Conception of a management strategy evaluation for Atlantic herring harvest control rules

NEFMC EBFM PDT
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Outline

I. General intro to MSE
   a. Current system
   b. System changes with MSE
II. Examples
   a. Generically
   b. For herring
      i. Life history characteristics
      ii. Harvest control rules
      iii. Miscellaneous
      iv. Results
      v. Conclusions

What we are used to…

Traditional Assessment

- Argue about data
- Argue about assessment model type and configuration
- Argue about reference points
- Argue about uncertainty
- Argue about stock specific considerations (e.g., forage)
- Lawyer up
- Repeat every 1-5 years

What we are used to…
Traditional Assessment

Consequences:

- instability in method and TAC
- little consideration of long-term
- not a full account of uncertainty (single assessment)
- common default of no change
- necessarily contentious

Butterworth 2007

Management Strategy Evaluation

a.k.a. management procedure

A formally accepted procedure to provide management advice (e.g., ABC) where the inputs and methods are prespecified

Stakeholder meetings to ID:

- objectives
- uncertainties

Develop a simulation with feedback loop to test

- Incorporate uncertainty into simulation
- Embed data collection, assessment, management within simulation model

Produces distributions of outcomes (probabilities)

Butterworth 2007

Management Strategy Evaluation
a.k.a. management procedure

Stakeholder meetings to agree on *robust*:

- data inputs
- methods of assessment
- methods of quota setting
- reference points / “optimum”

Management Strategy Evaluation

Consequences:

- no regularly scheduled arguing
- research time to address issues / improve
- in the context of risk, informs probability and severity of consequence
- stakeholder driven

- lengthy initial development
- autopilot, but can plan for flex and review

Butterworth 2007

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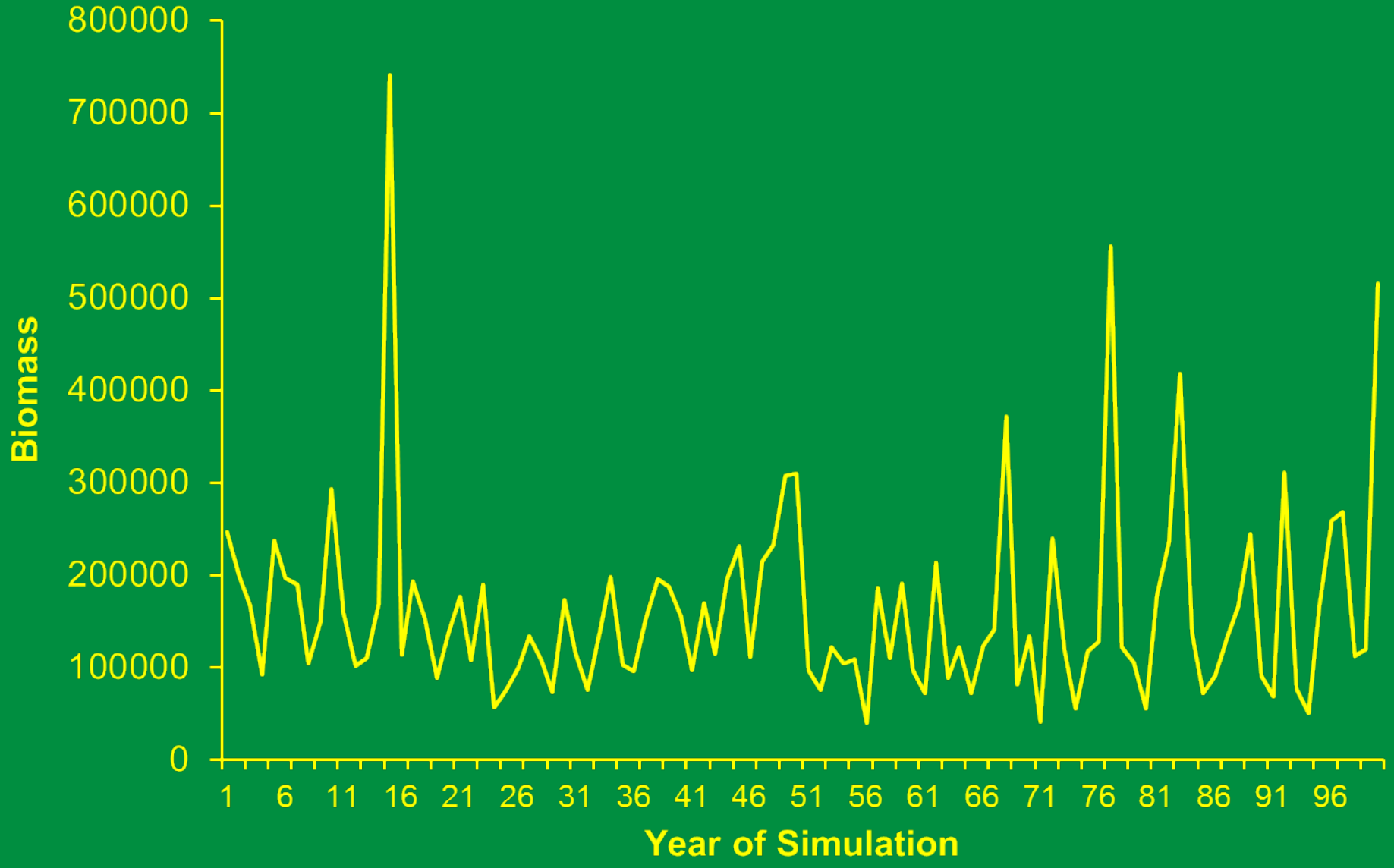
Generic Example

$$N_{y+1} = N_y - C_y - M_y + G + R_y\left(B_{y-1}, \theta\right)$$

Repeat for y=1 to y=100

Record results of interest (biomass, catch):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Biomass
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51
56
61
66
71
76
81
86
91
96
Year of Simulation

Generic Example

$$N_{y+1} = N_y - C_y - M_y + G + R_y\left(B_{y-1}, \theta\right)$$

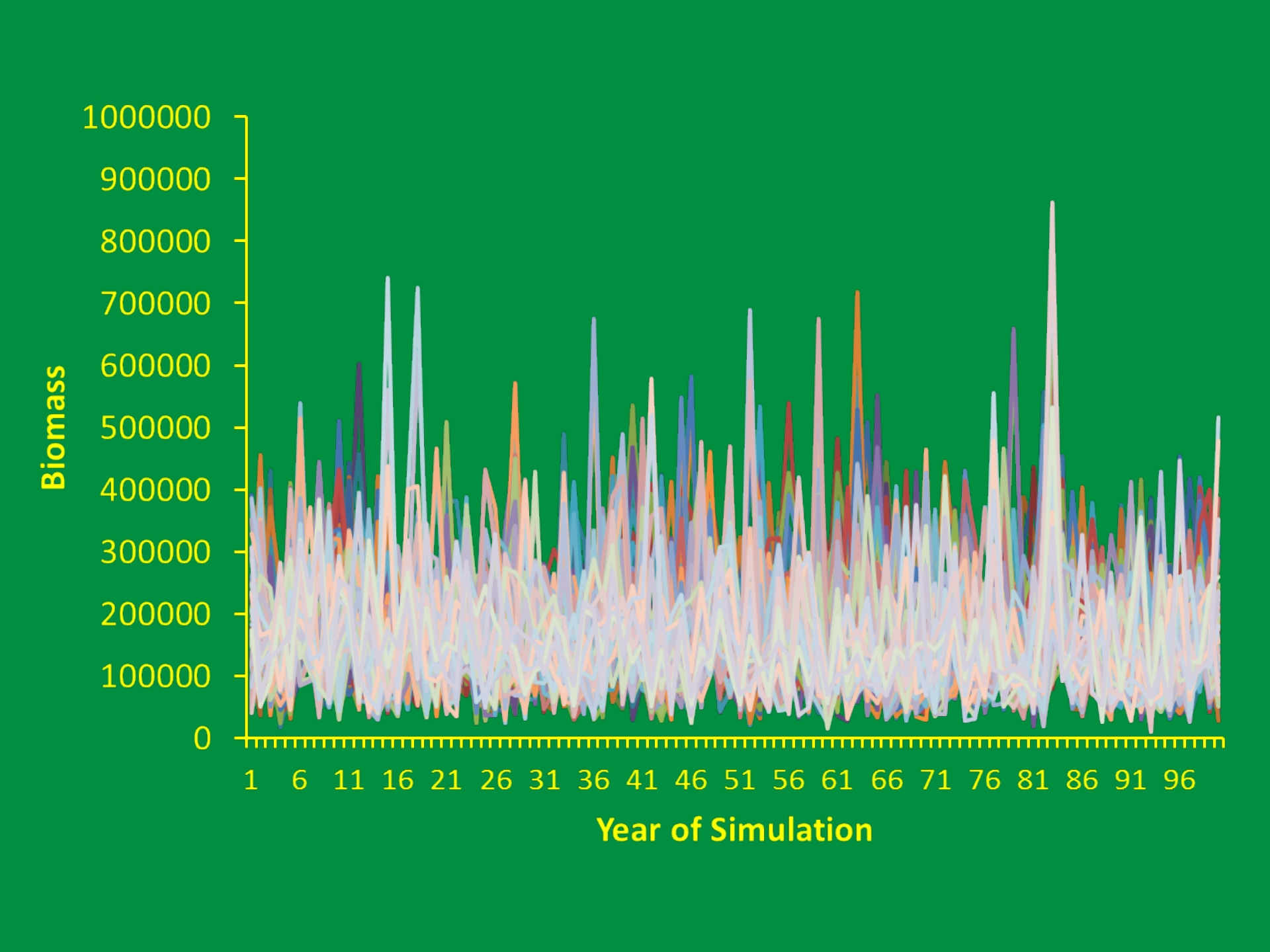
Repeat for y=1 to y=100

Record results of interest (biomass, catch):

Some elements uncertain, e.g., θ

Select a new θ for each realization (simulation)

Repeat 100 times, and record each result


1000000
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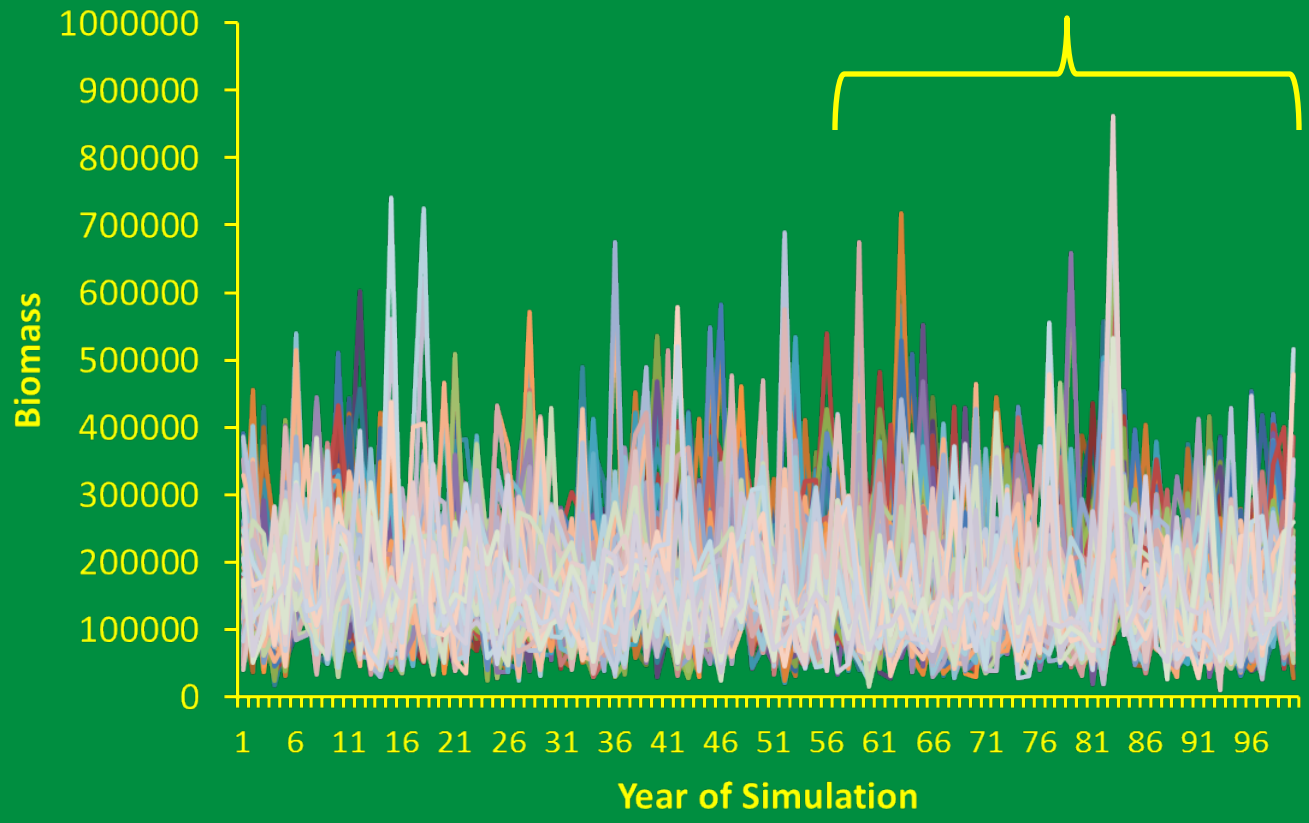
600000
500000
400000
300000
200000
100000
0
Biomass
1 6 11 16 21 26 31 36 41 46 51 56 61 66 71 76 81 86 91 96
Year of Simulation

Summarizing Results

Report median or other percentiles

Average last 50 years (100 values)



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Herring Example

$$N_{y+1} = N_y - C_y - M_y + G + R_y\left(B_{y-1}, \theta\right)$$

Age-1 to age-8+

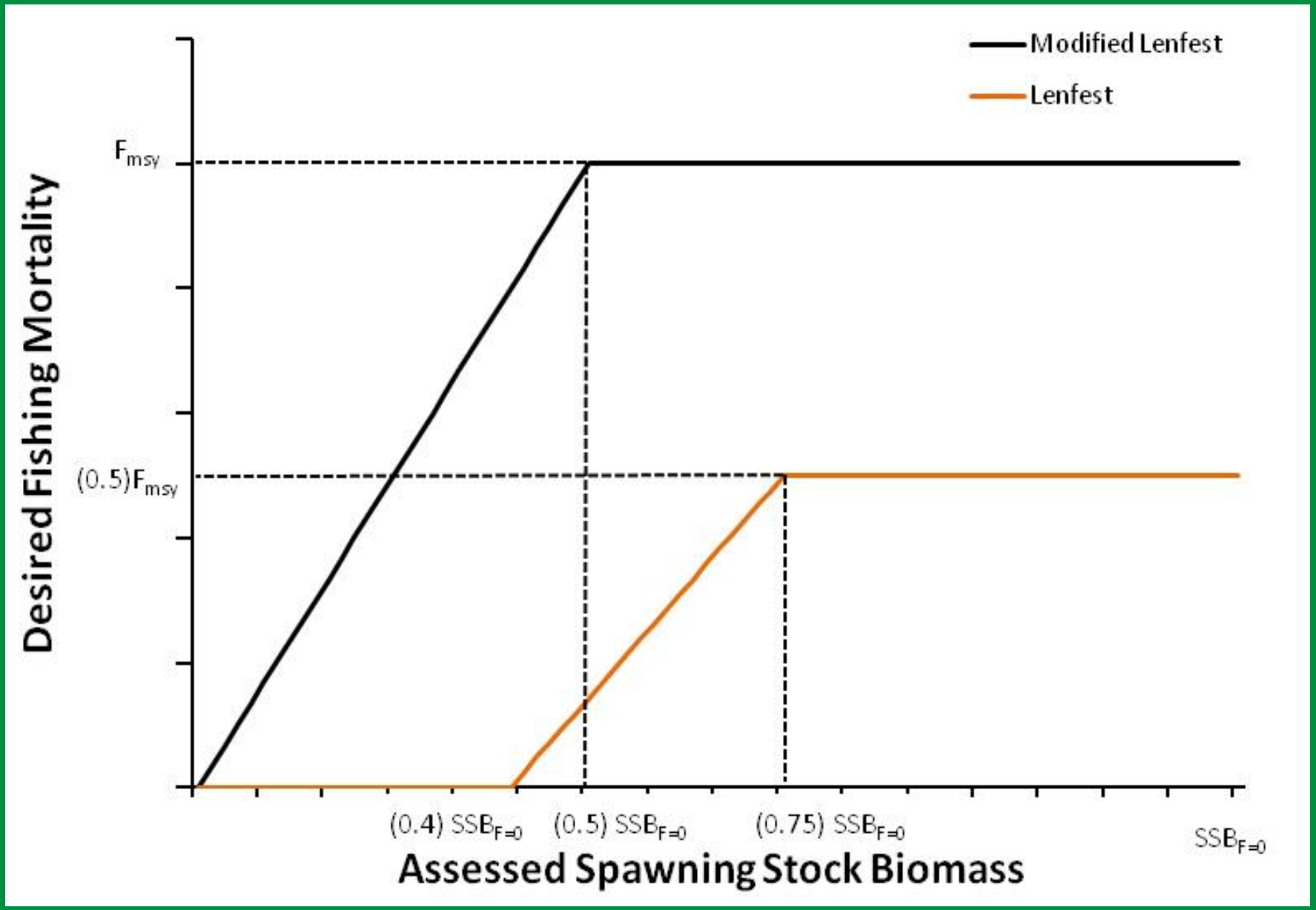
Maturity and weights at age equal average of 2007-2011

Selectivity equaled that from mobile gear

M was constant and equaled 0.5

Recruitment parameters only uncertainty

Control Rules



Miscellaneous

Unbiased, autocorrelated assessment errors

Did not include “real” assessment

Unbiased implementation errors

Each control rule evaluated using 100 simulations, each for 100 years

Recorded spawning stock, yield, interannual variability in yield

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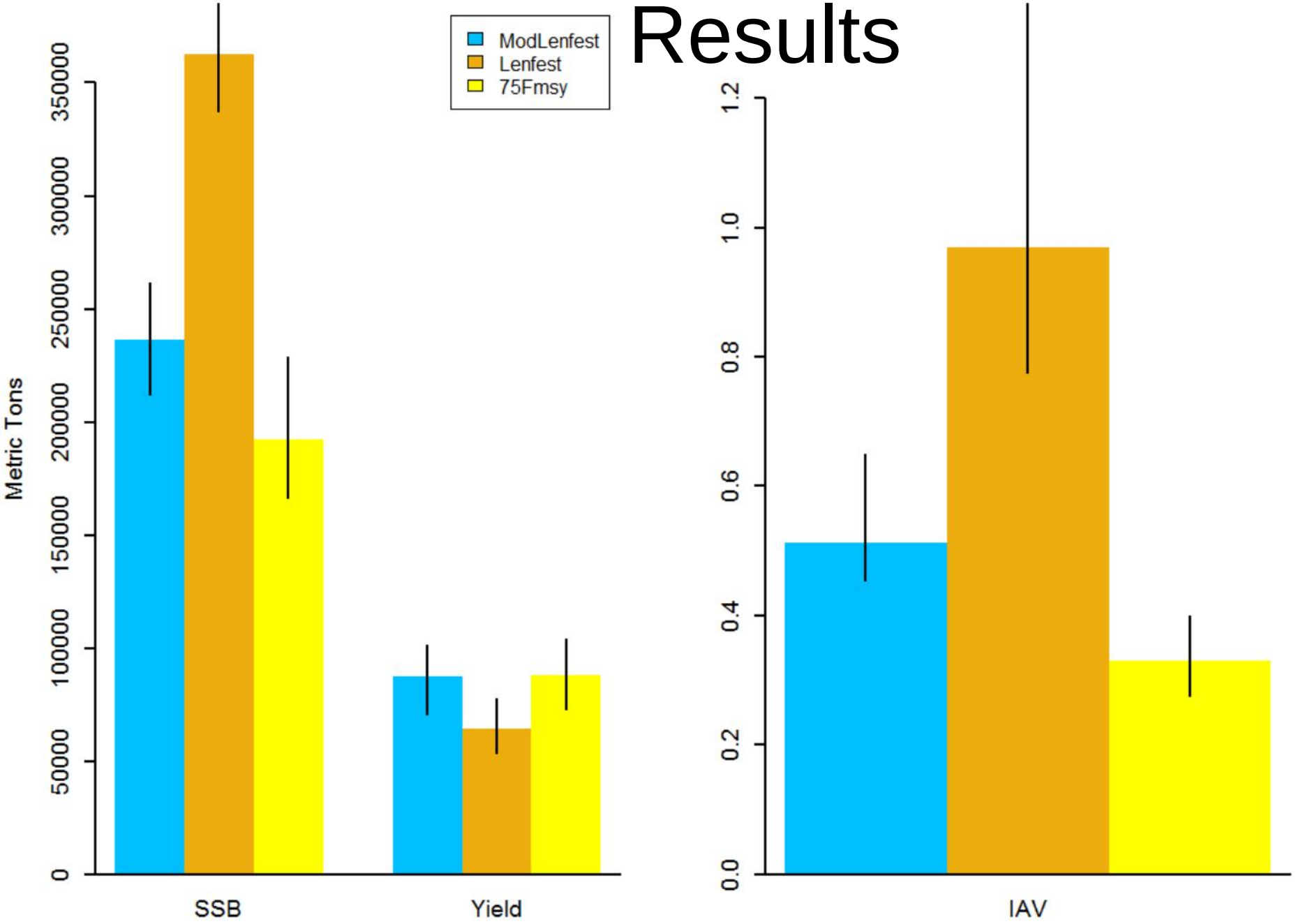
Results


ModLenfest
Lenfest
75Fmsy
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50000
100000
150000
200000
250000
300000
350000
SSB
Yield
0.0
0.2
0.4
0.6
0.8
1.0
1.2
IAV

Conclusions

Results largely consistent with previous research on control rules

Managers must choose control rule based on preferred tradeoffs

Need additional input on:

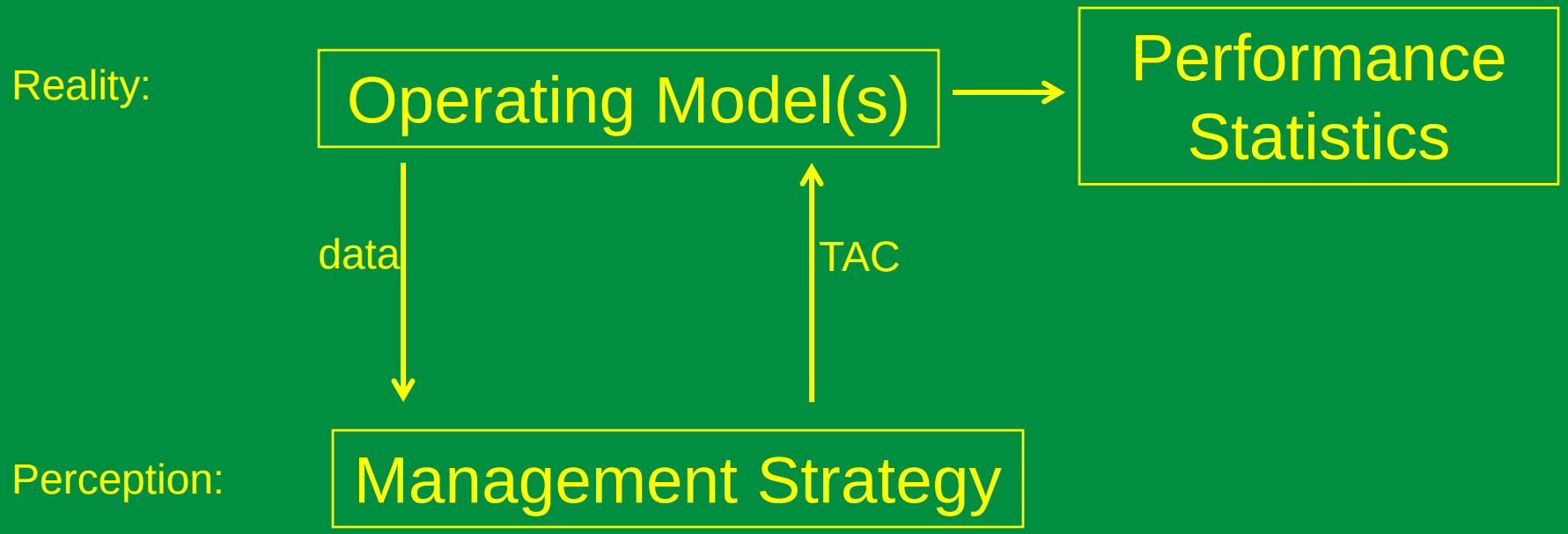
- ecosystem objectives (a metric)
- defining uncertainties
- alternative control rules
- stock assessment details

Could evaluate other data, assessment, mngm't questions (stock structure, assess. models)

Questions, comments, input

If confusion is the first step to knowledge, I must be a genius. (Larry Leissner)

MSE - schematic



Adapted from Butterworth 2008