National SCIENCE Challenges

SUSTAINABLE SEAS

Ko ngā moana whakauka

Improving the marine management framework to make good decisions on seabed mining

Summary

A high-performing, sustainable blue economy relies on using marine resources within environmental and biological constraints and in a way that contributes positively to ecological, cultural, and social well-being.

This paper summarises issues with managing seabed mining and other marine activities and recommends improvements to the marine management framework. It's based on a submission by the Sustainable Seas National Science Challenge for the Inquiry into seabed mining in New Zealand. Sustainable Seas' research looks at how to best develop a marine economy while protecting the marine environment.

The need for mineral resources must be balanced with protecting ecosystems and communities

Deep-sea mining poses risks to the environment and can impact the social and cultural values of local communities.

A balance is needed between society needs for mineral resources with the protection of ecosystems and confidence that local communities will not bear the social costs of poor implementation or management of seabed mining. To inform this balance, the impact of seabed mining on ecosystems needs to be better understood.

The effects of seabed mining are not well known

The effects of deep-sea mineral mining are not well known because little national or global seabed mining experience exists. For example, little is known about trace metal concentrations in deep seabed organisms or about organisms' responses to changes in environmental conditions.

Difficulties exist in collecting baseline information and understanding the impact of multiple, interacting stressors (known as cumulative effects). These difficulties sit against a background of environmental variability and climate change — generating high levels of uncertainty.

The current marine management framework has limitations

The existing marine management framework has challenges for managing activities, like seabed mining, for the following reasons.

Ecosystems are interconnected but our jurisdictional boundaries are not

An arbitrary line exists between the exclusive economic zone (EEZ), coastal marine area, (CMA), and land, but the environmental effects of an activity often cross these lines.

In its recent decision on an application for consent to extract and process iron within the EEZ off the South Taranaki coast, the Supreme Court noted that the effects of the sediment plume would be apparent in the coastal marine area and that 'there are good policy reasons for not ignoring the fact that if the proposed activity took place on the other side of an arbitrary line between two regimes, its proposed effects would be assessed differently'.

Current impact assessments don't take account of how whole ecosystems respond

Current impact assessments tend to map activities (like seabed mining) to individual stressor responses. But this approach does not consider how the ecosystem responds. Cumulative effects come from the combined impact of individually minor, yet collectively impactful, activities. Each activity and associated stressors generate distinct response footprints, but these footprints do not necessarily predict whole ecosystem responses, which can happen in apparently 'separate' areas, a long way away, and at later times.

Ecosystem responses to multiple, cumulative stressors depend on context and are difficult to predict, especially in data-scarce situations, like in our exclusive economic zone. To produce accurate impact assessments, we need frameworks that focus on ecosystem responses over different space and time scales.

'Best available information' can ignore other relevant information

'Best available information' has been taken to mean numeric data and models, which can rule out information that's less numeric but more relevant, and information that's less able to be collected over large spatial scales. Obtaining information on biodiversity responses to interacting stressors in the exclusive economic zone would be expensive, time consuming, and may not be useful at the right scales. However, robust decisions can be based on ecological theory, empirical experimentation, mātauranga Māori and local experiences.

Many risk assessment processes in use are not suitable for ecosystem-based management (EBM)

Decision-makers often use different risk assessment processes when deciding about activities and their impacts, like seabed mining. Many of the risk assessment methods used in Aotearoa New Zealand (and internationally) are not suitable as they focus on the direct impacts of a single stressor on a species or habitat rather than considering the whole ecosystem over time and in different places. Risk assessment methods and processes that take account of ecosystem-based management are essential.

Recommendations to address limitations

The following recommendations can help improve the marine management framework and help decision-makers approach issues like seabed mining in a more informed, robust way.

- Transition to ecosystem-based marine management.
- Adopt a more systematic approach to managing cumulative effects across space and time scales.
- Use an ecosystem response footprint framework to guide environmental management priorities.
- Provide a pathway for wider sources of information.
- Adopt improved risk assessment approaches.
- Transition to a principles-based blue economy.

Transition to ecosystem-based marine management (EBM)

We recommend Aotearoa New Zealand adopts ecosystem-based marine management — EBM is a holistic, relational, ecosystem-based approach to managing the ocean. In partnership with Māori, this approach can lead to improved marine resource decision-making and a thriving blue economy.

Successfully implementing EBM requires setting a vision for the health of ocean ecosystems that can be applied across sectors and scales.

EBM should be supported by legal and policy rules and processes that reinforce a coordinated approach, are properly resourced and mandated by government, and supported by effective institutions and community participation.

🔗 Read more about designing law and policy for the health and resilience of marine and coastal ecosystems on the Sustainable Seas website

Adopt a more systematic approach to managing cumulative effects across space and time scales

Effectively implementing EBM relies on understanding how ecosystems respond to cumulative effects.

To manage cumulative effects in marine environments, coordination and collaboration is needed across all levels of government, key institutes, and stakeholders. We've developed an online mapping tool to help visualise the spatial extent and patterns of multiple stressors from land and sea. The tool will help to better understand how stressors overlap with each other and with the distributions of marine organisms, habitats, and ecosystems.

🔗 Read more about tools to help manage cumulative effects in the coastal and marine environment Te Ukaipo o Hinemoana on the Sustainable Seas website

Use an ecosystem response footprint framework to guide environmental management priorities

Understanding how ecosystems respond to cumulative effects is important to avoid ecological surprises and irreversible ecosystem damage. Current tools for assessing cumulative effects can overlook important aspects of ecosystem responses in space and time. New research lays out a series of ecological characteristics of responses that can be used to conceptualise 'ecological response footprints'.

These characteristics include spatial extent and depth (time for recovery, magnitude of response, and how long the response persists). The spatial extent of a footprint can be generated from models, satellite data, or expert opinion. Large and long-term stressors leads to an extensive ecosystem footprint, which means less resilience and a more degraded state where recovery will be slow.

For seabed mining, assessing the size and depth of ecosystem response footprints rather than individual stressors gives a much more accurate representation of the cumulative impacts of mining.

Given the mismatch between stressor and response footprints, decision-makers must consider both stressor and response footprints when assessing drivers of cumulative effects.

🔗 Read more about using the ecosystem response footprints to guide environmental management priorities on the Sustainable Seas website

Provide a pathway for wider sources of information

Decisions should be based on knowledge and evidence such as ecological theory, empirical experimentation, matauranga Māori, local experiences, and expert knowledge.

Ensuring that decisions are informed by science and mātauranga Māori, and allowing tailored and flexible approaches to marine management, ensures that management approaches are adaptive and responsive and provide better management of the cumulative effects of activities, like seabed mining.

Recognising the importance of incorporating knowledge from a wide variety of sources and informed by community values and priorities strengthens marine management systems.

Adopt better risk assessment approaches

Better risk assessments can support ecosystem-based marine management and safeguard our marine environments for future generations. Better risk assessment approaches use:

• ecosystem-based management risk assessment criteria and an associated decision tree (see table below)
• community-engaged risk assessments
• shared information and data.

EBM risk assesment criteria
1. Does the method integrate ecosystem complexity?
Does it assess risk to multiple ecosystem components? • Physical disturbance • Multiple species removal and effects on benthic habitats • Changes to trophic levels, productivity, and size of important species • Alteration of food quantity and quality • Species addition, for example invasive species) • Biodiversity loss • Contamination, including behavioural changes and toxicity • Changes to ecosystem function, for example movement and connectivity, biological traits, chemical balances and elemental cycles Does it assess indirect effects, interactions, feedbacks, and non-linear responses?
2. Does the method accommodate a range of components, outcomes, and stressors?
As well as assessing the ecological response of multiple ecosystem components, a risk assessment method should incorporate social, cultural, and economic values and activities that will be affected by or drive ecosystem responses. Examples of cultural outcomes include cultural health indices and the Mauri Compass.
3. Does the method accommodate different knowledge types?
Data from multiple knowledge types is essential to fill quantitative data gaps, widen the evidence-base, and ensure that ecosystem-based management objectives align with the values of multiple sectors of society. Examples of knowledge types include expert opinion, mātauranga Māori or local knowledge, and quantitative data. Mauri is an example of mātauranga Māori being taken into account in decision making — under Te Mana o Te Wai.
4. Does the method assess risk at a specific place and time?
The relative importance of different ecosystem components, processes, and their connections differ with place and time, as do the disturbance or stressor regimes that affect them. Outputs that communicate the risk posed to the location of interest, for example maps, and how this risk varies through time are important.
5. Does the method evaluate recovery as well as degradation?
Risk assessment methods must be able to evaluate recovery explicitly and separately, rather than combining it with impact. Ecological feedbacks can create recovery lags that hinder recovery, even when stressors are reduced. The object of the risk assessment may be recovery of the mauri or ecosystem health rather than minimising future degradation.

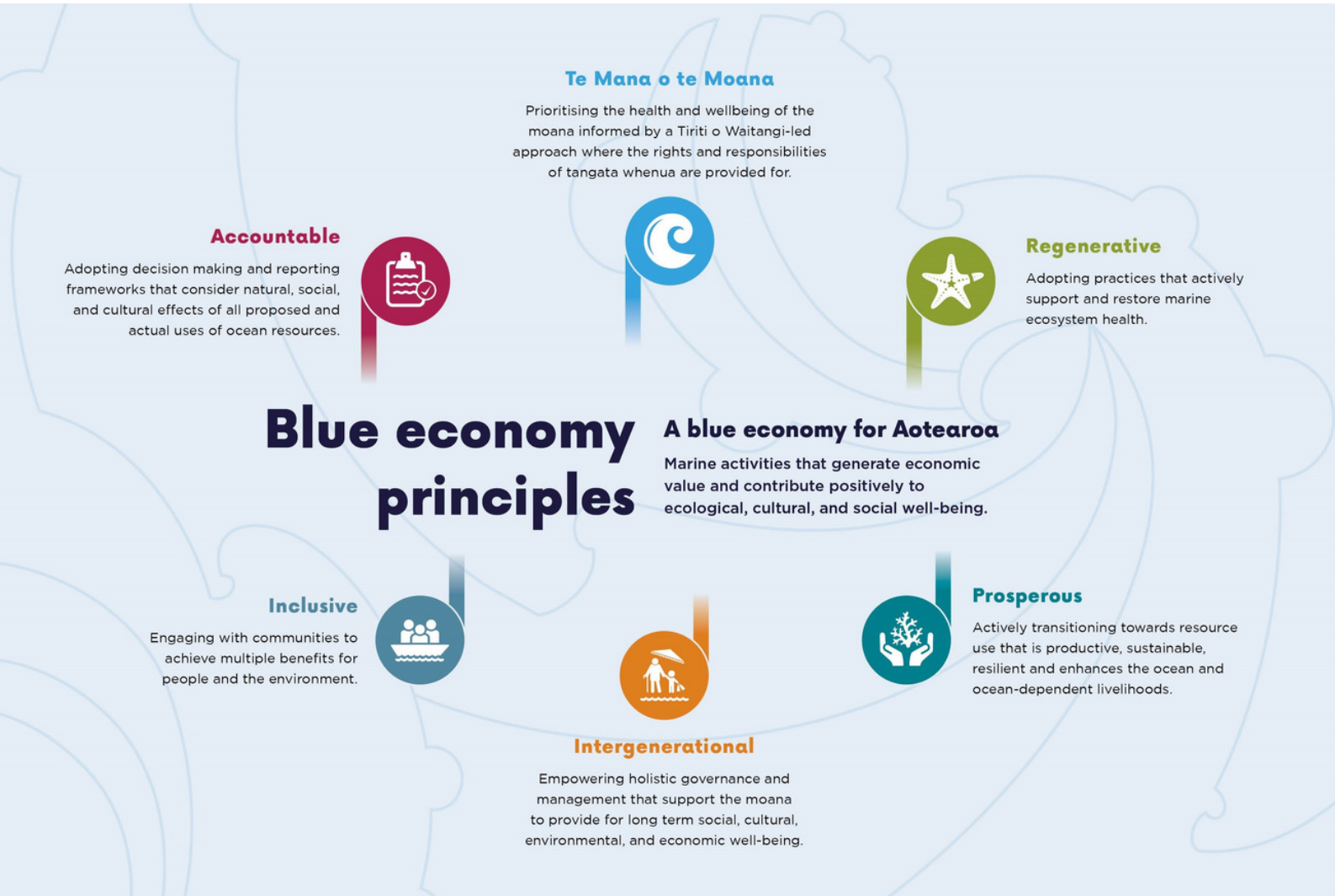
6. Does the method evaluate and communicate uncertainty?
Generally, uncertainty is explored through scenarios that evaluate the relative success of different actions. While uncertainty can be difficult to separate from risk, in a risk assessment method that's being used for decision making, uncertainty can be an important part. Uncertainty can be used to test whether more information would actually be helpful or whether this is being used as a delaying tactic. Uncertainty can also help with transparency in decision making by making explicit how likely different actions are to achieve the desired response — whether that response is environmental improvement or minimising degradation.

🔗 Read more about how to incorporate risk and uncertainty in ecosystem-based management in quick guide five on the sustainable seas website

Transition to a principles-based blue economy

Aotearoa New Zealand needs to transition to a blue economy – a new way of doing business with the ocean that goes beyond a traditional, purely economic concept of GDP. A blue economy includes marine activities that generate economic value and contribute positively to ecological, cultural, and social well-being.

We've developed six principles to underpin Aotearoa New Zealand's journey towards a sustainable blue economy. Along with ecosystem-based management, these principles can be used to inform future regulatory settings for activities such as seabed mining.



🔗 Read more about the blue economy principles on the Sustainable Seas website