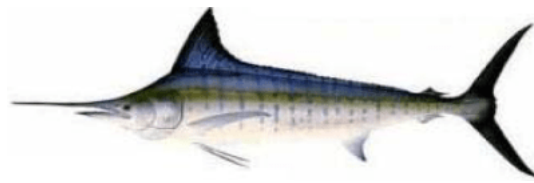


**Deterministic Constant Catch Projections in SS3.30 for the 2023
WCNPO striped marlin assessment**

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Abstract

A set of constant catch projections are provided for the 2023 Western and Central North Pacific Ocean striped marlin stock assessment.

Introduction

After the 2018 Western and Central North Pacific Ocean (WCNPO) striped marlin assessment, the Western and Central Pacific Fisheries Commission Northern Committee requested a series of constant catch projections to determine the catch levels at which there was a 60% probability of reaching the a rebuilding target in 5, 10, and 20 years. When the ISC billfish working group (BILLWG) decided to revise the assessment in 2022, it was requested that a rebuilding plan be produced in addition to the assessment. Due to the limited time and volume of work undertaken by the BILLWG in 2023, a rebuilding plan was not able to be completed. Instead, some simple deterministic projections at a constant catch are provided for management guidance, and the BILLWG intends to develop a comprehensive rebuilding plan in 2024.

Methods

Deterministic projections were completed using the forecast function in Stock Synthesis 3.30.18 (SS3). Maximum catch levels were set at intervals from no catch (0 mt) to 3500 mt to determine the catch level necessary to reach the 2-0%SSB_{F=0} (i.e. 20% spawning stock biomass at no fishing based upon the average of the last 20 years dynamic B₀) reference point within 20 years, with catch allocations to each fleet equal to the proportion of catch by fleet in 2020 (Figure 1). Recruitment was fixed at the average recruitment from 2001-2020, the same time frame used to calculate the 20%SSB_{F=0} reference point (Figure 2). Catch and spawning stock biomass were calculated for each year of the projection. As these are deterministic projections, all estimated parameters from the assessment model are fixed, recruitment is fixed, and catch is fixed, therefore the results are point estimates only and do not include uncertainty.

Results

Results suggest that projecting the current stock conditions with the average recruitment from 2001-2020 will result in the stock recovering to 20%SSB_{F=0} by 2028 if catch is set to 2,300 mt per year (Figure 3, Table 1). Average catch from 2018-2020 was 2,385 mt, which suggests that as long as fishery conditions do not change (i.e. recruitment remains at or above 224,000 fish per year), catch could remain just below recent levels and

allow for the stock to recover. However, these results should be considered relatively optimistic and used for guidance only until a fully stochastic rebuilding plan can be developed with considers multiple sources of uncertainty.

It should be noted that in the constant catch scenarios, some were able to achieve the rebuilding target, however none of the constant F scenarios reached the rebuilding target. For all of the F scenarios, the total projected catch were above the 2300 mt limit suggested by the constant catch projections (Figure 4).

Table 1. Estimated spawning stock biomass in metric tons for each year at 10 constant catch levels. Highlighted cells indicate the first year the SSB exceeds 20%SSB_{F=0}, which is 3720 mt. 2020 is the final year of the assessment, 2021 is the first year of the projections.

Year	No Catch	500 mt	1000 mt	1500 mt	2000 mt	2300 mt	2400 mt	2500 mt	3000 mt	3500 mt
2020	1696	1696	1696	1696	1696	1696	1696	1696	1696	1696
2021	3097	2907	2719	2537	2361	2258	2224	2190	2026	1868
2022	4809	4350	3892	3454	3030	2783	2703	2623	2238	1881
2023	6370	5639	4915	4213	3540	3152	3026	2901	2303	1779
2024	7587	6629	5679	4771	3874	3368	3204	3042	2274	1631
2025	8486	7358	6236	5160	4106	3509	3316	3126	2230	1505
2026	9135	7886	6641	5442	4258	3609	3395	3184	2192	1408
2027	9596	8265	6935	5648	4399	3683	3452	3225	2161	1334
2028	9920	8534	7146	5798	4491	3738	3495	3256	2136	1277
2029	10147	8725	7297	5907	4558	3779	3527	3279	2119	1233
2030	10304	8858	7405	5986	4607	3809	3551	3297	2104	1202
2031	10413	8952	7482	6043	4642	3832	3569	3310	2094	1175
2032	10488	9018	7537	6084	4670	3849	3582	3320	2084	1153
2033	10540	9064	7575	6114	4690	3862	3593	3327	2077	1136
2034	10575	9095	7603	6135	4704	3871	3600	3333	2071	1122
2035	10599	9117	7622	6151	4715	3879	3606	3337	2067	1112
2036	10616	9133	7636	6162	4723	3884	3610	3340	2063	1103
2037	10627	9143	7645	6170	4728	3888	3614	3343	2060	1096
2038	10635	9151	7652	6175	4732	3891	3616	3345	2059	1091
2039	10640	9156	7656	6179	4735	3893	3618	3346	2058	1086
2040	10644	9159	7660	6182	4738	3895	3619	3347	2058	1083

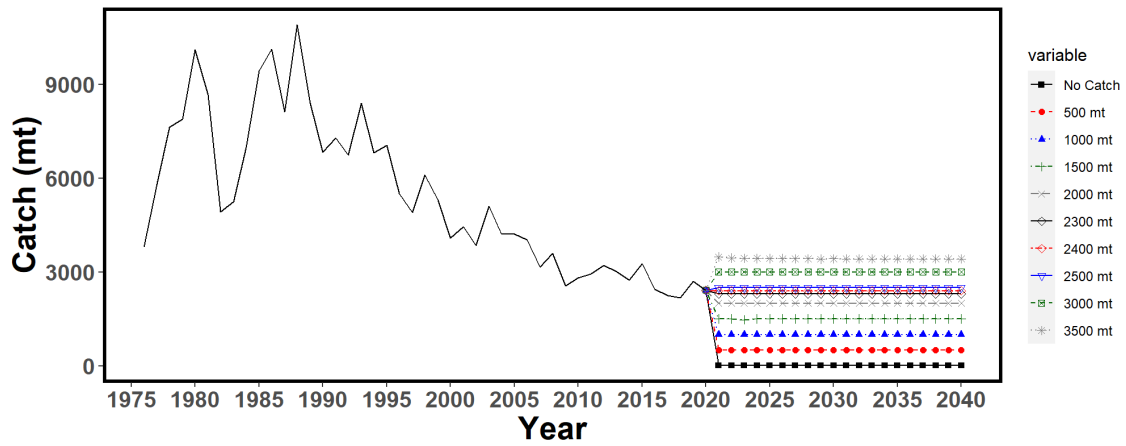


Figure 1. Historical and projected catch by scenario. Historical catch indicated by the solid black line.

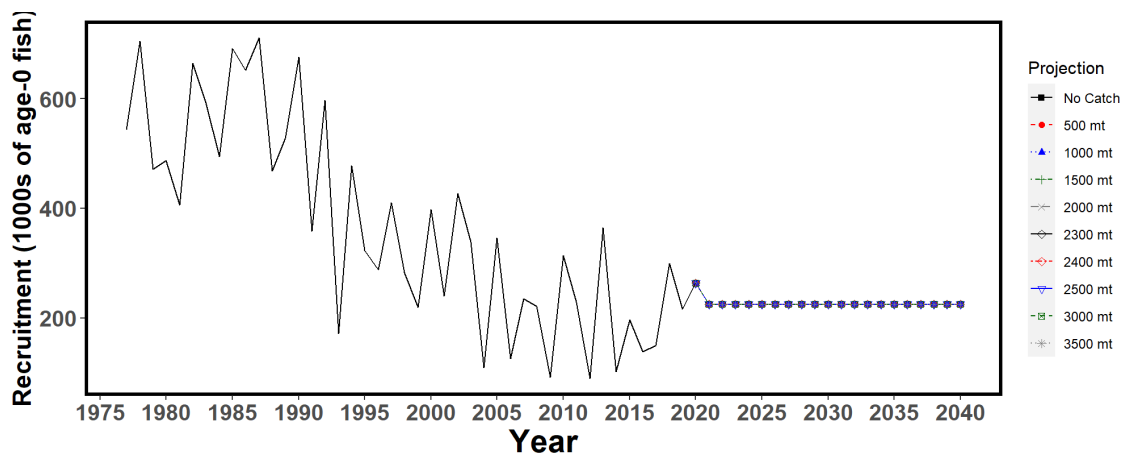


Figure 2. Historical and projected recruitment for each scenario. Historical estimated recruitment is indicated by the solid black line. Recruitment for each scenario is fixed at the average recruitment from 2001-2020.

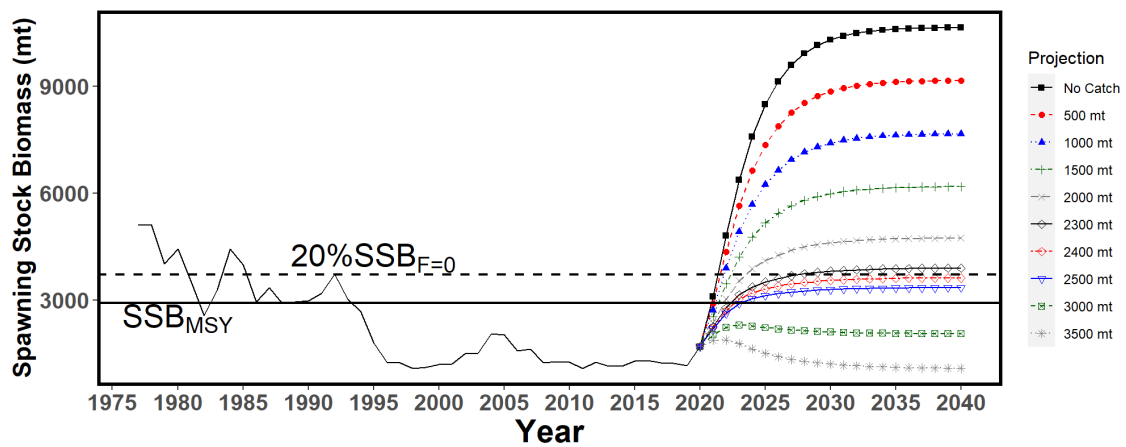


Figure 3. Estimated historical and projected spawning stock biomass for each scenario. Historical SSB is indicated by the solid black line. Projected SSB is indicated by the colored lines with shapes, as identified in the figure legend. $20\%SSB_{F=0}$ is indicated by the dashed horizontal line (3720 mt), SSB_{MSY} is indicated by the solid horizontal line (2920 mt).

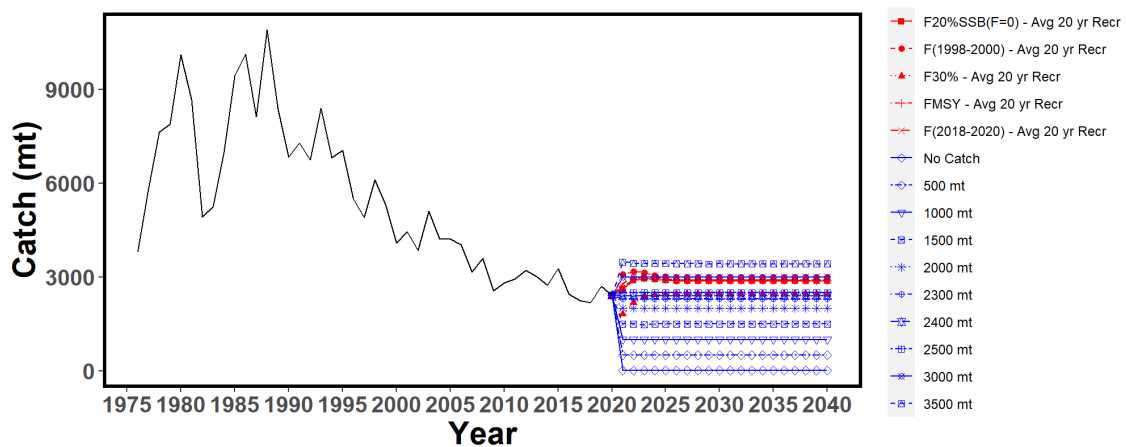


Figure 4. Historical and projected catch for the constant catch (blue) and constant F (red) projections scenarios. Constant F scenarios are described in the WNCPO MLS stock assessment report.