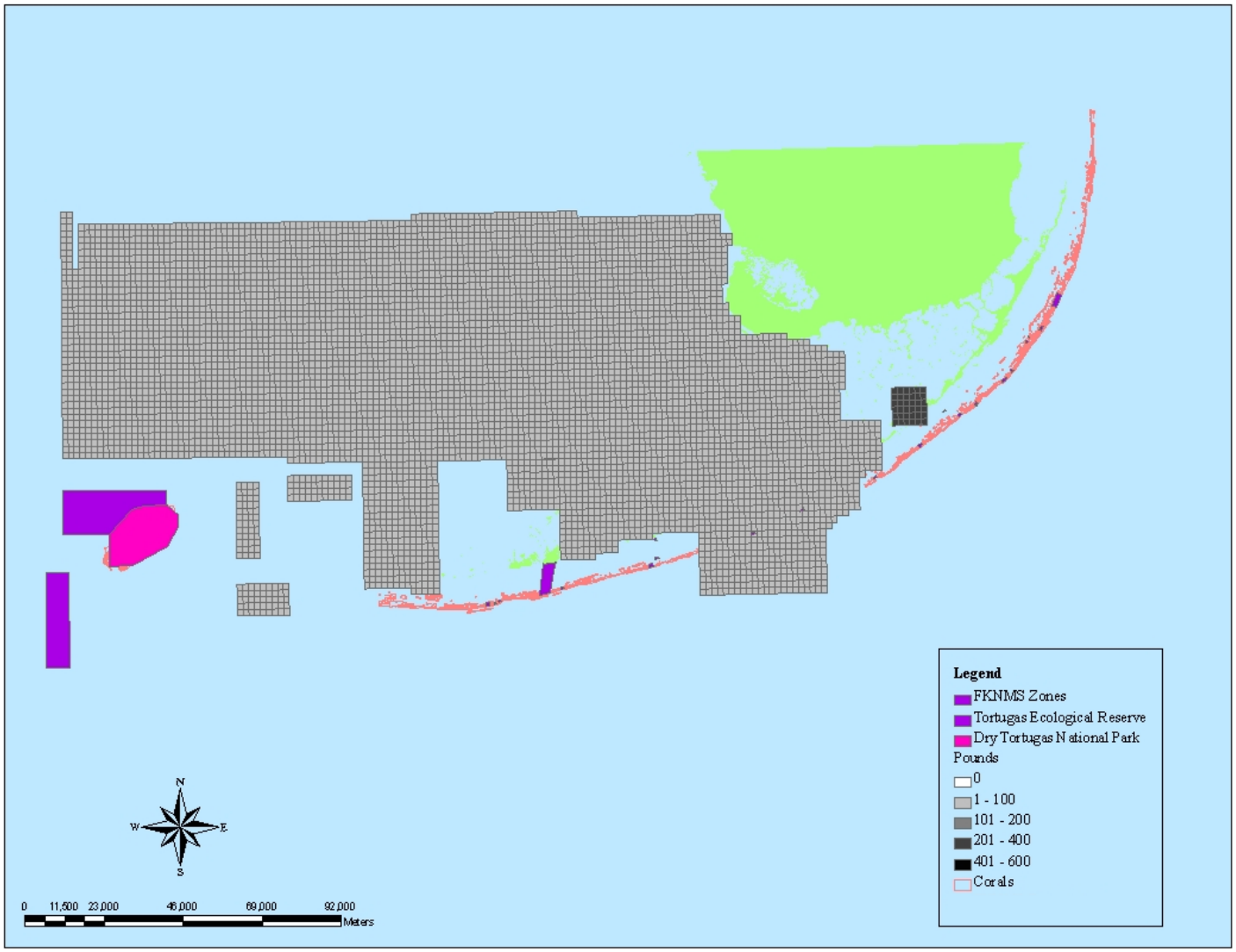

Figure 11: Commercial fisher stone crab landings - Middle Keys

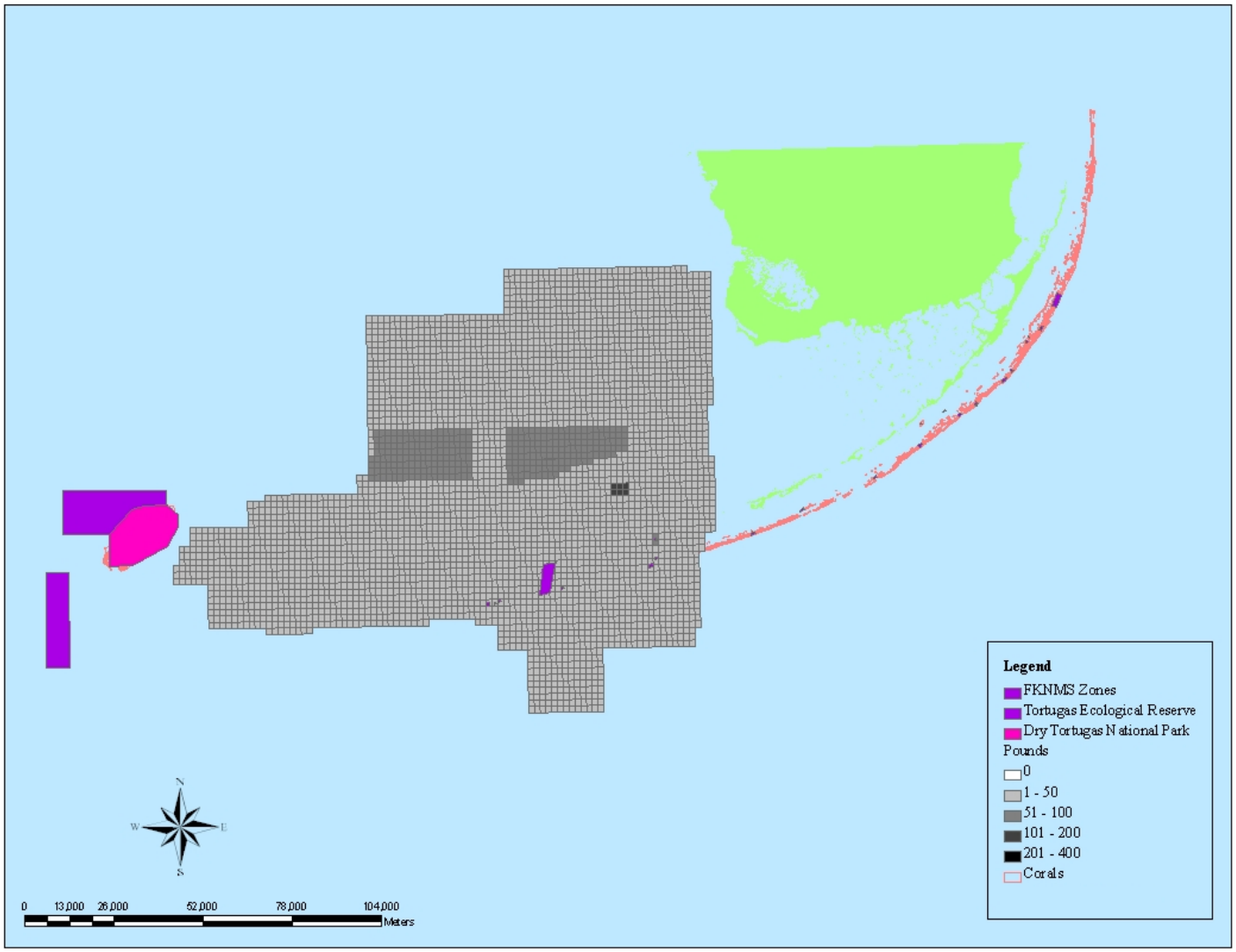

Figure 12: Commercial fisher stone crab landings - Lower Keys

Figures 9-12 show stone crab landings in the Florida Keys, as reported by the sample for the 2004-05 season (n = 86). Landings in the region including the entire FKNMS, but as with other species, Figure 9 shows that there were hotspots in which more stone crab was harvested than across the region. Most of the more heavily fished areas of the fishery were located in the middle section of the Florida Keys (on both sides of the Middle Keys).

As Figure 10 shows, the Upper Keys' stone crab landings were concentrated mainly in the Upper Keys regions south of Everglades National Park (where commercial fishing is prohibited)) and in Barnes and Card Sounds in the northern Florida Keys. The region contained the fewest traps and had the lowest catch, due in part to the lack of suitable stone crab habitat.

Figure 11 shows the Middle Keys' stone crab landings, which were concentrated on both sides of the Middle and Lower Keys and which extended into the western Gulf of Mexico. Although several respondents fished a considerable distance from port, the figure shows that most landings were concentrated around the principal port of Marathon in the Middle Keys.

Figure 12 shows that Lower Keys fishers separated much of their effort (and landings) from the adjacent Middle Keys fishers by concentrating in areas north and northeast of the Lower Keys and also in the western Florida Keys. Most overlap between fishers from the two regions (Lower and Middle Keys) occurred in the along the northern and northeastern sections of the Lower Keys.

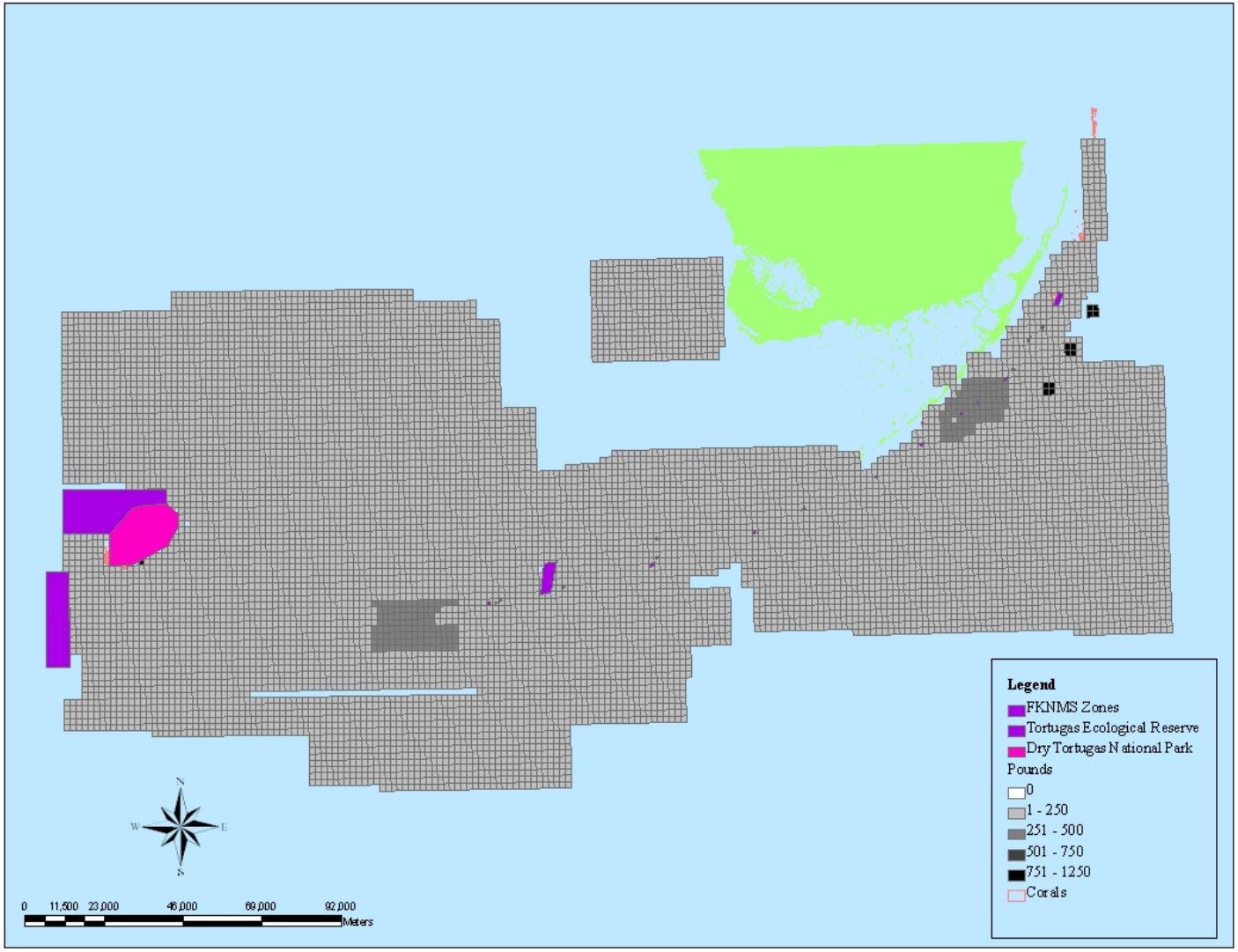

Figure 13: Commercial fisher reef fish landings

Figure 14: Commercial fisher reef fish landings - Upper Keys

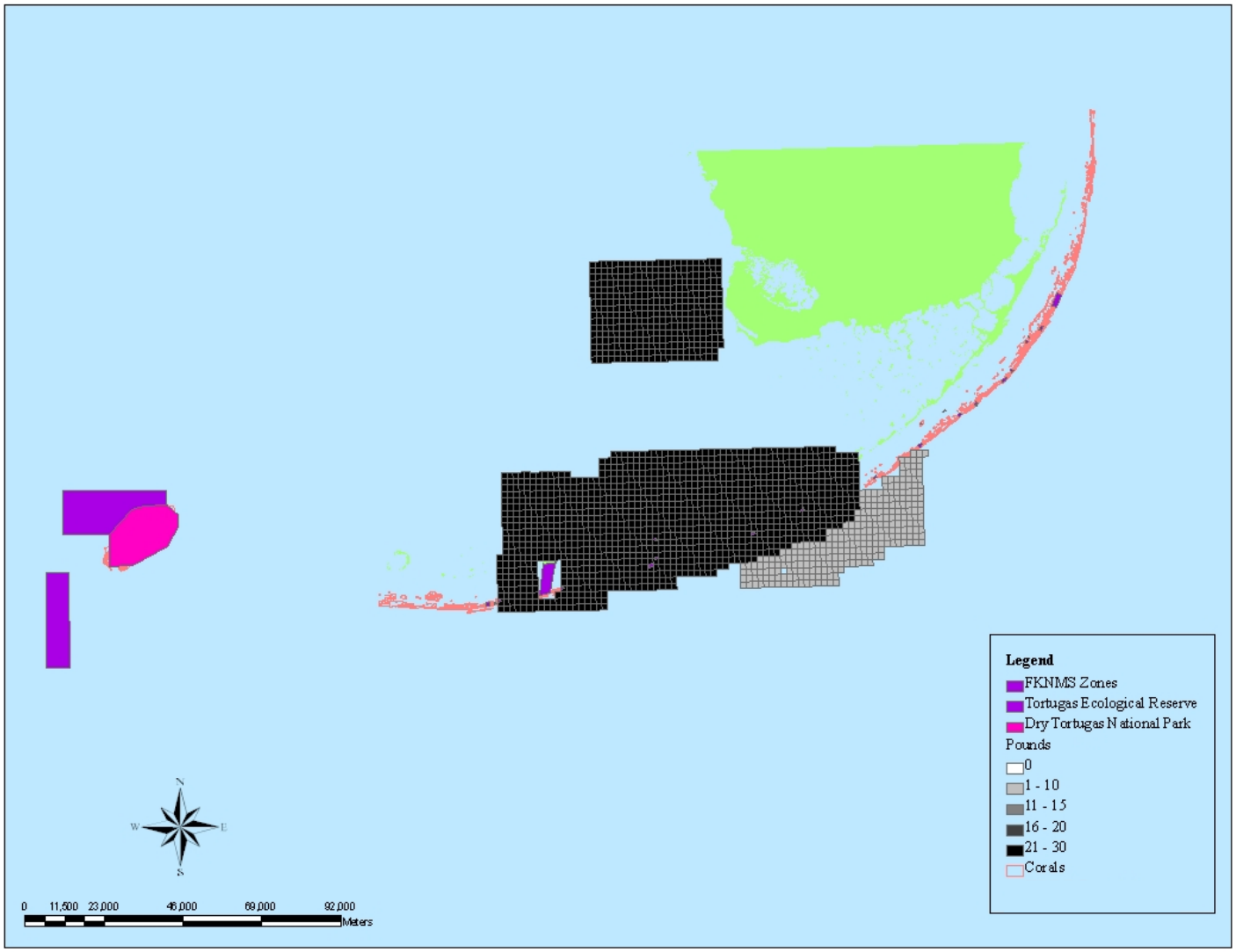

Figure 15: Commercial fisher reef fish landings - Middle Keys

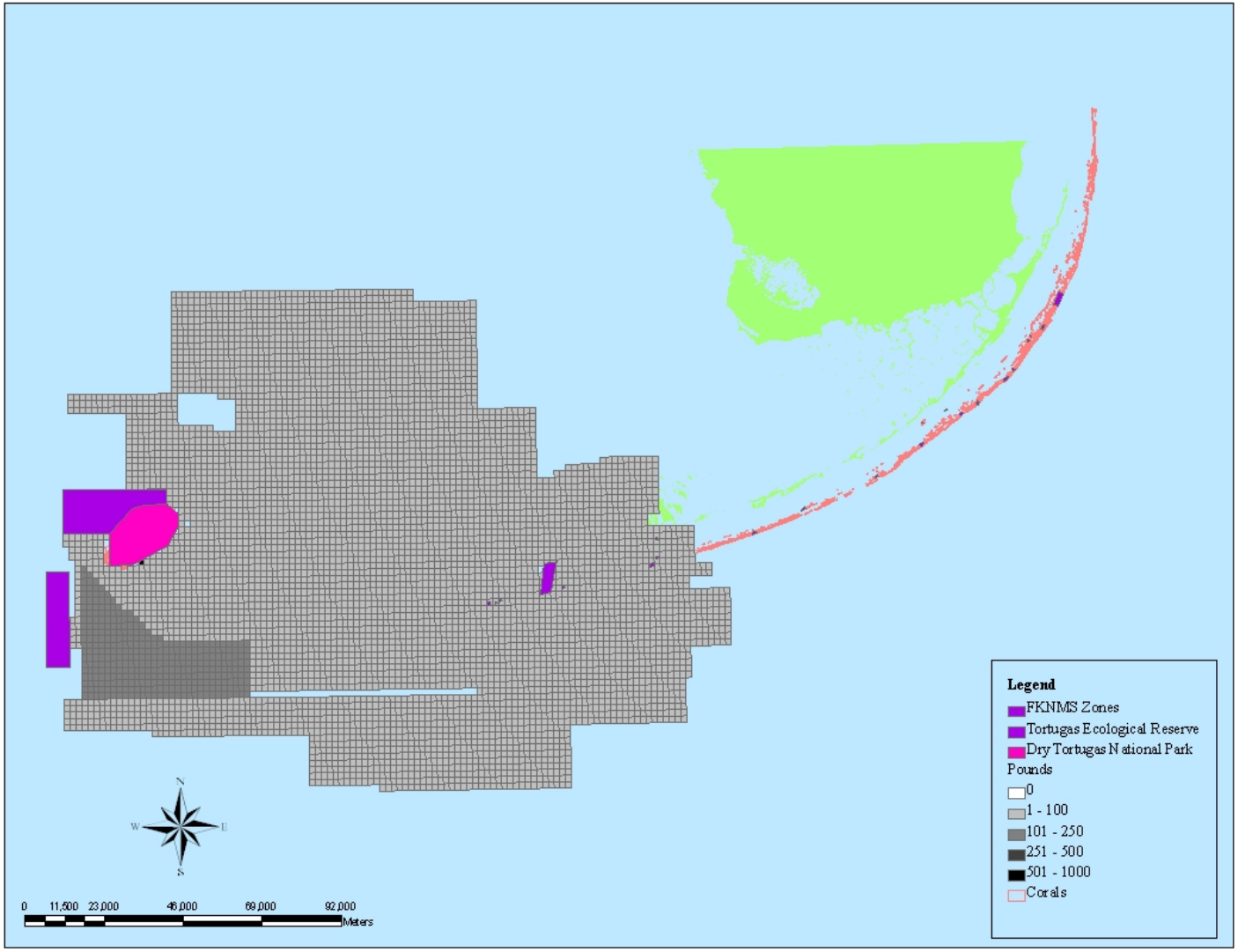

Figure 16: Commercial fisher reef fish landings - Lower Keys

Figures 13-16 show reef fishing landings in the Florida Keys, as reported by 45 respondents. Catch was prevalent all over the islands, both inside and out of the FKNMS (Figure 13. Landings were mostly concentrated in the Lower Keys, the western Gulf of Mexico and the South Atlantic.

Upper Keys fishers' landings (Figure 14) represented one of the few exceptions in all use profiles in that the landings were not restricted to the region in which the fishers resided. Instead, Upper Keys fishers targeted the entire Florida Keys and especially the South Atlantic section of the Lower Keys and areas north and west of the Dry Tortugas.

Middle Keys fishers' reef fish landings were more concentrated around their main port than those of Upper Keys fishers, and most fished in between the Middle and Lower Keys (Figure 15). However, there were landings along the eastern Gulf of Mexico.

As shown in Figure 16, Lower Keys fishers harvested reef fish only in the Lower Keys and Dry Tortugas, but where landings areas extended considerably north into the Gulf of Mexico and south into the South Atlantic Ocean. The most concentrated landings were in a swath inside the FKNMS, extending west from Big Pine Key to the Dry Tortugas.

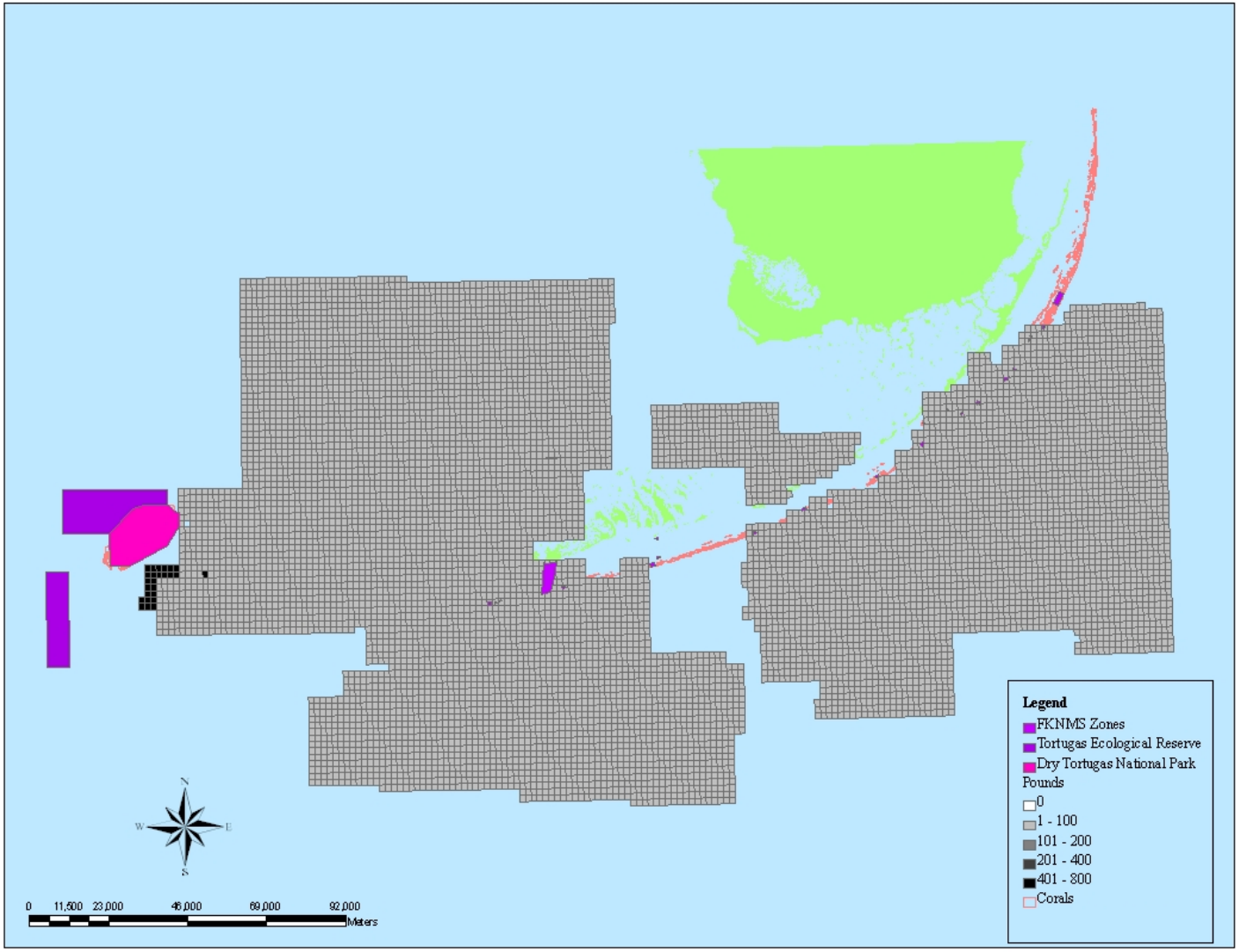

Figure 17: Commercial fisher pelagics landings

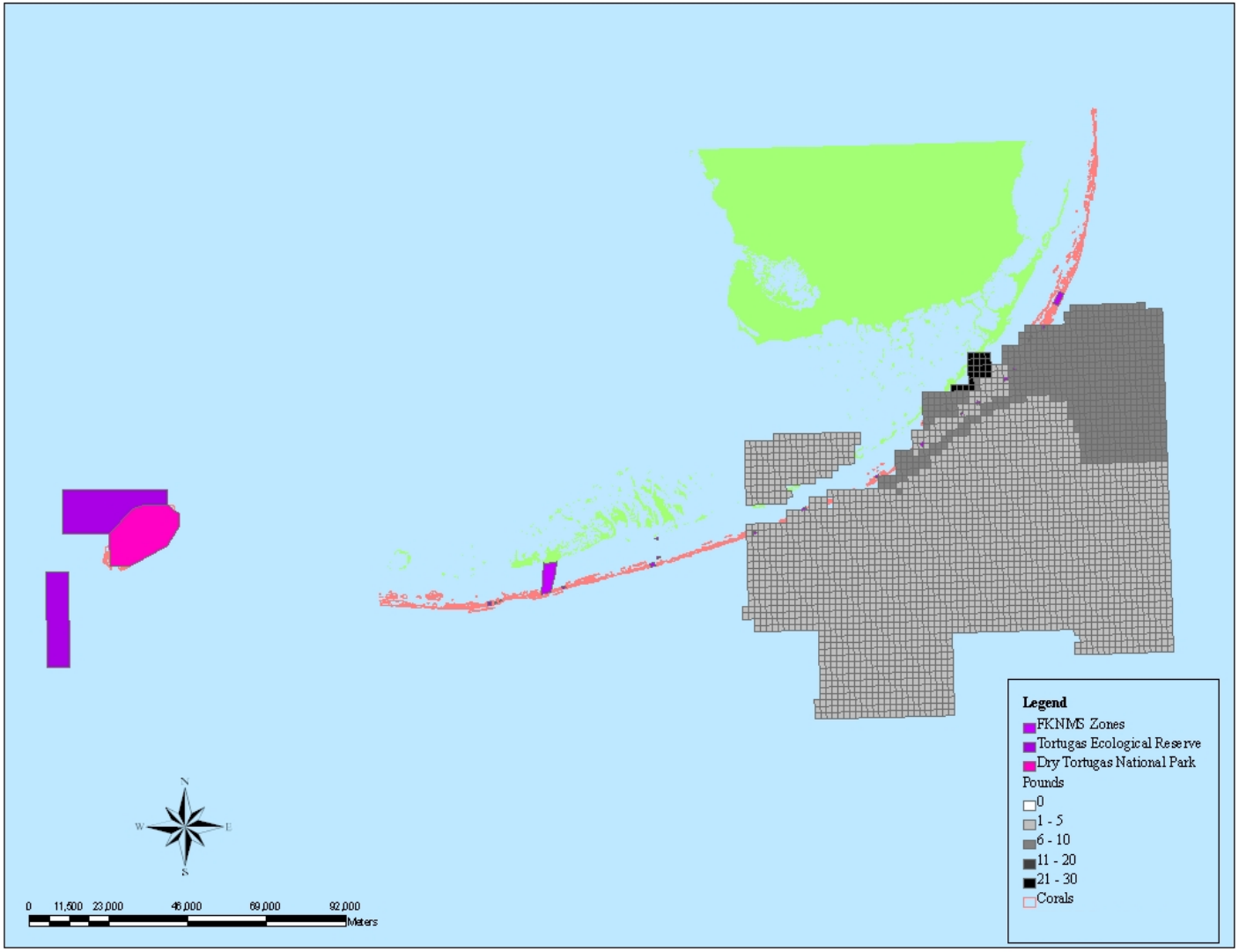

Figure 18: Commercial fisher pelagics landings - Upper Keys

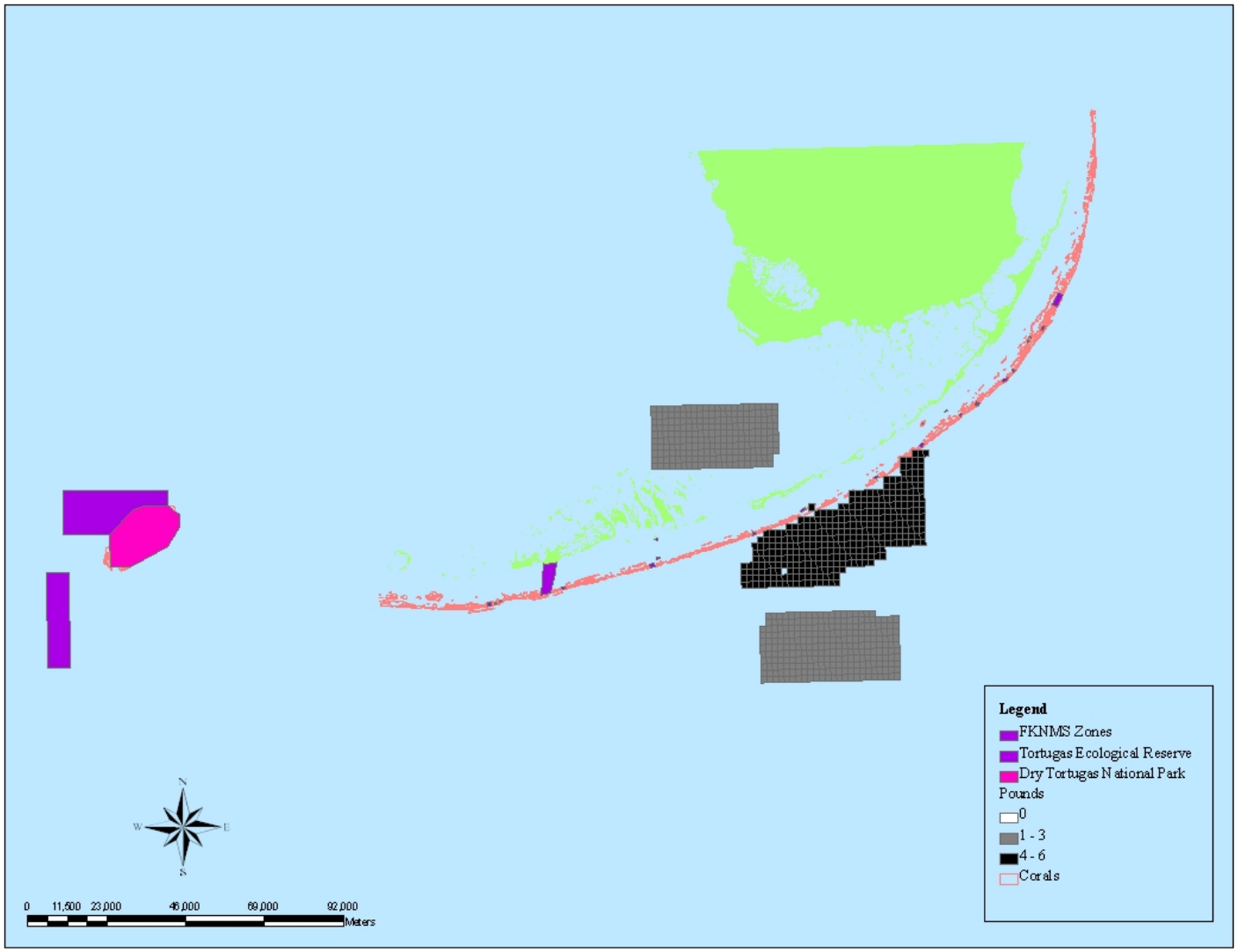

Figure 19: Commercial fisher pelagics landings - Middle Keys

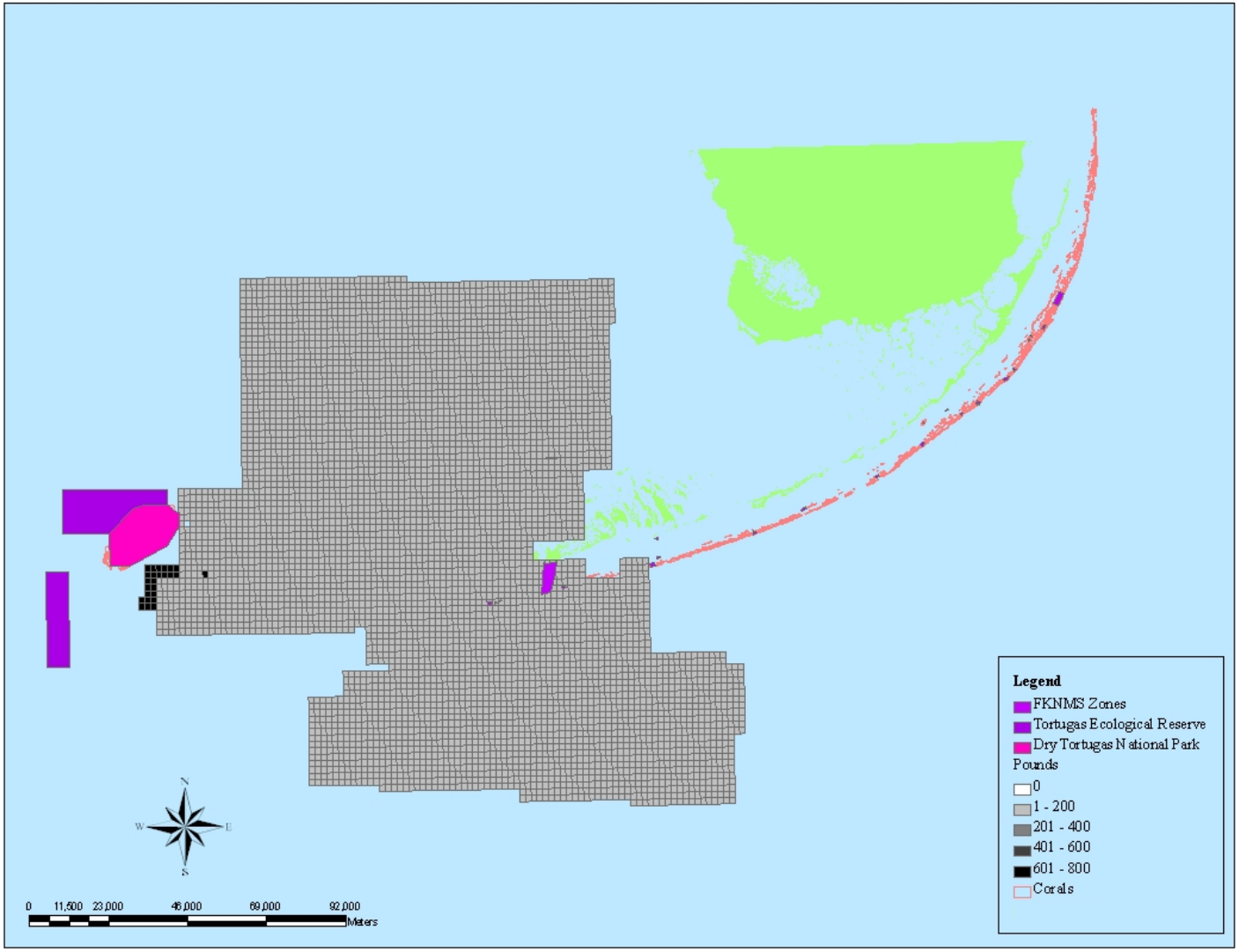

Figure 20: Commercial fisher pelagics landings - Lower Keys

Figures 17-20 show the distribution of pelagic fin fish landing in the Florida Keys, as reported by 33 fishers in the 2004-05 sample. Fishers targeted cobia, dolphin, tuna, and wahoo (among other pelagics) mainly along the southern sections of the region, and a majority of the harvest originated from outside the FKNMS (Figure 17). This finding is to be expected, as the pelagics targeted are found further from shore (in deeper waters), generally outside of the FKNMS boundary.

Figure 18 shows the Upper Keys fisher's pelagics landings, which were concentrated almost exclusively in the deeper waters south and southwest of the Upper Keys. Landings were highest in the northern section, and some harvest spilled over into the Middle Keys.

Due in part to the low participation rates in pelagics among Middle Keys fishers, the pelagics landings from that region were isolated in three areas, north and south of Marathon (Figure 19). Landings were concentrated in a region just south of the Middle Keys, and it extended towards the Upper Keys.

Lower Keys fishers used a wide area (located mainly in and around the Lower Keys), from south of Big Pine Key to the east past the Dry Tortugas to the west, to target pelagics (Figure 20). Both the Gulf of Mexico and South Atlantic areas outside the FKNMS were fished extensively. Also, as noted in a recent study on Tortugas Ecological Reserve (Thomas J. Murray & Associates, 2005), landings within the Dry Tortugas region were limited to the eastern end of the region.

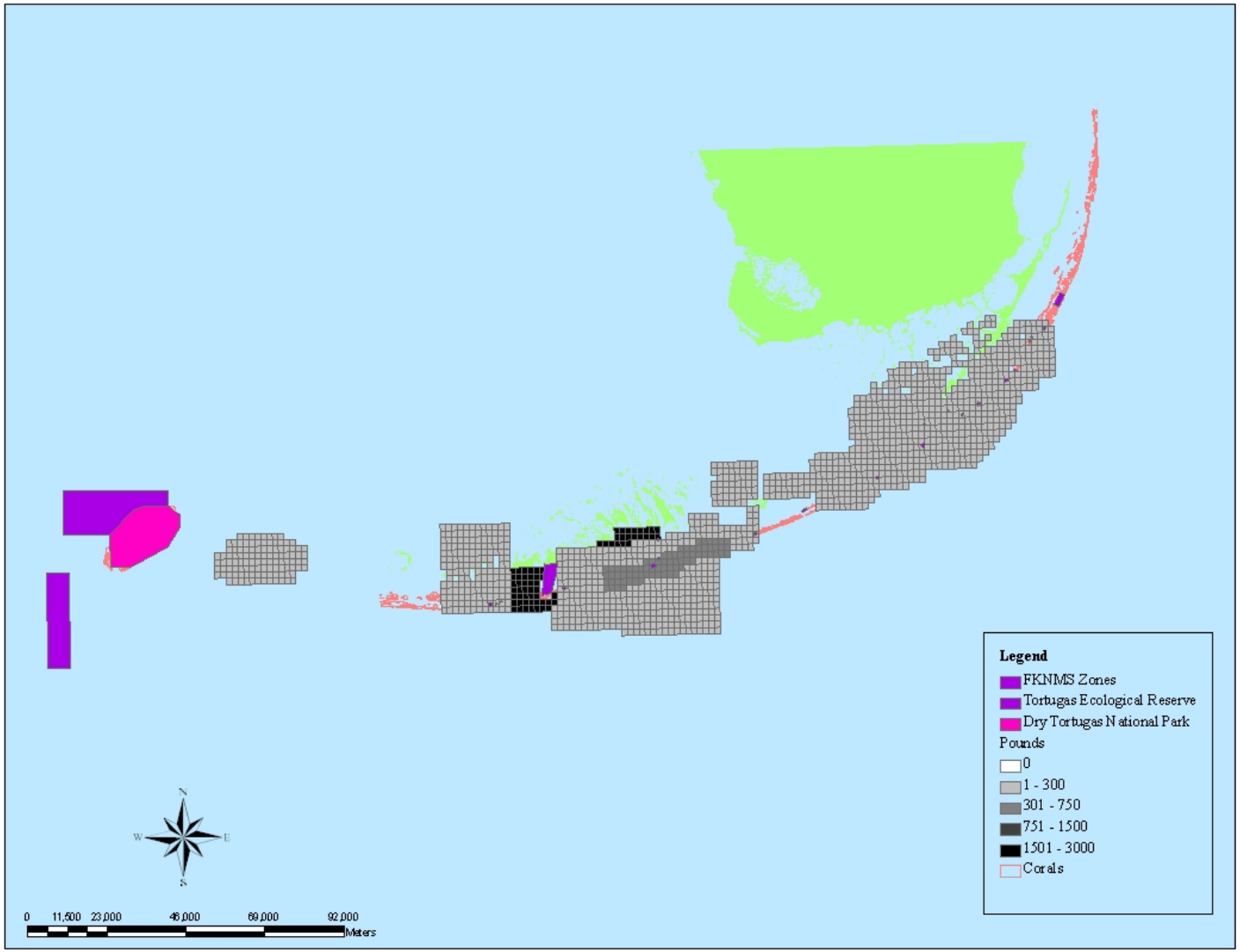

Figure 21: Marine life collection in the Florida Keys

Figure 21 shows the effort[8] reported by the 13 marine life collectors in the 2004-05 sample. The collectors took trips all over the Florida Keys, from the Upper Keys to the Marquesas Keys. Most of the effort was from within the FKNMS (and it is likely that those persons reporting trips from outside the FKNMS may have done so erroneously), with the most concentrated effort occurring south of the Lower Keys.

[8] Unlike the other maps in this section which are based on landings, the marine life collector map is based on effort, or trips. This is because marine life collectors harvest a large variety of species whose value is often derived by numbers and not weight. Moreover, not all collectors harvest the same species or the same suite of species.

Table 14: Percentage of commercial fishers fishing around FKNMS zones – based on total sample

FKNMS zone	*Spiny lobster*	*Stone crab*	*Reef fish*	*Pelagics*	*Marine life*	*Migratory*	*Bait fish*	*% change (std dev)*
1. Dry Tortugas Ecological Reserve	8.5	3.4	8.2	2.4	-	-	6.8	1.2 (23.8)
2. Sambos Ecological Reserve	17.0	6.5	2.7	0.7	2.0	0.7	-	2.6 (32.0)
3. Sand Key SPA	9.2	4.1	0.3	4.1	1.4	-	0.3	-8.6 (29.4)
4. Rock Key SPA	9.5	3.1	0.3	3.1	1.4	-	-	-5.4 (20.7)
5. Eastern Dry Rocks SPA	6.5	3.4	0.3	2.0	1.0	-	-	-5.9 (19.0)
6. Looe Key SPA	1.0	5.8	3.7	0.3	2.0	0.7	0.7	-10.0 (28.7)
7. Newfound Harbor Key SPA	0.7	7.5	1.4	-	1.4	0.3	-	-3.2 (10.4)
8. Sombrero Key SPA	1.7	3.7	1.7	0.3	1.7	0.3	0.3	0.9 (22.6)
9. Coffins Patch SPA	2.4	3.4	0.7	0.3	1.4	-	-	-8.4 (23.5)
10. Cheeca Rocks SPA	1.0	1.0	1.4	1.0	1.7	0.3	0.7	-16.9 (33.5)
11. Alligator Reef SPA	3.7	1.7	1.7	1.4	2.0	0.3	2.7	0.2 (32.0)
12. Hen and Chickens SPA	2.7	1.7	1.0	1.4	1.7	0.3	1.4	-3.3 (28.1)
13. Conch Reef SPA	5.4	0.7	1.4	1.4	2.0	0.3	2.4	-7.3 (25.6)
14. Molasses Reef SPA	4.1	-	2.0	1.4	1.7	0.3	0.7	-13.0 (28.6)
15. French Reef SPA	4.1	0.3	0.7	-	1.4	-	1.4	-13.5 (30.5)
16. Grecian Rocks SPA	3.4	-	0.7	-	1.4	-	-	-6.8 (28.5)
17. Dry Rocks SPA	2.7	-	0.3	-	1.4	-	-	-1.5 (26.4)
18. The Elbow SPA	3.7	-	1.7	-	1.4	-	-	-11.2 (38.1)
19. Carysfort/South Carysfort SPA	3.4	0.3	1.4	-	1.4	-	-	8.5 (33.3)
20. Eastern Sambos SUA	-	0.3	-	-	1.4	-	-	-10.0(N/A)
21. Looe Key SUA	-	3.4	0.7	-	1.7	-	0.7	8.0 (11.0)
22. Tennessee Reef SUA	2.7	4.1	1.0	0.3	1.7	-	-	-10.0 (28.9)
23. Conch Reef SUA	2.0	0.7	0.3	0.7	1.7	-	0.3	-1.4 (30.3)

Table 15: Percentage of commercial fishers fishing around FKNMS zones – based on participants in each fishery

FKNMS zone	*Spiny lobster*	*Stone crab*	*Reef fish*	*Pelagics*	*Marine life*	*Migratory*	*Bait fish*	*% change (std dev)*
1. Dry Tortugas Ecological Reserve	20.5	12.7	49.2	21.4	-	-	14.7	1.2 (23.8)
2. Sambos Ecological Reserve	41.0	24.2	16.2	6.2	65.3	8.2	-	2.6 (32.0)
3. Sand Key SPA	22.2	15.3	1.8	36.5	45.7	-	6.3	-8.6 (29.4)
4. Rock Key SPA	22.9	11.5	1.8	27.6	45.7	-	-	-5.4 (20.7)
5. Eastern Dry Rocks SPA	15.7	12.7	1.8	17.8	32.7	-	-	-5.9 (19.0)
6. Looe Key SPA	2.4	21.6	22.2	2.7	65.3	8.2	14.7	-10.0 (28.7)
7. Newfound Harbor Key SPA	1.7	27.9	8.4	-	45.7	3.5	-	-3.2 (10.4)
8. Sombrero Key SPA	4.1	13.8	10.2	2.7	55.5	3.5	6.3	0.9 (22.6)
9. Coffins Patch SPA	5.8	12.7	4.2	2.7	45.7	-	-	-8.4 (23.5)
10. Cheeca Rocks SPA	2.4	3.7	8.4	8.9	55.5	3.5	14.7	-16.9 (33.5)
11. Alligator Reef SPA	8.9	6.3	10.2	12.5	65.3	3.5	56.7	0.2 (32.0)
12. Hen and Chickens SPA	6.5	6.3	6.0	12.5	55.5	3.5	29.4	-3.3 (28.1)
13. Conch Reef SPA	13.0	2.6	8.4	12.5	65.3	3.5	50.4	-7.3 (25.6)
14. Molasses Reef SPA	9.9	-	12.0	12.5	55.5	3.5	14.7	-13.0 (28.6)
15. French Reef SPA	9.9	1.1	4.2	-	45.7	-	29.4	-13.5 (30.5)
16. Grecian Rocks SPA	8.2	-	4.2	-	45.7	-	-	-6.8 (28.5)
17. Dry Rocks SPA	6.5	-	1.8	-	45.7	-	-	-1.5 (26.4)
18. The Elbow SPA	8.9	-	10.2	-	45.7	-	-	-11.2 (38.1)
19. Carysfort/South Carysfort SPA	8.2	1.1	8.4	-	45.7	-	-	8.5 (33.3)
20. Eastern Sambos SUA	-	1.1	-	-	45.7	-	-	-10.0(N/A)
21. Looe Key SUA	-	12.7	4.2	-	55.5	-	14.7	8.0 (11.0)
22. Tennessee Reef SUA	6.5	15.3	6.0	2.7	55.5	-	-	-10.0 (28.9)
23. Conch Reef SUA	4.8	2.6	1.8	6.2	55.5	-	6.3	-1.4 (30.3)

Tables 14 and 15 present the percentage of commercial fishers in the sample and per fishery, respectively, that fished around the Ecological reserves (ERs), Sanctuary preservation areas (SPAs), and Special-use areas (SUAs). Fishers generally reported fishing spiny lobster and stone crab around most of the FKNMS zones, with the ERs attracting the most use. Over 40% of all spiny lobster fishers reported targeting area around Sambos Ecological Reserve for spiny lobster. The Tortugas Ecological Reserve region attracted almost half of all reef fish fishers. Areas around the smaller SPAs and SUAs did not attract as many fishers, suggesting that these zones do not provide much spillover benefit. However, a large percentage of the marine life collectors (a third or greater) targeted all zones except for the Tortugas Ecological Reserve. As might be expected, few zones offered benefits for those fishers targeting pelagics or migratory species (such as king mackerel), but Rock Key and Sand Key SPAs were important to over a quarter of pelagic fishers (in part as charter fishing trips). Similarly, although most areas around FKNMS zones were not important to bait fish fishers, the areas around Alligator Reef and Conch Reef SPAs were, attracting over half of all bait fish fishers in the sample.

Catch totals around these areas had remained largely unchanged (average differences in catches of +/- 10% around most zones), suggesting that fishers did not perceive either measurable spillover effects or insurmountable displacement impacts. Even fishers who targeted the larger zones (TER = 1.2% change and SER = 2.6% change) did not perceive large shifts in resource abundance around the zones. It is also noted that experiences among fishers varied around zone and by species, and the average change in overall catch rates is at best a crude measure. However, the results corroborate the spatial data described earlier in this section, showing how certain areas (ex. TER for spiny lobster and reef fish) are important for particular species. The other important result from these tables relates to the aforementioned, disproportionate effort reported by marine life collectors around these zones. While the zones, with the exception of the TER, do not affect many users, marine life collectors are highly dependent on the areas around almost all of the zones.

4.1.4. Commercial fisher survey attitudes, perceptions, and beliefs

Fishers described their views on the information sources on the FKNMS and their perceptions concerning the FKNMS process and its outcomes, the FKNMS zones, and FKNMS performance.

As shown in Table 16, commercial fishers used a variety of sources to learn about the FKNMS. Word of mouth represented the most common source of information, followed by FKNMS literature and FKNMS signage. Fewer fishers used media sources, among which newspapers were more often used than television or radio. Finally, few respondents identified direct contact with FKNMS staff or the Sanctuary Advisory Council as a source of information. There were several regional differences in which information source was utilized. Generally, Upper Keys fishers were better informed via most sources than their Middle and Lower Keys' counterparts.

When compared to the 1995-96 sample, fewer members of the 2004-05 sample received information on the FKNMS[9] from almost all similar sources. Newspapers and word of mouth served as the most important sources for fishers wanting to learn about the then FKNMS Draft Management Plan's zoning strategy and its potential impacts on their activities. However, because the FKNMS was implemented in July 1997, including its zoning and nine other action plans, information sources probably became less important to commercial fishers (with the noted exception of Dry Tortugas fishers from 1998-2001 period, during the *Tortugas 2000* process).

Table 16: Commercial fisher FKNMS sources of information

Information source	*1995-96 sample (n = 336)*	*Total sample (n = 294)*	*Upper Keys (n = 74)*	*Middle Keys (n = 75)*	*Lower Keys (n = 145)*
1. FKNMS website	-	9.2	9.5	14.7	6.2
2. FKNMS staff	22.6	11.2	17.6	4.0	11.7
3. Sanctuary Advisory Council	-	9.2	13.5	17.3	2.8
4. FKNMS literature	28.9	26.5	43.2	32.0	15.2
5. FKNMS signage	-	22.5	25.7	13.3	25.5
6. Newspapers	75.0	19.1	41.9	22.7	5.5
7. Radio	45.5	14.6	14.9	13.3	15.2
8. TV	45.5	13.3	25.7	24.0	1.4
9. Word of mouth	66.4	27.9	44.6	40.0	13.1

Fishers ranked the usefulness of the information sources on the FKNMS, generally rating each source used as among the most important; the results suggest that fishers sought sources that they believed would be the most useful, a finding in direct contrast to that found in the earlier study, where more fishers used a larger variety of information sources and then identified the most useful of these sources. Also, because a majority of fishers in the present study did not utilize multiple FKNMS information sources, as did the 1995-96 sample, their views on the usefulness of information sources were generally shaped by the fewer sources they referenced.

The sample provided its views on the transparency and fairness of the 1995-97 FKNMS designation process and the efficacy (even presence) of feedback and adaptive mechanisms since the implementation of the FKNMS. The questions used in the present study were all modified (in the past tense) from the 1995-96 study, when the same questions were presented in the conditional or future tense.

Table 17 shows that the overall views of commercial fishers on the FNKMS process had moderated since the 1995-96 study. The average response to the question (Question 1) concerning openness and fairness of the FKNMS zone designation process was significantly lower (i.e. more agreement) among 2004-05 study fishers than among 1995-

[9] The 1995-96 commercial fisher survey question on information sources requested that respondents identify sources they used on obtaining information on the then draft FKNMS zoning strategy; thus, the link between the earlier and 2004-05 sample is not direct and should be viewed as a general comparison, in how fishers received information in the two studies.

96 fishers. Similarly, the earlier study's sample was significantly more in agreement with the questions (Questions 4 and 5) that NOAA had not paid attention to local government and individual citizen concerns than were 2004-05 study respondents. In Question 6, 1995-96 study fishers were generally in agreement that there would be no way that the average person would be able to voice his/her opinion on the usefulness of FKNMS regulations. While the average response among fishers in the present study also suggested that they agreed with this question, the level of agreement was significantly lower than in the earlier study. Finally, and perhaps most importantly, the views held by the two samples in Question 7 elucidate the shift in fisher opinions on the FKNMS process. In 1996, fishers disagreed that the procedures that NOAA would adopt to address violation of FKNMS regulations would be fair and just. After a decade of FKNMS management, fishers changed that view, and the average response to the same question in the 2004-05 sample was slight agreement.

While the changes in between the two studies show perhaps a greater acceptance of the FKNMS and its zoning strategy over time, it should be noted that fishers nevertheless remained wary of many aspects of the FKNMS. As shown in Table 14, over half of the 2004-05 study sample disagreed that the processes that NOAA used to develop the FKNMS rules and regulations and the boundaries and regulations for the FKNMS zones were open and fair. Also, over 60% of the respondents agreed that participation did not matter in the process, and that the average person could not influence the final decisions. These results suggest a sense of inevitability within and isolation from the decision-making process, shared among both the 2004-05 and 1995-96 studies' samples.

Table 17: Commercial fisher views on the FKNMS process

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.	2004-05 (n = 294)	10.9	17.0	11.2	15.3	35.7	8.8	n = 268 3.55 (1.47)∫
	1994-95 (n = 317)	8.5	16.1	6.6	12.0	34.7	22.1	n = 247 3.62 (1.48)∫
2. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.	2004-05 (n = 294)	10.2	17.4	15.3	14.3	37.1	4.8	n = 280 3.53 (1.49)*∫
	1995-96 (n = 315)	3.2	5.7	6.0	14.0	47.6	23.5	n = 241 4.26 (1.14)*∫
3. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.	2004-05 (n = 293)	49.5	13.3	5.1	13.3	11.6	6.1	n = 275 2.19 (1.50)
	1995-96 (n = 318)	53.8	13.8	4.4	9.4	8.8	9.8	n = 287 1.95 (1.39)
4. NOAA has not addressed the concerns of local and state governments in developing rules and regulations for the FKNMS.	2004-05 (n = 292)	25.7	11.6	14.4	16.4	13.4	18.5	n = 238 2.76 (1.49)*∫
	1995-96 (n = 316)	52.2	12.7	7.0	4.1	3.8	20.3	n = 252 1.67 (1.13)*∫
5. NOAA has not addressed the concerns of individual citizens in developing rules and regulations for the FKNMS.	2004-05 (N = 293)	46.1	12.0	10.6	13.7	10.6	7.2	n = 272 2.25 (1.47)*∫
	1995-96 (n = 316)	62.3	13.3	2.53	3.8	3.5	14.6	n = 270 1.51 (1.04)*∫

6. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.	2004-05 (n = 285)	49.1	14.0	10.2	11.6	9.1	6.0	n = 268 2.12 (1.41)*∫
	1995-96 (n = 318)	70.0	7.2	1.3	5.7	5.0	13.8	n = 274 1.54 (1.17)*∫
7. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.	2004-05 (n = 283)	19.8	20.1	13.4	10.3	20.1	16.3	n = 237 2.89 (1.51)*∫
	1995-96 (n = 315)	2.5	5.7	4.8	6.7	50.2	30.2	n = 220 4.38 (1.14)*∫

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Next, fishers provided their views on the outcomes and/or performance of the FKNMS zones, as determined by the main purpose of the zones (i.e. the reason why the zones were designated), the groups that have most benefited from the zones, and fisher support for zones. Unlike in the earlier study when all FKNMS zone types were considered together (as 'FKNMS' zones), the present study divided the zones into their three main types that address access[10] and use: Ecological reserves (ERs), Sanctuary preservation areas (SPAs), and Wildlife Management Areas (WMAs)[11].

Table 18: Commercial fishers' views on FKNMS zone purpose and beneficiaries

Question	*1995-96 sample*	*Ecological reserves*	*Sanctuary preservation areas*	*Wildlife management areas*
1. Which of the following represents the main purpose of the FKNMS zones?				
a. Increasing overall fish stocks and biomass inside the zones	44.3	40.5	35.4	16.7
b. Increasing overall fish stocks and biomass outside the zones	23.1	22.5	26.2	15.0
c. Conserving and protecting corals, fish, and other marine life	39.0	42.9	51.4	25.5
d. Resolving user group conflicts		8.2	12.9	8.8
e. Supporting scientific research		22.8	25.5	15.0
2. Which groups have benefited the most from FKNMS zones?				
a. Commercial fishers	5.4	16.3	16.3	8.8
b. Recreational/sport fishers	32.1	25.5	33.7	19.1
c. Commercial dive operators		36.4	46.9	23.5
d. Recreational (local and tourist) divers	67.9	44.6	59.5	27.6

As shown in Table 18, most commercial fishers believed that the main purpose of the FKNMS zones is to conserve and protect corals, fish, and other marine life. Related in part to that view, the second most frequent purpose listed was that of increasing stocks and biomass within the zones. However, fewer fishers believed that the main purpose of the FKNMS zones is to export stocks and biomass from the zones (i.e. the replenishment concept). It is important to note that fishers, even after a decade of FKNMS management, had not embraced replenishment as one of the purposes of the zoning strategy, a position that had in part led to the renaming of replenishment reserves to

[10] A fourth type of zone, Special-use Areas (SUAs), also affects access in the FKNMS (NOAA, 1996); however, the FKNMS contains only four, very small SUAs, and these zones prohibit all activities, including consumptive and nonconsumptive uses. As discussed in the FKNMS management plan and corroborated by regional user group studies (Thomas J. Murray & Associates, 2007; Shivlani and Suman, 2000; Milon et al., 1997), very few stakeholders used and/or were negatively affected by the SUAs.

[11] The FKNMS includes a total of 27 Wildlife Management Areas, of which seven were created during the FKNMS designation process and are managed exclusively by the FKNMS. The remaining 20 WMAs existed prior to the implementation of the FKNMS, and these are co-managed by the FKNMS and the US Fish and Wildlife Service.

ecological reserves (Suman et al., 1999; NOAA, 1996). Fewer fishers believed that the main purpose of the zones is to resolve user group conflicts. Also, most respondents perceived ERs and SPAs as having similar purposes, as determined by the similar percentages provided for each zone type. However, fishers differentiated ERs and SPAs from WMAs, the latter which only a quarter or less of the sample attributed with any purpose. The results suggest that the respondents were mostly unfamiliar with WMAs, especially in terms of their purpose.

Also, Table 18 shows the sample's view on FKNMS zone beneficiaries. A majority of fishers in both the 2004-05 and 1995-96 samples identified recreational divers as the primary beneficiaries of the FKNMS zones. Their own group, that of commercial fishers, was perceived as the group that has least benefited from the FKNMS zones, a perception that remained unchanged since the earlier study. However, more fishers (16.3%) listed their group as benefiting from ERs and SPAs than did the 5.4% of fishers in the 1995-96 sample.

Importantly, the results show that fishers were able to separate objectives and beneficiaries between zone types, especially as these related to ERs and SPAs. For instance, a higher percentage of respondents (40.5%) listed ERs for having the purpose of increasing stocks and biomass within the ERs than did fishers (35.4%) who listed SPAs. Conversely, more fishers (59.5%) identified recreational divers as the primary beneficiaries of SPAs than did fishers (44.6%) who listed ERs. These differences suggest that the respondents understood that the smaller SPAs were designed to attract recreational use whereas the larger ERs were set up to protect ecosystem function. The results also demonstrate that the fishers were largely unsure of the WMAs, both in terms of their purpose and beneficiaries. As most of these zones had already been in existence prior to the FKNMS and are mainly associated with access regulations around islands, it is likely that fishers do not usually use the areas (or the vicinity).

Finally, fishers provided their opinions on the effectiveness of zones and their willingness to support present and future zones in the FKNMS. Table 19 demonstrates that respondents generally disagreed that FKNMS zones had either reduced conflicts or been effective in restoring coral reefs in the region. However, in terms of zone support and performance, fishers were more in favor of smaller zones such as the SPAs or WMAs but less so of ERs. Thus, the average responses provided for support for FKNMS zones in the Upper, Middle, and Lower Keys were generally more favorable for SPAs and WMAs than for ERs (although it should be noted from the response rates that many fishers opted not to provide opinions on WMAs, whose function and benefits were less clearly understood than those of the ERs and SPAs). Although fishers moderated their views on zones in particular regions (ex. a potential NIMBY response), they rejected the option of having more FKNMS zones.

An important finding in comparing the 2004-05 and 1995-96 samples was that the results on FKNMS zones suggest that fishers now are less trenchant in their views concerning marine protected areas. The average response for all questions concerning FKNMS zones and their benefits in the 1995-96 sample was 4.00 or greater (on a scale from 1 to

5, where 1 means strongly agree and 5 means strongly disagree). These means were all significantly higher for means of the same questions in the 2004-05 sample on ERs and SPAs, which were 3.7 or lower (WMA means were not compared as these were not used as part of the 1995-96 study). While fishers from the present study did not agree that FKNMS zones have reduced conflicts or been effective in restoring coral reefs in the Florida Keys, their average responses to these questions were significantly less skewed towards disagreement than were average responses by the 1995-96 sample. Similarly, support for FKNMS zones as they are currently established or in parts of the Florida Keys was higher among the current sample than the previous one. Along with the views on the FKNMS process, these findings show that the commercial fishing industry may have shifted moderately towards less disagreement over FKNMS policies over the past decade.

Table 19: Commercial fisher views on the outcomes of FKNMS zones

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. FKNMS zones have reduced conflicts between different user groups.	ER (n = 192)	5.2	17.2	20.3	13.5	43.8	-	n = 192 3.73(1.32)*∫
	SPA (n = 246)	9.8	17.9	23.2	14.2	34.2	0.8	n = 244 3.45(1.38)*∫
	WMA (n = 152)	9.9	17.8	21.1	13.8	34.2	3.3	n = 147 3.45 1.40)*∫
	1996 (n = 318)	3.8	7.6	4.7	7.9	66.9	9.2	n = 288 4.39(1.16)*∫
2. FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they used to be.	ER (n = 207)	13.5	19.3	14.0	13.0	36.7	3.4	n = 200 3.42(1.50)*∫
	SPA (n = 248)	15.7	19.0	16.1	16.1	30.6	2.4	n = 242 3.28(1.48)*∫
	WMA (n = 139)	13.0	13.0	18.0	11.5	36.7	7.9	n = 128 3.50(1.48)*∫
	1996 (n = 316)	7.9	11.1	5.4	8.9	60.4	6.3	n = 296 4.10(1.39)*∫
3. I support the establishment of FKNMS zones as they are established currently.	ER (n = 207)	22.7	16.9	10.6	12.1	36.2	1.5	n = 204 3.23(1.63)*∫
	SPA (n = 258)	24.4	21.3	9.3	12.8	30.6	1.6	n = 246 2.98(1.60)*∫
	WMA (n = 170)	27.1	17.1	14.1	11.2	25.9	4.7	n = 162 2.91(1.59)*∫
	1996 (n = 318)	1.9	3.8	3.8	5.7	80.5	4.4	n = 304 4.66(0.88)*∫
4. I support the establishment of FKNMS zones in the Upper Keys.	ER (n = 191)	23.6	14.7	13.6	10.5	34.0	3.7	n = 184 3.17(1.62)*∫
	SPA (n = 248)	25.4	18.2	13.7	8.5	20.6	3.6	n = 239 3.01(1.62)*∫
	WMA (n = 157)	26.8	14.7	14.7	10.8	27.4	5.7	n = 148 2.97(1.61)*∫

	1996 (n = 315)	9.5	13.3	7.3	2.9	62.2	4.8	n = 300 4.00(1.48)*∫
5. I support the establishment of FKNMS zones in the Middle Keys.	ER (n = 199)	20.6	15.1	15.1	11.1	34.7	3.5	n = 192 3.25(1.59)*∫
	SPA (n = 249)	23.7	18.5	15.3	9.2	30.1	3.2	n = 241 3.04(1.59)*∫
	WMA (n = 158)	24.1	14.6	16.5	10.1	29.1	5.7	n = 149 3.06(1.59)*∫
	1996 (n = 314)	7.3	10.8	5.4	4.8	66.6	5.1	n = 298 4.18(1.37)*∫
6. I support the establishment of FKNMS zones in the Lower Keys.	ER (n = 203)	19.7	16.3	12.8	9.8	37.4	3.9	n = 195 3.30(1.60)*∫
	SPA (n = 249)	22.5	18.9	14.9	8.8	30.9	4.0	n = 239 3.07(1.59)*∫
	WMA (n = 160)	21.9	16.2	16.2	10.0	20.0	5.6	n = 151 3.11(1.58)*∫
	1996 (n = 315)	7.6	13.6	4.8	2.9	67.6	3.5	n = 304 4.13(1.42)*∫
7. I support the establishment of FKNMS zones in the Dry Tortugas.	ER (n = 213)	22.5	14.1	10.8	12.7	36.6	3.3	n = 206 3.28 (1.63)
	SPA (n = 241)	25.3	13.3	14.9	9.1	31.9	5.4	n = 228 3.10 (1.63)
	WMA (n = 153)	22.2	11.1	15.0	12.4	32.0	7.2	n = 142 3.23 (1.60)
8. There should be more FKNMS zones in the Florida Keys.	ER (n = 218)	3.2	6.0	4.6	10.1	75.7	0.5	n = 217 4.50 (1.05)
	SPA (n = 266)	4.5	6.4	6.8	14.3	68.1	-	n = 266 4.35 (1.14)
	WMA (n = 175)	4.0	5.7	2.9	13.7	70.9	2.9	n = 170 4.46 (1.08)

* all 1995-96 and ER and SPA means are statistically significant ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
**1-5 scale, where 1 is strongly agree and 5 is strongly disagree

The respondents provided their views on the benefits of and support for FKNMS establishment, as well as their perceptions on the changes in resource conditions in the Florida Keys since the establishment of the FKNMS. Furthermore, the sample identified areas in which it believed that the FKNMS had succeeded and in those where it had failed.

As shown in Table 20, the sample was split in its views on whether the FKNMS had made positive economic and environmental contributions to the Florida Keys and if the marine environment had benefited from NOAA's National Marine Sanctuary Program. Also, an equal percentage of fishers were in favor of and against the establishment of the FKNMS. While these findings suggest a tepid view towards FKNMS management, the fishers' opinions represent a drastic and significant shift from the views held by the 1995-96 sample. In November 1996, 55% of those who voted in the Florida Keys wide referendum on the FKNMS voted against the establishment of the FKNMS (Suman et al., 1999). Over 78% of the fishers interviewed in the previous study stated that they were against the establishment of the FKNMS, while only 12.7% were in favor. In the present study, fisher support for the FKNMS increased to over 41%, almost equal to the 42% against FKNMS establishment. When viewed with other, similar findings in this section, it is clear that there has been a shift in fishers' views of the FKNMS, a theme that will be addressed in the discussion.

Table 21 shows the trends in resource conditions since the FKNMS implementation, as determined for the commercial fisher sample. The findings show that the fishers believe that almost all natural resources in the Florida Keys have shown a negative trend (mean > 3, on a scale from 1-5, where 1 is better and 5 is worse), water quality leading all worsening resource conditions. Fishers believe that the use and maintenance of mooring buoys has improved since the implementation of the FKNMS, and that vessel groundings have decreased. However, the sample did not attribute the changes in the resource conditions to the FKNMS, remaining neutral on its view whether the FKNMS is largely responsible for the observed resource conditions ($n = 252$; mean = 3.19; SD = 1.52).

Finally, as part of this section, commercial fishers identified areas in which the FKNMS had been a success and in others where it had failed. Just over half (52.2%) of the 187 respondents that listed an area of success identified FKNMS zones, of which the Tortugas Ecological Reserve was singled out as a particularly successful FKNMS zone (13.9%). Another 12.3% and 10.7% stated that coral reef conditions and fisheries had improved under the FKNMS' tenure, respectively, followed by resource protection (7.5%), education (5.4%), and the mooring buoy program (5.4%). Interestingly, among the failures that 149 fishers identified, many were similar to the successes. That is, a majority of the respondents, or 26.2%, believed that the FKNMS zones represented a failure (of which 3.4% listed the Tortugas Ecological Reserve as a failure). Over 14% identified deterioration in water quality as a failure, followed by a lack of enforcement (12.8%), boating impacts and insufficient mooring buoys (10.7%), decline in fisheries (10.1%) and coral reefs (8.1%), and a poor education program (4.0%). The findings clearly show that zoning remained the most important issue to commercial fishers in the FKNMS, dividing the group among proponents who believe that the FKNMS zones have

been the area in which the FKNMS has most succeeded and opponents who argue that the same zones represent the FKNMS' greatest failure.

Table 20: Commercial fisher views on FKNMS performance

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*2004-05 sample mean***
1. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program.	2006 (n = 293)	17.1	29.4	11.9	12.6	17.1	11.9	n = 258 2.81 (1.41)
2. The Florida Keys have benefited environmentally from the FKNMS (n = 293).	2006 (n = 293)	18.1	31.4	9.6	16.4	16.7	7.9	n = 270 2.81 (1.41)
3. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS (n = 292).	2006 (n = 292)	16.8	22.6	7.2	21.9	22.6	8.9	n = 266 3.12(1.49)*∫
	1996 (n = 317)	6.0	10.4	8.5	8.5	61.2	5.4	n = 300 4.14(1.32)*∫
4. I generally support the establishment of the FKNMS (n = 293).	2006 (n = 293)	14.7	27.0	14.3	10.6	31.4	2.1	n = 287 3.17(1.50)*∫
	1996 (n = 315)	3.8	8.9	6.7	5.7	72.7	2.2	n = 308 4.38(1.18)*∫

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Table 21: Commercial fisher views on resource conditions in the FKNMS

Better ←----Neutral------→ Worse

Resource	*Sample*	*1*	*2*	*3*	*4*	*5*	*Don't know*	*Sample mean***
1. Water quality	n = 291	5.8	6.9	32.0	18.6	33.0	3.8	n = 280 3.69 (1.19)
2. Land-based pollution/sewage	n = 291	7.2	11.0	26.1	14.1	32.0	9.6	n = 263 3.58 (1.30)
3. Sea-based pollution/marine debris	n = 291	10.0	17.9	30.9	12.0	23.7	5.5	n = 275 3.23 (1.30)
4. Coral reefs	n = 289	5.2	13.8	26.0	18.3	24.2	12.5	n = 253 3.49 (1.22)
5. Sea grasses	n = 291	8.3	16.1	29.9	16.1	17.9	11.7	n = 257 3.21 (1.23)
6. Fisheries	n = 291	6.9	15.5	38.1	17.9	20.3	1.4	n = 287 3.30 (1.16)
7. Mooring buoys	n = 291	30.6	27.8	19.2	7.6	4.5	10.3	n = 261 2.19 (1.44)
8. Vessel groundings	n = 280	14.3	21.1	35.0	10.0	12.1	7.5	n = 258 2.83 1.21

*1-5 scale, where 1 is better and 5 is worse; 3 is neutral or no change

4.1.5. Commercial fisher survey views on enforcement

Fishers answered a series of questions related to their views on enforcement, as related to the perceived frequency of violations, the efficacy of enforcement, and compliance within the FKNMS zones.

As shown in Table 22, fishers believed that fishery violations are infrequent (Question 1), and many respondents qualified the answer, stating that such commercial fishery violations occur due to ignorance and are not indicators of industry misbehavior. Fishers also believed that the chances of being detected (Question 2) and caught and penalized (Question 3) are low. However, even with low rates of detection and apprehension, the average view on illegally fishing in the FKNMS zones was that a very small percentage of commercial fishers may take that risk but that most abide by the restrictions. Several respondents stated that it is not worth the risk to commercial fishers, who stand to face stiff penalties and may even lose their fishing licenses, and recreational anglers more often fish inside FKNMS zones. The views on violations and enforcement remained largely unchanged between the two studies. As in the present study, the fishers interviewed in the 1995-96 study perceived low rates of violations among commercial

fishers and believed that while the chances of being detected and penalized were low, it was very unlikely that commercial fishers would enter and fish illegally in FKNMS zones.

Table 22: Commercial fisher views on fishery violations and enforcement

Question	*1995-96 sample*	*Total sample*
1. How often would you say that other commercial fishers violate fisheries regulations?**	n = 290 3.15 (0.69)	n = 282 3.05 (0.75)
2. How often do you believe that a fisher who is violating fisheries regulations would be seen or detected by the authorities?*	n = 303 2.77/4.0 (0.98)	n = 281 4.61/6.0 (1.23)
3. How often do you believe that a fisher who is violating fisheries regulations would be caught and penalized by the authorities?*	n = 306 2.42/4.0 (1.06)	n = 271 4.41/6.0 (1.39)
4. How often do you believe that other fishers still fish inside the FKNMS no-take zones and take the risk of being caught?*	n = 305 2.62/4.0 (1.17)	n = 259 4.98/6.0 (1.09)

* Responses for 1995-96 sample are calculated on a 1-4 scale, where 1 is extremely likely and 4 is not likely at all; responses for the current study (total) sample are calculated on a 1-6 scale, where 1 is always and 6 is never.
** 1-4 scale, where 1 refers to almost all trips and 4 to never.

4.1.6. Commercial fisher survey discussion

The 2004-05 commercial fisher study established a new baseline for commercial fishing use in the FKNMS and commercial fisher knowledge, attitudes, and perceptions on the Sanctuary and its zoning action plan. Building on the 1995-96 effort, the present study determined that the commercial fishing community has changed considerably, both in terms of overall size and other socio-demographic characteristics, and its opposition towards the FKNMS has lessened, especially in the areas of FKNMS process and FKNMS outcomes. While the findings do favor earlier hypotheses (Crosby et al., 2000; Crosby, 1994; Bohnsack, 1993) that suggest that stakeholder views will become more favorable of marine protected areas over time, overall commercial fisher attitudes towards FKNMS management remain negative. Thus, while the new baseline established that a change towards FKNMS acceptance may have occurred over the previous decade, current perceptions may be part of a still shifting baseline.

Crosby (1994) posited the following four hypotheses to evaluate the long-term socioeconomic impacts of alternative management strategies for marine protected areas:

1. Attitudes and perceptions of the users of resources in and adjacent to marine protected areas will change over time;

2. User perceptions of resource abundance in marine protected areas correlate with scientifically derived assessments of resource abundance
3. Increasing degrees of public participation will correlate to increasing levels of acceptance of marine protected areas, and;
4. Education and enforcement influence public acceptance of marine protected areas.

The 1995-96 study determined that commercial fishers strongly opposed the implementation of marine protected areas (i.e. the Sanctuary and its zoning strategy), and that most fishers did not agree that the zoning strategy would result in increased resource abundance or FKNMS-wide improvements in resource health. Moreover, the study also determined that while participation levels during the FKNMS designation process were high, the types of activities in which commercial fishers participated did not engender inter-group discussion or information exchange. The fishers argued that the process outcomes were pre-arranged and that participation in FKNMS organized fora had no influence on the final decisions.

In the decade following the establishment of the 1995-96 baseline, the results suggest that commercial fisher attitudes and perceptions on the FKNMS and its zones have changed. However, the results also suggest that these changes have largely occurred *in spite* of perceptions that the FKNMS zones have not affected resource abundance and under conditions of lower public participation. There are two likely reasons why these divergent findings have nevertheless not influenced attitudes on the FKNMS process and outcomes.

The first reason for the change in attitudes is the commercial fishers' likely conclusion that the dire predictions that the 1995-96 sample had made on the FKNMS process (in particular) and outcomes have not occurred. For instance, the 1995-96 sample on average disagreed that the procedures NOAA would adopt to deal with violations with FKNMS regulations would be fair and just. The sample from the present study took the opposite view, agreeing on average that the procedures that NOAA had adopted to deal with FKNMS are fair and just. Similarly, although both samples' opinions suggested frustration over the process used to develop FKNMS zone rules and regulations, the ability of individuals to influence final decisions, and NOAA's consideration toward their concerns, the opinions among the present sample were more moderate than those determined for the previous sample. These findings suggest that commercial fishers remain wary of the process used in the FKNMS designation process (1995-97), but that their views are less trenchant than in the past. This may be in part due to the subsequent actions taken by the FKNMS in addressing resource management and protection, which have involved considerable transparency and have often used public participation and stakeholder involvement. A good example of such an action is the *Tortugas 2000* process (1998-2001), used to develop boundaries and regulations for the Tortugas Ecological Reserve (Delaney, 2003; NOAA, 2000). This process commenced with 'no lines on a map', with the FKNMS instead delineating a study area in which it requested that a working group of stakeholders develop and recommend the boundaries and regulations for a no-take zone. The process involved considerable public and stakeholder input, including a Dry Tortugas commercial fisher characterization study (Leeworthy and

Wiley, 2001; Shivlani et al., 1999). Another example of the FKNMS utilizing transparency was when the Sanctuary Advisory Council took testimony from spongers and other interest groups in developing recommendations for continued sponging in the FKNMS (FKNMS, 2000). In that case, the FKNMS used broad stakeholder input to address (and resolve) a fishery and use conflict issue. As these and other examples have demonstrated to commercial fishers that the FKNMS would not use fiat-type decisions[12], it is likely that fishers have tempered their views.

A second reason to the fishers' conclusions on the FKNMS process and outcome has been the relatively minor impact (with the exception of the Tortugas Ecological Reserve[13]) of the FKNMS on commercial fisheries in the Florida Keys. Thomas J. Murray & Associates (2007) monitored four commercial fishing panels (based on the proximity to the FKNMS zones where the panels operate, a marine life panel, and a control panel) and the commercial fishing industry in the Florida Keys from 1998 to 2007, concluding that the FKNMS and the FKNMS zones had not resulted in significant impacts on commercial fishers. This does not mean that the FKNMS zones have had *no* impacts, as fishers were displaced from fishing areas due to the zone restrictions (Milon et al., 1997), but the areas closed prior to the Tortugas Ecological Reserve encompassed less than 1% of the FKNMS (NOAA, 1996) and were thus minor enough to not have affected much of the commercial fishing industry[14]. These views are reflected in the present sample's views on the FKNMS zones. The average response for fishers from the 1995-96 sample on the establishment of FKNMS zones was 4.66 (or strong disagreement), contrasted by the average view held by the 2004-045 sample on SPAs (2.98, or neutral) and ERs (3.23, or between neutral and moderate disagreement). The earlier sample was clearly apprehensive over the zoning strategy, and the fear has been mostly allayed by the relatively few impacts (especially of the smaller SPAs).

While the fishery has not been directly impacted by the FKNMS zoning strategy, the Florida Keys commercial fishery has declined considerably in the past decade. In the previous study, 2,430 Saltwater Products License (SPL) holders resided in Monroe County. That number declined by almost 48% to 1,268 SPL holders in 2006 (or by 53.1% if only the active SPL holders are considered). Most of the fishers in the present sample were highly 'professionalized', in that they identified themselves as full-time operators that rely almost exclusively on commercial fishing as a primary occupation. The present sample was also highly capitalized in (mostly trap) gear, fishing two or fewer species for the entire year. When compared to the current sample, the 1995-96 sample

[12] The overreaching power of the FKNMS was a popular position staked by various opponents during the FKNMS designation process, especially as related to Appendix K in the FKNMS Draft Management Plan (Suman et al., 1999; NOAA, 1996; NOAA, 1995).

[13] A study conducted two years following the closure of the Tortugas Ecological Reserve in 2001 determined that the fishery had contracted in the short-term and that commercial fishers had shifted effort away from the Tortugas Ecological Reserve (Thomas J. Murray & Associates, 2005).

[14] Another reason apart from the total area closed to fishing under the FKNMS Final Management Plan that fishers suffered only minor displacement impacts was a result of attributes and existing use profiles of the areas themselves, which were largely hardbottom and core coral habitats. These were less commonly used by most fishers (and favored mainly by marine life collectors and bait fish fishers) and more frequently by divers and snorkelers.

consisted of fishers that held less gear on average and relied less on commercial fishing for total income. Programs such as the Spiny Lobster Trap Certificate Program (Florida Statutes 370.142) have been instrumental in reducing effort (and participation) in the region, and the exiting fishers have been mainly part-time and marginal participants (Shivlani et al., 2004). Other actions, including the 1994 Florida Net Ban, the 1995 stone crab license moratorium, and the 2000 Stone Crab Trap Certificate Program (Florida Statutes 370.13), among others, limited entry into the most lucrative commercial fisheries and increased operating costs (ex. trap certificate costs, license fees, etc.). Many of the fishers that managed to withstand the regulatory changes in the past decade increased their share of these various fisheries and thus emerged as the successful (and 'professionalized') participants. It could be argued that the views determined from this study represent those of fishers who have withstood (even prospered, in some cases) in the decade of FKNMS management and their opinions may therefore be a reflection of that experience.

Finally, it is important to consider the sample's perceptions concerning FKNMS performance in more detail. Over 46% agreed that NOAA had made a positive contribution to the marine environment via the National Marine Sanctuary Program, and 49.5% agreed that the Florida Keys had benefited environmentally from the FKNMS. Most importantly, 41.7% generally supported the establishment of the FKNMS. As stated previously, these changes in perception did not occur as other conditions (ex. perceptions on resource abundance, increased participation, or increased enforcement or education) were met. Eventually, in addition to the reasons related to the FKNMS adopting a participatory approach and fewer than expected fishery impacts, commercial fishers may have accepted the FKNMS a fixture in the region and thereby acquiesced to its existing management strategies.

4.2 Dive operations survey results

A total of 69 dive operators participated in the study, conducted from June 2006 to October 2006; this represents a net response rate of 77.5%. The 1996 dive operator sample consisted of 62 respondents, representing a net response rate of 82.7%.

Initially developed as a stratified random sample, the research team conducted a census survey of the 89 operations identified in the region. A total of 39 surveys, or 56.5% of the sample, were conducted in the Upper Keys, which has 50.1% of the 89 dive operators in the Florida Keys. The Middle Keys, which accounts for 12.4% of the regional population, provided 14.5% of the sample. Finally, the study completed 20 surveys in the Lower Keys, representing 28.9% of the sample; the Lower Keys contains 37.1% of the population. Thus, the study over-sampled the Upper and Middle Keys and under-sampled the Lower Keys.

The results presented follow the survey instrument (see Appendix 2) and are divided into the following section: General information; economic information; trip information (including use patterns); and sources of information and perceptions.

4.2.1 Dive operations survey general information

As part of this section, respondents provided information on their race, ethnicity, and family members supported, affiliation with other dive organizations and local groups, and years in operation in the Florida Keys.

Table 23: Dive operator demographic information

Question	*2006 sample (std dev)*	*1996 sample (std dev)*
Age of dive operators	n = 69 3.19 (1.23)*	n = 59 2.78 (0.95)*
1. 18-30 years	13.0	8.5
2. 31-40 years	13.0	27.1
3. 41-50 years	30.4	47.5
4. 51-60 years	29.0	11.9
5. Over 60 years	14.5	5.1
Number of family members	n = 69 1.94 (1.16)	n = 57 2.18 (1.28)
Group affiliation	n = 69	n = 61
1. NAUI	30.4	14.8
2. PADI	81.2	70.5
3. KADO	43.5	16.4
4. FADO	30.4	40.1
5. Environmental groups	26.1	13.1
6. Chamber of Commerce	53.6	36.1
7. Local organizations	41.6	24.6
Years in the dive industry	n = 69 2.35 (1.02)	n = 60 1.98 (0.99)
1. 1-5 years	26.1	40.0
2. 6-10 years	27.5	30.0
3. 11-20 years	31.9	21.7
4. Over 20 years	14.5	8.3
Years the dive operation has been in existence	n = 69 2.88 (1.01)*	n = 47 2.06 (1.03)*
1. 1-5 years	11.6	34.0
2. 6-10 years	21.7	40.4
3. 11-20 years	33.3	10.6
4. Over 20 years	33.3	14.9

The average age of the respondents was just over 41-50 years old (n = 69; mean = 3.19; SD = 1.23), and 73.9% of the sample was 41 years or older (see Table 23). This was significantly older than the average age of dive operators from the 1996 sample, who averaged less than 41-50 years ago (n = 59; mean = 2.78; SD = 0.95) (Mann Whitney test: z-score = 2.22; $p < 0.05$). The difference in age is most likely the result of

participants from the earlier study who have since gotten older; in fact, 30 of the 69 dive operations (43.5%) interviewed were surveyed in 1996.

Over 95% (95.6%) of the sample identified itself as non-Hispanic and 97.1% as Caucasian. This was similar to the 96.6% of the respondents who identified themselves as Caucasian in the 1996 sample.

Dive operators supported an average of 1.94 family members (SD = 1.16), including themselves, in the 2006 study. In 1996, operators supported a slightly higher average of family members, or 2.18 family members (SD 1.28), including themselves.

As shown in Table 23, dive operator affiliation frequencies shifted in the two study periods. In 1996, for instance, 40.1% of the respondents reported being part of the Florida Association of Dive Operators (FADO), but that affiliation rate dropped to 30.4% in 2007. Conversely, the percentage of dive operators affiliated with the Keys Association of Dive Operators (KADO) increased from 16.4% in 1996 to 43.5% in 2006. This movement toward local affiliation was reflected in the gains in affiliation among other Keys-based groups, including Chambers of Commerce and local organizations.

When asked about how long they had been dive operators in the Florida Keys, the average tenure reported by the respondents was over 6-10 years (n = 69; mean = 2.35, on a scale from 1 – 4, where 1 = 1-5 years and 4 = over 20 years; SD = 1.02). This was higher than the average tenure reported by the operators in 1996 (n = 60; mean = 1.98; SD = 0.99). The average period during which the dive operation had been in existence in the 2006 sample was almost between 11-20 years (n = 69; mean = 2.88; SD = 1.01), which was significantly higher (Mann Whitney test: z-score = 3.87; $p < 0.001$) than the period of existence for dive operations from the 1996 sample (n = 47; mean = 2.06; SD = 1.03).

4.2.2 Dive operations survey economic information

Dive operators provided economic information that concerned vessel numbers and characteristics, replacement costs of vessels and gear, and annual operating expenses in 2005.

Table 24: Dive operator vessel costs and characteristics and employee information

Item	*2006 sample (std dev)*	*1996 sample (std dev)*
Vessel number	n = 67 1.72 (1.22)	n = 57 1.74 (0.95)
Vessel costs	n = 65 $352,762 (559,142)	n = 57 $306,998 (393,629)
Number of divers per vessel	n = 72 18.0 (12.9)	n = 100 26.8 (29.3)
Number of snorkelers per vessel	n = 86 20.6 (17.4)	-
Number of full-time employees	n = 62 4.77 (4.82)	n = 59 7.14 (7.59)
Number of part-time and seasonal employees	n = 56 3.11 (2.33)	-
Dive gear costs	n = 63 $52,738 (140,883)	n = 58 $43,788 (98,008)
Compressor costs	n = 38 $31,382 (25,575)	-

As shown in Table 24, the overall characteristics of the dive operations remained consistent across the two study periods, with the exception of gear costs. Although vessel costs increased over the decade in between studies, the average number of vessels operated was similar, as well as the number of employees. In the earlier study, the survey did not request that respondents separate full-time from part-time or seasonal employees; thus, when the sum of both types of employees (7.88) in the 2006 sample is compared to the 7.14 employees in 1996, the results suggest that dive operations have remained largely unchanged in terms of their personnel and vessel numbers. Finally, in 1996, dive operators only provided information on the maximum number of clients that they could take out on their vessels, which averaged 26.8 persons. In the 2006 study, respondents were requested to answer on both the number of divers and snorkelers. The number of snorkelers per vessels averaged 20.6, compared to 18.0 divers, suggesting a slight contraction in the size of the vessels; however, it should be noted that the earlier sample contained considerable variation in vessel capacity. Finally, dive gear costs increased by almost $20,000 per operation in the two reporting periods, and the average replacement value of an additional item, compressors, was estimated at $31,382 per operation (55.1% of the operations characterized had a compressor).

Table 25: Dive operator annual operating costs in 2005

Item	*2006 sample (std dev)*	*1996 sample (std dev)*
Docking fees	n = 37 $16,793 (12.707)	n = 35 $11,697 (12,566)
Interest payments on vessels	n = 13 $8,307.7 (9,650.8)	-
P&I[15]	n = 58 $10,578 (11,166)	-
Vessel maintenance and repair	n = 59 $21,722 (64,614)	n = 47 $15,855 (14,887)
Equipment maintenance and repair	n = 42 $4,000.0 (3,912.7)	n = 53 $4,255.5 (4,573.0)
Dive shop costs/rental	n = 25 $25,592 (31,411)	-
Advertising	n = 50 $10,190 (10,705)	
Average personal income from operation	n = 61 70.1 (33.9)	n = 53 74.5 (32.9)

Table 25 shows the average operating costs, as reported by the 2006 sample, and as compared to the 1996 sample. The highest costs for the 2006 sample were those related to dive shop mortgage or rental costs, followed by vessel maintenance and repair, docking fees, insurance (P&I), and advertising. In two of the three annual cost items obtained for the 1996 sample, concerning docking fees and vessel maintenance and repair, the 2006 sample reported significantly higher costs. With respect to docking, qualitative data collected during the interview session suggest that operators may be feeling the same price pressures as other waterfront operators due to higher dockage; moreover, dive operator vessels are often located in prominent marinas, which usually have among the highest dockage rates. The other costs that were significantly higher in the 2006 sample, compared to the earlier sample, were those related to vessel maintenance and repair. Also, while dive shop mortgage or rental costs and advertising

[15] P&I refers to property and indemnity insurance that covers operations at sea and damage and loss of life resulting from vessel operations.

fees were not determined for the 1996 sample, the present study's results found that such costs comprise a considerable percentage of overall dive operations' annual expenses. Among the 36.2% who disclosed what they paid for their dive shop via mortgage or rent, the average of $25,592 represented the highest portion of all expenses. Similarly, in an industry that relies strongly on advertising, the average cost that respondents spent on brochures, media-based advertisement, and other promotional material amounted to over $10,000 per year, on average. Finally, the average personal income derived from dive operations did not change significantly from 1996 to 2006. Formerly, dive operators reported earning an average of 74.5% of their total personal income from their dive operation, which dropped to 70.1% in the 2006 sample. The results show that the income from the industry remains an important source of revenue for its exponents and that reliance on the profession has declined only slightly, on average.

4.2.3 Dive operator survey trip information

In this section, dive operations provided use and costs information for the areas in which they took dive and snorkel trips, and these are presented based on region (i.e. Upper, Middle, and Lower Keys).

Table 26: FKNMS dive survey trip costs

Item	*Upper Keys (std dev)*	*Middle Keys (std dev)*	*Lower Keys (std dev)*
1. 2006 sample trip expenses			
a. Fuel and oil	n = 32 $52.1 (34.2)	n = 11 $50.8 (25.7)	n = 18 $80.6 (47.2)*
b. Supplies	n = 28 $16.4 (13.0)	n = 11 $11.2 (8.1)	n = 18 $33.7 (42.4)
c. Crew number	n = 14 1.9 (0.5)	n = 8 2.3 (0.9)	n = 10 1.9 (0.6)
2. 1996 sample trip expenses			
a. Fuel and oil	n = 30 $48.1(37.7)	n = 7 $31.9 (14.0)	n = 17 $40.3 (21.2)*
b. Supplies	n = 30 $11.4 (10.8)	n = 7 $10.8 (6.9)	n = 17 $32.6 (82.9)
c. Crew number	n = 30 2.1 (0.7)	n =7 2.1 (1.9)	n = 17 2.2 (0.7)

* refers to significant differences in means ($p < 0.05$)

As shown in Table 26, fuel costs comprised a majority of trip costs in all three regions of the 2006 sample, and the Lower Keys operators spent significantly more than the Upper and Middle Keys counterparts. When compared to the 1996 sample, the 2006 sample reported higher costs in both fuel and supplies (and fuel costs were significantly higher).

Also, while costs were similar across region in the previous study, Lower Keys operators' costs were higher than other regions in the present study, due most likely to the increase in multiple activity cruises (these are trips offered by operators that last a half or full day and consist of activities such as snorkeling, cruising, and picnicking on island beaches, among others).

Table 27: FKNMS dive survey total trips, average trips, and average divers per trip

Trips	*Total (std dev)*	*Upper Keys (std dev)*	*Middle Keys (std dev)*	*Lower Keys (std dev)*
1. Average trips				
a. 2006	n = 67 383.7 (209.0)	n = 35 437.6 (224.7)	n = 15 293.7 (195.0)	n = 17 352.2 (157.0)
b. 1996	n = 58 429.5 (314.7)	n =34 471.2 (380.8)*	n = 8 336..9 (160.1)*	n = 16 387.2 (186.6)
2. Average divers per trip				
a. 2006	n = 66 12.5 (13.9)	n = 34 14.4 (17.2)*	n = 15 8.0 (5.6)*	n = 18 12.5 (10.8)
b. 1996	n = 58 12.9 (15.2)	n = 34 15.0 (19.0)	n = 8 8.0 (4.4)	n = 16 10.9 (6.9)
5. Trips taken to FKNMS zones				
a. 2006				
i. ERs and SPAs	n = 67 73.1%	n = 35 73.0%	n = 15 78.8%	n = 17 69.4%
ii. WMAs	n = 4 1.5%	-	-	n = 4 6.3%
b. 1996	n = 58 72.7%	n = 34 82.6%	n = 8 30.8%	n = 16 65.0%
6. Divers taken to FKNMS zones				
a. 2006				
i. ERs and SPAs	n = 67 77.8%	n = 35 77.7%	n = 15 85.5%	n = 17 71.9%
ii. WMAs	n = 4 2.5%	-	-	n = 4 10.3%
b. 1996	n = 58 78.7%	n = 34 85.4%	n = 8 22.0%	n = 16 66.4%

*refers to significant differences in means ($p < 0.05$)

Table 27 shows that the 60% of the trips reported by 67 of the 69 dive operators surveyed in 2006 were taken in the Upper Keys. Fewer were taken in the Lower (23.9%) and Middle Keys (17.1%). On average, Upper Keys operators took almost 438 trips in 2005, which was higher than the average trips taken by Lower (352.2 trips) and significantly higher than the average trips taken by Middle Keys operators (293.7). Upper Keys operators also took the highest average total of divers and snorkelers per trip, averaging 14.4 clients per trip, compared to the 12.5 clients per trip for the entire sample, 12.5

clients in the Lower Keys, and significantly higher than the only 8.0 clients per trip in the Middle Keys. These patterns were consistent across the two study periods, in the Upper Keys in the 1996 sample also reported the highest number of trips, average trips, and average divers and snorkelers. While total trips were higher in the 2006 sample, average total trips per operator were higher in the 1996 sample. This may have been due to the reporting year in which the 2006 study was conducted. The reporting year, 2005, was less than an average year as related by several respondents because of the unprecedented threats of tropical cyclones and impacts by four hurricanes across the Florida Keys. As a result, water conditions (clarity, sea state) were negatively affected throughout much of the hurricane season (June – November), and these (along with the storm threats affecting tourism) led to fewer dive trips.

Table 28: FKNMS dive operations FKNMS zone trips and divers in 2005

Zone	*2005 % trips*	*2005 % divers*	*Total users*	*divers/trip*
Carysfort	2.19	1.19	6	7.46
The Elbow	3.92	2.73	8	9.61
Dry Rocks	6.18	7.79	15	17.4
Grecian Rocks	3.2	5.19	7	**22.3**
French Reef	5.5	6.02	13	15.1
Molasses Reef	**18.9**	**24.4**	**19**	17.8
Conch Reef	2.89	2.69	7	12.9
Davis Reef	3.15	2.52	9	11
Hen and Chickens	4.02	3.27	6	11.2
Cheeca Rocks	4.41	1.59	5	4.98
Alligator Reef	5.57	3.59	7	8.91
Coffins Patch	5.09	2.34	8	6.35
Sombrero Key	11.4	12.5	9	15.1
Looe Key	6.3	4.83	5	10.6
Newfound Harbor Key	0.35	0.47	1	18.4
Eastern Dry Rocks	7.6	11.6	12	21.1
Rock Key	2.2	1.69	4	10.6
Sand Key	1.38	1.14	3	11.4
Western Sambos ER	5.46	4.33	8	11
Tortugas ER	0.28	0.08	1	4

Table 28 shows the percentage of 2005 trips and divers taken to each of the FKNMS no-take zones (ERs and SPAs). The most popular site reported by the higher number of respondents was Molasses Reef SPA, which attracted the highest percentage of trips and divers in 2005. This was followed by another Upper Keys SPA – Dry Rocks SPA. In the Lower Keys, Looe Key SPA attracted the most trips and divers, followed by Western Sambos ER.

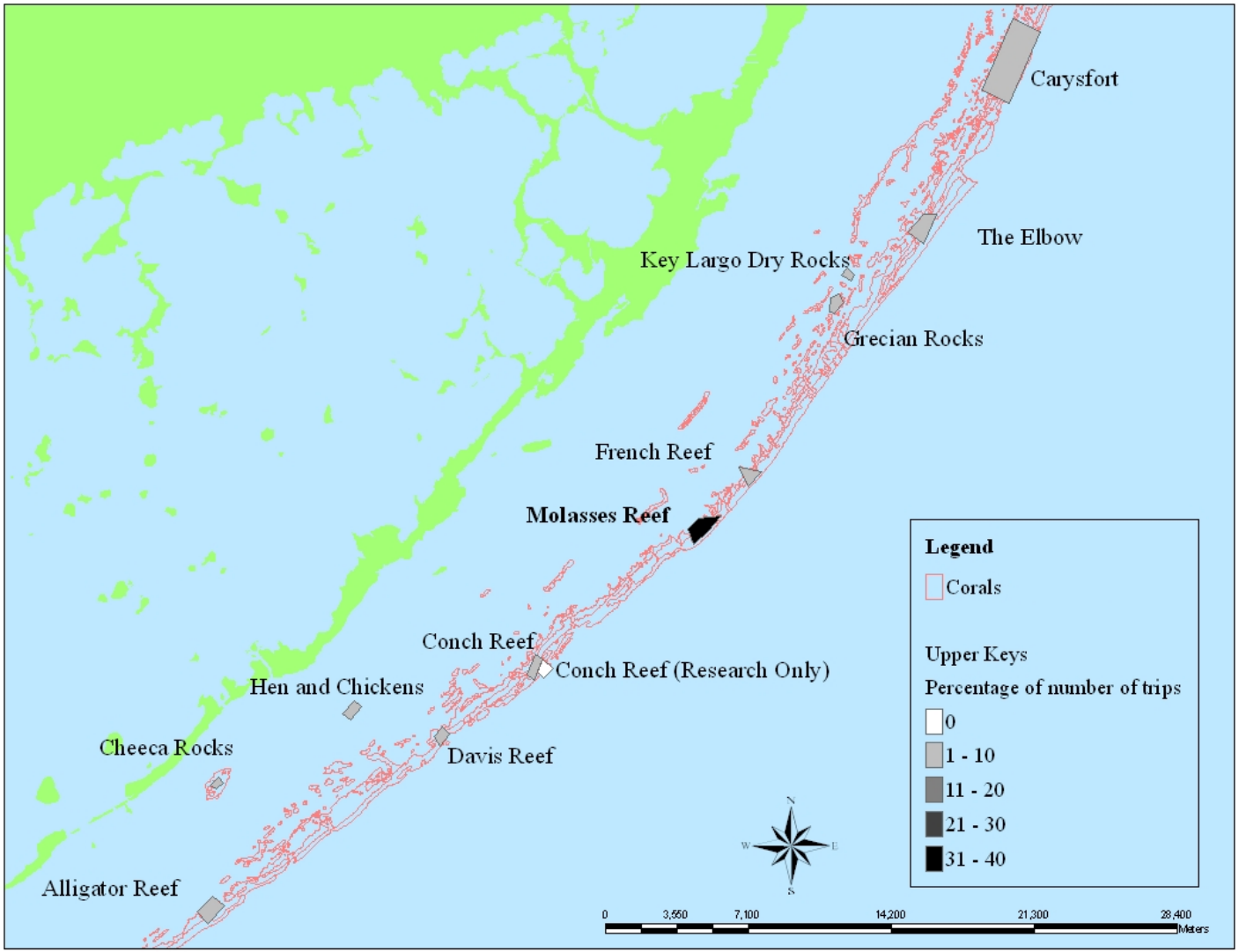

Figure 22: Upper Keys trips to FKNMS zones

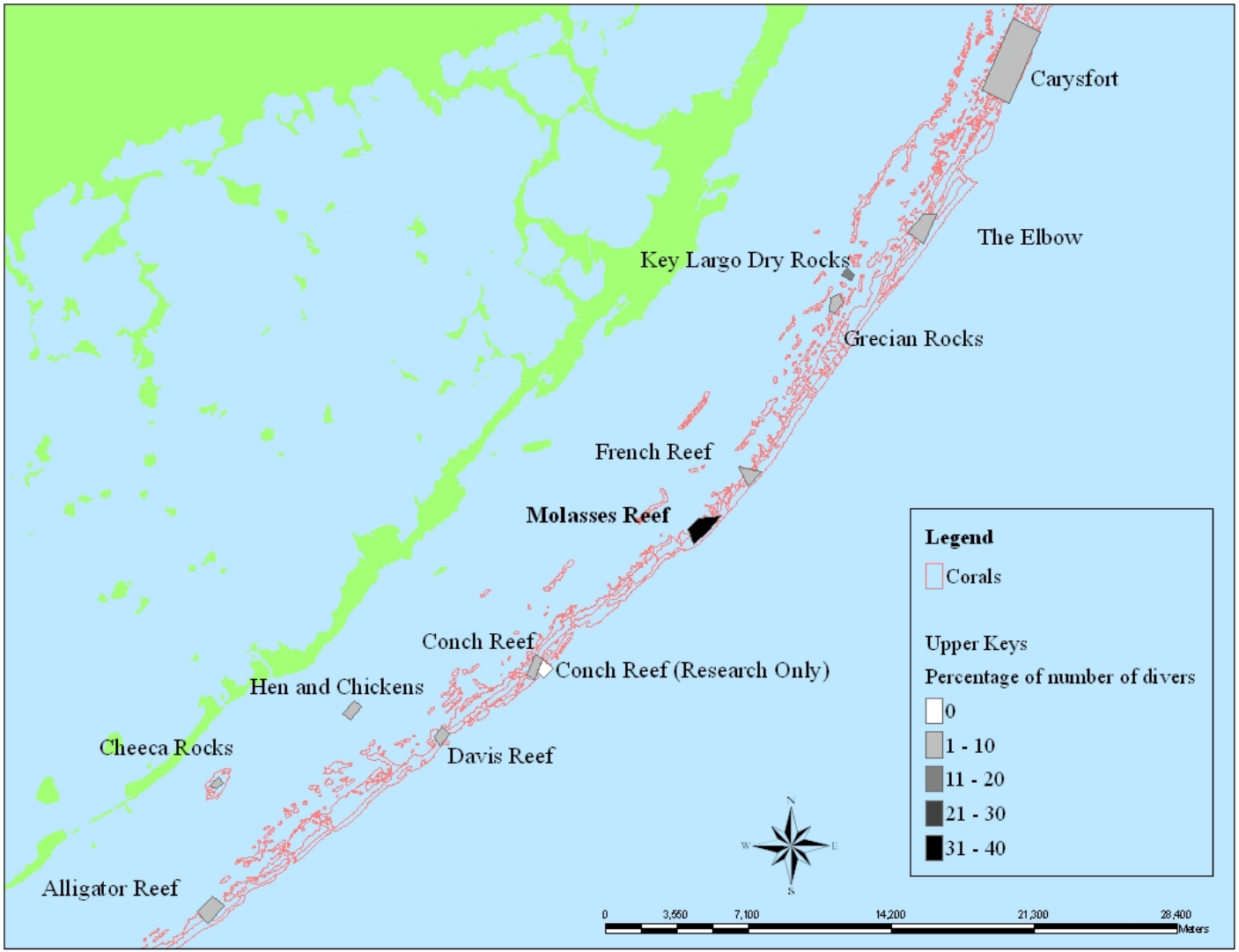

Figure 23: Upper Keys divers to FKNMS zones

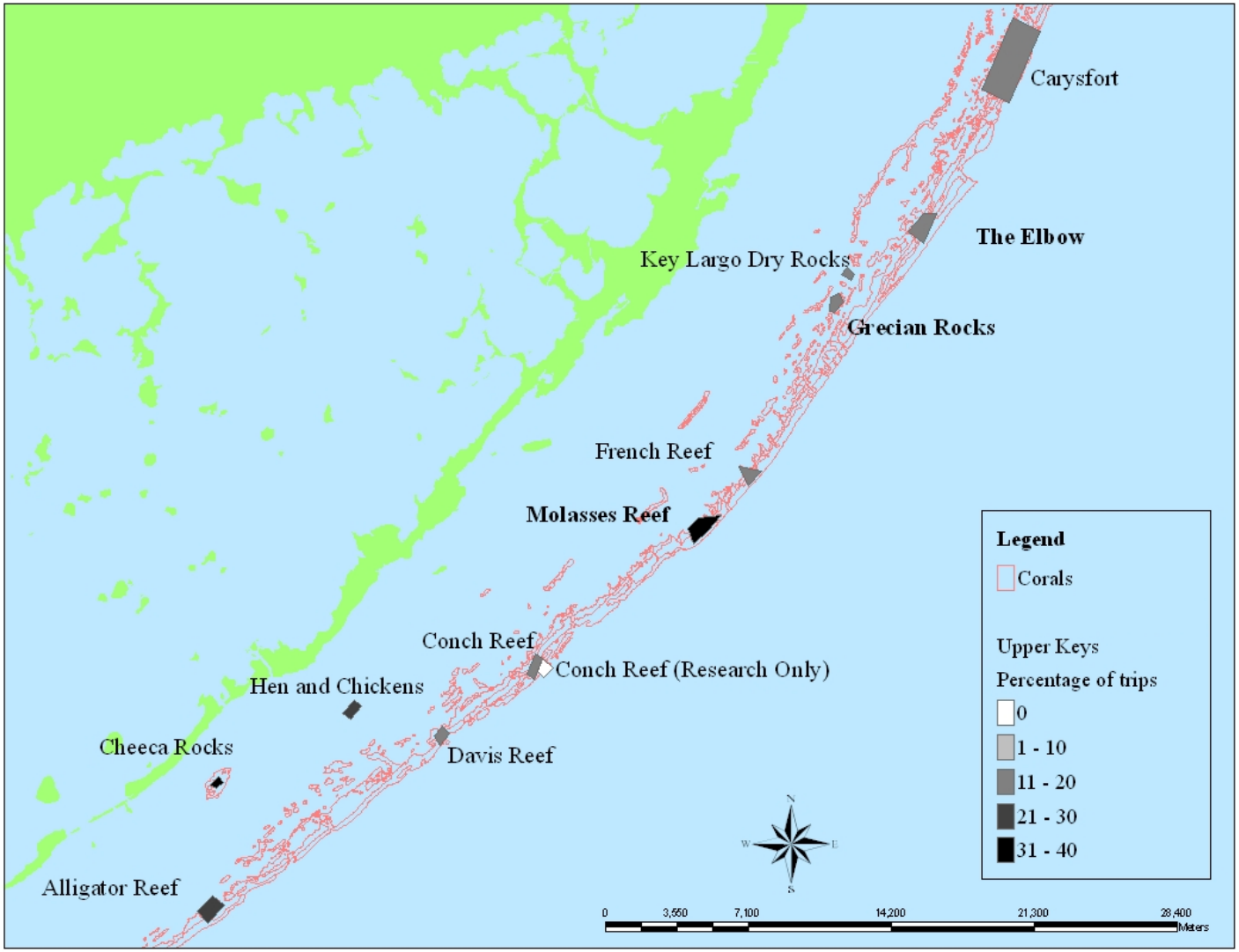

Figure 24: Upper Keys percent trips to FKNMS zones

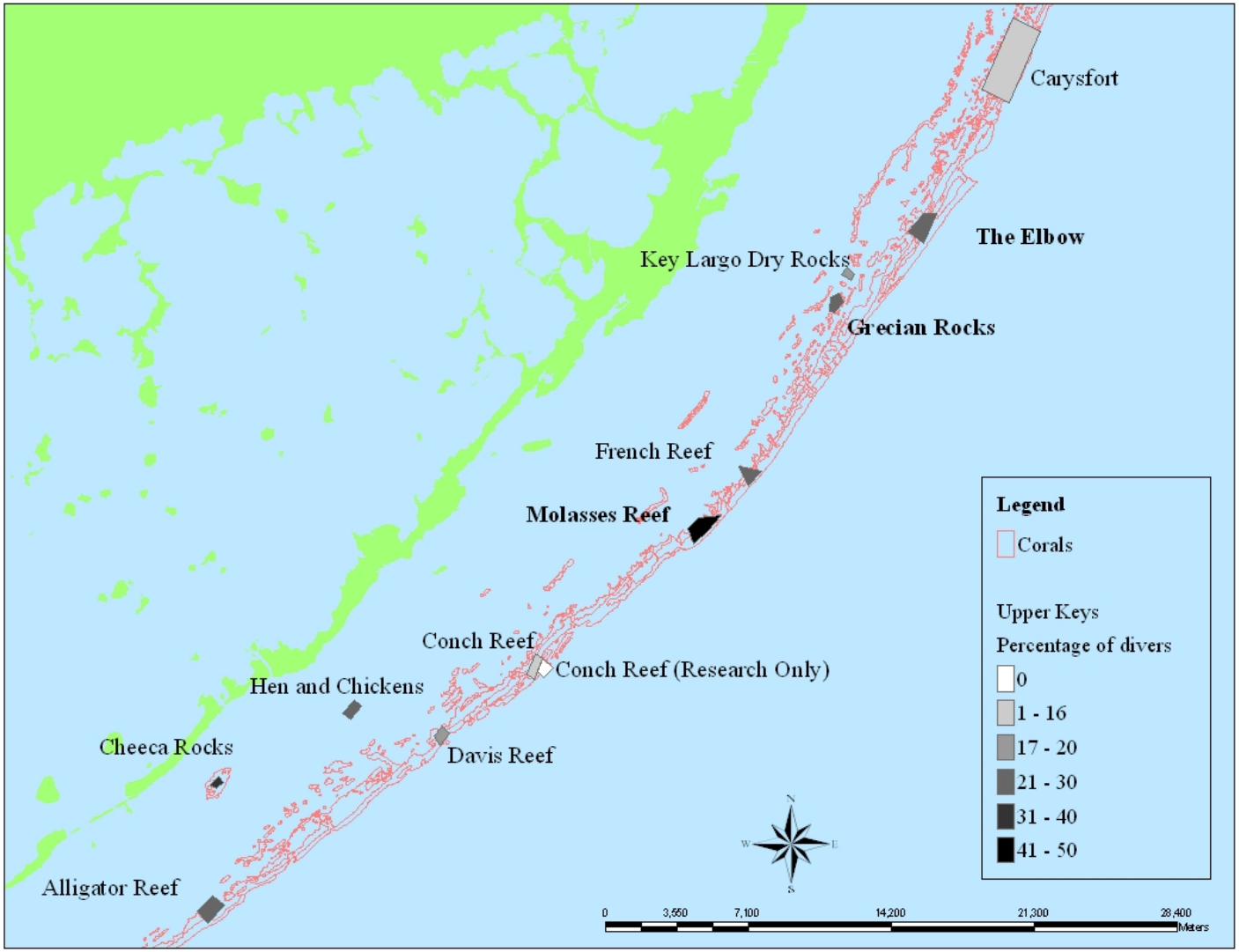

Figure 25: Upper Keys percent divers to FKNMS zones

Figures 22 – 25 show the dive and snorkel use in the Upper Keys FKNMS zones. As shown in Figures 21 and 22, use was highest in the section that previously comprised the Key Largo National Marine Sanctuary (KLNMS) and which includes SPAs between Carysfort SPA to Molasses Reef SPA, from the northeast to the southwest. This is mainly because of the high concentration of dive operations in Key Largo and Tavernier, which contained 82.1% of all dive operations in the Upper Keys. Also, Molasses Reef SPA is the most heavily dived reef site in the Florida Keys and together with the other SPAs in the KLNMS of the Upper Keys, these sites accounted for 62.9% of all trips and 77.6% of all divers to Upper Keys FKNMS zones. In the lower section of the Upper Keys, the remaining 17.9% of the dive operators in the region took trips in all five SPAs. Most trips and divers were taken to Alligator Reef SPA, followed by Cheeca Rocks SPA and Hen and Chicken SPA.

The relative importance of individual zones was determined by dividing the number of trips and divers taken to a zone by the total number of trips and divers taken by the users that used that zone (as determined in Shivlani and Suman (2000)). The relative importance of each zone by trips and divers is shown in Figures 23 and 24, respectively. In the Upper Keys, the 19 dive operators who used Molasses Reef SPA in 2005 took 39.2% of their total trips and 46.4% of their total divers to the SPA; thus, dive operators using Molasses Reef SPA did so almost every four out of 10 trips, which comprised almost half of their divers. Another zone, Cheeca Rocks SPA (primarily a snorkel site), attracted 36.4% of all trips and 23.6% of all divers that the five operators who reported using that site. In the Key Largo section of the Upper Keys, only Molasses Reef attracted more than 20% of trips and 25% of divers from dive operators who visited that site. In other sites, including The Elbow SPA, Grecian Rocks SPA, and French Reef SPA, percent trips and divers ranged between 15-19% and 20-22%, respectively. This shows that Upper Keys dive operator use patterns in this area relied on switching trips across various SPAs (with the exception of Molasses Reef SPA), as reported for the 1996 sample (Shivlani and Suman, 2000). By contrast, dive operators in the lower section of the Upper Keys demonstrated a greater reliance on individual SPAs, such that percent trips ranged between 15-36% and percent trips between 15-30%. Dive operators who reporting using Cheeca Rocks, Alligator Reef, and Hen and Chickens SPAs took a quarter or more of their total trips and a fifth or more of their divers to these zones. Therefore, while these dive operators did also switch their trips across several SPAs, they tended to rely on fewer SPAs than did their counterparts in the Key Largo section of the Upper Keys.

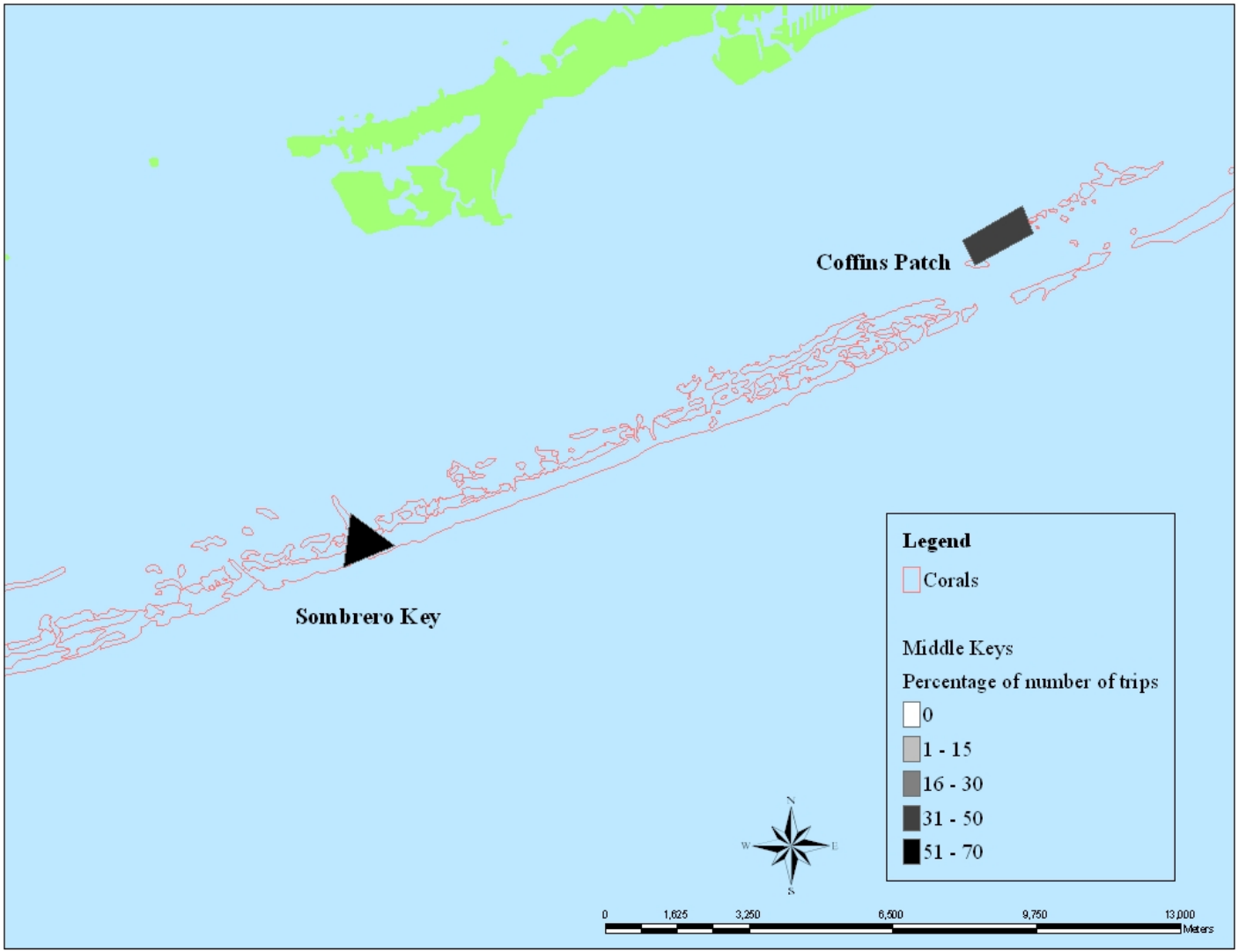

Figure 26: Middle Keys trips to FKNMS zones

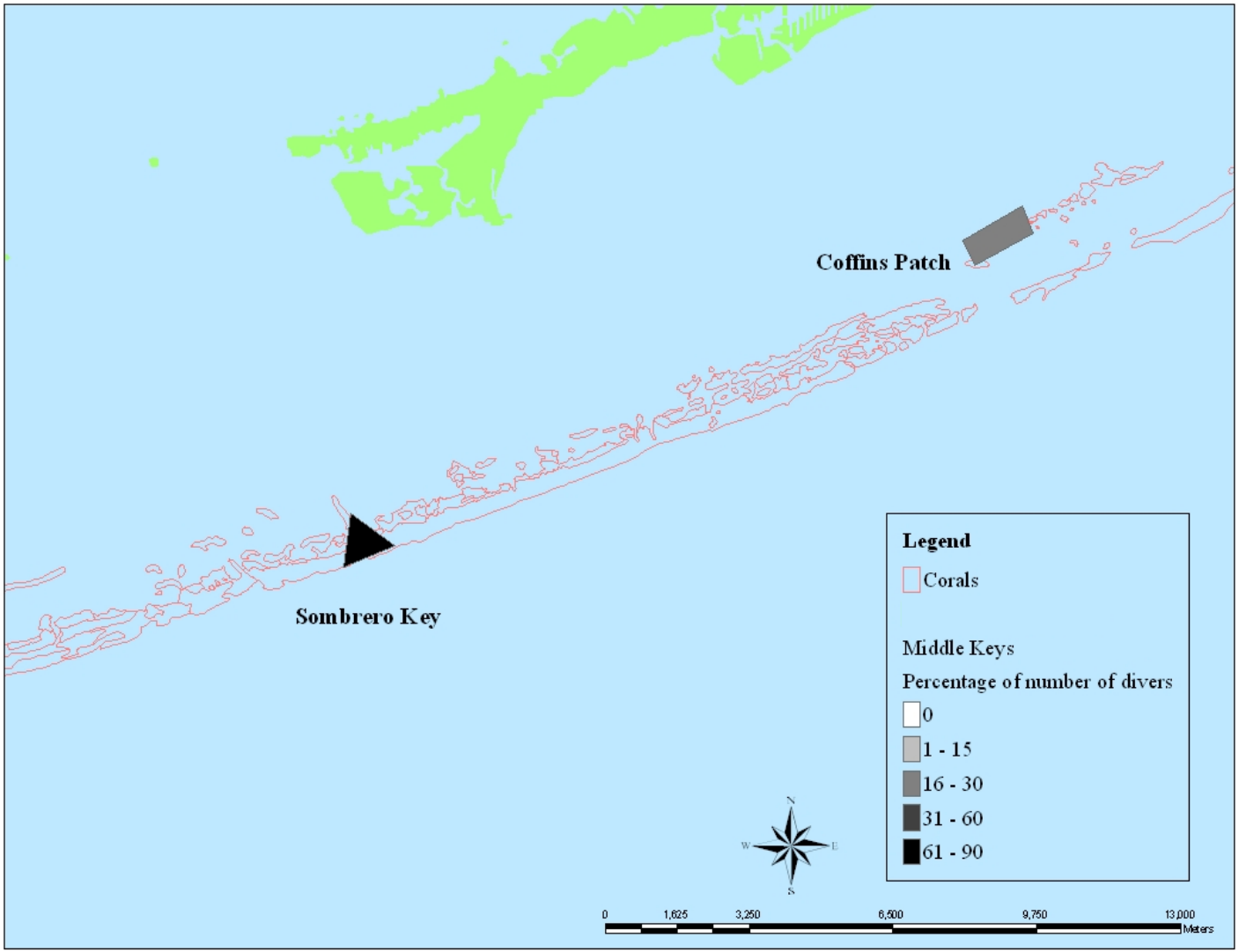

Figure 27: Middle Keys divers to FKNMS zones

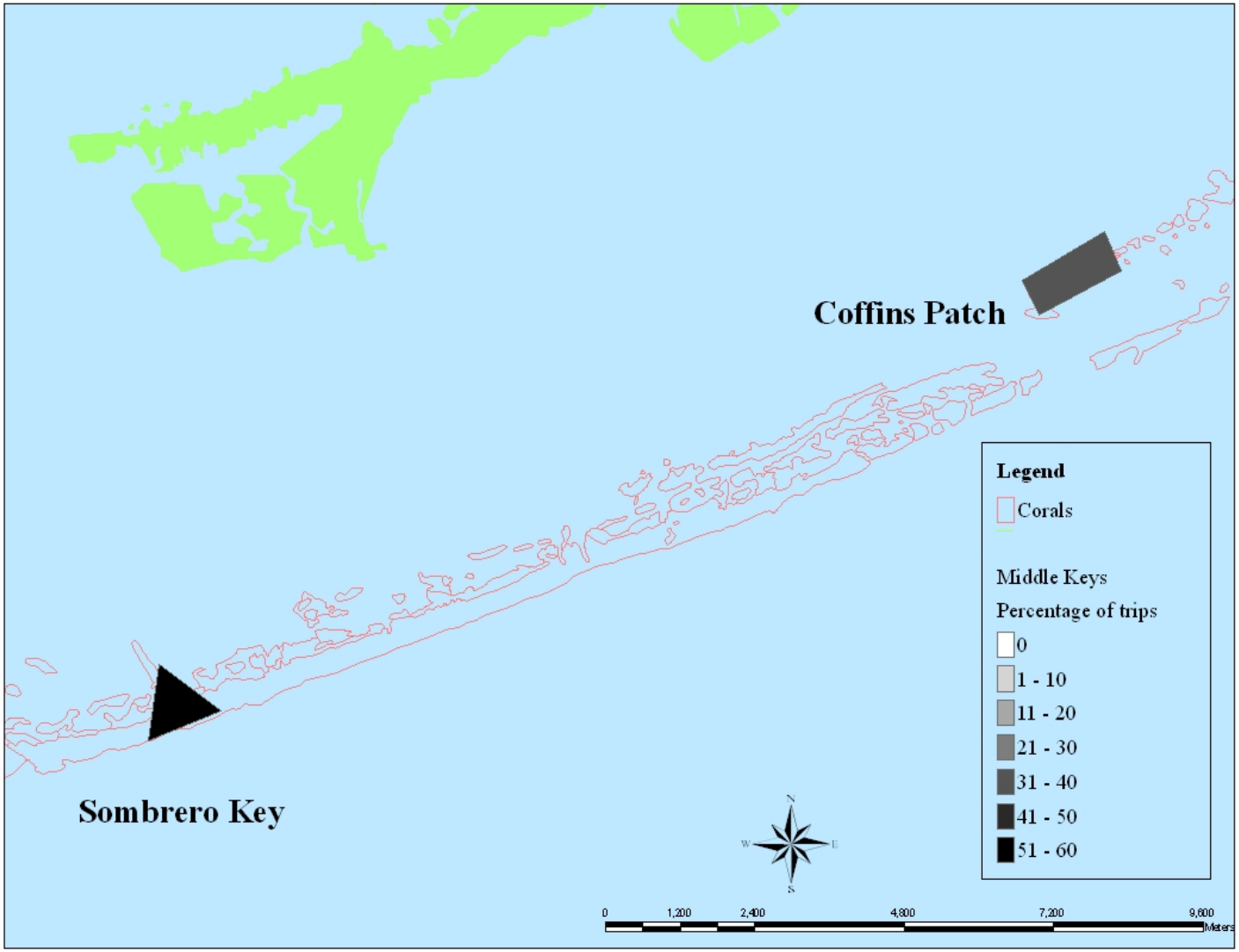

Figure 28: Middle Keys percent trips to FKNMS zones

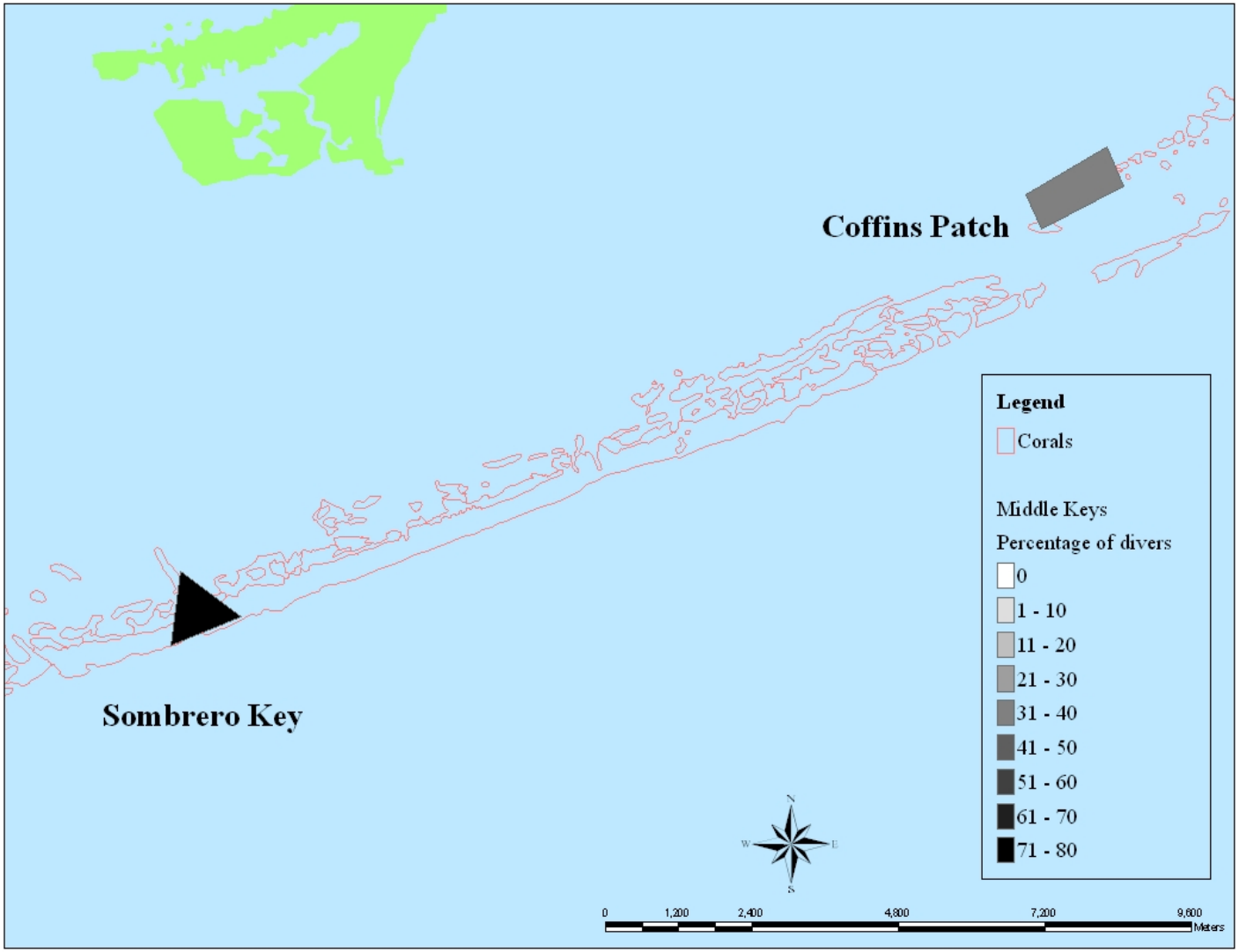

Figure 29: Middle Keys percent divers to FKNMS zones

Figures 26 – 29 show dive and snorkel use in the two SPAs in the Middle Keys. Use targeting the two SPAs – Coffins Patch and Sombrero Reef – originated from the adjacent (northern) island of Marathon. Overall, nine dive operators in the Middle Keys reported using Sombrero Key SPA and eight used Coffins Patch SPA. Sombrero Key SPA attracted a large number of trips and divers, and it was second only to Molasses Reef SPA in the Upper Keys in both categories for all FKNMS zones. In the Middle Keys, the almost 2,000 trips and 30,000 divers taken to Sombrero Key SPA represented 68.4% and 84.2% of the FKNMS zone trips and divers, respectively, for the region. Thus, while, Coffins Patch SPA did host almost a third of FKNMS zone trips in the Middle Keys, it only attracted 15% of the divers.

As per percent trips, both SPAs were very important to the users who reported taking trips and divers to the zones. The nine operators who used Sombrero Key SPA took 57.9% of their total trips and 73.6% of their total divers to that SPA. By contrast, Coffins Patch accounted for 35.1% of the total trips taken by the eight Middle Keys respondents who took trips to the zone, as well as 31.2% of their total divers. Together, these two zones captured a majority of all dive use in the Middle Keys (78.8% of all trips and 85.5% of all divers), and the percent trips show that unlike in the Upper Keys where dive operators switched their trips, the main use patterns in the Middle Keys were to visit Sombrero Key SPA as a primary site and to take relatively fewer trips and divers to Coffins Patch SPA.

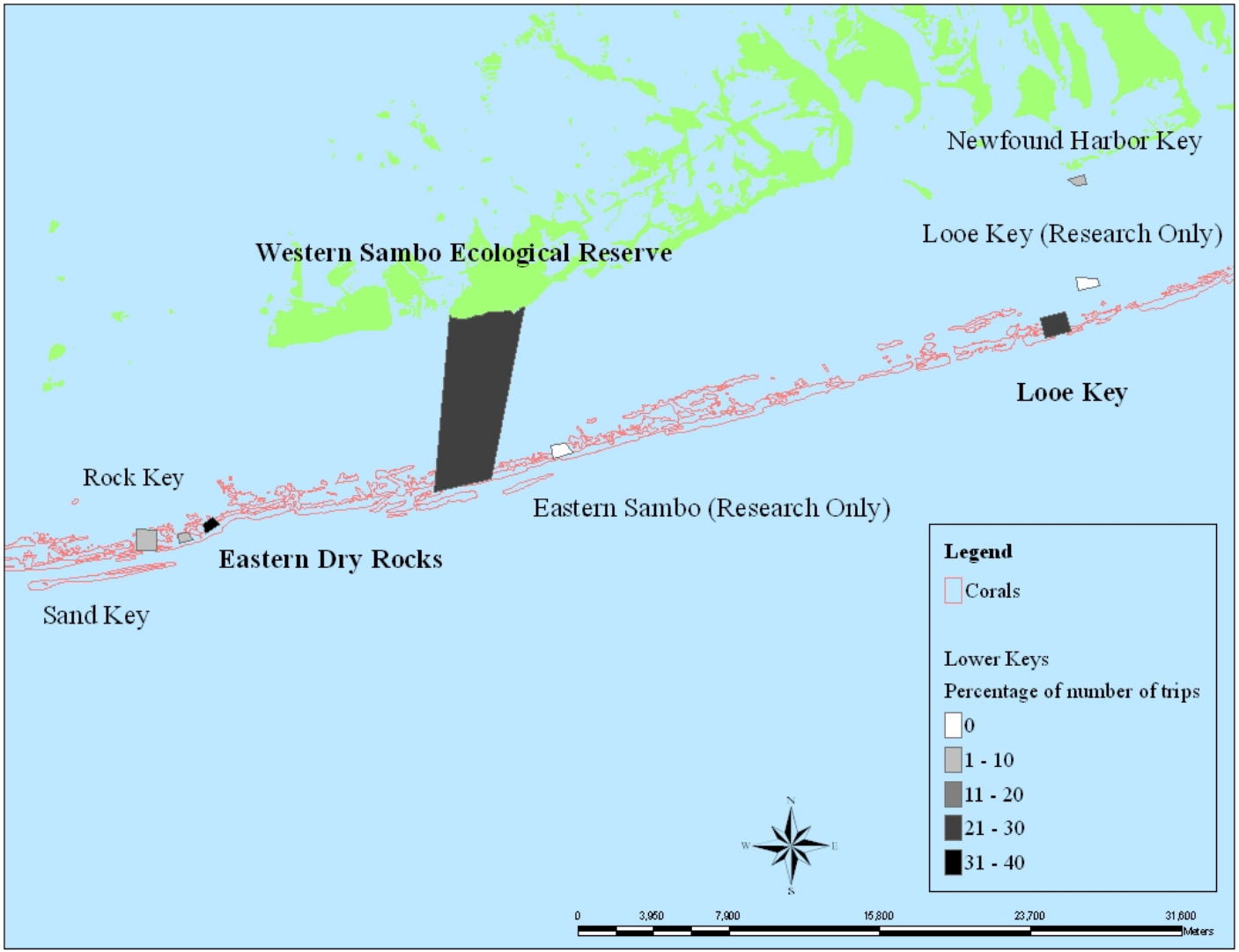

Figure 30: Lower Keys trips to FKNMS zones

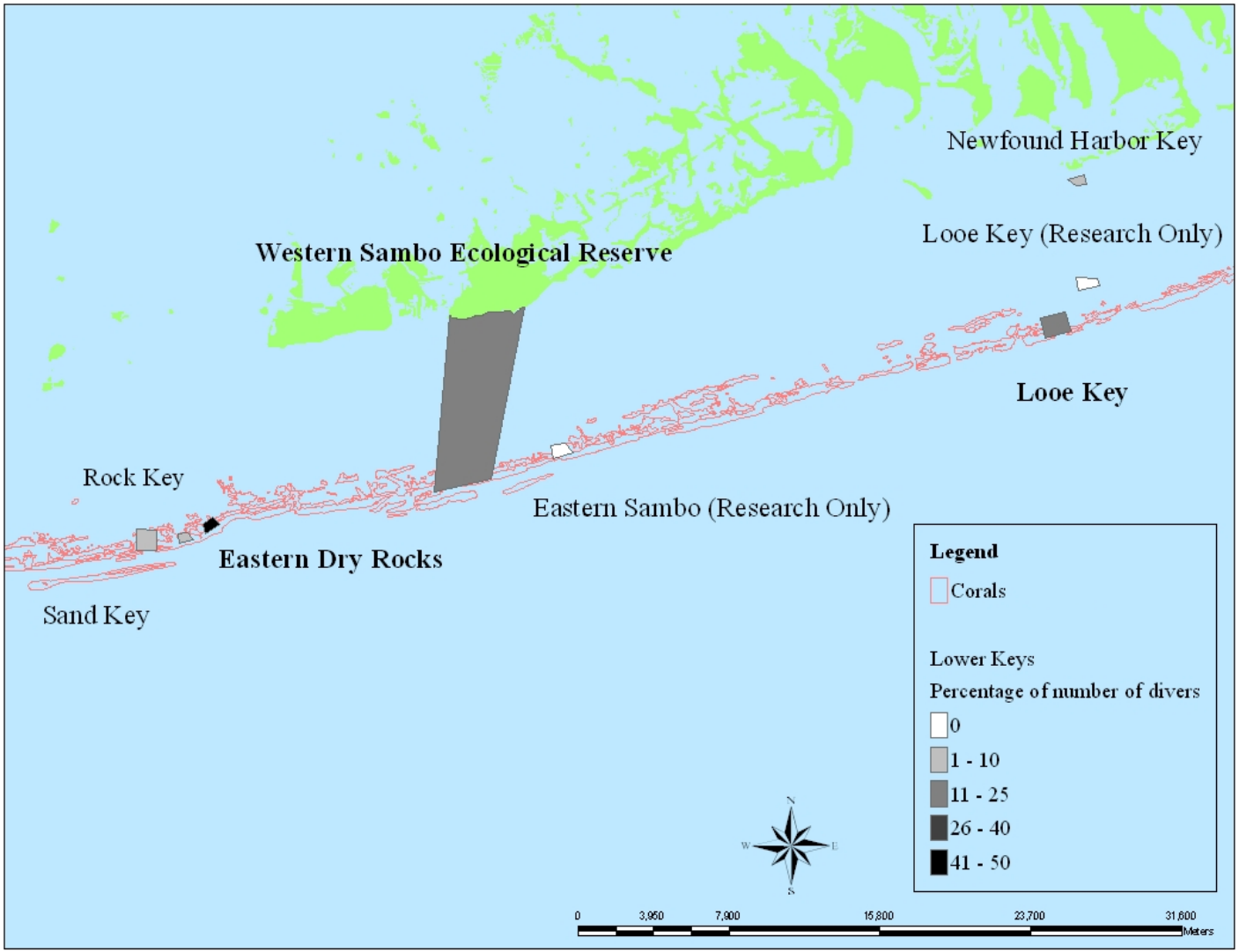

Figure 31: Lower Keys divers to FKNMS zones

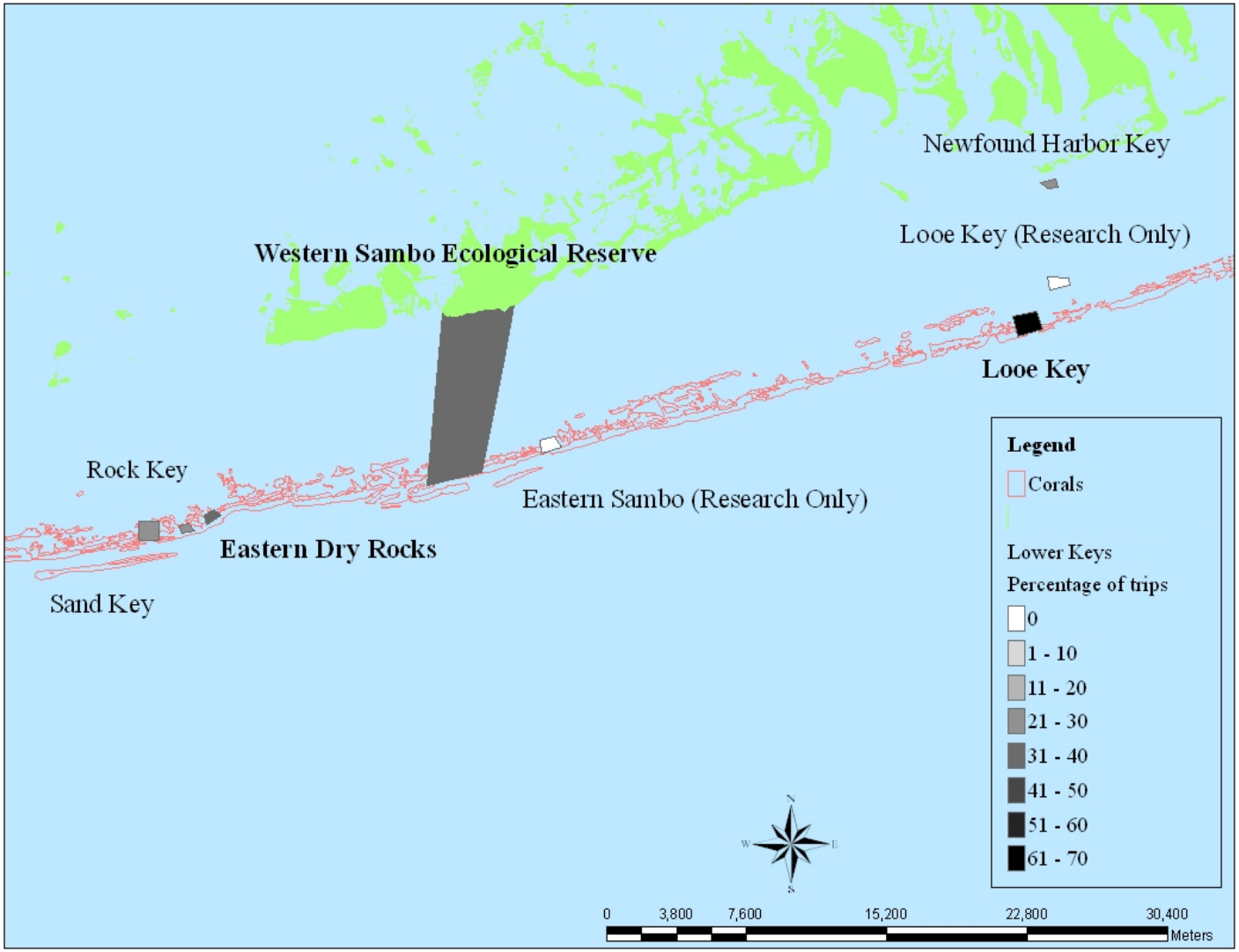

Figure 32: Lower Keys percent trips to FKNMS zones

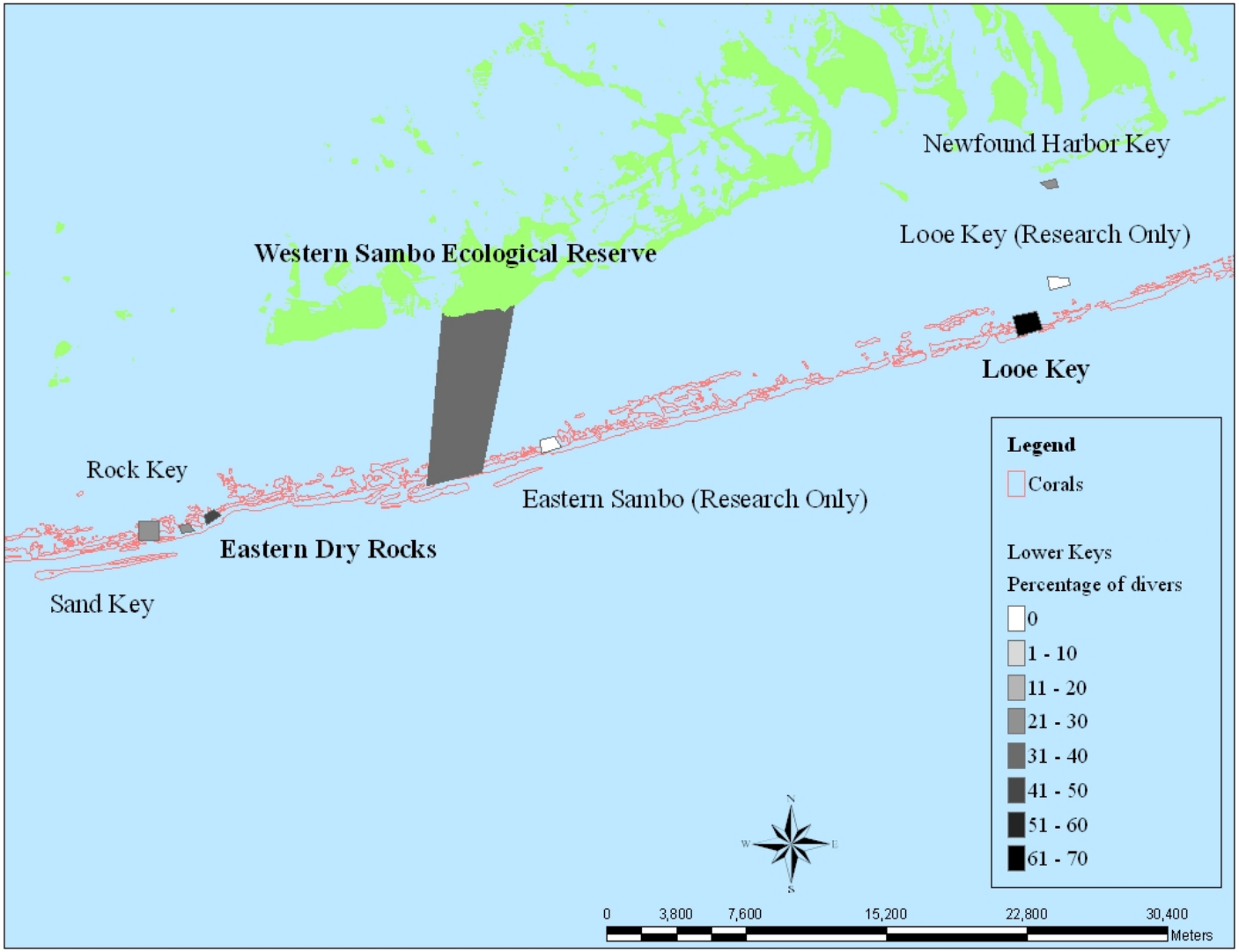

Figure 33: Lower Keys percent divers to FKNMS zones

Figures 30 – 33 show the trips and divers taken to Lower Keys FKNMS zones. The Lower Keys, like the Upper Keys, are evaluated in two sections. The eastern section is that which includes Looe Key SPA (formerly part of the Looe Key National Marine Sanctuary), Looe Key SUA, and Newfound Harbor Key SPA, and the northern, adjacent islands of Big Pine Key, Ramrod Key, and Summerland Key. The western section is comprised of the Sand Key-Rock Key-Eastern Dry Rocks SPA complex, Western Sambos ER, and Eastern Sambos SUA, which attract use mainly from islands of Key West and Stock Island. Within the eastern section, Looe Key SPA is the most important dive site, hosting 26.7% of all trips and 20% of all divers in the Lower Keys' zones. However, because there is no overlap in trips between the eastern and western sections, it should be stated that Looe Key hosted almost all trips and divers in the eastern section (with Newfound Harbor Key SPA hosting a handful of trips and divers). Within the western section, Eastern Dry Rocks SPA hosted 32.2% of all trips and 48% of all divers for the region's zones (again, these percentages would be considerably higher if only the western section is considered), followed by Western Sambos SPA (23.2% of all trips and 17.9% of all divers in the Lower Keys zones.

Percent trips and divers for each zone (Figures 32 – 33) demonstrate that Looe Key SPA was the most important zone in the eastern section of the Lower Keys, as it was in 1996 (Shivlani and Suman, 2000). The five operators who used Looe Key SPA took 62% of their total trips and 65.1% of their total divers to Looe Key SPA, suggesting a higher reliance among these users for Looe Key SPA than for those who used Molasses Reef SPA in the Upper Keys and comparable to those who used Sombrero Reef Key SPA in the Middle Keys. In the western section of the Lower Keys, Eastern Dry Rocks SPA and Western Sambos ER attracted the highest level of percent trips and divers. Twelve (or 60% of the Lower Keys' total dive operators) took 32.1% of their total trips and 44.1% of their total divers to Eastern Dry Rocks SPA; fewer operators (four or fewer) took trips to adjacent SPAs (Sand Key and Rock Key SPAs), which accounted for a quarter or less of those operators' total trips and divers. Finally, 40% of the Lower Keys' dive operators took trips and divers to the Western Sambos ER (a majority of the trips were taken along the southern part of the ER, which encompasses the preferred coral reef habitat and has mooring buoys), and the zone attracted 37.7% of all of the users' trips and 36.9% of their total divers. As in the lower section of the Upper Keys, where dive operators focused on a few zones for most of their trips, dive operators in the western section of the Lower Keys concentrated either on the southern Western Sambos ER or on Eastern Dry Rocks SPA, located further to the southwest.

4.2.4 Dive operator survey attitudes, perceptions, and beliefs

Dive operators described their views on the information sources on the FKNMS and their perceptions concerning the FKNMS process and its outcomes, the FKNMS zones, and FKNMS performance.

Table 29: Dive operator survey sources of information

Sources of information	*2006 sample (n = 69)*	*2006 sample ranking (std dev)*	*1996 sample (n = 62)*	*1996 sample usefulness of source (n = 62)*
1. FKNMS website*	38.8	n =22 3.5 (2.20)	-	
2. FKNMS staff/personnel	50.7	n = 35 1.91 (1.03)	53.2	24.2
3. FKNMS Draft Management Plan**	-		69.4	38.7
4. FKNMS Advisory Council*	26.1	n = 18 2.78 (1.96)	-	
5. FKNMS brochures/literature	65.2	n = 45 2.11 (1.3)	43.5	9.7
6. FKNMS signage*	42.0	n = 29 3.03 (1.61)	-	
7. NOAA meetings**	-		56.5	29.0
8. Newspapers	49.3	n = 34 3.23 (1.71)	66.1	16.1
9. Radio	23.2	n = 16 3.75 (1.81)	40.3	4.8
10. Television	17.4	n = 12 4.33 (2.06)	40.3	4.8
11. Anti-FKNMS groups**	-		32.3	4.8
12. Commercial fishing groups**	-		3.2	1.6
13. Environmental groups**	-		38.7	4.8
14. Government fisheries organizations**	-		17.7	4.8
15. Sea Grant**	-		3.2	1.6
16. Dive organization**	-		76.1	15.2
17. Rumors/word of mouth	59.4	n = 41 2.83 (1.39)	66.1	9.7

* refers to those sources listed in the 2006 survey but not in the 1996 survey
** refers to those sources listed in the 1996 survey but not in the 2006 survey

As shown in Table 29, dive operators used a variety of sources to obtain information on the FKNMS in both during the designation process and in the present study. The most frequently used sources listed by the 2006 sample consisted of FKNMS sources,

including FKNMS literature (65.2%), FKNMS staff/personnel (50.7%), FKNMS signage (42%), FKNMS website (38.8%), and the Sanctuary Advisory Council (26.1%). While there was a range in the level to which each was accessed, dive operators relied considerably on the suite of FKNMS sources. Almost 60% of dive operators also received information on the FKNMS from word of mouth sources, and fewer relied on media sources (with the exception of newspapers, which 49.3% of the sample identified as an FKNMS information source). This is to be contrasted with the 1996 sample which relied more frequently on media sources. Also, in 1996, only 43.5% of the respondents listed FKNMS literature as an information source, compared to almost two thirds of the 2006 sample (although it should be noted that 69.4% of the 1996 sample reported having read part of the FKNMS Draft Management Plan).

In terms of the usefulness of the information provided, dive operators in the 2006 sample ranked FKNMS personnel as the most useful source of information on the FKNMS, followed by FKNMS literature, and the Sanctuary Advisory Council. Generally, the sample did not rank non-FKNMS sources as useful as FKNMS sources, such that media sources were not considered very useful. However, word of mouth sources were ranked above all media sources, suggesting that intra-group communication plays an important role in information dissemination. Also, the respondents ranked the FKNMS website as the least useful of all FKNMS sources, suggesting that while it is used by almost 40% of the dive operators interviewed, it is not considered very useful. The respondents in the 1996 sample reported the FKNMS Draft Management Plan and FKNMS personnel as the most useful sources of information, respectively; thus, like their 2006 sample counterparts, dive operators in the 1996 study believed that FKNMS sources provided the most useful information on the FKNMS objectives and process. Similarly, media sources, though used frequently by respondents in the 1996 sample, were not considered as useful as FKNMS sources.

Table 30: Dive operator survey perceptions on FKNMS processes

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.	2006	34.8	15.9	13.0	7.3	7.3	21.7	n = 54 2.18 (1.35)
	1996	29.5	21.3	9.8	6.6	13.1	19.7	n = 49 2.41 (1.47)
2. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.	2006	37.7	14.5	5.8	10.0	7.3	24.7	n = 52 2.13 (1.41)*∫
	1996	14.8	24.6	8.2	11.5	18.0	22.9	n = 47 2.91 (1.49)*∫
3. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.	2006	18.9	13.0	11.6	24.6	18.9	13.0	n = 60 3.13 (1.48)
	1996	27.9	16.4	6.6	19.7	26.2	3.3	n = 59 3.00 (1.63)
4. NOAA has not addressed the concerns of local and state governments in developing rules and regulations for the FKNMS.	2006	8.7	8.7	21.7	20.0	15.9	24.6	n = 52 3.35 (1.27)
	1996	16.4	16.4	13.1	18.0	13.1	22.9	n = 47 2.94 (1.42
5. NOAA has not addressed the concerns of individual citizens in developing rules and regulations for the FKNMS.	2006	14.5	14.5	8.7	23.2	20.3	18.8	n = 56 3.27 (1.47)*∫
	1996	31.1	26.2	9.8	6.6	19.7	6.6	n = 57 2.54 (1.54)*∫
6. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.	2006	14.5	14.5	13.0	17.4	24.6	16.0	n = 58 3.25 (1.48)*∫
	1996	39.3	21.3	4.9	4.9	24.6	4.9	n = 58 2.52 (1.67)*∫
7. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.	2006	23.2	17.4	13.0	18.9	14.5	13.0	n = 60 2.81 (1.47)
	1996	8.2	18.0	4.9	14.8	22.9	31.1	n = 42 3.38 (1.48)

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Table 30 presents dive operators' views on process outcomes as these (mainly) relate to the FKNMS zoning strategy. Over half of the dive operators interviewed in 2006 believed that the processes NOAA used to develop rules and regulations for the FKNMS and to develop boundaries and regulations for the FKNMS zones were open and fair to all groups. In contrast, dive operators in the present study were significantly more in agreement than their 1996 sample counterparts that the process used to develop boundaries and regulations were open and fair to all groups. Similarly, a significantly higher percentage in the 2006 sample, compared to the 1996 sample, disagreed that NOAA had not addressed the concerns of individual citizens in developing rules and regulations for the FKNMS. Also, significantly more respondents in 2006 compared to those in 1996 disagreed that there has been no way that the average person has been able to voice his/her opinion on the usefulness of FKNMS regulations. Effectively, dive operators shifted their views on the FKNMS process from wariness to acceptance. Thus, while 57.3% of the respondents in 1996 believed that NOAA had not addressed the concerns of individual citizens in the FKNMS designation process, only 29% in the 2006 sample concurred. Also, 31.9%% of the dive operators surveyed in 2006 believed that participation on the FKNMS had not mattered, compared to 44.3% of the respondents in the 1996 sample. Finally, the industry's perceptions on the fairness of the FKNMS process since its implementation have become more favorable over time.

Thus, while in 1996, 60.6% of those operations surveyed agreed that there will be no way for the average person to voice his/her opinion on the usefulness of FKNMS regulations, only 29% in the 2006 sample agreed. Similarly, 40.6% of the respondents in the present study agreed that the procedures that NOAA has established to address FKNMS regulatory violations are fair and just, a large increase over the 26.2% who agreed in 1996. Taken together, these perceptions describe a change in overall views held by the dive operator industry on the FKNMS and the process that NOAA used to implement the FKNMS. Whereas many dive operators remained unsure of the FKNMS in 1996, especially as related to the participatory nature of the process that NOAA would use to develop FKNMS rules and regulations and the fairness of those rules and regulations, dive operators in 2006 had worked under FKNMS rules and regulations for almost a decade, determining that the FKNMS was not as arbitrary in its rulemaking as previously feared.

Table 31: Dive operators' views on FKNMS zone purpose and beneficiaries

Question	*1996 sample*	*Ecological reserves*	*Sanctuary preservation areas*	*Wildlife management areas*
1. Which of the following represents the main purpose of the FKNMS zones?				
a. Increasing overall fish stocks and biomass inside the zones	n = 62 83.9	n = 69 56.2	n = 69 60.9	n = 69 39.0
b. Increasing overall fish stocks and biomass outside the zones	59.7	43.5	37.7	34.8
c. Conserving and protecting corals, fish, and other marine life	83.9	56.2	75.3	46.4
d. Resolving user group conflicts		21.7	40.6	14.5
e. Supporting scientific research		52.2	62.3	37.7
2. Which groups have benefited the most from FKNMS zones?				
a. Commercial fishers	n = 62 24.2	n = 69 27.5	n = 69 30.4	n = 69 27.5
b. Recreational/sport fishers	35.5	30.4	34.8	15.9
c. Commercial dive operators	-	43.5	59.4	31.9
d. Recreational (local and tourist) divers	38.7	46.4	75.4	35.5

Dive operators provided their views on the purpose of the FKNMS zones and the prime beneficiaries of the FKNMS zones, as shown in Table 31. In terms of replenishment, 60.9% of the respondents agreed that the main purpose of SPAs was to increase stocks and biomass within the SPAs, compared to 56.2% and 39.0% who agreed that zone-specific replenishment represented the main purpose of ERs and WMAs, respectively. Fewer dive operators believed that any of the three zone types had been set up to increase replenishment across the region (although more respondents agreed that ERs, over SPAs and WMAs, may have been set up to increase regional replenishment). Most dive operators agreed, for all three zone types, that the main purpose of the zones was to conserve and protect corals, fish, and other marine life within the zones, with 75.3% agreeing that SPAs had been set up to fulfill that purpose. Also, a majority of the respondents agreed that ERs (52.2%) and SPAs (62.3%) had been set up to support scientific research. Fewer believed that zone designation addressed user conflict resolution, with 40.6% agreeing that SPAs were set up for that purpose, and fewer (21.7% for ERs and 14.5% for WMAs) believing that other zone types were set up to reduce user conflicts. These findings were similar to those reported for the 1996 sample, which also agreed that the main purpose of the zones was more to increase fish stocks

and biomass and to protect corals, fish, and other marine life within the zones than to replenish stocks and biomass outside the zones.

With respect to zone beneficiaries, dive operators identified recreational divers as the group that had most benefited from ERs (46.4%), SPAs (75.4%), and WMAs (35.5%). The dive operators also identified their own group as a prime beneficiary, with 43.5% agreeing that dive operators had benefited from ERs, 59.4% from SPAs, and 31.9% from WMAs. Fewer respondents agreed that consumptive users, such as commercial and recreational fishers, had been the primary beneficiaries of the zone closures, and these views were similar to those expressed by the 1996 sample. It is important to note that dive operators differentiated the level of benefits they derived from different zone types. For instance, 59.4% and 75.3% of the respondents agreed that dive operators and recreational divers had benefited from the SPAs, respectively. Fewer identified recreational divers (46.4% for ERs and 35.5% for WMAs) and dive operators (43.5% for ERs and 31.9% for WMAs) as prime beneficiaries of the other zones, as compared to SPAs. This was most likely related to the high level of SPA use, which accounted for 69.3% of total trips and 93% of all zone-specific trips taken by the dive operator sample in 2005.

Table 32: Dive operator views on FKNMS zone outcomes

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. FKNMS zones have reduced conflicts between different user groups.	ER (n =69)	23.2	11.6	18.8	10.1	5.8	30.4	n = 48 2.12 (132)*∫
	SPA (n = 69)	30.4	20.3	20.3	10.1	10.1	8.7	n = 63 2.44 (1.35)*∫
	WMA (n = 69)	18.8	11.6	20.3	7.2	5.8	36.2	n = 44 2.52 (1.28)*∫
	1996 (n = 61)	11.5	21.3	14.7	11.5	37.7	3.3	n = 59 3.44 (1.49)*∫
2. FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they used to be.	ER (n = 69)	11.6	15.9	11.6	15.9	17.4	27.5	n = 50 3.16 (1.43)
	SPA (n = 69)	21.7	15.9	13.0	17.4	26.1	5.8	n = 65 3.11 (1.55)
	WMA (n = 69)	11.6	15.9	11.6	8.7	17.4	34.8	n = 45 3.07 (1.48)
	1996 (n = 61)	14.7	22.9	8.2	14.7	34.4	4.9	n = 58 3.33 (1.55)
3. FKNMS zones have led to better diving conditions in the Florida Keys, such as healthy coral, more abundant marine life, and clearer water.	ER (n = 69)	13.0	29.0	17.4	7.2	5.8	27.5	n = 50 2.50 (1.15)
	SPA (n = 69)	17.4	37.7	20.3	8.7	8.7	7.2	n = 64 2.50 (1.18)
	WMA (n = 69)	11.6	24.6	14.5	5.8	5.8	37.7	n = 43 2.51 (1.18)
	1996 (n = 61)	16.4	37.7	6.6	11.5	26.2	1.6	n = 60 2.93 (1.51)
4. My use of FKNMS zones has increased since their establishment.	ER (n = 69)	24.6	4.3	24.6	4.3	11.6	30.4	n = 48 2.62 (1.45)
	SPA (n = 69)	29.0	10.1	30.4	7.2	15.9	7.2	n = 64 2.68 (1.43)
	WMA (n = 69)	20.3	2.9	24.6	4.3	8.7	39.1	n = 42 2.64 (1.39)

5. I support the establishment of FKNMS zones as they are established currently.	ER (n = 69)	40.6	14.5	10.1	2.9	5.8	26.1	n = 51 1.90 (1.52)*ʃ
	SPA (n = 69)	49.3	23.2	11.6	2.9	5.8	7.2	n = 64 1.84 (1.16)*ʃ
	WMA (n = 69)	34.8	13.0	10.1	2.9	4.3	34.8	n = 45 1.91 (1.15)*ʃ
	1996 (n = 61)	18.0	22.9	8.2	16.4	26.2	8.2	n = 56 3.11 (1.55)*ʃ
6. I support the establishment of FKNMS zones in the Upper Keys.	ER (n = 69)	34.8	11.6	11.6	2.9	5.8	33.3	n = 46 2.00 (1.30)
	SPA (n = 69)	43.5	18.8	14.5	4.3	4.3	14.5	n = 59 1.92 (1.16)
	WMA (n = 69)	33.3	11.6	8.7	1.4	4.3	40.6	n = 41 1.85 (1.22)
	1996 (n = 61)	31.1	34.4	9.8	6.6	14.7	3.3	n = 59 2.37 (1.40)
7. I support the establishment of FKNMS zones in the Middle Keys.	ER (n = 69)	37.7	7.2	13.0	2.9	5.8	33.3	n = 46 1.91 (1.15)
	SPA (n = 69)	42.0	17.4	15.9	2.9	4.3	17.4	n = 57 1.91 (1.15)
	WMA (n = 69)	34.8	10.1	10.1	2.9	1.4	40.6	n = 41 1.76 (1.07)
	1996 (n = 61)	32.8	31.1	9.8	6.6	14.7	4.9	n = 58 2.36 (1.42)
8. I support the establishment of FKNMS zones in the Lower Keys.	ER (n = 69)	36.2	10.1	8.7	5.8	5.8	33.3	n = 46 2.02 (1.36)
	SPA (n = 69)	42.0	17.4	14.5	4.3	4.3	17.4	n = 57 1.93 (1.18)
	WMA (n = 69)	34.8	10.1	8.7	4.3	2.9	39.1	n = 42 1.86 (1.20)
	1996 (n = 61)	36.1	34.4	8.2	4.9	14.7	1.6	n = 60 2.26 (1.40)

9. I support the establishment of FKNMS zones in the Dry Tortugas.	ER (n = 69)	36.2	10.1	8.7	5.8	5.8	33.3	n = 46 2.06 (1.39)
	SPA (n = 69)	42.0	17.4	14.5	4.3	4.3	17.4	n = 56 2.05 (1.31)
	WMA (n = 69)	34.8	10.1	8.7	4.3	2.9	39.1	n = 41 1.88 (1.21)
10. There should be more FKNMS zones in the Florida Keys.	ER (n = 69)	36.2	10.1	8.7	5.8	5.8	33.3	n = 52 2.17 (1.49)
	SPA (n = 69)	42.0	17.4	14.5	4.3	4.3	17.4	n = 65 2.34 (1.51)
	WMA (n = 69)	34.8	10.1	8.7	4.3	2.9	39.1	n = 46 2.02 (1.42)

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Dive operators provided their opinions on the outcomes of the FKNMS zones (Table 32), and the general consensus was that dive operators were in favor of the current zoning strategy but that the zones had produced mixed results. For example, while respondents generally agreed that the FKNMS zones (especially the SPAs) had reduced use conflicts, led to improved diving conditions, and had led to increased dive operator use, the sample was split in its opinion on whether the zones had restored coral reefs to their previous condition. Nevertheless, when compared with the 1996 sample, dive operators from the present study perceived mainly favorable zone outcomes. Thus, while the average response among dive operators in 1996 was moderate disagreement on average for the statement that zones would reduce use conflict, the average response in the 2006 sample was that of moderate agreement for the same statement. Similarly, dive operators showed significantly higher support for the zones as they are currently established in the present sample, compared to the 1996 sample. Moreover, even in those results which did not show a significant difference between samples, dive operators from the present study generally tended to favor the FKNMS zoning (ex. support for FKNMS zones in the various parts of the Florida Keys) than did their counterparts in 1996. Finally, a large percentage of dive operators surveyed in 2006 agreed that there should be more FKNMS zones in the Florida Keys, with 59.4% of the respondents agreeing that there should be more SPAs. These results show that dive operators recognize that their group has benefited from the FKNMS zoning strategy and that the FKNMS zones have, in part, generated conditions favorable to diving and snorkeling such that zone use has remained stable or increased (over 69% of dive operators agreed with or were neutral on the statement that their use of FKNMS zones had increased since they started using the zones)[16]. As such, the concerns expressed by respondents in the earlier study, in which dive operators were divided on whether the FKNMS zones would reduce use conflicts and the siting of the zones, had been largely allayed over the FKNMS tenure. Dive operators are now largely proponents of the FKNMS zoning strategy.

[16] In another question, 18.5% of 65 dive operators reported having increased their use of FKNMS zones since their implementation, compared to 4.6% who reported reducing FKNMS zone trips. A majority, or 76.9%, did not change their use patterns since FKNMS zone implementation.

Table 33: Dive operator views on FKNMS zone outcomes

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. I support the establishment of Special-use Areas (SUAs) in the FKNMS.	2006 (n = 69)	40.6	23.2	10.1	11.6	5.8	8.7	n = 63 2.11 (1.28)*∫
	1996 (n = 61)	27.9	26.2	4.9	8.2	32.8	-	n = 61 2.92 (1.68)*∫
2. There should be additional SUAs in the FKNMS.	2006 (n = 69)	24.6	14.5	20.3	10.2	14.5	15.9	n = 58 2.71 (1.45)*∫
	1996 (n = 61)	11.5	11.5	14.7	9.8	45.9	6.6	n = 57 3.72 (1.49)*∫
3. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program	2006 (n = 69)	47.8	40.6	7.3	1.4	2.9	-	n = 69 1.71 (0.89)
4. The Florida Keys have benefited environmentally from the FKNMS.	2006 (n = 69)	52.2	30.4	8.7	4.3	2.9	1.5	n = 68 1.73 (1.00)
5. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS.	2006 (n = 69)	39.1	26.1	13.0	8.7	7.3	5.8	n = 65 2.14 (1.27)*∫
	1996 (n = 61)	21.3	31.1	16.4	9.8	14.7	6.6	n = 57 2.63 (1.37)*∫
6. Diving and snorkeling have no effect on marine ecosystems or resources.	2006 (n = 69)	7.3	14.5	8.7	24.6	43.5	1.4	n = 68 3.84 (1.33)
	1996 (n = 61)	8.2	13.1	8.2	32.8	37.7	-	n = 61 3.79 (1.31)

7. Mooring buoys have a positive effect on the marine environment.	2006 (n = 69)	79.7	11.6	2.9	1.4	4.4	-	n = 69 1.39 (0.96)
8. There should be a dive/snorkel operator funded mooring buoy program in the FKNMS.	2006 (n = 69)	20.3	5.8	17.4	15.9	40.6	-	n = 69 3.51 (1.56)
	1996 (n = 61)	8.2	18.0	6.6	11.5	55.7	-	n = 61 3.89 (1.45)
9. There should be a diver/snorkeler (user) funded mooring buoy program in the FKNMS.	2006 (n = 69)	17.4	18.8	10.2	18.8	34.8	-	n = 69 3.35 (1.54)
	1996 (n =61)	3.3	24.6	1.6	4.9	37.7	27.8	n = 44 3.68 (1.52)
10. There should be limited entry for dive/snorkel operations in the Florida Keys.	2006 (n = 69)	14.5	11.6	21.7	13.0	37.7	1.5	n = 68 3.48 (1.47)
11. I generally support the establishment of the FKNMS.	2007 (n = 69)	53.6	33.4	7.3	2.9	1.4	1.4	n = 68 1.63 (0.86)*∫
	1996 (n = 61)	44.3	19.7	16.4	8.2	11.5	-	n = 61 2.23 (1.40)*∫

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

In Table 33, dive operators provided their views on effects of the FKNMS, the impacts of diving and snorkeling, and their support for management alternatives. Almost two thirds of the sample, or 63.8%, supported the establishment of the Special-use Areas (SUAs), which are no-dive zones; the level of support was significantly higher than in 1996, when 54.1% of the sample supported SUAs. However, the level of support dropped to 39.1% when dive operators were asked whether they would support additional SUAs (which was still significantly higher than the 23% that supported additional SUAs in 1996). Dive operators were overwhelmingly in support of the FKNMS and its parent agency, NOAA, in terms of the Sanctuary's performance. Over 88% of the sample agreed that NOAA had made a positive contribution to the marine environment via the National Marine Sanctuary Program, and 82.6% believed that the Florida Keys had benefited environmentally from the FKNMS. Also, 65.2% of the dive operators agreed that there had been a net economic benefit to the Florida Keys from the establishment of the FKNMS, a significantly higher level of support than shown by the 1996 sample for the same statement. Overall, 87% of the respondents supported the establishment of the FKNMS, compared to 64% who supported FKNMS establishment in 1996; in the previous study, 19.7% did not support the FKNMS, significantly higher than the 4.3% that did not support the FKNMS in the 2006 sample. Effectively, support for the FKNMS increased by 23% in the ten years since the FKNMS was implemented, suggesting a dramatic shift in the dive operator industry's views on the FKNMS and its effects on the industry.

As for their perceptions on their industry, dive operators remained convinced that their activity is not non-consumptive, as 68.1% disagreed that diving and snorkeling have no effects on marine ecosystems or resources. Conversely, 91.3% of those surveyed expressed support for mooring buoys, which they agreed have a positive effect on the marine environment. However, the 2006 sample did not report a higher preference for user fees to fund a mooring buoy program in the FKNMS than did the 1996 sample. Only 26.1% were in favor of a dive operator funded mooring buoy program (and 56.5% were against such a program), while 36.2% favored a diver funded mooring buoy program (with 53.6% against it). Dive operators were also not in favor of having a limited entry system, which just over a quarter (26.1%) supported and a majority (50.7%) opposed. These results show that while dive operators understood that their activities do have impacts on marine resources (i.e. diving and snorkeling are not completely benign), a majority of the industry was unwilling to bear the burden of funding (either directly or via user fees) a mooring buoy program. Several of those surveyed argued that the FKNMS should be charged with funding a mooring buoy program. Most dive operators in the sample were also against having a limited entry system, which may in part be a result of the high turnover in the industry (average tenure among dive operators was between 6-10 years).

Table 34: Dive operators' views on FKNMS resource conditions

Better ←----Neutral------→ Worse

Resource	*Sample*	*1*	*2*	*3*	*4*	*5*	*Don't know*	*Sample mean** (std dev)*
1. Water quality	n = 69	7.2	17.4	33.3	17.4	17.4	7.2	n = 64 3.22 (1.19)
2. Land-based pollution/sewage	n = 69	8.7	14.5	26.1	24.6	17.4	8.7	n = 63 3.31 (1.23)
3. Sea-based pollution/marine debris	n = 69	8.7	30.4	21.7	17.4	17.4	4.4	n = 66 3.04 (1.27)
4. Coral reefs	n = 69	8.7	18.8	14.5	37.7	17.4	2.9	n = 67 3.37 (1.24)
5. Sea grasses	n = 69	5.8	30.4	42.0	4.4	5.8	11.6	n = 61 2.70 (0.92)
6. Fisheries	n = 69	13.0	20.3	26.1	11.6	10.1	18.8	n = 56 2.82 (1.24)
7. Mooring buoys	n = 69	50.7	23.2	15.9	5.8	-	4.4	n = 66 1.82 (1.11)
8. Vessel groundings	n = 69	18.8	20.3	34.8	13.0	7.2	5.8	n = 65 2.68 (1.17)

**1-5 scale, where 1 is better and 5 is worse; 3 is neutral or no change

Table 34 shows the dive operators' perceptions on a variety of resource conditions, in terms of changes that have occurred in the resource conditions since the implementation of the FKNMS. Dive operators believed that vessel groundings had decreased and fisheries and sea grass conditions had improved since the implementation of the FKNMS, but that land-based pollution and water quality had worsened, and coral reefs had declined[17]. Of all the resources that had improved over the FKNMS tenure, dive operators pointed to the greater number and better siting of mooring buoys, both of which had assisted in the prevention of anchor and vessel damage on coral reefs. The respondents were mixed in their opinion on whether the FKNMS was responsible for the observed resource conditions, as 38.2% agreed that the FKNMS was responsible and 33.8% disagreed.

When asked about the areas in which the FKNMS had been a success, the most common response among dive operators was mooring buoys (28.9%), followed by FKNMS zones (18.0%), fisheries and marine life (13.3%), coral reefs (13.3%), and enforcement (10%). Respondents often identified the same areas that others had stated were successes as failures. For example, almost a third of those who identified a failure listed enforcement

[17] In a similar study conducted with seven stakeholder groups in the southeast Florida region, Shivlani and Villanueva (2007) determined that all stakeholder groups believed that coral reef and water quality conditions had declined over their tenure.

(32.3%). Other common areas of perceived failure were coral reefs (20%), pollution (18.5%), and vessel groundings (12.3%).

Table 35: Dive operators' views on resource conditions inside FKNMS zones

Resource type	*Changes in Ecological Reserves** (std dev)*	*Changes in Sanctuary Preservation Areas** (std dev)*	*Changes in Wildlife Management Areas** (std dev)*
Water quality	n = 39	n = 59	n = 42
	3.00	3.05	3.19
	(1.15)	(1.18)	(1.11)
Number of fish	n = 43	n = 63	n = 43
	2.42	2.28	2.65
	(1.16)	(1.18)	(1.04)
Types of fish	n = 42	n = 62	n = 41
	2.81	2.71	3.05
	(1.10)	(1.14)	(0.97)
Amount of living coral	n = 42	n = 62	n = 35
	3.29	3.48	3.51
	(1.13)	(1.18)	(1.09)
Other marine life	n = 42	n = 63	n = 41
	2.71	2.62	2.83
	(1.07)	(1.09)	(0.97)
Crowding	n = 40	n = 62	n = 41
	3.17	3.76	3.51
	(1.01)	(1.15)	(1.19)

**1-5 scale, where 1 is better and 5 is worse

Finally, dive operators stated their views on changes in six resource conditions inside FKNMS zones since the establishment of the zones (Table 35). There was general agreement across all three zone types that faunal conditions (i.e. number of fish, types of fish, and other marine life) had improved. The greatest improvement had occurred in the number of fish in SPAs (mean = 2.28 on a 1-5 scale, where 1 is better and 5 is worse). However, dive operators also believed that the coral conditions (i.e. amount of living coral) inside all three zone types had decreased. They also perceived higher (and less acceptable) levels of crowding in all three zones types, with the worse crowding reported for SPAs (mean = 3.76). These results demonstrate that dive operators perceived differences in the extent of resource changes in the different zones, such that numbers and types of fish were reported as having improved more in the ERs and SPAs than in the WMAs (the latter of which are open to consumptive activities). The results also corroborate worrying trends in coral reefs in south Florida, those of decreased coral cover and increased crowding, and signal the need for increased biophysical and socioeconomic monitoring to determined the long-term changes in coral reefs, their resources, and uses.

4.2.5 Dive operator survey discussion

Dive operations' objectives frequently align with those of resource management programs (Rivera Miranda, 2007; Davis and Tisdell, 1995; Dixon et al., 1993), especially where these programs may lead to privileged (and even exclusive) access (ex. no-take

zones) and when the costs of protection and management are borne by governments, NGOs, or users (Arjina and Kramer, 2002; Bunce et al., 1999). However, dive operators in the Florida Keys did not express similar support for exclusive access in FKNMS zones when the Sanctuary underwent its designation process in 1995-97 (Suman and Shivlani, 1998). While 64% of the dive operators interviewed in 1996 did support the establishment of the FKNMS, many respondents believed that the NOAA had not heeded the concerns of local citizens in the designation process and that their opinions would not matter once the FKNMS regulations were implemented. Also, the 1996 sample moderately disagreed, on average, that the FKNMS zones would reduce user conflicts, and over 42% were not in favor of the zone locations in the FKNMS Draft Management Plan. Finally, dive operators were generally against having more FKNMS zones in the Florida Keys and were opposed to additional SUAs. These views revealed a wary dive operator industry that was unsure of the effects that the FKNMS rules and regulations would have on their operations (indeed, ability to use dive sites on which they relied and were now designated as SPAs).

The industry's uncertainty was further affected by anti-FKNMS propaganda. Suman et al. (1999) and NAPA (2001) have described the volatile conditions in the Florida Keys in the period following the release of the FKNMS Draft Management Plan, during which Keys' residents took sides with and against the establishment of the FKNMS. Opponents of the FKNMS argued that NOAA expected to add another 'layer of bureaucracy' and that the federal government would eventually restrict or prohibit all water-based industries (Swift, 1996). Anti-FKNMS groups such as the Conch Coalition and Victims of NOAA were comprised of a variety of stakeholders (ex. treasure salvors, commercial fishermen, real estate developers and professionals, etc.) concerned about the impacts of the FKNMS (in particular with its submerged cultural resources action plan and its zoning action plan), and these groups held frequent meetings and produced anti-FKNMS literature. Almost a third of the dive operators in the 1996 sample reported receiving anti-FKNMS literature, and 66% considered word of mouth information or rumors as a source of information.

When considered together, it is indicative that dive operator uncertainty over what anti-FKNMS groups purported were the NOAA's ulterior motives in zoning led to the group's unwillingness to provide greater support for the FKNMS process and FKNMS zoning action plan. Thus, while support for FKNMS establishment was high (due to an aligned view on resource management), the industry took a "wait and see" approach to specific aspects of FKNMS management, including zoning.

In 1997, the FKNMS implemented its zoning action plan. With that, the industry obtained privileged access (which is almost exclusive among commercial stakeholders in the no-take zones) to the FKNMS zones, and almost a fifth of the sample reported increasing their total trips to FKNMS zones. The smaller SUAs, where no diving is permitted, did not attract much dive use prior to their implementation (see Shivlani and Suman, 2000; NOAA, 1996), and dive operators' fears over no-dive/entry zones were not realized. Finally, regulations concerning carrying capacity/limits of acceptable change

that NOAA included as part of the FKNMS mooring buoy action plan were not implemented.

After a decade of FKNMS management, the dive operator industry effectively embraced the Sanctuary and its zoning action plan. Dive operator support for the establishment of the FKNMS increased by 23% in the ten years between studies; that is, 87% of the dive operators interviewed in 2006 supported the FKNMS. Support in the 2006 sample extended beyond that for FKNMS establishment. Dive operators accepted many aspects of the FKNMS process that the previous sample had questioned. Specifically, dive operators in 2006 were more in agreement than those in 1996 that the process that NOAA had used to develop rules and regulations for the FKNMS zones was open and fair. Similarly, more dive operators in the present sample believed participation made a difference and that NOAA heeded the concerns of individual citizens. Most importantly from a process perspectives, dive operators were now more in agreement that their views on FKNMS management effectiveness can lead to changes in management direction (i.e. stakeholder-influenced adaptive management).

Dive operator support extended to FKNMS zones as well. Whereas in 1996, dive operators had been ambivalent about the FKNMS Draft Management Plan zoning action plan, 72.5% of the 2006 respondents approved of the present SPA locations. Dive operators even expressed greater support for SUAs in 2006 than they did a decade earlier, mostly agreeing that there should be additional SUAs in the FKNMS. As per the effects of the zoning strategy, there was general agreement within the sample that the zones had reduced user conflicts (especially SPAs), improved diving conditions, and generated positive impacts on the region's economy. Dive operators were now mostly willing to accept more FKNMS zones (especially SPAs) in the Florida Keys.

This support, however, should not be interpreted as a uniform approval of the FKNMS or its zoning strategy. For instance, the group was not convinced that the FKNMS had been able to restore coral reefs to their original state, and 20% of those who listed an FKNMS failure identified coral reefs as the area in which the FKNMS had most failed. Coral cover was listed, along with crowding and water quality, as a resource undergoing a worsening/declining trend, and dive operators believed, on average, that coral reefs had declined in the FKNMS since the implementation of the Sanctuary. Also, while the dive operators were in favor of mooring buoys (and the FKNMS mooring buoy action plan), the industry showed little support for either an industry or user-funded mooring buoy program.

Apart from the actual results that dive operators experienced and which led to an increase in their support for the FKNMS and its zoning strategy has been the change in the composition of sources of information that the respondents in the 2006 sample used to obtain FKNMS information. In 1996, dive operators reported using both the FKNMS and anti-FKNMS sources and rumors to learn about the FKNMS. By 2006, with the demise of anti-FKNMS groups, the dive operator industry relied mostly on the FKNMS for its sources of information (and particularly on FKNMS personnel and FKNMS literature). Without accessing anti-FKNMS movement to provide alternate

interpretations of FKNMS actions, dive operators have relied increasingly on FKNMS and some media sources, and this may have affected their views on the Sanctuary.

4.3 Environmental group survey results

A total 438 environmental group members returned complete or partially completed surveys, resulting in a response rate of 11.6%. Reef Relief members accounted for a majority (369 surveys, or 84.2%) of the returned surveys. However, when compared to the population size, the return rate for Reef Relief members was 10.7% (369 returns from 3,442 mailed surveys); by contrast, 20.9% of Last Stand members returned a survey (69 returns from 330 mailed surveys). Finally, another 577 members (15.3% of the total population) returned the non-response bias postcard[18].

The previous survey effort determined that there was considerable cross group affiliation, in that members of one of the target groups were members of one or both other target groups. In total, 27% of Last Stand and SFFK members reported being members of Reef Relief in 1996, compared to 8.9% of Reef Relief and SFFK members who were members of Last Stand, and less than 1% of Last Stand and Reef Relief members who were members of SFFK. In the present study, 37.7% (n = 29) of Last Stand members reported that they were also members of Reef Relief, and 7.8% (n = 26) of Reef Relief members identified themselves as members of Last Stand. These findings suggest that return rates, when the cross affiliations are considered, were as high as 13.1% (n = 493) for both groups.

The results presented generally follow the survey instrument (see Appendix 3) and are divided into the following two sections: General information, which concerns socio-demographic and use characteristics; and FKNMS information and perceptions, which addresses the types of information sources used on obtaining information on the FKNMS and views on the FKNMS designation process, FKNMS zones, and FKNMS outcomes.

4.3.1 Environmental group survey general information

Under this section, environmental group members provided information on their domicile, race and ethnic group, years within the environmental group, water-based

[18] The respondents from the non-response bias postcard survey answered two questions that were determined to have affected whether environmental group members completed and returned surveys from the original (1996) study (Suman et al., 1999). These related to the age of the individual and the individual's support for the FKNMS. In the present effort, the average age of the respondents who completed the postcard but not the survey was between 41-50 years old (n = 573; mean = 3.98; SD = 1.05), which was significantly lower (Mann-Whitney test: z-score = 12.9; p= 0.0) than the average age (51-60 years old) of the respondents (n = 403; mean = 4.92; SD = 1.01) who completed a survey. Similarly, there was a significant difference in the level of support shown for the establishment of the FKNMS (Mann-Whitney test: z-score = 3.81; $p < 0.001$) between those that completed a survey and showed less support (n = 368; mean = 1.94; SD = 1.54) and those that did not and showed more support (n = 570; mean = 1.47; SD = 0.96). Effectively, older individuals who were less satisfied with the FKNMS were significantly more likely to complete a survey than were younger individuals who were more satisfied with the FKNMS.

activities in which they participate in the Florida Keys, and whether their occupation is affiliated with the marine environment in the Florida Keys.

Table 36: Environmental group survey distribution by region

Region	*2007 sample (n = 438)*	*1996 sample (n = 401)*
Lower Keys	32.4	56.6
Middle Keys	3.0	4.0
Upper Keys	4.3	9.2
State of Florida	18.9	13.0
All regions outside of Florida	29.0	9.5
Not specified	12.3	7.7

As shown in Table 36, the 2007 sample of environmental group members consisted of a large percentage of residents from the Florida Keys, who made up almost 40% of all respondents. This was followed by respondents from states other than Florida (29.0%), Florida (18.9%), and those who did not provide a zip code (12.3%). Within the Florida Keys, Lower Keys members comprised a majority (81.6%), followed by the Upper Keys (10.9%) and the Middle Keys (7.5%). When compared to the previous sample, there were proportionally fewer responses from the Florida Keys (67.8% of the 1996 sample compared to 39.7% of the 2007 sample); this may have been in part due to having surveyed another local group in 1996, Sanctuary Friends of the Florida Keys (SFFK)[19], which had an almost exclusively Keys-based membership.

The average age of the respondents in the present sample was between 51-60 years old (n = 403; mean = 4.92; SD = 1.01), which was significantly higher than the average age (between 41-50 years and 51-60 years old) of respondents in the previous sample (Mann-Whitney test: z-score = 7.1; p = 0.0). Racially, 97.5% of the respondents identified themselves as Caucasian, similar to the 97.6% that gave the same answer in the 1996 sample.

The average period in which respondents had been members of Last Stand or Reef Relief was 6-10 years (n = 387; mean = 3.00, where 1 is less than one year and 6 is over 20 years; SD = 1.20), and almost 60% of the sample had been affiliated with its respective group for six or more years. This finding suggests that a majority of the sample was affiliated with its group during either or both the FKNMS designation process (1995-97) and the *Tortugas 2000* process (1998-2001) and thus may be familiar with the FKNMS history.

Almost two thirds of those who responded (64.3%) stated that they belong to one or more environmental groups. On average, environmental group members belonged to 2.22 other environmental groups (n = 232; SD = 1.41), with groups such as The Nature

[19] The research team attempted to re-survey this group but learned that the original Sanctuary Friends of the Florida Keys had not been in existence for a few years and that more recent group bearing the same name had been formed (but chose not to participate).

Conservancy (18.7%), Sierra Club (14.4%), and The Audubon Society (10.9%) representing the most popular groups. Table 37 shows the breakdown of environmental groups.

Table 37: Environmental group survey member affiliation

Environmental groups	*2007 sample (n = 395)*	*1996 sample (n = 395)*
1. One or more environmental groups	64.3	70.1
2. The Audubon Society	10.9	15.0
3. Environmental Defense Fund	3.3	-
4. Greenpeace	3.5	9.2
5. The Nature Conservancy	18.7	23.5
6. Natural Resources Defense Fund	6.3	-
7. The Ocean Conservancy	5.1	-
8. Sierra Club	14.4	8.0
9. The Wilderness Society	1.8	5.2
10. World Wildlife Fund	7.3	-
11. Other groups	40.0	46.0

As shown in Table 37, rates of environmental group affiliation dropped among group members from 1996 to 2007. Fewer respondents (64.3%) in 2007 reported being part of one or more environmental groups than did the 1996 sample (70.1%). Although the 1996 sample did not list all environmental groups, the groups in which both samples reported affiliation generally had higher percentages of members in the 1996 than in the 2007 sample (with the exception of the Sierra Club).

When asked about their residency, the average response among environmental group members was that they spend between 7-9 months each year in the Florida Keys (n = 258; mean = 3.22, on a scale where 1 refers to '1-3 months in the Florida Keys each year', and 4 refers to 'resident'; SD = 1.19). Almost two-thirds of the respondents (65.9%) identified themselves as residents, while 18.2% reported spending between 1-3 months each year in the Florida Keys. In the 1996 sample, the mean response for the amount of time spent in the Florida Keys (n = 353; mean = 3.54; SD = 0.98) was significantly higher (Mann Whitney Test: z-score = 2.90; $p < 0.01$) than that reported for the 2007 sample, and 79.3% of the 1996 sample identified themselves as residents. Thus, there were fewer residents in the present sample than in the previous one, and the current findings determined almost twice as many part-time residents who stay 1-3 months per year compared to the 1996 sample (9.9% of whom reported spending 1-3 months per year in the Florida Keys).

Table 38: Environmental group survey member activities

Activities undertaken in the Florida Keys	*2007 sample*	*1996 sample*
1. Sportfishing	n = 379	n = 267
	43.9	47.9
2. Swimming	n = 395	n = 267
	72.6	86.7
3. Snorkeling	n = 391	n = 267
	77.9	85.8
4. SCUBA diving	n = 380	n = 267
	47.1	48.5
5. Boating	n = 386	n = 267
	56.3	71.1
6. Water-skiing	n = 370	n = 267
	5.7	12.0
7. Jet-skiing	n = 370	n = 267
	5.1	5.0
8. Kayaking	n = 390	n = 267
	36.6	23.9
9. Net fishing	n = 370	n = 267
	1.6	1.6
10. Trap fishing	n = 371	n = 267
	3.2	1.0
11. Spear fishing	n = 373	n = 267
	14.2	14.4
12. Fish collecting	n = 370	n = 267
	3.8	1.0
13. Bird watching	n = 391	n = 267
	48.4	51.0
14. Underwater photography	n = 374	n = 267
	24.3	21.6
15. Glass bottom boating	n = 371	n = 267
	3.8	7.9
16. Sailing	n = 382	
	30.3	

As shown in Table 38, activities in which the respondents participated largely remained similar across study periods. For instance, swimming and snorkeling were the two most popular activities in both samples. While fewer 2007 sample members (56.3%) reported boating as a primary activity than did 1996 sample member (71.1%), it nevertheless ranked as the third most popular activity in both samples. The only activity which witnessed a considerable increase from 1996 to 2007 was kayaking; in the earlier sample, 23.9% of environmental group members listed kayaking, compared to 36.6% of the 2007 sample. Otherwise, nonconsumptive activities (such as swimming, snorkeling, boating, birdwatching, and SCUBA diving) remained more popular than consumptive ones (sportfishing, spear fishing, and fish collecting, among others). These results demonstrate the importance of nonconsumptive activities to the respondents and (in part) assist in characterizing their attitudes towards FKNMS management strategies.

4.3.2 Environmental group survey attitudes, perceptions, and beliefs[20]

Environmental group members described their views on the information sources on the FKNMS and their perceptions concerning the FKNMS process and its outcomes, the FKNMS zones, and FKNMS performance.

Table 39: Environmental group survey sources of information

Sources of information	*2007 sample*	*1996 sample*
1. FKNMS website*	n = 377 25.3	-
2. FKNMS staff/personnel	n = 381 22.1	n = 267 22.4
3. FKNMS Draft Management Plan**	-	n = 266 36.5
4. FKNMS Advisory Council*	n = 374 9.7	-
5. FKNMS brochures/literature	n = 385 45.2	n = 267 29.1
6. FKNMS signage*	n = 375 17.6	-
7. NOAA meetings**	-	n = 266 29.7
8. Newspapers	n = 398 52.7	n = 267 78.2
9. Radio	n = 381 21.3	n = 267 48.9
10. Television	n = 378 19.8	n = 267 48.9
11. Anti-FKNMS groups**	-	n = 266 13.0
12. Commercial fishing groups**	-	n = 265 10.0
13. Environmental groups**	-	n = 266 50.6
14. Government fisheries organizations**	-	n = 266 10.0
15. Sea Grant**	-	n = 266 5.2
16. Own environmental group**	-	n = 266 87.2
17. Rumors/word of mouth	n = 384 39.7	n = 267 30.3

* Source of information only in 2007 survey
** Source of information only in 1996 survey

[20] Results concerning group survey attitudes, perceptions, and beliefs, as well as those related to activities, have been weighted to compare only the two groups (Reef Relief and Last Stand) that were surveyed in both studies.

Table 40: Environmental group survey information source usefulness

Sources of information	*2007 sample*	*1996 sample*
1. FKNMS website*	n = 374 12.3	-
2. FKNMS staff/personnel	n = 374 8.0	n = 266 11.2
3. FKNMS Draft Management Plan**	-	n = 266 26.6
4. FKNMS Advisory Council*	n = 371 2.9	-
5. FKNMS brochures/literature	n = 375 25.6	n = 264 12.1
6. FKNMS signage*	n = 370 2.1	-
7. NOAA meetings**	-	n = 266 15.7
8. Newspapers	n = 384 29.0	n = 266 37.5
9. Radio	n = 373 4.2	n = 265 13.8
10. Television	n = 372 3.1	n = 265 13.8
11. Anti-FKNMS groups**	-	n = 266 4.1
12. Commercial fishing groups**	-	n = 266 4.6
13. Environmental groups**	-	n = 266 19.7
14. Government fisheries organizations**	-	n = 266 0.5
15. Sea Grant**	-	n = 266 3.3
16. Own environmental group**	-	n = 266 60.0
17. Rumors/word of mouth	n = 372 8.2	n = 266 4.5

* Source of information only in 2007 survey
** Source of information only in 1996 survey

Environmental group members generally relied on the same types of information sources in the two study periods (Tables 39 and 40), and while not all sources were asked across study periods, the results demonstrate the importance of media sources and rumors/word of mouth. Overall, however, a higher percentage of members from the 1996 sample obtained information from a variety of sources than did their 2007 sample counterparts. In fact, the only common source among samples in which a higher percentage of 2007 sample members received information than the 1996 sample members was that related to rumors/word of mouth. Also, the results demonstrate that environmental group members in both samples trusted official sources of information (ex. those emanating from the FKNMS) more than they did media sources such as radio and rumors/word of mouth. Finally, although rumors/word of mouth represented an important source of information in both samples, only 8.2% and 4.5% of the 2007 and 1996 samples listed the source as being the most useful, respectively. Put differently, only a fifth of the 2007 sample

members and a seventh of the 1996 sample members who *reported* receiving information from others believed that such information was useful.

Table 41: Environmental group survey perceptions on FKNMS processes

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.	2007	19.4	16.9	10.6	5.6	7.5	37.0	n = 248 2.41 (1.34)
	1996	17.7	13.6	10.3	7.0	9.2	37.4	n = 155 2.59 (1.43)
2. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.	2007	18.4	18.7	8.4	6.2	8.7	36.0	n = 251 2.52 (1.60)
	1996	16.4	14.4	10.1	7.1	13.7	33.2	n = 163 2.79 (1.52)
3. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.	2007	12.8	13.5	12.1	16.4	16.4	25.9	n = 292 3.14 (1.42)*∫
	1996	13.9	10.6	12.6	21.6	28.7	8.7	n = 234 3.46 (1.45)*∫
4. NOAA has not addressed the concerns of local and state governments in developing rules and regulations for the FKNMS.	2007	7.8	8.4	14.2	11.0	16.0	40.0	n = 237 3.33 (1.36)
	1996	8.5	6.5	15.4	17.8	16.9	30.0	n = 176 3.43 (1.32)
5. NOAA has not addressed the concerns of individual citizens in developing rules and regulations for the FKNMS.	2007	10.2	15.4	10.7	11.6	13.6	36.0	n = 253 3.04 (1.40)∫
	1996	9.8	13.2	10.8	21.1	16.4	23.2	n = 194 3.30 (1.36)∫
6. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.	2007	11.2	12.3	13.9	13.6	12.2	33.8	n = 259 3.05 (1.37)
	1996	18.9	11.9	6.9	16.9	20.0	21.1	n = 195 3..09 (1.59)
7. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.	2007	9.5	14.7	12.8	5.2	7.0	47.6	n = 204 2.70 (1.28)*
	1996	7.3	12.7	11.2	8.7	11.5	43.2	n = 136 3.08 (1.38)*

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Table 41 shows the respondents' perceptions on the FKNMS process. It should be noted that in both studies, large percentages of environmental group members stated that they did not know enough to answer these questions. Importantly, while such views could have been related to the respondents' unwillingness to predict the outcomes of FKNMS regulations and procedures in the earlier study, the high rates of environmental group members listing a lack of knowledge in the present study suggests a sample that has not learned more about the FKNMS process since the implementation of the FKNMS.

In most questions concerning the FKNMS process, the two samples were mainly in agreement, although environmental groups members surveyed in 1996 were significantly more in disagreement than those surveyed in 2007 that the participation in the FKNMS workshops and meetings did not matter because the average person could not influence the final decisions. Otherwise, similar percentages of respondents agreed that the processes that NOAA had used to develop rules and regulations for the FKNMS and the FKNMS zones were open and fair, whether NOAA had addressed local government or individual citizen concerns in developing the rules and regulations for the FKNMS, and the ability of the average person to voice his/her opinion on the usefulness of the regulations. It must be noted, however, that environmental group members in both samples generally sided in favor of the FKNMS process and that the comparisons between samples demonstrate a weakening (but not abandonment) of support.

Finally, it is important to discuss the large percentage of environmental group members in both samples who did not answer certain process related questions. In both the 2007 and 1996 samples, over a third of the respondents stated that they did not know enough about the process used to develop FKNMS and FKNMS zone rules and regulations, and over 40% did not know whether the procedures adopted to address FKNMS violations were fair and just. In fact, a quarter or greater of the 2007 sample stated that it did not know enough about any process related question to provide an opinion. These results suggest that environmental group members may know less now about the FKNMS process than they did a decade ago; while this is understandable in the case of process related issues related to the FKNMS designation process (which occurred in the mid-1990s), the lack of knowledge on current FKNMS management procedures identifies the need for greater outreach and education.

Table 42: Environmental group member views on FKNMS zone purpose and beneficiaries

Question	*1996 sample*	*2007 sample Ecological reserves*	*2007 sample Sanctuary preservation areas*	*2007 sample Wildlife management areas*
1. Which of the following represents the main purpose of the FKNMS zones?				
a. Increasing overall fish stocks and biomass inside the zones	n = 378 71.9	n = 415 22.7	n = 404 11.6	n = 385 14.3
b. Increasing overall fish stocks and biomass outside the zones	56.4	18.9	8.2	9.6
c. Conserving and protecting corals, fish, and other marine life	85.1	46.5	51.5	57.7
d. Resolving user group conflicts		3.9	22.3	11.2
e. Supporting scientific research		6.8	5.7	6.2
2. Which groups have benefited the most from FKNMS zones?				
a. Commercial fishers	n = 378 24.1	n = 374 17.4	n = 367 11.7	n = 346 11.3
b. Recreational/sport fishers	29.0	17.7	22.6	26.9
c. Commercial dive operators	37.6	14.2	21.3	7.8
d. Recreational (local and tourist) divers	50.3	42.8	40.9	47.1

Table 42 presents environmental group members' views on FKNMS zones, as determined by the main purpose that the respondents believed that the zones serve and by the user groups they identified as those that had most benefited from the zoning strategy. A majority of those surveyed listed conservation and protection of corals, fish, and other marine life as the primary purpose of ERs, SPAs, and WMAs. This view was consistent across samples, as 85.1% of the 1996 agreed that conservation and protection represented the primary purpose of all FKNMS zones. Also, environmental group members in both samples generally did not believe that replenishment outside the FKNMS zones is a main purpose, although the 1996 sample showed more support than the 2007 sample (although this is more likely due to the fact that respondents in the latter sample had to select one out of the five purposes whereas respondents in the 1996 sample were provided separate questions on the main purpose of the zones; in both studies, replenishment outside the zones trailed conservation and protection and replenishment within the zones as a listed primary purpose). Importantly, environmental group members in the 2007 study differentiated between the FKNMS zone types with respect to their primary purpose; thus, while only 11.2% and 3.9% believed that ERs and WMAs served to resolve use

group conflicts, respectively, over a fifth of the sample (22.3%) believed that SPAs served that purpose (which is a stated objective of the SPAs). Similarly, 22.7% of the respondents agreed that the main purpose of ERs is to provide replenishment inside the zones, whereas only 14% or less agreed that such replenishment was the main purpose for the other two zone types. Also, twice as many (18.9%) respondents agreed that ERs have been set up to provide region-wide replenishment than have SPAs or WMAs.

In terms of beneficiaries of the zoning strategy, a majority of respondents in the 1996 sample and a large percentage in the 2007 sample agreed that recreational divers had benefited (or would benefit) from the FKNMS zones. While the 1996 sample believed that commercial dive operators would benefit more than recreational or sport fishers, the 2007 sample felt that the recreational or sport fishers had gained more than the dive operators, especially in the WMAs (which restrict access but do not affect extractive activities). The environmental group members in both samples were also in agreement that the user group least likely to benefit from the FKNMS zones were (or would be) commercial fishers. As shown in the previous question concerning FKNMS zone purpose, environmental group members in the 2007 sample were able to differentiate among beneficiaries across zone types. Thus, while only 7.8% of the respondents identified dive operators benefiting from WMAs, 21.3% agreed that dive operators would benefit from SPAs (no-take zones that attract a majority of recreational dive use in the FKNMS (NOAA, 1996) and which have been set up to reduce user group conflict). Also, more environmental group members believed that recreational fishers had benefited from WMAs and SPAs than from ERs, due most likely to their understanding that the WMAs generally do not restrict fishing and because a few SPAs allow catch-and-release fishing (as well as the small size of SPAs, as compared to ERs).

Table 43: Environmental group member views on FKNMS zone outcomes

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. FKNMS zones have reduced conflicts between different user groups.	ER	7.8	18.9	12.2	9.6	5.6	36.4	n = 222 2.74 (1.20) ∫
	SPA	10.6	18.2	12.0	7.9	4.4	36.5	n = 219 2.57 (1.19)
	WMA	8.5	20.5	11.5	7.2	4.9	36.9	n = 217 2.61(1.17)
	1996	21.0	22.1	13.9	12.7	13.0	11.0	n = 220 2.69 (1.41) ∫
2. FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they used to be.	ER	6.0	16.3	7.8	18.6	22.1	20.2	n = 289 3.49 (1.36)*∫
	SPA	6.3	16.0	9.1	19.4	20.1	19.4	n = 289 3.43 (1.34)*∫
	WMA	6.0	13.6	11.8	17.9	20.9	20.1	n = 289 3.49 (1.33)*∫
	1996	33.8	29.3	7.2	11.1	10.3	5.4	n = 245 2.29 (1.37)*∫
3. I support the establishment of FKNMS zones as they are established currently.	ER	29.8	21.6	11.4	5.4	6.8	15.4	n = 306 2.17 (1.27)*∫
	SPA	29.1	22.8	11.1	5.4	6.3	15.1	n = 305 2.17 (1.23)*∫
	WMA	28.0	22.9	10.8	6.6	5.5	15.9	n = 302 2.16 (1.23)*∫
	1996	19.0	15.1	21.1	6.2	16.2	18.7	n = 201 2.81 (1.46)*∫
4. I support the establishment of FKNMS zones in the Upper Keys.	ER	46.9	17.1	6.3	2.7	5.6	12.0	n = 320 1.76 (1.18)
	SPA	45.6	18.7	6.5	2.1	5.1	12.0	n = 318 1.75 (1.14)
	WMA	45.5	17.6	8.0	1.9	4.8	12.0	n = 317 1.75 (1.13)
	1996	47.1	18.5	10.3	2.6	8.8	8.6	n = 233 1.94 (1.30)

5. I support the establishment of FKNMS zones in the Middle Keys.	ER	48.0	17.9	4.8	2.3	6.4	11.2	n = 324 1.76 (1.20)
	SPA	46.8	18.7	5.2	2.3	5.6	11.5	n = 321 1.74 (1.16)
	WMA	46.1	18.9	6.0	2.0	5.3	11.8	n = 320 1.74 (1.14)
	1996	47.0	18.3	10.7	3.1	9.3	7.4	n = 236 1.97 (1.32)*
6. I support the establishment of FKNMS zones in the Lower Keys.	ER	52.4	15.9	4.0	2.3	8.3	8.9	n = 338 1.77 (1.28)
	SPA	50.2	17.9	4.3	2.5	7.2	9.2	n = 335 1.77 (1.23)
	WMA	50.3	18.0	4.6	2.0	7.2	9.2	n = 335 1.75 (1.22)
	1996	48.7	17.7	8.4	2.6	11.8	6.4	n = 237 2.00 (1.40)*
7. I support the establishment of FKNMS zones in the Dry Tortugas.	ER	55.5	14.3	3.1	2.7	6.7	9.2	n = 336 1.69 (1.28)
	SPA	53.2	16.5	2.8	2.4	6.7	9.2	n = 333 1.69 (1.20)
	WMA	53.9	15.5	3.9	1.9	6.1	9.5	n = 332 1.66 (1.17)
8. There should be more FKNMS zones in the Florida Keys.	ER	46.7	13.5	5.4	3.5	11.0	11.5	n = 326 1.98 (1.43)
	SPA	46.8	13.6	6.2	3.2	10.2	11.5	n = 326 1.95 (1.40)
	WMA	45.3	13.4	6.3	4.0	10.2	11.8	n = 323 1.99 (1.41)
	1996	39.6	13.3	7.6	5.4	12.2	16.8	n = 210 2.20 (1.50)

* refers to significant differences in means ($p < 0.05$)
∫ refers to significant differences in distributions ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Table 43 shows that there have been either no changes or increased negative views in environmental group members' perceptions towards the FKNMS zones, especially as these relate to the outcome of the zones. For instance, environmental group members in 1996 were, on average, in agreement that FKNMS zones would be able to restore coral reefs to their original condition in the Florida Keys. By contrast, in the 2007 sample, respondents tended to disagree, on average, that any of the three FKNMS zone types had accomplished that prediction. Similarly, while respondents in both samples agreed that FKNMS would (1996 sample) or had (2007 sample) reduced user conflicts, while 43.1% of the 1996 sample agreed that user conflicts would be reduced, less than 30% of the 2007 sample agreed that user conflicts had been reduced.

Respondents in both samples supported the establishment of FKNMS zones across the Florida Keys as they were to be or are established currently; support actually increased, with the 2007 sample showing a significantly higher level of support for the established FKNMS zones than the 1996 sample. Also, there were less support for more FKNMS zones in the Florida Keys in both samples as compared to the support for FKNMS zones in the three (or four, in the 2007 sample) regions in the Florida Keys. Suman et al. (1999) suggested that lower support for more FKNMS zones may represent a "not in my backyard" (NIMBY) response, and that trend continued in the present study (note for instance the higher level of support for FKNMS zones in the Dry Tortugas, located within the western boundary of the FKNMS); however, it must be noted that while support did decline for implementing more FKNMS zones, the majority and overall responses in both samples still favored the closure of more marine areas.

Table 44: Environmental group member views on the effects of the FKNMS

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean** (std dev)*
1. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program	2007	32.6	28.9	5.7	4.0	4.0	16.8	n = 308 1.91 (1.09)*
	1996	34.7	25.2	9.2	4.2	10.6	12.8	n = 227 2.18 (1.35)*
2. The Florida Keys have benefited environmentally from the FKNMS.	2007	37.3	30.5	5.9	1.6	4.3	12.0	n = 326 1.81 (1.03)
	1996	44.0	26.3	6.6	4.3	8.6	7.5	n = 242 1.97 (1.27)
3. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS.	2007	26.8	22.9	9.2	3.9	5.9	22.6	n = 283 2.11 (1.22)
	1996	38.1	20.3	10.5	6.2	10.3	12.0	n = 226 2.18 (1.39)
4. I generally support the establishment of the FKNMS.	2007	53.2	18.5	4.2	2.7	4.8	6.8	n = 340 1.65 (1.10)*
	1996	57.4	17.5	4.9	3.1	11.9	2.6	n = 256 1.89 (1.38)*

* refers to significant differences in means ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

As shown in Table 44, environmental group members' views on the effects of the FKNMS remained positive throughout the samples, and the level of agreement over the beneficial economic and environmental effects of the FKNMS increased in the later sample. Environmental group members from the 2007 sample on average agreed that NOAA and the FKNMS had benefited the marine environment and the Florida Keys economy and marine ecosystem. Overall, 71.7% of those surveyed in 2007 agreed that they support the establishment of the FKNMS, similar to the 74.9% that supported FKNMS establishment in 1996.

Over 60% (61.5%) of the 2007 respondents agreed that NOAA has made a positive contribution to the marine environment, compared to 59.9% who agreed with the same statement in 1996. Also, over two thirds of the environmental group members in the present sample (67.8%) agreed that the Florida Keys have benefited environmentally from the FKNMS, compared to 59.7% who believed that there had been a net economic benefit to the region from the establishment of the FKNMS. Environmental group members were less certain about the economic benefits of FKNMS establishment than they were of its effects on the environment, as noted by the almost quarter of the 2007 that did not answer the question related to economic benefits. Moreover, the lower level of agreement on the Sanctuary's economic benefits compared to its environmental benefits suggests that environmental group members may either not link environmental and economic benefits (ex. ecosystem function, replenishment, etc.) or that they do not perceive the FKNMS having performed as effectively in the economic sector as it has for the environment.

Finally, overall response rates to statements related to FKNMS effectiveness were lower in the 2007 sample, as compared to the 1996 sample, a result that requires further discussion. It appears that respondents in the present study were less informed than their 1996 counterparts and therefore elected not to answer these questions; this is corroborated in part by the lower percentage of the 2007 sample who obtained information from fewer sources on the FKNMS compared to the 1996 sample. Also, the 2007 sample did not include members from one of the three environmental groups, SFFK, which was among the most active organizations in the Florida Keys during the FKNMS designation process. Finally, it is to be expected that ten years after the FKNMS has been established that environmental group members would have shifted their focus away from the FKNMS (which many members supported during its designation stage) to other issues. Collectively, these factors likely contributed to the lower response rates on statements concerning FKNMS effectiveness.

Table 45: Environmental group members' views on FKNMS resource conditions

Better ←----Neutral------→ Worse

Resource	*Sample*	*1*	*2*	*3*	*4*	*5*	*Don't know*	*Sample mean** (std dev)*
1. Water quality	n = 306	7.2	25.9	37.1	17.0	12.6	0.4	n = 305 3.02 (1.11)
2. Land-based pollution/sewage	n = 299	6.4	21.8	36.4	20.9	14.5	-	n = 299 3.15 (1.11)
3. Sea-based pollution/marine debris	n = 299	9.0	29.6	34.3	16.2	10.8	-	n = 299 2.90 (1.11)
4. Coral reefs	n = 305	8.8	21.0	32.3	19.8	18.0	-	n = 305 3.17 (1.20)
5. Sea grasses	n = 295	11.3	32.1	35.1	12.9	8.5	-	n = 295 2.75 (1.08)
6. Fisheries	n = 293	12.4	29.5	39.2	11.6	7.3	-	n = 293 2.72 (1.05)
7. Mooring buoys	n = 298	38.8	36.7	17.3	3.0	4.2	-	n = 298 1.97 (1.02)
8. Vessel groundings	n = 291	21.5	34.8	30.0	8.7	5.1	-	n = 291 2.41 (1.07)

*1-5 scale, where 1 is better and 5 is worse; 3 is neutral or no change

Table 45 shows environmental group members' views on the performance of eight resources in the past ten years, or during the FKNMS' tenure. A few resource conditions were perceived to have remained the same (mean = 3.0) or slightly worsened, including water quality (mean = 3.02), land-based sources of pollution (mean = 3.15), and coral reefs (3.17); respondents felt that on average the condition of the latter two resources had somewhat declined. The respondents believed that other resource conditions had improved since the implementation of the FKNMS, including fisheries (mean = 2.72). With respect to the number and quality of mooring buoys, environmental group members believed that the mooring buoy system used by the FKNMS represented an overall improvement (mean = 1.97). Also, the sample believed that vessel grounding problems had declined over the past ten years (mean = 2.41). Overall, the results show that respondents believe that conditions have either remained the same or improved over the past ten years, with the exceptions of land-based sources pollution and coral reefs.

When asked whether they believed that the FKNMS was responsible for the status of the resources that they characterized in Table 45, a plurality (36.8%) agreed. Fewer, or

14.6%, believed that the FKNMS was not responsible for the status of the resources, and under a fifth of the sample (17.5%) did not know. Thus, most environmental group members attributed perceived improvements in resource conditions on the FKNMS, which they believe is largely responsible for improvements in fisheries, sea grasses, the mooring buoy system, and fewer vessel groundings. However, this also suggests that the most environmental group members also believe that the FKNMS is largely responsible for perceived declining conditions in coral reefs and land-based sources of pollution.

When asked about the area in which they believed that the FKNMS was most successful, 54.3% of the sample listed one or more areas. Of these, the most commonly identified area of FKNMS success were the no-take zones, which 17.7% of the respondents listed, followed by education and awareness (15.9%), the mooring buoy action plan (15.0%), fisheries (13.6%), coral reef protection (12.3%), and lower vessel-related damage (9.1%). Fewer respondents believed that the FKNMS had improved water quality (3.6%) or reduced use conflicts (0.5%). The findings suggest that environmental group members believe that the zoning action plan, the outreach and education action plan, and the mooring buoy action plan have been the most successful FKNMS management strategies, especially as these plans have been perceived to have improved the other resource conditions identified in this question, including fisheries (as improving, in part, from the zoning action plan) and coral reef protection (from having no-take zones and mooring buoys and an education and awareness program).

Just over half, or 51.1%, of the sample listed areas in which the FKNMS had failed, of which the most commonly identified area was that related to water quality, resulting from land-based and sea-based pollution (41.1%). Another 18.4% believed that the FKNMS had been unsuccessful in adequately protecting coral reefs, 12.1% felt that fisheries had not improved under the FKNMS tenure, and 8.7% and 8.2% listed education and awareness and enforcement, respectively, as areas in which the FKNMS had failed. It is important to note that there was considerable overlap in areas in which some respondents believed that the FKNMS has been both a success and a failure (ex. coral reef protection, fisheries, etc.), but that in the area of pollution, there was a strong belief that the FKNMS has not enjoyed much success. Only 3.6% of those who identified an area of FKNMS success listed water quality, whereas 41.1% of those who identified an area in which the FKNMS had not succeeded listed marine pollution. While it could be argued that water quality improvement is part of the aforementioned success areas (ex. coral reef protection), the results show that environmental group members differentiated between the success areas based on regulatory approaches (ex. zoning) and failures that persist via lack of political or social will or are otherwise difficult to address (i.e. land-based sources of pollution). Thus, the failure to address water quality should not be viewed as an indictment on the FKNMS but rather as a shared responsibility that environmental group members believed that the stakeholders need yet to resolve.

4.3.3 Environmental group survey discussion

The environmental group survey results suggest that environmental group members remain the most steadfast supporters of the FKNMS and its parent agency, NOAA.

While it could be argued that this alignment is a result of a shared objective (i.e. resource protection), the results demonstrate that environmental group members are not entirely in favor of all FKNMS actions and outcomes; for instance, respondents understand that there are areas in which the FKNMS has not succeeded and that there are parts of the FKNMS designation process that were perhaps not as transparent as environmental group members had earlier anticipated. These views point to the group's nuanced approach to gauging the FKNMS and its management strategies and show that environmental approaches as proposed by the FKNMS, while in line with environmental group objectives, nevertheless need to provide meaningful results to maintain the same level of support. Moreover, results related to the information sources suggest that there remains a need to more effectively disseminate such results to the environmental groups which, when galvanized as they were in the 1995-97 FKNMS designation process (Suman et al., 1999), can prove the staunchest proponents of environmental policy.

Overall, the support displayed by environmental group members for the FKNMS in both the present and earlier samples has not waned. In terms of FKNMS outcomes, over 70% of the environmental group members surveyed in 2007 stated that they support the establishment of the FKNMS, and a majority of the respondents agreed that the FKNMS had positive economic and environmental benefits on the Florida Keys. The sample also believed that NOAA's National Marine Sanctuary Program is an important policy instrument, with 61.5% agreeing that the program has benefited the marine environment. While there were some differences in the level of support determined for the present and 1996 samples, both samples overwhelmingly favored the FKNMS.

When asked to consider the outcome of FKNMS zones, environmental group members' responses showed a nuanced understanding of both the different types of zones and their impacts and the relationship between zones and FKNMS resources. Thus, in considering the beneficiaries of the zones, respondents agreed that while commercial fishers had been the user group to least benefit from FKNMS zones that the impacts on that user group had been highest in the ERs (which are, after all, the largest closed zones). Similarly, environmental group members stated that recreational anglers had gained more from the smaller SPAs and less restricted WMAs than they had from the ERs. Finally, over a fifth of the sample agreed that dive operators had benefited from SPAs, compared to only 14.2% and 7.8% who believed that the user group had benefited from ERs and WMAs, respectively. Also, environmental group members were in greater agreement that SPAs, rather than ERs or WMAs, had led to a reduction in the number of use conflicts. This ability to differentiate between zone types and their related objectives was also identified in the environmental group members' views on FKNMS zone effects on coral reefs. In 1996, 63.1% of the respondents agreed that FKNMS zones would be effective in restoring coral reefs in the Florida Keys to what they used to be; however, in 2007, only 22.3% believed that ERs had been effective in the objective, similar to the 22.3% and 19.6% who felt that same about SPAs and WMAs, respectively. These results demonstrate that the earlier expectation that FKNMS zone management would lead to effective coral reef restoration had not been met, and the environmental group members had understood that zones by themselves had been unable to achieve the objective. The latter point is important as the perceived inability did not affect the respondents' support

for FKNMS zones; in fact, the 2007 sample showed a significantly higher approval of the final FKNMS zones than the 1996 showed for the then draft FKNMS zones. Thus, while they acknowledged the shortcoming of the strategy in restoring coral reefs, environmental group members understood that it was not a failed strategy (and perhaps only an incomplete one) and one that should be retained.

With respect to the FKNMS process, the results again show that overall views on the process-related activities and outcomes are generally favorable, with a majority of the 2007 sample agreeing that the processes used to develop FKNMS and FKNMS zone rules and regulations were open and fair, and that the procedures that NOAA had established to deal with violations of FKNMS regulations were fair and just. However, fewer respondents in the present study, compared to the 1996 sample, believed that participation had made a difference in influencing the final outcomes for the FKNMS, that individual citizens' concerns had been addressed in developing FKNMS rules and regulations, and that there are effective ways by which average persons can voice their opinions on the usefulness of FKNMS regulations. The latter results demonstrate that the respondents did not entirely agree with the public participation approach used in the FKNMS designation process or with the amount of feedback that individuals have on reforming FKNMS management strategies. Also, the results show that over a quarter or more of the 2007 sample did not provide an answer to the process-related statements, replying instead that they did not possess sufficient information to provide an opinion.

When the aforementioned percentages of non-responses are considered in conjunction with the relatively low rates of information sources respondents utilized and the group's perception on the FKNMS' inaction on water quality issues, it is clear that environmental group members remain the least informed of the three stakeholder groups considered in the present and 1995-96 studies (Suman et al., 1999). Although this lack of information has not affected support for FKNMS management strategies, it has led to environmental group members either misperceiving the FKNMS role in resource protection or under-estimating FKNMS success in management areas. Finally, and most importantly, as the group that most favors the establishment of the FKNMS, it is imperative that the FKNMS better inform environmental group members (through popular sources such as FKNMS brochures and literature and newspapers, for example) on its achievements and management direction; otherwise, while the group may yet remain aligned with the FKNMS environmental philosophy, it may not so readily embrace the means by which resource protection is achieved.

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6 Appendices

6.1 Appendix 1: Commercial fisher survey instrument

OMB No. 0648-0534. Expiration date: 1/31/2009.

GENERAL INFORMATION

Name_____

Telephone_____

Address_____
_____
_____

1. Which of the following includes your age?

18-30 31-40 41-50 51-60 over 60

2a. Are you Spanish/Hispanic/Latino? YES NO

- if YES: Puerto Rican Mexican Cuban Other

2b. What is your race?

White African American Native American Asian

Other (_____)

3. How many family members do you support (including yourself)?

Myself only 2 3 4 5 6 7 greater than 7

4. Are you a member of any of the following groups?

- MCCF	YES	NO
- OFF	YES	NO
- Chamber of Commerce	YES	NO
- An environmental group	YES	NO
- Other_____	YES	NO

5. Do you belong to a fish house? YES NO

- If YES, then which one?_____

- If NO, to which fish houses do you usually sell your catch?_____

6. What is your primary port? _____

7. Do you have a secondary port, from where you fish part of the year? YES NO

- If YES, then which one? _____

8. How many years have you been a commercial fisher?

< 1 yr 1-5 6-10 11-15 15-20 >20 yrs

ECONOMIC INFORMATION

9. Please provide your best estimate of the replacement value of the following items that you used for commercial fishing last season.

____Vessel(s) and electronic equipment:		$_____
Lobster traps*:	Number_____	$_____
Lobster trap certificates_____		$_____
Stone crab traps*:	Number_____	$_____
Stone crab certificates_____		$_____
Nets:	Number_____	$_____
Longline:	Number_____	$_____
Dive gear:		$_____
Rod/reels		$_____
Other gear (_____)		$_____

10. Please provide your best estimate for the following expenses last season.

Docking fees:	$_____
Interest payments on vessel:	$_____
P&I insurance on vessel, crew	$_____
Maintenance/repair on vessel:	$_____
Maintenance/repair on lobster traps:	$_____
Maintenance/repair on stone crab traps:	$_____
Maintenance/repair on nets:	$_____
Maintenance/repair on other gear:	$_____
Other_____	$_____

11. What approximate percentage of your personal income is derived from commercial fishing?_____%

12. What approximate percentage of your TOTAL household income is derived from commercial fishing?_____%

13. How would you describe your fishing occupation?

Full-time Part-time Charterboat Recreational

NOTES

Date of interview_____ SPL number_____ Location of interview_____

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FISHERY INFORMATION – 2005 (2004-05) season

Please refer to the following table to write in your best estimate of total catch in each fishery from the last season and the percentage of total catch in each area in Chart 1.

Total Catch in Pounds by Species and by Area

Fishery	Total catch	1	2	3	4	5	6	7
Stone crab								
Lobster								
Shrimp								
Reef fish								
King mackerel								
Spanish mackerel								
Bait fish								
Pelagics								
Marine life								
Others								

Now, use the following table to write in your best estimate of the total number of trips in each fishery and the percentage of total trips in each area in the last season.

Please make sure to note the number of days per trip, if trips last longer than a single day.

Total Effort by Species and by Area

Fishery	Total trips	1	2	3	4	5	6	7
Stone crab								
Lobster								
Shrimp								
Reef fish								
King mackerel								
Spanish mackerel								
Bait fish								
Pelagics								
Marine life								
Others								

Finally, please use the following table to write in your best estimate of costs for a typical trip in each of the fisheries in which you participated in the last season.

As for crew members, please include ALL crew members, including yourself.

Costs by fishery

Fishery	Fuel/oil	Ice	Bait	Food/ Supplies	Other	Crew (#/cost)
Stone crab						
Lobster						
Shrimp						
Reef fish						
King mackerel						
Spanish mackerel						
Bait fish						
Pelagics						
Marine life						
Others						

It is important also to learn whether and how the 2005 hurricanes affected your fishing, so please provide catch information for the 2004 season by all species fished, days fished, and costs.

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FISHERY INFORMATION – 2004 (2003-04) season

Please refer to the following table to write in your best estimate of total catch in each fishery from the last season and the percentage of total catch in each area in Chart 1.

Total Catch in Pounds by Species and by Area

Fishery	Total catch	1	2	3	4	5	6	7
Stone crab								
Lobster								
Shrimp								
Reef fish								
King mackerel								
Spanish mackerel								
Bait fish								
Pelagics								
Marine life								
Others								

Now, use the following table to write in your best estimate of the total number of trips in each fishery and the percentage of total trips in each area in the last season.

Please make sure to note the number of days per trip, if trips last longer than a single day.

Total Effort by Species and by Area

Fishery	Total trips	1	2	3	4	5	6	7
Stone crab								
Lobster								
Shrimp								
Reef fish								
King mackerel								
Spanish mackerel								
Bait fish								
Pelagics								
Marine life								
Others								

Finally, please use the following table to write in your best estimate of costs for a typical trip in each of the fisheries in which you participated in the last season.

As for crew members, please include ALL crew members, including yourself.

Costs by fishery

Fishery	Fuel/oil	Ice	Bait	Food/ Supplies	Other	Crew (#/cost)
Stone crab						
Lobster						
Shrimp						
Reef fish						
King mackerel						
Spanish mackerel						
Bait fish						
Pelagics						
Marine life						
Others						

SOURCES OF INFORMATION AND PERCEPTIONS

14. Please list the sources of information that you have received in the past on the FKNMS and rank the sources in terms of their usefulness. In terms of ranking, please rank only those sources that you used, and where 1 is the most important source, 2 the second most important source, and so on.

SOURCE	Sources Used	RANK Sources
a. FKNMS website	_____	_____
b. FKNMS Staff	_____	_____
c. Sanctuary Advisory Council	_____	_____
d. FKNMS brochures/literature	_____	_____
e. FKNMS signage	_____	_____
f. Information in newspapers	_____	_____
g. Radio	_____	_____
h. TV	_____	_____
i. Word of mouth	_____	_____

For the next set of questions, please provide your answer on a 1 to 5 scale, where 1 means **Strongly agree,** 2 means **Moderately agree**, 3 means **Neutral**, 4 means **Moderately disagree**, and 5 means **Strongly disagree**

15. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.

1 2 3 4 5 I don't know

16. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.

1 2 3 4 5 I don't know

17. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.

1 2 3 4 5 I don't know

18. NOAA has not addressed the concerns of local and state governments in developing rules and regulations for the FKNMS.

1 2 3 4 5 I don't know

19. NOAA has not addressed the concerns of individual citizens in developing rules and regulations for the FKNMS.

1 2 3 4 5 I don't know

20. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.

1 2 3 4 5 I don't know

21. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.

1 2 3 4 5 I don't know

NOTES

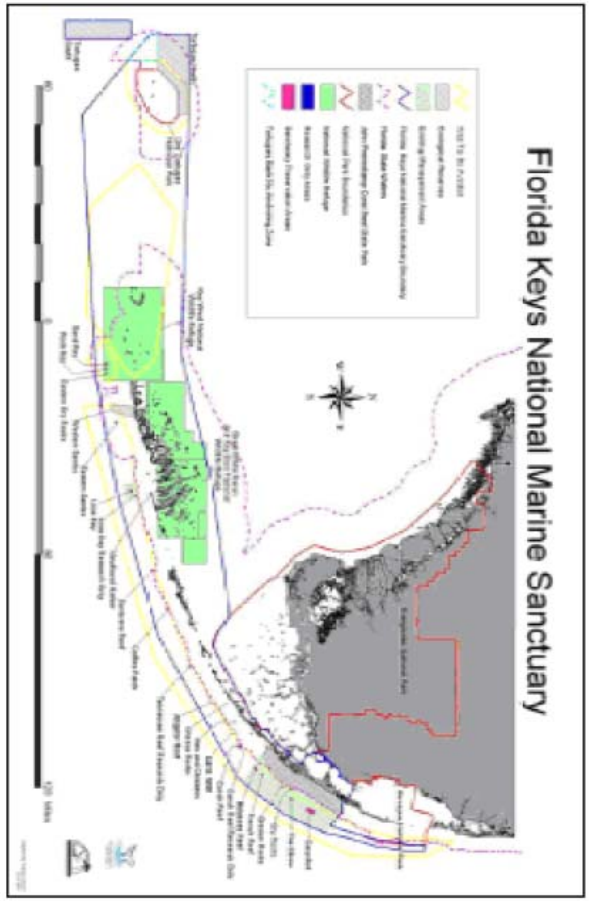
NOTE: THE FOLLOWING INFORMATION WILL BE PROVIDED ON A SEPARATE PAGE AS WELL, AS WELL AS THE CHART SHOWING FKNMS ZONES

There are five kinds of zones established within the FKNMS, and three of these zone types analyzed for this study are collectively referred to as 'FKNMS zones' in the survey. Zones allow different uses and are generally established for different purposes. Below, a short, general description for each of the three zone types is provided.

Sanctuary Preservation Areas, or SPAs, encompass discrete, biologically important areas and are designed to reduce user conflicts and sustain critical marine species and habitats. Regulations for SPAs are designed to limit consumptive activities while continuing to allow activities that do not threaten resource protection. There are 18 SPAs in the FKNMS.

Ecological Reserves, or ER, encompass large, contiguous, diverse habitats, in order to protect and enhance natural spawning, nursery, and permanent-residence areas for the replenishment and genetic protection of fish and other marine life. Regulations for Ecological Reserves are designed to meet the objectives of these zones by limiting consumptive activities while continuing to allow activities that do not threaten resource protection. Ecological Reserves therefore restrict all consumptive activities and allow non-consumptive activities only where such activities are compatible with resource protection. There are currently two Ecological Reserves in the Sanctuary, the Western Sambo Ecological Reserve and the Tortugas Ecological Reserve.

Wildlife Management Areas, or WMAs, include bird nesting, resting, or feeding areas, turtle-nesting beaches, and other sensitive habitats. Regulations are designed to protect these species or the habitat while providing for public use. Access restrictions may include no-access buffers, no-motor zones, idle-speed only/no-wake zones, and closed zones. Some restrictions may apply to time periods, others to areas. There are currently 27 WMAs, of which 7 are managed exclusively by the FKNMS (the FKNMS co-manages the others with the US Fish and Wildlife Service).



For the next two questions, please provide your opinion for *each* type of FKNMS zone by stating whether the zone type represents the main purpose and the groups that the zone type has benefited.

Question	ER	SPA	WMA
22. Which of the following represents the main purpose of FKNMS zones?			
a. Increasing overall fish stocks and biomass within the zones			
b. Increasing overall fish stocks and biomass outside the zones			
c. Conserving and protecting corals, fish, and other marine life inside the zones			
d. Resolving user group conflicts			
e. Supporting scientific research			
23. Which groups have most benefited from FKNMS zones?			
a. Commercial fishers			
b. Recreational/sport fishers			
c. Commercial dive operators			
d. Recreational (local and tourist) divers			

For the next eight questions, please provide your opinion for *each* type of FKNMS zone on a 1 to 5 scale, where 1 means **Strongly agree,** 2 means **Moderately agree**, 3 means **Neutral**, 4 means **Moderately disagree**, and 5 means **Strongly disagree**

Question	ER	SPA	WMA
24. FKNMS zones have reduced conflicts between different user groups			
25. FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they used to be.			
26. I support the establishment of FKNMS zones as they are established currently.			
27. I support the establishment of FKNMS zones in the Upper Keys.			
28. I support the establishment of FKNMS zones in the Middle Keys.			
39. I support the establishment of FKNMS zones in the Lower Keys.			
30. I support the establishment of FKNMS zones in the Dry Tortugas.			
31. There should be more FKNMS zones in the Florida Keys.			

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Please list the species landed around FKNMS zones and state whether the catch total has increased or decreased (by %) in each zone over the past 8 years.

Zone	Species (L=lobster; C=stone crab; S=shrimp; RF=reef fish; PL=pelagics; TR=tropicals; HM=migratory fish; BF=bait fish)	Catch total
1. Dry Tortugas Ecological Reserve	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
2. Sambos Ecological Reserve	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
3. Sand Key SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
4. Rock Key SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
5. Eastern Dry Rocks SPA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
6. Looe Key SPA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
7. Newfound Harbor Key SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
8. Sombrero Key SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
9. Coffins Patch SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
10. Cheeca Rocks SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
11. Alligator Reef SPA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
12. Hen and Chickens SPA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
13. Conch Reef SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
14. Molasses Reef SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
15. French Reef SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
16. Grecian Rocks SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
17. Dry Rocks SPA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
18. The Elbow SPA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
19. Carysfort/South Carysfort SPA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
20. Eastern Sambos SUA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
21. Looe Key SUA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
22. Tennessee Reef SUA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
23. Conch Reef SUA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
24. Marquesas Keys WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
25. Boca Grande Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
26. Woman Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
27. Little Mullet Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
28. Cottrell Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
29. Big Mullet Key WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
30. Bay Keys WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
31. Cayo Agua Keys WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
32. Lower Harbor Keys WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
33. East Harbor Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
34. Mud Keys WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
35. Snipe Keys WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
36. Tidal flat/Marvin Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
37. Sawyer Keys WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
38. Little Crane Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
39. West Content Keys WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
40. East Content Keys WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
41. Upper Harbor Key WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
42. Horseshoe Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
43, Pelican Shoal WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
44. Cotton Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
45. Snake Creek WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
46. Tavernier Key WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
47. Dove Key WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%
48. Rodriguez Key WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
49. Eastern Lake Surprise WMA	L ; C ; S ; RF ; PL ; TR ; HM ; BF	+ / - %
50. Crocodile Lake WMA	L___; C___; S___; RF___; PL___; TR____; HM___; BF___	+ / - ____%

For the next set of questions, please provide your answer on a 1 to 5 scale, where 1 means **Strongly agree,** 2 means **Moderately agree**, 3 means **Neutral**, 4 means **Moderately disagree**, and 5 means **Strongly disagree**

33. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program.

    1 2 3 4 5 I don't know

34. The Florida Keys have benefited environmentally from the FKNMS.

    1 2 3 4 5 I don't know

35. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS.

    1 2 3 4 5 I don't know

36. I generally support the establishment of the FKNMS.

    1 2 3 4 5 I don't know

37. Please rate the status/condition of the following resources by their status/condition since the implementation of the FKNMS, where 1 is much better and 5 is much worse.

	RESOURCE	Better ←--------→ Worse					
a.	Water quality	1	2	3	4	5	N/A
b.	Land-based pollution/sewage	1	2	3	4	5	N/A
c.	Sea-based pollution/marine debris	1	2	3	4	5	N/A
d.	Coral reefs	1	2	3	4	5	N/A
e.	Sea grasses	1	2	3	4	5	N/A
f.	Fisheries	1	2	3	4	5	N/A
g.	Mooring buoys	1	2	3	4	5	N/A
h.	Fewer vessel groundings	1	2	3	4	5	N/A

38. The FKNMS is mostly responsible for the status/condition of the resources that you rated in the previous question.

    1 2 3 4 5 I don't know

39. In which area(s) has the FKNMS been a success?

    _____

40. In which area(s) has the FKNMS been least successful?

    _____

ENFORCEMENT

41. Based on your observations, how often would you say that other commercial fishers violate fisheries regulations?
    a. On almost every trip
    b. On most trips
    c. Occasionally, on 1-2 trips per year
    d. Never

42. How often do you believe that a fisher who is violating fisheries regulations would be seen or detected by the authorities?
    a. Always
    b. 76-99%
    c. 51-75%
    d. 26-50%
    e. 1-25%
    f. Never

43. How often do you believe that a fisher who is violating fisheries regulations would be caught and penalized by the authorities?
    a. Always
    b. 76-99%
    c. 51-75%
    d. 26-50%
    e. 1-25%
    f. Never

44. How often do you believe that other fishers still fish inside the FKNMS no-take zones and take the risk of being caught?
    a. Always
    b. 76-99%
    c. 51-75%
    d. 26-50%
    e. 1-25%
    f. Never

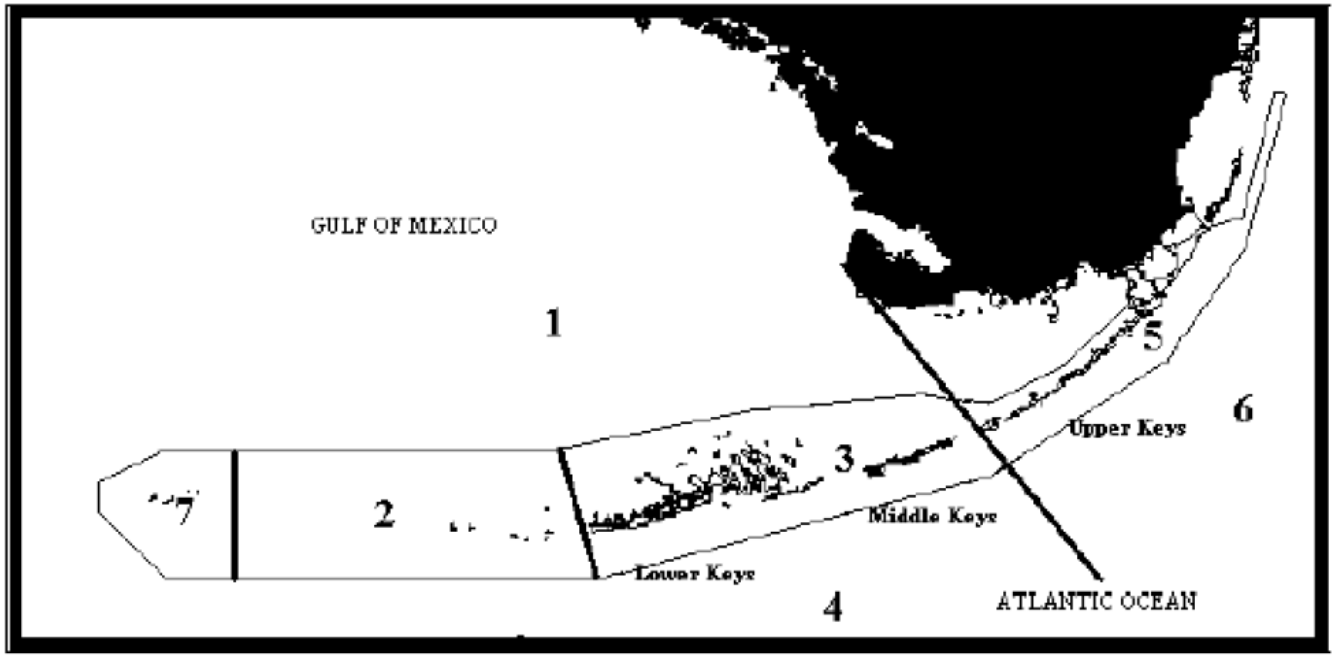


Figure 1: Fishing areas in the FKNMS

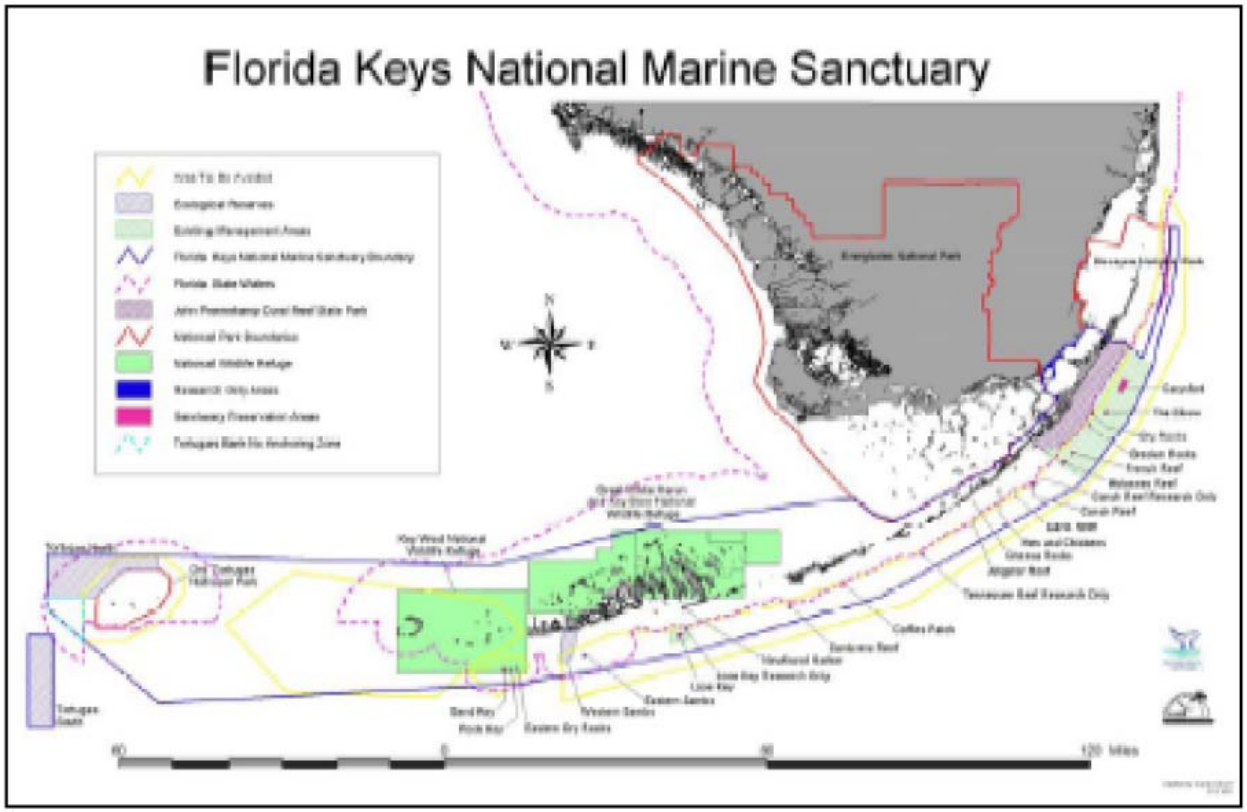


Figure 2: FKNMS zones

OMB No. 0648-0534. Expiration date: 1/31/2009.

COMMERCIAL FISHING OPERATIONS

IMPORTANT INFORMATION ABOUT THIS INFORMATION COLLECTION

Authorizations to Collect the Information

The National Marine Sanctuaries Act (16 USC 1431, et seq.) and The Florida Keys National Marine Sanctuary and Protection Act (Public Law 101-605, Sec 7 (5) authorizes the Florida Keys National Marine Sanctuary to establish regulations to protect sanctuary resources or resolve user conflicts. This act also authorizes the Sanctuary to do research and collect information necessary for evaluating new regulations and/or monitoring the effects of existing regulations.

How the Information Will Be Used

The information being collected will be used to conduct analysis of representative samples of commercial fishing operations that may have been impacted by Sanctuary regulations. A Socioeconomic Monitoring Program has been established in the Florida Keys National Marine Sanctuary and the commercial fishing industry is an important component of this program. This effort will address the knowledge, attitudes and perceptions of commercial fishermen as to Sanctuary management strategies and regulations.

Statement of Burden

Public reporting burden for this collection of information is estimated to average about two hours per response, including time for searching existing data sources, gathering and maintaining the data needed, and working with the data collection team providing information and answering questions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing burden, to Dr. Vernon R. (Bob) Leeworthy, Leader, Coastal and Ocean Resource Economics Program, National Ocean Service, Management and Budget Office, Special Projects Division, 1305 East West Highway, SSMC 4, 9th floor, Silver Spring, MD 20910.

Your Participation and Protections of Confidentiality

Your participation is voluntary. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless the collection of information displays a currently valid OMB Control Number.

Any information that identifies you or your business (name, name of business, address and telephone number) will not be given to anyone, including the government agencies sponsoring this information collection. The information that identifies you or your business will be destroyed by the contractor collecting the information at the end of the information collection. All other information will be available for distribution.

6.2 Appendix 2: Dive operator survey instrument

OMB No. 0648-0534. Expiration date: 1/31/2009.

The following questions relate to your primary dive/snorkel operation in Monroe County.

Name/position_____

Telephone_____

Address_____

GENERAL INFORMATION

1. Which of the following includes your age?

18-30 31-40 41-50 51-60 over 60

2a. Are you Spanish/Hispanic/Latino? YES NO

- if YES: Puerto Rican Mexican Cuban Other

2b. What is your race?

White African American Native American Asian Other (_____)

3. How many family members do you support, including yourself?

Myself only 2 3 4 5 6 7 8 over 8

4. Are you a member of any of the following groups?

a. NAUI	YES	NO
b. PADI	YES	NO
c. KADO	YES	NO
d. FADO	YES	NO
e. SSI	YES	NO
f. An environmental group	YES	NO
g. Chamber of commerce	YES	NO

Are you a member of any other local organizations? YES NO

If YES, then which one(s)?_____

5. How many years have you been a dive/snorkel operator in Monroe County?

1-5 years 6-10 years 11-20 years over 20 years (_____years)

6. How many years has this dive/snorkel operation been in Monroe County?

1-5 years 6-10 years 11-20 years over 20 years (_____years)

NOTES

Date of interview_____ Location of interview_____

ECONOMIC INFORMATION

7. Number of dive/snorkel boats at the operation: _____number of vessels

8. Capacity of divers/snorkelers per vessel at the operation.

Vessel 1: ____divers/____snorkelers Vessel 4: ____divers/____snorkelers
Vessel 2: ____divers/____snorkelers Vessel 5: ____divers/____snorkelers
Vessel 3: ____divers/____snorkelers Vessel 6: ____divers/____snorkelers

9. Number of employees at the operation.
a. Full time_____ c. Seasonal_____
b. Part time_____

10. Please provide your BEST estimate of the replacement value for the following items used for diving/snorkeling last year (2005).

a. Vessel(s) and electronic equipment $_____
b. Diving/snorkeling equipment $_____
c. Compressors $_____
d. Other (_____) $_____

11. Please provide your BEST estimate of the following expenses that you incurred in 2004.
a. Docking fees $_____
b. Interest payment on vessel(s) $_____
c. Vessel insurance on vessel(s) $_____
c. Maintenance and repair on vessel(s) $_____
d. Maintenance and repair on equipment $_____
e. Rent/costs on fixed location (if applicable) $_____
f. Advertising $_____
g. Other costs (_____) $_____

12. What approximate percentage of your total income is derived from the dive/snorkel operation? ____%

TRIP INFORMATION

The map in the appendix shows the Florida Keys and three areas that divide the region into the Upper, Middle, and Lower Keys within the FKNMS. Please refer to the map and use the following table to write in your BEST ESTIMATE for the total diving/snorkeling trips in 2005[1], divers/snorkelers per trip, renters (equipment) per trip, and percentage of trips taken to FKNMS zones.

Region	Total trips	Divers/snorkelers per trip	Renters per trip	% trips to ER and SPA	% trips to WMA
Upper Keys		___ divers per trip	___dive renters per trip		
		___snorkelers per trip	___snorkel renters per trip		
Middle Keys		___ divers per trip	___dive renters per trip		
		___snorkelers per trip	___snorkel renters per trip		
Lower Keys		___ divers per trip	___dive renters per trip		
		___snorkelers per trip	___snorkel renters per trip		

If you did enter the FKNMS no-take zones in 2004, please list the zones entered and the total percentage of trips spent in each zone.

FKNMS zone	% of 2004 trips in zone

Please use the following table to estimate your costs for a typical dive/snorkel trip in 2004.

Cost	Upper Keys	Middle Keys	Lower Keys
Fuel and oil			
Supplies			
Number of crew			

[1] Please provide information for a typical, recent year as well IF 2005 did not represent a typical year, due to the active hurricane season.

INFORMATION AND PERCEPTIONS

13. Please list the sources of information that you have received in the past on the FKNMS and rank the sources in terms of their usefulness. In terms of ranking, please rank only those sources that you used, and where 1 is the most important source, 2 the second most important source, and so on.

SOURCE	Sources Used	RANK Sources
a. FKNMS website	_____	_____
b. FKNMS Staff	_____	_____
c. Sanctuary Advisory Council	_____	_____
d. FKNMS brochures/literature	_____	_____
e. FKNMS signage	_____	_____
f. Information in newspapers	_____	_____
g. Radio	_____	_____
h. TV	_____	_____
i. Word of mouth	_____	_____

For the next set of questions, please provide your answer on a 1 to 5 scale, where 1 means **Strongly agree,** 2 means **Moderately agree**, 3 means **Neutral**, 4 means **Moderately disagree**, and 5 means **Strongly disagree**

14. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.

    1 2 3 4 5 I don't know

15. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.

    1 2 3 4 5 I don't know

16. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.

    1 2 3 4 5 I don't know

17. NOAA has not address the concerns of local and state governments in developing rules and regulations for the FKNMS.

    1 2 3 4 5 I don't know

18. NOAA has not address the concerns of individual citizens in developing rules and regulations for the FKNMS.

    1 2 3 4 5 I don't know

19. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.

    1 2 3 4 5 I don't know

20. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.

    1 2 3 4 5 I don't know

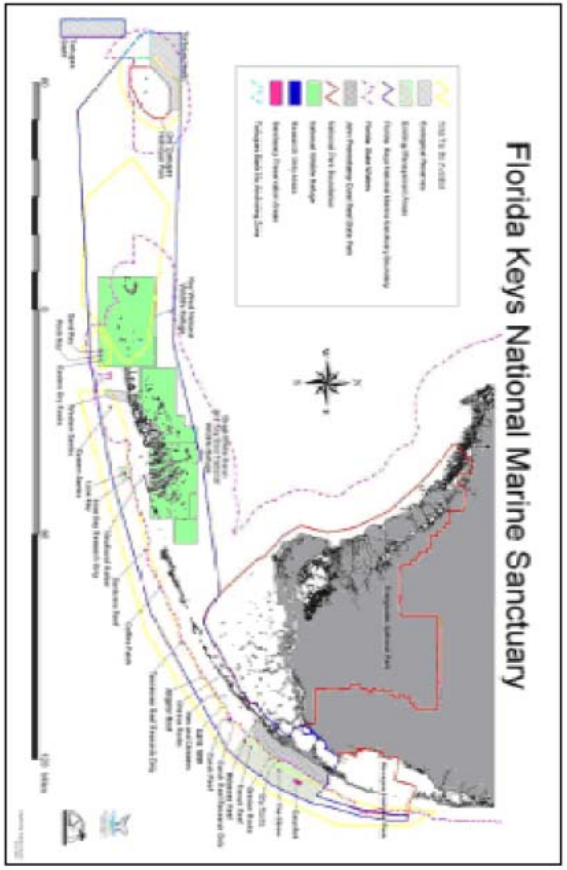
NOTE: THE FOLLOWING INFORMATION WILL BE PROVIDED ON A SEPARATE PAGE AS WELL, AS WELL AS THE CHART SHOWING FKNMS ZONES

There are five kinds of zones established within the FKNMS, and three of these zone types analyzed for this study are collectively referred to as 'FKNMS zones' in the survey. Zones allow different uses and are generally established for different purposes. Below, a short, general description for each of the three zone types is provided.

Sanctuary Preservation Areas, or SPAs, encompass discrete, biologically important areas and are designed to reduce user conflicts and sustain critical marine species and habitats. Regulations for SPAs are designed to limit consumptive activities while continuing to allow activities that do not threaten resource protection. There are 18 SPAs in the FKNMS.

Ecological Reserves, or ER, encompass large, contiguous, diverse habitats, in order to protect and enhance natural spawning, nursery, and permanent-residence areas for the replenishment and genetic protection of fish and other marine life. Regulations for Ecological Reserves are designed to meet the objectives of these zones by limiting consumptive activities while continuing to allow activities that do not threaten resource protection. Ecological Reserves therefore restrict all consumptive activities and allow non-consumptive activities only where such activities are compatible with resource protection. There are currently two Ecological Reserves in the Sanctuary, the Western Sambo Ecological Reserve and the Tortugas Ecological Reserve.

Wildlife Management Areas, or WMAs, include bird nesting, resting, or feeding areas, turtle-nesting beaches, and other sensitive habitats. Regulations are designed to protect these species or the habitat while providing for public use. Access restrictions may include no-access buffers, no-motor zones, idle-speed only/no-wake zones, and closed zones. Some restrictions may apply to time periods, others to areas. There are currently 27 WMAs, of which 7 are managed exclusively by the FKNMS (the FKNMS co-manages the others with the US Fish and Wildlife Service).



For the next two questions, please provide your opinion for *each* type of FKNMS zone by stating whether the zone type represents the main purpose and the groups that the zone type has benefited.

Question	ER	SPA	WMA
21. Which of the following represents the main purpose of FKNMS zones?			
a. Increasing overall fish stocks and biomass within the zones			
b. Increasing overall fish stocks and biomass outside the zones			
c. Conserving and protecting corals, fish, and other marine life inside the zones			
d. Resolving user group conflicts			
e. Supporting scientific research			
22. Which groups have most benefited from FKNMS zones?			
a. Commercial fishers			
b. Recreational/sport fishers			
c. Commercial dive operators			
d. Recreational (local and tourist) divers			

For the next eight questions, please provide your opinion for *each* type of FKNMS zone on a 1 to 5 scale, where 1 means **Strongly agree,** 2 means **Moderately agree**, 3 means **Neutral**, 4 means **Moderately disagree**, and 5 means **Strongly disagree**

Question	ER	SPA	WMA
23. FKNMS zones have reduced conflicts between different user groups			
24. FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they used to be.			
25. FKNMS zones have led to better diving conditions in the Florida Keys, such as healthy coral, more abundant marine life, and clearer water.			
26. My use of FKNMS zones has increased since their establishment.			
27. I support the establishment of FKNMS zones as they are established currently.			
28. I support the establishment of FKNMS zones in the Upper Keys.			
29. I support the establishment of FKNMS zones in the Middle Keys.			
30. I support the establishment of FKNMS zones in the Lower Keys.			
31. I support the establishment of FKNMS zones in the Dry Tortugas.			
32. There should be more FKNMS zones in the Florida Keys.			

For the next set of questions, please provide your answer on a 1 to 5 scale, where 1 means **Strongly agree,** 2 means **Moderately agree**, 3 means **Neutral**, 4 means **Moderately disagree**, and 5 means **Strongly disagree**

33. I support the establishment of Special-use Areas (SUAs) in the FKNMS.

    1 2 3 4 5 I don't know

34. There should be additional SUAs in the FKNMS.

    1 2 3 4 5 I don't know

35. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program.

    1 2 3 4 5 I don't know

36. The Florida Keys have benefited environmentally from the FKNMS.

    1 2 3 4 5 I don't know

37. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS.

    1 2 3 4 5 I don't know

38. Diving and snorkeling have no effect on marine ecosystems or resources.

    1 2 3 4 5 I don't know

39. Mooring buoys have a positive effect on the marine environment.

    1 2 3 4 5 I don't know

40. There should be a dive/snorkel operator funded mooring buoy program in the FKNMS.

    1 2 3 4 5 I don't know

41. There should be a diver/snorkeler (user) funded mooring buoy program in the FKNMS.

    1 2 3 4 5 I don't know

42. There should be limited entry for dive/snorkel operations in the Florida Keys.

    1 2 3 4 5 I don't know

43. I generally support the establishment of the FKNMS.

    1 2 3 4 5 I don't know

44. Please rate the status/condition of the following resources by their status/condition since the implementation of the FKNMS, where 1 is much better and 5 is much worse.

a.	Water quality	1	2	3	4	5	N/A
b.	Land-based pollution/ sewage	1	2	3	4	5	N/A
c.	Sea-based pollution/ marine debris	1	2	3	4	5	N/A
d.	Coral reefs	1	2	3	4	5	N/A
e.	Sea grasses	1	2	3	4	5	N/A
f.	Fisheries	1	2	3	4	5	N/A
g.	Mooring buoys	1	2	3	4	5	N/A
h.	Fewer vessel groundings	1	2	3	4	5	N/A

45. The FKNMS is mostly responsible for the status/condition of the resources that you rated in the previous question.

    1 2 3 4 5 I don't know

46. In which area(s) has the FKNMS been a success?

    _____

47. In which area(s) has the FKNMS been least successful?

    _____

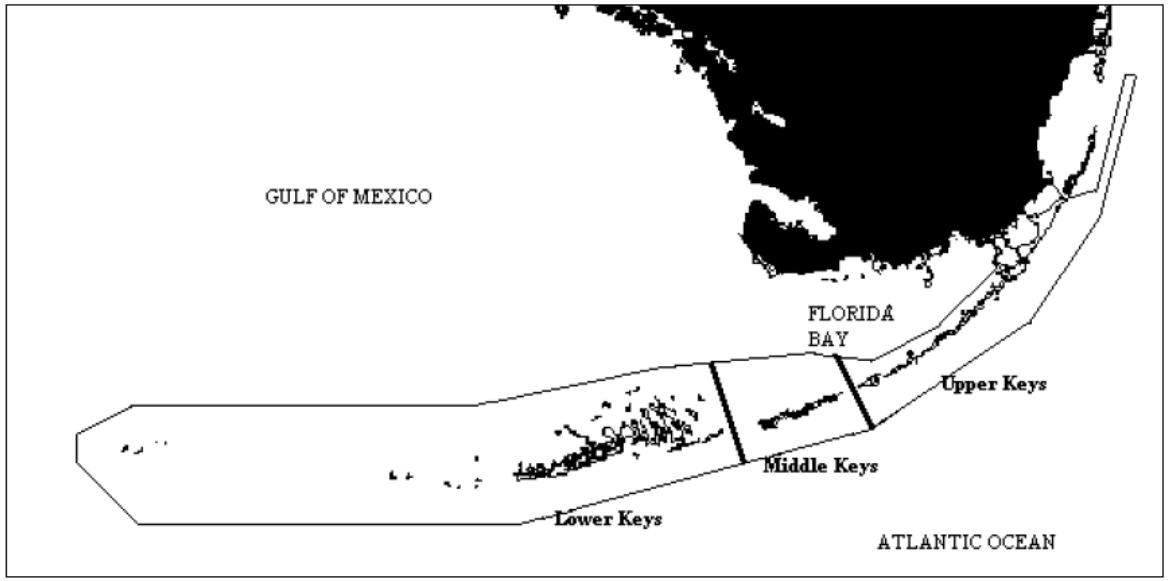
48. Use and views on FKNMS zones. Your use of FKNMS zones since their stablishment has:

INCREASED _____% SAME DECREASED_____%

Changes in FKNMS zones since their establishment:

	Better----------→ Worse						ER	SPA	WMA
a. Water quality	1	2	3	4	5	N/A	___	____	_____
b. Number of fish	1	2	3	4	5	N/A	___	____	_____
c. Types of fish	1	2	3	4	5	N/A	___	____	_____
d. Amount of living coral	1	2	3	4	5	N/A	___	____	_____
e. Other marine life	1	2	3	4	5	N/A	___	____	_____
f. Crowding (too many people)	1	2	3	4	5	N/A	___	____	_____

Appendix I: Study area map



OMB No. 0648-0534. Expiration date: 1/31/2009.

DIVE SHOPS AND OPERATIONS

IMPORTANT INFORMATION ABOUT THIS INFORMATION COLLECTION

13. Authorizations to Collect the Information

The National Marine Sanctuaries Act (16 USC 1431, et seq.) and The Florida Keys National Marine Sanctuary and Protection Act (Public Law 101-605, Sec 7 (5) authorizes the Florida Keys National Marine Sanctuary to establish regulations to protect sanctuary resources or resolve user conflicts. This act also authorizes the Sanctuary to do research and collect information necessary for evaluating new regulations and/or existing regulations.

14. How the Information Will Be Used

The information being collected will be used to assess the Dive Industry's knowledge, attitudes and perceptions of Sanctuary management strategies and regulations, especially for the no-take areas in the Florida Keys National Marine Sanctuary. A Socioeconomic Monitoring Program has been established in the Florida Keys National Marine Sanctuary and assessing the Dive Industry's opinions is an important element of the program.

15. Statement of Burden

Public reporting burden for this collection of information is estimated to average about 2 hours per year per response, including time for searching existing data sources, gathering and maintaining the data needed, and working with the data collection team, including answering questions. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing burden, to Dr. Vernon R. (Bob) Leeworthy, Leader, Coastal and Ocean Economics Program, National Ocean Service, Management and Budget Office, Special Projects, 1305 East West Highway, SSMC 4, 9th floor, Silver Spring, MD 20910.

16. Your Participation and Protections of Confidentiality

Your participation is voluntary. Notwithstanding any other provision of the law, no person is required to respond to, nor shall any person be subject to a penalty for failure to comply with, a collection of information subject to the requirements of the Paperwork Reduction Act, unless the collection of information displays a currently valid OMB Control Number.

Any information that identifies you or your business (name, name of business, address and telephone number) will not be given to anyone outside the agency sponsoring this information collection. Name address, business name, boat name and telephone will be treated as proprietary information. The information that identifies you or your business will not be released to anyone pursuant to the Freedom of Information Act (5 USC Section 552 (B) (4)). All other information will be available for distribution.

6.3 Appendix 3: Environmental group member survey instrument

DATE

Name of person
Address line 1
Address line 2

Dear Sir/Madam:

This letter serves as a follow up to an introductory letter that we sent you a month ago, detailing an important study being conducted by our group, Thomas J. Murray & Associates in conjunction with the University of Miami, on the effectiveness of the Florida Keys National Marine Sanctuary (FKNMS). As stated in that previous letter, our group has partnered with **your environmental group** in an effort to obtain your opinions on the FKNMS.

The FKNMS, which has been in effect since 1997, encompasses all of the Florida Keys and implements a comprehensive management strategy, which includes the operation of several action plans. Our group's study focuses in part on your views on the overall effectiveness of the FKNMS and its zoning action plan.

Your participation is essential to the success of this study, and we request that you please complete the enclosed survey questionnaire and mail it back using the accompanying, self-addressed and postage-paid, envelope. You may contact the research team at the University of Miami at 305-421-4608 with any questions concerning the study, and we will gladly provide you any information that you may require.

Finally, we wish to thank you for having taken the time to read this letter and hope to receive your completed survey soon. Thank you again for participating in this important effort, whose results we shall make available through **your group** and can provide to you, if you so request.

Sincerely,

Thomas J. Murray

Enclosures

IMPORTANT INFORMATION ABOUT THIS INFORMATION COLLECTION

36. Authorizations to Collect the Information

The National Marine Sanctuaries Act (16 USC 1431, et seq.) and The Florida Keys National Marine Sanctuary and Protection Act (Public Law 101-605, Sec 7 (5) authorizes the Florida Keys National Marine Sanctuary to establish regulations to protect sanctuary resources or resolve user conflicts. This act also authorizes the Sanctuary to do research and collect information necessary for evaluating new and/or existing regulations.

37. How the Information Will Be Used

The information being collected will be used to assess the knowledge, attitudes and perceptions of Sanctuary management strategies and regulations. A Socioeconomic Monitoring Program has been established in the Florida Keys National Marine Sanctuary and monitoring Sanctuary user's knowledge, attitudes and perceptions of Sanctuary management strategies and regulations is considered to be a high priority element of the program.

38. Statement of Burden

Public reporting burden for this collection of information is estimated to average about 2 hours per year per response, including time for reviewing instructions and completing and reviewing the enclosed questionnaire. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing burden, to Dr. Vernon R. (Bob) Leeworthy, Leader, Coastal and Ocean Resource Economics Program, National Ocean Service, Management and Budget Office, Special Projects, 1305 East West Highway, SSMC 4, 9th floor, Silver Spring, MD 20910.

39. Your Participation and Protections of Confidentiality

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Any information that identifies you (name, address and telephone number) will not be given to anyone outside the agency sponsoring this information collection. Name, address, and telephone will be treated as proprietary information. The information that identifies you will not be released to anyone pursuant to the Freedom of Information Act (5 USC Section 552 (B) (4)). All other information will be available for distribution.

General Information

Primary zip code ___ ___ ___ ___ ___ Zip code in the Florida Keys (if different) ___ ___ ___ ___ ___

1. Which of the following includes your age?

[ ] Under 18 years [ ] 18-30 years [ ] 31-40 years [ ] 41-50 years [ ] 51-60 years [ ] over 60 years

2a. Are you Spanish/Hispanic/Latino? [ ] YES [ ] NO

2b. Which of the following best describes your race?

[ ] White [ ] African American [ ] Native American [ ] Asian [ ] Other (_____)

3. How long have you been a member of Reef Relief?

[ ] Less than 1 year [ ] 1 – 5 years [ ] 6 – 10 years [ ] 11 – 15 years [ ] 16 – 20 years [ ] Over 20 years

4. Are you a member of any of the following groups?

a. Last Stand [ ] YES [ ] NO
b. Sanctuary Friends of the Florida Keys [ ] YES [ ] NO

5. Do you belong to any other environmental/conservation groups? [ ] YES [ ] NO

- If YES, then which one(s)? _____

6. How often do you visit the Florida Keys each year?

[ ] Resident [ ] 1 – 3 months [ ] 4 – 6 months [ ] 7 – 9 months [ ] Other_____

7. Please circle all activities from the following list in which you participate in the Florida Keys.

Sport fishing	Swimming	Snorkeling	Scuba-diving
Pleasure boating	Water-skiing	Jet-skiing	Kayaking
Net-fishing	Trap fishing	Spear fishing	Fish collecting
Bird watching	Underwater photography	Glass-bottom boating	Sailing
Other activities_____			

8. Is your occupation affiliated with the marine environment/industry in the Florida Keys? [ ] YES [ ] NO

- If YES, then please circle the industry that best fits your profession.

Commercial fishing	Charter/for-hire fishing	Flats/for-hire fishing	Dive/snorkel operation
Marina/boat operations	Watersports	Eco-tourism operation	Other_____

Information and Perceptions

9. Please circle all the sources of information from the following list that you have received in the past on the Florida Keys National Marine Sanctuary (FKNMS).

FKNMS website	FKNMS staff/personnel	Sanctuary Advisory Council	FKNMS brochures/literature
FKNMS signage	Information in newspapers	Radio	Television
Word of mouth		Other_____	

10. Of the sources of information, you circled in the previous question (question 9), please circle the MOST USEFUL source.

FKNMS website	FKNMS staff/personnel	Sanctuary Advisory Council	FKNMS brochures/literature
FKNMS signage	Information in newspapers	Radio	Television
Word of mouth		Other_____	

11. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

12. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

13. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

14. NOAA has not address the concerns of local and state governments in developing rules and regulations for the FKNMS.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

15. NOAA has not address the concerns of individual citizens in developing rules and regulations for the FKNMS.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

16. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

17. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

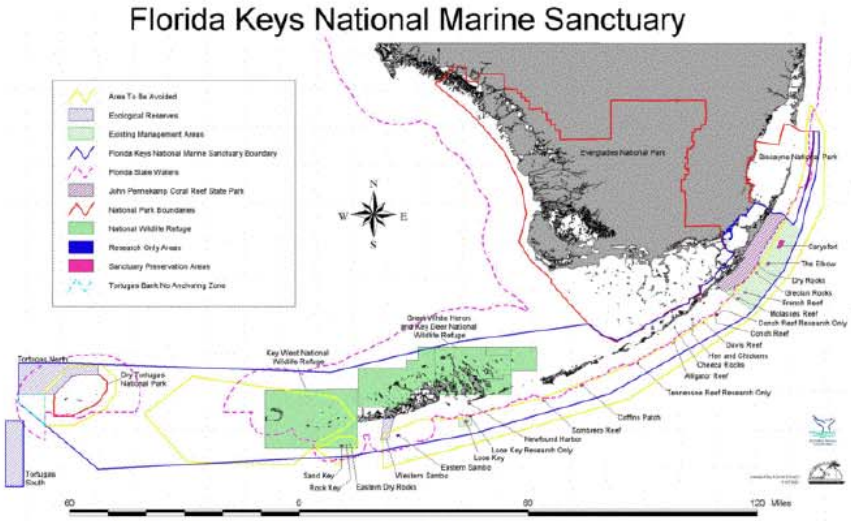
Please refer to the following description and map to answer questions 18 – 27.

There are five kinds of zones established within the FKNMS, and three of these zone types analyzed for this study are collectively referred to as 'FKNMS zones' in the survey. Zones allow different uses and are generally established for different purposes. Below, a short, general description for each of the three zone types is provided.

Sanctuary Preservation Areas, or SPAs, encompass discrete, biologically important areas and are designed to reduce user conflicts and sustain critical marine species and habitats. Regulations for SPAs are designed to limit consumptive activities while continuing to allow activities that do not threaten resource protection. There are 18 SPAs in the FKNMS.

Ecological Reserves, or ER, encompass large, contiguous, diverse habitats, in order to protect and enhance natural spawning, nursery, and permanent-residence areas for the replenishment and genetic protection of fish and other marine life. Regulations for Ecological Reserves are designed to meet the objectives of these zones by limiting consumptive activities while continuing to allow activities that do not threaten resource protection. Ecological Reserves therefore restrict all consumptive activities and allow non-consumptive activities only where such activities are compatible with resource protection. There are currently two Ecological Reserves in the Sanctuary, the Western Sambo Ecological Reserve and the Tortugas Ecological Reserve.

Wildlife Management Areas, or WMAs, include bird nesting, resting, or feeding areas, turtle-nesting beaches, and other sensitive habitats. Regulations are designed to protect these species or the habitat while providing for public use. Access restrictions may include no-access buffers, no-motor zones, idle-speed only/no-wake zones, and closed zones. Some restrictions may apply to time periods, others to areas. There are currently 27 WMAs, of which 7 are managed exclusively by the FKNMS (the FKNMS co-manages the others with the US Fish and Wildlife Service).



Reference: http://www.fknms.nos.noaa.gov/research_monitoring/map.html

Please answer questions 18 – 27 for each of the three main types of zones: Ecological Reserves (ER), Sanctuary Preservation Areas (SPA), and Wildlife Management Areas (WMA).

18a. Which of the following represents the MAIN purpose of the Ecological Reserves (ER)?

[ ] Increasing overall fish stocks and biomass WITHIN the zones
[ ] Increasing overall fish stocks and biomass OUTSIDE the zones
[ ] Conserving and protecting corals, fish, and other marine life inside the zones
[ ] Resolving user group conflicts
[ ] Supporting scientific research

18b. Which of the following represents the MAIN purpose of the Sanctuary Preservation Areas (SPA)?

[ ] Increasing overall fish stocks and biomass WITHIN the zones
[ ] Increasing overall fish stocks and biomass OUTSIDE the zones
[ ] Conserving and protecting corals, fish, and other marine life inside the zones
[ ] Resolving user group conflicts
[ ] Supporting scientific research

18c. Which of the following represents the MAIN purpose of the Wildlife Management Areas (WMA)?

[ ] Increasing overall fish stocks and biomass WITHIN the zones
[ ] Increasing overall fish stocks and biomass OUTSIDE the zones
[ ] Conserving and protecting corals, fish, and other marine life inside the zones
[ ] Resolving user group conflicts
[ ] Supporting scientific research

19a. Which of the following groups has MOST benefited from Ecological Reserves (ER)?

[ ] Commercial fishers
[ ] Recreational/sport fishers
[ ] Commercial dive operators
[ ] Recreational (local and tourist) divers

19b. Which of the following groups has MOST benefited from Sanctuary Preservation Areas (SPA)?

[ ] Commercial fishers
[ ] Recreational/sport fishers
[ ] Commercial dive operators
[ ] Recreational (local and tourist) divers

19c. Which of the following groups has MOST benefited from Wildlife Management Areas (WMA)?

[ ] Commercial fishers
[ ] Recreational/sport fishers
[ ] Commercial dive operators
[ ] Recreational (local and tourist) divers

20. FKNMS zones have reduced conflicts between different user groups.

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

21. FKNMS zones have been effective in restoring coral reefs in the Florida Keys to what they used to be.

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

22. I support the establishment of FKNMS zones as they are established currently.

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

23. I support the establishment of FKNMS zones in the Upper Florida Keys (Key Largo to Long Key).

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

24. I support the establishment of FKNMS zones in the Middle Florida Keys (Conch Key to Marathon).

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

25. I support the establishment of FKNMS zones in the Lower Florida Keys (Big Pine Key to Key West).

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

26. I support the establishment of FKNMS zones in the Dry Tortugas region.

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

27. There should be more FKNMS zones in the Florida Keys.

a. Ecological Reserves (ER)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

b. Sanctuary Preservation Areas (SPA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

c. Wildlife Management Areas (WMA)
[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

28. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

29. The Florida Keys have benefited environmentally from the FKNMS.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

30. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

31. I generally support the establishment of the FKNMS.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

32. Please circle the status or condition of the following resources since the implementation of the FKNMS, where 1 is much better and 5 is much worse.

	RESOURCE	*CONDITION* Better ←----------→ Worse				
a.	Water quality	1	2	3	4	5
b.	Land-based pollution and sewage	1	2	3	4	5
c.	Sea-based pollution and marine debris	1	2	3	4	5
d.	Coral reefs	1	2	3	4	5
e.	Sea grasses	1	2	3	4	5
f.	Fisheries	1	2	3	4	5
g.	Mooring buoys	1	2	3	4	5
h.	Vessel groundings	1	2	3	4	5

33. The FKNMS is mostly responsible for the status/condition of the resources that you rated in the previous question.

[ ] Strongly agree [ ] Moderately agree [ ] Neutral [ ] Moderately disagree [ ] Strongly disagree [ ] I don't know

34. In which area(s) has the FKNMS been a success?

_____

35. In which area(s) has the FKNMS been least successful?

_____

36. Do you use any of the FKNMS zones? [ ] YES [ ] NO

- If YES, then which one(s)?_____

- If YES, then since the establishment of the FKNMS and the zones, has your use of these zones:

[ ] Increased (by what percentage? _____%)
[ ] Stayed the same
[ ] Decreased (by what percentage? _____%)

END OF SURVEY

Thank you very much for your participation. Please return the survey in the postage paid envelope provided, and we look forward to completing this important effort with your help. If you have any questions, please feel free to contact Mr. Manoj Shivlani, the study coordinator at 305-421-4608. If you were not provided with a postage paid return envelope, please contact us at the number provided, or you may mail the survey directly to:

Manoj Shivlani
FKNMS Knowledge, Attitudes, and Perceptions Study
P.O. Box 560580
Miami, Florida 33156

Thank you again, and we hope to receive your survey very soon.

6.4 Appendix 4: Environmental group member survey plan

Knowledge, attitudes, and perceptions (KAP) survey study of environmental group members concerning the Florida Keys National Marine Sanctuary (FKNMS)

Rationale

The goal of this study is to survey environmental group members on their knowledge, attitudes, and perceptions concerning the management of the Florida Keys National Marine Sanctuary (FKNMS) and its zoning action plan (NOAA, 1996). The methodology adopted for this effort - set up as three steps - shall maximize data collection, in that it shall be devised to increase return rates and identify sources of non-response bias.

Methodology

The study utilizes mail surveys as a means by which to collect knowledge, attitudes, and perception data from a census of environmental group members, and it employs a three-step process (set up over a period of three months) to achieve an acceptable sample size and determine sources of non-response bias. Moreover, the methodology follows well-accepted survey procedures (Babbie, 1990; West, 1995). Each step follows the chronological order of the study.

Step 1: Promotion letter mailing
The first step in the mail survey shall consist of mailing a letter (Attachment A) to environmental group members promoting the study and shall be conducted in the **first** month. The research team shall work with the environmental group representatives in obtaining mailing lists for each group, and the promotion letters shall be formatted on group stationary.

The promotion letter shall introduce the recipient to the study and its objectives and the research team, it shall emphasize the importance of participating in the study by completing the survey to be sent within a month by demonstrating how group findings may assist in identifying important management recommendations, and it shall provide contact information that the recipient can use to learn more about the study or have his/her questions and concerns addressed.

It is expected that the promotion letter shall prepare environmental group members for the survey, thereby boosting returns and reducing non-responses. As the promotion letter will be sent on environmental group stationary, members will be able to identify the study with their group and understand that the survey has been approved by their group. Moreover, the contact information on the promotion letter will allow recipients a means by which to reach the research team with any questions or concerns prior to their receiving the survey. Finally, and importantly, those promotion letters that are returned

as a result of changes in address will assist in better identifying the total population for each environmental and prevent unnecessary survey mailings.

Step 2: Cover letter and survey questionnaire
In the **second** month, or a month after the promotion letter has been sent, the research team shall mail each environmental group member a cover letter and survey questionnaire. The cover letter, formatted on environmental group stationary, shall reference the promotion letter, reiterate the objectives and significance of the study, and emphasize the need for participation. As with the promotion letter, the cover letter shall contain contact information that each recipient can use to contact the research team with questions or concerns. Finally, the cover letter shall be signed by both the environmental group representative and a member of the research team.

As previously stated, the research team shall send out cover letters (Attachment B) and survey questionnaires to all environmental group members, effectively conducting a census. It is expected that with the promotion letter that informs group members of the impending survey, provides them with contact details that they use to ask questions and raise concerns, and links the survey directly to their environmental group, the return rates on the survey shall reach 60%. That is, six in 10 recipients are expected to complete and return the survey.

The research team shall also send out postcard reminders (Attachment B), which will be mailed two weeks following the cover letter and survey questionnaire mailing. These postcard reminders shall be used to inform recipients that they have not yet returned their surveys, but that they may still mail them back at their earliest convenience.

Step 3: Postcard reminders and non-respondent survey
In the third month, or a month after the cover letter and survey questionnaire mailing, the research team shall mail to each non-respondent a postcard (Attachment C) containing the following information: a. A final request to participate in the study, providing contact information that the recipient may use to reach the research team in order to obtain another copy of the survey questionnaire; and b. A short, two-question survey in the case where the person elects not to request another copy of the survey questionnaire.

The short, two-question survey shall consist of a demographic question, concerning the non-respondent's age group, and an attitude question, related to the non-respondent's approval of the Florida Keys National Marine Sanctuary. The differences among respondents and non-respondents for these two questions shall be used to address non-response bias.

Conclusions

By using the three-step process as described, it is expected that the study shall achieve a 60% (or greater) response rate and account for the remaining non-response bias. It should be emphasized that the scope of the survey shall be the *entire* population of each

environmental group, and that the effort shall effectively consist of a census survey. By working closely with each environment group to maximize 'buy-in' and support for the survey, the research team shall contact group members on a total of four, separate occasions prior to resorting to a non-respondent survey. Finally, the study has been structured in a way such that recipients are reminded of the importance of the survey effort and provided with contact information with each mailer; this dual re-enforcement shall ensure that more surveys are completed and returned *and* that respondents better understand the study objectives.

References

Alreck, P. L., and R. B. Settle. 1985. The Survey Research Handbook. Homewood, IL: Richard D. Irwin, Inc.

Babbie, E. 1990. Survey Research Methods. Belmont, CA: Wadsworth Publishing Company.

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

Attachment A: Promotion letter

DATE

Name of person
Address line 1
Address line 2

Dear Sir/Madam:

This letter serves as an introduction to an important study being conducted by our group, Thomas J. Murray & Associates, on the effectiveness of the Florida Keys National Marine Sanctuary (FKNMS). Our group has partnered with the **environmental organization** in an effort to obtain your opinions on the FKNMS.

The FKNMS, which has been in effect since 1997, encompasses all of the Florida Keys and implements a comprehensive management strategy, which includes the operation of several action plans. Our group's study focuses in part on your views on the overall effectiveness of the FKNMS and its zoning action plan.

Your participation is essential to the success of this study, and we hope that you will participate in our upcoming effort. We shall mail you a short questionnaire in the next month that we request that you please complete and mail it back using an accompanying, self-addressed and postage-paid, envelope. You may contact the research team at 305-421-4608 with any questions concerning the study, and we will gladly provide you any information that you may require.

Finally, we wish to thank you for having taken the time to read this letter and hope to send you the survey next month. Thank you for your attention.

Sincerely,

Thomas J. Murray

Attachment B: Cover letter for survey questionnaire and postcard reminder

DATE

Name of person
Address line 1
Address line 2

Dear Sir/Madam:

This letter serves as a follow up to an introductory letter that we sent you a month ago, detailing an important study being conducted by our group, Thomas J. Murray & Associates, on the effectiveness of the Florida Keys National Marine Sanctuary (FKNMS). As stated in that previous letter, our group has partnered with the **environmental organization** in an effort to obtain your opinions on the FKNMS.

The FKNMS, which has been in effect since 1997, encompasses all of the Florida Keys and implements a comprehensive management strategy, which includes the operation of several action plans. Our group's study focuses in part on your views on the overall effectiveness of the FKNMS and its zoning action plan.

Your participation is essential to the success of this study, and we request that you please complete the enclosed survey questionnaire and mail it back using the accompanying, self-addressed and postage-paid, envelope. You may contact the research team at 305-421-4608 with any questions concerning the study, and we will gladly provide you any information that you may require.

Finally, we wish to thank you for having taken the time to read this letter and hope to receive your completed survey soon. Thank you again for participating in this important effort, whose results we shall make available through the **environmental organization** and can provide to you, if you so request.

Sincerely,

Thomas J. Murray

Enclosures

Postcard Reminder

Dear Sir/Madam:

As part of a study effort concerning the effectiveness of the Florida Keys National Marine Sanctuary, we had sent you a survey with a postage-paid envelope in the last two weeks. If you have already mailed back the survey, we thank you for your participation; if you have not had the opportunity to do so yet, may we please request that you complete and mail us the survey, as your feedback is essential for the success of the study.

Thank you,

Thomas J. Murray

Attachment C: Non-respondent, two-question survey

Dear Sir/Madam:

As part of a study effort concerning the effectiveness of the Florida Keys National Marine Sanctuary, we had sent you a survey with a postage-paid envelope a month ago. If you did not receive the survey and would wish to obtain a copy, please request one via telephone at 305-421-4608, via email at mshivlani@rsmas.miami.edu, or via mail through: Mr. Manoj Shivlani, University of Miami, 4600 Rickenbacker Causeway, Miami, FL 33149.

If you choose not to complete the full survey, we would greatly appreciate your answering the following two questions that are related to our study and will greatly assist us in completing our research. You can mail us back this letter in the postage-paid, return envelope provided.

Question 1

Which of the following includes your age? (Please circle the age group that contains your age)

18-30 31-40 41-50 51-60 over 60

Question 2

I generally support the establishment of the FKNMS. (Please circle your response)

1. *Strongly agree*
2. *Moderately agree*
3. *Neutral*
4. *Moderately disagree*
5. *Strongly disagree*

Thank you for your help,

Thomas J. Murray

6.5 Appendix 5: Comparison of Last Stand and Reef Relief members' views on the FKNMS process and outcomes

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean***
1. The process that NOAA has used to develop rules and regulations for the FKNMS was open and fair to all groups.	LS (n = 62)	38.7	29.0	4.8	3.2	3.2	21.0	n = 49 1.78 (1.03)*
	RR (n = 331)	18.1	16.6	11.8	6.0	8.2	39.3	n = 201 2.50 (1.36)*
2. The process has used by NOAA to develop boundaries and regulations for the FKNMS zones was open and fair to all groups.	LS (n = 63)	39.7	33.3	1.6	3.2	1.6	20.6	n = 50 1.66 (0.87)*
	RR (n = 329)	17.0	17.9	10.0	6.7	9.7	38.6	n = 215 2.58 (1.41)*
3. It has not mattered whether the average person participated in the workshops and meeting on the FKNMS because the average person could not influence the final decisions.	LS (n = 63)	9.5	17.5	12.7	25.4	19.1	15.9	n = 53 3.32 (1.34)
	RR (n = 331)	13.6	13.6	12.7	16.0	26.6	27.5	n = 240 3.12 (1.44)
4. NOAA has not addressed the concerns of local and state governments in developing rules and regulations for the FKNMS.	LS (n = 63)	6.4	4.8	12.7	19.1	30.2	27.0	n = 46 3.85 (1.28)*
	RR (n = 332)	8.1	8.7	15.1	10.5	15.1	42.5	n = 201 3.27 (1.37)*
5. NOAA has not addressed the concerns of individual citizens in developing rules and regulations for the FKNMS.	LS (n = 63)	6.4	7.9	12.7	25.4	23.8	23.8	n = 48 3.69 (1.26)*
	RR (n = 332)	10.8	16.6	10.8	10.5	13.0	38.2	n = 215 2.97 (1.41)*
6. Once that the FKNMS regulations have been in effect, there has been no way that the average person to voice his/her opinion on the usefulness of the regulations.	LS (n = 63)	6.4	9.5	9.5	23.8	23.8	27.0	n = 46 3.67 (1.30)*
	RR (n = 331)	12.1	13.0	14.8	13.0	11.5	35.6	n = 223 2.98 (1.37)*

7. The procedures that NOAA has established to deal with violations of FKNMS regulations have been fair and just.	LS (n = 63)	17.5	36.5	6.4	1.6	3.2	34.9	n = 41 2.02 (0.96)*
	RR (n = 330)	9.1	13.0	13.9	5.8	7.6	50.6	n = 173 2.79 (1.30)*

* refers to significant differences in means ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

Question	*Sample*	*Strongly agree*	*Moderately agree*	*Neutral*	*Moderately disagree*	*Strongly disagree*	*Don't know*	*Mean***
1. NOAA has made a positive contribution to the marine environment via the National Marine Sanctuary Program	LS (n = 61)	50.8	32.8	1.6	3.3	-	11.5	n =54 1.52 (0.72)*
	RR (n = 311)	34.1	31.5	6.8	4.5	4.8	18.3	n = 254 1.95 (1.12)*
2. The Florida Keys have benefited environmentally from the FKNMS.	LS (n = 62)	51.6	38.7	-	3.2	-	6.5	n = 58 1.51 (0.68)
	RR (n = 311)	39.5	32.8	7.1	1.6	5.1	13.8	n = 268 1.84 (1.06)\
3. There has been a net economic benefit to the Florida Keys from the establishment of the FKNMS.	LS (n = 62)	41.9	30.6	4.8	4.8	3.2	14.5	n = 53 1.79 (1.04)
	RR (n = 310)	28.1	24.5	10.6	4.5	6.4	25.8	n = 230 2.14 (1.24)
4. I generally support the establishment of the FKNMS.	LS (n = 61)	73.8	16.4	4.9	-	-	4.9	n = 58 1.28 (0.56)*
	RR (n = 307)	57.7	20.9	4.5	3.2	5.9	7.8	n = 297 1.69 (1.14)*

* refers to significant differences in means ($p < 0.05$)
** 1-5 scale, where 1 is strongly agree and 5 is strongly disagree

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CONNECTIVITY Science, People and Policy in the Florida Keys National Marine Sanctuary (NMSP-08-02)

M/V *ALEC OWEN MAITLAND* Coral Reef Restoration Monitoring Report Monitoring Events 2004-2007 Florida Keys National Marine Sanctuary Monroe County, Florida (NMSP-08-01)

Automated, objective texture segmentation of multibeam echosounder data - Seafloor survey and substrate maps from James Island to Ozette Lake, Washington Outer Coast. (NMSP-07-05)

Observations of Deep Coral and Sponge Assemblages in Olympic Coast National Marine Sanctuary, Washington (NMSP-07-04)

A Bioregional Classification of the Continental Shelf of Northeastern North America for Conservation Analysis and Planning Based on Representation (NMSP-07-03)

M/V *WELLWOOD* Coral Reef Restoration Monitoring Report Monitoring Events 2004-2006 Florida Keys National Marine Sanctuary Monroe County, Florida (NMSP-07-02)

Survey report of NOAA Ship McArthur II cruises AR-04-04, AR-05-05 and AR-06-03: Habitat classification of side scan sonar imagery in support of deep-sea coral/sponge explorations at the Olympic Coast National Marine Sanctuary (NMSP-07-01)

2002 - 03 Florida Keys National Marine Sanctuary Science Report: An Ecosystem Report Card After Five Years of Marine Zoning (NMSP-06-12)

Habitat Mapping Effort at the Olympic Coast National Marine Sanctuary - Current Status and Future Needs (NMSP-06-11)

M/V *CONNECTED* Coral Reef Restoration Monitoring Report Monitoring Events 2004-2005 Florida Keys National Marine Sanctuary Monroe County, Florida (NMSP-06-010)

M/V *JACQUELYN L* Coral Reef Restoration Monitoring Report Monitoring Events 2004-2005 Florida Keys National Marine Sanctuary Monroe County, Florida (NMSP-06-09)

M/V *WAVE WALKER* Coral Reef Restoration Baseline Monitoring Report - 2004 Florida Keys National Marine Sanctuary Monroe County, Florida (NMSP-06-08)

Olympic Coast National Marine Sanctuary Habitat Mapping: Survey report and classification of side scan sonar data from surveys HMPR-114-2004-02 and HMPR-116-2005-01 (NMSP-06-07)

A Pilot Study of Hogfish (*Lachnolaimus maximus* Walbaum 1792) Movement in the Conch Reef Research Only Area (Northern Florida Keys) (NMSP-06-06)

Comments on Hydrographic and Topographic LIDAR Acquisition and Merging with Multibeam Sounding Data Acquired in the Olympic Coast National Marine Sanctuary (ONMS-06-05)

Conservation Science in NOAA's National Marine Sanctuaries: Description and Recent Accomplishments (ONMS-06-04)

Normalization and characterization of multibeam backscatter: Koitlah Point to Point of the Arches, Olympic Coast National Marine Sanctuary - Survey HMPR-115-2004-03 (ONMS-06-03)

Developing Alternatives for Optimal Representation of Seafloor Habitats and Associated Communities in Stellwagen Bank National Marine Sanctuary (ONMS-06-02)

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Olympic Coast National Marine Sanctuary: Proceedings of the 1998 Research Workshop, Seattle, Washington (MSD-01-04)

Workshop on Marine Mammal Research & Monitoring in the National Marine Sanctuaries (MSD-01-03)

A Review of Marine Zones in the Monterey Bay National Marine Sanctuary (MSD-01-2)

Distribution and Sighting Frequency of Reef Fishes in the Florida Keys National Marine Sanctuary (MSD-01-1)

Flower Garden Banks National Marine Sanctuary: A Rapid Assessment of Coral, Fish, and Algae Using the AGRRA Protocol (MSD-00-3)

The Economic Contribution of Whalewatching to Regional Economies: Perspectives From Two National Marine Sanctuaries (MSD-00-2)

Olympic Coast National Marine Sanctuary Area to be Avoided Education and Monitoring Program (MSD-00-1)

Multi-species and Multi-interest Management: an Ecosystem Approach to Market Squid (*Loligo opalescens*) Harvest in California (MSD-99-1)