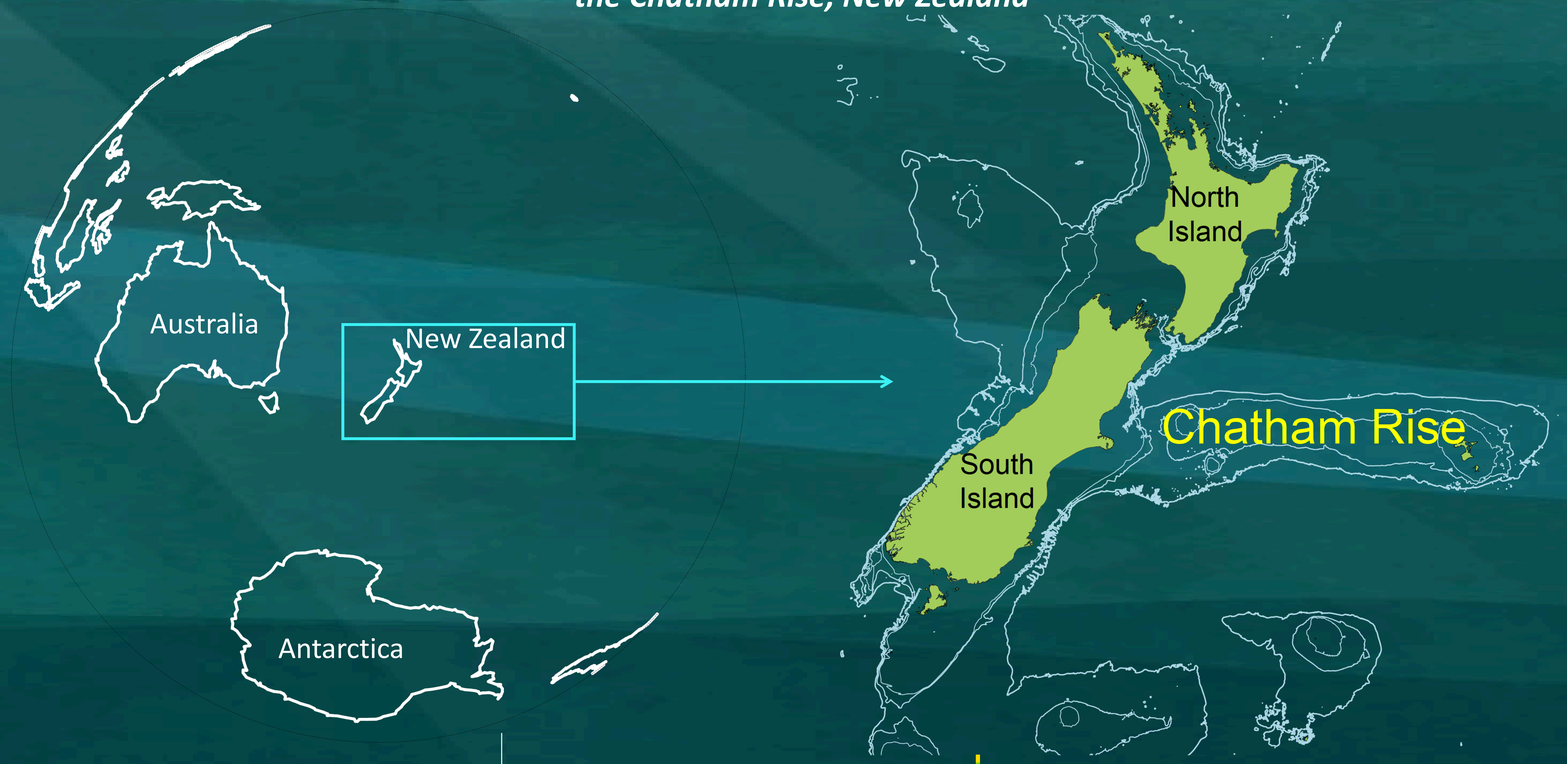
From data compilation to model validation

a comprehensive analysis of a full deep-sea ecosystem model of the Chatham Rise, New Zealand

The Chatham Rise is a *highly productive* deep-sea ecosystem. It supports numerous substantial commercial fisheries, and is a likely candidate for an *ecosystem based approach to fisheries management in New Zealand*.



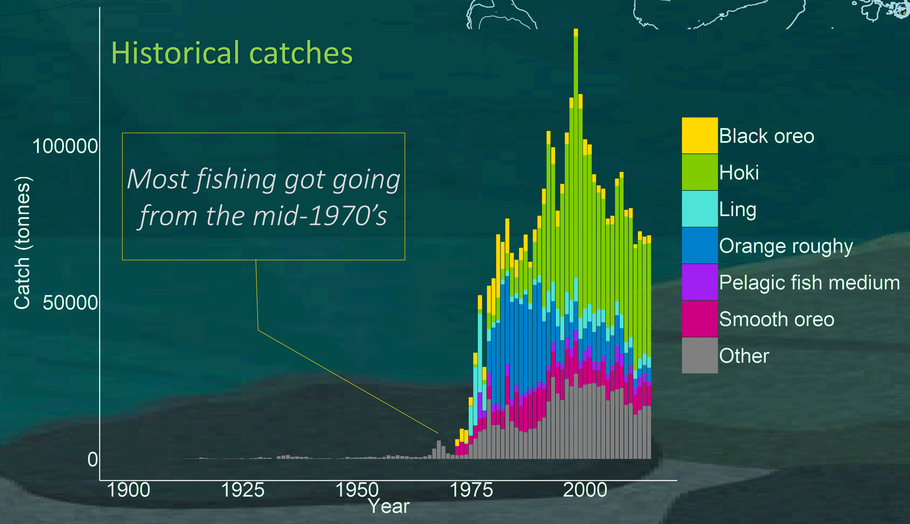
Data sources include:
- **Commercial fishery catch and effort data**
- **Trawl surveys**
- **Acoustic surveys**
- **Diet studies**
- **Benthic and habitat studies**
- **Growth and age studies**
- **Nutrient sampling**

Keystone species

Interaction analyses revealed ***keystone*** groups were
- **Orange roughy**
- **Hoki**
- **Myctophids**
- **Spiny dogfish**

Influential knowledge gaps

Oceanography, seabirds and ***cetaceans*** were the **knowledge gaps most likely to influence model results**.



Bottom-up variability

Bootstrapping oceanographic variables produced the most variability for *diatoms*, *carnivorous zooplankton* and *labile detritus*

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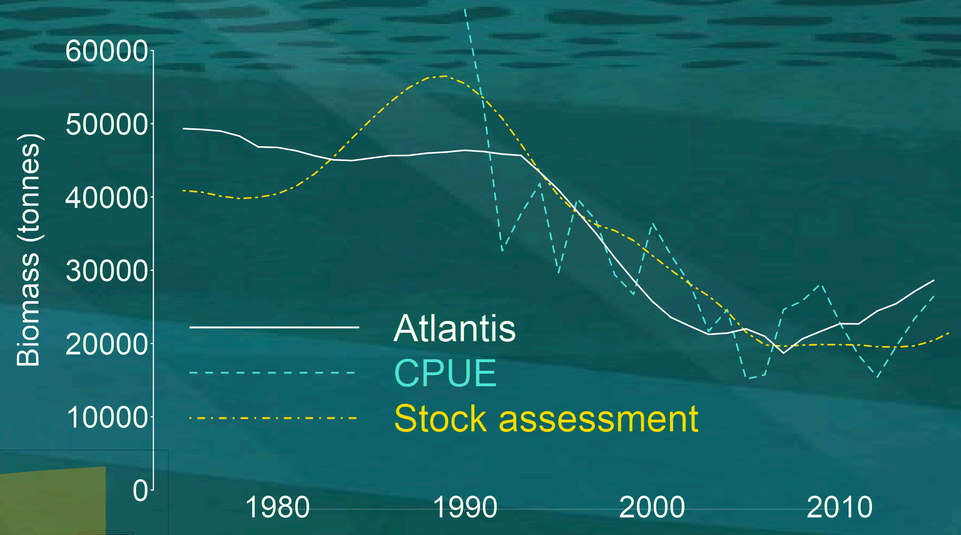
Realistic model dynamics

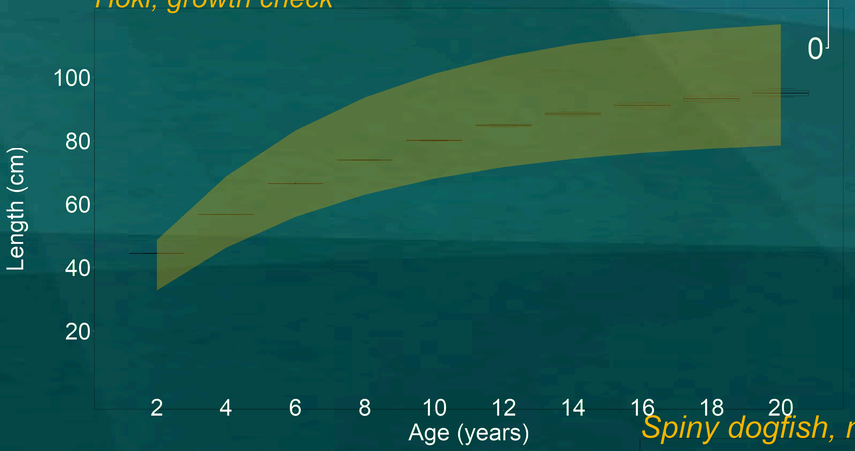
Responses to fishing
- ✓Match stock assessments

Realistic realised
- ✓Diet
- ✓Growth rates
- ✓ Mortality rates

Biomass trajectories - hake



Hoki, growth check



Spiny dogfish, mortality rate check

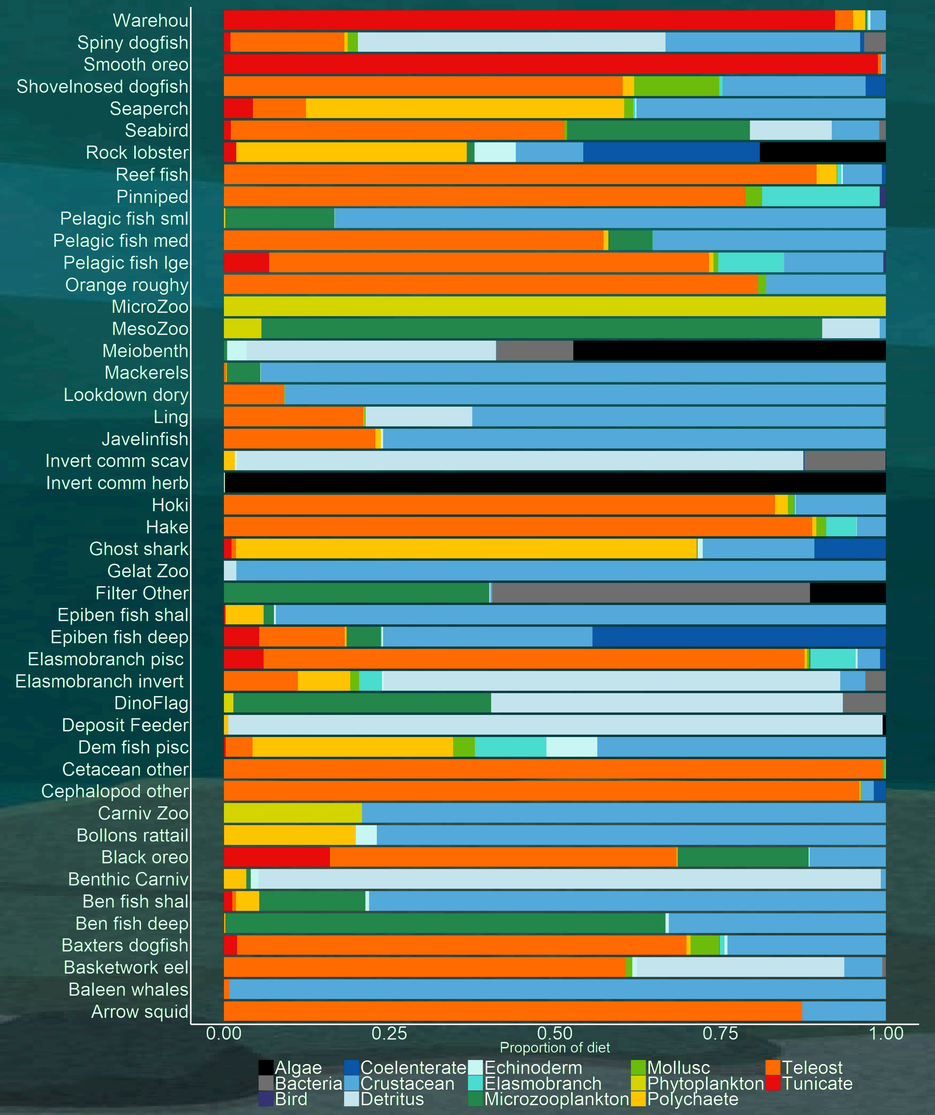
Steps to predation

(and hence growth of the predator, and mortality of the prey

1. Am I allowed to eat it?

2. Is it in the same place at the same time as me?

3. Does it fit in my mouth?

4. How much can I eat? (limited by growth rates)

5. Any habitat restrictions? E.g. refuge