Harvest Control Rule Update

Joint Groundfish Plan Team
September 2026

Outline:

- Overview of June Council Action and high level SSC recommendations
- Progress report on CLIM simulation results
- Discussion of HCR7 and paramerization feedback
- Draft performance metrics
- Plans for potential stakeholder meetings for feedback on Council objectives

Risk and Uncertainty in the Groundfish and Crab Harvest Specifications Process and Development of Alternative Harvest Control Rules May 2026[1]

HCR May 2026

Next steps:

- Support for continued HCR work leading to Council discussion on May 2027 beginning with request for JPT presentation on draft results
- Support the objectives provided by staff for purposes of the synthesis and initial review of performance metrics used to determine how alternative HCRs perform compared to status quo.
- Priority on evaluations for pollock and Pacific cod (BSAI and GOA) and Alaska sablefish.
- Develop communication and engagement strategy
- Address SSC recommendations from 2025-2026

High level SSC recommendations

HCR structure/design

- Test a small, targeted subset of HCRs rather than a wholesale overhaul, and evaluate changes stock-by-stock rather than across all stocks at once.
- Compare cap-like HCRs (e.g., HCR-5, HCR-10) against flat-Fmort HCRs (e.g., HCR-1/status quo) and environmentally-varying HCRs (HCR-7).
- Combine HCR-5 and HCR-10 into a single HCR (one parameter for the B40% offset, another for the exponential F decline slope), since the two are redundant in shape/intent.
- Don't limit alternative HCRs to climate indicators alone (as HCR-7 does) — the framework should also flex to TAC trends, biomass trajectories, recruitment signals, risk-table concerns, and socioeconomic factors, since management risk isn't only ecosystem-driven.
- Favor HCRs robust across a range of conditions over rules that switch on/off in response to specific uncertain conditions.

High level SSC recommendations

Climate/environmental scenarios

- Clearly define and communicate the scientific basis for warming scenarios; include most-likely scenarios plus mild-to-extreme bracketing scenarios.
- Timeframes should span both near-term (business/community relevance) and longer-term forecasts.
- Consider group-specific reference points reflecting life-history heterogeneity across species.

Modeling process

- SSC wants to review the experimental design before modeling begins: which models per species, which forcing scenarios, and how environment-biology links are modeled.
- Clearly identify which modeling platforms are used and flag where approaches diverge substantively (e.g., GOA Pacific cod trends under high-warming vs. other scenarios).
- Timetable should allow both Plan Team and SSC review of initial and final analyses.

Performance metrics & communication

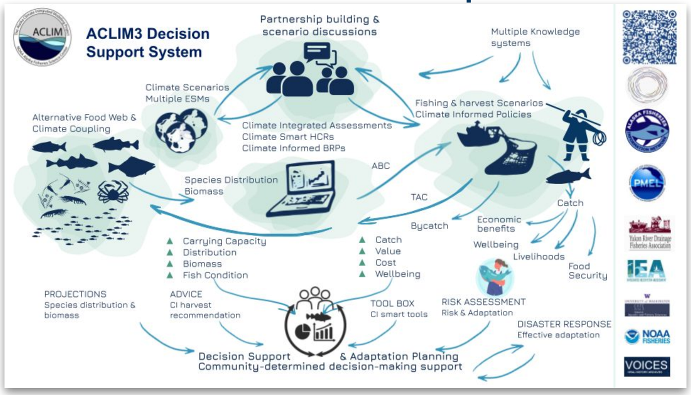
- Keep public/Council-facing metrics few and targeted to highlight key tradeoffs.
- Add economic metrics (catch stability, total value over time) alongside total catch.
- Explore adding social indicators, with attention to how to communicate them for decision-making.
- Develop a communication plan for non-technical audiences.

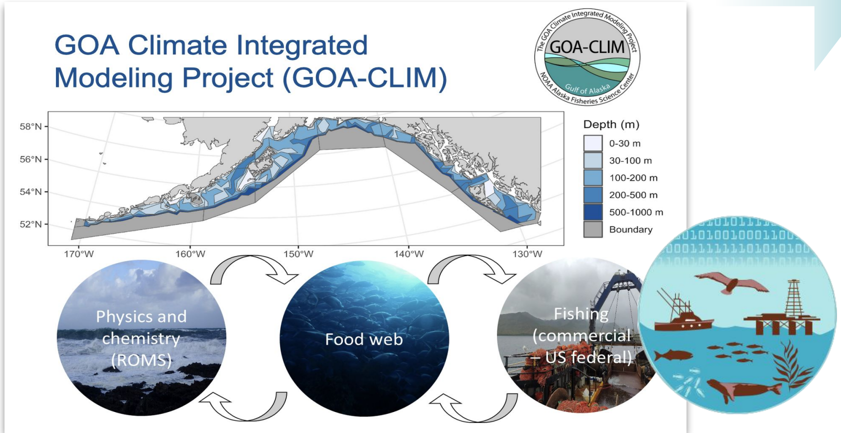
Objectives (to be further refined as alternatives developed) :

- Prevent overfishing
- Transitioning from the use of risk tables under the status quo system to an explicit analytical approach for species whose productivity is known to vary with environmental conditions
- Increased buffering against environmental shocks
- Socio-economic stability
- Community level objectives (to be defined)
- Transparency in the ABC setting process

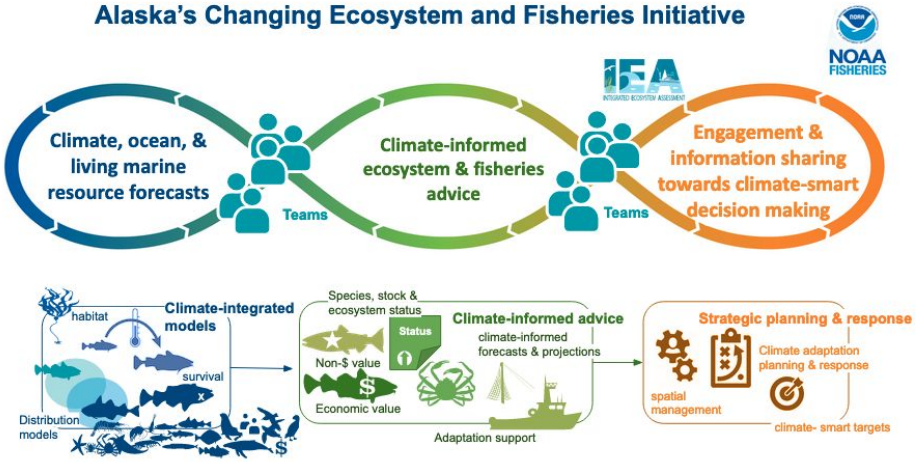
Operationalizing decision support tools and systems

Research & development





Long-term operational support



Climate & Ecological (CE) forecasts
CE assessment & foodweb models
CE informed SDMs
CE informed EBM advice
Robust alternative HCRs & CAPs
CE planning support & scenarios

CEFI: High Res. Oceanographic model (MOM6)

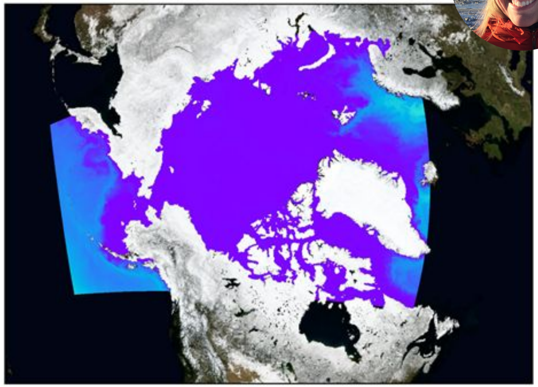
High resolution output:

- Hindcasts *Avail now*
- Forecasts *Fall/winter 2026*
- Decadal predictions
- 100 yr Projections

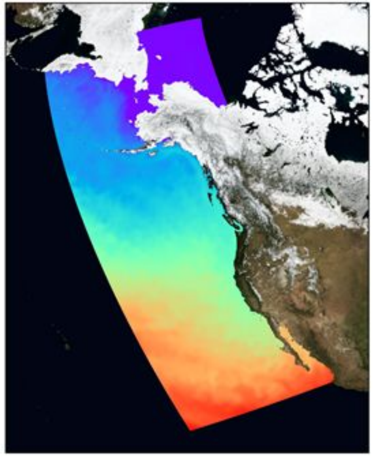
2027

(e.g., sea ice, water temp, pH, winds, currents, zooplankton)

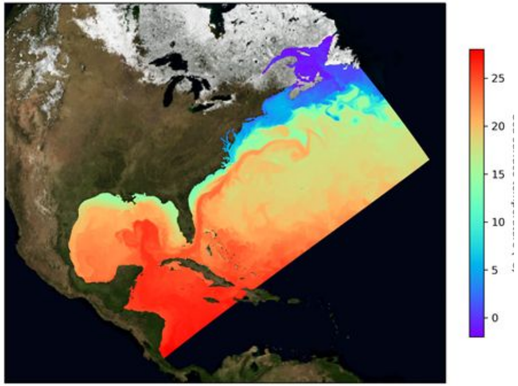
Arctic



Pacific



Atlantic



More info?

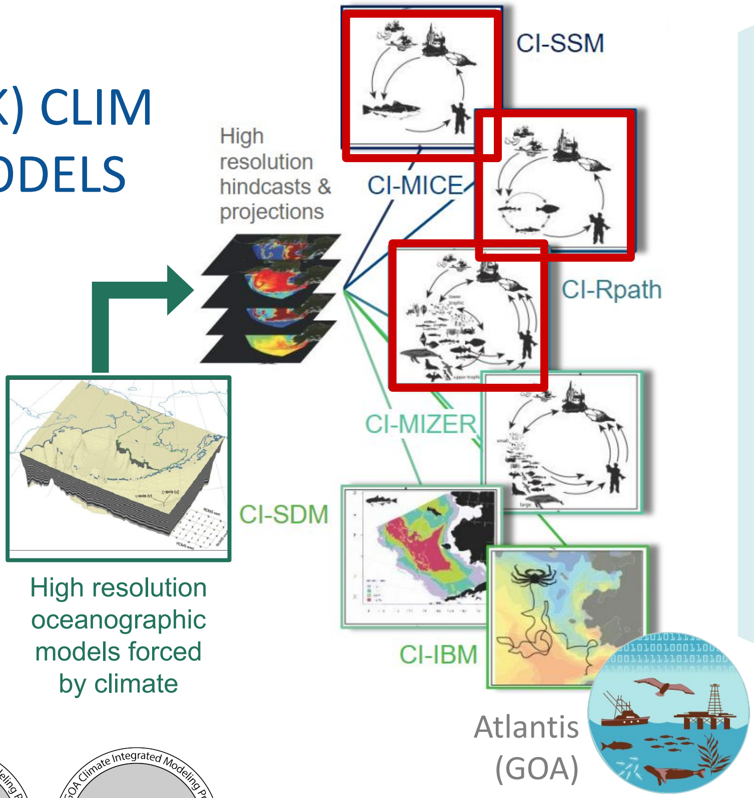
- **AK MOM6:** K. Kearny, W. Cheng, D. Pilcher
- **AK CEFI:** K. Holsman

NOAA's Changing Ecosystems and Fisheries Initiative (CEFI)

https://psl.noaa.gov/cefi_portal

Multimodal inference

(AK) CLIM MODELS



Quantify uncertainty & confidence

Climate change & oceanography

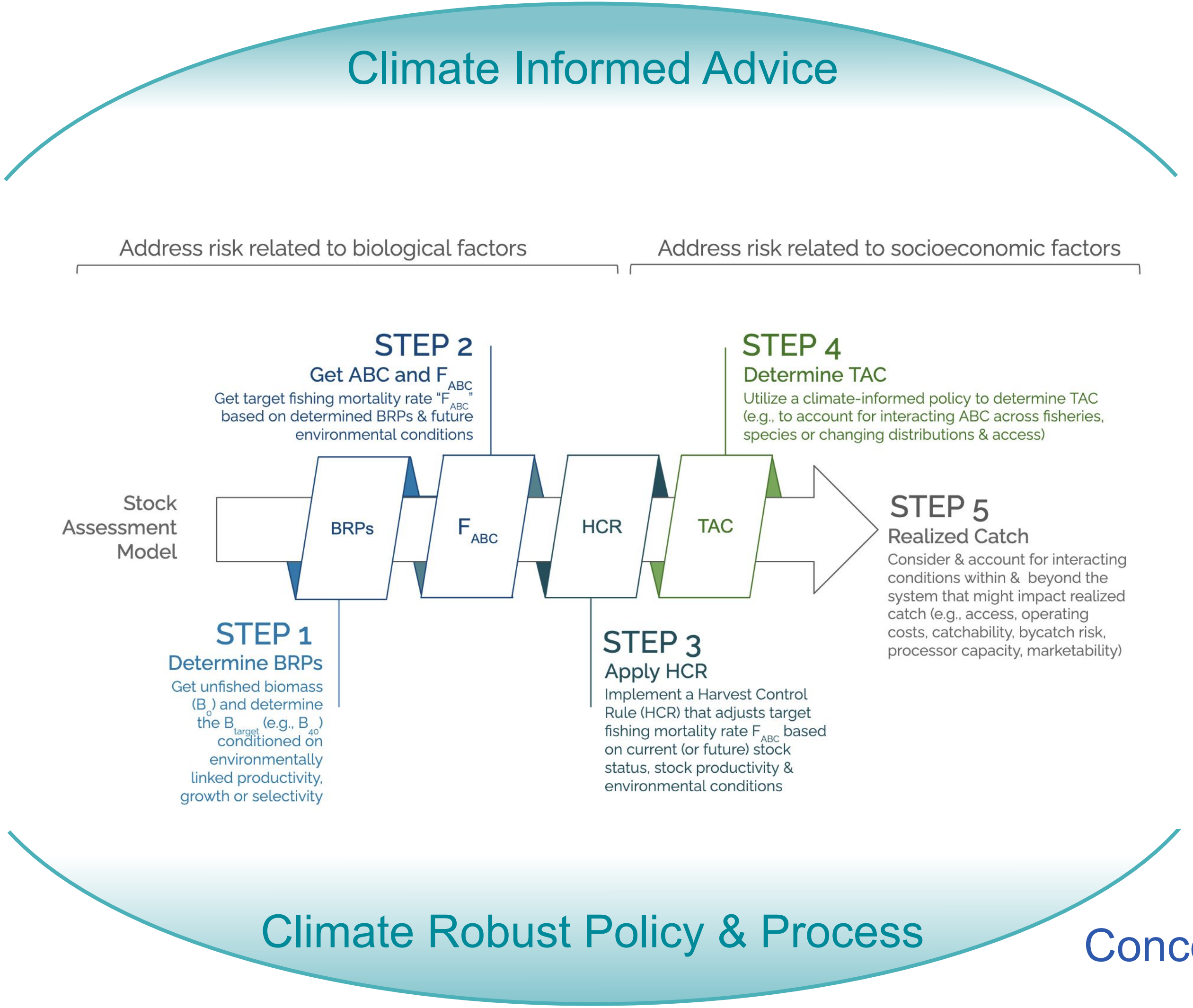
Climate impacts on growth, survival & biomass

Changes to stock distributions (& fishing grounds)

Climate impacts ecosystems & food webs

Climate Informed EBM advice

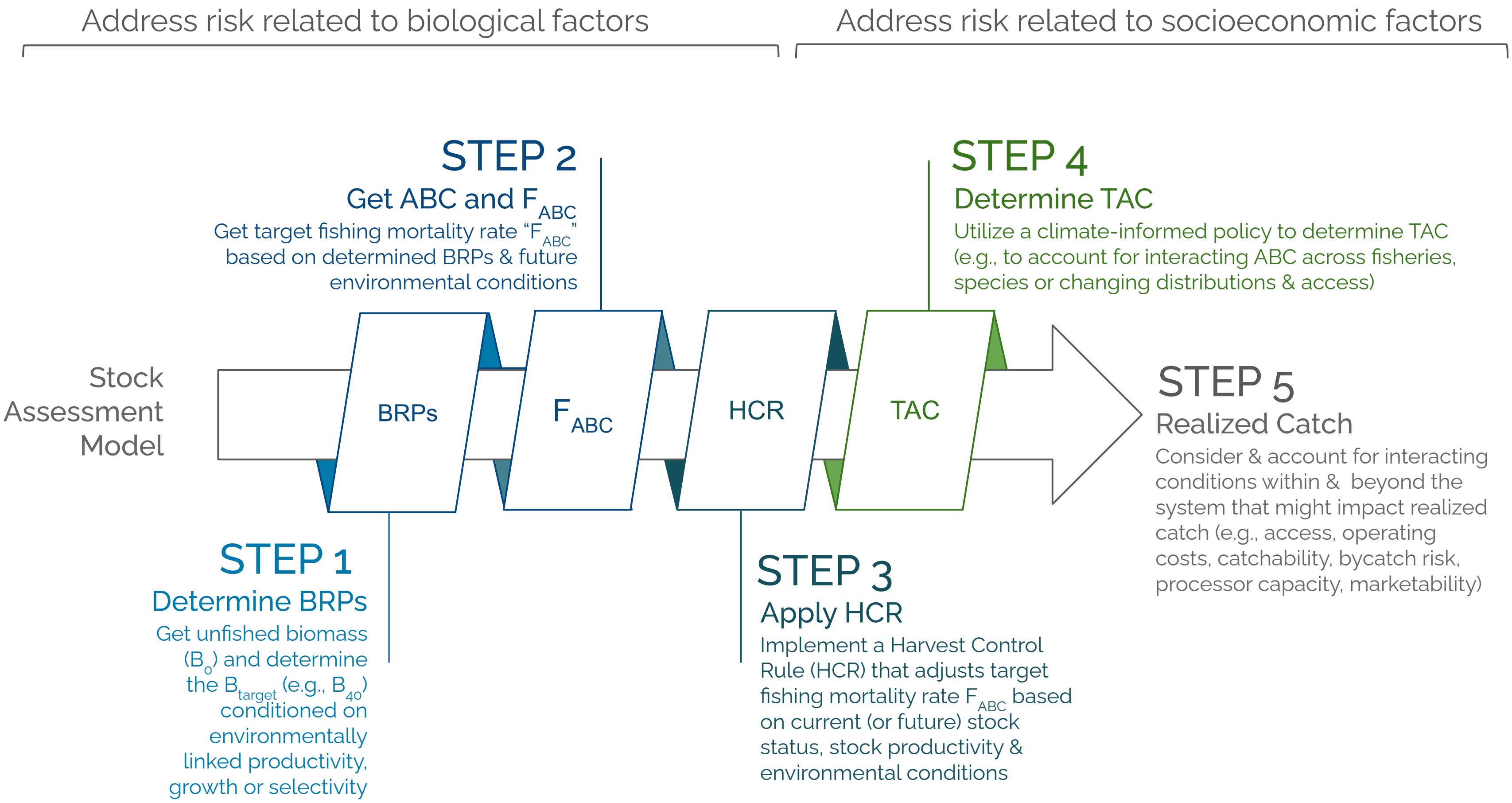
Climate workplan provides the roadmap

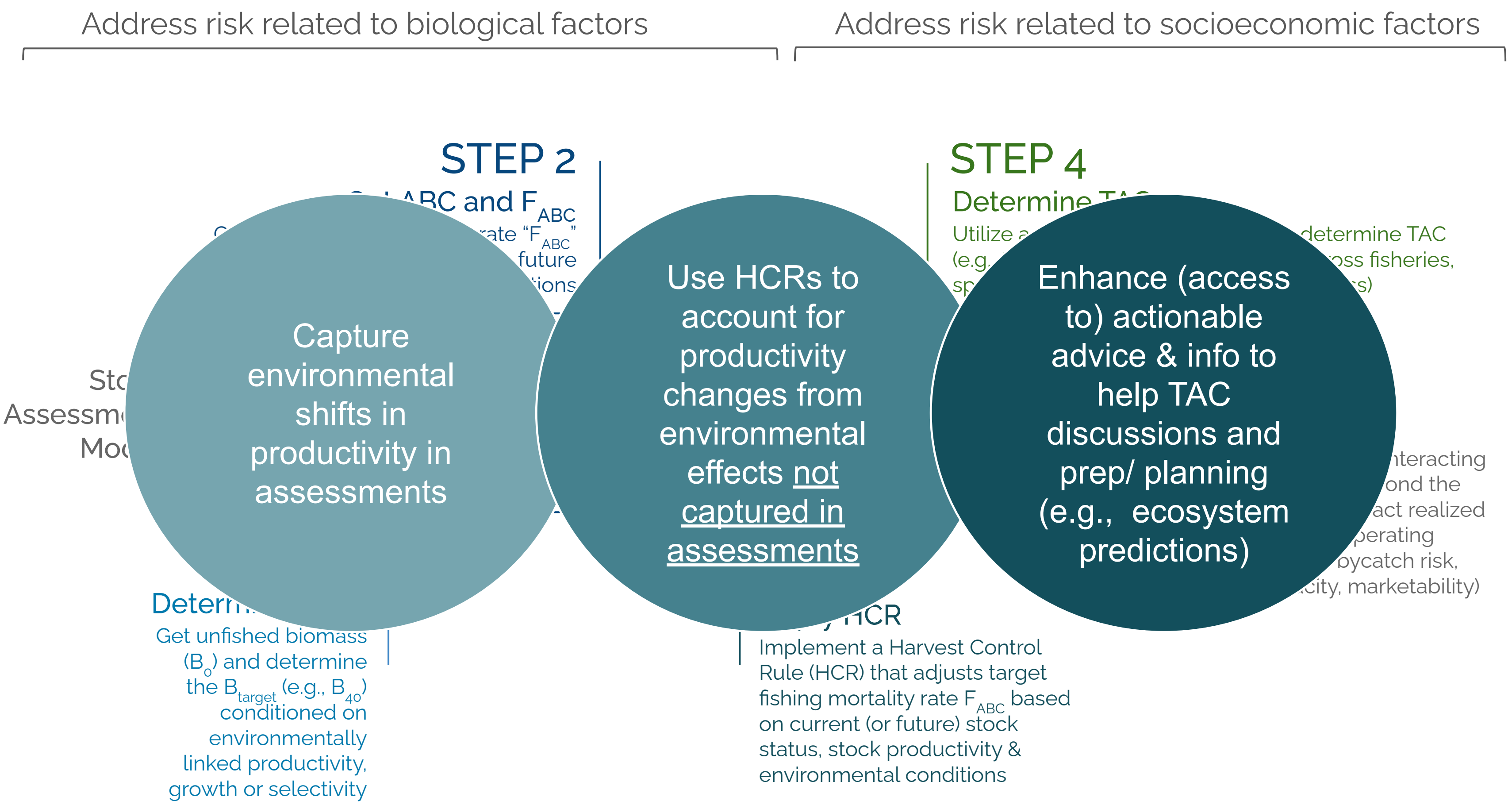


ACLIM GOA-CLIM

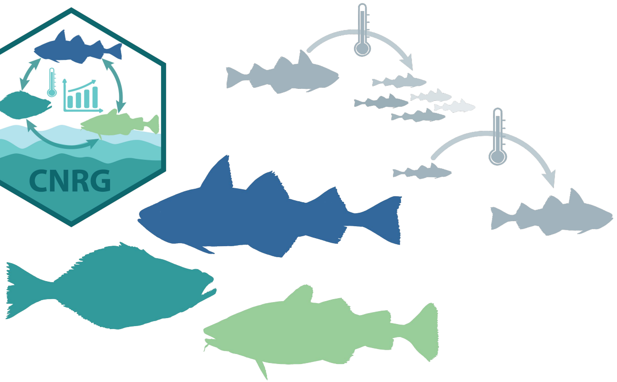
Hoslman et al. in prep

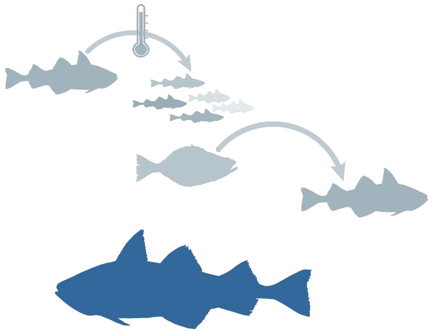
Conceptual Model


Address risk related to biological factors
Address risk related to socioeconomic factors
Stock Assessment Model
BRPs
F_{ABC}
HCR
TAC
STEP 1
Determine BRPs
Get unfished biomass (B_0) and determine the B_{target} (e.g., B_{40}) conditioned on environmentally linked productivity, growth or selectivity
STEP 2
Get ABC and F_{ABC}
Get target fishing mortality rate "F_{ABC}" based on determined BRPs & future environmental conditions
STEP 3
Apply HCR
Implement a Harvest Control Rule (HCR) that adjusts target fishing mortality rate F_{ABC} based on current (or future) stock status, stock productivity & environmental conditions
STEP 4
Determine TAC
Utilize a climate-informed policy to determine TAC (e.g., to account for interacting ABC across fisheries, species or changing distributions & access)
STEP 5
Realized Catch
Consider & account for interacting conditions within & beyond the system that might impact realized catch (e.g., access, operating costs, catchability, bycatch risk, processor capacity, marketability)


Address risk related to biological factors
Address risk related to socioeconomic factors
STEP 2
STEP 4
Capture environmental shifts in productivity in assessments
Use HCRs to account for productivity changes from environmental effects not captured in assessments
Enhance (access to) actionable advice & info to help TAC discussions and prep/ planning (e.g., ecosystem predictions)
Get unfished biomass (B_0) and determine the B_{target} (e.g., B_{40}) conditioned on environmentally linked productivity, growth or selectivity
Implement a Harvest Control Rule (HCR) that adjusts target fishing mortality rate F_{ABC} based on current (or future) stock status, stock productivity & environmental conditions

ACLIM Sneak Peak (*draft results, do not copy*)





SNEAK PEEK, not final results!

Multispecies Assessment model

- Age structured s
- 3 EBS stocks, P
  arrowtooth
- ROMSNPZ forces phytoplankton. & zooplankton
- BT drives predator energetics and vonB growth (projections)
- Rec ~f(ROMSNPZ indices)

Holsman et al. in prep
Holsman et al. 2024,2020,2016

EBS Food web model

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Whitehouse et al. in prep
Whitehouse et al. 2021

Env. enhanced Pollock model

- tock assessment
- lock
- multi-sub areas where predator (ATF) biomass drives M
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Spencer et al. in prep
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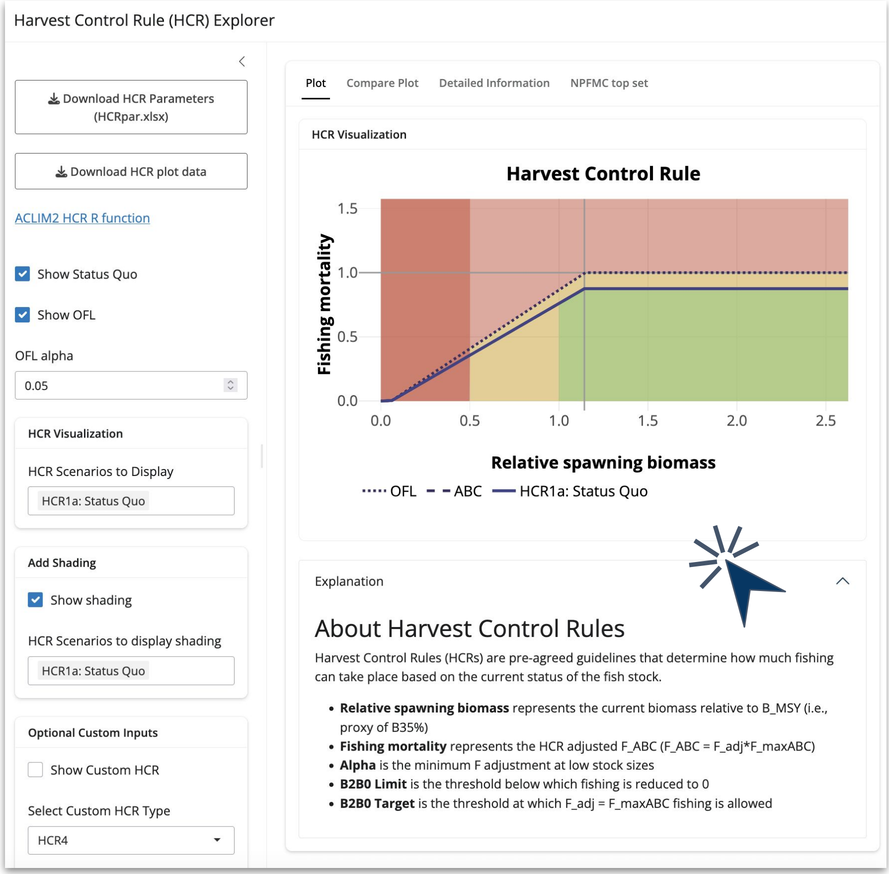
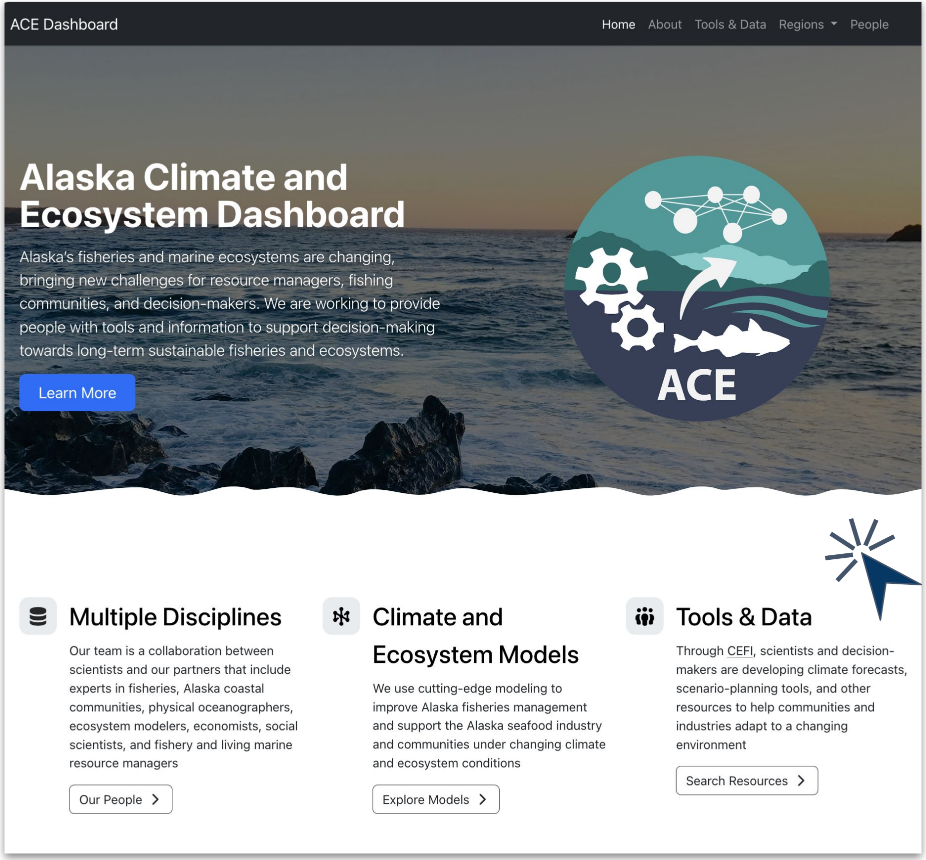
Want more info?



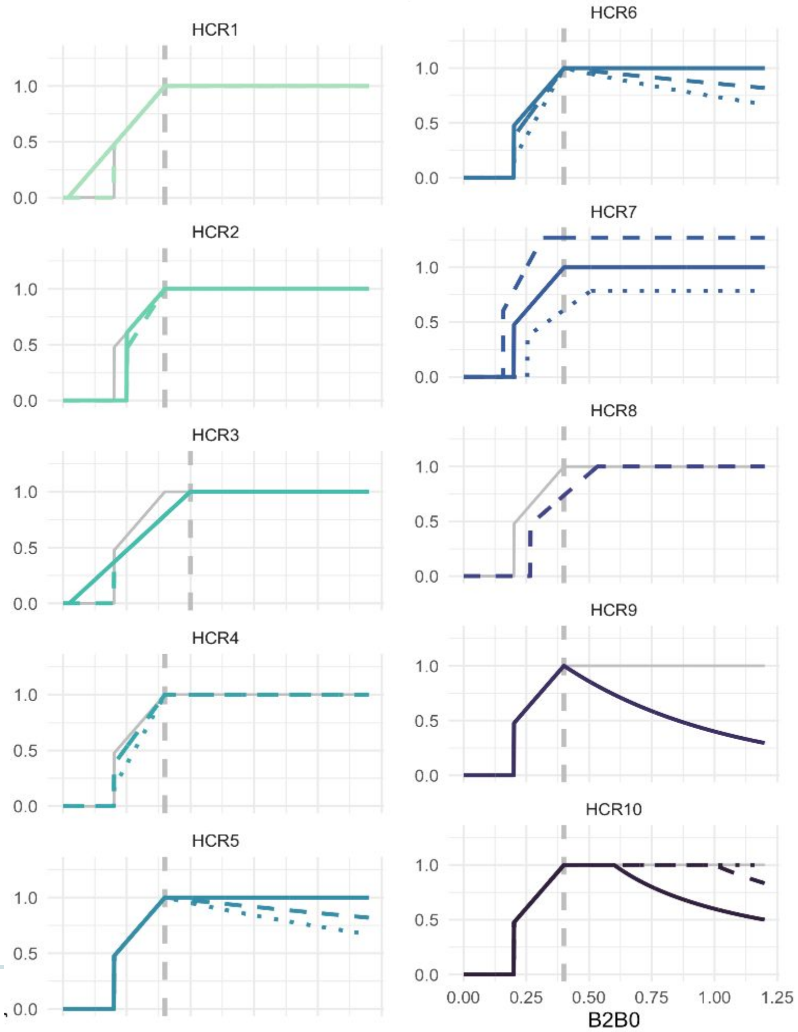


kholsman.shinyapps.io/HCRshiny

ace.psmfc.org

HCR Scenarios

HCR	Name
ABC+HCR 1	Status quo
ABC+HCR 2	Lagged recovery to estimate emergency relief financing needs
ABC+HCR 3	Long-term resilience (stronger reserve) B_target
ABC+HCR 4	Environmental index informed sloping rate, e.g., MHW category alpha
ABC+HCR 5	Maximize productivity/ increased reserve (buffer shocks)
ABC+HCR 6	Combination of MHW (HCR4) + Maximize productivity (HCR5)
ABC+HCR 7	Risk Table Bridging, R/S variability covariate adjusted HCR
ABC+HCR 8	Adjust effective spawning biomass (simulate adjusted B_target)
ABC+HCR 9	Forecast informed version of HCR 5
ABC+HCR 10	Maximize productivity/increased reserve (HCR5), linear version (1/ B_target) with offset



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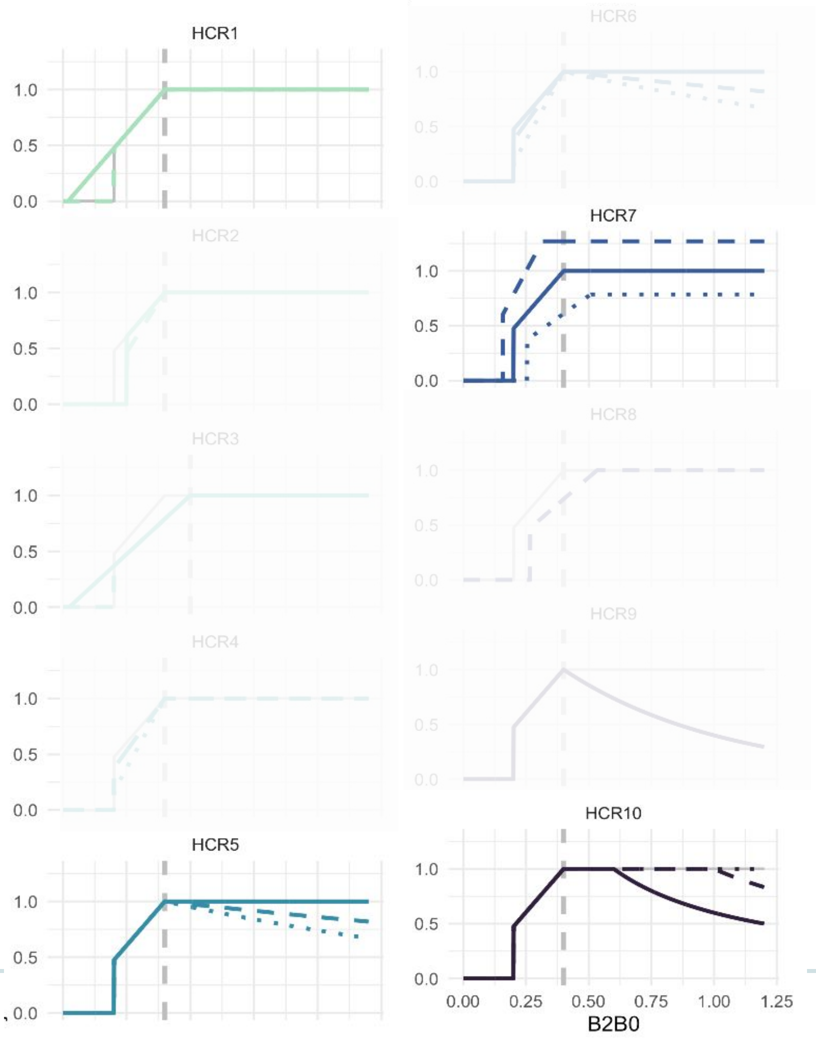
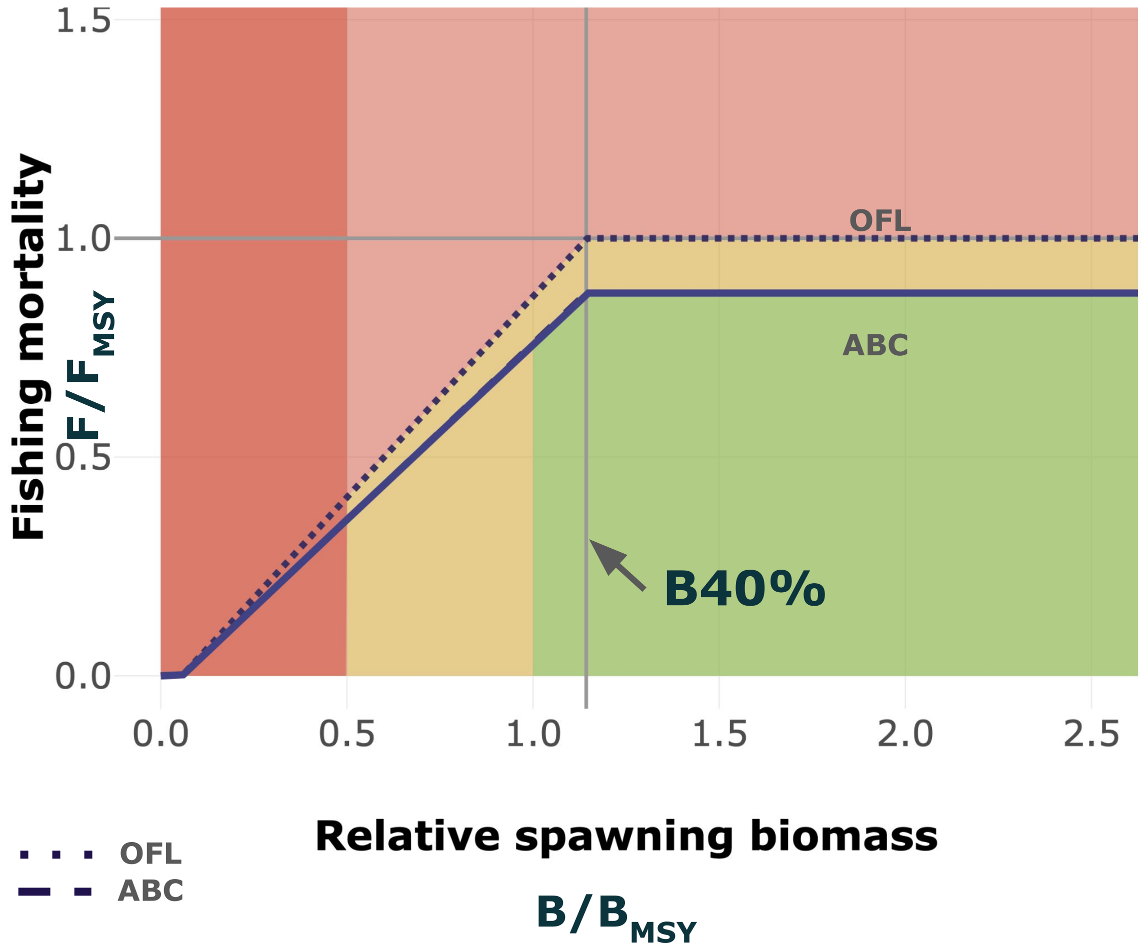


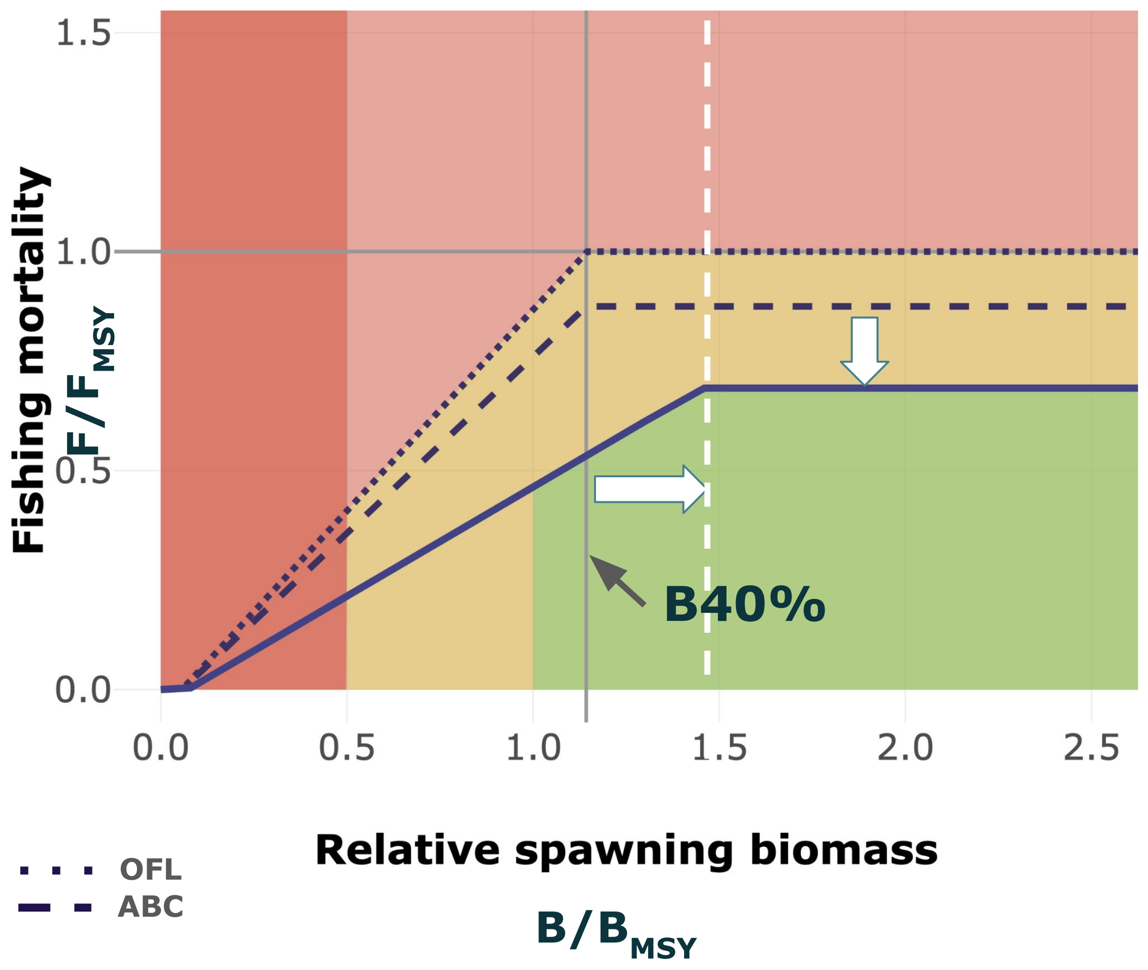


HCR 1

Status Quo Tier 3 OFL and ABC HCR

Automatic rebuilding below $B_{40\%}$

Alternative HCRs

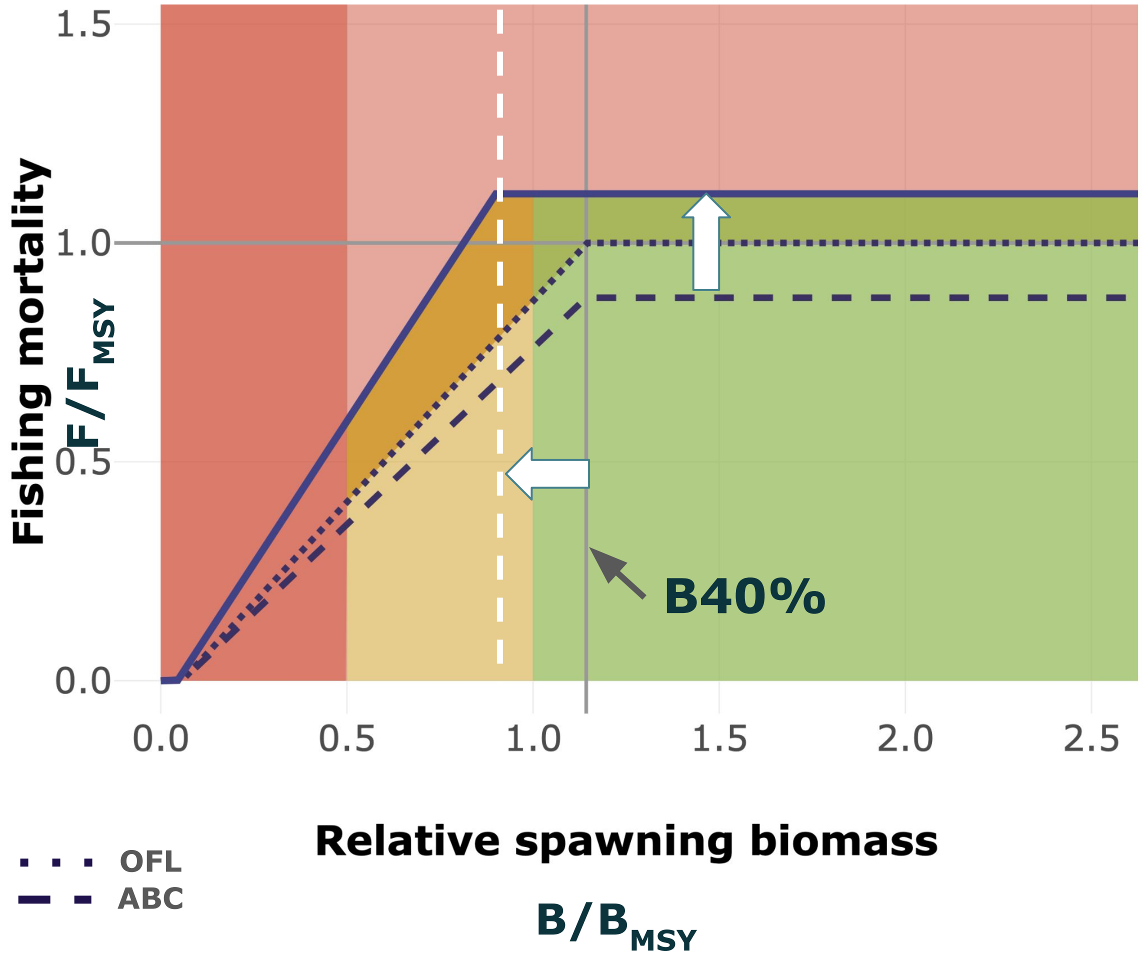


HCR 7

Analytical approach for variability based on species whose productivity is known to vary with environmental conditions.

Example shows a negative correlation in productivity with expected environmental conditions

Alternative HCRs



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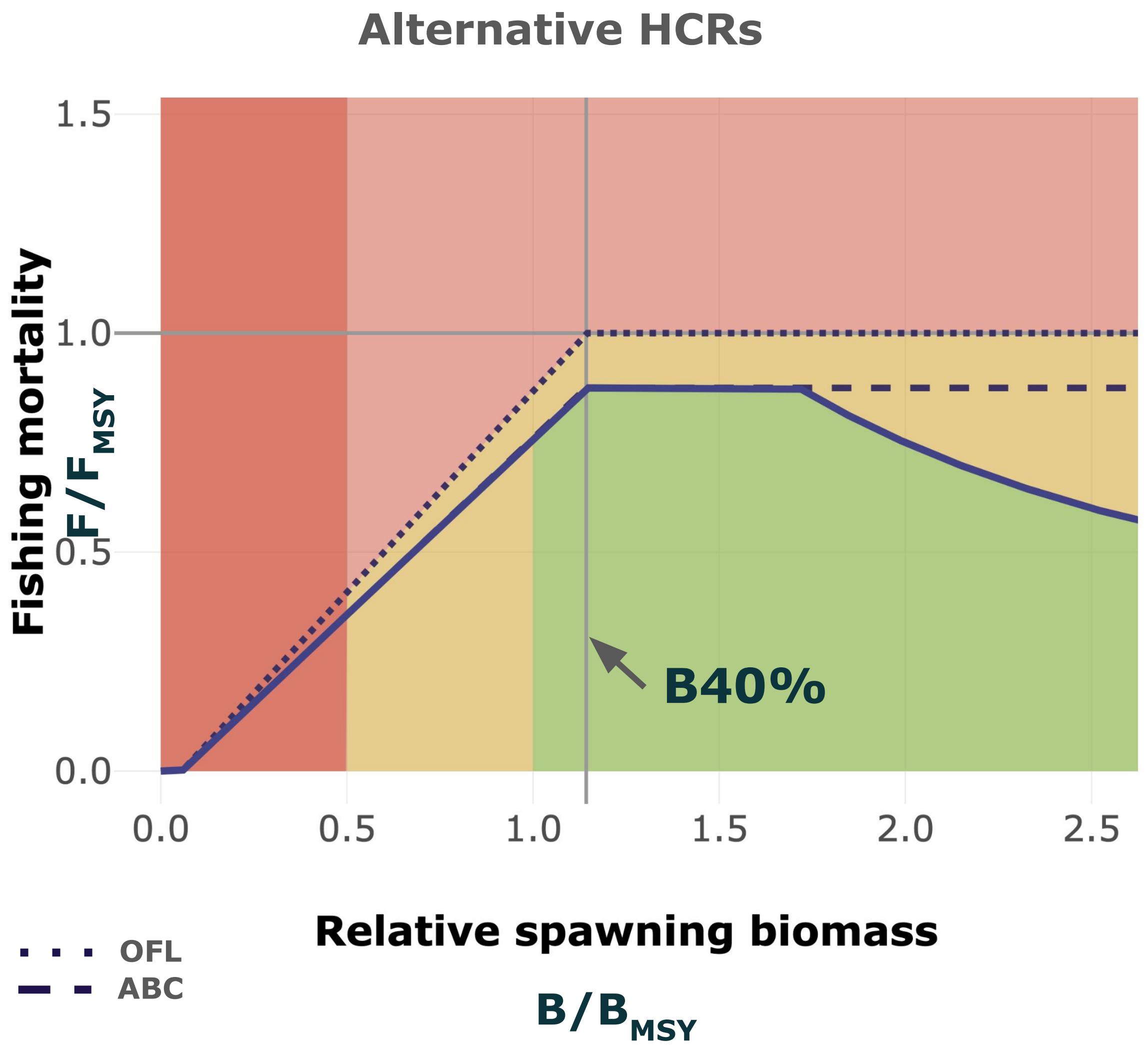


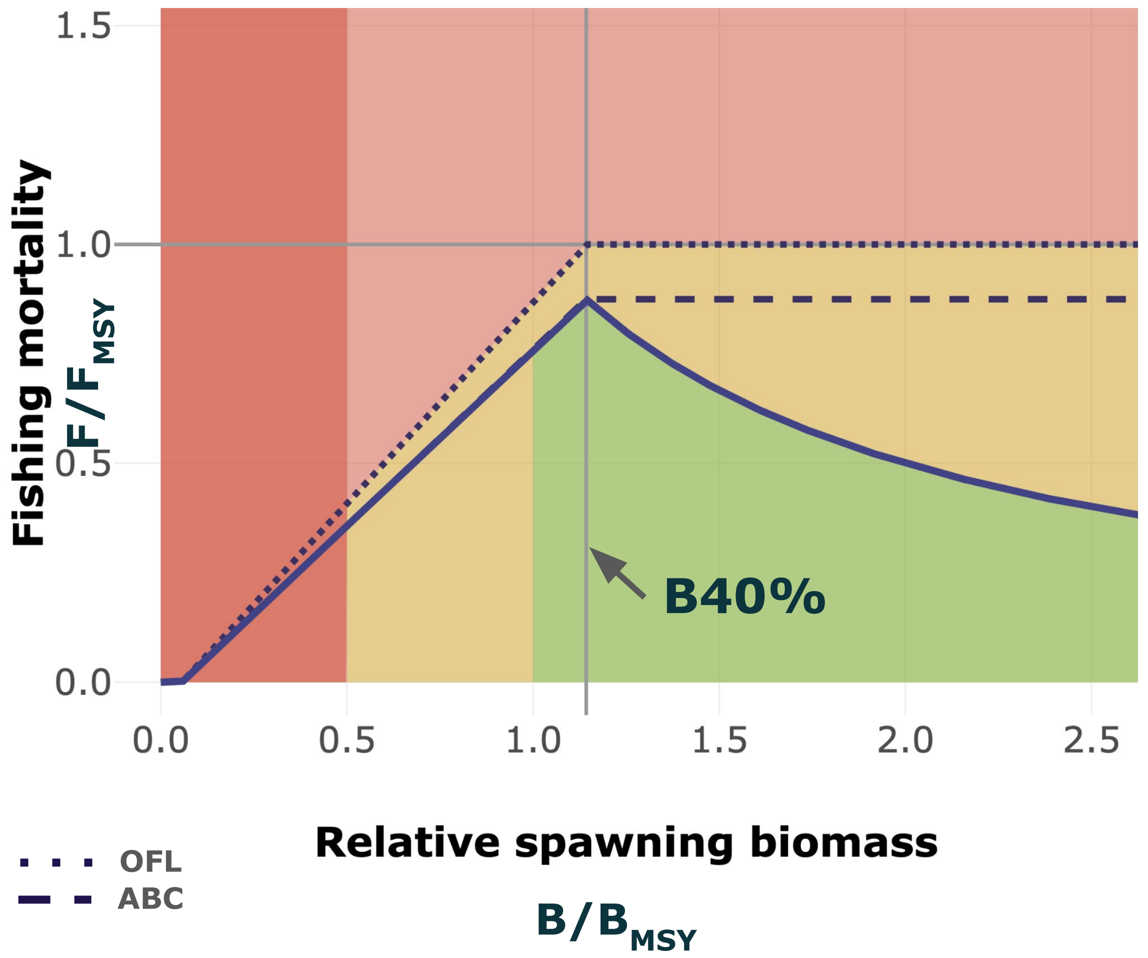
HCR 10

Buffer against environmental shocks with biomass reserve at high stock sizes

Similar to realized F for EBS pollock (2MT cap effect).

Example shows offset with catch capped at Catch corresponding to Catch at B60%.

Alternative HCRs

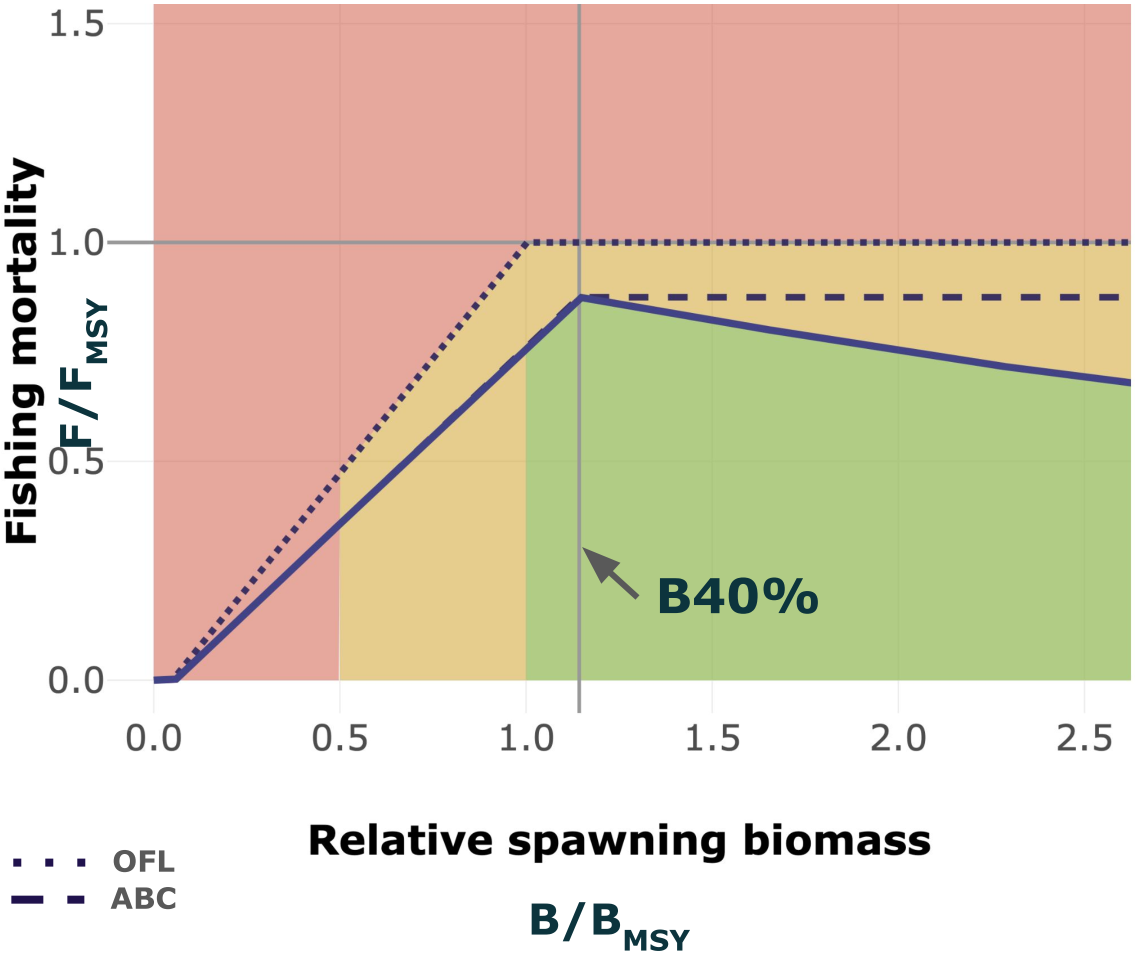


HCR 10

Buffer against environmental shocks with biomass reserve at high stock sizes.

Example shows catch capped at Catch corresponding to Catch at B40% (resulting exponential slope in F).

Alternative HCRs



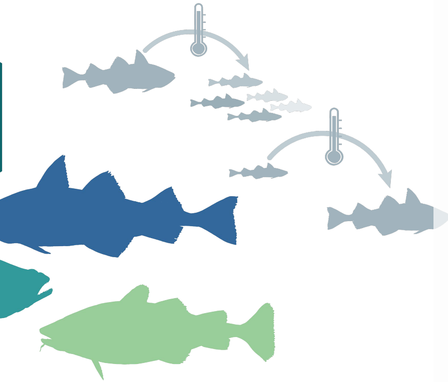
HCR 5

Buffer against environmental shocks with biomass reserve at high stock sizes.

Catch increases at a slower rate above B40% than below.

Example shows a biomass reserve for a species sensitive to env. variability, e.g., Pacific cod

ACLIM Sneak Peak (*draft results, do not copy*)



Multispecies Assessment model

- Age structured stock assessment
- 3 EBS stocks, Pollock, P. cod, arrowtooth
- ROMSNPZ forces phytoplankton. & zooplankton
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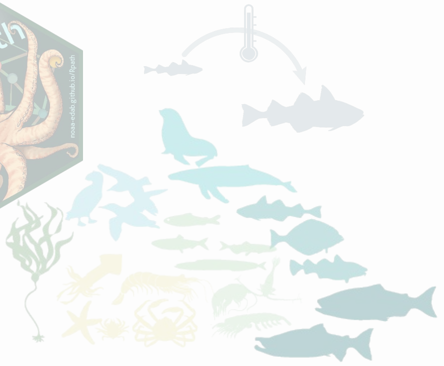

EBS Food web model

- 76 biological groups
- All 20 federally managed EBS stocks + protected species
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Env. enhanced Pollock model

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- 1 EBSstock: Pollock
- multi-sub areas where predator (ATF) biomass drives M
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Holsman et al. in prep
Holsman et al. 2024,2020,2016

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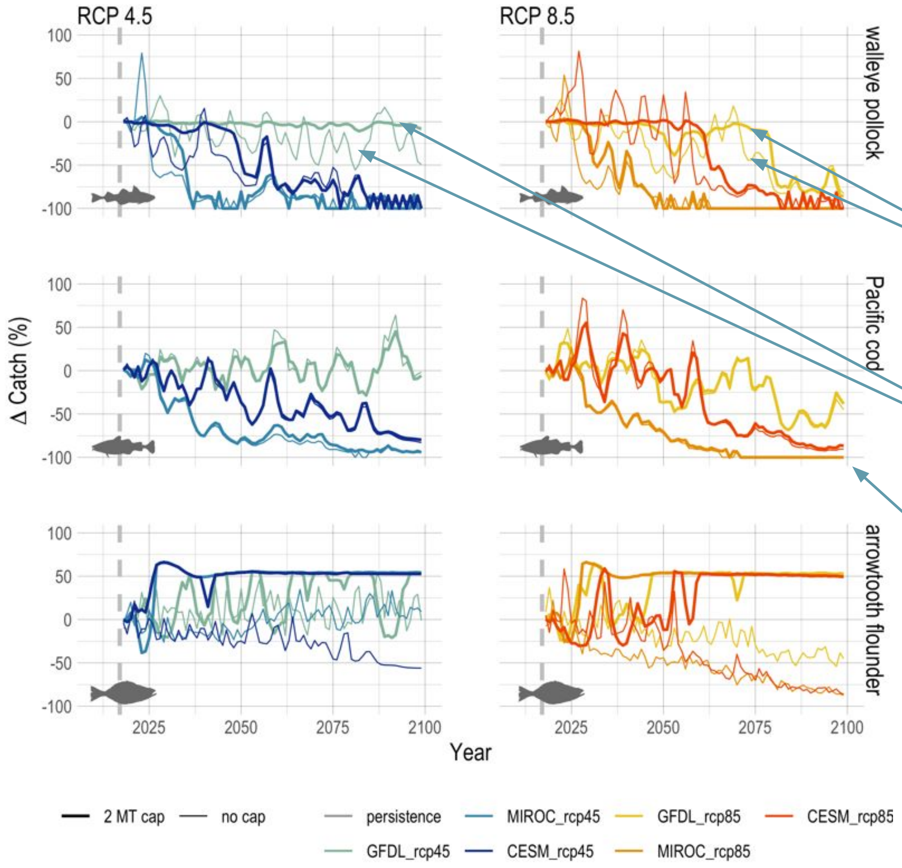
CEATTLE: EBFM vs non-EBFM cap

Assumes climate effects on recruitment, growth, & mortality;
Assumes no adaptation of fish or fisheries

moderate warming **high warming**



HCR 1 (status Quo) + ABC→Catch model (ATTACH)

EBFM = lower risk of declines & collapse

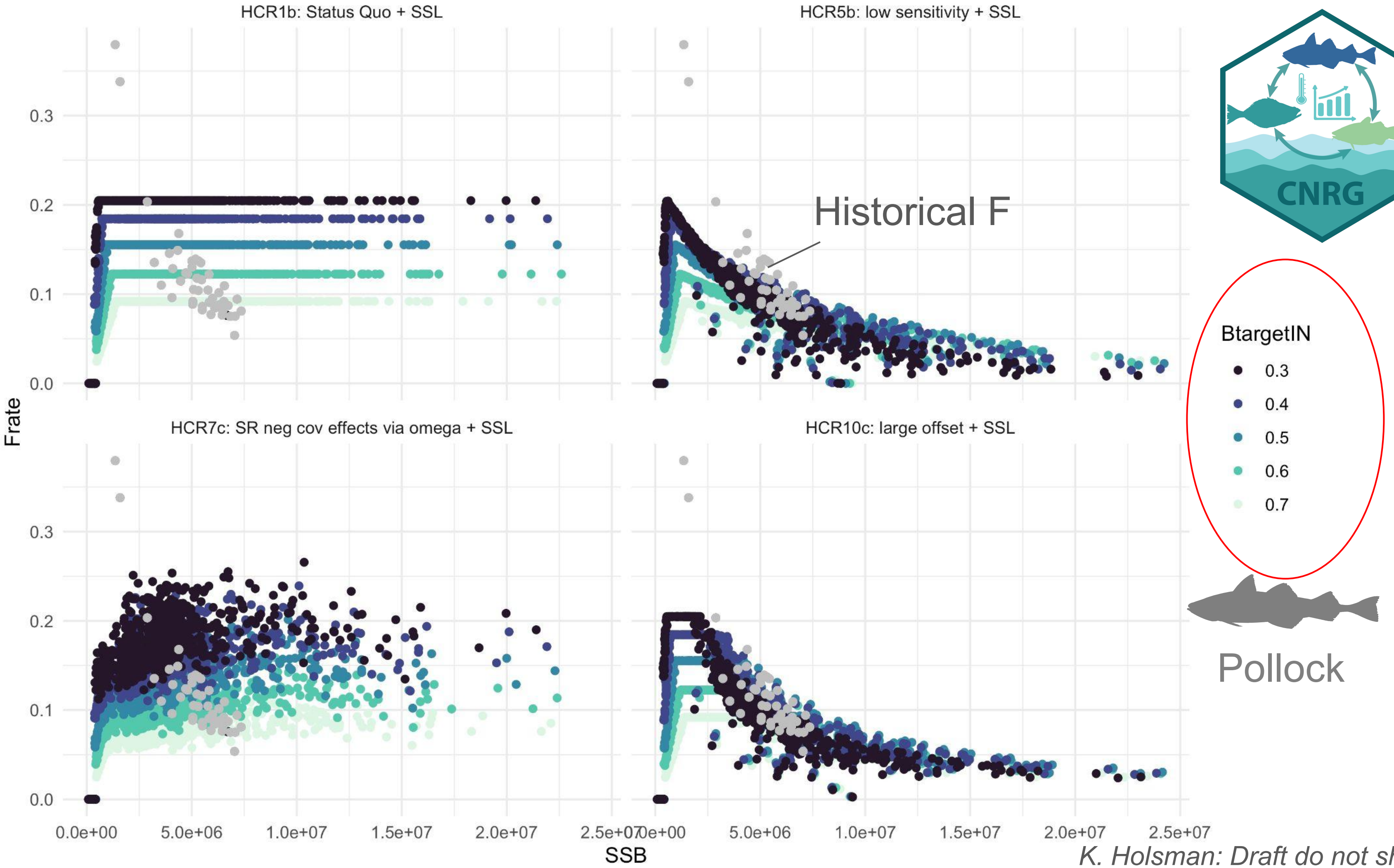
although risk increases over time & with warming

EBFM cap forestalled declines

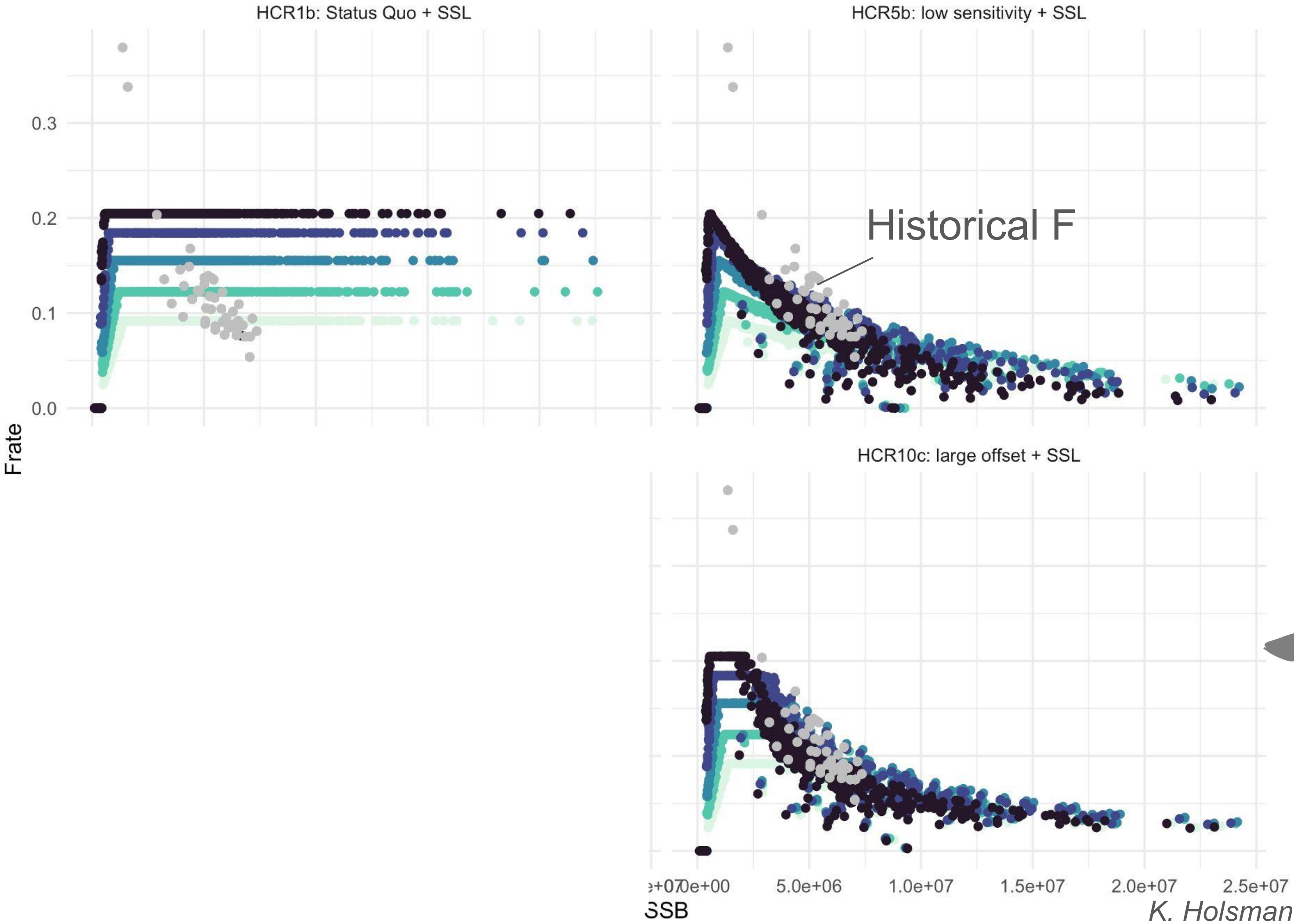
EBFM cap stabilized catches

EBFM cap had little effect on P. cod

Holsman, K.K., Haynie, A.C., Hollowed, A.B. et al. Ecosystem-based fisheries management forestalls climate-driven collapse. Nat Commun 11, 4579 (2020). https://doi.org/10.1038/s41467-020-18300-3



K. Holsman: Draft do not share



Pollock

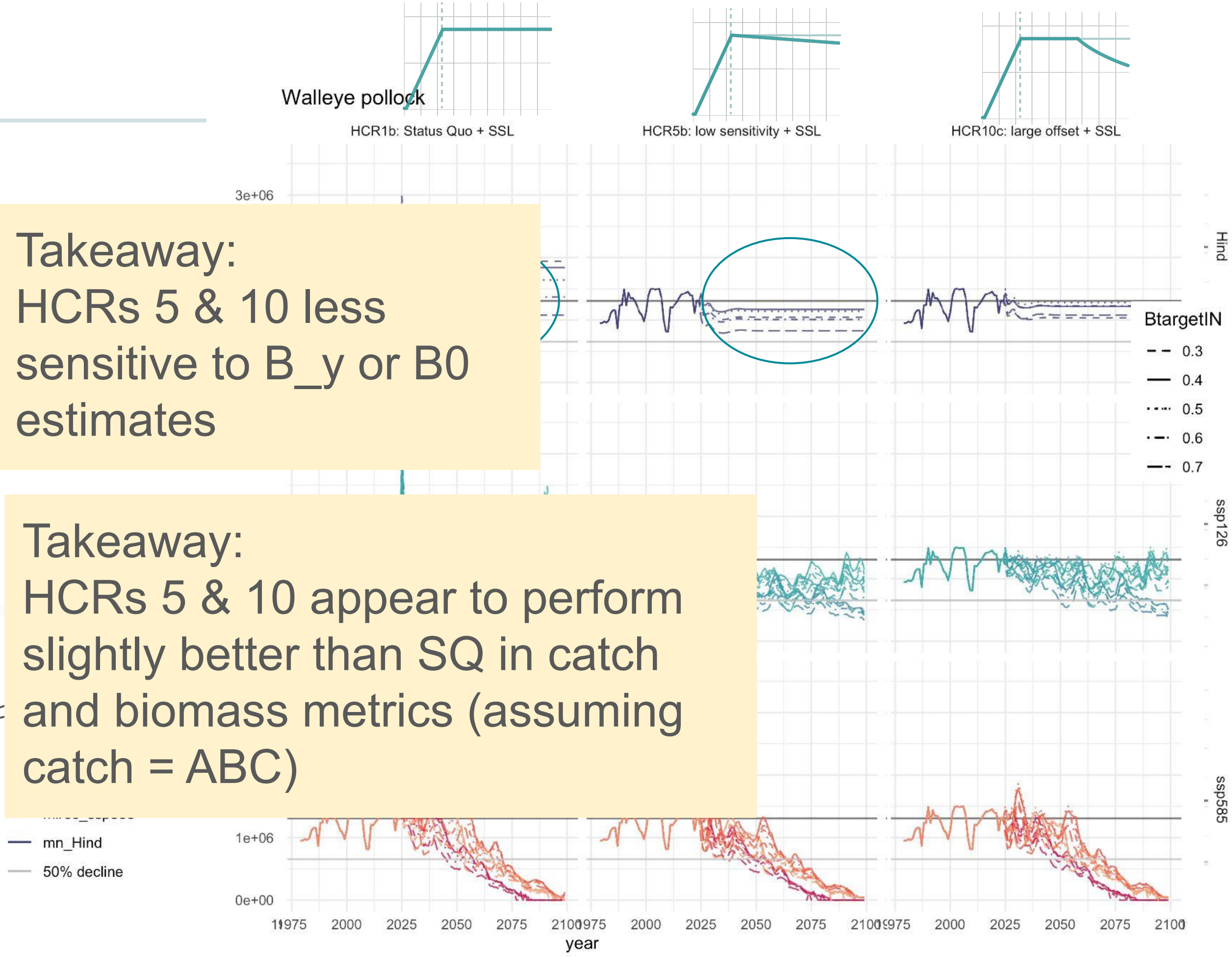
K. Holsman: Draft do not share

CEATTLE example (Catch = ABC)

Pollock

Cap-like HCRs reduce differences across Btarget

Cap-like HCRs stabilize catch (maybe good for markets?) [plan to add $value]



Takeaway:
HCRs 5 & 10 less sensitive to B_y or B0 estimates

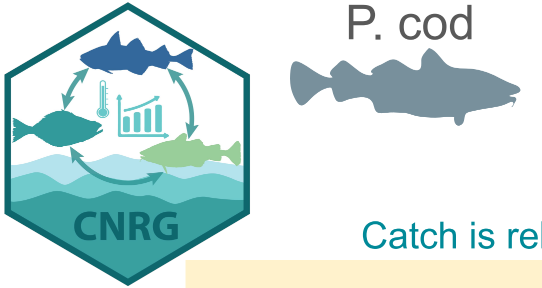
Takeaway:
HCRs 5 & 10 appear to perform slightly better than SQ in catch and biomass metrics (assuming catch = ABC)

Holsman et al. in prep

Draft Results do not copy

CEATTLE example (Catch = ABC)

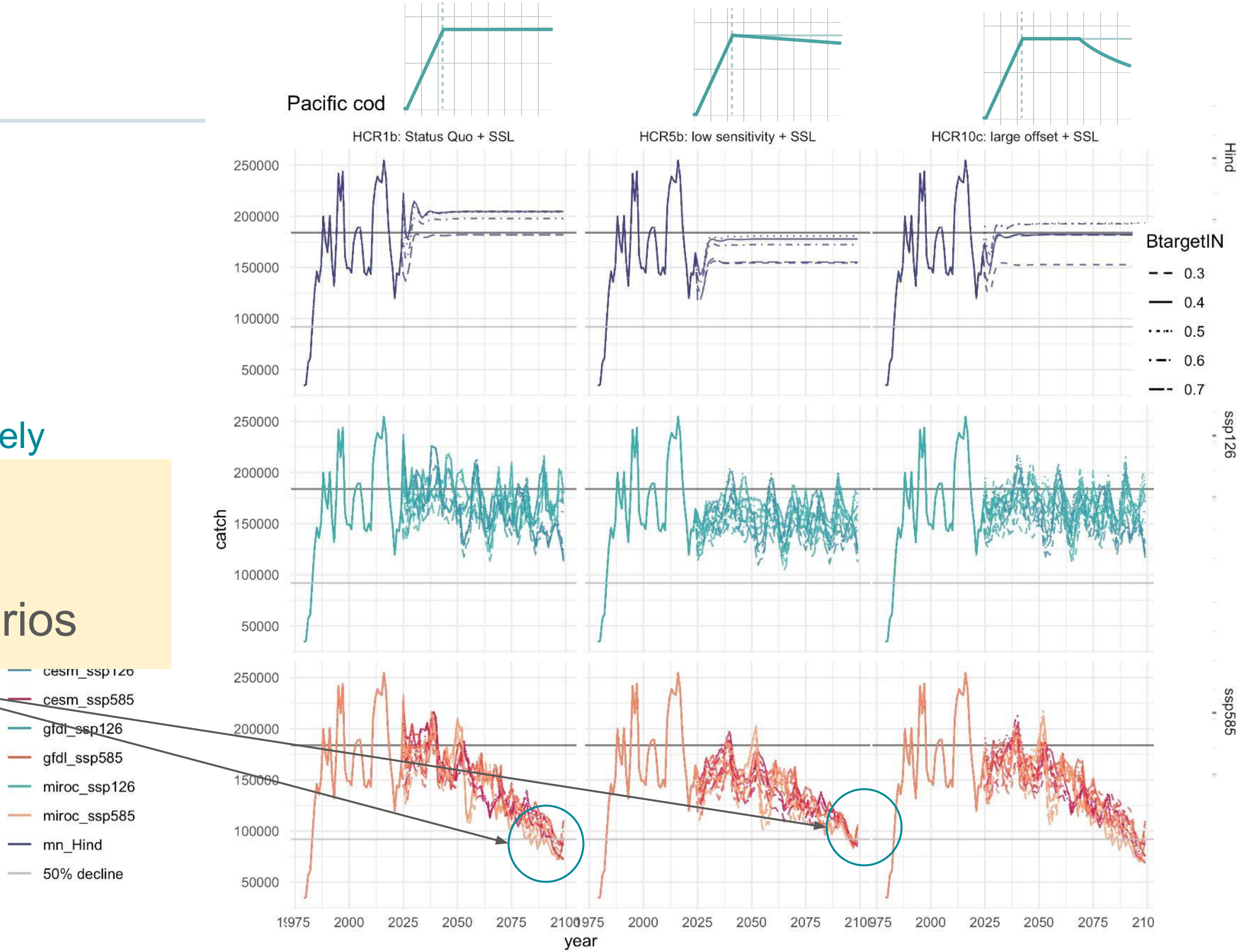
P. cod



Catch is relatively

Takeaway:
Variability from
HCRs << fut scenarios

S[…]
via reduction in # of
large declines



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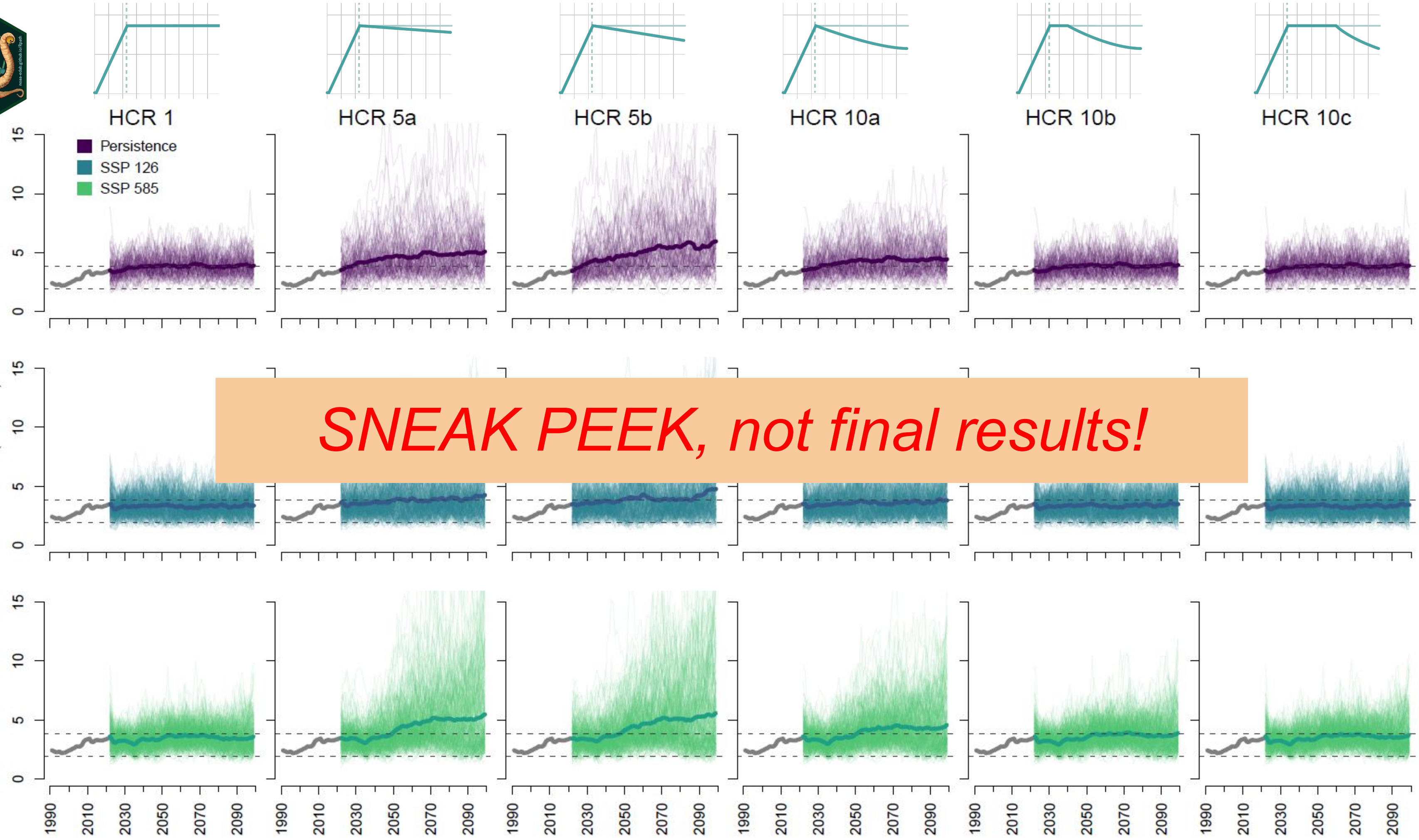
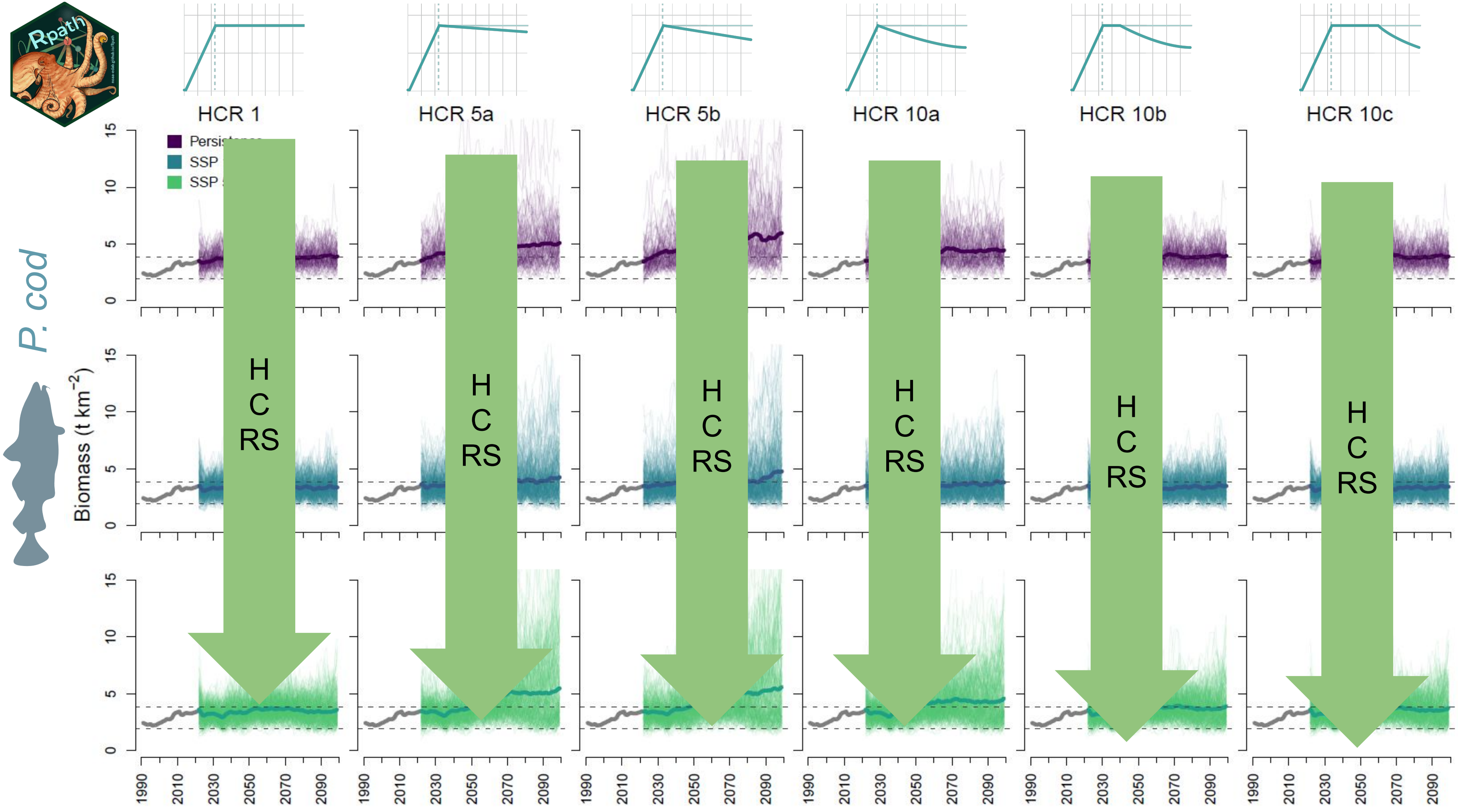
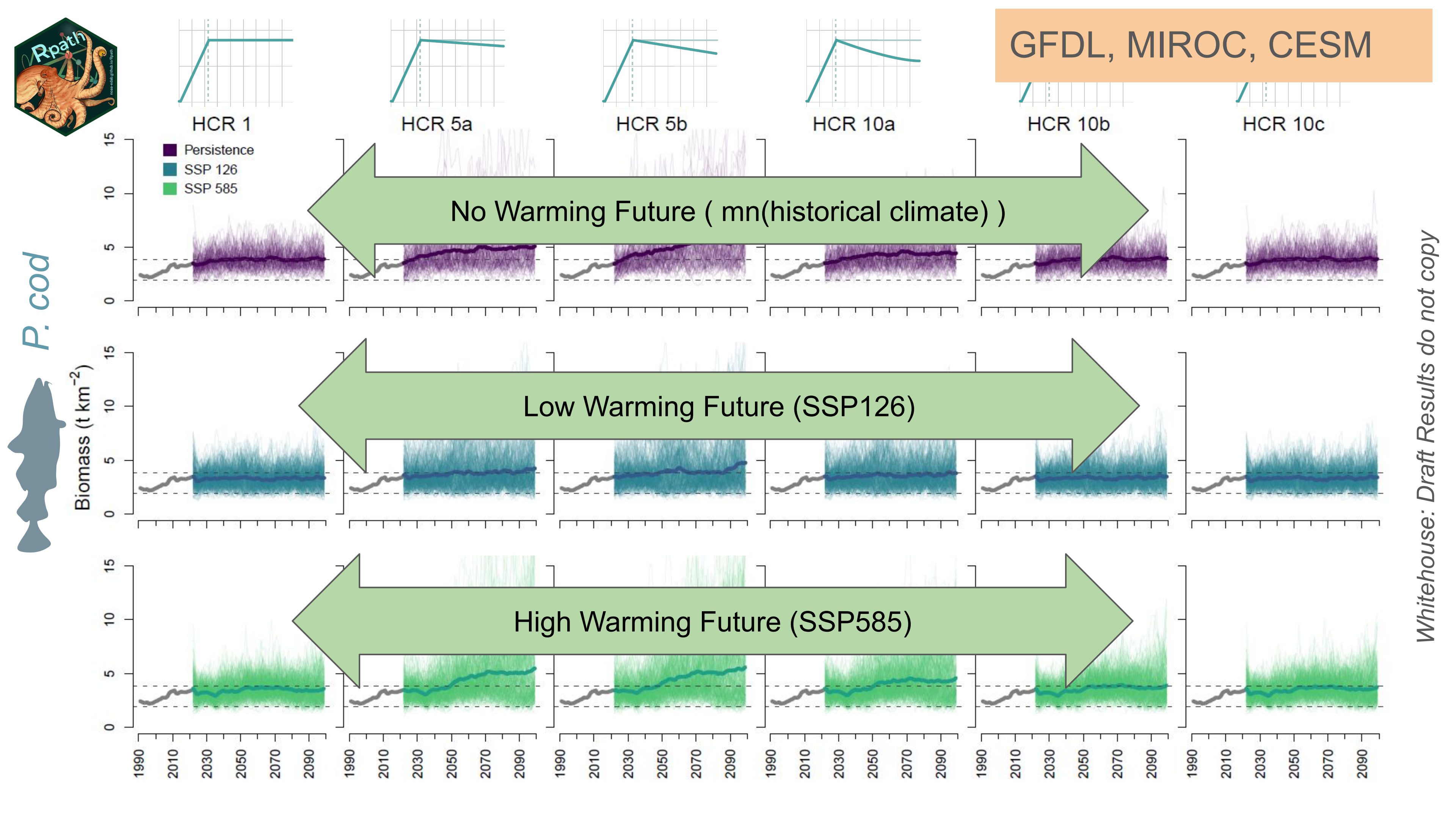


P. cod

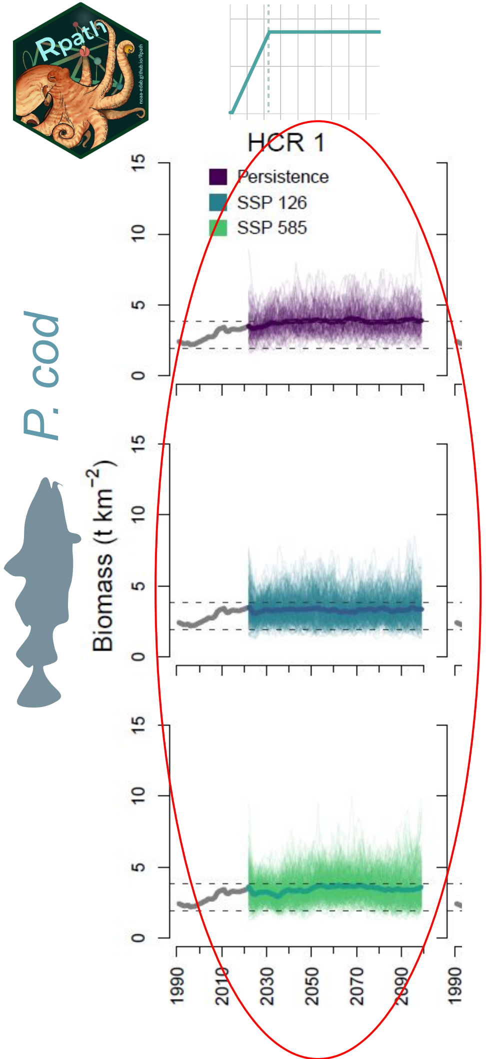
SNEAK PEEK, not final results!

Whitehouse: Draft Results do not copy


HCR 1
HCR 5a
HCR 5b
HCR 10a
HCR 10b
HCR 10c
SSP
SSP
P. cod
Biomass (t km^{-2})
0
5
10
15
1990
2010
2030
2050
2070
2090
H
C
RS



GFDL, MIROC, CESM
HCR 1
HCR 5a
HCR 5b
HCR 10a
HCR 10b
HCR 10c
Persistence
SSP 126
SSP 585
No Warming Future (mn(historical climate))
Low Warming Future (SSP126)
High Warming Future (SSP585)
P. cod
Biomass (t km^{-2})
0
5
10
15
1990
2010
2030
2050
2070
2090
Whitehouse: Draft Results do not copy

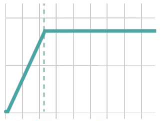


No Warming Future (mn(historical climate))

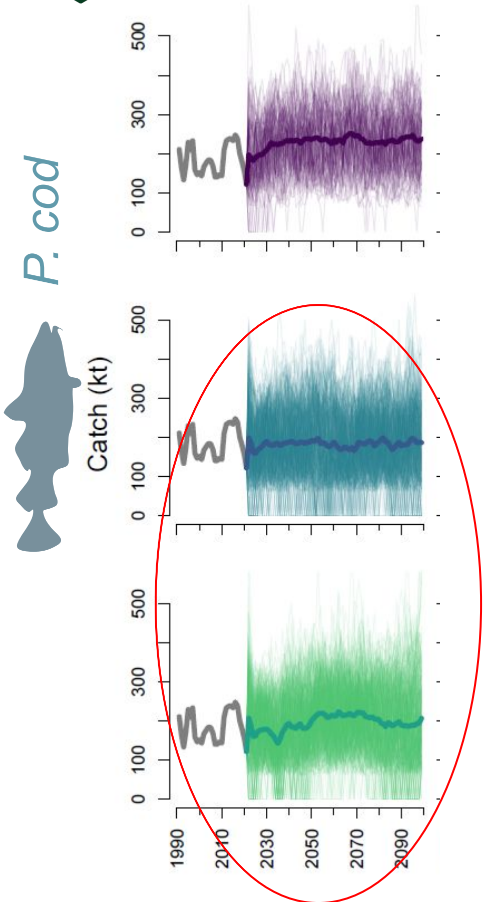
ng Future (SSP126)

Very little difference in biomass across future climate scenarios under SQ (HCR1)

High Warming Future (SSP585)



HCR 1



No Warming Future (mn(historical climate))

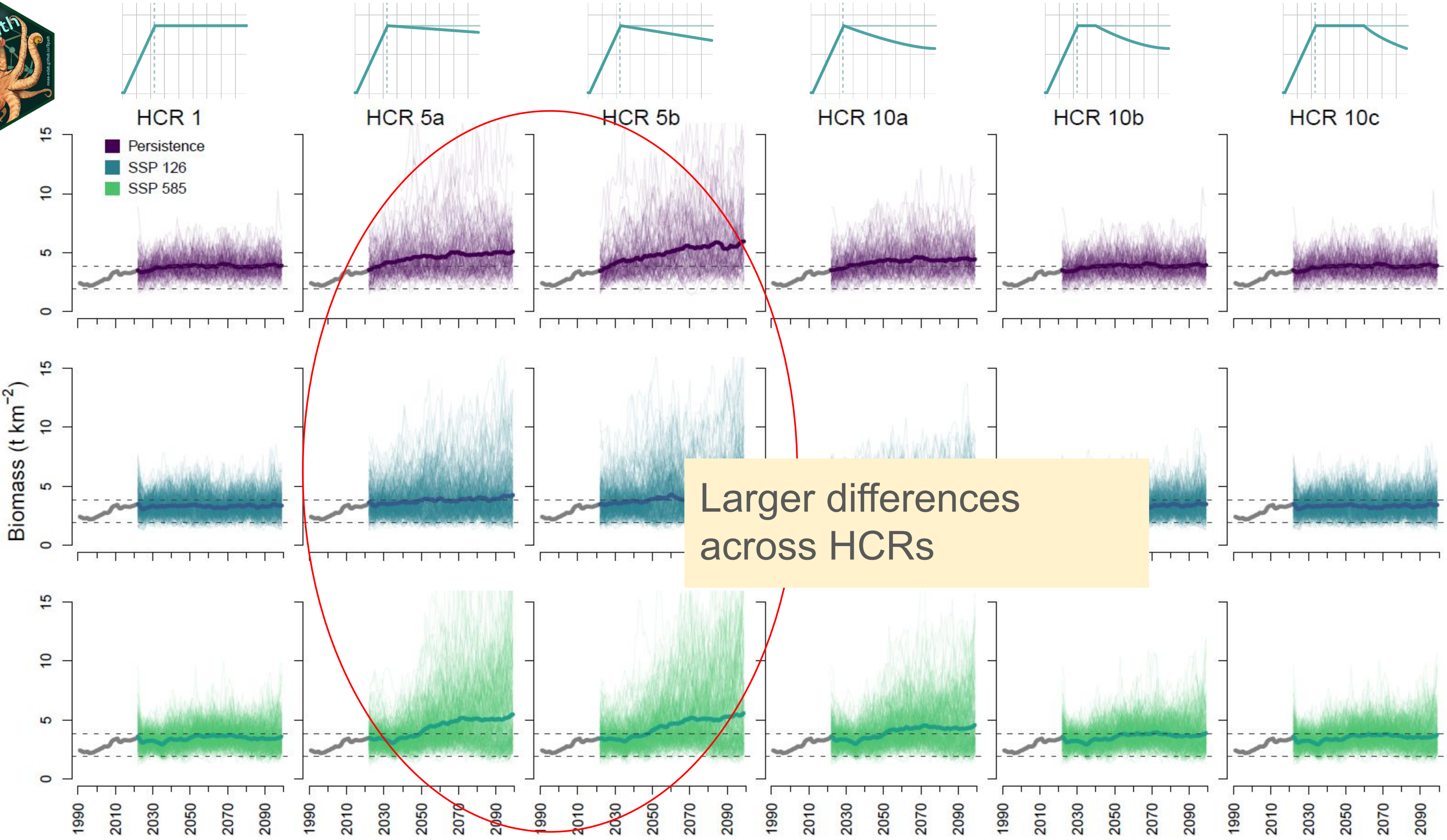
Low Warming Future (SSP126)

Minor / small differences in catch…

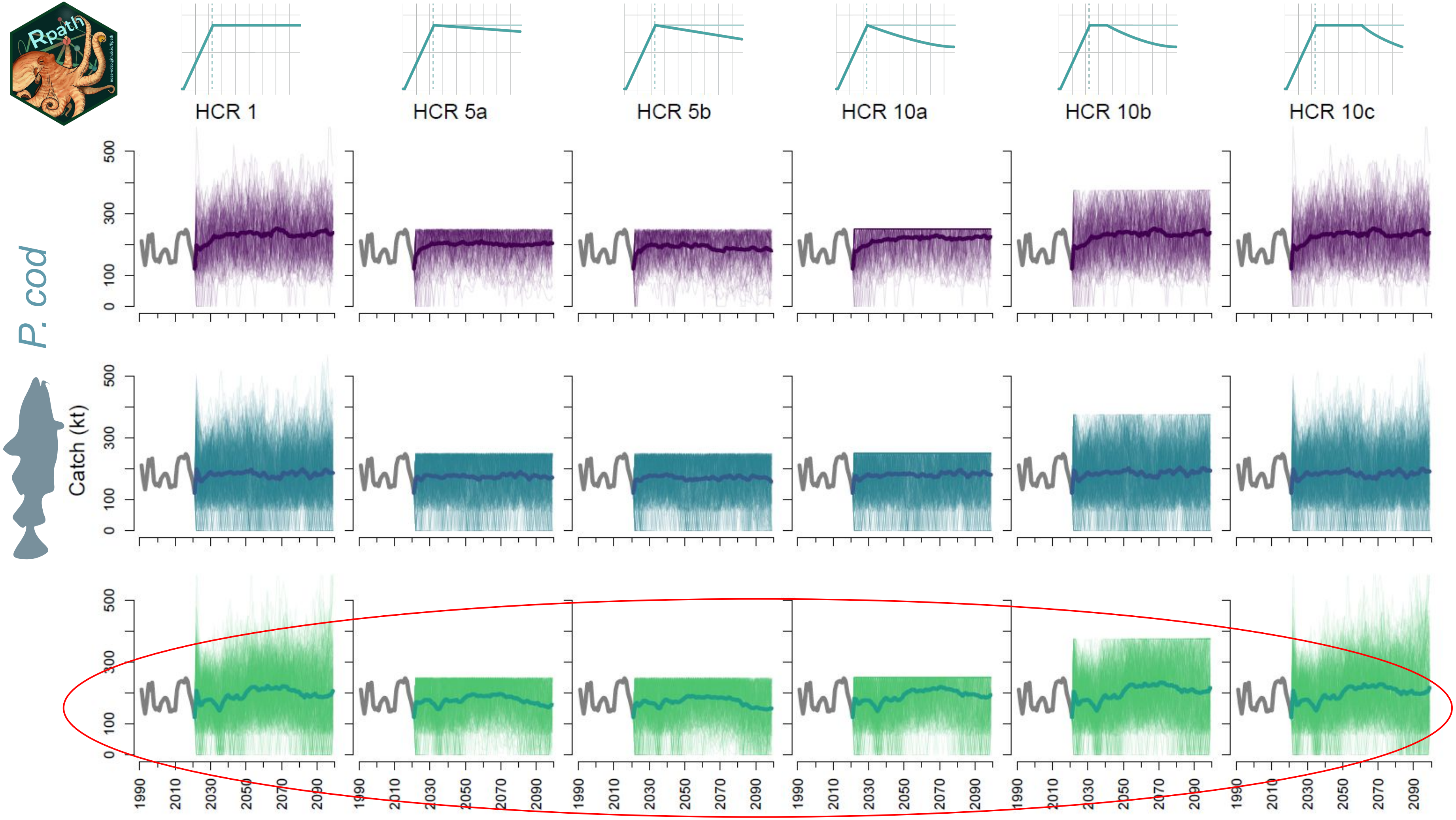
High Warming Future (SSP585)

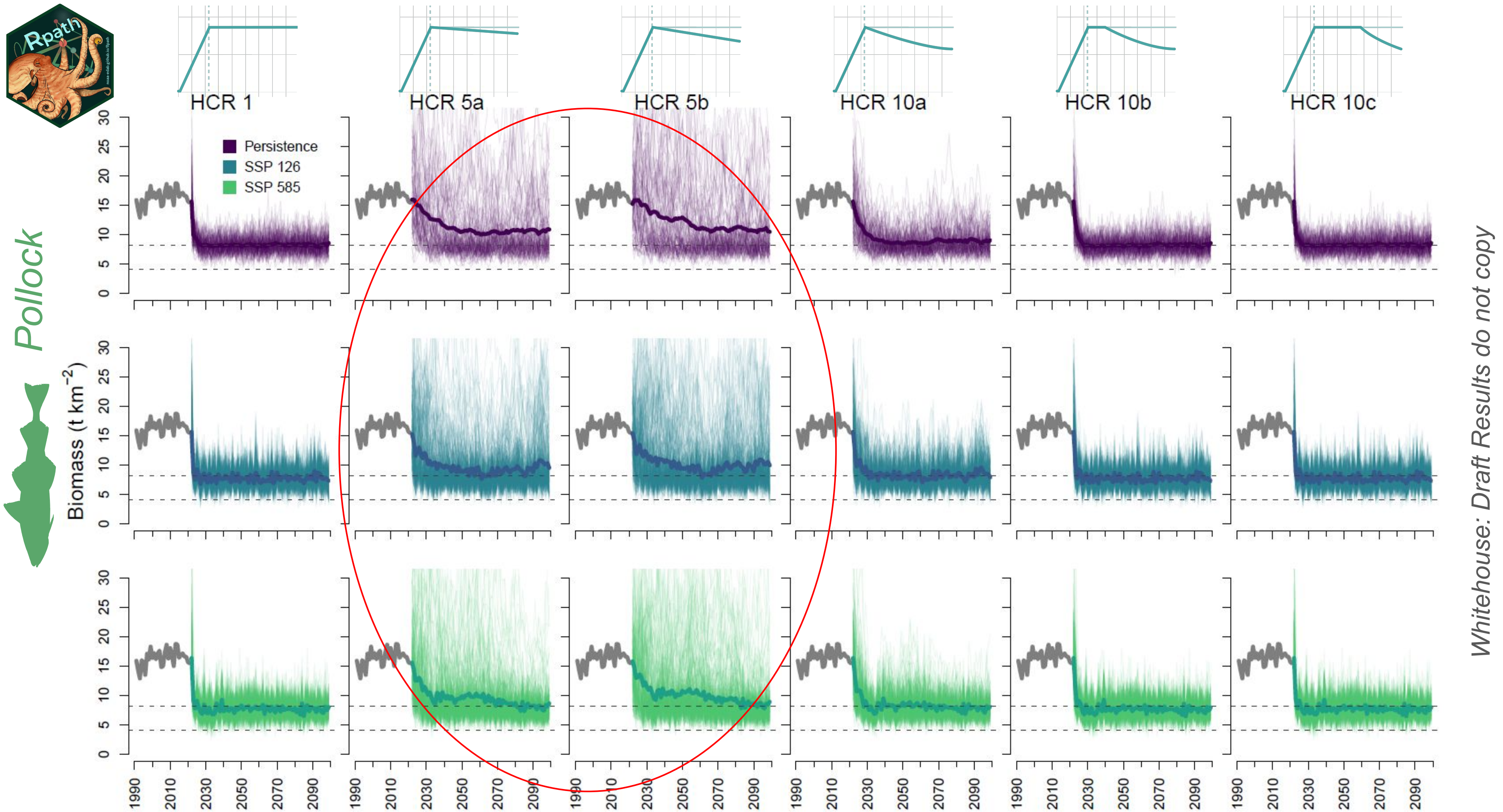
Whitehouse: Draft Results do not copy

P. cod

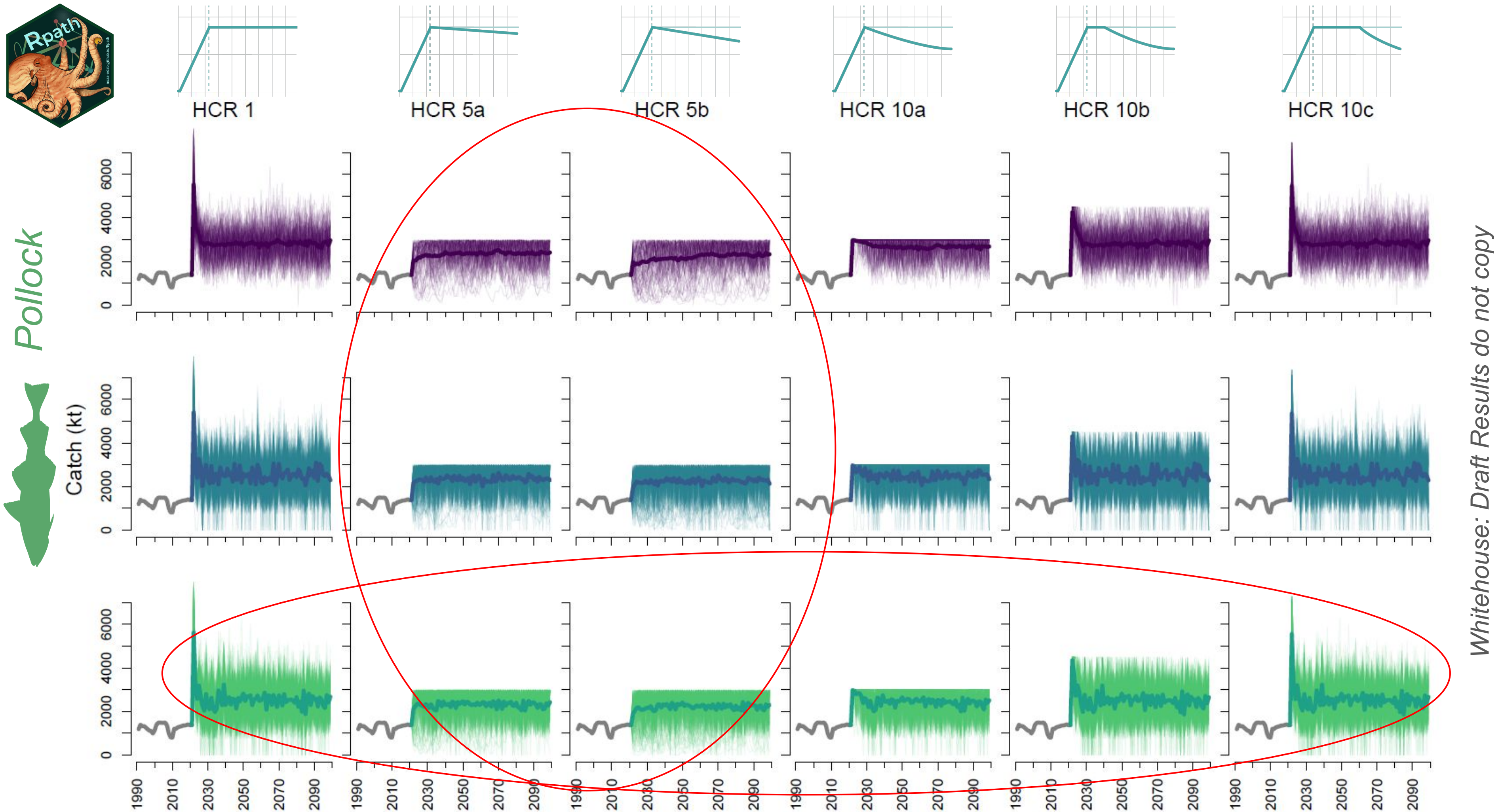


Larger differences across HCRs


HCR 1
HCR 5a
HCR 5b
HCR 10a
HCR 10b
HCR 10c
P. cod
Catch (kt)
0
100
300
500
1990
2010
2030
2050
2070
2090



Rpath
HCR 1
HCR 5a
HCR 5b
HCR 10a
HCR 10b
HCR 10c
Persistence
SSP 126
SSP 585
Pollock
Biomass (t km^{-2})
0 5 10 15 20 25 30
1990 2010 2030 2050 2070 2090
Whitehouse: Draft Results do not copy



HCR 1
HCR 5a
HCR 5b
HCR 10a
HCR 10b
HCR 10c
Pollock
Catch (kt)
0
2000
4000
6000
1990
2010
2030
2050
2070
2090
Whitehouse: Draft Results do not copy

Preliminary EBS Rpath outputs: descriptive overview

PUBLISHED
September 3, 2026

Table of contents

Purpose
Contents of the file
Historical series
Projection summaries
Terminal-decade catch and inter-annual variability
Basic checks

Purpose

This document provides a preliminary descriptive look at the objects in `preliminary_outputs_4Jim_4GPT_Sep2026.RData`. It summarizes the historical series and the distributions of projected annual catch and perceived biomass. The figures are descriptive only; the source file does not state measurement units, so axes retain the values in the reported units.

Contents of the file

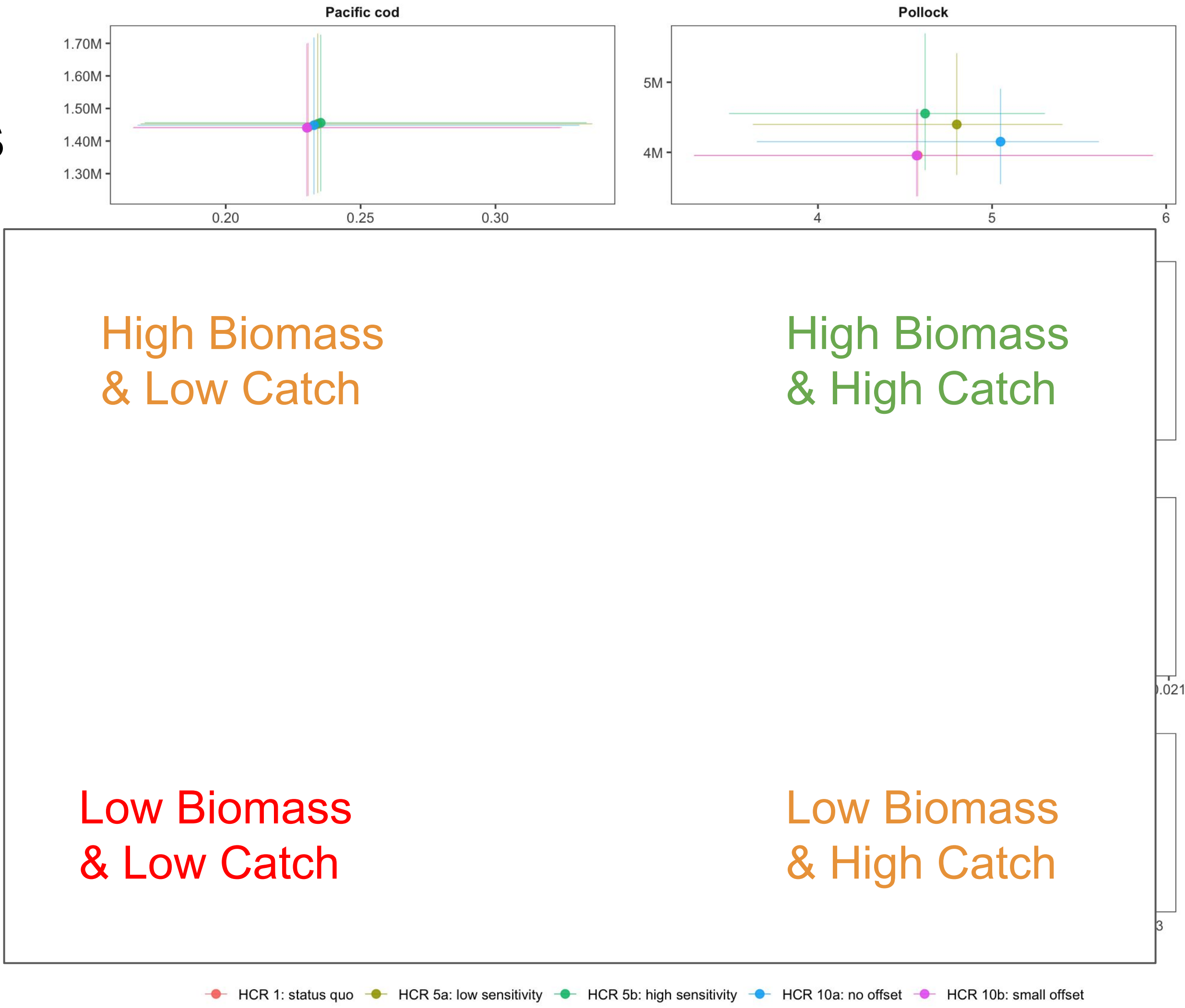
▸ Show code

Table 1: Inventory of objects in the preliminary output file.

object	class	dimensions	missing	minimum	maximum
hind_biomass	matrix	31 × 8	0	0.026	18.758
hind_catch	matrix	31 × 8	0	0.000	2.796
f01_prst_annC	array	109 × 8 × 100	0	0.000	15.198
f01_prst_ss	array	78 × 8 × 100	0	0.013	33.585
f01_g126_annC	array	109 × 8 × 100	0	0.000	12.774
f01_g126_ss	array	78 × 8 × 100	0	0.011	32.814
f01_g585_annC	array	109 × 8 × 100	0	0.000	14.901

Rpath trade-off plots

- ➔ Median annual catch versus median perceived biomass
- ➔ GFDL SSP1-2.6, pooling years 2031–2099 and all simulations.
- ➔ Horizontal and vertical segments show the marginal 25th–75th percentile ranges



Rpath trade-off plots

- ➔ Median annual catch versus median perceived biomass
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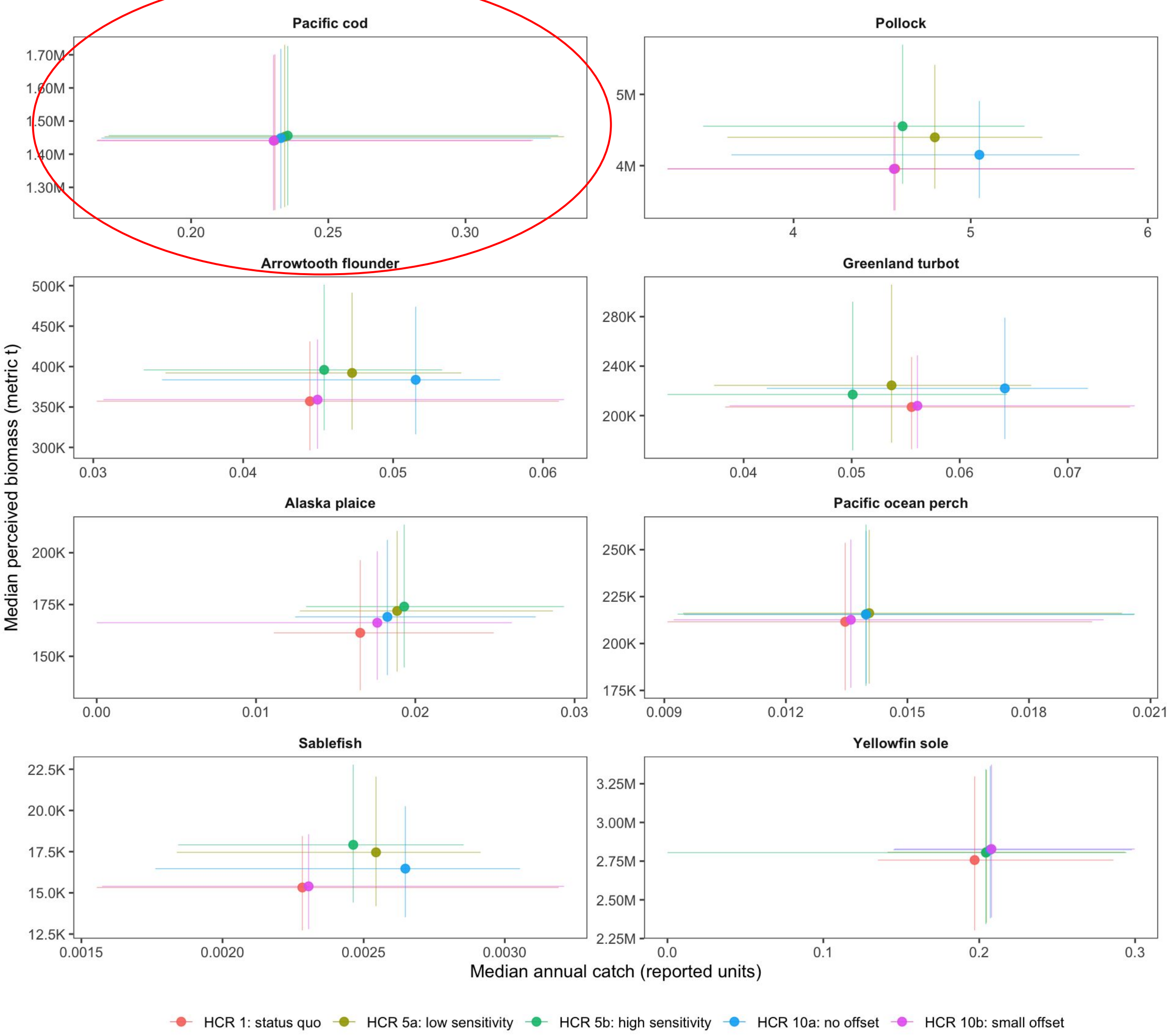
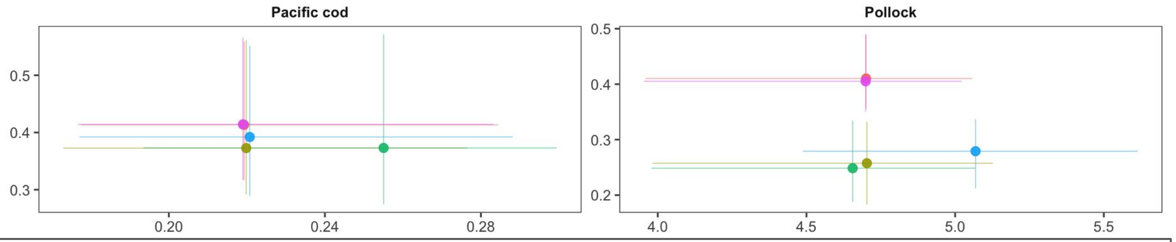


Whitehouse: Draft Results do not copy

Rpath trade-off plots



- ➔ Median annual catch versus inter-annual catch variability
- ➔ GFDL SSP1-2.6, pooling years 2031–2099 and all simulations.
- ➔ Horizontal and vertical segments show the marginal 25th–75th percentile ranges

High Catch Variability & Low Catch

High Catch Variability & High Catch

Low Catch Variability & Low Catch

Low Catch variability & High Catch

HCR 1: status quo · HCR 5a: low sensitivity · HCR 5b: high sensitivity · HCR 10a: no offset · HCR 10b: small offset

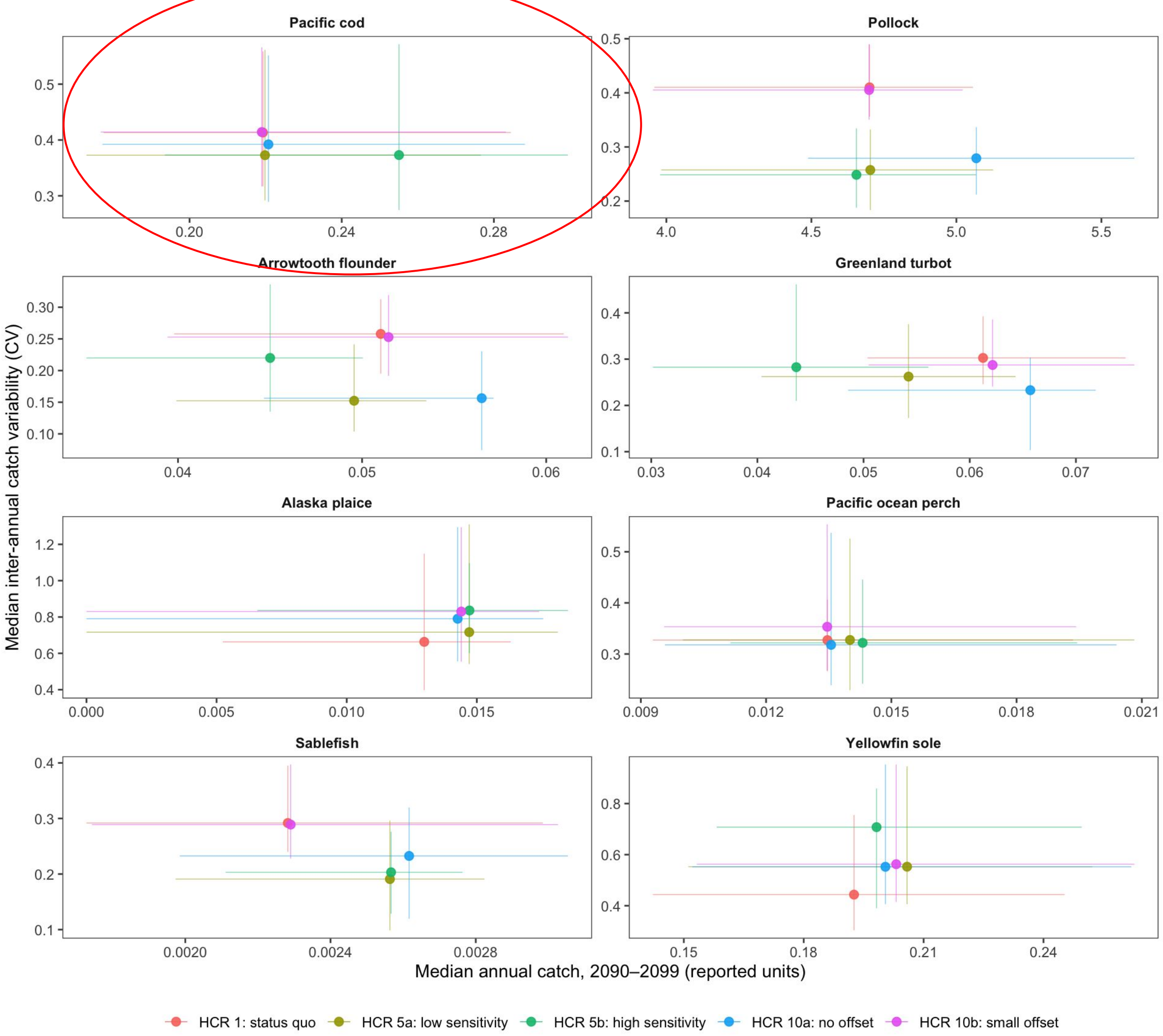
Whitehouse: Draft Results do not copy

Rpath trade-off plots

➔ Median annual catch versus inter-annual catch variability

➔ GFDL SSP1-2.6, pooling years 2031–2099 and all simulations.

➔ Horizontal and vertical segments show the marginal 25th–75th percentile ranges

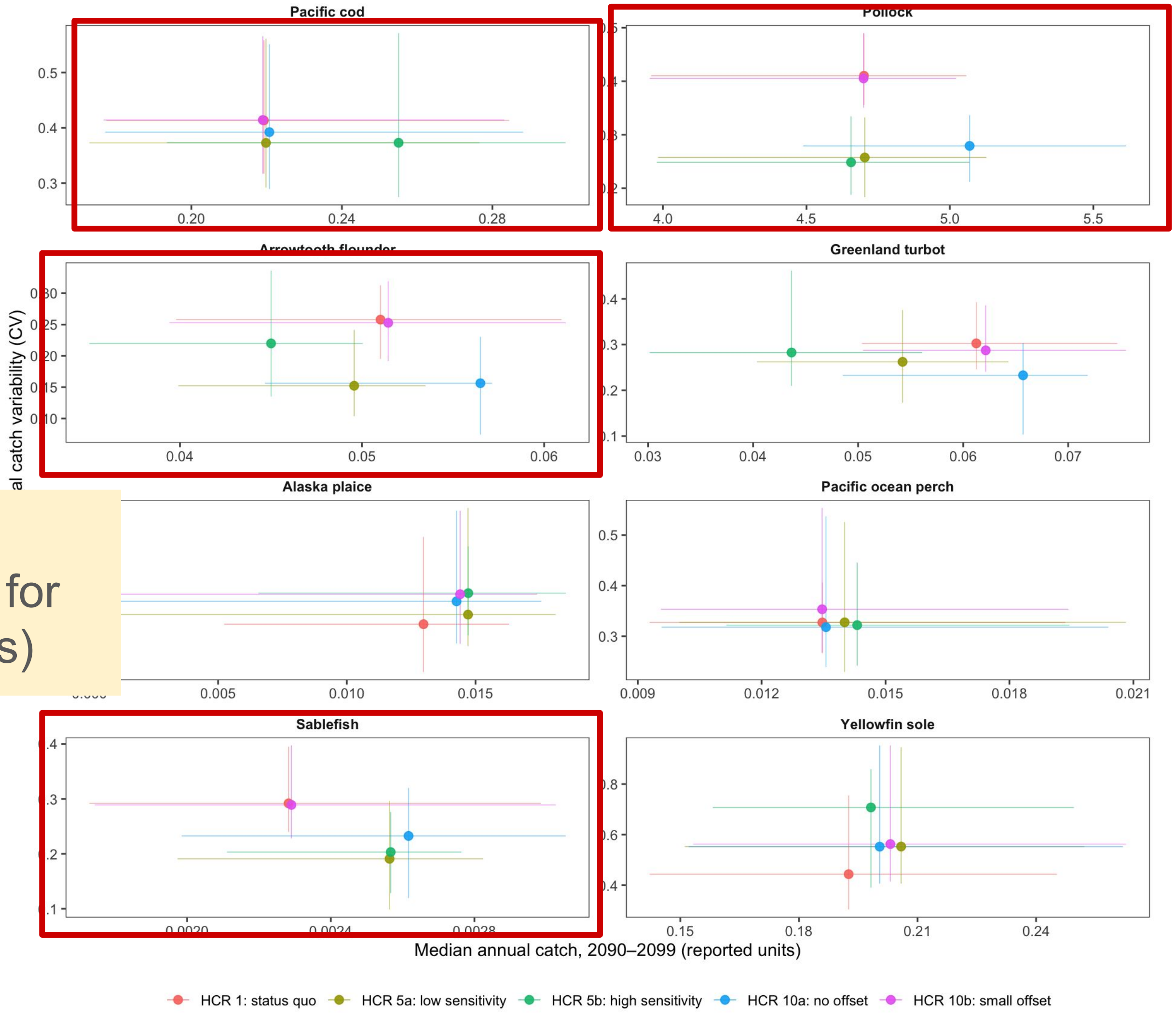


Whitehouse: Draft Results do not copy

Rpath trade-off plots

- ➔ Median annual catch versus inter-annual catch variability
- ➔ GFDL SSP1-2.6, pooling
- ➔ Horizontal and vertical segments show the marginal 25th−75th percentile ranges

Takeaway:
Maybe HCRs 5&10 >> SQ for some stocks (but not others)



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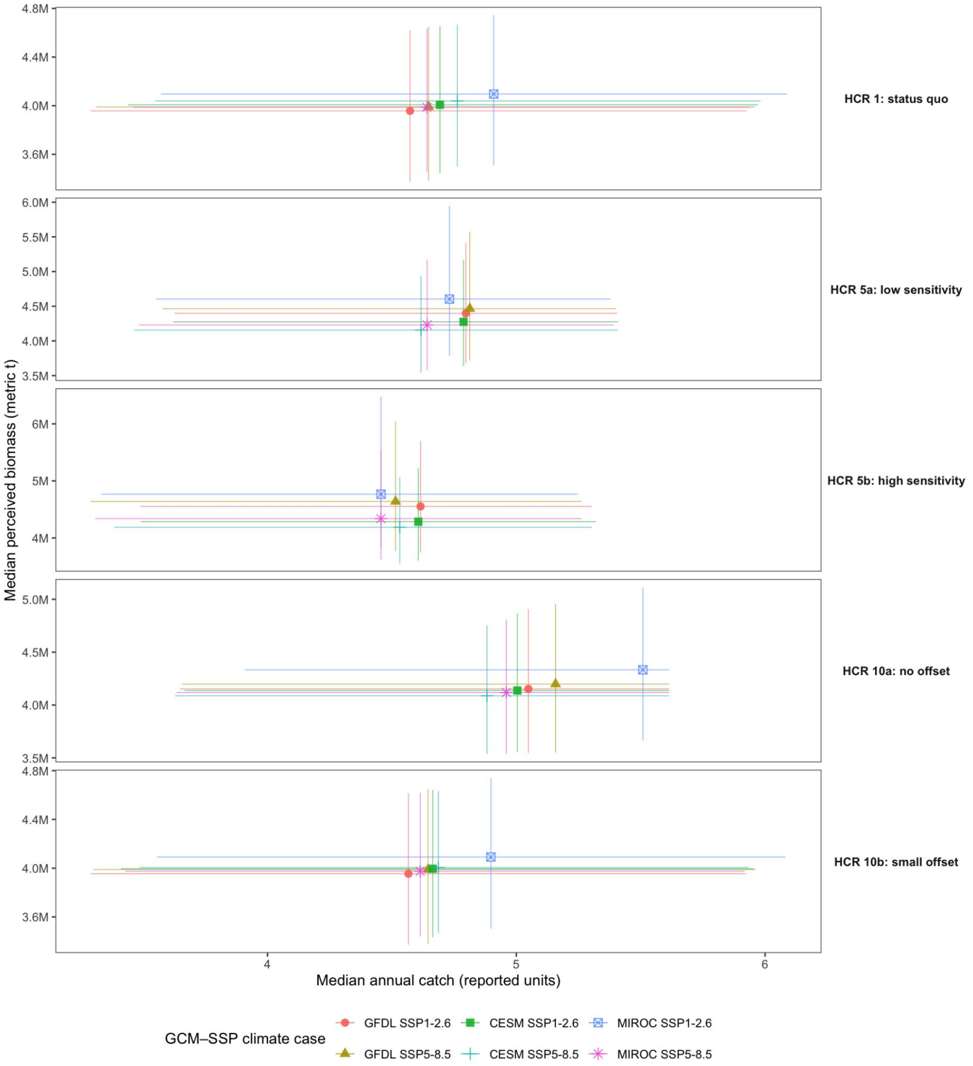
Rpath trade-off plots

- ➔ By HCR
- ➔ Pollock
- ➔ Horizontal and vertical segments show the marginal 25th–75th percentile ranges

Takeaway: Relative HCR performance within a stock is consistent across future scenarios



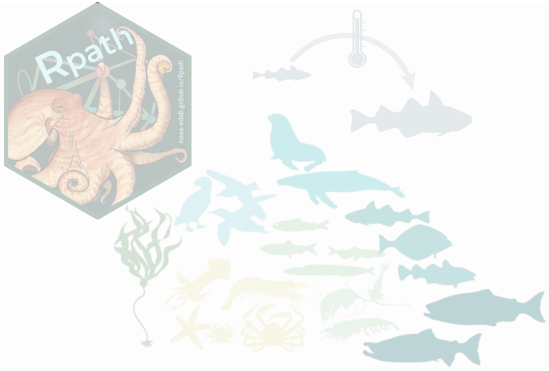
Whitehouse: Draft Results do not copy

ACLIM Sneak Peak (*draft results, do not copy*)

Multispecies Assessment model

- Age structured stock assessment
- 3 EBS stocks, Pollock, P. cod, arrowtooth
- ROMSNPZ forces phytoplankton. & zooplankton
- BT drives predator energetics and vonB growth (projections)
- Rec ~f(ROMSNPZ indices)

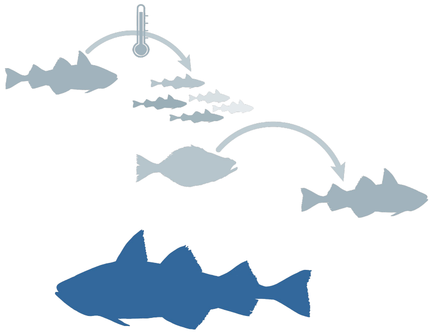
Holsman et al. in prep
Holsman et al. 2024,2020,2016



EBS Food web model

- 76 biological groups
- All 20 federally managed EBS stocks + protected species
- ROMSNPZ forces phytoplankton production
- BT drives predator energetics
- Rec functional responses emergent

Whitehouse et al. in prep
Whitehouse et al. 2021



Env. enhanced Pollock model

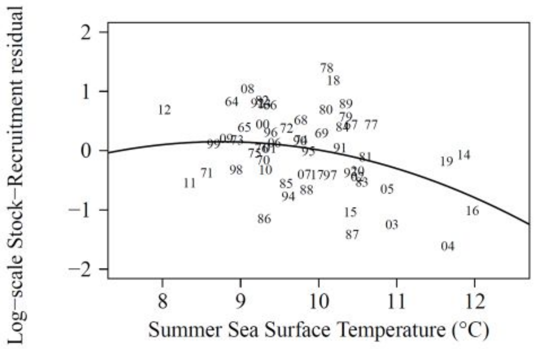
- Age structured stock assessment
- 1 EBSstock: Pollock
- multi-sub areas where predator (ATF) biomass drives M
- BT drives predator energetics
- Rec ~f(SST indices)

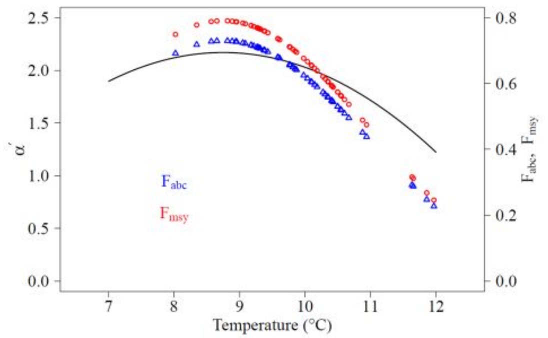
Spencer et al. in prep
Spencer et al. 2016

Paul

ACLIM Harvest Control Rule (HCR) 7 was motivated by work on temperature and stock productivity for EBS pollock

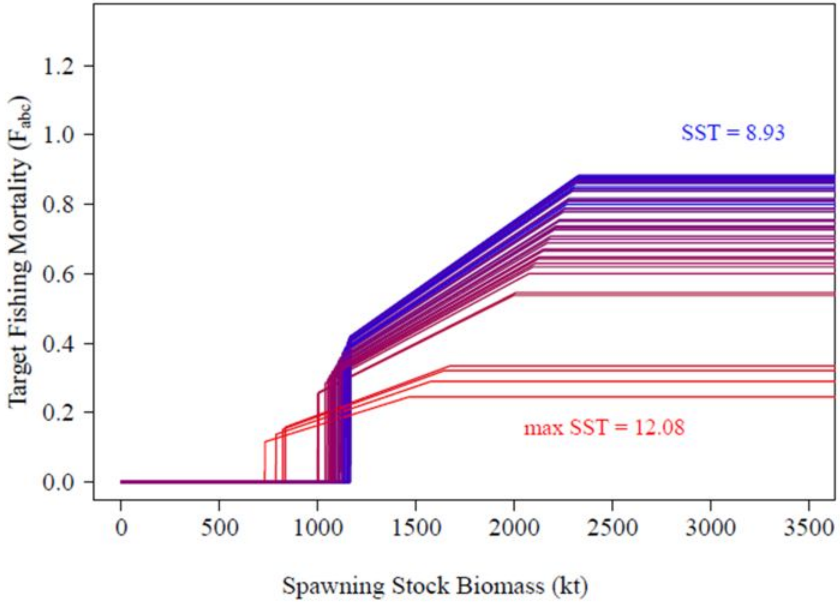
$$-7.71 + 1.76 * SST - 0.099 * SST^2$$





Paul

How would the harvest control rule change with temperature?



Paul

Description of HCR 7

$$F_{ABC_{max}} = \begin{cases} F_{ABC}\ e^{(\omega_1 * x_y)} & \frac{B_y}{\hat{B}_{target}} > 1 \\ F_{ABC}((\frac{B_y}{\hat{B}_{target}} - \alpha)/(1-\alpha))\ e^{(\omega_1 * x_y)} & \frac{B_y}{\hat{B}_{lim}} \leq \frac{B_y}{\hat{B}_{target}} < 1 \\ 0 & \frac{B_y}{\hat{B}_{target}} < \frac{\hat{B}_{lim}}{\hat{B}_{target}} \end{cases} (\#eq:HCR7eq)$$

such that F_{ABC} is adjusted by covariate x_y according the parameter ω_1 and B_{target} and B_{lim} are adjusted based on the parameters ω_2 and ω_3 such that:

$$\hat{B}_{target} = B_{target} e^{(-\omega_2 * x_y)}$$

and

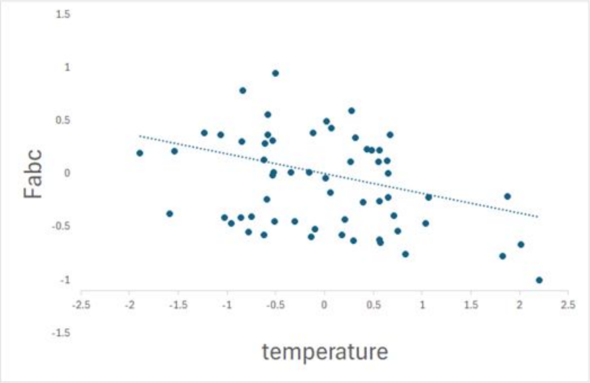
$$\hat{B}_{lim} = B_{lim} e^{(-\omega_3 * x_y)}$$

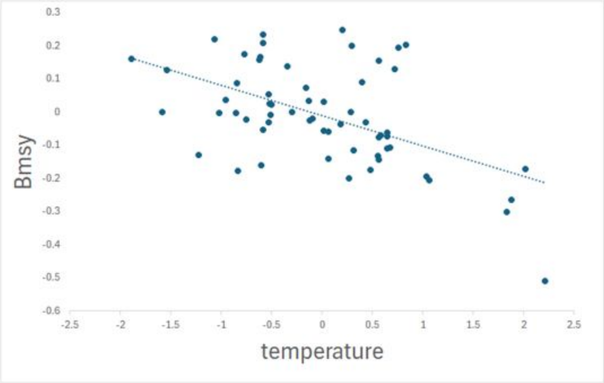
and ω_1, ω_2 and $\omega_3 \geq 0$.

For the ACLIM HCR 7 simulations ω_1 and ω_2 will eventually be fit using retrospective analyses of spawner-recruitment relationships across scaled (z-scored) SST (x_y) on EBS pollock by Spencer et al. in prep.

Paul

Estimation of omega parameters for HCR 7





Note that the relationship between the log of the reference points and the environmental covariate is linear, whereas it is quadratic in the pollock SR

Paul

Forecasting temperature

Table 5: Historical rolling temperature hindcast and HCR propagation results.

Method	Hindcasts	Temperature RMSE (C)	Temperature correlation	Mean absolute log FABC error	95% FABC factor range
Persistence forecast	40	0.974	0.441	0.147	0.747 to 1.364
Rolling AR(1) state-space forecast	40	0.857	0.390	0.121	0.807 to 1.467

The rolling state-space forecast has a temperature RMSE of 0.857 degrees Celsius, compared with 0.974 for persistence. Its central 95% `Fabc` factor range is 0.807 to 1.467. This result supports observed `t-1` temperature as the baseline and provides a state-space framework for future forecast evaluation. Issued forecasts and matching observations remain the next data requirement.

Paul

Treatment of Blim

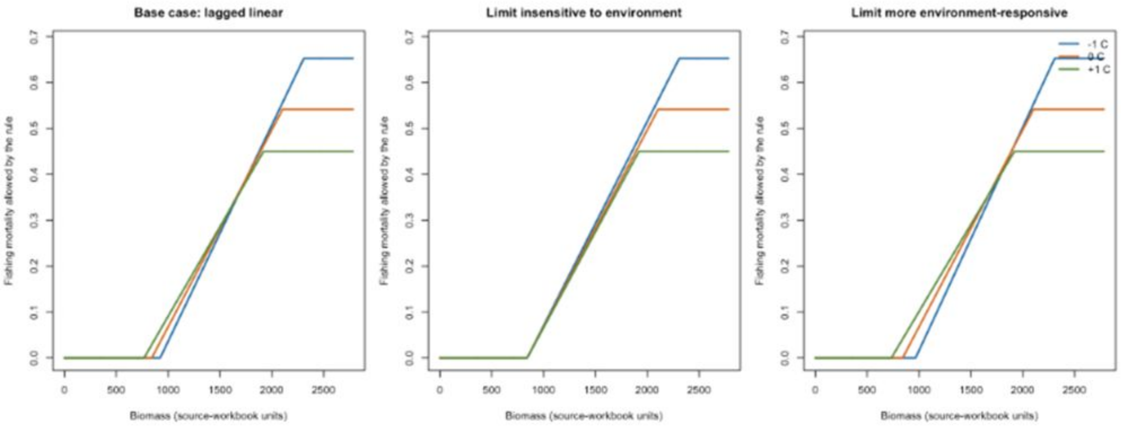


Figure 4: Illustrative HCR 7 biomass ramps in source-workbook biomass units. Each panel compares cool, reference, and warm conditions for one B limit case.

Paul

Trial cases

Case	Change from baseline	Decision question answered	Status
Base case	`omega3 = omega2`; observed `t-1` temperature anomaly	Does a common biomass response preserve a stable precautionary ratio?	Executed
Fixed limit	`omega3 = 0`	Should `B_lim` remain fixed while `B_target` changes?	Executed
Steeper limit	`omega3 = 1.5 * omega2`	What if the limit is more environment-responsive than the target?	Executed
Forecast timing	State-space forecast of `x_t` rather than observed `x_{t-1}`	Is added forecast uncertainty worth the responsiveness?	Rolling Kalman-filter test completed; issued-forecast calibration remains pending
Nonlinear response	Replace log-linear response with pollock-estimated nonlinear form	Is the linear response adequate over the observed temperature range?	Requires estimation
Stock-specific productivity	Estimate a time-varying spawner-recruit relationship for each stock	Does a stock-specific productivity history support a dynamic rule?	Preferred next analysis
Cross-stock transfer	Stock-specific anomaly scaling and response sign	Can a pollock-derived relationship be defensibly applied elsewhere?	Requires stock-specific rationale after the stock-specific analysis

"A stock-specific time-varying spawner-recruit model provides the preferred path for other stocks. It estimates each stock's productivity history directly and can use an environmental measure when evidence supports one. This approach reduces reliance on carrying the pollock-fitted curve across stocks."

Paul

Existing state-space modeling methods

- Analysis of stock-specific productivity and forecasting of environmental variables can be incorporated into a single model

$$log_e\left(\frac{R_{t+r}}{S_t}\right) = a_t - bS_t + v_t \qquad v_t \sim N(0, \sigma_v^2)$$

$$a_t = a_{t-1} + cH_t + w_t \qquad w_t \sim N(0, \sigma_w^2)$$

- In previous research, the environmental variable (*H*) was input without error, but it could be modeled as a state variable

FISH and FISHERIES

ORIGINAL ARTICLE OPEN ACCESS

Climate-informed stock-recruitment models identify potential environmental links for commercial fish stocks

Rachel C. Marshall[1] | Jeremy S. Collie[1] | Richard J. Bell[2] | Paul D. Spencer[3] | Cóilín Minto[4]

Groundfish Plan Team (GFPT) Decision Material

Status: HCR 7 has corrected coefficients, decision-time-consistent timing, and runnable trial cases for pollock. ACLIM projection results remain pending for comparison with HCR 1, 5, or 10; results to be included in peer reviewed papers in 2027.

Decision requests for the September 8 GFPT discussion:

HCR7 :

1. Confirm the `t-1` information set for size-at-age, selectivity, and the default temperature measure.
2. Select the `B_lim` treatment after reviewing the absolute-biomass crossover results for equal, fixed, and steeper limit responses.
3. Use the state-space forecast framework for future tests and calibrate it with issued forecasts and matching observations before using year-`t` temperature information.
4. Use stock-specific time-varying spawner-recruit models where possible; require a documented stock-specific mechanism and sign for any pollock-derived transfer.

Groundfish Plan Team (GFPT) Decision Material

Status: HCR 7 has corrected coefficients, decision-time-consistent timing, and runnable trial cases for pollock. ACLIM projection results remain pending for comparison with HCR 1, 5, or 10; results to be included in peer reviewed papers 2027.

Decision requests for the September 8 GFPT discussion:

→ Consider climate robust versus climate-informed approaches?

HCR 10:

a. **Climate Robust:** Evaluate 10% intervals for max catch relative to historical max catch.
b. **Climate-informed:** Evaluate MHW-specific offsets or stronger decay parameters in MHW years

HCR 5:

a. **Climate Robust:** Profile fixed linear scaling back of catch above B40% at various rates
b. **Climate-informed:** Evaluate forecast or MHW-specific offsets or stronger decay parameters in MHW years

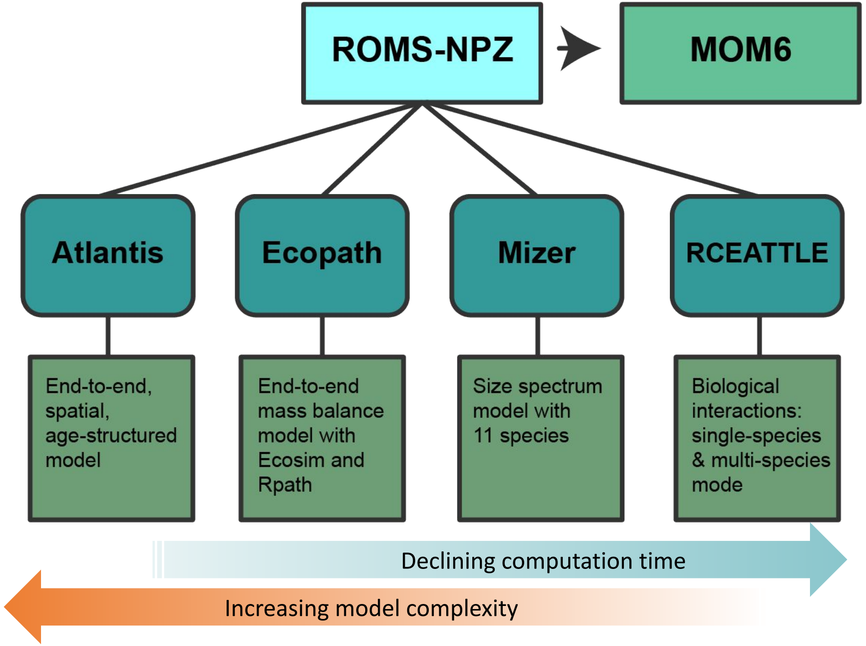
GOACLIM proposed timeline

Present - Beginning phase

May 2027 - Provide an update on progress to SSC

Sept 2027 - aiming for final results from simulations, GPT update?

October - December 2027 - Review by Council



credit: Heather Nibert

Performance metrics

A quantifiable measure used to determine how well a management alternative meets specified objectives.

Key component: Clearly specify objectives

Goal: Ensure performance measures align with fishery and ecosystem management objectives, fishery objectives, and socio-economic and community level objectives

Performance metrics

Appendix 3 in June Council HCR discussion paper:

- Example objectives and performance metrics (not an exhaustive list of options)

Plan for stakeholder meetings: Map FMP and ecosystem objectives to performance measures and link them to our suite of models

- Identify additional metrics tailored to objectives that come forth through discussions

Objective	Case study metrics
Maintain biomass above biomass limit/ Minimize the chance of being overfished	$P(B > 0.4B_{MSY}) \geq 0.95$[a] $P(B > 0.25B_0)$[b] $P(RSB < 20\%) < 0.05$[c] $P(SSB < 7.7\% SSB_0) < 0.10$[d]
Maintain spawning stock size above target reference points	$P(B_{2052} > B_{targ}) = 0.5$[a] $P(B > 0.4B_0)$[b] $P(RSB < 36\%) < 0.50$[c]
Maintain stock within the green zone of Kobe plot	$P(SSB \geq SSB_{MSY}$ & $F < F_{MSY}) \geq 0.6$[d]
Maintain age structure or size structure	Change in mean age or size
Maintain key predator/prey relationships	Average ratio of relative biomass of predator and prey[e]
Ecosystem structure	Mean trophic level of system biomass or of catch[e] Species diversity score for system[e] Relative abundance of non-target species or relative abundance of species groups[e]

Socio-Economic and Community Level Metrics:
Socio-economic data availability, objectives, & metric development

STATUS: **Under development to inform and assist with stakeholder meetings**

1. **Data Availability**
   Developing social and economic data tiers to communicate timing considerations. Currently no cost data & one to multi year time lags.

2. **Operationalizing Socio-Economic Objectives**
   Included in FMP, but operationalization in metrics less clear. Current ESSR focus on sustained fishing participation and local food production indicators.

3. **Metric Development and Selection**
   Indicators for tracking change may need to be tailored to species and co-developed through stakeholder discussions.

Draft Suggested stakeholder engagement for 2027

Council support for stakeholder engagement to refine objectives for HCR analysis

Looking for feedback from the public on refining initial objectives by stock (pollock, cod, sablefish) based upon preliminary results prior to May 2027 Council action to consider a purpose and need statement and alternatives for analysis

Potentially targeting Spring 2027 (timing TBD) as this ideal timing for inclusion of performance metrics in HCR simulations and evaluations for pilot stocks which are pollock, pcod, and sablefish.

Performance metrics & communication

- Keep public/Council-facing metrics few and targeted to highlight key tradeoffs.
- Add economic metrics (catch stability, total value over time) alongside total catch.
- Explore adding social indicators, with attention to how to communicate them for decision-making.
- Develop a communication plan for non-technical audiences.