Dolphin MSE Update

South Atlantic Fishery Management Council
June 2026 Meeting

Roles and Responsibilities

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

Overview

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

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

3. Management procedure demonstration: candidate MPs

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

4. Operationalize Management Objectives

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

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

Jun 2026 — July 2026 — Sept 2026 — Oct 2026 — Dec 2026 — 2027

June Council

Select preferred:

- *Regulatory Amendment 3 scoping*
- operationalize management objectives
- **Management procedure revision**

CIE Review

Review of MSE framework

Sept Council

Action:

- **choose preferred management procedure**

October SSC

Action:

- Final SSC review of MSE framework

Dec Council

Action:

- **Final choice management procedure**

2027

- Exceptional circumstance provisions & review schedule

Worked example: Empirical (index-based) Management procedure

yr	Q	D. ACL update (MP or IA)	Action
2025	4	Council action (1.5 years)	
2026	1	Council action (1.5 years)	
2026	2	Council action (1.5 years)	MP adopted
2026	3	NMFS rulemaking (6 months)	
2026	4	NMFS rulemaking	MP implementation
2027	1		ACL from MP
2027	2		Exceptional circumstances check
2027	3		
2027	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
2028	1		ACL from MP
2028	2		Exceptional circumstances check
2028	3		
2028	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
2029	1		ACL from MP
2029	2		Exceptional circumstances check
2029	3		
2029	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
2030	1		ACL from MP
2030	2		Exceptional circumstances check
2030	3		
2030	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
2031	1		ACL from MP
2031	2		Exceptional circumstances check
2031	3		
2031	4	SEFSC internal, SSC, AF/CE, Rulemaking (3 mos)	
2032	1	SEFSC internal (3 mos)	ACL from MP
2032	2	SEFSC internal (3 mos)	MSE review/status check
2032	3	SSC review (3 mos)	MSE review/status check
2032	4	Council action (6 mos)	
2033	1	Council action (6 mos)	ACL from MP
2033	2	AF/CE (3 mos)	
2033	3	NMFS rulemaking (3 mos)	
2033	4	AF/CE (3 mos)	
2034	1	NMFS rulemaking (3 mos)	ACL from existing or revised MP

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)

1. MSE tool

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

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

Code storage: https://github.com/Blue-Matter/mahiMSE

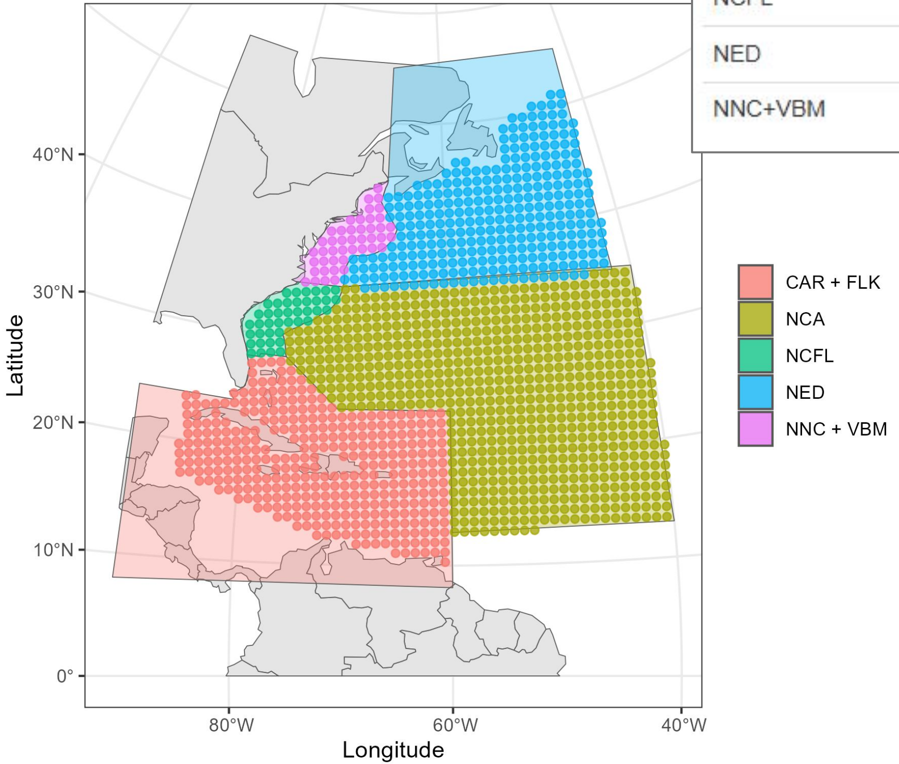
Management Strategy Evaluation for Atlantic Dolphinfish

Tom Carruthers tom@bluematterscience.com

13 March, 2026

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



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	Assummed 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

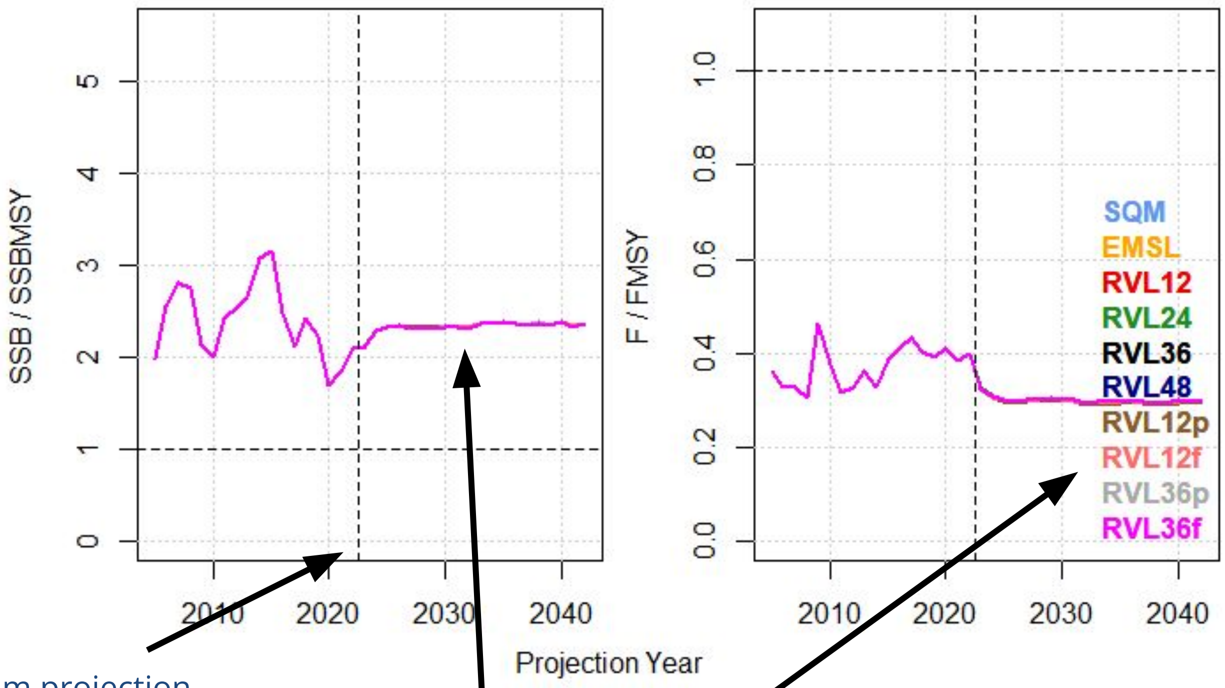
Modeled as Constant Catch

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).



Starting from projection year 2023

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

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.

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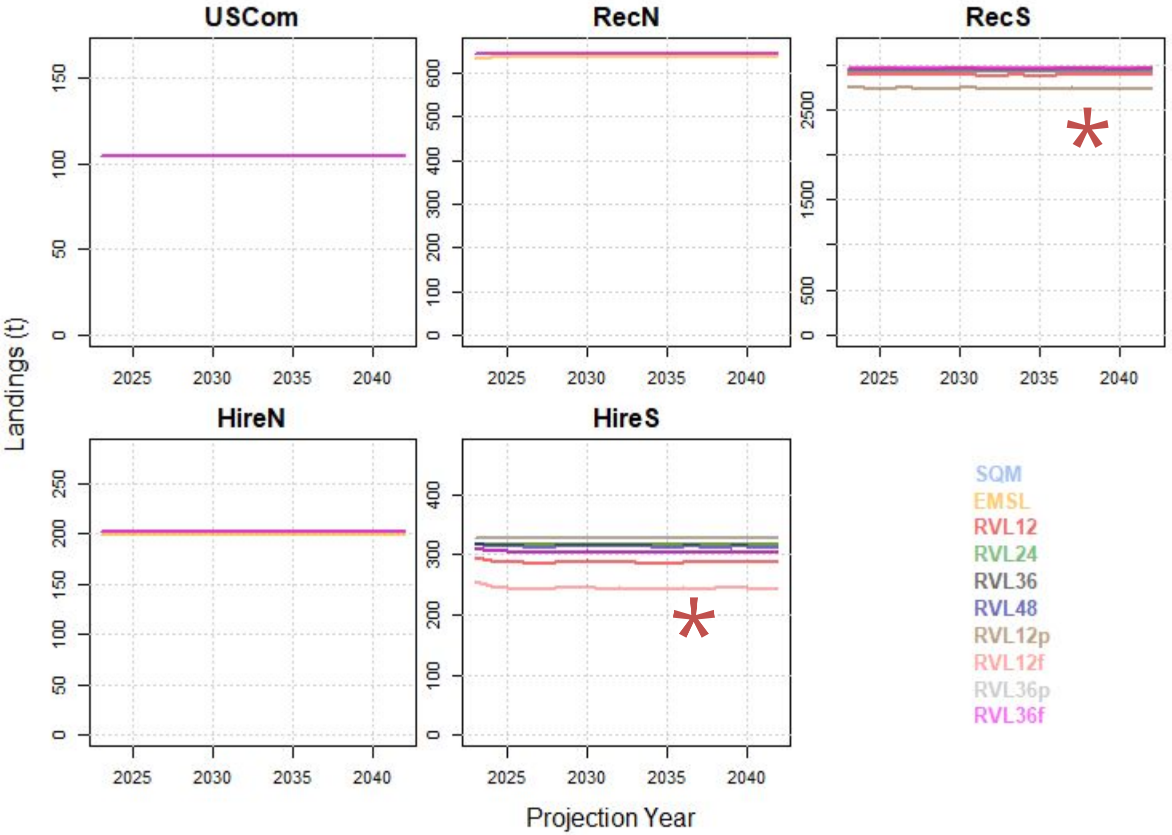
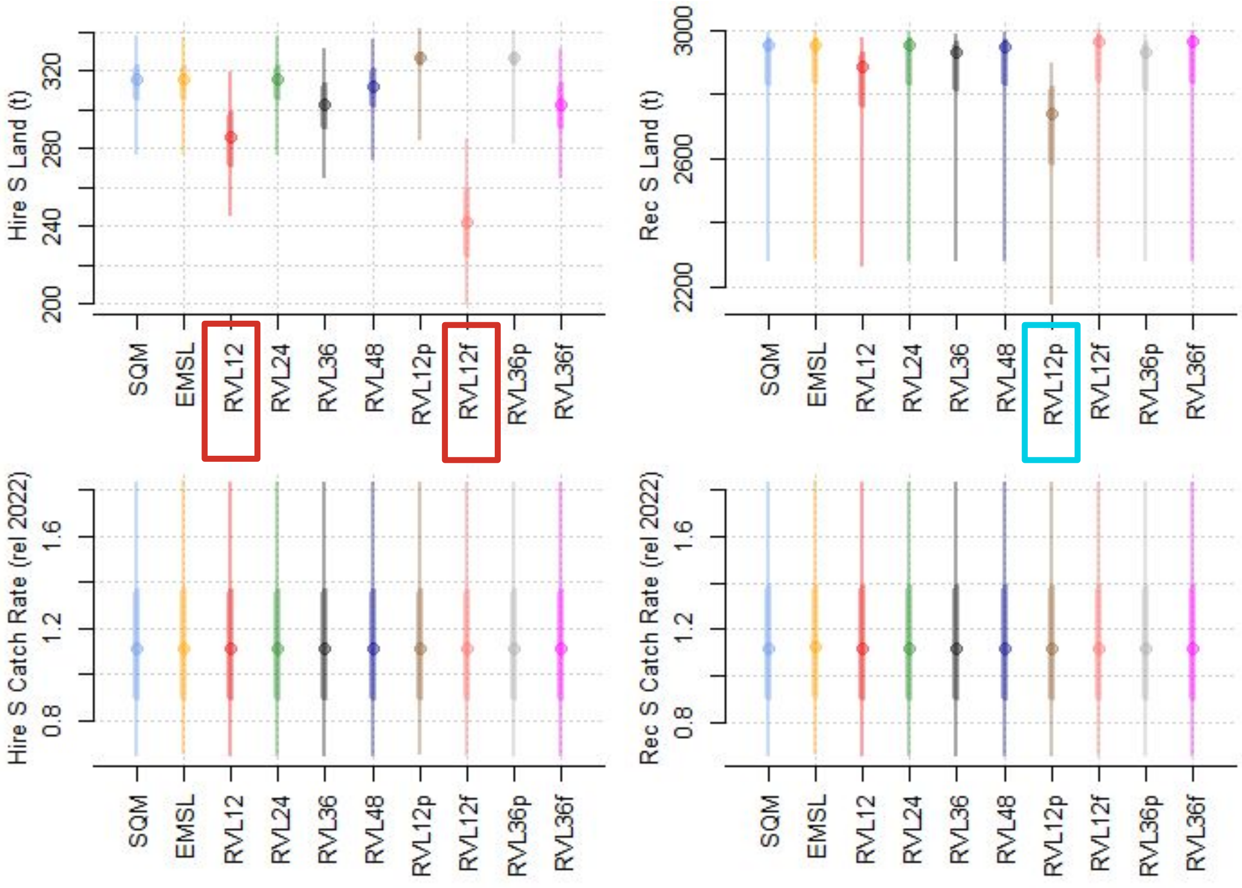


* Notice strongest impacts of size and vessel limits the southern recreational fleets.

* 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 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.

Regulatory Amendment 3 - Constant Effort

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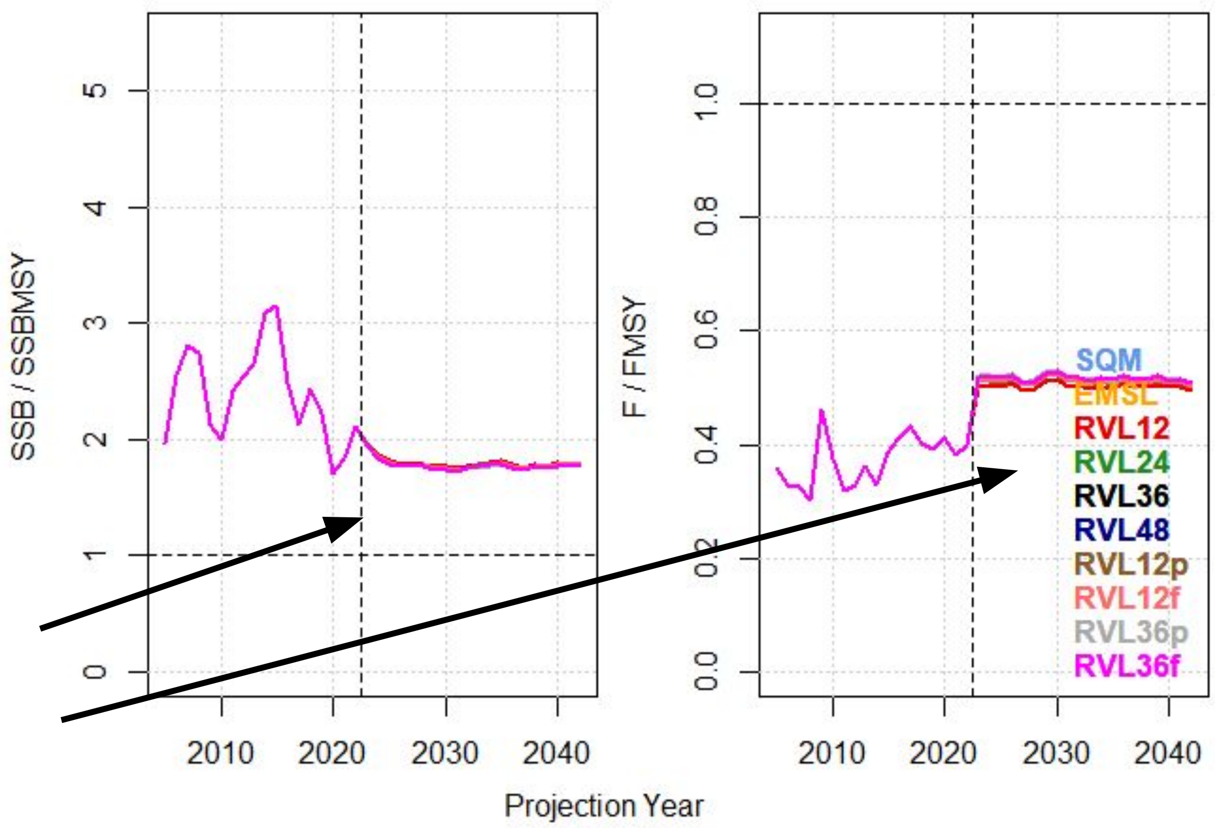

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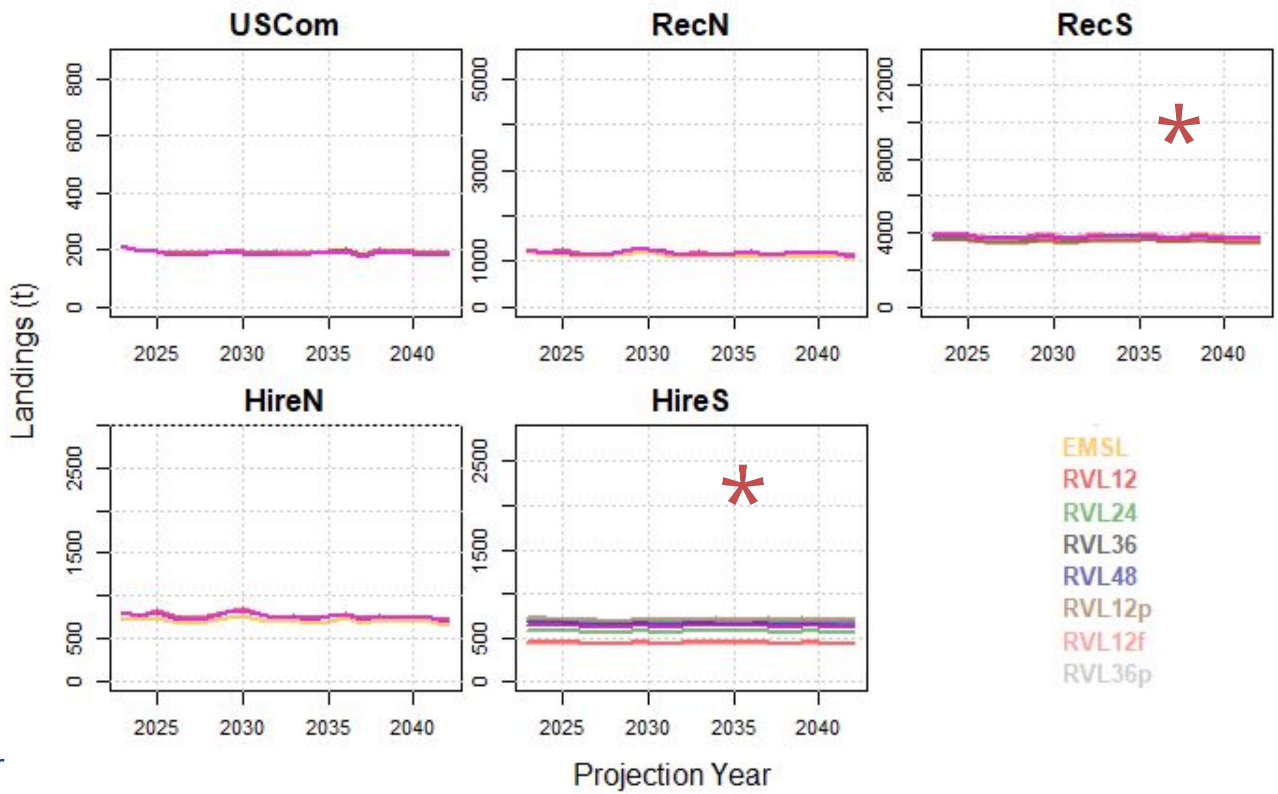

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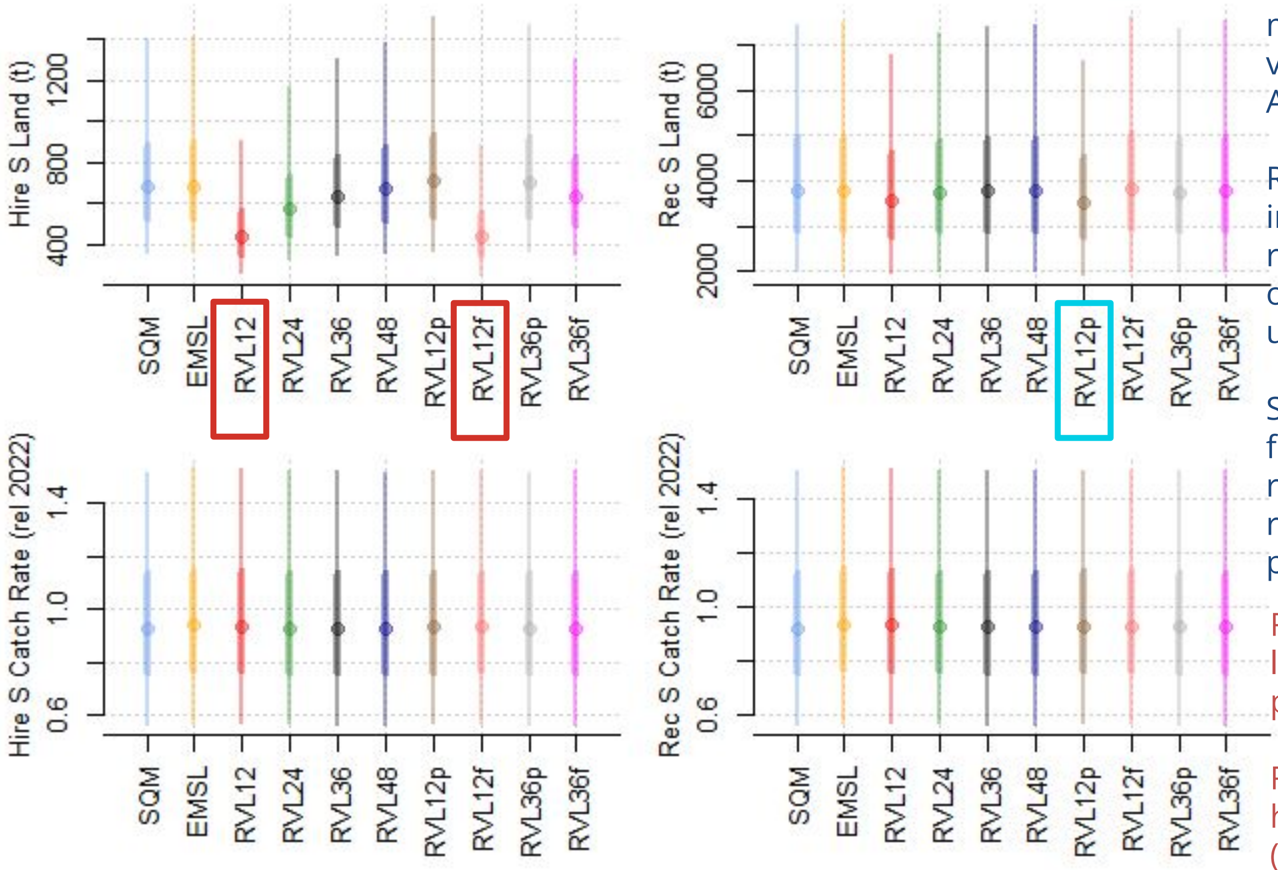

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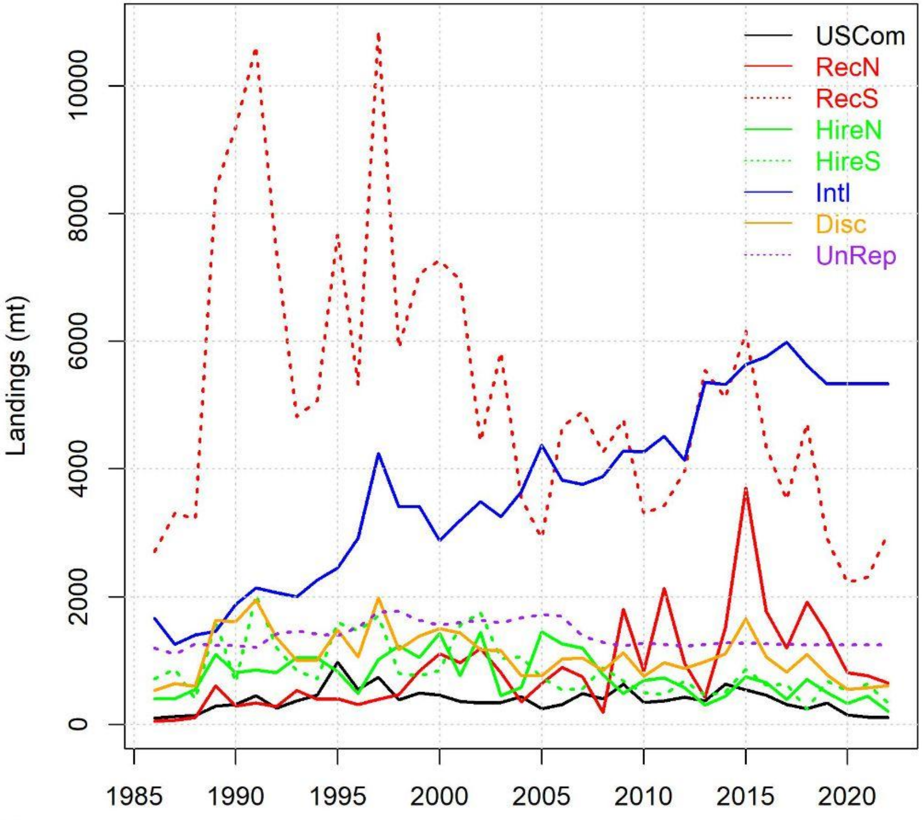
ACTION ITEM

Feedback on Regulatory Amendment 3 scoping

Relative magnitude of U.S. Dolphin fishing

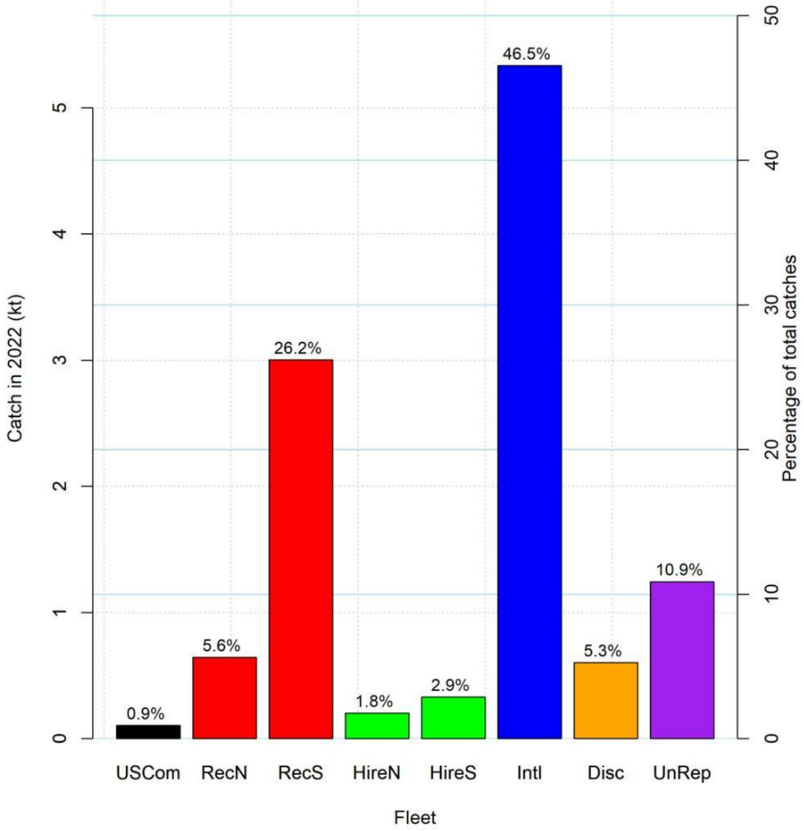


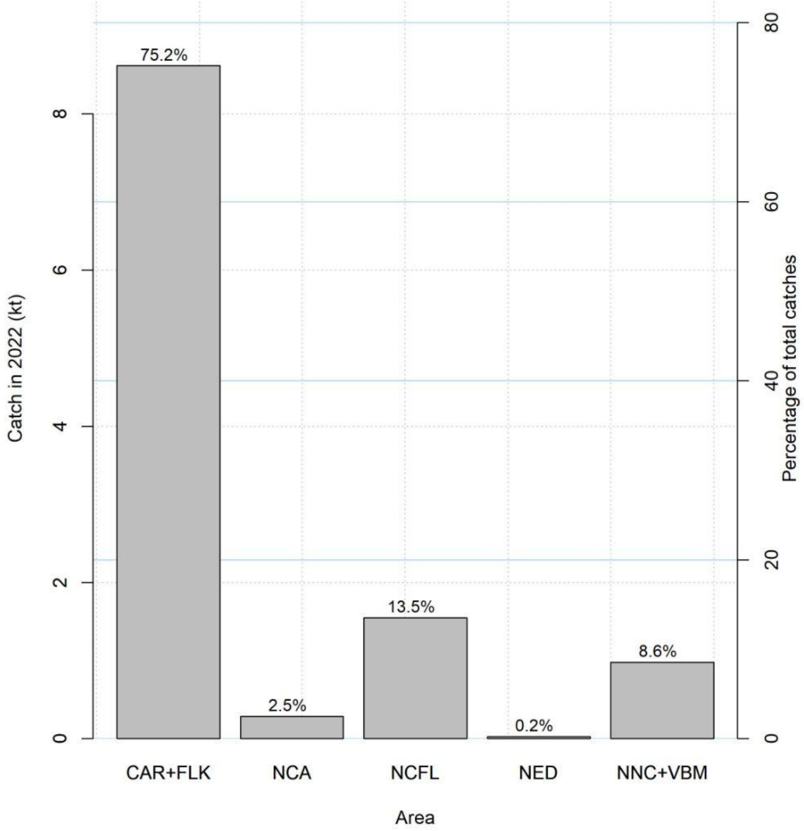
- Large increases in International Catches (1.5kt to 5.5kt)
- Large declines in southern recreational catches (10kt to 2.5kt)

Mandy Karnauskas. https://sefsc.github.io/SEFSC-dolphin-analyses/

Relative magnitude of U.S. Dolphin fishing

- 37% of dolphin catches in 2022
- Primarily a CAR+FLK fishery





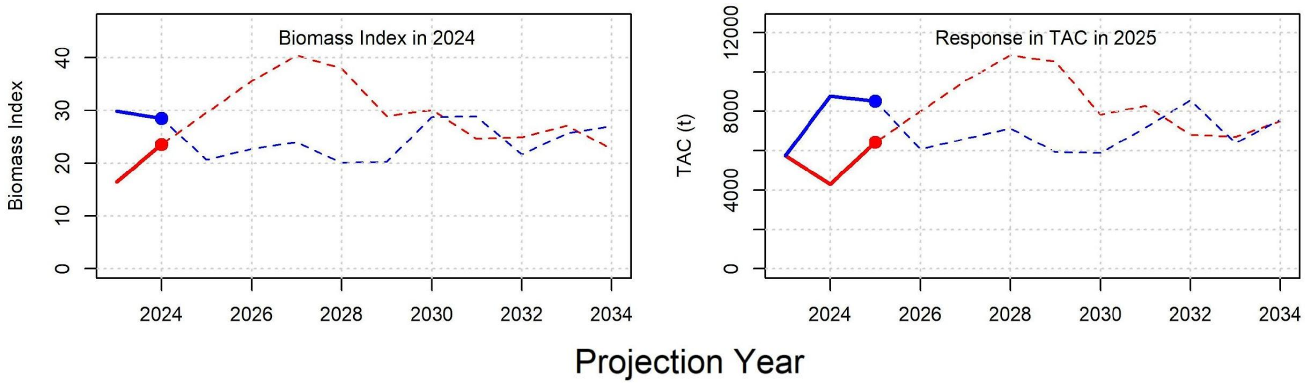
Responsive Management Procedures (MPs)

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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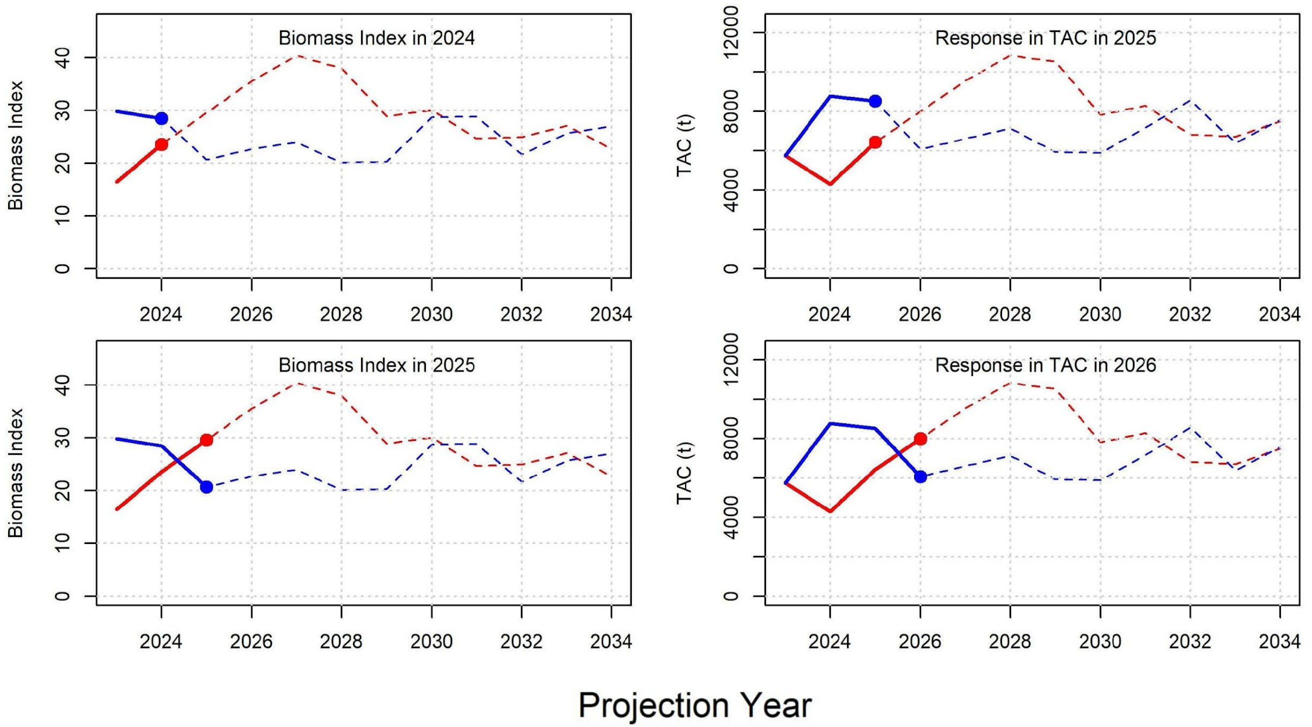

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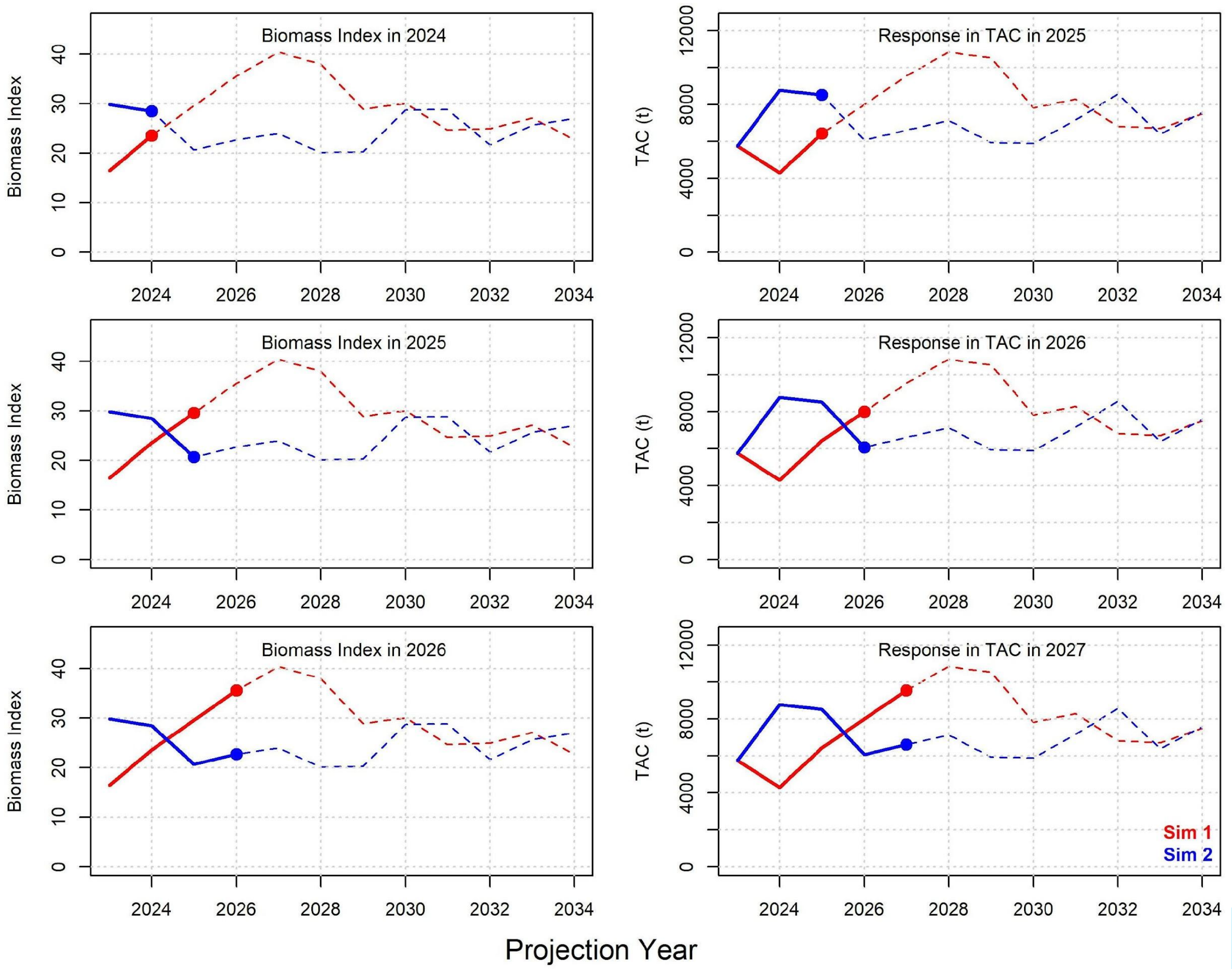
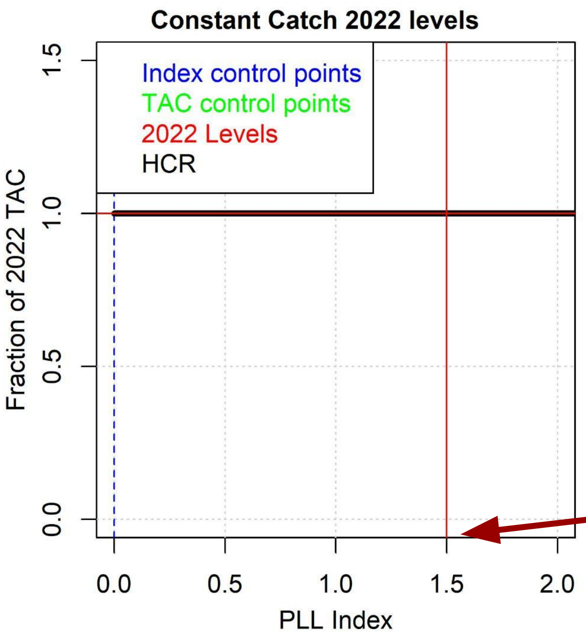


3. Empirical Management Procedures

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.

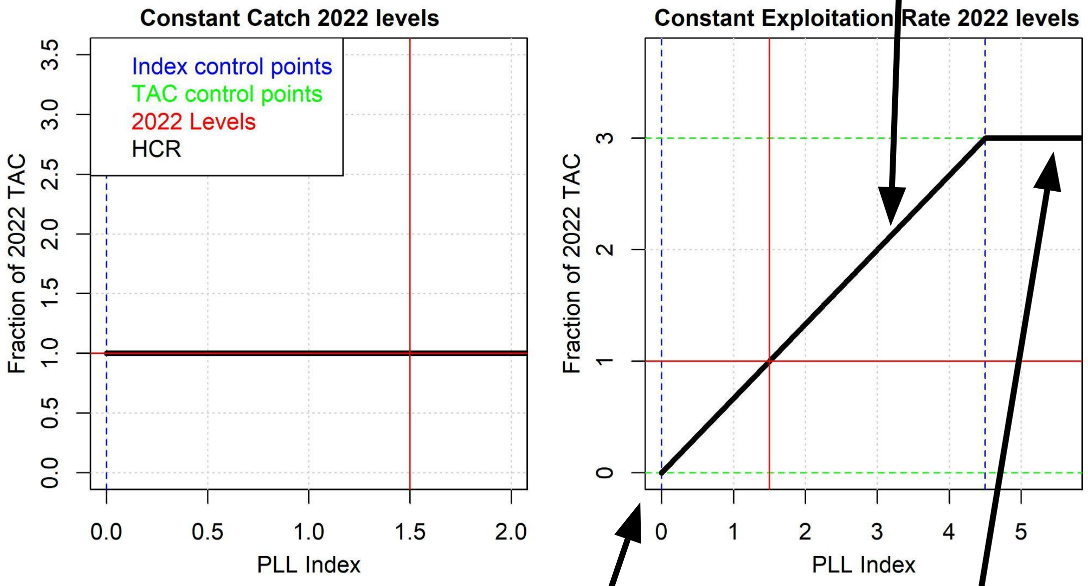
3. Empirical Management Procedures

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



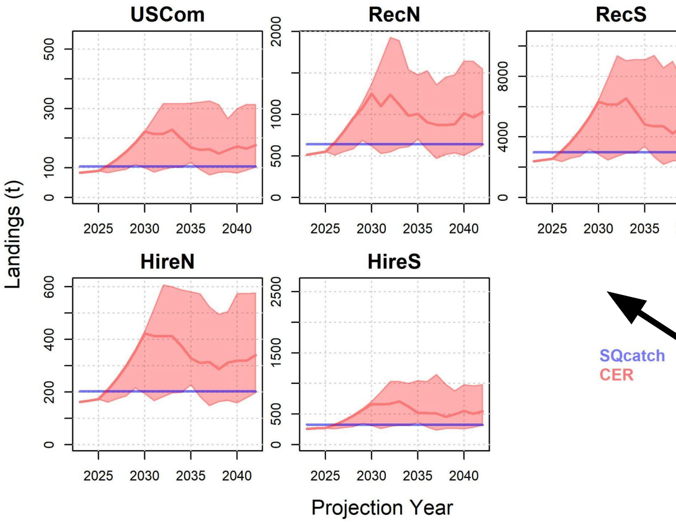
No catch when no PLL catch rate

Maximum catch is 3x 2022 levels

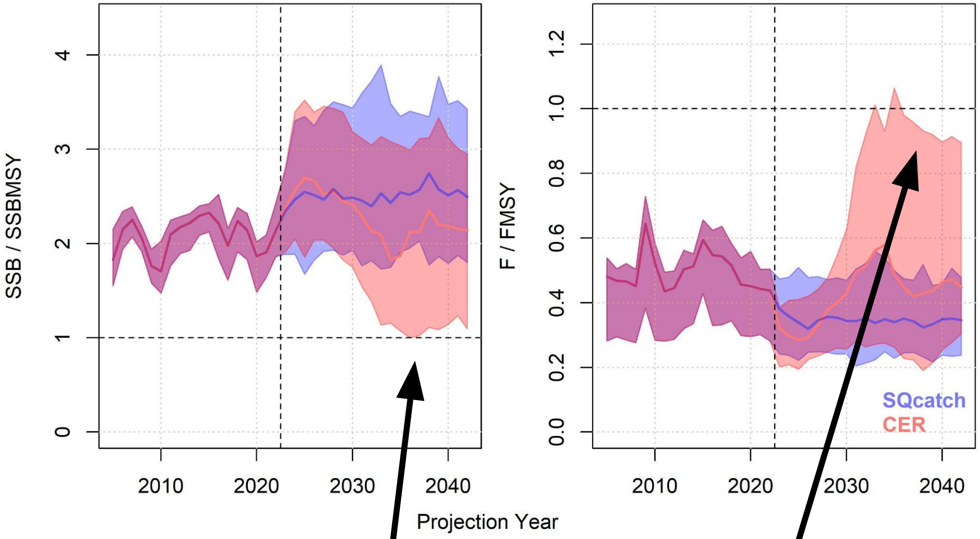
3. Empirical Management Procedures

Reference Case OM (100% recruitment)

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]



Substantially higher expected landings



Low probability of overfished status (SSB < SSBMSY)

Low probability of overfishing (F > FMSY)

3. Empirical Management Procedures

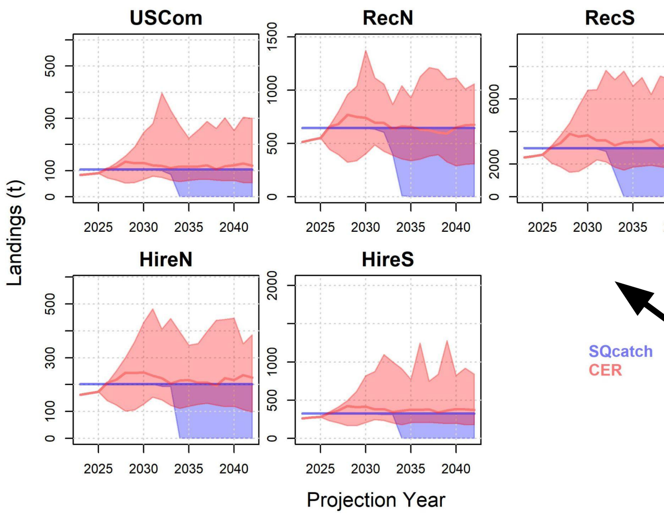
What happens if the future is less bright?

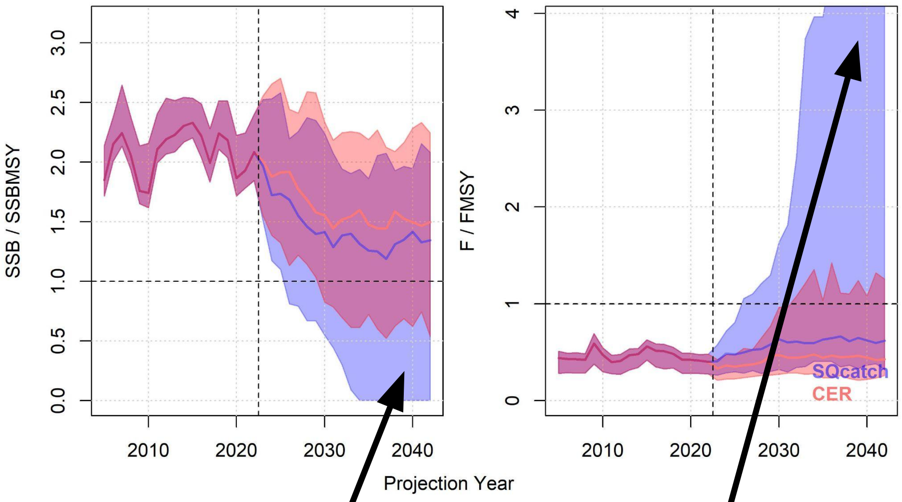
Let's look at constant catches vs the constant Exploitation Rate MP (CER) for projections where recruitment is 75% of the Reference Case OM....

3. Empirical Management Procedures

Scenario with 75% future recruitment

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]





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.

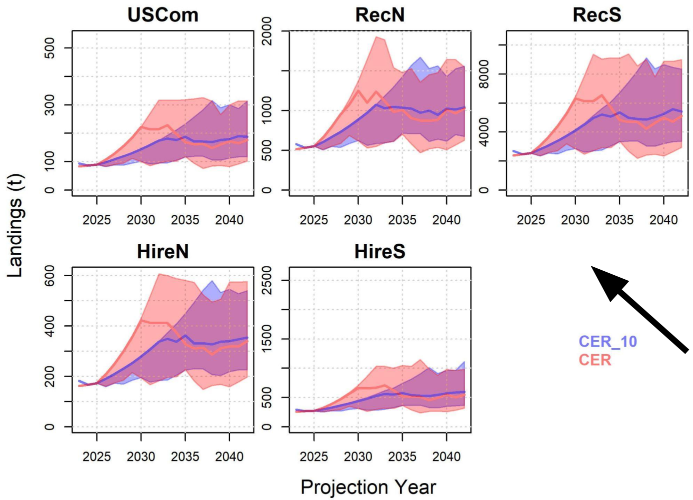
3. Empirical Management Procedures

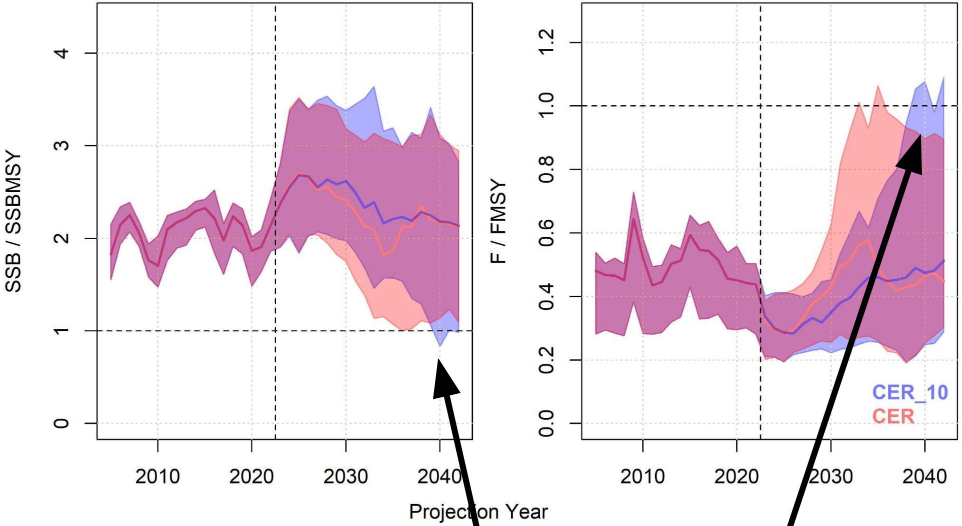
Dynamic management provides higher landings when biomass is available and higher biological protection (higher long term landings) in situations where productivity is reduced.

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.

3. Empirical Management Procedures

Constant Exploitation Rate for US fleets (CER) [max 20% change in catch] vs CER with max 10% change in catch (CER_10)





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

Less flexible MP (CER_10) has slightly higher risks of overfishing and overfished status over longer term.

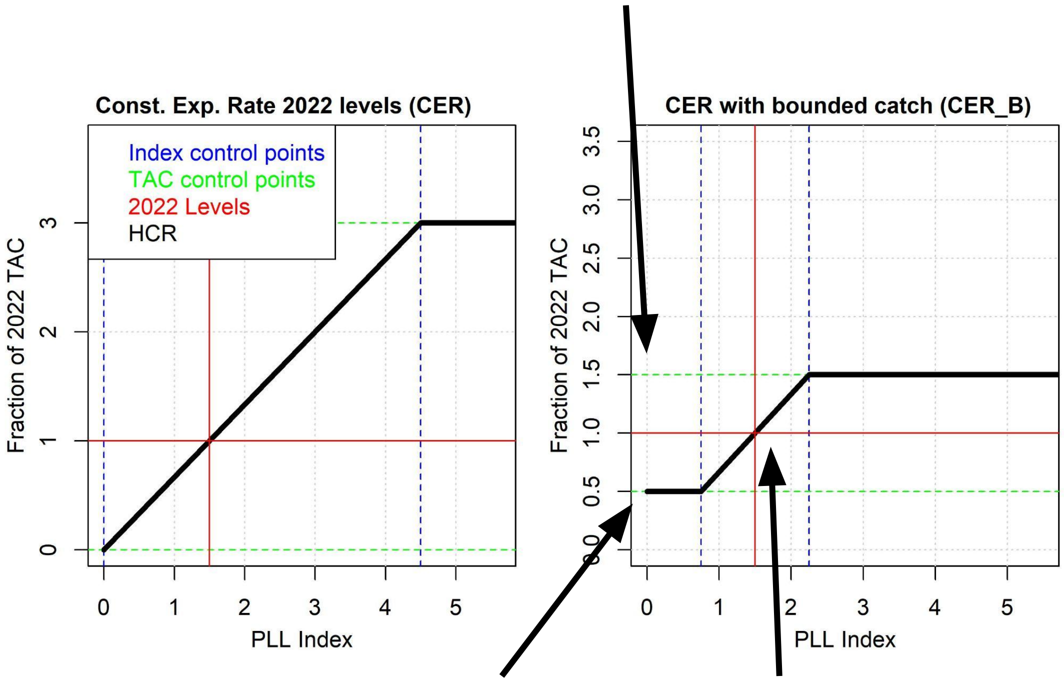
3. Empirical Management Procedures

Constant Exploitation rate for US fleets (CER)

vs

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

Upper bound is 1.5x 2022 catches

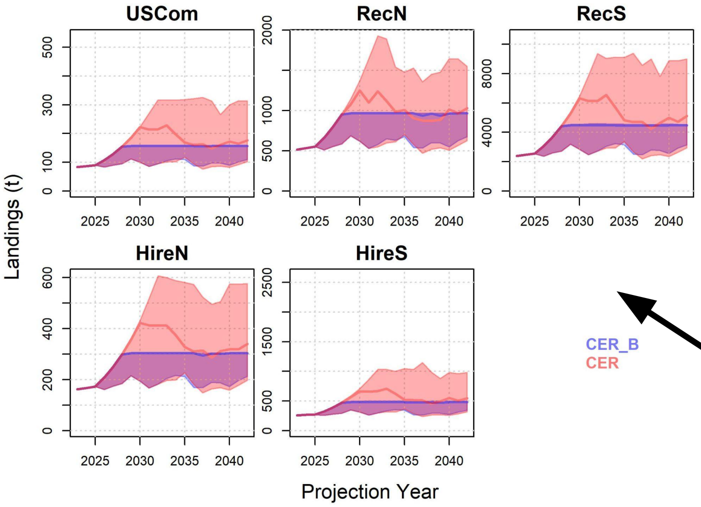


Lower bound is 50% 2022 catches

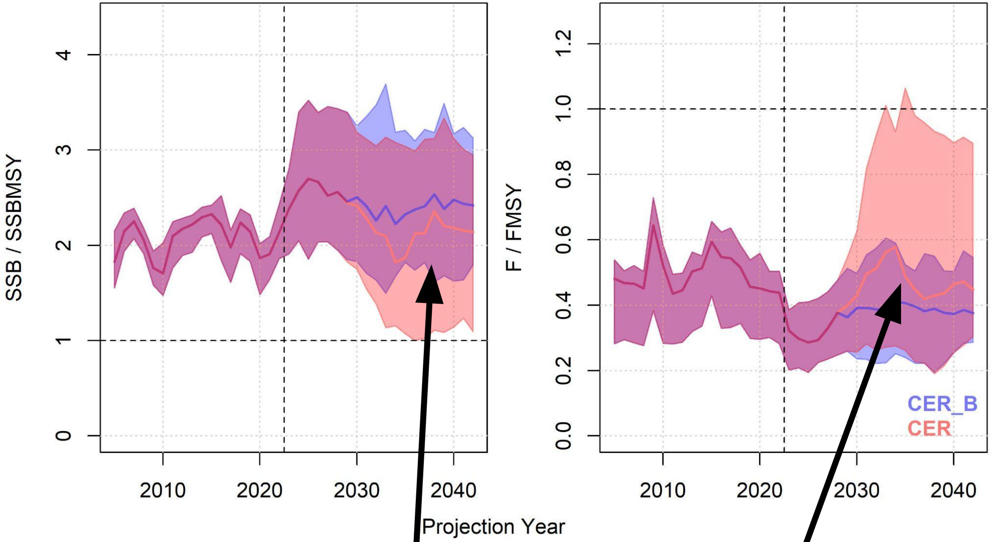
Same proportional response to PLL between bounds

3. 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.

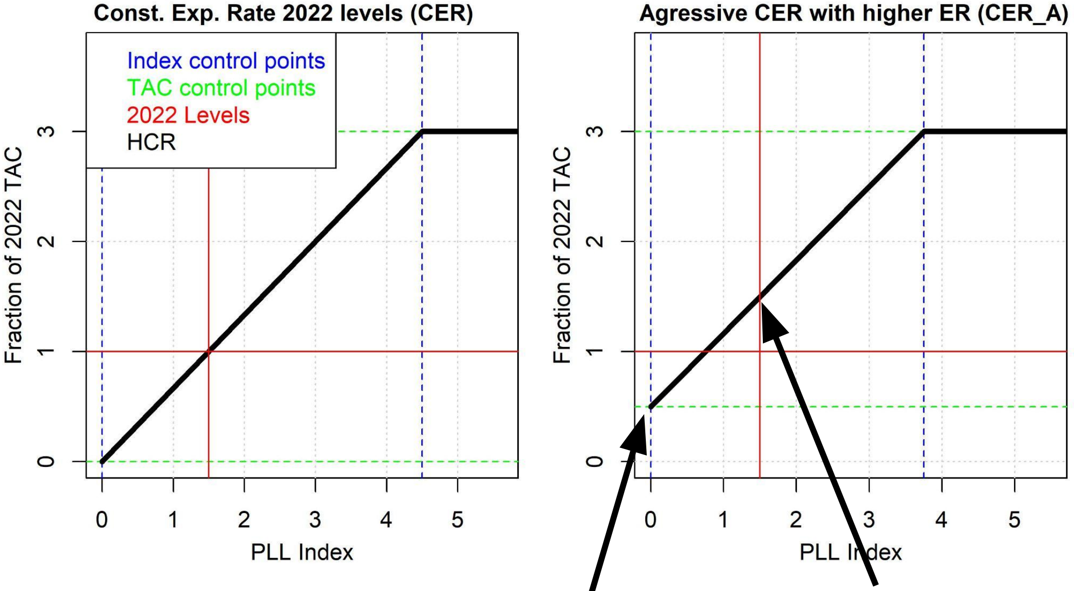
3. Empirical Management Procedures

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)

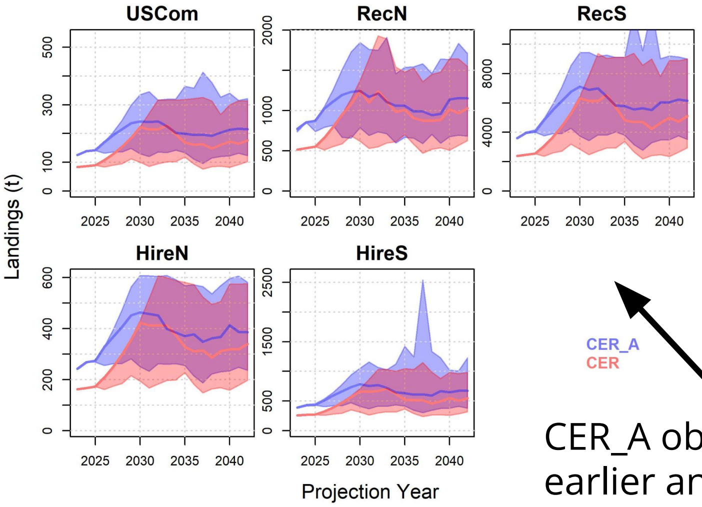


Lower bound is 50% 2022 catches

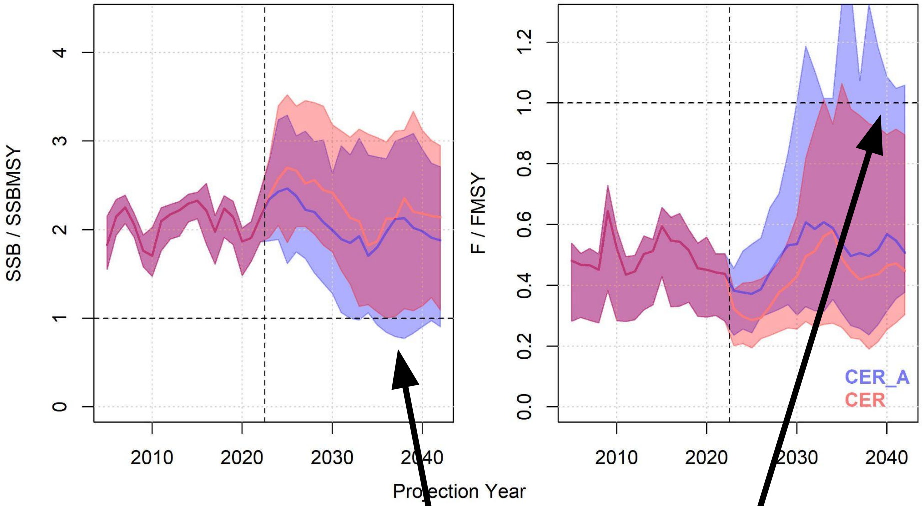
Starts by fishing at 150% 2022 exploitation rate.

3. Empirical Management Procedures

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%

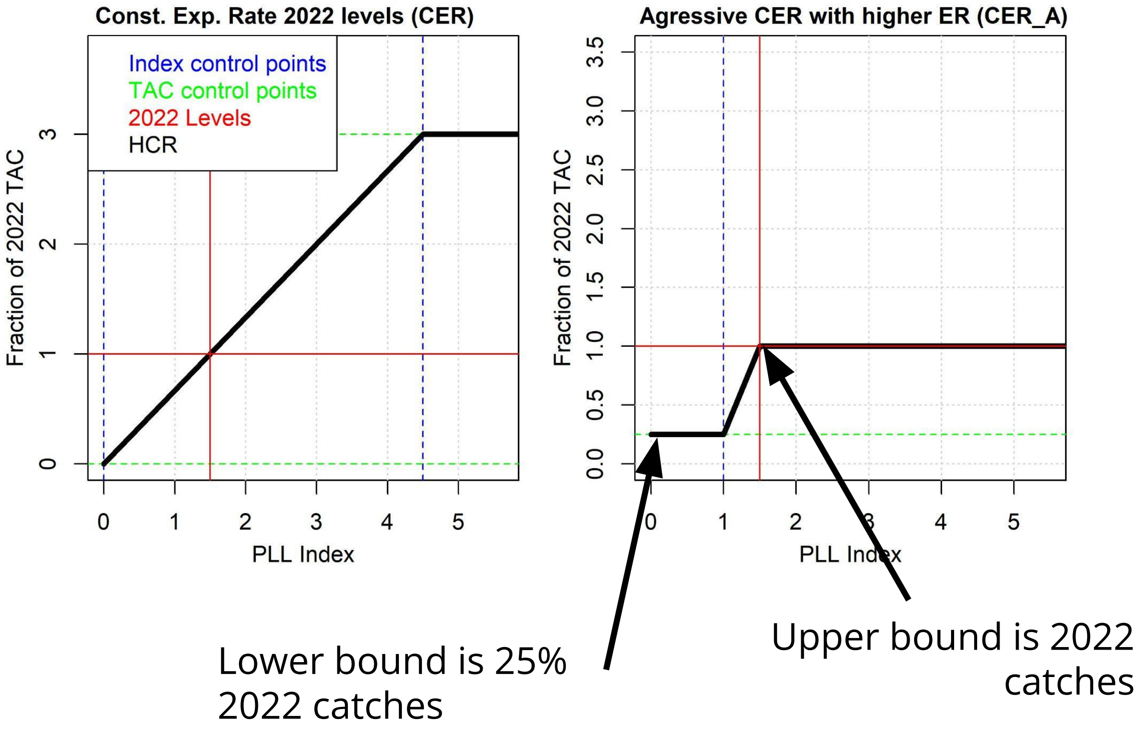
3. Empirical Management Procedures

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

Constant Exploitation rate for US fleets (CER)

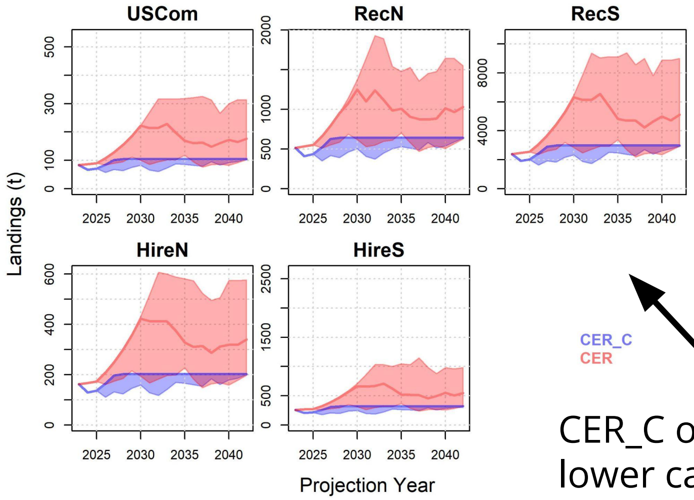
vs

Conservative constant exploitation rate (CER_C) with

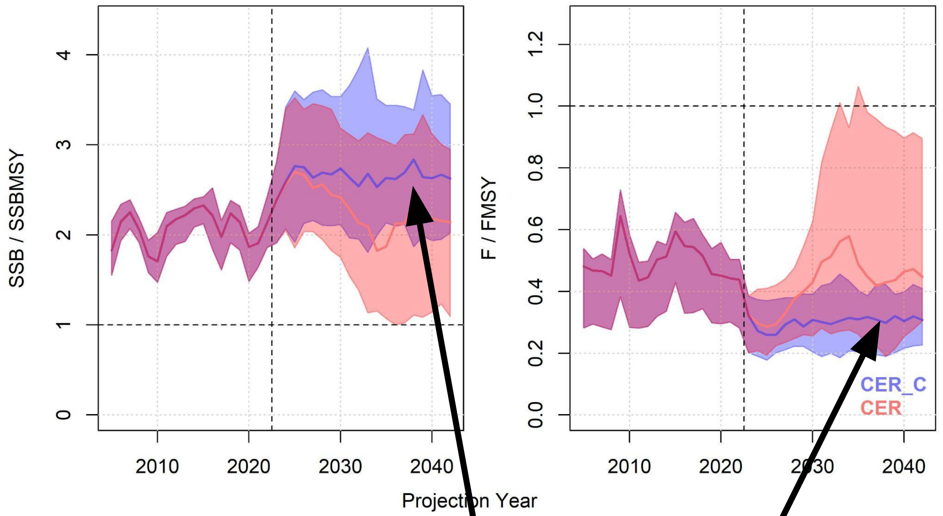


3. Empirical Management Procedures

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

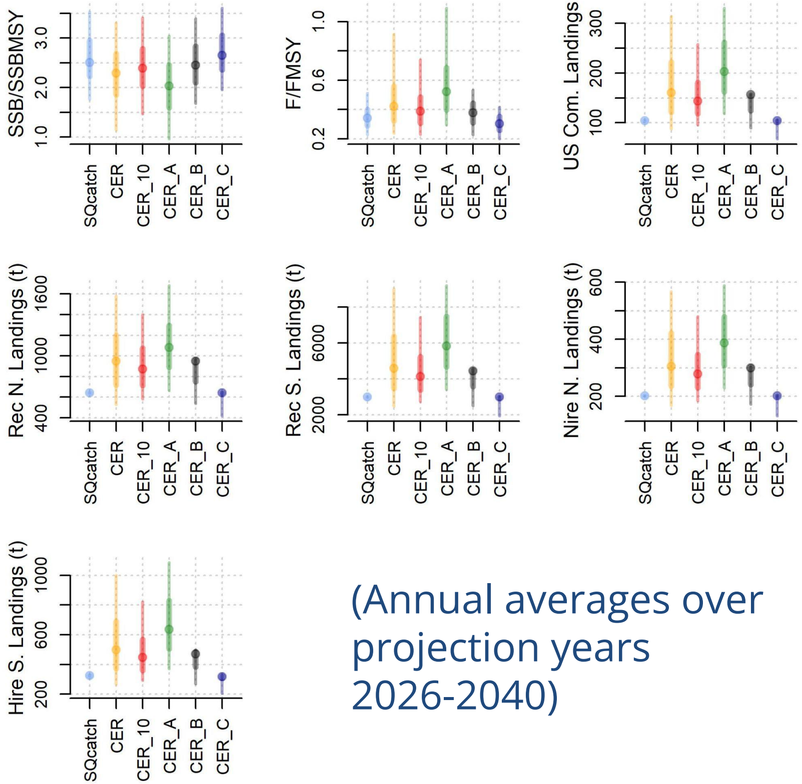


CER_C obtains substantially lower catches.

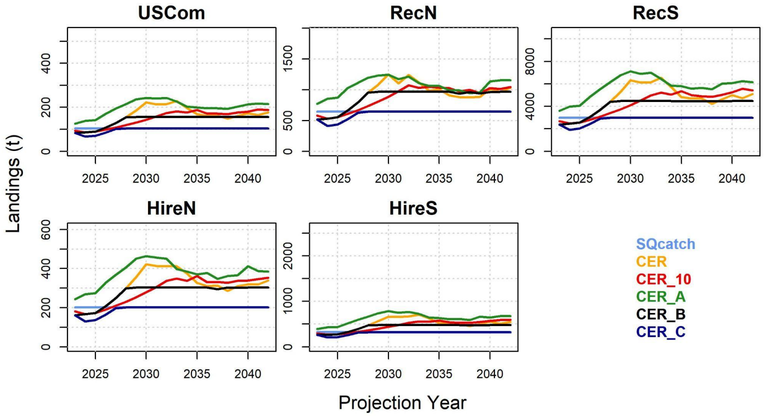


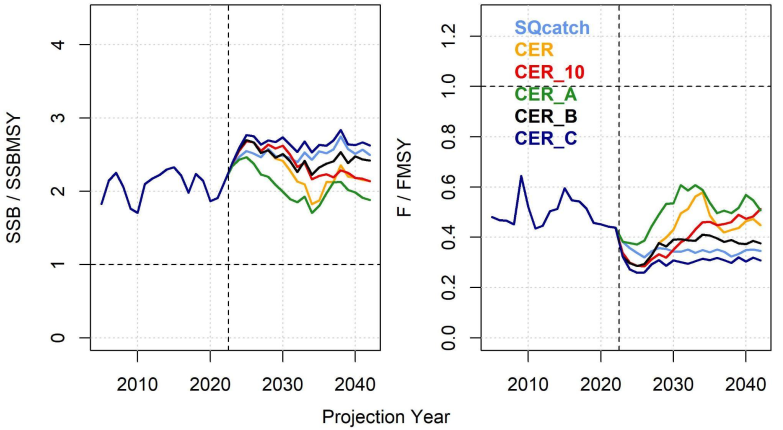
Almost zero risk of overfishing / overfished status from the more conservative CER_C

3. Empirical management procedures: Example summaries



(Annual averages over projection years 2026-2040)

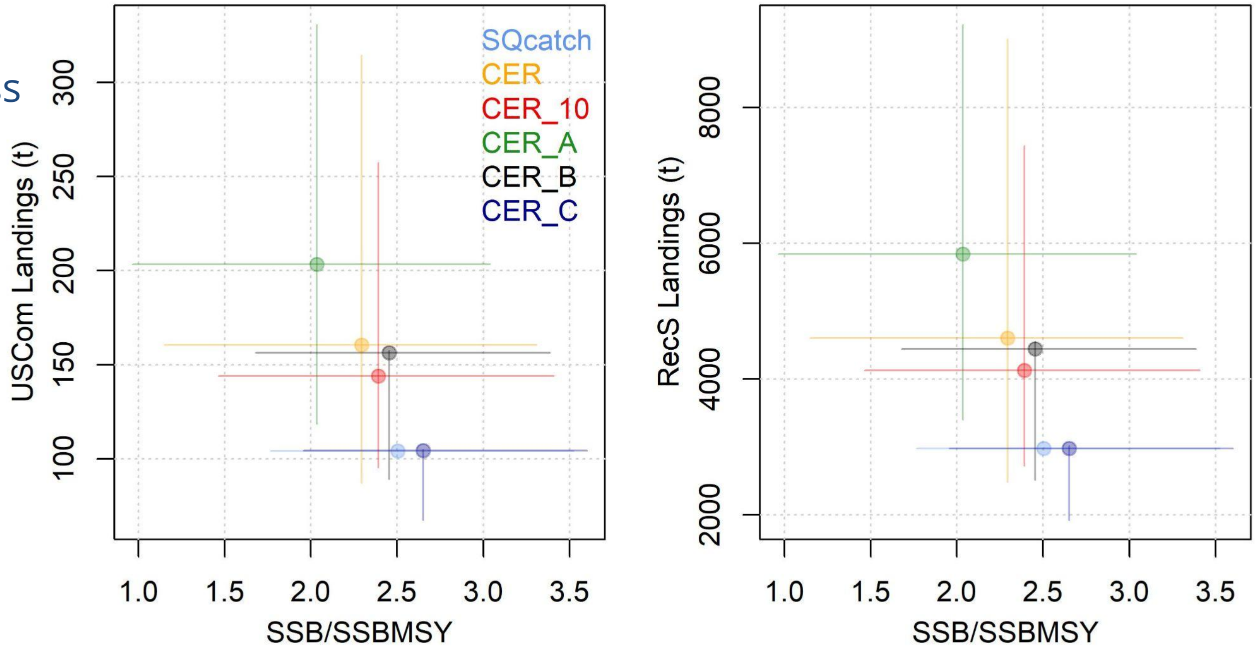




3. Empirical management procedures: Example summaries

(Annual averages over projection years 2026-2040)

Trade-off in expected biomass and landings performance:

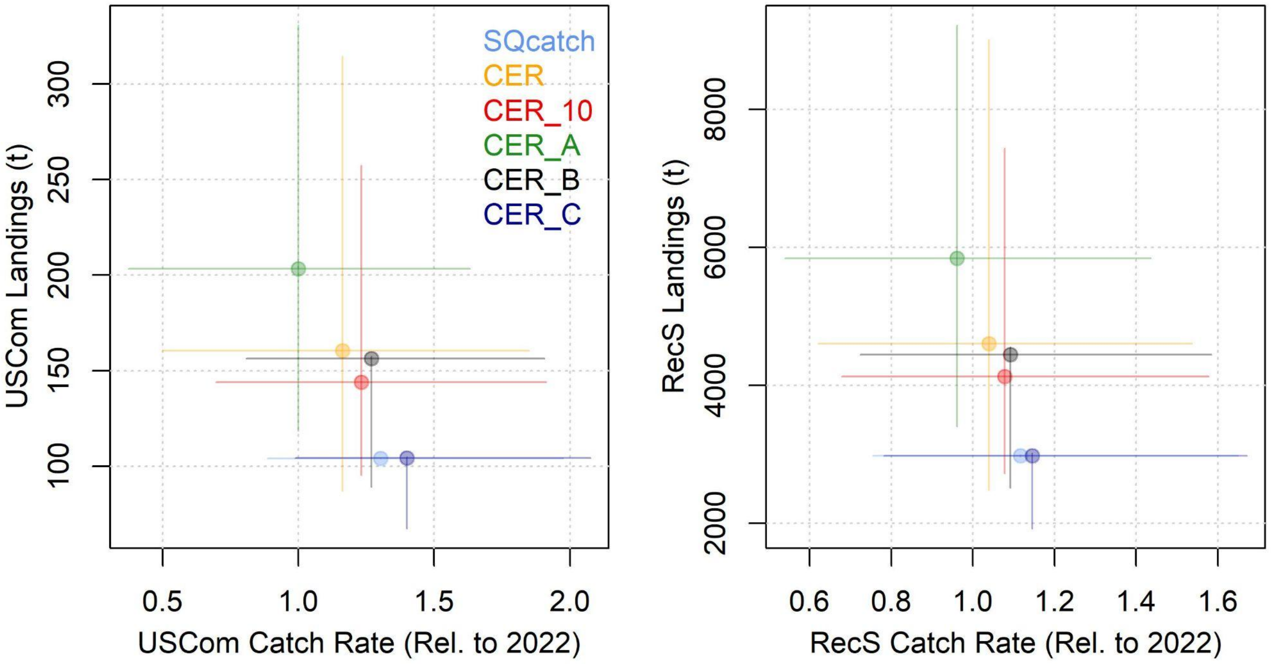


3. Empirical management procedures: Example summaries

(Annual averages over projection years 2026-2040)

Trade-off in expected catch rate and landings performance:

Catch rate is relative to 2022 levels.



3. 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

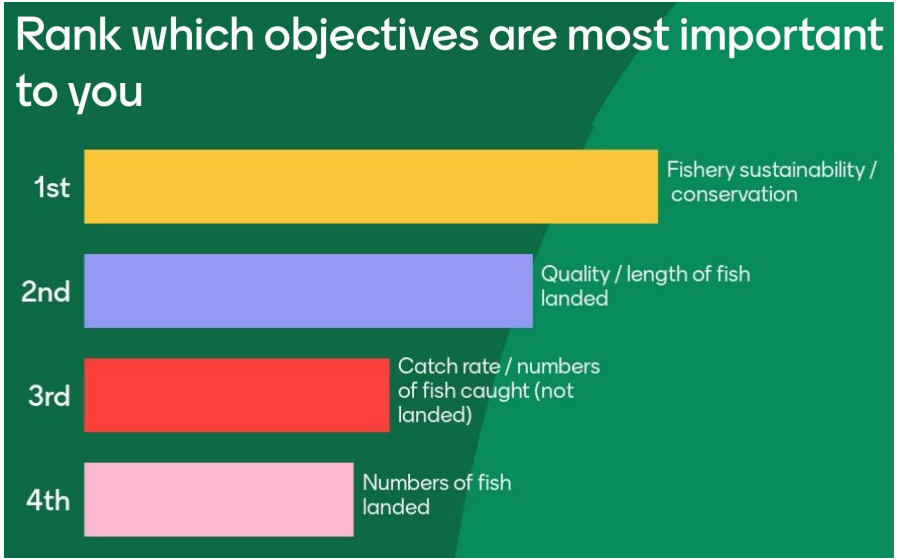
Advise on management procedure design and performance

- Do you agree to explore:
  - adaptive ACL-based management procedure?
  - exploitation-rate based management procedure?
- What management procedure specifications:
  - upper / lower bounds on catches?
  - indicator?
    - Examples herein with Pelagic Longline Logbook index. Others may be considered Puerto Rico tournament CPUE, combined index, etc.?
  - maximum / minimum allowable changes in catch at each management cycle?
- Include static tactical management measures (vessel limits, size limits)?
- Management cycle? (e.g., update ACL every year, 3 years)
- Separate control rules for each sector / region?

4. 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

4. Operationalize Management Objectives

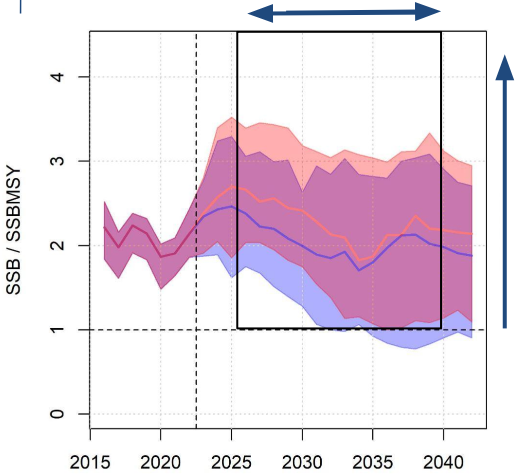
Management objectives

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 SSBMSY from 2026 - 2040

P(B>BMSY)
98%
94%

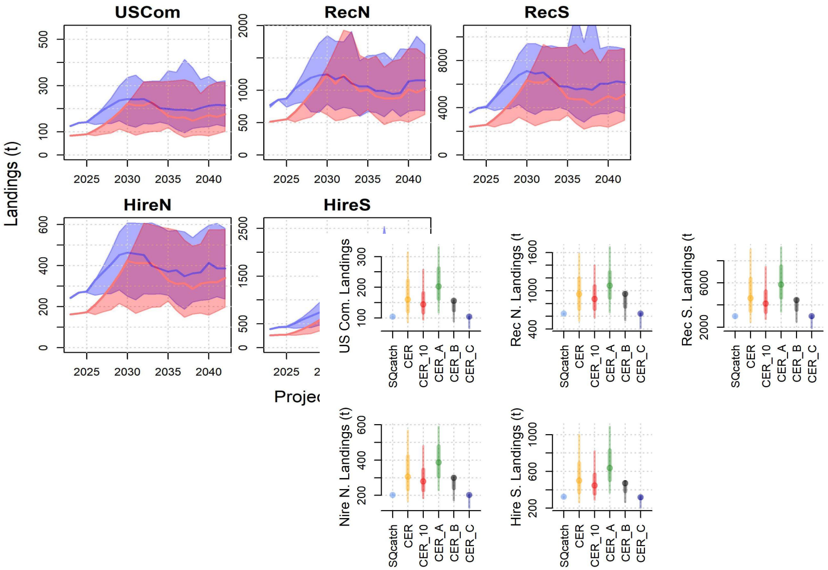
4. Operationalize Management Objectives

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
   - Maximize yield by fleet
3. **Stability**
4. **Catch rate** by fleet and area
5. **Opportunity**
6. **Size** of fish caught by fleet and area

Performance Metrics

$AvgLand_f$ - average annual landings by fleet



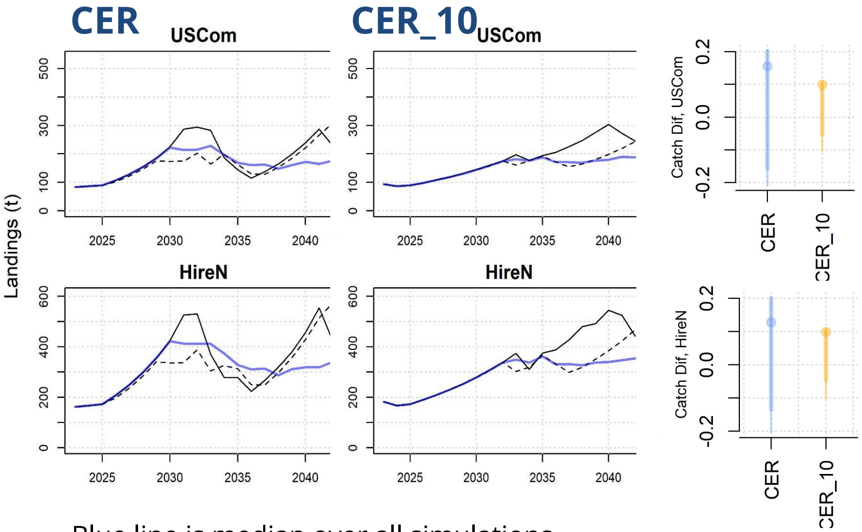
4. Operationalize Management Objectives

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
   - 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

AAVY$_f$- average annual variability in yield by fleet



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

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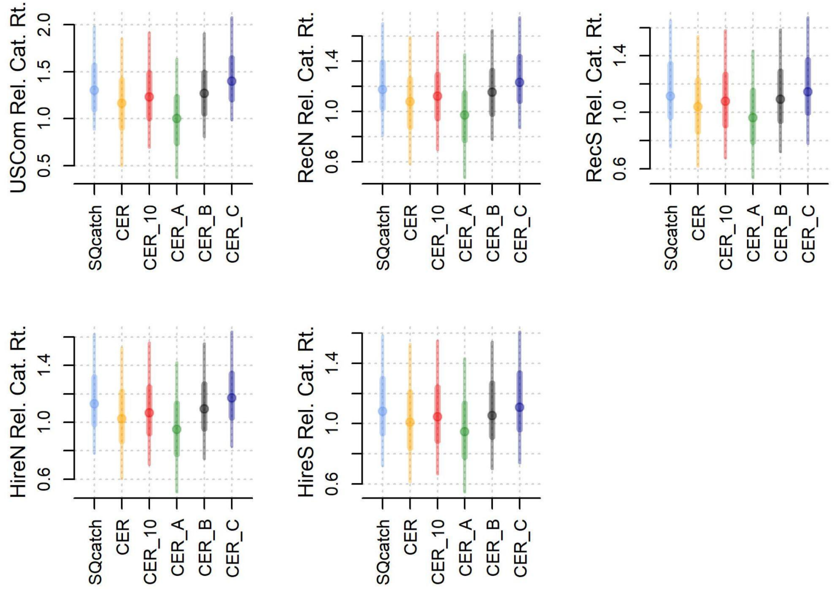
   - Maintain stability in regulations
4. **Catch rate** by fleet and area
   - Maximize catch rate by fleet
5. **Opportunity**
6. **Size** of fish caught by fleet and area

Performance Metrics

relCR$_f$- average catch rate relative to catch rate in 2022 for each fleet



4. Operationalize Management Objectives

Management objectives

1. **Status:**
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     - 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

Performance Metrics

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

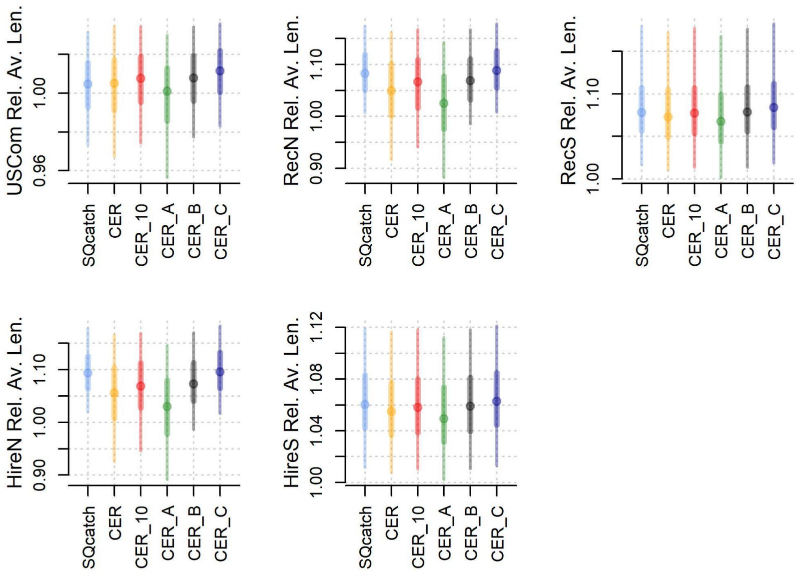
4. Operationalize Management Objectives

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
   - 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
   - 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

- Conceptual management objectives were approved in March 2025.
- 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?

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Blue Matter

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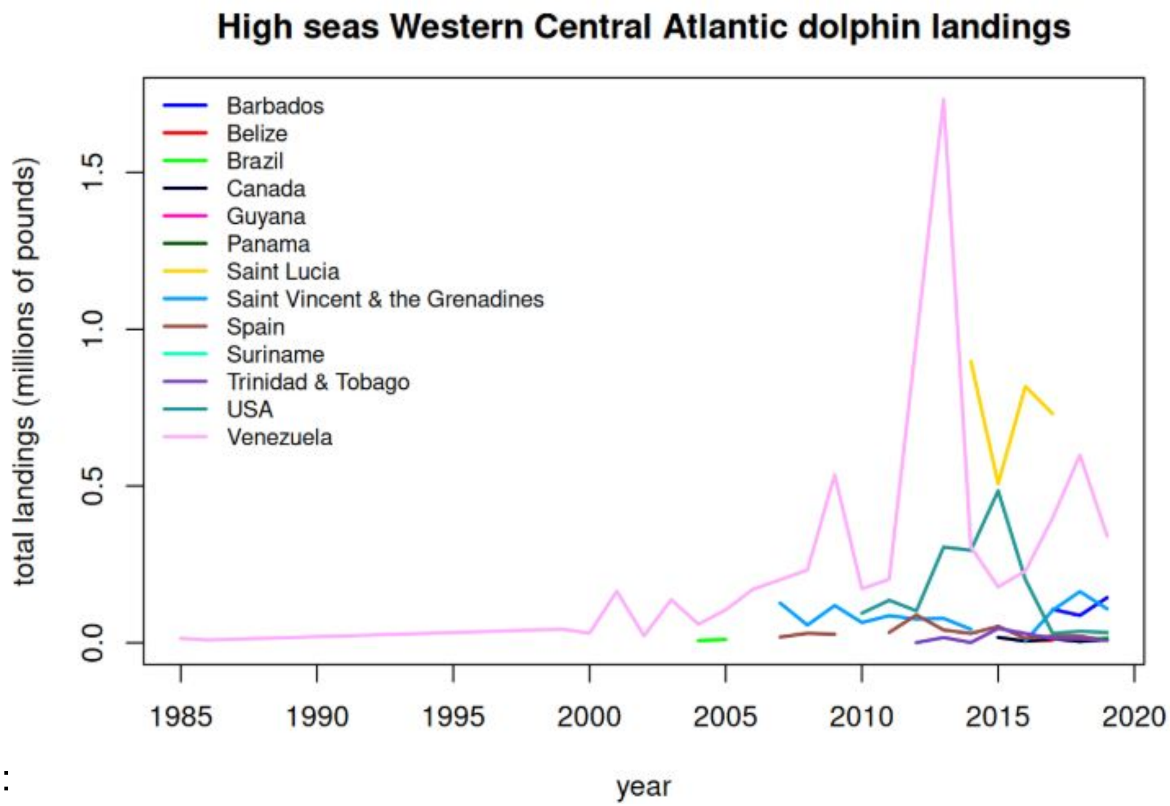
International landings by country



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