Scientists urge caution, further assessment of ecological impacts above deep-sea mining

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Some of the midwater animals that could be affected by deep-sea mining include squids, fishes, shrimps, copepods, medusae, filter-feeding jellies, and marine worms. Credit: E. Goetze, K. Peijnenburg, D. Perrine, Hawaii Seafood Council (B. Takenaka, J. Kaneko), S. Haddock, J. Drazen, B. Robison, DEEPEND (Danté Fenolio), and MBARI

Interest in deep-sea mining for copper, cobalt, zinc, manganese and other valuable metals has grown substantially in the last decade and mining activities are anticipated to begin soon. A new study, authored by 19 marine scientists from around the world, argues that deep-sea mining poses significant risks, not only to the area immediately surrounding mining operations but also to the water hundreds to thousands of feet above the seafloor, threatening vast midwater ecosystems.

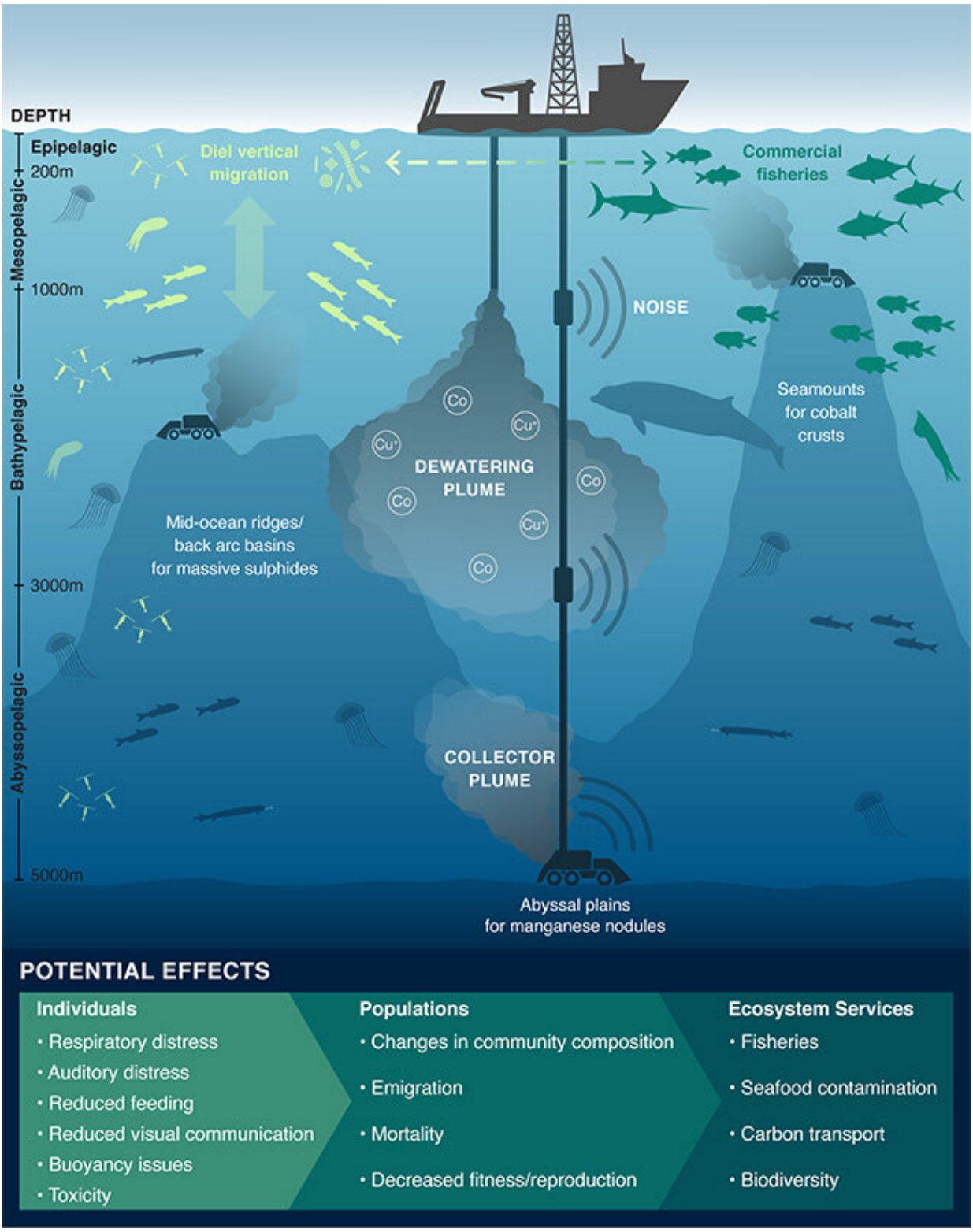
In their article, published today in the journal *Proceedings of the National Academy of Sciences*, the scientists suggest how these risks could be evaluated more comprehensively to enable society and managers to decide if and how deep-sea mining should proceed.

Currently, 30 exploration licenses cover about 580,000 square miles of the seafloor in international waters, and some countries are exploring exploitation in their own water as well. Most research assessing the impacts of mining and environmental baseline survey work has focused on the seafloor.

However, large amounts of mud and dissolved chemicals are released during mining and large equipment produces extraordinary noise—all of which travel high and wide. Unfortunately, there has been almost no study of the potential effects of mining beyond the habitat immediately adjacent to extraction activities.

"This is a call to all stakeholders and managers," said Jeffrey Drazen, lead author of the article and professor of oceanography at the University of Hawai'i, Mānoa. "Mining is poised to move forward yet we lack scientific evidence to understand and manage the impacts on deep pelagic ecosystems, which constitute most of the biosphere. More research is needed very quickly. Hawai'i is situated in the middle of some of the most likely locations for deep-sea mining," he added.

The deep midwaters of the world's ocean represent more than 90% of the biosphere, contain 100 times more fish than the annual global catch, connect surface and seafloor ecosystems, and play key roles in climate regulation and nutrient cycles. These ecosystem services, as well as untold biodiversity, could be negatively affected by mining.



This illustration (not to scale) shows some of the potential effects of deep-sea mining on midwater animals. Credit: University of Hawaii

"The current study shows that mining and its environmental impacts may not be confined to the seafloor thousands of feet below the surface, but could threaten the waters above the seafloor, too," said Drazen. "Harm to midwater ecosystems could affect fisheries, release metals into food webs that could then enter our seafood supply, alter carbon sequestration to the deep ocean, and reduce biodiversity which is key to the healthy function of our surrounding oceans."

"Many of the seemingly esoteric discoveries we have made about deep-sea life can inform us how water-column communities will be affected by mining," explained MBARI marine biologist Steve Haddock, a co-author on the paper. "The issue is the discharge plume—silty, toxin-laden water that is pumped back into the sea when the minerals have been extracted. The fine portions of this sediment will not settle straight to the seafloor, but be carried along by ocean currents over great distances."

"This plume of fine sediment, pumped into the water column continuously over the 30-year life of the project, could travel for hundreds if not thousands of kilometers. Not only does this mean that the midwater habitat is severely affected, but it also means that buffer zones set up around islands will not be effective."

Haddock continued, "We have found that many water-column organisms feed on particles, or on organisms that are particle feeders. These includes midwater worms, snails, salps, larvaceans, and even vampire squids. These animals are all part of a complex food web which connects all the way to our dinner plates."

"In addition to clogging the animals' filtering mechanisms and adding non-nutritious or toxic material to these animal's diets, such sediment

would absorb the blue-green light that glowing deep-sea animals use to attract prey, search for food, and find mates."

In accordance with UN Convention on the Law of the Sea (UNCLOS), the International Seabed Authority (ISA) is required to ensure the effective protection of the marine environment, including deep midwater ecosystems, from harmful effects arising from mining-related activities. In order to minimize environmental harm, mining impacts on the midwater column must be considered in research plans and development of regulations before mining begins.

"We are urging researchers and governing bodies to expand midwater research efforts, and adopt precautionary management measures now in order to avoid harm to deep midwater ecosystems from seabed mining," said Drazen.

More information: Jeffrey C. Drazen et al. Opinion: Midwater ecosystems must be considered when evaluating environmental risks of deep-sea mining, *Proceedings of the National Academy of Sciences* (2020). DOI: 10.1073/pnas.2011914117

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