SUMMARY

A guidance framework for marine habitat restoration in Aotearoa New Zealand

CAWTHRON | Department of Conservation *Te Papa Atawhai*

Photo credit: Paul Caiger

Kina barren | Photo credit: Paul Caiger

Purpose and context

Marine and coastal ecosystems across Aotearoa New Zealand support biodiversity, cultural connections, recreation and economic activity. However, land-based pressures, overharvesting, fishing impacts and climate-related stressors are acting together on key habitats, driving decline in their extent, condition and function.

To restore the health of our coasts and oceans, marine active restoration must work alongside other actions such as marine protection, biosecurity, sustainable fisheries management and improved catchment practices.

This **Framework** provides a structured, high-level pathway for anyone involved in planning, delivering, supporting or evaluating marine restoration projects in Aotearoa New Zealand. It draws on the best available information and international standards to support consistent, evidence-informed and transparent decision-making. It represents a first iteration of advice to begin restoration activities.

How to use this Framework

This guidance document provides a framework for restoration decision-making. It is not designed to be read from start to finish. Instead, the reader is encouraged to engage with the sections most relevant to their project at any given stage.

The Framework aims to guide individuals, community groups, tangata whenua, agencies, and organisations to:

- Understand when, where and how active restoration may be appropriate.
- Plan, implement, monitor and report on active restoration projects alongside passive restoration and broader management actions, using best practice methods.
- Complement other species or habitat-specific restoration guidance documents.
- Build partnerships that support long-term recovery.

It is structured around three key sections:

1. **Getting started** – understanding your system and defining restoration objectives.
2. **Making it happen** – implementing restoration actions.
3. **Monitoring and reporting** – tracking progress, adapting to change, and sharing your learnings.

This Framework does not

- Provide a comprehensive list of restoration tools, methods or site-specific advice for different species and habitats.
- Provide a comprehensive list of pressures currently impacting the marine environment.
- Prescribe a mandated approach for community engagement or project monitoring and reporting.
- Supersede mātauranga Māori, local knowledge or existing statutory and policy obligations; rather it is intended to complement and support their application.

The need for active restoration

The Framework addresses the need for active habitat restoration as part of a mixed approach alongside other restoration and management actions, including reducing and managing pressures.

Active restoration provides deliberate, hands-on interventions to accelerate or kick-start natural recovery. When combined with passive measures (such as protection, reduction of overharvesting and land management) active restoration can reconnect ecosystems, rebuild biodiversity, and strengthen community relationships with the moana.

Marine and coastal restoration in Aotearoa New Zealand is guided by three interconnected ecological priorities:

Restoring habitat-forming species like kelp forests, shellfish beds and seagrass meadows can recover lost ecosystem functions, support rare and indigenous species, and improve connectivity for diadromous species moving between freshwater and marine environments.

This Framework advocates that all marine restoration projects:

- Work in conjunction with all management actions across the region.
- Adopt a ki uta ki tai (mountains-to-sea) approach.
- Engage with tangata whenua at the beginning and throughout the project (if they are not leading the project).
- Obtain the necessary permits and consents.


Sponge garden in kelp forest | Photo credit: Paul Caiger

State of the environment

Historical and ongoing pressures have resulted in widespread habitat degradation, loss of ecosystem function, and reduced resilience across many parts of Aotearoa New Zealand. This has largely been driven by:

- **Land-based impacts:** caused by large increases in sediment run-off and contaminant influx due to:
  - forest clearance
  - urban development
  - agriculture
- **Habitat loss:** affecting all key marine habitats, including:
  - Repo / Saltmarsh
  - Karepō / Seagrass meadows
  - Kūtai / Green-lipped mussel reefs
  - Rimurimu / Kelp forests
  - Soft-sediment and live ground systems

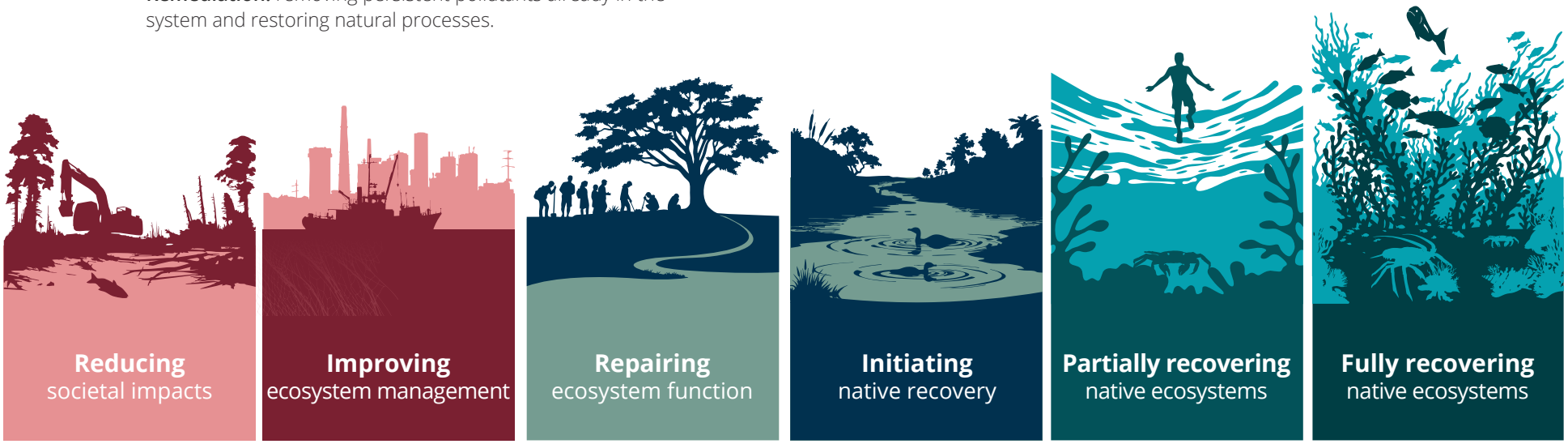
The loss of these critical habitats has had an outsized impact on the wider environment, directly reducing ecological, economic, social and cultural benefits. These habitats underpin ecosystem function by improving water quality, providing nursery grounds for important fishery species, and supporting kaimoana.

Key concepts

The restorative continuum

Ecological restoration occurs along a continuum of restorative actions (aka the **restorative continuum**) that help ecosystems recover. This includes:

- **Reduced impacts:** the removal or mitigation of pressures such as overfishing, elevated sediment and nutrient loads, or controlling marine pests.
- **Remediation:** removing persistent pollutants already in the system and restoring natural processes.
- **Rehabilitation:** the process of recovering an ecosystem's function, even if it can't be restored to its original state.
- **Ecological restoration:** the process of actively supporting the recovery of native ecosystem towards its original state.



The restorative continuum
Improving biodiversity, ecological integrity and ecosystem services.
Figure based on the Society for Ecological Restoration Standards Tools.
Image credit: Shaun Lee

Koura eating kina | Photo credit: Shaun Lee

Approaches to habitat restoration

Restoration approaches may be passive, active or a combination of both. These approaches may be applied sequentially or in parallel depending on the extent of degradation, ecosystem context and restoration objectives. Each approach is delivered through specific tools (e.g. shellfish translocations), and applied using methods tailored to the site context (e.g. transporting mussels by barge).

Passive restoration focuses on removing pressures so that nature can recover in its own time. This can be achieved through regulatory measures such as marine protection and fisheries closures.

Active restoration involves deliberate interventions to re-establish key functions, species and/or habitats. There are three types of interventions:

Reintroduction of a special function

e.g. removing urchins to reintroduce the function of overfished predators

Species reintroduction

e.g. reintroducing shellfish to recover lost populations

Substrate enhancement

e.g. deploying shell material or rock cobbles to the seafloor to recover or mimic lost substrate.

Combining approaches

Passive and active restoration can be combined in different ways depending on site conditions, target species and habitats and project objectives:

Passive SUPPORTING active: protecting remnant habitats or broodstock populations could improve the success of nearby active restoration efforts.

EXAMPLE

Protect remnant mussel reef as a broodstock source → Wild spat supply to the nearby active restoration site

Passive SUPPORTED BY active: when recovery stalls in a protected area - due to ongoing or new pressures, or disturbance events - active restoration can help put the system back on a recovery trajectory.

EXAMPLE

Giant kelp decline in a protected area due to marine heatwaves → Giant Kelp transplant in the affected area to support recovery

Active PROTECTED BY passive: can safeguard an active restoration site during and after restoration activities.

EXAMPLE

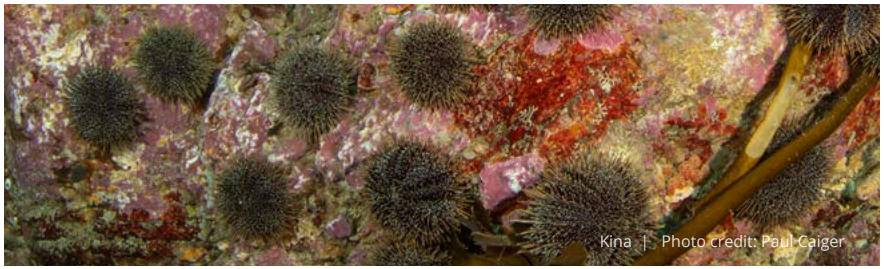
Actively restored shellfish bed → Establish a passive tool over all or part of the restored shellfish bed to support long-term recovery

Horse mussel bed | Photo credit: Shaun Lee

Active FACILITATING passive: active interventions undertaken first can accelerate habitat recovery once the passive restoration tool is implemented.

EXAMPLE

Targeted removal of kina from barrens → Establishing an MPA could accelerate kelp ecosystem recovery and reestablish a balanced kina population



Kina | Photo credit: Paul Caiger

Restoration projects share a core objective: to bring back the vital ecosystem functions and services that have been lost.

Ecosystem functions are the natural processes that keep ecosystems working, such as habitat provisioning, nutrient cycling and water filtration.

Ecosystem services are the benefits people gain from those processes.

Ecosystem services can be grouped into four main categories:

Supporting services such as sediment stabilisation.

Regulating services including water filtration and coastal protection.

Provisioning services like food, materials, and medicines.

Cultural services such as spiritual connection, recreation, and education.

Restoring habitat-forming species like saltmarsh, seagrass, mussels or kelp delivers both functions and services. Because these species provide multiple functions and services simultaneously, they are often prioritised in restoration efforts.

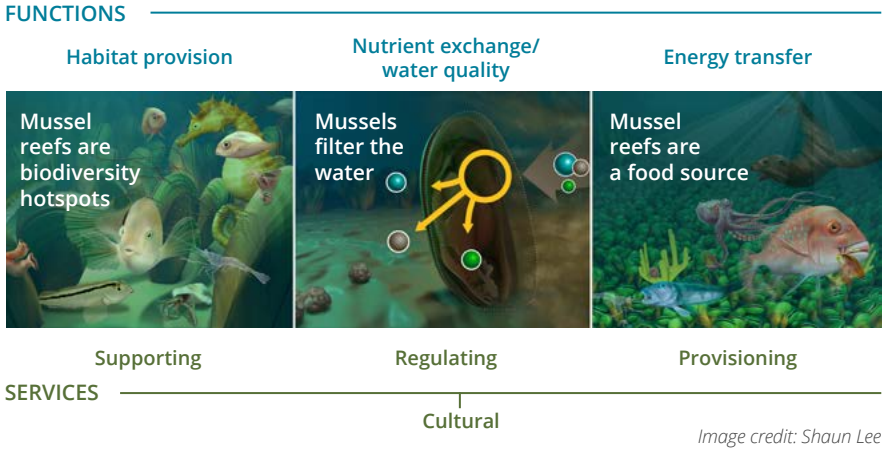
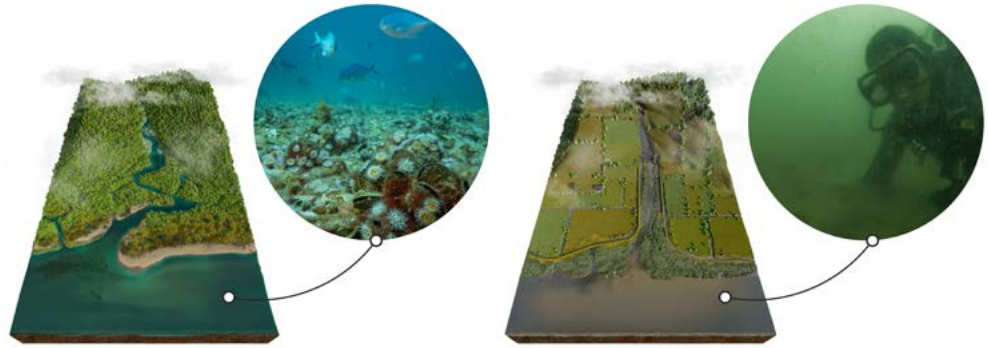


Image credit: Shaun Lee

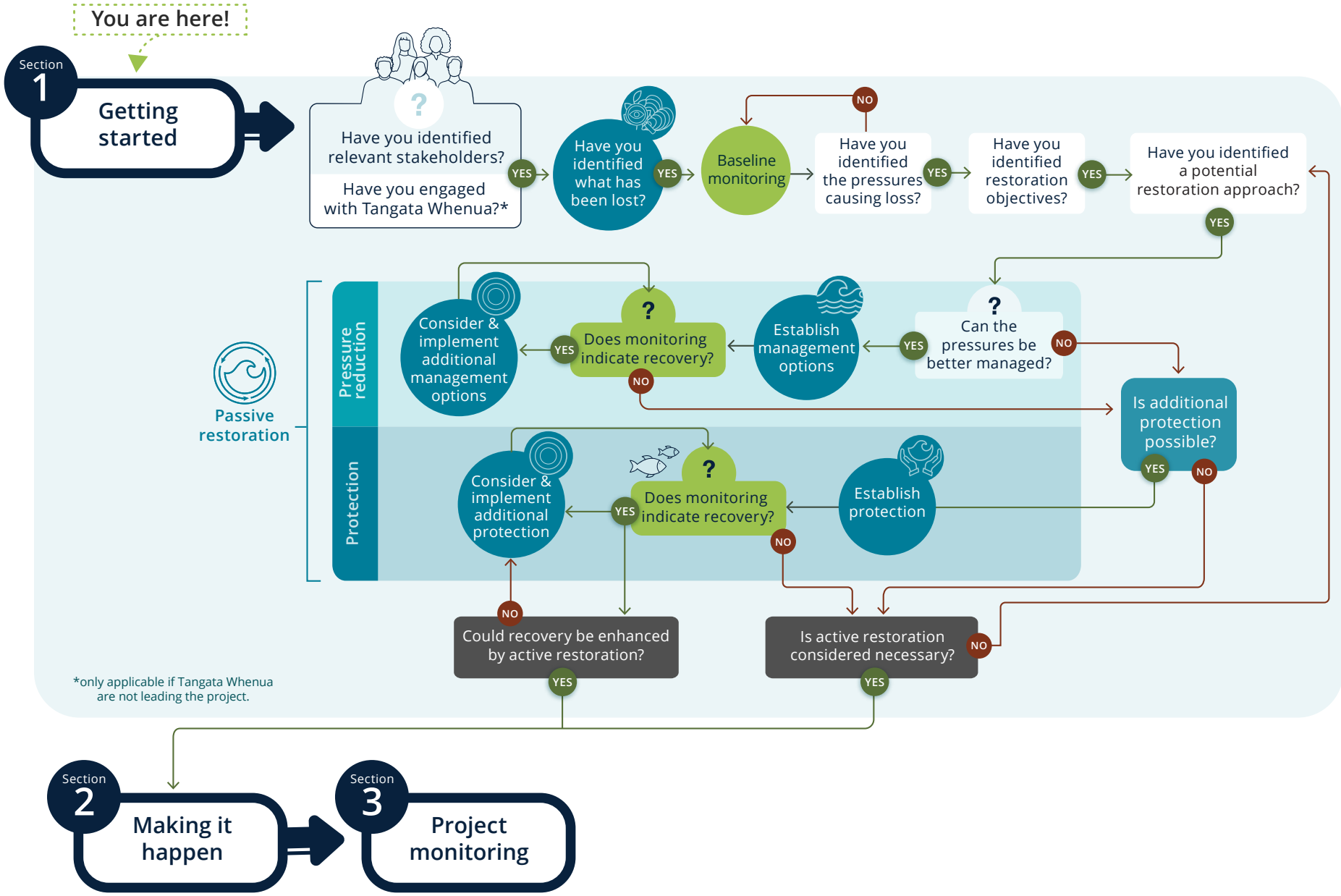


Sediment run-off from land affects marine life in the water column and on the seafloor | Image credit: Shaun Lee

Ki uta ki tai

Ecological restoration in the marine environment is directly impacted by processes that span **ki uta ki tai**, which often translates as "from mountains to the sea". This concept is deeply rooted in Māori culture and emphasises the continuous connections between the mountains, rivers, land and sea. In the context of restoration, ki uta ki tai highlights the influence of catchment-derived pressures on marine habitats and reinforces the importance of addressing wider system drivers when selecting and sequencing restoration approaches.

Scallop on soft sediment | Photo credit: Shaun Lee


You are here!
Section 1
Getting started
Have you identified relevant stakeholders?
Have you engaged with Tangata Whenua?*
YES
Have you identified what has been lost?
YES
Baseline monitoring
NO
Have you identified the pressures causing loss?
YES
Have you identified restoration objectives?
YES
Have you identified a potential restoration approach?
YES
Passive restoration
Pressure reduction
Can the pressures be better managed?
YES
NO
Establish management options
Does monitoring indicate recovery?
YES
NO
Consider & implement additional management options
Protection
Is additional protection possible?
YES
NO
Establish protection
Does monitoring indicate recovery?
YES
NO
Consider & implement additional protection
NO
Could recovery be enhanced by active restoration?
YES
Is active restoration considered necessary?
NO
YES
*only applicable if Tangata Whenua are not leading the project.
Section 2
Making it happen
Section 3
Project monitoring

Section 1: Getting started

Getting started with active restoration, while exciting, can be daunting. Four key components form the foundation of a successful restoration project:

Engage early and inclusively

- Develop a **Communication Plan**.
- Engage with tangata whenua at the beginning of and throughout the project (if they are not leading the project).
- Collaborate with local communities, councils, central government agencies, and research partners.

Understand your system

Before any restoration project begins, it is essential that you identify:

- What has been lost? Is it a species, habitat, or ecological function?
- What historic and/or current pressures caused the loss?
- Can pressures be better managed?

Subtidal seagrass meadow | Photo credit: Shaun Lee

Kelp forest | Photo credit: Lorna Doogan

Define your objectives

Once you have identified what's been lost and the relevant pressures, it's time to start developing objectives for your restoration project.

At a minimum, your objectives should include:

- The use of the restorative continuum to identify a desired outcome like initiating processes of natural recovery.
- Identification of a suitable reference ecosystem (aka non-degraded example of the ecosystem you are restoring) that provides a natural benchmark to evaluate restoration progress.
- Indicators you will monitor to measure progress, like percent cover of kelp forest or seagrass.
- Desired magnitude of effect, such as the percent increase in cover.
- Time frame to reach your objectives (e.g., 5 years).

Choose the right approach

Before selecting an active restoration approach, assess whether passive restoration can achieve your objectives on its own by reducing or removing the pressures preventing natural recovery within a ki uta ki tai lens. This can include:

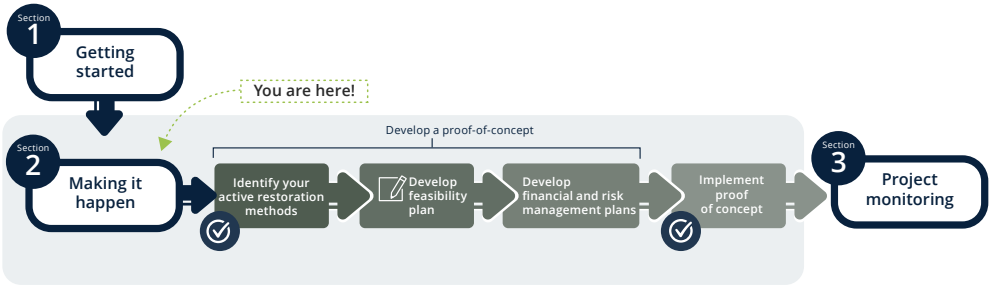
fisheries management.

improved catchment management.

establishing marine protection where feasible.

Active restoration should be considered where passive measures alone are not enough to support recovery, or where recovery could be meaningfully enhanced.

Nearshore rocky reef | Photo credit: Lorna Doogan



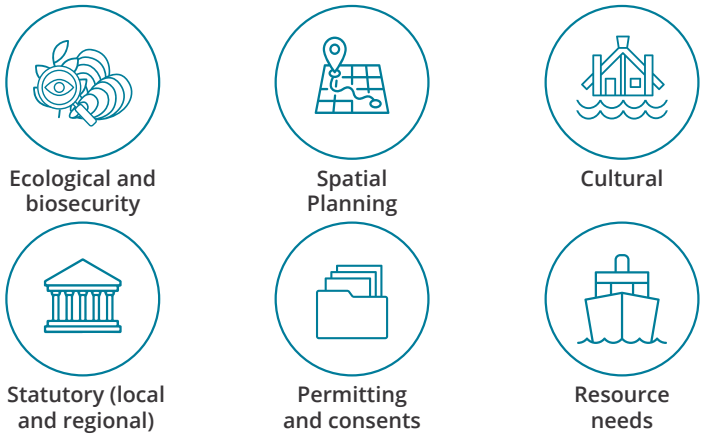
Section 2: Making it happen

Develop a proof-of-concept

Restoration is inherently place-based. Test your approach and associated tools and methods through proof-of concept projects projects to fill knowledge gaps and refine methods before scaling up.

Important considerations

Before progressing your proof-of-concept you must also identify and integrate relevant information from the wider local and regional context.



Not all considerations will be equally relevant to your project. They should be applied in a way that reflects project context, objectives, and constraints, and revisited as the project progresses through each phase.

Kina barren

Recovering kelp forest | Photo credits: Paul Caiger

Each proof-of-concept should include:

Your selected **active restoration tools** (e.g. species reintroduction - stimulating natural recruitment) and the specific method(s) the project will implement (e.g. natural fibre lines woven from harakeke to attract and recruit mussel spats).

A **feasibility plan** that assesses your approach's practicality, risks and monitoring plan. The plan must answer the core questions of what will be done, why, where and how the project will be managed.

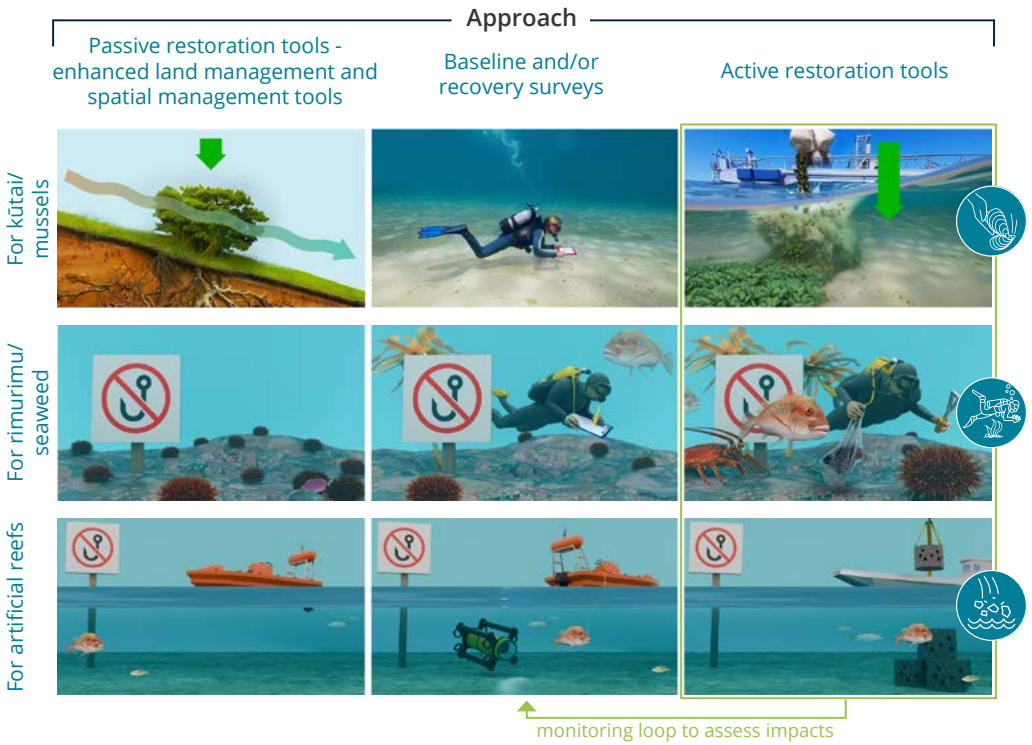
A **risk management plan** that identifies potential ecological, logistical, regulatory and social risks and defines ways to manage them.

A **financial plan** that outlines costs and resource requirements from planning and implementation through long-term monitoring and communication. Identifying funding pathways early will help you navigate the hurdles, communicate effectively and secure the funding to make it all happen!

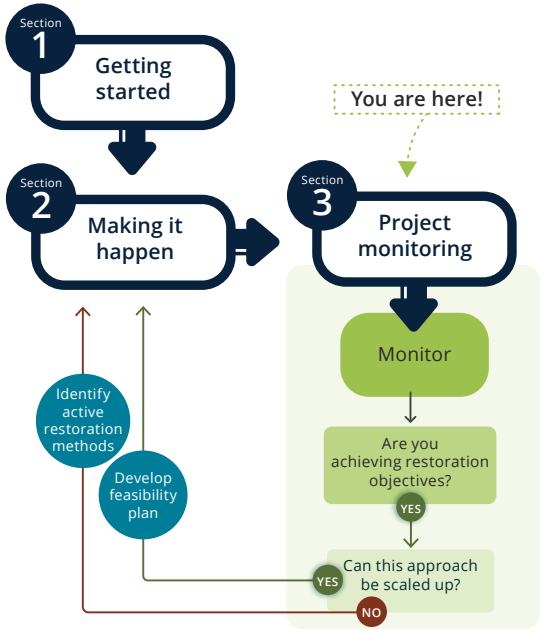

Snorkeler in kelp forest | Photo credit: Lorna Doogan

All projects should be designed around a Before-After-Control-Impact structure to enable robust evaluation of restoration outcomes:

1. **Baseline site surveys ('Before'):** Conducted before restoration activities start. At this stage you should also survey your control sites and (if applicable) reference ecosystem site.
2. **Restoration action:** Implement the selected restoration approach, tools and methods.
3. **Control and post-restoration site surveys ('After' and 'Control'):** Monitor selected indicators to measure immediate changes at restoration and control sites (where no restoration has occurred).
4. **Regular follow-up surveys ('Impact'):** Regular monitoring at intervals defined in your monitoring plan to assess restoration impacts over time.



Section 3: Project monitoring



Monitoring and reporting project performance

Monitoring is a vital part of any restoration project. It involves tracking key indicators that reflect changes in the ecological, social, cultural and economic components of a project. Because effectiveness can vary by site, species, and habitat type, each project must develop clear and measurable indicators during the planning phase that link directly to its objectives.

Monitoring and reporting requirements should be tailored to the specific context, with indicators and targets (to help track progress) chosen to reflect the species or habitat being restored. Establishing clear protocols ensures that data are consistent, transparent, and useful for comparing restoration and control sites to selected reference sites and for evaluating progress over time.

Examples of social, cultural and ecological indicators

Element	Indicator	Description	Example
Ecological	Density/ Abundance	Number of individuals per unit area	Kelp or shellfish per 1 square meter
Social	Community engagement	Measures the level of local participation and buy-in	Number of volunteers / volunteer hours, attendance at project meetings or presentations
Cultural	Mauri	Measures the spiritual health and well-being of the restored environment	Measurable indicators for these elements are likely to vary project-to-project.

Purpose of monitoring

- Regular assessment provides a clear understanding of whether the project is on track to meet the set objectives.
- Ensures restoration activities are implemented in ways that minimise and account for adverse effects.
- Verifies that consent conditions and environmental obligations are being met.
- Provides information that supports adaptive management of tools, helping refine methods for better outcomes.

Combining ecological, cultural, social and economic monitoring offers a more complete view of restoration success, revealing how ecosystems recover and the strengthening of connections between people, place and culture.

Monitoring mussel reef | Photo credit: Arie Spyksma

Waharoa | Photo credit: Shaun Lee

Ecological monitoring

Evaluating the effectiveness and success of ecological restoration activities can vary substantially between different species and habitat types. Common environmental parameters include:

- Presence or abundance of unwanted or invasive organisms.
- Sediment and water quality.
- Habitat condition and the health of associated species communities.

Cultural monitoring

Cultural monitoring recognises that the health of ecosystems is inseparable from the well-being of people and the expression of kaitiakitanga (guardianship).

Cultural monitoring should be developed by tangata whenua or in partnership with them. Indicators may include measures of cultural connection, the return of taonga species, or the restoration of mauri and waiora.

Keep in mind:

- Cultural indicators should be identified early and carried through the project life-cycle
- Kōrero (conversations) should occur throughout the project to share learnings and align outcomes with tangata whenua priorities.

Social and economic monitoring

Social and economic monitoring examines how restoration projects influence people and communities. It tracks changes in participation, public awareness, well-being, connections to restored environments and related economic benefits

Areas to consider include:

- Community engagement and participation: Who is involved, and how has engagement evolved over time?
- Perceptions and values: How do people feel about the project and its contribution to the health of the marine environment?
- Economic benefits: Are there measurable gains, such as local employment, eco-tourism and new businesses, or sustainable resource use?

Scaling up

Scaling up small, successful proof-of-concept projects to broader-scale restoration presents unique challenges; in part because the definition of project scale is context specific, influenced by the ecosystem, regional planning considerations and target species.

Scaling up should be treated as a new decision point rather than a continuation of the proof-of concept phase.

Key considerations

- **Complexity and management:** larger projects entail more complex logistics, higher costs, legal considerations and project management.
- **Context and integration:** scaling requires a more rigorous assessment for how the project will interact with other activities and management actions in the area.
- **Knowledge gaps:** where monitoring indicates mixed or uncertain outcomes, projects should prioritise refinement of methods or extended monitoring before scaling up.

However, the process for any project – large or small – is mostly the same. A successful proof-of-concept can therefore provide valuable insights into the nuances of scaling up efforts.

Adult green-lipped mussel reintroduction | Photo credit: Shaun Lee

Final points

Restoring the health and resilience of Aotearoa New Zealand's marine and coastal habitats requires a coordinated, long-term effort grounded in sound planning, effective pressure management and adaptive restoration practice.

This **Framework** supports consistent transparent and evidence-informed decision-making across restoration initiatives. Successful outcomes can be achieved by guiding practitioners through the critical steps of:

Holistic planning: Emphasising ki uta ki tai approaches that integrate land-based and marine pressure management; and setting clear, measurable restoration objectives.

Inclusive management: Recommending early, robust engagement and kōrero with tangata whenua so that mātauranga Māori is considered alongside conventional ecological science to ensure mutual benefits to both nature and culture.

Adaptive implementation: Leveraging proof-of-concept trials and adaptive management to reduce uncertainty and learn the nuances of scaling up efforts.

Comprehensive monitoring: Tracking progress using ecological indicators alongside cultural, social and economic monitoring.

This Framework provides the structure to maximise the efficacy of cumulative restoration actions. It will continue to evolve as new knowledge, monitoring results and practice-based insights emerge. Ultimately, this work will contribute to our shared goal to support the recovery of ecosystem health, and our marine and coastal taonga.

Mauri ora!

CAWTHRON | Department of Conservation *Te Papa Atawhai*