



2 *Reduce Impacts of Coastal Uses*

Introduction

Coral reef ecosystems are being continually, and in some cases irreparably, damaged by a number of potentially avoidable human activities. Coastal activities such as dredging for navigation or marinas, construction of breakwaters and other hardened shoreline protection measures, beach renourishment, sand mining, pipelines and cable installation, and land-use practices (e.g., road construction, mangrove deforestation, and land reclamation for agricultural and urban development) decrease water quality around reefs. Increased coastal tourism has led to increased pressure on coral reef resources, either directly through impacts on the reefs from anchoring or poor diving practices, or indirectly through increased levels of coastal development, sewage discharge, or vessel traffic.

As the number of people using and transiting coral reefs increases annually, so too has the frequency of vessel groundings on reefs. Vessels striking shallow coral reefs can cause profound damage to habitats by dislodging, crushing and fracturing the benthic community, displacing resident fishes, and eliminating critically important topographic complexity and habitat structure created during hundreds of years of growth. In addition, propeller scarring, anchoring, and other physical impacts are of growing concern in nearshore habitats. Some impacted habitats cannot recover without direct, and often expensive, human intervention in the form of immediate debris clean up, emergency triage of injured animals, stabilization of unconsolidated surfaces and reinforcement of the reef framework, and long-term restoration of habitats and benthic communities.

These growing pressures are signs of the rapid growth in coastal populations and tourism over the past few decades, and of current resource limitations in programs responsible for implementing and enforcing existing conservation authorities. Many of the adverse habitat impacts of coastal development, shoreline modification, and vessel groundings can be prevented through consistent and proactive application of existing Federal and state authorities and programs. While vessel groundings are unlikely to be completely avoided, prompt and careful removal of the vessel and evaluation of ecosystem injuries, followed by a rapid implementation of remedial actions, can significantly reduce collateral damage and enhance survivorship of corals and other reef species.

Between 2002 and 2006, the CRCP provided \$9.2 million (M) to support 265 projects in this category, as shown in Exhibit III-2-1a. This investment accounted for 7% of the overall CRCP funding and 20% of the overall number of projects.

To address and reduce the impacts of coastal uses, the CRCP focused its efforts through the implementation of projects within five different subcategories:





- General Coastal Uses (addressing multiple impacts)
- Restore Injured Habitats
- Reduce Impacts of Recreational Overuse
- Reduce Impacts of Coastal Development
- Reduce Impacts of Maritime Activities

Exhibit III-2-1a Investment in Reduce Impacts of Coastal Uses 2002-2006						
Spend Plan Category	Number of Projects	% Category Projects	% Total Projects	Funding	% Category Projects	% Total Projects
Reduce Impacts of Coastal Uses	265	100	20.4	\$9,226,486	100	7.1
General Coastal Uses (Address Multiple Impacts)	156	58.9	12.0	\$4,048,633	43.9	3.1
Restore Injured Habitats	37	14.0	2.8	\$2,488,422	27.0	1.9
Reduce Impacts of Recreational Overuse	33	12.5	2.5	\$1,508,788	16.4	1.2
Reduce Impacts of Coastal Development	17	6.4	1.3	\$430,477	4.7	0.3
Reduce Impacts of Maritime Activities	22	8.3	1.7	\$750,166	8.1	0.6

Exhibit III-2-1b shows the distribution of investment in each of these subcategories.

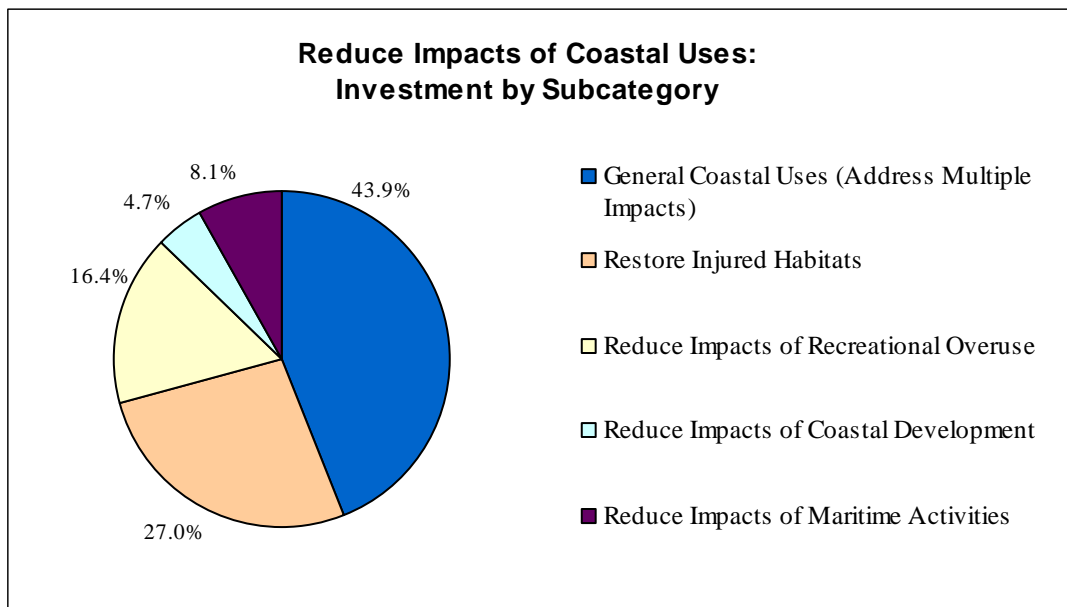


Exhibit III-2-1b. Distribution of Investments by Subcategory, 2002-2006





Subcategory: General Coastal Uses (Address Multiple Impacts)

a. Introduction to Subcategory

The general coastal uses subcategory includes projects and activities that address multiple aspects of coral reef ecosystem and marine resource conservation and protection. Areas addressed include general literacy and awareness projects, communications and outreach projects, general capacity building, and education projects targeting students or general population, as well as more focused economic valuation studies, community and stakeholder involvement, and partnership development.

Between 2002 and 2006, the CRCP provided \$4.0M to support 156 projects in this subcategory. This subcategory accounted for 44% of funding within the Reduce Impacts of Coastal Uses category and 3% of overall CRCP funding, and 59% of projects in the category and 12% of overall CRCP projects. Exhibits III-2-2a and -2b show the distribution of CRCP investments in the tools that support activities in this subcategory.

**Exhibit III-2-2a
General Coastal Uses
Investments by Tool**

Tool	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002		2003		2004		2005		2006		TOTALS 2002-2006			
Ecosystem Research	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Socioeconomic Research	1	\$64,250	2	\$70,000	3	\$130,000	0	\$0	1	\$14,400	7	4.5	\$278,650	6.9
Mapping and Monitoring	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Outreach	29	\$703,917	23	\$578,395	24	\$632,191	34	\$688,930	22	\$598,281	132	84.6	\$3,201,714	79.1
Management: Direct Implementation	1	\$2,000	0	\$0	5	\$145,156	2	\$43,302	2	\$37,437	10	6.4	\$227,895	5.6
Management: Training/Technical Assistance	1	\$56,974	1	\$50,000	2	\$100,000	1	\$45,000	2	\$88,400	7	4.5	\$340,374	8.4
None or N/A	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0





TOTAL	32	\$827,141	26	\$698,395	34	\$1,007,347	37	\$777,232	27	\$738,518	156	100	\$4,048,633	100
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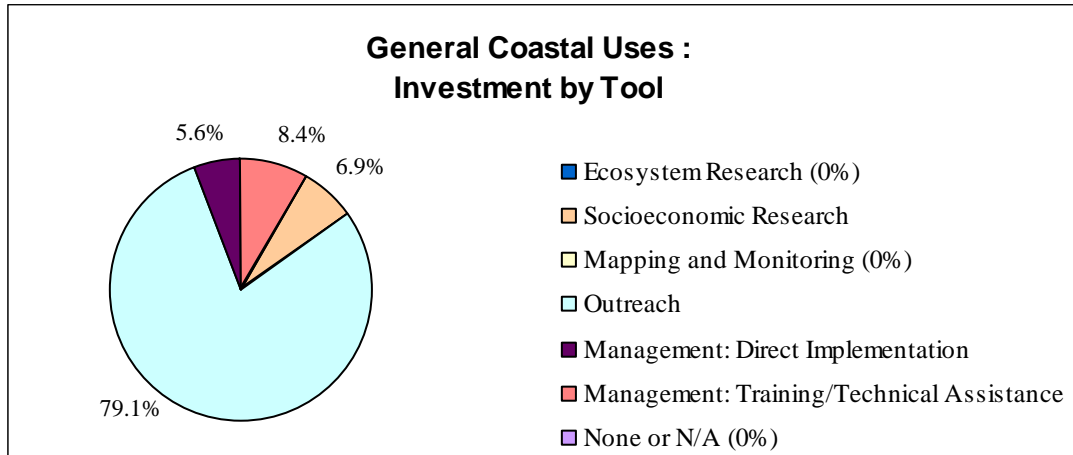


Exhibit III-2-2b. Distribution of Investments by Tool, 2002-2006

The regional breakdown of expenditures for the General Coastal Uses subcategory was as follows: 60% for Pacific activities, 31% for Atlantic/Caribbean, and 9% applicable to all regions (Exhibit III-2-3a and -3b).

**Exhibit III-2-3a
General Coastal Uses
Investments by Region**

Region	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002		2003		2004		2005		2006		TOTALS 2002-2006			
Atlantic/Caribbean	3	\$50,203	10	\$246,884	17	\$362,326	15	\$286,675	12	\$310,013	57	34.5	\$1,256,101	31.0
Pacific	27	\$621,939	13	\$331,511	19	\$597,521	23	\$438,057	15	\$428,505	97	58.8	\$2,417,533	59.7
Freely Associated States	0	\$0	0	\$0	1	\$7,500	1	\$7,500	0	\$0	2	1.2	\$15,000	0.4
International	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
All Regions	3	\$155,000	4	\$120,000	1	\$40,000	1	\$45,000	0	\$0	9	5.5	\$360,000	8.9





TOTAL	33	\$827,141	27	\$698,395	38	\$1,007,347	40	\$777,232	27	\$738,518	165	100	\$4,048,633	100
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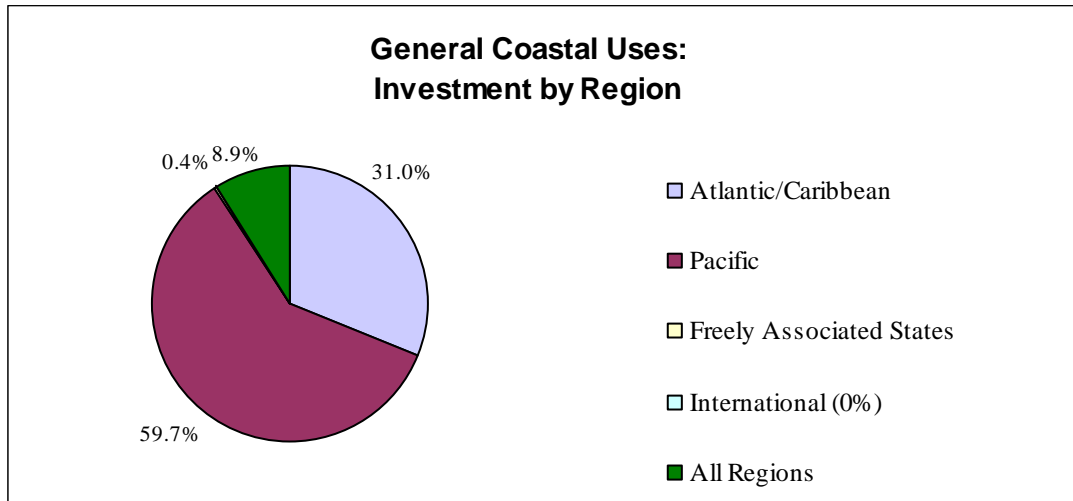


Exhibit III-2-3b. Distribution of Investments by Region, 2002-2006

b. Activities

The projects and activities supported by the CRCP use three tools to address the multiple impacts under the general coastal uses subcategory: outreach, management, and socioeconomic research. This section provides a summary of internal NOAA projects and external grant projects through the Coral Reef Conservation Grant Program. Outreach projects (79% of the general coastal uses projects and activities) supported local coral reef ecosystem education and outreach programs and initiatives. Management projects supported direct implementation as well as training and technical assistance (14% of projects), such as local agency efforts to develop long-term coral reef conservation and education strategies, ecosystem water quality standards, and amendments to local enforcement laws. Staff support and other capacity building efforts are key management priorities as well. Socioeconomic research projects (7% of projects) under this subcategory consist of coral reef economic valuation studies in multiple islands. These studies are used to determine the monetary value of coral reefs to support management decision making, develop appropriate mitigation costs, and to promote political buy-in to support coral reef management.





Program Highlight: Coral Reef Emergency Response

Damage to coral reefs happens instantaneously when a ship grounds; recovery takes decades or longer. Given the overall loss of resilience in coral reef ecosystems from other stressors, recovery may never be achieved without human intervention. When the *M/V Fortuna Reefer* grounded on Mona Island, Puerto Rico in 1997, NOAA led a multi-agency restoration action reattaching more than 1,800 fragments of the threatened elkhorn coral, *Acropora palmata*. By tracking the health of these colonies over time, CRCP-funded researchers learned several lessons furthering the science of restoration -- the type of substrate, the size of reattached fragments, and the method of attachment all determine coral restoration success. It has been close to a decade since the initial restoration, yet the site is still not fully recovered. However, when compared to earlier nearby grounding sites that were not restored, the *Fortuna Reefer* restoration demonstrates the benefit of these efforts. *Acropora* fragments are attached and growing, and fish abundance and diversity are starting to increase, indicating the positive impact of NOAA's restoration activities. Recent restoration activities have benefited from these lessons. In 2006, the 748-foot oil tanker *M/T Margara* ran aground off Guayanilla Bay, Puerto Rico, impacting 8,500 acres of coral reef including a relatively large thicket of threatened *Acropora cervicornis* (staghorn coral). The largest-ever undertaken emergency restoration focused on the time-sensitive task of securing the salvaged corals (approximately 10,000 pieces of hard and soft coral, along with more than 1,000 staghorn fragments), rebuilding portions of the impacted reef, and removing toxic anti-fouling paint from the site.

From these and other groundings, NOAA developed emergency response expertise for coral reef incidents in order to minimize impacts. Experience has shown coral survival rates are often very high if action is taken to collect and stabilize injured corals within days of a grounding, and the corals are reattached within a month or two depending on sea conditions. Unfortunately, these actions are rarely undertaken because of the lack of a funding or inability to recover costs from responsible parties. Given the decline of reefs, this is a critical gap to fill, which will require new authorities and a significant commitment of resources. The CRCP is hopeful it will be able to address the chronic problem of physical impacts through the 2007 reauthorization of the Coral Reef Conservation Act, which contains more expansive legislation to protect reefs, as well as fund efforts focused on impact prevention and programs designed to provide a rapid response capability to the hundreds of impacts that continue to occur annually.

While emergency restoration of coral impacts is a critical first step in returning impacted reefs to their natural state, more expansive restoration efforts are often necessary. To provide faster and more reliable methods, CRCP has supported research of diverse and innovative restoration approaches. Partnering with the University of Miami - RSMAS (UM-RSMAS) and the University of North Carolina/Wilmington (UNCW), NOAA scientists have collected gametes from broadcast-spawning parent colonies, effected fertilization and settlement in a laboratory setting and are raising tens of thousands of coral larvae each year for restoration activities. Settlement trials, applied directly onto reef surfaces or other substrates such as a new ceramic artificial structure, called an Ecoreef™, seek to improve survivorship of coral settlers. Laboratory-raised larvae are also tested to determine conditions that encourage coral survivorship and growth. Based on this research, Dr. Margaret Miller and her collaborators at UNCW and UM-RSMAS were featured in a coral spawning segment on Jean Michele Cousteau's nationally televised special, "America's Underwater Treasures."

CRCP-funded research is also developing methods to overcome many of the described bottlenecks in the early life history of Caribbean broadcasting corals including gamete collection, fertilization, planktonic larval culture, settlement, and zooxanthellae inoculation. These techniques have been described in both scientific (e.g., Szmant and Miller 2006) and applied (e.g., Miller and Szmant 2006) publications. The coral larval seeding efforts have resulted in the deployment of hundreds of thousands of competent coral larvae (*A. palmata*, *Montastraea faveolata*, and *Diploria strigosa*) for *in-situ* settlement and hundreds more advanced settled coral juveniles at the *Wellwood* restoration site (Florida Keys National Marine Sanctuary, or FKNMS). Even though the post-settlement survivorship of these baby corals is still very low, at least five cultured larval recruits of the threatened elkhorn coral, *Acropora palmata*, currently survive on or near the *Wellwood* restoration structure as a result of this project. Other experimental results have defined conditions that may limit restoration success. They have shown that stressful conditions during the week-long larval duration affect larval behavior, settlement choice, and post-settlement survival (Vermeij *et al.* 2006). Pilot results from experiments also suggest that the exudates from cyanobacterial mats which differentially occupy restoration structures inhibit settlement by elkhorn and brain coral larvae. Identification of limitations to success and ways to overcome those problems offer the promise of increasing our restoration effectiveness and reducing the time until more natural conditions and habitat functions can be restored in coral reef ecosystems.





c. Funding Recipients and Partners

More than 80 % of the projects were funded through grants and the remaining 20% were NOAA-led projects. To carry out the projects in this subcategory, the CRCP partnered with the NOAA offices and external partners listed in Exhibit III-2-4.

Exhibit III-2-4 General Coastal Uses Funding Recipients and Partners			
NOAA Offices	States and Territories	Academic Institutions	Non-Governmental Organizations
<ul style="list-style-type: none"> • NMFS - Habitat Conservation 	<ul style="list-style-type: none"> • CNMI 	<ul style="list-style-type: none"> • Florida State University 	<ul style="list-style-type: none"> • Community Conservation Network
<ul style="list-style-type: none"> • NMFS - Southeast Fisheries Science Center 	<ul style="list-style-type: none"> • Florida 	<ul style="list-style-type: none"> • Interamerican University of Puerto Rico 	<ul style="list-style-type: none"> • Consultores Educativos Ambientales
<ul style="list-style-type: none"> • NMFS - Southeast Regional Office 	<ul style="list-style-type: none"> • Guam 	<ul style="list-style-type: none"> • University of California-Los Angeles 	<ul style="list-style-type: none"> • MacGillivray Films
<ul style="list-style-type: none"> • NOS - Office of Ocean and Coastal Resource Management 	<ul style="list-style-type: none"> • Hawai'i 	<ul style="list-style-type: none"> • University of Hawai'i 	<ul style="list-style-type: none"> • Malama Kai Foundation
<ul style="list-style-type: none"> • NOS - Office of Response and Restoration 	<ul style="list-style-type: none"> • Puerto Rico 		<ul style="list-style-type: none"> • Marianas Resource Conservation and Development Council
<ul style="list-style-type: none"> • OAR - Atlantic Oceanographic and Meteorological Laboratory 	<ul style="list-style-type: none"> • U.S. Virgin Islands 		<ul style="list-style-type: none"> • Marine Aquarium Council
<ul style="list-style-type: none"> • OAR - Sea Grant Program 	<ul style="list-style-type: none"> • American Samoa 		<ul style="list-style-type: none"> • Project AWARE Foundation
			<ul style="list-style-type: none"> • Puerto Rico Tourism Company
			<ul style="list-style-type: none"> • Reef Relief, Inc.
			<ul style="list-style-type: none"> • St. Croix Environmental Association
			<ul style="list-style-type: none"> • The Nature Conservancy





**Exhibit III-2-4
General Coastal Uses
Funding Recipients and Partners**

NOAA Offices	States and Territories	Academic Institutions	Non-Governmental Organizations
			<ul style="list-style-type: none"> • The Ocean Conservancy • Urban Arts Institute • Virgin Island Network of Educators • Hawai'i Wildlife Foundation

d. Outputs

Key outputs from these projects include:

- A variety of outreach and education materials, such as brochures, hotel tent cards, coloring and activity books.
- A media kit, media excursions and a traveling exhibit in Florida.
- An educational kiosk in the Commonwealth of the Northern Mariana Islands (CNMI).
- A mobile learning lab in the U.S. Virgin Islands (USVI).

A number of public service announcements, films and videos and web pages were created as well. RARE Pride public awareness campaigns were developed for American Samoa, CNMI, FSM, and Micronesia. Products include a bilingual recreational uses coral reef booklet in Puerto Rico, a coral reef resources field guide and a natural history guide in American Samoa, and textbooks and teachers guides for elementary schools in Puerto Rico. Marine educator and teacher training workshops were conducted nationally, regionally, and in many individual locations.

Student scholarships and internships were sponsored in Hawai'i, CNMI, and American Samoa. Through a student internship program, CNMI's resource agencies hosted 22 college-level interns during the summers of 2003-2006. The internship program introduces local post-secondary students to natural resource careers and provides an opportunity for hands-on involvement in coral reef resource management. A coral reef and marine resources related education strategy was developed in Puerto Rico and coral reef conservation and management plans were developed in Hawai'i and CNMI.





e. Outcomes

Examples of key outcomes from activities in this area included:

- Local coral reef economic valuation studies addressed a priority need identified in a 2002 All Islands Coral Reef Economic Valuation Workshop. Valuations were completed for CNMI, Guam, American Samoa, and the Main Hawaiian Islands and studies are currently being conducted in the USVI and Puerto Rico. The resultant economic valuation reports have been used in some islands to develop outreach materials and to gain support from decision-makers for coral reef conservation and management. At the request of these jurisdictions, a workshop will be held during the 2007 USCRTF meeting in American Samoa to help local agencies use the valuation data to support management decision making, for damage assessment, and for outreach efforts.
- RARE Pride campaigns were completed or are currently underway in Pohnpei, Micronesia, CNMI, and American Samoa. The campaigns are designed by local leaders to build local capacity through raising public awareness and encouraging simple solutions to local problems through social marketing and focused outreach. In Pohnpei, the campaign was highly successful in increasing stakeholder support for Marine Protected Areas, in getting two new MPA communities to join Pohnpei's MPA network, and in building local support for UNESCO declaration for Ant Atoll as a Biosphere Reserve.
- Makai Watch programs in Hawai'i partner with community volunteers to improve management of coral reefs through education and outreach, observation and compliance, and biological and human use monitoring. The Makai Watch programs have been extremely successful and two communities, Milolii and Haena, have each worked to bring over five miles of coral reef habitat into enhanced marine management status. Community Conservation Network (CCN) is continuing to develop five of the already-established Makai Watch programs and plans to establish new programs in three additional communities. In addition to volunteer patrols to reduce resource violations, the Makai groups develop and implement Makai Watch institutional and financial sustainability plans, and hold workshops and trainings to exchange Makai Watch skills and lessons learned.
- In Puerto Rico, the wide distribution of educational materials—such as the recreational users' guide that addresses appropriate boating practices to promote the protection of the coral reef ecosystem—has led to the inclusion of education and outreach components in many proposed marine and other recreational boater projects.
- In Puerto Rico, the popularity of the bilingual coral reef ecosystem CD produced by the NOAA Fisheries Caribbean Field Office, along with other educational materials produced with funds from the CRCP, has led to the incorporation of marine sciences and conservation themes in science lessons in many local schools throughout the island.
- In USVI, the mobile learning lab with marine discovery modules created by the St. Croix Environmental Association has led to enhanced environmental literacy in St. Croix children and strengthened educational partnerships through the Virgin Islands Network of Educators (VINE).





f. Challenges

A key challenge in many jurisdictions proved to be the lack of efficient mechanisms and staffing at the local government level for managing and spending coral reef funds. In the U.S. Caribbean, additional complications were often encountered in coordinating with partners and communicating within the same agency for projects to develop coral education and public awareness strategies and initiatives, as well as for some broad-based outreach projects. Completing projects in a timely manner proved difficult in some jurisdictions, due to contracting and partnering issues.

g. Future Directions

Key future directions include identifying and securing sustainable funding for staff positions to coordinate and lead education and outreach efforts, providing long-term funding and support for community-led conservation efforts such as the Makai Watch programs in Hawai'i, and increasing capacity for conservation and education initiatives in general through student scholarships, internships and teacher awards. Jurisdictions need continued support and assistance with communicating and applying data from economic valuation studies to management decisions.

Subcategory: Restore Injured Habitats

a. Introduction to Subcategory

This subcategory includes projects that reduce impacts to coral reefs through direct restoration of injured coral reef habitats, evaluation and monitoring of different restoration techniques, mitigation activities for damaged coral reef services, removal of alien invasive species, and training personnel on rapid habitat assessment techniques. The CRCP approached these activities primarily through research efforts, through direct management implementation, and to a lesser extent through monitoring. Grant activities used these same tools and also incorporated outreach tools.

Between 2002 and 2006, the CRCP provided \$2.5M to support 37 projects in this subcategory. As seen in Exhibit III-2-5a, this subcategory accounted for 27% of funding within the Reduce Impacts of Coastal Uses category and 2% of overall CRCP funding, 14% of projects in the category, and 3% of overall CRCP projects.





**Exhibit III-2-5a
Restore Injured Habitats
Investments by Tool**

Tool	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002		2003		2004		2005		2006		TOTALS 2002-2006			
Ecosystem Research	6	\$328,113	5	\$360,000	6	\$371,975	4	\$210,000	3	\$112,534	24	64.9	\$1,382,622	55.6
Socioeconomic Research	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Mapping and Monitoring	1	\$30,000	0	\$0	2	\$40,300	1	\$130,000	0	\$0	4	10.8	\$200,300	8.0
Outreach	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Management: Direct Implementation	4	\$388,000	2	\$350,000	2	\$145,000	0	\$0	0	\$0	8	21.6	\$883,000	35.5
Management: Training/Technical Assistance	0	\$0	0	\$0	0	\$0	1	\$22,500	0	\$0	1	2.7	\$22,500	0.9
None or N/A	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
TOTAL	11	\$746,113	7	\$710,000	10	\$557,275	6	\$362,500	3	\$112,534	37	100	\$2,488,422	100





Exhibit III-2-5b shows the distribution of investments by tool for this subcategory.

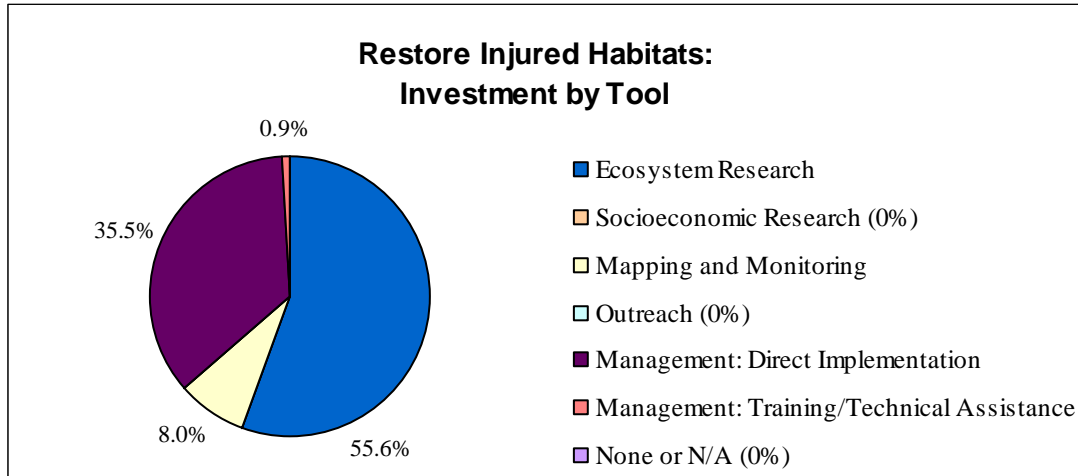


Exhibit III-2-5b. Distribution of Investments by Tool, 2002-2006

The regional funding breakdown for the Restore Injured Habitats subcategory was 63% for Atlantic/Caribbean activities, and 37% for Pacific activities. Exhibits III-2-6a and -6b show the distribution of CRCP investments in this subcategory by region.

Exhibit III-2-6a Restore Injured Habitats Investments by Region														
Region	Number of Projects		Funding		Number of Projects		Funding		Number of Projects		Funding		Number of Projects	
	2002		2003		2004		2005		2006		TOTALS 2002-2006		TOTALS 2002-2006	
	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
Atlantic/Caribbean	10	\$690,513	4	\$320,000	5	\$271,275	4	\$210,000	2	\$69,034	25	64.1	\$1,560,822	62.7
Pacific	1	\$55,600	3	\$390,000	5	\$286,000	4	\$152,500	1	\$43,500	14	35.9	\$927,600	37.3
Freely Associated States	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
International	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
All Regions	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
TOTAL	11	\$746,113	7	\$710,000	10	\$557,275	8	\$362,500	3	\$112,534	39	100	\$2,488,422	100



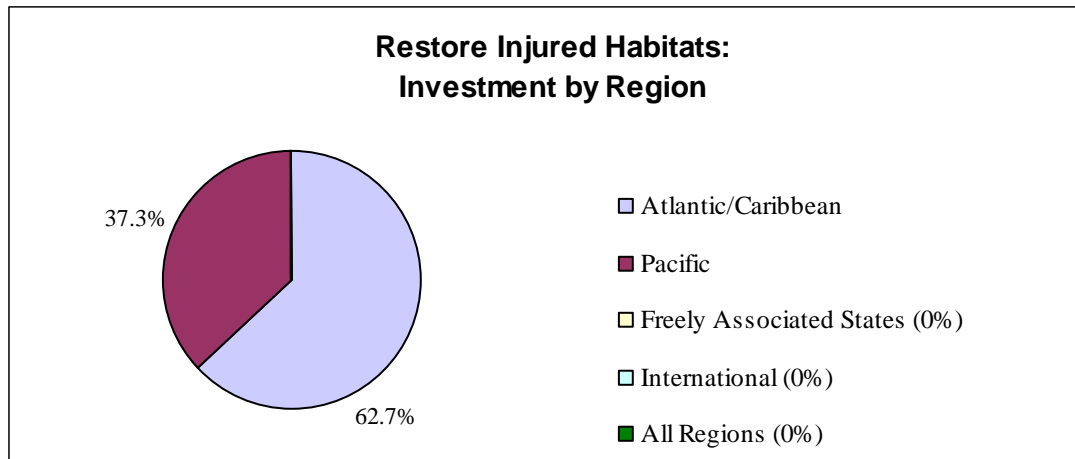


Exhibit III-2-6b. Distribution of Investments by Region, 2002-2006

b. Activities

Diverse activities occurred in the Atlantic and Pacific to restore coral habitats damaged by ship groundings, evaluate restoration methods, and monitor the effectiveness of coral replacement and the recreation of fish habitat. In the Atlantic, CRCP (in partnership with the Southeastern Fisheries Science Center (SEFSC)) projects have focused on evaluating reef restoration projects at ship grounding sites in the Florida Keys (*Elpis, Maitland, Wellwood, Iselin* sites) and in Puerto Rico (*Fortuna Reefer* on Mona Island) (see Program Highlight, p. III-2-6). In the Pacific, the CRCP, in partnership with the Pacific Islands Fisheries Science Center, coordinated initial response for the *Casitas* grounding in the NWHI and implemented the restoration of and mitigation for the *Cape Flattery* grounding off Oahu. This included one of the first practical uses of Habitat Equivalency Analysis (HEA) to quantify coral loss for mitigation planning in the Pacific Islands.

These restoration projects, generally implemented by NOAA in conjunction with other Federal and local management entities, are conducted under Federal regulations, such as the Oil Pollution Act and its Natural Resource Damage Assessment process. Under these regulations, experimental restoration approaches are discouraged and long-term monitoring of sites is rarely possible, although these activities are crucial to determining the ecological performance and cost/benefit of the projects. The CRCP recognizes this deficiency and has sought to fund activities that promote the science of coral reef restoration. Assessments focused on the performance of “rescued” elkhorn coral fragments (reattachment success, survival, growth, and susceptibility to disease), on the restoration of habitat value as demonstrated by fish communities using restored corals and restoration structures, and on the recruitment of new corals and benthic communities on the restoration structures.

Understanding reef ecosystems and the reasons they are degrading is critical for designing and implementing successful restoration efforts. This subcategory supports research and conservation actions to understand natural and anthropogenic changes in coral reef ecosystems and restore native





conditions and natural processes that sustain coral reef ecosystems. In Hawai'i, CRCP grants supported actions to manage invasive species, including eradication of an invasive soft coral from a Kauai harbor, alien algae removal and management on Oahu, a feeding study on the interactions between an introduced snapper and native reef fish, and cultivation of sea urchins to serve as algal biocontrols. CRCP grants also supported the initial development of an early warning system for invasive species in Hawai'i and a resultant taxonomic update of native and invasive species.

In the Atlantic, research seeking to enhance restoration examined the processes of coral spawning, larval culture, and early life history of broadcast-spawning coral species. Larval recruitment of these reef-building species in the Caribbean has become rare due to bottlenecks at early life history steps. Methods to predict spawning, collect gametes, accomplish effective fertilization, culture the larvae to competence, and settle them for deployment to a reef restoration structure in the Florida Keys are under development. Parallel and ongoing experimental studies are focused on evaluating specific factors that affect larval success and, in particular, enhance or deter post-settlement survivorship. Grant funding has supported efforts to develop coral nurseries that might readily supply colonies for restoration activities.

The linkages between habitat types and different plant and animal taxa are evident in coral reef ecosystems. In the Caribbean, particularly, sustainable coral reef ecosystems depend on integrated and interacting habitat types which include coral reefs of various configurations, seagrass beds, and mangroves. Seagrass and mangrove restoration projects in Puerto Rico (Gilligan's Island, Guánica) have been priorities and a guide to coral reef restoration has been supported. Efforts to model seagrass and coral restoration efforts have been supported as has research to identify stresses in corals and to advance restoration planning. Concurrently, the CRCP provided funding for other activities that support the Restore Injured Habitats subcategory, such as the Mangroves as Fish Habitat Conference (see *Reduce Adverse Impacts of Fishing*) and the Coral Disease and Health Consortium whose activities support the research needed to accomplish successful restorations (see *Reduce Impacts of Pollution and Coral Disease*).

In American Samoa, Guam, CNMI, and Puerto Rico, coral reef ecologists were hired to act as liaisons with local coral action groups and participate in Local Action Strategy (LAS) implementation, including habitat restoration. In American Samoa, several community-based management training meetings were held to empower villagers to restore habitats within their community.

c. Funding Recipients and Partners

To carry out the projects in this subcategory, the CRCP partnered with the NOAA offices and external partners listed in Exhibit III-2-7.





**Exhibit III-2-7
Restore Injured Habitats
Funding Recipients and Partners**

NOAA Offices	States and Territories	Fishery Management Councils	Academic Institutions	Non-Governmental Organizations
<ul style="list-style-type: none"> • NMFS - Office of Habitat Conservation • NMFS - Office of Law Enforcement • NMFS - Pacific Islands Fisheries Science Center • NMFS - Pacific Islands Regional Office • NMFS - Southeast Fisheries Science Center • NMFS - Southeast Regional Office • NOS - National Centers for Coastal Ocean Science • NOS - National Marine Sanctuaries Office • NOS - Office of Response and Restoration 	<ul style="list-style-type: none"> • American Samoa • CNMI • Florida • Guam • Hawai'i • Puerto Rico 	<ul style="list-style-type: none"> • Western Pacific 	<ul style="list-style-type: none"> • NURC/UNCW • University of Hawai'i • University of Miami/RSMAS • University of Puerto Rico - Mayaguez 	<ul style="list-style-type: none"> • Bishop Museum • Boqueron Aquatics • Mote Marine Lab • SeaCamp • The Nature Conservancy

d. Outputs

Publications and presentations (see Appendix III-2) on improving restoration management success addressed assessment of damage, restoration techniques, and monitoring results through a variety of outlets. Other outputs include management documents, equipment, and programmatic support.

Management Documents

- Draft Village Marine Management Plans (Hawai'i, American Samoa).
- Habitat Equivalency Analysis (HEA) for coral reef impacts (nationally applicable).
- Invasive species management plan (Hawai'i).





- Taape (introduced snapper) feeding study documenting little overlap (potential competition) between taape and native fish species.
- Initial development of invasive early warning system for Oahu and Kauai.

Other outputs

- Purchase of a super-sucker system to aid in alien algae removal in Hawai'i, and removing 120 tons of the alien algae *Gracilaria salicornia* with the help of 2,300 community volunteers.
- Increased capacity and improved coordination in local restoration efforts as a result of the island coral coordinators in American Samoa, Guam, and CNMI.
- Successful restoration and mitigation for the *Cape Flattery* grounding off Oahu, which included one of the first practical uses of habitat equivalency analysis to quantify coral loss for mitigation planning in the Pacific Islands.
- Coordinated initial response for the *Casitas* grounding in the NWHI.
- Initial development of the invasive species early warning system.
- Outputs from grants programs include an extensive taxonomic review all of marine species in Hawai'i and data on raising coral larvae in a controlled laboratory setting at the University of Miami.

e. Outcomes

Examples of key outcomes include:

- Enhanced restoration of coral reef habitats (corals - Cape Flattery, Barbers Point, Oahu, HI; seagrasses and mangroves - Gilligan's Island, Guánica, PR).
- Improved removal and management of invasive species (alien species removals in Oahu and Kauai).
- Dissemination of monitoring results leading to improvements in, and better understanding of, restoration techniques and recovery patterns (FL, PR).
- Results of monitoring and evaluation of reef restoration projects were provided to the broader scientific community in publications and reports and directly to coastal managers, particularly to the Florida Keys National Marine Sanctuary, National Marine Sanctuaries Programs, and PR DNER, enabling improvement in restoration techniques.
- Coral recruitment studies in the Florida Keys demonstrated that sexual recruits to a restoration site are largely dominated by a single weedy species, *Porites astreoides*. Natural recruitment of reef-building species (e.g., *Acropora* spp, *Montastraea* spp.) is currently rare meaning that coral assemblages may never resemble the original population without effective intervention or restoration. (See Program Highlight, p. III-2-6.)
- Experimental results have defined conditions that may limit restoration success. They have shown that stressful conditions during the week-long larval duration affects larval behavior (hence energy demand), settlement choice, and post-settlement survival. Pilot results from experiments also suggest that the exudates from cyanobacterial mats which are more prevalent in some restoration sites inhibit settlement by elkhorn and brain coral larvae.





- Substantial public outreach and awareness impacts have resulted from the coral spawning research activities. Examples include a segment on J.M. Cousteau's PBS television special ("Americas Underwater Treasures"; aired Sept 2006), AP news wire features appearing in multiple high-profile outlets, and newspaper features in the *Los Angeles Times* and multiple local papers.
- Some of the monitoring and evaluation activities have provided motivation and impetus for the implementation of more direct monitoring activities by restoration project managers (e.g. increased monitoring of the *M/V Wellwood* site) and have resulted in improvements in restoration techniques.
- The taxonomic review of Hawai'i species resulted in a series of changes to the numbers of known species in Hawai'i, an important step in developing Hawai'i's invasive species response plan and rapid response capability.
- Local island coordinators in American Samoa, Guam, and CNMI and Puerto Rico led to increased capacity and improved coordination in local restoration efforts as a result of the island coral coordinators.
- In American Samoa the workshops with local agencies and communities promoted environmental stewardship resulting in the drafting of village marine management plans.

f. Challenges

Even with advances in the science of habitat restoration, we are not capable of re-creating a coral reef ecosystem and have limited success at restoring even small sections of reef habitats following damage events. There are limited alternatives when a reef restoration project does not fulfill expectations. Monitoring and evaluation of restoration projects are essential to advance our abilities, as is experimentation. Legal settlements do not allow experimentation and permit only rudimentary monitoring. Programs such as CRCP:

- Lack multi-year, consistent funding for restoration efforts.
- Lack year-round funding to look at seasonal changes in coral growth and health.
- Lack understanding of the temporal aspects of current coral restoration methods (e.g., need for long term commitments to track effectiveness over longer time frames).
- May have narrow focus (e.g., on corals) and not be able to support restoration efforts across the coral reef ecosystems which are key to sustainability of the system.

In the Pacific and the Atlantic, a key challenge in island jurisdictions proved to be the lack of efficient mechanisms at the local government level for managing coral reef funds, spending funds, coordinating with partners and others within the same agency, and completing projects in a timely manner. In the Pacific, the creation of Regional Coral Coordinators should help to address this problem.

Working with broadcasting coral larvae is inherently challenging in that they only spawn two or three nights per year, at night, during hurricane season. Despite these challenges, we have made great strides in the methods to enhance settlement of these important coral species via larval culture





and seeding. Unfortunately, the settlers still suffer extremely low survivorship in the first year or so after settlement, a time when they are very small and thus difficult to characterize in the field. Because these life phases are poorly characterized, it is difficult to know if this poor survivorship is normal or a manifestation of the generally stressful and degraded condition of coral habitats in the Caribbean. Attempts to create coral nurseries based on fragmenting living corals have not proven to be sustainable, although some operations are better than others.

Fundamental challenges remain to stem the tide of coral loss in the Caribbean, and, in areas where restoration is needed, the challenge is to re-establish—in a cost- and ecologically-effective way—reef building coral populations that have been lost.

With respect to the grants programs in this subcategory, key challenges are long-term funding for coastal monitoring and early detection of marine invasive species, sample processing, and database maintenance.

g. Future Directions

- To improve coral reef restoration, we need a better understanding of ecosystem functioning and the proximate causes of degradation in coral reef ecosystems. Recognition of the value of integrated projects linking different components of the same ecosystem, such as seagrasses, shallow and deep reefs, lagoons, patch reefs, mangroves, and shoreline habitats, is needed.
- Support for well-designed, continuous monitoring of restoration projects. Monitoring or evaluation efforts need to be adequately resourced, with effective information-sharing to identify cost-effective practices and eliminate those that are not.
- Improve techniques for restoration through experimentation. Develop and implement creative means and methods to reduce further losses of live coral and habitat structure, particularly in the Caribbean. Explore proactive means to enhance coral populations that have declined or been lost.
- As demonstrated by work in American Samoa, a key future investment should be to promote environmental stewardship at the local or village level. The addition of other villages in American Samoa will foster protection of marine resources through community stewardship. This project may serve as a model to enlist community support for habitat conservation and restoration and community-based actions.
- The key future direction for coral larval research under existing projects is to develop means to increase post-settlement survivorship, such as targeted experiments to determine specific factors that impede (e.g., cyanobacterial mat from the restoration structures, temperature stress), or enhance (e.g., enhancing zooxanthellae inoculation, supplemental feeding in early stages) success of larvae and/or settlers.
- Alien species management efforts need to increase focus on early detection and control of further spread rather than eradication after establishment. Modeling and planning exercises offer some additional tools for improvement.





- The use of habitat equivalency analysis (HEA) needs to be further developed as a method of documenting coral reef ecological functions and values for the development of appropriate mitigation for coral loss due to ship grounding or other causes.

Subcategory: Reduce Impacts of Recreational Overuse

a. Introduction to Subcategory

Many projects within this subcategory were State and Territorial Local Action Strategies (LAS) projects in the Atlantic and Pacific, as well as part of internal coral reef projects to address coral reef ecosystem conservation priorities. Projects addressed LAS priorities in USVI, Puerto Rico, CNMI, Guam, Hawai'i, and Florida. Many of these projects also support management and marine protected areas (MPAs) through tour guide and diver training, implementation of park ranger programs, and installation of signage and designation of anchorage areas in MPAs.

Between 2002 and 2006, the CRCP provided \$1.5M to support 33 projects in this subcategory. This subcategory accounted for 16% of funding within the Reduce Impacts of Coastal Uses category and 1% of overall CRCP funding, 12% of projects in the category, and 3% of overall CRCP projects. Exhibits III-2-8a and -8b show the distribution of CRCP investments in the tools that support activities in this subcategory.





**Exhibit III-2-8a
Reduce Impacts of Recreational Overuse
Investments by Tool**

Tool	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002		2003		2004		2005		2006		TOTALS 2002-2006			
Ecosystem Research	0	\$0	0	\$0	1	\$43,632	0	\$0	0	\$0	1	3.0	\$43,632	2.9
Socioeconomic Research	0	\$0	0	\$0	0	\$0	1	\$30,000	2	\$114,448	3	9.1	\$144,448	9.6
Mapping and Monitoring	0	\$0	1	\$20,500	2	\$60,000	2	\$56,200	0	\$0	5	15.2	\$136,700	9.1
Outreach	0	\$0	0	\$0	3	\$42,500	1	\$15,000	3	\$132,052	7	21.2	\$189,552	12.6
Management: Direct Implementation	3	\$489,500	1	\$40,000	6	\$285,000	3	\$50,750	2	\$54,862	15	45.5	\$920,112	61.0
Management: Training/Technical Assistance	0	\$0	1	\$34,344	1	\$40,000	0	\$0	0	\$0	2	6.1	\$74,344	4.9
None or N/A	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
TOTAL	3	\$489,500	3	\$94,844	13	\$471,132	7	\$151,950	7	\$301,362	33	100	\$1,508,788	100

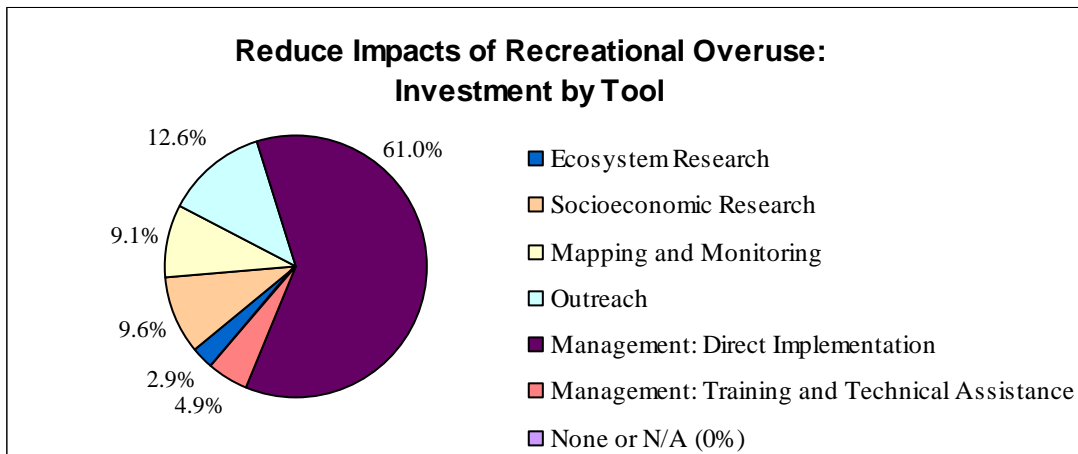


Exhibit III-2-8b. Distribution of Investments by Tool, 2002-2006





Exhibits III-2-9a and -9b show the distribution of CRCP investments by region for this subcategory.

Exhibit III-2-9a Reduce Impacts of Recreational Overuse Investments by Region														
Region	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002		2003		2004		2005		2006		TOTALS 2002-2006			
Atlantic/Caribbean	3	\$489,500	1	\$40,000	6	\$171,132	2	\$46,200	2	\$77,052	14	42.4	\$823,884	54.6
Pacific	0	\$0	1	\$20,500	6	\$285,000	5	\$105,750	5	\$224,310	17	51.5	\$635,560	42.1
Freely Associated States	0	\$0	1	\$34,344	0	\$0	0	\$0	0	\$0	1	3.0	\$34,344	2.3
International	0	\$0	0	\$0	1	\$15,000	0	\$0	0	\$0	1	3.0	\$15,000	1.0
All Regions	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
TOTAL	3	\$489,500	3	\$94,844	13	\$471,132	7	\$151,950	7	\$301,362	33	100	\$1,508,788	100

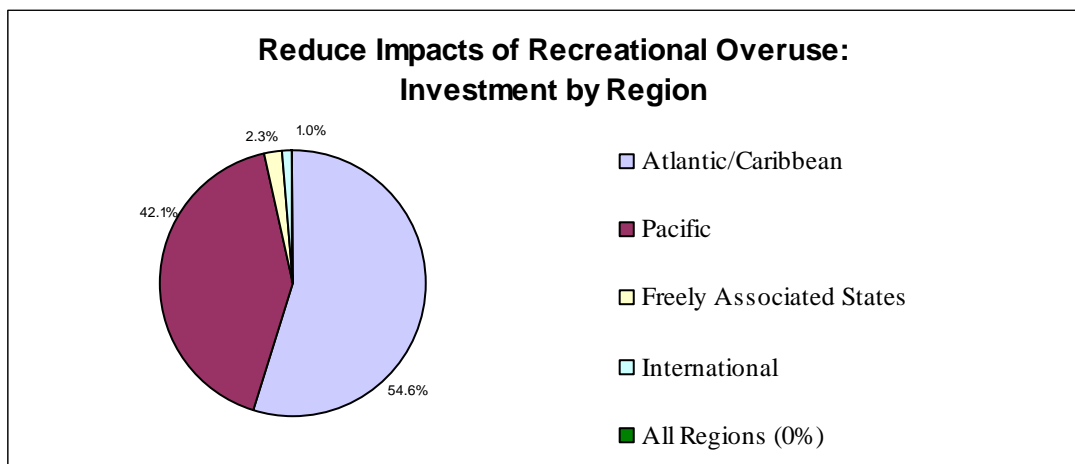


Exhibit III-2-9b. Distribution of Investments by Region, 2002-2006





b. Activities

This subcategory includes several projects related to the impacts of recreational boating on the greater coral reef ecosystem, including surveys of boating impacts and the installation of mooring buoys, boundary markers, and educational signage in MPAs in the U.S. Caribbean and CNMI. Other projects include training and other educational projects for tour guides, dive operators, local and foreign tourists, and Park Rangers in the U.S. Atlantic and U.S. Pacific, as well as international sites. Several of the projects support Local Action Strategy priorities.

Specific examples include:

- Supporting a Reef Check effort to develop and implement a standardized, voluntary certification program for dive resorts and shops in Central America.
- Implementing a multi-year campaign to educate the general public that the beaches of Puerto Rico are more than just sand.
- Developing a voluntary code of conduct for dive operators and CORAL (The Coral Reef Alliance) reef leadership network in Hawai'i.

c. Funding Recipients and Partners

To carry out the projects in this subcategory, the CRCP partnered with the NOAA offices and external partners listed in Exhibit III-2-10.

Exhibit III-2-10 Recreational Overuse Funding Recipients and Partners			
NOAA Offices	States and Territories	Academic Institutions	Non-Governmental Organizations
<ul style="list-style-type: none"> • NMFS - Pacific Islands Regional Office • NMFS - Southeast Regional Office • NOS - National Centers for Coastal Ocean Science • NOS - Office of Response and Restoration 	<ul style="list-style-type: none"> • American Samoa • CNMI • Florida • Guam • Hawai'i • Puerto Rico • U.S. Virgin Islands 	<ul style="list-style-type: none"> • North Carolina State University 	<ul style="list-style-type: none"> • Coral Reef Alliance (CORAL) • Kohala Center for Pacific Environments • Palau Conservation Society





d. Outputs

- A comprehensive survey of the benthic habitat and human use and the installation of mooring buoys based on the results of this survey within the Canal Luis Pena Natural Reserve.
- The installation of boundary markers and educational signage for the East End Marine Park, St. Croix.
- Assessment and mapping of mechanical damage due to boating within La Cordillera Reefs Natural Reserve in Puerto Rico to design management strategies for minimizing boating impacts to seagrass beds.
- Boater education/outreach via pamphlets and a 30-second Public Service Announcement about the La Cordillera Reserve and seagrass beds.
- Tour guide training in Palau.
- Completion of workshops to train displaced fishers to become dive masters in 4 Central American countries.
- Dive operator training seminars in Florida.
- Creation of an educational pamphlet in Spanish and English regarding fishing regulations and MPAs for USVI locals and tourists.
- Creation of educational materials in Puerto Rico including bilingual tourist pamphlets regarding the importance of coral reefs, seagrass beds, and mangrove forests; a 60-second Public Service Announcement that aired in movie theaters and television stations, and educational signage in public beach facilities.

e. Outcomes

Outcomes and impacts of CRCP-funded projects aimed at reducing recreational overuse include changes in the attitudes of recreational boaters regarding mooring buoys and the importance of marine habitats, and changes in diver practices. Key outcomes include:

- Seagrass bed survey results in Puerto Rico's La Cordillera Reefs Natural Reserve are being used by the Department of Natural and Environmental Resources to develop additional management measures to minimize further impacts to seagrass beds, enable seagrass to recover, and educate recreational users regarding appropriate boating practices.
- Bilingual information sheets for tourists regarding the importance of coral reefs, seagrass beds, and mangroves, created in partnership with the Puerto Rico Tourism Company, resulted in a shift in the focus of the Tourism Company toward conservation of marine resources and promotion of sustainable tourism practices.
- Increased awareness among dive instructors in Guam about the damage inexperienced divers can cause on healthy reefs led to use of more appropriate dive sites for diver instruction.
- Beach ecosystem outreach projects led to changes in management strategies of the Puerto Rico National Parks Company. Employees are now instructed regarding marine resource regulations, visitor orientation for protection of marine resources within beach facilities is in place, and education and outreach programs aimed at conservation of marine resources have been created.





f. Challenges

- Contract execution and development during planning and implementation phases of projects proved to be a challenge in the Atlantic and Pacific.
- Other key challenges common to both the Atlantic and the Pacific that affected NOAA and partner projects were securing funding for multi-year projects and ensuring that strides made toward marine conservation continue after the projects are complete. Some projects were also found to be controversial or proved not to be feasible to complete as proposed so the scope had to be altered by NOAA leads.
- In both the Pacific and the Atlantic, one key challenge in island countries proved to be the lack of efficient mechanisms at the local government level for managing coral reef funds, spending the funds, and coordinating with partners and within their own agency.
- In the Pacific and Atlantic, it was often difficult to get user groups involved in projects in order to ensure their success. This affected both NOAA and partner projects.
- In Hawai'i, a carrying capacity project proved to be difficult to complete because of the amount of resources needed and the controversial nature of the type of project.

g. Future Directions

- In the U.S. Caribbean and the Pacific, efforts should include working at the community level as well as the local agency level to try to effect changes in resource use through environmental stewardship.
- In the Southeast, NOAA should continue to strengthen communication efforts between offices and agencies, such as through the development of cross-NOAA initiatives in the Caribbean, establishing regional coral coordinator positions similar to those in place in the U.S. Pacific.
- Education and outreach efforts aimed at specific user groups, including politicians, boaters, divers, fishers, and others, are important to increase knowledge concerning impacts of recreational use and coastal development to the marine ecosystem and resultant impacts on human health and quality of life.
- More information is needed regarding methods to determine specific number of people that a recreational area can sustain, regulations that establish carrying capacities, and implementing management tools for determining whether strategies related to recreational use of coral reef areas are appropriate and effective.

Subcategory: Reduce Impacts of Coastal Development

a. Introduction to Subcategory

The majority of the projects in this subcategory were supported by NOAA through grants, particularly to state and local resource agencies, as the authority for regulating coastal development





lies predominantly within local jurisdictions rather than at the Federal level. Except for a small project in American Samoa, projects took place in the Atlantic, in particular South Florida and the U.S. Caribbean. The Reduce Impacts of Coastal Development subcategory includes projects to support LAS and state and territory coral reef ecosystem conservation priorities. Projects include training personnel to evaluate impacts from proposed coastal development projects and developing tools to aid in that process.

Between 2002 and 2006, the CRCP provided \$430K to support 17 projects in this subcategory. This subcategory accounted for 5% of funding within the Reduce Impacts of Coastal Uses category and less than 1% of overall CRCP funding; and 6% of projects in the category and 1% of overall CRCP projects. Exhibits III-2-11a and -11b show the distribution of CRCP investments in the tools that support activities in this subcategory.

Exhibit III-2-11a Reduce Impacts of Coastal Development Investments by Tool														
Tool	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002	2003	2004	2005	2006	TOTALS 2002-2006								
Ecosystem Research	0	\$0	0	\$0	0	\$0	0	\$0	1	\$19,477	1	5.9	\$19,477	4.5
Socioeconomic Research	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0.0
Mapping and Monitoring	1	\$63,000	0	\$0	0	\$0	0	\$0	1	\$55,000	2	11.8	\$118,000	27.4
Outreach	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Management: Direct Implementation	1	\$9,000	0	\$0	2	\$32,500	5	\$82,500	2	\$100,000	10	58.8	\$224,000	52.0
Management: Training/ Technical Assistance	1	\$12,500	1	\$30,500	1	\$16,500	1	\$9,500	0	\$0	4	23.5	\$69,000	16.0
None or N/A	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
TOTAL	3	\$84,500	1	\$30,500	3	\$49,000	6	\$92,000	4	\$174,477	17	100	\$430,477	100



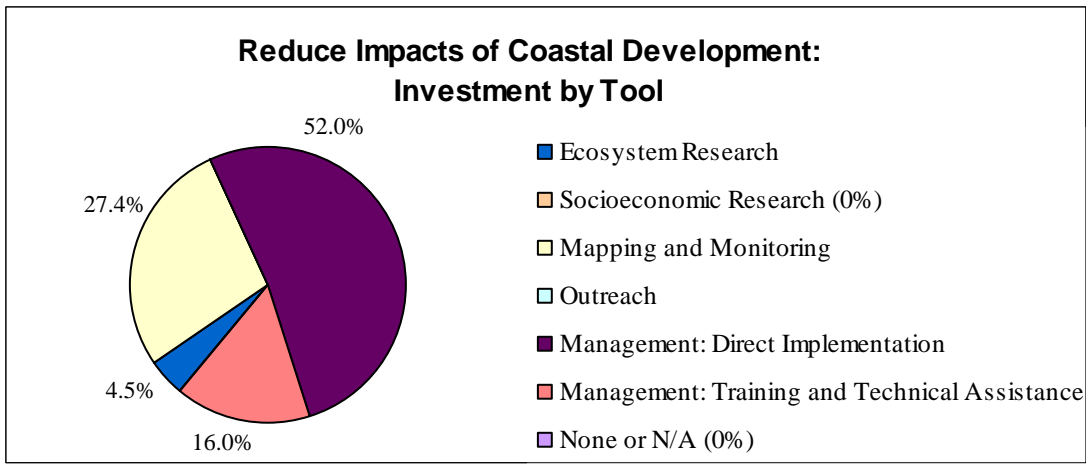


Exhibit III-2-11b. Distribution of Investments by Tool, 2002-2006

The regional funding breakdown for the Reduce Impacts of Recreational Overuse subcategory was as follows: 98% for Atlantic/Caribbean activities, and 2% for Pacific (Exhibits III-2-12a and -12b).

Exhibit III-2-12a Reduce Impacts of Coastal Development Investments by Region																
Region	Number of Projects		Funding		Number of Projects		Funding		Number of Projects		Funding		Number of Projects		Funding	
	2002		2003		2004		2005		2006		TOTALS 2002-2006		TOTALS 2002-2006		TOTALS 2002-2006	
	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding		
Atlantic/Caribbean	2	\$75,500	1	\$30,500	3	\$49,000	6	\$92,000	4	\$174,477	16	94.1	\$421,477	97.9		
Pacific	1	\$9,000	0	\$0	0	\$0	0	\$0	0	\$0	1	5.9	\$9,000	2.1		
Freely Associated States	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0		
International	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0		
All Regions	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0		
TOTAL	3	\$84,500	1	\$30,500	3	\$49,000	6	\$92,000	4	\$174,477	17	100	\$430,477	100		



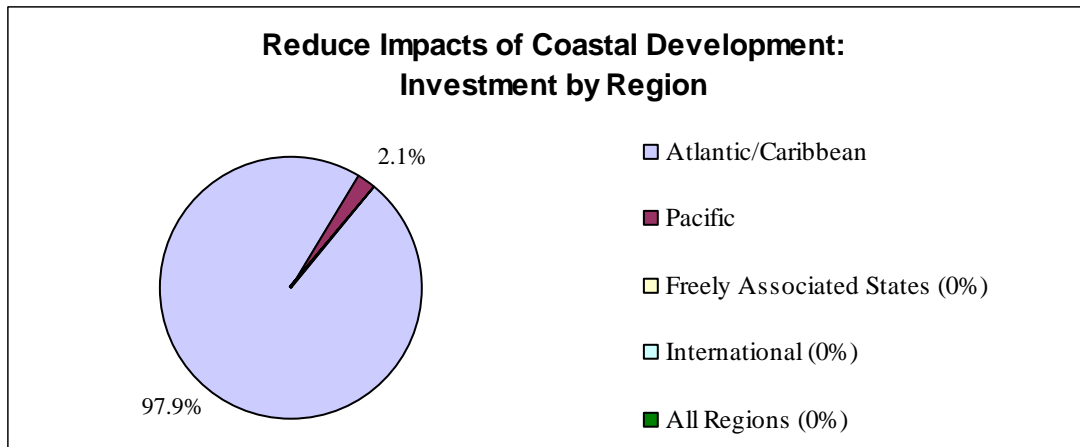


Exhibit III-2-12b. Distribution of Investments by Region, 2002-2006

b. Activities

Key activities include:

- Training personnel in Puerto Rico responsible for evaluating coastal water resources development projects.
- Evaluation of local and federal regulations to determine their effectiveness and level of compliance and effort.
- Identification of innovative technologies, construction practices and procedures to minimize coral reef impacts.
- Identification of criteria/methods for coral reef mitigation associated with reef impacts
- Development of best management practices.
- Streamlining and rulemaking to fill gaps for coastal zone development in Florida.
- Formation of a coral reefs and watersheds strategy in Puerto Rico for better management of coastal development.
- Development of a Programmatic Environmental Impact Statement (PEIS) for proposed Federal coastal construction activities in Southeast Florida which are expected to have significant environmental impacts, specifically those related to beach renourishment projects.

c. Funding Recipients and Partners

All but one of the CRCP supported projects were grant funded, via management grants, to the state of Florida and Commonwealth of Puerto Rico. American Samoa also received grant support, and NOAA’s SERO office led an internal project (Exhibit III-2-13).





Exhibit III-2-13 Coastal Development Funding Recipients and Partners	
NOAA Offices	States and Territories
<ul style="list-style-type: none"> • NMFS - Southeast Regional Office 	<ul style="list-style-type: none"> • American Samoa • Florida • Puerto Rico

d. Outputs

The key outputs and accomplishments from this subcategory focused on building capacity of state and territorial partners in this area. Activities focused primarily on training of personnel to evaluate impacts from proposed coastal water resource use development projects and development of tools to aid in that process. Examples include:

- Land use change analysis in Puerto Rico.
- Personnel in Puerto Rico responsible for the evaluation of water resources development projects in the coastal zone were trained in the use of GIS and other tools for determining potential impacts to reef watersheds and reef resources.
- Compilation of information on state and Federal regulations governing coastal zone development in Florida in order to evaluate their effectiveness and identify gaps.
- Compilation of information on innovative technologies and construction practices to minimize coastal development impacts to the marine environment and ensure adequate mitigation for unavoidable adverse impacts.
- Development of best management practices for construction, dredging, filling and other development activities around reefs, as well as for artificial reef siting, construction, and anchoring in southeast Florida.
- Flight surveys and GIS analysis to determine changes in seagrass cover and a literature review of studies and reports, including gray literature, related to coastal construction impacts and best management practices in coastal habitats in Florida.
- Preparation of “Methodology for Preparing Cumulative Impact Sections of Project Reviews and Assessments in Miami-Dade, Broward, Palm Beach and Martin Counties, Florida”.

e. Outcomes

Key outcomes and impacts of projects in this subcategory include:

- New methods of evaluating potential impacts of coastal water resources development projects by local resource agencies in Florida and Puerto Rico.





- New methods to analyze cumulative impacts to coastal and marine resources in Florida by local resource agencies to more effectively evaluate impacts on coral reefs and other coastal resources.
- Increased interest in tracking impacts of coastal development projects to marine resources to minimize and mitigate for future impacts in Florida and the U.S. Caribbean.
- Changes in land use planning in American Samoa that may reduce impacts on coral reef habitats.

f. Challenges

- Some projects proved to be controversial and hard to complete due to the extent of resources needed and difficulties in ensuring stakeholder involvement. The project scope and/or approach often had to be altered to address these challenges. For example, in Florida, agreeing on a template for preparation of project reviews and assessments by agencies was a challenge. In response, the project team leaders began recruiting additional members to the Maritime Industry and Coastal Construction Impacts LAS team who had experience in the areas that the team felt were lacking.
- In the Pacific, few projects were aimed at reducing impacts of coastal development, which may be due to a difference in development trends than those in the Atlantic.
- In Florida, public involvement in the decision-making process proved to be a significant challenge, as was buy-in on the part of regulatory agencies to adopt BMPs and ensure they are incorporated in permit requirements.
- In Florida, work involving overflights to photograph benthic habitats in Palm Beach County was delayed due to hurricanes.

g. Future Directions

- Successful implementation of Local Action Strategy projects to improve the effectiveness of coral reef protection in southeast Florida.
- Continued efforts to incorporate BMPs into permit requirements to reduce impacts to reefs from coastal construction and development activities.
- More productive inter-/intra-agency involvement and compromise throughout planning, implementation and outcome of projects.
- The cumulative loss of nearshore reef communities and effects on federal managed fisheries in southeast Florida is relatively unknown. Studies are needed to assess impacts to reef communities from proposed and retrofitted sewage outfalls, and to assess impacts of beach renourishment related to dredge and fill operations and the effectiveness of mitigations.
- In Florida, a comprehensive reef ecosystem management plan is needed for reef communities located north of the Florida Keys National Marine Sanctuary.
- In the U.S. Caribbean, detailed studies are needed to determine the effects of land based sources of pollution (including point and non-point sources) and recreational use on the coral reef ecosystem in order to develop effective management practices, assess the effectiveness





of existing regulations, and develop or strengthen regulations to ensure the protection of the coral reef ecosystem.

Subcategory: Reduce Impacts of Maritime Activities

a. Introduction to Subcategory

Ship groundings, anchor damage, abandoned vessels, and other destructive maritime activities can cause highly visible mechanical injury to coral communities; therefore, maritime impacts are a significant concern in all coral jurisdictions. On a global scale, maritime impacts are probably a second tier reason for coral declines; nevertheless, the acute and obvious destruction from vessel impacts is significant and has been important in the development of the political consensus to protect corals. The assessment, restoration, and legal tools initially developed for repair of corals following ship groundings has created a scientific foundation for broader coral reef restoration efforts.

Unlike other types of natural and anthropogenic impacts to corals such as overfishing, sedimentation, diseases, and excess nutrients, vessel impacts may be one of the most tangible opportunities to protect and restore corals, and much effort has been done in this regard. From a protection perspective, many maritime impacts are preventable. Unlike threats such as climate change or overfishing, maritime impacts are often isolated events that are the result of accidents or lack of knowledge. The mariner typically does not want to run aground or anchor in a sensitive area; however, storms, mechanical failures, chart deficiencies and/or human errors can all lead to groundings. Prevention and education tools about avoiding groundings can therefore reach a very receptive audience.

From the restoration perspective, there is good reason to be optimistic about addressing maritime incidents. First of all, groundings may occur on otherwise healthy reefs. Once the vessel and rubble is removed, recovery is possible, and the adjacent undamaged reefs can provide a source of ready recruits. Maritime impacts, while locally severe, are generally quite limited spatially, unlike other impacts to coral such as diseases or pollution that may result in chronic but geographically very widespread impacts. Furthermore, unlike other stressors to reefs, vessel grounding events typically have a clear and direct link to a financially viable responsible party: the ship owner. Because of these factors, restoration for such incidents is both economically and environmentally feasible.

Between 2002 and 2006, the CRCP provided \$750K to support 22 projects in this subcategory. This subcategory accounted for 8% of funding within the Reduce Impacts of Coastal Uses category and less than 1% of overall CRCP funding; and 8% of projects in the category and 2% of overall CRCP projects. Exhibits III-2-14a and -14b show the distribution of CRCP investments in the tools that support activities in this subcategory.





Exhibit III-2-14a Reduce Impacts of Maritime Activities Investments by Tool														
Tool	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002	2003	2004	2005	2006	TOTALS 2002-2006								
Ecosystem Research	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Socioeconomic Research	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
Mapping and Monitoring	1	\$32,000	1	\$30,000	1	\$30,000	3	\$145,000	3	\$98,201	9	40.9	\$335,201	44.7
Outreach	1	\$24,000	0	\$0	1	\$15,000	2	\$35,000	0	\$0	4	18.2	\$74,000	9.9
Management: Direct Implementation	4	\$152,000	0	\$0	3	\$90,000	0	\$0	2	\$98,965	9	40.9	\$340,965	45.5
Management: Training/Technical Assistance	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
None or N/A	0	\$0	0	\$0	0	\$0	0	\$0	0	\$0	0	0	\$0	0
TOTAL	6	\$208,000	1	\$30,000	5	\$135,000	5	\$180,000	5	\$197,166	22	100	\$750,166	100



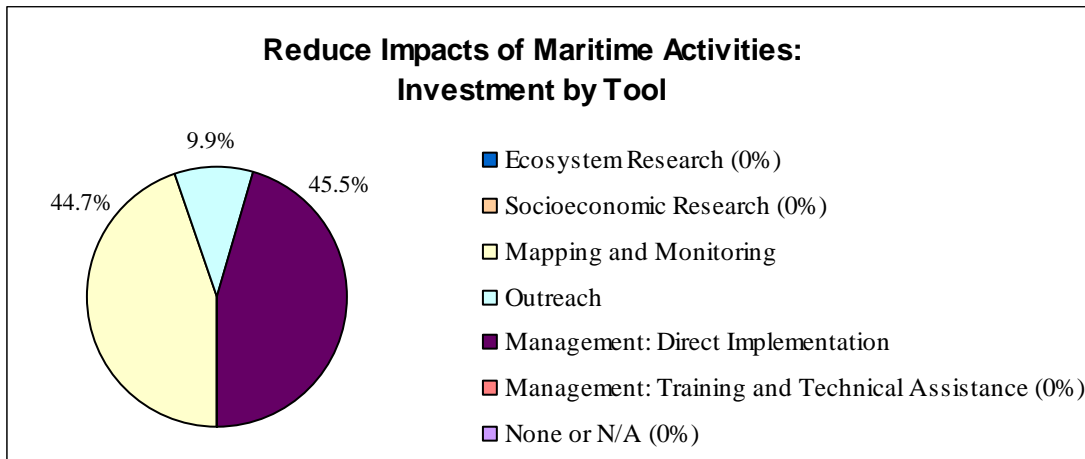


Exhibit III-2-14b. Distribution of Investments by Tool, 2002-2006

The regional funding breakdown for the Reduce Impacts of Maritime Activities budget is shown in Exhibits III-2-15a and -15b.

Exhibit III-2-15a Reduce Impacts of Maritime Activities Investments by Region														
Region	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	Funding	Number of Projects	% of Total Subcategory Projects	Funding	% of Total Subcategory Funding
	2002	2003	2004	2005	2006	TOTALS 2002-2006								
Atlantic/Caribbean	3	\$69,140	1	\$8,100	3	\$69,900	4	\$122,100	4	\$123,935	15	40.5	\$393,175	52.4
Pacific	5	\$130,860	1	\$13,800	1	\$12,600	3	\$41,400	3	\$65,834	13	35.1	\$264,494	35.3
Freely Associated States	1	\$8,000	1	\$8,100	1	\$7,500	1	\$5,000	1	\$7,397	5	13.5	\$35,997	4.8
International	0	\$0	0	\$0	1	\$30,000	2	\$11,500	0	\$0	3	8.1	\$41,500	5.53
All Regions	0	\$0	0	\$0	1	\$15,000	0	\$0	0	\$0	1	2.7	\$15,000	2.0
TOTAL	9	\$208,000	3	\$30,000	7	\$135,000	10	\$180,000	8	\$197,166	37	100	\$750,166	100



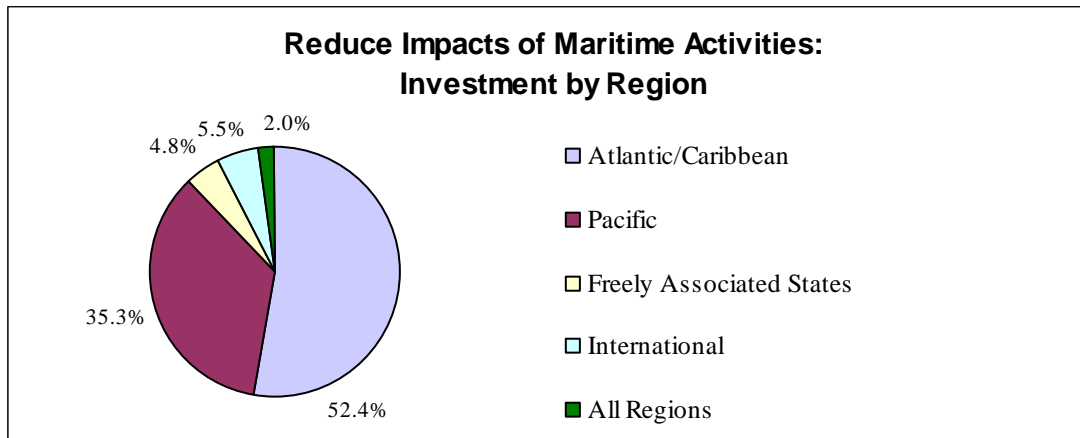


Exhibit III-2-15b. Distribution of Investments by Region, 2002-2006

b. Activities

In the category of Reducing Impacts of Maritime Activities, the NOAA Coral Reef Conservation Program funded projects which addressed the following five general subject areas:

- Issues associated with abandoned and derelict vessels.
- Improvements to electronic charting.
- Anchorage Management and Mooring Buoy Projects.
- Vessel grounding assessment and restoration protocols.
- Outreach materials and efforts to reduce groundings.

Most projects were modest in scope and duration, with all but two projects being single year efforts. The average cost of projects was \$32K. Of the two multi-year projects, abandoned vessel issues accounted for nine projects and totaled \$252K, and charting improvements accounted for two projects totaling \$100K. The projects were relatively evenly spread among the regions, with seven in the Pacific, nine in the Atlantic/Caribbean, and eight affecting both regions. Specific regional projects involved Guam, CNMI, USVI, Hawai’i, NWHI, American Samoa, and Puerto Rico.

This subcategory includes also projects and activities funded through grants to reduce impacts of maritime activities in coral reef areas. The grants in this subcategory use the following tools: direct management implementation, education and outreach, mapping, and monitoring. Projects which support direct management implementation include installation of mooring buoys, source identification for marine debris, coral reef mitigation projects, and boat anchor management. Mapping and monitoring projects include gathering information on fouling of recreational boats and mechanical damage to seagrass beds. One outreach project focused on preventing vessel groundings.





These projects took place in the CNMI, Hawai'i, USVI, Florida, and Puerto Rico. The types of activities supporting the reduction of maritime impacts subcategory include installing demarcation buoys in the Virgin Islands National Park and on the Big Island of Hawai'i, identifying debris source fisheries responsible for derelict fishing gear in the Northwestern Hawaiian Islands, developing regional operating procedures for reef mitigation in Florida, and preventing boat anchor damage in the Florida Keys.

c. Funding Recipients and Partners

Approximately 1/3 of the projects were grants and 2/3 were NOAA projects. To carry out the projects in this subcategory, the CRCP partnered with the NOAA offices and external partners listed in Exhibit III-2-16.

Exhibit III-2-16 Maritime Activities Funding Recipients and Partners			
NOAA Offices	States and Territories	Academic Institutions	Non-Governmental Organizations
<ul style="list-style-type: none"> • NOS - National Marine Sanctuaries Office • NOS - Office of Coast Survey • NOS - Office of Response and Restoration 	<ul style="list-style-type: none"> • Florida • Hawai'i • Puerto Rico 	<ul style="list-style-type: none"> • University of Hawai'i 	<ul style="list-style-type: none"> • Friends of Virgin Islands National Park • Malama Kai Foundation

d. Outputs

The key outputs of the projects included:

- A database of abandoned and derelict vessels affecting coral reefs, including field surveys of key coral reef jurisdictions.
- A website and resource guide.
- Protocols, technical assistance, and training for coral jurisdictions on the legal, technical, and regulatory issues regarding vessel salvage and wreck removal.
- Technical assistance leading to the removal of several vessels.
- Incorporation of corals and other sensitive habitats in electronic charts, including a website and a demonstration project for mariners that allow environmental data and other information to be displayed in digital layers overlaying traditional navigation information.





- Anchorage Management and Mooring Buoy Projects in Florida, Hawai'i, and the Virgin Islands.
- Vessel grounding assessment, enforcement, and restoration protocols, including standard operating procedures for rapid response and training for salvage of impacted corals.
- Standardized enforcement protocols, criteria for coral reef mitigation associated with reef impacts, and outreach materials and efforts to prevent and reduce groundings.

Major outputs from the grants programs in Hawai'i include publication of the Big Island Day-Use Mooring Guidebook, development of a statewide database for mooring inspection and maintenance, maintenance of eighty moorings, updated GPS coordinates for moorings, and two new community-based programs for local conservation efforts.

e. Outcomes

The primary outcomes of this category included better understanding of the scope and extent of maritime impacts, and increased capacity of managers to help prevent and restore such impacts. Because of the funding emphasis on the Abandoned Vessel Project, that category has a number of outcomes, and the entire set of projects links to improved management actions at local and national levels.

On the local level, the projects and products assisted certain jurisdictions such as Palau, Samoa, and CNMI¹ to aggressively address the problem of abandoned and grounded vessels, including development of draft legislation, and CNMI in particular has taken direct action to remove problem vessels.

On a national level, the projects have generated useful guidance; several have resulted in publications and other forms of public recognition. The assessment and enforcement protocols have been broadly disseminated and the abandoned vessel project has been the subject of several news stories, including recent coverage on National Public Radio and in the *Los Angeles Times*. Lessons learned from the project were used in addressing the thousands of stranded and sunken vessels from hurricanes Katrina and Rita.

Some of the projects have had international outcomes. Electronic navigational charting projects have garnered broader interest from the maritime community; other countries, including Australia, Canada, Belize, Cuba, and Mexico have expressed interest in the project.

Perhaps the broadest influence of the various projects is in the draft Administration version of the Coral Reef Conservation Act Amendments Act of 2007. Many of the issues addressed in this funding category are mentioned in the Act, including broader authorities to address “destruction or loss of, or injury to, coral reefs”, promotion of “ecologically sound navigation and anchorages.” Significantly, the Act includes specific language addressing abandoned vessels.

¹ Florida and Hawai'i already had some local capacity in this regard.





f. Challenges

A variety of programmatic, administrative, technical, legal and legislative challenges limit our ability to be effective in reducing maritime impacts to corals. Some of these challenges are not unique to this category.

Overall, the Maritime Impacts subcategory could use a more cohesive long-term vision. The projects are all useful and interesting, but it is not clear how these projects fit into an overall strategy for reducing maritime impacts. Certain types of impacts are well-represented, but others are absent. Individual projects are selected based on their merits, but it would be useful to have a broader blueprint for the category, and then actively solicit or rank specific proposals based on how they fill identified gaps.

Overall, the category could have been strengthened by greater participation by other entities within NOAA (only NOS had funded projects), and other critical Federal, state, and territorial partners. For example, NOAA Sea Grant, the U.S. Coast Guard (USCG), and the U.S. Navy were not directly involved with projects, despite their obvious link to prevention of maritime impacts. Only two states and one territory directly received funds.

The work related to abandoned vessels and vessel groundings is particularly complex and poses many challenges. The high cost of wreck removal has precluded significant direct action on problem vessels, but the program did assist with several vessel removals. Several large vessels were identified as high concern for removal, but funds and legal issues could not be resolved. One such vessel, the 93-foot derelict fishing vessel M/V Mwaalil Saat in Tanapag Harbor, Saipan, was afloat when surveyed in 2002, and could have been removed at an estimated cost of \$50-\$100K. The vessel later sank during Typhoon Tingting in 2004. The wreck was later cut apart and removed at a cost of over \$3M.

One of the needs identified by the Abandoned Vessel Project was legal support to coral jurisdictions on specific derelict vessel problems. NOAA General Counsel and the U.S. Department of Justice did provide broad legal review of authorities, but there was a difficulty in providing legal support to island jurisdictions. The legal issues associated with Admiralty Law can be complex, and successful removal actions may take years to resolve (the removals in Pago Pago, American Samoa, took seven years). Many island jurisdictions lack the specialized legal support and the staff to follow through on these multi-year projects.

g. Future Directions

The Coral Program has taken big steps in this area, and the pending Coral Reef Conservation Act Amendments Act of 2007 should give NOAA greater authority to address maritime impacts. The Coral Program will develop a multi-year blueprint for future activities and seek broader involvement of other agencies (e.g., USCG), and from programs in Australia and elsewhere relating to prevention





and reduction of maritime impacts. A focused vision and common set of issues areas needs to be developed in cooperation with other NOAA, USCG, states, and territories on the topic of maritime impacts.

Attached is a list of potential project themes that relate to maritime impacts. Based on leadership and input from CRCP, the U.S. Coral Reef Task Force has made progress on some of these topic areas, and established an interagency working group (led by NOAA) to consider these issues and others in development of a long-term vision, priority action list and potential partners to address this category.

Impacts of Maritime Activities: Potential Activities

- Abandoned and Derelict Vessels
- Aids to Navigation
- Anchorages and Mooring Systems
- Ballast Waters
- Charting and Areas To Be Avoided
- Disposal of Waste Materials and Marine Debris from Vessels
- Enforcement Strategies to Minimize Impacts of Maritime Activities
- Impacts of Dock and Bulkhead Construction to Support Boating Activities
- Impacts of Dredging and Channels to Support Boating Activities
- Impacts of Wreck Removal and Salvage
- Invasive Species
- Legal Support and Tools
- Legislative Authorities to Address Maritime Impacts
- Outreach and Prevention Actions
- Physical Damage to Marine Habitats by Ships' Hulls (Vessel Groundings)
- Prop Scarring and Laceration of Aquatic Vegetation

Future directions within the NFWF grant program include providing additional funding for maintenance of Anchors Away! (mooring buoy) projects to help reduce impacts of anchors and small vessels on reefs.





Appendix III-2 Publications and Media Coverage Resulting from CRCP Funding

PUBLICATIONS

- Anlauf Toller, U. 2007. Literature Review, Summary of Coral Spawning Information, and Collection of Development Project Location Data Points in the U.S. Virgin Islands. Final Report for Contract GA133F06SE3627, L. Carrubba (ed.), NOAA Fisheries Southeast Region Caribbean Field Office. 134pp.
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- Figueroa, E. 2006. Ecosistemas Marinos: Sus Características, Importancia y Medidas de Conservación, Un CD Educativo para los Jovenes y Maestros de las Islas [Marine Ecosystems: Characteristics, Importance and Conservation Measures, An Educational CD for Students and Teachers in the Islands]. NOAA Fisheries Southeast Region Caribbean Field Office.
- Hernández-Delgado, E.A. 2003. Suplemento Técnico al Plan de Manejo para la Reserva Natural del Canal Luís Peña, Culebra, Puerto Rico. I. Caracterización de Habitáculos [Technical Supplement to the Management Plan for Canal Luís Peña Natural Reserve, Culebra, Puerto Rico. I. Habitat Characterization]. Report for Puerto Rico Department of Natural and Environmental Resources and NOAA Fisheries Southeast Region Habitat Conservation Division Caribbean Field Office. 109pp.
- Hernández-Delgado, E.A., and B.J. Rosado-Matías. 2003. Suplemento Técnico al Plan de Manejo para la Reserva Natural del Canal Luís Peña, Culebra, Puerto Rico. II. Inventario Biológico [Technical Supplement to the Management Plan for Canal Luís Peña Natural Reserve, Culebra, Puerto Rico. II. Biological Inventory]. Report for Puerto Rico Department of Natural and Environmental Resources and NOAA Fisheries Southeast Region Habitat Conservation Division Caribbean Field Office. 60pp.
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- III. Usos Históricos, Actuales y Valor Arqueológico del Canal Luís Peña [Technical Supplement to the Management Plan for Canal Luís Peña Natural Reserve, Culebra, Puerto Rico. III. Historic and Actual Uses and Archaeological Value of Canal Luís Peña]. Report for Puerto Rico Department of Natural and Environmental Resources and NOAA Fisheries Southeast Region Habitat Conservation Division Caribbean Field Office. 45pp.
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POPULAR/OUTREACH OUTLETS

AP wire feature (16 Aug. 2006) appeared on myriad web, TV, newspaper, and radio outlets such as:

- <http://www.forbes.com/technology/feeds/ap/2006/08/16/ap2954482.html>
- <http://abcnews.go.com/Technology/wireStory?id=2320859>
- Feature in Los Angeles Times, 5 Oct. 2006
- Front page feature Key West Citizen, 7 Aug. 2006
- Airing of segment on PBS TV special, America's Underwater Treasures by Jean Michele Cousteau's Ocean Future Society (20-27 Sept. 2006).

