# The United States report to the 38th International Coral Reef Initiative (ICRI) General

9th – 13th September 2024 Jeddah, – Kingdom of Saudi Arabia

**Reporting Period: 2023 & 2024**

---

## A. Member Information:

- Name of ICRI member:
  Christine Dawson and Jennifer Koss
- Name of person(s) completing member's report:
  Michael Lameier
- Position/Title:
  ICRI Co-chairs
- Email:DawsonCL@state.gov and jennifer.koss@noaa.gov
- Are you a designated ICRI Focal Point: **Yes** ☐ No
  - If no, please indicate who you are completing the form on behalf of:
- Which was the last General Meeting you attended: 37th
- Will you be attending the 38th ICRI General Meeting in Jeddah, Kingdom of Saudi Arabia: ☐ **Yes** ☐ No
- Member social media:
  - Twitter/X: @noaacoral, @SciDiplomacyUSA
  - Facebook: @uscoralreefgov, @statedept
  - Instagram: @noaacoral, @sciencediplomacy_usa

**B. Reporting on the implementation of the ICRI Plan of Action 2021-2024: turning the tide for coral reefs.** *Your responses will help inform the Secretariat about members' contributions toward the current Plan of Action. You can download the ICRI Plan of Action here: https://icriforum.org/documents/plan-of-action-2021-2024/*

What are the main contributions you, as an ICRI member, have made to the ICRI Plan of Action?

**Hyperlinks:**

**Theme 1 - Preparing for the Future: Promoting Resilient Coral Reefs**
**Theme 2 - Coral Reef Science and Oceanography: Advancing and Utilizing the Latest Science and Technology**
**Theme 3 - Local Threat Reduction: Integrating Response Planning Frameworks**
**Theme 4 - Diversity and Inclusion: Expanding the Coral Reef Community**

*Answer:*

## Theme 1 - Preparing for the Future: Promoting Resilient Coral Reefs

1.A - Strengthening policies - Supporting conservation and recovery of coral reefs and associated ecosystems through resilience-based management frameworks

Resilience-based management (RBM) is the central focus of the Climate Change Pillar of NOAA CRCP's Strategic Plan. The recent reauthorization of the Coral Reef Conservation Act included the creation of a National Coral Reef Resilience Strategy, which will drive coral reef conservation in the United States through 2040. This new national strategic plan calls for the use of resilience-based management throughout five conservation areas - capacity-building, corals, fisheries, communities, and water quality and specifically lists RBM under climate change and coral restoration strategies.

At COP27 in November 2022, USAID announced a $15M funding commitment to create Egyptian Red Sea Initiative (ERSI), an initiative aimed at conserving the Red Sea's coastal ecosystem by investing in businesses that positively contribute to coral reef conservation. ERSI is expected to:

1. Establish a conservation trust fund (CTF) and business incubator to invest in reef-positive businesses that will build community resilience against climate change, reduce emissions, and create jobs;
2. Protect the Red Sea's coral reef and surrounding coastal ecosystem against the impacts of climate change and human activity;
3. Empower local communities to lead on climate action; and
4. Partner with private businesses and other donors to leverage up to $50 million in additional funding.

1.B - Promote capacity building for applying resilience-based management approaches to coral conservation Ad Hoc Committee on Resilience-based Management.

Below are two examples, one from Hawaii and one from Florida of leading practices, techniques, and strategies for building reef resilience that your organisation/country is involved in. Include their location and extent, methods of implementation, financing, and an assessment of their results (or likely results), with links for more information if possible.

**Updated herbivore rules in Hawai'i**

The Hawai'i Department of Land and Natural Resources – Division of Aquatic Resources (DLNR-DAR) recently passed updated herbivore rules on select species of herbivorous fish, including minimum harvest size adjustments for manini (the convict surgeonfish) and kole (yellow-eyed surgeonfish) and bag limits for uhu (parrotfish) and ala (blue spin unicornfish) after a two-year public scoping process. This is part of the Hololua Marine Initiative.

**Florida's Resilience Action Plan**

The Resilience Action Plan for Florida's Coral Reef 2021-2026 was developed by the Florida Reef Resilience Program to define the critical, near-term steps that the reef management community, policy makers, and reef users must take now and maintain for the foreseeable future in order to tackle threats to reefs and rapidly increase restoration efforts. It is complementary to existing and emerging plans focused specifically on coral disease response, coral reef restoration, and place-based management of the national and state parks, national marine sanctuary, and state conservation area that encompass essentially all of Florida's Coral Reef.

1.C - Promote and build capacity for the restoration of resilient coral reefs Ad Hoc Committee on Reef Restoration

Through historic legislation, including the Bipartisan Infrastructure Law and the Inflation Reduction Act, more than $ 176,380,339.00 million in grant funding for Transformational Habitat Restoration, Coastal Resilience, and Habitat Protect and Restoration has been awarded to partners in U.S. states and territories in 2023-24. These funds will help to enhance reef resilience in all U.S. coral reef states and territories.

Along with these efforts, in October of 2023, the US Coral Reef Task Force adopted a resolution recognizing coral reefs as National Natural Infrastructure. This resolution supports similar declarations already made by multiple U.S. states and territories. These declarations have already led to shifts in funding for coral reef restoration, including a Federal Emergency Management Agency (FEMA) Hazard Mitigation award in Puerto Rico. $3 million has been allocated for this initiative, which could total up to $38.6 million over multiple planned phases.

## Theme 2 - Coral Reef Science and Oceanography: Advancing and Utilizing the Latest Science and Technology

*2.A - Coral monitoring capacity building*

The U.S., in conjunction with the GCRMN data task force, is working with other task force members (e.g. Dr. Manu Gonzalez-Rivero, AIMS, ReefCloud) to better integrate training datasets for coral monitoring platforms used by the GCRMN globally (CoralNet, ReefCloud, MERMAID, etc). This will help build capacity in that it better aligns different platforms to increase interoperability and comparability between them for future reporting efforts. In theory, it will also increase capacity at a more local level as it will make it easier for users to upload their data and have these platforms generate output for them, as many data contributors are limited in analytical capacity.

*2.B - The Global Coral Reef Monitoring Network (GCRMN)*

The U.S. is contributing to three major regional or global reports via the GCRMN this year (2024): the Pacific node regional report (expected end of 2024), the Caribbean node regional report (expected mid-2025), and the next global report (expected early 2026). The GCRMN data task force, co-chaired by U.S. NOAA staff Dr. Erica Towle, is an integral part of leading the process that guides these reports. Towle also serves as editor of the Pacific regional report. The regional and global reports are incorporating socioeconomic data for the first time. Global SocMon case studies will be featured in the reports, highlighting quantitative socioeconomic results of coastal community interactions with coral reefs.

## Theme 3 - Local Threat Reduction: Integrating Response Planning Frameworks

Below is a summary of accomplishments from the U.S. Coral Reef Task Force Jurisdictional locations:

**American Samoa**
BLEACHING RESPONSE PLAN: American Samoa finalized its territory-wide Coral Bleaching Response Plan in February after holding five Coral Reef Advisory Group (CRAG) Technical Committee and Executive Council meetings.

**Commonwealth of the Northern Mariana Islands (CNMI)**
BLEACHING RESPONSE PLAN: Elly Perez, NOAA Coral Management Fellow, completed the development of a CNMI Bleaching Response Plan. This plan will be very useful for the CNMI as we expect bleaching to occur in the Saipan Lagoon.

**Florida**
CORAL BLEACHING RESPONSE PLANNING: Building off the previous bleaching response plan, Florida's Coral Reef Resilience Program developed lessons learned from 2023's bleaching event, including preferred intervention actions to be taken in preparation for and response to future events.

FRAMEWORK DEVELOPED: Florida's Coral Reef Coordination Team finalized a framework of actions to align water quality and benthic monitoring programs from the Everglades through the estuaries and across Florida's Coral Reef.

**Guam**

DISTURBANCE RESPONSE: The Guam Department of Agriculture hired a Reef Response & Restoration Coordinator to plan and coordinate disturbance response.

**Hawai'i**

UNOMIA: Hawai'i partners are responding to the spread of two species of non-native octocoral (*Unomia stolonifera* & *Capnella spicata*) introduced to the Pearl Harbor watershed on O'ahu by an aquarium release. *U. stolonifera* has spread to a surveyed 82 acres in Pearl Harbor and may spread further into State waters. The U.S. Navy has been testing removal methods. DAR is seeking funding to support further survey efforts throughout the State to monitor for new signs of invasion.

**U.S. Virgin Islands (USVI)**

U.S. REGIONAL SCTLD WORKSHOP: The USVI Department of Planning and Natural Resources' Coastal Zone Management Program successfully assisted in hosting the 2024 annual U.S. Caribbean stony coral tissue loss disease (SCTLD) workshop on St. Croix, USVI, focusing on coral rescue and coral disturbance management with Florida, Puerto Rico, and USVI participants.

EXPANDING FROM DISEASE TO DISTURBANCE: The Coral Disease Response and Restoration Coordinator is transitioning the Virgin Islands-Coral Disease Advisory Committee towards the Virgin Islands-Coral Disturbance Response Committee.

CORAL REEF EMERGENCY RESPONSE: USVI is working on emergency response efforts focused on bleaching events, storm damage, and vessel groundings.

**National**

The U.S. is working on a standardized bleaching monitoring protocol via the U.S. Coral Reef Task Force, which we hope to complete by the end of 2024. This protocol will be free and open access to our international partners and will be a best practices document that seeks to help surveyors target the most important metrics to gather before, during, and after a bleaching event to improve the way the coral reef conservation community can report on bleaching event impacts and potential recovery.

U.S. Coral Reef Task Force Coral Disease & Disturbance Working Group:
The U.S. Coral Reef Task Force Coral Disease & Disturbance Working Group supports local coral reef disturbance response, mitigation, and prevention efforts across the seven U.S. coral reef states and territories. It enhances coordination among activities occurring at the national level. Coral disturbances include coral disease outbreaks with significant impact, thermal stress events and bleaching, invasive/nuisance species, major storm events, and industrial disturbances. The Working Group ensures communication, coordination, and information-sharing among jurisdiction and federal partners. Efforts to support integrated responses to coral reef disturbances are organized under sub-teams:

- The Atlantic/Caribbean Team focuses on supporting local disturbance response in Puerto Rico, the US Virgin Islands, and Florida. Major initiatives include annual Caribbean Cooperation Workshops focused on increasing collaboration in the U.S. Caribbean; the identification of strategies to build capacity; and the development and distribution of communications materials.

- The Transmission Team focuses on reducing the likelihood of transmission of stony coral tissue loss disease (SCTLD). The team works to develop and distribute best management practices to relevant user groups, including the shipping industry; coordinate transmission-focused research; and identify regulatory and policy mechanisms to help reduce the threat of transmission.
- The Pacific Preparedness Team supports disturbance preparedness and response, with an emphasis on biosecurity, in the U.S. Pacific island jurisdictions of Hawai'i, American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands. The Team has developed SCTLD surveillance guidelines for the Pacific; hosts technical trainings and cross-basin in-person workshops; and the identification of resources to support capacity-building.
- The Invasive Soft Coral Team is a collaboration between the U.S. Coral Reef Task Force and the U.S. Aquatic Nuisance Species Task Force and focuses on supporting preparedness, prevention, and response efforts targeted at invasive soft corals that have invaded or are at risk of invading U.S. coral reefs.

More information is available at https://www.coralreef.gov/disease/welcome.html

## Theme 4 - Diversity and Inclusion: Expanding the Coral Reef Community

4.A - Connect with youth audiences

Knauss Fellows
NOAA Sea Grant John A. Knauss Fellowship

The NOAA Sea Grant John A. Knauss Fellowship was established to provide a unique educational and professional experience to graduate students interested in ocean, coastal, and Great Lakes resources, as well as the national policy decisions affecting those resources. This fellowship matches highly qualified graduate students with "hosts" in the legislative and executive branches of government and is a vital pathway for fostering the next generation of leaders in ocean and coastal policy, including but not limited to coral reef conservation.

NOAA's Coral Reef Conservation Program typically hosts one Knauss Fellow each year, although several other host offices also touch on coral reef-related issues. The CRCP fellow works directly with the U.S. Coral Reef Task Force USCRTF), gaining experience with various federal agencies as well as with local managers in the U.S. coral reef jurisdictions. Fellows are immersed in various pressing coral reef management issues and have worked on numerous projects related to the ongoing work of the USCRTF working groups, which span a wide array of coral reef-related topics, from climate change to communication to watershed management.

The Knauss Fellowship is crucial for capacity building in national and international coral reef management, offering essential training and skill development for early career ocean professionals. Previous fellows have gone on to work for federal agencies like NOAA and other agencies like state natural resource agencies that deal with coral reef-related issues or other ocean issues that may indirectly impact coral reefs.

**US Coral Reef Task Force (USCRTF) Coral Management Fellows Program**

The US Coral Reef Task Force supports the Susan L. Williams National Coral Reef Management Fellowship. The Fellowship was first established in 2003 to increase local capacity for coral reef management and conservation in the seven US All Islands Committee (AIC) jurisdictions, including Florida, Puerto Rico, the US Virgin Islands, Hawai'i, American Samoa, Guam, and the Central Northern Marianas Islands. Since 2016, Nova Southeastern University has administered the program, supporting 37 Fellows in five cohorts. Overall, since its inception in 2003, the program has supported 73 fellows. This Program is funded by NOAA, the US Department of Interior's Office of Insular Affairs, and the AIC jurisdictions.

Current Coral Fellows are working on some of the most pressing coral reef management concerns, including implementing coral reef restoration plans, integrating water quality data into management approaches, and enhancing community outreach and education efforts. The Fellowship continues to be the most important capacity building program for cultivating the next generation of coral reef managers in the U.S. Many past Coral Fellows now work within the jurisdictions and under USCRTF agencies in positions vital to coral reef management. This program provides essential training to young managers and provides them with skills to create effective programs that address the most significant threats facing coral reef ecosystems and reef-associated ecosystem services.

The 2024-2026 National Coral Reef Management Fellowship cohort began their work in the jurisdictions in January following recruitment in 2023. For many of the US CORAL reef jurisdictions, attracting local candidates to these positions is a top priority; we continue to advertise locally while also reaching out to USCRTF agencies and fellowship program staff for assistance with distributing fellowship announcements and encouraging strong candidates to apply. The USCRTF has long recognized capacity building as a priority issue and one of the biggest coral reef management needs in the jurisdictions. The Coral Reef Management Fellowship Program is a vital avenue for enhancing local capacity and yields benefits not only for the USCRTF and its members but, most importantly, for the health and longevity of U.S. coral reefs and reef-based ecosystem services.

4.B - Collaborate with Indigenous people and seek to incorporate Indigenous and local knowledge into policies and management plans

**Tribal Consultation for Reef Restoration Activities**

The U.S. Coral Reef Task Force Restoration Working Group has been developing a permitting guidance document for all U.S. coral reef jurisdictions. To comply with federal consistency and best management practices, a section was added on how to appropriately consult with federally recognized tribes and non-federally recognized tribal entities. Guidance was adapted from pre-existing NOAA guidance, which requires federal agencies to consult with federally recognized tribes and strongly recommends consultation with non-federally recognized tribes if a proposed action may affect a natural or cultural resource, the habitat, or the ecosystem

supporting a natural or cultural resource (e.g., Indigenous food security or sovereignty, spiritual activities, etc.).

**Native Hawaiian Ph.D. candidate and Kanaka ʻŌiwi scientist Joins the National Coral Reef Monitoring Program's (NCRMP) Hawaiʻi Mission**

On the second leg of the National Coral Reef Monitoring Program's (NCRMP) Hawaiʻi mission, NOAA scientists from the Pacific Islands Fisheries Science Center surveyed reefs in the Papahānaumokuākea Marine National Monument. NOAA was honored and excited to welcome aboard a Native Hawaiian Ph.D. candidate and Kanaka ʻŌiwi scientist, Nalani Olguin, who will be sharing her knowledge and experiences weaving Native Hawaiian knowledge systems and western sciences and guiding us in important considerations in building equitable and reciprocal approaches to grow long-term pilina (relationships) and partnerships with Native Hawaiian communities. Please check the photo gallery and Pacific Islands Facebook page for updates.

- (ICRI) What are your upcoming priorities for coral reefs?

*Answer:*

- Sustainable management of key coral reef fisheries taxa
- Supporting technical and institutional capacity development
- Restoring and preserving resilient, genetically diverse, reproductively viable coral populations
- Improving water quality for coral reef
- Improving resilience-based management
- Strengthening resilience, human well-being, and equitable outcomes for coastal communities through enhanced coral reef ecosystem services
- Facilitate the exchange of knowledge among US domestic and international partners.
- Increase support and resources for post-bleaching monitoring and management interventions.

## C. Reporting on the Restoration of Coral Reefs *(Target 2 GBF/Action Point 3 Coral Reef Breakthrough)*

- (ICRI) Are you able to estimate the total area ($km^2$) of coral reef under active restoration and the total area you consider to be 'restored', as a result of your organisation/country's in 2023?

  **Currently unable to estimate.**

  - Total area under active restoration in 2023: _____ $km^2$
  - Total area considered to be restored in 2023: _____ $km^2$

- (ICRI) If available, please provide further information on the total area considered to be restored, and under active restoration for the total period of the restoration programme, including the timeframe:

*Answer:*

NOAA facilitates, leads, funds, and implements efforts to grow corals in protected conditions. We work with our partners to collect detached corals—whether broken fragments or fully-formed colonies—and grow them in dense coral nurseries. The corals are then reattached to reefs piece by piece with cement, zip ties, and nails.

Mission: Iconic Reefs
NOAA and partners have launched an unprecedented effort to restore seven ecologically and culturally significant coral reefs within Florida Keys National Marine Sanctuary. Informed by years of research, successful trials, and expertise, the mission represents one of the largest investments ever undertaken in coral restoration. By focusing additional efforts on coral reef habitat, Mission: Iconic Reefs complements NOAA's ongoing Florida Keys National Marine Sanctuary Restoration Blueprint and management plan.

The effort to put Florida Keys coral reefs on track for recovery is an enormous undertaking, requiring long-term collaboration between many partners. A cross-NOAA team is engaging world-renowned scientists, local restoration partners, and other federal and state agencies to save these important, iconic resources.

Using the best available restoration science, we will restore diverse, reef-building corals at seven reef sites within Florida Keys National Marine Sanctuary:

- Carysfort Reef. (PDF, 2 pages)
- Horseshoe Reef. (PDF, 2 pages)
- Cheeca Rocks. (PDF, 2 pages)
- Newfound Harbor. (PDF, 2 pages)
- Eastern Dry Rocks. (PDF, 2 pages)
- Sombrero Reef. (PDF, 2 pages)
- Looe Key Reef. (PDF, 2 pages)

These sites represent the iconic diversity and productivity of Florida Keys coral reefs. They span the geographic extent of the region, a variety of habitats, and a range of human uses. They also have a history of restoration success, or have characteristics that indicate restoration is likely to succeed.

Additionally, more than 20 coral nurseries are active throughout the Caribbean. Each year, they provide more than 40,000 healthy corals for reef restoration throughout the region.

Active reef restoration is relatively new in the Pacific Islands Region (Hawai'i, Guam, the Northern Mariana Islands, and American Samoa) compared to the Caribbean. However, restoration work has been readily increasing in the past few years. Efforts are focused on working with local resource managers to develop restoration plans to increase capacity.

In Hawai'i, Kuleana Coral Restoration is a group of fishermen, surfers, and ocean advocates working to restore, protect, and monitor Hawaiian coral reefs using modern science and indigenous management techniques. Guided by the knowledge of coastal communities and our kuleana (responsibility) to the ocean, we develop scalable restoration methods unique to Hawai'i to sustain what sustains us: the reef. Alika Peleholani Garcia, Kuleana Coral Restoration Executive Director, participated in the listening session on incorporating local and Indigenous knowledge at the 2023 ICRI General Meeting. The 2023 Impact Report can be found here.

Johnston Applied Marine Sciences (JAMS), an independent marine research and consulting company based in Saipan, Commonwealth of the Northern Mariana Islands, has also been an active restoration partner with NOAA and local government agencies. JAMS's Saipan Coral Nursery Pilot Project is helping restore reefs impacted by storms. US Coral Reef Task Force members will visit this site during their next meeting this November.

NOAA is also exploring the use of innovative techniques for growing and planting resilient, genetically diverse populations of key coral species that can adapt to evolving environmental conditions. A NOAA-commissioned study evaluates how novel interventions could accelerate natural evolution and buy coral reefs time to adapt while ocean conditions continue to change.

- (ICRI) For the purpose of the above, please provide definitions for how your programme/organisation/country considers coral reefs to be:
    - A) Under active restoration
    - B) Restored

*Answer:*

*Under Active Restoration:*

Not an official definition, but under active restoration means a reef that received regular intentional restoration

*Restored:*

It is not an official definition, but a coral reef could be considered restored once it is a self-sustaining coral reef to provide fish habitat, recreation, and protection for coastlines.

Does your country have any restoration policies or regulations?

Many locations have outdated and insufficient regulations for coral reef restoration, resulting in inadequate oversight of restoration efforts. In addition, the absence, limitations, or differences among regulations between countries prevents the development and implementation of effective regional coral reef conservation strategies. To help local, state, and regional groups navigate this process, the U.S. Coral Reef Task Force created a guide for coral restoration permitting…(see next section).

- (ICRI) Please describe the restoration policies or regulations (if any) that are in place in your country.

*Answer:*
A Guide for Coral Restoration Permitting in the Seven U.S. Coral Reef Jurisdictions

## D. The Global Coral Reef Monitoring Network (GCRMN)

The production of future GCRMN reports, both at the regional and global level, relies on the ongoing support of data contributors who are willing to share their coral reef monitoring data for this purpose. As such, from 2024 to 2026, the GCRMN will undertake the rigorous process of developing the **Status of Coral Reefs of the World: 2025** global report, including an extensive data collation process.

Do you have data to contribute to the upcoming GCRMN global report? Yes, we will contribute both biological and socioeconomic data from the U.S. Atlantic, Caribbean, Gulf of Mexico, and Pacific Islands states and territories from NOAA's National Coral Reef Monitoring Program.

- Please provide the contact information for the data providers to allow for the GCRMN data collation team to request data and discuss the process of data contribution.

  *Please add further contacts as needed.*

*Answer:*

*Contact Name: Dr. Erica Towle*
*Organisation: NOAA CRCP*
*Email Address: erica.towle@noaa.gov*

*Contact Name: Dr. Mary Allen*
*Organisation: NOAA CRCP*
*Email Address: mary.allen@noaa.gov*

*Contact Name:*
*Organisation:*
*Email Address:*

## E. Capacity Building & Communications

Have you found the ICRI #ForCoral Webinar Series useful?

Through 2024, ICRI has hosted multiple webinars that aim to share knowledge and foster collaboration across critical topics concerning the conservation, protection, and restoration of coral reefs. These webinars form the #ForCoral webinar series, and topics include the 4th

Global Bleaching Event, impacts of land-based sources of pollution and National Biodiversity Strategies and Action Plans.

The full list of webinars and recordings can be found here: https://icriforum.org/forcoral-webinar-series/

- (ICRI) Did you attend any of the series' webinars, and if so which topics have you found the most useful and engaging? If you did not attend the webinars, please explain why, and how we could have done better.

*Answer:*

Several staff have presented at and attended various #ForCoral webinars. The Status of the Fourth Global Bleaching Event and the role of the global coral reef community webinar was the most useful and engaging for us. It helped initiate actions towards identifying post-bleaching monitoring and management interventions to develop and share among USCRTF and ICRI partners. That work is ongoing but should be completed soon (in 2024).

- (ICRI) Do you have any suggestions or request for topics that you wish for ICRI to host as part of this series? If you have a specific topic in mind, and would like to host a webinar, please indicate below.

*Answer:*

### Have you found the ICRI communications useful?

- (ICRI) Do you find the ICRI Monthly Round of News Useful? If yes, what do you like about it and how would you suggest improving ICRI's communications?

*Answer:*

Yes, the ICRI Monthly Round of News is useful. It provides a nice summary of a variety of topics that are relevant to our work in the U.S. and keeps us up-to-date on what ICRI and ICRI members are doing. It also provides examples of the type of news we should be submitting to ICRI. No suggestions for improving it, but please keep it going!

## F. Kunming-Montreal Global Biodiversity Framework

ICRI has continually supported the Convention on Biological Diversity and the Post-2020 process, developing a recommendation for coral reef indicators to be included in the Global

Biodiversity Framework and supporting Parties during the negotiation process. Following the Framework's adoption in 2022, ICRI's support now aims to support parties in implementing the framework, especially through National Biodiversity Strategies and Action Plans (NBSAPS) and the Marine and Coastal Work Programme.

In 2024, ICRI released **A Guide for Integrating Coral Reefs and Associated Ecosystems into National Biodiversity Strategies and Action Plans** to support coral reef countries to integrate coral reefs and associated ecosystems into their NBSAPs.

- (ICRI) Did you use read, use, and/or apply the Guide on integrating coral reefs and associated ecosystems into National Biodiversity Strategies and Action Plans (NBSAPs) useful? *Where possible, indicate specific elements that were useful or alternatively provide information if you did not find the guide useful.*

*Answer:*
*Yes, various U.S. government entities read the Guide.*

- (ICRI) Did you revise your current National Biodiversity Strategies and Action Plans (NBSAP) to include coral reefs? ***N.B.*** *if you are not a country representative, are you working with national focal points to help update their NBSAPs? Please provide further details.*

*Answer:*
*Not applicable.*

- (ICRI) How are you planning to implement the Kunming-Montreal Global Biodiversity Framework? Please list the target(s) and decisions that your work attributes to.

*Answer:*
*The United States is implementing the Global Biodiversity Framework (GBF) through our existing laws, such as the Endangered Species Act, the Lacey Act, the Coral Reef Conservation Act, the Marine Sanctuaries Act, and the Clean Water and Clean Air Acts, among others. The United States is also implementing the GBF through the American the Beautiful Initiative, which is focused primarily on Target 3 - 30 by 3 but touches on Targets 1, 2, 4, 6, 9, 10, 11, 12, 14, and 22.*

## G. Upcoming events

*Please tick the most any events that you will be, or are planning to attend:*

X September 10th – 24th: 79th Session of the UN General Assembly (UNGA 79)

Department of State will attend (Acting Assistant Secretary Jennifer Littlejohn)

☐ September 23rd – 26th: GEF International Waters Conference

x October 13th – 18th: 7th International Marine Conservation Congress (IMCC7)
NOAA Staff will attend (Gabrielle Johnson)

X October 21st – November 1st: CBD COP16
The Department of State will lead the U.S. delegation with representatives from many U.S. technical agencies, including the White House Council on Environmental Quality, NOAA.

X November 4th – 8th: 77th Annual meeting of the Gulf and Caribbean Fisheries Institute (GCFI77)
NOAA CRCP staff will attend.

☐ December 10th – 12th: The International Mangrove Conservation and Restoration Conference

X December 9th – 13th: Reef Futures
NOAA CRCP staff will attend.

? June 9th – 13th 2025: United Nations Ocean Conference
To be determined

X October 9th – 15th 2025: IUCN World Conservation Congress
Multiple U.S. government agencies

☐ Other

Please list any upcoming regional / international events relevant to ICRI that your organisation plans to attend:

*Answer:*

**H. Publications.** Please list relevant publications / reports you have released recently (+ add a link if possible)

| **Publication** | **URL** |
|---|---|
| Gaido-Lasserre, C., McNulty, V.P., Storlazzi, C.D., Reguero, B.G., Perez, D., Fogg, S., | https://doi.org/10.48330/E2KW2 |

| | |
|---|---|
| Ward, J., Cumming, K.A, Schill, S.R., Jarvis, C, Beck, M.W. 2024. Quantifying the Coastal Hazard Risk Reduction Benefits of Coral Reef Restoration in the U.S. Virgin Islands. https://doi.org/10.48330/E2KW29, 41 p. | |
| U.S. Coral Reef Task Force Restoration Working Group. 2023. A Guide for Restoration Permitting in the Seven U.S. Coral Reef Jurisdictions. U.S. Coral Reef Task Force, Department of the Interior, Washington, D.C. 46 pp. | https://www.coralreef.gov/assets/about/Restoration_Permitting_Guidance_v1.1.pdf |
| Draft National Coral Reef Resilience Strategy - Public Comment period coming in September | |
| Database of Grazing Metrics for Herbivorous Fishes of the Indo-Pacific<br><br>Pacific Islands Fisheries Science Center, 2024: Database of Grazing Metrics for Herbivorous Fishes of the Indo-Pacific. | https://www.fisheries.noaa.gov/inport/item/65072.<br>https://doi.org/10.1002/ecs2.4791 |
| Additional publications and reports are listed in Appendix 1: Recent Updates to the NOAA Coral Reef Information System (CoRIS) & NOAA's Coral Reef Conservation Program (CRCP) websites by Jurisdiction July 2024 | |
| | |

**I. ICRI Member Feedback.** What do you find most valuable about being a member of ICRI as well as completing the ICRI member reports? If you have any ideas to improve the Member Reports, please list below:

*Answer:*

ICRI is an excellent partnership for leveraging global support, policies, and science for coral reefs.

Knowledge sharing, collaboration, social and political networking.

The member report is a good way to exchange information and learn what other ICRI members are working on.

**J. Contact information & member information.** (Note that this information will be posted on the ICRI website on your member page: https://icriforum.org/members/).

*Please use the table below to provide us updates to your member's focal points as well as the blank cells to indicate changes to information (please add more rows, as needed):*

| **Focal Point 1:** | |
|---|---|
| *Name:* | **Christine Dawson** |
| *Title/Organisation:* | **Director of the Office of Conservation and Water in the Bureau of Oceans and International Environmental and Scientific Affairs (OES) in the U.S. Department of State** |
| *Email:* | **DawsonCL@state.gov** |
| **Focal Point 2:** | |
| *Name:* | **Jennifer Koss** |
| *Title/Organisation:* | **Director of NOAA's Coral Reef Conservation Program, US Department of Commerce** |
| *Email:* | **jennifer.koss@noaa.gov** |
| **Focal Point 3:** | |
| *Name:* | Michael Lameier - NOAA Federal |
| *Title/Organisation:* | **International Lead, NOAA's Coral Reef Conservation Program, US Department of Commerce** |
| *Email:* | **michael.lameier@noaa.gov** |
| **Member page updates:** | |
| *Section* | *Update* |
| | |
| | |
| | |
| | |
| | |

*Thank you very much for sharing your valuable experiences and information with ICRI. Members reports, meeting outputs and resources will be uploaded to: https://icriforum.org/events/icrigm38/*

**Appendix 1:**
**Recent Updates to the NOAA Coral Reef Information System (CoRIS) & NOAA's Coral Reef Conservation Program (CRCP) websites by Jurisdiction July 2024**

**********General Updates

**5-Year Reviews for 15 Species of Indo-Pacific Corals Listed under the Endangered Species Act**
https://repository.library.noaa.gov/view/noaa/61468

> Under section 4(c)(2) of the Endangered Species Act, we are required to conduct a review of all listed species at least once every 5 years to assess whether the current listing status remains accurate. Fifteen species of Indo-Pacific corals were listed under the ESA in 2014: Acropora globiceps, Acropora jacquelineae, Acropora lokani, Acropora pharaonis, Acropora retusa, Acropora rudis, Acropora speciosa, Acropora tenella, Anacropora spinosa, Euphyllia paradivisa, Isopora crateriformis, Montipora australiensis, Pavona diffluens, Porites napopora, and Seriatopora aculeata. In 2021, we initiated the 5-year review, which was done by the NMFS Pacific Islands Regional Office. The 5-year review is based on the best available data through August 2023. We concluded that no change to the listing status of the 15 species is warranted at this time. Since listing in 2014, the name of Euphyllia paradivisa has been changed to Fimbriaphyllia paradivisa, as noted in the 5-year review.

**Recovery Status Review for 15 Species of Indo-Pacific Reef-building Corals Listed under the Endangered Species Act**
https://repository.library.noaa.gov/view/noaa/61469

> This Recovery Status Review (RSR) is intended to inform the development of a recovery plan for the 15 Indo-Pacific reef-building coral species listed as threatened under the Endangered Species Act (ESA) in 2014 and the ecosystems upon which they depend. To that end, key ecosystem trends are first described to provide context, followed by a general evaluation of the most important threats to Indo-Pacific reef-building corals, and finally species reports for each of the 15 listed corals. The RSR provides the information needed to formulate actions in the recovery plan.

**Intervention : An Evolving Priority in National Marine Sanctuaries**
https://doi.org/10.25923/33q7-kv11

> Intervention refers broadly to human actions that intentionally modify resource characteristics in order to create a desirable state or move away from an undesirable one. Examples in the natural sciences include active species or habitat restoration. In the maritime heritage field, intervention often involves the conservation of artifacts, and for intangible cultural heritage may include the revitalization of languages or traditions. This document shares the perspective of NOAA's Office of National

Marine Sanctuaries on intervention activities as an aspect of national marine sanctuary management.

**Multi-Factor Coral Disease Risk: A new product for early warning and management**
https://doi.org/10.1002/eap.2961

Ecological forecasts are becoming increasingly valuable tools for conservation and management. However, there are few examples of near-real-time forecasting systems that account for the wide range of ecological complexities. We developed a new coral disease ecological forecasting system that explores a suite of ecological relationships and their uncertainty and investigates how forecast skill changes with shorter lead times. The Multi-Factor Coral Disease Risk product introduced here uses a combination of ecological and marine environmental conditions to predict the risk of white syndromes and growth anomalies across reefs in the central and western Pacific and along the east coast of Australia and is available through the US National Oceanic and Atmospheric Administration Coral Reef Watch program. This product produces weekly forecasts for a moving window of 6 months at a resolution of ~5 km based on quantile regression forests. The forecasts show superior skill at predicting disease risk on withheld survey data from 2012 to 2020 compared with predecessor forecast systems, with the biggest improvements shown for predicting disease risk at mid- to high-disease levels. Most of the prediction uncertainty arises from model uncertainty, so prediction accuracy and precision do not improve substantially with shorter lead times. This result arises because many predictor variables cannot be accurately forecasted, which is a common challenge across ecosystems. Weekly forecasts and scenarios can be explored through an online decision support tool and data explorer, co-developed with end-user groups to improve use and understanding of ecological forecasts. The models provide near-real-time disease risk assessments and allow users to refine predictions and assess intervention scenarios. This work advances the field of ecological forecasting with real-world complexities and, in doing so, better supports near-term decision making for coral reef ecosystem managers and stakeholders. Secondarily, we identify clear needs and provide recommendations to further enhance our ability to forecast coral disease risk.

**NCCOS Assessment: Chronic Turbidity Differentially Affects Physiological Processes in Two Threatened Caribbean, Atlantic Stony Coral Species from 2022-09-09 to 2022-12-06**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0292544

This dataset contains results from 12-week laboratory turbidity exposures on two species of threatened stony corals, Acropora cervicornis (ACER) and Orbicella faveolata (OFAV). Experiments were conducted between 9/13/2022 and 12/6/2022.

We measured endpoints (tissue regeneration, total lipids, total soluble protein, dry weight, symbiont chlorophyll a fluorescence and zooxanthellae numbers in gastrodermal tissues) and compared corals exposed to artificial seawater (control) to artificial seawater with sediment at 15 nephelometric turbidity units (NTU). We also measured sediment particle sizes within the treatment solutions. Corals were imaged throughout the exposure trials to document changes over time. Raw data are in image (.tif) format with results documented in spreadsheet format.

**Divergent bleaching and recovery trajectories in reef-building corals following a decade of successive marine heatwaves**
https://doi.org/10.1073/pnas.2312104120

Increasingly frequent marine heatwaves are devastating coral reefs. Corals that survive these extreme events must rapidly recover if they are to withstand subsequent events, and long-term survival in the face of rising ocean temperatures may hinge on recovery capacity and acclimatory gains in heat tolerance over an individual's lifespan. To better understand coral recovery trajectories in the face of successive marine heatwaves, we monitored the responses of bleaching-susceptible and bleaching-resistant individuals of two dominant coral species in Hawai'i, Montipora capitata and Porites compressa, over a decade that included three marine heatwaves. Bleaching-susceptible colonies of P. compressa exhibited beneficial acclimatization to heat stress (i.e., less bleaching) following repeat heatwaves, becoming indistinguishable from bleaching-resistant conspecifics during the third heatwave. In contrast, bleaching-susceptible M. capitata repeatedly bleached during all successive heatwaves and exhibited seasonal bleaching and substantial mortality for up to 3 y following the third heatwave. Encouragingly, bleaching-resistant individuals of both species remained pigmented across the entire time series; however, pigmentation did not necessarily indicate physiological resilience. Specifically, M. capitata displayed incremental yet only partial recovery of symbiont density and tissue biomass across both bleaching phenotypes up to 35 mo following the third heatwave as well as considerable partial mortality. Conversely, P. compressa appeared to recover across most physiological metrics within 2 y and experienced little to no mortality. Ultimately, these results indicate that even some visually robust, bleaching-resistant corals can carry the cost of recurring heatwaves over multiple years, leading to divergent recovery trajectories that may erode coral reef resilience in the Anthropocene.

**Coral thermal stress and bleaching enrich and restructure reef microbial communities via altered organic matter exudation**
https://doi.org/10.1038/s42003-023-05730-0

Coral bleaching is a well-documented and increasingly widespread phenomenon in reefs across the globe, yet there has been relatively little research on the implications for reef water column microbiology and biogeochemistry. A mesocosm heating experiment and bottle incubation compared how unbleached and bleached corals alter dissolved organic matter (DOM) exudation in response to thermal stress and subsequent effects on microbial growth and community structure in the water column. Thermal stress of healthy corals tripled DOM flux relative to ambient corals. DOM exudates from stressed corals (heated and/or previously bleached) were compositionally distinct from healthy corals and significantly increased growth of bacterioplankton, enriching copiotrophs and putative pathogens. Together these results demonstrate how the impacts of both short-term thermal stress and long-term bleaching may extend into the water column, with altered coral DOM exudation driving microbial feedbacks that influence how coral reefs respond to and recover from mass bleaching events.

**Microbial Interactions with Dissolved Organic Matter Are Central to Coral Reef Ecosystem Function and Resilience**
https://doi.org/10.1146/annurev-marine-042121-080917

To thrive in nutrient-poor waters, coral reefs must retain and recycle materials efficiently. This review centers on microbial processes in facilitating the persistence and stability of coral reefs, specifically the role of these processes in transforming and recycling the dissolved organic matter (DOM) that acts as an invisible currency in reef production, nutrient exchange, and organismal interactions. The defining characteristics of coral reefs, including high productivity, balanced metabolism, high biodiversity, nutrient retention, and structural complexity, are inextricably linked to microbial processing of DOM. The composition of microbes and DOM in reefs is summarized, and the spatial and temporal dynamics of biogeochemical processes carried out by microorganisms in diverse reef habitats are explored in a variety of key reef processes, including decomposition, accretion, trophic transfer, and macronutrient recycling. Finally, we examine how widespread habitat degradation of reefs is altering these important microbe–DOM interactions, creating feedbacks that reduce reef resilience to global change.

**Cumulative trophic curves elucidate tropical coral reef ecosystems**
https://doi.org/10.3389/fmars.2023.1324053

There are few generalizable patterns in ecology, with widespread observations and predictability. One possible generalizable pattern is the cumulative trophic theory, which consistently exhibits S-curves of cumulative biomass over trophic level (TL) for over 200 different marine ecosystems. But whether those cumulative biomass

patterns persist in some of the more distinct marine ecosystems, coral reefs, is unclear. Coral reefs are unique among marine ecosystems, representing global biodiversity hotspots and providing crucial ecosystem services. They are subject to many pressures, including both global (e.g., climate and ocean changes, warming, acidification) and local (e.g., overexploitation/overfishing, increase in turbidity, bleaching, habitat destruction, invasive species) stressors. The analysis of emergent ecosystem features, such as cumulative biomass S-curves, could represent a useful and new analytical option that can also be implemented for coral reefs. The cumulative biomass approach was applied to 42 U.S. Pacific islands (Guam and the Commonwealth of Northern Mariana Islands, American Samoa, the Pacific Remote Islands Areas, and the Northwestern and Main Hawaiian Islands), using data collected from fish surveys. Results show that coral reef ecosystems do indeed follow the S-curve patterns expected from cumulative trophic theory, which is not trivial for tropical reef systems that tend to be less widely examined and strongly dominated by structuring organisms like corals. The curve parameters results are also consistent with both fish assemblage diversity indexes and the benthic substrate ratio, which suggests this measure could serve as a useful ecosystem indicator to measure the ecological status of reefs. Moreover, the curve shape was consistent with what one would expect for different levels of perturbation, with the areas more densely inhabited showing less pronounced S-curves, in contrast to those observed in low human population density islands. All this is reflected in the curve parameters, particularly inflection point of the TL and steepness, generally showing a negative response to both natural and anthropogenic disturbances. Cross-archipelago differences have also been detected with the Hawaiian Island chain tending to have lower inflection points for biomass and TL than other regions. Collectively our findings demonstrate the potential application of the cumulative biomass approach to evaluate coral reef ecosystems.

**Ageing Of Juvenile Coral Grouper ( Plectropomus Maculatus ) Reveals Year-Round Spawning And Recruitment: Implications For Seasonal Closures**
https://repository.library.noaa.gov/view/noaa/53359

Temporal patterns in spawning and juvenile recruitment can have major effects on population size and the demographic structure of coral reef fishes. For harvested species, these patterns are crucial in determining stock size and optimizing management strategies such as seasonal closures. For the commercially important coral grouper ( Plectropomus spp.) on the Great Barrier Reef, histological studies indicate peak spawning around the summer new moons. Here we examine the timing of spawning activity for P. maculatus in the southern Great Barrier Reef by deriving age in days for 761 juvenile fish collected between 2007 and 2022, and back-calculating settlement and spawning dates. Age-length relationships were used to

estimate spawning and settlement times for a further 1002 juveniles collected over this period. Unexpectedly, our findings indicate year-round spawning activity generates distinct recruitment cohorts that span several weeks to months. Peak spawning varied between years with no clear association with environmental cues, and little to no alignment with existing seasonal fisheries closures around the new moon. Given the variability and uncertainty in peak spawning times, this fishery may benefit from additional and longer seasonal closures, or alternative fisheries management strategies, to maximize the recruitment contribution from periods of greatest reproductive success.

**Processing coral reef imagery using Structure-from-Motion photogrammetry : Standard operating procedures (2023 update)**
https://doi.org/10.25923/cydj-z260

The Pacific Islands Fisheries Science Center (PIFSC) has been testing, improving, and streamlining its Structure-from-Motion (SfM) processing pipeline to produce permanent digital records of coral reefs across the U.S. Pacific Islands and Territories. This SOP was developed in collaboration with Scripps Institution of Oceanography, the University of Hawai'i at Hilo and the Hawai'i Institute of Marine Biology to increase logistical efficiency in the field while continuing to produce streamlined coral demographic and benthic community data across the broad spatial scale of NCRMP.

**A Cnidarian Phylogenomic Tree Fitted With Hundreds of 18S Leaves**
https://doi.org/10.18061/bssb.v3i2.9267

Cnidarians are critical members of aquatic communities and have been an experimental system for a diversity of research areas ranging from development to biomechanics to global change biology. Yet, we still lack a well-resolved, taxonomically balanced cnidarian tree of life to place this research in appropriate phylogenetic context. To move towards this goal, we combined data from 26 new anthozoan transcriptomes with 86 previously published cnidarian and outgroup datasets to generate two 748-locus alignments containing 123,051 (trimmed) and 449,935 (untrimmed) amino acids. We estimated maximum likelihood phylogenies for both matrices under partitioned and unpartitioned site-homogeneous and site-heterogenous models of substitution. We used the resulting topology to constrain a phylogenetic analysis of 1,814 small subunit ribosomal (18S) gene sequences from GenBank. Our results confirm the position of Ceriantharia (tube-dwelling anemones), a historically recalcitrant group, as sister to the rest of Hexacorallia across all phylogenies regardless of data matrix or model choice. We find unanimous support for the sister relationships of Scleractinia and Corallimorpharia and of Endocnidozoa

and Medusozoa. We propose the name Coralliformes for the clade uniting scleractinians and corallimorpharians and the name Operculozoa for the clade uniting endocnidozoans and medusozoans. Of the 229 genera with more than a single representative in our 18S hybrid phylogeny, 47 (21%) were identified as monophyletic, providing a starting point for a number of taxonomic revisions. Together, these data are an invaluable resource for comparative cnidarian research and provide perspective to guide future refinement of cnidarian systematics.

**Short-term growth of octocorals Swiftia exserta and Muricea pendula in a mesocosm**
https://doi.org/10.3389/fmars.2024.1390702

To optimize fragmentation approaches for restoration applications, this study assessed fragmentation size influences on health and growth rates of mesophotic octocorals. Growth rates for Swiftia exserta (n=6) and Muricea pendula (n=9) were determined using photogrammetry in a mesocosm over a 90-day trial. No significant difference was found in growth between fragmented size classes (3, 6, and 12 cm) (S. exserta p=0.156, M. pendula p=0.393). There was a significant difference (p=0.013) in growth rates between species, with faster annual growth (mean ± SE) for S. exserta (1.490 ± 0.399 cm/year) than for M. pendula (0.550 ± 0.228 cm/year). Fragments from healthy source colonies remained healthy, while fragments from an unhealthy colony experienced tissue loss. Healthy colonies may successfully be used for fragmentation in laboratory propagation, though optimal fragment size for restoration remains debatable. Use of laboratory-based propagation techniques to recover injured species may require better understanding of factors influencing growth.

**Climate change impacts on mesophotic regions of the Great Barrier Reef**
https://doi.org/10.1073/pnas.2303336121

Climate change projections for coral reefs are founded exclusively on sea surface temperatures (SST). While SST projections are relevant for the shallowest reefs, neglecting ocean stratification overlooks the striking differences in temperature experienced by deeper reefs for all or part of the year. Density stratification creates a buoyancy barrier partitioning the upper and lower parts of the water column. Here, we mechanistically downscale climate models and quantify patterns of thermal stratification above mesophotic corals (depth 30 to 50 m) of the Great Barrier Reef (GBR). Stratification insulates many offshore regions of the GBR from heatwaves at the surface. However, this protection is lost once global average temperatures exceed ~3 °C above preindustrial, after which mesophotic temperatures surpass a recognized threshold of 30 °C for coral mortality. Bottom temperatures on the GBR (30 to 50 m) from 2050 to 2060 are estimated to increase by ~0.5 to 1 °C under lower climate emissions (SSP1-1.9) and ~1.2 to 1.7 °C under higher climate emissions (SSP5-8.5).

In short, mesophotic coral reefs are also threatened by climate change and research might prioritize the sensitivity of such corals to stress.

**Evidence on the ecological and physical effects of built structures in shallow, tropical coral reefs: a systematic map**
https://doi.org/10.1186/s13750-024-00336-3

Shallow, tropical coral reefs face compounding threats from climate change, habitat degradation due to coastal development and pollution, impacts from storms and sea-level rise, and pulse disturbances like blast fishing, mining, dredging, and ship groundings that reduce reef height and complexity. One approach toward restoring coral reef physical structure from such impacts is deploying built structures of artificial, natural, or hybrid (both artificial and natural) origin. Built structures range from designed modules and repurposed materials to underwater sculptures and intentionally placed natural rocks. Restoration practitioners and coastal managers increasingly consider incorporating – and in many cases have already begun to incorporate – built structures into coral reef–related applications, yet synthesized evidence on the ecological (coral-related; e.g., coral growth, coral survival) and physical performance of built structures in coral ecosystems across a variety of contexts (e.g., restoration, coastal protection, mitigation, tourism) is not readily available to guide decisions. To help fill this gap and inform management decisions, we systematically mapped the global distribution and abundance of published evidence on the ecological (coral-related) and physical performance of built structure interventions in shallow (≤ 30 m), tropical (35°N to 35°S) coral ecosystems.

Recent products from around the jurisdictions
American Samoa

**Agency Priorities for Mapping Coral Reef Ecosystems in American Samoa**
https://doi.org/10.25923/vdpb-5r44

NOAA's Coral Reef Conservation Program (CRCP) utilizes benthic mapping data on coral reef ecosystems to support a diversity of science-based management decisions. To efficiently allocate limited mapping resources, CRCP recognized a need to identify priority locations based on emerging management requirements. Specifically, this effort focuses on coral reef areas up to 40 m deep surrounding the islands of American Samoa.

**National Coral Reef Monitoring Program: Water Temperature Data from Subsurface Temperature Recorders (STRs) deployed at coral reef sites in American Samoa from 2015-03-19 to 2023-08-09**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0292926

Water temperature time series data provided in this data set are from subsurface temperature recorders (STRs) deployed at permanent coral reef sites across American Samoa by the NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD; formerly the Coral Reef Ecosystem Division) as part of the NOAA National Coral Reef Monitoring Program (NCRMP). The STRs were deployed for a minimum period of ~3 years from 2015-03-19 to 2023-08-09 and recovered during the ESD-led NCRMP mission to American Samoa in 2023.

The high-accuracy temperature loggers made by SeaBird Electronics (SBE) were weighted and strapped to solid substrate on the seafloor by SCUBA divers at depths ranging from 0 to 30 meters at permanent monitoring sites established by ESD's Ocean and Climate Change team. Sample interval is 5 minutes. Each time an STR was recovered another STR was typically deployed at the same location and depth and was assigned the same OCC_SITEID. Data were downloaded using the SeaBird SeaTerm V2 program and post-processed using R to trim “out of water” data.

**National Coral Reef Monitoring Program: Benthic Cover Derived from Analysis of Benthic Images Collected for Climate Stations across American Samoa from 2023-06-30 to 2023-08-08**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290792

The coral reef benthic community data described here result from the annotation (classification) of benthic images collected during photoquadrat surveys at permanent sites in the islands and atolls of American Samoa in 2023. These surveys are conducted by the NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD, formerly the Coral Reef Ecosystem Division) as part of NOAA's ongoing National Coral Reef Monitoring Program (NCRMP) according to protocols established by ESD and NCRMP.

SCUBA divers conducted benthic photoquadrat surveys at permanent sites established in coral reef habitats by ESD. A select number of these sites were chosen in hard-bottom habitat at ~15-m depths, and a subset of the permanent sites (climate stations) were established at north, south, east, and west points around each of the islands and atolls. The divers photographed the reef at 1-m intervals on both sides of the 15-m tape, generating 30 photographs per survey site.

Benthic habitat images were quantitatively analyzed using the web-based annotation tool, CoralNet (Beijbom et al. 2015). Ten points were randomly overlaid on each image and human analysts identified the organism or type of substrate beneath, with 300 annotations (points) generated per site. Benthic elements falling under each point were identified to genus/morphology for hard corals, and to genus/functional group for algae, invertebrates, and other taxa following Lozada-Misa et al. (2017). In general, the analysis resulted in three levels of benthic community data, including taxa group: Tier 1 (e.g., coral, soft coral, macroalgae, turf algae, etc.), Tier 2 (e.g., Coral = massive hard coral, branching hard coral, foliose hard coral, encrusting hard coral, etc.; Macroalga = upright macroalgae), and Tier 3 (e.g., Coral = Astreopora sp, Favia sp, Pocillopora, etc.; Macroalgae = Caulerpa sp, Dictyosphaeria sp, Padina sp, etc.). If Tier 3 resolution is not possible, the next finest resolution is used.. These benthic data can ultimately be used to produce estimates of relative abundance (percentage of benthic cover), frequency of occurrence, benthic community taxonomic composition, and relative generic richness.

**National Coral Reef Monitoring Program: Benthic Cover Derived from Analysis of Benthic Images Collected during Stratified Random Surveys (StRS) across American Samoa from 2023-03-30 to 2023-08-09**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290482

The data described here resulted from benthic photo-quadrat surveys conducted along transects at stratified random sites across American Samoa in 2023 as a part of Rapid Ecological Assessment (REA) surveys for corals and fish. Benthic habitat imagery was quantitatively analyzed using the web-based annotation tool CoralNet (Beijbom et al. 2016). Images were analyzed to produce three functional group levels of benthic cover: Benthic habitat images collected during photoquadrat surveys are quantitatively analyzed visually with the assistance of a web-based, machine-learning, image annotation tool, CoralNet. The robot tool annotates ten random points on each image for a total of 300 points per site, which are then reviewed by human analysts. The human annotations are then used to train the robot. This data is the final form of the robot-assisted human annotations.  Taxa identification occurs at three functional group levels of benthic cover. Tier 1 (e.g., coral, soft coral, macroalgae,

turf algae, etc.), Tier 2 (e.g., Coral = massive hard coral, branching hard coral, foliose hard coral, encrusting hard coral, etc.; Macroalga = upright macroalgae), and Tier 3 (e.g., Coral = Astreopora sp, Favia sp, Pocillopora, etc.; Macroalgae = Caulerpa sp, Dictyosphaeria sp, Padina sp, etc.). If Tier 3 resolution is not possible, the next finest resolution is used.

A stratified random sampling (StRS) design was employed to survey the coral reef ecosystems across the region. The survey domain encompassed the majority of the mapped area of reef and hard bottom habitats in the 0-30 m depth range. The stratification scheme included island, reef zone, and depth. Sampling effort was allocated based on strata area and sites were randomly located within strata. Sites were surveyed using photo-quadrats along transects to collect benthic imagery to ultimately produce estimates of relative abundance (benthic cover), frequency of occurrence, benthic community taxonomic composition and relative generic richness. The StRS design effectively reduces estimate variance through stratification using environmental covariates and by sampling more sites rather than sampling more transects at a site. Therefore, site-level estimates and site to site comparisons should be used with caution.

CNMI

**Economic Contributions of Small Boat Fisheries in Guam and the CNMI**
https://repository.library.noaa.gov/view/noaa/61357

The chief domestic fishery in Guam and the Commonwealth of the Northern Mariana Islands (CNMI) is a small boat, 1- to 2-day fishery that uses different gears to target pelagic, bottomfish, and coral reef fish. Fishers have a variety of fishing motivations ranging from full-time commercial, part-time commercial, recreational, cultural, to subsistence. This variation of fishing motivations demonstrates the importance of small boat fisheries in contributing to the local economy socially and culturally as well as economically. The purpose of this study is to evaluate the economic contributions of small boat fisheries in Guam and the CNMI.

**Characterizing benthic habitats of western Saipan, CNMI**
https://doi.org/10.25923/psjm-h924

Saipan is a U.S. territory located in the Commonwealth of the Northern Mariana Islands (CNMI) approximately 6,000 km west of Hawai‘i and 2,500 km south of Japan. Its western beaches are protected by an extensive fringing and barrier reef system, which is one of the most species-rich marine ecosystems in U.S. jurisdictions

**NCCOS Mapping: Bathymetric Lidar Waveform Metrics for Saipan, The Commonwealth of the Northern Mariana Islands (CNMI), 2019-07-11 to 2019-07-31**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0294340

This data package contains bathymetric light detection and ranging (lidar) Hawkeye-4X waveforms metrics (LWFM) for 0 to 50 meter depths around the island of Saipan, Commonwealth of the Northern Mariana Islands (CNMI). Bathymetric lidar waveforms depict the amount of laser light returned from the seafloor recorded during each laser pulse. Typically, only the leading edge of the seafloor return is used to calculate bottom depth. However, the shape of the seafloor return also contains novel information about the physical structure and biological cover on the seafloor (Collin et al. 2011, Wilson et al. 2019). To extract this information, the National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science (NCCOS) partnered with Oregon State University (OSU), NOAA Office for Coastal Management (OCM), Woolpert and Hexagon Leica to develop software to export, process, normalize and rasterize 16 LWFM describing the shape of the seafloor return (Jung et al. 2024; Collin et al. 2011; Parrish et al. 2014; Kashani et al. 2015; Kogut et al. 2022). The resulting LWFM rasters were used to predict the distribution of key coral reef taxa and habitats west of Saipan (Costa et al. 2024). This effort marks one of the few studies that have used LWFM to predict tropical coral reef habitats to date. These processing workflows and associated software will also make LWFM creation easier and more routine for future Hawkeye-4X lidar collections by NOAA and its partners. This project was funded by NOAA's Coral Reef Conservation Program (CRCP), and leverages significant investments made by NOAA NCCOS, NOAA National Geodetic Survey, NOAA Office for Coastal Management, and the U.S. Geological Survey in the region.

**NCCOS Mapping: Characterizing Benthic Habitats West of Saipan, Commonwealth of the Northern Mariana Islands (CNMI), 2018-11-05 to 2022-04-29**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0291792

This data package contains information and maps showing the geology and biology of select submerged lands (0 to 40 meters deep) offshore of western Saipan, Commonwealth of the Northern Mariana Islands (CNMI). This information and maps were developed using benthic information from underwater photographs, environmental predictor variables derived from satellite imagery and bathymetry, and machine learning modeling approaches. From this process, two types of map products were created. The first type describes the spatial distribution of 5 substrate and 14 biological cover types, where each grid cell denotes the probability (0 to 100%) that a given habitat is present. The second product was a classified map depicting the 7 most common combinations of substrate and cover types (plus artificial structures). The

performance and accuracy of these products were evaluated using an independent of underwater photographs. The overall accuracy of the classified map was 91.5% with user's accuracy of individual habitat classes between 84% and 100% correct. The substrate and cover predictions had little bias ($\bar{x}$ error = 0.01 ±0.01 SE), good to excellent ability to discriminate between presences and absences ($\bar{x}$ area under the curve = 0.82 ±0.02 SE) and they explained almost a quarter of the variation in the data ($\bar{x}$ percent deviance explained = 23.8% ±2.9 SE).

Over 95 square kilometers (km2) of seafloor was characterized west of Saipan, CNMI. Overall, 'Live and Upright Dead Coral Reef, Mixed Algae' was the most abundant habitat type mapped inside and outside the Lagoon, comprising 32% (31 km2) of the area. The largest, continuous patches were located outside the Lagoon north Susupe Point, as well as inside the lagoon on the reef crest and back reef north of the harbor channel. Most live coral (all species) observations were documented outside the Lagoon from the harbor channel to Agingan Point, as well as inside the Lagoon north of Garapan. Enhalus acoroides and Halodule uninervis seagrass were both located exclusively inside the Lagoon, from Tanapag Beach south to Oleai as well as north of Tanapag to Pau Beach and south of Garapan to Agingan Point, respectively. Endangered Species Act (ESA) protected corals (i.e., Acropora globiceps) were documented at 4 sites outside the Lagoon, located seaward of the reef crest between Susupe and Agingan Points. No nuisance species (i.e., C. vieillardi) or crown of thorns sea star (COTS) were photographed outside the Lagoon. The prevalence of coral bleaching and marine debris were also very low outside the Lagoon (<0.7% and <0.9%, respectively). Theses maps mark the first time that the seafloor area outside the Lagoon has been mapped since 2005, providing an updated inventory of marine resources and new baseline for future monitoring and management decisions in the region.

**Guam and CNMI Underwater Photomosaics**
https://www.fisheries.noaa.gov/inport/item/72703

This data package contains georeferenced underwater photomosaics for more than 600 sites in 0 to 50 meter depths around the islands of Guam and Saipan. The photographs used to create these photomosaics were acquired from August 2021 to May 2022 using digital single-lens reflex camera (DSLR) cameras. Green lasers provided a measurement scale (10 cm). A Trimble GeoXH GPS provided the location of the vessel, and a Blueprint SeaTrac ultra short baseline (USBL) X150 beacon and X010 transponder provided the location and depth (XYZ) of the drop camera. The photographs were georeferenced (i.e., given a latitude and longitude), and mosaicked using a custom Python script (Pierce and Winians, 2023; performed using Agisoft Metashape application programming interface). The field work in Saipan was funded

by NOAA National Centers for Coastal Ocean Science (NCCOS) and the NOAA Coral Reef Conservation Program (CRCP). The field work in Guam was funded by the Naval Facilities Engineering Command Marianas (NAVFAC Marianas). Both efforts were conducted in partnership with and in consultation with local partners and the territorial governments.

**National Coral Reef Monitoring Program: Water Temperature Data from Subsurface Temperature Recorders (STRs) recovered at coral reef sites in the Marianas Archipelago in 2022**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0284762

Water temperature data provided in this data set were collected using subsurface temperature recorders (STRs) recovered in 2022 from permanent coral reef sites in the Mariana Archipelago during the Pacific Reef Assessment and Monitoring Program cruise led by NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division. The high-accuracy temperature loggers made by SeaBird Electronics (SBE) were deployed on the reef for a period of 3 years (or 8 years if the instruments deployed in 2014 were not recovered in 2017) at depths ranging from 0 to ~30 meters along depth transects at Ocean and Climate Change monitoring survey sites. When a STR was recovered, typically another STR was deployed in the same location. Raw data with an original sample interval ranging from 5 to 10 minutes were averaged hourly, and gaps of longer than one hour in the time-series, due to instrument failure or battery death, were padded with null values. Temperature data are archived by region and year recovered. For analysis purposes, temperature sensor deployments are grouped by site, and temperature data from successive deployments at each site are concatenated.

Florida

**Implementing the Florida Keys Coral Disease Response & Restoration Initiative: Number of coral outplants and survivorship by species from 2022-01-01 to 2022-12-31**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0286285

This dataset consist of a spreadsheet containing 5,923 coral outplants, including but not limited to species Acropora cervicornis, Acropora palmata, Orbicella faveolata, Pseudodiploria clivosa and Montastraea cavernosa. These outplant data took place under the third year of the initiative by Mote Marine Laboratory, from 2022-01-01 to 2022-12-31 located in the Florida Keys. Mote Marine Laboratory continues to monitor each outplant one month post-outplant event, one year, three year and five years to monitor the survivorship of corals. As these coral species were outplanted in 2022, not all of the data is from 2022 as the survivorship data go into 2024.

**Parrotfish surveys and paired coral and parrotfish coral predation surveys conducted in the Caribbean Sea and Florida Keys National Marine Sanctuary from 2013-07-02 to 2019-09-11**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0293333

Data associated with the publication 'Ecological drivers of parrotfish coral predation vary across spatial scales', comparing parrotfish coral predation intensity as it relates to parrotfish density/biomass, coral cover, and other ecological variables from the scale of individual coral colonies to reefs spanning four regions of the Greater Caribbean. This dataset includes several datasets:

1) regional_coral_scar_data.csv: Surveys of coral colonies (with and without parrotfish predation scars) across all regions.

2) processed_coral_scar_data_colony_level.csv: Processed data from the file above filtered to only include coral taxa commonly predated by parrotfishes (determined as coral taxa for which at least 3 colonies across the entire dataset had 3 recent parrotfish predation scars). This includes the calculated coral colony surface area and the estimated total/sum recent scar area per coral colony.

3) regional_fish_data.csv: Parrotfish abundance and size for individuals greater than or equal to 15 cm fork length. This data includes estimated fish weight and related length-weight conversion values used to calculate these values.

4) site_coordinates.csv: Metadata of the latitude and longitude of all study sites.

**Genotypic inventory and impact of the 2023 marine heatwave on Acropora palmata (elkhorn coral) populations in the Upper Florida Keys, USA: 2020-2023**
https://repository.library.noaa.gov/view/noaa/60881

This report details the findings from extensive survey efforts conducted on reefs in the upper Florida Keys to characterize the abundance and distribution of genotypes for the ESA-listed coral species Acropora palmata. Between 2019 and 2023, we collected a total of 233 samples from A. palmata colonies present at reef sites spanning 50km of the Florida Reef Tract in the upper Florida Keys.

Flower Gardens

**Intersection of coral molecular responses to a localized mortality event and ex situ deoxygenation**

https://doi.org/10.1002/ece3.11275

In July 2016, East Bank of Flower Garden Banks (FGB) National Marine Sanctuary experienced a localized mortality event (LME) of multiple invertebrate species that ultimately led to reductions in coral cover. Abiotic data taken directly after the event suggested that acute deoxygenation contributed to the mortality. Despite the large impact of this event on the coral community, there was no direct evidence that this LME was driven by acute deoxygenation, and thus we explored whether gene expression responses of corals to the LME would indicate what abiotic factors may have contributed to the LME. Gene expression of affected and unaffected corals sampled during the mortality event revealed evidence of the physiological consequences of the LME on coral hosts and their algal symbionts from two congeneric species (Orbicella franksi and Orbicella faveolata). Affected colonies of both species differentially regulated genes involved in mitochondrial regulation and oxidative stress. To further test the hypothesis that deoxygenation led to the LME, we measured coral host and algal symbiont gene expression in response to ex situ experimental deoxygenation (control = 6.9 ± 0.08 mg L−1, anoxic = 0.083 ± 0.017 mg L−1) in healthy O. faveolata colonies from the FGB. However, this deoxygenation experiment revealed divergent gene expression patterns compared to the corals sampled during the LME and was more similar to a generalized coral environmental stress response. It is therefore likely that while the LME was connected to low oxygen, it was a series of interconnected stressors that elicited the unique gene expression responses observed here. These in situ and ex situ data highlight how field responses to stressors are unique from those in controlled laboratory conditions, and that the complexities of deoxygenation events in the field likely arise from interactions between multiple environmental factors simultaneously.

**National Coral Reef Monitoring Program: Assessment of coral reef fish communities in Flower Garden Banks National Marine Sanctuary from 2023-09-18 to 2023-09-21**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0292107

> The National Coral Reef Monitoring Program (NCRMP) assessed coral reef fish communities in the Flower Garden Banks National Marine Sanctuary using the stationary point count method (7.5m radius cylinder). This method collects and reports information on species composition, density, size structure, abundance and derived metrics (e.g., species richness, diversity). Data are collected using a 1-stage, stratified random survey design in hardbottom and coral reef habitats less than 30m in depth. All datasets contain data fields on general station information (e.g., survey strata, depth, rugosity). Each of these data tables contain additional survey-specific data fields. For complete information and descriptions of attributes and data fields for all data tables, refer to the data dictionaries. Three datasets are provided under the stationary point count fish protocols and are distributed as one compiled package: (1) Analysis Ready dataset, (2) Boatlog/Station dataset, and (3) raw QAQC'd sample data file. The methodology used for this survey can be found in the point count fish protocols. All three datasets contain data fields on general station information (survey strata, depth, rugosity). Each of these data tables contain additional survey-specific data fields. For complete information and descriptions of attributes and data fields for all data tables, refer to the data dictionaries.

Guam

**Economic Contributions of Small Boat Fisheries in Guam and the CNMI**
https://repository.library.noaa.gov/view/noaa/61357

> The chief domestic fishery in Guam and the Commonwealth of the Northern Mariana Islands (CNMI) is a small boat, 1- to 2-day fishery that uses different gears to target pelagic, bottomfish, and coral reef fish. Fishers have a variety of fishing motivations ranging from full-time commercial, part-time commercial, recreational, cultural, to subsistence. This variation of fishing motivations demonstrates the importance of small boat fisheries in contributing to the local economy socially and culturally as well as economically. The purpose of this study is to evaluate the economic contributions of small boat fisheries in Guam and the CNMI.

**Data Report : Assessment of Coral Reef Fishes Inside and Outside of Guam's Piti Bomb Holes Marine Preserve**
https://doi.org/10.25923/73w2-j904

In this report, we assess the effectiveness of Piti Bomb Holes by comparing reef fish biomass and size distributions inside and outside the preserve. We assess metrics for food fish species as defined by the the Division of Aquatic and Wildlife Resources (DAWR). We focused on these species because they are targeted and prone to poaching. We compare different taxonomic groups, trophic levels, and size classes from within Piti to other Guam preserves and to larger surrounding areas that are open to fishing to investigate the possibility of poaching.

**Guam and CNMI Underwater Photomosaics**
https://www.fisheries.noaa.gov/inport/item/72703

This data package contains georeferenced underwater photomosaics for more than 600 sites in 0 to 50 meter depths around the islands of Guam and Saipan. The photographs used to create these photomosaics were acquired from August 2021 to May 2022 using digital single-lens reflex camera (DSLR) cameras. Green lasers provided a measurement scale (10 cm). A Trimble GeoXH GPS provided the location of the vessel, and a Blueprint SeaTrac ultra short baseline (USBL) X150 beacon and X010 transponder provided the location and depth (XYZ) of the drop camera. The photographs were georeferenced (i.e., given a latitude and longitude), and mosaicked using a custom Python script (Pierce and Winians, 2023; performed using Agisoft Metashape application programming interface). The field work in Saipan was funded by NOAA National Centers for Coastal Ocean Science (NCCOS) and the NOAA Coral Reef Conservation Program (CRCP). The field work in Guam was funded by the Naval Facilities Engineering Command Marianas (NAVFAC Marianas). Both efforts were conducted in partnership with and in consultation with local partners and the territorial governments.

**Characterizing submerged lands around Naval Base Guam, Mariana Islands**
https://doi.org/10.25923/zwwa-h562

NOAA's National Centers for Coastal Ocean Science (NCCOS) collaborated with NAVFAC Marianas to develop detailed maps of the distribution of seafloor habitats, beginning with Apra Harbor and Haputo Ecological Reserve Area (ERA).

**NCCOS Mapping: Characterizing Submerged Lands Around Naval Base Guam, Mariana Islands, 2016-01-11 to 2022-05-13**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0292018

This data package contains information and maps showing the geology and biology of select submerged lands (0 to 50 meters deep) around Navy Base Guam (NBG) and Haputo Ecological Reserve Area (ERA) Guam, Mariana Islands. This information and

maps were developed using benthic information from underwater photographs, environmental predictor variables derived from satellite imagery and bathymetry, and machine learning modeling approaches. From this process, two types of map products were created. The first type describes the spatial distribution of 7 substrate and 12 biological cover types, where each grid cell denotes the probability that a given habitat is present (0 to 100%). The second product was a classified map depicting the 7 most common combinations of substrate and cover types. The performance and accuracy of these products were evaluated by local experts and by using an independent of underwater photographs. The overall accuracy of the classified map was 86.6%. The substrate and cover predictions had little bias ($x\bar{x}$ error = -2% ±1% SE), good to excellent ability to discriminate between presences and absences ($x\bar{x}$ area under the curve = 0.86 ±0.02 SE) and explained over a quarter of the variation in the data ($x\bar{x}$ percent deviance explained = 26.9% ±5.1 SE).

In Haputo ERA, 'Pavement, Mixed Algae' was the most abundant habitat type, comprising 54.5% (1.1 km2) of the area. The largest, continuous patches were located on the forereef along the coastline. Live coral was distributed throughout the ERA, with encrusting corals being most prevalent. No seagrass or mangroves were present. Around NBG, 'Sand, Bare' was the most abundant habitat type, comprising 42.3% (8.2 km2) of the area. The largest, continuous patches were in the eastern portion of Outer Apra Harbor, including Sasa Bay and south of Cabras Island. Live coral was common and most prevalent from San Luis Point around Point Udall to Acapa Point. Halodule uninervis seagrass was only documented outside Apra Harbor at 2 sites approximately 500 m north of Acapa Point. Mangroves were found only in nearshore areas in Sasa Bay and Inner Apra Harbor. No Endangered Species Act (ESA) protected corals or nuisance species (i.e., C. vieillardi) were photographed in either project areas. One crown of thorns sea star was photographed in Haputo ERA. The prevalence of coral bleaching, COTS scarring and marine debris were low (<1%, 0% and <4%, respectively). Theses maps mark the first time that these locations have been mapped since 2010, providing an updated inventory of marine resources and new baseline for future monitoring and management decisions in the region.

Hawaii

**Subsurface temperature estimates from a Regional Ocean Modelling System (ROMS) reanalysis provide accurate coral heat stress indices across the Main Hawaiian Islands**
https://doi.org/10.1038/s41598-024-56865-x

As ocean temperatures continue to rise, coral bleaching events around the globe are becoming stronger and more frequent. High-resolution temperature data is therefore critical for monitoring reef conditions to identify indicators of heat stress. Satellite

and in situ measurements have historically been relied upon to study the thermal tolerances of coral reefs, but these data are quite limited in their spatial and temporal coverage. Ocean circulation models could provide an alternative or complement to these limited data, but a thorough evaluation against in situ measurements has yet to be conducted in any Pacific Islands region. Here we compared subsurface temperature measurements around the nearshore Main Hawaiian Islands (MHI) from 2010 to 2017 with temperature predictions from an operational Regional Ocean Modeling System (ROMS) to evaluate the potential utility of this model as a tool for coral reef management. We found that overall, the ROMS reanalysis presents accurate subsurface temperature predictions across the nearshore MHI region and captures a significant amount of observed temperature variability. The model recreates several temperature metrics used to identify coral heat stress, including predicting the 2014 and 2015 bleaching events around Hawai‘i during the summer and fall months of those years. The MHI ROMS simulation proves to be a useful tool for coral reef management in the absence of, or to supplement, subsurface and satellite measurements across Hawai‘i and likely for other Pacific Island regions.

**Detection and impact of sewage pollution on South Kohala's coral reefs, Hawai‘i**
https://doi.org/10.1016/j.marpolbul.2023.114662

Sewage pollution from on-site sewage disposal systems and injection wells is impacting coral reefs worldwide. Our study documented the presence and impact of sewage on South Kohala's coral reefs, on Hawai‘i Island, through benthic water quality and macroalgal sampling (fecal indicator bacteria, nutrients, δ15N macroalgal tissue), NO3− stable isotope mixing models, water motion measurements, and coral reef surveys. Sewage pollution was moderate on the offshore reef from benthic seeps, and water motion mixed and diluted it across the benthos. These conditions likely contribute to the dominance of turf algae cover, and the severity and prevalence of growth anomalies and algal overgrowth on corals. Use of multiple indicators and studying water motion was necessary to assess sewage pollution and identify environmental drivers associated with impaired coral health conditions. Methods used in this study can be utilized by natural resource managers to identify and reduce anthropogenic stressors to coral reefs.

**Microbiomes and metabolomes of dominant coral reef primary producers illustrate a potential role for immunolipids in marine symbioses**
https://doi.org/10.1038/s42003-023-05230-1

The dominant benthic primary producers in coral reef ecosystems are complex holobionts with diverse microbiomes and metabolomes. In this study, we characterize

the tissue metabolomes and microbiomes of corals, macroalgae, and crustose coralline algae via an intensive, replicated synoptic survey of a single coral reef system (Waimea Bay, O‘ahu, Hawaii) and use these results to define associations between microbial taxa and metabolites specific to different hosts. Our results quantify and constrain the degree of host specificity of tissue metabolomes and microbiomes at both phylum and genus level. Both microbiome and metabolomes were distinct between calcifiers (corals and CCA) and erect macroalgae. Moreover, our multi-omics investigations highlight common lipid-based immune response pathways across host organisms. In addition, we observed strong covariation among several specific microbial taxa and metabolite classes, suggesting new metabolic roles of symbiosis to further explore.

**Lalo (French Frigate Shoals) Resilience Implementation Options Report : Report To The Papahānaumokuākea Marine National Monument Management Board**
https://repository.library.noaa.gov/view/noaa/56798

The Lalo Resilience planning process was initiated by the Papahānaumokuākea Marine National Monument (PMNM or Monument) co-managers: the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (FWS), the State of Hawai‘i Department of Land and Natural Resources (DLNR), and the Office of Hawaiian Affairs (OHA), collectively referred to as the Monument Management Board (MMB) in January 2020 (Figure 1). The MMB established a Lalo Resilience Working Group and tasked this group to (1) create assessment of the existing state of knowledge, research, and management within the terrestrial and marine areas of Lalo (referred to as the “state of the knowledge report”) and (2) develop a suite of management actions that could be implemented to enhance the resilience of Lalo (referred to as the “implementation options report”).

Florida

**Genotypic inventory and impact of the 2023 marine heatwave on Acropora palmata (elkhorn coral) populations in the Upper Florida Keys, USA: 2020-2023**
https://doi.org/10.25923/37c0-x182

This report details the findings from extensive survey efforts conducted on reefs in the upper Florida Keys to characterize the abundance and distribution of genotypes for the ESA-listed coral species Acropora palmata. Between 2019 and 2023, we collected a total of 233 samples from A. palmata colonies present at reef sites spanning 50km of the Florida Reef Tract in the upper Florida Keys.

**A quantitative assessment of the status of reef fish communities from a large-scale probability survey in southern Florida**
https://doi.org/10.5343/bms.2023.0020

Numerous reef fish monitoring programs worldwide produce the data necessary to describe the status and trends of coral reefs; however, quantitative description of status at ecosystem scales has been challenging. Our goal was to use southern Florida's coral reefs as the template to complete a holistic, ecosystem-scale evaluation of reef fish community status using large-scale diver surveys that sampled across a spatial gradient of human urbanization, exploitation, and fishery protection. Key aspects of the analysis were: (i) identification of a low human impact reference area as the basis for quantifying resource condition; (ii) selection of indicator variables that helped discriminate two classes of impacts: habitat quality and fishing; (iii) application of estimation methods that facilitated distinguishing anthropogenic impacts from inherent productivity of different habitats; and (iv) use of a sustainability benchmark to gauge the resource condition of the reference area. The reference-centering analysis approach reduced reliance on qualitative judgements by an expert panel and outputted results on a scale that was informative and could be easily interpreted by a variety of audiences. Our findings identified habitat quality issues in the most urbanized region, southeast Florida, and pervasive fishing issues throughout the ecosystem, including the remote Dry Tortugas region.

Puerto Rico

**Modeled Flooding by Tsunamis and a Storm Versus Observed Extent of Coral Erratics on Anegada, British Virgin Islands—Further Evidence for a Great Caribbean Earthquake Six Centuries Ago**
https://doi.org/10.1029/2023JB028387

Models of near-field tsunamis and an extreme hurricane provide further evidence for a great precolonial earthquake along the Puerto Rico Trench. The models are benchmarked to brain-coral boulders and cobbles on Anegada, 125 km south of the trench. The models are screened by their success in flooding the mapped sites of these erratics, which were emplaced some six centuries ago. Among 25 tsunami scenarios, 19 have megathrust sources and the rest posit normal faulting on the outer rise. The modeled storm, the most extreme of 15 hurricanes of category 5, produces tsunami-like bores from surf beat. In the tsunami scenarios, simulated flow depth is 1 m or more at all the clast sites, and 2 m or more at nearly all, given either a megathrust rupture 255 km long with 7.5 m of dip slip and M8.45, or an outer-rise rupture 130 km long with 11.4 m of dip slip and M8.17. By contrast, many coral clasts lie beyond the reach of simulated flooding from the extreme hurricane. The tsunami screening

may underestimate earthquake size by neglecting trees and shrubs that likely impeded both the simulated flows and the observed clasts; and it may overestimate earthquake size by leaving coastal sand barriers intact. The screening results broadly agree with those from previously published tsunami simulations. In either successful scenario, the average recurrence interval spans thousands of years, and flooding on the nearest Caribbean shores begins within a half-hour.

USVI

**Expansion of an established fishery-independent survey into the US Virgin Islands' upper mesophotic zone: feasibility and management implications**
https://doi.org/10.5343/bms.2023.0013

A three−year pilot study, the Deep Coral Reef Monitoring Program (DCRMP), expanded the National Coral Reef Monitoring Program's (NCRMP) established fishery−independent, diver−based reef fish visual survey to upper mesophotic reefs (>30 to 50 m) in the United States (US) Caribbean for the first time. The new DCRMP sample domain (>30 to 50 m) encompassed 2.4 times more survey area than NCRMP (0 to ≤30 m) and collected high quality data (CV <20%) on coral reef fishes [three survey years, 29 (5) species; mean (standard deviation)]. For the four representative, fishery−targeted, analysis species selected (i.e., a grouper, snapper, triggerfish, and parrotfish), domain−wide density and length comparisons between surveys showed similar or statistically higher abundances and larger lengths for fishes at deeper depths (>30 to 50 m). These results highlight the importance of surveying the entire insular shelf in St. Thomas and St. John, US Virgin Islands for fisheries management applications. Furthermore, the DCRMP survey leveraged NCRMP's methods and resources resulting in a seamless extension to deeper waters. However, if these programs were fully integrated and optimized within a single survey design, approximately half the sites would be needed to achieve the same level of precision, offering substantial time and cost savings. The principles of probabilistic sampling

successfully used in the present fishery-independent survey design (0 to 50 m) can be applied more broadly to develop an "ideal" large-scale, multi-gear survey from 0 to about 500 m to encompass the entire depth ranges of managed species in the US Caribbean.

**NCCOS Assessment: Fish tracking data from East End Marine Park in St. Croix, U.S. Virgin Islands from 2019-11-08 to 2022-09-27**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290601

This dataset includes detections of fish tagged with Vemco/Innovasea acoustic transmitters in East End Marine Park (EEMP), St. Croix, US Virgin Islands from 2019 through 2022. Detection data were obtained from an array of underwater dataloggers/receivers deployed across the study area which recorded transmissions from tagged fish. Data include identifying information for each fish tag/transmitter, species tagged, timestamp of detection, and positional information for the receiver that detected the tag.

**NCCOS Assessment: Fish and benthic communities in the East End Marine Park, St. Croix, U.S. Virgin Islands from 2022-04-25 to 2022-06-18**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290374

This dataset includes fish count and benthic cover data collected at 138 sites during 2022 in East End Marine Park (EEMP), St. Croix, U.S. Virgin Islands. Fish were counted, identified to species, and sized along a transect (Menza et al. 2006, Pittman et al. 2013). Biological benthic data was collected along the transect using the line point intercept method wherein cover types were identified on hard, soft, and rubble substrates (CRCP 2022).

**Coral Reef Ecosystem and Larval Research Consisting Of Biologic Data from the Nancy Foster in Caribbean Sea and Gulf of Mexico from April 11, 2015 to June 24, 2018**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0293057

National Oceanic and Atmospheric Administration (NOAA) scientists from the Southeast Fisheries Science Center (SEFSC) and Atlantic Oceanographic and Meteorological Laboratory (AOML), working with scientists from the University of the Virgin Islands (UVI) in St. Thomas conducted a multi-year interdisciplinary research project which was a continuation of the 2007-2011 project using the NOAA Ship Nancy Foster to conduct biological and physical oceanographic surveys of the Virgin Island's (VI) bank ecosystems and surrounding regional waters as well as areas

around Jamaica, Cuba and the Gulf of Mexico . The long-term sustainability of fisheries in the VI and surrounding regions is dependent on a comprehensive understanding of regional spawning aggregations, larval transport, and overall larval recruitment in the study area.

This survey sampled water properties, currents, and dispersal and transport of settlement-stage larvae in the VI and neighboring regions. Data in this archival package includes: processed larval fish data collected from the various net tows (BONGO, MOCNESS, etc.) , processed data from all conductivity, temperature, depth (CTD) casts, processed data from all lowered acoustic Doppler profiler (LADCP) casts, processed hull-mounted acoustic Doppler current profiler (SADCP), processed sea surface, flow-through data collected with the ship's thermosalinograph (TSG) and fluorometer collected aboard NOAA Ship Nancy Foster during cruises NF-15-02, NF-15-03, NF-16-02, NF-16-03, NF-17-03 and NF-18-03 from 2015-04-11 to 2018-06-24.

Pacific Remote Island Area

**National Coral Reef Monitoring Program: Water Temperature Data from Subsurface Temperature Recorders (STRs) deployed at coral reef sites in the Pacific Remote Islands Marine National Monument from 2018-06-09 to 2023-10-26**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0292925

Water temperature time series data provided in this data set are from subsurface temperature recorders (STRs) deployed at permanent coral reef sites across the Pacific Remote Islands Marine National Monument (PRIMNM) by the NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD; formerly the Coral Reef Ecosystem Division) as part of the NOAA National Coral Reef Monitoring Program (NCRMP). The STRs were deployed for a period of approximately 5 years from 2018-06-09 to 2023-10-26 and recovered during the ESD-led NCRMP missions to the PRIMNM in 2023.

The high-accuracy temperature loggers made by SeaBird Electronics (SBE) were weighted and strapped to solid substrate on the seafloor by SCUBA divers at depths ranging from 0 to 30 meters at permanent monitoring sites established by ESD's Ocean and Climate Change team. Sample interval ranges from 30 seconds to 5 minutes; the current sample interval is 5 minutes. Each time an STR was recovered another STR was typically deployed at the same location and depth and was assigned the same OCC_SITEID. Data were downloaded using the SeaBird SeaTerm V2 program and post-processed using R to trim “out of water” data.

**National Coral Reef Monitoring Program: Benthic Cover Derived from Analysis of Benthic Images Collected during Stratified Random Surveys (StRS) across the Pacific Remote Island Areas from 2023-03-15 to 2023-03-19**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290543

The data described here resulted from benthic photo-quadrat surveys conducted along transects at stratified random sites across the Pacific Remote Island Areas, including Baker and Howland in 2023 as a part of Rapid Ecological Assessment (REA) surveys for corals and fish. Benthic habitat imagery was quantitatively analyzed using the web-based annotation tool CoralNet (Beijbom et al. 2016). Images were analyzed to produce three functional group levels of benthic cover: Benthic habitat images collected during photoquadrat surveys are quantitatively analyzed visually with the assistance of a web-based, machine-learning, image annotation tool, CoralNet. The robot tool annotates ten random points on each image for a total of 300 points per site, which are then reviewed by human analysts. The human annotations are then used to train the robot. This data is the final form of the robot-assisted human annotations. Taxa identification occurs at three functional group levels of benthic cover. Tier 1 (e.g., coral, soft coral, macroalgae, turf algae, etc.), Tier 2 (e.g., Coral = massive hard coral, branching hard coral, foliose hard coral, encrusting hard coral, etc.; Macroalga = upright macroalgae), and Tier 3 (e.g., Coral = Astreopora sp, Favia sp, Pocillopora, etc.; Macroalgae = Caulerpa sp, Dictyosphaeria sp, Padina sp, etc.). If Tier 3 resolution is not possible, the next finest resolution is used.

A stratified random sampling (StRS) design was employed to survey the coral reef ecosystems across the region. The survey domain encompassed the majority of the mapped area of reef and hard bottom habitats in the 0-30 m depth range. The stratification scheme included island, reef zone, and depth. Sampling effort was allocated based on strata area and sites were randomly located within strata. Sites were surveyed using photo-quadrats along transects to collect benthic imagery to ultimately produce estimates of relative abundance (benthic cover), frequency of occurrence, benthic community taxonomic composition and relative generic richness. The StRS design effectively reduces estimate variance through stratification using environmental covariates and by sampling more sites rather than sampling more transects at a site. Therefore, site-level estimates and site to site comparisons should be used with caution.

**National Coral Reef Monitoring Program: Benthic Cover Derived from Analysis of Benthic Images Collected for Climate Stations across the Pacific Remote Island Areas from 2023-03-15 to 2023-03-19**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290628

The coral reef benthic community data described here result from the annotation (classification) of benthic images collected during photoquadrat surveys at permanent sites in the islands and atolls of the Pacific-Remote Island Areas (PRIA) in 2023. These surveys are conducted by the NOAA Pacific Islands Fisheries Science Center (PIFSC), Ecosystem Sciences Division (ESD, formerly the Coral Reef Ecosystem Division) as part of NOAA's ongoing National Coral Reef Monitoring Program (NCRMP) according to protocols established by ESD and NCRMP during ESD-led NCRMP missions to PRIA.

SCUBA divers conducted benthic photoquadrat surveys at permanent sites established in coral reef habitats by ESD. A select number of these sites were chosen in hard-bottom habitat at ~15-m depths, and a subset of the permanent sites (climate stations) were established at north, south, east, and west points around each of the islands and atolls. The divers photographed the reef at 1-m intervals on both sides of the 15-m tape, generating 30 photographs per survey site. Benthic habitat images were quantitatively analyzed using the web-based annotation tool, CoralNet (Beijbom et al. 2015). Ten points were randomly overlaid on each image and human analysts identified the organism or type of substrate beneath, with 300 annotations (points) generated per site. Benthic elements falling under each point were identified to genus/morphology for hard corals, and to genus/functional group for algae, invertebrates, and other taxa following Lozada-Misa et al. (2017). In general, the analysis resulted in three levels of benthic community data, including taxa group Tier 1 (e.g., coral, soft coral, macroalgae, turf algae, etc.), Tier 2 (e.g., Coral = massive hard coral, branching hard coral, foliose hard coral, encrusting hard coral, etc.; Macroalga = upright macroalgae), and Tier 3 (e.g., Coral = Astreopora sp, Favia sp, Pocillopora, etc.; Macroalgae = Caulerpa sp, Dictyosphaeria sp, Padina sp, etc.). If Tier 3 resolution is not possible, the next finest resolution is used.. These benthic data can ultimately be used to produce estimates of relative abundance (percentage of benthic cover), frequency of occurrence, benthic community taxonomic composition, and relative generic richness.

**National Coral Reef Monitoring Program: Stratified Random Surveys (StRS) of Reef Fish, including Benthic Estimate Data across the Pacific Remote Island Areas from 2023-03-15 to 2023-05-07**
https://www.ncei.noaa.gov/access/metadata/landing-page/bin/iso?id=gov.noaa.nodc:0290148

The reef fish and benthic estimate data provided in this data set were collected during SPC surveys as part of the ESD-led NCRMP mission around the Pacific Remote Island Areas, including Howland and Baker in 2023.

The SPC method catalogs the diversity (species richness), abundance (numeric density) and biomass (fish mass per unit area) of diurnally active reef fish assemblages in shallow-water (less than 30 m) hard-bottom habitats. Visual estimates of benthic cover and topographic complexity are also recorded, with benthic organisms grouped into broad functional categories (e.g., 'Hard Coral', 'Macroalgae'). A stratified random sampling (StRS) design is employed to survey the coral reef ecosystems throughout the Pacific Remote Island Areas. The survey domain encompasses the majority of the mapped area of reef and hard bottom habitats and the stratification includes island, reef zone, and depth. Sampling effort is allocated based on strata area.