

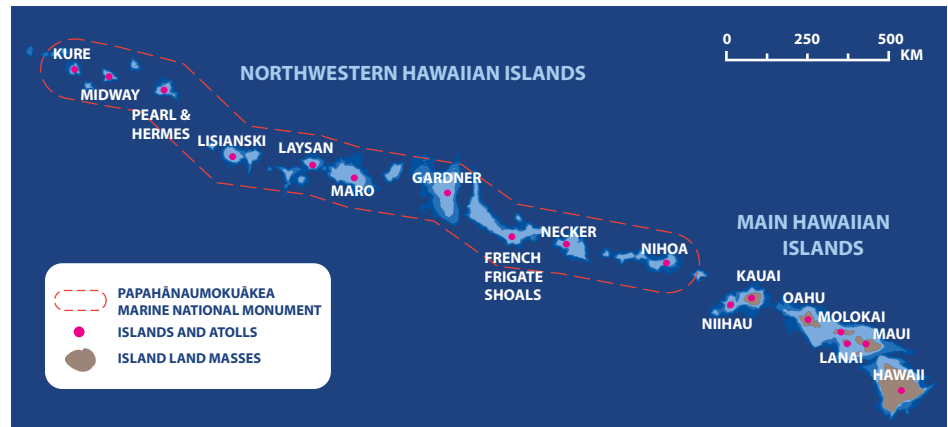
RESTORING CORAL REEFS:

removing marine debris in the
northwestern hawaiian islands **2012**



The Papahānaumokuākea Marine National Monument (PMNM) includes all of the Northwestern Hawaiian Islands (NWHI), encompassing 362,073 km² (139,797 mi²) of the Pacific Ocean. Inside the boundaries are reefs, atolls, and shallow and deep-sea habitats, including 10% of all tropical, shallow-water coral reef habitat (< 200 m) in the United States. PMNM was named a World Heritage site in 2010 by the 34th session of the World Heritage Committee in recognition of its cultural and natural values.

Map showing the islands and atolls of the Hawaiian Archipelago and the boundary of the Papahānaumokuākea Marine National Monument.



The extensive coral reefs found in the PMNM are home to more than 7000 marine species, one-quarter of which is found only in the Hawaiian Archipelago. Many of the islands and shallow-water environments in the PMNM are important habitats for rare species, such as the green sea turtle, listed as threatened under the U.S. Endangered Species Act, and Hawaiian monkseal, which is listed as critically endangered under the International Union for Conservation of Nature Red List and as endangered under the U.S. Endangered Species Act. The PMNM contains only 15 km² of emergent land, but 14 million seabirds representing 22 species use this land as breeding and nesting grounds. Land areas provide a home for 4 species of birds found nowhere else in the world, including the world's most endangered duck, the Laysan Duck (PMNM 2013).



Front: Pile of debris collected during the 2012 mission.
Back: Members of the marine debris team aboard the NOAA Ship *Oscar Elton Sette* in 2012.
All photos are NOAA photos unless otherwise specified.

Adult and juvenile Laysan Albatross on Midway Atoll. Photo courtesy of Rebecca R. Jackrel

The PMNM created a management plan in 2008 to protect its unique resources because of their ecological, historical, scientific, educational, and Native Hawaiian cultural significance. In 2010, NOAA, working with numerous partners across the state, created the Hawai'i Marine Debris Action Plan (updated in 2012), which established goals and strategies to promote coordinated action to address the significant threats posed by marine debris in the Hawaiian Archipelago (Marine Debris Program 2012).



Green sea turtle with marine debris wrapped around its neck and flipper at Pearl and Hermes Atoll.



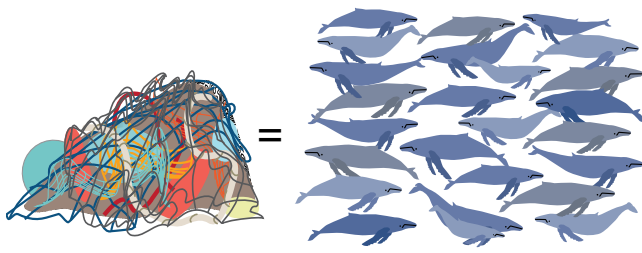
A NOAA diver carefully removes nets from entangled corals at Midway Atoll.

Marine debris, especially derelict fishing gear (DFG), presents a potentially lethal entanglement hazard to numerous marine species, most notably the Hawaiian monk seal, green sea turtle, and humpback whale, which is listed as endangered under the U.S. Endangered Species Act. Other potential effects of marine debris include habitat degradation in coral reef ecosystems, introduction of non-native species, and the creation of potential hazards to boat navigation. The negative effects of DFG on coral reef ecosystems are evident across the Hawaiian Archipelago, especially in the PMNM. The Hawaiian Archipelago is particularly prone to marine debris accumulation because of its central location in the North Pacific Gyre, a clockwise circular pattern of the prevailing ocean currents in which various types of debris from around the North Pacific Rim circulate.



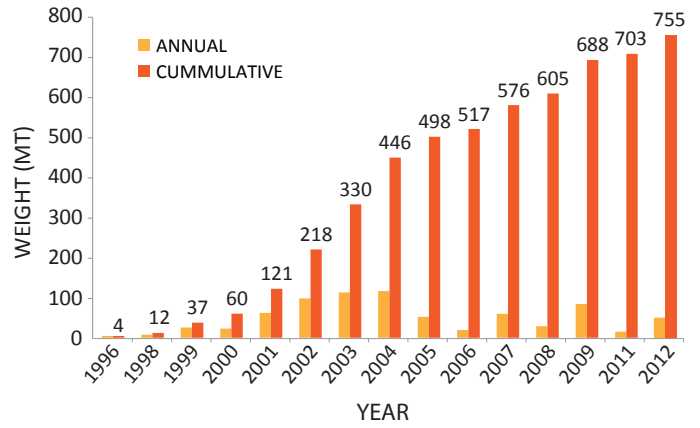
Map of the main currents that contribute to the North Pacific Gyre.

Since 1996, the Pacific Islands Fisheries Science Center (PIFSC) and several partners have surveyed the NWHI on a near annual basis and removed 755 metric tons (MT) of DFG from the area. In 2006, efforts to remove marine debris in the NWHI, led by the Marine Debris Project of the PIFSC Coral Reef Ecosystem Division (CRED), were adjusted to a maintenance level and focused on keeping pace with new accumulation by resurveying areas with historically high densities of marine debris. During the first season of this maintenance effort in 2006, 19 MT of DFG were removed, and debris continues to accumulate at an estimated 52 MT per year (Dameron et al. 2007), a projection that was proven and surpassed with the 83 MT of DFG removed in 2009 by the Marine Debris Project.



755 METRIC TONS WEIGH THE SAME AS 25 HUMPBACK WHALES

Annual and cumulative weight (MT) of derelict fishing gear removed from the Northwestern Hawaiian Islands between 1996 and 2012.



The CRED marine debris team completed 2 operations of marine debris survey and removal in the summer of 2012 (May 28–July 14): a 27-day shore-based operation at Midway Atoll with support from the U.S. Fish and Wildlife Service and a 21-day joint operation based from the NOAA Ship *Oscar Elton Sette* that combined deployments of monk seal camps for the PIFSC Protected Species Division and CRED

Map of the 2012 survey area and locations of debris removal around Midway Atoll.



marine debris operations at other islands in the PMNM. As part of the 2012 mission, the marine debris team conducted extensive shoreline surveys on Midway Atoll, adopting a modified version of an existing shoreline monitoring protocol of the NOAA Marine Debris Program and looking for debris related to the 2011 Japan tsunami event (<http://marinedebris.noaa.gov/tsunamidebris/>). Although no debris was found with an obvious connection to the tsunami, the team successfully completed survey and removal activities in high-density areas along the shorelines and back reefs of Midway Atoll. This shore-based operation resulted in the removal of 23,520 pieces of debris from 0.47 km² of shoreline and the removal of 247 net clusters of DFG from 6.33 km² of back reefs—all of which weighed nearly 24 MT (23,884 kg).

After this shore-based operation, the CRED marine debris team departed Midway Atoll on June 24 and embarked on the NOAA Ship *Oscar Elton Sette* to survey and remove marine debris in nearshore waters and along shorelines at Kure Atoll, Pearl and Hermes Atoll, Lisianski Island, Laysan Island, and French Frigate Shoals. On June 25–July 10, approximately 6 km² of shallow, backreef habitats and 0.68 km² of shoreline were surveyed at the various islands and atolls visited. This ship-based operation resulted in the removal of 406 net clusters of DFG that weighed 27 MT (27,162 kg).

ISLAND	OPERATIONAL DAYS	IN-WATER AREA SURVEYED (KM ²)	SHORELINE AREA SURVEYED (KM ²)	SOURCE OF DEBRIS	
				LAND (KG)	WATER (KG)
FRENCH FRIGATE	1	0.00	0.00	1490	0
KURE	3	1.92	0.00	934	1349
LAYSAN	1	0.00	0.19	1216	0
LISIANSKI	1	0.00	0.20	2226	0
MIDWAY	22	6.33	0.47	15,203	9015
PEARL & HERMES	9	3.99	0.29	1599	18,348

The entire 2-part cleanup effort in 2012—the shore-based and in-water Midway Atoll operations and the activities during the *Oscar Elton Sette* cruise—resulted in the identification of 653 net clusters of DFG in a total survey area of 13.40 km² and the removal of 52 MT (51,380 kg) of DFG from the 6 islands and atolls visited.



Members of the marine debris team transport derelict fishing gear back to the sea-plane tarmac at Midway Atoll.

Dameron OJ, Parke M, Albins MA, Brainard R. 2007. Marine debris accumulation in the Northwestern Hawaiian Islands: an examination of rates and processes. *Marine Pollution Bulletin* 54:423–433.

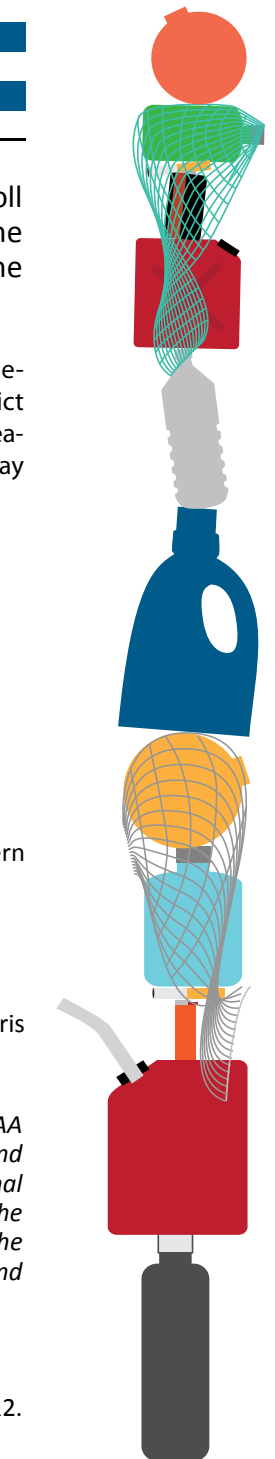
PMNM (Papahānaumokuākea Marine National Monument). 2013. About us. Last modified April 4. <http://www.papahanaumokuakea.gov/about/>.

Marine Debris Program. 2012. Hawai'i Marine Debris Action Plan: 2012–2013. NOAA Marine Debris Program, Honolulu, 94 p.

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This document may be referenced as:

PIFSC. 2013. Restoring coral reefs: removing marine debris in the Northwestern Hawaiian Islands 2012. NOAA Fisheries Pacific Islands Fisheries Science Center, PIFSC Special Publication, SP-13-001, 5 p.





CORAL REEF ECOSYSTEM DIVISION
PACIFIC ISLANDS FISHERIES SCIENCE CENTER
www.pifsc.noaa.gov/cred/mdr.php

PAPAHĀNAUMOKUĀKEA MARINE
NATIONAL MONUMENT
OFFICE OF NATIONAL MARINE SANCTUARIES
<http://www.papahanaumokuakea.gov>



NOAA MARINE DEBRIS PROGRAM
OFFICE OF RESPONSE AND RESTORATION
<http://marinedebris.noaa.gov>

DAMAGE ASSESSMENT REMEDIATION AND
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