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# SEDAR 52 Gulf of Mexico Red Snapper Stock Assessment: Assessment Review for the SSC



Matthew W. Smith  
Daniel R. Goethel

May 31-June 1, 2018

# Outline

- Overview of data
- Continuity models
- Base model settings
- Base model results
- Diagnostic runs
- Comparison of base and continuity model runs
- Sensitivity runs
- Projections



## SEDAR 52 Gulf of Mexico Red Snapper

### Assessment Terms of Reference

April 2017

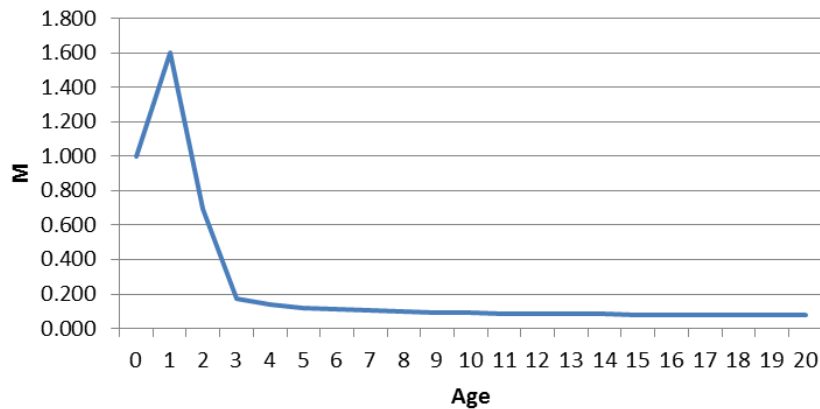
1. Update the approved SEDAR 31 Gulf of Mexico red snapper model, as modified and approved by the SSC during the 2014 update assessment, with data through 2016. Provide a model consistent with the previous assessment configuration to incorporate and evaluate any changes allowed for during this assessment.
2. Evaluate and document the following specific changes in input data or deviations from the benchmark model previous assessment model.
  - Investigate the use of Louisiana hydroacoustics/stereo camera length frequency
  - Use best available recreational catch and effort estimates (e.g. APAIS, FES)
  - Explore the effect of the IFQ program on commercial CPUE, and the sensitivity of model results to plausible alternative commercial CPUE series
  - Investigate the use of FL, MS and AL survey data collected through the NFWF Gulf Environmental Benefit Fund
3. Document any revisions or corrections made to the model and input datasets, and provide updated input data tables. Provide commercial and recreational landings and discards in numbers and weight (pounds).
4. Update model parameter estimates and their variances, model uncertainties, and estimates of stock status and management benchmarks. In addition to the base model, conduct sensitivity analysis to address uncertainty in data inputs and model configuration and consider runs that represent plausible, alternate states of nature.
5. Project future stock conditions regardless of the status of the stock. Use provisional 2017 catch estimates if available. Develop rebuilding schedules, if warranted. Provide the estimated generation time for each unit stock. Stock projections shall be developed in accordance with the following:
  - Scenarios to Evaluate (preliminary, to be modified as appropriate)
    1. Project  $F_{MSY}$  or proxy ( $F_{26\%SPR}$ )
    2. Project  $F_{OY}$  (75% of  $F_{26\%SPR}$ )
    3. Project  $F_{Rebuild}$  (to SPR 26% in 2032)
    4. Project  $F = 0$
  - For all scenarios (except  $F=0$ ), Use current sector allocations (51% COM: 49% REC) and retain shrimp bycatch at recent levels of exploitation (as in SEDAR31 and 2014 update).
6. Develop a stock assessment report to address these TORs and fully document the input data, methods, and results.

# Data

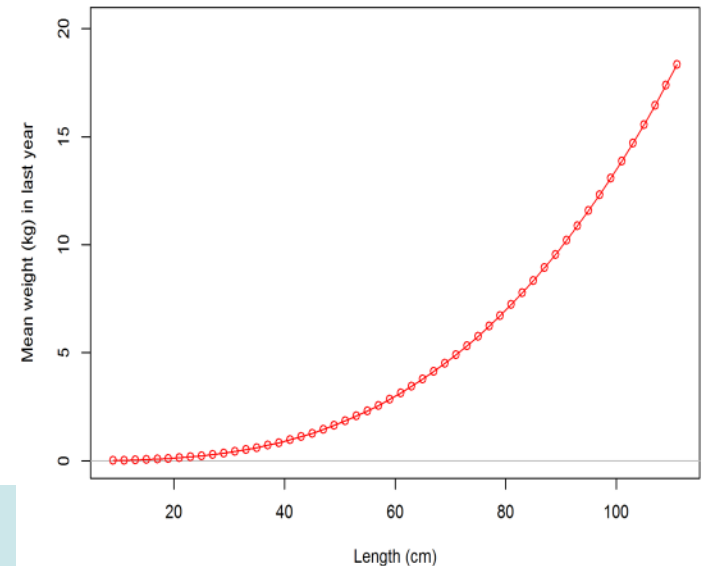
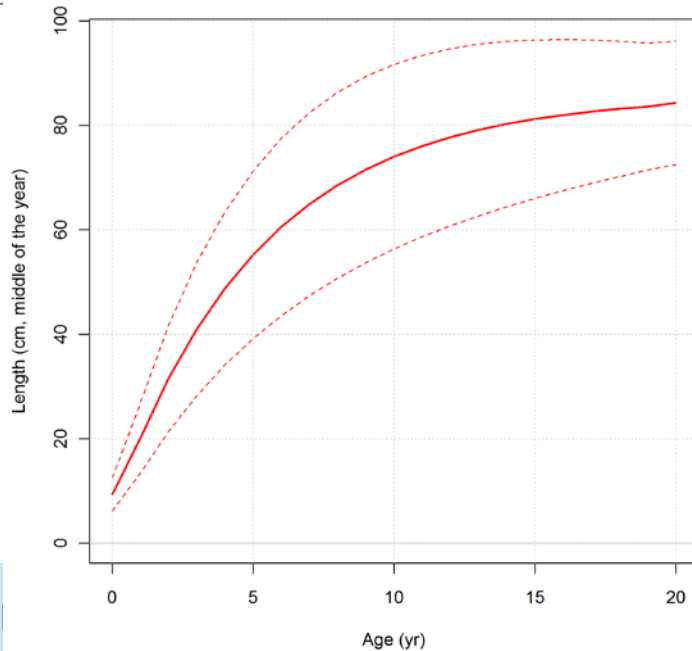
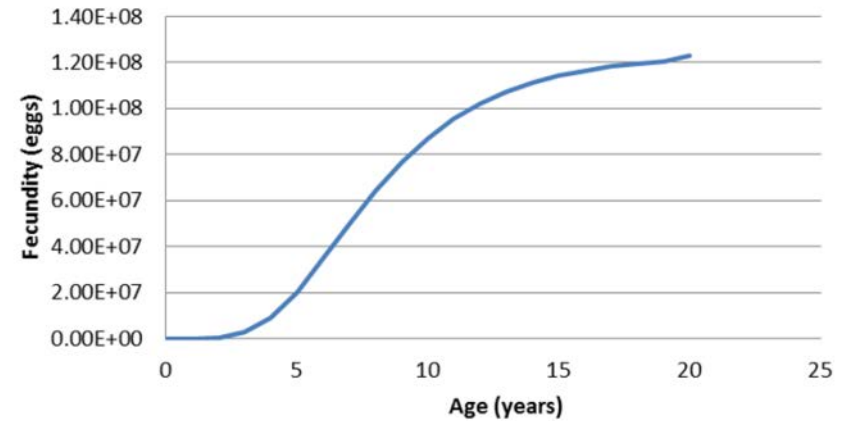


# Life History (unchanged)

**Natural Mortality**



**Per Capita Fecundity at Age**



# Discard Mortality

New data and rerun of meta-analysis indicated a new recreational discard mortality, post-2008 of 11.8%. This is up from 10% in the 2014 SEDAR 31 Update Assessment.

Sector	Venting (Y/N)	Year (Pre/Post 2008)	East		West	
			Closed	Open	Closed	Open
Recreational	N	Pre	0.21	0.21	0.22	0.22
Recreational	Y	Post	0.118	0.118	0.118	0.118
Commercial vertical line	N	Pre	0.74	0.75	0.87	0.78
Commercial vertical line	Y	Post	0.55	0.56	0.74	0.6
Commercial longline	N	Pre	0.74	0.81	0.87	0.91
Commercial longline	Y	Post	0.55	0.64	0.74	0.81



# Age-length Data

- Biological data from 12 data providers (n = 217,475).
- 49,000 new age-length records from 2014-2016
  - Majority of new samples from the Gulf States Marine Fisheries Commission Fisheries Information Network (GulfFIN) and the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Fund survey data.

Length Type	Observed (n)	Predicted (n)
Maximum Total Length	17,797	199,406
Natural Total Length	52,870	-----
Fork Length	192,973	24,230
Standard Length	14,627	-----

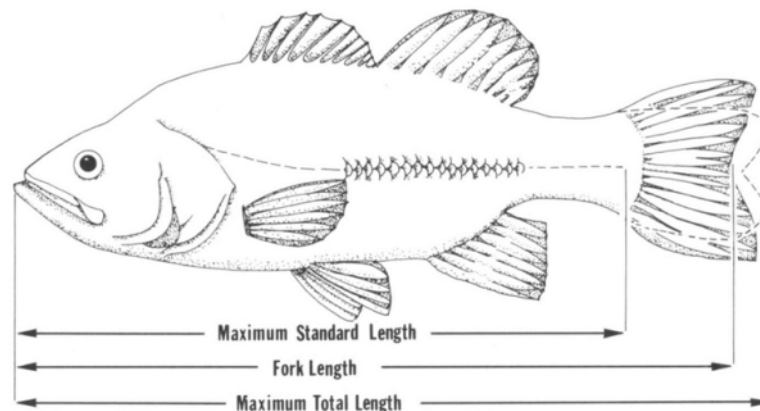


Figure 15.1 from Anderson and Gutreuter 1983)



# Age-Length Key East

- Single age length key developed for each region combined across fleets and years

Length (cm)	Age-1	Age-2	Age-3	Age-4	Age-5	Age-6	Age-7	Age-8	Age-9	Age-10	Age-11	Age-12	Age-13	Age-14	Age-15	Age-16	Age-17	Age-18	Age-19	Age-20
24	0.81	0.14	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
28	0.38	0.51	0.09	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
32	0.06	0.60	0.29	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
36	0.01	0.40	0.47	0.10	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
40	0.00	0.21	0.56	0.17	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
44	0.00	0.06	0.50	0.30	0.09	0.03	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	0.00	0.02	0.29	0.41	0.16	0.06	0.03	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
52	0.00	0.01	0.13	0.43	0.24	0.09	0.05	0.03	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
56	0.00	0.00	0.05	0.34	0.32	0.15	0.07	0.04	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
60	0.00	0.00	0.03	0.22	0.36	0.22	0.10	0.05	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
64	0.00	0.00	0.01	0.12	0.32	0.29	0.14	0.07	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
68	0.00	0.00	0.00	0.04	0.21	0.34	0.22	0.11	0.06	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
72	0.00	0.00	0.00	0.00	0.10	0.27	0.29	0.18	0.10	0.04	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
76	0.00	0.00	0.00	0.00	0.00	0.14	0.29	0.26	0.17	0.08	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
80	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.26	0.23	0.17	0.07	0.03	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.01
84	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.28	0.19	0.10	0.06	0.08	0.06	0.02	0.01	0.00	0.00	0.01	0.07
88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.17	0.11	0.05	0.05	0.06	0.01	0.01	0.05	0.03	0.02	0.35
92	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.12	0.04	0.06	0.06	0.02	0.54
96	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.00	0.00	0.00	0.07	0.71
100	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.75
104	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00
108	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00



# Age-Length Key East

- Comparison to 2014 Update [difference in proportions; (SEDAR 52 value)-(2014 Update value)]

LengthBin	Freq.1	Freq.2	Freq.3	Freq.4	Freq.5	Freq.6	Freq.7	Freq.8	Freq.9	Freq.10	Freq.11	Freq.12	Freq.13	Freq.14	Freq.15	Freq.16	Freq.17	Freq.18	Freq.19	Freq.20
24	-0.07937	0.031746	0.047619	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	-0.0647	0.046012	-0.00663	0.025316	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0.000345	0.021836	-0.01937	-0.00574	0.002929	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0.001401	0.005312	-0.01333	0.002043	0.002525	0.002051	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0.000824	-0.01159	-0.00563	0.008304	0.003597	0.003242	0.001257	0	0	0	0	0	0	0	0	0	0	0	0	0
44	7.96E-05	0.001593	-0.02386	0.005075	0.002336	0.004268	0.007228	0.00328	0	0	0	0	0	0	0	0	0	0	0	0
48	-0.00013	0.000159	-0.02464	-0.01047	-0.00053	0.00362	0.013685	0.012627	0.005681	0	0	0	0	0	0	0	0	0	0	0
52	1.14E-05	-0.00068	-0.02097	-0.02221	-0.01463	0.006261	0.019653	0.017261	0.011865	0.003429	0	0	0	0	0	0	0	0	0	0
56	0	0.000204	-0.01192	-0.02795	-0.01967	-0.01079	0.021544	0.025811	0.013636	0.006646	0.001661	0.000692	0.000138	0	0	0	0	0	0	0
60	0	-8.9E-05	-0.00501	-0.01992	-0.04332	-0.01072	0.026666	0.026023	0.017817	0.006046	0.002073	0.000347	8.47E-05	0	0	0	0	0	0	0
64	0	0	0.000579	-0.02448	-0.04948	-0.02596	0.018828	0.03878	0.030054	0.007789	0.002783	0.000779	0.000335	0	0	0	0	0	0	0
68	0	0	0	-0.01886	-0.04951	-0.06596	0.015433	0.052892	0.044865	0.012628	0.005155	0.001431	0.001648	0	0	0.000275	0	0	0	0
72	0	0	0	0	-0.05618	-0.11276	-0.01525	0.06966	0.066486	0.036703	0.01071	0.001128	-0.0008	-0.00027	9.97E-05	9.97E-05	0	0	0.000365	0
76	0	0	0	0	0	-0.11151	-0.11944	0.054207	0.109097	0.063332	0.008662	-0.00298	0.000229	-0.00138	-0.00073	0.000585	0	0	-0.00066	0.000585
80	0	0	0	0	0	0	-0.1094	-0.02677	0.076426	0.07956	0.027004	-0.00355	-0.0057	-0.00903	0.000833	-0.0059	-0.00542	-0.00229	0	-0.01577
84	0	0	0	0	0	0	0	-0.01058	0.113492	0.01746	0.039418	-0.01217	-0.02566	0.002116	-0.01349	-0.01032	-0.00344	-0.00714	0.000529	-0.09021
88	0	0	0	0	0	0	0	0	-0.02232	0.071429	0.03125	-0.01935	0.016369	-0.02083	-0.01339	-0.00149	-0.01935	0.019345	-0.00298	-0.03869
92	0	0	0	0	0	0	0	0	0	0	0.03619	-0.02381	-0.02381	0.07619	0.024762	-0.00762	-0.01143	0.012381	-0.02762	-0.05524
96	0	0	0	0	0	0	0	0	0	0	0	0	0.123377	0	-0.09091	0	0	0	0.071429	-0.1039
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.08333	0	0.083333
104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

# Age-Length Key East

- Comparison to 2014 Update [difference in number of fish; (SEDAR 52 value)-(2014 Update value)]

LengthBin	Freq.1	Freq.2	Freq.3	Freq.4	Freq.5	Freq.6	Freq.7	Freq.8	Freq.9	Freq.10	Freq.11	Freq.12	Freq.13	Freq.14	Freq.15	Freq.16	Freq.17	Freq.18	Freq.19	Freq.20
24	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	2	11	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	24	268	92	13	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	21	519	479	134	38	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	19	472	1634	656	184	89	24	0	0	0	0	0	0	0	0	0	0	0	0	0
44	4	241	1582	1193	351	179	140	53	0	0	0	0	0	0	0	0	0	0	0	0
48	0	62	763	1262	535	231	217	161	68	0	0	0	0	0	0	0	0	0	0	0
52	1	14	232	1078	596	305	257	189	120	34	0	0	0	0	0	0	0	0	0	0
56	0	8	66	694	678	300	271	218	108	51	13	5	1	0	0	0	0	0	0	0
60	0	0	31	351	532	379	294	192	115	41	14	2	1	0	0	0	0	0	0	0
64	0	0	14	100	326	353	269	218	152	38	14	4	2	0	0	0	0	0	0	0
68	0	0	0	5	159	286	319	264	184	51	21	8	6	0	0	1	0	0	0	0
72	0	0	0	0	24	129	315	316	223	105	33	6	0	0	1	1	0	0	1	0
76	0	0	0	0	0	37	167	280	246	124	35	5	6	1	1	1	0	0	0	1
80	0	0	0	0	0	0	43	107	125	100	41	11	8	0	2	1	0	1	0	-1
84	0	0	0	0	0	0	0	12	52	27	19	6	7	8	1	0	0	-1	2	-3
88	0	0	0	0	0	0	0	0	-1	8	4	-1	2	-1	-1	0	-1	2	0	1
92	0	0	0	0	0	0	0	0	0	0	2	-1	-1	4	2	0	0	1	-1	2
96	0	0	0	0	0	0	0	0	0	0	0	0	2	0	-1	0	0	0	1	1
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

# Age-Length Key West

Length (cm)	Age 1	Age 2	Age 3	Age 4	Age 5	Age 6	Age 7	Age 8	Age 9	Age 10	Age 11	Age 12	Age 13	Age 14	Age 15	Age 16	Age 17	Age 18	Age 19	Age 20
20	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
24	0.071	0.857	0.071	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
28	0.014	0.730	0.257	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
32	0.011	0.464	0.420	0.096	0.009	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
36	0.005	0.211	0.501	0.225	0.055	0.004	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
40	0.005	0.117	0.476	0.291	0.088	0.021	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
44	0.003	0.053	0.392	0.359	0.137	0.042	0.011	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
48	0.001	0.018	0.264	0.397	0.212	0.072	0.028	0.007	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
52	0.000	0.009	0.131	0.397	0.289	0.116	0.036	0.013	0.005	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
56	0.000	0.004	0.053	0.303	0.371	0.176	0.060	0.021	0.006	0.004	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
60	0.000	0.000	0.029	0.208	0.343	0.246	0.100	0.040	0.018	0.008	0.003	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
64	0.000	0.000	0.007	0.111	0.277	0.290	0.171	0.073	0.033	0.017	0.009	0.005	0.002	0.002	0.001	0.001	0.001	0.000	0.000	0.000
68	0.000	0.000	0.000	0.040	0.172	0.274	0.213	0.125	0.072	0.041	0.025	0.008	0.010	0.007	0.005	0.003	0.002	0.001	0.001	0.001
72	0.000	0.000	0.000	0.000	0.090	0.192	0.219	0.168	0.109	0.069	0.040	0.034	0.022	0.015	0.009	0.011	0.004	0.005	0.004	0.007
76	0.000	0.000	0.000	0.000	0.000	0.104	0.164	0.154	0.138	0.108	0.076	0.067	0.045	0.030	0.025	0.024	0.016	0.011	0.005	0.033
80	0.000	0.000	0.000	0.000	0.000	0.000	0.070	0.115	0.101	0.117	0.093	0.085	0.055	0.060	0.061	0.055	0.026	0.026	0.019	0.119
84	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.041	0.063	0.066	0.055	0.063	0.046	0.066	0.083	0.046	0.048	0.061	0.026	0.336
88	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.031	0.026	0.036	0.031	0.051	0.046	0.041	0.015	0.046	0.020	0.648
92	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.031	0.000	0.000	0.031	0.047	0.016	0.047	0.031	0.016	0.047	0.734
96	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.111	0.000	0.000	0.000	0.000	0.000	0.889
100	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000



# Age-Length Key West

- Comparison to 2014 Update [difference in proportions; (SEDAR 52 value)-(2014 Update value)]

	Freq.1	Freq.2	Freq.3	Freq.4	Freq.5	Freq.6	Freq.7	Freq.8	Freq.9	Freq.10	Freq.11	Freq.12	Freq.13	Freq.14	Freq.15	Freq.16	Freq.17	Freq.18	Freq.19	Freq.20
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	-0.0119	-0.05952	0.071429	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	-0.00119	0.038553	-0.03736	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	-0.00241	-0.05781	0.032068	0.01904	0.009112	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	-0.00025	-0.01938	-0.00124	0.010614	0.00659	0.003669	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	-0.00045	-0.0105	-0.0159	0.00943	0.009473	0.00629	0.001664	0	0	0	0	0	0	0	0	0	0	0	0	0
44	-0.00013	-0.00946	-0.02265	0.012983	0.011903	0.003015	0.001968	0.002368	0	0	0	0	0	0	0	0	0	0	0	0
48	-0.00016	-0.00503	-0.02466	0.014472	0.013815	0.001532	-0.00125	-0.00063	0.001911	0	0	0	0	0	0	0	0	0	0	0
52	-0.00014	0.000596	-0.01629	-0.00589	0.021109	0.002078	0.000381	-0.00132	-0.00102	0.000342	0.000155	0	0	0	0	0	0	0	0	0
56	0	-0.00134	-0.00931	-0.02709	0.027543	0.010124	-0.00107	0.000609	-0.00067	-0.00018	0.000489	0.000534	0.000356	0	0	0	0	0	0	0
60	0	-7.1E-05	-0.00263	-0.03126	0.009961	0.011753	0.004482	0.003761	0.003344	0.001197	0.000308	-0.00099	5.18E-06	-7.1E-05	0.000217	0	0	0	0	0
64	0	0	-0.00352	-0.01724	-0.00579	-0.00654	0.01416	0.01261	0.006291	0.001319	-0.00053	-9.8E-05	-0.00146	0.00056	-0.00051	0.000229	0.000537	0	0	0
68	0	0	0	-0.01307	-0.01362	-0.03335	0.00984	0.02462	0.016678	0.007385	0.000216	-0.00156	0.001362	-0.00034	-0.00021	0.000277	0.0003	0.000415	0.000645	0.000415
72	0	0	0	0	-0.01489	-0.02874	-0.02058	0.020729	0.017891	0.016681	0.009198	0.006682	0.000412	-0.0017	-0.00298	-0.00145	-0.00025	-0.00011	-0.00025	-0.00065
76	0	0	0	0	0	-0.02409	-0.02863	0.001185	0.036859	0.025002	0.008845	0.000326	-0.00666	-0.00428	-0.00532	-0.0016	-0.00274	0.000225	0.000205	0.000675
80	0	0	0	0	0	0	-0.00025	-0.02099	-0.00903	0.017557	0.004838	-0.00199	-0.0011	0.00211	0.004564	0.004072	0.000942	0.006117	-0.00084	-0.006
84	0	0	0	0	0	0	0	0.001105	-0.00794	-0.00576	0.007079	0.006312	-0.01353	-0.00813	-0.02154	-0.00165	-0.00185	0.001753	0.004823	0.039332
88	0	0	0	0	0	0	0	0	-0.01492	-0.00456	0.010435	-0.01956	-0.00456	0.000769	0.000692	-0.00441	-0.00479	-0.00936	-0.01979	0.07007
92	0	0	0	0	0	0	0	0	0	0.015377	0	0	-0.01637	-0.00074	-0.03199	-0.00074	-0.03224	-0.00025	-0.00074	0.067708
96	0	0	0	0	0	0	0	0	0	0	0	0	-0.08333	0.027778	0	0	0	0	0	0.055556
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

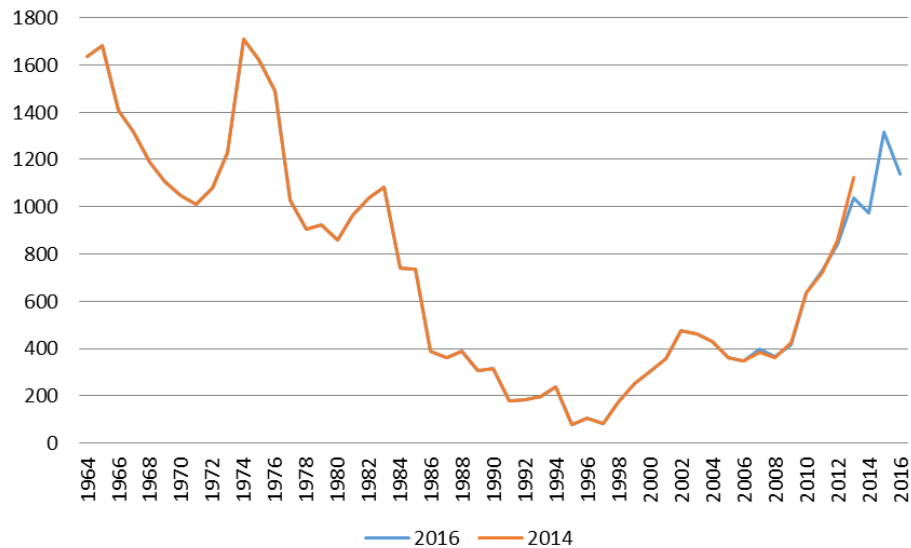
# Age-Length Key West

- Comparison to 2014 Update [difference in number of fish; (SEDAR 52 value)-(2014 Update value)]

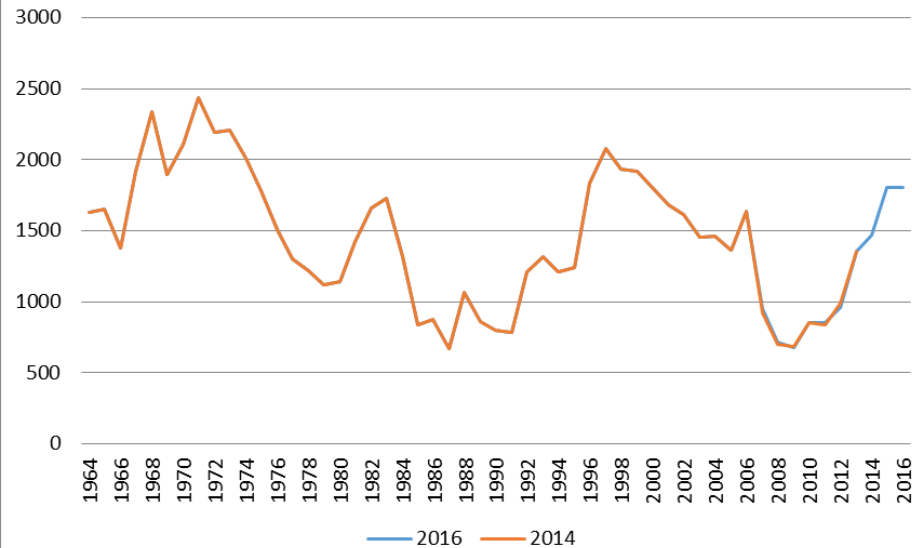
LengthBin	Freq.1	Freq.2	Freq.3	Freq.4	Freq.5	Freq.6	Freq.7	Freq.8	Freq.9	Freq.10	Freq.11	Freq.12	Freq.13	Freq.14	Freq.15	Freq.16	Freq.17	Freq.18	Freq.19	Freq.20
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	7	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	-1	11	107	38	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	3	74	430	257	85	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	1	37	410	436	196	86	18	0	0	0	0	0	0	0	0	0	0	0	0	0
44	3	-2	361	598	283	82	31	22	0	0	0	0	0	0	0	0	0	0	0	0
48	0	-4	243	681	400	117	34	6	15	0	0	0	0	0	0	0	0	0	0	0
52	0	17	114	560	533	183	56	13	3	4	1	0	0	0	0	0	0	0	0	0
56	0	0	44	354	681	311	88	35	6	5	5	3	2	0	0	0	0	0	0	0
60	0	0	24	127	423	319	129	58	32	13	5	-1	1	0	1	0	0	0	0	0
64	0	0	-2	68	270	281	214	109	51	21	8	5	-2	4	0	2	2	0	0	0
68	0	0	0	3	109	147	196	158	97	50	21	3	11	5	4	3	2	2	2	2
72	0	0	0	0	26	61	92	137	97	71	40	32	14	6	0	4	2	3	2	3
76	0	0	0	0	0	6	21	53	90	66	36	23	7	5	2	6	2	4	2	12
80	0	0	0	0	0	0	6	-6	2	24	12	6	4	7	9	8	3	7	1	6
84	0	0	0	0	0	0	0	2	-1	0	5	5	-4	-1	-6	1	1	3	3	29
88	0	0	0	0	0	0	0	0	-3	-1	2	-4	-1	0	0	-1	-1	-2	-4	12
92	0	0	0	0	0	0	0	0	0	1	0	0	-1	0	-2	0	-2	0	0	5
96	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	0	0	0	0	0	-2
100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

# Commercial Landings

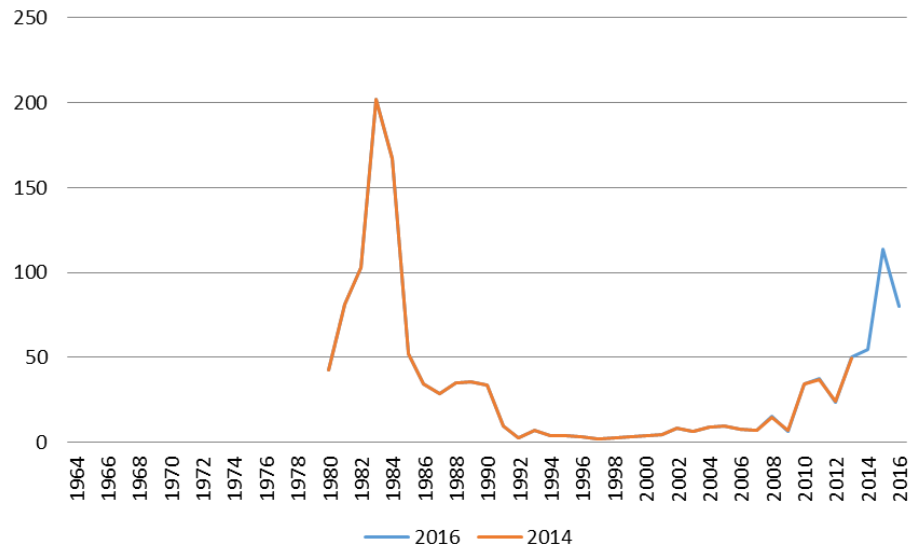
## East Handline (mt)



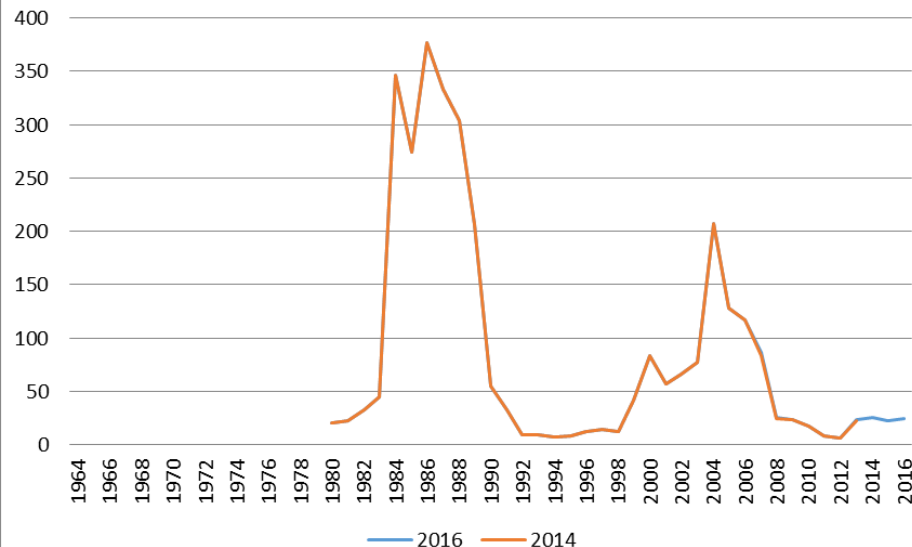
## West Handline (mt)



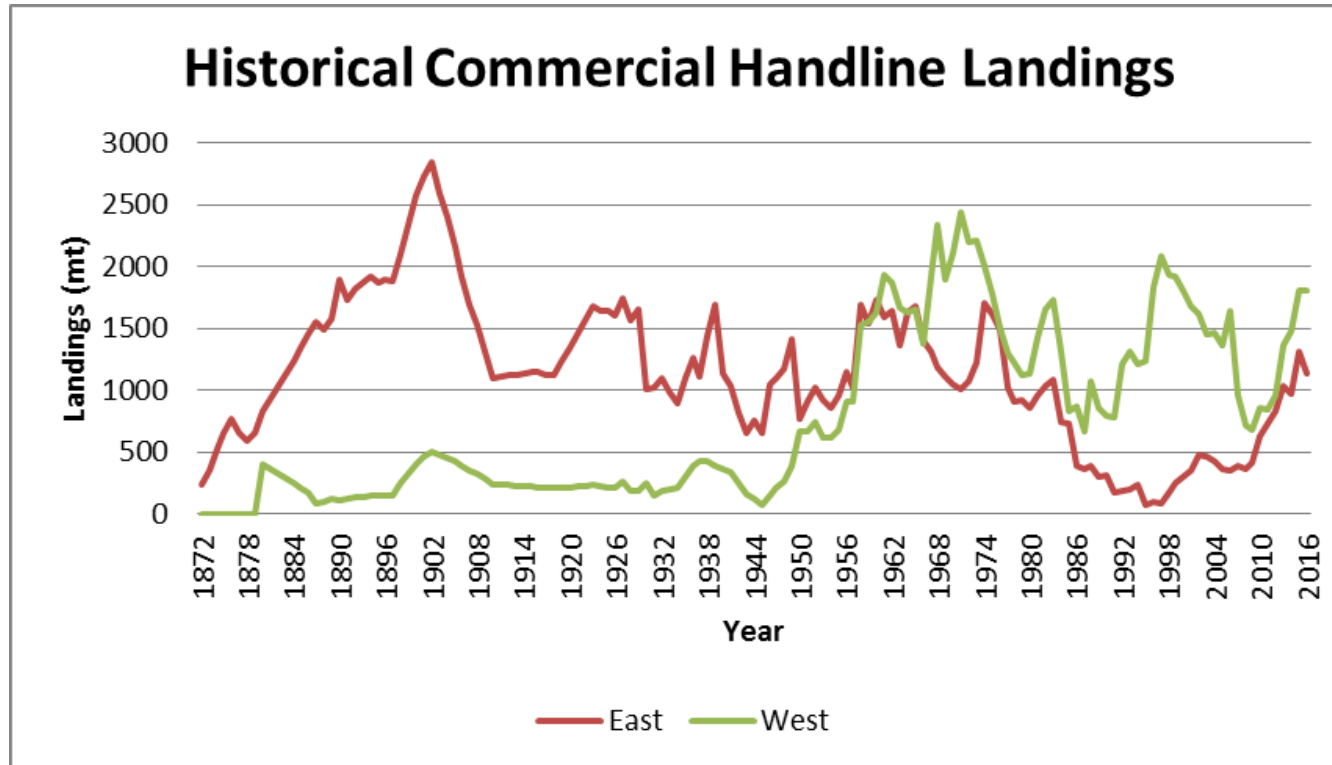
## East Longline (mt)



## West Longline (mt)



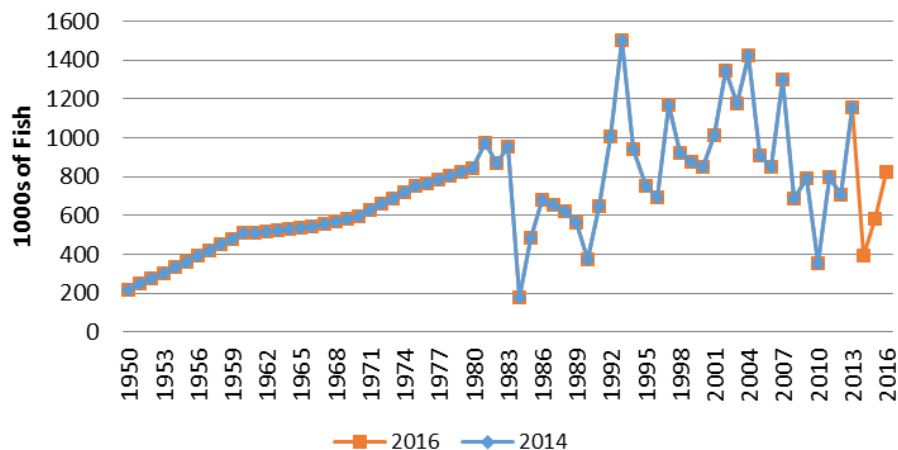
# Historic Commercial Landings (unchanged)



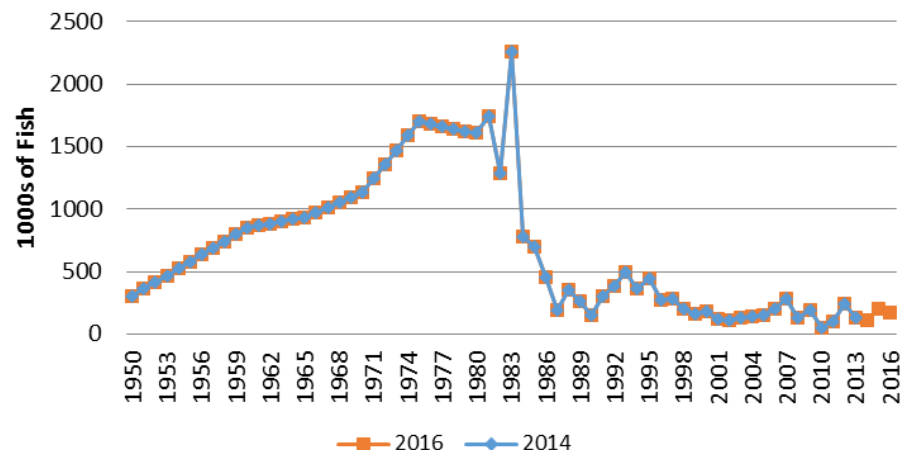


# Recreational Landings

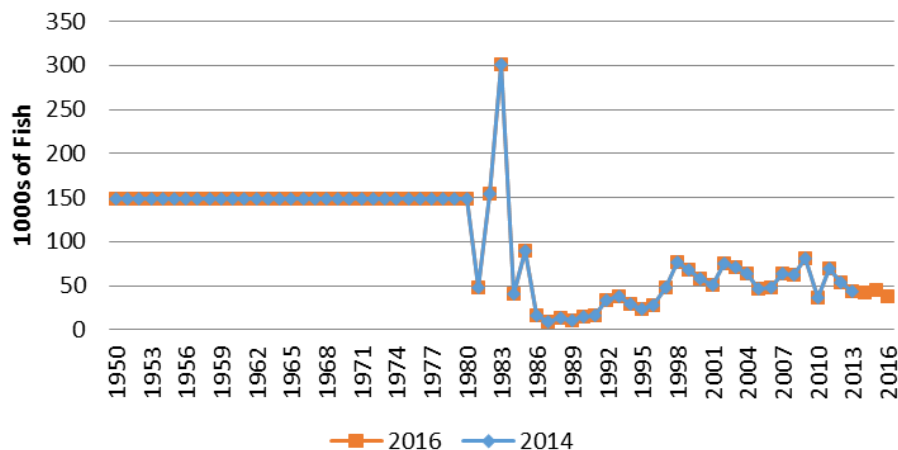
## MRIP-E Landings Comparison



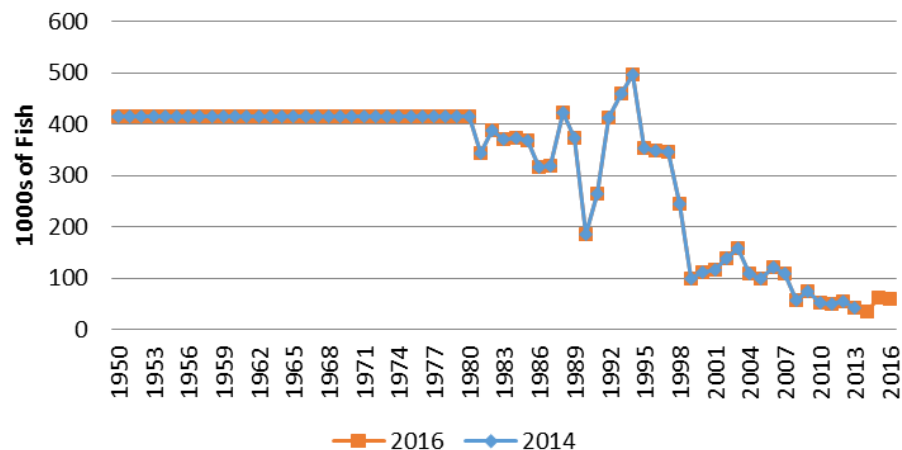
## MRIP-W Landings Comparison



## HBT-E Landings Comparison

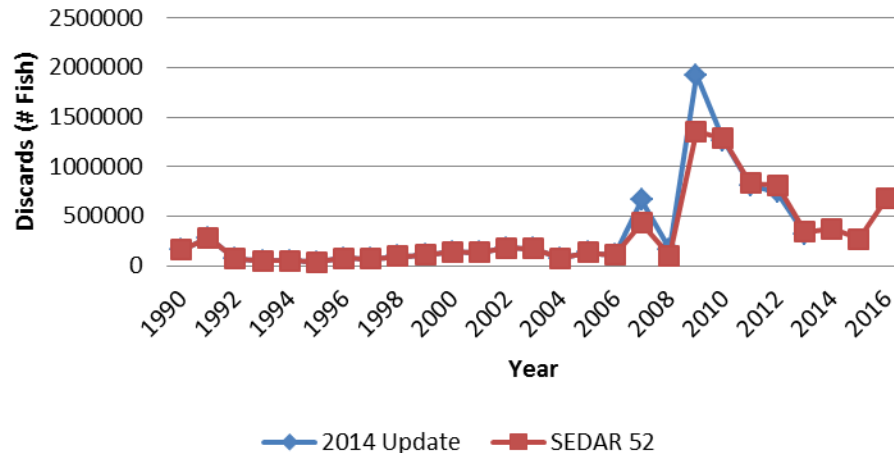


## HBT-W Landings Comparison

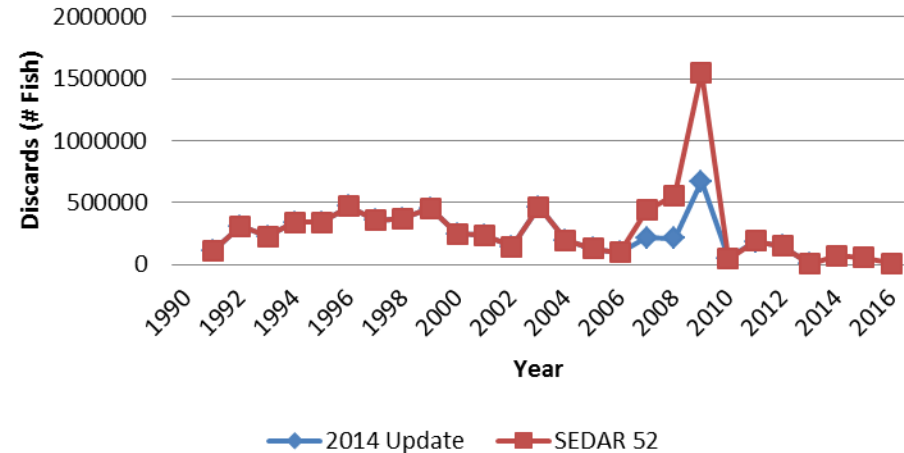


# Commercial Discards--Continuity

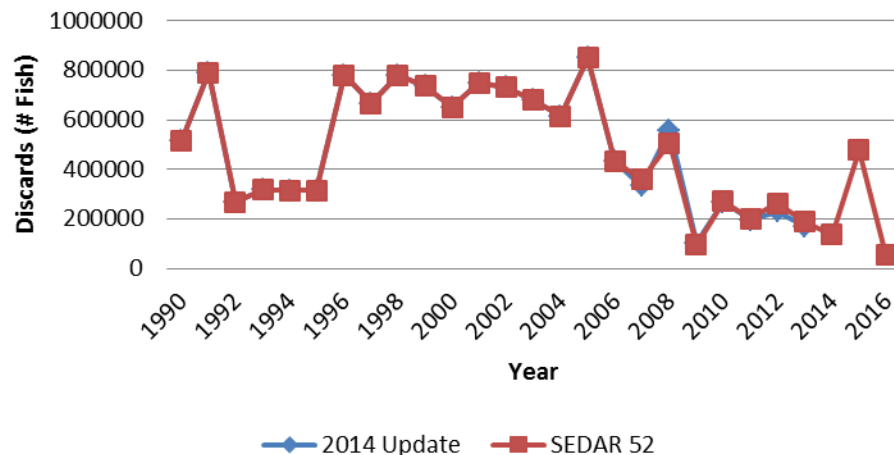
## Handline East Open Season Discards



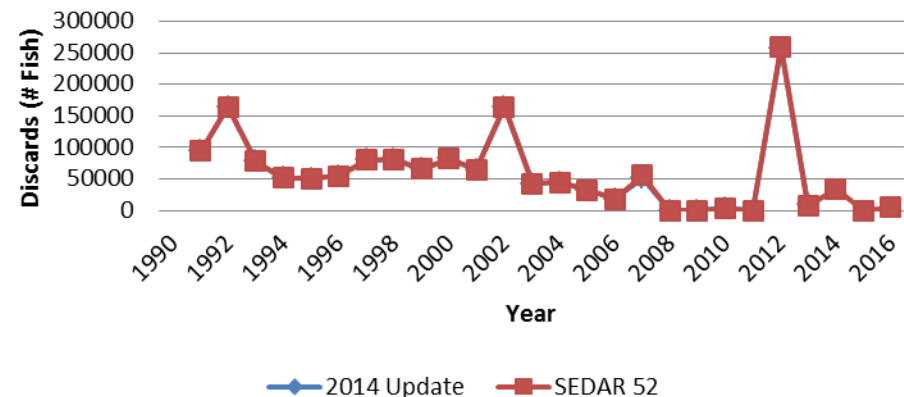
## Handline East Closed Season Discards



## Handline West Open Season Discards

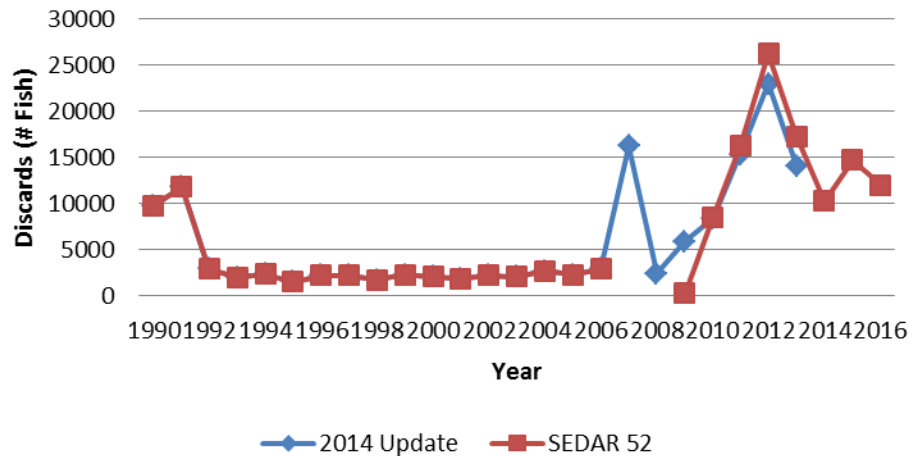


## Handline West Closed Season Discards

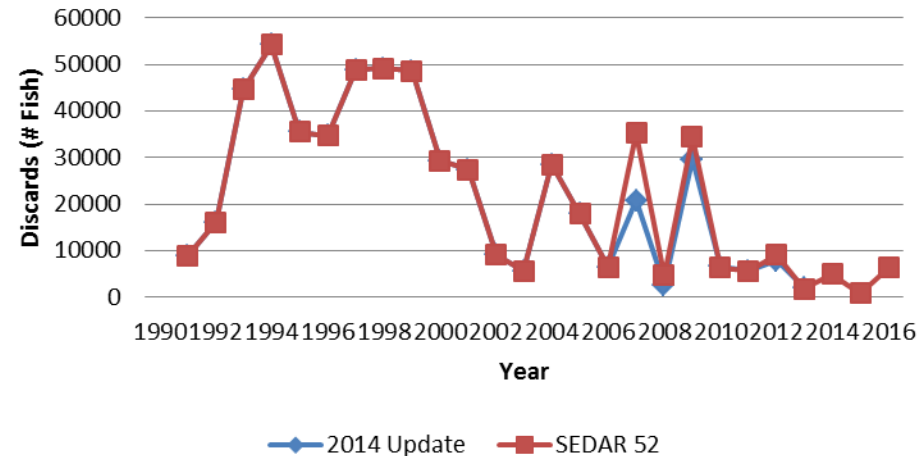


# Commercial Discards--Continuity

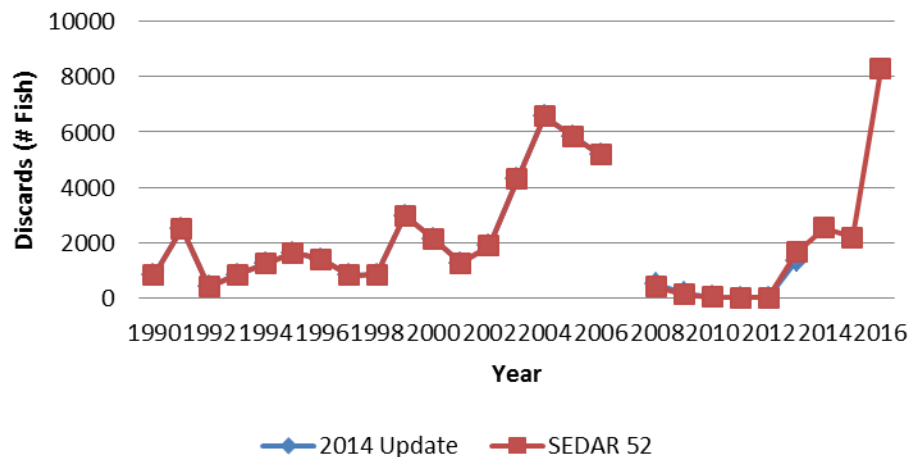
## Longline East Open Season Discards



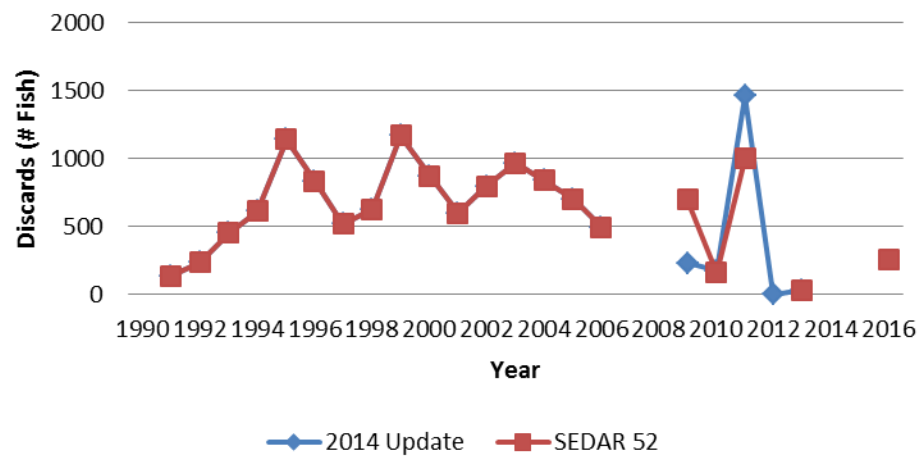
## Longline East Closed Season Discards



## Longline West Open Season Discards



## Longline West Closed Season Discards

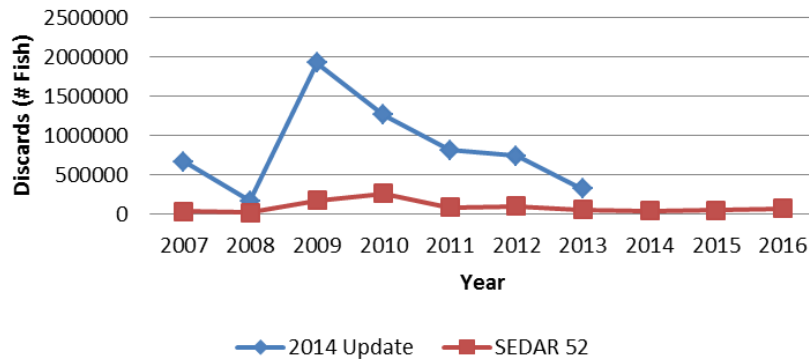


# Commercial Discards--Recommended

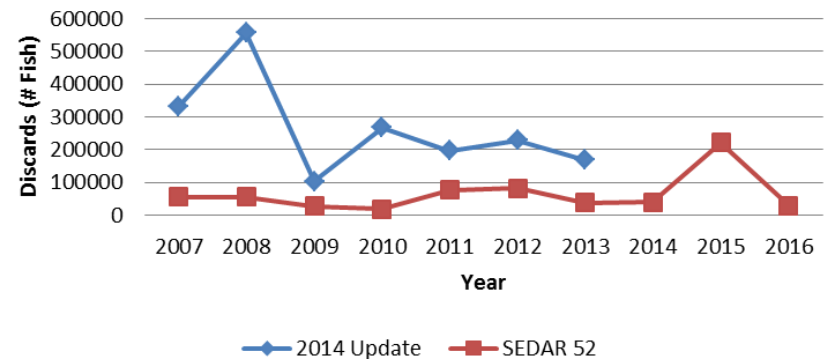
Old method tended to inflate landings and overestimate discards

New Method: Discards = (discard rate \* total effort)/landings ratio

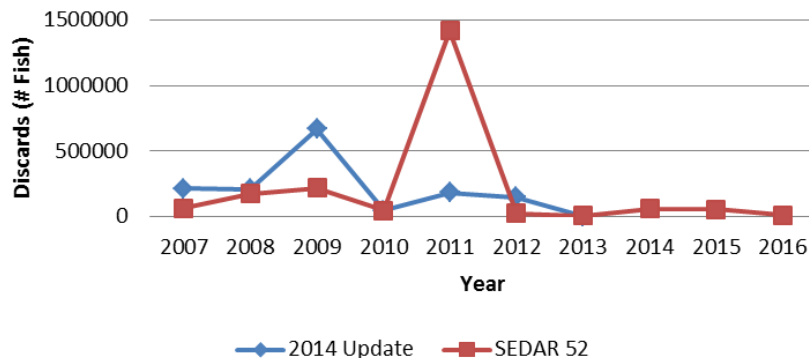
**Handline East Open Season Effort  
Corrected Discards**



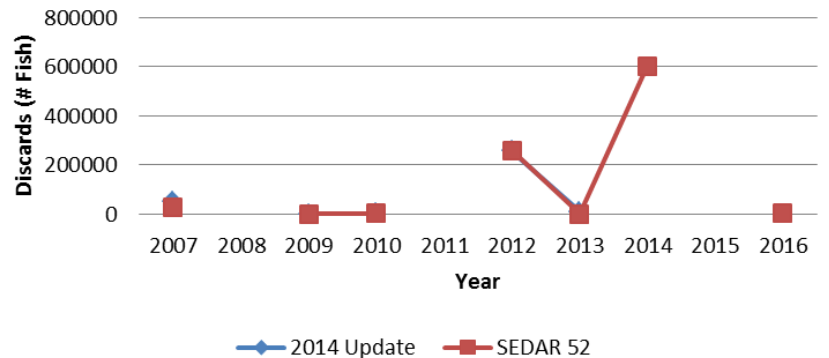
**Handline West Open Season Effort  
Corrected Discards**



**Handline East Closed Season Effort  
Corrected Discards**

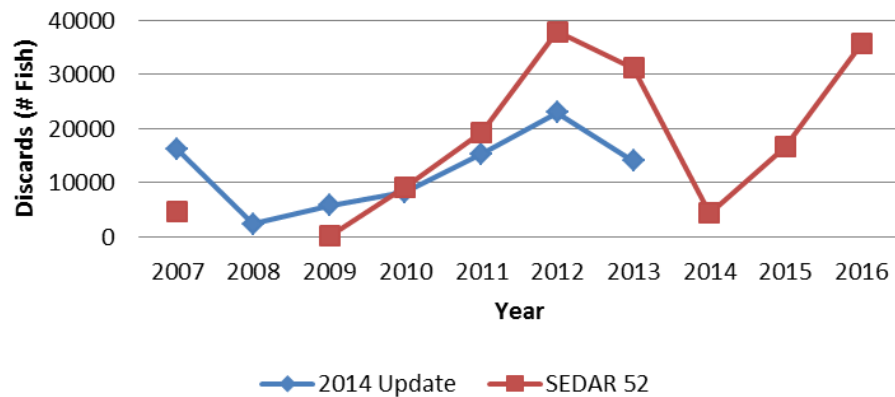


**Handline West Closed Season Effort  
Corrected Discards**

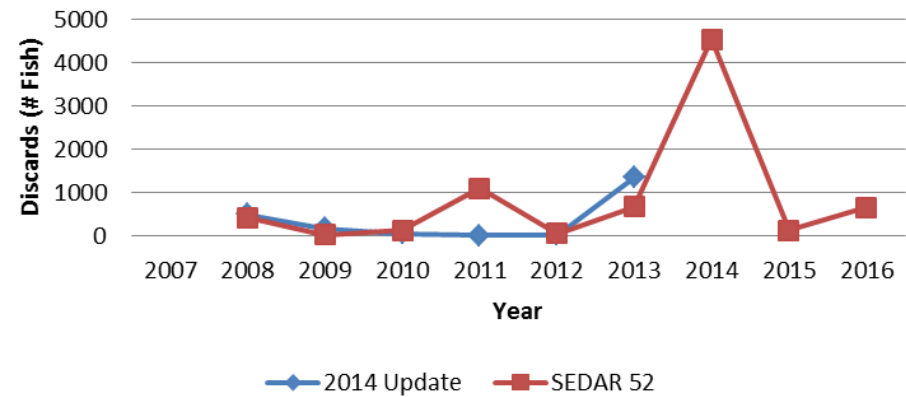


# Commercial Discards-Recommended

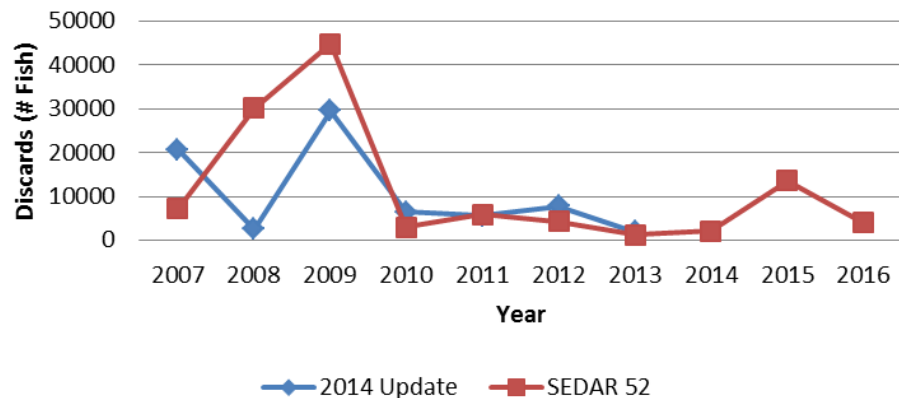
## Longline East Open Season Effort Corrected Discards



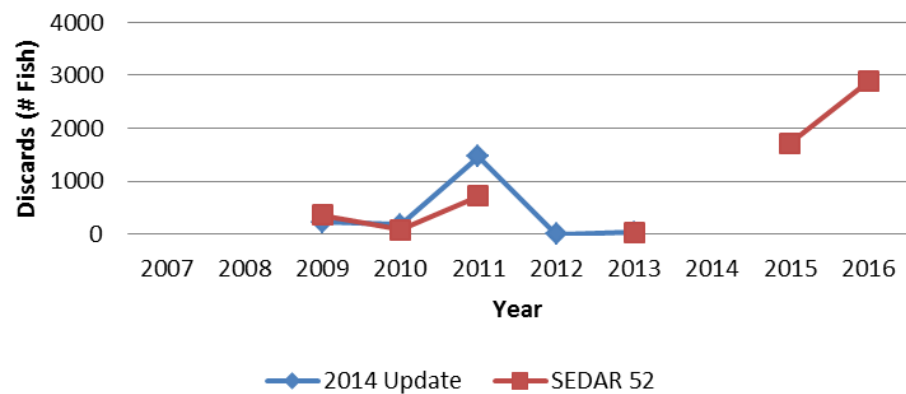
## Longline West Open Season Effort Corrected Discards



## Longline East Closed Season Effort Corrected Discards

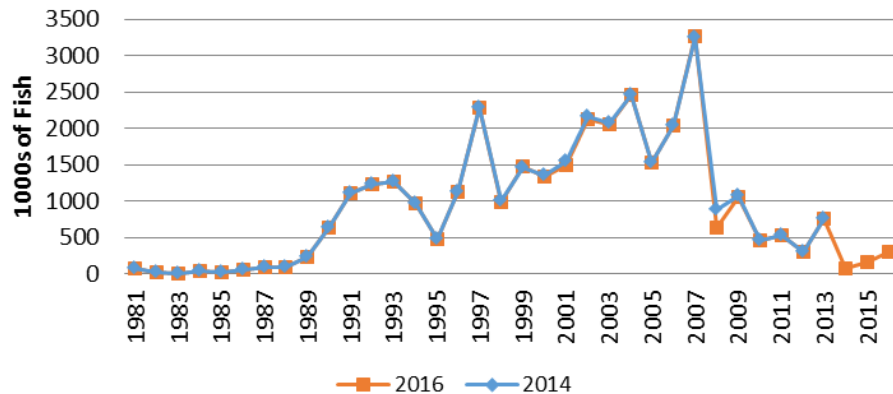


## Longline West Closed Season Effort Corrected Discards

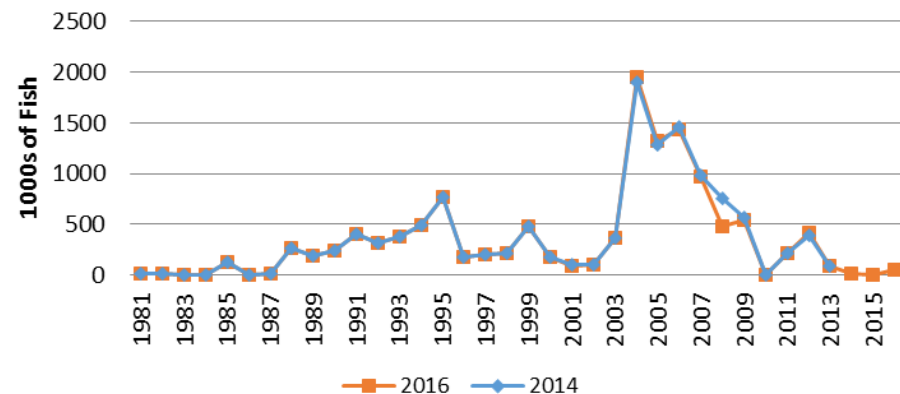


# MRIP Discards

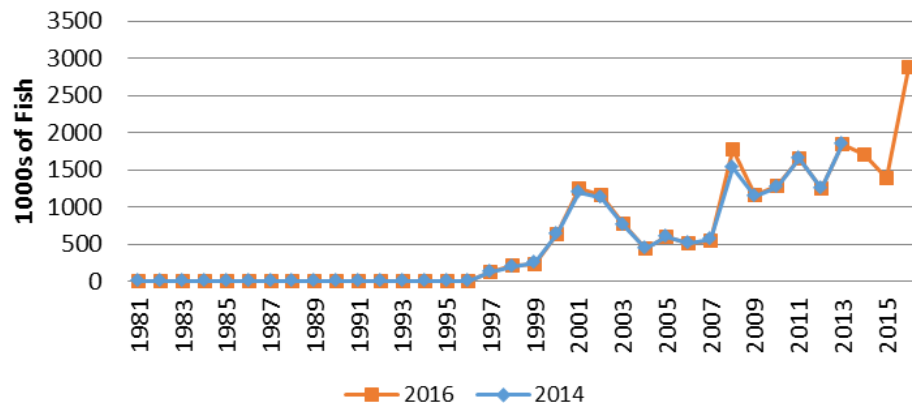
## MRIP-E Open Season Discards Comparison



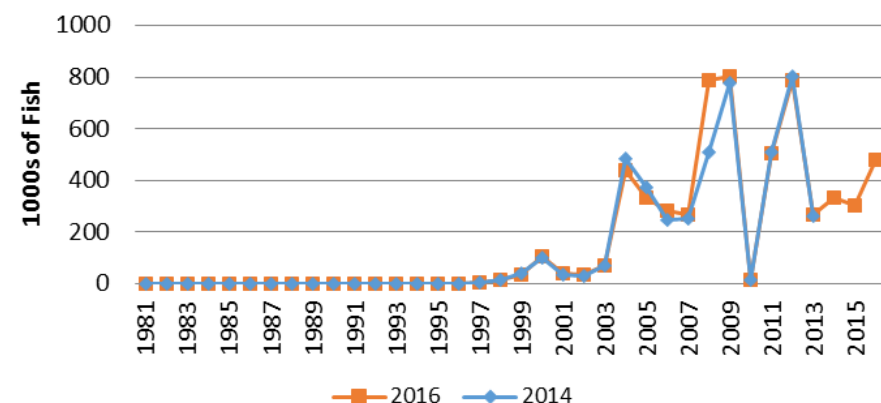
## MRIP-W Open Season Discards Comparison



## MRIP Closed Season East Discards Comparison



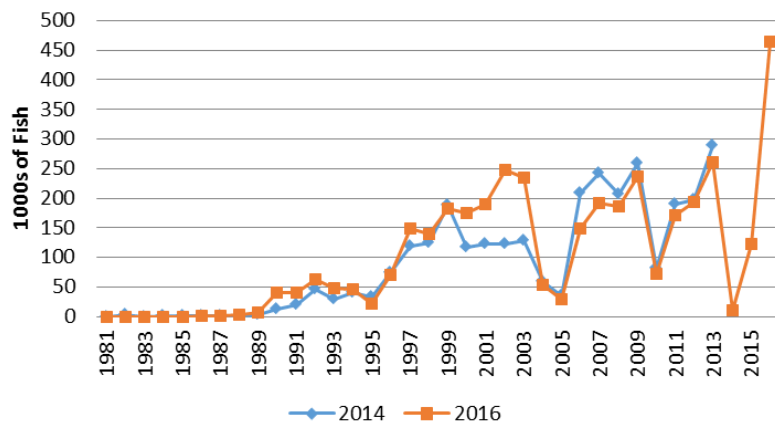
## MRIP Closed Season West Discards Comparison



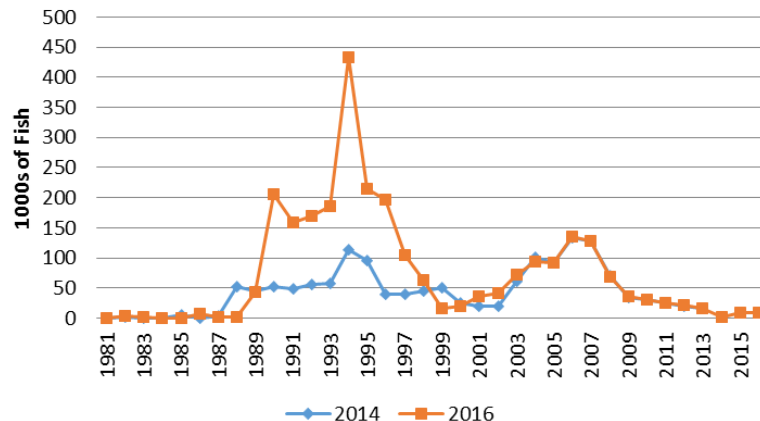
# Headboat Discards--Continuity

Change in MRFSS proxy prior to 2004 due to updated data resulting in new discard ratios

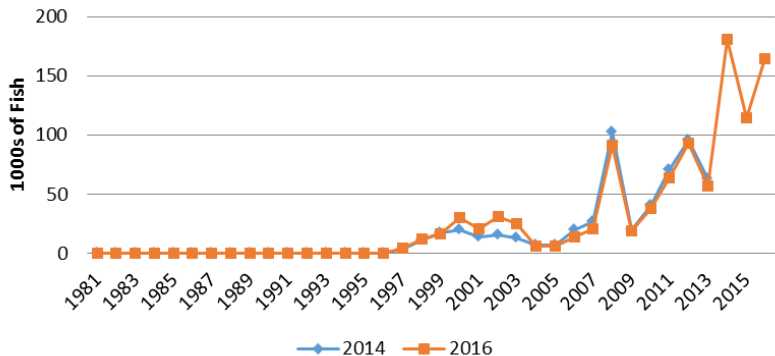
## HBT-E Open Season Discards Comparison



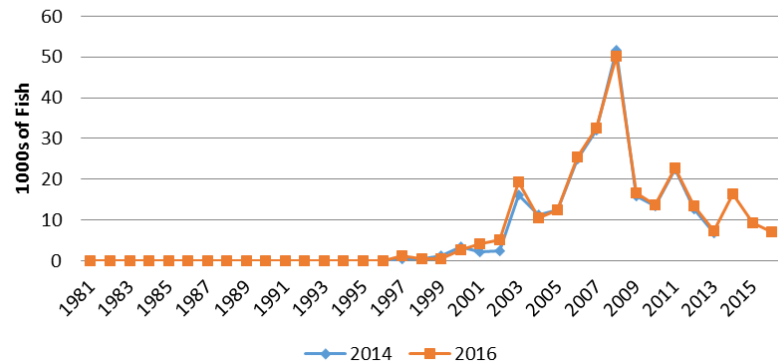
## HBT-W Open Season Discards Comparison



## HBT-E Closed Season Discards Comparison



## HBT-W Closed Season Discards Comparison

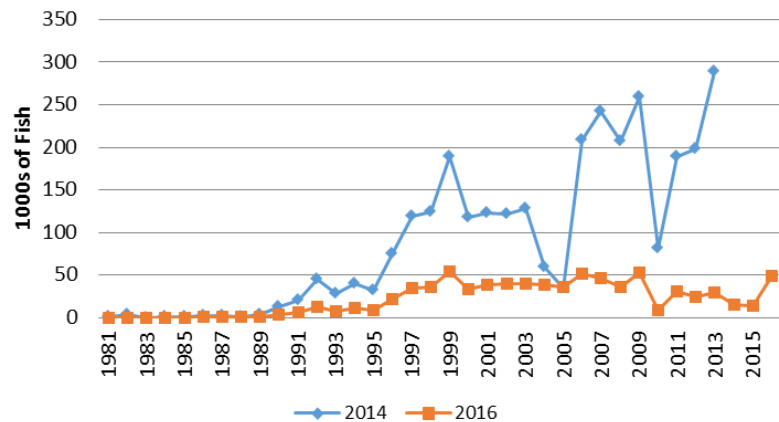




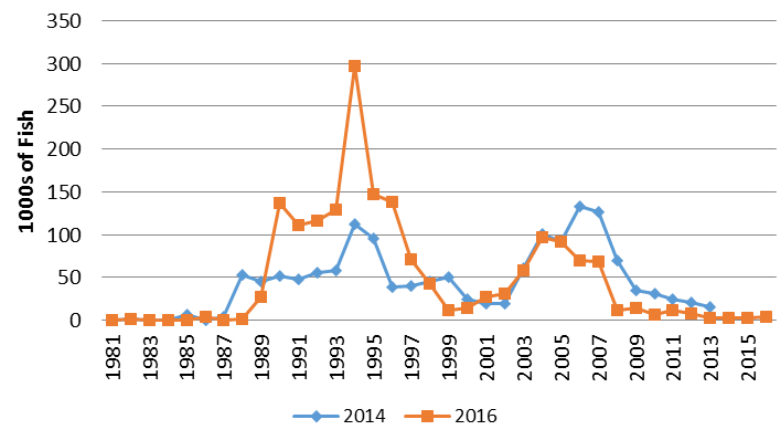
# Headboat Discards--Recommended

Mean MRIP CH : SRHS discard ratio method developed in SEDAR 28

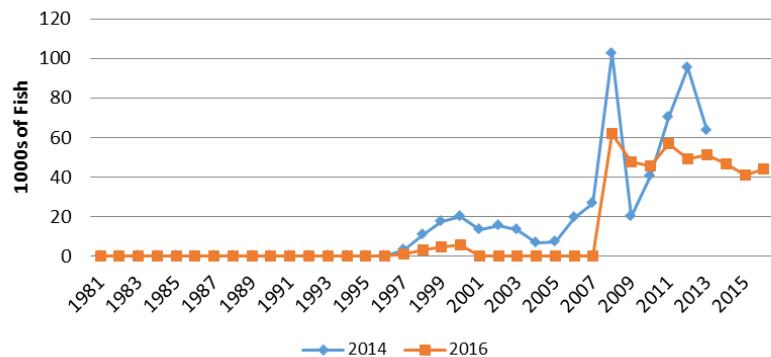
## HBT-E Open Season Discards Comparison



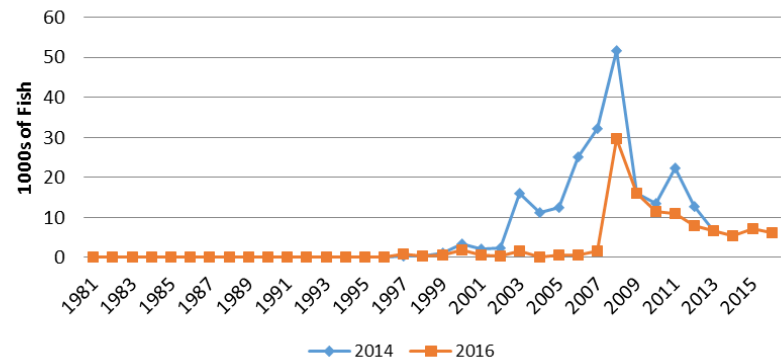
## HBT-W Open Season Discards Comparison



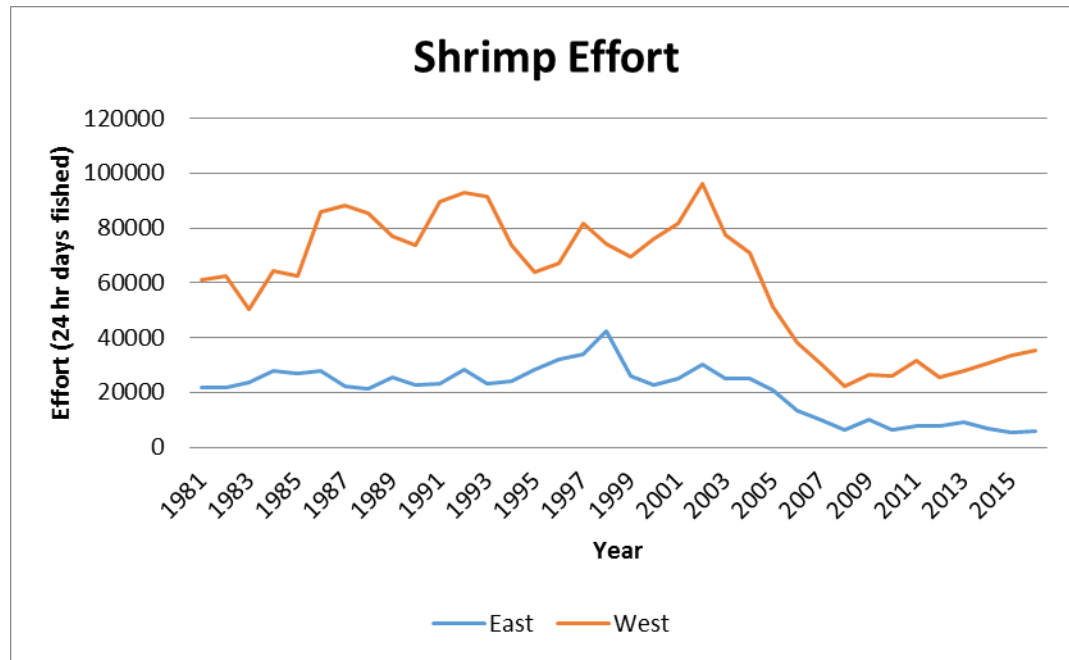
## HBT-E Closed Season Discards Comparison



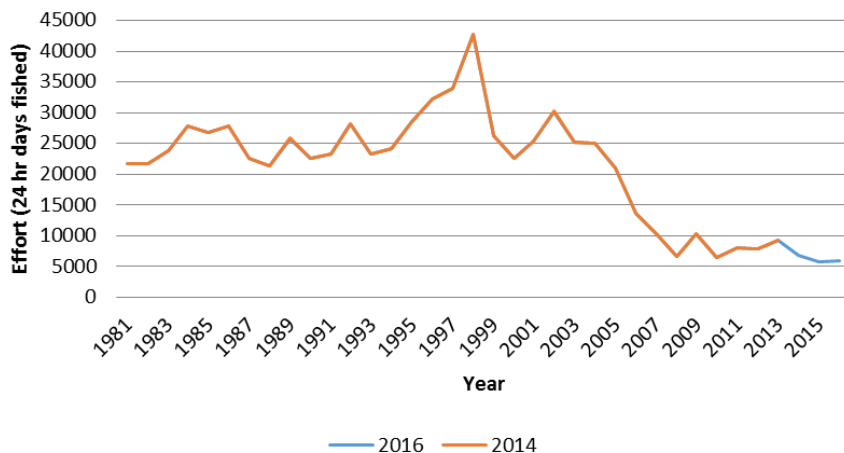
## HBT-W Closed Season Discards Comparison



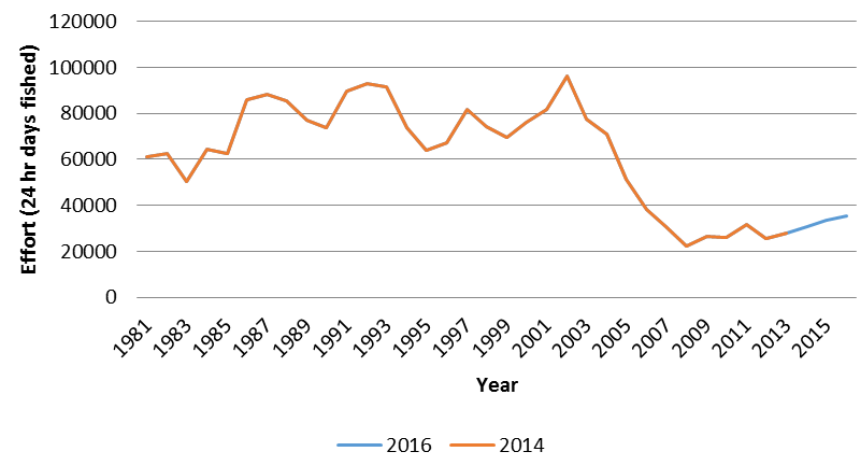
# Shrimp Effort



### Shrimp Effort East



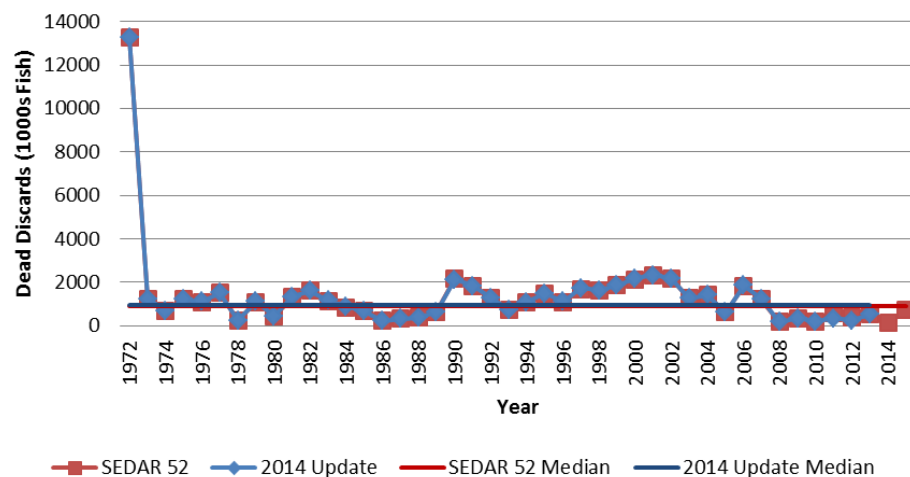
### Shrimp Effort West



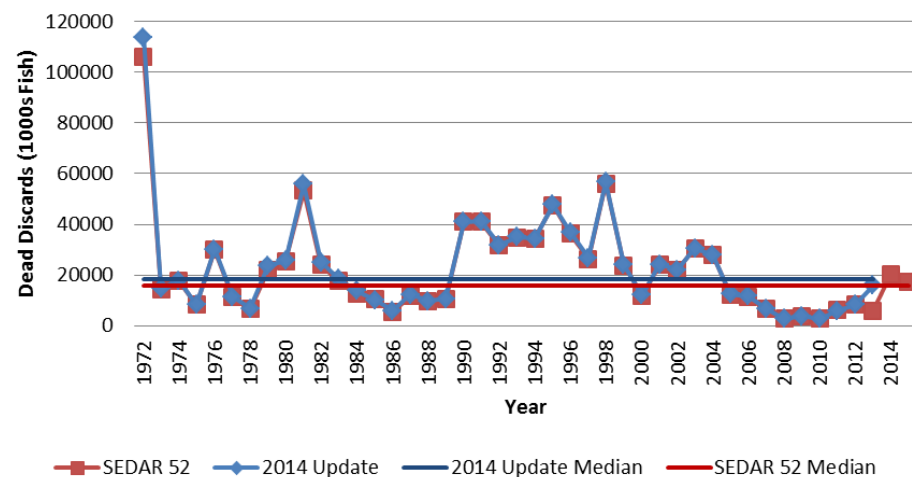
# Shrimp Bycatch

- 2016 values not deemed representative and excluded from analysis
- Little impact due to superyear approach

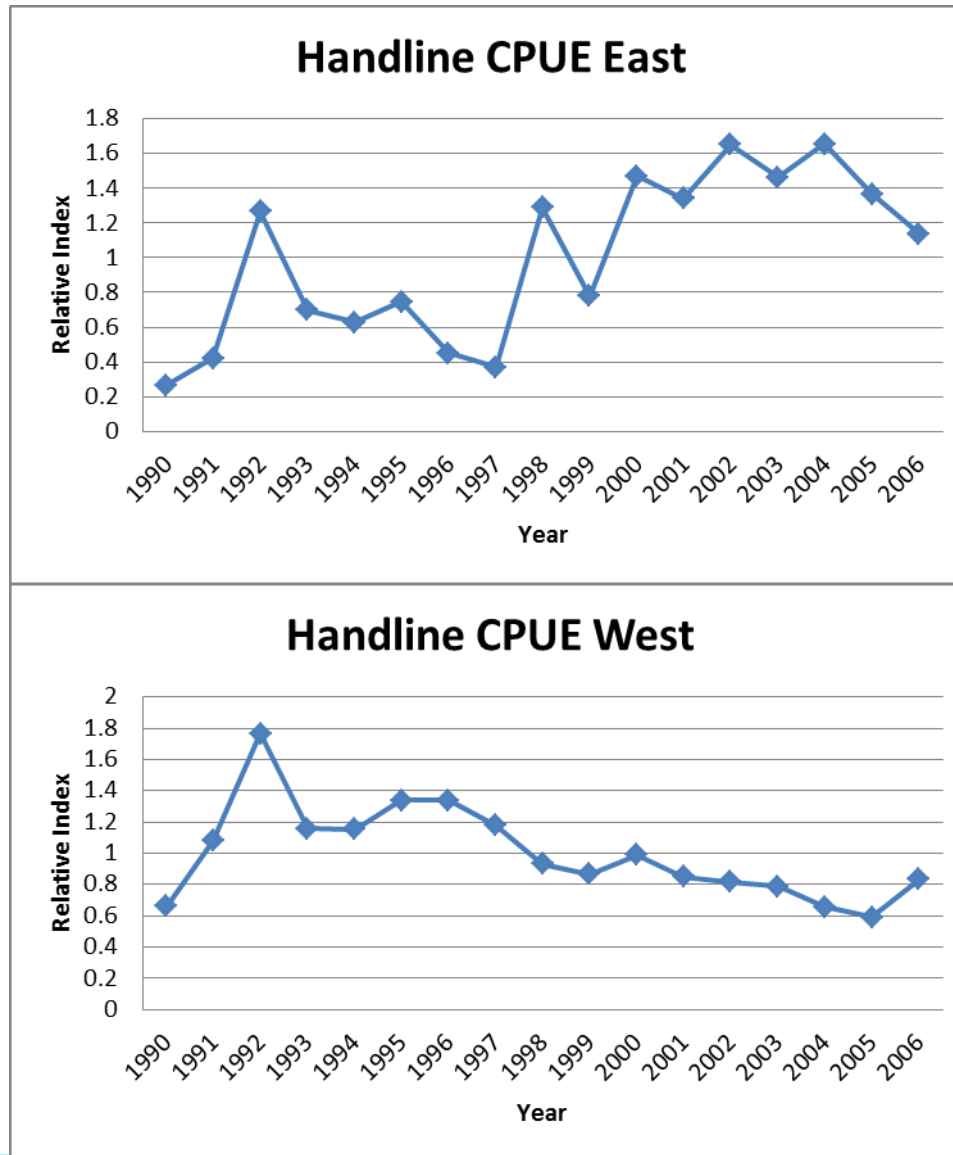
## Shrimp Bycatch East



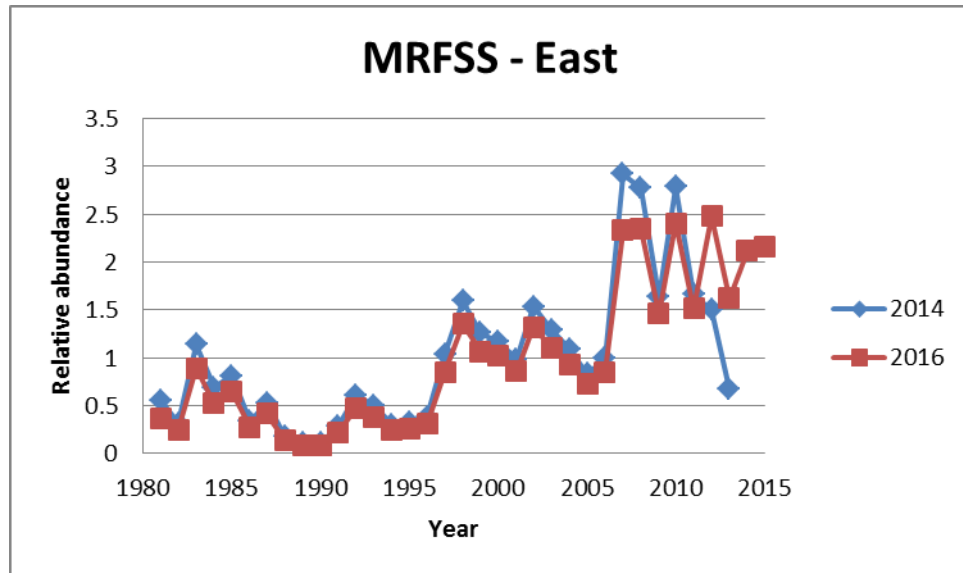
## Shrimp Bycatch West



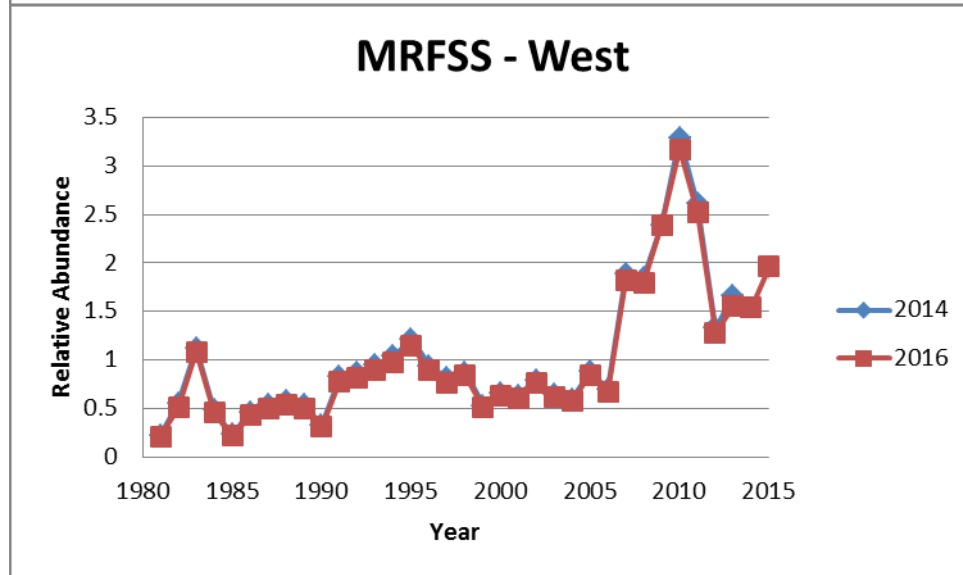
# CPUE—HL (unchanged)



# CPUE—MRFSS

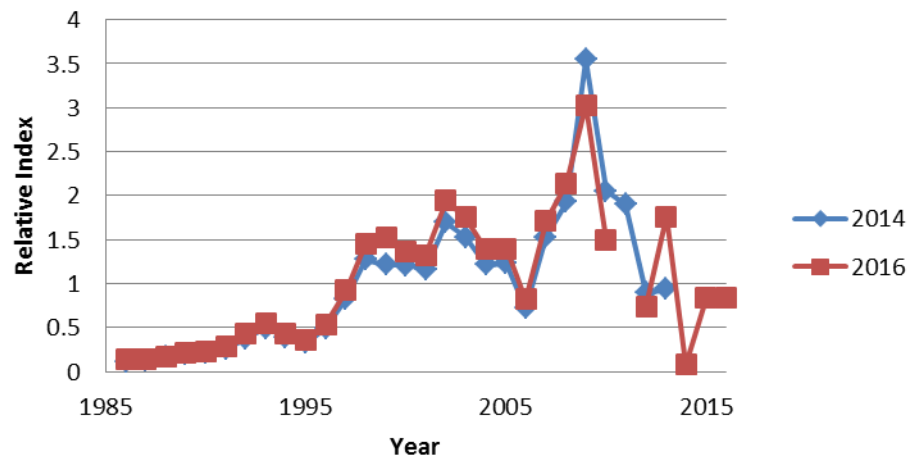


MRFSS-East: previous index did not include certain regulations in 2012-2013



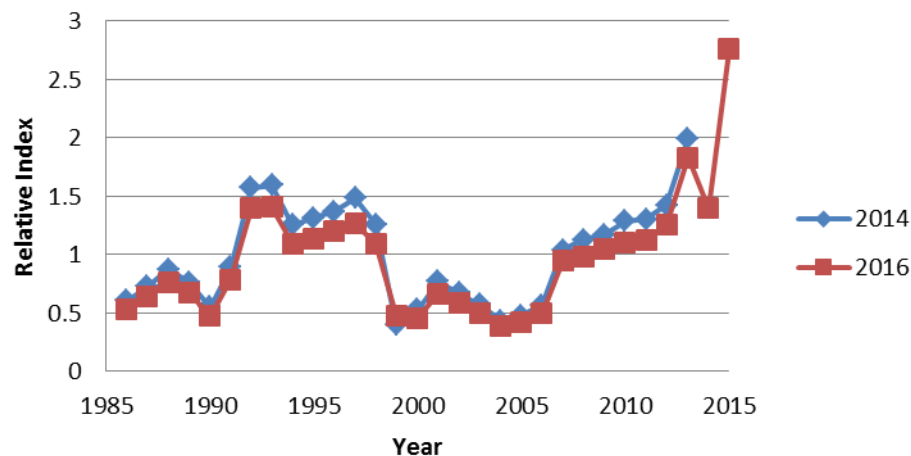
# CPUE—Headboat

## Headboat - East

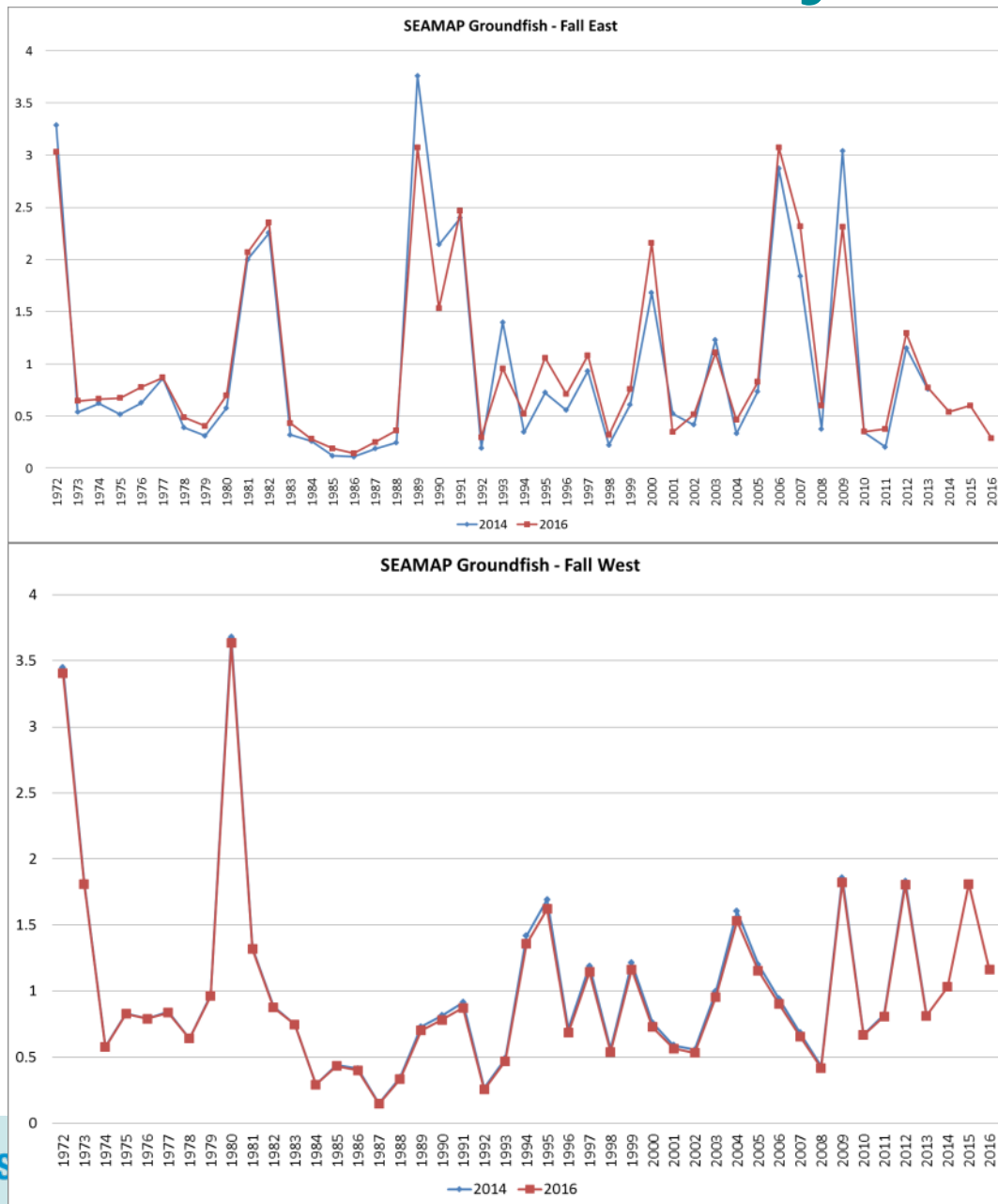


HBT-East: 2011 there are no trips with zero catch and therefore can't estimate CPUE based on the procedures recommended during SEDAR31

## Headboat - West

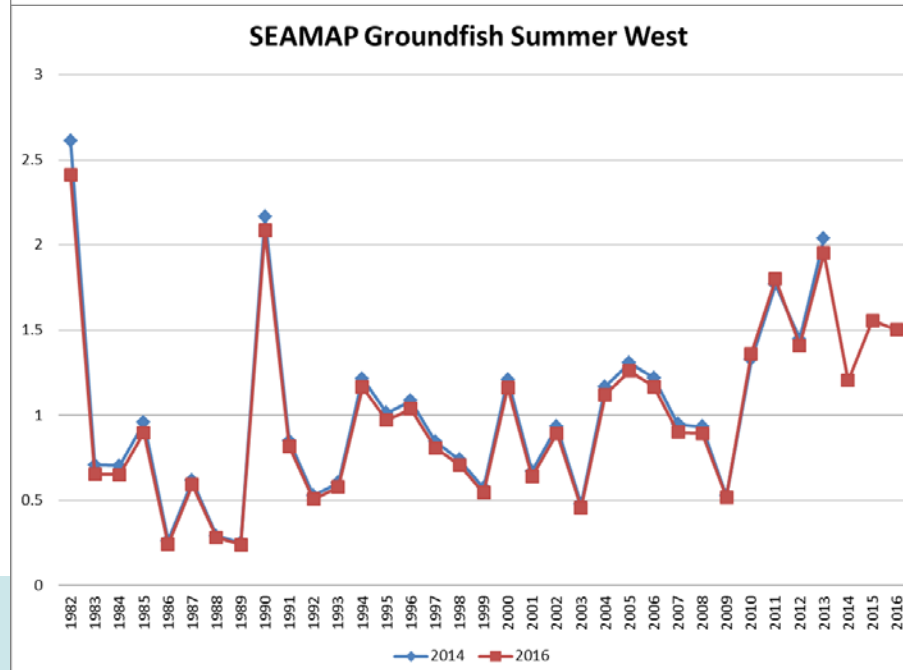
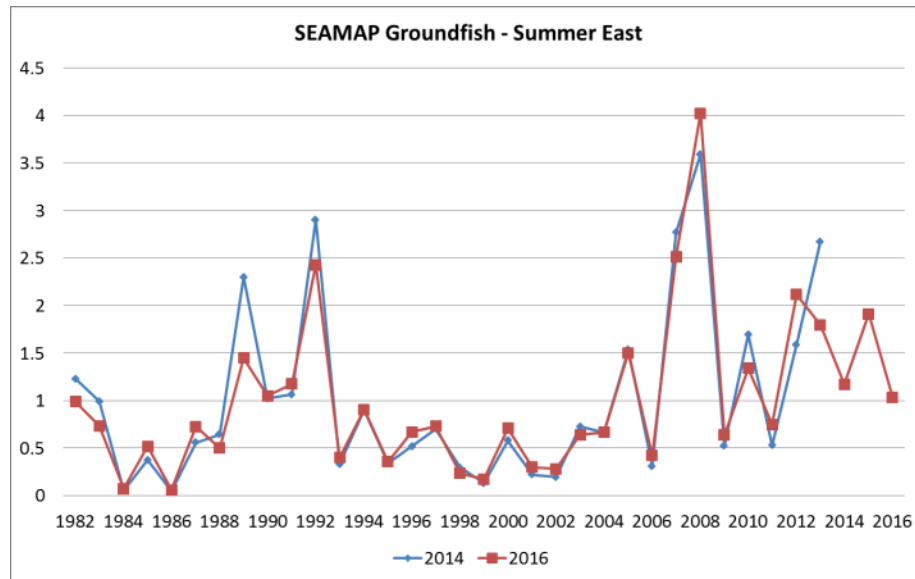


# SEAMAP Fall Groundfish Survey



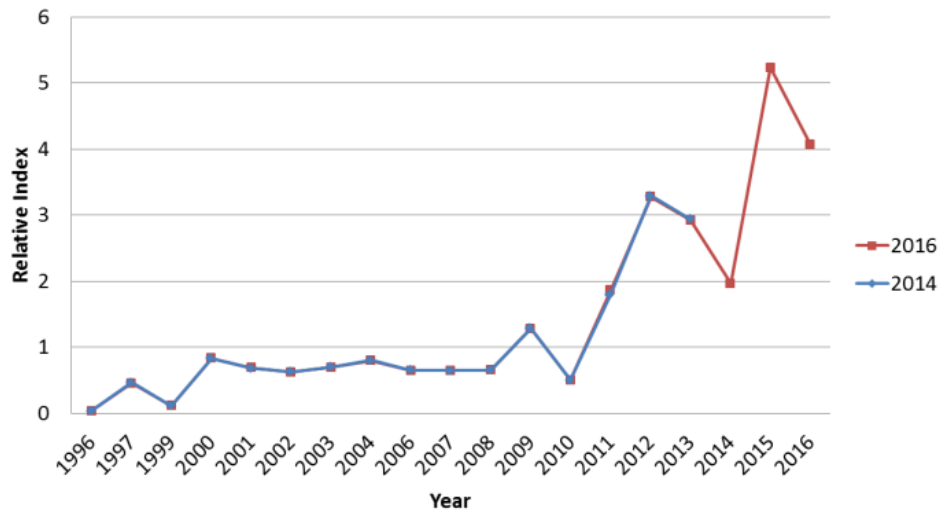


# SEAMAP Summer Groundfish Survey

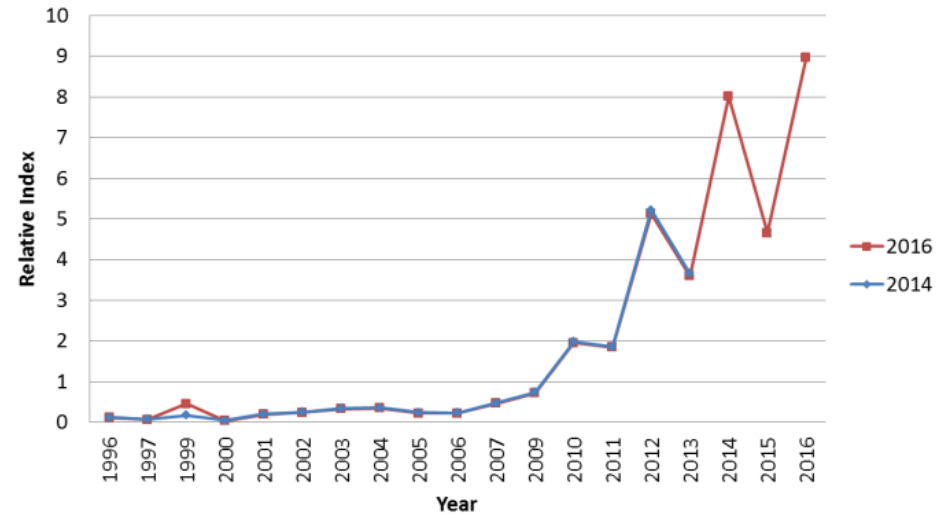


# NMFS Bottom LL

NMFS Bottom Longline Survey West GOM Scaled to Common Mean

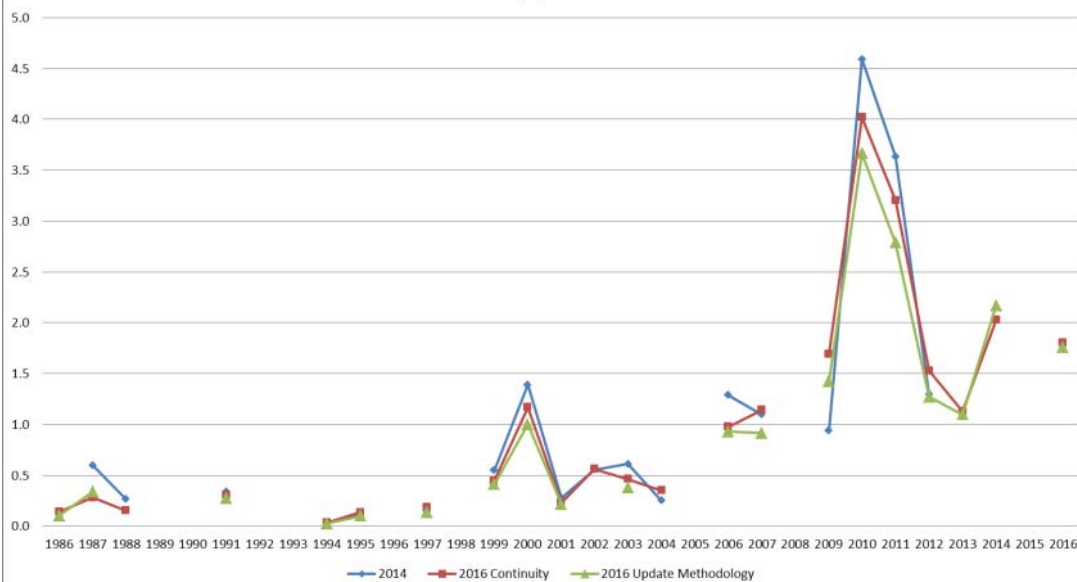


NMFS Bottom Longline Survey East GOM Scaled to Common Mean



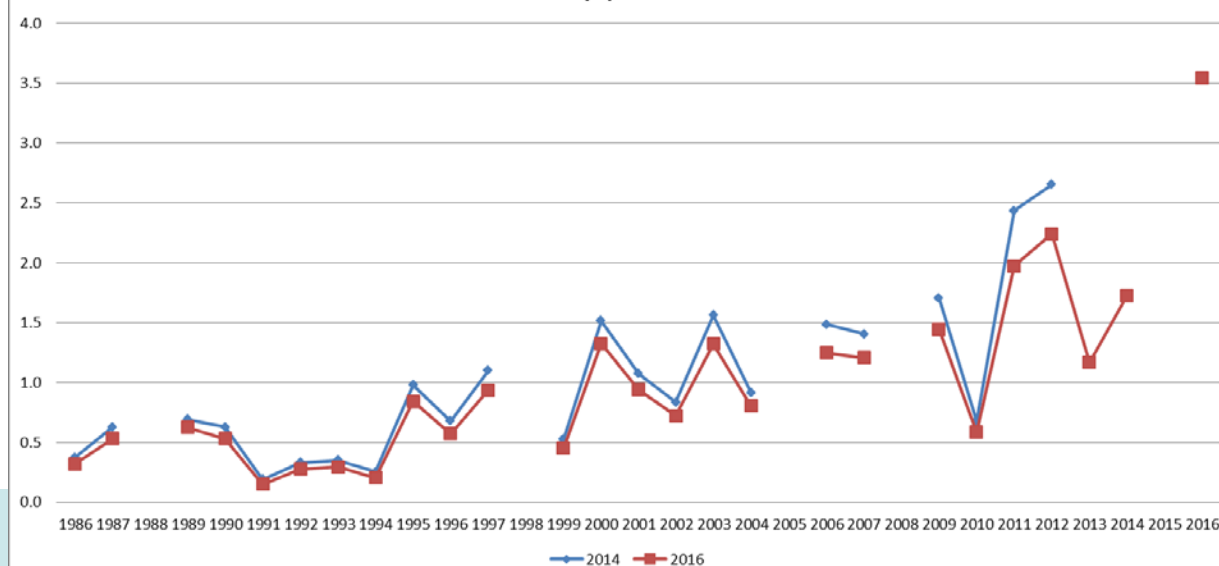
# SEAMAP Larval Survey

Fall SEAMAP Ichthyoplankton- Eastern GOM



Eastern GoM Site  
Selection Changed in  
2016

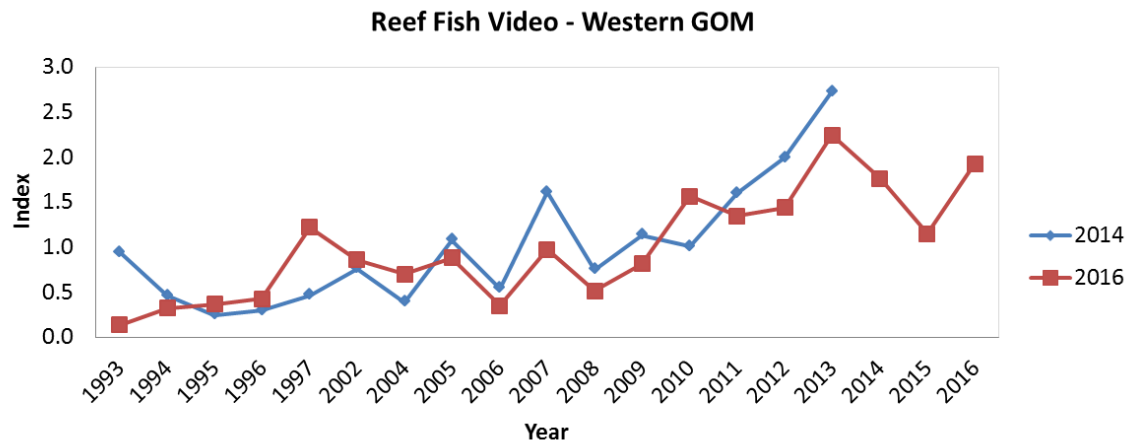
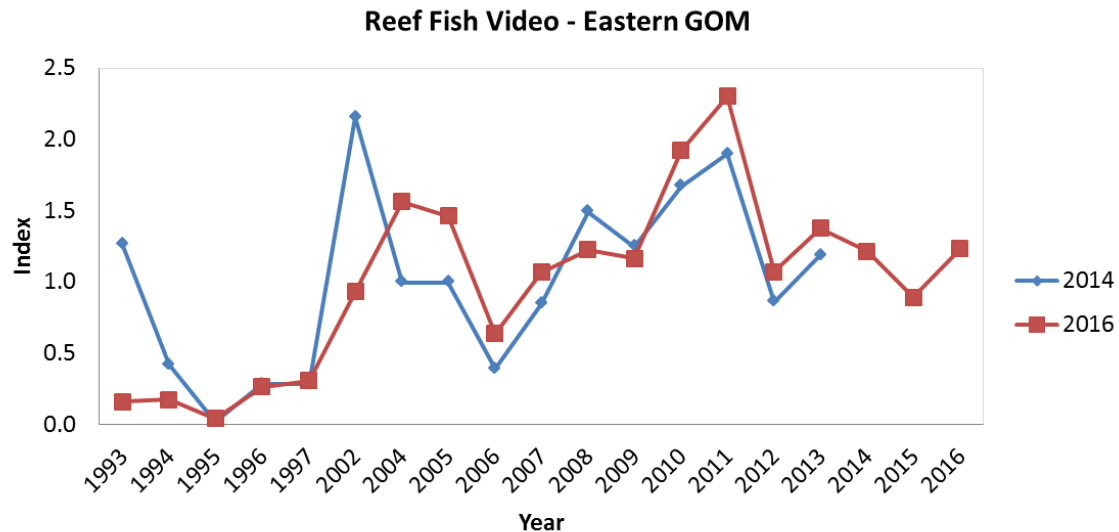
Fall SEAMAP Ichthyoplankton- Western GOM



NOAA FISHERIES

# Video Survey

Discrepancies in indices are largely due to updated QA/QC for SEDAR 52 assessment



# Summary of Data Updates

- Don't use unusually large 2016 shrimp bycatch data
  - Not likely to impact model due to super-year approach which fits median of timeseries
- Method for HBT discards?
  - Use recommended for final and continuity
- Method for commercial discards?
  - Use landings corrected (recommended) discards for base and continuity model
- Update recreational discard mortality (11.8%) for both East and West (open+closed season) post 2008 (post-venting implementation)
- Truncate MRIP or HBT CPUE?
  - Truncate HBT-E in 2013 (use for continuity and base)
  - Truncate MRFFS in 2013 (use for continuity and base)



# 'Continuity' Model



# Model Overview:

- **MODEL (SS3) AND STRUCTURE SAME AS SEDAR 31**
- Age structured model: ages 0 to 20+, 1872-2016
- 2 region model : East and West of Mississippi River
- Time-varying parameters
  - **Recruitment** – higher productivity in recent years (1984-2016); time-varying apportionment to region
  - **Selectivity** to account for implementation of IFQ program and circle hooks
  - **Retention** to account for changes in size limits and IFQ
  - **Discard mortality** to account for venting
- Shrimp bycatch treated as a ‘super-year’
  - Fit median bycatch not yearly bycatch
  - Use shrimp effort to scale F





# Model Changes

- Continuity Model Changes
  - Data:
    - Update recreational discard mortality (11.8%)
    - Update commercial discards using landings corrected method
    - Use best practices for headboat discard estimates
    - Update MRIP CPUE by truncating E+W in 2013
    - Update HBT-E by truncating in 2013
    - Use update larval index with new site selection in east
  - Assessment
    - Scale index standard errors to a common mean of 0.2



# Model Review: Data Inputs

## Fishing fleets

### **Directed fleets (landings)**

- Com Handline (E: 1872-2016) (W: 1872-2016)
- Com Longline E/W (1980-2016)
- MRFSS/MRIP E/W (1950-2016)
- Headboat E/W (1950-2016)

### **Directed fleets (discards)**

- Com Handline (1990-2016)
- Com Longline E/W (1990-2016)
- MRFSS/MRIP E/W (1981-2016)
- Headboat E/W (1990-2016)

### **Bycatch fleets (discards only)**

- Com Closed Season E/W (1991-2016)
- Rec Closed Season E/W (1997-2016)
- Shrimp Bycatch E/W (1972-2015)

## Indices of abundance (18)

### **Fishery dependent (8)**

- Commercial Handline E/W (1990-2006)
- MRFSS/MRIP E/W (1981-2013)
- Headboat E/W (1986-2013/16)
- Shrimp Fishing Effort E/W (1950-2016)

### **Fishery independent (10)**

- SEAMAP Video E/W (1993-2016)
- SEAMAP Plankton E/W (1986-2016)
- SEAMAP Summer Groundfish E/W (1982-2016)
- SEAMAP Fall Groundfish Trawl E/W (1972-2016)
- NFMS bottom longline E/W (1996-2016)



# Base model results



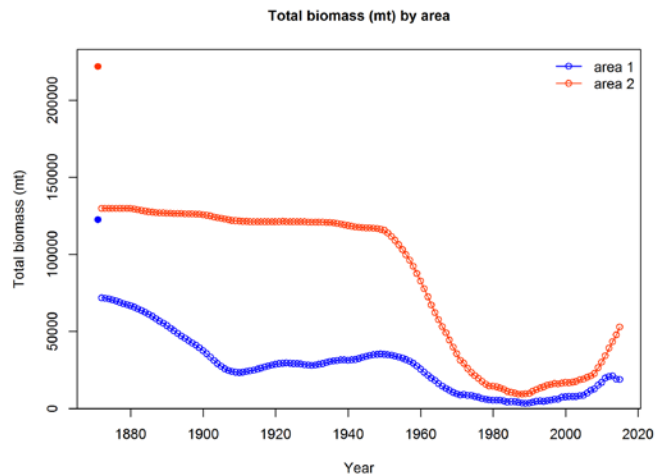
# Model Structure Changes:

- **MODEL (SS3) AND STRUCTURE SAME AS Continuity EXCEPT:**
  - Selectivity parameters now estimated as double normal (not random walk by age)
    - EXCEPT: SEAMAP Trawl, Shrimp, and BLL same as before
    - More data available (especially at older ages) to estimate selectivity parameters
  - Reweight age composition effective sample size
    - Improved diagnostics

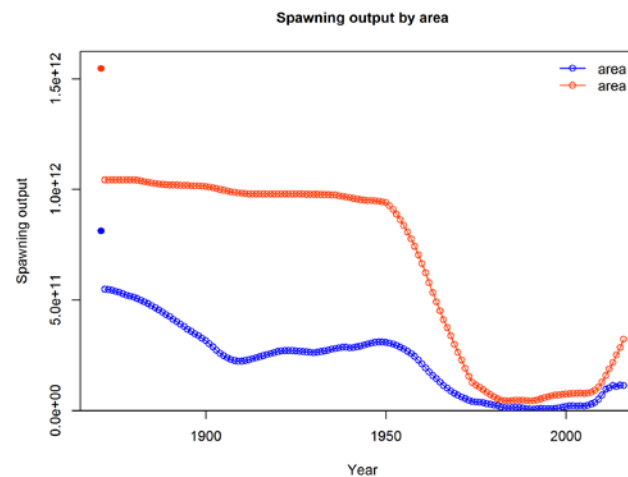
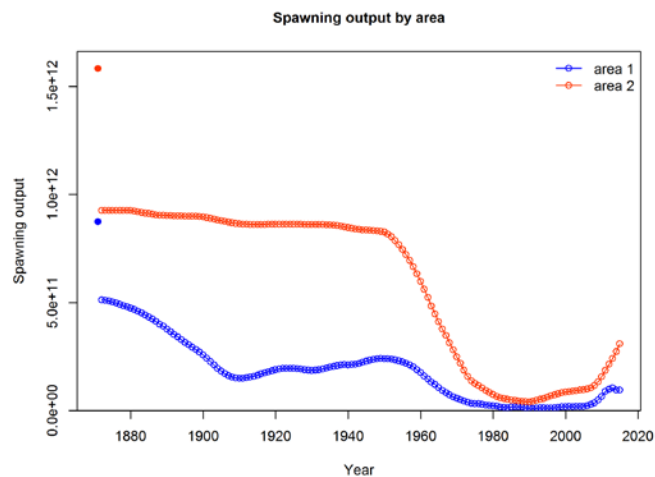
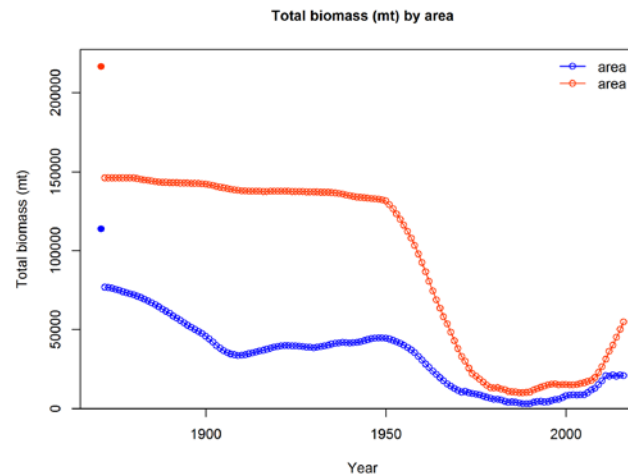


# Biomass Timeseries

2014 SEDAR 31 Update Assessment



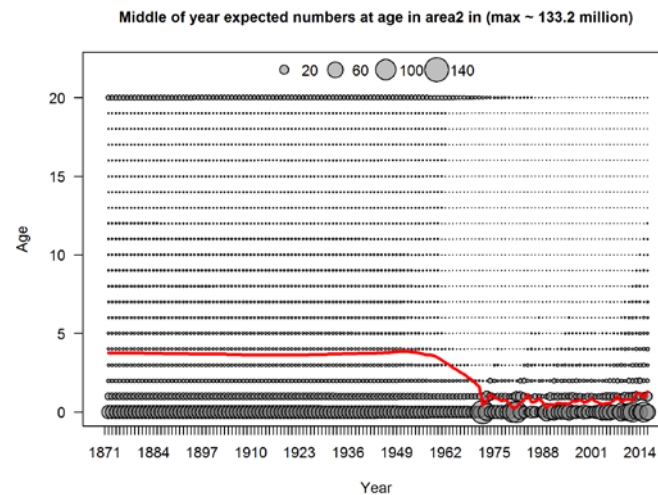
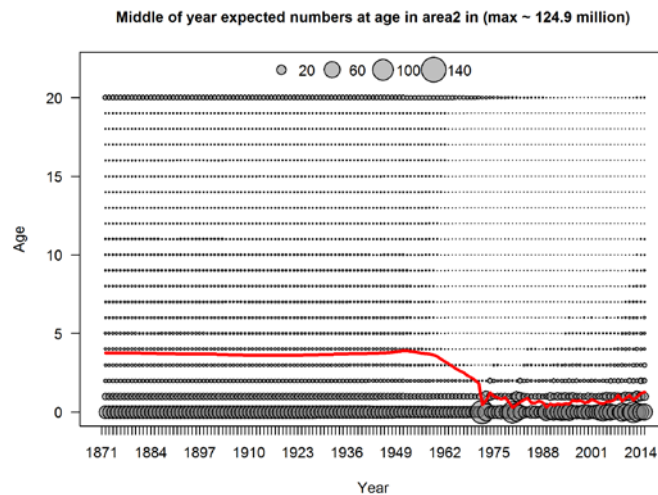
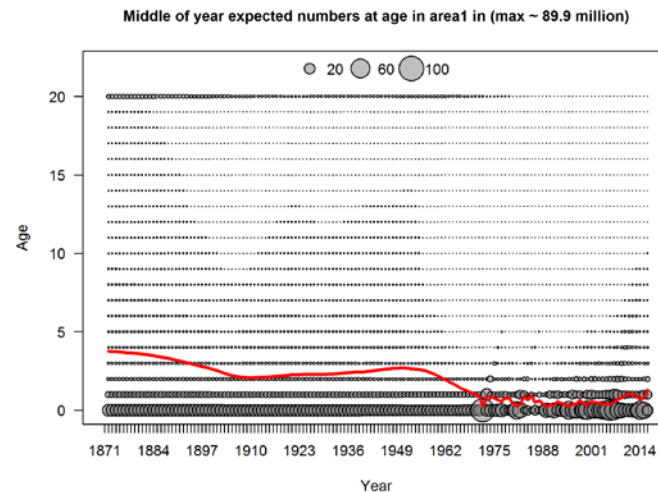
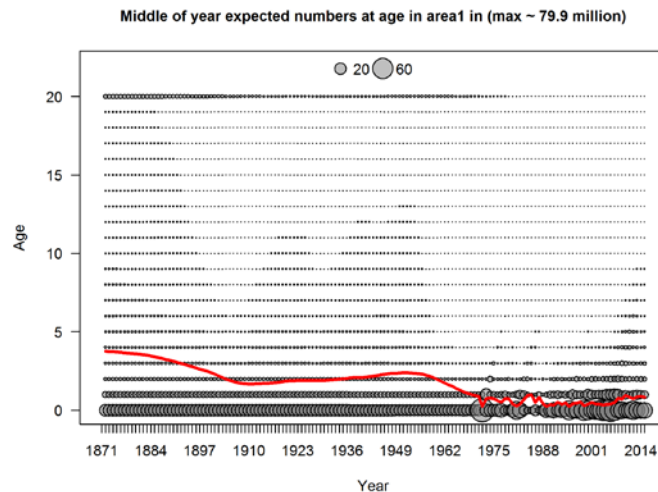
SEDAR 52



# Numbers-at-Age Timeseries

2014 SEDAR 31 Update Assessment

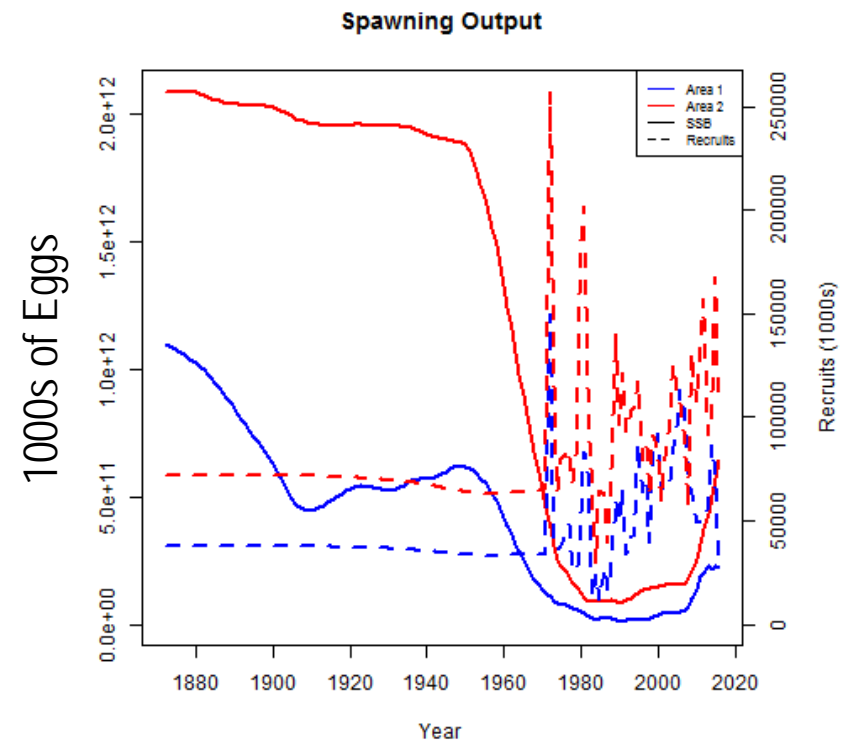
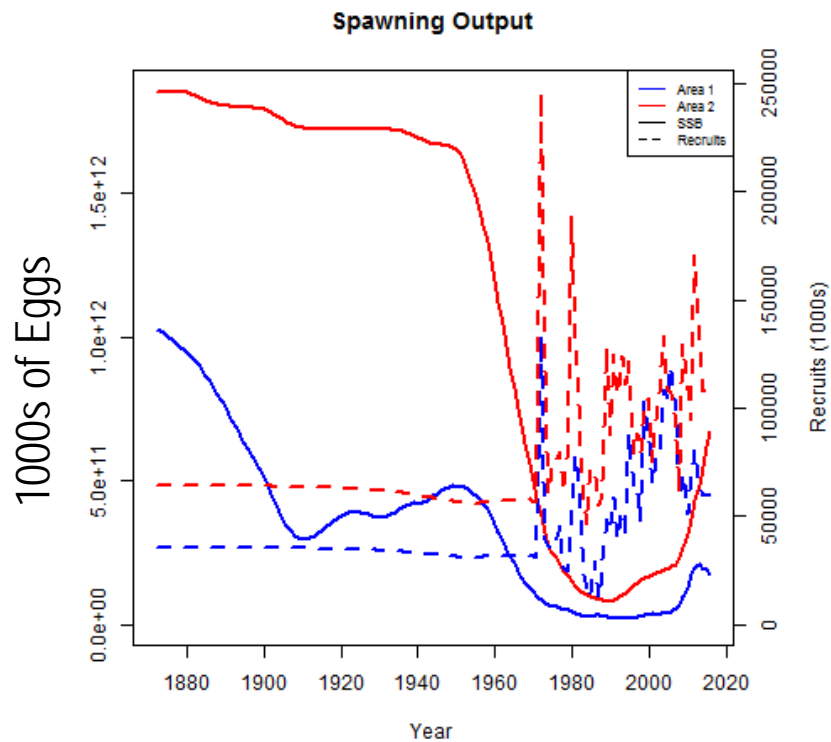
SEDAR 52



# SSB and Recruitment Timeseries

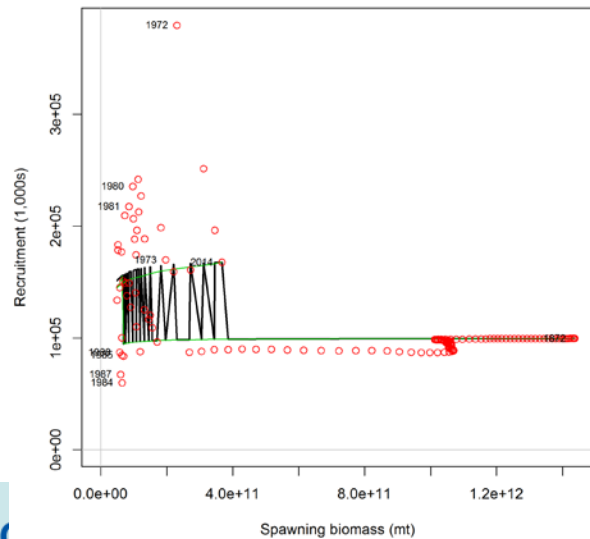
2014 SEDAR 31 Update Assessment

SEDAR 52

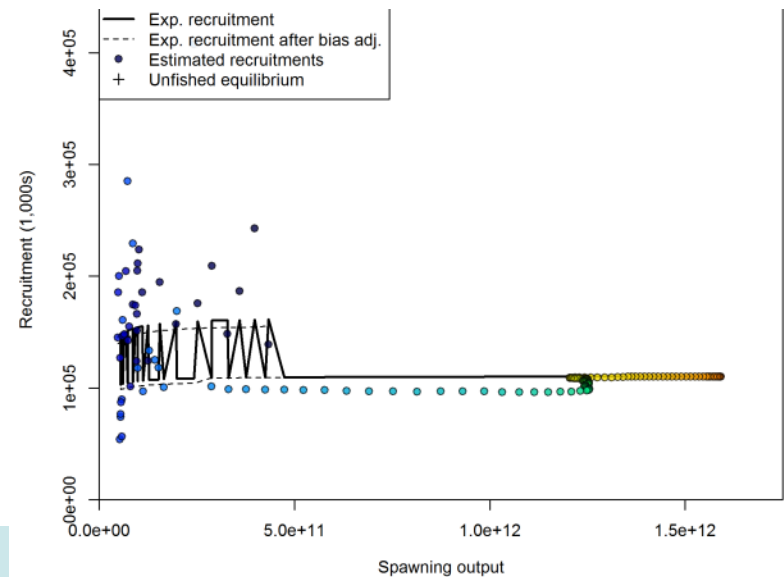
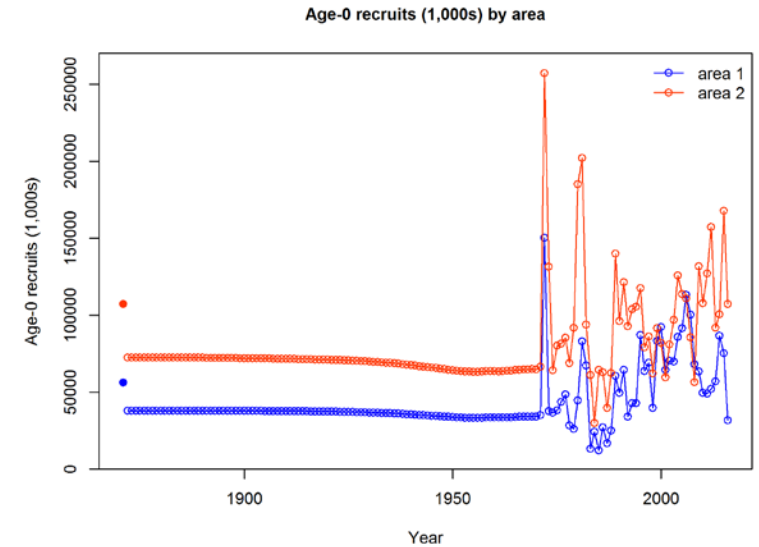


# Recruitment

2014 SEDAR 31 Update Assessment



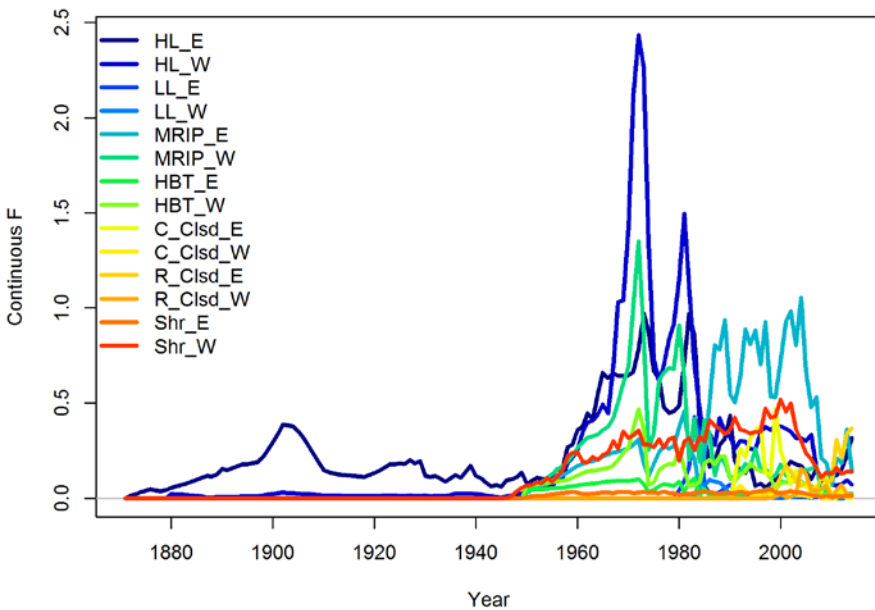
SEDAR 52



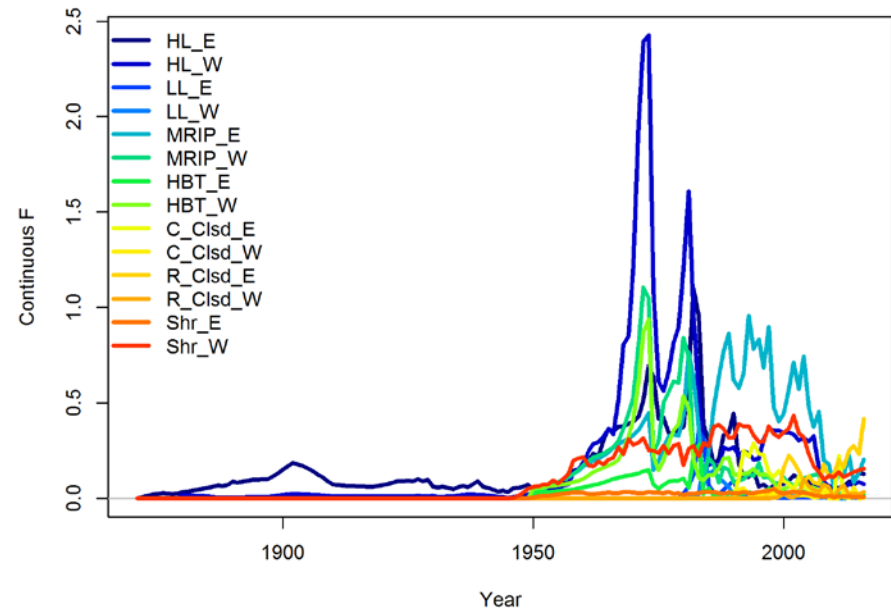


# Fully Selected F

2014 SEDAR 31 Update Assessment

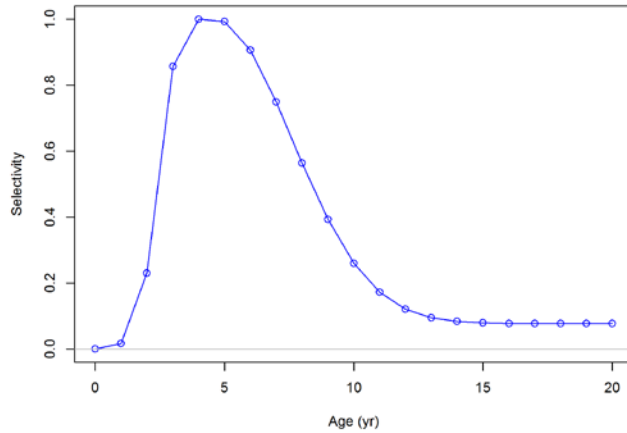


SEDAR 52

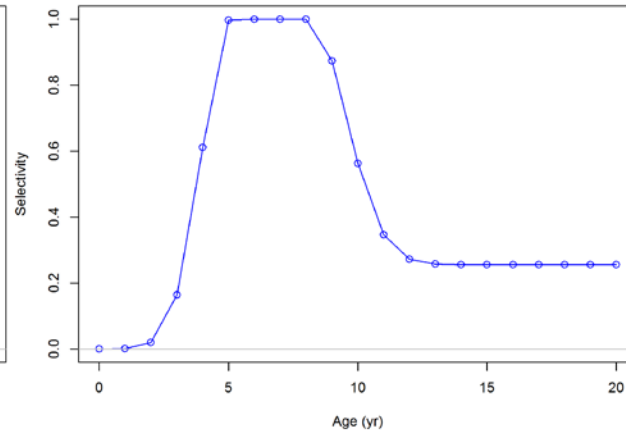


# Terminal Year Selectivity by Fleet

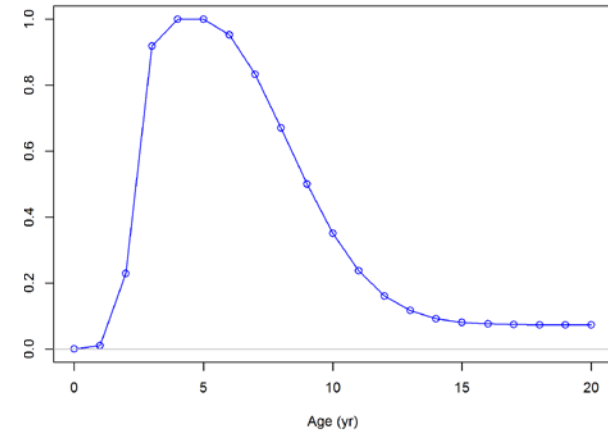
Ending year selectivity for HL\_E



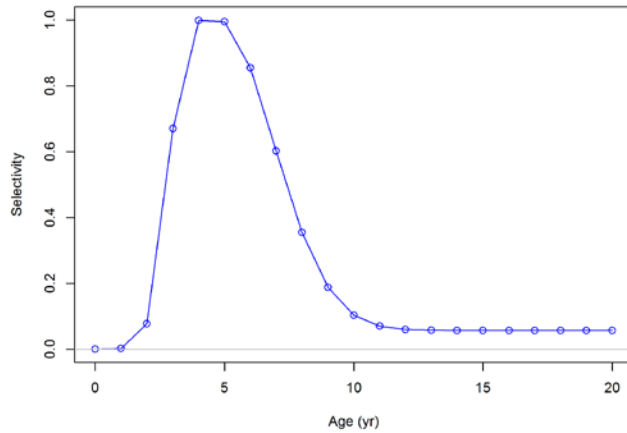
Ending year selectivity for LL\_E



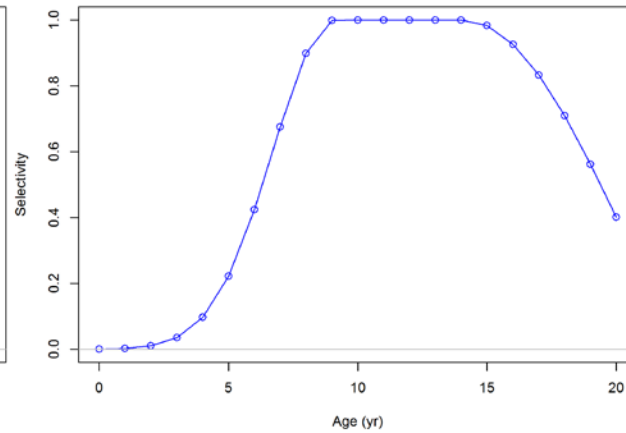
Ending year selectivity for C\_Clsd\_E



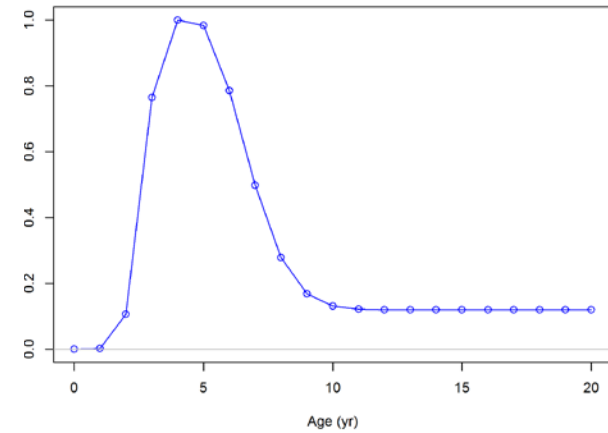
Ending year selectivity for HL\_W



Ending year selectivity for LL\_W

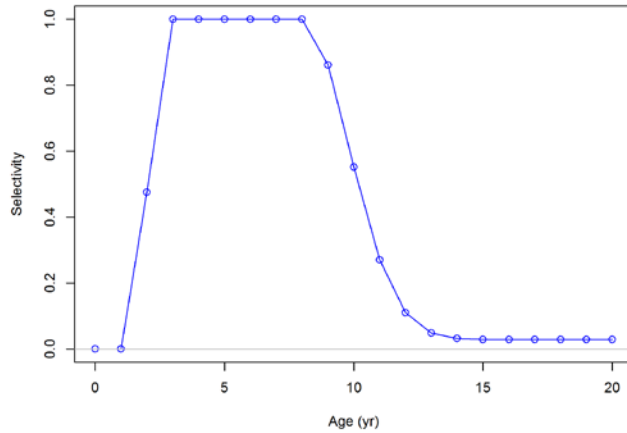


Ending year selectivity for C\_Clsd\_W

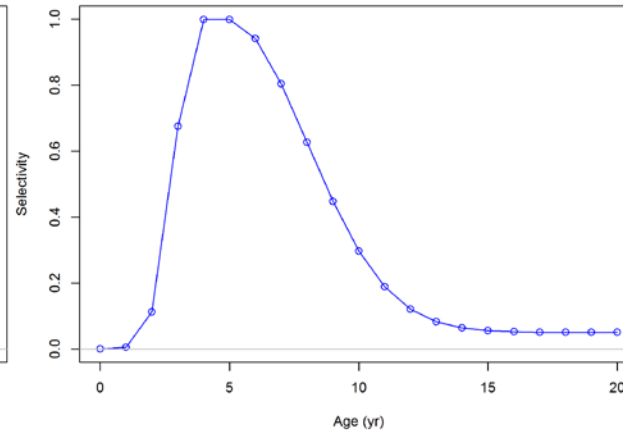


# Terminal Year Selectivity by Fleet

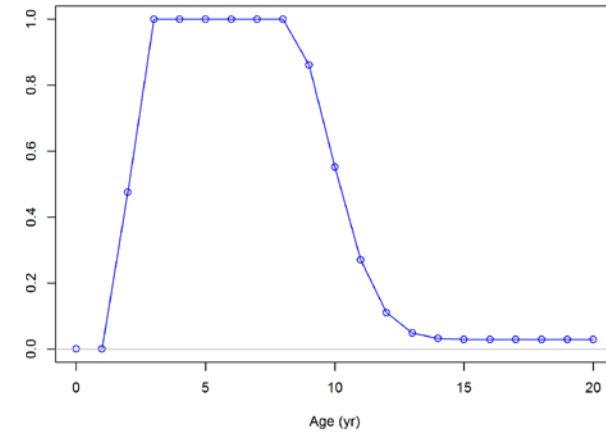
Ending year selectivity for MRIP\_E



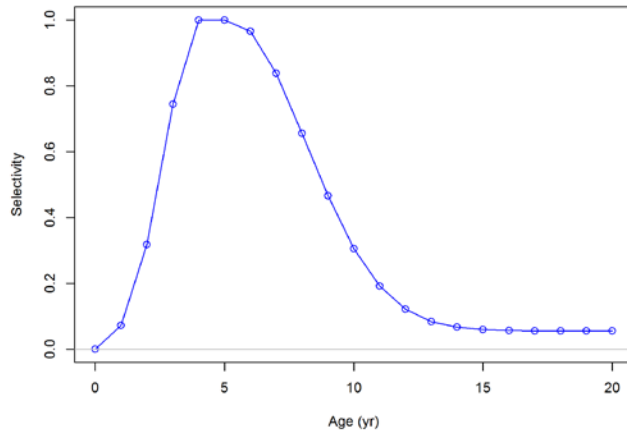
Ending year selectivity for HBT\_E



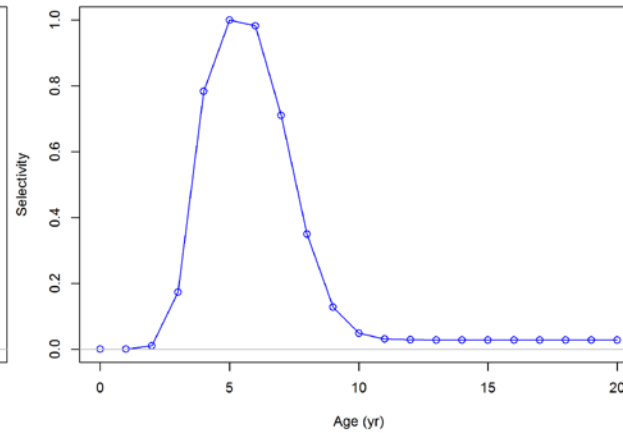
Ending year selectivity for R\_Clsd\_E



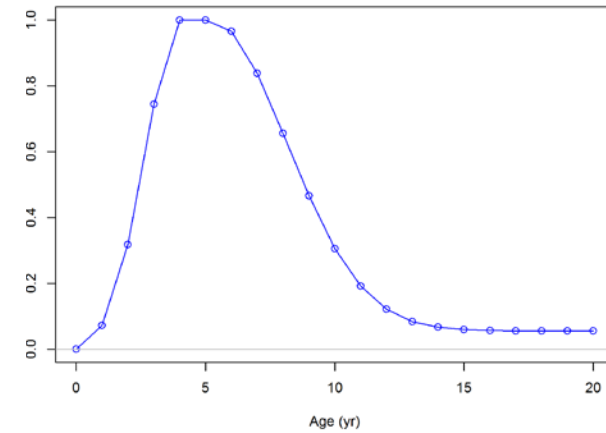
Ending year selectivity for MRIP\_W



Ending year selectivity for HBT\_W

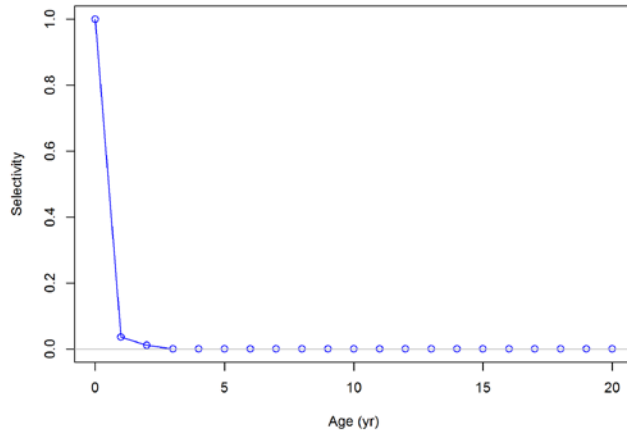


Ending year selectivity for R\_Clsd\_W

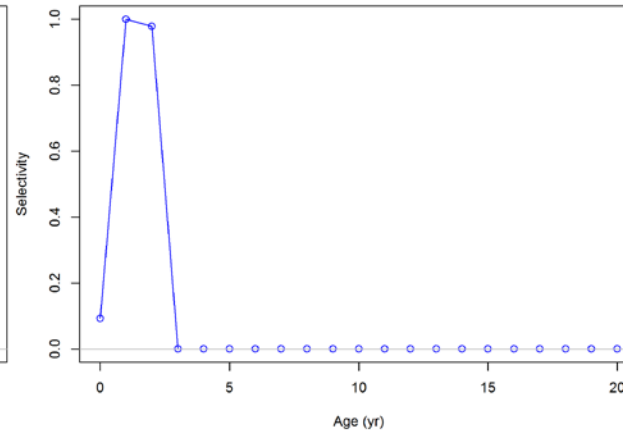


# Terminal Year Selectivity by Fleet

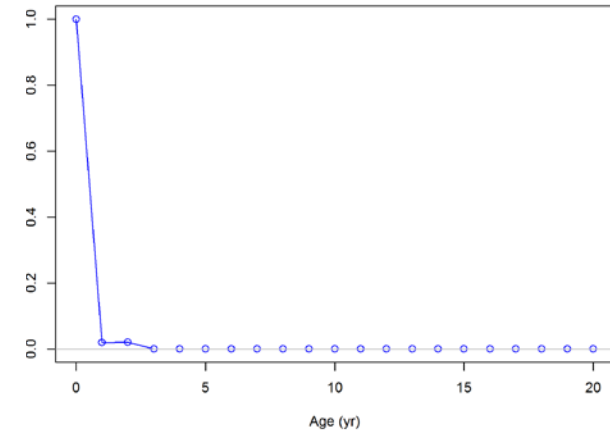
Ending year selectivity for Shr\_E



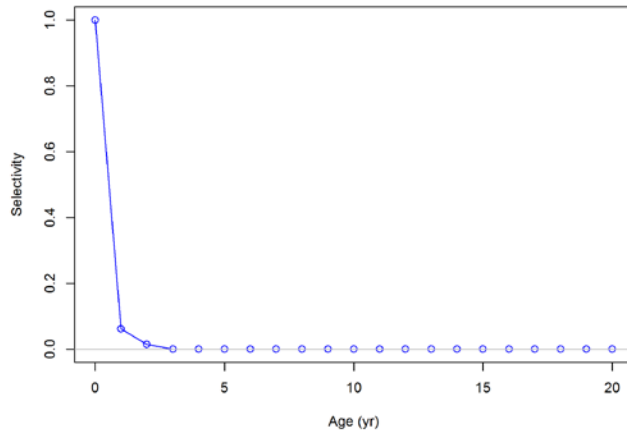
Ending year selectivity for Sum\_E



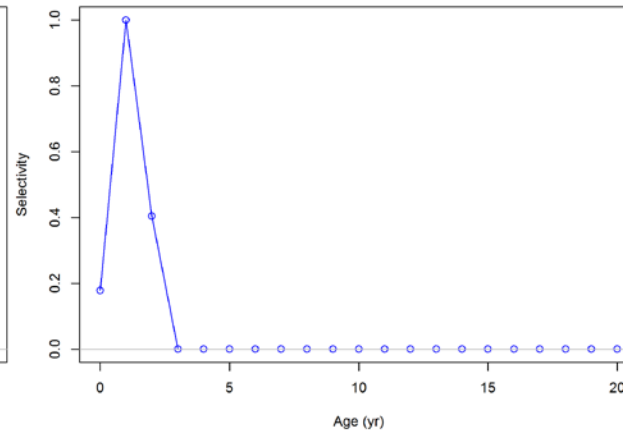
Ending year selectivity for Fall\_E



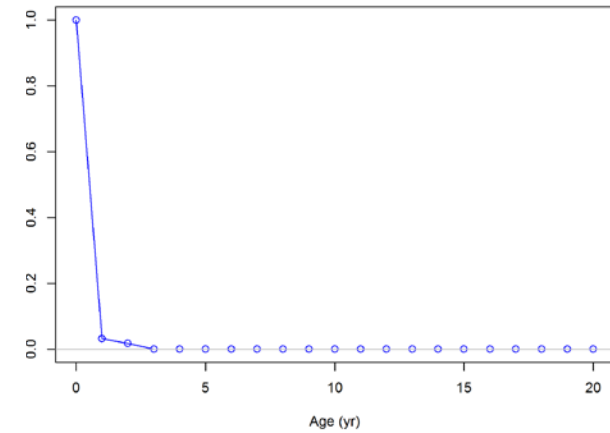
Ending year selectivity for Shr\_W



Ending year selectivity for Sum\_W

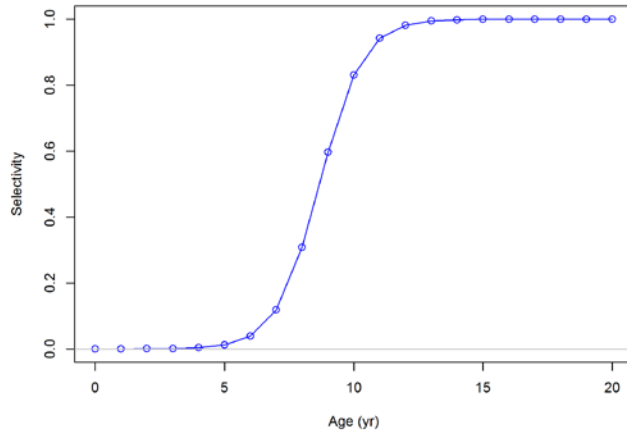


Ending year selectivity for Fall\_W

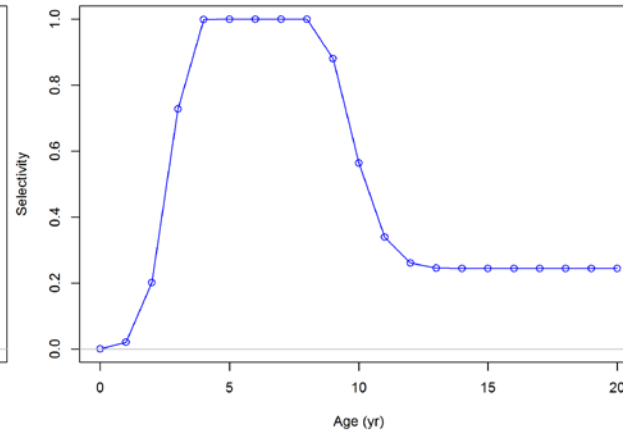


# Terminal Year Selectivity by Fleet

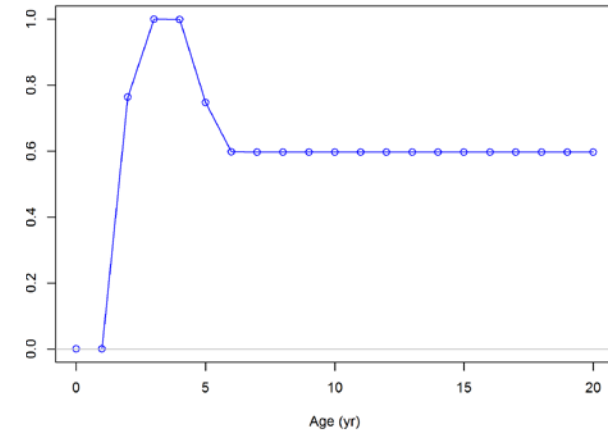
Ending year selectivity for BLL\_E



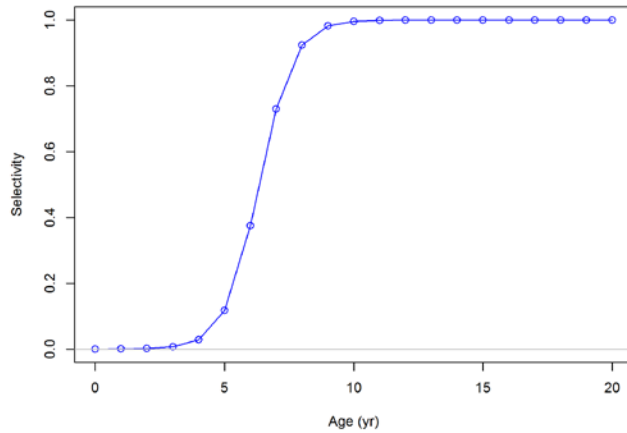
Ending year selectivity for Video\_E



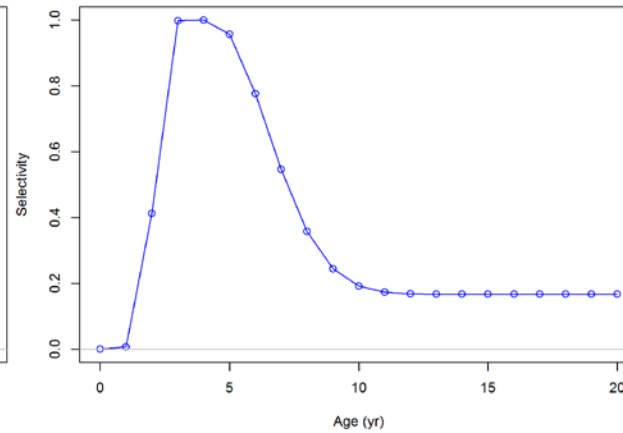
Ending year selectivity for ROV\_E



Ending year selectivity for BLL\_W

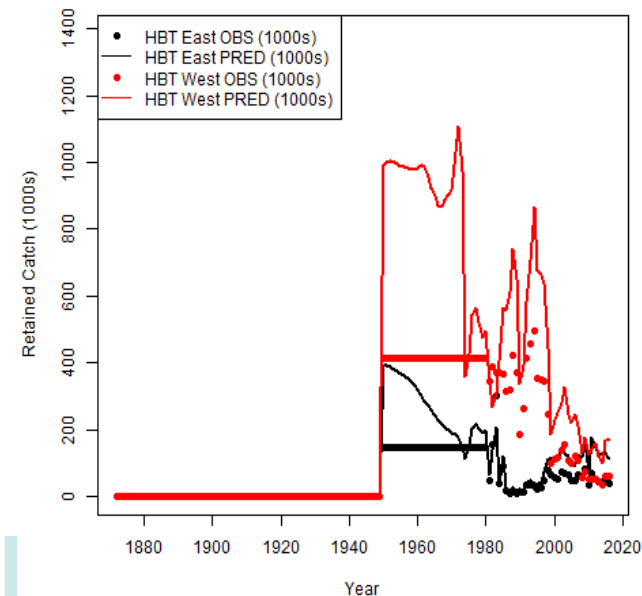
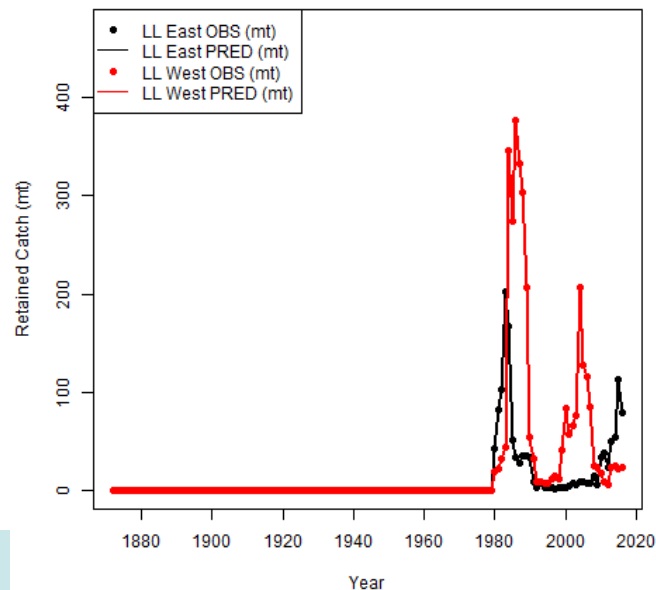
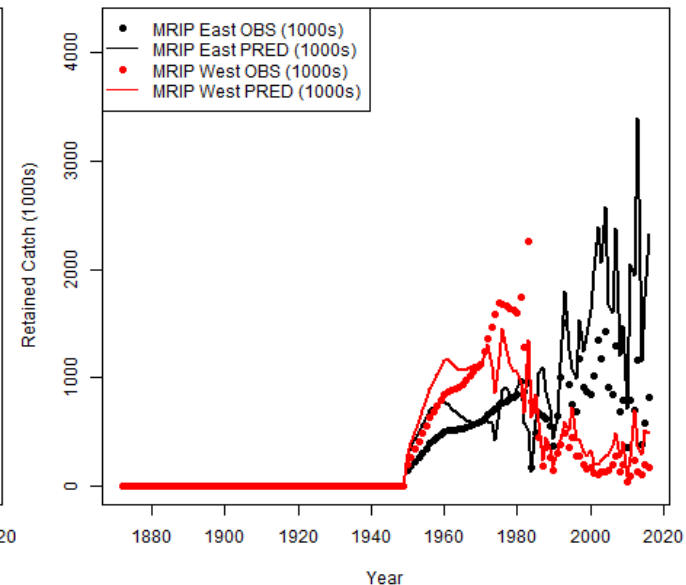
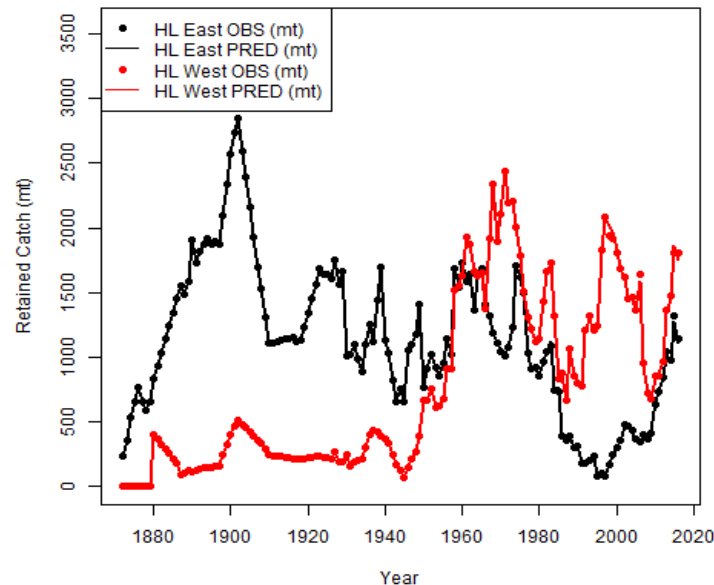


Ending year selectivity for Video\_W



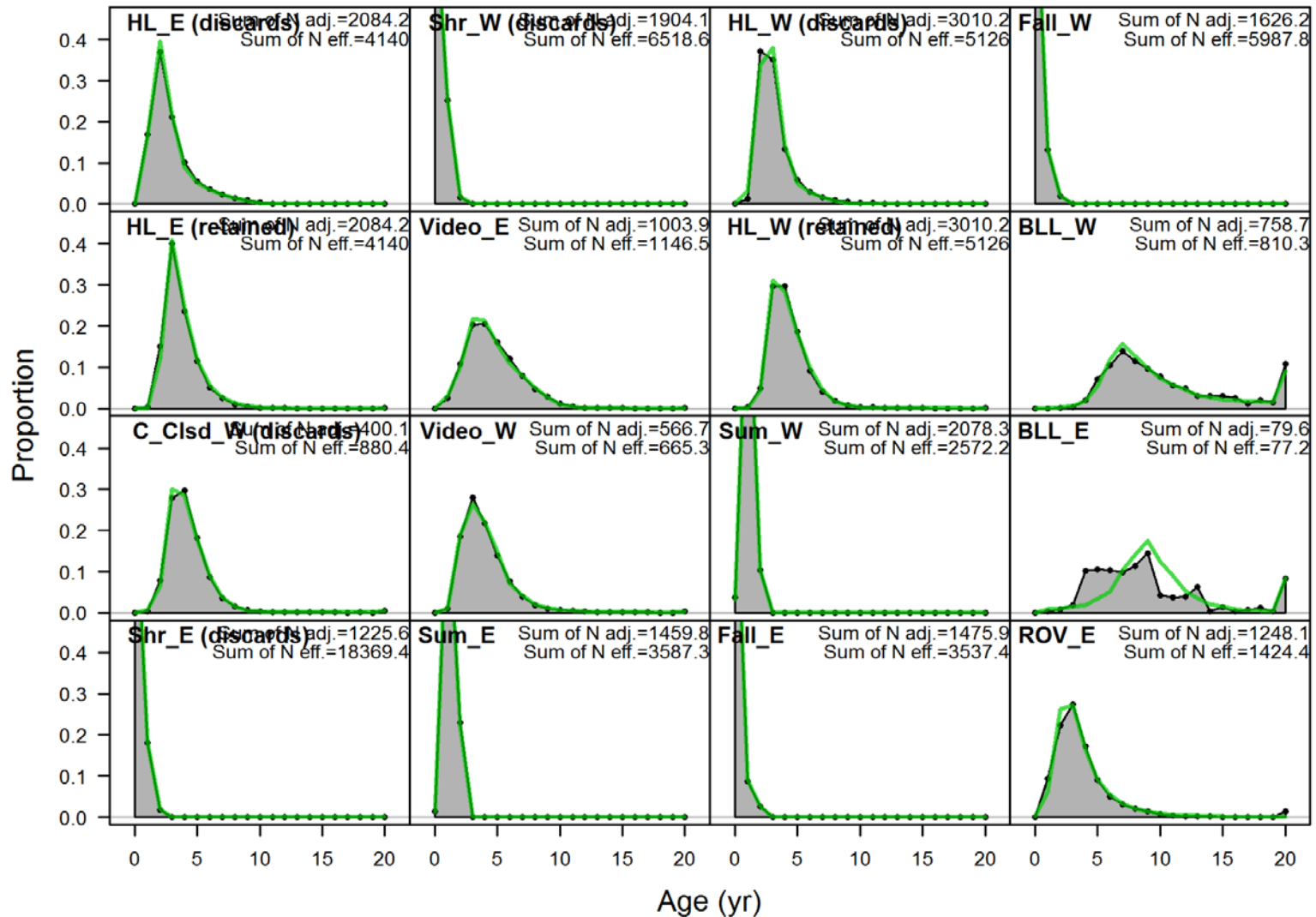
# Fit to Data

- Landings



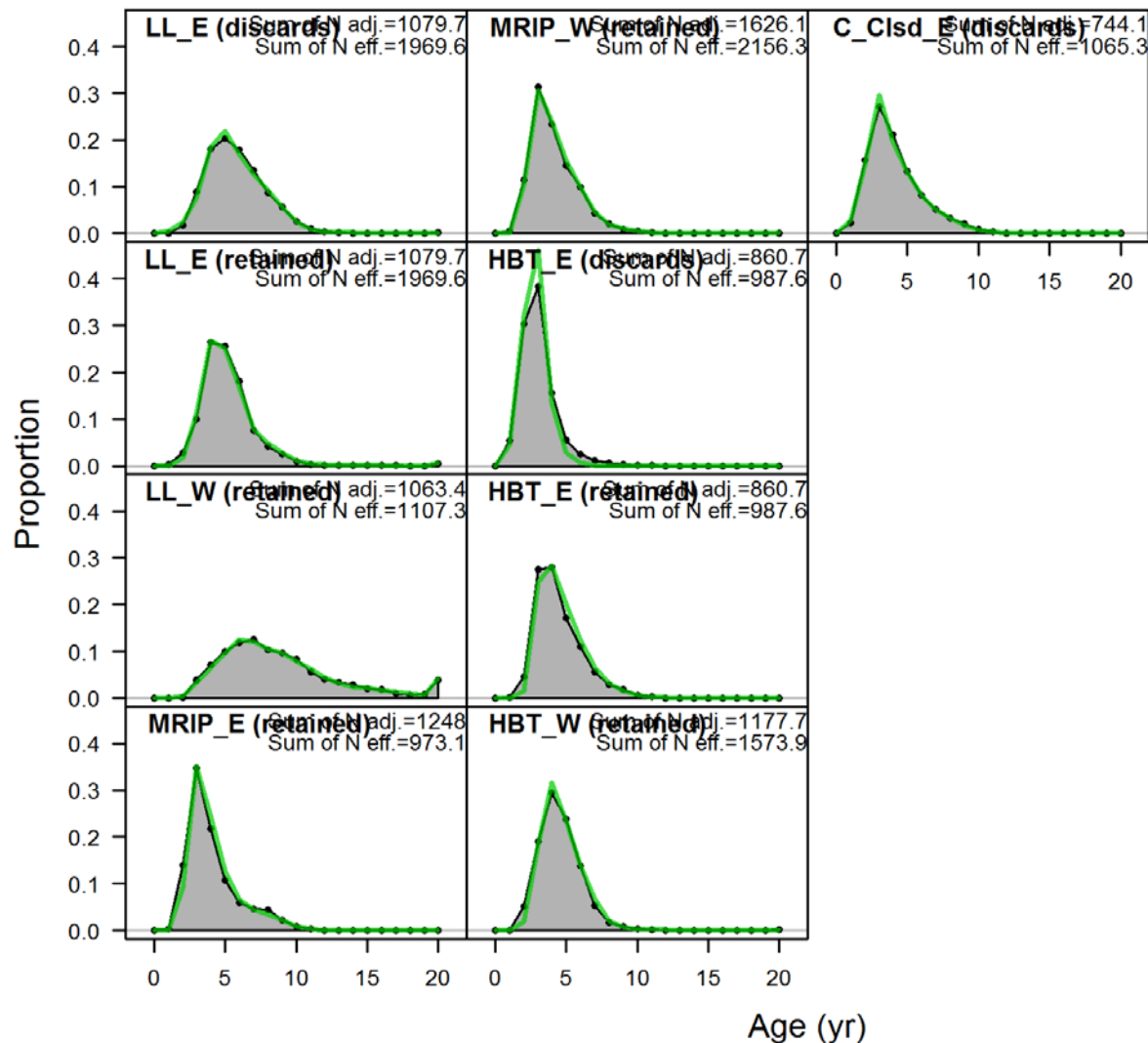
# Fit to Data

- Age composition



# Fit to Data

- Age composition

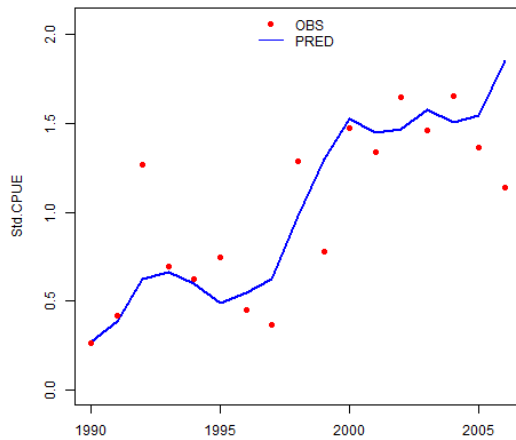




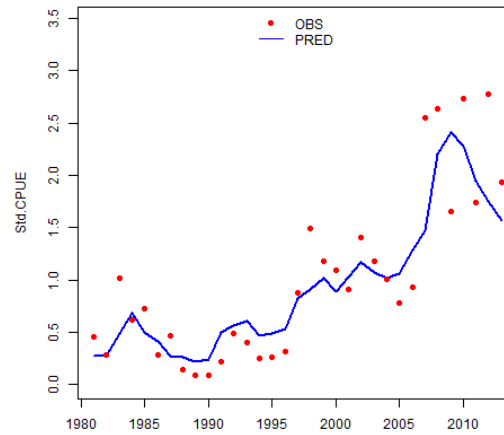
# Fit to Data

- Fishery Dependent Indices

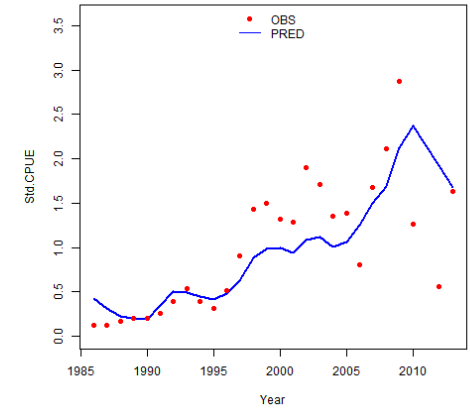
HL\_E CPUE



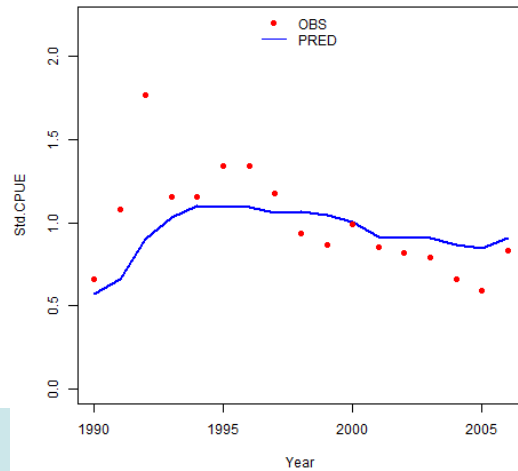
MRIP\_Index\_E CPUE



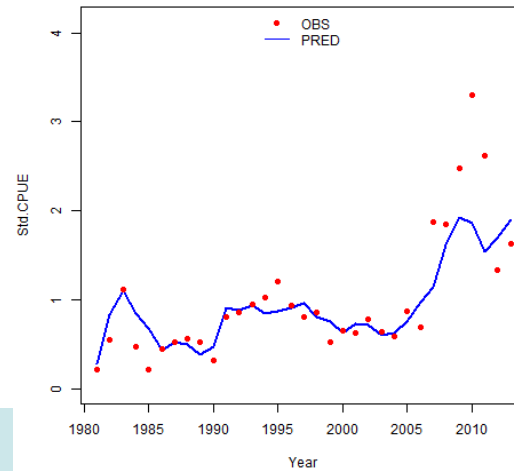
HBT\_Index\_E CPUE



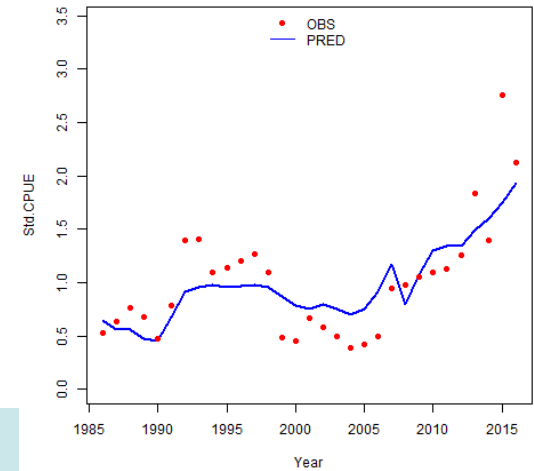
HL\_W CPUE



MRIP\_Index\_W CPUE



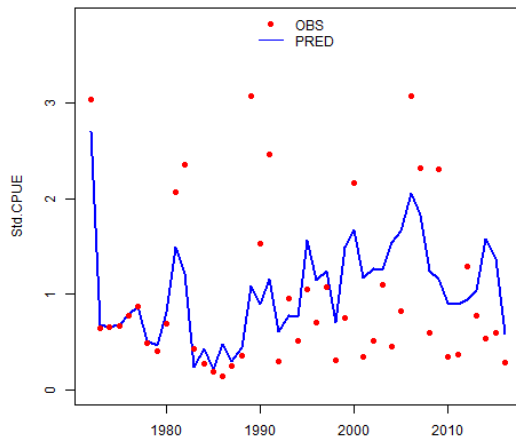
HBT\_Index\_W CPUE



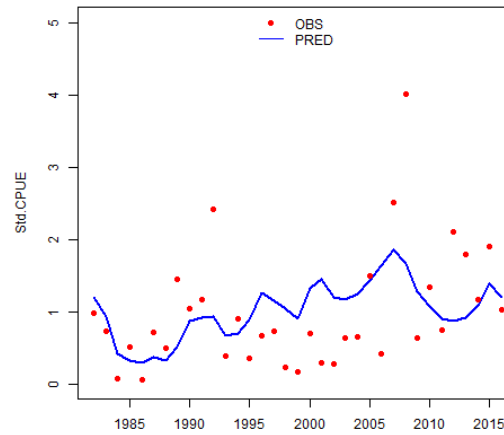
# Fit to Data

- Fishery Independent Indices

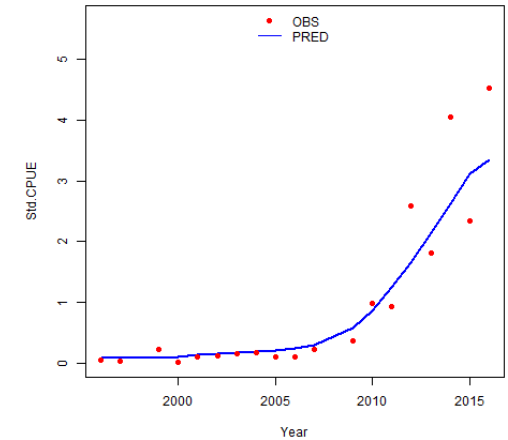
Fall\_E CPUE



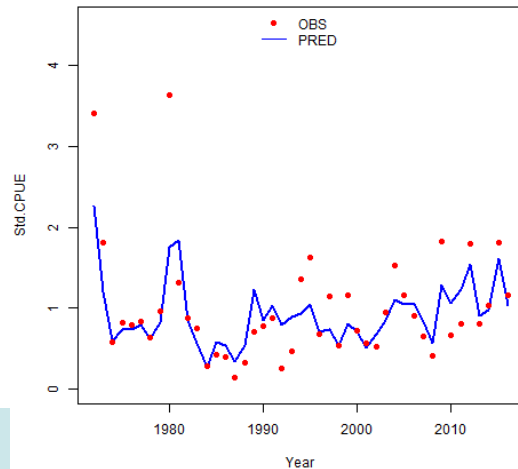
Sum\_E CPUE



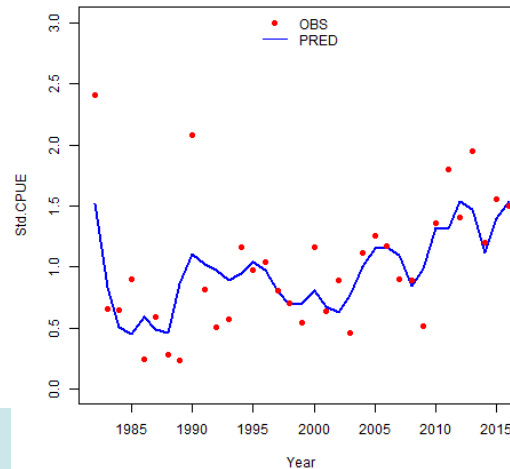
BLL\_E CPUE



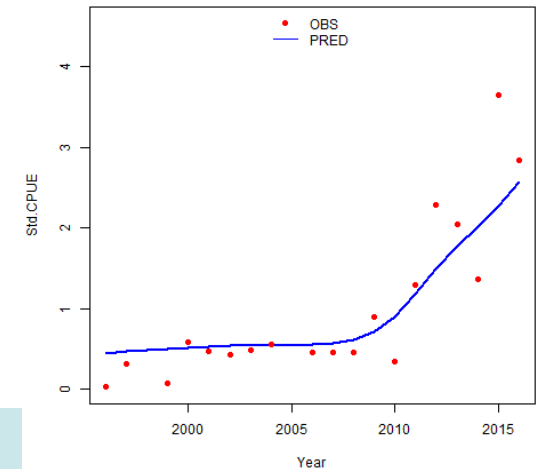
Fall\_W CPUE



Sum\_W CPUE



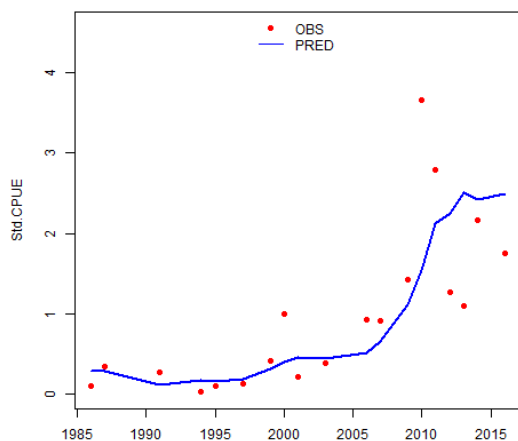
BLL\_W CPUE



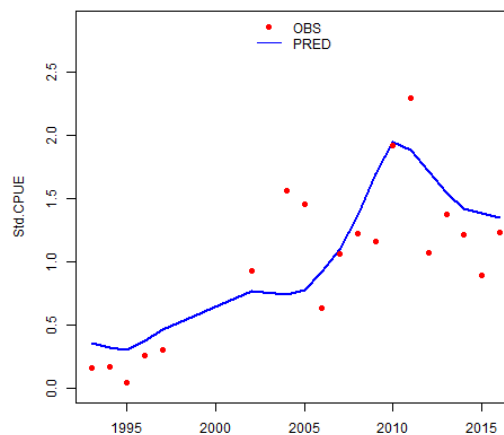
# Fit to Data

- Other Indices

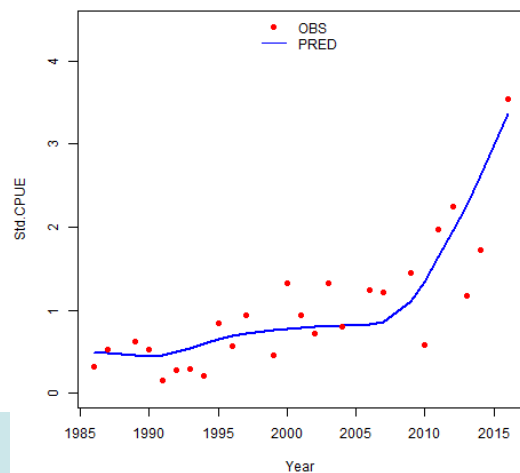
Larv\_E CPUE



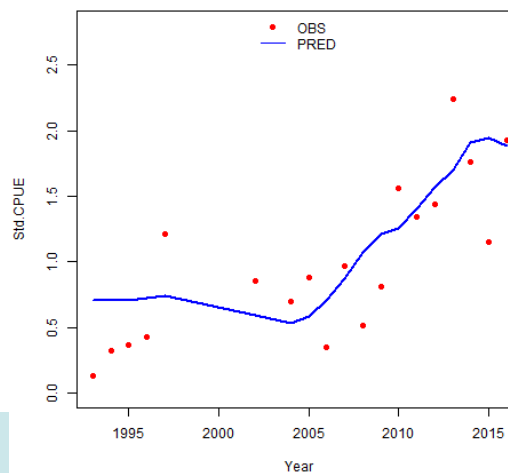
Video\_E CPUE



Larv\_W CPUE

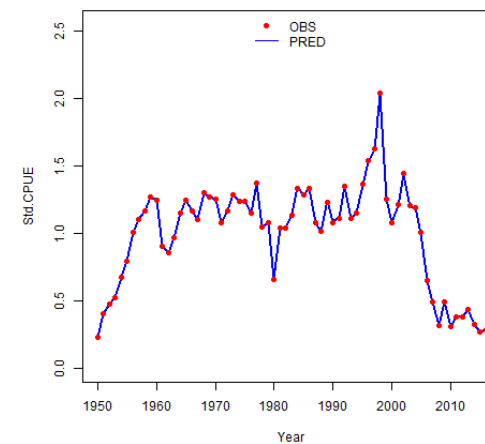


Video\_W CPUE

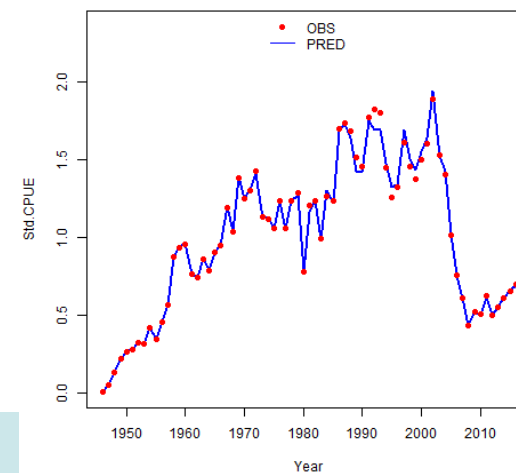


## Shrimp Effort

Shr\_E



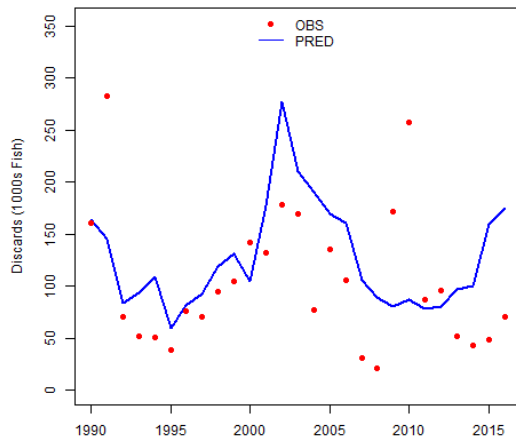
Shr\_W



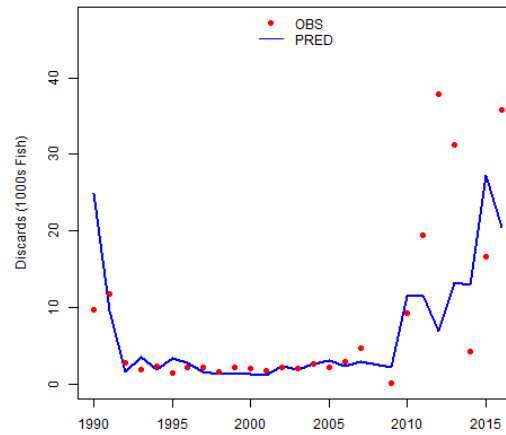
# Fit to Data

- Discards

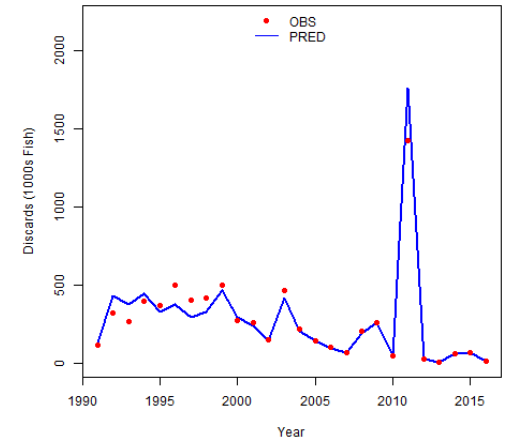
HL\_E Discards



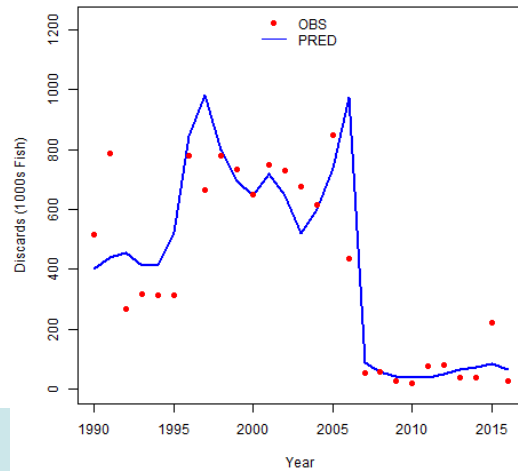
LL\_E Discards



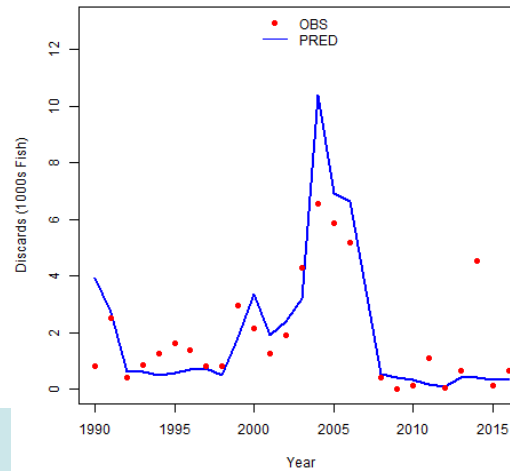
C\_Clsd\_E Discards



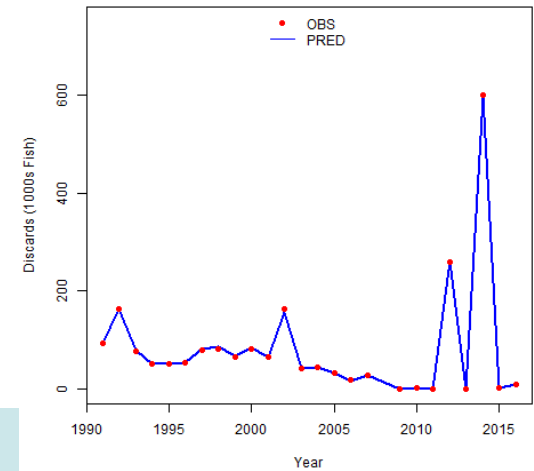
HL\_W Discards



LL\_W Discards



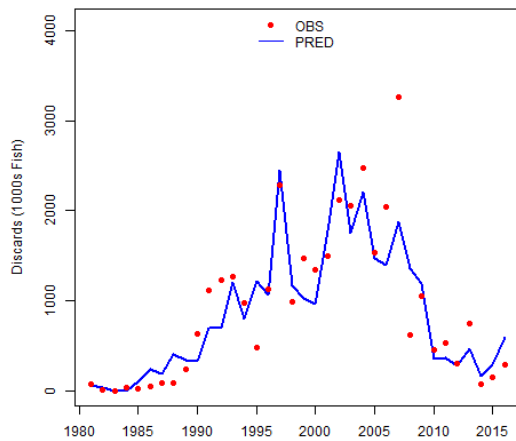
C\_Clsd\_W Discards



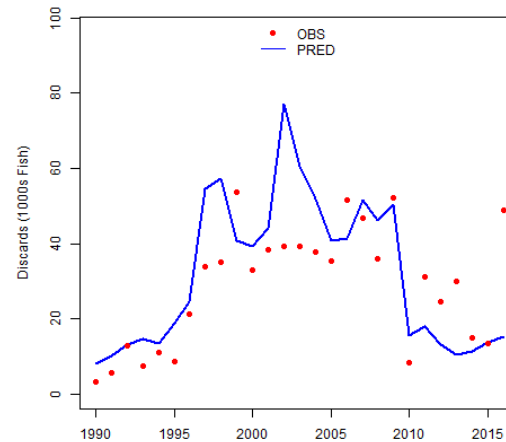
# Fit to Data

- Discards

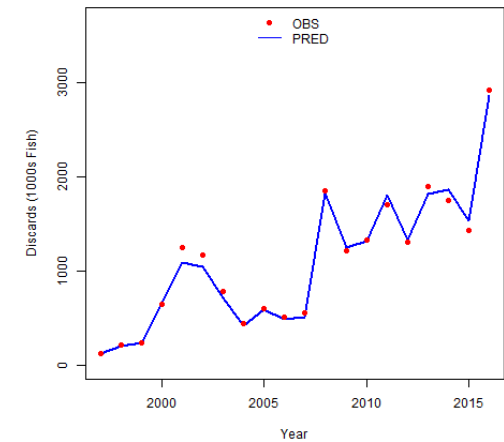
MRIP\_E Discards



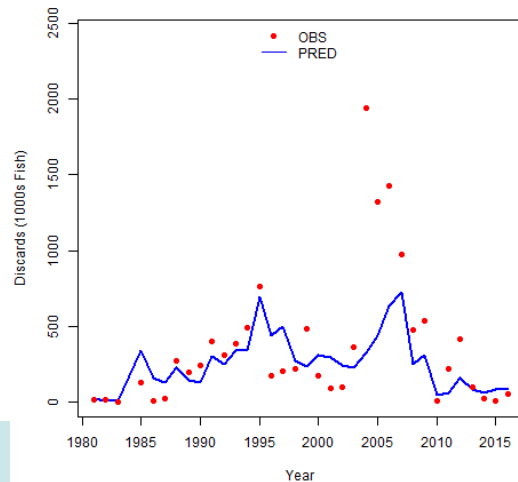
HBT\_E Discards



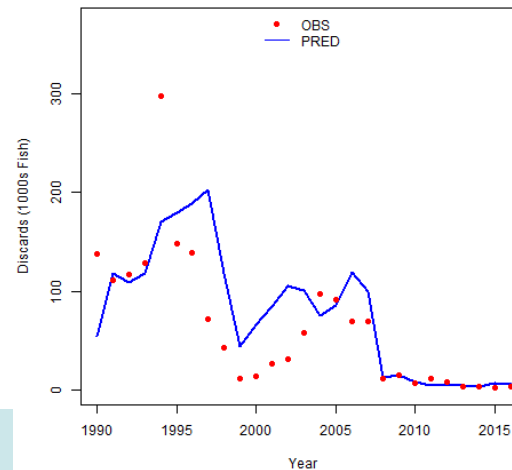
R\_Clsd\_E Discards



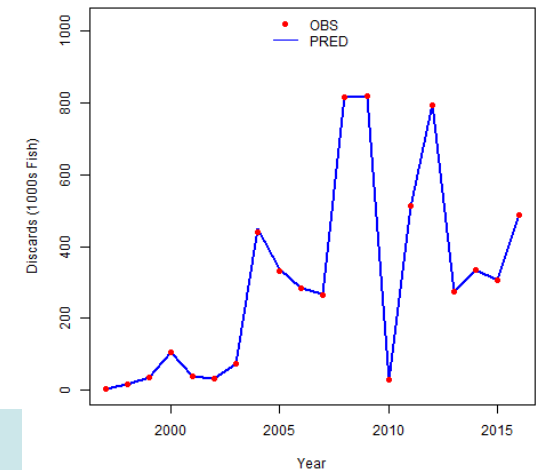
MRIP\_W Discards



HBT\_W Discards

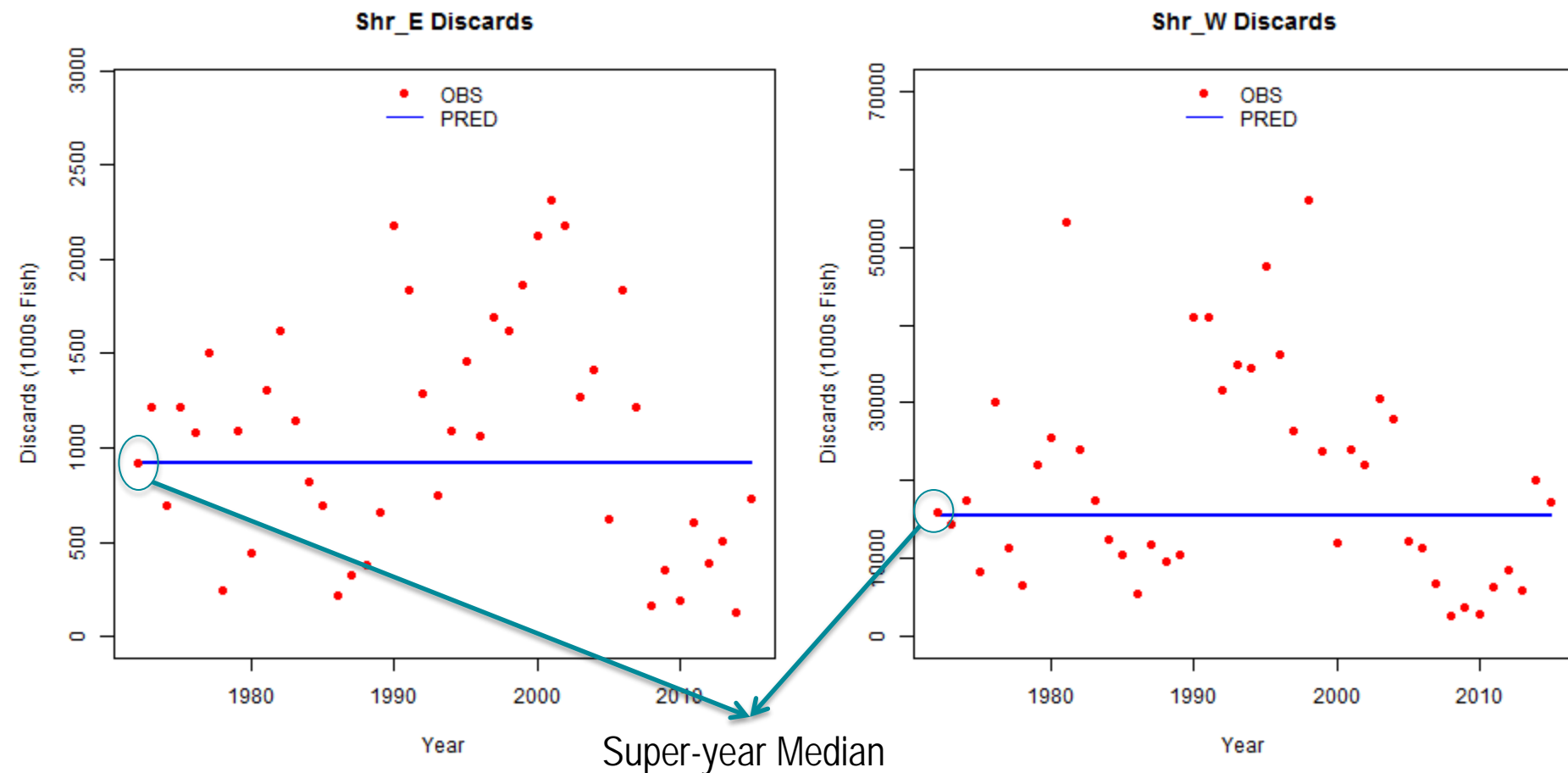


R\_Clsd\_W Discards



# Fit to Data

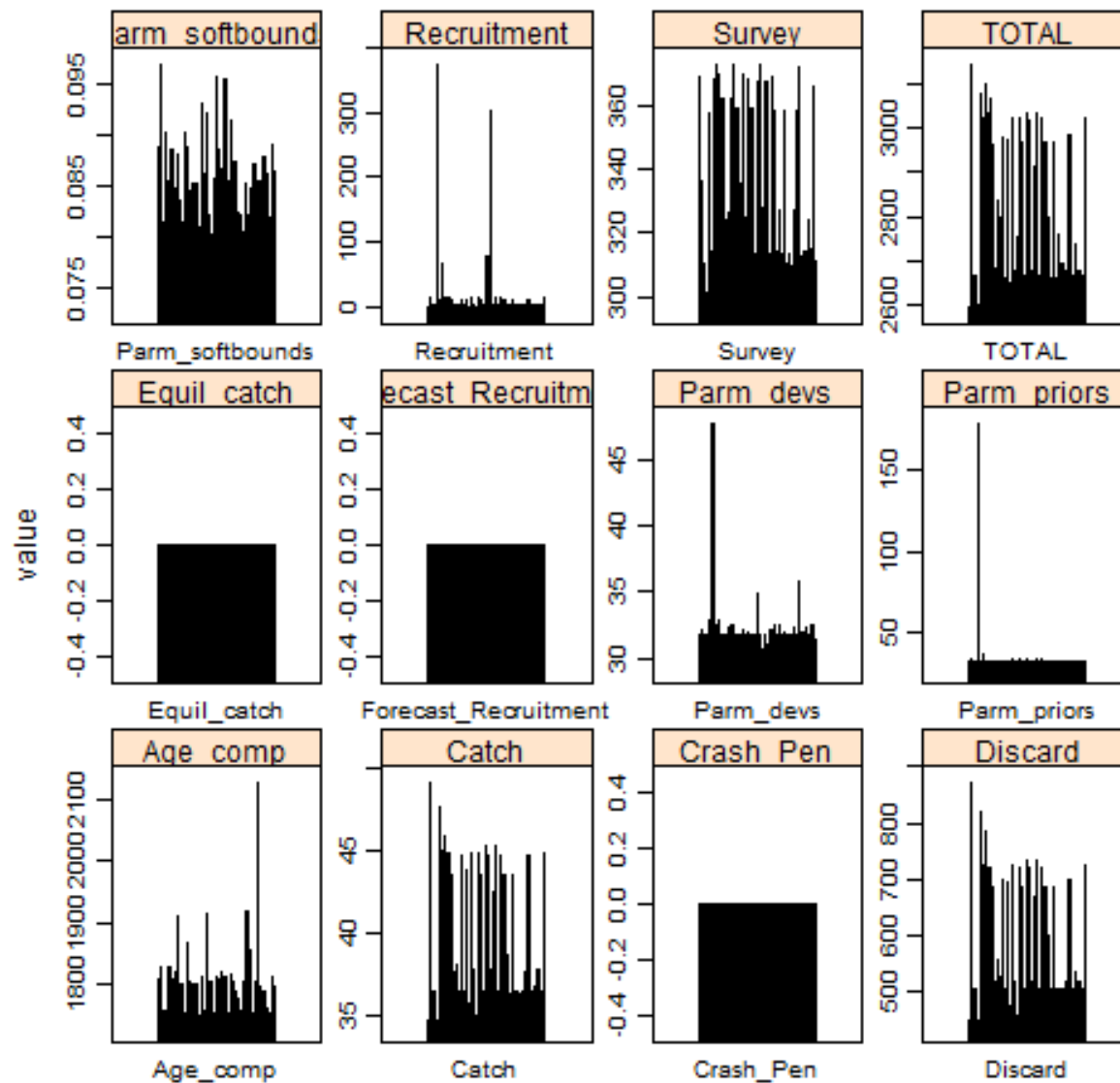
- Shrimp Discards



# Diagnostics



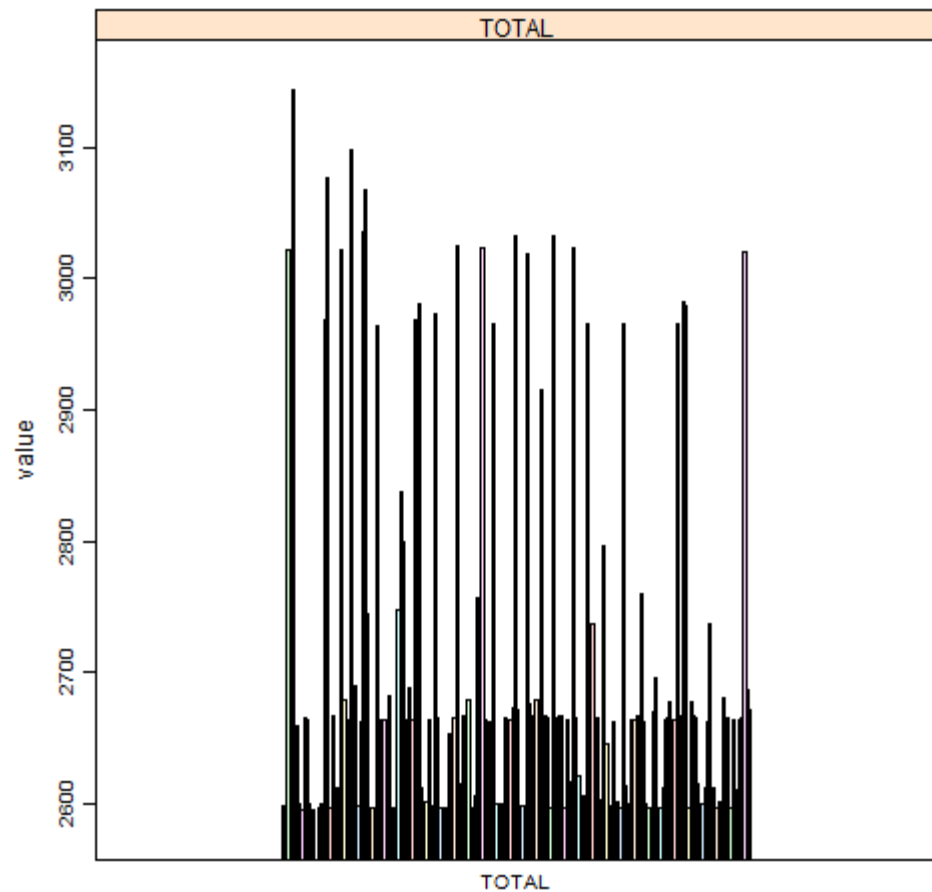
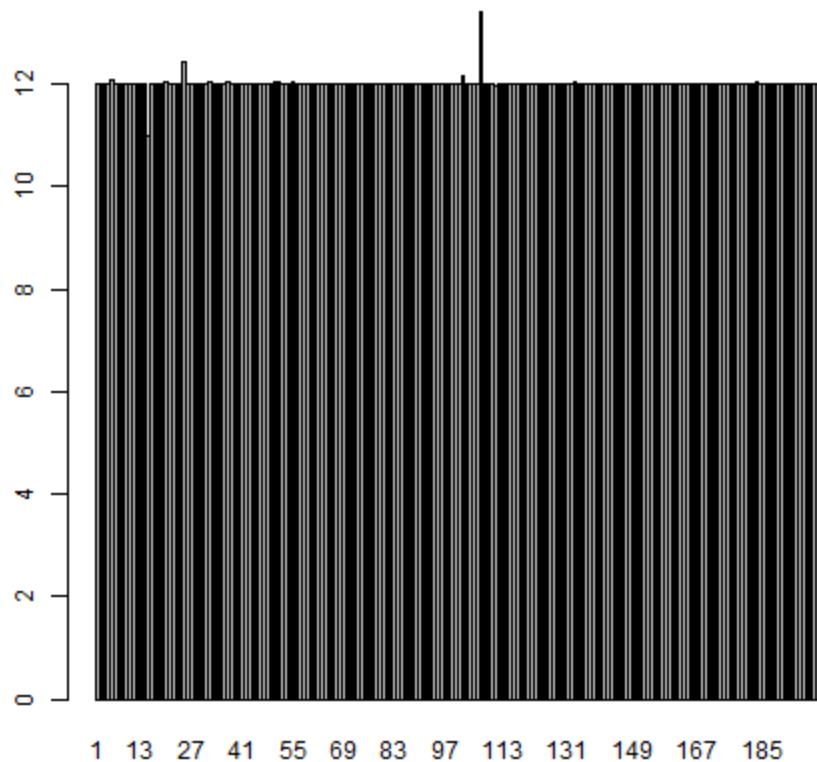
# Jitter





# Jitter

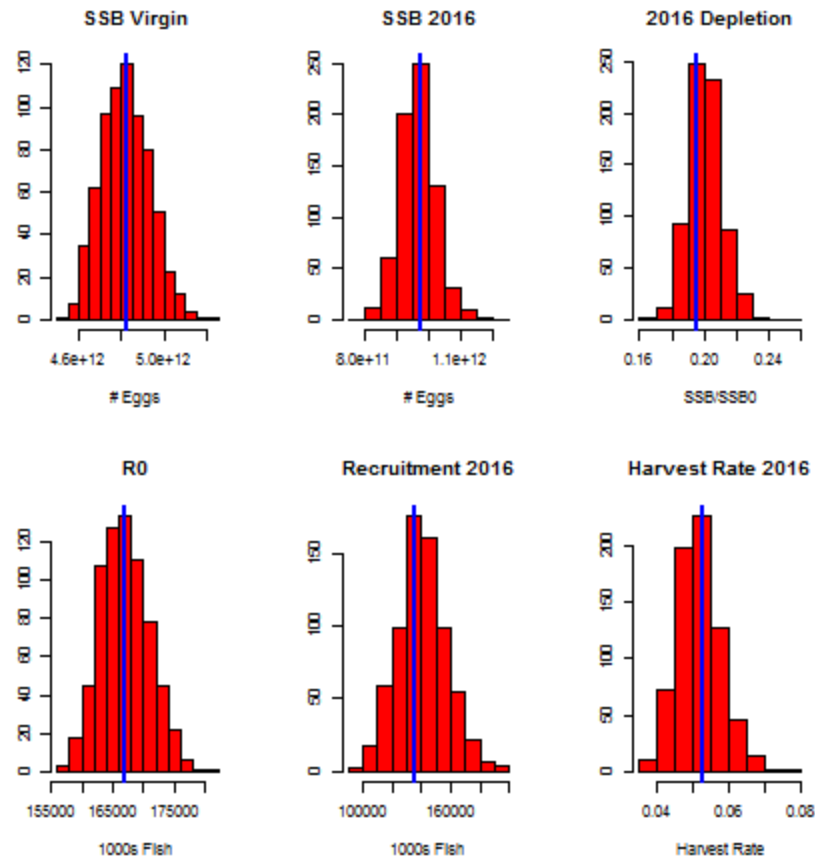
R0 Values



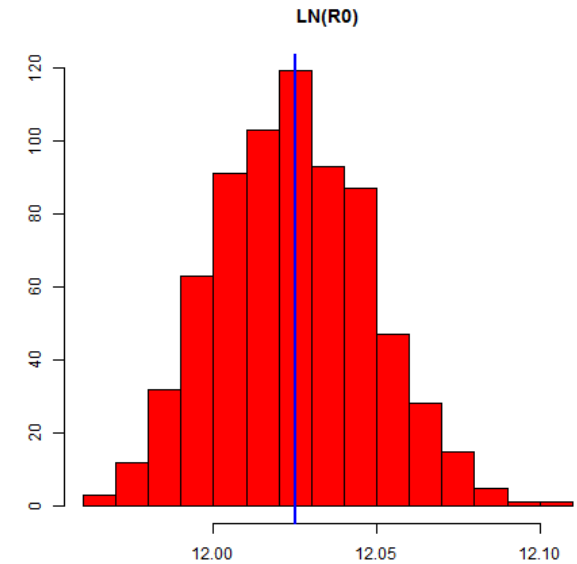
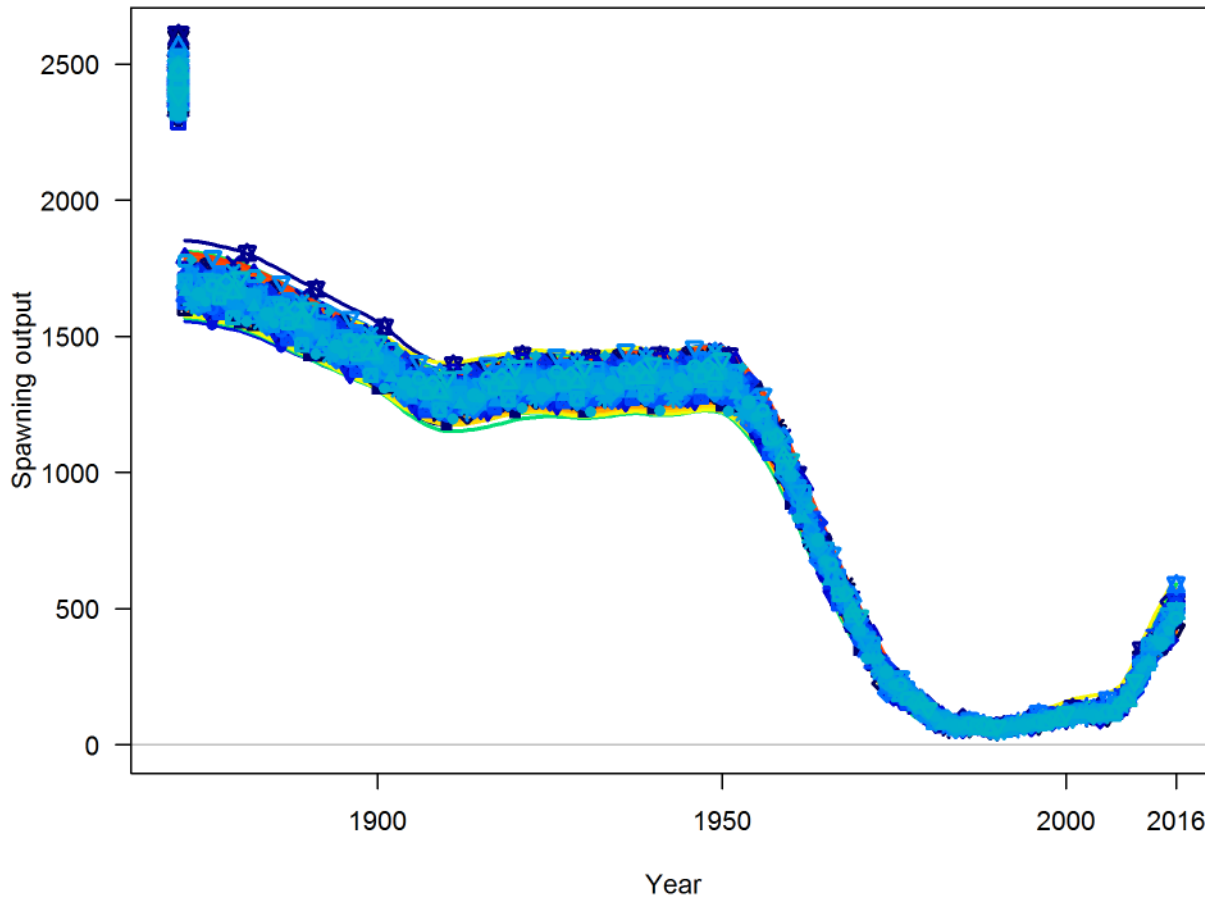
# Bootstrap Runs

700 runs

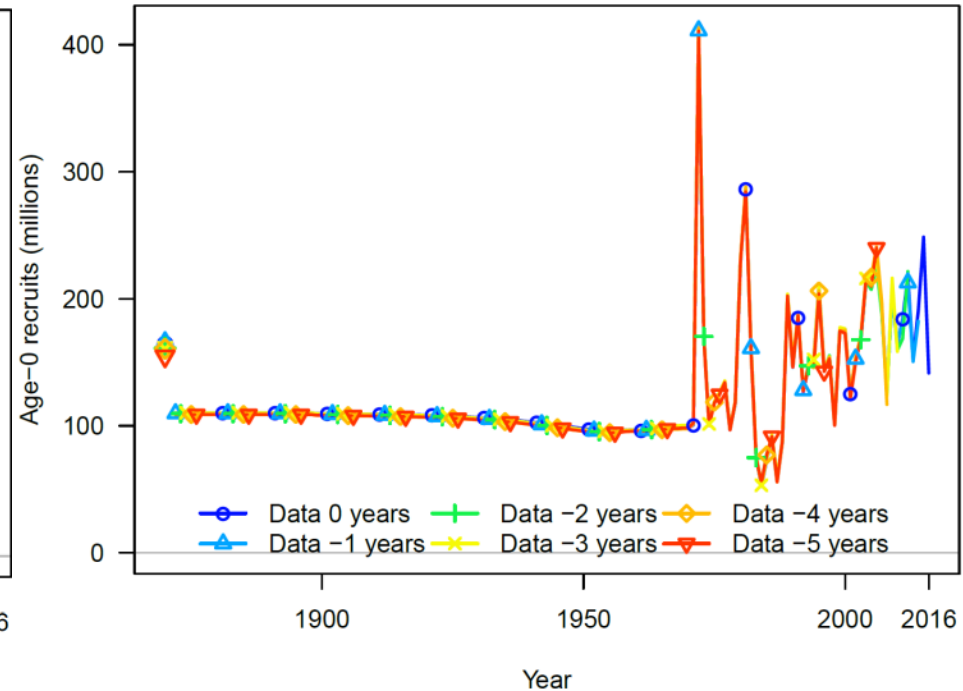
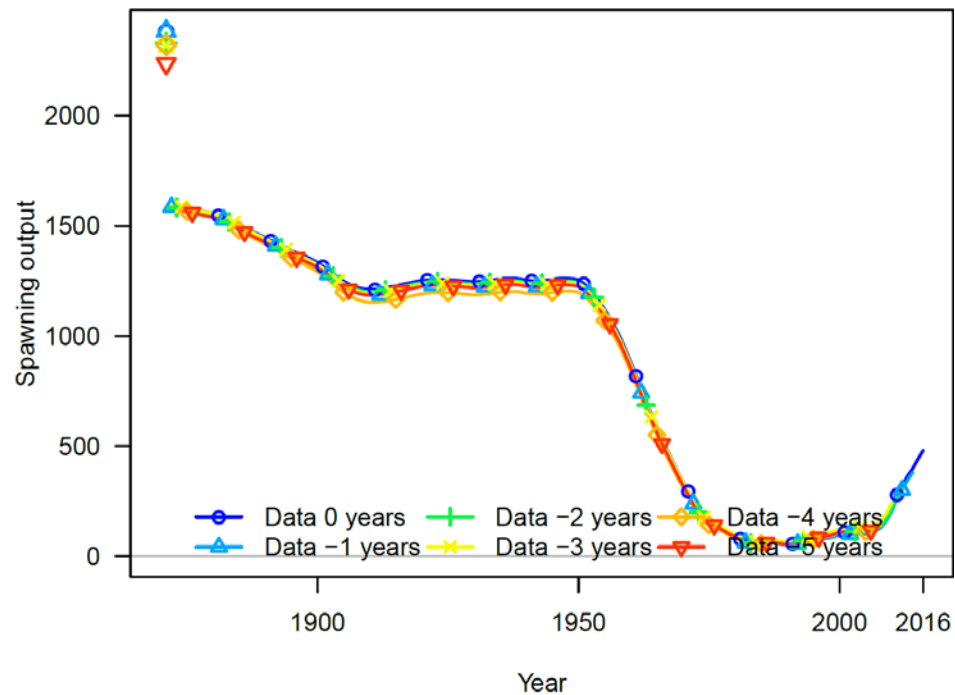
Population Quantities



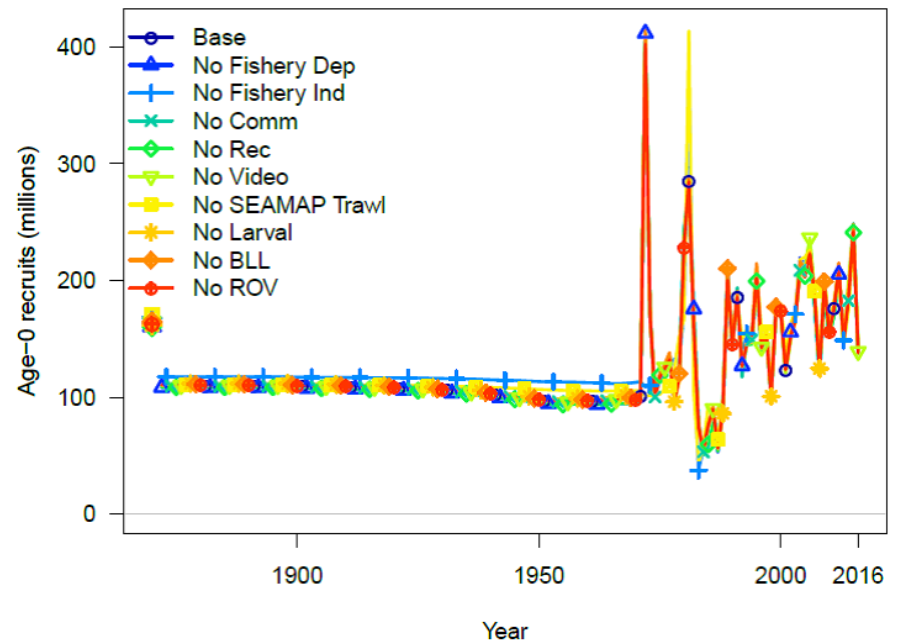
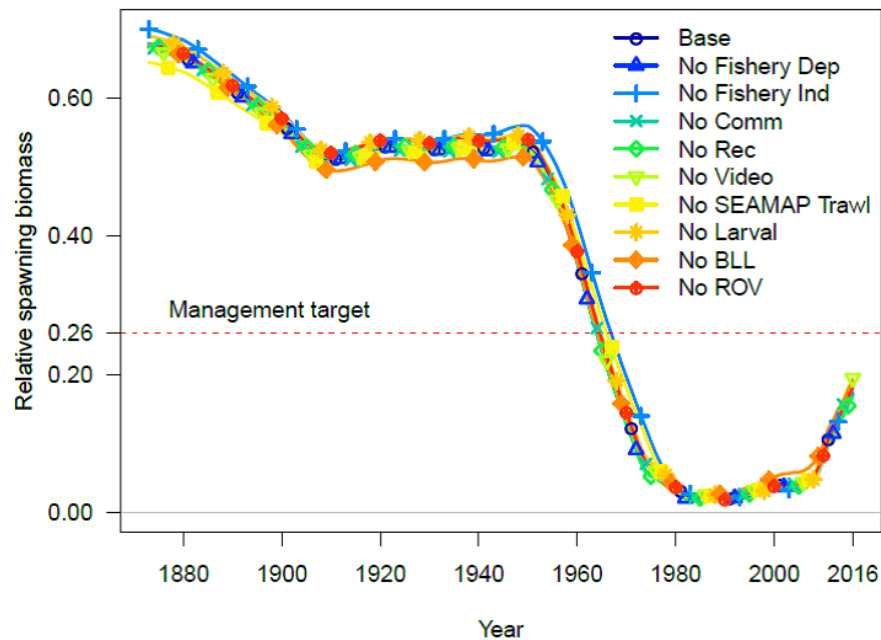
# Bootstrap Runs



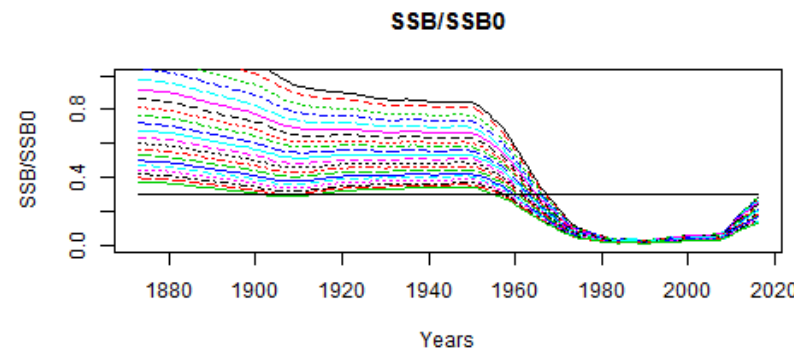
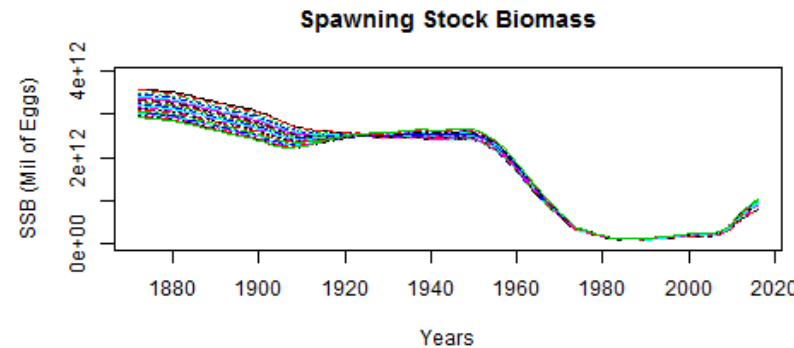
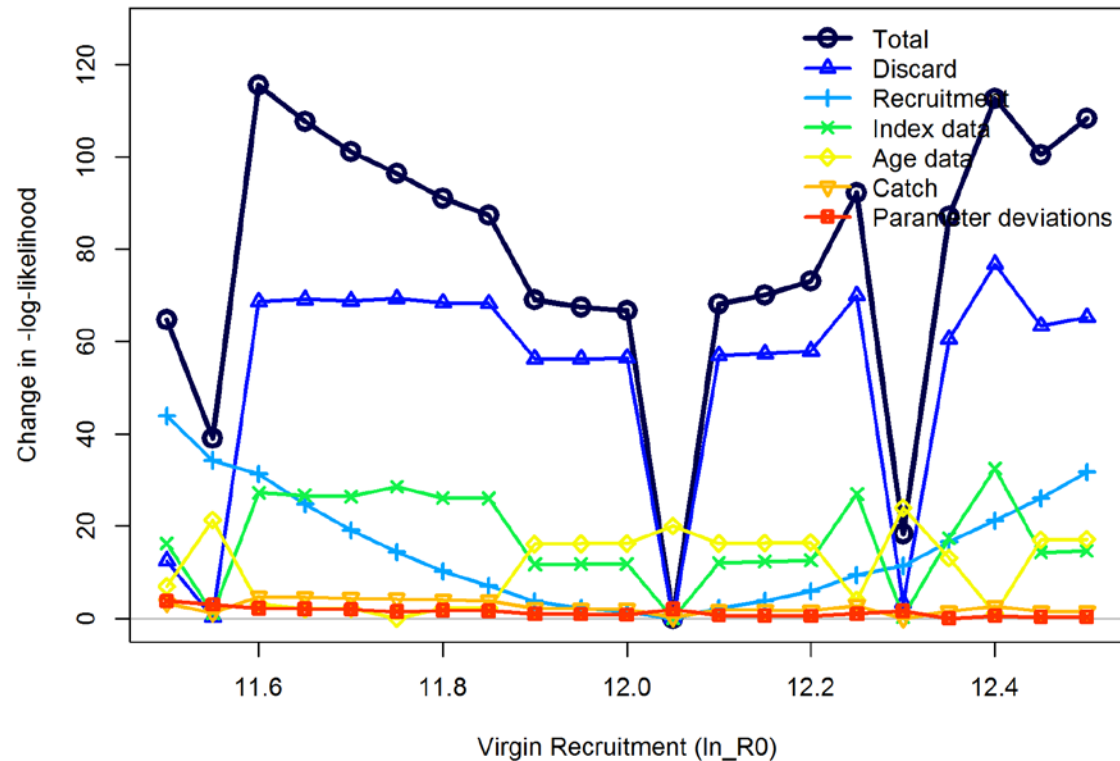
# Retrospective Runs



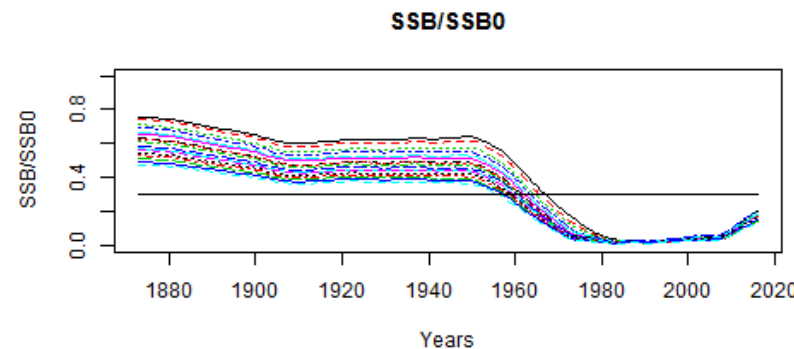
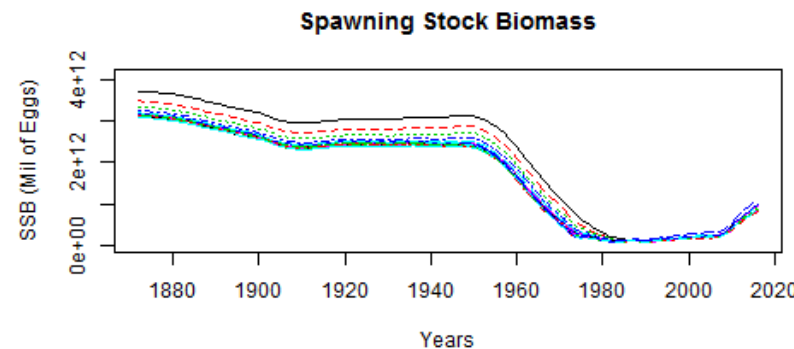
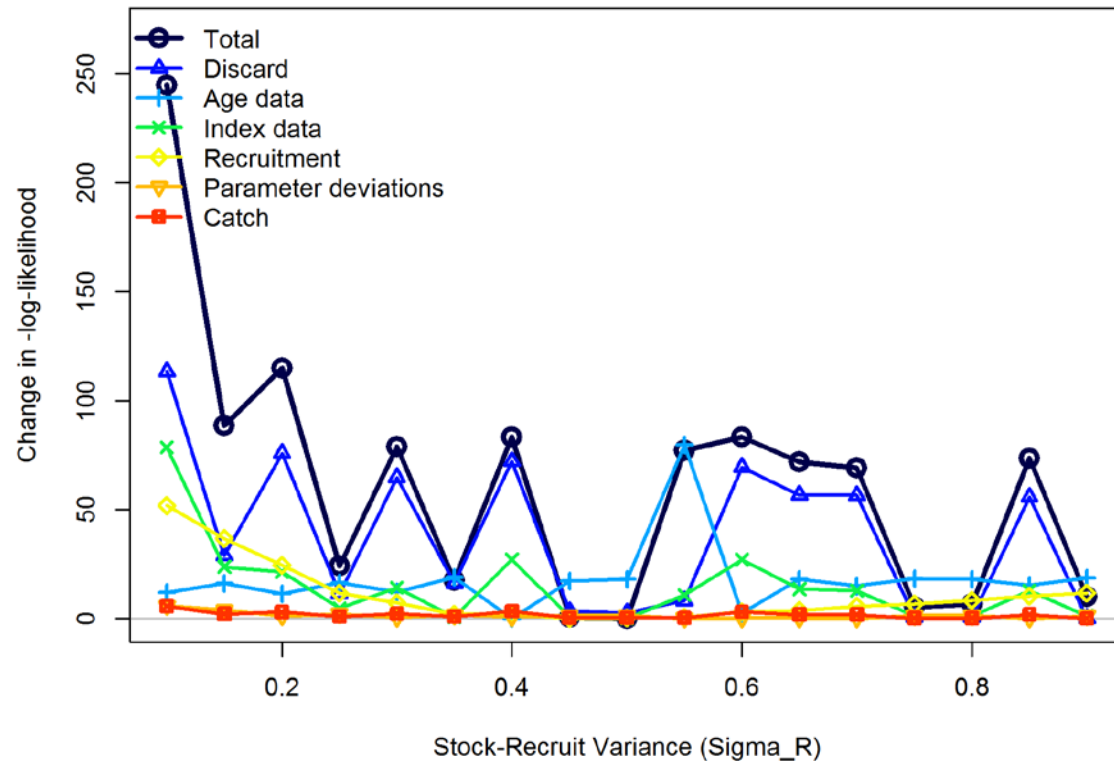
# Index Jack-knife Runs



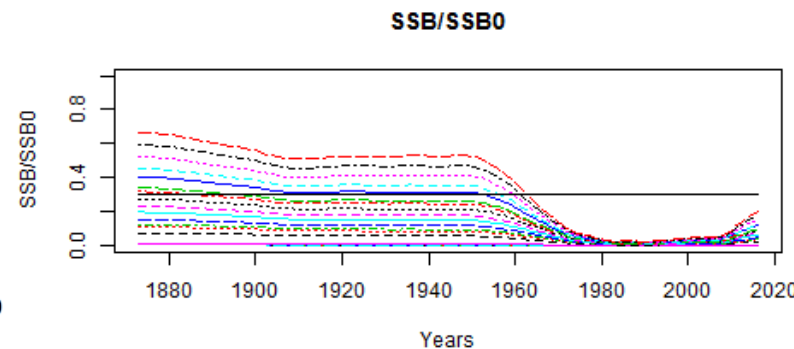
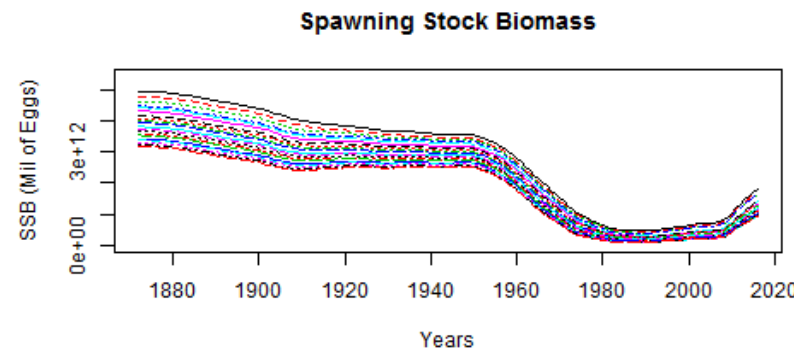
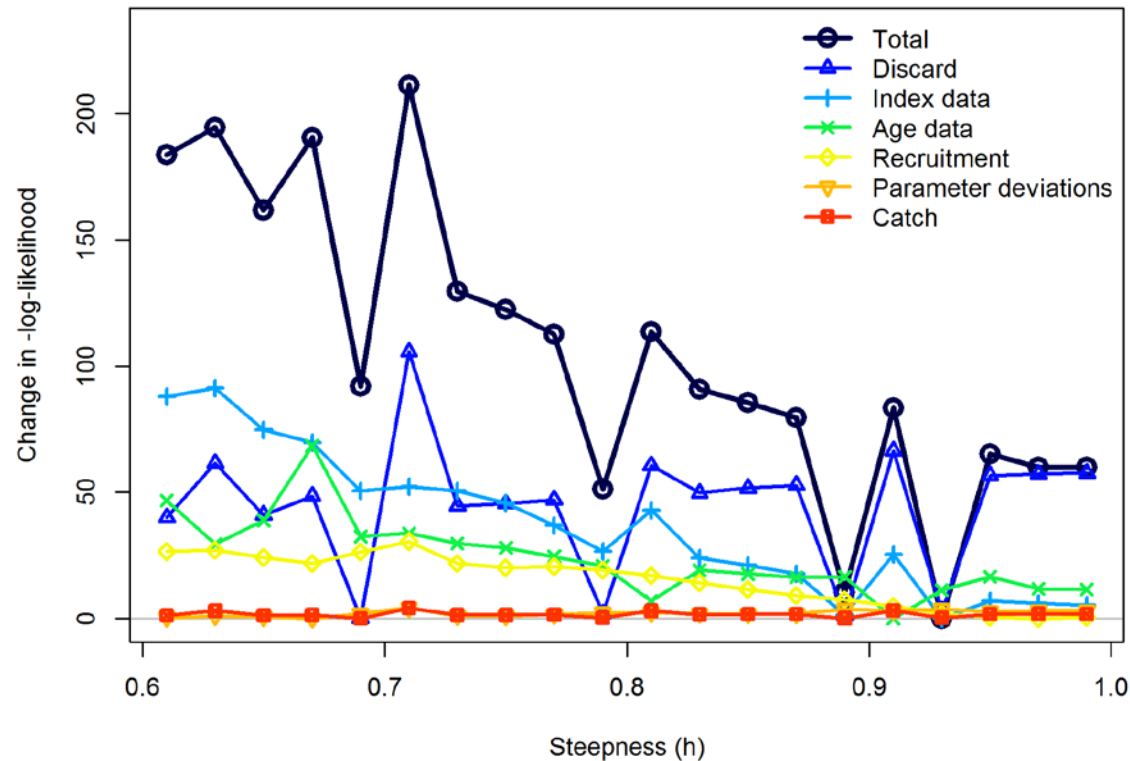
# Virgin Recruitment Profile Likelihood



# Recruitment Variance Profile Likelihood



# Steepness Profile Likelihood





# Comparison of model runs



# Continuity Model Runs

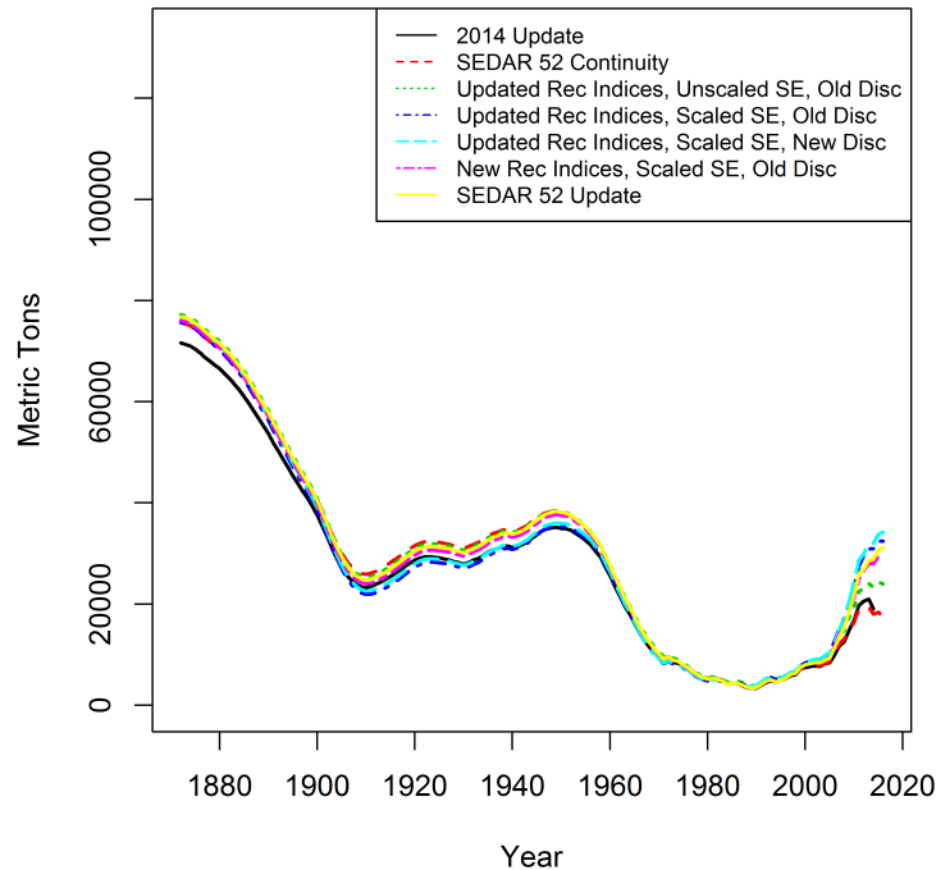
- 2014 Update
- - - SEDAR 52 Continuity
- ... Updated Rec Indices, Unscaled SE, Old Disc
- . - . Updated Rec Indices, Scaled SE, Old Disc
- - - Updated Rec Indices, Scaled SE, New Disc
- . - . New Rec Indices, Scaled SE, Old Disc
- SEDAR 52 Update

- 1) Final 2014 update assessment
- 2) Continuity run using values for recreational indices from 2014 update assessment (indices truncated in 2013), old discard methodology, and unscaled index standard errors
- 3) Same as 2, but with updated recreational indices
- 4) Updated recreational indices and old discard methodology, but with rescaled index standard errors
- 5) Same as 3, but with updated discard methodology
- 6) Same as 4, but with new (truncated) recreational index
- 7) SEDAR 52 best practices (updated discards, truncated indices, rescaled SEs)

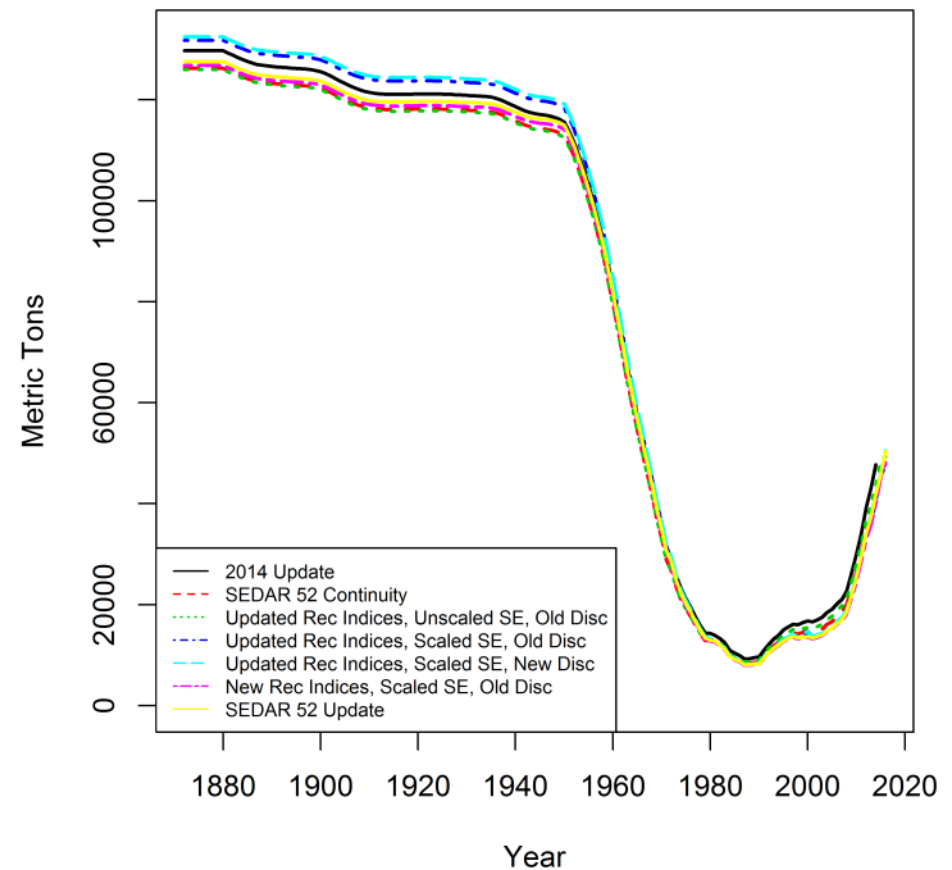


# Biomass Timeseries

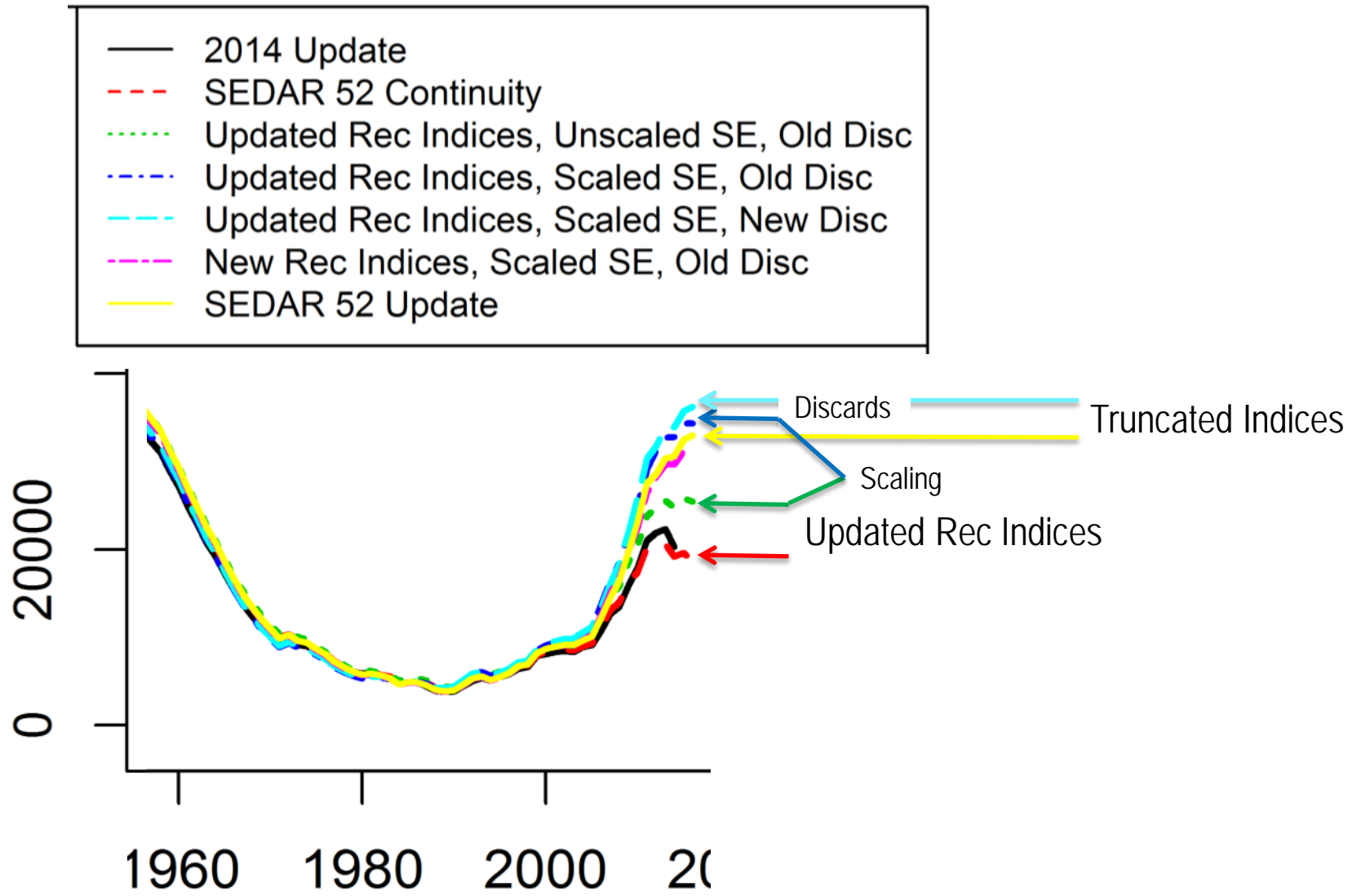
## Biomass Area 1



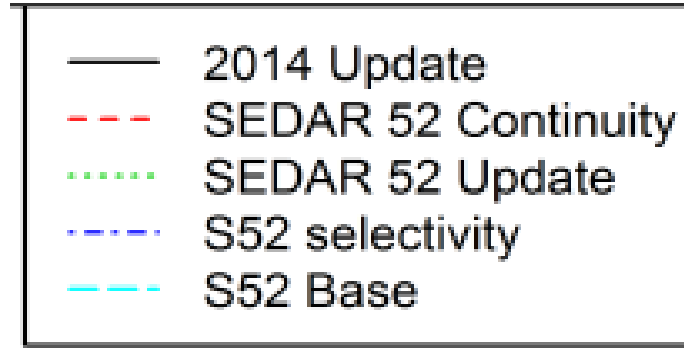
## Biomass Area 2



# Biomass Timeseries



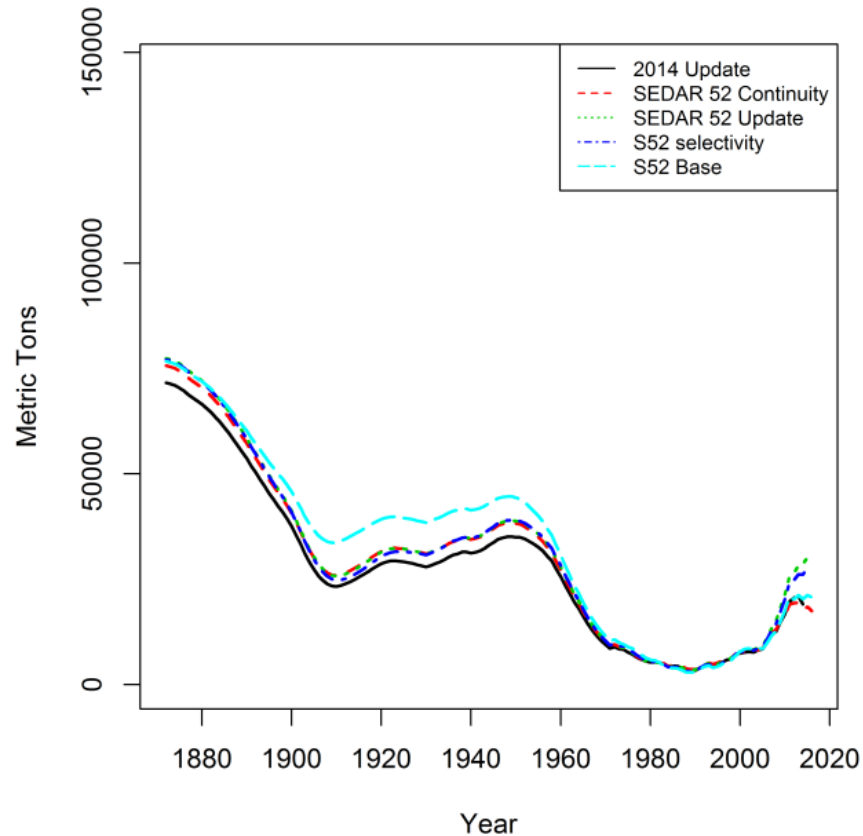
# Base Model Building Runs



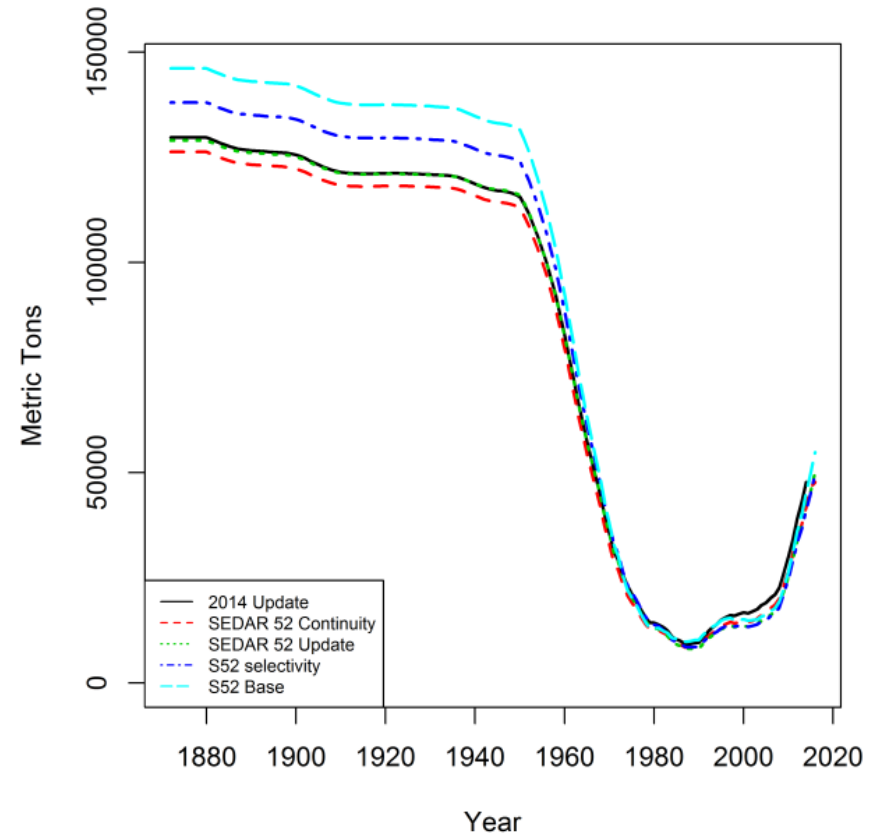
- 1) Final 2014 update assessment
- 2) SEDAR 52 Continuity
- 3) SEDAR 52 Update
- 4) SEDAR 52 with updated double normal selectivity functions
- 5) SEDAR 52 Base
  - Updated selectivity functions
  - Reweighted age composition effective sample sizes

# Area-Specific Biomass Timeseries

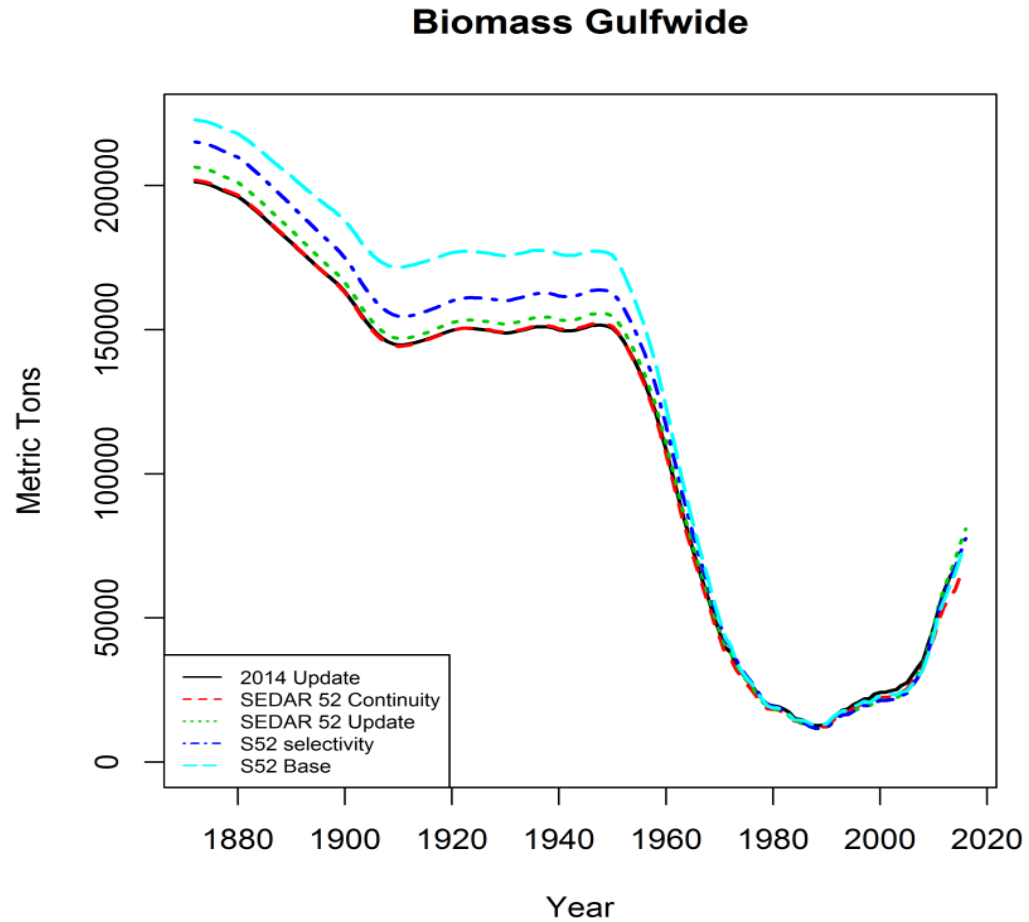
**Biomass Area 1**



**Biomass Area 2**



# Gulfwide Biomass



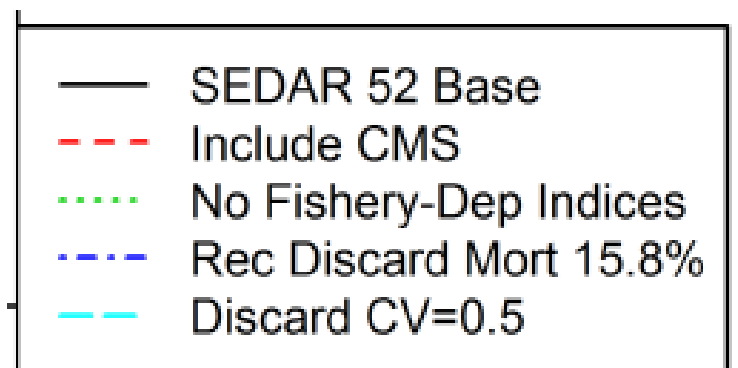


# Sensitivity Runs





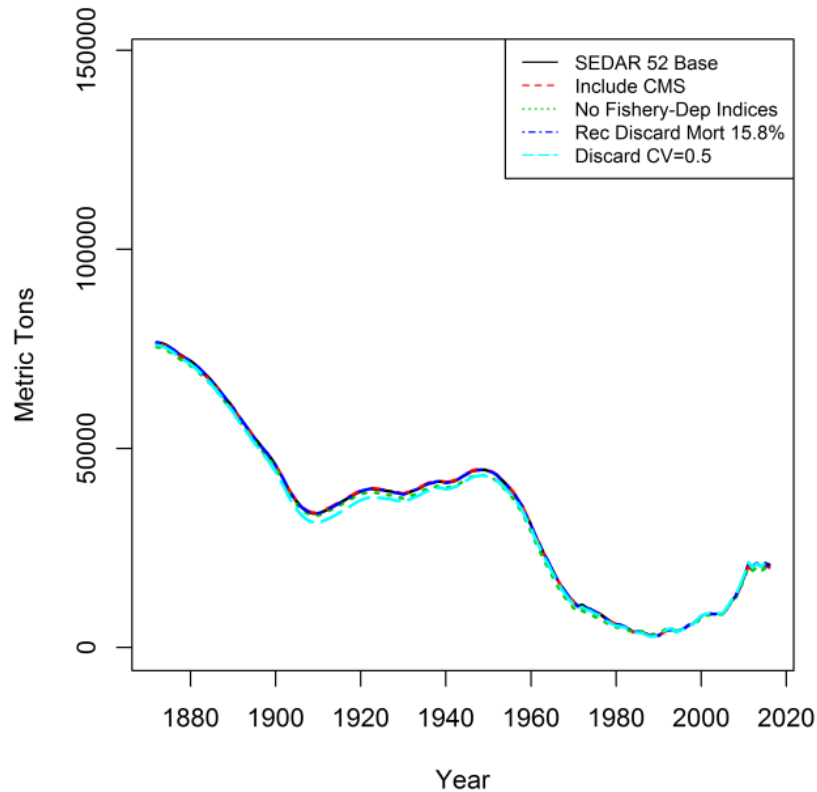
# Sensitivity Model Runs



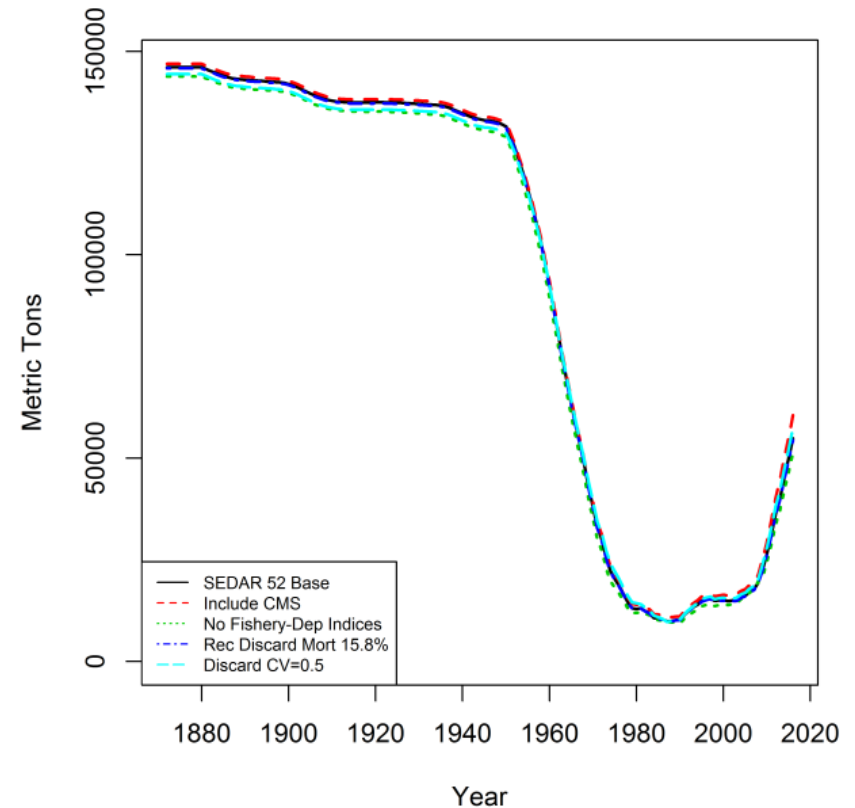
- 1) SEDAR 52 Base
- 2) Include Connectivity Modeling System (CMS) outputs as recruitment index
- 3) Remove Fishery Dependent CPUE Indices
- 4) Recreational Discard Mortality = 15.8% (post 2008)
- 5) Increase discard CV to 0.5 (matching 2014 Update)

# Region-specific Biomass

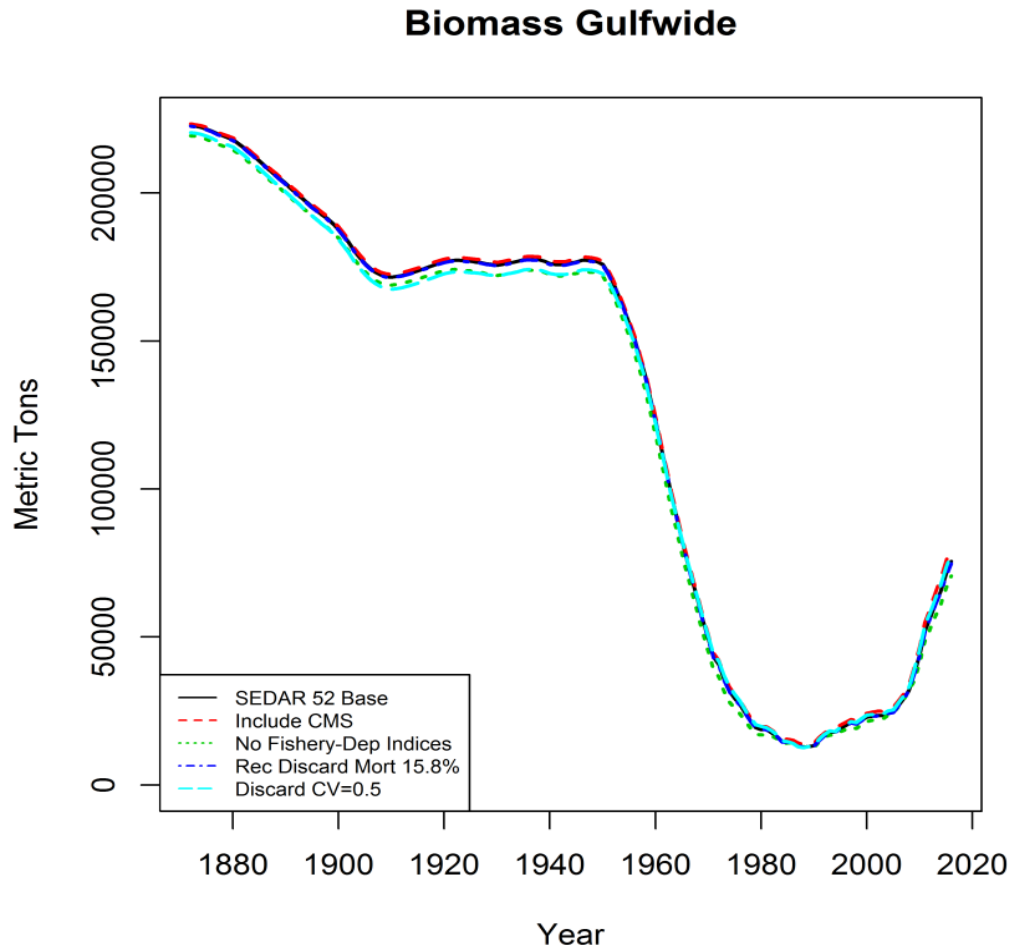
**Biomass Area 1**



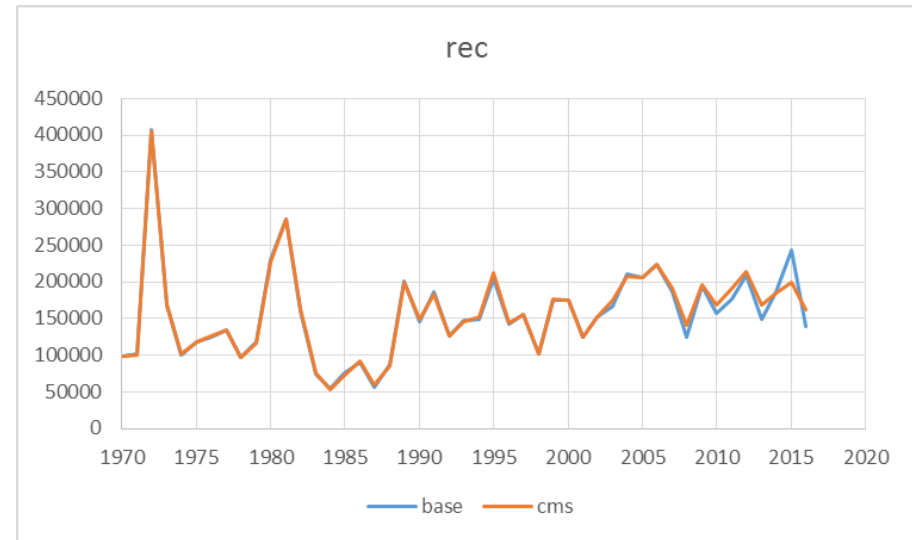
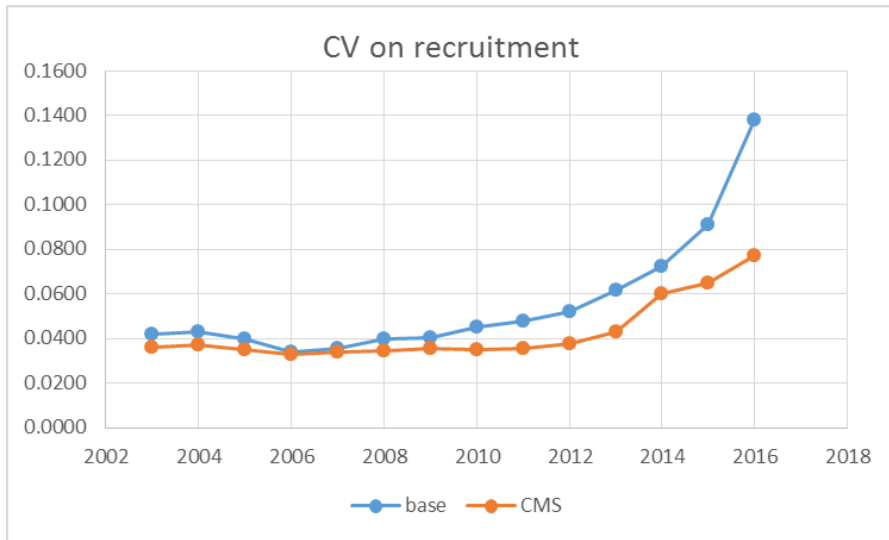
**Biomass Area 2**



# Gulfwide Biomass



# CMS Recruitment Results

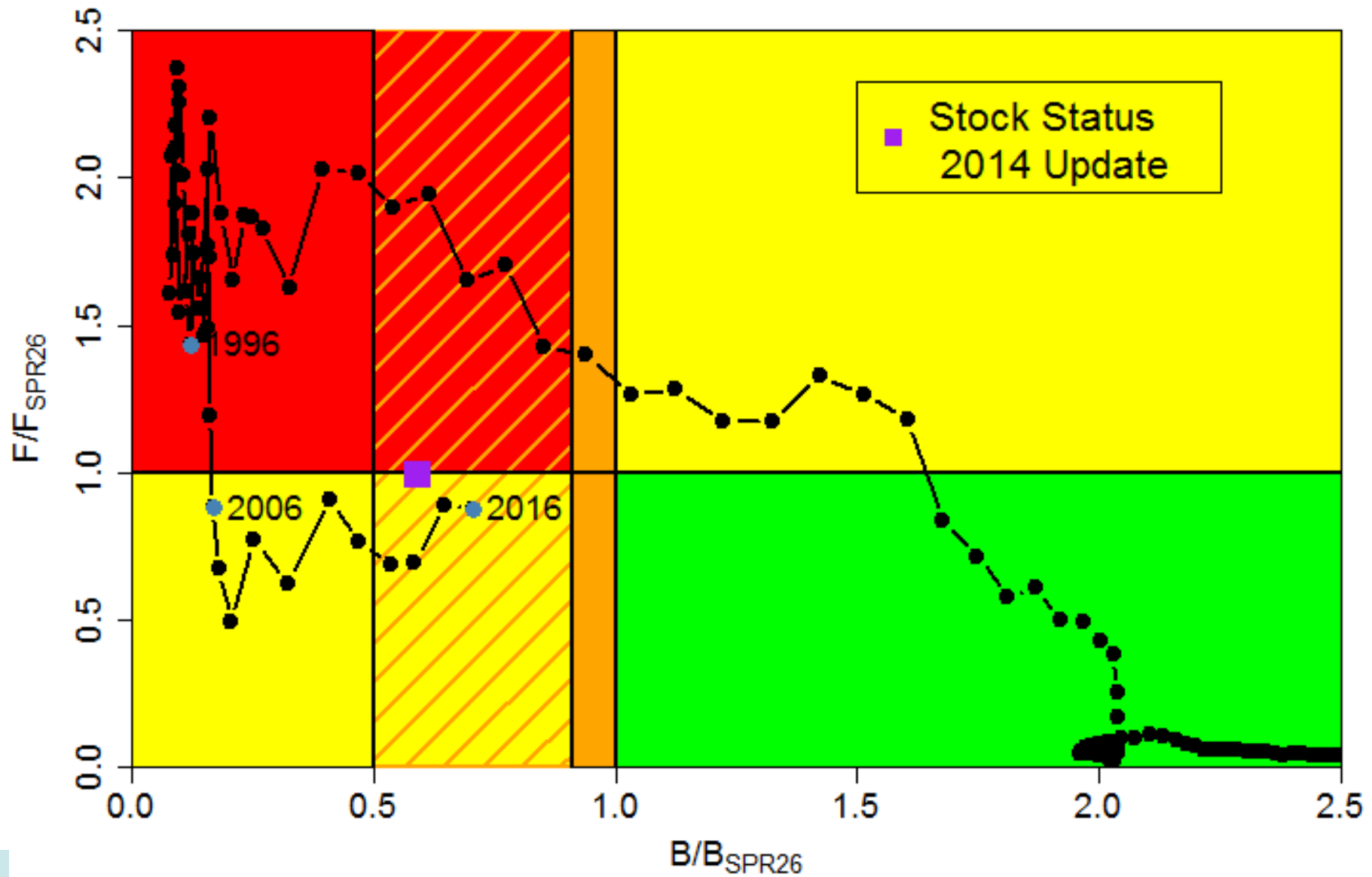


# MSRA Table

Criteria	Definition	2014 SEDAR 31 Update	SEDAR 52
Base M	Average M for Fully Selected Ages	0.09	0.09
Steepness	SR Parameter ( $h$ )	0.99	0.99
Virgin Recruitment	SR Parameter ( $R_0$ )	1.70E+08	1.63E+08
SSB Unfished (Eggs)		4.91E+15	4.72E+15
Generation Time	Fecundity-Weighted Mean Age	15	15
SPR target		0.26	0.26
<b>Mortality Rate Criteria</b>			
$F_{MSY}$ or Proxy	$F_{SPR26\%}$	0.0494	0.0588
MFMT	$F_{SPR26\%}$	0.0494	0.0588
$F_{OY}$	0.75 * Directed F at $F_{SPR26\%}$	0.0472	0.0564
$F_{Current}$	Average F Over Terminal 3 Years of Assessment	0.0491	0.0484
$F_{Current}/MFMT$		0.994	0.823
<b>Biomass Criteria</b>			
$SSB_{MSY}$ or Proxy	$SSB_{SPR26\%}$	1.28E+15	1.23E+15
$MSST_{OLD}$	(1-M) * $SSB_{SPR26\%}$	1.16E+15	1.12E+15
$MSST_{NEW}$	0.5 * $SSB_{SPR26\%}$	6.40E+14	6.15E+14
$SSB_0$	Virgin SSB	4.91E+15	4.72E+15
$SSB_{Current}$	Terminal Year SSB	6.90E+14	8.67E+14
$SSB_{Current}/SSB_{FSPR26\%}$		0.54	0.70
$SSB_{Current}/MSST_{OLD}$		0.59	0.77
$SSB_{Current}/MSST_{NEW}$		1.08	1.41
$SSB_{Current}/SSB_0$		0.14	0.18



# Stock Status

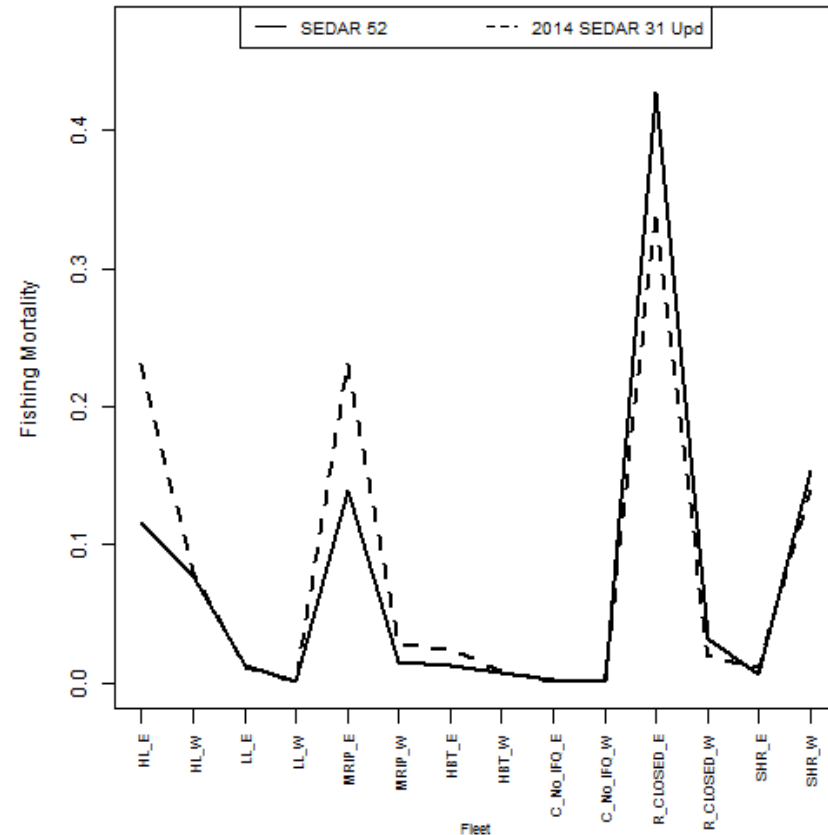


# Projections



# Projection Settings

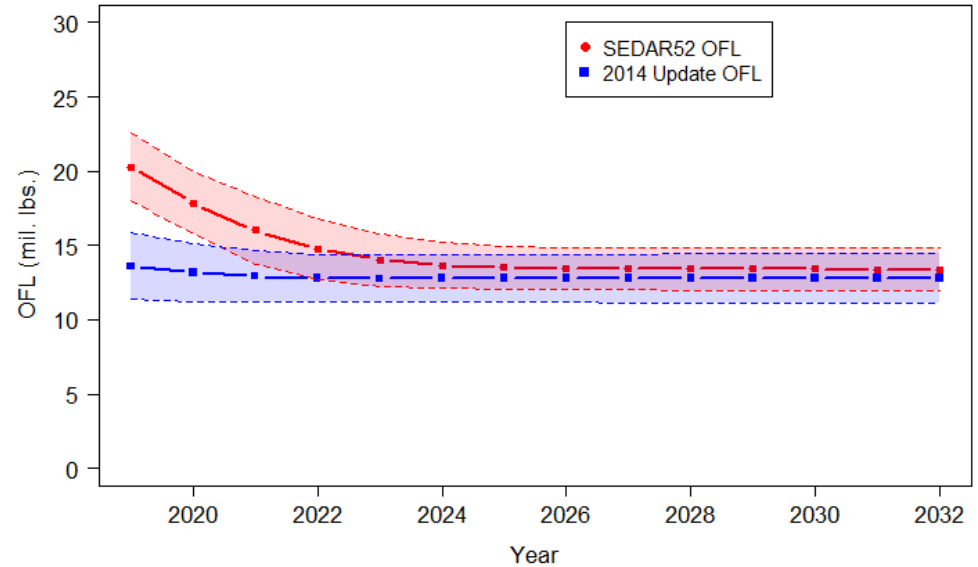
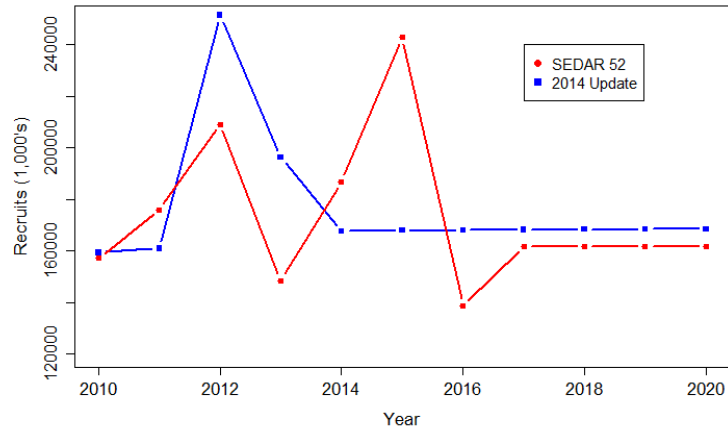
- Provisional 2017 landings incorporated with discards assumed equal to 2016
- 2018 combined ACL (~13 mil. Lbs.) assumed removed
- Constant recruitment based on recent period
- Selectivity, retention, and discard mortality taken from most recent timeblock
- Discard and bycatch fleets fishing mortality taken from terminal year and held constant
- Allocation 51:49, Comm : Rec



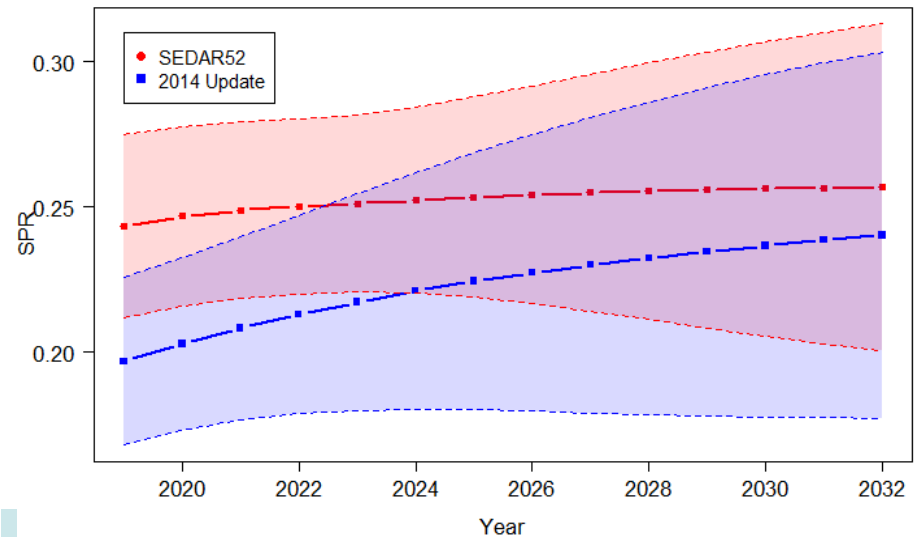
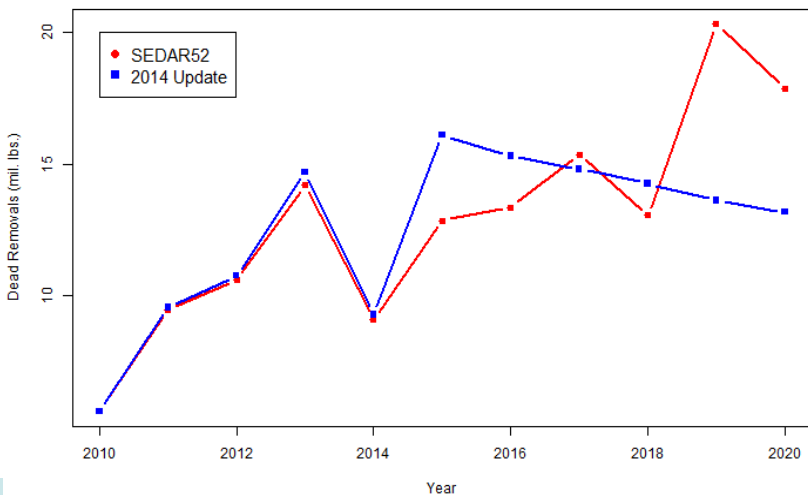


# Overfishing Limit

## Recruits

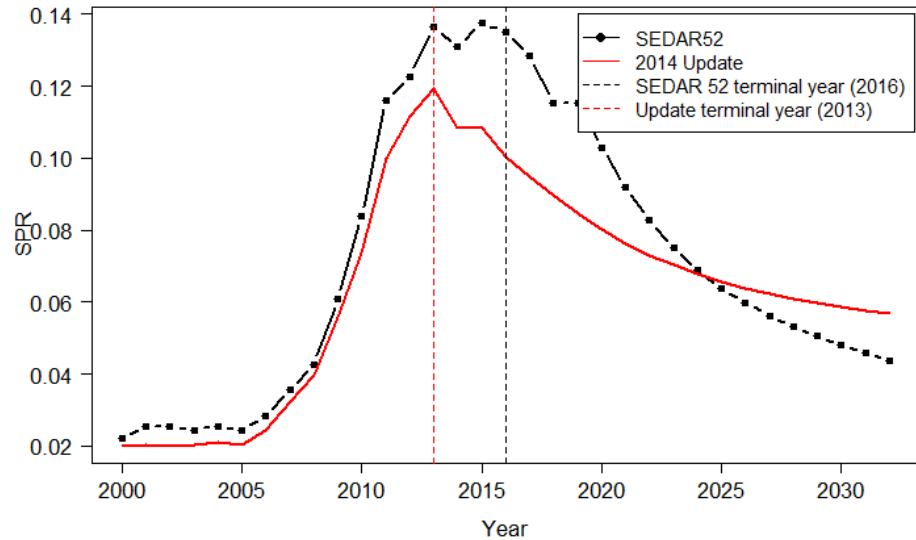


## Dead Removals

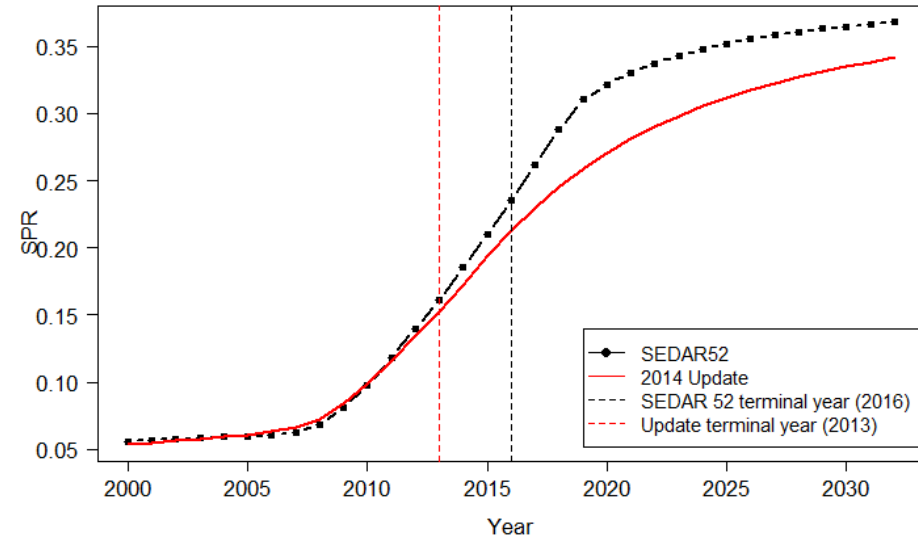


# Regional SPR

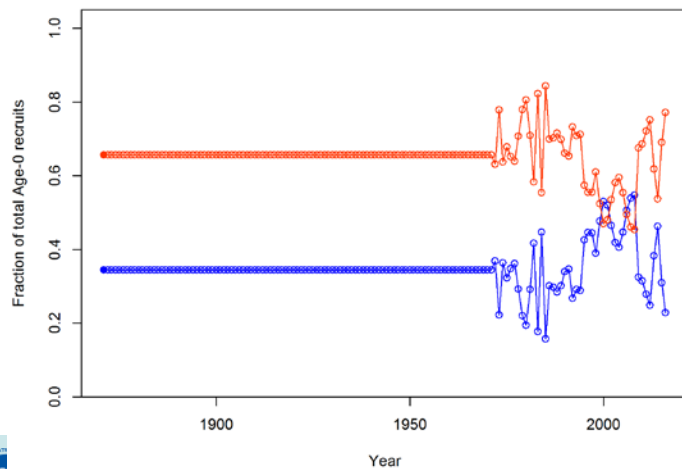
## Eastern Gulf of Mexico



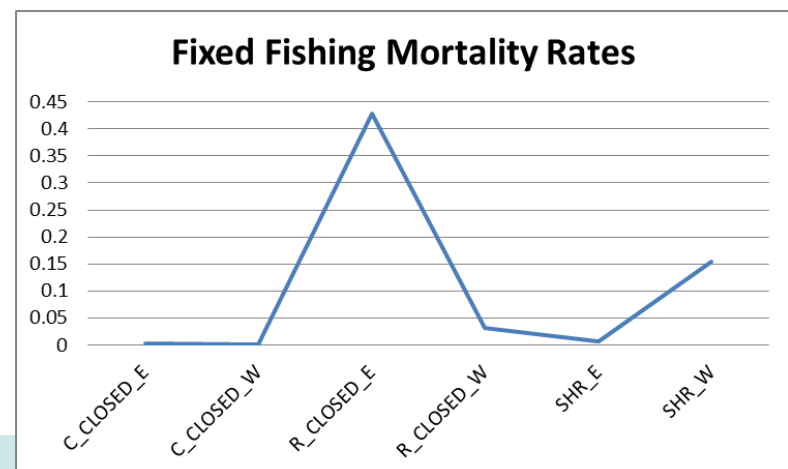
## Western Gulf of Mexico



## Fraction of total Age-0 recruits by area



## Fixed Fishing Mortality Rates



# Acceptable Biological Catches (ABCs)

- Constrained to rebuild to SPR 26% by 2032
- Used 2017 provisional landings by fleet

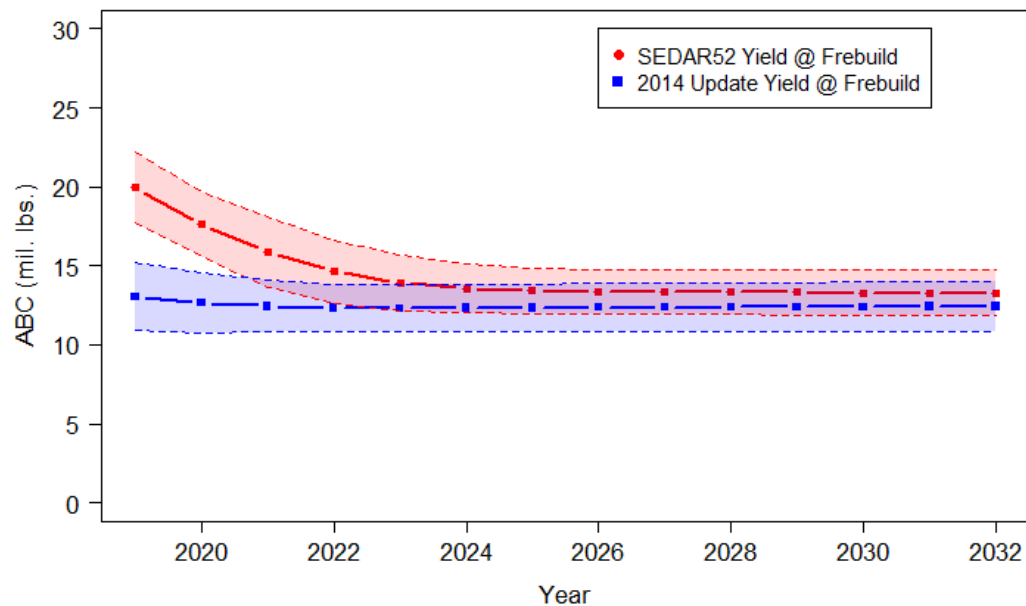
HL_E	HL_W	LL_E	LL_W	MRIP_E	MRIP_W	HBT_E	HBT_W	Total
1435.63 (mt)	1585.36 (mt)	85.8 (mt)	58.69 (mt)	1151.08 (#'s)	162.67 (#'s)	58.61 (#'s)	60.07 (#'s)	15.36 mil. lbs.

- Used ACL as landings for 2018

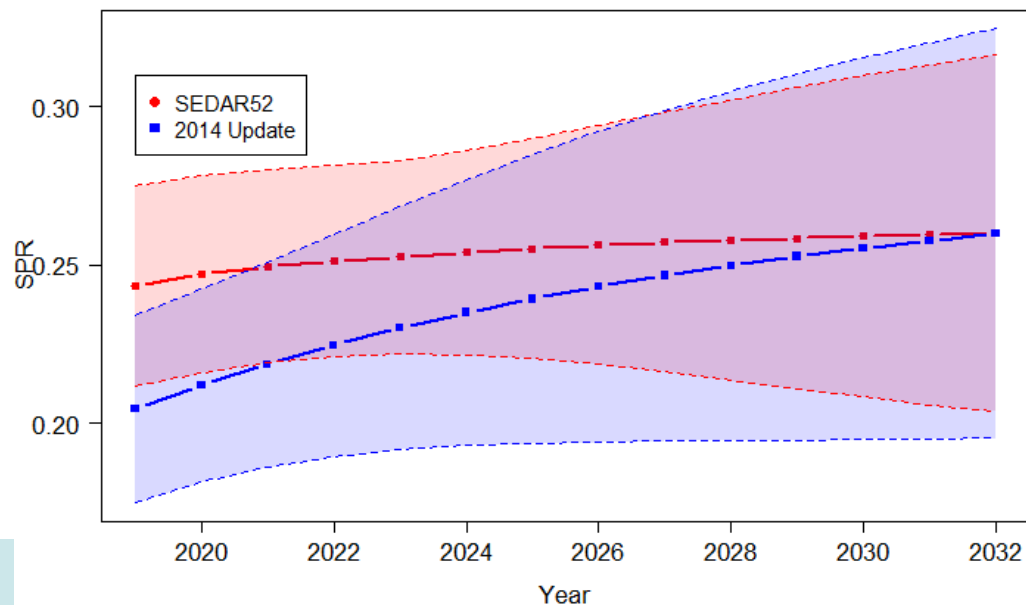
Comm.	Rec. for hire	Rec. private	Total
6,312,613 lbs.	2,848,000 lbs.	3,885,000 lbs.	13,045,613 lbs.

- Bycatch and discard fleets fishing mortality was the same as previous projections (and held constant)
- $P^* = 0.427$ , same as used in 2014 SEDAR 31 Update Projections

# Yield and SPR from Frebuild



Year	ABC (mil. lbs.)	OFL (mil. Lbs.)
2019	19.73	20.29
2020	17.42	17.85
2021	15.64	16.01
2022	14.44	14.75
2023	13.76	14.03
Equil.	13.11	13.34
CC5	16.20	16.59
CC3	17.60	18.05



CC5 = average all 5 years

CC3 = average first 3 years

# Did We Overfish in 2017

## 2017 Landings

HL_E	HL_W	LL_E	LL_W	MRIP_E	MRIP_W	HBT_E	HBT_W	Total
1435.63 (mt)	1585.36 (mt)	85.8 (mt)	58.69 (mt)	1151.08 (#'s)	162.67 (#'s)	58.61 (#'s)	60.07 (#'s)	15.36 mil. lbs.

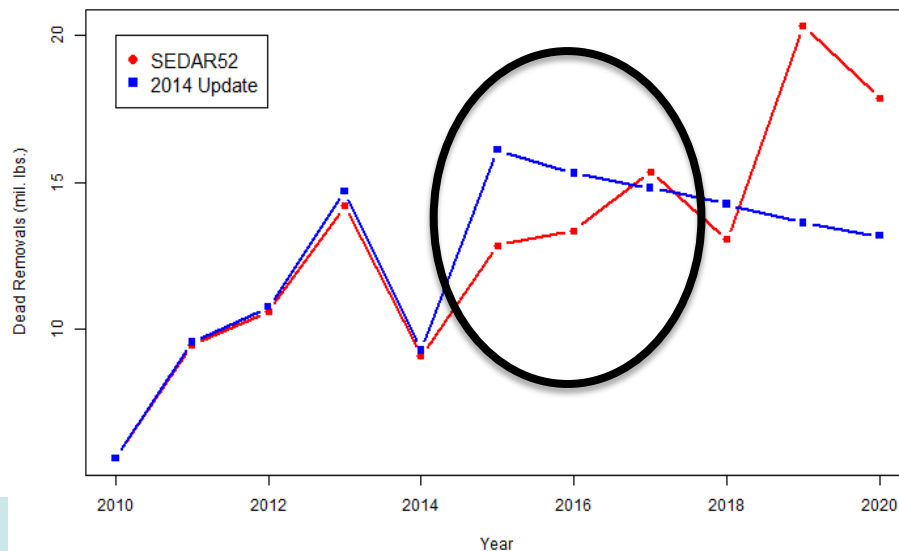
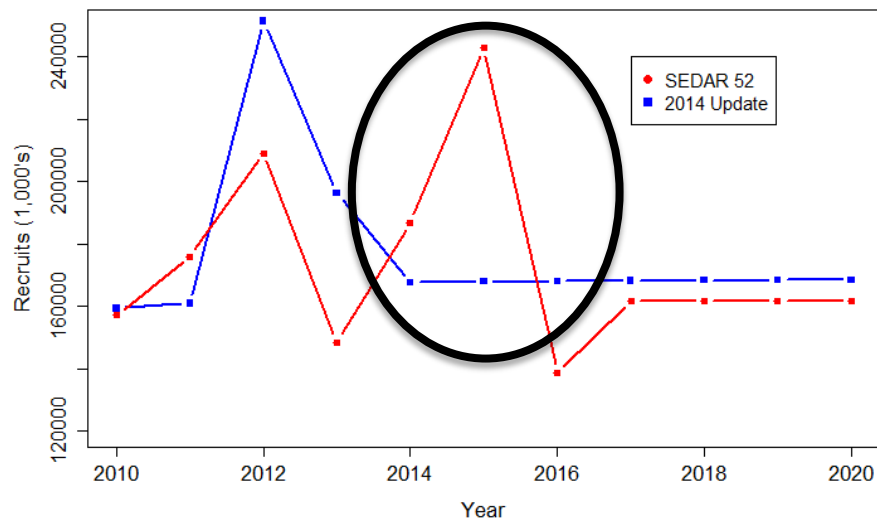
2017 ABC (update)	2017 OFL (update)	2017 Removals	2017 F	MFMT (update)
13.74 mil. lbs.	14.79 mil. lbs.	15.36 mil. lbs.	0.0551	0.0494

Based on 2014 update assessment **YES**

2017 ABC (SEDAR 52)	2017 OFL (SEDAR 52)	2017 Removals	2017 F	MFMT (SEDAR 52)
18.7 mil. lbs.	20.71 mil. lbs.	15.36 mil. lbs.	0.0551	0.0588

Based on SEDAR 52 **NO**

# Why Didn't We Overfish in 2017



# Questions

