

# Restoring marine ecosystems through better management and financing

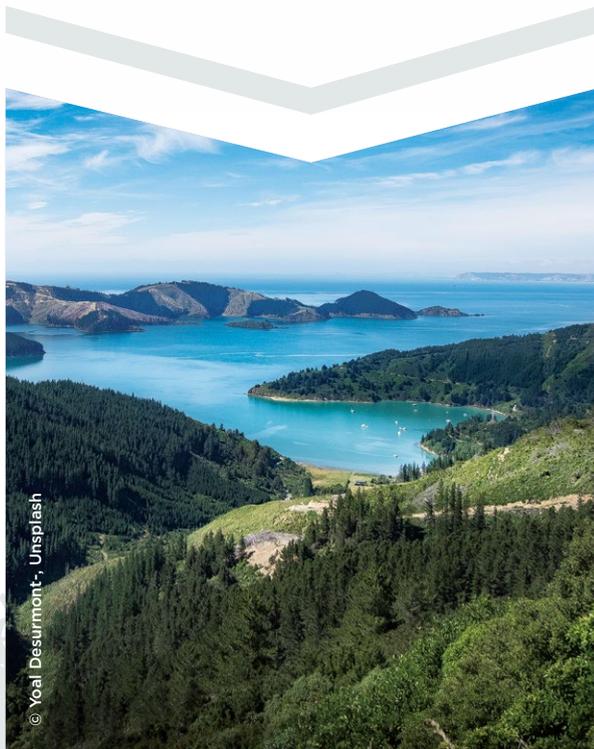
A healthy marine ecosystem can support a thriving, sustainable blue economy – and vice versa.

But coastal marine ecosystems in Aotearoa New Zealand are declining in health. This decline is characterised by biodiversity loss and the loss of valuable ecosystem functions and services that we rely on. Investment is needed to develop legal, policy, and finance mechanisms to support the enduring restoration of marine ecosystems.

To move forward, we need to improve how we manage marine ecosystems and how we fund restoration activities.

## About this document

This document explains why we need to improve how we manage and finance the restoration of marine ecosystems and recommends ways to support a restorative blue economy, which we envisage will be a key focus of marine management in the future. The recommendations are based on research findings from the Sustainable Seas National Science Challenge.



## Recommendations

These recommendations aim to support the ecological, social, and economic enabling factors to foster a restorative blue economy, which we envisage will be a key focus of future environmental management.

### Short-term recommendations

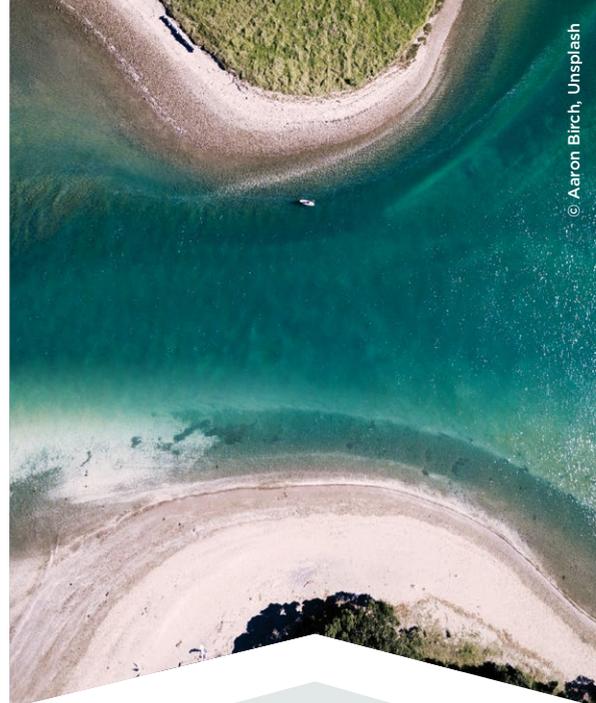
In the short-term, we recommend the following.

- » Enhance ongoing collaborative action and cross organisation leadership between iwi and hapū, central and regional government, researchers, business, and community to determine:
  - » what restorative or recovery actions are needed where and by who
  - » how to best achieve these actions to result in ecosystem recovery
  - » how to measure the effectiveness of restorative action.
- » Shift management focus from managing and monitoring activity and stressor footprints to managing ecological responses to support recovery, for example by incorporating ‘managed recovery’ as an objective within coastal plans.
- » Invest in marine restoration research and new ways of valuing all the benefits (economic and non-economic) provided by healthy marine ecosystems.
- » Strengthen social and management feedback so that the relationship between downstream issues in coastal ecosystems and upstream activities on land is acknowledged and appropriately managed.
- » Increase the size and number of marine protected areas in the network (via various tools such as Mātaitai reserves) and consider these areas in the context of ecological connectivity and enhancing the blue economy through restorative activities.

- » Add details of recovery activities to a portal so everyone knows what's going on and can learn from them (for example, ACRN portal, Tuhono Taio, and Department of Conservation's estuaries hub). Through this portal, finance opportunities can also be linked to recovery priorities and restoration economy opportunities.
- » Use adaptive processes to support action now (despite knowledge gaps) and use research to mitigate risks and inform successful restoration and recovery action. Use case studies (codeveloped with iwi, hapū, community, government, and investors) as a proof of concept to inform future restorative action and attract further investment.
- » Expand research and prototyping of new revenue and business models for restorative marine economies, including investment in ecosystem (seascape) level solutions. This requires greater understanding, knowledge building, and skills-sharing about revenue activation models and benefit-sharing mechanisms.

### Long-term recommendations

- » Set long-term priorities and management actions that transcend political cycles. Pathways forward include identifying universal political priorities, for example by quantifying the benefits provided by marine ecosystems in order to meet international obligations and responsibilities. As ecosystem recovery requires significant long-term investment, this also includes assigning the necessary funding to meet restoration finance gaps and recognising our aspirations and commitments as a country.
- » Develop legal, policy, and market mechanisms to support enduring restorative action, for example via nature markets and payments for ecosystem services, credit systems, targeted levies, and subsidies to better align costs of environmental degradation and the benefits of recovery.
- » Establish restoration and recovery as a mainstream asset class (green taxonomy).
- » Provide clarity and accountability around roles and responsibilities of central and regional government, researchers, business, iwi and hapū, and build greater collaboration between all parties.



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## Marine management must focus on restoration activities and ecosystem recovery

New Zealanders have an intimate relationship with the coast, value their marine environment and clean green image, and have a deep cultural and ethical responsibility to sustain the environment for future generations. Coastal and marine environments provide a variety of ecosystem services, for example, recreation, food, water filtration, coastal protection, carbon storage, and fish nurseries, which New Zealanders rely on for their livelihoods and wellbeing. However, the health of coastal marine ecosystems in Aotearoa is declining (MfE 2022), characterised by continued losses in biodiversity as well as the valuable ecosystem services and functions they provide.

Many factors contribute to marine ecosystem decline. Often, decline is not driven by a single stressor, but multiple cumulative stressors that arise from incremental, accumulating and interacting stressors that overlap in space and time (Rojas-Nazar et al 2023).

Because of the complexity of managing cumulative stressors, marine ecosystems in Aotearoa New Zealand have traditionally been managed by limiting environmental stressors from a single activity or stressor to minimise the decline of ecosystem health, for example, reducing the amount of land-based sediment or nutrients entering into coastal waterways, in the hopes the ecosystem will recover – a 'limit stress and let recover' approach. However, while this approach may reduce the speed of ecosystem decline, little evidence exists of ecosystem recovery occurring at scale. Even when stressor reduction is successful, in some areas the natural recovery of ecosystem health is not possible or may take a long time to occur, for example, due to hysteresis (delayed effects) and legacy effects that cause recovery lags (Hewitt et al 2022).

As well as a focus on a 'limit stress and let recover approach', a key contributor of marine ecosystem degradation is the practice of isolating environmental management and social-ecological research into ecosystem domains (land, freshwater, and sea), each with different management approaches and associated consequences (Gladstone-Gallagher et al 2022). For example, the conversion of native forestry may support productive farming, but has had harmful impacts on downstream coastal marine ecosystems, where the direct economic benefits are felt on the land, but the ecological costs are felt in the marine environment.

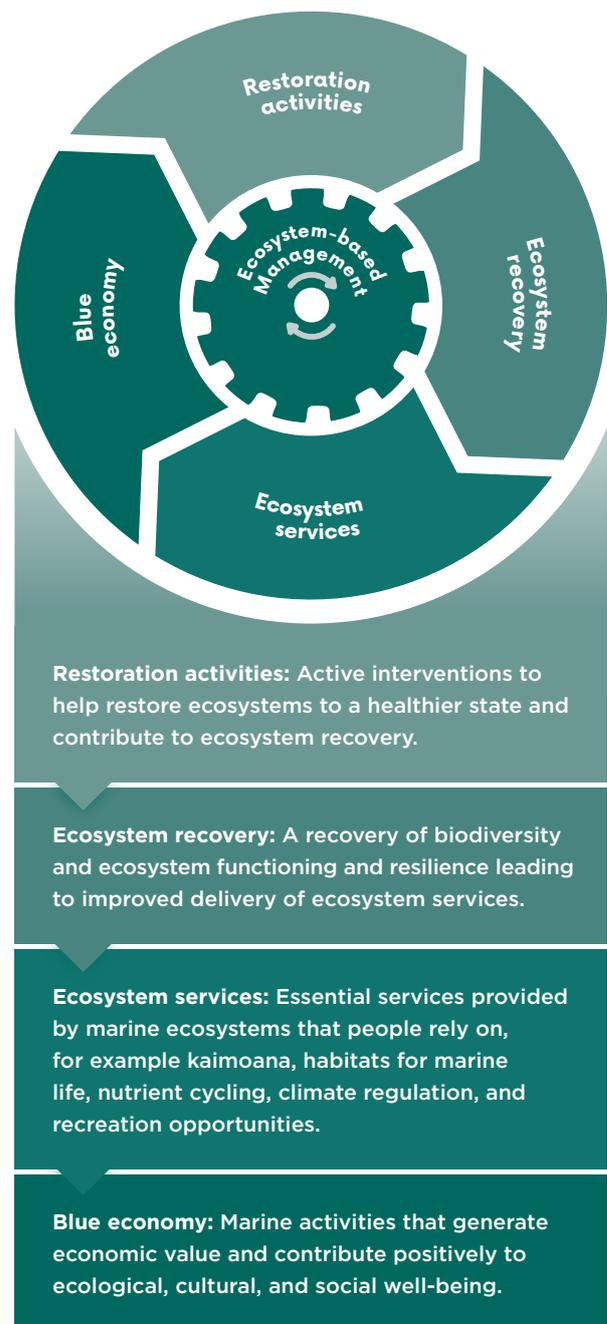
Restorative management of the marine environment is needed now. The longer the degradation goes on for, the greater the likelihood of legacy effects that will make ecosystems harder and more costly to restore (Hewitt et al 2022). This can lead to reduced ecosystem resilience causing devastating impacts from any unexpected shock to the environment, for example from a cyclone or earthquake. Marine management must therefore shift from a single focus on stressor management (and slowing ecological decline) to a dual focus on stressor management and restoration activities and ecosystem recovery.

## A thriving blue economy relies on a healthy marine ecosystem

The blue economy means marine activities generate economic value and contribute positively to ecological, cultural, and social well-being. The blue economy relies on a healthy ecosystem (and vice versa) and the adoption of the blue economy principles (figure 1).

Relationships between the marine environment and the economy are not limited to businesses such as fisheries and eco-tourism where the link with healthy marine ecosystems is more explicitly made (Short et al 2023, Envirostrat Ltd 2019). The whole economy benefits from healthy marine ecosystems (for example, kaimoana is a key food source for iwi/hapū and enjoyed more broadly), yet the economic reliance on this relationship is often poorly accounted for in decision-making.

Reviewing global blue economy examples, the prevailing view is that blue economy approaches promote social and environmental justice, including caring for the planet and incorporating Indigenous rights. This aligns with and underscores the importance of Te Tiriti o Waitangi/the Treaty of Waitangi as well as the unique context of te ao Māori/the Māori worldview as a foundation for the blue economy in Aotearoa New Zealand (Short et al 2023). Restoration activities are essential to a healthy ecosystem, which underpins a sustainable blue economy.



**Figure 1 Healthy ecosystems and a thriving blue economy are interdependent**

The marine economy is estimated by Statistics New Zealand to contribute \$3.8 billion per year to the national economy and much of this value is dependent on healthy marine ecosystems (for example, fisheries and aquaculture, marine tourism and recreation). This estimate is conservative, and research commissioned by Sustainable Seas from Market Economics puts this figure at \$7.4 billion (Envirostrat Ltd 2019). The economic cost of marine ecosystem decline is therefore substantial. Investment in restoration and recovery action is needed now and at multiple scales, not only to maintain and grow this economic value of a blue economy, but also to meet our legislative, cultural and ethical responsibilities and international agreement obligations.



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## **A significant restoration finance gap exists in Aotearoa – especially in marine ecosystems**

Around the globe, donors and governments have made major investments in marine restoration. For example, annual funding for watershed restoration for the Chesapeake Bay program in the USA exceeded 2.2 billion USD in 2023. In comparison, restoration actions undertaken in New Zealand are mainly smaller scale and led by iwi/hapū, community groups, government agencies (for example, Department of Conservation and regional councils), or researchers at a project-by-project scale, for example restoration of:

- mussel beds in the Hauraki Gulf and Ōhiwa Harbour
- seagrass in Nelson estuaries
- saltmarsh in the Bay of Plenty.

## **Collaboration and a common goal are important**

All these small scales, community-led efforts remain critical to restoring marine ecosystems, but without much more significant investment for carrying out restoration at much larger ‘ecosystem’ scales, we’re unlikely to reverse the downward trend. Implementing restoration at scale requires the finance gap to be addressed.

As well as active restoration where species are actively replanted or reseeded in an area, restoration may also be achieved by actions such as marine protection (Watson et al 2021, Macpherson et al 2024). Currently, the only large scale coastal and marine restoration initiative in New Zealand is Revive Our Gulf. This collaborative initiative will provide valuable insights to the opportunity of restorative marine economies at larger scales.

In contrast, a large number of restoration projects on land are often unified towards a common goal (for example, Predator Free 2050, One Billion Trees, and Ngā Awa River Restoration Programme). The discrepancy between the scale of restorative actions on land vs on the coasts and in the sea may be due in part to the ‘ownership’ of an ecosystem domain. Rights and responsibilities in the coastal fringes and ocean is less clear, inconsistent, and often highly contested. And because it’s ‘out of sight out of mind’, it’s much harder to do under water than on land.

Restoration actions currently at a community/hapū level tend to focus on improving local environments rather than being integrated into initiatives that will generate livelihoods or draw on or generate economic activities. However, there are a few emerging examples of this in practice with a clear opportunity to fund sustainable livelihoods through restoration actions.

## **The relationship between the blue economy and restoration ecology is key to success**

Potential funding mechanisms include nature-based disclosures and associated accounting, credit systems, targeted levies and subsidies to better align costs environmental degradation and the benefits of recovery in terms of tourism, high value fisheries, aquaculture, or even green impact investment. However, the ecological basis for restoration and how new economies can be developed to support or maintain efforts lags a long way behind terrestrial and freshwater ecosystems. To date, the relationship between the blue economy and restoration ecology has not been clearly articulated. Looking at the two elements together is needed to generate success.

## **Successful small-scale restoration can be used as a springboard**

Research has shown that a key component of restoration success includes the involvement of players from diverse backgrounds (including central and regional government, iwi and hapū, researchers, business, philanthropic organisations, and community). Ideally, restoration activities would incorporate short-term wins to build support such as community and industry backing, financial commitment, and political will, even if the ultimate restoration goal will be achieved over longer time periods. By demonstrating that initial restoration targets have been met, successful smaller scale restoration action can then be used as a springboard for upscaling and potentially building a restorative economy (Cortés et al 2021).

For restoration actions to translate into ecosystem recovery at scale, restoration requires social, cultural and economic investment, and to be driven by ecological ‘knowledge or opportunity’. This scaling-up will require an adaptive management approach, whereby actions are modified based on new insights gained from ongoing science and through the reclamation and restoration of mātauranga Māori, for example in Ōhiwa Harbour (Sustainable Seas 2024).

We can draw on a range of research to inform adaptive management processes. Research on cumulative effects can inform restoration actions and indicate opportunities where restoration is likely to be successful, including expectations of timelines. Ecological and stressor principles developed by

Gladstone-Gallagher et al (2024a) can be used to assess the ecological and stressor state of a system, which can indicate the likely response to protective and restorative interventions to maintain or improve ecosystem health (figure 2).

Understanding ecological disturbance-recovery dynamics can enable possible recovery outcomes to be assessed and the likely time and space scales at which recovery may occur (Hewitt et al 2022). In addition, the consideration of the depth and spatial extent of ecosystem response footprints can inform the scale and benefit of the restoration action, and whether stressor management accompanied by restoration actions are needed to improve ecosystem health (Low et al 2023).

### A case study on collaborative restoration

Ōhiwa Harbour restoration action provides a case study for how Iwi-led restorative action, supported by researchers (Paul-Burke et al 2022), community, regional and central government can improve the health of the ecosystem via the restoration of important shellfish to the harbour.

Restoration actions included:

- using the mātauranga Māori held by iwi and hapū members to identify historical mussel bed locations, scale and capacity to inform target areas for restoration activity

- developing biodegradable natural spat lines drawing on the expertise of the mātauranga Māori held by weavers to grow and retain mussels in the harbour and provide juveniles to replenish mussels on the seafloor of the harbour
- monitoring to understand the distribution and abundance of mussels and starfish – a significant predator – within the harbour
- modelling, using a combination of iwi knowledge/ mātauranga Māori and science, to identify the best areas to restore shellfish
- trials to work out the best methods for starfish control in future
- the use of removed starfish in skincare collagen products.

This iwi-led restoration project was embedded within a wider multiagency management initiative with the objective of improving the health of Ōhiwa Harbour (Ōhiwa Harbour Implementation Forum), which ensured a clear pipeline from research to management implementation. This initiative demonstrates the value of collaborative cross-agency action and the collaboration of mātauranga Māori and science.

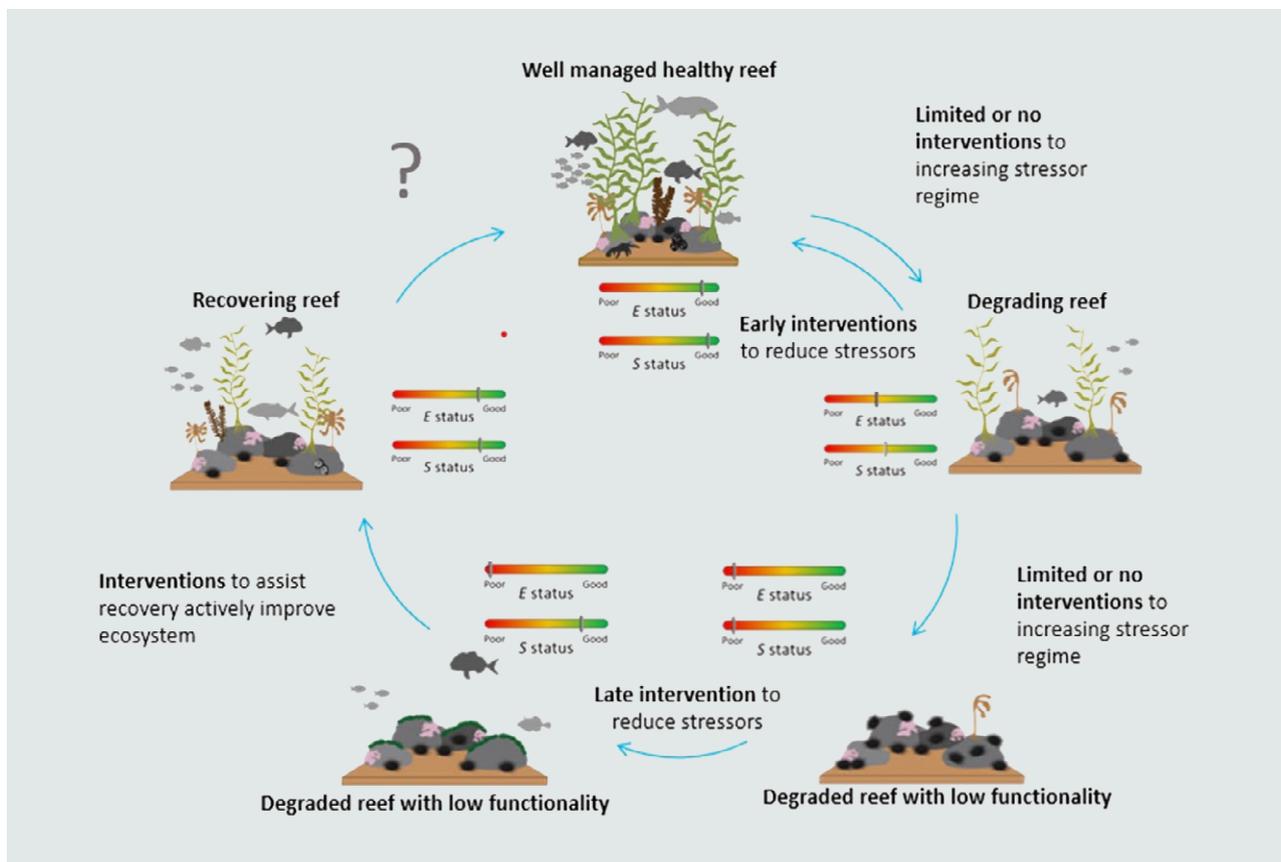


Figure 2 The management response to kina barrens is conditional on the ecological and stressor status of the reef (Gladstone-Gallagher et al 2024b)

## Better information on the benefits of ecosystem services and restoration can help mobilise blue economy investment

Ecosystem services provided by marine ecosystems are well recognised, for example kaimoana, habitats for marine life, nutrient cycling, climate regulation, and recreation opportunities (figure 3).

However, the value of many of these ecosystem services are typically poorly quantified or even considered in management decisions. Without quantifying, or at least communicating, the contributions of these services, the benefits (economic and non-economic) and cost of their loss due to ecosystem decline is often not considered in management actions, or by the public.

A lack of detailed narrative or quantification of the benefits of ecosystem restoration and recovery is also a major barrier to attracting and securing investment. This lack of information is compounded by limited knowledge of restoration costings or methodology options, which makes determining the best investments for restorative action challenging.

## Communicating the flow-on effects of small-scale restoration projects is key to increasing support for restoration activities

Ecosystems are networks of connecting and interacting components, so environmental stressors can have negative impacts on ecosystem components. This connectivity also means that positive impacts on an ecosystem through restoration can result in multiple points of positive impact to other connected components (Gladstone-Gallagher et al 2023).

Small scale restoration projects can improve ecosystem health and provide benefits at a larger scale, but these contributions are typically not accounted for. As benefits of restoration activities often accrue outside of the restoration activity footprint, these benefits are critical for supporting wider ecosystem recovery (figure 4). Improved attribution of wider ecosystem benefits for restoration actions is a key opportunity for increasing the financial and non-financial support for restoration activities.

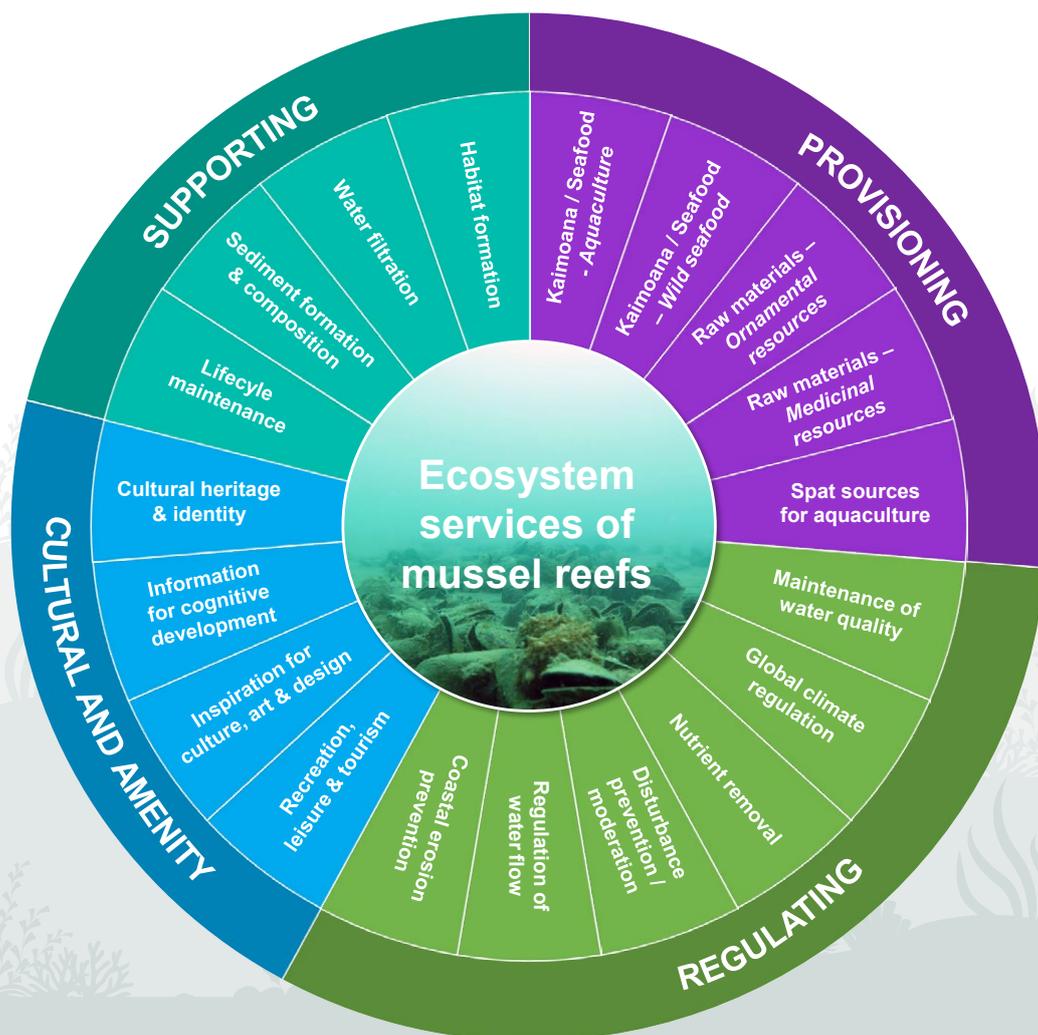


Figure 3 Example of the range of ecosystem services provided by seabed mussel restoration initiatives (from Douglas et al 2022)

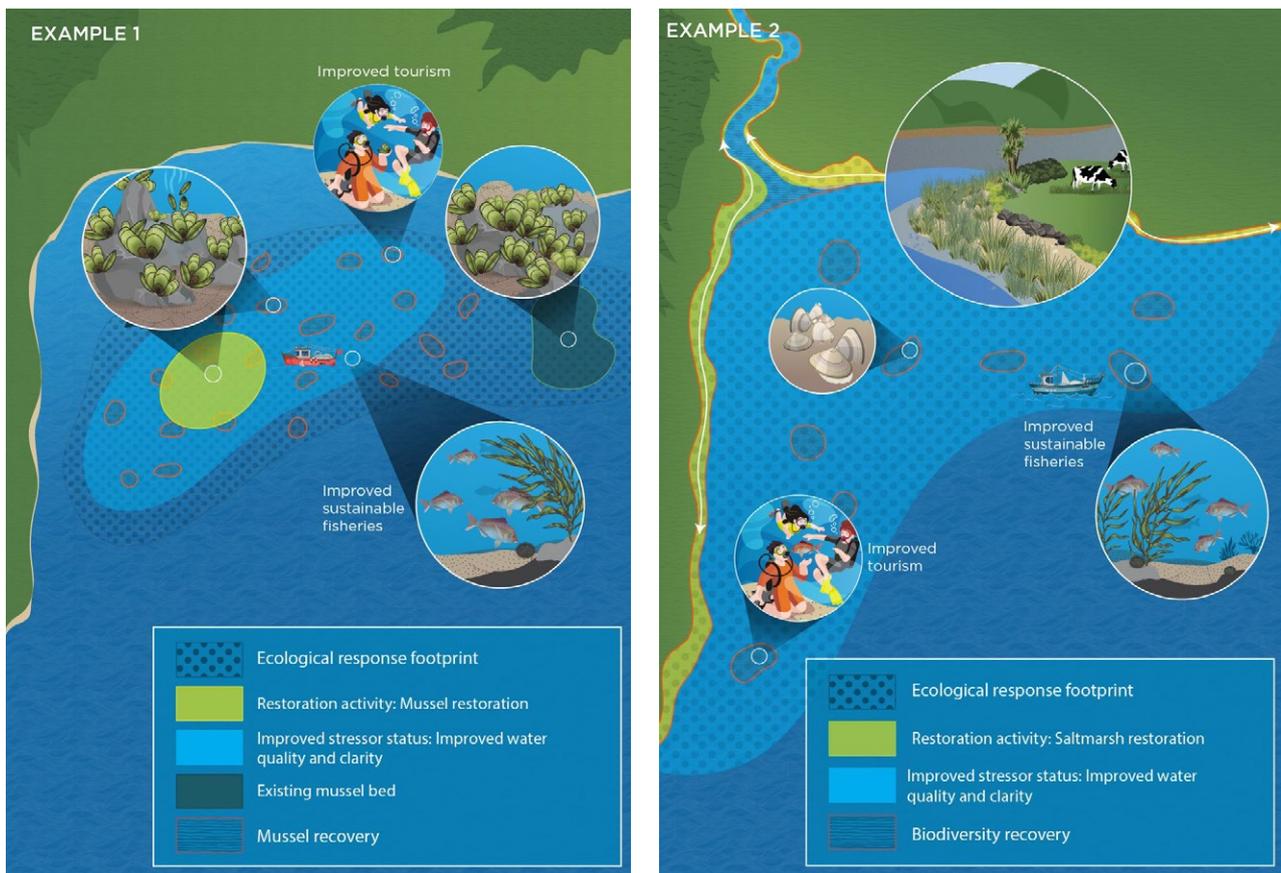


Figure 4 Identifying ecological responses to restoration activities is key to quantifying the value of restoration action. This image shows a mismatch between location of a restoration activity, the associated stressor reduction footprint and the ecological response footprint mean that benefits generated from restoration activities typically also occur outside of the location of the restoration activity

## Research on quantifying ecosystem services can help measure restoration success

Recent research has looked into quantifying the ecosystem services that coastal habitats provide (Sustainable Seas 2020) which can then be used as measures of ecosystem restoration success. This research includes the following.

- Investigating the spatial patterns of multiple ecosystem services associated with shellfish beds in Tauranga Harbour, for example, food provision and water-quality regulation (Rullens et al 2022)
- Using network modelling (Bayesian belief network) to better understand the relationship between the traits of species, the ecosystem processes they influence and the ecosystem services they contribute to (Siwicka and Thrush 2020).

- Using a matrix-based approach to investigate the ecosystem service potential of marine protected areas and the influence of seafloor habitat type, area and quality (Geange et al 2019).
- Developing a model to explore the implications of multiple interacting stressors on ecosystem functions and services. This information can provide an indication of who the key beneficiaries are and potential financial sources for restoration actions and help to communicate the value of non-economical services such as those that support and regulate ecosystem health (Bulmer et al 2022).



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