

**Papahānaumokuākea Marine National Monument
Agency Report to the Reserve Council
November 2022 – January 2023**

Agency: NOAA/NOS/ONMS/PMNM

Presented by: Eric Roberts, Acting Superintendent

Date: January 18, 2023

Agency Accomplishments & Recent Activities

Education, Outreach and Mokupāpapa Discovery Center Highlights

Staff Member Invited to Train Young Pacific Leaders at TechCamp on Climate Action

From October 26 to November 1, Malia Evans, O’ahu Education and Outreach Coordinator, traveled to Auckland, Aotearoa to train 50 [Young Pacific Leaders](#) (YPL) at a [TechCamp](#) hosted by the U.S. Department of State, the [U.S. Embassy New Zealand](#) and Cultural Vistas. The training, “Looking to the Past to Inform the Future: Weaving TEK, Tech and Culture to Build Resilient Communities” provided instruction in a culturally grounded and participatory methodology to identify and record Traditional Ecological Knowledge (TEK) and knowledge holders to monitor ecosystem change over time and develop climate action strategies to strengthen community resilience. In addition, the training highlighted Papahānaumokuākea management framework rooted in Native Hawaiian cultural perspectives, education and community engagement, and equitable partnerships as a case study to encourage the YPL delegates to develop indigenous approaches woven with technology and science to drive innovative environmental and community adaptation strategies. [Pacific youth leaders gather in NZ to discuss global issues | RNZ News 531 - TechCamp for Climate Action](#)

▶ [Meet The Trainers - TechCamp Young Pacific Leaders 2022](#)



Malia highlights innovative ways PMNM staff have woven TEK, technology and culture into management strategies (left). A portion of the Young Pacific Leaders delegates from 15 countries around the Pacific (right). (Credit: U.S. Embassy)

Mokupāpapa Weekly Report

During the months of November and December, MDC welcomed 2,478 visitors to the facility and outreach activities. MDC educators served 149 students through in-house lessons as well as 498 through two outreach activities, including the first return to the in-person Hawai’i Island Career Expo and a plankton lab with a local nonprofit running a NOAA B-WET funded youth program (refer to separate report). They hosted 1 school group of 70 students from Hilo Union

and participated in 1 outreach event with the Nā Wa‘a Mauō Marine Stewardship Program hosting 11 students and 1 kumu. MDC engaged an additional 314 students from 10 field trips, including several more Earth, Sea, Sky (ESS) programs—the collaboration with Hawai‘i Volcanoes National Park and ‘Imiloa Astronomy Center. The ESS program has been a great tool for our more remote and underserved students to connect with MDC and learn about PMNM

The Kenyan K. Beals Community Robotics Center welcomed 103 community members to connect with their weekly robotics activities. The Kapiolani Elementary Robotics team also volunteered their time to build a full competition arena to serve as a resource for all community robotics teams using the center.



Left: Educator Hōkū Pihana leads a chant while students paddle their wa‘a (canoe) as they take a journey through MDC (Credit: Justin Umholtz/NOAA). Right: Hilo High School volunteers pose with MDC educator Justin Umholtz as they prepare for the students to arrive at the Career Expo (Credit: Iwalani Harris).



Photo: MDC Educators Justin Umholtz and Hōkū Pihana greet Hilo Union students with chant (Photos: Virginia Branco).



Left: Students learn the Tide Hula as one part of a lesson exploring the interactions of ocean and land. Right: Students learn microscope skills and examine the components of volcanic and biogenic sands. (Credits: Jusin Umholtz/NOAA)

Catch Up and Keep Up: A Strategy for Marine Debris Mitigation

On November 17 as part of the [National Marine Sanctuaries Webinar Series](#) and the Mokupāpapa Third Thursday by the Bay Lecture Series, Kevin O'Brien and James Morioka, President and Executive Director of Papahānaumokuākea Marine Debris Project (PMDP), shared their 2022 field season success in removing over 200,000 pounds of marine debris from Papahānaumokuākea. Since its inception in 2019, PMDP has been working hard to increase the cadence of removal efforts in Papahānaumokuākea. Under PMDP's nonprofit leadership, 2022 marked year #1 of a strategic 5 year plan to catch up with backlogged accumulation and

keep up with new annual influx. Through intensive removal activities, this ambitious goal aims to reduce the impacts of marine debris to their lowest practicable levels, giving wildlife the best long-term chance of survival. There were 396 scientists, educators, students, and families registered for the webinar with 184 attending.



(Credits: PMDP)

Field Day with Nā Wa‘a Mauō Marine Stewardship Program

On November 18, the Nā Wa‘a Mauō Marine Stewardship Program hosted a field day for twenty-one Kea‘au High School to introduce them to practices and methods that blend institutional and indigenous sciences. Students engaged in hands-on activities that introduced them to using outrigger canoes in marine science, collecting and interpreting data from a Native Hawaiian worldview, and understanding the importance of including indigenous knowledge and science in marine stewardship in Hawai‘i. This partnership with Nā Wa‘a Mauō has been established through the 2022–2024 NOAA B-WET grant and will continue throughout the duration of the B-WET experience.

The educational outputs from this field experience were:

- 1) students understanding of how their marine stewardship on Hawai‘i Island is also connected to the health and wellness of Papahānaumokuākea
- 2) the importance of perpetuating the practices of our kūpuna (ancestors) to mālama hōnua

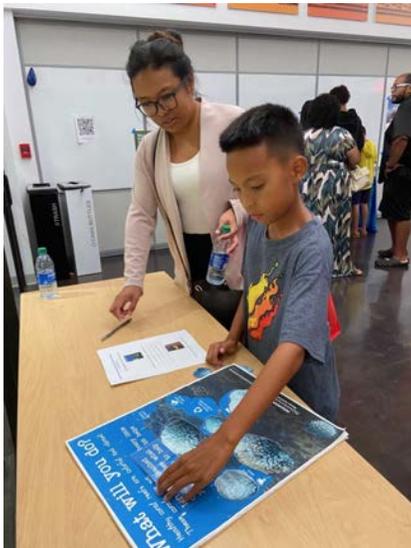




Images from the field day including introductions, plankton pulls, water property learning station, and a plankton id station. (Credits: Nā Wa‘a Mauō Marine Stewardship Program)

Inspiring the Next Generation of Ocean Stewards through Fun

On Friday, December 2nd, PMNM staff member Malia Evans partnered with B-WET Grantee Boys and Girls Club (BGC) and the Girls Scouts of Hawai‘i to provide a memorable educational activity at the BGC ‘Ohana Night, an intergenerational event for K-12 club members and family. The evening event at the [Kalaniho‘okaha Community Learning Center](#) in the Nānākuli Hawaiian Homesteads drew over 70 children and adults. Through a fun, PMNM focused scavenger hunt, the ‘ohana were encouraged to problem solve together as they moved through 10 different activity stations. The scavenger hunt was a unique way to connect people to new content and develop a deeper interest in the issues affecting the kūpuna (elder) islands of Papahānaumokuākea.





'Ohana members practice the essential skill of teamwork as they complete each task on their checklist (Credit: Boys and Girls Club of Nānākuli).

PMNM Staff Welcome Young Pacific Leaders to NOAA Inouye Regional Center

PMNM staff Kanoë Morishige, Kilo Ka'awa-Gonzalves and Malia Evans welcomed 27 Young Pacific Leaders (YPL) to the IRC on November 29th with Hawaiian cultural protocol and presentations grounded in Native Hawaiian knowledge systems, in addition to a tour and presentations provided by NOAA's National Center for Environmental Information and Marine Debris Program. The YPL cohort was on O'ahu attending the Regional Workshop on Marine Sustainability sponsored by the U.S. Department of State. The initiative brings together young ocean leaders from the Pacific to solve regional challenges associated with marine sustainability.



Top L: The YPL delegates represent 15 different Pacific nations. Top R: A brief history of Keawalau o Pu'uloa, later known as Pearl Harbor. Bottom: NOAA staff conduct a welcoming protocol for the YPL delegates (Credit: U.S. Embassy New Zealand).

Field Day with Nā Wa‘a Mauō Marine Stewardship Program

On December 02,, the Nā Wa‘a Mauō Marine Stewardship Program hosted a field day for 11 HAAS Charter School from Pāhoal to introduce them to practices and methods that blend institutional and indigenous sciences. Students engaged in hands-on activities that introduced them to using outrigger canoes in marine science, collecting and interpreting data from a Native Hawaiian worldview, and understanding the importance of including indigenous knowledge and science in marine stewardship in Hawai‘i. This partnership with Nā Wa‘a Mauō has been established through the 2022 - 2024 NOAA B-WET grant and will continue throughout the duration of the B-WET experience.

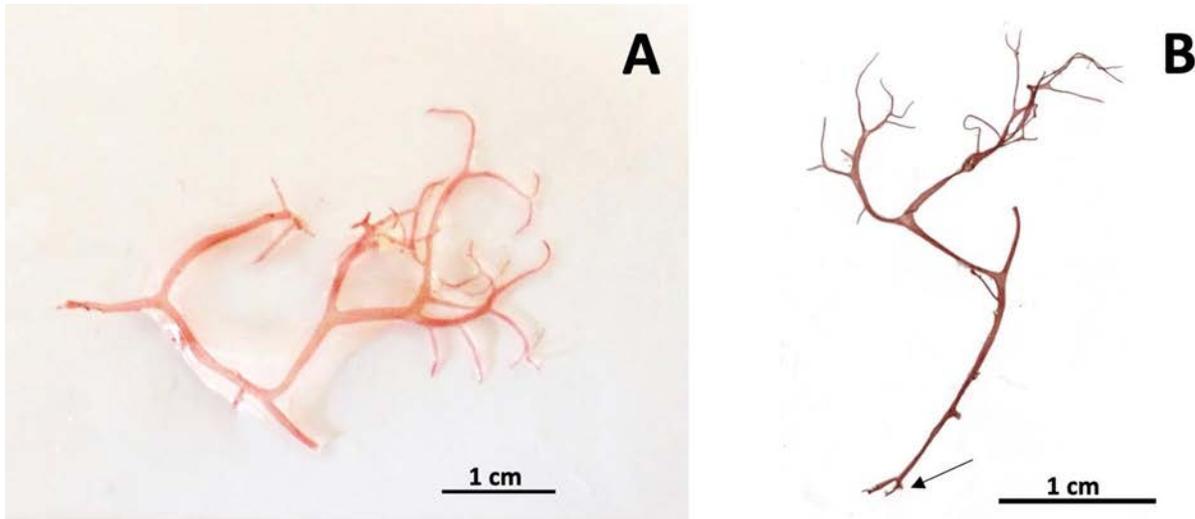


Photo: (Left) Nā Wa‘a Mauō Marine Stewardship Program teaches canoa (wa‘a) handling. (Right) HAAS Charter School students learn how to study their watersheds. (Photos: Hōkū Pihana).

Research and Field Operations

Scientists Name New Species After Papahānaumokuākea Educator Yumi Yasutake

On November 7, a team of scientists (including PMNM research ecologist Randy Kosaki) published the scientific description of a new species of red algae from Papahānaumokuākea. The new alga, *Calliblepharis yasutakei*, was named after widely respected marine educator and scientist Yumi Yasutake, who passed away in 2021 at the age of 41. Yasutake worked for many years at Papahānaumokuākea’s Mokupāpapa Discovery Center in Hilo, Hawai‘i, where he was fond of teaching students how to make beautiful presses of seaweeds from local beaches. It is thus fitting that a new species of algae from Papahānaumokuākea will bear his name in perpetuity. The algae was discovered by scientists using technical closed-circuit rebreathers to dive to extreme depths in excess of 300 feet. These deep coral reefs, or so-called Mesophotic Coral Ecosystems, are virtually unexplored, and host a wealth of undiscovered biodiversity. The full scientific paper was published in the journal *Phytotaxa*.



Fresh (A) and pressed (B) specimen of *Calliblepharis yasutakei*, originally collected at 323 feet at Kapou (Lisianski Island). Photo credit: Monica Paiano, University of Hawai'i at Manoa.

PMNM Scientists Validate Use of Satellite Imagery to Track Invasive Alga

On November 29, the journal *Coral Reefs* published the paper, "Using commercial high-resolution satellite imagery to monitor a nuisance macroalga in the largest marine protected area in the USA." Ground-truthing by divers confirmed that dark patches visible in readily available World View 2 (WV2) imagery coincided with areas of heavy infestation by *Chondria tumulosa*, the invasive alga recently described from Manawai (Pearl and Hermes Atoll, PMNM).

Full citation: Fraiola K., Miura T., Martinez J., Lopes K.H., Amidon .F, Torres-Perez J., Spalding H., Williams So K., Sachs E., Kosaki R. 2022. Using commercial high-resolution remote sensing to monitor a nuisance macroalga in the largest marine protected area in the USA. *Coral Reefs* DOI: [10.1007/s00338-022-02336-6](https://doi.org/10.1007/s00338-022-02336-6)

Photo: Emergency preparedness and disaster kits. Contents of personal emergency preparedness kit (Photos: J. Leonard).

PMNM Field Team Conducts Oahu Acoustic Mooring Deployment

On November 29th, PMNM Field Team members LTJG Luke Evancoe and Jason Leonard prepared and deployed an acoustic mooring package for the Sound Monitoring Project Sanctuary Soundscape Monitoring Project (SanctSound) in the waters off Makapu'u. The data collected from this device will help ONMS researchers identify the distribution of humpback whale occurrence off of O'ahu. The mission also allowed the field team to conduct small boat drills and test NOAA small boat Malolo R1903 after recent servicing.

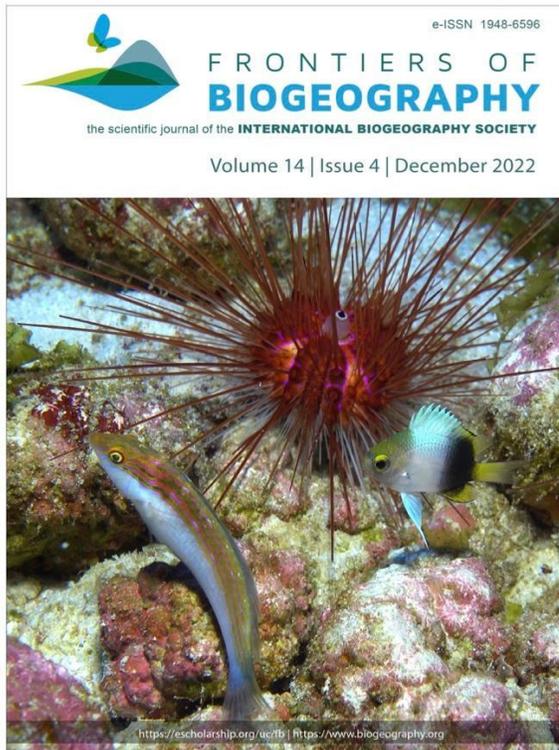


Photo: (Left) LTJG Luke Evancoe navigating to buoy drop site. (Right) Buoy sound monitoring package at the Makapu'u site (Photos: J. Leonard).

New Hypothesis Links Sea Level Changes and Habitat Stability with Coral Reef Diversity

On December 27, the journal *Frontiers of Biogeography* published an article proposing “The Habitat Persistence Hypothesis” (HPH) to explain the biogeographical distributions of organisms inhabiting tropical coral reefs. The HPH posits that deep mesophotic reefs (50-100+ m) are relatively unaffected by sea level changes associated with cycles of glaciation. Conversely, shallow atoll habitats (i.e. lagoons) would lose a large majority of their area (and thus much of their diversity) with each glacial maximum and associated sea level drops of up to 100 m. The HPH thus implies that the shallow-reef distributions observed today are the result of processes happening on timescales of tens of thousands of years, rather than hundreds of thousands or millions of years. The link between sea level fluctuations and within-habitat diversity on coral reefs was first proposed by PMNM research ecologist (and co-author on the current paper) Randy Kosaki in a paper back in the 1990s. The current iteration of the HPH, posing seven testable sub-hypotheses, was from the dissertation of Dr. Joshua Copus, a long-time PMNM deep reef research collaborator who was lost on a research expedition to the Solomon Islands in 2019. Copus is first author on the HPH paper, which was completed and published posthumously by his dissertation committee members.

Full citation: Copus JM, Pyle RL, Bowen BB, Kosaki RK, Webster JM. 2022. The Habitat Persistence Hypothesis: a new perspective on the distribution of coral-reef organisms. *Frontiers of Biogeography* e57427. DOI:10.21425/F5FBG57427.



Frontiers of Biogeography 2022, 14:4, e57427

PERSPECTIVE

Frontiers of Biogeography
the scientific journal of
the International Biogeography Society

The Habitat Persistence Hypothesis: a new perspective on the distribution of coral-reef organisms

Joshua M. Copus^{1,2†}, Richard L. Pyle¹, Brian W. Bowen², Randall K. Kosaki³ and Jody M. Webster⁴

¹ Ichthyology, Bernice P. Bishop Museum, 1525 Bernice Street, Honolulu, Hawai'i 96817, USA. E-mail: deepreef@bishopmuseum.org;
² Hawai'i Institute of Marine Biology, University of Hawai'i, 46-007 Lilipuna Road, Kane'ohe, Hawai'i 96744, USA;
³ Papahānaumokuākea Marine National Monument, 1845 Wasp Blvd, Building 176, Honolulu, Hawai'i 96818, USA;
⁴ Marine Studies Institute, Geocoastal Research Group, School of Geosciences, The University of Sydney, NSW 2006, Australia
[†] Deceased.

Abstract
 We propose and define the "Habitat Persistence Hypothesis" (HPH) to explain the biogeographical distributions of organisms (especially fishes, invertebrates and algae) inhabiting tropical coral reefs. Both published and unpublished sources indicate that species occurring on deep coral reefs show higher rates of endemism and a shallower biodiversity gradient across the Pacific Ocean than their counterparts inhabiting shallow coral reefs. The HPH accounts for these biogeographical differences by stipulating that deep reefs are relatively unaffected by sea level changes associated with glacial-interglacial cycles. Shallow-reef habitats may persist across sea level changes in regions with sloped bathymetry (e.g., continental regions and large islands), but are largely extirpated in regions with steep bathymetry (e.g., coral atolls). The HPH suggests that regions with habitat persistence are characterized by higher rates of endemism, and that patterns of attenuating diversity with increasing distance from centers of species richness are shaped by relatively recent recolonization of less persistent habitats from regions with greater habitat persistence. Whereas most existing hypotheses that attempt to explain biogeographical patterns observed on coral reefs (especially in the Indo-Pacific region) rely on observations limited to shallow (<30 m) coral-reef habitat and invoke processes operating on speciation time-scales (10^3 – 10^4 yr), the HPH incorporates patterns observed within the remaining 80% of coral-reef habitat, (30–150 m) and invokes processes operating on time scales associated with sea-level changes (10^5 – 10^6 yr). The HPH posits seven specific predictions about coral-reef biogeography that can be directly tested to distinguish it from previous hypotheses. Our intention is to describe the rationale and qualitative support for the HPH with the hope of providing a framework for accumulating sufficient quantitative data to test the predictions, which we anticipate will require decades of robust field surveys.

Highlights

- A novel hypothesis is presented to account for patterns of geographic distribution of marine organisms inhabiting both shallow and deep coral-reef habitats.
- In contrast to most existing hypotheses of tropical marine biogeography, the basis for the hypothesis reflects decades of published and unpublished data and observations across the entire depth range of coral-reef fishes (0–150m).
- The hypothesis posits that differences in large-scale biogeographic patterns between shallow- and deep-reef organisms is at least partly driven by the effects of sea-level changes associated with glacial cycles on persistence of shallow vs. deep habitats in areas with sloped vs. steep bathymetry.
- The hypothesis implies that much of the shallow-reef distributions observed today are the result of processes happening on timescales of tens of thousands of years (glacial cycles) rather than hundreds of thousands or millions of years (evolution and/or plate tectonics).
- Apparent increased rates of local endemism among species inhabiting deep habitats and shallow habitats in areas of sloped bathymetry (compared to shallow habitats in areas of steep bathymetry) are the result of habitat persistence allowing commensurate persistence of isolated populations for timescales sufficient to allow for evolutionary divergence.

Keywords: biodiversity hotspot, center of origin, Coral Triangle, coral reef, dispersal, endemism, marine, mesophotic coral ecosystems, sea level change, speciation

The journal "Frontiers of Biogeography" published the Habitat Persistence Hypothesis, and featured a cover photo of rare endemic marine life from the mesophotic (deep) reefs of PMNM. Pictured is a new species of wrasse (*Suezichthys n. sp.*), a rare, endemic deep-water Struhsaker's damselfish (*Chromis struhsakeri*), and a probable new species of urchin (*Diadema sp.*).

Scientists Describe and Name Newly Discovered Red Alga from HIHWNMS

On December 15, the journal *Algae* published the description of a new species of red algae, *Halopeltis nuahilihilia*, from HIHWNMS waters off Hawai'i Island. PMNM rebreather divers Randy Kosaki and Jason Leonard collected the holotype of this species at 300 ft. depth in 2015 during a joint HIHWNMS-PMNM research cruise on NOAA ship Hi'ialakai. The Hawaiian species epithet was conferred by the PMNM Native Hawaiian Cultural Working Group. "Nu'a" describes the thick growing nature of the alga. "Hilihili" refers to the action of braiding or plaiting. Together, these names honor the twisted-like appearance of this alga, which also earned it the nickname, "Mr. Twisty", from scientists. *Halopeltis* is a new genus record for the Hawaiian Islands. In addition to Kosaki and Leonard, PMNM's Keo Lopes, Jr. is also a co-author on the paper.

Full citation: Alvarado EA, Cabrera FP, Paiano MO, Fumo JT, Spalding HL, Smith CL, **Leonard J, Lopes KH, Kosaki RK, Sherwood AR.** 2022. Unveiling mesophotic diversity in Hawai'i: two new species in the genera *Halopeltis* and *Leptofaucheia* (Rhodymeniales, Rhodophyta). *Algae* 37(4):249-264. <https://doi.org/10.4490/algae.2022.37.10.31>



Holotype of Halopeltis nuahilihilia, a new species of red algae collected at 300 ft. from HIHWNMS waters off Hawai'i Island by PMNM rebreather divers.

PMNM Dive Team Conducts Closed Circuit Rebreather Work Up Dives

Over the past month, PMNM Field Team members Keo Lopes, LTJG Luke Evancoe, and Jason Leonard have worked to reconstitute PMNM's technical dive program. Closed Circuit Rebreather (CCR) equipment allows divers to experience safer dives that require extended underwater times and greater depths. The unit dive team, as well as their CCR gear, is undergoing intense scrutiny in order to make sure they are prepared to facilitate deep water data collection within PMNM this summer. In order to refresh themselves with the technical dive equipment, the team started out slowly by conducting pool dives, and have gradually progressed out into the ocean at increasing depths; extensive pre-dive checklists, safety drills, and underwater/above water communication have been the foundational concepts that the team is perfecting before the summer cruise season.



Photo:(Top) Keo Lopes and LTJG Luke Evancoe team up to give dive and vessel safety briefs. (Bottom) Closed circuit rebreathers on deck after a dive. (Photos: J. Leonard).

Agency Coordination

PMNM and NOAA Team Wins “People’s Choice Award” for Holiday Sculpture Competition

Papahānuamokuākea and NOAA staff win the “People’s Choice Award” at an all-NOAA gingerbread house competition. The annual competition challenges teams to create the best 100% edible holiday sculpture within a 2-hour window. This year’s winning creation, *Year of the Limu 2022* celebrates the year of the limu (seaweed) with beautifully crafted species from the ocean depths to the intertidal zone in Papahānaumokuākea including native limu, honu (Hawaiian green sea turtle), queen nenuē (pilot fish), ‘opihi (limpet), hā’uke’uke (sea urchin), pūnohu (pencil urchin), ko’a (coral), he’e (octopus), puihi (eel), papa’i (crab), pūpū (shell), and pololia (jellyfish).



Left to Right: 'Team Limu Hui' (Alyssa Miller, Malia Evans, Kanoe Morishige, Kahi Fujii, Pua Kamaka, Kilo Ka'awa-Gonzales, Luke Evancoe, and Brian Hauk—not pictured are Kaipō Perez and Pua Borges) captures the People's Choice award at the annual IRC competition (Credit: Leon Geschwind/NOAA). 'Year of the Limu 2022' holiday sculpture (Credit: Kahi Fujii/NOAA).