

Dolphin MSE: Regulatory Amendment 3 Scoping



South Atlantic Fishery Management Council
June 2026 Meeting



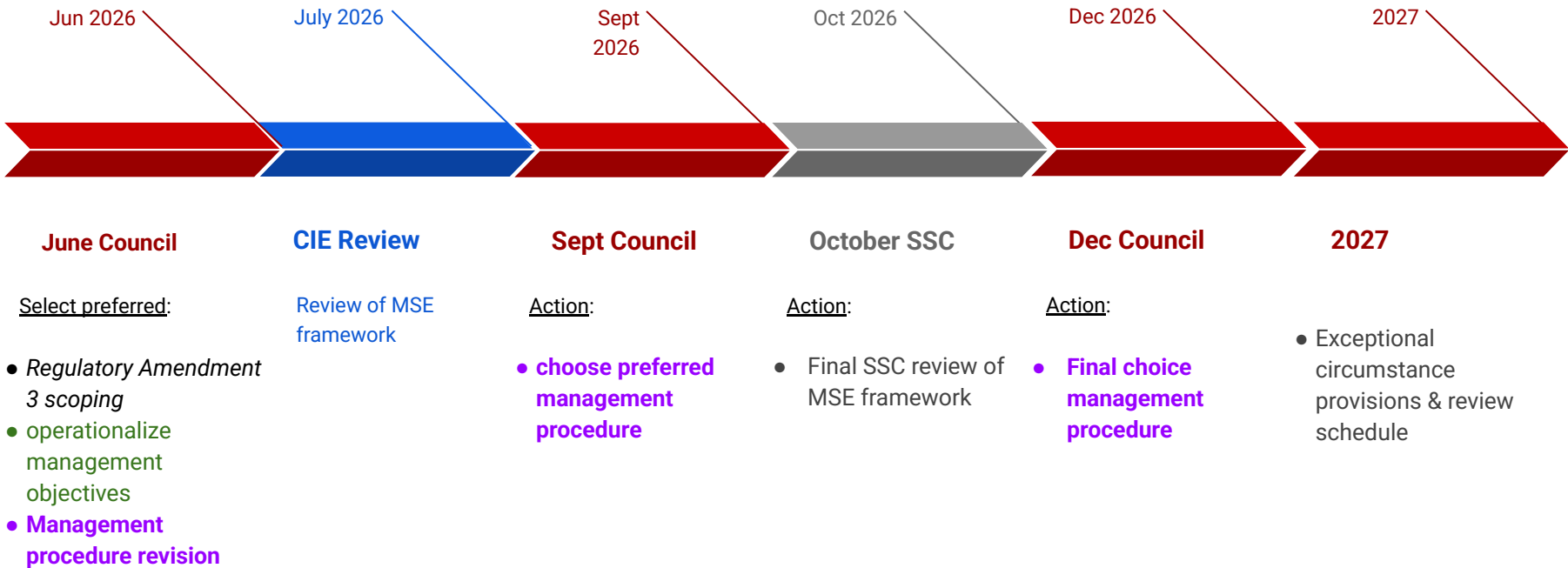
Draft Timeline & Schedule

* Timing of results will depend on ability to meet target timeline

Legend:

OM: operating models
PM: performance metrics
MP: management procedures

Council Meeting
SSC Meeting
CIE Review





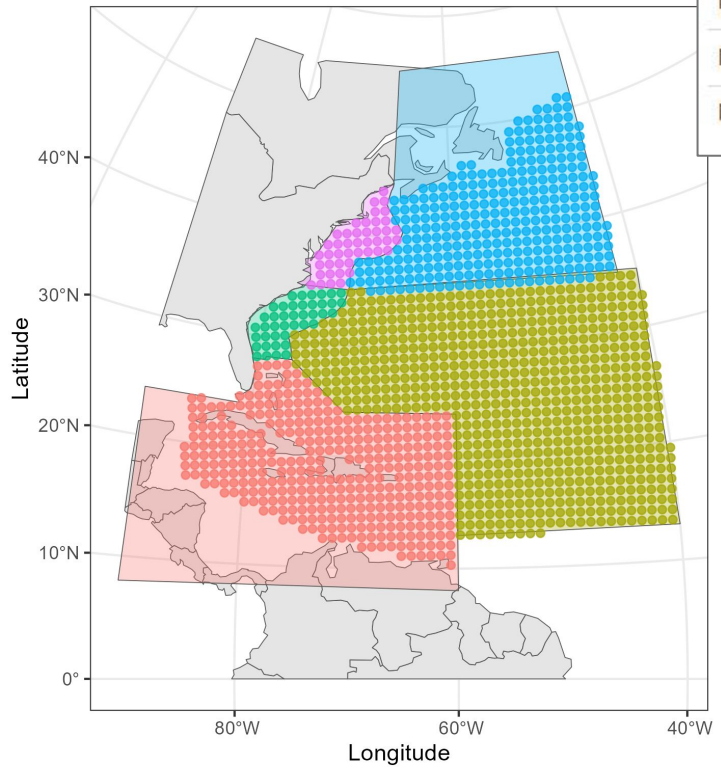
Overview

1. MSE Tool
2. Management procedure demonstration: Regulatory Amendment 3 results

ACTION ITEM: *Provide feedback on Regulatory Amendment 3 scoping*



1. MSE Tool



Code	Alternative code	Description
CAR+FLK	CAR+SFL	Caribbean, South Florida and the Keys
NCA	SAR	Off Caribbean, South Florida and the Keys
NCFL	SE	Wilmington down to Mid Florida
NED	NED	Off North coast
NNC+VBM	NC+NE	Wilmington to Montauk

- CAR + FLK
- NCA
- NCFL
- NED
- NNC + VBM

Code	Fleet	Areas	Description
USCom	USA commercial longline	All	US pelagic longline fleet
RecN	Recreational North	NNC+VBM	Private recreational fishing
RecS	Recreational South	CAR+FLK, NCFL	Private recreational fishing
HireN	For hire North	NNC+VBM	Headboat / party boat / charter
HireS	For hire South	CAR+FLK, NCFL	Headboat / party boat / charter
Intl	International	CAR+FLK, NCA, NED	Assumed to have the same seasonal distribution as the USCom fleet.
Disc	Discard	CAR+FLK, NCA, NNC+VBM	Assumed to have same catches as UnRep fleet and the same seasonal distribution as the USCom fleet.
UnRep	Unreported	CAR+FLK	Assumed to have the same catches as the Disc fleet and the same seasonal distribution as the USCom fleet.



2. Regulatory Amendment 3 Scoping

Potential regulatory measures:

1. Extending geographic range for 20 inch fork length minimum size limit for dolphin currently in place off Florida, Georgia, & South Carolina northward,
2. Modifying daily bag limit for dolphin,
3. Modifying vessel limit for dolphin,
4. Removing or reducing captain and crew bag limits for dolphin.

Test 1 & 3 with MSE tool. We do not model individual bag limits in MSE tool, so consider 2 & 4 as special cases of vessel limit, without average number of anglers / trip for each fleet & assuming bag limit sharing.



2. Regulatory Amendment 3 Scoping



SQM = status quo management



EMSL = expand min size limit (20" FL) for all commercial and private



RVL12 = recreational vessel limit of 12 fish



RVL24 = recreational vessel limit of 24 fish



RVL36 = recreational vessel limit of 36 fish



RVL48 = recreational vessel limit of 48 fish



RVL12p = recreational vessel limit of 12 fish for private rec only



RVL12f = recreational vessel limit of 12 fish for for-hire rec only



RVL36p = recreational vessel limit of 36 fish for private rec only

RVL36f = recreational vessel limit of 36 fish for for-hire rec only

Status quo management

- 1,719,953 lbs commercial ACL
- 22,850,811 lbs recreational ACL
- Recreational vessel limit of 54 fish / bag limit 10 fish
- 20" FL minimum size in SC, GA and FL

Modeled as Constant Catch

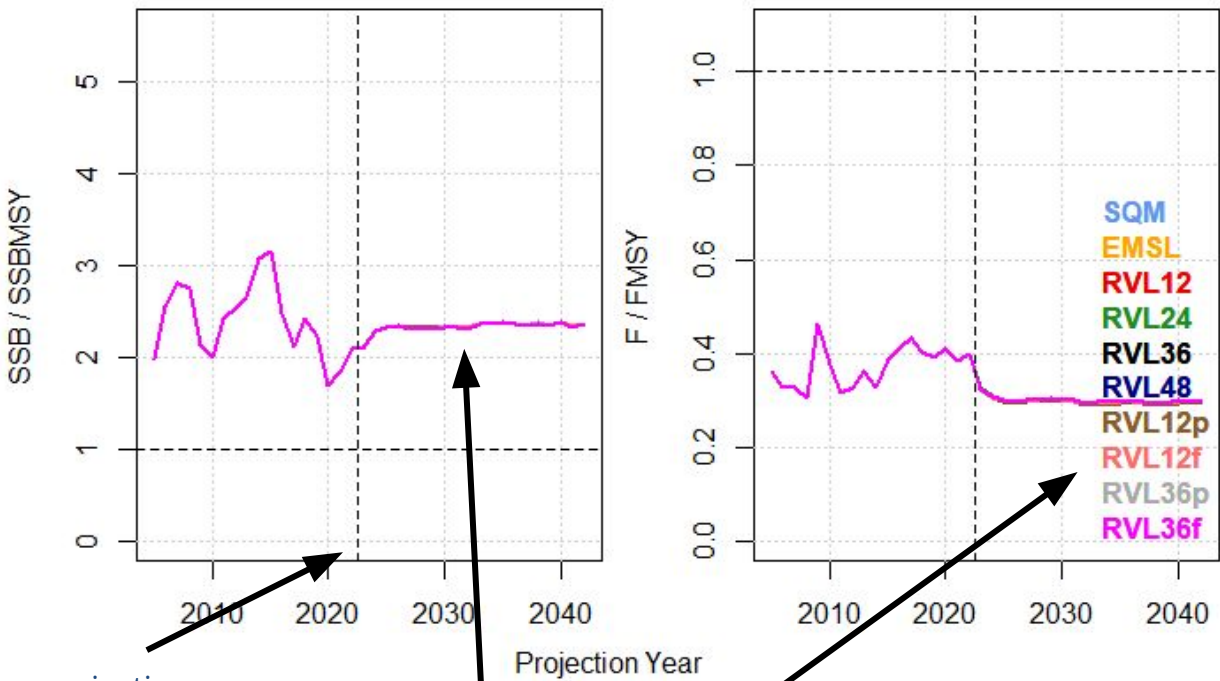
Modeled as Constant Effort



Regulatory Amendment 3 - Constant Catch

Figures show the results of the simulation, with respect to stock status, under status quo management (**constant catch**) versus all of the Regulatory Amendment 3.

Results are median values over all 32 reference operating models (possible 'true' underlying systems).



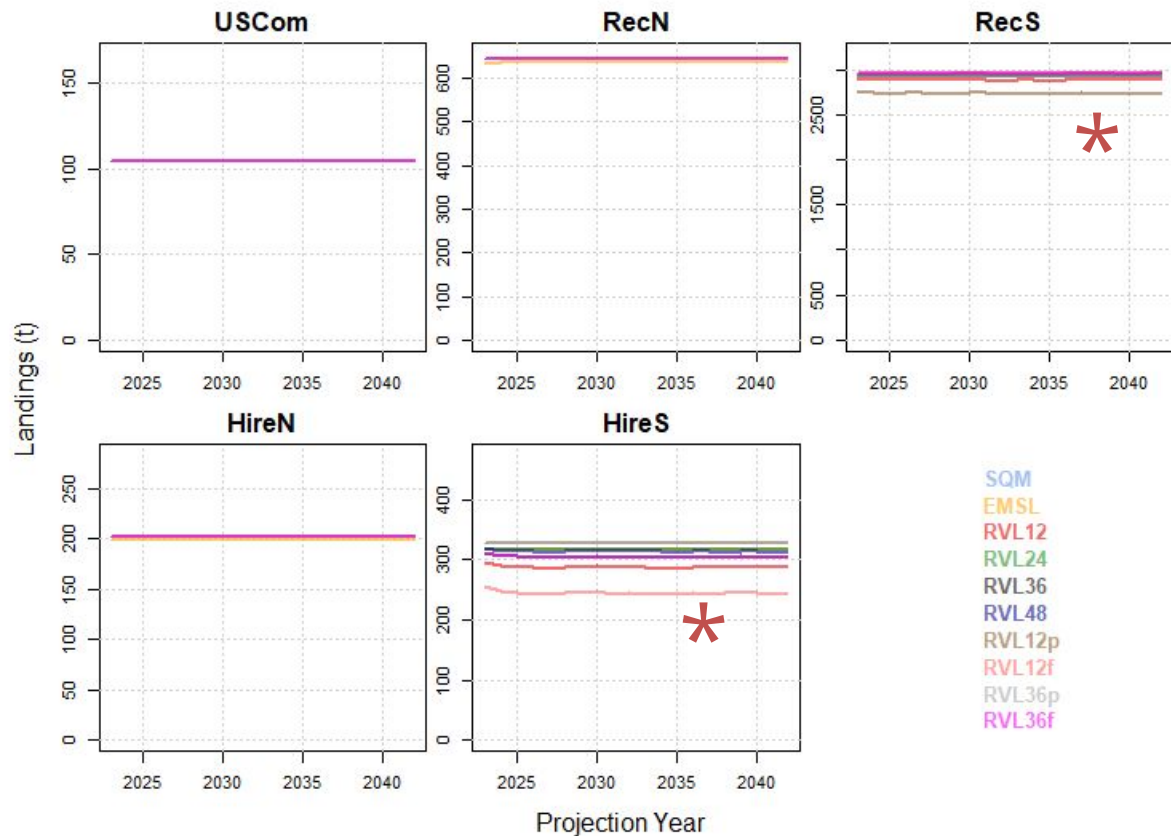
Regulatory Amendment 3 - Constant Catch

Figures show the results of the simulation, with respect to landings by fleet, under status quo management (**constant catch**) versus all of the Regulatory Amendment 3.

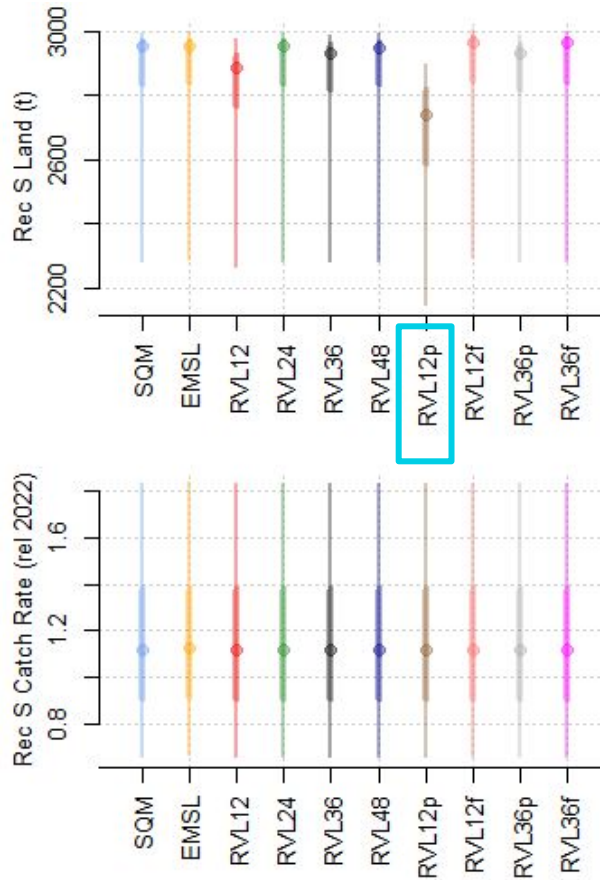
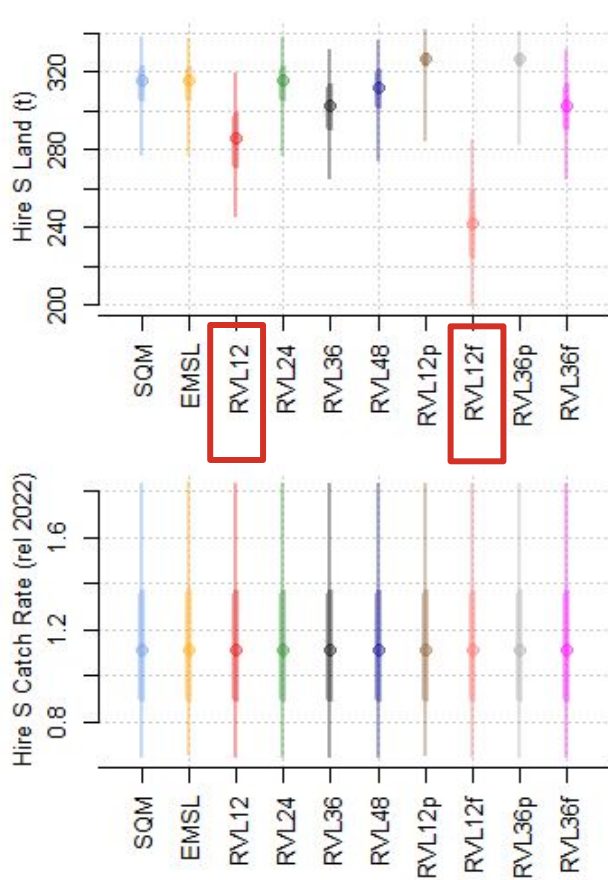
Results are median values over all 32 reference operating models (possible 'true' underlying systems).

* Notice strongest impacts of size and vessel limits the southern recreational fleets.

* Minimal impacts on landings for USComm and northern recreational fleets (EMSL slightly reduces landings in Northern regions)



Regulatory Amendment 3 - Constant Catch



Figures show the results of the simulation under status quo management (**constant catch**) versus all of the Regulatory Amendment 3.

Results are median values, interquartile, and 95th percentile ranges over all 32 reference operating models (possible 'true' underlying systems).

Summarized landings (top row following previous slide) and catch rate (bottom row) for southern recreational fleets across all projection period.

Reduced landings in extreme vessel limit (12 fish in all recreational, private, or fore hire).

Regulatory Amendment 3 options have very little impact on catch rate (shown), variability in yield, and mean length of landings.



ACTION ITEM

Feedback on Regulatory Amendment 3 scoping



Acknowledgements

Many thanks to the hard work of our project collaborators

Blue Matter

Tom Carruthers, Adrian Hordyk, Quang Huynh

MSE Modelling Technical Team

Cassidy Peterson, Mandy Karnauskas, Matt Damiano, Kyle Shertzer, Jie Cao, John Walter

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Stakeholder Small Group

Dolphin MSE Update



South Atlantic Fishery Management Council
June 2026 Meeting



Overview

1. Management procedure demonstration: candidate MPs

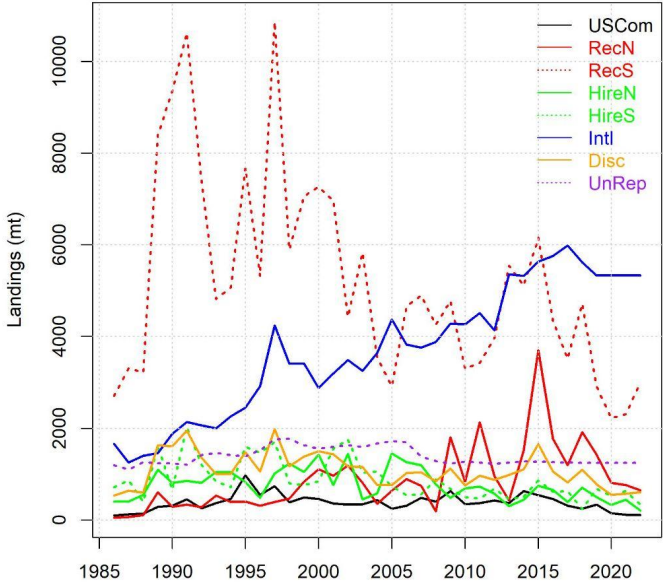
ACTION ITEM: *Advise on the management procedure design and performance*

2. Operationalize Management Objectives

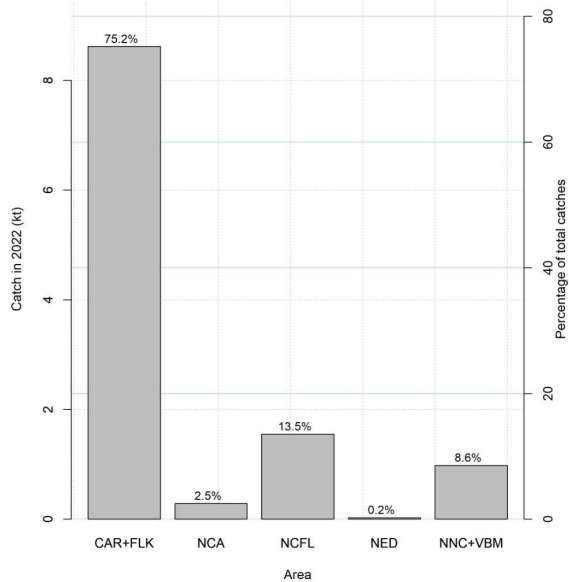
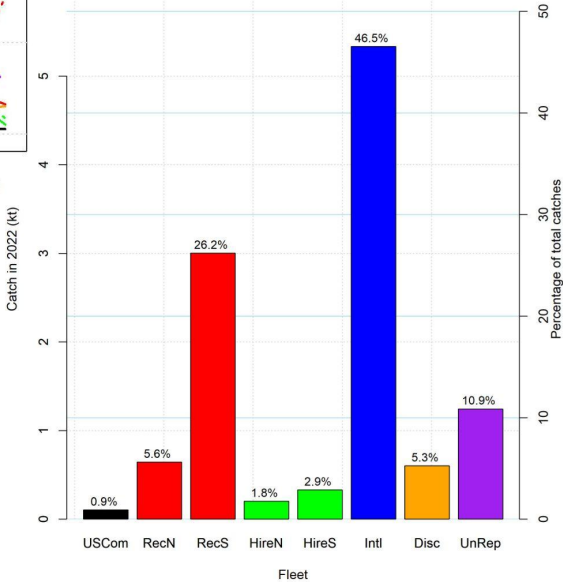
ACTION ITEM: *Advise on operational management objectives, performance metrics, and risk tolerance*



Relative magnitude of U.S. Dolphin fishing

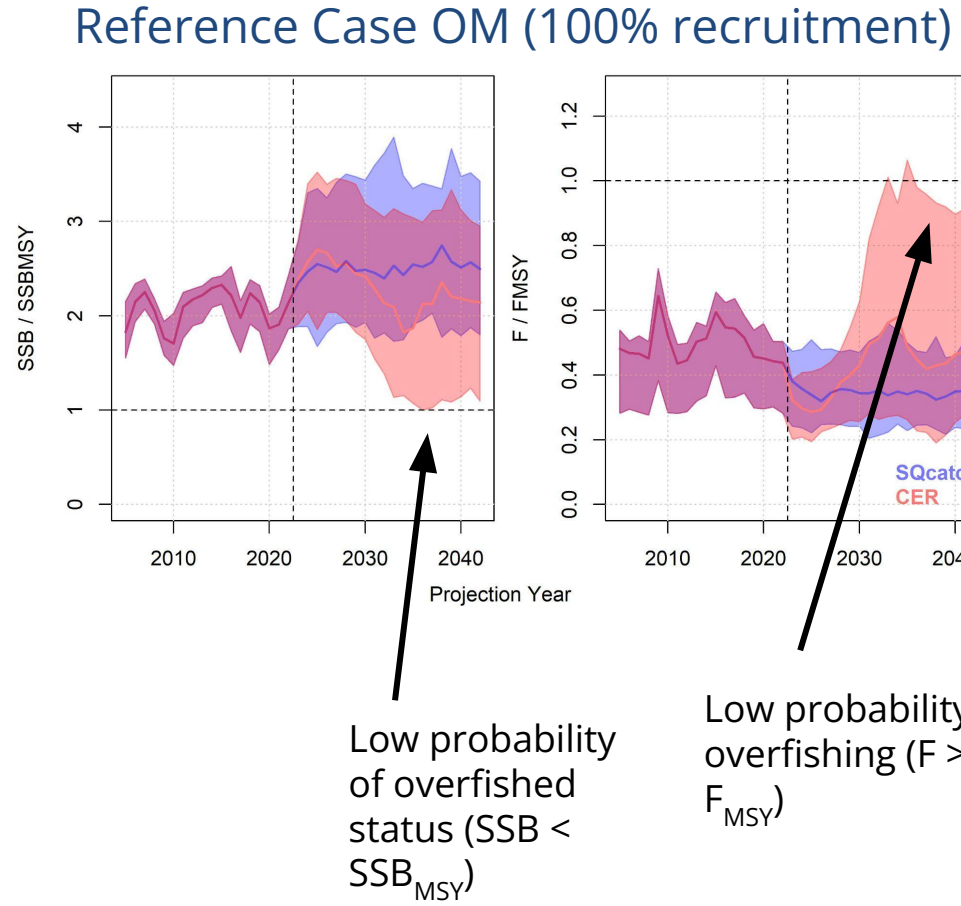


- Large increases in International Catches (1.5kt to 5.5kt)
- Large declines in southern recreational catches (10kt to 2.5kt)
- 37% of dolphin catches in 2022
- Primarily a CAR+FLK fishery



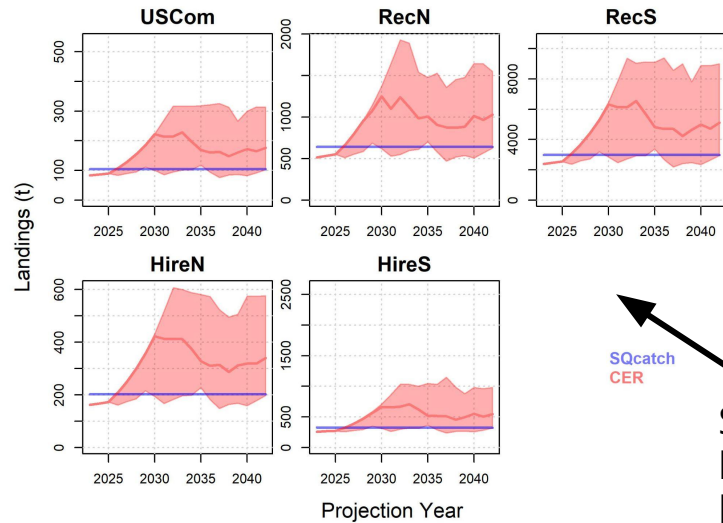
1. Empirical Management Procedures

Constant 2022 Catches for US fleets (SQcatch) vs Constant Exploitation Rate for US fleets (CER) [CER has a maximum change of 20% catch between years]

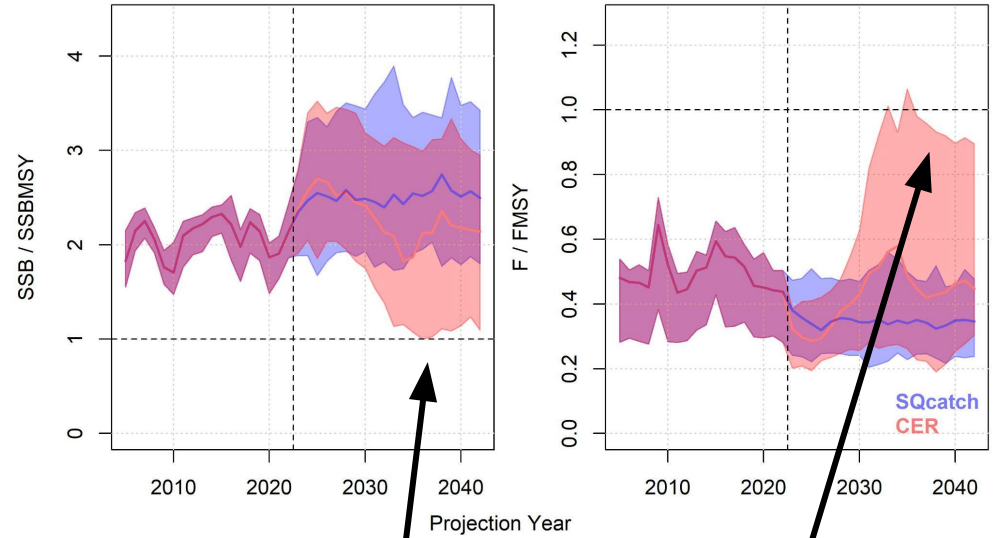


1. Empirical Management Procedures

Constant 2022 Catches for US fleets (SQcatch) vs Constant Exploitation Rate for US fleets (CER) [CER has a maximum change of 20% catch between years]



Reference Case OM (100% recruitment)



Substantially higher expected landings

Low probability of overfished status ($SSB < SSB_{MSY}$)

Low probability of overfishing ($F > F_{MSY}$)



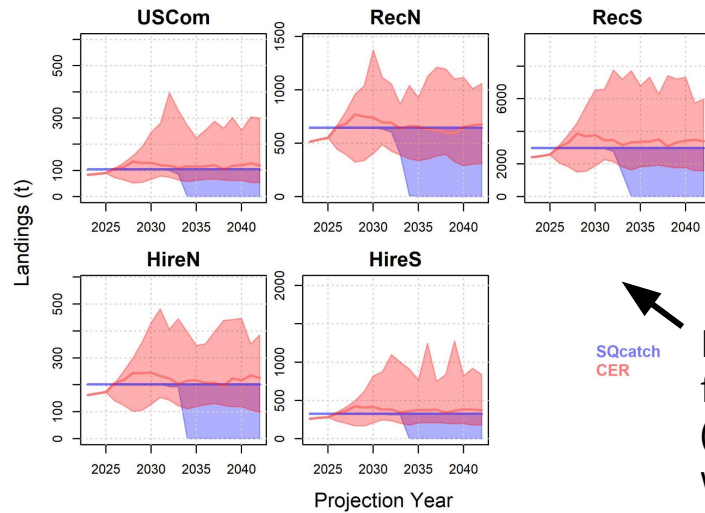
1. Empirical Management Procedures

What happens if the future is less bright?

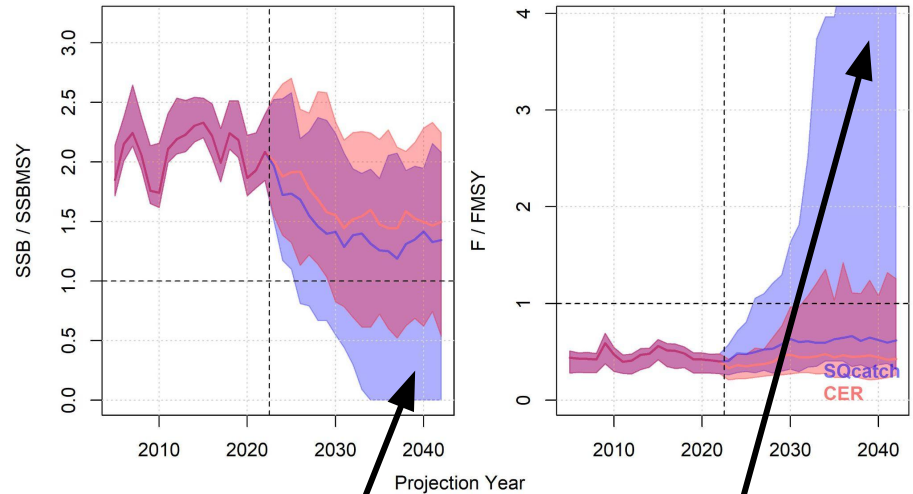
Let's look at constant catches vs the constant Exploitation Rate MP (CER) for projections where recruitment is 75% of the Reference Case OM....

1. Empirical Management Procedures

Constant 2022 Catches for US fleets (SQcatch) vs Constant Exploitation Rate for US fleets (CER) [CER has a maximum change of 20% catch between years]



Scenario with 75% future recruitment



Possible for fishery collapse (zero landings) with constant catches

Possible to crash the stock if the constant catches are taken

Possible for fishing mortality rate to go to very high levels with constant catches.

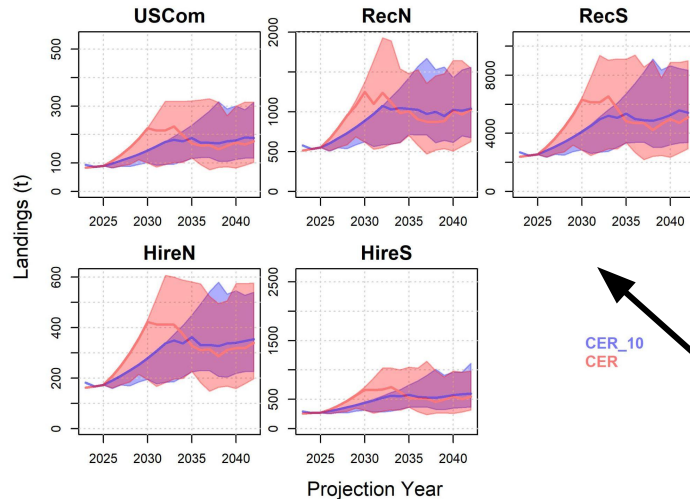
1. Empirical Management Procedures

Dynamic management provides higher landings when biomass is available and higher biological protection (higher long term landings) in situations where productivity is reduced.

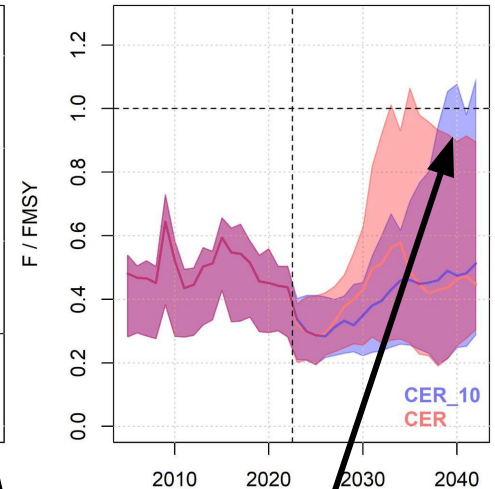
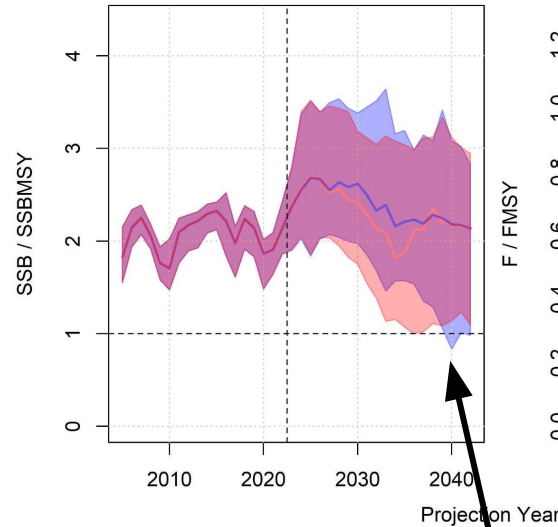
For this reason, dynamic empirical management procedures have become a common goal for regional fisheries management organizations and a requirement to obtain the highest MSC certification standard.

1. Empirical Management Procedures

Constant Exploitation Rate for US fleets (CER) [max 20% change in catch] vs CER with max 10% change in catch (CER₁₀)



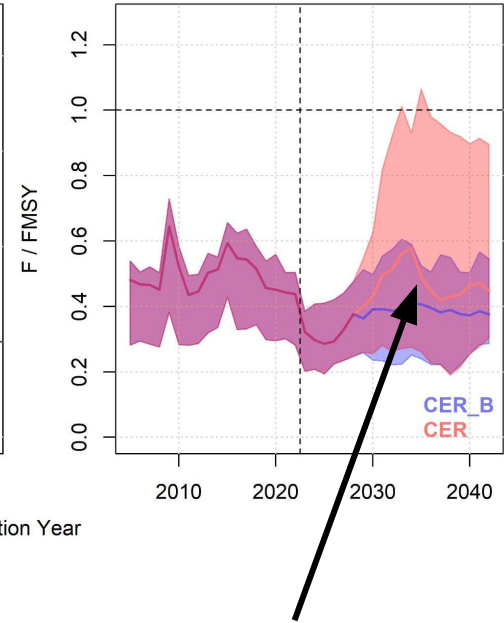
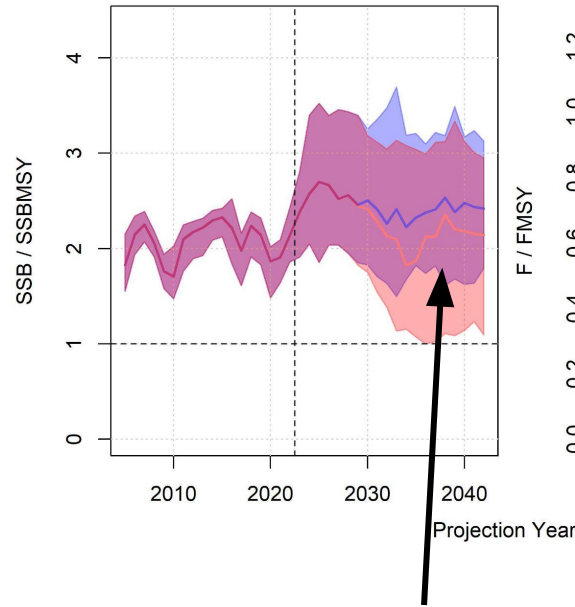
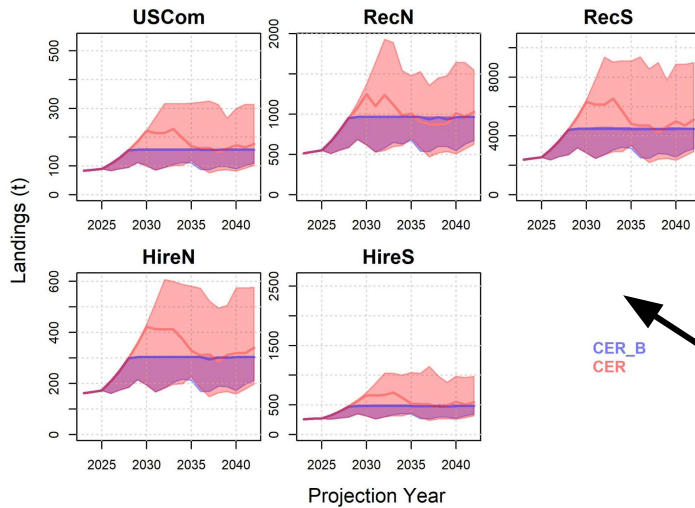
Smaller near-term landings traded-off against somewhat higher and more stable landings over longer term.



Less flexible MP (CER₁₀) has slightly higher risks of overfishing and overfished status over longer term.

1. Empirical Management Procedures

Constant Exploitation Rate for US fleets (CER) vs Constant Exploitation Rate for US fleets with bounds of 50% and 150% 2022 catches (CER_B)

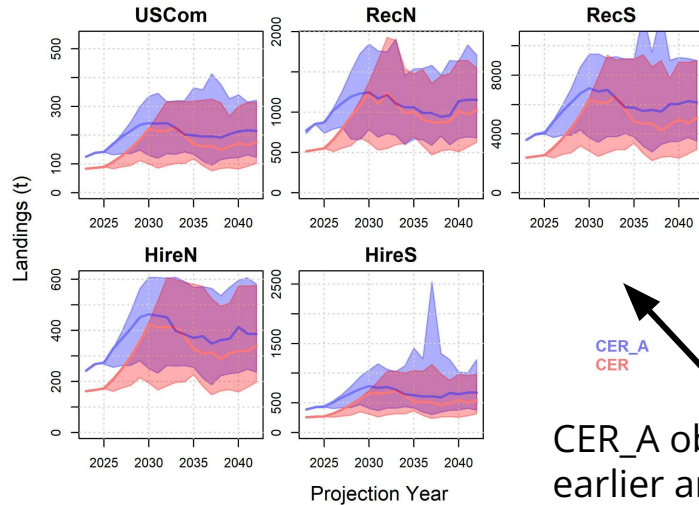


CER_B hits upper bound frequently

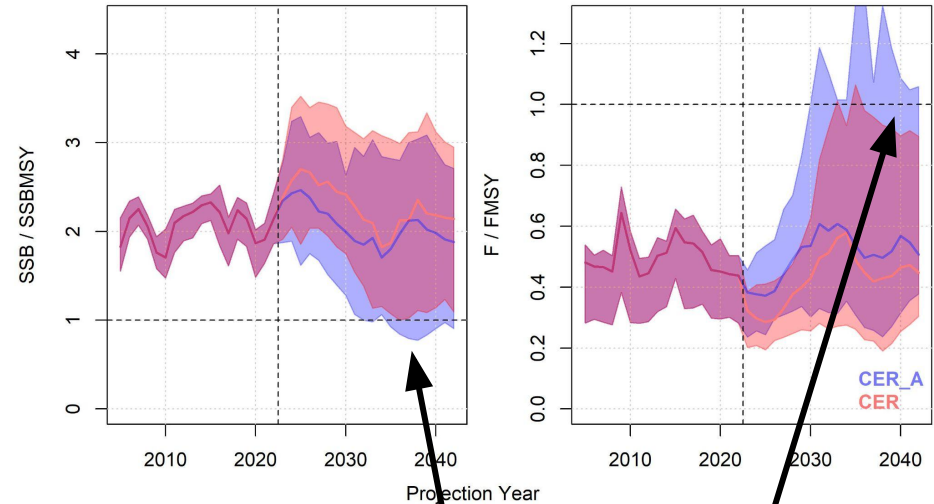
Bounded MP has substantially lower risks of overfishing and overfished status. Trading biological risk against maximum potential landings via an upper bound on catches.

1. Empirical Management Procedures

Constant Exploitation Rate for US fleets (CER) vs Aggressive high exploitation rate version with lower bound of 50% 2022 catches (CER_A)



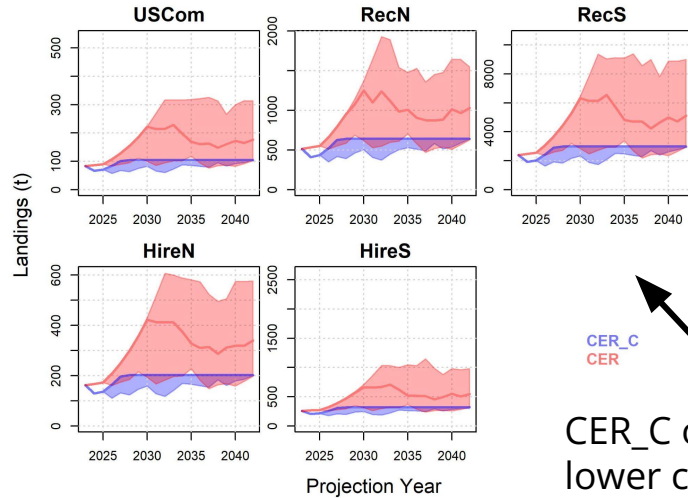
CER_A obtains higher landings earlier and consistently higher thereafter.



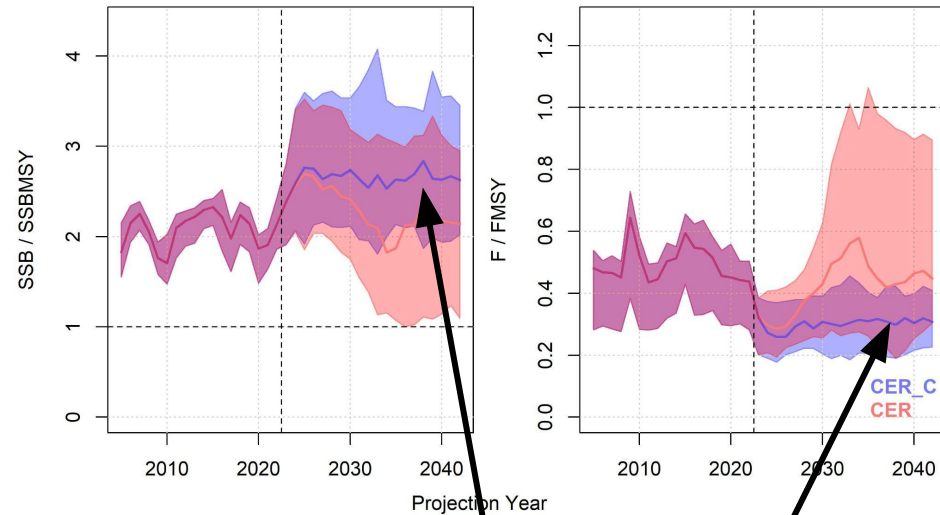
Higher risks of overfishing / overfished status from the more aggressive CER_A, however still < 10%

1. Empirical Management Procedures

Constant Exploitation Rate for US fleets (CER) vs Conservative constant exploitation rate (CER_C)



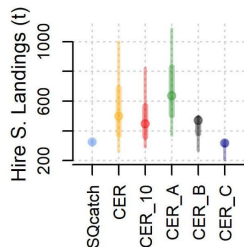
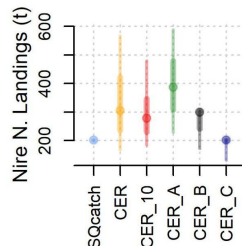
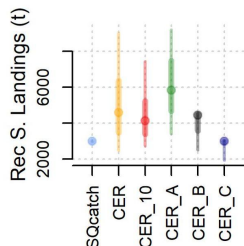
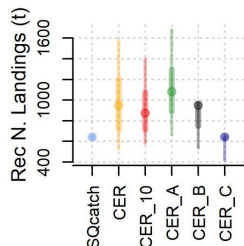
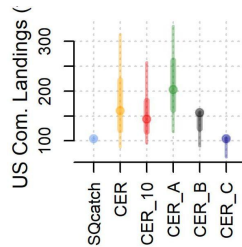
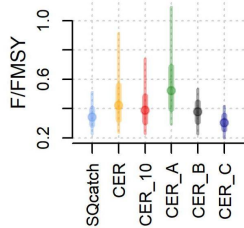
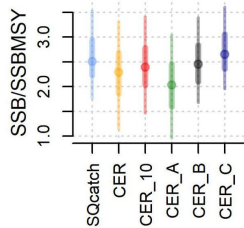
CER_C obtains substantially lower catches.



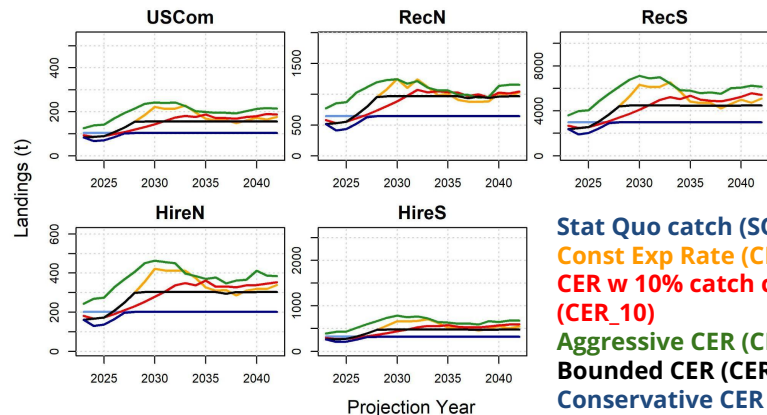
Almost zero risk of overfishing / overfished status from the more conservative CER_C

1. Empirical management procedures:

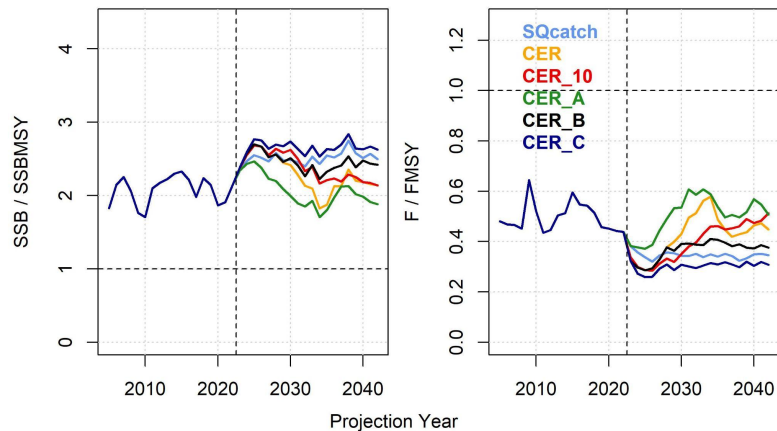
Example summaries



(Annual averages over projection years 2026-2040)



Stat Quo catch (SQcatch)
 Const Exp Rate (CER)
 CER w 10% catch change (CER_10)
 Aggressive CER (CER_A)
 Bounded CER (CER_B)
 Conservative CER (CER_C)



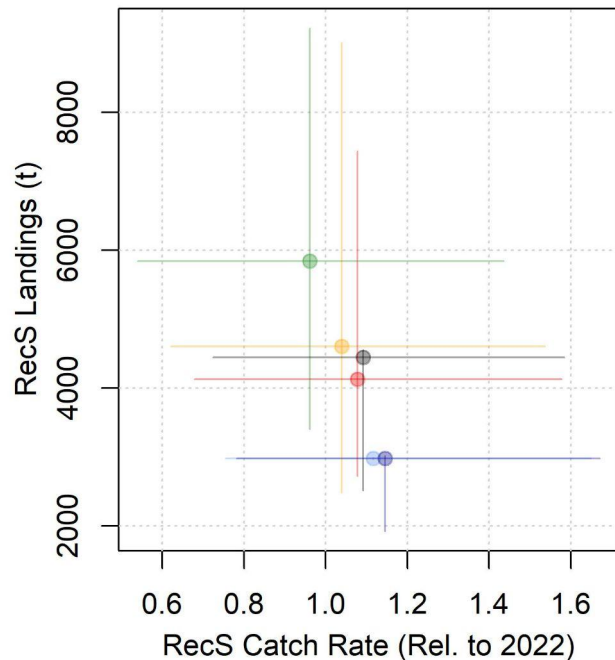
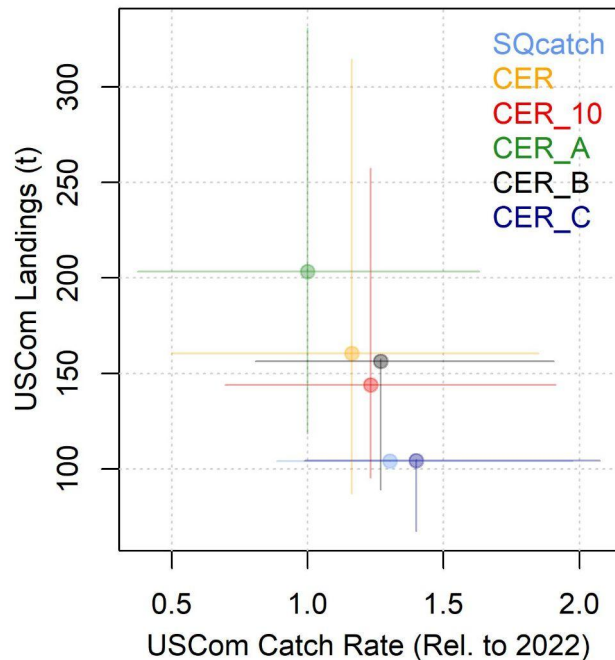
1. Empirical management procedures:

Example summaries

(Annual averages over projection years 2026-2040)

Trade-off in expected catch rate and landings performance:

Catch rate is relative to 2022 levels.





1. Empirical management procedures: Conclusions

Empirical MPs are tractable:

- indices are available to inform dynamic management advice
- empirical MPs have been widely applied elsewhere
- can include limits on advice or changes in advice

Dynamic MPs provide responsiveness that allows for:

- higher catches when fish are available
- biological protection and higher long-term catches if productivity were to change.



ACTION ITEM



Advise on management procedure design and performance



- Do you agree to explore:
 - adaptive ACL-based management procedure?
 - exploitation-rate based management procedure?
- Include static tactical management measures (vessel limits, size limits) in MP?
- Management cycle? (e.g., update ACL every year, 3 years)



2. Operationalize Management Objectives

Management objectives

1. **Status**
2. **Yield** by fleet and area
3. **Stability**
4. **Catch rate** by fleet and area
5. **Opportunity**
6. **Size** of fish caught by fleet and area

All metrics to be analyzed over all projection years (1-20 years), short (1-5 year), medium (5-10 year), long (10-15 year) time horizons

Rank which objectives are most important to you



2. Operationalize Management Objectives

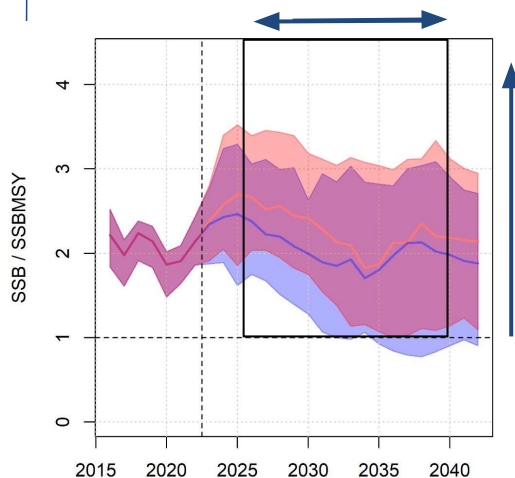
Management objectives

1. **Status:**
 - Stock should have a P^* of []%
 - E.g., probability of overfishing in projection
 - Stock should have a less than []% probability of being overfished
2. **Yield** by fleet and area
3. **Stability**
4. **Catch rate** by fleet and area
5. **Opportunity**
6. **Size** of fish caught by fleet and area

Performance Metrics

P^* - probability of not overfishing ($U < U_{MSY}$)

$P(B > BMSY)$ - probability of not being overfished ($SSB > SSB_{MSY}$)



Fraction of simulations above SSB_{MSY} from 2026 - 2040

$P(B > BMSY)$
98%
94%



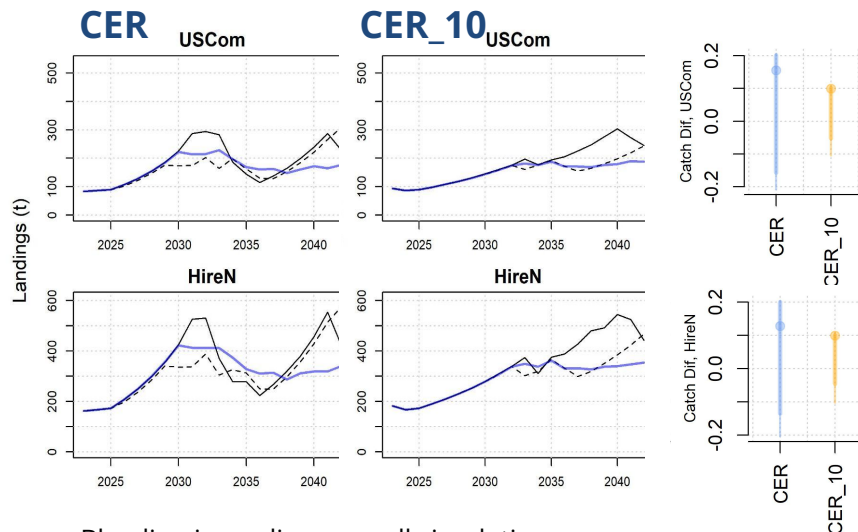
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 - Stock should have a less than []% probability of being overfished
2. **Yield** by fleet and area
 - Maximize yield by fleet
3. **Stability**
 - Maintain stability in regulations
4. **Catch rate** by fleet and area
5. **Opportunity**
6. **Size** of fish caught by fleet and area

Performance Metrics

AAV_f - average annual variability in yield by fleet



Blue line is median over all simulations.
The solid and dashed black lines are two example simulations.



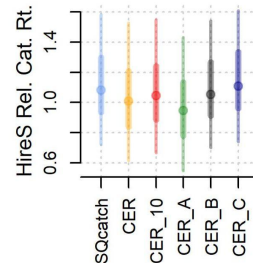
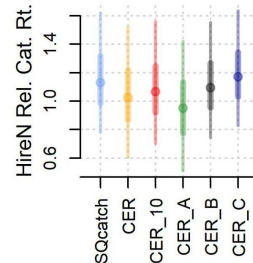
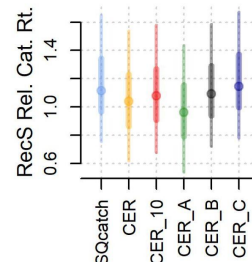
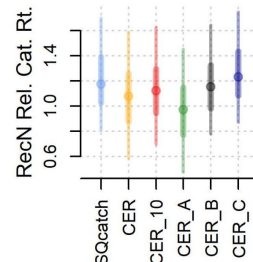
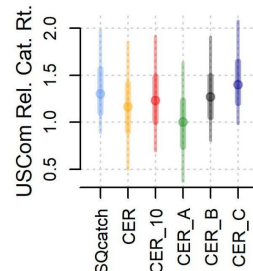
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 - Maintain stability in regulations
4. **Catch rate** by fleet and area
 - Maximize catch rate by fleet
5. **Opportunity**
6. **Size** of fish caught by fleet and area

Performance Metrics

relCR_f - average catch rate relative to catch rate in 2022 for each fleet





2. Operationalize Management Objectives

Management objectives

Performance Metrics

1. **Status:**

- Stock should have a P^* of []%
 - E.g., probability of overfishing in projection
- Stock should have a less than []% probability of being overfished

2. **Yield by fleet and area**

- Maximize yield by fleet

3. **Stability**

- Maintain stability in regulations

4. **Catch rate by fleet and area**

- Maximize catch rate by fleet

5. **Opportunity**

- Reduce probability of fishery closure and/or accountability measures

6. **Size of fish caught by fleet and area**

meetACL- proportion of years in which landings equal ACL by sector (commercial, recreational)



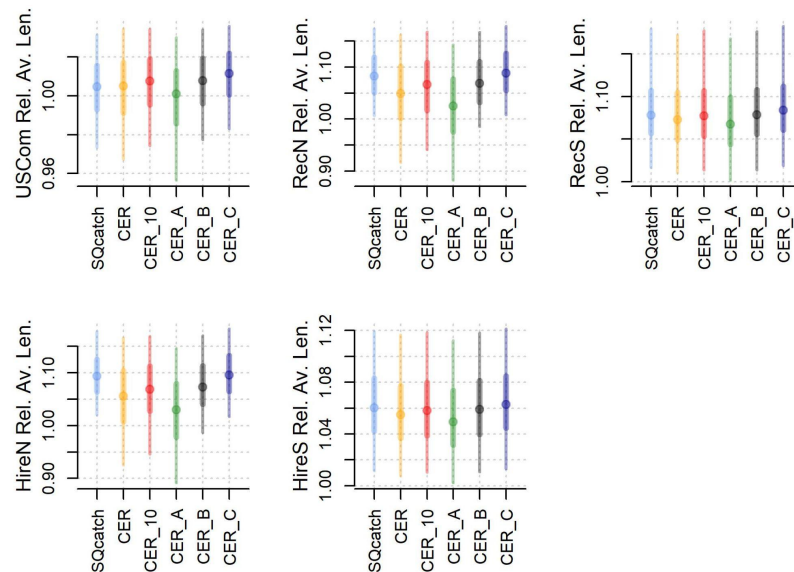
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- Yield by fleet and area**
 - Maximize yield by fleet
- Stability**
 - Maintain stability in regulations
- Catch rate by fleet and area**
 - Maximize catch rate by fleet
- Opportunity**
 - Reduce probability of fishery closure and/or accountability measures
- Size of fish caught by fleet and area**
 - Maximize average length of catch by fleet

Performance Metrics

avLen_f - average length of fish caught by fleet





ACTION ITEM

Advise on operational management objectives, performance metrics, and risk tolerance

- Define P^* and minimum probability of overfished percentages.
 - Status is unlikely to be limiting. Any reason to diverge from $P^* = 40\%$?
- Do you agree with proposed performance metrics for each management objective?
- Do you request additional performance metrics?



Acknowledgements

Many thanks to the hard work of our project collaborators

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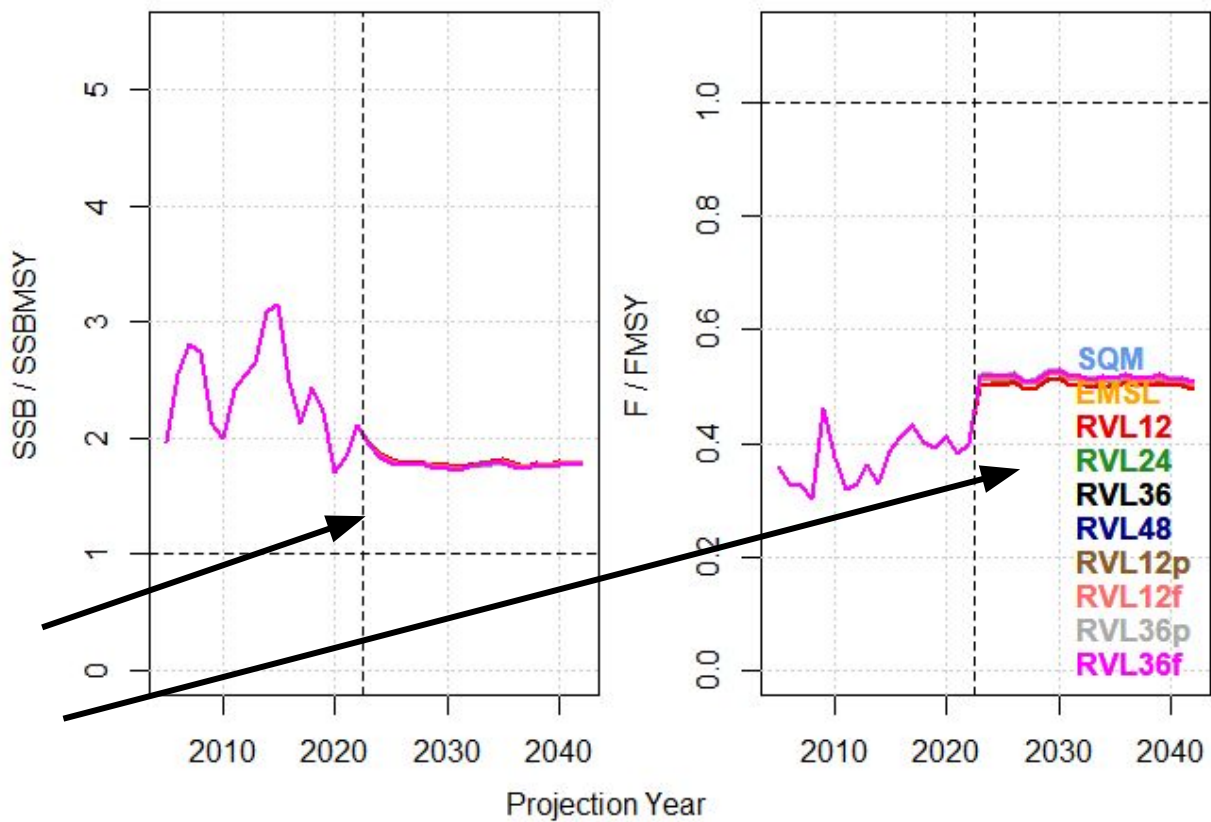


Regulatory Amendment 3 - Constant Effort

Figures show the results of the simulation, with respect to stock status, under status quo management (constant effort) versus all of the Regulatory Amendment 3.

Results are median values over all 32 reference operating models (possible 'true' underlying systems).

Lines are overlapping, suggesting Reg Am 3 do not strongly affect stock-wide status



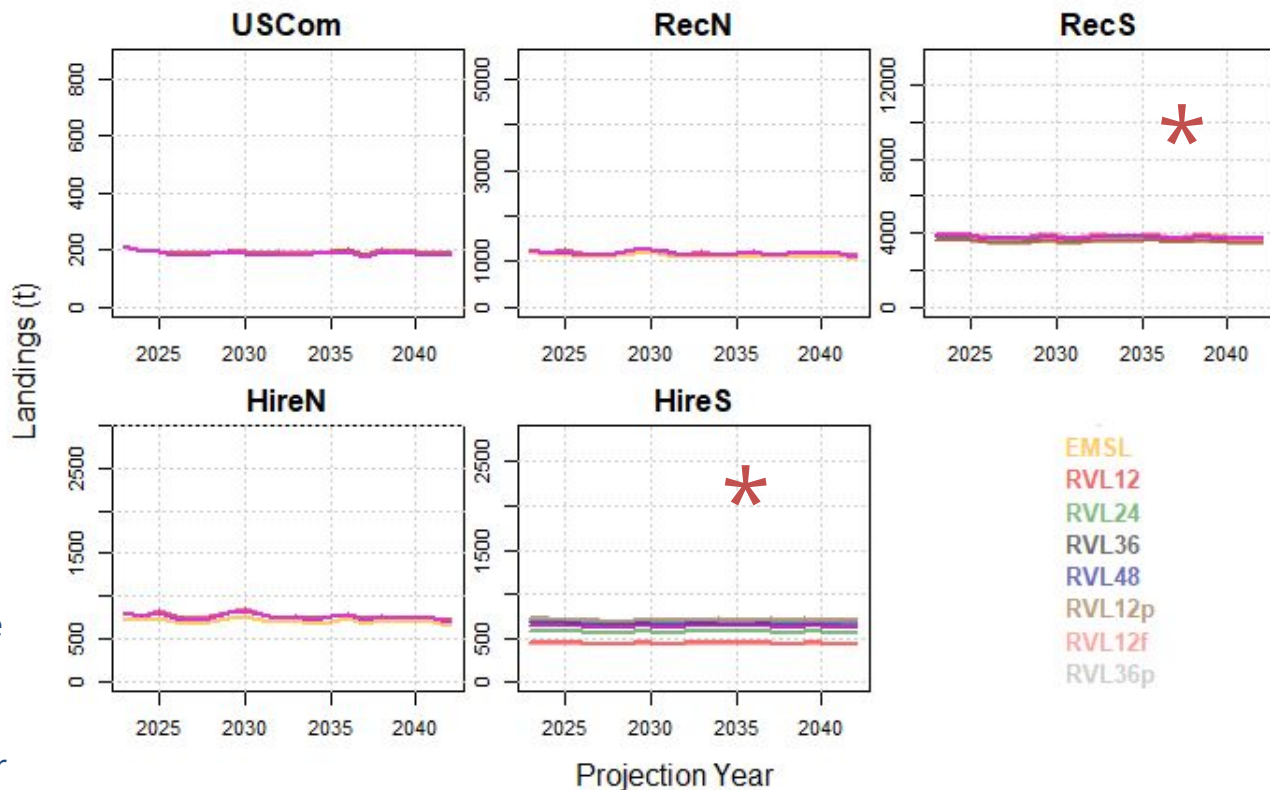
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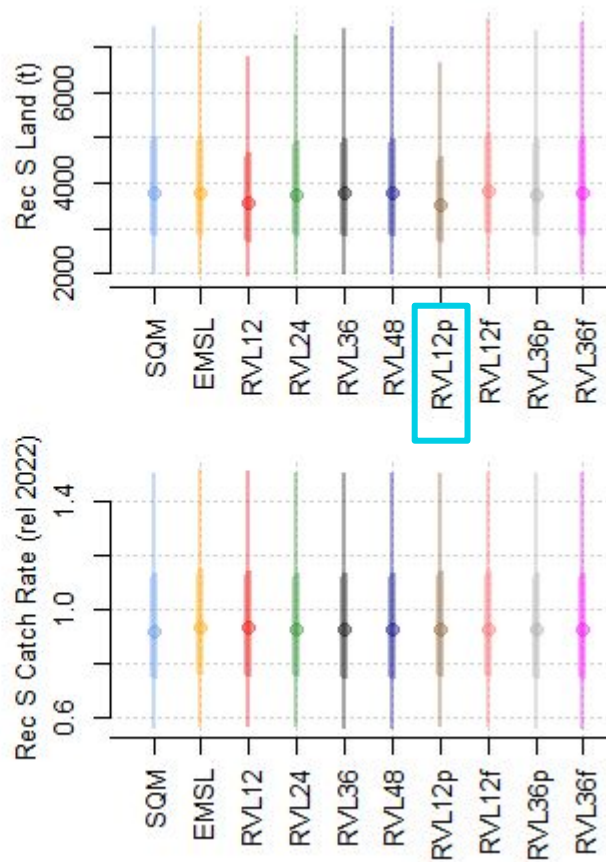
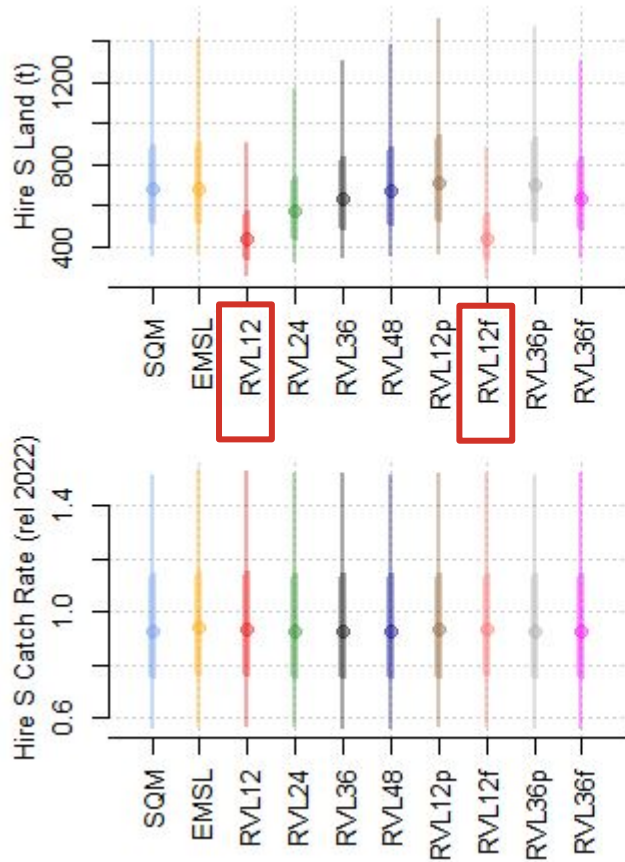
Results are median values over all 32 reference operating models (possible 'true' underlying systems).

* Notice strongest impacts of size and vessel limits the southern recreational fleets.

* Minimal impacts on landings for USComm and northern recreational fleets



Regulatory Amendment 3 - Constant Effort



Figures show the results of the simulation under status quo management (constant effort) versus all of the Regulatory Amendment 3.

Results are median values, interquartile, and 95th percentile ranges over all 32 reference operating models (possible 'true' underlying systems).

Summarized landings (top row following previous slide) and catch rate (bottom row) for southern recreational fleets across all projection period.

Reduced landings in extreme vessel limit (12 fish in all recreational, private, or fore hire).

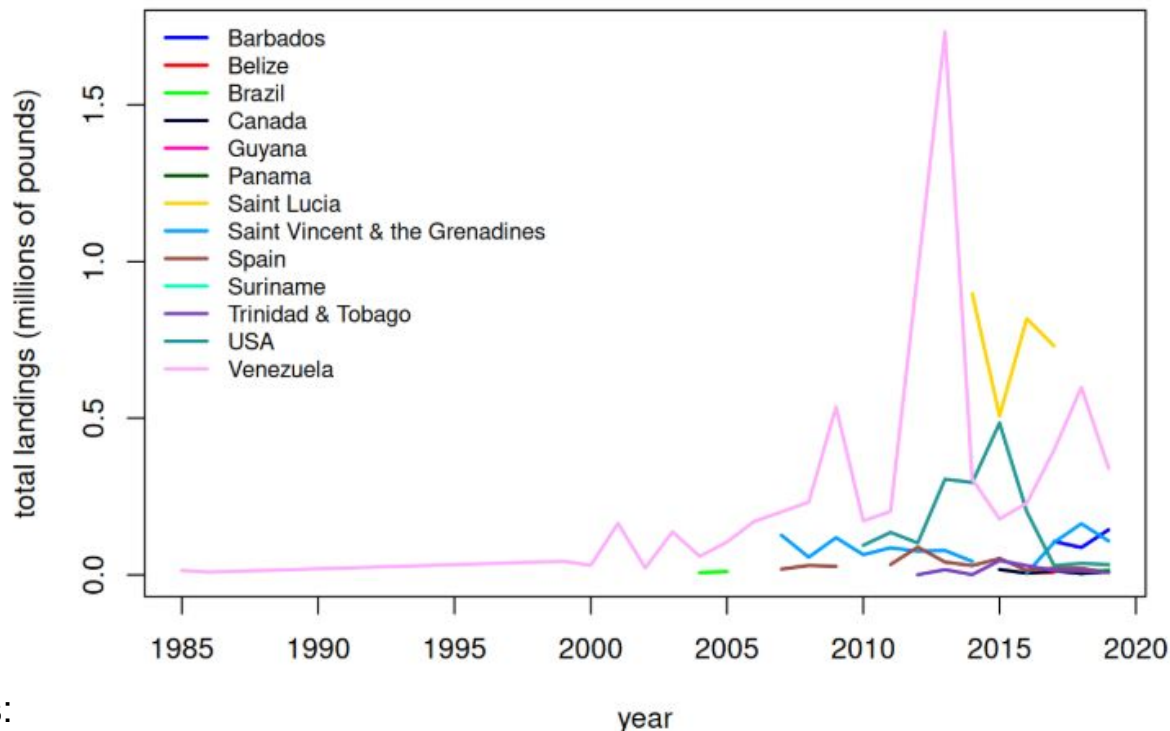
Regulatory Amendment 3 options have very little impact on catch rate (shown), variability in yield, and mean length of landings.



International landings by country



High seas Western Central Atlantic dolphin landings



Mandy Karnauskas:

https://sefsc.github.io/SEFSC-dolphin-analyses/SAU_highseas.html



1. MSE tool



Project webpage: <https://blue-matter.github.io/mahiMSE/>



Technical User Guide: [https://blue-matter.github.io](https://blue-matter.github.io/mahiMSE/tsd/TSD.html)



[/mahiMSE/tsd/TSD.html](https://blue-matter.github.io/mahiMSE/tsd/TSD.html)



Code storage:
[https://github.com/](https://github.com/Blue-Matter/mahiMSE)



[Blue-Matter/mahiMSE](https://github.com/Blue-Matter/mahiMSE)



Management Strategy Evaluation for Atlantic Dolphinfish

Tom Carruthers tom@bluematterscience.com

13 March, 2026



Responsive Management Procedures (MPs)



Mahi show high variability in biomass levels.



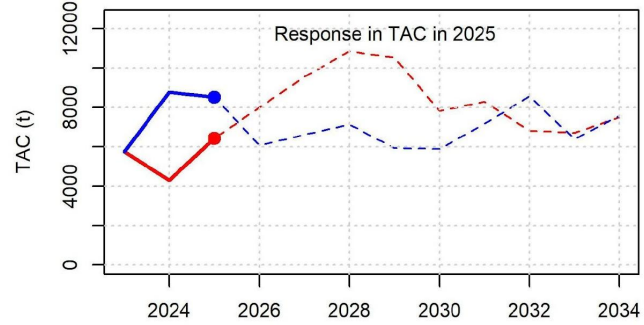
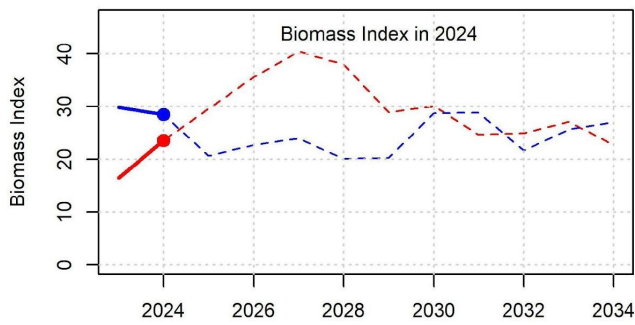
Instead of a fixed policy, management could respond to biomass levels.



These 'empirical MPs' are investigated in most MSEs because they maximize catches while providing appropriate safety.



In this case an empirical MP sets ACL levels in proportion to a relative biomass index from the previous year.





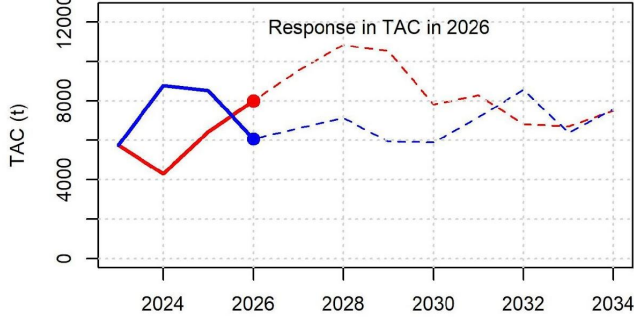
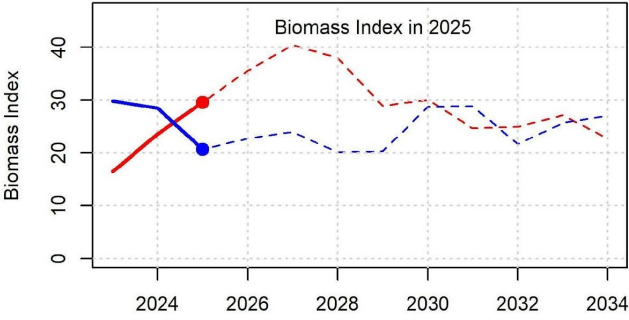
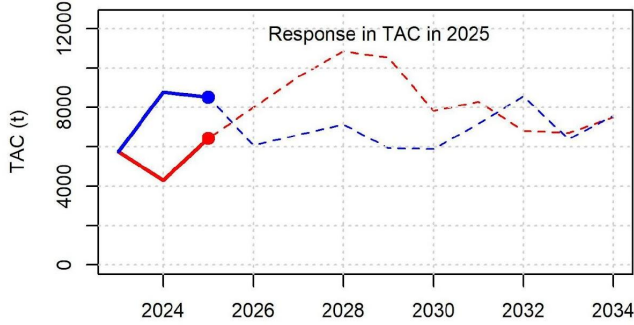
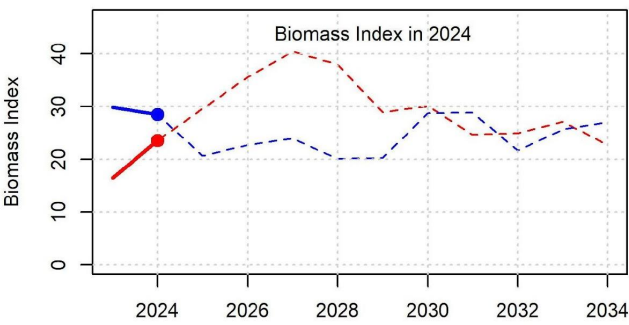
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Projection Year



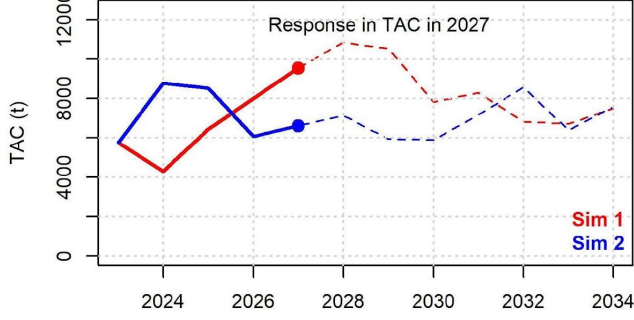
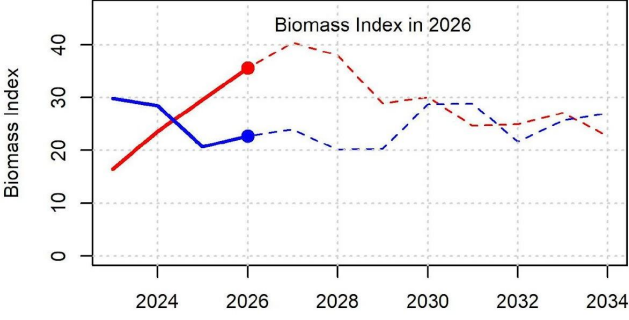
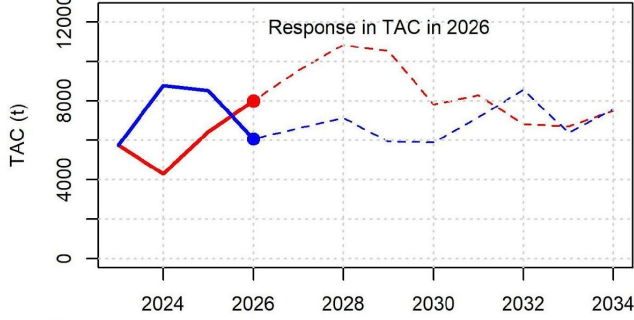
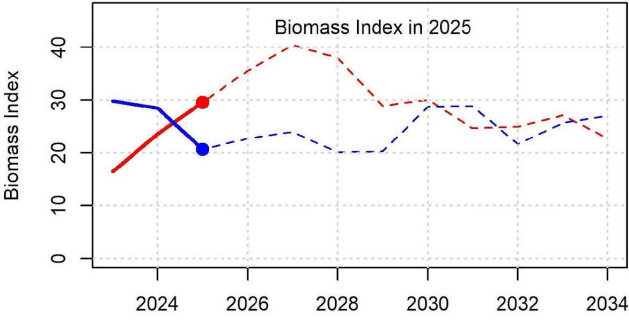
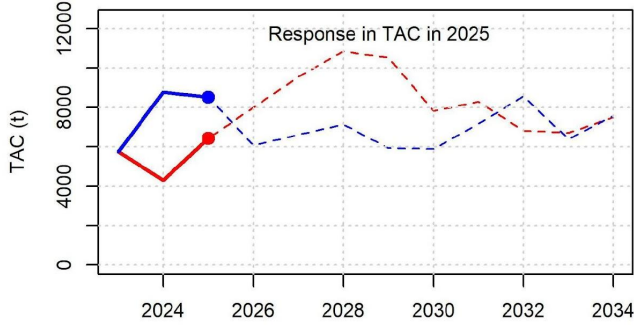
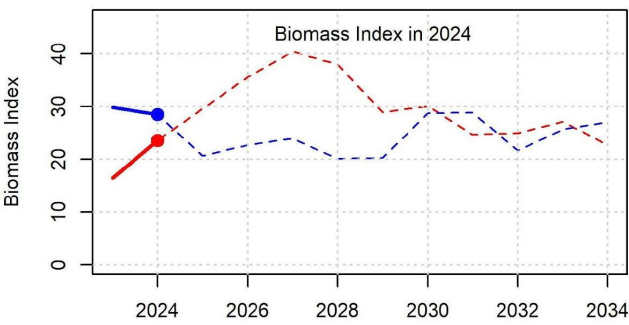
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Projection Year

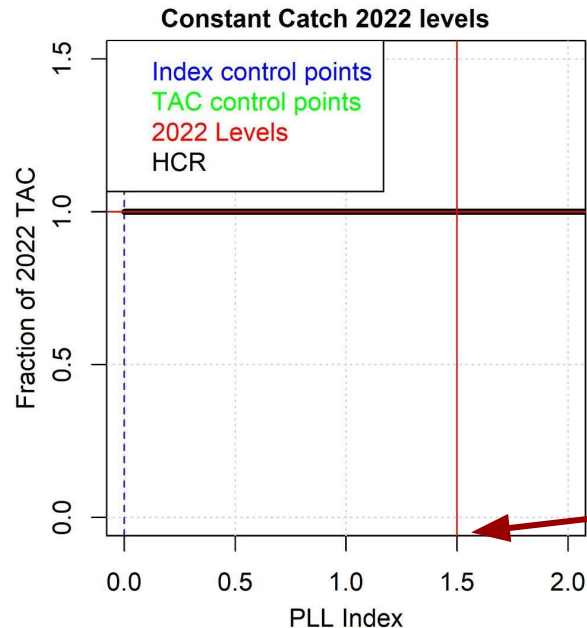
Sim 1
Sim 2

3. Empirical Management Procedures

Constant 2022 Catches
for US fleets

vs

Constant Exploitation rate
for US fleets: the same
ratio of catches to Pelagic
Longline index (PLL)



Regardless of the
index, constant catch
at 2022 is
recommended.

Pelagic Longline
Index (area 1) is 1.5
in 2022.

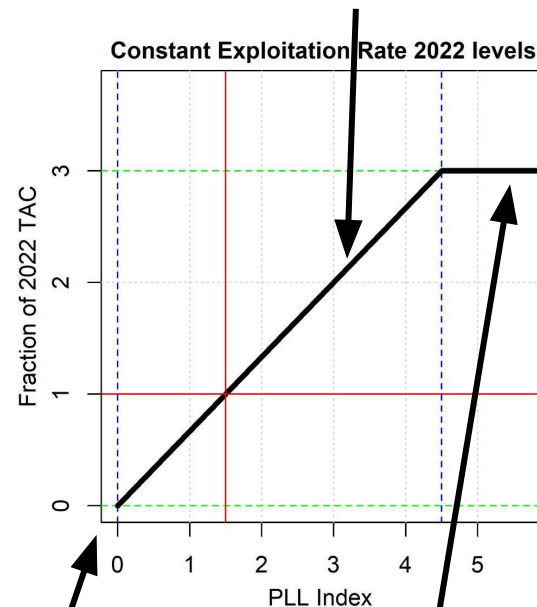
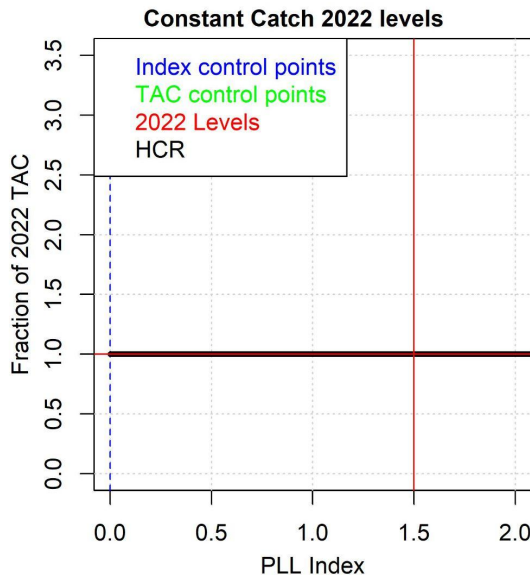
3. Empirical Management Procedures

Constant 2022 Catches
for US fleets (SQcatch)

vs

Constant Exploitation rate
for US fleets (CER): the
same ratio of catches to
Pelagic Longline index
(PLL)

If PLL is higher, catch is proportionally higher.
Catch advice is a fixed multiple of the PLL index



No catch when no
PLL catch rate

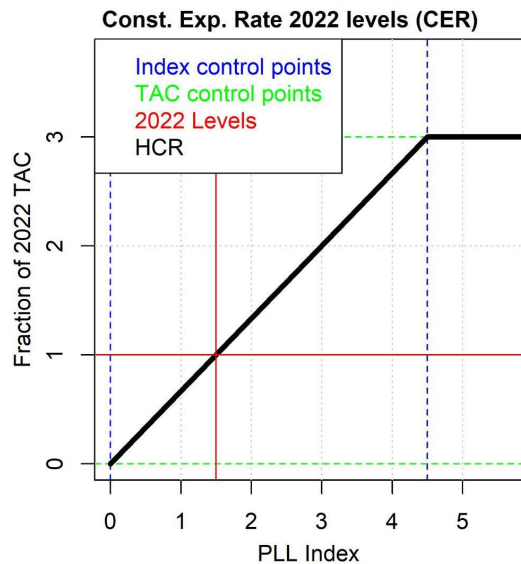
Maximum catch is 3x
2022 levels

3. Empirical Management Procedures

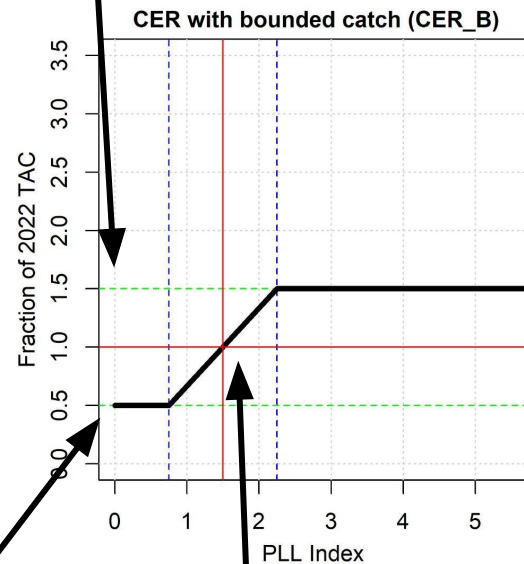
Constant Exploitation rate
for US fleets (CER)

VS

Constant Exploitation rate
for US fleets with upper
and lower bounds on
catches (CER_B)



Lower bound is 50%
2022 catches



Same proportional
response to PLL
between bounds

Upper bound is 1.5x 2022 catches

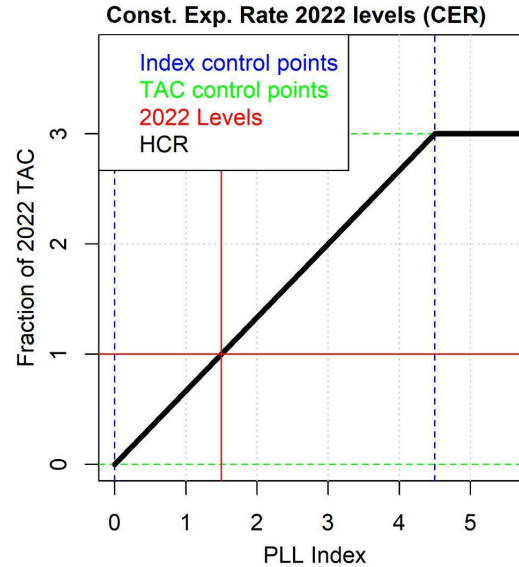
3. Empirical Management Procedures

Very similar to CER but with higher exploitation rate.

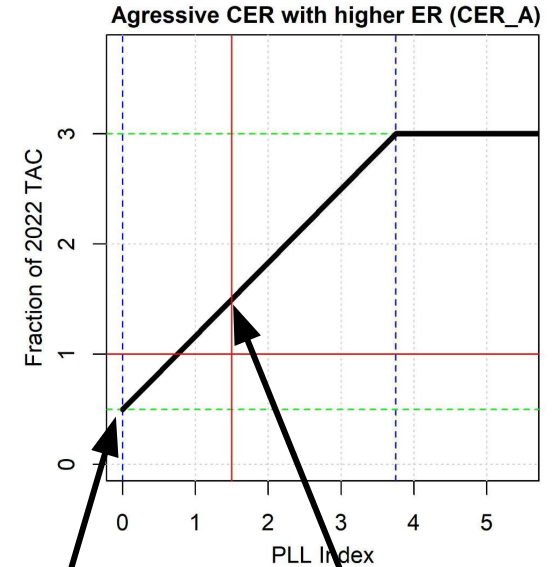
Constant Exploitation rate
for US fleets (CER)

vs

Aggressive Constant
Exploitation rate for US
fleets with upper and
lower bounds on catches
(CER_A)



Lower bound is 50%
2022 catches



Starts by fishing at 150%
2022 exploitation rate.

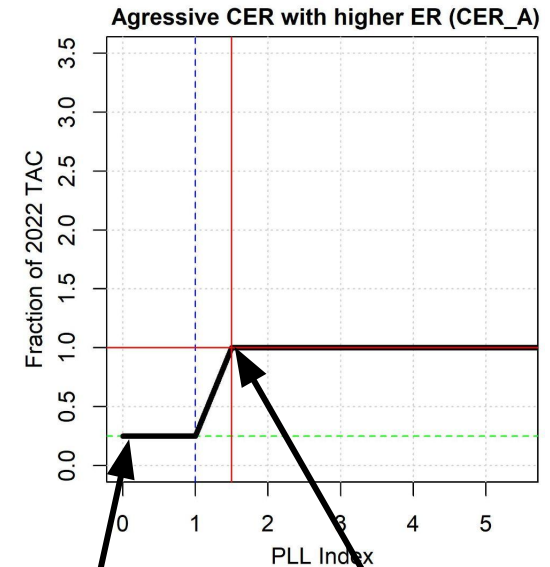
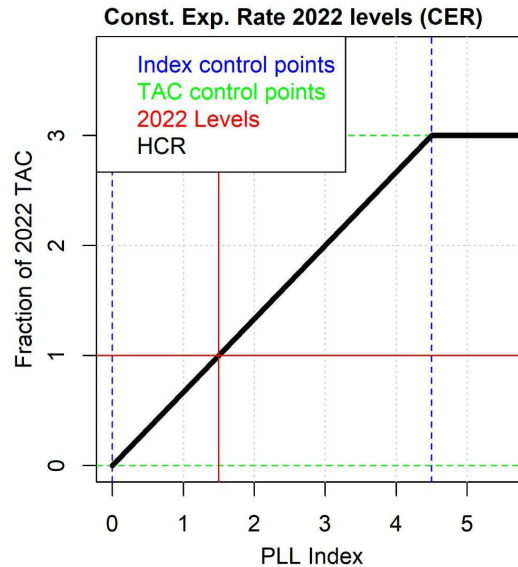
3. Empirical Management Procedures

HCR that moves between 25% and 100% 2022 catches (up to max 20% change between years)

Constant Exploitation rate
for US fleets (CER)

VS

Conservative constant
exploitation rate (CER_C)



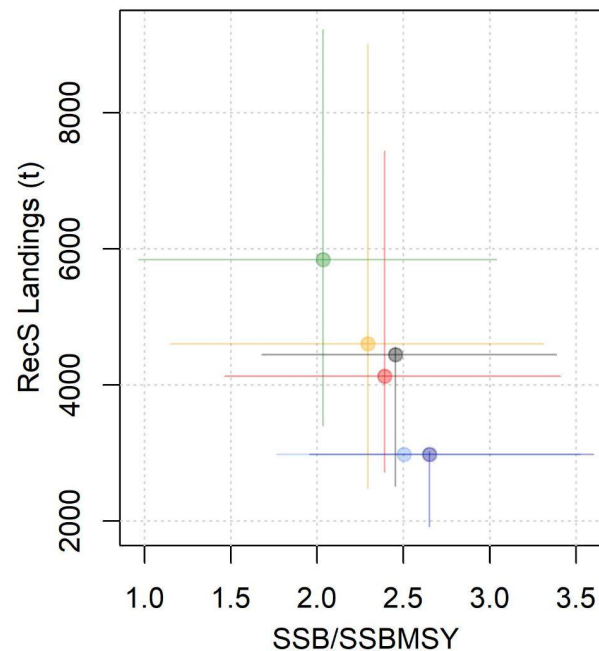
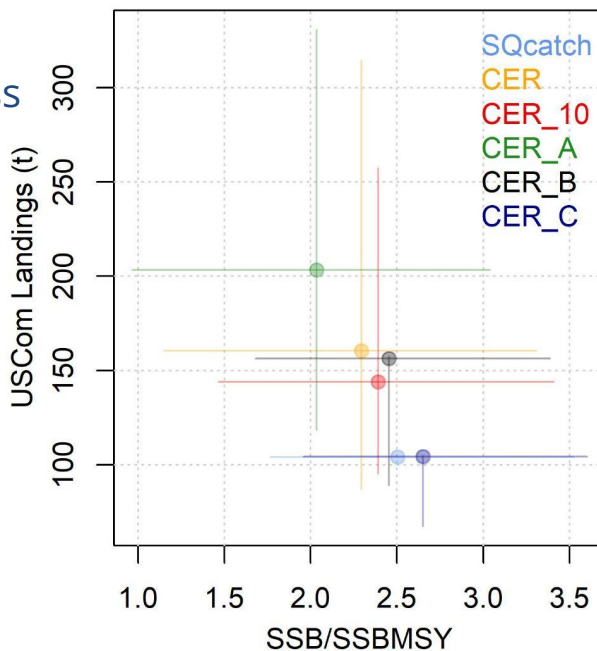
Lower bound is 25%
2022 catches

Upper bound is 2022
catches

3. Empirical management procedures: Example summaries

Trade-off in
expected biomass
and landings
performance:

(Annual averages over projection years 2026-2040)





Roles and Responsibilities



	Modeling team	Stakeholders (and Council-associated advisory bodies)	SSC	Council
Management objectives & Performance metrics	<i>Quantify</i> operational management objectives and associated performance metrics	<i>Advise</i> on and articulate secondary management performance	<i>Advise</i> on biological minimum performance criteria (e.g. not overfishing and rebuilding) and risk tolerance	<i>Advise</i> on desired performance and <i>adopt</i> operational management objectives, performance metrics, and risk tolerance
Operating models (OMs)	<i>Construct</i> based on best scientific information available and agency player feedback	<i>Advise</i> on OM structure and key uncertainties	<i>Adopt</i> as best scientific information available	<i>Advise</i> on OM structure and key uncertainties
Management procedures	<i>Test</i> and <i>refine</i> MPs based on agency player feedback	<i>Advise</i> on MP features and management levers	<i>Advise</i> on MP structure and parameterization	<i>Adopt</i> and <i>implement</i> management procedure based on performance
Exceptional circumstances provisions (ECPs)	<i>Determine</i> ECP and regularly test for exceptional circumstances	<i>Advise</i> on unacceptable MP performance	<i>Advise</i> on unacceptable MP performance	<i>Adopt</i> and <i>implement</i> ECPs

Worked example: Empirical (index-based) Management procedure



Initial management procedure adoption would require full rule-making in a Framework action. But once specified annual or biennial TAC setting could be nearly automatic

Scope for efficiency gains in SEFSC, council and rulemaking

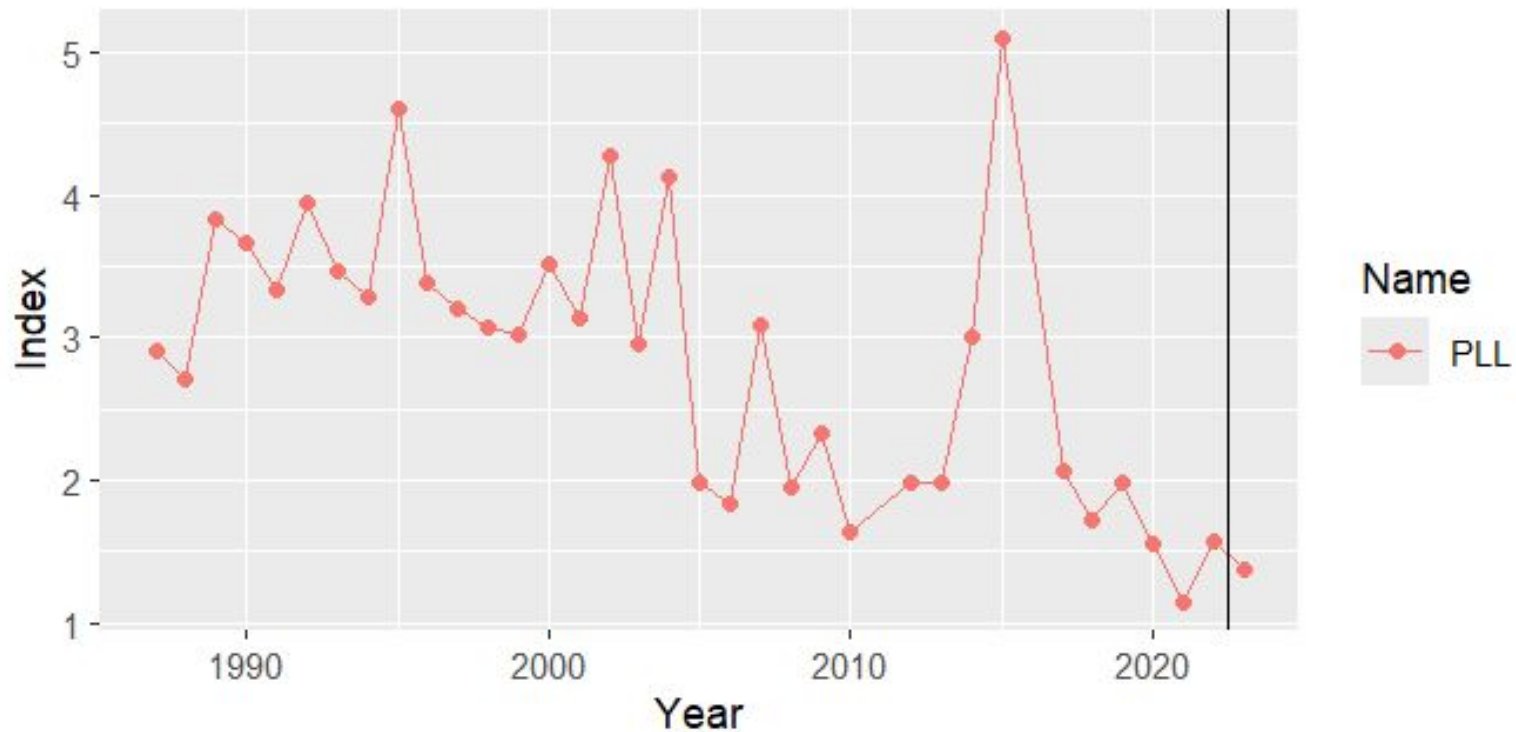
Exceptional circumstances determination by either SEFSC or SSC. Situations, often not deemed plausible, where the MP may no longer apply

MSE review process (9 years)

Year	Quarter	ACL Update	Action
0	4	Council action (1.5 years)	
1	1	Council action (1.5 years)	
1	2	Council action (1.5 years)	MP adopted
1	3	NMFS rulemaking (6 months)	
1	4	NMFS rulemaking (6 months)	MP implementation
2	1		ACL from MP
2	2		Exceptional circumstances check
2	3		
2	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
3	1		ACL from MP
3	2		Exceptional circumstances check
3	3		
3	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
4	1		ACL from MP
4	2		Exceptional circumstances check
4	3		
4	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
5	1		ACL from MP
5	2		Exceptional circumstances check
5	3		
5	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
6	1		ACL from MP
6	2		Exceptional circumstances check
6	3		
6	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
7	1	SEFSC internal (3 mos)	ACL from MP
7	2	SEFSC internal (3 mos)	MSE review / status check
7	3	SSC review (3 mos)	MSE review / status check
7	4	Council action (6 mos)	
8	1	Council action (6 mos)	ACL from MP
8	2	AF/CE (3 mos)	
8	3	NMFS rulemaking (3 mos)	
8	4	AF/CE (3 mos)	ACL from existing or revised MP
9	1	NMFS rulemaking (3 mos)	



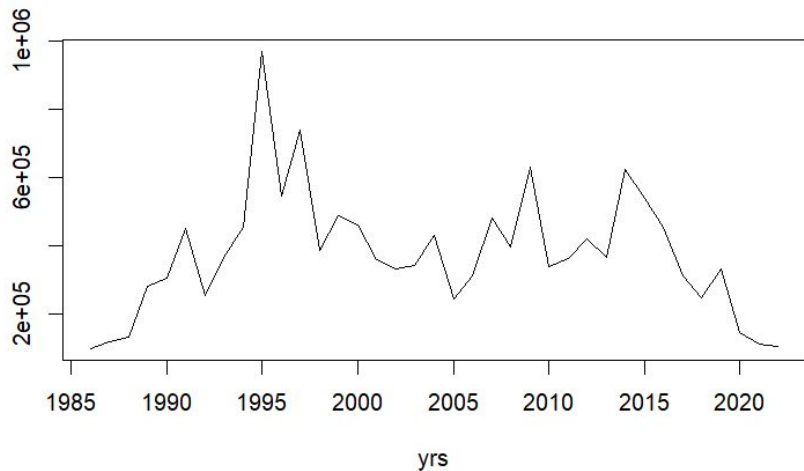
Winter PLL index



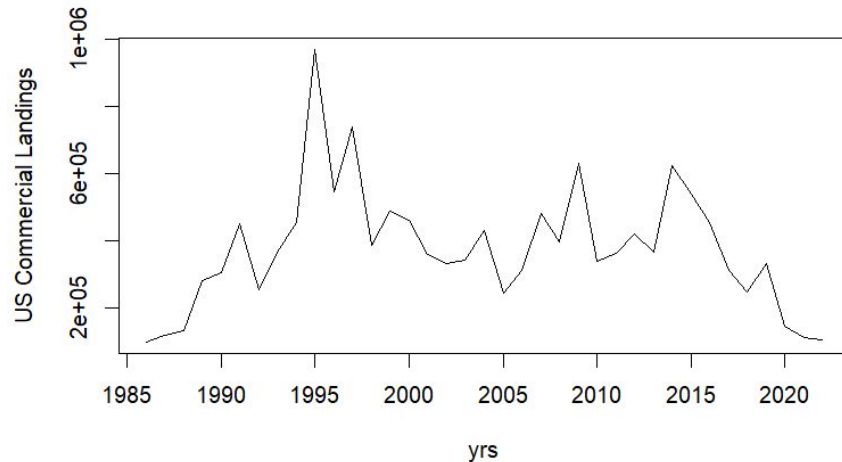


Catches

US Recreational



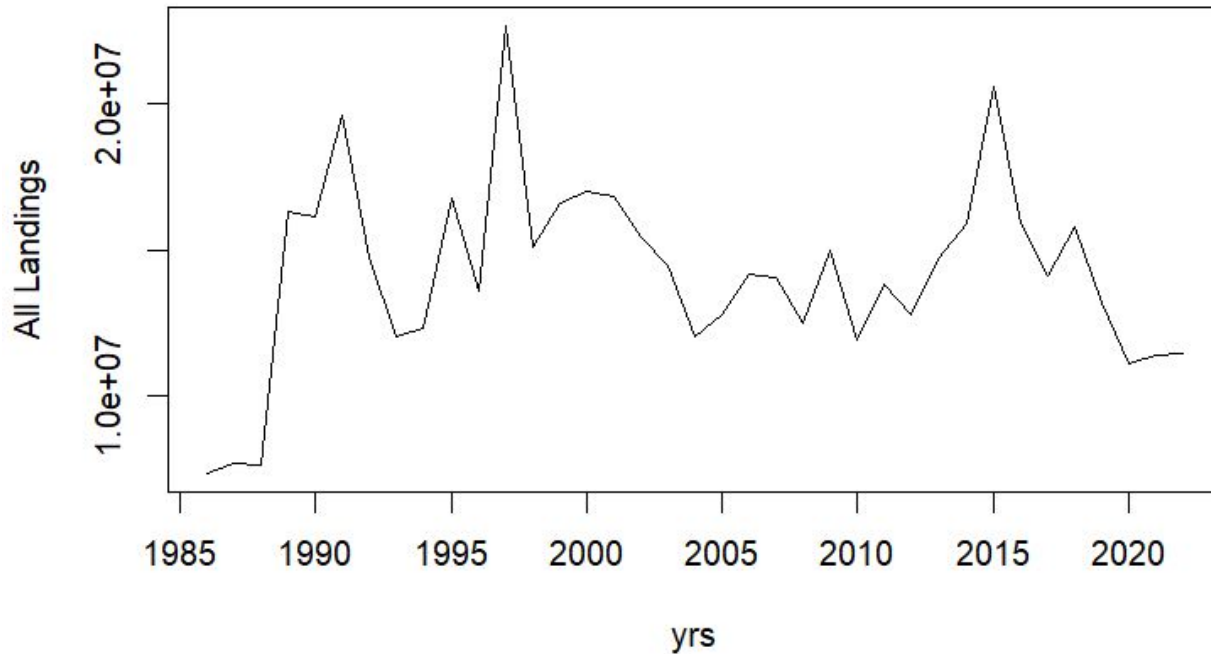
Commercial Landings





Catches

Cumulative Landings





Reference Operating Model Grid

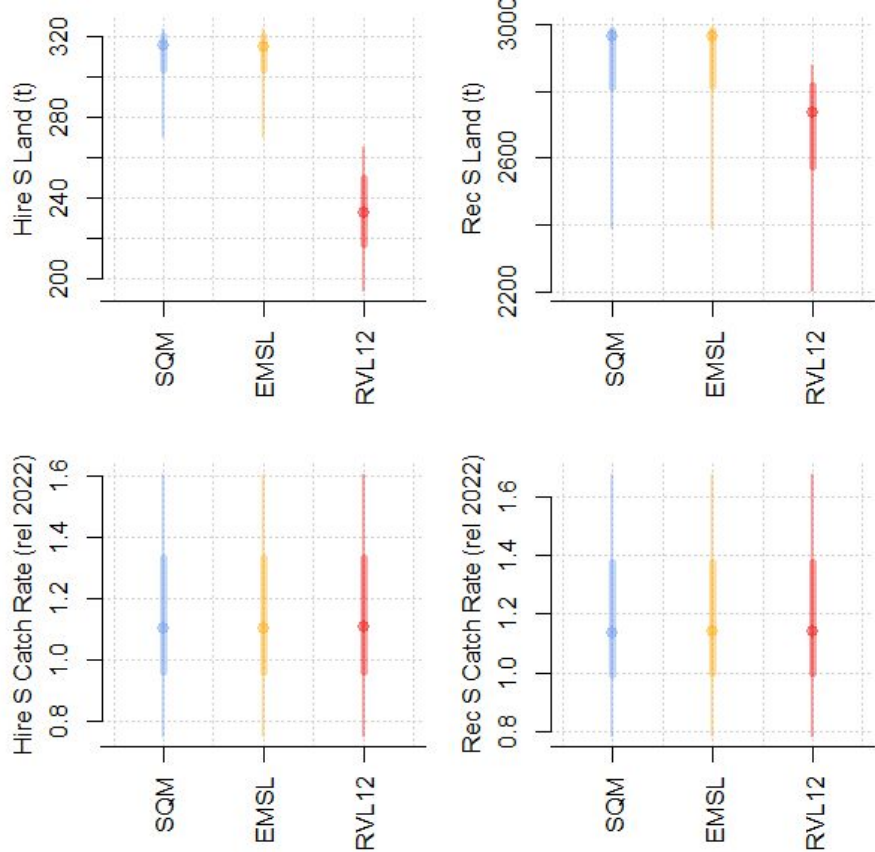
Uncertainty	Level 1	Level 2
Natural Mortality	Low (m): 0.25 per season	High (M): 0.5 per season
Resilience (steepness)	Low (s): 0.7	High (S): 0.95
Catch levels of Disc and Unrep	Low (c): half NOAA calculated	High (C): 100% NOAA calculated
Recruitment Level	Low (r) 75% historical mean levels	High (R) 100% historical mean levels
Viscosity	Low (v): prob. stay. = 0.4	High (V) prob. stay. = 0.6





Reg Am 3

Sensitivity

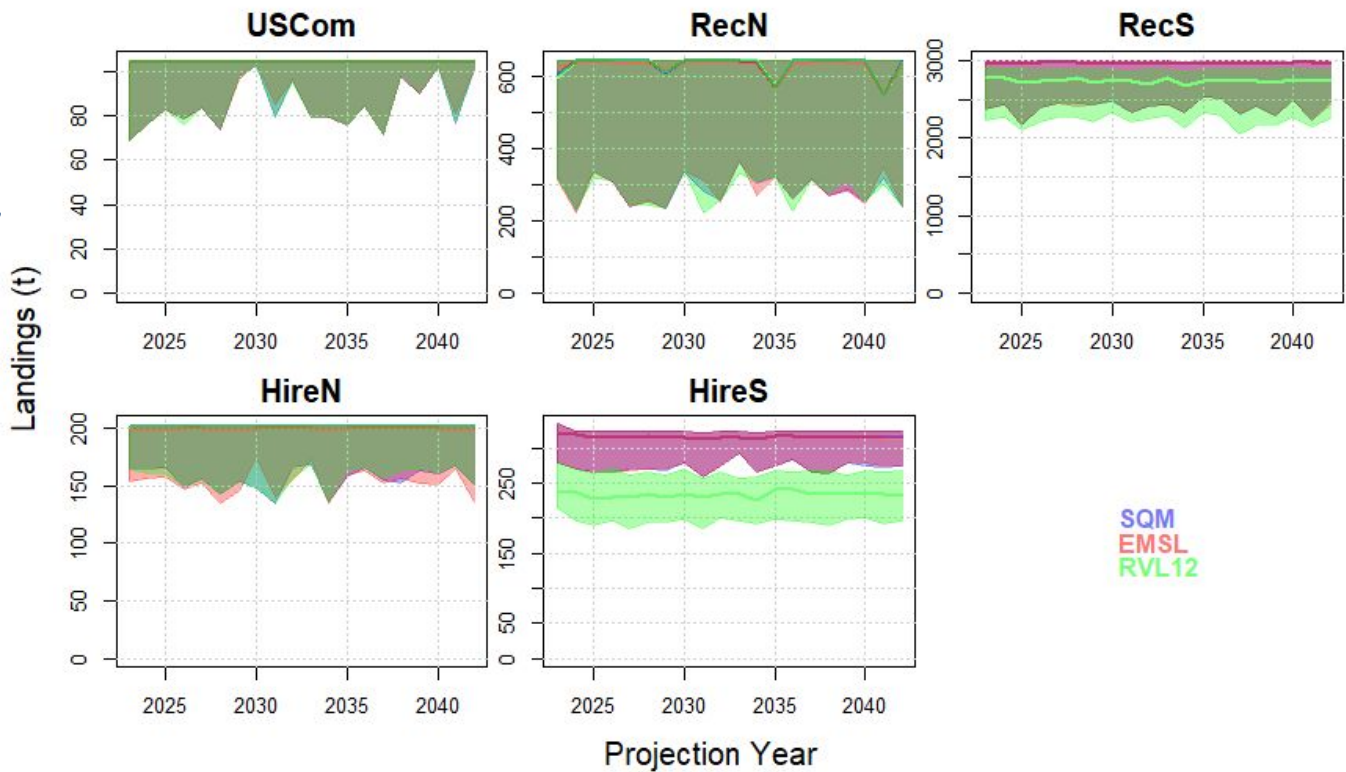


ROM_S1	Two percent decline in CAR and SFL, 1 percent increase in SE, 2% increase in NC and NE
ROM_S2	50% greater variability in spatial / seasonal distribution
ROM_S3	1% pa. increase in catchability reflecting range contraction



Reg Am 3

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