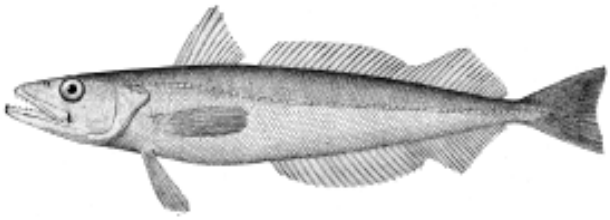

Last Revised: January 2001

Summary Status

Landings and Abundance Trends

Landings Data

Silver Hake

by
Jon Brodziak

The silver hake or whiting, *Merluccius bilinearis*, is a swiftly swimming gadid that ranges from Newfoundland to South Carolina. Silver hake are important fish predators that also feed on shrimp and squid. In U.S. waters, two stocks have been identified from morphological differences: the northern silver hake stock, which inhabits Gulf of Maine - Northern Georges Bank waters, and the southern silver hake stock, which inhabits Southern Georges Bank-Middle Atlantic Bight waters. Silver hake migrate in response to seasonal changes in water temperatures, moving towards shallow water in the spring, where spawning occurs during late spring and early summer, and returning to deeper waters in autumn. During summer, portions of both stocks can be found on Georges Bank. During winter, fish in the northern stock move to deep basins of the Gulf of Maine, while fish in the southern stock move to outer continental shelf and slope waters.

Major spawning areas include the coastal region of the Gulf of Maine from Cape Cod to Grand Manan Island, southern and southeastern Georges Bank, and the southern New England area south of Martha's Vineyard. Peak spawning occurs earlier in the south (May to June) than in the north (July to August). Over one-half of age-2 fish (20 to 30 cm, 8 to 12 in.), and virtually all age-3 fish (25 to 35 cm, 10 to 14 in.) are sexually mature. Silver hake grow to a maximum length of over 60 cm. Ages up to 14 years have been observed in U.S. waters, but few fish older than age 6 have been observed in recent years.

Due to its abundance and availability, silver hake have been important to U.S. and Canadian fishermen as well as to distant-water fleets. Following entrance of distant-water fleets to the fishery in 1962, nominal catches from both stocks increased rapidly to a peak of more than 350,000 mt in 1965, but declined to only 55,000 mt by 1970. Landings then increased to 137,000 mt in 1973 and then declined sharply with increased restrictions on foreign effort and inception of the Magnuson Fishery Conservation and Management Act (MFCMA) in 1977. Prior to MFCMA, distant-water fleets accounted for about 49% and 87% of total landings for the northern and southern stocks, respectively. Fishing activity by distant-water fleets ceased after 1977 for the northern stock, but foreign exploitation of the southern stock continued until 1987, primarily as bycatch in the squid fishery. U.S. landings during the last decade have been stable, but lower than in the early years of the fishery, averaging about 16,000 mt per year.

The otter trawl remains the principal gear used in the U.S. fishery. Recreational catches since 1985 have been low. Silver hake are managed under the New England Fishery Management Council's Multispecies Fishery Management Plan ("nonregulated multispecies" category).

Northern Stock

The NEFSC autumn bottom-trawl survey biomass index declined during the period of heavy exploitation by distant-water fleets, reaching a minimum in 1967-68. With the appearance of the strong 1973 and 1974 year classes, biomass indices increased during the mid-1970s, but declined slightly during the late 1970s. Biomass indices have again increased since 1980 and recent recruitment appears to be at or above that of the mid-1970s.

During 1973-1982, fishing mortality rates on fully recruited fish (age 3+) derived from virtual population analysis or VPA fluctuated between 0.38 and 1.1, and generally increased from 1982 (0.45, 30% exploitation rate) through 1988 (0.70, 42% exploitation rate). Although VPA-based estimates are not available for subsequent years, total mortality estimates based on NEFSC survey abundance indices suggest that fishing mortality during 1993-1995 exceeded the overfishing threshold.

Substantial mortality of juvenile silver hake has occurred through discarding in the large mesh and small mesh otter trawl fisheries and in the northern shrimp fishery. Discard estimates during 1989-1992 ranged from 1,700 mt to 7,200 mt (17 million to 76 million fish) per year. High juvenile discard mortality is a cause for concern because it can diminish future yields and spawning potential.

Bottom-trawl survey indices show that stock biomass has fluctuated over the past 15 years, but has remained relatively high. In 1999, the northern stock biomass index was almost two times the current proxy for stock biomass at MSY. Thus, the northern stock was not overfished in 1999. However, apparent increases in recruitment during recent years have not expanded the age composition of this stock as would be expected, and older northern silver hake remain relatively rare.

Southern Stock

The NEFSC autumn bottom trawl survey biomass index has declined by more than 50% since 1985, and survey indices have been very low since 1995. Between 1955 and 1962, fishing mortality was relatively low, ranging from 0.09 to 0.41 (average = 0.24, 18% exploitation rate). With increased effort by distant-water fleets, fishing mortality increased rapidly to 0.98 in 1965. Fishing mortality decreased to 0.5 (33% exploitation rate) during 1978-1980 and then again increased to over 1.0 (54% exploitation rate) during 1983-1987. Although VPA-based estimates of fishing mortality and stock size are not available from 1988 onward, total mortality estimates based on NEFSC survey data suggest that fishing mortality exceeded the overfishing threshold during 1993-1995.

As in the northern stock, significant mortality of juvenile southern silver hake has occurred

through discarding in the large mesh and small mesh otter trawl fisheries. Annual discard estimates over the 1989-1992 period ranged from 1,300 mt to 10,000 mt (10 million to 81 million fish) per year. Excessive discard mortality on juveniles may severely limit opportunities to rebuild the southern silver hake stock.

NEFSC bottom trawl survey indices show that stock abundance is low and has not improved in recent years. Age structure of the southern silver hake stock is severely truncated, with few fish older than age 4. In 1999, the southern stock biomass index was roughly 10% below the minimum biomass threshold and less than one-half of the B_{MSY} proxy value. Thus, the southern silver hake stock was overfished in 1999. The index has remained below B_{MSY} proxy since 1991.

For further information

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

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Summary Status - Northern Stock

Long-term potential catch (MSY)	=	Unknown
Biomass corresponding to MSY[1]	=	B_{MSY} proxy = 6.63 kg per tow
Minimum biomass threshold	=	$^1/_2$ B_{MSY} proxy = 3.31 kg per tow
Stock biomass in 1999[2]	=	13.1 kg per tow (Implies stock was not overfished)
F_{MSY}[3]	=	0.41
F_{TARGET}	=	Not defined (less than $F_{0.1}$)
Overfishing definition	=	$F_{THRESHOLD}$[3] = 0.41
F_{1999}	=	Unknown
Age at 50% maturity	=	1.7 years (both sexes)
Size at 50% maturity	=	22.3 cm (8.8 in., males) 23.1 cm (9.1 in.,females)
Assessment level	=	Index
Management	=	Multispecies FMP

M=0.4 **$F_{0.1}$=0.41**

[1] Proxy based on autumn bottom trawl survey average for 1973-1982.

[2] Three-year moving average of the NEFSC autumn survey weight per tow index, 1997-1999.

[3] Current proxy for F_{MSY} is $F_{0.1}$ = 0.41.

Summary Status - Southern Stock

Long-term potential catch (MSY)	=	Unknown
Biomass corresponding to MSY [1, 2]	=	B_{MSY} proxy = 1.78 kg per tow
Minimum biomass threshold [2]	=	$^1/_2$ B_{MSY} proxy = 0.89 kg per tow
Stock biomass in 1999 [3]	=	0.78 kg per tow (Implies stock was overfished)
F_{MSY} [4]	=	0.39
F_{TARGET}	=	Not defined (less than $F_{0.1}$)
Overfishing definition	=	$F_{THRESHOLD}$ [4] = 0.39
F_{1999}	=	Unknown
Age at 50% maturity	=	1.6 years (both sexes)
Size at 50% maturity	=	22.7 cm (8.9 in.), males 23.2 cm (9.1 in.), females
Assessment level	=	Index
Management	=	Multispecies FMP

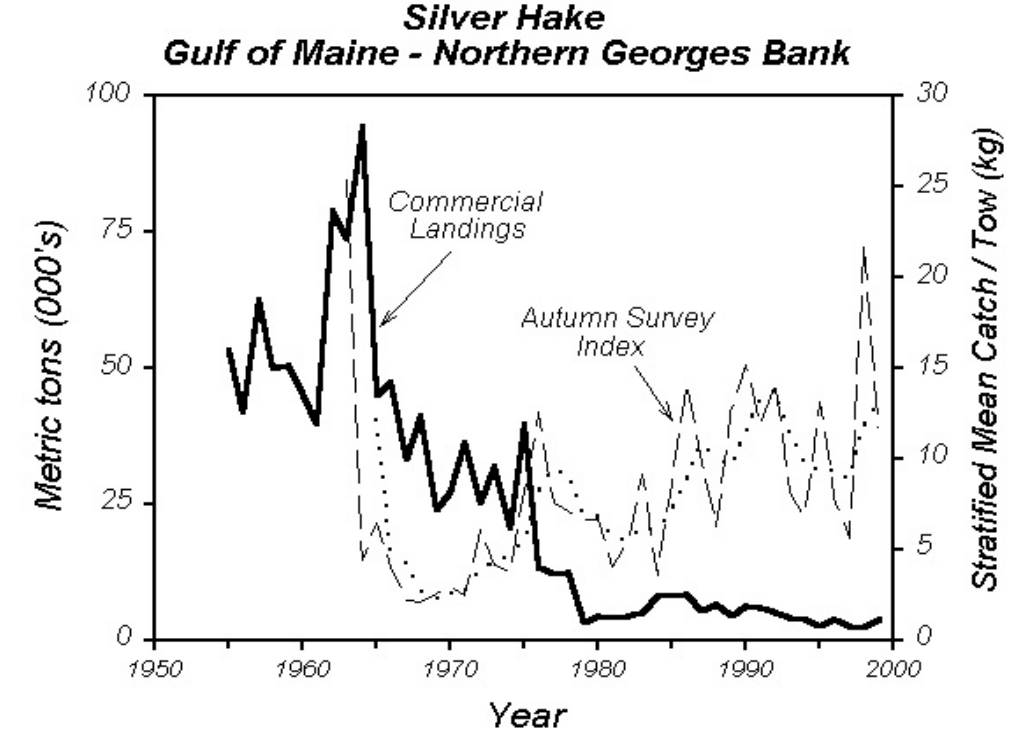
M = 0.4 **$F_{0.1}$ = 0.39**

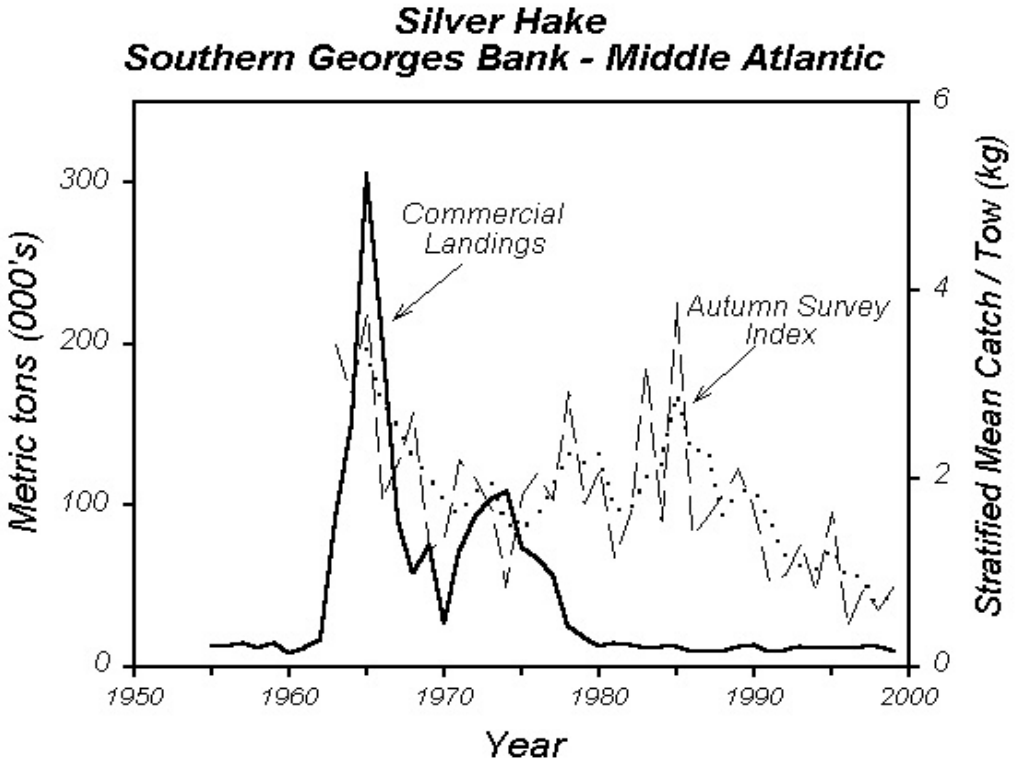
[1] Proxy based on autumn bottom trawl survey average for 1973-1982.

[2] Recomputed from original value (SAW 32).

[3] Three-year moving average of the NEFSC autumn survey weight per tow index, 1997-1999.

[4] Current proxy for F_{MSY} is $F_{0.1}$ = 0.39.


Silver Hake
Gulf of Maine - Northern Georges Bank
Metric tons (000's)
Stratified Mean Catch / Tow (kg)
Commercial Landings
Autumn Survey Index
Year
0
25
50
75
100
0
5
10
15
20
25
30
1950
1960
1970
1980
1990
2000


Silver Hake
Southern Georges Bank - Middle Atlantic
Metric tons (000's)
Stratified Mean Catch / Tow (kg)
Commercial Landings
Autumn Survey Index
Year
0
100
200
300
0
2
4
6
1950
1960
1970
1980
1990
2000

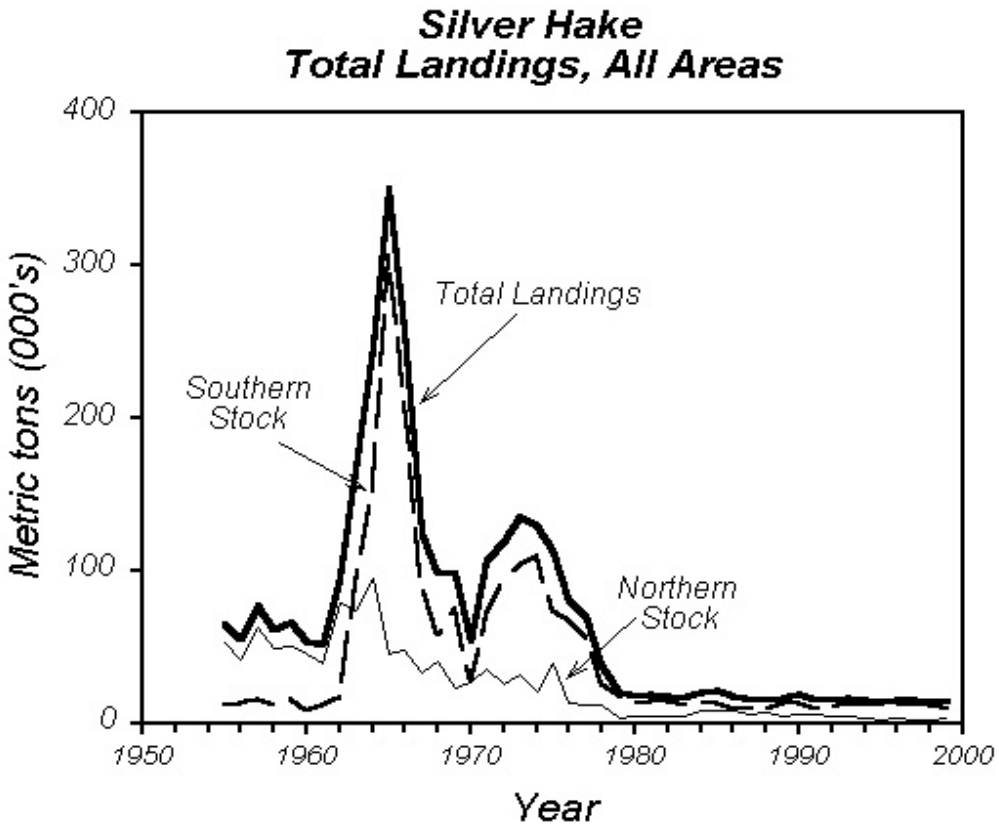


Table 4.1 Recreational catches and commercial landings (thousand metric tons)

		Year									
Category	**1980-89 average**	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
U.S. recreational	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	18.5	20.0	16.1	15.6	17.3	16.1	14.7	16.2	15.6	15.0	14.1
Canada	-	-	-	-	-	-	-	-	-	-	-
Other	1.0	-	-	-	-	-	-	-	-	-	-
Total nominal catch	19.6	20.0	16.1	15.6	17.3	16.1	14.7	16.2	15.6	15.0	14.1