Evaluating harvest strategies for forage fish

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SAFS SCHOOL OF AQUATIC and FISHERY SCIENCES


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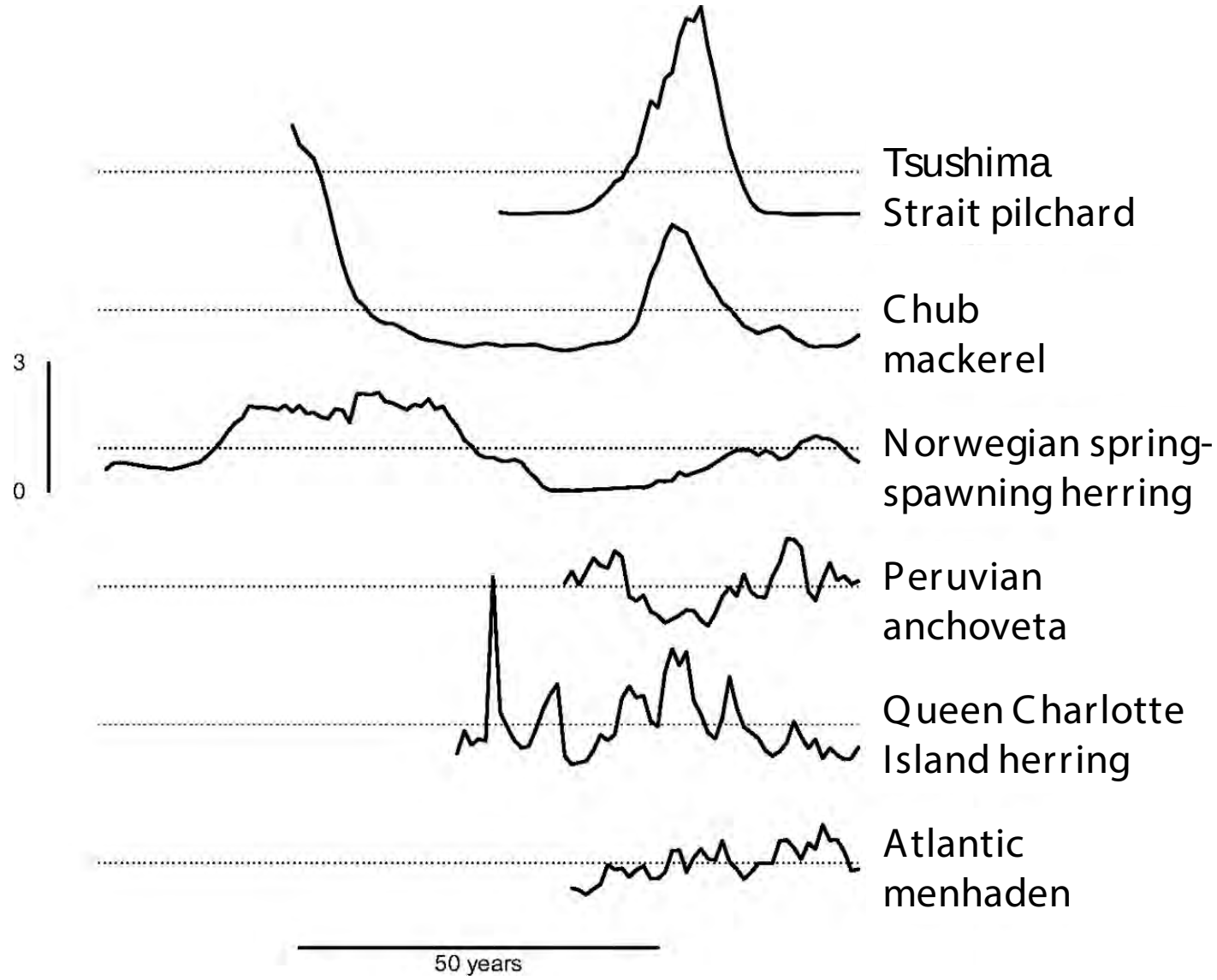
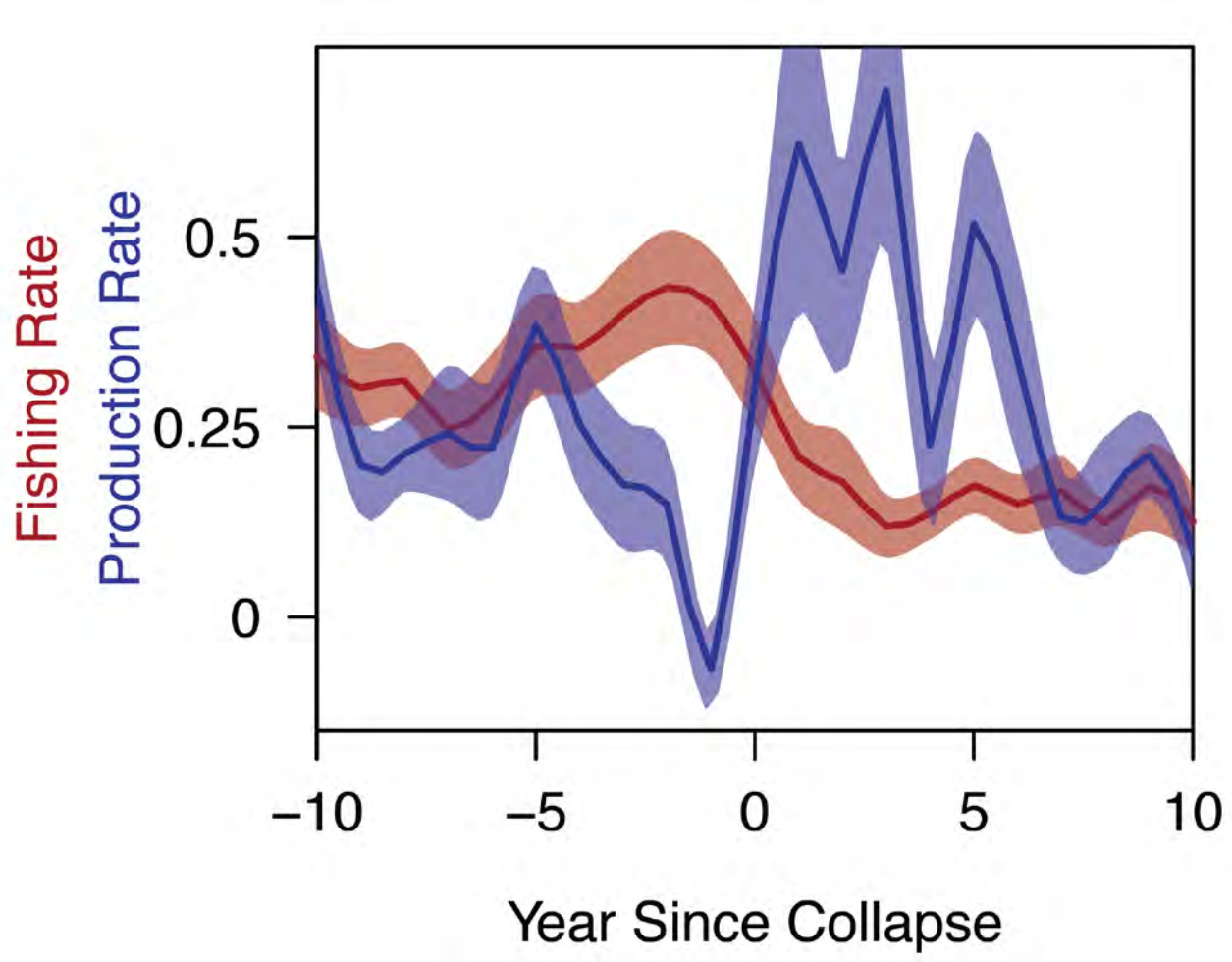
Ian McAllister



Timothy E. Essington et al. PNAS 2015;112:6648-6652

Fishing intensifies population collapses



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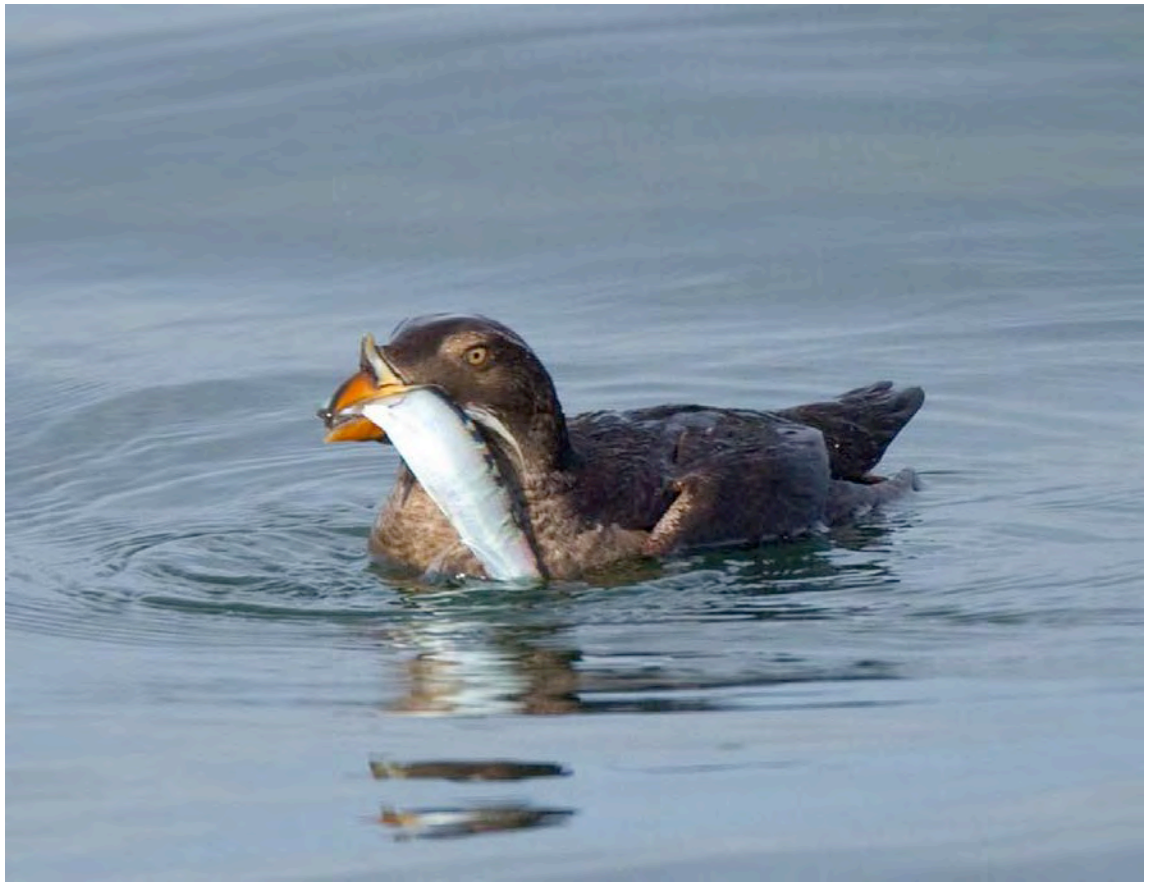


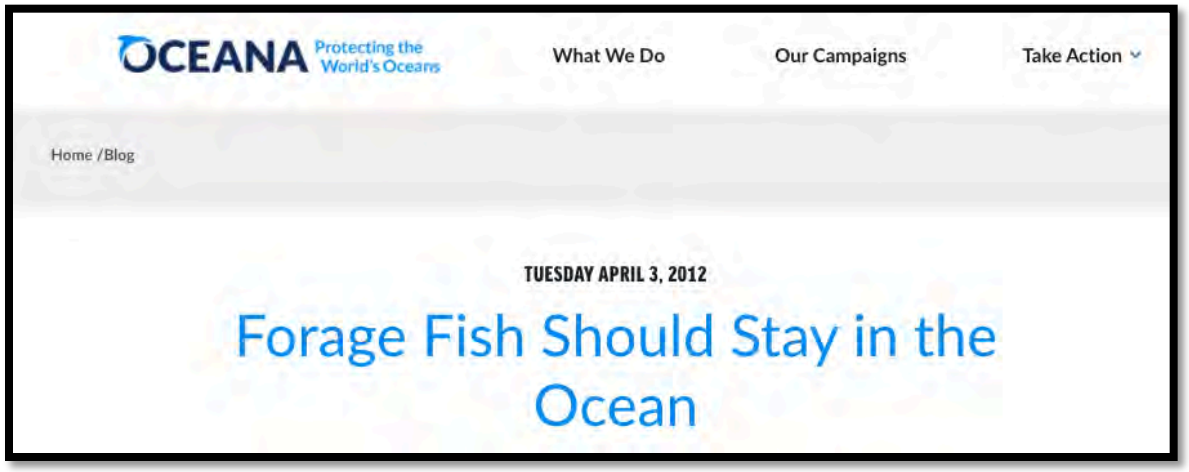
Suggested strategies for forage fish management

COMMENTARY

Stop-loss order for forage fish fisheries

Ellen K. Pikitch[1]
Institute for Ocean Conservation Science, School of Marine and Atmospheric Sciences, Stony Brook University, Stony Brook, NY 11794-5000

proposed as a component of fishery management guidance (2, 6, 7), they have not as yet been widely adopted.



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TUESDAY APRIL 3, 2012

Forage Fish Should Stay in the Ocean

2014 timelines: El Nino hitting Peruvian anchovy, fishmeal supply

December 18, 2014, 1:58 pm

Alicia Villegas

Motivating question:

How well do different harvest strategies perform for forage fish?

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“Success” depends on who is asking

- High long-term mean biomass
- Low variation in biomass
- Many years when biomass is above a certain threshold

- High long-term mean catch
- Low variation in catches
- Low number of closures
- Low number of years with zero catch

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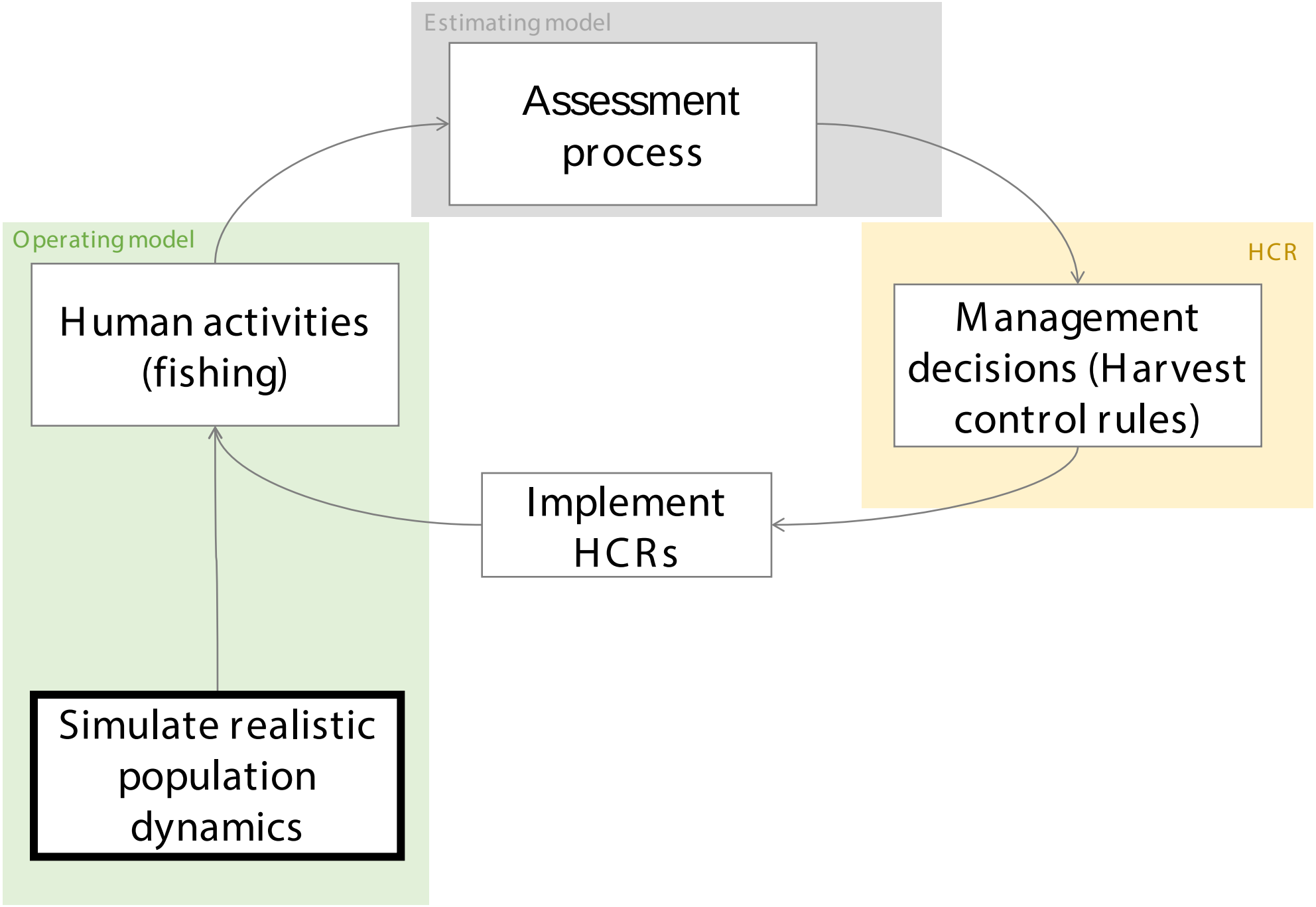
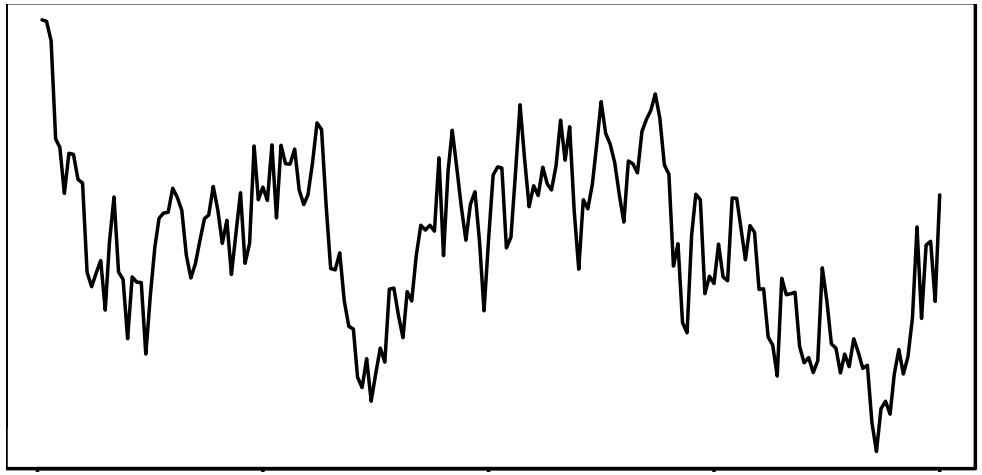

Estimating model
Assessment process
Operating model
HCR
Human activities (fishing)
Management decisions (Harvest control rules)
Implement HCRs
Simulate realistic population dynamics

“Sardine-like” forage fish

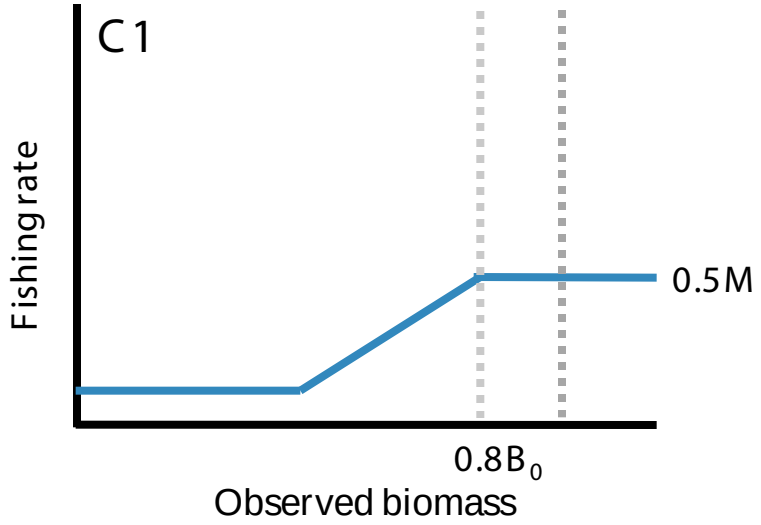
- Longer-lived
- Lower natural mortality
- Low-frequency variation in productivity

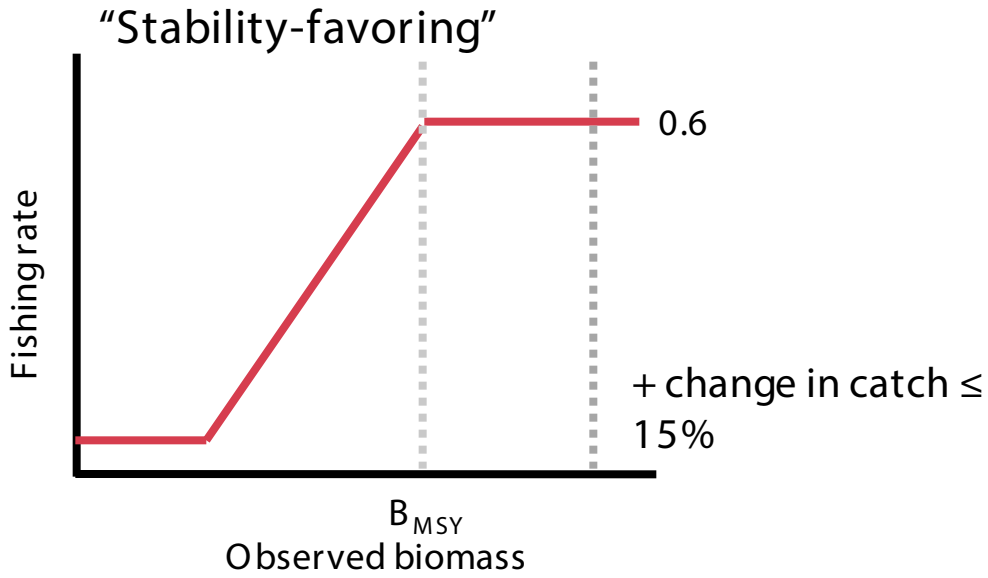


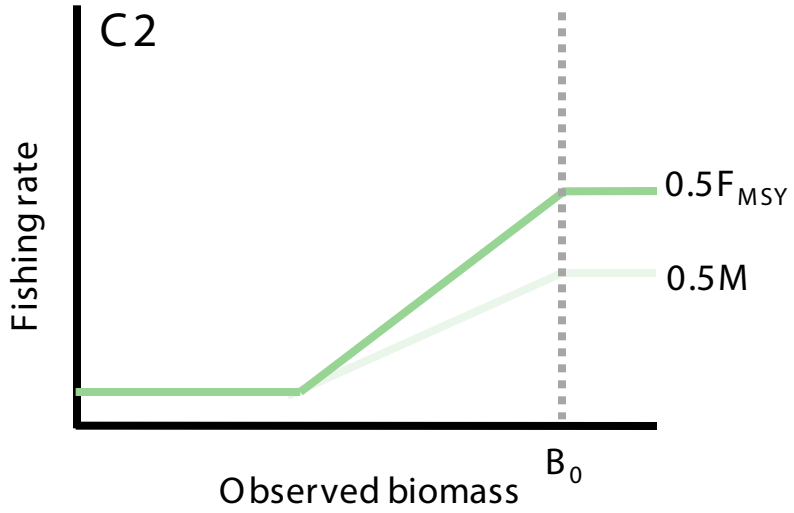
“Anchovy-like” forage fish

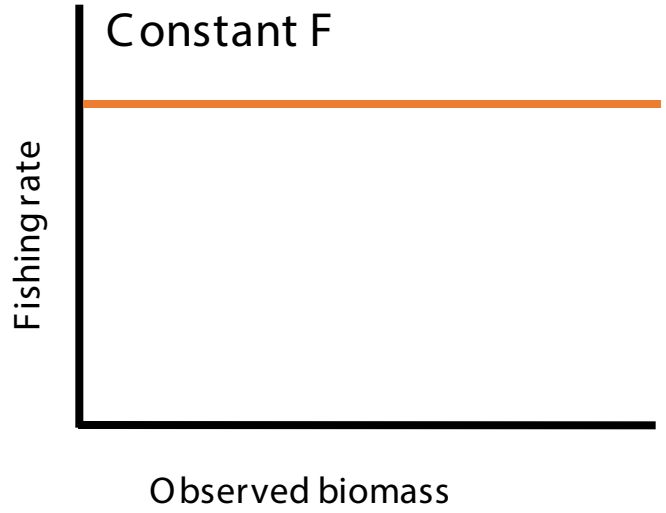
- Shorter-lived
- High M
- High-amplitude, high-frequency variation

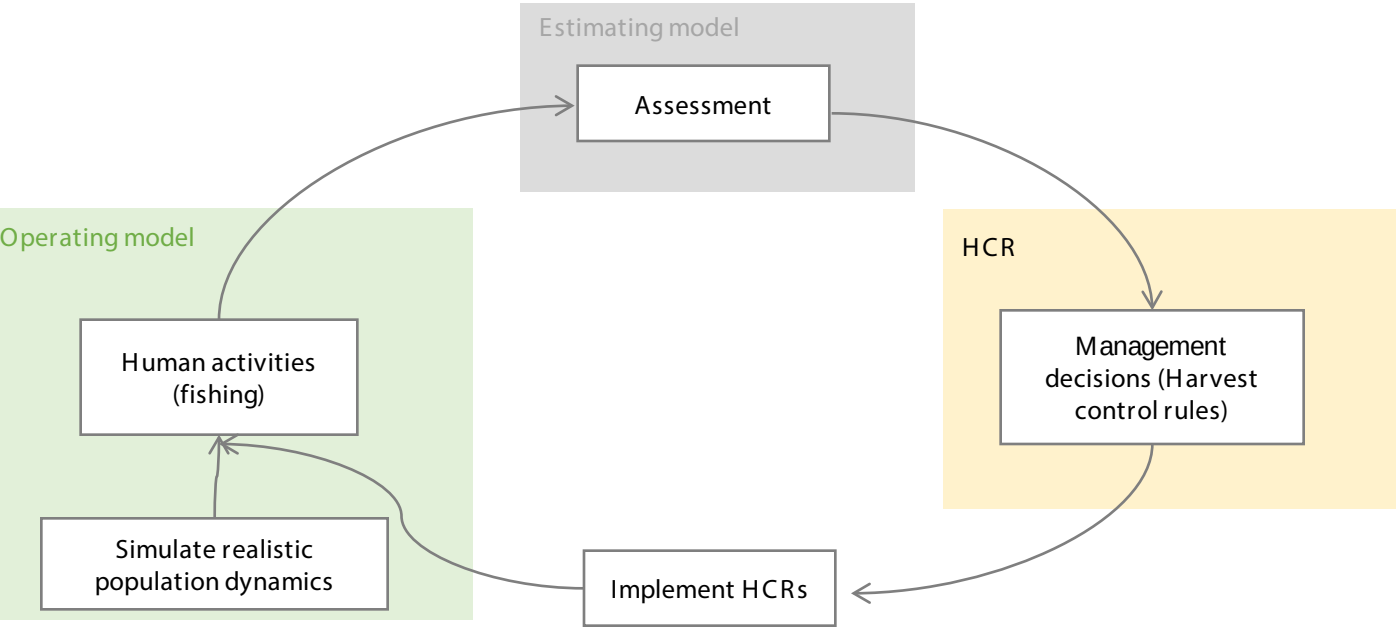
Harvest control rules







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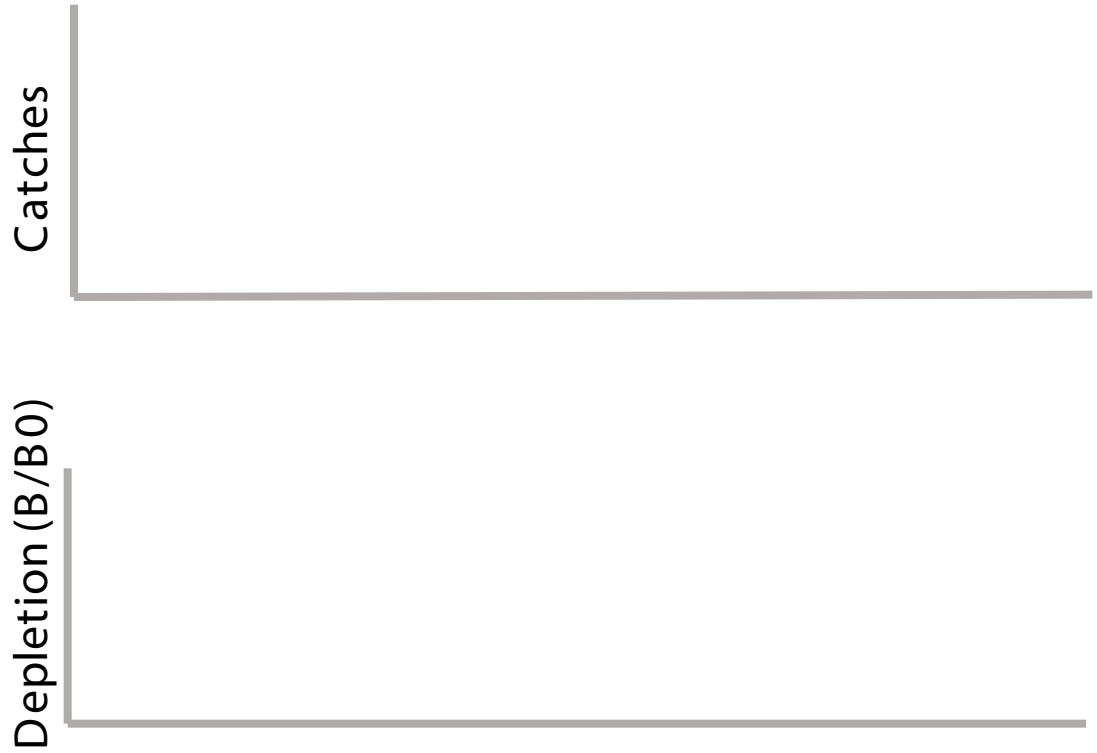
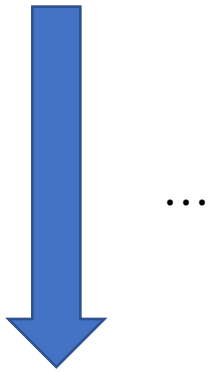

Catches
Depletion (B/B0)



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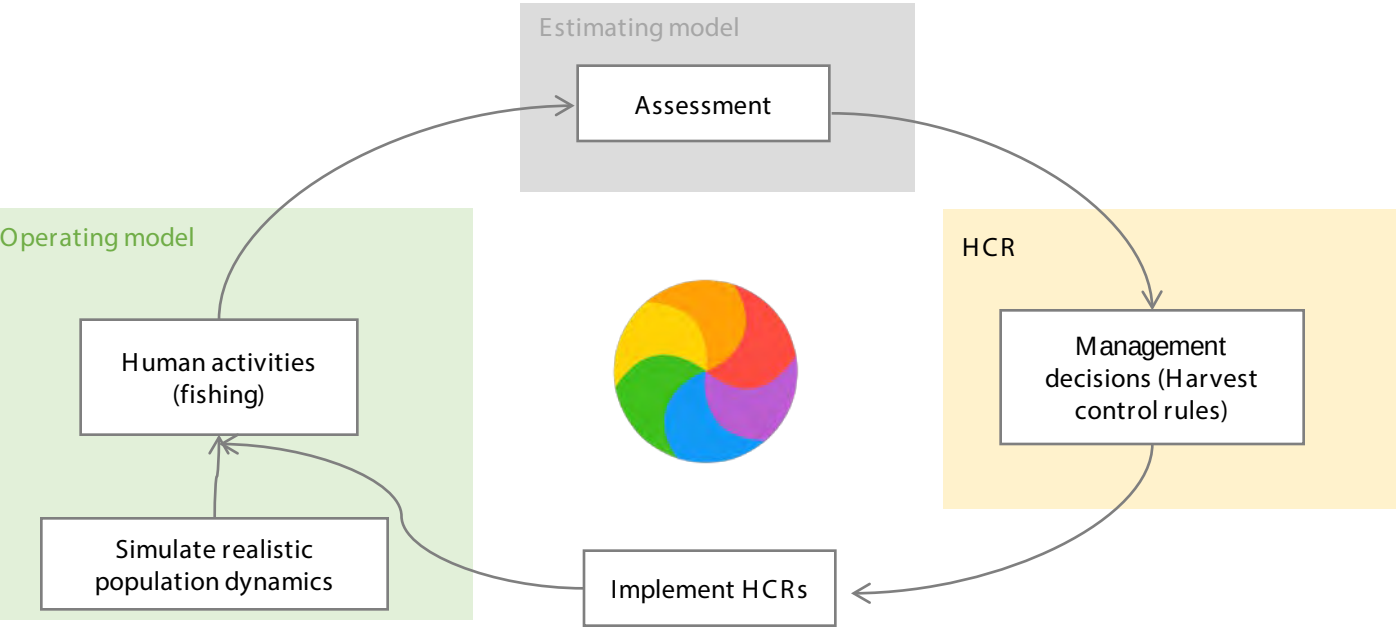
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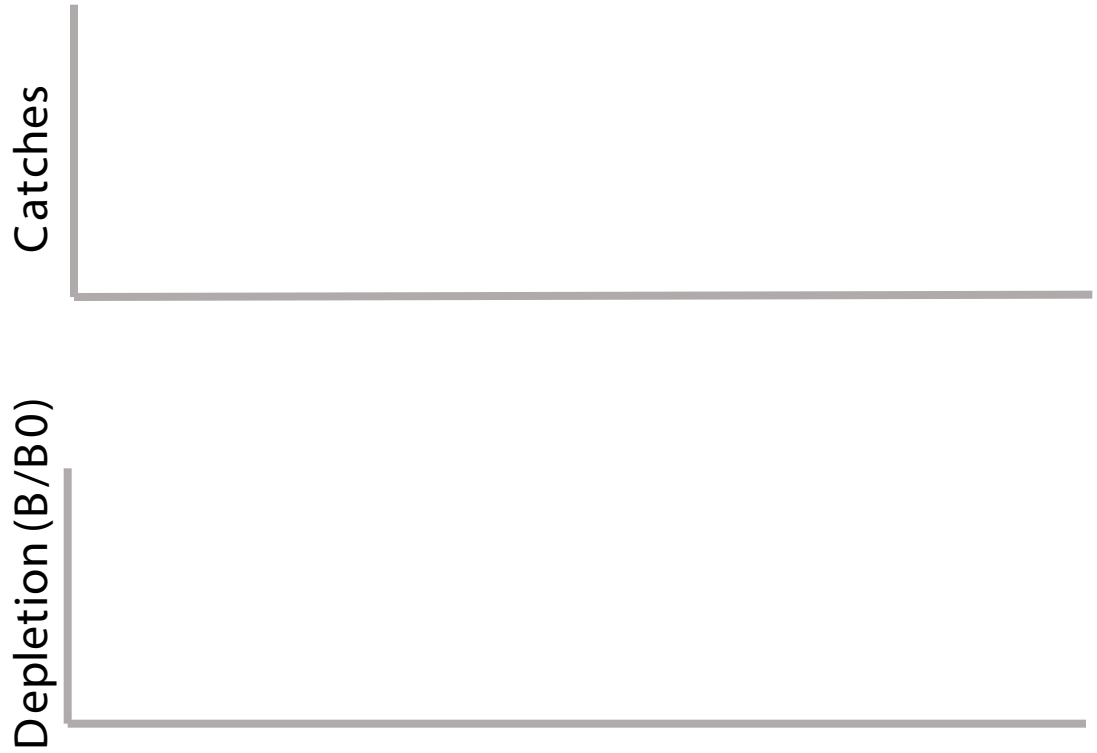
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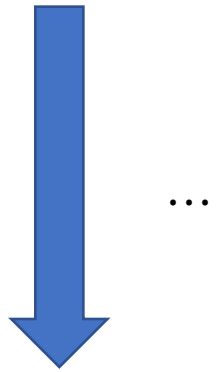

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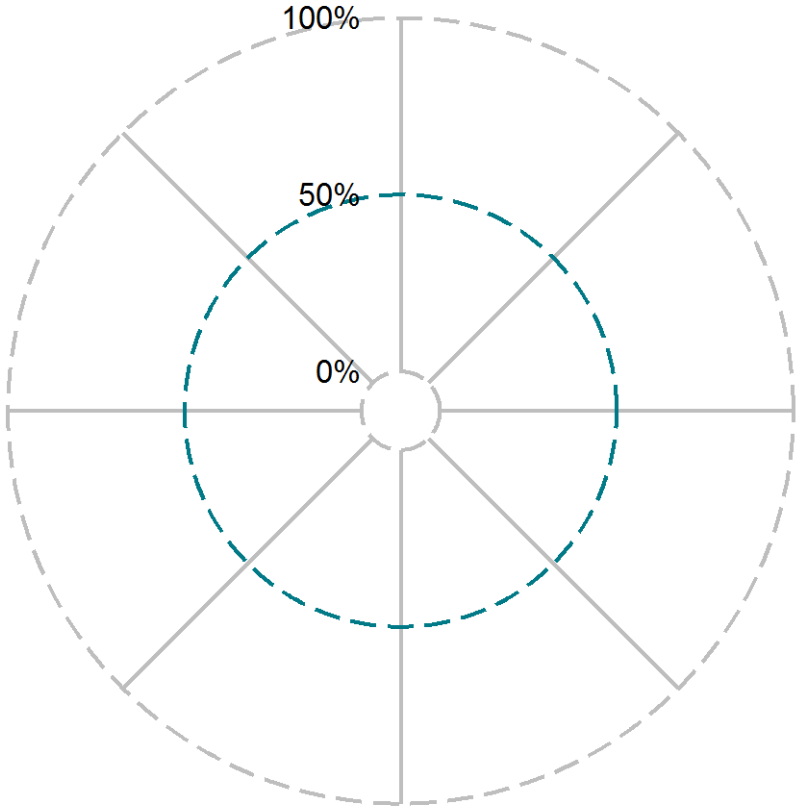

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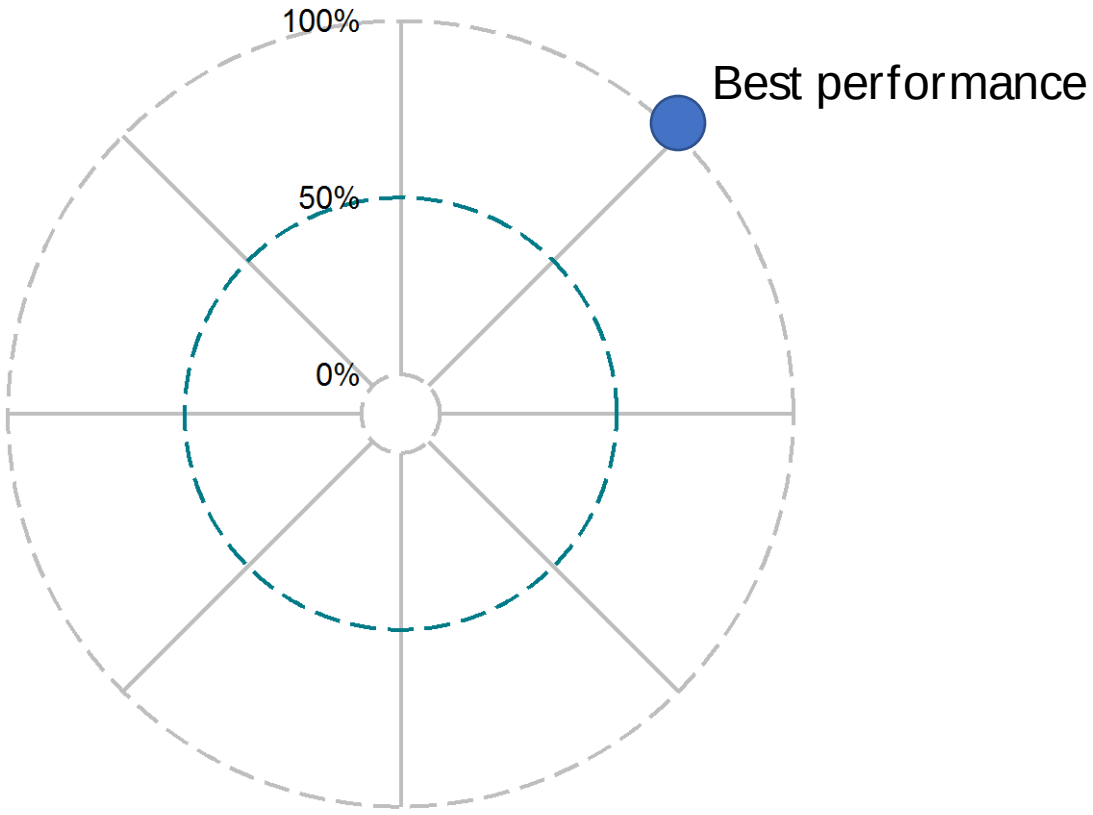

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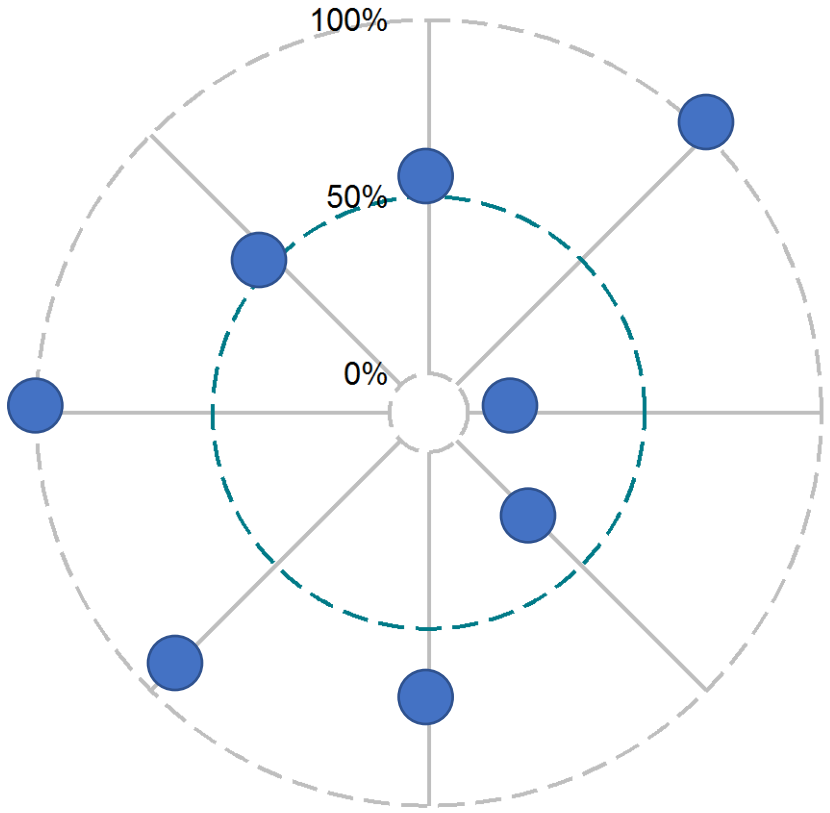
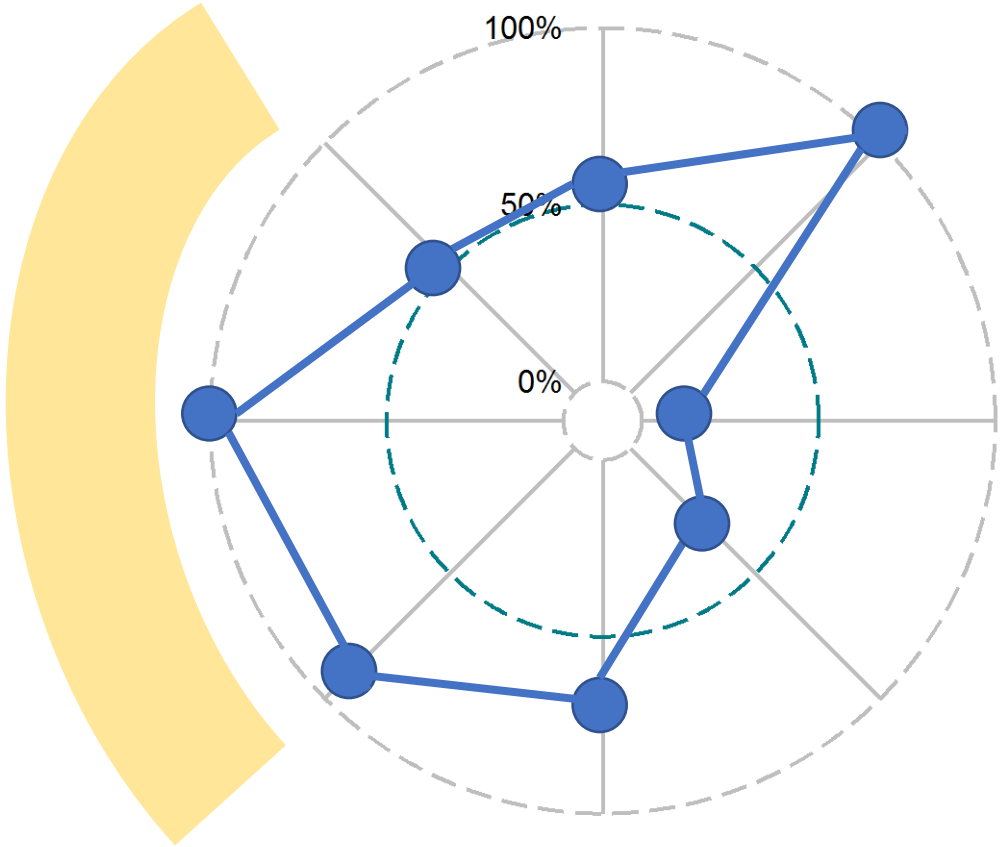
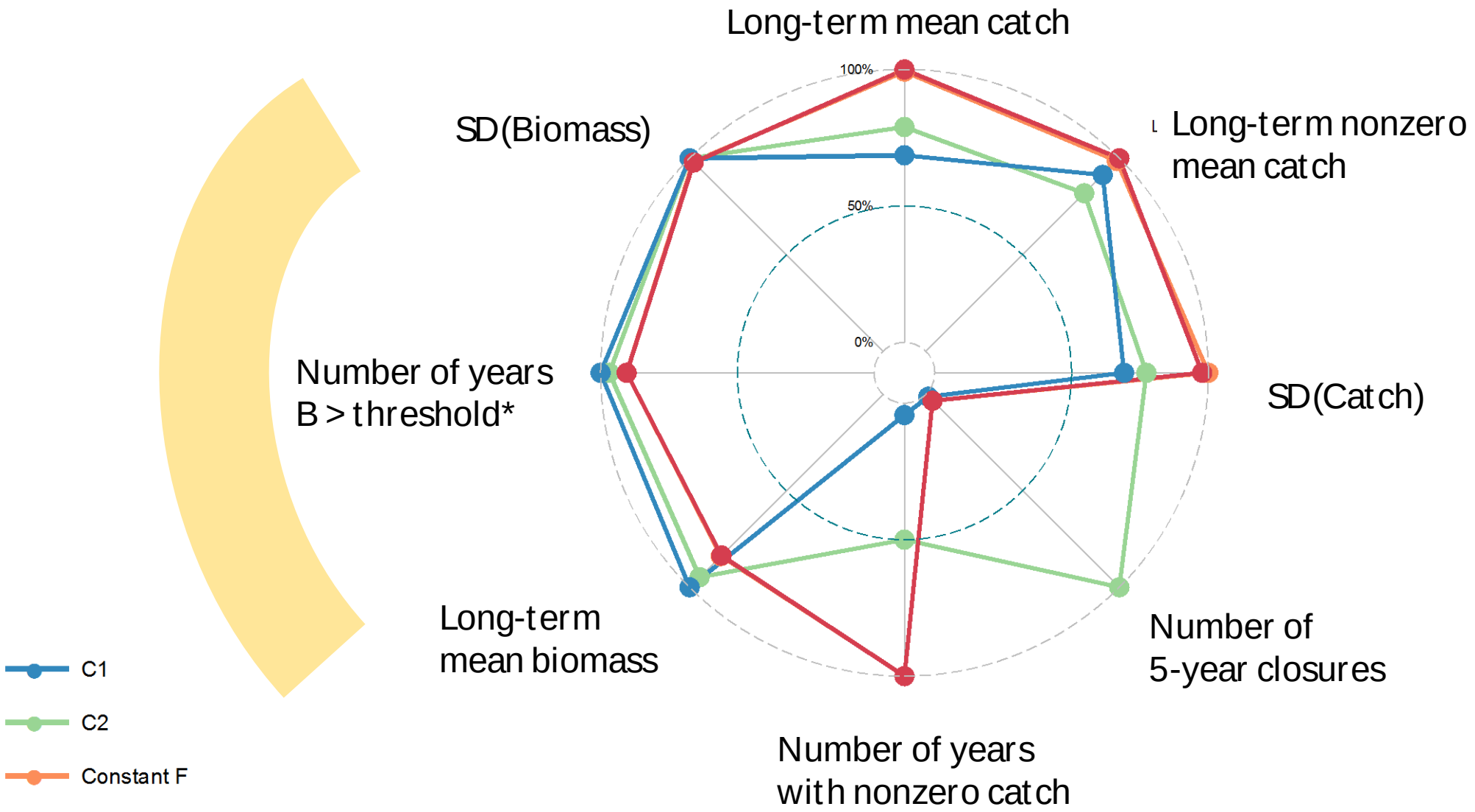


Which harvest strategies perform the best?

Ecological performance metrics

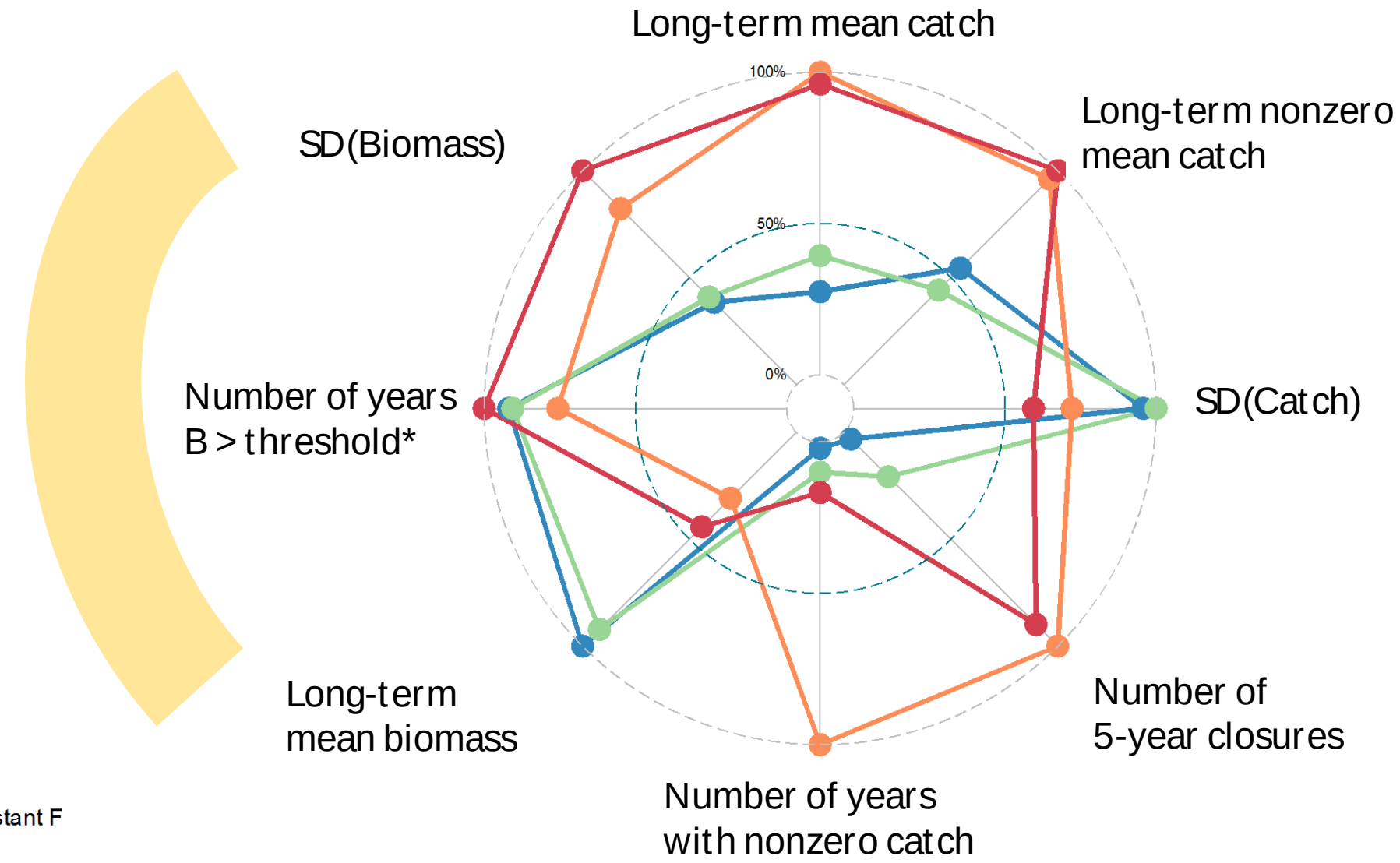


Anchovy-like forage fish



* 75% of long-term mean biomass

Sardine-like forage fish



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1. What constitutes "good" performance?

   Performance measures reflect the priorities of the stakeholders –
   But perhaps we can find harvest rules that fulfill multiple objectives

2. Which harvest strategies perform the best?

   "Conservation-based" control rules are generally better for ecosystem objectives but can also do well on industry-based metrics (e.g., SD of catches)
   What works well for one life history type probably won't work for another!

3. Are there inherent tradeoffs between performance measures?

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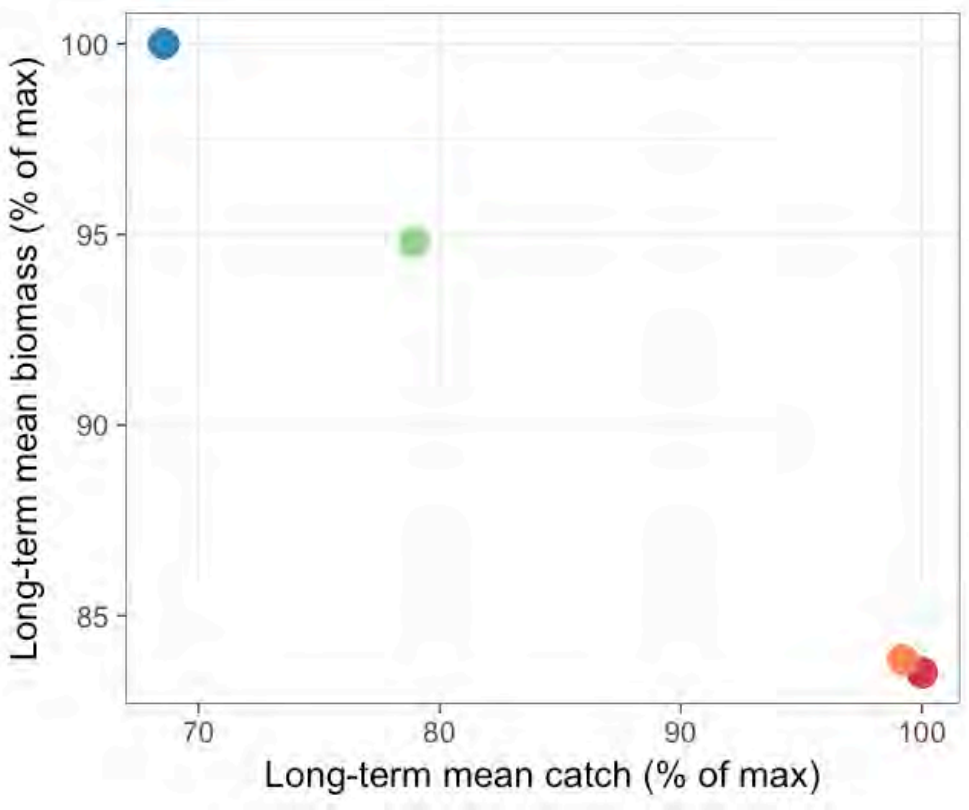
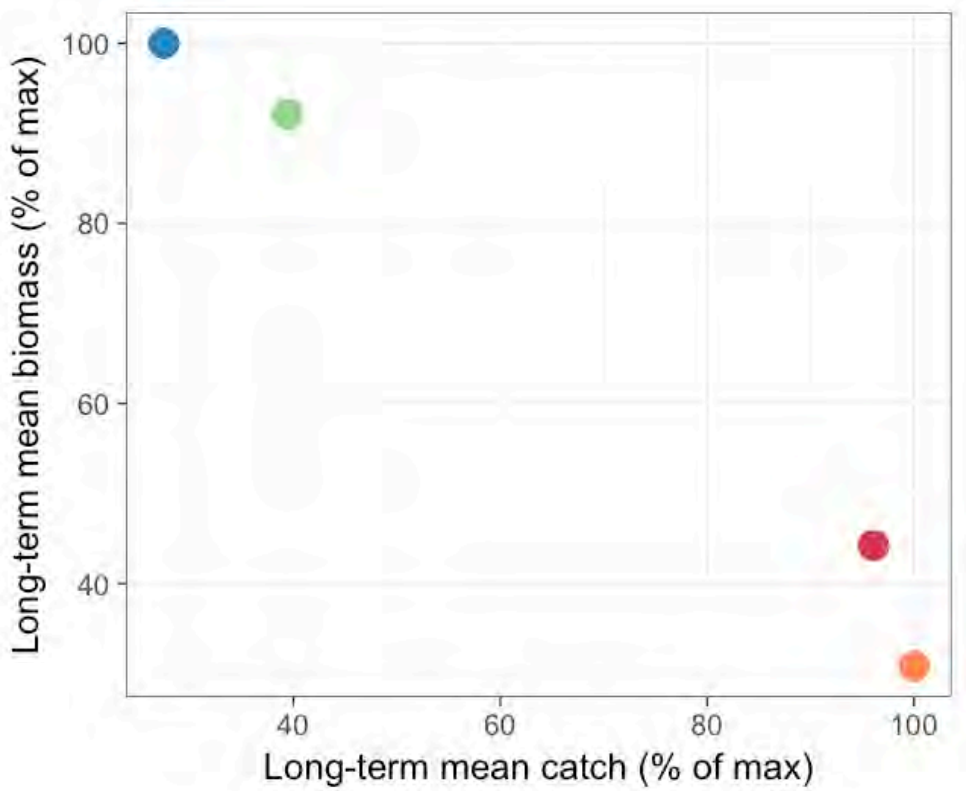
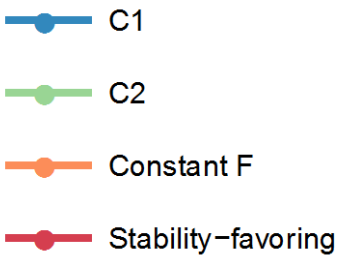


Sardine-like





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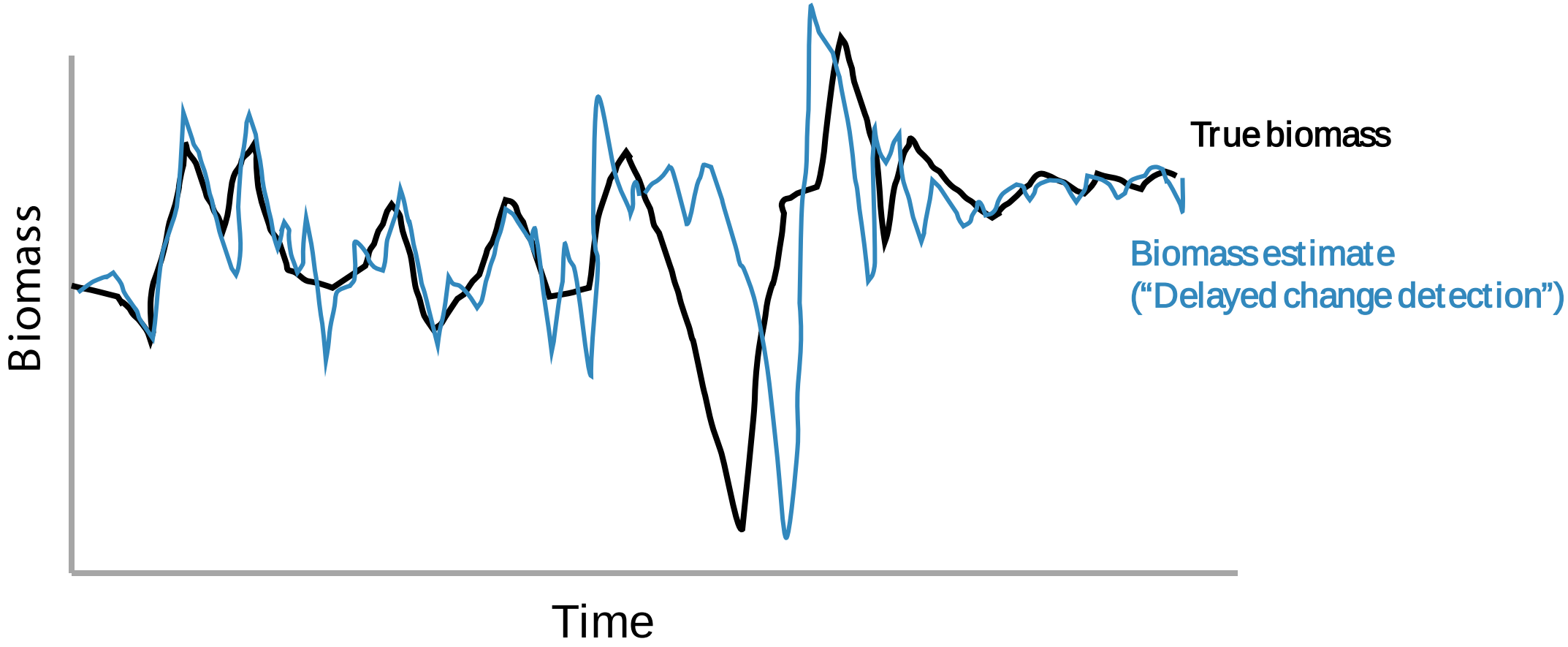
A unique challenge: The difficulty of detecting collapses



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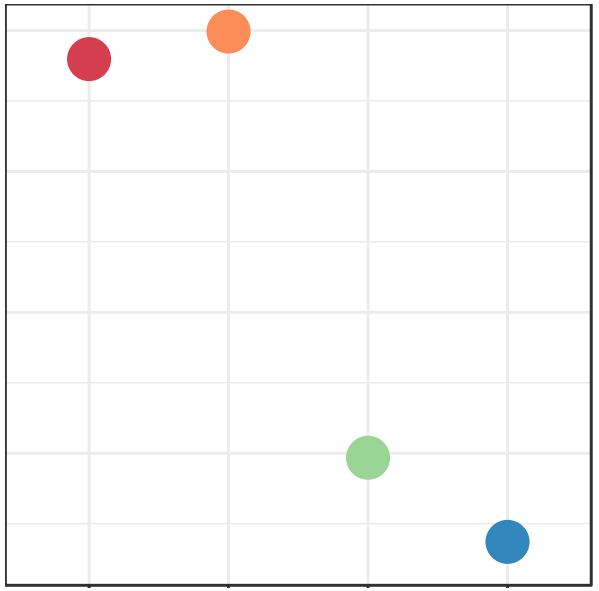

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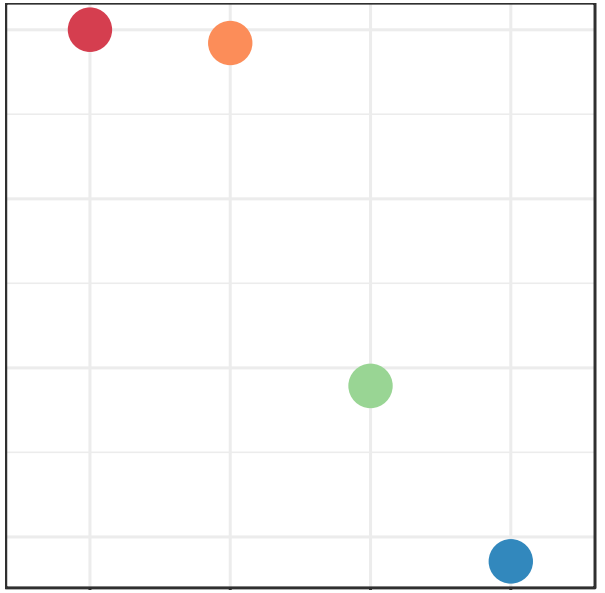

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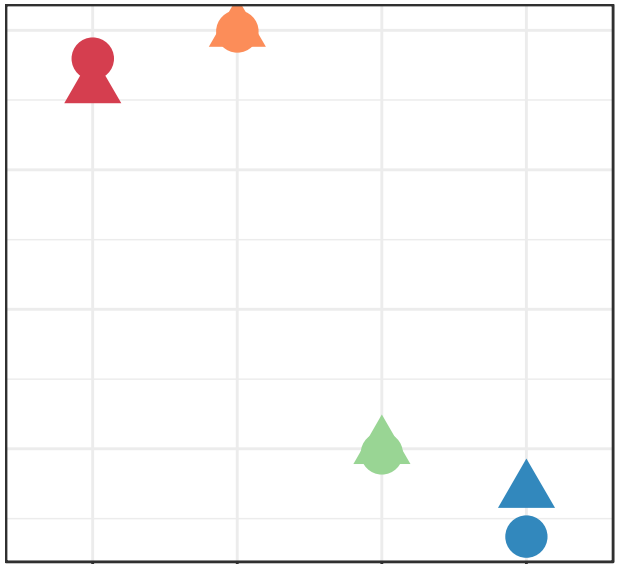

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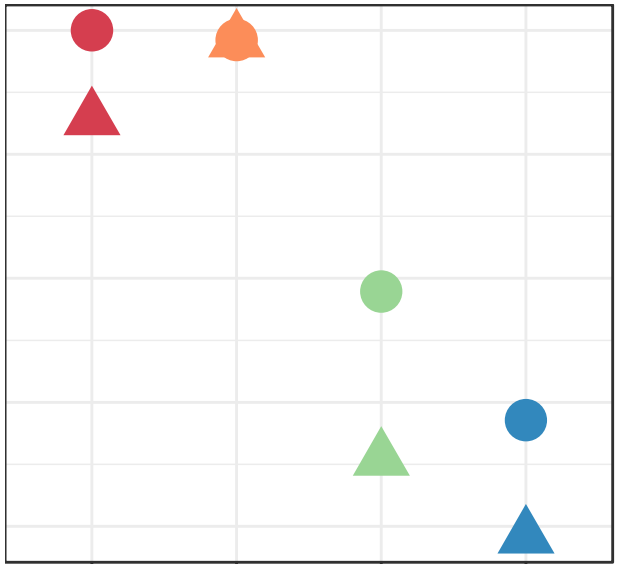

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3. Are there inherent tradeoffs between performance measures?

   So far, yes.
   But there might be strategies that work well for both!

4. How does performance depend on our ability to detect changes?

   Performance depends on ability of surveys to catch large swings in productivity

Next steps

1. Control rule performance sensitive to h, M, and error type
2. Test sensitivity to changing reference points (e.g., B_0)
3. Include some special forage fish rules like trend-based control rules

Thank you

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