

Does forage fish abundance affect predator productivity?

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Yes, predators depend on forage fish

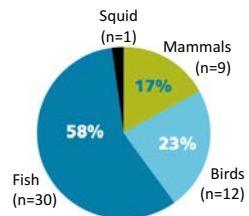


Forage fish link the energy produced by plankton to large bodied fishes, birds, and mammals and play a critical role in marine food webs.

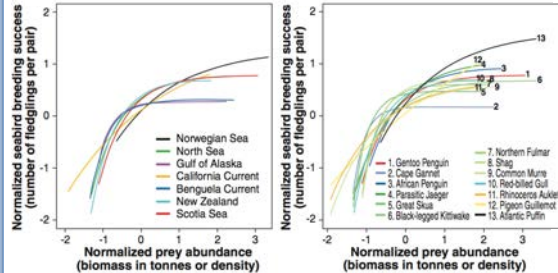
Fisheries of forage fish are among the largest in the world and demand for products derived from forage fish is increasing.

Some scientists have argued for precautionary management to protect forage fish and allow for predators to remain abundant and productive.

Fish, birds, and mammals rely on forage fish for >75% of their diet (Pikitch et al. 2012)



Seabird breeding success increases with prey abundance across 7 ecosystems and 14 species (Cury et al. 2011)

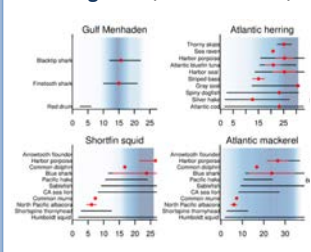


No, predators follow and switch prey easily

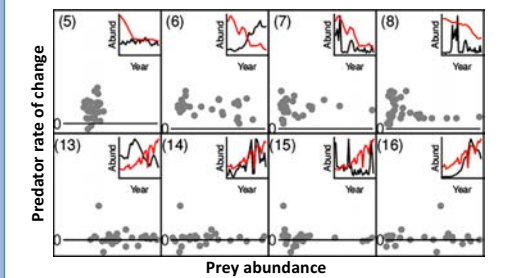
Other scientists have argued that there is no evidence that predator productivity depends on forage fish biomass and have offered the following explanations:

1. Forage fish population size is highly variable
2. Predators and fishermen are not always competing
3. Predators are flexible and can prey switch and move

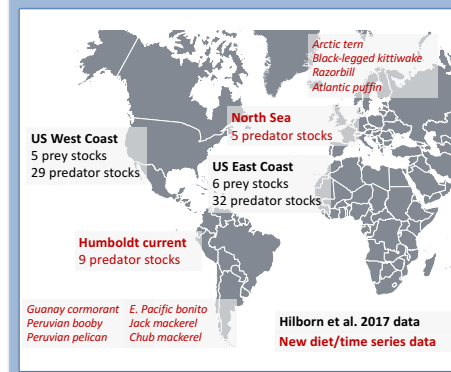
Predators and fishermen are not always competing for the same size forage fish (Hilborn et al. 2017)



Only 5 of 51 stocks show a positive relationship between prey biomass and predator production (Hilborn et al. 2017)

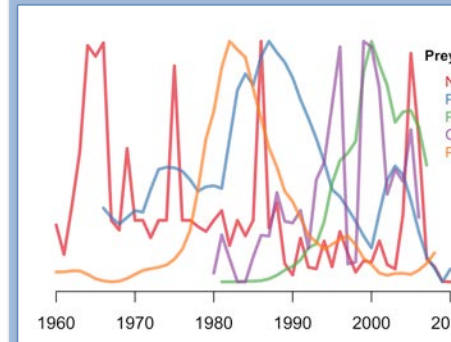


Our approach



Step 1. Collect predator/prey time series and predator diet composition data

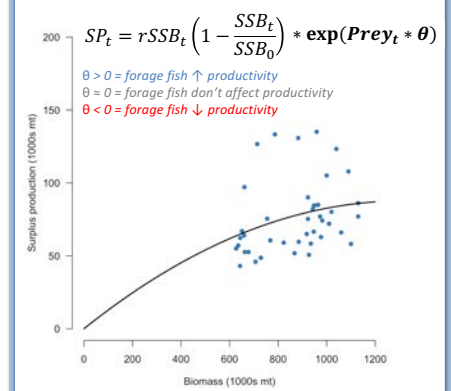
The analysis workflow described below uses the North Pacific albacore tuna stock as an example.



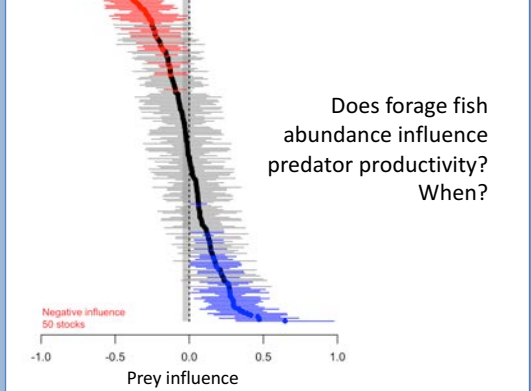
Step 2. Link predator and prey time series

- Option #1: Abundance of primary prey (e.g. Northern anchovy)
- Option #2: Weighted abundance of all contributing prey (e.g. five species index)

Step 3. Fit surplus production models with link to prey biomass



Example results



Does forage fish abundance influence predator productivity? When?