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Published on MPA News (<https://mpanews.openchannels.org>)

Marine Debris and MPAs: Managing the Impacts of Litter on Marine Ecosystems

Marine debris - also called marine litter or ocean trash - can be one of the most visible challenges an MPA faces. Whether it is a plastic bag floating on the sea surface or a discarded fishing net snagged on a coral head, such debris is an easy-to-see reminder that the oceans are not free from human impacts, even in protected areas.

The aesthetic issues may be the least of the problem. The effects of marine debris on wildlife can be deadly. Plastic bags are mistaken by sea turtles for jellyfish, their prey. A snagged net can smother coral while continuing to fish indiscriminately for years, effectively rebaiting itself again and again. Species that feed on the seafloor, where debris often ends up, can be particularly susceptible to impacts. In 2010, a gray whale that beached and died in the US was found to have in its stomach a golf ball, tape, surgical gloves, small towels, sweatpants, and more than 20 plastic bags (www.cascadiaresearch.org/WSeattle-ER.htm).

All MPAs face the challenge of marine debris to one extent or another with litter generated inside their boundaries or floating in from elsewhere, such as from watersheds upstream. For some MPAs, marine debris is one of the most significant problems they face. In this issue, MPA News discusses the challenge of marine debris with MPA practitioners, including the nature and extent of the problem and how they are handling it. [Editor's note: For a definition of marine debris, please see the box at the end of this article.]

A destination for marine debris: Papahānaumokuākea Marine National Monument

The Northwestern Hawaiian Islands are a remote place. A long string of uninhabited islands and atolls, they stretch 1200 nautical miles westward from the main Hawaiian Islands. Due partly to the isolation, the ecosystem contains some of the healthiest coral habitat in the US. To protect it, former US President George W. Bush designated the area in 2006 as an enormous MPA, the Papahānaumokuākea Marine National Monument (PMNM).

Despite its remoteness, however, the MPA is significantly impacted by marine debris. PMNM is located in the middle of the North Pacific subtropical gyre, a clockwise-moving series of currents that has the effect of retaining and circulating much of the debris that enters the North Pacific. The Northwestern Hawaiian Islands act as a kind of comb, catching debris from the gyre and piling it up on the reefs and shorelines.

The agencies that manage PMNM have several initiatives in place to monitor the debris, remove it, and dispose of the waste properly. Perhaps the most innovative is the Hawaii Nets-to-Energy Program. Much of the debris that impacts PMNM consists of fishing nets - abandoned, lost, or discarded by users as far away as Alaska or Asia. During the nets' slow drift toward the islands, they often get tangled with others, forming conglomerations that can weigh thousands of kilograms apiece. These present a major environmental hazard to the PMNM ecosystem. The Hawaii Nets-to-Energy Program, involving multiple federal and state agencies and private sector partners, addresses the problem. Once a year, trained NOAA divers remove nets carefully from PMNM reefs and other underwater habitats. The nets are transported to the island of Oahu, where a scrap metal recycling company (Schnitzer Steel) uses its powerful shredder to chop the nets into fragments. The fragments are then taken to a waste-to-energy facility, which burns the material to produce electricity for the island. Since the program's launch in 2002, it has processed more than 700 metric tons of nets, line, and rope - producing enough energy to run nearly 350 of Oahu's homes for an entire year. More information on the program is at <http://marinedebris.noaa.gov/projects/netstoenergy.html>.

The institutional partnerships formed for the Hawaii Nets-to-Energy program are about to be needed more than ever. A new and enormous challenge awaits Papahānaumokuākea managers. The earthquake and tsunami that destroyed parts of eastern Japan in March 2011 and killed more than 15,000 people also washed vast amounts of debris (possibly millions of tons) into the Pacific Ocean. The buoyant portion of that debris - parts of buildings, housewares, and anything else washed to sea - is currently making its way across the ocean. Based on computer models and sightings of the debris by sailors, first landfall is expected to occur in the Northwestern Hawaiian Islands in the coming months, perhaps as soon as January/February 2012. (Landfall estimates and other information on the tsunami debris are available at <http://marinedebris.noaa.gov/info/japanfaq.html>.)

Carey Morishige, Pacific Islands regional coordinator for the NOAA Marine Debris Program, says much remains unknown about what will end up hitting PMNM. "We do not yet have a good idea of the types and amounts of potential Japan tsunami-generated debris still afloat in the North Pacific Ocean," says Morishige. "We are currently working with and through our partners - e.g., other NOAA offices (including PMNM site management), government agencies, shipping and fishing industry, and recreational sailors - to gather information on significant sightings of marine debris in the North Pacific. A tsunami debris workgroup has been formed with partners from governmental, non-governmental, and academic sectors to address, coordinate, and plan for tsunami-generated marine debris. It is this workgroup's goal that through working together and sharing resources, expertise, and knowledge, any impacts of tsunami-generated marine debris will be mitigated or prevented." (Workgroup partners were panelists in a webinar on 14 November on mitigating coastal impacts of the tsunami debris, coordinated by the International Pacific Research Center; an audio recording will soon be available at <http://iprc.soest.hawaii.edu/users/nikolai/2011/tsunami-debris-workshop>.)

Monitoring the landfall of the tsunami debris will be essential for a timely response. The US Fish and Wildlife Service (USFWS), which manages the terrestrial parts of the Northwestern Hawaiian Islands, has shoreline debris monitoring programs in place. "The NOAA Marine Debris Program has worked with USFWS personnel on Tern Island (in the French Frigate Shoals, Northwestern Hawaiian Islands) to update data collection and monitoring," says Morishige. "Weekly surveys of the island are being conducted, with data analysis. This is a good site as it has baseline data dating back to 1996. We should be able to notice any changes in the coming months." A similar debris-monitoring program, established in 2008, is in place on Midway Atoll.

Morishige notes that a figure often cited in the media for the quantity of tsunami debris - 25 million tons - was a Japanese government estimate of total debris (both terrestrial and marine) from the disaster. The actual amount of floating debris may be significantly lower than that figure, since much of the disaster debris stayed on land and another portion likely sank in Japan's nearshore waters. Still, she says, "Even if only a small fraction of that amount arrives in the Northwestern Hawaiian Islands, the impacts could potentially be substantial. It depends on the types and quantities of debris still afloat. The best case would be no significant increase in marine debris to the area, and the worst case would be any significant increase."

Using MPAs to drive regional debris management

A two-year project to help reduce marine litter across the Wider Caribbean region was completed in July 2011. Co-managed by the Gulf and Caribbean Fisheries Institute (GCFI) and the Caribbean MPA Management Network and Forum (CaMPAM), with financial support from the US State Department, the project aimed to develop and implement best practices for coastal waste management in the region. It addressed a problem identified by GCFI: that there was a general lack of knowledge about marine litter issues and preventative measures throughout the region - in government, NGOs, and the private sector. (The project was also an opportunity to implement broad recommendations from a regional action plan for marine litter management, developed by the UNEP Caribbean Environment Programme.)

The project strategy focused on marine protected areas. There were three reasons for this:

- Increasing public awareness: Marine protected areas can be a useful geographic focal point for the public on issues that impact local "ambassador" species. So by engaging MPAs on the need to address marine debris, the MPAs in turn could help raise public awareness of the problem.
- Improving management: MPAs provide pre-existing, dedicated platforms for environmental protection. So any best practices developed for litter management could be implemented readily.
- Improving compliance: MPAs can serve as a unifying force and catalyst for change, bringing together an array of stakeholders and responsible authorities (government ministries, coast guards, NGOs,

universities, resource users, and more) to support and/or comply with new litter management practices.

The project engaged MPAs in five countries: The Bahamas, Belize, Grenada, Jamaica, and St. Vincent and the Grenadines. Managers worked together to develop a series of best practices such as installing waste and recycling receptacles for MPA visitors, posting anti-littering signage, and educating community leaders and law enforcers about anti-littering laws. Then project leaders and in-country partners worked with the MPAs to help implement those practices.

Project manager Emma Doyle of CaMPAM says the initiative provided several benefits for the participating MPAs. "Through this project, the MPAs were able to focus on implementing the marine litter legislation and regulations that they have the power to enforce, and to educate and develop new efforts in support of these," she says. "The issue of marine litter also encompasses other important issues like watershed management, ecosystem-based management, and broader stewardship. The experience the managers gained from dealing with marine litter - a problem generated largely outside MPA boundaries - can help prepare them to take on other big, external challenges that call for regional and multistakeholder solutions."

There were also networking-related benefits for the MPAs. "For the regional MPA network, we had the benefit of achieving collaboration between MPAs and related institutions on a single important issue," says Doyle. "This potentially gives us a model project to build on when trying to address other MPA issues and when seeking to increase collaboration between ecologically-connected MPAs in the Caribbean."

She notes that, as with so many issues facing marine resource management, there is no one-size-fits-all solution to marine litter. "The Wider Caribbean region is highly diverse, composed of more than 40 countries and territories with several languages, differing political contexts, and great economic disparities," says Doyle. "Educational and interpretive materials, training programs, and initiatives like recycling must be tailored to the local culture and context." GCFI and CaMPAM are sharing outcomes from the project with the regional network of MPA professionals; the materials and experiences are available at www.gcfi.org.

Training rangers to monitor and remove derelict fishing nets

Most of the marine debris encountered by the coastal regions of northern Australia is fishing-related: nets, ropes, floats, and associated items. Based on analyses of net types, nearly 90% of the derelict nets that can be identified originate from Southeast Asia. During the monsoon season each year, hundreds of nets - some several kilometers long - float into the Gulf of Carpentaria in Australia's Northern Territory. This annual surge of "ghostnets" poses a challenge for management of the region's indigenous protected areas. (Most of the northern Australia coast is owned and occupied by indigenous peoples of Australia. An indigenous protected area, or IPA, is where traditional indigenous owners have entered into a voluntary agreement with the Australian federal government, namely to promote biodiversity and conserve cultural resources.)

GhostNets Australia is an alliance of 22 indigenous communities from coastal northern Australia (www.ghostnets.com.au). Established in 2004, the program has trained and supported indigenous ranger groups in removing more than 7500 nets so far, on shore and at sea. The patrols can be arduous. One ranger group, for example, leaves home each May for three weeks to undertake cleanups of fishing gear and other debris at sea. Using a barge and two patrol boats this year, the rangers removed 465 ghostnets weighing a total of 66 tons.

The operational areas of the ranger groups transcend the boundaries of individual IPAs - technically the rangers operate independently of the protected areas. However, there is overlap in the stewardship goals of rangers and IPA managers, and rangers often conduct work inside protected areas. "Typically, GhostNets Australia officers work with rangers based on an agreed plan that aims to respect cultural protocols and ties in with existing cultural and natural resource management in the region," says the program's Scott Morrison.

A central element to the program has been training rangers to survey and record what they find. "In recent years our data collection has transitioned from traditional paper-based data sheets to include the use of touch-screen technology and picture-based questions in handheld devices," says Morrison. The devices run a customized GhostNets Australia application that tracks where and when nets were spotted and recovered, as well as technical details like mesh and twine size.

"The technology incorporates much of the equipment needed for ghostnet surveys into one unit, including GPS, camera, tape measure, and survey sheets," says Morrison. "This means rangers are able to carry fewer pieces of equipment on patrol, and it also negates the need for reentering data afterward." The devices are resistant to water, heat, cold, and dust, and can survive being dropped.

An analysis this year of the data collected from 2004-2009 showed hotspots of ghostnet accumulation in the northeast and northwest corners of the Gulf of Carpentaria. The most frequently recorded nets were trawl nets, and came from Taiwan and Indonesia.

In 2010, GhostNets Australia took a group of rangers to Aceh, Indonesia. The rangers met with local fishermen there to communicate the Australian experience with ghostnets, as well as how the rangers work together as a community to achieve good outcomes for their land and sea. If the impact of ghostnets on northern Australia shores is to be stopped, it will need to come through more than just patrols. Prevention at the source will be necessary as well.

For more information:

Carey Morishige, Marine Debris Program, NOAA Honolulu, Hawaii, US. E-mail: Carey.Morishige@noaa.gov

Emma Doyle, CaMPAM. E-mail: emma.doyle@gcfi.org

Scott Morrison, GhostNets Australia, Darwin, Northern Territory, Australia. E-mail care of: niki.ghostnets@northerngulf.com.au

BOX: Defining marine debris

The Marine Debris Program of the (US) National Oceanic and Atmospheric Administration defines marine debris as "any persistent solid material that is manufactured or processed and directly or indirectly, intentionally or unintentionally, disposed of or abandoned into the marine environment..."

This encompasses a wide array of materials, from large items - like abandoned vessels that have run aground - to tiny ones, such as microscopic particles that result from the slow breakdown of plastic material. For more background on marine debris, go to <http://marinedebris.noaa.gov>.

BOX: "Say No to Plastic Bottles" campaign in Malaysian MPAs

Last year, MPAs in the Malaysian state of Sabah faced a problem: a growing amount of litter - much of it in the form of plastic bottles - was posing a threat to both the marine ecosystem and the tourism industry. Cleanup efforts were struggling to keep pace. Over the course of a day in September 2010, volunteers collected more than 800 kg of trash from one of Sabah's MPAs (Tunku Abdul Rahman Park, which has 30 km² of marine area). Just one year earlier, volunteers had gathered 700 kg of trash from the same site.

In response, the State Tourism, Culture, and Environment Minister Masidi Manjun directed the Sabah Parks agency to institute a plastic bottle reduction program. Implemented this year in cooperation with Borneo Divers (a leading dive operator in Sabah), the program has urged tourists to avoid using plastic bottles inside Sabah MPAs.

"Asking people not to use plastic is difficult," Minister Masidi told reporters upon launching the program. "However, if we don't do something to reduce plastic bottles, the problem will persist and get bigger."

Although just a year old, the program is producing positive results. "As a result of the 'Say No to Plastic Bottles' campaign, the amount of plastic waste has already been significantly reduced," says Theresa Tham, director of Borneo Divers. The long-term goal of the program is to end all plastic bottle use in Sabah MPAs.

For more information: Theresa Tham, Borneo Divers, Sabah, Malaysia. E-mail: theresa@borneodivers.info

BOX: Most common debris items collected from 25 years of the International Coastal Cleanup

On 17 September 2011, hundreds of thousands of volunteers in countries around the world participated in the annual International Coastal Cleanup, now in its 25th year. Managed by The Ocean Conservancy, the event has collected more than 65 million kg of debris over the past quarter-century. The 10 most common debris items found have been, in order:

1. Cigarettes/cigarette filters
2. Food wrappers/containers
3. Caps, lids
4. Cups, plates, forks, knives, spoons
5. Beverage bottles (plastic)
6. Bags (plastic)

7. Beverage bottles (glass)
8. Beverage cans
9. Straws/stirrers
10. Rope

Source: The Ocean Conservancy (2011)

BOX: More resources on marine debris

International Coastal Cleanup

www.oceanconservancy.org/our-work/marine-debris/

Fifth International Marine Debris Conference (occurred March 2011)

www.5imdc.org

***Journal of Integrated Coastal Zone Management*, March 2011 issue on marine litter (available for free)**

www.aprh.pt/rgci/issue11f1.html

Source URL: <https://mpanews.openchannels.org/news/mpa-news/marine-debris-and-mpas-managing-impacts-litter-marine-ecosystems#comment-0>