Catch Advice Developed using Alternative SPR Proxies for Gulf of Mexico Gray Snapper (SEDAR 51)

Shannon L. Cass-Calay, Jeff Isely

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INTRODUCTION

- The Gray Snapper S/R relationship was not estimable. Therefore, an MSY proxy is necessary
- Goethel et al., 2018 concluded that SPR at maximum yield per recruit can be regarded as a lower limit for SPR at MSY. For gray snapper, this value is approximately 23.4%.
- A simulation approach (Harford et al., 2018) suggested that achieving MSY-based performance outcomes is *most* probable when a proxy of $F_{40\%SPR}$ is used for gonochoristic reef fishes. This could be considered an upper bound since only the more conservative Beverton and Holt relationship was considered.

COUNCIL REQUEST

- These topics were discussed at the June 2018 Gulf Council meeting
- The Council requested that the SEFSC produce SSB trajectories, OFL and ABC yield streams for alternative F_{MSY} proxies ranging from $F_{23\%SPR}$ to $F_{40\%SPR}$
- The Council also requested that $SSB_{CURRENT}$ be compared to MSST at levels of (1-M)*SSB_{MSY} and 0.50*SSB_{MSY} for the range of proxies considered

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This terminology will be used throughout the presentation for simplicity. SSB_{MSY} is often approximated using proxy

PROJECTION SPECIFICATIONS

- Constant F projections run at F = F_{SPR23} to F_{SPR40}
- All runs projected from 2016-2023 using SS 3.24s. SPR targets > 30%SPR required longer projections to assure they achieved the SPR target in equilibrium
- Assumed recruitment would continue at recent (1990-2015) average in the short term, therefore steepness was fixed at 1.0
- Assumed selectivity and retention parameters retained at the average of the three most recent years (2013-2015)

FISHING MORTALITY RATIO

- SPR targets ≥ 26%SPR suggest overfishing is occurring in the terminal year (red)
- When projected at constant FSPR, overfishing is eliminated during the projection interval for all SPR targets.

F/FSPR target													
YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2015	***0.92***	***0.95***	***0.99***	***1.02***	***1.06***	***1.10***	***1.13***	***1.17***	***1.25***	***1.33***	***1.42***	***1.52***	***1.61***
2019	1.00	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01
2020	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2021	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2022	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2023	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

*** Terminal year of assessment (2015) in bold italics

SPAWNING STOCK RATIO

- MSST = (1-M)*SSB_{MSY}
  - Proxies ≥ 25%SPR indicate overfished status in the terminal year (red shading)
- MSST = 0.5*SSB_{MSY}
  - Stock not overfished during terminal year at SPR targets considered

SSB/(1-M)*SSB_{MSY}													
YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2015	***1.08***	***1.04***	***0.99***	***0.96***	***0.92***	***0.89***	***0.86***	***0.83***	***0.77***	***0.73***	***0.69***	***0.65***	***0.62***
2019	1.26	1.24	1.21	1.18	1.16	1.13	1.11	1.09	1.05	1.01	0.97	0.94	0.91
2020	1.26	1.24	1.22	1.20	1.17	1.15	1.14	1.12	1.08	1.05	1.02	0.99	0.96
2021	1.25	1.23	1.22	1.20	1.18	1.17	1.15	1.14	1.11	1.08	1.05	1.03	1.01
2022	1.24	1.23	1.21	1.20	1.19	1.18	1.16	1.15	1.13	1.10	1.08	1.06	1.04
2023	1.23	1.22	1.21	1.20	1.19	1.18	1.17	1.16	1.14	1.12	1.10	1.08	1.07

SSB/(0.5*SSB_{MSY})													
YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2015	***1.84***	***1.76***	***1.69***	***1.63***	***1.57***	***1.51***	***1.46***	***1.41***	***1.32***	***1.24***	***1.17***	***1.11***	***1.05***
2019	2.15	2.10	2.06	2.01	1.97	1.93	1.89	1.85	1.78	1.72	1.66	1.60	1.55
2020	2.15	2.11	2.07	2.03	2.00	1.97	1.93	1.90	1.84	1.79	1.74	1.69	1.64
2021	2.13	2.10	2.07	2.04	2.02	1.99	1.96	1.94	1.89	1.84	1.80	1.75	1.71
2022	2.11	2.09	2.07	2.04	2.02	2.00	1.98	1.96	1.92	1.88	1.84	1.81	1.77
2023	2.09	2.08	2.06	2.04	2.02	2.01	1.99	1.97	1.94	1.91	1.88	1.85	1.82

*** Terminal year of assessment (2015) in bold italics

REBUILDING PLANS

- MSST = (1-M)*SSB_{MSY}
  - Some SPR proxies result in overfished status (red)
- General rebuilding guidance:
  - *SPR target and rebuild year must be specified before final guidance can be developed.*
  - SPR targets ≤ 32%SPR, allow stock recovery within 10 years *even when fished at* F_{SPR}

SSB/(1-M)*SSB_{MSY}

YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2015	***1.08***	***1.04***	***0.99***	***0.96***	***0.92***	***0.89***	***0.86***	***0.83***	***0.77***	***0.73***	***0.69***	***0.65***	***0.62***

SSB/SSB unfished

YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2015	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***	***0.21***
2019	0.25	0.25	0.26	0.26	0.26	0.27	0.27	0.28	0.28	0.29	0.30	0.30	0.31
2020					0.27	0.27	0.28	0.28	0.29	0.30	0.31	0.32	0.33
2021						0.28	0.28	0.29	0.30	0.31	0.32	0.33	0.34
2022							0.29	0.29	0.31	0.32	0.33	0.34	0.35
2023								0.29	0.31	0.32	0.34	0.35	0.36
2024								0.30	0.31	0.33	0.34	0.36	0.37
2025									0.31	0.33	0.35	0.36	0.38
2026									0.31	0.33	0.35	0.36	0.38
2027									0.32	0.33	0.35	0.37	0.38
2028										0.33	0.35	0.37	0.39
2029										0.34	0.35	0.37	0.39
2030											0.35	0.37	0.39
2031											0.36	0.37	0.39
2032												0.38	0.39
2033													0.39
2034													0.40

OFL and ABC Yield Streams (million of pounds)

If MSST = (1-M) * SSB_{MSY} is retained, ABC will require adjustment pending specification of rebuild target and year for all SPR proxies ≥ 25%SPR (italics).

If MSST = 0.5*SSB_{MSY} is selected, no correction is required.

OFL													
YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2019	2.68	2.62	2.57	2.52	2.46	2.41	2.36	2.31	2.21	2.11	2.01	1.92	1.83
2020	2.65	2.61	2.56	2.52	2.47	2.42	2.38	2.33	2.24	2.15	2.07	1.98	1.90
2021	2.63	2.59	2.55	2.51	2.48	2.44	2.40	2.36	2.27	2.19	2.11	2.03	1.95
2022	2.61	2.58	2.55	2.51	2.48	2.44	2.41	2.37	2.30	2.22	2.15	2.07	2.00
2023	2.59	2.57	2.54	2.51	2.48	2.45	2.42	2.38	2.32	2.25	2.18	2.10	2.03

ABC (P* = 0.4)													
YEAR	SPR23	SPR24	SPR25	SPR26	SPR27	SPR28	SPR29	SPR30	SPR32	SPR34	SPR36	SPR38	SPR40
2019	2.63	2.58	*2.52*	*2.47*	*2.42*	*2.37*	*2.32*	*2.27*	*2.17*	*2.07*	*1.98*	*1.89*	*1.80*
2020	2.61	2.56	*2.52*	*2.47*	*2.43*	*2.38*	*2.34*	*2.29*	*2.21*	*2.12*	*2.03*	*1.95*	*1.86*
2021	2.58	2.55	*2.51*	*2.47*	*2.43*	*2.39*	*2.36*	*2.32*	*2.24*	*2.16*	*2.08*	*2.00*	*1.92*
2022	2.56	2.53	*2.50*	*2.47*	*2.44*	*2.40*	*2.37*	*2.33*	*2.26*	*2.19*	*2.11*	*2.04*	*1.96*
2023	2.55	2.52	*2.49*	*2.46*	*2.44*	*2.41*	*2.37*	*2.34*	*2.28*	*2.21*	*2.14*	*2.07*	*2.00*

CONCLUSIONS

- Stock status determination criteria depend on the MFMT and MSST definitions, and SPR proxy selected
  - MFMT = $F_{MSY\ (or\ Proxy)}$
    - Proxies ≥ 26%SPR suggest overfishing
  - MSST = $(1-M)*SSB_{MSY\ (or\ Proxy)}$
    - Proxies ≥ 25%SPR indicate overfished status
      - The rebuild target and year need to be specified
      - ABC yield streams require adjustment for overfished stocks (rebuild plan)
  - MSST = $0.5*SSB_{MSY\ (or\ Proxy)}$
    - Not overfished at any proxy considered
    - OFL and ABC yield streams do not require adjustment