SEDAR 68 OA
South Atlantic Scamp & Yellowmouth Grouper: Follow-up analyses

NOAA FISHERIES
SEFSC
Atlantic Fisheries Branch
Beaufort, NC

SSC Review

April 2023

Topics

- Council requests (abbreviated here, full text in accompanying report)
  - A base run with the MSY proxy at 30% static spr is needed.
  - Guidance on developing a rebuilding scenario for overfished stocks to determine Tmin would be useful for the SSC discussions in April.

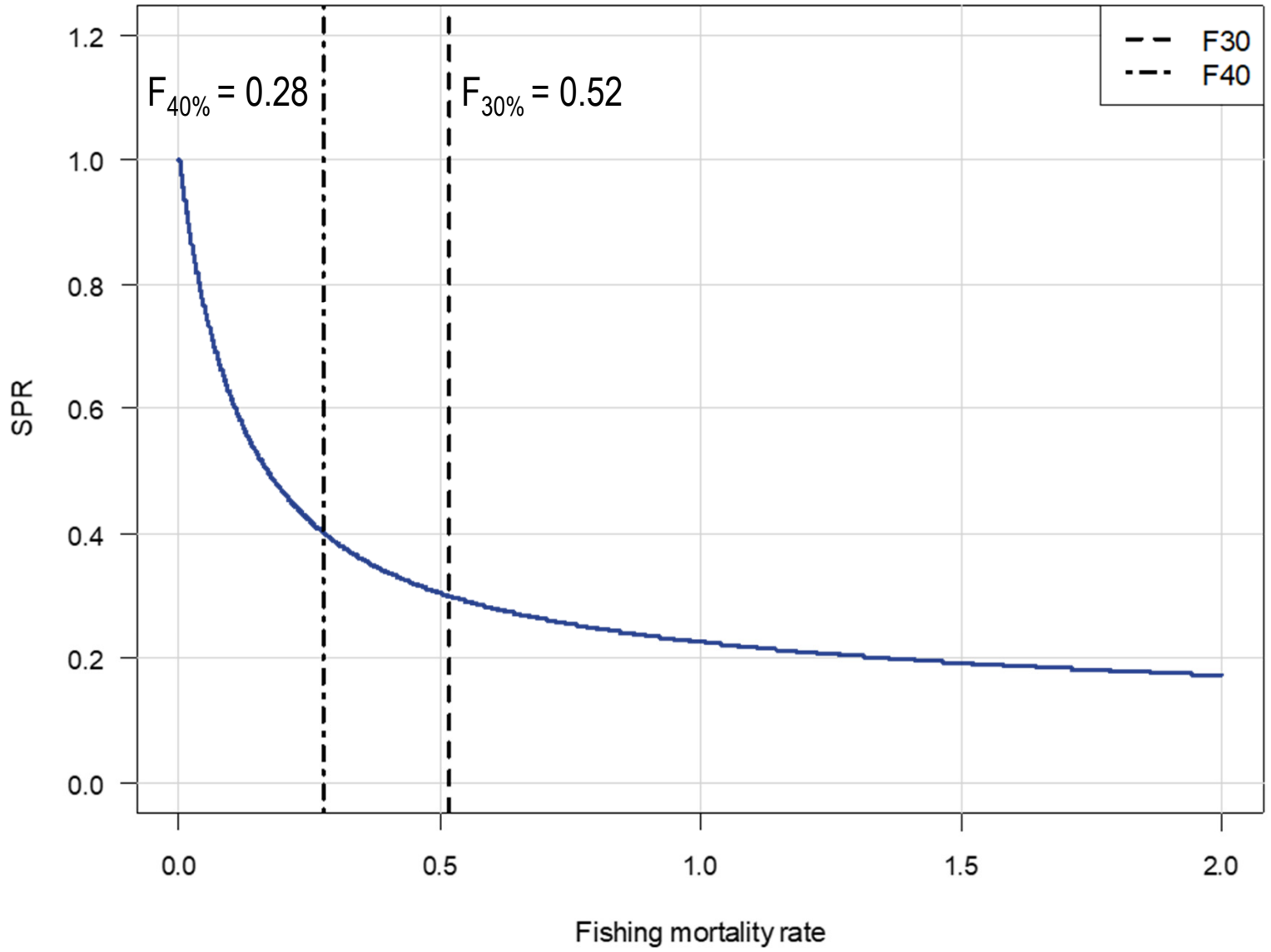
- SSC request (from January 20 report)
  - The SSC requests the following analysis: Determine constant F that will allow the stock to rebuild within 10-year time frame assuming long-term average recruitment.

SPR

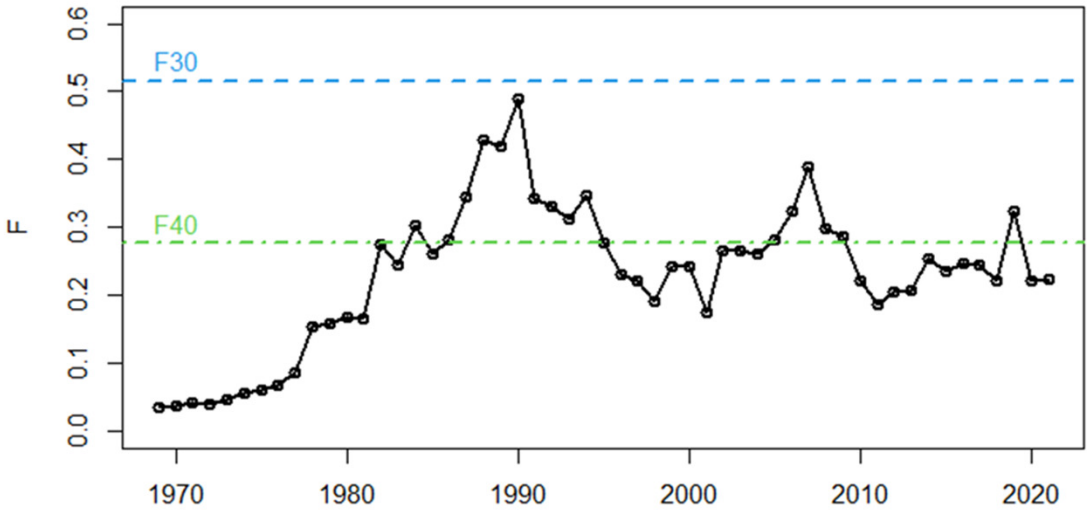
SPR=30%

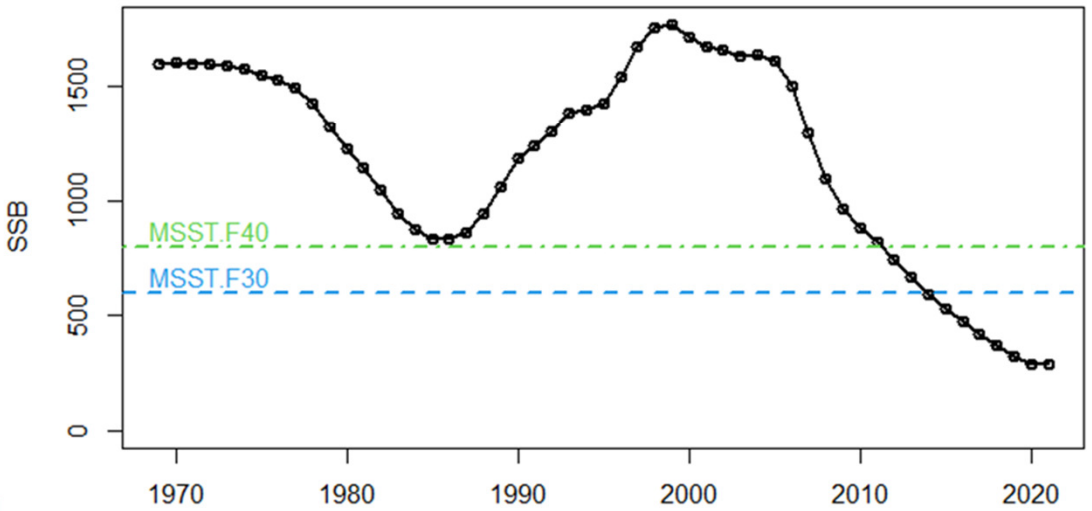
- The assessment recommended SPR=40%
- The SSC agreed
  - "F40% as MSY proxy is supported by recent literature and also aspects of scamp life history (e.g., their protogynous reproductive strategy). F40% is also supported by the uncertainty in discard rates and natural mortality, similar to other members of the snapper-grouper complex."
- In consideration of SPR=40%, the Council requested the comparison to SPR=30%

SPR = 30% and SPR = 40%



F and SSB time series





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REBUILDING TIME FRAME

Rebuilding time frame (from NS1 Guidelines)

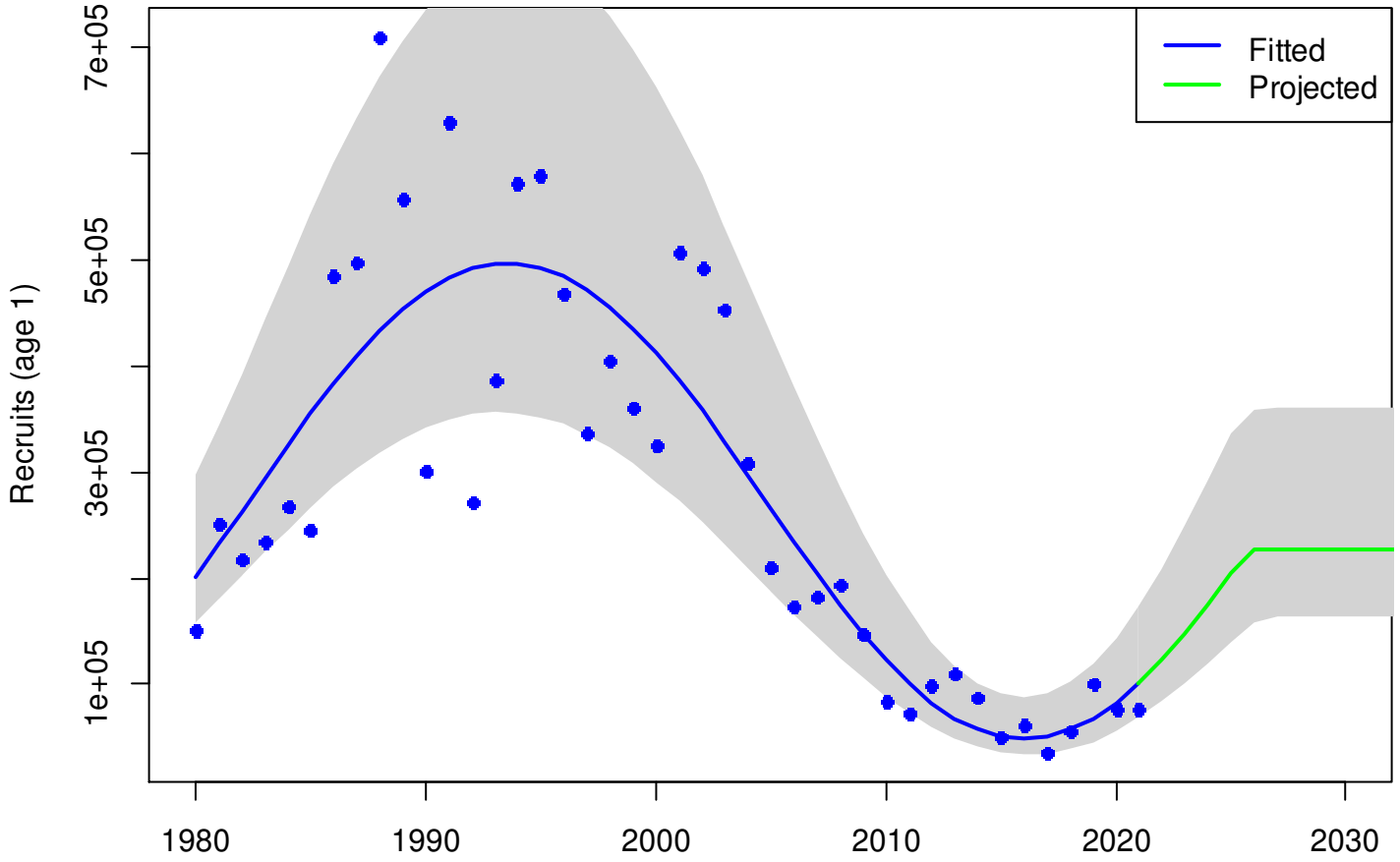
- T_{min} means the amount of time the stock or stock complex is expect to take to rebuild to its MSY biomass level in the absence of any fishing mortality. In this context, the term "expected" means to have at least a 50 percent probability of attaining the B_{msy}, where such probabilities can be calculated. The starting year for the T_{min} calculation should be the first year that the rebuilding plan is expected to be implemented.
- If Tmin for the stock or stock complex is 10 years or less, then Tmax is 10 years. If Tmin for the stock or stock complex exceeds 10 years, then one of the following methods can be used to determine Tmax:
  - i. Tmin plus the length of time associated with one generation time for that stock or stock complex. "Generation time" is the average length of time between when an individual is born and the birth of its offspring,
  - ii. The amount of time the stock or stock complex is expected to take to rebuild to Bmsy if fished at 75 percent of MFMT, or
  - iii. Tmin multiplied by two.

First step: compute T_{min}

- Projection with F = 0
- New management (F = 0) assumed to start in 2025
  - Advice from SERO, based on the Council having two years to implement a rebuilding plan from when they are notified of overfished status
- Two potential probabilities of rebuilding
  - 0.5 (minimum probability specified by NS1)
  - 0.7 (based on SSC P*)
- Two assumptions about recruitment
  - Long-term average starting in 2023
  - Hypothetical, more gradual return to the long-term average …

Hypothetical, more gradual return

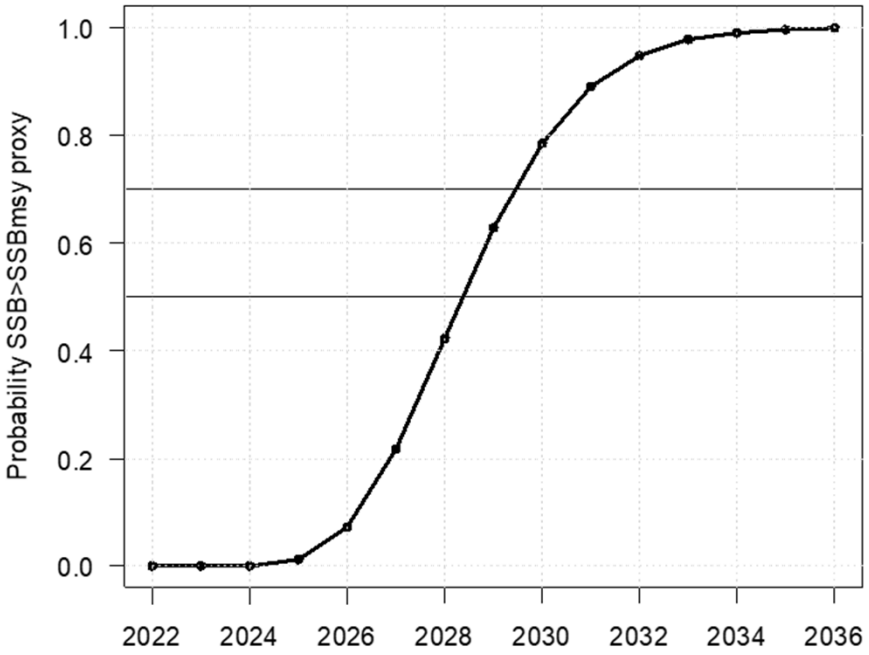
- Fit a sine curve to the assessment values and continue it forward in time until reaching the long-term average
- Repeat for each MCBE iteration
- Intent is NOT to hypothesize long-term cyclic spawning, but rather to use gradients from the past to predict the gradient in the future


Recruits (age 1)
1e+05
3e+05
5e+05
7e+05
1980
1990
2000
2010
2020
2030
Fitted
Projected

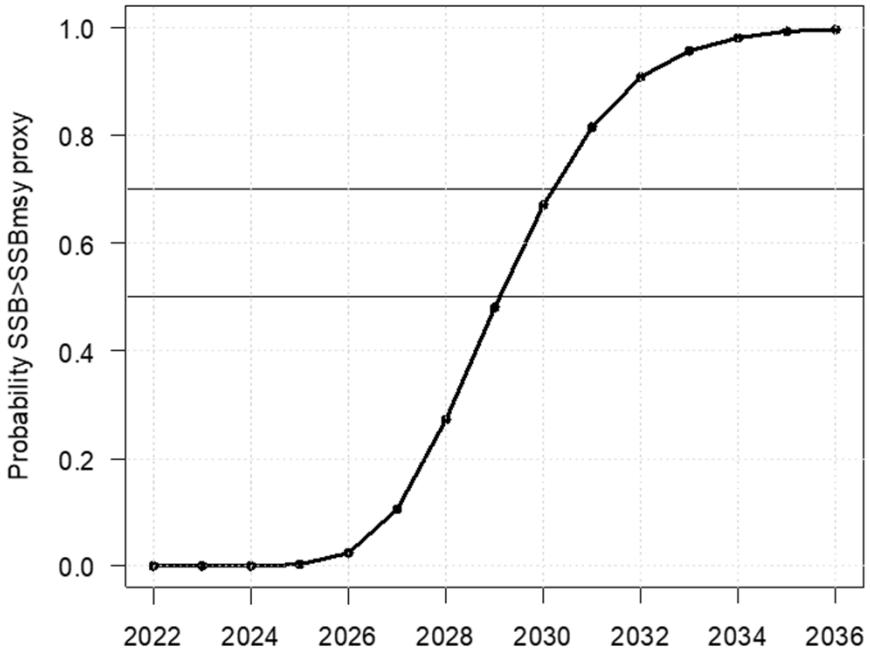
Probability of rebuilding

- With either probability and either recruitment assumption, the stock rebuilds within 10 yr of 2025

Long-term average



Sine → long-term average



Time frame for rebuilding

- Based on those projections, $T_{min} < 10$
- $T_{max} = 10$ yr
- Thus, the target year for rebuilding would be 2034, and that year was used in subsequent rebuilding projections

FORECASTS

Forecast scenarios

- Four scenarios to fulfill the SSC request
  - *"The SSC requests the following analysis: Determine constant F that will allow the stock to rebuild within 10-year time frame assuming long-term average recruitment."*

- Two scenarios to address the SSC comment
  - *"The rebuilding schedule should be based on long-term recruitment patterns following conclusions from the Catch Level Projections workgroup report. However, near-term ABC should be determined using recent recruitment estimates."*

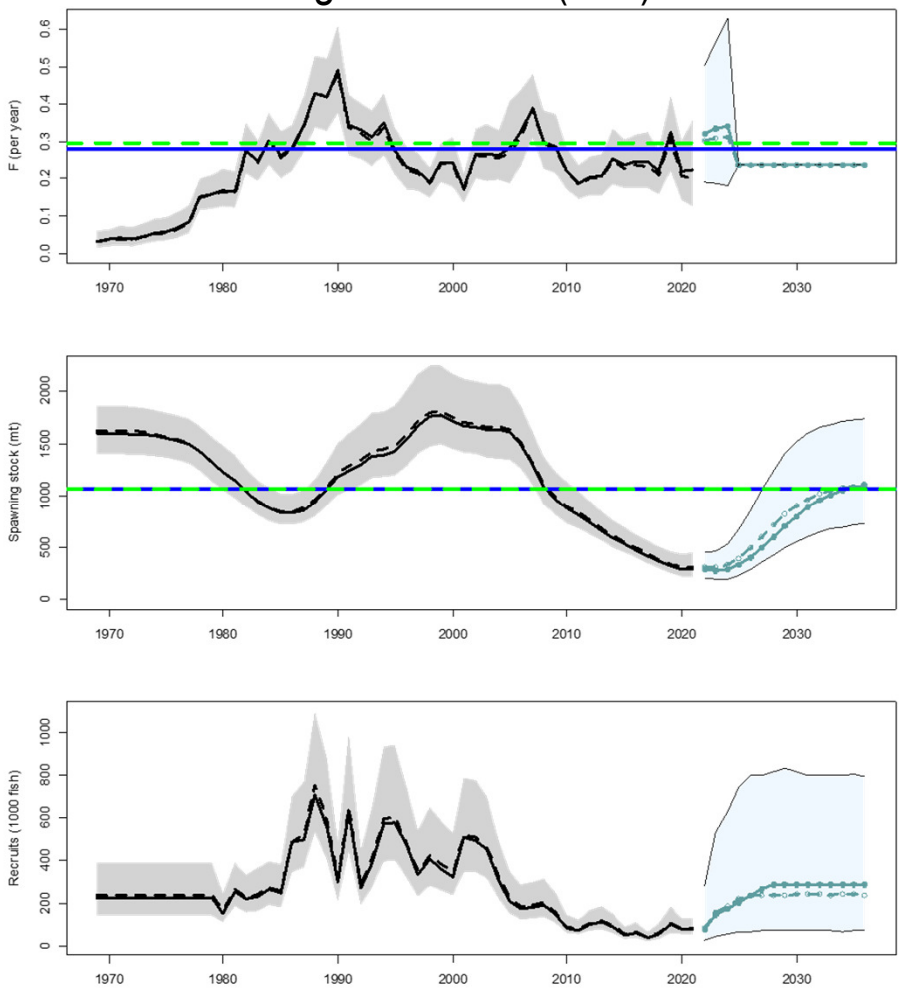
Forecast scenarios

- Scenario 3. F = $F_{rebuild}$, with Prebuild = 0.5 and long-term average recruitment starting in 2023.
- Scenario 4. F = $F_{rebuild}$, with Prebuild = 0.7 and long-term average recruitment starting in 2023.
- Scenario 5. F = $F_{rebuild}$, with Prebuild = 0.5 and increasing recruitment (sine) starting in 2023 until reaching the long-term equilibrium.
- Scenario 6. F = $F_{rebuild}$, with Prebuild = 0.7 and increasing recruitment (sine) starting in 2023 until reaching the long-term equilibrium.

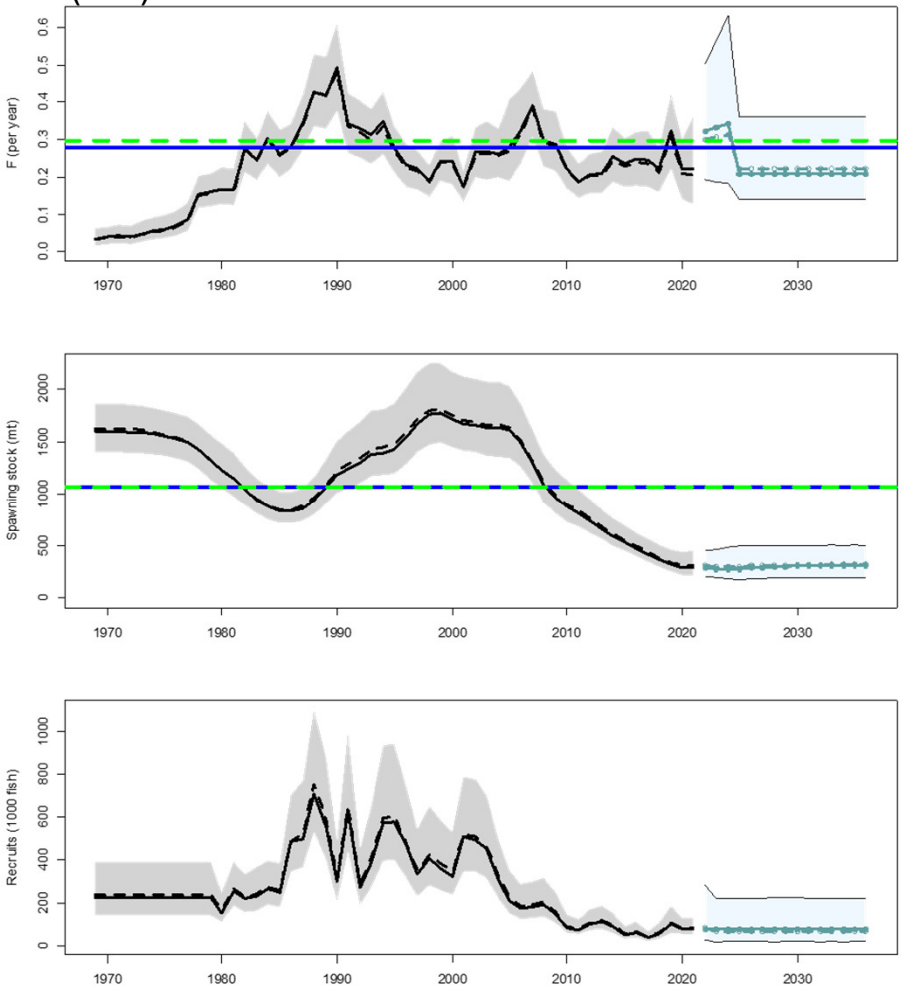
- Scenario 7. F = 75%F40, with recent average (low) recruitment.
- Scenario 8. F = $F_{current}$, with recent average (low) recruitment.

Example forecasts

Scenario 5: F = $F_{rebuild}$, with Prebuild = 0.5 and increasing recruitment (sine)



Scenario 7: F = 75%$F_{40\%}$, with recent average (low) recruitment



Scenario 7

Table 6. Scenario 7: F = 75%$F_{40\%}$, with recent average (low) recruitment. Values shown include recruitment (R), fishing rate (F), spawning biomass (S), total removals of landings and dead discards (TR) in both numbers and weight, and probability of rebuilding (pr.rebuild). Extension ".base" refers to deterministic projections extending from the base assessment model, and ".med" refers to median values from the stochastic MCBE projections.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	TR.base (1000)	TR.med (1000)	TR.base (1000 lb)	TR.med (1000 lb)	pr.rebuild
2022	76	83	0.32	0.30	289	311	17	17	115	115	0.00
2023	76	65	0.33	0.31	281	307	18	18	115	115	0.00
2024	76	65	0.34	0.31	273	305	19	19	115	115	0.00
2025	76	66	0.21	0.22	273	304	12	14	71	83	0.00
2026	76	65	0.21	0.22	284	308	12	14	76	88	0.00
2027	76	64	0.21	0.22	293	311	13	14	79	89	0.00
2028	76	65	0.21	0.22	300	313	13	14	82	90	0.00
2029	76	65	0.21	0.22	305	314	14	14	84	90	0.00
2030	76	66	0.21	0.22	309	316	14	14	86	91	0.00
2031	76	65	0.21	0.22	312	317	14	14	87	91	0.00
2032	76	65	0.21	0.22	314	318	14	14	88	91	0.00
2033	76	65	0.21	0.22	315	320	14	14	88	91	0.00
2034	76	65	0.21	0.22	317	320	14	14	89	92	0.00
2035	76	65	0.21	0.22	317	320	14	14	89	92	0.00
2036	76	65	0.21	0.22	318	320	14	14	90	92	0.00

Scenario 8

Table 7. Scenario 8: F = $F_{current}$, with recent average (low) recruitment. Values shown include recruitment (R), fishing rate (F), spawning biomass (S), total removals of landings and dead discards (TR) in both numbers and weight, and probability of rebuilding (pr.rebuild). Extension ".base" refers to deterministic projections extending from the base assessment model, and ".med" refers to median values from the stochastic MCBE projections.

year	R.base (1000)	R.med (1000)	F.base	F.med	S.base (mt)	S.med (mt)	TR.base (1000)	TR.med (1000)	TR.base (1000 lb)	TR.med (1000 lb)	pr.rebuild
2022	76	83	0.32	0.30	289	311	17	17	115	115	0.000
2023	76	65	0.33	0.31	281	307	18	18	115	115	0.000
2024	76	65	0.34	0.31	273	305	19	19	115	115	0.000
2025	76	66	0.25	0.24	271	304	14	14	85	88	0.000
2026	76	65	0.25	0.24	277	307	14	15	87	91	0.000
2027	76	64	0.25	0.24	281	309	15	15	89	92	0.000
2028	76	65	0.25	0.24	284	310	15	15	91	93	0.000
2029	76	65	0.25	0.24	287	310	15	15	92	93	0.000
2030	76	66	0.25	0.24	288	309	15	15	93	93	0.000
2031	76	65	0.25	0.24	290	309	15	15	94	93	0.000
2032	76	65	0.25	0.24	291	309	15	15	94	93	0.000
2033	76	65	0.25	0.24	291	309	15	15	94	93	0.000
2034	76	65	0.25	0.24	292	309	15	15	95	93	0.000
2035	76	65	0.25	0.24	292	308	15	15	95	93	0.000
2036	76	65	0.25	0.24	292	308	15	15	95	93	0.000

Discussion

- Rebuilding T_{max} = 10 yr is predicated on the assumptions about recruitment returning to the long-term average either as a jump or over the course of a few years
- The latter seems more realistic, but both are best described as hypotheses
  - We could easily propose another trajectory for which $T_{min} > 10$
- In reality, we don't know when, how, or even if recruitment will return to the long-term average
- In other words, forecasts can't provide a T_{max} with any scientific confidence
- Low recruitment for short-term catch advice is reasonable, but can T_{max} be chosen without relying on forecasts?