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Biscayne National Park

Mooring Buoy

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Abstract of a master's thesis submitted to the Faculty of the University of Miami
Rosenstiel School of Marine and Atmospheric Science. The thesis is 100 pages in length.
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**Biscayne National Park:
Mooring Buoy
Management Recommendations**

by

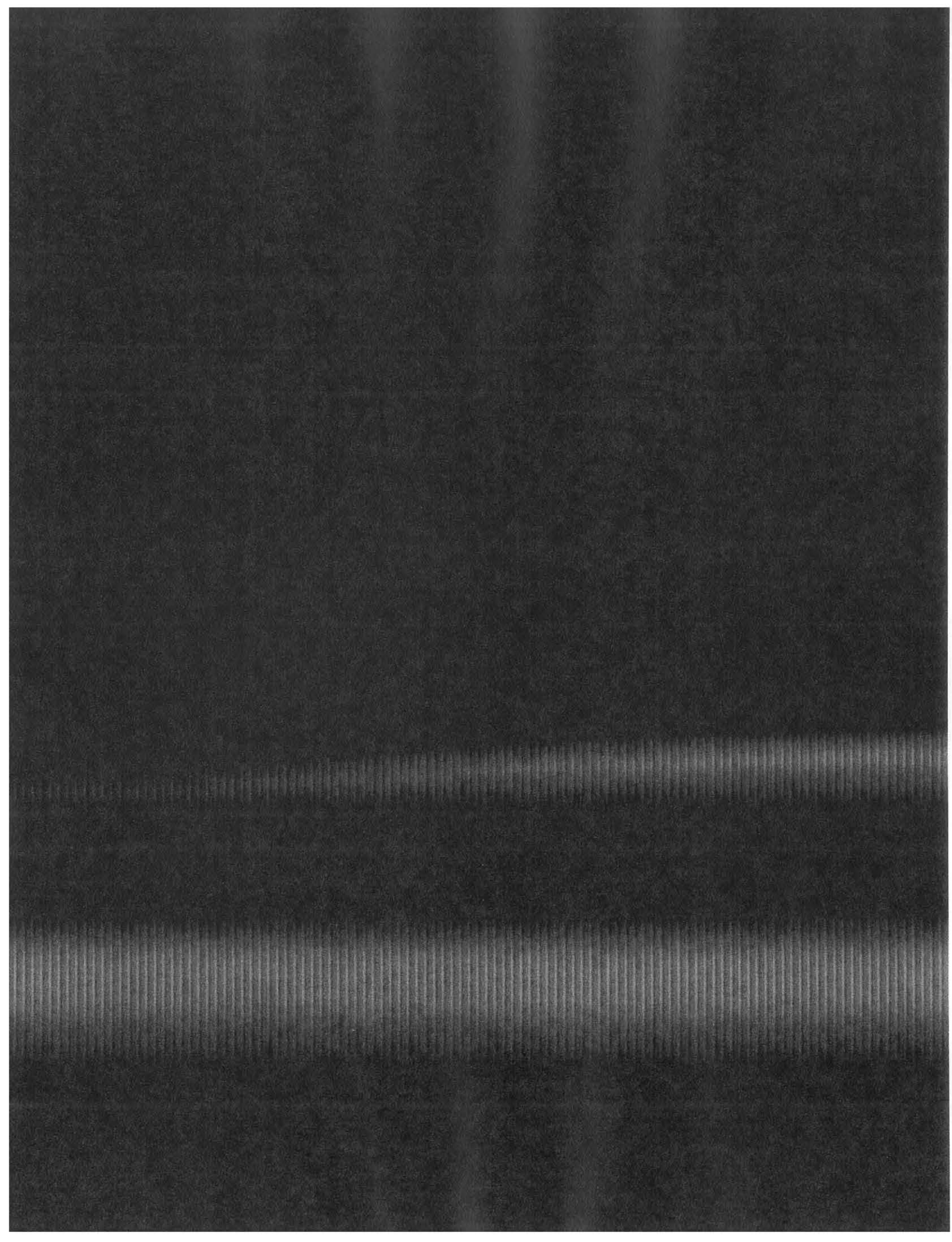
Bradford Hamilton Wilcox

**An Internship Report
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Biscayne National Park:
Mooring Buoy Management Recommendations

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Abstract

Biscayne National Park (BNP) is in the process of updating their mooring buoy program with a new management plan. The park's need for the Mooring Buoy Management Plan is twofold: the main priority is to assess the current mooring buoy program, to prepare and consider options for its improvement, while a secondary function of the project is to achieve compliance with the National Environmental Policy Act (NEPA). The purpose of my internship was to study the advantages and disadvantages of mooring buoys and, in collaboration with a mooring buoy management team, determine a framework for their use as a management tool in BNP.

The Mooring Buoy Management Plan is the culmination of our work, a comprehensive document that provides practical guidance for managers to mitigate human impact on the reefs and shipwrecks in BNP. The standard Nation Park Service objective is to present a balanced management approach for recreational activities that adversely affect cultural and biological resources, without interfering with the public's right to access. However, several of the policy recommendations are intentionally aimed outside of the public domain standard, with the intent to improve marine resource protection in BNP by changing that principle. The final judgment over which policies best suit BNP rests on the authority of the park.

Acknowledgements

During the eight month period of my internship, the organization of the management plan was facilitated by the knowledge and experience provided through consultations with the BNP mooring buoy management team, during interviews with managers from other marine protected areas (MPAs), and in discussions with marine policy professionals at various institutions and non-profit organizations in the U.S. and overseas. I would like to thank them for their partnership in the project. Special thanks goes to the mooring buoy management team – Richard Curry, Karl Bachman, Steve Newman, Terry Helmers, and Tom Perkins – for their commitment to this project. I am also grateful to Billy Causey for the support of the Florida Keys National Marine Sanctuary (FKNMS); upon contacting him, he immediately arranged an interview with John Halas, the pioneer of the most popular mooring buoy system in history.

I would like to extend my thanks to everyone who contributed to the Mooring Buoy Management Plan, and to those who provided support throughout the course of the project. I would particularly like to thank my committee: Dr. Moreno, Dr. DiResta and Dr. McManus, for all of their encouragement and wisdom in the short amount of time we've known each other. I look forward to the growth in our relationships, and to working together in the near future. I'm almost without words for those closest to my heart, my family: to my wife Monika, my parents, Toni and Liz, Cyndi and Mendy, my brothers, Max, Win, and Danny, my sisters, Stacey and Kasia, whose empathy for my romantic affair with the ocean continues to provide an endless wave of support that always reminds me how fortunate I am to do what I love.

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Mooring Buoy Program Planning

Before getting into the new management strategy for mooring buoys in Biscayne National Park (BNP), it is important to go back in time and make sense of the process that created the formal management plan. The first instructions to update BNP's mooring buoy program arrived by memo from the Superintendent— a copy of which is located in Appendix A.

When I began my internship I had some experience with mooring buoys, but nothing near what I know now. In the beginning I got my hands on anything I could that related to mooring buoys. It didn't take long to find John Halas's name, and realizing the opportunity to easily meet with him in the Keys, I successfully made arrangements for an interview. With a week to prepare for our meeting, I discussed BNP's goals with several members of the management team and reviewed as much research as I could. Walking out of that interview, I hit the ground running and set out to realize the potential of the new management plan.

When it comes to mooring buoys, there's a scarcity in the amount of information that goes into detail about management consideration; most of the writing pertains to the public's relationship with buoys— step-by-step instructions on how to use them and other general material. But eventually I found the "Mooring Buoy Planning Guide," the lengthy and very resourceful document from which the Mooring Buoy Program Planner in Appendix B, and the Mooring Buoy Contact Information in Appendix C, was taken. The information in Appendix B outlines the full document, while Appendix C provides a complete list of contact information related to mooring buoys. The full document was produced in a partnership between PADI Project Aware and the Ocean Conservancy.

Once the baseline information had been established, the policy adjustments responsible for tailoring that management agenda into a personal approach for BNP took place face to face. The progress of the management plan was kept in check during one-on-one conversations and frequent mooring buoy team meetings. The Mooring Buoy Team Minutes are located in Appendix D; there one can follow the order of priority throughout the creation of the document and get a feel for the decision-making process.

In addition to internal conversations, I found other successful channels for information exchange. One of two Mooring Buoy Questionnaires was drafted and sent to five marine protected areas (MPAs) in the region; two of them were returned to BNP, and they are located in Appendix E. The successes and failures of these MPAs were especially useful. The second questionnaire, also found in Appendix E, is a discourse which took place on and off throughout the course of the project on the Florida Sportsman Forum in the South section, where recreational interests in BNP most likely reside. A series of questions were posted and the public responses flowed freely; their remarks are recorded for the record.

And so, after almost a year in production, herein I present the final recommendations for BNP's new mooring buoy program, for immediate review by the National Park Service and, hopefully, to lend assistance to future mooring buoy programs around the world.

Mooring Buoy Management Plan

Executive Summary

The scientific community has spread a global call to action for reef protection, imparted by the weakening ability of delicate corals to proliferate under the burden of anthropogenic impacts. In response, marine protected areas (MPAs) around the world are implementing mooring buoy programs with policies that govern human interaction. "The use of environmentally sensitive moorings as a means to reduce or eliminate anchor damage has become a widely accepted tool for managing the coral reef environment" (Halas 1997). Mooring buoy systems play an important role in protecting reefs from physical damage caused by anchors and vessel groundings. The underlying purpose to which BNP is responding in this document is the need for a comprehensive management plan for its mooring buoy program.

The ocean-side boundary of BNP has a diversity of cultural and biological resources. Its warm, shallow waters are home to the northern boundary of the Florida Keys reef tract, attracting visitors to coral reefs and historic shipwrecks. For more than twenty-five years, the park has endeavored to meet the recreational demands on sensitive marine resources by encouraging the use of mooring buoys. Physical reef damage caused by boaters is "a well-documented marine resource protection problem," especially for MPAs that experience high levels of visitation on the reefs, such as BNP (van Breda; Gjerde 1991).

The recommendations for the Mooring Buoy Management Plan (MBMP), as presented in this document, provide BNP with a framework for mooring buoys to be used

as a management tool to reduce the adverse impact of human activity on the reefs inside BNP. In addition to highlighting the knowledge requisites that are necessary for a successful mooring buoy program, the MBMP conveys the inherent roles and responsibilities that BNP must assume for the plan to be successful. These guidelines serve the purpose of organizing the current mooring buoy program to improve performance and eliminate guesswork. The issues to be addressed are safety expectations and liability, maintenance, vessel size limitations, boat use surveys, public notice, education, carrying capacity and funding alternatives. In a separate document, supplementary to the MBMP, a Mooring Buoy Action Plan considers policy recommendations for no-anchor zones and future site selection to complement BNP's updated management plan. As a whole, the recommended mooring buoy program mitigates direct human impact to the reef by establishing sustainable management practices for the use of mooring buoys.

Authorizing Legislation and Regulations

The operational policy created by this management document is consistent with the goals and objectives identified in the General Management Plan (GMP) for BNP, in accordance with regulations and the delegated authority provided in Title 36, Code of Federal Regulations (CFR), Chapter 1, Sections 1 through 7, authorized by Title 16, United States Code, Section 3 (36 CFR 2001). In addition, guidance for the project came from "Director's Order 12: Conservation Planning Environmental Impact Analysis, and

Decision Making," which outlines National Park Service (NPS) policy and procedure with respect to the National Environmental Policy Act (Director's Order 2001).

Introduction

In recent years the Florida reef tract suffered an unprecedented loss of overall coral cover (see Figure 1 for an aerial view of the Florida reef tract). From the Dry Tortugas to Miami Beach, where the highest diversity of coral is located, the average coral cover was only "14 percent in the late 1990s, reaching 30-40 percent on some patch reefs behind the reef crest" (Spalding 2001).



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Figure 1: South Florida and the Florida Keys

(<http://eol.jsc.nasa.gov/scripts/sseop/clickmap.pl?hashnumber=6663&fieldlist=GEON,FEAT,LAT,LON,TILT,CLDP,PDATE,FCLT,IMAGE&options=none> 2005)

The decline is connected to a combination of environmental impacts. As a testament to the amount of damage caused, two species of branching corals that used to proliferate shallow depths in the Atlantic and Caribbean basin, *Acropora Palmata* and *Acropora Cervicornis*, were recently granted protection under the Endangered Species Act (ESA) because of their rapid decline. A list of influencing factors related to coral decline has been compiled specifically for BNP, as identified in the General Management Plan, which include:

- commercial fishing pressure
- the destruction of coastal wetlands from development
- urban development
- vessel groundings on grass beds and reefs
- Turkey Point Nuclear Reactor
- runoff from agriculture and the South Dade landfill operations.

(Flik 1993)

However, unlike harmful byproducts of development such as run-off, pollution or oil spills, physical impacts can be effectively mitigated, and possibly even eliminated, with a fairly simple solution— a network of mooring buoys.

When compared to managing other adverse impacts affecting reefs, using mooring buoys to regulate direct human impact is a more tangible management goal. The Florida Keys National Marine Sanctuary (FKNMS) has taken on a progressive management approach that sets an example for best use practices. FKNMS maintains over four hundred mooring buoys for public use.

In the protected areas of BNP and the FKNMS, the most catastrophic, yet preventable, direct human impact results from vessel groundings experienced in that

region. Over 500 vessel groundings a year are recorded in the FKNMS alone; BNP is much smaller than the represented area but significant damage nevertheless has take place. Then, on a lesser scale with more frequent events, physical anchor damage selectively destroys coral near popular sites. The result, which initially looks something like the illustration in Figure 2, eventually leads to severe tissue damage and potential death for the colony. Regardless of the severity of the impact, damaged corals expend their energy healing instead of on growth and reproduction. With fewer desirable sites available, the carrying capacities of individual sites can quickly reach their limits.

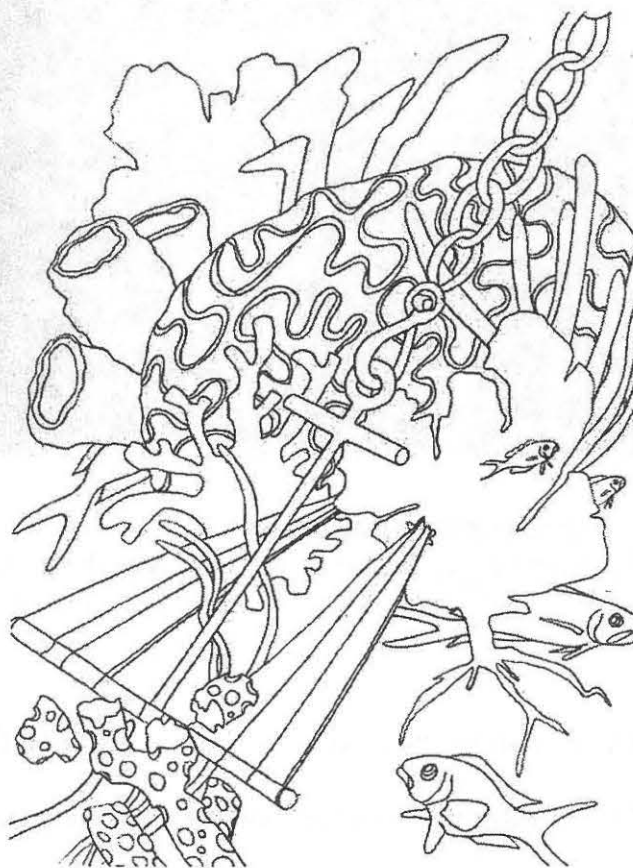


Figure 2: anchor in coral

([http://www.kathyjohnston.com/color book/anchor and coral reef.htm](http://www.kathyjohnston.com/color%20book/anchor%20and%20coral%20reef.htm) 2005)

Given the increasing scale of development in south Florida, reef protection in BNP is an immediate concern. Figure 3 reveals the proximity of BNP to the metropolitan area of Miami, which sprawls across the majority of the land area of the park's western boundary.



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Figure 3: Biscayne National Park

(<http://eol.jsc.nasa.gov/scripts/sseop/clickmap.pl?hashnumber=6663&fieldlist=GEON,FEAT,LAT,LON,TILT,CLDP,PDATE,FCLT,IMAGE&options=none> 2005)

The biological health of corals and other sensitive marine organisms can and will improve in the absence of anchor damage. Mooring buoys therefore protect reef communities “in a manner that will leave them unimpaired for the enjoyment of future generations” (36 CFR 2001). And while they’re protecting the environment, mooring

buoys can potentially help in other ways. There are less obvious advantages to mooring buoys that, however subtle, benefit the overall value of a mooring buoy program.

One of these added features is a mooring buoys' aid to navigation. Because they are easy to see from a distance, "a reef tract surrounded by mooring buoys provides a warning to boaters that this is an area of shallow water, which should reduce accidental groundings of boats on the reef" (Reef Mooring Buoys 2005). The proximity of BNP's mooring buoys to dangerously shallow water might deter boaters from those areas.

Another positive aspect occurs underwater, where mooring buoys attract fish. Because visitors obviously like to see more fish, the quality of a dive site would improve with the addition of a mooring buoy. Finally, a third asset is that the mooring lines help divers ascend and descend onto deeper sites and provide a reference point for the area (Quirolo 1992).

These are just a few of the extra features mooring buoy systems provide; there are many more recreational and ecological benefits that are explained further in the latter sections of the document, along with an assessment of potentially negative impacts.

Background

BNP has a history of experience with mooring buoys in the park. Information gathered from individuals involved with the current mooring buoy program made it easier to decide what would and wouldn't work for the management plan. Other guidance came from marine policy professionals and resource managers that are responsible for mooring

buoy programs of their own; testimonies of their success and failure were useful in the decision-making process.

The recommendations of this management plan provide BNP with a formal framework to develop its new mooring buoy program. The foundation of these recommendations rest on the establishments of knowledge requisites, which provides the basis for key management considerations in the park. The primary concerns relate to the effects mooring buoys have on critical habitats, use patterns, user conflicts, and carrying capacity. The management objectives outlined in the following sections rely heavily on monitoring efforts to maintain the success of the mooring buoy program. It includes provisions for optional management solutions, such as public use limits and policies on anchoring. However, the need for future regulations limiting public access should be validated by sufficient data. It would be problematic for BNP to advance that type of strict regulation without first establishing knowledge requisites for heavily used areas.

Roles and Responsibilities

The most critical undertaking in the success of this program is meeting the legal duty of care that BNP assumes as a provider of the mooring buoys. Consequently, there is a "reasonable care standard" to uphold— a duty vested upon BNP to use "good judgment" in order to prevent unreasonable risk to users (Gjerde 1991). Satisfying the appropriate degree of care can be accomplished by closely following the roles and responsibilities outlined in this section of the MBMP.

The following management objectives highlight points of interest in coral reef protection, which are presented in BNP's "Statement for Management." "BNP management will strive:

- to manage the park's natural resources in a positive and scientific manner so as to protect, to the greatest degree possible, the complex and interrelated biological and geological processes.
- to identify, evaluate and preserve cultural resources in accordance with legislative and executive requirements and NPS policy.
- to encourage and participate in natural and social scientific research for the purposes of developing adequate baseline data and monitoring changes in park resources.
- to foster visitor understanding and appreciation of the park's resources and aesthetic values by providing access to and interpretation of natural and cultural resources and processes.
- to interpret and provide visitor experiences of underwater resources through the development and use of innovative and varied techniques that minimize disturbance of these resources."

(GMP 1983)

Maintenance

There are two types of mooring buoy systems of interest to BNP. All of the existing and future mooring buoys will either be Halas or Manta-Ray systems, as determined by the substrate. Figure 4 demonstrates the Halas mooring buoy system. Each Halas mooring system includes a polyurethane foam buoy, UV-treated polypropylene line (3/4-inch for the down and pick-up line, and 7/8-inch for the buoy through line), small weights, shackle and a stainless steel eyebolt (Halas 1991). The only difference in this construction and a Manta-Ray mooring system, as Figure 5

demonstrates, is the utility anchor rod that the Manta-Ray uses to penetrate the substrate.

Aside from the anchoring devices, maintenance for both systems is the same. Procedures for maintenance will follow a similar format as those found in Appendix F, titled Mooring Buoy Maintenance Manual (FKNMS).

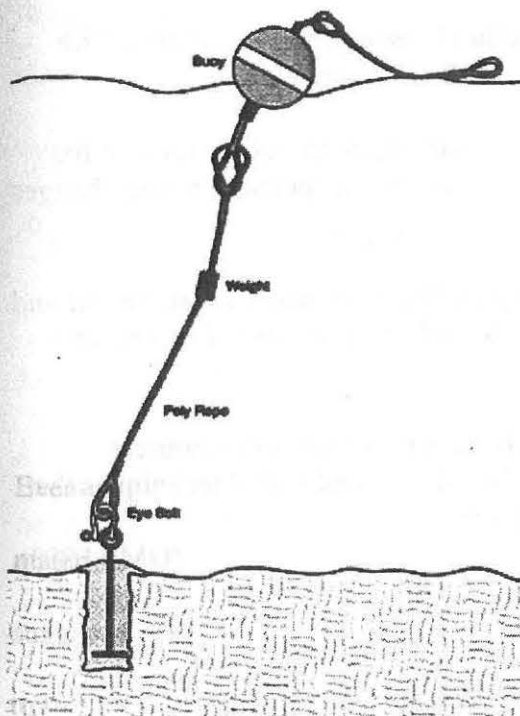


Figure 4: Halas Mooring System
(van Breda A., Gjerde K.M, 1991)

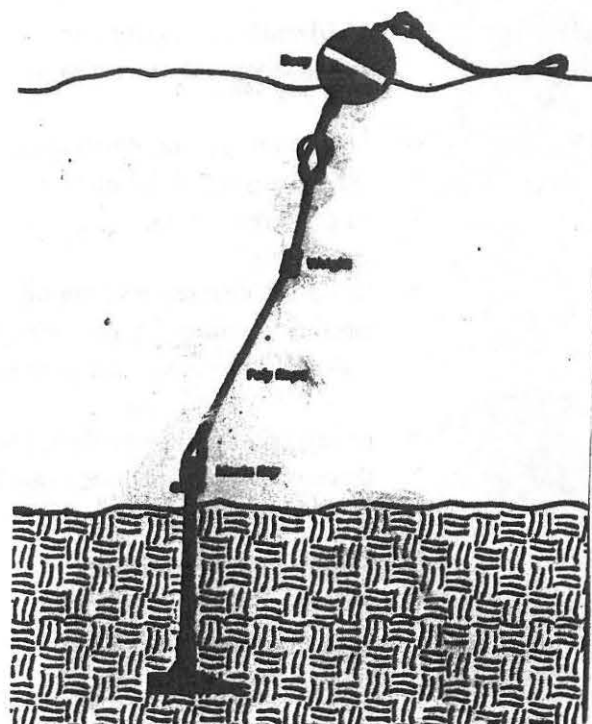


Figure 5: Manta Ray Mooring System
(van Breda A., Gjerde K.M, 1991)

The Maintenance Division at BNP will serve as the administrative manager of the mooring buoy program, and will therefore arrange all related maintenance and fiscal activities, which includes purchasing replacement materials. In order to safely provide mooring buoys to the public, BNP will continue to follow regular inspection and maintenance activities. They will also coordinate with independent contractors and volunteers, during which time it will be necessary to manage non-park staff closely to

guarantee performance. It is recommended that BNP keep a maintenance record of all inspection and maintenance activities.

Mooring systems often suffer damage from boats; therefore regular inspection is a high priority. The standard maintenance procedure should at least take place every three months, or more often if possible, on all mooring buoy systems, following these guidelines:

- Inspect all buoys, pickup lines and ground tackle for wear and tear.
- Clean pickup line and buoys of growth; replace if necessary.
- Inspect and clean exposed portions of the buoy through-line, checking for cracks in the buoy; replace as needed.
- Check for anchor movement between anchor and cement core or between the cement core and the surrounding substrate.

Eventually, with enough use, every mooring buoy system will need replacement materials after a certain period of time. For BNP's mooring buoys, maintenance records suggest that the buoy through-lines and pickup lines need replacement at least every eight to twelve months.

When new sites for mooring deployment are decided, additional equipment needs to be rented or purchased to install the mooring buoy systems, including an underwater jack hammer, power source, and hoses. Drive gad, and load locker (van Breda; Gjerde 1991). The specific installation procedure for both systems must be consulted before attempting installation without prior experience.

Funding Alternatives

Beyond the park's budget, the best avenue for financial assistance comes through grant sponsorships such as the "Anchors Away!," which is a partnership between National Oceanic and Atmospheric Administration (NOAA), Environmental Protection Agency (EPA), and National Fish and Wildlife Foundation (NFWF). Grant candidates that "provide for the expertise necessary to install mooring buoys and carry out a robust maintenance program" will receive priority (www.nfwf.org/programs/anchors_away.htm 2005). Grant money is also available for outreach projects through South Florida National Parks Trust.

Through the development of a fundraising program, BNP could sponsor functions to specifically benefit the mooring buoy program, such as an "Adopt-a-Buoy" program. Local dive shops, dive clubs, private businesses, and non-profit organizations would all be likely candidates for sponsorship. To maintain their commitment in the "Adopt-a-Buoy" program, sponsors could make annual payments to BNP or coordinate with the park to perform inspection and maintenance procedures of their buoys on their own. Volunteers could assist with boat support, splicing rope, handing out education materials, or photography.

Elsewhere in the world, other creative approaches are helping finance mooring buoy projects. In Hawaii, the Malama Kai Foundation has found a proven marketing incentive for larger sponsorships. "Contributors receive a certificate of adoption and, for donations over \$500, are recognized on a plaque located at the Hawaii Department of Land and Natural Resources (DLNR) Headquarters in Honolulu;" in addition, donors also get to choose the location of the approved future mooring buoy site (Malama Kai

Foundation 2005). Bali will soon try a new approach with their new mooring buoy program, sending participants on an expedition to finance and install new mooring buoys. And in Negril, Jamaica, an MPA held a reggae benefit concert for their mooring buoy program.

All of these techniques are noteworthy to replicate as they provide an interactive approach, which encourages an exchange of education and awareness of the benefits of mooring buoys on coral reefs among participants in the community. Getting the community involved in the mooring buoy program creates a sense of ownership for the public, which in turn induces compliance. Whichever combination of funding alternative BNP decides on, consideration for the public's involvement must be held in the highest regard, because they are the ones who ultimately make mooring buoys effective. Any of the above recommendations would work for BNP, but if the park should choose to secure long-term financial support, the superintendent is authorized to establish a recreation fee.

Despite some concern related to the park's infinite access and limited enforcement, a "user fee" for the mooring buoys remains in discussion at BNP. The fee is for "entering designated entrance fee areas or using specialized sites, facilities, equipment or services, or participating in group activities recreation events, or other specialized recreation uses for which recreation fees have been established" (36 CFR 2001). Should a "user fee" receive further consideration, given the appropriate circumstances, there are multiple options for this service:

- Fee collections could take place indefinitely, or only during peak season and special events.

- Collection could take place with the assistance of a designated park boat that could receive payment from each vessel, or by payment through the mail, over the internet, or in person at BNP headquarters.
- A sticker would need to be produced to display on the vessel.
- If it's decided that the fee shouldn't be mandatory, that payment could be a voluntary donation.

Other MPAs, like the Florida Keys National Marine Sanctuary (FKNMS), accept voluntary donations for their mooring buoy programs in various drop box locations. Fees would vary depending on the length of desired use, so BNP could provide permits ranging from one day to one year.

Vessel Size Limitations

For the purposes of safety, no vessel larger than sixty feet may use mooring buoy systems in BNP. Otherwise, only one other policy is suggested to govern the interaction of two vessels: when one vessel is significantly larger than the other. When two vessels of different length wish to share the same mooring buoy,

- if the smaller vessel is less than thirty feet and weather conditions are reasonable, the larger vessel must always take the mooring, allowing the smaller vessel to tie off onto their stern.

Boat Use Survey

As the exclusive concessionaire of the park, Biscayne National Underwater Park Inc. makes use of the mooring buoys frequently, usually operating two trips daily,

weather permitting. The concessionaire's input is a tremendous asset, helping BNP on and off the water. On the water, they are generally the first ones to report missing buoys, which is noted along with a record of visitation and user information. Other boats on mooring buoys are also recorded, as is preference data from passengers aboard the concessionaire's boat. All of that information is always available to BNP; also, a record of the categories of data found in that logbook is located in Appendix H.

As of May 27, 2004 Biscayne National Underwater Park Inc. has maintained additional items in the captain's logbook that are of interest to the mooring buoy program. The data will assist BNP's monitoring efforts. The following information on private vessels is available from the concessionaire:

- Name of the mooring ball.
- Time observed.
- Type of boat and approximate length.
- Type of activity (i.e. diving, snorkeling, or fishing).

There is a need for more user data, particularly quantitative representation of BNP use patterns and visitation data. This information would be useful to managers during decision-making processes for future mooring buoy issues such as closures and future site selection.

Public Notice

The General Management Plan for BNP establishes that "[t]he objective for managing the reef tract is to preserve its cultural and natural resources and to provide a

meaningful and safe surface and underwater experience for visitors” (GMP 1983). Changing priorities in the park sometimes cause managers to validate closures and public use limits that affect the public “based upon a determination that such action is necessary for the maintenance of public health and safety, protection of environment or scenic values, protection of natural or cultural resources, aid to scientific research, implementation of management responsibilities” (36 CFR 2001). Adjusting the number of mooring buoys provides control over the use patterns and can be used as a means to limit excessive use. Changing or rotating buoys allows localized areas to recover without stress caused by physical damage. In the future, BNP should establish a monitoring program for mooring buoy sites to determine if there’s a need for further regulations to control user access in heavily used areas.

In the event of a closure or public use restriction in BNP, “the public shall be notified by one or more of the following methods:

- Signs posted at conspicuous locations, such as normal points of entry and reasonable intervals along the boundary of the affected park locale.
- Maps available in the office of the superintendent and other places convenient to the public.
- Publication in a newspaper of general circulation in the affected area.
- Other appropriate methods, such as the removal of closure signs, use of electronic media, park brochures, maps and handouts.”

(36 CFR 2001)

Education

Since “most of the people who visit the park will continue to arrive by water in private boats,” there’s a genuine difficulty in providing reef awareness information to most boaters (GMP 1983). As a result, the amount of physical contact users have with reefs – anchors, accidental boat groundings, diving and snorkeling damage – is ultimately dependent on the knowledge of individuals with varying boat experience. Establishing mooring buoy usage as voluntary further delegates the stewardship of the reef community to the users of the resource. And so, given that reality, BNP would be wise to focus the public’s attention on the value of mooring buoy use through education and awareness materials to reach boaters before they arrive in the park, so they are conscious of their ecological impact during their stay.

For recreational boaters, tying up to a mooring buoy provides a simple, safe and convenient alternative to dropping anchor, and it saves time. Further, using a mooring buoy eliminates the unnecessary physical damage caused by an anchor, thereby allowing more natural environmental conditions for the reef community. In BNP, if people who recreationally enjoy the park’s natural resources come to understand the conservation ethic associated with mooring buoys, many of them will want to take control over their impact on coral reefs by using mooring buoys. The problem is mainly ignorance. And who can blame them; not everyone can be expected to understand how fragile corals are. The burden falls on BNP to get the message out. Examples of successful campaigns are found in Appendix G, titled Miscellaneous Education / Interpretation Sample Material.

Carrying Capacity

There is an apprehension in BNP and elsewhere related to the exploitative potential of mooring buoys— concerns that the benefits mooring buoys provide can potentially be offset by harmful impacts. Concentrated use makes the area vulnerable to diver and snorkel damage, accidental boat groundings, sedimentation, pollution, and increased harvest pressure. Under the right combination of circumstances, this tradeoff could potentially offset the net advantage of mooring buoys.

Establishing a baseline for the health of reefs and the condition of submerged cultural resources (SCR) in the park will credit future monitoring analysis and comparison. Ongoing biological and cultural assessment provides BNP extra time to address environmental changes and find a balanced management approach. By virtue of their function, the mooring buoys “confine the damage from careless snorkelers and divers to the general area of the mooring,” which facilitates the monitoring of impact assessments.

Boat use is another variable of interest because mooring buoys are known for “attracting more boaters, divers, and fishermen than would have previously used the areas (Mooring Buoy Action Plan 1995). If BNP finds that an assessment of mooring buoy impacts reveals a decrease in the health of the reefs or negative effects on submerged cultural heritage caused by concentrated use in those areas, the superintendent can respond with closures and public use limits, such as those suggested in the Action Plan. Monitoring will therefore be useful to determine the carrying capacity of popular mooring buoy sites, so that mooring buoys can be removed or added as necessary, or

sufficiently protect the park from liability claims. Since there are unforeseen risks associated with the marine environment, it is necessary to "use that degree of care which a reasonable person would exercise under the circumstances to prevent unreasonable risk" (Gjerde 1991). However, to be extra sure to reduce BNP's exposure to liability, more can be done.

There are additional measures of precaution that are recommended to remove any question of liability that BNP would otherwise assume. These actions will complement standard preventative techniques such as mooring buoy inspection and repair; and the additional measures will "also be useful in establishing the standard of care expected of mooring buoy users" (Gjerde 1991). Warnings and disclaimers lend responsibility to the user and may remove liability from the provider of the mooring buoys, if used correctly. One suggestion for a disclaimer reads "use at your own risk; provider assumes no responsibility (even for negligence) for injuries or property damage resulting from use of the buoys" (Gjerde 1991). This notice could be put on the buoys themselves, which would credibly establish that users are informed of the risk, and that users have the choice to take the risk, or not.

It would be difficult, and even aesthetically undesirable, to post signs in the area of mooring buoys. Instead, BNP could locate more detailed information in pamphlets or other material on mooring buoys, to additionally provide adequate warning in detail; posting notices at nearby boat ramps would also be helpful. Noteworthy themes for discussion include instructions for use (and the importance of checking the integrity of the ground tackle of the mooring), potential danger resulting from the failure of a mooring buoy system, and weather and vessel size considerations.

Lastly, there is one other legal concern related to the mandatory usage of mooring buoys, which is an idea that this management plan endorses. When a marine park insists on boaters using mooring buoys, thereby eliminating the alternative to anchor instead, the "vessel owners discretion over whether to use mooring systems" is gone, and the burden of liability falls back on the provider (Gjerde 1991). In this case, "it cannot be argued that a vessel owner 'assumed the risk' of using a mooring buoy. A disclaimer of liability would similarly be declared invalid. A person cannot be said to have assumed the risk of injury when he or she had no alternative but to use the mooring system" (Gjerde 1991). Then again, FKNMS makes it mandatory to use their mooring buoys in the ecologically sensitive marine zones in the park. This is a significant issue to keep under consideration when deciding the course of implementation for the proposed no-anchor zones in the Action Plan.

Mooring Buoy Action Plan

No-Anchor Zones

BNP should consider enforcing the mandatory use of mooring buoys to help recover and sustain the biodiversity of reef communities. BNP is within its' legal right to close "a portion of a park area to all public use or a specific use or activity" (36 CFR 2001). This Action Plan calls for a restriction on anchoring in specified areas to limit stress in designated reef areas, which protects reefs in the immediate vicinity of mooring buoy sites. Mooring buoys would provide the only means of access, which would keep direct impact to a minimum.

In addition to the biological and cultural advantages, no-anchoring zones will facilitate users and managers of the resource establishing protected areas to take pleasure in, or study, the reef community. For managers, analysis of the coral cover, species diversity and increased fish abundance in the protected areas can serve as a baseline by which to compare reef health, fish and coral recruitment, and direct, physical impacts outside of the no-anchor zones. That knowledge base could then be used to establish the nature of issues impacting the reefs and determine policies for further protection. The proposed no-anchoring area in BNP serves several purposes:

- It immediately establishes definitive protection from anchor damage in marine areas that are the most sensitive to direct physical impact— coral reefs.
- It elevates the intrinsic and economic value of a visitor's experience as a result of the improved biological health of the area, creating a more genuine wilderness experience.

- It creates control sites for scientists to compare analogous reef complexes without the no-anchoring regulation.
- It enables law officers the ability to easily distinguish violators from other boats tied to a buoy (or another boat), instead of personally checking the vessel's anchor to see if it's in sand or coral.

In BNP and elsewhere, one of the most common threats to the reef is caused by damage from misplaced anchors and chain that injure the sensitive, living tissue comprising a coral's outer layer. An "anchor dragging on the ocean bottom can physically scar corals and other sea life, opening it up to infection and disease" (Quirolo 1992). Direct physical damage is "more limited in spatial extent, but in some cases more damaging and irreversible than any of the others" (Spalding 2001). In other words, damage is proportional to the popularity of the site.

Ironically, direct impacts are also the most responsive to management action, and reducing the use of anchors is the most sensible approach. Executing a policy for the mandatory use of mooring buoys effectively reduces physical damage to reefs as recreational pressure would then become "highly localized," hence easier to monitor and manage (Spalding 2001).

Future Site Selection Criteria:

For over twenty-five years, the park has maintained up to 33 of its own mooring buoys without an official management document. However, several of those mooring buoys were temporarily abandoned when they were not visible at a known site, at least

until time allows for their search and revival. In the meantime, those buoys are listed as either missing or inoperative.

Currently, it is assumed that 22 mooring buoys are available for use along the eastern, ocean-side boundary of the park. Of the original fifteen sites, eleven are still maintained: two shipwrecks, one deep reef site, and eight patch reefs. Generally speaking, there are two to five mooring buoys per site.

This Action Plan presents a set of guidelines for the modification of existing mooring buoys in the park, and makes recommendations for future site selection. Increased recreational pressure and other special circumstances may create the need for additional mooring buoys at a particular site. Instead of purchasing new materials, replacement parts for future mooring buoy sites can be incorporated from ground tackle on existing sites that are below their carrying capacity. Each mooring buoy site will require a different number of mooring buoy systems to support visitation, which is currently between one and three. However, since several mooring buoy sites currently have more buoys than they need, the extra mooring systems could be relocated to another site with a higher demand.

Figure 6 shows a map of Biscayne National Park in a Geographic Information Systems (GIS) program with the mooring buoy sites in their respective locations (mooring buoys are represented with a yellow star).

Appendix H provides GPS numbers and names for all of the sites, as well as a recent assessment of the condition of each specific mooring buoy system. In the future, as BNP adds to their mooring buoy inventory, the new coordinates can conveniently be updated in the digital GIS file at the park.

For the purposes of future site selection, the demand of the site must first be considered. Popular diving and snorkeling sites in BNP that are exposed to significant recreational pressure will take priority in the determination for the need for mooring buoys. The second most important feature, which decides the number of mooring buoys, is the size of the area. Vulnerable sites that need mooring buoys the most are those with complex reef structures; not desirable are areas with more sensitive, fragile colonies of *acropora spp.* Areas with growth potential for stressed organisms of any kind should be prohibited to the public in a similar fashion as the Legare Anchorage, or with special no-anchor zones, as proposed.

Although a "shipwreck trail" is in the works at BNP, the specific names and location of submerged cultural heritage site are intentionally left out of the map in Figure 5 in order to prevent heavy use at particular sites, especially shipwrecks. Although this information is public knowledge, it is not easily found. Further, until mooring buoys become available to those cultural sites, the preferred management approach is to leave their location unspecified at this time.

In addition to providing a management agenda for the existing mooring buoys, this document provides guidance for future mooring buoy sites. Experience suggests that two mooring buoys are sufficient for shipwrecks, and either one or two moorings for

smaller patch reefs, with no more than three at larger reef complexes. There is currently one deepwater reef with 2 buoys, which is a sufficient amount.

There is one specific area in dire need of mooring buoy systems; Figure 7 is a NOAA map of that specific area. Extending north and south of the Fowey lighthouse is a well-defined reef tract with thriving coral at varying depths— a marine area frequented by the majority of visitors to BNP. On the outer reef, where many regular divers and snorkelers from the metropolitan area find recreation in the marine community, accessing a chosen site by dropping anchor in the sand is far more complicated than doing so at a patch reef (which, in BNP, can usually be seen and negotiated).

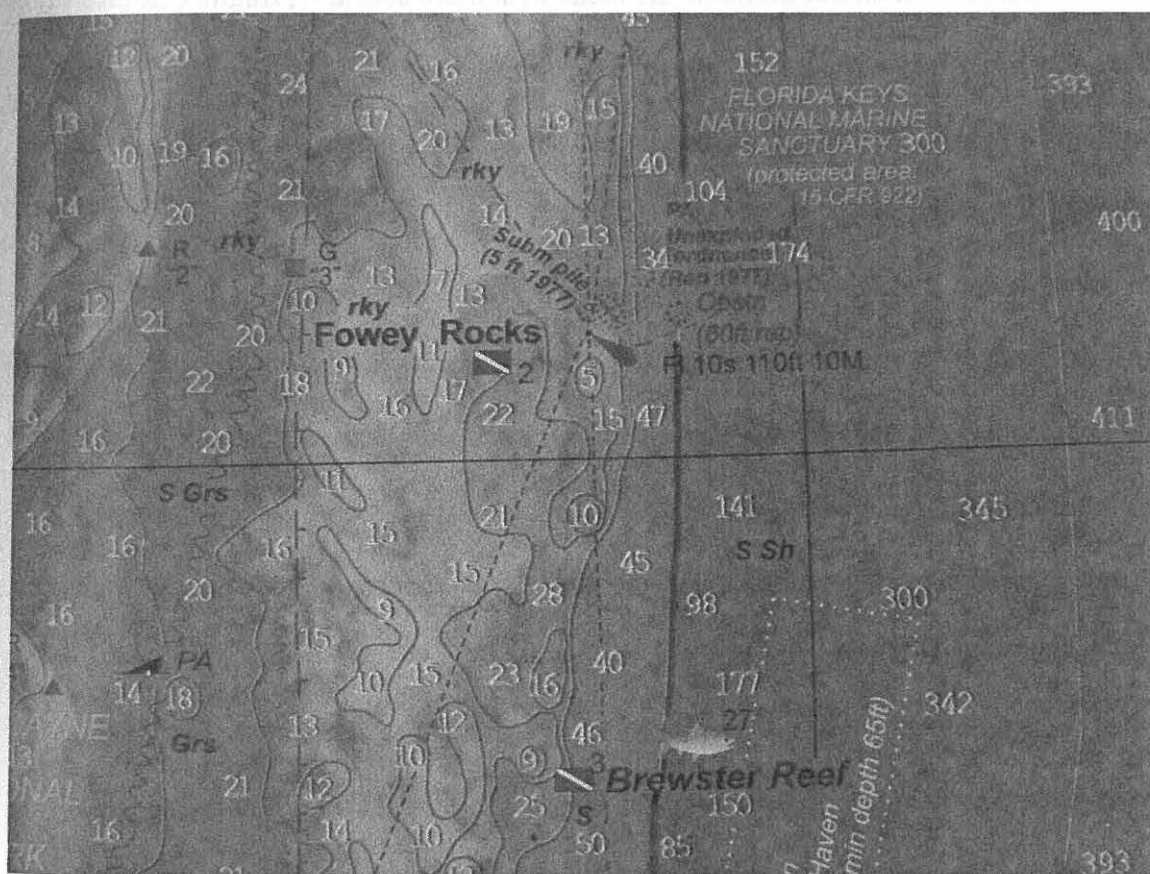


Figure 7: Northeast Boundary (BNP)

(Miami and Biscayne Bay Mercator Projection Map by Navisat 1984)

The barrier reef in the Fowey area isn't a spur-and-groove formation; it's linear, and sandy areas are harder to find. The area is therefore a critical habitat and, given its heavy recreational use, should be managed as such with mooring buoys to limit anchor damage. It would be practical to create mooring buoy sites near the northern boundary of the park for a more comprehensive representation of mooring buoy sites, and because so much recreational activity takes place there.

Consultation and Coordination

Andy Hooten, AJH Environment Services; International Coral Reef Action Network
Caroline Rogers, U.S. Geological Survey
Department of the Environment, Cayman Islands
Don Pybas, Miami-Dade County Extension Service
Gary Davis, Channel Islands National Park
John Halas, Florida Keys National Marine Sanctuary
Marianne Cufone, Environment Matters, Inc.
Terry Helmers, University of Miami
Thomas Kelley, Virgin Islands National Park
Tom Perkins, Biscayne National Underwater Park
Zandy Hillis-Starr, Buck Island Reef National Monument

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<http://www.kathyjohnston.com/color_book/anchor_and_coral_reef.htm>

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Appendix A



United States Department of the Interior

NATIONAL PARK SERVICE
Biscayne National Park
9700 S. W. 328th Street
Homestead, Florida 33033-5634

IN REPLY REFER TO:

L46

NOV 06 2002

Memorandum

To: Decision Memorandum File
From: Superintendent
Subject: Mooring buoys

Over the years the Park has installed 33 mooring buoy anchor pins. Four mooring pins (sites) are missing or have been in somewhat lost. The placement of these mooring buoys was based more on convenience and frequency of visits by science and resource management rather than on visitor interest, uniqueness within the resource or an attempt to reduce the incidence of resource damage. Since placement, Terry Helmers a park volunteer for more than 15 years has been maintaining the anchor tackle and mooring buoys on the remaining 29 sites. He has been doing this largely at his own expense (those expenses beyond the cost of the ground tackle and buoy), according to his own schedule of availability, and largely without the physical assistance of park staff. However he has been extremely diligent in coordinating and communication his activities with the Science, Resource management, and Maintenance Divisions.

The mooring buoy discussions were lengthy and active and the discussion often strayed beyond the realm of mooring buoys and into a more general discussion of maintaining navigational aids in general. Although the discussion varied widely, there was a general consensus that mooring buoys were a separate issue from Navigational Aids, but that both would be ultimately maintained, and funded through the Maintenance Division. The Management Team would handle however the planning and placement of future mooring buoy systems with assistance by both the Science and Resource Management Divisions. It was also generally agreed upon that the Maintenance Division would continue to maintain the existing moorings in a manner very similar to that which we are currently using (Helmers). It was also generally agreed that the park would not deploy additional mooring systems on the coral reef platform or in Biscayne Bay, except when needed for a special purpose. However additional mooring systems (buoys) would, and will be, considered in the future after 1) a study has been completed on the impacts and benefits of the mooring and 2) a mooring buoy plan has been developed and approved by the Management Team.

Funding for the mooring buoy study was submitted for funding through the Program Management Information System (PMIS) in FY02 for consideration for funding in either FY 03 or FY04. The Science and Resource Management Divisions will continue to seek funding for this research. Science and resource management will also investigate the possibility of joint research project, partnering with other parks maintaining or considering the use of mooring buoys. These two division will jointly draft a mooring buoy plan for review and revision if the desired research is funded. No completion date for the mooring buoy plan was discussed or identified as a work element for either Division for this fiscal year.

Mooring Buoy Program Planner

I. INITIAL PLANNING PHASE:

- Identify all user groups, local organizations and government agencies and their roles
- Educate community and government agencies on need for moorings
- Identify how to reach pertinent government agencies to grant permits, etc.
- Discuss liability issues
 - Identify need for legislation to enforce mooring use (if any)
 - Identify methods of enforcement (including volunteer)
 - Identify needs (for or against) establishing marine parks, sanctuaries, etc. To further protect coral reefs
- Research

General water quality of area

Needs assessment of sites for mooring buoys Types of Substrates, etc.

Types of suitable mooring systems available

- Identify parties to perform administration
 - Over-all Project Planning
 - Fund-raising
 - Mooring Buoy Installation
 - Mooring Program Enforcement
 - Mooring Buoy Monitoring (physical condition/deterioration) Regular Maintenance Program for Mooring Buoys
- Needs assessment of training program for installation and maintenance
- Identify local user groups, government agencies and/or NGO's to support project
 - With publicity
 - With cash
 - With volunteers
 - With equipment
- Develop Time Line

II. ECONOMIC AND ADMINISTRATION

- Gather data required for permit proposals
- Write proposals for permits
- Plan and implement fund-raising events
- Obtain various sources of funding
- Obtain financial support for phone and fax support

III. INSTALLATION

- Map and mark mooring buoy sites
- Develop complete equipment and materials lists
- Recruit volunteers:

People

Boats and captains

- Determine best mooring system type to use based on research:
 - Halas System (pin)
 - Helix
 - Hughes
 - BEWR
 - Manta Ray
- Find suppliers of mooring systems and other equipment and materials
- Customs assistance & duty-waivers from government agencies for imported equipment
- Needs assessment for technical assistance
- Logistics Shipping times/places/dates of materials Shipping times/place/dates of equipment Management of personnel

IV. MOORING BUOY PROJECT PROGRAM MAINTENANCE:

- Develop system of monitoring and logging condition of mooring buoy
- Develop system of monitoring and logging condition of mooring site
- Develop system of responsibility for each mooring buoy's replacement (& parts)
- Develop on-going financial support system
- Develop system of logging maintenance of each mooring buoy

Appendix C

Listing of Sources to Contact for Additional Information on Mooring Buoy Project

Center for Marine Conservation

1725 DeSales St. NW
Washington, DC 20036
Pamphlet: The Use Of Moorings As A Management Tool

Dor-Mor Inc.

RFD #2
Box 476
Claremont, NH 03743
(603) 542-7696

Environmental Moorings International

172 Lorelane Pl.
Key Largo, FL 33037
(305) 451-5984
Components for Halas System

Foresight Products Inc.

116 Cass St.
Traverse City, MI 49684
(616) 941-4212 or (800) 748-0471
Manta Ray

Florida Keys Marine Sanctuary

Mile 100
U.S. Highway 1
Key Largo, FL 33037
(305) 451-6476
Information on Halas eyebolt system

Hazellett Corp.

217 Lakeshore Dr.
P.O. Box 600 Colchester, VT 05446
(802) 863-6376
Elastic rode

Helix Mooring Systems, Inc.

170 Spring St.
Southington, CT 06489
(603) 672-1930 or (800) 866-4775
Distributes helical moorings from A.B. Chance Products

Sea Spike Marine Supply Co., Inc.

994 Fullerton St.
Farmingdale, NY 11735 (516)
249-2241
Mushroom Anchors

Environmental Funding Sources

Greenpeace

1436 U Street, NW, Washington, DC 20009
(202) 462-4507

The Nature Conservancy

785 Market Street, San Francisco, CA 94103
415-777-0487 415-777-0244 fax

Ocean Futures Foundation

Atten: Jon Englander
2050 S. Santa Cruz St., Ste. 1000
Anaheim, CA 92807
714-939-6399 714-939-6398 fax

Project AWARE Foundation

Atten: Kristin Valette
1251 E. Dyer Rd., Ste. 100, Santa Ana, CA 92705
714-540-7234 x328 714-241-7271 fax

PADI Foundation

Atten: Charles Rettig
9150 Wilshire Blvd., Ste. 300, Beverly Hills, CA 90210
310-281-3243 310-859-1430 fax

Patagonia Environmental Grants Program

Patagonia, Inc.
PO Box 150, Ventura, CA 9300

Reef Relief

PO Box 430, Key West, FL 33041
(305) 294-3100

Surfrider Foundation

122 S. El Camino Real #67
San Clemente, CA 92672
(714) 492-8170

The World Conservation Union (ICUN)

Marine and Coastal Activities
Rue Mauverney 28
CH-1196 Gland
Switzerland

Appendix D

Brad Wilcox
Volunteer, Biscayne National Park
Mooring Buoy Management Team
July 8, 2004

To the Concessions Team:

Please excuse our belated invitation to the Mooring Buoy Team meeting this morning at 9:00 am. The absence of that information was entirely a result of my own lack of awareness that the Concessions Team would have an interest in a preliminary brainstorm on the mooring buoy subject. I am new to the park as an intern from University of Miami's Rosenstiel School. My goal for the summer is to establish a mooring buoy management plan with the assistance of as many individuals as possible to provide for the best practice possible for Biscayne National Park's mooring buoy sites.

The following represents an account of the highlights of this morning's meeting so that the Concessions continue to remain current and involved in the operation of a mooring buoy management plan for Biscayne National Park. The gathering lasted one hour.

Basically, after settling into introductions, the group members discussed their individual expectations of the mooring buoy plan. Related marine parks from the Caribbean region were introduced to find agreement on which would serve to provide the most useful examples of failures and successes. Public hearing potential was also discussed, as was the mooring buoy plan's relation to fisheries management given their attraction to fish and fishers. We then spent some time discussing likely interview questions for contacts at other marine parks.

The meeting went off well. It was mostly a brainstorm of potential contacts, interview questions, and the history of the mooring buoy maintenance process as determined by Terry. In addition to Terry, attendees at the meeting included Monica, Karl, Richard, Steve, and myself (Brad Wilcox).

Our next meeting is scheduled in the conference room August 5, 2004 @ 9:00 am. However, I will be in touch in the very near future to follow up on this issue as I have lots of questions for the Concessions.

Thank you,

Brad Wilcox

Biscayne National Park
Meeting Minutes
Mooring Buoy Management Team
August 2, 2004

Goals:

1. Outline for the project by the end of July
2. Interviews and background research
3. Management Plan Ideas
4. Criteria for Monitoring of Mechanical, Biological and Use Level

Progress:

Researched existing mooring buoy management plans at Bonaire Marine Park and Curacao (Netherlands Antilles), Soufriere Marine Management Area (St. Lucia), St. John National Park (USVI), and San Salvador (Bahamas).

Conducted interviews with Jean Paul Claude at Riding Rock Resort in San Salvador, Bahamas; Conducted a phone interview with Kalli DeMeyer at BMP; confirmed future interviews with the remaining individuals provided in "Outside Contacts."

Questions:

Can we incorporate a mooring buoy monitoring program into an existing coral reef monitoring agenda?

Can we add relevant mooring buoy questions onto the park's survey questionnaire [Shelby's fisheries survey]?

Where can I find a copy of a study of natural and artificial reef usage in SE Florida (June 2000- May 2001) and other related impact assessments?

Is there a demand for more than 30 mooring buoys, as there are currently 23 existing buoys plus 7 missing buoys? Is that enough?

Outside Contacts:

Caroline Rogers, Thomas Kelley, Kaf Smith, Kai Wolf, Andy Hooten, Kalli DeMeyer, John Hallas, Judy Hallas, Jim Thomas, Liana McManus, Cara Dickman.

Dear all:

After yet another round of close calls — Charlie, Frances and Ivan— now that the past month of emergency preparation of Miami has educated me towards "hurricane veteran" status, I am especially thankful for our wellbeing. Considering the fatal effects in neighboring areas of the tropics, we were triple lucky. In comparison to many islands in the Caribbean basin, marine systems in Florida suffered minimal damage. However, please realize that my calculation does not abate the recent devastation to mangrove and seagrass communities from the Ten Thousand Islands to the Panhandle from Frances (and possibly Ivan, which remains to be seen). And to that regard, it also lacks an assessment of the physical damage to reef systems in and near the Dry Tortugas. In summary: this week, as Ivan crosses west in the southern horizon, a local sigh of relief will settle over South Florida like a comfortable blanket on a cold night; but regionally, a tragedy to the Caribbean reef community has taken place.

Category 5s and mature reef complexes don't mix well. Therefore, considering the hurricanes are visiting some of the best reef sites in the Caribbean, the impacts will be severe. In my travels, I have built a personal connection with several of those reefs. It is the process of wondering about their condition compelled me to write on the subject. For the past three summers, as a TA at the Gerace Field Station, College of the Bahamas, San Salvador, I was fortunate to witness, first-hand, the experience only made possible by a thriving, remote reef (not to mention the amazing "wall"). While working for ICRAN, I spent a week scuba diving fringing reefs in Bonaire, conducting research and interviews related to the success of Bonaire Marine Park. A similar project took place in St. Lucia, and another at Sian Ka'an Biosphere Reserve, in Mexico. A trip in-between took me to Jamaica. Now, after two category 5 hurricanes have shaken those areas, I am re-experiencing the privilege of my own interaction with reefs that might not exist anymore, or at least be the same, and above all expressing concern for their future. But even without the passport stamps, I have come to realize another underlying connection— the parallel biological relationships that unite Florida corals with Bahamian, Mexican, Bonairian, Cuban and every other coral in the Caribbean.

As stewards of the environment, we cannot offer it protection from a category 5 hurricane. Granted. However, accepting that possibility doesn't justify neglecting our management potential. Given the socio-political, economic and ecological conditions that managers face today, anthropologic and natural, it is my newly formed opinion that one should not overanalyze fate— whether it be the ecological fate of globalization or a natural disaster. Instead, when it comes to resource protection, invest energy into preemptive strategies and remove Mother Nature and other "uncertainties" from the political-scientific equation. Our environment would surely be better off; and, as 6.6

billion of us have already noticed— natural systems have enough stress as it is. Now on to the “stress-less” mooring buoy.

Start here if you want to skip my 2 cents →

My preparations for the mooring buoy management plan are nearly finished, aside from tidying up the drafts with corrections, citations, etc.

I have attached the management plan for your review, hopefully before the next meeting so we can discuss it. At the moment it follows a similar format as FKNMSs mooring buoy plan, with supportive approaches from other progressive marine protected areas in the Caribbean. Once the mooring buoy management plan is finalized, I will be anxious to see if Biscayne National Park is ready for specifically designated moorings for snorkelers and SCUBA, creating additional buoys for the shipwreck trail and otherwise locating potential mooring buoy sites for the future growth of the program.

The management plan attached to this message is a rough draft and changes are already underway. However, I would still appreciate your criticism of this draft. The format for this document is based on the recommendations of two competent authors who are versed and immersed in NEPA dialogue, as well as NPS Compliance Guidelines. The final document will satisfy the legality of the NEPA process, and in light of the fact that the mooring buoys in discussion already exist, an EIS is completely unnecessary. An EA will still need to be prepared, however, which should be worked as close to the decision making for the management plan as possible.

I also hope to submit the plan for review at a public meeting of some sort in October, so if anyone can help with that I'd appreciate it. I signed the mooring buoy management plan up for an exhibition at the Coral Reef Task Force Meeting for this purpose.

Finally, once the preparations are finalized for the plan, we should think about some awareness material. I will share examples from other parks at the next meeting.

All of the contacts that we gathered were instrumental to the development of the mooring buoy management plan. I especially appreciated all of the assistance from the Virgin Islands National Park, Cayman Islands DOE, John Halas, Tom Perkins, Marianne Cufone, Maarten Schuit, and Caroline Rogers, and many more than I can list who took an interest in this project. Thank you to everyone.

***FINALLY... When can we have another mooring buoy meeting???

I will start with next Wednesday, September 22 @ 9:00 am. Does it work? I'll be in my office Tuesday afternoon and I will check in on everyone's schedule.

Biscayne National Park
Second Discourse on Mooring Buoys
Meeting Minutes
October 7, 2004

Topic:

Mooring Buoy Management Plan.

Focus:

If the new General Management Plan divides BNP into various use zones, will it give the mooring buoy program an opportunity to take a more dynamic management approach?

Observations:

I have been through *all* of the literature on the subject. The advantage of second-hand experience from other mooring buoy programs has enabled me the perspective to objectively consider BNP's coral reefs for active recovery strategies. I found a lot of pain in reading that in the 1980s, BNP was polled to be the second best snorkeling destination next to the Great Barrier Reef. If that consensus was ever correct, hasn't the park's coral reef biomass declined enough that it's about time for a new approach?

If the management plan finds that the impact on reefs in BNP reveal a connection with direct impacts (anchors, boat accidents, humans), proper management channels to mitigate the effect should pursued immediately. Based on the research, snorkelers and divers definitely put extra demands on reefs, but the majority of the damage comes from anchors and accidental boat groundings. Several surveys found close to 80% of divers touch the reef. BNPs situation is most extreme: the park is close to massive population and oil threats from the port of Miami, which would be promising with the north current of the gulf stream but septic systems in the Keys also influence water quality. Additionally, a burgeoning concoction of public interests—underwater “looky loos”(as one BNP regular B'reef Relief calls them) and recreational and commercial fishermen—have entered the debate at the same time interested parties are questioning the future of our ocean's integrity. Mooring buoys play their part in the solution and implementing a management plan is necessary to reduce direct impacts to the reef. But back to the question: does the power exist to do more?

Appendix E

MOORING BUOY QUESTIONNAIRE

Virgin Islands National Park

To benefit the evolving mooring buoy program at Biscayne National Park, Florida, please take a few minutes to answer the following:

How many mooring buoys are you responsible for? What are their primary uses?

219 moorings. SCUBA = 8, Day use = 15, Commercial = 17, Fishing = 6 and 173 overnight moorings.

Are any dive operators involved with the mooring buoys (as users, volunteers or otherwise?)

We do have several dive companies as well as private boats that use our SCUBA moorings. They do not participate in the installation or maintenance of the moorings. They do let me know if something is missing or looks suspect at some of our remote sites, that we don't get to very often. We have over 200 moorings and almost 200 other floating objects (channel markers etc.) so any help from the public on what needs work is a blessing. Also two dive operators donated money to The Friends of the National Park to help with the initial cost of installation for two SCUBA moorings. They also helped finalize placement of these moorings.

Are investors or sponsors involved in the mooring buoy program?

Yes, the initial funds \$250,000 were donated by a local merchant to Friends of the National Park for the specific purpose of installing moorings in the park. Also the dive companies mentioned above.

What are the issues or conflicts related to fishing vs. diving on the mooring buoys?

We have 8 moorings dedicated as SCUBA moorings at reefs throughout the park. We don't tend to have problems other than occasional resource damage from novice divers kicking the reef. We allow people to fish from the day use and overnight moorings with rod and reel. However, from a cleaning and maintenance standpoint it is a hassle and dangerous. The fishing line often gets wrapped around the mooring line breaks and creates a danger of entanglement. It's also difficult to get the long hair algae off of the line. We have six moorings designated as fishing moorings. These are used by local fisherman usually around the full moon for blue runner.

Are there any enforcement issues or concerns?

People don't always use the mooring correctly and refuse to do so when they are told the correct way. Last December we started charging \$15 for the overnight use of our moorings and we are having some compliance issues. Since then a lot of people have

been anchoring instead of mooring. Our LE are having to explain the resources to the visitors and occasionally hand out a ticket. We have some staff shortages in LE. Also, not all of our LE Rangers are concerned about seagrasses and coral so Resource Management is sometimes at odds with LE.

What are the failures and successes with the mooring buoys?

Many people appreciate that the mooring are there. We are protecting areas that previously had significant anchor damage. We are starting to see seagrass return and more sea turtles feeding in those areas. We have the capability of generating enough money through our mooring program to offset the cost of maintenance.

Some failures include actual failures in the mooring system that have led to lawsuits. We also can't protect all of the seagrass and reef that we would like to. It is a constant battle with so many moorings to keep up with everything. The job never ends. I can check a mooring and it is perfect, then 20 minutes later someone cuts the line with their prop.

What is the degree of community involvement in the mooring buoy program?

The public has an opportunity to review plans and make comments. They voice their opinions on the program. They are expected to pay the overnight fee.

Is anchoring allowed in the area surrounding a mooring buoy site?

Yes, although people are supposed to pick up a mooring if one is available.

Does a fee collection exist for the mooring buoys in your program?

Yes.

Are there vessel limitations for mooring buoy use?

Yes, 60 length on deck. They must vacate the mooring is sustained winds exceed 40 mph.

What is the material and attachment of the buoy?

We use one of three types of embedment anchoring systems. We attach the line to the anchoring system with a 5/8" shackle. All moorings have a swivel to prevent unraveling. We use 1" nylon line. The bottom eye-splice has chaff gear (plastic tubing). We add a subsurface buoy to keep the line off of the sea floor. The painters are 20 ft long, also 1" nylon. We attach the ball and painter to the down line using inter-locking loops. For the ball we use 3/4" nylon with a top knot.

Are there critical areas where anchoring is not permitted?

Yes, on the south shore of St. John, in the Coral Reef National Monument and in our swim areas.

(If applicable) what are the triggers for rotating buoys on heavily used dive sites?

What do you mean by this? Do you mean changing the line? We look for obvious signs of wear, nicks or cuts in the line and eye-splices coming undone. The nylon can last between 2 and 5 years.

MOORING BUOY QUESTIONNAIRE

Cayman Islands Marine Parks

To benefit the evolving mooring buoy program at Biscayne National Park, Florida, please take a few minutes to answer the following:

How many mooring buoys are you responsible for?

Approximately 300 Public Mooring Buoys

What are their primary uses?

Primarily for use at popular dive and snorkel sites, plus an additional 15 for use of visiting yachts in the main harbour.

Are any dive operators involved with the mooring buoys (as users, volunteers or otherwise)?

The dive community is the primary users of the public moorings. The Cayman Islands Watersports Operators (commercial dive and snorkel operators) assist in deciding the placement of moorings and reporting damaged or missing moorings, but the Department of Environment install and maintain the mooring.

Are investors or sponsors involved in the mooring buoy program?

Not really.

What are the issues or conflicts related to fishing vs. diving on the mooring buoys?

The moorings are public so in areas where fishing is allowed ie non protected areas some conflicts of use do exist with the dive community feeling that the mooring is primarily for diving and trying to push fishermen off.

Are there any enforcement issues or concerns?

The DOE maintains routine marine patrols to enforce the Marine Conservation Law - lack of personnel is a concern.

What are the failures and successes with the mooring buoys?

Failures: Mooring buoys not managed in terms of Carrying Capacity for diving, hence diving pressure and the negative impacts of over diving have become an issue. 50% of Grand Cayman's dive sites take over 2500 divers per year - with the top ones taking around 20,000 divers per year.

Successes: has reduced anchor damage to coral reefs significantly and greatly streamlined the diving operators use of sites and the industry as a whole ie standard names and locations for dive sites.

What is the degree of community involvement in the mooring buoy program?

The dive community and public report on missing or damaged moorings and have input as to where new moorings are placed. The DOE maintains and places the mooring.

Is anchoring allowed in the area surrounding a mooring buoy site?

In Marine Parks anchoring is restricted to boat less than 60 feet only, and only allowed to anchor in sand. Nothing can impact corals or other reef growth forms. Grappling hooks not allowed. Outside of Marine Parks anchoring is allowed, but again nothing can harm coral reefs, to do so is an Marine Conservation Law offence with a penalty of upto US\$ 600,000 fine or one year in prison. See attached Marine Parks brochure for more details on laws.

Does a fee collection exist for the mooring buoys in your program?

There are no direct fees for use of the moorings, but a 2\$ (air) or 4\$ (cruiseship) departure tax is collected under one umbrella Environmental Fee.

Are there vessel limitations for mooring buoy use?

Yes single pin moorings are for boats less than 60 feet and two pin moorings are for boats less than 100 feet.

What is the material and attachment of the buoy?

The Halas Mooring system – ie four inch diameter seabed core filled with cement and stainless steel pin/eye. Polypropylene rope, mooring bouy and pick up line.

Are there critical areas where anchoring is not permitted?

No anchoring is permitted in coral anywhere in the Cayman Islands, and also within the North Sound Environmental Zone (see attached map in Marine Park Broucher.)

(If applicable) what are the triggers for rotating buoys on heavily used dive sites?

No rotation or resting of dive sites exists because there is no law to prevent people from visiting the site once the mooring is removed!!

Mooring Buoy Questionnaire
Posted on the Florida Sportsman Forum
to receive input from local recreational interests

If you are familiar with Biscayne National Park, please provide what you can...

I am working on a proposal for more mooring buoys in Biscayne National Park (BNP). A general agreement that mooring buoys reduce adverse impacts to the marine environment has now been internationally recognized (although please feel free to interject if you feel otherwise).

Question 1: If you use mooring buoys in BNP, which sites are your favorite and why?

Question 2: If more mooring buoys could become available, which reef areas (specific names or general) would you designate?

Question 3: In your opinion, what is the most popular site in BNP?

Note- Mooring buoys also bring stress on a particular area because of increased congestion, diver/snorkeling damage, sedimentation, accidental boat groundings, increased fishing pressure, etc. However, all of the above are considerably less destructive than anchor damage to a reef.

Response 1:

I have seen more mooring buoys go up right past pacific light but there are not many. I feel it is a good idea but I have to object to it. My only concern is the park making a no fishing zone like John Pennecamp is now. You give a little and they take alot. No more giving. The channel at Homestead Marina used to be no wake just at the jetty on in. Now it is all the way out thanks to my Dad and a few people at the Homestead boat club. Their reason was the other boats going by sailboats with high drafts. As the sailboat goes down the other boats wake, it would hit the bottom. Most if not all the sailboats can not leave the marina unless it is high tide. The flat at sands key used to be beautiful but now it is littered with boats pulling up destroying the grass. Instead of keeping the boats off the flat which should be done, they just made a no wake zone. So now we have destroyed grass flats along with no wake signs that litter the scerery.

What we need is a Park ranger that keeps people off the flat and keeps people from anchoring on reefs and just generally makes sure the park is safe. I hate to say this but we are loosing our park people. The no jet-ski and now the new proposed no motor zones. There is got to be a better solution to the parks problems.

Response 2:

I'm no expert on BNP but I'd try to put these in places for snorkeling or diving. Maybe also in places where boats congregate. This kind of thing isn't very useful to fishermen who want to be in their own spot. If you're fishing you usually want at least the illusion of being in a place that isn't pounded.

Response 3:

As followotherboats said the real problem in the parks system is enforcement. There arent enough officers in boats out there making sure the rules and common sense are enforced.

Why not make a no anchoring rule? or no anchoring areas? That would alleviate some of the problem.

Response 4:

Question 1: If you use mooring buoys in BNP, which sites are your favorite and why?

Shark Reef. Diversity of reef structure/relief/species

Question 2: If more mooring buoys could become available, which reef areas (specific names or general) would you designate?

Watch the word designate here. You will set off some alarms with folks as in designating the area as a MPA.

The area east of Green "21" in Hawk's Channel and more to the north and around Anniversary and Alinas Reef.

Question 3: In your opinion, what is the most popular site in BNP?

Hands Down . . . Bache Shoal and Ball Buoy.

Make the Reef Rover/Cruncher accountable for impacts to the reef!!!

Brad Wilcox wrote:

Thanks for bringing my post back to life Pucker Factor; I appreciate your input, and yeah, thanks for actually responding to the questions asked. I agree 100% with your recommendations minus one correction-- Biscayne National Park is an MPA (doesn't have to have a no-take zone to be an MPA). I am in no shape or form suggesting measures near that scope of regulation (nor do I possess that power); we are only talking

about mooring buoys here. These conversations will not lead to the designation of anything but more buoys so that people can snorkel easier and cause less impact on the reef.

Here's what else we're not talking about: we're not talking about secret lobster or yellowtail numbers, just snorkeling the shipwrecks, patch reefs and the drop. These are places that recreational interests should look after to benefit the integrity of the park.

Again, any suggestions would be useful?

Response 5:

Thank you for the direct answer to my question. You must understand our concern when questions are asked which can possibly affect our boating activities. Are they planning on opening up the Triumph Triangle (legare anchorage)?

- 1) Of the few mooring buoys in BNP I have used all of none for diving and one for fishing. Pacific Reef
- 2) As far as mooring buoys on specific reefs, this is complicated as there aren't the spectacular reef areas in BNP as I see further south. Sure there are a few really nice small reef areas, but not like the keys. I dive quite alot of the reef from fowey south to pacific and fished to turtle rocks. Two large areas which should be considered for mooring buoys would be fowey rocks and triumph reef. Fowey rocks and quite a bit of this reef north and south of the light has some very beautiful reef and relief which could benefit from mooring balls for snorkelers and divers. I use this reef when I bring inexperienced divers on my boat or people that are just looking to see some reef in shallow water. Triumph reef doesn't seem to get the diver traffic, but it does see alot of fishing traffic especially at night during the summer. The problem with mooring buoys for fishing is that they don't factor in fishing constraints. Typically when bottom fishing a boat anchors slightly up current from the reef and chums to draw fish from the reef. Or while motoring along a school of fish is noticed on the sounder the boat anchors up current from this position. Buoys don't take into account for moving fish. If I were to set up buoys for fishing I would make a big square or circle around the reef so current could ba taken into effect. But then this would now increase pressure on that particular reef. As it would allow anyone with a little current knowledge to effectively target that reef.

- 3) Popular for snorkeling maybe fowey, but I don't see alot of snorkeling and diving done in BNP. Popular for fishing heck just go out on a single weekend in the summer boats are anchored spread from fowey to Pennecamp.

As far as numbers of diver/snorkelers vs fisherman. I see about 1 diver in 10 boats when at the ramps in the mornings sometimes the number of divers/snorkelers is even smaller (I am not counting Looky Loos and Booze Cruzers). Dade county doesn't seem to have near the dive snorkeling numbers that broward or Monroe has especially on a tourist level. Just look at the number of dive charters in each county and you will see what I

mean. Then look at the number of dive charters that cater to BNP. I know of only one and that is run by the park and is more a snorkel boat than a dive boat.

Will adding buoys to particular reefs help divers and snorkelers? I'd say yes, but it is a much smaller user group than fisherman in this particular park. Like I said there are very few dive operators that even run into BNP. Go to the keys on one weekend and you'll see quite a number of dive operators all over each reef and morring ball. You don't see that here. And individual use compared to fishing is low.

What about adding buoys to high stress areas like sand bars for Looky Loos and Booze Cruzers?

Response 6:

Put a mooring buoy on a reef and write it off for any thing other than 6 inch ytails and even smaller grunts an mangos. even those would probly be caught out in a year. you can chum ballyhoo, other bait and macks but as real fishin goes, it'll kill it. might as well make them no take dive zones if you want any chance of keeping any quality reef speices there. keep those things away from my numbers please.

Brad Wilcox wrote:

Thank you to everyone for continuing to keep this thread alive. Just wanted to clarify for TAILHUNTER (your response is much appreciated and very helpful) that I am also a boat owner and a life-long native fisherman of Florida waters. That's why I am pursuing an interest in marine affairs and policy, so that I can instill my experience as an angler into the ongoing discourse of fisheries management. I am finishing my M.A. at RSMAS, and next year, after the internship project at Biscayne National Park, I'm off to University of Rhode Island for PhD work. My work will mostly be outside of the country but I am very involved in the endeavors of the NMFS, NGOs and and professionals that influence the (mis)management of our fisheries.

By the way, sorry TAILHUNTER but the "Closed Area" is staying put for the protection of submerged cultural resources (even though I kind of doubt its effectiveness).

And LILOODY, in my opinion, mooring buoys won't change the dynamics of the reef fish populations as there are very few sizable fish to begin with. In that area, Grouper and Hogfish are basically already gone.

Response 7:

Just look at the number of dive charters in each county and you will see what I mean. Then look at the number of dive charters that cater to BNP. I know of only one and that is run by the park and is more a snorkel boat than a dive boat. That is because the park only allows one dive concessionaire to legally operate in the park. If there are any other dive charters offering trips to BNP, they are doing it illegally. The Reef Rover out

of HBM is the only charter that has a permit to do so.

I believe that there are more folks that dive in the park than you are alluding to in your post. Conde Nast many years ago ranked BNP as the second best place to snorkel in the world next to the Great Barrier Reef. This was due to many factors. I tried finding the article, but I was unable to locate it on the web.

I believe one of the intents of the mooring buoy program is to minimize impact to soft and hard coral from anchor damage. Tailhunter, your knowledge of how to anchor on a patch reef is not known to about 90% of boaters using the park to fish or dive the patches. Many of the boaters are complete novices and have no clue. They see the patch reef, drive up to it and throw their anchor directly on top as opposed to the side and up current/wind of the patch reef.

Response 8:

If I were to add buoys specifically for snorkelers it would have to be just south of the legare triangle and just south of an imaginary line out of angelfish creek both east of Hawks Channel in 10-20 foot. There are quite a number of small to medium patch reefs that three to four balls could outline the reef. Also by adding the balls hopefully it would keep larger draft vessels from hitting them. I know they are marked on the map and are in every charting software but that doesn't help inexperienced boaters as PF pointed out. Good luck with your PhD

Response 9:

Since most mooring bouys are used to prevent reef damage, they are best placed by core drilling a 4" hole in the coral and epoxy placement of a galvanized eye bolt placed in the hole. The main investment is the core drill but they can be rented. This technique is used throughout the keys National Marine Sanctuary and I have used them to moor 250' barges when I was performing reef restoration work in Key Largo and Looe Key. The same technique is used to anchor the UNC lab in Key Largo.

In sand bottom, a Manta Anchor driven into the bottom has proved to be very good also. E-mail me if you need more info or get in touch with Harold Hudson of the National Marine Sanctuary office in Key Largo. He has probably installed more of these than anyone.

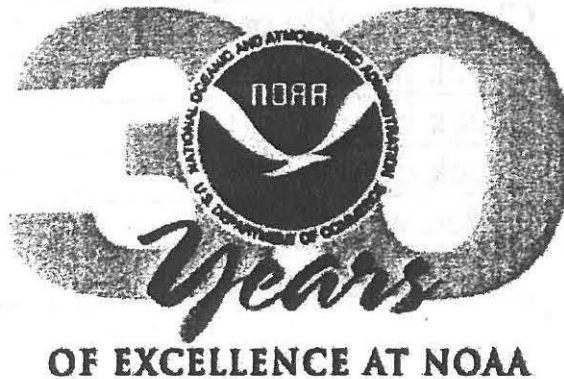
Appendix F

Mooring Buoy Maintenance

Florida Keys National Marine Sanctuary

Key Largo, FL

OUR SEAS AND OUR SKIES



Manual

Mooring Buoys
R/V Agassiz

✓

A) Code for maintenance field reports

C	Cleaned
R	Refurbished (replaced with)
N	New (replaced with)
0	Install manta or pin
1	Change pick-up line
2	Change buoy through line
3	Change downline / shackle
4	Check shackle or pin
5	Check pick up line
6	Check buoy
7	Check downline
8	Added weight
9	Added numbers / letters

B) Example Masterlist

	LAT	LONG	M/P	DEPTH	SCOPE	LENGTH	INST. DATE	COMMENTS
North Patch								
1	18.67	11.976	PIN	18	8	26		
2	18.817	11.934	PIN	22	8	30		
3	18.777	11.883	PIN	24	8	32		
North East Patch								
E1	18.404	12.113	PIN	22	8	30		
E2	18.439	12.053	PIN	17	8	25		
E3	18.503	12.034	PIN	24	8	32		
Turtle Rocks								
1	16.539	12.419	PIN	16	8	24		
2	16.747	12.449	PIN	20	8	28		
3	16.824	12.419	PIN	15	8	23		
4	16.956	12.417	PIN	22	8	30		
5	17.018	12.383	PIN	23	8	31		
6	17.105	12.378	PIN	26	8	34		
7	18.000	12.908	PIN	18	8	26		
8	17.877	12.984	PIN	24	8	32	06-07-99	GPS IS OFF BY 15FT TO EAST
9	17.746	13.042	PIN	27	8	35		
10	17.662	13.148	PIN	20	8	28	06-07-99	
11	17.59	13.251	MANTA	19	8	27		
12	16.642	13.384	P-block	17	8	25		
13	16.53	13.489	MANTA	18	8	26		
14	16.327	13.729	PIN	17	8	25		
Laysfort Shoal/ IN								
13	15.724	12.387	PIN	24	8	32		
14	15.687	12.404	PIN	24	8	32		
Laysfort Shoal/ OUT								
11	14.875	11.788	PIN	18	8	26		
12	14.926	11.774	PIN	18	8	26		
Laysfort Trench								
11	13.97	11.897	PIN	59	10	69		
12	14.026	11.87	PIN	58	10	68		

D) Example Monthly Report

	LAST DIVED	VISUAL	CLEANED	PICK UP LINE	BOUY/THRU	DOWN LINE	SHACKLE/PIN	COMMENTS
Patch								
	8\11\99		11\22\99	11\22\99	11\22\99			
	8\11\99		11\22\99	11\22\99	11\22\99			
	8\11\99		11\22\99	11\22\99	11\22\99			
East Patch								
	8\11\99		11\22\99	11\22\99	2\23\99	2\23\99		
	8\11\99		11\22\99	11\22\99	2\23\99	2\23\99		
	8\11\99		11\22\99	11\22\99	2\23\99	2\23\99		
Rocks								
	8\11\99		11\22\99	10\13\99 R	10\13\99 R			
	8\11\99		11\22\99	11\22\99	10\13\99 R			
	8\11\99		11\22\99	11\22\99	11\22\99	11\22\99	11\22\99	
	8\11\99		11\22\99	11\22\99				
	8\11\99		11\22\99	11\22\99	11\22\99	11\22\99	11\22\99	
	8\11\99		11\22\99	11\22\99				
	8\11\99		11\22\99	6\22\99	6\22\99	6\22\99	6\22\99	
	8\11\99		11\22\99	6\22\99	6\22\99	6\22\99	6\22\99	
	8\11\99		11\22\99					
	8\11\99		11\22\99	11\22\99	2\23\99	2\23\99		
	8\11\99		11\22\99	10\13\98 R				
	8\11\99		11\23\99					
	8\11\99		11\23\99	11\23\99	11\23\99 R	2\23\99		
	8\11\99		11\23\99					
Port Shoal/In								
	8\11\99		11\23\99	11\23\99				
	8\11\99		11\23\99	11\23\99				
Port Shoal/O								
	8\11\99		11\23\99	11\23\99	11\23\99			
	8\11\99		11\23\99	11\23\99	11\23\99			
Port Trench								
	8\11\99		11\29\99	11\29\99	11\29\99			
	8\11\99		11\29\99	11\29\99	5\24\99 R			

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Mooring Buoys

Materials,

Measurements

&

Set Up

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Materials

Buoys:

Mooring buoy (18" diameter, white with blue reflective stripe)
Deep water buoy (22-24" diameter, white with reflective blue stripe)
SPA buoy (30" diameter, yellow with yellow reflective stripe)
Spar buoy (cylindrical buoy with orange markings)

Lines:

Downline mooring, wreck, SPA, spar buoy
(Yellow 7/8" UV treated polypropylene line with blue tracer)
Downline wildlife management buoy (WMB)
(Yellow 3/4" polypropylene line with blue tracer)
Through line mooring, SPA buoy and deep water float
(White 7/8" poly plus line with red tracer)
Pick-up line
(Yellow 7/8" UV treated polypropylene line with blue tracer)

Floats

Brown float for downline (6" diameter, 4" thick)
Lobster float as marker buoy (6" diameter, round)
Football float for wildlife management buoy (5" diameter)
Hard float for deep water buoy (21" diameter, round)
Torpedo float for SPA and spar marker (7" diameter, 14" length)

Hose:

Blue Plivic hose for downline (1" diameter)
Clear hose for SPA through line (1 1/8" diameter)
Fire hose for wreck attachment (1 1/2" diameter)

Shackle:

Heavy duty stainless steel shackle
for stainless steel anchor attachment (1/2" x 3 3/4")
Stainless shackle
for spar buoy, wildlife management buoy (3/8" x 3")
Galvanized shackle
for Manta Ray anchor attachment (5/8" x 4 1/4")

Weight:

Lead weight for downline (Size 1"x12"x1/8")

Cable ties:

Heavy duty cable tie for splice, SPA buoy (Length 14 1/2")
Small cable tie for lead weight (Length 8")

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Anchoring System/

316 Stainless steel pin with eye: (size 5/8" x 18")

A) Threaded pin

B) T- pin

Manta Ray anchoring system

Misc.:

Tech Flex (1" diameter, heavy-duty wall)

Letter (3" black vinyl self adhesive letters and numbers)

Wax (Fastwax brand spray wax)

Scouring pads (heavy-duty green Scotch Brite 6" x 4 1/2")

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Measurements

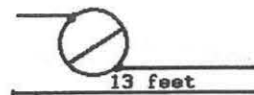
Pick-Up Lines:

long: cut length 18 feet
short: cut length 15 feet
Splice: 14 inches from each end

Buoys:

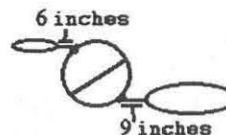
Mooring buoy:

White line: 13 feet
Tech Flex: 22 inches
Blue reflecting tape: 57 inches



Deep water buoy :

White line: 15 feet



SPA:

White line: 9 feet
Clear hose: 4 feet
Tech Flex: 27 inches

Wreck float:

~~White line:~~ 9 feet

Miscellaneous:

Wreck line:

White line: 15 feet (both ends spliced to same galvanized ring)
Fire hose: 12 feet

Blue Pliovic hose:

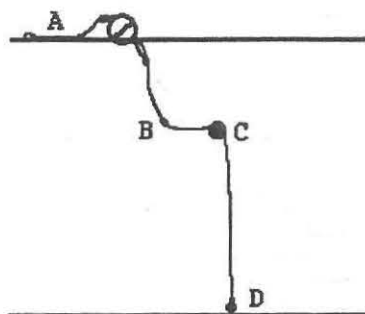
Downline: 18 inches
WMB: 16 inches

Clear hose:

WMB: 12 inches

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Mooring Buoy Set Up



Black vinyl letters facing inside,
blue reflective tape

A)

Pick up line: long (16 feet) for dive reefs / short (13 feet) for snorkel reefs

Mooring Buoy: White with blue reflective tape, 1" PVC pipe with bushings
7/8" white nylon through-line with Tech Flex protection,
black vinyl letters (wipe with acetone and heat surface with heat gun
before attaching !) Wax buoy up to 8" from top bushing.

B)

Weight: 40 ft or less: One wrap-around weight, secured with small cable tie stuck
through braid 8 feet below buoy.

Deeper than 40 ft: One weight 8 feet down, second weight halfway to float.

C)

Float: 50 ft or less: one float set 15 feet below the surface.

Deeper than 50 ft: two floats set 15 feet below surface

(6" piece of line braided through down line as float stopper)
(subtract 15 feet from water depth not total cut-length)

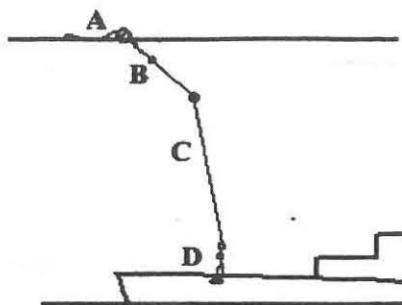
D)

Down line: Water depth plus 8 to 12 feet scope = total length
(8 feet for shallow reefs, 12 feet for deeper areas)

7/8" yellow PP line, one end spliced with 18" blue hose, other end spliced 18"
from end without hose. Attach to the bottom with stainless steel shackle for pin
or galvanized shackle for Manta Ray anchoring system.
Use heavy-duty cable tie to secure shackle!

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Wreck Buoy Set Up
USCG Duane, Bibb and wreck of the Eagle



A)

Mooring Buoy: -24" buoys on Bibb, Duane
-18" mooring buoy on Eagle
- long pick-up line

B)

Downline 1: 50 foot yellow 7/8" PP line, two weights secured with cable ties (8 ft and 16 ft down), single brown float (30 to 40 feet down), one end with 18" blue Plivovic hose spliced in, attached to "down line 2" with stainless shackles.

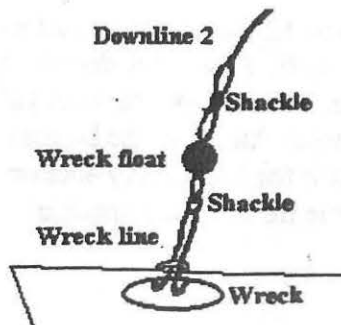
C)

Downline 2: 70 foot 7/8" PP line both ends spliced with 18" blue Plivovic hose, big float 3 foot under top splice, attached to wreck float with galvanized shackle.

Note: If attachment point is in a depth less than 85 feet, shorten downline 1 to keep not more than a total of 20 feet of scope and lower the float on downline 2 to 20 feet below splice.

D)

Wreck attachment: -Wreck line: white 7/8" Poly Plus line protected by fire hose both ends spliced to the same galvanized ring
-Wreck float: hard float with splice on both sides, to keep line from chafing on wreck
Feed wreck line through the attachment point, shackle ring to the wreck float and then the float to downline 2. (use galvanized shackles)



Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Buoy Approach



Approach and Hook Up

Steer the boat from a helm station that enables you to see the buoy during the entire hook up maneuver.
Establish unmistakable hand signals to communicate during hook-up and release.

Approach buoy from down wind / current slowly.
Keep buoy on the same side as the helm station for better visibility during approach.
Shift to neutral when buoy is alongside.
Grab pick up line with boat hook at stern and pull buoy aboard.
Ensure that the boat is clear from the downline before shifting into reverse.
Lay buoy in aft barrel and hook to top splice of downline.

If current or wind prevents pulling the buoy aboard, attach pick-up line to cleat and let boat swing until it can back up straight against the wind / current to the buoy.
Then lift buoy aboard and attach the hook and line to top splice of the downline.

Florida Keys National Marine Sanctuary
Upper Keys Mooring Buoy Maintenance

Buoy cleaning

Buoy cleaning:

Clean top splice of downline and bottom splice of buoy.
Clean buoy with pressure washer. (keep pick-up line in barrel with diluted bleach water)
Clean top splice of buoy and pick-up line with pressure washer.
(stretch pick-up line out on mat !)
Clean remaining growth off the buoy with scraper and green scouring pads.
Replace letters/numbers if necessary.
(Wipe buoys with acetone and preheat surface with heat gun before attaching the new letters!)

Check for:

Wear on through line, top splice and pick-up line
Weight in place
Float on down line at correct depth
Wax on buoy worn off
Damage to reflective tape
Other damages to pick-up line, buoy or down line
Check maintenance log if inspection dive is due

Replace if:

Any sign of excessive wear
No sign of wax
Any visible damage to down line

Recycle for reuse:

Weights
Floats
Shackles (replace shackle pin if it shows excessive wear)

Refurbish buoys for reuse:

Thoroughly clean buoy with pressure washer (use muriatic acid on heavy build up)
Check / replace PVC pipe and bushings
Seal holes or cuts with 5200, Marine Tex or similar sealant
Replace through line if it shows any wear
Remove damaged reflective tape
Retape after cleaning the buoy with acetone and heating the surface with an electric heat gun
Apply coat of wax to 8" below the top bushing

Appendix G

PROTECT LIVING CORAL



The living coral polyp **DIES**
when we **step** on it,
anchor in it,
or **touch** it.



SNORKEL AWARE

DIVE WITH CARE

REEF RELIEF

Mailing Address: Post Office Box 430, Key West, Florida 33041

Environmental Education Center: 201 William Street, Key West, Florida 33040

Telephone: (305) 294-3100 / FAX: (305) 293-9515



These 30" yellow buoys warn "caution, you are within or near a special, protected area." There are three types of "no-take" areas marked by these buoys: Sanctuary Preservation Areas, Ecological Reserves, and Special-Use Areas.

Within these areas "no-take" means: no fishing, no lobstering, no shell collecting, and no removal or harvesting of any marine life by any means.

Each of the smaller areas' corners are marked with yellow boundary buoys that create imaginary lines marking the boundary. Larger areas may have more buoys so that the boundaries are easy to visualize.

There are four Special-Use Areas designated for permitted research only. The yellow buoys marking these areas are identified by "RESEARCH ONLY" in 3" black letters.

DO NOT TIE YOUR BOAT UP TO OR MOOR ON THESE BUOYS! Please use the standard white and blue mooring buoys, or anchor **CAREFULLY**, so your anchor and chain do not touch living coral!

For more information contact the
Florida Keys National Marine Sanctuary

Upper Keys: (305) 852-7717

Marathon: (305) 743-2437

Lower Keys: (305) 292-0311



HOW CAN YOU HELP? 10 THINGS YOU CAN DO

1. Avoid purchasing souvenirs made from coral or any threatened or endangered marine species.
2. Support the establishment of coral reef protected areas and encourage better protection and management for those that exist.



3. While traveling, choose resorts and tour operators that properly treat all sewage and wastewater.
4. While operating a boat, navigate carefully to avoid contact with coral reefs and other vulnerable ecosystems such as seagrass beds and maintain engine equipment to prevent oil and gas spills.
5. As a diver or snorkeler, choose tour operators that use mooring buoys or drift diving techniques whenever possible rather than anchors that can cause reef damage.
6. Make wise choices in selecting seafood by avoiding menu items that are caught or farmed using destructive or unsustainable practices including reef-killing poisons, explosives and illegal equipment.
7. Avoid purchasing tropical wood furniture or products obtained from clear-cut tropical forests causing siltation damage to coral reefs.
8. As a diver, practice buoyancy control skills in a pool or sandy area before diving near a coral reef. Make sure your gauges and equipment are secured to avoid accidental contact with the reef and never touch, stand on or collect coral. Be an A.W.A.R.E. diver.
9. Report all damage of coral reefs to dive operators, scientific or conservation groups that monitor coral reef health.
10. Enroll in an AWARE-specialty course with a PADI professional to increase your knowledge about coral reefs and other aquatic environments. (Project AWARE Specialty, Underwater Naturalist, AWARE-Fish Identification, Peak Performance Buoyancy and AWARE-Coral Reef Conservation.)

Ten Ways A Diver Can Protect The Underwater Environment



**Aquatic World Awareness,
Responsibility and Education**

PADI

Ten Ways a Diver Can Protect the

Produced by PADI for Project A.W.A.R.E.®

1 *Dive carefully in fragile aquatic ecosystems, such as coral reefs.*

Although, at first, they may look like rocks or plants, many aquatic organisms are fragile creatures that can be damaged or harmed by the bump of a tank, knee or camera, a swipe of a fin or even the touch of a hand. It is also important to know that some aquatic organisms, such as corals, are extremely slow-growing. By breaking off even a small piece, you may be destroying decades of growth. By being careful, you can prevent devastating and long-lasting damage to magnificent dive sites.

2 *Be aware of your body and equipment placement when diving.*

Much damage to the environment is done unknowingly. Keep your gauges and alternate air source secured so they don't drag over the reef or bottom. By controlling your buoyancy and taking care not to touch coral or other fragile organisms with your body, diving equipment or camera, you will have done your part in preventing injury to aquatic life.

3 *Keep your diving skills sharp with continuing education.*

If you haven't dived in a while, your skills (particularly buoyancy control) may need

sharpening. Before heading to the water, seek bottom time with a certified assistant or instructor in a pool or other environment that won't be damaged by a few bumps and scrapes. Better yet, take a diving continuing education course such as PADI Scuba Review, the PADI Adventures in Diving course or a PADI Specialty Diver course.

4 *Consider your impact on aquatic life through your interactions.*

As every diver soon learns, very few forms of aquatic life pose a threat to us. In fact, some creatures even seem friendly and curious about our presence. As we become bolder and more curious ourselves, we may even feel compelled to touch, handle, feed and even hitch rides on certain aquatic life. However, our actions may cause stress to the animal, interrupt feeding and mating behavior, introduce food items that are not healthy for the species or even provoke aggressive behavior in normally nonaggressive species.

5 *Understand and respect underwater life.*

Through adaptation to an aquatic environment, underwater life often differs greatly in appearance from life we are used to seeing on land. Many creatures only appear to look like plants or inanimate objects. Using them as "toys" or food for other animals can leave a trail of destruction that can disrupt a local

TO HELP CORAL REEFS

Support reef-friendly businesses.

When you visit a coral reef, keep it healthy by respecting all local guidelines.

Don't leave trash on the beach.

Hire local guides.

If you dive, don't touch the coral or collect souvenirs.

Use boat moorings.

Maintain your boat engine so you won't spill petroleum products in reef areas.

Be a wastewater crusader! Make sure that sewage from your boat or home is correctly treated.

Volunteer. Community coral reef monitoring and cleanup programs are very important.

Aquatic Realm

ecosystem and rob other divers of the pleasure of observing or photographing these creatures. Consider enrolling in a PADI Underwater Naturalist or AWARE Fish Identification course.

6 Resist the urge to collect souvenirs.

Dive sites that are heavily visited can be depleted of their resources in a short period of time. Collecting specimens, coral and shells in these areas can strip their fascination and beauty. If you want to return from your dives with trophies to show friends and family, you may want to consider underwater photography.

7 If you hunt and/or gather game, obey all fish and game laws.

You may be among the group of divers who get pleasure from taking food from the aquatic realm. If you engage in this activity, it is vital that you obtain proper licensing and become familiar with all local fish and game rules. Local laws are designed to ensure the reproduction and survival of these animals. Only take creatures that you will consume. Never kill anything for the sake of killing. Respect the rights of other divers who are not hunting. Avoid spearfishing in areas that other divers are using for sight-seeing and underwater photography. As an underwater hunter, understand your effect on the environment.

8 Report environmental disturbances or destruction of your dive sites.

As a diver, you are in a unique position to monitor the health of local waterways, lakes and coastal areas. If you observe an unusual depletion of aquatic life, a rash of injuries to aquatic animals, or notice strange substances or objects in the water, report them to local authorities, such as the local office of the Environmental Protection Agency or similar organization in your country.

9 Be a role model for other divers in diving and nondiving interaction with the environment.

As a diver, you realize that when someone tosses a plastic wrapper or other debris overboard, it is not out of sight out of mind. You see the results of such neglect. Set a good example in your own interactions with the environment, and other divers and nondivers will follow suit.

10 Get involved in local environmental activities and issues.

You may feel you can't save the world, but you can have a great impact on the corner of the planet in which you live and dive. There are plenty of opportunities to show your support of a clean aquatic environment, including local beach cleanups and attending public hearings on matters that impact local coastal areas and water resources. Know all sides of the aquatic environmental legislative issues and make your opinions known at the ballot box.

National Marine Sanctuary Program

Keys



REEF ETIQUETTE

Your visit to the Florida Keys National Marine Sanctuary will delight you with beautiful coral formations and a variety of reef organisms in a tropical reef setting.

Please follow the guidelines and regulations below while in the Sanctuary:

Just touching coral may cause damage to this fragile animal, therefore, do not allow your hands, knees, fins, gauges or tank to contact the coral.



Marc Gill



When anchoring, the anchor, anchor chain or line should not be in contact with coral. Use mooring buoys that are provided. If one is not available, ask to tie off to another stern. If neither option is available carefully anchor in sand.

Corals, shells, sea biscuits and other animals, living or dead, cannot be removed from the Key Largo or Looe Key National Marine Sanctuaries.

The red and white divers down flag must be flown while SCUBA diving or snorkeling. Boats must slow to no-wake speed within 100 yards of a dive flag. Divers should stay within 100 yards of their dive flag.



Spearfishing, possession of spearfishing equipment or of speared fish is not allowed within the boundaries of the Key Largo National Marine Sanctuary. Within the Looe Key National Marine Sanctuary, spearfishing is not allowed, however, equipment may be stowed and not readily available onboard. Call the Florida Marine Patrol concerning other closed areas.

Florida law requires a fishing license. Special stamps are required for lobster, snook and tarpon. Applicable size, bag limits and seasons must be observed when harvesting seafood products. Consult State and Federal authorities for current regulations.



Marc Gill

SAFE BOATING TIPS



Always consult and carry the local NOAA nautical chart to determine safe courses of navigation. Use channels, don't take shortcuts.



Avoid areas which appear brown in color. Shallow reef areas and seagrass beds will appear brown. Brown, brown run aground.

If you run aground: Immediately turn the engine off. Do not try to motor off. Wait until high tide to remove the vessel. Call for assistance when necessary.



Marc Gill

Fines are imposed for damaging seagrasses and coral by running aground.



Motor slowly parallel to the reef, in deep water, until a mooring buoy is selected. Turn and idle directly to the buoy without meandering among other dive boats. Reverse this procedure when motoring to another dive site.

When in a dive area, slow down to an idle speed. Make sure your bow is down and the motor or stern is not digging down deep into the water.



Boaters, use extra caution near charter vessels. The concentration of divers off these vessels poses a greater potential for accidents.

Fishermen, do not troll over or near divers. Stay at least 100 yards from a red and white "diver's down" flag and watch for bubbles.

Regulations prohibit littering. Do not discard your chum box, fishing line or other trash into the water.

Hand feeding of fish is discouraged. Such activity changes the natural behavior and diet of the fish.

Other rules and regulations apply in various areas of the Florida Keys, check with the appropriate governing agencies for current regulations.

Enjoy yourself and be cautious while boating in the Sanctuary.

For More Information, Contact:

Florida Keys National Marine Sanctuary
P.O. Box 500368
Marathon, FL 33050

Administration: 305-743-2437
Upper Region: 305-852-7717
Lower Region: 305-292-0311



Marc Gill

Appendix H

Phone 305-230-1100
Fax 305-230-1120

May 27, 2004

MEMO

From: Tom Perkins

To: All BNUP Employees and NPS

Re: Monitoring Vessel's and Water Turbidity

In an effort to work more closely with the Park Service and also to preserve and maintain the mooring systems of the park, the following items will be included in the daily log of the vessel's.

When our vessel's are oceanside and the captain or crewmember observes a private vessel on a mooring ball the following items should be noted in the logbook as soon as possible.

1. The location of the mooring ball. i.e. Shark-Bache-etc
2. The time observed
3. The type of boat and approximate length. i.e. openfisherman runabout etc.
4. Type of activity. i.e. diving, snorkeling, fishing.

This will enable the park service to get a realistic idea on what the uses of the mooring system entail and will help enhance BNUP and the Park to possibly install new locations.

Secondly we have all noticed on the bayside large plumes of turbidity in the water that appear out of nowhere, especially during the winter monthes. If one of these should observed the following will be entered into the logbooks.

1. lat-lon
2. time of day
3. weather conditions at time

The Park Service and I greatly appreciate your help in this.
Thank you

Appendix I

Mooring Buoy GPS Coordinates

Soldier Key	25.35.272 N	80.09.179 W	11 ft
Bache Shoal	25.29.172 N	80.08.878 W	15 ft
Bache Shoal	25.29.110 N	80.08.908 W	15 ft
Bache Shoal	25.29.108 N	80.08.953 W	12 ft
Bache Shoal	25.29.092 N	80.08.939 W	12 ft
Tracy	25.28.968 N	80.08.459 W	9 ft
Triumph	25.28.592 N	80.06.680 W	15 ft
Triumph	25.28.333 N	80.06.704 W	18 ft
Lugano	25.26.690 N	80.07.150 W	22 ft
Lugano	25.26.650 N	80.07.176 W	18 ft
Lugano	25.26.618 N	80.07.181 W	19 ft
Schooner	25.23.935 N	80.09.653 W	10 ft
Schooner	25.23.924 N	80.09.658 W	11 ft
Anniversary	25.23.330 N	80.09.868 W	10 ft
Anniversary	25.23.296 N	80.09.863 W	14 ft
Pacific	25.22.197 N	80.08.350 W	19 ft
The Drop	25.21.967 N	80.08.261 W	45 ft
The Drop	25.21.950 N	80.08.251 W	45 ft
Elkhorn	25.21.782 N	80.09.841 W	16 ft
Elkhorn	25.21.776 N	80.09.957 W	9 ft
Shark Reef	25.20.367 N	80.09.936 W	12 ft
Shark Reef	25.20.290 N	80.10.064 W	12 ft
Rocky Reef	25.20.077 N	80.09.700 W	25 ft
Rocky Reef	25.20.034 N	80.09.691 W	26 ft
Ball Buoy	25.18.966 N	80.11.290 W	18 ft
Ball Buoy	25.18.929 N	80.11.245 W	20 ft

Mooring Buoy Status

Bache Shoals: 4 out of 5 mooring buoys located off Hawk Channel far into the back reef area of Triumph Reef, just off BNP's UCH "Closed Area."

Triumph Reef: 2 out of 3 mooring buoys located on the ocean side of the reef terrace.

Lugano Wreck: 3 out of 3 mooring buoys located on Long Reef.

Schooner Wreck: 2 out of 2 mooring buoys located on the back reef between Ajax Reef and Hawk Channel.

Anniversary Reef: 1 out of 2 mooring buoys located next to Schooner Wreck.

Pacific Reef: 1 out of 1 mooring buoy located on the fore reef slope.

The Drop: 2 out of 2 mooring buoys located on the fore reef slope of the continental shelf.

Elkhorn: 1 out of 2 mooring buoys on the first slope of the back reef on the south end of Pacific Reef.

Shark Reef: 2 out of 2 mooring buoys located on the fore reef south of Pacific Reef.

Rocky Reef: 2 out of 3 mooring buoys located next to Shark Reef.

Ball Buoy: 3 out of 5 mooring buoys located on a reef terrace/back reef, at south boundary of the park's jurisdiction, next to Pennekamp State Park, between Hawk Channel and the drop off.

*Fowey, Tracy, Alina, and Soldier Key and several of the other sites are missing all of the components of the mooring buoy system except for the pin.

