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Sea Scallops

by
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Sea scallops, *Placopecten magellanicus*, are found in western North Atlantic continental shelf waters from Newfoundland to North Carolina. North of Cape Cod, concentrations are generally scattered in shallow water less than 20 m (11 fathoms) deep. South of Cape Cod, sea scallops are normally found at depths between 40 and 200 m (22 to 110 fathoms). Commercial concentrations generally exist between 40 and 100 m (22 to 55 fathoms) in waters cooler than 20°C (68°F).

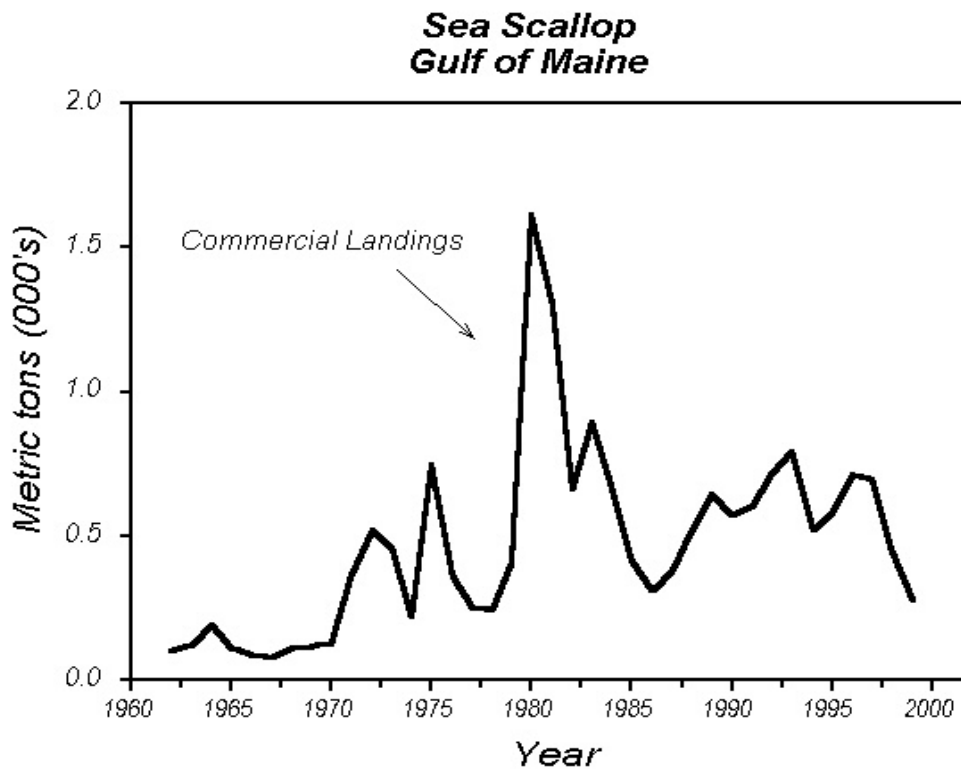
Principal U.S. commercial fisheries are conducted in inshore waters of the Gulf of Maine, on Georges Bank (west of the ICJ line), and in the Mid-Atlantic offshore region. Recreational fishing is insignificant, and takes place primarily in Maine where shallow-water scallop beds most commonly occur.

Scallops grow rapidly during the first several years of life. Between ages 3 and 5, scallops commonly increase 50 to 80% in shell height and quadruple their meat weight. During this time span, the number of meats per pound is reduced from greater than 100 to about 23. Maximum size is about 23 cm (9.0 in.) shell height, but scallops larger than 17 cm (6.7 in.) are rare. Sexual maturity commences at age 2, although scallops younger than age 4 probably contribute little to total egg production. Spawning occurs in late summer and early autumn; spring spawning may also occur, primarily in the Mid-Atlantic region. Eggs become buoyant after fertilization, and larvae remain in the water column for four to eight weeks before settling to the bottom.

The commercial fishery for scallops occurs year round, and is conducted using primarily dredges and otter trawls. The U.S. fishery is managed under the New England Fishery Management Council's Fishery Management Plan for Atlantic Sea Scallops (*Placopecten magellanicus*). Management measures include a moratorium on permits, days-at-sea restrictions, closed areas, and restrictions on gear and crew size. The Canadian fishery is managed using individual transferable quotas. The total U.S. nominal catch averaged 14,750 mt (meats) from 1987-1992 but declined sharply in the mid-nineties, and averaged 6,960 mt from 1994-1998. Three large areas of Georges Bank were closed to scallop fishing in December 1994 to protect groundfish resources. Later, in April 1998, two areas in the Mid-Atlantic were closed to protect undersized scallops present in these areas. Landings increased substantially in 1999. Total U.S. landings for 1999 were about 10,150 mt (meats), the highest level since 1992.

Gulf of Maine

Since 1987, U. S. landings have been relatively constant about an average of 600 mt (meats); the 1998 and 1999 totals were 455 and 280 mt, respectively. Canadian landings from the Gulf of Maine are negligible. More than 75% of the landings are typically taken in state territorial waters indicating continued dependence of the fishery on inshore scallop beds.



Georges Bank

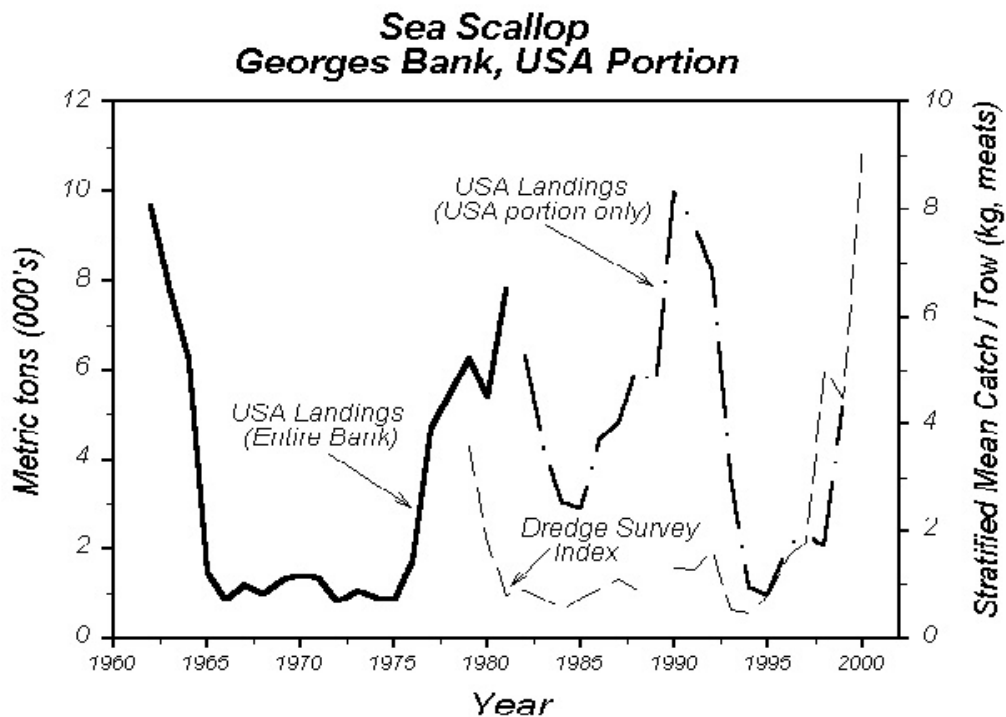
Total (U.S. and Canadian) landings from Georges Bank were 6,007 mt (meats) in 1998 and 8,854 mt (meats) in 1999, well below the 1987-1992 average of about 12,800 mt. Of the 1998 total, U.S. landings accounted for 34% (2,016 mt) while Canadian landings were 66% of the total (3,991 mt). In 1999, US landings (5,155 mt) were 58% of the total, and Canadian landings (3,699 mt) were 42%. This was the first year since 1993 that U.S. landings were higher than Canadian landings. Landings for the U.S. portion of Georges Bank have quintupled since 1995.

Since December 1994, about half of the U.S. portion of Georges Bank has been closed to scallop harvesting due to implementation of area closures to protect groundfish stocks. This appears to have contributed to an increase in sea scallop stock biomass. In June 1999, a portion of Closed Area II (south of 41° 30' N) was reopened to limited scallop fishing. This fishery was closely monitored by observers and via electronic reporting of daily catches. Approximately

2,700 mt (meats) of scallops were landed from this area before closure based on attainment of a yellowtail flounder bycatch limit. Portions of all three groundfish closed areas were opened to limited fishing in 2000.

The NEFSC sea scallop dredge survey index has increased over an order of magnitude since its 1994 low, and was at a record level of 9.1 kilograms per tow (meats) in the 2000 survey, above the B_{MSY} proxy biomass reference point of 8.16 kilograms per tow. Much of this increase was due to high levels of biomass in the groundfish closed areas, which contained about 80% of the total biomass in 2000. However, substantial increases have also been observed in the portions of Georges Bank outside these closed areas. The observed increase in stock biomass was due to area closures, effort reduction measures, and strong recruitment.

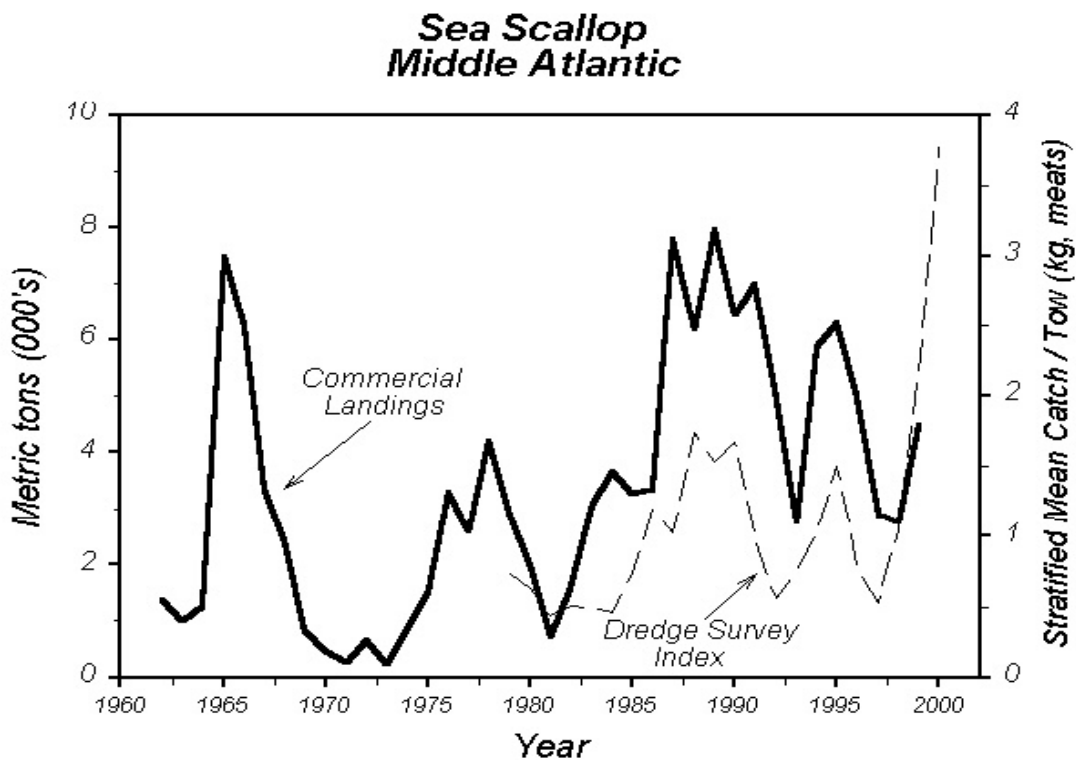
Fishing mortality in the U.S. portion of Georges Bank peaked in the late eighties and early nineties, and averaged about 1.5 (75% exploitation rate) between 1988 and 1993. Fishing mortality has declined substantially in recent years because of area closures, effort reduction measures, and a shift in effort to the Mid-Atlantic. Fishing mortality in 1999 was estimated at about 0.14 (12% exploitation rate), below the overfishing threshold of 0.24.



Middle Atlantic

The total nominal catch in 1999 was 4,653 mt. This was above the 1998 total of 2,948 mt, but still below the levels seen in the early to mid 1990s. The NEFSC sea scallop dredge survey index was

at low levels of about 0.5 kilograms per tow in the early eighties, and then peaked at a little over 1.5 kilograms per tow in 1988-1990. The index dropped to a low of about 0.5 kilograms per tow in 1992, rebounded to 1.5 kilograms per tow in 1995, only to fall again to 0.5 kilograms per tow in 1997. In 1998, two areas were closed to scallop fishing for three years to protect high concentrations of small scallops. The 1999 and 2000 surveys indicated a substantial increase in biomass, and the NEFSC sea scallop dredge survey index reached a record high of 3.8 kilograms per tow in 2000, nearly equal to the B_{MSY} proxy biomass reference point of 3.9 kilograms per tow. This sharp increase was due to the area closures, good recruitment, and to effort reduction measures. About half the biomass in 2000 was located in the closed areas. Fishing mortality averaged about 1.2 (67% exploitation rate) between 1989 and 1996, and has since declined continuously. The estimated fishing mortality for 1999 of 0.43 (33% exploitation rate) was the lowest in twenty years, but was still above the overfishing threshold of 0.24.



Closed Areas

The rapid growth potential of sea scallops and the implications of reduced fishing mortality for management have been demonstrated in the closed areas of the Georges Bank and Mid-Atlantic Bight regions. Between 1994 and 2000, biomass, as measured by research vessel survey indices, increased over twentyfold in the groundfish closed areas of Georges Bank. In the two years since the closures in the Mid-Atlantic Bight have been in effect, the biomass of scallops in these areas increased over threefold. Several cooperative surveys conducted with commercial fishing vessels since 1998 not only corroborated the findings of the NEFSC research vessel survey but also

provided valuable insights into the fine-scale distribution of scallops. Moreover, depletion experiments and underwater photography permitted estimation of dredge efficiency and selectivity of commercial dredges. The cooperative studies involved scientists from academia, government and commercial fishermen in a unique partnership. Continuation of such studies is likely to become an integral part of future management, particularly as the New England Fishery Management Council moves toward area-based management policies. Area closures have demonstrated the value of diminished fishing effort as a means of increasing stock biomass and reducing growth overfishing. Recent good recruitment suggests that the closed areas may also be acting as a source of recruitment, but this has yet to be proven. A new management system (Amendment 10) is currently under development that would implement a systematic area rotation policy.

For further information:

NEFSC [Northeast Fisheries Science Center]. 1997. [Report of the] 23rd Northeast Regional Stock Assessment Workshop (23rd SAW). Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. 97-05. 191 p.

NEFSC [Northeast Fisheries Science Center]. 1999. [Report of the] 29th Northeast Regional Stock Assessment Workshop (29th SAW). Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. 99-14. 347 p.

NEFSC [Northeast Fisheries Science Center]. 2001. [Report of the] 32nd Northeast Regional Stock Assessment Workshop (32nd SAW). Stock Assessment Review Committee (SARC) consensus summary of assessments. Northeast Fish. Sci. Cent. Ref. Doc. (In review)

Summary Status

Long-term potential catch (MSY) ¹	=	22,000 mt (Georges Bank, U.S. portion) 8,500 mt (Mid-Atlantic)
Biomass corresponding to MSY ²	=	90,000 mt (Georges Bank) 35,000 mt (Mid-Atlantic)
Minimum biomass threshold	=	$(1/4)B_{MSY}$
Stock biomass in 2000 ³	=	100,000 mt (Georges Bank) 34,000 mt (Mid-Atlantic) (implies stocks were not overfished)
F_{MSY}	=	0.24 (F_{MAX})
Overfishing definition	=	$F_{THRESHOLD}^4 = 0.24$
F_{1999}	=	0.1 (Georges Bank) (implies overfishing was not occurring) 0.4 (Mid-Atlantic) (implies overfishing was occurring)
Age at 50% maturity	=	2 to 4 years
Size at 50% maturity	=	60 - 90 mm (2.4-3.5 in)
Assessment level	=	Index
Management	=	NEFMC Sea Scallop FMP (Amendment 7)

$$M = 0.1 \quad F_{MAX} = 0.24$$

¹ Calculated as F_{MAX} times the swept area biomass corresponding to B_{MAX} . F_{MAX} and B_{MAX} are proxies for F_{MSY} and B_{MSY} obtained by yield-per-recruit analysis assuming median historical recruitment.

² Calculated as corresponding to survey biomass values of $B_{MAX} = 8.16$ kg/tow (Georges Bank), and 3.9 kg/tow (Mid-Atlantic), assuming a survey dredge tow path area of 8' times 1 nm, 50% dredge efficiency in Georges Bank and 70% in the Mid-Atlantic.

³ Assumes a survey dredge tow path area of 8' times 1 nm, 50% dredge efficiency in Georges Bank and 70% in the Mid-Atlantic.

⁴ $F_{THRESHOLD}$ is the F_{MSY} proxy $F_{MAX} = 0.24$ whenever biomass exceeds B_{MSY} , declining linearly to zero as biomass decreases to $(1/4)B_{MSY}$. Whenever biomass falls below $(1/4)B_{MSY}$, fishing mortality should be reduced to allow rebuilding to B_{MSY} within a ten year period.

Table 33.1 Recreational and commercial landings (thousand metric tons, meats)

Category	Year										
	1980-89 average	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
U.S. recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
Gulf of Maine											
United States	0.7	0.6	0.6	0.7	0.8	0.5	0.7	0.8	0.7	0.5	0.3
Canada	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total	0.7	0.6	0.6	0.7	0.8	0.5	0.7	0.8	0.7	0.5	0.3
Georges Bank ^{1,2}											
United States	5.1	10.1	9.4	8.4	3.7	1.1	1.0	2.1	2.4	2.1	5.2
Canada	4.7	5.2	5.8	6.1	6.2	5.0	2.0	3.0	4.3	4.0	3.7
Total	9.8	15.3	15.2	14.5	9.9	6.1	3.0	5.1	6.7	6.1	8.9
Mid-Atlantic											
United States	4.0	6.4	7.0	5.0	2.8	5.9	6.3	5.0	2.9	2.9	4.7
Total nominal catch ¹	14.5	22.3	22.9	20.2	13.5	12.5	10.0	10.9	10.3	9.5	13.9

¹ Includes Canadian portion of Georges Bank

² Includes Southern New England