Setting thresholds for good ecosystem state in marine seabed systems

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SPRFMO
South Pacific Regional Fisheries Management Organisation

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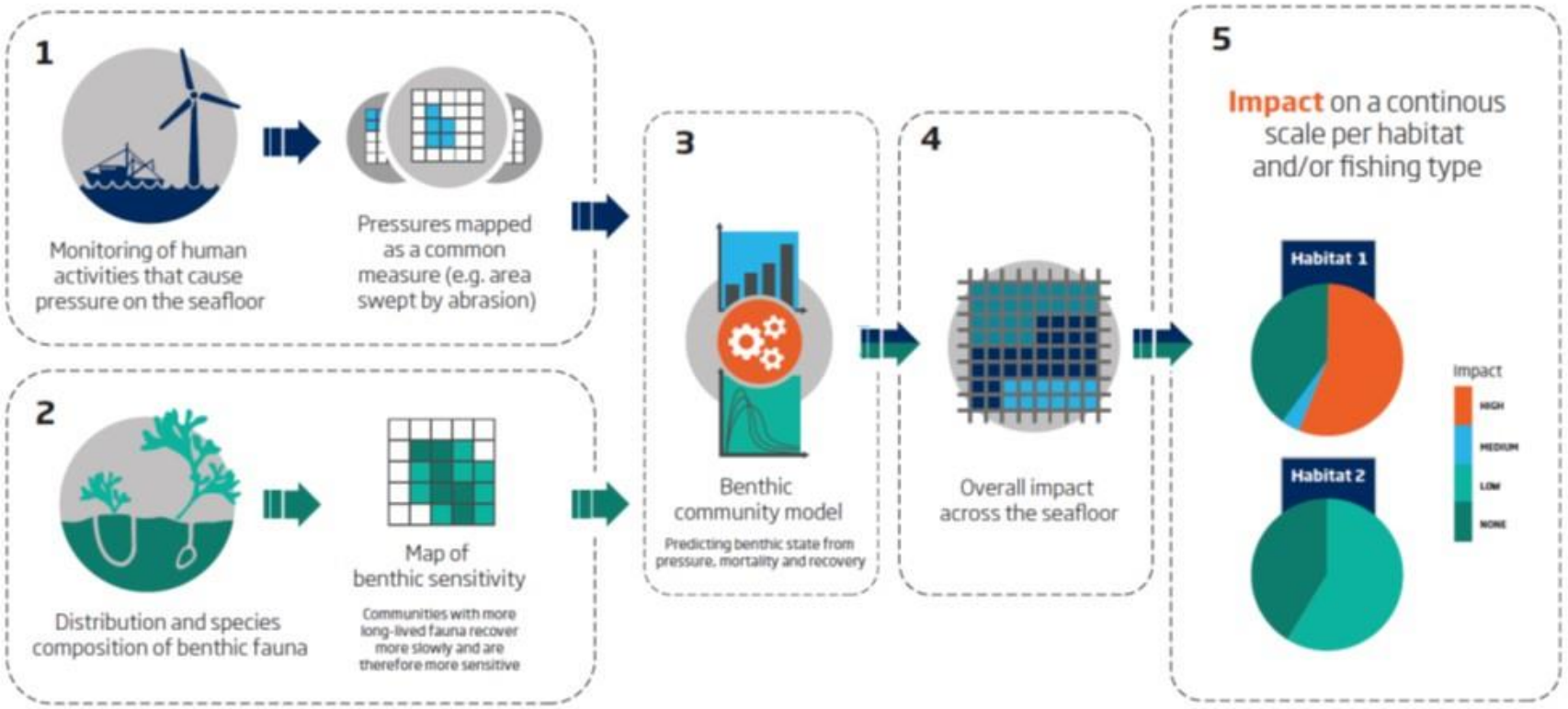
1884

Ecosystem Approach to Fisheries Management
evaluate and manage ecosystem impacts



But how impact is too much?

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What are thresholds? Why do we need them?

Marine legislation	MSFD UKMS	BBNJ	KM-GBF	RFM Os
Objective	***"Good Environmental Status by 2030***	***"...maintain and restore ecosystem integrity***	***"30% degraded ecosystems restored by 2030***	***"...avoid significant adverse impacts***

What is good? How do we know when we've reached it?

Thresholds distinguish between good & degraded ecosystem states

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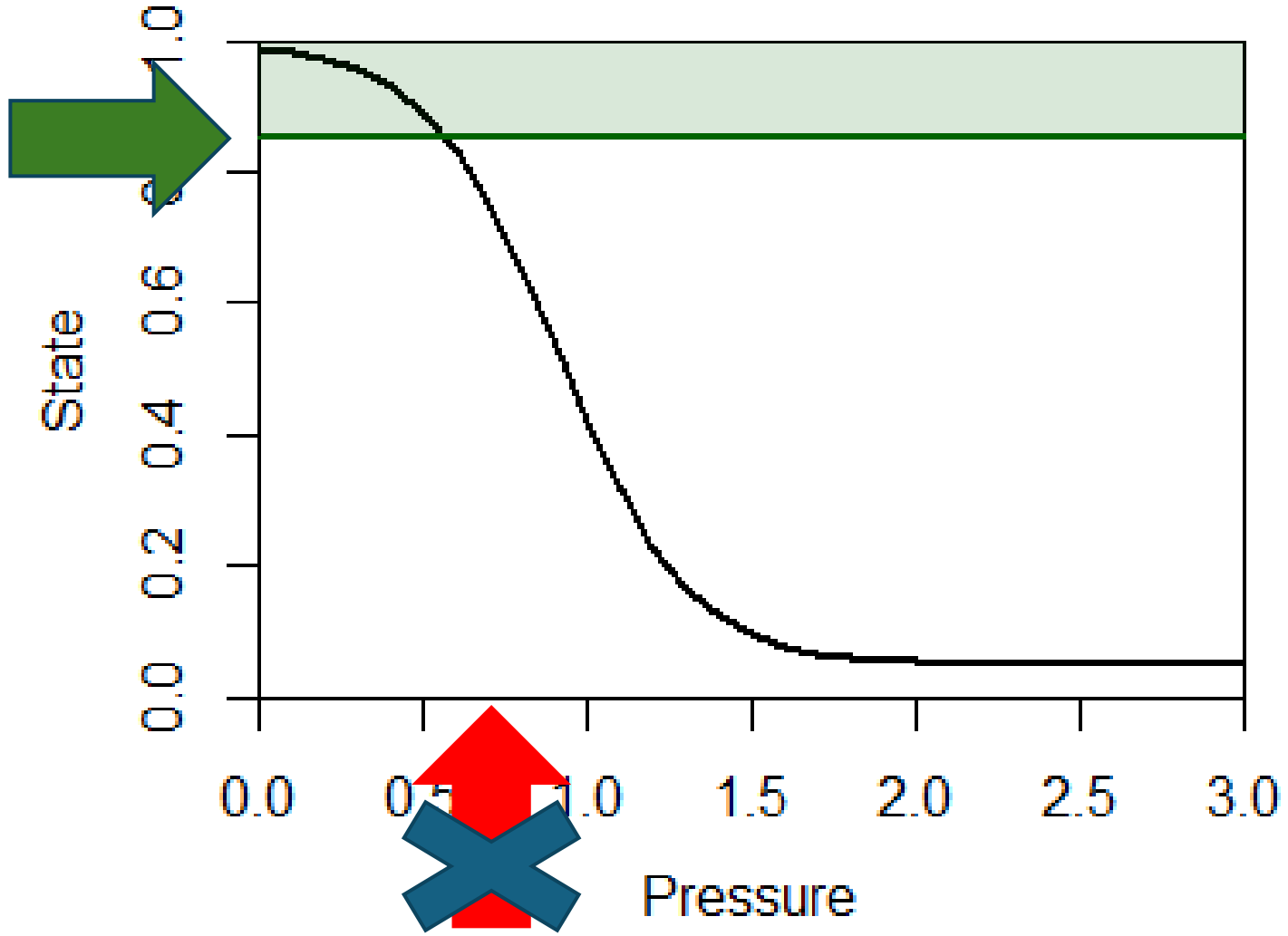
State thresholds

Some change can be compatible with a good state

Transition from a good to a degraded state.



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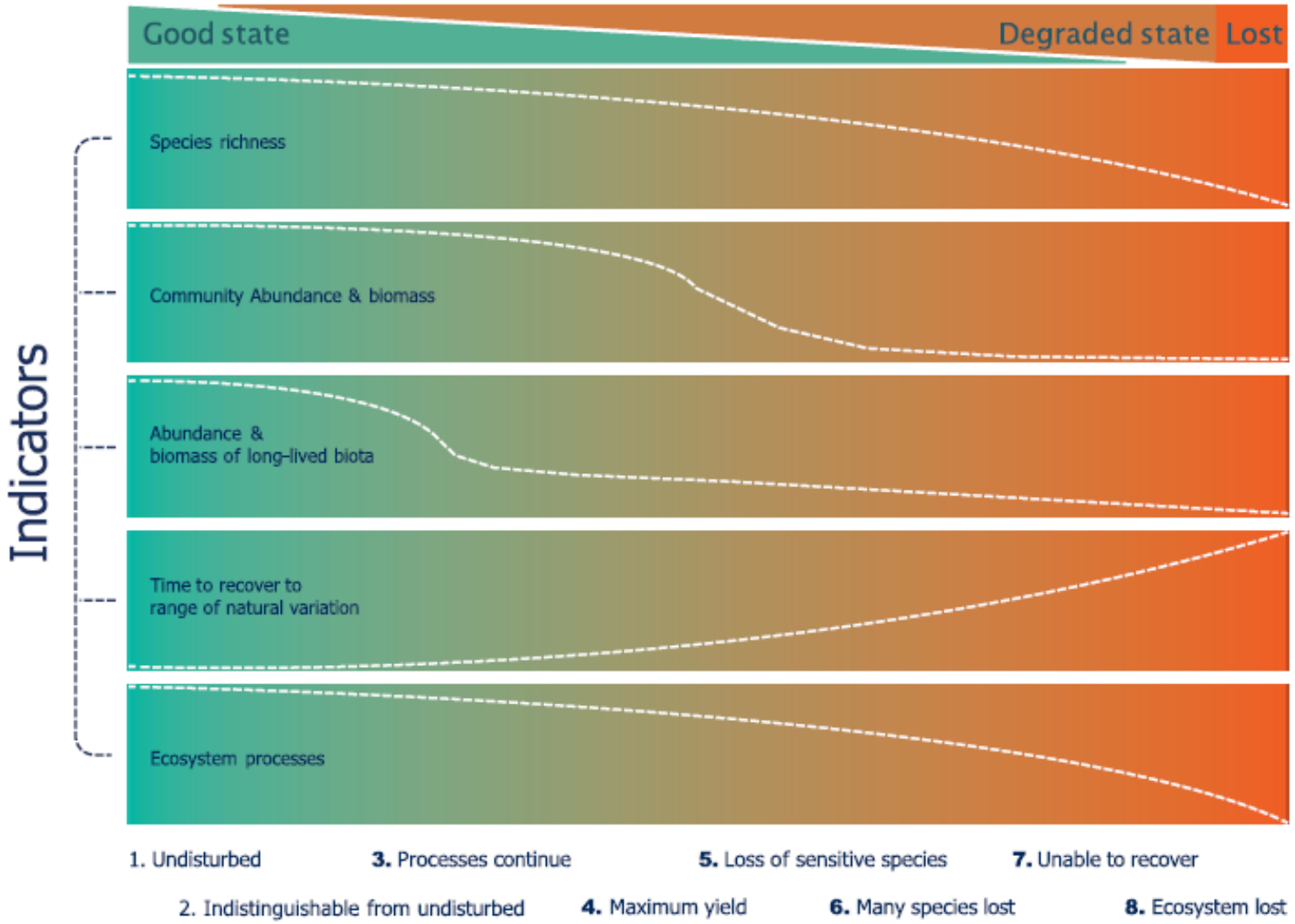
What is good and what is degraded?



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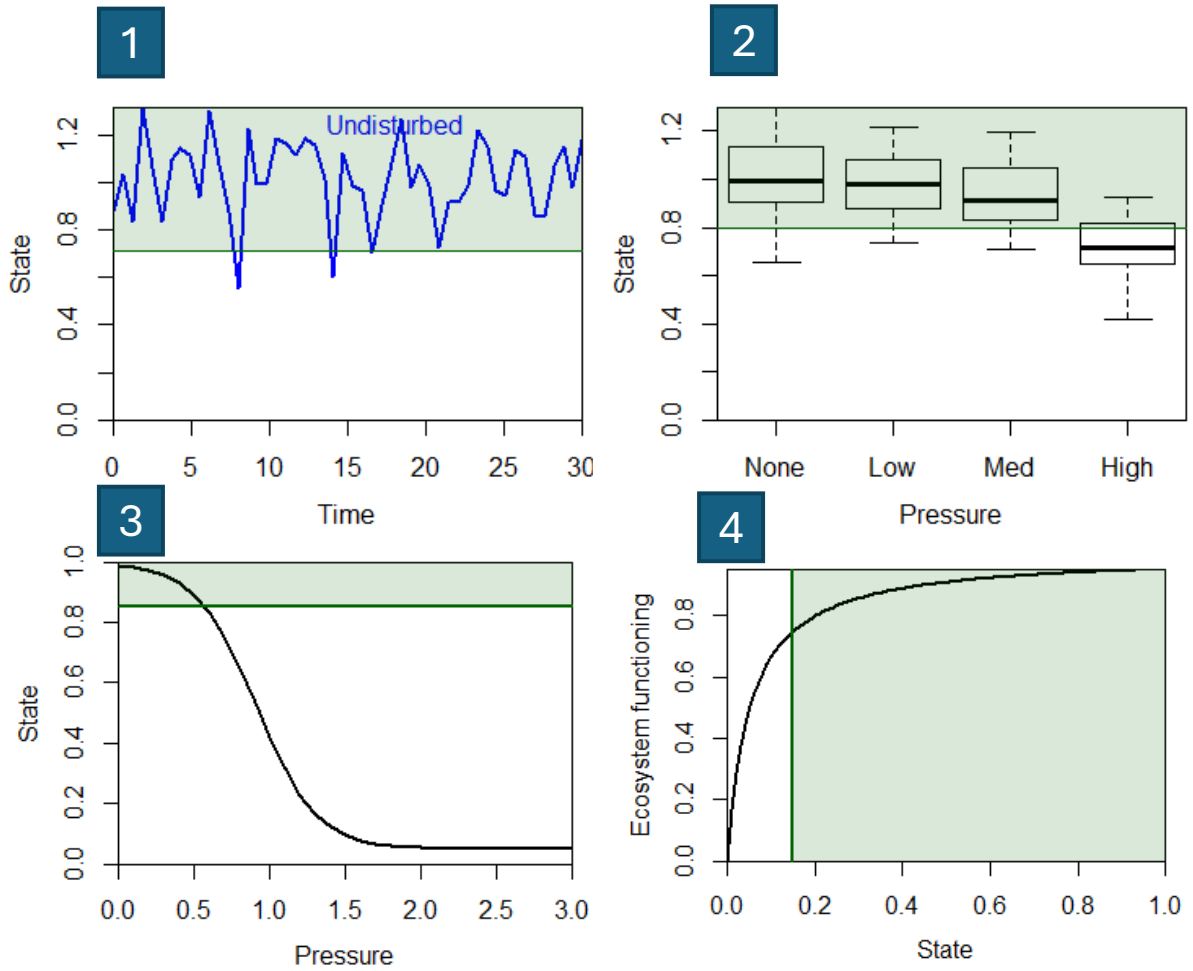
Approaches to set thresholds

Ecological reasoning

1. Natural variation
2. *Detectable change*
3. Tipping points
4. Maintain the function



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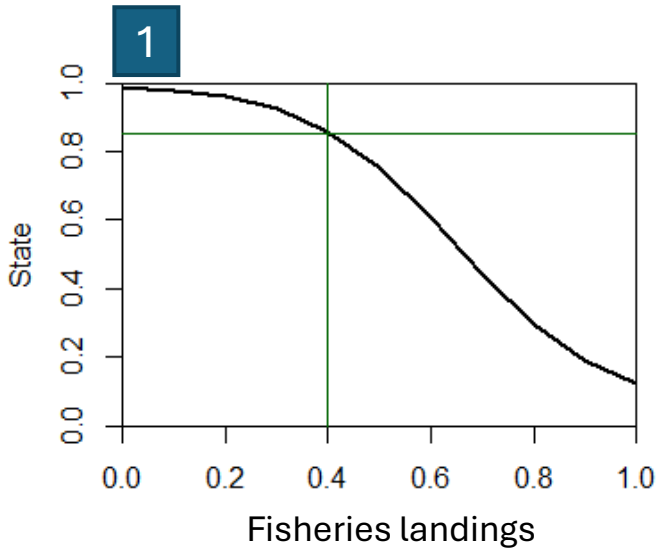
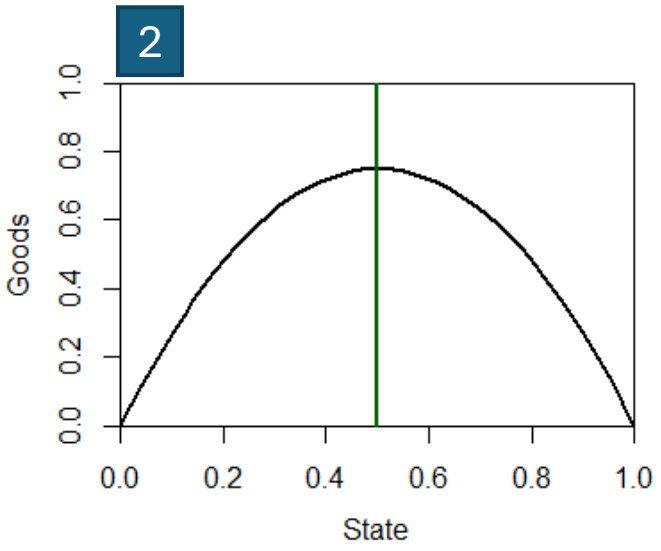
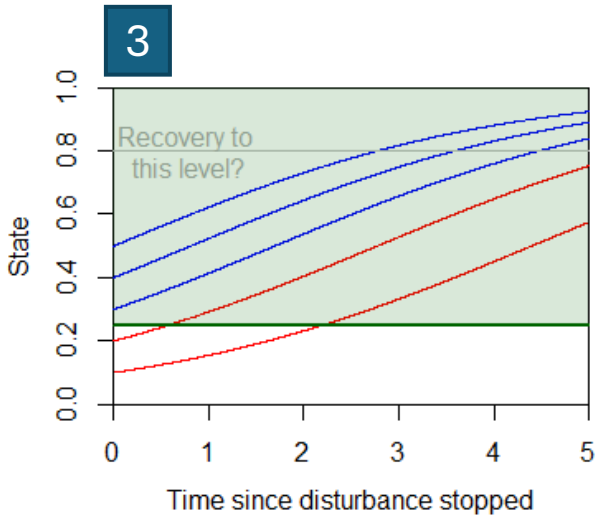
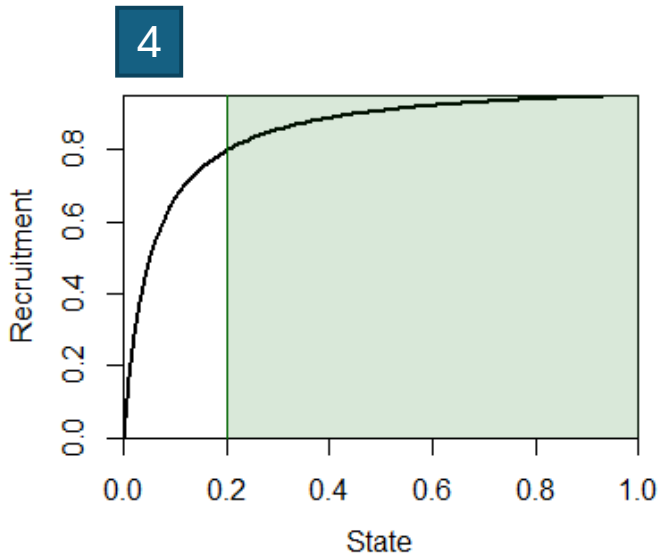
Approaches to set thresholds

1. Trade-off
2. Maximizing goods
3. Recovery possible
4. Avoid collapse









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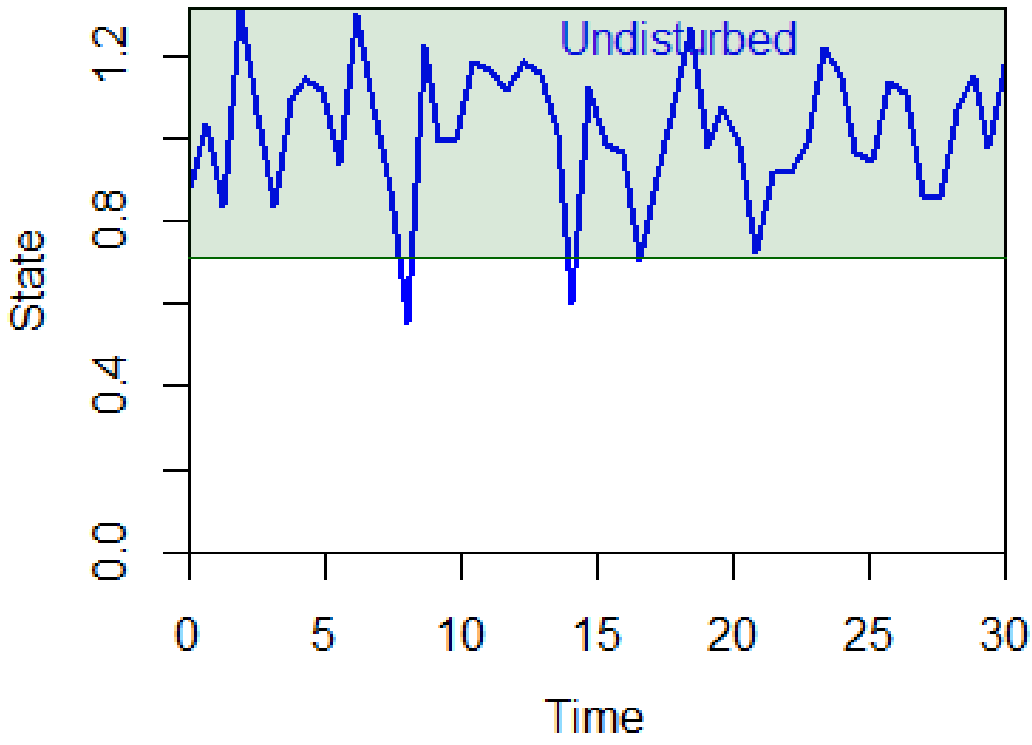
Objective and ecologically meaningful

"Staying within natural variation" &
"Maintaining ecosystem functioning"

- Objective, repeatable and quantitatively derived
- Identifying a current (rather than future possible) good state

- Of these 2, 'range of natural variation' is easier to operationalize
  - Requires time-series from undisturbed communities.



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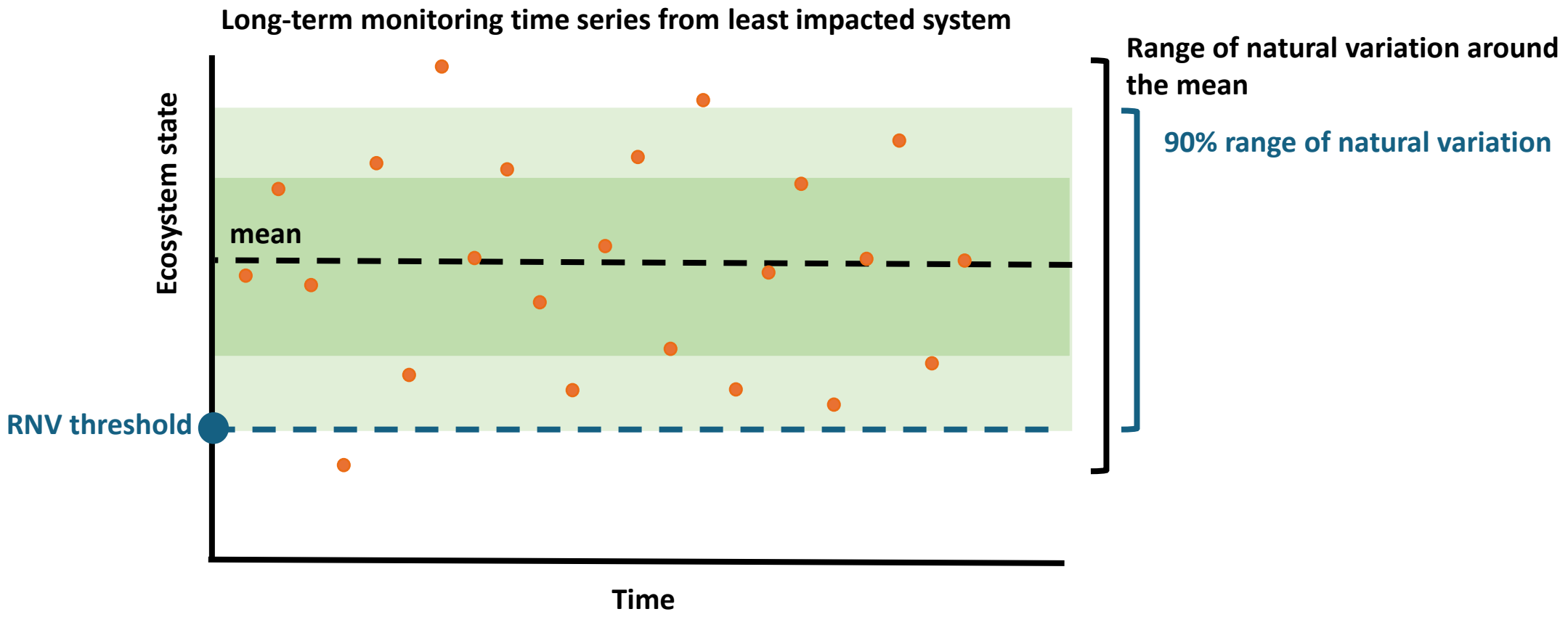
Operational: Range of natural variation



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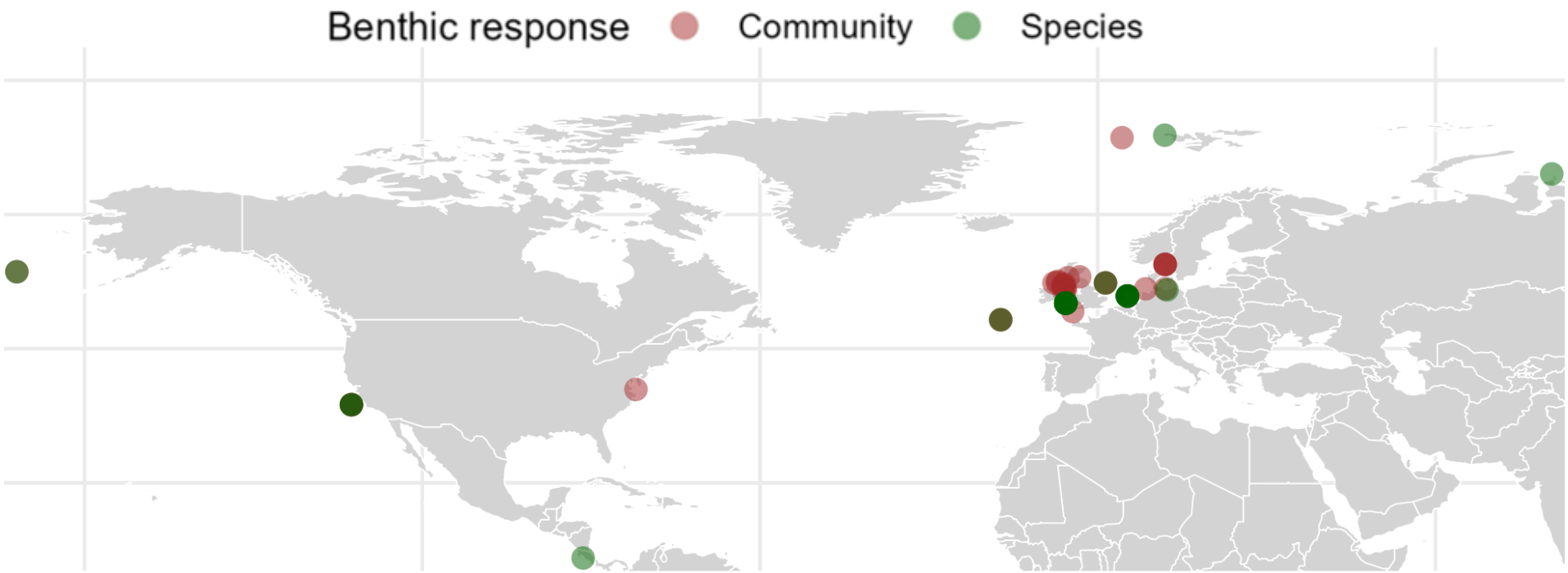
Time-series of undisturbed benthos

derive general rules for systems without time-series

Benthic invertebrate biomass

33 species & 31 communities

Minimal physical disturbance



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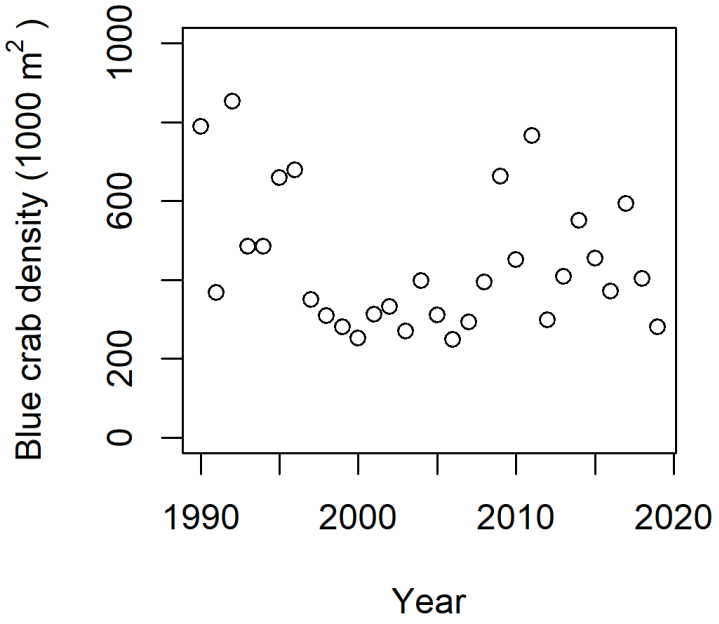
Reference condition data

1 dataset

Data

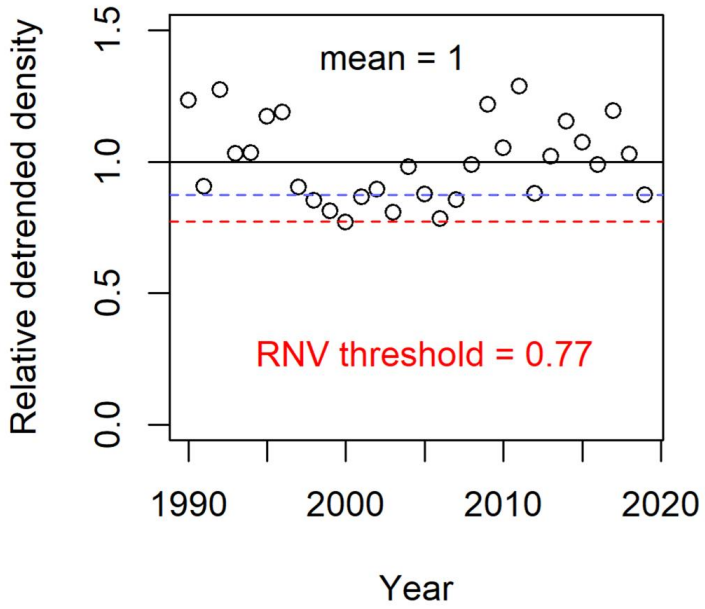


1 x long-term benthic monitoring dataset

Methods

Range of natural variation

Thresholds



threshold = 0.77

23% reduction from mean abundance

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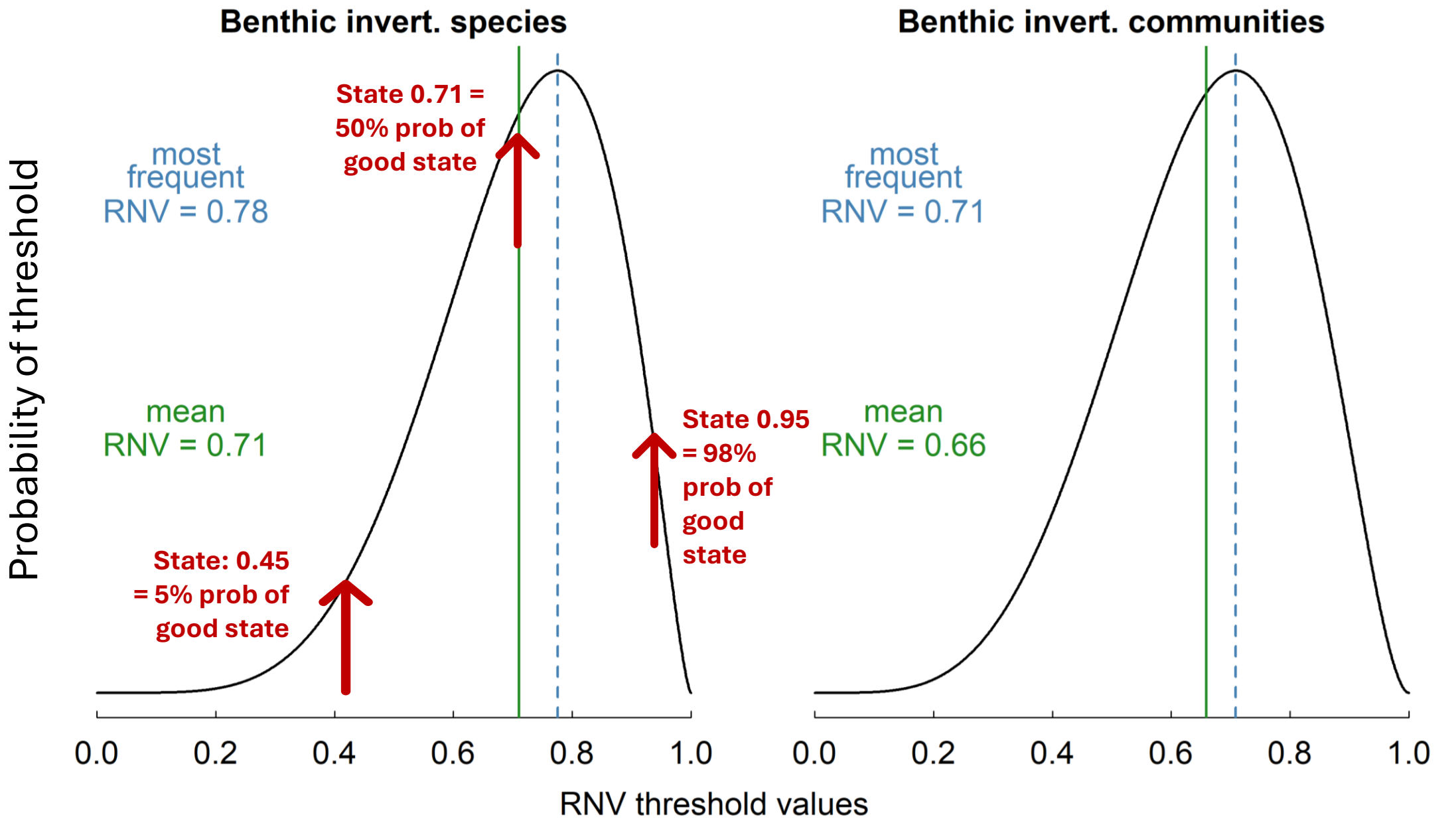
Probability of being above threshold at a given state B/K

thresholds from >30 datasets



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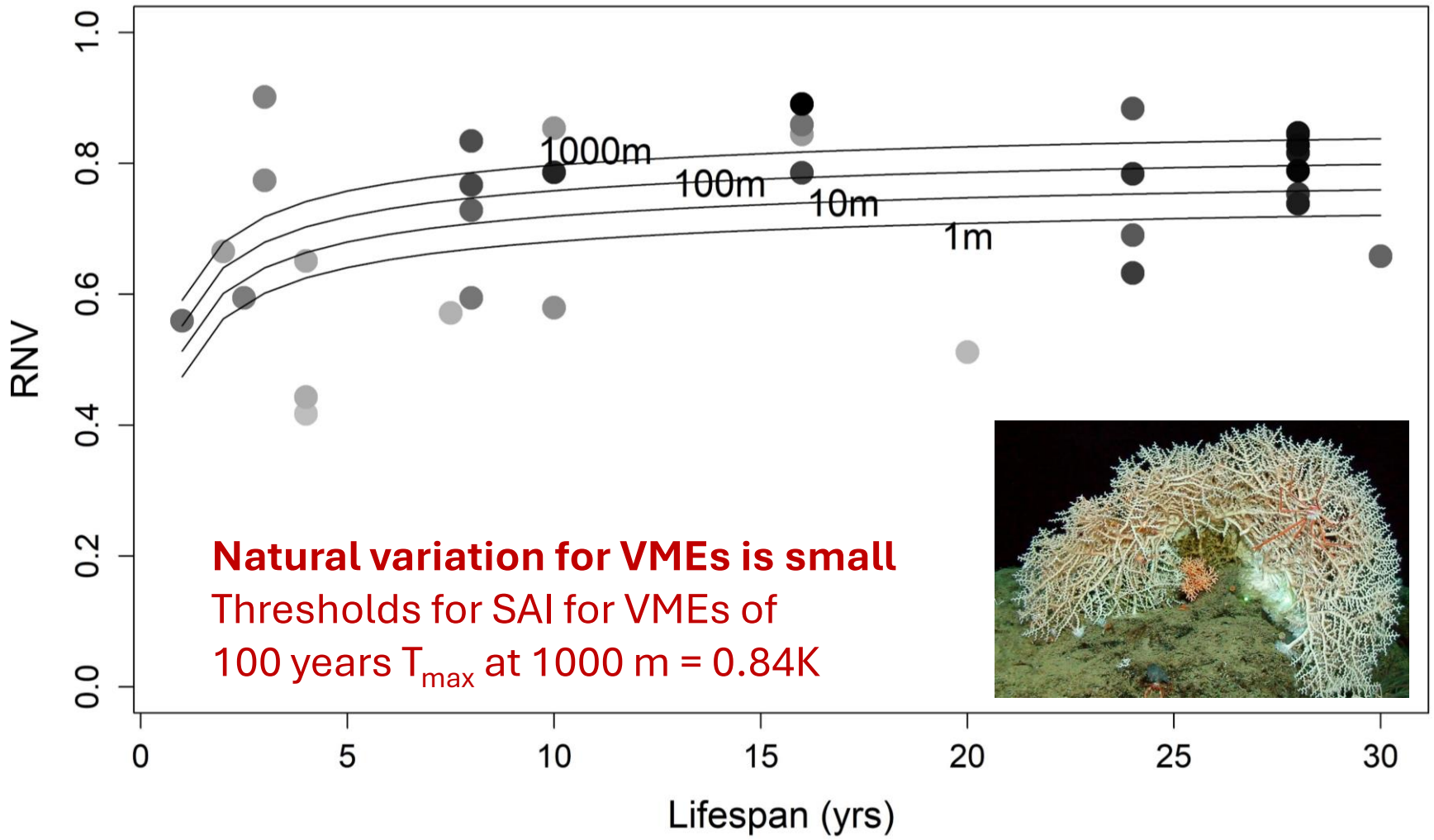
Threshold increases with depth and lifespan

Threshold for good state B/K
50% probability



Natural variation for VMEs is small

Thresholds for SAI for VMEs of
100 years T_{max} at 1000 m = 0.84K

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Conclusions

1. **EAFM require identification of acceptable level of ecosystem impacts to avoid SAI.**

2. **Range of Natural Variation approach can be applied to multiple systems – consistent, transparent thresholds**

3. **General relationships with environment & life history useful for data poor areas**

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Food for Thought

ICES International Council for the Exploration of the Sea
CIEM Conseil International pour l'Exploration de la Mer

Setting thresholds for good ecosystem state in marine seabed systems and beyond

J. G. Hiddink [1,*], S. Valanko [2], A. J. Delargy [1,‡], and P. D. van Denderen [2,3,4]

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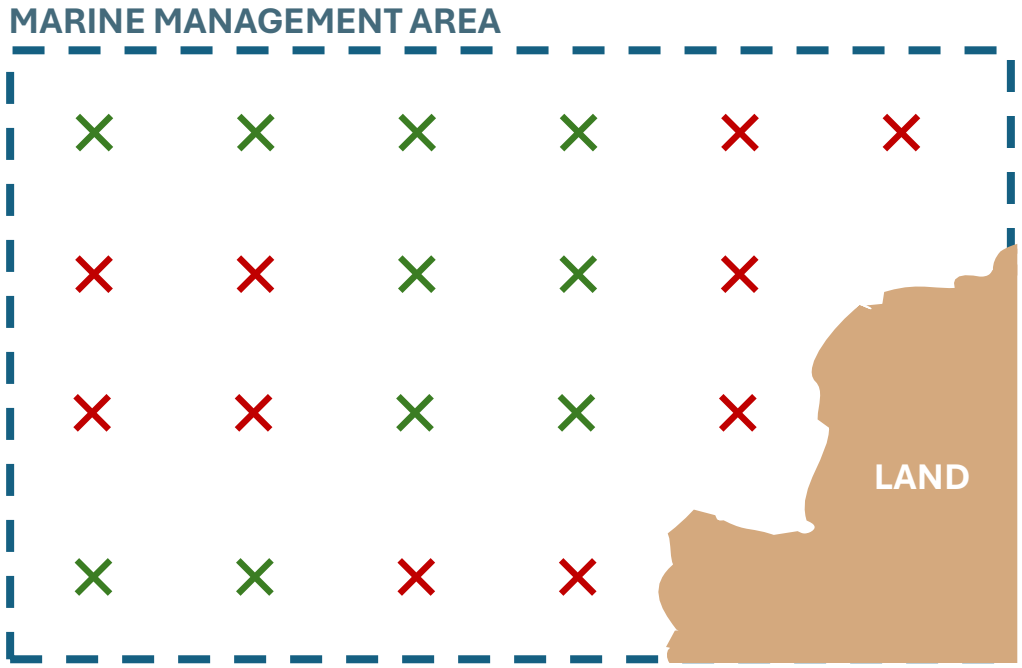
Quality threshold:
At a point/cell scale, what is good?



Quality threshold = 80% benthic invertebrate abundance at carrying capacity

Extent threshold = 50% monitoring locations meet quality threshold

Monitoring location **failed to reach quality threshold**

Monitoring location **reached quality threshold**

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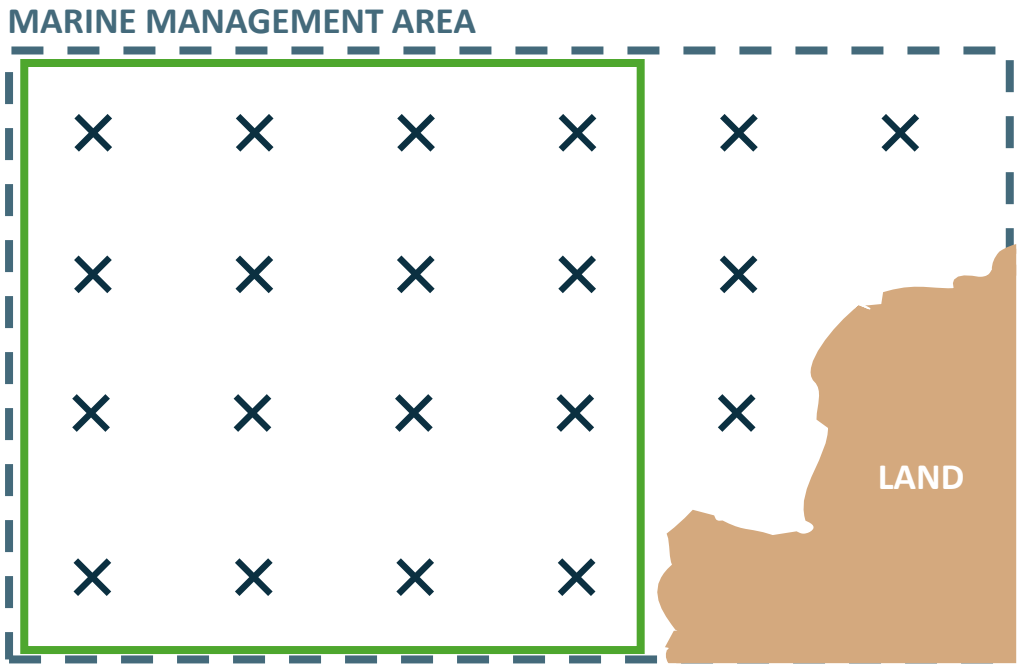
Extent threshold:

What fraction of the area needs to be above the quality threshold, for the region to be good?



location monitored for quality threshold

80% of monitoring locations must meet quality threshold

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