

## K. Ocean Pout by S.E. Wigley

### 1.0. Background

Ocean pout, *Zoarces americanus*, are assessed as a unit stock from Cape Cod Bay south to Delaware (Figure K1). An index assessment for this species was last reviewed at the 2008 Groundfish Assessment Review Meeting (Wigley et al. 2008). At that time, the three year average spring biomass index (2006-2008 average = 0.48 kg/tow) was below the biomass threshold ( $\frac{1}{2}$  Bmsy = 2.4 kg/tow) of the Bmsy proxy (1977-1985 median = 4.9 kg/tow). The relative exploitation ratio (0.38) indicated that fishing mortality was well below the F threshold (Fmsy proxy = 0.76). 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. 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 K1, Figure K2). 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. The majority of landings are taken using otter trawl gear, except in 2010 (Table K2). On May 1, 2010, the Multispecies FMP prohibited ocean pout landings. Total landings in 2010 were less than 1 mt, a record low in the time series (Table K1, Figure K2).

Dock-side sampling of commercial ocean pout landings began in 1984 (Appendix Table K1); 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 or non-existent.

#### *Discard Estimation*

The primary reason reported in the Northeast Fisheries Observer Program<sup>3</sup> (NEFOP) for ocean pout discards is "no market". For the 1989 to 2010 time period, limited NEFOP data are available for gear types other than otter trawl, gillnet and scallop dredge gear. A combined ratio estimator, discard weight of ocean pout to kept weight of all species, was used to estimate ocean pout discards in the otter trawl fishery by large ( $\geq 5.5$  inch) and small ( $< 5.5$  inch) mesh groups, gillnet, and scallop dredge using the NEFOP data from the

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<sup>3</sup> Northeast Fisheries Observer Program was implemented in 1989.

Cape Cod Bay, Georges Bank, Southern New England and Mid-Atlantic regions<sup>4</sup> for 1989 to 2010<sup>5</sup>. Total discards were derived by expanding the discard ratios by the kept weight of all species, by gear type and mesh group, using the Dealer weighout data for 1989 – 2010 (Appendix Tables K2 and K3).

Prior to 1989, ocean pout discards were estimated using the survey-scale method (as described in Palmer et al. 2008) utilizing an average combined ratio based on 2004 to 2006 NEFOP data, the NEFSC spring survey weight per tow indices, and the kept weight of all species. Ocean pout discards (mt) were derived for four fleets (large-mesh otter trawl, small-mesh otter trawl, gillnet and scallop dredge) from 1968 – 1988 (Appendix Table K4). Total discards range between 120 mt in 2008 to 9,434 mt in 1990; discards in 2010 was the second lowest in the time series (Table K3 and Figure K2). The majority of ocean pout discards occur in the large-mesh and small-mesh otter trawl fisheries. Discards from the otter trawl fleets exceed landings in most years (Table K1).

### 3.0 Research Surveys

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 K4 and Figure K2). 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 the 2010 index (0.299 kg/tow) is the lowest value in the time series (Figure K3). The NEFSC survey strata areas are given in Appendix Table K5. 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 (Appendix Tables K6 and K7, Appendix Figures K1 and K2). Decreases in maximum size can be observed in the NEFSC spring survey length frequencies over time (Appendix Figure K3).

#### *Survey conversion factors: 1968 – 2008*

There are no significant net or door conversion factors for ocean pout, however, there are significant vessel conversion factors between *R/V Albatross IV* and *R/V Delaware II* for ocean pout (Byrne and Forrester 1991). Vessel conversion factors for numbers and weight are 0.70 and 0.69 (p-value 0.004), respectively. The vessel conversion factors were based upon 510 paired tows from five experiments conducted in the Mid-Atlantic, Southern New England, Georges Bank, and Gulf of Maine regions during the autumn, with the exception of 40 paired tows that were conducted during February. These experiments are spatially appropriate for this species; however, the temporal aspect is problematic. The availability of ocean pout to the otter trawl gear is very different between spring and autumn due to the life history behavior of ocean pout to nest-guard their egg masses in rocky areas during the autumn. In the autumn, ocean pout are not as available to the otter trawl gear as in the

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<sup>4</sup> Statistical areas (514, 521,522,561,562,525,562,537-539,611-616).

<sup>5</sup> In 2010, NEFOP At-Sea Monitoring (ASM) data were pooled with NEFOP observer (OB) data for the large-mesh otter trawl discard estimation. A comparison of the discard rates using ASM and OB indicated no statistical differences for ocean pout in otter trawl gear by quarter (Wigley et al. 2011).

spring. Given this, the NESFC spring survey is used to monitor trends for this species. Since the majority of paired tows during these experiments took place in the autumn when breeding behavior is occurring and relatively low numbers of ocean pout are caught, it is questionable whether it is appropriate to apply the vessel conversion factors to the NEFSC spring survey. As in past assessments, the vessel conversion factors have not been applied to the 1968 - 2008 survey indices (see Wigley et al. 2008 for sensitivity analyses with and without vessel conversion factors).

#### *Survey conversion factors: 2009 – 2011*

There are significant vessel conversion factors between the *FS/V Bigelow* and the *R/V Albatross IV* for ocean pout (Miller et al. 2010). Vessel conversion factors for numbers and weight are 3.9115 and 4.5752, respectively. These vessel conversion factors have been applied to the 2009 - 2011 NEFSC spring bottom trawl surveys. Length-based conversion factors have not been established for ocean pout.

## **4.0 Assessment**

In previous assessments, the data for ocean pout had insufficient dynamic range over the time series to provide estimates for biological reference points; the AIM and LOSS (an age structured biomass dynamic model; Palmer and Legault 2008) analyses were non-informative (NEFSC 2002; Wigley and Col 2005, Wigley et al. 2008). These analyses were not updated.

#### *Relative Exploitation Rate*

Computing survey biomass indices of exploitable biomass for use in calculating exploitation ratio were updated. 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. In this assessment update, revised 2007 catch was used and 2008 - 2010 catch were added. Revised 2008 survey data were used and 2009 - 2011 survey data were added.

Exploitation ratios were derived using catch (landings and discards) divided by the three year average of NEFSC spring survey biomass indices (without vessel conversion factors applied during the 1968 to 2008 period and with vessel conversion factors applied during the 2009 through 2011 period). Exploitation ratios 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 K5, Figure K4). The 2010 exploitation index is 0.31.

#### *Sensitivity Analyses*

Since GARM 2008, the 2007 catch and the 2008 survey biomass index have been revised (Tables K1, K4 and Appendix Table K8). There was no change in 2007 landings, however there was a 10 mt decrease in discards that resulted in a -5.6% change in total catch in 2007. The change in 2007 discards was a result of changes in NEFOP data as well as changes to commercial landings of all kept species. The NEFSC spring 2008 index

changed slightly (-0.002 kg/tow) from the preliminary value of 0.424 kg/tow used in GARM 2008. These changes had a negligible effect on the 2007 exploitation ratio in (0.375 in GARM 2008 and 0.355, Appendix Table K7) and would not have resulted in a change in stock status for ocean pout in 2007.

## 5.0 Biological Reference Points

Biological reference point proxies were first established for ocean pout by the Overfishing Definition Panel (Applegate et al. 1998). The Overfishing Definition Panel visually inspected the landings and survey trends and chose values for MSY and Bmsy that appeared to be sustainable. The Bmsy proxy (4.9 kg/tow) was based on the 1980-1991 median NEFSC spring survey biomass index. The MSY=1,500 mt was chosen because stock biomass appears to decline when landings exceeded this level (Applegate et al. 1998). MSY was based on landings, not catch. Fmsy proxy (0.31) was derived from MSY and Bmsy proxy.

Discards were estimated in the GARM 2008 assessment, thus biological reference point proxies were updated using catch. The median NEFSC 3yr average spring biomass index (4.94 kg/tow) and the median exploitation ratio (0.76) during 1977-1985 are used as Bmsy and Fmsy proxies, respectively. The 1977-1985 time period corresponds to the time when the replacement ratio was above 1 and biomass increased (Appendix Figure K4). Based on these proxies, MSY is estimated to be 3,754 mt ( $4.94 * 0.76 * 1000$ ). Given below are biological reference point proxies used in GARM 2005 and the re-estimated proxies for GARM 2008 that were accepted by the GARM 2008 Biological Reference Point Meeting Panel. For the 2012 Update, the biological reference points do not change.

GARM 2005 using landings	GARM 2008 using catch	Update 2012
Bmsy = 4.9 kg/tow Fmsy = 0.31 MSY = 1,500 mt	Bmsy = 4.94 kg/tow Fmsy = 0.76 MSY = 3,754 mt	Same as GARM 2008

Trends in average survey biomass indices and relative exploitation rates are given in Figure K5. Since the mid-1990s, the 3yr average survey biomass index has been at or below the  $\frac{1}{2}$  Bmsy proxy and the relative exploitation rate has been below the Fmsy proxy (Table K5 and Figure K5).

The NEFSC spring survey biomass indices have been expanded to total population biomass using the survey strata area and the swept-area of the survey net. In recent years, estimates of total population biomass are below the estimate of MSY (Figure K6).

## 6.0 Projections

No projections have been conducted for ocean pout.

## 7.0 Summary

The updated analysis presented above was used to determine stock status in 2010. The three year average of NEFSC spring survey indices and the exploitation ratio (2010 catch / average of 2009, 2010, 2011 spring survey biomass indices) are used as proxies for biomass and fishing mortality, respectively. In 2010, the three year average survey index (0.41 kg/tow) was 8% of the Bmsy proxy (1977-1985 median = 4.94 kg/tow; Figure K7). The relative exploitation ratio (0.31) indicates that fishing mortality was 41% of the F threshold (Fmsy proxy = 0.76; Figure K7). In 2010, ocean pout was overfished, but overfishing was not occurring.

This index assessment reveals that catch, survey indices and exploitation ratios remain at, or near, record low levels and the annual estimates of discards exceed the landings. Although exploitation has been low, stock size has not increased suggesting that this stock may be in a depensatory state. Discards are estimated to be an important component of catch and may be sufficiently high to hinder recovery of the stock.

For ocean pout, the replacement ratio and relative F analyses, as well as age-structured biomass dynamics model analyses, were not informative upon which to base Bmsy, Fmsy, and MSY. Thus, biological reference points for ocean pout remain based upon research vessel survey biomass trends and the exploitation history based on total catch.

### *Changes from Last Assessment*

Catch (landings and discards) have been updated from 2007 onward. Survey indices have been updated for 2008 onward.

### *Sources of Uncertainty*

- Due to the lack of commercial length samples (13 samples since 1997), the size composition of the commercial landings could not be characterized.
- Biological reference points are based on catch; the estimated discards used in catch are based on a mix of direct and indirect methods. The catch used to determine MSY is based on indirect methods.

## 8.0 Conclusions

### *Status of Stock for Ocean Pout*

SSB in 2010 is estimated to be 0.41 kg/tow.

Relative F in 2010 is estimated to be 0.31 kt/kg/tow.

No change in biological reference points.

The estimates of the biological reference points are:

SSB<sub>msy</sub> proxy= 4.94 kg/tow,

F<sub>msy</sub> proxy = 0.76 kt/kg/tow, and

MSY proxy= 3,754 mt.

Based on these results, ocean pout is overfished and overfishing is not occurring. The stock is below the biomass target, the same stock status as GARM-III.

The results are based on the same model used in GARM-III (NEFSC 2008, CRD#08-15), which includes catch (landings and discards), survey indices and relative exploitation ratios.

The BRPs remain the same as GARM-III.

Ocean Pout. Summary of Assessment Information

Ocean Pout	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Average	Min	Max	Year Range
<b>Landings (mt)</b>	18	12	26	5	4	5	4	7	3	<1	2282	3	26972	1963-2010
<b>Discards (mt)</b>	532	576	427	291	201	183	165	120	164	127	1891	120	9434	1968-2010
<b>Catch (mt)</b>	549	588	452	296	205	188	169	127	168	127	3928	20	30101	1963-2010
<b>Centered 3 yr ave SSB (kg/tow)</b>	2.280	2.527	1.776	1.277	0.533	0.510	0.475	0.485	0.450	0.409	2.918	0.409	6.126	1969-2010
<b>F catch/3 year avg index</b>	0.241	0.233	0.255	0.232	0.384	0.368	0.355	0.261	0.373*	0.311*	1.061	0.149	5.394	1968-2010

\*Vessel conversion factors have been applied.

### *Panel Comments*

The work that is presented is accepted by the Review Panel for determining stock status and providing catch advice.

The Review Panel recognized that an AIM analysis was attempted at previous assessments, including the 2008 GARM, but there was not a significant relationship between the exploitation rate and stock productivity. The same lack of relationship continues during the updated fishery catch and survey observations, which both remained extremely low. The lack of correspondence between exploitation history and productivity would present a problem for any conventional stock assessment modeling approach. Therefore, the Review Panel concluded that status determination and catch advice should continue to be based on relative exploitation ratios with no change in the biological reference points.

The index-based assessment approach does not support catch projections, so catch advice should continue to be based on the target exploitation rate and the most recent, centered 3-year average biomass index from the NEFSC spring survey.

There was extensive discussion on the continued low productivity, despite low fishery catch, and the slow population growth rate. Previous productivity may have been supported by a few large year classes (e.g., in the late 1970s), but there has been weak recruitment in the last decade. The cause of the abrupt decrease in survey biomass and abundance at all sizes in 2004 remains unknown. The decrease in biomass in the last decade is supported by other surveys (e.g., the NEFSC winter survey and the Mass DMF surveys). Declines in ocean pout on the Scotian Shelf (not included in this stock assessment) are similar to those in U.S. waters, but the abrupt decrease occurred earlier (Clark et al. 2010). Other factors, such as environmental change, loss of habitat or increased natural mortality may be negatively influencing production. The life history and recent low productivity of ocean pout are relevant for catch advice. Prospects for rebuilding in the near term are poor.

## **9.0 Acknowledgements**

I 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. I thank all the members of the Groundfish Assessment Review Meeting for their review and helpful comments.

## 10.0 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.
- Byrne, C.J. and J.R.S. Forrester. 1991. *In*: NEFSC. 1991. Report of the Twelfth Northeast Regional Stock Assessment Workshop (12<sup>th</sup> SAW). Northeast Fisheries Science Center Reference Document 91-03, Northeast Fisheries Science Center, Woods Hole, Massachusetts.
- Clark, D., J. Emberley, C. Clark and B. Peppard. 2010. Update of the 2009 Summer Scotian Shelf and Bay of Fundy Research Vessel Survey. Canadian Science Advisory Secretariat Research Document 2010/008.
- Miller TJ, Das C, Politis PJ, Miller AS, Lucey SM, Legault CM, Brown RW, Rago PJ. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. Northeast Fish Sci Cent Ref Doc. 10-05; 233 p. Available from: National Marine Fisheries Service, 166 Water Street, Woods Hole, MA 02543-1026, or online at: <http://www.nefsc.noaa.gov/publications/crd/crd1005/>
- NEFSC [Northeast Fisheries Science Center]. 2002. Final Report of the Working Group on Re-Evaluation of Biological Reference Points for New England Groundfish.
- NEFSC [Northeast Fisheries Science Center]. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p + xvii.
- Palmer, M., L. O'Brien, R. Mayo, P. Rago and L. Hendrickson. 2008. A brief description of discard estimation where observer coverage is unavailable. Working Paper 4.5, Biological Reference Point Meeting - Groundfish Assessment Review Meeting April 28-May 2, 2008. Woods Hole, MA.
- Palmer M. and C. Legault. 2008. Sensitivity of the Long-term Observation-error Survey Series (LOSS) model to variable stock-recruit steepness and stock depletion inputs: A test case using Gulf of Maine haddock. Working Paper 4.3, Biological Reference Point Meeting - Groundfish Assessment Review Meeting April 28-May 2, 2008. Woods Hole, MA.
- Wigley, S. and L. Col. 2005. *In*: Mayo, R.K and Terceiro, M. editors, 2005. Assessment of 19 Northeast groundfish stocks through 2004. 2005 Groundfish Assessment Review Meeting (2005 GARM), Northeast Fisheries Science Center, Woods Hole MA, 15-19 August 2005. *U.S. Dep. Commer., Northeast Fish. Sci. Cent. Ref. Doc.* 05-13, 499 p. Available at: <http://www.nefsc.noaa.gov/publications/crd/crd0513/index.htm>

Wigley, S., L. Col and C.M. Legault. 2008. In. Northeast Fisheries Science Center. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007: Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. US Dep Commer, NOAA Fisheries, Northeast Fish Sci Cent Ref Doc. 08-15; 884 p + xvii.

Wigley, S.E., M. Palmer, C. Legault. 2011. A Comparison of Discard Rates Derived from At-Sea Monitoring and Observer Trips. SARC 52 Southern Demersal Working Group (SDWG) Working Paper 11 – April 2011. 39 p.

Table K1. Commercial landings and discards (mt, live) of ocean pout from the Gulf of Maine to the Mid-Atlantic region (NAFO Subareas 5 and 6), 1962-2010.

Year	USA Landings			Other Landings	Total Landings	Discards	Total Catch
	5	6	Total				
1962	0	0	0	0	0		0
1963	20	0	20	0	20		20
1964	2123	0	2123	0	2123		2123
1965	877	0	877	0	877		877
1966	7149	0	7149	6231	13380		13380
1967	7090	0	7090	271	7361		7361
1968	8373	364	8737	4324	13061	3476.9	16538
1969	5571	966	6537	20435	26972	3129.5	30101
1970	5851	426	6277	895	7172	2765.8	9938
1971	2678	1448	4126	1784	5910	2021.5	7932
1972	1927	358	2285	1066	3351	1498.2	4849
1973	2810	285	3095	2275	5370	1294.2	6664
1974	2790	459	3249	483	3732	1133.9	4866
1975	209	65	274	3	277	716.6	994
1976	341	337	678	0	678	522.2	1200
1977	809	250	1059	0	1059	928.1	1987
1978	715	320	1035	0	1035	1377.6	2413
1979	658	14	672	0	672	1509.3	2181
1980	339	11	350	0	350	2015.9	2366
1981	234	17	251	0	251	2743.2	2994
1982	317	4	321	0	321	4439.5	4761
1983	408	0	408	0	408	4488.7	4897
1984	1324	0	1324	0	1324	3692.2	5016
1985	1450	54	1504	0	1504	3161.0	4665
1986	801	1	802	0	802	3296.4	4098
1987	2111	74	2185	0	2185	2623.6	4809
1988	1765	46	1811	0	1811	2243.6	4055
1989	1308	6	1314	0	1314	7414.9	8729
1990	1299	13	1312	0	1312	9434.0	10746
1991	1361	63	1424	0	1424	4925.6	6350
1992	406	68	474	0	474	1520.0	1994
1993	217	15	232	0	232	1345.9	1578
1994	137	59	196	0	196	1280.9	1477
1995	51	14	65	0	65	573.5	639
1996	34.7	16.3	51.0	0	51	628.6	680
1997	7.6	25.4	33.0	0	33	521.5	555
1998	8.6	8.4	17.0	0	17	672.9	690
1999	8.9	9.1	18.0	0	18	786.1	804
2000	8.4	10.6	19.0	0	19	347.8	367
2001	8.4	9.2	17.6	0	18	531.6	549
2002	3.5	8.6	12.1	0	12	575.7	588
2003	18.1	7.4	25.6	0	26	426.8	452
2004	3.0	2.4	5.4	0	5	290.7	296
2005	0.6	3.0	3.6	0	4	200.8	205
2006	0.2	4.9	5.1	0	5	182.5	188
2007	1.4	2.1	3.5	0	4	165.3	169
2008	1.7	5.6	7.2	0	7	119.5	127
2009	0.5	2.7	3.2	0	3	164.4	168
2010	0.0	0.3	0.3	0	<1	126.8	127

Table K2. Percentage of annual commercial landings of ocean pout by gear type, 1964 -2010.

YEAR	Longline & Handline	Otter Trawl	Fish Pot	Lobster Pot	Unknown	Other	Total
1964		100					100.0
1965		100					100.0
1966		100					100.0
1967		100					100.0
1968		100					100.0
1969		100					100.0
1970		100					100.0
1972		100					100.0
1973		100					100.0
1975	4.0	96.0					100.0
1976	0.1	99.9					100.0
1977	0.0	100.0					100.0
1978		100.0				0.0	100.0
1979		99.9				0.1	100.0
1980		100.0					100.0
1981		100.0					100.0
1982		100.0				0.0	100.0
1983		100.0					100.0
1984		100.0					100.0
1985		100.0					100.0
1986		100.0					100.0
1987	0.6	99.2				0.2	100.0
1988	0.2	99.6	0.0			0.2	100.0
1989	0.2	99.5	0.0	0.1		0.2	100.0
1990	0.3	99.5	0.0	0.0		0.2	100.0
1991	1.2	97.5	1.2	0.0		0.1	100.0
1992	6.6	90.1	2.5	0.0		0.8	100.0
1993	5.3	91.3	2.2	0.3		0.9	100.0
1994	4.7	91.2	3.2	0.2	0.0	0.7	100.0
1995	9.7	77.9	3.5	1.0	6.5	1.4	100.0
1996	5.4	89.3	2.4	1.6	0.0	1.3	100.0
1997	3.8	85.7	1.6	6.1	0.0	2.8	100.0
1998	9.0	77.9	4.9	3.9	0.3	4.0	100.0
1999	12.7	74.4	7.3	2.7		2.9	100.0
2000	11.7	65.2	4.7	9.1		9.3	100.0
2001	15.5	71.5	5.9	5.0	2.0	0.1	100.0
2002	1.1	73.8	12.6	5.7	6.3	0.5	100.0
2003	4.9	80.3	6.9	0.9	0.2	6.8	100.0
2004	18.2	62.4	5.0	10.8	3.0	0.6	100.0
2005	31.8	32.8	9.2	25.8	0.4		100.0
2006	25.6	35.5	21.4	4.9	11.3	1.3	100.0
2007	12.9	47.4	14.9	16.9	2.0	5.9	100.0
2008	14.0	37.6	34.5	10.8	3.1		100.0
2009	10.2	47.1	11.5	14.7	16.3	0.2	100.0
2010	11.4	0.6	48.4	38.6	0.3	0.7	100.0

Table K3. Ocean pout discards (mt) and coefficient of variation from the large-mesh ( $\geq$  5.5 inches) otter trawl, small-mesh ( $<$ 5.5 inches) otter trawl, gillnet, and scallop dredge fleets, 1968 – 2010. A combined ratio estimator of ocean pout discard to kept of all species based on NEFOP data is used to estimate discards from 1989 to 2010. The survey scale method is used to estimate discards prior to 1989.

YEAR	Large-mesh Otter Trawl		Small-mesh Otter Trawl		Gillnet		Scallop Dredge		Total	
	mt	CV	mt	CV	mt	CV	mt	CV	mt	CV
1968			3470.4		1.0		5.5		3476.9	
1969			3125.1		0.9		3.5		3129.5	
1970			2761.6		0.9		3.2		2765.8	
1971			2018.4		0.6		2.5		2021.5	
1972			1495.9		0.8		1.4		1498.2	
1973			1292.2		0.6		1.4		1294.2	
1974			1131.6		0.7		1.6		1133.9	
1975			714.8		0.3		1.5		716.6	
1976			520.0		0.2		2.0		522.2	
1977			922.9		0.4		4.7		928.1	
1978			1369.5		1.3		6.9		1377.6	
1979			1499.2		1.9		8.1		1509.3	
1980			2002.6		5.1		8.3		2015.9	
1981			2724.3		5.5		13.5		2743.2	
1982	2110.5		2308.1		6.3		14.6		4439.5	
1983	3308.0		1161.2		6.0		13.4		4488.7	
1984	2988.9		687.0		7.0		9.3		3692.2	
1985	2506.7		636.8		7.4		10.1		3161.0	
1986	2420.9		851.0		10.4		14.1		3296.4	
1987	2002.6		597.1		7.5		16.5		2623.6	
1988	1681.5		541.4		6.7		14.0		2243.6	
1989	4912.2	0.33	2488.3	0.50	0.1	1.50	14.3		7414.9	0.28
1990	8887.3	0.30	525.4	0.42	1.8	1.26	19.5		9434.0	0.29
1991	3189.1	0.41	1713.2	0.37	3.5	0.58	19.7		4925.6	0.30
1992	1147.6	0.36	192.3	0.42	3.1	0.27	177.1	0.57	1520.0	0.29
1993	941.5	0.28	146.6	0.62	3.9	0.39	254.0	0.34	1345.9	0.21
1994	445.0	0.40	784.8	4.51	4.9	0.85	46.1	0.52	1280.9	2.77
1995	417.9	0.34	146.2	0.48	0.8	0.65	8.6	0.45	573.5	0.28
1996	448.7	0.39	137.6	1.21	1.1	0.84	41.2	0.72	628.6	0.39
1997	456.3	0.53	29.3	0.49	3.2	0.59	32.6	0.29	521.5	0.46
1998	595.7	0.63	30.2	0.57	0.3	0.80	46.7	0.75	672.9	0.56
1999	701.5	0.30	45.6	0.69	4.4	0.57	34.6	0.68	786.1	0.27
2000	310.3	0.64	19.5	0.51	8.4	0.75	9.6	0.27	347.8	0.57
2001	490.0	0.36	30.4	0.43	1.3	0.56	9.8	0.41	531.6	0.34
2002	539.4	0.33	28.0	0.34	3.4	0.54	5.0	0.56	575.7	0.31
2003	379.7	0.17	34.6	0.40	3.1	0.34	9.3	0.28	426.8	0.15
2004	248.1	0.12	38.8	0.29	2.7	0.34	1.2	0.54	290.7	0.11
2005	140.5	0.09	56.2	0.21	1.0	0.62	3.1	0.20	200.8	0.09
2006	113.3	0.12	65.0	0.54	0.5	0.77	3.8	0.21	182.5	0.21
2007	133.0	0.11	27.1	0.44	0.9	0.72	4.3	0.28	165.3	0.11
2008	101.6	0.13	12.2	0.38	3.1	0.50	2.6	0.15	119.5	0.12
2009	153.7	0.12	7.7	0.31	0.3	0.58	2.7	0.27	164.4	0.11
2010	88.3	0.12	34.2	0.28	0.5	0.28	3.9	0.27	126.8	0.11

Table K4. Stratified mean catch per tow in weight and numbers, individual average fish weight, mean length and swept-area population biomass of ocean pout in **NEFSC spring surveys**, in the Gulf of Maine-Mid-Atlantic region (strata 1-26, 73-76), 1968-2011.

Year	Mean weight per tow		Mean number per tow		Individual average weight		Swept-area population biomass (mt)
	(kg)	CV	per tow	CV	(kg)	length (cm)	
1968	5.446	28.3	6.768	25.1	0.805	51.1	17,065
1969	6.154	15.6	8.629	15.2	0.713	49.3	19,282
1970	5.143	24.5	6.133	25.2	0.839	51.9	16,115
1971	2.195	22.9	3.135	28.8	0.700	50.2	6,879
1972	4.463	28.3	5.104	27.8	0.874	51.6	13,986
1973	3.373	17.4	4.591	15.6	0.735	48.8	10,569
1974	1.479	20.6	2.310	14.8	0.640	47.0	4,636
1975	1.293	25.3	1.358	23.8	0.952	53.4	4,052
1976	1.400	22.8	2.440	36.1	0.574	46.5	4,387
1977	3.605	55.3	6.366	56.9	0.566	44.8	11,274
1978	3.371	15.0	11.831	17.6	0.285	31.6	10,562
1979	1.493	25.0	5.197	54.6	0.287	34.7	4,678
1980	5.729	23.2	11.837	23.2	0.484	42.6	17,952
1981	7.605	22.4	14.131	26.0	0.538	42.7	23,829
1982	4.743	24.6	8.690	43.2	0.546	44.0	14,863
1983	4.236	15.9	5.076	13.7	0.835	50.5	13,274
1984	5.540	21.8	7.275	26.5	0.762	50.0	17,359
1985	6.494	18.1	9.011	19.6	0.721	48.7	20,348
1986	6.345	25.1	6.995	22.8	0.907	53.0	19,880
1987	2.705	33.7	3.076	31.3	0.879	51.7	8,475
1988	3.244	18.1	5.405	27.6	0.600	45.0	10,165
1989	2.792	15.5	5.323	20.6	0.525	44.0	8,748
1990	5.074	21.1	6.369	21.1	0.797	50.3	15,898
1991	3.783	16.2	5.596	15.3	0.676	49.7	11,853
1992	2.257	16.0	2.639	13.6	0.855	52.9	7,071
1993	3.084	21.5	3.546	18.9	0.870	53.4	9,663
1994	2.309	18.4	2.640	16.1	0.875	54.3	7,234
1995	1.916	18.2	2.525	15.5	0.759	50.5	6,004
1996	2.058	29.6	3.127	22.6	0.658	47.6	6,450
1997	1.632	22.0	2.069	20.0	0.789	52.4	5,113
1998	1.733	31.1	2.957	27.9	0.586	46.1	5,430
1999	2.561	21.2	3.340	19.9	0.767	50.2	8,025
2000	2.016	22.8	3.113	21.5	0.648	48.2	6,317
2001	2.798	28.4	3.748	26.3	0.746	51.6	8,767
2002	2.025	24.3	2.809	23.0	0.721	51.3	6,345
2003	2.758	56.8	2.919	41.6	0.945	55.4	8,643
2004	0.546	21.3	0.673	19.3	0.812	50.8	1,712
2005	0.526	28.0	0.854	23.8	0.616	45.9	1,648
2006	0.526	34.5	0.789	24.4	0.667	47.4	1,649
2007	0.477	28.0	1.076	20.2	0.443	42.9	1,493
2008	0.422	17.1	0.835	17.1	0.506	43.8	1,327
*2009	0.556	30.3	1.621	22.5	0.304	37.5	1,807
*2010	0.371	25.4	1.097	20.6	0.289	35.5	1,164
*2011	0.299	31.9	0.909	19.7	0.281	34.5	936
mean 1968-2011	2.922						9,157
median 1968-2011	2.633						8,250

\* *F/V Bigelow to R/V Albatross conversion factors have been applied (3.9115 and 4.5752 for weight and numbers, respectively). The uncertainty associated with the conversion factor is included in the CV.*

Table K5. NEFSC spring survey index (kg/tow), total catch ('000 mt), 3 year moving average of spring survey biomass index, relative exploitation rate (catch/ 3 yr average of spring survey biomass index) for ocean pout, 1968 – 2010.

Year	NEFSC Spring Index kg/tow	Total Catch ('000, mt)	Annual relative exploitation rate (catch/spr index)	3 year moving average (kg/tow)	Exploitation ratio (catch/ 3yr avg index)
1968	5.446	16.5379	3.037	5.800	2.851
1969	6.154	30.1015	4.892	5.581	5.394
1970	5.143	9.9378	1.932	4.497	2.210
1971	2.195	7.9315	3.613	3.934	2.016
1972	4.463	4.8492	1.086	3.344	1.450
1973	3.373	6.6642	1.976	3.105	2.146
1974	1.479	4.8659	3.289	2.048	2.375
1975	1.293	0.9936	0.768	1.391	0.714
1976	1.400	1.2002	0.857	2.099	0.572
1977	3.605	1.9871	0.551	2.792	0.712
1978	3.371	2.4126	0.716	2.823	0.855
1979	1.493	2.1813	1.461	3.531	0.618
1980	5.729	2.3659	0.413	4.942	0.479
1981	7.605	2.9942	0.394	6.026	0.497
1982	4.743	4.7605	1.004	5.528	0.861
1983	4.236	4.8967	1.156	4.840	1.012
1984	5.540	5.0162	0.905	5.423	0.925
1985	6.494	4.6650	0.718	6.126	0.761
1986	6.345	4.0984	0.646	5.181	0.791
1987	2.705	4.8086	1.778	4.098	1.173
1988	3.244	4.0546	1.250	2.914	1.392
1989	2.792	8.7289	3.126	3.703	2.357
1990	5.074	10.7460	2.118	3.883	2.768
1991	3.783	6.3496	1.679	3.704	1.714
1992	2.257	1.9940	0.884	3.041	0.656
1993	3.084	1.5779	0.512	2.550	0.619
1994	2.309	1.4769	0.640	2.436	0.606
1995	1.916	0.6385	0.333	2.094	0.305
1996	2.058	0.6796	0.330	1.869	0.364
1997	1.632	0.5545	0.340	1.808	0.307
1998	1.733	0.6899	0.398	1.975	0.349
1999	2.561	0.8041	0.314	2.103	0.382
2000	2.016	0.3668	0.182	2.458	0.149
2001	2.798	0.5492	0.196	2.280	0.241
2002	2.025	0.5879	0.290	2.527	0.233
2003	2.758	0.4524	0.164	1.777	0.255
2004	0.546	0.2960	0.542	1.277	0.232
2005	0.526	0.2048	0.389	0.533	0.384
2006	0.526	0.1875	0.356	0.510	0.368
2007	0.477	0.1688	0.354	0.475	0.355
2008	0.422	0.1267	0.300	0.485	0.261
*2009	0.556	0.1676	0.302	0.450	0.373
*2010	0.371	0.1271	0.342	0.409	0.311
*2011	0.299				
mean 1968-2010	2.92			2.99	1.01
median 1968-2010	2.63			2.79	0.62
median 1977-1985				4.94	0.76

\* F/V Bigelow to R/V Albatross conversion factors have been applied (3.9115 and 4.5752 for weight and numbers, respectively).

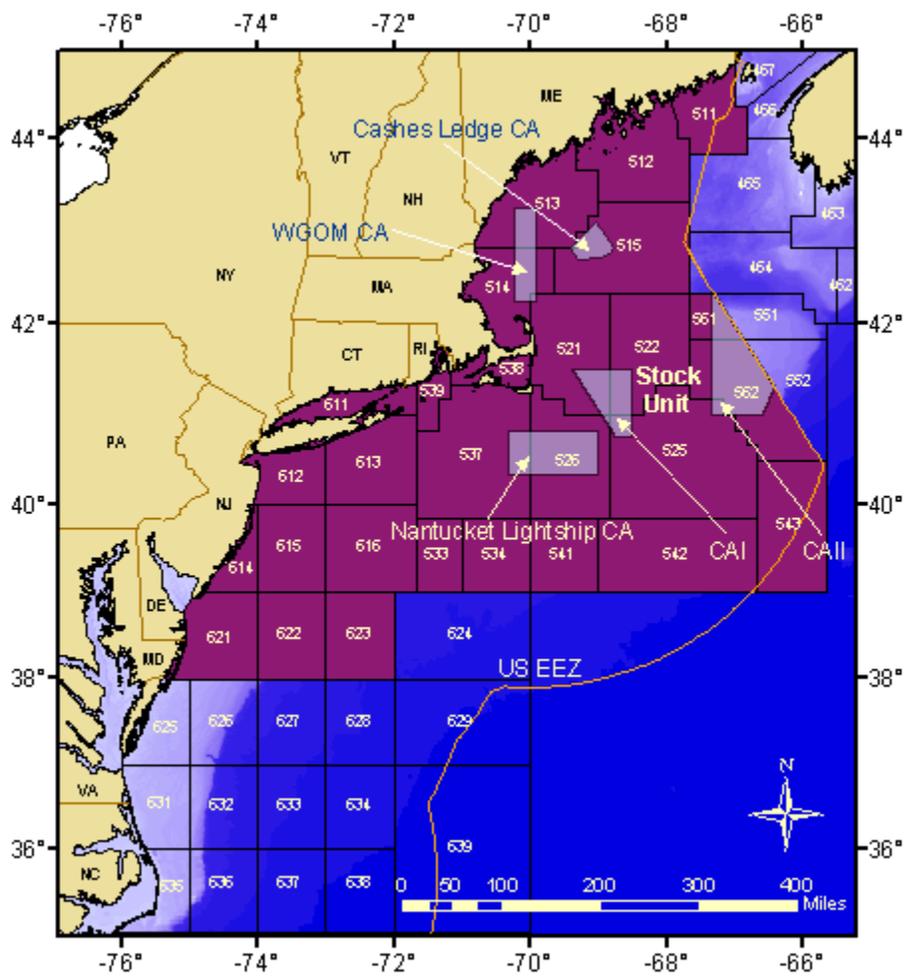


Figure 17.1. Statistical areas used to define the ocean pout stock.

Figure K1. Statistical areas used to define the ocean pout stock.

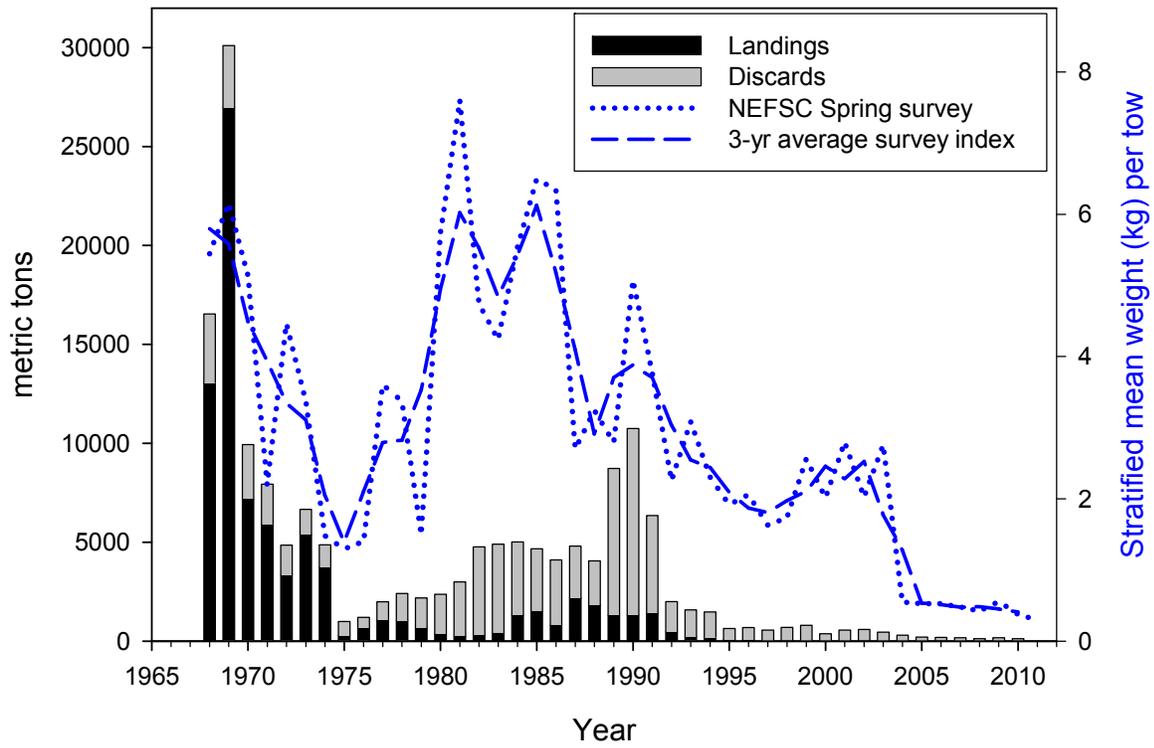


Figure K2. Trends in landings (mt), discards (mt) and NEFSC spring survey biomass (kg/tow) for ocean pout, 1968 – 2010.

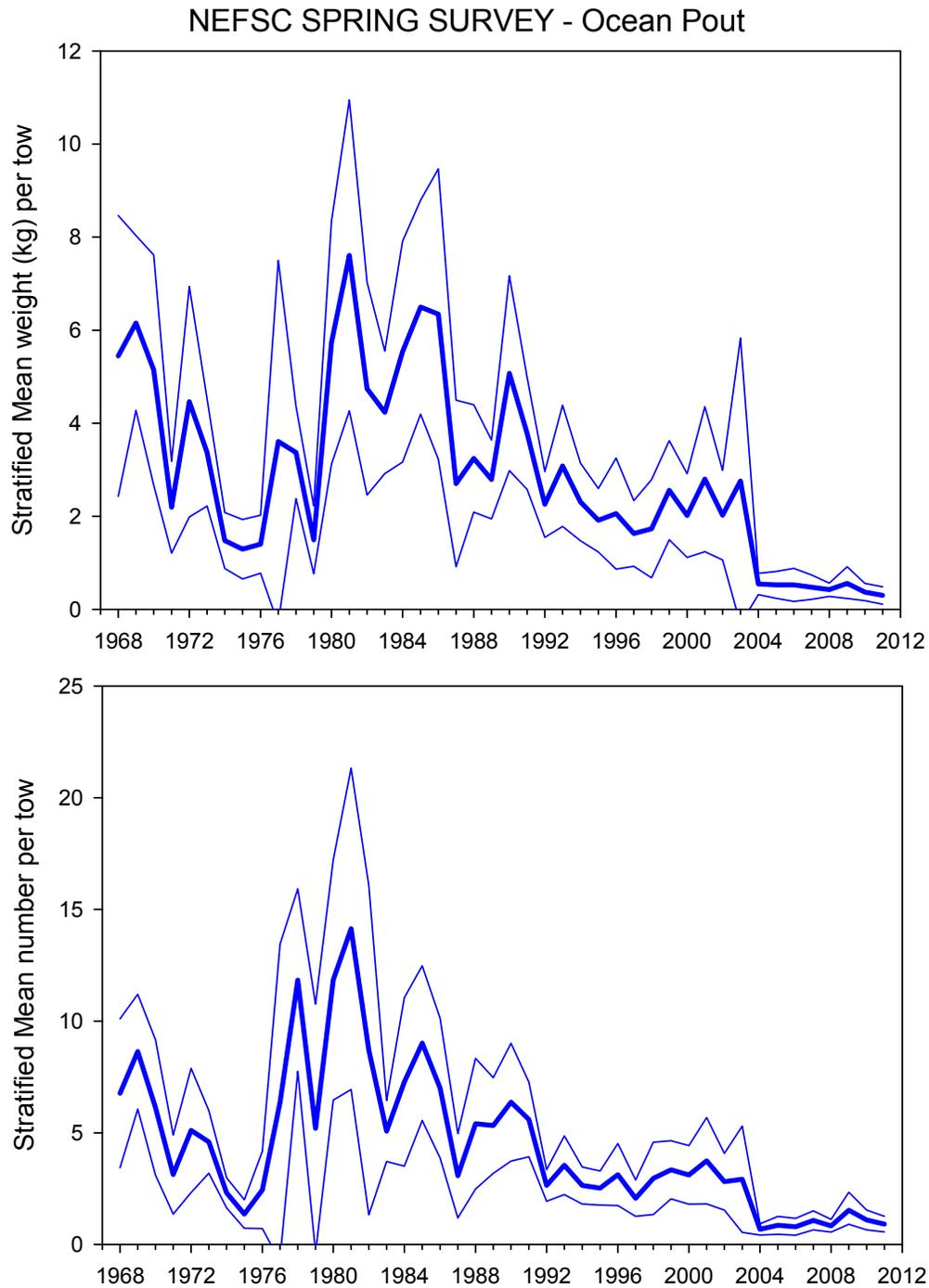


Figure K3. Stratified mean weight (kg) per tow (top) and mean number per tow (bottom) of ocean pout in the NEFSC spring survey, 1968 – 2011. Thin lines represent 95% confidence intervals.

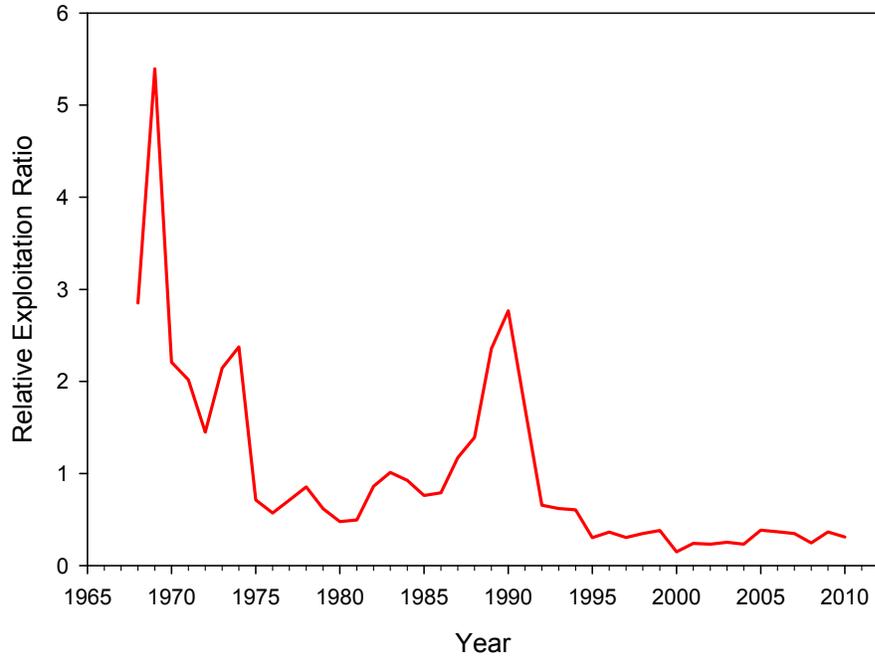


Figure K4. Trends in relative exploitation ratio (catch / 3-yr average of spring biomass index) for ocean pout, 1968 – 2010.

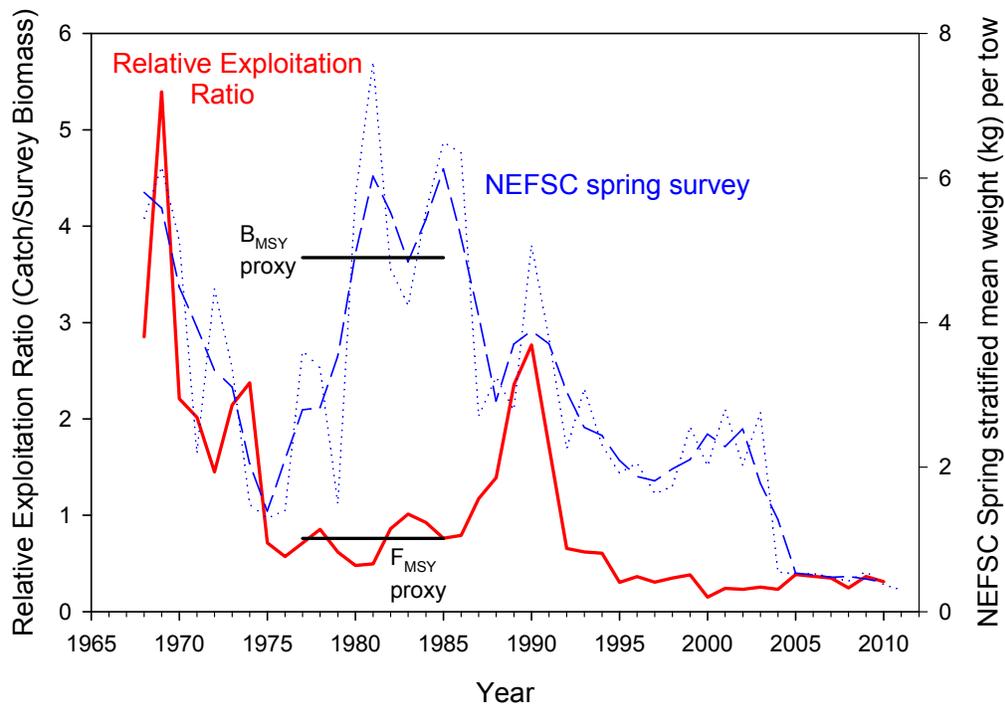


Figure K5. Trends in relative exploitation rate (catch / 3-yr average of spring biomass index) and NEFSC spring survey weight (kg) per tow for ocean pout, 1968 – 2010, with biological references point proxies based on total catch.

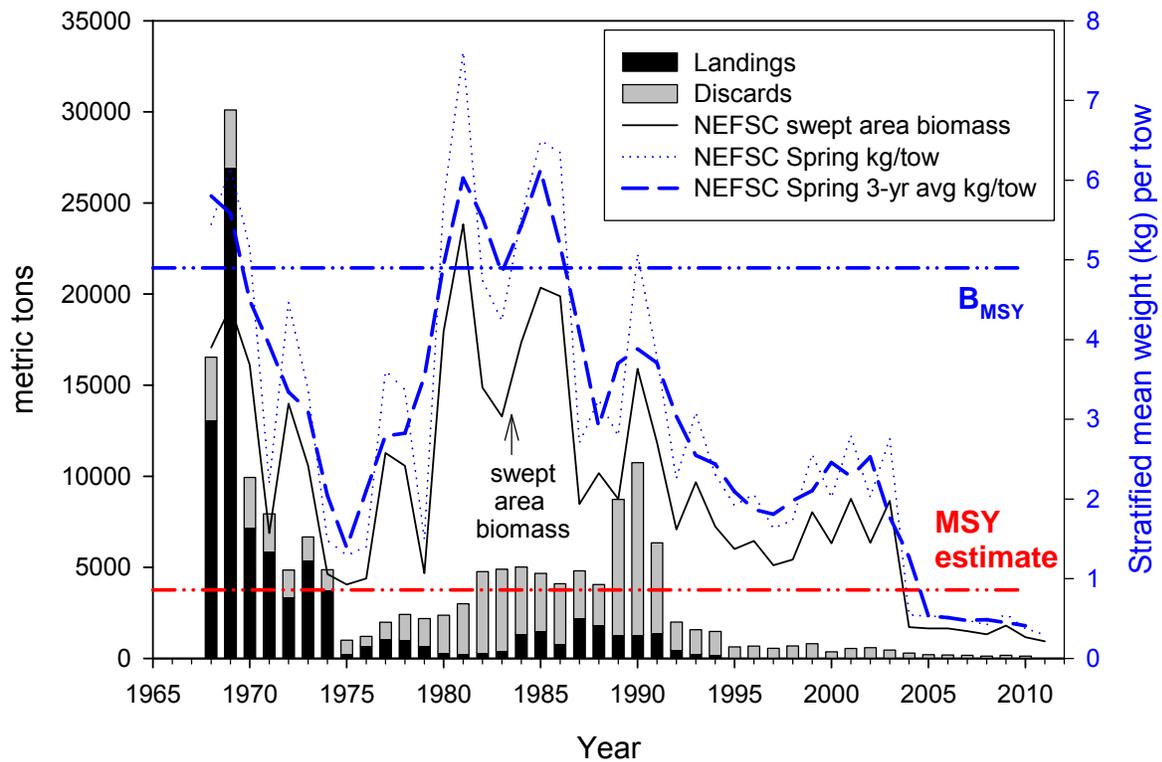


Figure K6. Trends in landings (mt), discards (mt), NEFSC spring survey biomass (kg/tow) and total population biomass (mt) for ocean pout, 1968 – 2010, with biological reference points based on total catch.

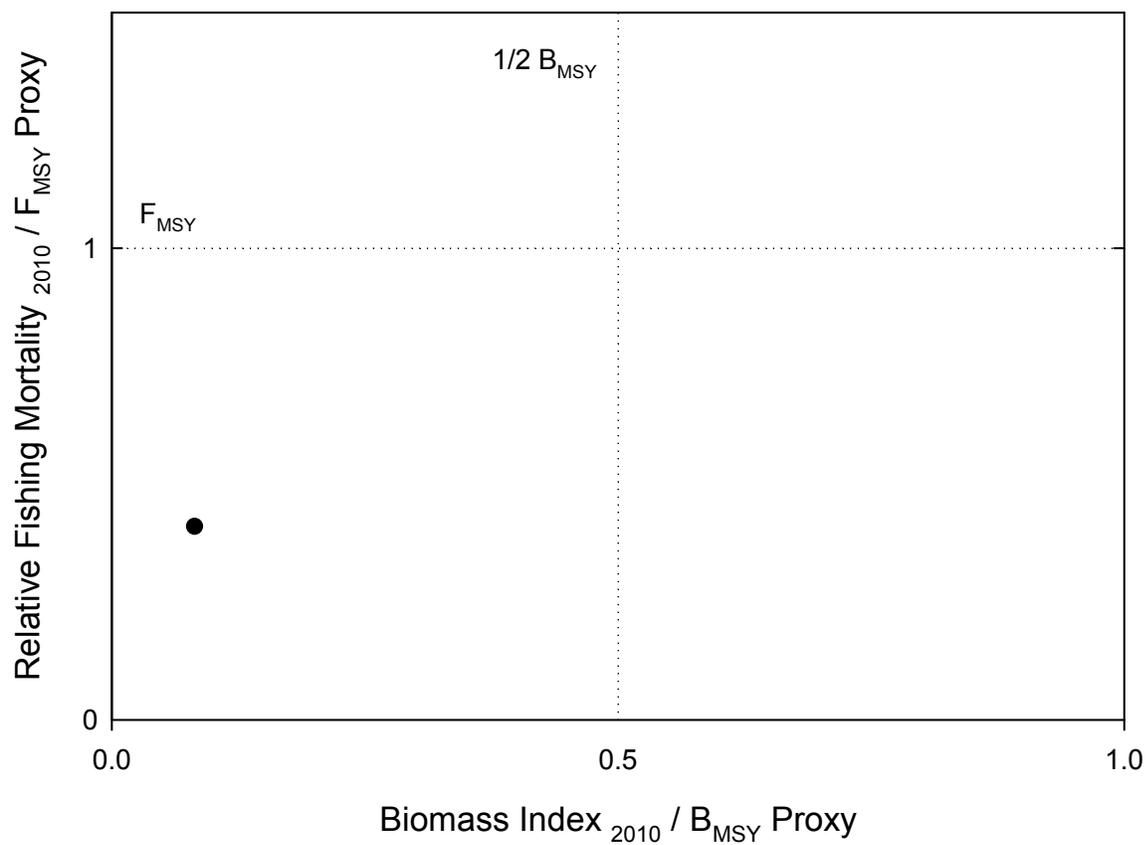


Figure K7. Ocean pout survey biomass index and relative fishing mortality in 2010, with respect to biological reference point proxies. The updated analysis was used to determine ocean pout stock status in 2010.

Appendix Table K1. Number of commercial lengths (individual fish measured) and number of samples for ocean pout collected during 1969 to 2010, by calendar quarter.

Year	Q1	Q2	Q3	Q4	Total	# of Samples
1969					0	
1970					0	
1971					0	
1972					0	
1973					0	
1974					0	
1975					0	
1976					0	
1977					0	
1978					0	
1979					0	
1980					0	
1981					0	
1982					0	
1983					0	
1984		592			592	5
1985	670	335			1005	9
1986	780	458			1238	11
1987	1477	717			2194	19
1988	1093	805		106	2004	17
1989	1283	864			2147	17
1990	1006	112			1118	12
1991	1044	259		93	1396	14
1992	402	181			583	6
1993	93				93	1
1994					0	1
1995		76			76	1
1996				17	17	1
1997					0	0
1998					0	0
1999					0	0
2000					0	0
2001					0	0
2002	109				109	1
2003	136	76			212	4
2004	37				37	1
2005					0	0
2006	133	54			187	4
2007	167	11			178	3
2008	112	16			128	5
2009	31	42			73	3
2010					0	

*Five commercial age samples have been obtained: 28 fish in 1985; 29 fish in 1989; 53 fish in 1991(from 2 samples); and 21 fish in 1992.*

Appendix Table K2. Number of observed trips and combined discard ratio of ocean pout discards to kept of all species for selected fleets, 1989 – 2010 using NEFOP data.

YEAR	Large-mesh Otter Trawl		Small-mesh Otter Trawl		Gillnet		Scallop Dredge	
	OB trips	d/k ratio	OB trips	d/k ratio	OB trips	d/k ratio	OB trips	d/k ratio
1989	34	0.07836	91	0.06529	67	0.00001		
1990	43	0.11079	55	0.01436	84	0.00014		
1991	56	0.04205	127	0.04462	448	0.00028		
1992	58	0.01583	74	0.00543	599	0.00023	13	0.00177
1993	27	0.01606	23	0.00374	420	0.00024	20	0.00457
1994	28	0.00792	17	0.01852	195	0.00030	18	0.00200
1995	74	0.00890	77	0.00456	182	0.00004	22	0.00026
1996	44	0.00840	59	0.00356	136	0.00005	35	0.00087
1997	26	0.00922	60	0.00074	152	0.00016	26	0.00075
1998	17	0.01144	34	0.00075	209	0.00001	23	0.00138
1999	33	0.01458	53	0.00123	122	0.00023	28	0.00056
2000	93	0.00572	43	0.00058	137	0.00059	250	0.00012
2001	150	0.00827	59	0.00101	92	0.00009	64	0.00009
2002	197	0.00945	101	0.00111	125	0.00020	84	0.00004
2003	352	0.00656	106	0.00150	418	0.00017	91	0.00008
2004	563	0.00375	312	0.00163	971	0.00014	213	0.00001
2005	1363	0.00299	358	0.00293	787	0.00008	268	0.00002
2006	639	0.00269	185	0.00175	221	0.00003	199	0.00002
2007	725	0.00344	220	0.00127	259	0.00005	288	0.00127
2008	817	0.00244	144	0.00064	225	0.00019	303	0.00064
2009	937	0.00385	353	0.00032	338	0.00002	192	0.00032
2010	1046	0.00238	443	0.00180	1392	0.00003	222	0.00180

Appendix Table K3. Ocean pout discards (mt) and coefficient of variation from the large-mesh otter trawl, small-mesh otter trawl, gillnet, and scallop dredge fleets, 1989 – 2010. Discards were derived using a combined ratio estimator of ocean pout discarded weight to kept weight of all species.

YEAR	Large-mesh Otter Trawl		Small-mesh Otter Trawl		Gillnet		Scallop Dredge		Total	
	mt	CV	mt	CV	mt	CV	mt	CV	mt	CV
1989	4912.2	0.33	2488.3	0.50	0.1	1.50			7400.6	0.28
1990	8887.3	0.30	525.4	0.42	1.8	1.26			9414.5	0.29
1991	3189.1	0.41	1713.2	0.37	3.5	0.58			4905.9	0.30
1992	1147.6	0.36	192.3	0.42	3.1	0.27	177.1	0.570	1520.0	0.29
1993	941.5	0.28	146.6	0.62	3.9	0.39	254.0	0.340	1345.9	0.21
1994	445.0	0.40	784.8	4.51	4.9	0.85	46.1	0.525	1280.9	2.77
1995	417.9	0.34	146.2	0.48	0.8	0.65	8.6	0.451	573.5	0.28
1996	448.7	0.39	137.6	1.21	1.1	0.84	41.2	0.722	628.6	0.39
1997	456.3	0.53	29.3	0.49	3.2	0.59	32.6	0.290	521.5	0.46
1998	595.7	0.63	30.2	0.57	0.3	0.80	46.7	0.748	672.9	0.56
1999	701.5	0.30	45.6	0.69	4.4	0.57	34.6	0.679	786.1	0.27
2000	310.3	0.64	19.5	0.51	8.4	0.75	9.6	0.265	347.8	0.57
2001	490.0	0.36	30.4	0.43	1.3	0.56	9.8	0.413	531.6	0.34
2002	539.4	0.33	28.0	0.34	3.4	0.54	5.0	0.561	575.7	0.31
2003	379.7	0.17	34.6	0.40	3.1	0.34	9.3	0.276	426.8	0.15
2004	248.1	0.12	38.8	0.29	2.7	0.34	1.2	0.544	290.7	0.11
2005	140.5	0.09	56.2	0.21	1.0	0.62	3.1	0.196	200.8	0.09
2006	113.3	0.12	65.0	0.54	0.5	0.77	3.8	0.210	182.5	0.21
2007	133.0	0.11	27.1	0.44	0.9	0.72	4.3	0.28	165.3	0.12
2008	101.6	0.13	12.2	0.38	3.1	0.50	2.6	0.15	119.5	0.12
2009	153.7	0.12	7.7	0.31	0.3	0.58	2.7	0.27	164.4	0.11
2010	88.3	0.12	34.2	0.28	0.5	0.28	3.9	0.27	126.8	0.11

*Note: 1989 – 1991 total discards do not include scallop discards.*

Appendix Table K4. Ocean pout discards (mt) from the large-mesh otter trawl, small-mesh otter trawl, gillnet from 1968 - 1988 and scallop dredge fleets from 1968 – 1991 based on the survey scale method.

YEAR	Large-mesh Otter Trawl	Small-mesh Otter Trawl	Gillnet	Scallop Dredge	Total
1968		3470.4	1.0	5.5	3476.9
1969		3125.1	0.9	3.5	3129.5
1970		2761.6	0.9	3.2	2765.8
1971		2018.4	0.6	2.5	2021.5
1972		1495.9	0.8	1.4	1498.2
1973		1292.2	0.6	1.4	1294.2
1974		1131.6	0.7	1.6	1133.9
1975		714.8	0.3	1.5	716.6
1976		520.0	0.2	2.0	522.2
1977		922.9	0.4	4.7	928.1
1978		1369.5	1.3	6.9	1377.6
1979		1499.2	1.9	8.1	1509.3
1980		2002.6	5.1	8.3	2015.9
1981		2724.3	5.5	13.5	2743.2
1982	2110.5	2308.1	6.3	14.6	4439.5
1983	3308.0	1161.2	6.0	13.4	4488.7
1984	2988.9	687.0	7.0	9.3	3692.2
1985	2506.7	636.8	7.4	10.1	3161.0
1986	2420.9	851.0	10.4	14.1	3296.4
1987	2002.6	597.1	7.5	16.5	2623.6
1988	1681.5	541.4	6.7	14.0	2243.6
1989				14.3	
1990				19.5	
1991				19.7	

*Note: Regulatory otter trawl mesh size prior to 1982 was less than 5.5 inches;  
1989 – 1991 scallop dredge discards were estimated using this method due to no  
observer coverage of this fleet.*

Appendix Table K5. Summary of NEFSC survey area (square nautical miles; offshore strata 1-26; 73-76) used in the ocean pout stock assessment and the USA statistical areas associated with ocean pout stock (Figure K1).

NEFSC		USA	
Survey		Statistical	
Strata	Area	Areas	Area
1	2,516	464	208
2	2,078	465	258
3	566	467	75
4	188	511	1,313
5	1,475	512	3,652
6	2,554	513	3,567
7	514	514	2,573
8	230	515	4,603
9	1,522	521	3,853
10	2,722	522	3,663
11	622	525	7,461
12	176	526	4,029
13	2,374	533	1,547
14	656	534	2,320
15	230	537	6,261
16	2,980	538	800
17	360	539	742
18	172	541	2,320
19	2,454	542	5,402
20	1,221	543	2,281
21	424	561	765
22	454	562	3,562
23	1,016	611	1,421
24	2,569	612	1,893
25	390	613	3,258
26	1,014	614	1,131
73	2,145	615	2,781
74	1,273	616	3,707
75	139	621	3,702
76	60	622	2,820
Total	35,094	623	2,820
		Total	84,786

Appendix Table K6. Stratified mean catch per tow in weight and numbers, mean length and individual average fish weight of ocean pout in **NEFSC winter surveys** (strata 1-3, 5-7, 9-11, 13-14, 73-75), 1992-2007. The NEFSC winter survey time series ended in 2007.  
*No vessel conversion factors applied.*

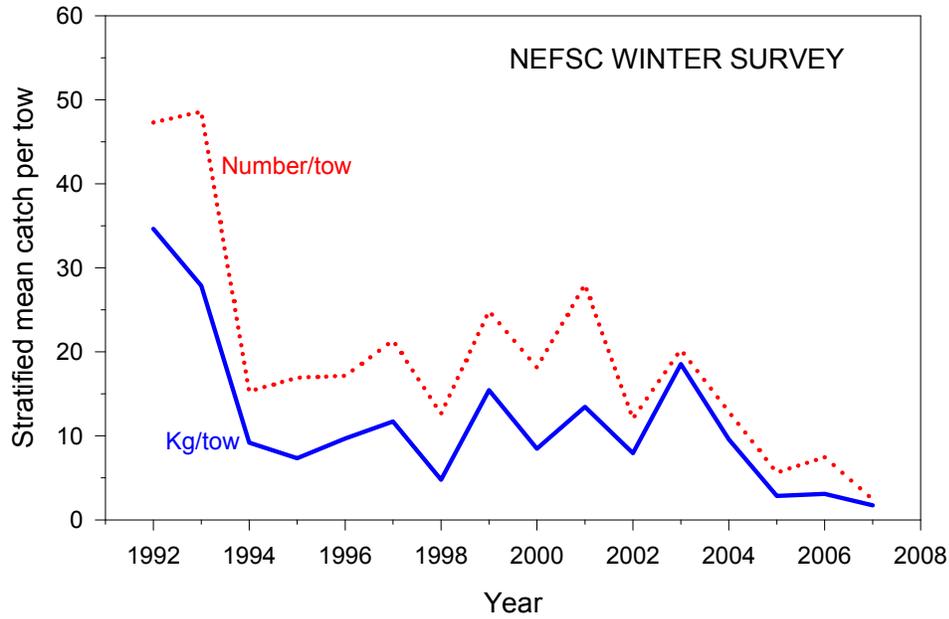
Year	Mean weight per tow (kg)	Mean number per tow	Individual average weight (kg)	Mean length (cm)
1992	34.64	47.29	0.733	51.9
1993	27.86	48.57	0.574	47.1
1994	9.18	15.28	0.601	47.1
1995	7.32	16.92	0.433	43.3
1996	9.68	17.13	0.565	47.2
1997	11.70	21.36	0.548	47.5
1998	4.77	12.63	0.378	40.4
1999	15.44	24.85	0.621	48.3
2000	8.46	18.14	0.466	44.6
2001	13.45	28.01	0.480	46.1
2002	7.94	12.05	0.659	51.1
2003	18.54	20.25	0.916	56.0
2004	9.58	12.89	0.744	49.6
2005	2.84	5.61	0.506	41.3
2006	3.09	7.44	0.415	40.3
2007	1.72	2.43	0.709	48.9

Appendix Table K7. Stratified mean catch per tow in weight and numbers, individual average fish weight and mean length of ocean pout in **Mass. inshore spring surveys** (strata 25-36), 1978-2011.

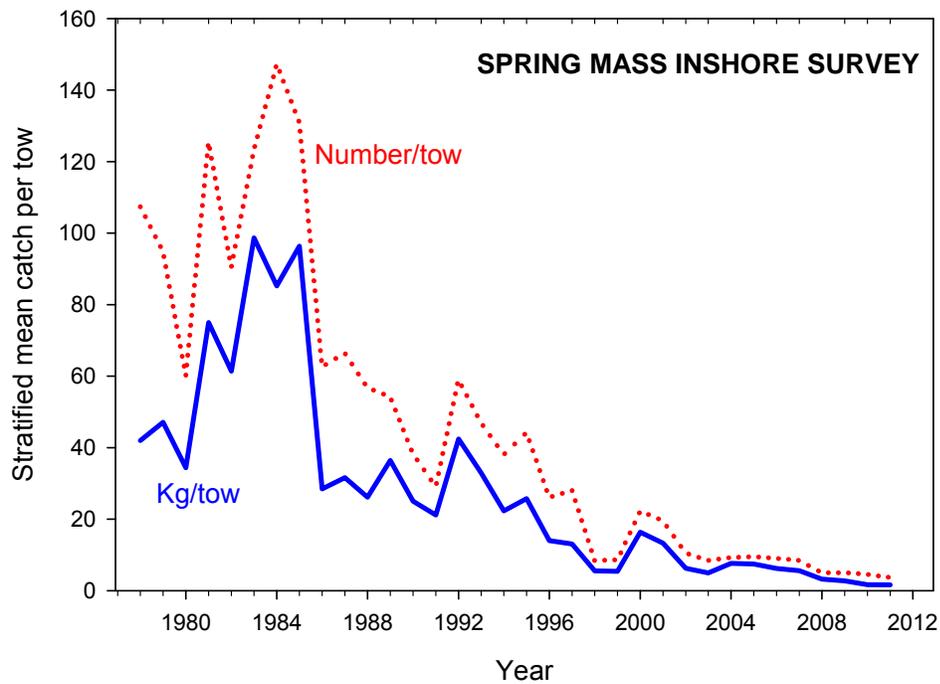
Year	Mean weight per tow (kg)	CV	Mean number per tow	CV	Individual average weight (kg)	Mean length (cm)
1978	42.00	30.9	107.39	20.9	0.391	38.8
1979	47.11	16.5	94.79	18.2	0.497	39.6
1980	34.42	17.7	60.13	20.3	0.572	42.9
1981	74.98	16.6	125.46	19.6	0.598	43.5
1982	61.39	24.3	90.50	21.0	0.678	47.2
1983	98.69	17.2	123.35	15.7	0.800	50.2
1984	85.25	27.5	147.25	29.6	0.579	45.0
1985	96.36	32.4	130.93	19.4	0.736	47.2
1986	28.46	17.0	62.62	22.9	0.454	39.4
1987	31.61	27.2	66.44	19.9	0.476	41.3
1988	26.18	17.7	56.71	28.5	0.462	39.7
1989	36.40	20.4	54.19	15.8	0.672	46.8
1990	25.04	23.3	38.19	20.8	0.656	47.0
1991	21.20	21.6	29.08	23.0	0.729	49.6
1992	42.43	23.6	59.02	21.6	0.719	48.5
1993	32.87	19.6	46.82	16.7	0.702	51.0
1994	22.92	20.5	38.05	21.9	0.602	46.9
1995	25.75	16.4	44.22	14.4	0.582	46.5
1996	14.03	20.5	26.06	16.6	0.538	45.6
1997	13.05	17.0	28.04	16.1	0.465	41.9
1998	5.56	25.8	8.45	28.9	0.658	49.7
1999	5.42	19.8	8.61	15.5	0.630	46.5
2000	16.35	38.8	22.22	31.8	0.736	49.8
2001	13.27	26.9	19.55	23.0	0.679	49.9
2002	6.27	31.9	10.47	26.0	0.599	48.1
2003	4.96	16.3	8.42	14.9	0.589	47.8
2004	7.66	39.8	9.27	32.4	0.827	53.0
2005	7.48	40.4	9.51	40.3	0.787	53.4
2006	6.22	22.9	9.03	17.8	0.689	49.6
2007	5.58	29.1	8.44	26.2	0.661	48.6
2008	3.22	28.3	4.94	26.4	0.651	47.7
2009	2.76	23.9	5.01	17.8	0.550	43.4
2010	1.66	31.5	4.53	24.4	0.365	37.6
2011	1.61	23.9	3.69	18.1	0.436	38.5

Appendix Table K8. Sensitivity run of GARM 2007 using updated values for 2007 catch and 2008 survey index. Bold values represent revised values used.

Year	NEFSC Spring Index kg/tow	Total Catch ( <sup>'000</sup> , mt)	Annual relative exploitation rate (catch/spr index)	3 year moving average (kg/tow)	Exploitation ratio (catch/ 3yr avg index)
1968	5.446	16.5379	3.037	5.800	2.851
1969	6.154	30.1015	4.892	5.581	5.394
1970	5.143	9.9378	1.932	4.497	2.210
1971	2.195	7.9315	3.613	3.934	2.016
1972	4.463	4.8492	1.086	3.344	1.450
1973	3.373	6.6642	1.976	3.105	2.146
1974	1.479	4.8659	3.289	2.048	2.375
1975	1.293	0.9936	0.768	1.391	0.714
1976	1.400	1.2002	0.857	2.099	0.572
1977	3.605	1.9871	0.551	2.792	0.712
1978	3.371	2.4126	0.716	2.823	0.855
1979	1.493	2.1813	1.461	3.531	0.618
1980	5.729	2.3659	0.413	4.942	0.479
1981	7.605	2.9942	0.394	6.026	0.497
1982	4.743	4.7605	1.004	5.528	0.861
1983	4.236	4.8967	1.156	4.840	1.012
1984	5.540	5.0162	0.905	5.423	0.925
1985	6.494	4.6650	0.718	6.126	0.761
1986	6.345	4.0984	0.646	5.181	0.791
1987	2.705	4.8086	1.778	4.098	1.173
1988	3.244	4.0546	1.250	2.914	1.392
1989	2.792	8.7289	3.126	3.703	2.357
1990	5.074	10.7460	2.118	3.883	2.768
1991	3.783	6.3496	1.679	3.704	1.714
1992	2.257	1.9940	0.884	3.041	0.656
1993	3.084	1.5779	0.512	2.550	0.619
1994	2.309	1.4769	0.640	2.436	0.606
1995	1.916	0.6385	0.333	2.094	0.305
1996	2.058	0.6796	0.330	1.869	0.364
1997	1.632	0.5545	0.340	1.808	0.307
1998	1.733	0.6899	0.398	1.975	0.349
1999	2.561	0.8041	0.314	2.103	0.382
2000	2.016	0.3668	0.182	2.458	0.149
2001	2.798	0.5492	0.196	2.280	0.241
2002	2.025	0.5879	0.290	2.527	0.233
2003	2.758	0.4524	0.164	1.777	0.255
2004	0.546	0.2960	0.542	1.277	0.232
2005	0.526	0.2048	0.389	0.533	0.384
2006	0.526	0.1875	0.356	0.510	0.368
2007	0.477	<b>0.1688</b>	0.354	0.475	0.355
2008	<b>0.422</b>				
mean 1968-2007	3.17			3.18	1.06
median 1968-2007	2.78			2.87	0.68
median 1977-1985				4.94	0.76

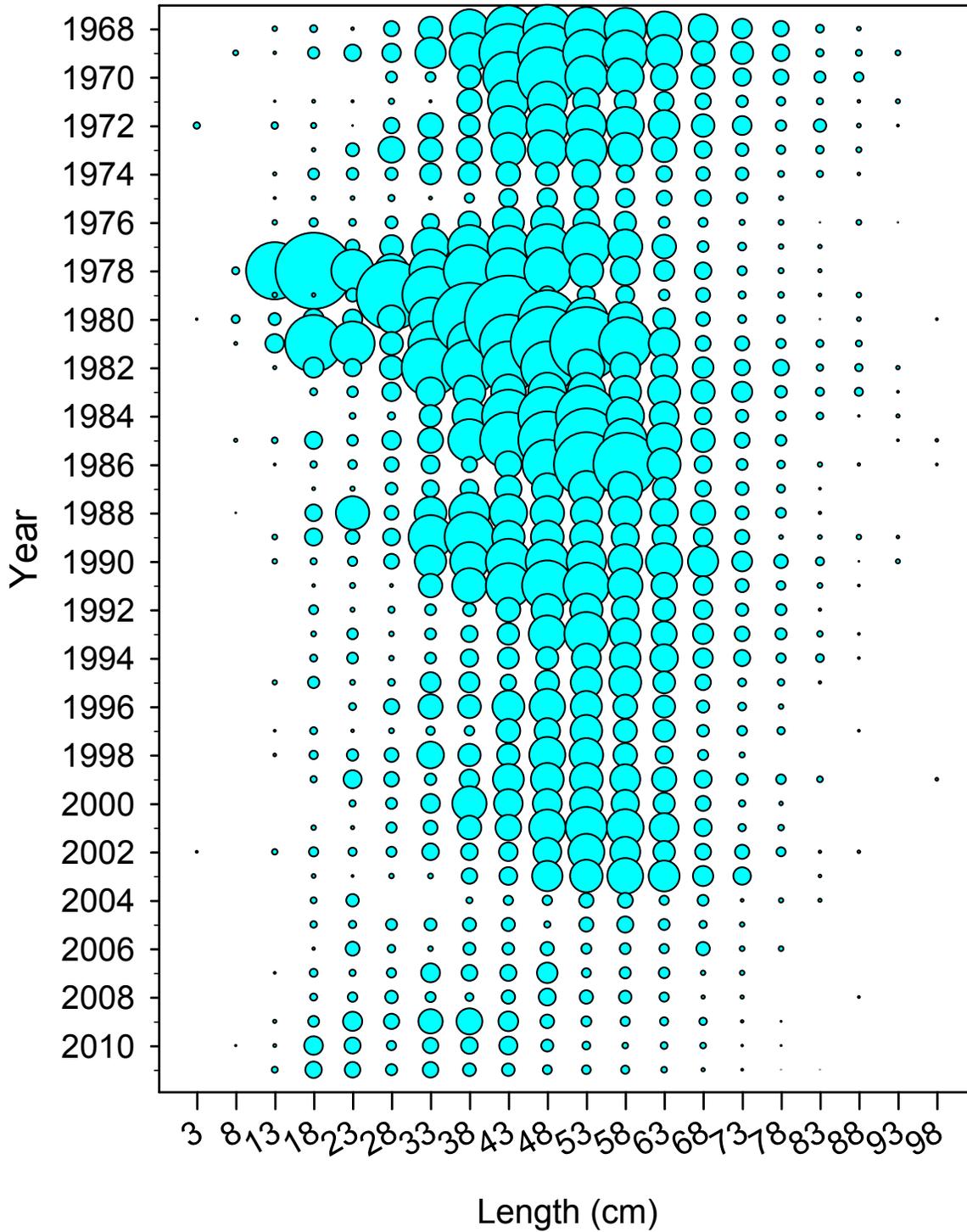


Appendix Figure K1. Trends in mean catch per tow, in numbers and weight (kg) for ocean pout in the NEFSC winter survey, 1992 – 2007. The NEFSC winter survey time series ended in 2007.



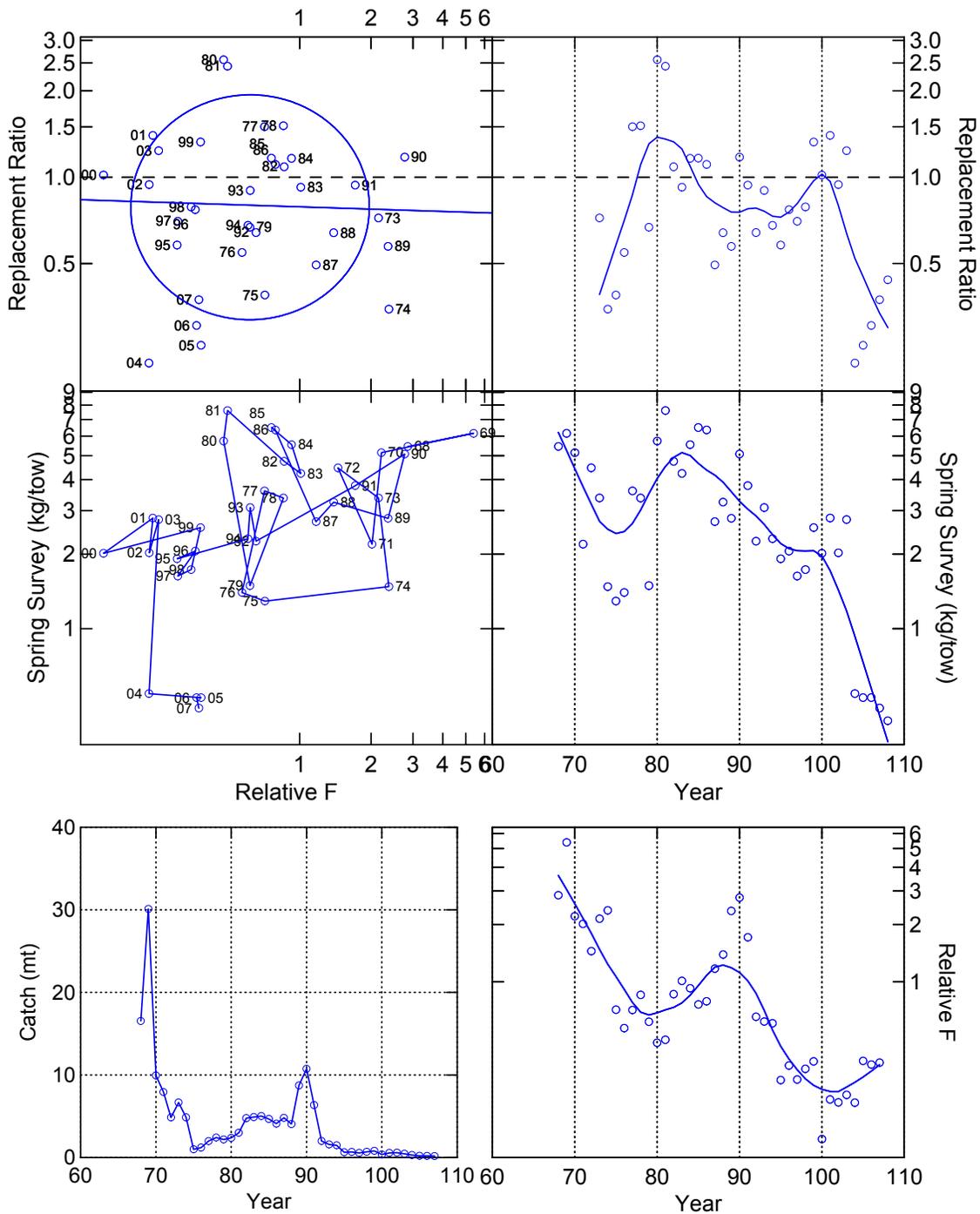
Appendix Figure K2. Trends in mean catch per tow, in numbers and weight (kg) for ocean pout in the Massachusetts inshore survey, 1978 – 2011.

# Ocean Pout



Appendix Figure K3. Stratified mean number per tow at length for ocean pout from the NEFSC research vessel spring survey, 1968 to 2011, binned into 5 cm intervals.

# Ocean Pout



Appendix Figure K4. Trends in relative biomass, total catch, fishing mortality rate indices (catch / survey index) and replacement ratios for ocean pout. Relative F is computed as catch in year t divided by a 3 yr average of indices in year t-1, t, and t+1. ***Taken from GARM 2008, see Wigley et al. 2008.***