

An ecosystem-based approach to protect the deep sea from mining

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Deep sediments are home to a surprising diversity of animal life. Researchers from the University of Hawaii at Manoa have helped establish a new network of marine protected areas to safeguard biodiversity and ecosystem function in the Clarion-Clipperton fracture zone, a mining prospecting region in international waters of the Pacific Ocean. Credit: University of Hawaii

Five hundred miles southeast of Hawai'i, in international waters far out of sight of any land, there are vast mineral resources 5,000 meters below the sea.

Manganese nodules, rich in commercially valuable mineral resources including nickel, copper, manganese, cobalt and rare-earth elements, overlay a broad swath of the deep-sea floor. It took millions of years to

form these deposits. The potato-sized nodules themselves and the deep sediments where they are found are home to a surprising diversity of animal life—many species of which are yet to be documented.

Now, nations are eyeing these undersea mineral resources to help meet a rapidly growing societal demand. Cell phones, computers, building materials and household appliances all require metals such as copper, nickel, cobalt and rare-earth elements.

Large scale mining in the deep sea has not yet begun. But at least 12 mining exploration claims, each up to 75,000 square kilometers, have already been established in the Pacific Ocean region known as the Clarion-Clipperton fracture zone (CCZ).

Who grants the access to these mineral resources in international waters? An administrative body called the International Seabed Authority (ISA) is charged with developing the regulations for exploration and extraction.

Formed by the United Nations Law of the Sea, the ISA's duties include establishing and enforcing certain "preservation reference areas" that will remain unimpacted by mining.

The goal is to protect biodiversity and ecosystem function in the seafloor regions with manganese nodules. However, setting up such [protected areas](#) across a poorly sampled region the size of the continental United States is literally no small matter.

"This was uncharted territory in many ways," said Craig Smith, a professor of oceanography in UH Mānoa's School of Ocean and Earth Sciences and Technology (SOEST). Smith proposed to convene a group of experts to help ISA define the areas to be protected within the CCZ.

"Ecosystem-based management using a spatial approach was just

beginning to be accepted," said Smith. "Using guidelines from the State of California, modified for the actual CCZ, we were able to develop a scientifically rigorous process for setting up [marine protected areas](#) in this vast deep-sea area. This is one of the first times that such an approach has been implemented."

The protected area network is actually both the first and the largest of its kind.

"It's just massive," said Jack Kittinger, a Social Science Fellow at Stanford University's Center for Ocean Solutions and the science advisor for Conservation International's Hawai'i Fish Trust program. "It's one of the biggest examples of a protected area that's being implemented before the start of any impacts."

The marine protected area network now covers 24% of the 6 million square kilometers that comprise the CCZ management area. That's 10 times more area than the protected waters that comprise the Papahānaumokuākea Marine National Monument. And although the CCZ protected areas are not all contiguous, the network was specifically designed by scientists to safeguard biodiversity and ecosystem function in the abyss as well as unique features such as seamounts.

The effort was also unprecedented in its reach, bringing together diverse stakeholders including deep sea specialists, conservation biologists, non-governmental organizations, consultants with the mining industry and representatives from the ISA.

"Our goal was an efficient allocation that maximizes benefits of biodiversity protection and minimizes the costs to mining claims," said UH Mānoa's Smith.

With only a few minor changes to accommodate existing claims, the ISA

has accepted the forum's recommendations on a provisional basis and is excluding new mining claims from overlapping these protected areas (called by the ISA "Areas of Particular Environmental Interest"). Now Smith and many others would like to see the ISA make the group's recommendations, and the network of protected areas, permanent.

Smith and his colleagues published a description of their expert-driven conservation planning process in a November 2013 issue of the scientific journal, *Proceedings of the Royal Society B*.

"Establishing protections at the international scale represents a major marine management accomplishment in areas beyond national jurisdiction," Smith said. "Setting up marine protected areas in the high seas has long been a focus of discussion for the conservation community. This also sets a precedent for establishing protected areas before mining activities actually begin—in essence, we are closing the barn doors before the cows escape! We're optimistic that this will lead to better management and protection of the remarkable, poorly studied ecosystems found in the deep ocean."

More information: From principles to practice: a spatial approach to systematic conservation planning in the deep sea. L.M. Wedding, A.M. Friedlander, J.N. Kittinger, L. Watling, S.D. Gaines, M. Bennett, S.M. Hardy, and C.R. Smith. *Proceedings of the Royal Society B* 280:20131684. [DOI: 10.1098/rspb.2013.1684](https://doi.org/10.1098/rspb.2013.1684)

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