

Spiny Dogfish Update 2012

**MAFMC SSC Webinar
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Objectives

- Summarize 2011 landings and discard estimates
- Summarize survey results for 2012
- Estimate stock biomass in 2012 and fishing mortality in 2011
- Compute OFL for 2013-2015 using constant F harvest strategy

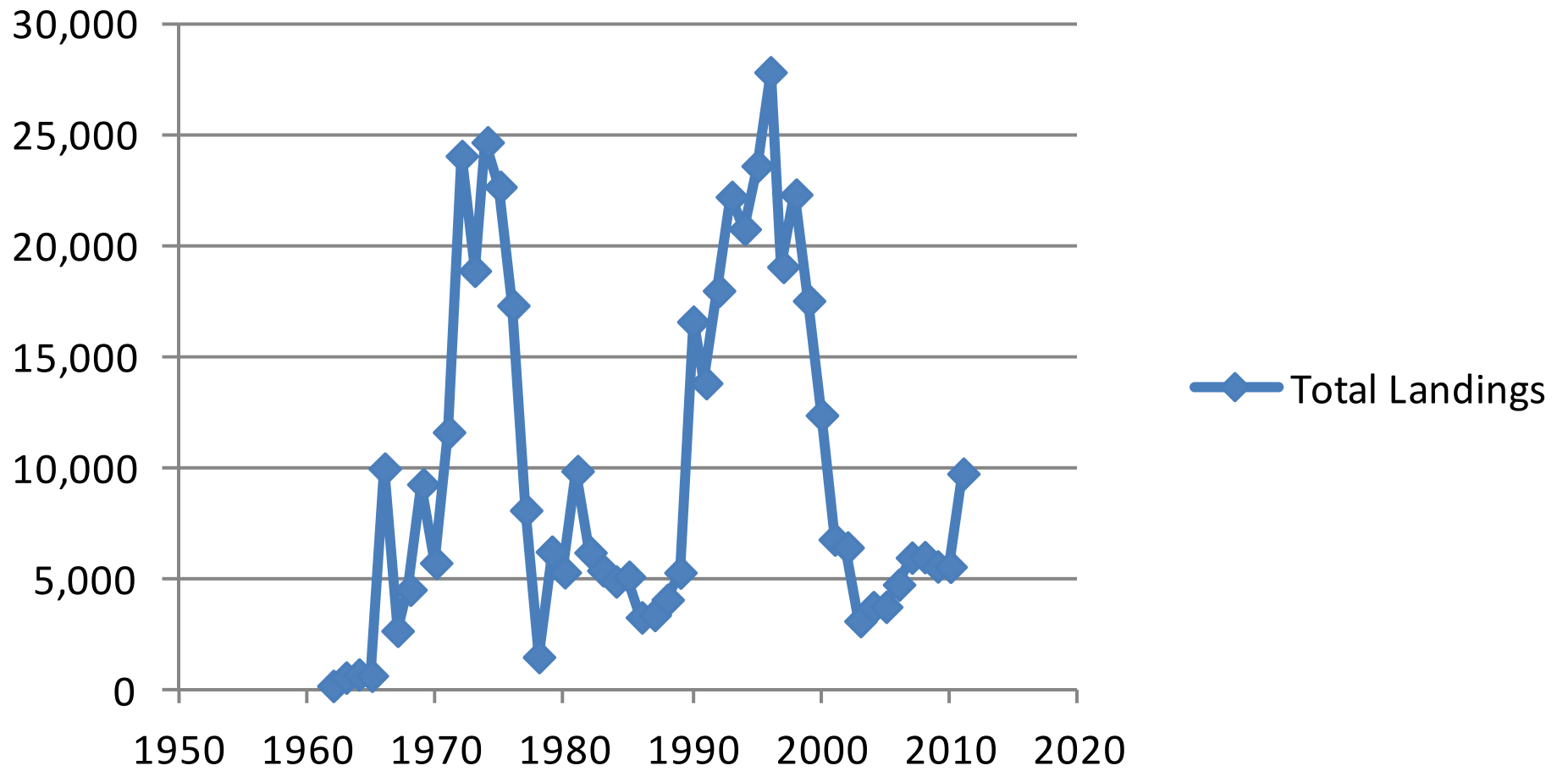
Catch Highlights

- Total landings increased from 5,594 mt in 2010 to 9,779 mt in 2011. (+74%)
Recreational, Canadian and foreign fleets were only 299 mt.
- Total discards increased from 10,584 in 2010 to 12,264 in 2011. (+16%)
- Total DEAD discards increased from 4,081 to 4,787 mt (+17%).
- Ratio

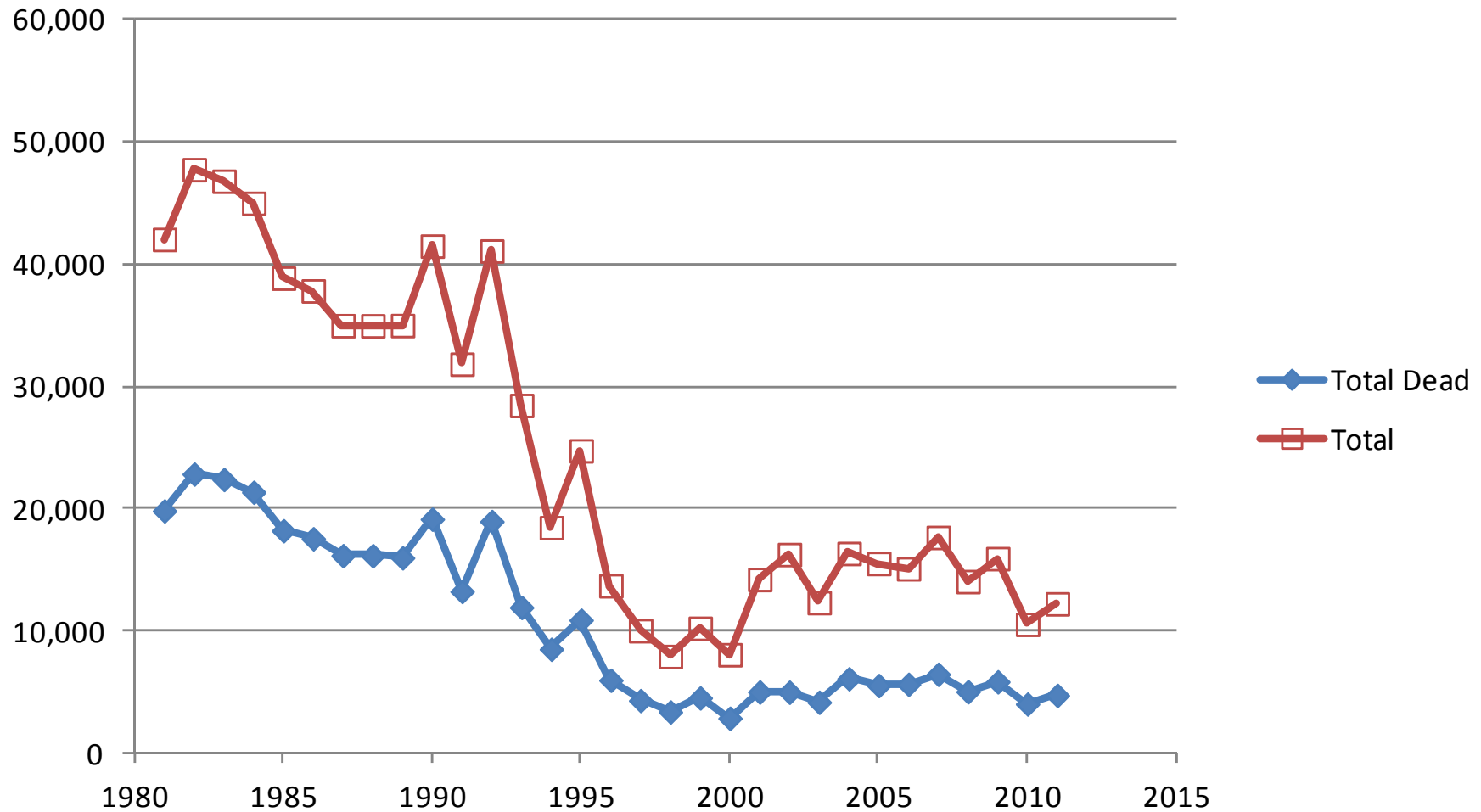
Year	Total Discard	Total Dead Discards (mt)	Total Landings (mt)	Dead Disc/Landings	Total Discard / Landings	Total Catch (mt)
1989	34,990	16,020	5,333	3.00	6.56	21,353
1990	41,474	19,174	16,611	1.15	2.50	35,785
1991	31,831	13,274	13,848	0.96	2.30	27,122
1992	41,066	18,983	18,008	1.05	2.28	36,991
1993	28,461	11,969	22,225	0.54	1.28	34,194
1994	18,486	8,556	20,774	0.41	0.89	29,330
1995	24,760	10,932	23,615	0.46	1.05	34,547
1996	13,742	6,025	27,827	0.22	0.49	33,852
1997	10,065	4,366	19,078	0.23	0.53	23,443
1998	7,963	3,435	22,329	0.15	0.36	25,764
1999	10,263	4,581	17,552	0.26	0.58	22,134
2000	8,111	2,917	12,405	0.24	0.65	15,321
2001	14,252	5,063	6,819	0.74	2.09	11,882
2002	16,283	5,049	6,462	0.78	2.52	11,510
2003	12,358	4,225	3,155	1.34	3.92	7,380
2004	16,370	6,146	3,778	1.63	4.33	9,925
2005	15,552	5,589	3,792	1.47	4.10	9,382
2006	15,126	5,688	4,792	1.19	3.16	10,480
2007	17,681	6,510	6,002	1.08	2.95	12,512
2008	14,080	5,088	6,025	0.84	2.34	11,113
2009	15,952	5,897	5,606	1.05	2.85	11,503
2010	10,584	4,081	5,594	0.73	1.89	9,675
2011	12,264	4,787	9,779	0.49	1.25	14,566

*Total catch
and
discards*

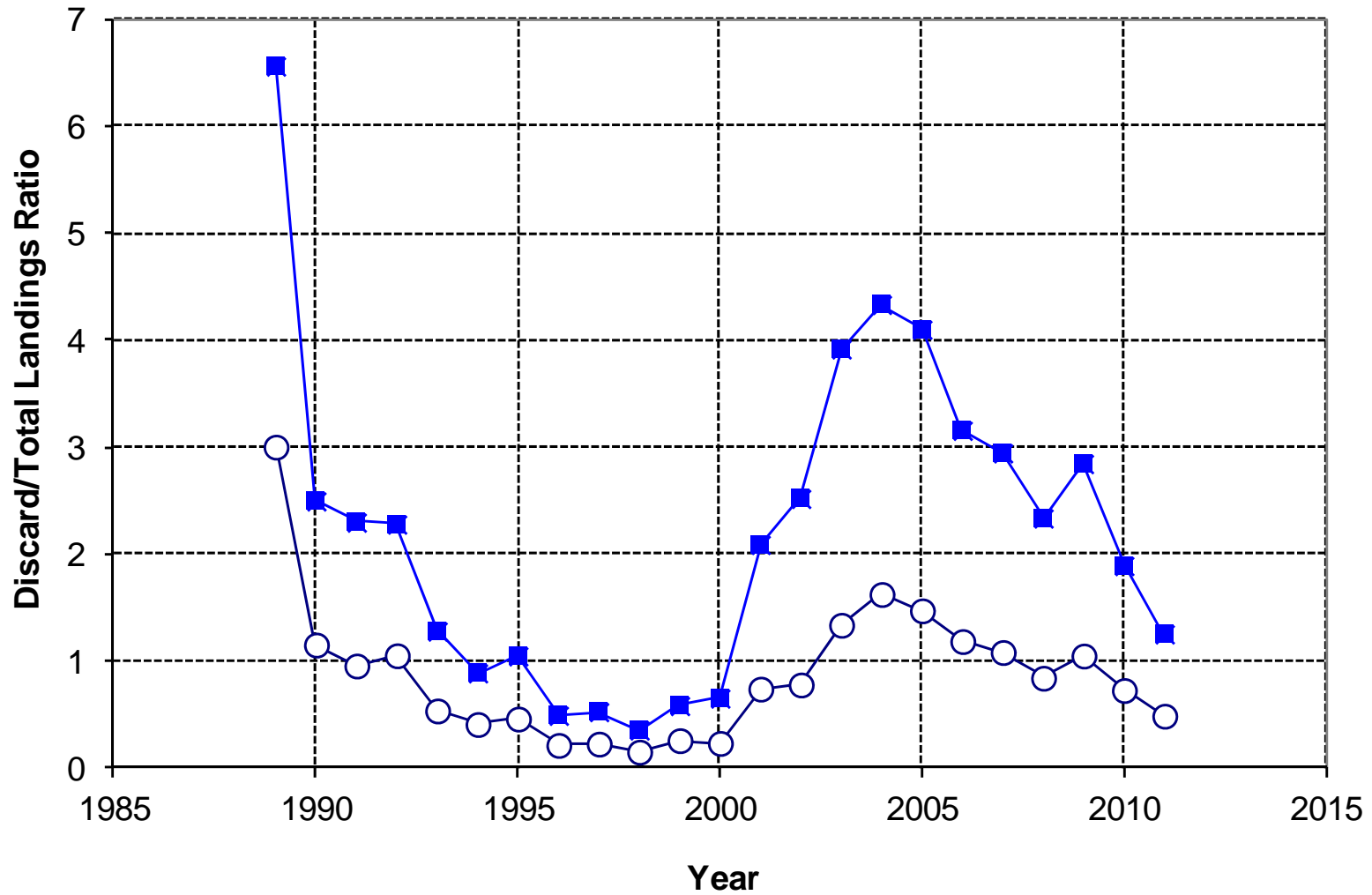
Total Landings (mt)



Comparison of total and estimated dead discards (mt), 1981-2011



Ratio of Discards to Landings: 1989-2011



—○— Dead Disc/Landings —■— Total Discard/Landings

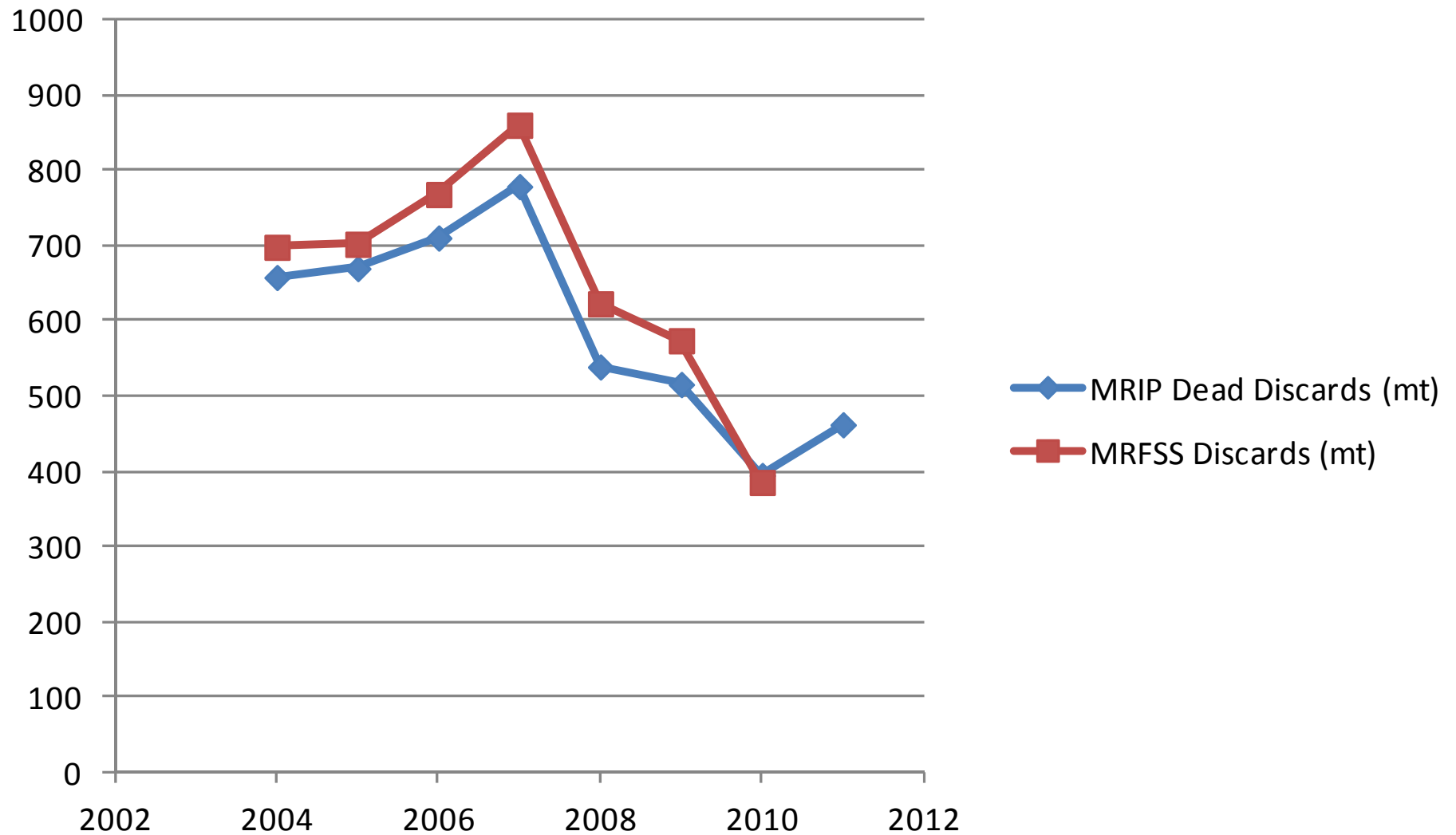
MRIP vs MRFSS: 2004-2011

- New MRIP estimates available for 2004-2011
- Estimates are based on MRIP estimator applied to historical intercept data collected under MRFSS program.
- Overall changes are minor.
 - MRIP estimates of landings are about 18% lower than MRFSS.
 - MRIP estimates of discards are about 7% lower
- Recreational catch is a small fraction of total removals. In 2011 rec catch/total catch=3.3%

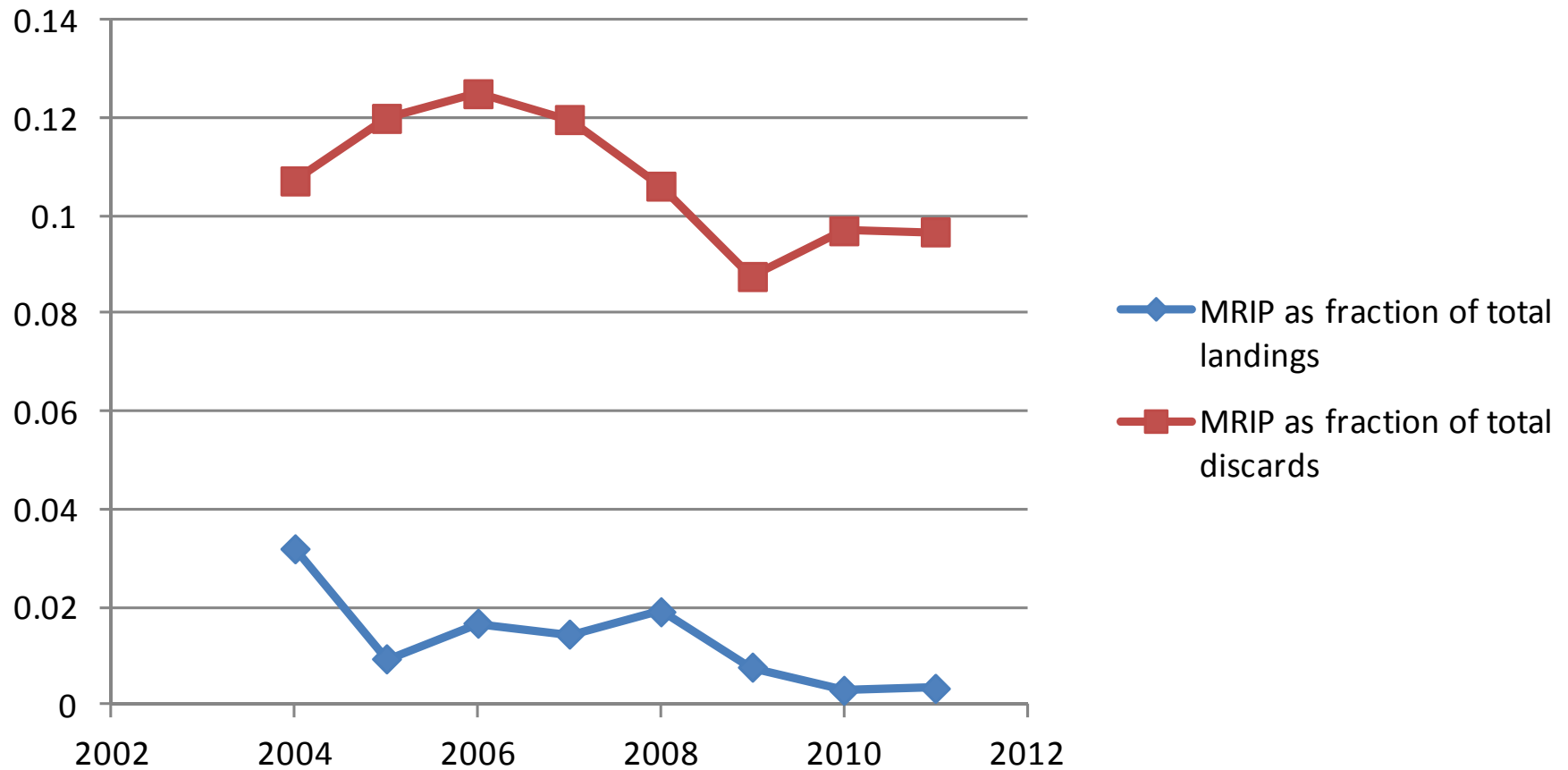
Comparison of MRFSS vs MRIP landings data 2004-2011 (Blue=MRIP, Red=MRFSS)



Comparison of MRFSS vs MRIP dead discard Estimates for 2004-2011



Fraction of total landings and discards represented by MRIP estimates



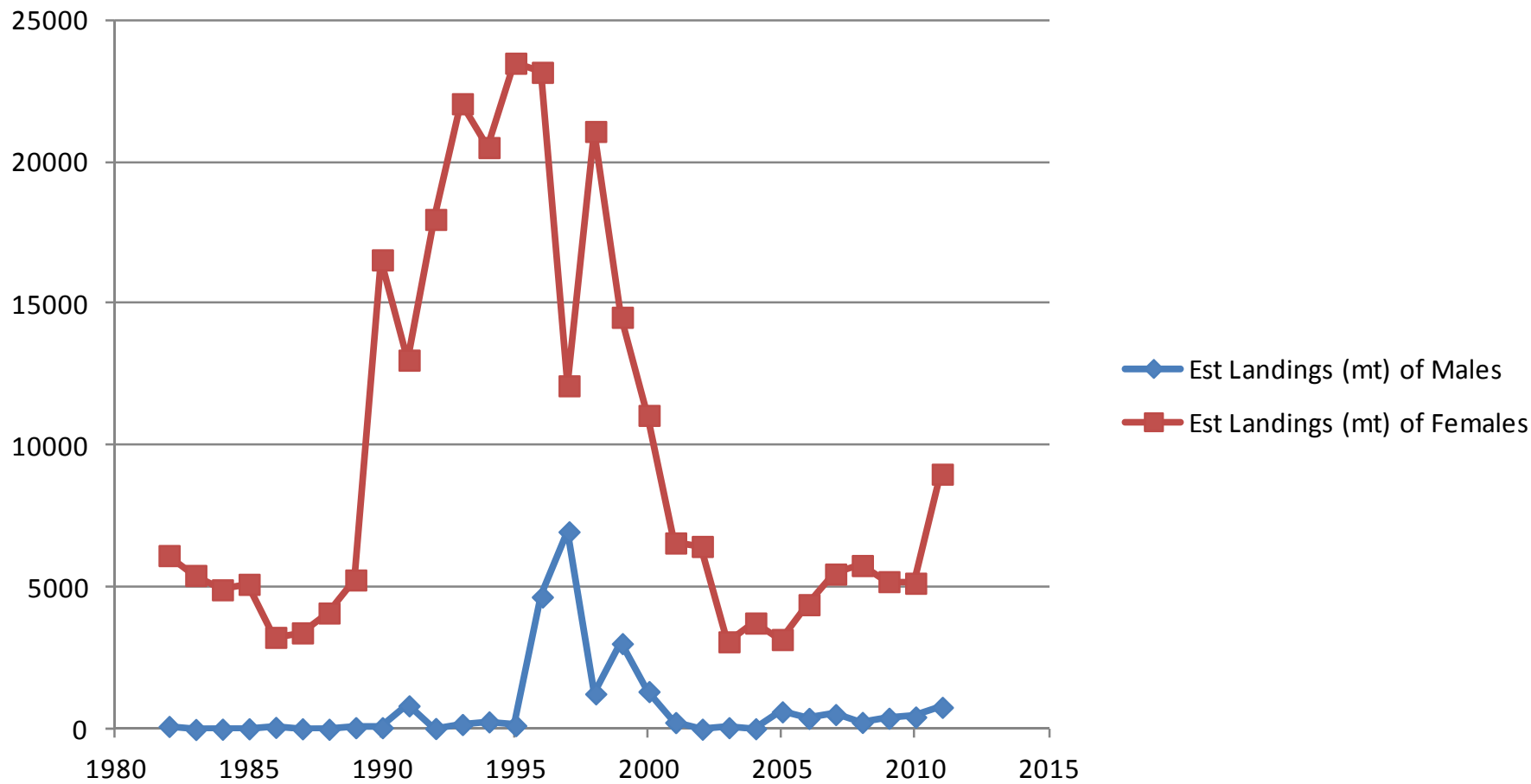
Biological Composition of Catch

- Overall landings and discards dominated by female landings.
- Pattern has been consistently observed except for small period, 1996-2000.

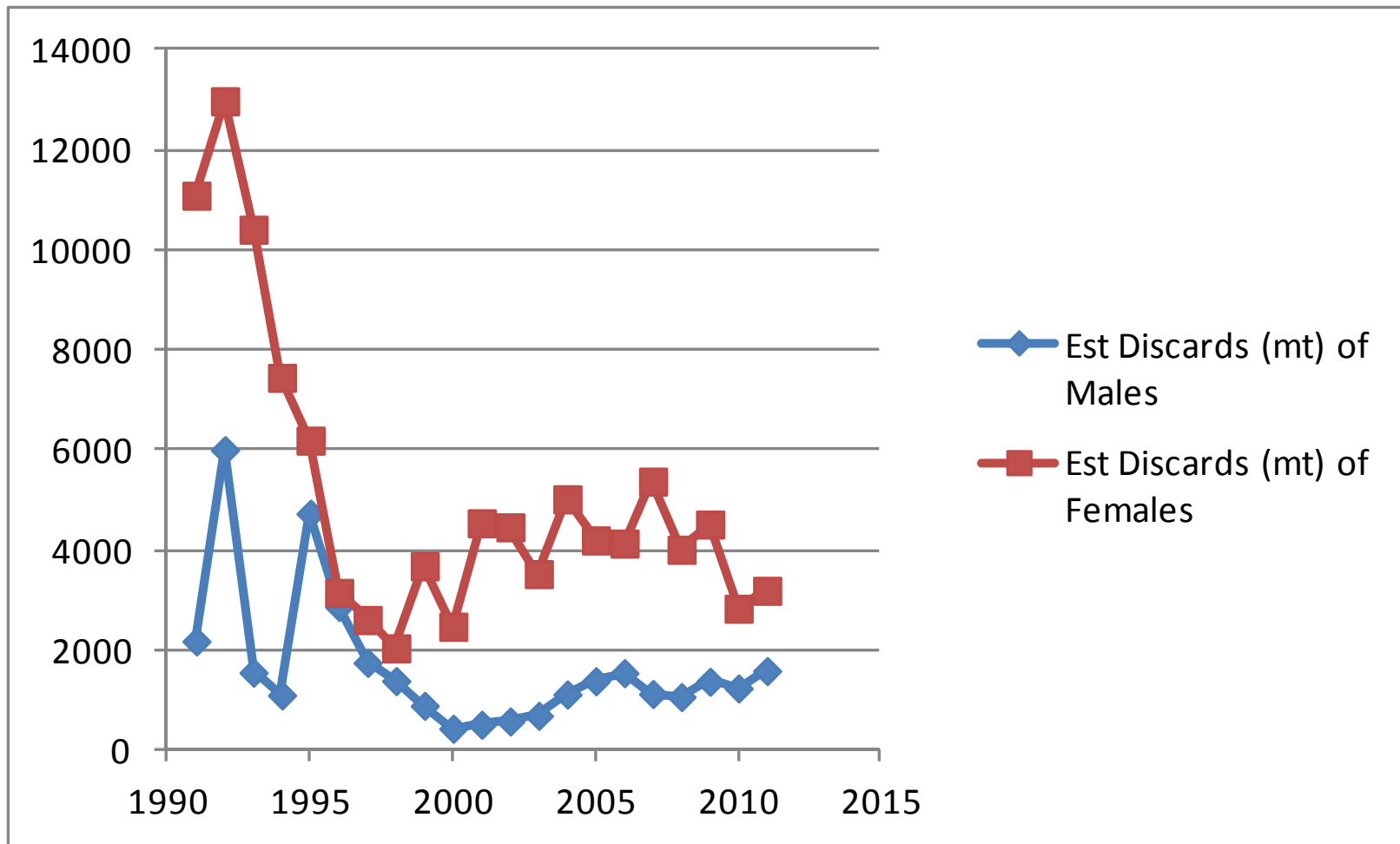
Biological composition of discards, landings and measures of uncertainty

Year	<i>Trawl Discards (mt)</i>				<i>Gill Net Discards (mt)</i>				<i>Recreational Discards (mt)</i>				<i>Landings (mt)</i>	
	<i>Male</i>		<i>Female</i>		<i>Male</i>		<i>Female</i>		<i>Male</i>		<i>Female</i>		<i>Males</i>	<i>Females.</i>
	<i>Total</i>	<i>SE</i>	<i>Total</i>	<i>SE</i>	<i>Total</i>	<i>SE</i>	<i>Total</i>	<i>SE</i>	<i>Total</i>	<i>SE</i>	<i>Total</i>	<i>SE</i>		
1990	7636.00	1918.55	9485.0	2382.9	256.00	65.12	1563.00	397.55	58.068	8.478	354.497	51.757	61.9	16378.1
1991	4309.00	843.49	5352.0	1047.6	466.00	54.53	2843.00	332.91	56.413	7.616	344.394	46.493	824.4	12878.6
1992	7274.00	1971.88	9034.0	2449.1	251.00	24.09	1535.00	147.10	58.890	6.242	359.514	38.108	32.5	17721.5
1993	3855.00	993.13	4788.0	1233.5	414.00	78.23	2530.00	477.57	48.101	7.456	293.651	45.516	173.0	21908.0
1994	3102.00	786.56	3852.0	976.9	122.00	36.74	744.00	224.31	48.975	7.444	298.982	45.445	266.3	20354.7
1995	2275.00	444.94	6224.0	1217.3	957.00	314.93	1062.00	349.68	90.048	10.356	99.983	11.498	137.0	23536.0
1996	1683.00	465.96	3018.0	835.9	599.00	181.61	568.00	172.39	53.432	6.839	50.719	6.492	4679.8	23213.2
1997	1716.00	566.41	1637.0	540.4	220.00	54.14	478.00	117.73	67.339	8.215	146.416	17.863	6941.6	12070.4
1998	1077.00	363.50	1558.0	525.9	239.00	69.66	351.00	102.48	65.098	8.593	95.770	12.642	1254.4	21059.6
1999	982.00	340.73	2860.0	992.3	117.00	31.19	485.00	129.44	30.914	3.586	128.314	14.884	3082.3	14798.7
2000	644.00	156.37	720.0	174.7	149.00	43.50	1256.00	367.38	13.277	2.191	112.138	18.503	543.8	11792.2
2001	428.00	68.78	2031.0	326.2	185.00	55.76	1977.00	596.91	38.062	3.464	407.459	37.079	242.3	6483.7
2002	533.00	168.91	2237.0	708.6	107.00	23.23	1392.00	301.06	40.479	4.291	524.542	55.601	114.7	5954.3
2003	524.00	101.64	1402.0	272.0	172.00	22.41	1452.00	189.62	67.346	5.455	569.759	46.150	63.1	3053.9
2004	1261.00	201.44	2888.0	461.3	127.00	11.85	1083.00	101.38	81.937	7.374	700.708	63.064	26.3	3623.7
2005	994.46	111.79	2762.9	310.6	192.57	24.29	808.89	102.03	125.441	15.053	526.908	63.229	488.4	2491.6
2006	790.81	88.89	2123.0	238.6	244.21	29.30	655.59	78.67	177.048	21.246	475.301	57.036	385.6	4330.3
2007	704.25	84.51	3353.0	376.9	290.54	34.86	1383.29	166.00	155.874	18.705	742.126	89.055	512.5	5339.9
2008	589.80	97.20	2212.2	364.6	307.15	55.13	1152.02	206.79	131.127	12.510	491.818	46.919	242.0	5652.1
2009	883.00	90.36	2895.0	296.4	361.00	52.52	1185.00	172.28	134.000	16.490	439.745	54.100	396.0	5201.0
2010	893.00	70.86	2036.0	161.6	234.00	23.19	533.00	52.89	118.000	13.130	268.687	29.950	440.0	5154.0
2011	1143.00	110.49	2296.0	222.0	294.00	15.27	591.00	30.67	154.000	22.440	309.000	45.070	781.0	8998.0

Landings by sex 1982-2011



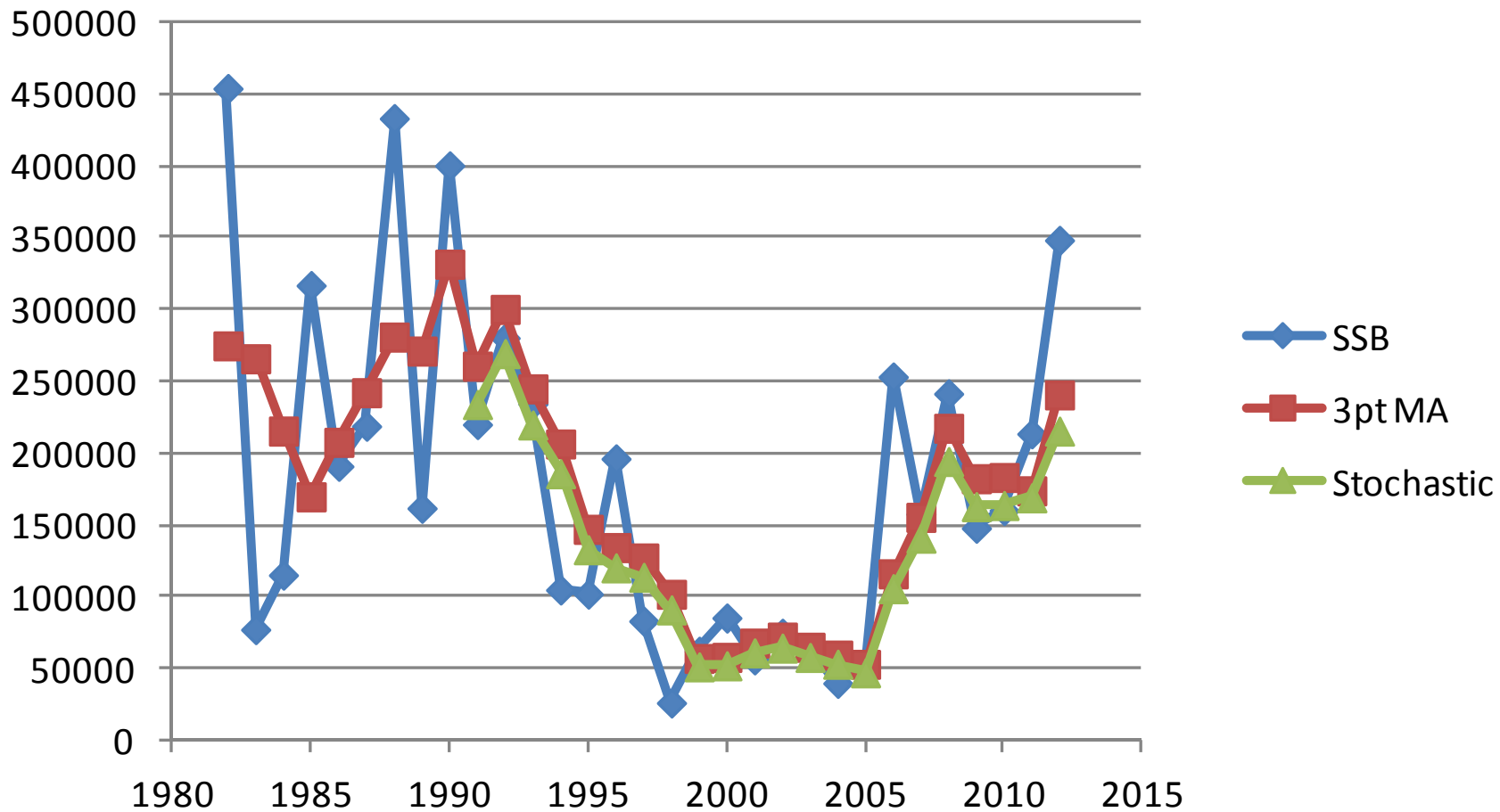
Dead Discards by Sex, 1991-2011



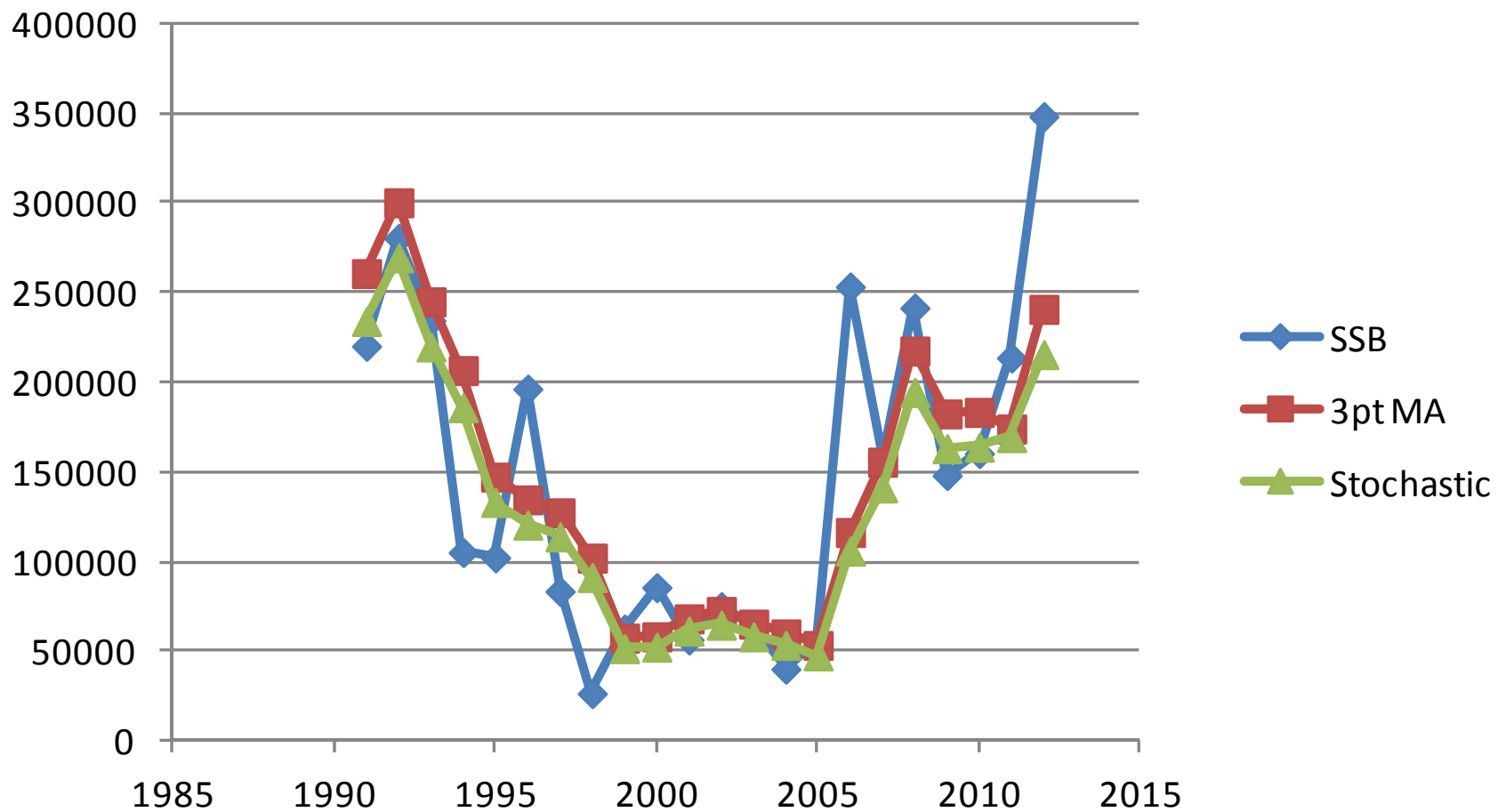
Survey Highlights

- Survey abundance for 2012 increased sharply.
- Point estimates among highest on record for all size ranges and by sex.
- The raw 3-yr average of Female SSB increased to 241,000 mt in 2012 from 174,200 mt in 2011.
- Pup Production was the highest on record, since 1968.
- The stochastic estimator accounts for increased variability in survey estimates and dampens the rate of change.

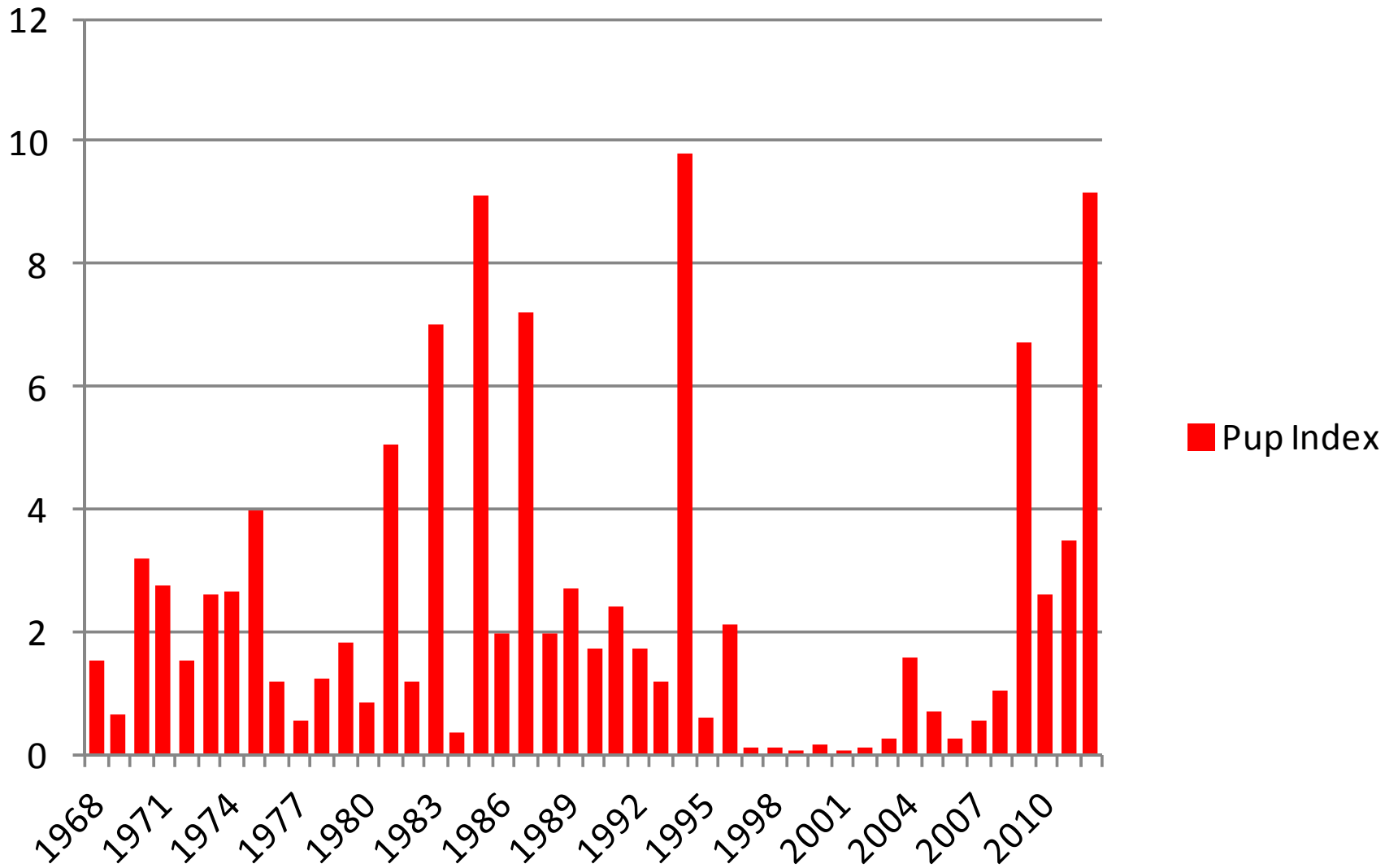
Female spawning stock biomass Estimates 1982-2012



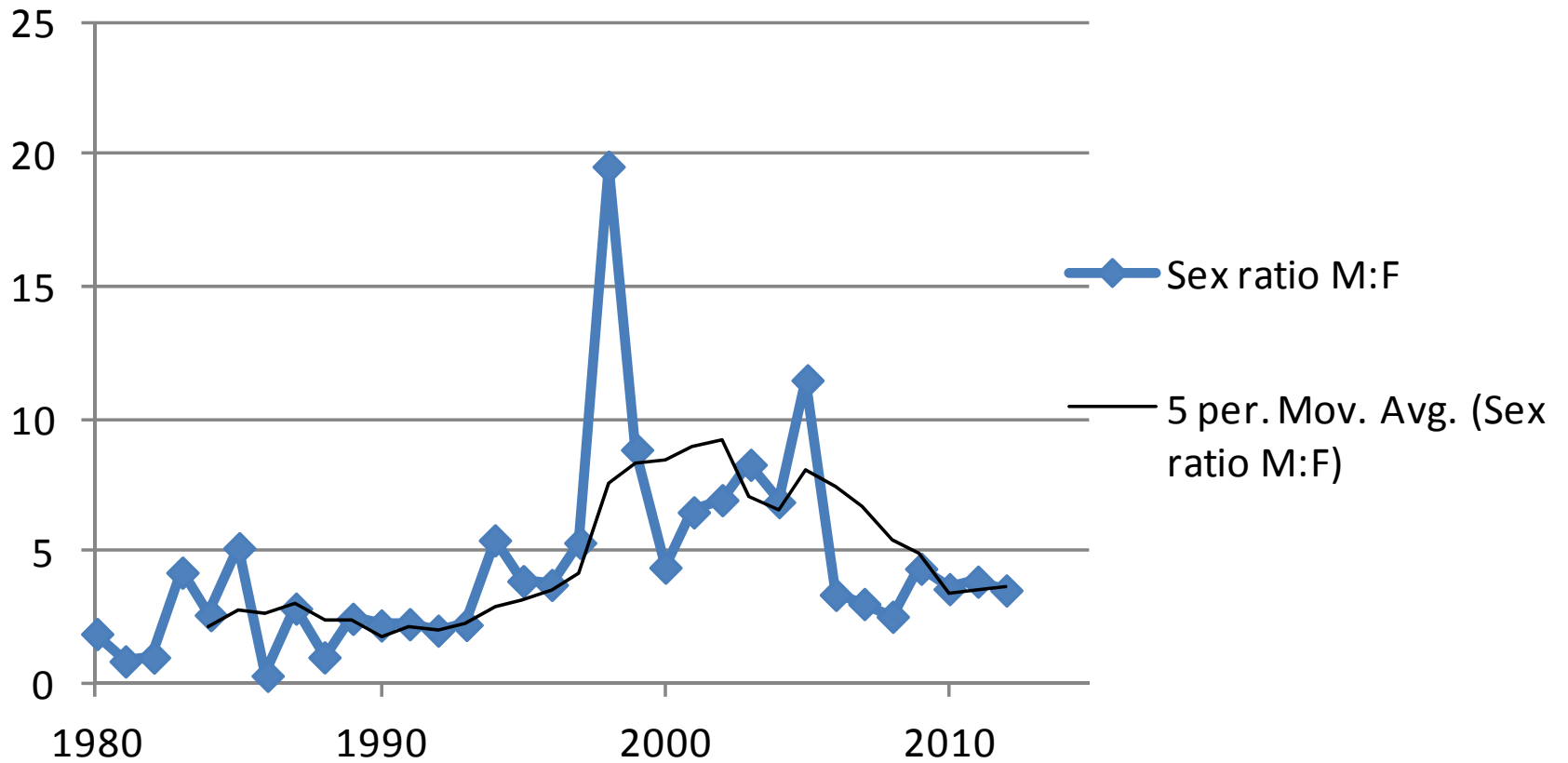
Spawning stock biomass Estimates 1991-2012



Pup Index, 1968-2012



Sex ratio of Mature Males to Females by number



Biomass for 2012 and F Estimates for 2011

Projected F and SSB in 2012 assuming Catch in 2012 equals the MAFMC recommendatio

2012						
Percentile	<i>F</i>	<i>Catch</i>	<i>Landings</i>	<i>Discards</i>	<i>Female SSB</i>	<i>Exploitable Female Biomass</i>
1	0.269	16,321	10,916	5,405	121,496	55,672
2	0.256	16,309	10,907	5,402	127,302	58,332
3	0.247	16,330	10,923	5,408	132,170	60,563
4	0.239	16,328	10,921	5,407	136,394	62,498
5	0.231	16,293	10,895	5,398	140,147	64,218
10	0.208	16,296	10,898	5,399	154,739	70,905
15	0.195	16,320	10,915	5,405	165,635	75,897
20	0.184	16,334	10,925	5,409	174,671	80,038
25	0.176	16,298	10,899	5,399	182,603	83,673
30	0.169	16,323	10,917	5,406	189,826	86,982
35	0.163	16,334	10,925	5,409	196,579	90,077
40	0.157	16,291	10,894	5,398	203,023	93,029
45	0.153	16,330	10,923	5,408	209,278	95,896
50	0.148	16,340	10,930	5,410	215,444	98,721
55	0.144	16,328	10,921	5,407	221,611	101,547
60	0.140	16,297	10,898	5,399	227,866	104,413
65	0.136	16,325	10,918	5,406	234,310	107,366
70	0.131	16,263	10,873	5,390	241,063	110,460
75	0.128	16,304	10,903	5,401	248,286	113,770
80	0.124	16,347	10,935	5,412	256,218	117,404
85	0.120	16,340	10,930	5,410	265,254	121,545
90	0.115	16,307	10,906	5,402	276,150	126,538
95	0.109	16,311	10,908	5,403	290,742	133,224
96	0.107	16,305	10,904	5,401	294,495	134,944
97	0.106	16,316	10,912	5,404	298,719	136,879
98	0.104	16,351	10,938	5,413	303,587	139,110
99	0.102	16,325	10,919	5,406	309,393	141,770

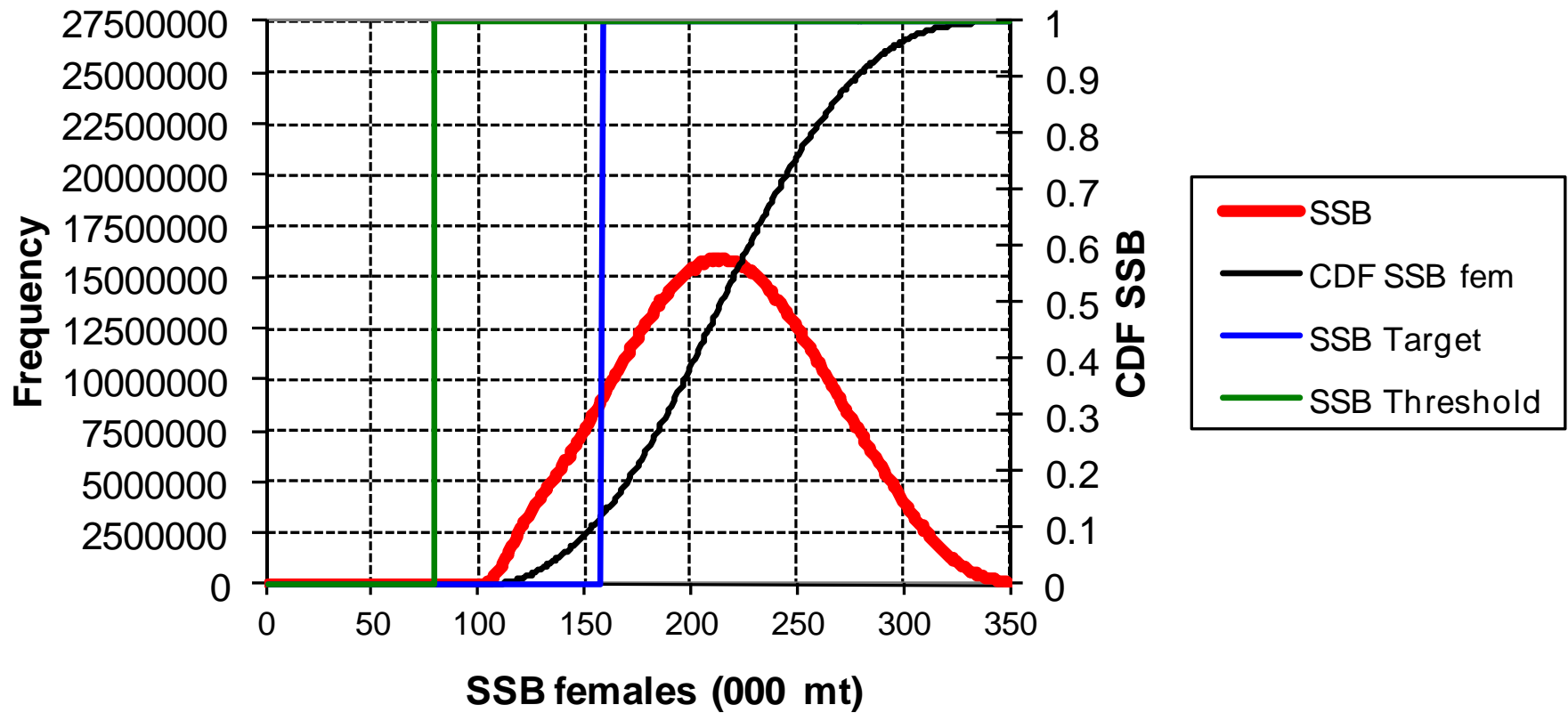
Projected F and SSB in 2012 assuming Catch in 2012 equals the MAFMC's ACL

Summary Stats for 2011/12

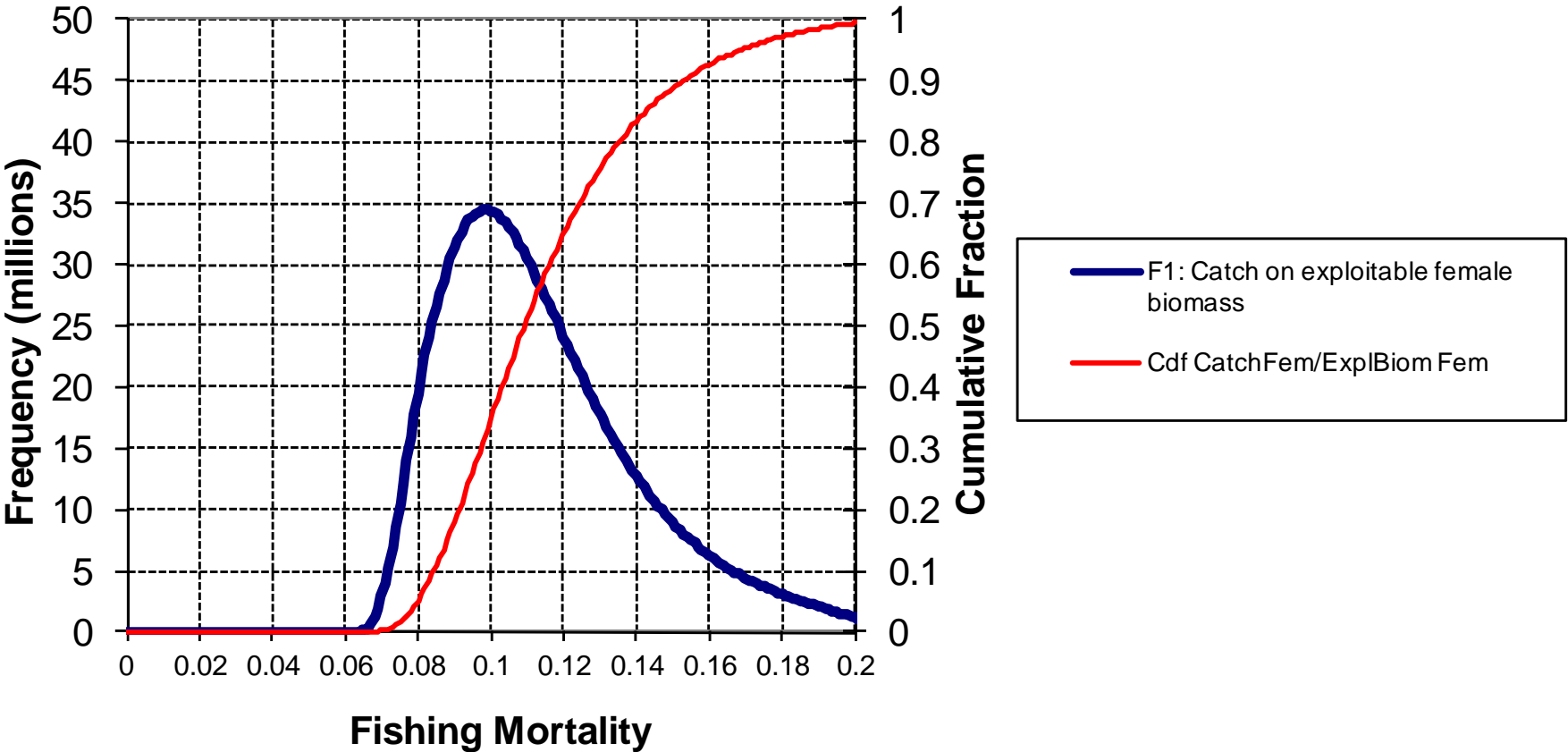
Median F =0.148
 Median SSB=215,444 mt
 Median exploitable biomass =98,721 mt

Stochastic estimate of SSB in 2012 is at the ~74%-ile of forecast from 2011 (see last year's update).

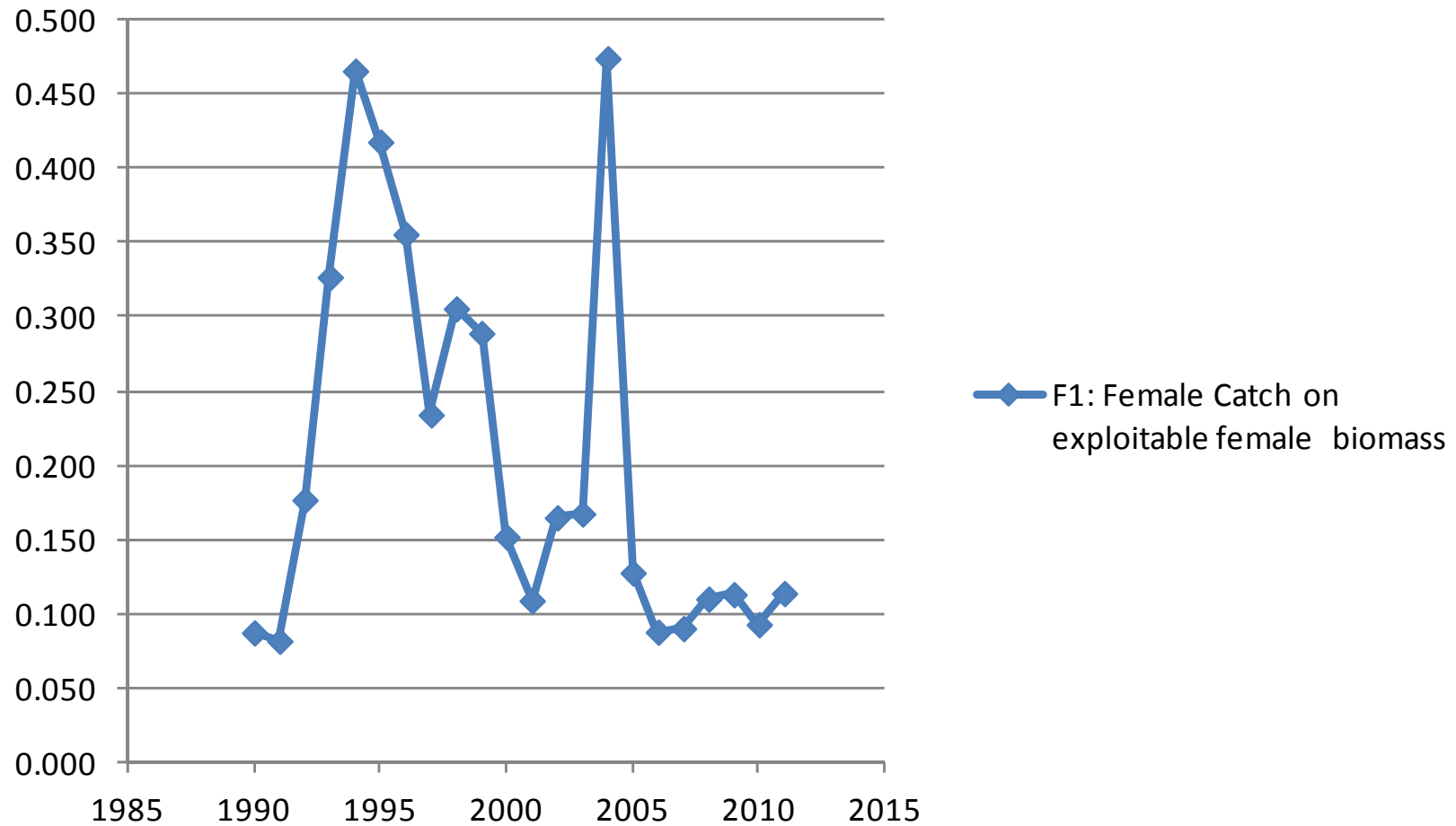
Stochastic Estimate of Spawning Stock Biomass with nominal target and threshold biomasses, 2012



F1: Female Catch vs exploitable biomass: 2011



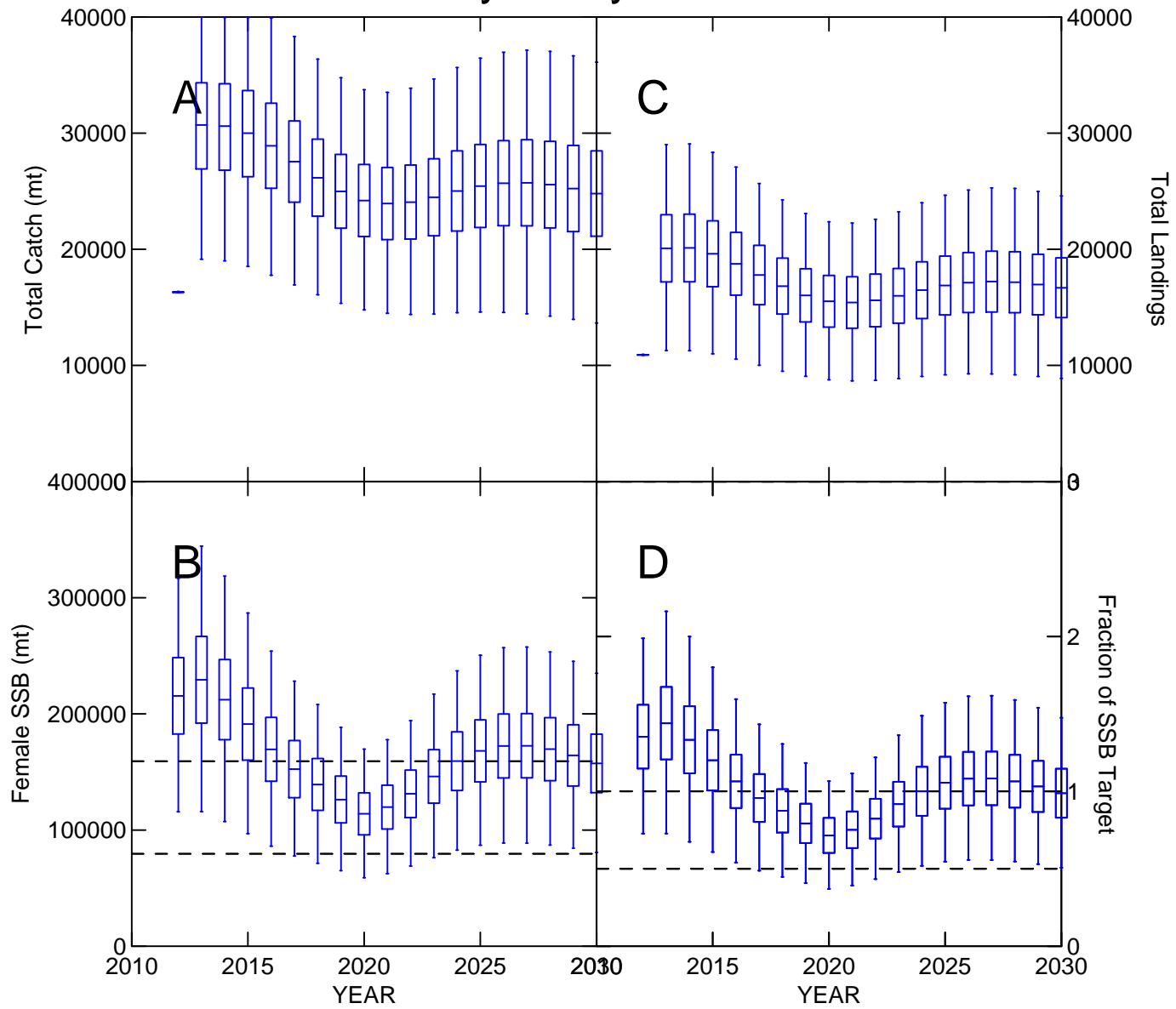
F1: Female Catch on exploitable female biomass



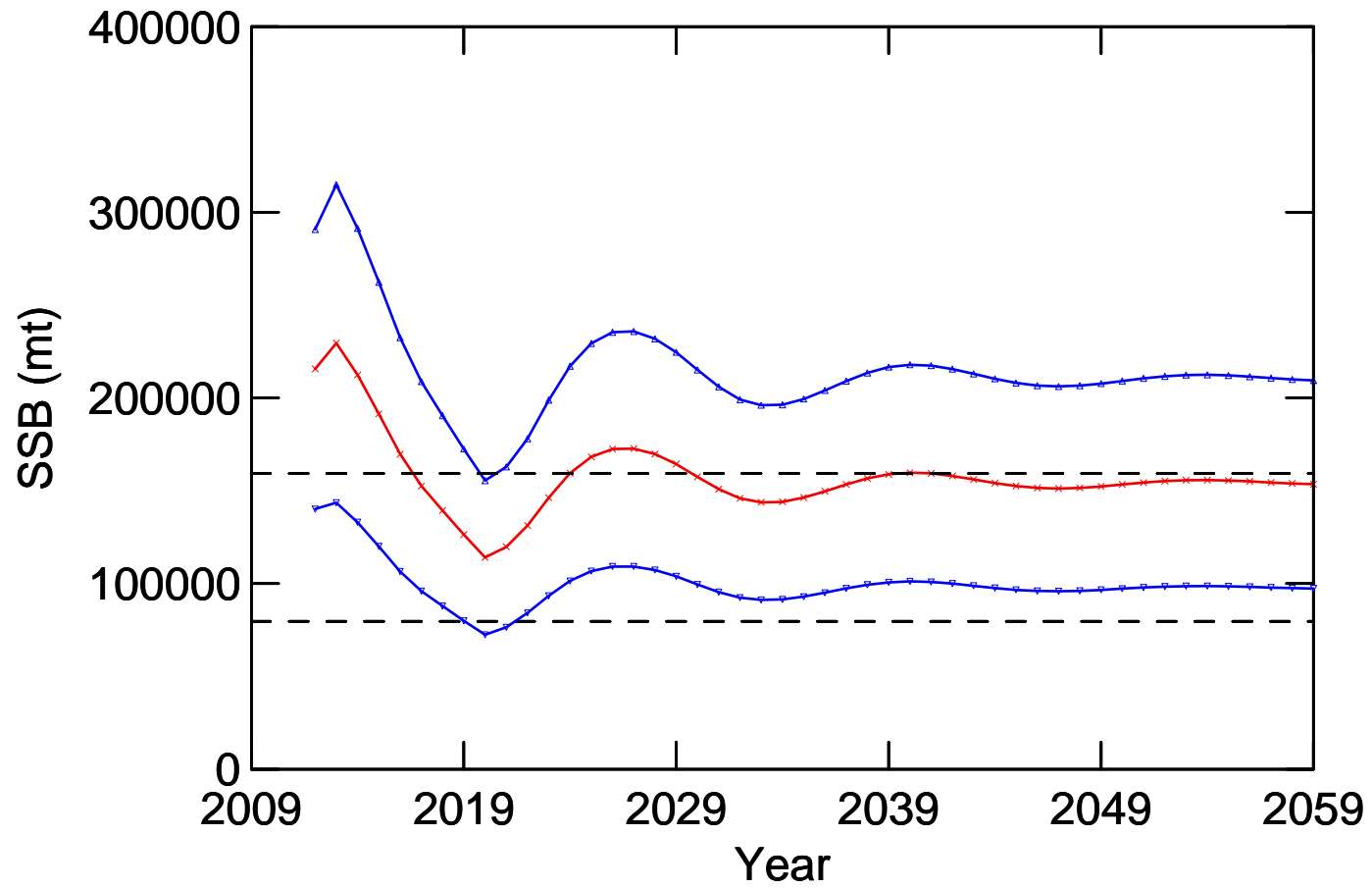
Projections

- Assumed that 2012 catches are 16,191 mt
- Projected for 250 yrs to check for stability at F_{msy}
- Decrease in stock size is still likely by 2020 but current runs suggest the stock has low probability of declining below the threshold biomass.

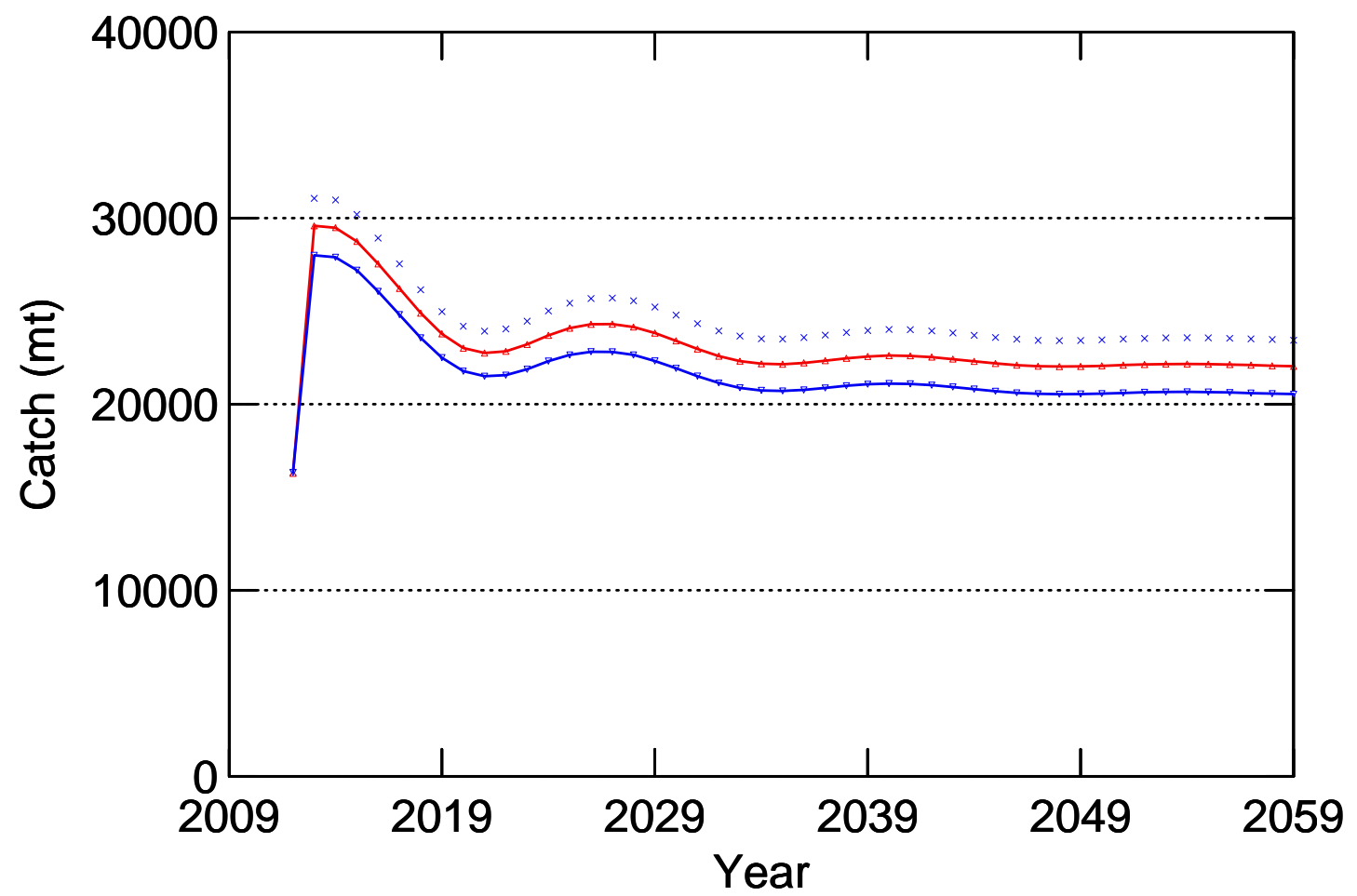
Scenario: $F=F_{msy}$ Proxy=0.2439



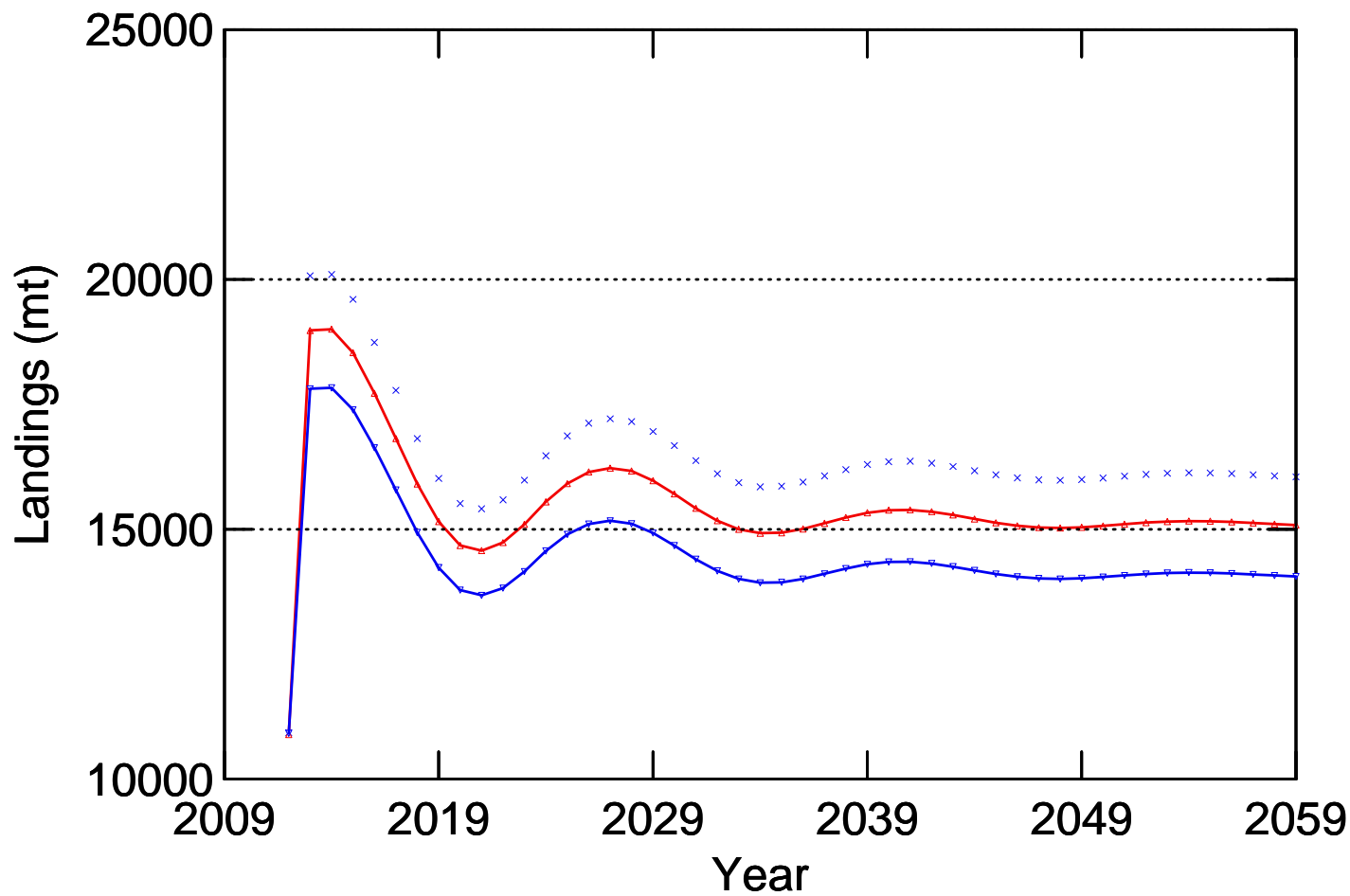
Stochastic SSB Projections at $F=F_{msy}$: 90% CI



Stochastic Catch Projections at $F=F_{msy}$: 50, 40, 30%iles



Stochastic Landings Projections at $F=F_{msy}$: 50, 40, 30%iles



	2013			
Percentile	<i>Catch</i>	<i>Landings</i>	<i>Discards</i>	<i>Female SSB</i>
1	19,824	11,779	8,045	122,336
2	20,520	12,292	8,228	128,953
3	21,100	12,720	8,380	134,465
4	21,605	13,093	8,512	139,272
5	22,058	13,428	8,631	143,582
10	23,804	14,715	9,088	160,178
15	25,104	15,675	9,429	172,546
20	26,184	16,472	9,712	182,811
25	27,138	17,175	9,962	191,879
30	27,999	17,811	10,188	200,069
35	28,806	18,406	10,399	207,740
40	29,582	18,979	10,603	215,123
45	30,326	19,528	10,798	222,196
50	31,063	20,072	10,991	229,201
55	31,802	20,617	11,185	236,234
60	32,555	21,173	11,382	243,389
65	33,323	21,739	11,583	250,690
70	34,139	22,341	11,797	258,447
75	34,998	22,976	12,022	266,620
80	35,942	23,672	12,270	275,598
85	37,025	24,471	12,554	285,890
90	38,333	25,436	12,897	298,330
95	40,079	26,725	13,354	314,934
96	40,529	27,057	13,472	319,213
97	41,034	27,429	13,604	324,008
98	41,612	27,856	13,756	329,507
99	42,310	28,371	13,939	336,146

Projected Catch,
Landings, Discards and
SSB in **2013** assuming
 $F=F_{msy}=0.2439$

	2014			
Percentil	<i>Catch</i>	<i>Landings</i>	<i>Discards</i>	<i>Female SSB</i>
1	19,689	11,775	7,914	113,413
2	20,388	12,291	8,097	119,526
3	20,970	12,720	8,249	124,619
4	21,477	13,095	8,382	129,060
5	21,932	13,430	8,502	133,042
10	23,684	14,723	8,961	148,375
15	24,990	15,687	9,303	159,803
20	26,074	16,487	9,587	169,287
25	27,031	17,193	9,838	177,664
30	27,896	17,831	10,065	185,231
35	28,705	18,429	10,277	192,318
40	29,485	19,004	10,481	199,138
45	30,232	19,555	10,677	205,673
50	30,971	20,100	10,871	212,145
55	31,714	20,648	11,065	218,642
60	32,469	21,206	11,263	225,251
65	33,240	21,774	11,465	231,997
70	34,059	22,379	11,680	239,162
75	34,922	23,015	11,906	246,713
80	35,869	23,715	12,155	255,009
85	36,956	24,517	12,440	264,516
90	38,269	25,486	12,784	276,008
95	40,022	26,779	13,243	291,348
96	40,474	27,112	13,362	295,300
97	40,980	27,486	13,494	299,730
98	41,561	27,914	13,647	304,812
99	42,262	28,432	13,830	310,944

Projected Catch,
Landings, Discards and
SSB in **2014** assuming
 $F=F_{msy}=0.2439$

Percentile	2015			
	<i>Catch</i>	<i>Landings</i>	<i>Discards</i>	<i>Female SSB</i>
1	19,198	11,494	7,704	102,345
2	19,879	11,996	7,882	107,843
3	20,446	12,415	8,032	112,424
4	20,941	12,779	8,162	116,417
5	21,384	13,106	8,278	119,997
10	23,092	14,365	8,727	133,785
15	24,365	15,304	9,061	144,063
20	25,421	16,082	9,339	152,591
25	26,354	16,770	9,584	160,123
30	27,197	17,392	9,805	166,929
35	27,986	17,974	10,013	173,302
40	28,746	18,534	10,212	179,433
45	29,474	19,070	10,404	185,311
50	30,195	19,602	10,593	191,131
55	30,918	20,135	10,783	196,973
60	31,654	20,678	10,977	202,915
65	32,406	21,232	11,174	208,982
70	33,204	21,820	11,384	215,423
75	34,045	22,440	11,605	222,214
80	34,969	23,122	11,847	229,674
85	36,028	23,902	12,126	238,224
90	37,308	24,846	12,462	248,556
95	39,016	26,105	12,911	262,350
96	39,457	26,430	13,027	265,904
97	39,950	26,794	13,156	269,888
98	40,516	27,211	13,305	274,458
99	41,199	27,715	13,484	279,971

Projected Catch,
Landings, Discards and
SSB in **2015** assuming
 $F=F_{msy}=0.2439$

Conclusions

- Not overfished
- Overfishing is not occurring
- Stock is above Bmsy
- Utilization rate of resource (landings/Catch) is improving
- Median OFL for 2013 = 31,063 mt
- 90% Confidence limit= { 22,058, 40,529}
- 40%ile of OFL for 2013 = 29,582 mt
- Much depends on selectivity pattern of fishery.

End

Stochastic Estimates of Swept Area Biomass, 2012

