IN TOO DEEP

WHAT WE KNOW, AND DON'T KNOW, ABOUT DEEP SEABED MINING

© NARTT / Shutterstock

A WORLD UNDER THREAT

The deep seabed is our planet's final frontier. Covering around half the Earth's surface, it's a largely unknown, uncharted world. But we're beginning to discover that it's a world teeming with life, and that it exerts a major influence on the whole ocean ecosystem and on our climate.

It's also rich in metals and minerals. Some argue that mining the deep seabed is our best bet for providing the cobalt, lithium, nickel and other minerals needed under a business-as-usual scenario to enable the massive growth in the number of electric vehicle batteries, solar panels and wind turbines over coming decades. Proponents also suggest that mining the deep seabed could avoid the negative environmental and social impacts of mining on land.

But the risks are great. Mining would have a destructive impact on deep-sea ecosystems and biodiversity, which could have a knock-on effect on fisheries, livelihoods and food security and compromise ocean carbon, metal and nutrient cycles. It also runs counter to the transition to a circular economy, undermining efforts to increase recycling and reduce the use of finite resources.

Ultimately, moving to a low-carbon future will require major structural changes in our economy and in our lifestyles – not a rush to exploit the resources of previously untouched areas of our planet.

This briefing presents the existing knowledge on the likely environmental and socioeconomic impacts of deep seabed mining in the context of global efforts to transition to a low-carbon circular economy. It draws on a detailed research study available here.

© NOAA OER

DO WE NEED MORE METALS?

Material demand is expected to increase significantly over the coming decades with the rapid growth in electric vehicles. One 2019 study, for instance, includes scenarios where demand for cobalt, lithium and nickel well exceeds current mining reserves by 2050 – in the case of cobalt by around 420%.[1] Other studies have made similar projections.

But these estimations are at the upper end of the range – the same studies say that mineral demand can in fact be kept within terrestrial limits. Demand reductions of as much as 60-90% for almost all minerals are possible with increased material efficiency and recycling.[2]

The models also don't take account of the rapid technological developments in material science, innovative business models or policy and lifestyle changes that could reduce demand. The electric vehicle sector in particular is young and rapidly evolving, with manufacturers regularly announcing innovations – from new solid-state battery technologies that could halve battery size to modular battery rental schemes that can optimize battery utilization.

WHAT IS ON THE OCEAN FLOOR?

Much of the deep sea remains yet to be explored and scientifically understood – but we do know that, contrary to long-held beliefs, it's full of life.

Mining interest centres around three main marine mineral resources: polymetallic nodules, seafloor massive sulphides and cobalt-rich crusts, although exploiting the latter is currently not expected to be commercially profitable.[3] These metal-rich geologies provide habitat for a wide variety of microbial life and other larger lifeforms. In fact, the very minerals that mining companies wish to exploit are the foundation of deep-sea ecosystems.

In the absence of sunlight, deep-sea microorganisms use the energy from chemical reactions to absorb carbon and form organic compounds through a process called chemosynthesis. This builds the bottom layer of the food chain for the wider marine ecosystem. It also has a significant influence on the ocean's ability to cycle nutrients, balance chemical concentrations, and absorb carbon dioxide from the atmosphere.

WHAT IS THE ENVIRONMENTAL IMPACT OF OCEAN MINING?

Up to now, deep-sea ecosystems have experienced little disturbance from human activities. But we know they are likely to have low levels of resilience. Various characteristics reduce their capability to withstand and recover from disturbance: species are long-lived and slow to reach reproductive age, and fertility rates are low. Given the slow pace of deep-sea processes, destroyed habitats are unlikely to recover within human timescales.[4]

Next to direct destruction of ecosystems when minerals are mined, major damage and disturbance would likely arise from light, noise and sediment pollution. It's important not only to consider these risks at a project level but to look at their cumulative impact, since deep seabed mining would affect areas at continental scale. A single polymetallic nodule mining operation would pour millions of tonnes of sediment back into the water, releasing already accumulated metal particles and smothering the habitat of deep-sea organisms.

While deep seabed mining as an industry has been valued at US$2-20 billion,[5] it threatens to disrupt a much wider ocean economy, valued at US$1.5-2.4 trillion annually.[6] Because marine ecosystems have no obvious physical boundaries, deep seabed mining cannot occur in isolation and its impacts would not be limited to the ocean floor. Disturbances can easily cross ecological and jurisdictional boundaries, leading to unexpected and unquantifiable consequences, even on land. Loss of primary production, for example, could affect global fisheries, threatening the main protein source of around 1 billion people and the livelihoods of around 200 million people, many in poor coastal communities.

[1] Dominish, E., Teske, S. & Florin, N. 2019. *Responsible minerals sourcing for renewable energy*. A report prepared for Earthworks by the Institute for Sustainable Futures, University of Technology Sydney.

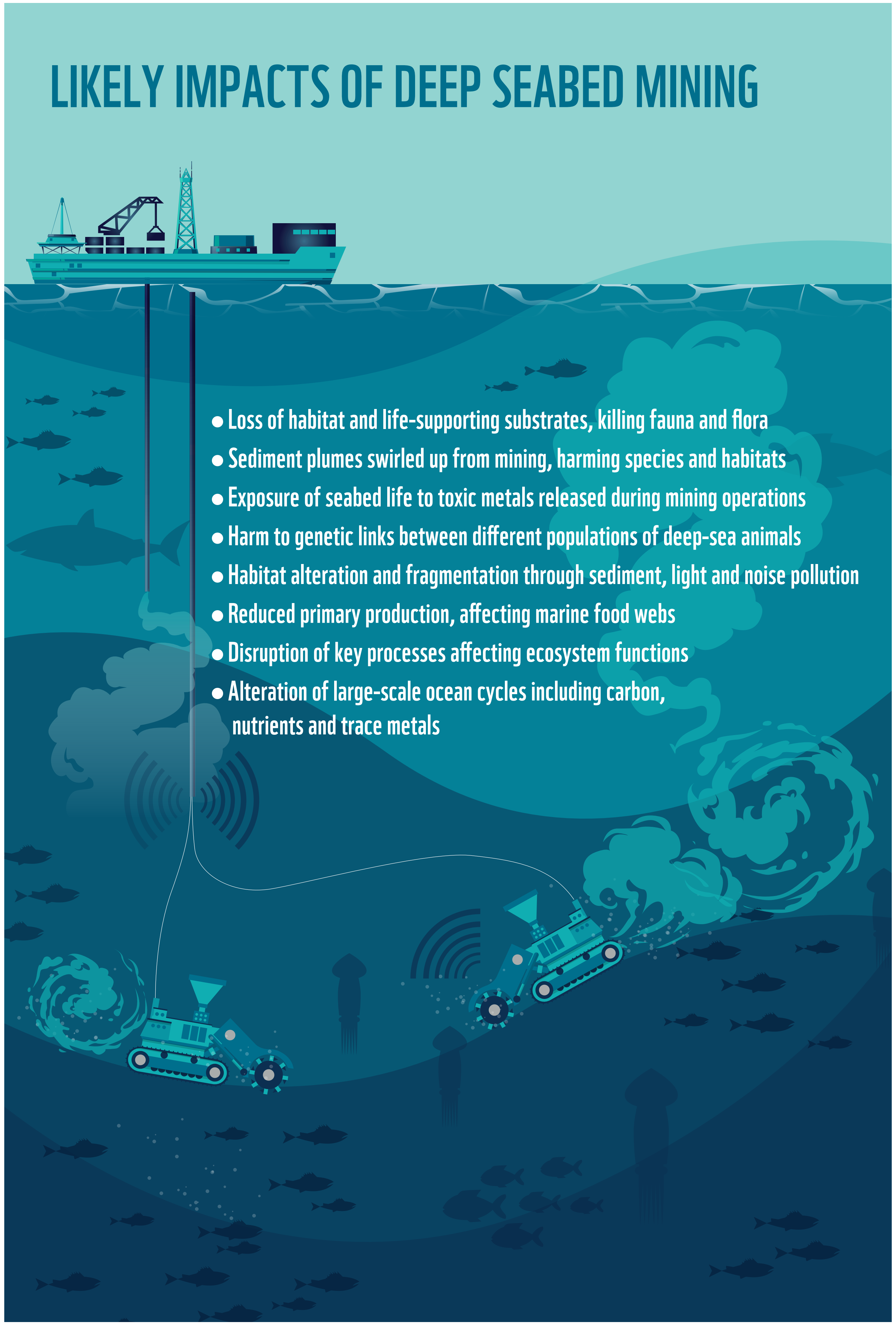
[2] Månberger, A. & Stenqvist, B. 2018. Global metal flows in the renewable energy transition: Exploring the effects of substitutes, technological mix and development. *Energy Policy* 119: 226–241. doi:10.1016/j.enpol.2018.04.056

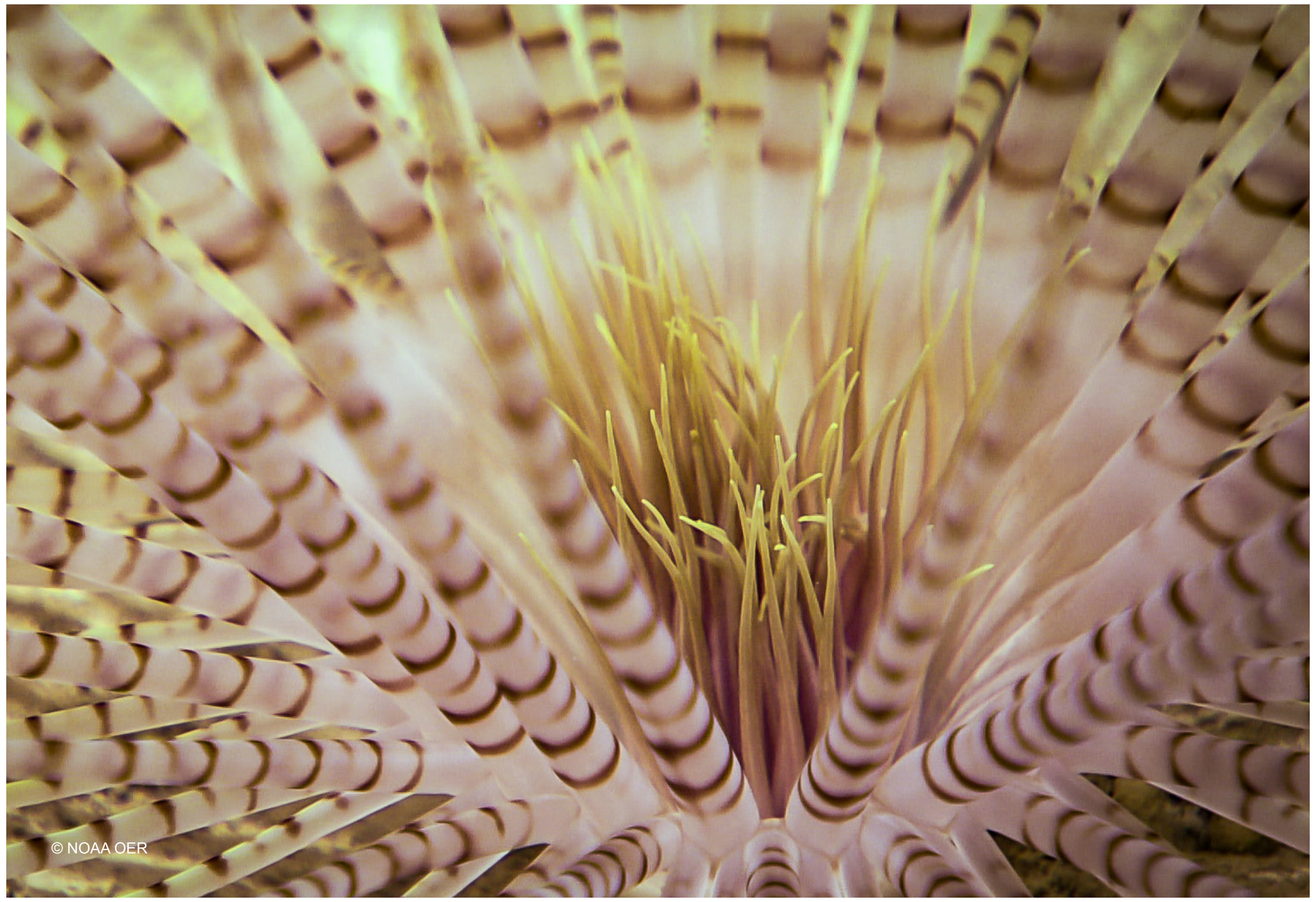
[3] European Commission. 2014. *Study to investigate the state of knowledge of deep-sea mining*. 2014. European Commission - DG Maritime Affairs and Fisheries. ec.europa.eu/maritimeaffairs/publications/study-investigate-state-knowledge-deep-sea-mining_en

[4] Volkmann, S.E. & Lehnen, F. 2018. Production key figures for planning the mining of manganese nodules. *Marine Georesources & Geotechnology* 36(3), 360–375. doi:10.1080/1064119X.2017.1319448; FFI. 2020. An assessment of the risks and impacts of seabed mining on marine ecosystems. cms.fauna-flora.org/wp-content/uploads/2020/03/FFI_2020_The-risks-impacts-deep-seabed-mining_Report.pdf

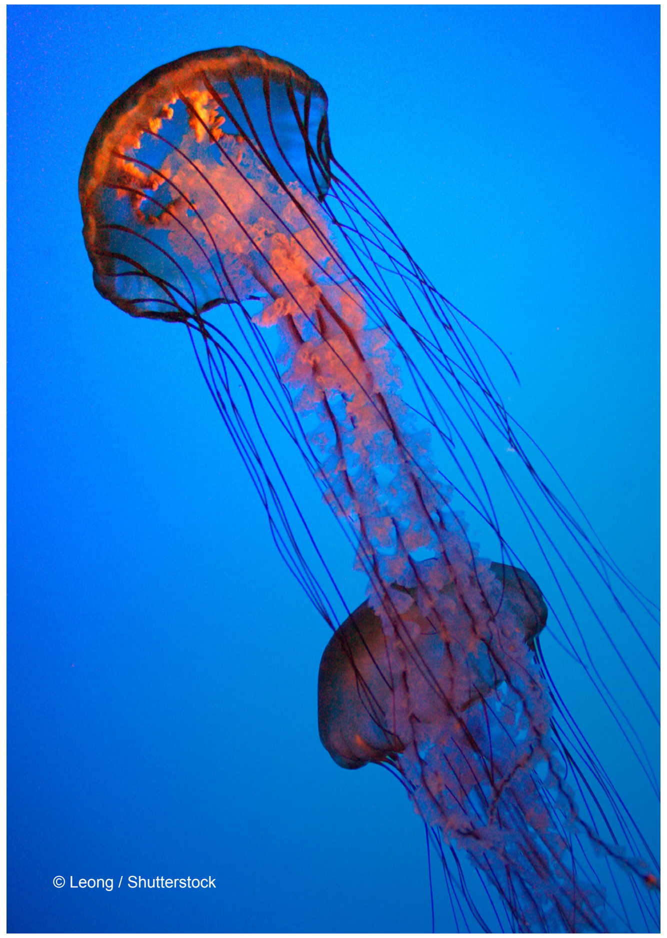
[5] FFI 2020.

[6] Hoegh-Guldberg, O., Tanzer, J., Gamblin, P. & Burgener, V. 2015. Reviving the Ocean Economy: the case for action. WWF International, Gland, Switzerland; OECD. 2016. The Ocean Economy in 2030. OECD, Paris, France.





© NOAA OER



© Leong / Shutterstock

© NOAA OER

© Jürgen Freund / WWF

LAND-BASED MINING HAS NEGATIVE SOCIAL AND ENVIRONMENTAL IMPACTS, SO WOULDN'T THE DEEP SEABED BE A BETTER ALTERNATIVE?

Some proponents speculate that deep seabed mining would have fewer negative impacts than land mining – which is associated with deforestation, pollution, human rights abuses and other environmental and social issues.

However, the extent to which deep seabed mining may replace land-based mining is highly uncertain. It's a nascent technology and lacks scientific proof for its supposed environmental advantages over land-based mining. A lack of historical experience and limited scientific understanding of deep-sea ecosystems make it impossible to fully compare the impacts of deep seabed mining against potentially avoided impacts on land.

Despite many historical problems, mining operations represent significant sources of employment and income for some of the poorest countries and communities on the planet.

Deep seabed mining, on the other hand, would be highly automated and dominated by only a few operators who have the required technology and capital.

HOW DO DEEP SEABED MINING PROCESSES WORK?

While different mineral deposits require different mining techniques, all destroy seabed habitats by physically removing sediments. Seafloor massive sulphides and cobalt-rich crusts require the use of cutting and drilling tools to break up and extract the minerals, while polymetallic nodules are sucked up by vacuum cleaner-like collection vehicles. The equipment is remotely operated, and the collected material is piped to a collection vessel on the water's surface. From there, the minerals are processed and transported to land, while the remaining sediments are released back into the water.

Operational similarities mean some project management standards from the offshore oil and gas industry could be adapted to deep seabed mining operations – but not all standards will be applicable. The same applies to environmental standards: while these draw on many years of research, this is mostly limited to the shallow waters of the continental shelf. Deep-sea environments below 3,000m pose different challenges, and there is little knowledge or experience of managing the impacts.

WHAT ARE THE REGULATIONS AROUND DEEP SEABED MINING?

Most of the deep seabed falls outside the jurisdiction of national governments. The United Nations Convention on the Law of the Sea (UNCLOS) designates the deep sea and its resources as the Common Heritage of Humankind.

Deep seabed mining operations in areas beyond national jurisdiction are regulated by the International Seabed Authority (ISA). This intergovernmental body is responsible for drafting standards and regulations on the management and funding of environmental monitoring and safeguarding. However, monitoring and oversight of offshore deep-sea operations is extremely costly: a single day of offshore research may cost up to US$80,000.[7]

The ISA is also tasked with establishing a benefit-sharing mechanism that will redistribute some of the financial profits from deep seabed mining to projects for the global good. While this may be well intentioned, having a single institution in charge of regulating deep seabed mining while also having an interest in its financial benefits presents a possible conflict of interest.

Governments face a similar conflict. Deep seabed mining operations need to be sponsored by a state that is a signatory to UNCLOS. These states will benefit from the success of the deep seabed mining operators they sponsor, but are also ultimately responsible for pursuing liabilities against them in case of misconduct or damages.

[7] FFI 2020.

WHY CAN'T WE JUST RECYCLE?

Most studies agree that recycling alone won't be enough to meet our rapidly rising metal demands. To avoid catastrophic climate change, we need to ramp up production of electric vehicles and renewable energy technologies over the next two decades – but the long lifetime of solar cells and electric vehicle batteries keeps the metals they contain in circulation for many years before they can be recycled.

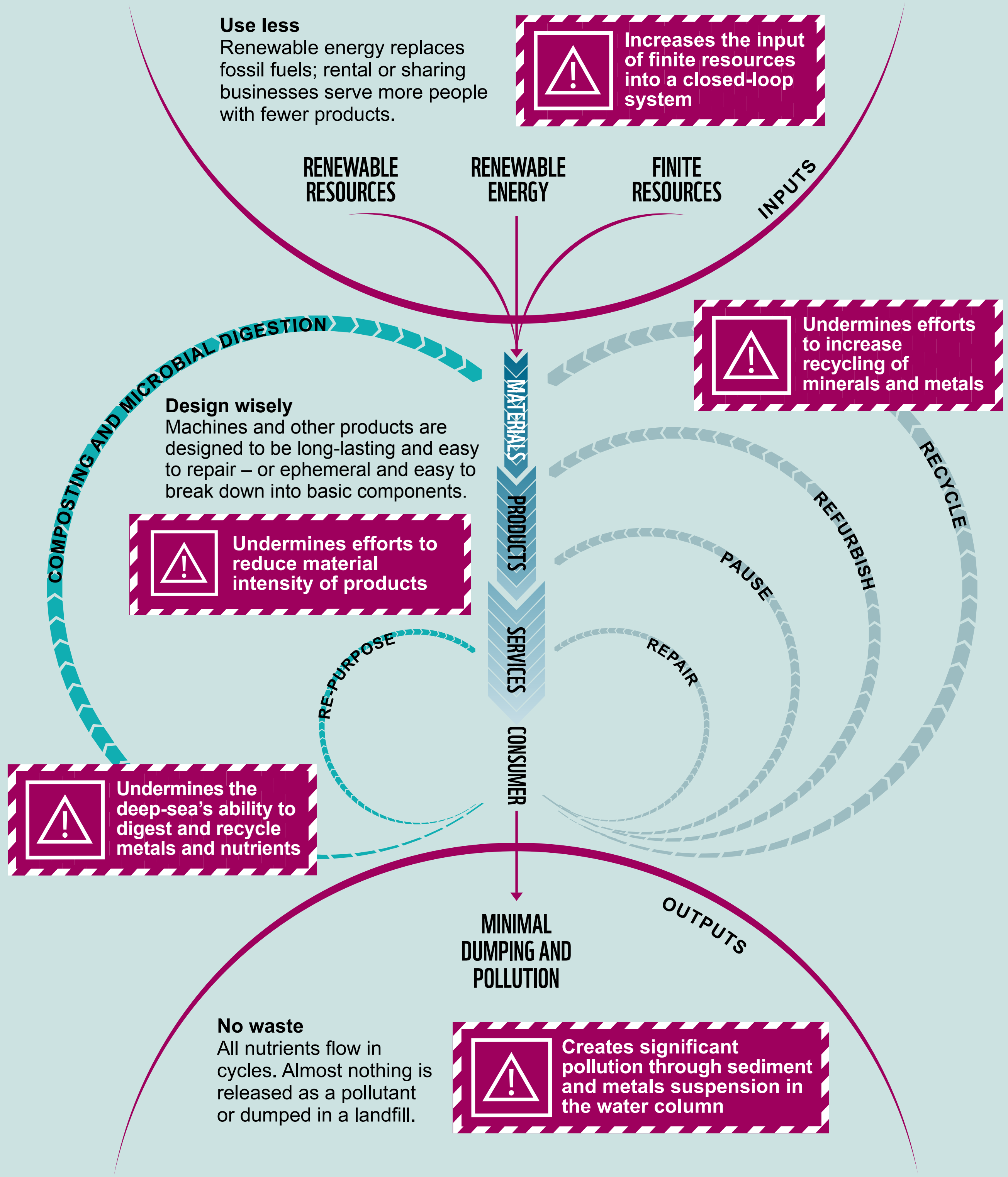
Recycling also has high labour costs, which reduces its competitiveness against mining. Under current projections, producing copper through recycling in 2060 will still be around 15% more expensive than through mining, and other recycled non-ferrous metals will be up to 25% more expensive[8]. Adding a new supply of minerals from deep seabed mining could dampen prices and undermine long-term incentives for producers and governments to scale up recycling efforts, especially in emerging economies. Profit-driven deep seabed mining companies will also face pressure to extract excessive quantities of minerals for many years to recoup their initial capital costs.

Ultimately, the aim must not be to feed enough material into the system to make recycling possible, but to reduce material demand at customer, design and production stages to levels where recycling can cope.

DEEP SEABED MINING GOES AGAINST THE PRINCIPLES OF A CLOSED-LOOP ECONOMY BY:

- Creating significant pollution and environmental destruction
- Exploiting finite resources that are essential to the functioning of deep-sea ecosystems
- Upsetting ocean carbon, metals and nutrients cycles
- Undermining efforts to increase recycling of minerals and metals
- Undermining efforts to reduce material intensity in design and production

[8] OECD. 2019. *Global Material Resources Outlook to 2060: Economic Drivers and Environmental Consequences*. OECD, Paris, France.

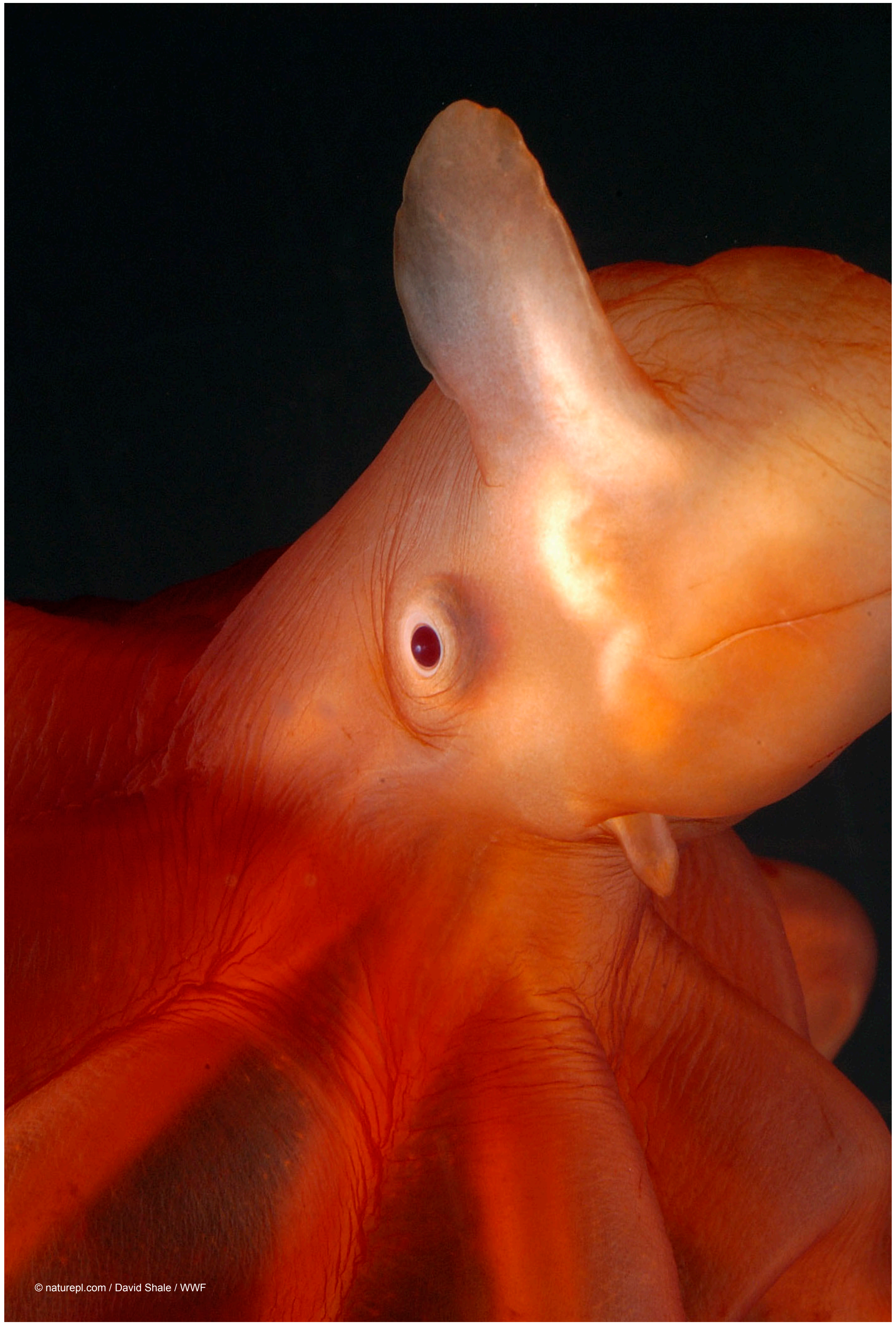


Source: adaptations introduced into original illustration from Kunzig, R. 2020. Is a world without trash possible? *National Geographic*. www.nationalgeographic.com/magazine/2020/03/how-a-circular-economy-could-save-the-world-feature

DEEP SEABED MINING IS AN ENVIRONMENTAL DISASTER WE CAN STILL AVOID

A transformational change in how we use ocean and planetary resources is required if the world is to achieve the goals and aspirations, set by the United Nations Agenda 2030, for a better future for all. We need to steer urgently towards a truly sustainable and circular Blue Economy. With this transformation in mind, WWF wants to see an immediate moratorium on deep seabed mining activities, unless and until:

- The environmental, social and economic risks are comprehensively understood.
- It is clearly demonstrated that deep seabed mining can be managed in a way that ensures the effective protection of the marine environment and prevents loss of biodiversity.
- Where relevant, there is a framework in place to respect the free, prior, informed consent of Indigenous peoples and to ensure consent from potentially affected communities.
- Alternative sources for the responsible production and use of the metals also found in the deep sea have been fully explored and applied, such as reduction of demand for primary metals, a transformation to a resource-efficient, closed-loop economy, and responsible terrestrial mining.
- Public consultation mechanisms have been established and there is broad and informed public support for deep seabed mining, which should fulfil the obligation to benefit humankind as a whole.
- Member States reform the structure and functioning of the International Seabed Authority to ensure a transparent, accountable, inclusive and environmentally responsible decision-making and regulatory process.



OUR MISSION IS TO CONSERVE NATURE AND REDUCE THE MOST PRESSING THREATS TO THE DIVERSITY OF LIFE ON EARTH.

WWF

Working to sustain the natural world for the benefit of people and wildlife.

together possible™

panda.org

For contact details and further information, please visit our international website at panda.org/ocean