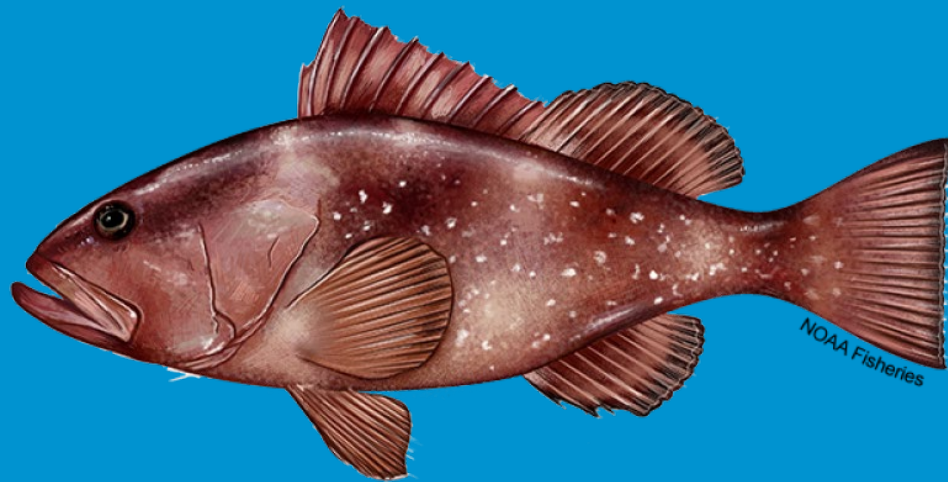




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SEDAR 88: Gulf of Mexico Red Grouper



Virtual SSC Meeting
December 5th, 2024

What we are asking of the SSC

- Provide feedback about data and model changes
 - Suggestions towards modeling best practices
- Provide a recommendation about any additional sensitivities, diagnostics or configurations of the model
- Projection configurations that are not covered in the TORs

SEDAR 88 Overview

Notable **changes** compared with the SEDAR 61 Benchmark assessment model (end year 2017):

- Recreational landings and discards from Florida changed from Marine Recreational Information Program Fishing Effort Survey (**MRIP-FES**) to Florida's State Reef Fish Survey (**SRFS**) data (for private mode only)
 - Fit to **mean weight of catch** for recreational fleet
 - Included **mean length at age** for three fishing fleets
 - **Updated combined video index**
 - Updated **natural mortality** vector to current best practices
- Freely **estimated** more selectivity parameters
 - Estimate **steepness** (or fix at a biologically plausible estimate)
 - Estimated growth (L_{∞} and k) with/without platoons
 - **Age-based selectivity** for commercial handline, longline and recreational fleets
 - Empirical **selectivity-at-age** for Red Tide years

Current best practice
TORs
SSC Feedback Requested



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Beverton-Holt SR Model

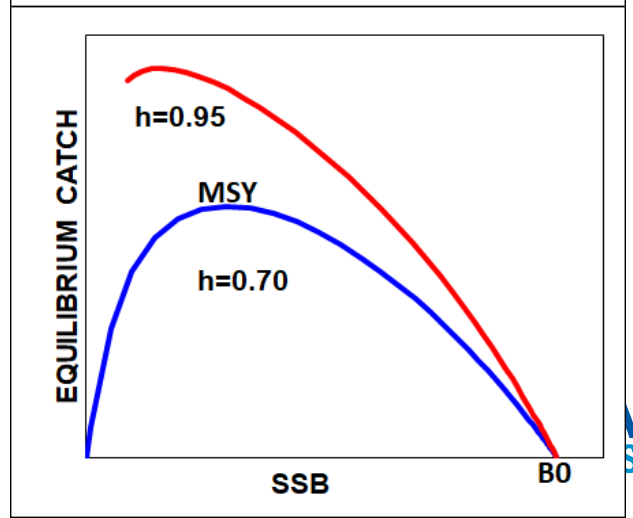
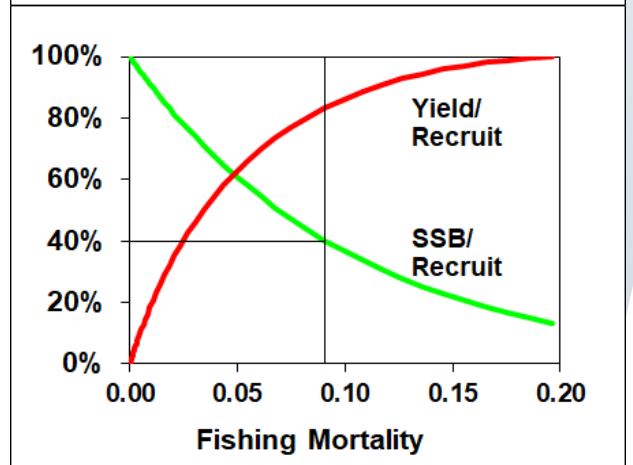
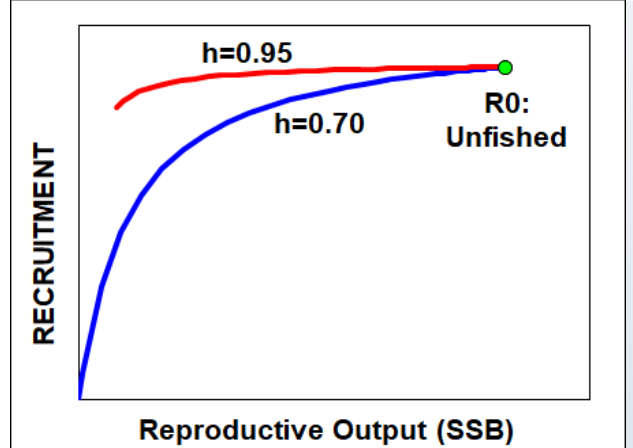
- Estimated:
 - Virgin recruitment (R_0): unexploited equilibrium recruitment on log-scale
 - Recruitment deviations from 1993-2022
 - Recruitment variability (σ_R)
- Steepness (**SSC feedback requested**):
 - Estimable with low CV and clear profile (discussed in Diagnostic section)OR
 - Fixed at biologically plausible estimate obtained from FishLife (0.786)
 - As comparison: Fixed at 0.99 in S61 (fixing at 0.99 no longer recommended unless we are not modeling a S/R relationship)
 - Has implications for the value of R_0



If S/R curve is used

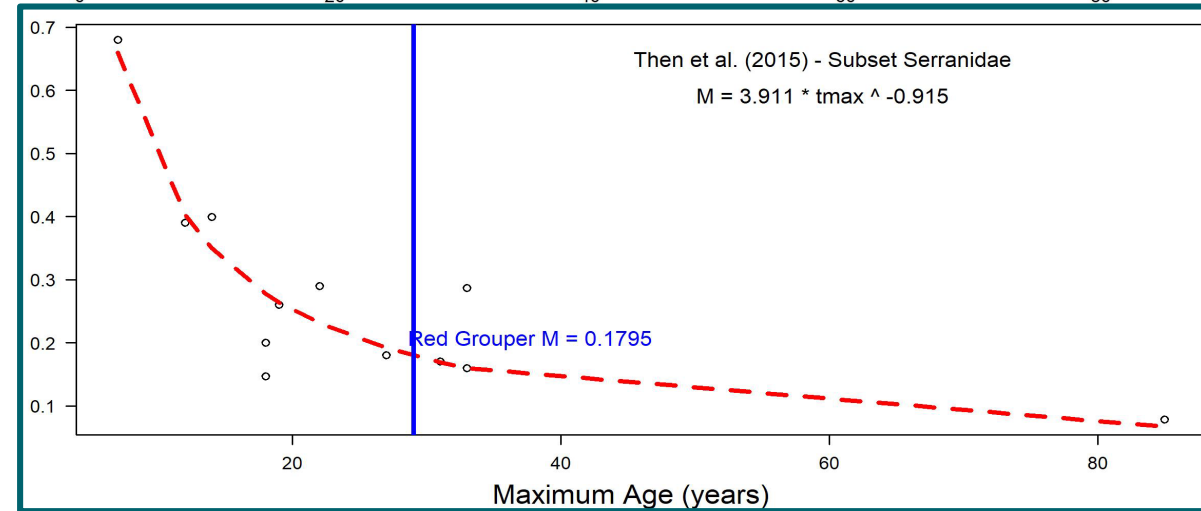
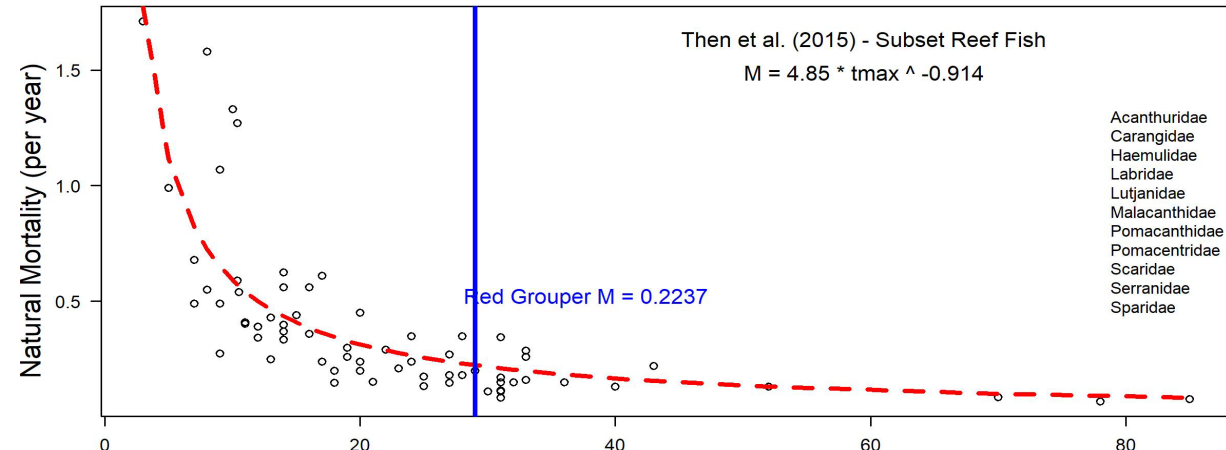
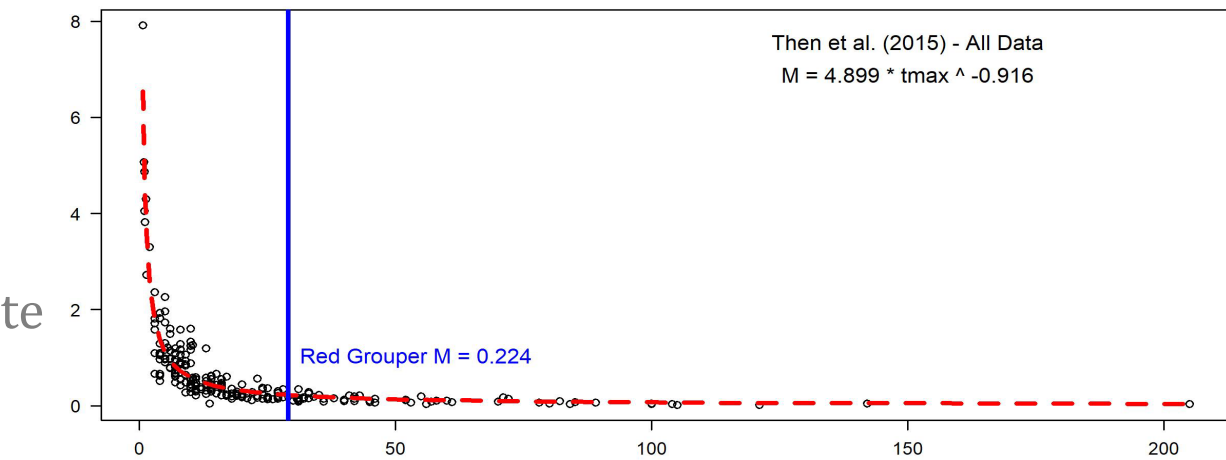
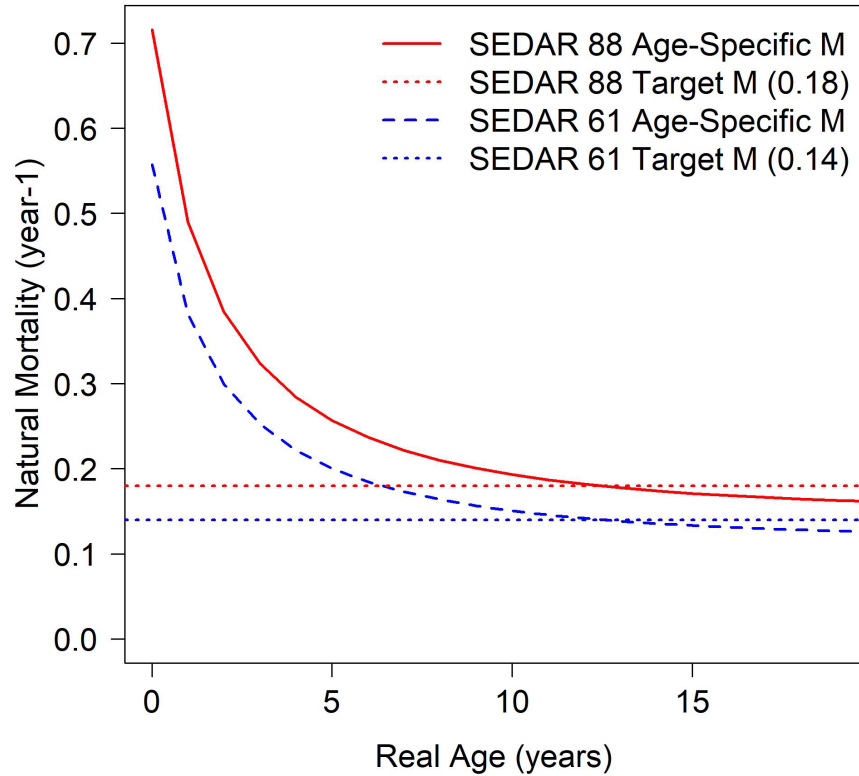
From NS1 Technical Memo:

- Recruitment linked to SSB through stock recruit curve
 - Enables straightforward calculations of the MSY-based reference points
 - Fixing S/R parameters at constant value:
 - Should be done with caution and thorough investigation
 - essentially determines reference points *a priori*
 - limits the way data can inform the estimation of reference points
 - fixing the steepness parameter at a single value essentially same as using an SPR proxy
 - with less transparency and a false sense of precision in the reference points.
- Fixing steepness is not recommended



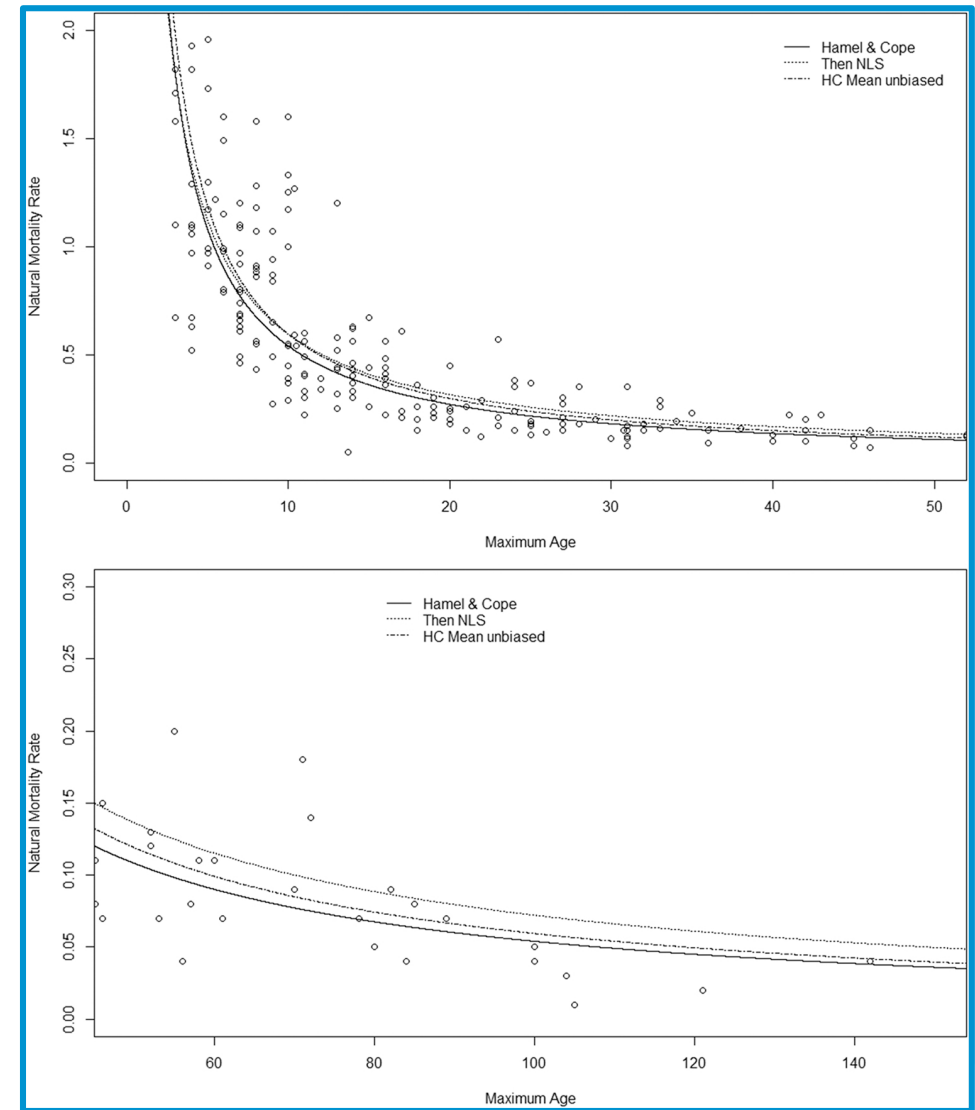
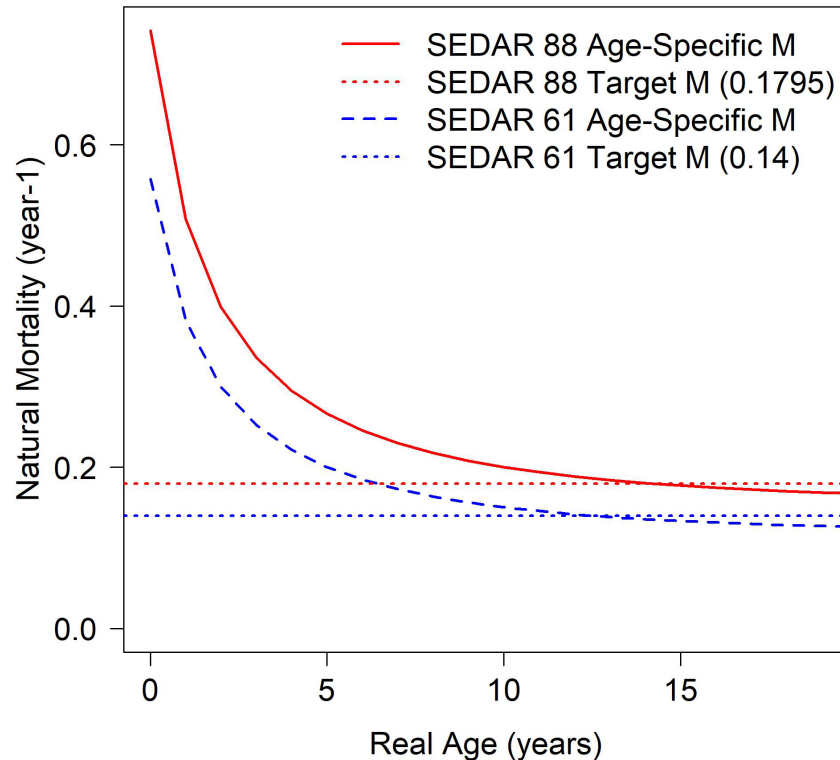
Natural Mortality

- **SSC Feedback requested:** method for M point estimate
- Then et al. 2015
 - Updated point estimate of M from S61



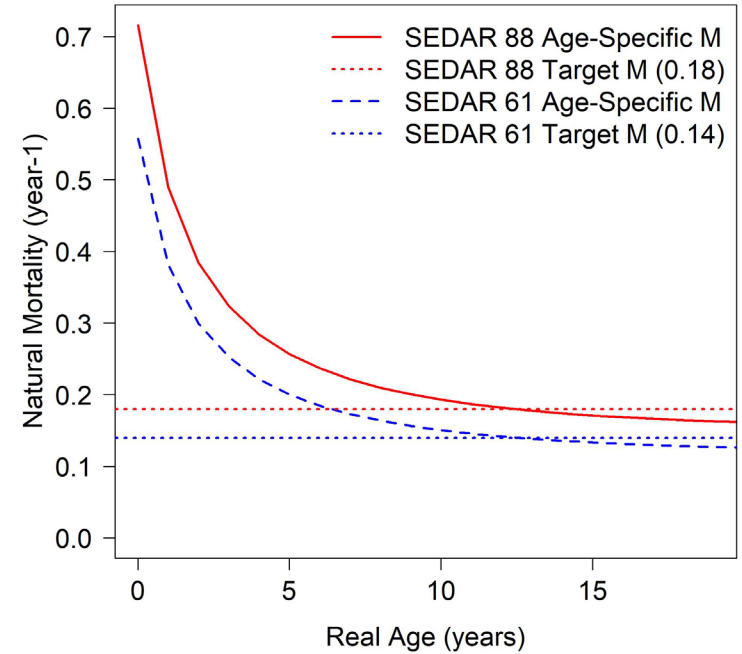
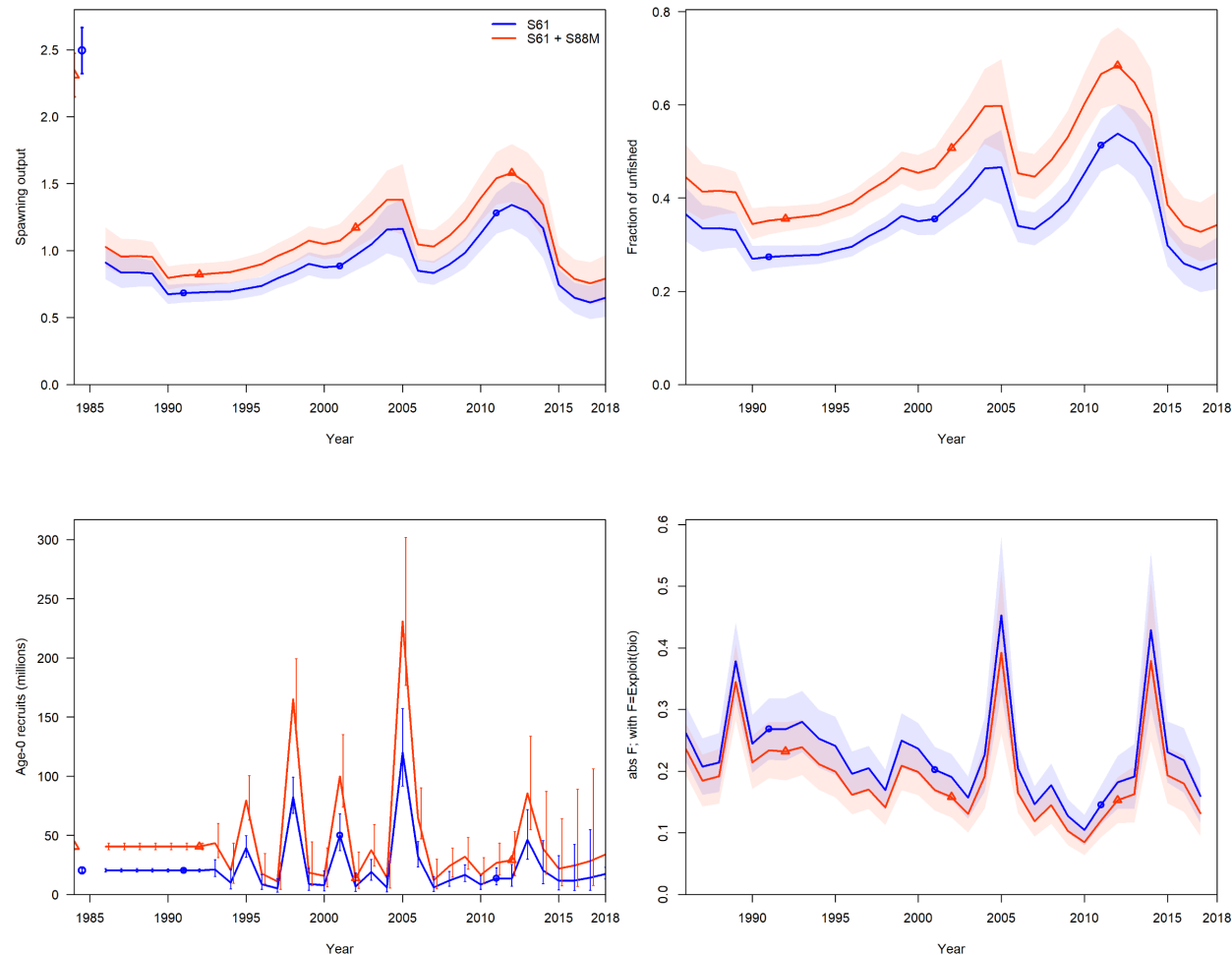
Natural Mortality

- Hamel and Cope (2022)
 - Estimate M from max age
 - Updated point estimate of M from 0.1795 (Then et al) to 0.1862



Hamel, Owen S., and Jason M. Cope. "Development and considerations for application of a longevity-based prior for the natural mortality rate." *Fisheries Research* 256 (2022): 106477.

Effects of Model Changes: Updating M



*Then et al. point estimate



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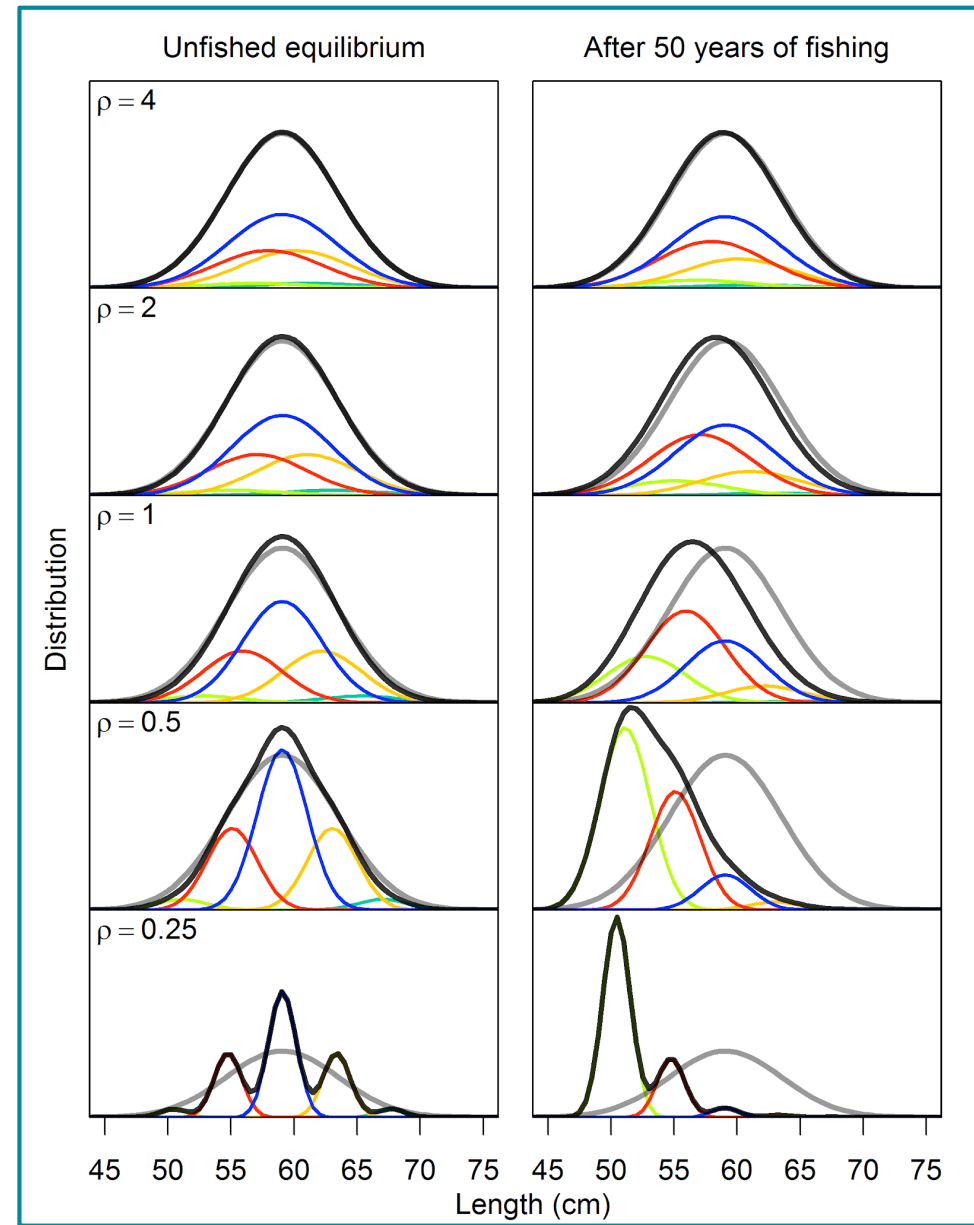
Growth

- SEDAR 42 and SEDAR 61:
 - Externally calculated L_{∞} value used and model allowed to estimate k
 - Estimated L at min age
- **SSC feedback requested:**
 - Attempt to estimate L_{∞} with use of platoons within Stock Synthesis and MLAA data



Growth

- “Rosa Lee Phenomenon”: Fish that survive fishery tend to be smaller than projected from growth of fish that entered fishery
 - Faster growing fish more vulnerable to size selective fishery and at earlier age
- SS3: platoons mimic the effect of size selectivity on the distribution of size-at-age for the surviving fish
- Possible to estimate population’s L_{∞} value: contemporary data affected by the Rosa Lee phenomenon (McGarvey et al, 2024)
- Red grouper fishery records back to mid-1880s (SEDAR 12 WP-DW- 11)



From Taylor and Methot, 2013



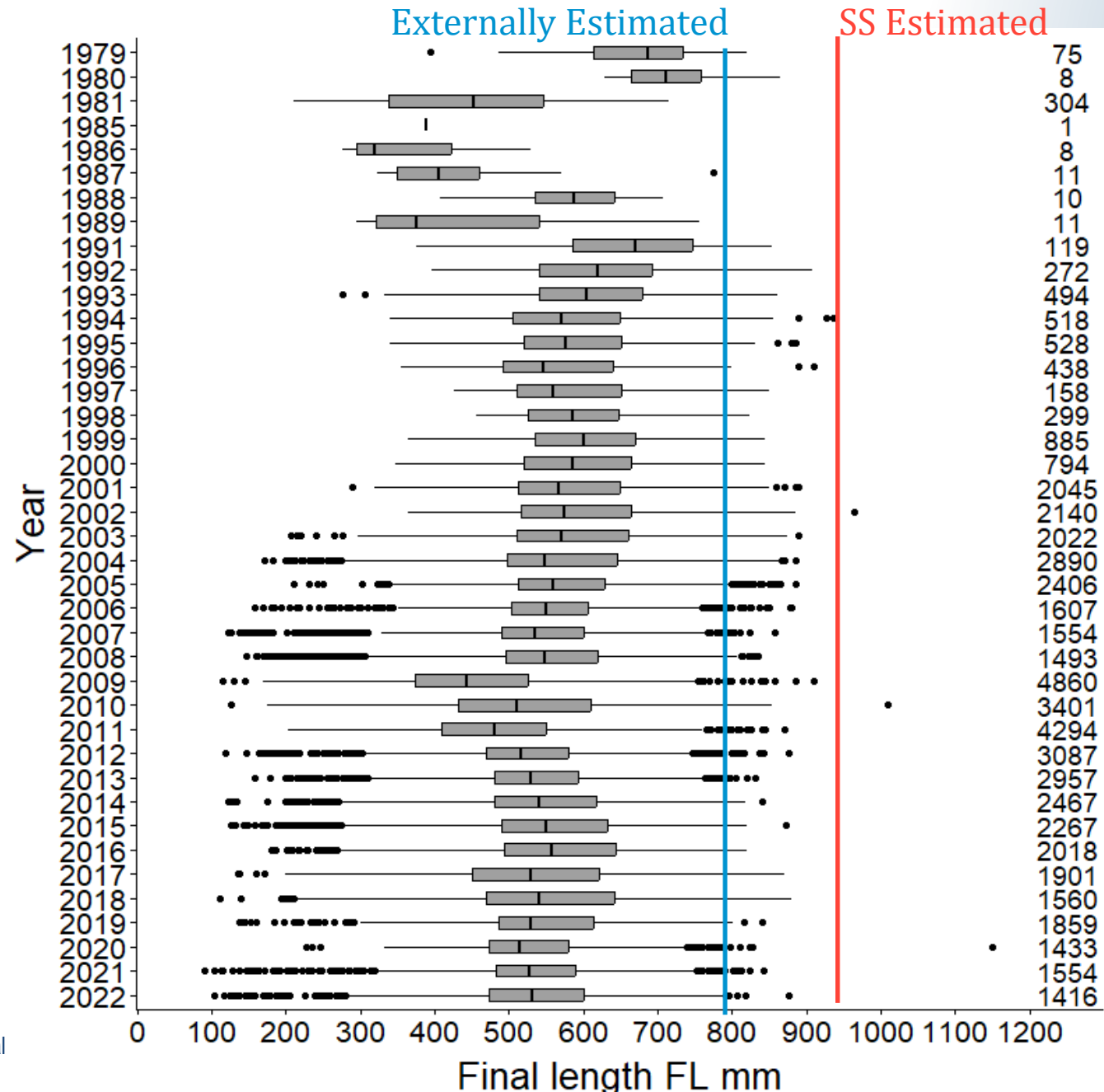
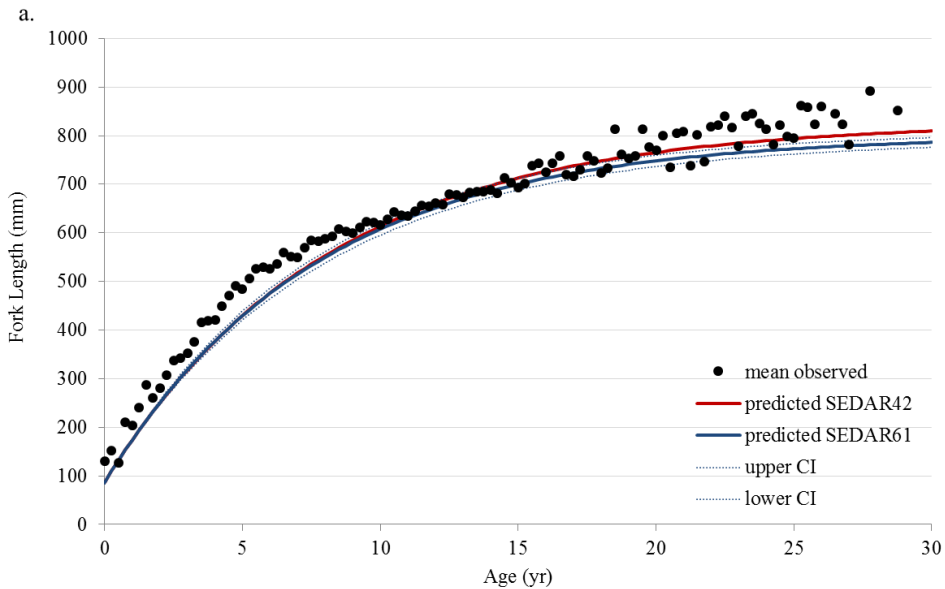
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Growth

Data from 1978-2022 (WP-88-11)

Parameter	SEDAR42	SEDAR61
Linf	82.719	79.995
k	0.124	0.131
t ₀	-0.899	-0.875

Data from 1991-2017 (SEDAR 61)



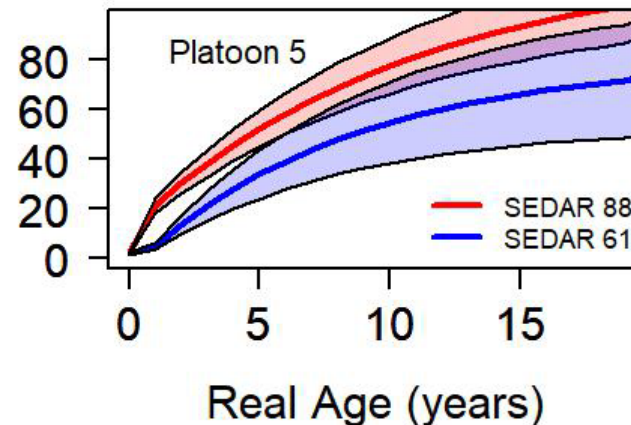
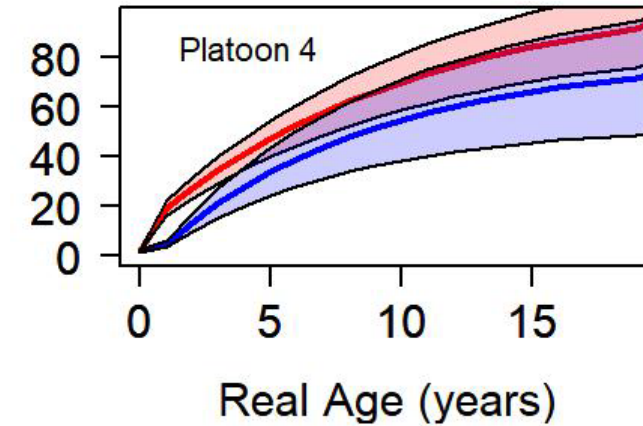
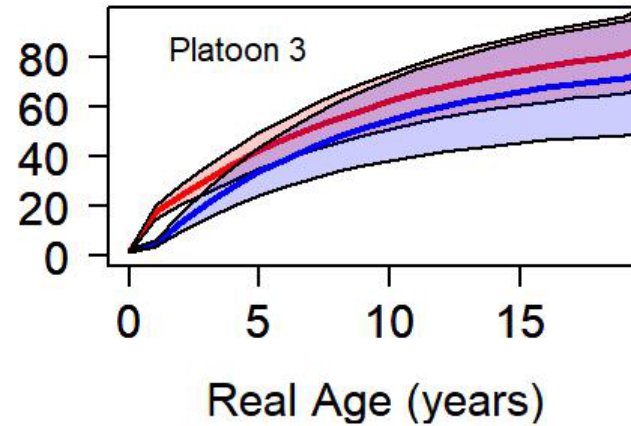
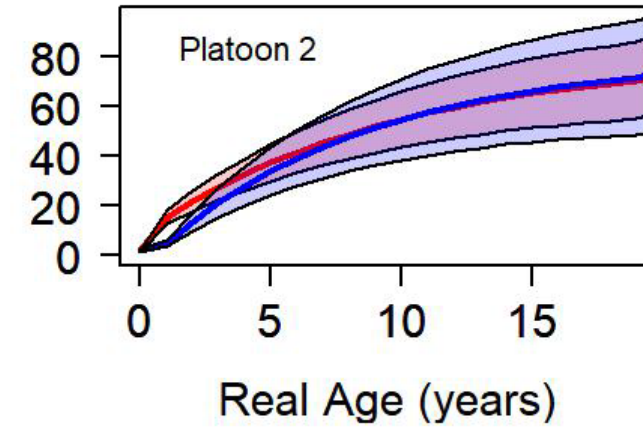
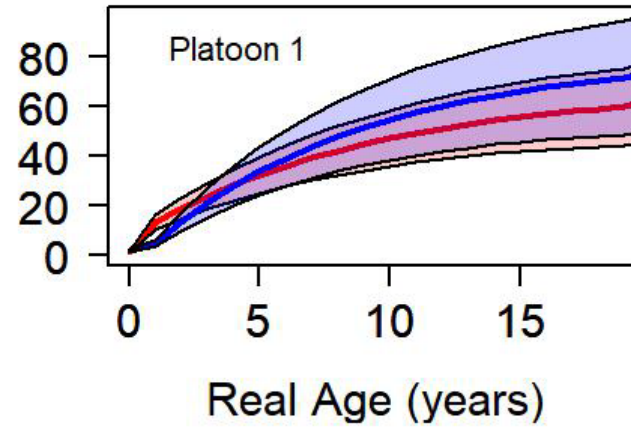
Growth

- Estimated by SS:

	L_at_Amax (cm)
Platoons	94.2 (0.032)
No Platoons	87.9 (0.03)

- As comparison:

- South Atlantic: 84.8 cm (BAM estimate SS58)
- FishBase: 125 cm (1992 ref.)



Changes to model specification

Requesting feedback on:

- Estimating steepness
- Natural mortality point estimation method
- Estimating L_{∞} with/without use of platoons

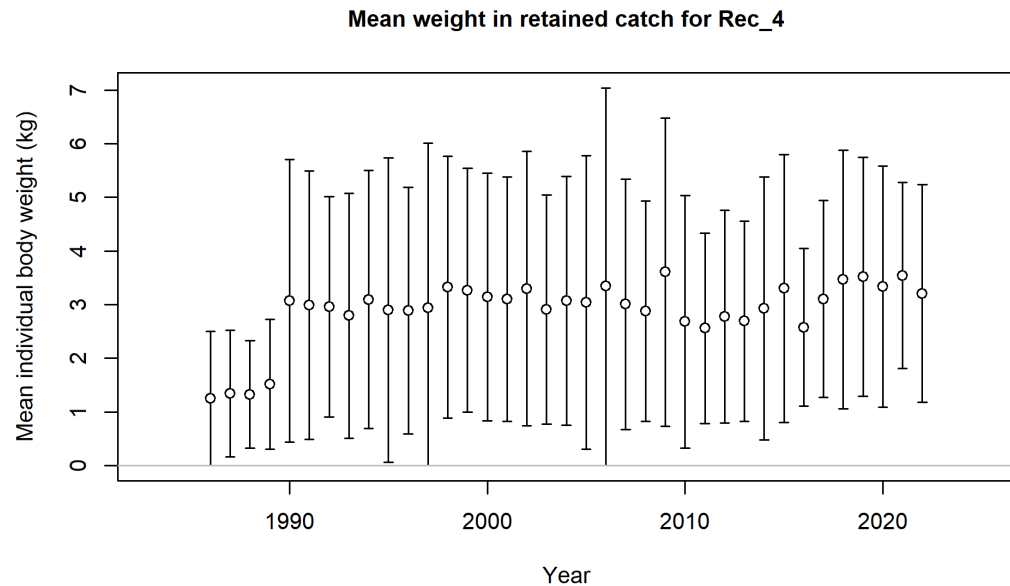
Recommended:

- Selectivity:
 - Switch from length-based selectivity for fishing fleets to age-based selectivity
 - Switch from dome shaped selectivity for Longline to logistic



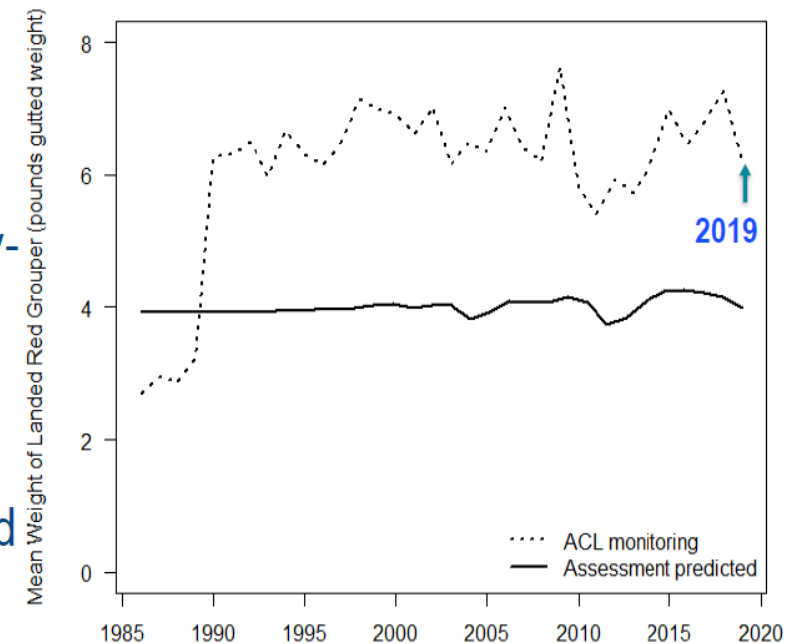
Changes to Model Specification

- Fit to mean weight of catch



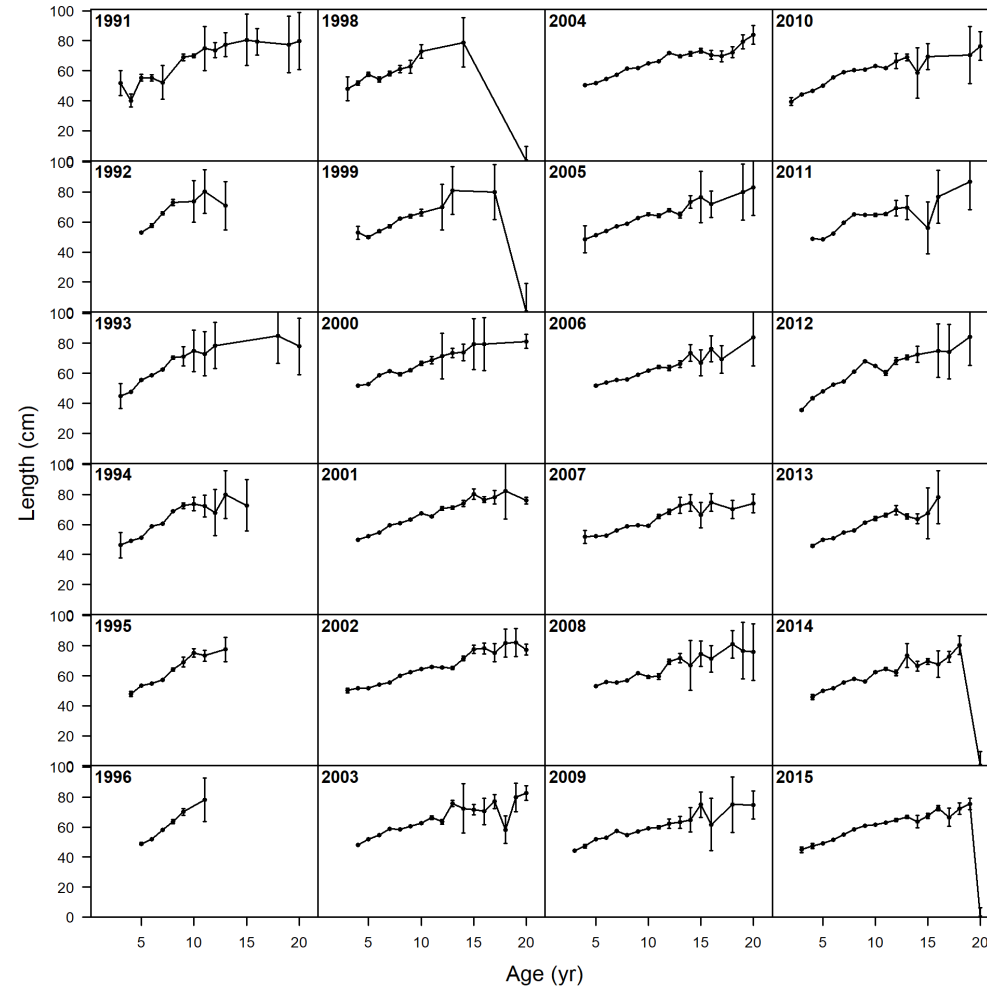
SEDAR61 mean weight of Red Grouper

- Assessment model underestimated mean weight landed by the recreational fishery
 - External growth curve (i.e., assumed distribution of variability-at-length [CV])
 - Length-weight conversion
 - No weight data included in assessment model



Changes to Model Specification

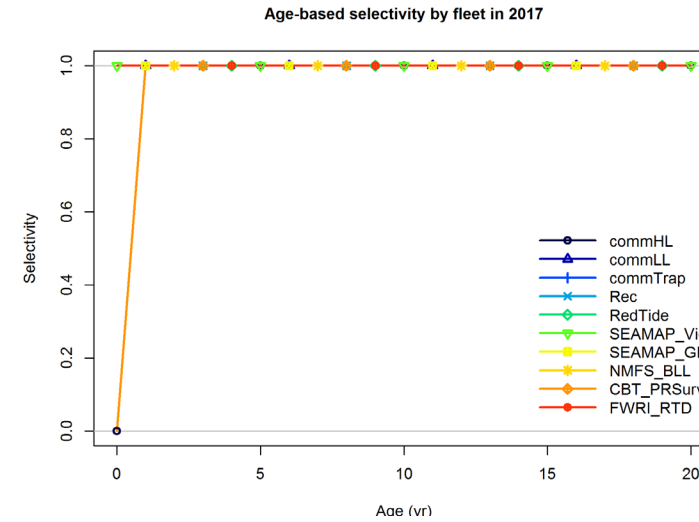
- Fit to mean weight of catch
- Input mean length at age for model checking



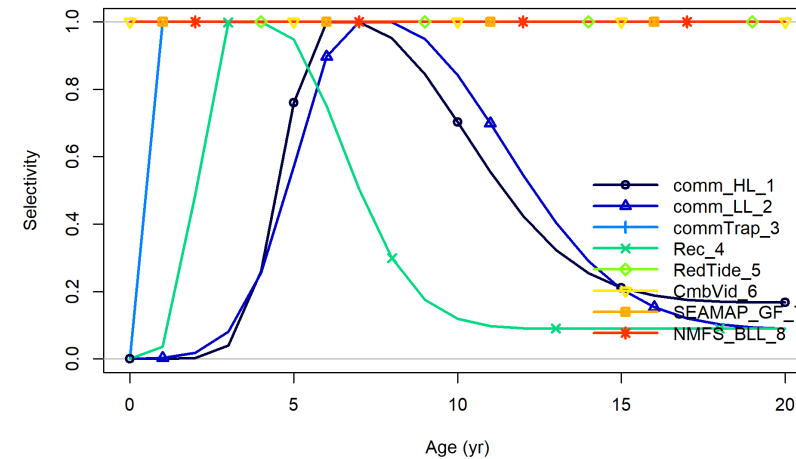
Changes to Model Specification

- Fit to mean weight of catch
- Input mean length at age for model checking
- Age selectivity for three of the fishing fleets
 - Com HL, Com LL and Rec

S61



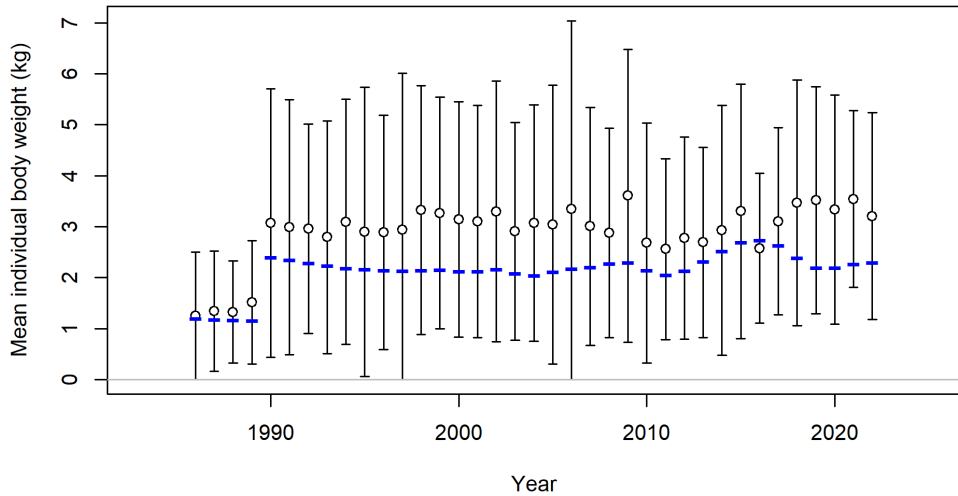
S88



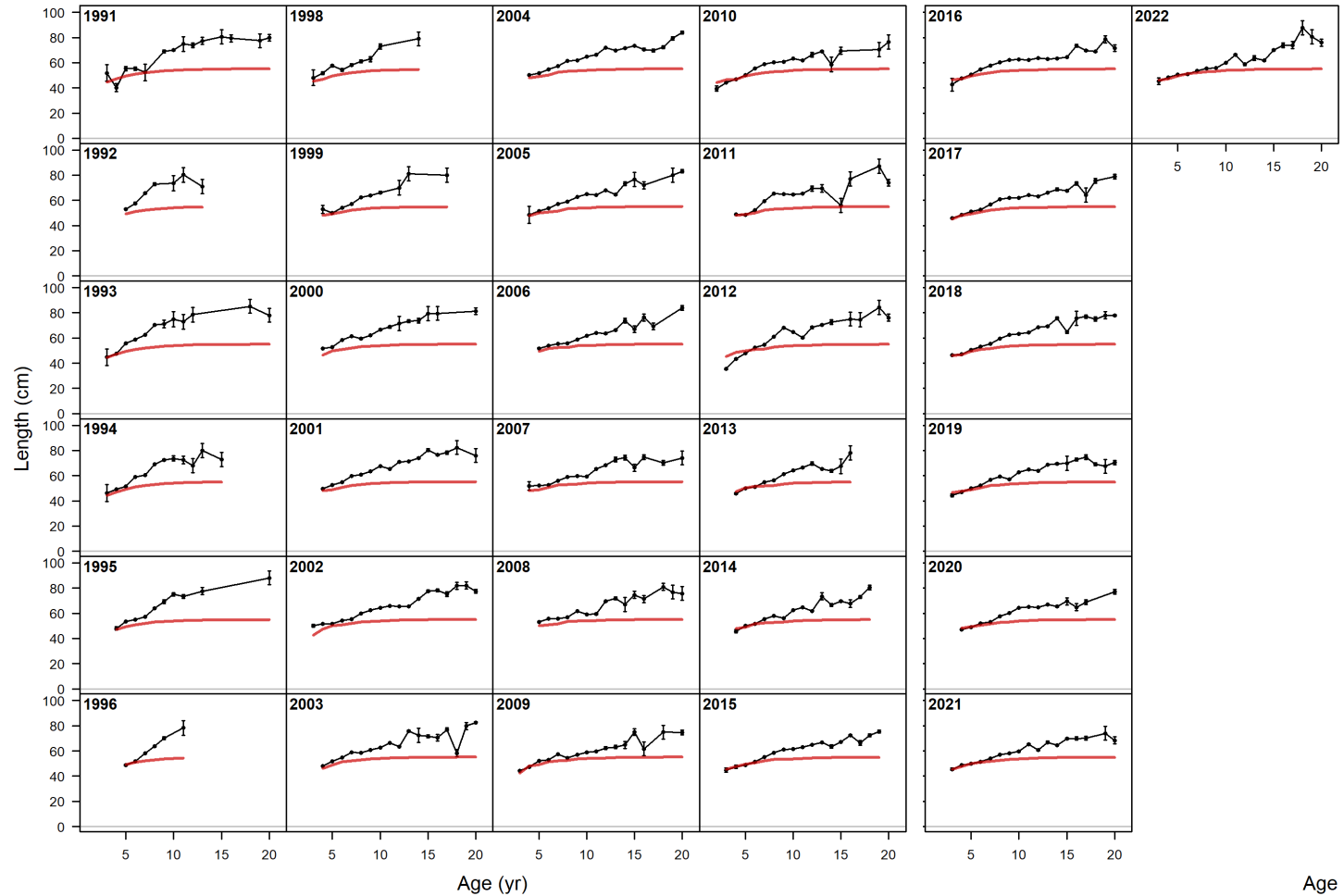
Age Selectivity vs. Length Selectivity

- Model building runs with length-based selectivity underestimated mean weight and MLAA for HL, LL and Rec
- Corrected with age-based selectivity

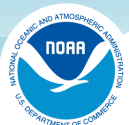
Mean weight in retained catch for Rec



Example: Longline



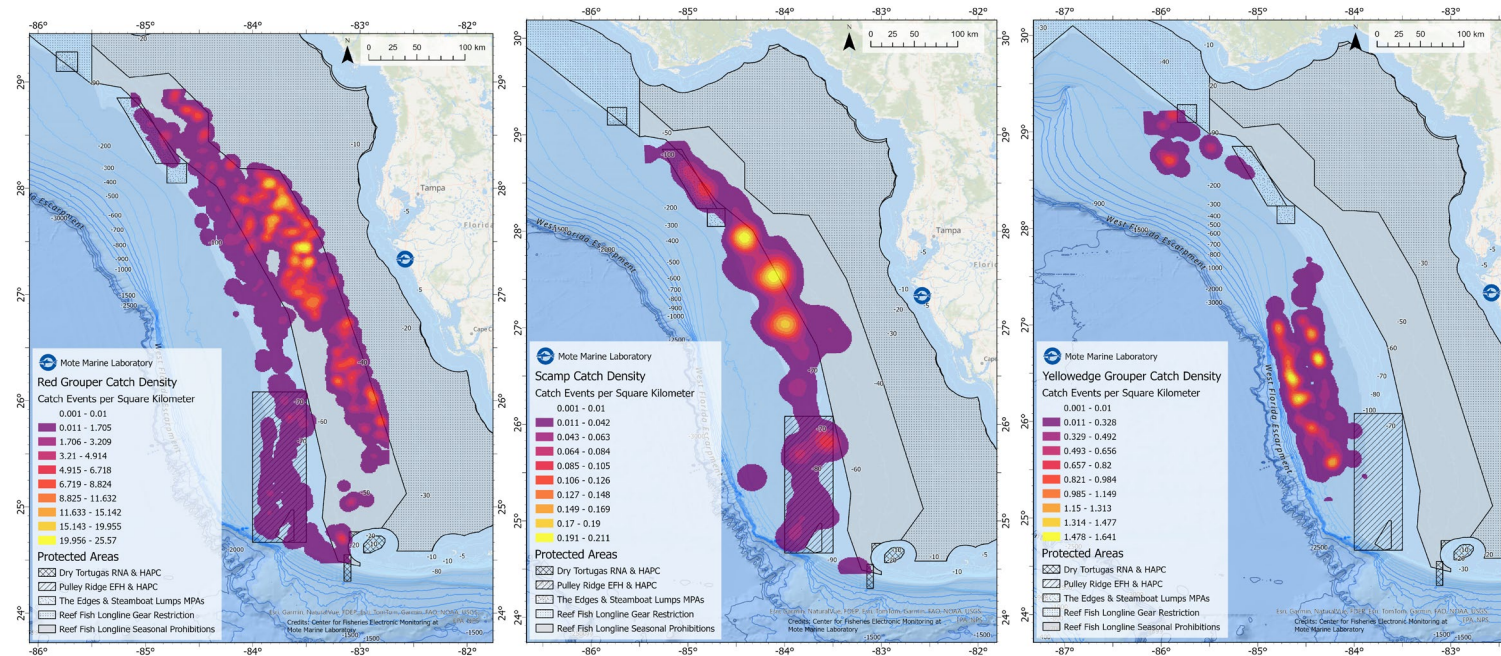
Age (



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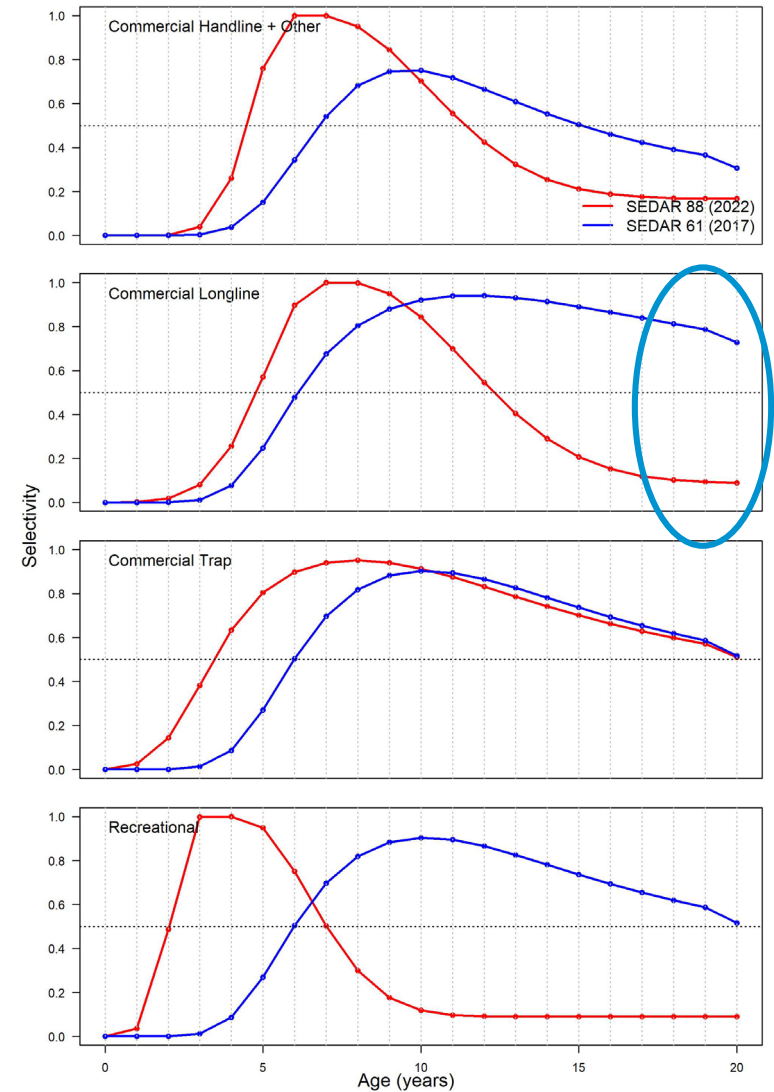
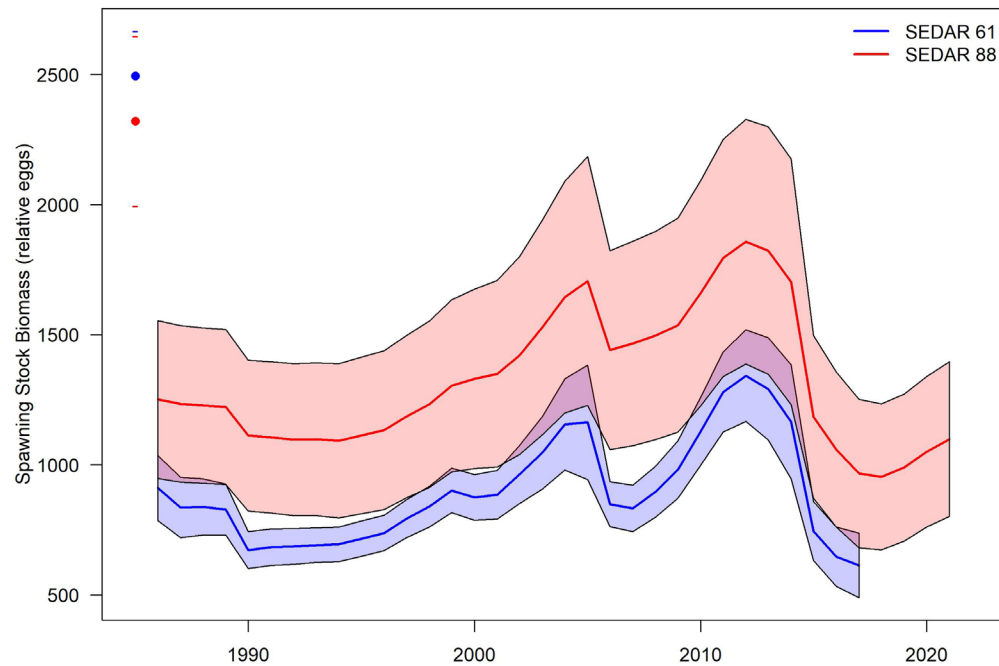
Changes to Model Specification

- Longline Selectivity:
 - Modeled as dome shaped in SEDARs 42 and 61
 - Functionally dome-shaped in SEDAR12
 - Bottom Longline modeled as logistic
 - Logistic selectivity used for Longline in other grouper species in Gulf:
 - Yellowedge
 - Gag
 - Scamp



Longline Selectivity

- Freely estimated dome shaped yielded unrealistic SSB and fishing mortality (selectivity at oldest/largest fish)



Diagnostics



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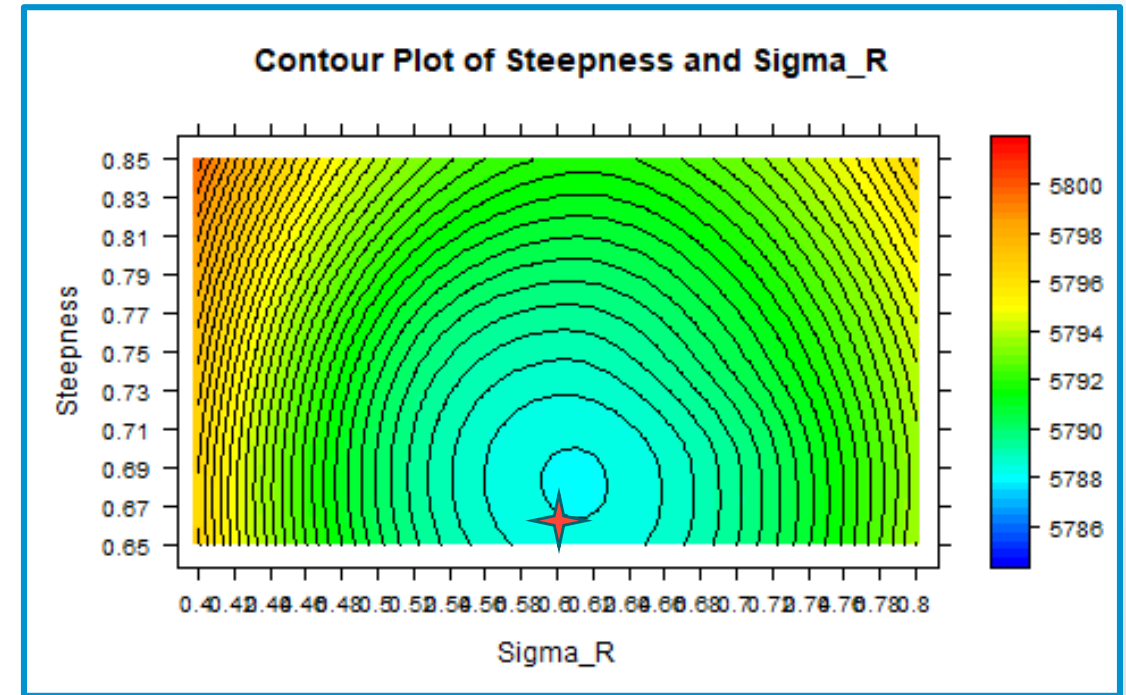
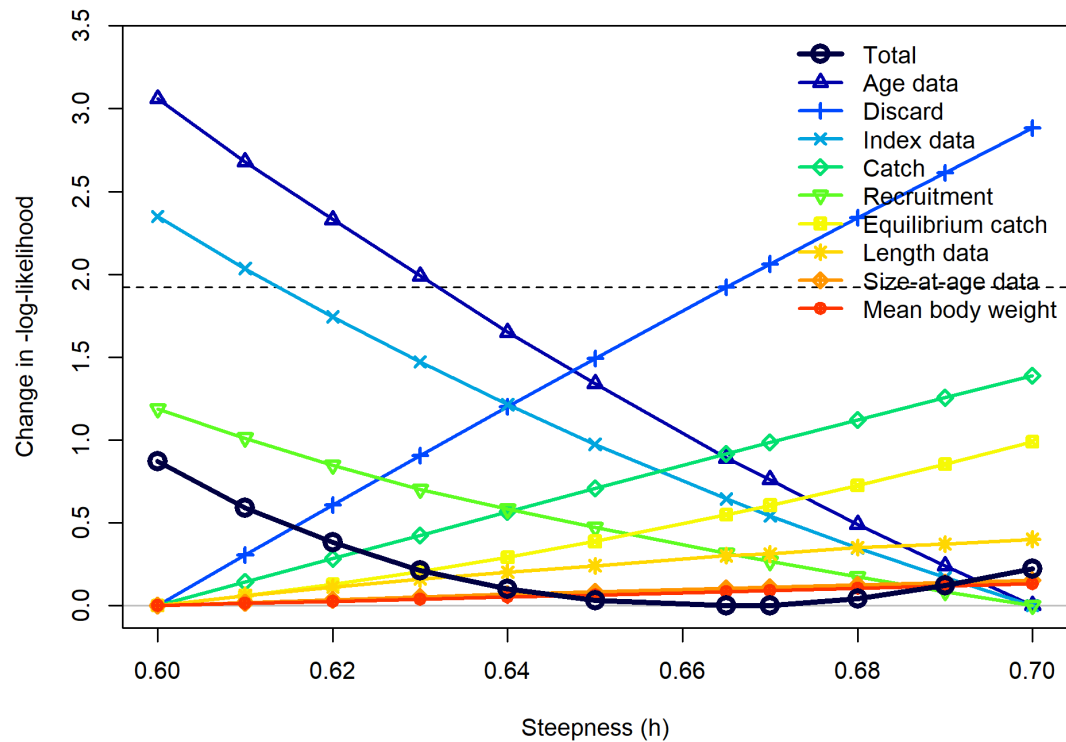
Base Options

- Run with estimated h and L_∞ lowest NLL

Parameters	Fix h, est. L_∞	Est h, est. L_∞	Est h, fix L_∞	Fix h, Fix L_∞
NLL	5,790.4	5,788.47	5,808.51	5,810.27
$L_{at_A_{min}}$	17.536 (0.018)	17.521 (0.018)	16.707 (0.027)	16.744 (0.026)
$L_{at_A_{max}}$	94.254 (0.032)	94.217 (0.032)	79.995	79.995
VonBert_K	0.098 (0.056)	0.098 (0.056)	0.132 (0.013)	0.132 (0.013)
SR_LN(R0)	10.251 (0.003)	10.305 (0.004)	10.364 (0.004)	10.315 (0.003)
SR_BH_steep	0.7859	0.663 (0.079)	0.663 (0.081)	0.7859
SR_sigmaR	0.603 (0.099)	0.599 (0.097)	0.585 (0.095)	0.585 (0.098)



Likelihood profiles



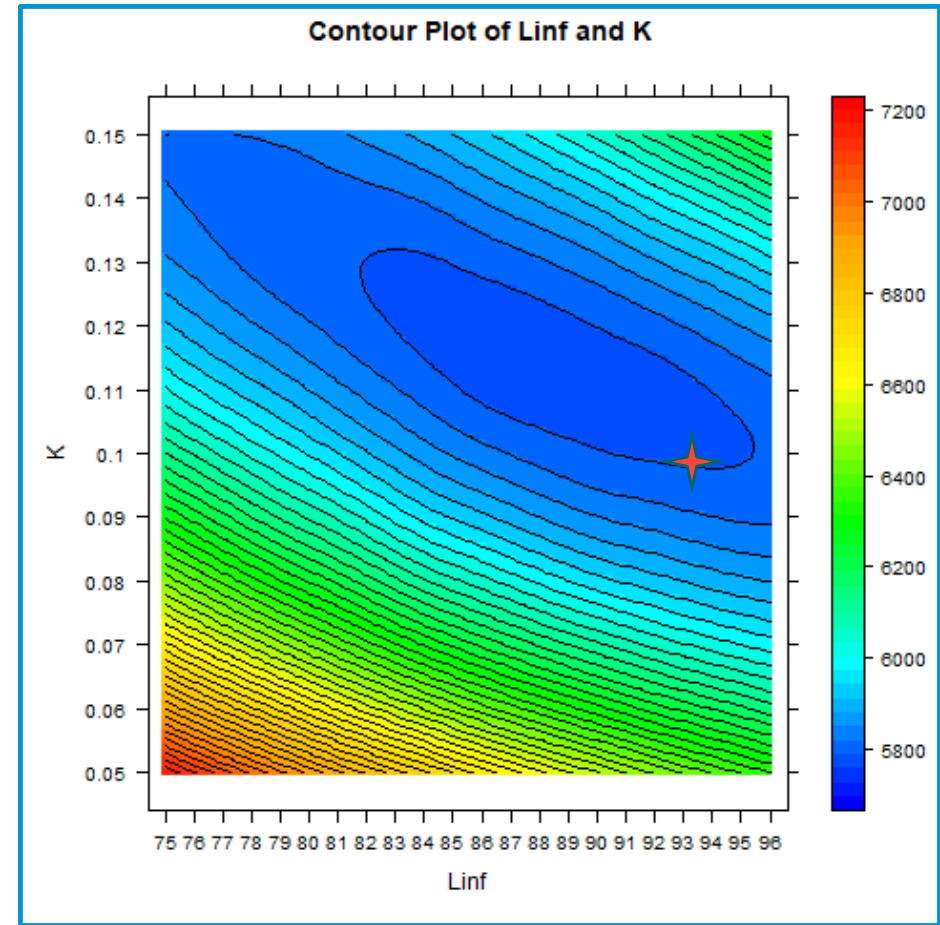
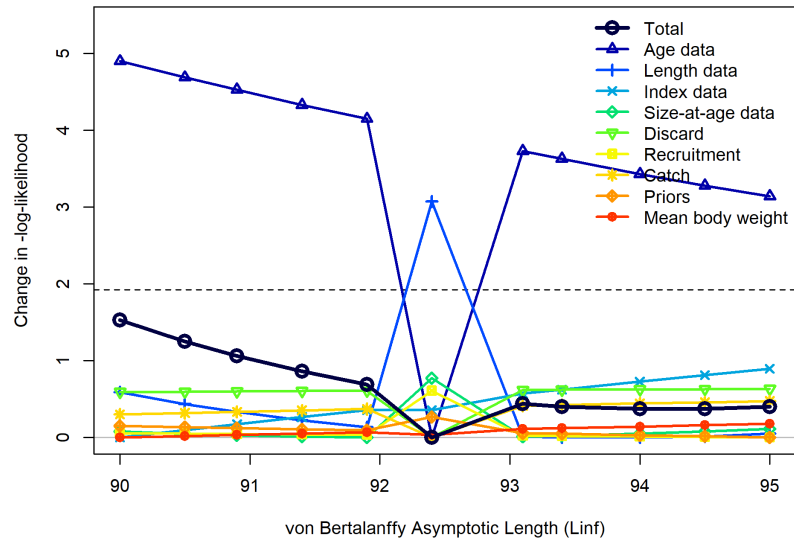
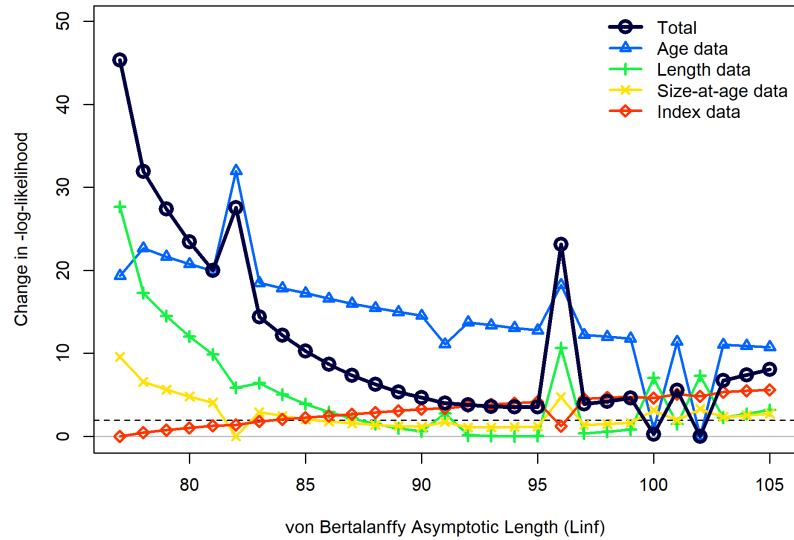
- All three S/R parameters estimated
- Acceptable to fix recruitment variability (σ_R) at 0.6
 - Model estimating close to that value

Label	Value
SR_LN(R0)	10.305 (0.004)
SR_BH_steep	0.663 (0.079)
SR_sigmaR	0.599 (0.097)



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Likelihood profiles: Growth

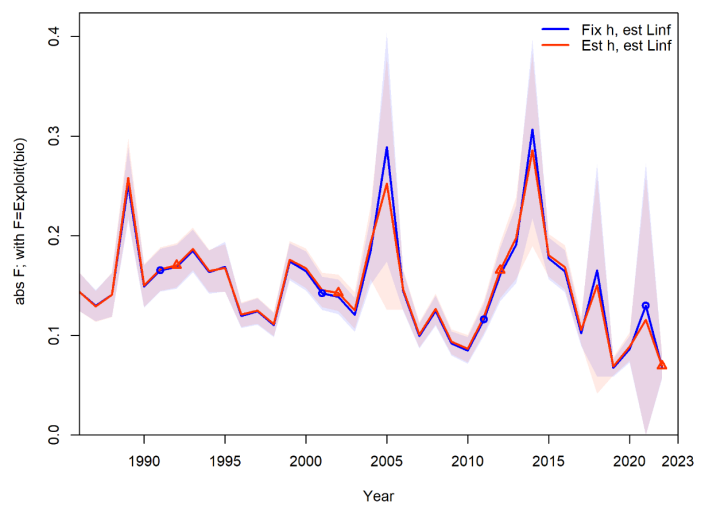
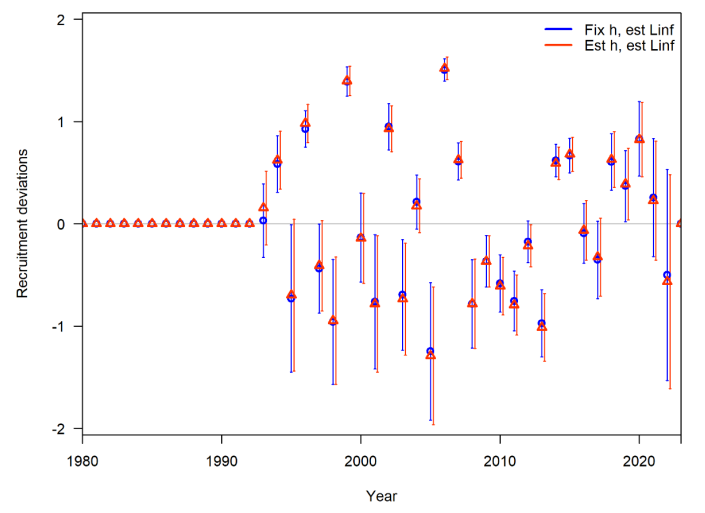
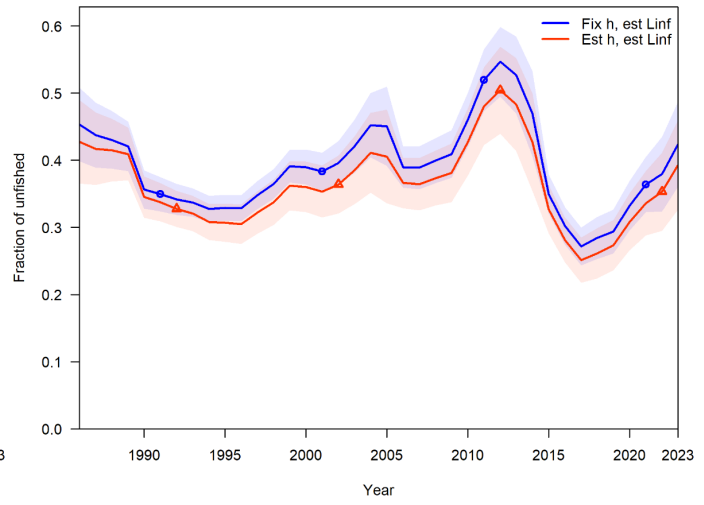
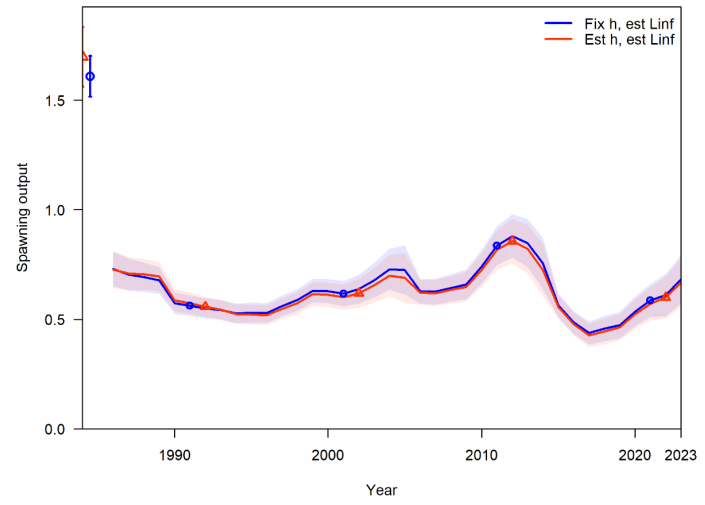


Label	Value
L_at_Amax	94.217 (0.032)
VonBert_K	0.098 (0.056)

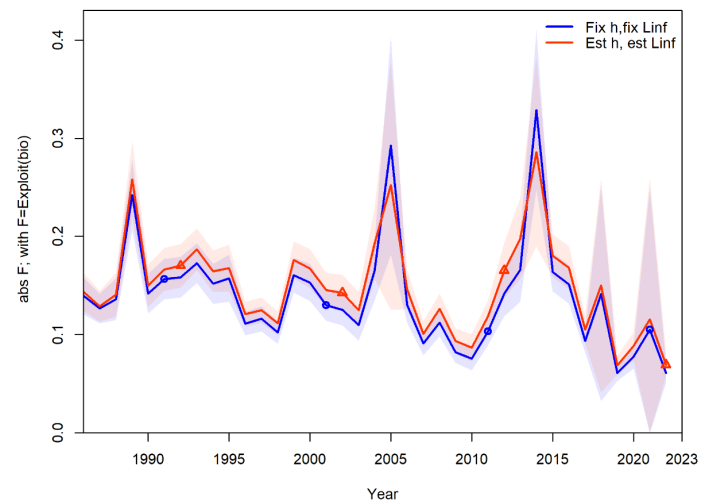
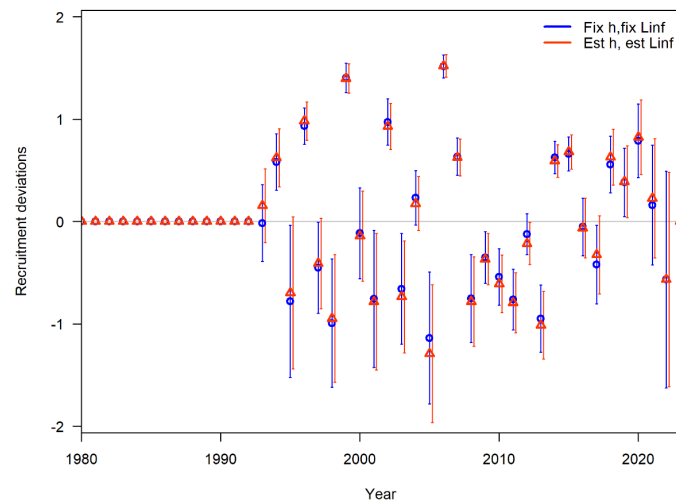
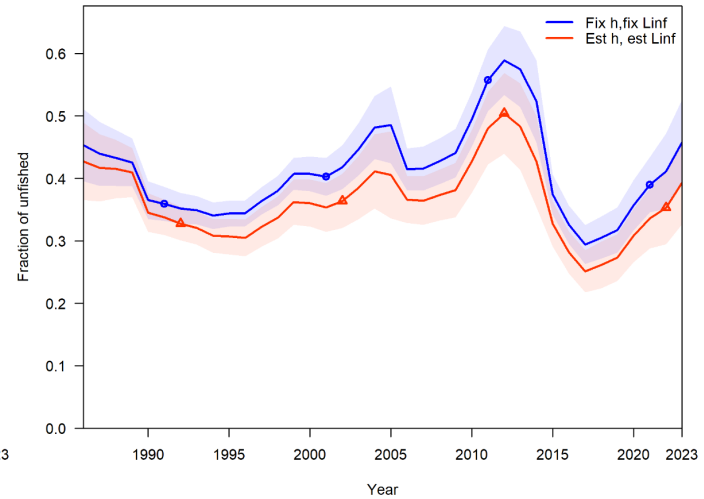
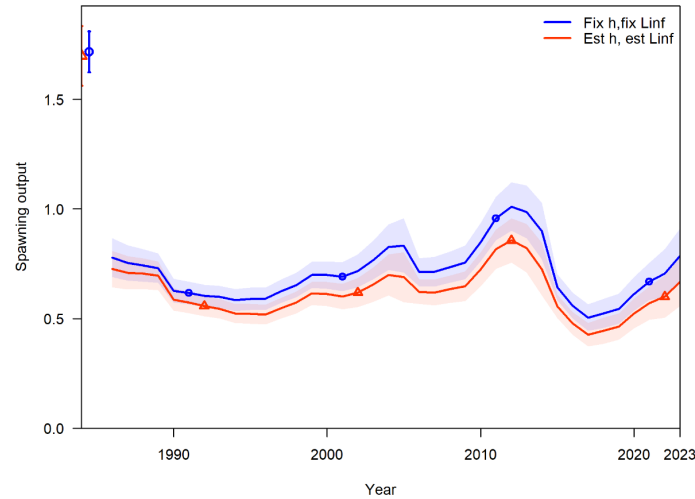


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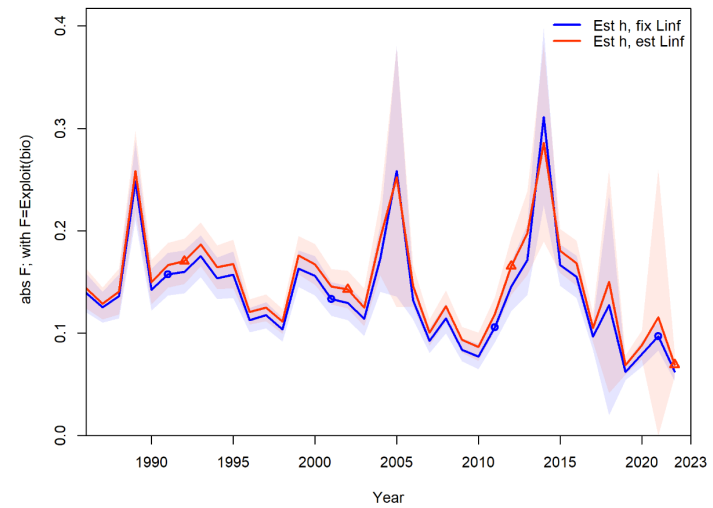
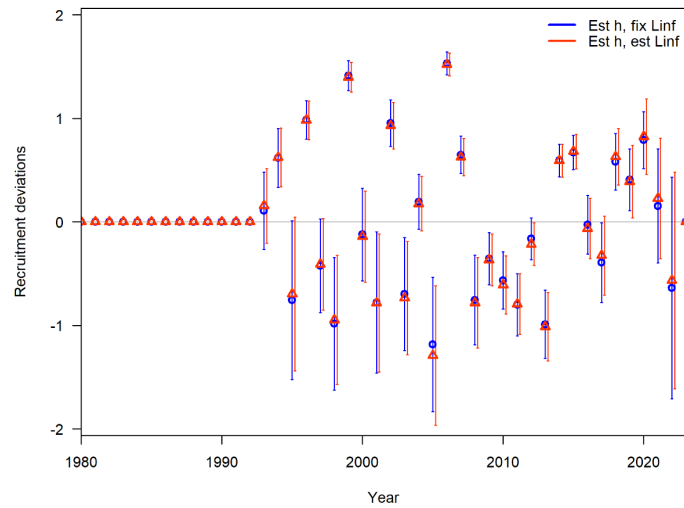
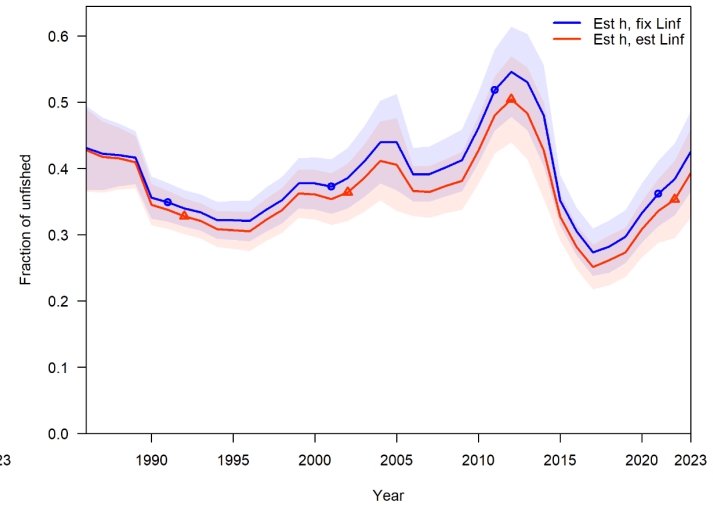
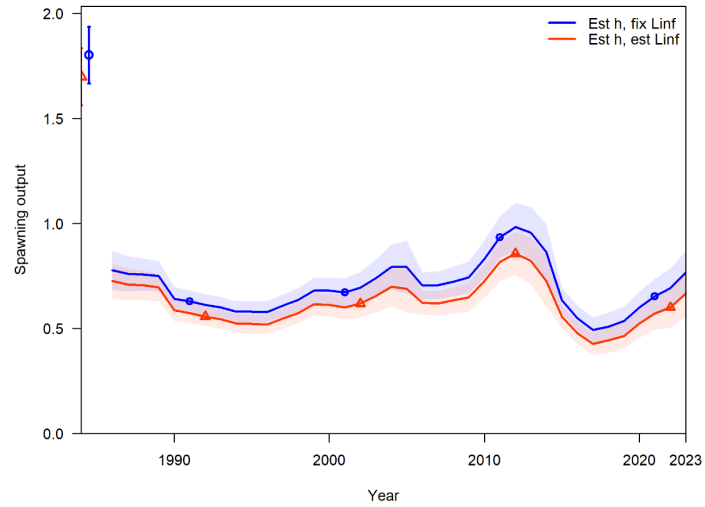
Fix vs estimate: Steepness



Fix vs estimate: Steepness & Linf



Fix vs estimate: Linf



Projection Configurations

- MSY (if steepness is estimated)
- MSY proxy = $F_{MSY} = F_{30\%SPR}$
 - Estimates of MSY proxy of $F_{40\%SPR}$ (requested in ToRs)
- No red tide mortality in interim years (2023, 2024, 2025)

SSC feedback: Any additional needs?



Next Steps

- One more red tide TWG (Jan)
 - Review empirical age-based selectivity for red tide years
- Projections: to be presented at February SSC Meeting



Thank you!



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