Zoning experiences from New Zealand: some selected aspects of design and monitoring of deep-sea sites

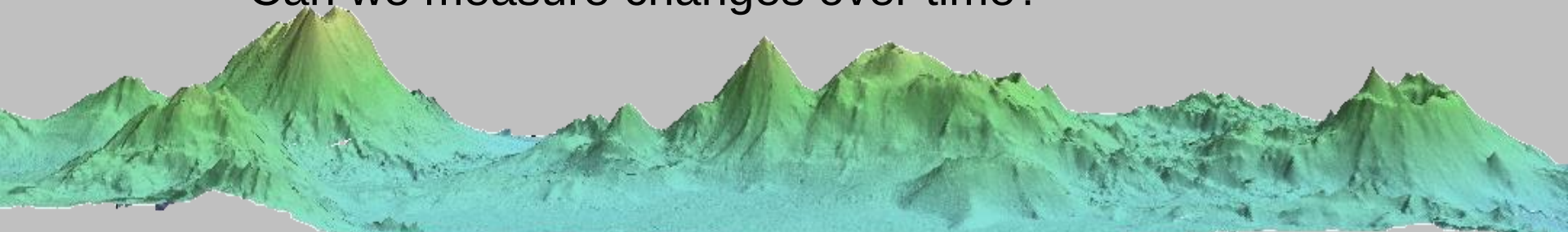
Malcolm Clark[1], Ashley Rowden[1], Rachel Boschen[2], Dave Bowden[1]

[1] NIWA, [2] Victoria University

ISA IRZ-PRZ Workshop, Berlin, September 2017

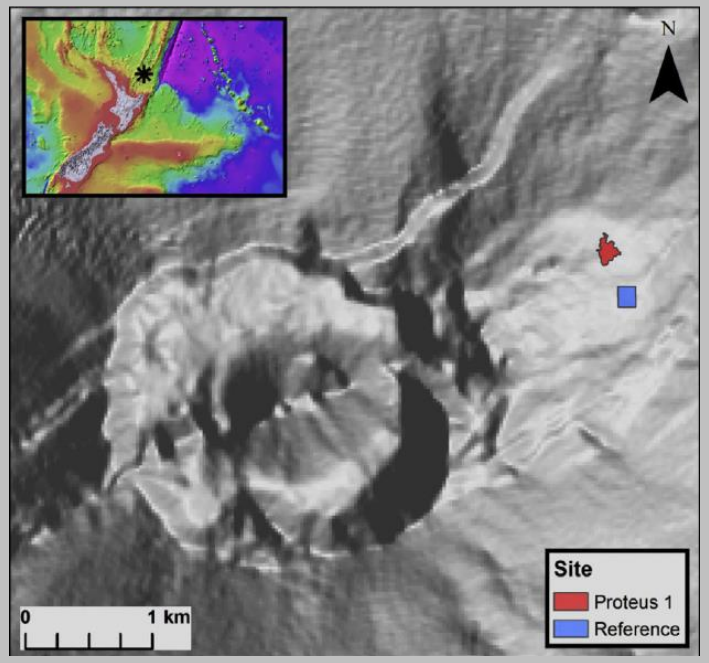
Presentation Outline

- Three examples of work in New Zealand
  - Not a “how to” talk
  - Highlights some issues we have experienced
- SMS mining vs reference site
  - Was the site selection adequate?
- Protected area network inside a licence area
  - Phosphorite nodule habitat
  - Was spatial planning useful?
- Monitoring recovery
  - Post closure to bottom trawling on seamounts
  - Can we measure changes over time?



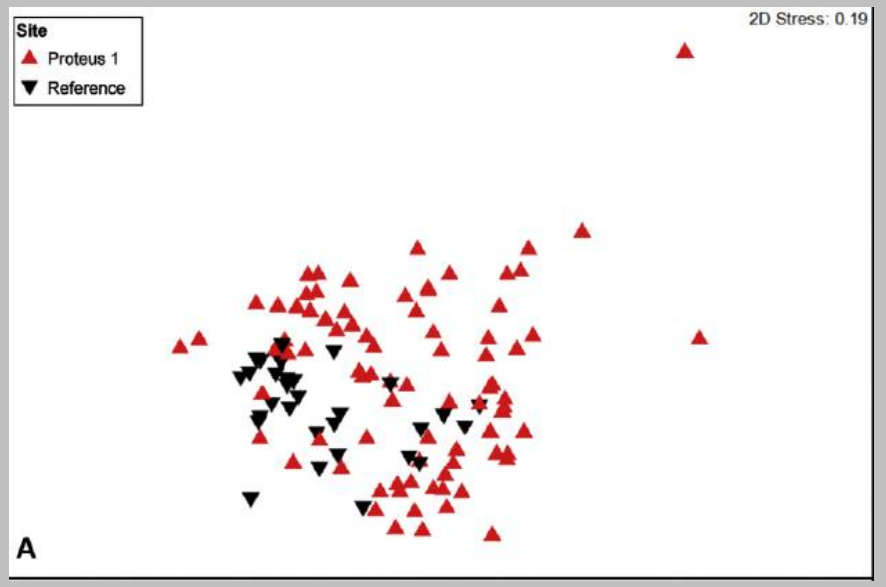
Kermadec seamount IRZ-PRZ

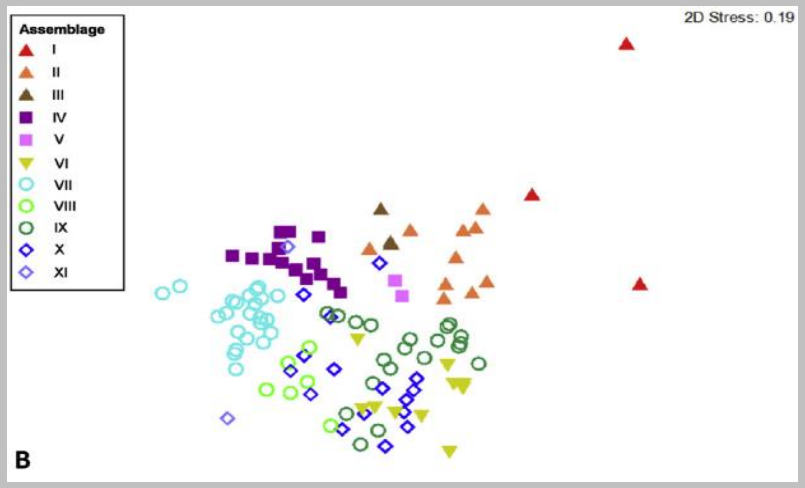
- SMS deposit on Rumble II west seamount
- 2011 Neptune Minerals identified a potential deposit “Proteus 1” and a nearby reference site
- Intended to serve purpose of IRZ and PRZ
- PRZ assessed by multibeam
  - Similar to IRZ in terms of:
  - Area (~22km^2)
  - Topography (flank)
  - Depth (1400m)
  - Slope
  - Aspect
- 200 m separation



Biological survey

- ROV seafloor camera survey
- Epifauna recorded along transects
- Variable resolution of identification (fam-species)
- Indicated Reference site was subset of Proteus 1 mining site
- 11 assemblages
  - 6 found only on Proteus
  - 5 shared in common

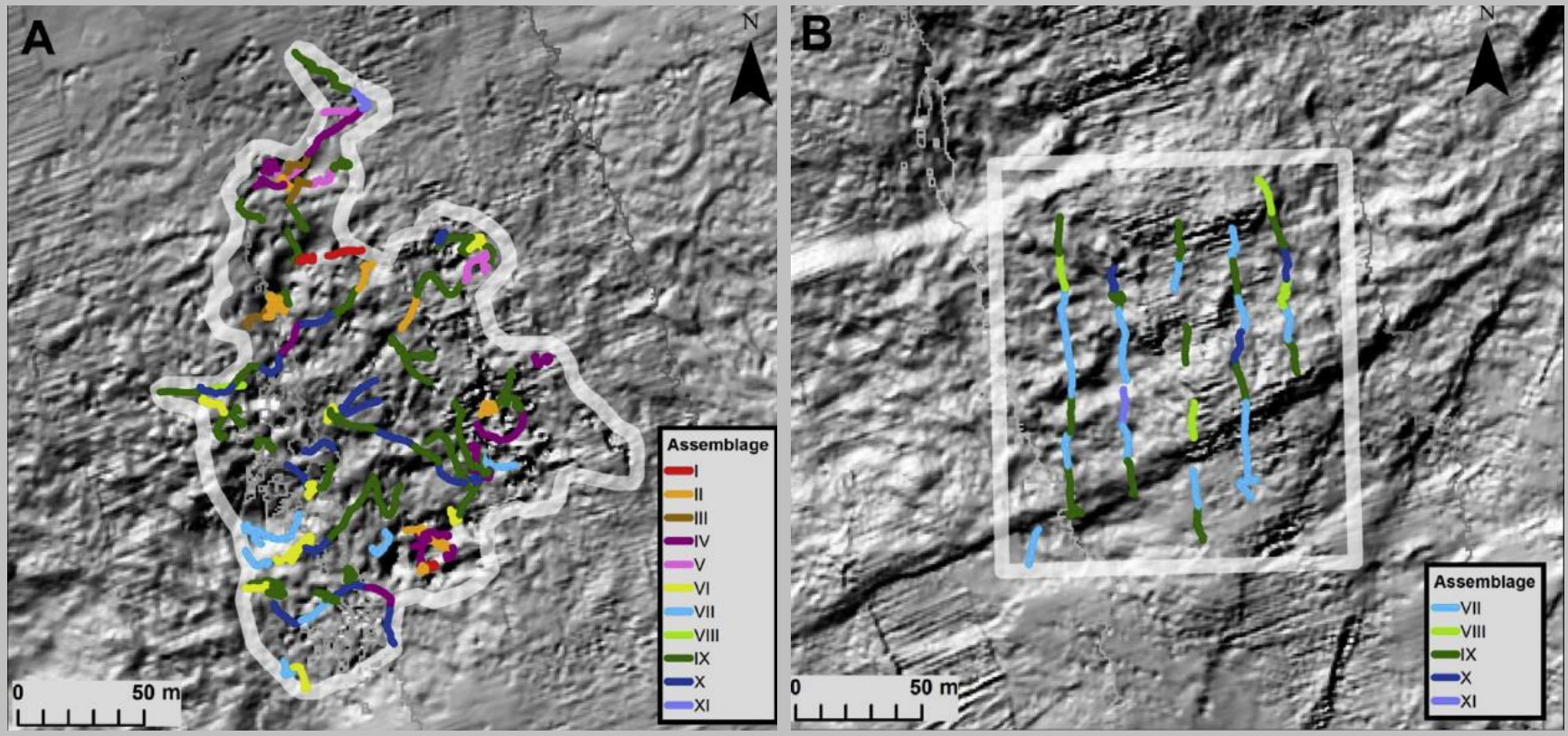




[Boschen et al. 2016]

Biological survey (2)

- Transects showing different communities



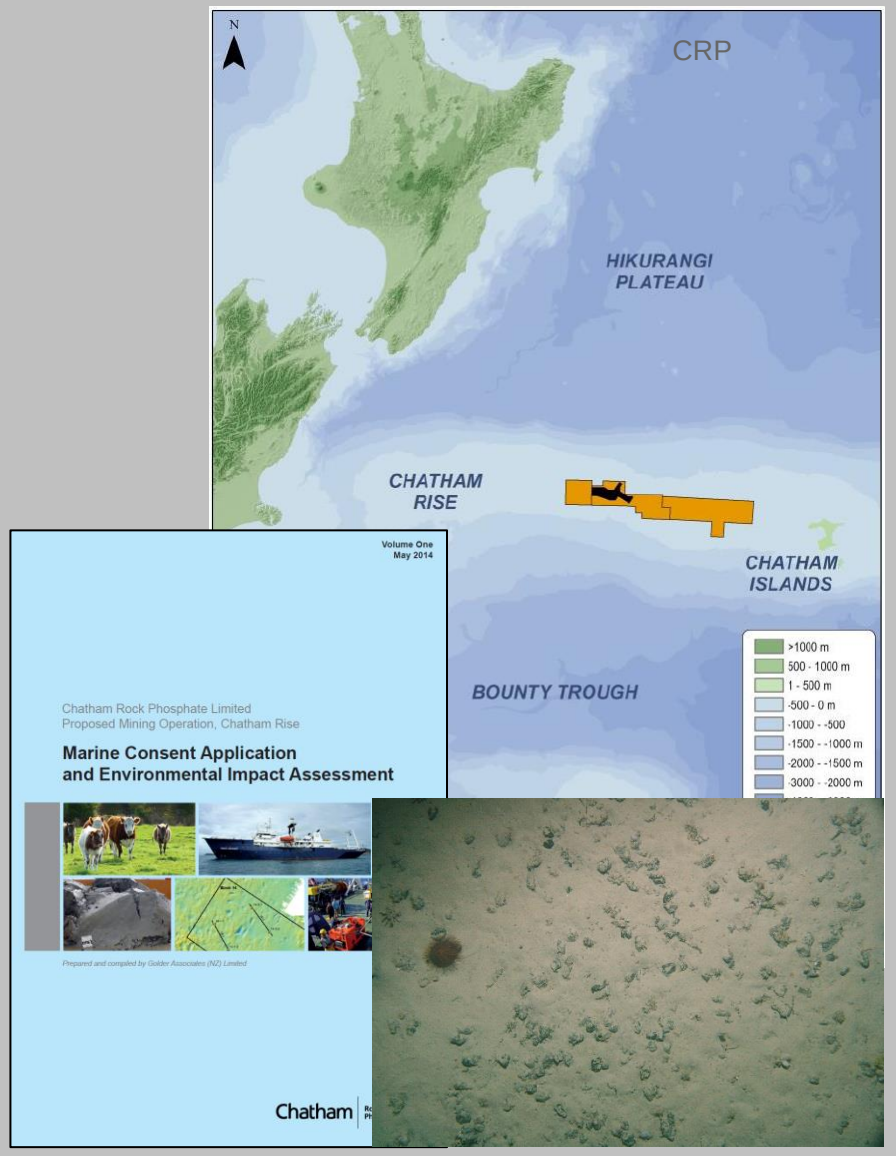
- Small chimney features, low temperature venting
  - Supported vent species and associations of corals-urchins not present at Reference site

Biological survey conclusions

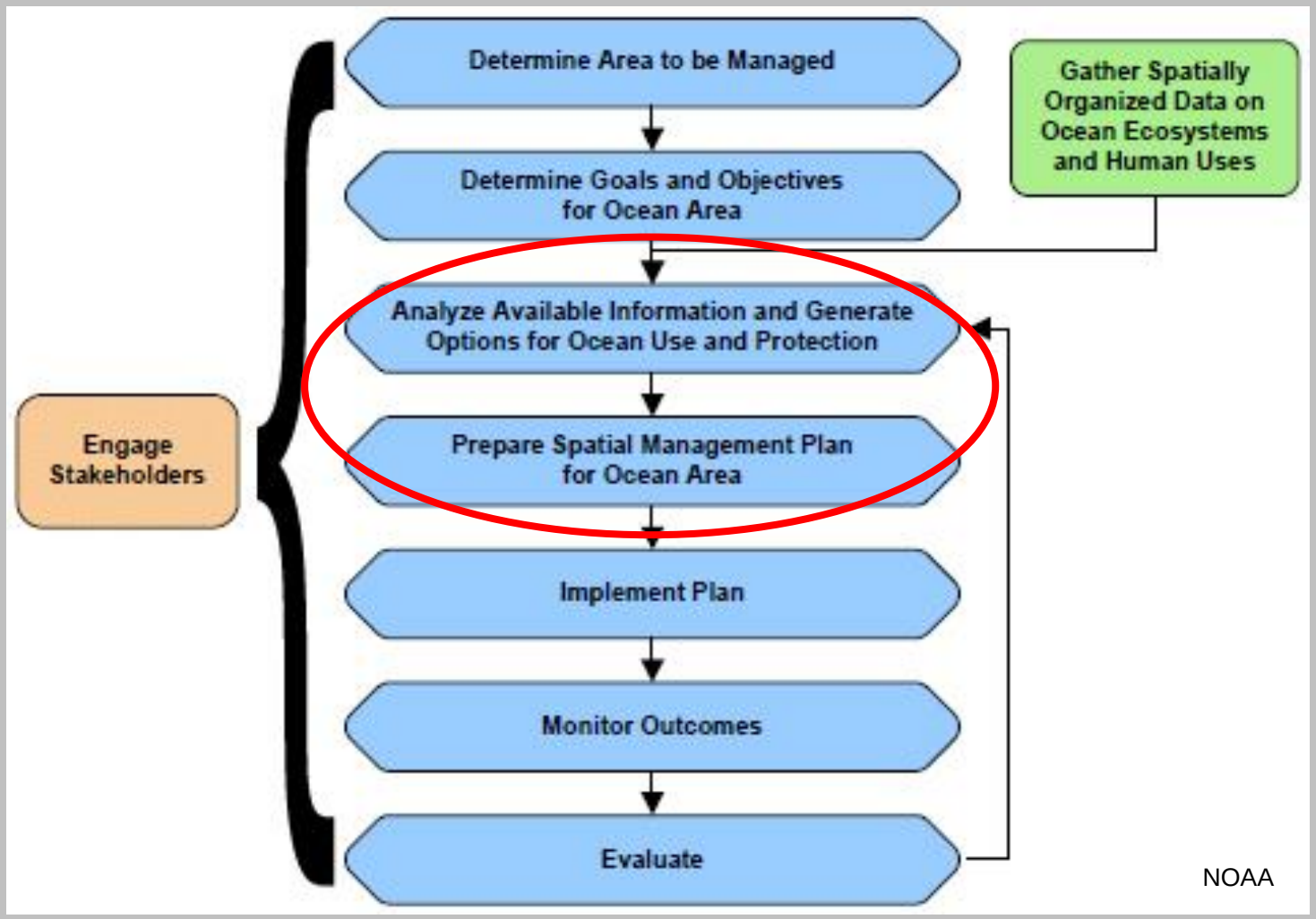
- Study shows a single PRZ was inadequate
- The multibeam survey, and physical proxies, did not pick up the smaller spatial-scale variability
- Highlighted that studies conducted at multiple spatial scales are needed
  - Large-scale survey to define regional/licence area significance of a potential PRZ
  - Small-scale to describe heterogeneity within the licence area
- The PRZ was too close to the impact area, as plumes could extend 1 km
  - Balance between proximity for faunal similarity and being clear of any long-term mining impact (variable plume)

Spatial Planning approach

- Chatham Rock Phosphate (CRP)
- Central Chatham Rise
- Phosphorite nodules
  - 300-400 m
- EIA 2014
- For the EMP, CRP considered a network of no-mining areas to protect “biodiversity” values and act as reference sites



Marine Spatial Planning



The CRP approach

- Attempt to structure zoning on objective rather than subjective grounds
- Transparency in assessment
- Zonation software produces a hierarchical prioritisation of the seascape based on the conservation value of the site (grid cells), iteratively removing the least valuable cells

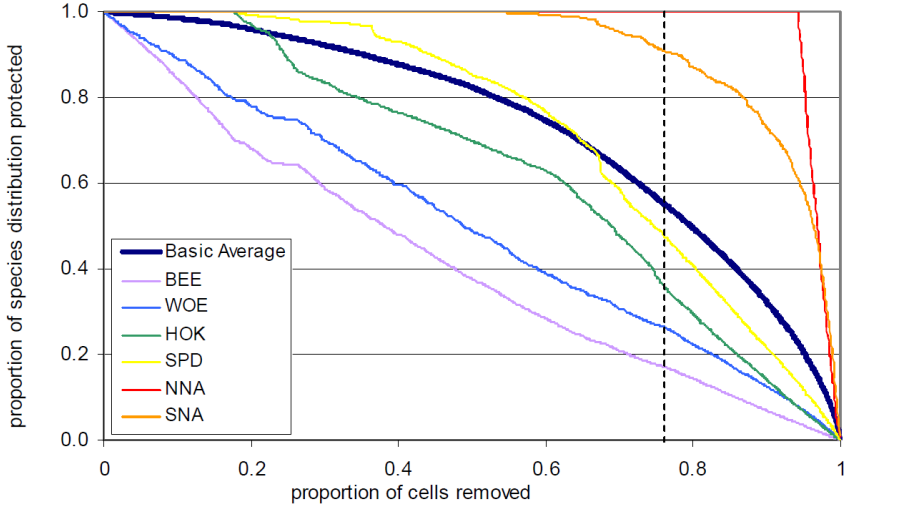
Marxan

Informing Conservation Decisions Globally

Marine Geospatial Ecology Tools

ZONATION

Conservation planning software

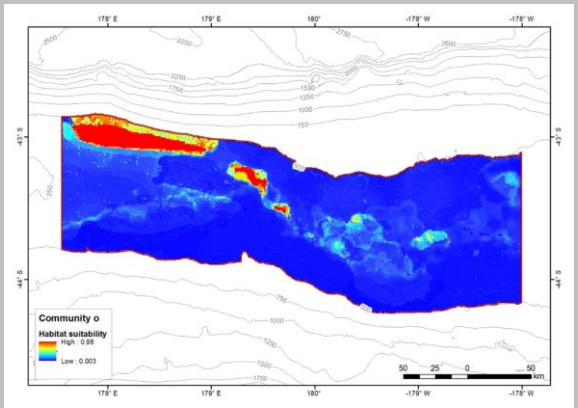


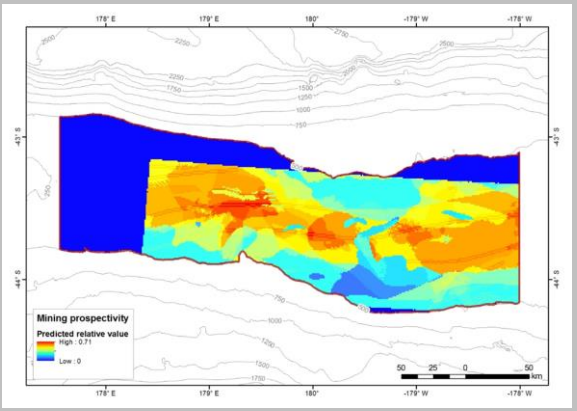
Data

Biodiversity

Resource cost

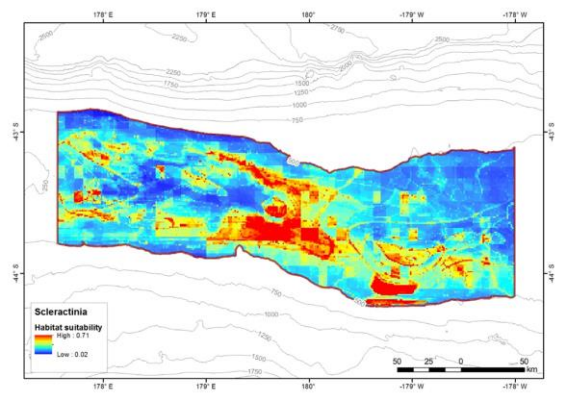
8 x benthic epifauna communities

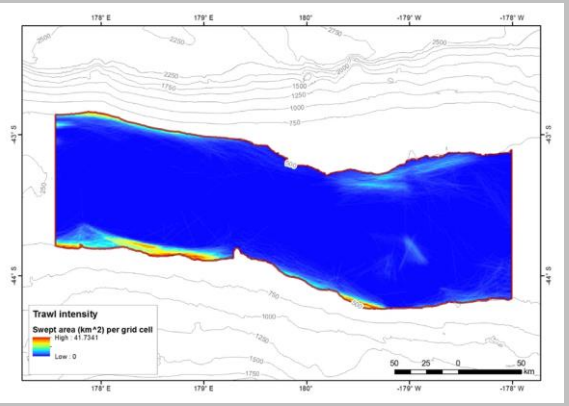




mining prospectivity

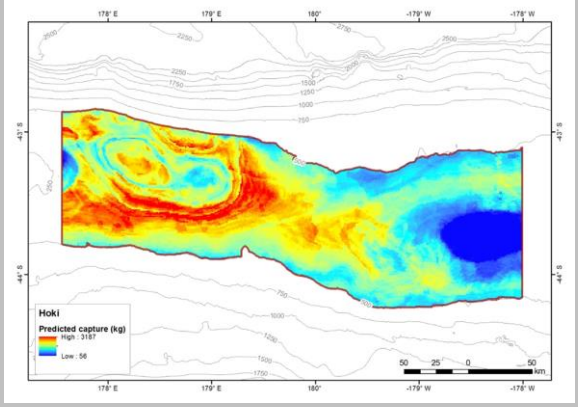
4 x protected coral taxa





trawl intensity

8 x demersal fish of commercial interest

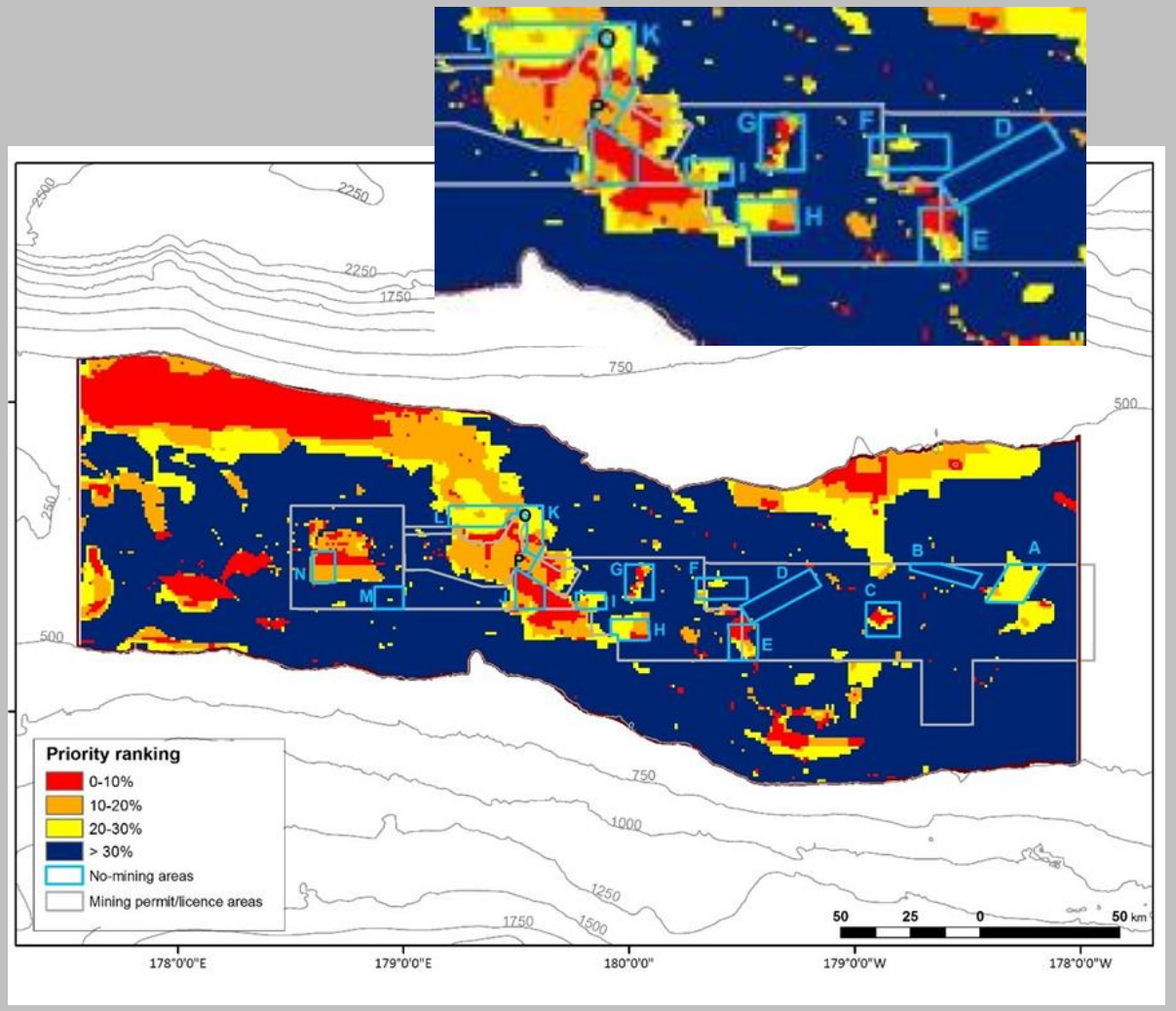


Numerous iterations with different weightings and sensitivities were trialled

Protected Area selection

Criteria:

- Protect high biodiversity priority areas (weighting of protected corals)
- Distant from highest mining priority areas
- Large as possible
- Distributed throughout area and MEC classes
- Ranged in size from 6-200 km^2



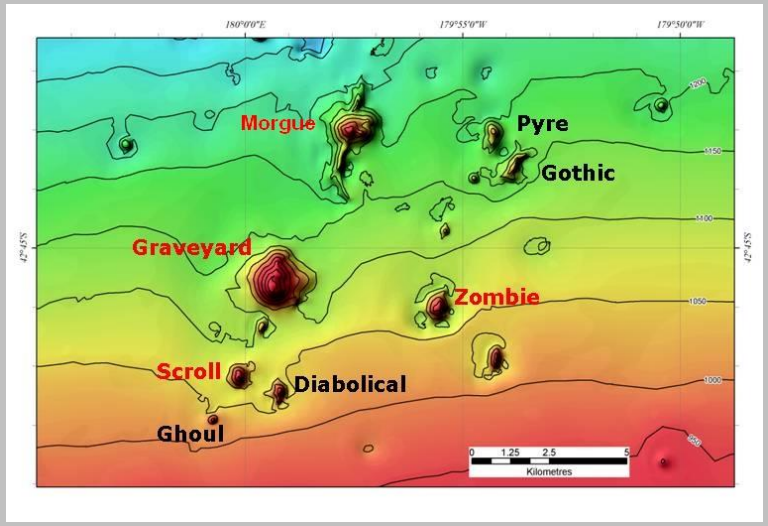
No-mining areas selected by CRP

Where did it get to?

- Important step in process of generating management options for mitigating impact of phosphorite nodule mining on the Chatham Rise
- Demonstrated the utility of this sort of approach
- Within the mining and licence area, the no-mining areas could protect:
  - >20% for all biodiversity features and ~90% of the coral-dominated epifaunal communities
- The application for mining was turned down
  - Many issues not related to the EMP and closed area plans
  - Important point relevant to THIS zoning was lack of REGIONAL protection areas (issue of how PRZs relate to APEIs)
  - Similar to the multiple scales Kermadec issue
  - Highlights the regional-local issue of APEIs and PRZ roles

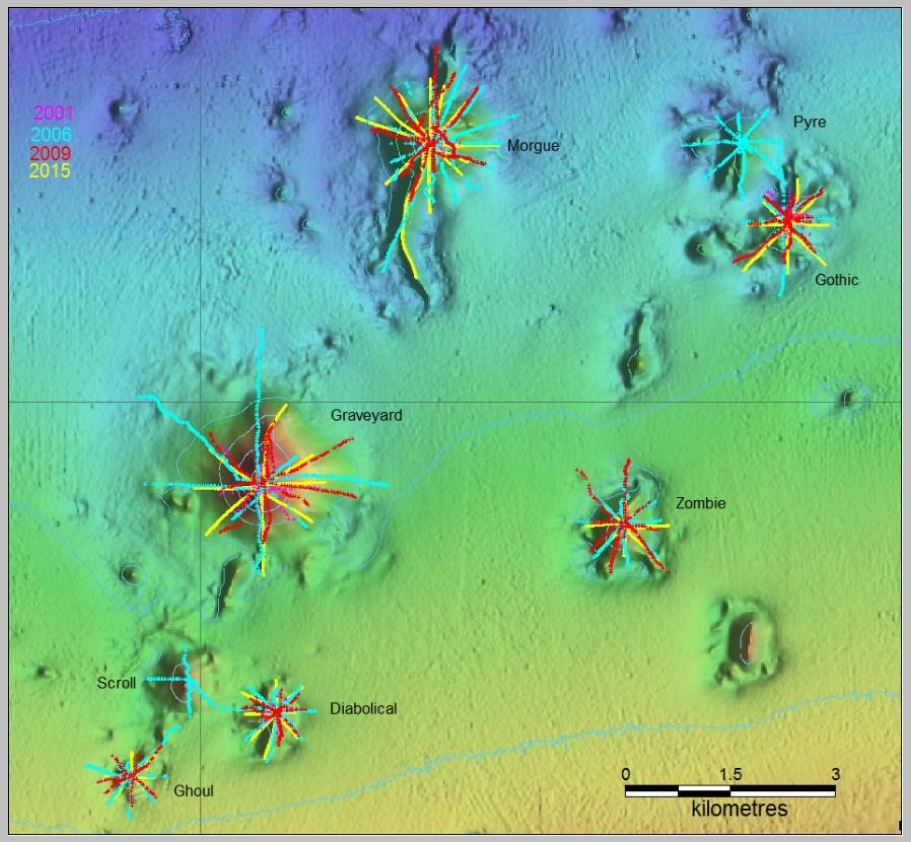
Monitoring changes over time

- An illustration that it is not as easy as one might think…..
- Example is the “Graveyard Knolls”, a cluster of volcanic peaks east of NZ
- 8 features close together, of similar depth and size
  - 4 have been fished, 4 are unfished
  - In 2001 3 were protected, including a previously fished feature
- Provided opportunity for a robust “compare and contrast” analysis of recovery
  - Fished-fished
  - Fished-unfished
  - Unfished-fished



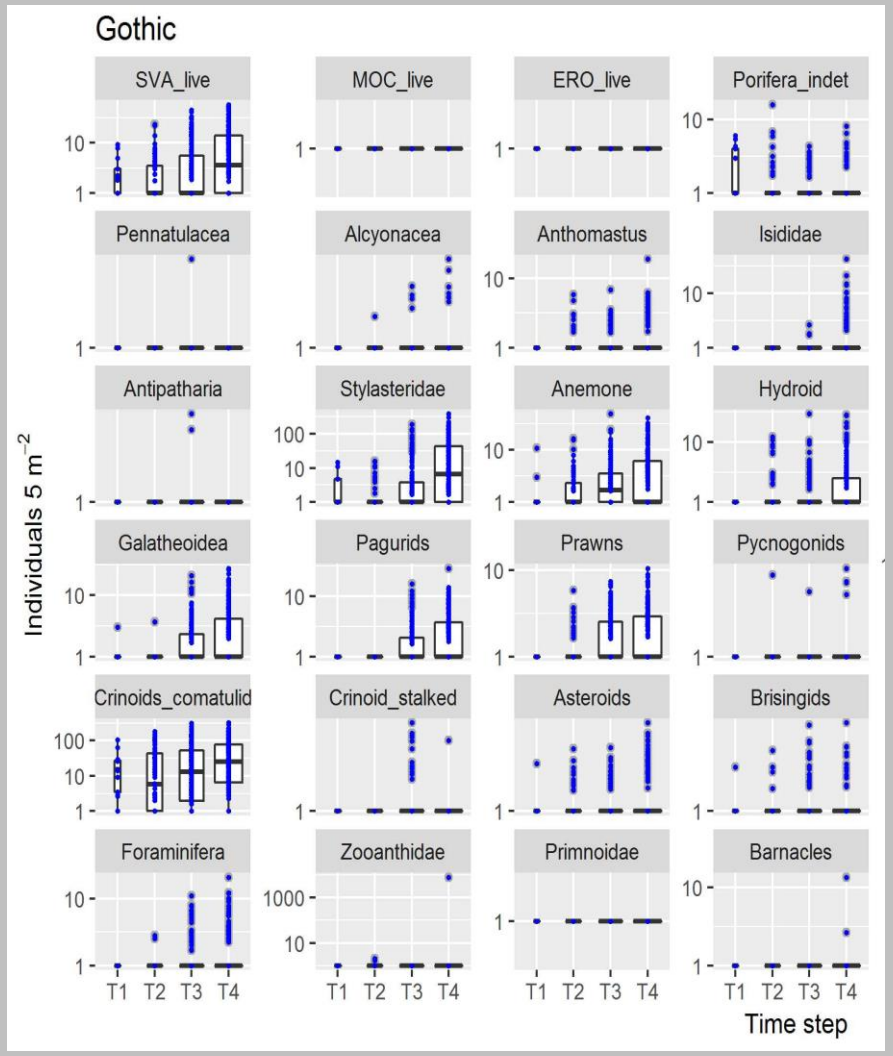
Survey design

- Four surveys over 15 years
  - 2001, 2006, 2009, 2015
- Using towed camera close to the seafloor
- Attempted to survey same lines



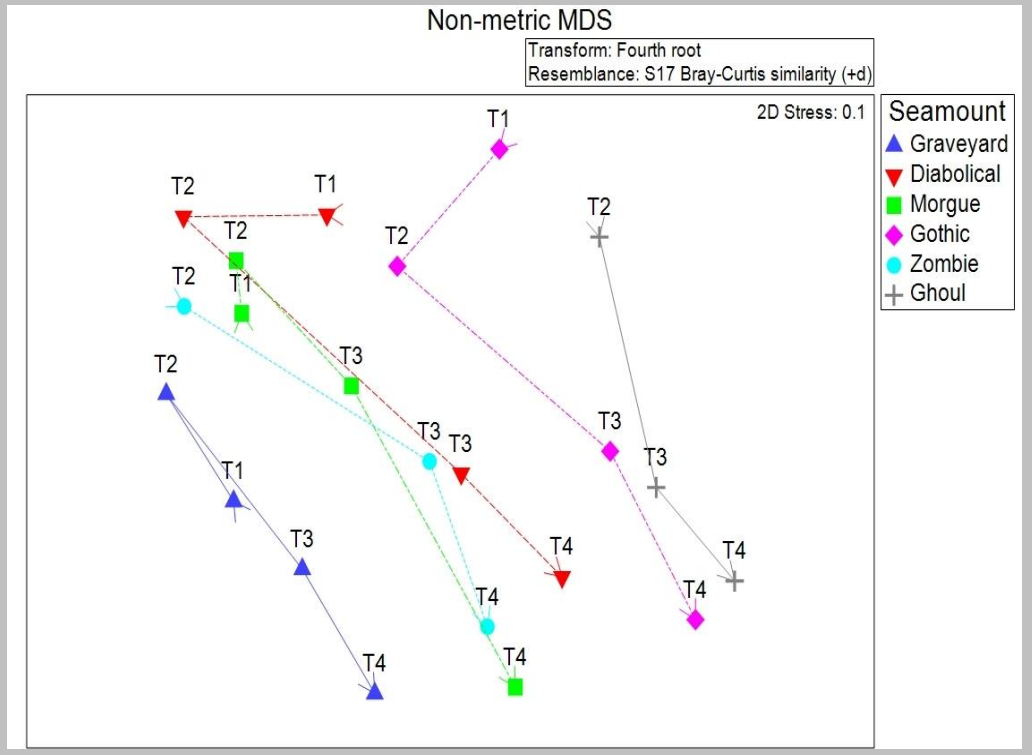
Technology creep

- Most taxa on all seamounts show an increase in abundance over time
- Includes taxa unlikely to actually be able to increase
- But camera resolution (still images1.5, 5, 10, 10 MP), ship control (DPS part 2009, all 2015) improved and mean more stable and clearer images over time
- Despite the SAME image analyst, hard to maintain consistent “down-grading” of identifications and counts



Overall trends

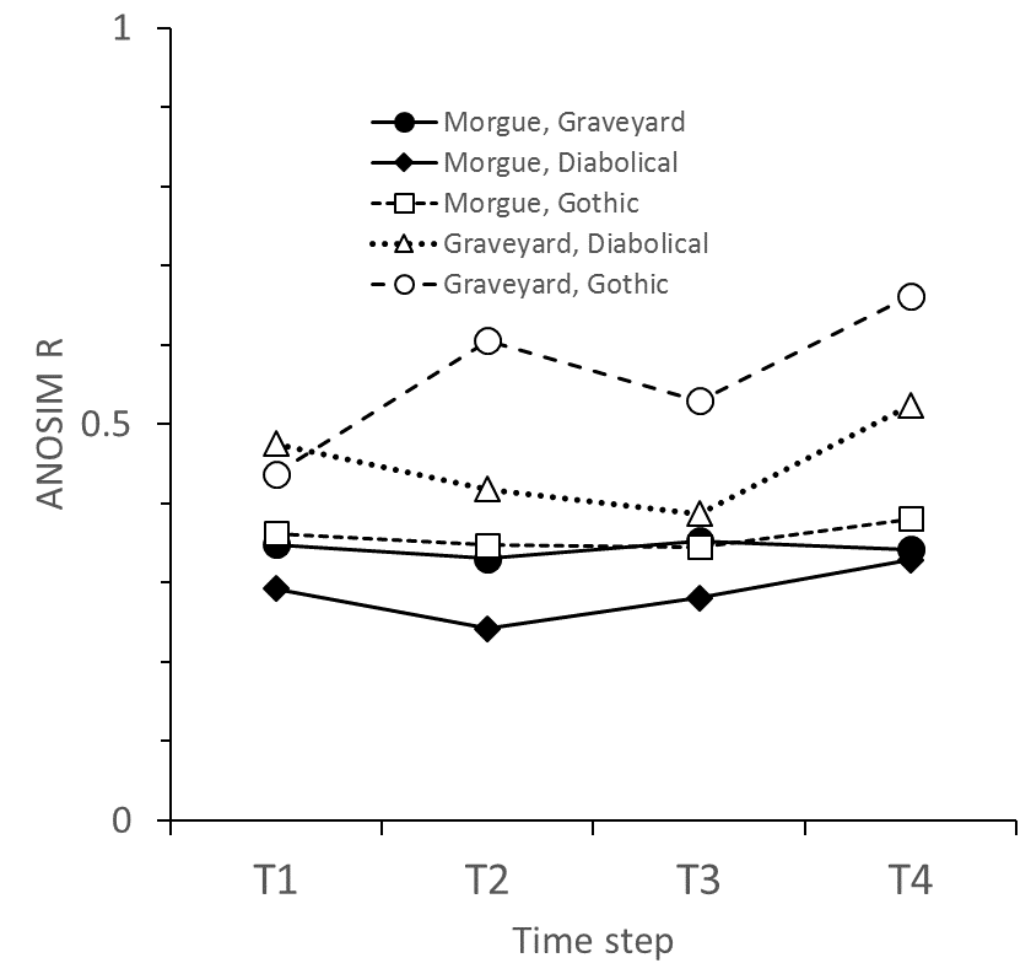
- All seamounts show a similar “movement pattern” in MDS space
- None are staying in the same place-which we would expect for unfished seamounts
- Highlights value of multiple seamounts/sites to confirm patterns, and improves our confidence in being able to separate human-induced from natural changes over time



Within any given survey, relative positions are similar. Indicates no recovery over 15 years

Seamount comparisons

- ANOSIM analysis of seamount pairs enables us to evaluate the patterns
- MORG-GRAV should be recovery-no sign
- GRAV-GOTH should be the most contrast (fished, unfished)
- Monitoring over time allows us to pick up real changes, technology changes, and outliers which can be missed if few surveys in time series



Thoughts from our experience

- Each resource and location has its own environmental and faunal characteristics. Detailed biological surveys are necessary to confirm IRZs and PRZs-physical proxies may be inadequate.
- The complex spatial scale patterns in benthic communities need to be described and incorporated into design. There are both regional-scale and local-scale issues.
- Spatial planning software can be a useful tool to aid selection of PRZs, especially for long-term biodiversity protection
- Replication of sites (so several PRZs) may be needed to confirm the nature and extent of natural changes.
- Careful planning is required to ensure time series data are consistent and can support robust comparisons.

Thank you

NIWA
Taihoro Nukurangi

- This presentation has used material from NIWA research projects funded by the New Zealand Ministry of Business, Innovation and Employment and Ministry for Primary Industries
- A large amount of research has been funded and carried out in collaboration with Trans Tasman Resources, Chatham Rock Phosphate, and Neptune Minerals.
- My appreciation to the organisers and the ISA for the invitation to participate in the workshop.

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