Two takes on the impacts of climate change and fishing:

Comparing a size-based food web model and an Ecopath with Ecosim model in the central North Pacific

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NOAA Fisheries Pacific Islands fisheries Science Center

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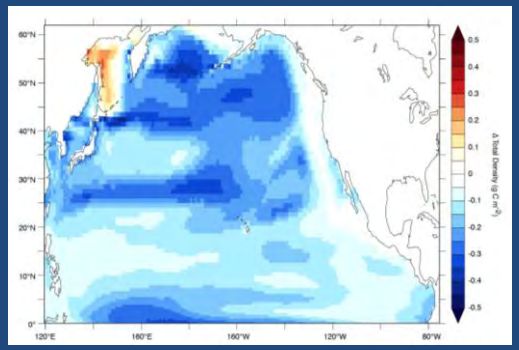
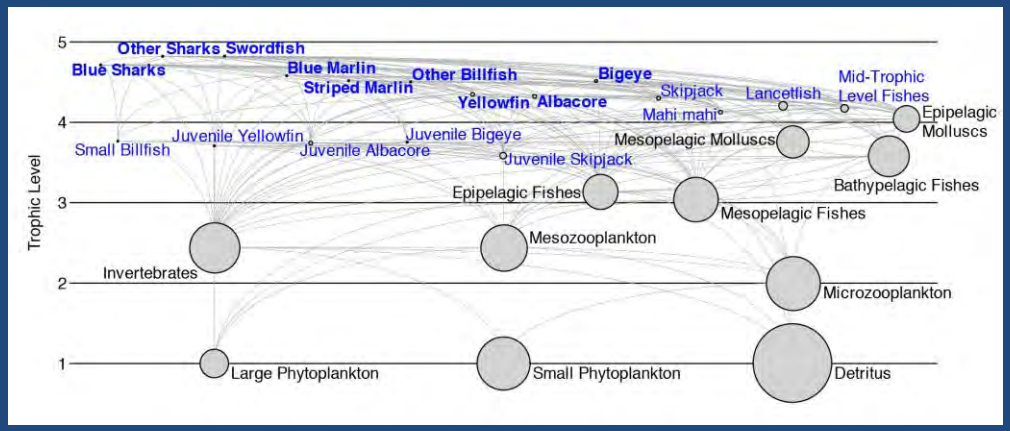
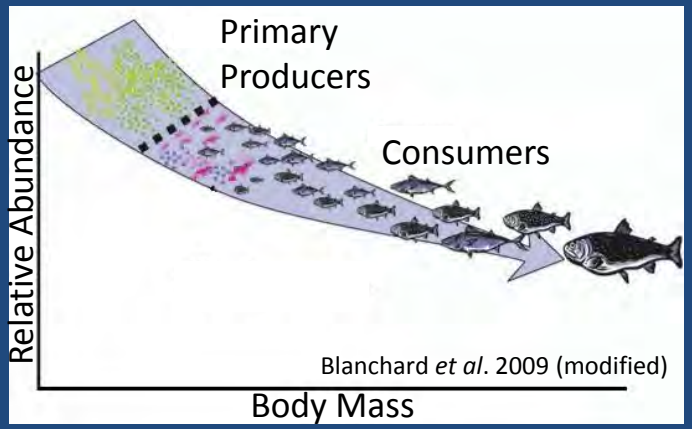
University of Sheffield

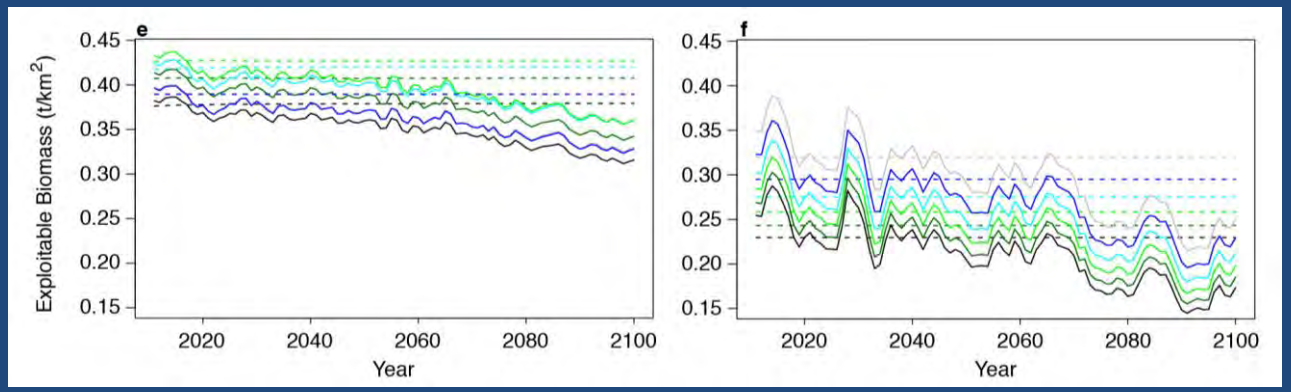
Model Comparison Approach



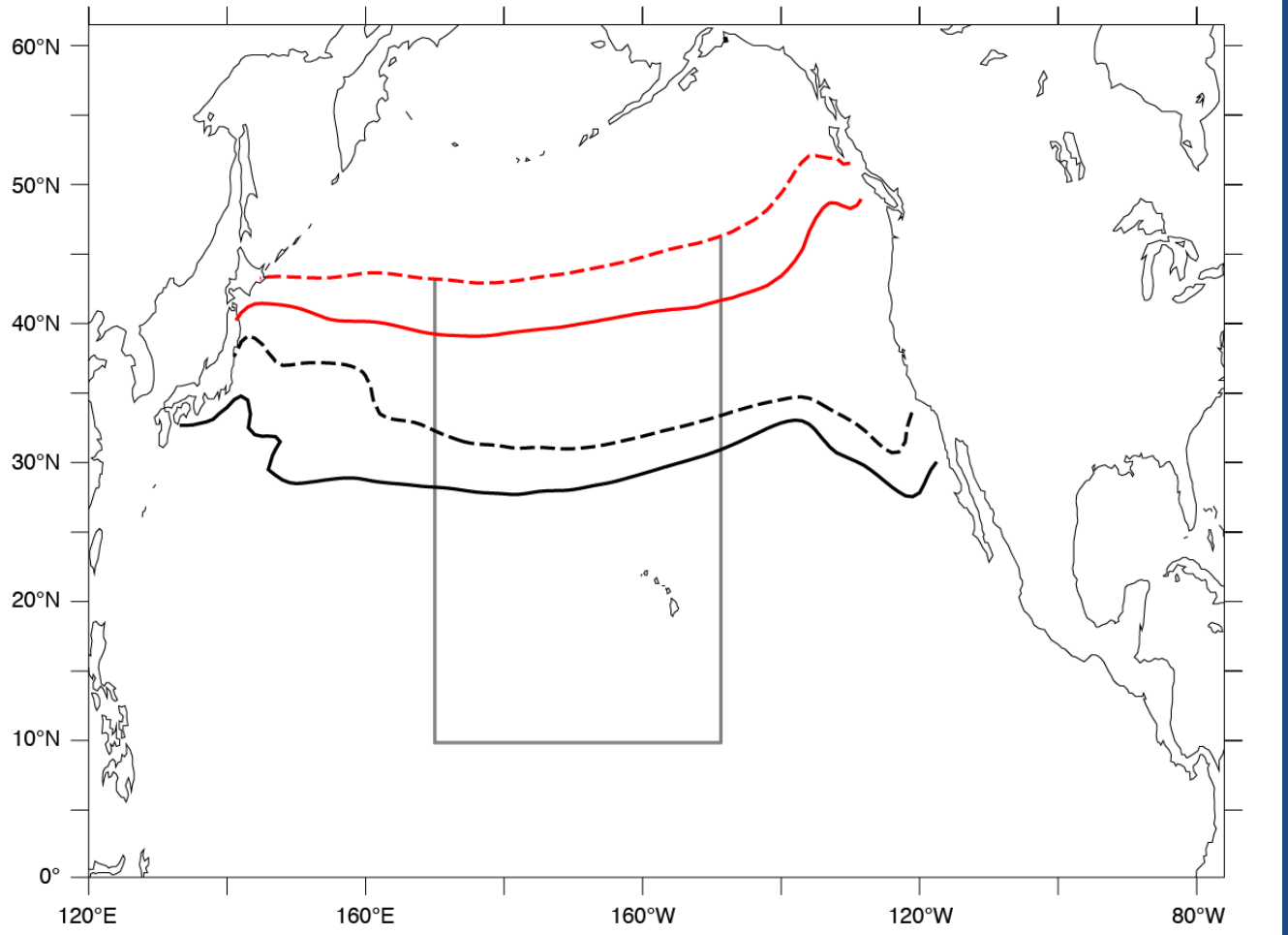


vs.





Hawaii-Based Longline Fishing Ground



17°C SST

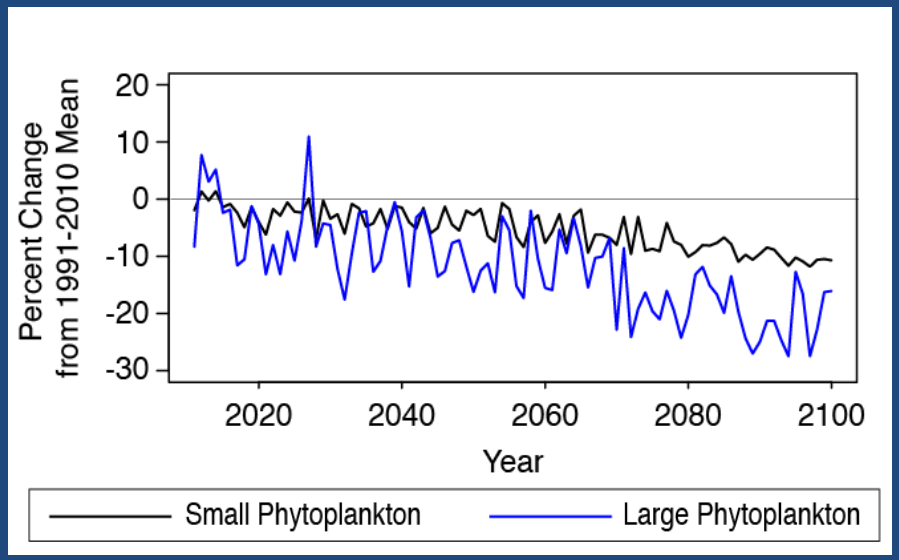
1991 – 2010
February Mean
August Mean

2081 – 2100
February Mean
August Mean

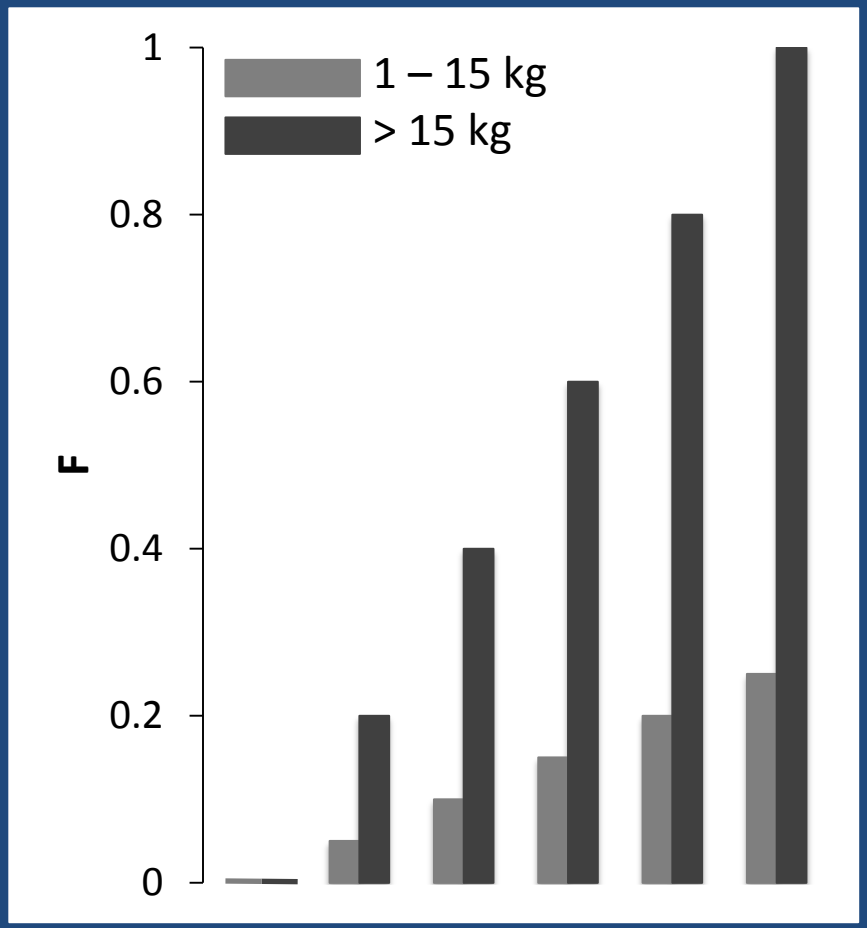
Geographic Boundaries

Howell *et al*. 2012

Earth System Model 2.1 (ESM2.1) and Fishing Mortality

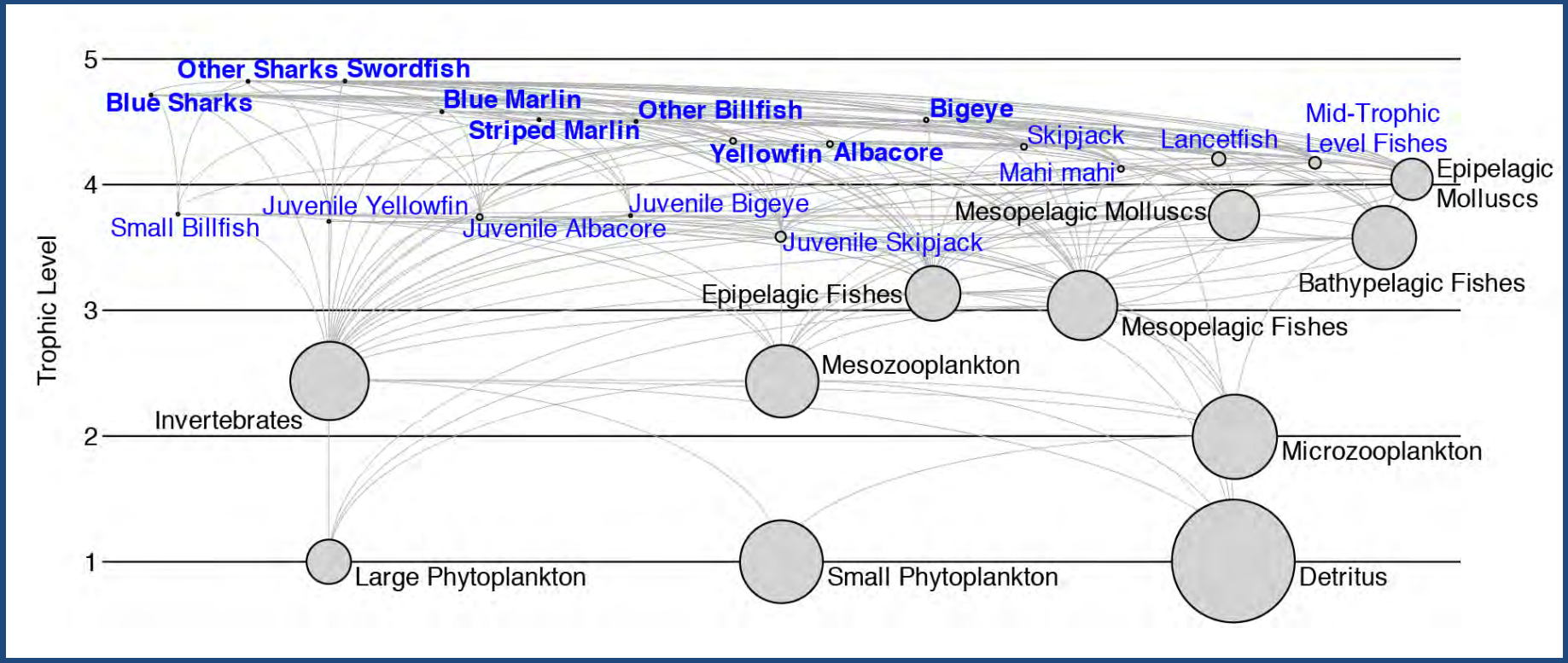


Small Phytoplankton: 0.2 – 5 µm
Large Phytoplankton: 5 – 200 µm



Delworth *et al*. 2006, Gnanadeskian *et al*. 2006, Nakićenović *et al*. 2000, Polovina and Woodworth-Jefcoats 2013

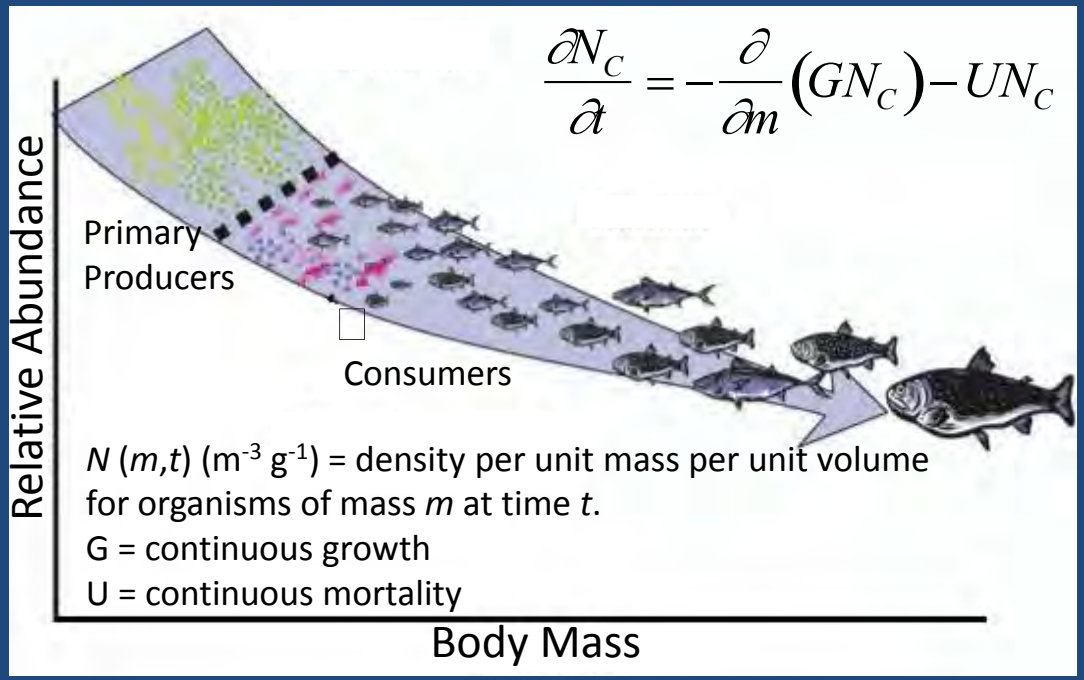
Ecopath with Ecosim



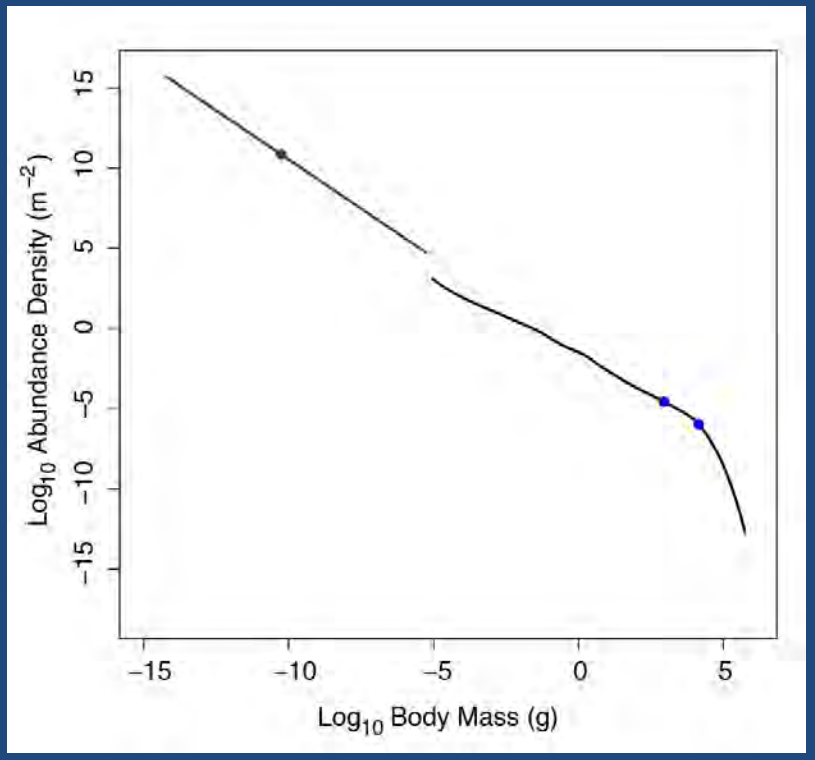
Howell *et al*. 2012, Polovina 1984, Christensen *et al*. 2008, Christensen and Walters 2004, Polovina and Woodworth-Jefcoats 2013

Size-Based Food Web Model

$$\frac{\partial N_C}{\partial t} = -\frac{\partial}{\partial m}\left(GN_C\right) - UN_C$$

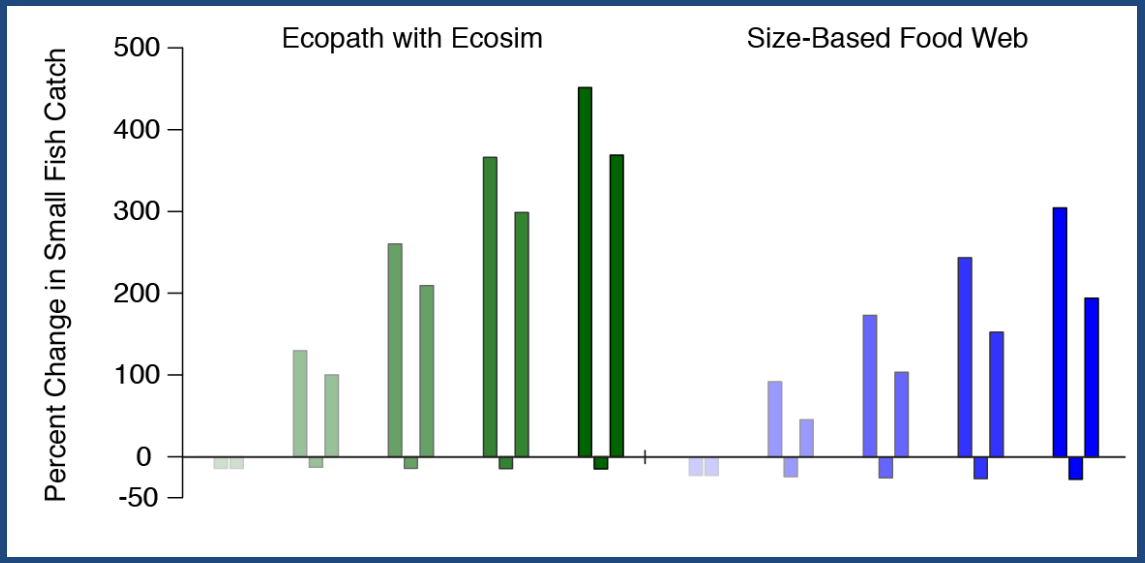


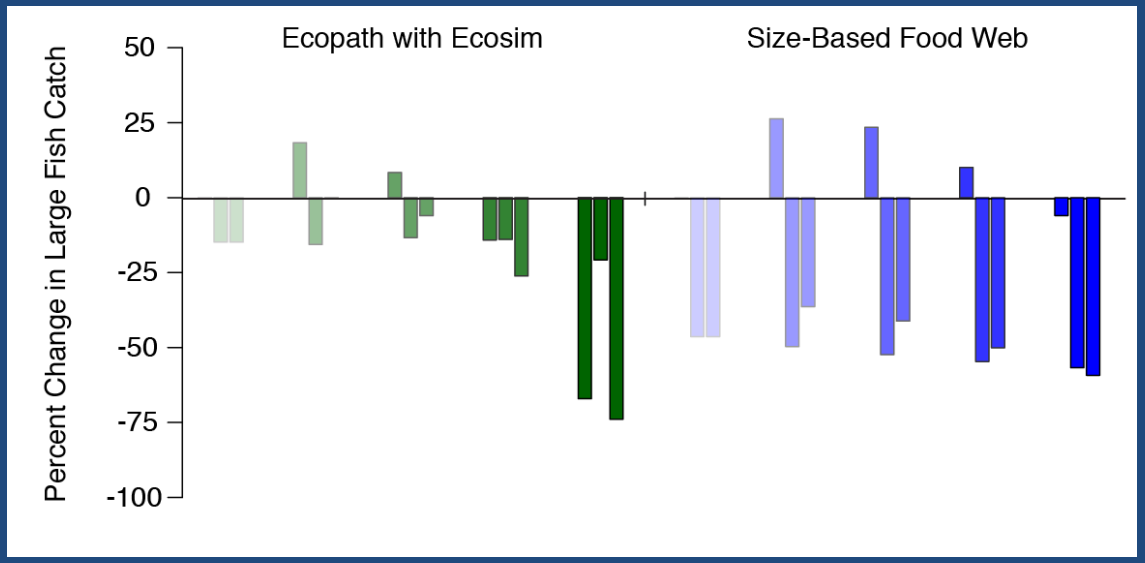
$N(m,t)$ (m^{-3} g^{-1}) = density per unit mass per unit volume for organisms of mass m at time t.
G = continuous growth
U = continuous mortality

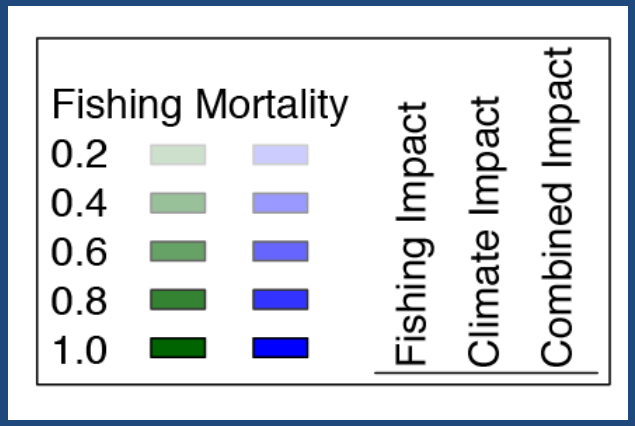


Blanchard *et al*. 2012, Schematic figure modified from Blanchard *et al.* 2009

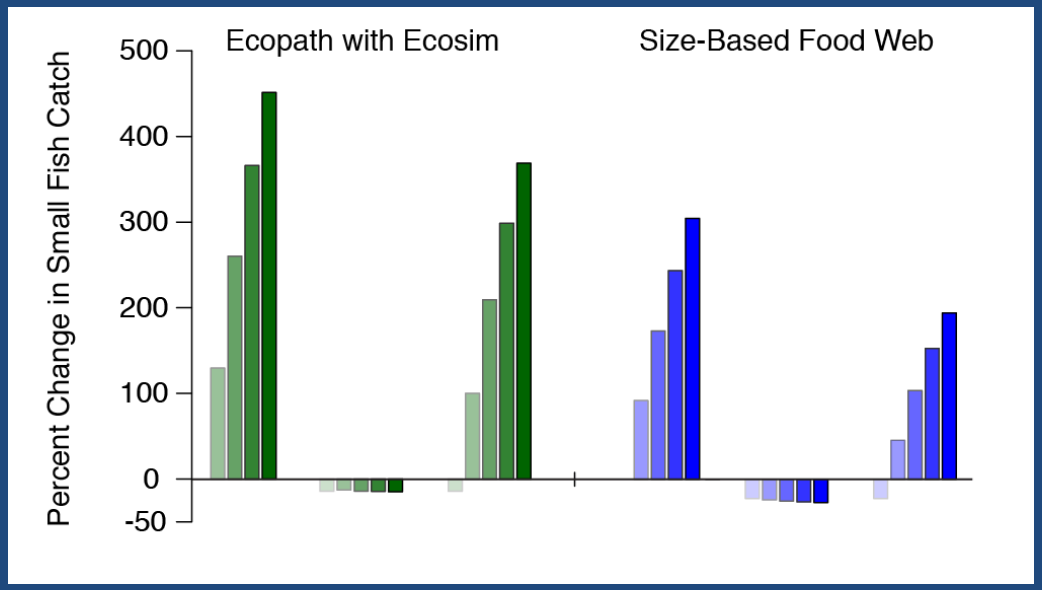
Insights from Model Agreement

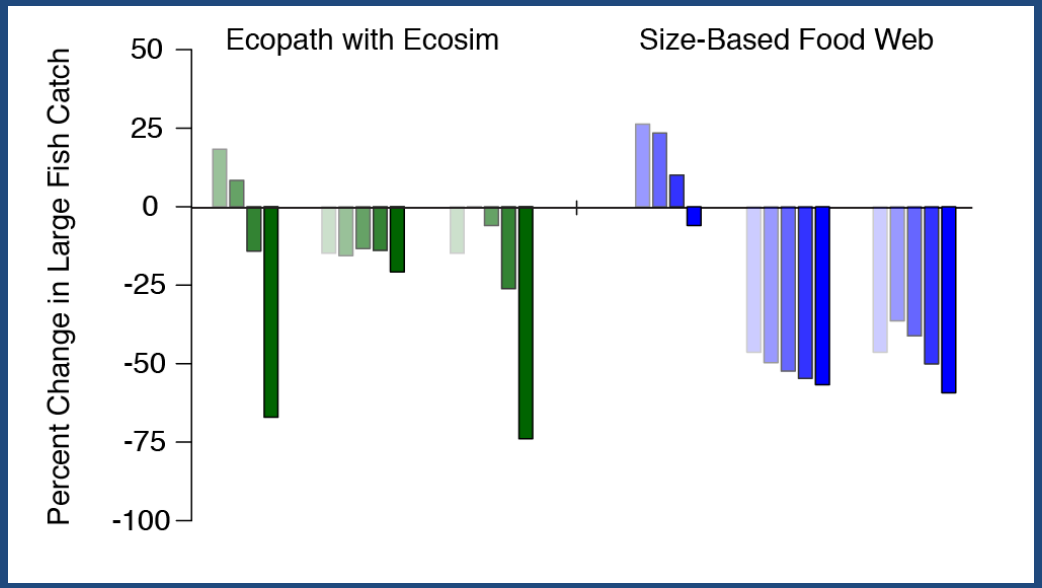


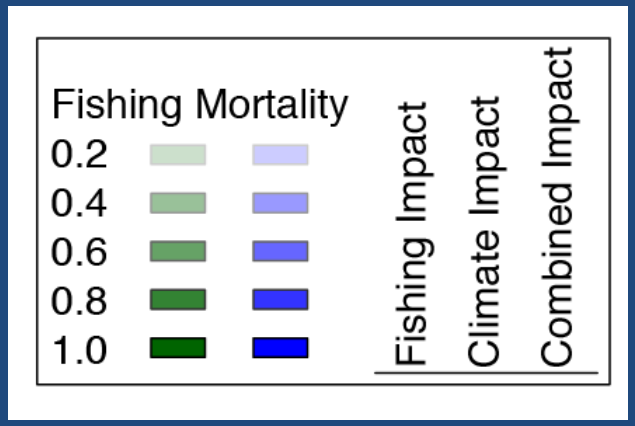




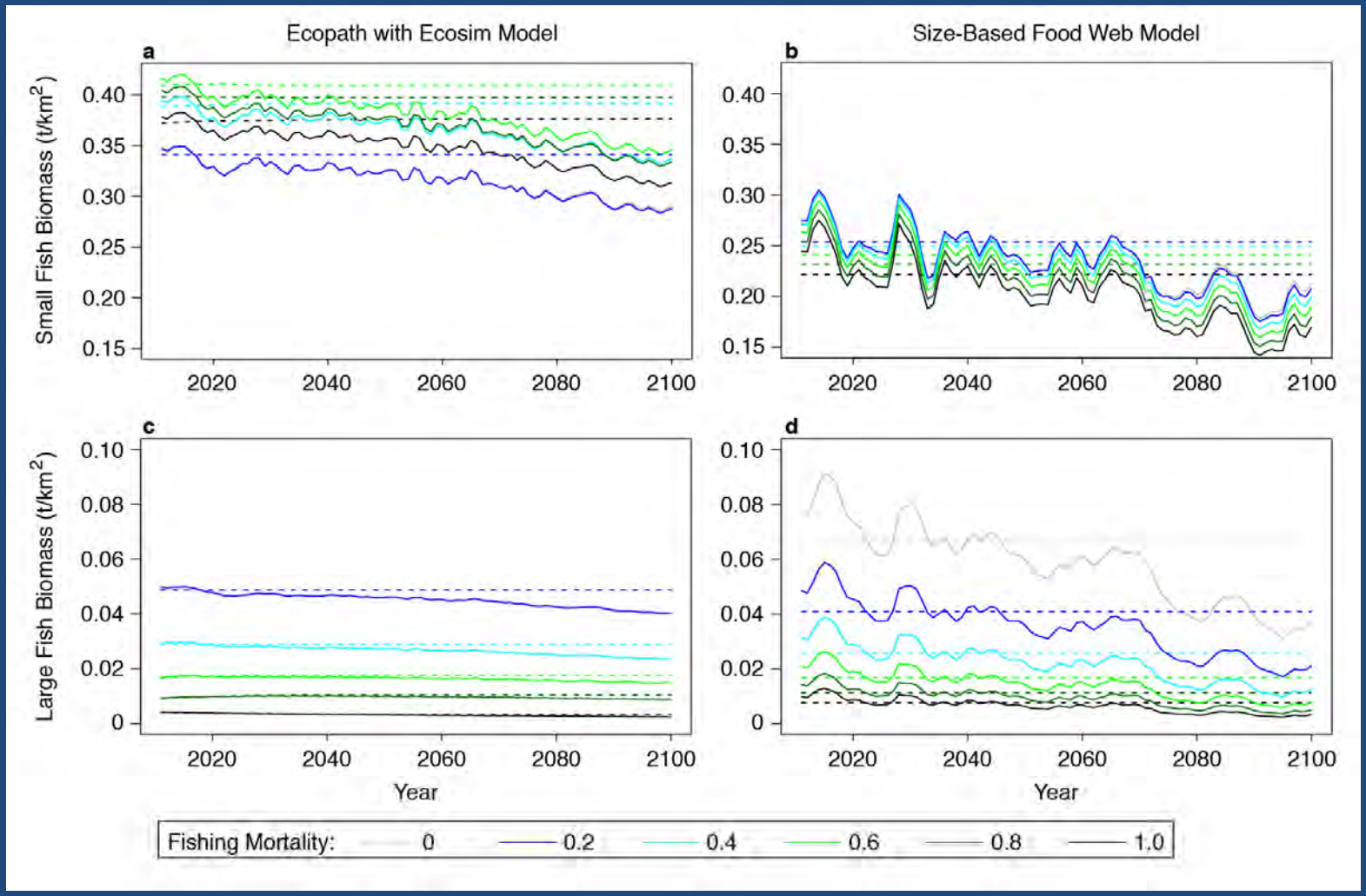
Insights from Model Disparity







Insights from Model Disparity



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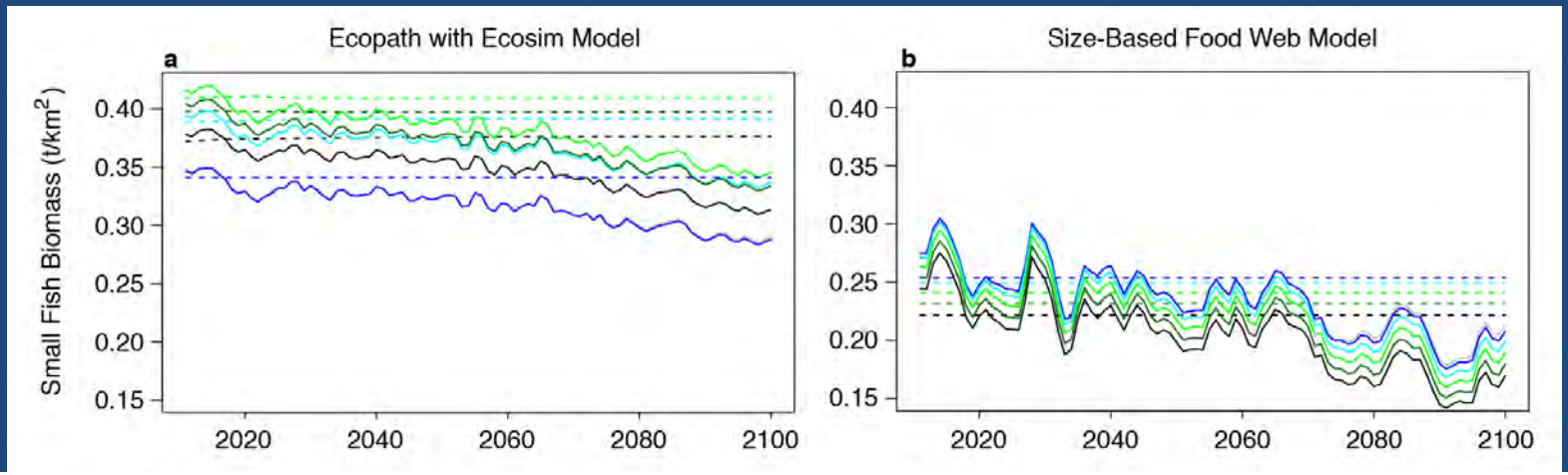

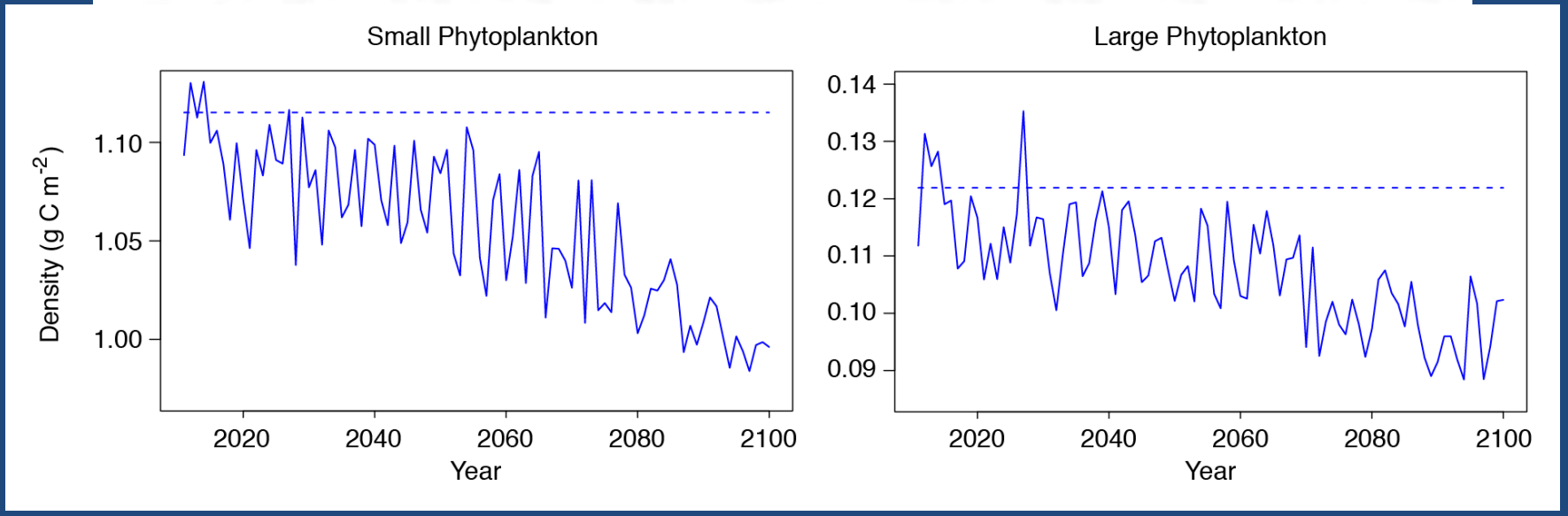

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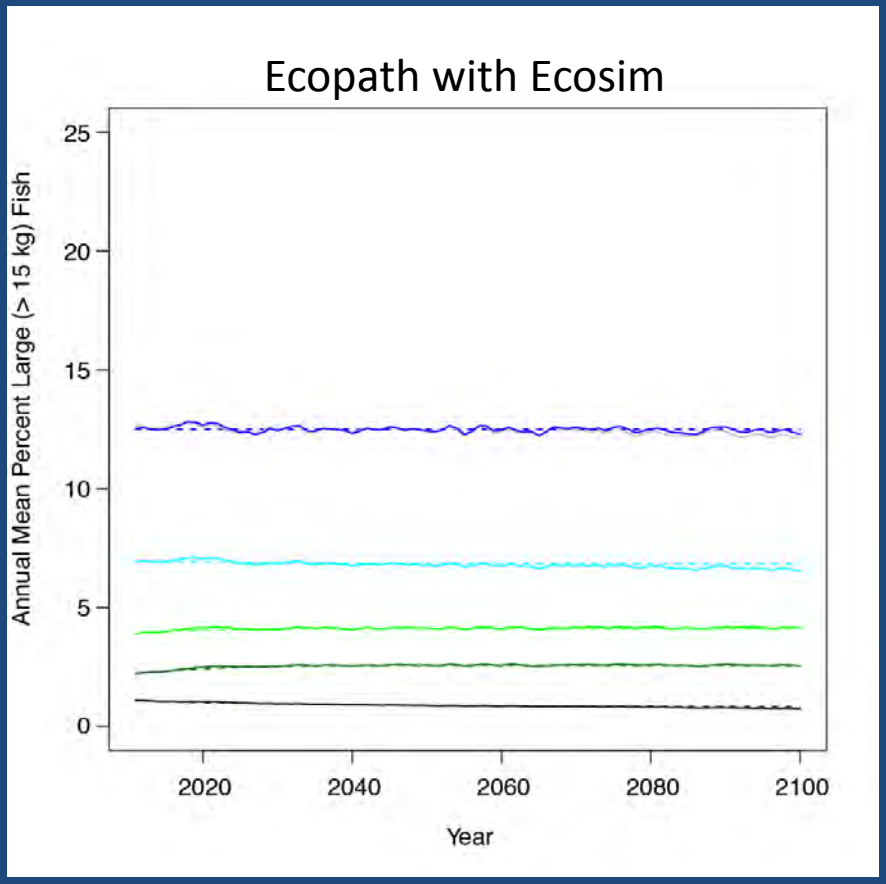
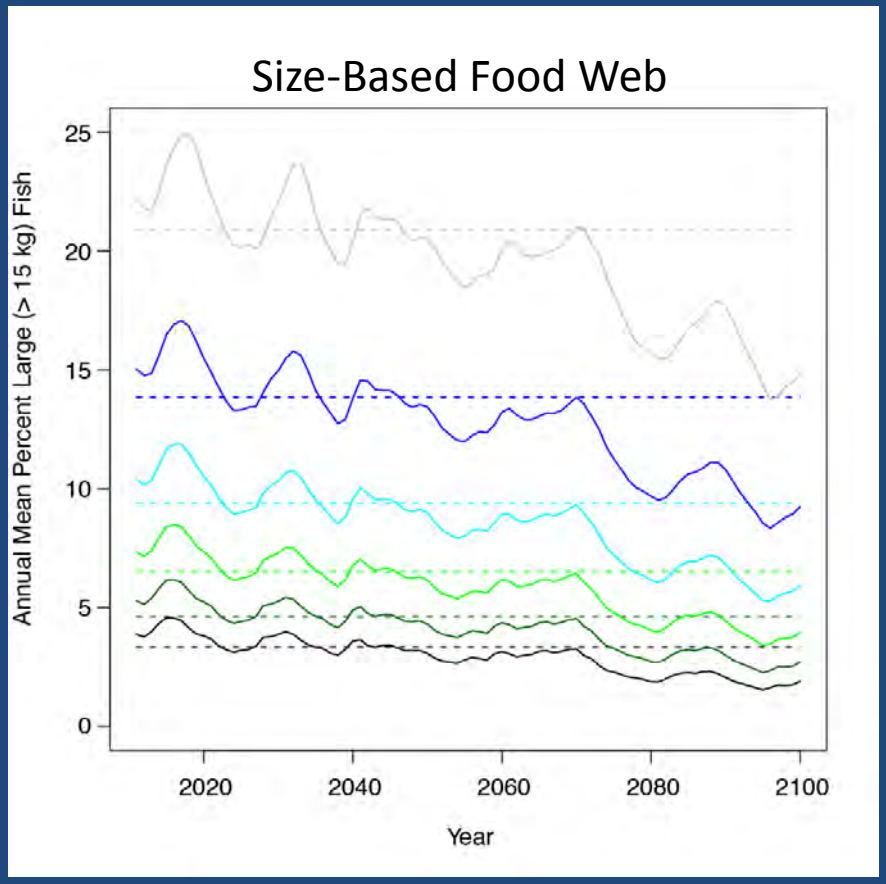




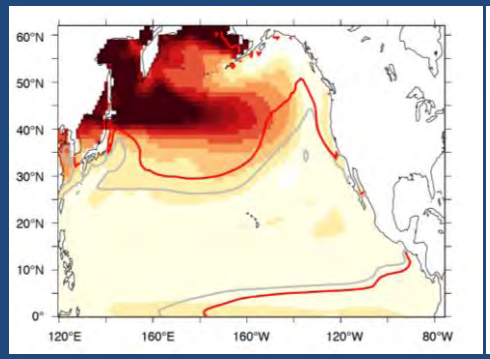
Fishing Mortality: 0 0.2 0.4 0.6 0.8 1.0

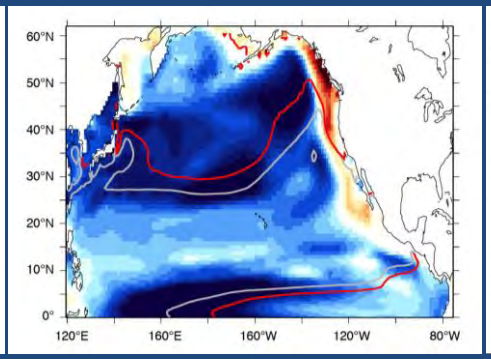
Next Steps

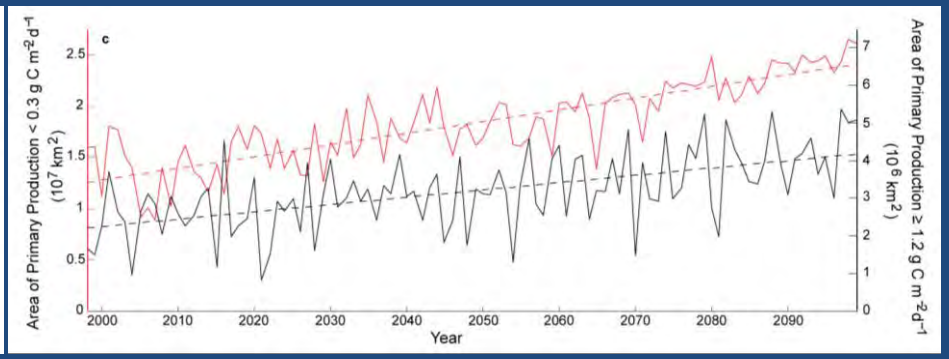
- Verification with empirical data




- Range of climate models from CMIP5







blogs.nicholas.duke.edu/hawaii, hahana.soest.hawaii.edu/hot, Polovina *et al*. 2011, Taylor *et al*. 2012, Woodworth-Jefcoats *et al*. 2013