APPENDIX 1
PROJECT BRIEF

A. PROJECT TITLE	Measuring progress towards Ecosystem Based Fisheries Management – developing a monitoring and indicator framework for the Hauraki Gulf Marine Park
"SHORT" TITLE	EBFM in the Hauraki Gulf
B. THEME / PROGRAMME	EBM and the blue economy in action (Synthesis)

C. PROJECT KEY RESEARCHERS (CVs for all listed to be provided in SharePoint container using template provided in container)

Role	Name	Institution / company	Email
Project Leader(s)	Darren Parsons and Adam Slater	NIWA	darren.parsons@niwa.co.nz; adam.slater@mpi.govt.nz;
Māori engagement and Researcher	Darcy Karaka	Sustainable Seas NSC	
Researcher	Matt Pinkerton	NIWA	
Researcher	Judi Hewitt	University of Auckland	
Researcher	Ian Tuck	MPI	
Researcher	Irene Middleton	NIWA	
Researcher	Paula Holland	NIWA	

D. CO-DEVELOPED WITH

Name	Role	Organisation / company / agency	Level of partnership
John Willmer	Co-development partner	Fisheries Inshore New Zealand	Workshop participant, proposal review, anticipated involvement in research activities
Peter Longdill	Co-development partner	Sanford	Workshop participant, proposal review, anticipated involvement in research activities
Nathan Reid	Co-development partner	Moana New Zealand	Workshop participant, proposal review, anticipated involvement in research activities
Tom Searle	Co-development partner	Lee Fish Ltd	Workshop participant, proposal review, anticipated involvement in research activities
Denham Cook	Co-development partner	Pelco NZ	Workshop participant, proposal review, anticipated involvement in research activities
Sam Woolford	Co-development partner	LegaSea	Workshop participant, proposal review, anticipated involvement in research activities
Raewyn Peart	Co-development partner	Environmental Defence Society	Workshop participant, proposal review, anticipated involvement in research activities
Megan Carbines	Co-development partner	Auckland Council	Workshop participant, proposal review, anticipated involvement in research activities
Michael Townsend	Co-development partner	Waikato Regional Council	Workshop participant, proposal review, anticipated involvement in research activities
Sue Neureuter	Co-development partner	Independent	Workshop participant, proposal review, anticipated involvement in research activities
Manuel Greenland	Co-development partner	Good Fishing	Workshop participant, proposal review, anticipated involvement in research activities
Matt von Sturmer	Co-development partner	Salt Fly Fish	Workshop participant, proposal review, anticipated involvement in research activities
Joe Davis	Tangata Whenua		Workshop participant, proposal review, anticipated involvement in research activities
Laurie Beamish	Tangata Whenua		Workshop participant, proposal review, anticipated involvement in research activities
Valmaine Toki	Tangata Whenua		Workshop participant, proposal review, anticipated involvement in research activities
Tame Te Rangi	Tangata Whenua		Workshop participant, proposal review, anticipated involvement in research activities
Nicola MacDonald	Tangata Whenua		Workshop participant, proposal review, anticipated involvement in research activities

Alex Rogers	Co-development partner	Hauraki Gulf Forum	Workshop participant, proposal review, anticipated involvement in research activities
Apanui Skipper	Co-development partner	Department of Conservation	Workshop participant, proposal review, anticipated involvement in research activities
Jacob Hore	Co-development partner	Ministry for Primary Industries	Workshop participant, proposal review, anticipated involvement in research activities
Jordi Tablada	Co-development partner	Department of Conservation	Workshop participant, proposal review, anticipated involvement in research activities
Linda Faulkner	Co-development partner	Sustainable Seas NSC	Workshop participant, proposal review, anticipated involvement in research activities

E. ABSTRACT

The fisheries resources of the Hauraki Gulf are under pressure from a variety of sources. Recently, the Government began to implement *Revitalising the Gulf*, its strategy for restoring the health and mauri of the Hauraki Gulf. This strategy takes a more ecosystem-based management (EBM) approach to management of the Gulf's marine resources and consists of a package of marine conservation and fisheries management actions that together work towards healthy, functioning ecosystems and fisheries. Implementation of this Plan presents an excellent opportunity for the Sustainable Seas National Science Challenge (SSNSC) to progress Ecosystem-Based Fisheries Management (EBFM), enable mātauranga Māori, and support a Te Ao Māori worldview in partnership with the Ministry for Primary Industries (MPI), tangata whenua and stakeholders. This project will co-develop a suite of fisheries system indicators (covering ecological, environmental, economic, cultural, and social elements and management aspects) to monitor fisheries resources and associated aquatic ecosystems as well as measuring the performance of management actions. We have engaged with a group of Hauraki Gulf tangata whenua and stakeholders (including recreational and commercial fishers, individuals with environmental interests, scientists, Government and Council representatives) to capture core principles for the co-development of this proposal and, ultimately, the indicator suite. Together we will undertake a co-development process to generate an indicator framework and a report detailing how that framework was formed. These indicators will have practical utility providing an understanding of how the health of the Hauraki Gulf has changed in response to the Fisheries Plan and other EBFM strategies.

F. RELEVANCE TO CHALLENGE OBJECTIVE

The goal of *Revitalising the Gulf* is to achieve step-change improvement for the Gulf to improve its waiora (health) and mauri (life force). This case study will help work towards that goal by co-developing a suite of fisheries system indicators (covering ecological, environmental, economic, cultural, and social elements and management aspects) to monitor fisheries resources and associated aquatic ecosystems in the Hauraki Gulf Marine Park (as well as measuring the success of the Fisheries Plan and other *Revitalising the Gulf* interventions). Indicators are an essential part of the EBFM cycle; they are the performance metrics that let you know if you are working towards your goals (or not) and enable adaptation within the EBFM cycle. As such, this project, and what it will enable within *Revitalising the Gulf*, is very well aligned with the Challenge's objective of "enhancing utilisation of our marine resources within environmental and biological constraints."

G. OUTPUTS	This project will produce the following Outputs:	Linked to which Theory of Change Outputs:	Explain briefly your plan to ensure uptake by iwi and stakeholders:
	Framework: A hierarchical framework of Hauraki Gulf fisheries system indicators including potentially useful indicators for which there is currently no data.	(h) Frameworks for decision making that consider multiple values and blue economy activities developed and evaluated.	This framework will be co-developed with tangata whenua and stakeholders as well as end-users such as the MPI, the Department of Conservation (DOC), Councils, and the Hauraki Gulf Fisheries Plan Advisory Group. As such it will encapsulate their values and be constructed to be utilised by end-users as a tool for them to monitor and communicate change within the Hauraki Gulf fisheries system and the effectiveness of the Hauraki Gulf Fisheries Plan.
	Report: A final project report	(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,	While the framework above is intended for direct use by co-development partners for monitoring the health of the Hauraki Gulf fisheries system, the report here is intended to communicate how the framework was

		and demonstrated.	co-developed. As such it will describe the indicator development process, the workshops undertaken, their outcomes, the indicator screening process and the final indicator suite selected. These methodological details may serve as useful guidance for the development of similar processes elsewhere. This report will also be presented to the co-development group and other interested parties via a webinar.
	Image/graphic/video/pamphlet	(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. (k) Pathways for knowledge, understanding and skills developed by the Challenge to be understood by iwi and stakeholders are developed.	While MPI will ultimately be responsible for communicating the suite of indicators and the monitoring plan, this output is intended to be a short and digestible form of communication suitable for the general public.

H. OUTCOMES	This project will contribute to the following Theory of Change Outcomes:
	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)
	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)

I. INTRODUCTION

He waka eke noa, kia eke panuku, kia eke Tangaroa

We're in this waka together, through our combined efforts, Tangaroa will thrive

This whakataukī (proverb) pays homage to Tangaroa (deity of the ocean) and that through our combined efforts, Tangaroa and the moana (ocean) will thrive. It captures the essence of this proposed research and binds people, place, and culture together through our combined efforts to enhance the mana (prestige) and mauri of Tangaroa and the moana. The waka is a metaphorical representation of the voyage/journey that this research, the researchers, tangata whenua (local people) and tangata tiriti (non-Māori New Zealanders) are on to achieve the moemoeā (aspiration) for Ngā Moana Whakauka - SSNSC: that Aotearoa New Zealand has healthy marine ecosystems providing value for every New Zealander.

The SSNSC wishes to trial an EBM approach to management through a series of case studies in marine environments experiencing multiple stressors to explore management options to improve ecosystem health. To succeed, EBM requires involvement of groups with a diversity of interests in the marine environment. The involvement of these groups is essential to ongoing improvement of management processes, and to ensure that a Te Ao Māori worldview is supported to enable mātauranga Māori knowledge to inform the research and our journey together. The intersection of mātauranga Māori and Science presents a rich tapestry of knowledge unique to the context of Aotearoa New Zealand.

Te Moananui-a-Toi, Tīkapa Moana, or the Hauraki Gulf as it is commonly referred to today, is highly valued and utilised, with multiple stressors acting on it[1]. There are signs the health of the Gulf, and its fisheries, have declined[1]. Through a collaborative co-governance process, a plan to enable multiple uses of Te Moananui-a-Toi while restoring its health, *Sea Change – Tai Timu Tai Pari Hauraki Gulf Marine Spatial Plan,* was released in 2017[2]. In 2018, the Government initiated an engagement process which resulted in *Revitalising the Gulf* - Government Strategy in response to the Sea Change Plan in June 2021[3].

Revitalising the Gulf is organised into eight themes addressing threats to the health and mauri of the Hauraki Gulf. The Fisheries Management theme will develop a Hauraki Gulf Fisheries Plan (supported by the Hauraki Gulf Fisheries Plan Advisory Group, and the indicators and monitoring framework). This plan will progress EBM using an integrated approach to manage competing values for

resources while maintaining the ecosystems that support them. To assess the overall ecosystem health of the Hauraki Gulf and determine how the Fisheries Plan is progressing towards these goals, indicators will be selected that reflect the status of the fisheries and ecosystems in the Hauraki Gulf. These indicators will monitor the status of fisheries and other cultural, socio-economic and ecosystem components of value to tangata whenua and stakeholders.

Since the Governments response strategy was released, we have been working to establish a group of Hauraki Gulf tangata whenua and stakeholders (including recreational and commercial fishers, individuals with environmental interests, scientists, Government and Council representatives) to co-develop this proposal.

J. AIMS

This Hauraki Gulf EBFM case study will help MPI implement one of the fisheries management components of *Revitalising the Gulf* by co-developing (with tangata whenua and stakeholders) suitable indicators for monitoring the Hauraki Gulf fisheries system. The purpose of this indicator framework is to: (1) assess the status and trends of important ecological, economic, social, and cultural components of the fishery system; (2) measure progress and evaluate the impact of the Hauraki Gulf Fisheries Plan and other future initiatives; and (3) identify potential indicators for which there are currently no data. These aims will be communicated with tangata whenua, stakeholders, and managers by producing an indicator framework and reports detailing how that framework was formed (as outlined in Section G. Outputs). These indicators will have great utility in allowing managers and co-developers to understand how the health (mauri) of the Hauraki Gulf changes as EBFM strategies (and other management interventions) are implemented.

K. PROPOSED RESEARCH

Te Moananui-a-Toi - Tīkapa Moana - The Hauraki Gulf Marine Park

The Hauraki Gulf Marine Park spans 1.2 million hectares, extending twelve nautical miles seaward from the east coast of the Auckland and Waikato regions. It encompasses a diversity of habitats from sheltered estuaries to fully exposed open ocean over 250 metres deep[1,2]. The Hauraki Gulf is also a taonga (treasure) of cultural and spiritual significance to mana whenua through the rich history of settlement and use since the first waka navigated its waters.

Given the beauty, diversity, and importance of the Hauraki Gulf, it is not surprising that it is used for a variety of purposes and has high value to many different people. Its many uses include customary, commercial and recreational fisheries, as a place of cultural and spiritual significance, aquaculture, tourism, as a major commercial port and transport route, sightseeing, recreation and as a home to a diversity of marine life[1,2]. The catchment of the Hauraki Gulf supports New Zealand's largest city, Auckland, and large areas of farmland in the Waikato. Some of the stressors that the Hauraki Gulf faces include fishing, pollutants, nutrients, sediment, invasive species, and climate change[1,2].

From a fisheries perspective, many of the Hauraki Gulf's taonga fish species have been depleted. This includes tāmure (snapper), tarakihi, kōura (rock lobster), tipa (scallops), and tuangi (cockles)[1,4]. Fish extraction can also impact other parts of the ecosystem. For example: (1) bottom trawling, Danish seining, and dredging all impact benthic fauna, which provide habitats supporting many fish species; prior to the 1960s large areas of green-lipped mussels were removed from the Gulf by dredging[5]; bottom trawling has reduced the diversity of soft-sediment fauna throughout the Gulf[6]; (2) fishing (both recreational and commercial) can catch unwanted species, some of which are threatened (e.g., black petrel)[7]; (3) fishing can also affect ecosystem structure. The presence of kina barrens on rocky reefs may be a consequence of fishery related predator removal[8].

Non-fishing related factors can also affect fisheries. For example, nutrients and sediments from the land can also impact pelagic and benthic community structure, with flow on effects for fish and the habitats that support them[9]. Many species will be sensitive to climate related factors, potentially leading to reduced abundances or altered distributions[10]. To address these broad reaching concerns for the Hauraki Gulf's fisheries, the ecosystems that support them, and the cultural, social and economic value systems connected to them, a new more holistic approach to fishery management is required.

Ecosystem Based Management (EBM) and indicators

The underlying concepts of Ecosystem Based Management (EBM) are not new, having been considered by scientists for over a century and more formally discussed since the 1970s[11]. The Te Ao Māori world view, which shares principles such as interconnection of humans and nature, has been around for much longer. Some key principles of EBM include[12]:

- Ecologically meaningful boundaries – place based, recognising connections across space and time.
- Holistic (integrative) approaches to management, incorporating physical, biological, social, and economic complexity.
- Humans are part of the ecosystem – socially and culturally meaningful boundaries and values, providing for intergenerational use.
- Incorporates multiple ecosystem components and disciplines.
- Has multiple goals/objectives.
- Addresses diverse societal objectives/values (trade-offs).
- Collaborative and participatory decision-making process.

- Adaptative management process that prioritises vulnerabilities and risks to ecosystems and their components to maintain resilient ecosystems for future generations.
- EBM should give effect for Tiriti o Waitangi Partnership, incorporate mātauranga, and remain compatible with a Te Ao Māori world view.

Indicators are an important component of the implementation of EBM and a Te Ao Māori world view. Indicators allow complex systems to be monitored through a subset of characteristics (which act as a proxy for a broader set of ecosystem attributes), communicating the trends in that system (identifying the stressors acting on it), the response of management, and the progress towards objectives[13-17]. Indicators should cover ecological, environmental, economic, cultural, social, and management aspects, and are often arranged into a hierarchy (i.e., nesting from many indicators at the bottom level into higher levels with fewer categories). A good indicator is easily measured, easy to understand, has an existing time series, is sensitive to stressors, and complements other indicators to avoid redundancy. There are a variety of approaches to the development of an indicator suite, but they largely have the following steps in common[13-17]:

(1) Relevant partners, end-users, and managers are identified to co-develop objectives and a framework for the indicators.

(2) Candidate indicators are co-developed, often facilitated by subject matter experts.

(3) These candidate indicators are scored against a set of screening criteria. There are a variety of screening criteria that can be used, with each candidate indicator scored against each criterion in a process that involves researching existing information about the candidate indicator and the use of expert judgement where needed. The scores for the screening criteria are then combined so that overall scores for each candidate indicator can be compared. It is important that decisions made during this process are well documented.

(4) The screening results are summarised and a final decision on the indicator suite is made with the co-development group.

(5) The results are communicated, and the process is updated and iterated going forward.

Ultimately indicators are intended to support management decisions, however, this requires an understanding of the directionality of the indicators selected (is a bigger number better or worse), how the response of these indicators relate to one another (some indicators may get better while others may get worse) and eventually the setting of management reference points. The consideration of reference points across an entire suite of interrelated indicators, and establishing the data to support decisions around these reference points, is clearly a big step forward. First, the indicators themselves need to be established. Their subsequent monitoring will lead to an understanding that will result in the setting of management reference points beyond the life of this project.

Co-development – what we heard

As mentioned in Section I, to foster co-development we formed a group of tangata whenua (five Hauraki Gulf tangata whenua hereafter referred to as the Core Tangata Whenua Group (CTWG)) and stakeholders. Below is a summary of what we heard from this group:

- The project should incorporate a meaningful partnership with tangata whenua:
  - It should give effect for Te Tiriti o Waitangi – a korowai (cloak) for both Te Ao Pākehā and Te Ao Māori indicators.
  - A Te Ao Māori perspective should be embraced to promote interconnectedness as fish do not recognise boundaries.
  - Te Ao Pākehā and Te Ao Māori indicators should be aligned, but not forced together. This can be thought of as a waka taurua (double hulled canoe) – both sets of indicators have space to co-exist in their respective hiwi (hulls) with the opportunity to come together in the shared space on the papanoho (deck). The overarching principle is to keep the indicators navigating together aligned.
  - Mātauranga Māori should be incorporated. A 'tātai' perspective should be adopted to allow space for knowledge to grow and adapt to changes, supporting intergenerational knowledge transfer along with mātauranga-a-iwi (localised tribal knowledge) and hau kāinga (local people) led actions and aspirations. The sources of this knowledge should be appropriately acknowledged so that the knowledge remains with the hau kainga that have shared it.
  - Ngā kōrero o ngā hau kāinga – This refers to the conversations and discussions of hau kāinga and the implicit mātauranga that comes with acknowledging, supporting, and actioning the voices and aspirations of hau kāinga in relation to the Hauraki Gulf. It recognises individual uri as descendants of people and place through whakapapa and that the preservation of the mātauranga and intergenerational knowledge is supported through active engagement and participation from hau kāinga. For this project we will only be building the upper levels of an indicator framework, but we need to make sure that this framework allows for place-based context from individual uri to be added at a later stage.
- The indicator development process should be transparent and simple, with a clear scope. This promotes engagement with the process, producing understandable and accessible indicators. This process should incorporate and respect a diversity of perspectives/values, so that it captures “the voice of the Gulf.” The scope should incorporate a connection to the land, and a connection to other themes within *Revitalising the Gulf*, but recognise that the key area of focus is the Hauraki Gulf fisheries system. Whatever is produced should be effectively communicated.

- Datasets with an existing time series are valuable. Likewise, potential indicators with no existing data should also be identified.
- The indicator suite that is developed should: have broad coverage, be complementary, be informed by data, include measurable indicators but also explore qualitative indicators, be cost-effective, include place-based indicators, be spatially and temporarily representative, and have a fisheries focus.
- Where possible, indicators should take into account the connectivity of the Hauraki Gulf to a broader system.
- The indicator suite should link, where practical, to the Desired Outcomes, and Management Objectives of the Fisheries Plan, but not to the extent of ruling out aspects identified during the process as being of importance for "the voice of the gulf". While it is urgent that indicators be established, they should also be nimble/responsive going forward.

Proposed research – what we will do

The aims and outputs listed in Sections J and G detail different aspects that the final indicator suite will incorporate and how it will be presented and communicated. Ultimately, the development of this indicator suite will follow one process, as described below.

(1) Co-develop a framework

The indicators themselves will be connected to a hierarchical framework that acts as a backbone supporting the overall indicator suite (e.g., Fig. 1). As such, the first step in defining the indicator suite is to set that backbone in place, thus identifying different categories of indicators. This will be achieved through a workshop (with the broader co-development group and subject matter experts). This framework will use the draft Hauraki Gulf Fisheries Plan as a starting point for discussion as well as the principles outlined above.

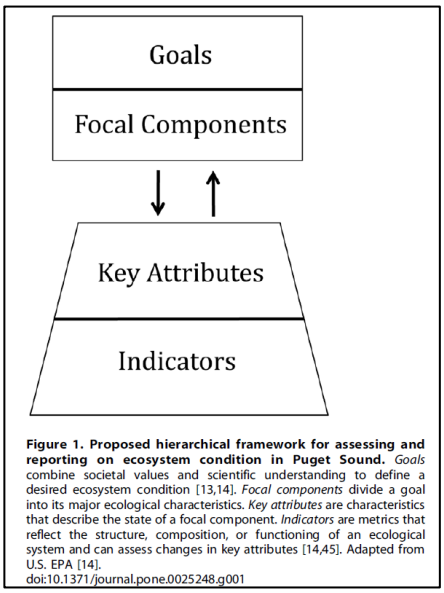

Figure 1. Proposed hierarchical framework for assessing and reporting on ecosystem condition in Puget Sound. *Goals* combine societal values and scientific understanding to define a desired ecosystem condition [13,14]. *Focal components* divide a goal into its major ecological characteristics. *Key attributes* are characteristics that describe the state of a focal component. *Indicators* are metrics that reflect the structure, composition, or functioning of an ecological system and can assess changes in key attributes [14,45]. Adapted from U.S. EPA [14].
doi:10.1371/journal.pone.0025248.g001

Figure 1: An example hierarchical indicator framework structure (from Kershner et al. 2011).With the co-development group we will develop a similar hierarchical framework, using the the draft Hauraki Gulf Fisheries Plan as a starting point.

(2) Co-develop candidate indicators

After the framework has been agreed, candidate indicators will be generated by the co-development group through workshop sessions. These workshops will focus on different parts of the indicator framework, with relevant subject matter experts communicating data sets available in each area, and co-development partners self-identifying to workshops of interest.

Tangata whenua led indicators, will also be considered. The CTWG will also discuss, analyse, and generate indicators that are informed and aligned with iwi, hapū, and whānau outcomes for EBFM in the Hauraki Gulf.

Te Ara Tika will help guide the researchers when working alongside the CTWG and co-development group to inform best practice based on the following principles[19]:

- Whakapapa (genesis and purpose of the research)
- Tika (validity of the research)
- Manaakitanga (cultural and social responsibility)
- Mana (equity, justice and rights).

Te Ara Tika also provides guidance for ethical review:

- Kia tupato (be careful; consider the value of your research)
- Kia āta whakaaro (precise analysis)

- Kia āta kōrero (robust discussion)
- Kia āta whiriwhiri (determine the appropriate conditions)
- Kia āta haere (proceed with understanding)

The researchers will work with the CTWG to support the development of a tangata whenua led indicator framework. A Māori researcher has been brought in to facilitate this process with the CTWG and the other researchers. In addition, we will also form a small group of senior Māori researchers to periodically provide feedback, guidance, and support where necessary. The team acknowledges the importance of providing support for the Māori researcher and the CTWG to ensure the cultural safety, relevance, and appropriate framing for developing Tangata whenua led indicators for EBFM in the Hauraki Gulf.

(3) Score candidate indicators against screening criteria

There are a variety of screening criteria that can be applied to assess candidate indicators[13-17]. Some considerations for good indicators include: cost-effectiveness, theoretical basis, relevance to management; measurability (but noting importance of qualitative indicators); extent and spatio-temporal frequency and coverage of existing time-series; signal-noise ratio; sensitivity to change; complementary nature; and ease of understanding. Assessing indicators against these criteria is a labour-intensive process that will be largely conducted by the research team, but decisions made will be well documented.

(4) Summarise results to co-development group

The results of the candidate indicator screening will be summarised and presented to the co-development group at a workshop. This group will consider the decisions made and any gaps in the suite and together recommend a suite of indicators. Population of these indicators with existing data will be conducted where possible given budget and time constraints.

(5) Communicate results

The recommended indicator suite will be communicated to the public. For this project we will deliver the suite of indicators to MPI as well as a technical and some form of short digestible communication. The technical report will describe the indicator development process described here, detailing the workshops undertaken, their outcomes, the indicator screening process and the final indicator suite selected. This report will also be presented to the co-development group and other interested parties via a webinar. Beyond this project, MPI will use this information to communicate the indicators and their status with the public in a suitable form (e.g., a website). Subsequent monitoring of these indicators will likely lead to a level of understanding that will result in the setting of management reference points, but this is also beyond the life of this project.

Overall, the steps described above will produce an indicator suite that is well connected to our aims (see Section J). As such, the indicator development process will ensure: (i) that different categories of indicators are considered (e.g., ecological, economic, social, and cultural components), (ii) that the status of the indicators selected will be informative about the impact of management interventions from the Hauraki Gulf Fisheries plan, (iii) that some indicators will be selected to address the implementation of management interventions themselves, (iv) that potential indicators for which there are currently no data will also be identified, (v) that final results will be effectively communicated.

L. LINKS TO PHASE I RESEARCH

CP2.1 Trialling EBM in the Tasman Bay – Golden Bay case study

5.1.4 Interactive tools for enabling participation and knowledge exchange

5.1.1 Ecosystem models

2.1.3 Measuring ecosystem services and assessing impacts

2.1.1 Development of valuation frameworks and principles

1.1.1 Testing participatory processes for marine management

1.3.2 Enabling inter-agency collaboration on cumulative effects

M. LINKS TO & INTERDEPENDENCIES WITH PHASE II RESEARCH PROJECTS

S7 Ki uta ki tai. This project will identify health indices and tohu to inform management, so is relevant to the indicator work we will be conducting in project S4.

S6 Ecosystem-based management of shellfish in the Marlborough Sounds – Stage 2. This project will engage with tangata whenua, stakeholders, and decision-makers to visualise the current state of shellfish resources, so has similarities to our work under S4 as it emphasises engagement and understanding the status of resources.

S1 Enabling EBM in the Hawke's Bay – stage 2. The engagement and systems mapping components are similar to the co-development of value-based indicators that we will be conducting as part of S4.

4.3 Enabling Kaitiakitanga and EBM. Kaitiakitanga is also a key principle for the work we will be conducting under S4.

2.17 Kia tika te ī ika: exploring fisheries tikanga and mātauranga. This project will document fisheries tikanga, which is highly informative to developing a suite of fisheries system indicators conducted under S4.

T1 Awhi mai awhi atu: Enacting a kaitiakitanga-based approach to EBM. This project brings together mātauranga Māori, science and kaitiakitanga to understand important species. These are some of the same principles central to our indicators project as well.

N. VISION MĀTAURANGA (VM)

Te Moananui o Toi te Huatahi (the Great Sea of Toi) and Tīkapa Moana are two of the original names that tangata whenua gave to the body of water often referred to today as the Hauraki Gulf. The eponymous ancestor, Toi te Huatahi is embodied in the pūrākau (stories, narratives) of the iwi, hapū, marae, whānau, and hāpori who have whakapapa, or genealogical ties to Toi and their rohe moana (tribal waters), Te Moananui o Toi te Huatahi. It is important to acknowledge this. Through this acknowledgement, we recognise mātauranga-a-iwi (tribal knowledge) and the holistic and integrative nature by which mātauranga is carried in the pūrakau, and informs the tikanga, and kawa embodied in Te Moananui o Toi te Huatahi. Despite this commonality, in acknowledging the pre-colonial name(s) for this area, we pay tribute to the vast body of mātauranga that exists in Te Ao Māori. As such, we recognise that there are many iwi and hapū who have their own pūrakau and mātauranga for Tīkapa Moana, Te Moananui o Toi te Huatahi, the Hauraki Gulf.

The CTWG has been developed for the purpose of advising and guiding the research and indicator development for the Hauraki Gulf. The CTWG is comprised of iwi representatives from across the twenty-six iwi within the Hauraki Gulf. In addition, the research also seeks advice and guidance from a range of third parties and stakeholders in the Hauraki Gulf's marine estate. These advisory groups are made up of representatives from industry, local government, central government, commercial and recreational fisheries, iwi, mātanga (experts), and communities. The cause and effect of non-Māori decision making in the Hauraki Gulf has resulted in the degradation of the Hauraki Gulf through the harvest of fish, deposition of sediment and nutrients, and other stressors. Therefore, when it comes to health indicators for the Hauraki Gulf, it is imperative that the CTWG are engaged frequently and meaningfully throughout the course of this research. This will support the voice, ideas, and aspirations of hau kāinga in developing a set of indicators that are informed by mātauranga Māori and science through the course of this research. To support this process, we will also form a small group of senior Māori researchers to periodically provide feedback on our progress towards establishing a tangata whenua led indicators framework.

Vision Mātauranga Deliverables

Partnerships:

VM P1. Iwi partners (CTWG and Māori owned businesses) actively participate at hui to co-develop a tangata whenua led indicators framework.

Distinctive Contribution:

VM D1. The indicators framework co-developed with CTWG, and Māori owned businesses gives effect for Te Tiriti o Waitangi and incorporates a Te Ao Māori perspective.

Meaningful Outcomes:

VM M1. The indicators framework is presented via appropriate fora (e.g., seminars, workshops, reports, or websites) so that the structure it provides can be utilised by individual iwi, hapū, and whānau to provide place-based context for specific indicators at a later stage.

O. ENGAGEMENT REQUIRED WITH IWI AND STAKEHOLDERS

We have already formed a co-development group of Hauraki Gulf tangata whenua (the CTWG) and stakeholders (including recreational and commercial fishers (including Māori owned businesses), individuals with environmental interests, scientists, Government and Council representatives). We have engaged with this group in person and via online workshops, and many one-on-one calls, which enabled us to capture the key principles (outlined in Section K) that will be used to guide this project going forward. We will continue to engage with this group throughout the project, where they will have an especially important role in workshops that guide the co-development of the framework, the generation of candidate indicators, and in making decisions on the final indicator suite. The final indicators suite will be of interest not only to this co-development group, but all the iwi and stakeholders of the Hauraki Gulf. MPI, as the lead management agency for this part of Sea Change will be primarily responsible for communicating

the final indicator suite (and the status of these indicators), although it will be a useful tool for all Gulf management agencies to understand the status of a variety of aspects within the fisheries system.

P. PROJECT COMMUNICATIONS
This project has already formed a co-development group of about 25 people representing commercial and recreational fishing interests, Government and councils, the environment and tangata whenua. We will continue to work with this group, using email, phone, face to face communication, and workshops. At the conclusion of the project, the indicator framework itself will be provided to MPI, a technical report will be made available to MPI, researchers and the general public (this report will also be presented via a webinar to the co-development group and a wider audience of interested parties) and a short digestible form of communication (exact type of media yet to be determined) will ensure that the project findings reach a general audience. While some of the indicators selected by this project may have direct transferability as indicators for other areas, it is important to note that local context is critical to indicator selection and EBM in general. As such, the applicability of the outputs of this project to other areas are more likely to lie in the learnings obtained from the process implemented rather than the specific indicators selected. The technical report produced will capture this process, so its utility can be considered elsewhere.

Q. RISK & MITIGATION
Primary risks are: 1) working with a co-development group of diverse partners, potentially with conflicting objectives; and/or 2) an unfocussed case study, which make it challenging for some groups to commit time and resources. Two-way communication is key to mitigating these risks. We will host workshops at key stages of the project to ensure that all voices are heard regarding input to the project outcomes. We have included resources within the budget to enable attendance of key groups at the workshop. Once the indicator suite has been identified, we will populate it with existing data where possible given budget and time constraints.

R. CONSENTS & APPROVAL required to undertake research	Approval will be gained for access to MPI fisheries data where required. No other consents or approvals will be required.

S. PROJECT MILESTONES AND DELIVERY DATES

Project Title	**Measuring progress towards Ecosystem Based Fisheries Management – developing a monitoring and indicator framework for the Hauraki Gulf Marine Park**
Project Leader	**Darren Parsons**

No.	*Milestones and Outputs*	*Delivery date*
M1	Host initial workshop(s) with CTWG and co-development partners to discuss indicator framework structure and commission review of existing Te Ao Māori indicators	31 Dec 2022
M2	Finalise indicator framework structure and finalise review of existing Te Ao Māori indicators	31 Mar 2023
M3	Initiate process of conducting individual interviews to assess tangata whenua led indicator framework and host workshop(s) to initiate candidate indicators generation with co-development partners.	30 Jun 2023
M4	Finalise candidate indicators with co-development partners	30 Sep 2023
M5	Start candidate indicator screening process with research team	31 Dec 2023
M6	Complete candidate indicator screening process	31 Mar 2024
M7	Finalise Te Ao Māori framework with CTWG and finalise overall indicator suite with co-development partners	30 Mar 2024
O1	Deliver list of final indicators to MPI.	30 Jun 2024
O2	Produce final report describing the co-development of Hauraki Gulf fisheries system indicators.	30 Jun 2024
O3	Produce short and digestible form of communication about Hauraki Gulf indicators suitable for the general public.	30 Jun 2024

T. REFERENCES

1 Hauraki Gulf Forum. State of our Gulf. Available from: https://www.aucklandcouncil.govt.nz/about-auckland-council/how-auckland-council-works/harbour-forums/docsstateofgulf/state-gulf-full-report.pdf 91 p. (2020).

2 Sea Change. Sea Change – Tai Timu Tai Pari Hauraki Gulf Marine Spatial Plan. Available from: https://gulfjournal.org.nz/wp-content/uploads/2022/01/5086-SCTTTP-Marine-Spatial-Plan-WR.pdf. 315 p. (2017).

3 NZ Government. Revitalising the Gulf - Government Strategy in response to the Sea Change – Tai Timu Tai Pari – Hauraki Gulf Marine Spatial Plan. Available from: https://www.doc.govt.nz/globalassets/documents/our-work/sea-change/revitalising-the-gulf.pdf. 144 p. (2021).

4 Fisheries New Zealand. Fisheries Assessment Plenary, May 2021: stock assessments and stock status. Compiled by the Fisheries Science Team, Fisheries New Zealand, Wellington, New Zealand. 1782 p. (2021).

5 Paul, L. J. A history of the Firth of Thames dredge fishery for mussels: use and abuse of a coastal resource. New Zealand Aquatic Environment and Biodiversity Report No. 94. 27 p. (2012).

6 Thrush, S. F. *et al.* Disturbance of the marine benthic habitat by commercial fishing: impacts at the scale of the fishery. *Ecological Applications* **8**, 866-879, doi:https://doi.org/10.1890/1051-0761(1998)008[0866:DOTMBH]2.0.CO;2 (1998).

7 Richard, Y., Abraham, E. & Berkenbusch, K. Assessment of the risk of commercial fisheries to New Zealand seabirds, 2006–07 to 2016–17. New Zealand Aquatic Environment and Biodiversity Report 237. 57 p. (2020).

8 Shears, N. T. & Babcock, R. C. Marine reserves demonstrate top-down control of community structure on temperate reefs. *Oecologia* **132**, 131-142, doi:10.1007/s00442-002-0920-x (2002).

9 Morrison, M. A., Lowe, M. L., Parsons, D. M., Usmar, N. R. & McLeod, I. M. A review of land-based effects on coastal fisheries and supporting biodiversity in New Zealand. New Zealand Aquatic Environment and Biodiversity Report No. 37. 100 p. (2009).

10 Portner, H. & Peck, M. Climate change effects on fishes and fisheries: Towards a cause-and-effect understanding. *Journal of Fish Biology* **77**, 1745-1779 (2010).

11 Link, J. S. & Marshak, A. R. Ecosystem-based fishery management: progress, importance and impacts in the United States. Oxford University Press. (2021).

12 Hewitt, J., Faulkner, L., Greenaway, A. & Lundquist, C. Proposed ecosystem-based management principles for New Zealand. *Resource Management Journal* **November 2018**, 10-13 (2018).

13 Boldt, J. L. *et al.* Developing Ecosystem Indicators for Responses to Multiple Stressors. *Oceanography* **27**, 116-133, doi:10.5670/oceanog.2014.91 (2014).

14 Jennings, S. Indicators to support an ecosystem approach to fisheries. *Fish and Fisheries* **6**, 212-232, doi:10.1111/j.1467-2979.2005.00189.x (2005).

15 Kershner, J., Samhouri, J. F., James, C. A. & Levin, P. S. Selecting Indicator Portfolios for Marine Species and Food Webs: A Puget Sound Case Study. *Plos One* **6**, doi:10.1371/journal.pone.0025248 (2011).

16 Rice, J. C. & Rochet, M. J. A framework for selecting a suite of indicators for fisheries management. *Ices Journal of Marine Science* **62**, 516-527, doi:10.1016/j.icesjms.2005.01.003 (2005).

17 Shin, Y. J. *et al.* Using indicators for evaluating, comparing, and communicating the ecological status of exploited marine ecosystems. 2. Setting the scene. *Ices Journal of Marine Science* **67**, 692-716, doi:10.1093/icesjms/fsp294 (2010).

18 Smith, G. H. The development of Kaupapa Māori: Theory and praxis. PhD thesis, University of Auckland, 526 p. (1997).

19 Hudson, M., Milne, M., Reynolds, P., Russell, K. & Smith, B. Te ara tika. Guidelines for Māori research ethics: A framework for researchers and ethics committee members. Health Research Council of New Zealand. 29 p. (2010).