

**CHANNEL MARKING MASTER PLAN
FOR THE FLORIDA KEYS**

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PREFACE

This document represents the channel marking master plan as described in both the Channel/Reef Marking Action Plan of the Florida Keys National Marine Sanctuary Management Plan, and the Development of a Comprehensive Boat Channel Marking Plan for the Florida Keys by the Monroe County Department of Marine Resources. Funding for the channel marking master plan was provided by a \$35,000 grant from the Special Waterway Projects Program of The Florida Department of Environmental Protection, Office of Waterway Management. In-kind matching funds were provided by the Monroe County Department of Marine Resources.

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GENERAL INTRODUCTION

The development of a comprehensive plan for channel marking in the Florida Keys has evolved over the past seven years in response to growing concern over increasing impacts to the shallow-water resources. Seagrass meadows are the dominant habitat found throughout most of the coastal areas of the Keys on both the bay and ocean sides, and are incurring significant damage from a variety of users. The relatively soft bottom of the meadows makes this habitat vulnerable to scarring and dredging from boat traffic. Expansive shoal areas combined with increasing boating pressure result in extensive areas of damaged seagrasses. The slow growth and recovery of the damaged seagrass beds intensify the problem. This relatively long-term damage is evidenced from any vantage point overlooking frequently used areas in the Keys.

The importance of seagrasses from both a biological and human perspective are well understood. These lush underwater meadows are an important component of the coastal ecology of the Keys, creating a diverse and complex marine community. This biodiversity makes seagrass meadows a highly productive area, attracting a variety of commercial and recreational user groups. The nearshore meadows experience additional impacts due to the proximity to populated shoreline areas and adjacent, deeper water destinations. Extremely shallow areas containing seagrasses are often found near launching sites and marinas, within cuts between islands, and along most routes to popular sites offshore and in Florida Bay. This vulnerable distribution of seagrass meadows results in the beds being damaged by boaters utilizing these areas as well as boaters en route to typically safer, deeper areas.

Development first made a significant impact on seagrass meadows in the early 1900's with the construction of the Overseas Railroad, followed by a series of bridge and highway projects. Bridge replacement projects in the 1970's and 1980's further impacted the coastal areas and were found to cause over 93 acres of seagrass scarring, causing concern from both government and environmentalists (Lewis et al. 1994). Those numbers now seem insignificant as an increase in numbers and types of users has placed more and more pressure on the marine environment. Rapid waterfront and recreational development during the 1970's and 1980's generated a dramatic increase in the number and size of watercraft in the Keys, resulting in more widespread resource damage. The effects of increasing boater usage were recognized in the late 1980's as scientists and resource managers felt the importance of better understanding the scope of the

problem. A task force called the Boating Impacts Work Group was formed by Curtis Kruer, an environmental consultant, to examine the growing resource problems. In 1990 the group completed a 'Four Point Plan', which took a multi-faceted approach to dealing with the wide variety of user groups and impacts to the Keys marine resources (Barker and Garrett 1992). One 'point' was the utilization of channel marking as a means of preventing seagrass scarring.

This management strategy appeared promising, and in the early 1990's the Florida Keys National Marine Sanctuary (FKNMS) and the Monroe County Department of Marine Resources (DMR) began a collaborative effort to address the problem of increasing seagrass damage in the Keys. Resource managers working within the Sanctuary determined that much of the seagrass damage was occurring in areas lacking appropriate navigational aids. The idea of improved channel marking continued to develop as a means of minimizing shallow-water resource damage. It was believed that an enhanced channel marking scheme would keep the growing number of boaters within the deeper channels and away from adjacent seagrass beds, in addition to increasing boater safety and awareness. The idea became widely accepted and channel marking was included as one of the action plans for the developing Sanctuary management plan, and cooperating institutions (Florida Department of Environmental Protection, US Coast Guard, National Oceanic and Atmospheric Administration) were enlisted to provide supporting data for the project.

At this time the Florida Department of Environmental Protection (FDEP) began to study the damage to seagrasses in the Keys as part of a statewide investigation of shallow-water resource impacts. Recognizing the severity of seagrass damage in the Keys, FDEP committed resources to the project and began a comprehensive assessment of seagrass damage that was conducted from 1992 to 1993 by the Florida Marine Research Institute (FMRI). Low-level aerial surveys were conducted to determine the extent and severity of prop scarring (Kruer 1994). The data was then incorporated into FMRI's Marine Resources Geographic Information System, providing digital analysis capabilities. Results of the study indicated that 2% (30,000 acres) of the existing 1.5 million acres of seagrass habitats were damaged to varying degrees. The percentage of damage to the shallow seagrass meadows and intertidal banks (where scarring actually occurs), however, is much higher.

With the acceptance of channel marking as a management strategy and the findings of FMRI's seagrass scarring study, the Channel Marking Work Group

was formed by the County in late 1993 to focus on the scope of the proposed channel marking project for the Keys. The central theme was to provide the basis for sound shallow-water resource management through the use of channel marking. The primary product of the group's efforts was a set of criteria which could be used to determine where, when, and how channel marking could be utilized as a means for protecting benthic resources (Garrett et al. 1994).

Throughout this time period (1990-1994) Monroe County had assumed the lead role in the development and implementation of a comprehensive channel marking plan. In 1994 DMR completed the final report on the Development of a Comprehensive Boat Channel Marking Plan for the Florida Keys (Garrett et al. 1994). This report included the findings of the Channel Marking Work Group and defined the scope of the channel marking project. At this same time the FKNMS management plan was being written and it was decided that Monroe County would continue as the lead agency for the channel marking project. As such, DMR took the principal role in writing the Channel/Reef Marking Action Plan, which is the first of ten action plans in the FKNMS Final Management Plan (NOAA 1996). The 'Reef' portion of the action plan is being carried out by the Sanctuary, while the County is conducting the 'Channel' portion.

In early 1997 two significant goals were achieved as the Florida Keys National Marine Sanctuary Management Plan was accepted by the Governor and the Cabinet, and Monroe County DMR received funding from the state for the development of the comprehensive channel marking plan. The state grant made provisions for a nine month study to be performed, with the product being a master plan for channel marking the coastal areas throughout the Florida Keys archipelago. In February 1997 Richard Jones was hired as the Channel Marking Planner to conduct this extensive study. Surveys and site assessments began in March and were completed in October, covering the entire coastal area from North Key Largo to Boca Grande, just beyond Key West.

This final report, The Channel Marking Master Plan for the Florida Keys, represents the culmination of seven years of evolution and development of the Channel Marking Plan, the cooperation and contributions of numerous agencies, and the findings of an intensive study of the navigational aid system and marine resources found throughout the nearshore areas of the Florida Keys.

The findings of this study indicate that numerous coastal areas throughout the Keys are in need of modifications to the aids to navigation system. Resource

damage was found to be most extensive in the Upper Keys, but identifiable scarring patterns were seen throughout various regions of the entire archipelago. Recommendations call for the addition of approximately three hundred-fifty lateral aids, shoal markers, and informational signs in areas with the greatest boating impact, as well as the relocation of numerous existing aids. The installation of these navigational aids over the next several years should significantly improve boating practices, increase boater safety, and minimize overall resource damage to our fragile coastal environment.

RESOURCE DAMAGE OVERVIEW

Damage to seagrass beds is generated from many sources, with the effects varying widely, from sediment plumes to deep long lasting scars. Damage may cover

areas as small as a few square meters to several square nautical miles. Although the problem may seem simple at first, it is necessary to realize that differing boating patterns, water depths, routes, and designs in the aids to navigation system combine to create unique situations throughout the various damaged areas we encounter in the Keys archipelago. For that reason it is essential to recognize and understand the different types of damage patterns within each locale to be able to provide an informed, thorough assessment for use in improvement measures. The following three sections examine the different types of users of the coastal waters, how those users impact the resources, and the short and long term effects of those impacts.

USERS

Boating pressure in the Florida Keys is tremendous and is only increasing. There are currently over 80,000 residents in the Keys, with about every other household having a registered recreational vessel. There are another 2.5 million visitors each year to the archipelago, most of whom participate in water-related activities. In addition, there are several thousand commercial fishing and diving vessels operating throughout the Keys (NOAA 1996). Unfortunately the rapid increase in numbers of boaters has been accompanied by an obvious decrease in boating and navigational skills by the general boating public.

Along with the increase in numbers of boats are the types of boats utilizing the coastal waters. The increase in water related activities in the last several decades has been answered by the boating industry with the production of water craft for every imaginable use. Each type of vessel has its own particular purpose and is designed for use in specific waters and associated habitats. The generalized list below (Table 1) indicates some of the most prominent user groups by vessel type and application (listed in order of general size of the vessel). The various types of vessels impact the resources, specifically seagrass beds, in different ways. Damage can often be traced to the type of vessel, providing clues as to why the damage occurred and how it may be prevented.

Table 1. Types of vessels in the Keys and the designed use and/or habitat

<u>Vessel type</u>	<u>Design/Purpose/Habitat</u>
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Jet skis	go anywhere, but typically in shallow water, almost no draft
Flats boats	very shallow draft (<1 ft on a plane), frequent shoals nearshore and in the back country areas, utilize 'no motor' zones
General recreation	small boats with 1-3 ft draft, go all over but typically frequent protected areas, general purpose (fish, dive, snorkel, etc.)
Rental boats	the same as general recreation except operators may have no local knowledge, typically in the vicinity of rental operations
Private fishing boats	somewhat larger seaworthy craft, 2-3 ft draft, venture farther, bay and ocean sides but utilize inshore channels and canals
Small comm. fishing boats	typically work bayside areas (e.g. spongers), 2-4 ft draft, often run in fairly shallow water close to islands and mangroves
Dive charters	carry from 6-20 plus passengers, typically 3-5 ft draft, usually go offshore, need to use larger channels and facilities inshore
Large pleasure craft	both power and sail vessels, usually 3-5 ft draft or greater, typically use Intracoastal and offshore routes, need marinas and anchorages, use deeper channels and canals inshore
Large comm. fishing boats	typically work the Gulf, Hawk Channel, and offshore, 4-5 ft draft, often run any available channels to get to fishing grounds
Party fishing boats	typically carry over 20 passengers, 5 ft draft or more, utilize main channels and major facilities shoreside
Large comm. work boats	vessels involved in dredging, construction, etc., usually deep draft, work the ICW, Hawk Channel, causeways, etc.

The categories of vessels listed above are referred to by these general names in the following sections of this document, particularly in the Site Assessments section.

SOURCES OF IMPACTS

The types of vessels described above impact seagrass beds in different ways, but a generalization can be made that most prop scarring is due to boats traveling through water too shallow for the draft and design of the vessel. However, it is

necessary to differentiate between the different boating patterns that lead to scarring and better understand how, where, and why these patterns occur. Many different circumstances combine to cause scarring and we must examine more closely the site specific sources of shallow water impacts for the purpose of resource management (see Table 2 for a general listing of impact types).

Scarring patterns can initially be categorized by the intent of the vessel operator. Is the operator unknowledgeable of a particular area or is he/she purposefully running through shallow water? For those without local knowledge channel markers may be all the information they have to navigate by (in addition to charts). In this case poor quality marker routes may contribute to bottom damage. Channel markers are often few and far between, not gated (a red and green pair), improperly located, in disrepair or missing altogether. Often times charts do not reflect new markers or changes to marker locations. Or even worse, boaters will not refer to charts. In addition, boaters are often not familiar with marker symbols and the numbering system, adding to the confusion. These problems may cause boaters to wander out of channels onto the adjacent shoals, take single markers on the wrong side, or run entire routes incorrectly.

Boaters from other regions of the country are often accustomed to the deep water in their home cruising grounds and are not familiar with the shoals and other hazards in the Keys. They are often tempted to just point their boat toward the reef and run without regard to shallow areas. This type of boating practice is not that uncommon, particularly with rental boat users, and can cause damage virtually anywhere.

Conversely, boaters with local knowledge are often responsible for much of the damage that we see. When running over soft bottom the seagrass usually takes the brunt of the impact rather than the boat. For this reason many vessel operators know they can 'just make it' through many areas without damaging their boats, regardless of the impact on the bottom. Local boaters often shortcut marker routes by running in or out before the end of the marker chain, just short of safe deeper water. This short cutting pattern is also observed with the many routes that are run on the bay side, between the shore and the Intracoastal Waterway (ICW). Numerous wheel ditches can be seen throughout the Keys where boaters, usually with shallow draft vessels, make their own route. Many of these routes are marked with PVC poles that the locals are very familiar with. The back country of the Lower Keys is famous for its historic local routes, and many boaters attempt to use them with varying degrees of success.

Flats fishermen, enforcement officers, and others with local knowledge are known to run through 'skinny' water, often without damaging the bottom. However, this practice can send the wrong message out to the recreational boating public. A common scenario is for a larger fishing boat to follow a flats guide through a tricky shoal area, only to end up hard aground. Local boaters will often run on the wrong side of markers, again setting a bad example.

There are many locations where oversized vessels will damage an area on the way to their destination. Many charter vessels are simply too large for the waters and will plow through the shallowest sections of a marked channel to and from their dockside facilities. Commercial fishing vessels are also known to prop dredge when en route to their fishing grounds. Many times these routes are dictated by weather and time constraints rather than appropriate water depths. Unfortunately, for these boats the controlling depth is determined by what the boat can physically motor through rather than the actual depth of the water.

Routine groundings by vessels can cause even more extreme benthic damage. Large recreational and commercial vessels are increasingly involved in groundings on seagrass banks, damaging and rearranging large seagrass areas, and often having to be towed off. Severe groundings can denude extensive areas leaving long term, and possibly permanent damage.

The proliferation of shoreline development contributes to much of the damage found nearshore. Prop scars are often generated from boaters attempting to approach the numerous residences and docks adjacent to very shallow water. It has been a common practice for deep wheel ditches to be illegally created, providing access to canals and subdivisions. In addition, many old access channels are subject to natural filling and are maintained by prop dredging. Some dredged channels and canals abruptly terminate in shallow water where boats repeatedly scar as they enter and exit.

Many of the larger, more powerful vessels can cause damage without actually coming in contact with the bottom. Sediment plumes can routinely be seen behind boats as they traverse relatively shallow areas. This 'prop dusting', created by the turbulence from large props, often leaves a discoloration at the surface miles long. Dense sediment plumes (in excess of the state standard) have been determined to be a point source of pollution, and causing this excessive turbidity is illegal (ruling of US and FDER vs. M.C.C.).

Another notable source of damage is anchoring. Although less of a resource impact than prop scars, the increasing numbers of large vessels and liveaboards in the Keys are leaving their mark in the form of circles or halos created from anchors, chains, and often the hull itself dragging around. The continuous swinging on anchor has displaced seagrasses and in some instances denuded large areas, particularly at the many heavily used, shallow anchorages located throughout the archipelago.

Table 2. General types of damage and the causes and effects

Damage Type	Cause/Effect
Prop dusting	sediment suspension created by excessive propeller turbulence, resulting in a sediment plume trailing the vessel
Prop scar	individual scar or furrow created by the penetration of the boat propeller below the surface of the substrate
Prop dredge	the purposeful dredging of a channel through repeated prop scarring
Wheel ditch	the long term result of prop dredging, a large dredged channel created to provide access through a shallow area
Blow out	large sandy patches resulting from scouring of scarred areas
Anchor circles	the barren circle or halo created by the continued swinging of a boat and/or its ground tackle while anchored or moored
Grounding	impact from a vessel running hard onto a shoal, often needing assistance to get off, often causing extensive damage

EFFECTS OF IMPACTS

Seagrasses are crucial to the ecology and physical and biological processes of the nearshore environment. The lush, natural seagrass beds have aesthetic and economic value as well. Damage to seagrasses can be short term or have long lasting deleterious effects. At the very least, the multitude of scars left behind by inconsiderate boaters is a lasting reminder of the lack of respect for our “precious environment” in the Florida Keys.

Seagrasses are aquatic vascular plants with a true leaf, stem, and root system. When prop scarring takes place and the prop penetrates the substrate the rhizomes of the plant are severed. Since many adjacent seagrass shoots sprout off of the rhizomes, which run laterally through the sediment, the cutting of a single rhizome may kill numerous seagrass shoots. The initial scars may be hundreds, if not thousands of feet long, and over a foot wide. The damaged area can widen as adjacent shoots die off due to the severed rhizomes. This pattern is sometimes seen when the seagrass between scars left by twin props slowly dies. The effects of scarring by larger commercial vessels can be much greater with scars being as much as three feet wide and several feet deep. Continued scarring of an area can result in completely denuding a seagrass bed. When disturbances are minimal and conditions optimal, rapid seagrass re-growth may occur. But when persistent disturbances and/or scouring and significant tidal flushing occur, growth of seagrasses is inhibited.

The bare substrate left by prop scarring can have compounding effects on the immediate area. The complex faunal community associated with the seagrass structure is displaced. Not only are the shelter and sustenance depleted, but water flow may be altered as well. The natural sheet flow, important to the vegetation, is redirected and begins to funnel through the deep troughs created by the boat propellers. This reduces the flushing effect vital to the health of seagrasses in many locations.

Extensive scarring may be exacerbated by erosional forces such as tidal currents and storms, increasing the amount of habitat loss. In high velocity areas, such as the mouth of tidal channels, the scouring effect on scarred seagrasses may create blow outs. Shallow areas previously stabilized by seagrass may deepen as the sediments are washed away. In this case the natural bottom contour and structure may never be re-established. These same processes often occur where wheel ditches have been created through shoals or sand bars. What was once a shallow sandy bar may become an unnatural tidal channel with high velocity currents. The combined impacts of these types of damage result in a cumulative reduction of productive habitat.

Recovery rates in damaged seagrass beds are highly variable depending upon water depth, water quality, water velocity, scar depth, sediment composition and wave and wind energy. In addition, different seagrass species have varying growth rates. Structural and physiological differences between species affect their growth characteristics. Turtle grass, the predominant species in most seagrass

meadows in the Keys, has a slower regrowth rate than manatee grass, the second most dominant species, particularly due to the differential development of the rhizomes (Duarte et al. 1994). Studies indicate that most seagrasses recover quite slowly from scarring, averaging at least three to five years (Durako et al. 1992). Recovery periods are probably much longer where scarring is severe and repetitive. In fact, some scarred seagrass beds may never recover (Sargent et al. 1995).

Special Note

It is important to address some associated effects of excessive boating in shoal areas that may not directly damage the benthos. Routine boat traffic through shallow seagrass meadows can cause considerable disturbance to fish and wildlife, including wading birds, that utilize this productive habitat. Repetitive running of boats and personal watercraft through these habitats may not directly impact the bottom, but the noise of the engines often spooks both fish and birds. This has resulted in the displacing of important wildlife in many areas throughout the Keys. Many previously productive fishing areas no longer support flats fishing due to the increase in boating pressure. 'No motor' or 'Vessel exclusion' zones have become an important management tool in these productive and/or sensitive areas to provide some degree of refuge to the wildlife, while providing limited user access where possible.

MANAGEMENT OPTIONS

Resource managers in the Florida Keys may consider several approaches for addressing prop scarring, as well as other related boating impacts. The pressure from increasing boat traffic and the resulting benthic damage has encouraged the Sanctuary, DEP, and DMR to examine a variety of tools and their effectiveness in protecting the coastal resources. No single strategy can solve the problems alone. The wise application of a combination of well designed tools, or management systems, is believed to be the best approach to address widespread benthic resource damage.

One of the first steps in addressing prop damage has been the acceptance of such an act as destructive to the environment and a form of unsafe boating. Regulations have recently been established by the Sanctuary that prohibit prop scarring and prop dredging. These regulations are enforceable by state and federal authorities including FMP and Sanctuary enforcement officers. However, enforcement officers are already spread thin and have difficulty effectively monitoring damaging boating practices in the Keys.

The creation of regulatory zones, which restrict boat use in high impact areas, is currently being used in select locations throughout south Florida and the Keys with varying levels of success. Zoning can be effective in increasing boater safety as well as protecting sensitive resource areas. Idle speed or slow speed zones are primarily established for boater safety and/or wildlife protection but may also minimize bottom damage, such as in the case of commercial boats that may otherwise prop dredge when heavily loaded. No motor zones help prevent prop scarring in selected areas such as productive seagrass flats (with the use of trolling motors still allowed). Vessel exclusion zones completely restrict boat activity, protecting sensitive wildlife areas from scarring as well as other disturbances such as noise.

Channel markers in the Keys are essential for navigation both for commercial and recreational traffic. The placement of markers and the design of marker routes can be critical to the effectiveness of the marker system. Besides increasing the number of markers, existing markers can be strategically relocated to enhance their effectiveness. Improvements to the Aids to Navigation System (ATONS) can increase boater safety and awareness, while minimizing bottom damage.

Mooring buoys can be an effective management tool used to minimize anchoring damage in a variety of habitats. Currently used for protecting popular reef sites, mooring fields are being considered to relieve boating pressure at the numerous anchorages throughout the Keys. Boaters currently are not allowed to anchor on live coral or cause damage to seagrasses within the Sanctuary. Properly designed, mooring buoys reduce the need for anchoring and tend to decrease boat densities, while still providing reasonable access to resources.

Restoration of scarred seagrass beds has been considered for significantly damaged areas. Methods include intact plant transplantation, collection of plant materials (fruits, seedlings, vegetative shoots), accelerating restorative processes

through selective succession, and enhancement procedures such as fertilization and hormone injection (Phillips and Lewis 1983; Anderson et al. 1997). Although restoration efforts are important for badly damaged beds in particular habitats, they do not address the prevention or minimizing of prop scarring.

Site monitoring is important to establish trends and determine levels of benthic damage in particular areas. Mapping prop scars, assessing damage, and monitoring changes via aerial photography has been an invaluable tool for evaluating benthic damage in several managed areas in the Keys, including Lignumvitae Key Management Area and John Pennekamp Coral Reef State Park. This management tool is important in determining the effectiveness of specific management strategies.

Education is an essential part of any management effort. Without public education most management strategies would not be effective, particularly in the Keys where a large percentage of boaters are not familiar with local regulations and Sanctuary management rules. Whatever management tools are utilized, it is imperative that the strategies are integrated with an aggressive educational program to ensure awareness, understanding, support, and compliance with regulations and existing management plans.

THE FOUR-POINT PLAN

In 1990, an ad hoc coalition of conservationists, fishermen, and wildlife officials worked together as The Boating Impacts Work Group to develop a four-point plan for protecting submerged land and shallow water resources (Wilderness Society et al. 1990). The group advocated local and state action on a four-point program that called for education, improved and expanded channel marking, enforcement, and boating restricted zones. The proposed program set out to reduce current impacts and rehabilitate degraded shallow water habitats.

This multifaceted approach has been adopted by Monroe County and is considered necessary in dealing with the wide variety of user groups, activities and physical

perturbations. The four-point plan forms the basis for effectively managing prop scarring in the Keys and is an integral part of the Sanctuary Management Plan. This comprehensive approach, described below, is expected to reduce seagrass scarring when implemented.

The Four Point Plan

1) Education

Education is essential in making boaters aware of the sensitive nature of seagrass communities, damage that results from improper boating practices, and how damage can be minimized by utilizing appropriate boating techniques.

2) Channel Marking

Improved channel marking is necessary to provide a suitable Aids to Navigation System throughout the coastal areas of the Keys that addresses increasing boating pressure and associated benthic damage.

3) Enforcement

An aggressive enforcement program is critical for the effective regulation of laws prohibiting vessel related damage to seagrass beds.

4) Zoning

Appropriate zoning is essential to protecting sensitive resources in selected areas, while allowing public access compatible with environmental protection.

CHANNEL MARKING SCHEME

A well designed, comprehensive channel marking scheme is believed to be an effective method for minimizing prop scar damage throughout the Keys archipelago. This primary facet of the four-point approach is fundamental in providing a solution to the increasing seagrass damage in the highly trafficked coastal areas. The installation of additional channel markers and improvements to existing markers is imperative in addressing current boating needs.

Few modifications have been made to the ATONS system in the Keys in recent years, particularly in terms of numbers of aids. With rapid development and the proliferation of recreational boaters in the Keys, it is necessary to re-evaluate what functions channel markers should provide and how the system may be designed to

accommodate a changing maritime community. The channel marking scheme has been developed to assess damage to seagrass beds in association with proximity to channel markers, evaluate the overall design of the ATONS system, and recommend and implement an improved marking system that will enhance navigation, increase boater safety, and minimize scarring to seagrasses.

The Monroe County Department of Marine Resources has assumed the central role throughout the development of the channel marking plan. The Sanctuary Management Plan has assigned DMR with the lead responsibility for implementing this activity, ensuring the assistance of pertinent state and federal agencies. The project is designed to utilize all available related marine resource data, enabling a comprehensive investigation of seagrass damage and associated boating information.

A COMPREHENSIVE CHANNEL MARKING PLAN

The channel marking plan has been designed to take a comprehensive approach to understanding not only how seagrass damage occurs, but also how modifications and enhancements to the ATONS system can address those impacts, while improving navigation and increasing boater safety. In this plan we examine the distribution and severity of seagrass scarring, existing permitted and unpermitted aids to navigation, prominent boating routes and patterns, and several types of coastal accesses.

First, data on the problem areas and associated systems were integrated, displayed and reviewed. Next, extensive field studies were conducted to examine and evaluate benthic damage and the effectiveness of existing aids to navigation. And finally, assessments were completed and recommendations made for modifications to both private and federal aids to navigation. The following sections explain in detail the analysis procedures, how field surveys were conducted, and the process of determining how modifications to the ATONS system will reduce shallow-water resource damage.

DATA ANALYSIS

The Channel Marking Action Plan of the Sanctuary Management Plan has provided for the compilation of various marine resource databases for use in this project. This strategy was designed to acquire existing information from both state and county agencies for incorporation into the County's Geographic

Information System (GIS) to provide integrative analysis capabilities. The digital resource data enabled the Channel Marking Planner to identify the specific areas and levels of resource damage, and examine the features considered most important in determining impact sources and patterns.

In addition to GIS data, several other information sources were utilized. Standard NOAA charts were used as a reference of the ATONS system, in addition to navigational use during field surveys. A variety of aerial photography, acquired by DMR, was also used extensively to supplement the digital data. Large scale black and white, color, and color infra-red photographs were used to examine and substantiate prop scar levels and patterns throughout the study area. Though these data sources were useful in the examination of prop scarring and the ATONS system, the GIS system and digital data analysis capabilities provided the principal tools for evaluating benthic damage and associated marine resource features.

GIS System

Both the State's marine resource agency (FMRI) and the County Growth Management Division run GIS systems that maintain a variety of data, including marine resource information. GIS is a powerful tool providing the capabilities to manage, manipulate, and analyze large spatial databases. Both agencies currently run UNIX platform ARC/INFO GIS system software. Data generated by FMRI

and DMR were acquired and assembled for use in the County's GIS system. The GIS workstation environment provides the system operator with the ability to view distributional data, query the various databases, overlay thematic layers, and create hardcopy display output. These capabilities provide full exploitation of information in the various resource databases.

Data Layers

A variety of resource and boating related data have been generated by the State and the County over the past six years and were acquired for use in this project. Much of the data was generated specifically for the channel marking project. The following table lists the types of data utilized and the general purpose (Table 3).

Table 3. GIS data layers, sources, and general purpose

<u>Data Layer</u>	<u>Source</u>	<u>Purpose</u>
Shoreline	DMR	provides a background coverage of all the islands and coastal areas in the Keys archipelago
Prop Damage	FMRI	indicates the distribution and severity of seagrass damage, or scarring, throughout the Keys
ATONS	USCG	light list of all USCG and privately maintained aids to navigation (ATONS)
Bathymetry	FMRI	provides a contour of water depths
Waterway	FMRI	indicates the route of the ICW through the Keys
Marinas	DMR	provides locations and facilities of all private and public ramps, marinas, and other access points
Unpermitted Markers	DMR	indicates the location, number, design, materials, and color of unofficial (unpermitted) markers
Roads	DMR	indicates the major roads and locations of bridges
Subdivisions	DMR	provides information on accesses to subdivisions
Routes	DMR	indicates prominent boat travel patterns

The *Prop Damage* data layer was the central, driving theme behind the channel marking project. Curtis Kruer used low-level aerial surveys (conducted October 1992 to March 1993) and photography (1991-1:12,000 vertical Color IR, and other miscellaneous oblique and vertical color photos) to locate and assess area and severity of scarring throughout the coastal areas of the Keys (Kruer 1994). Damaged areas of at least one acre were delineated as polygons on navigation charts and categories of severity were assigned: light scarring was defined as the presence of scars in less than 5% of the delineated polygon, moderate scarring as the presence of scars in 5-20%, and severe scarring as the presence of scars in >20%. Scarred areas were then transformed to digital data on the Marine Resources GIS system at FMRI. A ‘Comparison Chart for Visual Estimation of Percentage Composition’ was then used to refine damage estimates (Terry and Chilingar 1955). The scarring data did not distinguish among different causes of damage, but provided the most accurate data for investigating shallow-water damage and boating impact patterns available.

The *ATONS* data layer was the other primary theme, used in reference to the *Prop Damage* theme. The *ATONS* data base could be manipulated and updated as changes to the system were periodically made by the County and USCG. The spatial relationship between markers and seagrass damage was critical in determining likely reasons for damage and the effectiveness of channel marker placement and/or route design.

The *Shoreline* data layer was used simply as a reference map, indicating the shoreline and all the canals, channels, cuts, and island passes in the archipelago.

The *Bathymetry* data layer, like that on a NOAA chart, was used to identify the association of prop scar damage and channel markers with adjacent channels, shoals, etc. The depth of the water was important in determining the effectiveness of both existing and recommended channel markers in respect to vessel draft and surrounding hazards or resources.

The *Waterway* data layer was used as a reference in indicating the primary established bayside route (the ICW) and crossovers to the ocean side. This was important in considering what provisions should be made for navigation along this route and for reasonable access to the coastal areas.

The *Unpermitted Markers* data layer was extremely valuable as an indication of common routes of local users. The location of many of these markers is often correlated with areas of scarring and is useful in explaining the development of scarring patterns, typically through ‘skinny’ water.

Both the *Marinas* and *Subdivisions* data layers were important in indicating focal points of coastal access. The *Marinas* theme also supplied information on the number of boats that may utilize a particular facility. The *Subdivision* theme further indicated whether a development has four-foot access to bay and/or ocean sides, important in determining the types of vessels that utilize those areas. All of these factors were critical in understanding why scarring takes place and how channel markers should be designed to address local needs.

The *Roads* data layer simply indicated the location of US1 and the bridges connecting the islands. This theme was important in understanding through-routes and relating scarring patterns with the location of, and navigational access through, the many bridges.

The *Routes* data layer was originally designed to determine typical routes of travel used by all segments of the public. The data was gathered through comments at public meetings in 1992 and shows several general routes used in the Keys. This information is basically common knowledge and did not prove to be particularly useful in the channel marking study.

The various data layers (also referred to as coverages or themes) were topographically overlaid in ARC/INFO, creating maps illustrating the geographic relationship of scarring damage with associated marine resources (see Appendix). These graphic illustrations were initially output to the computer screen enabling a pre-survey evaluation of seagrass damage and other marine resource features. Each separate theme could be queried to examine any attributes, or features, contained within the database, such as: area of scarring, color or size of channel markers, distances between markers, depths at locations of unpermitted markers, types of marine facilities, depths entering subdivisions, etc. Color hardcopy maps were then generated for use in the on-the-water surveys as well as presentations at various public meetings.

FIELD SURVEYS

The field surveys were designed to look at areas of scarring throughout the Keys and evaluate the effectiveness of existing channel markers in keeping boaters in appropriate depth waters and off of the shallower seagrass beds. Utilizing the maps generated with the GIS, the Channel Marking Planner could direct the survey activities to the 'hot-spot' areas and verify the extent of the damage. Existing channel markers were checked for their exact location in relation to the damaged areas. An on-the-water determination was made of the effectiveness of the markers, considering the boating patterns observed.

Areas marked with PVC poles or other materials were also surveyed to determine damage patterns along the numerous informal, local routes and evaluate the need or justification for establishing permitted channel markers (and removing unpermitted markers).

Every major channel, subdivision approach, and marina facility entrance was surveyed to determine if the existing marking and water depths were adequate to

provide suitable access to the user vessels in those areas. Dredged approach channels were examined to determine damage levels and usage trends.

ASSESSMENT PROTOCOL

Following each field survey an assessment was written for the area. These assessments describe general boating patterns observed and the extent of associated seagrass damage, evaluate the effectiveness of existing markers, and provide recommendations for improvements to the ATONS. These recommendations were primarily based on the severity of damage and the level of need for improvements to adjacent channel markers. However, numerous factors were considered in determining the need and justification for marking at individual sites.

In 1992 the Channel Marking Work Group developed a marking scheme that provided a list of criteria as a means of prioritizing which sites should be marked (Garrett et al. 1994, NOAA 1996). Those same criteria were useful in this project as guidelines for the application of channel marking, based on standard responsible management practices. All these factors were weighed in determining marker recommendations for scarred areas (Table 4).

Table 4. Factors used in determining prioritization for channel marking.

-
- Total area and severity of scarring at each particular site
 - Level of use, size and types of vessels, and observed boating patterns
 - Effectiveness of location, spacing, gating, and route design of existing ATONS
 - Suitability of water depths and/or the presence of preferred alternate routes
 - Location of damaged area in proximity to sensitive management areas
 - Estimated effectiveness of modifications to markers in minimizing scarring
-

The recommendations for markers, found at the end of each survey assessment, prioritize channel marking according to the criteria above. Recommendations are categorized as High, Medium, or Low priority. High and Medium are considered

sites with serious concerns and feasible solutions. Low priority areas may need to be further reviewed, installed at a later date, or reassessed after implementation of High and Medium priority markers.

MARKING STRATEGIES

Proposed additions and modifications to the current ATONS system have been designed to reduce benthic damage, enhance navigation, and increase boater safety. The utilization of different types of USCG standard markers is being applied to facilitate changing user needs, while addressing resource impacts. These priorities have shifted from traditional applications geared solely toward the routing of commercial traffic. In the past the Coast Guard has designed marker systems for the prudent mariner, with channel markers spaced far apart, often using single markers, and locating lateral aids close to hazards and shoals. In coastal applications this design leaves many recreational routes unmarked, and where routes exist, often draws vessels close to shoal areas. In addition, the lack of gating lends itself to incorrect passing of markers by less experienced boaters. In some cases, more specialized or less common markers are simply not understood. The decrease in boater knowledge further increases potential piloting errors.

By modifying the application and location of standard USCG markers it is possible to improve navigation and reduce resource damage simultaneously. A variety of strategies are being implemented to address these concerns. The following items describe the specific approaches that will be utilized:

- 1) The most common problem is the frequency of markers. By increasing the number of markers (decreasing the spacing) the chances of a vessel 'wandering' out of the designated channel are decreased. This is a common problem seen in narrow channels adjacent to seagrass flats, and in areas that span great distances in proximity to isolated shoals. In some areas routes are not run correctly because it is not obvious which marker is next, especially along a winding route.
- 2) Gating of markers has become essential along many routes to ensure the correct rounding of markers. This situation is becoming more prevalent due to the lack of understanding of the 'red-right-returning' rule (see the following Special Note), resulting in scarring on the shallow side of lateral aids.

- 3) Lead markers or head-pins need to extend a sufficient distance into safe water. Channel entrances should be marked in such a way as to ensure that vessels stay within the channel and short-cutting is deterred by increasing the frequency and gating of markers.
- 4) Lateral aids should be located further into channels where allowable, providing buffers along edges of adjacent seagrass flats. Lateral aids should not be used to mark shoal areas.
- 5) Lateral aids should be placed as close to the intended route as possible. These markers should not be placed off the route, intended to perform double duty such as indicating hazards. Though this strategy may have worked in the past, it has the tendency to draw boaters toward the hazard, often far out of the way of the intended route.
- 6) An attempt should be made to exclusively use Danger Shoal markers to indicate shoal areas, rather than lateral aids or aids of no lateral significance. Shoal markers should only be used where the water to be avoided is actually shallow.
- 7) Informational signs should be installed at lead markers indicating controlling depths of channels (or routes where no real channel exists) where depths may be shallower than typically encountered in a channel marked area.
- 8) Additional signage should be erected at strategic locations in the Keys to supply cruising yachts with information on depths along the primary routes (i.e. the ICW) and suggested alternate preferred routes (Hawk Channel). This will help deter inappropriate draft vessels from entering the bay side of the Keys. Information signs may be placed in areas such as Biscayne Bay, warning boaters of shallow waters ahead and providing them with suitable alternatives before finding themselves further into tight quarters.
- 9) For shallow channels that are utilized by small boats, but are not appropriate for large vessels, markers designed for 'Secondary' or 'Small Boat' channels are being recommended. Informational signs and smaller dayboards may be utilized in designated channels to mark a few highly used shallow routes, while deterring larger vessels that can use alternate deep channels close by. Signage will still conform to USCG standards, but the reduction in size will decrease the nominal range of the markers to prevent the possibility of drawing in deep draft vessels

from greater than a half mile away. Informational signs mounted on entrance markers will caution boaters of the limited intended use of the designated channel.

10) Where applicable, meeting routes should be changed to through-routes. This will eliminate the confusion encountered when separate marker chains meet, usually at an island pass. Sign colors and numbers would be changed to reflect the modified route design, which would also simplify the red-right-returning situation.

Special Note

There has been great confusion with the application of the ‘Red-Right-Returning’ rule in the Florida Keys. Standard USCG rules apply, but we do have certain situations not encountered in other areas of the country. Marker routes have been designed to reflect the following rules:

- Red markers normally mark the right side of the channel when returning from the open ocean. In the Keys, the Atlantic Ocean has priority over Florida Bay or the Gulf of Mexico. Normally keep red on the right going from ocean to bayside when the route is a through-route.
- Otherwise, keep red on the right when returning from a larger body of water to a smaller body of water, such as returning from the Intracoastal Waterway to a harbor or marina on the bay side of the Keys.
- Along the Intracoastal Waterway and Hawk Channel red markers should be kept on the right when heading south (or west) in the Keys.

- Aids to navigation along the outer reef line (oceanside) are marked with red aids in a southerly/westerly direction. These aids are NOT intended to mark a channel through the outer reefs into Hawk Channel, therefore, ‘Red-Right-Returning’ does not apply.

*** The U.S. Aids to Navigation System is intended for use with navigational charts.**

When in doubt, remember red is always on the right as marker numbers increase.

PROJECT INTERACTION AND UPDATES

As with all aspects of the Sanctuary Management Plan, it was important to work in cooperation with the numerous governmental agencies involved, as well as the Keys community, in providing information and inviting opinions on the objectives of the Channel Marking Project. This has been a continuing process and has resulted in increased understanding and acceptance by most, if not all, of the parties involved. The following three sections explain how the project has: 1) cooperated with state and federal agencies in pursuing common goals and ensuring efficiency of efforts, 2) involved the public in the project by soliciting input and support, and 3) held periodic meetings to update the overseeing committees on the direction, progress, and findings of the project.

AGENCY INTERACTION

Numerous agencies have been involved with the Channel Marking Project, due not only to needs for assistance with marine resource and regulatory information, but also the geographic scope of the project and overlap of jurisdictional boundaries throughout many areas of the Florida Keys. As the project surveys progressed we collaborated with all management areas within or adjacent to the Keys

archipelago. The staff of these areas were all informed of the objectives of the project in order to ensure cooperation, provision of data, and streamlining of efforts. Subsequently, we were better able to identify channel marking needs in those specific areas. In nearly all cases the area managers provided boats and personnel, as well as local information necessary for optimizing surveys in their specific areas. As surveys proceeded all agencies were notified of the findings of the surveys and recommendations, and were supplied any resulting information requested (survey maps, assessments, etc.). We will again be coordinating activities with these management areas at which time implementation of the marking plans takes place.

PUBLIC INTERACTION

Due to the size of the maritime community in the Keys and the involvement of the public in local government it was important that this project have the input and support of individuals and user groups wherever possible. Since this type of project is unique to Monroe County, as well as the rest of Florida, we wanted to know how a variety of boaters and related users felt about the different aspects of

channel marking. We were able to promote cooperation with the public through public meetings, newspaper articles, etc. The project solicited opinions and feedback from a wide variety of user groups, including: resort managers, fishing guides, commercial fishermen, recreational boaters, eco-tour guides, dockmasters, environmental groups, community associations, dive shops, sailing clubs, and numerous other groups. The DMR also made itself available for presentations to civic groups and organizations on the problems of seagrass damage and the objectives of the Channel Marking Project.

Probably the most important aspect of community involvement was through volunteerism and vessel/personnel support for the field surveys. This was an opportunity for individuals and user groups to take us out on the water in their area of local knowledge and provide information and opinions on problems related to aids to navigation and boating pressure/resource damage. The feedback obtained through these numerous interactions provided a vast amount of information on local problems and needs, viewpoints on the direction and popularity of the project, and helped the project to develop and be conducted in the most effective, productive, and supportive manner possible.

PROJECT MEETINGS AND UPDATES

Throughout the course of the project several formal meetings were held to bring together the numerous agencies and committees involved, provide updates on the surveys and assessments, and meet the required timeline of the project proposal and grant agreement. The project leaders reported to the Marine and Port Advisory Committee, as they oversee spending of Boating Improvement Funds and advise on projects staffed by the county. Representatives from the former Channel Marking Work Group were also assembled, from thirteen state and federal agencies, to advise on the project, oversee the direction and progress, and give final approval of the completed plan.

The Marine and Port Advisory Committee (MPAC) met at a public meeting on 6 May 1997, with the central agenda item being the Channel Marking Project. The Channel Marking Planner presented the background, goals, and progress of the project to the committee. This presentation informed the committee members of the direction and actions the project had taken in respect to prior committee requests. The MPAC members acknowledged their satisfaction with the project and provided advice for future development and direction.

The Channel Marking Planner met before the MPAC again on 7 October 1997 and presented the findings of the project to date. The implementation phase of the Channel Marking Project was also discussed, including plans for site monitoring and education. The committee voiced their satisfaction with the current work and support for the plan's recommendations and upcoming installation phase.

The former Channel Marking Work Group was assembled at several meetings throughout the course of the project to discuss the objectives, progress, and future of the Channel Marking Project. The following agencies were represented:

- U.S. Coast Guard 7th District, Division of Waterways Management
- John Pennekamp Coral Reef State Park
- Florida Keys National Marine Sanctuary
- Florida Marine Patrol, Division of Law Enforcement, District Three
- Florida Marine Patrol, Office of Waterway Management, Tallahassee
- U.S. Environmental Protection Agency
- National Marine Fisheries Service
- U.S. Army Corps of Engineers, Miami
- U.S. Fish & Wildlife Service

- Florida Department of Environmental Protection, Submerged Lands & Environmental Resources
- Florida Department of Environmental Protection, Florida Marine Research Institute
- Monroe County, Department of Marine Resources
- Lignumvitae Key Management Area
- Everglades National Park

The first meeting, held 17 June 1997, was used to provide an overview of the project background, objectives, methods, and findings to date. We also discussed the needs and concerns of each agency and their particular role in the project. The results of the meeting confirmed that the project scope and initiative were well accepted and that the project should continue as is, with consideration taken for present concerns and wishes of the various agencies and marine area managers. A repeat meeting was held the following week on 26 June for those agencies and managers unable to attend the first meeting.

The second meeting for the Channel Marking Project was held on 9 September 1997 to review the project progress and discuss the nearing completion of the field surveys. We then focused on the second phase of the channel marking project; implementation of channel marking throughout the Keys. Possibilities for personnel and funding for the upcoming implementation phase were discussed and there was overall agreement for using Boating Improvement Funds (BIF) for salary to oversee and complete the installation process. This proposal was put before the Board of County Commissioners, and on 17 September 1997 the Board voted unanimously to create a temporary position for the sole purpose of implementation of the Channel Marking Master Plan. Richard Jones was offered the position, continuing his present work as Channel Marking Planner into the implementation phase as the Marine Resources Planner for the project.

The third and final meeting of the Channel Marking Work Group was held on 24 November 1997. At that meeting the Department of Marine Resources presented the Channel Marking Master Plan to the thirteen other agencies that have been involved with the project. We reviewed the document, and discussed the findings and recommendations. All the agencies voiced their satisfaction with the project and the overall marking scheme, and collectively approved the master plan. The permitting process was discussed and the various permitting agencies provided suggestions for the most efficient manner for processing permits. Each of those agencies expressed their support, with their involvement in the development of the

plan providing the foundation for permitting consent and approval. Sanctuary representatives proposed that due to the magnitude and importance of the master plan it additionally should go through a formal review process by the appropriate committees (i.e. Sanctuary Advisory Council, Marine and Port Advisory Committee). This would ensure further public input and provide strength to the document, allowing the implementation phase to proceed smoothly. Education plans were also discussed, as outreach tools are already being developed to provide a variety of channel marking related information to the public.

The completed master plan was presented to the Sanctuary Advisory Council on 17 February 1998. Council members voiced their support for the project and collectively endorsed the strategies and recommendations of the plan.

SITE ASSESSMENTS

Field surveys began on 26 March and were completed on 17 October 1997. A total of 23 surveys were conducted throughout the coastal areas beginning at the northernmost end of the county at Broad Creek, working southwest and ending in Boca Grande, just beyond Key West. Consecutive survey areas were contiguous on both ocean and bay sides. This progression allowed for the detection of subtle differences in damage patterns and boat use as surveys advanced through the Keys. Thus, providing a thorough understanding of conditions, trends, and needs throughout the various regions.

The marine resource overlay maps, generated prior to the surveys, were used to locate damaged areas and provide information on spatially related features. An attempt was made to visit all the damaged areas, indicated by the *Prop Damage* data layer on the survey maps. In most instances all the significant areas (greater than two or three acres) of scarring were seen, while concentrating on moderate to severe damage. However, it was not possible to survey all the numerous smaller (usually lightly damaged) isolated scarring sites. Rather, small scattered scarring areas, or any areas inaccessible by boat, were viewed via aerial surveys to verify the extent of damage.

Field surveys collectively covered nearly one thousand square miles of coastal waters. Individual site assessments typically covered twenty to fifty square miles,

usually taking four to six hours to complete. Surveys were conducted during favorable conditions, with winds less than 15 knots (preferably less than 10 knots), and suitable visibility for observing prop scars. Trouble areas (i.e. scars and insufficient marking situations) were photo-documented for all sites. In addition, aerial surveys were conducted before and after field surveys for each region of the Keys, providing an overview as well as an opportunity to confirm questionable findings. Both aerial and on-the-water photos were integral to the post-survey assessment process in determining channel marking needs.

The following sections include a general overview and characterization of each region (Upper, Middle, and Lower Keys) followed by detailed site assessments describing seagrass damage, marking conditions, and suggestions for improvements. Most of the recommendations for new markers are specific for numbers and locations, such as for gating existing markers or increasing frequency in existing marker chains. In some instances the number of new markers recommended is approximate, particularly in the case of currently unmarked channels. Locations of recommended marker installations are indicated on the accompanying survey maps (see Appendix). The indicated marker locations may be slightly altered during the final marker siting in the implementation phase.

The Marking Summary in the subsequent section provides a compilation of marker recommendations and explains the integration of new markers, and modifications to existing markers, with the current ATONS system.

UPPER KEYS

The Upper Keys includes the islands and coastal areas from the northern extreme of Key Largo at Broad Creek (the Monroe/Dade county line) to Channel 5, adjacent to and just east of Long Key. This region includes the larger populated islands of Key Largo, Plantation Key, Windley Key, and Upper and Lower Matecumbe, and numerous smaller islands and mangrove areas.

A total of nine surveys were conducted from 26 March to 14 May 1997. A wide variety of agencies, organizations, and volunteers provided boat support and information within specific survey areas. Upon completion of the field surveys, the earlier assessments were reviewed and updated after having a better understanding of the trends, scarring patterns and marking systems encountered throughout the region.

Region Characterization

The Upper Keys span over sixty miles, nearly half the distance of the entire island chain. The survey coverage, however, is relatively narrow due to the elongate shape and alignment of the islands in this region. In contrast to the Middle and Lower Keys, there are numerous basins on the bay side and relatively few cuts connecting to the ocean. In addition, this region is in close proximity to the Gulf Stream. This geographic arrangement contributes to the clarity of water typically seen inshore throughout most of the region. There are expansive flats nearshore on the ocean side, as well as an intricate system of shoals on the bay side.

There is a wide variety of user groups due to the size of the region, the proximity to the mainland, the diversity of habitats, the attraction of the well developed reefs, and the sheer popularity of the area. Trends can be observed throughout this region, with particular sites being most damaged by specific types of users. Surveys included the ocean side waters out to one mile offshore, where depths typically drop beyond the limits of prop scarring. On the bay side surveys covered up to two to five miles north and west of the Keys, often extending beyond the boundaries of Everglades National Park.

Cooperating Agencies & Volunteers

The waters of the Upper Keys fall within or are adjacent to numerous state and federally managed areas, including: Biscayne Bay National Park, Card Sound State Aquatic Preserve, John Pennekamp Coral Reef State Park, Key Largo National Marine Sanctuary, Lignumvitae Key Management Area, and Everglades National Park. Managers of these parks were all informed of the surveys and assessments being conducted throughout the area, and provided input and support as needed.

In conducting surveys in this region we utilized vessels and captains from a variety of agencies and organizations, including: Ocean Reef Public Safety Department, Ocean Reef Community Association, John Pennekamp Coral Reef State Park, The Nature Conservancy, Environmental Consulting Systems, The Izaak Walton League, Florida Keys National Marine Sanctuary, and Lignumvitae Key Management Area. The array of volunteer boat drivers, from enforcement officers to biologists to private individuals, provided a wide range of opinions and input on reasons for damage and suggestions for improvements. These types of input, available only with access to local knowledge, proved quite valuable in assessing impacts and understanding different situations that were encountered throughout such a large area.

Assessment Summary

The Upper Keys incur some of the greatest prop scar damage in the archipelago, in terms of both severity and area. Seventeen thousand acres of seagrasses are

scarred, which is slightly more than half of the scarring of the entire Keys. Of that area nearly a third is severely scarred. This high level of damage can be attributed to the geographic extent of the Upper Keys (45% of the length of the island chain), the numerous extremely popular boating areas, and the sheer number and variety of boaters. The proximity to the mainland allows daytrippers and weekenders from the mainland to easily reach the Upper Keys, which translates into a low level of local knowledge on the water. Large, contiguous areas of moderate to severe scarring are indicated in several locations and many of the problem areas cannot be addressed simply through marking. Rather, a combination of education, enforcement and in some instances zoning (no motor and/or exclusion zones) will be necessary to address the problems in these high impact areas.

The proximity to south Florida, through Biscayne Bay, provides a gateway for cruisers on increasingly larger vessels, including both sail and power boats. The first trend observed, working south along the ICW entering Monroe County, is the extensive scarring in water depths of three to five feet where the many large vessels have inappropriate draft for the bay side. Controlling sections along the ICW are typically located in the historically dredged channels¹ cutting through banks, shallow basins, and mangrove islands. Boats often wander out of the narrow channels, in many cases where markers are not gated. Though ATONS may have been sufficient in the past, the increasing numbers and size of vessels have created a need for more ICW markers and gating many existing markers. There is a need to inform and deter these large craft in their use of the ICW, also referred to as the inside route. Posting signs, explaining the depths and alternate routes, has been suggested. Deep draft vessels should be encouraged to use outside routes, either Hawk Channel or waters beyond the reef line.

Another user which is quite prominent at the northern extreme of the Keys, as well as throughout the rest of the archipelago, are flats boats. Flats fishing is one of the biggest fishing sectors in the Upper Keys and the increasing numbers do impact seagrass beds. Expansive shoals on both the bay and ocean sides are scarred by less educated and/or conscientious flats fishermen. One problem with flats boats is the tendency to create their own routes, regardless of existing vegetation both above and below the water. Numerous wheel ditches are created, deepened, and maintained by flats boats, occasionally cutting right through mangroves. Larger vessels will often follow the shallower draft boats through the wheel ditches. This is a difficult problem to address for resource managers, and 'no motor' and 'vessel exclusion' zones are becoming essential management strategies in cases like this (i.e. Lignumvitae & Pennekamp).

Numerous dive charter operations impact the approaches to oceanside channels, typical in the Key Largo Area. The vessels often draw slightly more than the soft bottom shallows that are traversed on the way to the reefs. This situation is seen with other vessels as well, including fishing charters and private sportfishers. Scarring of this type is seen in numerous channels and creek entrances.

¹ channels previously dredged in the upper reaches of the Intracoastal Waterway in the Keys are not maintained

Rental boats and jet skis are a significant problem in the Upper Keys, particularly in the resort area of Windley Key. The operators typically have a low level of boating knowledge, are often drinking, and are usually oblivious to their impact on the shallow resources. A lack of knowledge of navigational rules is greatest with this user group. The limited understanding of how to apply the Red-Right-Returning rule is quite obvious with non-locals such as rental users and makes gating markers in most applications a necessity. Education will play a big part with this user group in conveying information about the Keys waters and basic marking designs.

Some problems encountered are typical of local boaters, such as purposeful short cutting. Boat operators often short cut when going in and out of channel entrances to save a little time. Numerous channels in this region exhibit patterns of prop scarring fanning out in all directions just short of the lead entrance markers.

A big problem on the bay side of the Upper Keys is vessels running an inappropriate nearshore route. Locals have created a route running relatively close to shore throughout most of this region. Rather than running out to the Intracoastal Waterway many boaters utilize this nearshore route, running parallel to shore. The numerous shoals extending up to a mile from shore are often cut-through, creating and using wheel ditches to connect adjacent basins. This promotes additional scarring in the vicinity of the wheel ditches. In some areas significant changes to tidal flow patterns have occurred, accompanied by scouring and shifting channel shoulders. In addition, this can become a safety hazard where vessels run at high speed in tight quarters. Numerous PVC poles mark these man-made channels and it is an issue whether to remove the unpermitted markers, mark with standard aids, or just leave the situation as is.

Recommended Markers

Channel marking recommended for the Upper Keys includes: marking of new (unmarked) channels, improving existing channels by increasing the frequency of markers, gating ungated channel markers, relocating existing markers, extending lead channel markers and/or installing head pins, redesigning marker routes, removal of daymarkers, installation of Danger Shoal markers, removal of inappropriate unpermitted markers, marking certain wheel ditches, closing certain wheel ditches, installation of controlling depth signs, changeover of sign types, posting of appropriate vessel/use information signs, suggestions for appropriate areas for no motor zones, and the application of secondary channel markers.

The following list breaks down the number and kinds of markers recommended for the entire Upper Keys region. Numbers of markers are approximate. Marker numbers may fluctuate as implementation proceeds and needs in specific areas are re-assessed.

<u>Type of Marker</u>	<u>Signage</u>	<u>Misc.</u>	<u># of Markers</u>
Daymarker	green/red		126
Information	Danger Shoal		5
	Controlling Depth	existing pile	11
		Total Markers (daymarkers & shoal markers)	<u>131</u>
		Signs only (controlling depth signs)	<u>11</u>

Of the one hundred twenty six daymarkers recommended for installation, forty four would be installed in existing federal marker chains.

In addition to the above marker installations, eight pilings are recommended for removal and four markers are to be relocated.

Survey Number: 1

Date: 3/26/97

Region: Upper Keys

Area: Extreme north Key Largo, Ocean Reef

Range: From Broad Creek south to the Ocean Reef main channel (Dispatch Creek) on the ocean side and to the Angler's Club on the sound side

Assisting Parties: Ocean Reef Public Safety Department, Capt. Jim Kirkman

Launch Location: Ocean Reef Marina

Vessel Type: 22' Mako

Conditions: Clear, winds SE 10-15 kt, excellent visibility

Time: Approximately 3 1/2 hours

General Overview:

The northern extreme of this area (bordering the Monroe County line) contains large expanses of flats on both the ocean and sound sides. Two main passes, Broad Creek and Angelfish Creek, connect Card Sound to the ocean. Two well marked channels, Main Channel and North Channel, lead into the Ocean Reef Club on the ocean side. Several private and unpermitted marked minor channels lead into subdivisions on the Card Sound side.

There are large areas of scarring across most of the flats, mostly due to flats fishermen, as well as the poorly defined and somewhat tricky entrances to Broad Creek, the only channel in the area lacking permitted markers. Much of the scarred area falls within the boundaries of Biscayne National Park. Numerous large power yachts traverse the areas adjacent to Ocean Reef Club.

Survey Assessment:

Broad Creek has numerous PVC poles that correctly mark the channel, however extensive damage adjacent to the creek indicates that boaters may not be knowledgeable enough to effectively use the markers. Daymarkers here would be indicated on charts, be more visible, and would help keep boaters within the channel and not wandering out onto the flats. This channel should be designated as 'secondary' or 'small boats only', to deter use by larger vessels. In addition, informational signs indicating the controlling depth should be installed on the lead markers. The flats adjacent to the entrances to Broad Creek would be prime candidates for 'no motor' zones, preferably marked with regulatory buoys. Pennekamp has a 'no motor' regulation for all areas less than four feet. Pennekamp managers are currently working on expanding their zoning buoys to include the Broad Creek area. On the bay side, Cutter Bank would also be appropriate for designation as a 'no motor' zone. This would cross over into the Biscayne

National Park area. Management at Biscayne National Park has been informed of these surveys and should be consulted with in the future on this matter.

Angelfish Creek has USCG markers, however there is damage adjacent to the channel at both entrances, probably due to several single markers. Gating the existing markers may keep boaters from passing incorrectly and short-cutting the entrance markers. In addition, informational signs indicating the controlling depth should be installed on the lead markers.

The Ocean Reef North Channel is well marked and gated all the way, but has small dayboards, several facing only one side. There is a narrow shoreside channel north of North Channel leading to oceanfront homes and Pumpkin Creek. Boaters entering this area must transit North Channel and turn north, hugging the shoreline. Several 'idle speed' buoys (maintained by Ocean Reef Club) run along this dredged channel on the shoal side. Extensive damage in this shoal area indicates that boaters cross the flats rather than using the adjacent channel. A 'Danger Shoal' marker on the seaward side of the shoal may deter traversing those flats and help remind flats fishermen of the regulations. Alternatively, this would be a prime area for a 'no motor' zone (see notes below).

The Ocean Reef Main Channel is marked and gated all the way, but has small dayboards, several facing only one side. There is no reason for boats to wander adjacent to this well marked channel. Scarring through sections of the channel indicates the use of inappropriate draft vessels. The controlling depth in this channel is maxed out by the numerous large yachts that reside here.

On the sound side of Ocean Reef, south of the creeks, the most significant damage is shoreward of Pumpkin Key and along a one mile stretch along the shoreline, due to vessels accessing shorefront homes. The damaged area indicated adjacent to (shoreward of) Pumpkin Key appears to have over 4' of water, so any damage must be due to large yachts. Aerial surveys revealed that there really is little damage in this area, except in the shallower areas close to the shore. There appears to be no way to protect this area, short of preventing homeowners from allowing vessels in and out. ORCA representatives are currently working with Pennekamp to make this shallow shoreline area a 'no motor zone' and install spar buoys.

Suggested Plan:

High priority

- install 10-12 sets of gated daymarkers through Broad Creek, concentrated at the approaches
- install informational signs indicating controlling depths on Broad Creek entrance markers
- install sister markers to markers not gated along Angelfish creek (both entrances)
- install informational signs indicating controlling depths on Angelfish Creek entrance markers

Medium priority

- install a Danger Shoal marker at the eastern edge of the flats north of North Channel
- install a Danger Shoal marker at the eastern edge of the flats east of Angelfish Creek

Low priority

Notes:

Danger Shoal markers may be used as a supplement to, or in lieu of, 'no motor' zoning at the eastern edge of several of the ocean side flats. Need to coordinate with Pennekamp on this.

The suggested marked route for Broad Creek should be designated as a 'secondary' or 'small boat' channel and marked accordingly.

Survey Number: 2

Date: 4/9/97

Region: Upper Keys

Area: North Key Largo- Oceanside

Range: From Dynamite Docks south to North Sound Creek and outside of Sound Point

Assisting Parties: John Pennekamp Coral Reef State Park, Capt. Bob Newbould

Launch Location: Pennekamp Marina

Vessel Type: 24' T-Craft

Conditions: Clear and calm, winds <5 kt, excellent visibility from tuna tower

Time: Approximately 4 hours

General Overview:

This entire area is within Pennekamp Park. The ocean side of Key Largo, north of Largo Sound, has relatively little boat traffic. Most of the traffic is from boats going in and out of North Sound Creek, including several dive charter vessels with too much draft. The most severe problems in this area are associated with the tricky Garden Cove area and navigating the entrance to North Sound Creek. Several marked and unmarked channels lead into developments or defunct developments to the north, with very light use. Expansive flats used by some flats fishermen are located along most of the coastline, dropping off not far from shore. The entire area appears to be near pristine with lots of fish and a healthy hard bottom community.

Survey Assessment:

At the northern extreme of this survey area, prop scar maps indicate that Dynamite Docks has moderate damage along an extensive shoal area running along the coastline. However, very few scars were seen from the water and aerial surveys confirmed little or no scarring. Scarring was probably there from construction years ago, but the seagrass has since recovered. The pier has been removed, and only a small spoil island remains with park signs indicating a rookery and vessel exclusion area.

At the defunct Carysfort Yacht Basin, channel markers have been removed. There is still a deep channel going into the yacht basin. A small area of scarring is indicated, but may be diminishing with the removal of markers. No marking is needed here.

At the defunct Ocean Forest channel, there are still markers and a deep channel. A small area of scarring is indicated at the entrance to the channel. The scarring may be reduced with the removal of the markers. These markers should be removed.

There is a very small area of scarring at the Gulfstream Shores area. The approach is marked with PVC poles (not indicated on the GIS map). Markers would not help this fairly insignificant area.

The Garden Cove area has the most extensive and severe scarring in this survey area. Though marked with Pennekamp's daymarkers, this route is confusing and tends to draw boaters across the flats area just north of (coming out of) North Sound Creek, due to poor marking and an open view of the more distant markers. The Garden Cove marking chain is missing marker #8, and also needs a sister marker to marker #11A. There is also a problem with vessels with too much draft using the channel, particularly dive charters. The larger boats are known to run the wrong side of marker #17, due to deeper water on the south side. The marker should be relocated to provide for that. Informational signs indicating the controlling depth should be installed on the lead marker into Garden Cove and at marker #29 leading into North Sound Creek from Largo Sound. The North Sound Creek exit is the big problem. Leading north out of North Sound Creek, #27 is too far out of the channel, leading boats toward open flats to the east. It should be moved in and a sister marker added. As the creek opens to Garden Sound the biggest problem begins. There are not enough markers and they are not gated. Markers should be added and relocated as indicated on the accompanying survey map. Another problem is at #22 where there is a small island in the middle of the waterway. Markers #22 and #21 are not both on the correct sides. The colors should be corrected with sister markers added. These changes and additions should take care of most of the straying boat problems.

There is a large area of scarring south of Upper Sound Pt. (off of Rattlesnake Key and Sound Pt.). This is probably due to boats trying to get into the shoal areas, either to fish or to approach North Sound Creek. Additional 'no motor' buoys along the edge of the flats should be installed by Pennekamp alerting boaters and preventing motoring by flats fishermen.

Suggested Plan:

High Priority

- install sister markers to #11A, 21, 22, 26 and 27 in Garden Cove
- install informational signs indicating controlling depth on the lead markers at Garden Cove
- install two additional sets of gated markers in Garden Cove
- replace marker #8 in Garden Cove
- relocate markers #25 and 27 in Garden Cove

Medium Priority

- relocate Garden Cover marker #17 into slightly deeper water to the south

Low Priority

- remove daymarkers at the defunct Ocean Forest entrance

Notes:

Any 'no motor' buoys installed in this area should be done by Pennekamp, as they have already done in the Garden Cove area. Also, removal of markers should be decided by and performed by Pennekamp.

Survey Number: 3

Date: 4/15/97

Region: Upper Keys

Area: Card Sound

Range: From Cutter Bank south to extreme north Barnes Sound

Assisting Parties: Ocean Reef Community Association, Capt. Bruce Miller

Launch Location: Angler's Club

Vessel Type: 18' flats boat

Conditions: Cloudy, scattered showers, winds south 10-15 kt, good visibility

Time: Approximately 2 1/2 hours

General Overview:

Card Sound has expansive shoal areas that incur extensive prop damage. The area is used mainly by flats fishermen, a few commercial crabbers, owners of large yachts, and vessels traversing the ICW. Cutter Bank and Card Bank generally cross the entire width of Card Sound, making those banks prone to damage from boats improperly piloting the area (in other words, not staying within the confines of the marked ICW channel). This area is the last chance for large yachts to opt for the outside route before entering the back side of the Keys, where controlling depths are typically about five feet or less.

Survey Assessment:

At the northern extreme of Card Sound, Cutter Bank extends east of the ICW and more shoals extend west of the ICW. A well marked, dredged channel cuts through the banks here. But the channel is quite narrow and the markers are far enough apart that large yachts appear to wander out of the channel onto the shoulders. A few gated markers between existing markers would help, in addition to installing sister markers as needed (as shown on accompanying chart). Making Cutter Bank a 'no motor' zone may be appropriate (see also Survey #1), especially considering that flats fishing is the primary use here. That would complement the existing 'no motor' zones to the south (on the ocean side) at Pennekamp. However, this entire area is mostly within Dade County and Biscayne National Park. Biscayne park management is looking at marking problems in their waters and may cooperate in implementing similar (consistent with ours), continuous zoning in this area (extreme south Biscayne Bay).

Working south in Card Sound, the next area of scarring is across Card Bank. Moderate to severe scarring is indicated across nearly the entire span between the east and west sides of the sound. This situation is similar to Cutter Bank: the dredged channel is narrow and markers are

far between. Two more sets of markers would keep deep draft vessels within the confines of the channel. It is difficult to prevent smaller boats from cutting across the rest of Card Bank.

A large area of light scarring is indicated east of Little Card Point, and appears to be caused by local crab fishermen. There is no good way to prevent scarring in this shallow area.

Going through the Card Sound Bridge channel there is a significant area of severe scarring. This is due to a combination of deep draft boats traversing the ICW and smaller boats rounding the corner at Barnes Point going east. Again, more daymarkers should be installed between existing markers, with sister markers added as needed, to help boat stay within the confines of the channel.

An area of moderate scarring exists all around Alabama Jack's marina on the southwest side of the Card Sound Bridge. This is due to only 2-3' of water at the 3 poorly marked entrances (unpermitted markers). This area needs another look to see if boats should be limited to the one deeper channel leading east, and permitted markers may need to be installed. Also, may want to advise Alabama Jack's owners to beef up their existing unpermitted markers.

The numerous scarred areas east of the Card Sound Bridge are primarily from fishermen approaching the shore and entering/exiting the small cuts. Some of this damage should be alleviated with the installation of 100' buffer buoys for the new Crocodile Lake Wildlife Management Area. Steamboat Creek entrances will remain open, however, and two sets of gated markers should be installed at the south entrance to the creek (probably the most westerly of the two south entrances), directing boaters to the creek approach.

Suggested Plan:

High Priority

- add two sets of gated markers between existing sets of markers in the Card Bank channel
- add two sets of gated markers between existing sets of markers through Card Sound Bridge
- install sister markers to markers # 22 & 25 in the Card Sound Bridge marker chain
- install two sets of gated markers at the south entrance to Steamboat Creek
- install informational signs indicating ICW depths in both Card Sound and Biscayne Bay

Medium Priority

- have Biscayne Nat. Park install more channel markers through the Cutter Bank channel
- have Biscayne Nat. Park install 'no motor' buoys around Cutter Bank

Low Priority

- install a set of gated markers (possibly) leading into the east entrance to Alabama Jack's

Notes:

The southern section of this survey area is adjacent to Crocodile Lake National Wildlife Refuge. Channel marking in this vicinity should consider USFWS regulations, and installations should be performed outside of crocodile nesting season.

Additional assessments should be made around Alabama Jack's. The management there should possibly be conferred with to advise them on upgrading their markers around their various approach channels.

This is the beginning of the ICW in the Monroe County, and scarring is indicated across nearly every bank that the Intracoastal Waterway crosses. The Card Sound/Biscayne Bay area is one of several strategic locations considered for posting of information on ICW depths and alternate routes for large cruising vessels to deter those craft from entering the bay side of the Keys. Signage will be installed within Dade County waters by Monroe County DMR with the cooperation of Biscayne National Park.

Survey Number: 4

Date: 4/17/97

Region: Upper Keys

Area: Black Water Sound & Vicinity

Range: From the middle of Barnes Sound, south to the north end of Buttonwood Sound

Assisting Parties: The Nature Conservancy, Capt. George Maier

Launch Location: George Maier's home in Twin Lakes

Vessel Type: 18' Flats boat

Conditions: Partly cloudy, winds SW 10-15 kt, good visibility

Time: Approximately 4 1/2 hours

General Overview:

This area, specifically Jewfish Creek, is considered the gateway to the Keys. General boating use changes here, in comparison to north Key Largo, from mostly flats fishing to primarily large yachts transiting the ICW. The scarring patterns reflect the different types of use: instead of large expanses of scarred flats there are smaller pockets of scarring, typically associated with cuts and historically dredged channels. Areas of scarring along the ICW indicate that large vessels with too much draft are entering the back side of the Keys, working their way down. In addition, there are numerous areas of scarring adjacent to shallow cuts leading into the Everglades. These westerly areas were surveyed and assessed, however they fall within Everglades National Park (ENP), and they should be addressed by ENP.

Survey Assessment:

Along the east side of Barnes Sound there is a long narrow area of light scarring along the undeveloped shoreline. Numerous crab traps indicate that this scarring is caused by crabbers working the very shallow shoreline. This scarring is fairly insignificant.

On the far west side of Barnes Sound there are several marinas tucked up in the basin south of Manatee Bay. This is also used as an anchorage by numerous sailboats. The extensive but light prop scarring indicates the heavy use by boats motoring in and out of the marinas as well as boats coming in to anchor. The Manatee Creek Marina is well marked. The Moorings Marina to the southwest is poorly marked, it's missing markers #3 and 4, and markers #1 and 2 are not where they are supposed to be (they're at the old 3 and 4). The markers need to be re-established as reflected on the charts. Leading boats out of this shallow marina entrance will prevent short-cutting, and minimize scarring in that area. In the cut leading into Manatee Bay there is light scarring and several sunken boats. A single set of markers in the deepest part of that pass would prevent scarring across the span of the cut.

Heading south out of Jewfish Creek there is a lot of scarring associated with the ICW as well as Gilbert's Marina. The several canals on the backside of Gilbert's have scarring all around them. Gilbert's may want to consider placing appropriate markers there to keep boats from wandering. Boats move all around this marina area before getting back into the ICW.

There needs to be a sister marker added to red #38 to prevent boats from going wide at that turn in the ICW.

At the north corner of Blackwater Sound there is significant scarring in the area of the ruins and Blackwater Pass, mainly from fishermen and general recreational boating. This area is within Everglades National Park. ENP may want to install some of their small arrow markers here. At the west side of Blackwater Sound, also within Everglades, there is significant scarring around the extreme shallows of The Boggies, mainly from fishermen. The main cut there is marked with arrow markers. Directly south of The Boggies, along a semi-beach area, there is light scarring from recreational boaters.

Near the cut into Lake Surprise there is severe scarring in about 4 ft of water, likely due to larger vessels from the adjacent subdivisions. There is similar scarring in smaller areas just to the south around Stellrecht Point. No marking is advised for these areas.

At the western entrance to Adams waterway there is a single USCG marker ('No Lateral Significance') surrounded by scarring. There is not a defined channel at this entrance. Additional marking would not appear to be useful.

At the north approach to Dusenbury Creek there is a large area of moderate scarring, apparently caused by boats transiting the ICW wandering west of the deeper water of the ICW indicated on the charts. Marker #40 is way too far west of the ICW and should be moved to deeper water, with a sister marker added. Another set of gated markers should be installed at the slight bend, south of #40. A sister marker should also be added to marker #41, entering Dusenbury Creek.

In Tarpon Basin, the entire area along the ICW is scarred. All the red markers (#46 through 50) should be gated to keep larger boats from taking the bends too wide and to keep them in the deeper water of the historically dredged ICW channel. Aerial surveys verified this damage. Some of the scarring here, however, is simply due to deep draft boats that should not be on the backside of the Keys. In addition, there is a lot of damage from recreational boaters running all over the shallow areas east and south of the ICW.

In Little Buttonwood Sound there is scarring associated with the numerous cuts. Lots of recreational boaters go into this area. Everglades National Park may want to install some of their markers here.

Heading south out of Grouper Creek there is more scarring associated with the ICW. A sister marker should be installed to #54, to help large vessels stay within the dredged channel.

Suggested Plan:

High Priority

- install a sister marker to #38 coming south out of Jewfish Creek
- move #40 (north of Dusenbury Creek) closer (east) to the ICW and install a sister marker
- install a set of gated markers at the slight bend in the ICW, just south of #40
- install a sister marker to #41 at Dusenbury Creek north entrance
- install sister markers to daymarkers #46 through 50 along the ICW in Tarpon Basin
- install a sister marker to #54, coming south out of Grouper Creek

Medium Priority

Low Priority

-install a single set of gated markers at the cut on the SW corner of Manatee Bay

Notes:

The owners of the Moorings Marina should be contacted to repair and re-establish their two sets of gated markers to reflect the charted layout of the markers.

The numerous dredged channels of the ICW in this area typically have scarring along their lengths. Much of this is probably due to the lack of gated markers and the narrowness of the channels. For this reason adding sister markers and installing more gated markers is a high priority to minimize damage and keep boats within the confines of the ICW.

Due to the general problem of large deep draft vessels entering the backside of the Keys, and continuing down the ICW, the county and the Coast Guard should consider a long term plan of monitoring and informing large yachts intending to use the inside route. There should be a station set up at the Jewfish Creek channel which provides information to boaters heading south: both general environmental and boating safety information, and suggested draft limits due to controlling depths ahead (throughout the Keys). This information could be as simple as signs, or even a person (Coast Guard, county employee, Sanctuary, or other) designated to inform or even regulate boats and boaters. Information signs, informing yachts of depths on the inside route should be installed in Biscayne Bay to allow an alternate route to the 'outside' via Caesars Creek or Angelfish Creek, before reaching this too-late-to-turn-around area (also see Survey 2).

Survey Number: 5

Date: 4/22/97

Region: Upper Keys

Area: South Key Largo- Oceanside

Range: From South Sound Creek south to Tavernier Creek

Assisting Parties: John Pennekamp Coral Reef State Park, Capt. Bob Newbould

Launch Location: Pennekamp marina

Vessel Type: 24' T-Craft

Conditions: Partly cloudy, winds SE 10 kt, good visibility

Time: Approximately 4 1/2 hours

General Overview:

The upper half of this survey area is within Pennekamp. Most of the large scarring areas are associated with the extensive flats around South Sound Creek, Rodriguez Key, and Tavernier Key. Smaller areas of scarring are also associated with channels (or lack of) leading to the numerous subdivisions along the south end of Key Largo.

The productive flats areas around Rodriguez Key, Dove Key and Tavernier Key that are badly scarred will be addressed through the 'no motor' zoning of the new Sanctuary Wildlife Management Area. The new zones will encompass all the scarring in these areas, so no additional channel marking is needed or advised for these large flats, unless found to be necessary at a later date.

Survey Assessment:

The entrance to South Sound Creek, otherwise known as 'the Bowling Alley', is well marked with a long, straight chain of gated markers alternating with 'no motor' buoys. No motor areas are designated by Pennekamp on the north side of the Bowling Alley up to Lower Sound Point, and on the south side of the Bowling Alley across to the Port Largo entrance. These areas are extensively scarred, but scarring should be reduced with the existing no motor zones. The park is adding buoys around the perimeter of the no motor zones to make them more obvious, and Sanctuary enforcement officers patrol the area regularly. Local boaters appear to be aware of the no motor zones.

The entrance to Port Largo has no markers and is known for boats exiting, going too far east and grounding. There should be 2 or 3 red daymarkers and a single green (next to entrance) leading out toward existing #2 marker to help both local and transient boaters (see Notes). Due to the amount of traffic in this channel, continuous gated markers are not preferred. Daymarkers would also provide a mount for 'no wake' signs, which is currently a big problem in the entrance area.

There is a large area of scarring in Rock Harbor. Boats go in and out of the several marinas and this is also a large anchorage for sailboats. PVC poles currently well mark the two entrances. Channel marking would not help here.

The large scarred areas around Rodriguez and Dove Keys should be reduced with the Sanctuary's new 'no motor' zones.

The small narrow area of scarring seen along the shore west of Dove Key is due to boats going in and out of the numerous shorefront homes. No serious problems here.

There is significant scarring near the entrance to Dove Creek. This is a shallow area of less than three feet, with lots of boat traffic going into Dove Creek, Snapper's Restaurant and several shorefront facilities. Snapper's should probably be responsible for posting the controlling depth at the approach to their docks. Daymarkers would be preferable to their existing, but good, buoys. The entrance to Dove Creek is marked with PVC poles and does not need improvement.

All the scarring around Tavernier Key and Tavernier Creek should be reduced with the Sanctuary's new 'no motor' zone. In addition, the highly used easterly side channel should be marked with gated markers, replacing the current PVC poles. Informational signs, indicating the controlling depth, should be installed at each end of the marker chain. This channel is intended for use by operators of smaller vessels with local knowledge (see Notes).

Suggested Plan:

High Priority

- install 8-10 sets of gated daymarkers through the east side channel into Tavernier Creek
- install an informational sign, indicating the controlling depth and vessel usage at each end of the suggested Tavernier Creek easterly marker chain

Medium Priority

- 2 or 3 red daymarkers at the entrance to Port Largo, leading out to existing marker #2
- install a green daymarker at the entrance to Port Largo
- install a idle speed regulatory sign on one of the (above) suggested markers, near the entrance to Port Largo

Low Priority

Notes:

The county is currently working with Pennekamp managers on a cooperative effort to install the above mentioned channel markers at Port Largo. These markers should be installed within the next year.

The suggested marked route for the easterly side channel of Tavernier Creek should be designated as a 'secondary' or 'small boat' channel, and marked accordingly.

Survey Number: 6

Date: 4/30/97

Region: Upper Keys

Area: South Key Largo- Bayside

Range: Buttonwood Sound south to Cowpens Anchorage

Assisting Parties: Environmental Consulting Systems, Inc., Capt. Susan Sprunt

Launch Location: Susan Sprunt's house in Tavernier

Vessel Type: 20' Mako

Conditions: Partly Cloudy, winds variable 5 kt, good visibility

Time: Approximately 6 hours

General Overview:

The geography begins to change in this area, with fewer basins and cuts going through mangroves and small islands. We begin to see a continuous system of shoals running perpendicular to shore, often reaching close to the ICW. These shoals are often short-cutted, creating wheel ditches. The wheel ditches are usually marked with PVC and typically become deeper with time and use, resulting in heavily used channels. This is basically a nearshore route for smaller boats that do not want to use the ICW. Local boaters rarely go around the end of the shoals when running the bayside.

Survey Assessment:

There is an area of scarring all around the entrance to Caloosa Campground at the east side of Buttonwood Sound. A well marked PVC channel leads in through the deepest area, however numerous scars indicate that many boaters do not use the channel. Additional marking would not be helpful.

At the SE side of Buttonwood Sound there is a small scarred area due to anchored vessels. West of that anchorage is an area of scarring along the shoreline adjacent to numerous homes. Everglades National Park personnel have reported seeing large mats of seagrass surfacing in this area. No marking is suggested.

At Baker Cut, sister markers to #55 and #57A would help keep boats in the dredged channel. There appears to be a lot of wandering in this area.

Numerous scarred areas are indicated SE of Baker Cut adjacent to shorefront homes at Rock Harbor. No marking is suggested.

Small areas of scarring are indicated at the entrances of two canals at 2 mi. ENE of Pigeon Key. No marking is suggested.

Several areas of scarring are indicated on the shoals between the ICW and Butternut Key. This is due to general boating activity and cannot be prevented. The areas of moderate scarring indicated between the ICW and the adjacent spoil islands appeared relatively deep (>3') and no scarring was observed.

The shoal SE of Pigeon Key shows extensive scarring. There is a wheel ditch marked with two sets of PVC markers crossing the shoal adjacent to the shoreline. The wheel ditch is Ok, as is (see Notes).

A lightly scarred area is indicated at the entrance to Hammer Point, leading into the marked channel (one set of permitted and one set of PVC markers). No scars were found adjacent to Hammer Point's east side. Light scarring was seen where boats come out of Hammer Point on the west side, which would be the best alternate entrance to the subdivision. It would be best for the residents to mark that entrance themselves. On the south side of Hammer Point scarring is seen where boats go in and out over the shallows rather than using one of the two existing entrances. Boats should not enter and exit at that point.

Significant scarring is indicated along the dog-leg entrance to Community Harbor. No scarring, however, was seen in the area between marker #2 and #3, 4. Severe scarring was seen where the channel turns SW at markers #3, 4 toward markers #11, 12 which are not indicated on the ATONS list (the owner of Cambell's Marina said they were previously owned by the marina and are 25 yr. old). The turn in this channel is problematic, with lots of scarring and indications of numerous wrong turns by vessels. The route of this channel should be re-assessed and possibly reworked. An information sign indicating the controlling depth may deter large vessels which are severely scarring the harbor. Lots of recreational boaters run all around the harbor, causing much of the scarring. This is also a popular anchorage.

There is a small area of severe scarring on a shoal just south of Ramshorn Cut. A wheel ditch is present due to shortcutting through the shoal.

There is severe scarring at the somewhat shallow entrance to Tavernier Creek. Although fairly well marked, a sister marker to #14 immediately west of the entrance to Tavernier Creek would deter shortcutting and reduce a lot of scarring.

At the east end of Cross Bank extensive scarring was seen across the entire shoal. The infamous 'Toilet Seat Cut' shortcuts the shoal and is poorly marked with PVC poles hung with toilet seats. This is a deep cut with high flow, keeping the cut deep and clear. Although this cut should probably be marked properly, it would most likely outrage the local boaters (to remove their decorated markers) and possibly create the incentive for future wheel ditches (see Notes).

The scarring indicated just south of Toilet Seat Cut could not be seen, and if it exists is due to larger boats, due to the water depth of over four feet.

Extensive scarring was seen all across the shoal south of Cowpens Cut. A very shallow wheel ditch is marked with PVC poles across the narrowest point of the shoal. Several other PVC markers were seen, placed haphazardly across the cut, and should be removed. In addition, two pilings are in about 4' of water just SW of the westernmost point of the shoal. These should either be removed, or marked with Danger Shoal signs, or optimally removed and the tip of the shoal marked with a Danger Shoal marker.

Suggested Plan:

High Priority

- install sister markers to daymarkers #55 and 57A at Baker Cut
- install a sister marker to #14 at the entrance to Tavernier Creek
- remove PVC markers across the shoal south of Cowpens Cut

Medium Priority

- install a controlling depth sign to marker leading into channel at Community Harbor
- install a Danger Shoal marker at tip of shoal south of Cowpens Cut

Low Priority

- remove pilings off tip of shoal just south of Cowpens Cut

Notes:

Several shoals in this area have PVC marked wheel ditches crossing the narrowest part. This issue should be considered in more detail as to whether to: leave as is, remove the PVC and deter use of the wheel ditch, or properly mark the wheel ditch. In some cases the unpermitted markers effectively mark the crossing, in other cases there are specific problems such as ever widening wheel ditches, poorly marked channels, boaters thinking they can mark and cross any area, etc. The unpermitted markers at 'Toilet Seat Cut' are a particular problem due to: scouring that has led to deepening of the wheel ditch, people improperly locating the markers, and the public's attraction for this whimsically marked channel. The primary issue however, is whether is it wrong to mark a channel that was created by prop dredging, which then may provide incentive for future prop-dredging. In some places it may be necessary.

The problem area at Community Harbor should be looked at again to consider redesigning the marker route. The extensive damage and number of boats in the harbor warrant a re-examination of the marking system there.

Survey Number: 7

Date: 5/2/97

Region: Upper Keys

Area: Windley Key- Bayside

Range: Cowpens Anchorage to Little Basin

Assisting Parties: Izaak Walton League, Capt. Karen Lee

Launch Location: Karen Lee's home in Venetian Shores

Vessel Type: 13' Boston Whaler

Conditions: Partly cloudy, winds variable 10 kt, good visibility

Time: Approximately 5 hours

General Overview:

This general area experiences some of the heaviest use and abuse in the Keys, mainly due to the proximity to Holiday Isle Resort Complex and intense boating and jet skiing pressure from rental operations and typically partying, unknowledgeable boaters. The Florida Marine Patrol reports that this area has the highest rate of boating accidents in the U.S.

Numerous scarred shoals are seen throughout the bay side of lower Plantation Key, Windley Key, and Upper Matecumbe. Large areas of scarring are also indicated around numerous side channels associated with Snake Creek and Whale Harbor Channel.

A new Wildlife Management Area will encompass the shoal area south of Cotten Key extending to the small channel (wheel ditch off of Whale Harbor Channel) at the north end of Upper Matecumbe. This area will be designated a 'no motor' zone, and should address some of the impacts to the shoal area.

Survey Assessment:

A long narrow area of moderate scarring is indicated along the approach to Plantation Yacht Harbor. Scarring was not seen from the water, but some scar lines could be seen from aerial surveys, heading straight into the marina. This is likely due to large yachts motoring across this 5' deep area. Plantation Yacht Harbor asks visiting yachts to be limited to 5' draft.

There is a conglomeration of PVC and other materials intended to mark the tip of the shoal 1 mile directly west of Plantation Yacht Harbor. The markers are in about 4' of water, away from the shoal, and should be removed. Any marker for the shoal should be placed on the edge of the shoal itself. In addition, there is an unpermitted toilet seat marking a growing wheel ditch across the shoal that should be removed. There is severe scarring on that shoal, but marking it is not suggested.

There is scarring in the cove adjacent to (on the east side of) Venetian Shores. There are deep canals for boats to go in and out, but some residents apparently cut across the 2' shoal causing severe scarring. The community association for Venetian Shores should educate/regulate themselves on the use of their own channel system and only exit through Snake Creek.

There is severe scarring around the entrance to Snake Creek. Adding sister markers to the existing red markers #12 and 10 should limit the scarring.

There is a shallow scarred area at the fork in Snake Creek. A set of gated markers there would help keep boaters in the channel, off the shallow area, and keep confused boaters from taking the west fork. Though the side channels to the NW have deep water, both of them have extremely shallow entrances that are severely scarred and cannot be marked.

There are several areas of light to moderate scarring bordering the cove on the bay side of Windley Key. These are due to general recreation in the shallow shore areas and a lightly used anchorage at the south side of the cove. No marking is suggested.

The Whale Harbor Channel area has several areas of extensive scarring due to the intense boating activity and numerous shoals. The large scarred shoal at the center of the area is particularly problematic due to several natural blind channels that run through the shoal, just west of the primary marked channel. The most westerly of those channels is well marked with PVC but boats run all around it then hit the shallow entrance at the north end. This situation will be helped with the 'no motor' zone that will be marked with buoys by the Sanctuary. The new 'no motor' zone should minimize the extensive damaged area between Upper Matecumbe and Cotten Key. A wheel ditch exists adjacent to the north tip of Upper Matecumbe. Several areas of scarring adjacent to the primary channel would benefit from the addition of a set of gated markers between #15,16 and #13. In addition a sister marker should be installed to #13.

The large anchorage east of Wilson Key is completely damaged with prop scars and anchor circles. There are numerous sunken, derelict vessels. This is an excellent anchorage and all the derelict vessels should be removed.

The shoals west and north of Cotten Key are badly scarred, and a new wheel ditch is starting in the middle of the westerly shoal. No marking is suggested.

There are several small areas of scarring in the shallows off the point extending south off the north end of Upper Matecumbe. Mangroves extend from the point and fishermen are probably scarring the bottom running along the shore and around the point.

In the middle of Upper Matecumbe there is severe scarring all around The Lorelei Restaurant area. This area experiences intense boating traffic. There is also a large, popular anchorage adjacent to The Lorelei. The entire area is relatively shallow and no deeper water exists to mark an appropriate channel.

Little Basin is an extreme problem due to the consistent 2-3' bottom contour and numerous marinas and restaurants. Both commercial and recreational vessels use the shorefront docks. There is a trend from commercial fishing to recreational use in this area, due to the recent closing of Green Turtle Fish House. The new Worldwide Sportsman store will be open to shallow draft vessels, but there will be a major reduction in slips, and presumably boat traffic in and out of the scarred marina area. There is a marked channel on the north side of the basin, and several other unmarked entrances. The main channel has small boards that should be upgraded to standard size. An informational sign indicating the controlling depth should be placed on the entrance marker, which may help deter deeper draft vessels. There is heavy cross through traffic, mainly by flats fishermen.

The long shoal extending NW of Little basin is scarred, but is within the boundaries of Lignumvitae Key Management Area and will be addressed by the area management.

Suggested Plan:High Priority

- install sister markers to #10 and 12 at the Snake Creek entrance
- install a set of gated markers just beyond the fork in Snake Creek
- install a set of gated markers in Whale Harbor Channel between #15,16 and #13
- install a sister marker to #13 in Whale Harbor Channel

Medium Priority

- install an informational 'controlling depth' sign at the marked entrance to Little Basin (in process by Worldwide Sportsman)

Low Priority

- remove the PVC marker (s) just off the shoal 1 mile west of Plantation Yacht Harbor
- remove the toilet seat marking a wheel ditch on the shoal 1 mi. west of Plantation Yacht Harbor

Notes:

This entire area is particularly problematic due to the heavy boating use, partying, etc. Any plans for this area should take into consideration the concerns and opinions of FMP and the USCG (stationed at Snake Creek) as well as the local user groups.

Plans are underway for Worldwide Sportsman to take over ownership of the Little Basin markers, improve the markers, and install the controlling depth signs. This will be performed independently of the master plan.

Survey Number: 8

Date: 5/8/97

Region: Upper Keys

Area: Windley Key- Oceanside

Range: Plantation Point to Teatable Key

Assisting Parties: Florida Keys National Marine Sanctuary, Capt. Mary Tagliarini

Launch Location: Sanctuary docks in Port Largo

Vessel Type: 25' Robalo

Conditions: Clear, winds NE 10-15 kt, good visibility

Time: Approximately 6 hours

General Overview:

The Windley Key/Holiday Isle Resort area has the most intense boating pressure in the Keys, and has the highest rate of boating accidents in Florida, as well as the U.S. With the intense sport craft and rental boat use and the expansive shoal areas, the area of seagrass scarring is quite extensive. In fact, there is one continuous scarred area from Treasure Harbor south to beyond Whale Harbor Channel covering over thirteen hundred acres. Any channel marking schemes in this area should be carefully designed due to the sheer number of boats and the level of boating knowledge of the typical recreational boater.

Two of the three dredged channels cutting through the shoals between Snake Creek and Whale Harbor Channel have recently been marked and may help keep boats off the flats. In addition, the shoal adjacent to (east of) Snake Creek will become a Sanctuary Wildlife Management Area and zoned 'no motor', providing some relief to that area.

Survey Assessment:

There is a very small area of scarring leading into Treasure Harbor. The approach is well marked with a large yellow buoy (unpermitted) and several gated PVC markers.

Heading southwest there is one large moderately to severely scarred area, broken only by the deeper channels of Snake Creek and Whale Harbor Channel. East of Snake Creek will be the Snake Creek Wildlife Management Area. The scarring there will be addressed by the 'no motor' zone that will be demarcated with buoys. However, a large tongue of moderate scarring extends east, out of the new management area. A 'Danger Shoal' marker at the shallowest, easternmost point of the shoal would provide a reference, as well as a warning, and may help deter boats from traversing the shoal. Snake Creek is not completely gated and would be improved by the addition of sister markers to #5, 4A, 6, and 7A. A set of gated markers should also be installed between #7A and 8,9. Heading west, two of the three dredged channels (the two western most) have recently been marked with daymarkers, which should help keep boaters off the flats and in the deeper marked channels. Several PVC marked wheel ditches exist near shore, running between the dredged channels and Snake Creek. Boaters use the wheel ditches to traverse the shoals close to shore, and to go in and out of Hog Heaven Restaurant. Whale Harbor Channel is not completely gated and would be improved by the addition of sister markers to #4, 4A, 5, and 6. The improved marking to Snake Creek and Whale Harbor Channel will make the routes more obvious and less confusing, and help keep boats from wandering outside the channels. These are

the only feasible options for addressing scarring here unless a comprehensive plan, specifically designed for the intense boating impacts to this area, is developed.

Just west of the Whale Harbor main channel are three natural winding channels that are marked with PVC. These channels are all used by recreational boaters and scarring runs between all the channels and across the shoal. The westernmost of the side channels is the best and deepest, with a 3 1/2' controlling depth. This channel is often used by the charter boats out of Whale Harbor during good weather and high tide, in lieu of the main channel. The dockmaster at Whale Harbor does not recommend marking the channel, as the captains are quite familiar with the channels.

A large triangular shaped shoal exists at the middle of Upper Matecumbe, which is completely scarred. There are several homes, resorts, and piers and docks along the extremely shallow shoreline in this area. Approaching the shore in this area is quite difficult. Cheeca Lodge Resort has a line of buoys marking the port side of an ill-defined cut, on a heading straight in from Cheeca Rocks. Much of the scarring in this area is due to overflow from the Holiday Isle area. Rental operators often cut across the extensive shoal, totally unaware of the water depth. A single shoal marker at the southeast tip of the shoal would provide a point of reference, helping to keep boaters to the south of the shoal in deeper water.

There is scarring all around the approaches to both Hampton Inn and Bud and Mary's Marina. Hampton Inn has plans to install private markers to the entrance to their docks. They should definitely display the controlling depth with their signage, as the approach is quite shallow at less than two feet. Bud and Mary's Marina is already marked. No additional marking would be helpful.

The areas of scarring southeast and south of Teatable Key are addressed through the extensive marking system of Lignumvitae Key Management Area.

Suggested Plan:

High Priority

- install sister markers to ungated markers in Snake Creek (#5, 4A, 6, 7A)
- install a set of gated markers in Snake Creek between #7A and 8,9
- install sister markers to ungated markers in Whale Harbor Channel (#4, 4A, 5, 6)

Medium Priority

- install a Danger Shoal marker at the eastern edge of the shoal south of southern Plantation Key.
- install a Danger Shoal marker at the SE point of the shoal off the middle of Upper Matecumbe

Low Priority

- have Hampton Inn install a controlling depth informational sign for their planned daymarkers

Notes:

Holiday Isle has a system of 'Protected Area-Turtle Grass' signs distributed around the seagrass flats on both the ocean and bay sides. This signage was an act of mitigation determined by Ann Lazar at DEP and the Holiday Isle dockmaster several years ago. Also, Holiday Isle limits their jet-ski rentals to a confined, buoyed area in front of the beach.

Survey Number: 9

Date: 5/14/97

Region: Upper Keys

Area: Lower Matecumbe

Range: North end of Lower Matecumbe to Channel 5

Assisting Parties: Lignumvitae Key Management Area, Capt. Pat Wells

Launch Location: Lignumvitae's dock on Lower Matecumbe

Vessel Type: 20' Privateer

Conditions: Partly cloudy, winds variable 10 kt, good visibility

Time: Approximately 4 hours

General Overview:

The extensive scarring around the north end of Lower Matecumbe is addressed by the marking system at Lignumvitae Key Management Area. Most of the remaining scarring in this survey area is found close to shore, across the shoals at the lower end of Lower Matecumbe and Craig Key. The Intracoastal Waterway in the Florida Keys formally ends in this area at Bowlegs Cut with marker #98. Here the route branches with a southerly route crossing over to Hawk Channel on the outside at Channel Five. The westerly course continues as the inside route, but is no longer observed as the ICW by USCG. There were never any improvements (i.e. dredging) to the route beyond this point.

An idle speed zone is scheduled for implementation along the eastern shoreline of Matecumbe Harbor, wrapping around to the north at Safety Harbor. This zoning should reduce some of the scarring adjacent to the developed shoreline in that area.

Survey Assessment:

A small area of moderate scarring is indicated at the south end of Matecumbe Bight, adjacent to some shorefront homes and several channels leading to subdivisions. However, no scars were seen.

A small area of moderate scarring is indicated on the west side of the entrance to White Marlin Beach subdivision, probably due to large vessels. Little scarring was actually seen there.

A small area of severe scarring was seen at the entrance to Safety Harbor. This scarring should be addressed with a single set of gated markers and a string of idle speed buoys that are due to be installed by the county.

There is a large area of severe scarring across the shoals on both sides of the entrance to Matecumbe Harbor. This good, relatively deep channel is fairly well marked (unpermitted) with large pipes. The Boy Scouts Sea Base is located here and the harbor is used regularly by the Scouts as well as a variety of recreational boaters. Matecumbe Harbor also provides a good anchorage and is popular with sailboats. The numerous adjacent areas which incur scarring should all be positively affected by the installation of a chain of gated markers leading into the harbor. Currently there is only a single marker #2 at the channel entrance leading into the harbor. A representative of Sea Camp said their organization would encourage such marking.

The shoal extending west from Matecumbe Harbor is badly scarred but is marked with a 'Danger' sign in front of 'The Coffins'. No further signage would be helpful.

Light scarring is indicated across the shoal areas on the north side of Craig Key. Three narrow, shallow channels run in to the two homes on the bayside. The most westerly of those channels is marked with PVC. The scarring here is relatively minor considering the extensive shoals and flats.

There is an extensive area of light scarring indicated across the shoal on the south side of Craig Key, mostly due to fishermen. No markers are suggested.

There is scarring adjacent to both sides of Channel 2, likely due to the lack of gated markers. Boats take the westerly side of the channel too far west, and boats run on the wrong side of the red markers on the east side as well. Gating the existing markers (just #4 and 6) would address that scarring and greatly improve the marking of this highly used channel. The entire marking chain belongs to Caloosa Cove Marina. The lightly scarred area on the north side of the approach to Caloosa Cove is simply due to improper boating (not using the well marked channel). The severely damaged area seen just south (SSE) of Caloosa Cove is due to numerous flats boats heading straight out to deep water, crossing over the shallows. Various other deeper draft vessels often observe this pattern and follow the flats boats, further scarring the area.

There is a small, lightly scarred area adjacent to the shorefront homes off Matecumbe Beach, in the middle of Lower Matecumbe. This problem is relatively minor.

A small area of severe scarring is indicated toward the upper end of Lower Matecumbe on the ocean side. That scarring was confirmed to be a wheel ditch leading into Mar Celeste subdivision. This damage is not significant.

The extensive moderate to severe scarring indicated at the upper end of Lower Matecumbe is addressed by the marking system for Lignumvitae Key Management Area.

Suggested Plan:

High Priority

-install a chain of gated markers leading into Matecumbe Harbor (8-10 individual markers)

Medium Priority

-install sister markers to Caloosa Cove markers #4 and 6

Low Priority

Notes:

Caloosa Cove needs to replace the seaward facing board on daymarker #6

MIDDLE KEYS

The Middle Keys region encompasses the islands and coastal areas from Channel 5 to the northeast down to Moser Channel, just west of Marathon. This region includes the populated islands of Long Key, the Conch Keys, Duck Key, Grassy Key, Fat Deer Key, and Vaca Key, and several small unpopulated nearshore islands.

A total of five surveys were conducted from 28 May to 15 July 1997. As with the previous survey region, a wide variety of volunteers provided logistical and informational support.

Region Characterization

The Middle Keys span approximately thirty miles. Significantly smaller in size than the Upper or Lower Keys, this is a transitional area where discrete changes in boating and damage patterns between adjacent regions can be observed. The regions are geographically separated by the two largest navigational channels in the Keys; Channel 5 and Moser Channel. In contrast to the Upper Keys, the islands are generally shorter, resulting in cuts spaced closer together. The Middle Keys are known for strong currents within cuts, and somewhat more turbid water. There are no basins on the bayside and bottom depths beyond a mile from shore typically exceed six feet. There are several areas of complex shoals, particularly in the areas of Duck Key, north of Long Key, and northwest of Marathon. Oceanside flats exist, but are not as expansive as in the Upper Keys. The ICW is no longer formally recognized by the USCG below Long Key but a good, relatively deep marked route still runs through open water until reaching the back country of the Lower Keys.

There is a wide variety of user groups in this region, but not the level of boating pressure we find in the Upper Keys. There is less rental and thrill craft boating here and there are no large resorts catering to the holiday/party crowd. We also find a higher percentage of resident boaters. Like the rest of the Keys distinct trends can be observed, with particular areas being most impacted by specific types of vessels and users. Surveys included the ocean side waters out to one mile, where depths typically drop beyond the limits of prop scarring. On the bay side surveys extended from two to five miles north of the Keys.

Cooperating Agencies & Volunteers

In contrast to the Upper Keys, only one managed area besides the Sanctuary is located in the Middle Keys. Long Key State Park is within this region, but has no jurisdiction over the waters. Due to a lack of managed area resources, we sought out and were provided vessel support from other agencies and private entities.

In conducting surveys in this region we utilized vessels and captains from agencies, organizations, and volunteers including: The Nature Conservancy, Hawk's Cay Resort & Marina, the Florida Marine Patrol, and a private fishing guide. Like support in the Upper Keys, these volunteers provided a wide range of opinions and input on reasons for damage and suggestions for improvements.

Assessment Summary

The Middle Keys region covers half the area of either the Upper or Lower Keys. In addition, there is significantly less boating pressure here than to the northeast or the west. This results in less overall seagrass scarring. In fact, this region has less than 15% of the scarring indicated in the archipelago, totaling about 4500 acres. But, there are numerous areas which do incur moderate to severe scarring, both oceanside and around the bay side shoals. Although most transient or vacationing boaters stop in the Upper Keys or pass through to the Lower Keys, many boaters still make this region their destination. The large boating population of Marathon also contributes highly to resource damage in that vicinity. In addition to the marking scheme suggested for the Upper Keys, several optional marking strategies are proposed for consideration.

Probably the largest user group in the region is recreational fishermen. Large numbers of rentals and privately owned vessels head out from several resorts and numerous motels and hotels. Damage caused by these boaters is primarily due to not using charts and a lack of familiarity with channels and adjacent shoals.

Some of the most severe problems in the region are in the Marathon vicinity. Particularly the poorly marked route at the tricky approach to Vaca Cut, and damage associated with the two accesses to Boot Key Harbor (the main channel and Sisters Creek).

Larger cruising vessels, both sail and power yachts, probably do best in the Middle Keys due to the good crossovers at Moser Channel and Channel 5 and the deepest

water in the Keys for approaches to marinas and subdivisions on both sides of the islands. Fortunately no scarring is indicated along the ICW from these large vessels.

The ever present charter fleets, both fishing and diving, cause little damage in this region due to the relatively deep water and their experience in piloting throughout the area. Inappropriate draft does not appear to be a problem here.

Flats fishing in the Middle Keys is not nearly as prevalent as in the Upper Keys, as good fishing grounds are limited to the Long Key area and several bayside shoals. Though scarring does occur from this user group, it is minimal. No motor zones are not necessary.

The severe problem of bayside wheel ditches seen in the Upper Keys is minimal in this region, primarily due to the lack of shoals extending perpendicular from shore. However, the expansive shoals found off of Duck Key and Marathon do incur scarring from poor boating practices and a few PVC marked crossovers. The problems associated with nearshore routes seen in the Upper Keys is all but non-existent in the Middle Keys due to deeper water near shore in most areas of the bay side.

Recommended Markers

Channel marking recommended for the Middle Keys includes improving existing channels by increasing the frequency of markers, gating ungated channel markers, relocating existing markers, extending lead channel markers and/or installing head pins, moving marker lights, changeover of meeting channels to through channels, removal of daymarkers, installation of Danger Shoal markers, installation of controlling depth signs, changeover of sign types, re-installing missing markers, and the application of secondary channel markers.

In this region the use of ‘secondary channel’ markers is being considered through an area on the bay side where natural channels exist nearshore. A route, running through this system of channels parallel to shore, is heavily used by small recreational vessels. This is a non-typical area for marking, but appears to be quite suitable for the application of ‘secondary channel’ markers and signage.

The following list breaks down the number and kinds of markers suggested for the entire Middle Keys region. Numbers of markers are approximate. Marker

numbers may fluctuate as implementation proceeds and needs in specific areas are re-assessed.

<u>Type of Marker</u>	<u>Signage</u>	<u>Misc.</u>	<u># of Markers</u>
Daymarker	green/red		84
Information	Danger Shoal		20
	Controlling Depth	existing pile	8
		Total Markers	<u>104</u>
		(daymarkers & shoal markers)	
		Signs only	<u>8</u>
		(controlling depth signs)	

Of the eighty four daymarkers recommended for installation, sixteen would be installed in existing federal marker chains.

In addition to the above marker installations, four pilings are recommended for removal and four markers are to be relocated.

Survey Number: 10
Date: 5/28/97
Region: Middle Keys
Area: Long Key

Range: From Channel 5 west to the Long Key Viaduct

Assisting Parties: Florida Marine Patrol, Officer Wiggley

Launch Location: Key Colony Beach

Vessel Type: 25' Mako

Conditions: Partly cloudy, winds NE 10-15 kt, good visibility

Time: Approximately 4 hours

General Overview:

Seagrass scarring in the Long Key area is fairly light, in comparison to the Upper Keys. However, there are several important areas of concern, particularly the major navigational crossover at Channel 5 and the heavily used areas adjacent to Fiesta Key. There are also several small banks on the bay side that incur damage.

There is a fork in the historic ICW route just north of Long Key. The main inside route continues to the southwest with numbering starting over with marker #1 near Old Dan Bank. Here another route splits off to the northwest. This is the route to Cape Sable, skirting the banks of Florida Bay to the east.

Survey Assessment:

South of the western tip of Long Key there is an expansive shoal which is lightly scarred. This is due to boats short cutting around the tip of the island as well as flats fishing and boats going in and out of shorefront homes. This scarring is minimal and no marking is suggested.

There is a long narrow area of light scarring just off Long Key State Park campgrounds, mostly due to flats fishing. This scarring is minimal and no marking is suggested.

There is large, lightly scarred shoal off the southeast dogleg of Long Key, also due to heavy flats fishing. This scarring is minimal and no marking is suggested.

In the Channel 5 area there is extensive scarring due to a combination of fishing, recreational traffic, and cruising boats traversing the channel. This is an important channel for large yachts, and is currently poorly marked. The moderate scarring just west of marker #1 is due to numerous boats short cutting across the flats on the wrong side of the marker. Improper passing is also indicated by the severe damage on the flats on the backside of marker #2. This channel would be improved with the installation of sister markers to #1 and 2, as well as set of gated markers beyond the current lead marker. The suggested location for adding sister markers and new entrance markers is indicated on the accompanying survey map. Several of the new markers would help keep boaters off of adjacent shoals. While one marker, across from existing #2, would be in deeper water helping to keep non-local traffic in a well defined and highly visible, marked channel. This would also provide a reference for boaters entering Long Key Bight. The Channel 5 entrance light, currently on marker #2 should be moved to a lead marker in the chain.

There is extensive scarring across much of the shallow areas inside Long Key Bight. A Danger Shoal marker should be placed near the southeast edge of the shoal on the northern side of the bight. This would also provide a reference for boaters heading west to Layton Channel. Although a well marked entrance leads into Layton Channel, there is significant scarring all around the approach. The marker chain appears to start in four feet of water, so no further extension of the chain is suggested. Much of the problem appears to be from commercial and

other deeper draft vessels entering the channel and scarring with their keel and/or rudder. A controlling depth sign should be installed on the lead marker.

Rounding the northeast corner of Long Key into the bay side, there are numerous shoals with extensive prop damage. There are numerous PVC poles at the edge of the shoals which do not appear to be very effective, particularly due to the amount of night traffic traversing this area and non-local traffic going in and out of Fiesta Key campgrounds. An obvious route is observed running between the shoals of Jewfish Bush Banks and the natural cut-through at Jewfish Hole. The edges of the shoals next to this PVC marked route lend themselves to easy formal marking. But, the boating patterns and size and depth of the channels are important considerations for the type of marking to be utilized. This would be an appropriate area for 'secondary channel' markers, since any marking does not need to be seen from far away, and the smaller pilings would minimize any damage from collisions. Informational signs indicating the controlling depths should be installed on the terminal markers. The suggested route design and marker locations are indicated on the accompanying survey map. In addition, a Danger Shoal marker should be installed at the north edge of the large shoal one half mile north of the northeast tip of Long Key.

Several single daymarkers are currently marking the edges of shoals north of Long Key, inside the historic ICW. These red and green daybeacons mark an inside route, using the numbers 1X, 2X, and 4X. The signage does not appear to be very effective as evidenced by the moderate to severe scarring on the shoal side of each of the markers. In addition, this is inconsistent with the markers at Old Sweat Bank to the west, which has 'no lateral significance markers'. Because they are single markers, it appears that much of the damage is due to boaters taking the markers on the wrong side. All three of these markers should be changed to Danger Shoal markers, which should be less confusing and warn boaters of the shoal that each marker is there for. If they are converted to Danger Shoal markers, they may need to be moved slightly closer to the shoal. At Old Dan Bank, two more Danger Shoal markers should be installed, in the middle and on the far end of the shoal.

At marker #1 on the historic ICW there is a route that splits off, heading northwest to Cape Sable. This is an important area due to converging routes, but there is only a single green marker at this fork. Some boats cross on the wrong side, scarring a small shoal south of marker #1. A sister marker should be installed across from #1, on the east side of the Cape Sable route. This will provide a much improved visual landmark for this split, adjacent to the hazardous shoal. Just to the west, daymarker #2 is approximately one half mile north of the old ICW and should be moved closer to the designated route.

Two fairly insignificant areas of light scarring were seen on the bay side of the western tip of Long Key, simply due to shallow areas. This scarring is minimal and no marking is suggested.

Suggested Plan:

High Priority

-install sister markers to #1 and 2 in Channel 5

- install an extra set of gated markers at the entrance to Channel 5
- move the light from Channel 5 marker #2 to the new lead marker
- install five or six sets of gated markers through the Jewfish Bush Banks/Jewfish Hole area
- install informational signs indicating controlling depths on the nearshore route terminal markers
- install a sister marker across from historic ICW marker #1
- install a Danger Shoal marker at the north end of the shoal NE of Long Key (1 mile east of 1X)

Medium Priority

- install an information sign indicating the controlling depth on lead marker into Layton Channel
- change daymarkers (1X, 2X, 3X) north of Long Key to Danger Shoal markers
- install two more Danger Shoal markers (at the middle and north end) at Old Dan Bank
- install a Danger Shoal marker at the SE edge of the shoal on the north side of Long Key Bight

Low Priority

- move historic ICW marker #2 approximately 1/2 mile south, closer to the indicated route

Notes:

This is the first survey area where channel markers are suggested for use in marking a nearshore route. The Jewfish Hole/Jewfish Bush Banks area lends itself to the effective use of 'secondary channel' or 'small boat' markers: the bottom is shallow, the route to be marked is short (approximately one mile), the cuts are narrow, and the route is fairly straight forward. The smaller signs would not draw in cruising vessels traversing the ICW, and any collisions would not be as great as with standard sized markers.

Survey Number: 11

Date: 6/6/97

Region: Middle Keys

Area: Duck Key & Vicinity- Bayside

Range: Old Sweat Bank to Grassy Key Bank

Assisting Parties: Florida Marine Patrol, Officer Dan Williams

Launch Location: Coast Guard Station, Marathon

Vessel Type: 25' Mako

Conditions: Partly cloudy, winds SW 10 kt, fair conditions, fair visibility

Time: Approximately 2 1/2 hours

General Overview:

The area on the north side of Duck Key encompasses a complex shoal system. Shoals run nearly continuously from the causeways north to Yacht Channel and past Arsenic Bank, just north of the survey area. Moderate to severe scarring can be found throughout the nearshore areas. Light scarring further extends across the Channel Key Banks, past the ICW, and up to Yacht Channel where scarring becomes more severe.

The extensive shoals inside of the ICW incur the most prop damage, but are not too highly traversed due to the lack of navigable cuts or channels. Most of the boating in this area is by flats guides and other knowledgeable locals. Few non-local boaters use these waters in comparison to the Lignumvitae area to the north and Marathon to the south. Larger yachts use the marked routes of the old ICW and the northwest route to Cape Sable. The shoals are so tricky that even FMP does not boat here at night. There is a winding nearshore route that is used, often hugging the shoreline and lined with numerous PVC poles. However, prop scar maps indicate the lack of effectiveness of the PVC markers and damage associated with the extensive, complex shoals.

Although both Toms Harbor Cut and Toms Harbor Channel funnel through this area, the bridges are so low that they prevent most crossing traffic. Water depths at the bridges are minimal as well. Thus, any channel marking will only need to address bayside routes.

Survey Assessment:

Along the historic ICW route there are several small problems. At Channel Key Pass markers #5 and 7 are not both needed. Marker #5 tends to lead boats too far into the shoal on the south side. That marker should be removed and the light moved to #7. Marker #9 is about a half mile south of the ICW and is intended to also mark the north end of a moderately scarred shoal. That marker should definitely be moved north next to the ICW and away from the shoal. ICW marker #11 is also out of line from the route by about a quarter mile. It was intended to mark the north end of Grassy Key Bank and should be moved next to the ICW and a sister marker installed.

The Channel Key Banks, north of the historic ICW route, are all lightly scarred but get relatively little use. No marking is suggested here. However, there is a navigational problem at Yacht Channel where the markers for the route to Cape Sable begin. Due to the orientation of the pass through the shoal, #1 and 2 are in a direct line on the route. This makes them difficult to distinguish and easy to take on the wrong side, as evidenced by severe scarring on the back side of each of the two markers. This is a relatively remote and very inconvenient area for large vessels to run aground. Gating each marker would help keep boats in the narrow cut and allow each marker set to be seen from dead ahead.

The 'no lateral significance' markers currently marking either end of Old Sweat Bank are poorly understood and do not appear to be effective in keeping boaters off the banks. In addition, these aids are inconsistent with the marking of other shoals in the area; specifically Old Dan

Bank to the east which uses lateral aids to keep boaters south of the shoal. The marking of these shoals should be uniform. Danger Shoal markers are suggested for both Old Sweat Bank and Old Dan Bank.

As an informal nearshore route continues to the west, a short system of markers is suggested to help boaters weave through the shoals, from Conch Key to the eastern end of Grassy Key. A combination of lateral aids and shoal markers is suggested to provide boaters with numerous points of reference, as well as warnings of hazardous shoals. This route is heavily used and 'secondary channel' markers would be appropriate for routing recreational boaters through this somewhat tricky area, while deterring larger vessels. Seven or eight sets of gated markers are recommended, with accompanying informational signs at the entrance markers. The installation of several strategically placed Danger Shoal markers will complement this system of lateral aids. Danger Shoal markers should be placed at the edge of shoals both east and west of Channel Key. The shoal marker suggested for the north end of the shoal west of Channel Key should be lit, replacing the lighted green #9 currently located there and recommended for relocation north to the ICW. This light is regularly used for night traffic in and out of the Duck Key area. Markers are not suggested for the center area immediately north and south of Channel Key where boats should not be traversing at all. This integrated marker system will provide a safe navigable nearshore route for smaller recreational vessels. The design of the route is indicated on the accompanying survey maps.

Further to the west, there is light to moderate scarring across Grassy Key Bank. Danger Shoal markers are suggested for the north and south ends of the bank. This is the last shoal area encountered heading west toward Marathon.

Suggested Plan:

High Priority

- move ICW marker #9 next to the ICW
- change signs on Old Sweat Bank to Danger Shoal markers
- install a Danger Shoal marker on the shoal north of the center of the Long Key Viaduct

- install a Danger Shoal marker on the shoal extending SE from the Channel Key Banks
- install a Danger Shoal marker on the south end of the shoal just west of Channel Key
- install a lighted Danger Shoal marker on the north end of the shoal just west of Channel Key
- install seven or eight sets of gated markers through the Channel Key nearshore route
- install informational signs indicating controlling depths on the nearshore route terminal markers
- install sister markers to Arsenic Bank LT #1 and 2 (on Cape Sable route)

Medium Priority

- install Danger Shoal markers on either end of Grassy Key Bank
- move ICW marker #11 next to the ICW
- install a sister marker to ICW marker #11

Low Priority

- remove ICW marker #5 and move light to #7

Notes:

The nearshore route adjacent to Channel Key is to be designated as a 'secondary' or 'small boat' channel. This will be a continuation of the same marking system recommended for the bay side of Long Key and will provide boaters with a well marked nearshore route through the only complex nearshore shoal system in the Middle Keys.

Survey Number: 12

Date: 6/16/97

Region: Middle Keys

Area: Duck Key- Oceanside

Range: Conch Keys to middle of Grassy Key

Assisting Parties: Hawk's Cay Resort-Ecotours, Capt. George Shattuck

Launch Location: Hawk's Cay marina

Vessel Type: 15' inflatable

Conditions: Early morning, winds SE 10-15 kt, visibility fair to poor

Time: Approximately 2 hours

General Overview:

The Duck Key vicinity has several large areas of light to moderate scarring. Much of the damage is associated with resort and residential traffic going in and out of Hawk's Cay. There is also a lot of traffic from boats going in to Duck Key Marina for fuel and maintenance. Three natural channels lead into Duck Key, including; Toms Harbor Channel, Duck Key Channel and Toms Harbor Cut. However, only two of the three channels are safely navigable. Although there are through channels on either side of Duck Key there is little crossing traffic from the ocean to bay side, due to the low clearance of the bridges and minimal water depths. Thus, through marking channels is not a consideration.

Flats fishing is quite popular in the Duck Key area and numerous boaters utilize the adjacent shoals. These boaters appear to cause minimal impact to the seagrass bottom. Though jet skis are rented out of Hawk's Cay, operation is restricted to a small buoyed area in Toms Harbor Cut.

Beyond the primary shoals adjacent to Duck Key most of the scarring in this survey area appears to be minimal.

Survey Assessment:

There is a small area of light scarring adjacent to the south tip of Conch Key. Any scarring in this area is solely due to commercial fishing boats going in and out of this fishing community. No marking is suggested for this fairly insignificant area.

On the west side of Walker's Island there is an area of light to severe scarring. Light scarring occurs adjacent to a well marked (unpermitted) channel going into the most southerly basin. The worst scarring is around the very shallow area adjacent to the rental cottages and docks to the north. Owners of Conch Key Cottages may want to install additional markers and inform renters of the shallow area adjacent to the docks there.

The shoals on either side of Toms Harbor Cut incur extensive light to moderate scarring. This good, natural channel is routinely used by yachts going in and out of the north entrance to Hawk's Cay as well as smaller vessels going through the bridge there. Although cruising vessels are advised to use the southerly entrance for entering Duck Key, many vessels attempt to use this easterly approach and ground on the extremely shallow flats. Due to the number of groundings and the planned expansion of Hawk's Cay it would be wise to install gated markers through Toms Harbor Cut, to just beyond the flats near the bridge. An informational sign should be installed on the lead marker indicating the four foot controlling depth.

Duck Key Channel is extensively scarred, primarily due to the expansive shallows all around and inappropriate use of the channel. Not far up the channel it comes to a blind end in less than two feet of water. However, the #2 and 4 markers indicated on the chart are helpful for boats entering the Duck Key west inlet and the dredged channel hugging the shoreline, without leading vessels further up the channel. The moderate scarring indicated on the west side of the entrance to the channel could be minimized with the addition of sister markers to #2 and 4. The #4 marker is missing and needs to be re-installed. Extending the marker chain any further is not

suggested due to the shoaling beyond #4, as well as the access to deeper water just one half mile to the west at Toms Harbor Channel. It would be helpful to install an informational sign explaining that this is not a through channel, and is only for residential traffic.

Extensive moderate scarring is indicated all around the Toms Harbor Keys. Toms Harbor Channel is highly used by fishermen and motor yachts traversing the area and going in and out of Toms Harbor, Duck Key Marina, and all parts of Duck Key. There is a good four feet of water throughout this natural channel. Scarring to the adjacent shoals would easily be minimized with the installation of a complete marker chain through Toms Harbor Channel. A small side channel is already well marked with floats, indicating that vessels can enter and exit through several routes here. The recommended gated markers should be placed along the widest of the channels here as indicated on the accompanying survey map. The markers should start at the four foot entrance and continue to near the bridge where Toms Harbor opens up and depths are constant. An informational sign should be installed on the lead marker indicating the four foot controlling depth.

Along the shoreline of Grassy Key there is a relatively large area of light scarring just off of the Grassy Key Beach Motel. This scarring is due to the very shallow approach to numerous shorefront homes and docks. This type of scarring is typically insignificant, and no channel marking is suggested.

Suggested Plan:

High Priority

- reinstall marker #4 leading into Duck Key Channel
- install sister markers to #2 and 4 in Duck Key Channel
- install an information sign for 'residential traffic only' on lead marker to Duck Key Channel
- install a chain of gated daymarkers along Toms Harbor Channel (12-16 daymarkers)
- install an informational sign indicating the controlling depth for the Toms Harbor Channel chain

Medium Priority

- install a chain of gated markers at Toms Harbor Cut (6-10 daymarkers)
- install an informational sign indicating the controlling depth for the Toms Harbor Cut chain

Low Priority

Notes:

Although the main entrance channel to Duck Key is well marked and no damage is indicated, it is reported that quite a few boats do not see the lead markers and head into Duck Key Channel by mistake. Installing a head-pin further outside the existing lead markers may be a consideration in the future, after monitoring the effectiveness of the adjacent recommended marker installations.

Survey Number: 13

Date: 6/18/97

Region: Middle Keys

Area: Vaca Key & Vicinity- Bayside

Range: Bamboo Key to Red Bay Bank

Assisting Parties: Private fishing guide, Capt. Karl Wagner

Launch Location: Private dock in Duck Key

Vessel Type: 22' Aquasport

Conditions: Mostly clear, winds SE 10 kt, good visibility

Time: Approximately 4 1/2 hours

General Overview:

The bay side of Vaca Key and Fat Deer Key has surprisingly little damage nearshore. There is relatively deep water at most of the approaches to shoreline developments. The central areas of concern are the bank systems to the west and northwest of Marathon. A few of the banks are currently marked with lateral aids, but still sustain extensive damage from both fishing and general recreational vessels, particularly during lobster season.

Big changes to the ATONS system have been underway in this area since the spring of 1997 when the USCG started revamping both the Moser Channel route and the historic ICW route. The new Moser Channel route is now complete and extends eight miles north of the 7 Mile Bridge, threading through several shoals and heading toward Cape Sable. The east-west route has also been improved with the addition of several lateral aids as well as shoal markers. Numbering has changed on all the east-west aids west of Rachel Bank. The formerly marked route which split southwest off the old ICW at marker #20 (formerly #16) is being eliminated and daymarkers have been replaced with shoal markers. So, the more southerly route will still have points of reference for traversing the area, but no numbered lateral aids.

Survey Assessment:

On the south side of Bamboo Key there is a small area of light scarring. This damaged shoal area adjacent to the small island is quite obvious. The scarring is mostly due to rental boats and general recreational vessels without local knowledge transiting the area, as well as approaching the island. No marking is suggested.

At the north entrance to Vaca Cut there is a severely scarred shoal on the west side of the channel. There is a narrow natural channel between the shoal and the shore which is heavily used. The prominent shoal is an obvious problem and scarring would be minimized with the addition of one more set of gated markers on the southeast side of the shoal. These markers should be designed as part of a continuous marked route coming in from the ocean (see survey #14 assessment for more details). Additional markers here will significantly increase boating safety as well as addressing the scarring problem.

The small pockets of scarring indicated northwest and southwest of Russel Key appear to be very light and of little significance. There is a good unpermitted marked channel leading into Stirrup Key subdivision, minimizing any damage in that area.

The moderately scarred area indicated leading into Roosevelt Point Dodge, just east of Rachel Key, was not seen. This area does not appear to be a problem.

At the small cut-through off Crane Point very little scarring was seen, just some pitting and blowout areas.

At Key Boat Works a dredged channel permits access to large commercial vessels. An area of severe scarring is indicated on the west side of the dredged area. However, little damage was seen. There are just a few straight lines from deep draft boats approaching the area.

Very little scarring was seen off the point leading into Faro Blanco. Large vessels do use the marina however, and prop dusting is often observed.

Moderate scarring was seen on the shoals just around the western most of the Fanny Keys. There is a dredged channel leading into this area, and boats appear to be short cutting

across the shoals and not using the channel appropriately. This area however is quite small and insignificant. There is a larger, more severely scarred area just west of that, at the approach to 7 Mile Marina. Numerous small buoys lead into the marina to assist boaters and there is also a separate buoyed exit for jet skis. No further marking is suggested

The banks northwest of Marathon are fished heavily by flats boats and experience increased pressure during high season. Locals know the bank system pretty well and most of the scarring is likely due to lack of local knowledge. The USCG has installed several new markers bordering this bank system. There is a new Moser Channel marker #13 marking the edge of the shoal northwest of Red Bay Bank. That marker should minimize the moderate damage in that area. The newly installed Moser Channel marker #16 is intended to be gated with Bullard Bank LT #17 but is nearly a mile away. Marker #16 should be relocated adjacent to #17. Red Bay Bank is extensively scarred and will be helped somewhat with the addition of the #13 marker. The installation of a shoal marker at the eastern edge of the bank would provide a reference for boats traversing from both the north and east, in addition to keeping boats off the bank. This will work well in conjunction with the new USCG shoal marker on John Sawyer Bank. The moderately scarred Middle Banks will benefit from new markers on all sides. The severe scarring across Bethel Bank will be minimized with the newly installed sister marker to #20 (previously #16), as well as other new markers adjacent to the bank.

The Pigeon Key Banks have several natural channels running north to south with the adjacent shoals incurring extensive damage. Most of the damage is on the north side of the 7 Mile Bridge and would be minimized with the simple installation of shoal markers at either end. This would be consistent with the changes that the Coast Guard has made in the area, changing daymarkers over to shoal markers.

Knight Key Bank always has problems and is severely damaged. Although marked on the north end, and quite obvious on the charts, boaters consistently run aground here. The existing marker on the northeast end of the bank was recently changed over from a lateral aid to a shoal marker by the USCG. The boating problems here warrant the installation of an additional shoal marker on the southeast side of the shoal.

Both John Sawyer Bank and Rachel Bank incur damage, but the existing markers on the north edge of each shoal should suffice. No additional marking is suggested.

Suggested Plan:

High Priority

- install an additional set of gated markers at the north entrance to Vaca Cut
- install a Danger Shoal marker at the eastern edge of Red Bay Bank
- install two Danger Shoal markers at either end of the north side of Pigeon Key Banks
- install a Danger Shoal marker on the southeast side of Knight Key Channel

Medium Priority

-relocate Moser Ch DBN #16 adjacent to marker #17

Low Priority

Notes:

The marking of either side of Vaca Cut should be designed as one marker route, and colored/numbered accordingly (see Survey 14). This would change the colors and numbers of the existing markers at the north entrance.

Survey Number: 14

Date: 7/15/97

Region: Middle Keys

Area: Vaca Key & Vicinity- Oceanside

Range: From the southern tip of Grassy Key to Boot Key Harbor main channel entrance

Assisting Parties: The Nature Conservancy, Capt. Gil Marlowe

Launch Location: Gil Marlowe's home on Flamingo Isle

Vessel Type: 24' Grady White

Conditions: Clear, winds east at 5 kt, good visibility

Time: Approximately 6 hours

General Overview:

The ocean side of Marathon, up to the south end of Grassy Key has a slightly different suite of boaters than we find in the north part of this region. There is little, if any, flats fishing in the area. There are more recreational boaters and large pleasure craft, particularly due to the yachting population of Marathon. Also, the Marathon area has a high level of winter residents and rental boat users. There are few dive operations based on the ocean side. The only crossing traffic is through Vaca Cut, which is very poorly marked. Numerous shoals make approaching channels (both natural and man-made) somewhat tricky, although most areas are currently well marked. One of the biggest problems is at Vaca Key Bight, where numerous historically dredged channels run north and south through the expansive shoal area providing access to shoreside developments. Although there is extensive light scarring throughout the survey area, there are only a few significant areas of scarring that need to be addressed.

Survey Assessment:

There are two areas of light scarring at the southeast end of Grassy Key, due to shoals just off of shoreside homes and Rainbow Bend resort. This scarring is not significant.

Light scarring is indicated adjacent to the approach to Crawl Key. There is a fairly well marked channel that makes an S-turn going through the best water into the small harbor. Marker #9 is not in the position indicated on the NOAA charts. The scarring outside the channel appeared to be fairly insignificant.

There is a newly installed extension of the Coco Plum Channel which has about five feet of water all the way through. The severe scarring indicated on prop scar maps was not seen, but if present would be due to deep draft vessels going in and out of the entrance. The light and moderate scarring indicated along Coco Plum Beach is just a wide dredged area.

At the entrance to Bonefish Bay channel the severe scarring indicated was not seen. There is at least five feet of water all the way in to the channel entrance. There is a large shoal in Bonefish Bay which incurs scarring. A marking project is already underway for this area and should address scarring within the bay.

Vaca Cut is the most heavily traveled route in this area and has extensive scarring on the west side of the previously dredged channel. Scarring is due to a combination of extensive shoals, a lack of local knowledgeable, and the lack of gated markers along the length of the channel. In addition, there is added confusion due to the north approach having markers laid out in the opposite direction. The entire cut should be marked as a through route with the addition of a series of gated markers, as indicated on the accompanying survey map.

There are six previously dredged channels running north and south across the shoals in Vaca Key Bight. The most easterly channel, 97th St. Canal, was recently marked and serves numerous subdivisions. Others are marked with PVC poles. There is still light prop scarring all across the shoals. There is nothing more that can be done in this area, short of denying access to the numerous subdivisions.

The severe scarring indicated at the approach to Sombrero Beach Villa is a wheel ditch well marked with two large pilings and numerous PVC poles. This area is not a problem. The moderate scarring indicated at the southerly approach to Sombrero Beach Villa was not seen from the water survey.

Two small areas of moderate and severe scarring were seen at the shallow, narrow approaches to the subdivisions adjacent to Tingle's Island. No marking is suggested.

Sisters Creek is a big trouble spot due to the shoals on both sides of this natural channel and the heavy boat traffic. Large vessels ground at the approach to the creek routinely. The addition of sister markers to the existing markers would help keep boaters within the channel, prevent incorrect rounding, and deter short cutting before reaching the lead marker. The shoals extend west to West Sisters Rock and beyond. This is a popular 'sand bar' area for local recreational boaters, particularly on weekends. This trend is inviting inappropriate draft vessels into this shoaly area and scarring will probably increase. A shoal marker in the vicinity may deter some boaters from approaching the shallows, or at least make them more careful as they approach.

Shoal areas continue around the southwest tip of Boot Key and severe scarring was seen along the shallowest spots. This is due to general recreational boaters being careless and running too close to shore when traversing the area. Marking would not be appropriate here.

Scarring continues along the shoreline near the approach to Boot Key Channel. Most of the scarring is due to boats short cutting and not giving a wide berth to the shallows nearshore. The permitted markers at Boot Key Channel are in extreme disrepair and were not constructed with appropriate materials. The piles are PVC poles and nearly all the boards are missing.

The Boot Key Harbor marking chain has several problems. There is severe scarring along the north side of the channel from markers #3 through 7. These markers need to be gated to prevent incorrect rounding. Also, there are several unpermitted and illegal red signs on both sides of the channel indicating a 'slow speed' zone. The shape and color of these signs are very misleading as placed. Also, the terminal markers, #20 & 21, have always been a source of confusion, as they appear to head toward Sisters Creek rather than Boot Key Harbor. It gives the appearance of red-left-returning coming in from Sisters Creek. The entire Boot Key Harbor route may be reworked in the future with the development of the proposed municipal marina (see Notes).

Suggested Plan:

High Priority

- install sister markers to #1, 3, and 6 in Vaca Cut
- add four sets of gated markers among existing markers in Vaca Cut
- install sister markers to #2, 3, 4, 6, and 8 in Sisters Creek

Medium Priority

- install a Danger Shoal marker at the southern edge of the shoals west of Sisters Creek
- remove unpermitted 'slow speed' zone markers in Boot Key Harbor channel
- install sister markers to #3, 5, and 7 in Boot Key Harbor Channel

Low Priority

Notes:

The scarring associated with West Sisters Rock is severe and difficult to address. This area needs to be looked at again. An attempt should be made to deter traffic or re-route traffic in this area. This is one area where boaters do not seem to care, and just plow across the shoals.

The owners of the private permitted markers at Boot Key Channel need to be contacted about replacing all their markers to bring them up to standard materials and suitable condition.

The Boot Key Harbor marker chain needs to be looked at further to determine needs and relocate some of the markers, mainly within the actual harbor. The biggest problem is with the terminal markers that are confusing and appear to lead to Sisters Creek rather than further up the dredged channel along the south shore of Boot Key Harbor. In consideration of the future Municipal marina and current confusion, redesigning the marker chain is strongly advised.

LOWER KEYS

The Lower Keys encompasses the islands and coastal areas from Moser Channel west to Boca Grande, approximately ten miles west of Key West. This region includes the major populated islands of Bahia Honda Key, Big Pine Key, the Torch Keys, Ramrod Key, Summerland Key, Cudjoe Key, Sugarloaf Key, Big Coppitt Key, Boca Chica Key, Stock Island, Key West, and several smaller keys, in addition to the numerous mangrove islands of the back country.

A total of nine surveys were conducted in the Lower Keys from 29 July to 17 October, 1997. Several county, state, and federal agencies provided logistical and

informational support in conducting these surveys. Several aerial surveys were required to view some of the more isolated, shallow areas.

Region Characterization

The Lower Keys span approximately fifty miles, comparable in length to the Upper Keys. However, this region contrasts geographically with the other regions of the Keys. The Lower Keys region is much more two dimensional, with the islands, cuts, and basins spanning between five and twelve miles from the ocean to gulf sides. Most of the islands in this region are oriented north to south, with long channels separating the keys. Many of these keys are relatively large, several with shallow, yet navigable routes through the sounds.

There are several intricate systems of shoals oceanside, with narrow natural channels winding through. But the most characteristic feature of the Lower Keys is the back country region between US1 and the Gulf of Mexico. This is the true back country of the Keys and covers over five hundred square miles of shallow basins, tidal creeks, mangrove islands, and extensive protected areas. This area was once marked with federal markers from east to west, but the aids were removed by the USCG since plans to dredge the route by the Army Corps of Engineers (ACOE) were dropped. The route now only has scattered PVC poles providing direction to shallow draft vessels. Local knowledge is required to properly run the back country, as there are dozens of cuts and wheel ditches which are routinely used to traverse the area. Boater safety is a big concern in the isolated areas of the back country, and channel markers to assist FMP and USCG for emergency responses are an important consideration.

Most of the back country area is within US Fish and Wildlife Service (USFWS) refuges, which were created to provide sanctuary to native birds and other wildlife. Channel marking within the refuges is discouraged due the sensitive nature of much of the habitat. The USFWS has concerns that formal marking will draw in more boaters and increase impacts. Furthermore, there are numerous areas within the refuges designated as 'Wilderness' where the presence of signs is considered visual pollution and the installation of markers would be counter to the mandates of these highly protected areas. Many of the islands in the refuges are important bird rookeries, and slow speed and vessel exclusion zones have been established by USFWS to provide increased protection in these sensitive areas.

The island areas beyond Key West, heading toward the Marquesas Keys, comprise the Key West National Wildlife Refuge and are part of a different marine environment. The ten mile wide area, known as The Lakes, is set out in open water on shallow banks. A marked route runs through the area, passing by numerous small scattered islands. Though this area is near-pristine it receives increasing pressure due to the proximity to Key West.

There is a wide variety of user groups in the Lower Keys, like the regions to the east. The habitats are quite diverse, attracting large numbers of Keys residents as well as the thousands of tourists that find their way to Key West. Much of this region, outside of Key West, is used mostly by locals until the population swells during season. Trends can be observed throughout this region, with particular areas being most damaged by specific types of users. Surveys included the ocean side waters out to one mile offshore, where depths typically drop beyond the limits of prop scarring. On the north side surveys covered all of the back country out to the Gulf of Mexico.

Cooperating Agencies & Volunteers

The waters of the Lower Keys include several state and federally managed areas, including: National Key Deer Refuge, Great White Heron National Wildlife Refuge, Coupon Bight State Aquatic Preserve, and Key West National Wildlife Refuge. We met with the managers of both USFWS and the Aquatic Preserve and informed them of the scope of this project and the surveys being conducted in their areas. Each of the area managers provided input and support as needed.

In conducting surveys in this region we utilized vessels and captains from several agencies, including; Florida Keys National Marine Sanctuary, US Fish and Wildlife Service, Coupon Bight State Aquatic Preserve, Monroe County Department of Environmental Resources, and the Monroe County Sea Grant Extension Office. The boat drivers, including both marine and wildlife biologists, provided informed input on user groups, routes used, and damage patterns seen throughout this expansive region. Their input provided valuable insight to boating trends, impacts, and management needs in both the populated coastal areas and the vast back country region.

Assessment Summary

The Lower Keys does not incur the boating pressure and damage seen in the Upper Keys, but is still significant in the extent of resource damage. This region spans approximately 35% of the length of the archipelago, but covers more than half the surveyed area of the Keys due to north-south orientation of the major islands and the enormous back country area coverage. One third of the damage in the Keys is found here, most of which is light to moderate scarring. Damage in some of the channels and back country areas can be attributed to the lack of channel markers and expansive flats and shoal areas. Boating pressure from non-locals is not as great in this region, as many visitors choose to stop in the Upper and Middle Keys for boating. Other than in Key West, there are no large resorts here that contribute to high boating impact. Most of the larger damaged areas are due to vessels traversing shoals that span popular routes, both for recreation and commercial use. There are numerous back country routes that are heavily used, mostly with local knowledge, that have historic cuts and wheel ditches through shallow controlling sections dividing the larger basins. Though primarily used by shallow draft vessels, many larger commercial boats traverse these areas, using the tides and extensive experience. There are a large number of boats in the Lower Keys but the sheer area of the back country minimizes boat densities, which is probably one of the reasons for a lack of major scarring in this region. The population of the small resorts and campgrounds increases significantly in season, and these boaters may be responsible for much of the seagrass damage.

A user pattern seen in several areas of the Lower Keys is the scarring and dredging caused by commercial fishing vessels. Seagrasses along the historic routes used by fishermen out of Marathon (heading northwest) and Summerland Key incur damage due to the inappropriate draft of the vessels. Large areas are scarred from this continual inappropriate use.

A prominent user group in this region is liveaboards. Several heavily used anchorages are located in the Lower Keys south of US1 with access to the ocean side. Most of these anchorages are relatively shallow and incur scarring and often denuding from swinging ground tackle and dragging keels.

Flats boats are found throughout all the back country areas, but some of their impacts may have leveled off, as most of the cuts and routes that can be used or prop dredged already exist. As in other areas of the Keys, flats fishermen here appear to be conscientious in their boating practices.

Many of the island areas bordering the Gulf incur damage from weekend party traffic accessing some of the beaches and mangrove creeks. Some of this activity occurs on the more sensitive islands under the jurisdiction of USFWS and these activities are prohibited.

Jet skis have some impact but are excluded from most of the back country by USFWS regulations. Most of the jet ski pressure is seen in the Key West vicinity. Jet skis are excluded from all of Key West National Wildlife Refuge.

There are numerous rental boat facilities that contribute to increased boating pressure, particularly in season. Users of these vessels utilize most of the habitats in this area, but are not typically associated with the heavy party boating seen in the Upper Keys.

Several charter boats and ferries contribute to seagrass damage en route to their destinations due to inappropriate draft. These vessels often prop scar and/or prop dust as they pass through shallow areas.

In the central part of this region, many boaters impact shallow areas by using an inappropriate nearshore oceanside route. This is a short-cutting pattern that has left numerous prop dredged channels. Short-cutting in and out of marked channels is also common throughout the Lower Keys.

Recommended Markers

Channel marking recommended for the Lower Keys includes: limited marking of new unmarked channels, improving existing channels by increasing the frequency of markers, gating ungated channel markers, relocating existing markers, changeover of marker types, installation of Danger Shoal markers, installation of controlling depth signs, upgrading dayboard signs, the application of secondary channel markers, and changeover of buoys to daymarkers.

The following list breaks down the number and kinds of markers recommended for the Lower Keys region. Numbers of markers are approximate. Marking recommendations are minimal considering the size of the region. This is primarily due to the expanse of the back country where water depths typically make marking inappropriate, in addition to the priorities of the USFWS refuges. Marking

recommendations may increase after further review of particular back country areas.

<u>Type of Marker</u>	<u>Signage</u>	<u>Misc.</u>	<u># of Markers</u>
Daymarker	green/red		61
Information	Danger Shoal		13
	Controlling Depth	existing pile	4
		Total Markers	<u>74</u>
		(daymarkers & shoal markers)	
		Signs only	<u>4</u>
		(controlling depth signs)	

Of the sixty one daymarkers recommended for installation, thirteen would be installed in existing federal marker chains.

In addition to the above marker installations, two pilings are recommended for removal and five markers are to be relocated.

Special Note on Niles Channel

Channel marking of Niles Channel has been an issue for over a decade. This channel is not marked (north of US1) and has long been used by commercial fishing vessels out of Summerland Key. Some of these boats have contributed to scarring, particularly along the shallower sections at the north end of the channel. Most of these fishermen have voiced the desire to have markers installed, although they often claim that they themselves are quite familiar with the route and are not the user group causing the benthic damage. However, markers would certainly help fishermen during periods of inclement weather and poor visibility. Many fishermen also feel (incorrectly) that by running through a marked channel it will preclude them from any possible charges of prop dredging.

The construction of the new bridge over Niles Channel in the early 80's provided more incentive to install markers. The forty foot high bridge now allows larger vessels to enter the upper reaches of Niles Channel. Along with this development was the associated benthic damage caused by the contractor responsible for towing construction barges to the building site. The severe dredging and loss of seagrass habitat resulted in a federal court ruling establishing willful prop dredging by the offending company, M.C.C. of Florida, Inc., and levied extensive fines (Case NO. 81-2373-CIV-EBD).

The central problems with marking Niles Channel have been the sheer lack of water along the controlling sections, and objections by USFWS to install markers within their protected areas. The 3-4 foot controlling sections make it difficult to justify marking, particularly due to the types of vessels that are likely to use the channel (heavily laden fishing boats, large yachts, etc.). Other concerns are that markers will establish a 'highway' into the backcountry which may increase the number of users and the amount of damage, as well as the disturbance to wildlife in the area. There is also a concern that concentrating scars may be worse than having random, spread-out scars. One of the biggest concerns is that marking through the previously dredged area (by M.C.C.) may be seen as legitimizing prop dredging, and encourage further scarring and dredging in other areas.

In 1995 the County approved a plan to mark all of Niles Channel. This plan was met with great controversy and several public meetings were held to discuss the issues. As in the years before, most of the fishermen were for marking while numerous agencies were against any installations that may exacerbate the resource damage problems. The County attempted to address the objections, and conducted several site visits to review the situation with the concerned parties (FKNMS, EPA, DEP, USFWS, ACOE, NMFS, TNC, MCCF). A year later a solution was still not reached and it was decided to wait until the Channel Marking Master Plan was conducted and review the findings at Niles Channel within the context of seagrass damage throughout the Keys. However, before the master plan was begun DEP offered the County a modified marking plan for Niles Channel that provided a compromise solution, hopefully making both sides happy. This plan calls for fewer markers, only in the most needed areas, and avoids creating a through route from the ocean to bay sides.

Because the Channel Marking Master Plan evaluates all areas within the Keys by the same criteria, many of the previous issues were not considered when making recommendations for Niles Channel. This has resulted in this plan recommending

no lateral aids through the channel, but rather several strategically placed shoal markers. However, due to the importance of the issue it has been decided that Niles Channel should be considered separately from the master plan. The numerous agencies and private interest groups previously involved will again visit the site in spring 1998 to determine if the modified marking plan is indeed the best method for marking Niles Channel. The County Department of Marine Resources expects that the plan which is finally chosen will be a compromise for many of the concerned agencies and groups, and will enhance navigation in the area while still addressing the critical environmental concerns.

Survey Number: 15

Date: 7/29/97

Region: Lower Keys

Area: Bahia Honda & Vicinity

Range: From Moser Channel west to Spanish Harbor and north to Little Pine Key

Assisting Parties: Florida Keys National Marine Sanctuary, Capt. Lauri MacLaughlin

Launch Location: Sanctuary dock at Bahia Honda State Park

Vessel Type: 21' Mako walkaround

Conditions: Partly cloudy, winds SE 5-10 kt, good visibility

Time: Approximately 6 hours

General Overview:

Most of the scarring in this survey area ranges from light to moderate and is located primarily around the smaller islands along US1 and the adjacent shoals. Less scarring (in area) is indicated north of US1 through Bogie Channel and beyond the No Name Key Bridge. This difference in scarring patterns can be attributed to higher numbers of non-local, recreational boaters going in and out of Bahia Honda State Park, Sunshine Key (Ohio Key) campground and

marina, and the several boat ramps along US1. Through routes under US1 are not suggested as bridge clearances are minimal, though several natural channels do exist. From Bahia Honda Channel west we find mostly local traffic traversing that channel and Bogie Channel, running north-south routes and going in and out of numerous subdivisions. The unmarked route through Bogie Channel is generally muddy in the deeper areas with extensive hard bottom as well as seagrass shoals adjacent to the channel. Running into the shallow hard bottom flats is a self correcting problem, so fewer areas actually have seagrass scarring.

The USCG just completed modifications to the federally marked routes in this area in the fall of 1997. The historic ICW route has been improved with the addition of several lateral aids. The southerly route, branching off the ICW and running south out Bahia Honda Channel has been eliminated with the changeover of lateral aids to shoal markers. Although most of the changes are beneficial there appear to be some inconsistencies that are addressed below.

Survey Assessment:

An area of moderate scarring was seen across a rocky shoal just northwest of the historic ICW marker #26 (formerly #18). Gating marker #26, at this slight bend in the ICW route, should improve navigation in this area and minimize the risk of taking #26 on the wrong side and grounding on the shoal. In addition, there is a smaller lightly scarred area about a half mile northwest of #26. That area is in about three feet of water and did not appear to be very significant.

There is a lightly scarred shoal adjacent to ICW marker #25 (formerly #17). This daymarker is about one half mile south of the route it is intended to mark and may tend to draw boats close to the shoal. This is the only marker on the former route that was left as a lateral aid. This marker could be easily changed to a shoal marker as it is adjacent to a pronounced shoal area, which would be consistent with the recent USCG changes.

There are several lightly scarred areas surrounding the Molasses Keys. This is a popular weekend destination for camping, swimming, etc., and gets heavy use. The several shoal areas are relatively easy to navigate and do not warrant channel marking.

Money Key is another popular area due to easy landing and anchoring. Numerous shoals on both sides of the island only incur light damage.

Moderate scarring was seen in the vicinity of Little Money Key due to an extensive shoal and cross traffic through the somewhat tricky, small natural channels. Channel marking is not suggested here.

There are small areas of scarring on both the north and south sides of the 7-Mile Bridge leading to a small boat ramp at the east end of Little Duck Key. Although the narrow natural channels are somewhat tricky, no channel marking is suggested due to mostly light scarring seen in the area.

The former marker #19 was changed to a shoal marker by USCG. Although this is preferable to a lateral aid the marker is in six feet of water. The marker would be more appropriately positioned at the north edge of one of the several shoals off of Ohio, Missouri, or Little Duck Keys as indicated. Numerous shoals may benefit from the proper placement of a single shoal marker in that area, while still providing a reference for boats traversing the area. Markers #20 and 22 were also changed to shoal markers and should be removed, as they are both in six to seven feet of water and not adjacent to any shoals.

There is extensive, moderate scarring on both sides of the Bahia Honda-Ohio Key Channel north entrance. The two sets of small buoys maintained by Sunshine Key Marina are not very effective due to their size and placement. This is a heavily used area due to crossing traffic, and the numerous slips and fuel docks at the marina. The buoys should be changed over to standard daymarkers and placed more effectively to minimize damage, considering present travel patterns. Damage on the approach at the south end of the channel is light. There are sandy, shifting shoals here and marking is not suggested, primarily due to the restrictive height of the bridge.

There is a small area of light scarring just off the western tip of Bahia Honda Key caused by boaters short cutting rather than rounding the small islet (Little Bahia Honda) further out. There is another small area of light scarring just across Bahia Honda Channel, on the north side, across a very shallow rocky shoal. Neither of these areas warrant channel marking.

There is a small lightly scarred area leading into Camp Sawyer on the western end of West Summerland Key. Very little scarring was seen at this location from aerial surveys.

There are two small lightly scarred shoals on either side of the channel on the south side of the Spanish Harbor Bridge. Much of the boating traffic leading through this area and north through Spanish Harbor and Bogie Channel is local, which may contribute to lighter damage in these areas.

There is a very small area of moderate scarring at the approach to Big Pine Key Fishing Lodge. This damage did not appear to be significant.

There are three small lightly scarred shoals southeast and west of Don Quixote Key. These areas are approached via a heavily used dredged channel, adjacent to an old borrow pit on the north side of Spanish Harbor Keys, connecting Bahia Honda Channel with Spanish Harbor. These scarred areas are fairly insignificant and the connecting dredged channel appears to be well known and properly used by most local traffic. Several PVC poles mark the channel.

There are several small to large areas of scarring along the east side of Bogie Channel. There is a very small area of severe scarring at the tip of the shoal extending south of Big Mangrove Key. A small area of moderate scarring is at the western end of the shoal located half way up Bogie Channel. The most extensive scarring was seen all across the shoal west of No Name Key. A chain of lateral aids may be appropriate to route boaters from Spanish Harbor, up through Bogie Channel to the No Name Bridge, especially considering the amount of boating traffic through here.

A significant area of moderate scarring is indicated off the end of the groin going into Big Pine Shores (Kohen subdivision). The scarring was not seen by boat or from aerial surveys. This area is in five feet of water and if it was scarred it would have been from larger deep draft vessels.

Markers #1 and 2 just south of Porpoise Key are the only remaining federal markers from the old back country marker route which was removed in the last ten years. The two existing markers only lead boats from Big Spanish Channel to the adjacent, western dead end channel just off the northeast shoreline of Big Pine Key. Only unpermitted markers exist from there across the old, extremely shallow back country route towards Key West.

Suggested Plan:

High Priority

-install a sister marker adjacent to marker #26 on the old ICW route

-changeover Ohio Key Channel buoys to standard daymarkers

Medium Priority

-change ICW marker #25 to a Danger Shoal marker

-move Little Money Key Danger Shoal marker (formerly #19) south, next to the nearest shoal

-install 4-5 sets of gated daymarkers through Bogie Channel

Low Priority

-remove two Danger Shoal markers (formerly #20 and 22)

Notes:

Several of the markers that were changed over by the USCG from lateral aids to shoal markers may be inappropriate due to locations in over 6' depths (# 19, 20, 22). Shoal markers in the coastal areas of the Keys would be more helpful for recreational boaters if used to indicated depths of less than 2 or 3 feet. These markers should either be removed or, as in the case of #19, moved to the edge of an adjacent shoal (see above). All opinions and suggestions for changes to or relocation of present and proposed markers are indicated on the accompanying survey map.

Survey Number: 16

Date: 8/14/97

Region: Lower Keys

Area: Jack Bank & Vicinity

Range: The backcountry areas from Jack Bank west to Rocky Channel and Harbor Channel

Assisting Parties: Florida Keys National Marine Sanctuary, Capt. Lauri MacLaughlin

Launch Location: Sanctuary dock at Bahia Honda State Park

Vessel Type: 21' Mako walkaround

Conditions: Mostly clear, winds SE 10 kt, good visibility

Time: Approximately 6 hours

General Overview:

Most of this survey area is within the USFWS refuges and the policies and concerns of refuge managers are an important consideration for assessments and suggestions. Any channel marking suggested in this survey area will be minimal due to the sensitive nature of the refuge waters and islands. Only Big Spanish Channel is formally marked, providing a route leading

through the backcountry and north to the gulf. The more remote areas are marked with PVC poles and appear to be fairly effective when used with local knowledge.

The predominant seagrass damage in this survey area is around Jack Bank. In fact, the scarring on and adjacent to Jack Bank is the single largest area of damage in the Lower Keys, at greater than three thousand acres. This is twice the size of the extensive damage in the Windley Key and Tavernier Creek areas in the Upper Keys. This problem, however, is much different in that it goes mostly unnoticed, and the most severe damage is caused almost exclusively by a single user group. The worst scarring is in the four to five foot deep channel referred to as 'The Box'. Commercial fishermen out of Marathon use this channel heading northwest to fishing grounds in the gulf. Several other unmarked channels, running parallel, also lead to the gulf. But, 'The Box' provides the best protection in heavy weather from the north. These use patterns have led to long-term damage, and scars in varying degrees of recovery can be seen. The trap boats often draw slightly too much for the water, particularly during lower tides and when loaded down.

Other damage in the survey area can be seen in numerous small pockets adjacent to channels, in shallow 'bump' areas, or at the unmarked entrances to the several channels leading south from the gulf. Most of these areas are indicated as lightly scarred, and are more often sandy blow-out areas rather than prop-scars. It is difficult to determine whether many of these areas are natural or the long term results of scarring and scouring.

Survey Assessment:

There are two small areas of scarring indicated at the northwest edge of Horseshoe Bank. Both areas are 'bumps' adjacent to the channel and are mostly large sandy blow-out areas which may have been caused by boats wandering outside the channel and onto the seagrass in about three feet of water. These areas are relatively insignificant.

A long lightly scarred area was seen south of Horseshoe bank on a very shallow shoal adjacent to a wide channel where The Box and Horseshoe Channel meet. Channel marking is not suggested.

The Jack Bank area has two distinct, adjacent areas of scarring. The actual shoal has light to moderate scarring over the entire area. This is mostly due to smaller recreational vessels approaching and coming onto the bank in search of the numerous bomb holes, which are popular snorkeling sites. Long scars can be seen from both water and aerial surveys heading in from the edges of the bank, and out from the bomb holes. This shoal is expansive and the scars are somewhat spread out and infrequent. Marking would not appear to help, as this area is quite remote and marking would only invite more boaters into this otherwise natural region. The severely scarred area along the southwest edge of Jack Bank is from larger commercial fishing boats traversing 'The Box', often wandering into the shallower areas on the outskirts of the bank. This moderate and severely scarred area is approximately one quarter mile wide and over two miles long. Both aerial and water surveys confirm this heavy scarring which consists of numerous, mostly parallel scars, in three to five feet of water. The scars are typically over two feet wide and quite deep. Scars appear to be both old and new. Scarring patterns indicate the seasonal use of the channel, primarily during fall and winter, with scars from different years in different stages of recovery. Unpermitted markers are located at strategic points along the channel mainly on the east side (along the edge of the shoal), starting at the south end of Jack Bank. Several PVC poles are also located on the shallow bump in the center of the channel at the

northern approach. Several pockets of light to moderate scarring were also seen on either side at that same point, where the channel splits. Boats obviously have a choice as to which of the two deeper channels to take at the north end of 'The Box'. Though most of the commercial boats have navigational electronics and experience in this area, navigating could be assisted with the installation of markers along the edge of Jack Bank and at the conspicuous mid-channel bump. Final suggestions will be held off until we receive more input from commercial fishermen using the area (see Notes).

There are several areas of light to moderate scarring indicated around the shallow edges of Bullfrog Banks. These areas were found to be sandy blow-out patches which may or may not be long term results of prior scarring. The most severe damage is indicated at the south side of the bank, where commercial boats may be short-cutting between Rocky Channel and The Box. The existing marker 'BB' is helpful, but may be an inappropriate marker application as it is a 'no lateral significance' marker, but can only be taken on one side as it marks the shallow shoal. No further marking is suggested here.

There are similar blow-out areas, with a few prop scars around the northern edge of Spanish Banks and one lightly scarred area at the bump at Turtle Crawl Bank.

There are several patches of light damage indicated in the Harbor Bank area and along the western edge of Harbor Channel. There is a PVC marked channel cutting through the bank that is heavily used. This area is a popular recreation spot with lots of fishing, snorkeling and lobstering. The damaged areas were found to have both sandy blow-outs and some scattered prop scars. There are more PVC markers heading down Harbor Channel leading into Pine Channel.

There are more lightly scarred areas indicated northeast of Little Spanish Key across numerous 'bumps' along the western edge of Rocky Channel. Aerial surveys confirmed only light scattered scarring in this isolated area.

There is an area of moderate scarring across the shoal on the backside marker #43 (formerly #33) in Big Spanish Channel. This is a congested area with numerous markers, none of which are gated. Marker #43 is the first marker heading north in this stretch and would be appropriate as part of a gated pair, reminding boaters of which way is red-right-returning as they are running in either direction, and helping to keep them off the shoal. The severely scarred area just southeast of #43 (not seen due to poor visibility, but known to be a problem) is probably due to deeper draft vessels transiting the channel. This brief stretch appears to be the controlling depth section of the entire Big Spanish Channel. Channel marking will not help this problem. However, it would be useful to install an information sign indicating the controlling depth at the north entrance to Big Spanish Channel, probably at marker #53.

Suggested Plan:

High Priority

- install either a series of shoal markers or lateral aids along the southwest edge of Jack Bank
- install an information sign, indicating the controlling depth, at #53 in Big Spanish Channel

Medium Priority

- install a sister marker to #43 in Big Spanish Channel

Low Priority

Notes:

The scarring problem at Jack Bank, specifically in the area of 'The Box', needs to be looked at again to determine the state of the problem (whether it is getting better or continuing), and determine exactly which commercial fishermen are causing the problem (trappers, netters, etc.). We need the cooperation of the Monroe County Commercial Fishermens organization to better understand their fishing routes, vessel types, temporal fishing patterns, awareness of the problem, etc. Due to the remote location of this extensively damaged area this issue is new and will have to be explained to the fishing community to begin to address the situation and try to come to a feasible, acceptable solution. The answer may be a combination of limited channel marking and recommending the rerouting of vessels during certain periods (i.e. extreme low tides, loaded down vessels, etc.).

Big Spanish Channel is one of the major entrances into the Keys coming from the Gulf of Mexico and southwest Florida. Marker #53 (formerly #39) may be an appropriate location for an information sign explaining controlling depths in the Keys and along the ICW. This would be one of several major entrance points in the Keys chosen for the new informational signage being developed.

Survey Number: 17

Date: 8/19/97

Region: Lower Keys

Area: Pine Channel & Vicinity

Range: All of Pine Channel north to the Water Keys, and the old backcountry channel behind Annette Key and Cutoe Key

Assisting Parties: US Fish & Wildlife Service, Capt. Tom Wilmers

Launch Location: USFWS field office on Pine Channel

Vessel Type: 15' Boston Whaler

Conditions: Mostly cloudy, scattered showers, winds SE 10-15 kt, fair to poor visibility

Time: Approximately 4 hours

General Overview:

Pine Channel is relatively shallow with several large shoals which incur heavy damage, mostly from recreational boats traversing the area. There are several PVC marked routes guiding boaters between shoals, up the channel, and northeast between Big Pine Key and Howe Key. This area is heavily used by local boaters and has moderate to severe damage across nearly all the

shallowest areas. Damage decreases where Pine Channel meets the deeper, but narrow Harbor Channel to the north.

The old back-country route, formerly marked with federal markers, winds through this area and is lined with numerous PVC markers. The route begins at the northeast tip of Big Pine Key, running north of Howe Key and continues west between Big Torch and the Water Keys. This route is extremely shallow. Heavy scarring can be seen along the length of this route, particularly around the numerous shallow stretches and through island passes. This damage pattern is seen in subsequent surveys, all the way to Key West.

This entire survey area is within the USFWS refuges, and as such, management concerns are taken into consideration for marking strategies.

Survey Assessment:

Just south of the Big Pine/Little Torch causeway there are several areas of scarring. The light to moderate scarring adjacent to the southeast side of Little Torch is a good distance from the shore, adjacent to a dredged channel running along the shoreline. The moderate scarring indicated at the entrance to Cahill Pines and Palms on the eastern shoreline was determined to be a wheel ditch. More significant scarring was seen on the south side of the causeway, around a small anchorage area, mostly caused by recreational boats running the area. Channel marking is not suggested for these areas.

Several light to moderately scarred areas are indicated at the entrances to canals along the south Pine Channel shoreline. Most of these areas were found to be insignificant, including several prop dredged channels and some small denuded areas.

A shallow PVC marked route runs from southwest to northeast between expansive shoals heading toward the north tip of Big Pine Key. There is significant scarring all over this area on either side of this informal route. Continuing in that same direction is a heavily scarred wheel ditch adjacent to Port Pine Heights. Several PVC poles mark this area, but the extreme shallows and use by boats running through to Annette Key result in extensive scarring through and adjacent to the ditch. This area would not be appropriate for marking due to the water depth, location within the refuge, and the fact that this should not be considered a through route as it leads only to subdivisions on Big Pine and the even shallower back country route.

The worst scarring in this survey area is found across the shoals at the north end of Pine Channel. An informal route is run on the west side of the channel that connects to the Harbor Channel tongue to the east, which extends deep into the shoals. PVC markers indicate this preferred, dogleg route into the deeper Harbor Channel. That route has the deepest water and its use probably causes the least damage. However, another heavily used route continues running north in very shallow water, resulting in more severe damage. This entire area requires local knowledge to run, and even then can only be traversed with appropriate tides and draft. Although water depths in this part of Pine Channel are minimal, the extensive prop scarring warrants management action. A series of 'secondary' channel markers running from the northeast side of Middle Torch Key along the preferred route entering the tongue of Harbor Channel should help keep boaters off the expansive shoals along the middle of Pine Channel. Most boaters would likely use a marked channel through this area, allowing the adjacent seagrasses to recover. The newly marked route would also help provide a reference for boaters heading up the PVC marked route to Port Pine Heights.

There is a small area of scarring indicated at the cut-through at the north end of the Water Keys. This cut is probably used mostly by flats fishermen. No scars were seen from the survey. Prior seagrass scarring may have healed.

Several areas of scarring are indicated along the old back country route. Moderate to severe scarring was seen along a two mile stretch running northwest between Big Pine and Annette Keys before the route takes a westward turn at the northeast point of Howe Key. Numerous PVC poles line the not so obvious channel, directing shallow draft vessels along the beginning of the backcountry route. Scarring is indicated through and adjacent to (but still near) the informal route. This route appears to be usable only at middle to high tides. Similar scarring patterns were seen along a one mile stretch between Big Torch and the Water Keys, where few PVC markers remain to help boaters through this tricky section of the run. Markers are not a consideration for this route due to the sheer lack of water.

Suggested Plan:

High Priority

- install 10-12 sets of daymarkers on the west side of Pine Channel connecting to Harbor Channel
- install information signs indicating the controlling depth on lead markers for Pine Channel

Medium Priority

Low Priority

Notes:

The use of lateral aids in Pine Channel is not highly desirable due to the shallow water through the route. However, due to the severity of damage in the area and high levels of use limited marking is being recommended. By using smaller markers, informational signage, and marking only a two mile section of Pine Channel it is hoped that large vessels and non-local traffic will be deterred.

Survey Number: 18

Date: 9/2/97

Region: Lower Keys

Area: Newfound Harbor and Vicinity

Range: Waters south of US 1 from Coupon Bight to Niles Channel

Assisting Parties: Coupon Bight Aquatic Preserve, Capt. Charley Jabaly

Launch Location: Public boat ramp at Spanish Harbor Keys

Vessel Type: 16' Wahoo

Conditions: Partly cloudy, scattered showers, winds SE 10 kt, fair visibility

Time: Approximately 4 hours

General Overview:

The eastern portion of this survey area is within the Coupon Bight Aquatic Preserve. The preserve includes the bight itself and the numerous islands and cuts that make up the Newfound Harbor Keys. Large moderately scarred areas are indicated throughout the survey area. Most of this scarring is associated with the extensive shoals at the southwest side of Coupon Bight, the shallow eastern edge of Newfound Harbor Channel, and numerous shoals on both sides of the

approach to Niles Channel. Scarring patterns indicate a heavily used nearshore route south of Ramrod, and short cutting throughout the area.

Of particular concern is the inappropriate use of the shallow mangrove channels between islands of the Newfound Harbor Keys. None of the cuts have more than two feet of water, and most have less than one foot. However, several of the passes are regularly used, as indicated by the well placed PVC poles and adjacent scars. This is a special concern for the management of Coupon Bight, as closing of channels may become an option.

In addition to seagrass damage in the area is the severe impact at the nearshore patch reefs off the Newfound Harbor Keys. This is a unique problem due to the proximity of the shallow coral heads to shore and the heavily used Newfound Harbor Channel.

Survey Assessment:

Moderate scarring is found all across the two large shoals on the southwest side of Coupon Bight. These grass flats are extremely shallow and are routinely criss-crossed by recreational boaters. Though difficult to mark to prevent scarring, one shoal marker strategically placed at the tip of the shoal extending into the bight would provide a point of reference for boaters. This would be particularly helpful for those trying to go around the shoal. Adding a sister marker to #3 in Newfound Harbor Channel would also help keep boats off the most westerly of the two shoals.

The first two passes west of Long Beach are occasionally used as cross-overs, as indicated by the PVC poles, but appear to have minimal scarring. The pass between Cook and Hopkins Islands has extensive scarring throughout the cut, and depths are minimal, particularly at low to middle tides. Though well marked with PVC poles this cut can only be traversed at a higher tide, with local knowledge, and with a shallow draft vessel. In addition, a submerged water pipe supplying Little Palm Island is lying in only one to two feet of water at the northerly entrance creating a boating hazard. Damage through the cut, and at both entrances is severe. This pass should not be used, especially considering the concerns of the aquatic preserve. Closing the pass to traffic is recommended.

Light to moderate scarring was seen all around Little Palm and Big Munson Islands. Much of this scarring is from rental boats out of Little Palm (see Notes). The shoal extending southwest from Little Palm is scarred from short-cutting around the island. Marker #2 currently provides a reference for clearing the shoal but many boaters shortcut the marker heading southeast, causing moderate scarring. An additional red marker between #2 and Little Palm would better define the eastern channel edge and deter boaters from short-cutting over the shoal. There are also several older blown out spots at the Little Palm docks and around the east side channel approach. In addition, the nearshore coral patches just south of Big Munson Island have been heavily impacted by boats piloting in and out of the adjacent Newfound Harbor Channel. Part of the problem is the location of Hawk Channel marker #50 which appears to draw boats toward the coral heads. This marker needs to be moved to the southwest to lead boats away from the patch reefs, and create a better defined approach to Newfound Harbor Channel.

A poorly defined, unmarked natural channel leads north through Newfound Harbor. A moderately scarred area is located at the tip of a shoal where the channel leads to shorefront homes on both the Ramrod and Little Torch sides of Newfound Harbor. Only light scarring was seen across the adjacent shallow areas just south of US 1.

Large areas of significant scarring are indicated on every shoal adjacent to the Niles Channel approach. This channel is minimally marked. Cuts between adjacent shoals are heavily used and boats routinely miss the cuts, as is evidenced from scarring across all the shoals. The overall area would be vastly improved with a few well placed markers. A sister marker to #6 would help keep boats off the shoal to the west and help define the entire channel approach. In addition, another set of markers beyond #6 will further define the route and help lead boaters up the channel toward the bridge. A shoal marker at the south tip of the shoal extending off the southwest tip of Ramrod Key would provide a reference to boaters running an inside route between channels. A shoal marker just southwest of Niles Channel marker #5 may reduce scarring, mostly from larger commercial boats short cutting the area, and provide an additional point of reference.

A moderately scarred area is indicated just north of Pye Key. However, no scars were seen from the water or the air.

The severely scarred area indicated at the south tip of Summerland was found to be just a few sand patches adjacent to a wheel ditch leading into Summerland Beach.

Suggested Plan:

High Priority

- install a shoal marker at the tip of the shoal extending northeast into Coupon Bight
- install a sister marker to Newfound Harbor Channel marker #3
- install a sister marker to Niles Channel marker #6
- install a set of gated daymarkers between Niles Channel marker #6 and the Niles Channel bridge
- install a shoal marker at the south tip of the shoal extending south from Ramrod Key
- relocate Hawk Channel light #50 approximately 1/2 mi. to the southwest

Medium Priority

- install a red daymarker between #2 and 3 just west of Little Palm Island
- install a shoal marker at the tip of the shoal just southwest of Niles Channel marker #5

Low Priority

Notes:

Charley Jabaly, the aquatic preserve manager, has been advised to refer to Pat Wells and others on methods, procedures, and applications of closing inappropriate waterways. This appears to be the most practical way to deal with the hazardous and extremely shallow island passes in the Newfound Harbor Keys.

The management of Little Palm Resort should be consulted with on the damage occurring in their area primarily due to rental operations. The management needs to educate boat operators on the shoals in the area and appropriate boating techniques.

Survey Number: 19

Date: 9/3/97

Region: Lower Keys

Area: Niles Channel & Vicinity

Range: Niles Channel from US 1, through the eastern branch of Cudjoe Channel and to the gulf

Assisting Parties: US Fish & Wildlife Service, Capt. Tom Wilmers

Launch Location: USFWS field office on Pine Channel

Vessel Type: 15' Boston Whaler

Conditions: Partly cloudy, scattered showers, winds SW 10 kt, fair visibility

Time: Approximately 4 hours

General Overview:

Niles Channel has long been an area of controversy due to the request for channel marking by commercial fishermen and the opposing concerns of USFWS. However, for the purpose of this survey, the assessment was performed only with regards to the project goals and channel marking criteria.

Niles Channel is navigable throughout its length, with about a four foot controlling depth. Currently unmarked north of US 1, the channel winds west past Toptree Hammock joining the easterly branch of Cudjoe Channel. Light scarring is seen primarily near residential shorelines and canals along the west side of Big Torch Key. A few areas of scarring are also found along particular stretches of the channel caused by the deeper draft of commercial fishing boats. In addition, numerous smaller lightly scarred areas are indicated along the northern extreme of the study area, a pattern which continues throughout the Lower Keys.

Niles Channel is not significantly damaged in comparison to the adjacent Pine Channel, primarily due to a lack of extensive shoals.

Survey Assessment:

A long shoal runs for about a mile at the southern end of Niles Channel. The Danger Shoal markers that previously marked both ends of the shoal are no longer there. A sign in poor condition currently marks the south end of the shoal but does not appear to be very effective. Moderate scarring was seen all around this shoal area. A standard shoal marker installed at that location should minimize damage to the shoal and improve navigation up the south end of the channel. In addition, there should be a set of gated markers just north of the bridge (southwest of the shoal), leading boaters through the turn here coming north through the bridge. This will ensure that boaters do not run up the wrong side of the shoal.

An elongate area of light scarring is indicated along the west side of Niles Channel, up to about Toptree Hammock. This area is in four to five feet of water. Very little scarring was seen in this location. Prior scarring, probably from commercial fishing boats, may have recovered since the original prop-scar survey.

Moderate scarring was seen in the center of Niles Channel, across a shoal adjacent to a shallow route leading east. This route, which runs between shoals, is marked with PVC poles and there is a very shallow area that must be traversed to get to the deeper water channel adjacent to Big Torch. Significant scarring was seen all around this area which is used primarily by recreational vessels and boats going in and out of Torchwood West subdivision. There is scarring all along the west side of the deep channel heading northwest to the junction with Niles proper. The severe scarring indicated at the fork in the channel was not seen, only light scattered scarring. No scarring could be seen in this section of the main channel that commercial vessels must use. A shoal marker placed at the fork, indicating the shoal to be taken on one side or the other, would provide a point of reference for both recreational and commercial boaters and reduce scarring in this area.

A moderately scarred area is indicated just north of Toptree Hammock in one foot of water. No scarring was seen here. This appears to be a flats fishing area only.

The light to moderate scarring indicated along a two mile stretch extending northwest of Toptree Hammock was found to be only light and scattered, both from water and aerial surveys. Some scars from wandering recreational vessels were seen on the shallow areas on the north side of the channel. Aerial surveys confirmed that scarring along this stretch is limited to a few patches and not as significant as previously believed.

A narrow stretch of scarring is indicated along the old back country route near the Torch Key Mangroves. Most of the PVC markers are now missing, and scarring was found to be concentrated mainly along the northern end.

Scarring is indicated across several extremely shallow areas on the east side of Raccoon Key. Support vessels traverse the shallow area adjacent to the dock on the 'monkey island', as is evidenced by a few scattered scars near the dock area which is mostly denuded.

Large patches of light scarring are indicated in the vicinity of Cudjoe Channel, particularly around the fork heading to Niles Channel. The only area where significant scarring was seen is just inside the junction of the channels. This may be an appropriate location for a shoal marker, as it will keep boats off the shallower shoal and provide a reference for vessels heading down either channel.

As in other parts of the Lower Keys, there are numerous small sandy blow-out areas seen at the northern edge of the survey area, adjacent to the gulf.

Suggested Plan:

High Priority

- install a Danger Shoal marker at the south tip of the shoal just north of US 1 in Niles Channel
- install a set of gated daymarkers just north of the bridge leading west of the prominent shoal
- install a Danger Shoal marker at the fork in Niles Channel adjacent to Treetop Hammock

Medium Priority

- install a Danger Shoal marker at the fork in Cudjoe Channel

Low Priority

Notes:

If there were a need now or in the future to provide one navigable marked channel from oceanside to gulfside in the Lower Keys, Niles Channel would be the most appropriate. Niles has a fairly well defined channel with depths generally from four to five feet (except for the shallowest controlling sections), and does not cross any major shoals. The ocean approach is deep, wide open, and easily traversed. In addition, the bridge's vertical clearance of forty feet allows most vessels to clear.

Survey Number: 20

Date: 9/10/97

Region: Lower Keys

Area: Bow and Kemp Channels

Range: Both Bow and Kemp Channels from the oceanside approaches out to Johnston Key Channel, and including upper Sugarloaf Sound

Assisting Parties: Monroe County Dept. of Environmental Resources, Capt. Ralph Gouddy

Launch Location: Canal on Upper Sugarloaf

Vessel Type: 17' tri-hull

Conditions: Partly cloudy, scattered showers, winds SE 10 kt, fair visibility

Time: Approximately 4 1/2 hours

General Overview:

This survey area can be broken down into two distinct areas; oceanside channels and shoals, and back country regions. Scarring patterns in the back country are similar to those in previous surveys, with numerous cut-throughs, wheel ditches, and scattered sandy blow-outs near

the gulf. There are several significantly scarred cut-throughs associated with the historic back country route, most of which are marked with PVC poles. Numerous small, lightly scarred areas are indicated around the complex shoals north of Johnston Key. Much of the boating traffic in the back country area is local, minimizing resource impacts. Both Bow and Kemp Channels have very shallow sections north of US 1, further deterring boaters without local knowledge. Overall seagrass damage in this area is light, and the location within the USFWS refuge dictates minimal use of channel marking.

The majority of seagrass damage and marking problems are on the oceanside. Both Kemp and Bow channels have narrow stretches that incur moderate to severe scarring. The KOA campground on Sugarloaf increases the non-local boating traffic in season, exacerbating the problem. Both channels, near the bridges, have complex shoals and several side channels which add confusion to navigating the areas. Much of the boating traffic is associated with the numerous facilities and subdivisions south of the bridges. However, the eight foot vertical clearance of both bridges allows recreational boats to traverse the channels, which in the case of Bow Channel shoals quickly just after the one mile stretch of dredged channel.

Survey Assessment:

The Kemp Channel entrance is quite narrow and winds through numerous shoals. Prop scars can be seen on both sides of the channel due to the four foot controlling depth and shallow shoulders. The shoal east of marker #14 is badly scarred from boats crossing over from Niles Channel. A PVC marked wheel ditch leads through the shoal but is not effectively used, as is evidenced by the much larger scarred area surrounding. At marker #21 scarring was seen leading to Venture Out Trailer Park. The channel makes several turns through an elongate system of shoals approaching the bridge. Though fairly well marked, the turns and a blind channel to the east can be confusing, contributing to extensive scarring seen over most of the shoal area. Gating markers #18, 20, & 23 will improve the route, keep boaters on course, and minimize damage to the adjacent shoal. Heading north through the Kemp Channel bridge, an elongate shoal is encountered that must be taken on the west side, but is not obvious without local knowledge, particularly due to the approach angle. A shoal marker at the southern tip of the shoal would minimize damage and provide a point of reference to vessels heading up Kemp Channel. Several elongate areas of light scarring are indicated farther up the channel. A few scars were seen but did not appear significant. The remainder of Kemp Channel appears to be relatively scar free through to Cudjoe Channel with the exception of one lightly scarred bump adjacent to the old back country route.

The area between Kemp and Bow Channels, north of Key Lois is a large bank cut-through with both blind and through-channels. Like other areas to the east, this bank is criss-crossed and short-cutted. The primary damage is a large moderately scarred area north and west of Key Lois. North of that bank a cross over exists just below Gopher Key. More scarring is seen west and north of Gopher Key. The shoal extending southeast of Key Lois incurs extensive scarring, as it is often rounded too closely. A shoal marker strategically placed at the tip of that shoal will minimize damage and provide boaters with a reference for properly rounding the shoal.

Bow Channel is quite narrow for most of the length of the oceanside approach. Severe scarring was seen on both sides of the channel entrance, primarily due to short cutting and inappropriately placed lead markers. This area should be re-assessed to consider repositioning

markers #1 and (most importantly) #2. Gating markers #3 and 4 will help keep boaters within the channel. Between markers #4 and 5 there is a split in the channel where the shoal island incurs heavy damage. Adding a set of gated markers at the southerly split will eliminate the confusion which causes many boaters to ground there. Moderate scarring continues on the west side of the channel up to marker #10, due to boats simply wandering out of the channel. At marker #20 the main channel forks left past a badly damaged shoal area. Two private marker chains have been recently installed where the channel forks to the right: an A series and a B series leading to separate marinas and subdivisions. Although primarily used by local boaters, the numerous signs likely add confusion to non-local traffic. Continuing up the main channel, significant scarring all around would suggest the need to gate markers #20, 22 & 24. In addition, the signs from #11 on are not appropriately sized and need to be upgraded to standard size. One additional set of markers beyond #24 would complete the route to the point where shoals begin on the east side. The installation of all the above markers should considerably improve navigation to the entire area, particularly the congested shoal area just south of the bridge. The proximity of KOA campground at the west side of the channel significantly effects boating practices in the area, and the suggested marking will assist those boaters as well as local traffic. Continuing north beyond the Bow Channel bridge there is little safely navigable water, with the exception of a one mile stretch of dredged channel. Two areas of significant damage are indicated at the north end of the channel and were confirmed from aerial surveys. A large shoal, well indicated on the NOAA chart, is badly scarred primarily due to a lack of local knowledge. Just off the north tip of Sugarloaf is an expansive flat that is cut-through by a well defined, PVC marked wheel ditch. This area, leading to the back country, is too shallow of a run to consider marking.

Beyond Bow Channel is Johnston Key Channel and the surrounding islands and mangrove keys. This is a popular recreational destination and requires some degree of local knowledge as there are no markers. The only scarring indicated appeared (from aerial surveys) to be the usual scattered small, sandy blow-out areas.

Heading up through Upper Sugarloaf Sound, there is a small scarred area at the oceanside channel approach. Information signs caution boaters of 'controlling depths' and 'local knowledge required' at both entrances to the marked route through the sound. Many of the lateral aids going through the sound have a tide gauge installed to further inform boaters. Scarring was seen at both ends of the cut going through the US 1 bridge, where the lateral aids end. Most of the scarring is on the east side. The same scarring patterns are seen at the entrances to Perky Creek.

There are several areas of scarring indicated adjacent to the old back country route. There is a small area of light scarring at a bump just north of Little Swash Keys where the old route rounds the bump on the south side. A more significant area of scarring is just south of Pumpkin Key where the route runs through a shallow area cut through with a PVC marked wheel ditch. There is a large, lightly scarred shoal south of Galdin Key, just west of the route. None of these back country areas should be marked.

Suggested Plan:

High Priority

- install a Danger Shoal marker on the south end of the shoal just north of the Kemp Ch bridge
- install a Danger Shoal marker at edge of shoal extending SE of Key Lois

- upgrade signs on markers #11 through 24 in Bow Channel to standard (primary channel) size
- install sister markers to #3, 4, 20, 22 and 24 in Bow Channel
- install a set of gated markers just past marker #24 in Bow Channel
- install a set of gated markers between #4 and 5 in Bow Channel

Medium Priority

- relocate entrance markers #1 and 2 in Bow Channel
- install sister markers to markers #18, 20, & 23 in Kemp Channel

Low Priority

Notes:

Bow and Kemp channels south of the bridges should be carefully looked at again prior to implementation. Improvements need to be made, but traffic patterns should be further assessed to ensure effective and efficient route design.

Survey Number: 21

Date: 9/19/97

Region: Lower Keys

Area: Snipe Keys and Vicinity

Range: Through Lower Sugarloaf Sound and Shark Channel, north to the Mud and Snipe Keys

Assisting Parties: Florida Keys National Marine Sanctuary, Capt. Lauri MacLaughlin

Launch Location: Ramp at Trumbow Point in Key West

Vessel Type: 17' Boston Whaler

Conditions: Mostly cloudy, scattered showers, winds NE 10 kt, fair to poor visibility

Time: Approximately 6 hours

General Overview:

This area contains relatively little seagrass damage, compared to the rest of the Lower Keys. Most of the damage is limited to small areas of light to moderate scarring associated with cut-throughs in the back country, extreme shoals, and Shark Channel. There are no appropriate, navigable channels from the ocean to the gulf side. The old back country route continues through this survey area, with only a few scarred spots. Areas within the Mud Keys and Snipe

Keys are designated Wildlife Management Areas with idle speed, no motor, and vessel exclusion zones. Light scarring around these sensitive islands is typically associated with approaches and tidal creek entrances. Most of the traffic to these back country areas is local, which may explain the lack of overall scarring.

There is a PVC marked route through Lower Sugarloaf Sound that is a little tricky and quite shallow, but has little scarring. There are several pockets of light to moderate scarring associated with the very shallow Saddlebunch/Shark Channel pass. These are the only routes from the ocean to the back country in this survey area.

Survey Assessment:

Heading north through Lower Sugarloaf Sound, there is a small area of light scarring at the ocean side entrance to Sugarloaf Creek, also known as Sammies Creek. Although the S-turn approach is tricky, it is well marked with PVC poles. The sound is very shallow, but a route is marked with PVC from Sugarloaf Creek, through the US1 bridge, and out Fivemile Creek. There is a small scarred area just south of the bridge. There are also scattered scars at the north entrance to Fivemile Creek. This run is too shallow for marking.

Heading north through Saddlebunch Harbor/Shark Channel, there is some light scarring on either side of the narrow oceanside channel leading into Saddlebunch Harbor, due to boats wandering and short cutting. The moderate scarring just south of marker #10 was not seen. After marker #18 the channel empties into an old dredged channel which dead ends to the north. There is some scarring on either side of the dredged area both from Seaside Resort on Big Coppitt and traffic heading northeast crossing under the Shark Channel Bridge. There is scattered scarring near the bridge and two wheel ditches next to O'Hara Key where traffic continues north. Rounding Shark Key there is a long wheel ditch leading boats into the harbor north of Big Coppitt Key. There are numerous scars off the east side of the very narrow wheel ditch.

There is a long wheel ditch running through the mangroves at the Inner Narrows, which is on the old back country route. Most of the scarring is confined to the area of the wheel ditch. The Middle Narrows has a long winding wheel ditch running through the pass with widespread scarring at both approaches. All the PVC markers were missing. Only light scarring was seen around Snipe Point. Scars were seen along the east approach to the main tidal creek, which is an idle speed zone.

Small pockets of light scarring were seen around Marvin Key and the Barracuda Keys from aerial surveys. Some scarring is adjacent to the tidal channels at the island approaches.

There are several areas of light scarring indicated around Fish Hawk Key. The old back country route passes just south of Fish Hawk Key, and light scarring was seen across the shoals extending south of the island. More scarring was seen across the narrow shoals extending northeast and northwest of Fish Hawk Key. Several cut-throughs were seen bisecting the shoals, with one main wheel ditch being well marked with PVC poles connecting Waltz Key Basin with Jewfish Basin. Another cut-through was seen north of Coon Key.

There are several areas of light scarring indicated across the shoals on the west side of the Mud Keys. Scars were seen adjacent to the tidal channels approaching the islands. Some narrow areas of scarring are indicated at Mud Key Channel. Scarring was seen adjacent to the somewhat tricky tidal channels running south from the gulf. The most navigable channel, hugging the Snipe Keys, is marked with PVC poles.

Suggested Plan:

High Priority

Medium Priority

Low Priority

Notes:

No channel markers are recommended for this area. Saddlebunch Harbor/Shark Channel is the only permitted, marked channel in this area and is fine as is. Marking in the back country is not advised due to the shallow water. PVC markers already mark most of the trickiest cuts in this area. And, markers are not suitable for the sensitive USFWS islands of the Mud Keys and Snipe Keys.

Survey Number: 22

Date: 10/2/97

Region: Lower Keys

Area: Key West and Vicinity

Range: From Boca Chica and Cow Key Channels, north to the Lower Harbor and Bay Keys

Assisting Parties: County Sea Grant Extension Office, Capt. Doug Gregory

Launch Location: Ramp at US 1 Marine on Stock Island

Vessel Type: 20' Sea Dart

Conditions: Partly cloudy, scattered showers, near calm, fair visibility

Time: Approximately 4 hours

General Overview:

The various environments in this study area are all easily accessed by the populace of Key West and Stock Island. We find the same scarring patterns and severity of damage in the back country areas, as in the rest of the Lower Keys, despite the heavy boating population in this vicinity. However, more damage can be seen around the numerous anchorages and heavily used channels. There are numerous dredged channels, primarily created for Navy vessels. Though several good oceanside channels provide access on both sides of Stock Island, the waters north of

US 1 continue to be shallow and local knowledge is necessary to safely navigate. Several cut-throughs and wheel ditches are seen along back country routes, but damage is generally limited. More severe damage is seen associated with several of the larger shoals. Numerous pockets of light scarring are indicated around the islands bordering the gulf, typically associated with tidal channels and creeks, consistent with areas to the east. Some of the northerly islands are within USFWS Wildlife Management Areas.

Survey Assessment:

Boca Chica Channel is a long, nearly straight channel leading into the Naval Air Station turning basin. Several small pockets of light to moderate scarring are indicated along the dredged channel, but scarring appeared to be minor. Two channels split northwest off of Boca Chica Channel. Stock Island East Channel A has significant scarring on the west shoulder. The only gated markers are #3A and 4A, but #4A is located at the tip of a shoal, a good distance from #3A. It appears that many boaters short cut or just take the green markers on the wrong side. It would be more effective to have #4A located adjacent to #3A and gate #5A as well. Stock Island East Channel B appears to be well marked, but there is significant damage across the shoal area west of the channel, particularly near the shoulders of the several small natural channels that wind through the area. This is a large anchorage, but is inappropriate due to the shallow water. The entire anchorage area has scattered scars and circles. The route continuing north of Boca Chica Channel through the bridge is heavily used, but unmarked and relatively shallow.

An area of moderate scarring is indicated off the southwest point of Safe Harbor. This area is used for tying up barges and is five feet deep. Scars were not seen.

Cow Key Channel has good water (three to four feet) but is quite narrow. Scarring adjacent to the channel, particularly on the west side, should be minimized by the installation of five additional markers that are currently planned. This channel is heavily used by recreational and commercial traffic, including some water skiing. The channel can be hazardous due to vessels running in tight quarters. The large anchorage off House Boat Row has scattered scars and circles and contributes to the overall damage of this busy, overcrowded area. A new marked route continues north of the bridge, in slightly shallower water, continuing to Sigsbee Park.

Garrison Bight Channel is heavily used and well marked. There is some light, scattered scarring on the shoals adjacent to the entrance to the route. The moderate scarring indicated at the easterly turn in the channel was not seen, as this area is in fairly deep water. Some scarring was seen on the north side of the channel, going into Garrison Bight, due to wandering and short cutting. This damage did not appear to be very significant. This area is also used as an anchorage. Scars were not seen inside the bight, which has been dredged extensively.

Calda Channel is quite narrow but fairly well marked. There is some confusion at the bend at marker #21, with scarring seen on both sides of the channel. A sister marker to #21 would improve the route.

A large area of scarring is indicated across the shoal on the north side of Wisteria Island. This is another large anchorage. Scattered scars and circles were seen, but the area did not appear to be too badly damaged.

In the back country, next to the southeast side of Channel Key is a wheel ditch cutting across a heavily damaged shoal. A pile of PVC poles marks the cut-through, but requires local knowledge to use, as is evidenced by all the scars nearby. Numerous recreational and

commercial vessels use this route heading out of Boca Chica Channel and continuing to the north and east.

There are several wheel ditches between Channel Key and Grassy Keys. Moderate scarring was seen along the most prominent cut-through, just north of Channel Key, on the old back country route. This cut-through is well marked with large gated PVC poles.

A heavily used route continues north, just east of Grassy Keys, adjacent to a long moderately scarred shoal. Scarring is concentrated where the route winds northeast across the PVC marked shoal, entering Jewfish Basin. A route exits Jewfish Basin to the north leading to the gulf. Numerous PVC poles line the shoals along that tidal channel. The channel splits around a PVC marked shoal about half way through. Light scarring was seen along the west shoulder of the channel. Although scarring in this area is minimal, this would be an appropriate location for a marked entrance to the back country from the Gulf to facilitate emergency response activities for FMP. Three sets of markers are recommended to help guide enforcement officers through this strategic area, particularly for running at night.

There are numerous lightly scarred patches throughout the Lower Harbor Keys, mostly adjacent to the tidal channels leading in from the gulf and tidal creeks winding through the Keys. Numerous PVC poles mark the creeks and approaches, but navigating is still tricky. This is a Wildlife Management Area with 'idle speed' and 'no access' zones.

Several areas of scarring are indicated around the Wildlife Management Areas of Cayo Agua and the Bay Keys. Very little scarring was seen from aerial surveys.

Bluefish Channel is a deep natural channel but the entrance can be difficult to locate. There are some PVC markers along the channel, but it still requires local knowledge. Only some light scarring was seen along the shoulders of parts of the channel, which comes to an abrupt dead end. Local boaters also use a poorly defined approach route from the east to enter the channel from the southern terminus.

Suggested Plan:

High Priority

- install a sister marker to #21 in Calda Channel
- install three sets of daymarkers through Jewfish Channel into Jewfish Basin from the Gulf

Medium Priority

- relocate marker #4A in Boca Chica Channel adjacent to #3A
- install a sister marker to #5A in Boca Chica Channel

Low Priority

Notes:

Survey Number: 23

Date: 10/17/97

Region: Lower Keys

Area: Lakes Passage & Vicinity

Range: Fleming Key to Boca Grande Key

Assisting Parties: US Fish & Wildlife Service, Capt. Tom Wilmers

Launch Location: Municipal Marina at Garrison Bight

Vessel Type: 17' Mako

Conditions: Clear, winds east 5 kt, excellent visibility

Time: Approximately 6 hours

General Overview:

This survey assessed damage mainly in the vicinity of the Lakes Passage. Although a deep water route is available on the south side of this shallow area, this route was marked fairly recently to provide a sheltered passage to Boca Grande from Key West. As such, the route runs through some sections that are quite shallow and thus have significant scarring. It is debatable whether this route should be improved or removed considering that it runs through, and provides access to, some of the most sensitive areas within the Key West National Wildlife Refuge.

Although there is a central marked route running through The Lakes area many vessels criss-cross the area and access the extensive shoals on the south side for fishing, primarily for bait fish. These are some of the most pristine areas of the Keys but are easily accessible by boat from Key West. USFWS states that there is heavy boating pressure in this area, particularly at Boca Grande Key.

Survey Assessment:

There was some light to moderate scarring seen on both sides of the Northwest Channel, adjacent to the entrance markers to The Lakes Passage. The channel is wide and well marked but the adjacent shoals appear to be occasionally scarred from boats approaching The Lakes Passage. Adding a sister marker across from #15A would help define the channel in that area and reduce scarring adjacent to The Lakes Passage entrance. In addition, a marker should be installed between #15A and #17 due to the severe grounding damage occurring on the Middle Grounds.

The Lakes Passage has shallow controlling sections throughout the marked route, informational signs indicating the controlling depth should be installed at the terminal markers. There is a significant area of moderate scarring seen at markers #6 and 7, just south of Mule Key. This is a controlling section of the route and can be less than two feet at low tide. The markers are fine and there is nothing that can be done about this shallow section. However, there is some confusion at this S-turn when returning from Boca Grande. The route abruptly turns northeast but is not obvious due to the distance to marker #4. Boats may incorrectly head straight east, running over the shoal ahead where numerous scars were seen. An additional marker between #4 and gated markers #6 and 7 may correct this problem.

Light scarring is indicated all along the stretch from markers #6 to 10. This a relatively shallow section and scattered scarring was seen throughout. A pocket of more significant scarring is indicated around marker #8, just south of Archer Key. This area is quite shallow and numerous deep scars were seen.

A lot of scarring was seen around markers #13 through 16 at the approach to Boca Grande Key. There are several narrow natural channels running through the shoals here. The first markers encountered running west from #12 are confusing, as markers #13 and 14 are in line. Scarring on the adjacent shoals indicate that boaters may take the markers on the wrong side. The addition of sister markers to #14 and 13 may improve the route by clarifying the approach.

Marker #17 is located too close to the beach, in shallow water. This is drawing boats close to the shoreline where there is significant erosion at a sea turtle nesting beach. This marker should be relocated farther from the beach.

Numerous small areas of light scarring are indicated along the southerly islands adjacent to deep water. Numerous cut-throughs here are used by fishermen and recreational boaters. The scarring in this area did not appear to be significant from on-the-water and aerial surveys.

Suggested Plan:

High Priority

- install informational signs indicating the controlling depth at each end of The Lakes Passage
- install a green daymarker between markers #4 and 6 in The Lakes Passage
- install sister markers to #13 and 14 in The Lakes Passage
- relocate Lakes Passage marker #17 farther from the shoreline towards the channel

Medium Priority

- install a sister marker across from NW Ship Channel marker #15A
- install a green daymarker between #15A and 17 in NW Ship Channel

Low Priority

Notes:

The markers at Boca Grande Key should be looked at carefully again to determine how to best deal with the approach problem on the north side of the island.

USFWS is currently pursuing a slow speed zone for the channel at Boca Grande in an attempt to reduce erosion to the turtle nesting beach on the west side of the island. This would best be accomplished in conjunction with relocating marker #17.

MARKING SUMMARY

The findings of the twenty three surveys confirmed that there are numerous areas throughout the Keys where significant damage from prop scarring is occurring. Many of these scarring patterns can be attributed to a lack of effective navigational marking in or adjacent to the areas. Channel marking recommended for each survey area within each region of the Keys addresses those sites with significant damage and boating pressure, and that can be effectively improved with the proper design and installation of markers or marker systems.

A combination of marking strategies are utilized in addressing the particular needs found at the various damaged sites throughout the archipelago. The types of aids recommended for all the improvements to the ATONS system typically fall within three classes: lateral aids, shoal markers, and information signs.

Lateral aids are the primary marking aid recommended to help keep boaters in safe water and off the shallows. Marker installations have been designed to improve

existing channels and routes, as well as creating new greatly needed routes. Lateral aids will address current needs with increased gating and frequency, and most importantly proper placement in regards to depths and adjacent shoals. The planning of new routes and changes to existing routes has addressed the boating public's general knowledge of marker chains by ensuring a standard, yet easy to understand layout of markers, particularly in regards to numbering and direction.

Danger Shoal markers will be an important aid for protecting some of the hardest hit shoals, complementing the enhanced lateral aid system. There are currently less than a dozen shoal markers in the Keys and the new aids should help keep boaters away from numerous trouble spots. The designed application will be consistent throughout the archipelago, with only Danger Shoal markers used for this purpose. These aids will closely mark hazards while still providing points of reference for boats traversing the areas.

Information signs will complete the enhanced ATONS system by providing depth and vessel restriction information in strategic areas. Used in conjunction with lateral aids, these signs will deter the inappropriate use of restrictive channels by larger vessels and in some cases provide alternate route information.

The combined use of these three primary marking aids has been recommended for numerous sites throughout the Florida Keys (Table 5). The Upper Keys is slated for the greatest number of improvements, due to the extensive damage and boating pressure in that region. The Lower Keys is planned for the fewest new lateral aids (especially considering the size of the region), primarily due to water depths in the back country and locations within the USFWS refuges. Shoal markers and information signs will be utilized throughout the coastal areas of the Keys.

Table 5. Summary of new marker recommendations by region

<u>Region</u>	<u>Lateral aids</u>	<u>Shoal Markers</u>	<u>Information</u>
Upper Keys	126	5	11
Middle Keys	84	20	8
Lower Keys	<u>76</u>	<u>9</u>	<u>5</u>
Total number	286	38	24

Many of the two hundred-eighty six recommended lateral aid installations fall within existing USCG or privately owned marker chains. Addition of County markers to non-County privately maintained marker chains should not present a problem, as the County will own and maintain any markers installed, and in some instances may take over maintenance of the adjacent markers.

However, along USCG marker routes, it will be the decision of the Coast Guard to approve those recommendations and allow modifications to the federal marker chains. About a quarter of the recommended lateral aids fall within federal marking chains. The County is cooperating with the USCG on this issue and will work to proceed with increased marking in federal chains where approved. This part of the project may involve exchange of ownership and/or maintenance of markers, in some instances, between the County and the USCG. The concern is to avoid mixing private and federal markers within a single marking chain. The cooperating agencies will attempt to meet each others needs and priorities, while ensuring the appropriate planning and organization of the overall ATONS system in the Keys.

The application of 'Secondary' or 'Small Boat' channel markers has been recommended for implementation at several sites throughout the Keys. Though this is a unique type of marking application it appears to have great potential for routing smaller boats through shallow heavily used areas, while deterring use by larger vessels. This type of marking has proven to be effective at one current site in the Lower Keys. Though this marking will target specific user groups, it will be used in a consistent manner and markers will conform to standard USCG specifications.

In addition to the installation of the above mentioned aids, fourteen markers are recommended for relocation and another fourteen for removal at various sites throughout the three regions.

Special Note

The numerous unpermitted markers throughout the Keys are a special concern from the standpoint of contributing to the resource damage problem, as well as a

boating safety problem. These markers are usually placed by locals so as to provide references for navigating through shallow sections of numerous informal routes. Although illegal, in some locations these markers do provide some degree of effectiveness and may help minimize scarring by providing the best route through a shallow area. In other instances, unpermitted markers may increase damage by promoting boat travel through areas that should not be traversed. Though recommendations have been made in the past to remove unpermitted markers, it may be prudent to allow some of the markers to remain, especially considering the possible consequences of such actions (i.e. markers would only be re-installed, scarring could possibly increase, etc.). However, on the matter of boating safety, many markers have been observed throughout this project that are considered to be a navigational hazard and have not been placed in an effective manner for piloting through shallow water. Although no specific policies have yet been made on this issue, it is the consensus from the findings of this plan that any removal of unpermitted markers begin with those that may pose a hazard to navigation.

POST-SURVEY PLANS

Upon completion of this master plan for channel marking several subsequent projects will begin. Foremost is the implementation of the master plan, including the permitting process and the actual installation of the proposed markers. A site monitoring project will also proceed with the photo documentation of scarring at selected sites throughout the Keys. And finally, an education program will be implemented to provide information about seagrass scarring, the channel marking project, and the appropriate use of the ATONS system.

IMPLEMENTATION

The implementation phase will proceed following the acceptance of the master plan by the representing agencies of the former Channel Marking Work Group, in addition to final input from FKNMS management. Implementation will begin in Spring 1998 and is expected to take two to four years to complete. The Channel Marking Planner will continue to oversee the project under the title of Marine Resources Planner, and will be responsible for the permitting process and the installation of the approximately three hundred-fifty markers and signs.

Permitting

The permitting process will follow the standard procedures of submitting applications to the five permitting agencies, including: USCG, ACOE, FMP Office of Waterway Management, DEP Office of Submerged Lands and Environmental Resources, and DEP Waterway Management Division. Processing time is expected to be minimized, as each of the agencies has taken part in the development of the Channel Marking Plan and is familiar with the objectives and general application of the proposed markers.

Permit applications will be grouped by region, with several ‘packages’ of proposed markers submitted for permitting within each region. Sets of markers in common channels or vicinities will be lumped into each ‘package’ for permitting, further streamlining the permitting process. The Marine Resources Planner will work closely with each of the permitting agencies to ensure a logical and efficient manner of grouping markers for permitting. Permit applications and marker packaging will be designed to best meet the procedural protocol of each of the permitting agencies, and help ensure timely processing.

Upon approval of each package of permits, the Marine Projects Coordinator will be responsible for the bid process and choose a contractor for marker installations in each region. The chosen contractor will then be responsible for the installation of the markers for each package in the given region, within a reasonable period of time.

Marker Installations

The Marine Resources Planner will oversee the installation process and coordinate activities with the respective contractors. Prior to installation, the Marine Resources Planner will return to the field and site each proposed marker to determine final placement, using temporary buoys and obtaining precise coordinate data. The installations will then be carefully observed to ensure the appropriate placement, use of specified materials, and application of correct signage to all aids.

All new installations will be reported immediately to FMP to provide information to local enforcement officers for safety purposes. The USCG will also be provided new navigational aid and coordinate information for updating the official light list, and for posting in the Local Notice to Mariners.

A marker maintenance program will be developed by the County to monitor the condition of all County owned markers and provide needed repairs. The Marine Projects Coordinator has developed marker specifications that ensure the use of durable materials for the marine environment, promoting longevity of the aids.

SITE MONITORING

The site monitoring project has been designed to monitor changes to seagrass scarring patterns at five selected sites throughout the Keys. These sites have been chosen according to levels of scarring, planned marker implementations, and in some cases additional planned boating restrictions (Table 6).

Aerial mapping will be conducted prior to marker implementation, generating large scale (1:3600) stereoscopic color photographs of each monitoring site. These photos will be used to further examine specific scarring patterns and levels at each site.

Table 6. Monitoring sites and associated implementations

<u>Site</u>	<u>Current damage</u>	<u>Implementation</u>	<u>Other changes</u>
Broad Creek	Moderate/Severe	New marked route	Regulatory zoning
Tavernier Cr.	Moderate/Severe	Secondary channel	Sanctuary W.M.A.
Windley Key	Moderate/Severe	Improvements	Sanctuary W.M.A.
Vaca Cut	Moderate/Severe	Improvements	
Niles Channel	Light/Moderate	Minimal new marking	

Following the completion of marker installations, aerial mapping will be repeated to examine the effects of improved navigational marking. This is expected to take place in four to six years, after current scars have had time to recover and the effects of marker implementations are well developed.

EDUCATION

The implementation of an educational program focusing on shallow water resource damage and the use of aids to navigation will play a big part in the effectiveness of the improved marker system in the Florida Keys. The County will be working closely with the Sanctuary Educational Advisory Board in further developing educational tools and providing information to recreational and commercial users of the coastal areas, targeting both local and visiting boaters.

The boating public must be educated on the fragile nature of the seagrass environment and understand how the proper operation of their vessels can minimize benthic damage. It is important to address three main areas of concern: 1) that seagrass scarring has become a serious problem, 2) the need to correctly use charts and the ATONS system, and 3) that the ATONS system is being modified and the importance of staying abreast of changes and installations of new markers. It is necessary for users to acknowledge the growing impacts to the coastal ecosystems and realize the need to improve boating practices. Once

boaters understand these concerns it will be easier to get them to appropriately utilize the navigational aids available to them.

A well developed educational plan should incorporate a variety of information sources that are integrated with the continuing implementations to the ATONS system. The FKNMS already has a variety of education/outreach programs that address these subjects, but more will need to be done to specifically target the goals of the channel marking project. Several avenues have been considered for disseminating information:

- Erect signs at boat ramps and marinas that display local charts indicating hazards in the area, as well as any important changes to the marker system
- Provide press releases to local newspapers and radio stations explaining boating impacts and improvements to the ATONS system
- Utilize local cable television station spots to display scrolling ATONS and resource management information
- Utilize existing Sanctuary television programming (Waterways) as a platform for describing resource problems and ongoing implementations

The Sanctuary will take the lead role in education for the Channel Marking Project. The County Marine Resources Planner will make himself available to assist with this project, and provide input on problems and needs.

REFERENCES

- Anderson, J., N. Ehringer and B. Thomas. 1997. Seagrass Recovery Experiments in the Florida Keys. A proposal by Seagrass Recovery, Inc. Ruskin, FL. 4p.
- Barker, V. and G. Garrett. 1992. Boating Impacts Management Plan. Draft Final Report. FDNR Contract #C-7442. Monroe Co. Dept. Mar. Res. Key West, FL. 74p.
- Garrett, G., V. Barker, and R. Dye. 1994. Development of a Comprehensive Channel Marking Plan for the Florida Keys. Final Report. FDEP Contract #C-8200. Monroe Co. Dept. Mar. Res. Marathon, FL. 56p.
- Duarte, C.M., N. Marba, N. Agawin, J. Cebrian, S. Enriques, M.D. Fortes, M.E. Gallegos, M. Merino, B. Olesen, K. Sand-Jensen, J. Uri, and J. Vermaat. 1994. Reconstruction of seagrass dynamics: age determinations and associated tools for the seagrass ecologist. *Mar. Ecol. Prog. Ser.* 107:195-209.
- Durako, M.J., M.O. Hall, F. Sargent, and S. Peck. 1992. Propeller scars in seagrass beds: an assessment and experimental study of recolonization in

- Weedon Island State Preserve, Florida. Pp. 42-53 in Webb, F. (ed.), Proceedings from the 19th Annual Conference of Wetlands Restoration and Creation. Hillsborough Community College. Tampa, FL.
- Kruer, C.R. 1994. Mapping Assessment of Vessel Damage to Shallow Seagrasses in the Florida Keys. A report to the Florida Dept. of Natural Resources and the University of South Florida/Florida Institute of Oceanography. 9p.
- Lewis, R.R., C.R. Kruer, S.F. Treat, S.M. Morris. 1994. Wetland Mitigation Evaluation Report; Florida Keys Bridge Replacement. Florida D.O.T., Environmental Management Office. Tall., FL.
- Phillips, R.C. and R.R. Lewis. 1983. Influence of environmental gradients on variations in leaf width and transplant success in North American seagrasses. Mar. Tech. Bull. 17(2):59-68.
- Sargent, F., T.J. Leary, D.W. Crewz, and C.R. Kruer. 1995. Scarring of Florida's seagrasses: assessment and management options. FMRI technical report TR-1. 46p.
- NOAA 1996. Florida Keys National Marine Sanctuary: Final Management Plan/Environmental Impact Statement. Sanc. Res. Div. Vol. I. 319p.
- Terry, R.D. and G.V. Chilingar. 1955. Comparison charts for visual estimation of percent composition. Allen Hancock Foundation. L.A. Calif. Reprinted from Journal of Sedimentary Petrology. 23:8. pp. 226-234.
- The Wilderness Society, Florida Keys Audubon Society and Lewis Environmental Services. 1990. Is uncontrolled boating damaging thousands of acres of Florida's submerged seagrass meadow? A report to the Florida Department of Natural Resources. 36p.

APPENDIX

Survey Maps

The eighteen maps included in this section accompany the previous survey assessments. These maps are intended to be used with the 1:30,000 and 1:40,000 scale NOAA charts covering the Florida Keys, including: #11463, 11449, 11448, 11445, and 11441. The survey maps indicate land, prop scarring, and existing and recommended aids to navigation. More complete color maps including subdivisions, unpermitted markers, and marinas are archived in the office of the Monroe County Department of Marine Resources. The survey maps included here are provided to indicate the location of existing aids and the approximate location of proposed aids to navigation, in relation to the distribution of prop scarring.

(Due to map being in GIS format, they are not available in this document)