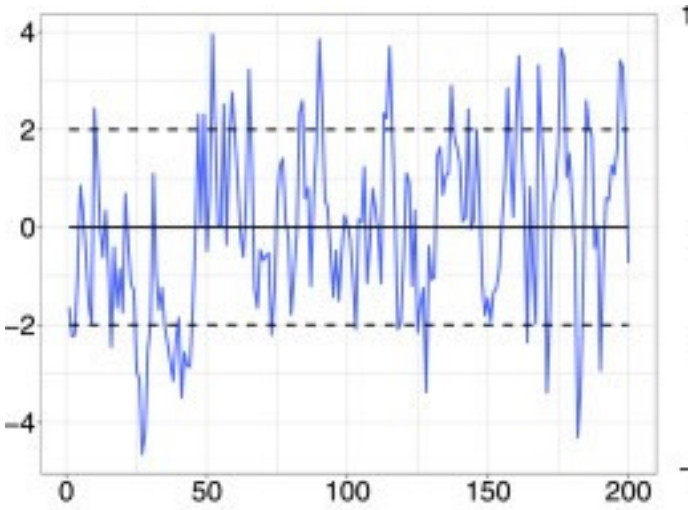
Stock assessments: Climate effects and nonstationarity

Kyle Shertzer, Erik Williams

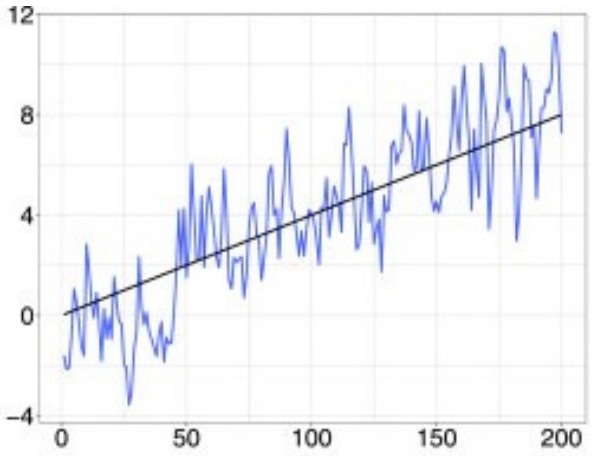
NOAA Fisheries, Southeast Fisheries Science Center

Stationarity

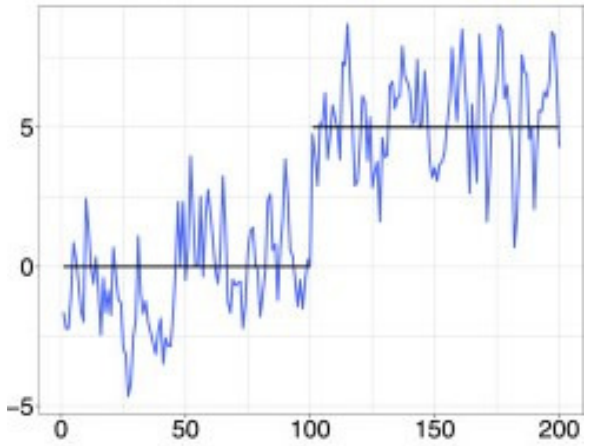


Nonstationarity

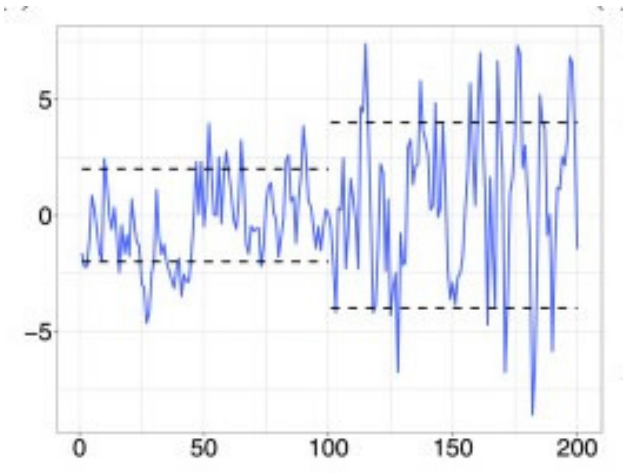
Trend



Shift in the mean



Shift in the variance



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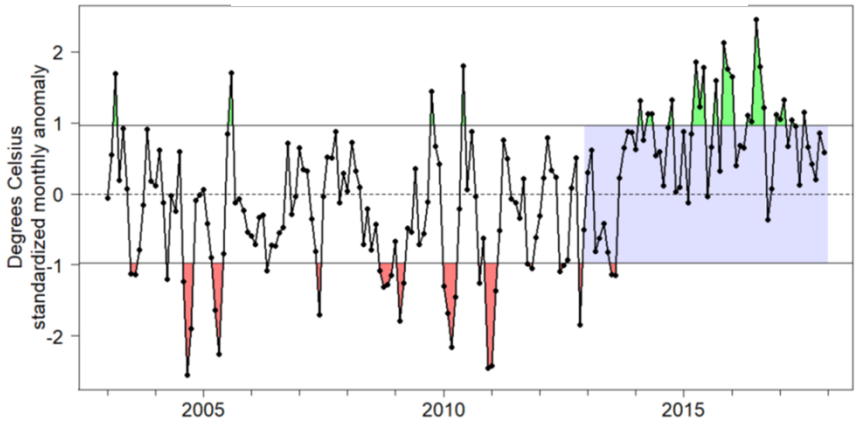
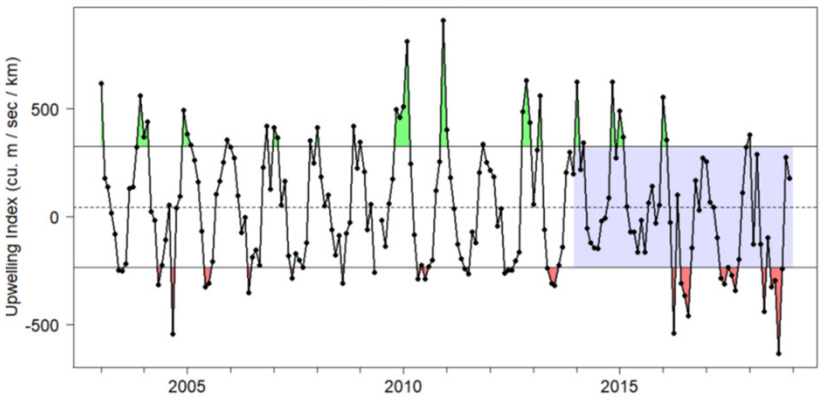
Images from Salles et al. 2019

Examples of environmental nonstationarity in the SA

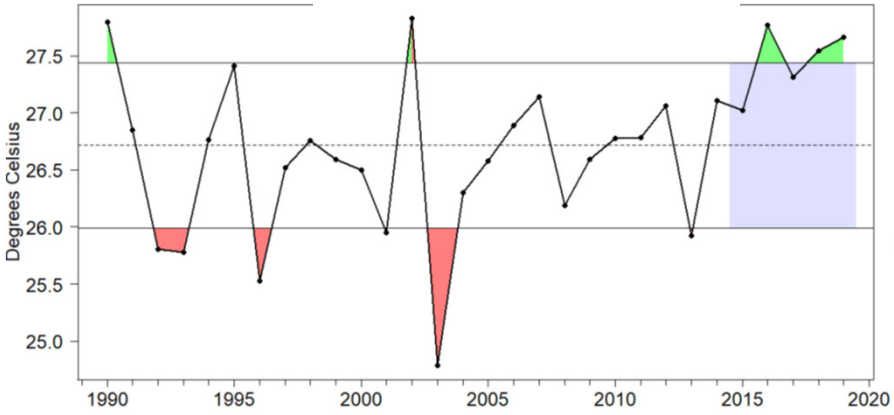
Sea Surface Temperature



Upwelling



Bottom Temperature



Craig et al. 2021

Environmental nonstationarity can affect fish populations

- Spatial distribution
- Growth rates
- Survival rates
- Recruitment … *Maybe in the SA?...*

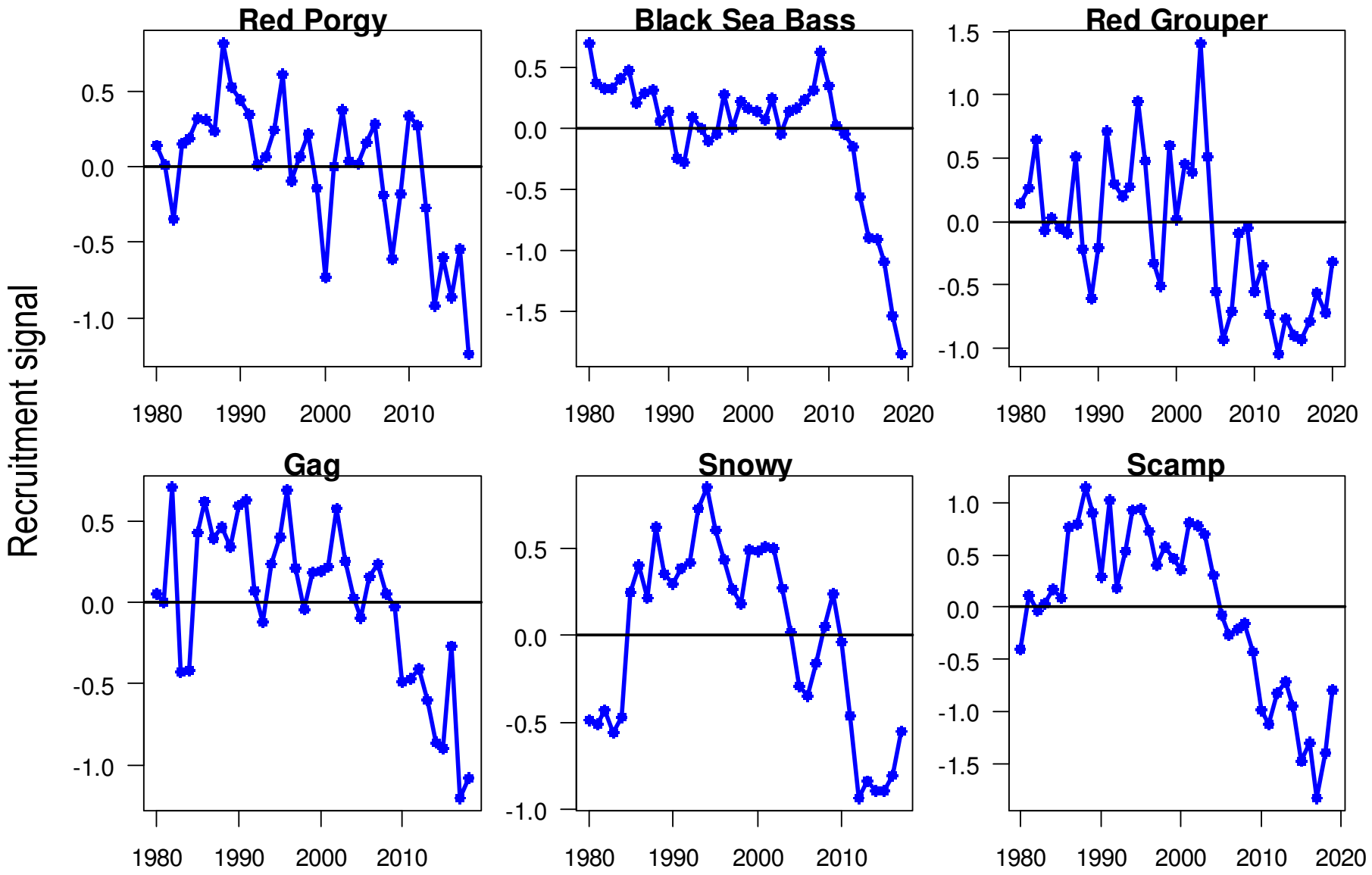
Evidence of recent poor recruitment in the SA

- Stock assessments: black sea bass, gag, scamp, red grouper, red porgy, snowy grouper

- SERFS trends reports: bank sea bass, knobbed porgy, sand perch, scup

- Peer-reviewed publications:
  - Scamp (*Bacheler & Ballenger 2018*)
  - Red porgy (*Bacheler et al. 2023*)
  - Multiple species (Wade et al. 2023)

Estimates of recruitment from stock assessments



Implications of recruitment nonstationarity

- Biomass benchmarks (e.g., B_{MSY}) are dynamic
  - Estimating stock status is challenging, especially in projections
- Rebuilding time frames are highly uncertain
  - Now the goalpost moves in ways we can't predict

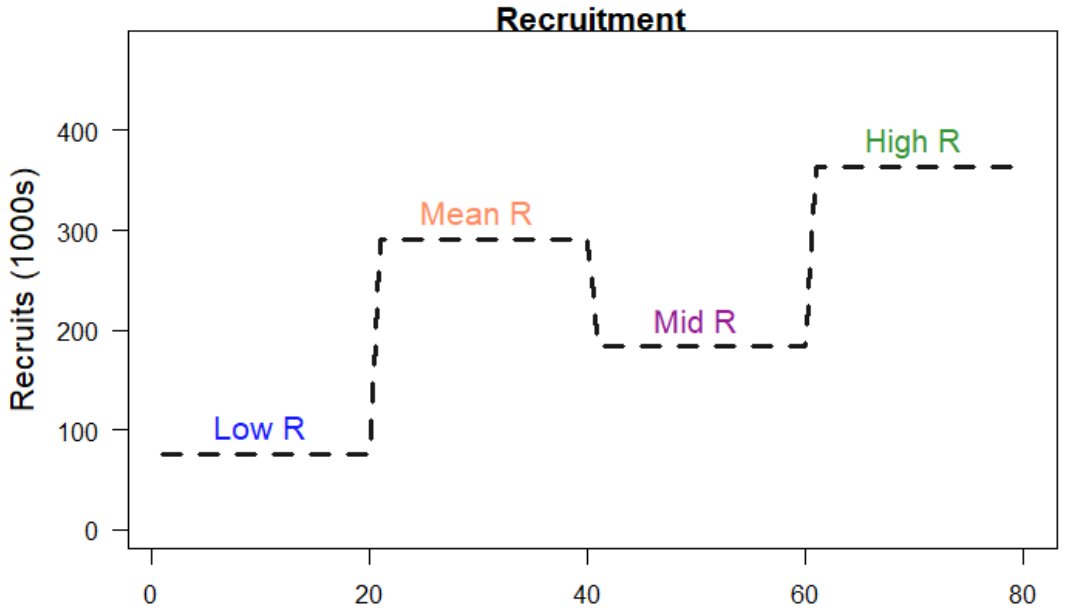
The good news

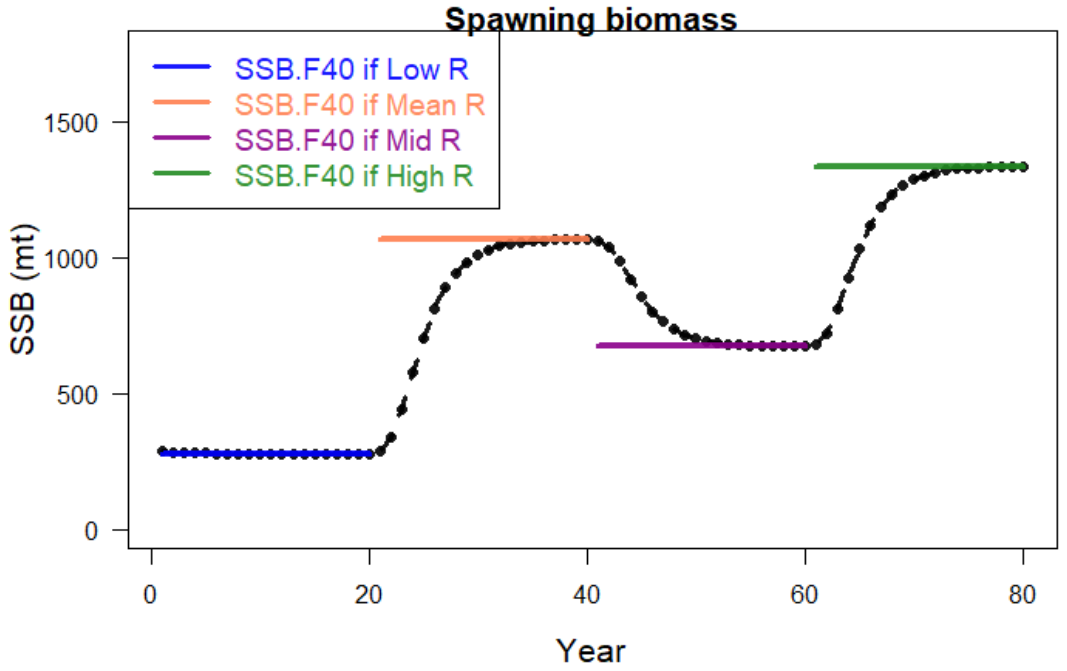
- Fishing benchmarks (e.g., F40%) are robust

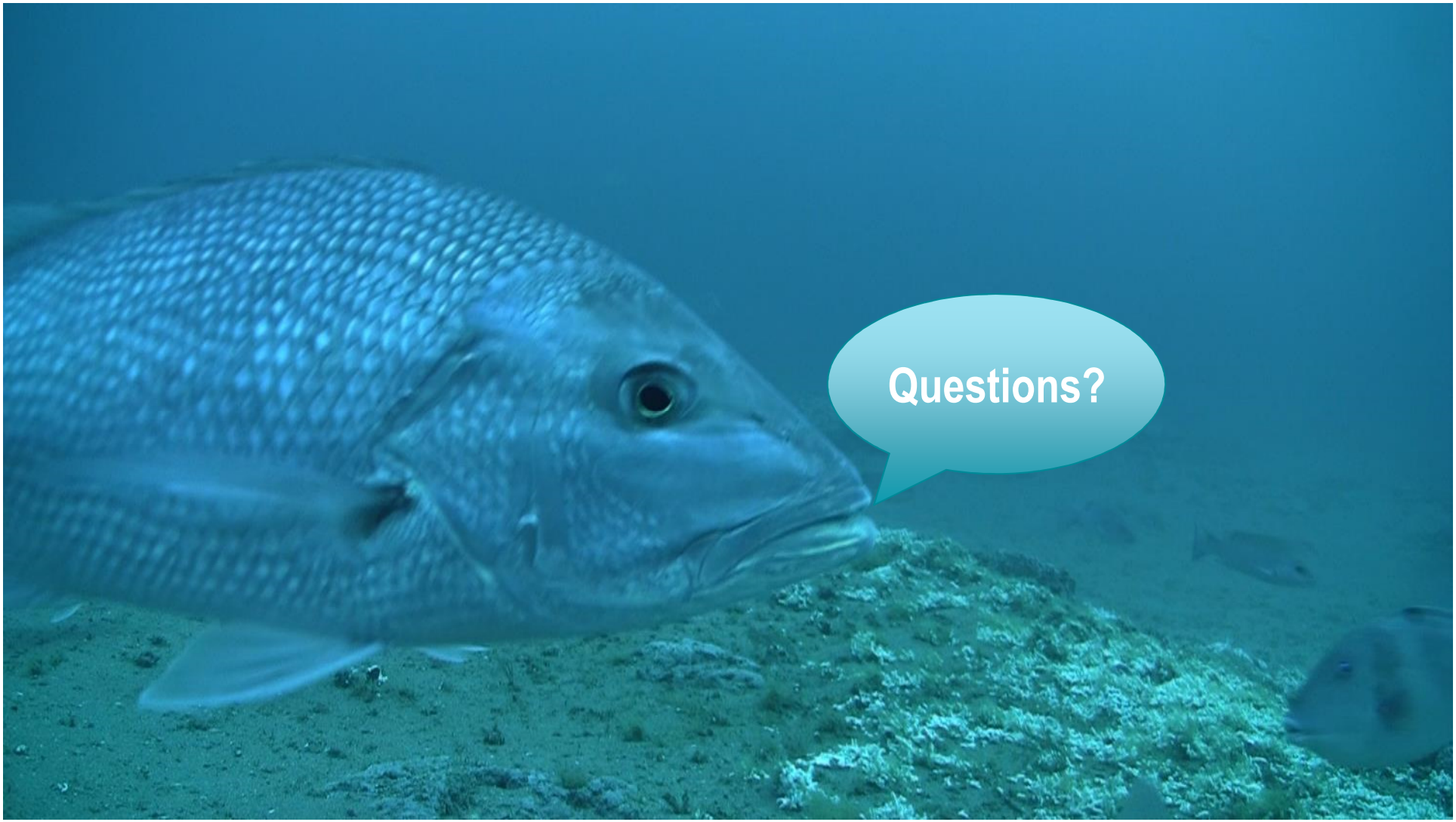
- Short-term catch advice using recent recruitment is reliable
  - ✓The SSC takes this approach

- The stock level should tend toward its target level, even if that level is unknown
  - ✓Cartoon simulation using SA scamp, fishing at F=F40…

Cartoon simulation: SA scamp fished at F=F40






Questions?

A clue?

XXX = peak spawning

Abundance decrease, Evident low recruitment

Abundance increase, No signs of low recruitment

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Black sea bass		XXX	XXX	XXX								
Gag		XXX	XXX	XXX								
Stenotomous spp.		XXX	XXX									
Red grouper	XXX	XXX	XXX	XXX	XXX							
Red porgy	XXX	XXX	XXX								XXX	XXX
Scamp			XXX	XXX	XXX							
Sand perch					XXX	XXX	XXX					
Almaco jack							XXX					
Lane snapper						XXX	XXX	XXX				
Red snapper						XXX	XXX	XXX	XXX	XXX		
Vermilion snapper						XXX	XXX	XXX				
White grunt					XXX	XXX						
Mutton snapper					XXX	XXX	XXX					
Gray snapper						XXX	XXX					