Australian Marine Sciences Association Inc.

Postal Address: PO Box 220
Campbelltown
SA 5074

ABN: 35 279 182 164
ARBN: 604 875 774

President: Dr Rachel Przeslawski
Mobile: 0401 035 829
Email: president@amsa.asn.au

Dr Paul Vogel
Chairperson
NT Environment Protection Authority
Darwin NT

Dear Dr Vogel

The Australian Marine Sciences Association (AMSA) welcomes the opportunity to provide comments on the NT EPA Draft review into seabed mining in the Northern Territory.

AMSA is a professional society of more than 500 members nationwide, committed to promoting all aspects of marine sciences. Our members are from universities, museums, private sector and government agencies and have expertise spanning all disciplines related to marine science. AMSA actively promotes the advancement of marine sciences in Australia and provides evidence-based scientific advice and support on matters of national and global interest. As well as operating nationally, AMSA has active Branches in most states and territories, including the Northern Territory.

Introduction

The NT Government's imminent decision on its seabed mining moratorium comes at a time when the health of Australia's marine and coastal environments are in decline. Expansion of industrial development into the coastal and marine environment is placing increasing pressure on marine biodiversity and the well-being and security of the vast number of people it supports.

A national (and global) trajectory of decline in marine biodiversity has been systematically documented (i.e. GBRMPA Outlook Report, CSIRO Outlook report, State of the Environment Report, Senate enquiry into faunal extinctions) during the last decade and since European settlement in Australia. Since the beginning of this century there have been extensive losses of coral reefs (>50%) and seagrass (300,000 ha), between 20% and 35% of mangrove habitat has been lost since approximately 1980 [13], three key NT habitats, along with temperate seaweed forests (up to 95% declines in some species), saltmarsh habitats (50-100% losses) and oyster

reefs (90-99% declines). These habitats support tremendously diverse communities, which have also declined alarmingly in many places.

These foundation marine habitats are essential for the economic and social wellbeing of Australians because they underpin marine biodiversity and enable ecosystem services that support Australian communities and societies. Recent economic models suggest that by 2025, services provided by ocean and coastal ecosystems could be worth in excess of $25 billion p.a. However, this income, and the many intangible benefits so many Australians reap from living near the coast are contingent on the maintenance of biological diversity in marine ecosystems. This diversity underpins the ecosystem services that Australian communities all rely on, directly or indirectly, for prosperity, health and in many cases, survival. Conservation efforts to slow down or prevent the loss of these coastal ecosystems have mostly been ineffective, as many of the drivers behind biodiversity declines have generally not been adequately managed.

The Australian marine estate is vast and much of its biodiversity values have not been comprehensively documented in a systematic way. The cultural values of many Indigenous peoples in Australia extend into coastal waters where their connection to place, plants and animals is intrinsically connected to the health of the environment. The Northern Territory has exceptional examples of strong cultural connections evident in coastal management by Aboriginal groups. The available evidence points to extensive declines and redistribution of biological diversity in Australia's marine estate and future projections of further losses are alarming. The biodiversity losses will commensurately impact Indigneous coastal peoples around Australia.

One of the core objectives of National Strategy for Ecologically Sustainable Development (ESD) is to protect biological diversity and maintain essential ecological processes and life-support systems. It is AMSA's firm position that in order to effectively conserve and protect biological diversity, the causes of declines of biological diversity must first be addressed. In marine ecosystems, these drivers include (but are not limited to) climate change, land use changes and associated run-off changes, overfishing, invasive species, coastal development, dredging and offshore resource extraction. There is also increasing recognition that reducing human impacts is no longer sufficient for protection of biodiversity. In addition to managing the causes of declines, there is growing demand and interest for restoration or rehabilitation of lost habitats, a management approach that can also create jobs and produce substantial economic benefits.

With this in mind, it is crucial that threats are minimised or avoided, in this case that seabed mining is not allowed to undermine the Territory's largely intact tropical marine and coastal environments. Therefore, **AMSA cannot support a lifting of the NT moratorium on seabed mining.**

Comments on the Draft Review

Australian Marine Sciences Association Inc.

Our comments on the Draft Review centre on data availability, resources and expertise for environmental impact assessments and the likely impacts during seabed mining's three main phases, namely exploration, extraction and rehabilitation/recovery.

1. Data availability

The Australian coastline and marine estate are vast, and much of it is yet to be properly explored or have its biodiversity documented in any systematic way. Marine ecosystems are inherently challenging to access compared to terrestrial ecosystems, making traditional monitoring of ecosystems and biological diversity difficult. Thus, the loss of biological diversity from Australia's marine estate is likely to be much greater than what has been presented in peer-reviewed scientific publications.

Differences between marine and terrestrial systems exist, including in ecology, the availability of biodiversity information to understand impacts and the governance of natural resources. The connectivity in marine systems can make it difficult to disentangle project- and non-project related impacts. Effective mitigation requires a good understanding of the wider oceanographic and ecological baseline, as well as other human influences, typically across much broader spatial and temporal scales than on land. That sound understanding does not exist for the Territory's marine and coastal environments.

Throughout the Draft review and commissioned reports, there are many references to the lack of scientific data on the Territory's marine and coastal environments. The DENR report in Appendix 4 sums up the situation well:

> 'The Northern Territory marine and coastal environment remains poorly studied or described. This lack of information introduces the largest and most significant uncertainty for assessing and managing risks of seabed mining. Without such data, it will be challenging to conduct evidence-based risk assessment of impact from seabed mining on marine and coastal values'[1].

This data deficiency has been recognised in the Territory for some time. Information gaps for the Gulf of Carpentaria, Arafura Sea and Joseph Bonaparte Gulf were listed in the report of a 2007 expert workshop that described the Characterisation of the Marine Environment of the North Marine Bioregion. The NT EPA's 2012 Interim Report on seabed mining also identified key knowledge gaps, as did the 2018 Northern Territory Marine Science End Users Analysis. However, there has been little effective action and resourcing to address the data deficiency. Such a deficiency will take many years to overcome, even if there is a strong commitment from the NT Government and its agencies for the development and implementation of a well-resourced and integrated strategic marine and coastal scientific research plan.

AMSA stands ready to advise on and support efforts to fill the knowledge gaps for the Territory's marine and coastal environments. To that end, we support the Draft Review's finding of the need for 'a government managed and resourced central data repository'. This should be part of

a national environmental data and monitoring program that links federal, state and territory data on biodiversity, strategic planning and environmental impact assessment. Similarly, an online monitoring and reporting hub for comparative reporting with public and professional access to documents on public registers; licensing, compliance and enforcement data; bioregional plans, strategic assessments, and associated performance audits; periodic and annual reports should be developed.

Another area of concern is whether the NT EPA will have the required level of resources, data and expertise to effectively assess what would be, by nature, very complex environmental impact assessments of seabed mining proposals.

2. The exploration phase of seabed mining

During the exploration phase, mining companies could use test drilling and seismic surveys to determine how prospective the seabed was for minerals (currently the resources are unproven according to the Draft Review).

Research has shown that seismic surveys can impact marine mammals and fish, and more recently zooplankton. McCauley, R. et al. (2017) stated that:

> ‘Zooplankton underpin the health and productivity of global marine ecosystems. Here we present evidence that suggests seismic surveys cause significant mortality to zooplankton populations’[2].

Research by Day, R. et al. (2019) noted that the effect of seismic surveys on marine invertebrates was poorly understood but found that they interfered with the righting reflex and stacocyst morphology of the palinurid rock lobster. In other research (Day, R. et al. 2017[3]) found that seismic surveys increased mortality in scallops.

Kavanagh et al (2019) found:

> ‘strong evidence of multispecies impacts from seismic survey noise on cetaceans. Given the global proliferation of seismic surveys and large propagation distances of airgun noise, our results highlight the large-scale impacts that marine species are currently facing’[4].

In a critical review of the effects of seismic surveys on marine invertebrates and fish, Carroll et al (2017) [14] noted the challenges extrapolating to real-world populations and made recommendations for such studies. These are now being implemented through designated studies such as the North-West Shore to Shoals program (Australian Marine Institute of Marine Science) with results still pending.

3. The extraction phase of seabed mining

The Draft Review uses a number of case studies to discuss the potential impacts of the extraction phase of seabed mining. Most regard dredging operations for the establishment and

maintenance of shipping channels or the provision of materials for beach renourishment and other major works. This focus by the Draft Review is an acknowledgement that seabed mining projects in shallow waters, like those proposed for the Northern Territory, are few in number, with most mining-sector interest being in deep-sea mining.

The Draft Review and its commissioned reports describe the dredging process and many of its on-site and off-site impacts. What it fails to do, however, is to locate these impacts in relation to the mining applications and the likely locations of the mine sites, the minerals being sought, the methods to be used and the habitats found at and adjacent to the sites. As a result, it is a theoretical analysis of the potential impacts and provides little guidance to the communities in those coastal areas where seabed mining could occur.

The places where mining applications have been made include significant environments in Hyland Bay, Anson Bay, Fog Bay, Tiwi Islands, Elcho Islands, Wessel islands, Blue Mud Bay, Groote Eylandt, Limmen Bight and the Sir Edward Pellew Islands. The habitats found in these locations and which could be impacted by seabed mining include mangroves, seagrasses, coral reefs, tidal mudflats and estuaries, along with sandy beaches that provide nesting sites for threatened marine turtles and islands that host colonies of seabirds.

Habitats will be damaged and removed by the dredging process or smothered by spoil dumps and from plume sediments falling out of suspension. Ecological processes such as natural productivity, connectivity and climate regulation could also be compromised.

Mangroves are an important coastal habitat providing coastal protection and nurseries, shelter and food for many marine fish and invertebrates, as well as being a significant store of carbon. In the Territory they have been impacted by clearing and climate change but could also be affected by seabed mining. Andutta et al. (2014) investigated the impacts of dredging in Darwin Harbour and forecast that:

> ‘In the future, DH [Darwin Harbour] is likely to accumulate polluted sediment’ … and lead to … ‘similar conditions to many European estuaries, where pollutant sediment has been found to be buried since the industrial revolution’[5].

They also concluded that the:

> ‘trapping of polluted sediment within mangrove areas combined with increased suspended sediment concentration in the estuarine waters would negatively impact marine species. Additionally, if sediment pollution affects the mud crabs and many other local marine species that are responsible for local bioturbation, trapping of polluted sediment would increase further’[6].

Two other key habits in the Territory’s marine environments are coral reefs and seagrasses. The impact of sediment plumes on these habitats have been closely studied by scientists at the Western Australian Marine Science Institution (WAMSI).

In the case of corals, Jones et al. (2017) found:

> ‘Potential damage associated with dredging and turbidity-generating activities were then separated into *direct* and *indirect* effects. The *direct* effects included the removal of hard and soft substrate i.e. the dredging footprint and smothering of the seabed at the dredge material placement sites (spoil disposal grounds). The *indirect* effects were associated with mobilization of sediments into the water column (i.e. turbidity or plume-generation), and formed a second and larger group of cause-effect pathways’[7].

The researchers concluded that:

> ‘In terms of impact prediction, the review concludes that the proximal stressors associated with dredging (elevated SSCs, light reduction and sedimentation) are very interlinked, that they could act alone or in combination, and that the most relevant parameter(s) may change according to dredging activities, metocean conditions, distance from the dredge etc. This ‘protean’ nature of suspended sediments i.e. the ability of the stressor parameters to change shape and form, makes it particularly challenging to (a) identify which is the most relevant or important parameter(s) at any given time (the cause-effect pathway(s)), and (b) establish dose-response relationships. This potentially confounds and confuses laboratory and field experiments and observations and their interpretation’.

For seagrasses in the north-west of Western Australia, McMahon et al. (2017) identified five dredging related stressors: ‘reduced benthic light quantity; burial by sediment; sediment anoxia and increased hydrogen sulfide production; altered benthic light quality (i.e. spectral characteristics); and increased suspended sediment’[8]. The researchers also identified various knowledge gaps in relation to these stressors.

Schönberg (2016) conducted research on the impacts of sediment plumes on filter feeders such as sponges, which are also an important element in the ecology of the Territory’s coastal waters:

> ‘In summary, sediment associated with dredging activity can affect the physiology of filter feeders in very complex ways, which are not yet adequately understood. The responses are manifold, difficult to quantify and can vary significantly between taxa, life stages, and with other environmental factors. It is thus very difficult to recognise trends and patterns from fieldwork or even from controlled experiments. At a community or ecological level it is also difficult to predict how filter feeders would respond to dredging-related pressures when considering the wide range of responses to sediments, the large variability in sensitivity between taxa and the large range of interacting environmental variables, which cannot always be separately assessed’[9].

In another study of dredging impacts in Western Australia’s tropical waters, Fisher et al. (2015) found that dredge plume ‘effects were observed predominantly up to three km from dredging, but in one instance up to nearly 20 km’[10].

In a meta-analysis of literature on dredging-related stressors on fish, Wenger et al. (2017) found:

> ‘Across all dredging-related stressors, studies that reported fish mortality had significantly higher effect sizes than those that describe physiological responses, although indicators of dredge impacts should endeavour to detect effects before excessive mortality occurs. Studies examining the effects of contaminated sediment also had significantly higher effect sizes than studies on clean sediment alone or noise, suggesting additive or synergistic impacts from dredging-related stressors. The early life stages such as eggs and larvae were most likely to suffer lethal impacts, while behavioural effects were more likely to occur in adult catadromous fishes. Both suspended sediment concentration and duration of exposure greatly influenced the type of fish response observed, with both higher concentrations and longer exposure durations associated with fish mortality’[11].

Hughes (2014) outlines the impacts that spoil disposal can have on the Great Barrier Reef and these are summarised in the following extracts from his article:

> ‘Long-term monitoring of dredging impacts so far has been woefully inadequate. Monitoring tends to focus on the short-term impacts at each inshore dredging site, rather than the longer-term effects of dumping sediment elsewhere’.
>
> ‘But there is substantial scientific literature from around the world which shows that sediment from dredging can smother and kill marine species. Sediment also reduces light levels, causes physiological stress, impairs growth and reproduction, clogs the gills of fish, and promotes diseases. The extent to which this is already occurring on the Great Barrier Reef due to dredging is poorly understood’.
>
> ‘Dispersal of suspended particles by currents, wind and tides has been extensively studied on the Great Barrier Reef for several decades, beginning with pioneer work on the spread of the larvae crown-of-thorns starfish. No scientist would accept assertions that sediment spoil doesn’t disperse long distances’.
>
> ‘For example, a recent modelling study predicts that fine sediments in suspension can spread up to 200 kilometres from coal ports within 90 days’[12].

The research cited above underlines the critical lack of data on the impacts of dredging/seabed mining on marine life. Application of the precautionary principle, which is embedded in the Environment Protection Act 2019, should preclude the lifting of the moratorium on seabed mining in the Northern Territory.

The above research is also focused on the in-water impacts of seabed mining. Unfortunately, the Draft Review excludes any analysis of land-based impacts, which could be significant due to the construction of roads, jetties, processing facilities, storage units and roads. To ensure an integrated and holistic analysis of the potential impacts of seabed mining on the Territory’s marine and coastal environments are presented to the community, it is imperative that the Final Review includes analysis of land-based impacts.

4. The rehabilitation and recovery phase of seabed mining

The Draft Review clearly states that the rehabilitation and recovery of seabed habitats from seabed mining will be problematic. AMSA believes this is yet another reason why the seabed mining moratorium in the Northern Territory should not be lifted.

References

[1] Smit N, Groom R and Griffiths A 2018, Seabed mining and coastal and marine environments of the Northern Territory. Department of Environment and Natural Resources, Palmerston, p.34.

[2] McCauley, R., Day, R., Swadling, K. et al. Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nat. Ecol. Evol.* **1,** 0195 (2017). https://doi.org/10.1038/s41559-017-0195.

[3] Day R et al 2017, Exposure to seismic air gun signals causes physiological harm and alters behavior in the scallop *Pecten fumatus, PNAS* October 2 2017, 114 (40) E8537-E8546

[4] Kavanagh A et al 2019, Seismic surveys reduce cetacean sightings across a large marine ecosystem, Scientific reports (2019) 9:19164

[5] Andutta F, Wang X, Li Li and Williams D 2014, 'Hydrodynamics and sediment transport in a macro-tidal estuary: Darwin Harbour, Australia', in E. Wolanski (ed.), *Estuaries of Australia in 2050 and beyond, Estuaries of the World*, Springer Science+Business Media, Dordrecht, p.115.

[6] Andutta F, Wang X, Li Li, and Williams D 2014, p.116.

[7] Jones R, Bessell-Browne P, Fisher R, Klonowski W, Slivkoff M (2017) Assessing the impacts of sediments from dredging on corals. Report of Theme 4 – Project 4.1 Dredging Science Node, Western Australian Marine Science Institution (WAMSI). Perth, Western Australia, 33pp, p.ii

[8] McMahon K, Lavery P, McCallum R and Hernawan U (2017) Current state of knowledge regarding the effects of dredging-related 'pressure' on seagrasses. Report of Theme 5 - Project 5.1.1 prepared for the Dredging Science Node, Western Australian Marine Science Institution, Perth, Western Australia, pp. ii and v.

[9] Schönberg CHL 2016. Effects of dredging on filter feeder communities, with a focus on sponges. Report of Theme 6 – Project 6.1 prepared for the Dredging Science Node, Western Australian Marine Science Institution, Perth, Western Australia pp. i-ii.

[10] Fisher R, Stark C, Ridd P, Jones R (2015) Spatial Patterns in Water Quality Changes during Dredging in Tropical Environments. *PLoS ONE* 10(12): e0143309. https://doi.org/10.1371/journal.pone.0143309

[11] Wenger et al 2017, A critical analysis of the direct effects of dredging on fish, Fish and Fisheries, vol. 18 Issue 5 September 2017

[12] Hughes T, 2014, Mounting evidence shows dredge spoil threat to the Great Barrier Reef, *The Conversation*, 18 August 2014.

[13] Polidoro BA, Carpenter KE, Collins L, Duke NC, Ellison AM, et al. (2010) The Loss of Species: Mangrove Extinction Risk and Geographic Areas of Global Concern. PLOS ONE 5(4): e10095. https://doi.org/10.1371/journal.pone.0010095

[14] Carroll AG, Przeslawski R, Duncan A, Gunning M, Bruce B. (2017) A critical review of the potential impacts of marine seismic surveys on fish and invertebrates. Marine Pollution Bulletin. 114: 9-24