National SCIENCE Challenges

Fisheries: Tools, resources and research

SUSTAINABLE SEAS

Ko ngā moana whakauka

Summary

The long-term economic use of our marine resources is dependent on healthy marine ecosystems. Fisheries (commercial, customary, and recreational) are significant marine resources for Aotearoa New Zealand. To ensure fishing remains a sustainable way of life for future generations, the Government has made progressing towards ecosystem-based fisheries management approaches a priority. Together with our Māori partners and stakeholders we are developing knowledge, tools and resources to support this.

This is a catalogue of our tools, resources and research projects that support an EBM approach to fisheries – some are available now to use or develop further, others are currently in development.

June 2021

» AVAILABLE NOW

Fisheries and a blue economy

What is a 'blue economy', and how can Aotearoa New Zealand build one?

In this webinar, Nick Lewis discusses our definition of a 'blue economy', a term which is being increasingly used around the world. This webinar bridges the blue economy research we did in Phase I (2014–2019), with what we are working on for blue economy now.

Presentation

Scan to watch

sustainableseaschallenge.co.nz/building-a-blue-economy

Contact: Nick Lewis, University of Auckland

Mapping the Māori marine economy

Māori businesses are on track to be the largest commercial interest in Aotearoa New Zealand fisheries. This report mapped the Māori marine economy and the level of activity, from those engaged in Annual Catch Entitlement trading and the development of joint ventures with third parties to fish quota, through to those actively fishing, processing, exporting, marine farming, and engaging in marine-based tourism.

As part of this research, people involved in Māori customary and commercial fishing were surveyed on their application of mātauranga Māori in fisheries.

Report

Scan to download

sustainableseaschallenge.co.nz/mapping-the-māori-marine-economy

In this public talk at the New Zealand Maritime Museum (June 2019), Jason Mika discusses some of the history behind Treaty of Waitangi Fisheries Settlements and mapping the Māori marine economy.

Presentation

Scan to watch

sustainableseaschallenge.co.nz/the-māori-marine-economy

Contact: Jason Mika, Massey University

Transitioning to a blue economy: fisheries sector

This report is a stocktake of national and international blue economy developments, status and trajectories. It also documents views of more than 40 iwi and stakeholders on sector-level threats, opportunities, and change.

With regards to the fisheries sector, the report identified:

- A movement towards managing commercial fisheries for resilience instead of abundance, switching away from maximum sustainable yield (MSY) as a fisheries 'target', and closer to ecosystem-based fisheries management (EBFM)
- Emerging technologies including by-product value capture, values-based supply chain, new methods and low impact fishing gear and fishing practices

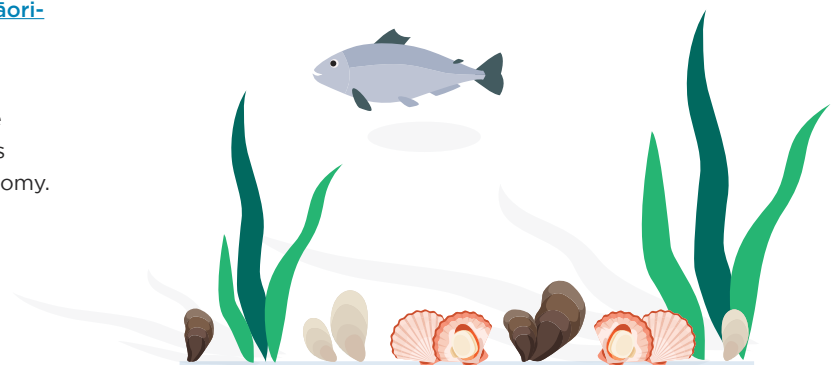Research opportunities specific to the fisheries sector were also identified:

- Define kaitiakitanga and rangatiratanga in relation to Māori aquaculture and commercial fisheries
- Develop scenarios for the future blue economy in the Hauraki Gulf, including managing fisheries for resilience (ie above MSY); recreational fisheries policy considerations; explore the interaction with commercial fisheries and marine protected areas

Report

Scan to download

sustainableseaschallenge.co.nz/transitioning-to-a-blue-economy

Contact: Nigel Bradly, EnviroStrat

Cover images: Top left: Scallops from Marlborough Sounds © lynnmc, iStock. Top right: © Nazar Abbas, iStock. Bottom left: Collecting shellfish on Pakiri Beach © Chris Williams, NZ Story. Bottom right: Snapper caught off the Tutukaka Coast © Chris Sisarich, NZ Story.

Kaitiaki-centred business models: Case studies of Māori fishing businesses

This report explores 7 case study areas to examine aspects of their operations that have a resonance with kaitiaki-centred business models.

The case studies are:

- Ngāi Tahu Seafoods – a large iwi fishing company
- Moana New Zealand – the largest Māori-owned fishing company
- Iwi Collective Partnership – a collective of iwi fisheries organisations
- Ngāti Kahungunu – a tribe with a range of fisheries assets
- Whakatōhea – an iwi with aquaculture and fisheries interests
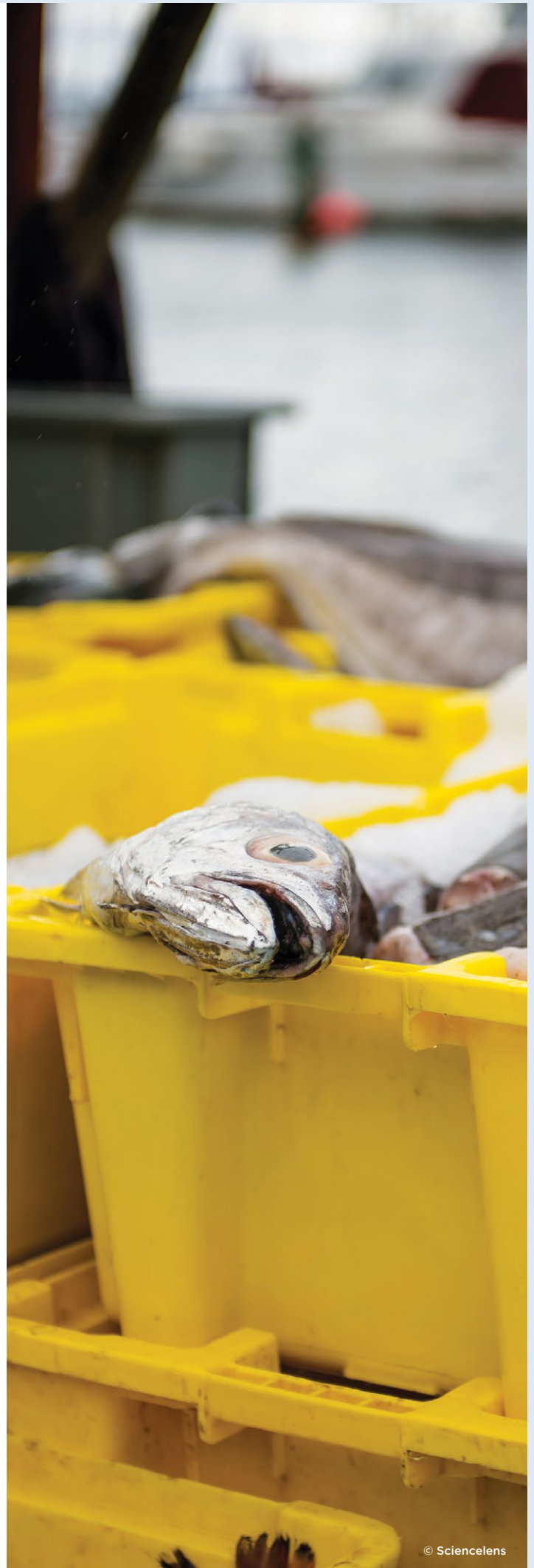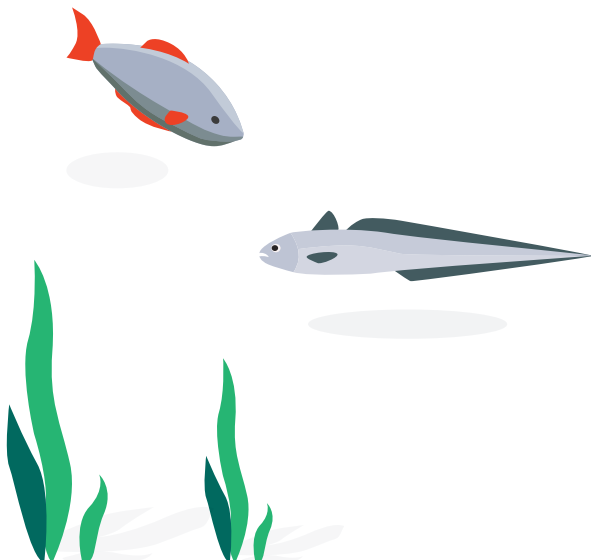- Aotearoa Clams – a Māori-owned start-up fishing company

These case studies suggest that where Māori have more control, they manage things better. This in turn suggests that the Māori marine economy would benefit if kaitiaki-centred business models were recognised and formalised to allow fishers to control the quota allocation process and set their own boundaries.

Scan to download

sustainableseaschallenge.co.nz/case-studies-māori-fishing-businesses

Contact: John Reid, University of Canterbury or Jason Mika, Massey University

Fisheries law, policy and legislation research

A Māori perspective of EBM in Aotearoa New Zealand

In this peer-reviewed publication (paywall), researchers argue that the successful implementation of ecosystem-based fisheries management in Aotearoa New Zealand's marine estate is dependent on the establishment of a new Māori-Crown governance arrangement.
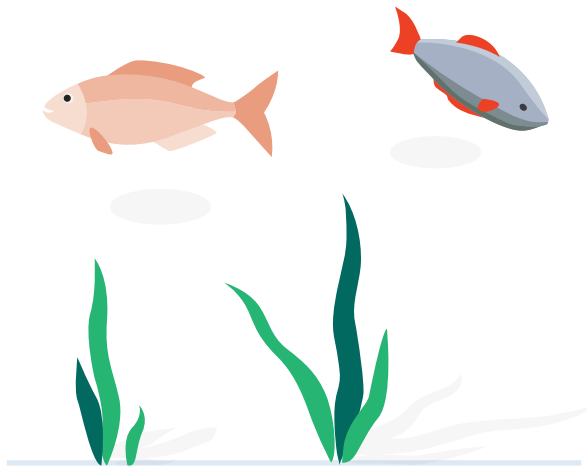
Academic Publication

Scan to see highlights

sustainableseaschallenge.co.nz/ebm-in-nz-a-māori-perspective

Note: This publication is behind a paywall, please contact the authors for more information

Contact: John Reid or Matthew Rout, University of Canterbury

EBM within Aotearoa New Zealand's existing legislative framework

We investigated how well EBM aligns with Aotearoa New Zealand's legislation, policy and governance relating to the marine environment. Research outputs relevant to the fisheries sector include:

Advancing EBM in Aotearoa New Zealand through current governance arrangements – This discussion paper looked at EBM under current legislation, including the RMA and Fisheries Act 1996 (refer to pages 16 – 20).

How current legislation enables the contemporary practice of rāhui – In this discussion paper, rāhui as an example of customary management provides a useful lens to review and analyse how current policy and legislation enables kaitiakitanga and EBM in Aotearoa New Zealand.

NZ law and the principles of EBM – In this webinar, Raewyn Peart and Alison Greenaway summarise the legal framework that applies to the management of Aotearoa New Zealand's marine environment, and explain the extent to which the 7 principles of EBM are already incorporated into law.

Summary *Presentation*

Scan to find these resources

sustainableseaschallenge.co.nz/ebm-nz-legislative-framework

Contact: Alison Greenaway, Manaaki Whenua – Landcare Research

Fishing on rocks © Darryl Ward, NZ Story

Exploring management scenarios

Supporting scallop fisheries management

This guidance describes how Bayesian network models can combine data with expert knowledge (ecological, physical or mātauranga Māori), to bridge the data gaps and support decision-making. It includes a proof-of-concept example, where we developed a digital tool to compare outcomes on seabed health and scallop abundance from different management scenarios. The management objectives – fisheries, sediment and nutrient inputs, and restoration of seabed habitat – were identified with iwi and local stakeholders.

This digital tool enables users to compare outcomes on seabed health and scallop abundance from different management scenarios for fisheries, sediment and nutrient inputs, and restoration of seabed habitat. Please note that this tool is not currently active as it requires a software license. The model that sits behind this tool can be adapted for other environmental management scenarios to support decision-making.

This presentation describes how the tool was developed using expert knowledge, and how application of the Bayesian network model with a structured decision-making framework enables stakeholders and managers to make informed management decisions.

This pilot research explored whether systems mapping could be useful for EBM, focused on the issue of scallop decline in Tasman and Golden Bays. Section 5 of the report provides a summary, and outlines recommendations for potential applications of this process.

Guidance

Digital tool

Model

Presentation

Report

Map

Scan to find all of these resources

sustainableseaschallenge.co.nz/scallop

Contact: sustainableseasNC@niwa.co.nz

Scallops from Marlborough Sounds © lynnmc, iStock

Ecosystem models

We have developed 3 ecosystem models to explore the implications of a range of environmental or management scenarios in Tasman and Golden Bays.

- *Atlantis Model* – an 'end-to-end' modelling tool that allows researchers and decision-makers to test the effects of different scenarios on the whole ecosystem, encompassing everything from sunlight and nutrients through to predators and fisheries.
- *Food web model* and *size-based ecosystem model* – simpler and have shorter run times than Atlantis and can be used to prioritise scenarios for Atlantis runs.

You can identify possible scenarios for all these models; however, a modelling expert is required to run the models and interpret their outputs.

Which model works best for what you need?

In this webinar, the researchers discuss which ecosystem model is best for different scenarios and criteria.

Model   Presentation

Scan to find models and webinar

sustainableseaschallenge.co.nz/ecosystem-models

Contact: sustainableseasNC@niwa.co.nz

Systems mapping to explore EBM scenarios

Systems mapping is a visual tool that builds a picture of interconnected factors contributing to, and impacted by, a certain issue(s) of interest. It specifically focuses on the circular nature of these relationships and how they 'feedback' on themselves and each other. It can be used to explore how any action taken will impact other parts of the system over time.

We have used systems mapping to assess:

Blue economy activities: Wild fishery – This describes the interconnections, influences, risks and tensions in a conceptual wild fishery system. (Refer to pages 15–23 and 42–46.) The systems maps are used to explore a scenario where fishing companies make a voluntary commitment to greener performance by limiting their catch and improving their fishing methods. (Refer to page 71.)

Report

Scan to download

sustainableseaschallenge.co.nz/conceptual-system-maps-of-blue-economy-activities

Contact: sustainableseasNC@niwa.co.nz

Marine stressors in Hawke's Bay – This describes the interlinked influences on the local ecosystem (including the social impacts) of 2 main environmental stressors, freshwater sediments and disturbance of the seabed, to inform management action.
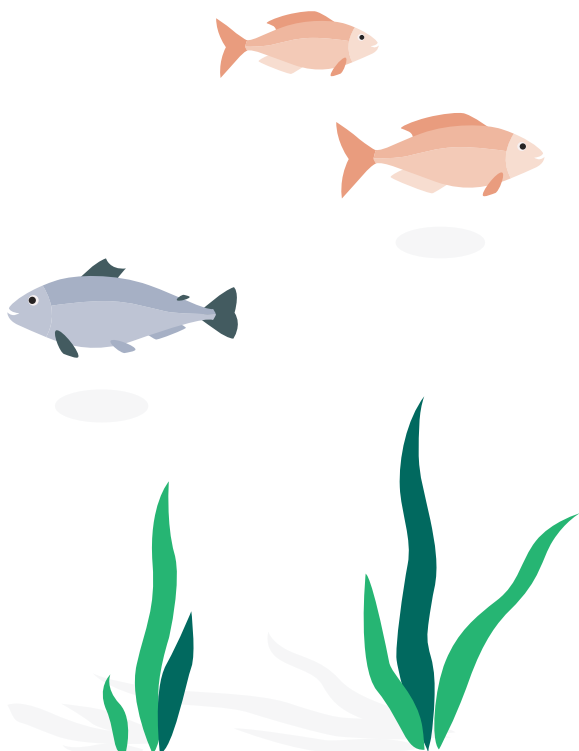
Summary

Scan to download

sustainableseaschallenge.co.nz/summary-HB-systems-maps

Presentation

Scan to watch

sustainableseaschallenge.co.nz/mapping-marine-stressors-in-HB-webinar

Contact: Carolyn Lundquist, NIWA/University of Auckland

Building baseline knowledge

Ecosystem connectivity of coastal and offshore fisheries

We studied the effects of environmental change and removal of marine resources on the food web structure of coastal and offshore fisheries from pre-industrial to present times. Two peer-reviewed publications (both open access) have been produced that may be of specific interest to fisheries.

Durante et al (2020) looked at how food web structures of commercial fish species in New Zealand have changed over time (from 1930 to 2019). The data provides a history of the development of industrialised fishing in New Zealand and important ecological baseline information.

Academic Publication

Scan to view

sustainableseaschallenge.co.nz/shifting-trophic-architecture-marine-fisheries

Udy et al (2019) explored kelp food webs in temperate rocky reef fish communities to increase understanding of ecosystem function and variability in fisheries production. The findings highlight the need for EBM approaches to recognise spatial variability in primary production that supports coastal food webs.

Academic Publication

Scan to view

sustainableseaschallenge.co.nz/kelp-food-webs-rocky-reef-fish

Contact: Steve Wing, University of Otago

Past and present stressors on shellfish fisheries in Tasman and Golden Bays

This academic publication (open access) outlines the methodology and results of an investigation into the effects of bottom-contact fishing and sedimentation on the decline of green-lipped mussel, oyster and scallop fisheries in Tasman and Golden Bays.

The researchers conclude that historic legacy effects, ongoing sedimentation and fishing disturbance have worked together to modify the sediment characteristics from 'natural' baseline conditions. Those changes have likely contributed to the collapse and lack of recovery of Nelson Bays shellfish fisheries. A palaeoecological dataset from sediment cores was also produced.

Academic Publication *Dataset*

Scan to find both resources here

sustainableseaschallenge.co.nz/estimating-historic-effects

Contact: sustainableseasNC@niwa.co.nz

Sea-floor species tolerance to suspended sediment

We investigated the impact of suspended sediment on two sea-floor animals: dog cockles and common sponge. The aim was to understand how resilient these species are, and how quickly they can recover from suspended sediment levels caused by human activities, such as fishing. Results show they can recover – under certain experimental conditions.

Presentation *Summary*

Scan to watch webinar or read summary

sustainableseaschallenge.co.nz/suspended-sediments-sea-floor-species

Contact: Malcolm Clark, NIWA

Filling in marine data gaps

Measuring and mapping marine ecosystem services

These maps show where biogenic refuge habitats, which act as nurseries for young fish and invertebrates, are predicted to be found. Maps are available for the Hauraki Gulf, Queen Charlotte Sound and Tasman Bay, Golden Bay and Marlborough Sounds. The methodology underpinning these maps can be used to estimate the location of ecosystem services at low cost and with modest data requirements. A thesis and an academic publication(s) on mapping the ecosystem services of shellfish in estuaries has been submitted.

Scan to see all 3 maps
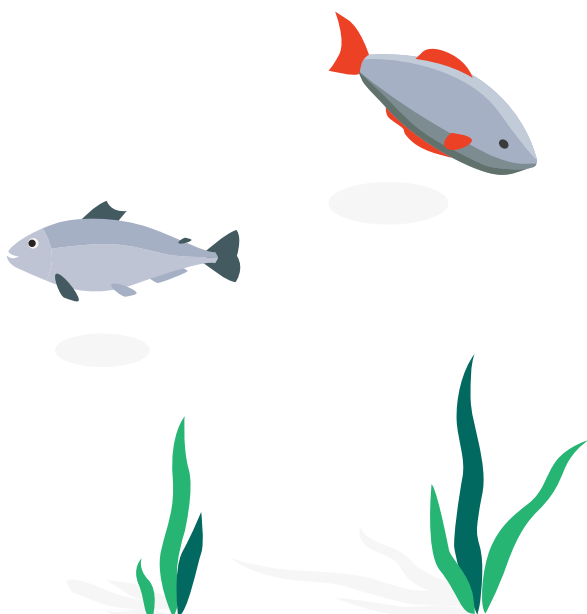
sustainableseaschallenge.co.nz/biogenic-maps

In this webinar, Drew Lohrer presents research that used a rules-based approach to predict and map refuge habitat in the Hauraki Gulf and Marlborough Sounds, and then validated this technique by surveying the seafloor at a range of sites around Great Barrier Island.

Scan to watch the webinar

sustainableseaschallenge.co.nz/webinar-measuring-mapping-marine-ecosystem-services

Contact: Drew Lohrer, NIWA

Using ecosystem service bundles to improve marine management

Ecosystem services (ES) are the goods and services that nature provides, which people benefit from. A single ecological process can underpin multiple services, eg shellfish filter feeding improves water quality, supports the food web and leads to kaimoana.

This 2-page guidance document explains how ES interact with each other and are affected by stressors – and which values might be affected for better or worse following a management decision. It uses the ecosystem services provided by shellfish as a case study.

Scan to download

sustainableseaschallenge.co.nz/using-ecosystem-service-bundles-to-improve-marine-management

Contact: Drew Lohrer, NIWA

Using Gradient Forest models

This guidance describes how large numbers of different data sets can be effectively pooled to group marine species into 'community assemblages'. These assemblages can be used to identify biodiversity hotspots and explore 'gifts and gains' (trade-offs) resulting from management decisions.

Advantages of this approach:

- It requires less data to run than considering 100s of species individually
- It provides a limited number of groups of species (community assemblages) for decision-makers to consider, which is:
  » Easier than individually assessing 100s of species
  » More holistic as these species interact and affect one another
- It predicts assemblages that serve as proxies for rare species that cannot be modelled as they are poorly represented in available data

Scan to download

sustainableseaschallenge.co.nz/filling-data-gaps

Contact: Fabrice Stephenson, NIWA

Improving decision-making

Visualising uncertainty to inform decision-making

We have developed a visualisation of cetacean diversity hotspots that incorporate varying levels of uncertainty. The visualisation identifies the best locations for protection and can help to incorporate uncertainty for marine spatial planning and/or decision-makers for consent applications.

The underpinning method is applicable to other species or taxa and can be used as a framework for incorporating uncertainty when dealing with multiple species. The visualisations can be used in a participatory process to inform better decision-making.

Scan to watch the webinar

sustainableseaschallenge.co.nz/visualising-uncertainty-webinar

Scan to download

sustainableseaschallenge.co.nz/conference-poster-cetacean-conservation-planning

Contact: Fabrice Stephenson, NIWA

Ingredients tool

A practical 1-page resource for to support broad participation in marine decision-making. If a fisheries company is planning to expand operations or to improve community relationships, this can be used to structure discussions to build consensus and reduce conflict.

Scan to download

sustainableseaschallenge.co.nz/ingredients-tool

Contact: sustainableseasNC@niwa.co.nz

Aotearoa Cumulative Effects framework

A framework to help planners and agencies collaboratively manage cumulative effects across a range of scales (spatial and temporal), developed in partnership with central government agencies, regional councils, Te Ohu Kaimoana, Aquaculture New Zealand, and community representatives.

It can be used to facilitate discussions with community, stakeholders, local authorities, and other users. It can also help identify potential issues to do with cumulative effects when developing resource consents applications.

It is underpinned by the principles of Te Tiriti o Waitangi/Treaty of Waitangi, especially regarding partnership and rangatiratanga.

Scan to download

sustainableseaschallenge.co.nz/ace-framework

Contact: sustainableseasNC@niwa.co.nz

Tools for risk assessment under uncertainty

This report reviews a range of best practice analytical tools and processes that can be used to support risk assessment across a spectrum of problems of differing complexity and uncertainty.

It includes:

- The role of risk assessment in decision-making
- Methods for eliciting, representing and incorporating uncertainty in risk assessments
- Methods for assessing cumulative and indirect risks from multiple stressors
- Scenario-based methods for evaluating management alternatives under uncertainty

Scan to download

sustainableseaschallenge.co.nz/tools-for-risk-assessment-under-uncertainty

Contact: Graeme Inglis, NIWA

» ACTIVE RESEARCH

We have projects underway that are investigating ways to improve and modernise fisheries management and practices, and to help the understanding of how EBM can work for fisheries.

Active projects

Kia tika te hī ika: Exploring fisheries tikanga and mātauranga

We are investigating the tikanga of Iwi Collective Partnership (ICP) Iwi Partners as it relates to commercial fishing practice, as an example of fisheries leadership in Aotearoa New Zealand. This research is expected to be completed end of 2022.

sustainableseaschallenge.co.nz/
kia-tika-te-hī-ika

Contact: Maru Samuels, ICP or Irene Kereama-Royal, Ngā Wai A Te Tūī Māori & Indigenous Research Centre

Quantifying seafloor contact

This project is investigating and reducing interactions between commercial fishing gear and the seafloor in the Hawke's Bay. This project is expected to be completed June 2022.

sustainableseaschallenge.co.nz/
quantifying-seafloor-contact

Contact: Oliver Wilson, FINZ

Marlborough Sounds regional study

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

sustainableseaschallenge.co.nz/
marlborough-sounds-regional-study

Contact: Vonda Cummings, NIWA

EBFM in the Hauraki Gulf

In collaboration with Fisheries New Zealand, MPI and DOC, we are developing a monitoring and indicator framework for the Hauraki Gulf Marine Park.

sustainableseaschallenge.co.nz/
ebfm-in-the-hauraki-gulf

Contact: Darren Parsons (NIWA)

Hawke's Bay regional study

This collaboration has mapped 2 environmental stressors (sedimentation and seabed disturbance from fishing activity) and their interactions (see *Marine stressors in Hawke's Bay* systems maps). The project, expected to be completed end of 2021, will be providing guidance for managers to reduce the impacts of these stressors.

sustainableseaschallenge.co.nz/
hawkes-bay-regional-study

Contact: Carolyn Lundquist, NIWA/University of Auckland

Policy and legislation for EBM

We are developing a research base for government, Māori (organisations, iwi, hapū and whānau) and stakeholders to navigate the legislative, policy and practice constraints surrounding EBM and any changes required to enable it. This research project will produce a transition plan towards EBM and recommend governance arrangements appropriate to local, regional and national scales. The underlying research will focus on changes presently occurring in regulatory and practice frameworks, and a systems mapping exercise of multispecies management complexes (centred on a trawl fishery) conducted with Fisheries New Zealand.

sustainableseaschallenge.co.nz/
policy-and-legislation-for-ebm

Contact: Elizabeth Macpherson, University of Canterbury or Steve Urlich, Lincoln University

Indigenising the blue economy in Aotearoa

Extending earlier research into mapping the Māori marine economy, this project will address key barriers that currently prevent Māori from using their marine resources in a more culturally relevant, economically impactful, and environmentally sustainable manner. One of the research themes will look at the issue of quota fragmentation.

sustainableseaschallenge.co.nz/
indigenising-the-blue-economy

Contact: Jason Mika, Massey University or John Reid, J D Reid Ltd

Spatially-explicit cumulative effects tools

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

sustainableseaschallenge.co.nz/
spatially-explicit-cumulative-
effects-tools

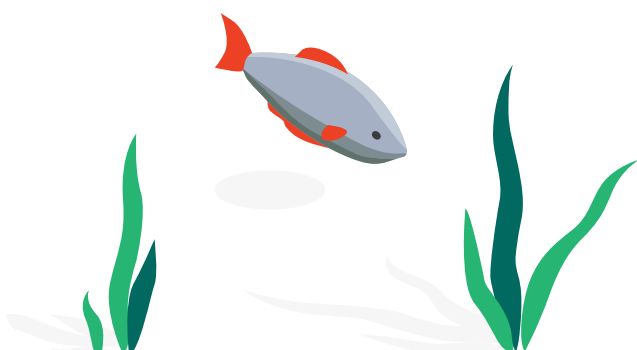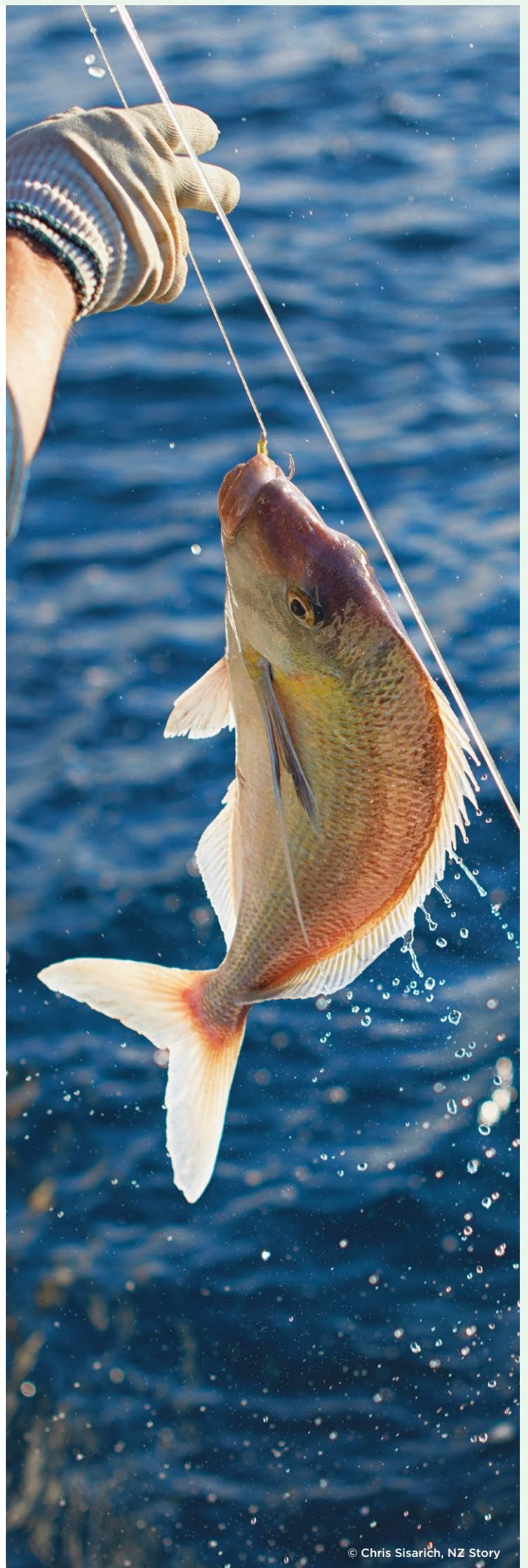**Contact:** Carolyn Lundquist, NIWA/ University of Auckland

Ecological responses to cumulative effects

We are developing new methods to map ecological response footprints of stressors and their impacts on ecosystem services. We are also developing ecological footprint analysis to support improved decision-making, investment, and knowledge of how activities and stressors impact on biodiversity and ecosystem services.

sustainableseaschallenge.co.nz/ecological-
responses-to-cumulative-effects

Contact: Simon Thrush, University of Auckland or Kura Paul-Burke, MUSA Environmental/University of Waikato

© Chris Sisarich, NZ Story

Many of our other tools, resources and research projects in the aquaculture and innovation space may also be of interest to people and organisations working in fisheries.

» **To hear about new tools and resources, subscribe to our newsletter:**
sustainableseaschallenge.co.nz/newsletter

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