

# Under the Sea, But at What Fee:

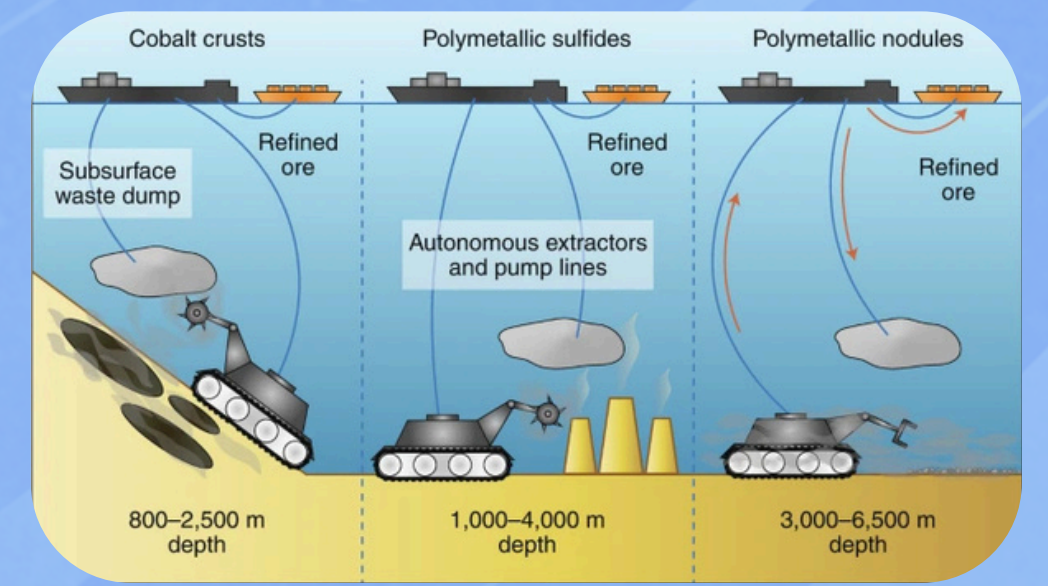
## Can Deep-Sea Mining Be Conducted in A Sustainable Manner?

### WHY IS IT IMPORTANT?

- Minerals extracted by deep-sea mining can support clean energy transitions.
- No mining activities yet, but 2025 may set the stage for operations by 2026<sup>(1)</sup>.
- The **growing demand** for these minerals can negatively impact the marine environment, especially on deep sea ecosystem biodiversity.

### CURRENT DEEP-SEA MINING METHODS

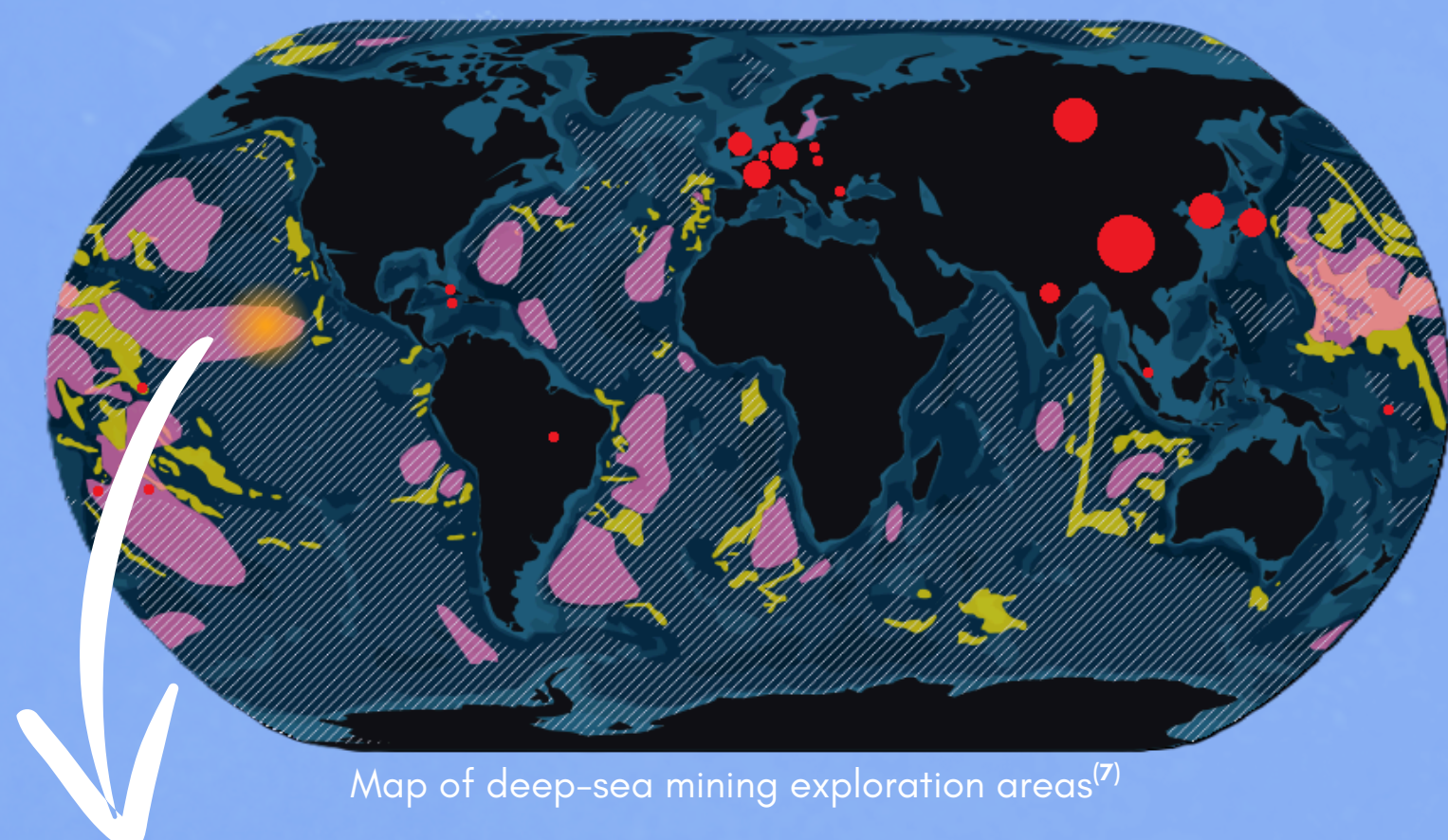
- Deep-sea mining uses ROVs and large surface vessels to collect metals and rare elements by **sucking, scraping** or **cutting** the seafloor<sup>(2)</sup>.
- This can create **sediment plumes**<sup>(3)</sup>, but the environmental impact is uncertain. If well controlled, it might be acceptable.



Schematic of mineral extraction mode<sup>(2)</sup>

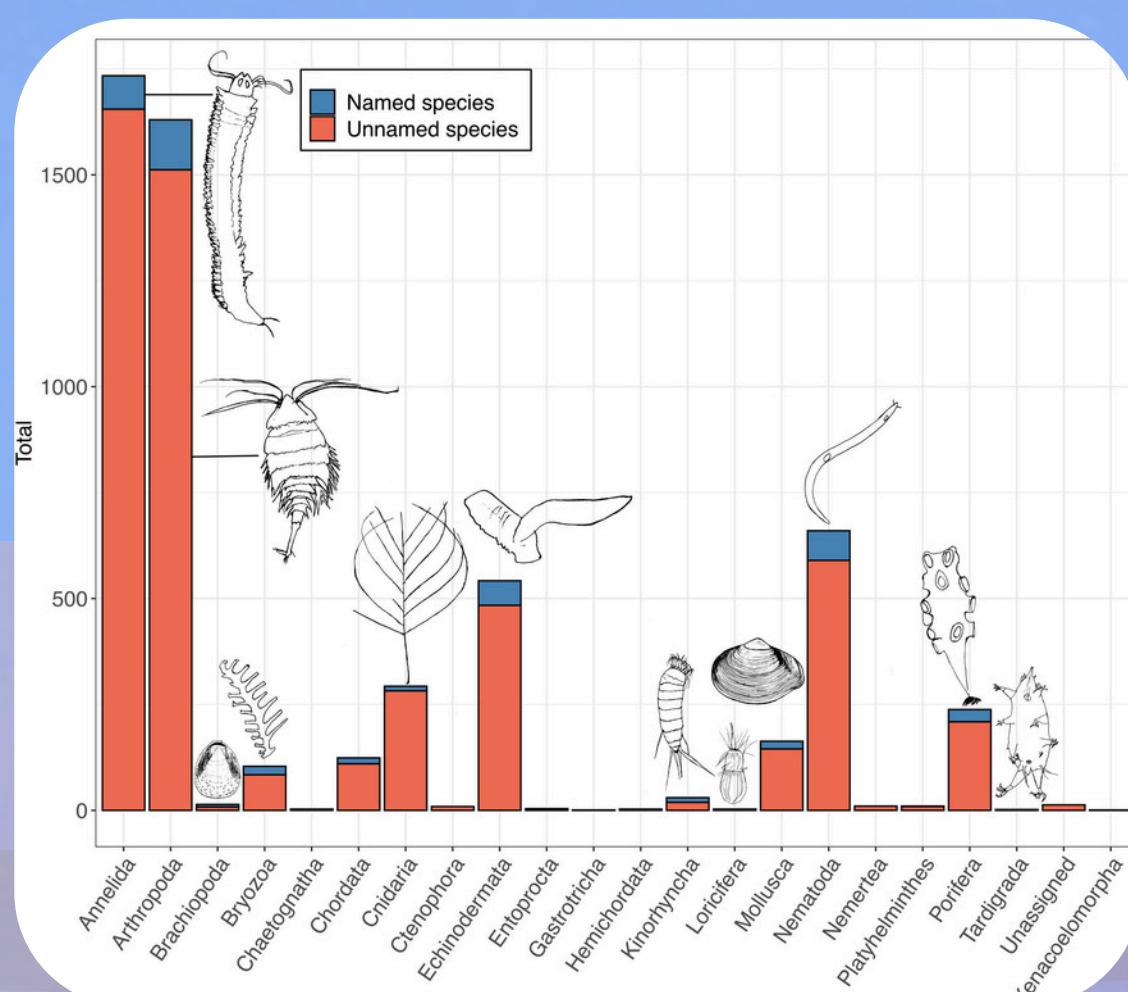
### FINDINGS AND DISCUSSION

- Some mineral-rich seabeds lie within nations' EEZs<sup>(4)</sup>.
- The Area* (50% of oceans) is regulated by ISA<sup>(4)</sup>, tasked with regulating & promoting mining while protecting the environment<sup>(5)</sup>.
- 31 exploration contracts signed; key sponsors include China, Russia, and South Korea<sup>(4)</sup>.
- ISA's completion of Mining Code draft by 2025 is 'unlikely'<sup>(6)</sup>.

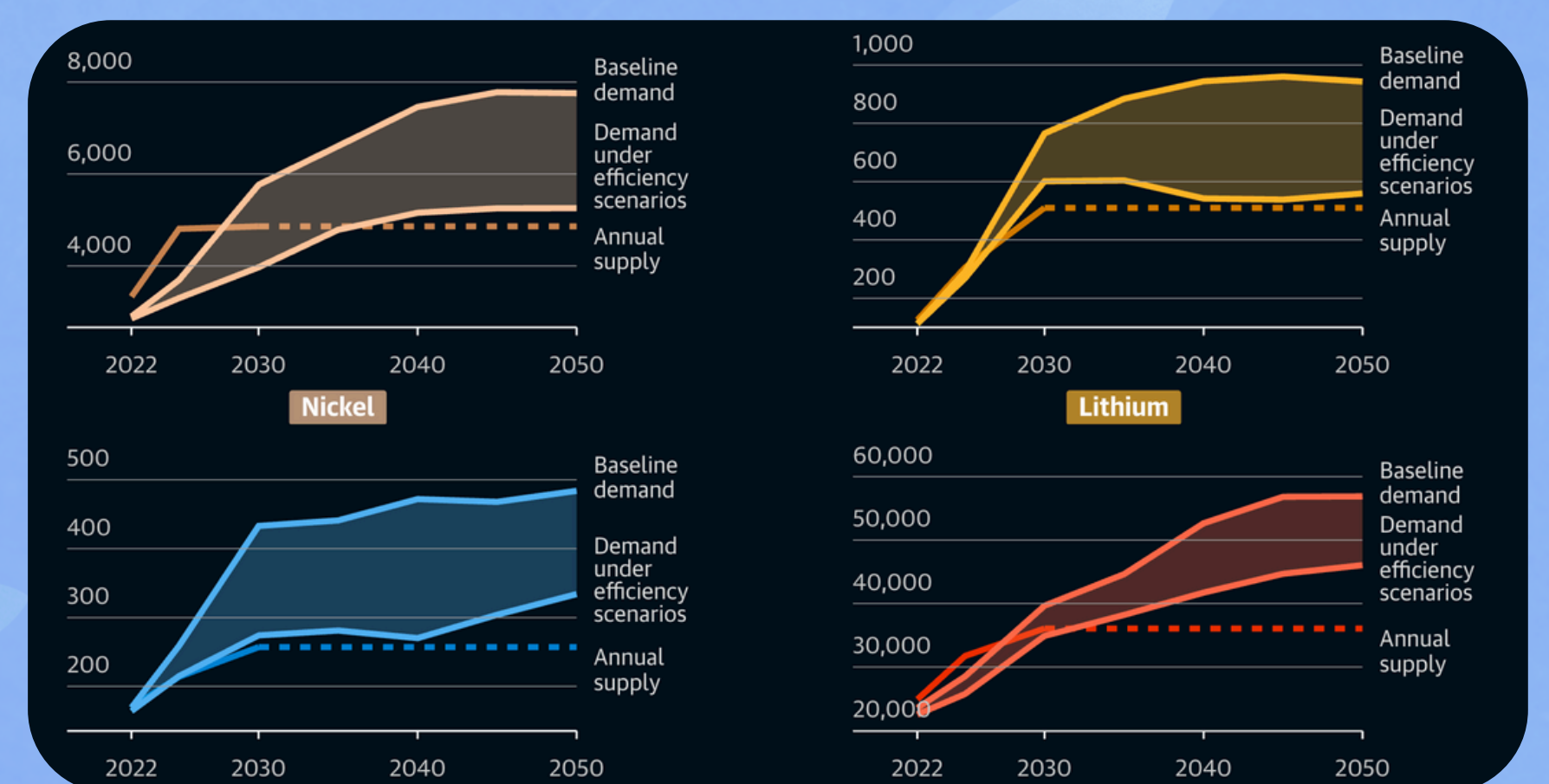


Map of deep-sea mining exploration areas<sup>(7)</sup>

- The **Clarion-Clipperton Zone (CCZ)**: rich deposits of manganese nodules.
- Mining noise in the CCZ can impact **cetacean species** observed in the Area<sup>(7)</sup>.
- Thousands of invertebrate species may be at risk in the CCZ, with new ones discovered every year<sup>(8)</sup>.



Benthic metazoan diversity in the CCZ<sup>(9)</sup>



Projected impact of efficiency scenarios on mineral demand (2022-2050)<sup>(9)</sup>

- The demand for all four metals is expected to rise.
- A shift to efficiency and recycling could slow this growth<sup>(10)</sup>.
- Demand could drop by over 30% for cobalt, nickel and lithium and 19% for copper<sup>(9)</sup>.

### TAKE HOME MESSAGE

- Improve scientific understanding of deep-sea ecosystems and technological innovations of deep-sea mining is crucial.
- Developing a robust regulatory framework is essential to minimize the economic, environmental, and societal impacts, ensuring the resources for future generations.



#### REFERENCES:

- Albert EC. 2024. Deep-sea mining's future still murky as negotiations end on mixed note. Mongabay News.
- Levin LA, Amon DJ, Lily H. 2020. Challenges to the sustainability of deep-seabed mining.
- Muñoz-Royo C, Peacock T, Alford M.H. et al. 2021. Extent of impact of deep-sea nodule mining midwater plumes is influenced by sediment loading, turbulence and thresholds.
- International Seabed Authority. 2025. Exploration Contracts & FAQs.
- Chakraborty A. 2024. Push to Mine Seabed in International Waters Faces Legal Hurdles. The Pew Charitable Trusts.
- Pickens C, Lily H, Harrold-Kolleb E, Blanchard C, Chakraborty A. 2024. From what-if to what-now: Status of the deep-sea mining regulations and underlying drivers for outstanding issues.
- Thompson K.F, Miller K.A, Wacker J, Derville S, Laing C, Santillo D, Johnston P. 2023. Urgent assessment needed to evaluate potential impacts on cetaceans from deep seabed mining.
- Rabone M, Wierthase J.H, Simon-Lledó E, Emery A.M, Jones D.O.B, Dahlgren T.G, Bribiesca-Contreras G, Wiklund H, Horton T, Glover A.G. 2023. How many metazoan species live in the world's largest mineral exploration region?
- Kirk A, Corgan E, Shah P, McVeigh K. 2025. As countries scramble for minerals, the seabed beckons. Will mining it be a disaster? - Visual Explorer. The Guardian.
- Pachouri R, Spencer T, Renjith G. 2023. Exploring Electricity Supply-mix Scenarios to 2050. Energy Transitions Commission Publications.



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