Kaikōura's deep seabed is rapidly recovering, say experts

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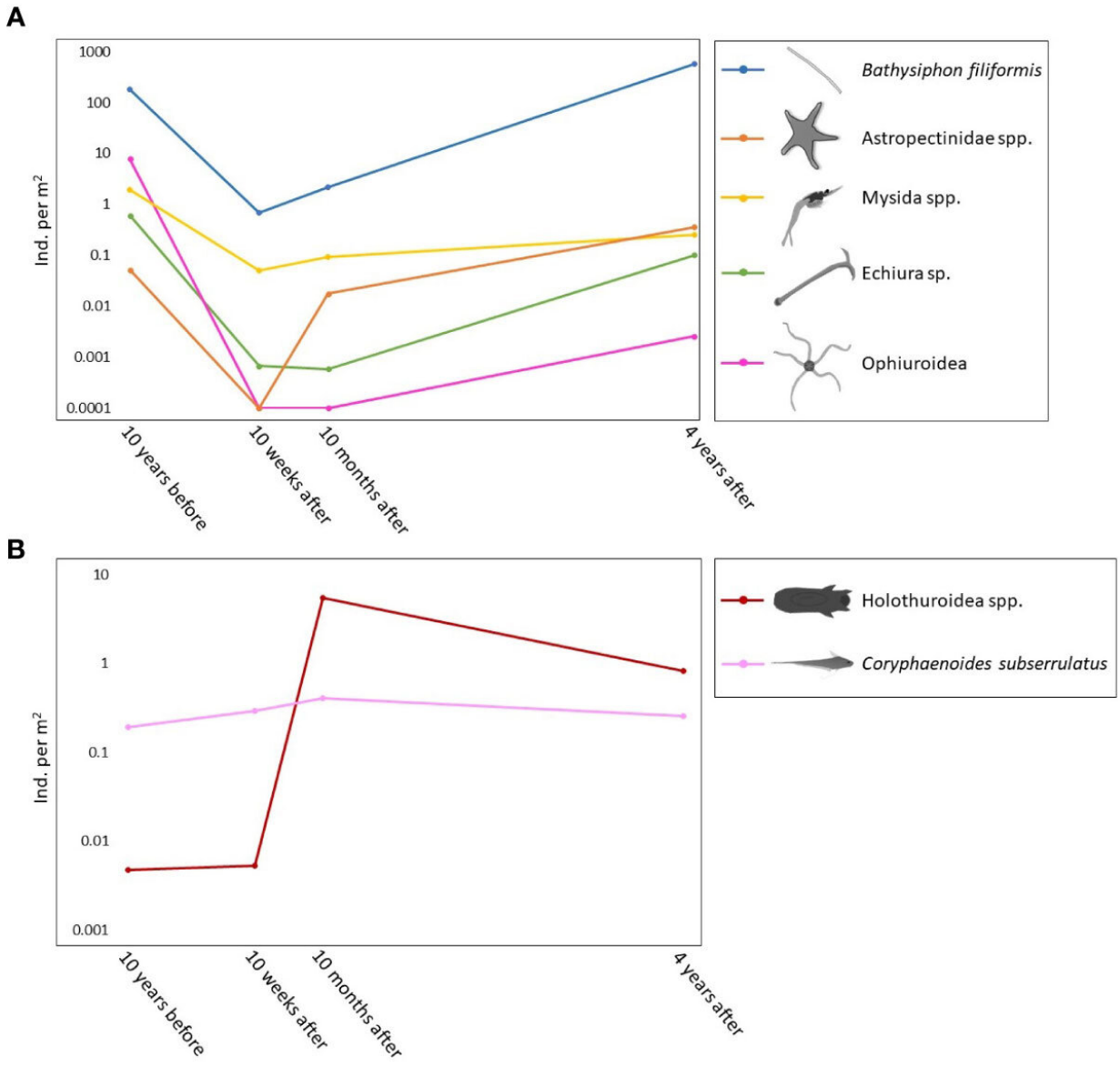

Line plots showing the change in abundance of key megafaunal taxa identified

by the SIMPER analysis. (A) Primary pattern for five of the seven key taxa (B. filiformis, Astropectinidae, Mysida, Echiura, and Ophiuroidea); abundances decreased immediately after the turbidity flow but increased towards or above pre-event levels by 4 years after the event. The two exceptions to this pattern were (B) the rattail fish Coryphaenoides subserrulatus, which increased in abundance above pre-event levels 10 weeks and 10 months after the turbidity flow and Holothuroidea spp. which increased considerably in abundance 10 months after the turbidity flow and remained higher than pre-event levels by 4 years after the event. Scale for both plots is logarithmic. Credit: *Frontiers in Marine Science* (2023). DOI: 10.3389/fmars.2023.1180334

Areas of Kaikōura's seabed show promising signs of recovery just four years after the 2016 earthquake, says NIWA.

The Kaikoura Canyon, in the Hikurangi Marine Reserve, was among the most biologically productive deep-seabed environments on the planet, but the 7.8 magnitude earthquake nearly completely wiped out some of its ecosystems.

However, NIWA and Victoria University of Wellington Ph.D. student Katie Bigham says that the area is showing astonishing resilience to the physical and biogeochemical disturbance caused by the earthquake.

"The earthquake caused a highly complex 'full canyon flushing event' that reshaped the canyon floor and transported 850 metric megatons of sediment out along the Hikurangi Channel. Inevitably, this was devastating for the abundant marine life in the area, which is New Zealand's only deep-sea marine reserve."

"However, it also provided a rare opportunity to study the impacts of an underwater earthquake on seabed communities. And encouragingly, the ecosystem is showing great resilience—many of the marine organisms

have returned, with some parts well on the way to being fully recovered," said Katie.

There was already a lot of information on Kaikōura's deep-sea environment due to earlier surveys in the canyon, including thousands of images and datapoints. NIWA was therefore able to compare that information to images collected several weeks, months and years after the earthquake.

Those seabed images taken shortly after the earthquake showed that the "canyon flushing event" had been catastrophic for the once productive benthic community on the seafloor. However, within months, there was a notable increase in some species, including fish and sea cucumbers.

Within four years, the community appeared similar to the pre-disturbance community. NIWA predicts that the whole area will be fully recovered up to 12 years after the earthquake, but it may only take as little as 4.5 years.

NIWA Principal Scientist of Marine Ecology and Professor of Marine Biology at Victoria University of Wellington, Dr. Ashley Rowden, believes that it's the very nature of the volatile environment that makes it such a resilient ecosystem.

"We think this habitat can so easily recover because it's an area often at the mercy of Mother Nature. The earthquake was a 1-in-140-year event, which may seem infrequent, but in evolutionary terms it's the blink of an eye. This means the marine life there has regularly experienced massive stressors such as earthquakes, and in turn species are adapted to be resilient to them. This is like when our bodies are exposed to pathogens and vaccines, which makes our immune system more resilient to disease so we can bounce back quicker," said Dr. Rowden.

While the results of this study are encouraging for the long-term efficacy of the Hikurangi Marine Reserve, questions remain.

"There aren't just implications around natural pressures on deep-seabed ecosystems, but how humans interact with them, too. We still don't know how surrounding deep-sea fisheries were in turn impacted by the earthquake, which is a big gap because these are some of New Zealand's most productive fisheries. We also want to understand how deep-sea mining will affect such ecosystems, but the findings from this study aren't easily comparable, so more research is needed," said Katie.

The paper is published in the journal *Frontiers in Marine Science*.

More information: Katharine T. Bigham et al, Deep-sea benthic megafauna hotspot shows indication of resilience to impact from massive turbidity flow, *Frontiers in Marine Science* (2023). DOI: 10.3389/fmars.2023.1180334

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