

U.S. CARIBBEAN REGIONAL FISHERIES WORKSHOP

Appendix 3: Transcript of Workshop Sessions

Welcome- Dr. Dail Brown- Office of Habitat Conservation, NOAA Fisheries

Introduction to Day's Themes- Dr. Thomas Hourigan NOAA Fisheries

Coral Reef Fisheries are Important, Diverse and Threatened. Values are increasingly threatened because of: over fishing; habitat impact of fishing operations; by-catch and over collection of aquarium fishes, corals, etc.

U.S. Coral Reef Task Force:

- National Plan: “Establish *additional no-take ecological reserves* to provide needed protection to a balanced suite of representative U.S. coral reefs and associated habitats, with a goal to protect at least 5% of all coral reefs and associated habitat types in each major island group and Florida by 2002, 10% by 2005, and at least 20% by 2010.”
- The Task Force will be meeting on Oct.2-3 to identify five (5) threats on which to focus and to develop 3-5 year local action plans. Task Force expects to identify 5 threats on which to focus:
 - *Overfishing* will be one priority
 - States, Territories and Federal Agencies will jointly develop 3-5 year plans to address these threats – Including:
 - ▶Identifying specific actions needed in specific locations
 - ▶Lead agencies
 - ▶Quantitative milestones
- This workshop will contribute to this process

Goals of the Workshop:

- Exchange Experiences Among Reef Fishery Managers in Puerto Rico and U.S. Virgin Islands – Focus on *Solutions*.
- Provide Focused Recommendations for Priority Action over the Next 3 – 5 Years
- Specific action or goal
- Milestones – “By 2003 Puerto Rico will achieve ...”
- Research, technical assistance, education and financing needed to achieve this
- Present these Recommendations to the U.S. Coral Reef Task Force

Workshop Approach/Format

- Managers present overviews or case studies on four major reef fisheries issues:
 - ▶Coral Reef Fisheries Uses
 - ▶Reef Fisheries in the Context of Marine Management

- ▶ Reef Fisheries Regulations and Enforcement
- ▶ Education and Outreach
- Panelists respond and each presents 1-2 top priorities for action – followed by discussion
- Break-out sessions on 3 major impacts of fishing:
 - ▶ Overfishing (including ecosystem impacts),
 - ▶ Habitat impacts (both direct & indirect), &
 - ▶ Overharvesting of aquarium species.

Panelists are asked to be as focused as possible about making fishing sustainable.

Welcome- Mr. Viridin Brown- Caribbean Fishery Management Council Chairman

Decline of resources is proportional to the growth of commercial fishers, and the demand for seafood. Overfishing however, is not the only contributor to the decline. Other factors include:

- Industrial demand
- Residential/ tourism development
- Dredging/ filling
- Removal of mangroves
- Sediments

Regulatory efforts should take all of the different contributing factors into consideration. Historically, marine resources were thought to be inexhaustible. Legislation has been enacted to protect coastal and marine resources in USVI and PR. CMP- government utilization of coastal and marine resources. Magnuson-Stevens Fishery Conservation and Management Act- Caribbean Fisheries Management Council- marine protected areas. Marine Conservation District which designates a no-take zone, which is a marine protected area, at approximately 17 miles of southern part of St. Thomas.

By contrast in 2001, Clinton designated approximately 30 acres to the Department of the Interior in detriment of marine protection efforts in the USVI. The fishermen and the general public objected. Recommendations should comply with all applicable laws, and should recognize that fishers and the public are not just stakeholders but partners in the process.

Welcome- Dr. Salvador Salas: Secretary, Department of Natural and Environmental Resources, Puerto Rico- welcomed the audience on behalf of Governor Sila M. Calderón. He thanked the steering committee for choosing Puerto Rico for the conference. He also thanked UPR Sea Grant/NOAA personnel, USVI, Florida/Atlanta, and Mr. Chaparro. He encouraged attendees to visit Culebra.

Session 1: Coral reef fisheries uses in Puerto Rico and the U.S. Virgin Islands

The Coral Reef Fisheries Session provided an overall introduction to the state of commercial, recreational and artisanal fisheries in the U.S. Caribbean, their value to communities and the territories, their contribution to the degradation of reefs, gaps in knowledge, and major challenges to management.

Moderator: Ernesto Díaz, Director, Coastal Zone Management Program, PRDNER.

Dr. Craig Lileystrom, Director of Fisheries, PRDNER (Puerto Rico's Department of Natural and Environmental Resources).

Recreational Fishery Statistics of Coral Reef Fisheries in Puerto Rico

Craig G. Lilyestrom, Director, Division of Marine Resources, PR DNER
Elizabeth A. Hoffmaster, Biologist, Division of Marine Resources, PR DNER

Until 2000, fishery statistics data in Puerto Rico had only been obtained from the commercial fishing industry. With the enactment of new laws, a project was started within the PR Department of Natural and Environmental Resources (DNER) in January of 2000 to gather data from marine recreational anglers. The project, initiated with the help of the Fisheries Information Network (FIN) program of the Gulf States Marine Fisheries Commission (GSMFC), is carried out in cooperation with the Marine Recreational Fisheries Statistics Survey (MRFSS) program under National Marine Fisheries Service (NMFS). An economic value survey, added to the existing survey, will be initiated in September of 2003.

The goals of the project are to produce estimates of fishing effort and catch per unit effort and to provide essential data to specialized entities such as the PR DNER, Caribbean Fisheries Management Council (CFMC), the San Juan Bay Estuary Program, etc. The project has the potential to help managers forecast demand for artificial reefs, FADs, new fishing piers, and marinas and boat ramps. There is also the potential to contribute to the planning of habitat conservation and restoration strategies important to fishery resources.

The project follows MRFSS methods (non-tournament) using point intercept interviews in three modes: shore (SH), charter (PC), and private/rental boat (PR). NMFS sets a bi-monthly 'wave' quota for each mode, currently 130 SH, 90 PC, and 200 PR. Random digit dialing phone interviews are also conducted, by the staff of ORC Macro, a private company contracted by NMFS to analyze project data for several states. The PR DNER currently employs 4 full-time personnel on the project, and ORC Macro employs 2 part-time personnel to conduct interviews. Interviewers are subject to field checks for quality control purposes. A total of 2,699 point intercepts were conducted in 2000, 3,165 in 2001, and 2,547 in 2002.

Preliminary results from the project show some 3-year trends. Catch data are calculated based on the point intercepts and effort data are calculated based on the phone interview.

- The 3-year average of resident anglers vs. non-resident anglers is 82% vs. 18%.
- Total angler participation has dropped from 249,869 in 2000 to 222,128 in 2001 to 204,661 in 2002.

- Total trips taken have fluctuated from 1,362,703 in 2000 to 1,411,943 in 2001 to 1,098,420 in 2002.
- Number of fishing trips by mode were: in 2000, 59% SH, 40% PR, and 1% PC; in 2001, 64% SH, 35% PR, and 1% PC; in 2002, 58% SH, 39% PR, and 3% PC.
- Average trip length in SH mode has increased from 2.64 hr in 2000 to 2.79 hr in 2001 to 3.31 hr in 2002.
- Average trip length in PC mode has remained fairly constant from 3.76 hr in 2000 to 3.69 hr in 2001 to 3.96 hr in 2002, due to the tendency of charter companies to stick to a set trip schedule.
- Average trip length in PR mode has increased from 4.33 hr in 2000 to 4.36 hr in 2001 to 5.23 hr in 2002.
- Reef fish comprised 16% of the total catch for 2000 and 29% of the total catch for 2001. Among the 3 modes, PR represents the largest percentage of reef fish catch; 73% in 2000 and 69% in 2001.

Catch per unit effort (CPUE) has declined in the past 3 years. Total catch in 2000 was 3,728,321 fish and 4,601,748 lbs. In 2001, catch was 2,160,532 fish and 3,301,926 lbs. In 2002, catch was 1,346,707 fish and 2,413,878 lbs. This calculates to a CPUE of 2.74 for 2000, 1.53 for 2001, and 1.23 for 2002. CPUE has declined an average of 40% per year.

Consistent declines were noted in the catch of several species. It is important to remember, however, that these data are based on only 3 years of statistics.

- Dolphin catch in PR and PC modes combined has declined an average of 32% per year.
- Lane snapper catch in PR and SH modes combined has declined an average of 52% per year.
- Mutton snapper catch in PR and SH modes combined has declined an average of 49% per year.
- Silk snapper catch in PR and SH modes combined has declined an average of 46% per year.

Recreational fishing is a very significant component of Puerto Rico's marine fisheries, with nearly 200,000 resident anglers and 40,000 non-residents. The majority of fishing effort is concentrated in SH mode. PR mode represents the most diverse range of species caught, and anglers spend more time on PR trips than SH and PC. CPUE has declined in the past 3 years, as has capture of several important species, and the continuation of this project into the future will improve statistical accuracy and data reliability.

Data can be accessed through the internet at the web site:

www.st.nmfs.gov/st1.recreational/queries/index.html

Dr. Barbara Kojis, Director of the Division of Fish and Wildlife, USVI DPNR.
Commercial and Recreational Fishery Uses in the USVI

The Virgin Islands is composed of three major islands divided into two Districts. Two of these islands, St. Thomas/St. John, comprise one District and St. Croix, the largest island, comprises the other. The two Districts have distinctive commercial and recreational fisheries. A commercial fisher in the USVI is defined as anyone who sells or trades part of their catch or who fishes with pots, traps, set-nets or seines. In the 2000-2001 fishing year (July to June), there were 177 registered commercial fishers in St. Thomas/St. John District and 240 in St. Croix District. This number remains static as there is currently a moratorium on the issuance of new commercial fishing licenses. Commercial fishers are required to submit monthly catch reports, which require fishers to report on their catch by family, location fished, gear used and effort. In 2000-2001, fishers reported catching approximately 650,000 lbs and 850,000 lbs of fish (including shellfish) in St. Thomas/St. John District and St. Croix Districts, for a total reported catch of 1.5 million lbs.

In both districts, hook and line is the most frequently used gear and is commonly used to catch snapper, dolphin and tuna. The former species is caught more frequently in St. Thomas/St. John while the catch of the latter two is higher on St. Croix. On St. Croix, scuba is the second most commonly used gear with traps a close third. On St. Thomas/St. John traps are the second most commonly used gear with seine nets being the third. Scuba gear is much less commonly used on St. Thomas/St. John for commercial fishing because the shelf is deeper (25-45m) than St. Croix (<12m). Trap fishing in both districts targets parrotfish, snapper, surgeonfish and grunt. However, in St. Thomas/St. John traps also target triggerfish and groupers. Lobster are mainly caught using scuba on St. Croix and in traps on St. Thomas/St. John. On St. Croix scuba is used to harvest conch, parrotfish and snapper as well. Few fishers harvest conch in St. Thomas/St. John District.

Recreational fishers in the Virgin Islands range from subsistence fishers that fish with hook and line from docks and rocks around the island to sport fishers with large, expensive boats that target blue marlin. There is no recreational fishing license in the VI. Based on a telephone survey of registered boaters, 2,509 fish recreationally from boats and contribute \$5.9 million to the local economy. There are many more people without access to a boat who fish from the shoreline using hook and line, spear guns, and scuba. Ten offshore sport fishing tournaments are hosted annually on St. Thomas/St. John and four on St. Croix. Many of these tournaments target offshore pelagics such as blue marlin, dolphin and wahoo.

Dr. Juan Agar, Southeast Fisheries Science Center-NOAA Fisheries.
Production relationships in the Puerto Rican Fish Trap Fishery

The fish trap fishery is one of the most important fisheries in the Commonwealth of Puerto Rico. In 2001 the Puerto Rican fish trap fishery yielded 22 % of the total landings and 24 % of the total value.¹ The most prevalent type of fish trap is the West Indian Chevron style. Fish traps catch a variety of species including, spiny lobsters, deep-water snappers, shallow-water snappers, box-fishes, grunts, groupers, and triggerfish. Snapper and spiny lobster landings alone accounted for over 60 % of the total fish trap revenue.

In recent years, the Caribbean Fishery Management Council has come under increasing pressure to regulate the fish trap fishery. Several studies have shown that the haphazard placement and hauling of traps damages coral heads, soft corals, gorgonians, and sponges. Also, these studies have observed that fish traps target various overexploited reef-fish species threatening the health and stability of coral reef habitats. Reef-fish species are particularly vulnerable to harvesting pressure because of their sedentary behavior, slow growth, and delayed reproduction.

A simple economic model is developed to evaluate the performance of various trap management alternatives. Drawing on dual revenue functions, the model investigates the technological interdependencies among the species present in the fishery. Model results show a mixed pattern of substitution and complementarity relationships among the species harvested. In addition, the model shows that fishermen do respond to price signals; hence, have a limited control over their catch composition. These results suggest that output controls will likely be ineffective because fishermen are able to redirect part of their effort into other species (i.e., domino effect). In light of these findings, closer examination of input controls to rebuild overexploited stocks is warranted.

¹ National Marine Fisheries Service estimates that 3,479,816 pounds with an estimated ex-vessel value of \$ 7,869,207 were landed in the Commonwealth of Puerto Rico in 2001.

Daniel Matos- PRDNER Fisheries Lab

Puerto Rico's commercial fishing statistics

A total of 1,254 fishers reported consistently their landings to the PRDNER Commercial Fisheries Statistics Program. A total of 13,678,567 pounds (6,204.6 metric tons) of fish and shellfish were reported in Puerto Rico during 1998-2001. The mentioned landings have a market value of \$26,946,777. Coral reef fishes, spiny lobster and conch were the most targeted species in Puerto Rico's fishery. The most important fish grouped in terms of percentage of total pounds landed (fish and shellfish included) for 1998-2001, were the yellowtail snapper (*Ocyurus chrysurus*) 9%, the deep water snappers (mainly *Lutjanus vivanus* and *Etelis oculatus*) 7%, lane snapper (*Lutjanus synagris*) 6%, mackerel species (*Scomberomorus cavalla* and *S. regalis*) 5%, various species of tuna 5%, dolphinfish (*Coryphaena hippurus*) 4%, various species of trunkfish 3%. The most landed by weight shellfish was the spiny lobster (*Paulirus argus*) 9% and Queen Conch (*Strombus gigas*) 7%. The results of species landings by gear and coast will be shown and discussed. Also the highlights of the biostatistical data results for most caught species will be discussed at the presentation.

Biostatistics program:

The program serves to identify fish caught by species, length and weight. In the thirty-year period from 1971-2001 there has been a significant change in terms of species and quantities of fish caught. For instance, in 1979 there were 7,300,000 pounds of fish, while in year 2000-2001 there were 3.3-3.5 million pounds of fish caught. The number of commercial fishermen in 1971 was 1,000, 1,800 in 1979 and 1,775 in 1999.

Over fishing has caused a trend whereby fish that was once considered third rate, such as parrot fish, are now considered first rate due to lack of availability of other species. Mero Cherna (red hind) was very popular in the 1950's but very rare in the 1990's. The same can be said about Yellowtail Snapper, which was very popular, but now it's scarce due to over fishing as well as the fact that snappers are commonly caught (92%) as juveniles.

There is a Fishery Management Plan for the spiny lobster, which currently has a 7% catch rate as well as for conch, which has a 6% catch rate. The Fishery Management Plan has helped stabilize the population for these two species.

Dr. Ernesto Otero: Department of Marine Sciences UPRM

Propeller Scars in Seagrass Beds of La Parguera and Guánica Reserves

Introduction

Seagrass beds are important habitats providing services to coral reef ecosystems. Seagrasses are one of the main primary producers in coral reef systems and constitute one of the most ubiquitous habitats in shallow/calm waters of the back-reef. Expanses of seagrass beds provide natural controls regulating nutrients and sediment resuspension, as well as stabilizing marine bottoms of coastal areas. Seagrasses also have developed as critical habitat for a diverse assemblage of vertebrate and invertebrate species. Some of these species, including yellowtail and mutton snappers, groupers, spiny lobster, and queen conch, have fisheries value. In addition, the range of some protected/endangered species such as the West Indian manatee and hawksbill turtle includes seagrass meadows. Seagrasses provide marine organisms important services including shelter for juvenile and small organisms, food, and a means to maintain a portion of coral reef ecosystem biodiversity.

The natural distribution of seagrasses in shallows makes them vulnerable to mechanical disturbances both natural and man-made. Profound effects on coral reef ecosystem function and health may arise in the presence of acute or persistent disturbances. Some of the anthropogenic effects perturbing seagrass habitats are dredging, boat groundings, trampling, propeller wash, and propeller scarring. Hurricanes or high-seas constitute the main natural phenomena potentially impacting seagrass habitats.

Purpose

The present increase of recreational boat use in Puerto Rico is potentially an important factor when considering human impacts to shallow seagrass meadows. Aerial photographic evidence of propeller scarring in various coastal areas of southern Puerto Rico shows serious local impacts to seagrass habitats. However, no quantification of these effects has been conducted to date. The purpose of this work is to provide initial information on this subject and specifically to: 1.) Quantify damage caused by propellers within La Parguera and Guánica Natural Reserves, PR; 2.) Establish position and extent of propeller scars in shallow areas; 3.) Create GIS coverages summarizing propeller scar data compatible with NOAA/NOS Benthic Habitat Maps; 4.) Estimate relative impacts of boating activities in different areas; and 5.) Provide baseline data for future studies and development of management strategies.

Methods

The methods consist of multi-tiered observations of the location of propeller scars in various areas of La Parguera and Guánica Natural Reserves. Aerial reconnaissance was performed first, followed by boat/skin diving surveys of the areas identified during overflights as the most impacted areas within each reserve. Scar length and distribution of each of the observed scars was determined using a DGPS modified to be used while skin diving. Impact was defined as visual evidence of scarring and scarring was defined as dredging, and/or significant removal of foliage. DGPS data were collected during each survey and downloaded to a computer where they were converted to the appropriate format to be integrated into a geographic information system (GIS; ArcView 3.2). Within the GIS, further analysis of the data, consisting of the quantification of Impacted Area (Measured Impacted Area; MIA), Probable Impacted Area (PrIA; area including most of measured scars) and Potential Impacted Area (PoIA; area shallow enough and close enough to impacted sites to be at risk of being impacted, 0-4ft) was conducted in a compatible format to NOAA/NOS Benthic Habitat Maps. More details are available at:

home.coqui.net/eotero2/

Results

Measured impacted areas in both sites accounted for 19,072 m² while PrIA and PoIA accounted for 50,554 and 54,3671 m², respectively. Seven areas are presented in detail, four in La Parguera and three in Guánica (Table 1). These sites accounted for approximately 70% of all scar impacts measured and 10% of the total seagrass area (as classified by NOAA's Benthic Habitat Maps) potentially impacted throughout both sites. The areas of La Parguera Natural Reserve known as Collao, Magueyes Channel and Caracoles accounted for 10, 36 and 22 % of all impacts documented during this study or 94% of the impacts associated with the seven referenced sites (including Short Channel and Monsio Jose in La Parguera and Canal Ballenas, San Jacinto, and Isla Guilligan's in Guánica.)

Conclusions

Our observations indicate that most of the damages to seagrass beds caused by propellers are associated with the most favored destinations of recreational boaters. These observations confirmed significant detrimental effects to seagrasses unintentionally caused by recreational boaters during arrival and transit to their destination. Overall, it can be concluded:

- That propeller scar impacts are significantly greater in La Parguera than in Guánica Natural Reserve
- That there is a need to manage boat traffic in certain areas of La Parguera and Guánica
- That recovery of highly impacted areas could be achieved by the creation of boat exclusion zones in shallow areas that could be designated for swimmers only
- That navigational aids and boater education would lessen impacts to shallow areas, as would designation of anchorage areas based on water depth
- That stricter navigation measures to regulate boat traffic should be in place and enforced to restrict depth of anchoring according to boat size.

Acknowledgements

Lisamarie Carrubba (NOAA Fisheries) collaborated providing valuable insight and expertise from the planning stages of this work and specially during application and analysis using GIS. Nilda Jiménez and Jorge Bauzá made possible the collection and analysis of data. Miguel Canals and Carlos Pacheco (PRDNR) provided access to the study area in Guánica as well as guidance in relation to sampling at specific sites. This research was possible thanks to funds provided by National Fish and Wild-Life Foundation from Royal Caribbean Settlement funds.

Session 2: Caribbean Coral Reef Fisheries in the Context of Marine Management

The Coral Reef Fisheries and Marine Management Session explored how fisheries fit in the larger context of coral reef management. Of special interest was the link between marine protected area management and fisheries, and the implementation of no-take reserves.

Moderator: Mr. Bill Rohring, Coastal Zone Management Program, USVIDPNR

Dr. Edwin Hernández: Biology Department, UPR

Marine Fishery Reserves or “paper parks”: Luis Peña Natural Reserve, Culebra, Puerto Rico two sides of the same coin

Reef fish communities in Culebra Island (27 km off northeastern Puerto Rico) have declined significantly in recent years. In 1999 the government of Puerto Rico established the Luis Peña Channel Marine Fishery Reserve (LPCMFR) with the objective of restoring local fisheries. Random stationary visual census and permanent line intercept transects have been used since 1996 to document the long term changes in the coral reef fish and epibenthic community assemblages before and after designation. A preliminary comparison of data from 1999 and 2002 shows a 38% increase in mean fish species richness/census. A dramatic increase in the abundance (414%) and in the biomass (868%) of the schoolmaster, *Lujanus apodus*, was documented. In spite of that a significant decline of epibenthic communities was observed between 1997 and 2001, including coral species richness (331%), colony abundance (24%), and % coral cover (39%). Also, a 175% mean increase in macroalgal cover was documented. This decline was attributed to a combination of long-term indirect cascade effects of spear fishing, still low densities of *Daidema antillarum*, coral disease outbreaks and to a slow but chronic water quality degradation due to remote sedimentation and raw sewage pollution. These results suggest that although a MFR can be an excellent management tool to restore depleted fish stocks, the recovered fish communities alone are not enough to prevent further coral reef decline associated with acute coral disease outbreaks and/or poor water quality. Restoration will be required to recover coral reef epibenthic communities. This will require the development of strong co-management partnerships among local government, academia and base communities. The Culbera Island co-management model will be discussed as an alternative to other Caribbean Islands.

Nicholas Drayton, The Ocean Conservancy, USVI

Fishery issues in the implementation of the St. Croix East End MPA

Abstract

The notion of Marine Parks conjures up a wide variety of fears, concerns and objections in the minds of many fishermen. The introduction of the East End Marine Park initiative to the fishing community of St. Croix, U.S.V.I. was no exception. This paper examines the interventions made primarily by fishermen throughout the MPA planning process, for the East End Marine Park on St. Croix, and seeks to group recurring comments concerns and recommendations into a few basic categories. An enhanced understanding of the broad concerns of the fishing community can lead to more effective education and awareness campaigns, and more successful management planning and implementation.

Introduction

The East End Marine Park on St. Croix in the U.S. Virgin Islands is the first of a series of MPAs to be established by USVI Department of Planning and Natural Resources. The development of this Marine Park was highlighted by an extensive participatory process, facilitated to a large extent by the Nature Conservancy's Site Conservation Planning methodology. This presentation represents a synopsis of some of the issues raised in the various public meetings and consultative sessions. Issues raised were grouped into broad categories:

Appropriateness of identified site:

The site designation of a Marine Park raised concerns among fishermen who consider the protected area too large, and feel that they are being forced out of a major portion of the remaining prime fishing area. Their concern stems from the belief that their fishing area has been significantly reduced as a result of land-based sources of pollution as well as other impending closures by federal agencies.

Species of concern:

Species most frequently mentioned in the meetings included grouper, parrotfish, yellow tail and mutton snappers tuna, dolphin and wahoo.

The “Other Fishermen”:

There was the common sentiment that illegal and recreational fishing are the biggest problem since they take undersized fish that commercial fishermen would not normally take, since there is no market for those fish. It was felt that the legal commercial fishermen are being punished, while the illegal fishermen are allowed to go free.

Legal issues

On the issue of legality, it was felt that while some fishermen are illegal because they have become tired and frustrated from dealing with DPNR, the majority have been illegal from the onset. This includes particularly individuals who are illegal aliens. On the issue of regulation of sizes of various species of commercial fishes, it was felt that to try to regulate the sizes of approximately 100 species of fishes would simply be impossible to execute. Additionally, the fishermen felt that enforcement can sometimes be hindered by the reluctance of officers to arrest friends and relatives.

The study highlighted some of the problems that need to be addressed when working with fishermen, based again, on their own comments throughout these meetings. These included:

- Lack of alternatives to commercial fishing
- Transparency / mistrust issues: feelings of powerlessness and betrayal
- Use of terms and jargon in presentations and discussions. These create confusion and a sense of alienation.

Conservation/ Park Management related issues

With regard to specific management-related issues, the fishermen's comments centered around three basic themes:

- Who determines the ideal area or size of an MPA, and what are acceptable limits?
- The need for multiple agency management of single resources
- The need for participation in planning and implementation

Recommendations / Discussion:

Work with fishermen and get them involved in the process. Fishermen support conservation, but some concerns arise out of misconceptions and misunderstandings.

Dr. Jorge García: Department of Marine Sciences, UPRM

*MPA formation and community-based management efforts in
Puerto Rico: Turrumote case study*

With the goal objective to establish a Marine Protected Area (MPA) in La Parguera, Lajas (southwest coast of Puerto Rico), a feasibility study was launched with support from The Caribbean Fisheries Management Council, DNER, Sea Grant and the Department of Agriculture. The specific objectives of the study were to establish a scientific baseline on reef fish stocks, including pelagic larval distributions and to stimulate local fishermen receptiveness to participate in decision making processes leading to the permanent fishing closure of one of the largest reefs in La Parguera: Cayo Turrumote. The scientific study demonstrated that large adult fishes of commercially exploited populations were absent or found in very low abundance at the three reefs surveyed, but the occurrence of juveniles from many important reef fish populations (e.g., snappers, grunts, jacks) evidenced the suitability of these reef habitats as MPA sites. Larval distributions showed that inshore and shelf-edge reefs of La Parguera function both as important sources and also as recruitment sites (sinks) for reef fish larvae. Taxon specific spatial distributions patterns of fish larvae associated with neritic, oceanic and shelf-edge waters were observed. Highly relevant oceanographic processes acting south-westerly undercurrents crossing the Mona Passage and tidally-induced water current reversals in La Parguera. The project did not go beyond its feasibility stage due to acute social and political problems, exacerbated by the pass of hurricane Georges and its destructive impact upon the local fishermen community of La Parguera and El Papayo-Salinas.

Dr. Ron Hill: NOAA Fisheries

Effects of fishing on coral reefs

Coral reefs exist where conditions are conducive to growth and survival of a complex of organisms that contribute to the physical structure of the reef. While this statement is obvious in its simplicity, it is also key to understanding the response of coral reef ecosystems to multiple stresses. Stresses offer at both a global or local scale – global climate change, airborne dust, terrigenous run-off of sediments and nutrients, or physical changes to the structure and functions of the reef. Stresses may affect the reef through a variety of organisms from hard corals, gorgonians, or urchins. Fisheries, exploiting the resources of the coral reef ecosystem, can cause ecological changes in reef structure and/or function. For example, system functions can be disrupted by changes in the trophic dynamics of reefs and physical structure essential to a variety of important species and can be adversely affected by physical

dame of fishing. Ongoing interagency research is investigating the placement and effects of fishing traps in coral habitats in the US Caribbean and the Florida Keys. To date, we have documented distribution of traps by habitat for selected areas of Puerto Rico, St. Thomas, St. Croix, and Marathon Key, Florida. Less than 20% of traps have been found in hard corals habitat and the damage from traps is less than the footprint of the trap. However, damage has been document to many different taxa, including gorgonians, stony corals, seagrass, and sponges. As this project continues, more complete survey data will be compiled for all seasons. Information on fishing intensity and recovery time will be emphasized. A more complete assessment of the dynamics of trap fisheries will provide an informed estimate of the impact on coral reef ecosystems and will lead to appropriate conservation recommendation, if they are needed.

Marcia Taylor in representation of Dr. Richard Nemeth: UVI, Center for Marine and Environmental Studies

Coral Reef management recommendations for the Caribbean based on research findings

Five Priorities:

1. Port surveys: Data Collection of essential statistical data to assess condition of the fishery.
2. Spawning aggregations: groupers, snappers and other species extremely vulnerable to overfishing. Protection during spawning season.
3. Mapping, MPA development. Implement and support mapping of habitat. NOAA, NMFS need to implement or support the systematic mapping of these essential habitats.
4. Habitat utilization and movement. Very little information on the habitat utilization patterns, timing of habitat shifts, migration patterns or potential bottlenecks in life history transactions for any commercially important species. Expanding research using standard tagging, telemetry, genetic markers will provide valuable insights.
5. Response to non-fisheries stresses. Fishing industry bears the brunt of regulations, although there is data linking overfishing to coral reef degradations there are a lot of other non-fishing stresses that can affect essential fish habitats. For example loss of mangroves, sedimentation, eutrophication, pollutants, toxins, disease. Research comparing low and high impact systems and monitoring a variety of physical and biological parameters may provide information on the effects of the stresses on coral reefs.

Billy Causey: Superintendent, Florida Keys Marine Sanctuary

Successful management strategies for the Florida Keys and overcoming the most important management challenges

Recommendations for Priority Action:

- 1) Take Action to address water quality degradation at Local and Regional scales – while attempting to understand the role of climate change on the global

scale as coral reefs are stressed from bleaching events; coral diseases; algal blooms; and wide scale diseases affecting fish and other marine-life.

(1) Water quality degradation

- Water quality degradation is a concern to everyone – an issue that we all agree on. The causes are sometimes obvious.
- Pollution
- Waste water discharges
- Stormwater runoff
- Sedimentation from dredging/landfilling and deforestation are all affecting the health of coral reefs

Take action to protect all coastal and marine habitats from degradation.

2) Protect and conserve coastal and marine habitats

- We need to take every possible action to stop destroying critical coastal and marine habitats –
 - seagrasses
 - mangroves
 - hardbottoms
 - and all coral reef habitats

Often, we point at fishing practices as a major source of impact, but we all have to share the blame – boating, diving, development, and fishing.

3) Implement ecosystem approaches to management of marine species and the habitats that they depend on.

- Take the guess work out of attempting to manage single fisheries, single habitat types, or simply within the boundary of a Marine Protected Area – or just the coastal zone – we must utilize an ecosystem approach to management – realizing the ecosystem may be defined by watershed influences.
- We need to apply a holistic approach to management

The use of the concept of marine zoning helps move us from the guess work of species focused management to an ecosystem-based approach to management. However, the success of implementing fully-protected zones or areas is dependent on the way you go about it.

THE PROCESS.

The process must include local experts and leaders in the community:

- Commercial fishing leaders have PhDs in commercial fishing
- Recreational fishermen

- Divers
- Conservation groups
- Scientists
- Managers – ALL managers
- General public
- Use the best available science to drive the process – but don't hesitate to make decisions if the science is not available
- Use socio-economic science, as well as natural science.
- Use ecosystem approach and ignore various jurisdictions or boundary lines in the process.
- Use a collaborative process

Implement the concept of marine zoning – balance conservation and resource protection with continued use of the resources.

Break-out sessions - Priority Actions for addressing threats

Reports from break out sessions:

Overfishing

1. Need for data collection: better knowledge of what fisheries and fishes are doing.
2. Compatibility among jurisdictions
 - Puerto Rico-finalize fishery law.
 - Puerto Rican waters versus federal waters
3. Subsidies / alternatives to Marine Reserves
 - Monetary subsidies
 - Involve fishermen in conservation activities or as part of research efforts.
4. Permits for recreational sector- include it in management activities in Puerto Rico.
5. Identify and protect fish spawning aggregation
6. Implement no-take zones and Marine Reserves
7. Involve fisher in research from the beginning and give other stakeholders same participation as scientists have.
8. Create a network of no-take zones: Partnership with NGO's

Habitat impacts of fisheries:

1. More data on physical effects of gear on ecosystems
2. Analyze what the Caribbean Council did and use it in management efforts- limit some gear in some habitats
3. Shorten time frame for publishable study to come up with some measures
4. Establish acceptable levels (of habitat impact)
5. Collect payment for damaging habitats: the offending party should pay for damage caused.
6. PR and St. Croix more damaging gear: prohibit nets
7. Prevent ghost fishing: trap buoys
8. Consider experimental artificial reefs to allow some recovery of natural ones.
9. Study: sites monitoring

Aquarium trade

1. Fisher management policy
2. Incorporate data
3. Network of no-take zones
4. Monitoring
5. Licensing
6. MAC certification
7. Consultative process
8. Recognize value of ornamentals as educational tool

Tuesday, October 1st, 2002

Welcome/Highlights from Day 1, **Dr. Manuel Valdés Pizzini**, Director, Puerto Rico Sea Grant College Program

Introduction to Day's Themes

Two key topics enforcement and education. In order to do enforcement you need to do education.

Session 3: Coral Reef Fisheries Enforcement and Regulations,

Moderator: Carlos Fachetti, Recreational SCUBA divers representative, *The Coral Reef Fisheries Regulation and Enforcement Session explored the challenges facing the regulation of coral reef fisheries in each jurisdiction and provided recommendations for ways in which new regulations might assist management. The session also assessed the state of fisheries enforcement and identified additional enforcement needs.*

Ms. Aida Rosario, DNER Director of Fisheries Laboratory

Coral reef fisheries regulations of Puerto Rico

Fisheries Impact on Coral Reef Habitat

- Over 90% of the commercial fish landed in Puerto Rico are related to coral reefs.
- Fisheries statistics data show that over 180 species of coral reef fish are commercially exploited.
- Commercial fishers harvest their catch with traps, nets, hook and line and scuba diving.
- All of these gears have an impact on coral reefs if not used wisely.

Coral Reef Fisheries Regulations

- Law Number 278 Puerto Rico's Fishery Law – November 29, 1998
- Law Number 147 For the Protection, Conservation and Management of Coral Reefs – July 15, 1999
- Law Number 57 Designation of ½ nautical miles around Desecheo Island as Marine Reserve – March 10, 2000

Laws related to fisheries and coral reefs

- Marine Reserves – two laws establishing marine reserves were approved.
- House Resolution 307 designates 3% of the insular platform as marine reserves. The definition given in this resolution of marine reserves is “no take zones”.
- Law 57 designate ½ nautical mile around Desecheo Island

Law 278 Fishery Law

- Was adopted to provide a more appropriate definition of fishery, fishers and other concepts to address the present situation.
- For instance the former fishing law did not provide fisher license categories.
- The first amendment to the law establishes the penalty for oil spills and discharge.

Fishery Law Regulations

- Prohibit the deployment of nets and traps over the coral reef structures.
- Nets cannot be set to encircle coral reefs among other structures.
- Forbids the use of explosives, chemicals, drugs and any venom to harvest any aquatic organisms
- Prohibit fishing within half (½) mile around Mona and Monito Islands.

Spawning Aggregation Closed Areas

- Red hind is the most important species of grouper landed in Puerto Rico
- This species is considered to be overfished
- They form spawning aggregations at very specific times from December to February
- As a management measure, three sites off the west coast are closed to all forms of fishing

Effects of Closing Areas

- Sabat et al, 2000 demonstrate the benefit of the closure on red hind populations
- Although no study has been done to assess the effect on the Coral Reefs of the closed areas, at least the reduced fishing pressure during the closure is thought to have beneficial effects

Law Number 147

- The main purpose is to provide protection, conservation and management of the coral reefs.
- Establishes a program that will provide the scientific criteria to identify different areas that are ecologically sensitive, the designation for those areas and the activities that can be carried out within them.
- Defines which actions constitute violations of the law, such as: removing, mutilating and destroying coral.
- Prohibits sale, traffic, barter, donation of any coral or coral reef dead or alive and organisms attractive for aquarium trade.
- Contaminate, discharge or use of chemicals substances in coral reefs, coralline communities and/or associated communities such as sea grass beds are prohibited.
- In areas designated as marine reserves, or areas of special designation it is prohibited to anchor, must use mooring buoys.
- Forbids fishing and diving in marine reserves or in areas of special designation.
- Requires the adoption of a management plan.
- Any project that might have an impact on coral reefs will require the approval of an Environmental Impact Statement.

Regulations on coral reefs

- In 1979 under the authority of the Fishing Law Number 83, the Coral Reef Regulations were issued.
- Prohibits the harvest of all species of coral, hard and soft coral.
- It was amended in the 90's to allow the collection of dead coral on the beaches for artisanal purposes by certified "artisans"

- DNER is working on a draft of new regulations for the coral reef law.
- A Committee that will be in charge of establishing the criteria to designate areas to be protected must be constituted.
- Create the program that will be implementing the new law.
- Prepare an Environmental Impact Statement for the new set of regulations.

Next Steps

- Approval of the Environmental Impact Statement of the Fisheries Regulations that is under consideration by the Environmental Quality Board
- Approval of the Proposed Fishing Regulations
- Finish the Coral Reef Regulations and prepare the EIS

Ms. Lucia Roberts Francis, Director of the USVI Dept. of Planning and Natural Resources Enforcement Division

USVI coral reef fisheries regulations

USVI DPNR Enforcement division: Duties and Responsibilities

- Safe boating
 - Numbering and registration
 - Negligent operation: boating under the influence
- Coastal Zone
 - Major and minor permit requirements
 - Site monitoring: compliance with permit condition
- Education
 - Boating safety handbook
- Fishing
 - Fish trap
 - Gear
 - Lobster, conch, and whelk regulations
 - Closed season
 - Sanctuary protection
 - Prohibited acts
- Hunting
 - weapon regulation
 - bag limit
 - Indigenous species
- Assist Environmental Protection Division
 - Water, air and land pollution
 - Oil spills response
 - Issuance of notice of violation: cease and desist orders

Federal cross-designation:

- NMFS/Fisheries
- NOAA/Endangered and Threatened Species
- Sea Turtle Protection
- Marine Mammal Protection

Closed season: December 1st - February 20th

Law enforcement Issues:

- Need of more manpower
- Equipment: currently four patrol boats
- New methods of fishing using scuba to gill net fish

Ms. Karen Raine, NOAA Office of General Council

MPA designation process from a legal standpoint: Enforcement, Prosecution

I. Goals

- Education and enforcement go hand in hand.
- We do want to encourage voluntary compliance with the laws enforced.
- At the same time we want laws to be clear and enforceable.
- Decision makers need to be taken into account
- Help policing
- Capabilities and limitations of enforcers.

It is very difficult to have a set of regulations not easily enforceable or with loopholes- perhaps this encourages violations.

II. Input

- From Affected Communities - any number of complementary and opposing viewpoints; helps to develop understanding/buy-in, voluntary compliance, self-policing
- From Law Enforcement and Prosecutors - capabilities and limitations of law enforcement; regulatory language that may/not be enforceable/prosecutable

III. Various Management Measures

1. Location: close enough to enforcement, get there soon enough, enforcers may not be able to complete an adequate patrol.
2. Create boundaries
 - Not too small
 - Latitude/longitude (not a depth)
 - Box/rectangle (not odd shapes)
 - Fixed buoy markings (particularly if vessels in area don't use GPS)
3. Determining What Activities Will be Permitted/Prohibited
 - Prohibit all activities - e.g., transit, fishing, diving, anchoring
 - Transit only - stow/disable gear
4. Permit some gear types - harder to enforce/prosecute

5. Permit some species to be taken - harder to enforce; prohibit possession of filets
6. Definitions of gear are important.
7. Be very specific about species.
8. Other considerations:
 - Gear markings
 - Closed seasons
 - Observers
 - Vessel Monitoring Systems.

Mr. Gerson (Nickey) Martínez, member of the Caribbean Fishery Management Council Advisory Panel and Chairman of the St. Croix Fisheries Advisory Committee (FAC)

Discussion of fishermen's proposed fishery regulations for St. Croix

- Rules and regulations followed by Fisheries Advisory Committee. There is one in St. Croix, St. Thomas and St. John.
- Composition of FAC: up to 40 members: DPNR, NGO's, Dept. of Agriculture, one marine scientist, some commercial fishermen, recreational fishermen, diving association. One-year appointment.
- Function of FAC: Collaborate in drafting and administration of rules and regulations for the promotion of conservation of fisheries resources in the islands.
- Moratorium 2001 for new commercial fishing permits.
 - Public hearings July 2001.
 - Grace Period 3 weeks.
 - Closed 8/24/2001 until revision of permitting regulation.
- A subcommittee defined commercial fishing and fisherman. Establish limited entry into commercial fisheries.
- No new permits are being issued but fishermen helpers will be given priority for future permits.
- New commercial fishing and permitting regulations: joint effort St Croix and St. Thomas FACs
 - FAC also worked on recommendations for St. Croix East Marine Park.
 1. Established a conservation zone.
 2. No commercial taking allowed within conservation zone.
 3. Reserve area: Protected Sea Turtle nesting areas
 4. Establish an area close to turtle nesting area, net fishing prohibited.
 5. Permit recreational fishing, with species size and bag limits.
 6. Catch and release within coastal zone
 - Commercial fishermen got preference for guide permit.
 7. Limit size.
 8. Maintain public access plots.
- St. Croix FAC recommended annual funding for marking of red hind areas. Seasonal closure for lobsters.

Sergeant Edgar Vega, DNER Maritime Enforcement Division
Coral reef fisheries enforcement and regulations

Puerto Rico Rangers Corps

- Created in June 21, 1977 by Law Number 1, June 29, 1977.
- Mission: to enforce all local laws, federal laws, regulations and municipal orders adopted for the protection, conservation and preservation of natural resources of Puerto Rico and to promote the effective use of them by public education and preventive patrol.
- Personnel:
 - 271 ground operations
 - 81 marine operations

Regulations

- Regulation 45
- Swordfish regulation
- Administrative order 97-09 (conch)
- Administrative order 96-09 (mero cabrilla – red hind)
- Administrative order 99-08 (Juey común – common land crab)
- Coral reef regulations

Marine law enforcement coral reef fisheries cases
January 2000 – August 2002

- all marine laws = 11,208 cases
- 2000 = 4,336 cases
- 2001 = 4,109 cases
- 2002 (jan – aug) = 2,763 cases
- fisheries laws = 493 cases

YEAR 2001:Received = 450
Investigated = 450

Tasks for the next few months: Coral reefs

- Monitor
- Budget
- Education
- Report violations to federal authorities
- Educate agents
- Increase personnel: 8 to 16

Panel - Response, Recommendations, and Discussion

Ms. Julita de León – Legal counsel, USVIDPNR Coastal Management Zone Program
Legal processes for passing a conservation law or plan for coral reef ecosystems

Recommendations:

1. All laws should be integrated
2. Examine existing laws to eliminate gaps.
3. Funding creativity and flexibility
4. Education is the key form of enforcement.

Three statutes:

1. Authority to Commission VI DPNR
VI Coastal Zone Management Act
2. First Marine Park – St. Croix East End Marine Park
3. Wildlife and Marine Sanctuaries
5 sanctuaries in St. Thomas: no-take
Broad discretion to commissioner
Statutes do not mention coral reefs
They do give authority to protect areas.

MAC_Track

Recommendations:

1. Support efforts of MAC: responsible, sustainable practices

Ms. Sylvia Spalding, Marine Aquarium Council

Alternatives to ornamental fish trade regulations by way of voluntary programs for collection compliance procedures for certification.

During the past two days we have heard much about the need to regulate the marine aquarium fishery in Puerto Rico, to develop no take zones, to involve fishermen and communities in the management of reefs and to monitor reefs through both fishery dependent and independent means. The Marine Aquarium Council Certification for the marine aquarium trade addresses all of these issues.

The Marine Aquarium Council, which also known as MAC, was established in 1998 by a group representing conservation organizations, the marine aquarium industry, marine aquarium hobbyists, public aquariums and others concerned about coral reef ecosystems, their organisms and the marine aquarium industry and hobby. The mission of MAC is to conserve coral reef ecosystems by establishing standards and a certification program for the marine aquarium trade. MAC's success is based on its multi-stakeholder approach and because it involves the entire chain of custody, which includes the collection area, the collectors, and the exporters, importers and retailers. After years of multi-stakeholder consultation involving more than 80 experts internationally, the MAC Standards and Certification system were launched in late 2001. These standards meet the requirements of the World Trade Organization, enabling their application in the more than 50 countries that participate in the marine aquarium trade.

MAC Certified collection areas must comply with a standard that requires, among other things, the development of a collection area management plan. Development of this plan is the responsibility of those who have authority of the collection area, and it must involve fishermen and other stakeholders. MAC encourages that the plan includes provisions for a 20-percent no-take area. MAC Certified collectors must comply with a standard that

requires, among other things, that they collect to order only, use methods that do not destroy the habitat, record their catches and maintain the optimum health of the collected organisms. MAC Certified exporters, importers and retailers must comply with a standard that requires, among other things, that they maintain the optimum health of organisms, record mortalities and keep documents that allow organisms to be traced back to their collection area.

Organisms that are caught in MAC Certified collection areas, by MAC Certified collectors and pass only through MAC Certified facilities are labeled as MAC Certified marine aquarium organisms. The Marine Aquarium Council works with public aquariums, trade and mainstream media, marine aquarium societies, retailers and others to inform consumers about marine aquarium trade issues and why they should purchase MAC Certified organisms. Third-party independent certifiers assess compliance to the standards through both initial and follow-up visits. Monitoring is utilized to assess the appropriateness of the management plan. Reef Check has partnered with MAC to develop a reef monitoring protocol, called MACTRAQ, which is specifically designed for marine aquarium collection areas.

Mike Barandiaran- USFWS Enforcement Wildlife Inspector
International cooperation for enforcement

Trade issues- International Trade of Corals

Most of it comes from the Pacific. Problem in the Caribbean is not the International trade but local importers / exporters.

- From VI and PR- big demand to supply hobbyists.
- Obscure regulations; DNER, local authorities
- Need for laws in writing.
- Avoid conflicts/ work together.
- Personnel is limited- I am the only inspector for PR and USVI.
- Educate the court system
- Write to local representatives for financial support.

Session 4: Coral Reef Fisheries Education and Outreach,

Moderator Ruperto Chaparro, Associate Director, Puerto Rico Sea Grant College Program

This Session explored how education and outreach can contribute to the improved management of coral reef fisheries. What can be the role of schools, management agencies, NGOs, the National Park Service, and Sea Grant?

Mr. Ruperto Chaparro, Associate Director of UPR Sea Grant and Director of Sea Grant Marine Outreach Program

Extension and outreach

There are activities that are carried out by different groups, universities, NGO's, and government agencies. The importance of extension and outreach activities is that they are directed to changing the behaviors of resource users. There are several activities and techniques that are used in this field. The University of Puerto Rico Sea Grant Program has been operating a Marine Extension Service for years through several specialists, together with extension specialists from the University of the Virgin Islands. They offer extension services to marine resource users of these two archipelagos.

Extension can be defined as transferring scientific information to resource users and to the public. This scientific information is supposed to be delivered from scientists to extension agents who translate the information into a language that can be understood by laypeople. Outreach implies a series of activities designed to bring scientific information to solve the problems of resource users. Some of our services are offered via telephone calls.

We may also visit resource users or coordinate a workshop. Through educational materials and workshops we try to take the scientific information and disseminate it. We also offer workshops for teachers K to 12. When I was in sixth grade I was taught about polar bears and pine forests, but we don't have those here in Puerto Rico. We now try to teach about sea turtles, whales, manatees, mangroves, etc. to let them know the significance of those resources, because if you don't know about the significance of marine resources you will not be interested in protecting them. We also try to help fishermen in partnership with other agencies. Field visits are the most useful tool oftentimes.

An extension agent needs a particular personality: should want to help people and should know how to communicate with them. Management of resources means management of people.

Ms. Aileen Velazco, Puerto Rico Aquatic Resources Program Coordinator, Coral Reef Program Coordinator and PR-POC, USCRTF

Introducing aquatic education and fishing into the regular curriculum

During the past 15 years, the Puerto Rico Aquatic Resources Education Program (AREP) has developed a series of strategies geared towards integrating aquatic education and fishing into the regular curriculum. Among the primary components of our Program we offer workshops for educators utilizing Aquatic WILD strategies and its Action Education component, "Hooked On Fishing Not On Drugs" (HOFNOD), and fishing clinics. The integration has taken place at various levels, by partnering since 1991 with the University of Puerto Rico Resource Center for Science and Engineering Continuing Education program for Teachers, we were able to develop a comprehensive workshop (60 contact hours) to introduce the

Aquatic Program at schools, complement the curriculum and improve the teaching of topics related to our aquatic resources.

Recreational fishing was introduced to educators as a practical exercise in ecology and as a means also to divert the youth from negative behaviours and to promote responsible use of the resource and appreciation of the aquatic environment. Through these efforts, HOFNOD was incorporated into the regular health sciences curriculum in 1995. AREP complements its educational efforts through the establishment of Tackle Loaner Centers and the AREP Auxiliary Instructors, by the publication and distribution of over 40 educational and informational materials, and the program's internet page and newsletter. Through these actions and others, we aim to encourage understanding and appreciation of Puerto Rico's aquatic resources, and influence attitudes of future anglers towards the adequate use of fishery resources.

Puerto Rico Aquatic Resources Education Program (AREP)

- Puerto Rico began an aquatic education program in 1987 to...
- Develop interest in fishing and provide information on angling opportunities in Puerto Rico, with the purpose of influencing the attitudes of future anglers towards the adequate use of fishery resources;
 - Promote ethical and responsible use of aquatic resources and instill respect for private and public property;
 - Encourage understanding and appreciation of marine and freshwater resources, by involving the public in programs conducted throughout the Island; and
 - Promote the use of AREP as an educational resource by schoolteachers and other youth leaders.
 - AREP accomplishes program goals via:
 - ◆ Workshops
 - Aquatic WILD
 - PERA/CRCI: Advance Aquatic WILD (summer)
 - Hooked On Fishing Not On Drugs
 - ◆ Talks
 - ◆ Fishing Clinics
 - AREP Auxiliary Instructors
 - Tackle Loaner Centers
 - ◆ Program Presentations and Exhibitions
 - ◆ Informational and Educational Materials
 - ◆ Newspaper Supplement
 - ◆ Electronic Page in the Internet
 - Integrating aquatic education into the regular curriculum to provide teachers the means to develop interactive activities on the topics of our aquatic resources that offer an opportunity to develop critical thinking skills in students.
 - **WORKSHOPS**
Workshops were designed for teachers to introduce the Aquatic Program at schools, complement the curriculum and improve the teaching of topics related to our aquatic resources.

- STRATEGIES:
 - Aquatic WILD and its Action Education component, reinforce educational contents in areas such as ecological knowledge, ethical, social and civic aspects.
 - ◆ Recreational Fishing as a Practical Exercise in Ecology
 - Tackle Loaner Centers
 - Located in recreational fishing facilities managed by the DNER, with the purpose to provide a hands-on fishing experience, promote ethical and responsible behavior and increase awareness about the importance to conserve our resources.
 - ◆ “Hooked On Fishing Not On Drugs” (HOFNOD)
 - The "*Hooked On Fishing - Not On Drugs*" program is sponsored by the Future Fisherman Foundation, a non-profit organization affiliated to the American Sport Fishing Association, which promotes participation in recreational fishing as well as improvement and protection of natural resources. By mid 1995, the Puerto Rico Department of Education's School Health Program endorsed the *Hooked on Fishing - Not On Drugs* (HOFNOD) initiative and incorporated recreational fishing and aquatic education as part of their curriculum.
- FISHING CLINICS
 - Were designed to promote public understanding of the recreational value of fishing, teach principles of ecology through the practical exercise of fishing, and promote responsible use of the resource and appreciation of the aquatic environment.
- INFORMATION AND EDUCATION: MATERIALS
 - Developed for anglers, teachers and the general public to provide basic information needed to understand ecological principles as they relate to recreational fishing, the quality of the aquatic systems and peoples impact on the resource. 498,736 publications distributed (about 40 items available for distribution). Newsletter Escamas y Anzuelos (published three times a year)
 - Newspaper Supplement (Over 2 million issues from 1989 to 1995)

Final thoughts: As educators, our challenge is to present options and projects that appeal to the energy youngsters bring, to their desire ‘to belong’ and be part of the team, and to their ardent desire to understand, challenge, debate and find a solution to real life situations

Ms. Mayra Suárez, University of the Virgin Islands Sea Grant
Vimas-STT marine outreach activities

Youngsters Understanding Coastal Pollution: a Dynamic Approach to Environmental Teaching is an innovative VIMAS/ St. Thomas project that was developed to fill existing gaps in environmental education for culturally diverse communities in the Virgin Islands. The program has three educational tools used during workshops for students and teachers. These are: a comic book, **Detective Goo-Too Preventing Water Pollution**, a coloring book, **Children and the Sea: a coloring book on ocean care and conservation** and a **Caribbean Watershed Non-Point Source Pollution Model**. These have become innovative

educational tools for environmental teaching in our schools and are a major success of this project. During 2001-02 we reached over 1,200 students with our **Detective Goo-Too Preventing Water Pollution** workshops, 80 teachers through our training workshops and distributed 2,900 copies of **Detective Goo-Too Preventing Water Pollution** and **Children and the Sea: a coloring book on ocean care and conservation**. Our educational materials are unique to our location and our goal is to increase public involvement in environmental action in the future. For example, **Detective Goo-Too Preventing Water Pollution** helps youngsters understand water pollution and how it affects our marine environment. The comic book also creates awareness of human impacts to coastal areas. Detective Goo-Too is a parrot fish that is approached by other sea creatures seeking help to stop pollution in their environment; with the help of a grouper he contacts five kids to help him find the sources of coastal pollution. The kids become Goo-Too detectives and take action to look for and solve environmental problems. The kids represent Virgin Islands cultural diversity and the story develops in a context that represents our unique Caribbean setting. The main character is named Goo-Too since that's the local name for this particular parrot fish. **Children and the Sea: a coloring book on ocean care and conservation** presents two children with their Uncle that while walking through the beach find an entangled seabird (a pelican) and later meet the University marine advisor that takes them on a trip to discover coastal ecosystems. The following issues are discussed in the book: animal entanglement in plastic debris, ocean health, coastal ecosystems (Coral reefs, mangroves and seagrasses) and human impacts to the coast through construction sites, shoreline developments, sewage and boating. Our **Caribbean Watershed Non-Point Source Pollution Model** consists of an interactive activity where students take action on preparing model demonstrations. For example, they help to add coffee grounds on a construction site to simulate loose soil; mineral oil on roads and marina parking lots to simulate car oil leaks (and grease) and colored drink mix on gardens and small crops to simulate excess fertilizers and pesticides. Finally, they add food coloring to represent failing septic tanks and boat sewage. A spray bottle is used to simulate rain and children can actually see how non-point source pollution takes place in our watersheds. The model is very colorful and unique to our Caribbean setting. It demonstrates the steepness of our hills and has mangroves on the coastline, two of which are removable to demonstrate the importance of these ecosystems in preventing water pollution. All these materials can be adapted to different environmental topics from marine ecosystems and coastal zone management to fisheries.

Dr. Manuel Valdés Pizzini, Director of University of Puerto Rico Sea Grant
Marine education and outreach at UPR Sea Grant

I will give you a presentation of the UPR Sea Grant program outreach and education activities that are directly or indirectly related to coral reefs fisheries and share with you some thoughts about the future

The Sea Grant Model

- We provide funds for research and then we try to translate that into our outreach programs. Marine outreach---marine extension and publications. We want to provide information to probably change perceptions, knowledge and change practices into more sustainable conservation practices. Research--- marine education--- marine outreach.

- We never go out there without knowing what is needed. We first do needs assessment and then design our outreach and extension activities to address those needs.
- **Marine outreach strategies**
 - ▶ Applied research (assessments)
 - ▶ Workshops and conferences
 - ▶ Capacity building and empowerment
 - ▶ The Web (<http://seagrant.uprm.edu>)
 - ▶ Pilot projects on conservation practices
 - ▶ Technical support to projects
 - ▶ One-on-one assistance
 - ▶ Partnerships and collaborations
 - ▶ Publications
- **Partnerships: everything we do, we do it in collaboration:**
 - ▶ Caribbean Fishery Management Council
 - ▶ National Marine Fisheries Service
 - ▶ DNER: Fisheries Laboratory, Programa de Educación en Recursos Acuáticos (PERA), and the Coastal Training Program (Jobos Bay NERR, CZMP)
 - ▶ Health Department (Hyperbaric Chamber)
 - ▶ NGOs: Puerto Rico Conservation Trust, Surfrider, Environmental Defense Council, etc.
 - ▶ Fishermen Associations
 - ▶ Universities: UPR (CUH, RP), University of the Virgin Islands (VIMAS, CMES)
 - ▶ Department of Marine Sciences (UPR-M)

Expected outcomes: Interrelationship research-education-outreach

- ▶ Conservation: develop consciousness and practices
- ▶ Wise use of coastal and marine resources
- ▶ Sustainability: sustainable development: we need desperately to talk about this.

Research: More than \$800,000

Marine Fisheries Reserves: The Turrumote Reserve-Reproduction-Coral transplantation and reef rehabilitation-Climate and corals-Habitat connectivity (reefs-sea grasses)-Reef fishes in the Luis Peña Reserve-Mapping of benthic habitats-Fish pathways-Larval dispersion-Nursery habitats-Mathematical models for MPA-Effectiveness of MPA-Heat Shock Proteins in corals-Indicators of coral reef vitality-Monitoring of stress in corals- Sedimentation-Social and human sciences: Folk knowledge of species and habitats-Perceptions- Life histories- Spatial utilization-Human uses (DNER & NOAA)-Coastal training needs (NERRS Coastal Training Program, Jobos Bay)

Marine Education

- ▶ Training teachers
- ▶ Training graduate students
- ▶ Visits to schools
- ▶ Changes in curriculum at the Commonwealth level
- ▶ Habitat conservation and management

- ▶Cajaya marine camp
- ▶From the mountain to the coast
- ▶Students and teachers' participation in field activities and conservation practices
- ▶Undergraduate and graduate students' training and research experiences
- ▶Knauss Fellowship

NOAA's Environmental Entrepreneurship Program for Minority Serving Institutions

- Capacity building
- Careers in resource management
- Vocational experiences
- Pilot project: MPA in Culebra and La Parguera

Marine Outreach with direct impact on coral reefs

- ▶Marine Protected Areas-Water quality and NPS-Watershed conservation
- ▶Awareness on policy issues: Taking Action for Coral Reefs
- ▶Beach management and conservation programs
- ▶Marine ornamentals: collaboration with all users
- ▶Information on regulations, policies, participation, and organizational models
- ▶Health of divers
- ▶*Boletín Marino-Sea Grant in the Caribbean*
- ▶*Posters-Leaflets-Identification cards*
- ▶*Internet-Radio programs-Geoambiente TV program*
- ▶Human uses impacting coral reefs: an assessment for a monitoring program
- ▶Volunteer monitoring of the health of coral reefs in PR and the USVI
- ▶Identification cards.

The future

- ▶Communities and stakeholders: we keep paying lip service to these, but we don't do enough. I hope this conference is a step in that direction.
- ▶Reaching the general public
- ▶Coral reefs: the centrality of fishers
- ▶Socioeconomic processes
- ▶Marine Protected Areas
- ▶Alternative management strategies
- ▶Interdisciplinary efforts
- ▶Partnerships and collaborations
- ▶A unified strategy and the "big" picture

Scientific intricacies of Marine Protected Areas

- ▶Translate science to fishers and the general public
- ▶The complexity of MPA (nature, science, policies, and human behaviors)
- ▶What we know and what we don't
- ▶MPA as a link in a chain of processes and events

Marine Education

- ▶The general public
- ▶Publications and materials for children
- ▶Continuous changes in curricula
- ▶Teach the teachers: the multiplier effect
- ▶Sustainability

Eliminate this simple equation: *fish + fishing = overfishing* because it is too simple for tropical insular environments

Socioeconomic processes

- ▶Critical impact of development on coastal and marine habitats
- ▶Over-fishing in the context of market / consumption
- ▶Enforcement and “environmental justice”: we cannot ask fishermen to start working in MPA’s and comply with the law when there are so many other people who are not complying with the law.

Capacity building and “the big picture”

- ▶Land use planning
- ▶Environmental legislation and enforcement
- ▶Watershed protection
- ▶Integrated Coastal Zone Management
- ▶Sustainable use of coastal resources

Mr. Antonio Ortíz, NGO representative and key participant in the coral project with Guánica State Forest and Natural Reserve and Caborrojeños Pro Salud y Ambiente, Inc.

Coral farm project and the NGO activities with the public

We are Caborrojeños Pro-Salud y Ambiente an environmental NGO currently receiving funding from the National Fish and Wildlife Foundation for a coral restoration project. We also receive financial assistance from the Ferré Rangel Foundation and The Toyota Foundation.

Our main educational effort consists of talks to schoolchildren about coral reefs. But for the last two years our main effort has been the coral farm restoration project.

Coral farm restoration project

We need to find the seed to propagate corals.

- There are farms in the south, west and southwest.
- Process: using cement platforms coral fragments of 12 cm are planted and harvested after 18 months to be transplanted into an area in need of restoration.
- New culturing device: 20 fragments per platform
- Transportation of platform: reduces mortality, survival 99.6% after one month
- After 18 month the coral is ready to harvest.
- This planting method has proven very successful.
- **Future expectations:** a community-based coral nursery.
- Joint effort among community, scientists and government
- Community: fishermen, divers, educators and NGO’s
- Scientists: technical support
- Government: management, permits, funds and facilities

Another project: Guánica DNER- Reef Balls Project

Goal: Increase fish landing, since habitats were not available the reef balls may provide habitat. There is coral planting on reef balls.

Combination of methods to increase fish populations.

Panel - Response, Recommendations, and Discussion

Ms. Dorothi Santiago, member of Comité Vecinos de La Parguera, Marine Biologist and Educator

Recommendations on how to approach and educate local fisherman

La Parguera is a showcase for tragedy of the commons, poor development and poor planning.

Recommendations:

1. Allocation of funds for research from the beginning.
2. Allocation of funds in partnership to implement MPA's in curriculum
3. No-take zones
4. Fishermen compensation
5. Mandatory licenses for recreational and commercial fishers: course requirement
6. Establish a Marine Aquarium for Puerto Rico

Ms. Mary Ann Lucking, CORALations, Inc.

Legal aspects of coastal development that impact coral reefs: Conserve, nurture, educate

Her organization has been lobbying for stricter water quality standards. Two lawsuits: one against EPA for failure to implement discretionary power regarding water quality standards- Federal Exclusion of Puerto Rico from water Quality Act; one against a development project in Culebra for inadequate planning.

DNER: coming hard on fishermen but propelling development.
Culebra Fishermen Association involved in offshore aquaculture project.

Recommendations:

1. Open up communication in respectful fashion: do not address fishermen in condescending ways.
2. Agencies also need to interact with their constituents in a respectful manner.

Ms. Raquel Siebert, USVI The Nature Conservancy

The Nature Conservancy strategy includes purchasing land and working with the local communities to develop locally significant conservation strategies. The TNC management plan for Puerto Rico involves local non-governmental agencies as well as dive operators

Recommendations:

1. Focus on education of resource user groups: meet them on their own turf.
2. Encourage institutions to do more cultural exchanges among fishermen: Ex. Belize
3. Provide funding for fishers to come to meeting like this one

Dr. Ken Lindeman, Environmental Defense

Productive Collaborations between fishermen and scientists in the Northern Caribbean

Historical overview of biologists' dependence on commercial fishers.

Example from Florida Keys

Recommendations:

1. Address coral Reef Action Plan: B1, B2 in Puerto Rico
2. Bring closure to Law 278 and Law 147 in PR
3. To accomplish sections A4 and A3 from the Coral Reef Action Plan there should be an outreach effort to fishers in order to accomplish B1 and B2.

Panel Recommendations:

Aileen Velazco: Need for education. Empower fishers and community groups. Maybe work with La Parguera's group to educate peers.

Manuel Valdés Pizzini: - Sea Grant has produced a Public Policy Paper to address the complex issue of beach management in Puerto Rico.
- Interdisciplinary research and outreach program-including fishers
- Re-think what participation means: There is a lengthy experience of co-management and negotiations. Casa Pueblo (NGO in Adjuntas, PR) could be a good example of co-management.
- Democratic management practices.
- Equity and environmental justice: we cannot ask some people for support and not apply the laws to others.

Mayra Suárez: - There is a need for more funds for education and outreach.
- Come together to avoid duplicating efforts.
- Let's collaborate on similar issues.
- There is a need for more educational resources: Caribbean specific.
- Integrate what we have into educational guidelines.
- Crossover to multidisciplinary approach
- Develop workshop for enforcement personnel.
- Bring fishery science to fishers and fishers perspectives into fishery science.

Ortíz: Multidisciplinary efforts are not new but there is a global demand for this type of educational effort, always starting at the community level.