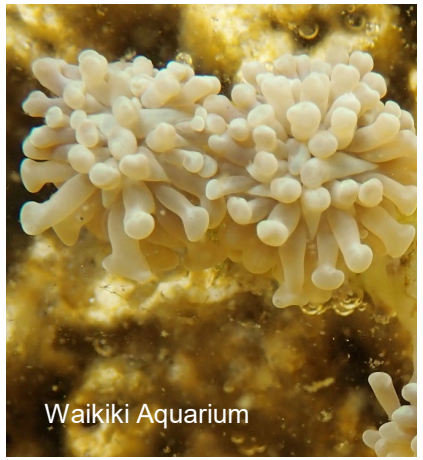

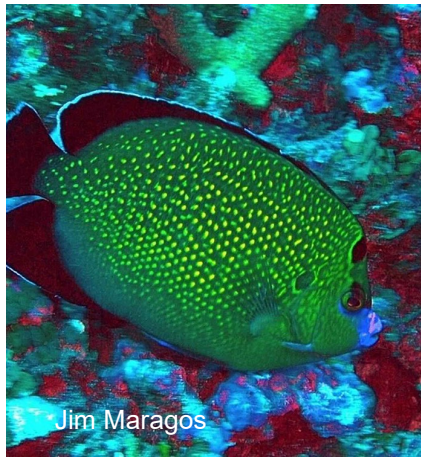

Response to Pulse Coral (*Unomia stolonifera*) and Kenyan Tree Coral (*Capnella cf spicata*), and considerations for secondary pathways

Pacific Ballast Water and Biofouling Working Group Meeting, 4/29/25

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STOP THE SILENT INVASION
COORDINATING GROUP ON ALIEN PEST SPECIES

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Pulse coral (*Unomia stolonifera*)

- Pulse coral is a soft (non-reef-building) coral with a fleshy base and many stalks, each ending in eight tentacles (octocoral) that capture and eat plankton and small animals from the water column. Pulse coral also contains zooxanthellae, tiny cells that photosynthesize and provide extra energy to the pulse coral.
- Grows attached to hard bottom, coral, and in loose rubble. Forms dense colonies with 50-80% coverage, kills coral, reduces fish and invertebrate populations, and overall reef value.

Unomia stolonifera, also known as pulse coral, in Pearl Harbor, the first record of this species in state waters, and believed to be the first in the U.S. Photo: Stantec GS/Sea Engineering Inc./Marine Resource Consultants Team.

Pulse coral (*Unomia stolonifera*)

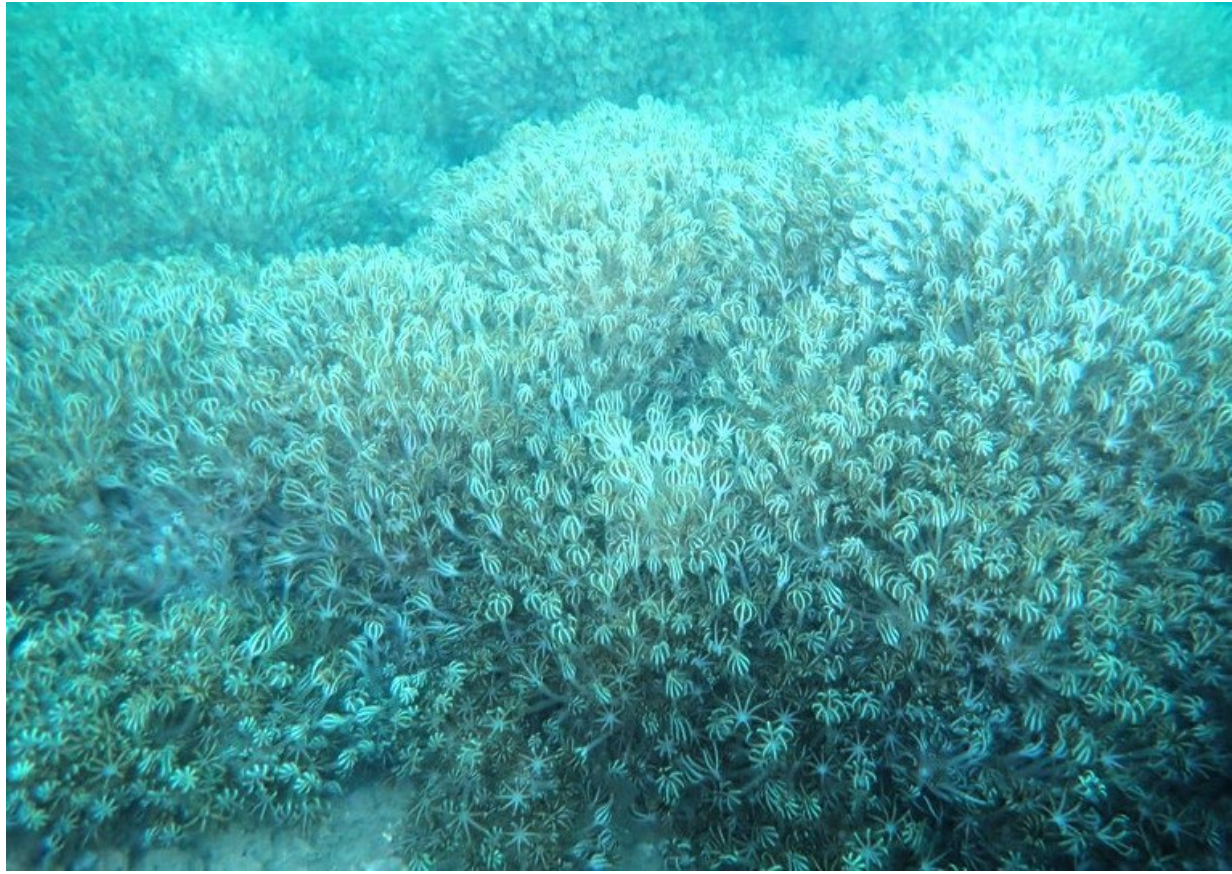
- Multiply and spread via **fragmentation, budding**, and sexual reproduction (assessing sexual reproduction capacity. Internal brooders with **planulae dispersal likely**)
- **Fragments drift with seafloor current and can reattach to the bottom** or to other drifting items (example in image F from Venezuela)
- If allowed to spread to areas where they are close to vessel hulls, **they may be able to attach and spread via biofouling** (not observed during ongoing monitoring of ship hulls and ballast, Small vessel movement minimized in infestation zone)
- We have a goal of **eradication through adaptive management** (e.g. learn as you go)

Top: *Unomia stolonifera* (formerly known as *Xenia elongata*) was recently redescribed based partly on the **presence of polyps along the stalk**. Fragments drift (E) and can re-attach (F). Photo D: Reefbuilders; photos E, F: Ruiz-Allais et al 2021

Video provided by *Stantec GS/Sea Engineering Inc./Marine Resource Consultants Team.*

HI Timeline: *U. stolonifera*

- 2017 anecdotal report by fishermen of a “stinky anemone” washed ashore in the area (DAR, pers comm).
- 2020: benthic surveys of Pearl Harbor at Joint Base Pearl Harbor Hickam, Oahu report of an unidentified xeniid octocoral (no samples taken, no delimiting, estimate was approx. 9 acres)
- Fall 2022: U.S. Navy engages partners to advise on control techniques across est. 37,000 m^2

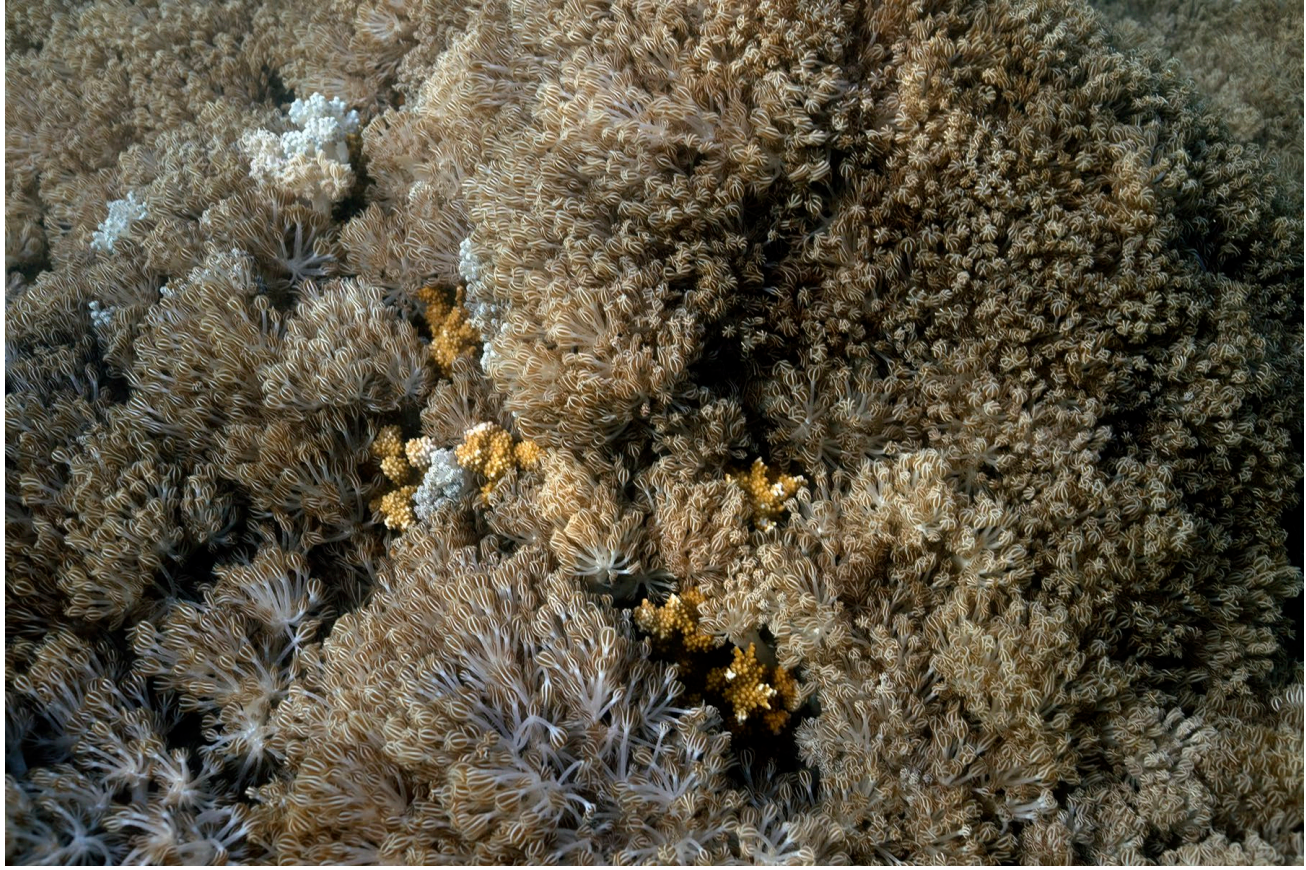


In 2020, an unknown Xeniid species was observed and reported to the U.S. Navy as part of benthic surveys in support of the P-209 Dry Dock 3 Replacement. Photo: Stantec GS/Sea Engineering Inc./Marine Resource Consultants Team.

Timeline (cont.)

- January 2023: multi-agency Hawaii Invasive Octocoral Working Group formed to advise and assist; agree to the **goal of *eradication using an adaptive management approach,*** *with the* understanding that it will take years

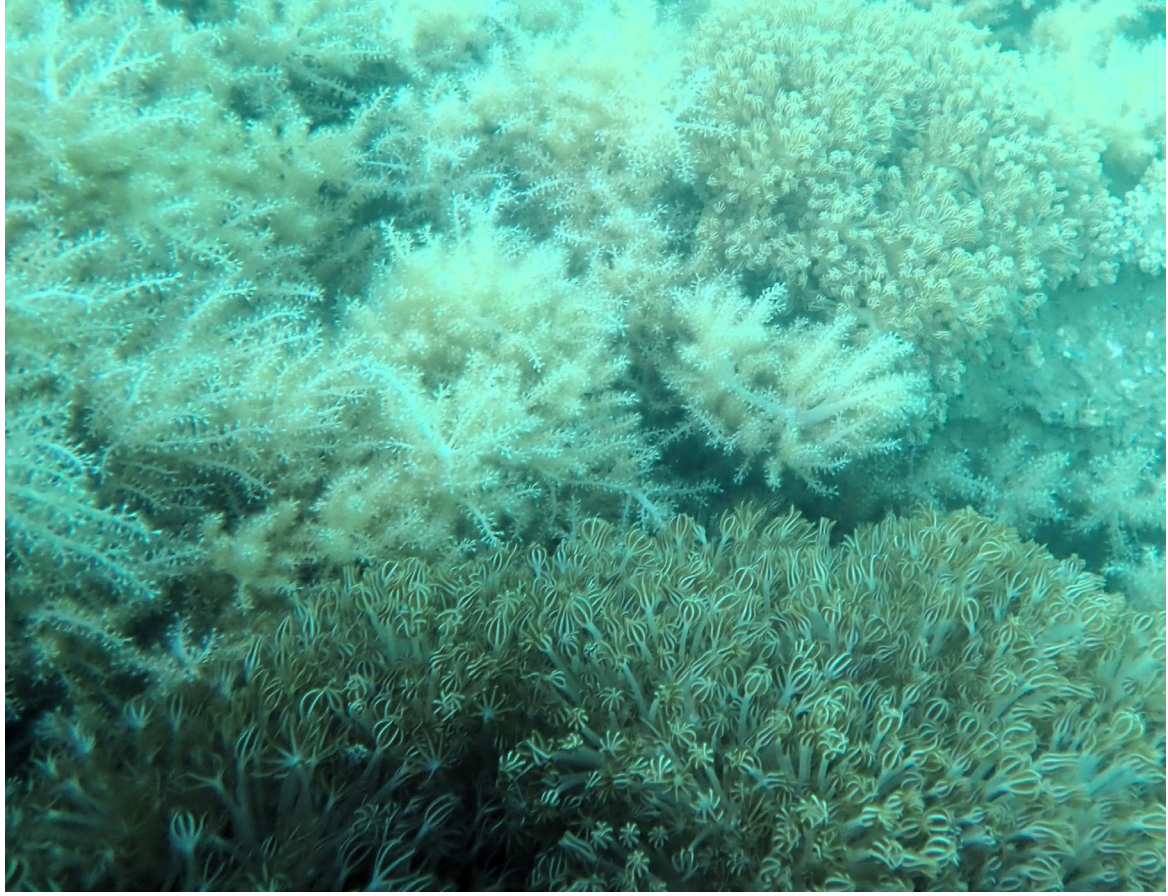
- February 2023: Sampling protocol developed, 6 samples collected by Pearl Harbor Naval Shipyard Dive Locker divers **noting growth on all hard substrates, including pilings in 17-22’ depth water**



Unomia overgrows and kills sessile species, displaces the biota that rely on them, and excludes the settling and growth of other species. Photo: *Stantec GS/Sea Engineering Inc./Marine Resource Consultants Team.*

Timeline

- March/April 2023: ID by partners: *Unomia stolonifera*
- *Anemonia manjano* found in March 2023 nearshore at Ford Island, a separate introduction event, likely aquarium
- May 2023: U.S. Navy contractors conduct delimiting surveys via SCUBA and ROV, determine that Unomia is still contained within harbor but spread across channel.
- May 2023 shoreline site visit found additional octocoral species within core Unomia area, identified as *Capnella cf. spicata*.



Unomia (bottom of photo) and Capnella, also known as Kenyan tree coral (top of photo). Photo: Stantec GS/Sea Engineering Inc./Marine Resource Consultants Team.

Results of Contractor Surveys in 2023

- ***Unomia* "footprint" (known + buffers) is approx. 82 acres**; *Capnella* occupies .8 acres within *Unomia* core, believed the original introduction site
- 2 goldspotted or goldflaked angelfish (*Apolemichthys xanthopunctatus*) and a few colonies of hammer coral (*Euphyllia* sp.) also within the supposed original release site
- A corallimorph (*Rhodactis* sp.) occupies about .06 acres within the Unomia core, but distance suggests it could be a different introduction event

Anemonia manjano, found in 2023 in shallow waters in a different area of Pearl Harbor, can attach to drifting objects. All but one of these 6 species are popular in the marine aquarium trade and are illegal to import, possess, and release in Hawaii. Photo: U.S. Navy – Joanne Hayag.

Findings & Control trials to-date: pier, small boat harbor

- **Pier piles wrapped in pallet wrap plastic and secured**. Lethality within 3 days, but left for 1 week. New Unomia buds/fragments continued to establish on pier piles from harbor floor, so new management trial (next bullet)
- **Current trial to manage recruitment up pier piles: silt curtain as a skirt** around pier, anchored at base via sand bags. 100% effective if left in place and no recruitment to the skirt material to date
- **Manual removal** in areas with soft sediment, placed in fine-mesh bags to prevent fragment escape, dewatered, then left on land to desiccate. Lesson: Easy to remove from soft substrate but some new fragments reinvaded within days
- **For *Unomia*, tarps sealed with sandbags effective at 8 days.** Some native hard corals bleached but recovered. Tarps **ineffective on *Capnella*—**induces budding.
- Ingress (not re-growth from basal material) of a few pieces in as little as a week. **When left unmanaged for several months, 100% re-invasion**.

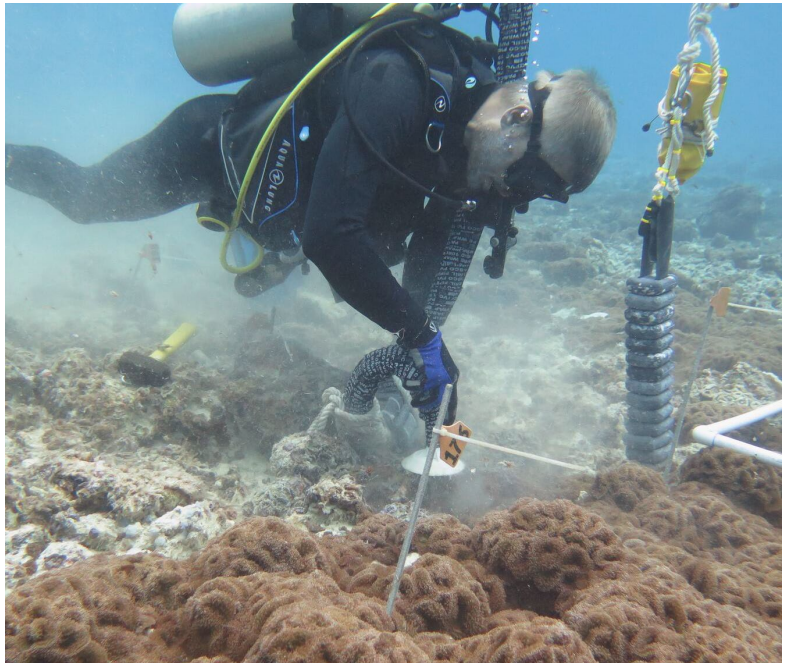
Next steps:

- Secure dedicated funding for DOD to continue to ensure the infestation is not allowed outside of the harbor and to move steadily towards eradication
- Secure additional funds to regularly survey outside of the harbor
- Continue to pursue mirroring of local laws in DOD installation regulations
- Provide opportunities to surrender illegal pets & provide outreach

New Hawaii campaign, “Don’t Let it Loose Hawaii” launched October 28, 2024. Logo by Hannah Chang for open use/modification by other jurisdictions upon request to CGAPS.

Next steps:

1. ESTCP grant to Thierry Work USGS National Wildlife Health Center for hot water treatment units, $979K
2. REPI funding for DAR, subaward to UH HIMB Toonen Lab and Bishop Museum: eDNA post-doc and cnidaria barcoding, $168K
3. Hawaii Invasive Species Council FY25 grants for eDNA to UH HIMB Toonen Lab, $43,274; and outreach display @ Bishop Museum via CGAPS, $4,000
4. SERDP grant to NMFS PIFSC/CIMAR awarded, $600K year 1 (4 yr award, total amount TBD) for AI detection of imagery, eDNA, and some survey work
5. USFWS ANS EDRR to the U.S. Navy, $245K. Funding for additional surveys on the southern (seaward-most) edge of the infestation and the development of a response plan. Spending of award is on hold due to federal order
6. NFWF Coral Reef Stewardship awarded to UH Pacific Cooperative Studies Unit for CGAPS, USGS NWHC, and Bishop Museum, $79,669.13. Support for an early detection/ID & state waters response planning and statewide EDRR workshops, update rapid response plan, some eDNA/barcoding.



USGS scientists and partners applied hot water as a control method for invasive corallimorphs at Palmyra Atoll National Wildlife Refuge. An ESTCP grant is supporting modifications and trials in Pearl Harbor. Photo from: https://www.usgs.gov/news/state-news-release/new-tools-manage-invasive-species-threaten-palmyra-atolls-coral-reefs

Hawaii Invasive Octocorals Working Group & Assistance:

- U.S. Navy
- Hawaii Department of Land and Natural Resources – Division of Aquatic Resources
- Hawaii Invasive Species Council
- University of Hawaii – Coordinating Group on Alien Pest Species, ToBo Lab at Hawaii Institute of Marine Biology, Cooperative Institute for Marine and Atmospheric Research
- U.S. Fish and Wildlife Service - Pacific Islands Fish and Wildlife Office
- National Oceanic and Atmospheric Administration – National Marine Fisheries Service - Pacific Islands Regional Office, Pacific Islands Fisheries Science Center, Papahānaumokuākea Marine National Monument
- U.S. Geological Survey – National Wildlife Health Center Honolulu Field Station
- Bishop Museum
- Williams College

Drs. Cathy McFadden, Yehuda Benayahu, and Les Watling also provided information and advice; and the papers by Ruiz-Allais *et al.,* 2014, 2021 have been invaluable.

Mahalo!

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- Hawaiʻi Invasive Species Council
- Hawaii Department of Land and Natural Resources-Division of Forestry & Wildlife
- National Park Service
- U.S. Fish & Wildlife Service

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