



On the trail of fauna associated with polymetallic nodules in the abyssal plains of Clarion-Clipperton




At a time when industrial companies are interested in the metals and rare earths found in the deep sea, Ifremer scientists are heading for the Clarion-Clipperton zone to discover the biodiversity that lives on and around polymetallic nodules. Aboard *L'Atalante*, a vessel of the French Oceanographic Fleet operated by Ifremer and its armament subsidiary Genavir, the scientists of the EDEN campaign are studying the abyssal plains of this Pacific region from November 2024 to January 2025 to gain a better understanding of the biodiversity associated with polymetallic nodules and how these ecosystems function.



A wide variety of species thrive on and around polymetallic nodules in the sediments of the abyssal plains of the Clarion-Clipperton zone. - CC-BY Ifremer - Nodinaut campaign

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The precipitation of metals dissolved in seawater can lead to the formation of [polymetallic nodules](#) on certain abyssal plains, at depths of between 4,000 and 6,000 meters. These pebbles, 5 to 10 centimetres in diameter, grow at a rate of around ten millimetres per million years, forming "nodule fields" that are home to



a wide variety of as yet little-known fauna. At a time when some industrialists are considering exploiting these metal-rich rocks, Ifremer scientists are visiting the French exploration contract zone, Clarion-Clipperton, to gain a better understanding of the ecosystems that depend on these nodules. From November 19, 2024 to January 2, 2025 aboard [L'Atalante](#), they will study the fauna of these abyssal plains and the links between biodiversity and nodule abundance and distribution.

°This is the 5 oceanographic campaign conducted by Ifremer since 2004, as part of the nodule exploration contract awarded to the institute by the International Seabed Authority (ISA) on behalf of France. The aim is to identify the baseline state of nodule plains ecosystems, a prerequisite for assessing the potential impact of mining operations. This research is also in line with the objective of acquiring knowledge of the deep seabed as part of the "deep seabed" program of France 2030, which is funding the campaign.

NODULES PROVIDE A BASE FOR THE DEVELOPMENT OF ABYSSAL PLAINS FAUNA

Polymetallic nodules are the only solid support available on the unconsolidated soils of the abyssal plains, making them an ideal base for fixed organisms such as cold-water corals, sponges and cnidarians. Around the nodules, buried in the sediment, crustaceans, echinoderms (including sea stars), marine worms and microbial communities cohabit.

"Species diversity can be very high, but most are very rare, so only a few individuals of each species are observed on each mission. Since the 1980s, several hundred species have been observed, nearly 90% of which were new," explains **Pierre-Antoine Dessandier, Ifremer benthic ecology researcher and mission leader**. The challenge is not only to inventory them, but also to understand the role each plays in the ecosystem and their life cycles.




During the EDEN campaign, Ifremer teams will be taking nearly 120 sediment samples from the Clarion-Clipperton zone. Their objective: to use the [latest taxonomic methods \(environmental DNA, imaging and artificial intelligence\)](#) to draw up a more complete inventory of the species present in these ecosystems and identify the links between the different communities of organisms. Scientists will also complete estimates of the abundance and distribution of nodules in the area, begun during a [previous campaign in March 2024](#). The aim is to better understand the links between biodiversity and polymetallic nodules, both because they represent a habitat for fixed organisms and because of their role in bottom currents and the deposition of organic matter.

CAN BIODIVERSITY RETURN AFTER A TEST MINING OPERATION?

The EDEN campaign will also quantify the impacts of polymetallic nodule mining. As part of [the European Mining Impact research project](#) of the Joint Programming Initiative Oceans, scientists will also visit the Belgian contract area where a prototype nodule collector has been deployed in 2021 by the company GSR.

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"After several years, we can still see the tracks of the caterpillars on the bottom. Our objective on site is to check whether the fauna has been able to return and develop on the site since the collector passed through," explains **Pierre-Antoine Dessandier**. This is one of the great unknowns about abyssal plains species: what is their capacity to recolonize an area disturbed by human activity? To find out, we are seeking to better understand their life cycle, their short- and long-term reactions to anthropogenic stress, identify their breeding grounds and measure the distance they can travel.

In the area covered by the French exploration contract, almost 50% of the seabed consists of slopes with an inclination of more than 5 degrees, which will be particularly studied during the EDEN campaign. Indeed, in the event of nodule exploitation being authorized by a country, prototype collectors are not capable of operating on these slopes, and they could therefore constitute refuge areas for biodiversity.

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