FRDC Futures Scenario 1: A degraded environment

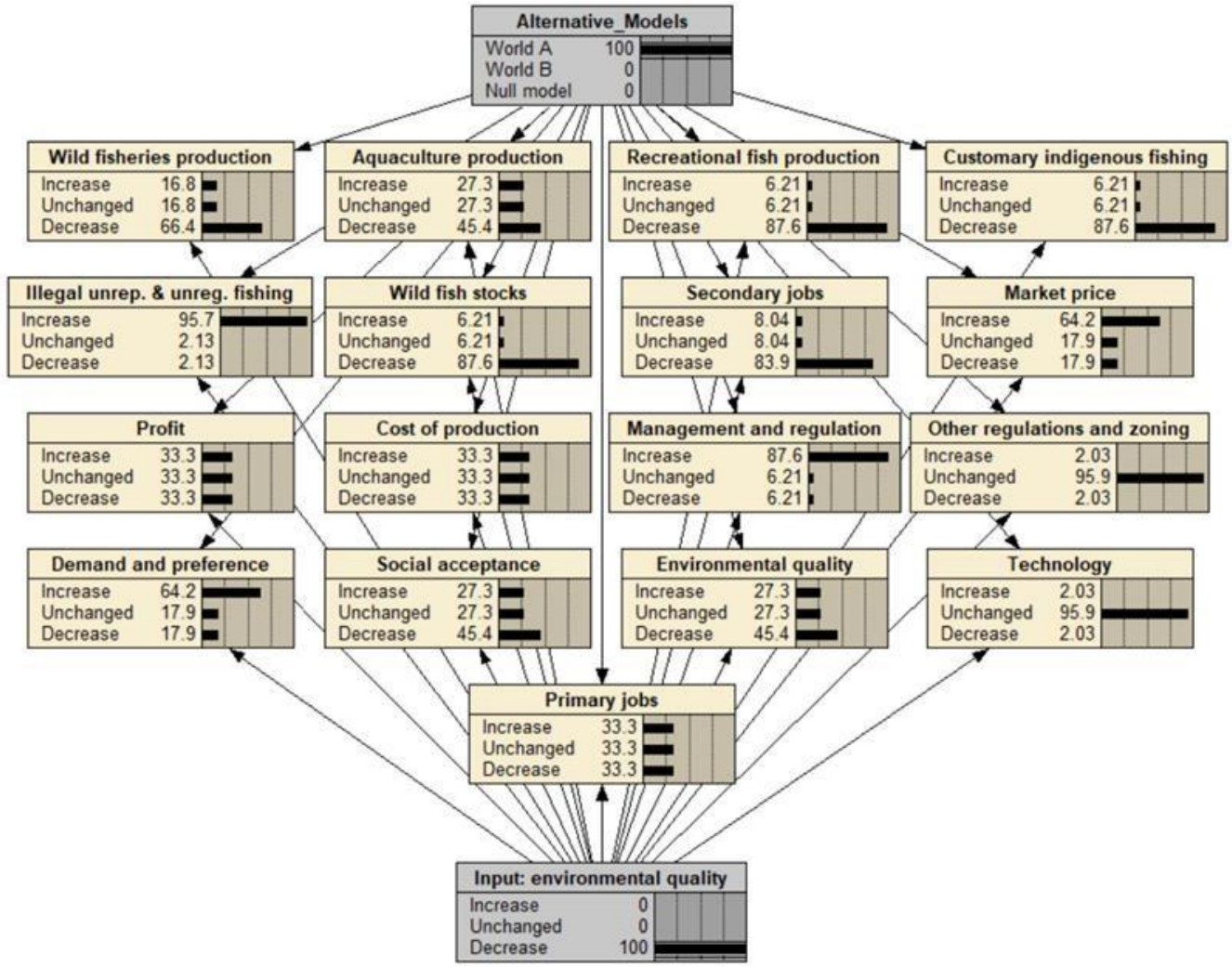
The Bayes Net representation of the Australian seafood system can be used to explore scenarios that may influence research priorities, monitoring decisions and engagement activities. This is an example to illustrate the information that might be extracted from the model.

Scenario 1: An extreme event (e.g. marine heatwave) in the oceans surrounding Australia has led to major environmental degradation and loss of important habitat and species that support important fisheries.

.

Perturbation – an experiment with the Bayes Net seafood system model

To test the effect of environmental degradation, we changed the input (lower grey box) in the model to "decrease" and assumed that our world is Model A (top grey box). Responses to this decrease are shown in the yellow boxes, as increase, decrease or no change. The number associated with each is the probability or "confidence" in the direction of change, but importantly, not its magnitude. The Bayes net predicts that wild fisheries production will decrease (top left yellow box), with a probability of 66%, which is higher than predictions for increase or no change (16.8% each). Similarly, market price would increase, as would demand and preference.



The most informative indicators (right hand table) that would confirm a change in environmental quality had occurred are the levels of IUU (81.5% of total possible mutual information), followed by a set of equally informative indicators, all at 65.9%. Secondary jobs is in the third most informative level. Indicators that are least informative are at the lower end of the table.

Sensitivity of 'Input: environmental quality' to a finding at another node:

Node	Mutual Info	Percent	Variance of Beliefs
Input: environmental qua	1.58496	100	0.4444444
Illegal unrep. & unreg.	1.29205	81.5	0.3780439
Customary indigenous fis	1.04373	65.9	0.3018434
Recreational fish produc	1.04373	65.9	0.3018434
Management and regulatio	1.04373	65.9	0.3018434
Wild fish stocks	1.04373	65.9	0.3018433
Secondary jobs	0.95338	60.2	0.2709837
Wild fisheries productio	0.62127	39.2	0.1489210
Demand and preference	0.58865	37.1	0.1365216
Market price	0.58865	37.1	0.1365216
Environmental quality	0.37666	23.8	0.0580731
Social acceptance	0.37666	23.8	0.0580731
Aquaculture production	0.37666	23.8	0.0580731
Profit	0.30096	19	0.0362286
Primary jobs	0.30096	19	0.0362286
Cost of production	0.30096	19	0.0362286
Technology	0.00000	0	0.0000000
Alternative_Models	0.00000	0	0.0000000
Other regulations and zo	0.00000	0	0.0000000

How to use this information

This or other perturbation scenarios can be used to understand how the Australian seafood system works and to proactively evaluate and develop management and research options. For instance, if we saw this happening, where and how could we intervene to achieve a desired outcome or objective? Is the data we are currently collecting (e.g. levels of IUU fishing, recreational fishery production) going to be informative across the range of possible impacts to the system. By running a range of scenarios, a robust set of indicators that are useful can be identified.

In this example we have used the Bayes net model to show how one can PREDICT a response, and to identify informative INDICATORS, however, it has four primary functions or uses.

1. PREDICT the response of Australia's seafood system to an input or perturbation
2. To DIAGNOSE the cause of change and identify the most likely drivers given an observed change in the system
3. TEST if the way the model describes Australia's seafood system is consistent with observed responses in the system
4. Identify most informative INDICATORS for monitoring change in the system

Table 1. Description of variables in Bayes model of Australian fisheries shown on Page 1

Variable Name	Description
Wild fisheries production	Level of effort and catch in wild-caught fisheries
Aquaculture production	Level of production in aquaculture industry Recreational fisheries production
Wild fish stocks	Level of stock abundance
Secondary jobs	Number of secondary jobs associated with fisheries
Market price	Market price for wild-caught and aquaculture fish products
Profit	Profit from commercial fisheries
Cost of production	Cost of production for commercial fisheries
Management and regulation	Control of fisheries effort levels
Other regulations and zoning	Other regulations of fisheries and spatial zoning
Demand and preference	Consumer demand and preference for fisheries products
Social acceptance	Societal tolerance for wild-caught and aquaculture industry
Environmental quality	Quality of environmental and habitat supporting wild fish stocks and aquaculture production systems
Technology	Labour saving technology
Primary jobs	Number of jobs directly associated with commercial fisheries

Further information

				
Alistair Hobday	Jeffrey Dambacher	Fabio Boschetti	Chris Moeseneder	Linda Thomas
Project Lead	Modelling Lead	Scenario Lead	Data Analyst	Project Officer

For further information about the FRDC Futures Project and to download and explore the model further, see https://research.csiro.au/oceanfutures/frdc-futures/