

Navy Commemorates International

Year of the Reef 2008

Efforts Seek to Conserve Critical Coral Reef Ecosystems

Coral reefs are one of the world's natural wonders. They cover less than one percent of the earth's surface, yet support millions of plant and animal species. They provide food, medicines, storm protection and recreational opportunities. Their monetary value to humans is estimated to be billions of dollars. While reefs are largely out of sight, and therefore, out of mind, for many people who live away from coastal areas, human activity in all areas of the world is imperiling the survival of reef ecosystems.

The International Year of the Reef (IYOR) 2008 is a worldwide effort to publicize the value of reefs; help people learn about threats to reefs; and motivate individuals, governments and organizations to take actions to protect reefs around the world. The U.S. Coral Reef Task Force (CRTF) is a leading U.S. proponent of the IYOR 2008, and

the Department of the Navy is the Executive Agent for the Department of Defense to the CRTF.

Reefs: More than Corals

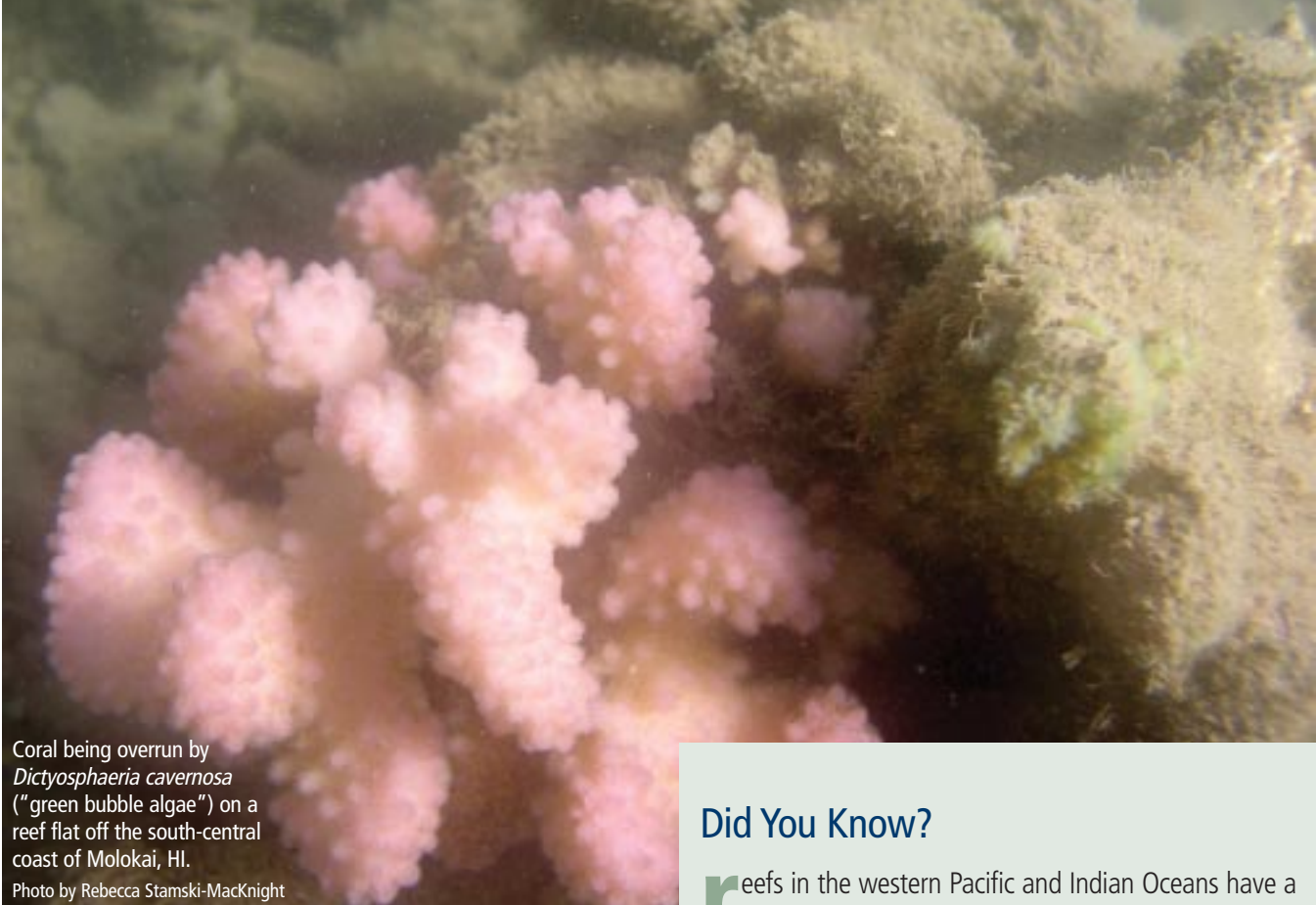
Coral polyps are the tiny colonial animal that forms the calcareous structures we commonly call reefs. Coral reefs are actually ecosystems comprised of a myriad of different plants and animals. In most reef communities there are over 1,000 different species (not just coral) that make up the community. Over time the hard corals are joined by algae, sponges, sea grasses, soft corals, mollusks, sea cucumbers, crabs, and fish of many sizes. Reefs also provide food and shelter to migrating marine creatures including whales, sharks, sea turtles and commercially valuable fish. In many cases, calcareous algae and shellfish also contribute significantly to building the reef's hard framework, sometimes more than the corals do.

Corals have much greater variety than is commonly thought. The coral reefs generally pictured in popular media are restricted to warm tropical waters and depths of 300 feet or less.

However, corals are found from the North to the South Pole, and from the intertidal zone to the abyss. There are generally considered to be seven major groups of corals:

1. Fire corals (Order Milleporina);
2. Lace corals (Order Stylasterina);
3. Stony corals (Order Scleractinia);
4. Black and wire corals (Order Antipatharia);
5. Soft corals (Order Alcyonacea);
6. Horny corals/sea fans (Order Gorgonacea); and,
7. Blue corals (Order Helioporacea). Some corals specialize in deep water living such as the *Lophelia sp.* reefs off of Norway are found at depths of 6,500 feet. Some *Lophelia* reefs reach up to 100 feet off the sea floor and extend for more than seven miles.

50 percent of the world's reefs are at risk of either near-term or long-term collapse.



Coral being overrun by *Dictyosphaeria cavernosa* ("green bubble algae") on a reef flat off the south-central coast of Molokai, HI.
Photo by Rebecca Stamski-MacKnight

Reefs at Risk

Tropical and subtropical coral reefs continue to decline in many regions. The *Status of Coral Reefs of the World: 2004* report estimates that 20 percent of reefs are beyond recovery and 50 percent of the world's reefs are at risk of either near-term or long-term collapse. Some factors that contribute to the decline include:

- Poor land-use and agricultural practices that contribute excess sediment and nutrients to reef areas. Sediment clouds the water and chokes many filter-feeding reef residents. Excess nutrients contribute to excessive algal growth that can then smother the reef.
- Damage from fishing drag nets, explosion-based fishing, boat anchors, clumsy or inattentive divers and coral collectors, all of which contribute to injuring and breaking fragile coral.
- Pollution from harbor uses and ship discharges. Oils, sewage and trash all deteriorate water quality and ecosystem health.
- Trophy-fishing that takes the largest individuals of a species, which often are also the best breeders.
- Overfishing that disturbs the natural balance of the reef community. In Hawaii, for example, overfishing and excessive nutrient input are believed to contribute to a native alga, *Dictyosphaeria cavernosa* ("green bubble algae") over-running some reefs.

Did You Know?

Reefs in the western Pacific and Indian Oceans have a greater variety of organisms than reefs in the western Atlantic and Caribbean. For example, there are approximately 50 species of stony coral in the Caribbean, but more than 450 in Guam.

- Climate change is exacerbating the stresses inflicted on coral communities, as well as contributing to additional problems. Increased ocean temperatures have caused widespread coral bleaching and rising sea levels are changing water chemistry and available sunlight.

International Year of the Reef 2008

The IYOR, organized by the International Coral Reef Initiative (ICRI), is a world-wide effort to bring the wonders, benefits and plight of reefs to the world's attention. The first IYOR in 1997 spurred considerable research and numerous protection efforts. Yet as new threats are discovered and reef health continues to decline, increased awareness and understanding of coral reefs remains an urgent need. To boost conservation and management of valuable coral reef and associated ecosystems, the ICRI designated 2008 as the International Year of the Reef.

The stated goals for IYOR 2008 are:

- Strengthen awareness about the ecological, economic, social and cultural value of coral reefs and associated ecosystems,

CORAL BLEACHING

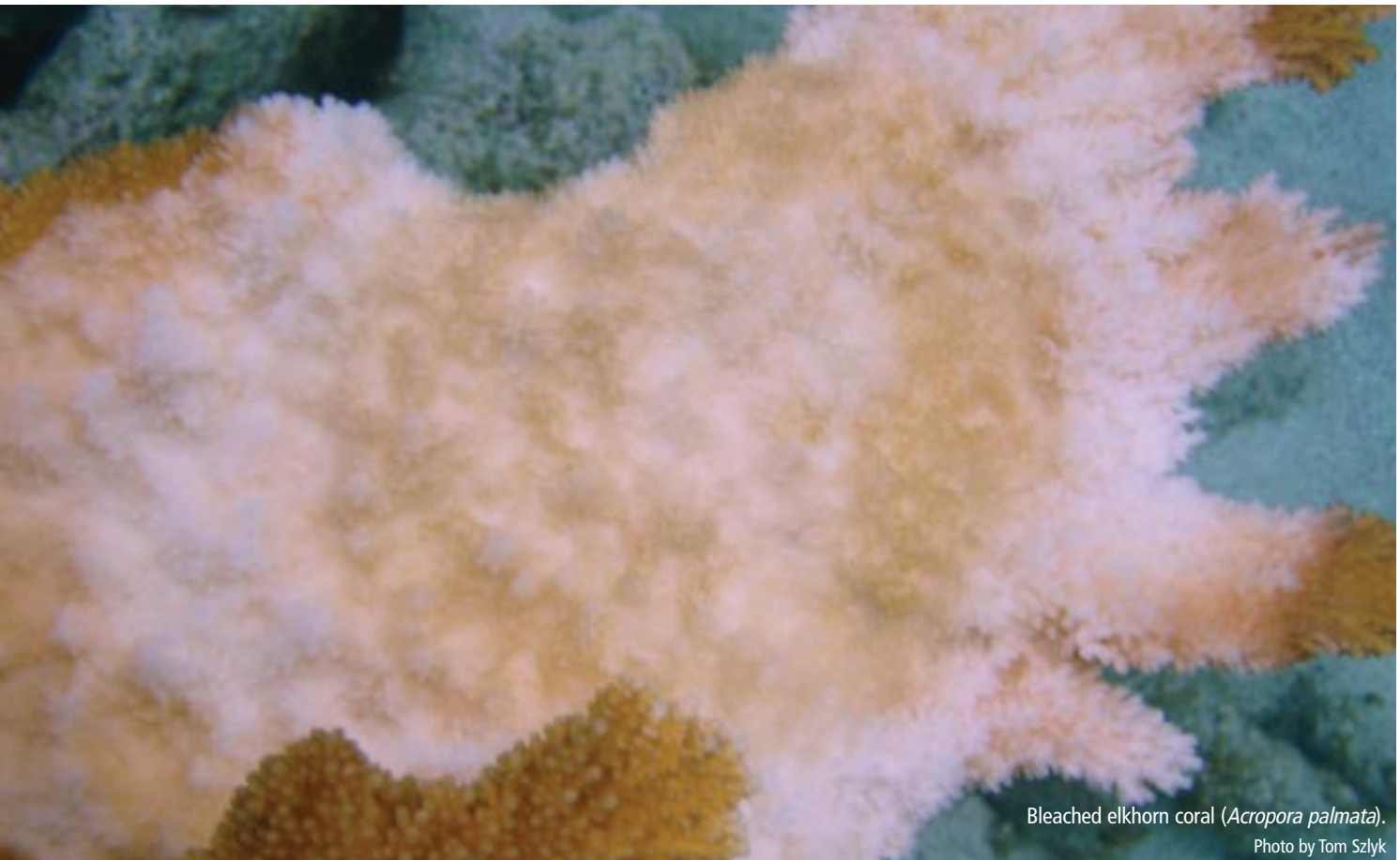
Warm, tropical ocean waters where extensive reefs comprised of hundreds of types of coral can be found are surprisingly low in available nutrients. Although coral can feed on minute, free-floating organisms (plankton), these warm-water corals largely depend on symbiotic algae called zooxanthellae. The algae convert sunlight to energy, providing a critical energy source in the nutrient-poor tropical waters, and incidentally providing an array of spectacular colors for coral. Under adverse conditions, including increased water temperature, the host coral might expel the algae on which it depends. This act “bleaches” the coral, causing it to lose its remarkable color. If the resulting coral bleaching is sustained, the coral will die.

- Improve understanding of the critical threats to coral reefs and generate both practical and innovative solutions to reduce these threats, and
- Generate urgent action at all levels to develop and implement effective management strategies for conservation and sustainable use of these ecosystems.

U.S. Coral Reef Task Force

The CRTF is a leading U.S. proponent of IYOR 2008. Presidential Executive Order 13089 created the CRTF in 1998 to implement comprehensive coral reef conservation. The CRTF includes all federal agencies whose actions can affect coral reefs, as well as leaders of seven U.S. states and territories and three freely associated states. The Department of Navy represents the Department of Defense on CRTF. The overarching themes for CRTF are:

1. Understanding coral reef ecosystems by supporting mapping, assessment and research efforts; and



Bleached elkhorn coral (*Acropora palmata*).

Photo by Tom Szlyk

2. Reducing the adverse effects of human activities by promoting education, laws and local protection.

Navy Role in Reef Protection

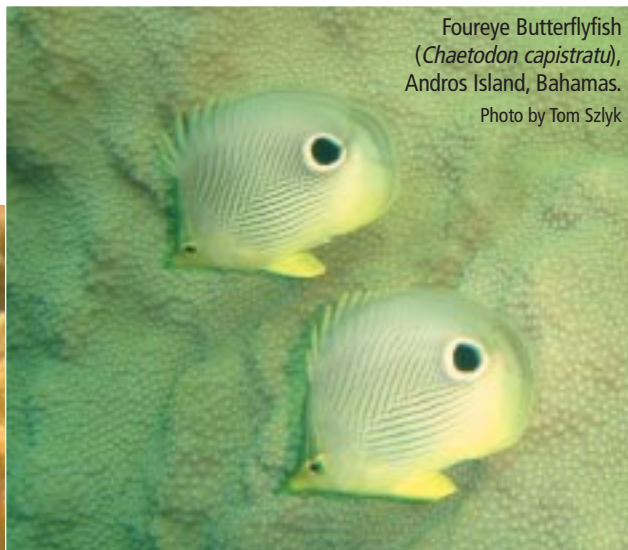
While the Navy's mission is to maintain, train and equip combat-ready Naval forces, its facility locations, technology and environmental stewardship have made the Navy an important partner in understanding and conserving reefs ecosystems around the world.

Research, Mapping & Assessment

Coral reef assessments, mapping and monitoring are ongoing at several locations. The U.S. Navy's Atlantic Undersea Test and Evaluation Center (AUTECH) maintains an active monitoring program for the extensive reef system at Andros Island, the Bahamas. AUTECH initiated reef monitoring approximately 30 years ago, making it one of the few institutions with such a long record of near-shore reef conditions. AUTECH currently is working with the University of Miami to analyze these data sets to evaluate long-term trends in reef health.



Photo from IYOR/Dean Jacobson



Four-eye Butterflyfish
(*Chaetodon capistratus*),
Andros Island, Bahamas.
Photo by Tom Szlyk



Yellowtail Damselfish—juvenile
(*Microspathodon chrysurus*) and
Staghorn Coral (*Acropora cervicornis*)
Andros Island, Bahamas.
Photo by Tom Szlyk

The Naval Facilities Engineering Command's Marine Ecological Dive Support (MEDS) team brings exemplary skills in both marine ecology and advanced diving to Navy marine natural resources work around the world. The marine ecologists, who are Navy-trained divers, collect data and conduct assessments to support baseline monitoring, environmental impact statements, Integrated Natural Resource Management Plans (INRMP) and coral reef assessments. The MEDS team has completed marine natural resources surveys adjacent to Naval installations and at sites of interest to the Navy in Florida, California, Washington, Hawaii, Guam, Northern Marianas Islands, Palau, Japan, Diego Garcia and Cuba. Other team services include inspecting ship hulls to help prevent the spread of invasive species and conducting surveys for invasive algae identification on submerged lands and for other submerged aquatic vegetation.

Technology

Navy natural resource managers are finding ways to apply existing technology to coral reef protection, and researchers are combining technolo-



Hydrozoan corals, like this fire coral (*Millepora sp.*), are important members of many coral reefs. The whitish leafy algae is *Padina sp.* Apra Harbor, Guam.

Photo by Stephen Smith

gies to develop new ways for gathering detailed habitat data rapidly and less expensively. Increasingly, Navy planners use Geographic Information Systems to direct operations away from sensitive marine resources, including reef areas. The Naval Research Submarine, NR-1, has helped researchers study reefs too deep for

individual divers to assess. The Navy's AUTECH is the host site for a Department of Defense Strategic Environmental Research and Development Program effort to develop a new underwater "video mosaics" tool to advance the state-of-the-art in coral reef mapping and monitoring. Image spectroscopy is

Economic Value of Coral Reefs

Methods for estimating the economic value of coral reefs vary, yet each suggests the reefs' importance for humans. A report from the Hawaii Coral Reef Initiative Research Program, a partnership of the University of Hawaii and the State of Hawaii supported by the National Oceanic and Atmospheric Administration's Center for Sponsored Coastal Ocean Research, indicated that the over-all value of Hawaii's potential 410,000 acres of coral reef is \$10 billion. Based on reef-related tourism and fisheries activities, the reefs generate \$360 million each year for the state's economy. This estimate does not include

such vital assets as providing a natural barrier against wave erosion and coastal hazards, cultural values and other intangible benefits that are difficult to measure economically. The United Nations Environment Programme (UNEP) estimates the value of coral reefs is between \$100,000 to \$600,000 per square kilometer a year while the cost of protecting them, through the management costs of a marine protected area, is just \$775 per square kilometer annually.

Source: UNEP-WCMC (2006), *In the front line: shoreline protection and other ecosystem services from mangroves and coral reefs*



ABOVE: A green sea turtle (*Chelonia mydas*), listed as Threatened over most of its range and Endangered in Florida and Mexico, swimming over a bed of *Porites rus* coral in Apra Harbor, Guam.

Photo by Stephen Smith



Convict Surgeonfish (*Acanthurus triostegus*), Guam.

Photo by Stephen Smith

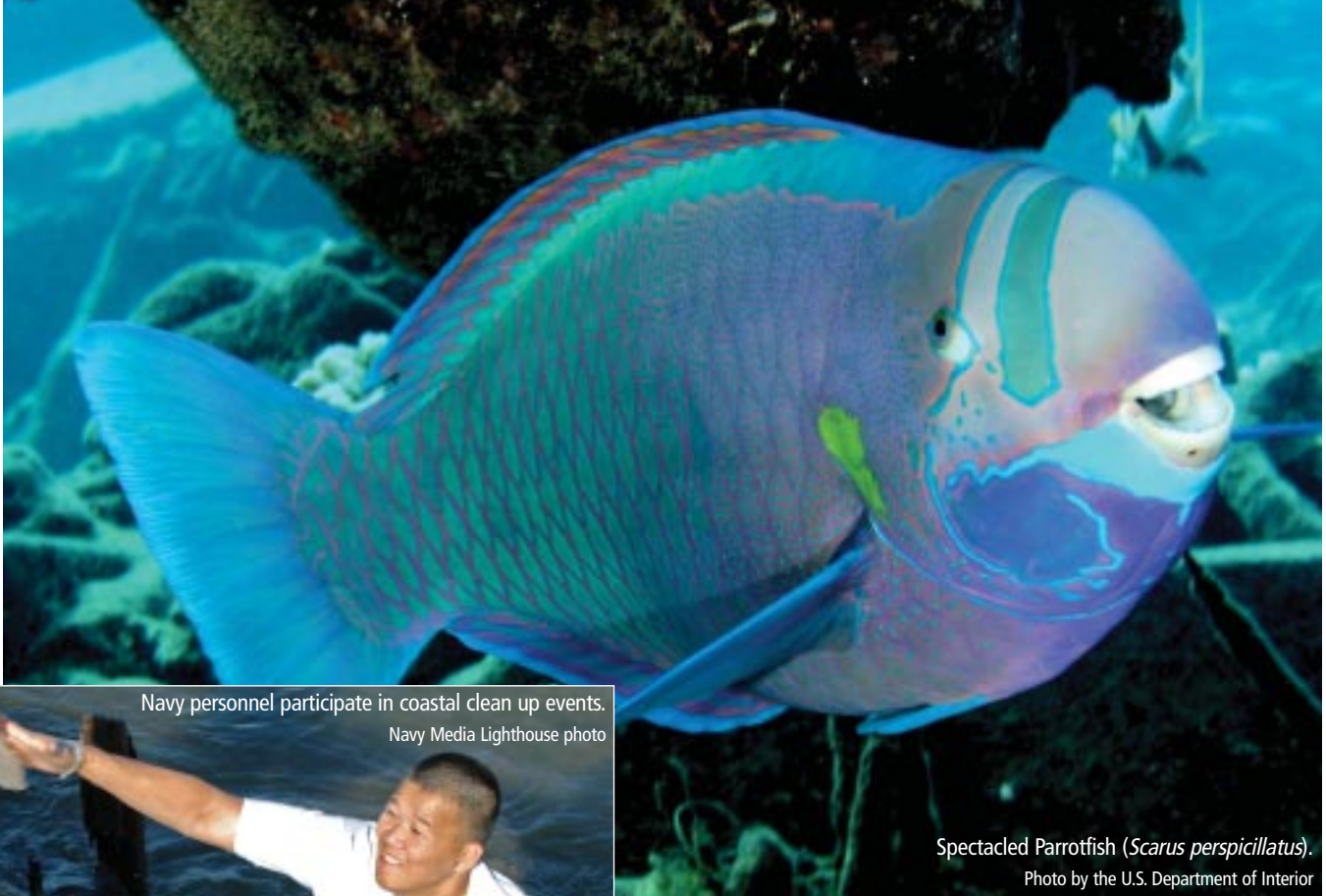
allowing for non-invasive reef health monitoring. Other technology research includes developing remote sensing techniques that will allow reef managers to measure biochemical changes that could be precursors to a bleaching event.

Sanctuary Effect

Much like the land-based protection that restricted access to military facilities provides to plant and animal species, restrictions around coastal Naval installations appear to be providing sanctuary for reef species. Data collected in Pearl Harbor show that, for the species studied, fish are more abundant and larger than at other locations in the

Main Hawaiian Islands. For example, the highly prized spectacled parrotfish averages 71 grams body weight per fish off Lanai with an average of 1.8 individuals sighted per standard survey transect. Within Pearl Harbor, the spectacled parrotfish averages 243 grams body weight and an average of 14 individuals were sighted per transect. This example of the stunning difference between locations is thought to be

primarily the result of Navy restrictions on boating, fishing and diving. But Pearl Harbor is not unique. Studies at facilities including former Navy bombing range Isla De Vieques, Puerto Rico; Diego Garcia in the Indian Ocean; Okinawa, Japan; and Guantanamo Bay, Cuba, suggest benefits from restricted access such as limited physical damage, healthy fish populations and greater species diversity.



Spectacled Parrotfish (*Scarus perspicillatus*).

Photo by the U.S. Department of Interior



Navy personnel participate in coastal clean up events.

Navy Media Lighthouse photo

Integrated Natural Resource Management

Naval facilities with significant natural resources prepare INRMPs to coordinate the facility's military and natural resource land use requirements. For facilities adjacent to reef systems, INRMPs include steps to evaluate and protect the reefs. Onshore protective measures include stormwater management, erosion control and low-input landscape maintenance. Offshore measures include boating and anchoring guidelines, installation of permanent mooring buoys to avoid anchoring damage, adding channel markers and additional measures to avoid ship and boat groundings.

Naval Facility Practices & Community Service

It is Navy policy to protect coral reefs from routine actions and to prevent

water pollution. These policies are carried forward through the array of environmental planning, resource management and pollution prevention standards applied at Navy facilities and at sea. Coral reef protection guidelines for vessels and installations include managing waste disposal from shore and vessels. Ballast water discharge restrictions help limit the introduction of invasive species to the near-shore environment. As part of community service efforts, Navy and Marine Corps personnel regularly participate in efforts to remove reef-threatening debris as well as to eradicate invasive species, both on land and off shore. The Navy also helps to install shallow water marker and mooring buoys to prevent propeller and anchor damage to reef communities. This year, new programs are being developed to educate base personnel and families about reef ecology and how to avoid negative effects in reef ecosystems from morale welfare and recreational

activities such as scuba diving, snorkeling, and fishing.

The Navy will use IYOR 2008 to note accomplishments, work with natural resource managers to complete reef surveys, provide opportunities for Commanders to incorporate reef conservation in routine training activities, expand education on reef protection for Navy personnel, and seek new opportunities to coordinate with other agencies to advance research and increase enforcement of reef protections.

On shore and at sea, on duty or off, Navy personnel will do their part to protect coral reefs. ♣

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