

Testing the adoption of decision support tools with end-users for ecosystem-based management



The utility of guidance, frameworks and tools (GFTs) developed by Sustainable Seas National Science Challenge (the Challenge) partners were tested with two different groups of end-users (cases). The process with both cases included moments of reflection amongst the group as to the utility of the GFTs to assist decision making.

Here we describe the process, but not the detailed content, of matching GFTs with the objectives identified in each case. Key lessons related to the adoption of GFTs to support the improved health and utilisation of our seas are summarised.

Case one: A fisheries management scenario

This case aimed to elicit feedback on the usefulness of Bayesian Networks (BNs) as a risk assessment/decision support tool from employees of two key governance agencies: Fisheries New Zealand (FNZ, part of the Ministry for Primary Industries) and the Department of Conservation (DOC).

Case two: A restoration planning scenario

Challenge researchers collaborated with the marine workstream of the Kotahitanga mō te Taiao Alliance (KMTT) and The Nature Conservancy (TNC) to identify relevant GFTs that could support marine restoration projects in the top of the South Island. The marine workstream developed a results chain of outcomes needed to work towards the restoration goals. Challenge researchers identified GFTs which may be able to support the achievement of those outcomes.

	End-users	Process	GFTs used/explored
Case one	Fisheries NZ (FNZ) & Department of Conservation (DOC)	Bayesian Networks (BNs) were selected as the decision-making tool to explore with the end-user group as it met all the criteria that were identified to be required for ecosystem-based management (EBM). (Clark et al. 2022), and therefore showed promise as being useful for informing EBM. In addition, BNs had characteristics that mapped to the types of management decisions the end-user group faced. Over three workshops BNs were socialised with the end-user group and example BNs co-developed by the end-user group and Challenge researchers were used to demonstrate their potential for aiding management decisions.	Tools <ul style="list-style-type: none"> Bayesian Network
Case two	Kotahitanga mō te Taiao Alliance (KMTT) & The Nature Conservancy (TNC)	During one of the marine workstream workshops, Challenge researchers presented a suite of GFTs that support EBM while the marine workstream identified some of their key considerations for GFT selection. Subsequently once the marine workstream had articulated a priority restoration project (Restoration and/or rehabilitation to support cultural harvest and support ecosystem health and resilience), Challenge researchers refined the list of GFTs which had the potential to support the activities and objectives of the project results chain to help achieve the desired impact (<i>Abundance, harvest, and restoration of native kai increases cultural, economic and ecological health across Te Taihu</i>).	Guidance <ul style="list-style-type: none"> Decision support tools (Blackett et al. 2023, Quick guide 5: Navigating risk and uncertainty) Stakeholder considerations (Quick guides: Navigating risk and uncertainty) Tools <ul style="list-style-type: none"> Species distribution models Spatial prioritisation models Systems models (system mapping, agent-based modelling and BN's).

Key lessons for adopting GFTs for EBM

1. GFTs can be useful as a communication tool for stakeholder engagement

The ease with which the purpose of a GFT and its outcomes are able to be easily communicated amongst different groups and individuals, and illustrate the views or values of different stakeholders, was recognised as a desirable characteristic, particularly for stakeholder engagement. It was highlighted that if GFTs were able to be effectively communicated to stakeholders with a wide range of backgrounds and technical abilities then they could better support EBM. In Case One, BNs were specifically identified as a useful tool to demonstrate the complexity of a system and illustrate the relationship between nature and people. Thereby, BNs were highlighted as a useful tool for the stakeholder engagement process.

2. GFTs that can perform scenario testing are valuable

The ability to undertake scenario testing was identified as a valuable aspect of GFTs in both cases. Scenario testing allows end-users to ask 'what if' questions in relation to achieving different management objectives. Scenario testing was also highlighted as useful for government officials as a means of exploring different management actions/decisions and the uncertainty around the likely outcomes of a particular decision/management action. For example, in Case One 'what if' questions were used to demonstrate the potential outcomes of different fishery management decisions on kelp cover and the abundance of snapper and kina.

3. Ability for tools to be holistic and flexible is important for decision-making to transition towards an EBM approach

The flexibility of GFTs to accommodate different data types from different disciplines was seen as an important attribute, recognising that this complexity is needed as decision-making transitions towards an EBM approach. GFTs that have the capacity to integrate multi-disciplinary information/different knowledge types allow the complexity of social-ecological systems to be reflected in line with a move towards the more holistic approach of EBM. In addition, the capacity to integrate different knowledge types can allow GFTs to support an approach that is inclusive of different views and values of end-users.

In Case Two, a tool that enabled information to be incorporated when there was little quantitative data available, was identified by the workstream as a key tool consideration. This is a quality of BNs that was demonstrated in Case One, where for example detailed quantitative data on the size classes of snapper (derived from a previously undertaken stock assessment), less detailed information on the quantity of terrestrial sediment in coastal habitats coming from the land, and qualitative information on the value of snapper to tourism were all able to be included to inform the output. The flexibility of BNs to combine and summarise outputs from other models was also identified as a positive attribute of the tool in Case One, for which the BNs developed incorporated aspects of a BN that had been developed previously by [Parsons et al. 2021](#).

4. For GFTs to be effective, they need to be interpretable

For GFTs that support EBM to be adopted they need to be interpretable by end-users/stakeholders with a wide range of backgrounds and technical abilities. This is especially important under circumstances where the interpretability is compromised by the complexity of the tools or where there are information gaps in the data. In Case One, the end-user group mentioned that BNs can be perceived as 'black boxes' (both for stakeholders and for decision makers) in which the output of the model is produced without revealing any information (or easily interpretable information) about how the output was derived. This highlights the need for a particular level of understanding of the tool by end-users, and so the value of a socialisation phase, so that they can be applied, interpreted and communicated effectively.

5. GFTs need to be assessed/prioritised based on suitability

A suite of GFTs to support decision making were created throughout the Challenge, each of which have different practical operational considerations (e.g., amount of information required, time/cost to implement). Additionally, each GFT can accommodate, to different levels, the criteria identified as useful to support EBM ([Clark et al. 2022](#)). The suitability of a GFT is reliant on the resources/data availability and the key considerations/characteristics of the management objective of the end-user. Considerations for selecting risk assessment tools (a subset of decision support tools) for EBM are provided by [Blackett et al. 2023](#) and summarised in [Quick guide 5: Navigating risk and uncertainty in marine management](#).

In Case One, BNs were selected as the tool to explore with the end-user group, as it was identified as the only risk assessment tool to meet all 12 criteria required for EBM (Clark et al. 2022) and had the characteristics that mapped to the types of management decisions the end-user group faced. In Case Two, Challenge researchers mapped particular results chain outcomes to an extended version of the decision tree for risk assessment GFTs presented in Quick guide 5: Navigating risk and uncertainty in marine management to illustrate which GFTs may be suitable for a particular management objective/outcome (Figure 1). Multiple GFTs can also be used in combination to inform EBM decisions.

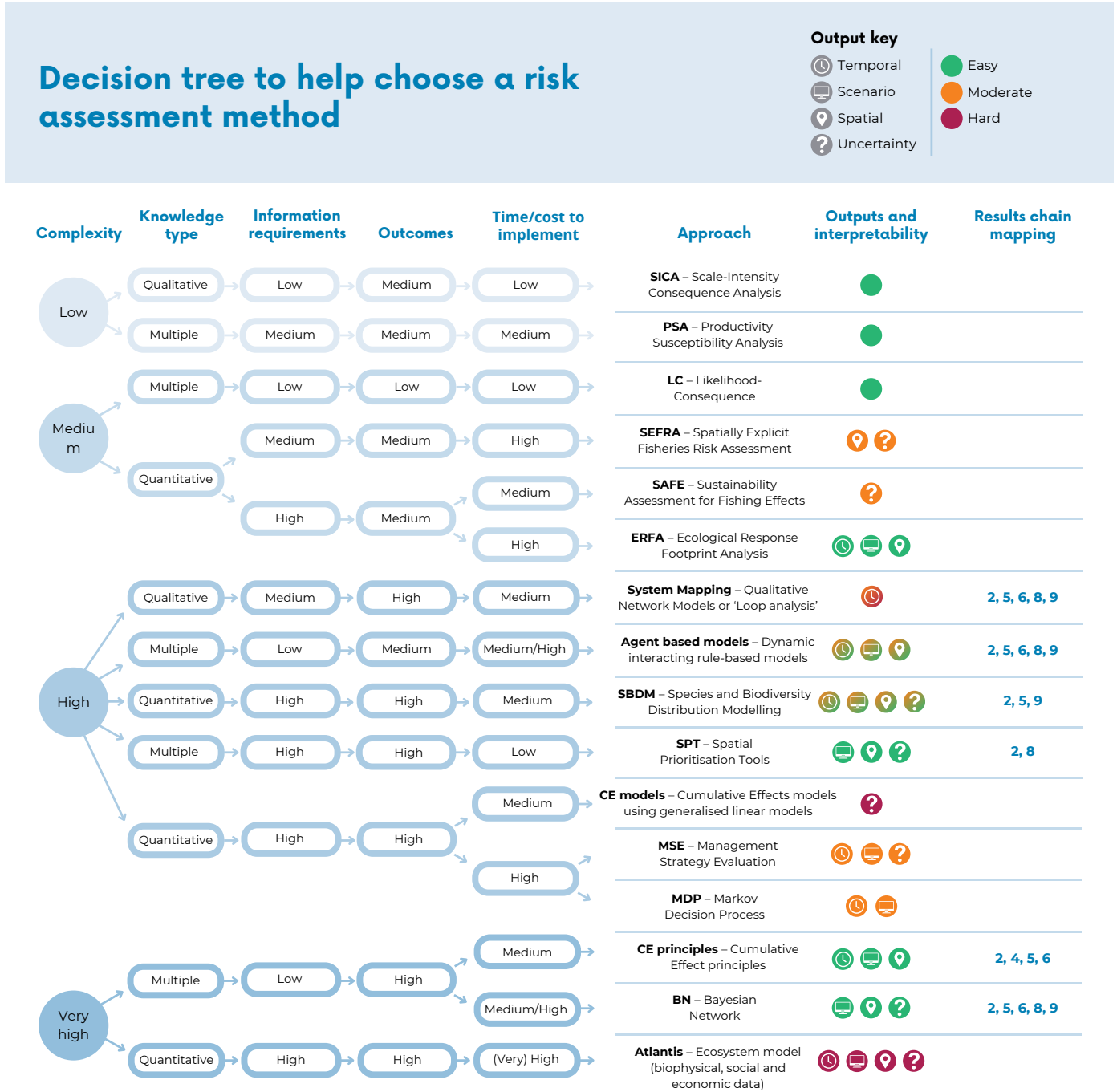


Figure 1: Decision tree to help choose a risk assessment method for use in Aotearoa New Zealand with an example of how nine results chain outcomes (not shown) from the KMTT strategy: Restoration and/or rehabilitation to support cultural harvest and support ecosystem health and resilience were mapped to the different tools.

The decision tree is expanded on that presented in Quick guide 5: Navigating risk and uncertainty in marine management. The symbols distinguish whether the outputs account for spatial or temporal variation, allow scenario testing and/or account for uncertainty. Each tool is also assessed as being relatively as easy, moderate, or difficult to use.

What needs to be in place in order for GFTs to be successfully adopted by end-users?

1. Socialisation of GFTs/Tools

Socialisation of decision support tools is an important process both for end-users within an institutional setting and for their stakeholders to ensure there is an understanding of the inputs/outputs of the tool and its considerations/limitations. This includes what data can be used, how the tool works, what kind of questions the tool can be used to answer and the type of outputs the tool can generate. This process is needed to ensure uptake and buy-in by users and stakeholders. Socialisation of tools will additionally help with ensuring they are interpretable by and can be communicated to end-users with a wide range of backgrounds and technical abilities.

For Case One, BNs were socialised with the research group over the three workshops. Polls undertaken prior to the workshops and after the third workshop showed an increase in perceived usefulness of the tool. The group felt the tool could be a useful for their research and management goals and that the BNs appeared useful for supporting EBM/Ecosystem-based fisheries management.

For Case Two, as specific geographic locations for restoration had not yet been identified, socialisation and final selection of relevant GFTs will be an important part of the stakeholder implementation process and will need to be accounted for in planning.

2. Opportunities to assess risk from different points of view

Different ways of understanding the world underpin perceptions of risk and uncertainty as described in [Quick guide 1: Perceptions of risk and uncertainty influence marine management decisions](#). Beliefs about how the world does or should work (worldview), previous learning or training (discipline) and experiences and context (positionality) influence the way that people understand and expect to experience the impact of a change on something they value or a change to a desired future outcome.

In Case Two, the identification of the need for tools that enable information to be incorporated when there was little quantitative data available reflects the range of different stakeholders in the working group. Creating opportunities for different positions and perceptions to be understood and selecting GFTs that are able to include different types of knowledge can help with a more place-based, holistic approach to risk and ensure that different types of information can inform decision making.

3. In-house capabilities required to ensure the adoption of some tools

For more complex tools, strategic investment in capacity to support the use of tools was recognised as being necessary to ensure effective use of tools for EBM. In Case One, the in-house capability to develop, apply and communicate the outputs from BNs was highlighted by the end-user group as desirable to ensure on-going use for management decisions. This is opposed to contracting in capabilities to use the tool through research providers for discrete research projects.

Acknowledgements

This work was made possible through the opportunity for Sustainable Seas to collaborate with the KMTT Alliance and TNC NZ in their facilitation of a Restoration by Design process providing strategies for major threats to our marine ecosystems and with Fisheries NZ (FNZ) and Department of Conservation (DOC).

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- [Quick guides: Navigating risk and uncertainty in marine management - Sustainable Seas National Science Challenge](#)