

National
SCIENCE
Challenges

**SUSTAINABLE
SEAS**

.....
Ko ngā moana
whakauka

Research Book 2022

Research themes and projects that are
active during 2019-2024

April 2022

**Tangaroa, Tangaroa, whakamau, whakamau tai
Tangaroa ū mai, kaweā mai
Kaweā mai rā ki waho
Kaweā mai rā ki te moana pipiri, ki te moana hōhunu
Hōhunu ana te wai
Hei aha rā, ki uta!**

Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment (2017). Dr Anne-Marie Jackson (Ngāti Whātua), Ms Ngahuia Mita (Te Aitanga-ā-Māhaki), Dr Hauiti Hakopa (Ngāti Tūwharetoa). Report for the Sustainable Seas National Science Challenge.



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**SUSTAINABLE
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Moemoeā Our vision

Aotearoa New Zealand has healthy marine ecosystems providing value for every New Zealander

Nau mai, haere mai Welcome

**Kia whakapapa pounamu te moana kia teretere te kārohirohi e
May the days ignite – as sunlight on greenstone waters
(the shining seas hold the promise of bright futures)**

To support our vision, our interdisciplinary research is focused on developing an ecosystem-based management (EBM) approach uniquely tailored to our specific context here in Aotearoa. Working with Government, iwi, hapū and Māori organisations, industry and communities is critical to co-develop the knowledge and tools needed to achieve this.

The aim is an EBM approach that is holistic and inclusive. One that enables us to better manage, restore, reclaim and even reimagine, our relationship with our coasts and oceans, including multiple uses and demand on marine resources. It must support Te Tiriti o Waitangi/Treaty of Waitangi partnership and the development of a blue economy that is based on marine activities that create economic value and contribute positively to social, cultural and ecological well-being.

This book describes our 2019–2024 (Phase II) research projects. We are grateful to be working alongside our Māori partners and stakeholders to ensure what comes out of the research will be useful, fit-for-purpose, and have a meaningful impact beyond the life of the Challenge.

To find the tools and resources generated by research, including our completed 2014–2019 (Phase I) projects, please visit our website.

Thank you to everyone who has taken the time to partner and engage with us, your contribution is critical. We look forward to continuing to work with you and others to improve the health of the moana, support sustainable livelihoods, nurture a more productive and reciprocal relationship with our coasts and oceans, and safeguard New Zealanders' social and cultural values, for future generations.



DR JULIE HALL
DIRECTOR



LINDA FAULKNER
MANAHAUTŪ

Te Au o Te Moana

**Like each of us, our oceans have a distinct voice –
Te Au o Te Moana – and to hear that voice is to
understand the state of its wellbeing.**

To enable us to hear Te Au o Te Moana, our research brings together the knowledge and philosophy of two world views – western science and mātauranga Māori. As Sustainable Seas Kāhui Māori kaumātua Joe Harawira says, understanding the voice of the ocean enables us to “be more connected with the heartbeat of Tangaroa and Hinemoana”, to turn the tide on the challenges our oceans face.

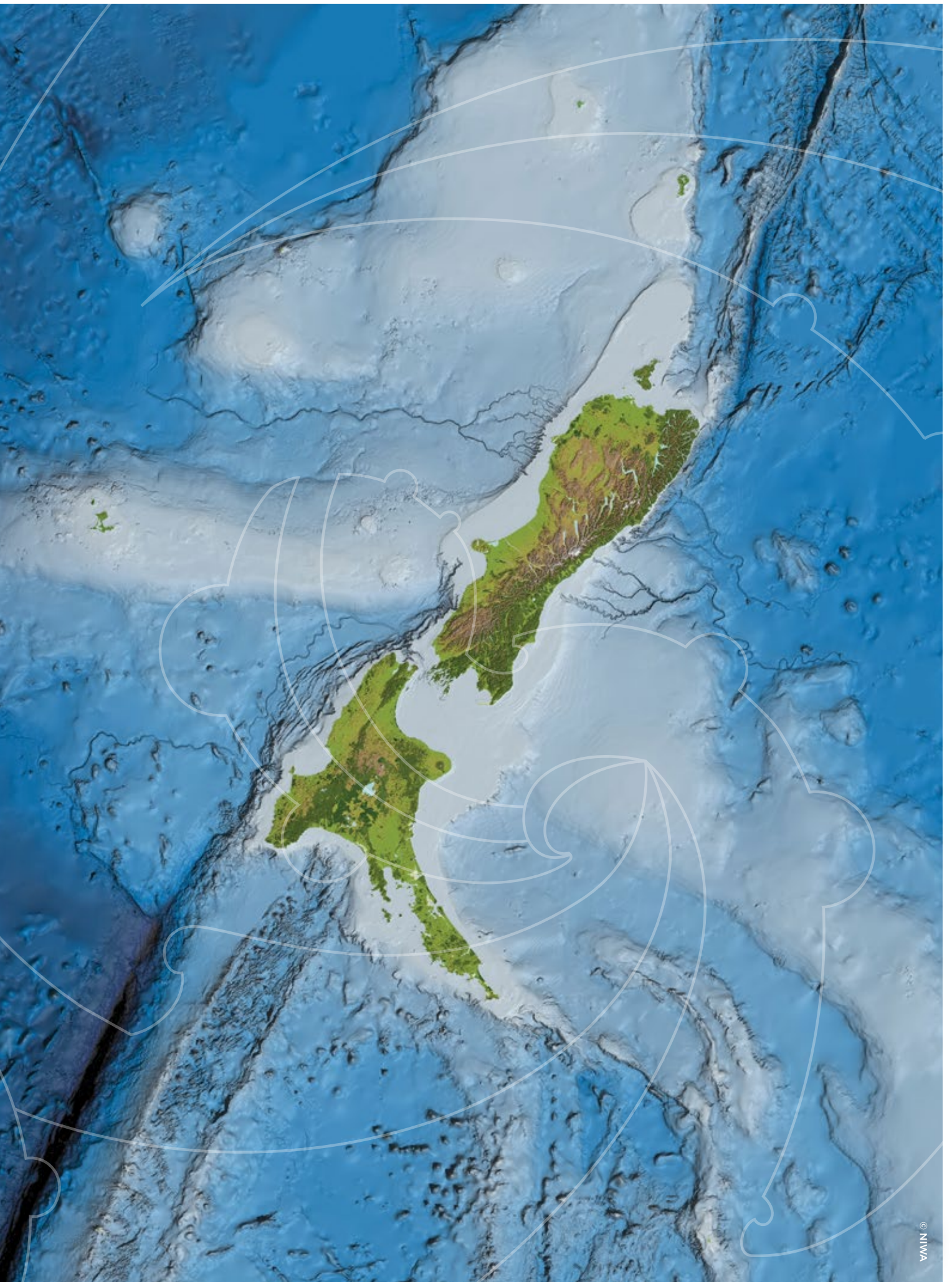
Our two worlds lens is represented in Sustainable Seas in a variety of ways, from our overarching strategy and structure of our projects, to the diversity of research partners and approaches to bringing knowledge to life.

It is also represented in the way we view our world.

A western context largely views Aotearoa New Zealand through an understanding that north is up, and south is down.

Within Te Ao Māori, Te Wai Pounamu or Te Waka-ā-Māui (the waka of Māui) is the South Island and Te Ika-ā-Māui (the fish of Māui) is the North Island so conceptions of our place differ markedly. You’ll notice this distinction in the maps of Aotearoa New Zealand depicted on each project page.

Te Au o Te Moana is a concept and theme given to Sustainable Seas by Kāhui Māori kaumātua Joe Harawira to remind us that the moana is at the heart of what we do.



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About the Sustainable Seas Challenge

WHAT WE DO

There are many and growing uses of Aotearoa New Zealand's marine environment – some of which are competing. Our research addresses the question:

How can we best develop our marine economy, while protecting the taonga of our marine environment?

To help achieve this, our research focuses on:

- Improving marine resource decision-making and the health of our seas through holistic, ecosystem-based management (EBM)
- Transforming New Zealand's ability to enhance our marine economy into a blue economy

All forms of knowledge are important. Our interdisciplinary research includes biophysical science, economics, mātauranga Māori, social science, and policy.

IN 2019 – 2024, WE HAVE:

35 
PROJECTS
all have been co-developed
with Māori partners
and/or stakeholders 
18 ARE LED OR
CO-LED BY MĀORI

186 
RESEARCHERS
from **65** organisations
across
Aotearoa 
61 IDENTIFY AS MĀORI
41 ARE EARLY CAREER RESEARCHERS*

*postgraduates, and those in first 5 years following postgraduate

EBM for Aotearoa



Human activities

Humans, along with their multiple uses and values for the marine environment, are part of the ecosystem.



Co-governance

Governance structures that provide for Treaty of Waitangi partnership, tikanga and mātauranga Māori.



Knowledge-based

Based on science and mātauranga Māori, and informed by community values and priorities.

Ecosystem-based management for Aotearoa

A holistic and inclusive way to manage marine environments and the competing uses for, demands on, and ways New Zealanders value them.



Sustainability

Marine environments, and their values and uses, are safeguarded for future generations.



Collaborative decision-making

Collaborative, co-designed and participatory decision-making processes involving all interested parties.



Tailored

Place and time specific, recognising all ecological complexities and connectedness, and addressing cumulative and multiple stressors.

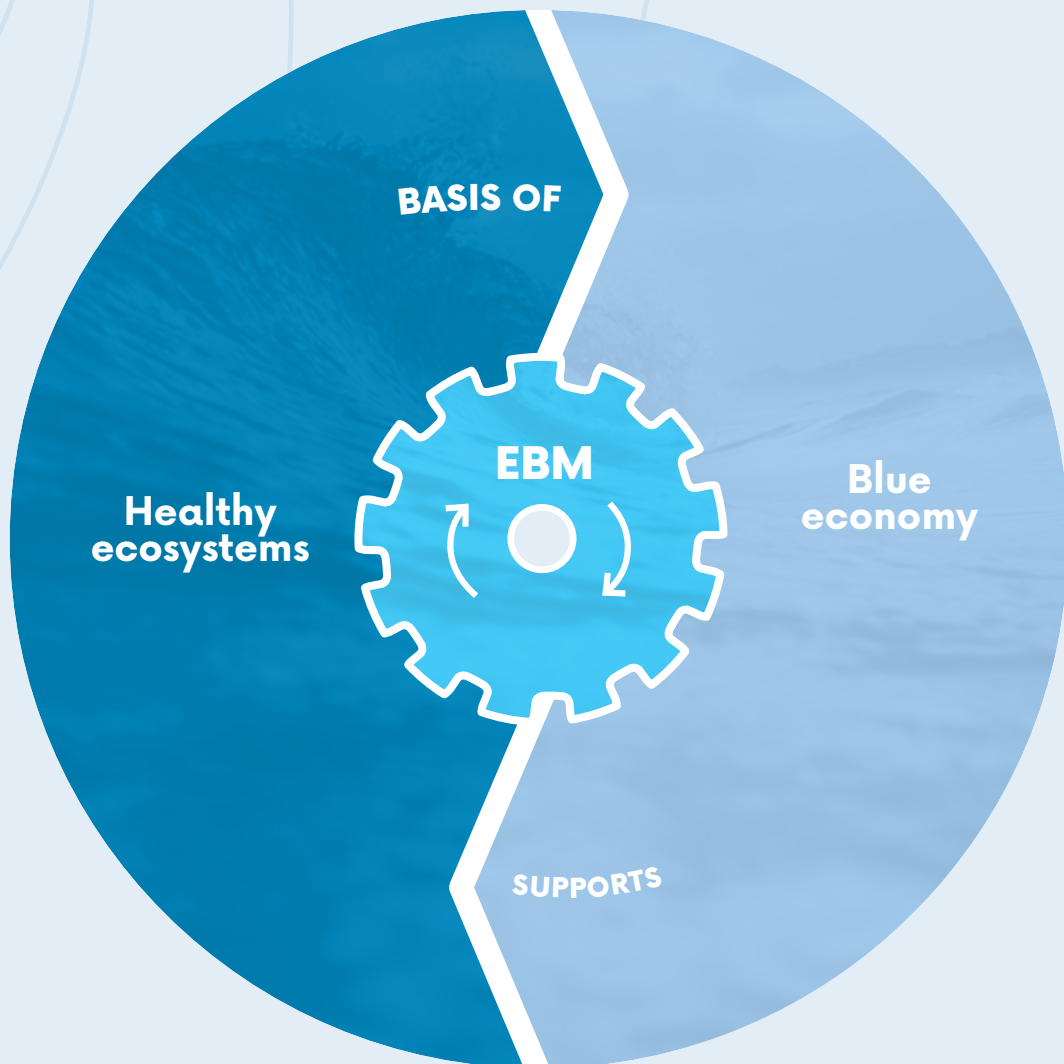


Adapts

Flexible, adaptive management, promoting appropriate monitoring, and acknowledging uncertainty.

EBM and the blue economy

EBM is a mechanism for realising healthy, functioning, marine ecosystems that provide a basis for a thriving blue economy – which in turn supports the maintenance of healthy ecosystems.



Our research 2019 – 2024

Overview of themes and projects

If you'd like to know more about our completed 2014 – 2019 research please visit the website.

TANGAROA

Shaun Awatere, Manaaki Whenua

- **T1: Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based EBM**
Kura Paul-Burke, University of Waikato
Richard Bulmer, NIWA
- **T2: Huatuakina o hapū e!**
Ian Ruru, Maumahara Consultancy Services Ltd
- **T3: Ngā Tohu o te Ao: Maramataka and marine management**
Caine Taiapa, Manaaki Te Awanui
Waiaria Rameka, Manaaki Te Awanui
- **T4: Te Tāhuhu Matatau: Empowering kaitiaki of Tangaroa**
Caine Taiapa, Manaaki Te Awanui
- **T5: He Kāinga Taurikura o Tangitū: Treasured coastal environment**
Kelly May, NIWA
Leigh Tait, NIWA
Hayley Lawrence, Maungaharuru-Tangitū Charitable Trust

DEGRADATION AND RECOVERY

Conrad Pilditch, University of Waikato

- **1.1: Ecological responses to cumulative effects**
Simon Thrush, University of Auckland
Kura Paul-Burke, University of Waikato
- **1.2: Spatially-explicit cumulative effects tools**
Carolyn Lundquist, NIWA
- **1.3: Modelling restorative economies**
Eva Siwicka, University of Auckland

BLUE ECONOMY

Nick Lewis, University of Auckland

- **2.1: Transitioning to a blue economy**
Nigel Bradly, EnviroStrat
- **2.2: Restorative marine economies**
Drew Lohrer, NIWA
Nigel Bradly, EnviroStrat
- **2.3: Indigenising the blue economy in Aotearoa**
John Reid, University of Canterbury
Jason Mika, University of Waikato
- **2.4: Growing marine ecotourism**
Simon Milne, AUT
Chris Rosin, Lincoln University
- **2.5: Building a seaweed sector**
Serean Adams, Cawthron

INNOVATION FUND

- **2.11: Pātangaroa hua rau: The bioactive potential of sea stars**
Matt Miller, Cawthron
Kura Paul-Burke, University of Waikato
Mathew Cumming, Plant and Food Research
- **2.12: Kohunga Kutai**
Andrew Jeffs, University of Auckland
Nicola MacDonald, Ngāti Manuhiri Settlement Trust
- **2.13: Seaweed sun defence**
Mike Packer, Cawthron
- **2.14: Whakaika te Moana**
Te Rerekohu Tuterangiwhiu, Cawthron

INNOVATION FUND (continued)

- **2.15: Thinking outside the can: engineering toheroa aquaculture**
Phil Ross, University of Waikato
Taoho Patuawa, Te Roroa
- **2.16: A novel approach to aquaculture in Aotearoa New Zealand**
Simon Muncaster, University of Waikato
- **2.17: Kia tika te hī ika: Exploring fisheries tikanga and mātauranga**
Maru Samuels, Iwi Collective Partnership
Irene Kereama-Royal, Ngā Wai A Te Tūi
Māori & Indigenous Research Centre
- **2.18: Quantifying seafloor contact**
Oliver Wilson, FINZ

About the Innovation Fund



This fund is for innovative research in partnership with enterprise and business organisations, that will help build a blue economy in Aotearoa New Zealand. Sustainable Seas supports these small, short-term projects with up to \$250k for two years; innovation fund project partners provide co-funding or funding in kind.

RISK AND UNCERTAINTY

Judi Hewitt, University of Auckland

- **3.1: Perceptions of risk and uncertainty**
Paula Blackett, NIWA
Shaun Awatere, Manaaki Whenua
- **3.2: Communicating risk and uncertainty**
Joanne Ellis, University of Waikato
Fabrice Stephenson, University of Waikato
- **3.3: Risks to businesses from uncertainty**
Stephen FitzHerbert, NIWA
Katherine Short, Terra Moana
Tony Craig, Terra Moana

ENHANCING EBM PRACTICES

Karen Fisher, University of Auckland

- **4.1: Tangaroa Ararau**
Beth Tupara-Katene, Awatea Consulting
- **4.2: Policy and legislation for EBM**
Elizabeth Macpherson, University of Canterbury
Eric Jorgensen, P Jorgensen & Sons
- **4.3: Enabling Kaitiakitanga and EBM**
Lara Taylor, Manaaki Whenua
Dan Hikuroa, University of Auckland
- **4.4: Scale and EBM**
Joanne Ellis, University of Waikato

EBM AND BLUE ECONOMY IN ACTION

Chris Cornelisen, Cawthron

- **S1: Hawke's Bay regional study**
Carolyn Lundquist, NIWA
- **S2: Synthesis of Tasman Bay and Golden Bay Phase I research**
Emma Newcombe, Cawthron
- **S3: Synthesis of Tangaroa Phase I research**
Lara Taylor, Manaaki Whenua
Jason Mika, University of Waikato
- **S4: EBFM in the Hauraki Gulf**
Darren Parsons, NIWA
Alexandra Schwaab, Fisheries New Zealand
- **S5: Waikato Regional Council Coastal Plan Review**
Karen Fisher, University of Auckland
- **S6: Marlborough Sounds regional study**
Vonda Cummings, NIWA
Oliver Wade, Marlborough District Council
Eric Jorgensen & Larncce Wichman,
Marlborough Sounds Integrated
Management Trust
- **S7: Ki uta ki tai: Estuaries, thresholds and values**
Drew Lohrer, NIWA

Tangaroa

This research places Māori at its centre, and aims to promote and support Māori-led or partnered projects to enable direct benefits to iwi, hapū and Aotearoa New Zealand.

LED BY SHAUN AWATERE (MANAAKI WHENUA)

Ko te moana
ehara rawa i te wai kau
Nō Tangaroa kei tēnei marae
He maha ona hua i ora ai
ngā manu o te rangi
Te iwi ki te whenua

The sea is not any water
It is the marae of Tangaroa
It yields life for many things
the birds in the sky
the people upon the land

Note: No macrons used in original text

Whakataukī shared by TAC Royal (1989), referenced by *Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment* (2017, p41). Dr Anne-Marie Jackson (Ngāti Whātua), Ms Ngahuia Mita (Te Aitanga-ā-Māhaki), Dr Hauiti Hakopa (Ngāti Tūwharetoa). Report for the Sustainable Seas National Science Challenge, Aotearoa New Zealand



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Māori maintain a unique and longstanding connection with the ocean that permeates aspects of Māori life, including cultural, spiritual and economic. This connection is recognised through obligations, rights and interests as Treaty of Waitangi partners. This research helps address the specific aspirations and needs of Māori, where they align with the Challenge objective, in a way consistent with kaupapa and mātauranga Māori.

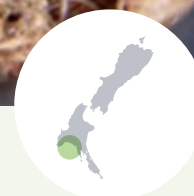
These projects contribute to:

- Addressing the aspirations of Māori in halting ecosystem degradation and supporting recovery, including by developing a model that harmonises mātauranga Māori and western science, and enables tangata whenua and rohe specific approaches and outcomes
- Supporting Māori innovation in blue economy initiatives to enable development founded on principles of kaitiakitanga, manaakitanga, whanaungatanga, wairuatanga and whai rawa
- Achieving a marine decision-making and management framework that addresses risks and uncertainty within a Māori cultural and commercial context that recognises intergenerational well-being
- Developing an EBM approach that is informed by mātauranga Māori, enables innovative governance and jurisdiction models at different scales, and recognises Māori rights and interests through greater partnership
- Collaborating across all Challenge research to support a Te Ao Māori approach and ensure research outputs meet the needs and aspirations of Māori

T1



ONGOING



Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM

PROJECT LEADERS Kura Paul-Burke (University of Waikato) & Richard Bulmer (NIWA)

DURATION April 2020 - June 2023

BUDGET \$1,073,700

This project combines mātauranga Māori, western science and local kaitiakitanga to better understand the culturally and socially important species in Ōhiwa Harbour.

This research is investigating habitat connectivity as it applies to the unique social, cultural and ecological context of Ōhiwa Harbour. This will help better understand the degrading harbour and promote recovery of the once abundant mussel reefs and shellfish.

The key aim is to co-develop and co-produce marine research that actively positions tikanga and mātauranga Māori as a fundamental approach alongside western science for present and future generations.

The other research aims are:

- *Ngā tohu o te taiao* – Recognising, interpreting and responding to contemporary tohu or environmental signs, signals and indicators of the natural world
- *Mahi tahi* – Collaborative observation, action and reflection, look to an

intergenerational past to enact the present and inform the future

- *Kaitiakitanga* – Active guardianship, combine learnings from localised mātauranga Māori with Western science to enact positive, proactive decision-making and management action

This project has been co-developed with hapū/iwi of Ōhiwa harbour. It is supported by the Bay of Plenty Regional Council and the seven partners of the co-management Ōhiwa Harbour Implementation Forum. This project has arisen from the issues, challenges, actions and aspirations of Māori and is grounded in Whanaungatanga, the principle of working in meaningful, genuine collaboration to influence how mātauranga Māori and western science principles and practices are translated operationally in ways that recognise cultural values, knowledge systems and opportunities.

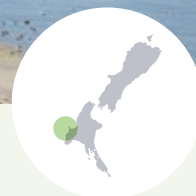
RESEARCH TEAM: Shaun Ogilvie (Eco Research Associates Ltd), Conrad Pilditch (University of Waikato), Joe Burke (MUSA Environmental), Megan Ranapia (University of Waikato)



T2



ONGOING



Huataukina o hapū e!

PROJECT LEADER Ian Ruru (Maumahara Consultancy Services Ltd)

DURATION September 2020 - June 2023

BUDGET \$902,800

This project is enabling kaitiaki to better manage Whareponga and Waipiro Bays.

'Huataukina' is a metaphor for the challenge facing kaitiaki and marine managers around Aotearoa New Zealand. Huataukina once symbolised an abundance of taonga species and a thriving community, but now heralds a biodiversity tipping point and the quest for kaitiaki to restore balance and the prosperity of their hapū and iwi.

This project provides a unique opportunity for hapū-led and driven research to support kaitiaki to better manage their rohe moana, build hapū capacity and capability, and give meaningful effect to the principles of the *Nga Rohe Moana o Nga Hapū o Ngati Porou Act 2019* for two hapū rohe moana case studies.

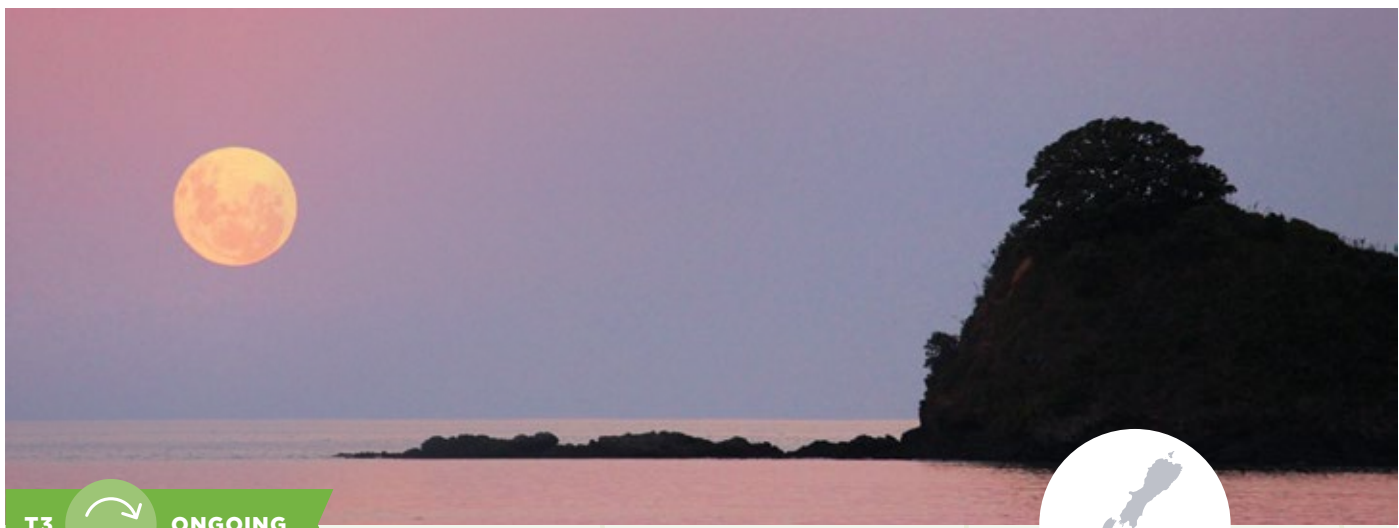
Anchored in Whareponga and Waipiro Bays, the project team is looking to:

- Unlock the potential of the Act, mātauranga Māori and western science to give effect to the practice of kaitiakitanga over ngā rohe moana

- Create mātauranga-a-hapū frameworks, processes and tools that will enable kaitiaki and other decision-makers to protect and manage ngā rohe moana
- Build whānau and hapū capability to actively participate in decision-making and management of ngā rohe moana
- Develop understanding and guidance relevant to the application of a whānau, hapū, iwi and mātauranga Māori based approach to EBM in the two hapū rohe moana case studies

The project team is holding a series of wānanga with hapū to co-develop tools and frameworks specific to Whareponga and Waipiro Bays, including: a database of knowledge, a dive survey report, a Mauri Compass for the marine environment, a state of the environment report, and decision-making and policy frameworks.

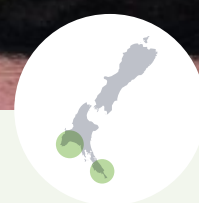
RESEARCH TEAM: Pia Pohatu, Justin Tibble, Agnes Walker (Hapū Kaitiaki Trust Healthy Families East Cape), Riripeti Reedy (Maitai Group Ltd), Nick Shears (University of Auckland), Joseph Burke (MUSA Environmental), Ngarangi Walker (AgFirst Ltd)



T3



ONGOING



Ngā Tohu o te Ao: Maramataka and marine management

PROJECT LEADERS Caine Taiapa (Manaaki Te Awanui) & Waiaria Rameka (Manaaki Te Awanui)	
DURATION April 2020 - June 2023	BUDGET \$580,900

This project is investigating maramataka (Māori moon calendars) as a framework to develop cultural coastal indicators to inform marine monitoring practices.

Maramataka are an ancient knowledge system developed over many millennia through an intimate connection with the environment. Maramataka are a natural timekeeping system that use the movement of the moon through any given month or season to determine appropriate times for various customary activities. Although maramataka are not as widely applied today, the knowledge and practices surrounding moon calendars have been preserved in indigenous communities across the Pacific.

In Aotearoa, maramataka are still applied by indigenous practitioners to inform interaction with the environment and guide ecosystem management practices. The cultural marine and coastal seascapes of Aotearoa have undergone rapid ecosystem change. Understanding the extent of change and the associated impact to social, economic and cultural well-being is critical to effective implementation of ecosystem-based management (EBM).

This project addresses the need to reposition mātauranga Māori as an integral and vital

knowledge system for understanding coastal ecosystems and informing knowledge-based EBM. Maramataka will be used as a tool to explore mātauranga Māori specific to coastal and marine ecosystems. This project is investigating three questions:

1. How do we reclaim maramataka knowledge and practices to inform transformative practice in coastal and marine assessment?
2. How can maramataka be used as a catalyst to reclaim mātauranga Māori for the coast and marine environment?
3. How do we use both maramataka and reclaimed mātauranga Māori to reframe cultural indicator framework development?

Ngā Tohu is set across three case study areas, Pākirikiri Wānanga – Tokomaru Bay, Ngātaki Collective – Ngāti Kuri, and Manaaki Te Awanui – Tauranga Moana.

RESEARCH TEAM: Kelly Ratana (Manaaki Te Awanui), Te Rerekohu Tuterangiwhiu (Wheiao Whakaaro), Karen Pewhairangai (Pākirikiri Wānanga), Rawinia Olsen-Kingi (Pākirikiri Wānanga), Karauria Ratapu (Pākirikiri Wānanga), Wayne Petera (Ngātaki Collective), Ayani Ferens (Ngātaki Collective), Phil Ross (University of Waikato)

T4



ONGOING



Te Tāhuhu Matatau: Empowering kaitiaki of Tangaroa

PROJECT LEADERS Caine Taiapa (Manaaki Te Awanui)

DURATION April 2020 - June 2023

BUDGET \$600,100

This project is co-developing tools and resources to empower kaitiaki decision-making in the domain of Tangaroa.

Bringing the worlds of mātauranga Māori and science closer together can enhance the expression of kaitiakitanga by connecting kaitiaki to trusted sources of knowledge and tools for ecosystem-based management (EBM).

This project builds on the Tāhuhu Matatau Te Ao Tangaroa project, which focused on reclaiming and reframing mātauranga Māori to enable kaitiaki of Tauranga Moana to develop relevant tools for marine decision-making. The project team, with participating hapū and kaitiaki, co-developed a prototype of an online pātaka mātauranga (digital resource).

For this project, the overarching aim is to empower kaitiaki across Aotearoa with relevant environmental management approaches, frameworks and tools for an EBM approach. This will be achieved by further developing the pātaka mātauranga website, focused on:

- A marine spatial mapping tool to assist with reclaiming mātauranga
- Digital resources to improve science communication between academics and kaitiaki

- Māori tools and frameworks to help academics and government agencies engage with kaitiaki
- How to maintain the online resources beyond the life of this project

The incorporation of tikanga Māori and pou matua (guiding principles) continue to be a hallmark feature, guided by the previous learnings:

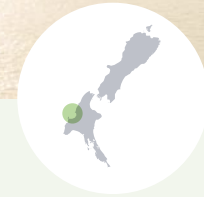
- Building trust – Through kanohi ki te kanohi, kōrero, uiui and wānanga
- Telling the stories of kaitiaki – Acknowledging kaitiaki stories and their whakapapa connections
- Connection – Building whanaungatanga by connecting kaitiaki to knowledge, tools and people
- Ownership – Maintaining tino rangatiratanga over kaitiaki knowledge
- Protocols – Creating the space to wānanga tikanga and kawa required for the safe keeping of kaitiaki stories

RESEARCH TEAM: Te Rerekohu Tuterangiwhiu (Wheiao Whakaaro), Pakirikiri Wānanga (Tokomaru Bay), Waiora Marae (Ngāti Kuri), Rereata Makiha/Rihi Motutere, Robert McGowan (Ngā Whenua Rāhui), Phil Ross (University of Waikato), Regan Fairlie (Manaaki Te Awanui)

T5



ONGOING



He Kāinga Taurikura o Tangitū: Treasured coastal environment

PROJECT LEADERS Kelly May (NIWA), Leigh Tait (NIWA) & Hayley Lawrence (Maungaharuru-Tangitū Charitable Trust)

DURATION November 2021 – June 2023

BUDGET \$299,770

This project is supporting coastal hapū to express kaitiakitanga by assessing and accessing high-quality ecosystem data.

“Ka tuwhera a Maungaharuru, ka kati a Tangitū. Ka tuwhera a Tangitū, ka kati a Maungaharuru”

When the season of Maungaharuru (the mountain) opens, the season of Tangitū (the sea) closes. When the season of Tangitū opens, the season of Maungaharuru closes.

This hapū based project is helping support coastal hapū and our expression of kaitiakitanga by assessing and accessing high-quality ecosystem data produced by technological tools.

Mātauranga-a-hapū underpins this project, which is situated within the Tangitū rohe moana (northern Hawke's Bay) and on a kuku (mussels) reef which is under threat due to anthropogenic pressures and the impacts of fragmented management.

Our project has four key phases:

1. Identify attributes, indicators and targets: Wānanga and bring together our

mātauranga-a-hapū to describe the state and pressures on the kuku reef.

2. Identify new tools and technologies to complement mātauranga-a-hapū: Wānanga to learn about and assess different leading-edge technologies. This will inform a long-term plan to establish quality ecological information about the kuku reef, ongoing coastal monitoring and process that can weave new data into our cultural assessments.
3. Evaluate technology: We will test a technology for its effectiveness and cultural acceptability, eg Remotely Operated Vehicles (ROV), environmental DNA (eDNA).
4. Develop a Coastal Cultural Assessment Framework and adaptive management: We will develop a framework to monitor the kuku reef and align with our ki uta ki tai freshwater cultural assessments and restoration projects.

This project will benefit coastal hapū kaitiakitanga alongside an ecosystem-based management approach in a practical and accessible manner.

RESEARCH TEAM: Rachel Hale (NIWA), Ani Kainamu (NIWA)



© Dave Allen, NIWA

An aerial photograph of a coastal landscape. In the foreground, a wide, shallow river or estuary flows through a sandy and silty delta. The water is a mix of light blue and green. To the left, a small town with several houses and trees is visible. In the background, there are rolling hills and mountains under a clear blue sky. The entire image is overlaid with a large, faint white outline of a leaf or a similar organic shape.

Degradation and recovery

Investigating ways to assess the effects of human activities on marine ecosystems, and the potential for recovery.

LED BY CONRAD PILDITCH (UNIVERSITY OF WAIKATO)



Marine ecosystems are affected by human-induced stressors (eg climate change, fishing, pollutants, dredging) at multiple scales. These stressors interact in complex ways and some can be transported long distances, causing cumulative effects that extend over large areas and build up over time. This makes managing marine environments, and assessing the likely degradation – or recovery – of ecological, social and cultural values if certain activities proceed, extremely challenging.

Stakeholders and Māori partners have consistently highlighted that a greater understanding of the cumulative effects from multiple activities, and how they can be managed to recover ecological function and marine values, is a priority.

We are therefore developing:

- Methods to map stressor footprints and their impacts on ecosystem services
- Methods to assess the recovery potential of degraded habitats
- An assessment of how ecological degradation and recovery alters peoples' values from a mātauranga and tikanga Māori context
- Tools to improve cumulative effects management

© Rob Suisted

1.1



ONGOING



Ecological responses to cumulative effects

PROJECT LEADERS Simon Thrush (University of Auckland) & Kura Paul-Burke (University of Waikato)

DURATION March 2020 - June 2023

BUDGET \$3,904,000

This project brings together mātauranga Māori and western science to address the cumulative effects (CE) of multiple stressors on soft-sediment and rocky reef biodiversity and ecosystem function.

This knowledge is necessary to underpin models, decision-making processes and to implement EBM. Building on our *Tipping points* and *Ecosystem services* research, this project is:

- Co-developing place-based tohu (indicators) of the ecological condition of our estuaries and coasts
- Developing ecological footprint analysis to support improved decision-making, investment and knowledge of how activities and stressors impact on biodiversity and ecosystem services
- Investigating recovery bottlenecks of reef and soft-sediment seafloor ecosystems
- Developing new methods to map ecological response footprints of stressors and their impacts on ecosystem services
- Providing a CE assessment framework based on understanding of interactions between ecosystem components to inform marine spatial planning and risk assessment

- Identifying constraints on ecosystem recovery to better manage risk and expectations.

We will engage in field studies, develop models and work with broader environmental initiatives across Aotearoa New Zealand proposed by iwi, community groups and central or regional government that support EBM developments in the Hauraki Gulf, Tauranga and Ōhiwa harbours, Marlborough Sounds, and Southland estuaries. In the context of each of these initiatives, we are identifying the ecological communities and processes that play important roles in ecosystem service delivery and resilience.

This research will allow us to develop frameworks across the Challenge that improve the way we make decisions about the risks posed by different activities in the marine environment, and the opportunities we have to improve the ecological health and mauri of our coasts and estuaries.

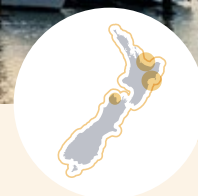
RESEARCH TEAM: Conrad Pilditch (University of Waikato), Karin Bryan (University of Waikato), Nick Shears (University of Auckland), Judi Hewitt (University of Auckland), Drew Lohrer (NIWA), Carolyn Lundquist (NIWA/University of Auckland), Dave Schiel (University of Canterbury), Steve Wing (University of Otago), Candida Savage (University of Otago)



1.2



ONGOING



Spatially-explicit cumulative effects tools

PROJECT LEADER Carolyn Lundquist (NIWA)

DURATION June 2020 – June 2023

BUDGET \$1,100,000

This project is incorporating cumulative effects of multiple stressors (from human activities on land and sea) into decision-making tools.

One of the challenges of ecosystem-based management (EBM) is the difficulty of incorporating the cumulative effects (CE) of multiple stressors into decision-making.

Current marine management practice typically focuses on single stressors, or single sectors, single habitats, or single species. However, the interactions between multiple stressors and where and when a stressor footprint occurs are important considerations when determining effects on ecosystems.

Few tools exist to assess the CE of multiple stressors in marine ecosystems. This makes effective management difficult and can be a source of uncertainty in management decisions around an ecosystem's capacity to cope with the effects of new activities.

To address this issue, this project is building the capacity of existing marine spatial management tools to include CE assessment.

Specifically, this project will incorporate the findings from the *Ecological responses to cumulative effects* project (which is looking at the interactions between stressors, and how these stressors act both singularly and in combination) into new decision support tools.

These new tools will help decision-makers better understand CE and develop robust criteria for assessing whether new activities can be accommodated or are likely to trigger an ecological tipping point.

This project is developing three models that will be user-tested at the national, regional and local rohe moana levels and include SeaSketch education support tools. These models address:

1. Stressor interactions
2. System capacity
3. Recovery dynamics

RESEARCH TEAM: Amy Whitehead (NIWA), Anne-Gaelle Ausseil (Manaaki Whenua), James Whetu (Whetu Consulting), Hilke Giles (Pisces Consulting Limited), Tom Brough (NIWA), Stephanie Watson (University of Waikato), Shane Geange (DOC), Hugh Smith (Manaaki Whenua)



1.3



ONGOING

Modelling restorative economies

PROJECT LEADER Eva Siwicka (University of Auckland)

DURATION August 2021 – June 2023

BUDGET \$437,218

This project is determining the benefits of small-scale, community-based marine restoration initiatives.

Successful marine restoration projects from around the world all have a community-led 'ground-up' approach.

In Aotearoa New Zealand, many iwi and community groups champion and lead initiatives to restore degraded marine environments. However, gaining support from government and/or investors is often difficult because the benefits (social, ecological, and economic) are hard to quantify. To bridge this gap, we are synthesising and integrating knowledge from across our research to provide baseline information and guidance for communities, iwi, businesses, and investors looking to engage in marine restoration initiatives.

This involves the evolution of a Bayes Net model first developed by our *Measuring and mapping ecosystem services* project to develop a social-ecological framework that will:

- model the probability of success of the recovery-focused action(s)
- determine the synergies and trade-offs of a restorative intervention
- provide context to economic analyses and investment opportunities.

We are incorporating information into this framework from the following projects.

Ecological responses to cumulative effects – research into recovery processes and bottlenecks is helping us to develop a foundation to identify the social-ecological benefits of active restoration and where these benefits are most likely to gather.

Awahi Mai Awahi Atu – weaving together mātauranga, kaitiaki and ecology, this project is determining the cultural benefits and opportunities of restorative actions and the development of relevant infrastructure to rural Māori economies. We are linking mātauranga and tohu (fundamental ecological knowledge) to these cultural benefits and opportunities.

Restorative marine economies – a review of current restoration practices in Aotearoa New Zealand provides sustainability and economic indicators that will allow a range of potential investors to assess the viability of restorative economy projects. We are drawing on the ways that investors consider benefits and costs of restoration.

In addition to the Bayes Net model, we will produce a social-ecological network analysis (SNA) map to help iwi and communities navigate bureaucratic structures, and link current policy and plans to ecologically and culturally feasible recovery plans that attract potential investors and businesses.

RESEARCH TEAM: Simon Thrush (University of Auckland), Kura Paul-Burke (University of Waikato/MUSA Environmental), Nick Lewis (University of Auckland), Sandra Cortés Acosta (EnviroStrat), Karen Fisher (University of Auckland), Eric Jorgensen (P Jorgensen & Sons)



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Blue economy

Investigating opportunities for marine activities that create economic value and contribute positively to social, cultural and ecological well-being in Aotearoa New Zealand.

LED BY NICK LEWIS
(UNIVERSITY OF AUCKLAND)



Developing the economy is generally still seen as separate to, and often at odds with, social and environmental goals, but they are intrinsically linked. Healthy marine ecosystems require a marine economy that is committed to ecologically sustainable practices – and long-term economic use of marine resources depends on healthy marine ecosystems.

Our research has identified opportunities to help Aotearoa New Zealand transition to a blue economy by encouraging activities that are sustainable, resilient to climate change, minimise waste, and have positive impacts on society and culture.

Our current research is focused on helping to grow these activities and develop a blue economy made up of activities that:

- Arise from ecologically and socially responsible investment
- Use ecologically and culturally appropriate technologies to create economic values from marine activities
- Reduce ecological risks and harms
- Respond to, and encourage, ecologically and culturally responsible consumer behaviour
- Contribute directly to social, cultural and ecological well-being

We define a ‘blue economy’ as being made up of marine activities that generate economic value and contribute positively to social, cultural and ecological well-being.

2.1



COMPLETED



Transitioning to a blue economy

PROJECT LEADER Nigel Bradly (EnviroStrat)	
DURATION August 2019 - November 2019	BUDGET \$90,000

This project identified which marine activities have the potential to help New Zealand transition to a blue economy - ie they are sustainable, resilient to climate change, minimise waste, and have positive impacts on society and culture.

This project did a stocktake of national and international blue economy developments, and examined threats and constraints, as well as opportunities.

The team worked closely with iwi and stakeholders to gather a range of perspectives to ensure a broad understanding.

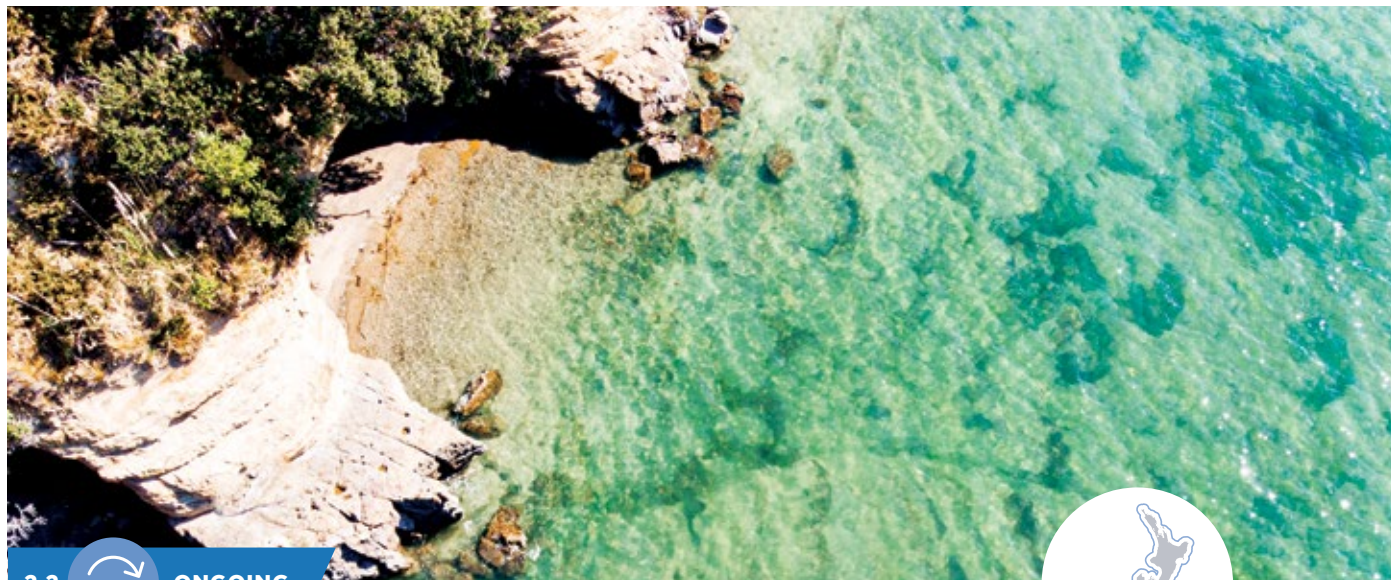
This work was a critical foundation for developing other projects under our Blue Economy research theme and the Innovation Fund.

RESEARCH TEAM: John Reid (Canterbury University), Cerasela Stancu (EnviroStrat), Fraser Stobie (EnviroStrat), Victoria Jollands (University of Auckland), Nick Lewis (University of Auckland)

KEY FINDINGS

Current status and trajectories of New Zealand (and international) blue economy sectors





2.2



ONGOING

Restorative marine economies

PROJECT LEADERS Drew Lohrer (NIWA) & Nigel Bradly (EnviroStrat)

DURATION January 2021 – September 2022

BUDGET \$900,000

This project is investigating how to build restorative economies in Aotearoa New Zealand's coastal and marine spaces.

Healthy marine ecosystems require a marine economy that is committed to ecologically sustainable practices – and long-term economic use of marine resources depends on healthy marine ecosystems.

'Restorative economies' combine business activities and environmental restoration. They aim to foster new investments and business enterprises that instead of ignoring degradation or contributing to it, actively seek to enhance the biodiversity and health of degraded ecosystems. This goes beyond the traditional economic concept of operating within environmental and biological constraints.

There is growing interest in restorative marine economy practices from:

- Iwi, communities and individuals interested in restoring their local environment
- Businesses aiming to reduce their environmental impact and increase their resilience through activity diversification

- The sustainable finance sector and councils interested in using environmental credits to spur sustainability solutions and generate benefits in their communities.

However, moving towards restorative marine economies requires investment, new science and technology, altered practices and regulations, and new measures of performance.

This project is developing knowledge, frameworks and decision-support tools to enable restorative marine economies to emerge. As well as developing investment propositions, we will develop proof-of-concepts using place-based research, and build the relationships and roadmaps required for the future of the sector.

RESEARCH TEAM: Richard Bulmer (NIWA), Fabrice Stephenson (University of Waikato), Emily Douglas (NIWA), Cerasela Stancu (EnviroStrat), Sandra Cortes Acosta (EnviroStrat), John Reid (University of Canterbury), Jason Mika (University of Waikato), Ann Smith (EnviroStrat Associate, ex CEO Toitū Envirocare), Izzy Brown (EnviroStrat), Tahlia Bridger (EnviroStrat), Nick Lewis (University of Auckland), Jenny Hillman (University of Auckland)



2.3



ONGOING

Indigenising the blue economy

PROJECT LEADERS Jason Mika (University of Waikato) & John Reid (J D Reid Ltd)

DURATION September 2021 - August 2023

BUDGET \$800,000

This project is addressing key barriers that currently prevent Māori from using their marine resources in a more culturally relevant, economically impactful, and environmentally sustainable manner.

This project is exploring three themes identified by Māori as constraints in achieving restorative Indigenous blue economies.

These themes are:

1. Pāhekoheko (integration) – supporting Māori-led integrated planning
2. Auahatanga (differentiation) – kaitiaki centred products and business models
3. Whakatautika (balance) – creating opportunities for Māori in coastal communities

We are partnering five iwi and pan-iwi entities and Māori enterprises to explore and support Māori who aspire to a blue economy imbued with mātauranga Māori, treaty principles, and a focus on Māori wellbeing, human potential and relational balance with Tangaroa as our tīpuna.

These are:

- Kahungunu Asset Holding Company Limited
- Iwi Collective Partnership
- Ōnuku Rūnanga
- Ngāti Mutunga o Wharekauri Iwi Trust
- Hokotehi Moriori Trust

This mahi is extending earlier research by the *Whai Rawa, Whai Mana, Whai Oranga* project, which mapped the Māori marine economy, its institutions and enterprises, and the business models they employ.

RESEARCH TEAM: Matthew Rout (Applied Research Collective), Jay Whitehead (Matatihi Ltd), Annemarie Gillies (Whitimaia Ltd), Fiona Wiremu (Te Whare Wānanga o Awanuiārangī), Georgia McLellan (Te Au Rangahau)



2.4



ONGOING



Growing marine ecotourism

PROJECT LEADERS Simon Milne (AUT) & Chris Rosin (Lincoln University)

DURATION December 2020 - July 2023

BUDGET \$500,000

This project is supporting development of marine ecotourism that embraces regenerative principles and supports a blue economy.

Before Covid-19, tourism contributed 9.8% GDP, \$40.9 billion and 14.4% national employment (StatsNZ, 2019). While Covid-19 has diminished the country's most valuable export sector, tourism, it is also a catalyst to develop more sustainable experiences.

Our extensive coastline and unique marine environment places Aotearoa New Zealand in an excellent position to develop this sector. But our understanding of marine ecotourism and how it connects to the blue economy is lacking. Marine ecotourism is an area often overlooked by policy makers and the connections to the spiritual, cultural, social, environmental, and economic well-being of communities is largely unexplored.

To develop marine ecotourism activity that embraces sustainability/regeneration and supports a blue economy, we need to understand where we are now, where we want to go, and how we will get there.

Drawing on mātauranga Māori, this project aims to develop marine ecotourism from low impact

ecosystem-based management (EBM) principles. We are using innovative approaches to identify, investigate, and achieve the desired outcomes. Key to this is forming a network that enables cross-sectoral learning and can drive and enact change.

We are working in partnership with iwi, industry, government and community to:

- Establish a baseline of marine ecotourism activity
- Co-create an actionable definition
- Construct collaborative measures for 'success' and test this in North and South Island case studies.

This research includes wānanga with case communities and mātauranga experts in factors that contribute to te Taiao, and participation in existing marine ecotourism activities. An iterative process of adaption and collaboration across sectors and cultures will enable knowledge exchange and learning to develop tools and frameworks that support the development of marine ecotourism.

RESEARCH TEAM: Keri-Anne Wikitera (AUT), Carolyn Deuchar (AUT), Joanna Fountain (Lincoln University), Helen Fitt (Lincoln University), Eilidh Thorburn (AUT)

2.5



ONGOING



Building a seaweed sector

PROJECT LEADER Serean Adams (Cawthron)

DURATION November 2020 - June 2022

BUDGET \$500,000

This project is developing a seaweed sector framework for Aotearoa New Zealand.

Seaweed has huge potential to contribute to our blue economy.

Seaweed makes up more than 30% of aquaculture production worldwide. In 2018, the global seaweed sector was valued at more than \$13 billion USD, and grew 8% from 2016 to 2018 (fao.org).

Successful seaweed sectors overseas have hatcheries, large- and small-scale farming operations, processing capability and established seaweed-based products that supply markets. These are assisted by on-going research and development, and workforce support.

Aotearoa New Zealand has more than 900 native seaweeds, a third of which are endemic. We have a fledgling but highly dynamic seaweed sector operating at small scales, but many gaps and barriers exist, limiting the potential growth.

With the right framework grounded in ecosystem-based management (EBM) principles, a thriving seaweed sector could be possible in Aotearoa New Zealand.

We are working with Māori*, stakeholders, industry, researchers, and government agencies that currently, or plan to, operate in the sector – either as farmers or as users of seaweed products – to co-develop a Seaweed Sector Framework grounded in blue economy and EBM principles.

This project is (1) reviewing the current state of the seaweed sector (Seaweed Sector Review), (2) co-developing a Seaweed Sector Framework for Aotearoa New Zealand, incorporating EBM principles, and (3) testing the framework using Seaweed Case Studies to understand how it can effectively operate across different scales (eg local, regional, national and small to large businesses).

RESEARCH TEAM: Nigel Bradly (EnviroStrat), Rob Major (Cawthron), Marie Magnusson (University of Waikato), Victoria Jollands (EnviroStrat), Sandra Cortez (EnviroStrat), Leo Zamora (Cawthron), Tom Wheeler (Cawthron), Emma Newcombe (Cawthron), Shaun Ogilvie (Cawthron), Te Rerekohu Tuterangiwhiu (Cawthron), Dana Clark (Cawthron), Paul South (Cawthron), Cam Inskeep (EnviroStrat), Donato Romanazzi (Cawthron), Rebecca Lawton (University of Waikato), Chris Glasson (University of Waikato), Deanna Clement (Cawthron), Cam Ingram (Cawthron), Andy Elliot (Auora, Wakatū)

*In this context Māori is taken to mean iwi, hapū, whānau and/or Māori organisations.



2.11



ONGOING



Pātangaroa hua rau: The bioactive potential of sea-stars

PROJECT LEADERS Matt Miller (Cawthron), Kura Paul-Burke (University of Waikato) & Mathew Cumming (Plant and Food Research)

DURATION December 2020 - December 2022

BUDGET \$250,000

This project is investigating the economic potential of collagen and bioactives from 11-armed sea-stars to manage overpopulations.

An over-abundance of pātangaroa (11-armed sea-stars) is causing dramatic decline in populations of mussels, pipi and cockles. This is causing management issues in coastal areas of Aotearoa New Zealand, in particular the Ōhiwa harbour.

Local iwi, with the support of the Bay of Plenty Regional Council and Ōhiwa Harbour Implementation Forum (OHIF), are seeking innovative ways to manage pātangaroa.

Because they have the ability to regrow lost limbs, pātangaroa have bioactive properties that could potentially aid human wound healing and skin health. They could also be a source of marine collagen, which is in high demand for cosmetics and supplements.

We are addressing how to create an economic opportunity from these properties to cover the costs for managing pātangaroa in Ōhiwa harbour, which are causing significant environmental and biodiversity problems.

The aim of this project is to identify the bioactive potential of pātangaroa, including unique collagens and marine bioactives, and estimate their economic potential. To achieve this, we are working with local iwi to:

- Determine the bioactives found in pātangaroa
- Undertake the essential proof-of-concept steps for producing marine collagen and/or novel bioactives from pātangaroa
- Create a new blue economy model

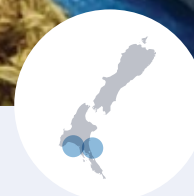
The ultimate goal is to co-create a sustainable economic opportunity that could fund pātangaroa management, and aid an ecosystem-based management model for the harbour and surrounding coastline that aligns with local Māori values.

RESEARCH TEAM: Shaun Ogilvie (Cawthron)

2.12



ONGOING



Kohunga kutai

PROJECT LEADERS Andrew Jeffs (University of Auckland) & Nicola MacDonald (Ngāti Manuhiri Settlement Trust)

DURATION January 2021 - December 2022

BUDGET \$250,000

This project is investigating how to create a sustainable supply of seed mussels using mātauranga Māori and western science.

Every year, the green-lipped mussel aquaculture industry uses large quantities of plastic ropes to catch wild mussel spat (seed mussels) to stock mussel farms around Aotearoa New Zealand. However, there are concerns about loss of this plastic spat-catching rope into the sea, and after a number of years of use, much of this rope ends up in landfill because it is not always recyclable.

We are working with iwi and project partners to develop an effective, biodegradable alternative to plastic spat-catching rope. Mussel spat appear to have a strong natural affinity to attach to native plant fibres such as muka fibre from harakeke (flax), kuta (swamp reed) and tī kōuka (cabbage tree). Mātauranga Māori is guiding the identification of these plant fibres, their sources, and processing and uses for a series of field experiments to determine the most suitable fibres for commercial spat collection.

Developing a commercial-scale, natural spat-catching product built on mātauranga Māori will reduce plastic pollution from aquaculture activities, lead to the emergence of a new local industry based on native plants, and improve the sustainability of the green-lipped mussel industry.

We are partnered with three Māori aquaculture businesses who are providing their infrastructure, facilities and expertise for experiments in real-life industry settings: Aotea Marine Farms Ltd (a spat-collection farm), Rough Waters Ltd (an inshore farm), and Whakatōhea Mussels (Ōpōtiki) Ltd (an offshore farm).

This project was initiated in direct partnership with Ngāti Manuhiri and Ngāti Rehua, and is co-led by kairarangā (master weavers) of Ngāti Manuhiri and Ngāti Rehua who are matatau (expert) in uses of traditional plant fibre products.

RESEARCH TEAM: Brad Skelton (University of Auckland), Katarina Tawiri (Manaaki Whenua)



2.13



ONGOING



Seaweed sun defence

PROJECT LEADER Mike Packer (Cawthron)

DURATION February 2021 – January 2023

BUDGET \$250,000

This project is investigating the potential of algae bioactives to prevent and improve the outcomes of sunburn.

Sunscreen, make-up and lip care products contain ingredients that can filter UV rays. However, many suncare products can have damaging side-effects, and many are being banned due to their environmental impact on corals and other marine life. We need products that don't harm us or the environment.

Some seaweed and algae species have compounds that can protect them from UV damage. Some of these compounds are being used overseas in high-value 'natural' suncare products. We are interested in their potential to prevent and treat sunburn in new ways beyond simply blocking damaging UV light. These include potentially interacting with the processes underlying the sunburn process in the skin and modulating this for beneficial effects; ie having a 'bioactive' effect.

We are drawing on mātauranga Māori and western science to identify which of Aotearoa New Zealand's native and endemic seaweed and

algal species are best to develop for innovative, environmentally friendly sunscreen protection.

We have partnered with Wakatū Incorporation and SRW Laboratories Ltd to:

- Undertake an 18-month marine farm seaweed biodiversity study to sample and collect species seasonally
- Identify seaweed and algal species
- Analyse the collected material and extracts for the target bioactives and antioxidants
- Develop a proof-of-concept for commercialisation

The knowledge generated in this project will help to diversify aquaculture activities, provide employment, improve ecosystem health, and develop a seaweed aquaculture industry in Aotearoa.

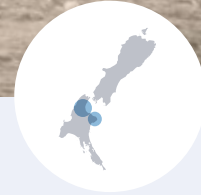
This project was co-developed with Wakatū Incorporation and SRW Laboratories Ltd.

RESEARCH TEAM: Gary Fisher (University of Michigan), Andy Elliott (Wakatū Incorporation), Paul South (Cawthron), Jonathan Puddick (Cawthron), Jonathan Banks (Cawthron), Tom Wheeler (Cawthron)

2.14



ONGOING



Whakaika te Moana

PROJECT LEADER Te Rerekohu Tuterangiwhiu (Cawthron)

DURATION June 2021 – June 2023

BUDGET \$250,000

“Ka tākina te kawa, whakaika rā te Moana a Tangaroa-whakamau-tai”

No mua rawa i te taenga mai o tauwiwi, i rawekeweke ai, i whakawhanake ai, whakahaere hoki ai e ngā matua tupuna i ngā momo hanganga pēnei i te pā-ika, te pā-tuna, te pā-auroa me ngā momo māra-mātaaitai. Ko ēnei pūkenga, he mōhiotanga, he mātau, i whakaheke mai i ngā kāwai whakapapa i heke iho i te Moana-nui-a-Kiwa. Ehara ēnei auahatanga i te hanganga kikokiko noa, he tiaki, kei roto, he mana-aki, otira, he rangatiratanga o te mauri ora kei roto i ēnei kura-huna. He tānonitanga ēnei mātauranga i te āhuatanga o ngā kawa, ngā tikanga, me ngā ritenga tuku iho hei whakahuahua, hei whakamatomato te tupu o ngā ika, o te waiti, o te wai-tā hoki.

E tika ana, mā te wairua tūku iho ēnei mahi rangahau e kawē. I hangaia e mātou i etahi tikanga rangahau no ngā kura o te Wānanga, hei waka kawē whakaaro mo ngā mahi o ngā pou o tēnei whare mātauranga.

- 1. Te Pou-Kai-Āwha** – Me wānangahia i ngā aronga o ngā hapū hapū kia whakatōpū he *Pūna Mātauranga*.

- 2. Te Pou-Toko-Manawa** – Me Wherawherahia i nga akoranga ki ngā momo ture e tāmia ana i ngā hapū, kia whakataiapa mai i tētahi huarahi e taea ai ngā hapū te whakatairanga i ngā pā-ika.

- 3. Te Pou-Tu-a-Rongo** – Me tūhono atu ki ngā mōhiotanga a ngā tūakana o te Moana Nui-a-Kiwa he whakatauirataga mo ngā mahinga whakarauora Taiao a ngā hapū. Kei kīa he wānanga o te *Tuakana me te Teina*.

E tūmanakō ana mā te tira rangahau nei, hāpai i ngā Kaitiaki mātauranga o Ngaruahine, o Te Awa Tūpua o Wanganui, ki te whakatānoni mai i nga pūkorero o ēnei pūkenga, hei pūna mātauranga mo ngā pukenga pā-ika, māra-mātaaitai hoki. Ka whakarūnanga mai i ngā pūkenga taiao a ngā uri o Te Moana-nui-a-Kiwa, ki tēnei ohu rangahau. Ka tūhono atu ki ngā tohunga Loko i`a me ngā tohunga mārā mātaaitai o te Moana-nui-a-Kiwa, hei hāpai o te whakarauoratanga o ngā mōhiotanga Māori. Otirā kia whakatinana i te āhuatanga o te Tuakana me te Teina hei iho pūmanawa mo ngā wānanga nei.

Mā te Māori a ia anō e hāpai, e whakarauora ki te rapu i te ara e tiaki ai i te Ao-tūroa, mā tōna mātauranga, mā nga ūmanga pūtaiao (o te EBM), me nga ūmanga pākahi a ngā hapū ake.

Nā tēnā, ka kauwhatatia ngā wānanga rangahau nei, hei rapu i te mōhio, o ēnei kura huna, e whakatinana mai ai i te mana motuhake me te rangatiratanga o ngā hapū ki tā ngā tikanga o te Te Tiriti o Waitangi. Me hura i ētahi ara ki te Kaitiakitanga mo enei tikanga tawhito-hou a te Māori, hei hua mō te hangarau, me te pākihi e tupu matomato ai ngā ika i nga takiwā katoa o Tangaroa, me ōna mātauranga katoa.

Ko te pae tawhiti e kainamu mai nei, kia whakaoho i te hinengaro Māori o ēnei rā, ki ngā tikanga tuku iho o te pā-ika, te mārā mātaimai, te pā-tuna me āua momo hanganga. Otirā, ki te ōhia i ngā rauemi pū-taiao, ngā rauemi hangahanga o naianei hei whakarewa ano i ēnei pā hangahanga a te Māori. E tumanako ana kia rere te wairua Māori mai i te timatatanga o tēnei kaupapa rangahau, tae rawa atu ki te pūakītanga o ngā hua, ngā rauemi ki ngā hapū. Me tangata-whenua ai ngā pūkenga o te reo Māori, me ōna tikanga, me ōna mātauranga, me ona kura pākihi hoki, ki roto i ngā mahinga mōana o ngā hapū o te motu, kia whakaika te moana, kia uru-oratia te Ao-tū-roa.

This project is exploring traditional aquaculture practices to inform a hapū-based blue economy.

Indigenous cultures have practiced aquaculture in the Pacific and Aotearoa New Zealand for hundreds of years. The Hawaiian loko i'a (fishponds) and the Canadian clam gardens of today are successful examples of local, indigenous economies based on traditional aquaculture practices. Māori have been alienated from their traditional aquatic cultivation practices (TACP) and their ability to enact kaitiakitanga over marine spaces, their inherent rights as practitioners are undervalued, and their contribution to aquaculture is not yet recognised. Thus, there are no examples of aquaculture operating from a Māori paradigm.

We aim to implement this philosophy, to retrieve and re-initiate Māori TACP through a 'practice-first' approach and wānanga-based applied science research methodology. Our 3 research aims or pou (pillars) are:

1. Te Pou-Kai-Āwha – Use key meaningful engagements and wānanga to record the aronga of specific hapū TACP and establish a *Pūna Mātauranga* or corpus of mātauranga Māori to draw from.

2. Te Pou-Toko-Manawa – Examine the akoranga around legislative restrictions and limitations for hapū, establish a clear consenting pathway to initiate hapū based TACP.

3. Te Pou-Tu-a-Rongo – Use a *Tuakana-Teina* approach to develop practical examples of hapū (Māori) based restorative aquaculture, through observing the mōhiotanga of indigenous practitioners of the Pacific.

We are investigating the TACP and knowledge and practices held by our hapū partners from Whanganui and South Taranaki, and our indigenous relatives, to re-explore a hapū-based blue economy. We are applying a Tuakana-Teina approach to support the reclamation of the TACP by learning from our relatives in Hawai'i and Haida Nation (Canada), who are active practitioners. Strengthening an international indigenous practitioners' network (Aotearoa, Hawai'i, Canada where possible), we will draw on the collective wisdom to innovate new aquaculture focused mātauranga alongside our hapū partners.

This project is exploring examples of where a blue economy can honour the Treaty partnership and create space for mātauranga, kaitiakitanga and TACP centred around hapū local economies, to improve livelihoods and generate restorative aquaculture to support ecosystems that promote the health, wealth and wellbeing of hapū and their communities.

The re-connection of hapū to mātauranga, tikanga, kawa, and traditional aquaculture practice will have cascading impacts and effects for hapū including building their local blue economy. Not only will this expression of kaitiakitanga support our blue economy and an EBM approach, it will also be a catalyst for Māori development. This may include reinforcing te reo Māori retention, exploring mātauranga-based engineering, as well as supporting kaupapa Māori approaches to aquaculture, indigenous innovation, bilingual education, and potential future economic activities. These will be significant contributions to the Aotearoa blue economy and a unique point of difference benefiting all New Zealanders.

RESEARCH TEAM: Caine Taiapa (Manaaki te Awanui), Kelly Ratana (Manaaki te Awanui), Peter Van Kampen (The Nature Conservancy), Rangiroa Rongonui, Ngaruahinerangi Hapū (Iwi & Hapū Mātauranga co-ordinator – South Taranaki), Gerard Albert, Ngā Tāngata Tiaki o Whanganui (Iwi & Hapū Mātauranga co-ordinator – Whanganui)

2.15



ONGOING



Thinking outside the can: Engineering toheroa aquaculture

PROJECT LEADERS Phil Ross (University of Waikato) & Taoho Patuawa (Te Roroa)

DURATION December 2020 - June 2023

BUDGET \$250,000

This project is developing sustainable, community-based aquaculture in Te Taitokerau.

The toheroa, an iconic surf clam and taonga species, were once plentiful on the west coast beaches of Te Taitokerau and were a world-renowned kaimoana. But populations collapsed in the 1960s after decades of unsustainable harvest, and harvesting was banned. Despite more than 50 years of protection, wild toheroa populations haven't recovered.

However, spat (juvenile toheroa) still appear along the west coast in large numbers. While most of the spat will die in the wild, we believe they can be sustainably harvested to supply a community-based toheroa aquaculture industry.

On paper, toheroa are the perfect aquaculture species. Known to some iwi as 'the food of the gods', they are delicious, nutritious, fast growing and thrive at high densities. While growing wild-harvested spat on farms has been successful for the green-lipped mussel industry, we do not know if this approach will work for toheroa.

To find out if toheroa aquaculture is viable, we are working with our project partners to:

- Look at the reliability and sustainability of wild toheroa spat supply
- Determine the knowledge and technology we need to grow it in land-based aquaculture systems
- Develop capacity and capability (including educational opportunities for upcoming generations) to support iwi and community leadership and participation in aquaculture

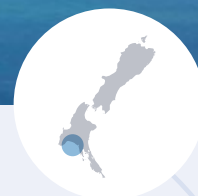
Overall, we are generating knowledge to facilitate the development of a sustainable toheroa aquaculture and create opportunities that will contribute positively to the social, cultural, economic, and ecological well-being of the people and communities of Te Taitokerau. This kaupapa may also serve as a model for other community-based aquaculture development in Aotearoa.

RESEARCH TEAM: Phil Ross (University of Waikato), Taoho Patuawa (Te Roroa), Jonny Hill (Bluetide Aquaculture), Leo Zamora (Cawthron)

2.16



ONGOING



A novel approach to aquaculture in Aotearoa

PROJECT LEADER Simon Muncaster (University of Waikato)

DURATION April 2021 – June 2023

BUDGET \$250,000

This project is growing community wellbeing with pātiki tōtara/ yellowbelly flounder.

Aotearoa New Zealand's aquaculture industry has an ambitious goal of growing into a \$3 billion industry by 2035. Aquaculture is a difficult industry for new investors, with high start-up costs and risks due to the expertise required, the expensive infrastructure, and scale of operation. Lack of diversity has also been identified as key risk to industry resilience and growth. In the past, a corporate business model focused on capital investment has been used to address these issues. Because of the high investment cost of this exclusive model, many iwi are unable to enter the aquaculture industry despite their strong connection and whakapapa as cultural guardians of the marine environment. These remote communities often suffer high unemployment and socio-economic deprivation, but still own prime coastal land.

We are co-developing a 'disruptive' community-led business model that will allow small, whānau-owned aquaculture farms with fewer resources to compete as alternate stakeholders within the industry. Pātiki tōtara/ yellowbelly flounder is a strong candidate species to achieve this.

Grounded in kaupapa Māori to reflect value across three key dimensions – social (hauora, oranga), environmental/ecological (kaitiaki) and economic (mana motuhake), our three workstreams are:

1. *Exploring the relevant mātauranga-a-hapū (knowledge of local hapū)* – To better understand the distribution, seasonal movement and feeding habits of pātiki tōtara.
2. *Co-creating a minimal viable product based on a kaupapa Māori approach* – Working with local whānau and hapū enterprise, we will co-create a minimal viable product that is acceptable to local communities. We will develop a unique 'Aquaculture Ecosystem Canvas' to show how whānau-owned aquaculture farms can co-operate to generate economies of scale and scope.
3. *Advancing the science of pātiki aquaculture and hatchery technology* – To ensure a sustainable and scalable supply of juvenile pātiki with a focus on optimising spawning protocols.

RESEARCH TEAM: Steve Bird (University of Waikato), Kura Paul-Burke (University of Waikato), Tim Coltman (University of Waikato), Jason Murray (Matakana Island Marine Club), Dicki Farrar (Whakatohea Māori Trust Board), Aubrey Te Kanawa (Ahikōmako – Centre of Māori Innovation & Entrepreneurship)



2.17



ONGOING



Kia tika te hī ika: Exploring fisheries tikanga and mātauranga

PROJECT LEADERS Maru Samuels (Iwi Collective Partnership) & Irene Kereama-Royal (Ngā Wai A Te Tūi Māori & Indigenous Research Centre)

DURATION February 2021 – December 2022

BUDGET \$250,000

This project is investigating the tikanga of ICP Iwi Partners as it relates to commercial fishing practice.

Fishing in Aotearoa New Zealand was first practiced according to tikanga (customs) within whānau, hapū and iwi, and founded in te Ao Māori. Colonisation brought laws and customs that were imposed on tikanga practices. 150 years later, the Fisheries Treaty Settlement recognised Iwi Māori as quota owners – however, they had to modify their practices and behaviours to fit in with legislation, which separated customary and commercial fishing. This is an artificial split for Māori; in the past whānau and hapū managed resources to fit the need.

We are developing transformative fisheries practice based on tikanga Māori to improve the social, cultural and ecological goals of the Iwi Collective Partnership (ICP) as an example of fisheries leadership in Aotearoa.

This research asks: *What can tikanga do to inform commercial fishing practice?*

To answer this, we are:

- Identifying and reflecting Māori knowledge systems, values frameworks, and tikanga based practices in fisheries management
- Developing case studies of where tikanga has or is being applied in specific locations or with respect to certain species of fish that are of special significance to ICP's iwi membership
- Integrating that knowledge to inform a unique fisheries management system developed in collaboration with ICP's commercial fishing partners

Research outputs will include: a literature review, interviews and videos of the case studies, a final report of the tikanga, and a future research plan for the development of a tikanga informed assessment and evaluation framework. We expect that this tikanga framework may be applicable nationally within the Iwi Māori fisheries sector.

RESEARCH TEAM: Eruera Lee-Morgan (Ngā Wai A Te Tūi Māori & Indigenous Research Centre)



2.18  ONGOING



Quantifying seafloor contact

PROJECT LEADER Oliver Wilson (Fisheries Inshore New Zealand)	
DURATION February 2021 - June 2022	BUDGET \$249,900

This project is investigating and reducing interactions between commercial fishing gear and the seafloor.

Trawling has been used for generations and is the method that catches most of our finfish. It is highly effective at catching fish but faces increasing pressure from those concerned about its impact on life on the seafloor.

Towed fishing gears and their components contact the seabed, but the effect caused will depend on the type of trawl doors and ground gear used, the way the gear is rigged, and the physical and biological characteristics of the seabed habitats.

Understanding how, when, and where trawl gear contacts the seafloor is key to evidence-based decision making. We intend to demonstrate how collecting data on current gear use can inform modifications and improvements to reduce contact where appropriate.

Phase 1: Development and deployment of bottom contact sensors

We are collaborating with ZebraTech to develop a low-cost, user-friendly sensor prototype.

Phase 2: Understand and minimise contact

The sensors will collect baseline data on points of contact (the footprint) between commonly used fishing gear and the seafloor over normal fishing operations. This baseline data will inform gear modifications to minimise and reduce contact with the seafloor.

We will trial this modified gear then compare the footprint of the commonly used gear versus the modified gear to test the effectiveness of the modifications.

Phase 3: Evidence-based decision making

We will work with the *Hawke's Bay regional study* to demonstrate how the sensor data can be used as decision-making tools for mitigating seafloor habitat disturbance by fishing gear. This research also aligns with Fisheries New Zealand (FNZ)'s Fisheries Change Programme.

We aim to produce a sensor prototype, footprints of commonly used and modified fishing gear contact with the seafloor based on real-world observational data, comparison of the footprints/maps to demonstrate changes in benthic interactions, and peer-reviewed reports.

RESEARCH TEAM: Shade Smith (Ngāti Kahungunu), John Radford (ZebraTech), Brianna King (Wild Pacific Fisheries Research), Emma Jones (NIWA), Ian Tuck (FNZ/MPI)



Risk and uncertainty

Addressing how to improve decision-making by investigating people's perceptions of risk and uncertainty, and the best ways to communicate them.

LED BY JUDI HEWITT (UNIVERSITY OF AUCKLAND)



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Being able to estimate the risk(s) associated with a course of action is necessary for any management regime; but where understanding is incomplete – ie uncertainty is high – it is difficult to assess risk.

Understanding how marine ecosystems respond to stressors is limited due to lack of knowledge – coasts and oceans are vast, dynamic, and increasingly being affected by more uses.

There is also limited understanding of how environmental variability and climate change affect ecosystem responses; how direct effects of stressors spread through social and ecological systems to create indirect effects on ecological and economic health and social and cultural values; and how sectoral, personal and cultural perceptions of risk differ.

Understanding perceptions is critical to understanding whether certain decisions and the potential consequences are acceptable to broad sectors of society.

We are investigating:

- Methods that can:
 - (i) Address risks to multiple ecosystem components, ecosystem services or values rather than single-species responses
 - (ii) Accumulate risks across multiple stressors
 - (iii) Predict sudden large changes
- How to incorporate these methods into tools for decision-makers, businesses, and other interested parties

3.1



ONGOING



Perceptions of risk and uncertainty

PROJECT LEADERS Paula Blackett (NIWA) & Shaun Awatere (Manaaki Whenua)

DURATION May 2020 - June 2022

BUDGET \$852,100

This project is investigating people's perceptions of risk and uncertainty in the marine environment and how these different experiences can improve decision-making about marine resources.

There are many ways people understand and react to risk and uncertainty. These differences can be a source of conflict in decision-making, especially in the marine environment. Given the diversity of mātauranga Māori, values and preferences, it is not surprising that some decisions made about marine resources are contested.

But there is very little knowledge on the degree to which these perceptions of risk differ and how this affects decisions. Understanding the different perceptions of risks and uncertainty is crucial to building consensus around decisions, or at least appreciating why a decision has been made.

This research is taking a grounded (case study) approach with mātauranga Māori at its centre.

This approach recognises that perceptions of risk are underpinned by many different ways of understanding and interpreting that risk.

By comparing the different ways people perceive risk and uncertainty, we will be able to inform more inclusive tools, policies, practices and processes that can improve decision-making.

The aims of this project are to identify tools, frameworks or processes that:

- Can help make marine decision-making practices more inclusive
- Address both risk and knowledge uncertainty in a way that reduces risks to the benefits derived from marine resources
- Promote Māori rights, interests and values in tools, frameworks or processes.

RESEARCH TEAM: Nikki Harcourt (Manaaki Whenua), Erena Le Heron (Le Heron Leigh Consulting Limited), Richard Le Heron (Le Heron Leigh Consulting Limited), Jade Hyslop (Manaaki Whenua)



3.2



ONGOING



Communicating risk and uncertainty

PROJECT LEADERS Joanne Ellis & Fabrice Stephenson (University of Waikato)

DURATION May 2020 - June 2023

BUDGET \$1,399,990

This project is creating guidelines, models and tools that explicitly identify risk and uncertainty, to help make decision-making more inclusive and multi-sectorial.

Decision-making tools that can communicate the degree of risk and uncertainty associated with a particular decision are urgently needed. Although there are risk assessment methods available internationally, these typically focus on single stressors and do not incorporate mātauranga Māori or ecosystem-based management (EBM).

This project addresses two overarching questions:

1. What risk assessment tools are available that incorporate uncertainty into their estimates, deal with multiple stressors, and are easy for stakeholders and Māori partners to understand and/or use?
2. How do uncertainties (and thus social and ecological risks) accumulate during decision-making?

The second question includes the:

- Uncertainties inherent in merging data from different scales – eg, scaling environmental, ecological and social information up or down to match each other or available model types

- Uncertainties and risks at separate stages of assumptions, modelling and decision-making.

The team is working with Māori*, stakeholders, investors, managers and policy makers to co-develop, and scenario test, decision-making tools that are informed by mātauranga Māori and EBM frameworks.

They are considering the cumulative effects of both marine and land-based activities – with a focus on sediment, nutrients, bottom disturbance and climate change, as these have been identified as the main stressors affecting New Zealand's marine environments.

The team will use scenario testing to integrate environmental and socio-economic risks into integrated risk analysis frameworks.

These tools will be trialled in a case study area, working with Māori researchers in the *Awhi Mai Awhi Atu* and *Perceptions of risk and uncertainty* projects.

RESEARCH TEAM: Judi Hewitt (University of Auckland), Ilze Ziedins (University of Auckland), Maria Armoudian (University of Auckland), Richard Bulmer (NIWA), Dana Clark (Cawthron), Rebecca Gladstone-Gallagher (University of Auckland), Ani Kainamu (NIWA), Vera Rullens (University of Waikato)

*In this context Māori is taken to mean iwi, hapū, whānau and/or Māori organisations.



3.3



ONGOING



Upholding the value of pāua quota

PROJECT LEADERS Stephen FitzHerbert (NIWA), Katherine Short (Terra Moana) & Tony Craig (Terra Moana)

DURATION November 2021 – June 2023

BUDGET \$325,000

This project is exploring what pāua fishery investors (quota owners, divers, processors etc) need to know to have the confidence to invest; and the relationship between risk, quota valuation and management responses

In these rapidly changing times, socially, economically and environmentally, it is essential to bring all that we can of our knowledge of science, social justice and sustainable finance to underpin rural economies and the ecosystems they depend upon.

This project brings together advances in marine science sedimentation and climate change knowledge with Māori pāua quota owners, sustainable finance, and fishery management. Alongside the marine science we will look at the risks to the rural pāua fishery from climate related sea level rise and storms to rural infrastructure such as boat ramps, wharves and roading.

With respect to the focal Wairarapa Pāua fishery (PAU2), it is imperative to uphold its value to local communities, to quota owners and to the markets that prize it as a delicacy through:

1. Understanding the risk to the fishery from climate change and sedimentation, and using that to influence investment decisions in better care for the fishery and rural communities

2. Knowing that the right management is in place and working effectively at all scales

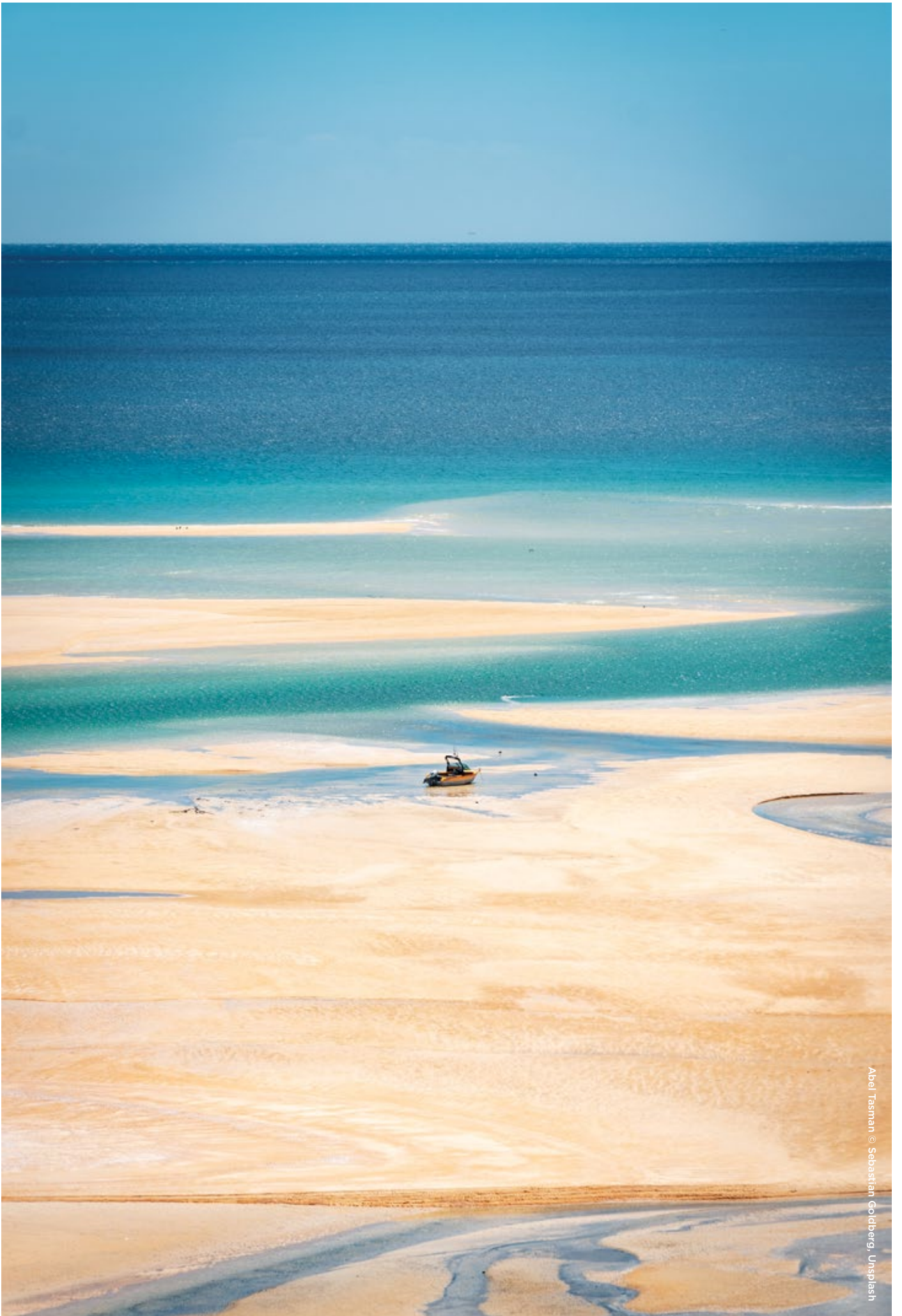
Tailored, nested management responses at various scales are essential given pāua is a sedentary coastal species. It is relevant from the fishery through to local landowners, and regional council catchment management.

With a focus on sedimentation and climate change the project is:

- Characterising the fishery
- Building quantitative and qualitative risk analysis tools
- Profiling these environmental risks as they pertain to the PAU2 Fishery
- Documenting key response strategies that are essential to reduce that risk

This mahi extends along the east coast of Te Ika-a-Māui from Southern Hawke’s Bay through the eastern border of Manawatū-Whanganui to Wairarapa.

RESEARCH TEAM: Dean Spicer (ANZ), Christine Smith (independent finance analyst), Tom McCowan (Pāua Industry Council), Tom McClurg (Toroa Strategy), Vonda Cummings (NIWA)



Abel Tasman © Sebastian Goldberg, Unsplash



Enhancing EBM practices

Investigating how practice, policy, regulation and legislation can be tailored to support EBM for Aotearoa New Zealand.

LED BY KAREN FISHER (UNIVERSITY OF AUCKLAND)



Achieving ecosystem-based management (EBM) requires institutional, regulatory and other arrangements that are tailored specifically to Aotearoa New Zealand. We also need to develop a widespread understanding of what EBM involves, and the adoption of EBM-supportive practices.

Successfully implementing EBM requires evaluating existing policies, practices and regulation to determine the extent that they enable EBM and presenting options to support policy makers, iwi and stakeholders with any changes required adopt it.

Attention to the relationship between the Treaty of Waitangi/Te Tiriti o Waitangi, the obligations arising from the Treaty, and generating an understanding of how cross-scale interactions influence EBM in practice are critical components of this research.

This research will:

- Identify and analyse a range of legal and policy options to enable both progressive and transformative change across different scales and, the practice, policy, and legislative implications involved in transition to EBM
- Deepen our understanding of the relationship between the Treaty and EBM
- Consider the implications of, and for, Treaty rights, responsibilities and obligations for the practice and implementation of EBM
- The synergies, complementarities and divergences between EBM and kaitiakitanga
- Exploring how mātauranga Māori and science can each inform decision-making whilst preserving the integrity of both



4.1



ONGOING



Tangaroa Ararau – Te Tiriti o Waitangi, Tikanga Māori and the marine environment

PROJECT LEADER Beth Tupara-Katene (Awatea Consulting)

DURATION November 2021– June 2023

BUDGET \$574,000

This project is exploring the fundamental idea of what an oceans-centric governance model could look like, unburdened by existing approaches and constraints as well as recognising and providing for the intent guaranteed to Māori under Te Tiriti o Waitangi.

In Aotearoa, our history as navigators, voyagers, explorers and mariners dates back more than a thousand years, to the times of Kupe, Kuramarotini, Huitangiora, and the Great Captains of the migration waka.

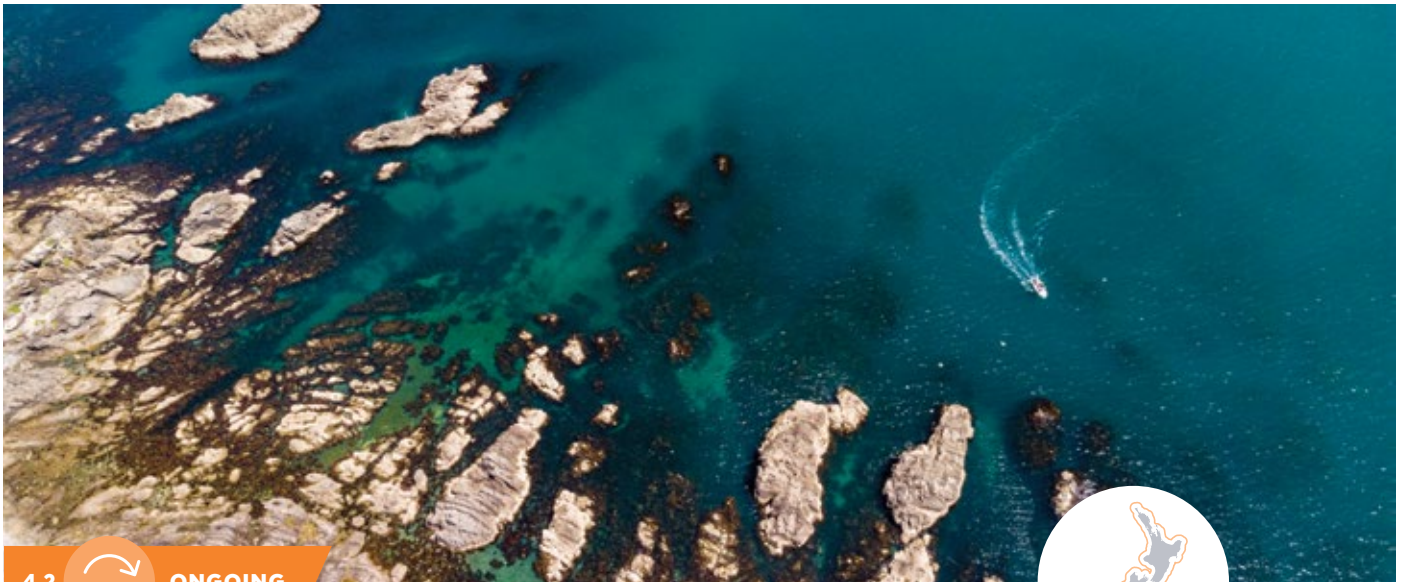
Over generations, keystone concepts emerged to continuously reinforce a synergistic relationship with Tangaroa and everything that influences the wider marine ecosystems. Complex ocean economies developed in step with ecosystem health indicators. This body of knowledge informed traditional management systems that put Tangaroa, the embodiment of the ocean's health and vitality, at the heart of decision making.

Tangaroa Ararau is exploring the myriad relationships within Aotearoa New Zealand's Oceans, to reimagine a governance system that places Tangaroa at its heart. Built upon a foundation of tikanga Māori and Te Tiriti o Waitangi, it aims to reshape our approach to the oceans, in a uniquely Aotearoa approach.

This potential system will be aspirational and far reaching in its design. And whilst fundamental features of the proposed governance model include Tikanga Māori and Te Tiriti, this potential system will be unique to, and born of, Aotearoa to reflect and connect to all its citizens.

Tangaroa Ararau, or Tangaroa of the many paths, acknowledges these many braided threads, views and journeys that have led to this moment in time.

RESEARCH TEAM: Horiana Irwin-Easthope (Whaia Legal), Toni Love (Whaia Legal), Nicki Douglas (Independent), Te Puoho Katene (Awatea Consulting), Josie Te Rata (Whaia Legal)



4.2



ONGOING



Policy and legislation for EBM

PROJECT LEADERS Elizabeth Macpherson (University of Canterbury) & Eric Jorgensen (P Jorgensen & Sons)

DURATION April 2020 – June 2023

BUDGET \$1,374,800

This project is developing a research base for policy makers, Māori and stakeholders to navigate the legislative, policy and practice constraints surrounding EBM and any changes required to enable it.

There are many laws, policies, institutions, and practices that affect the management of marine areas and resources in Aotearoa. These are often not well-integrated nor well-aligned.

This project's objective is to provide an evidence base to support policy makers, Māori organisations, iwi, hapū, whānau, industry and communities to navigate the legislative, policy and practice constraints surrounding EBM and any changes required to enable it.

We aim to identify and analyse a range of options for enabling EBM, in practice, policy, and legislation.

Research aims:

1. To identify and analyse a range of legal and policy options to enable both progressive and transformative change, and the practice, policy, and legislative implications involved in transition to EBM.

2. To understand and articulate the risk of different management options and scales in an EBM context; and create adaptive management options appropriate to fluid spatial and temporal scales.
3. To identify what opportunities exist for EBM implementation, and determine what needs to change to support successful implementation of EBM in Aotearoa New Zealand.

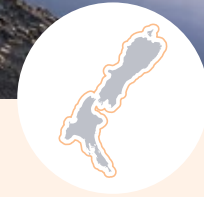
To better understand the experiences, perspectives and challenges of the diverse organisations responsible for managing marine areas and resources, our project is being co-developed with government, Māori, industry and community input.

RESEARCH TEAM: Judi Hewitt (University of Auckland), Hamish Rennie (Lincoln University), Karen Fisher (University of Auckland), Adrienne Paul (University of Canterbury), Andrew Allison (NIWA), Julia Talbot-Jones (Victoria University of Wellington), Steve Urlich (Lincoln University)

4.3



ONGOING



Enabling Kaitiakitanga and EBM

PROJECT LEADERS Lara Taylor (Manaaki Whenua) & Dan Hikuroa (University of Auckland)

DURATION June 2020 - June 2023

BUDGET \$638,900

This project is exploring how Kaitiakitanga and EBM can operate alongside one another within coastal and marine environments.

Aotearoa New Zealand's increasingly degraded coastal and marine environments are, in part, a consequence of the radical ecological changes following colonisation.

The colonising processes sidelined mātauranga Māori and kaitiakitanga-based environmental management in favour of western scientific knowledge, and associated environmental management and governance approaches.

We need new marine management approaches that incorporate multiple forms of knowledge, including scientific and mātauranga Māori.

Any new approach must also address Māori rights, interests and values as Treaty partners, mana whenua and kaitiaki.

This project explores how science and mātauranga Māori – the knowledge systems informing ecosystem-based management (EBM) and Kaitiakitanga – can better inform the

governance and management of the marine and coastal environments of Aotearoa.

This project explores two key questions:

1. What are the alignments and differences between Kaitiakitanga and EBM, and how can these approaches successfully work together?
2. How can place-based practitioners, policy makers and others engaged in EBM bring both science and mātauranga Māori together to underpin decision making?

The project team is co-developing a practical kete of strategies and tools that practitioners can use for collaborative, Tiriti-based, kaitiakitanga and EBM approaches in environmental governance and management at local, regional and national scales.

The Project Advisory Group is comprised of diverse experts from across the three spheres of influence: rangatiratanga, kāwanatanga and relational.

RESEARCH TEAM: Meg Parsons (University of Auckland), Karen Fisher (University of Auckland), Jarrod Walker (Tataki Ltd)



4.4



ONGOING



Scale and EBM

PROJECT LEADER Joanne Ellis (University of Waikato)

DURATION April 2022 - December 2023

BUDGET \$400,000

This project is improving understanding and communication of scale-dependencies for EBM.

Ecosystem-based management (EBM) is a dynamic process, focused on understanding and managing ecosystems across a range of organisational (eg iwi, hapū and whānau; local councils, regional councils and central government agencies), spatial (eg local, regional, national) and temporal scales (eg past, present and future effects).

Despite the importance of scale, scale-dependency in different disciplines, and the interactions between them, is rarely explicitly stated and acknowledged as affecting both the decision-making process and its success.

While some Sustainable Seas research explicitly focuses on producing results for different scales, there are gaps in understanding of how EBM can be achieved across a variety of scales. Scale also influences components that may have to change if jurisdictional boundaries or management resolutions are changed, such as the prediction of impacts from cumulative interactions, the return periods of events for

management, or the creation of spatial and temporal rules for consenting.

To support development of decision-making practices that explicitly identify scale and scale-dependencies to increase the success of EBM decision-making processes we are:

1. Reviewing existing knowledge of scale dependencies from other Sustainable Seas projects.
2. Analysing scale-dependencies, specifically in the legal-policy, ecological, socio-psychological, mātauranga Māori and economic realms.
3. Creating visual summaries to aid understanding of cross-scale implications and contribute to robust, transparent decision making.

RESEARCH TEAM: Judi Hewitt (University of Auckland), Simon Thrush (University of Auckland), Karen Fisher (University of Auckland), Taciano Milfont (University of Waikato), Elizabeth Macpherson (University of Canterbury), Erica Williams (NIWA), Eric Jorgensen (P Jorgensen & Sons), Ani Kainamu (NIWA)



EBM and blue economy in action

Working with stakeholders and Māori partners to undertake real-world trials of the EBM knowledge and tools our research is generating.

LED BY CHRIS CORNELISEN (CAWTHRON)



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This research draws together knowledge and tools (ie models, frameworks, guidelines and indicators) from across the Sustainable Seas Challenge for use in implementing EBM and developing the blue economy.

Co-development and co-implementation with stakeholders and Māori partners are critical to ensure the outputs are well targeted and usable in the real world.

Research activities include:

- Integrating knowledge from across Sustainable Seas to produce high impact outputs for use in implementing EBM
- Developing novel outputs that effectively communicate the use and limitations of tools in a manner that maximises future uptake
- Facilitating regional studies, co-developed and co-implemented with stakeholders and Māori partners, to trial EBM tools and approaches to marine management and the development of blue economy initiatives

S1



ONGOING



Hawke's Bay regional study

PROJECT LEADER Carolyn Lundquist (NIWA/University of Auckland)

DURATION August 2019 - June 2022

BUDGET \$300,000

This collaboration is mapping environmental stressors, their interactions, and providing guidance for reducing their impacts.

We are working with stakeholders and iwi partners in Hawke's Bay to take a holistic approach to local marine management. Our focus is on implementing ecosystem-based management (EBM) in a real-world example by combining science and mātauranga Māori with the tools and resources from our previous research.

STAGE 1 (COMPLETE)

We worked closely with the HBMaC Group, stakeholders and iwi to develop a conceptual map of stressors and their impact. The systems map focused on two marine stressors: freshwater sedimentation and loss of benthic (seabed) structure. This map helps identify mechanisms and levers to inform critical levels of these stressors and their interactions.

STAGE 2

Based on priorities identified by HBMaC in consultation with the project team, we are adapting EBM tools to identify and prioritise potential management or policy options, and/or fill gaps in both scientific and

mātauranga knowledge identified by the systems mapping.

WHY HAWKE'S BAY?

Hawke's Bay has a diverse coastal marine ecosystem with sandy beaches, intertidal reefs, dunes and estuaries. The region has large river systems, fisheries, productive lands and ocean outfalls that can add stress to the marine system and impact on people's values for the coastal area.

WHAT ARE MARINE STRESSORS?

Marine stressors include contaminants or sediment from the land, climate change, habitat loss and fisheries activities.

WHO ARE HBMaC?

Hawke's Bay Marine and Coastal Group (HBMaC) is a multi-stakeholder group that includes recreational and commercial fishers, tangata whenua and government agencies, and is chaired by Hawke's Bay Regional Council science staff.

RESEARCH TEAM: Justin Connolly (Deliberate), Anna Madarasz-Smith (HBRC), Becky Shanahan (HBRC), Ellen Robotham (HBRC), Barry Lynch (HBRC), James Whetu (Whetu Group), Richard Bulmer (NIWA), Andrew Allison (NIWA), Ian Tuck (MPI/FNZ)



S2



COMPLETED



Synthesis of Tasman Bay and Golden Bay Phase I research

PROJECT LEADER Emma Newcombe (Cawthron)

DURATION October 2019 – March 2020

BUDGET \$30,000

This project integrated knowledge from our previous research in Tasman and Golden Bays to inform the production of useful tools and resources to carry out EBM.

During 2014 – 2019 (Phase I), many of our research projects were focused on the Tasman Bay / Te Tai-o-Aorere and Golden Bay / Mohua areas.

To maximise accessibility and use of this knowledge, we:

- Collated Phase I research, data and findings relevant to the Tasman Bay – Golden Bay area
- Identified the best opportunity for synthesising Phase I research to provide the knowledge needed to support EBM in Tasman Bay – Golden Bay

This information is informing the whakatutuki mahi being done to bring together the knowledge, tools and resources generated into end-user focused formats to support implementation.

WHY TASMAN AND GOLDEN BAYS?

This area includes both coastal and offshore waters, and a variety of marine environments; as well as many different uses, activities and interests – some of which are competing. This diversity is a good basis for developing initial the tools and knowledge needed for EBM.

RESEARCH TEAM: Chris Cornelisen (Cawthron), Marc Tadaki (Cawthron), Dana Clark (Cawthron), Charlotte Šunde (Cawthron)



S3



COMPLETED



Synthesis of Tangaroa Phase I research

PROJECT LEADERS Lara Taylor (Manaaki Whenua)

DURATION March 2020 - September 2020

BUDGET \$70,000

This project aimed to draw together insights and learnings from our previous research to ensure the significant Tiriti o Waitangi/Treaty of Waitangi, cultural, legal and commercial interests of Māori are emphasised and appropriately integrated into future research and tools, information and resources.

This project reviewed, identified and pulled together common themes and elements from across our 2014 - 2019 research illustrating a wealth of mātauranga Māori made available in a range of different forms.

The insights and learnings are relevant to enabling uniquely Māori ways of knowing and doing in our marine seascape. They will support iwi, hapū and Māori organisations and contribute to achieving the Challenge's mission.

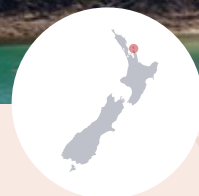
The team identified oranga (well-being) as a central overarching motivation and aspiration driving the relationship of Māori to the marine environment. In Te Ao Māori terms this reflects an interdependence founded in whakapapa, that informs relationships and responsibilities.

A set of options for taking these findings forward was provided in the form of a set of recommendations and discussion grouped under four pou:

- Ngā Uara - Values
- Ngā Whakanōhanga me ngā tikanga ā rawa - Institutions and property rights
- Ngā kahapupuri me ngā āheitanga - Building and strengthening capacity and capability
- Ngā auahatanga me to ōhanga - Innovation and economy

The ideas and recommendations directly informed the development of our Synthesis Plan (available via the website), and where possible have also been incorporated across a range of Phase II projects. Ultimately, they will inform the co-development of information, tools and resources for target audiences from our 2019 - 2024 research.

RESEARCH TEAM: Jason Mika (University of Waikato), Melanie Mayall-Nahi (Ngāti Whātua o Kaipara), Suliasi Vunibola (Massey University)



S4



ONGOING

EBFM in the Hauraki Gulf

PROJECT LEADERS Darren Parsons (NIWA) & Alexandra Schwaab (Fisheries New Zealand)

DURATION May 2021 - April 2022 (Stage 1)

BUDGET \$80,000 (Stage 1)

This project is developing a monitoring and indicator framework for the Hauraki Gulf Marine Park.

In moving towards a holistic, inclusive, and integrated approach to managing the marine environment in Aotearoa New Zealand, an important step is for our fisheries to be managed using an ecosystem-based fisheries management approach (EBFM).

In 2021, the Government released the *Revitalising the Gulf* strategy and recommendations to restore the health and mauri of the Hauraki Gulf Marine Park. It outlines 8 themes: fisheries, habitat restoration, aquaculture, biosecurity, marine protection, protected species, ahu moana, and governance.

In response to the fisheries theme, Fisheries NZ and DOC are developing a draft Hauraki Gulf Fisheries Plan that seeks to progress EBFM approaches. We are working together to co-develop a project proposal for a case study of fisheries indicators and monitoring framework (Stage 1).

To assess the overall ecosystem health of the Hauraki Gulf, and determine if and how the Fisheries Plan is progressing us towards our goals for EBFM, first socially acceptable indicators must be selected that most accurately reflect the status of the fishery and ecosystem in the marine park. These indicators need to monitor the status of fisheries and other cultural, socio-economic and ecosystem components of value to iwi and stakeholders.

RESEARCH TEAM: Ministry for Primary Industries (MPI), Fisheries New Zealand (FNZ), Department of Conservation (DOC)

S5



ONGOING



Waikato Regional Council coastal plan review

PROJECT LEADER Karen Fisher (University of Auckland)

DURATION April 2021 - October 2022

BUDGET \$150,000

This project is supporting the Waikato Regional Council to review their Regional Coastal Plan with the principles of ecosystem-based management.

Waikato Regional Council (WRC) is currently reviewing its Regional Coastal Plan as part of the review process under the Resource Management Act to update provisions as necessary, and take into account legislative changes.

The aim of this project is to support WRC in meeting its duties and obligations by applying research from Sustainable Seas and the principles of ecosystem-based management (EBM).

Researchers from Sustainable Seas are working alongside WRC to identify possibilities to support the inclusion of EBM principles within a policy setting for the revised coastal plan, which other Regional Councils will be able to draw on when reviewing their own coastal plans.

RESEARCH TEAM: Julie Hall (Sustainable Seas Challenge), Judi Hewitt (Sustainable Seas Challenge), Linda Faulkner (Sustainable Seas Challenge), Conrad Pilditch (Sustainable Seas Challenge), Chris Cornelisen (Sustainable Seas Challenge), Hannah Palmer (Place Group Limited), Angus McKenzie (Place Group Limited), Nancy Willems (Place Group Limited)



S6



ONGOING



Marlborough Sounds regional study

PROJECT LEADERS Vonda Cummings (NIWA), Oliver Wade (Marlborough District Council), Eric Jorgensen (Marlborough Sounds Integrated Management Trust), Larnce Wichman (Marlborough Sounds Integrated Management Trust)

DURATION December 2020 – February 2024

BUDGET \$345,000

In this collaboration, we are investigating how EBM can be used to manage shellfish populations in the Marlborough Sounds.

The Marlborough Sounds is a large, diverse, and ecologically valuable area. The idea of an ecosystem-based management (EBM) case study with a shellfish focus was co-developed at workshops attended by representatives of iwi and stakeholders from the Marlborough community, central, regional, and local government, as well as researchers.

Stage 1: Together with our co-developers, we identified the specific focus and the pathway for trialling EBM of shellfish in the Marlborough Sounds area. Our findings were discussed and agreed at an end-of-stage in-person workshop, then used to develop Stage 2.

Stage 2: We are:

- Developing a method for shellfish-ecosystem evaluation and management in a region of stakeholders with diverse interests and values

- Producing a decision support tool – an interactive (and updatable) mapping product to:
 - » Visualise the current state, and state of knowledge, of shellfish and their habitats
 - » Prioritise EBM activities and future restoration efforts

These will improve EBM practises, providing a pathway and plan for improving shellfish populations and habitats that can guide future management actions and priorities including identifying local aspirations for shellfish recovery, and the information and activities required to achieve these.

We are engaging with iwi, stakeholders and decision-makers, and will hold virtual and in person workshops (at least three) at specific stages of the project.

RESEARCH TEAM: Vera Rullens (Contractor), Jane Halliday (NIWA), James Williams (NIWA), Sean Handley (NIWA), Emma Toy (Marlborough District Council)



S7



ONGOING



Ki uta ki tai: Estuaries, thresholds and values

PROJECT LEADERS Drew Lohrer (NIWA) & Alex Herzig (Manaaki Whenua)

DURATION September 2021 – September 2023

BUDGET \$450,000

This project is assessing the interactions between loadings of different contaminants from freshwaters on the health and functioning of estuaries.

The health and functioning of estuaries are affected by contaminants (stressors) from freshwater. These stressors interact with each other, causing cumulative effects. The *National policy statement for freshwater management* does not include yet how to assess stressor interactions.

Sustainable Seas and Our Land and Water National Science Challenges are working together to run a combined programme of work, in partnership with Te Rūnanga ō Ngāti Whakahemo, Te Ao Mārama Inc (Ngai Tahu ki Murihiku), and the Ministry for the Environment (MfE), to address this gap.

In case study estuaries, Māori researchers will work with whānau, hapū, iwi and local community groups to identify aspirations for their estuary, and present uses and stressors.

Informed by mātauranga Māori, this mahi/work will:

- Identify contaminant thresholds required to restore the ecological structure and function and the mauri of estuaries

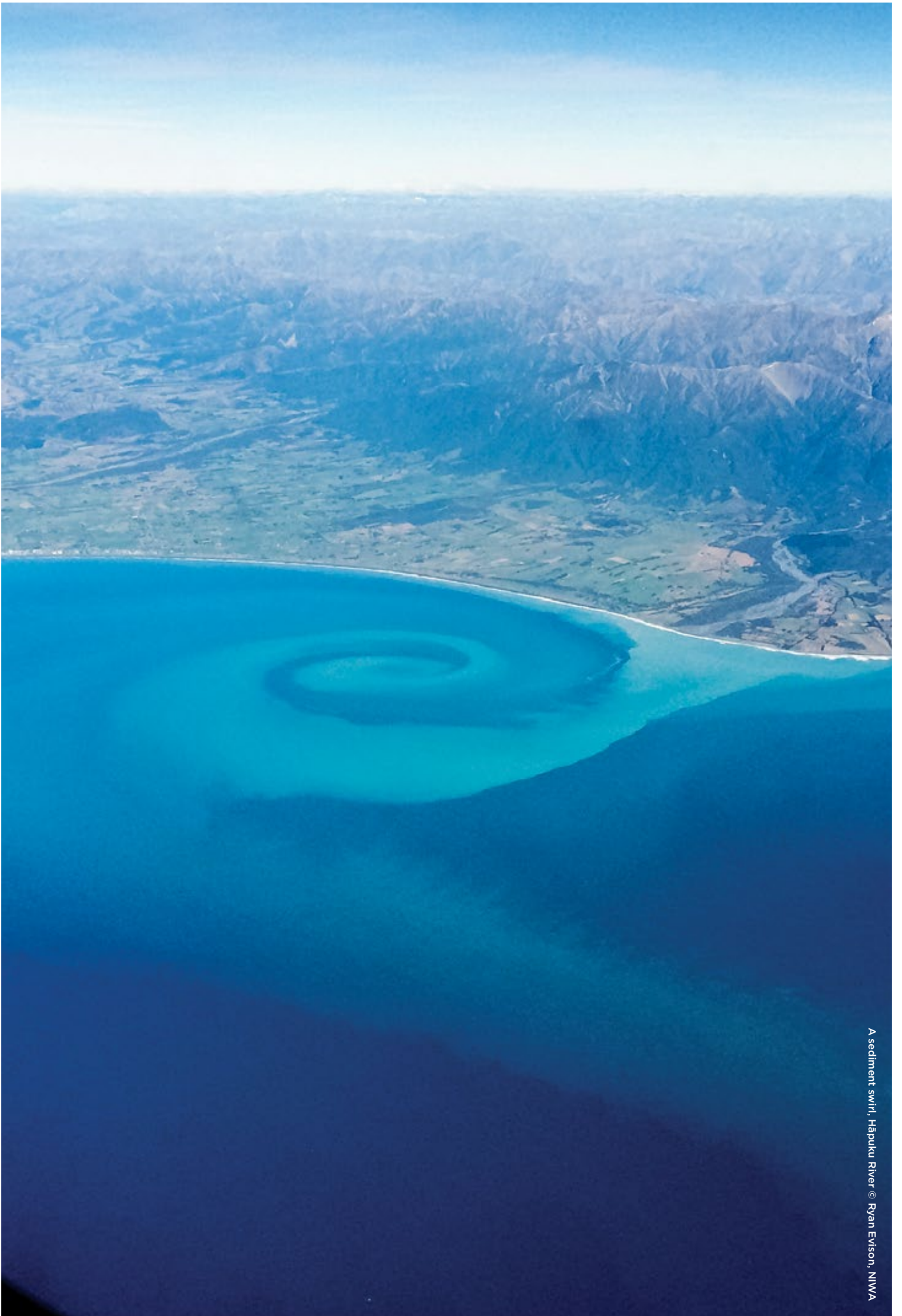
- Assess the impact of identified contaminant thresholds on catchment land use and whether thresholds can be achieved considering realistic land-management options
- Identify health indices and tohu to inform the management priorities for enhancing estuarine functionality and its mauri

The research focuses on the Kaipara, Waihi and New River estuaries. These case studies represent different estuary types and sizes with different surrounding land uses and climates.

The collaboration with MfE is a critical part of extending this research nationally, including:

- Spatial and temporal ecological analyses in 12 estuaries nationwide
- Landcover and freshwater input assessments for more than 200 estuarine systems all around Aotearoa New Zealand

RESEARCH TEAM: Shaun Awatere (Manaaki Whenua), Kura Paul-Burke (MUSA Environmental), Jane Kitson (Kitson Consulting), Conrad Pilditch (University of Waikato), Rich Bulmer (University of Waikato), Candida Savage (University of Otago), Dana Clark (Cawthron), Patricia Clark (IKHMG), Andrew Neverman (Manaaki Whenua), John Dymond (Manaaki Whenua), Sandy Elliot (NIWA), Ton Snelder (Land Water People)



A sediment swirl, Hāpuku River © Ryan Evison, NIWA

How we make our research findings and resources accessible

WHAT WE PRODUCE

As well as academic research papers, we produce a variety of printed and multimedia content.



Academic publication

Published peer-reviewed journal articles, books and book chapters (some require a subscription)



Model

A simplified description, often mathematical, of a system or process, to assist calculations and predictions



Dataset

Publicly available datasets or metadata catalogue entries



Presentation

From webinars, conferences or public events; may be a recording and/or a pdf of the slide deck



Digital tool

A mobile app or a website



Report

Project reports detailing research findings



Graphic

Images, (info)graphics, diagrams, and data visualisation



Summary

Print summaries including: research round-ups, discussion papers, Research Book 2021, impact case studies, executive summaries of reports



Guidance

Recommendations, briefing documents, frameworks and processes



Video

Plain language short films about our research and relevant issues



Map

A visual diagram or graphic to show physical and other features

HOW TO FIND WHAT YOU'RE LOOKING FOR

The website is a great first stop – all of our projects, tools and resources are colour-coded, and tagged by *location*, *resource type*, and *topic* to help you search and sort.

There's something for everyone! Here's some examples.

Regional Council scientist

Looking for:
Information about marine monitoring

MPI aquaculture planner

Looking for:
Aquaculture and marine spatial planning resources

Teacher

Looking for:
Multimedia resources for Seaweed

Hapū

Looking for:
Research happening in their rohe, Bay of Plenty/ Te Moana-a-Toi

sustainableseaschallenge.co.nz

Project, tool & resource finder

Use one, some or all the filters below to explore our projects, research outputs and resources.

Search projects and/or tools and resources:

Enter keyword or key phrase

Filter by:

Location Tools & resources type Topic

All Projects Tools & resources

Tools and resources for marine managers

- Monitoring estuaries in a changing world: Lessons for designing long-term monitoring programmes
- Using ecosystem service bundles to improve marine management
- Monitoring for tipping points in the marine environment
- Managing the impact of turbidity, nutrients and sea level rise on coasts and estuaries

[+ more](#)

Aquaculture: Tools, resources and research

- Filling gaps in marine data using Gradient Forest models
- Futureproofing the green-lipped mussel aquaculture industry against ocean acidification
- Stocktake and characterisation of Aotearoa New Zealand's seaweed sector: Species characteristics and Te Tiriti o Waitangi considerations

[+ more](#)

EBM: a remedy for Aotearoa New Zealand's oceans

- Hui-te-ana-nui: Kaitiakitanga cards
- Ocean Plastic Simulator
- Science Learning Hub collection
- Carbon cycle within a seaweed farm

[+ more](#)

Where's our research happening?

- Ngā Tohu o te Ao: Maramataka and marine management
- Awahi Mai Awahi Atu: Enacting a kaitiakitanga-based approach to EBM

[+ more](#)



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