CHAPTER 6:
Reducing the Adverse Impacts of Fishing

Goal:

Reduce the adverse impacts of fishing and other extractive uses to protect coral reef ecosystems and ensure sustainable fisheries.

Coral reefs and associated habitats provide important commercial, recreational, and subsistence fishery resources in the United States and around the world, and represent a critical source of food. Fishing plays a central social and cultural role in many island communities. The rich biodiversity of reefs also supports a valuable marine aquarium industry, and promises a rich genetic resource for pharmaceuticals and other natural products. However, human population growth, the emergence of export fisheries, and the use of more efficient fishing equipment have led to overfishing and fishing-related impacts on habitats and ecosystems. Inadequately regulated fishing may significantly alter ecological balance, contributes to the degradation of coral reef ecosystems, and threatens the social and economic sustainability of communities depending on these valuable resources. USCRTF members and partners are working to reduce the adverse impacts of fishing and increase the sustainable management of coral reef fisheries through

improved scientific information, coordination, enforcement, targeted management approaches, and education.

Accomplishments by Objective

Objective 1: *Identify, monitor, and protect critically important U.S. coral reef fisheries habitats and spawning populations through an expanded network of no-take ecological reserves; ensure effective enforcement of existing no-take marine reserves; monitor reef fish stocks in no-take marine reserves and reference sites to evaluate the effectiveness of reserves; and identify and protect new areas necessary to ensure the integrity of fisheries and ecosystems.*

The members and partners of the USCRTF are evaluating the effectiveness of established MPAs to improve fish stocks and protect spawning aggregations (when fish gather at a particular time and place for simultaneous reproduction en masse). A goal of many established marine protected areas is to protect spawning aggregations of fish important for commercial and cultural uses.

Researchers studying the reserves in Florida and the Dry Tortugas have documented increased numbers and sizes of reef fish important from economic and ecological perspectives—such as black grouper *(Mycteroperca bonaci)*, and yellowtail snapper *(Ocyurus chrysurus)*—within the protected areas. At Riley's Hump in the Dry Tortugas, researchers have documented the reformation of a mutton snapper *(Lutjanus analis)* aggregation since this site is now protected from fishing. In Pohnpei in the FSM, researchers found the no-take year-round Kehpara Marine Sanctuary is effective in protecting squaretail coralgrouper, and adjacent spawning aggregations of brown-marbled grouper *(Epinephelus fuscoguttatus)*, and camouflage grouper *(E. polyphekadion)*. But, it was also evident that many reproductively active groupers never reach the spawning site and are taken along migration routes or in staging areas adjacent to the Sanctuary, thus reducing overall annual reproductive output for the spawning population.

Southeast Florida Coral Reef Initiative Fishery Profile

In support of the goals of the Southeast Florida Coral Reef Initiative (SEFCRI), NOAA described total landings, effort, and trends in recreational, headboat, and commercial fisheries off Dade, Broward, Palm Beach, and Martin counties of southeastern Florida (SEFCRI Local Action Strategy region). A NOAA Technical Report released in 2006 illustrated the value of reef resources to southeast Florida fisheries. In southeast Florida fishery landings from 1990-2000, reef fishes comprised nearly a quarter of all landings, an annual average of 4.79 million pounds. Reef fishes comprised 27 percent of recreational fish landings, 38 percent of headboat landings, and 17 percent of commercial landings. The report—*Description and Discussion of Southeast Florida Fishery Landings*, 1990-2000—is available online at: https://grunt.sefsc.noaa.gov/P_QryLDS/DisplayDocuments.jsp?min_series_code=&min_record_id=&direction=next&total_rows=&description=SEFSC%20Technical%20Memorandum#.

An additional activity to end overfishing in the Caribbean includes the Puerto Rico Department of Natural Resources (PRDNR) recently published regulations prohibiting all fishing of red hind during their spawning season around the entire shelf in Puerto Rico jurisdictional waters, complementing federal fishing measures. This management action was

Big Eye in National Park.

the direct result of NOAA and the PRDNR's hydroacoustic research on fish spawning aggregations showing their re-appearance in specific locations in the Puerto Rico shelf. Closures apply to commercial and recreational fishing under Puerto Rico Fishing Regulations.

Objective 2: *Reduce overfishing by monitoring coral reef fisheries, assessing the adequacy of current fishing regulations, revising regulations as needed (using existing statutory processes in the case of federal regulations), and providing enhanced enforcement and education.*

Key elements of effective fishery management include understanding the current state of the fishery resources, implementing effective regulations, enhancing and strengthening enforcement capacity, and providing information on regulations to the fishing communities. USCRTF members and partners actively work to address information and capacity gaps to improve the state of the coral reef fisheries.

For example, USCRTF members are assessing reef fish populations and fishing activities to improve upon current fishery management activities. In Florida, NOAA, working with partners, completed a four-year study of the reef fishes along all three reef tracts of Broward County, surveying 208 species. Progressive increases in mean species richness, biomass, and abundance were seen from inshore to offshore across the three reef tracts. Of concern are the low number of legal-sized groupers and snappers found off Broward County. Researchers saw only two out of 232 red groupers of legal minimum size and observed no legal-sized gag *(Mycteroperca microlepis)*, yellowfin *(Mycteroperca venenosa)*, or scamp *(Mycteroperca phenax)* groupers. This indicates an important group of predators is now largely missing from this reef system.

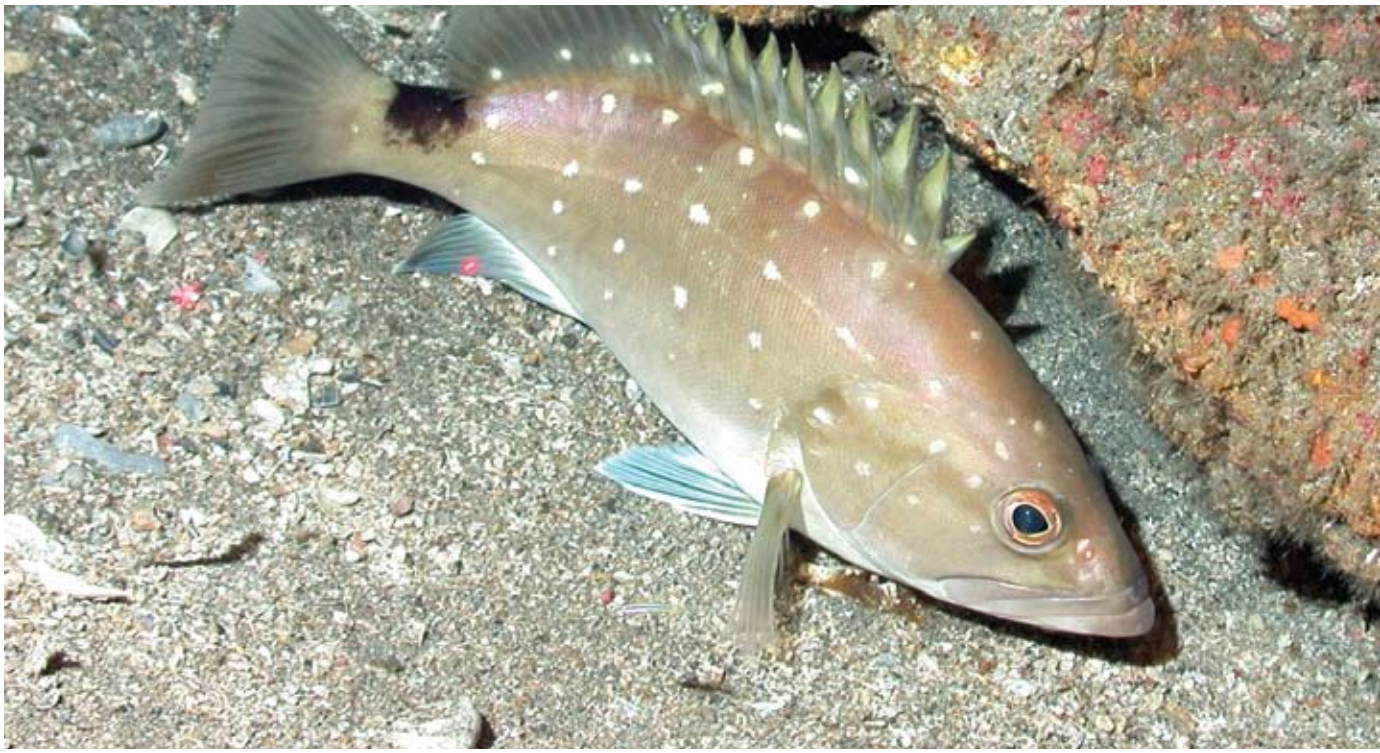
Information collected as part of the NOAA Coral Reef Conservation Program provided important fisheries data for NOAA stock assessment activities in the South Atlantic, Gulf of Mexico, and U.S. Caribbean (The Southeast Data, Assessment and Review process). Data from fishery-independent surveys provided information on fishery distribution and abundance and habitat interactions essential to many recent reef stock assessments, including yellowtail snapper, conch, red grouper, and mutton snapper. This type of data is of special importance when assessing Caribbean resources, which tend to be data-limited.

In the south Atlantic, *Coral Reef and Live/ Hardbottom Habitat Plan* is the basis for coral reef ecosystem management. The Plan prohibits harvest of stony corals, seafans, coral reefs and live rock except as authorized for scientific and educational purposes. The harvest of allowable octocorals for the aquarium trade is limited in number and only allowed south of Cape Canaveral, Florida. In addition Coral Habitat Areas of Particular Concern (HAPC), the Oculina Bank and Satellite Coral HAPCs have been designated in the South Atlantic. Within those areas, habitat damaging fishing gear is prohibited including bottom tending trawl gear, traps, dredges, and bottom longlines. Anchoring or the use of grapples is also prohibited for all fishing vessels. The Plan also established criteria for issuance of permits to take prohibited coral for scientific research and educational purposes and a permit system for use of allowable chemicals and harvest of octocorals. NOAA has been successful in protecting the fragile coral resources in the South Atlantic from degradation due to direct harvest and/or unintended damage from bottom tending fishing gear.

The Grammanik Bank, located nine miles south of St. Thomas in the U.S. Virgin Islands, is a charismatic, multi-species spawning aggregation site for aggregations of 35,000 – 84,000 fish annually; including yellowfin, yellowmouth, and tiger grouper; and cubera and dog snapper. NOAA activities led to the discovery of these previously undocumented snapper aggregations. Although Nassau grouper are present at the Bank, numbers have not returned to the critical mass needed to reform the spawning aggregation. NOAA provided funding for research on the resources in this area which informed the decision by the Caribbean Fishery Management Council to institute a seasonal closure of the bank to protect spawning aggregation sites in 2005. This closure, in addition to protecting fish populations, allows researchers to monitor and study spawning aggregations of Nassau grouper, which appear to be returning in increasing numbers to the bank. They are returning presumably to spawn (spawning coloration and behavior are present), but actual spawning has yet to be observed. Monitoring of Grammanik Bank continues, collecting information on grouper and snapper distribution, abundance and behaviors. A new facet of this project includes an extensive acoustic component to help passively monitor movements of fish to and from the area.

Across U.S. Pacific Island reefs analyses of fish data show strong correlations between the population status of targeted reef fish species and local human densities. Scientists found the highest fish biomass around the uninhabited or sparely populated and protected islands such as the NWHI and Howland, Baker, Jarvis, Wake, Palmyra, and Kingman islands. Fish biomass on these reefs ranged from two to six metric tons per hectare. In contrast, scientists found the lowest fish densities (~0.5 metric tons per hectare (0.01 square kilometer)) around islands with large populations, such as O‘ahu and Guam.

In 2005, CNMI reinstituted inshore creel surveys



Juvenile Snowy Grouper.

(an estimate of overall fishery yield) in Saipan, to increase understanding of the coastal fish species targeted by local fishermen and to collect data on inshore fisheries, an important component of the CNMI coral reef fishery. Initial surveys concentrated on the heavily utilized Saipan Lagoon area to monitor fishery-dependent trends in food fish abundance and biomass.

NOAA has also provided information leading to management decisions undertaken by the State of Hawai'i to protect coral reef-associated fish stocks from harmful fishing practices. Fisheries information collected in 2005 and 2006 led to a lay gill net ban on parts of O'ahu and all of Maui, as approved by Governor Lingle in March 2007.

Activities Related to Improving Regulations

To reduce fishing pressure and restore fish stocks, USCRTF members have implemented new regulations, and furthered the development of fisheries management plans. The Puerto Rico DNER published regulations prohibiting all fishing of red hind during their spawning season (December 1–February 28th) around the entire shelf in Puerto Rico jurisdictional waters. This management action was based on results of hydroacoustic research on red hind *(Epinephelus guttatus)* spawning aggregations along the Puerto Rico shelf. The closures apply to commercial and recreational fishing under Puerto Rico Fishing Regulations.

Florida and the NPS have taken steps to implement an agreement to adopt a joint Fisheries Management Plan between the State of Florida and Biscayne National Park to address increased park visitation and declines in reef fisheries. The park hosts more than 500,000 visits per year at its location to the immediate south of Miami. The NPS and the Florida Fish and Wildlife Conservation Commission intend to publish a proposed Draft Environmental Impact Statement on the plan. The goals of the joint plan are to restore

Blue striped grunt and grey snappers in waters off the Florida Keys.

depleted fish stocks and sustain recreational opportunities at Biscayne National Park.

NOAA has also taken several actions for its Gulf of Mexico reef fish complex to address or prevent overfishing. During 2005 and 2006, moratoria on the issuance of additional commercial and charter/headboat vessel permits for reef fish were established, as well as a moratorium on shrimp vessel permits (shrimp vessels have a bycatch of reef fish). In addition, all vessels with a reef fish permit were required to install and use a vessel monitoring system, and to carry de-hooking devices for the incidental take of protected turtle species.

For red snapper, NOAA approved a rebuilding plan in 2004 and implemented it in July 2005. In 2006, an individual fishing quota system was established for the commercial red snapper fishery, which in part, was intended to reduce fishing mortality. In late 2006, NOAA Fisheries began developing additional harvesting restrictions to address overfishing of red snapper during 2007.

For groupers, several harvesting restrictions, including seasonal closures and bag limits were implemented in 2005 and 2006. Additional harvesting restrictions are currently being developed by the Gulf Council to end overfishing of several grouper species as well as other reef fishes.

Within the Caribbean Exclusive Economic Zone (EEZ), actions to address overfishing included: seasonal area closures to possession of members of the snapper/grouper complex at various times of the year; a requirement that fish captured or possessed in the EEZ not be filleted at sea and be landed with heads and fins intact; prohibitions against the use of gill and trammel nets to catch Caribbean reef fish or spiny lobster; and prohibition on the use of pots/traps, gill/trammel nets, and bottom longlines on coral or hard bottom year-round in existing seasonally closed areas and Grammanik Bank.

The western Pacific addresses the management of its coral reef species through ecosystem-based management. The Coral Reef Ecosystem Plan of the Western Pacific Region (CREFMP) is the first ecosystem-based fishery management plan for U.S. waters. The coral reefs that are managed under the CREFMP are healthy and, based on the best scientific information available, are not overfished or experiencing overfishing conditions. Management measures under the CREFMP, established a coral reef ecosystem regulatory area with no-take and low-use marine protected areas (MPAs); special permitting and reporting requirements for low-use MPAs; large vessel no-anchoring zone on the offshore southern banks around Guam; gear restrictions in the remote U.S. Pacific Islands, such as no spear fishing at night with SCUBA gear. The CREFMP also contains a framework regulatory process that enables the Western Pacific Fishery Management Council and NOAA to implement regulatory adjustments in a timely manner to address overfishing of coral reef ecosystem stocks that include shallow-water marine fauna and flora.

Activities Related to Improving Enforcement

Effective law enforcement is an essential part of successful management and conservation of coral reef fishery resources. The USCRTF has long recognized the need to build the capacity of local enforcement offices though training and increases in materials and personnel. Federal members of the USCRTF, through the Enforcement Working Group, trained territorial enforcement personnel on the federal legal authorities available to address pollution, illegal fishing, and other illegal activities affecting coral reefs. The workshops provided effective strategies for addressing environmental compliance and other problems affecting coral reef conservation. Workshop locales included St. Croix, St. Thomas, and Puerto Rico.

To address needs of law enforcement, officers in Puerto Rico received guides to identifying and reporting violations of fisheries laws, marine resource protection laws, coastal habitat protection laws, and other laws affecting impacts to the coral reef ecosystem and associated habitats. An additional tool developed with NOAA funding was a Marine Species Identification Guide depicting marine species protected by Puerto Rico regulations. The guide included photos of fish and other species out of the water as well as species often confused with those regulated. The manual highlighted characteristics of each species and applicable regulations to help officers better enforce existing regulations. Two workshops were held to train Puerto Rico rangers in the use of this tool. A third workshop on enforcement procedures included representatives of the Puerto Rico Department of Justice, Puerto Rico Tribunal, DNER Legal Division, DNER Ranger Corps, and the Department of the Police Maritime Unit. This workshop was the first forum promoting the increased interaction between different law enforcement disciplines working in coral reef and fisheries enforcement.

CNMI hired three new enforcement officers and implemented a joint enforcement operations plan with NOAA. The plan has provided increased funds to support enforcement operations in terms of fuel, equipment, uniforms, and other operational expenses.

In American Samoa, the Community Fisheries Management Program (CFMP) provides an enforcement program for participating villages, empowering village communities by deputizing the village mayor and one village policeman to assist DMWR in CFMP enforcement efforts.

Violators may be brought in front of the Village Council to determine punishment at the village level, but when higher-level enforcement is needed, legal support is provided through this set of regulations. A menu of village by-laws has been drafted by an attorney, incorporating all existing village by-laws regulating the use of a village marine protected area. This final draft under the DMWR Code is in its final stages before adoption and registration. This regulation strengthens enforcement capabilities by the CFMP village communities and DMWR.

In Guam, local agencies developed a user-friendly, pocket-sized, water-resistant booklet to increase public knowledge of fishing regulations. It includes descriptive photos and diagrams of legal-size fish; and locations of marine preserves, fish aggregation devices, and shallow-water mooring systems. To improve enforcement of marine preserves, Guam created a Conservation Reserve Officers Program, which will increase the number of enforcement officers in the field by 50 percent (Guam now has ten full-time enforcement officers). This program provides stipends, uniforms, and equipment for peace officers, who are employed by enforcement divisions of other local agencies. Peace officers are paired with existing conservation officers to increase shift coverage. In addition, Guam passed a law creating the Marine Preserve Eco Permit, which restricts certain non-fishing activities in the Marine Preserves.

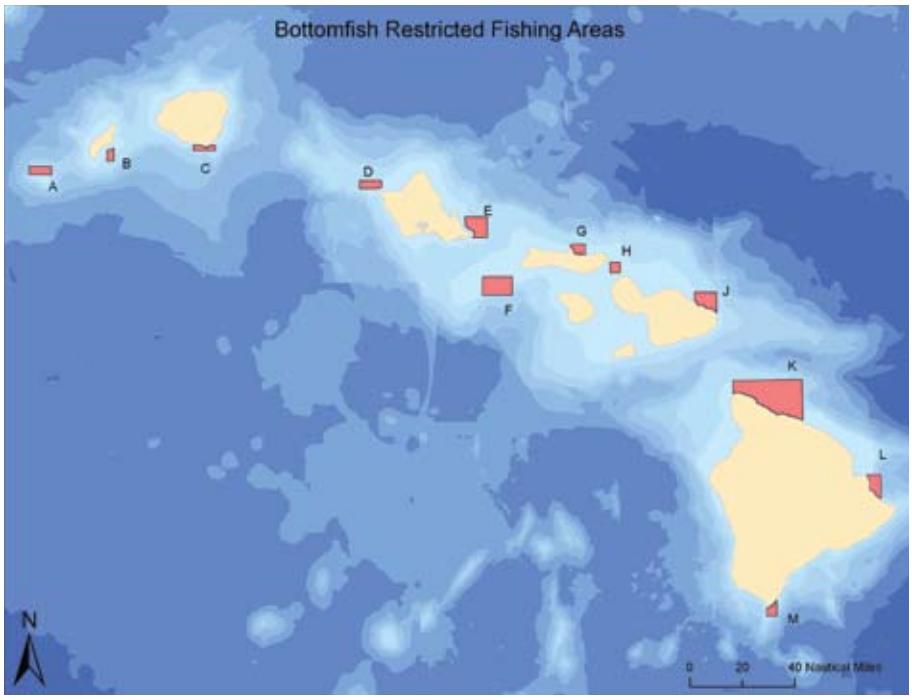
Objective 3: *Enhance coordination on coral reef fishery issues with the U.S. territories in the Caribbean and Western Pacific.*

NOAA has held a number of workshops to improve coordination among federal, state, and territory USCRTF members and to increase communication and interaction with local fishing communities and stakeholders. For example, NOAA held several workshops on Tutuila, American Samoa for public input on management needs for coastal fisheries. Fisheries biologists tailored presentations with the objective of providing the fundamental scientific and management information for effective management of a coral reef fishery. The workshops provided an introduction to assessing the status of fish stocks and fishing effort on a coral reef and covered life histories of fish species, impacts of water quality and poor watershed management, and the benefits and risks of particular management approaches (e.g., area closures, seasonal closures, gear regulations, etc.). The participants suggested additional training on more specific topics including in-depth coral reef fish life histories, coral reef water-quality parameters and monitoring requirements, and analysis of fishery data and management needs. Based on the success of this workshop, the USCRTF is considering conducting a similar effort for other U.S. Pacific Islands.

Objective 4: *Reduce adverse environmental impacts of fishing by assessing essential fish habitat; identifying the effects of fishing gear; implementing actions or additional gear and fishing vessel anchoring restrictions to reduce habitat damage; eliminating destructive fishing practices; assessing and mapping deeper coral reefs, banks, and beds; and developing strategies to conserve these deeper ecosystems.*

Deeper reef ecosystems provide essential habitat for many fish species. Some fish inhabiting these deeper reef systems spend their entire lives there while others, such as some snappers and groupers, may migrate between shallower reefs and deeper reefs, and still other species may spend their juvenile stages in shallower waters and move to the deeper reefs as adults.

USCRTF members have made an effort to protect deeper reefs and habitats. For



GIS-based tool for managing the bottomfish fishery in Hawai'i.

example, researchers developed a GIS-based tool for managing the bottomfish fishery in Hawai'i, which has been declared in a state of overfishing. GIS layers derived from the bathymetry include hill-shades and depth contours, and biological and fishing information helped make the GIS map an effective tool for managing this fishery. Hawai'i has used this GIS map to revise a bottomfish Restricted Fishing Area plan encompassing quality habitat and to reduce fishing pressure.

Objective 5: *Incorporate ecosystem-scale considerations into coral reef fishery management by performing targeted research, including the development of models, to understand the ecosystem effects of fishing and the socioeconomic impacts of fishery management.*

Ecosystem-based coral reef and fishery management, including the use of place-based management tools (e.g., MPAs), requires an understanding of the origins of fish larvae, their movements, and habitat needs. NOAA researchers, in partnership with El Colegio de La Frontera Sur in Chetumal, Mexico, are mapping spawning aggregations, larval distributions, and oceanic currents in the Caribbean to determine potential coral reef population connections with Florida reefs. Floating drifters (ocean current detection devices) released in the Yucatan quickly left the region and headed north toward Florida, suggesting fish larvae could travel along the same path with relative ease. Light trap collections off Mexico yielded an unprecedented diversity of fish larvae, including tuna, bonefish, and groupers, all of which could be heading toward Florida.

Coral reef ecosystems provide economic and cultural benefits to human communities worldwide. Through cultural assessments of fishing communities, scientists, and managers can obtain broad, region-wide overviews

of fishing activities and characterize the economic and sociocultural importance of reef resources. Socioeconomic information helps managers include human dimensions in comprehensive coral reef ecosystem management. Social scientists from NOAA have characterized the fishing communities in Puerto Rico and the USVI. Highlights from interviews with the Puerto Rico fishing community include:

> *Increasing family involvement in fishing enterprises is often associated with adding value to catches through further processing of seafood products, establishing restaurants, and direct retail sales from home markets;*
>
> *Most fishermen surveyed in Puerto Rico believe MPAs are achieving their biological objectives, but they are more ambivalent about the sociological benefits of MPAs; and*
>
> *Most fishermen feel that management efforts in Puerto Rico focus on the preservation and conservation of fish stocks without considering the preservation of fishing communities and the importance of fishing ways of life to Puerto Rican culture and coastal heritage.*

NOAA conducted interviews with indigenous fishermen on Saipan, Rota, and Tinian to understand perceptions and attitudes related to CNMI fishery resource management; the results will feed into a tailored outreach effort. The fishermen showed interested in increasing their understanding of fisheries biology, fisheries management, human impacts affecting fisheries, marine protected areas, and the principles of marine conservation.

Objective 6: *Reduce the over-exploitation of reef organisms for the aquarium trade by banning the domestic commercial collection of coral and "live rock" and monitoring the collection of other species, developing new management measures or ecologically sound alternatives to wild collection, evaluating the effectiveness of existing legal authorities and policies governing the collection and importation of coral and other reef-dwelling species, and addressing inconsistencies among federal and state/territory regulations on collection and trade of ornamental coral reef species.*

In late 2006, Department of Justice (DOJ) prosecutions were completed in a USFWS investigation that documented the theft and illegal interstate sale of more than 140 tons of coral and live rock from Hawaiian waters. This case secured more than $135,000 in restitution from defendants for use in State marine conservation efforts.

The Puerto Rico Fishing Regulations manage the aquarium trade of ornamental fish and crustaceans through a quota of allowed species for this activity. Only 20 species of fish and eight species of invertebrates are allowed to be captured in Puerto Rico for the aquarium trade. Taking of live rock is also banned through these regulations which also prohibit the take, sale, and barter of any coral for commercial purposes. New coral reef regulations will protect other invertebrates such as sponges and mollusks, among others.

Objective 7: *Develop a process to evaluate issues and possibly develop guidance related to coral reef aquaculture in conjunction with stakeholders and relevant interagency groups, including the Aquatic Nuisance Species Task Force and the National Invasive Species Council.*

Nassau grouper on a deep reef off the west coast of Puerto Rico

Aquaculture is a growing industry in and around coral reef resources. Although aquaculture can provide jobs for economically depressed coastal communities and increase regional and domestic food supply and security, aquaculture practices may have unintended adverse effects on the surrounding ecosystem. To promote best management practices, NOAA developed monitoring and permitting criteria to address potential impacts to coral reef ecosystems from several large proposed mariculture projects for the cage farming of cobia and other fish, including shellfish, in Culebra, Humacao, and Rincón, Puerto Rico. The monitoring and permitting criteria will inform the appropriate location and design of these and other future projects.

The USCRTF formed an ad-hoc Aquaculture Working Group to provide a forum for information sharing and to better coordinate the efforts of its members. Thus far, this working group has consisted of USCRTF federal agency members playing a significant role in regulating, permitting, or researching aquaculture activities. The group compiled input on environmental concerns related to aquaculture and provided resources pertaining to existing environmental guidelines.