Confronting red tide-induced fish kills through management strategy design

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NOAA FISHERIES

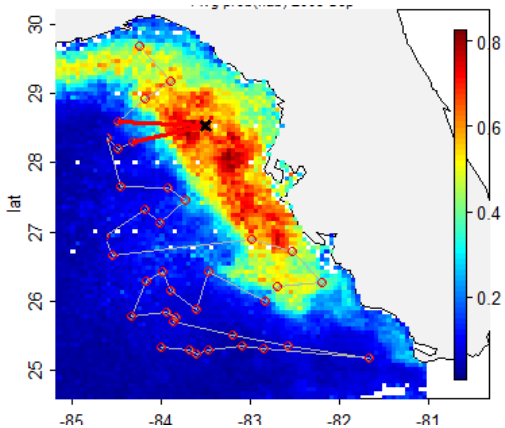
UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

CIMAS
Cooperative Institute for Marine and Atmospheric Studies

IEA
INTEGRATED ECOSYSTEM ASSESSMENT

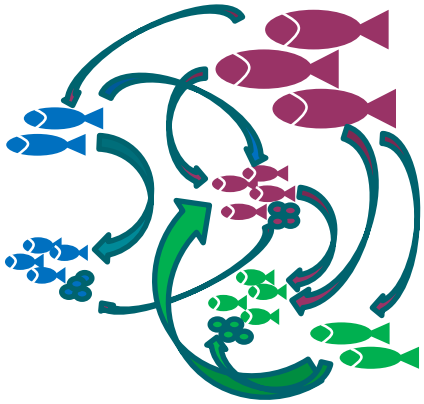
Research & assessment recap

Satellite-derived red tide index



Walter et al. 2013
SEDAR document

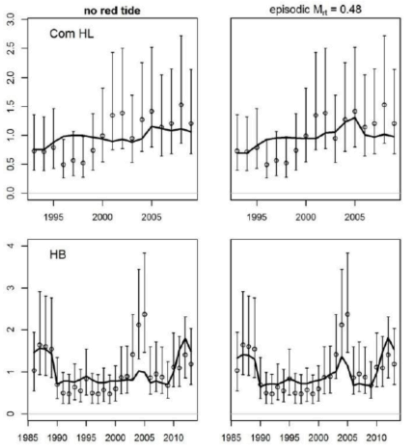
Ecosystem modeling



Arnaud Gruss University of Miami

David Chagaris FWRI

Stock assessment fitting



Several SEDAR documents

Research & assessment recap

2014

- Red tide event postponed decisions on Gag Grouper catch limits to wait for scientific analysis (analysis later provided by D. Chagaris)

June 2014

- Via SSC and IEA support, GMFMC motion:

  "…evaluate the current Red Grouper harvest control rule to determine if it is robust to possible future changes in intensity and frequency of episodic events of non-fishing mortality."

  Are the GMFMC management strategies robust to red tide events?

Sept 2015

- Harford, Gruss, & GOM IEA team discussion with SSC

  Scoping:
  Key uncertainties
  Types of harvest control rules
  Identifying performance metrics

Today's scope of discussion

Jan 2018

- Present broad themes and outcomes obtained via management strategy evaluation
- Intended as non-technical talk
- Seek SSC feedback for on-going and future work
- SEFSC has allocated time (Harford) to continuing this research

Talking points

1) Simulating a Red Grouper management strategy, including current practices

2) Evaluate consequences of assessment reactivity to severe events

3) Evaluate consequences of ACL reductions*
   *Using an approach that fits within GMFMC approach OFL →ABC→ ACL

Are the GMFMC management strategies robust to red tide events?

Point #1: Building a Red Grouper management strategy

Data

Stock assessment

Harvest control rule

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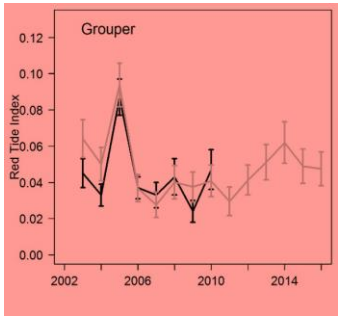
Stock assessment

Harvest control rule

Catch
Indices
Age/length composition
Life history parameters

Red tide index
(Satellite derived product)



Walter et al. SEFSC

Point #1: Building a Red Grouper management strategy

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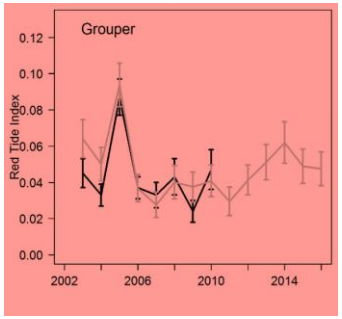
Catch
Indices
Age/length composition
Life history parameters

Red tide index
(Satellite derived product)



Walter et al. SEFSC

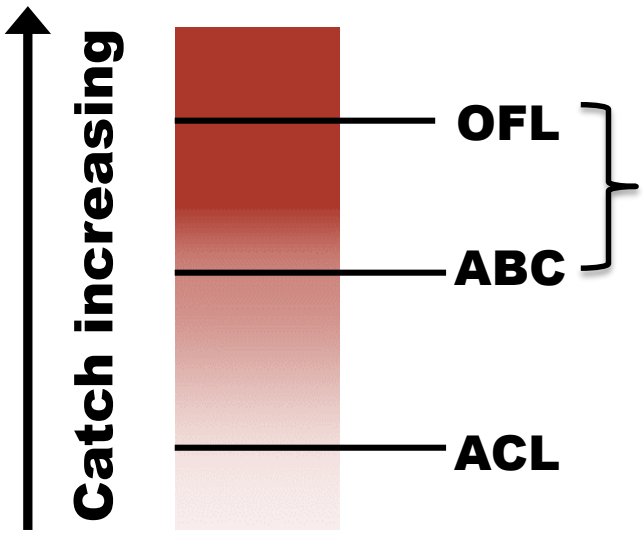
Stock assessment

Stock Synthesis
Age structured model

Time-varying M
via red tide index

Harvest control rule

Point #1: Building a Red Grouper management strategy



GMFMC current ABC rule

Scientific uncertainty

"Assessment information"
"Characterization of uncertainty"

Alternatives

Continue to incorporate current ABC rule

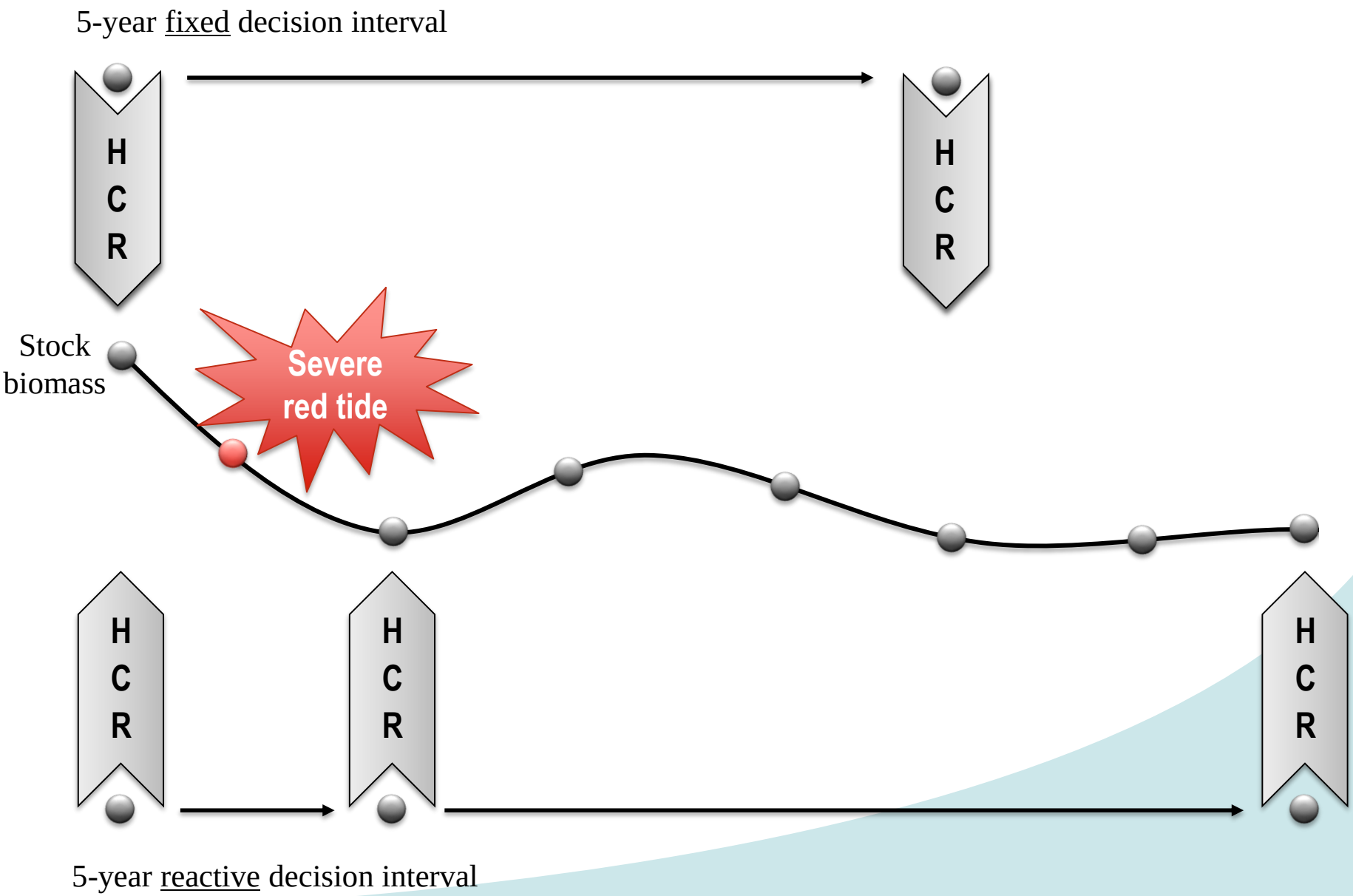
Additional buffer to produce ACL?

Are the GMFMC management strategies robust to red tide events?

Estimating time-varying M *could* increase stock assessment uncertainty

After setting multi-year ACLs, red tide events *could* jeopardize achievement of objectives.

Point #1: Building a Red Grouper management strategy



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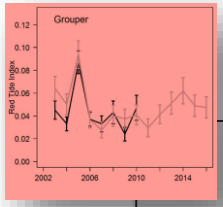


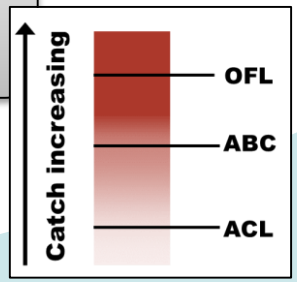
Data

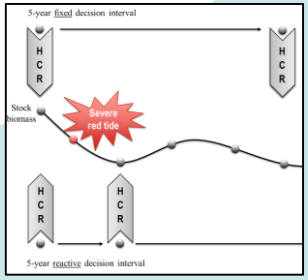
Stock assessment

Stock Synthesis
Time-varying M

Harvest control rule

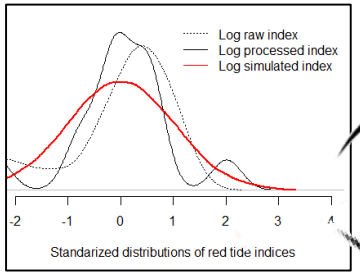
- Existing ABC rule
- ACL reductions
- Assessment frequency

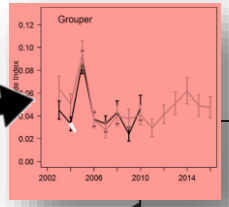




Point #1: Building a Red Grouper management strategy

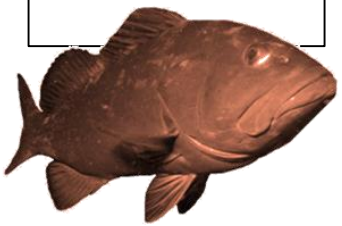
Environment: red tide





Historical intensity

Red grouper



Data

Stock Synthesis
Time-varying M

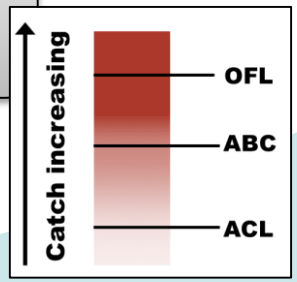
Stock assessment

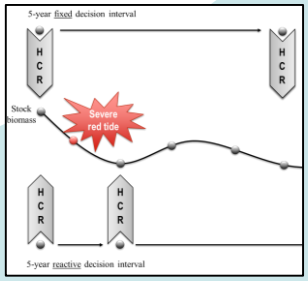
Fish stock

Fishery

Harvest control rule

- Existing ABC rule
- ACL reductions
- Assessment frequency



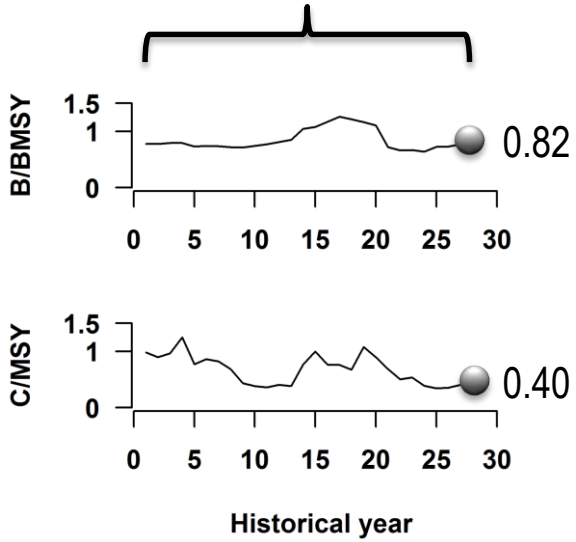


Point #1: Building a Red Grouper management strategy

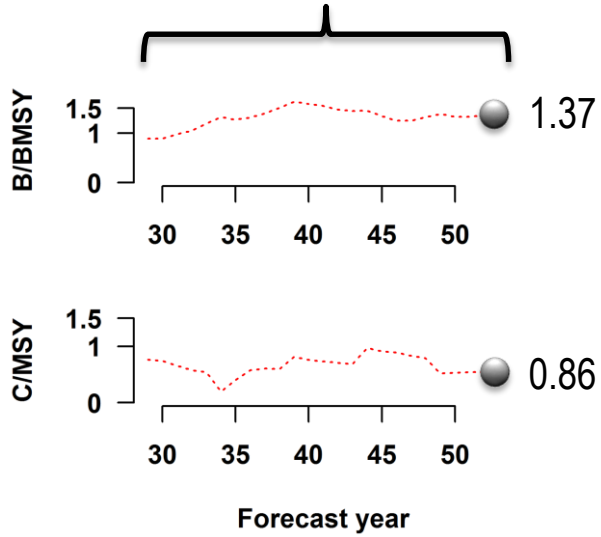
Current ABC control rule approach:

Existing ABC rule, no ACL buffer, 5-year fixed assessment interval

Historical stock dynamics
Similar to SEDAR assessment



25-year forecasts



Percent simulations overfished in 25th year
34%

Percent simulations exceeding acceptable probability of overfishing
54%

*Some model refinements on-going, results not finalized

Is this existing strategy robust to red tide events?

Point #2: Evaluate consequences of assessment reactivity to severe events

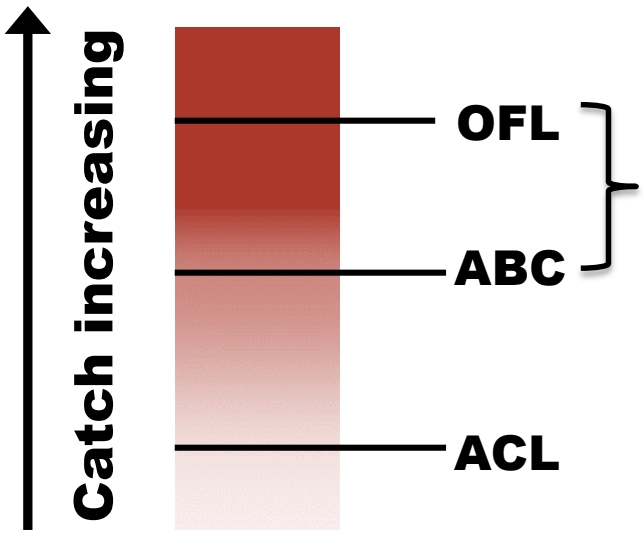
Option	Percent simulations exceeding probability of overfishing	Percent simulations overfished in 25th year
Fixed 5-yr interval	54%	34%
Reactive interval	44%	28%

Trade-offs

- Timing and cost of stock assessments
- Reliable detection of severe events
- Multiple stocks affected?
- Will other stocks be assessed less frequently as a consequence?
- Reactionary versus precautionary principles?

*Some model refinements on-going, results not finalized

Point #3: Evaluate consequences of ACL reductions



GMFMC current ABC rule

Scientific uncertainty

Alternatives

Continue to incorporate current ABC rule

Evaluate consequences of ACL setting

Point #3: Evaluate consequences of ACL reductions

Fixed 5-yr interval ACL reduction	Percent simulations exceeding probability of overfishing	Percent simulations overfished in 25th year	Median C / MSY in 25th year	Median B / BMSY in 25th year
0%	54%	34%	0.86	1.37
-10%	34%	26%	0.93	1.56
-20%	12%	20%	0.94	1.73
-30%	<1%	14%	0.83	1.85
-40%	<1%	10%	0.87	2.12

*Some model refinements on-going, results not finalized

Summary

- Progress report, work currently under scientific review
- MSE as process, not just products
- Further and on-going research needed before SSC/Council should consider ACL strategy
- Approach accounts for a source of environmental variability in single-species ACL setting
- Approach meets NFMS EBFM policy to *"develop robust management alternatives in the face of changing conditions"*

Funding program: Gulf of Mexico
Integrated Ecosystem Assessment

INTEGRATED ECOSYSTEM ASSESSMENT

Proposals for on-going/future work

1) Produce comprehensive evaluation of management strategy robustness to red tide events

- Evaluate managements strategies that are consistent with current assessment and decision-making practices (Today's talk)
- Strategic MSE analysis of reactive vs. non-reactive strategies (Today's talk)
- Strategic MSE analysis of future <u>increases in intensity and frequency</u> (2018)
- Tactical MSE using SS assessment as full complexity operating model for short-term forecasting (MARFIN, 2018)
- Tactical MSE to utilize suite of relevant performance measures

<u>Bottom line:</u>

- Combination of (1) <u>strategic</u> and (2) <u>tactical</u> projects will provide Council with comprehensive evaluation of red tide effects on ACL setting

Proposals for on-going/future work

2) Synthesize research in best format(s) for communicating with stakeholders

- Decision tables
- Web-based tools?
- Guidance sought by SSC and Council staff

Proposals for on-going/future work

1) Produce comprehensive evaluation of management strategy robustness to red tide events

2) Synthesize research in best format(s) for communicating with stakeholders