NOAA Fisheries' Deep-Sea Coral Research & Technology Program Science Planning Workshop for the Pacific Islands Regional Initiative

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Pacific Islands Fisheries Science Center
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Beth Lumsden[1], Frank Parrish[1], Heather Coleman[2], Alexis Weinnig[2], Jessica Clyburn[2]

[1] Pacific Islands Fisheries Science Center
National Marine Fisheries Service
1845 Wasp Boulevard
Honolulu, HI 96818

[2] NOAA Fisheries Office of Habitat Conservation
1315 East-West Highway, 14th Floor
Silver Spring, MD. 20910

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Cover photo: Pacific deep-sea coral with crinoids and crab within its branches. Photo credit: NOAA Fisheries. Photographer: Frank Parrish

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Executive Summary

This report sets the stage for the next phase of deep-sea coral (DSC) and sponge research under the Pacific Islands (PI) Deep-sea Ecosystems of Sponges and Corals: Exploration, iNvestigation, and Technology (DESCENT) Initiative (2025–2028). To map out this ambitious effort, the Pacific Islands Fisheries Science Center convened a science planning workshop on November 13–14, 2024. Building on the achievements of CAPSTONE (Campaign to Address Pacific monument Science, Technology, and Ocean NEeds, 2015–2018) and other foundational research, the workshop brought together experts from across the country to advise on a strategic course for advancing our understanding and management of deep-sea ecosystems in the Pacific.

The workshop opened with a comprehensive review of the current state of knowledge about these ecosystems, laying the groundwork for a collaborative effort to shape future research priorities. Participants explored the complex environmental factors that drive the distribution of deep-sea corals and sponges, such as oxygen gradients, water column characteristics, and geographic variables. These discussions emphasized the need to move beyond isolated studies and embrace a holistic, ecosystem-level approach that connects biological, geological, and oceanographic perspectives. One of the recurring themes was the critical need for technological innovation. Participants identified advanced tools like autonomous underwater vehicles (AUVs), remotely operated vehicles (ROVs), and environmental DNA (eDNA) methods as essential for gathering more detailed and accurate data. These technologies not only promise to enhance our capacity for high-resolution mapping and environmental monitoring, but they also allow researchers to overcome logistical challenges in these remote and extreme environments. The workshop also addressed the growing threats facing deep-sea ecosystems. Participants voiced concerns about the potential impacts of climate change, deep-sea mining, and energy infrastructure, urging the integration of these emerging issues into research agendas. They underscored the importance of establishing robust baseline data sets and implementing long-term monitoring programs to track changes over time. Predictive modeling emerged as a key tool for anticipating future shifts and guiding conservation strategies, ensuring that management decisions are grounded in the best available science.

Collaboration and accessibility featured prominently in the discussions as participants highlighted the need to bridge silos between organizations and disciplines, fostering partnerships that can accelerate progress. They also called for efforts to reduce the backlog of unanalyzed data and make existing data sets more accessible to a broader range of researchers, policymakers, and stakeholders. Recognizing the need to sustain and expand the field, participants stressed the importance of investing in the next generation of scientists. Providing opportunities for hands-on training and mentorship will not only build capacity but also help equip future researchers to tackle the unique challenges of deep-sea exploration and conservation. Ultimately, the Pacific DESCENT Initiative seeks to address critical gaps in our knowledge, lay the foundation for more effective and informed conservation strategies, and expand our understanding of these fragile and poorly understood ecosystems..

Background

NOAA's Deep-Sea Coral Research and Technology Program (DSCRTP), administered by NOAA Fisheries' Office of Habitat Conservation, was established under Section 408 of the Magnuson-Stevens Fishery Conservation and Management Act. It is the nation's only federal research program dedicated to understanding ecosystems supported by deep-sea corals and sponges. The work conducted by the DSCRTP includes exploration and science that supports critical management decisions about these habitats and their associated ecosystems, informs essential fish habitat discussions, and improves our understanding of the impacts of deep-sea activities, such as potential energy infrastructure siting and marine mineral mining. Due to the high cost of deep-sea research, funds are rotated around the country to support research activities and maximize collaborative opportunities with other NOAA offices (Ocean and Atmospheric Research (OAR), National Ocean Service (NOS), National Environmental Satellite, Data, and Information Service (NESDIS)) and federal partners (e.g., United States Geological Survey (USGS), Bureau of Ocean Energy Management (BOEM), U.S. Fish and Wildlife Service (FWS), National Science Foundation (NSF)). This two pronged approach allows the regional initiatives (such as the Pacific Islands (PI) Deep-sea Ecosystems of Sponges and Corals: Exploration, iNvestigation, and Technology (DESCENT)) to best meet the requirements articulated in the NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems: Research, Management, and International Cooperation.

About the Workshop

During the two-day workshop held from November 13–14, 2024, staff from the NOAA Fisheries Pacific Islands Fisheries Science Center (PIFSC) and the DSCRTP organized a deep-sea coral and sponge science planning workshop at the Inouye Research Center on Ford Island in Honolulu, HI. The workshop brought together experts from around the Nation to help identify exploration, research, conservation, and management priorities during FY26-27 for deep-sea coral and sponge ecosystems in the U.S. Pacific Island waters. A steering committee (Appendix A) consisting of representatives from NOAA Ocean Exploration, Office of National Marine Sanctuaries (ONMS), NOAA Fisheries, the University of Hawai'i, and the Western Pacific Fishery Management Council (WPFMC) developed the workshop's goals, objectives, schedule, logistics, and final summary. The workshop consisted of two parts: (1) presentations providing a general overview on the goals of the national DSCRTP, followed by presentations on the state of knowledge on deep corals in the Pacific, the associated management responsibilities, and potential tools for future investigations; and (2) a series of breakout group discussions to identify and refine critical information needs followed by plenary discussions (Appendix B).

On Nov 13–14, 2024, just over ten years after its previous such workshop, scientists and resource managers came together at the Inouye Research Center on Ford Island in Honolulu, HI, to discuss focused research, share thoughts on priority work to complete in the coming 2 years, and identify critical information needs to meet regional conservation and management priorities for deep-sea coral and sponge ecosystems in the Pacific Islands Region. The workshop participants included representatives from a suite of federal agencies, an environmental non-governmental organization, the WPFMC, and academia (see Appendix B for a full list of participants and affiliations). These participants volunteered their substantial expertise towards the development of a 2-year exploration and research science priorities plan.

Workshop Presentation Summaries

The workshop opened with a warm welcome and an introduction to DESCENT by Charles Littnan, Director of the Pacific Islands Fisheries Science Center, and Kara Meckley, Division Director of the Habitat Protection Division within the Office of Habitat Conservation, which oversees the DSCRTP. Their remarks set the stage for a series of presentations by experts, who provided a comprehensive overview of the current state of knowledge on Pacific Islands deep-sea coral and sponge ecosystems. These presentations explored topics such as biology, ecology, distributions, connectivity, physiological limitations, data gaps, management strategies, and threats. This informative session laid the groundwork for small breakout discussions aimed at identifying and prioritizing key research needs for the next few years.

NOAA's Deep-Sea Coral Research and Technology Program

Heather Coleman, NOAA Fisheries, Office of Habitat Conservation

Heather Coleman, Deep-Sea Coral Research and Technology Program (DSCRTP) manager, shared an introduction to the national program and its operational strategy. The DSCRTP, established in 2007 under the Magnuson-Stevens Fishery Conservation and Management Act, serves as a national hub for deep-sea coral science and management. The program's mission is to support peer-reviewed research that informs the sustainable management of these vulnerable marine ecosystems. DSCRTP activities encompass primary research, such as habitat mapping, taxonomic identification, biological sampling and ageing, habitat suitability modeling, and impact assessment from human activities like fishing. Data applications include maintaining a database of coral and sponge observation records, developing species distribution models, and creating species and habitat guides. Management support includes characterizing resources within national marine sanctuaries and marine national monuments, evaluating the effectiveness of fishing regulations, and providing science-based recommendations for infrastructure siting, including aquaculture and energy developments. Achieving these goals requires extensive collaboration across NOAA offices and with external partners, including BOEM and USGS. These partnerships leverage diverse expertise and resources, facilitating a bridge from research to actionable management. The program's science directly informs council decisions, sanctuary and monument planning, experimental fishing permits, and the siting of renewable energy infrastructure, ensuring the protection and sustainable use of deep-sea coral habitats across U.S. waters.

The First Pacific Islands Deep-Sea Coral Research Initiative (2015–2017) Additional Subheading

Frank Parrish, NOAA Fisheries, Pacific Islands Fisheries Science Center

Frank Parrish provided a retrospective on the first Pacific Island deep-sea coral research initiative conducted from 2015–2017. This first effort sought to meet the needs of managers to deepen our understanding of monk seal foraging and preybase found in these deep habitats, fish/habitat associations, and the growth, life history, resilience, and environmental drivers of deep coral communities. The Initiative focused on five questions.

1. What information can be derived from existing data sets?
2. What are the biogeographic patterns at the basin-scale?
3. What are the depth distributions of corals and sponges, especially between 500 and 4000 m?
4. What are the environmental factors that affect the distributions of deep-sea corals and sponges?
5. What are the life history traits, genetic factors, and growth characteristics that determine how long it takes a deep-sea coral or sponge community to recover from disturbance?

Each of the chosen eight projects touched on all or most of those five questions.

1. Look at existing data from deep-coral and sponge observations to create a system that supports a national deep-sea coral database.
2. Update bathymetry and backscatter and map synthesis with visual survey of previously unknown seamounts in the U.S. Pacific Islands. (CAPSTONE)
3. PIFSC multibeam survey and analysis of mesophotic Bathymetry <500 m in American Samoa, PRIA, HI, and Marianas (with their regionally associated Reef Assessment and Monitoring Programs) R/V *Hiialika*i.
4. Survey and map areas of high abundance (rift zone ridges) of deep corals to look at vertical distribution throughout the Pacific Islands.
5. Population size-structure, diversity, vertical distribution, growth, and resilience of shallow water black coral in the MHI.
6. Field surveys of SCUBA-accessible black coral populations in Hawai‘i and American Samoa looking at taxonomy and distribution.
7. Field and laboratory work to estimate community succession and recruitment rates using known age lava flows as settling plates.
8. Instrumentation and environmental monitoring collecting temp, currents, backscatter in patches of deep-sea corals.

The Initiative maximized the use of a variety of platforms and opportunistic funding support mechanisms to produce a variety of peer reviewed as well as internal reports on diverse topics such as coral resilience in previously trawled habitats, research on isotope concentrations in corals, using survey data to look at biodiversity transitions around American Samoa, and developing predictive models to help target the occurrence of deep-sea coral communities.

NOAA Ocean Exploration's Gold Medal Capstone Campaign 2015–2017

Chris Kelley, retired, former CAPSTONE Chief Scientist

Chris Kelley, now retired, led the Campaign to Address Pacific monument Science, Technology, and Ocean Needs (CAPSTONE) 2015–2017. The CAPSTONE initiative focused on the U.S. monuments in the Pacific using the paired tools of the ROV and multibeam mapping capabilities of NOAA Ship *Okeanos Explorer* and Exploration Command Centers to bring the deep-sea and the on-going science to communities in the region and across the U.S. CAPSTONE had seven research priorities with the aim of simultaneously achieving multiple goals with each ROV dive by selecting target areas, depths, and physical sample collections with this objective in mind. The seven priorities included the following.

1. Survey the deepwater resources in the U.S. Pacific monuments
    a. Conducted 101 of 173 ROV dives in U.S. Pacific monuments and eight dives in the Phoenix Islands Protected Area (PIPA).
2. Find and survey high-density deep-sea coral and sponge communities with emphasis on their species composition and the environmental factors conducive to their formation.

    a. Found and surveyed 56 new high-density deep-sea coral and sponge communities bringing the known total to fifty-eight as of 2017. Thirty-nine of these are in the Prime Crust Zone (PCZ) and at manganese crust depths of 1000-3000 m.
3. Survey seamounts within the PCZ, their manganese crust and nodule deposits, and the animals living on these seamounts that could be severely impacted by deep-sea mining operations.
    a. Surveyed the animals living on manganese crust substrates on 59 PCZ seamounts.
4. Obtain data and samples to help forward our understanding of the geologic history of Pacific seamount chains important to the understanding of plate tectonics.
    a. Obtained geologic data and samples from 98 seamounts throughout the Pacific.
5. Obtain data and samples to help forward subduction zone geology and biology
    a. Conducted 34 ROV dives in the Marianas subduction zone obtaining geologic and biological data and samples.
6. Survey deep-sea fisheries resources in the U.S. Pacific monuments.
    a. Conducted 20 ROV dives focused on deep-sea fisheries resources.
7. Find and survey historically significant submerged cultural resources.
    a. Conducted surveys of four historically significant submerged cultural resources.

CAPSTONE focused its work on megahabitats such as guyots, seamounts, and ridges. In total, CAPSTONE conducted 173 ROV dives, retrieved 767 biological specimens and 286 geological samples, generated 92,513 annotated video records of corals, sponges, fishes, and commensals. Products generated from this wealth of information contributed to a 5000+ image guide of benthic deep-water animals, eight regional and over 100 site characterization reports. A surprising finding was that community density drops off dramatically between 2500–3000 m, with no high-density communities below 3000 m depth. CAPSTONE ended with many questions unanswered. What impact does ridge morphology and orientation have on deep-sea habitats and biota? Is the lack of high-density communities below 3000 m a pan-Pacific phenomena and why? The Musician Seamounts offer a rich and dense array of seamount types that can address many questions and they deserve further study.

Revealing the Deep: A Compilation of Deep-Sea Video Coverage of the Pacific

Nikki Cunanan, Sarah Bingo, Aaron Judah, Cooperative Institute for Marine and Atmospheric Research (CIMAR), Deep-Sea Animal Research Center (DARC), University of Hawai‘i at Mānoa

Nikki Cunanan, Sarah Bingo, and Aaron Judah of the Deep-Sea Animal Research Center (DARC) assemble and curate data from ROVs, submersibles, and stationary camera systems using various annotation platforms and databases. The DARC team are experts in animal identifications, from corals to fishes. The DARC team produces comprehensive animal guides featuring the best imagery of each unique species

observed within a visual data set. They also integrate physical, chemical, habitat, and animal identification data, and quantitative visual transect analysis for incorporation into their and other databases. The DARC team has streamlined the process and ensures the highest quality output. The annotation workflow involves data import, annotation quality assurance, formatting and integrations, data storage, and submission. Collection methods are primarily ROVs and baited drop cameras. Image and video media collected from those ROV platforms are processed and stitched together into uniform 2-hour segments for consistency and imported into the Video Annotation and Reference System (VARS). After animal occurrences are annotated in VARS, the occurrence records are merged with the sensor and location data associated with each media file. Baited drop camera media are uploaded to Tator (web-based video annotation software) for annotation. Thus, the records are preserved until the DARC team is available to conduct the more thorough analysis. During the annotation process, ROV videos are evaluated in VARS for information on species, habitat, and interactions while baited drop camera footage is annotated in Tator with information on species, habitat, time of first arrival, maximum number of individuals in a frame, and behavioral interactions. Quality assurance ensures data integrity by checking for accuracy against the VARS knowledge base, consulting with taxonomic experts, and checking for other conflicting associations. Final data sets are formatted in flattened tabular spreadsheets, cross-referenced with the latest species data in WORMS (World Register of Marine Species), and prepared for submission to the DSCRTP, National Geographic Society Pristine Seas (NGS PS) and other agencies. While metadata is retained from cruises and dives and uploaded assiduously, to date, a significant number of dives on various platforms and across different geomorphological regions remain unannotated.

Beyond the Blue: Illuminating the Pacific

Kasey Cantwell, NOAA Ocean Exploration

Kasey Cantwell, NOAA Ocean Exploration, spoke on behalf of the Beyond the Blue Campaign to share the details of their current Pacific campaign and 2024 results. The campaign seeks to leverage the assets and capabilities of many partners (including U.S. Government, non-profit organizations, industry, academic institutions, and others) to address identified gaps and priorities in the Pacific Islands region. Beyond the Blue is only a little older than DESCENT, kicking off in January 2024. As a multiyear, collaborative science and research campaign, Beyond the Blue hopes to bring partners together to deepen our shared knowledge, understanding, and appreciation of waters in the Pacific Islands region through coastal and ocean mapping, exploration, and characterization. Geographically, the campaign extends as far north as the Emperor seamounts, as far east as French Polynesia, as far south as Tonga, as far west as Palau and the Marianas. To effectively close mapping and exploration gaps within this massive area, the campaign is seeking new partners both within and outside the federal government. Aside from the science operations, partners in Beyond the Blue share a common interest in outreach and capacity development, with several of the partner organizations offering internships, training, at-sea opportunities, and educator development workshops as well as outreach events with local communities at ports of call. To date, the Campaign has mapped 2% of the US EEZ or 8% or the unmapped

areas in the Pacific Islands Region which included: 10% of PMNM (~140,000 sq km) and 10% of Johnston Atoll Unit of PRIMNM (43,904 sq km). In 2025, the BTB planned operations include those highlighted in Figure 1.

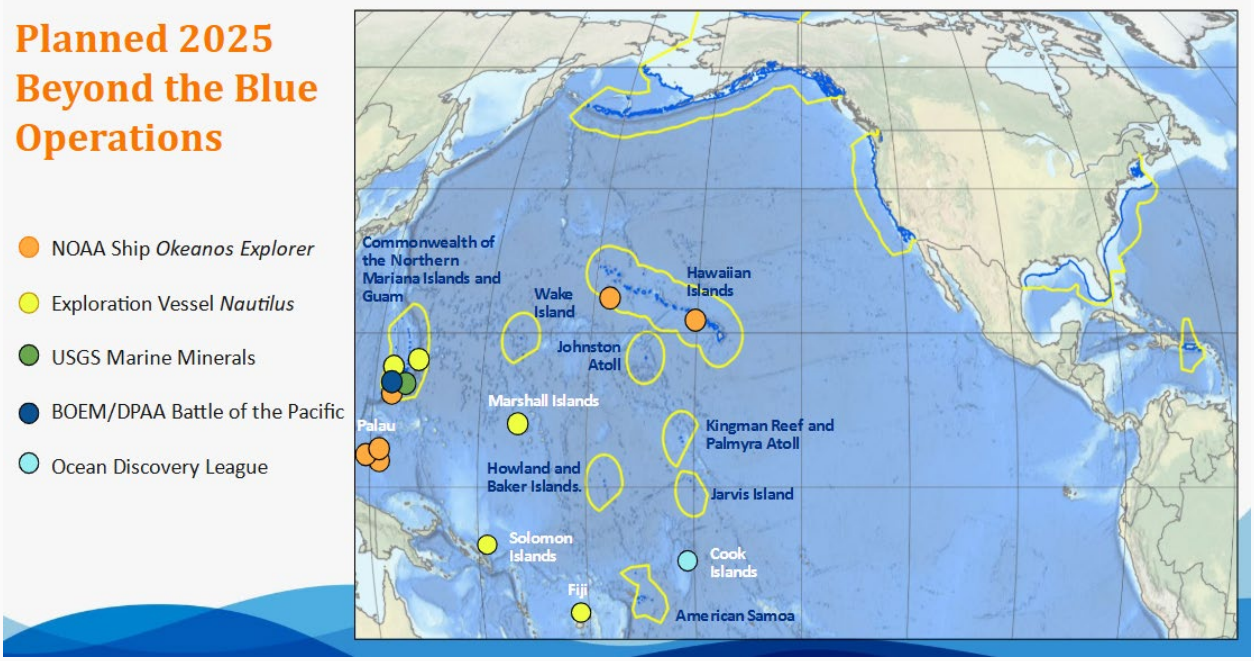

Figure 1: Planned 2025 operations for the Beyond the Blue Campaign. Orange represents the NOAA Ship *Okeanos Explorer.* Yellow dots represent Ocean Exploration Trusts' plans with Exploration Vessel Nautilus. Green dots indicate a USGS Marine Mineral project, and Blue dots mark the BOEM/DPAA Battle of the Pacific project.

ONMS Conservation Priorities for Deep-Sea Corals and Sponges

Sarah Head, NOAA's Ocean Service, National Marine Sanctuary of American Samoa

Sarah Head of the National Marine Sanctuary of American Samoa (NMSAS) highlighted conservation priorities for deep-sea corals and sponges, emphasizing place-based strategies to ensure healthy, resilient marine protected areas. The ONMS includes 17 sanctuaries and two marine national monuments (MNM), with three sites in the Pacific: Papahānaumokuākea (PMNM), the NMSAS, and Rose Atoll MNM. These areas, particularly their deep-sea ecosystems, remain underexplored and undermapped, emphasizing the need for enhanced characterization and monitoring efforts. Key goals for the FY22-27 ONMS Strategic Plan that intersect with DESCENT include integrating local and Indigenous knowledge, advancing mapping and habitat characterization, and leveraging data from biological sampling to validate predictive models. Tools like eDNA and molecular sampling are essential for identifying species of concern and understanding ecosystem dynamics. Ecosystem-based approaches are encouraged, coupling technologies like Structure-from-Motion for benthic habitats with fish surveys while monitoring climate indicators such as temperature, dissolved oxygen, and currents. The linkages between midwater, surface, and deep-sea conditions are critical for understanding these ecosystems' responses to changing ocean conditions. These

programs provide opportunities to establish baselines, refine methodologies, and address questions of connectivity and biogeography between sanctuary sites and other jurisdictions. Sanctuaries bring unique capabilities to the collaboration, including community engagement through Sanctuary Advisory Councils, robust educational programs, and translating science into actionable conservation strategies.

State of Knowledge of DSC in the Pacific

Amy Baco, Florida State University

Dr. Amy Baco-Taylor of Florida State University shared her insights on the current state of knowledge regarding the deep-sea coral and sponge ecosystems of the U.S. Pacific and outlined key research priorities to advance understanding over the coming years. Seamount ecosystems exhibit high alpha diversity, characterized by a significant number of species and a balance between species richness and evenness. Beta diversity, which reflects species turnover and changes in community composition between sites, also reveals remarkable variability across these ecosystems. For example, at Makapu‘u (320–530 m depth), southwest of O’ahu, six distinct biological assemblages were identified within a 1-km range, with 93% dissimilarity among communities. Similarly, the steeply sloped sides of Mokumanamana, an uninhabited island in the Northwestern Hawaiian Islands within the Papahānaumokuākea Marine National Monument, support nine distinct assemblages exhibiting 90–95% dissimilarity, despite their proximity. Community structure, species composition, and diversity often vary substantially within a single seamount based on depth and slope. Fish communities exhibit similar patterns of variability. For instance, the western sides of Pioneer Bank and French Frigate Shoals, though separated by 900 km, exhibit 100% similarity in community structure. Conversely, the west side of Mokumanamana, despite its geographic proximity, shows only 40% similarity to these areas. Other sides of the same seamounts exhibit even lower similarity, highlighting the high beta diversity within and among these seamount ecosystems. This diversity warrants further exploration to understand the ecological drivers of community structure.

Genetic studies corroborate these findings, showing high genetic diversity across seamount sides. Using *Hemicorallium laauense* as a model, samples demonstrated significant genetic variability within and between populations. U.S. Pacific seamounts host diverse deep-sea coral and sponge communities, dominated by octocorals, with high alpha, beta, and genetic diversity. These findings suggest two potential management strategies: (1) establishing fully protected areas off-limits to all bottom-contact activities or (2) adopting site-specific management strategies to retain ecological functions post-impact. Determining the best approach requires comprehensive baseline surveys, particularly in areas targeted for activities such as mining, fishing, energy infrastructure, and assessments of climate change impacts like ocean acidification.

Research comparing untrawled, recovering, and actively trawled sites reveals significant adverse impacts to vulnerable marine ecosystems (VMEs). Evidence includes coral entanglement in nets, trawling scars, and reduced coral abundance. Long-term trawling drastically reduces the likelihood of recovery, even in protected areas. For instance, *H. laauense*, a dominant coral species, is nearly absent from trawled and recovering sites,

underscoring the widespread impact on VMEs. Nevertheless, with adequate protection, recovery is possible, making it imperative to safeguard these ecosystems. The conservation of VMEs and deep-sea coral communities requires both additional research and active engagement by subject matter experts in policy and management frameworks. U.S. governmental agencies should prioritize high-seas VMEs and enable academic scientists to participate in Regional Fisheries Management Organization delegations.

Understanding connectivity among deep-sea coral communities is critical for effective management, including insights into their development, recovery, and resilience. Current knowledge of deep-sea currents, larval dispersal mechanisms, and population genetics is limited. Genetic data reveal that disturbed sites exhibit reduced genetic diversity, relying heavily on local recruitment and resulting in diminished resilience. Measurements of FIS (inbreeding coefficient) indicate that trawled areas experience greater genetic isolation, while G'ST (genetic differentiation) highlights significant divergence between trawled and untrawled populations. Recovering sites play a vital role in maintaining connectivity and should be prioritized for protection. Further research on genomics, larval dispersal, and reproductive biology is essential to inform connectivity models and conservation strategies. Comprehensive baseline data, including reproduction, current modeling, and ecosystem function studies, are necessary to guide management. U.S. Pacific and high-seas seamounts face significant pressures from fishing, climate change, and other seabed activities. Enhancing our understanding of these ecosystems and their connectivity is vital for their long-term conservation and the preservation of their ecological functions. Active engagement in high-seas management, with the input of academic subject matter experts, is crucial to achieving these goals.

Threats to DSC and Science Needs to Support Deep Coral Habitat Conservation and Management

Malia Chow, Pacific Islands Regional Office

Malia Chow of the Pacific Islands Regional Office (PIRO) Habitat Conservation Division outlined the priorities and challenges associated with the identification, conservation, and management of deep-sea coral and sponge ecosystems within the Pacific marine national monuments (Figure 2), including the Marianas Trench, Pacific Remote Islands, Papahānaumokuākea, and Rose Atoll. Conservation efforts are guided by statutory frameworks such as the Essential Fish Habitat provisions under the Magnuson-Stevens Act and the Fish and Wildlife Coordination Act, emphasizing the protection of habitats critical to federally managed species and the mitigation of anthropogenic impacts. Emerging threats, including deep-water technologies (e.g., fiber-optic cables, energy infrastructure, and aquaculture), necessitate proactive strategies to minimize impacts on these long-lived, slow-growing ecosystems. Research priorities include habitat characterization, identification of biodiversity hotspots, understanding the drivers of coral and sponge distribution, assessing connectivity among populations, and exploring ecosystem linkages. Tools such as habitat suitability models are essential for mapping, permitting, and predicting vulnerabilities under changing ocean conditions. These

models, combined with ground-truthing efforts, enable managers to prioritize conservation actions and adapt to climate-induced and human-mediated pressures. Through interdisciplinary collaboration and advanced modeling, documenting and understanding the scope and scale of resources under our protection, and integrating ecological data into management frameworks allows resource managers to mitigate the threats to these communities and inform long-term conservation strategies.

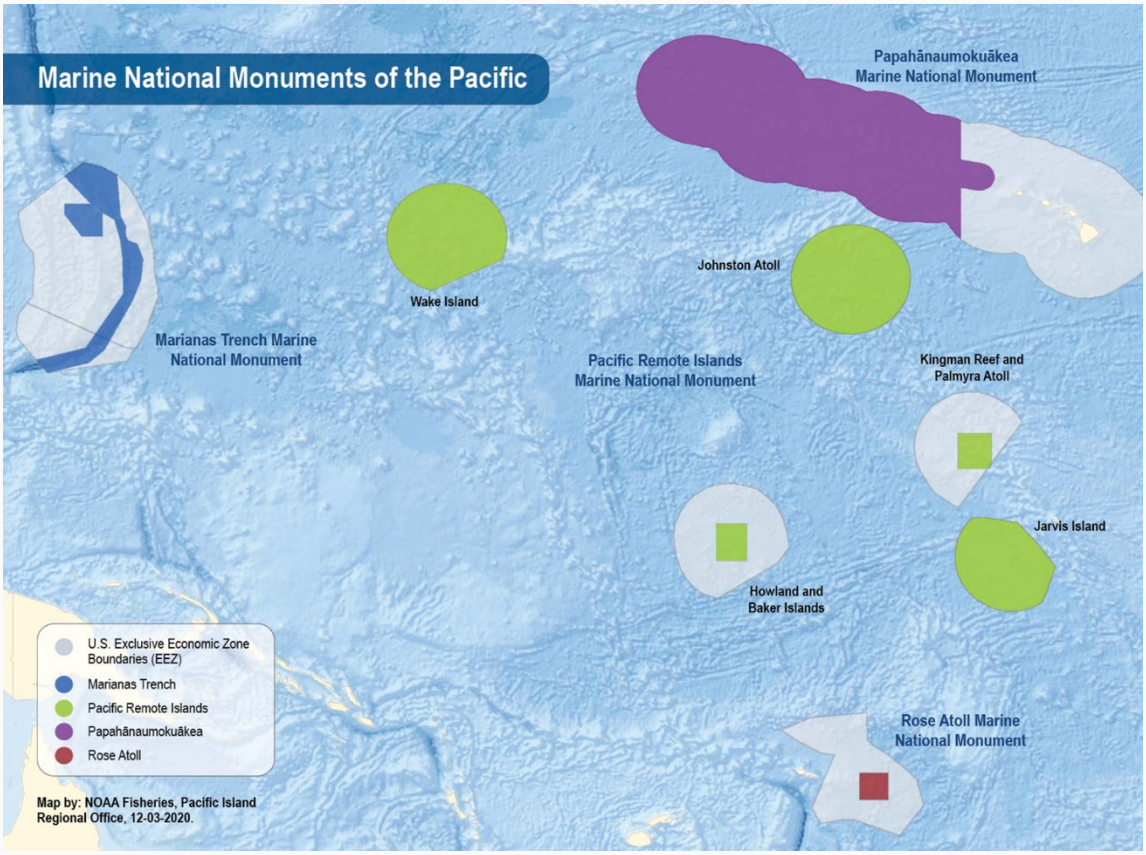

Figure 2: Map of the U.S. Pacific Islands region showing U.S. islands, their exclusive economic zones (grayed areas), and monument boundaries (green, purple, and red areas).

Science Needed to Support Deep-Sea and Precious Coral Management

Joshua DeMello, Western Pacific Fishery Management Council

Joshua DeMello, of the Western Pacific Fishery Management Council, discussed the history and prospective future of precious coral harvest in the Western Pacific region. The Council's inaugural Fishery Management Plan (FMP) established management strategies for key species, including pink coral (*Pleurocorallium secundum*), red coral (*Hemicorallium laauense*), gold coral (*Kulamanamana haumeaae*), bamboo coral (*Acanella sp.*), and black coral (*Antipathes griggi, Antipathes grandis, Myriopathes ulex*). This plan employed an area-based management approach, designating specific beds and refugia, setting annual harvest limits and minimum size requirements, and mandating the use of selective gears under permit regulations. Effective management

depends on accurately delineating the extent of coral beds. During the initial implementation of the FMP, 10 harvestable beds were identified, but today, only the Makapu‘u bed off O‘ahu remains active. U.S. territories such as Guam, the Commonwealth of the Northern Mariana Islands, and American Samoa are exploratory areas as there are not many, if any, known precious coral beds. Updated stock assessments are urgently needed to recalculate quotas and revise annual catch limits, which are still based on data from the 1970s. An assessment of the Makapu‘u bed could serve as a proxy for other beds in the refinement of quotas and also contribute to improving Essential Fish Habitat designations. Renewed interest in the fishery has prompted the Council to prioritize improving management of black coral and to study the effects of climate change on both precious and black coral populations. Research priorities remain consistent with those initially identified in the 1970s and include:

- stock assessments to refine estimates of maximum sustainable yield;
- evaluation of overfishing and overfished conditions,
- economic data collection, including costs of harvest, production, and ex-vessel value;
- analysis of growth rates, mortality, and stock-recruitment relationships;
- examination of harvest impacts on recruitment and adult stocks; and
- assessment of bycatch and refinement of selective harvest methods.

Addressing these research gaps will enhance the Council’s ability to sustainably manage precious coral fisheries, adapt to climate-related challenges, and support the economic and ecological resilience of these valuable marine resources.

Overview of BOEM Activities in the Pacific Islands Region

Jennifer Le, Bureau of Ocean Energy Management, Pacific Region

Jennifer Le, from the BOEM Pacific Region, highlighted recent and upcoming activities in the Pacific Islands region, emphasizing the agency’s mission to manage 3.2 billion acres of the U.S. Outer Continental Shelf for energy, mineral, and geological resource development in an environmentally and economically responsible manner. Energy infrastructure siting is a primary focus, with early-stage planning underway in the Pacific. The leasing process follows a structured framework: planning and analysis to identify energy infrastructure areas, competitive or non-competitive auctions, and several rounds of lessee plan submission and detailed project review. Public engagement, environmental reviews, and consultations ensure sustainable development over the 35-year operational period. Hawai‘i’s Intergovernmental Renewable Energy Task Force reconvened to refresh Hawai‘i’s renewable energy goals, understand BOEM’s leasing process and current region-specific studies, and hear the status of regional energy infrastructure planning (BOEM.gov/hawaii). Guam established a similar Intergovernmental Renewable Energy Task Force this year, meeting for the first time in September (BOEM.gov/guam). Mooring and anchors for turbines at up to 1,300 m deep are being planned for near-term commercialization, and moorings at up to 2,600 m are anticipated for the longer term. Marine mineral exploration is another activity of interest, focusing on polymetallic nodules containing

critical materials such as nickel, cobalt, and rare earth elements, found at depths of 3,500–6,000 m. These resources require continued research and monitoring to improve understanding of potential seabed resources and their opportunities, risks, and uncertainties. BOEM's Environmental Studies Program (ESP) underpins energy infrastructure and critical mineral efforts, providing data on the impacts of offshore energy and mineral activities on human, marine, and coastal environments. The ESP supports baseline assessments, impact analyses, and mitigation and monitoring strategies. Current partnerships include NOAA's Pacific Islands Fisheries Science Center and the Beyond the Blue campaign, with planning for FY26 funding cycles underway.

National Ocean Mapping Exploration and Characterization (NOMEC) Prioritization

Heather Coleman, NOAA NOMEC Representative

Heather Coleman discussed the activities of the National Ocean Mapping, Exploration, and Characterization (NOMEC) Council's Interagency Working Group on Ocean Exploration and Characterization (IWG-OEC). NOMEC facilitates a coordinated, multidisciplinary approach to ocean mapping and characterization, bringing together 11 federal agencies and departments to align efforts and fulfill national mandates. The IWG-OEC operates through five thematic subgroups: Benthic Ecology, Cultural Heritage, Non-living Marine Resources, Seafloor Hazards, and Water Column. Each subgroup established strategic priorities in 2022 to better coordinate exploration and characterization across all U.S. waters. In 2024, the groups refined goals and associated data needs specifically for the Pacific Islands, revising priorities to align with both Beyond the Blue and DESCENT. Workshop participants were encouraged to contribute recommendations to foster collaborative discussions and shape future exploration and characterization strategies.

Opportunities and Constraints for the Next Pacific Islands Initiative

Frank Parrish, NOAA Fisheries, Pacific Islands Fisheries Science Center

Frank Parrish shared an overview of the opportunities and challenges facing the next phase of deep-sea coral (DSC) research, drawing on the synthesis of the preceding initiative and the current state of available assets. He highlighted the achievements of the CAPSTONE project, emphasizing its contributions to advancing our understanding of DSC communities in the Pacific. Despite the progress, none of the five priority questions from the first initiative were definitively answered and could still be a focus of work. Recommended for the future is a stronger focus on ecosystem-level research, including revisiting previously unanalyzed samples, investigations into the drivers of coral distribution such as oxygen gradients, water column characteristics, and other geographic variables. Addressing these factors would not only help refine habitat models for predicting coral patch distribution but also address foundational CAPSTONE questions regarding coral patch formation and persistence.

Expanding the scope of surveys to include greater depths, particularly those overlapping with seabed mining interests, is critical to mitigating the threat to DSC

habitats associated with mineral extraction. Crucial to this future is the next generation of scientists and developing their expertise and skills in this challenging field. The initiative could play an important role in fostering the next generation by looking for opportunities for students to identify natural experiments, such as coral communities colonizing shipwrecks or those regenerating after volcanic disturbances. The data they collect would both enhance our understanding of the deep-sea community and build a base of expertise. Our work in the coming few years should embrace cutting-edge technologies to characterize the deep-sea environment more effectively. Integrating data from visual surveys using telepresence, baited cameras, landers, ROVs, and AUVs could build a data stream that moves beyond presence-absence characterization into life history, behavior, and interactions of DSC organisms. Additionally, elemental analysis of coral skeletons holds promise for unraveling the impacts of climate change on DSC life histories and connectivity across spatial and temporal scales. Collaborations between the DESCENT program, NOAA Ocean Exploration, the Ocean Exploration Trust, and academic partners will be essential to maximize the scientific and operational potential of upcoming research efforts.

Breakout Sessions

Breakout sessions were intended to encourage small group discussions on each of three deep-sea coral and sponge research topics: (1) biology and ecology, (2) biogeographic distributions, and (3) threats to deep-sea coral communities. Below are the goals, guiding discussion questions, and summaries of each session.

Biology and Ecology Breakout

The biology and ecology breakout sessions focused on identifying and prioritizing research objectives for assessing the population dynamics, biology, and ecological interactions of deep-sea corals and sponges during the 2025–2028 DESCENT Initiative. Emphasis was placed on defining priorities across multiple spatial and temporal scales, with a focus on generating results that can be integrated into other initiative components or directly inform and enhance resource management decisions.

Guiding questions included:

- *Growth, survival, and reproductive strategies:* What specific life history traits should we prioritize to support the long-term sustainable management of these ecosystems, considering threats such as climate change?
- *Methodologies:* What new sampling tools will bear the most fruit in terms of achieving near-term management/conservation goals? How can we best coordinate efforts to standardize sampling methodologies so that data are consistent and transferable?
- *Habitat mapping:* What specific data should be prioritized in mapping efforts to support effective management strategies?
- *eDNA:* What specific insights can eDNA provide to link deep-sea corals, fish populations, and protected species? How can we integrate eDNA data with traditional monitoring methods to create a more comprehensive understanding of marine ecosystems?
- *Sampling:* How should collected specimens be handled and stored for long-term study?

Summary of Biology and Ecology Plenary Session

Four breakout groups discussed, identified, and prioritized deep-sea coral and sponge biology, ecology, and population dynamics key research questions to facilitate the development of a science plan for the DESCENT initiative. Habitat mapping was ranked as a top priority, emphasizing the need for high-resolution bathymetric data, backscatter analysis, and the inclusion of oceanographic covariates (e.g., oxygen, temperature, and currents) to support large-scale management efforts. Methodological advancements, such as deploying landers, building eDNA libraries, and standardizing sampling protocols were highlighted to ensure consistent and transferable data collection. Participants felt addressing existing data backlogs through artificial intelligence (AI) and machine learning (ML) tools, video annotation, and metadata standardization to be critical for maximizing the value of historical samples. Establishing long-term monitoring

stations and integrating these results into other components of the initiative will enhance understanding of coral and sponge life history traits and ecosystem interactions. Taken together these efforts would produce actionable insights that directly inform management decisions at multiple scales.

Growth, Survival, and Reproductive Strategies: Addressing critical gaps in the understanding of deep-sea corals and sponge life history is essential for sustainable management, particularly with regard to reproduction, recruitment, growth, and mortality. Histological studies will inform reproductive mechanisms and variability across temporal and spatial scales. Repeated surveys and improved understanding of population dynamics, such as recruitment and mortality, are essential. Work should leverage existing archived samples and video data where possible. Investigations into symbiotic relationships and recruitment dynamics, especially on seamounts, will provide foundational insights into the ecology of these species and their broader ecosystem roles.

Methodologies: Advancing research methodologies will require the deployment of innovative tools such as landers, ROVs/AUVs, and shipboard systems. Integrating them (where possible) with AI/ML. AI/ML, when fully operationalized, will increase the throughput of historical and unprocessed data backlogs and accelerate image processing. Participants advocated for standardizing sampling protocols and ensuring compatibility with Ocean Exploration tools to enhance data reliability and transferability. There was widespread agreement to emphasize validating historical models and expanding the use of autonomous sampling technologies and eDNA to address current knowledge gaps. Participants also rallied around the deployment of seabed monitoring stations to understand the temporal and spatial variance at high priority locations such as those within monuments.

Habitat Mapping: Participants concluded that habitat mapping should focus on integrating biological and oceanographic data to better refine spatial models, improve our understanding of distribution and connectivity while supporting resource management strategies. These efforts include leveraging bathymetric and backscatter data to classify habitat features, improving microhabitat resolution, and validating model outputs with ground-truthed data. Any new mapping should prioritize ground-truthing model output as well as higher resolution habitat mapping in underrepresented areas.

Sampling: Improving sampling strategies (e.g., eDNA) and specimen preservation standards would assist in addressing diverse research objectives, from biodiversity assessments to connectivity studies. Efforts should prioritize dominant taxa, balance exploration with targeted collection strategies and adopt preservation techniques tailored to specific research needs, including histology, genetics, and aging analyses. Accessibility and collaborative use of samples will enhance long-term research utility, while standardized protocols will ensure robust and reproducible results

Biogeographic Distribution Breakout

The biogeographic distribution breakout sessions focused on deep coral and sponge communities and how to understand what influences their distribution. Participants

discussed prioritizing key areas for targeted research and identified critical data types and products necessary to advance understanding and management. These included bathymetric data, backscatter, underwater imagery (videos and photographs), and habitat maps. The session also considered the application of these data to diverse management and conservation needs, such as fisheries, energy development, and habitat protection. Guiding questions included:

- *Oceanography (e.g., currents, temperature gradients, and nutrient availability):* How can we leverage this knowledge to better understand distribution and life history, and enhance our management/conservation efforts in vulnerable marine ecosystems?
- *Monuments:* What baseline data are essential for characterizing a "pristine" coral and sponge community, and how can this baseline understanding inform resource management?
- *Ecosystem structure and biodiversity:* What specific data should be prioritized in mapping efforts to explore and characterize habitats?
- *Biogeographic Focus:* What should be the geographic focus/foci? In light of limited funds, what geographic area(s) should be prioritized? For example, should we focus on ridges again? Slopes? Trenches? The Hawaiian or Marianas Archipelago? PMNM, PRIAs, or AS MNM?
- *Coupling:* How can we connect physical, hydrographical, biological, habitat diversity and availability, and fisheries distribution with depth, identifying (and fleshing out) those processes to connect shallow and deep-water productivity and inform conservation efforts?

Summary of Biogeographic Distribution Plenary Session

The breakout session addressed the critical themes outlined above that influence the understanding, exploration, and management of deep coral and sponge ecosystems. These discussions emphasized identifying key data gaps, prioritizing research efforts, and exploring interdisciplinary opportunities to advance knowledge and conservation strategies. Cross-cutting themes such as data standardization, accessibility, and collaboration remained consistent through this session as well.

Oceanography: Oceanographic factors like currents, temperature gradients, and nutrient availability influence the spatial distribution of deep coral and sponge communities. Though challenging to collect at DSC depths, these data would inform our work to understand the species-environmental relationships, impacts of ocean acidification, larval distribution, and the effects of smaller-scale features such as seamounts. Tools exist to pair biological observations with physical data; however, gaps in large-scale oceanographic models pose challenges and require downscaling to understand the impacts at the deep coral community, or even the seamount, level. Our understanding of the temporal and spatial variability of oceanographic factors like oxygen availability limit our ability to model species distributions. Priorities include engaging with physical oceanographers, consolidating existing data, and leveraging opportunities to implement long-term monitoring to validate regional models and assess environmental variability.

Monuments: The notion of “pristine” ecosystems within marine monuments is challenging to define and may not be useful for our purposes in understanding DSC communities. However, protected areas within monuments are important comparative sites for research and conservation. For example, there are low levels of micro plastics in samples from the Phoenix Islands but Howland and Baker, another protected area, have high levels of marine debris. Rather than “pristine,” identify sites that seem primed for coral conditions such as the Musician Seamounts which have high biodiversity, high density, and high carrying capacity.

Different coral taxa and communities can tell us different things about the surrounding environment. Data from species distribution models and visual surveys are useful starting points, but more systematic surveys are needed to fully understand the sources and sinks that allow deep-sea communities to thrive. Efforts should focus on integrating historical and current data to evaluate impacts, such as fishing pressure and debris, and identifying areas of high coral density and biodiversity, such as the Musician Seamounts.

Ecosystem Structure and Biodiversity: Improved habitat characterization requires enhanced integration of bathymetry (depth), backscatter (hardness), and visual survey (presence/absence) data. These data sets contribute to our understanding of patchiness and habitat associations in deep coral ecosystems. Prioritizing data processing, leveraging previous collections, reducing spatial bias in surveys, and expanding research into underexplored habitats may be useful to inform biodiversity gaps.

Biogeographic Focus: Geographic prioritization should align with management goals and ecological needs, and where they overlap with opportunistic platforms such as the *OceaneXplorer*, *EV Nautilus* and NOAA Ship *Okeanos Explorer* cruises. Starting with known coral habitats and extending surveys into less-studied areas can help refine understanding of biogeographic patterns. Some participants recommended a stratified random sampling approach centered around key research questions and management priorities while others suggested starting with where high densities of corals are located and moving outward from that reference point to examine how conditions change and how those changes impact communities. Case studies of specific seamounts or regions could provide insights into mechanistic drivers of ecosystem variability, aiding in the development and predictive power of models.

Coupling: Integrating physical, hydrographic, and biological data across depth gradients is critical for understanding connectivity in deep coral and sponge ecosystems, coupling surface and deep-sea processes with detailed observations and modeling. Utilizing existing hydrographic models like CEFI and implementing long-term monitoring at key sites can help validate temporal and spatial patterns, guiding both conservation and resource management efforts.

Threats Breakout

Deep-sea coral and sponge communities are characterized by their extreme longevity and slow growth rates, rendering them highly vulnerable to anthropogenic disturbances.

These ecosystems face mounting threats from climate change, ocean acidification, and resource exploitation, all of which exacerbate their limited resilience and recovery potential. Under the DSCRTP and the Magnuson Stevens Fishery Conservation and Management Act, resource managers are tasked with the stewardship of these critical habitats amidst escalating global pressures. This breakout session focused on identifying and prioritizing these threats by understanding the impacts, discussing potential mitigation strategies, and exploring regulatory levers that resource managers can employ to protect and sustain deep-sea coral and sponge ecosystems in the face of ongoing and future challenges.

Questions for consideration included:

- *Management needs*: What are the management-driven data product needs that will facilitate understanding management and conservation of deep-sea coral and sponge communities?
- *Climate Change*: How can we best assess the impacts of climate change and other changes in the deep Pacific and the communities found there? What specific effects does ocean warming have on the growth, survival, and reproductive strategies of deep-sea corals? How can understanding the cumulative effects of climate change inform our conservation strategies to enhance their resilience to climate change?
- *Mining*: How can we gather and use baseline data around guyot edges and seamounts to identify areas at risk from deep-sea mining? What methodologies should be prioritized to ensure accurate assessments of biodiversity and ecosystem health, and how can this inform responsible management practices?
- *Energy infrastructure:* How will energy development impact habitat and habitat use by benthic species? How can we assess these impacts in Pacific Island waters?

Summary of Threats Plenary Session

The breakout groups identified research priorities related to management, climate change, mining, and energy infrastructure development to protect and sustain deep-sea coral and sponge ecosystems. These communities, characterized by extreme longevity and slow growth, face increasing threats from anthropogenic activities, climate change, and resource exploitation. The discussions focused on assessing impacts, proposing mitigation strategies, and exploring regulatory levers to address these challenges.

Management: Participants emphasized the need for comprehensive management tools that integrate spatial data and species distributions with high-resolution mapping of bathymetry, habitats, and oceanographic variables. Static maps of coral density and habitat suitability, paired with quantitative ROV transects, can inform decisions about areas requiring protection or sustainable use. Functional biodiversity and ecosystem services should guide management strategies, with particular attention to connectivity studies and trophic linkages between corals and associated species. Effective management also requires overcoming data access barriers and ensuring baseline surveys in areas targeted for exploitation, including mining and energy infrastructure development.

Climate Change: Understanding the impacts of climate change on deep-sea ecosystems emerged as a critical need. Ocean warming, acidification, and the expansion of oxygen minimum zones threaten coral and sponge resilience. Participants recommended using oceanographic models to identify areas at risk, such as those with low aragonite saturation horizons (ASH) or decreasing oxygen levels. Baseline data on coral skeletons, temperature, and pH can inform future impact studies. Connectivity and refugia studies can identify areas likely to withstand climate impacts, guiding conservation efforts. Participants highlighted the importance of temporal data and integrating physiological experiments to assess cumulative effects, including changes in the carbon cycle and trophic connectivity.

Mining: Deep-sea mining poses significant risks to coral and sponge habitats, particularly on seamounts and abyssal plains. The groups stressed the need for baseline biodiversity and ecosystem health assessments around mining hotspots, such as guyot edges and nodule fields. Mapping sediment plume effects and understanding their connectivity to source populations were identified as critical for responsible management. Archival seafloor instruments and revisiting historical survey sites could provide valuable time series data. Participants also called for leveraging existing deep-sea research initiatives to build Hawai‘i-based experimental wet labs for studying mining impacts under controlled conditions.

Energy Infrastructure Development: Offshore energy development introduces multiple stressors including habitat disturbance, cable laying, and potential effects of heat, noise, and electromagnetic radiation. Participants stressed the need for spatial overlap studies between energy infrastructure areas and critical habitats, particularly in Guam and O‘ahu, where development is likely. Improved coordination among stakeholders can help minimize impacts, but data gaps and uncertainty in model predictions complicate decision-making. The breakout groups recommended using available mapping and environmental data to identify hotspots and prioritize mitigation strategies, emphasizing the need for cooperative approaches to align development with ecosystem protection.

Overall, the discussions underscored the urgency of advancing research and management strategies that address these interconnected threats, fostering ecosystem resilience and sustainability through evidence-based decision-making.

Cross-Cutting Themes

Several cross-cutting themes emerged. Participants concluded that data rescue and analyzing pre-existing data to be worthy of significant resources, noting that the cost of gathering data on expensive research platforms far exceeds that of analysis. Establishing long-term monitoring stations and oceanographic moorings would facilitate our broad understanding of these communities from their functional traits and life history patterns over time, to the impacts of disturbances across multiple temporal and spatial scales and, potentially, their connectivity across ocean basins. The integration of biology, geology, and oceanography data sets across disciplines would inform habitat mapping and resource management strategies. Such a meta-analysis of Pacific deep-coral research would serve many needs. Involving communities, including cultural and

governmental entities, could potentially ensure awareness, access, and interoperability of data.

Research Gaps and Threats

Many discussions also highlighted research gaps and threats to the success of the initiative. Taxonomic expertise and training to are needed improve the throughput and analyses of imagery and samples, but there are few opportunities to learn and employ such skills. Funding for analysis of data collected during the course of the research or the survey is often of lower priority; the focus is rather on gathering data which leads to a large amount of unanalyzed data. Participants repeatedly stressed the importance that some portion of requested funds be allocated to analyzing data as a part of research proposals within this and other initiatives. Participants also noted the uneven geographic and temporal data coverage as well as disparate methodologies in research efforts. They shared that these inconsistencies could potentially lead to inconsistencies in data interpretation and poor management advice/outcomes. The power of collaboration came to the forefront of discussions with participants emphasizing the importance of leveraging existing resources, refining methodologies, and adopting integrated, collaborative approaches to address the challenges and opportunities in deep-sea coral and sponge research.

Synthesis

Participants selected one of three breakout sessions—biology and ecology, distributions, or threats—to refine and rank (1-N) specific research priorities within each area. These ideas were then presented to the larger group for broader discussion and evaluation. This collaborative process was designed to provide critical input to decision-makers as they finalized the science plan. The collective contributions of this diverse group of experts resulted in a robust compilation of ideas, opportunities, and strategies to advance our understanding of deep-sea coral and sponge ecosystems in the Pacific Islands region.

Conclusion

As DESCENT embarks on two years of intensive data collection, four key themes will serve as its focus. Projects that stem from these themes should be discreet and able to be completed in the time frame allotted. Underpinning each of these arenas is the need to sustain and grow the field by investing in the development of the next generation of deep-coral and sponge scientists.

1. Analysis of data from past expeditions and collections to contribute to our understanding of deep-sea coral biology and ecology. Examples of existing data include but are not limited to physical samples for taxonomic and life history analysis and video data from research expeditions that took place before 2025.
2. Development of broad species (taxonomic) distribution and habitat suitability models to increase our understanding of connectivity between habitats, potential oxygen minimum zones and areas of vulnerability, and where hotspots of biodiversity might occur and be targeted for further exploration.
3. Explore the key (a) physical and (b) biological factors influencing the growth, reproduction, distribution, and ecological roles of deep-sea corals and sponges across the Pacific in varying environmental conditions.
    a. Physical—impact of environmental drivers (e.g., temperature, oxygen, nutrient availability, and substrate), responses to anthropogenic impacts (fishing, deep-sea mining, and climate change)
    b. Biological—growth rates and longevity, reproductive strategies, dispersal mechanisms, etc.
4. Use current and advanced technology such as eDNA, ROVs, AUVs, seabed monitoring stations and landers. Such tools will facilitate our understanding of seamount and sea floor physical, chemical, and biological processes and the temporal influence of ecosystem structure, function, and resilience in deep-sea habitats.
5. The ultimate success of Pacific DESCENT will hinge on leveraging partnerships, many of which were represented during the workshop. Strengthening these collaborations will remain a central commitment as the Initiative progresses.

Acknowledgements

The Pacific Islands DESCENT Steering Committee extends its heartfelt gratitude to all participants, both virtual and in person, for their invaluable input and patience throughout the workshop. Your expertise and contributions made this a highly productive event, laying the foundation for a Pacific Islands deep-sea coral and sponge science strategy. We would like to give special thanks to those who facilitated the workshop—Jenni Samson, Aaron Judah, Heather Coleman, and Jessica Clyburn—and to those who documented the complex and wide-ranging discussions in the small groups—Kasey Cantwell, Sam Candio, Sarah Groves, Heather Coleman, and Frank Parrish. We also deeply appreciate the presenters for their time and effort in preparing materials to share with attendees, as well as all participants who engaged thoughtfully and patiently in the virtual space. A special acknowledgment goes to NOAA's DSCRTP for funding this workshop, enabling the critical, cross-disciplinary discussions that will guide the development of the science plan. Finally, we extend our deepest appreciation to Heather Coleman for her invaluable guidance and support throughout the entire process. Thank you all for making this workshop a success.

Appendix A – Agenda

Pacific DESCENT: FY 25–FY28
Deep-sea Ecosystems of Sponges and Corals: Exploration, iNvestigation and Technology
Inouye Research Center, Ford Island

November 13, 2024 - Day 1

8:30 AM **Welcome Remarks**
Charles Littnan, PIFSC Center Director; Kara Meckley, Office of Habitat Conservation

Logistics

8:40 AM **Overview - 80 Min**
NOAA's Deep-Sea Coral Research and Technology Program
Heather Coleman, Office of Habitat Conservation

*The **First** Pacific Islands Deep-Sea Coral Research Initiative (2015–2017)*
Frank Parrish, Pacific Islands Fisheries Science Center

OER's Gold Medal Capstone Campaign 2015–2017
Chris Kelley, retired

Revealing the Deep: A compilation of deep-sea video coverage of the Pacific
Nikki Cunanan, Sarah Bingo, Aaron Judah, CIMAR University Of Hawai'i at Mānoa

10:00 AM **Break**

10:10 AM **Continue Overview - 50 min**
Beyond the Blue: Illuminating the Pacific
Kasey Cantwell, NOAA's Ocean Exploration and Research

ONMS Conservation Priorities for Deep-Sea Corals and Sponges
Sarah Head, National Marine Sanctuary Office

State of Knowledge of DSC in the Pacific
Amy Baco, Florida State University

11:00 AM **Biology and Ecology: Small Group Discussion 1 - 60 min**
Biology and Ecology Breakout: Identify and prioritize a list of research questions related to deep coral and sponge biology and ecology
Facilitators: Jenni Samson, Jessica Clyburn, Aaron Judah

12:00 PM **Lunch - 60 min**

1:00 PM **Report out from Biology and Ecology Breakout groups - 20 min**

1:20 PM **Managing and Conserving Deep-sea Ecosystems - 60 min**

Threats to DSC and Science Needs to Support Deep Coral Habitat Conservation and Management
Malia Chow, Pacific Islands Regional Office

Science Needed to Support Deep-Sea and Precious Coral Management
Josh DeMello, Pacific Islands Fishery Management Council

Overview of BOEM Activities in the Pacific Islands Region
Jen Le, Bureau of Ocean Energy Management

National Ocean Mapping Exploration and Characterization (NOMEC) Prioritization
Heather Coleman, NOAA NOMEC Representative

2:20 PM **Break**

2:30 PM **Distribution: Small Group Discussion 2 - 60 min**
Distribution Breakout: Identify and prioritize a list of research questions related to the distribution of deep coral and sponge communities
Facilitators: Jenni Samson, Jessica Clyburn, Aaron Judah

3:30 PM **Report out from Distribution Breakout group - 20 min**

3:50 PM **Brief wrap up: Accomplishments for today and review tomorrow's agenda**
Beth Lumsden, Pacific Islands Fisheries Science Center

4:00 PM **Pau Hana at Restaurant 604**

November 14, 2024 - Day 2

9:00: AM **Coffee and gathering**

9:15 AM ***Group discussion: Yesterday's takeaways - 15 min***

9:30 AM ***Threats:* Small Group Discussion 3 - 60 min**
Threats Breakout: Identify and prioritize a list of research questions related to the threats faced by deep coral and sponge communities
Facilitators: Jenni Samson, Jessica Clyburn, Aaron Judah

10:30 AM **Break**

10:40 AM ***Report out from breakout groups - 20 min***

11:00 AM **Small group discussion - 60 min**
Develop a prioritized list of research activities for the next two years to meet the critical information needs determined during Day one
Biology and Ecology: Aaron Judah, University of Hawai‘i

Distribution: Jenni Samson, Pacific Islands Fisheries Science Center
Threats: Jessica Clyburn, Office of Habitat Conservation

12:00 PM **Lunch - 60 min**

1:00 PM ***Report out from Breakout group* - 30 min**

1:45 PM **Plenary: Opportunities and constraints, synergies, cruises etc. - 30 min**
Frank Parrish, Pacific Islands Fisheries Science Center

2:15 PM **Break**

2:30 PM **Plenary: Summary list of activities - 20 min**
Beth Lumsden Pacific Islands Fisheries Science Center

2:50 PM **Review workshop Accomplishments and Discuss Next Steps - 10 min**
Beth Lumsden, Pacific Islands Fisheries Science Center

3:00 PM **Adjourn for *Okeanos Explorer* Ship Tour**
CLOSED TOED SHOES REQUIRED

4:00 PM **Pau**

Appendix B - Participant list

Workshop Participant	Organization
Aaron Judah	University of Hawai‘i
Alexis Weinnig	U.S .Geological Survey
Allison Fundis	OET/Nautilus
Amanda Demopoulos	U.S. Geological Survey
Amy Baco	Florida State University
Andrea Schmidt	NOAA/NMFS/PIFSC
Becky Walker	NOAA/NMFS/PIFSC
Beth Lumsden	NOAA/NMFS/PIFSC
Brendan Roarke	Texas A&M University
Brian Kennedy	Ocean Discovery League
Charles Littnan	NOAA/NMFS/PIFSC
Chelsie Counsel	NOAA/NOS/PMNM
Chris Kelley	University of Hawai‘i
Daniel Wagner	OET/Nautilus
Don Kobayashi	NOAA/NMFS/PIFSC
Fanny Girard	University of Hawai‘i
Frank Parrish	NOAA/NMFS/PIFSC
Hannah Barkley	NOAA/NMFS/PIFSC
Heather Coleman	NOAA/NMFS/OHC
Jennifer Le	Bureau of Ocean and Energy Management
Jeriyla Kamau-Weng	NGO: OceanX
Jessica Clyburn	NOAA/NMFS/OHC
Joey Lecky	NOAA/NMFS/PIRO
Joshua DeMello	Western Pacific Regional Fishery Management Council
Kaipo Perez	NOAA/NMFS/PIRO
Kara Meckley	NOAA/NMFS/OHC
Kasey Cantwell	NOAA/OAR/OER
Kisei Tanaka	NOAA/NMFS/PIFSC
Les Watling	University of Hawai‘i
Malia Chow	NOAA/NMFS/PIRO
Matt Poti	NOAA/NOS/NCCOS
Meagan Putts	University of Hawai‘i
Nikki Cunanan	University of Hawai‘i
Ray Boland	NOAA/NMFS/PIFSC
Rhane Malae	NOAA/NMFS/PIFSC
Rich Hall	NOAA/NMFS/PIRO
Rob Ahrens	NOAA/NMFS/PIFSC
Sam Candio	NOAA/OAR/OER
Sarah Bingo	University of Hawai‘i
Sarah Groves	NOAA/OAR/OER
Sarah Head	NOAA/NOS/ASNMS
Sean Hanser	NOAA/NMFS/PIRO

Sonia Rowley	University of Hawai‘i
Steve Auscavitch	Boston University
Tony Montgomery	U.S. Fish and Wildlife Service
Val Brown	NOAA/NOS/ASNMS