Red Drum Management Scenarios

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Overview

The simulated projections of the Louisiana Red Drum stock presented in this report use the parameter values and population dynamics model of the most recent Louisiana Department of Wildlife and Fisheries (LDWF) Red Drum stock assessment (West et al. 2022).

Management Scenarios

Management scenarios representing reductions in fishery yield were projected forward thirty-nine years (the lifespan of the species) from 2022 (Table 1; Figure 1) by reducing equilibrium fishery yield with specific percent reductions (0 to 70% by factors of 5). The thirty-nine year projection was conducted by assuming future recruitment levels as the average of the most recent decade of recruitment estimates (2012-2021) from the 2022 stock assessment. Projected population metrics are stock status indicators only: spawning potential ratio (SPR) and the escapement rate of juvenile fish.

In each projection, 2023 represents the first full year of new regulation implementation. If regulations are implemented during the course of 2023, the effects of those measures would not have a full year's impact. In such a case, specific values of each following year would be different, but the equilibrium population trajectories would remain consistent with those reported here.

Changes to size limits were not explicitly modeled due to limitations of the age-structured population dynamics model. Estimated benefits for each management scenario are modeled directly from changes in the overall yield of the fishery without adjusting the age-structure of the catch. If size limit regulations are increased, population trajectories of SPR would likely increase marginally from those reported here due to that differential fishing mortality-at-age.

Fishery Savings

Empirical fishery savings, in terms of fishery yield (landed weight) of juvenile fish, from changes in creel and slot limits were calculated using the 2019-2021 information available from the LDWF Recreational Creel Survey and Biological Sampling Programs (Tables 3 and 4; Figures 3 and 4). Savings in terms of fishery yield of juvenile fish was calculated rather than total fishery yield to correspond with the calculation of escapement rates of juvenile fish. The current fishery yield is composed of 97% juvenile fish. Fishery yield reductions from slot limit increases were calculated based a 5% discard mortality rate. Fishery yield reductions from creel limit decreases were calculated based on the assumption that future directed fishery effort will remain comparable to current directed fishery effort. Fishery savings from alternative management measures such as closed seasons or areas are not included in this report.

Tables:

Table 1: Projection of SPR. Red cells represent values below the limit (20% SPR). Yellow cells represent values above the limit, but below the proposed target (30% SPR). Green cells represent values above the proposed SPR target.

SPR	Percent Reduction (Equilibrium Yield)														
Year	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%
2021	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401	0.401
2022	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351
2023	0.325	0.325	0.325	0.326	0.326	0.326	0.326	0.326	0.326	0.327	0.327	0.327	0.327	0.327	0.327
2024	0.300	0.301	0.301	0.302	0.302	0.303	0.303	0.304	0.304	0.305	0.305	0.306	0.306	0.306	0.307
2025	0.279	0.280	0.281	0.282	0.283	0.284	0.285	0.286	0.287	0.288	0.289	0.290	0.291	0.292	0.293
2026	0.258	0.260	0.262	0.264	0.266	0.267	0.269	0.271	0.273	0.275	0.277	0.279	0.281	0.283	0.285
2027	0.237	0.240	0.243	0.246	0.249	0.252	0.256	0.259	0.262	0.265	0.268	0.272	0.275	0.278	0.282
2028	0.218	0.222	0.227	0.231	0.236	0.240	0.245	0.249	0.254	0.259	0.263	0.268	0.273	0.278	0.283
2029	0.201	0.207	0.213	0.219	0.225	0.231	0.237	0.243	0.249	0.256	0.262	0.268	0.275	0.281	0.287
2030	0.186	0.194	0.201	0.209	0.217	0.224	0.232	0.240	0.248	0.256	0.264	0.272	0.280	0.288	0.296
2031	0.174	0.183	0.193	0.202	0.212	0.222	0.232	0.242	0.252	0.262	0.272	0.282	0.292	0.302	0.312
2032	0.163	0.174	0.186	0.198	0.210	0.221	0.233	0.245	0.257	0.269	0.281	0.293	0.305	0.317	0.329
2033	0.153	0.167	0.181	0.194	0.208	0.222	0.236	0.250	0.263	0.277	0.291	0.304	0.318	0.331	0.345
2034	0.145	0.160	0.176	0.192	0.208	0.224	0.239	0.254	0.270	0.285	0.300	0.315	0.330	0.345	0.360
2035	0.137	0.155	0.173	0.191	0.208	0.225	0.242	0.259	0.276	0.293	0.309	0.325	0.341	0.358	0.374
2036	0.130	0.151	0.170	0.190	0.209	0.227	0.246	0.264	0.282	0.300	0.317	0.335	0.352	0.369	0.386
2037	0.124	0.147	0.168	0.189	0.209	0.229	0.249	0.268	0.287	0.306	0.325	0.343	0.361	0.379	0.397
2038	0.119	0.143	0.166	0.188	0.210	0.231	0.252	0.272	0.292	0.312	0.332	0.351	0.370	0.389	0.408
2039	0.114	0.140	0.165	0.188	0.211	0.233	0.255	0.276	0.297	0.318	0.338	0.358	0.378	0.397	0.417
2040	0.110	0.137	0.163	0.188	0.212	0.235	0.257	0.279	0.301	0.322	0.343	0.364	0.385	0.405	0.425
2041	0.106	0.135	0.162	0.188	0.213	0.237	0.260	0.283	0.305	0.327	0.349	0.370	0.391	0.412	0.433
2042	0.102	0.133	0.161	0.188	0.213	0.238	0.262	0.285	0.308	0.331	0.353	0.375	0.397	0.418	0.440
2043	0.098	0.131	0.160	0.188	0.214	0.239	0.264	0.288	0.312	0.335	0.357	0.380	0.402	0.424	0.446
2044	0.095	0.129	0.159	0.188	0.215	0.241	0.266	0.290	0.314	0.338	0.361	0.384	0.407	0.429	0.451
2045	0.092	0.127	0.159	0.188	0.215	0.242	0.268	0.293	0.317	0.341	0.365	0.388	0.411	0.434	0.456
2046	0.089	0.126	0.158	0.188	0.216	0.243	0.269	0.295	0.319	0.344	0.368	0.392	0.415	0.438	0.461
2047	0.087	0.124	0.157	0.188	0.216	0.244	0.270	0.296	0.322	0.346	0.371	0.395	0.418	0.442	0.465
2048	0.085	0.123	0.157	0.188	0.217	0.245	0.272	0.298	0.323	0.349	0.373	0.398	0.422	0.445	0.469
2049	0.082	0.122	0.156	0.188	0.217	0.246	0.273	0.299	0.325	0.351	0.376	0.400	0.424	0.448	0.472
2050	0.080	0.121	0.156	0.188	0.218	0.246	0.274	0.301	0.327	0.352	0.378	0.402	0.427	0.451	0.475
2051	0.078	0.120	0.156	0.188	0.218	0.247	0.275	0.302	0.328	0.354	0.380	0.405	0.429	0.454	0.478
2052	0.076	0.119	0.155	0.188	0.218	0.248	0.276	0.303	0.330	0.356	0.381	0.406	0.431	0.456	0.480
2053	0.074	0.118	0.155	0.188	0.219	0.248	0.276	0.304	0.331	0.357	0.383	0.408	0.433	0.458	0.482
2054	0.073	0.118	0.155	0.188	0.219	0.249	0.277	0.305	0.332	0.358	0.384	0.410	0.435	0.460	0.484
2055	0.071	0.117	0.154	0.188	0.219	0.249	0.278	0.306	0.333	0.359	0.385	0.411	0.437	0.462	0.486
2056	0.070	0.116	0.154	0.188	0.219	0.249	0.278	0.306	0.334	0.360	0.387	0.412	0.438	0.463	0.488
2057	0.068	0.116	0.154	0.188	0.220	0.250	0.279	0.307	0.334	0.361	0.388	0.414	0.439	0.464	0.489
2058	0.067	0.115	0.154	0.188	0.220	0.250	0.279	0.308	0.335	0.362	0.389	0.415	0.440	0.466	0.491
2059	0.065	0.115	0.153	0.188	0.220	0.251	0.280	0.308	0.336	0.363	0.389	0.416	0.441	0.467	0.492
2060	0.064	0.114	0.153	0.188	0.220	0.251	0.280	0.309	0.336	0.364	0.390	0.416	0.442	0.468	0.493
2061	0.063	0.114	0.153	0.188	0.220	0.251	0.281	0.309	0.337	0.364	0.391	0.417	0.443	0.469	0.494

Table 2: Projection of juvenile escapement rates. Red cells represent values below the limit (30%). Yellow cells represent values above the limit, but below the proposed target (43%). Green cells represent values above the proposed escapement rate target.

Escapement	Percent Reduction (Equilibrium Yield)														
Year	0%	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%
2021	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201	0.201
2022	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086	0.086
2023	0.094	0.110	0.128	0.148	0.171	0.196	0.224	0.254	0.288	0.325	0.366	0.410	0.457	0.509	0.565
2024	0.108	0.134	0.163	0.194	0.229	0.266	0.305	0.347	0.390	0.436	0.482	0.531	0.580	0.631	0.682
2025	0.118	0.152	0.190	0.230	0.272	0.316	0.362	0.408	0.454	0.501	0.549	0.596	0.642	0.689	0.735
2026	0.126	0.167	0.211	0.257	0.304	0.352	0.399	0.447	0.494	0.540	0.586	0.630	0.675	0.718	0.760
2027	0.132	0.179	0.228	0.278	0.327	0.376	0.424	0.471	0.518	0.562	0.606	0.649	0.692	0.733	0.773
2028	0.136	0.188	0.240	0.292	0.343	0.393	0.441	0.487	0.532	0.576	0.619	0.660	0.701	0.741	0.780
2029	0.139	0.195	0.250	0.303	0.354	0.404	0.451	0.497	0.541	0.584	0.626	0.666	0.706	0.745	0.783
2030	0.140	0.200	0.256	0.310	0.362	0.411	0.458	0.503	0.546	0.589	0.630	0.670	0.709	0.747	0.785
2031	0.141	0.203	0.261	0.316	0.367	0.416	0.462	0.507	0.550	0.592	0.632	0.672	0.711	0.749	0.786
2032	0.141	0.205	0.264	0.319	0.370	0.419	0.465	0.509	0.552	0.593	0.634	0.673	0.712	0.750	0.787
2033	0.141	0.207	0.267	0.322	0.373	0.421	0.467	0.511	0.553	0.595	0.635	0.674	0.713	0.750	0.787
2034	0.140	0.208	0.268	0.323	0.374	0.422	0.468	0.512	0.554	0.595	0.636	0.675	0.713	0.751	0.788
2035	0.139	0.209	0.269	0.325	0.375	0.423	0.469	0.513	0.555	0.596	0.636	0.675	0.714	0.751	0.788
2036	0.138	0.209	0.270	0.325	0.376	0.424	0.470	0.513	0.556	0.597	0.637	0.676	0.714	0.752	0.789
2037	0.136	0.209	0.271	0.326	0.377	0.425	0.470	0.514	0.556	0.597	0.637	0.676	0.714	0.752	0.789
2038	0.135	0.209	0.271	0.326	0.377	0.425	0.471	0.514	0.557	0.598	0.638	0.676	0.715	0.752	0.789
2039	0.133	0.208	0.271	0.327	0.378	0.426	0.471	0.515	0.557	0.598	0.638	0.677	0.715	0.752	0.789
2040	0.131	0.208	0.271	0.327	0.378	0.426	0.471	0.515	0.557	0.598	0.638	0.677	0.715	0.753	0.789
2041	0.130	0.208	0.271	0.327	0.378	0.426	0.472	0.515	0.558	0.598	0.638	0.677	0.715	0.753	0.790
2042	0.128	0.207	0.271	0.327	0.378	0.426	0.472	0.516	0.558	0.599	0.639	0.678	0.716	0.753	0.790
2043	0.126	0.207	0.271	0.327	0.378	0.426	0.472	0.516	0.558	0.599	0.639	0.678	0.716	0.753	0.790
2044	0.124	0.206	0.271	0.327	0.379	0.427	0.472	0.516	0.558	0.599	0.639	0.678	0.716	0.753	0.790
2045	0.123	0.206	0.271	0.327	0.379	0.427	0.472	0.516	0.558	0.599	0.639	0.678	0.716	0.754	0.790
2046	0.121	0.205	0.271	0.327	0.379	0.427	0.473	0.516	0.559	0.599	0.639	0.678	0.716	0.754	0.790
2047	0.119	0.205	0.270	0.327	0.379	0.427	0.473	0.516	0.559	0.600	0.640	0.678	0.716	0.754	0.791
2048	0.118	0.204	0.270	0.327	0.379	0.427	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2049	0.116	0.204	0.270	0.327	0.379	0.427	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2050	0.114	0.204	0.270	0.327	0.379	0.427	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2051	0.113	0.203	0.270	0.327	0.379	0.427	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2052	0.111	0.203	0.270	0.327	0.379	0.427	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2053	0.110	0.203	0.270	0.327	0.379	0.428	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2054	0.108	0.202	0.270	0.327	0.379	0.428	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2055	0.107	0.202	0.270	0.327	0.379	0.428	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2056	0.105	0.202	0.270	0.327	0.379	0.428	0.473	0.517	0.559	0.600	0.640	0.679	0.717	0.754	0.791
2057	0.104	0.202	0.270	0.327	0.379	0.428	0.474	0.517	0.560	0.600	0.640	0.679	0.717	0.754	0.791
2058	0.102	0.202	0.270	0.327	0.379	0.428	0.474	0.517	0.560	0.601	0.640	0.679	0.717	0.754	0.791
2059	0.101	0.201	0.270	0.327	0.379	0.428	0.474	0.518	0.560	0.601	0.640	0.679	0.717	0.755	0.791
2060	0.099	0.201	0.269	0.327	0.379	0.428	0.474	0.518	0.560	0.601	0.640	0.679	0.717	0.755	0.791
2061	0.098	0.201	0.269	0.327	0.379	0.428	0.474	0.518	0.560	0.601	0.640	0.679	0.717	0.755	0.791

Table 3: Fishery savings in terms of percent yield reductions of juvenile fish for different combinations of creel and slot limits with the allowance of one fish over the slot.

	Creel				
Slot	1	2	3	4	5
16 to 20	61.1%	44.4%	34.8%	28.6%	24.5%
16 to 21	57.4%	39.1%	28.5%	21.8%	17.2%
16 to 22	54.5%	34.9%	23.7%	16.5%	11.6%
16 to 23	52.2%	31.7%	19.9%	12.3%	7.2%
16 to 24	50.5%	29.3%	17.1%	9.2%	3.9%
16 to 25	49.4%	27.7%	15.2%	7.1%	1.7%
16 to 26	48.8%	26.8%	14.2%	6.1%	0.6%
16 to 27	48.5%	26.4%	13.7%	5.5%	0.0%
17 to 20	67.0%	52.8%	44.7%	39.4%	35.9%
17 to 21	63.2%	47.5%	38.4%	32.6%	28.7%
17 to 22	60.3%	43.3%	33.5%	27.2%	23.0%
17 to 23	58.1%	40.1%	29.7%	23.1%	18.6%
17 to 24	56.4%	37.7%	26.9%	20.0%	15.4%
17 to 25	55.3%	36.1%	25.0%	17.9%	13.2%
17 to 26	54.7%	35.2%	24.0%	16.9%	12.0%
17 to 27	54.4%	34.8%	23.5%	16.3%	11.4%
18 to 20	72.8%	61.1%	54.4%	50.1%	47.2%
18 to 21	69.1%	55.8%	48.1%	43.2%	39.9%
18 to 22	66.1%	51.6%	43.3%	37.9%	34.3%
18 to 23	63.9%	48.4%	39.5%	33.7%	29.9%
18 to 24	62.2%	46.0%	36.7%	30.7%	26.6%
18 to 25	61.1%	44.4%	34.8%	28.6%	24.4%
18 to 26	60.5%	43.5%	33.8%	27.5%	23.3%
18 to 27	60.2%	43.1%	33.3%	26.9%	22.7%
19 to 20	77.9%	68.4%	62.9%	59.4%	57.0%
19 to 21	74.1%	63.0%	56.6%	52.5%	49.8%
19 to 22	71.2%	58.9%	51.8%	47.2%	44.1%
19 to 23	68.9%	55.6%	48.0%	43.0%	39.7%
19 to 24	67.3%	53.2%	45.2%	40.0%	36.5%
19 to 25	66.1%	51.6%	43.2%	37.9%	34.3%
19 to 26	65.5%	50.8%	42.3%	36.8%	33.1%
19 to 27	65.2%	50.3%	41.7%	36.2%	32.5%

Table 4: Fishery savings in terms of percent yield reductions of juvenile fish for different combinations of creel and slot limits without the allowance of one fish over the slot.

	Creel				
Slot	1	2	3	4	5
16 to 20	76.2%	66.0%	60.1%	56.3%	53.8%
16 to 21	72.2%	60.3%	53.5%	49.1%	46.1%
16 to 22	68.5%	55.0%	47.2%	42.2%	38.9%
16 to 23	64.9%	49.9%	41.2%	35.7%	31.9%
16 to 24	61.5%	45.1%	35.6%	29.5%	25.4%
16 to 25	58.4%	40.5%	30.2%	23.6%	19.2%
16 to 26	55.9%	37.0%	26.2%	19.2%	14.5%
16 to 27	53.9%	34.2%	22.8%	15.5%	10.6%
16 to 28	52.0%	31.4%	19.6%	12.0%	6.8%
16 to 29	50.7%	29.6%	17.4%	9.6%	4.3%
16 to 30	49.8%	28.3%	15.9%	7.9%	2.5%
17 to 20	82.1%	74.4%	70.0%	67.1%	65.2%
17 to 21	78.1%	68.7%	63.3%	59.8%	57.5%
17 to 22	74.4%	63.4%	57.1%	53.0%	50.3%
17 to 23	70.8%	58.3%	51.1%	46.5%	43.4%
17 to 24	67.4%	53.5%	45.4%	40.3%	36.8%
17 to 25	64.2%	48.9%	40.1%	34.4%	30.6%
17 to 26	61.8%	45.5%	36.0%	30.0%	25.9%
17 to 27	59.8%	42.6%	32.6%	26.3%	22.0%
17 to 28	57.9%	39.8%	29.4%	22.8%	18.3%
17 to 29	56.6%	38.0%	27.3%	20.4%	15.8%
17 to 30	55.7%	36.7%	25.7%	18.7%	14.0%
18 to 20	87.9%	82.7%	79.7%	77.8%	76.5%
18 to 21	83.9%	77.0%	73.0%	70.5%	68.8%
18 to 22	80.2%	71.7%	66.8%	63.7%	61.6%
18 to 23	76.6%	66.6%	60.8%	57.1%	54.6%
18 to 24	73.2%	61.8%	55.1%	50.9%	48.1%
18 to 25	70.1%	57.2%	49.8%	45.1%	41.9%
18 to 26	67.6%	53.8%	45.8%	40.6%	37.2%
18 to 27	65.6%	50.9%	42.4%	36.9%	33.3%
18 to 28	63.7%	48.1%	39.2%	33.4%	29.5%
18 to 29	62.4%	46.3%	37.0%	31.1%	27.0%
18 to 30	61.5%	45.0%	35.5%	29.3%	25.2%
19 to 20	93.0%	89.9%	88.2%	87.1%	86.3%
19 to 21	89.0%	84.3%	81.5%	79.8%	78.6%
19 to 22	85.3%	79.0%	75.3%	73.0%	71.4%
19 to 23	81.7%	73.8%	69.3%	66.4%	64.5%
19 to 24	78.3%	69.0%	63.6%	60.2%	57.9%
19 to 25	75.1%	64.4%	58.3%	54.4%	51.7%
19 to 26	72.7%	61.0%	54.3%	49.9%	47.0%
19 to 27	70.7%	58.1%	50.9%	46.2%	43.1%
19 to 28	68.8%	55.4%	47.7%	42.7%	39.4%
19 to 29	67.5%	53.5%	45.5%	40.3%	36.9%
19 to 30	66.6%	52.2%	43.9%	38.6%	35.1%

Figures:

Figure 1: Projections of SPR and juvenile escapement rates relative to limits and proposed targets.

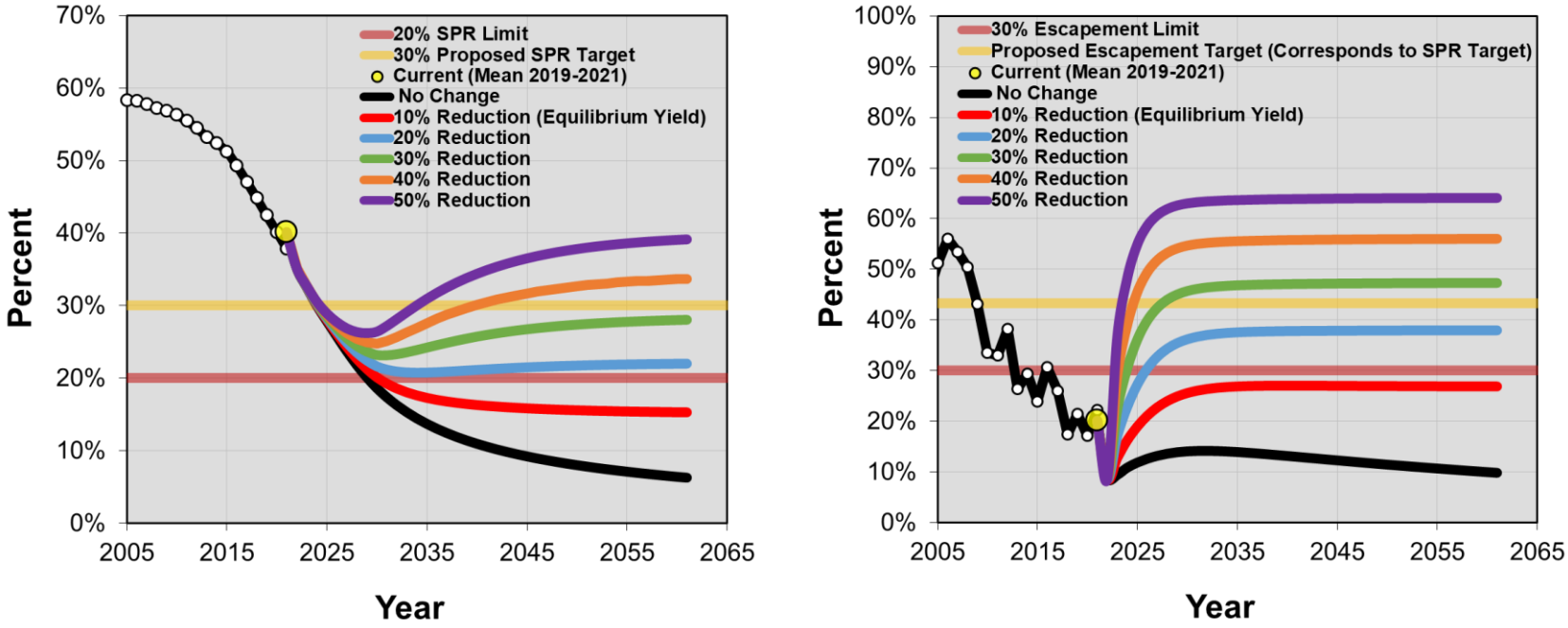
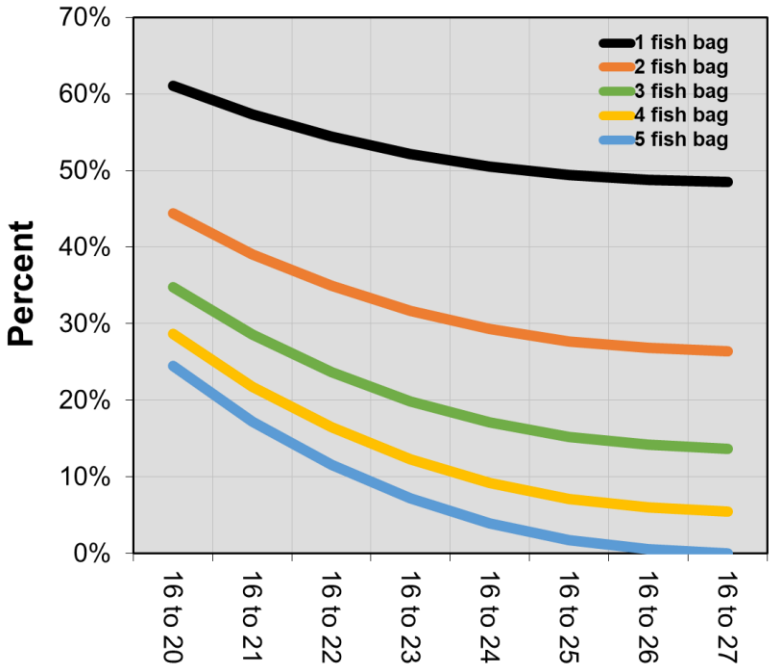


Figure 2: Fishery savings in terms of percent yield reductions of juvenile fish for different combinations of creel and slot limits with the allowance of one fish over the slot.



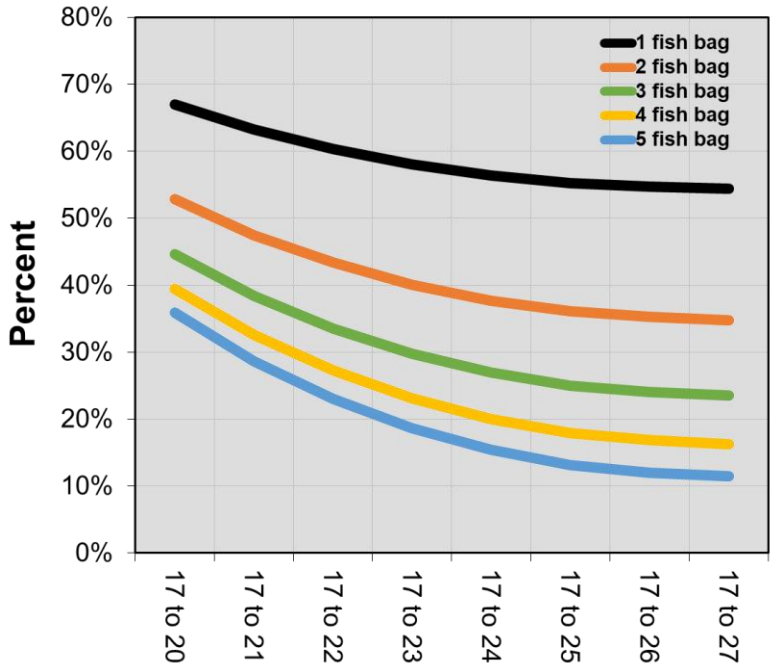
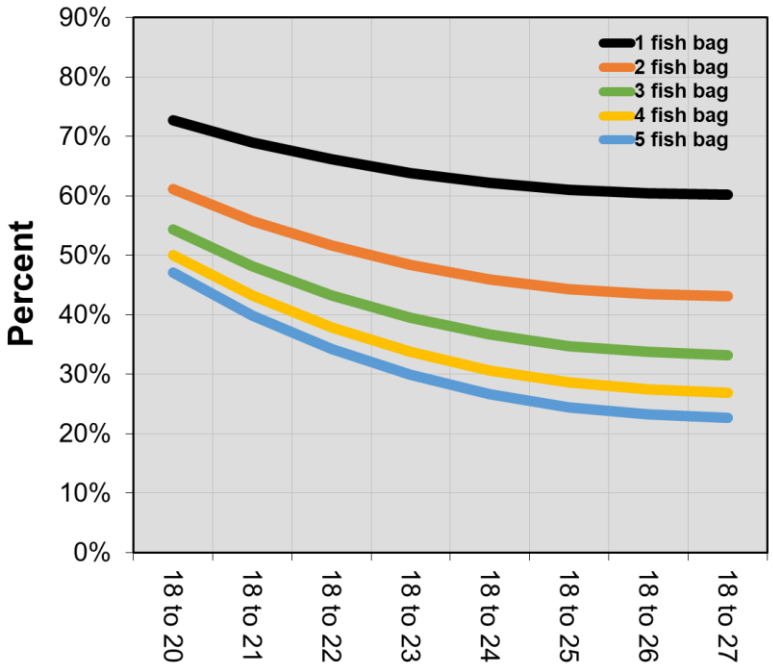


Figure 2: (continued)



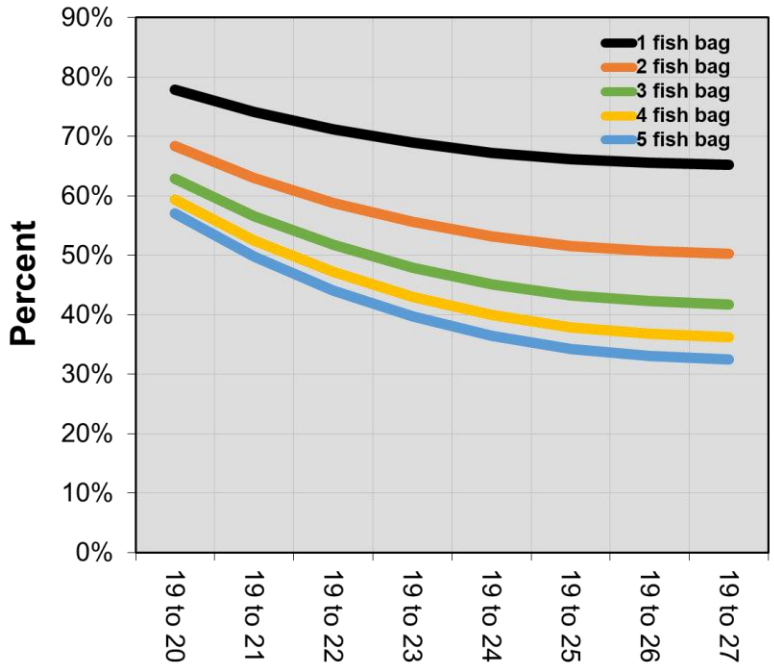


Figure 3: Fishery savings in terms of percent yield reductions of juvenile fish for different combinations of creel and slot limits without the allowance of one fish over the slot.

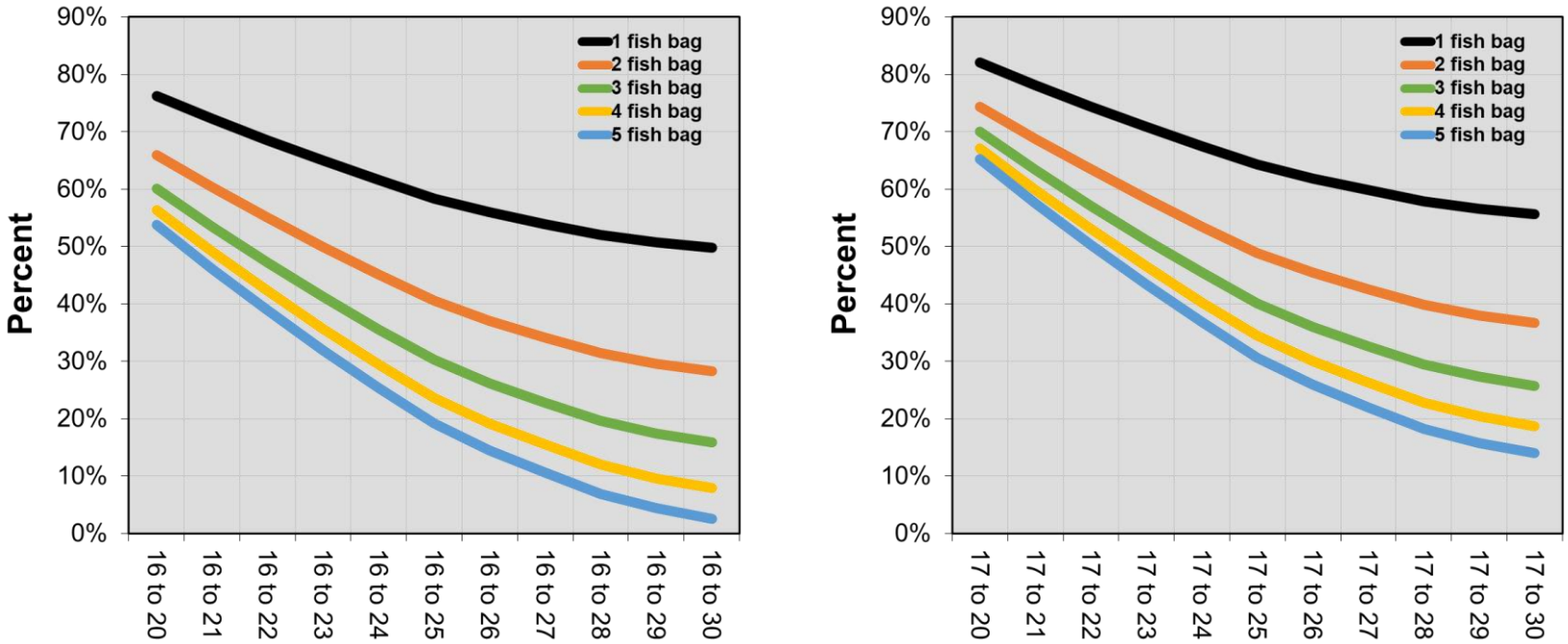


Figure 3: (continued)