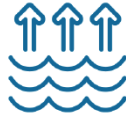# Policy Brief

Key research priorities for the future of marine science in New Zealand

Fisheries & aquaculture

Biosecurity

Climate change

Marine reserves & protected areas

Ecosystems & biodiversity

Policy & decision-making

Marine guardianship (kaitiakitanga)

Coastal & ocean processes

Other anthropogenic factors

Key takeaway

The New Zealand (NZ) marine science community collectively identified priority research questions for the future of marine science in NZ. Answering these questions will bridge existing knowledge gaps that can make the greatest contributions to marine science, conservation, sustainable use, policy, and management.

Stakeholders

Researchers, policy-makers, managers, practitioners, funding bodies, donor organisations, industry, tangata whenua, communities, NZ citizens.

Application

The questions identified can be used to drive the development of new and important research areas, complement ongoing science initiatives, encourage collaboration, and guide the formation of inter- and trans-disciplinary teams dedicated to working towards these priorities.

Implications

Targeted research to answer these questions can:

- Bridge existing knowledge gaps
- Inform and align marine science, conservation, policy, and management in NZ
- Deliver greater environmental, social, economic and cultural benefits for the future of NZ seas and society
- Contribute towards the international targets of the Convention of Biological Diversity (CBD), Sustainable Development Goals (SDGs), and the United Nations Decade of Ocean Science (2021-2030)

Recommendations

1. Prioritise research activities and collaboration working towards answering the priority questions
2. Develop policies and funding opportunities that support work towards answering the priority questions

Fisheries & aquaculture

1. What new tools and technologies can be developed as alternatives to bottom-trawling that would allow this practice to be phased out?
2. How can fisheries management be improved to reduce impacts on marine environments and species?
3. How can we design an integrated management system that includes networks of marine protected areas (MPAs) to enable commercial, customary, and recreational fisheries to be sustainable?
4. What is the impact of fishing on coastal marine biodiversity and ecosystems?
5. How are commercial interests in fisheries influencing the ability to put in measures that adequately conserve and manage our marine environments and resources?
6. How does trawling and dredging affect productivity on continental shelves, and benthic habitats of significance?
7. What are the factors preventing wild shellfish stocks from recovering to historic levels?
8. What can be done to optimise fishing catch while minimising bycatch and incidental mortality?
9. How do terrestrial coastal processes, and human activities on land and the coast, impact shellfish populations and shellfish bed recovery?
10. How will multiple stressors impact and interact to affect the food security of marine resources in the future?

Biosecurity

1. How can we better mitigate the impact of invasive species?
2. What new molecular techniques can be developed to improve the early detection of invasive species?
3. How can we identify and monitor the impact of marine pests on native biodiversity?
4. How do marine introduced species and climate-change-induced range shift alter ecological structure?
5. How can biodiversity be increased to ensure marine communities are resilient to the impacts of pests?
6. What are the impacts of current and future marine biosecurity risks?
7. How can we use genomic-scale DNA taxonomy to identify where alien species came from and when they arrived in NZ?
8. Which newly invasive toxin-producing microalgae might establish in NZ waters due to future expansion of the subtropical latitudes?
9. What is the reproductive potential of biofouling species on commercial and recreational ships arriving into the NZ Exclusive Economic Zone (EEZ)?
10. How do invasive marine invertebrates get distributed over long distances?

Climate change

1. How will primary production that supports coastal and ocean food webs respond to future change?
2. How will the increasing frequency of marine heatwaves affect marine ecosystems and the distribution and abundance of marine biodiversity?
3. What impacts will climate change and ocean acidification have on marine resources and how can this best be managed to ensure sustainability?
4. How resilient are marine species to changes in water temperature, and what impact will this have on local biodiversity?
5. How can we improve and prioritise our coastal restoration efforts to ensure we can adapt to climate change?
6. How will climate change affect the spatial patterns and extent of marine species, food webs, and their interactions within and across ecosystems?
7. How does the changing climate, and its impacts on our waters and the Southern Ocean, affect the oceanography around NZ?
8. How will the different factors of global change (temperature increase, ocean acidification, eutrophication, plastic pollution, etc.) act synergistically upon coastal and ocean ecosystem functioning?
9. How will ocean ecosystem services be affected by, and respond to, climate change?
10. How will global change affect biophysical interactions and ocean processes?

Marine reserves & protected areas

1. What are the spatial requirements for an effective, national marine reserve network?
2. Where and how should we implement more marine protected areas (MPAs)?
3. What additional areas could be designated as marine protected areas (MPAs) or reserves in order to protect ecosystems that are not currently represented?
4. How effective are mixed-model marine protected areas (MPAs) (e.g., taiāpure, mātaitai, some rāhui) at protecting and restoring marine system function?
5. What are the environmental, social, cultural, and economic values of marine reserves?
6. What is the protection value of different marine protected area (MPA) tools (e.g. no-take, partially protected, etc) for different species and habitats?
7. How can we integrate NZ's marine protected areas (MPAs) into a wider Pacific network that maximises biodiversity conservation while allowing for multiple use?
8. Should an expanding marine reserve network focus on many small or few large reserves to deliver the most benefits while ensuring representation, adequacy, and effectiveness?
9. What are the benefits and impacts of marine reserves and marine protected areas (MPAs) that are currently designated?
10. Can a traditional 'no take' rāhui that is well-enforced locally provide benefits that are equivalent to a nationally designated marine reserve?

Ecosystems & biodiversity

1. How can degraded benthic habitats be restored to resume critical ecosystem functions?
2. What is NZ's current baseline of biodiversity and species abundance across its different marine habitats?
3. What are the most cost-effective techniques for restoration of degraded coastal ecosystems?
4. What are the factors hindering the recovery of depleted marine species, and what are the factors required to counteract depletion?
5. How can we identify and assess the biggest threats to marine habitats to inform their management?
6. How will multi-stressor impacts affect coastal species?
7. How can we quantify change and risk to ecosystem function and integrity associated with multiple stressors and cumulative impacts?
8. How can we best predict tipping points in marine ecosystems?
9. How do coastal, benthic, and pelagic ecosystems respond to natural and human-induced perturbations?
10. What are the key indicator species that demonstrate healthy or unbalanced marine ecosystems?

Policy & decision-making

1. How can cumulative effects and multiple stressors in coastal marine environments be better accounted for to ensure robust decision making for regional councils?
2. What is the best approach to manage the cumulative effects of multiple activities occurring in the marine environment?
3. How can we improve the processes between science, decision-making, and action to improve our conservation and management outcomes?
4. How do we encourage more sustainable practices in the utilisation of marine resources?
5. How can uncertainty and risk be better incorporated into effective ocean governance and policy-making?
6. How can we better navigate the distribution of power in decision-making across multiple and diverse stakeholders?
7. How might a voice for the ocean be empowered, and an integrated ocean policy be advanced?
8. What policy, legal, or institutional arrangements are required to effectively integrate the management of terrestrial watersheds and adjacent coastal environments?
9. How does NZ form a coherent marine research policy when are there so many different disparate pieces of legislation that cover the oceans?
10. What are the most effective methods, approaches, and outcomes for developing marine spatial planning in a NZ context?

Marine guardianship (kaitiakitanga)

1. How could we improve public awareness of, and compliance with, sustainable use of our marine resources?
2. How knowledgeable are the general public about their personal impact on the marine environment, and what level of knowledge makes people want to protect it?
3. How can we give the wider community a better awareness and understanding of what's happening beneath the surface of our waters, to inform better behaviour, management, and decision making?
4. How can citizen science be utilised to maximise observations of changes in the marine environment?
5. Can local and/or community monitoring detect changes in the environment to inform local marine management and behaviour change?
6. How can outreach and engagement efforts be developed to better connect New Zealanders with their marine heritage?
7. What are the impacts of poor environmental condition on mātauranga Māori and iwi place-based interaction?
8. How best to achieve a partnership of inquiry between Western science and mātauranga Māori?
9. How can we better understand and account for the social perceptions of marine environments and resources to improve conservation and management?
10. What is the spatial distribution of marine social, ecological, economic, and cultural values?

Coastal & ocean processes

1. How do long-term changes in ocean water masses around NZ impact the marine ecosystem?
2. What are the impacts of suspended sediment on primary production and carbon pathways in coastal waters?
3. What is the impact of sedimentation on nearshore ecosystems and species?
4. How could coastal inundation forecasting help us manage low-lying and vulnerable coastal areas?
5. How do current impacts of terrigenous fine sediment on key coastal processes and ecosystem services vary nationally, and how are these likely to change in the future?
6. What else do we need to know to accurately forecast biophysical transport and transformation in shelf seas at the space and timescales sufficient to aid conservation and management?
7. How is the increase of sedimentation affecting the behaviour and survival of benthic and non-benthic organisms in offshore sites?
8. What is the baseline for biophysical transport and transformation in NZ's shelf seas, and how will these processes change in the coming century with changing climate and land-use practice?
9. What are the greatest barriers to accurate quantification of physical and biogeochemical processes, and how do we overcome them?
10. What approaches can be used to better determine the loading of nutrients and sediments into estuaries?

Other anthropogenic factors

1. How can we better mitigate the impacts of land-use on the coastal ocean?
2. What are the impacts of runoff from terrestrial farms on marine environments?
3. What are the combined effects of very low levels of multiple contaminants (e.g., pesticides, natural resource extraction contaminants, salinity, pharmaceuticals and personal care products, endocrine disrupting chemicals) with different modes of action on aquatic organisms and ecosystems?
4. What are the impacts of land-use change and future development on coastal ecosystems and the marine environment?
5. What are the relative effects of different land-use types and activities on coastal water quality and biodiversity?
6. How can we best monitor river plumes and their pollution burden on coastal waters?
7. What are the ecological and social impacts of deep sea mining?
8. How do we develop appropriate regulatory guidelines and standards specifically for contaminants of emerging concern that account for multiple modes of toxicity and multi-generational sub-lethal effects?
9. How do the interrelated and interacting effects of human activity on land and resource use in the sea affect marine ecosystems?
10. What are the fates and impacts of microplastics, nanomaterials, and other marine debris?