O. Ocean Pout by **S. Wigley and L. Col**

1.0 Background

Ocean pout, *Macrozoarces americanus*, are assessed as a unit stock from Cape Cod Bay south to Delaware. An index assessment for this species was last reviewed at the 2002 Groundfish Assessment Review Meeting (NEFSC 2002a). At that time, the three year average spring biomass index (1999-2001 average = 2.46 kg/tow) was at the biomass threshold (½ Bmsy = 2.4 kg/tow) of the Bmsy proxy (1980-1991 median = 4.9 kg/tow). The relative exploitation ratio (0.007) indicated that fishing mortality was well below the F threshold (Fmsy proxy = 0.31). Ocean pout are included in the New England Fishery Management Council's Multispecies Fishery Management Plan and is one of twelve species listed in the "Large Mesh/Groundfish" group based on fish size and type of gear used to harvest the fish.

2.0 The Fishery

From 1964 to 1974, an industrial fishery developed for ocean pout, and nominal catches by the U.S. fleet averaged 4,700 mt (Table O.1, Figure O.1). Distant-water fleets began harvesting ocean pout in large quantities in 1966, and total nominal catches peaked at 27,000 mt in 1969. Foreign catches declined substantially afterward, and none have been reported since 1974. United States landings declined to an average of 600 mt annually during 1975 to 1983. Catches increased in 1984 and 1985 to 1,300 mt and 1,500 mt respectively, due to the development of a small directed fishery in Cape Cod Bay supplying the fresh fillet market. Landings have declined more or less continually since 1987. In recent years, landings from the southern New England/Mid-Atlantic area have continued to dominate the catch, reversing landing patterns observed in 1986-1987, when the Cape Cod Bay fishery was dominant. The shift in landings is attributed to the changes in management (gear/mesh) regulations. Total landings in 2004 were 5 mt, a record low in the time series (Table O.1, Figure O.1).

Dock-side sampling of commercial ocean pout landings began in 1984; landed ocean pout range between 40 and 90 cm, with most fish between 50 and 60 cm. In recent years, dock-side sampling has been sporadic.

3.0 Discard Estimation

The Vessel Trip Report (VTR, 1994-2004) and Northeast Fisheries Observer Program (NEFOP, 1989 – 2004) data were explored to estimate the magnitude of discarding in fisheries which may impact ocean pout.

Based on the VTR, landings and discards from the recreational fishery are minimal. The commercial VTRs indicate that discarding of ocean pout may have exceeded the reported landings 2004. [Note: the VTR program was implemented in May 1994 and ocean pout landings primarily occur in the late winter and early spring, therefore, the VTR values may not fully reflect all landings in 1994.]. Based on the VTRs, ocean pout discarding in the commercial fishery occurs primarily with otter trawl, longline, and lobster pot gears.

The primary reason reported in the NEFOP for ocean pout discards is "no market".   Limited NEFOP data were available for gear types other than otter trawl gear. Two ratio estimators, discards to days fished (d/df) and discards to days absent (d/da), were used to estimate ocean pout discards in the otter trawl fishery by large (>=5.5 inch) and small (<5.5 inch) mesh groups and half year using the NEFOP data. These ratios were expanded by the days fished and days absent in the Dealer weighout data for 1989 – 1994 and estimated from the VTR data for 1994 – 2004 assuming that the VTR represent a near census of the commercial trips. The discard amounts derived from the two ratio estimators were different in the first part of the time series (1989 – 1993) but were similar during 1994 – 2004 (Table O.2). This may be attributed to: 1) the year-around closures coupled with reductions in days at sea, and 2) the change in data collection. Days absent is assumed to be a more stable metric over time.   Using the d/da ratio, ocean pout discards range between 600 mt and 9,600 mt t during 1989 to 2004, roughly 3 to 109 times the landings (Table O.2, Figure O.2).   Ocean pout discard data prior to the observer program are too sparse to estimate discards; consequently, ocean pout discards prior to 1989 have not been estimated.

4.0   Research Survey Indices

Commercial landings and the NEFSC spring research vessel survey biomass index followed similar trends during 1968 to 1975 (encompassing peak levels of foreign fishing and the domestic industrial fishery); both declined from very high values in 1968-1969 to lows of 300 mt and 1.3 kg per tow, respectively, in 1975 (Table O.3 and Figure O.1). Between 1975 and 1985, survey indices increased to record high levels, peaking in 1981 and 1985. Since 1985, survey catch per tow indices have generally declined, and are presently below than the long-term survey average (3.3 kg per tow); the 2004 and 2005 spring survey indices are 0.55 and 0.53 kg per tow, respectively, are the lowest values in the time series.   Both NEFSC winter survey and the Massachusetts Division of Marine Fisheries inshore research vessel surveys confirm the declining trend observed in the NEFSC spring survey.

5.0   Exploitation Indices

Computing survey biomass indices of exploitable biomass for use in calculating exploitation ratio was explored. However, given no minimum fish size, no market demand, no mesh selection parameters, and limited commercial length frequency data, there was insufficient information to apply a selection ogive to the ocean pout survey length frequency data.

Exploitation ratios (landings/three year average survey biomass index) have declined sharply from a peak in 1973 to low levels in the early 1980s then increased slightly in the late-1980s, after which they declined to record low levels (Table O.4, Figure O.3). The 2004 exploitation index (0.003) was the lowest in the time series and well below the Fmsy proxy (0.31), derived as the MSY proxy (1,500 mt) divided by the Bmsy proxy.   Although discards have been estimated for a portion of the time series, discards were not included in the exploitation ratio, and, as such, the exploitation ratios may be underestimated. The biological reference points were based on landings, not catch, therefore it is not be appropriate to incorporate discards into the relative exploitation analyses and use the current MSY control rule.

6.0   Assessment Results

The index assessment presented above reveals that landings, survey indices and exploitation ratios remain at, or near, record low levels and the annual estimates of discards exceed annual landings. The record-low survey biomass index has caused the stock status for ocean pout to change from the last assessment.

For ocean pout, the replacement ratio and relative F analyses were not informative upon which to base Bmsy, Fmsy, and MSY (NEFSC 2002). Thus, biological reference points for ocean pout remain based upon research vessel survey biomass trends and the exploitation history (Applegate et al. 1998). MSY was chosen to be 1,500 mt and the B-msy proxy was determined as the median survey index from 1980-1991 (4.9 kg/tow).   Given these proxies, the threshold F-msy proxy is 0.31 (1.5/4.9). The minimum biomass threshold is ½ of the B-msy proxy (2.45 kg/tow). The MSY control rule states that a target F should be set to the F calculated to rebuild to Bmsy in 10 years when biomass is between ½ Bmsy and Bmsy. When stock size is less than the threshold biomass, the F will be established by the formal rebuilding program.

To evaluate stock conditions, the three year average of NEFSC spring survey indices and the exploitation ratio (2004 landings/ average of 2002, 2003, 2004 spring survey biomass indices) were used as proxies for biomass and fishing mortality, respectively. In 2004, the three year average survey index (1.78 kg/tow) indicates that biomass is below the minimum biomass threshold (2.45 kg/tow) and the exploitation ratio (0.003) indicates F is below the F threshold to allow for stock re-building. Thus, the ocean pout population appears to be overfished but overfishing did not occur in 2004.

An adaptive rebuilding trajectory is used in the formal rebuilding program for ocean pout in Amendment 13.   The realized stock size (kg/tow) is below the stock size projected in Amendment 13 (Figure O.4) even though the relative exploitation rate has been below the Fmsy proxy used the rebuilding program.

7.0 Panel Comments

The Panel noted that exploitation has been low yet stock size has not increased. Discards are now estimated to be an important component of catch and the currently estimated level of discards may be sufficient to hinder recovery of the stock. The Panel also noted that low water temperatures may contribute to the low survey biomass indices in 2004-2005.

The Panel also noted the lack of strong recruitment since 1989 which may also contribute to the lack of recovery of the stock.   It was suggested that the absence of a recovery may not be due solely to current fishing activity but rather a combination of past exploitation and low fecundity.

8.0 Research recommendations

- Explore methods to extend the catch series (landings and discards) back beyond 1989. Approaches could include applying the observed discard rate based on the 15 years of

existing data to the pre-1989 data as well as investigating fleet specific characteristics of vessels targeting ocean pout.

- Until studies on discard mortality are available, explore the impacts of various discard mortality rates through sensitivity analyses.

9.0   Sources of Uncertainty

- Due to the lack of commercial length samples (one sample of 37 fish since 2004), the size composition of the commercial landings could not be characterized.

- Biological reference points are based on landings; landings, not catch, are used to derive exploitation ratios. Exploitation ratios may be underestimated.

10.0   Acknowledgements

We would like to recognize and thank all those who diligently collected data from the commercial fisheries (port and at-sea) and the research vessel surveys. We thank all the members of the Groundfish Assessment Review Meeting for their review and helpful comments.

11.0   References

Applegate, A., S.X. Cadrin, J. Hoenig, C. Moore, S. Murawski, and E. Pikitch. 1998. Evaluation of existing overfishing definitions and recommendations for new overfishing definitions to comply with the Sustainable Fisheries Act. New England Fishery Management Council Report.

NEFSC [Northeast Fisheries Science Center]. 2002a. Assessment of 20 Northeast Groundfish Stocks through 2001. A Report of the Groundfish Assessment Review Meeting (GARM), Northeasst Fisheries Science Center, Woods Hole, Massachusetts, October 8-11, 2002. CRD 02-16 http://nefsc.noaa.gov/nefsc/publications/crd/crd0216/

NEFSC [Northeast Fisheries Science Center]. 2002b. Final Report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish.

Table O.1. Commercial landings (mt, live) of ocean pout from the Gulf of Maine to the Mid-Atlantic region (NAFO Subareas 5 and 6), 1962-2004.

	USA				
Year	5	6	Total	Other	Total
1962	0	0	0	0	0
1963	20	0	20	0	20
1964	2123	0	2123	0	2123
1965	877	0	877	0	877
1966	7149	0	7149	6231	13380
1967	7090	0	7090	271	7361
1968	8373	364	8737	4324	13061
1969	5571	966	6537	20435	26972
1970	5851	426	6277	895	7172
1971	2678	1448	4126	1784	5910
1972	1927	358	2285	1066	3351
1973	2810	285	3095	2275	5370
1974	2790	459	3249	483	3732
1975	209	65	274	3	277
1976	341	337	678	0	678
1977	809	250	1059	0	1059
1978	715	320	1035	0	1035
1979	658	14	672	0	672
1980	339	11	350	0	350
1981	234	17	251	0	251
1982	317	4	321	0	321
1983	408	0	408	0	408
1984	1324	0	1324	0	1324
1985	1450	54	1504	0	1504
1986	801	1	802	0	802
1987	2111	74	2185	0	2185
1988	1765	46	1811	0	1811
1989	1308	6	1314	0	1314
1990	1299	13	1312	0	1312
1991	1361	63	1424	0	1424
1992	406	68	474	0	474
1993	217	15	232	0	232
1994	137	59	196	0	196
1995	51	14	65	0	65
1996	34.7	16.3	51.0	0	51
1997	7.6	25.4	33.0	0	33
1998	8.6	8.4	17.0	0	17
1999	8.9	9.1	18.0	0	18
2000	8.4	10.6	19.0	0	19
2001	8.4	9.2	17.6	0	18
2002	3.5	8.6	12.1	0	12
2003	18.1	7.4	25.6	0	26
2004	3.0	2.4	5.4	0	5

1994-2004 spatial patterns are based upon Vessel Trip Report data.

Table O.2   Ocean pout discards (mt) in the VTR and observer data [using discards to days absent ratio (via DA) and using a discards to days fished ratio (via DF)] and landings (mt) from the VTR, Dealer Weighout (WO), and the estimated landings using a kept weight to days absent ratio from observer data, and the ratio (%) of discards (via DA) to Dealer WO landings.

| | | DISCARDS | | | LANDINGS | | |
| | | OBSERVER | | | | | |
YEAR	VTR	via DA	via DF	VTR	WO	Est. Kept	%
1989		7014.1	19438.5		1314.0	397.2	5.3
1990		8430.7	17852.3		1312.0	1072.5	6.4
1991		9589.2	20996.5		1424.0	2574.3	6.7
1992		1545.8	6027.2		474.0	334.6	3.3
1993		1550.4	4648.3		232.0	192.0	6.7
1994	21.7	1918.0	3016.8	16.8	196.0	12.2	9.8
1995	16.7	872.0	1261.3	61.5	65.0		13.4
1996	3.6	828.7	1271.3	48.5	51.0		16.2
1997	1.9	989.5	1288.1	20.8	33.0	48.0	30.0
1998	1.9	1000.3	1160.4	13.2	17.0		58.8
1999	3.9	5545.6	4036.0	13.6	18.0		308.1
2000	1.0	1031.1	1132.7	11.8	19.0		54.3
2001	2.2	1227.0	992.9	13.8	17.6	13.9	69.8
2002	4.1	1291.1	433.4	7	12.1	0.8	106.4
2003	2.3	810.5	331.6	18.3	25.6	5.3	31.7
2004	1.3	589.6	353.5	3.3	5.4	0.4	109.4
*1999		1023.2			18.0		56.8

Note: *1999 represents the imputed discard estimate using average of surrounding values.

Table O.3. Stratified mean catch per tow in weight and numbers, mean length and individual average fish weight of ocean pout in NEFSC spring surveys, in the Gulf of Maine-Mid-Atlantic region (strata 1-26, 73-76), 1968-2005.

Year	Mean weight (kg) per tow	Mean number per tow	Mean Length (cm)	Individual average weight (kg)
1968	5.366	6.766	51.1	0.793
1969	6.154	8.629	49.3	0.713
1970	5.180	6.133	51.9	0.845
1971	2.183	3.135	50.2	0.696
1972	4.453	5.090	51.6	0.875
1973	3.373	4.591	48.8	0.735
1974	1.479	2.310	47.0	0.640
1975	1.293	1.358	53.4	0.952
1976	1.400	2.440	46.5	0.574
1977	3.605	6.366	44.8	0.566
1978	3.371	11.831	31.6	0.285
1979	1.493	5.197	34.7	0.287
1980	5.729	11.837	42.6	0.484
1981	7.605	14.131	42.7	0.538
1982	4.743	8.690	44.0	0.546
1983	4.236	5.076	50.5	0.835
1984	5.540	7.275	50.0	0.762
1985	6.494	9.011	48.7	0.721
1986	6.345	6.995	53.0	0.907
1987	2.705	3.076	51.7	0.879
1988	3.244	5.405	45.0	0.600
1989	2.792	5.323	44.0	0.525
1990	5.074	6.369	50.3	0.797
1991	3.783	5.596	49.7	0.676
1992	2.257	2.639	52.9	0.855
1993	3.084	3.546	53.4	0.870
1994	2.309	2.639	54.3	0.875
1995	1.916	2.525	50.5	0.759
1996	2.058	3.127	47.6	0.658
1997	1.632	2.069	52.4	0.789
1998	1.733	2.957	46.1	0.586
1999	2.561	3.340	50.2	0.767
2000	2.016	3.113	48.2	0.648
2001	2.801	3.748	51.6	0.747
2002	2.026	2.809	51.3	0.721
2003	2.757	2.919	55.4	0.945
2004	0.547	0.673	50.8	0.812
2005	0.526	0.854	45.9	0.616

Table O.4. NEFSC Spring survey index (kg per tow), total landings ('000 mt), annual relative exploitation rate, 3 yr moving average of Spring survey biomass index, relative exploitation rate (landings / 3 yr average of spring survey biomass index) for ocean pout, 1970-2005.

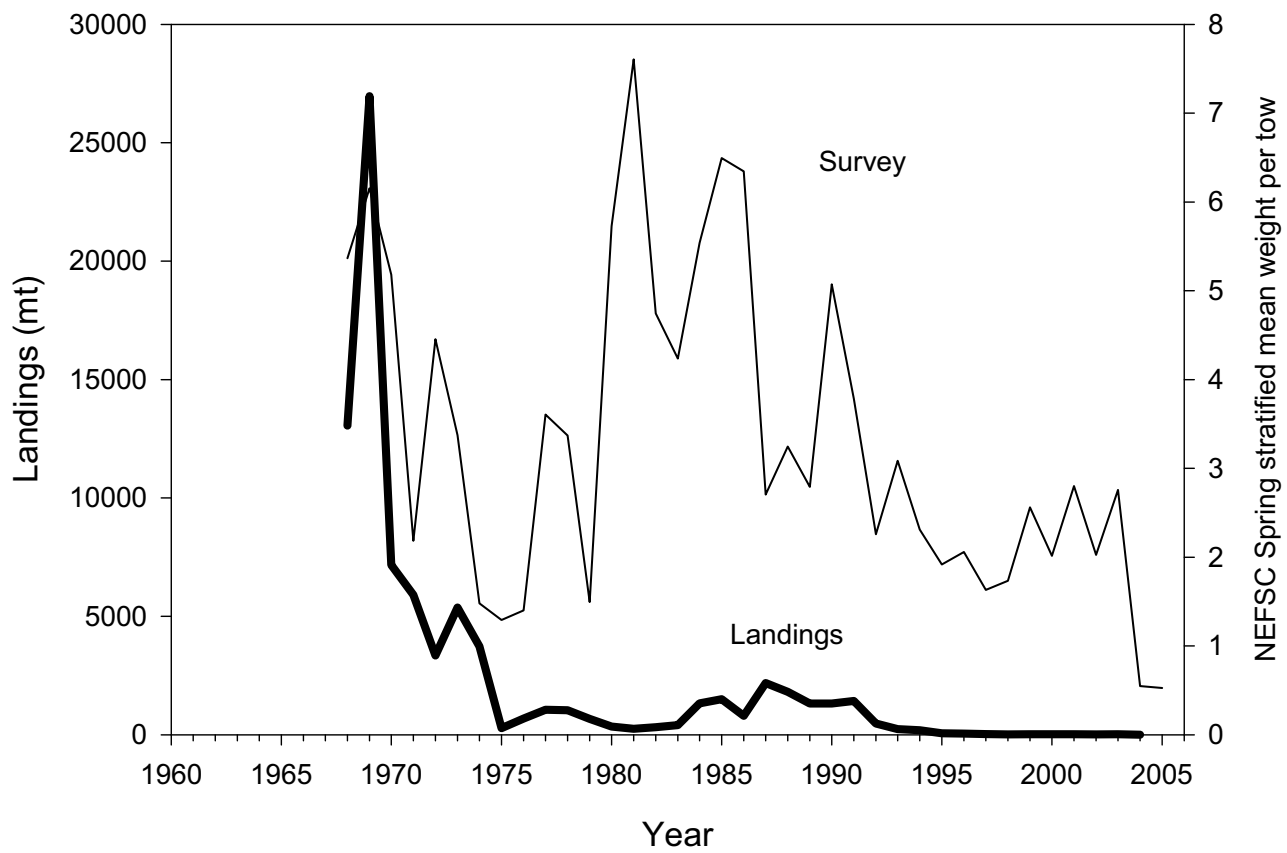|					**Control Rule**
Year	NEFSC Spring Index kg/tow	Total Landings ('000)	Annual relative expliotation rate (land./spr index)	3 year moving average (kg/tow)	Relative Exploitation Rate (land./ 3yr avg spr index)
1968	5.366	13.0610	2.434		
1969	6.154	26.9720	4.383		
1970	5.180	7.1720	1.385	5.5667	1.288
1971	2.183	4.9100	2.249	4.5057	1.090
1972	4.453	3.3510	0.753	3.9387	0.851
1973	3.373	5.3700	1.592	3.3363	1.610
1974	1.479	3.7320	2.523	3.1017	1.203
1975	1.293	0.2770	0.214	2.0483	0.135
1976	1.400	0.6780	0.484	1.3907	0.488
1977	3.605	1.0590	0.294	2.0993	0.504
1978	3.371	1.0350	0.307	2.7920	0.371
1979	1.493	0.6720	0.450	2.8230	0.238
1980	5.729	0.3500	0.061	3.5310	0.099
1981	7.605	0.2510	0.033	4.9423	0.051
1982	4.743	0.3210	0.068	6.0257	0.053
1983	4.236	0.4080	0.096	5.5280	0.074
1984	5.540	1.3240	0.239	4.8397	0.274
1985	6.494	1.5040	0.232	5.4233	0.277
1986	6.345	0.8020	0.126	6.1263	0.131
1987	2.705	2.1850	0.808	5.1813	0.422
1988	3.244	1.8110	0.558	4.0980	0.442
1989	2.792	1.3060	0.468	2.9137	0.448
1990	5.074	1.3120	0.259	3.7033	0.354
1991	3.783	1.4240	0.376	3.8830	0.367
1992	2.257	0.4743	0.210	3.7047	0.128
1993	3.084	0.2321	0.075	3.0413	0.076
1994	2.309	0.1964	0.085	2.5500	0.077
1995	1.916	0.0654	0.034	2.4363	0.027
1996	2.058	0.0512	0.025	2.0943	0.024
1997	1.632	0.0336	0.021	1.8687	0.018
1998	1.733	0.0175	0.010	1.8077	0.010
1999	2.561	0.0170	0.007	1.9753	0.009
2000	2.016	0.0187	0.009	2.1033	0.009
2001	2.801	0.0175	0.006	2.4593	0.007
2002	2.026	0.0121	0.006	2.2810	0.005
2003	2.757	0.0256	0.009	2.5280	0.010
2004	0.547	0.0054	0.010	1.7767	0.003
2005	0.526			1.2766	
	1968 - 2004	1980-1991			
mean	3.387	1.0832			
median	2.801	4.9090			

Figure O.1. Trends in landings (mt) and NEFSC spring survey biomass (kg/tow) for ocean pout.
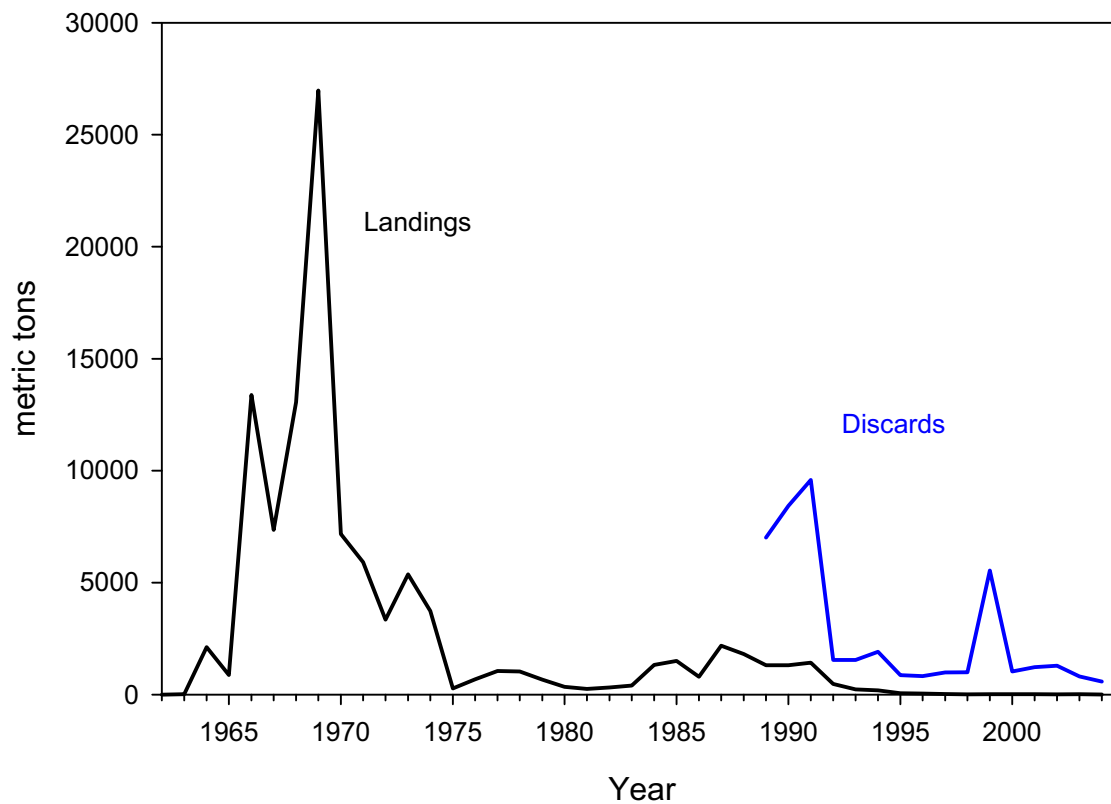
Figure O.2.   Trends in landings (mt) and otter trawl discards for ocean pout [Note: 1999 value influenced by small sample size on first half –year of small mesh otter trawl fishery; the 1999 imputed discards equals 1023.2 mt].
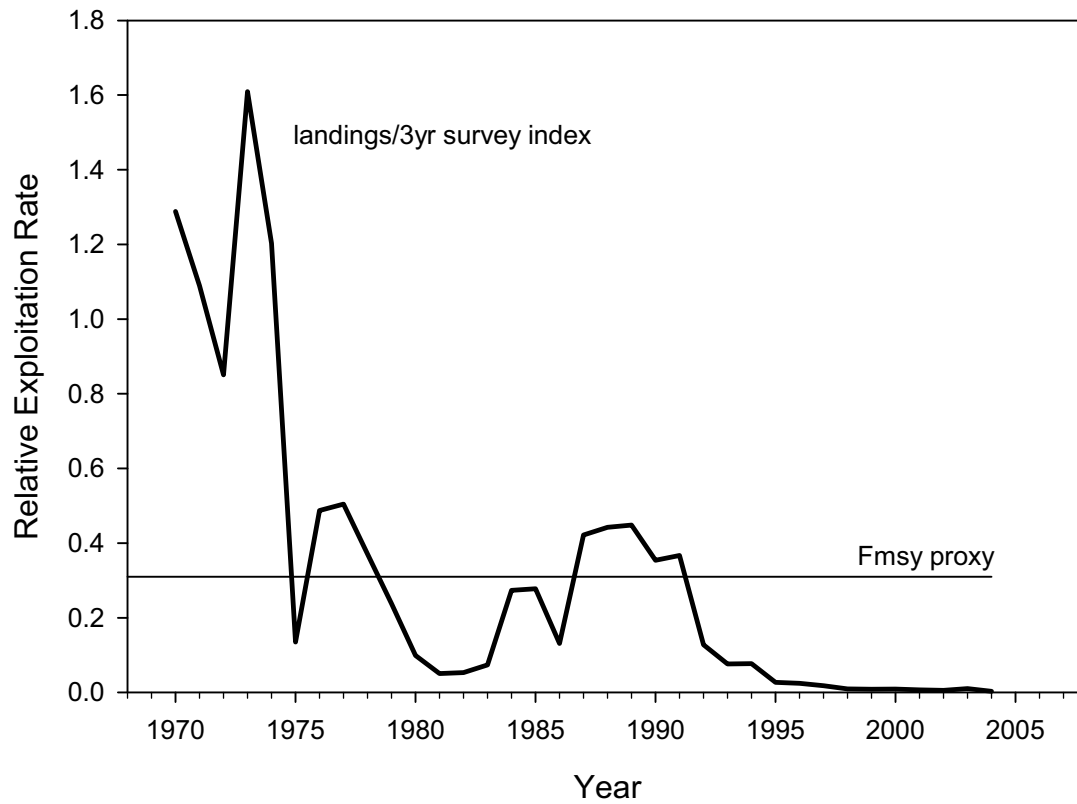
Figure O.3. Relative exploitation indices (landings/three year average of spring biomass index) for ocean pout, 1970 - 2004.
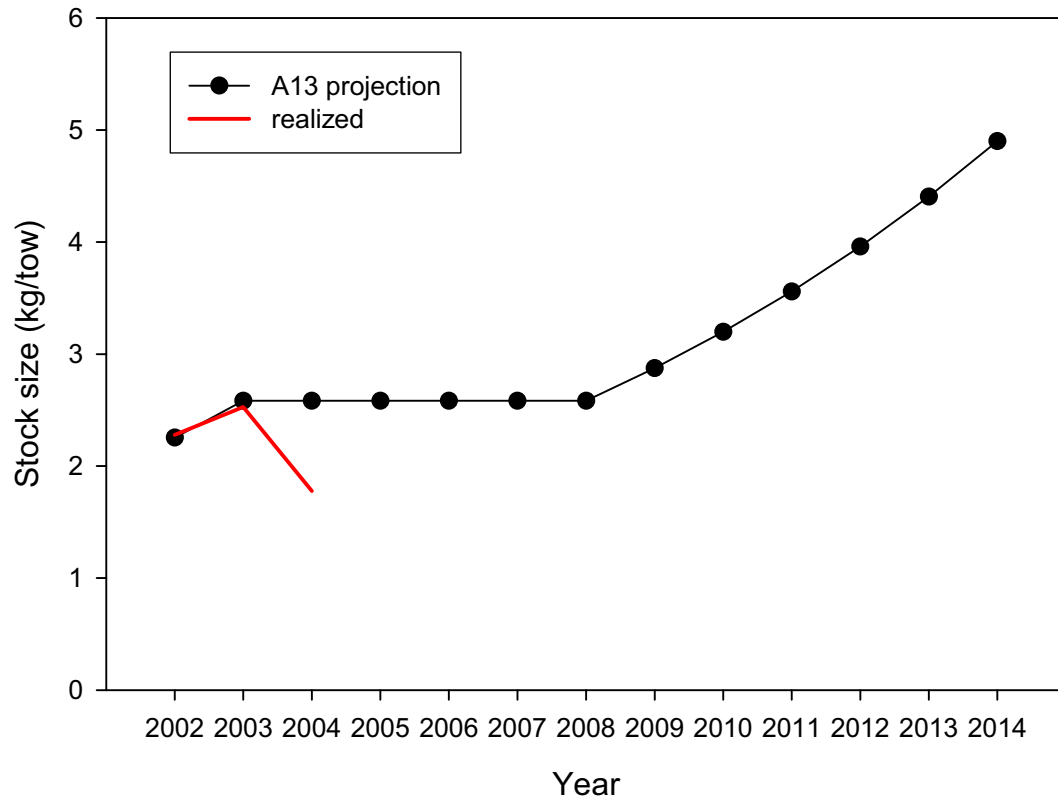
Figure O.4. Amendment 13 projected and realized size stock (kg/tow) for ocean pout in 2002, 2003 and 2004.