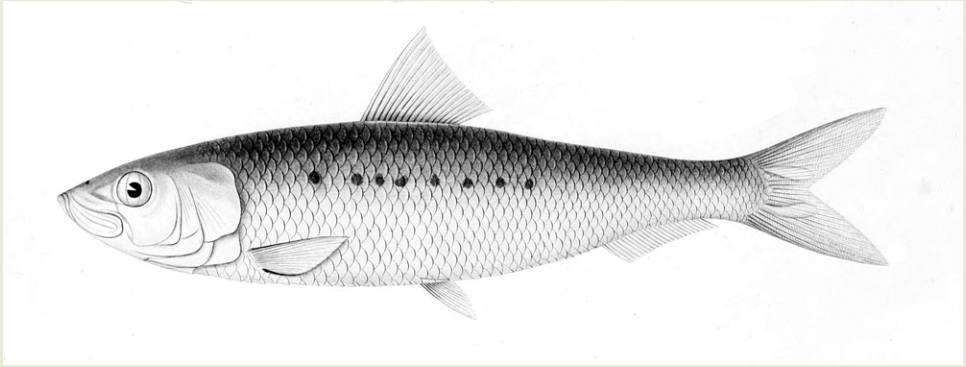
REVISED ANALYSES RELATED TO EVALUATING PARAMETER VALUE CHOICES FOR PACIFIC SARDINE



Felipe Hurtado-Ferro and André E. Punt

School of Aquatic and Fishery Sciences, University of Washington

SUMMARY

- Context
- Environmental index
- Recalculated relationship and new harvest control rule
- Simulation testing of the harvest control rule
- Sensitivities

CONTEXT

Pacific Sardine: Management Process
(Amendment 8 & 13)

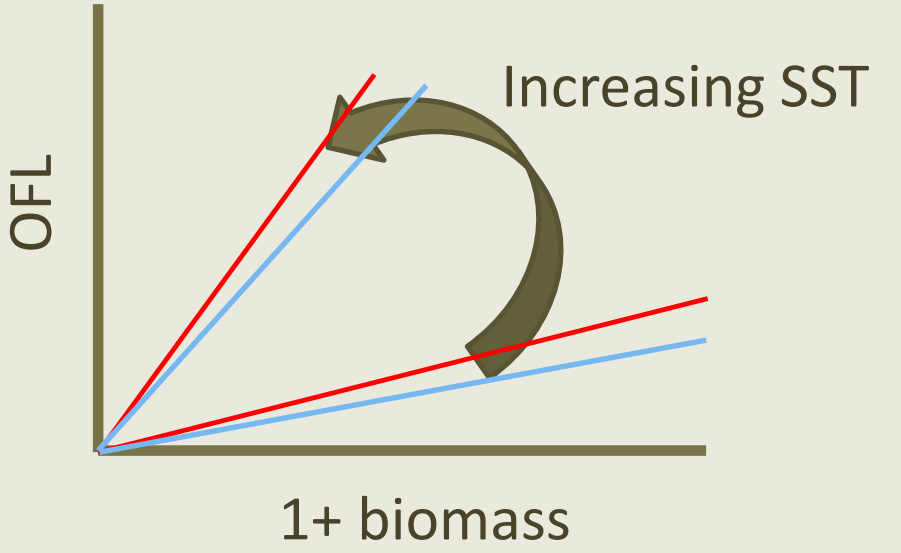
Overfishing Level (OFL)

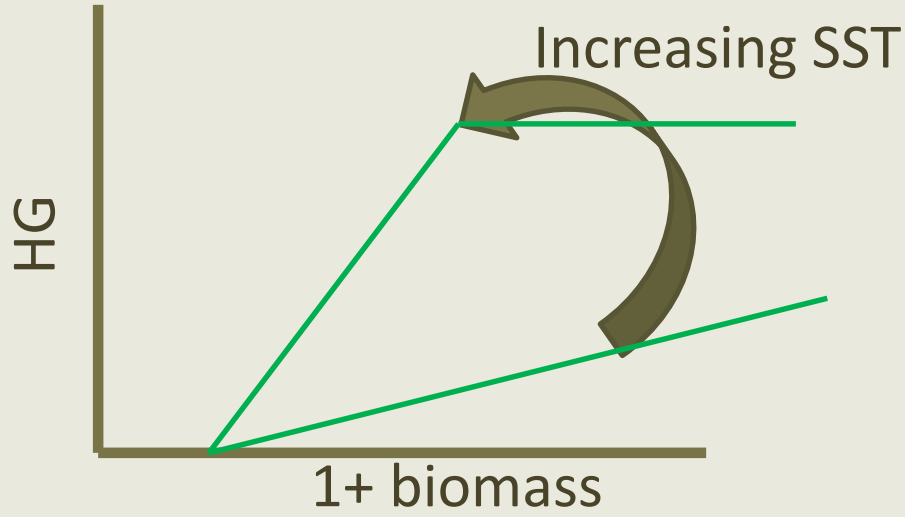
↓ *P**

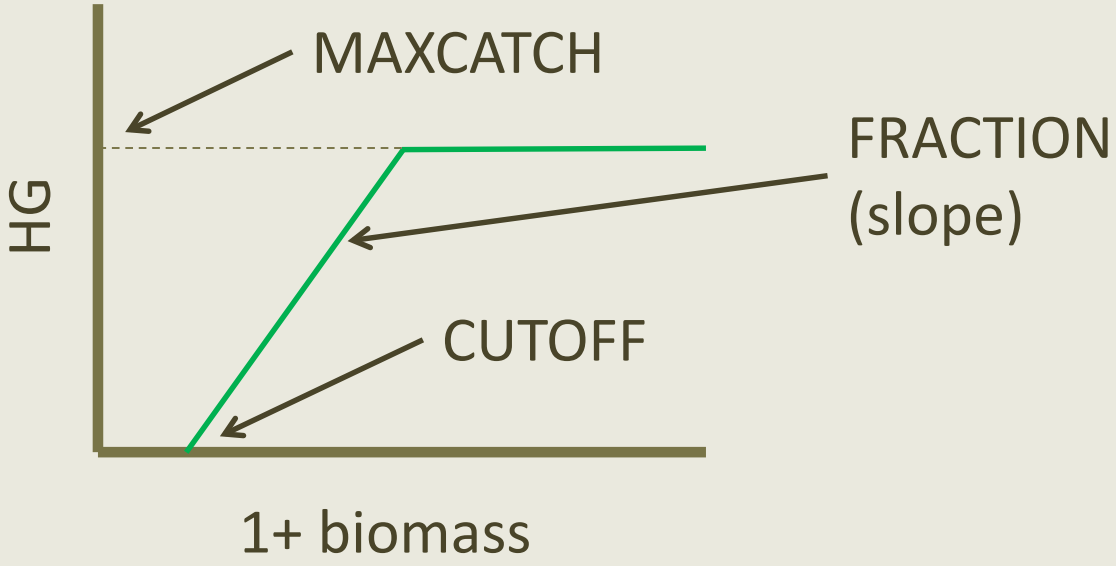
Acceptable Biological Catch (ABC)

↓

Harvest Guideline (HG)







ISSUE:

- Value for MAXCATCH?
- Value for CUTOFF?
- Relationship between FRACTION and an environmental variable?
- What environmental variable to use?

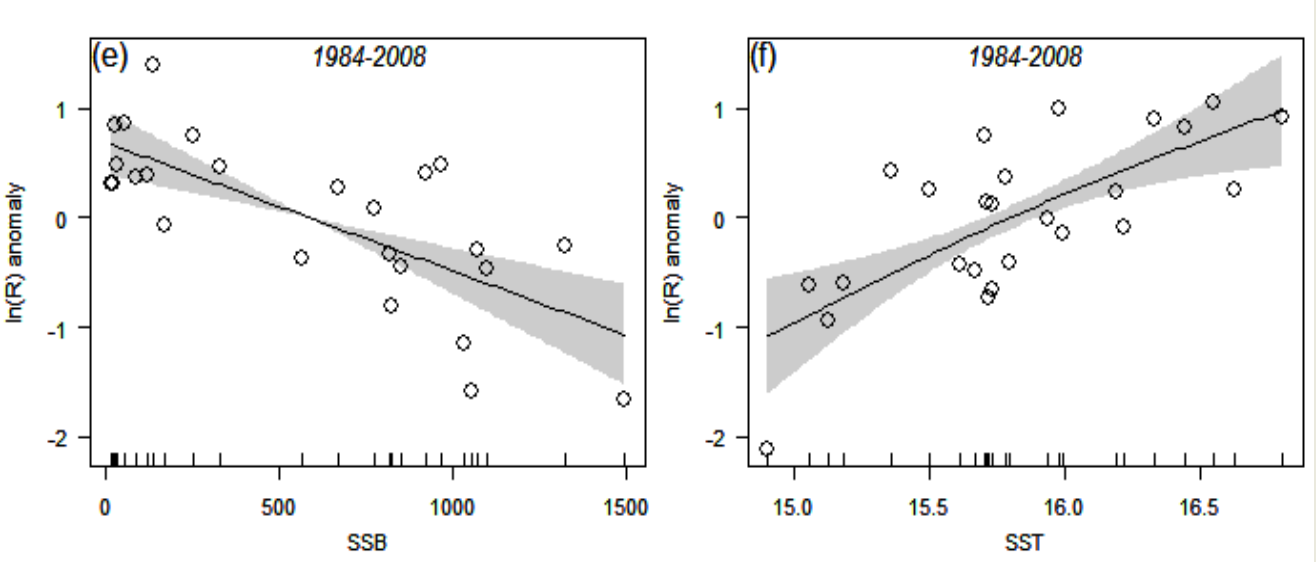
Background

- In Amendment 8 to the CPS FMP, FRACTION is a function of 3-year average sea surface temperature (SST) at Scripps Pier (SIO) (bounded by 5 and 15%).
- McClatchie et al. (2010)* reanalysed the data on which the SST-recruitment relationship was based and found the relationship was no longer significant.

*McClatchie, S., Goericke, R., Auad, G., and Hill, K. 2010. *Canadian Journal of Fisheries and Aquatic Sciences* **67**: 1782–1790.

ENVIRONMENTAL INDEX

Recruitment is related to both environment and spawning biomass



The relation between several environmental indices and recruitment was evaluated.

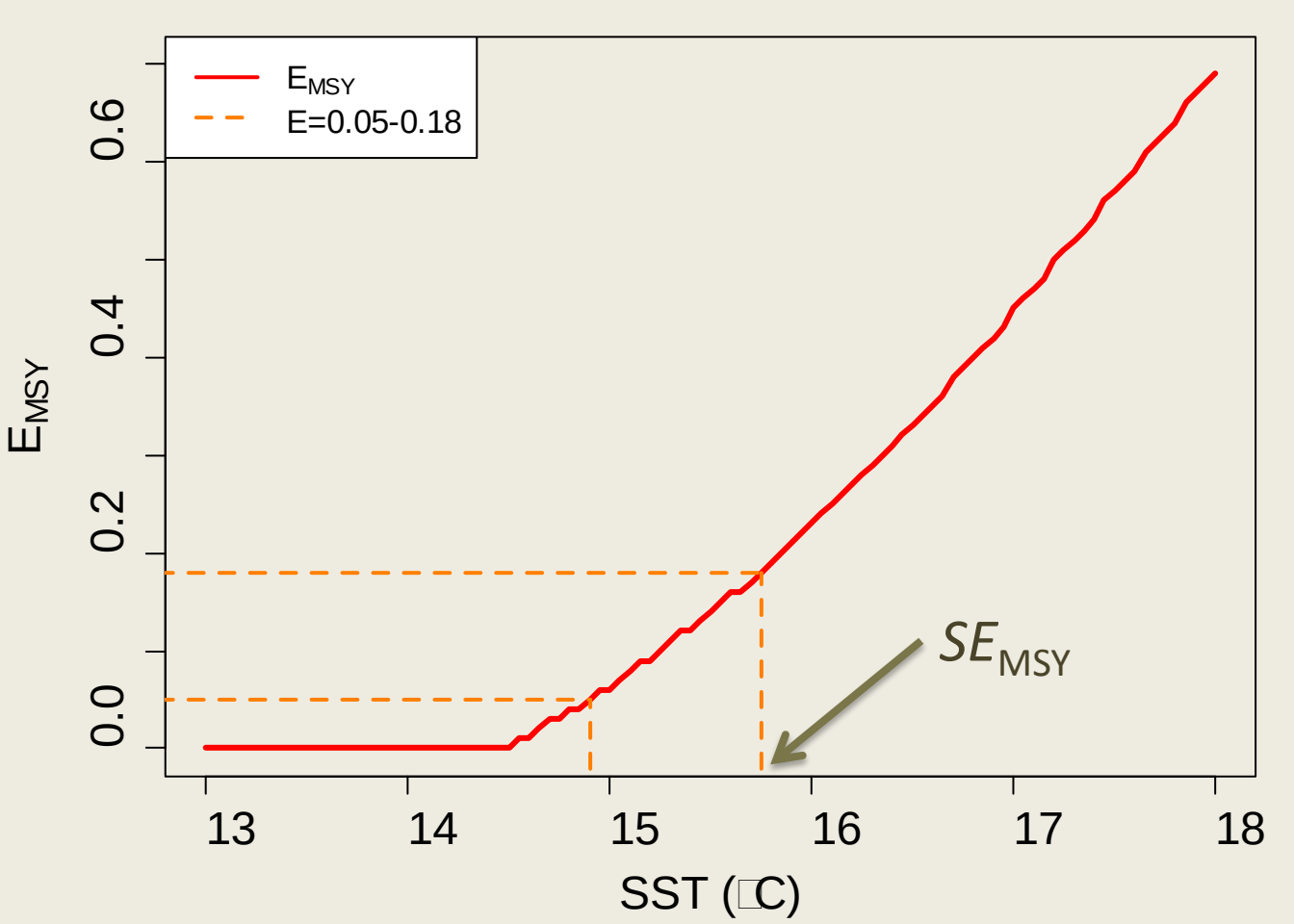
CalCOFI SST provides a better fit than SIO or ERSST to the stock-recruitment data for 1984-2008

Series	AIC	R^2
SST_CC_ann	45.79	0.72
SIO_SST_ann	56.81	0.61
ERSST_ann	55.3	0.63

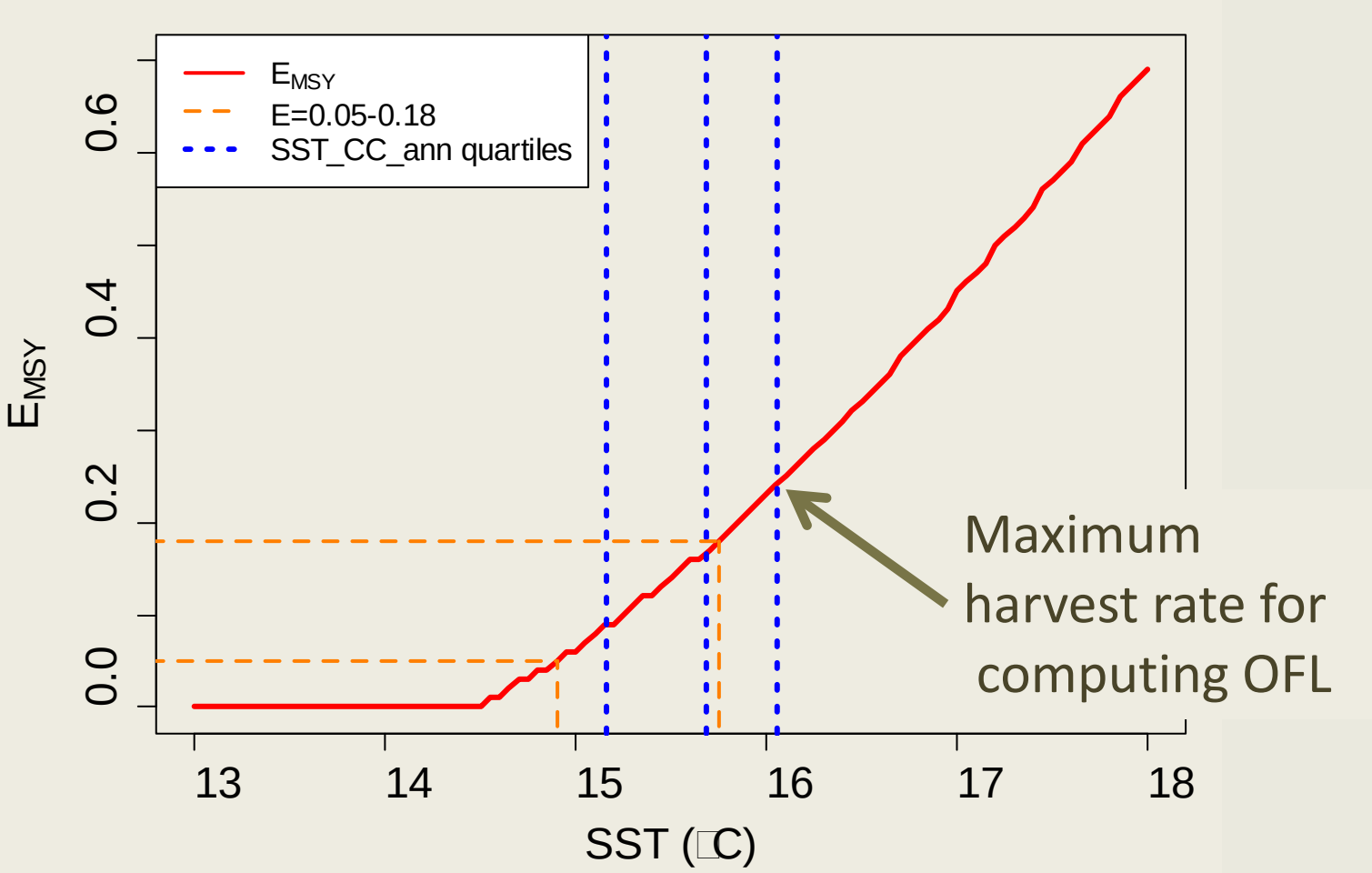
From PFMC 2013, Table App.E.6

RECALCULATED RELATIONSHIP BETWEEN ENVIRONMENT AND E_{MSY}

Calibrating the “CalCOFI” HG control rule



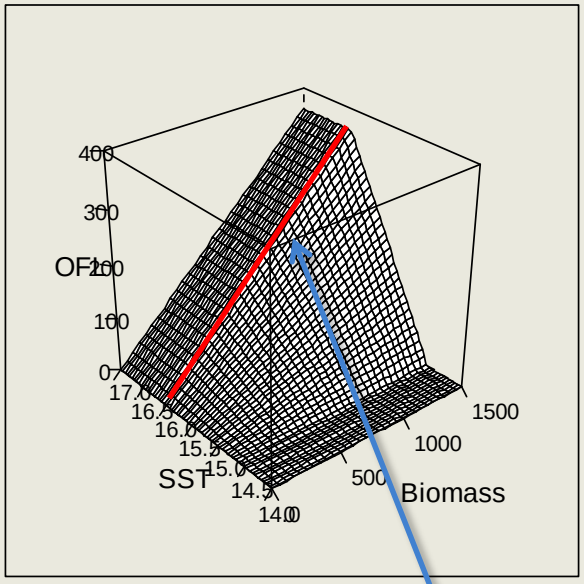
Calibrating the “CalCOFI” HG control rule



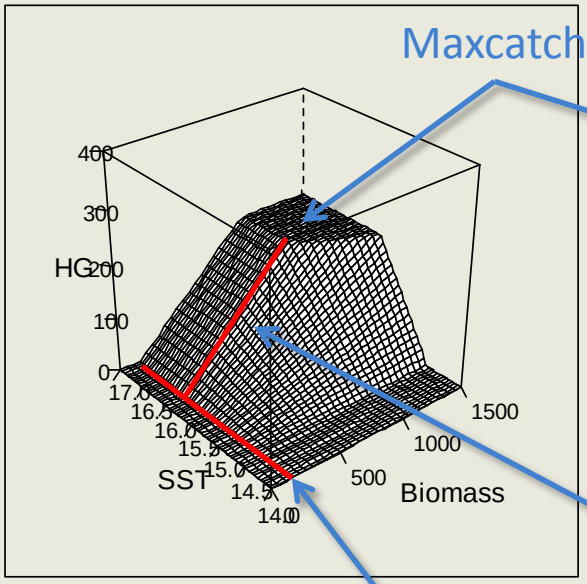
CalCOFI-based harvest control rule

The harvest control rule depends on both the 1+ biomass and the CalCOFI SST

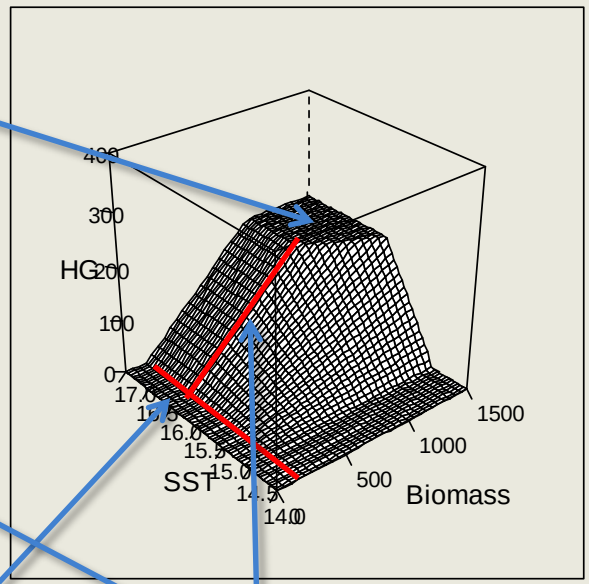
OFL control rule



HG control rule



HG control rule < ABC



Maxcatch

Maximum harvest rate for OFL

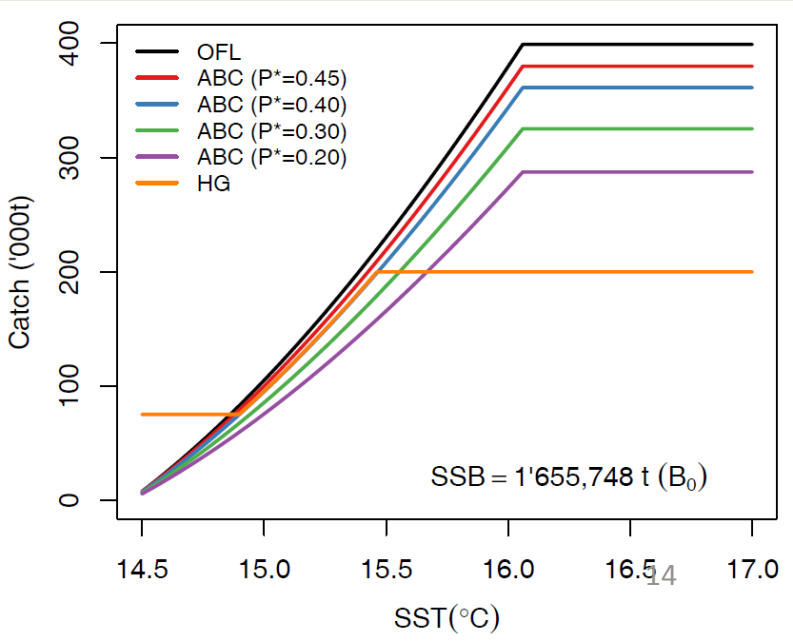
Cutoff

Maximum harvest rate for HG

SIMULATION TESTING OF THE HARVEST CONTROL RULE

Harvest Control Rule variants

- Different choices for FRACTION, CUTOFF and MAXCAT
- FRACTION :
  - can be a constant (e.g. E_{MSY}) or
  - can be related to the environmental variable (e.g. 5% at 14.89^{0}C and E_{MSY} at 15.47^{0}C)
- Note: results are provided for illustrative “harvest policy variants”.

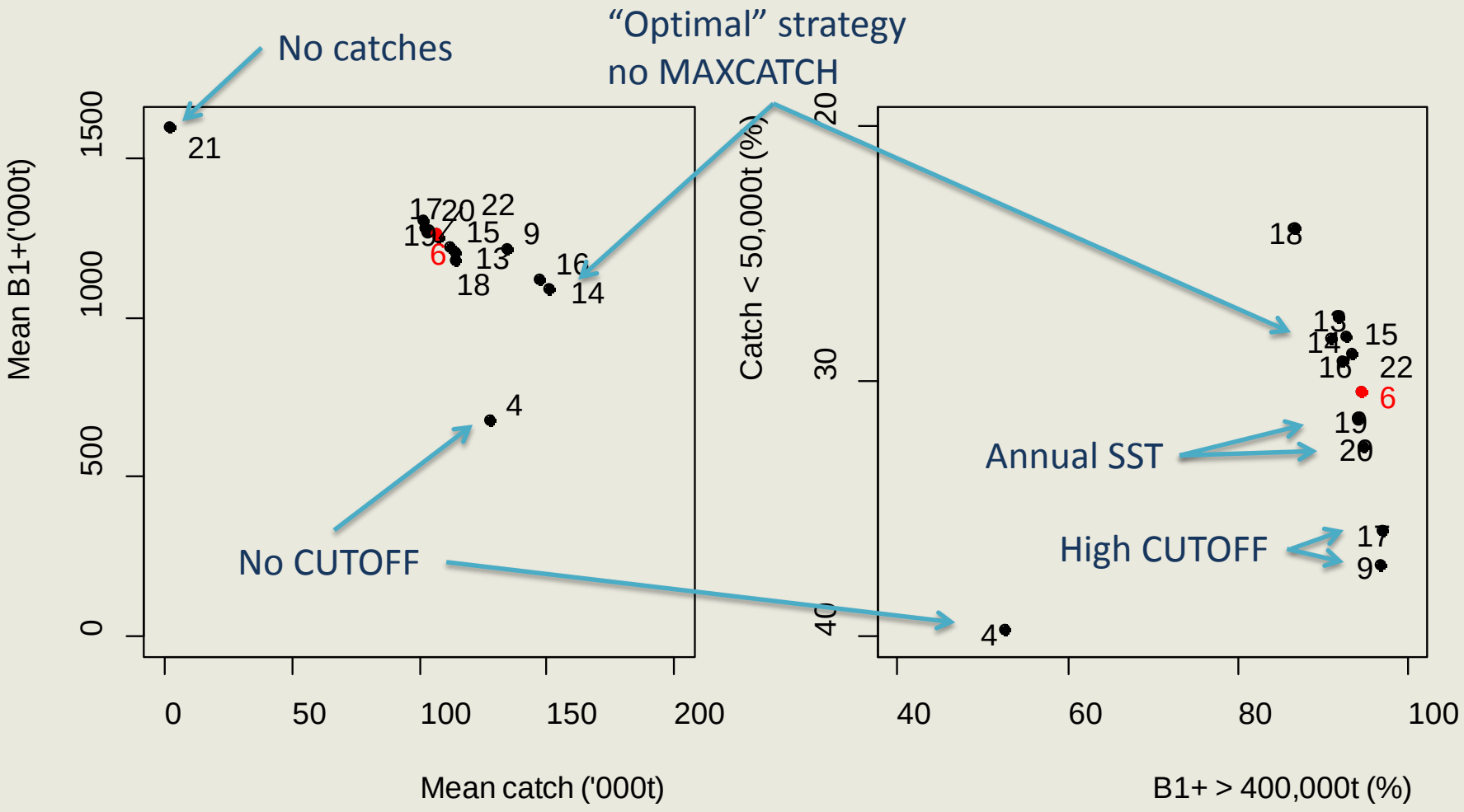


Quantifying trade-offs between different HCR variants: Biomass vs. catch

The performance measures are selected to quantify performance relative to [some] management goals.

- Average catch (total)
- Average population size (1+ biomass)
- Probability [total] catch is less than some threshold (e.g. 50,000t)
- Probability 1+ biomass is below a threshold.

Quantifying trade-offs between different HCR variants: Biomass vs. catch



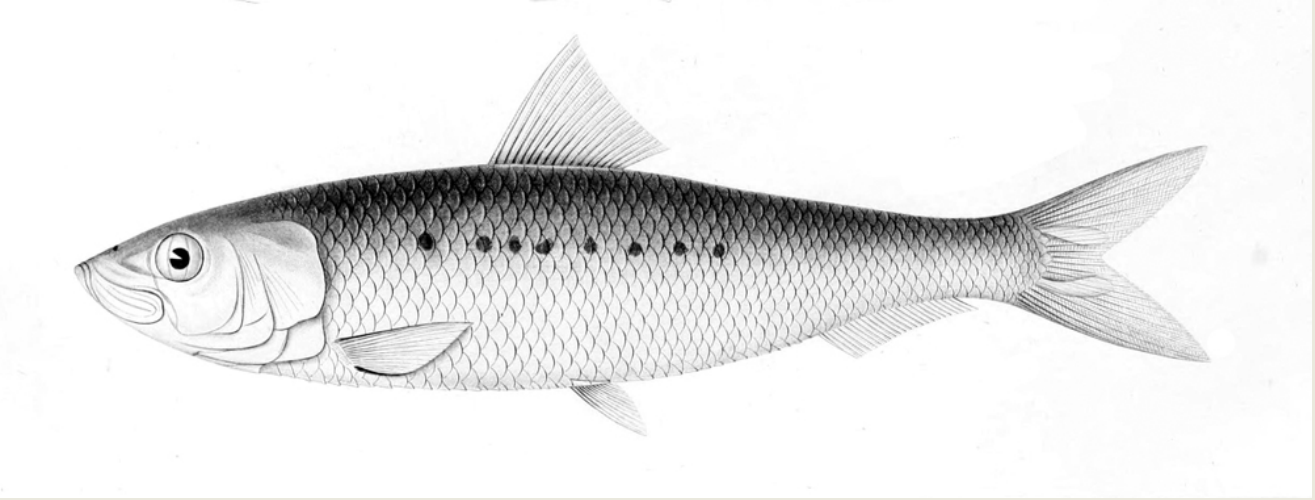
CONCLUSIONS

- There is a trade-off between catch and biomass: maintaining higher biomass levels imply having lower catches.
- Higher cutoffs have higher probability of low catches. However, including a cutoff results in higher mean catches and higher mean biomass than not doing it.
- With the exception of variant 4, all variants explored produce mean biomass at or above ~70% of unfished biomass.
- Using an annual index increases catch variance.

SENSITIVITIES

Sensitivity analyses allow to evaluate the HCR under alternative assumptions

- Lower environmental variability leads to higher, more stable catches.
- Results are not sensitive to changes in selectivity, growth, natural mortality or to hyper-stability in biomass estimates.
- Results are very sensitive to Mexico and Canada not following the US control rule.
- Results are robust to the use of alternative environmental indices (e.g. ERSST or SIO).



Questions?

Technical assistance: Kerry Griffin, Joshua Lindsay, Kevin Hill, Richard Parrish, Kirk Lynn, Ed Weber, Sam McClatchie