

# Coral Reef News

## Volumes 8, No. 6

### March 2011

#### FROM THE DESK OF THE PROGRAM MANAGER

The CRCP's mission is to support effective management and sound science to preserve, sustain and restore valuable coral reef ecosystems for future generations. Addressing the root causes of threats to coral ecosystems is best achieved with an engaged public taking part in the solutions. With this in mind, the CRCP has begun employing some unique approaches within the arena of communications, education, and outreach.

First, the CRCP now has its very own [Facebook page](#) that features highlights from our site and other coral news. If you are a member of Facebook, please visit our page and 'like' us or write on our Wall—help us reach 1,000 'likes' by the end of April! Learn more about this and other social media tools the CRCP employs on its website [here](#).



Second, the NMFS Southeast Regional Office, in concert with For the Sea Productions and various local partners, recently produced a six-minute educational video and corresponding 30-second PSA in English and Spanish entitled “[Caribbean Marine Etiquette](#)”. The purpose of the video is to educate tourists visiting Puerto Rico and the USVI of the harm caused to coral ecosystems by the illegal collection of shells and coral (which are often confiscated at the airport as the tourists head home), standing on corals, and impacts caused by careless boating. Academy Award Winner Benecio del Toro voiced the main character (a trunkfish) in both the Spanish and English versions of the video.

Lastly, in response to officials from the Commonwealth of the Northern Mariana Islands (CNMI) designating Laolao Bay as a local focal point for coral conservation, CNMI partners, SeaWeb and NOAA have teamed up to develop a social marketing campaign to support efforts there. The purpose of an Oct. 2010 kick-off workshop was to provide an overview of social marketing for CNMI stakeholders and in turn, begin the yearlong process of designing a locally-driven social marketing campaign for Laolao Bay. This spring, the CRCP worked with SeaWeb and local partners to conduct a survey of Saipan residents for market research to inform the campaign. The survey was completed last week and we'll be sharing some interesting results soon.

-Steve

## UPCOMING EVENTS

### *April*

**16:** Submissions to [2<sup>nd</sup> Annual NOAA Marine Debris Program Art Contest](#) due.

**16-18:** “Establishing an Acropora Surveillance Network in the Caribbean” workshop, Grand Cayman, British West Indies.

### *May*

**14-18:** [2<sup>nd</sup> International Marine Conservation Congress: Making Marine Science Matter](#), Vancouver, BC, Canada.

### *July*

**17-21:** [Coastal Zone 2011](#), Chicago, IL.

## CURRENT/UPCOMING MISSIONS

**March 10-May 24:** [Wake Atoll and CNMI Reef Assessment and Monitoring Program cruise](#), [NOAA Ship Hi'ialakai](#).

**March 28-April 16:** Annual Caribbean seafloor mapping mission, [NOAA Ship Nancy Foster](#).

**April 15-May 5:** Mesophotic Coral Ecosystems Cruise to PR and USVI, [Charter M/V Spree](#).

## ANNOUNCEMENTS

**‘Caribbean Marine Etiquette’ Video and PSA Launched.** A new video and PSA have been launched by NOAA’s [Fisheries Service](#) and the CRCP on March 29 to educate visitors to the US Virgin Islands (USVI) and Puerto Rico about the impacts of collecting corals and marine life as souvenirs and on how to be a steward of the marine environment. The six-minute ‘[Caribbean Marine Etiquette](#)’ video and corresponding 30-second public service announcement are available in English and Spanish and specifically educate viewers on the impacts of throwing litter on the beach, kicking or standing on live corals, anchoring boats on corals and seagrass, and collecting corals and other animals as souvenirs. The video, produced by [For the Sea Productions](#), will air in hotels, dive shops and on television throughout the US Caribbean to promote responsible tourism. Stunning underwater imagery of the Caribbean Islands is combined with important messages of marine conservation delivered by animals in their environment "talking" to the viewer. Academy Award Winner Benecio del Toro voiced the main character (a trunkfish). Read the NOAA [press release](#) to learn more.

**CRCP Explores New Frontier: Social Media.** The CRCP's mission is to support effective management and sound science to preserve, sustain and restore valuable coral reef ecosystems for future generations. Addressing the root causes of threats to coral ecosystems is best achieved with an engaged public taking part in the solutions. Using and promoting CRCP’s new Facebook page, and other Web 2.0 resources such as RSS and AddThis, our objective is to facilitate conversations on coral

conservation by allowing visitors to easily share and access our web content. We seek to expand the shared passion for coral ecosystem resources and grow the community of stakeholders that is willing to be vocal about the importance of coral conservation. To that end, we invite you to check out three new social media tools available from our website that were launched on March 28.

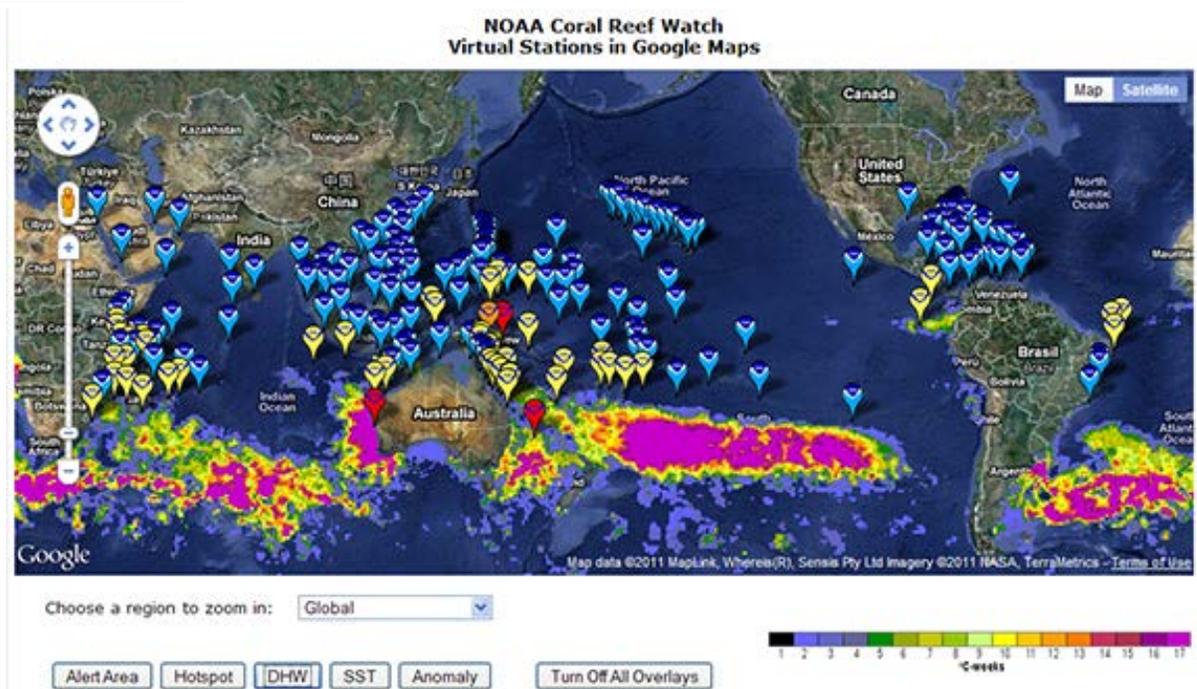
- The [CRCP RSS feed](#) features news stories about coral ecosystems from around the globe from the '[Corals in the News](#)' section of our site. Learn more about RSS and how to use RSS readers [here](#).
- AddThis is a tool that allows visitors to our website to easily share our web content on social media venues, email, etc. The AddThis button appears in each '[Featured Story](#),' as well as at the bottom of every page on our site. The most popular social media venues are featured on the button, but if you hover over it, you will have the option to choose one of over 300 ways to share our content.

- As mentioned above, the [CRCP Facebook page](#) features highlights from our site, including 'Featured Stories,' 'Corals in the News,' 'Coral Facts,' new issues of our [newsletter](#), and more. If you are a member of Facebook, please visit our page and 'like' us. Help us achieve our goal of reaching 1,000 'likes' by the end of April!



## UPDATES FROM HEADQUARTERS

**CRW Launches Expanded Virtual Stations Network With New Google Maps Interface.** On March 31, NOAA [Coral Reef Watch](#) (CRW) launched an improved and expanded Virtual Stations network, meeting a goal to expand coverage to more major coral reef locations. Based on user requests from coral reef ecosystem managers, CRW added 36 new stations, bringing the total to 227 stations worldwide. Coverage was especially increased in Brazil, the Western Indian Ocean, and Micronesia. CRW also conducted quality assurance of existing sites, renaming and repositioning specific experimental stations based on input provided by users. [Satellite Bleaching Alert](#) e-mails are available for all of the stations.



Snapshot of the new Google Maps webpage. Image courtesy: NOAA CRW

CRW also implemented a brand-new Google Maps interface for the Virtual Stations network. This [webpage](#) will help users easily navigate CRW's large network of stations, graphs, and data files.

CRW provides tools and products used around the world to predict and assess coral bleaching and the thermal stress that causes it. CRW works with international and regional scientists to develop and disseminate remote sensing tools to improve resource management.

**CRW releases a New Module for Online Reef Resilience Training.** [The Nature Conservancy](#) offers a free online training program on [Reef Resilience](#) to provide coral reef ecosystem managers, trainers, and policymakers with guidance on how to build resilience to climate change into the design of Marine Protected Areas and daily management activities. NOAA [Coral Reef Watch](#) (CRW) has just released a new module for this free course: *Tools to Predict Mass Bleaching*. The main focus of the training module is CRW satellite products that pinpoint areas at risk for mass bleaching. Several data animations from the NOAA Environmental Visualization Lab were included in the module. The course has already been accessed by more than 200 students from around the world and will continue to grow via a "training of trainers" program.

## UPDATES FROM THE ATLANTIC/CARIBBEAN REGION

**NOAA Maps USVI and Puerto Rico Coral Ecosystems.** The underwater habitats that lie below the calm, turquoise waters surrounding the Caribbean islands of Puerto Rico and the US Virgin Islands (USVI) are at the heart of a current NOAA scientific research mission. The [National Centers for Coastal Ocean Science](#) is leading a group of researchers as they try to locate and map the sensitive coral reef ecosystems and areas where fish reproduce (spawning grounds) in the region. Between March 28 and April 16, the group will explore a large area of the open ocean south of the islands of St. Thomas, St. John and eastern Puerto Rico looking for clues.

The data collected will be used to create seamless habitat maps of the sea floor. Identifying the location and distribution of coral reefs and other habitat types in this manner is critical for resource managers and scientists. Much like the maps we use above water to find streets and buildings, coral reef ecosystem scientists and managers use the sea floor maps to locate important habitats they need to study, monitor and protect. These maps are also useful to ship and ferry captains who need to safely navigate their vessels to avoid contact with the reef that can damage both the sensitive habitat and their vessels.

Twenty-four hour operations take place aboard the [NOAA Ship Nancy Foster](#), a 187-foot oceanographic research vessel equipped with all the tools needed for complex mission like this one. Researchers use technologies like sonar (a process similar to how a bat or dolphin locates objects), a remotely operated vehicle that captures live underwater video feeds, small drop cameras, and other tools to collect data. The researchers are also interested in fish behavior and ecology, particularly coral reef and coastal fish communities. Sonar and other high-tech gadgets will be used to study fish movements and how fish use certain habitats.

To read daily mission logs from this cruise, or to see archives from previous missions for this project, click [here](#). To hear a podcast about this mission, click [here](#). The [JASON Project](#) is a participating partner this year and will conduct an interview of two NOAA scientists during the mission. In addition, you can read more about the 2010 cruise [here](#).

**Sedimentation Studies Examine Reef Impacts From the Guánica Bay Watershed in Puerto Rico.** The Guánica Bay Watershed Project is a multi-agency effort to evaluate, design and implement restoration actions to reduce effects of land-based sources of pollution. A [Caribbean Coral Reef Institute](#) (CCRI) researcher, in collaboration with NOAA, is characterizing and quantifying sedimentation patterns in the watershed. Since August 2009, an array of sediment traps within Guánica Bay and at adjacent reef sites have been measuring sediment accumulation and composition. Preliminary results show the highest sedimentation rates and percentage of terrigenous sediment (sediment derived from terrestrial environments) to be found in the bay. Reef sites to the south and southwest have slightly higher sedimentation rates than sites to the southeast. This suggests that the bay serves as a source of terrigenous material to coastal waters, which is then transported westward with the prevailing currents. The results of these studies not only identify the extended range over which Guánica sediments impact coral reefs, but also serve as the front line for assessing the success of watershed restoration efforts.

Land-based sources of pollution is one of the most difficult problems facing coral reef ecosystems, due to their diffuse nature and multiple sources. These sedimentation studies in Guánica Bay are collecting samples to assess the baseline nutrient and sediment inputs into the bay and adjacent coral reefs and are providing input for NOAA's [Center for Coastal Monitoring and Assessment](#), NOAA's [Restoration Center](#), the [Center for Watershed Protection](#), and other local partners to assist in prioritizing and evaluating the feasibility of proposed restoration projects for the Guánica Bay Watershed Project.

## UPDATES FROM THE PACIFIC REGION

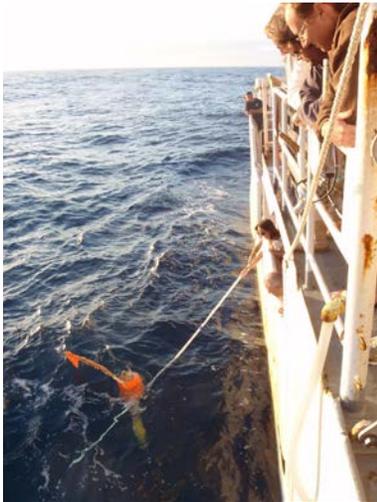
**Hawai'i Coastal Use Mapping Project Web Page Launched.** The results of the CRCP-sponsored [Hawai'i Coastal Use Mapping Project](#) are now available online. A collaboration between NOAA's [Pacific Islands Regional Office](#), [Marine Protected Areas Center](#), and [Pacific Islands Fisheries Science Center](#), as well as the [Hawai'i Division of Aquatic Resources](#), the project mapped 16 different uses representing the majority of human marine and coastal activities in the Hawai'i Coral Program's priority site on the northwestern coast of Hawai'i Island. The project was designed to enhance ocean management by gathering geospatial data on human uses of the nearshore ocean environment in the Kawaihae-Keahole region of Hawai'i Island. It has provided an unprecedented, comprehensive, consistent and spatially explicit picture of human uses for management agencies, policy makers and stakeholders interested in sound and equitable ocean governance.

Use data were collected in September 2010 during a three-day participatory mapping workshop with local residents and experts. Project background, data, and maps are available on the project's webpage. A [data viewer](#), built by NOAA's [Special Projects Office](#), is also available

and allows interaction with project data and simple analysis of use patterns without the need for specialized software.

This project represents an initial step in providing baseline information on human uses to improve management planning and effectiveness in the Hawai'i Coral Program's priority sites, as well as providing information for improved marine spatial planning in the Pacific. Next, a coastal use mapping workshop will take place in August 2011 on the island of Maui to provide baseline information for the Maui priority site.

**Pacific RAMP Cruise Monitors Coral Reef Ecosystems at Wake Atoll, Guam, and the Mariana Archipelago.** Scientists with the [Coral Reef Ecosystem Division](#) (CRED) of the NOAA [Pacific Islands Fisheries Science Center](#) (PIFSC) and their partners left Honolulu on March 10 aboard the [NOAA Ship \*Hi'ialakai\*](#) for a nine-week Pacific [Reef Assessment and Monitoring Program \(Pacific RAMP\) cruise](#) at Wake Atoll, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI). As part of the Pacific RAMP, this expedition is the fourth biennial cruise to remote Wake Atoll and the fifth biennial cruise to Guam and the CNMI.



CRED scientists and crew aboard the NOAA Ship *Hi'ialakai* retrieve an EAR near Kure Atoll. Photo credit: NOAA photo by Brian Hauk

The *Hi'ialakai* changed course twice from its route to Wake Atoll, diverting to islands in the Northwestern Hawaiian Islands to help with evacuations after the March 11 tsunami in Japan. The *Hi'ialakai* crew and CRED staff first picked up three PIFSC scientists and four [US Fish and Wildlife Service](#) (USFWS) personnel and volunteers from Laysan Island on March 15 and took them to Midway Atoll. Then, they helped five NOAA and USFWS personnel stationed on Kure Atoll evacuate to Midway Atoll, and on March 17 the *Hi'ialakai* again began a route to Wake Atoll. This diversion of the *Hi'ialakai* allowed for the recovery of a deepwater [ecological acoustic recorder](#) (EAR)—a passive listening device that records ambient underwater sounds, such as whale song, on a programmable schedule—on March 17 in the vicinity of Kure Atoll.

The *Hi'ialakai* arrived at Wake Atoll on March 22, and researchers began the first of five days of field operations on March 23 during which they conducted comprehensive oceanographic and ecological surveys of coral reef ecosystems at this remote atoll and retrieved and deployed various monitoring structures and oceanographic instruments.

The *Hi'ialakai* began operations in Saipan, CNMI, on April 7, and Pacific RAMP activities will be conducted around several islands of the CNMI and Guam through May 9. The *Hi'ialakai* will return to Honolulu in late May.

Chief Scientists for this expedition are both CRED oceanographers. Research partners are from the [University of Hawaii's Joint Institute for Marine and Atmospheric Research](#) and [Hawai'i Institute of Marine Biology](#), the [Division of Aquatic Resources](#) of the [Hawai'i Department of Land and Natural Resources](#), the [CNMI Division of Environmental Quality](#), the [Guam Coastal](#)



For five days in March, Wake Atoll, which is part of the Remote Pacific Islands Marine National Monument, was the focus of field operations for the latest Pacific RAMP cruise. Photo credit: United States Air Force

[Management Program](#), the [University of Guam](#), [San Diego State University](#), [Scripps Institution of Oceanography](#) of the [University of California San Diego](#) and NOAA's [Pacific Islands Regional Office](#).

Monitoring biological, physical, and oceanographic parameters in the Mariana Archipelago and at Wake Atoll is a critical part of understanding the condition of and changes to the coral reef

ecosystems in these regions and the processes that influence them, ultimately providing resource managers with information needed for ecosystem-based management. Follow the scientists and crew on the [mission blog](#). Periodic updates are also posted to the [CRCP](#), [CRED](#), and [Hi'ialakai](#) Facebook pages.

**Workshop Focuses on Responding to Coral Bleaching in the NWHI.** From March 8-10, an interdisciplinary group of managers, scientists, and cultural practitioners participated in the “Coral Bleaching and Disease Response Workshop” in Honolulu to develop a Bleaching and Disease Response Plan for the [Papahānaumokuākea Marine National Monument](#) (PMNM) in the Northwestern Hawaiian Islands (NWHI). Specifically, this [workshop](#) was centered on developing an integrated approach to predicting bleaching events based on the refinement, analysis, and improvement of existing forecasting tools and available real-time data; and establishing monitoring protocols to help answer key management questions about bleaching extent and severity, identify trends in temperature-driven [diseases](#), and facilitate assessment of ecosystem resilience. Read the workshop [press release](#) to learn more.

Coral bleaching—a condition that results from a reduction in the intensity or complete absence of coloration within coral tissues because of loss of pigmentation in or expulsion of endosymbiotic zooxanthellae—can be a short-term and immediate manifestation of climate change since unusually high water temperatures can induce bleaching events. Widespread [bleaching](#) has been observed in the NWHI in the past, although mass bleaching was not seen during the most recent Pacific Reef Assessment and Monitoring Program (Pacific RAMP) [cruise](#) in the NWHI in September 2010, when coral bleaching was observed only in a few areas including at Pearl and Hermes Atoll and Kure Atoll.

The end product of this workshop will be a response plan document that allows managers to respond more rapidly and effectively during the onset of a mass bleaching event by outlining the goals of the response plan, the specific steps to be undertaken to fulfill those goals, and the resources required to implement the response. The response plan will also include procedures for bleaching prediction, ecological assessment, and communication, within the context of routine, responsive, and strategic actions.

During the workshop, NOAA Coral Reef Watch (CRW) staff gave an overview of CRW's relevant operational and experimental coral bleaching tools. CRW staff also discussed CRW's ongoing and planned product development, improvements to existing products, and the importance of collaboration for providing region-specific, customized prediction and monitoring products. Most of CRW's existing products will be used as key decision support tools for the 2011 Bleaching and Disease Response Plan. Higher-resolution products, which are currently under development, as well as customized products for the Northwestern Hawaiian Islands that will be developed in collaboration with local partners in Hawai'i, will be used to improve future versions of the response plan, especially over the next three years.

In addition to staff from the PMNM and CRW, workshop participants included representatives from of the NOAA [Pacific Islands Fisheries Science Center](#) and its [Coral Reef Ecosystem Division](#), NOAA's [Atlantic Oceanographic and Meteorological Laboratory](#), NOAA's Pacific Climate Information System, the [Office of National Marine Sanctuaries Pacific Region](#), the [Hawaiian Islands Humpback Whale National Marine Sanctuary](#), [NOAA Fisheries Habitat Conservation Division](#), the [U.S. Fish and Wildlife Service](#), the [University of Hawai'i at Hilo](#), [Hawai'i Community College](#), and the [New England Aquarium](#).

### **Hawai'i Mesophotic Project Combines Submersible and Technical Diver Operations.**

Collaborators from the NOAA [Pacific Islands Fisheries Science Center](#), the [University of Hawai'i](#), and the [Bishop Museum](#), completed a 13-day cruise focused on the study of mesophotic coral reef ecosystems in the `Au`au Channel off the island of Maui on March 10. Mesophotic coral ecosystems—'meso' for middle and 'photic' for light—are the deepest of the light-dependent coral reefs. During this cruise aboard the University of Hawai'i [research vessel \*Ka'imikai-o-Kanaloa\*](#), two significant milestones were achieved. First, the mission logged the first combined operation using both technical divers and a submersible. Second, the mission logged the thousandth dive of the [Pisces V](#) submersible.



Research divers place a dome over a set of corals 290 feet deep as part of an experiment to determine coral feeding patterns, while the pilot and science observers watch on from the *Pisces V* submersible. Photo credit: Richard L. Pyle

To study the feeding patterns and growth rates of mesophotic corals, technical divers and scientists in the *Pisces V* submersible worked together in six combined missions to take advantage of the strengths of both techniques. With the submersible, scientists used an eight-hour bottom time to cover large areas of seafloor in search of sampling locations, carry sampling gear to the seafloor, and assist with sample collections. Meanwhile, with a 30-min bottom-time limit, technical divers focused on deploying experiments and collecting samples. The *Pisces V*, for example, carried acrylic domes to a sampling location, and then divers placed the dome carefully over corals and injected stable isotopes of nitrogen and carbon to create markers

that later with periodic sampling helped track the source of nourishment of corals. In another example, using the same domes, several sets of coral colonies were stained to mark their current size and enable measurements of growth in future years.

Overall, participants came away from the experience confident that similar combined operations can be conducted safely and produce results more effectively than can operations using either method independently. During this cruise, scientists completed 10 dives in the *Pisces V* submersible and another 11 remotely operated vehicle (ROV) dives were made. The other group of scientists completed 10 days of technical diving. This expedition was part of the [Mesophotic Coral Reef Ecosystem Studies](#) project funded by NOAA's [Center for Sponsored Coastal Ocean Research](#) in collaboration with the joint University of Hawai'i and NOAA [Office of Ocean Exploration & Research Hawai'i Undersea Research Laboratory](#).

Daily logs and video highlights from this mission are available [online](#).

**Humpback Whale Song Suggests Wintering Activity in the NWHI.** Scientists with the [Hawai'i Institute of Marine Biology](#) (HIMB) of the [University of Hawai'i](#) and the [Coral Reef Ecosystem Division](#) (CRED) of the [Pacific Islands Fisheries Science Center](#) have discovered that the wintering ground of the humpback whale (*Megaptera novaeangliae*) extends to the Northwestern Hawaiian Islands (NWHI). The main Hawaiian Islands (MHI) are the principal breeding ground for the humpback whale in the north Pacific, and population recovery over the last three decades from whaling-era losses has resulted in a geographic expansion of the distribution of the humpback whale in the MHI. Now, evidence resulting from a joint effort to capture and study recordings of whale song in the NWHI shows that humpback whale are common in the NWHI.

To better understand the occurrence of humpback whales in the NWHI, an [ecological acoustic recorder](#) (EAR) —a passive listening device that records ambient underwater sounds on a programmable schedule— was deployed at nine sites throughout the Hawaiian Archipelago to record the occurrence of [humpback whale song](#), an indicator of winter breeding activity. Deployment and retrieval of EARs typically occurred during Pacific Reef Assessment and Monitoring Program (Pacific RAMP) cruises, led by the CRED and funded primarily by the CRCP, as part of a collaborative effort with the HIMB and [Papahānaumokuākea Marine National Monument](#).

The timing and abundance of song recorded at each site provides evidence that humpback whales were common in the NWHI from late December to mid-May and closely followed trends observed at O'ahu in the MHI, strongly suggesting that humpback whales use the NWHI as a wintering area. These findings, which were published in the February 10 issue of the [Marine Ecology Progress Series](#), is of particular relevance in light of recent suggestions, based on photo-identification data, that a yet undocumented wintering area exists somewhere in the central north Pacific. The NWHI could be that area. Also, this discovery underscores the value of passive acoustic technologies for monitoring biological activities in marine ecosystems, particularly in remote marine protected areas. This discovery resulted in significant media coverage, including articles in the [New York Times](#) and [Our Amazing Planet](#) (syndicated by *USA Today*, MSNBC, and Fox News, among others).

## INTERNATIONAL UPDATES

**International Conference Highlights Marine Debris Strategies.** Marine debris is a major threat to coral reef ecosystems worldwide, destroying coral reef habitats, entangling wildlife, marring beaches, serving as a conduit to invasive species, and presenting a hazard to boat navigation and safety. The ecosystems in the Hawaiian Archipelago are especially vulnerable as the Northwestern Hawaiian Island (NWHI) reefs have been reported to contain extraordinarily high densities of derelict fishing gear.

The [5th International Marine Debris Conference](#) was held March 20–25 in Honolulu and co-organized by NOAA and the [United Nations Environment Programme](#). An international assembly of marine debris researchers, natural resource managers, policymakers, and representatives from industry and the nongovernmental community highlighted research advances and shared strategies and best practices to assess, reduce, and prevent the effects of marine debris. This conference also aimed to raise public awareness and encouraged international cooperation in minimizing, monitoring, and removing marine debris. The keynote speaker was Jean-Michel Cousteau, and the five-day conference program included dozens of presentations.

Within NOAA, the NOAA [Marine Debris Program](#), the [Coral Reef Ecosystem Division](#) of the NOAA [Pacific Islands Fisheries Science Center](#), and the CRCP collaborate to remove marine debris from US coral reefs, particularly in the Hawaiian archipelago. Staff from these offices participated in the conference. Specifically, on March 24, two CRED staff led a session titled “Shoreline marine debris: removal and disposal methods” to explore different mechanisms, special equipment and training needs, hazards associated with removing debris, solutions for disposal of collected debris, and special considerations for removal in remote areas. Two additional staff led a session on March 25, titled “Diving for debris: methods and approaches for human-powered in-water marine debris removal.” The session explored the use of different diving methodologies for marine debris removal including safety precautions, specific trainings, and debris handling techniques. The CRED staff presented case studies of surveys and removal in American Samoa after a tsunami and in the Papahānaumokuākea Marine National Monument. CRED staff also presented a poster on “Derelict fishing gear removals from the Northwestern Hawaiian Islands,” and a short video, titled “Two Hands,” was shown during a programmed evening of movies related to marine debris.

## DIVE DEEPER: DEEP-SEA CORALS

NOAA recognizes the need to conserve deep-sea coral and sponge ecosystems within areas under its jurisdiction and internationally. One approach to enhance conservation is through education. There are a surprising number of materials for educators to use to help teach students, from elementary through high school, about deep-sea corals, their ecosystems, and how scientists study them. Many of these materials have been developed by educators and scientists working with NOAA. Here are links to some lesson plans and activities (if the link leads directly to a PDF download, the file size is noted for your convenience):

GRADE	TYPE	Title	TOPIC	FILE TYPE & SIZE
5-6	Lesson Plan	<a href="#">Architects of the Deep Reef</a>	Reproductive strategies of Cnidaria	PDF, 264 kb
5-6	Lesson Plan	<a href="#">Deep Gardens</a>	How deep-sea coral reefs compare to coral reefs in shallow tropical waters	PDF, 225 kb
5-6	Lesson Plan	<a href="#">Forests of the Deep</a>	Deep-sea coral communities associated with seamounts	PDF, 160 kb
5-6	Activity	<a href="#">Leaving Home</a>	Dispersal of benthic invertebrate larvae	PDF, 254 kb
7-8	Lesson Plan	<a href="#">Deep Sea Coral Biodiversity</a>	Biodiversity of deep sea corals	PDF, 286 kb
7-8	Lesson Plan	<a href="#">Treasures in Jeopardy</a>	Conservation of deep-sea coral reefs	PDF, 200 kb
7-8	Lesson Plan	<a href="#">Architects of Seamount Ecosystems</a>	Morphology and ecological function in habitat-forming deep-sea corals	PDF, 188 kb
7-8	Activity	<a href="#">How Am I Supposed to Eat That?</a>	Feeding adaptations among benthic organisms	PDF, 120 kb
	Lesson Plan	<a href="#">Who's New in the Deep Sea?</a>	Introduction to technology and methods scientists use to study the deep sea, and making connections between organisms and their habitat.	Web page with link to download 487 kb PDF
	Lesson Plan	<a href="#">Classifying Deep-sea Organisms</a>	Applying principles of classification to deep-sea animals	PDF, 81 kb
9-12	Lesson Plan	<a href="#">Cool Corals</a>	Biology and ecology of <i>Lophelia</i> corals	PDF, 279 kb
9-12	Lesson Plan	<a href="#">Who's Your Neighbor?</a>	Benthic invertebrate groups associated with deep-sea coral reefs	PDF, 283 kb
9-12	Lesson Plan	<a href="#">History's Thermometers</a>	Paleoclimatological proxies	PDF, 120 kb
9-12	Activity	<a href="#">Conservation, Restoration, and Monitoring</a>	Conservation, restoration and monitoring of deep water corals and associated resources	PDF, 113 kb
9-12	Lesson Plan	<a href="#">Let's Go to the Video Tape!</a>	Characteristics of biological communities on deepwater reef habitats	PDF, 305 kb
9-12	Lesson Plan	<a href="#">How Does Your (Coral) Garden Grow?</a>	Growth rate estimates based on isotope ratios	PDF, 287 kb
9-12	Lesson Plan	<a href="#">Designing an Autonomous Underwater Vehicle (AUV)</a>	Engineering principles behind the design of underwater robots, and how they relate to locomotion in aquatic animals like fishes, sea turtles, and whales	PDF, 698 kb

## PUBLICATIONS

**CRCP Technical Memorandum Explores Storage Medium for Coral Samples.** The recently released CRCP Technical Memorandum; [Saline-Saturated DMSO-EDTA as a Storage Medium](#)

[for Microbial DNA Analysis from Coral Mucus Swab Samples](#) is now featured on the NOAA Coral Reef Information System.

Culture-independent methods for studying the microbial community of the coral surface mucopolysaccharide layer (SML) increasingly have been used to evaluate the health of the animal host. After the initial collection and preservation of the sample, the duration of the sample's voyage to a recipient laboratory is often another critical part of the sampling process. Unanticipated delays may exceed the length of time a dry shipper can remain cold, or mishandling of the shipper can cause it to exhaust prematurely, damaging the sample. In remote areas, service by international shipping companies may be non-existent, which requires the use of an alternative preservation medium. Other methods for preserving environmental samples for microbial DNA analysis include drying on various matrices (DNA cards, swabs), or placing samples in liquid preservatives. These methodologies eliminate the need for cold storage, however, they add expense and permitting requirements for hazardous liquid components, and the retrieval of intact microbial DNA often can be inconsistent. This paper evaluates saline-saturated DMSO-EDTA (SSDE) as an ambient temperature storage medium for coral mucus samples, including reports on tests to determine the efficacy of SSDE as an ambient temperature storage medium for coral mucus samples. This publication is a product of the NOAA [National Centers for Coastal Ocean Science](#).

**CRW Co-Authors Florida Keys Coral Growth Rate Paper.** NOAA has identified climate change as one of the three key threats to coral reef ecosystems. NOAA's [Coral Reef Watch](#) (CRW) works across Federal agencies, and with local, regional, and international scientists, managers, and staff, to coordinate efforts on climate change impacts to coral reefs and to help corals survive the effects of climate change.

The CRW Coordinator recently co-authored a paper published in *Nature Communications*, entitled "[Growth rates of Florida corals from 1937 to 1996 and their response to climate change.](#)" The paper documents the trends, variability, and decadal averages of historical coral growth records in relation to climate change and ocean acidification. Cores from seven *Montastraea faveolata* coral colonies in the upper Florida Keys were analyzed for the period 1937-1996. Linear trends in the density banding of the *Montastraea* colonies indicated that skeletal extension increased, density decreased, and calcification remained stable. In addition, changes in coral extension and calcification in the most recent decade were not significantly different than decadal averages from the preceding 50 years. This may indicate that growth rates in this species of subtropical coral have been tolerant to recent climate changes (up to 1996) or that local conditions in the Florida Keys have buffered these corals from oceanic temperature increases and ocean acidification. Support for this project was provided by NOAA's CRCP and CRW as well as the [National Coral Reef Institute](#).

#### Additional Document Citations

Lammers MO, Fisher-Pool PI, Au WWL, Meyer CG, Wong KB, Brainard RE. 2011. [Humpback whale \*Megaptera novaeangliae\* song reveals wintering activity in the Northwestern Hawaiian Islands.](#) *Marine Ecology Progress Series* 423:261–268.