Agenda Item I.1.b
Supplemental Workshop and Risk Assessment PowerPoint (Punt)
April 2013

Pacific Sardine Harvest Parameters Workshop and Risk Assessment

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Outline

- February 2013 Workshop
- Results of Initial Risk Assessment Calculations

Objectives

- Design a risk assessment projection model that can evaluate the current use of selected harvest control rule (HCR) parameters with regard to risk in jeopardizing long-term stock productivity, for potential Council decision making in 2013.
- Consider recommendations for:
  - a new predictive relationship between recruitment success and environmental variables; and
  - a new estimate of the proportion of the stock that occurs in U.S. waters.
- Prepare an initial plan for a full management strategy evaluation (MSE) for Council consideration in 2015.

Finding a new predictive relationship between recruitment success and environmental variables

OBJECTIVE 2A

Background

- In Amendment 8 to the CPS FMP, FRACTION is a function of 3-year average SST at Scripps Pier (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.

Workshop Progress

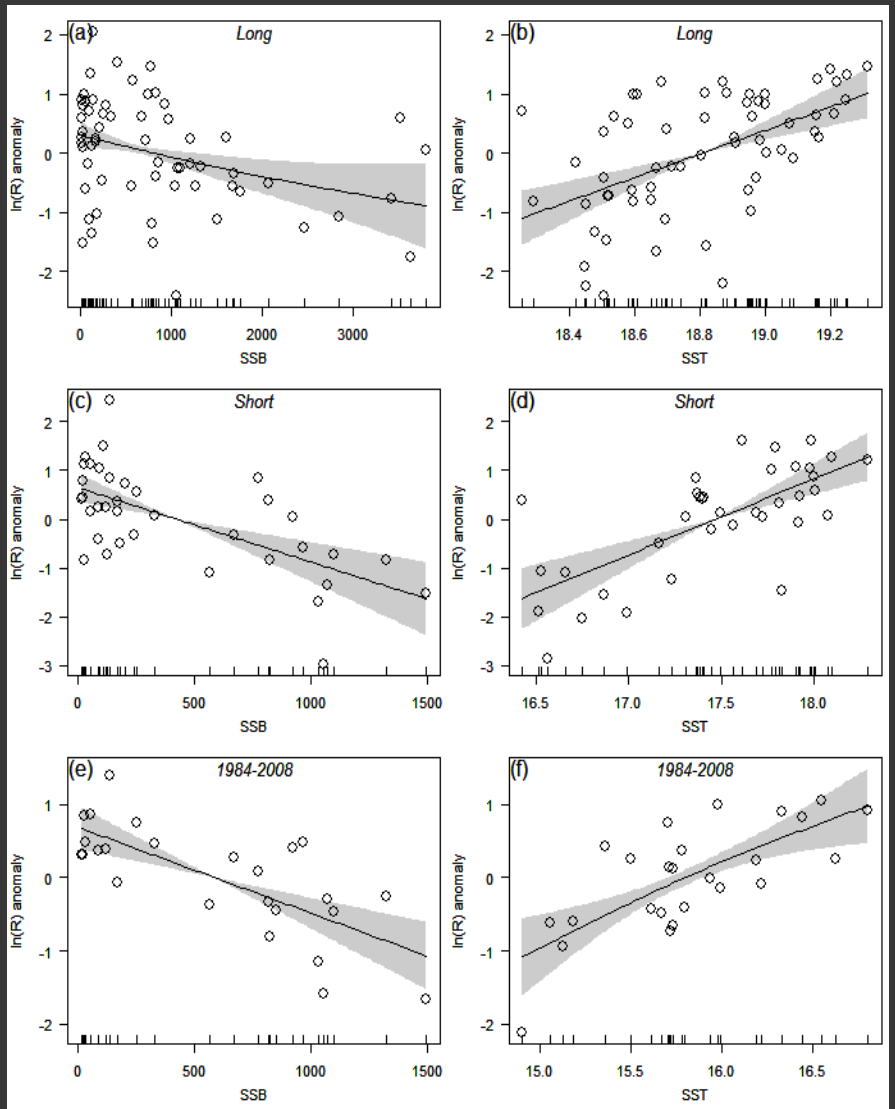
(Is recruitment related to the environment)

ER_SST_T5

- All Data
- Common data

CalCOFI SST

- 1984+



Workshop Progress
(Conclusions)

- Inclusion of the mean 5-15m temperature data from the regular CalCOFI area significantly improves the fit to the stock-recruitment data for 1984-2008 and should be used in the operating model to evaluate harvest policy options and well as in some of the candidate harvest control rules.
- Spawning stock biomass and CalCOFI SST explain about equal proportions of the variance in recruitment and both need to be included in predictive relationships.
- Several new environmental indexes are under development. There needs to be some (but not too much) flexibility related to being able to base the environmental index used in HCRs to reflect the best available science regarding prediction of recruitment.

Finding a new estimate of the proportion of the stock that occurs in U.S. waters

OBJECTIVE 2B

Workshop Deliberations

- **What is the definition of "DISTRIBUTION"**:
  - Time-dependent vs time-invariant (87% or a function of time, season, etc.)
  - Should DISTRIBUTION be updated based on recent survey data / habitat models.
  - Can DISTRIBUTION be defined in terms of catches (and be forecasted)
- **Recommendation**:
  - The current value for DISTRIBUTION of 0.87 was developed when there was no appreciable biomass off Canada and was based on information up to 1992. The data which pertains to the distribution of sardine biomass in U.S. waters is patchy, but efforts should be made to assemble and synthesize the available information.

Prepare an initial plan for a full management strategy evaluation (MSE) for Council consideration in 2015

OBJECTIVE 4

Items Considered

- Status of California Current Ecosystem Models in relation to Pacific sardine and its fisheries.
  - none of ecosystem models presented were sufficiently well developed to form the basis for an MSE, and substantial modifications would need to be made to them before they could be used for this purpose.
- Economic models
- Alternative control rules
- Alternative environmental indexes

Design a risk assessment projection model

OBJECTIVE 1

Pacific Sardine: Management Process

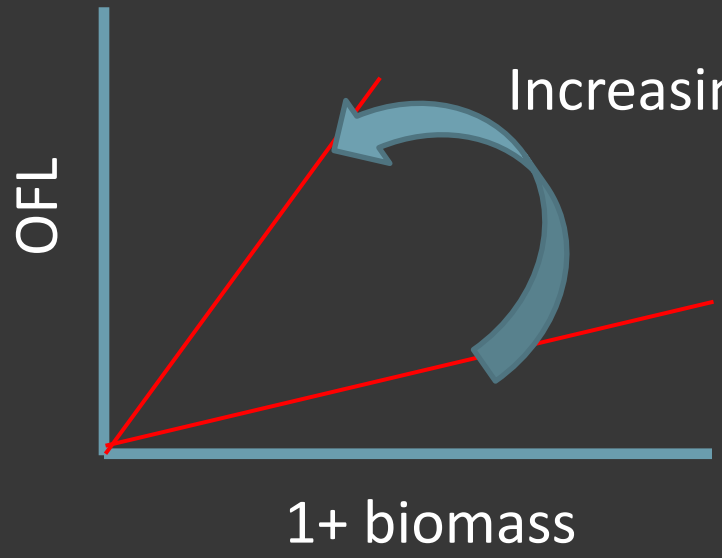
(Amendment 8 & 13)

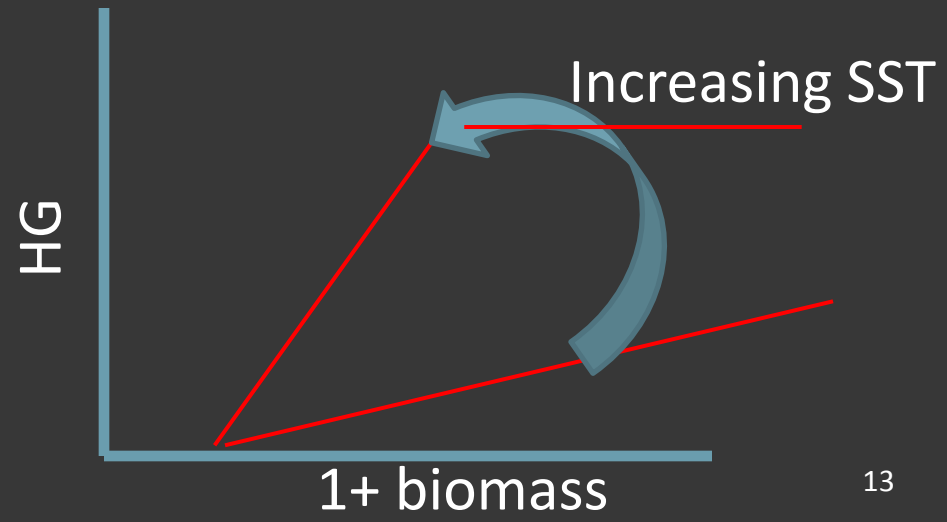
Overfishing Level (OFL)

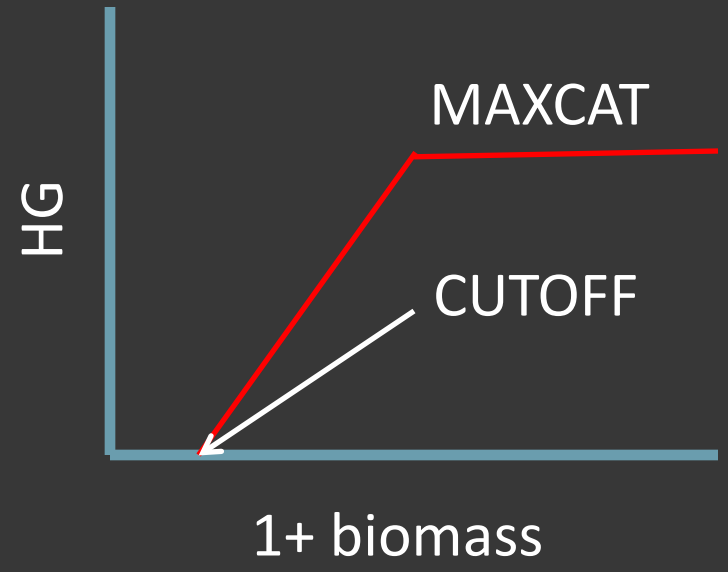
P*

Acceptable Biological Catch (ABC)

Harvest Guideline (HG)



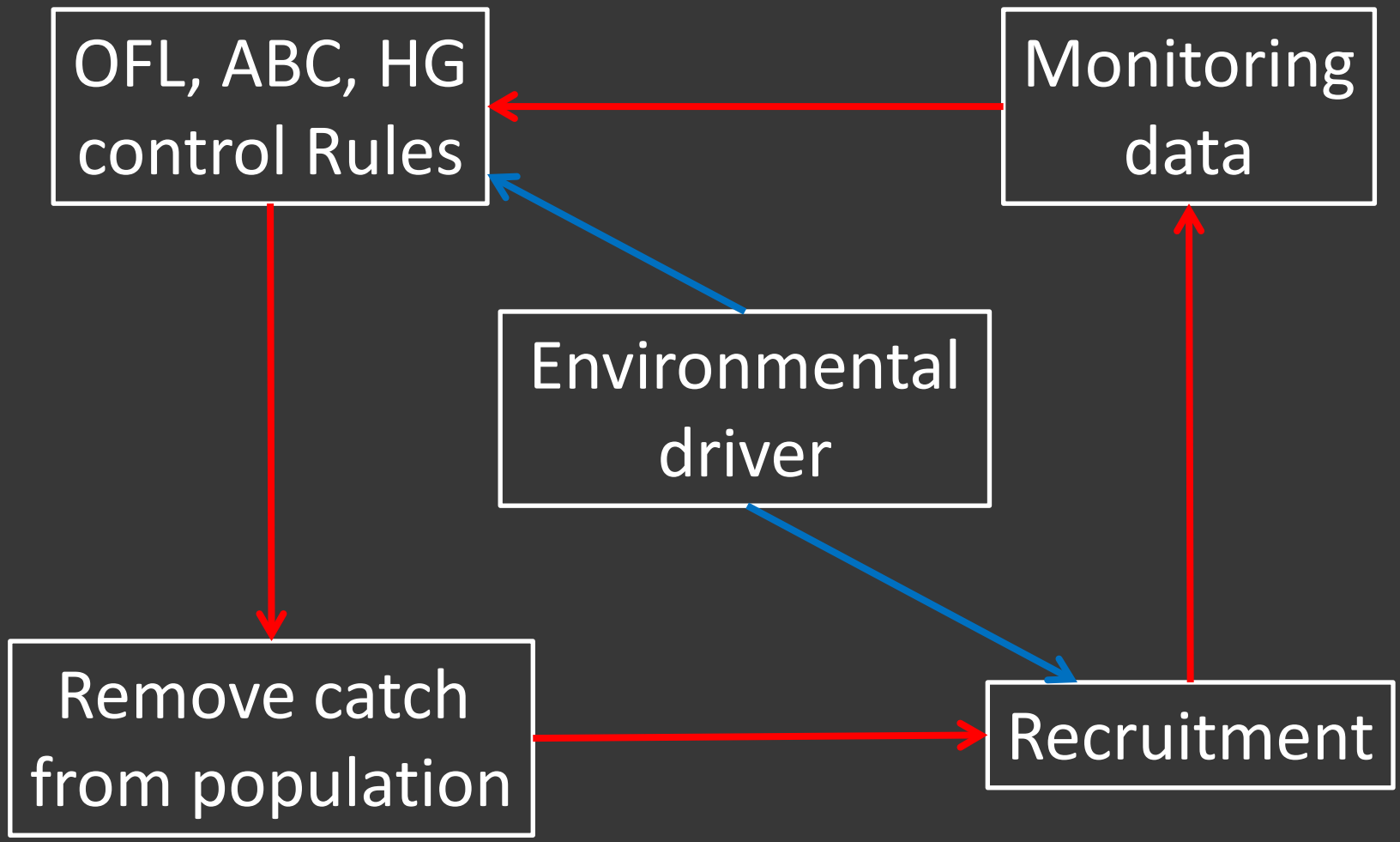




ISSUE:

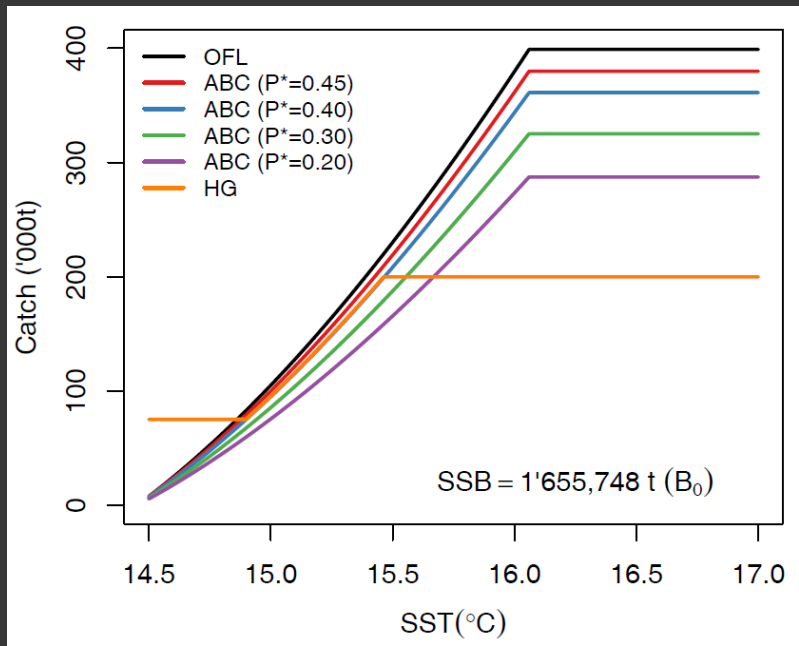
- Value for MAXCAT?
- Value for CUTOFF?
- Relationship between FRACTION and an environmental variable?

Risk Assessment Framework



Harvest Policy variants

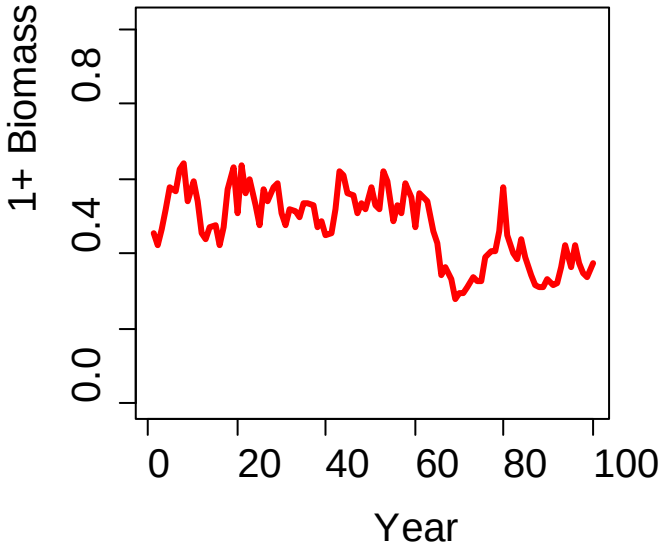
- Different choices for FRACTION, CUTOFF and MAXCAT
- FRACTION :
  - can be a constant (e.g. E_{MSY}) or
  - can be related to an environmental variable (e.g. 5% at 14.89^{0}C and E_{MSY} at 15.47^{0}C)
- Note: results are provided for illustrative “harvest policy variants”.



Measuring Trade-offs-I

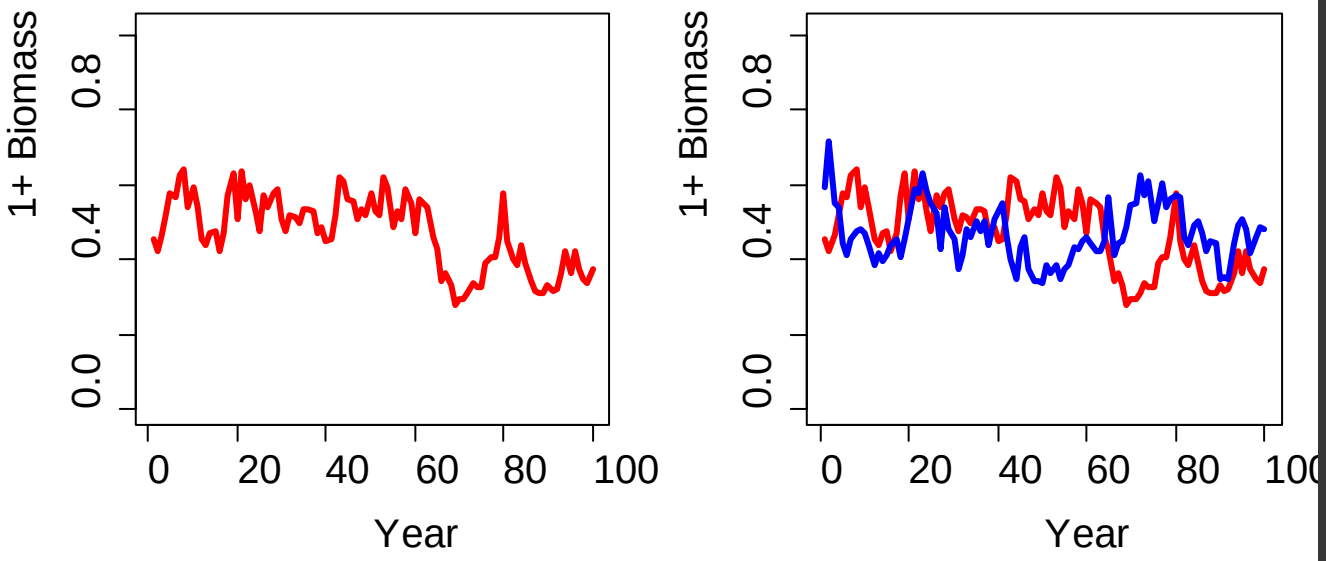
The performance measures are selected to quantify performance relative to [some] management goals.

- 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.

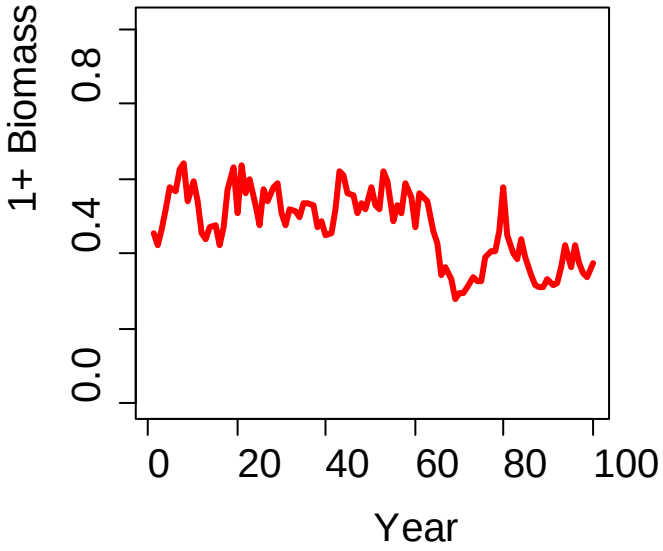


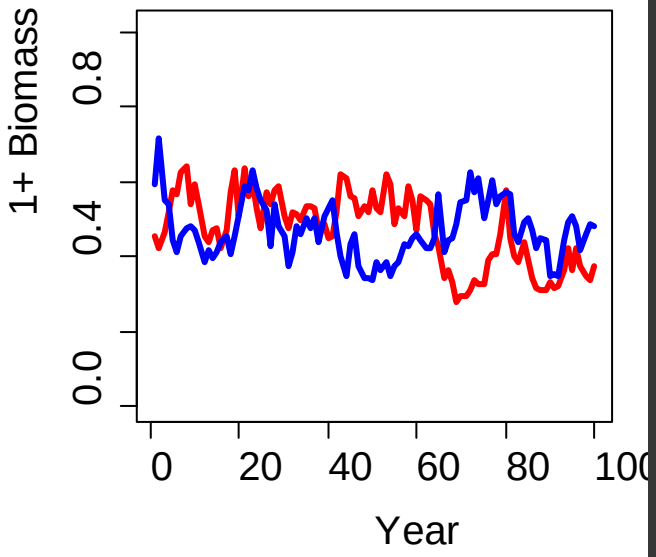
One [example] stochastic projection of biomass – the projection accounts for noise due to recruitment.

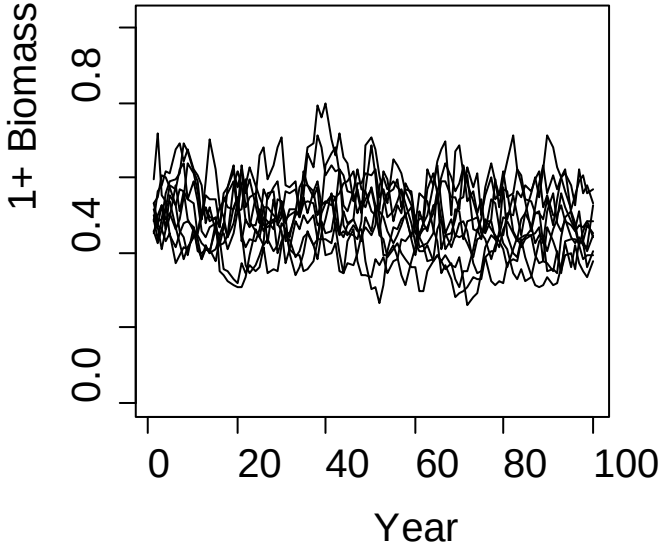
Note that this illustrative – i.e. not sardine



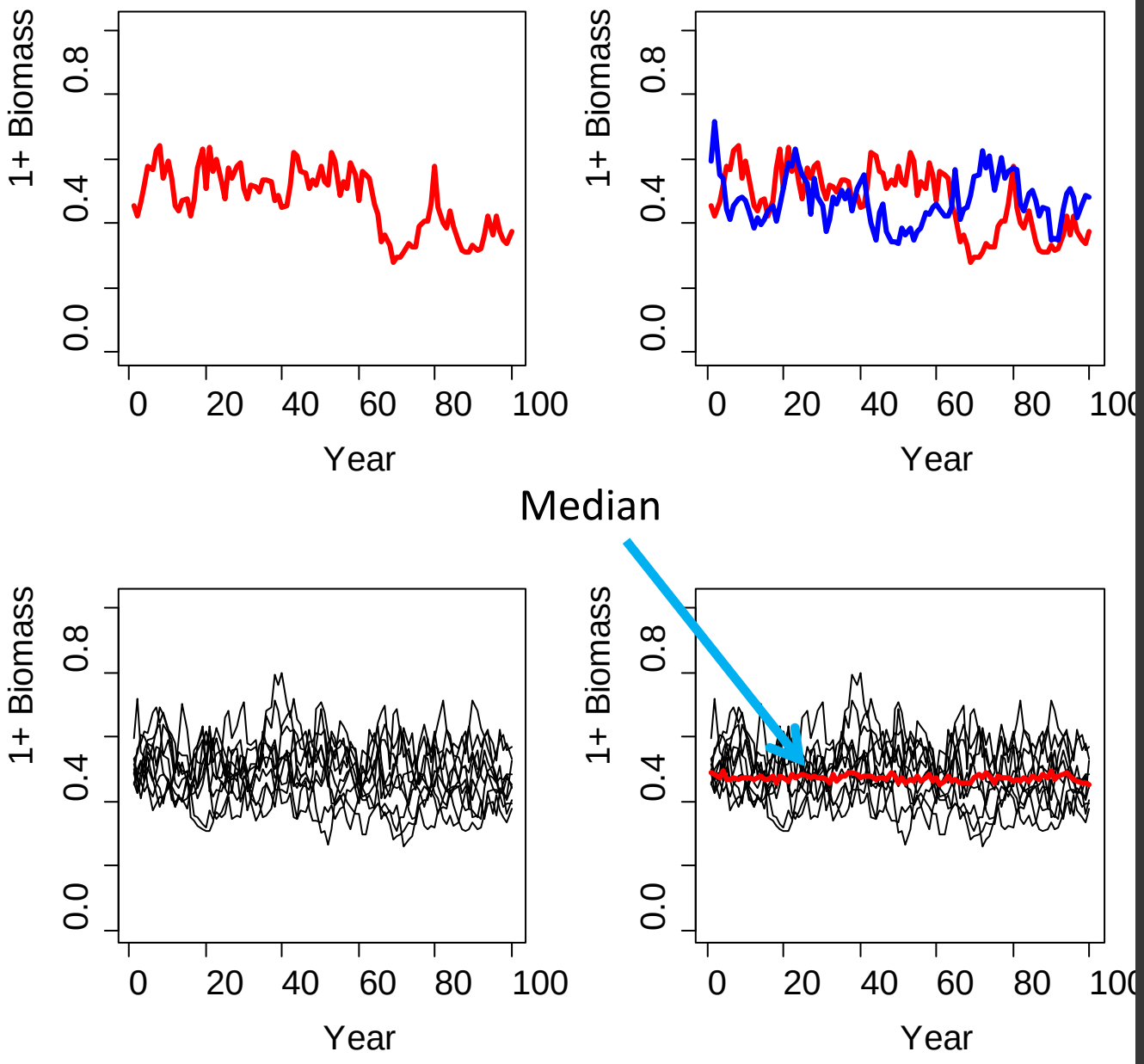
Two [example] stochastic projections of biomass – the projections differ due to (a) random recruitment and (b) a random period of continuous poor [average] recruitment.







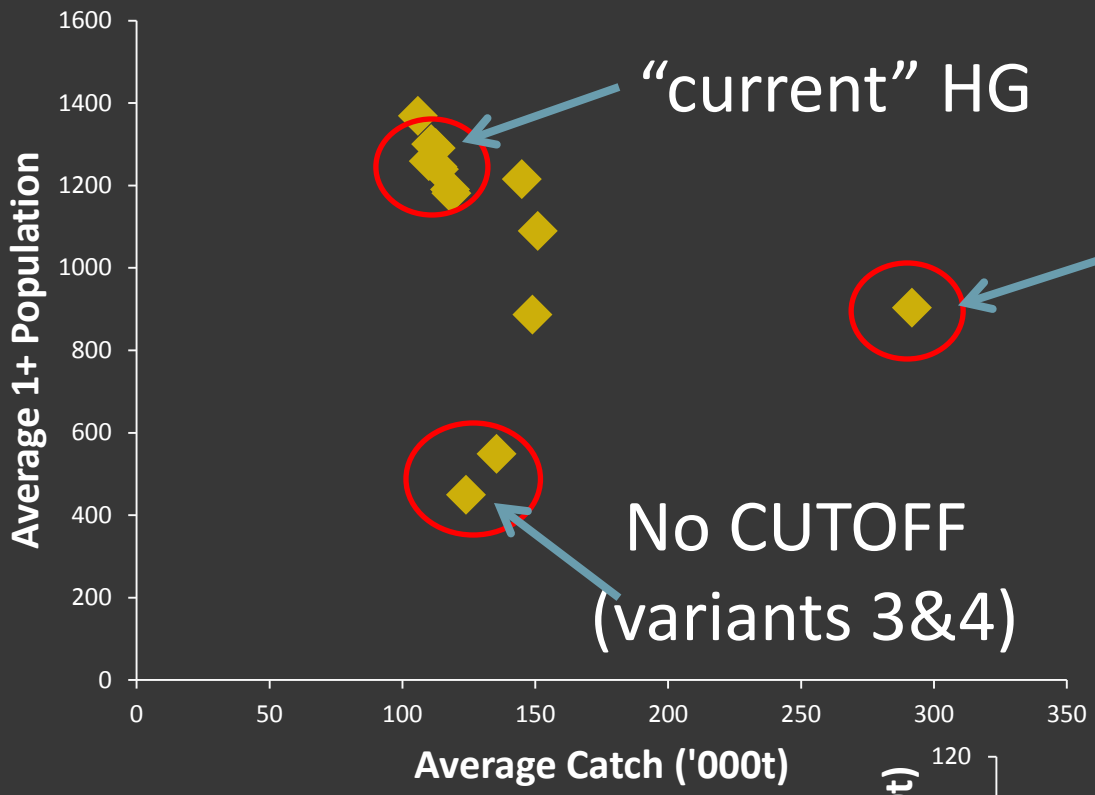
Many projections


1+ Biomass
0.0
0.4
0.8
0
20
40
60
80
100
Year
1+ Biomass
0.0
0.4
0.8
0
20
40
60
80
100
Year
Median
1+ Biomass
0.0
0.4
0.8
0
20
40
60
80
100
Year
1+ Biomass
0.0
0.4
0.8
0
20
40
60
80
100
Year

Measuring Trade-offs-II

The performance measures need to:

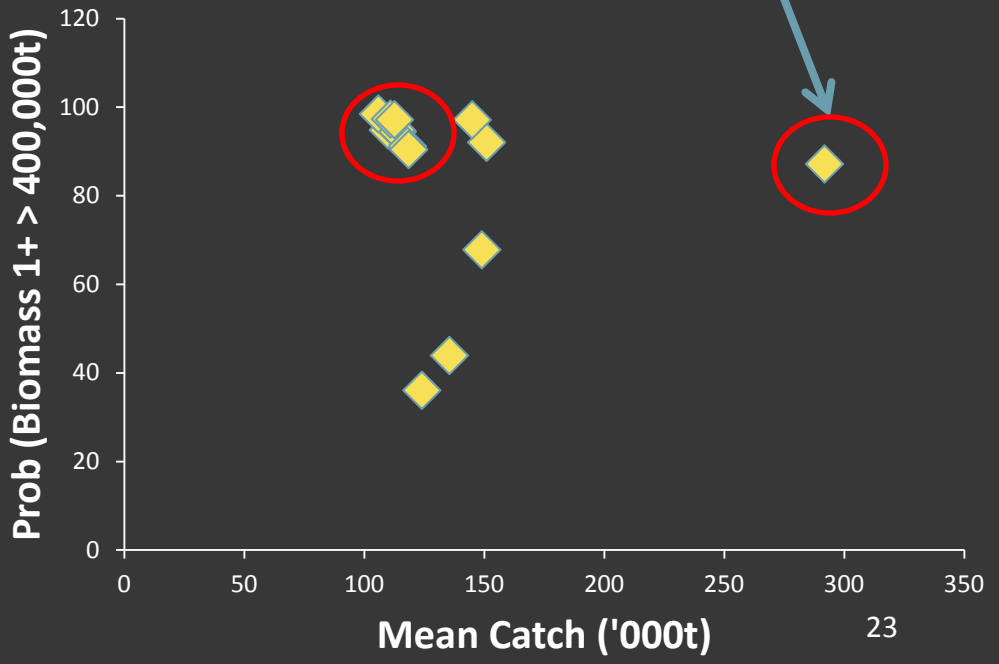
- capture “average” outcomes [means and medians over replicates of reality].
- capture variation and uncertainty.
  - variation can be random or systematic (long periods of poor recruitment); and
  - uncertainty is also captured by conducting analyses for values for parameters which capture the likely range.



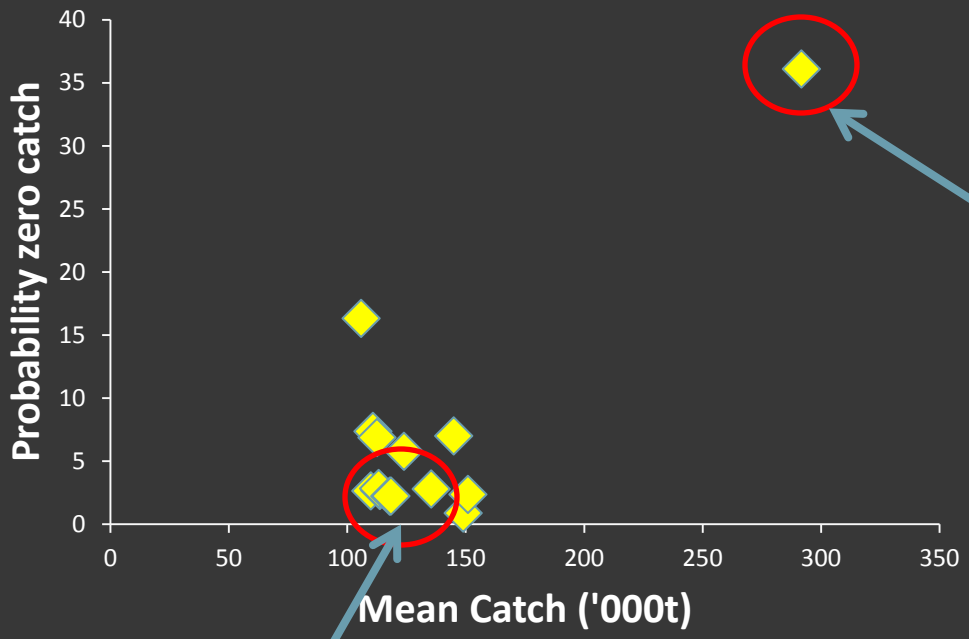
"current" HG

45% harvest rate & high CUTOFF (variant 5)

No CUTOFF (variants 3&4)



Performance measures are defined over many cycles of the environmental variable and are not predictions of short-term catches / biomass.



45% harvest rate & high CUTOFF (variant 5)

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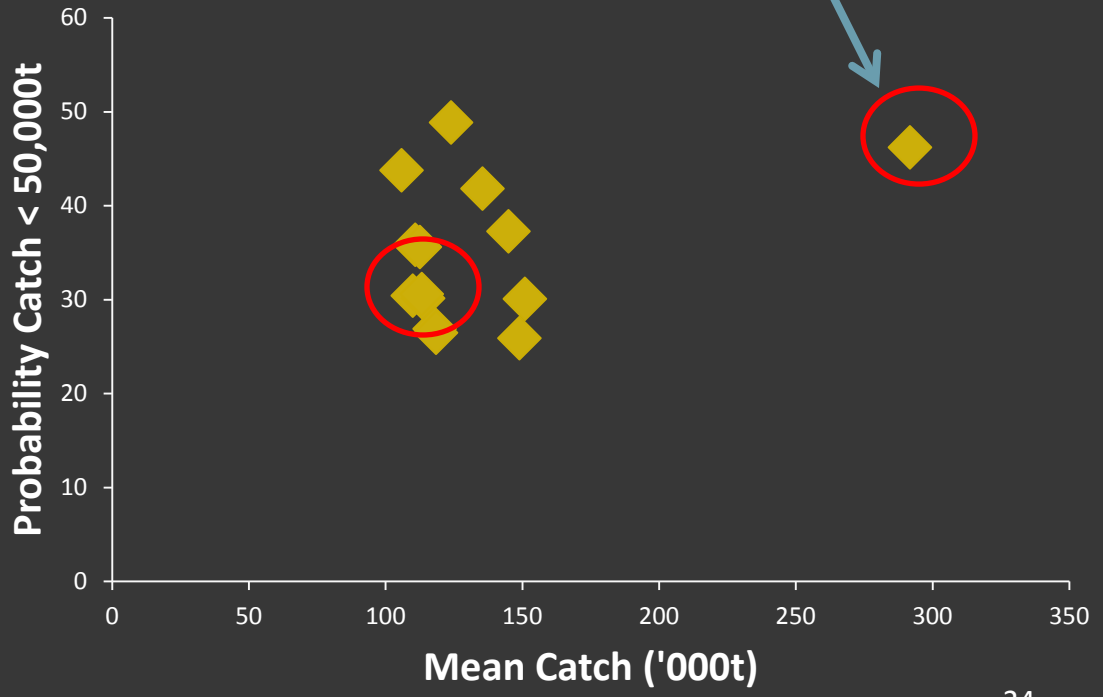
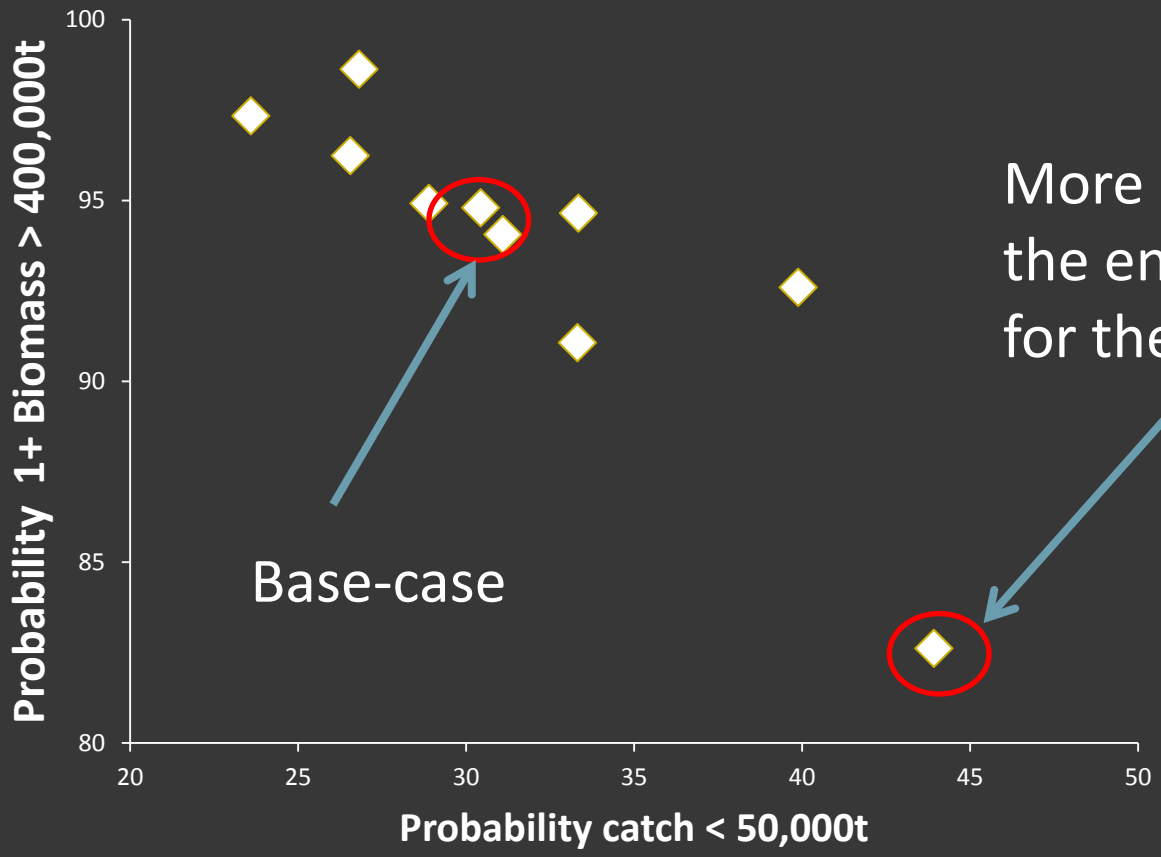
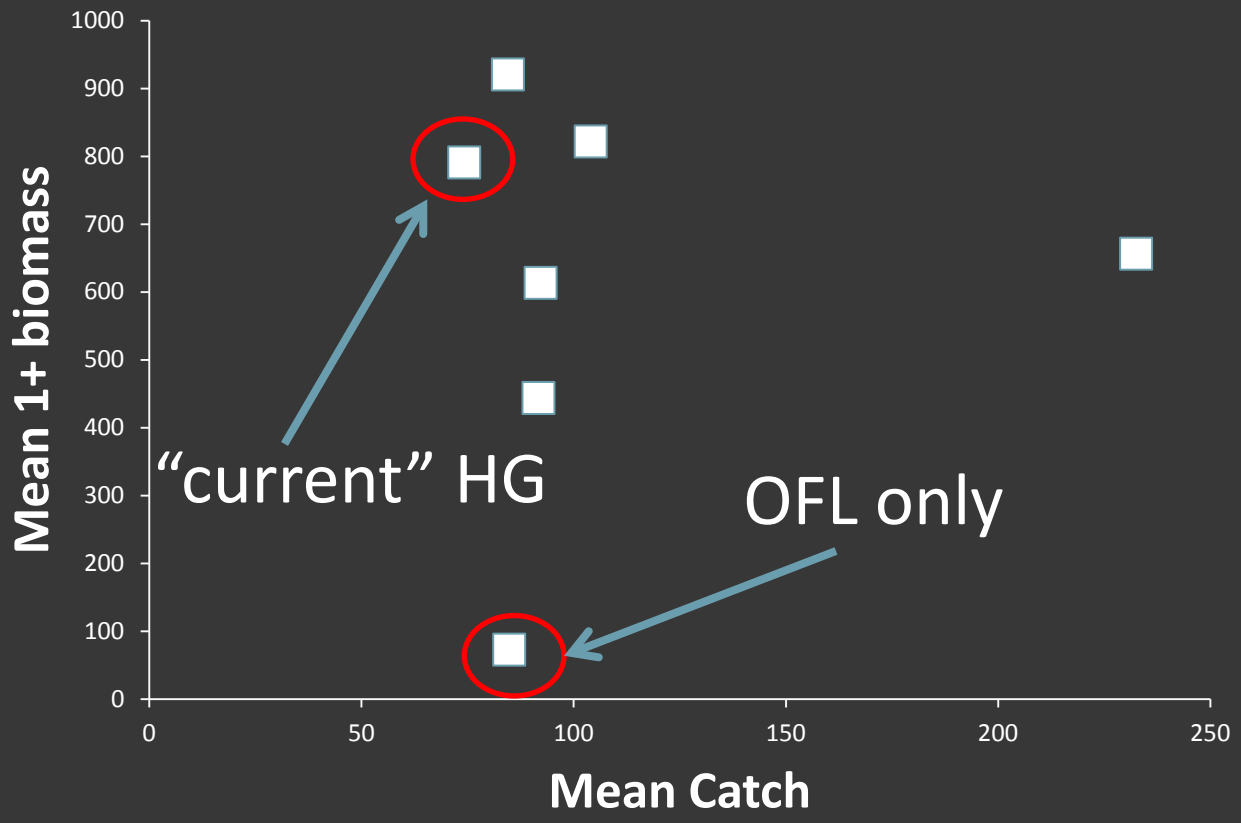




Performance depends on the values for the parameters determining, for example, how the environment impacts recruitment.



Key Major Sensitivity: The assumption everyone follows the US control rules (for this test Mexico and Canada are assumed to have a constant fishing mortality rate no matter what)

Possible Next Steps

- Refinement of:
  - harvest policy variants (e.g. years of which the environmental variable is average); and
  - performance measures
- Additional sensitivity scenarios to more fully explore performance given sources of uncertainty.