National SCIENCE Challenges

SUSTAINABLE SEAS

Ko ngā moana whakauka

Core research project portfolio for Phase II (2019–2024)

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Introduction

The Sustainable Seas National Science Challenge is pleased to present the core research project portfolio for Phase II of the Challenge.

The Challenge Objective is:

"To enhance utilisation of our marine resources within environmental and biological constraints"

and our Mission is:

"To transform Aotearoa New Zealand's ability to enhance our marine economy, and to improve decision-making and the health of our seas through ecosystem-based management".

Delivering on the Objective requires extensive knowledge of ecological functioning and how it is affected by human activities, the economic potential of marine resources, and the social, cultural and environmental values that must be balanced through effective management and decision-making.

Ecosystem Based Management (EBM) is a holistic and inclusive approach to managing marine environments and competing uses for them, demands on them and the ways New Zealanders value them and to support healthy resilient marine ecosystems. Drawing on traditional knowledge, international literature and discussions with marine managers, Sustainable Seas determined that the best way to meet its objective is to provide research that will underpin an EBM approach specifically for Aotearoa New Zealand's unique needs and aspirations. Using an EBM approach will lead to fundamental changes in the way we manage our marine environment and the future development of our blue economy.

This holistic approach enables consideration of, multiple and cumulative stressors on marine ecosystems, scientific and mātauranga knowledge and risk and uncertainty in decision making. EBM tailored for New Zealand circumstances will provide for co-governance in the context of the Treaty of Waitangi partnership where the rights and perspectives of Māori are central to all questions of healthy and prosperous ecosystems. It will also allow for adaptive management approaches and more transparent decision-making processes.

Sustainable Seas will provide underpinning research and tools to support the design and implementation of an EBM approach tailored to Aotearoa New Zealand. Partnering with central and regional government, Māori, industry and other stakeholders is critical for the implementation of EBM and the success of the Challenge.

The development of a blue economy will also be supported by EBM through underpinning sustainability of healthy marine ecosystems. A blue economy is not a 'business as usual' marine economy. Rather, it builds sustainable economic value through investment and production practices that balance growth with a focus on value-add, the long-term ecological health of marine ecosystems, and local, regional and national sustainable development goals. A blue economy recognises all dimensions and beneficiaries of the marine economy and all values that marine environments currently produce. This vision of marine economy is increasingly expected by ethical investors, global consumers and Aotearoa New Zealand's key global economic and political partners. This aligns with New Zealand's movement toward transforming how it defines and understands success, particularly economic success. Many public and private-sector leaders are looking beyond short-term financial targets and reviewing how to safeguard our future prosperity and create sustainable wealth. This is consistent with a Te Ao Māori approach where intergenerational well-being and prosperity is at the heart of decision-making. The Treasury, Ministry for the Environment and Statistics NZ are also investigating the best way to value our natural capital.

Sustainable Seas National Science Challenge will measure its success by:

- Sustainable Seas research being incorporated into policy frameworks to support EBM;
- Tools and knowledge developed being used in decision-making for the marine environment;
- Proof of concept for an EBM approach to marine management has been successfully demonstrated;
- A vibrant blue economy is developing regionally and nationally, enabled by Sustainable Seas research;
- Māori knowledge, rights, interests and values underpinning our outputs; and
- Science from the Challenge has been published high-quality international journals;

Implementation of the research is critical to developing EBM as an approach for marine management in New Zealand. We will achieve this by:

- Co-developing proposals with Māori and stakeholders;
- Involving Māori and stakeholders, particularly environmental managers, directly in research projects;
- Engaging and co-designing outputs with Māori and stakeholders to ensure they are fit for purpose;
- Applying Vision Mātauranga to all Themes and Programmes;
- Implementing multiple case studies of EBM approaches to decision-making; and
- Ensuring that data collected are widely and freely available.

Development of core research project portfolio

The core research projects (Table 1) which are critical to meeting the Challenge objective have been identified based on research conducted in Phase I, the Strategy for Phase II (2019-2024), input gathered from six co-development workshops with iwi and stakeholders held in January and February 2019 and the feedback on the draft portfolio from the Challenge Kāhui, Stakeholder Panel and Independent Science Panel and workshop participants.

This portfolio of core research projects contains concept outlines of each project, not fully developed proposals, as we will be co-developing the research projects with Māori and stakeholders and do not want to pre-empt this process. They do however clearly identify the research that is required.

The core research project concepts have been developed for each of the following Themes and Programme (Figure 1).

- Theme 1: Understanding degradation and recovery in social-ecological systems;
- Theme 2: Creating value from a blue economy;
- Theme 3: Addressing risk and uncertainty;
- Theme 4: Enabling Ecosystem-based management;
- The Tangaroa programme.

To draw together all knowledge and tools developed by the research projects, and to ensure an overall pathway to implementation of the Challenge, the activity "**EBM and the blue economy in action**" has been developed.

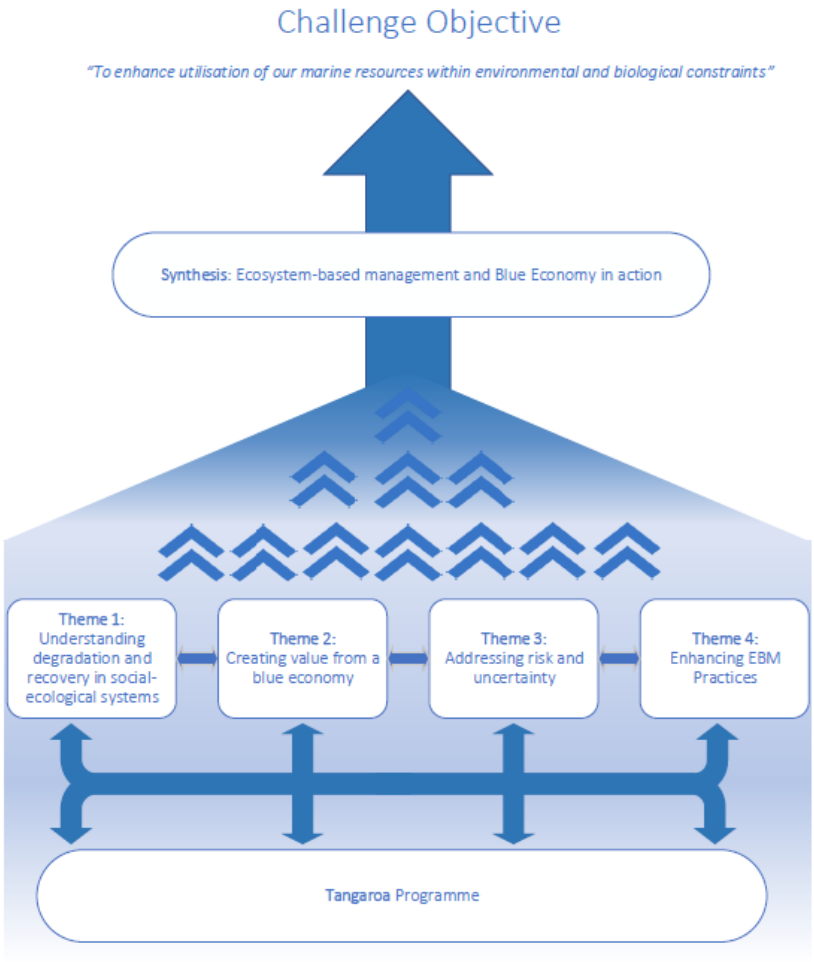

Figure 1: Sustainable Seas Phase II Challenge Structure

Please note that there is not a full set of project concepts under Theme 2: Creating value from a blue economy. Following feedback received, we have decided that further engagement in the next few months with Māori and stakeholders is needed to more fully develop this Theme.

Table 1: Indicative Phase II Project budgets (2019 – 2024)

REVISED* Draft Full Phase II Proposed Budget 2019-2024	
5,004,000	**Theme 1: Understanding degradation and recovery in social-ecological systems**
3,904,000	1.1 Understanding ecological responses to cumulative effects
1,100,000	1.2 Tools for incorporating ecological responses to cumulative effects into management action
3,216,900	**Theme 2: Creating value from a blue economy**
75,000	Transitioning to a blue economy in New Zealand
3,141,900	Hold for future projects
2,502,000	**Theme 3: Addressing risk and uncertainty**
852,100	3.1 Perceptions of risk and uncertainty
1,399,900	3.2 Communicating risk and uncertainty to aid decision-making
250,000	3.3 Risks to businesses from investment and environmental uncertainty
2,038,400	**Theme 4: Enhancing Ecosystem-based management (EBM) practices**
227,500	4.1 Treaty Relationships and EBM
474,100	4.2 Options for policy and legislative change to enable EBM
246,500	4.3 EBM and Kaitiakitanga
189,600	4.4 Science and mātauranga working together
900,700	4.5 Enabling EBM at different scales
3,931,700	**Tangaroa Programme**
1,073,700	T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM
902,800	T2 Huatuakina o hapu e!
580,900	T3 Ngā Tohu o te Ao
600,100	T4 Te Tāhuhu Matatau o Tangaroa, mai Tauranga Moana ki te Ao: Empowering the kaitiaki of Tangaroa from Tauranga Moana to Aotearoa and beyond
298,900	T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment
475,300	Hold for future projects
3,893,400	**Synthesis: Ecosystem-based management and blue economy in Action**
1,600,000	**Vision Mātauranga**
4,000,000	**Innovation & Opportunities Fund***
900,000	**Post Doc**
27,086,400	**TOTAL RESEARCH BUDGET**

***5Jun2019: Budget revised** - *a Challenge Governance decision has been made to hold $1,000,000 of the Innovation & Opportunities Fund as part of the overall Challenge Contingency budget, with the intention it will be used for Innovation & Opportunities Fund initiatives should it not be required elsewhere*

The projects are clearly linked to the Road Map of outputs and outcomes for the Challenge that has been developed for Phase II of the Challenge (Theory of Change Outputs and Outcomes; Tables 2 and 3). These links will be identified in more detail as the full project proposals are developed and the outputs of the projects identified in detail.

Table 2: Phase II project links to Theory of Change **Outputs**

		Theme 1: Understanding degradation and recovery in social-ecological systems		Theme 2: Creating value from a blue economy	Theme 3: Addressing risk and uncertainty			Theme 4: Enabling EBM					Tangaroa Programme					Synthesis: EBM and BE in action
		1.1	1.2	2.1	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5	T1	T2	T3	T4	T5	
a.	Biophysical and socio-ecological knowledge that supports the development of understanding and tools that underpin EBM as a viable approach to managing Aotearoa New Zealand's marine environment developed and accessibly packaged.	■	■				■				■	■	■					■
b.	Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised.	■			■					■	■	■	■	■	■	■	■	■
c.	Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated.							■	■	■				■	■		■	■
d.	Decision-making processes that recognise risk and uncertainty evaluated, developed, and demonstrated.				■	■												■
e.	Scales of management and place-based strategies that reduce environmental risks are identified and demonstrated.								■			■					■	■
f.	Tools for predicting and managing cumulative and multiple stressors developed, assessed and demonstrated.	■	■			■												■
g.	Governance and policy practices that support EBM identified, evaluated and packaged for targeted decision-makers.							■	■			■						■
h.	Frameworks for decision making that consider multiple values and blue economy activities developed and evaluated.																	■
i.	Guidelines developed, opportunities identified and innovations, for transitioning to a blue economy for businesses operating in the marine sector.			■			■											■
j.	Guidelines for participation in EBM decision-making processes evaluated, refined and packaged for targeted iwi, stakeholders and decision-makers.													■				■
k.	Pathways for knowledge, understanding and skills developed by the Challenge to be understood by iwi and stakeholders are developed.													■		■		■
l.	Remaining knowledge gaps that increase environmental risks of decision making are identified for iwi and stakeholders.					■												■

Table 3: Phase II project links to Theory of Change **Outcomes**

		Theme 1: Understanding degradation and recovery in social-ecological systems		Theme 2: Creating value from a blue economy	Theme 3: Addressing risk and uncertainty			Theme 4: Enabling EBM					Tangaroa Programme					Synthesis: EBM and BE in action
		1.1	1.2	2.1	3.1	3.2	3.3	4.1	4.2	4.3	4.4	4.5	T1	T2	T3	T4	T5	
1	The value of blue economy business models is recognised and adopted by Aotearoa New Zealand businesses	■	■	■			■											■
2	Decision-making practices that are more inclusive, multi-sectorial and account for the effects from cumulative and multiple activities are adopted	■	■		■	■			■									■
3	Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy	■	■					■			■				■	■	■	■
4	The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled							■	■	■		■	■	■	■	■	■	■
5	Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing				■	■	■		■			■						■
6	EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi							■	■			■	■	■				■
7	Māori rights, interests and values are supported through the application of EBM				■	■		■	■	■	■			■				■
8	Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

All the research projects will feed into the "EBM and blue economy in action" synthesis. The synthesis knowledge and the regional case studies will enable knowledge and tools (i.e., models, frameworks, guidance, indicators) developed in Phase I, and Phase II to be trialled, evaluated and refined for future implementation in EBM. Projects within each Theme and Tangaroa are closely linked and links and dependencies with other projects have been identified within these project concepts.

A strong Vision Mātauranga oversight will be maintained across the breadth of the Challenge research, and its approach to working with Māori. This will be achieved through resourcing specific support and initiatives that will assist and guide science leaders and researchers in the application of the Vision Mātauranga Policy to ensure clear and beneficial pathways for the delivery and uptake of research outcomes for Māori. This will include proactively creating and supporting mechanisms for building capability and capacity, as well as effective engagement, communication and relationship management with iwi, hapū and Māori organisations.

Funds have also been set aside for an Innovation and Opportunities Fund. This fund is designed to support small, co-funded opportunities, i.e., innovative blue economy initiatives and opportunities for collaboration with regional and central government and other national science challenges. The development of Innovation and Opportunity fund projects will be initiated in late 2019.

The timeline for each of the projects is outlined in Figure 2. It should be noted that all projects spanning more than the initial two years will be reviewed in mid-2021 to ensure that the projects are delivering what is needed to meet

the Objective and remain a priority for the Challenge. The final year of the Challenge, 2023-2024, will focus on the synthesis of all knowledge and tools developed during the life of the Challenge to ensure the overall outcome of the Challenge is greater than the sum of the parts.

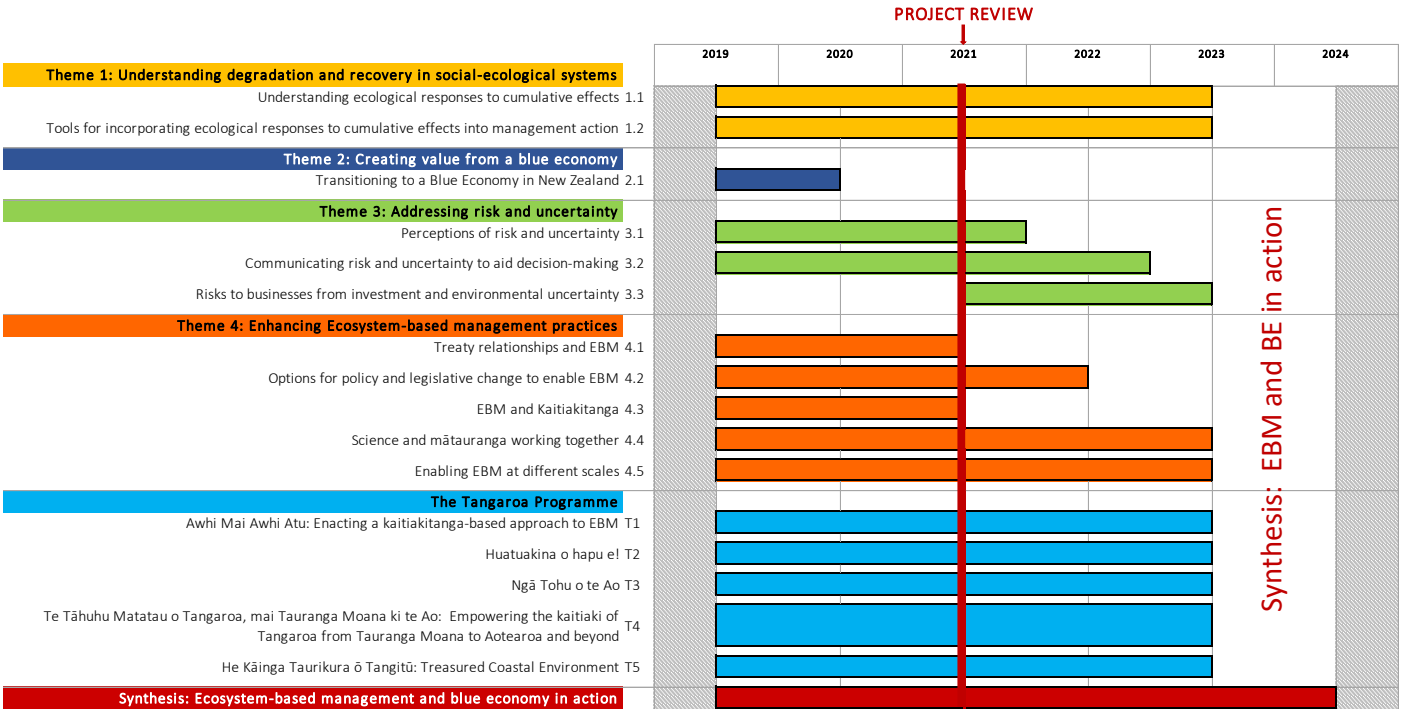

Figure 2: Phase II project timelines

Next steps

- Project Leaders identified, and the best teams for developing full project proposals identified. This will include discussions with Māori and stakeholders regarding their involvement in the co-development of the research projects. Late June-July 2019.
- Project proposals are co-developed with Māori and stakeholders. Late July to end September 2019.
- Project proposals are peer reviewed. October 2019.
- Funding for projects in portfolio are approved. November 2019.
- Contracting of projects. November 2019.

Synthesis: Ecosystem-based management and blue economy in action

Indicative Phase II budget: $3,893,400

Synthesis will focus on ensuring that the overall outcome of the Challenge is greater than the sum of the individual research projects. It will draw together knowledge and tools (i.e., models, frameworks, guidelines and indicators) from all the projects in Phase I and II to synthesis the knowledge for use in implementing EBM and in developing the blue economy (Figure 3). The research undertaken will require considerable co-development and co-implementation with iwi and stakeholders to ensure the results are well targeted and usable in the real world.

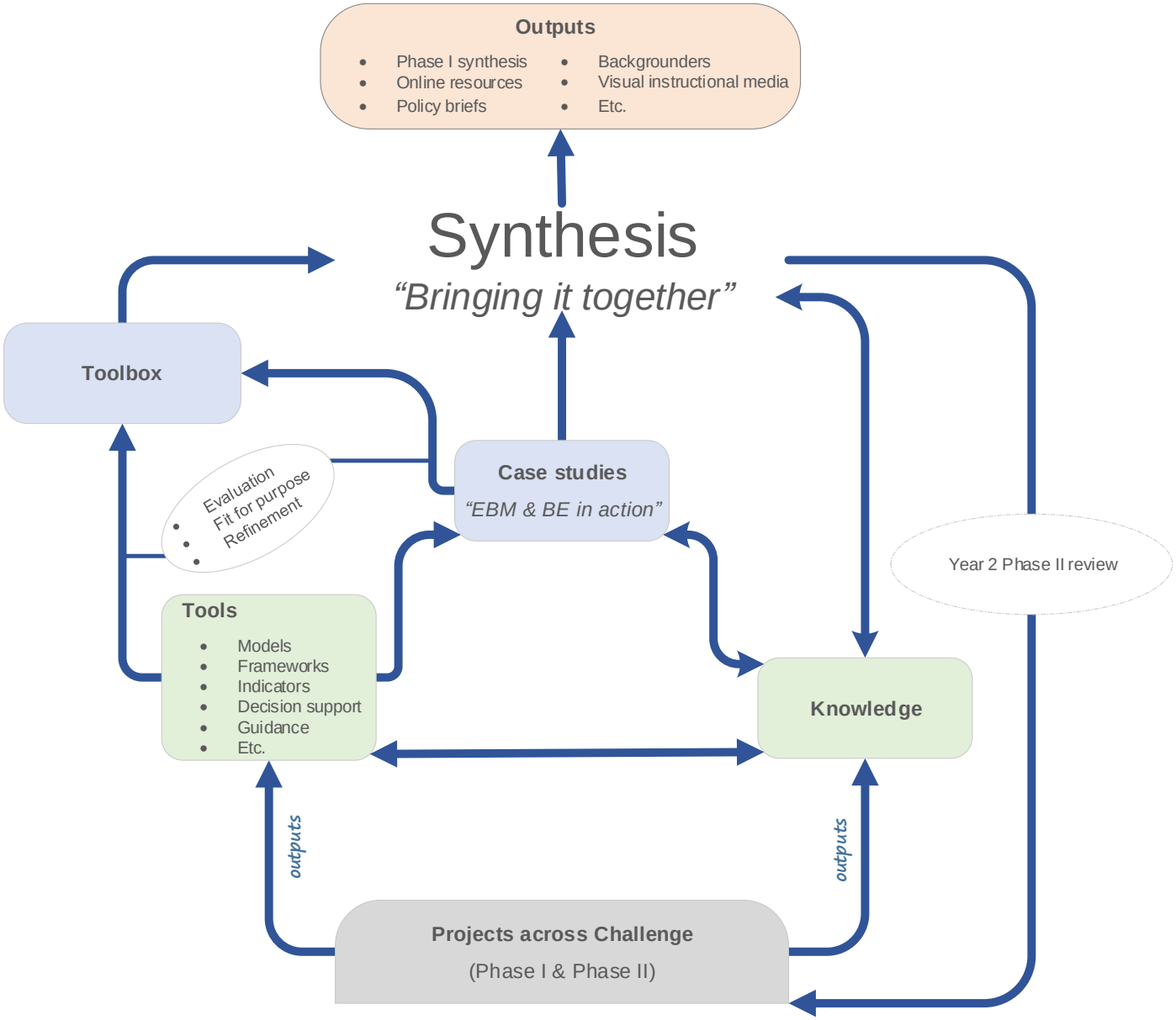

Figure 3: Process of *Synthesis: Ecosystem-based management and blue economy in action*

The Synthesis activities will include facilitating the evaluation and further refinement of the tools developed in projects to ensure they are fit for purpose. Activities will lead to novel outputs that communicate effectively the use and limitations of the tools in a manner that maximises future uptake. Synthesis outputs identified as being essential to enabling EBM and growing the Blue Economy will be developed and packaged in ways that facilitates their use and implementation; examples include online toolboxes, management guidelines, visual instructional media, webinars, research backgrounders, situation statements and policy briefs.

The Synthesis activities will also include facilitating regional case studies that will be co-developed and co-implemented with iwi and stakeholders to trial EBM approaches to marine management and the development of blue economy (BE) initiatives. The case studies trialling EBM and BE 'in action' will be supported by the Opportunities and Innovation funds, respectively, and will be co-developed with stakeholders and iwi. Synthesis across the regional case studies as well as those undertaken in the Tangaroa programme will be required to provide an impact pathway for the collective tools being developed; this in turn will help socialise and promote outputs to maximise their future use and impact in enabling effective EBM.

The Synthesis activities will be one large project involving several targeted tasks aimed at bringing tools, learnings from regional case studies, and broader knowledge from across the Challenge together. Synthesis of Phase I will be the first initiated activity, with the first outputs expected before the end of 2019. Synthesis activities will continue for the duration of Phase II and will lay the groundwork and processes for the Challenge synthesis in the final year.

The synthesis of knowledge, trialling and evaluation of tools from Phase I will provide an integrated pathway to impact and delivery for the research carried to date and in turn provide a mechanism for identifying remaining key gaps that may need to be addressed to achieve the Challenge objective and outcomes.

The synthesis 'team' will include members of the Challenge Leadership Team, Challenge communications staff, key stakeholders and iwi advisors/participants as well as project researchers.

Theme 1: Understanding degradation and recovery in social-ecological systems

Indicative Phase II Theme budget: $ 5,004,000

Marine ecosystem management is difficult because of the co-occurrence of multiple human activities and a high degree of habitat connectivity (due to organism and water movement) that expand stressor footprints. The spatial-temporal complexity of overlapping stressors represents today's management reality, and the ability to assess the cumulative degradation resulting from human activities and natural stressors on marine ecosystems is a fundamental component of EBM. Cumulative effects of multiple stressors, including stressors generated from land-based activities, challenge our ability to set appropriate targets for marine resource use that will maintain or allow recovery of ecological function and services in degraded systems.

Current practice typically manages for single stressors or single sectors, but interactions among stressors often generate adverse effects at thresholds well below those anticipated for single stressors. Similarly, impact assessments often are focused around a single activity and are reactive rather than forward-looking, overlooking the prospective combined effects of multiple activities on the environment. A lack of understanding of cumulative effects is preventing us from determining how much activity can be accommodated before a tipping point is passed and whether better stressor management can improve ecological function. We must also understand relationships between changes in ecological functioning and cultural/societal values, since this influences decision making.

A greater understanding of the cumulative effects from multiple activities and how they can be managed to recover ecological function and values was consistently highlighted at iwi and stakeholder workshops. To address this urgent need two highly integrated, focused and co-developed projects are proposed for Theme 1. Project *1.1 Understanding ecological responses to cumulative effects* focuses on understanding social and ecological responses to cumulative effects and the causes of hysteresis in recovery of ecological function. It will develop new methods to map ecological response footprints and their impacts on ecosystem services as well as methods to assess the recovery potential of degraded habitats. An assessment of how ecological degradation and recovery alters peoples' values including in a mātauranga and tikanga Māori context is proposed. Project *1.2 Tools for incorporating ecological responses to cumulative effects into management action* will develop tools that capture understanding gained in *1.1 Understanding ecological responses to cumulative effects* to deliver management action, e.g., new ways of integrating cumulative effects and ecological recovery potential into spatial management tools will assist in determinations of system capacity for new activities. These projects are globally novel and will deliver the understanding and tools needed to improve stressor management across New Zealand's marine environment.

The proposed research will extend the excellent platform developed in Phase I. For example, a national experiment demonstrated how the interaction of two stressors (sediment and nutrients) changed estuary ecological networks predisposing them to tipping points. Coastal food web studies highlighted how the loss of kelp forests reduces the productivity of exploited reef fish populations and new methods for mapping stressor transport by currents were developed. Significant advances were also made in translating spatial variations in ecological functions into identification of hotspots of ecosystem service delivery and mapping single stressor footprints/responses. The broad foundation provided by Phase I has allowed the evolution of a targeted research program on cumulative effects that now includes research to understand how stressor management can aid ecological recovery. A focus on cumulative effects and their management is central to the Challenge objective of enhancing both the ecological health and utilisation of marine ecosystems.

Theme 1 knowledge and tools will underpin projects across the Challenge, e.g., in Blue Economy, which seeks new economies that lead to improved ecological health, Risk and Uncertainty project *3.2 Communicating risk and uncertainty to aid decision-making* which will develop assessments of environmental uncertainty that arise from multiple stressors, and project *4.5 Enabling EBM at different scales* grappling with the consequences of mismatches between spatial scales of management and ecological scales of degradation and recovery. There will also be a close alignment with the Tangaroa Program where, for example, understanding the causes of hysteresis in ecological

recovery will be central to *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* as it aims to facilitate shellfish recovery in Ōhiwa Harbour. The high level of inter-project connectivity this Theme needs to meet its objectives will be achieved through common place-based research. Inter-Theme connectivity will be achieved by a combination of common place-based research where possible, involvement of some researchers in multiple projects.

Project title	1.1 Understanding ecological responses to cumulative effects
Indicative Phase II Budget:	$3,904,000
Theme / Programme	Theme 1: Understanding degradation and recovery in social-ecological systems
Problem definition	Current practice typically manages for single stressors or single sectors, but interactions among stressors (both natural and human induced) often generate adverse ecological effects at thresholds well below those anticipated for single stressors. Research that builds understanding of the cumulative effects of multiple stressors on ecological function is central to EBM - it will inform stressor management and system capacity for new activities ensuring that functions, services and values are maintained or allow recovery of degraded systems.
Research question(s)	1. How do we map ecological response footprints to stressors (acknowledging that the response and stressor footprints may differ in spatial and temporal extent)? 2. How do we assess cumulative effects (and stressor interactions) on ecological functions and ecosystem services? 3. How can we assess the recovery potential of degraded systems (both rate and likelihood) and what are the causes of hysteresis in the recovery of key habitat forming species? 4. How does ecological degradation and recovery affect what people value and how do these values vary with time across Māori, stakeholders and society? 5. What do degradation and recovery mean and what ecological indicators are presently used at local and national levels?
Research activities	• Develop methods (in conjunction with project *1.2 Tools for incorporating ecological responses to cumulative effects into management action*) to determine the spatial-temporal ecological response footprints of diffuse broad-scale stressors such as fishing/sedimentation overlapping with localised activities (e.g. marine farming). Research must account for the multiple effects arising out of single activities. Critically these methods must address the ecological response footprint that is influenced by factors such as organism tolerance, ecological connectivity, species interactions and environmental context. Research approaches are likely to include ecological-physical models, tracking, validation of context dependencies and developing new ways of rapidly assessing seabed health. • Research is required to tease apart the role of stressor interactions (and feedbacks) on ecological function and how this impacts both food-webs and ecosystem service delivery, at larger scales. Field surveys of ecological function across stressor gradients and experimental studies are needed and linked to indicators of function at larger scales that can be used to assess impacts on service delivery. This work is linked to project *4.5 Enabling EBM at different scales*. • Approaches to assessing recovery potential will need to consider organism habitat requirements, species-species interactions, meta-community dynamics and present/future stressor regimes. Approaches need to be able to prioritise stressor removal to reverse cumulative effects. Utilising measures of ecological connectivity, beta diversity and behavioural traits will increase generality and allow easy conversion to effects on ecological function, ecosystem services and human values. • Biodiversity and functional recovery of coastal ecosystems is often predicated on the re-establishment of key habitat forming species. On coastal rocky reefs this is kelp whereas in soft sediment habitats it is often shellfish beds. Research is needed to understand the processes and conditions that are preventing the recovery of these key habitat formers in the context of different stressor regimes. Empirical field

	research across stressor gradients, case studies capturing mātauranga Māori, analysis of existing data sets and models will be useful approaches. This work will be linked to project *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM*. • Develop understanding of different perceptions of ecological degradation and recovery from case studies projects across the Challenge. Explore how the indicators of degradation could be imbedded into local management plans and policy and used to support kaitiaki.
Outputs	(a) Biophysical and social-ecological knowledge that supports the development of understanding and tools that underpin EBM (b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised (f) Tools for predicting and managing cumulative and multiple stressors developed, assessed and demonstrated
Outcomes	(1) The value of blue economy business models is recognised and adapted by Aotearoa New Zealand businesses (2) Decision making practices that are more inclusive, multi-sectorial and account for the effects from cumulative and multiple activities are adopted (3) Knowledge form the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences marine management and policy (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Spatial mapping • Statistical analysis • Ecological-physical modellers • Ecologists • Ecosystem service/social scientists • Biogeochemists • Complex system modellers • Mātauranga
Potential location(s)	The output/comes will be maximised if locations can be found where a number of the research questions can be answered simultaneously. At regional scales possible locations might include the Marlborough Sounds, Hawkes Bay and Hauraki Gulf. The project will also work with placed-based research in the Tangaroa program (*T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM*, *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment*).
Potential co—developers, collaborators & partners	Regional councils, Regional scale community groups, Ministry for Primary Industries, Department of Conservation, Ministry for the Environment, Iwi, Business, Te Ohu Kaimoana, Environmental NGO's.
Links to and dependencies with other Themes / Tangaroa	Interdependencies: *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *3.1 Perceptions of Risk and Uncertainty* Relationships: 2 Blue economy Theme *3.2 Communicating risk and uncertainty to aid decision making* *3.3 Risks to businesses from investment and environmental uncertainty* *4.4 Science and mātauranga working together* *4.5 Enabling EBM at different scales* *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* *T3 Ngā Tohu o te Ao* *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment* Synthesis: Ecosystem-based management and blue economy in action; regional case

	studies NSC Our Land & Water; Deep South; Biological Heritage
Timing	2019-2023 (4 years)
Building on which Phase I research	*1.2.1 Frameworks for achieving and maintaining social licence* *2.1.3 Measuring ecosystem services and assessing impacts* *2.2.2.3 Near real-time forecasting using operational oceanographic forecasting of contamination risk to reduce commercial shellfish harvest and beach closures* *4.1.1 Tracking biogeochemical fluxes to inform EBM* *4.2.1 Tipping points in ecosystem structure, function & services* *4.2.2 Stressor footprints and dynamics* *4.3.1 Submarine canyons: how important are they for connecting coastal and deep-sea ecosystems?* *4.3.2 Sediment tolerance and mortality thresholds of benthic habitats* *4.3.4 Estimating historic disturbance effects* *4.3.5 Overnight tipping points from cataclysmic event* *5.1.2 Spatially explicit decision support tools*

Project title	1.2 Tools for incorporating ecological responses to cumulative effects into management action
Indicative Phase II Budget:	$1,100,000
Theme / Programme	Theme 1: Understanding degradation and recovery in social-ecological systems
Problem definition	A lack of relevant tools to assess the cumulative effects of multiple stressors is hampering effective stressor management to maintain and/or recover ecological functioning and associated ecosystem services in degraded systems. It is also a source of uncertainty in management decisions around a system's capacity for new activities.
Research question(s)	1. How do we integrate ecological responses to cumulative effects into spatial management tools? 2. How do we calculate ecological-physical system capacity to stressor loading and how does this vary between systems and drivers? 3. How do we integrate recovery dynamics/potential in ecological systems into spatial management tools? 4. How can we communicate/translate information generated by spatial management tools into indicators (ecological, cultural and societal) of degradation and recovery?
Research activities	• Build on prior work that has integrated stressor footprints into spatial management tools to incorporate multiple stressors and stressor interactions. In Phase I, two tools were used to address spatial management of multiple stressors – a seabed disturbance-recovery model and a systematic conservation planning tool. • Convert stressor footprints into ecological response footprints to assess system capacity. It is anticipated that an ecosystem services framework will be used as a basis to for this. • Develop ways to integrate recovery potential from both ecological and societal (e.g. management response lags) perspectives into marine spatial planning tools. Potential approaches include adaptation of existing tools from Phase I, or development of new tools such as spatial Bayes Net models. As an example, systematic conservation planning tools could be further developed to discount recovery potential from prior impacts and incorporate estimated time to recovery that includes connectivity and lags in management responses. • Develop ways to communicate information generated by spatial management tools as indicators (ecological, cultural and societal) of degradation and recovery.
Outputs	(a) Biophysical and social-ecological knowledge that supports the development of understanding and tools that underpin EBM (f) Tools for predicting and managing cumulative and multiple stressors developed, assessed and demonstrated
Outcomes	(1) The value of blue economy business models is recognised and adapted by Aotearoa New Zealand businesses (2) Decision making practices that are more inclusive, multi-sectorial and account for the effects from cumulative and multiple activities are adopted (3) Knowledge form the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences marine management and policy (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Spatial modellers • Ecologists • Bio-physical modellers • Ecosystem service scientists
Potential location(s)	The output/comes will be maximised by working in the same locations as *1.1*

	Understanding ecological responses to cumulative effects. At regional scales possible locations might include the Marlborough Sounds, Hawkes Bay and Hauraki Gulf. The project could also work with placed-based research in the Tangaroa programme (*T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM*, *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment*).
Potential co—developers, collaborators & partners	These will depend on the specific locations but potential co-developers, collaborators and partners would include iwi, industry, regional councils, Department of Conservation, Fisheries NZ, Ministry for Primary Industries, Ministry for the Environment, business, Marine hub and Te Ohu Kaimoana, Environmental NGO's
Links to and dependencies with other Themes / Tangaroa	Interdependencies: *1.1 Understanding ecological responses to cumulative effects* *S1 Synthesis and evaluation of tools, frameworks and knowledge for EBM* Relationships: Theme 2. Blue economy Theme *3.1 Perceptions of risk and uncertainty* *3.2 Communicating risk and uncertainty to aid decision-making* *3.3 Risks to businesses from investment and environmental uncertainty* *4.5 Enabling EBM at different scales* *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* *T3 Ngā Tohu o te Ao* *T4 Te Tāhuhu Matatau o Tangaroa, mai Tauranga Moana ki te Ao* *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment* Synthesis: Ecosystem-based management and blue economy in action; regional case studies
Timing	2019-2023 (4 years)
Building on which Phase I research	*2.1.3 Measuring ecosystem services and assessing impacts* *4.1.1 Tracking biogeochemical fluxes to inform EBM* *4.2.1 Tipping points in ecosystem structure, function & services* *4.2.1 Stressor footprints and dynamics* *5.1.1 Ecosystem models* *5.1.2 Spatially explicit decision support tools* *CP 2.1 Learning what EBM could look like in Tasman and Golden Bay*

Theme 2: Creating value from a blue economy

Indicative Phase II Theme budget: $ 3,216,900

Securing and enhancing the ecological health of New Zealand's oceans requires a marine economy that is committed to ecologically sustainable practices, just as sustainable economic utilisation of marine resources requires healthy marine ecosystems. These interdependent sets of goals further require an effective response to the shifting needs and concerns of communities.

The concept of the blue economy has become a cornerstone for debating marine futures in around the world. It is used widely by governments, international governance bodies, policy agencies, investment funds, and international banks. At core a blue economy is built on four propositions: societies must look to the oceans to secure their food, energy and wider economic futures; oceans offer enormous opportunities for economic development; realising these opportunities will require significant investment in science and technology; and growth must involve a fundamental transition to ecologically and socially sustainable economic activities. New international environmental initiatives, enhanced expectations of corporate environmental responsibility, and ever-deepening concerns about the environmental and ecological impacts of marine economies, mean that definitions of 'sustainability' are sharpening and require new, transparent and recorded actions by businesses. However, globally developing the economy is still seen as separate and often at odds with social and environmental goals.

In the Aotearoa New Zealand context, there are further drivers towards a blue economy. These include the requirement to incorporate Te Ao Māori world views into resource management, the introduction of a four capitals (Human, Natural, Social and Financial) approach to guiding central government policy and a four well-beings (Social, Environmental, Cultural, Economic) approach to local government, and the ever-pressing need to ensure access to overseas markets and add value by demonstrating strong environmental performance. Incorporating these drivers with meeting the Sustainable Seas objective through an EBM approach to marine management allows us to develop a blue economy that is made up of *activities that utilise ecologically and culturally appropriate technologies to create economic values from marine activities, reduce ecological risks and harms, and contribute directly to social, cultural and ecological well-being.*

Phase 1 research has shown that New Zealand has a growing marine economy, with many enterprises beginning to develop blue economy initiatives and position themselves to take advantage of its opportunities. Blue economy initiatives are being led by a range of champions at different scales and across different sectors. A thriving Māori blue economy is leading the way. Founded on investment and resource management guided by principles such as kaitiakitanga, the Māori business blue economy is being built across the full range of sectors by enterprises of different types, sizes and ownership structures.

Further transition to and growth of this blue economy will not just happen by itself. Internationally, it is recognised that while some business will see opportunities and take the leap, others will not - often intensifying conflicts among resource users and unnecessary tensions for resource management agencies. Transition pathways have to be built through investment; new science and technology; altered commitments, practices and objectives; and new measures of performance. This will require demonstrations of the value of new approaches, institutions that foster a new economy and new regulatory frameworks such as EBM.

This Theme will both support and draw on research in the Understanding Risk and Uncertainty theme to foster new investment initiatives, Enabling EBM to secure an EBM for a Blue Economy, and the Understanding degradation and recovery theme to use science to develop innovative investment opportunities. Research will be closely aligned with the Opportunities and Innovation Fund, which will make funding available to support science for innovative blue economy initiatives. It is expected that these projects will be co-funded by interested parties to the research. The development of projects for the Innovation funding will begin later this year.

Blue Economy Projects

We see the core research projects within this Theme supporting the development of a blue economy by: conducting the research necessary to encourage, support and secure transitions pathways (including fostering innovation; building supportive cross-sectoral infrastructure, identifying and applying science needs, and ensuring the development of supportive regulatory and decision-making settings); and designing measures, tools and approaches for securing that pathway.

The feedback we received on the projects in the Blue economy theme in the draft portfolio has led us to identifying a small project that will establish a basis for co-developing the requirements and activities of future projects in this Theme.

Project title	2.1 Transitioning to a blue economy in New Zealand
Indicative Phase II Budget: $75,000	
Theme / Programme	Theme 2: Creating value from a blue economy
Problem definition	Transitions to a growing blue economy will not just happen by themselves but require investment, commitments to change among marine businesses, and support from public and agencies. However, the need for change and the opportunities it will provide are not yet well understood. Building support, fostering commitments, and attracting investment will require a detailed mapping of the drivers and opportunities at national and sectoral scales.
Research question(s)	1. What are the technological, legal, social, political and sector level horizons of blue economy futures and how do they overlap with current sector activities and structures and innovation landscapes in New Zealand?
Research activities	• Interviews and focus groups with business leaders across different marine sectors supported by Department of Conservation analysis of domestic and international research on marine futures.
Outputs	(l) Remaining knowledge gaps that increase environmental risks of decision making are identified for iwi and stakeholders: A PESTLE analysis of blue economy in Aotearoa New Zealand, including mapping of current blue economy innovation landscapes and horizons
Outcomes	(1) The value of blue economy business models is recognised and adopted by Aotearoa New Zealand businesses. (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Business economics • Green economy • Iwi strategy • Mātauranga Māori • Marine sector innovators • National accounting expertise • Futures experts • Marine ecologists • Marine policy expertise
Potential location(s)	Not location based
Potential co—developers, collaborators & partners	Māori marine businesses and organisations at national and rohe scales Treasury, Stats NZ, Industry organisations, Marine businesses operating at a variety of scales, Regional economic development agencies, Green economy consultancies (EnviroStrat), Economic development consultancies (Market Economics)
Links to and dependencies with other Themes / Tangaroa	Fundamental linkages to Implementing EBM and a Blue Economy, and to the Innovation Fund As underpinning platform for the development of future projects will have strong links across Themes Synthesis: Ecosystem-based management and blue economy in action; regional case studies
Timing	2019 (1 year)
Building on which Phase I research	*2.2.1 Cultivating value from a Blue Economy* *3.2.1 Whai Rawa, Whai Mana, Whai Oranga: Creating a world-leading indigenous blue economy* *1.2.1 Frameworks for achieving and maintaining social licence* *2.2.2.4 Huataukīna tō iwi e: Developing marine bioactives from kina;* *Development of valuation frameworks and principles*

Theme 3: Addressing risk and uncertainty

Indicative Phase II Theme budget: $ 2,502,000

The ability to estimate risks associated with actions is necessary for any management regime, whether it be managing the economy, a business or the environment. When managing multiple strands, having robust methods and understanding of both the uncertainties and the effects of those uncertainties increases exponentially in importance. This is particularly true for EBM in the marine environment as uncertainty levels of direct responses to stressors are often very high, mainly due to difficulties in collecting knowledge of what is out there, and in understanding how ecological functioning responds to stressors against a background of environmental variability and climate change.

This problem is further complicated by a lack of understanding of two other factors. Firstly, how direct effects of stressors promulgate through social and ecological systems to create indirect effects on ecological and economic health and social and cultural values. Secondly, the degree to which sectoral, personal and cultural perceptions of risk (to themselves, the economy or the environment) differ. This latter is central to understanding whether certain decisions and the potential consequences are acceptable to broad sectors of society.

While there are a large number of risk assessment methods available, these exhibit deficiencies both from a mātauranga Māori and an EBM perspective. We need methods that address risks to multiple ecosystem components, ecosystem services or values rather than single-species responses and that can accumulate risks across multiple stressors, and that can predict sudden large changes. These methods need to be incorporated into tools that can communicate the degree of uncertainty associated with specific aspects of the risk predictions are needed and the potential consequences of specific decisions to the environment and society (including businesses).

The Theme must be highly integrative with key projects in other Themes to be successful. In particular, information on cumulative effects and recovery pathways from project *1.1 Understanding ecological responses to cumulative effects* will be needed to underpin both the development of understandings of perceptions of risk and uncertainty and tools that can express the risks associated with cumulative effects – or uncertainties around predicting these effects. Stressors considered will include those arising from both marine and land-based activities that impact on the marine environment from estuaries to the deep sea. Other key projects are projects *1.2 Tools for incorporating ecological responses to cumulative effects into management action*, Blue economy, and Tangaroa projects, and the regional case studies that will be completed under the Programme "EBM and blue economy in action".

Similarly, the Theme will provide information for other Themes. The risk assessment models produced and the understanding of differences in how risks and uncertainties are perceived will inform development of EBM policies and practices at different scales and will be particularly important in defining when and where the precautionary principle should be invoked.

External to the Challenge, likely outputs from the Theme include: guidelines around categories of risk and uncertainty and their use in decision making that would inform local and central governmental processes; development and testing of a training module for environmental commissioners; and production of easily usable models and communication tools that bring together key business-social-cultural- ecological uncertainties in predicting consequences of decisions. It is important to note that these tools can also be used to demonstrate crucial knowledge gaps.

Project title	3.1 Perceptions of risk and uncertainty
Indicative Phase II Budget: $852,100	
Theme / Programme	Theme 3: Addressing risk and uncertainty
Problem definition	There is very little knowledge on the degree to which sectoral, personal and cultural perceptions of risk (to themselves, the economy or the environment) differ and how this affects which decisions would be made (and supported) in different locations by different groups of people. This understanding is crucial to building consensus around decisions, or at least appreciating why specific decisions have been made.
Research question(s)	1. How is risk and uncertainty dealt with and perceived in Mātauranga Māori? How do sectors (e.g., community groups, businesses (new, physical product-based, e-product based, large), regional councils) differ in their perceptions of rick and uncertainty? Leading to: a. How do sectoral and cultural perceptions of uncertainty and risk affect the level of uncertainty at which different sectors and cultures would want the precautionary principle for the environment to be invoked and how they expect it to be applied? b. Are perceptions altered when climate change is considered? c. How can we best convey differences in perceptions?
Research activities	• Development of indicators and definitions of risk in mātauranga (e.g., intergenerational well-being) and EBM terms, together with a set of understandings around the definition of "uncertainty" and "adaptive management". • Scenario development of a set of decisions and uncertainties for testing differences in when and how different cultures and sectors would want to see the precautionary principle invoked. The scenarios should be primarily based on case studies being conducted within Tangaroa and EBM and blue economy in action and should integrate information from projects *1.1 Understanding ecological responses to cumulative effects* and *1.2 Tools for incorporating ecological responses to cumulative effects into management action*. Information on the desired scenarios, the decisions made and the uncertainties accepted for those decisions should be fed into the spatial models developed into proposed project *1.2 Tools for incorporating ecological responses to cumulative effects into management action*. • Understanding of the perceived ecological, cultural, business and social risks of adaptive management and the precautionary principle and the effect of benefits/costs and power (or lack of) on perceptions of risks- to be closely linked with scenario testing in proposed project *3.2 Communicating risk and uncertainty to aid decision-making*. • In association with projects *1.2 Tools for incorporating ecological responses to cumulative effects into management action* and *3.2 Communicating risk and uncertainty to aid decision-making*, create guidelines for decision makers around categories of risk and uncertainty and their link to the use of the precautionary principle, extra data collection and adaptive management. • Consideration of parallel versus integrated processes for iwi. • Interactions with proposed projects Blue economy Theme, *3.3 Risks to businesses from investment and environmental uncertainty, 4.5 Enabling EBM at different scales, T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM, T2 Huatuakina o hapū e!* and *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment*. • Development and testing of a training module for understanding/dealing with different perceptions of risk.

Outputs	(b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised (d) Decision-making guidelines that recognise risk and uncertainty evaluated, developed, demonstrated and made available for iwi and stakeholders
Outcomes	(2) Decision-making practices that are more inclusive and multi-sectorial and use predictions of effects from cumulative and multiple activities are adopted (5) Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing (7) Māori rights, interests and values are supported through the application of EBM (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• mātauranga • survey design • Ecological risk assessment • social science • participatory tools • Scenario testing • psychology • educational practices • Business risk assessment
Potential location(s)	Needs to be conducted in place and at a national scale. Suggested places are in connection with *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM, T2 Huatuakina o hapū e!, T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment,* and the Hawkes Bay and Marlborough Sounds regional case studies
Potential co—developers, collaborators & partners	Iwi trusts, hapū and whanau (through Tangaroa projects) Iwi fisheries collective and Te Ohu Kaimoana, small and large business enterprises Lawyers – environmental court processes Environmental Protection Agency, Ministry for Primary Industries, Marine hub, Department of Conservation Ministry for the Environment, RC councillors, planners and consent processers Farmers and forestry collectives Environmental NGO's Community groups
Links to and dependencies with other Themes / Tangaroa	Links to *1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *3.2 Communicating risk and uncertainty to aid decision-making* *3.3 Risks to businesses from investment and environmental uncertainty* *4.5 Enabling EBM at different scales* *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* *T2 Huatuakina o hapū e!* *T3 Ngā Tohu o te Ao* *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment* Synthesis: Ecosystem-based management and blue economy in action; regional case studies
Timing	2019 - 2022 (2.5 years)
Building on which Phase I research	*1.2.1 Frameworks for achieving and maintaining social licence* *1.2.2 Navigating marine socio-ecological systems* *4.2.1 Tipping points in ecosystem structure, function & services* *5.1.3 Novel risk assessment tools for EBM*

Project title	3.2 Communicating risk and uncertainty to aid decision-making
Indicative Phase II Budget: $1,399,900	
Theme / Programme	Theme 3: Addressing risk and uncertainty
Problem definition	We lack relevant tools that allow us to understand and communicate the consequences (of limited knowledge) on the outcomes of the decisions we make on ecological and business health and social and cultural values
Research question(s)	1. What risk assessment tools are available that incorporate uncertainty into their estimates, deal with multiple stressors and are easily communicated to Māori and stakeholders? Including: a. whether presently used, well-documented risk assessment procedures are fit for EBM processes, (i.e., can they deal with complex social and ecological processes and the type of data commonly available, are they able to produce the types of outputs required)? b. Identification of any adaptations needed to these or less well-known procedures to create fit for EBM purpose risk assessment tools. 2. How do uncertainties, and thus social and ecological risks, accumulate during decision-making? Including: a. the uncertainties inherent in merging data from different scales (e.g., scaling environmental, ecological information and social up or down to match each other or available model types). b. the uncertainties and risks at separate stages of assumptions, modelling and decision-making.
Research activities	• Integration with the work in proposed project *3.1 Perceptions of risk and uncertainty* on defining risks that fit with EBM and mātauranga • Review of present well documented procedures e.g., stock assessment, biosecurity, business, ERAEF, GLC, BN) to assess fit-for-purpose and selection of elements that can be successfully integrated into tools • Spatial data collation and simulation testing for analysis of scaling effects on uncertainty • Development of scenarios to be used to test tools and understand how uncertainties and risks accumulate- to be done in conjunction with proposed projects *3.1 Perceptions of risk and uncertainty*, *1.2 Tools for incorporating ecological responses to cumulative effects into management action, 4.5 Enabling EBM at different scales, T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM*, *T2 Huatuakina o hapū e!* and *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment*, as well as any case studies that project *1.1 Understanding ecological responses to cumulative effects* is aligned with. • Building/adapting tools based on models that bring together key business/environmental/biophysical uncertainties, and incorporate definitions and perceptions of risks understood from proposed project *3.1 Perceptions of risk and uncertainty*, to assess risks to indicators used in *1.1 Understanding ecological responses to cumulative effects* and *1.2 Tools for incorporating ecological responses to cumulative effects into management action*. Studies conducted under the Blue economy Theme should be utilised. The tools should provide outputs that can be used by proposed projects *1.2 Tools for incorporating ecological responses to cumulative effects into management action* and the Blue economy Theme on EBM risk assessments. • Testing and socialising these with Māori and stakeholders under the developed scenarios
Outputs	(d) Decision-making guidelines that recognise risk and uncertainty evaluated, developed, demonstrated and made available for iwi and stakeholders

	(f) Tools for predicting and managing cumulative and multiple stressors developed, assessed and packaged for iwi and stakeholders (l) Remaining knowledge gaps that increase environmental risks of decision making are identified for iwi and stakeholders
Outcomes	(2) Decision-making practices that are more inclusive and multi-sectorial and use predictions of effects from cumulative and multiple activities are adopted (5) Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing. (7) Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy. (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Mātauranga • System modelling • Physical modelling • Participatory tools • Ecological scaling • Risk assessment • Law • Consenting • Policy
Potential location(s)	Needs to have a place anchor but a national focus. Suggested places are in connection with the recent initiatives in the Hauraki Gulf, *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM*, *T2 Huatuakina o hapū e!*, *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment* and the Hawkes Bay and Marlborough Sounds regional case studies
Potential co—developers, collaborators & partners	Iwi fisheries collective and Te Ohu Kaimoana, business enterprises Iwi environmental trusts, Fisheries NZ, Ministry for Primary Industries Environmental court and Environmental Protection Agency Ministry for the Environment policy, regional council planners and consent processers Community groups Iwi trusts, hapū and whanau (through Tangaroa projects) business enterprises (through Theme 2 projects) Department of Conservation Environmental NGO's Regional councils
Links to and dependencies with other Themes / Tangaroa	Depends on: *1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *2 Blue Economy Theme* *3.1 Perceptions of risk and uncertainty* *4.5 Enabling EBM at different scales* *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* *T2 Huatuakina o hapū e!* *T5 He Kainga Taurikura o Tangitu: Treasured Coastal Environment* Synthesis: Ecosystem-based management and blue economy in action; case studies
Timing	2019 – 2023 (3.5 years)
Building on which Phase I research	*1.2.2 Navigating marine socio-ecological systems* *4.2.1 Tipping points in ecosystem structure, function & services* *5.1.2 Spatially explicit decision support tools* *5.1.4 Interactive tools for enabling participation and knowledge exchange* *IF1.3.2 Navigating the implementation impasse: enabling interagency collaboration on cumulative effects* *5.1.3 Novel risk assessment tools for EBM*

Project title	3.3 Risks to businesses from investment and environmental uncertainty
Indicative Phase II Budget:	$250,000
Theme / Programme	Theme 3: Addressing risk and uncertainty
Problem definition	There is a likely to be a strong, but not well understood, linkage between environmental variability and risks to ecological health and business sustainability
Research question(s)	1. What can science contribute to measure, minimise and manage the investment risks and business uncertainties driven by environmental variability and impacts? 2. Can environmental risks be part of ethical investment portfolios. 3. How does long term planning affect the levels of social and environmental risks?
Research activities	Will be developed in partnership with interested industry/businesses to gain innovation and co- funding- but likely to include: • Interrogation of environmental data to determine time scales of predictive ability and related uncertainty – comparison with business planning horizons derived from case studies in Theme 2: Creating value from a blue economy. Environmental data should include: o Available long-term ecological monitoring o Remotely assessed temperature and productivity data o Climate and hydrodynamic data • Analysis of environmental data requirements for different types of business decisions- comparison between environmental impact uncertainty and business risk utilising information from Blue economy projects and *3.1 Perceptions of risk and uncertainty* • Quantification of the flow through of environmental to business risks in single vs multi products businesses across traditional extractive vs new BE businesses • Quantification of primary environmental concerns of ethical investors and time scales of such investments and analysis of these concerns and time scales to determine how they relate to risks to ecological health • Investigation of the relationship between environmental and social risks and long-term business strategies in different sectors and at different scales through use of case studies held in common with proposed projects *1.1 Understanding ecological responses to cumulative effects, T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* and *T2 Huatuakina o hapū e!* • Co-developing risk management models with enterprises to manage key business / environmental uncertainties
Outputs	(a) Biophysical and socio-ecological knowledge that supports the development of understanding and tools that underpin EBM as a viable approach to managing Aotearoa New Zealand's marine environment developed and accessibly packaged. (i) Guidelines developed, opportunities identified and innovations, for transitioning to a blue economy for businesses operating in the marine sector.
Outcomes	(1) The value of blue economy business models is recognised and adopted by Aotearoa New Zealand businesses (5) Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• mātauranga • survey design • remote assessment • economics • investment practices • business risk • predictive environmental science • ecological health

	techniques	assessments	indicators
Potential location(s)	To be developed in conjunction with interested industry/businesses		
Potential co—developers, collaborators & partners	Iwi trusts, fisheries and aquaculture, tourism, small businesses especially innovative blue economy businesses, Ministry of Business, Innovation, and Employment, Te Ohu Kaimoana, Environmental NGO's		
Links to and dependencies with other Themes / Tangaroa	Depends on: Blue economy Theme *1.1 Understanding ecological responses to cumulative effects* *3.1 Perceptions of risk and uncertainty* *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM* *T2 Huatuakina o hapū e!* Synthesis: Ecosystem-based management and blue economy in action; regional case studies		
Timing	2021 - 2023 (2 years)		
Building on which Phase I research			

Theme 4: Enhancing Ecosystem-based management (EBM) practices

Indicative Phase II Theme budget: $ 2,038,400

Achieving an EBM approach to managing our marine environment requires institutional, regulatory and other arrangements tailored specifically to the Aotearoa New Zealand context. Fundamental to implementation within this institutional setting is clarifying the processes necessary to support the uptake of EBM by Māori, government (local, regional and central), industry and communities working across multiple scales. This includes evaluating existing policies, practices and regulation to determine how they affect the implementation of EBM; giving attention to the relationship between the Treaty of Waitangi and EBM and the obligations arising from the Treaty particularly as they relate to kaitiakitanga and mātauranga; and generating an understanding of how cross-scale interactions influence EBM in practice.

Successful implementation of EBM, thus, requires identifying the enabling conditions required to support EBM and EBM activities, and identifying solutions to obstacles that need to be overcome. This includes developing a thorough understanding of EBM as both a place-based set of practices and as an overarching approach to management across multiple scales. A clearer understanding of the diversity of challenges and opportunities that shape the relations between science, governance and implementation in Aotearoa New Zealand is also required.

Research in this Theme builds on Phase I, which reviewed and characterised existing processes and systems governing marine management in Aotearoa New Zealand. Research in Phase I identified the potential of the existing marine legislative framework to support EBM (including an EBM approach that is informed and/or complimentary to mātauranga and tikanga Māori), but unevenness in terms of applying an EBM approach. Other research findings confirmed a diversity of processes, both formal and informal, that facilitate participation in decision making in the marine environment. Phase II will focus on identifying new forms of governance and practice needed for EBM to become more effectively embedded into our marine management. This includes identifying a range of potential mechanisms or policy options that could enable the transition from existing management arrangements to those necessary for successful EBM. A key consideration in Phase II is research focused on providing a sophisticated understanding of the multiple cross-scalar interactions within marine social-ecological systems and implications for EBM governance and institutional arrangements.

Research in this Theme will deepen our understanding of the relationship between the Treaty of Waitangi and EBM and will 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; and, exploring how mātauranga Māori and science can both inform decision-making whilst preserving the integrity of both. This builds on Phase I research, which provided insights into Māori and existing New Zealand legal systems as they relate to the marine management and an understanding of the key historical and contemporary concepts underpinning kaitiakitanga as practiced by Māori and articulated in a range of contexts.

The projects in this Theme are strongly interconnected to each other and to projects in other Themes. Projects will be co-developed to enhance these connections and to take advantage of relationships developed elsewhere in the Challenge, particularly those projects undertaking in-depth place-based research where nascent EBM approaches are emerging; for example, in Degradation and Recovery, EBM and Blue Economy in Action, and Tangaroa projects.

Research in this Theme will align with policy programmes proposed by central government, including Ministry for Primary Industries' future implementation of ecosystem-based management of fisheries through its Fisheries Change Programme and the emerging Marine Futures initiative led by Ministry for the Environment (MfE) in collaboration with "Marine Hub", which includes Department of Conservation (DOC) Ministry for Primary Industries (MPI) and Fisheries New Zealand.

Project title	4.1 Treaty relationships and EBM
Indicative Phase II Budget: $227,500	
Theme / Programme	Theme 4: Enhancing EBM practices
Problem definition	Ensuring the effective implementation of EBM in a manner that gives effect to Treaty obligations requires understanding the different ways in which rights and interests of iwi, hapū and whanau are provided for in legislation. Research that distinguishes different institutional mechanisms and arrangements available can inform policy and regulatory reform to support EBM while strengthening Treaty relationships.
Research question(s)	1. How do the range of different ways that Treaty relationships are being provided for (or not) in the marine environment have a bearing on rights and interests of iwi, hapū and whanau? 2. What are the implications of different provisions for Treaty relationships for healthy ecosystems and blue economy?
Research activities	• Review the range of different forms of Treaty recognition (existing and emerging) across different marine spatial/resource management arrangements (e.g. Takutai Moana (~200 claims); fisheries resource allocations to iwi; co-governance arrangements; co-management arrangements; devolved management arrangements under Fisheries Act/Regs (e.g. Taiapure, Mataitai); devolution arrangements under RMA, etc. • Undertake hui with iwi/hapū regarding the implications of different forms of Treaty recognition for their long-term rights and interests in the marine environment, as well as for their ability to be actively involved in governance and management and implications for healthy ecosystems and a blue economy. • Undertake hui, meetings and/or key informant interviews with relevant policy agencies as to their perspectives on the implications of the evolution of these arrangements for rights and interests of Māori and New Zealanders more generally. • Draw tentative conclusions as to the implications for Treaty rights and interests, EBM, kaitiakitanga, healthy ecosystems and blue economy, particularly in relation to any risks and ways to mitigate these risks. • Share and discuss tentative conclusions with research participants as above prior to finalising conclusions. • Collaborate with *4.2 Options for policy and legislative change to enable EBM*, *4.3 EBM and kaitiakitanga* and *4.5 Enabling EBM at different scales* to ensure relevant insights and findings are regularly exchanged.
Outputs	(c) Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated. (g) Governance and policy practices that support EBM identified, evaluated and packaged for targeted decision-makers.
Outcomes	(3) Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy (4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (6) EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi (7) Māori rights, interests and values are supported through the application of EBM (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge

Critical skills required	• Legal expertise especially relating to Treaty of Waitangi	• Good knowledge of Māori rights and interests in marine environment	• Mana for facilitation of hui
Potential location(s)	Ngāti Porou; Ngāti Pahauwera (Takutai Moana) East Otago taiapure Tangaroa case study locations		
Potential co—developers, collaborators & partners	Pan-Māori organisations and iwi/hapū organisations Marine Hub; Ministry for Primary Industries/Fisheries NZ, Ministry for the Environment, Department of Conservation, Environmental Protection Agency, regional councils, youth/ rangatahi Ngāti Porou; Ngāti Pahauwera (Takutai Moana) East Otago taiapure Tangaroa case study iwi Te Ohu Kaimoana Te Ara Whiti		
Links to and dependencies with other Themes / Tangaroa	*1.2 Tools for incorporating ecological responses to cumulative effects into management actions* 2 Blue Economy Theme *4.2 Options for policy and legislative change to enable EBM* *4.3 EBM and kaitiakitanga* *4.5 Enabling EBM at different scales* All Tangaroa projects Synthesis: Ecosystem-based management and blue economy in action; regional case studies		
Timing	2019-2021 (2 years)		
Building on which Phase I research	*VM2.1* International Comparative Study *3.3.1 (Tuhonohono: the dynamic between Māori lore and law);* *3.3.2 (Mana whakahaere: Innovatively improved pathways)* *CP1.1 (EBM within NZ's existing legal framework) and particularly the output "Enabling marine ecosystem-based management: Is New Zealand's legal framework up to the task?"*		

Project title	4.2 Options for policy and legislative change to enable EBM
Indicative Phase II Budget: $474,100	
Theme / Programme	Theme 4: Enhancing EBM practices
Problem definition	The ability for EBM to improve decision-making and transform how we utilise marine resources in Aotearoa New Zealand is affected by statutory and non-statutory regulation, practices and policy across all levels of government. Research that identifies current gaps in policy and practice and the barriers to implementation, and which evaluates options for policy and legislative changes are necessary to enhance uptake of EBM.
Research question(s)	1. What options exist for policy and legislative changes that would better enable widespread uptake of EBM in NZ and recognise rights and interests? 2. To what extent is implementation of EBM not reaching its potential due to interpretation and/or practices by government and local government departments/agencies, and how might this be improved? 3. What EBM-aligned governance arrangements are appropriate to different socio-cultural and ecological scales?
Research activities	• Focus on gaps/needs/opportunities to successfully implement all EBM principles in law, policy and practice. This involves both options to change law/policy and options for practice changes where law/policy is supportive of EBM principles, but implementation is limited. • In relation to fisheries management in particular, assess extent to which the fisheries management system already takes an ecosystems-based approach, and identify options for implementation of an ecosystem-based fisheries management approach. • Engage with stakeholders and Māori to help identify issues and options, e.g. how policy/law and its implementation is holding back aspirations to implement EBM at different scales; options for change; any concerns regarding implications of change to rights and interests. • Assess implications of law/policy/practice change options for rights and interests of Māori and other stakeholders in the marine environment. • Consider needs for change at different scales of governance and in relation to different institutional arrangements (e.g. commercial fisheries governance compared to a local coastal community). • Test draft recommendations for law, policy and implementation change with stakeholders and Māori.
Outputs	(c) Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated. (e) Scales of management and place-based strategies that reduce environmental risks are identified and demonstrated. (g) Governance and policy practices that support EBM identified, evaluated and packaged for targeted decision-makers.
Outcomes	(2) Decision-making practices that are more inclusive, multi-sectorial and account for the effects from cumulative and multiple activities are adopted. (4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled. (5) Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing.

	(6) EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi. (7) Māori rights, interests and values are supported through the application of EBM. (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge		
Critical skills required	• Legal analysis • Policy analysis • Fisheries and other marine sciences • Fisheries management	• Treaty of Waitangi familiarity • Māori community engagement	• social science/ community engagement
Potential location(s)	A national perspective will be taken.		
Partners in co-development of research	Marine Hub; Ministry for Primary Industries/Fisheries NZ, Ministry for the Environment, Department of Conservation, Environmental Protection Agency, regional councils, Environmental NGO's Existing EBM-like initiatives who have faced problems getting established (e.g. Sea Change; various taiāpure and rahui initiatives) Te Ohu Kaimoana Businesses		
Links to and dependencies with other Themes / Tangaroa	*3.2 Communicating risk and uncertainty to aid decision-making 4.1 Treaty Relationships and EBM* *4.1 Treaty Relationships and EBM* *4.3 EBM and kaitiakitanga* *4.5 Enabling EBM at different scales* All Tangaroa projects Synthesis: Ecosystem-based management and blue economy in action; regional case studies		
Timing	2019-2022 (3 years)		
Building on which Phase I research	Build on findings from *CP1.1 EBM within NZ's existing legal framework* and particularly the output "Enabling marine ecosystem-based management: Is New Zealand's legal framework up to the task?" *CP1.1 EBM within NZ's existing legal framework* *VM2.1 International comparative study* *3.3.1 Tuhonohono: the dynamic between Māori lore and law* *3.3.2 Mana whakahaere: Innovatively improved pathways* *1.1.1 Testing EBM-supportive participatory processes for application in multi-use marine environments*		

Project title	4.3 EBM and Kaitiakitanga
Indicative Phase II Budget: $246,500	
Theme / Programme	Theme 4: Enhancing EBM practices
Problem definition	Implementing EBM in Aotearoa New Zealand requires decision-making processes that enable and support the application of kaitiakitanga. This, in turn, requires research that demonstrates the synergies, complementarities and divergences between EBM and kaitiakitanga.
Research question(s)	1. What are the alignments and differences between kaitiakitanga and EBM, and how can these approaches successfully work together for healthy ecosystems and a vibrant blue economy?
Research activities	• Explore and communicate the synergies between EBM and kaitiakitanga, both in practices and principles, and considering the implications for the Challenge's tentative description of EBM principles • Identify examples of practices/approaches to marine management that are underpinned by EBM principles; and practices/approaches underpinned by kaitiakitanga/Te Ao Māori concepts • Identify where practices/approaches are similar, divergent or synergistic, and whether/how they have informed each other or developed learnings from each other • Engage Māori and stakeholders in discussion on whether the Challenge's concept of EBM (and its principles) sufficiently recognises kaitiakitanga or whether it needs to change (e.g. in order to recognise kaitiakitanga as a parallel approach which provides for similar outcomes sought by the Challenge). • Consider how EBM and kaitiakitanga can best support each other and not compete. • Work closely with *4.1 Treaty Relationships and EBM, 4.2 Options for policy and legislative change to enable EBM, 4.4 Science and mātauranga working together, 4.5 Enabling EBM at different scales.*
Outputs	(b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised. (c) Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated.
Outcomes	(4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (7) Māori rights, interests and values are supported through the application of EBM (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Māori social research • Mātauranga • Policy • Social science
Potential location(s)	National scale
Potential co—developers, collaborators & partners	Marine Hub; Ministry for Primary Industries/Fisheries NZ, Ministry for the Environment, Department of Conservation, Environmental Protection Agency, regional councils Māori organisations (e.g. Te Ohu Kaimoana) Youth/rangatahi Existing initiatives using kaitiakitanga and/or EBM approaches
Links to and dependencies with other Themes / Tangaroa	*4.1 Treaty Relationships and EBM* *4.2 Options for policy and legislative change to enable EBM* *4.4 Science and mātauranga working together* *4.5 Enabling EBM at different scales*

	All Tangaroa projects Synthesis: Ecosystem-based management and blue economy in action; regional case studies
Timing	2019-2021 (2 years)
Building on which Phase I research	Build on Phase 1 outputs including on EBM principles (Hewitt et al), kaitiakitanga (Jackson et al) and waka taurua framework (Awatere et al) *3.1.1 Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment* *3.2.1 Whai Rawa, Whai Mana, Whai Oranga: the Māori marine economy* *3.3.1 Tuhonohono: the dynamic between Māori lore and law* *3.3.2 Mana whakahaere: Innovatively improved pathways* *VM2.1 International comparative study*

Project title	4.4 Science and mātauranga working together
Indicative Phase II Budget: $189,600	
Theme / Programme	Theme 4: Enhancing EBM practices
Problem definition	EBM relies on a sound knowledge base from which to make decisions and to take action. Mātauranga is crucial to understanding Māori practice, values and interest as they relate to physical, social, economic and cultural dimensions of the marine environment. Research that identifies how different knowledges and practices (i.e. from science and mātauranga) have been harnessed and enacted to enhance EBM is needed to enable the benefits for people and the environment to be realised.
Research question(s)	1. How can place-based practitioners and scientists successfully bring both science and mātauranga to underpin decision making for healthy ecosystems and a strong blue economy?
Research activities	• This project occurs over Years 3-4 and draws from experiences/learnings across the Challenge projects • Build on existing work on the fundamental differences between science and mātauranga but focus here more on the practices and synergies of collaboration. • Identify places / projects where mātauranga and science have both been used to develop new management approaches for marine spaces, including in Challenge case studies (e.g. Tangaroa projects) • Work with willing practitioners/scientists to identify (for example) (a) how they worked together and how this developed over time, (b) how knowledge was invited/offered/developed/used, (c) successes and pitfalls and learnings from the process (including any IP issues), (d) how the two forms of knowledge together informed changes in practice, (e) how/whether the collaborations led to cross-fertilisation between knowledge systems and outcomes of this. • Develop draft guidelines on how science and mātauranga knowledge holders can successfully collaborate, and test with Māori and stakeholders including case study communities before finalising guidelines.
Outputs	(a) Biophysical and socio-ecological knowledge that supports the development of understanding and tools that underpin EBM as a viable approach to managing Aotearoa New Zealand's marine environment developed and accessibly packaged. (b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised.
Outcomes	(3) Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy (7) Māori rights, interests and values are supported through the application of EBM (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Māori & non-Māori scientists • Mātauranga • Social science • Facilitation skills
Potential location(s)	Existing regional case studies, Tangaroa project locations and other exemplars of existing complementarity (e.g. East Otago Taiāpure)
Potential co—developers, collaborators & partners	Māori organisations, Te Ohu Kaimoana Marine Hub; Ministry for Primary Industries/Fisheries NZ, Ministry for the Environment, Department of Conservation, Environmental Protection Agency, regional councils Youth/rangatahi Māori and non-Māori scientists who have collaborated across science and mātauranga

Links to and dependencies with other Themes / Tangaroa	*1.1 Understanding ecological responses to cumulative effects* *4.1 Treaty Relationships and EBM* *4.2 Options for policy and legislative change* *4.3 EBM and kaitiakitanga* *4.5 Enabling EBM at different scales* All Tangaroa projects Synthesis: Ecosystem-based management and blue economy in action; regional case studies
Timing	2019-2023 (4 years)
Building on which Phase I research	*3.1.2 He Poutokomanawa: Kaitiakitanga in practice in our marine environment* *3.1.3 Tāhuhu Matatau Te Ao Tangaroa: Māori marine management strategies*

Project title	4.5 Enabling EBM at different scales
Indicative Phase II Budget: $900,700	
Theme / Programme	Theme 4: Enhancing EBM practices
Problem definition	Existing management efforts are undermined by scale mismatches between physical systems and jurisdictions, institutional fragmentation, and scale effects of activities (spatially and temporally). Effective EBM requires a sophisticated understanding of the multiple cross-scalar interactions within marine social-ecological systems.
Research question(s)	1. How can different scales of priorities/strategies be accommodated in an EBM framework? 2. What are the risks (environmental, social, cultural, economic) of management at scales larger (or smaller) than those at which the key species (especially when those key species provide a habitat for other species) interact with the environment? 3. What options for governance or practice changes might mitigate those risks?
Research activities	• Identify and exemplify the range of different scales of governance, management, species-environment interactions, and socio-cultural interactions, e.g. o different scales of management actions used by different governance arrangements/actors – e.g. national (including EEZ); regional; iwi & hapū rohe; community; business interests (e.g. quota, tourism activities) o scales at which key species interact with the environment, and any knowledge gaps. • Explore the risk implications of these varying scales with Māori and stakeholders that are actively involved in management activities, including the kinds of management actions that might be relevant at different scales • Develop potential risk mitigation approaches and feed through into *4.2 Options for policy and legislative change*. • Develop coupled management - ecological models and network connectivity models to examine the implications of management and decision making at scales larger or smaller than key species interactions using simulations
Outputs	(a) Biophysical and socio-ecological knowledge that supports the development of understanding and tools that underpin EBM as a viable approach to managing Aotearoa New Zealand's marine environment developed and accessibly packaged. (b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised. (e) Scales of management and place-based strategies that reduce environmental risks are identified and demonstrated. (g) Governance and policy practices that support EBM identified, evaluated and packaged for targeted decision-makers.
Outcomes	(4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (5) Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing (6) EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Marine ecology especially regarding scale, mobility, key species and • Policy expertise regarding marine governance arrangements

	species interactions including fish • Māori research expertise relating to customary and commercial marine interests	• Coupled complex system modelling • Knowledge of different scales of commercial interests in marine environment
Potential location(s)	While this project would draw insights from Challenge case studies, e.g. Hawkes Bay, Tasman Bay/Golden Bay, East Cape, Tangaroa case studies, which would include a range of governance, species-environment interactions, and management, it is also important that it operates at national strategy and fisheries management scales as well as scales of ocean usage by mobile species such as marine mammals	
Potential co—developers, collaborators & partners	Marine Hub, Ministry for Primary Industries/Fisheries NZ, Ministry for the Environment, Department of Conservation, Environmental Protection Agency, Environmental NGO's, regional councils, community groups, small local and large national-scale businesses, National level NGOs Māori organisations at national and rohe scales, Te Ohu Kaimoana Youth/rangatahi	
Links to and dependencies with other Themes / Tangaroa	*1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *2 Blue Economy Theme* *3.2 Communicating risk and uncertainty to aid decision-making* *4.1 Treaty Relationships and EBM* *4.2 Options for policy and legislative change* All Tangaroa Synthesis: Ecosystem-based management and blue economy in action; regional case studies	
Timing	2019-2023 (4 years)	
Building on which Phase I research	*1.2.2 Navigating marine socio-ecological systems* *1.3.2 Enabling inter-agency collaboration* *2.1.3 Measuring ecosystem services and assessing impacts* *4.1.1 Tracking biogeochemical fluxes to inform EBM* *4.2.2 Stressor footprints and dynamics*	

The Tangaroa Programme

Indicative Phase II Programme budget: $ 3,931,700

Māori maintain a unique and longstanding connection with the ocean that continues to permeate aspects of Māori life, including cultural, spiritual and economic. This connection is recognised through specific rights and interests as Treaty of Waitangi partners. The Tangaroa Programme in Phase II provides a vehicle for Sustainable Seas to contribute to addressing the specific aspirations and needs of Māori, where they align with the Challenge objective, and to do this in a manner consistent with kaupapa and mātauranga Māori. It places Māori at the centre of the research, and aims to promote and support Māori-led or partnered projects to enable direct benefits to those iwi, hapū or commercial groups involved.

The Tangaroa Programme in Phase I focused on research that increased our collective understanding of, and support to, the knowledge and practice of kaitiakitanga in the marine environment. The findings from this research will be critical to establishing an EBM and blue economy framework and relationship that works in our unique cultural and Treaty of Waitangi context. Tangaroa research in Phase II has been informed by our interactions with Māori during Phase I as well as workshops and discussions in planning for Phase II. Specific research questions are identified within each Theme that reflect key issues and priorities identified by Māori and build upon Tangaroa research undertaken in Phase I. These questions will be answered within the Tangaroa Programme and in partnership with the relevant Themes. Projects *T1 Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM, T2 Huatuakina o hapū e!*, and *T3 Ngā Tohu o te Ao* represent a kaitiakitanga based scale approach from which valuable research across the Challenge can be sited, and whose individual issues of focus stand to support enhancing our development and application of EBM. Projects *T4 Te Tāhuhu Matatau o Tangaroa, mai Tauranga Moana ki te Ao: Empowering the kaitiaki of Tangaroa from Tauranga Moana to Aotearoa and beyond* and *T5 He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment* address a broader scale focus that utilise a Te Ao Māori context to consider marine management, and the provision of information accessible to, and tailored to the needs of Māori in marine management. The projects each contribute to:

- Addressing the aspirations of Māori in halting ecosystem degradation and supporting improved ecosystem recovery including through the development of a model that embodies a harmonisation of mātauranga Māori and western science, and that enables tangata whenua and rohe specific approaches and outcomes;
- Encouraging investment by profiling and supporting Māori innovation in blue economy initiatives to enable further development founded on the mātauranga Māori principles of kaitiakitanga, manaakitanga, whanaungatanga, wairuatanga and whai rawa;
- Understanding the needs of Māori in 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, including through the exploration of traditional approaches to decision-making; and
- Providing for the development and implementation of 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.
- Working collaboratively across the Tangaroa portfolio and Theme research to support the application of a Te Ao Māori approach and to ensure outputs and outcomes produced by Challenge research meet the ongoing needs and aspirations of Māori.

The Themes will feed into, and be informed by, the Tangaroa Programme research as it provides a visible recognition of the Treaty of Waitangi partnership and cultural relationship of Māori to the marine environment. Undertaking these areas of research focus under the Tangaroa Programme recognises that achieving Māori priorities and needs may require a holistic approach to project structure and management (i.e. projects may address more than one of

these areas of focus and so be cross-Theme in delivery and outcome). In addition, they will be Māori-led or partnered, and the ability of the Māori researchers involved to work collaboratively, cohesively and in a culturally appropriate manner will be important.

Some of the funding for the Tangaroa Programme has also been set aside to enable the Challenge to benefit from research opportunities either not yet fully developed, or that may arise early in Phase II. This approach enables us to explore value-add or extension opportunities to specifically support a range of relevant initiatives undertaken by our Māori partners. For example, this could involve incorporating existing networks or projects to maximise our reach and relevance among Māori. It also enables us to leverage off the valuable cohort of Māori researchers and the relationships established with Māori groups and organisations in Phase I.

Project title	T1: Awhi Mai Awhi Atu: Enacting a kaitiakitanga-based approach to EBM
Indicative Phase II Budget:	$1,073,700
Theme / Programme	Tangaroa
Problem definition	This project enables a kaitiakitanga based and site-specific cultural context scale to contribute to and assess the development and application of an EBM approach relevant to both the aspirations of iwi, hapū and Māori organisations and the Challenge objective.
Research question(s)	1. How do we bring together mātauranga Māori and science to better understand habitat connectivity as it applies to the unique social, cultural and ecological context of Ōhiwa Harbour? 2. How can we co-develop opportunities to grow a blue economy informed by mātauranga Māori principles of whanaungatanga, kaitiakitanga, manaakitanga, raNgātiratanga and whai rawa? 3. How do we better estimate and communicate the risks and uncertainties of a dynamic and complex Ōhiwa system? 4. What frameworks, policies and tools do we need to apply a kaitiakitanga based approach to EBM in the planning and implementation of management for Ōhiwa Harbour?
Research activities	• Work collaboratively, and through a transdisciplinary approach, with experts/researchers under each of the four Themes of the Challenge to answer specific questions consistent with the aspirations of Māori for Ōhiwa Harbour. • Combine a novel kaupapa Māori-based 4-dimensional (4D) approach with biophysical science to assist understandings of the harbour with a focus on cumulative effects, multiple stressors and dispersal to support increased attention to land-sea interactions and the impacts of/on human socio-cultural-ecological connectivity. • Enable and empower Māori co-innovation in blue economy initiatives by co-developing and co-implementing a mātauranga Māori process for a bio-technological product to assist shellfish recovery in soft-bottom Harbours. • Co-design a model that integrates and communicates mātauranga Māori with current understandings and assessments of risk and uncertainty to assist decision-making for Ōhiwa Harbour. • Bring together the learning/tools/models from across the project with a co-developed kaitiakitanga-based approach to EBM marine management plan for Ōhiwa Harbour to inform and influence policy frameworks and work programmes of the Bay of Plenty Regional Council and Ōhiwa Harbour Implementation Forum.
Outputs	(a) Biophysical and socio-ecological knowledge that supports the development of understanding and tools that underpin EBM as a viable approach to managing Aotearoa New Zealand's marine environment developed and accessibly packaged. (b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised.
Outcomes	(4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (6) EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Kaupapa Māori marine research • Bio-physical science • Social science • Modellers • Resource Management

	• Policy development • Mātauranga &Tikanga Māori	• Māori fibres expertise • Bio-technology	• Place-based kaitiaki knowledge
Potential location(s)	Ōhiwa Harbour, Eastern Bay of Plenty		
Potential co—developers, collaborators & partners	NIWA, Eco Consultants Ltd, Marine and Environmental Services, others TBC. Te Ūpokorehe Resource Management Team, Te Rūnanga o Ngāti Awa, Bay of Plenty Regional Council and the seven partners of the Co-Governance Ōhiwa Harbour Implementation Forum. Other agencies/bodies TBC.		
Links to and dependencies with other Themes / Tangaroa	*1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *2 Blue Economy Theme* *3.1 Perceptions of risk and uncertainty* *3.2 Communicating risk and uncertainty to aid decision-making* *4.3 EBM and Kaitiakitanga* *4.4 Science and Mātauranga working together* *4.5 Enabling EBM at different scales* Synthesis: Ecosystem-based management and blue economy in action; regional case studies		
Timing	2019-2023 (4 years)		
Building on which Phase I research	*1.1.1 Testing EBM-supportive participatory processes for marine management* *IF 1.3.2 Enabling inter-agency collaboration on cumulative effects* *2.1.2 Mauri moana, mauri tangata, mauri ora – documenting social values* *2.2.2 Huataukīna tō iwi e: Developing marine bioactive economic opportunities from Tairāwhiti kina to combat diabetes, heart disease and inflammation.* *3.1.1 Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment* *3.1.3 Tāhuhu Matatau Te Ao Tangaroa: Empowering kaitiaki* *3.3.2 Whaia te Mana Māori Whakahaere Tōtika ki Tangaroa: In pursuit of Māori governance jurisdiction models over marine resources* *4.2.1 Tipping points in ecosystem structure, function and services*		

Project title	T2: Huatuakina o hapū e!
Indicative Phase II Budget:	$902,800
Theme / Programme	Tangaroa
Problem definition	Phase I research identified that the application of existing policy and legislation for marine management does not sufficiently enable the expression of Kaitiakitanga and the application of a Te Ao Māori context complimentary to EBM. This project provides an opportunity to explore new and unique Treaty of Waitangi based legislation to develop and evaluate an EBM and Blue Economy approach consistent with hapū aspirations.
Research question(s)	1. How do we unlock the potential of Tiriti o Waitangi based legislation, mātauranga Māori, kaupapa Māori research and science to enable the effective implementation of kaitiakitanga and EBM? 2. How can mātauranga-ā-hapū and distinctive cultural interests inform and influence increased involvement in decision making and blue economy initiatives and outcomes? 3. What frameworks, systems and models to we need to enable kaitiaki to better participate at all levels in the implementation of kaitiakitanga and EBM in the management of Rohe Moana?
Research activities	A kaupapa Māori research approach will be employed to: • Collect and explore existing knowledge and information relating to the marine ecosystems within the case study rohe moana to enable the utilisation of mātauranga Māori and science to support kaitiakitanga and the application of EBM in our rohe moana. • Establish partnerships necessary within the case study rohe moana to facilitate hapū based aspirations for increased participation and leadership in decision-making and management consistent with the respective hapū tikanga and an EBM approach. • Assess the development of a long-term framework and plans to increase capacity and capability to establish and implement a kaitiakitanga informed EBM approach. • Identify and develop the tools, methodologies and systems necessary to achieve the implementation of kaitiakitanga and EBM including GIS; data management; e-learning and app developments; media, publications, etc. • Assess hapū based IP approaches to support hapū based blue economy outcomes • Identify and assess Blue Economy initiatives and opportunities within the case study rohe moana including building relationships and connections to the commercial sector. • Support and work in partnership with research across the Challenge to enhance opportunities to leverage and enhance kaitiakitanga and EBM outcomes.
Outputs	(b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised (c) Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated (j) Guidelines for participation in EBM decision-making processes evaluated, refined and packaged for targeted iwi, stakeholders and decision-makers (k) Pathways for knowledge, understanding and skills developed by the Challenge to be understood by iwi and stakeholders are developed
Outcomes	(4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (6) EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi

	(7) Māori rights, interests and values are supported through the application of EBM (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge		
Critical skills required	• Mātauranga Māori • Kaitiaki and kairangahau • Marine ecology and biology • Social science	• Economic / business analysis	• Web & tool development • GIS • Legal – Governance, IP, Policy & Legislative
Potential location(s)	Ngā Rohe Moana ō te Tairawhiti (Rohe Moana of the East Coast)		
Potential co—developers, collaborators & partners	ESR, Hikurangi Bioactives Partnerships Ltd, Mauri Compass Ltd, Cawthron Institute, Ngā Hapū o Ngāti Porou, others TBC Kaitieki Trusts, Fisheries Committees of Ngāti Porou, Te Wānanga o Awanuiārangi, Whakatohea, Te Aitanga ā Mahaki, Ngāti Whakahemo, others TBC		
Links to and dependencies with other Themes	1.*1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *2 Blue Economy Theme* *3.1 Perceptions of risk and uncertainty* *3.2 Communicating risk and uncertainty to aid decision-making* *3.3 Risks to business from investment and environmental uncertainty* *4.1 Treaty relationships and EBM* *4.2 Options for policy and legislative change to enable EBM* *4.3 EBM and Kaitiakitanga* *4.4 Science and Mātauranga working together* *4.5 Enabling EBM at different scales* Synthesis: Ecosystem-based management and blue economy in action; regional case studies		
Timing	2019-2023 (4 years)		
Building on which Phase I research	*IF 2.2.2.4 Huataukina tō iwi e: Developing marine bioactives from kina* *3.1.1 Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment* *3.1.3 Tāhuhu Matatau Te Ao Tangaroa: Empowering kaitiaki* *3.2.1 Whai Rawa, Whai Mana, Whai Oranga: Creating a world-leading indigenous blue economy* *3.3.1 Tūhonohono: Tikanga Māori me te Ture Pākehā ki Takutai Moana* *3.3.2 Whaia te Mana Māori Whakahaere Tōtika ki Tangaroa: In pursuit of Māori governance jurisdiction models over marine resources*		

Project title	T3: Ngā Tohu o te Ao
Indicative Phase II Budget: $580,900	
Theme / Programme	Tangaroa
Problem definition	There are few examples of existing models and frameworks for reclaiming, restoring and applying traditional ecological knowledge to establish mātauranga Māori based marine ecological baselines, against which to assess degradation and recovery, and to design mātauranga Māori enabled EBM approaches and models.
Research question(s)	1. How can Maramataka be used as a catalyst to reclaim, guide, teach, protect traditional knowledge of the environment 2. What place specific indicators of the Maramataka can inform traditional, contemporary and future baselines for the coastal environment. 3. How do we develop a process/framework/tool that guides whanau/hapū /iwi to reclaim traditional knowledge for the assessment of coastal ecosystems.
Research activities	• Explore existing information relevant to the focus of the project including connecting to organisations, groups who are working in this area. • Identifying tikanga and kawa for collecting repositories of mātauranga o Whakahua: Give expression to the tikanga, kawa of the kaupapa (Maramataka), define principles of engagement and outcomes o Kohikohi: Define modes of collecting content (what, where, how and who) and begin reclaiming mātauranga of Maramataka o Whakarite: Defining tikanga for organising and classifying information – • Within each case study area develop a framework based on Maramataka to establish traditional marine ecological baselines o Wananga: Conduct a synthesis (investigate, reflect, adapt), create linkages and cross refences of mātauranga collected to reframe a conceptual framework to establish traditional ecological baselines o Wananga: Identify place specific indicators that can inform traditional physical/biophysical marine ecosystem baselines using reclaimed mātauranga related to Maramataka • Establishment of a framework to define place specific tohu (indicators) related to Maramataka to assess degradation/recovery within coastal marine areas o Wananga: Test and refine Maramataka based indicators to establish a contemporary baseline of physical/biophysical marine ecosystems o Pataka: Identify changes in traditional and contemporary baselines for a proxy for analysis • Define a framework that will enable whanau/hapū /iwi to reclaim traditional ecological knowledge of Maramataka to establish place specific indicators for assessing physical/biophysical coastal marine ecosystems o Wananga: Establish a suite of western science methods for uptake that align with the Maramataka indicator Themes o Wananga: Draw out learnings with other case study areas (x3) to establish its application nationally
Outputs	(b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised (c) Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated

Outcomes	(3) Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy (4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge		
Critical skills required	• Maramataka and tikanga Māori pūkenga • Hapū Leadership Roles	• Wananga Facilitators • Frontline Kaitiaki	• Coastal marine ecologists
Potential location(s)	Karitane (Otago) Tokomaru Bay Tauranga Moana		
Potential co—developers, collaborators & partners	Manaaki Te Awanui, others TBC Iwi, hapū, whānau, and research organisations relevant to locations/sites of research.		
Links to and dependencies with other Themes / Tangaroa	*1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *3.1 Perceptions of risk and uncertainty* *3.2 Communicating risk and uncertainty to aid decision-making* *4.1 Treaty relationships and EBM* *4.3 EBM and Kaitiakitanga* *4.4 Science and Mātauranga working together* *4.5 Enabling EBM at different scales* Synthesis: Ecosystem-based management and blue economy in action; regional case studies		
Timing	2019-2023 (4 years)		
Building on which Phase I research	*2.1.2 Mauri Moana Mauri Tangata Mauri Ora* *3.1.3 Te Tāhuhu Matatau o Tangaroa, mai Tauranga Moana ki te Ao* *3.1.2 He Potokomanawa*		

Project title	T4: Te Tāhuhu Matatau o Tangaroa, mai Tauranga Moana ki te Ao: Empowering the kaitiaki of Tangaroa from Tauranga Moana to Aotearoa and beyond
Indicative Phase II Budget: $600,100	
Theme / Programme	Tangaroa
Problem definition	Phase I research developed a mechanism and engagement-based process for capturing and making more accessible science information for kaitiaki within a specific rohe. This project aims to address gaps relevant to further enhancing and refining this approach; enabling its extension to different locations and scales; building on the engagement model established to explore its potential in the application of an EBM approach.
Research question(s)	1. How might the specific tools of marine spatial mapping encourage the capture and storage of mātauranga Māori to streamline whānau/hapū/iwi responses to marine degradation? 2. How might scientific reports and articles be produced in a more accessible way to increase efficiencies of whānau/hapū/iwi capture and dissemination? 3. How might Māori tikanga inform western science researchers and academics, through a wānanga based hapū engagement approach? 4. How might the development of the Te Tāhuhu Matatau Ao Tangaroa (TTMAT) phase one web application and training resource be implemented in a fast-changing technological world through phase two to ensure effective access and uptake more beyond Tauranga Moana?
Research activities	This project will build on the unique engagement framework developed in previous relevant research to: • Develop a marine spatial mapping tool, in accordance with tikanga Māori, for efficient reclamation of mātauranga Māori within a wānanga hapū engagement setting. • Investigate and develop/adapt new digital mediums for capturing scientific knowledge, in accordance with tikanga Māori, that helps kaitiaki to connect to, discuss and disseminate scientific and EBM information to the wider whānau/hapū/iwi in a way that most suits them. • Investigate and develop mātauranga Māori tools and frameworks for western researchers, academics and resource managers to more effectively take part in co-management activities. • Investigate the changing and trending technologies of dissemination of information to keep the phase one web application current, applicable and more widely accessible over time.
Outputs	(b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised (k) Pathways for knowledge, understanding and skills developed by the Challenge to be understood by iwi and stakeholders are developed
Outcomes	(3) Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy (4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills	• Mātauranga Māori Pukengā • Technology Experts in Information

required	• Wānanga Based Hapū Engagement Leaders • Tikanga Māori Tohunga • Frontline Kaitiaki	Capture, Storage and Dissemination • App Developers • Disruptive Technologies Experts • Spatial mapping
Potential location(s)	Tauranga Moana Te Tau Ihu o te Waka Kaikoura Tokomaru Bay	
Potential co—developers, collaborators & partners	Manaaki Te Awanui, others TBC Iwi, hapū, whānau, and research organisations relevant to sites and locations of research.	
Links to and dependencies with other Themes / Tangaroa	*1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *4.3 EBM and Kaitiakitanga* *4.4 Science and Mātauranga working together* *4.5 Enabling EBM at different scales* Synthesis: Ecosystem-based management and blue economy in action; regional case studies	
Timing	2019-2023 (4 years)	
Building on which Phase I research	*3.1.2 He Poutokomanawa* *3.1.3 Tāhuhu Matatau Te Ao Tangaroa: Empowering kaitiaki* *2.1.2 Mauri Moana, Mauri Tangata, Mauri Ora* *VM 4.1 Repository of knowledge: mātauranga Māori*	

Project title	T5: He Kāinga Taurikura ō Tangitū: Treasured Coastal Environment
Indicative Phase II Budget:	$298,900
Theme / Programme	Tangaroa
Problem definition	This project enables a kaitiakitanga based scale opportunity to assess the use of science and mātauranga Māori to take EBM from theory in to practice in a Treaty-based coastal management context.
Research question(s)	1. How do we generate both ecosystem-based management opportunities and challenges for Aotearoa to move from theory to practice encompassing Māori values within a Treaty-based coastal management context? 2. What robust and accessible tools do we need to support kaitiaki to separate natural variation in coastal ecosystems from that caused by human activities that could potentially be better managed? 3. What mātauranga Māori and science-based indicators of such change could be developed to provide evidence to inform coastal management decision making and action?

Research activities	• Develop a framework that focusses on cultural values, uses and opportunities
	• Apply inter-generational thinking to identify desired outcomes including goals of management and the rules to meet desired objectives (e.g. how much habitat to protect, acceptable levels of harvest to protect cultural values, uses and opportunities)
	• Develop a dynamic management paradigm shift to include:
	  ○ adaptive management
	  ○ mātauranga Māori monitoring indicators – evaluated from a mātauranga Māori basis; and science-based ecosystem monitoring indicators – evaluated from a science basis
	• identify, evaluate the utility of, and where useful, advance a suite of practical and effective tools for kaitiaki to include mātauranga Māori and science-based ecosystem monitoring indicators
	• Identify, evaluate the utility of, and where useful, advance an information management visualisation and communication system to accumulate robust evidence and support the achievement of desired outcomes via various regulatory mechanisms
	• Identify collaborative alignment, research activities and transferable outputs with other relevant Phase II Sustainable Seas Science Challenge projects.

Outputs	(b) Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised (c) Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated (e) Scales of management and place-based strategies that reduce environmental risks are identified and demonstrated
Outcomes	(3) Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy (4) The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (8) Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge
Critical skills required	• Kaupapa Māori research • Mātauranga and Tikanga Māori • Biophysical science • Social science • Resource management • System mapping • Policy • Data management • Web development

Potential location(s)	The traditional area of the hapū of Maungaharuru (the mountain) to Tangitū (the sea) located in northern Te Matau-a-Māui (Hawke's Bay).
Potential co—developers, collaborators & partners	Maungaharuru-Tangitū Trust, others TBC Ngāti Marangatūhetaua, Ngāti Whakaari, Ngāi Tauira, Ngāti Kurumōkihi, Ngāi Te Ruruku ki Tangoio and Ngāi Tahu Hapū of northern Hawke's Bay, Hawke's Bay Regional Council, others TBC
Links to and dependencies with other Themes / Tangaroa	*1.1 Understanding ecological responses to cumulative effects* *1.2 Tools for incorporating ecological responses to cumulative effects into management action* *3.1 Perceptions of risk and uncertainty* *3.2 Communicating risk and uncertainty to aid decision-making* *4.1 Treaty relationships and EBM* *4.3 EBM and Kaitiakitanga* *4.4 Science and Mātauranga working together* *4.5 Enabling EBM at different scales* *T4 Te Tāhuhu Matatau o Tangaroa* Synthesis: Ecosystem-based management and blue economy in action; regional case studies
Timing	2019-2023 (4 years)
Building on which Phase I research	*1.1.1 Testing EBM-supportive participatory processes for marine management* *2.1.2 Mauri moana, mauri tangata, mauri ora – Documenting social values* *3.1.1 Hui-te-ana-nui: Understanding kaitiakitanga in our marine environment* *3.1.2 He Poutokomanawa: Kaitiakitanga in Practice* *3.1.3 Tāhuhu Matatau Te Ao Tangaroa: Empowering kaitiaki* *3.2.1 Whai Rawa, Whai Mana, Whai Oranga* *3.3.2 Whaia te Mana Māori Whakahaere Tōtika ki Tangaroa: In pursuit of Māori governance jurisdiction models over marine resources*

Challenge Theory of Change (Outputs & Outcomes)

Theory of Change
Sustainable Seas Phase II
Version date: 13 May 2019

Objective: Enhanced utilisation of our marine resources within environmental and biological constraints

Mission: Transformation of Aotearoa New Zealand's ability to enhance our marine economy, and to improve decision-making and the health of our seas through ecosystem-based management

High level outcomes 2024 -

- FO1 Enhanced marine blue economy
- FO2 Improved decision-making using an EBM approach
- FO3 Improved health of our seas
- FO4 Increased involvement of tikanga and mātauranga Māori

Outcomes 2023 - 2024

Principles of EBM are being used to improve management

1. The value of blue economy business models is recognised and adopted by Aotearoa New Zealand businesses (FO1)
2. Decision-making practices that are more inclusive, multi-sectorial and account for the effects from cumulative and multiple activities are adopted (FO2, FO4)
3. Knowledge from the Challenge (science and mātauranga) is used in decision making to improve ecological health and influences Aotearoa New Zealand's marine management practice and policy (FO3)
4. The complementarity of local expressions of Kaitiakitanga and EBM are well understood and enabled (FO2, FO4)
5. Decision-making processes explicitly identify and address both risk and knowledge uncertainty in a way that reduces risks to ecological, social, cultural and economic wellbeing (FO1, FO2 and FO3)
6. EBM practices are understood and accepted as a viable approach by decision makers, stakeholders and iwi (FO2)
7. Māori rights, interests and values are supported through the application of EBM (FO4)
8. Researchers and iwi and stakeholders involved during the life of the Challenge continue to actively promote, research in, and use knowledge from the Challenge (FO1-FO4)

Contribution

Attribution

Co-development, engagement and communication activities to increase knowledge and awareness of EBM approach, the complementarity of kaitiakitanga and EBM approaches, and the potential of the blue economy of Aotearoa New Zealand

Outputs 2019 - 2024

The models, tools and knowledge for Nzers to maintain or enhance ecosystem health and promote the blue economy are available and accessible

a. Biophysical and socio-ecological knowledge that supports the development of understanding and tools that underpin EBM as a viable approach to managing Aotearoa New Zealand's marine environment developed and accessibly packaged.

b. Traditional, local and other cultural knowledge that supports EBM is captured/understood/recognised.

c. Effective partnership models for an EBM approach to decision-making and management developed, evaluated, and demonstrated.

d. Decision-making processes that recognise risk and uncertainty evaluated, developed, and demonstrated.

e. Scales of management and place-based strategies that reduce environmental risks are identified and demonstrated.

f. Tools for predicting and managing cumulative and multiple stressors developed, assessed and demonstrated.

g. Governance and policy practices that support EBM identified, evaluated and packaged for targeted decision-makers.

h. Frameworks for decision making that consider multiple values and blue economy activities developed and evaluated.

i. Guidelines developed, opportunities identified and innovations, for transitioning to a blue economy for businesses operating in the marine sector.

j. Guidelines for participation in EBM decision-making processes evaluated, refined and packaged for targeted iwi, stakeholders and decision-makers.

k. Pathways for knowledge, understanding and skills developed by the Challenge to be understood by iwi and stakeholders are developed.

l. Remaining knowledge gaps that increase environmental risks of decision making are identified for iwi and stakeholders.

Underpinning principles
To achieve healthy ecosystems and a vibrant blue economy

- **Collaborative decision-making** — Collaborative, co-designed and participatory decision-making processes that involve all interested parties
- **Co-governance** — Governance structures that provide for Treaty of Waitangi partnership, tikanga and mātauranga Māori
- **Sustainability** — Marine environments, and their values and uses, are safeguarded for future generations
- **Knowledge-base** — Based on science and mātauranga Māori, and informed by community values and priorities
- **Adaptive** — Flexible, adaptive management, promoting appropriate monitoring and acknowledging uncertainty
- **Human use and values** — Humans and their multiple uses and values for the marine environment, are part of the ecosystem
- **Tailored** — Place and time specific, acknowledging all ecological complexities and connectedness, and addressing cumulative and multiple stressors

Application of learnings from Phase I

Treaty of Waitangi partnership where the rights and perspectives of Māori are central