



2017 Hawai'i Marine Debris Action Plan Research Workshop

August 2017

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All images are courtesy of the National Oceanic and Atmospheric Administration

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Executive Summary

Marine debris research is a vast and multidisciplinary field that requires collaborations at local, national, and global scales. Many organizations and researchers studying marine debris are continually publishing new findings. In order to focus the regional priorities in the State of Hawaii, participants of the [2016 Hawai'i Marine Debris Action Plan](#) (HI-MDAP) Workshop created "Goal 5: Conduct High Quality Research to Understand Marine Debris," and the first action under this goal is to "identify marine debris research priorities through a consultative workshop."

On March 30, 2017, the National Oceanic and Atmospheric Administration Marine Debris Program (NOAA MDP) and University of Hawai'i at Mānoa hosted the first HI-MDAP Research Workshop at the University of Hawai'i on O'ahu. The one-day workshop included 23 participants who currently and actively engage in marine debris research or data collection. The purpose of this workshop was to determine the current state of knowledge, deficiencies, and capacity of stakeholders in the state to further the regional understanding of marine debris.

The following document summarizes the discussions and presentations from the 2017 HI-MDAP Research Workshop.

Plenary Discussion

The 2017 HI-MDAP Research Workshop used the 2016 HI-MDAP Goal 5 as guidance to prioritize marine debris research in Hawaii. The following six strategies represent marine debris research priorities listed under Goal 5 as identified by stakeholders at the federal, state, non-profit, private, and academic levels in Hawaii:

1. Develop an understanding of marine debris physical and chemical traits, life cycle, transport, quantity, impacts, and accumulation rate of marine debris.
2. Develop or identify standardized methods or best management practices for applicable aspects of research to ensure data/projects can be meaningfully analyzed.
3. Improve research on ecological impacts of marine debris.
4. Improve research on economic impacts of marine debris.
5. Evaluate the effectiveness of mitigation, outreach, and removal efforts of marine debris.
6. Support communication and collaboration of research to all stakeholders.

The 2017 HI-MDAP Research Workshop addressed three priority objectives in accordance with Goal 5:

1. Detail current studies of marine debris research in the Hawaiian Islands and the people and organizations involved.
2. Determine marine debris research priorities for Hawaii and establish goals in research topics to be addressed in the next five to ten years.
3. Evaluate resources and support needed to address these priorities and to achieve these goals.

Thirteen of the participants presented their research in accordance with these three objectives, and the remaining sessions were dedicated to open discussions among the group. In the first discussion session, the group prioritized marine debris research in Hawaii on the following topics:

- Polymer characterization to assess microplastics and the mechanism in which these polymers are transferred and affect human health.
- Invasive species and the diseases they can carry.
- Economic studies on marine debris damage to coral reefs and other key species in Hawaii.

The unique characteristics associated with Hawaii as an island chain within the subtropical gyre and part of a convergence zone of multiple currents repeatedly influenced the discussion. Island dynamics are tremendously complex, and as a result, Hawaii is exposed to debris originating from various countries along the North Pacific Rim.

In the second discussion session, participants considered the various resources available and the challenges for Hawaii in conducting competitive scientific studies and addressing the existing gaps in knowledge. They identified geographic isolation, limited access to facilities, and funding as significant limiting factors. Due to the remote location of the Hawaiian Islands relative to other states, research in Hawaii can have greater logistical obstacles. Additionally, space is a finite resource, and storage facilities are needed for plastic and biological samples collected from marine debris. Designated laboratories equipped for chemical and biological sample analyses are necessary to support domestic marine debris investigations. Furthermore, the scope of needed research is far broader than one or two funding opportunities can support, and the advances in the field stand to improve significantly with more resources, funding, and stakeholder collaboration.

Future Steps

The participants of the 2017 HI-MDAP Research Workshop determined annual in-person meetings would benefit the research community by providing a forum for collaboration, discussion, and exchange. This initial workshop focused on research in Hawaii, while future workshops could expand to include a national and international perspective. Future workshops could also include a broader network of expertise from additional NOAA researchers and appropriate State of Hawaii scientists and professionals from the health, economics, and waste management sectors.



Participants engaged at the first HI-MDAP Research Workshop.

Appendix

2017 HI-MDAP Research Workshop Agenda: Honolulu, HI

March 30, 2017 (Thursday) 8:30am-4:00pm

8:30-9:00am – Check-in

9:00-9:30am – Welcoming Remarks

9:30-10:30am – Research Presentations I (15 min ea.)

9:30 - Kirsten Moy

9:45 - Jennifer Lynch

10:00 - Nikolai Maximenko

10:15 - James Callahan

10:30-10:45pm – Break

10:45-11:30am – Research Presentations II (15 min ea.)

10:45 - Kevin O'Brien

11:00 - Grace Chon

11:15 - Michelle Hester

11:30-12:00pm – Organization/Program research update (5 min ea.)

11:30 - Cheryl King (Presented by Kirsten Moy)

11:35 - Jens Currier

11:40 - Lauren Blickley

11:45 - Steve Colbert

11:50 - Cynthia Welti

11:55 - Megan Lamson

12:00-1:00pm – Lunch brought to UH

1:00-2:10pm – Plenary Discussion (Led by Grace & Mark)

2:10-2:20pm – Break

2:20-3:25pm – Plenary Discussion (Led Nikolai & Kirsten)

3:25-3:30pm – Break

3:30-4:00pm – Summary and Evaluation

4:00pm – Adjourn

2017 HI-MDAP Research Workshop Participant List

Name	Organization
Kelsey Barrow	Hawaii Coral Reef Initiative
Lauren Blickley	Swell Consulting
Kayla Brignac	National Institute of Standards and Technology - University of Hawai'i at Mānoa
Michael Burns	NOAA Hawaiian Monk Seal Research Program
James Callahan	TransPacific Marine Debris Survey
Grace Chon	NOAA Marine Debris Program
Steven Colbert	University of Hawai'i at Hilo
Jens Currie	Pacific Whale Foundation
Jan Hafner	International Pacific Research Center - University of Hawai'i at Mānoa
Michelle Hester	Oikonos / Pelagicos Hawai'i Pacific University
Melissa Jung	National Institute of Standards and Technology - Hawai'i Pacific University
Megan Lamson	Hawai'i Wildlife Fund
Jennifer Lynch	National Institute of Standards and Technology
Mark Manuel	NOAA Marine Debris Program
Nikolai Maximenko	International Pacific Research Center - University of Hawai'i at Mānoa
Anupam Misra	Hawai'i Institute of Geophysics and Planetology - School of Ocean and Earth Science and Technology
Kirsten Moy	Hawaii Coral Reef Initiative
Jordan Muratsuchi	University of Hawai'i at Mānoa
Kevin O'Brien	NOAA Coral Reef Ecosystem Program
Sarah-Jeanne Royer	Center for Microbial Oceanography: Research and Education
Jim Potemra	University of Hawai'i at Mānoa
Gisela Speidel	International Pacific Research Center - University of Hawai'i at Mānoa
Cynthia Welti	Surfrider Foundation – Kaua'i Chapter

2017 HI-MDAP Research Workshop Presentation Summaries

Research Presentations

Mapping Marine Debris in the Main Hawaiian Islands to Strengthen Public Partnerships

Kirsten Moy¹, Kelsey Barrow¹, Amber Meadows¹, Anne Rosinski¹, Brian Neilson², Miguel Castrence³, Stephen Ambagis³, Kristine Davidson¹

¹Hawaii Coral Reef Initiative, University of Hawai'i at Mānoa, ²Division of Aquatic Resources, Department of Land and Natural Resources, ³Resource Mapping Hawaii

The 2015 aerial marine debris surveys of the main Hawaiian Islands provided precise measurements of the quantity, location, type, and size of marine debris accumulations along the eight islands' coastlines. The study identified and mapped 20,658 individual items, the majority of which was concentrated on the northeast (windward) shorelines and was composed primarily of plastic materials (47%). Derelict fishing gear (33%) was the second most prominent debris type, and has remained much unchanged compared to the aerial surveys conducted by NOAA's Coral Reef Ecosystem Division in 2006 and 2008. Aerial surveys are effective and comprehensive means of tracking marine debris accumulations to direct resources and management priorities for research, nonprofit cleanup organizations, and state and federal agencies. Marine debris removals must be considered and should be quantified and characterized to understand the state of marine debris on shorelines. The Hawai'i Environmental Cleanup Coalition, a partnership between ten Hawaii cleanup organizations, will begin to standardize data collection and report their respective organizations' removal efforts in Hawaii from the past ten years to improve our understanding of marine debris in the state.

Marine Debris Ingested by Pelagic Pacific Sea Turtles: A Focus on Chemical Properties

Jennifer M. Lynch¹, Katharine Clukey², Melissa Jung³, George Balazs⁴, David Hyrenbach³, Brenda Jensen³, T. Todd Jones⁴, Christopher Lepczyk^{2,5}, Qing Li², Thierry Work⁶

¹National Institute of Standards and Technology, ²University of Hawai'i, ³Hawai'i Pacific University, ⁴NOAA Pacific Islands Fisheries Science Center, ⁵Auburn University, ⁶U.S. Geological Survey

NIST in collaboration with NOAA, USGS, HPU, and UH have been archiving tissues from sea turtles that are caught as bycatch in the Hawaiian and American Samoan longline fisheries. Tissues are stored cryogenically in the NIST Marine Environmental Specimen Bank and used for health and chemical contaminant research. Portions of these samples have been used to perform three studies pertaining to plastic marine debris, which will be presented at the workshop. The studies address 1) the quantity, general characteristics, and overt health effects of ingested plastics in four species of pelagic Pacific sea turtles; 2) whether these plastics are a significant source of persistent organic pollutants to the turtles; and 3) what polymers make up these plastics. This information can help us understand several basic questions about marine debris and how chemical properties of different plastic polymers affect the way they move through the marine environment and influence the fate and transport of other chemical pollutants.

Pathways of Marine Debris in Hawaii

Nikolai Maximenko¹, Jan Hafner¹, Gisela Speidel¹

¹University of Hawai'i, International Pacific Research Center, School of Ocean and Earth Science and Technology

IIRC team studies interaction of ocean circulation with various types of buoyant objects: from microplastics to larger general debris and to debris from disasters and accidents. Currently, IIRC research focuses on the following projects.

- IIRC drift model simulates accumulation of microplastics in the subtropical gyres and allows its global assessment.
- IIRC analyzes a surprisingly large amount of microplastics found buried in rocks on one of Hawaiian beaches, with the density increasing with depth. Composition of microplastics, fragmentation processes, and correspondence of properties of small and larger fragments are studied through digitization and computer processing of the samples.
- Model of debris drift from the 2011 tsunami is synthesized with observations to assess various impacts, including transport of alien species. Connectivity of Hawaiian ecosystem to coastal ecosystems east and south of Japan is demonstrated through analyses of paths and variations of ocean conditions along these paths.
- IIRC works with NASA, ESA, and other partners designing observing systems of marine debris based on remote sensing and Lagrangian trackers.

Trans Pacific Marine Debris Survey: Do we need it?

James Callahan¹

¹TransPacific Marine Debris Survey

The Trans Pacific Marine Debris Survey provides visual observations of at sea marine debris data to the public since 2009. The project collaborates between researchers and citizen scientists to inspire ocean awareness and sea stewardship within the sailing community.

Midway Atoll Marine Debris Shoreline Accumulation

Kevin O'Brien¹

¹National Oceanic and Atmospheric Administration, Pacific Islands Fisheries Science Center Coral Reef Ecosystem Program

Since 2012, NOAA's Pacific Islands Fisheries Science Center (PIFSC) has been conducting a marine debris accumulation study at Midway Atoll. Shoreline debris and in-water debris has been surveyed and removed from stratified randomly-selected plots on an annual basis as part of this study. Debris is weighed, sorted and tallied based on size and debris type in an effort to track and measure debris accumulation across the atoll. In addition to continuing the Midway accumulation study in future years, PIFSC is exploring the use of Structure from Motion (SFM) technology to quantify derelict fishing gear impact on coral reef communities and to enable documentation of ecological succession at debris impact sites.

NOAA Marine Debris Program Research in the Pacific

Grace Chon¹, Mark Manuel¹

¹National Oceanic and Atmospheric Administration, Marine Debris Program

The NOAA Marine Debris Program has several research projects currently occurring in Hawaii. In a partnership with the NOAA Pacific Islands Regional Office Observer Program, a unique dataset is collected through at-sea

marine debris observer encounter reports to record derelict fishing gear interactions with longline fisheries. In Hawaii, over 200 surveys have been entered into the citizen science Marine Debris Monitoring and Assessment Project, which allows for standardized shoreline data that can be compared nationally. In collaboration with the NOAA Science and Operations Division, an analysis on microplastic distribution in West Hawaii is underway.

Hawaiian Seabirds as Samplers of Marine Debris: Ingestion and Foraging Studies

David Hyrenbach^{1,2}, Michelle Hester¹, Jessie Beck¹, Andrew Titmus², Shannon Lyday², Sarah Youngren², Dan Rapp², Cynthia Vanderlip³, Josh Adams⁴

¹*Oikonos – Ecosystem Knowledge*, ²*Pelagicos Lab, Hawai'i Pacific University*, ³*Division of Forestry and Wildlife, State of Hawaii Department of Land and Natural Resources*, ⁴*U.S.G.S. Western Ecological Center, Santa Cruz*

Marine birds are valuable biological indicators of the productivity and structure of marine ecosystems, and are used throughout the world to learn about changes in the availability of commercially important prey species and the transfer of pollutants in marine food webs. Pelagicos (HPU), Oikonos, and partners are focusing on quantifying the diet and plastic ingestion by seabirds and fish. The far-ranging Black-footed and Laysan Albatross are ideal indicators for the broader North Pacific while locally foraging seabirds, such as shearwaters, track conditions near breeding colonies in Hawaii. This presentation will showcase examples of local and regional seabirds and what they are teaching us about marine debris, forage fish, and threats to their populations.

Organization/Program Research Updates

Sharkastics – Cheryl King

In addition to simply removing the debris from Ka'ehu, Maui every month, Sharkastics also sorted and counted each piece of marine debris during monthly cleanups from July 22, 2012 through June 28, 2015, on September 27, 2016 ("Get the Drift and Bag It" campaign), and so far in 2017: January 22 and February 26. This process is very time consuming with all of the specific categories being analyzed, but collecting data during 38 out of the 54 monthly cleanups yielded 167,926 pieces of marine debris collected/sorted/counted. The debris items were classified under the following major categories: plastics (78.3%), polystyrene/foam (9.0%), fabric (4.9%), metal (3.4%), rubber (3.1%), glass (0.8%), and processed wood (0.6%).

Pacific Whale Foundation – Jens Currier

Pacific Whale Foundation has been conducting marine debris monitoring and removal efforts since 2013 from both land and ocean based platforms. These efforts have led to establishing a database of over 26,000 debris items, which form a crucial record of debris type and location to help guide management and mitigation measures. The presented work will provide an overview of Pacific Whale Foundation's research on marine debris within the Maui four-island region.

Swell Consulting – Lauren Blickley

Establishing a baseline understanding of debris accumulation on Maui, and utilizing this baseline to determine the efficacy of local policies to decrease debris loads.

University of Hawai'i, Hilo – Steve Colbert

At UH Hilo, marine debris issues are examined in class and through independent research projects. During Summer 2016, marine debris accumulation was 0.9 kg/d at Pololu Valley, Hawai'i Island (NE Coast). Microplastics (0.125-1 mm) were abundant in beach sands and found to be consumed by Cnidarians.

Surfrider Foundation – Kaua‘i Chapter – Cynthia Welti

Surfrider Foundation – Kaua‘i Chapter leads volunteers to clear its coasts of the Marine Debris arriving in ever-increasing doses. Kauai has been heavily hit by tsunami debris, and receives tons of fishing nets and plastic on its east-facing beaches. A recent study shows a marked increase of Shearwater birds having consumed plastic. Cynthia Welti is a member of the Executive Committee for the organization, serving as data collector and analyst.

Hawai‘i Wildlife Fund – Megan Lamson

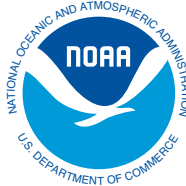
Hawai‘i Wildlife Fund and volunteers have removed over 212 metric tons (469,624 lbs) of marine debris from the shores of the Hawaiian Islands since 1996. Of this debris, over 184 metric tons were from the south end of Hawai‘i Island. On average about 13.2 metric tons (29,100 lbs) are removed annually from this coastline (approx. 41% DFG by weight) but the amount recovered has decreased since the initial project year, despite increasing effort. Recent efforts with the NOAA shoreline monitoring protocol have revealed that the majority of the marine debris at Kamilo Point are plastic (86.0%), followed by glass (11.0%), plastiglomerates (2.3%), and other debris (0.7%), however, the selected survey site is not where the majority of debris accumulates along this beach.

NOAA Protected Species Division – Michael Burns

The Pacific Island Fisheries Science Center (PIFSC) Hawaiian Monk Seal Research Program, in collaboration with PIFSC’s Coral Reef Ecosystem Program (CREP), will launch a shoreline debris accumulation study during the 2017 monk seal field season. The study will occur at five islands and atolls (French Frigate Shoals, Laysan, Lisianski, Pearl and Hermes Reef and Kure Atoll) throughout the Papahānaumokuākea Marine National Monument (PMNM). Due to the size of the study sites and the limited field personnel, a modified version of the Midway Atoll accumulation study will be utilized. Islands will be segmented into plots and in selected segments, plastic debris ranging from 2.5 cm and larger will be collected, counted, weighed and removed. Using this data in conjunction with the Midway Atoll data, a better understanding of shoreline debris accumulation can be obtained. This provides an important effort that has been missing at most of the islands in the PMNM and will assist in reducing the accumulation of large entangling nets that make their way to shore in the periods between the large scale removal efforts by CREP. This data can then help better mitigate the impacts of debris on the wildlife that call this monument home.

2017 HI-MDAP Research Workshop participants.





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