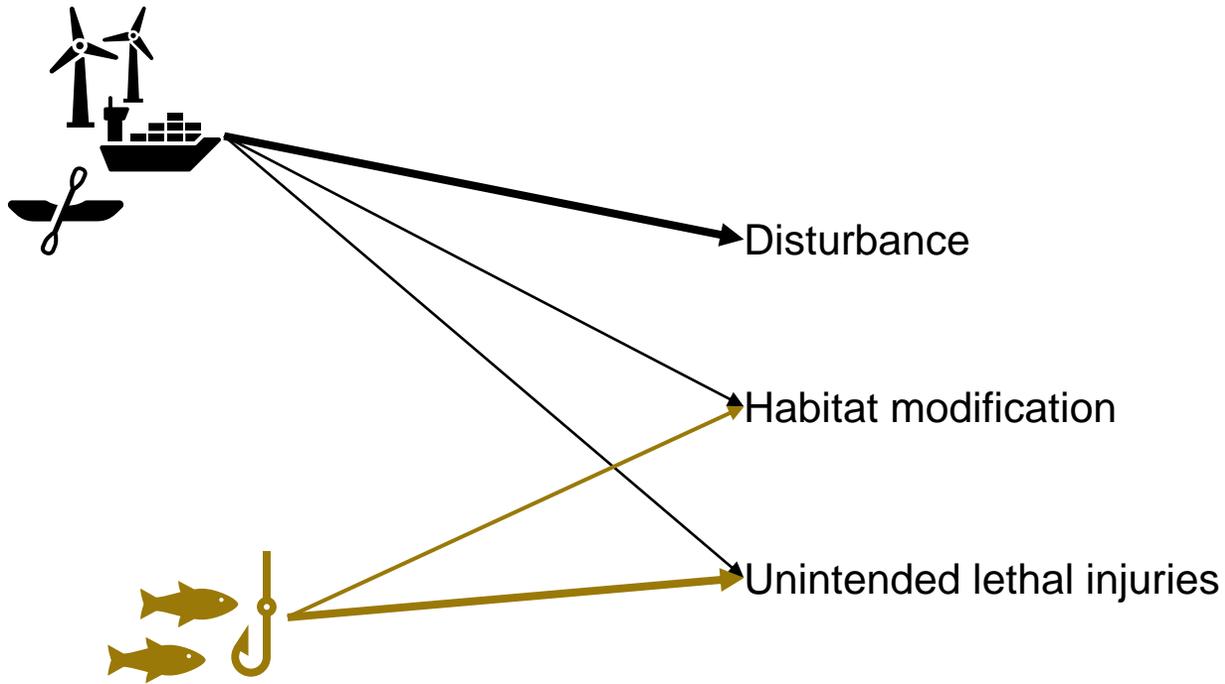


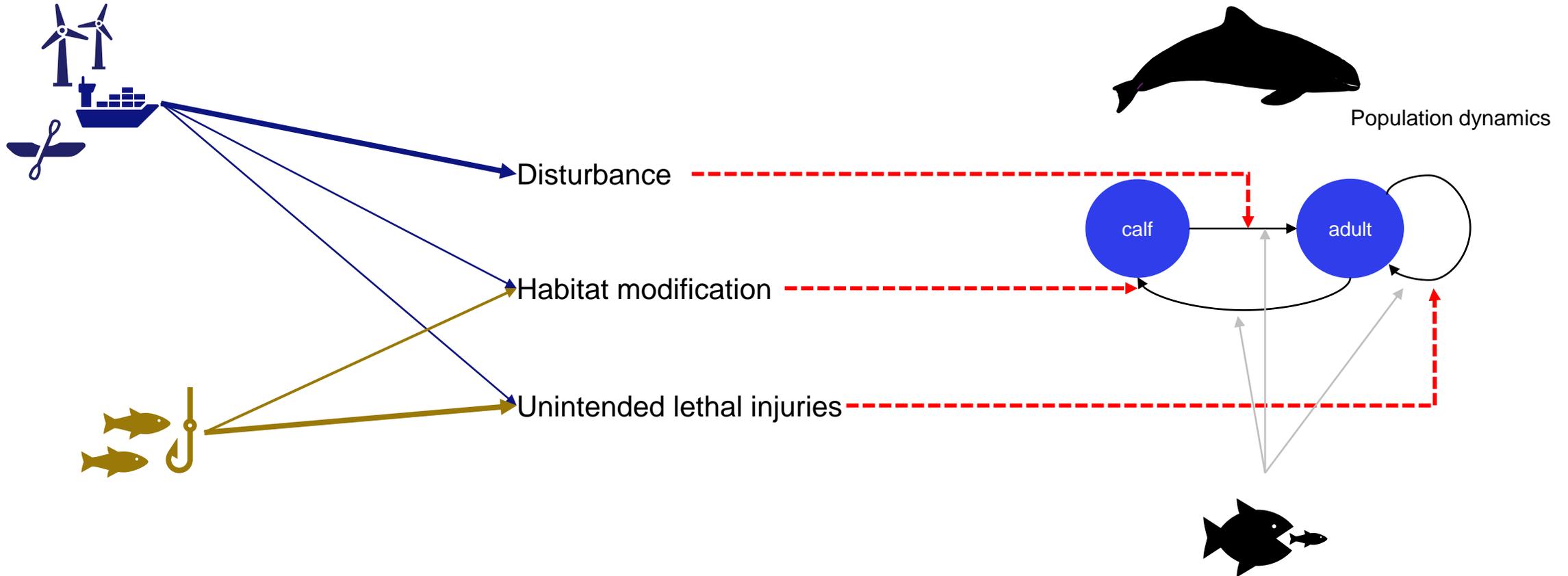
Emergent interactions in the management of multiple threats to the conservation of harbour porpoises

David Lusseau
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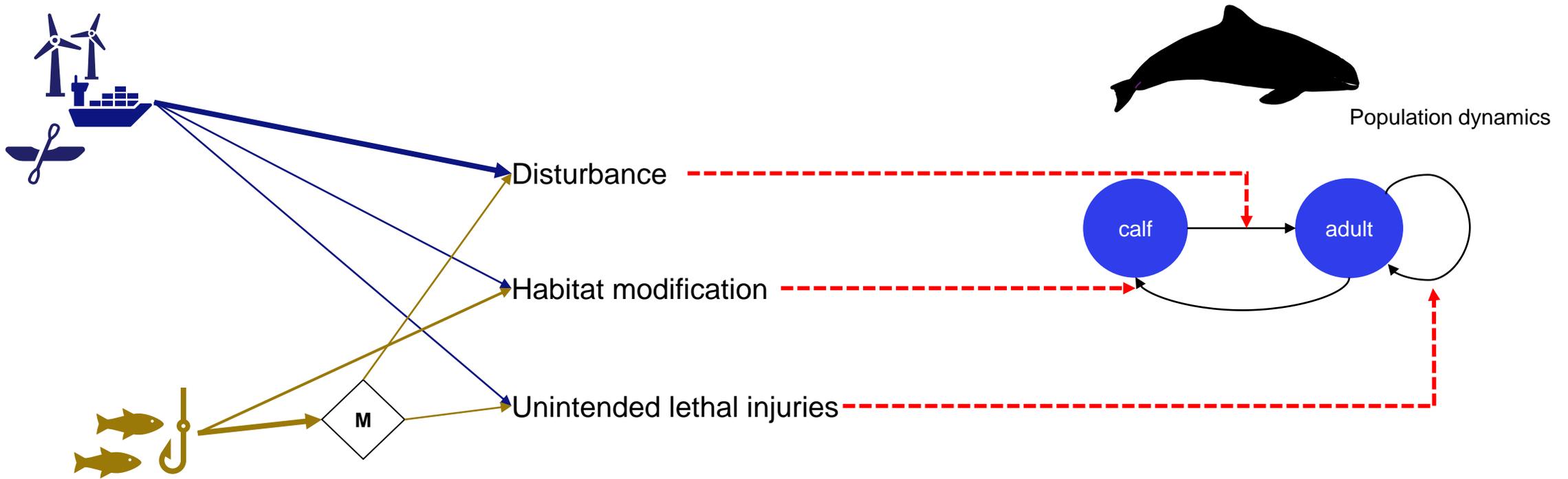
Non-independent pressures are prevalent creating complex hazard landscapes



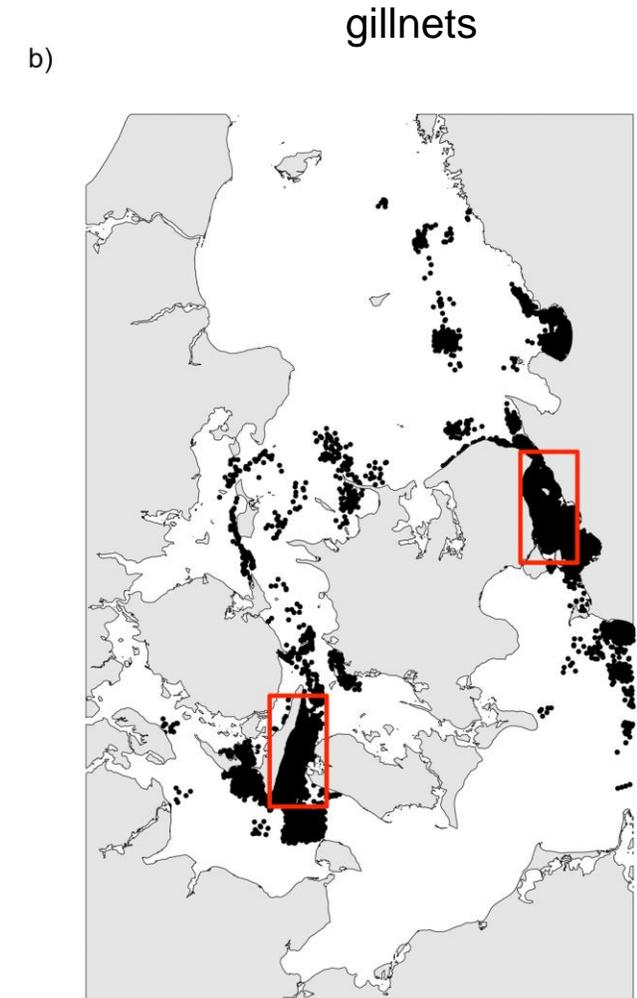
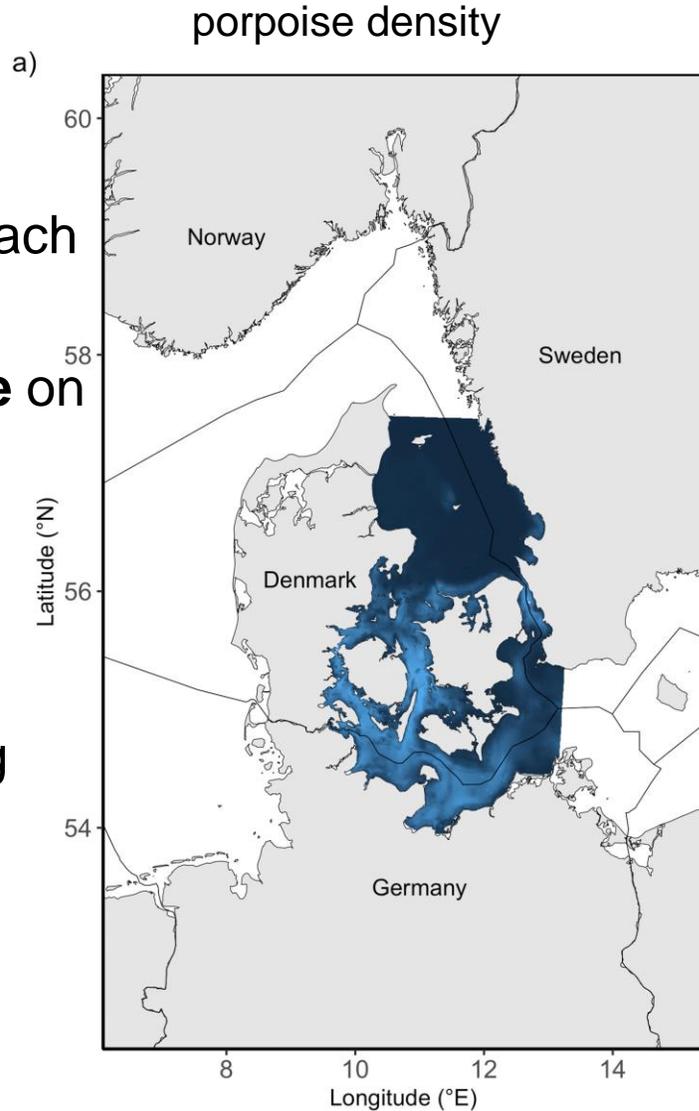
Complex hazard landscapes create complex risk states



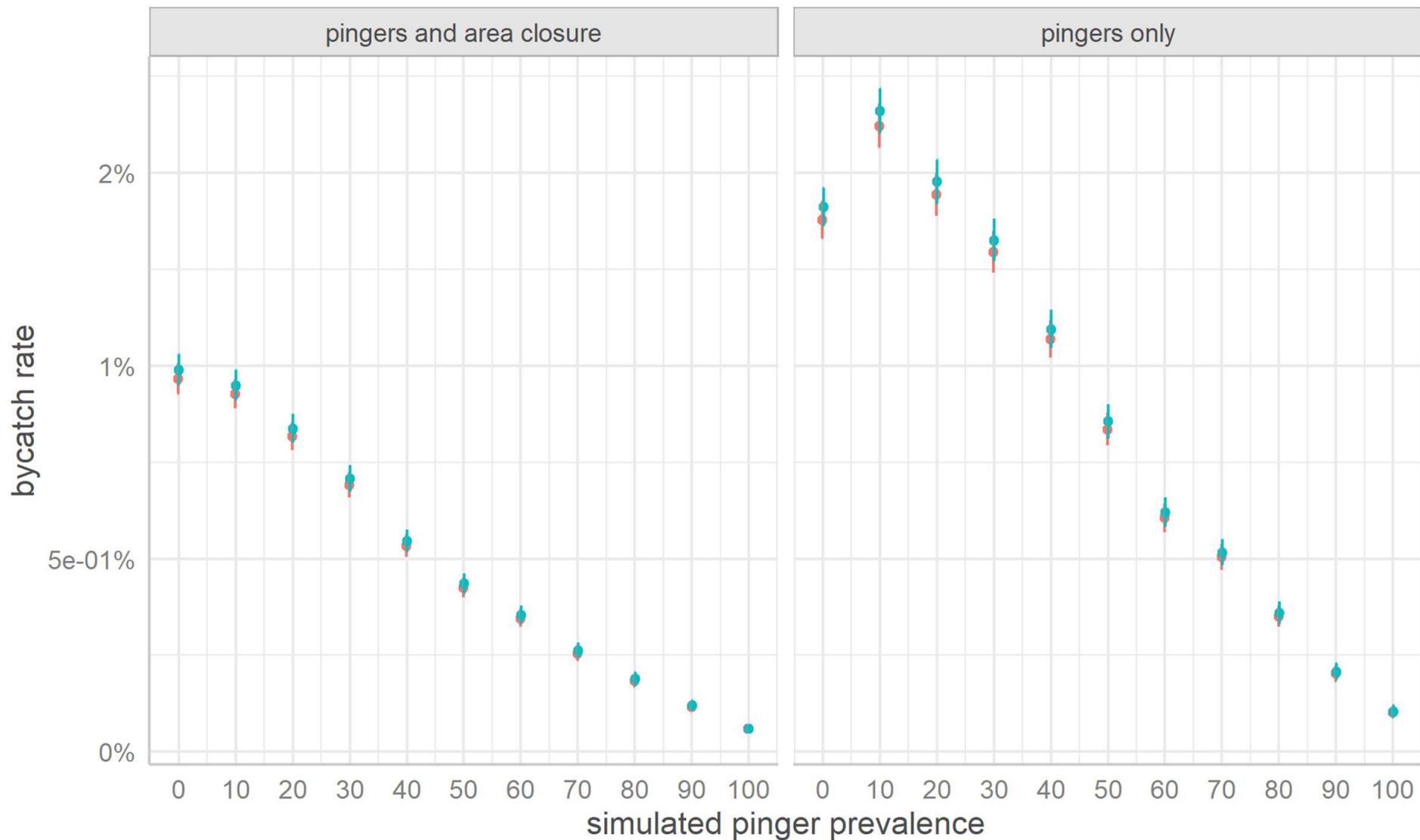
Interventions can have unintended consequences



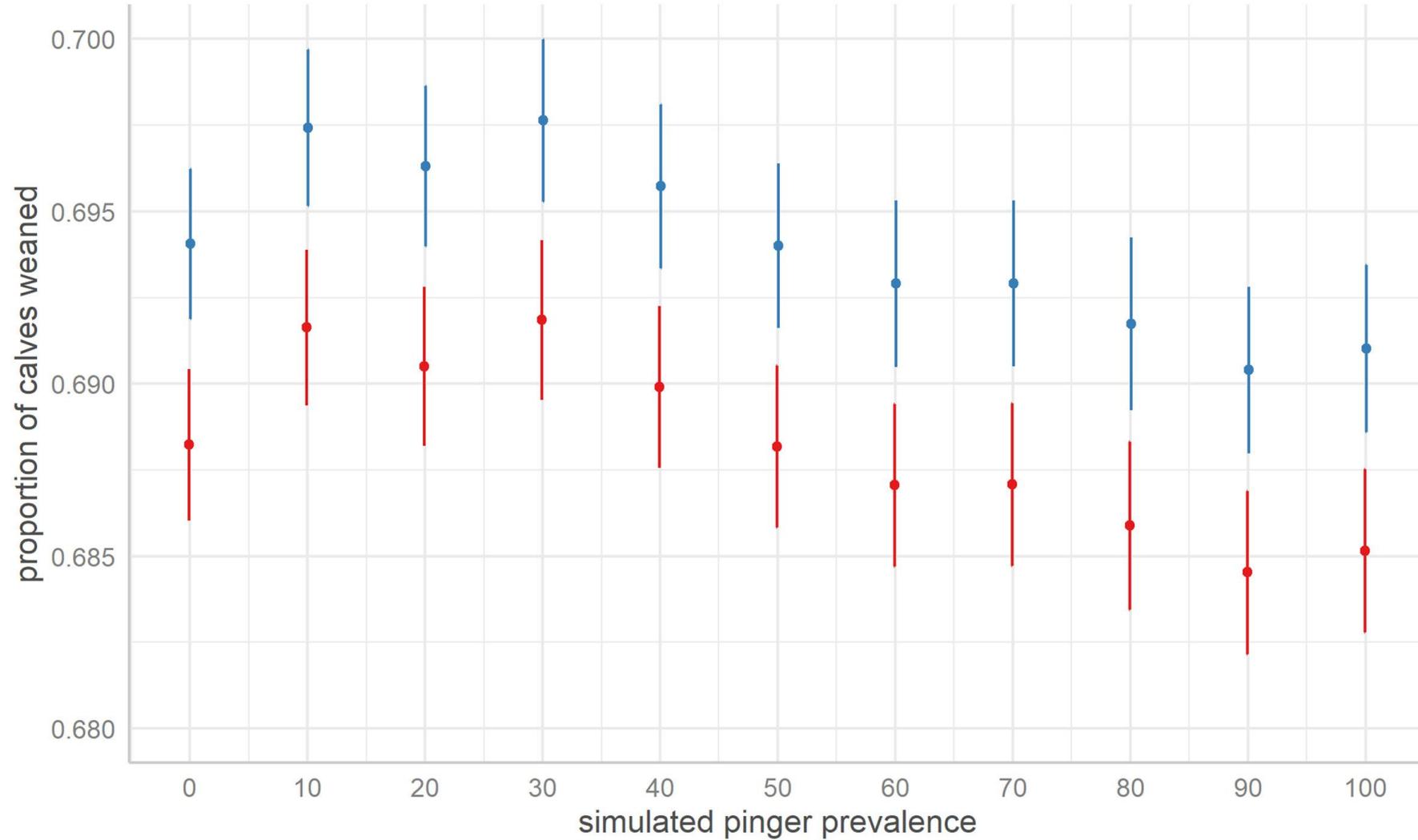
- Multi-agent based model
- Spatially-explicit data-driven approach
- Introduced **condition-dependence** on response to disturbance
- **Pinger prevalence (0-100%)**
- Model parameters tuned to existing observations:
 - How does the tuned system reacts to perturbations
 - Relative conclusions



Bycatch rate

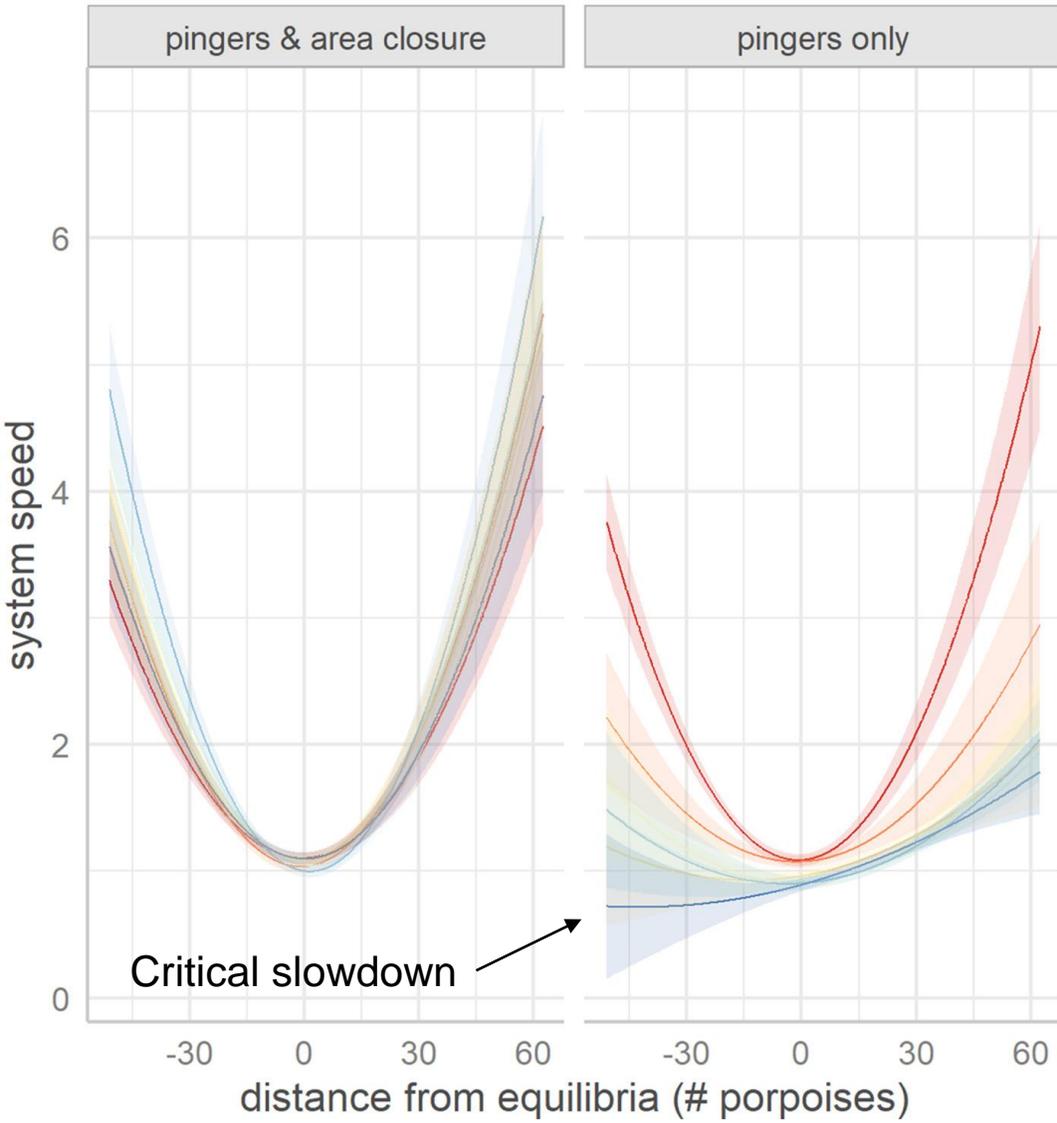


Calf weaning rate

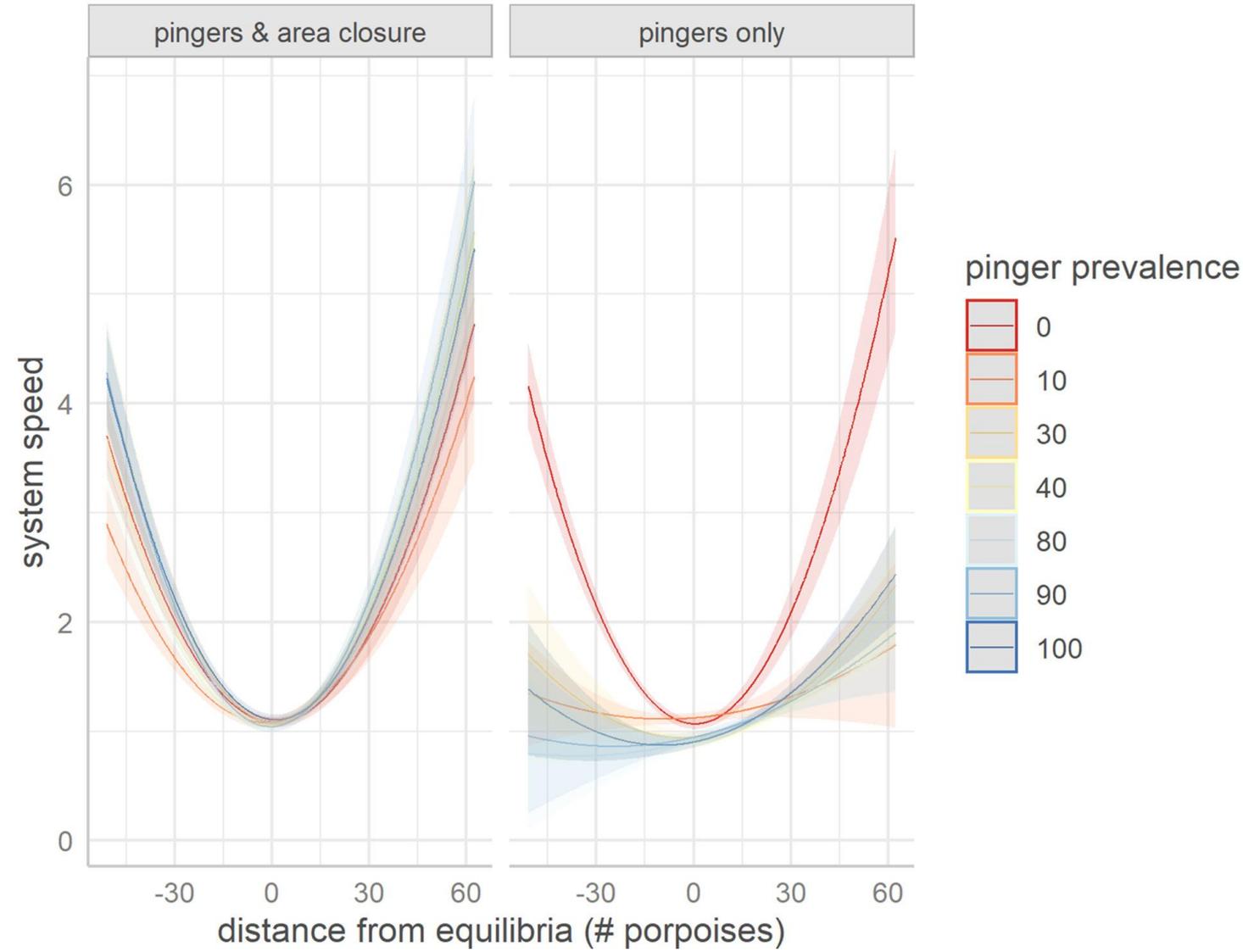


Engineering resilience in (abundance,condition) space

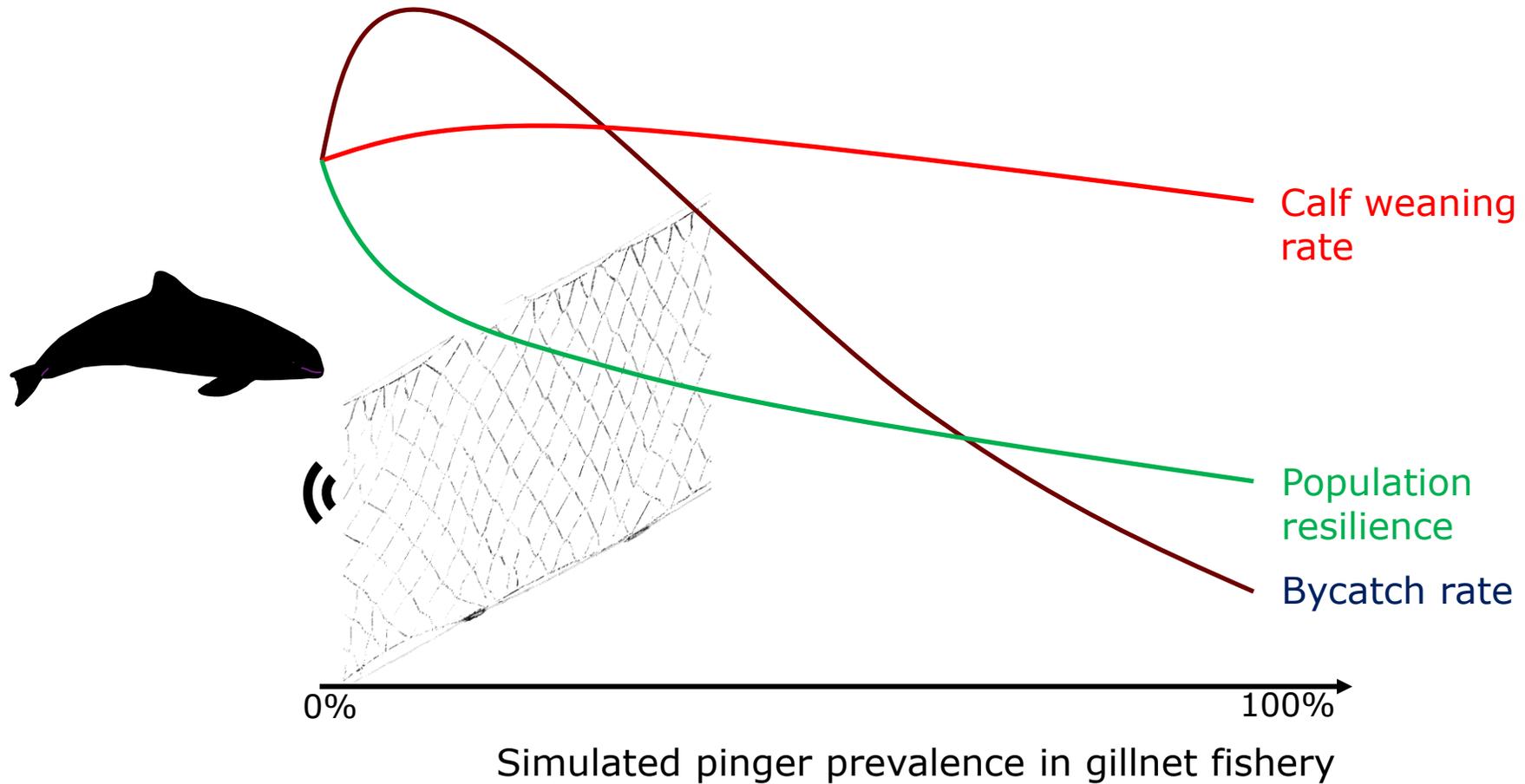
condition = no condition effects



condition = non-linear condition effects



Bycatch and noise from bycatch mitigation



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- Science of the Total Environment 2023 855, 158936

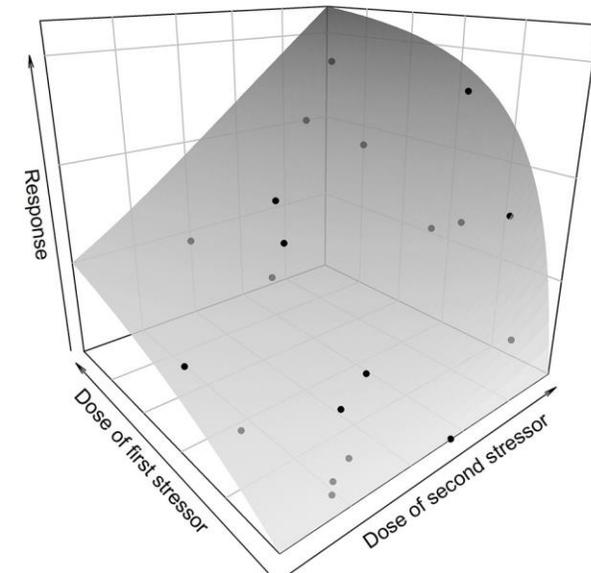
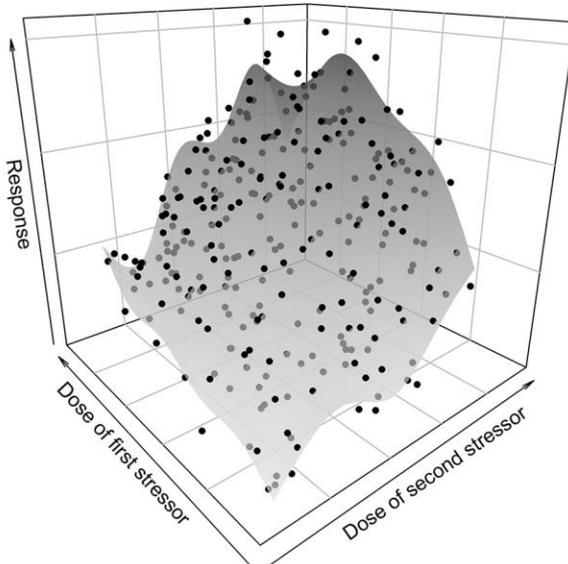
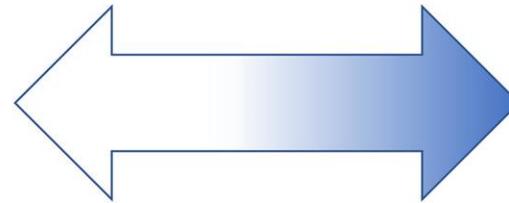


mechanistic models and simulations are useful for CRA



- ✓ Low bias
- ✓ Few assumptions
- x Noisy
- x Low precision
- x Limited predictive power

- x Potentially high bias
- x More assumptions
- ✓ Reduced empirical noise
- ✓ High precision
- ✓ Increased predictive power



More limited scope when conditions change