



## MODULE 3, LESSON 2

### BIOLOGY OF POLYMETALLIC NODULES

#### READING LIST

##### REQUIRED READING

SPC. “Deep Sea Minerals: Manganese Nodules, a Physical, Biological, Environmental and Technical Review,” 2013. <http://www.grida.no/files/publications/ebooks/deepsea/vol1B/index.html>. (focus on the biology part)

Lins, Lidia, Daniela Zeppilli, Lénaïck Menot, Loïc N. Michel, Paulo Bonifácio, Miriam Brandt, Ellen Pape, et al. “Toward a Reliable Assessment of Potential Ecological Impacts of Deep-Sea Polymetallic Nodule Mining on Abyssal Infauna.” *Limnology and Oceanography: Methods* 19, no. 9 (2021): 626–50. <https://doi.org/10.1002/lom3.10448>.

Vanreusel, Ann, Ana Hilario, Pedro A. Ribeiro, Lenaïck Menot, and Pedro Martínez Arbizu. “Threatened by Mining, Polymetallic Nodules Are Required to Preserve Abyssal Epifauna.” *Scientific Reports* 6 (June 1, 2016): 26808. <https://doi.org/10.1038/srep26808>.

Simon-Lledó, Erik, Diva J. Amon, Guadalupe Bribiesca-Contreras, Daphne Cuvelier, Jennifer M. Durden, Sofia P. Ramalho, Katja Uhlenkott, et al. “Carbonate Compensation Depth Drives Abyssal Biogeography in the Northeast Pacific.” *Nature Ecology & Evolution*, July 24, 2023, 1–10. <https://doi.org/10.1038/s41559-023-02122-9>.

Gollner, Sabine, Stefanie Kaiser, Lena Menzel, Daniel O. B. Jones, Alastair Brown, Nelia C. Mestre, Dick van Oevelen, et al. “Resilience of Benthic Deep-Sea Fauna to Mining Activities.” *Marine Environmental Research*, 2017. <https://doi.org/10.1016/j.marenvres.2017.04.010>.

Pape, Ellen, Tania Nara Bezerra, Hendrik Gheerardyn, Marius Buydens, Amanda Kieswetter, and Ann Vanreusel. “Potential Impacts of Polymetallic Nodule Removal on Deep-Sea Meiofauna.” *Scientific Reports* 11, no. 1 (October 7, 2021): 19996. <https://doi.org/10.1038/s41598-021-99441-3>.

Washburn, Travis W., Lenaïck Menot, Paulo Bonifácio, Ellen Pape, Magdalena Błazewicz, Guadalupe Bribiesca-Contreras, Thomas G. Dahlgren, et al. “Patterns of Macrofaunal Biodiversity Across the Clarion-Clipperton Zone: An Area Targeted for Seabed Mining.” *Frontiers in Marine Science* 8 (2021). <https://doi.org/10.3389/fmars.2021.626571>.

Molari, Massimiliano, Felix Janssen, Tobias R. Vonnahme, Frank Wenzhöfer, and Antje Boetius. “The Contribution of Microbial Communities in Polymetallic Nodules to the Diversity of the Deep-Sea Microbiome of the Peru Basin (4130–4198m Depth).” *Biogeosciences* 17, no. 12 (June 25, 2020): 3203–22. <https://doi.org/10.5194/bg-17-3203-2020>.

## OPTIONAL READING

Uhlenkott, Katja, Erik Simon-Lledó, Annemiek Vink, and Pedro Martínez Arbizu. "Habitat Heterogeneity Enhances Megafaunal Biodiversity at Bathymetric Elevations in the Clarion Clipperton Fracture Zone." *Marine Biodiversity* 53, no. 4 (July 19, 2023): 55. <https://doi.org/10.1007/s12526-023-01346-z>.

Pasotti, Francesca, Lisa Mevenkamp, Ellen Pape, Paulo Bonifácio, Torben Riehl, Nene Lefaible, Lidia Lins, and Ann Vanreusel. "A Local Scale Analysis of Manganese Nodules Influence on the Clarion-Clipperton Fracture Zone Macrobenthos." *Deep Sea Research Part I: Oceanographic Research Papers* 168 (2021). <https://doi.org/10.1016/j.dsr.2020.103449>.

Cuvelier, Daphne, Sabine Gollner, Daniel O. B. Jones, Stefanie Kaiser, Pedro Martínez Arbizu, Lena Menzel, Nélia C. Mestre, et al. "Potential Mitigation and Restoration Actions in Ecosystems Impacted by Seabed Mining." *Frontiers in Marine Science* 5 (2018). <https://doi.org/10.3389/fmars.2018.00467>.