

**NOAA**  
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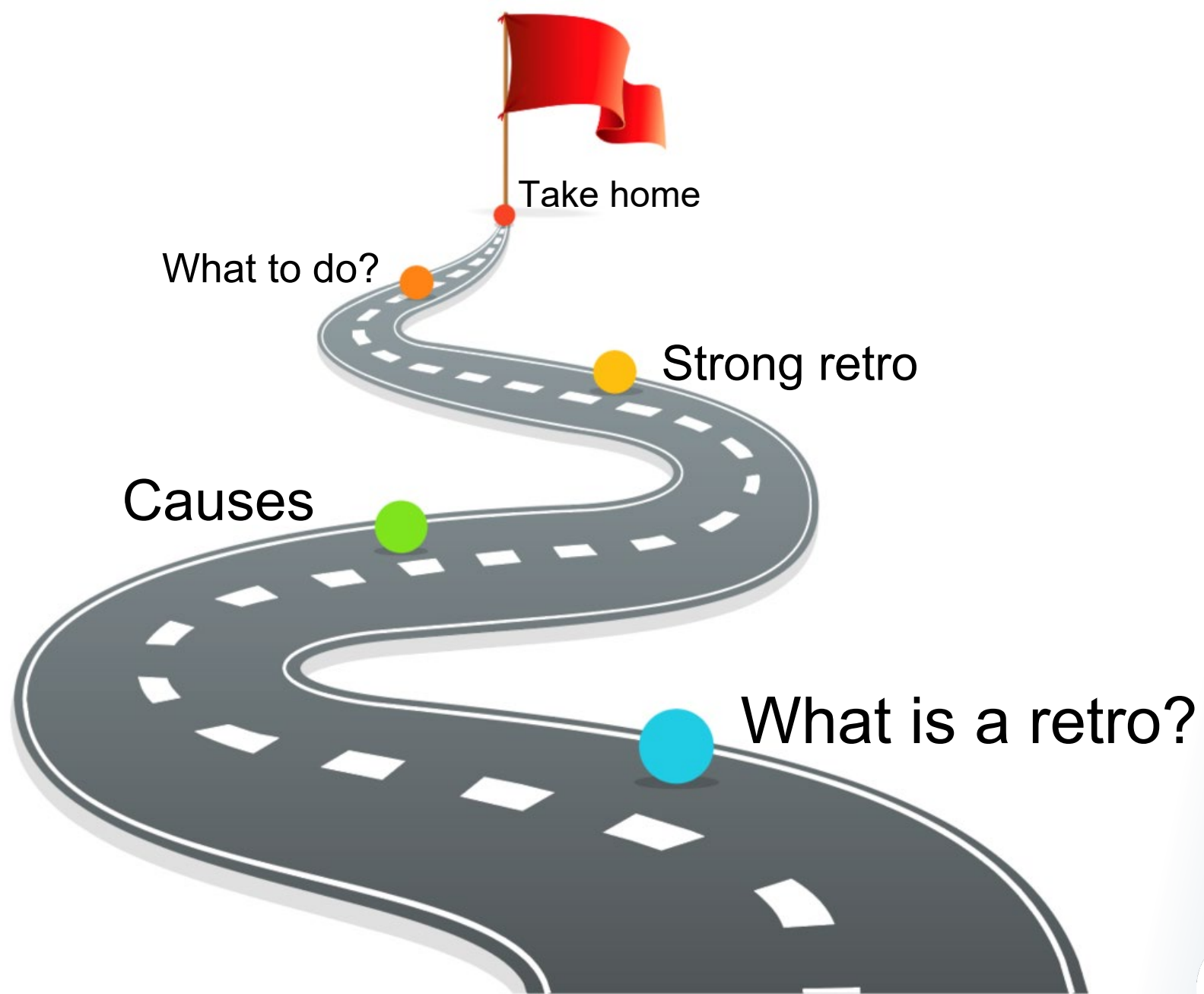
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# Retrospective Analysis as a Diagnostic

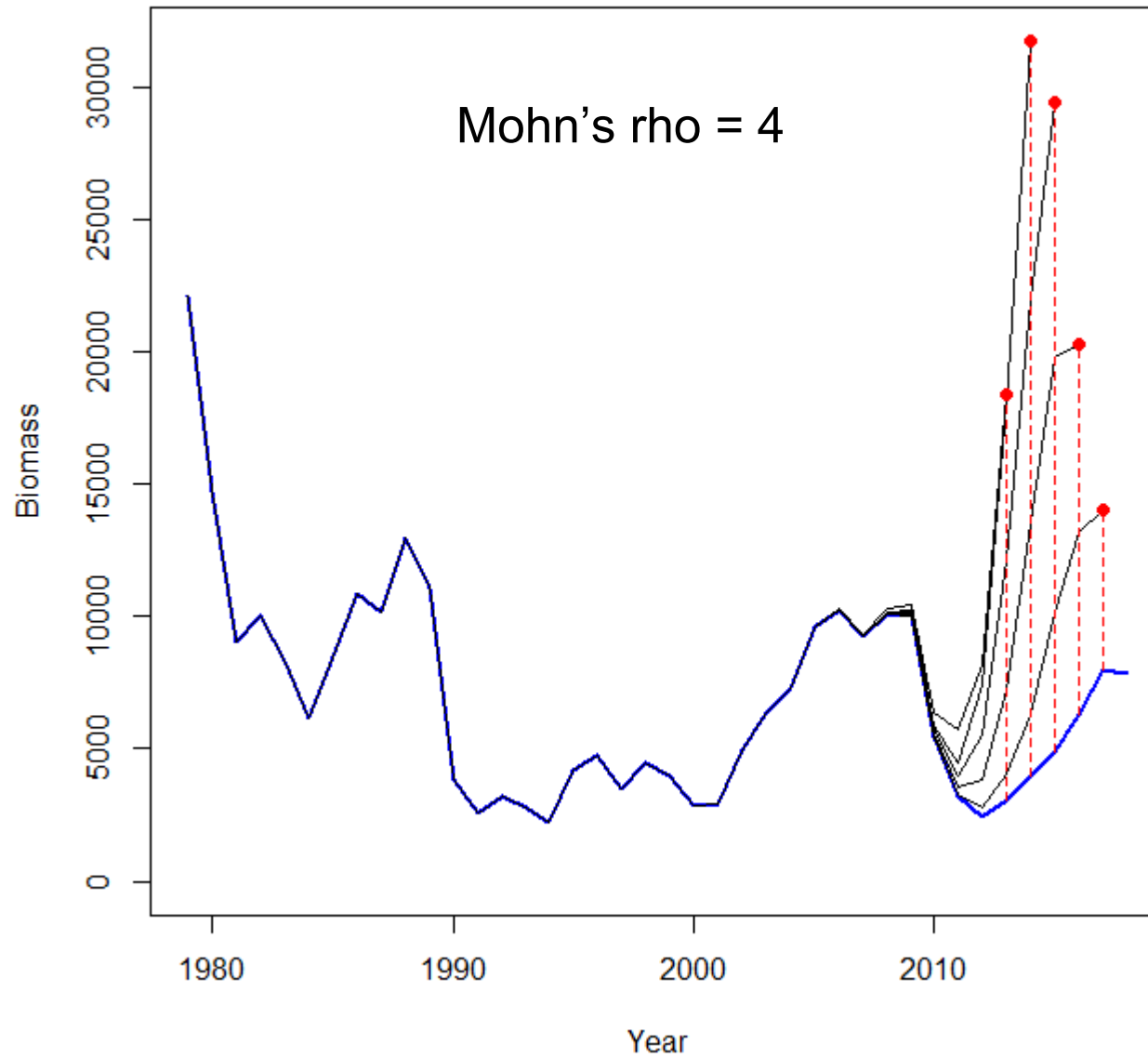
CAPAM/IATTC Workshop on Model Diagnostics in  
Integrated Stock Assessments

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Christopher M. Legault (NOAA Fisheries, NEFSC)

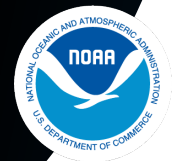


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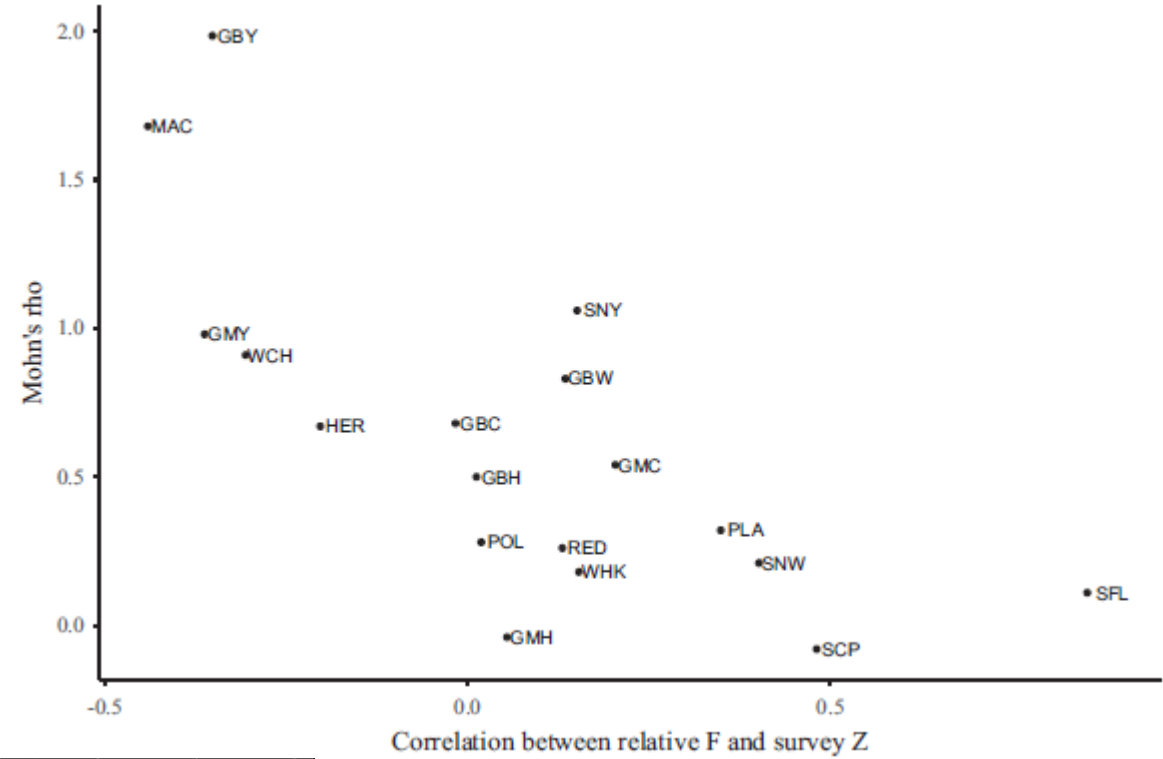
Bob Mohn  
1994-2021



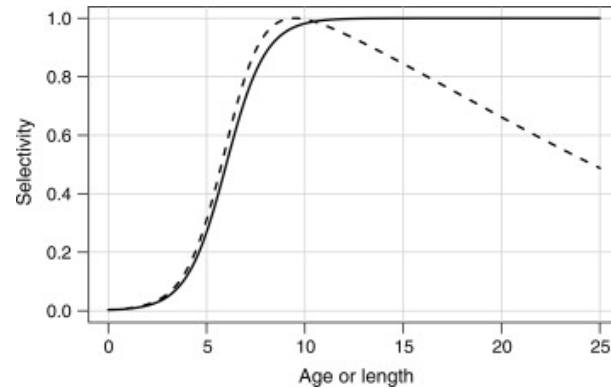
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# Causes?

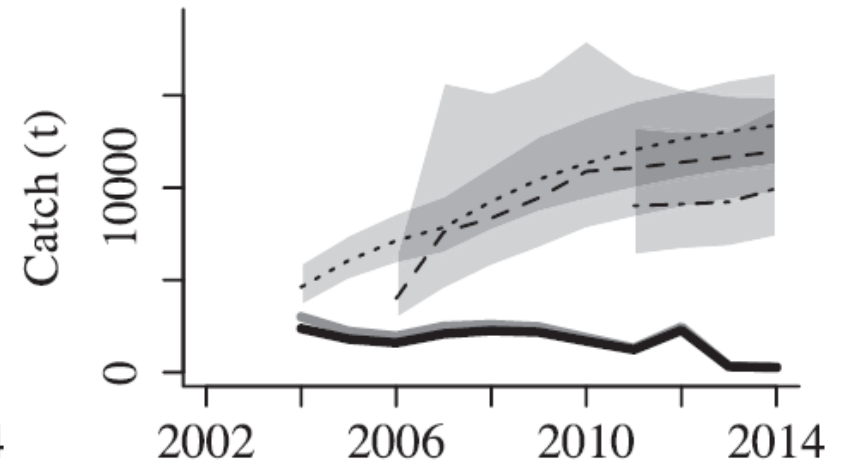
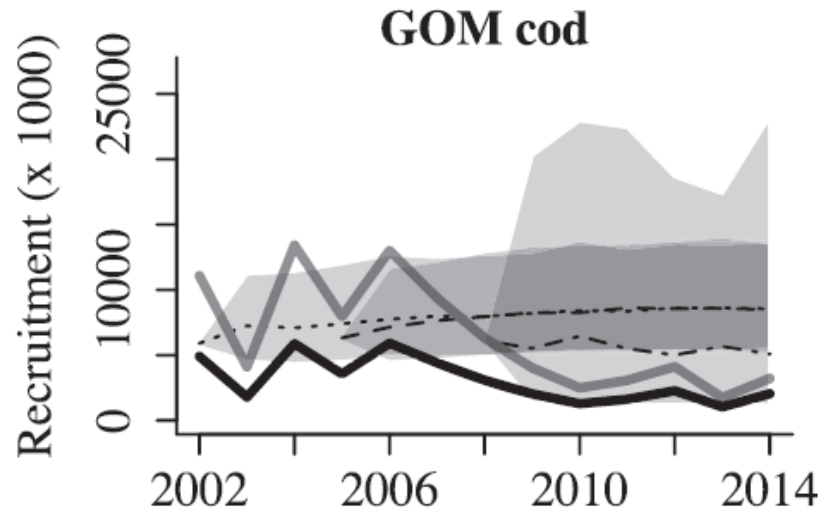
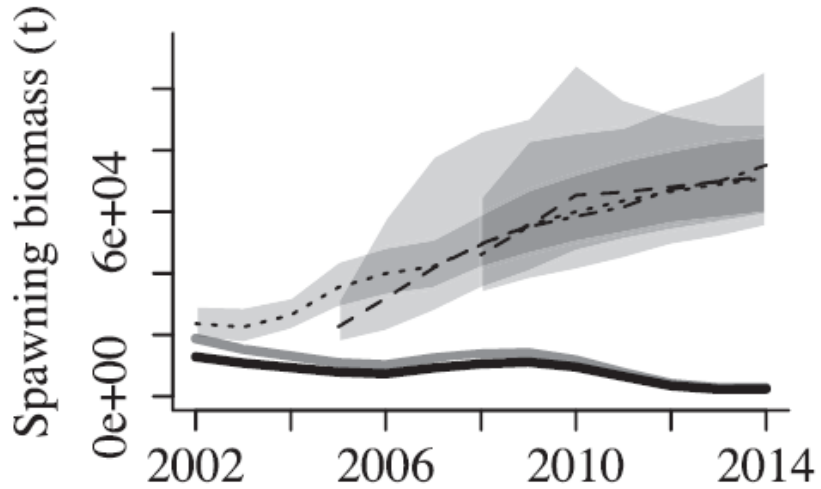


Wiedenmann and Legault (2022)



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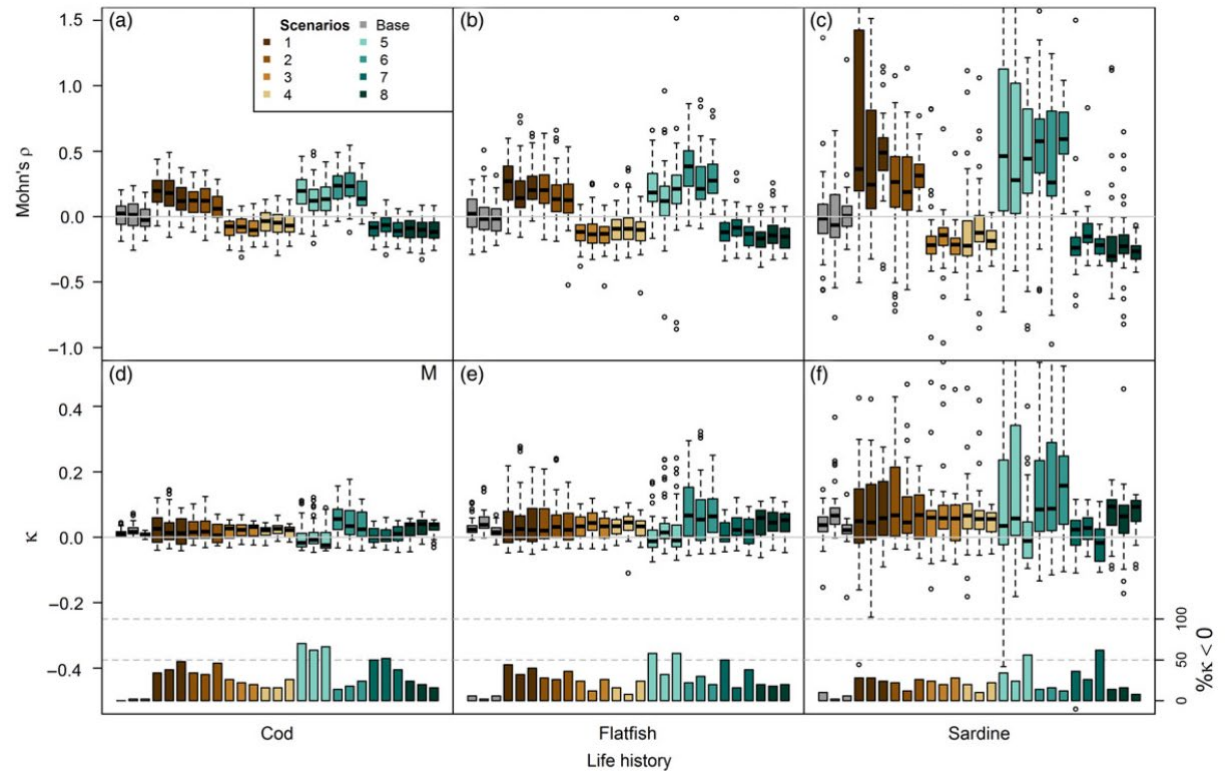
# So what?



Wiedenmann and Jensen (2018)

# Strong Retro I

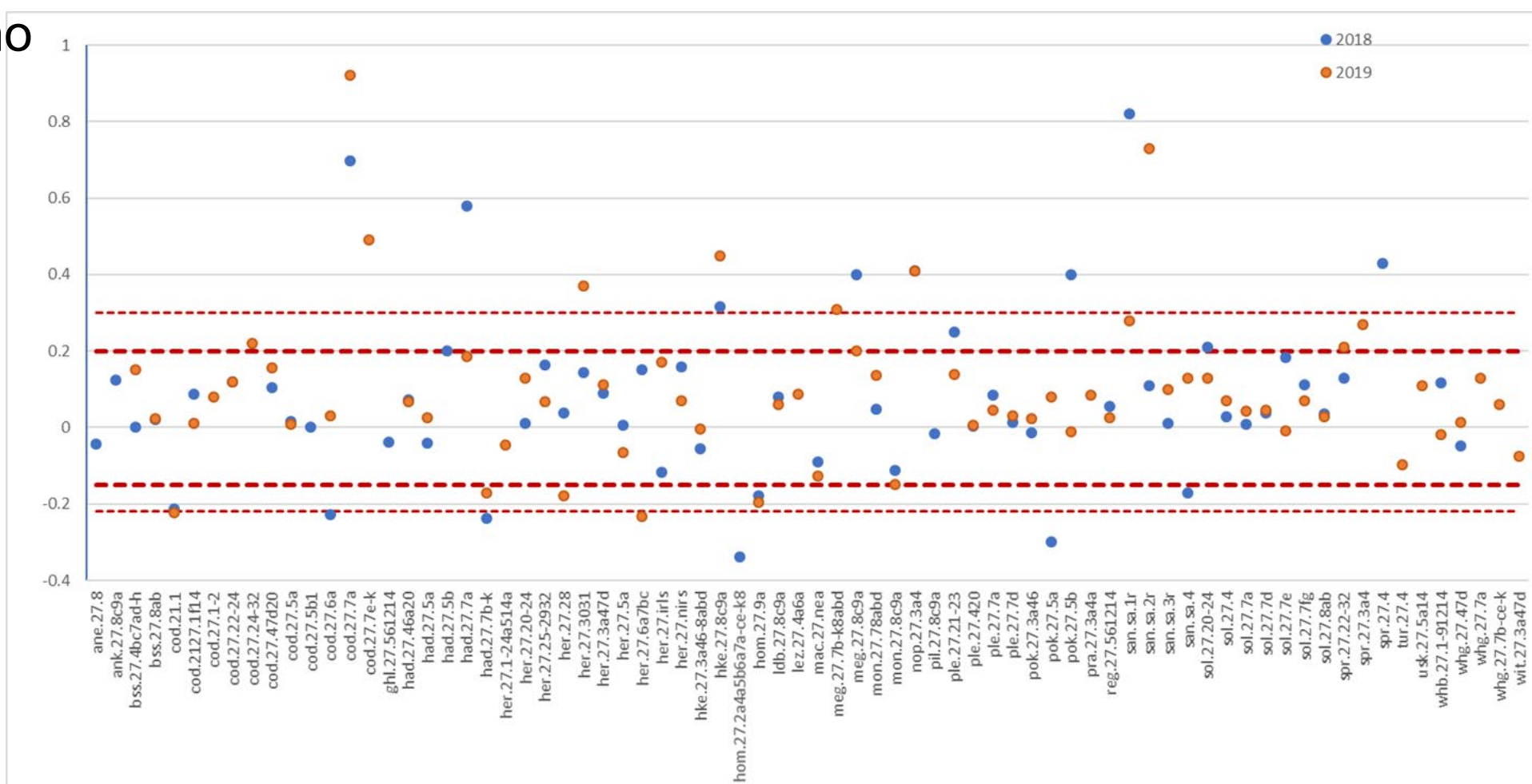
-0.15 to 0.20 long-lived  
-0.22 to 0.30 short-lived



Hurtado-Ferro et al. (2015)



# Mohn's rho



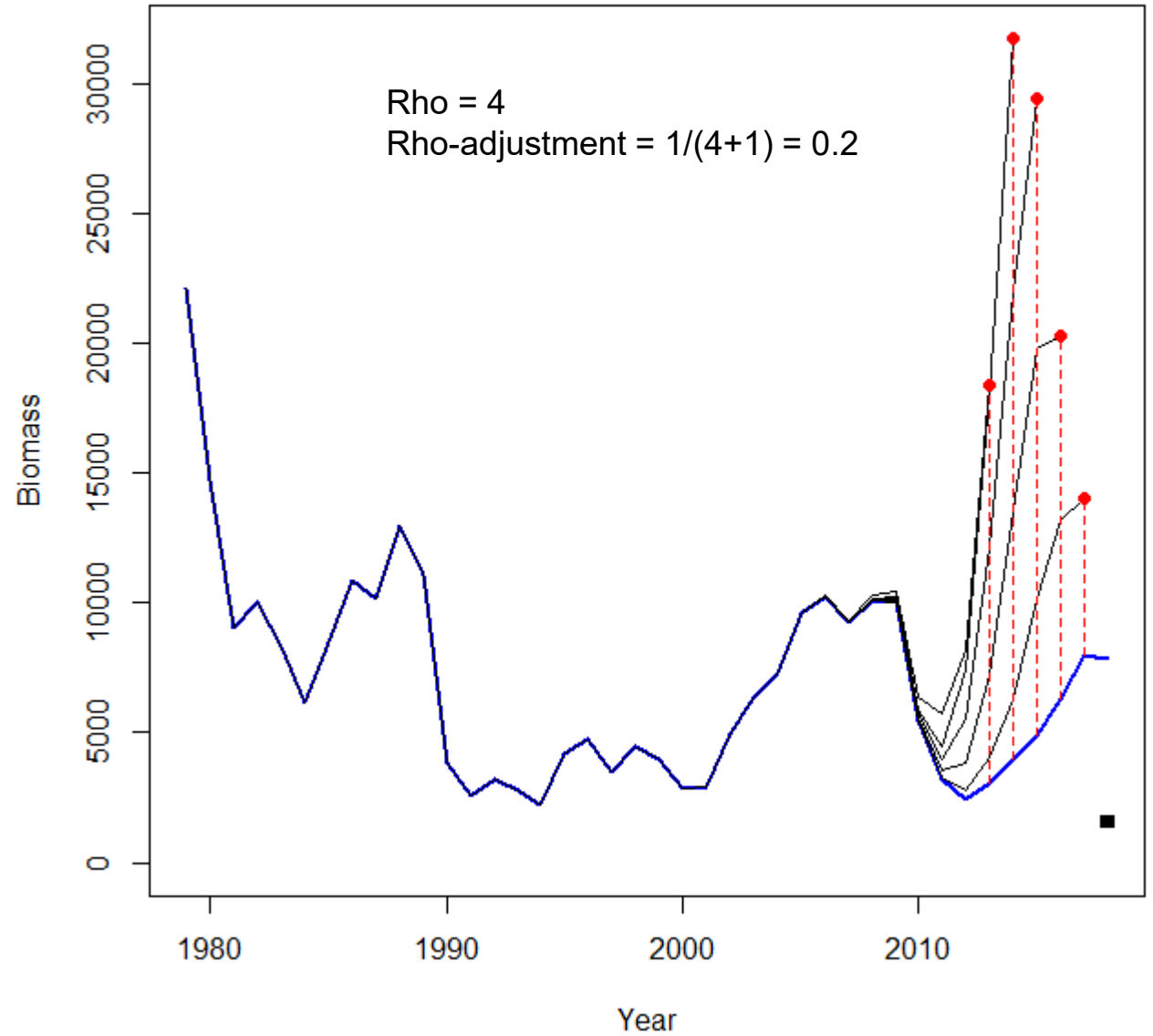
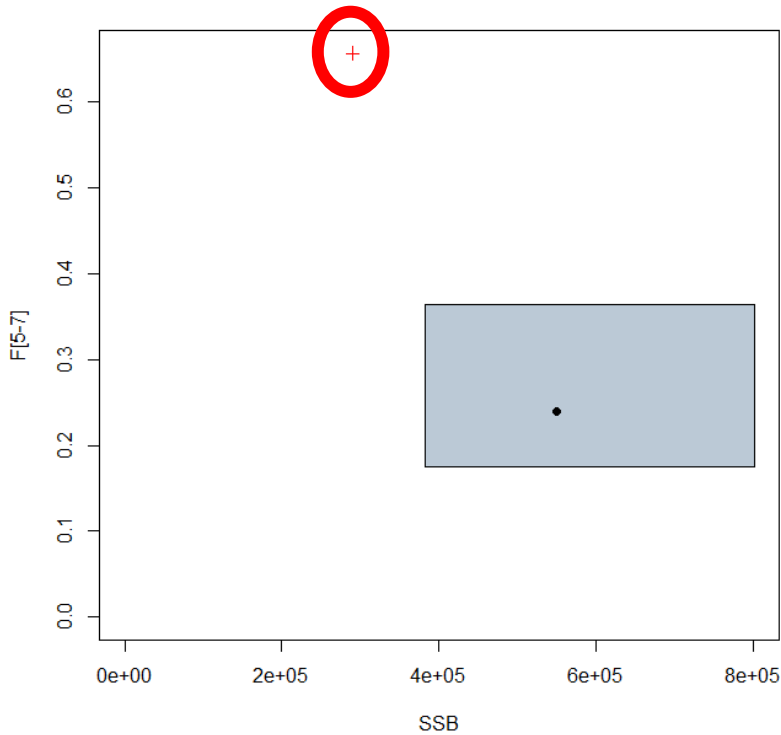
ICES WKFORBIAS (2019)



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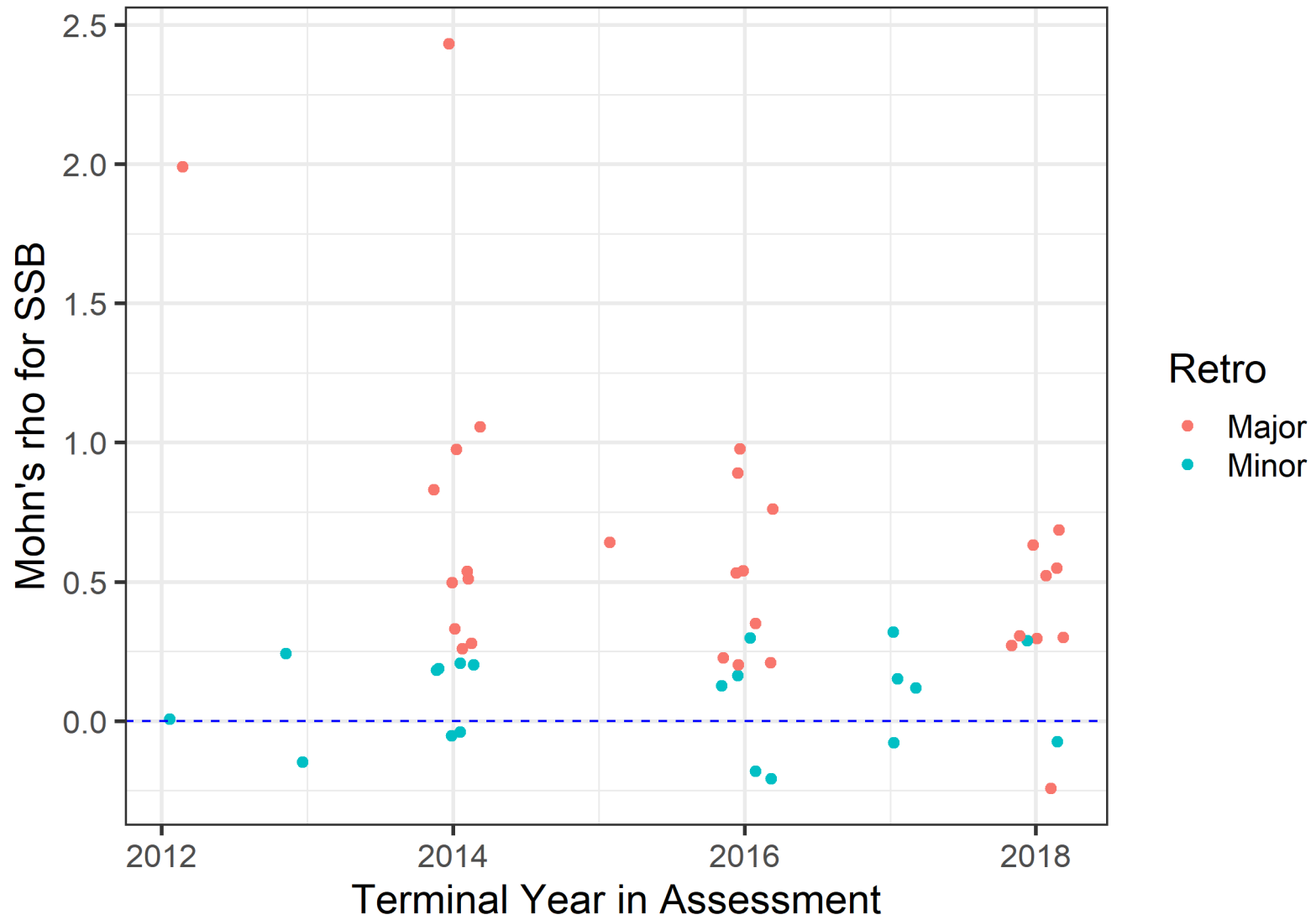


# Strong Retro II



$$SSB_{adj} = SSB / (1 + rho\_SSB)$$

$$F_{adj} = F / (1 + rho\_F)$$



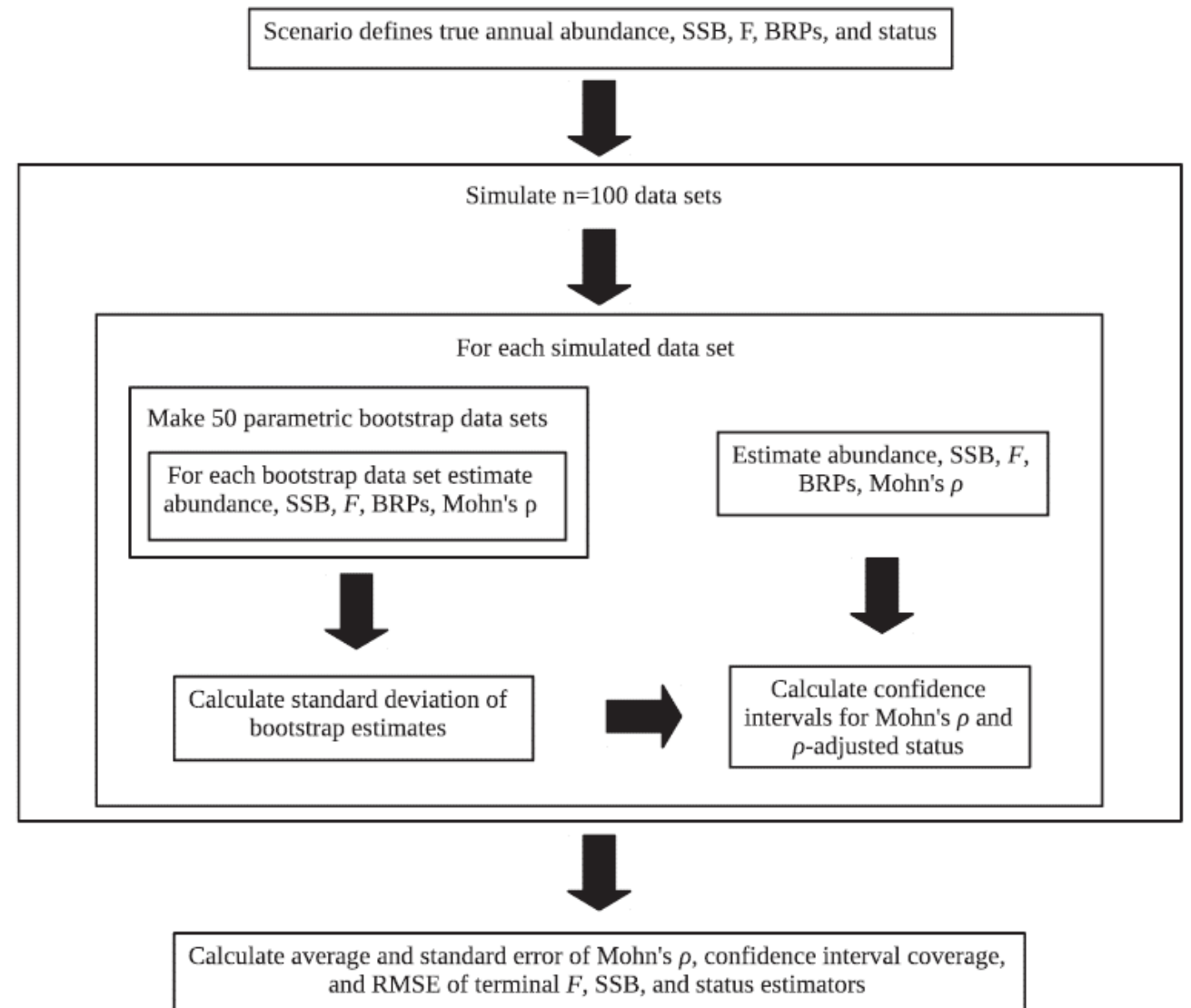
ICES WKFORBIAS (2019)



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# Strong Retro III

Does CI of Mohn's rho overlap 0?



Miller and Legault (2017)



# What to do?



Contents lists available at [ScienceDirect](#)

Fisheries Research

journal homepage: [www.elsevier.com/locate/fishres](http://www.elsevier.com/locate/fishres)



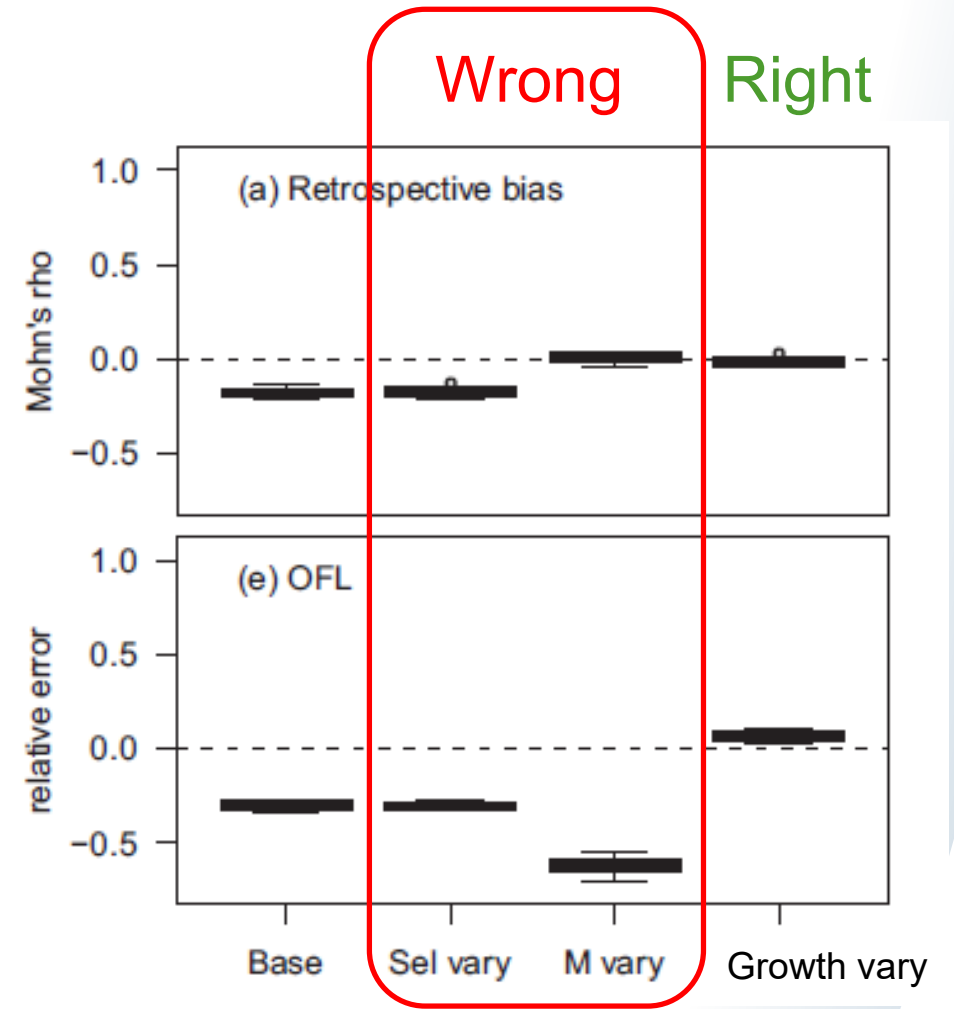
When are model-based stock assessments rejected for use in management and what happens then?

André E. Punt<sup>a,b,\*</sup>, Geoffrey N. Tuck<sup>a</sup>, Jemery Day<sup>a</sup>, Cristian M. Canales<sup>c</sup>, Jason M. Cope<sup>d</sup>, Carryn L. de Moor<sup>e</sup>, José A.A. De Oliveira<sup>f</sup>, Mark Dickey-Collas<sup>g,h</sup>, Bjarki Þ. Elvarsson<sup>i</sup>, Melissa A. Haltuch<sup>d</sup>, Owen S. Hamel<sup>d</sup>, Allan C. Hicks<sup>j</sup>, Christopher M. Legault<sup>k</sup>, Patrick D. Lynch<sup>l</sup>, Michael J. Wilberg<sup>m</sup>

- Fix model
- Simpler model
- Add parameters
- Different model
- Rho-adjust



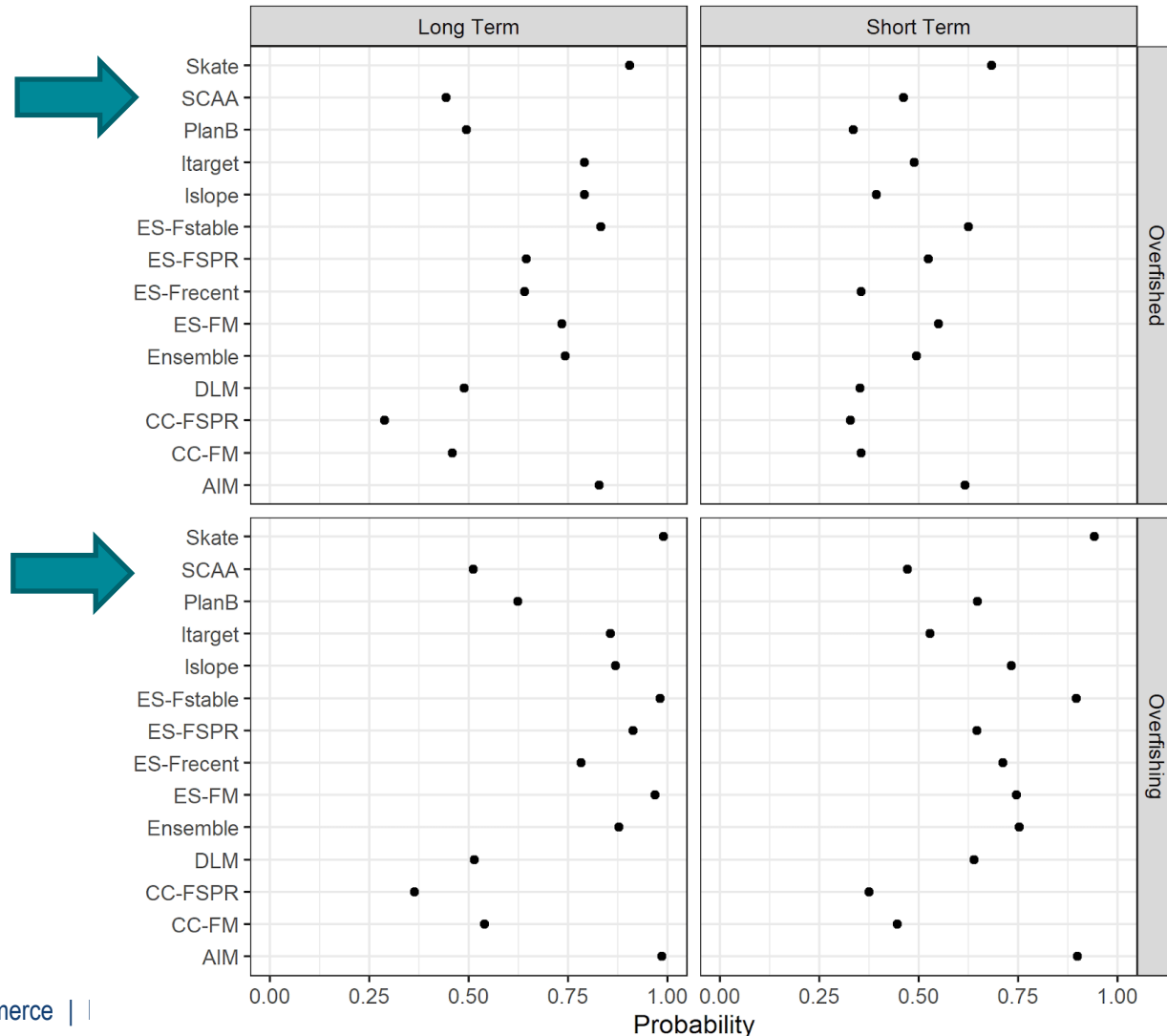
# Be careful of wrong fix



Szuwalski et al. (2018)



# Simpler Models Don't Always Work Better



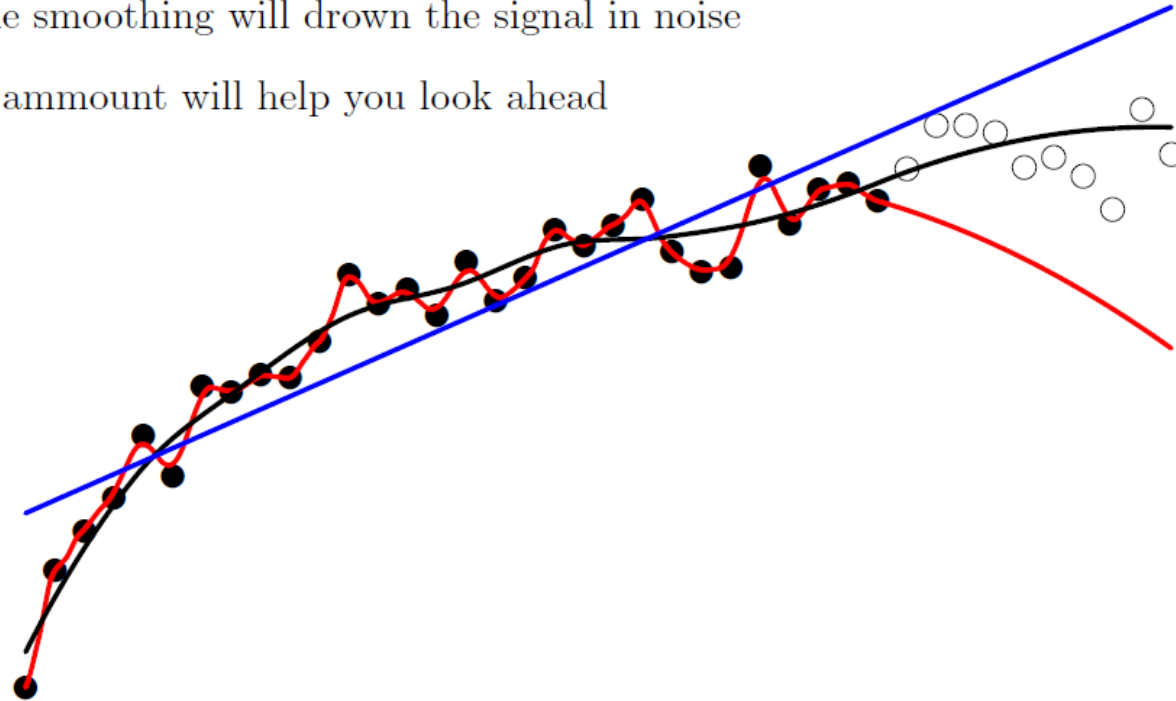
Index Based Methods and Control Rules Research Track



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## Is smoothing evil?

- Too much smoothing will bias the signal
- Too little smoothing will drown the signal in noise
- Correct amount will help you look ahead



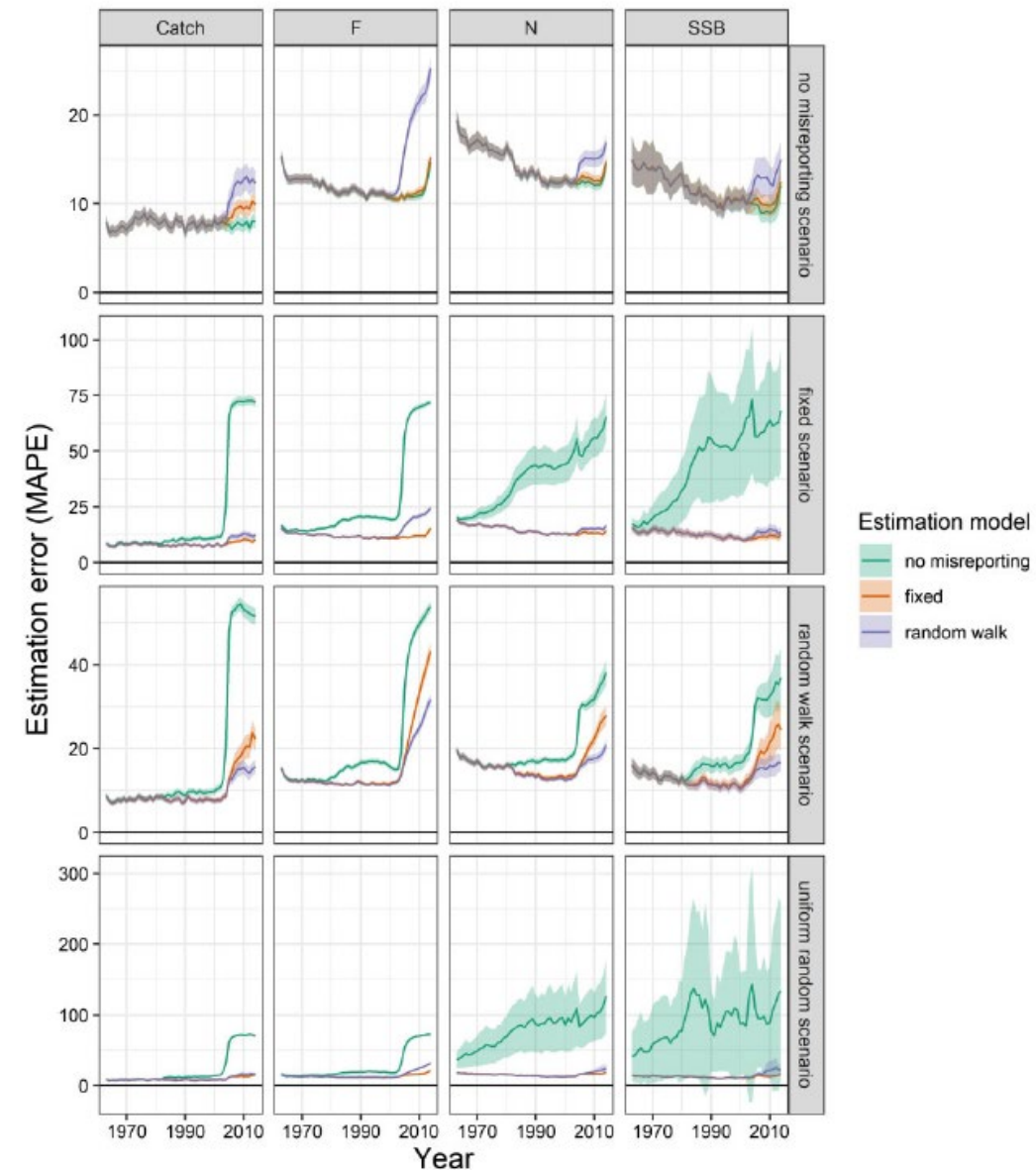
- Correct amount should not be subjective.

Slide from Anders Nielsen TMB Workshop 2018 in Woods Hole

# State-Space the Answer?

Model	Mean	SD
$\bar{F}$		
A4A	-0.01	0.24
ASAP	-0.22	0.28
SAM	-0.11	0.19
WHAM	-0.05	0.18
$R$		
A4A	1.13	2.30
ASAP	0.41	0.81
SAM	0.25	0.31
WHAM	0.06	0.26
SSB		
A4A	0.23	0.53
ASAP	0.42	0.58
SAM	0.20	0.21
WHAM	0.09	0.15

ICES Methods Working Group (In progress)  
Mean and SD of Mohn's rho across 13 stocks



Perretti et al. (2020)



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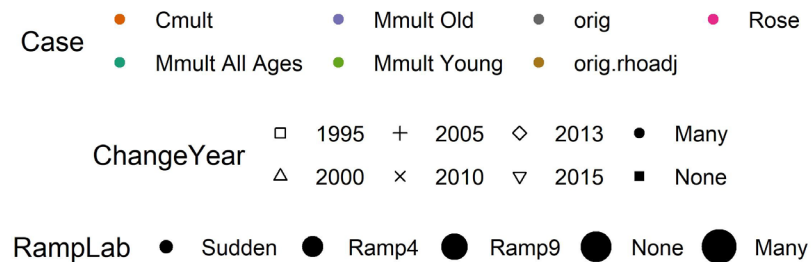
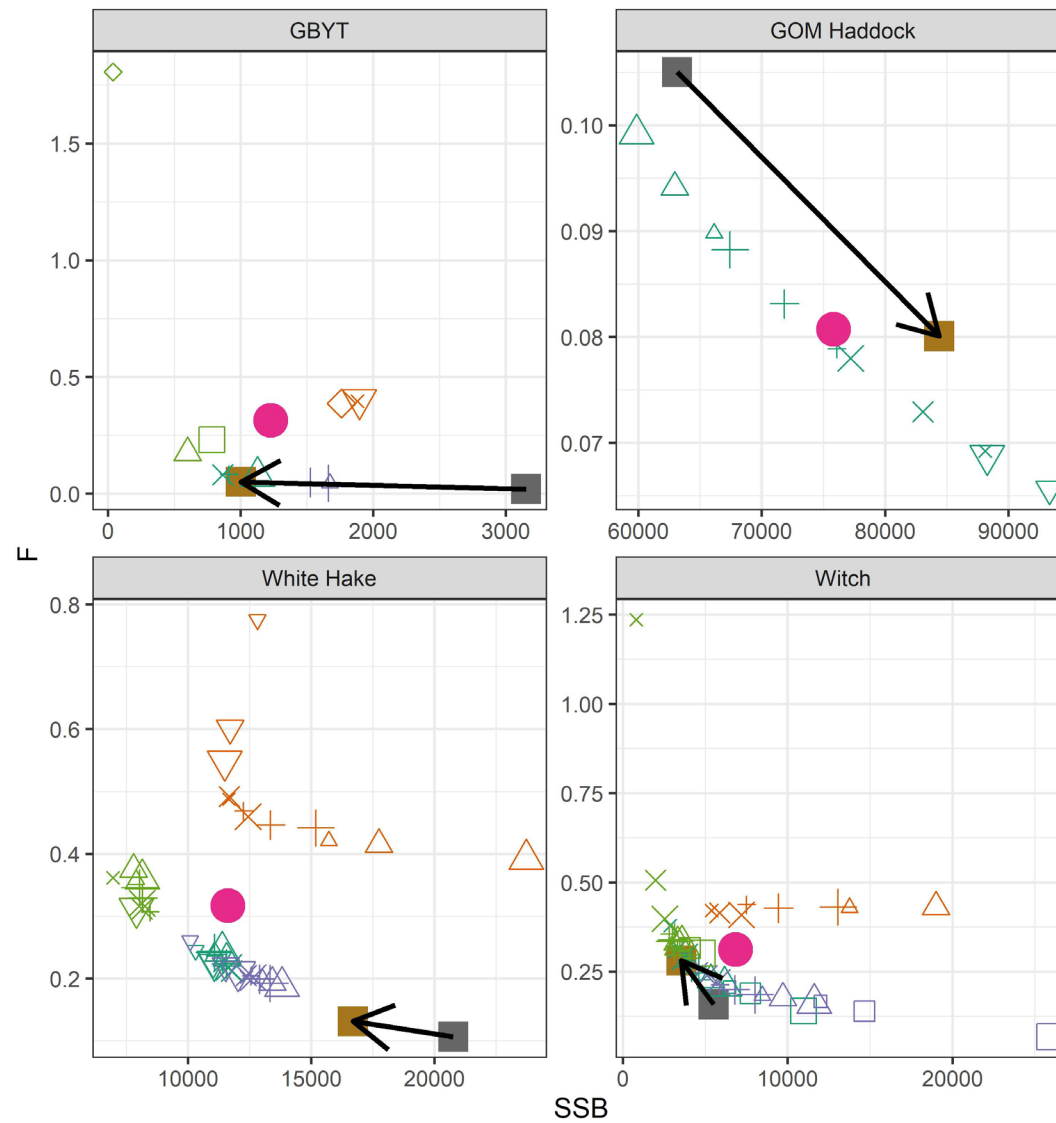


# Rose vs Rho



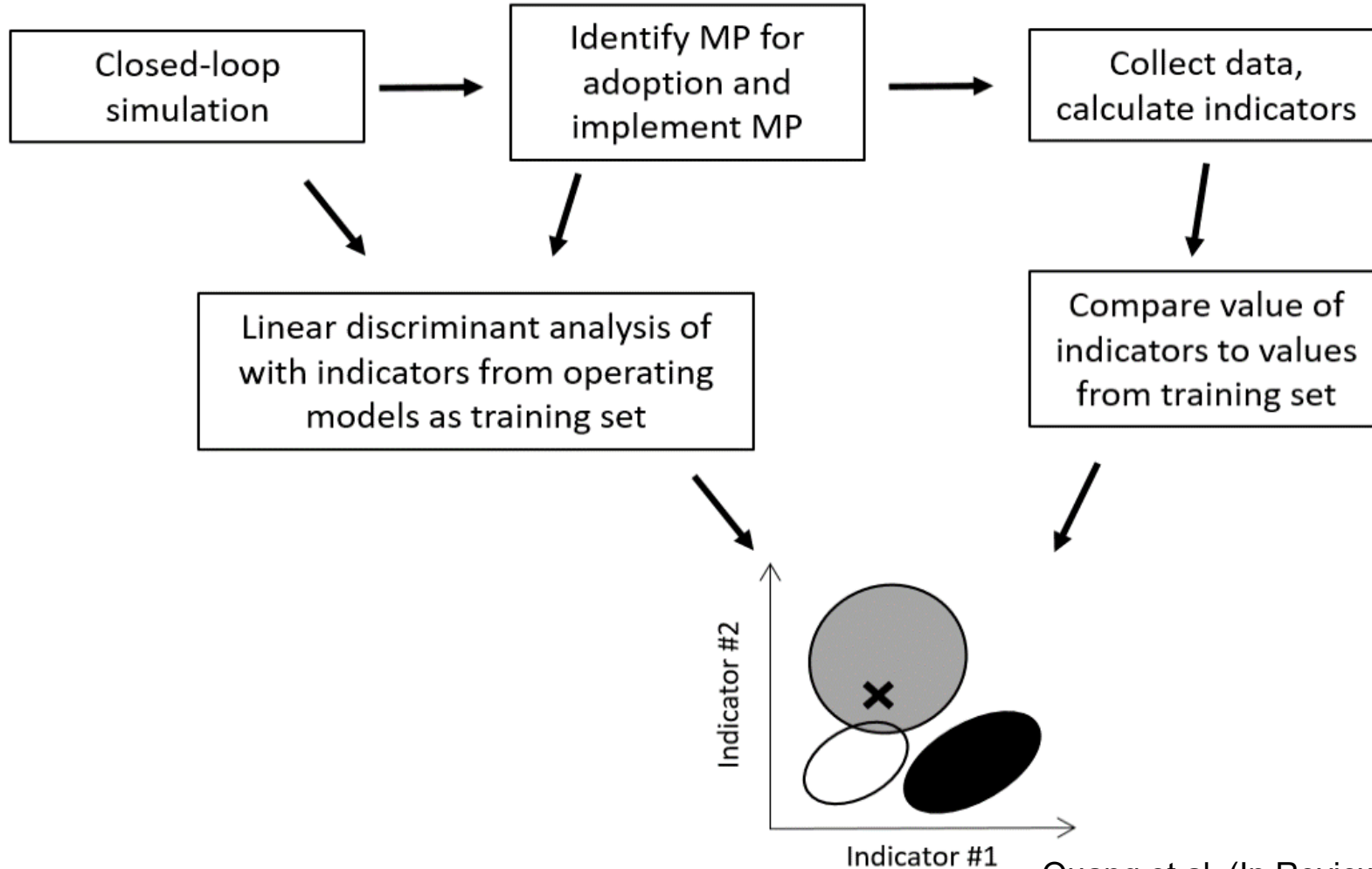
Irene Andrushchenko (DFO)

Legault (2020)



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# A way forward?



Quang et al. (In Review)



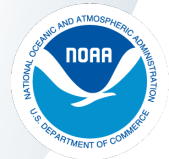
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# Take Home

- Retrospective analysis is a required diagnostic
  - Multiple ways to measure strong
- Model adjustments must be made with care
  - Wrong fix can lead to poor advice
  - Identifying correct fix is hard
- More research needed
  - State-space models
  - Rose
  - Closed-loop simulation and indicators
  - Statistical properties of Mohn's rho



# Questions?



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