Confronting red tide-induced fish kills through management strategy design

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NOAA FISHERIES

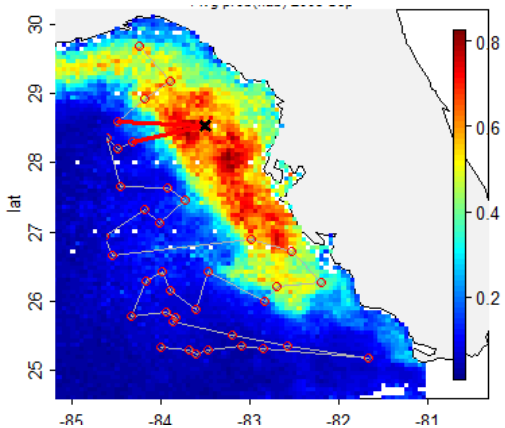
UNIVERSITY OF MIAMI
ROSENSTIEL SCHOOL of MARINE & ATMOSPHERIC SCIENCE

CIMAS
Cooperative Institute for Marine and Atmospheric Studies

IEA
INTEGRATED ECOSYSTEM ASSESSMENT

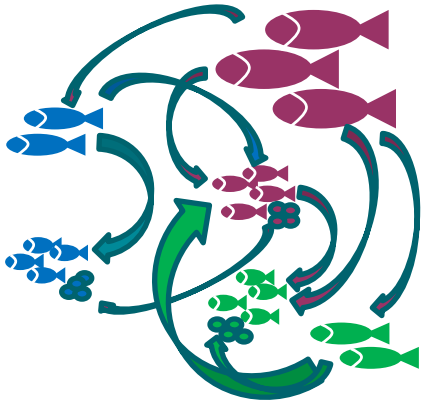
Research & assessment recap

Satellite-derived red tide index



Walter et al. 2013
SEDAR document

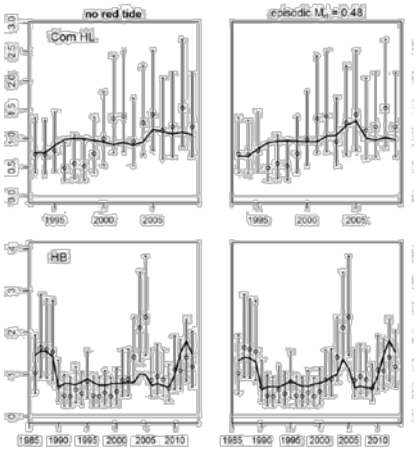
Ecosystem modeling



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 contractor 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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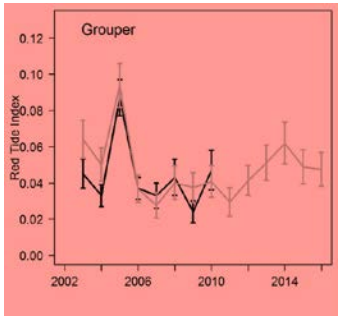
Stock assessment

Harvest control rule

Catch
Indices
Age/length composition
Life history parameters

Red tide index
(Satellite derived product)



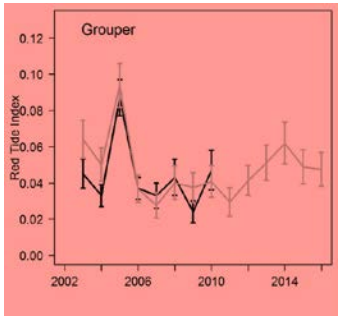
Walter et al. SEFSC

Point #1: Building a Red Grouper management strategy

Data

Catch
Indices
Age/length composition
Life history parameters

Red tide index
(Satellite derived product)



Walter et al. SEFSC

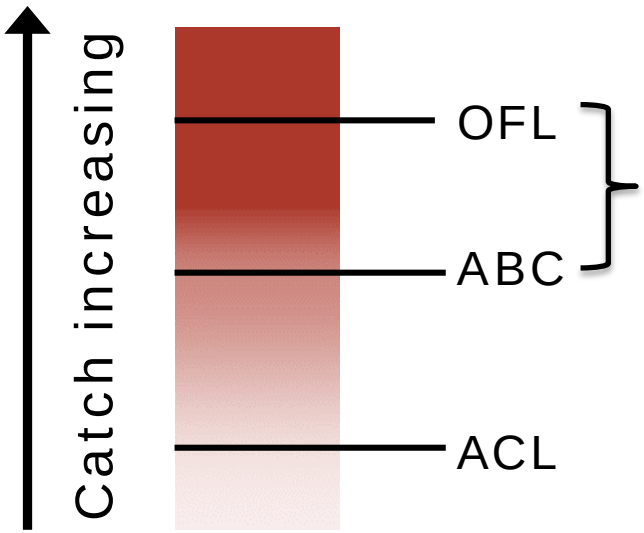
Stock assessment

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

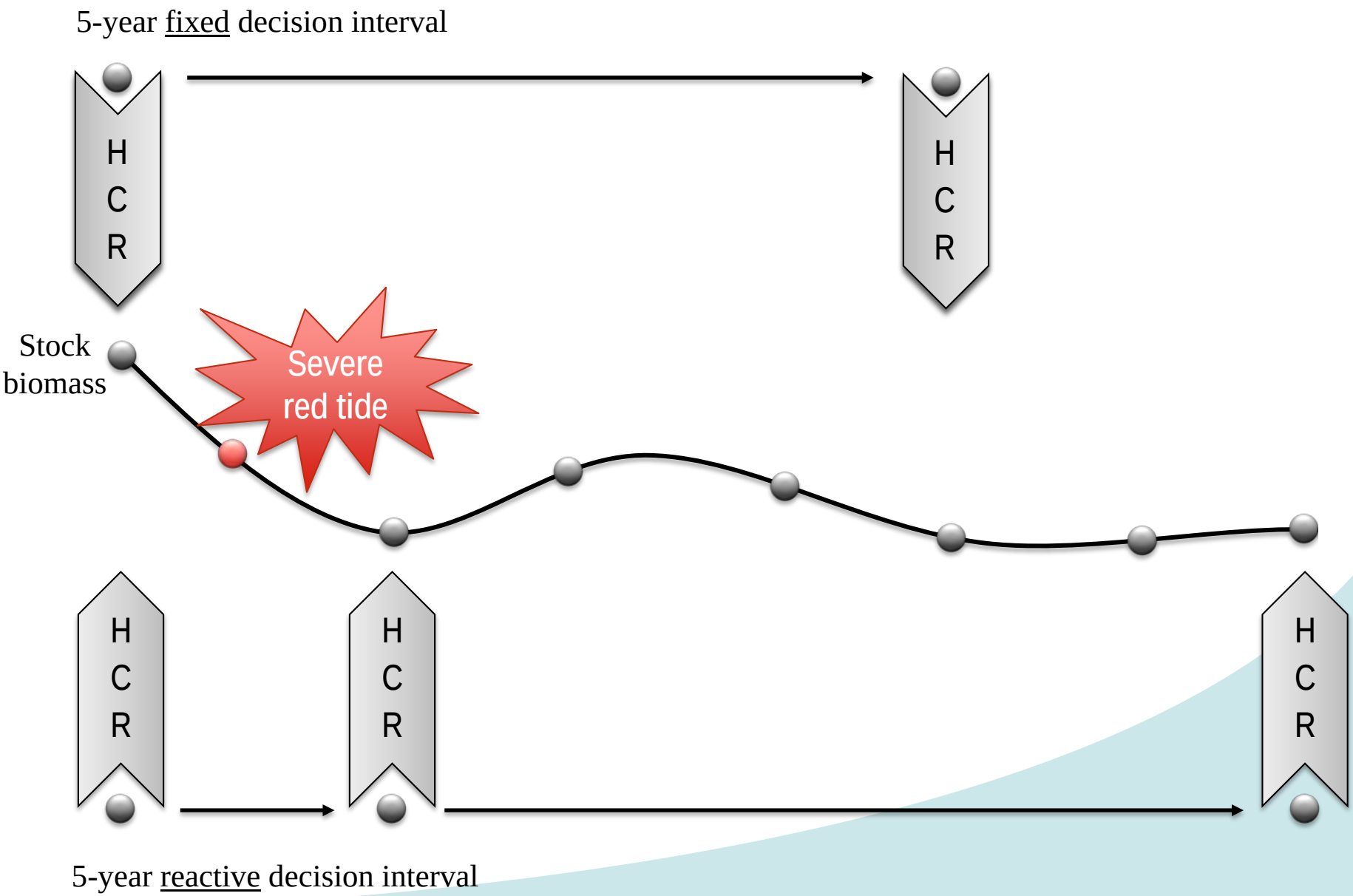
Additional buffer to produce ACL?

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

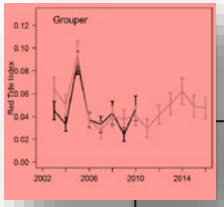
After setting multi-year ACLs, red tide events *could* jeopardize achievement of objectives.

Are the GMFMC management strategies robust to red tide events?

Point #1: Building a Red Grouper management strategy



Point #1: Building a Red Grouper management strategy



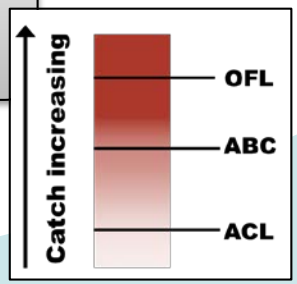
Data

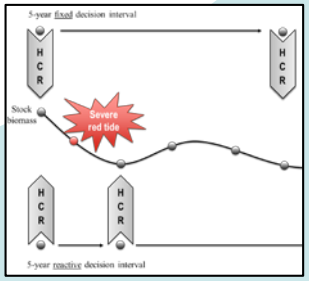
Stock assessment

Stock Synthesis
Time-varying M

Harvest control rule

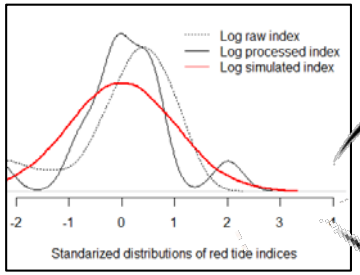
- Existing ABC rule
- ACL reductions
- Assessment frequency

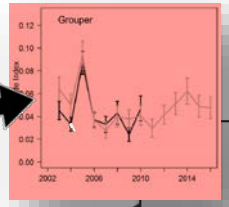




Point #1: Building a Red Grouper management strategy

Environment: red tide





Historical intensity

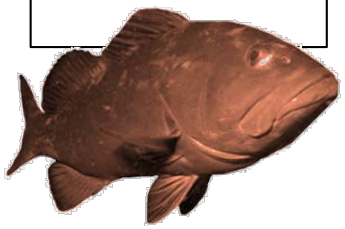
Data

Stock Synthesis
Time-varying M

Stock assessment

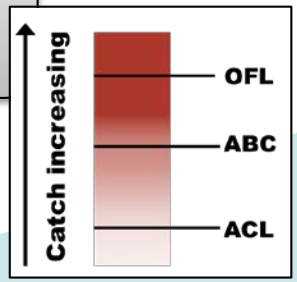
Fish stock

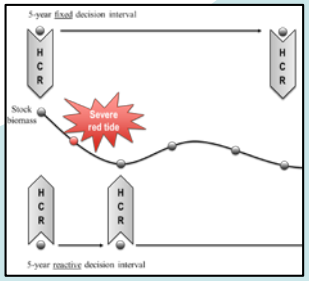
Red grouper



Harvest control rule

- Existing ABC rule
- ACL reductions
- Assessment frequency





Fishery

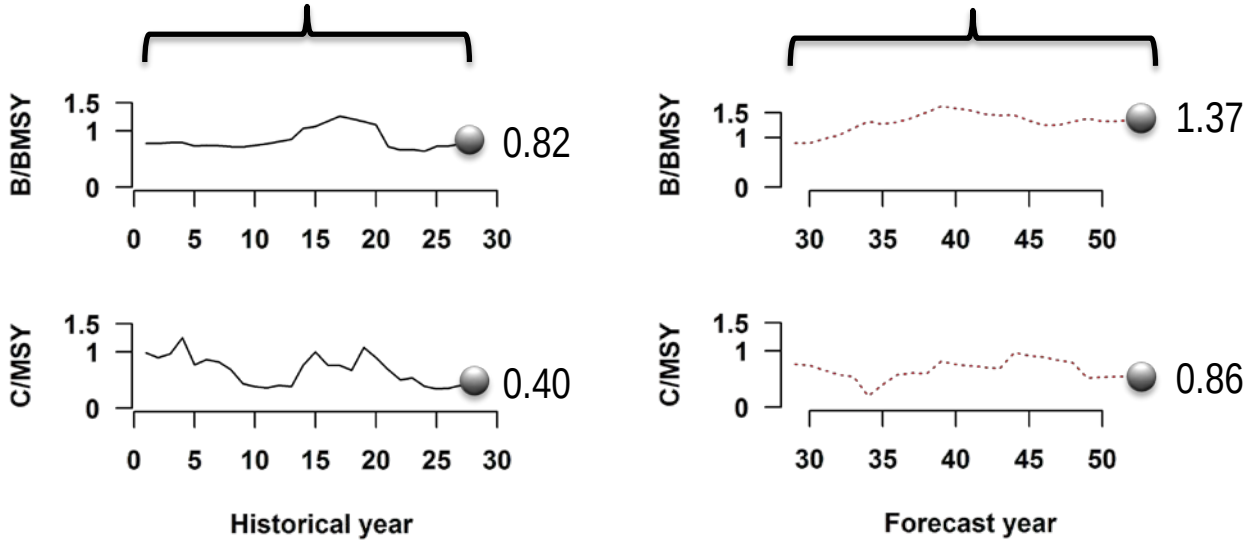
Point #1: Building a Red Grouper management strategy

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 <u>assessment reactivity</u> to severe events

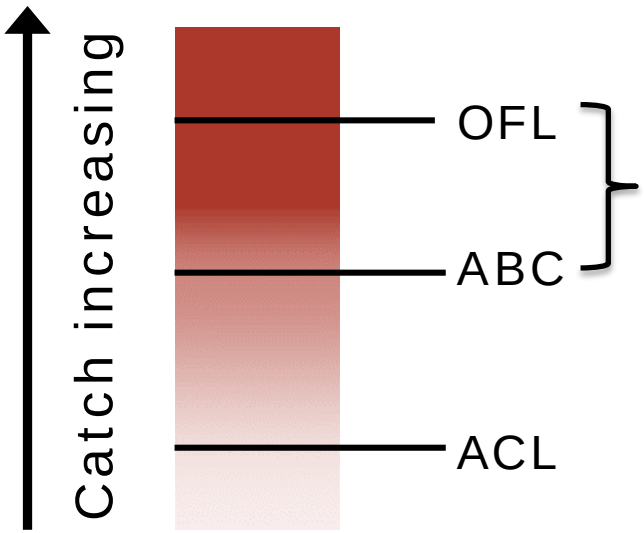
ACL option	Percent simulations exceeding probability of overfishing	Percent simulations overfished in 25th year
Fixed 5-yr interval	54%	34%
Reactive interval	44%	28%

<u>Trade-offs</u>

- 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