National Environmental Research Program

UTAS

Measuring and predicting success in marine reserves

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Problems faced by managers of marine biodiversity

1. The marine environment is out of sight, hence we have a poor idea of its current state and the extent of impacts.

2. Without good spatial and temporal information on condition and threats to the marine environment, management is inefficient.

Scientific problems

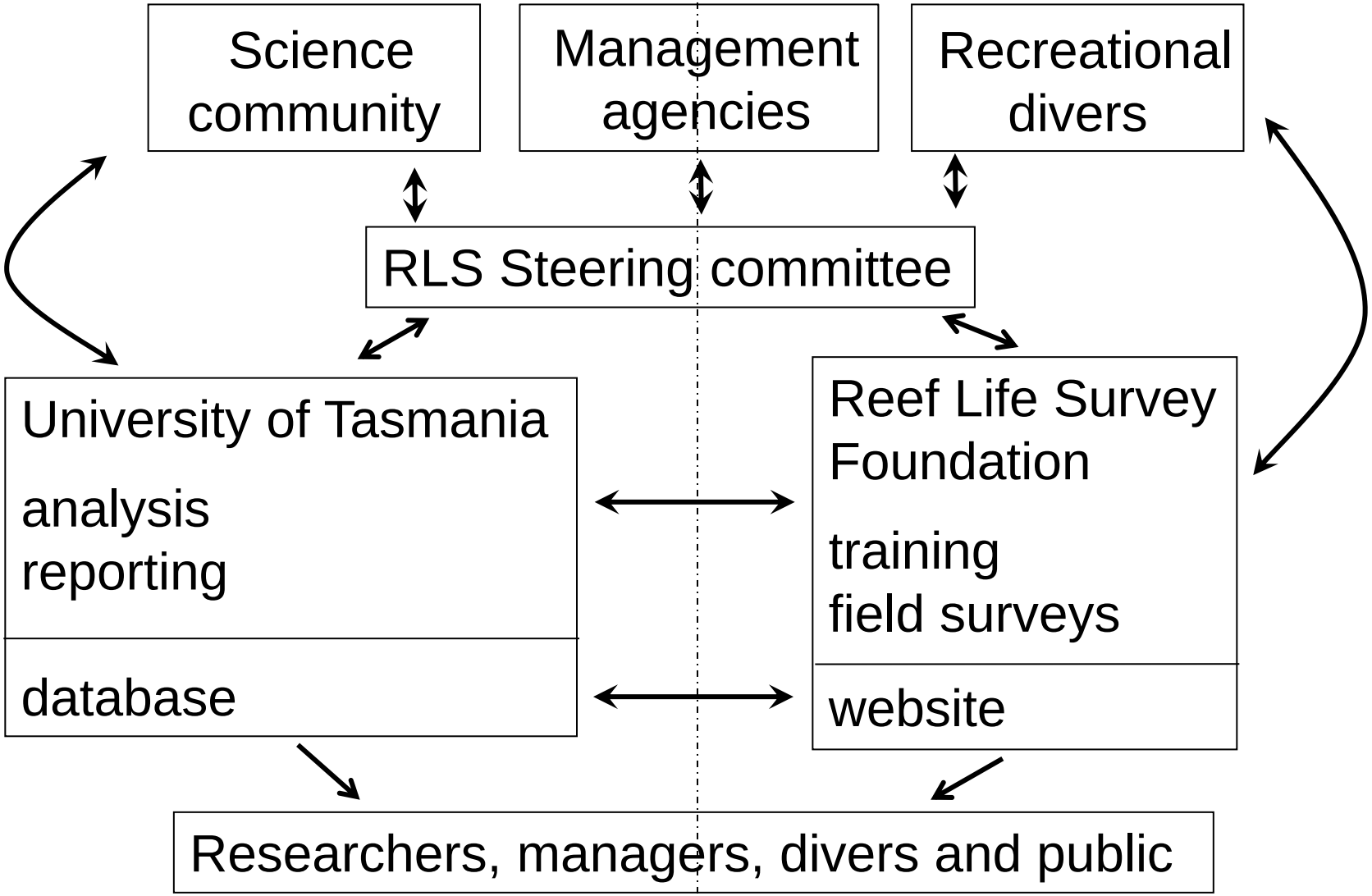
- Paucity of data on distribution of marine biodiversity
- Patchiness of data
- Variable quality of data
- Sliding baselines
- Marine ecological monitoring by scientific teams is expensive

→ access support of skilled recreational divers to generate broad-scale data (CERF Significant Project)

Reef Life Survey

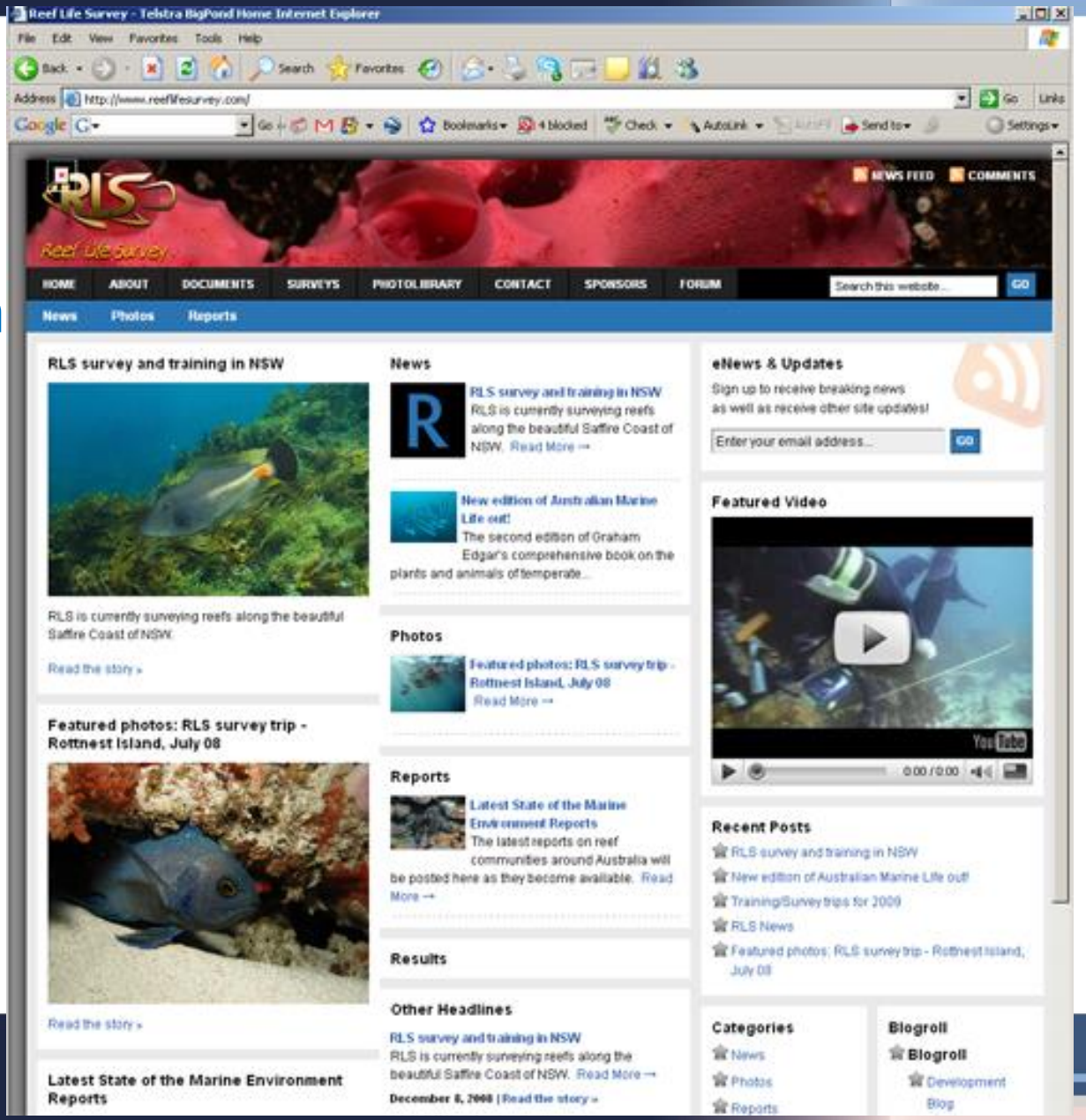
A program based around a team of skilled and enthusiastic volunteer SCUBA divers who undertake biodiversity monitoring of reefs in a standardised and scientifically rigorous manner

Directed by a steering committee of managers, divers and scientists

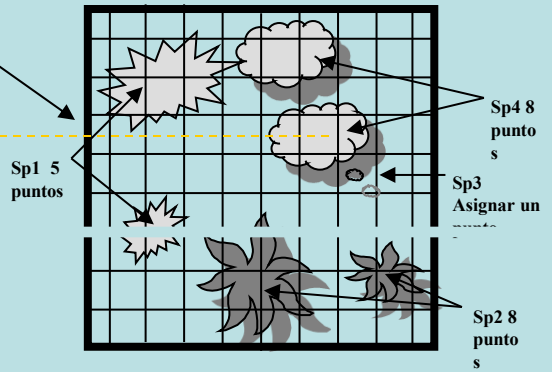

Science community
Management agencies
Recreational divers
RLS Steering committee
University of Tasmania
analysis
reporting
database
Reef Life Survey Foundation
training
field surveys
website
Researchers, managers, divers and public

Reef Life Survey website

www.reeflifesurvey.com



RLS subtidal survey methodology



Fishes:
250 m² transect
5m distance each side of the line

Mobile macroinvertebrates and cryptic fishes:
50 m² transect
1m distance each side of the line

Plants and sessile invertebrates:
20 photoquadrats

Methods – underwater visual census

FISHES: recorded within duplicate 50 m x 5 m belt transects

MACROINVERTEBRATES: recorded within duplicate 50 m x 1 m blocks

CORAL/MACROALGAE cover: photo-quadrats taken at 2.5 m intervals along transect

- archived within the database
- digitised as needed

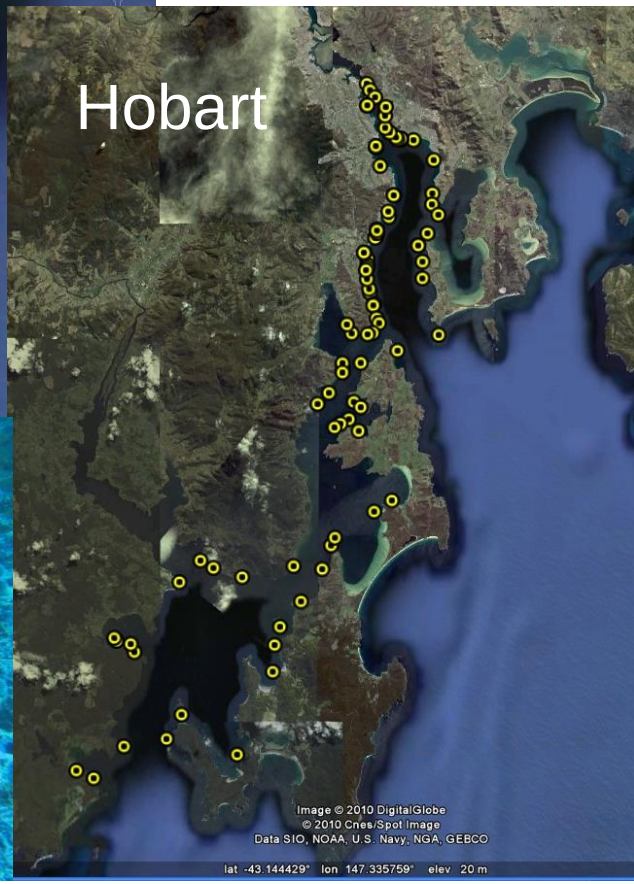
Diver training

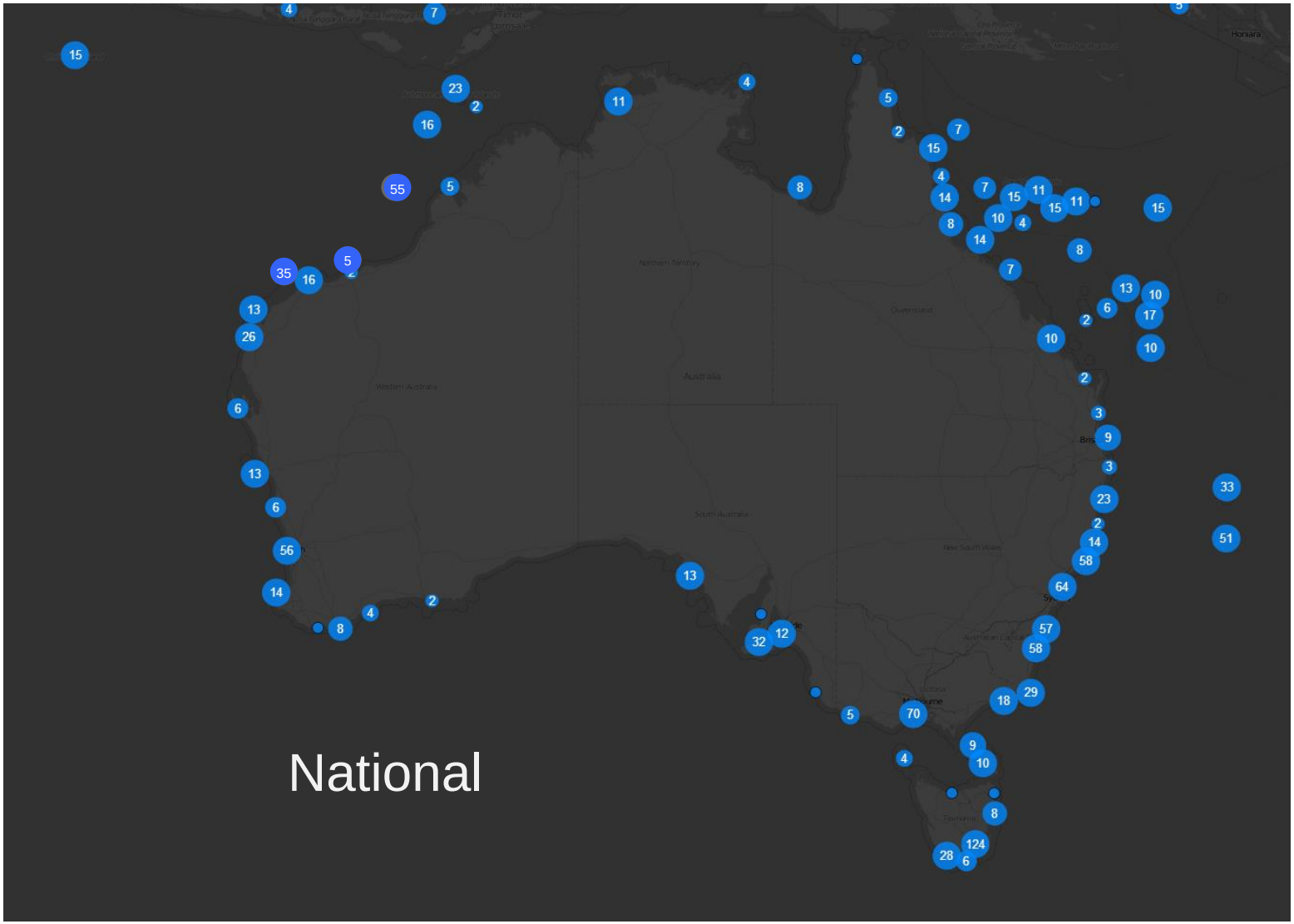
- Intensive training both above and below water
- One to one assistance with technique, IDs
- Importance of data entry emphasised

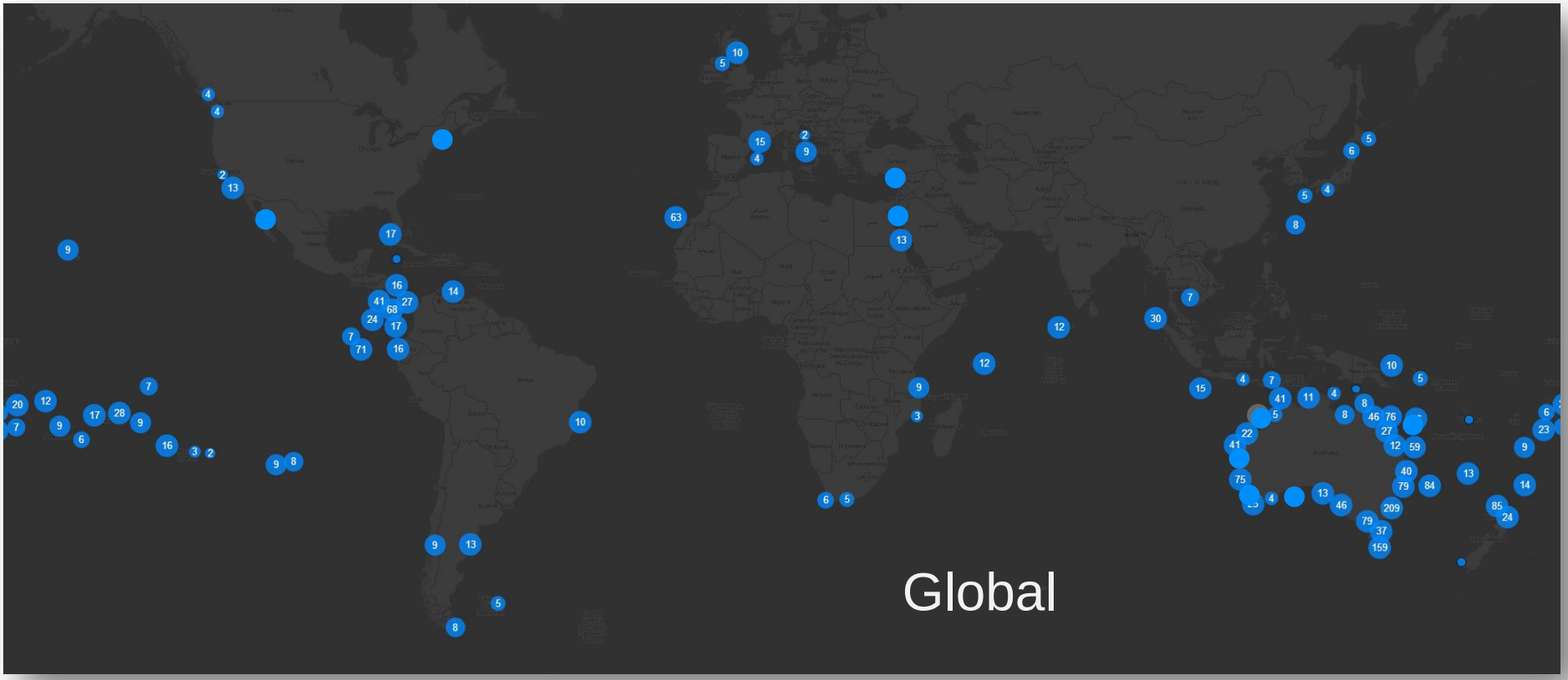
Local


Sydney


Melbourne
Image © 2010 Sinclair Knight Merz & Fugro
Image © 2010 GeoEye
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2010 DigitalGlobe


Hobart
Image © 2010 DigitalGlobe
© 2010 Cnes/Spot Image
Data SIO, NOAA, U.S. Navy, NGA, GEBCO


National


Global

Characteristics of RLS dataset

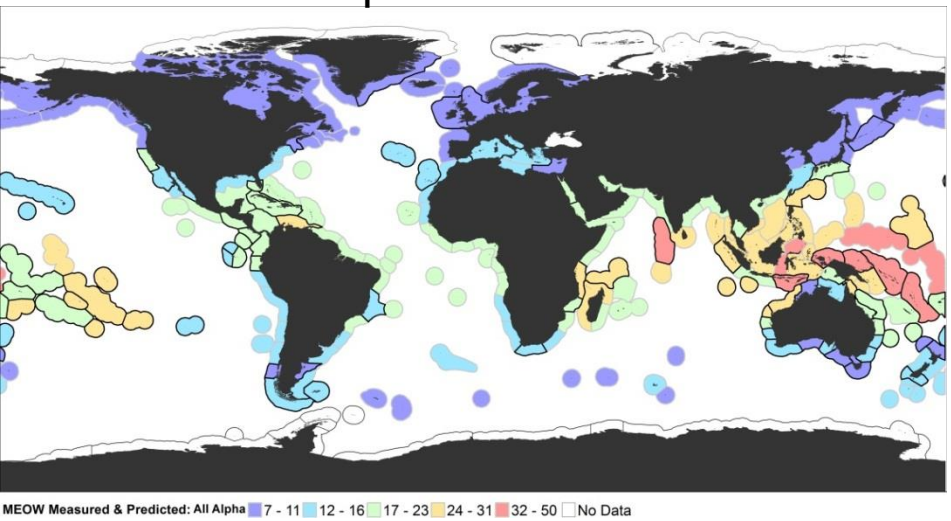
- Systematic methodology
- Quantitative
- Three functional components
- Thousands of species
- Global in span
- Long term
- Covers all mobile taxa >2 cm

Number of IUCN threatened species

PHYLUM	CR	EN	VU	LC	NT	DD	NA	Total	Threate	Threate	NA
Global									%	%	%
Arthropoda				15		5	152	172	0	0	88.37
Chordata	2	13	41	757	42	59	1498	2412	2.322	6.127	62.11
Echinodermata				1			336	337	0	0	99.7
Mollusca		1	2	9	1	7	601	621	0.483	15	96.78
Grand Total	2	14	43	782	43	71	2587	3542	1.666	6.178	73.04

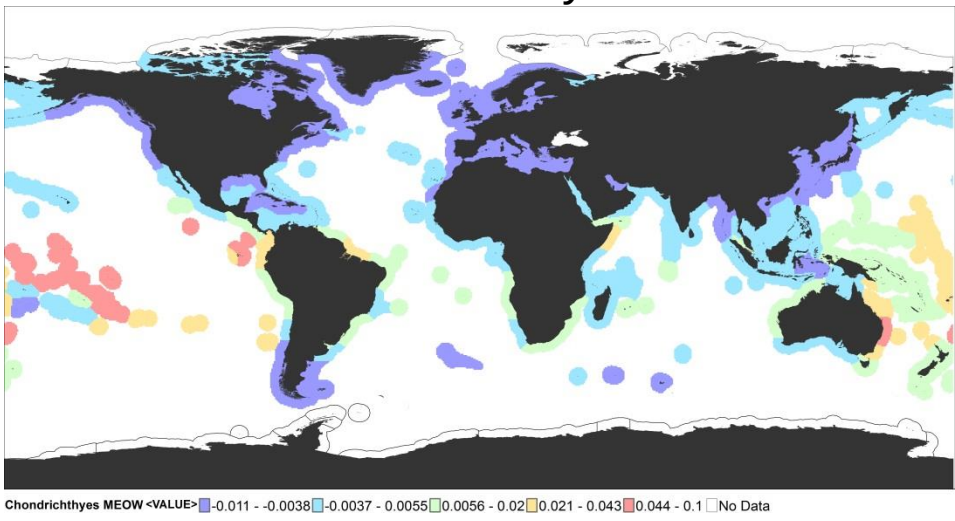



All species



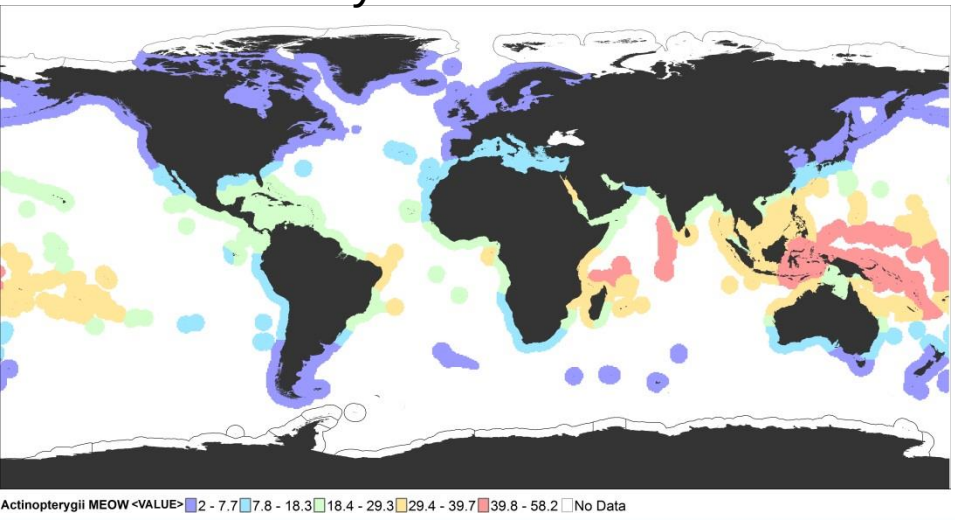
MEOW Measured & Predicted: All Alpha 7 - 11 12 - 16 17 - 23 24 - 31 32 - 50 No Data

Sharks and rays



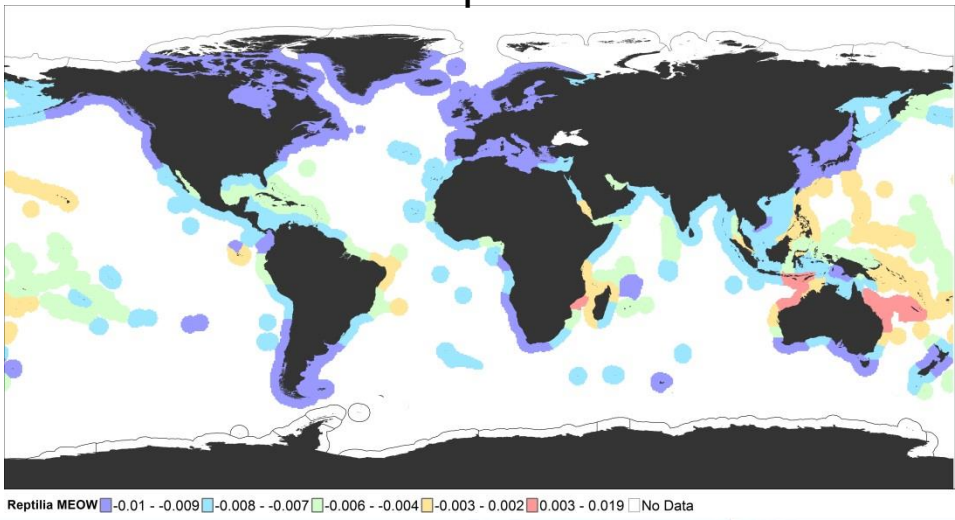
Chondrichthyes MEOW <VALUE> -0.011 - -0.0038 -0.0037 - 0.0055 0.0056 - 0.02 0.021 - 0.043 0.044 - 0.1 No Data

Bony fishes



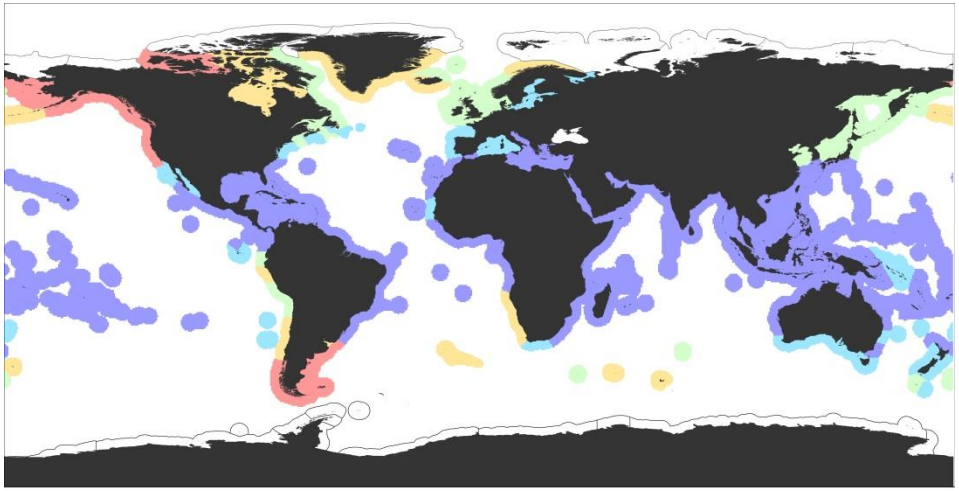
Actinopterygii MEOW <VALUE> 2 - 7.7 7.8 - 18.3 18.4 - 29.3 29.4 - 39.7 39.8 - 58.2 No Data

Reptiles



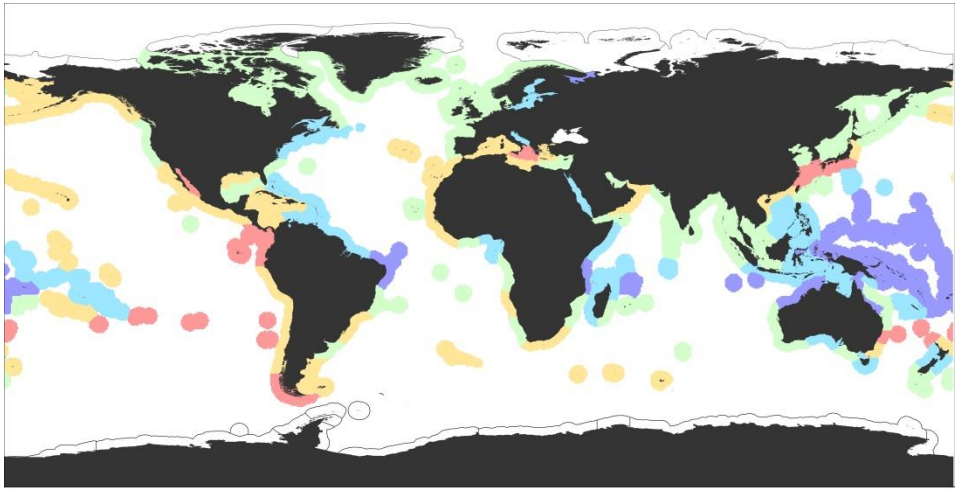
Reptilia MEOW -0.01 - -0.009 -0.008 - -0.007 -0.006 - -0.004 -0.003 - 0.002 0.003 - 0.019 No Data

Sea stars



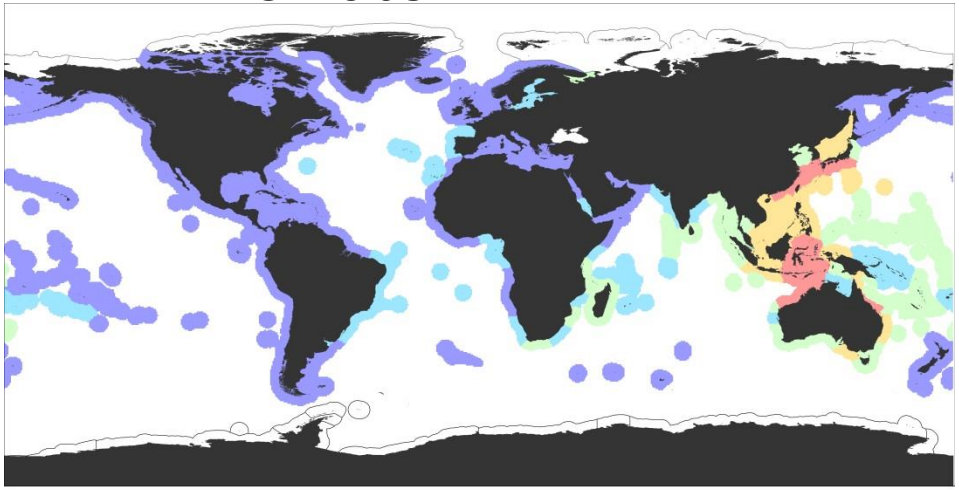
Asteroidea MEOW <VALUE> 0.0000051 - 0.16 | 0.17 - 0.51 | 0.52 - 0.96 | 0.97 - 1.5 | 1.6 - 3.2 | No Data

Sea urchins



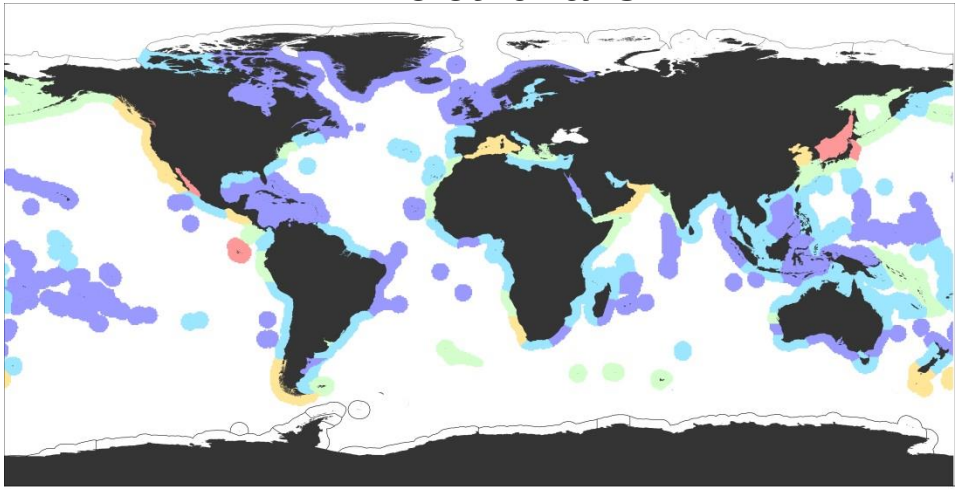
Echinoidea MEOW <VALUE> 0.015 - 0.24 | 0.25 - 0.44 | 0.45 - 0.7 | 0.71 - 1.1 | 1.2 - 1.8 | No Data

Crinoids



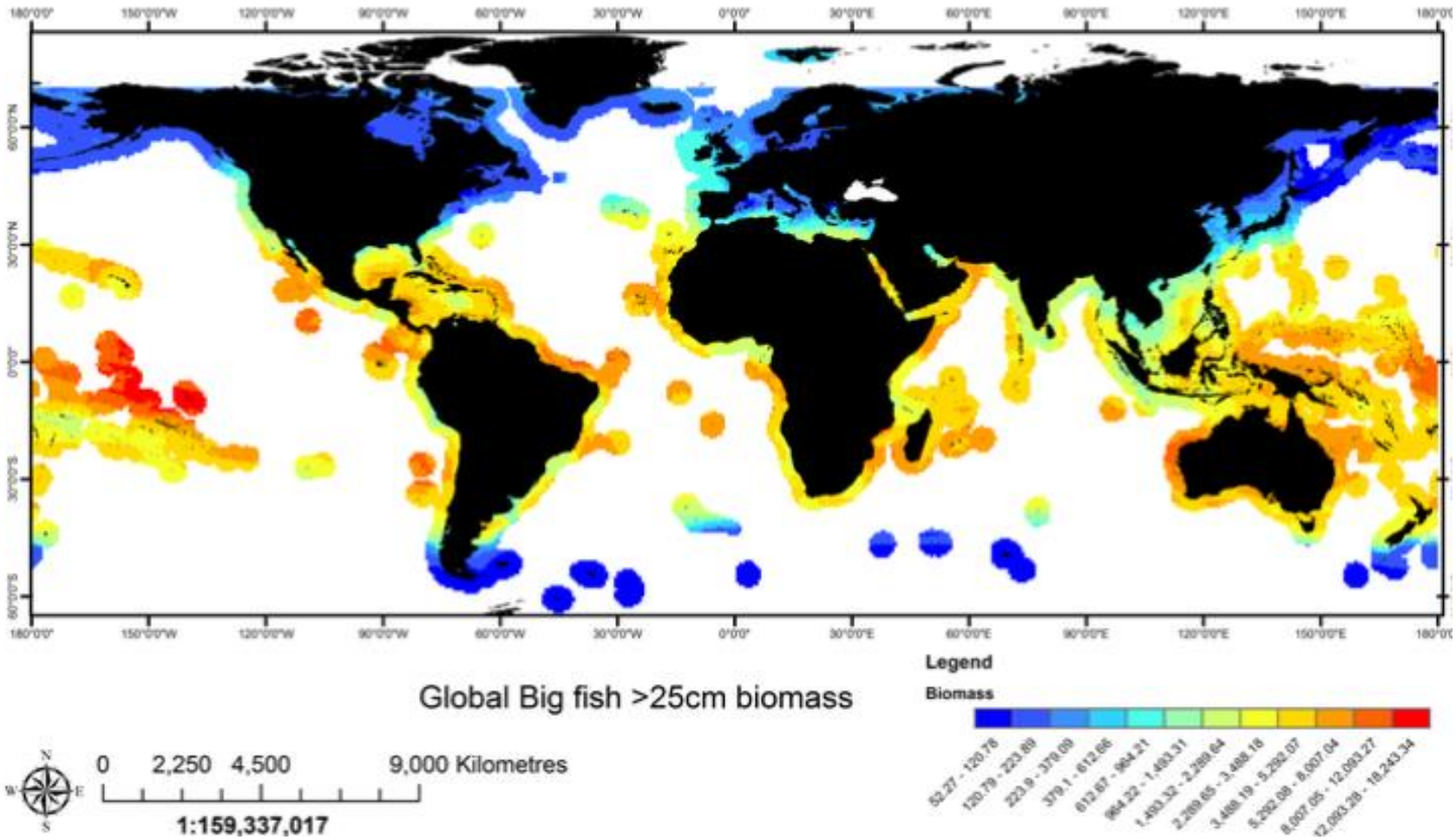
Crinoidea MEOW <VALUE> -0.018 - 0.016 | 0.017 - 0.053 | 0.054 - 0.1 | 0.11 - 0.19 | 0.2 - 0.43 | No Data

Holothurians



Holthuroidea MEOW <VALUE> 0.002 - 0.031 | 0.032 - 0.064 | 0.065 - 0.11 | 0.111 - 0.186 | 0.187 - 0.437 | No Data

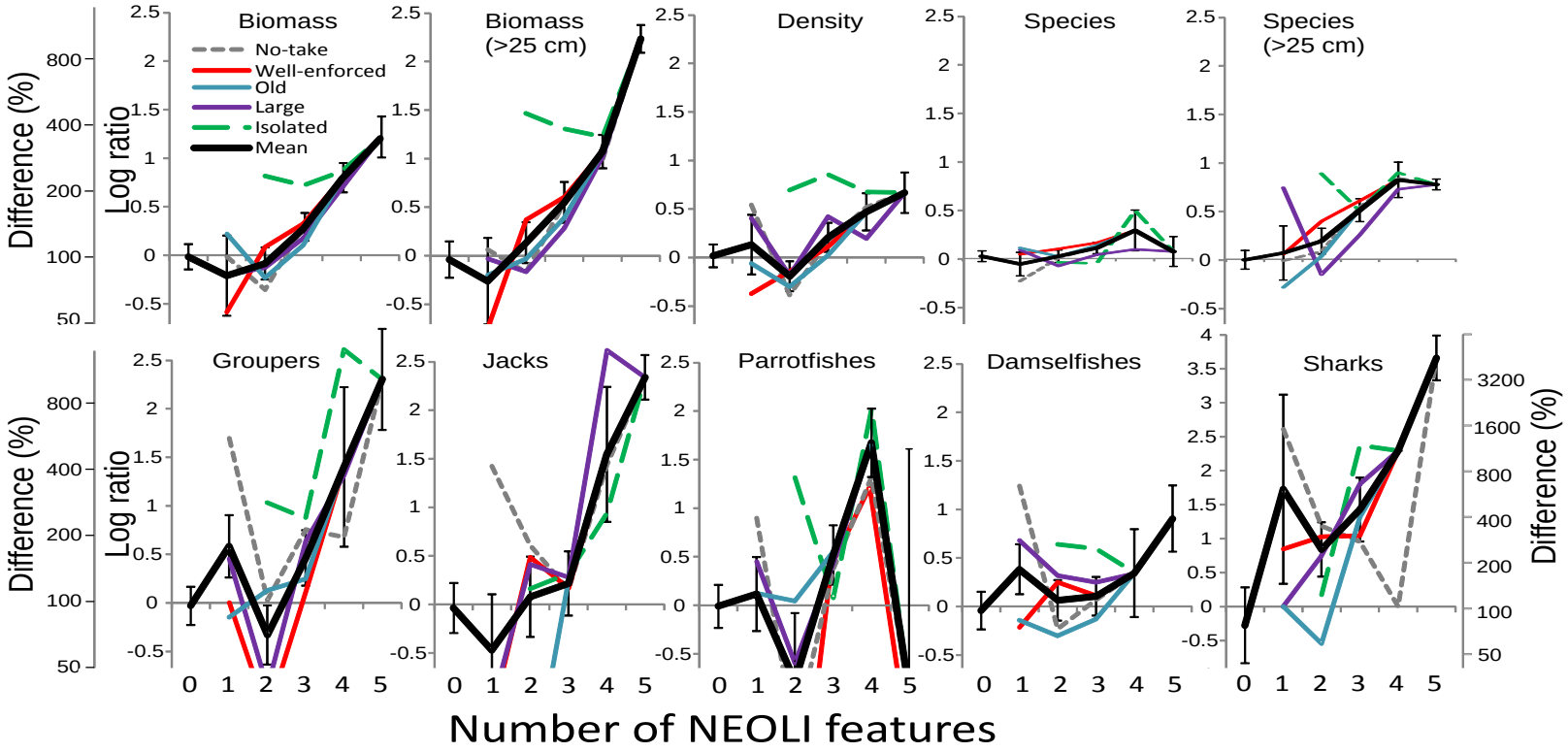
Biomass large (>25 cm) fishes



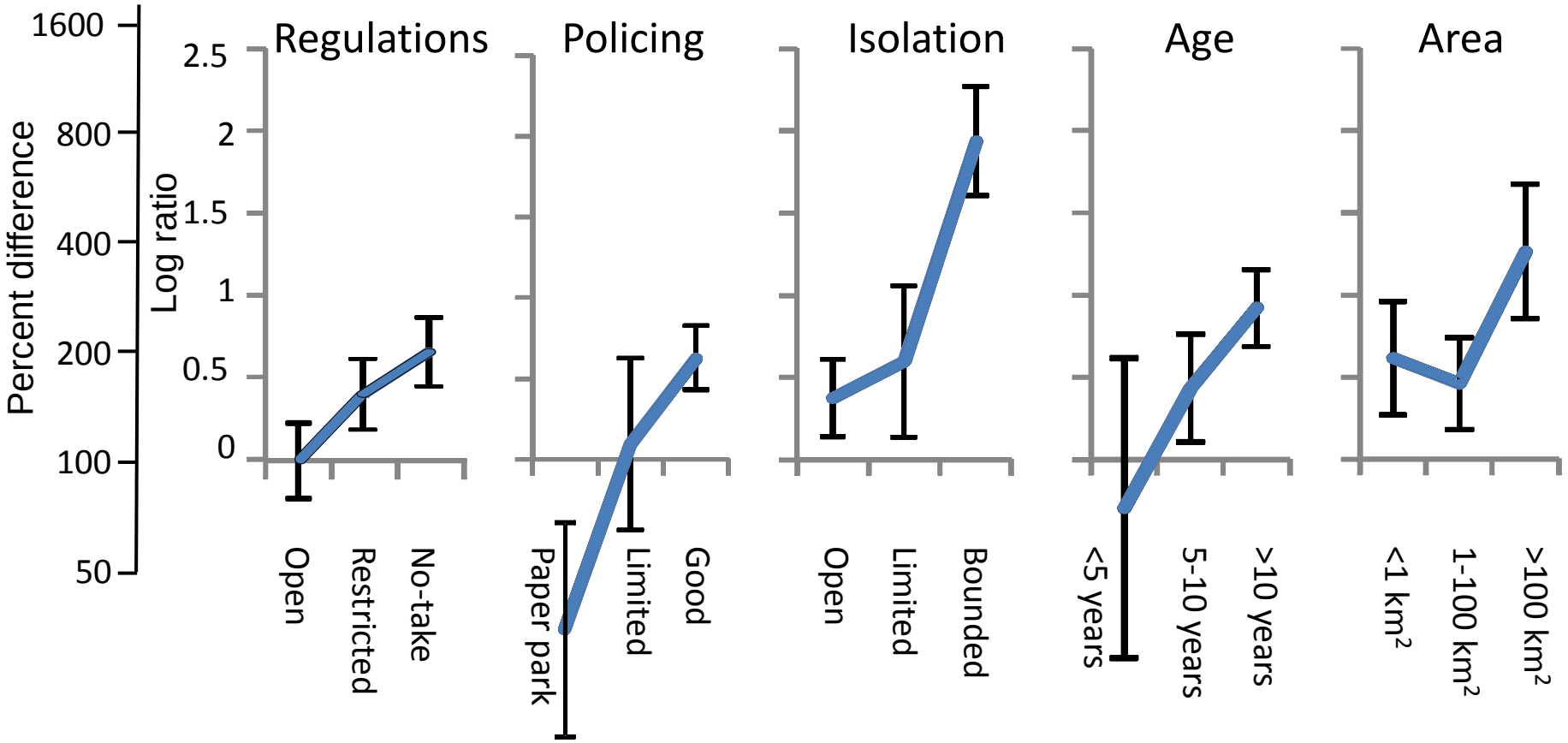
Key attributes of Marine Protected Areas ("NEOLI MPAs")

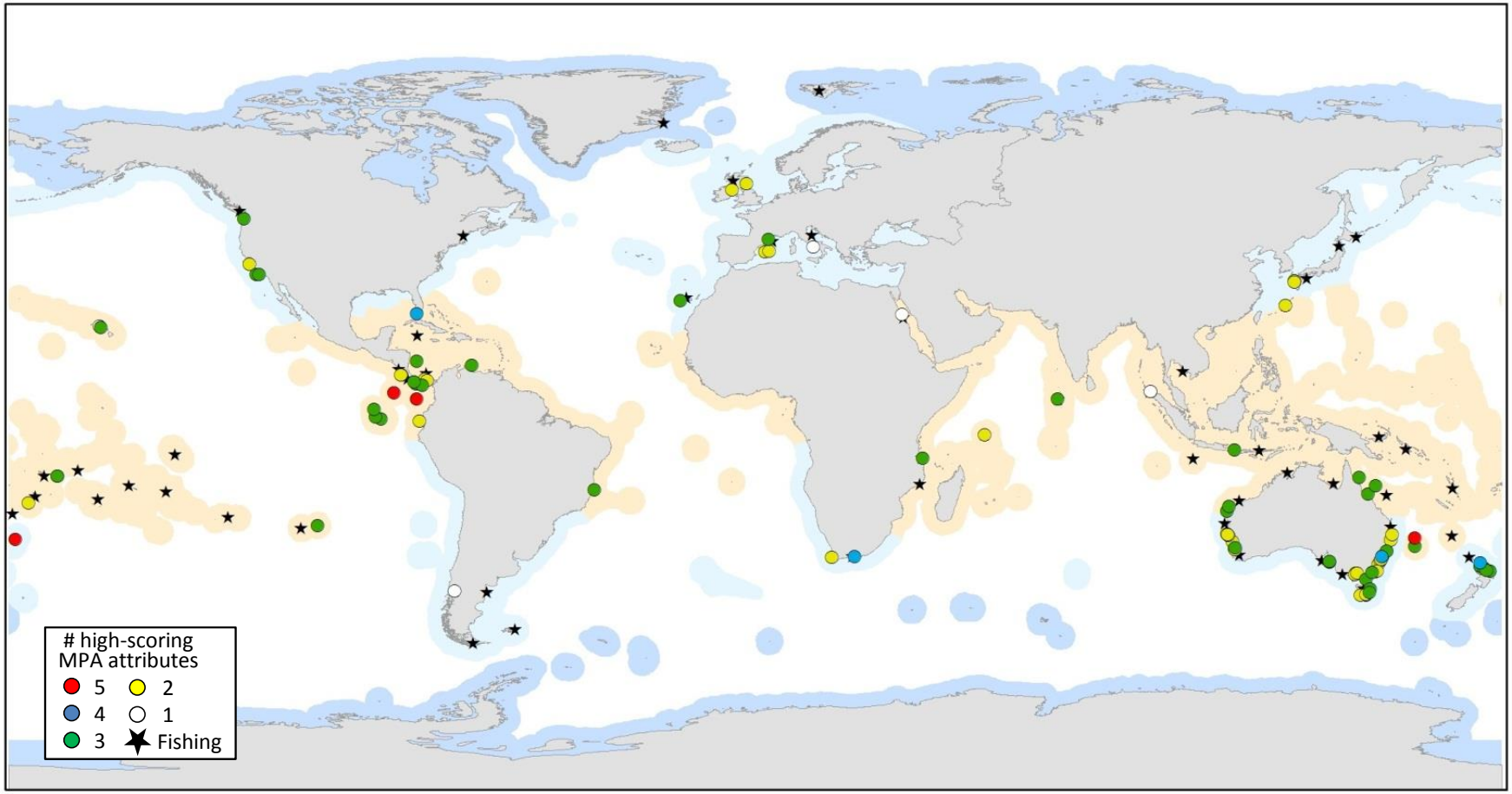
1. No-take
2. Enforced
3. Old
4. Large
5. Isolated

Biomass (>25 cm)

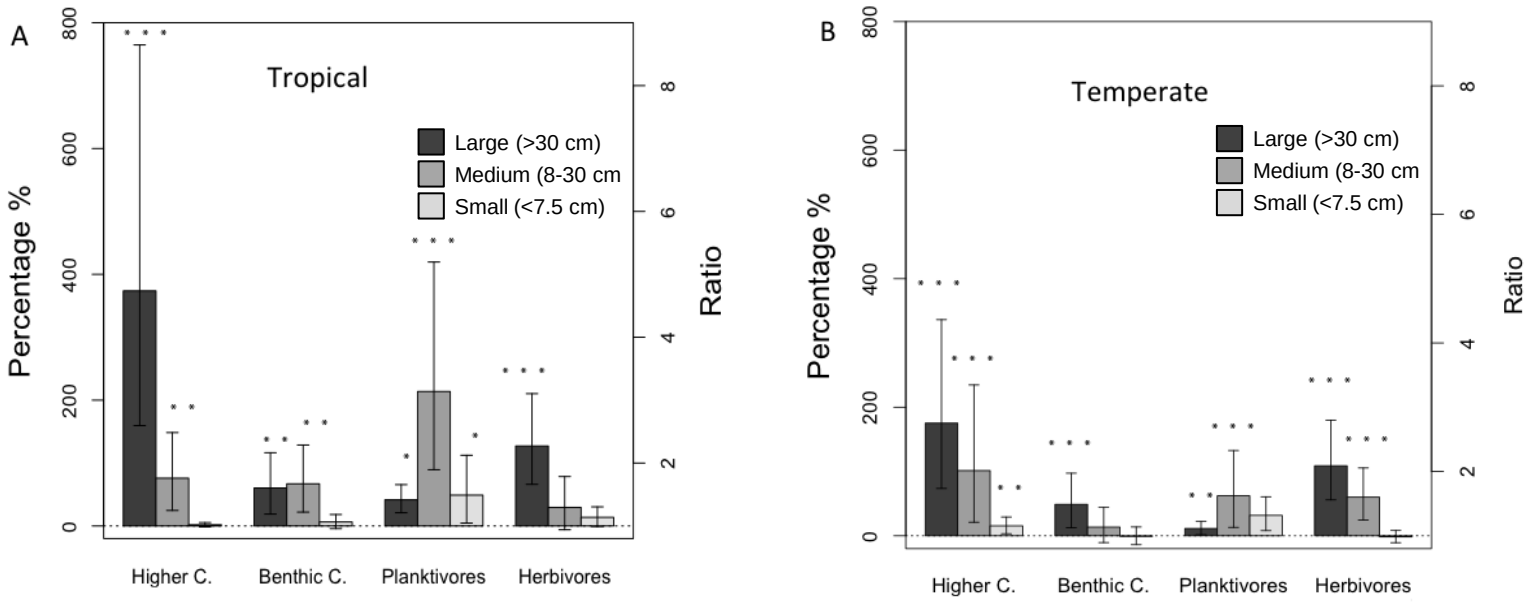


Global MPA analysis – large fish biomass

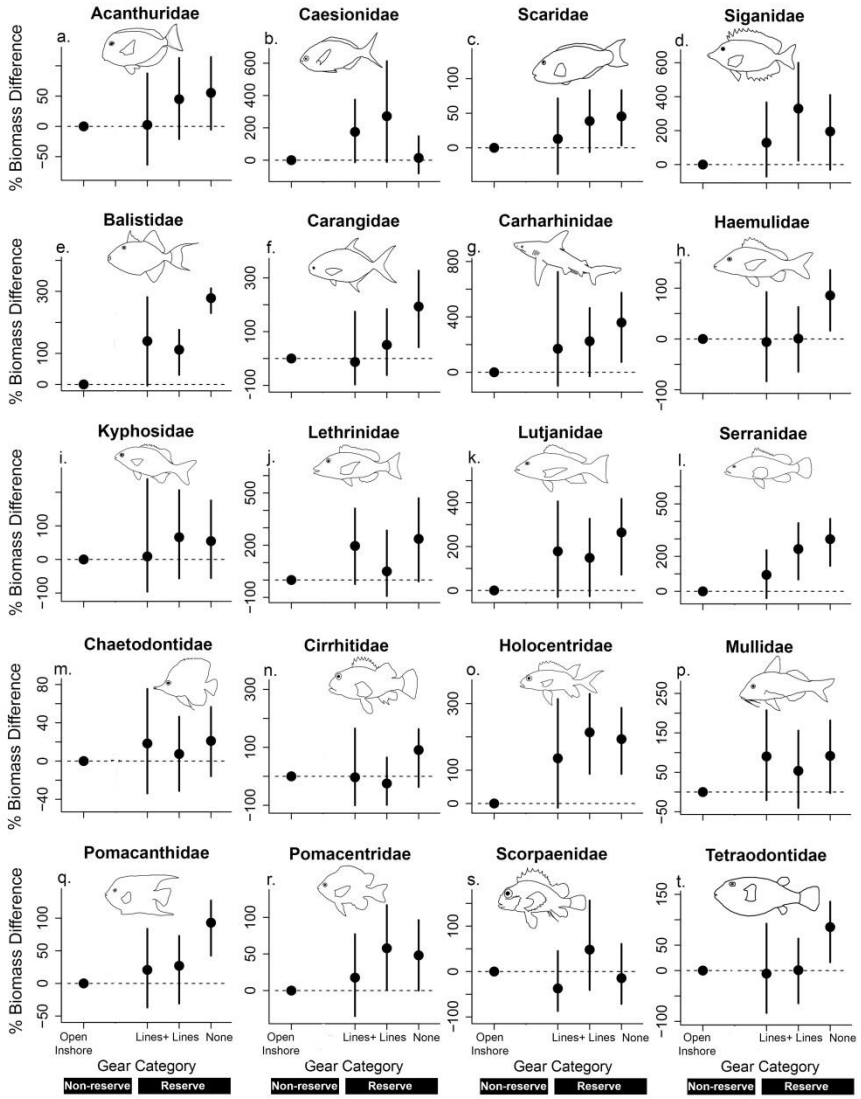



high-scoring MPA attributes
5
2
4
1
3
Fishing

Biomass response of different trophic and body size groups in effective MPAs relative to fished sites



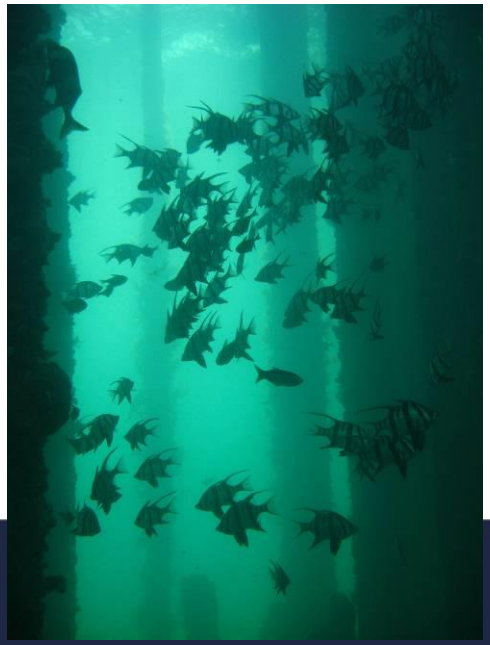
Biomass response of different fish families in MPAs with various gear restrictions

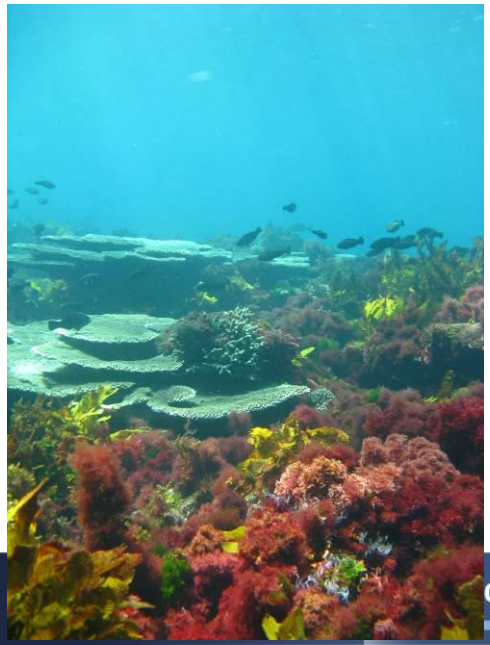


Conclusions

1. Most MPAs worldwide cannot be distinguished ecologically from fished areas.
2. Some MPAs are extremely effective.
3. Conservation benefits of MPAs increase exponentially with the accumulation of five key features – no-take, well-enforced, old (>10 years), large (>100 km^2), and isolated by deep water or sand.
4. MPAs with all five key features had twice as many large (>25 cm) fish species per transect, nine times more large fish biomass, and 39 times more sharks than fished areas.
5. Fish biomass has been reduced by over two-thirds on fished reefs worldwide compared to effective MPAs.
6. The five key MPA features vary in their influence on different elements of the reef fish community.
7. More emphasis is needed on better MPA design, durable management, and compliance to ensure MPAs achieve their full conservation value.

Value of marine biodiversity baseline will increase every year!





Thanks

- Project Staff

  Rick Stewart-Smith, Antonia Cooper, Marlene Davey, Jemina Stewart-Smith
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