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Winter Flounder

by

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The winter flounder, blackback, or lemon sole, *Pseudopleuronectes americanus*, is distributed in the Northwest Atlantic from Labrador to Georgia. Abundance is highest from the Gulf of St. Lawrence to Chesapeake Bay. Winter flounder may attain sizes up to 64 cm (25 in.) total length. The diet consists primarily of benthic invertebrates. Movement patterns are generally localized. Winter flounder undertake small-scale migrations into estuaries, embayments, and saltwater ponds in winter to spawn, subsequently moving to deeper water during summer. Winter flounder tend to return to the same spawning locations in consecutive years. Restricted movement patterns, and differences in growth, meristic, and morphometric characteristics suggest that relatively discrete local groups exist.

Tagging and meristic studies indicate separate groups of winter flounder north of Cape Cod, east and south of Cape Cod, and on Georges Bank. Three groups are recognized for assessment purposes: Gulf of Maine, Southern New England - Middle Atlantic, and Georges Bank.

Winter flounder are typically exploited in coastal locations, although offshore shoal areas, particularly Georges Bank and Nantucket Shoals, support important winter flounder fisheries. The principal commercial fishing gear used is the otter trawl. Recreational catches are significant, especially in the southern parts of the range. U.S. commercial and recreational fisheries are managed under the New England Fishery Management Council's Multispecies Fishery Management Plan (FMP) and the Atlantic States Marine Fisheries Commission's Fishery Management Plan for Inshore Stocks of Winter Flounder. Under the Northeast Multispecies FMP winter flounder are included in a complex of 15 groundfish species which has been managed by time/area closures, gear restrictions, minimum size limits and, since 1994, direct effort controls including a moratorium on permits and days-at-sea restrictions under Amendments 5 and 7 to the FMP. Amendment 9 established rebuilding targets, and defines control rules which specify target fishing mortality rates and corresponding rebuilding time horizons. The goal of the management program is to reduce fishing mortality to levels which will allow stocks within the complex to initially rebuild above minimum biomass thresholds, and ultimately to remain at or near target biomass levels.

Total winter flounder landings in 1998 was 5,500 mt, among the lowest on record.

Gulf of Maine

Commercial landings from the Gulf of Maine increased from a steady 1,000 mt for the period 1964 to 1975 to nearly 3,000 mt in 1982. Recreational landings estimates for 1981-1982 averaged 2,200 mt. Total landings declined from 5,000 mt in 1981 to an average of 2,700 mt during the mid-1980s. Since 1989, total landings have continued to trend downward, to 600 mt in 1997-1998, a record low. Estimated recreational catches have declined to less than 100 mt during 1995-1998.

Bottom trawl survey abundance indices from the Massachusetts Division of Marine Fisheries (MADMF) spring survey decreased after 1983, and reached a record-low in 1994. Since 1995 the survey indices have increased somewhat. The relative exploitation index (catch biomass / MADMF spring survey biomass) declined from 1994 to 1998; however, much of the increase in survey biomass is due to increases of age 1 and 2 fish. These increases do not follow through to older ages, suggesting that exploitation is higher than suggested by the relative exploitation index.

Improvements in the condition of the stock will depend on decreases in exploitation (both recreational and commercial). The stock is at a low biomass level and is considered to be overexploited.

Summary Status

Long-term potential catch (MSY)	=	Unknown
Biomass corresponding to MSY	=	Unknown
Minimum biomass threshold	=	Unknown
Stock Biomass in 1998	=	Unknown
F_{MSY}	=	Unknown
F_{TARGET}	=	Unknown
Overfishing definition	=	20% MSP (NEFMC) 40% MSP (ASMFC)
F_{1998}	=	Unknown
Age at 50% maturity	=	3.3 years, males 3.5 years, females
Size at 50% maturity	=	27.6 cm (10.9 in.), males 29.7 cm (11.7 in.), females
Assessment level	=	Index
Management	=	Northeast Multispecies FMP (NEFMC) FMP for Inshore Stocks of Winter Flounder (ASMFC)

$$M = 0.20$$

$$F_{0.1} = \text{Unknown}$$

$$F_{max} = \text{Unknown}$$

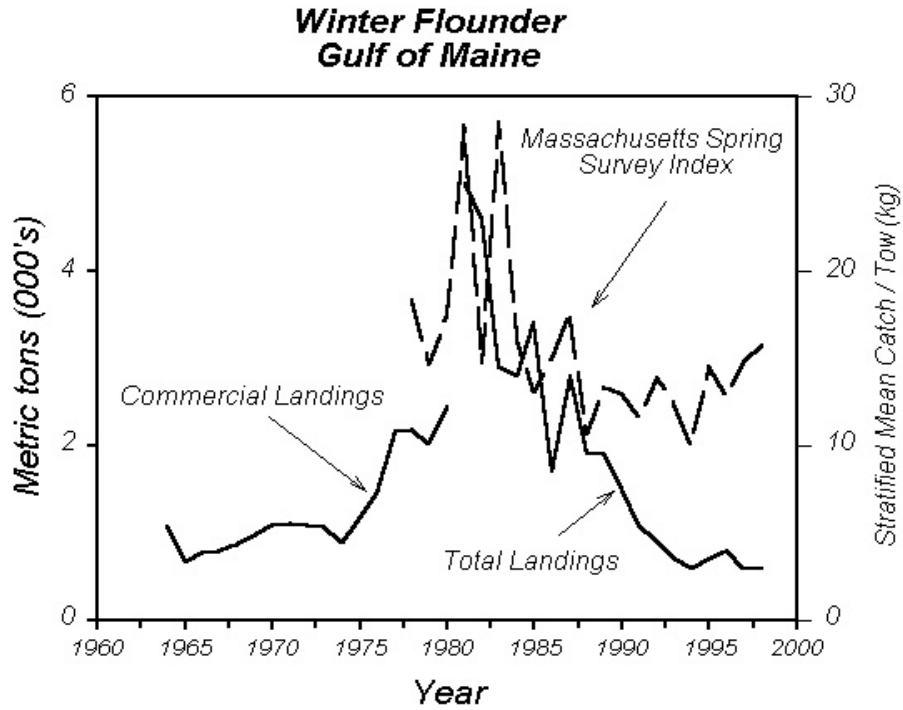


Table 11.1 Recreational and commercial landings (thousand metric tons)

Category	Year										
	1979-88 Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
U.S. recreational	1.4 ¹	0.6	0.4	0.1	0.1	0.1	0.1	<0.1	0.1	<0.1	<0.1
Commercial											
United States	1.9	1.3	1.1	1	0.8	0.6	0.5	0.7	0.7	0.6	0.6
Canada	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total nominal catch	3.3	1.9	1.5	1.1	0.9	0.7	0.6	0.7	0.8	0.6	0.6

¹1981-1988

Georges Bank

Commercial landings from the Georges Bank region increased from 1,900 mt in 1976 to near record high levels during 1980-1984 (average of 3,800 mt per yr). Between 1985 and 1988, landings averaged 2,400 mt per year, but then declined steadily to less than 800 mt in 1995. Landings increased to 1,300 mt in 1996 due to improved recruitment, and remained at this level through 1998. No recreational catches have been reported from this stock.

The NEFSC autumn bottom trawl survey biomass index declined from the mid-1970s until 1991, when it reached an all-time low of 0.1 kg per tow. Since 1991, indices have increased, reaching 1.8 kg/tow in 1996 and stabilizing between 1.5 and 1.6 kg/tow in 1997 and 1998. However, current survey indices remain significantly below former levels.

Stock size declined more or less continually from 26 million fish in 1982 to less than 9 million fish in 1993, increased to 13.6 million fish in 1995, and then declined to less than 6 million fish in 1998. Age 2 recruitment was relatively stable throughout the time period, with the larger 1980, 1985, 1987 and 1994 year classes being prominent (greater than 5 million fish at age 2). The 1996 year class, however, appears to be the lowest in the time series.

Spawning stock biomass declined from 8,000 mt in 1982 to less than 2,000 mt in 1994, but then increased to an average of 3,600 mt for 1996 and 1997. In the early 1980s, the spawning stock was composed of a wide range of ages, and young fish (ages 2 and 3) comprised less than 40% of the total spawning stock biomass. The age structure of the spawning stock biomass became truncated in the mid 1980s to mid 1990s, when the youngest mature ages (2 and 3) comprised 45% to 75% of the spawning stock biomass. Some broadening of the age structure is evident after 1994, but the age structure of the spawning stock remains truncated relative to historical levels.

The Georges Bank winter flounder stock declined to record low levels in the early 1990s, and was overexploited. Although there is some evidence to suggest that stock rebuilding has been initiated, stock levels remain well below the historic average. The status of this stock relative to the biomass level estimated to produce maximum sustainable yield is assessed based on a proxy developed from research vessel survey biomass indices, and overfishing is assessed based on a proxy for fishing mortality that evaluates the ratio of total catch to research vessel survey stock biomass indices. The biomass proxy value for 1998 (0.897) was below the minimum biomass threshold of 1.365, while the F_{1998} proxy value of 1.467 exceeded the $F_{\text{THRESHOLD}}$ level. Thus the most recent assessment indicates that the stock was overfished and that overfishing was occurring with reference to the Amendment 9 MSY-based harvest control rule.

Summary Status

Long-term potential catch (MSY)	=	2,700 mt
Biomass Corresponding to MSY ¹	=	B_{MSY} proxy = 2.73
Minimum Biomass Threshold	=	$\frac{1}{2} B_{MSY}$ proxy = 1.365
Stock Biomass proxy in 1998	=	0.897 (Implies stock was overfished)
F_{MSY} proxy ²	=	1.125
F_{TARGET} ³	=	0.74
$F_{TARGET98}$	=	0.00
Overfishing Definition	=	$F_{THRESHOLD\ 98}$ ⁴ = 0.00
F_{1998} proxy	=	1.467 (Implies overfishing was occurring)
Age at 50% maturity	=	1.9 years (both sexes)
Size at 50% maturity	=	25.6 cm (10.1 in.) male 24.9 cm (9.8 in.) females
Assessment level	=	Age Structured
Management	=	Northeast Multispecies FMP

$$M = 0.2$$

$$F_{0.1} = 0.17$$

$$F_{max} = 0.36$$

$$F_{1998} = 0.41^5$$

¹A NEFSC autumn survey biomass index value of 2.73 is used as a proxy for B_{MSY} .

²An exploitation index (catch / NEFSC autumn survey biomass index) equal to 1.125 is used as a proxy for F_{MSY} .

³ F_{TARGET} is defined as 75% of the F_{MSY} proxy when B_{MSY} proxy is greater than 2.73.

⁴ $F_{THRESHOLD} = F_{MSY}$ proxy = 1.125 when biomass exceeds B_{MSY} proxy; $F_{THRESHOLD}$ decreases linearly from 1.125 at B_{MSY} proxy of 2.73 to zero when B is $\frac{1}{2} B_{MSY}$ proxy (1.365).

⁵Fully-recruited F.

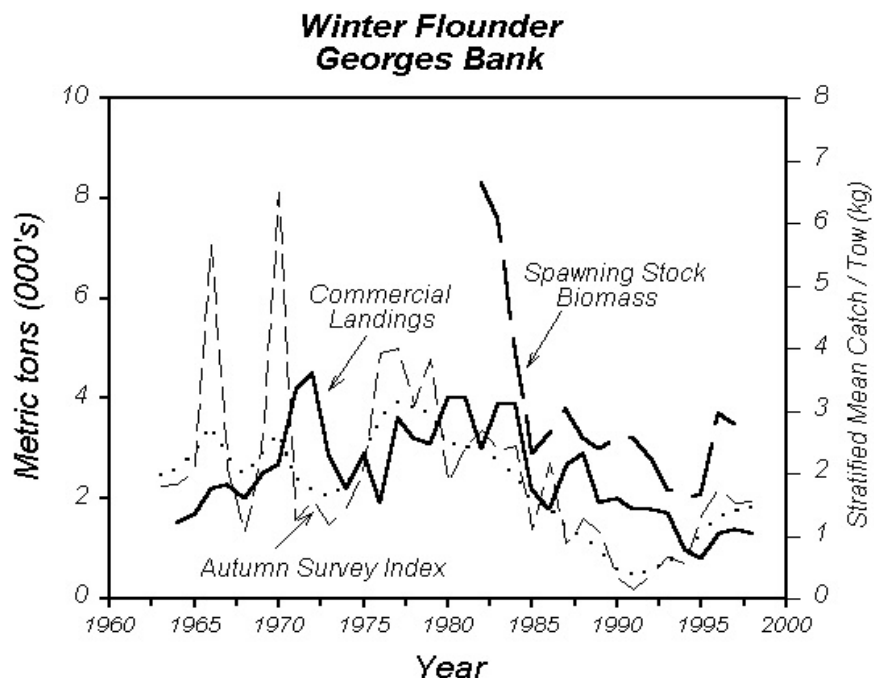


Table 11.2 Recreational and commercial landings (thousand metric tons)

Category	Year										
	1979-88 Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
U.S. recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	3.1	1.9	1.9	1.8	1.8	1.7	0.9	0.7	1.2	1.3	1.2
Canada	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	0.1	0.1	0.1	0.1	0.1
Other	-	-	-	-	-	-	-	-	-	-	-
Total nominal catch	3.1	1.9	2.0	1.8	1.8	1.7	1.0	0.8	1.3	1.4	1.3

Southern New England-Middle Atlantic

Commercial landings from the Southern New England to Mid-Atlantic area increased from roughly 4,000 mt in the mid-1970s, to more than 11,000 mt in 1981. Commercial landings have since declined steadily, while recreational catches increased from 1981 to 1985, and then declined. Combined recreational and commercial landings decreased to 2,800 mt in 1994, the lowest in the 1979-1998 time series. Combined landings have since been relatively stable, averaging about 3,600 mt during 1995-1998. Total catch including estimated commercial and recreational discards declined from 15,800 mt in 1984 to 3,100 mt in 1994 and averaged 3,900 mt from 1995-1998.

The NEFSC spring bottom trawl survey biomass index shows trends similar to those for commercial landings since about 1975, increasing through 1981 and thereafter declining. The 1993 survey index value was the lowest in the 29-year time series. Since then, the survey index has increased.

Virtual population analyses indicate that mean stock biomass (age 1+) declined from 34,100 mt in 1983 to a record low level of 8,000 mt in 1992. During 1981-1993, fully-recruited fishing mortality was very high, varying between 0.5 and 1.4. Reductions in fishing mortality, and improved recruitment, have contributed to rebuilding of stock biomass to 22,300 mt in 1998, which is about 80% of $B_{msy} = 27,800$ mt. Fishing mortality has been at or below 0.5 since 1993. The biomass weighted F of 0.19 in 1998 was lower than $F_{THRESHOLD98} = 0.36$. Thus, the stock was not in an overfished condition and overfishing was not occurring with reference to the Amendment 9 MSY-based harvest control rule.

Summary Status

Long-term potential catch (MSY)	=	10,200 mt
Biomass corresponding to MSY	=	$B_{MSY} = 27,800$ mt
Minimum biomass threshold	=	$\frac{1}{4}B_{MSY} = 7,000$ mt
Stock biomass in 1998	=	22,300 mt (Indicates stock was not overfished)
F_{MSY}^1	=	0.37
$F_{TARGET}^{1,2}$	=	0.24
$F_{TARGET98}^1$	=	0.24
Overfishing definition	=	$F_{THRESHOLD98}^{1,3} = 0.36$
F_{1998}^1	=	0.19 (Indicates overfishing was not occurring)
Age at 50% maturity	=	3.3 years, males 3.0 years, females
Size at 50% maturity	=	29.0 cm (11.4 in), males 27.6 cm (10.9 in), females
Assessment level	=	Age structured
Management	=	Northeast Multispecies FMP (NEFMC) FMP for Inshore Stocks of Winter Flounder (ASMFC)

$$M = 0.20$$

$$F_{0.1} = 0.22$$

$$F_{max} = 0.71$$

$$F_{1998} = 0.33^4$$

¹Biomass weighted

²The target fishing mortality to be used when stock biomass is greater than B_{MSY} was estimated as the 10th percentile of $F_{MSY} = 0.24$.

³ $F_{THRESHOLD} = F_{MSY} = 0.37$ on biomass when biomass = B_{MSY} . When total stock biomass is between $\frac{1}{2}B_{MSY}$ and B_{MSY} , a 10-year rebuilding strategy applies. When total stock biomass is between $B_{THRESHOLD} = (\frac{1}{4}B_{MSY})$ and $\frac{1}{2}B_{MSY}$, a 5-year rebuilding strategy applies. When biomass is below $\frac{1}{4}B_{MSY}$, $F_{THRESHOLD} = 0$.

⁴Fully recruited (age 4-6)

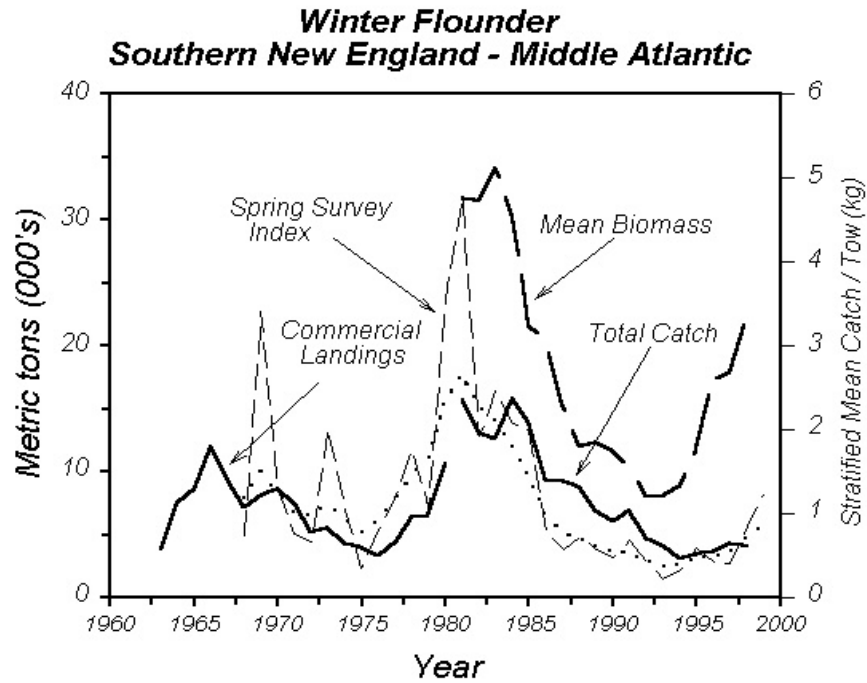


Table 11.3 Recreational and commercial catch (thousand metric tons)

Category	Year										
	1979-88 Average	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
U.S. recreational											
Landings	3.6 ¹	1.8	1.1	1.2	0.4	0.5	0.6	0.7	0.7	0.6	0.3
Discards	0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Commercial											
United States											
Landings	7.3	3.7	4.2	4.8	3.8	3.0	2.2	2.6	2.8	3.5	3.3
Discards	1.2	1.4	0.7	0.8	0.5	0.5	0.3	0.1	0.2	0.3	0.2
Canada ²	<0.1	<0.1	<0.1	<0.1	-	-	-	-	-	-	-
Total nominal catch ²	10.9	5.5	5.3	6.0	4.2	3.5	2.8	3.3	3.5	4.1	3.6

¹1981-1988

²Excludes discards

For further information

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