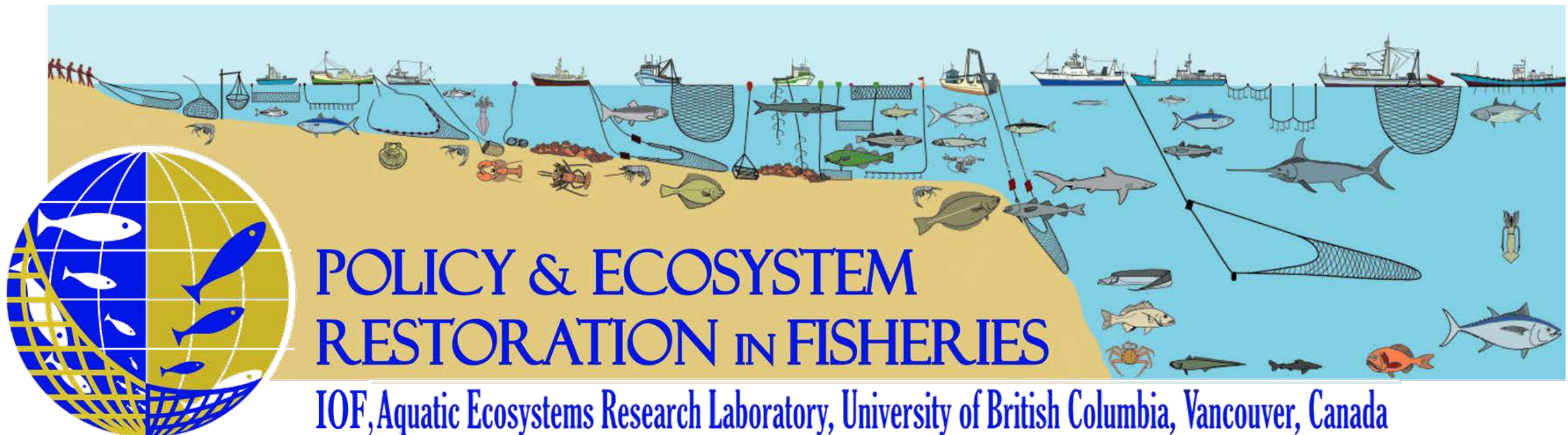


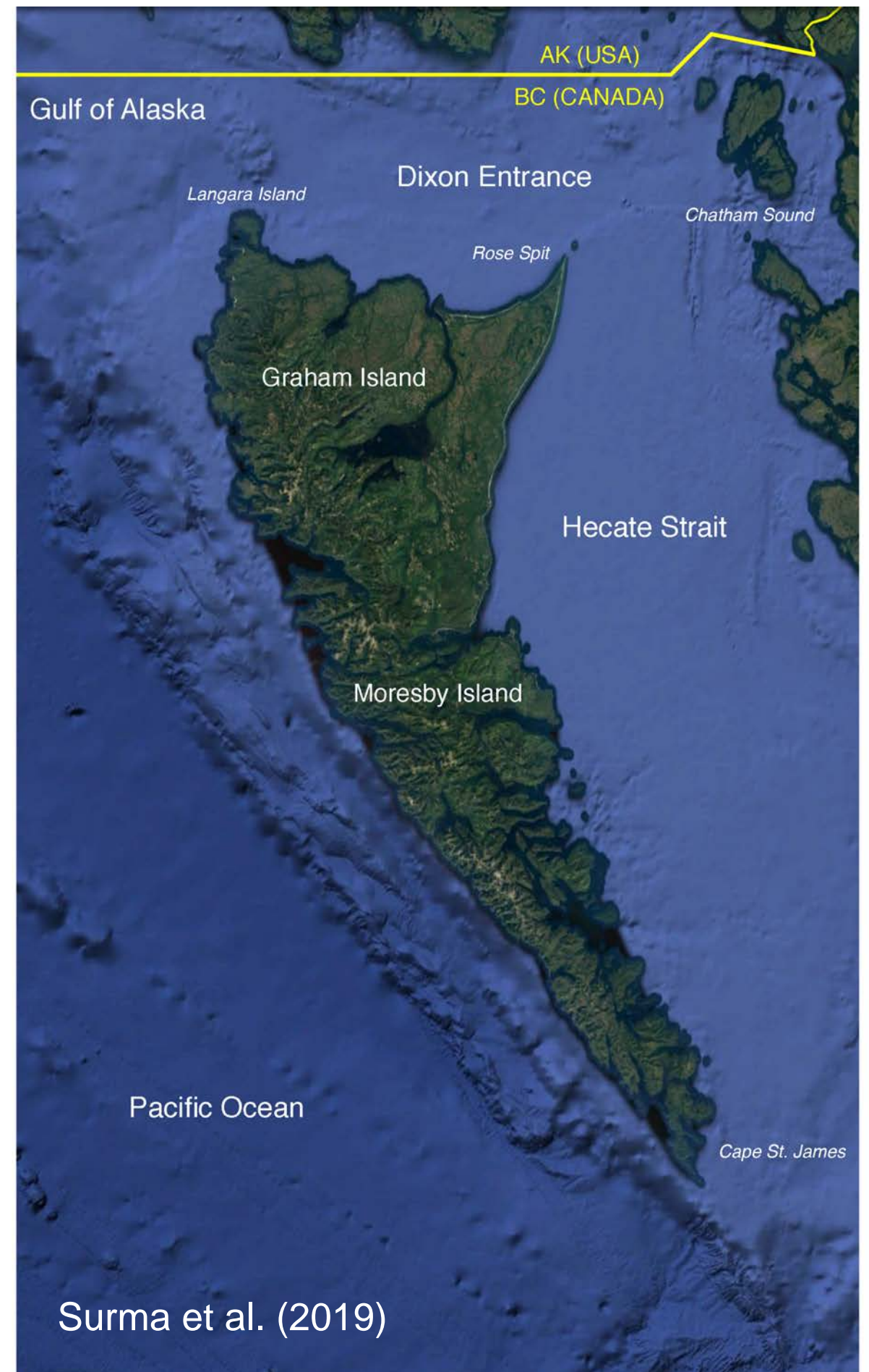
Reconstructing and projecting trends in a Northeast Pacific ecosystem

Szymon Surma

Institute for the Oceans and Fisheries
University of British Columbia

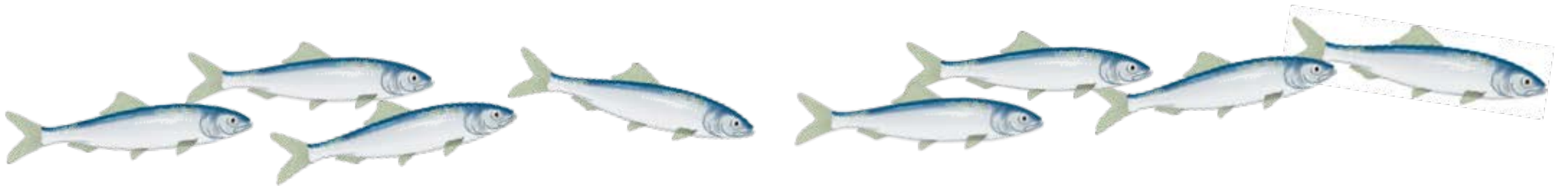


Haida Gwaii (Northeast Pacific)



Explain and emulate

- identify main drivers of ecosystem change
- reconstruct ecosystem trends 1950-2015
- project ecosystem dynamics into the future



Ecosystem modelling

- Ecopath with Ecosim
- basis: mass balance
- Ecopath: static food web snapshot
- Ecosim: dynamic ecosystem simulation



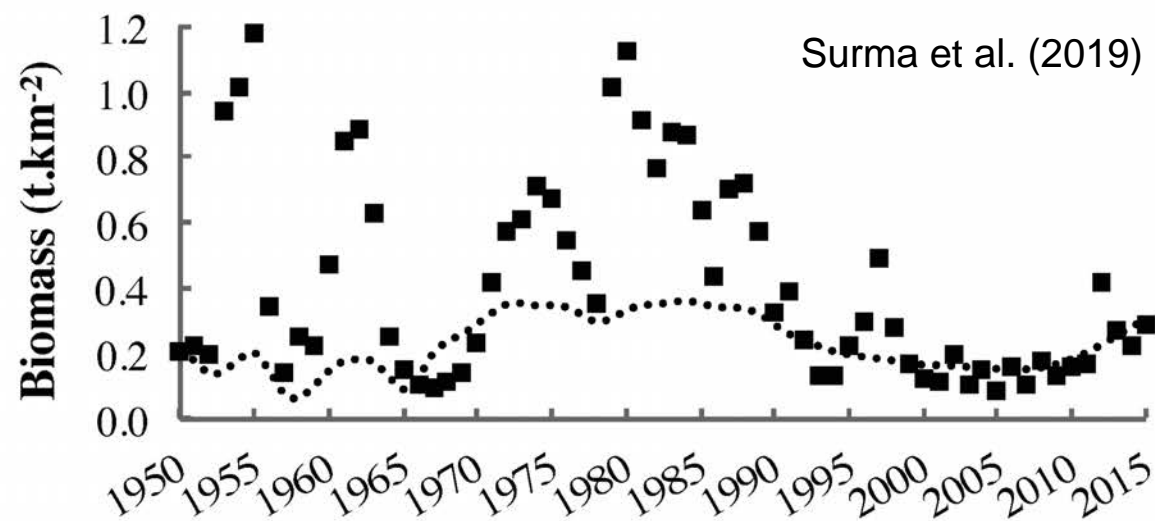
Ecosystem simulations

- start: Ecopath model for 1950 ecosystem state
- fitting: biomass & catch time series (1950-2015)
- drivers: fishing mortality & primary productivity

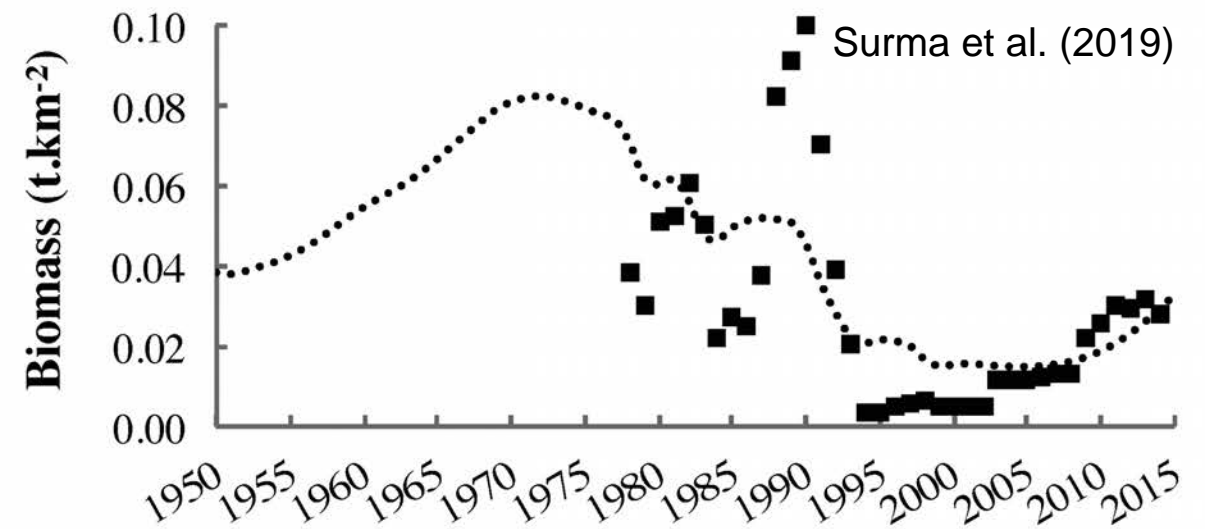


Fit to time series

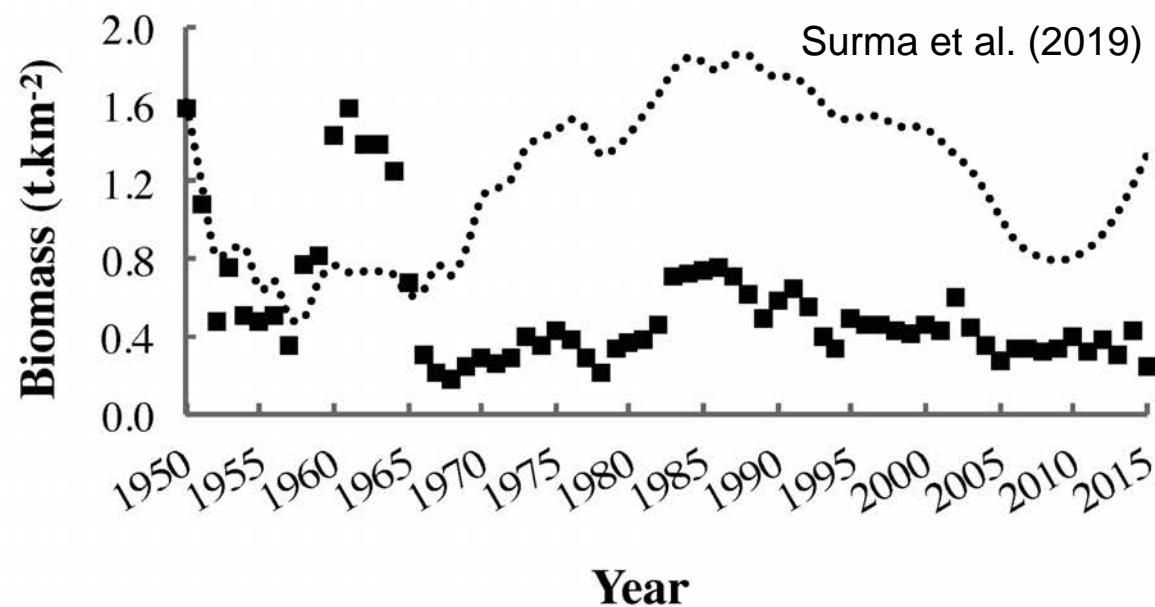
HG herring age 3+



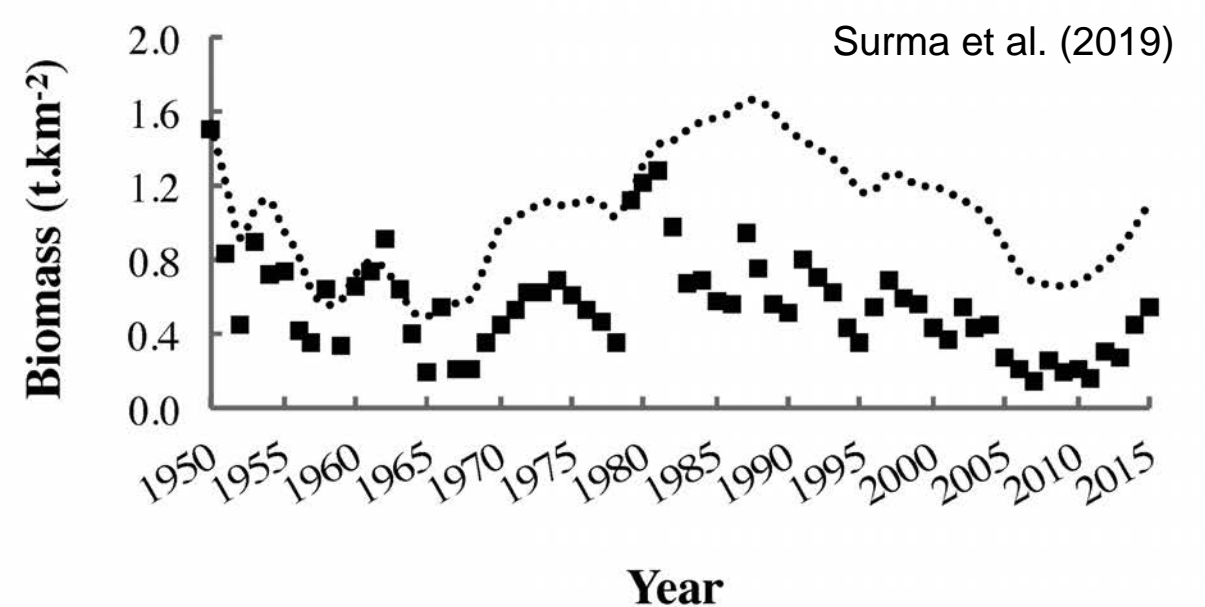
HG 2W herring age 3+



PRD herring age 3+



CC herring age 3+



Ecosystem dynamics

- fishing mortality drivers enhance simulation skill
- trophic interactions (predation) also improve fits
- reconstructed primary productivity reduces AICc
- top-down, bottom-up, and intermediate control

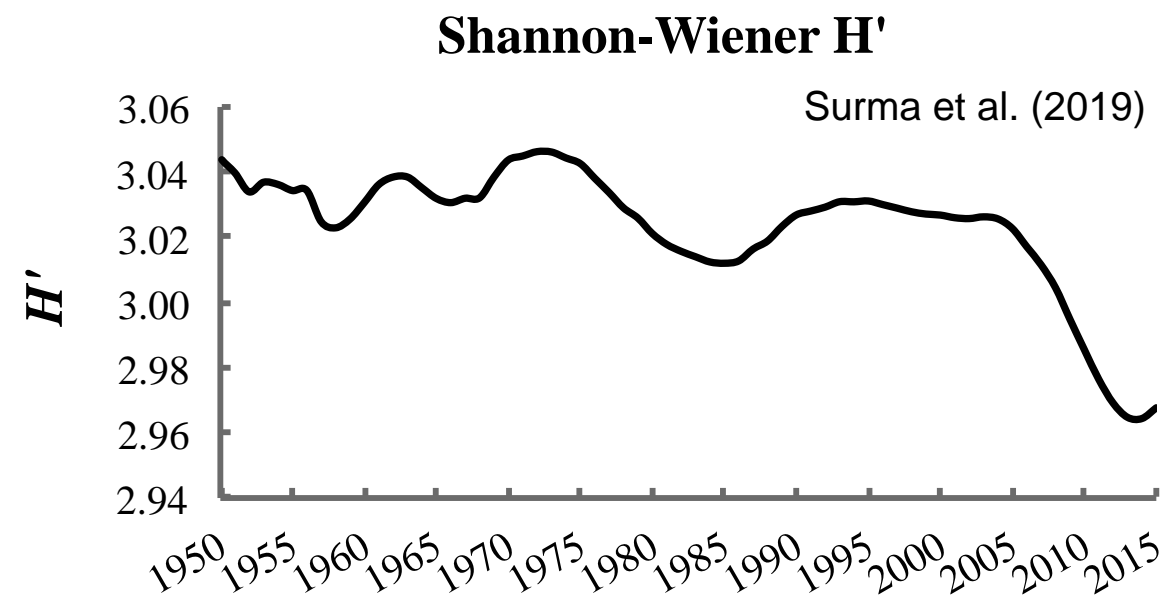


Ecosystem indicators

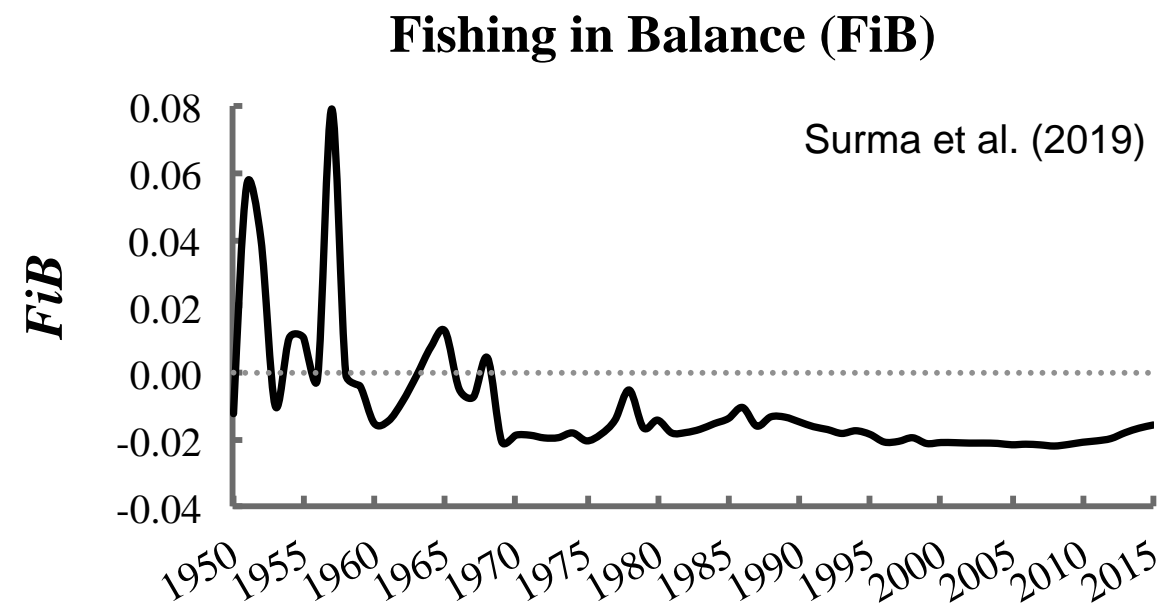
- biomass-weighted mean ecosystem trophic level
- Shannon-Wiener biodiversity (functional groups)
- Fishing in Balance index (fishing down food web)



Ecosystem indicators



Biodiversity decline



“Fishing down the food web”

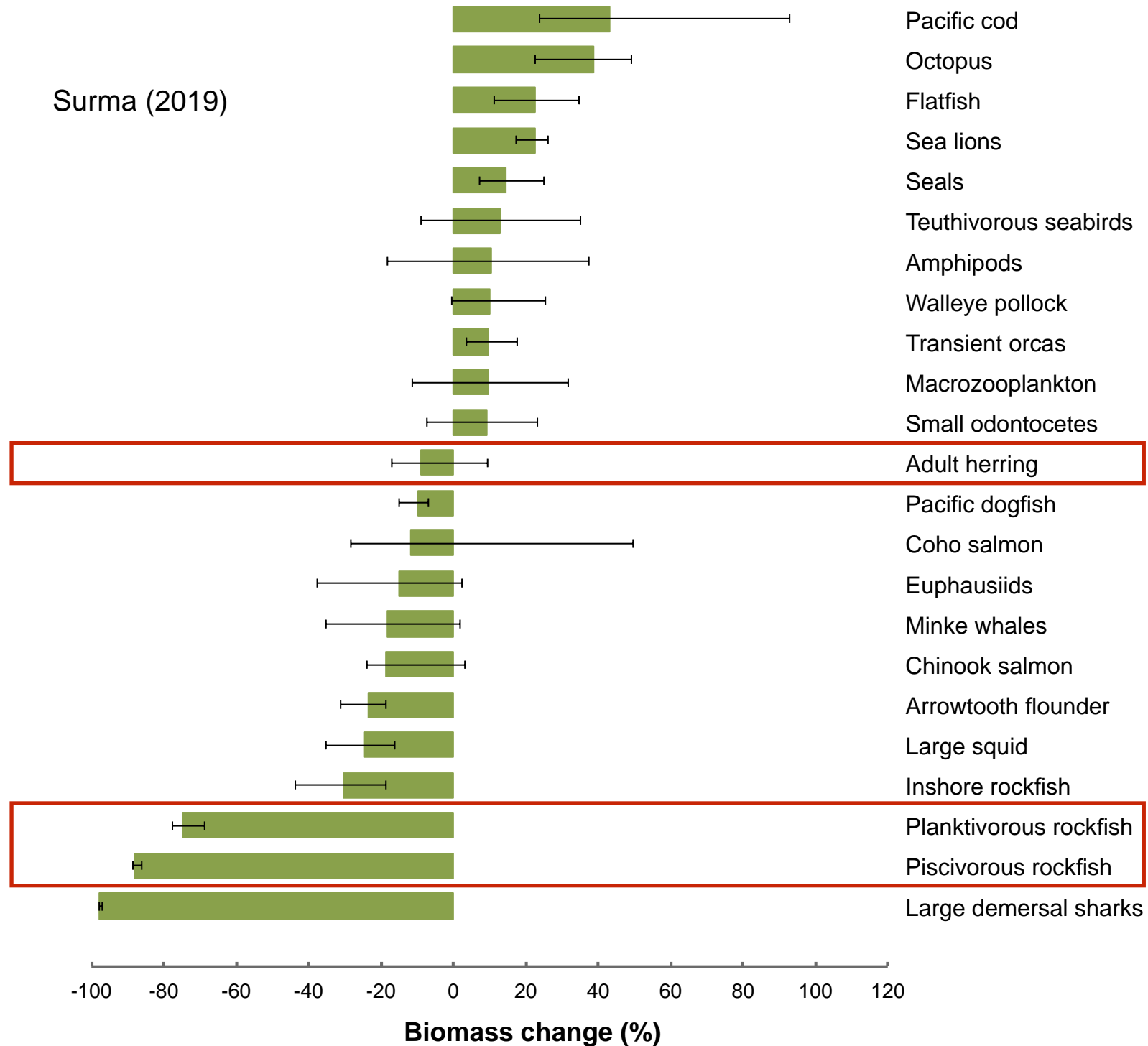
Ecosystem projections

- ecosystem impacts of continued whale recovery
- whale population dynamics: surplus production
- primary productivity: resampling historical data



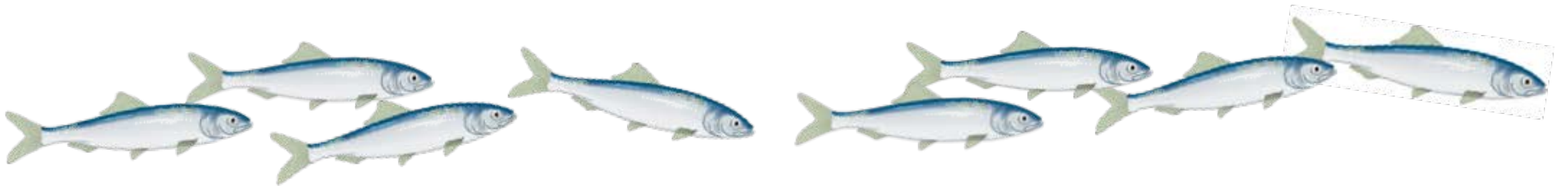
Ecosystem projections

Surma (2019)



Conclusions

- three main drivers govern NE Pacific ecosystem
- complex mosaic of top-down & bottom-up control
- biodiversity decline & “fishing down” since 1950
- effects of future whale recovery likely substantial



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Thank you!

