National SCIENCE Challenges

SUSTAINABLE SEAS

Ko ngā moana whakauka

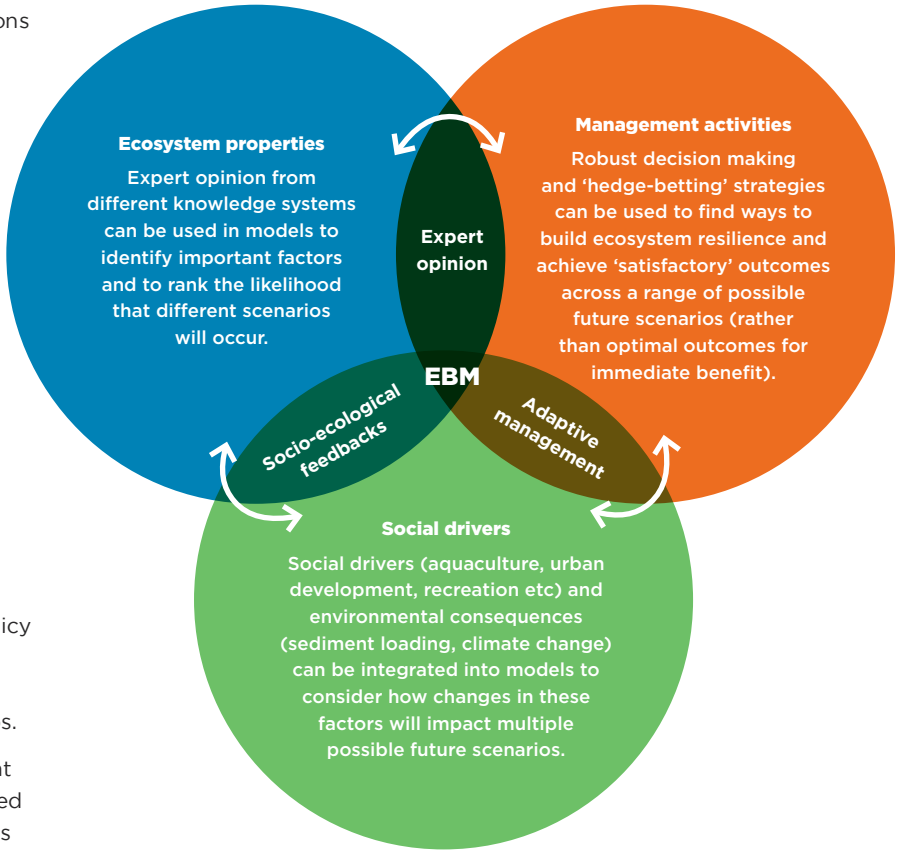
# Using Bayesian network models to bridge the gap between ecology and management

Bayesian network models can combine data with expert knowledge (ecological, physical or Mātauranga Māori), to bridge data gaps and support decision making.

Guidance

## Benefits of Bayesian network models

- They can be used to examine the effect of uncertainty on management decisions in the absence of data.
- They are relatively fast and easy to build – and to update when more information becomes available.
- They reduce the complexity of the underlying science to make it easier for decision makers to visualise the interactions between ecosystem properties, social drivers and management activities.
- Drivers/stressors can be 'dialled up' or 'dialled down' to see what effect they have on ecosystem function and on the other interactions in the network, resulting in a total 'score' for ecosystem health.
- They enable marine managers and policy makers to produce decision-making scenarios that predict outcomes for a wide range of possible future scenarios.
- They are participatory, so management decisions are more likely to be accepted by the Māori partners and stakeholders involved.




## Recommendations: how to use Bayesian network models to develop robust policies

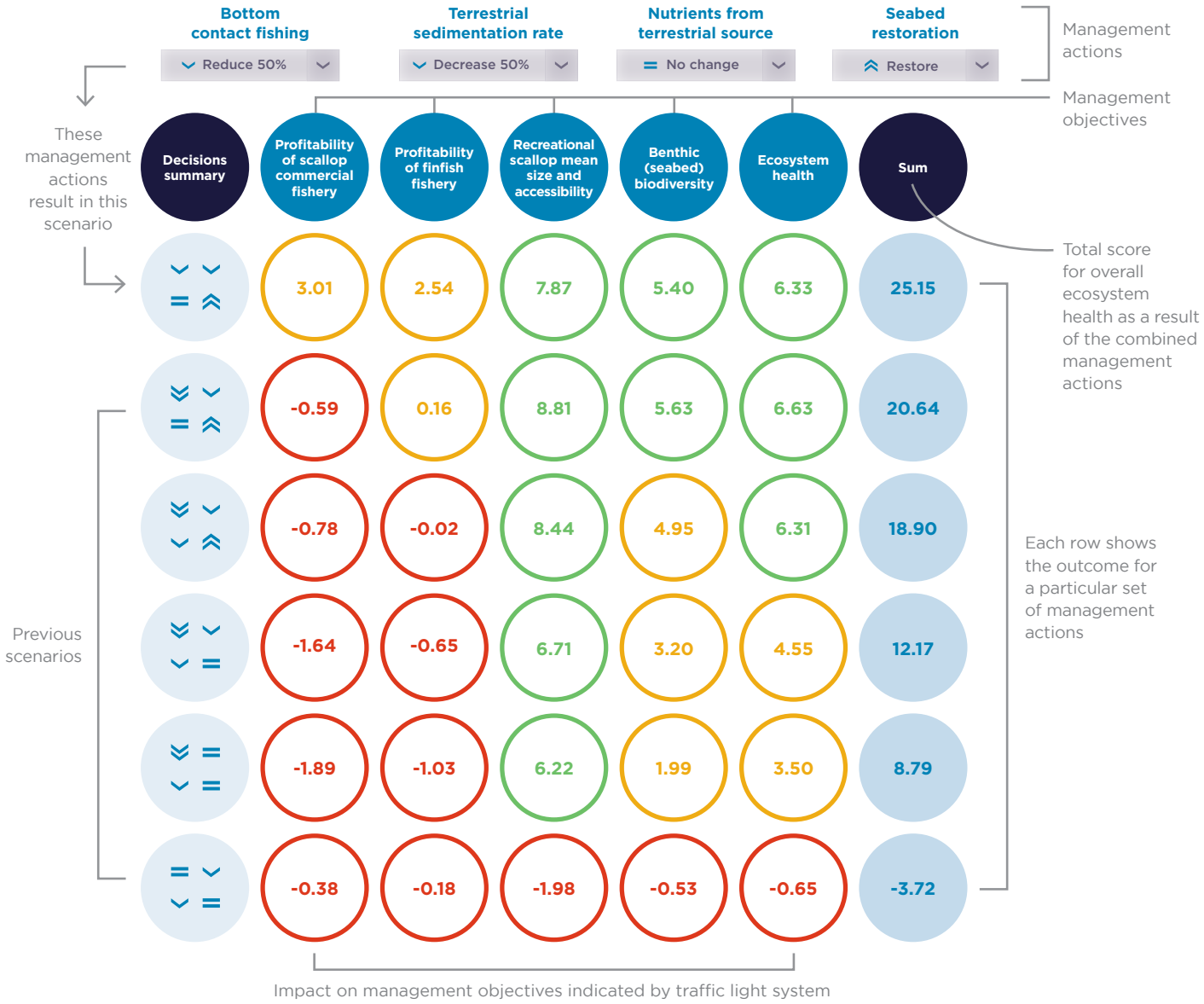
1. **Strive for 'satisfactory' outcomes across a range of future scenarios** – rather than 'optimal' outcomes that maximise the immediate perceived 'value' of an action but have sub-optimal outcomes over the long-term.
2. **Focus not only on the potential drivers of a tipping point but on identifying actions that can change how an ecosystem responds to those drivers** – ie, resilience-enhancing actions such as restoration of key habitats/ species, or fishing at levels where recruitment is likely to be successful under changing environmental conditions.
3. **Adapt to changes that occur in the ecosystem over time**

Turn over for an example

CASE STUDY

# Bayesian network tool: Seabed health and scallop fisheries

We used expert knowledge to develop an online user interface (see diagram) that could be used by to explore the impact that different management decisions can have. The management objectives were identified with iwi and local stakeholders in Tasman and Golden Bays. The tool enabled 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.




***Note:*** *This tool was a proof-of-concept to show its potential for supporting marine management decision-making. The tool is not currently being used for scallop management in Tasman-Golden Bay.*

**Applications:** The model that sits behind this tool can be adapted for other environmental management scenarios to support decision-making.

**Contact:** **sustainableseasNC@niwa.co.nz** to find out more about the tool's capabilities, and what resource is required to run or adapt it.

Presentation

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