National SCIENCE Challenges

SUSTAINABLE SEAS

Ko ngā moana whakauka

Incorporating multiple stressors in decision support tools

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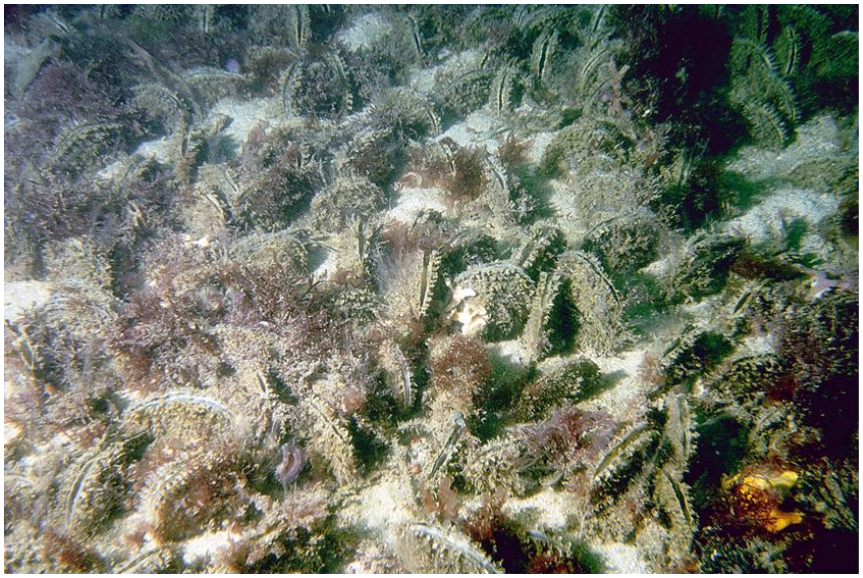
Models to inform management of seafloor disturbance

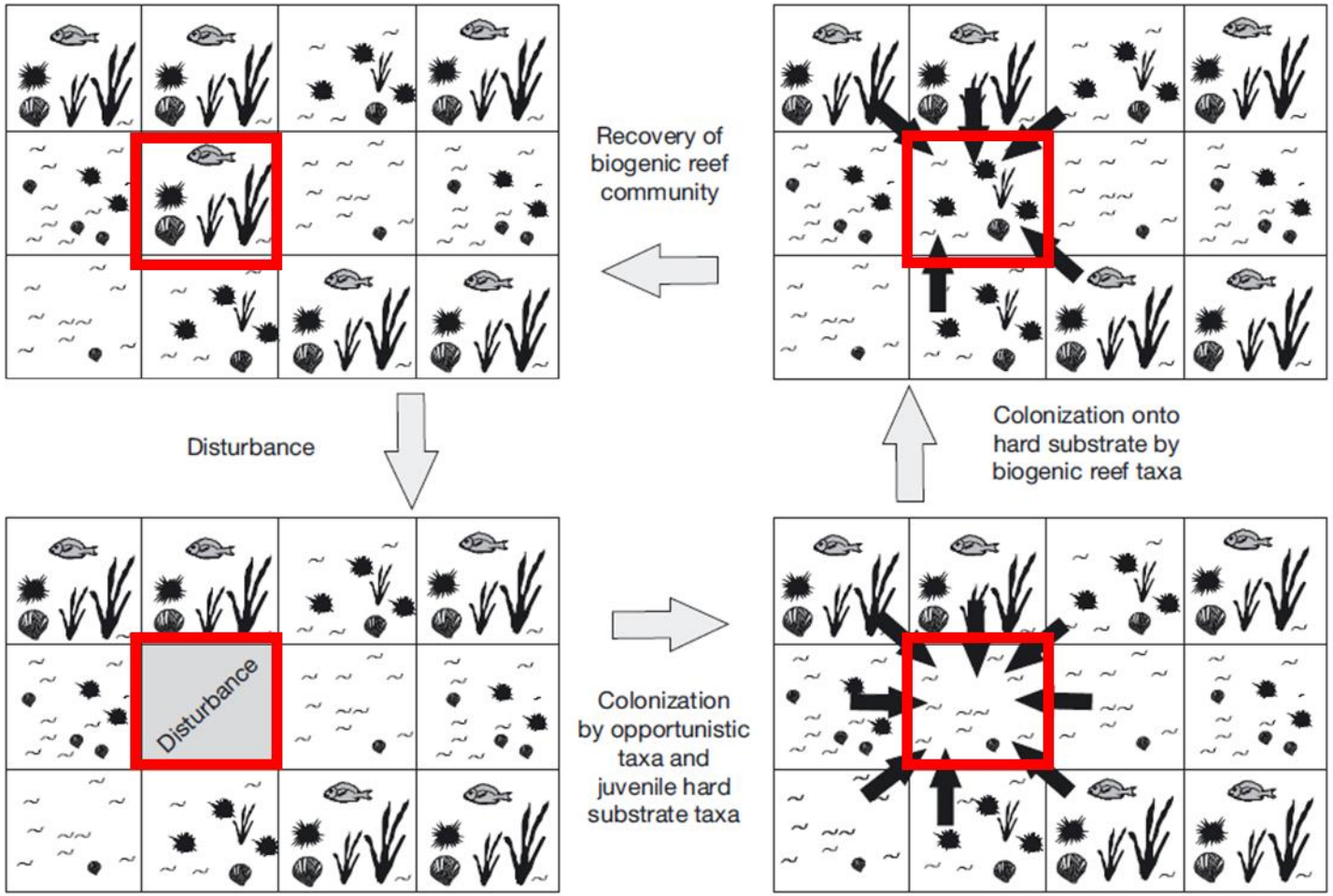


Pristine, undisturbed state

After trawl

Sedimentation

Patch dynamic model of seafloor disturbance



Lundquist et al. (2010) Interactions between disturbance and dispersal decreases persistence thresholds of a marine benthic community. *Marine Ecology Progress Series* 413: 217-228

Current Model

8 interacting functional groups (FG's) characterised by:

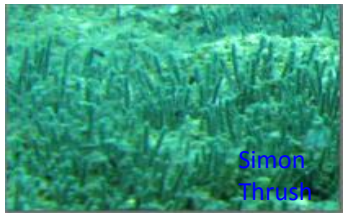
- Age of maturity
- Age of mortality
- Seasonality of reproduction
- Dispersal properties
- Dependence on hard substrate for settlement
- Adult-juvenile interaction matrix that allow presence/absence of each group to impact colonisation/recovery potential after disturbance

FG1 - opportunistic

FG5 - shellhash

FG2 - opportunistic

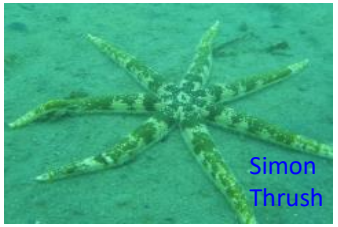

FG6 - epifauna



FG3 - tubemat

FG7 – deep burrow

FG4 - destabiliser



FG8 - scavenger

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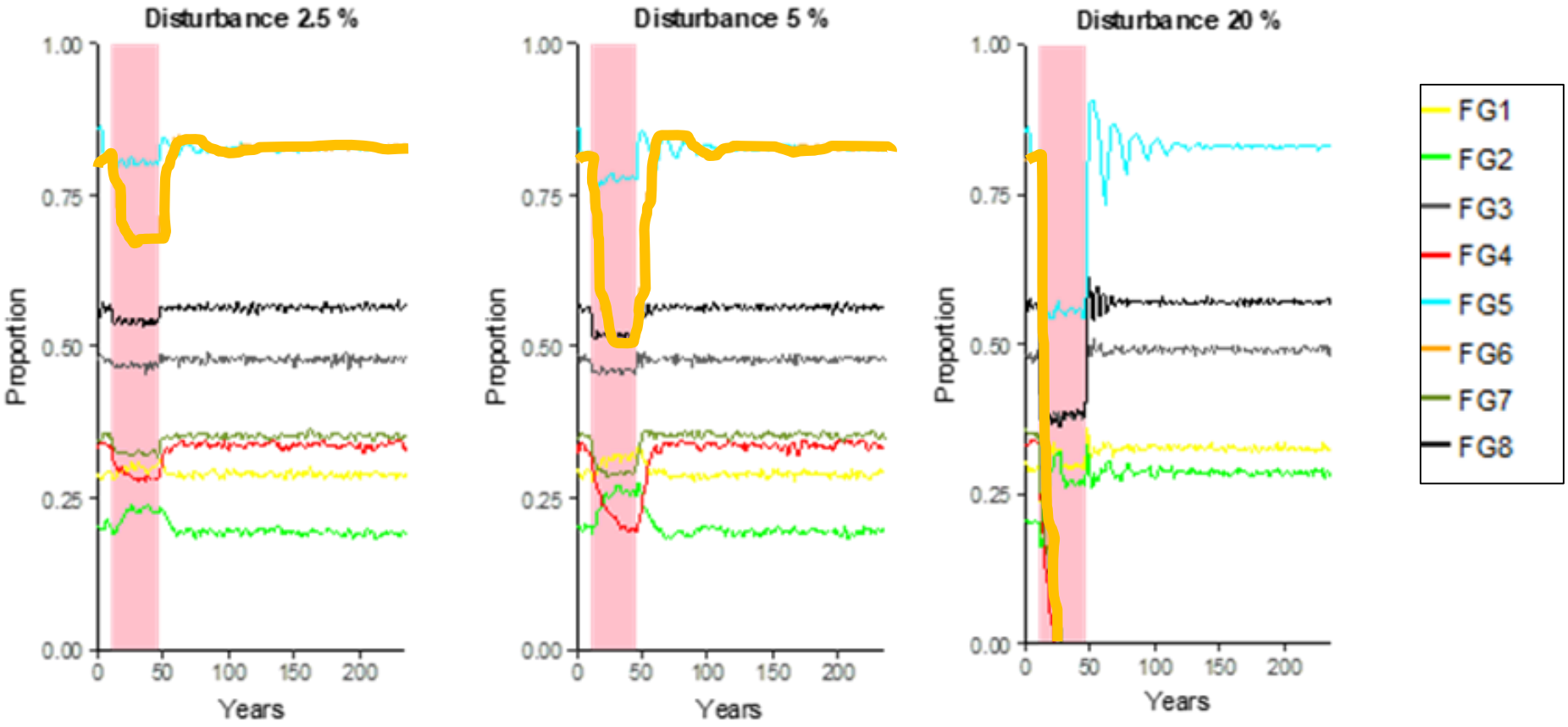
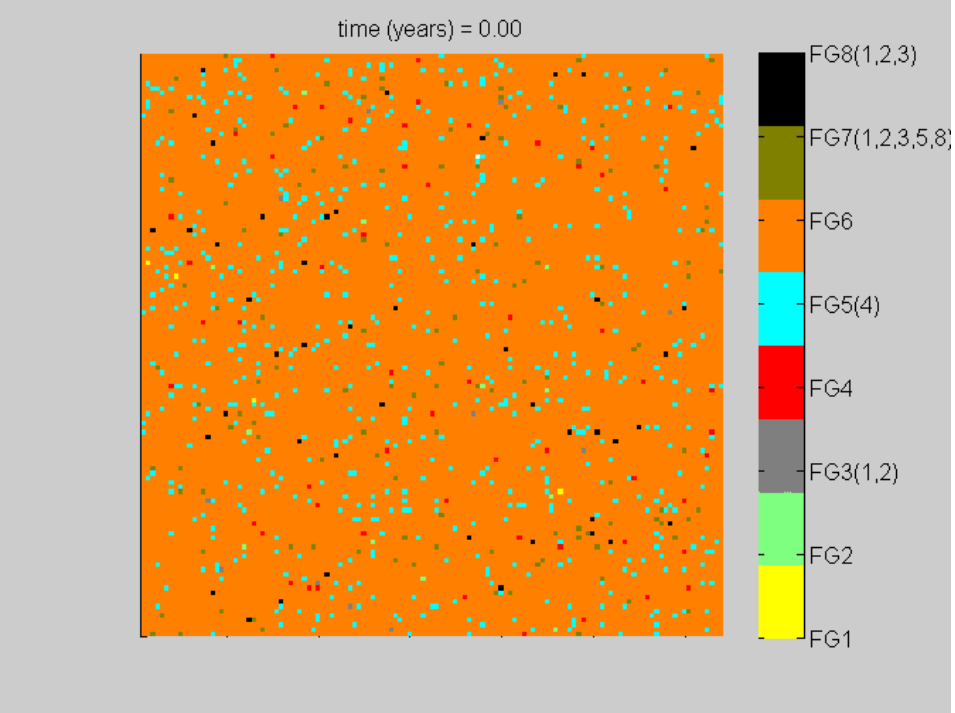
Lundquist, C.J. et al. 2013. Bottom disturbance and seafloor landscapes: *NZ Aquatic Environment and Biodiversity Report No. 118.* 58 p. http://www.mpi.govt.nz/news-resources/publications

Increasing disturbance can result in a irreversible loss of sensitive functional groups



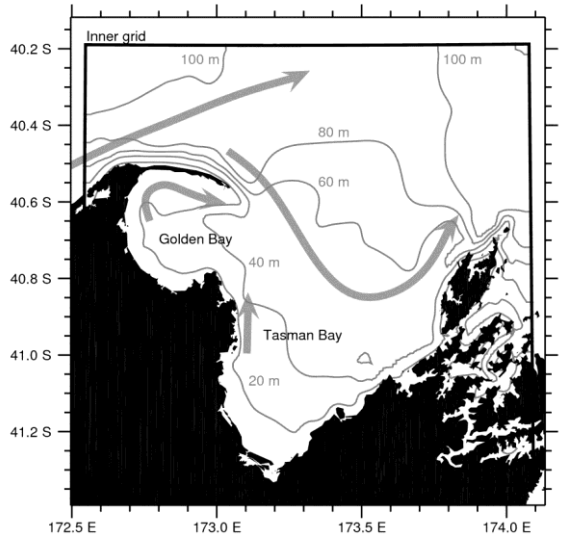
Model simulations

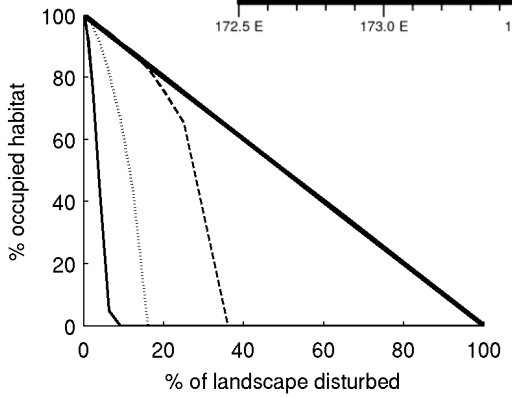


10 x 10 disturbance between timesteps 25 & 63 equating to approximately **2 % of landscape** disturbed per year (4 time steps/yr)

Applying the DR model to help inform decision making in Tasman and Golden Bays

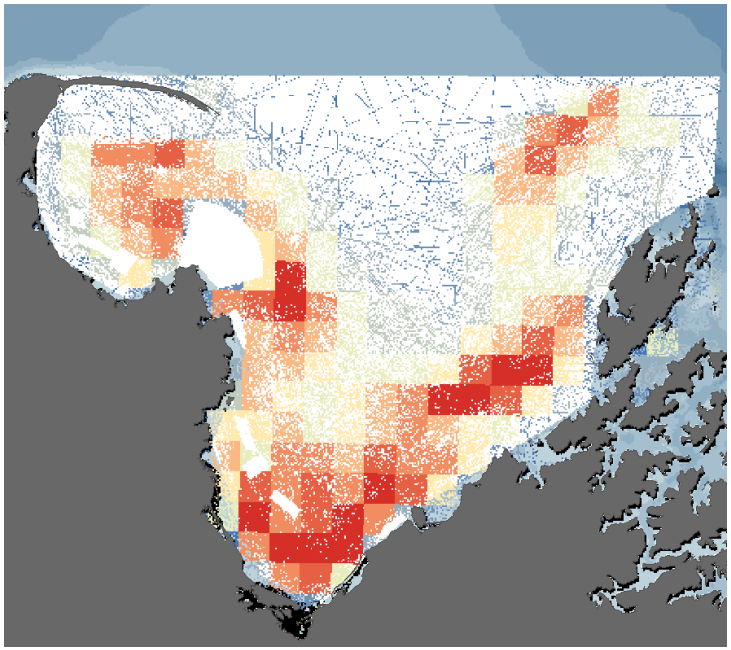
- Concern in regards to the impact of fishing and sedimentation
- Adapt model to multiple types of fishing and different sensitivities to fishing gear
- Include other types of disturbance (sedimentation)
- Identify indicators and warning signs of ‘tipping points’





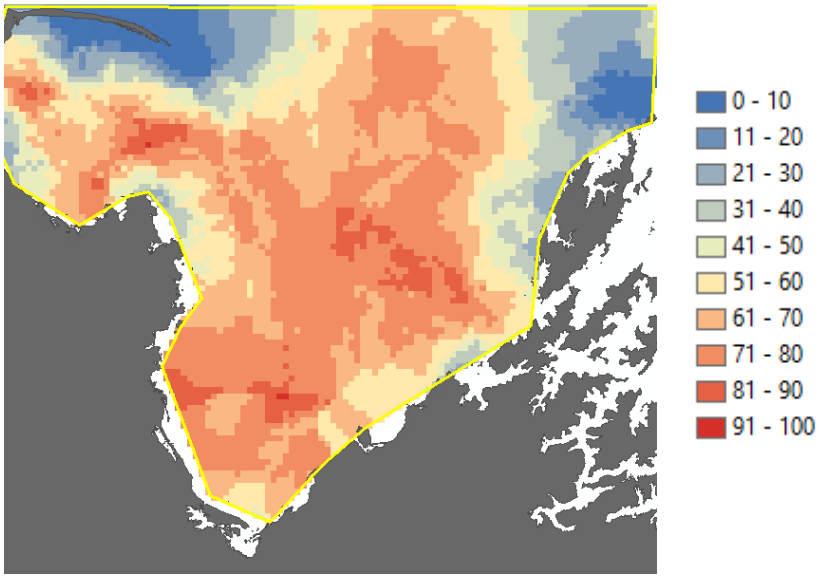
Fishing

- Extensive literature review to develop fishing sensitivity curves for individual functional groups
- Refined spatial response to fishing



Sedimentation

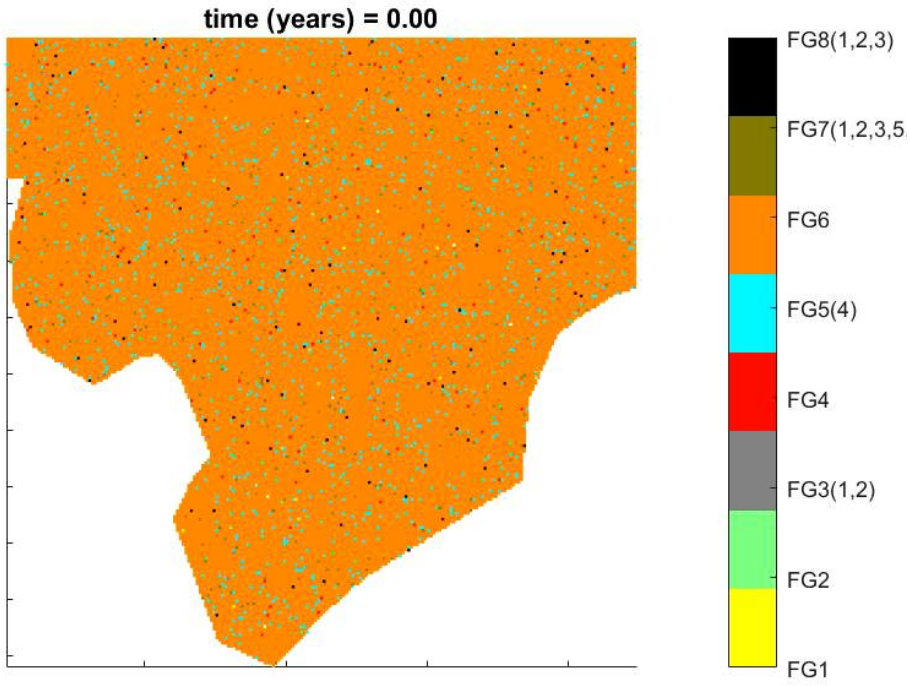
- Used extensive subtidal macrofaunal datasets (including TGB) to develop relationships between FG abundance and sedimentation (via mud content)
- Used maps of mud content available for TGB to modify FG composition throughout the model.



%mud throughout TGB

Next steps

- Investigate the combined impact of different magnitudes of fishing and sedimentation on FG responses.
- Exploring modifying the model to better represent the shape and characteristics of TGB.
- Meeting in December where we will get feedback from stakeholders to refine scenarios of interests to TGB community.



Acknowledgements

- **Sustainable Seas National Science Challenge, Project Spatially Explicit Decision-Support Tools (NIWA Project #SUSS16203)**
- **NIWA Coasts & Oceans Programme (Biodiversity, Connectivity & Health)**
- Ministry of Primary Industries: Fisheries data; Functional Biodiversity (ZBD200925)
- NIWA: Sediment and macrofaunal data
- TGB Stakeholder community: input to date which has informed model scenarios and development

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