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Atlantic Mackerel

by

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Distribution, Biology and Management

Atlantic mackerel, *Scomber scombrus*, is a fast swimming, pelagic, schooling species distributed in the Northwest Atlantic between Labrador and North Carolina. There are two major spawning components in the population: a southern group that spawns primarily in the Mid-Atlantic Bight during April and May, and a northern group that spawns in the Gulf of St. Lawrence in June and July. Both groups winter between Sable Island (off Nova Scotia) and Cape Hatteras in waters generally warmer than 7°C (45°F), with extensive northerly (spring) and southerly (autumn) migrations to and from spawning and summering grounds (Figure 23.1). The two groups are managed as a unit stock. Maximum observed size in recent years is about 42 cm (16.5 in) in length and 1.0 kg (2.2 lb) in weight. Sexual maturity begins at age 2 and is usually complete by age 3. Maximum age is about 20 years.

Mackerel are subjected to seasonal fisheries, both commercial and recreational, throughout most of their range. U.S. commercial landings are taken primarily between January and May in southern New England and Mid-Atlantic coastal waters, and between May and December in the Gulf of Maine. U.S. recreational catches occur mainly between April and October. Canadian commercial landings have typically been taken off Nova Scotia, in the Gulf of St Lawrence, and Newfoundland between May and November.

The U.S. fishery is managed using annual quotas under the Mid-Atlantic Fishery Management Council's Atlantic Mackerel, Squid, and Butterfish Fishery Management Plan. The information provided herein reflects the results of the most recent peer-reviewed assessment for Atlantic mackerel (NEFSC 2006).

The Fishery

Atlantic mackerel were heavily exploited by distant water fleets during the late 1960s-early 1970's. Total landings averaged 350,000 mt during 1970-1976 but decreased to less than 50,000

mt during 1978-1984 (Table 23.1, Figure 23.2). Landings in Canadian waters remained relatively stable at an average of 24,000 mt during 1968-2000, where landings in US waters increased during 1985-1991 to an average of 76,000m mt, with the advent of a joint venture fishery in the Mid-Atlantic region. Recently both USA and Canadian landings have increased due to improved demand. U.S. landings increased from 5,646 mt in 2000 to 53,724 mt in 2004; Canadian increased from 13,383 mt in 2000 to 51,444 mt in 2004, declining to 41,234 mt in 2005. USA recreational landings averaged 1,344 mt during 1990-2000, declined to only 467 mt in 2004, and then increased again to 1,042 mt in 2005.

Many age groups were present in the mackerel landings during the late 1960s and early 1970s, but the age structure of the landings became very truncated after the stock collapsed in the late 1970s. As the stock recovered in the late 1980s and early 1990s, the age distribution expanded and age groups up to 10 were again represented in the landings. Older fish have not been present in the landings during the last several years, but this is mostly due to an availability problem (Figure 23.3).

Research Vessel Survey Indices

NEFSC spring survey biomass indices increased during 1980-2000 but have since declined a bit (Figure 23.4).

Several large cohorts were produced in the stock during 1968-2005 (Figure 23.5). The 1967, 1982, and 1999 cohorts were relatively strong. Moderate year-classes and expansion of the age structure are apparent during the late 1980s through 1998. Large catches at age 1 and 2 for mackerel have dominated the survey catches in recent years. Recent surveys also show an apparent lack of older fish.

Assessment Results

Fishing mortality (ages 4-6, unweighted) was high during 1969-1975, peaking at 0.54 in 1975 (Figure 23.6), and then sharply declined to 0.05 in 1978 followed by a very low and stable period during 1979-1986. Fishing mortality increased very slightly in 1988 to 0.09, (coincident with the joint venture (JV) fishery that operated for several years), and then declined and has since been below 0.06. Spawning biomass peaked in 1972 at 1.7 million mt, declined until 1976, and has increased thereafter reaching a record high of 2.3 million mt in 2003-2004 (Figure 23.7). Recruitment ranged between 0.1-5.8 billion fish during 1962-2004 and averaged 1.1 billion fish (Figure 23.8). Three large year-classes were produced during this period, the 1967, 1982, and 1999 cohorts. The 2003 and 2004 cohorts appear to be above average but their magnitude is still uncertain.

Biological Reference Points

Yield and spawning stock biomass reference points are shown in Table 23.2. These reference points were re-estimated in the most recent (fall 2005) assessment as $F_{0.1} = 0.25$ and $F_{40\%} = 0.24$ (NEFSC, 2006).

The spring stock recruitment relationship for Atlantic mackerel is highly variable with strong year classes produced at both high and low spring stock levels. Survival ratios have been relatively low during 1962-2005 with the exception of the four largest year-classes (Figure 23.9). Recent R/S ratios have been very low except for the 1999 year-class.

MSY reference points were estimated in the most recent (Fall 2005) assessment and MSY = 89,000 mt, $SSB_{msy} = 644,000$ mt, and $F_{msy} = 0.16$ (NEFSC, 2006).

Summary

Spawning stock biomass has increased steadily since 1978, reaching a recent high of 2.3 million mt in 2004, for B_{MSY} (644,000 mt). Fishing mortality has remained very low (below $F= 0.06$) since 1992. Therefore, the stock is not overfished and overfishing is not occurring.

Table 23.1. Commercial and recreational landings of Atlantic mackerel (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	2	1	2	1	1	1	2	1	1	<1	1
Commercial											
United States	14	16	15	14	12	6	12	26	34	54	41
Canada	24	20	21	19	17	13	24	34	44	51	35
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	40	38	38	34	30	20	38	62	79	105	77

Table 23.2. Yield and MSY (SSB based) reference points for Atlantic mackerel.

Yield and SSB per Recruit-based Reference Points

$$F_{0.1} = 0.25$$

$$F_{40\%} = 0.24$$

MSY-based Reference Points

$$MSY = 89,000 \text{ mt}$$

$$SSB_{msy} = 644,000 \text{ mt}$$

$$F_{msy} = 0.16$$

For further information

Anderson, E. D., and A. J. Paciorkowski. 1980. A review of the Northwest Atlantic mackerel fishery. Rapp. P.-V. Reun. Cons. Int. Explor. Mer 177:175-211.

Gregoire, F., C. Levesque, J. Guerin, L. Hudon, and J. Lavers. 2003. Atlantic mackerel (*Scomber scombrus* L.) fishery and biology in NAFO Subarea 3 and 4 in 2002. DFO CSAS Res. Doc. 2003/085. 36 p.

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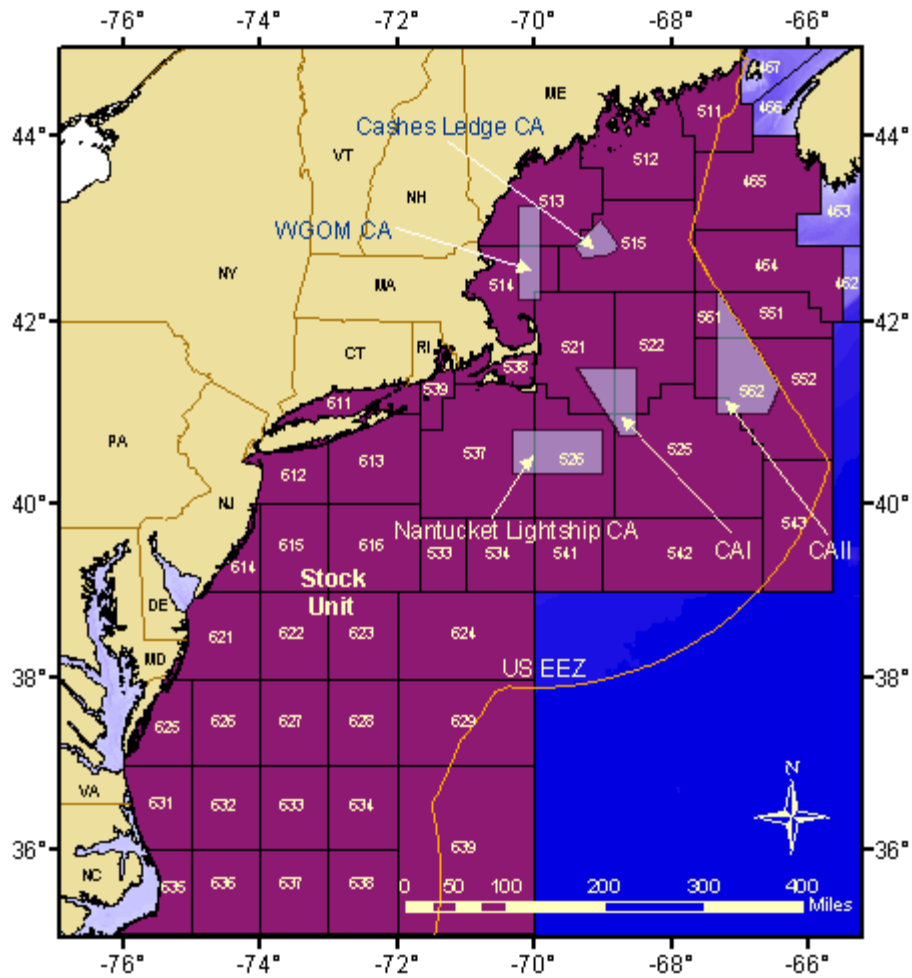


Figure 23.1. Statistical areas used to define the Atlantic mackerel stock.

Atlantic Mackerel Total Commercial Landings

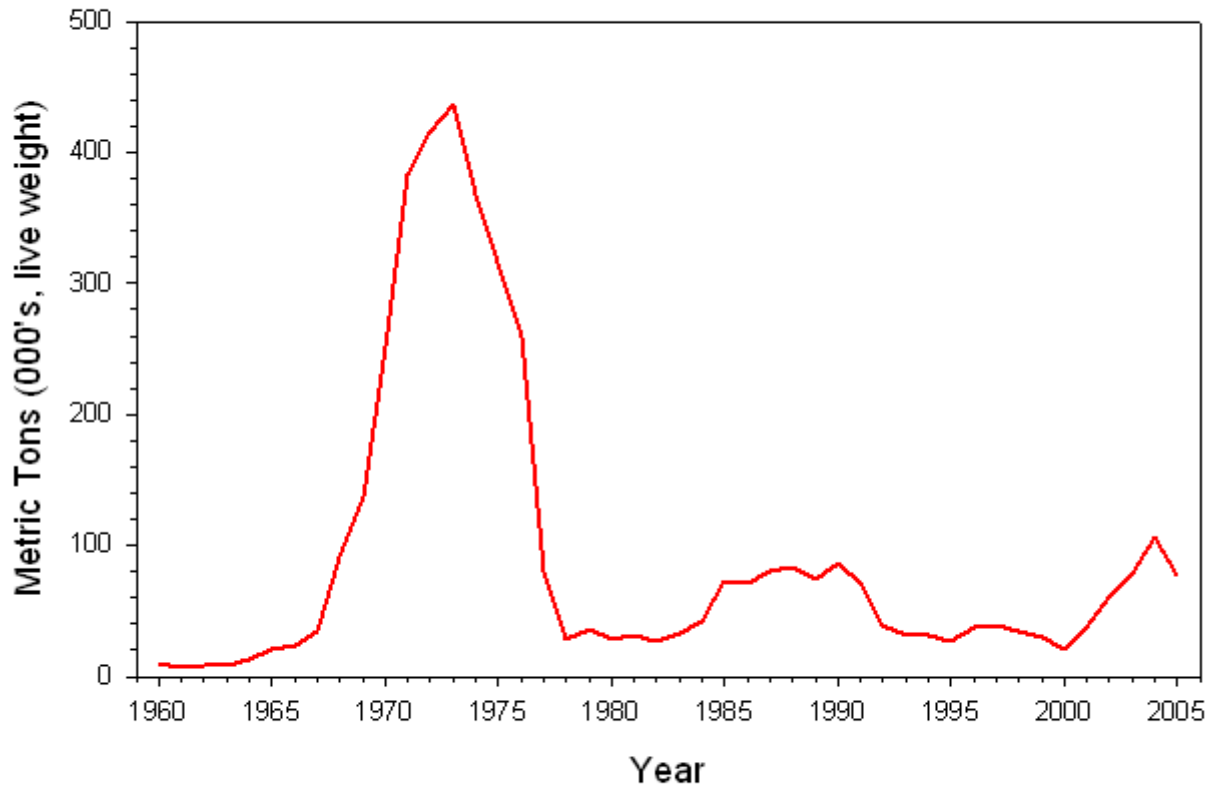


Figure 23.2. Total commercial landings of Atlantic mackerel (NAFO SA 2-6), 1960-2005.

Atlantic Mackerel Commercial Landings by Age

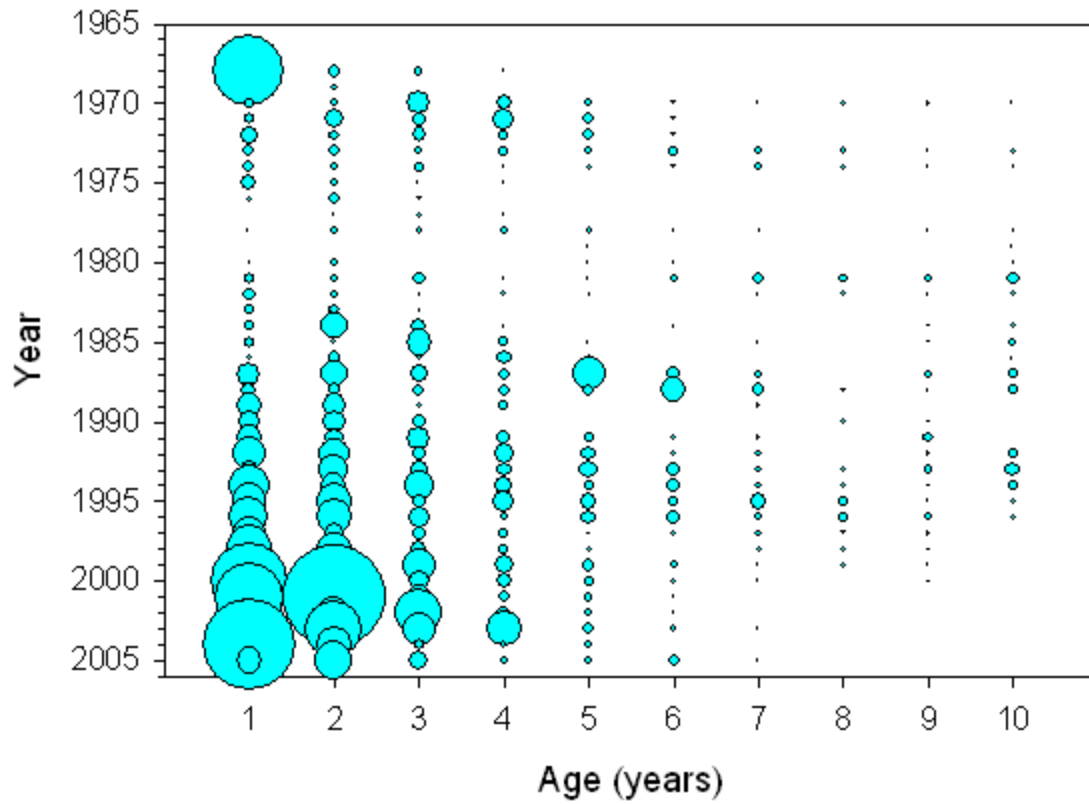


Figure 23.3. Age structure of total Atlantic mackerel landings, 1968-2005.

Atlantic Mackerel NEFSC Spring Biomass Indices

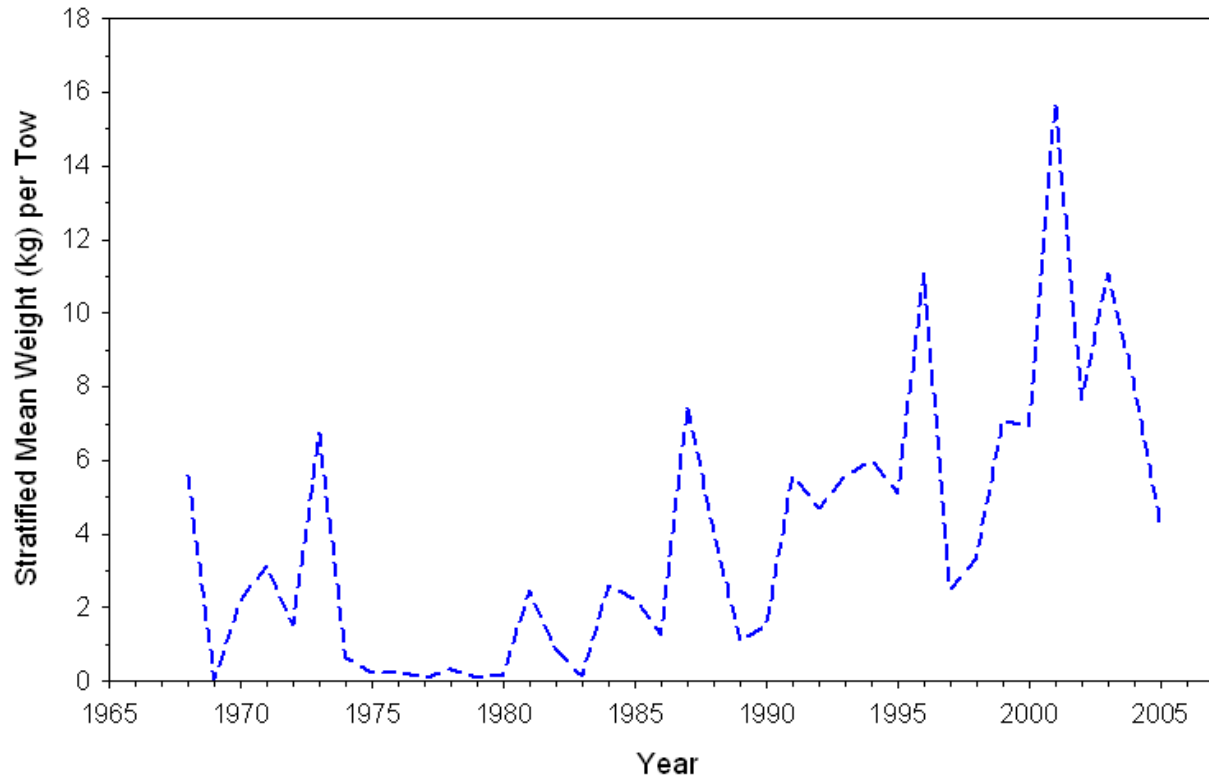


Figure 23.4. Biomass indices (stratified mean weight per tow) for Atlantic mackerel from NEFSC spring research vessel surveys.

Atlantic Mackerel Spring Survey Indices by Age

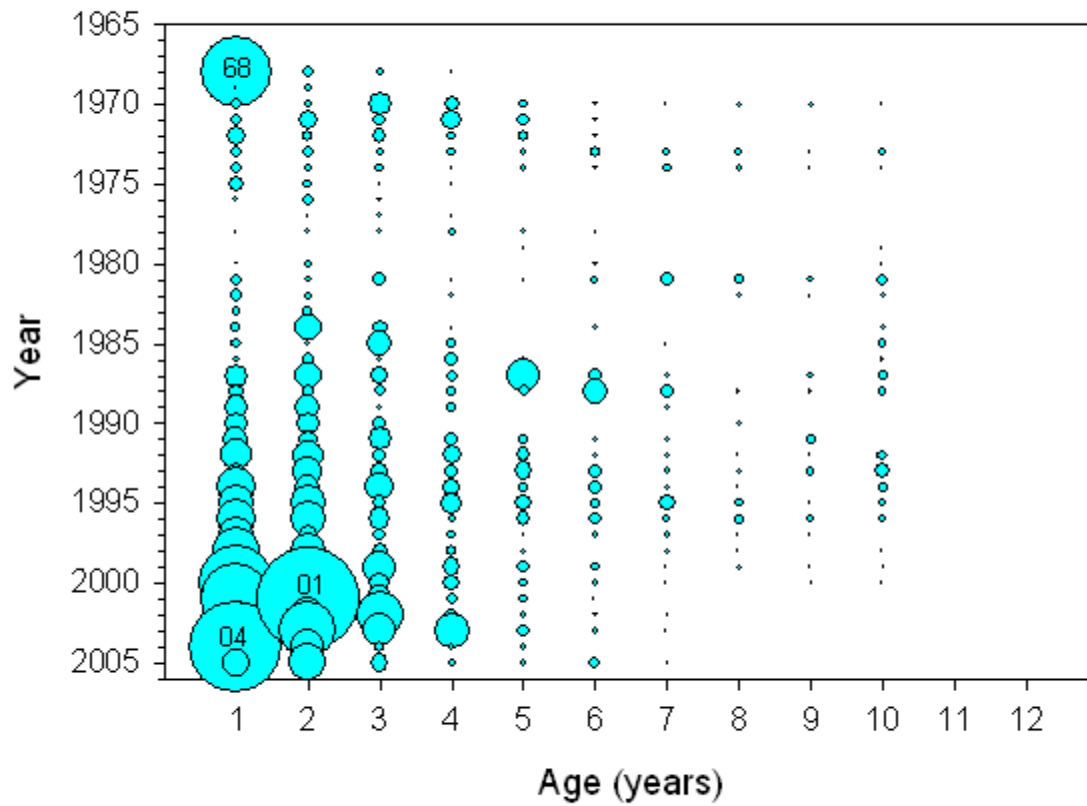


Figure 23.5. Age structure of the Atlantic mackerel population, 1968-2005.

Atlantic Mackerel Trends in Catch and Fishing Mortality

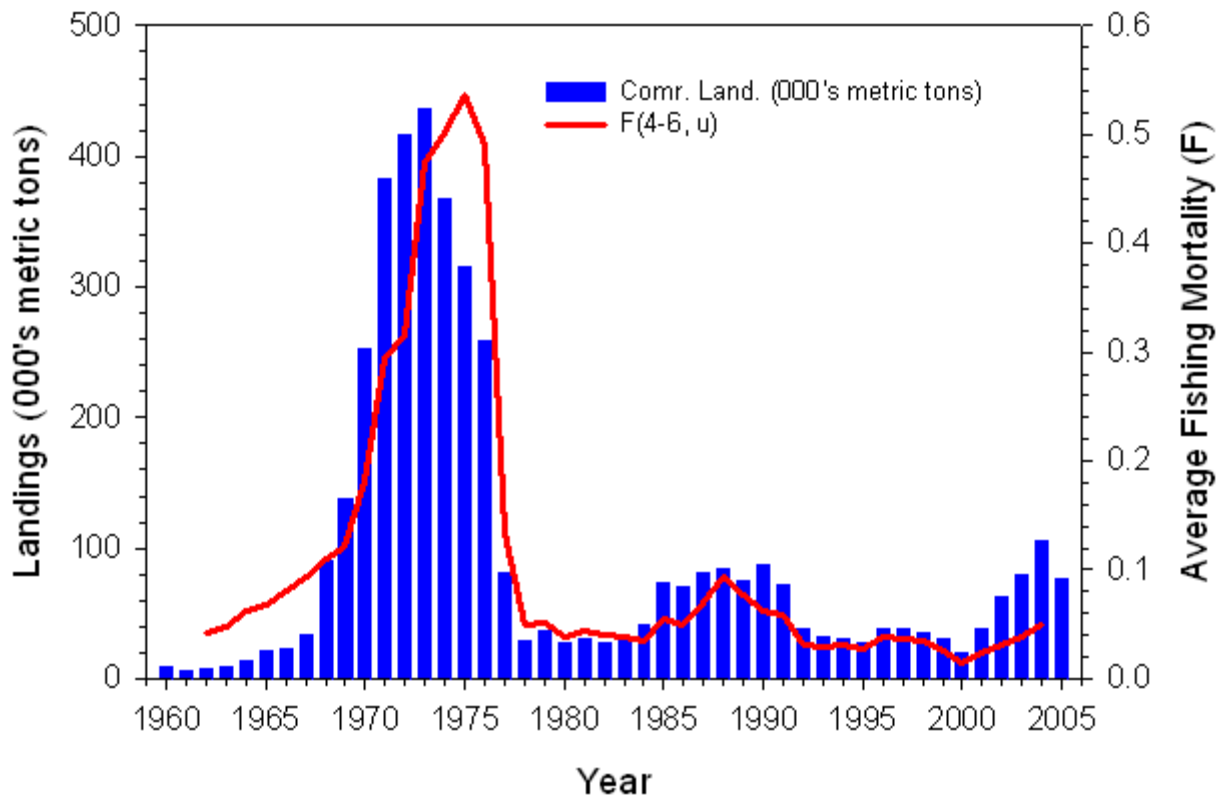


Figure 23.6. Trends in catch and fishing mortality for Atlantic mackerel.

Atlantic Mackerel Trends in Recruitment and Biomass

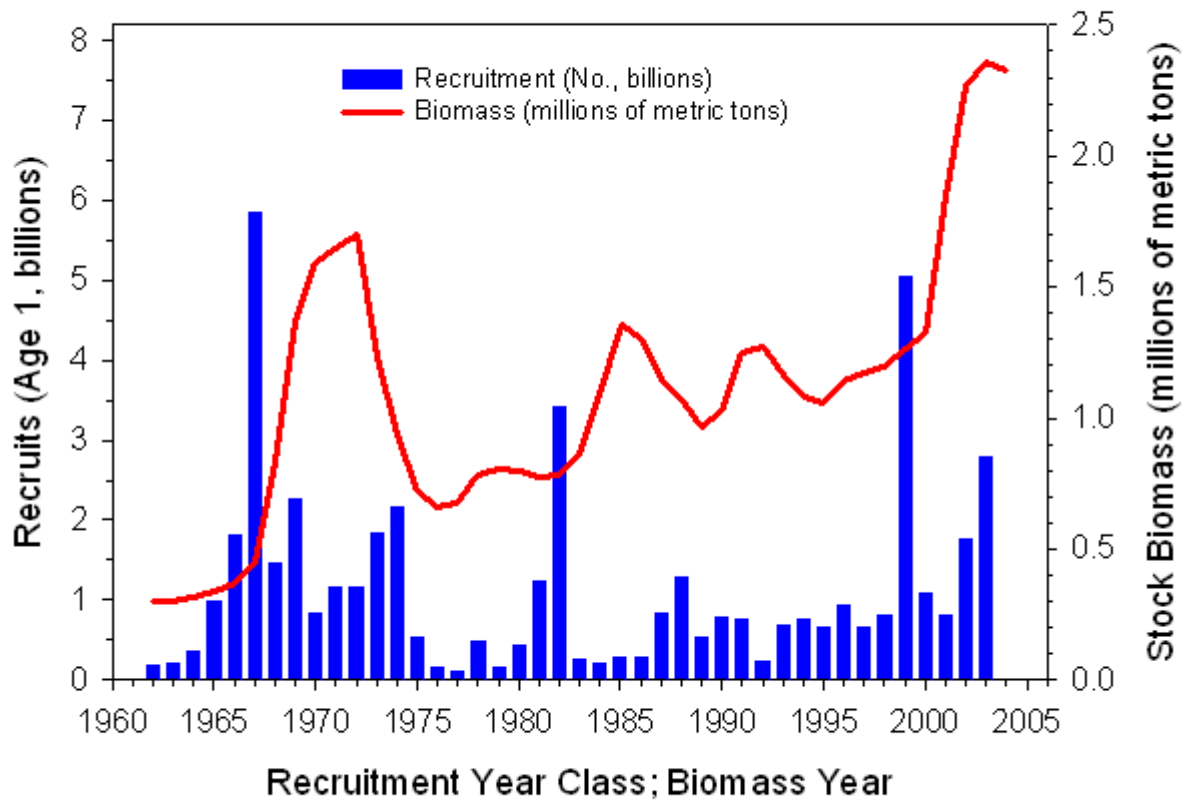


Figure 23.7. Trends in recruitment (age 1) and spring biomass for Atlantic mackerel.

Atlantic Mackerel Stock-Recruitment Plot

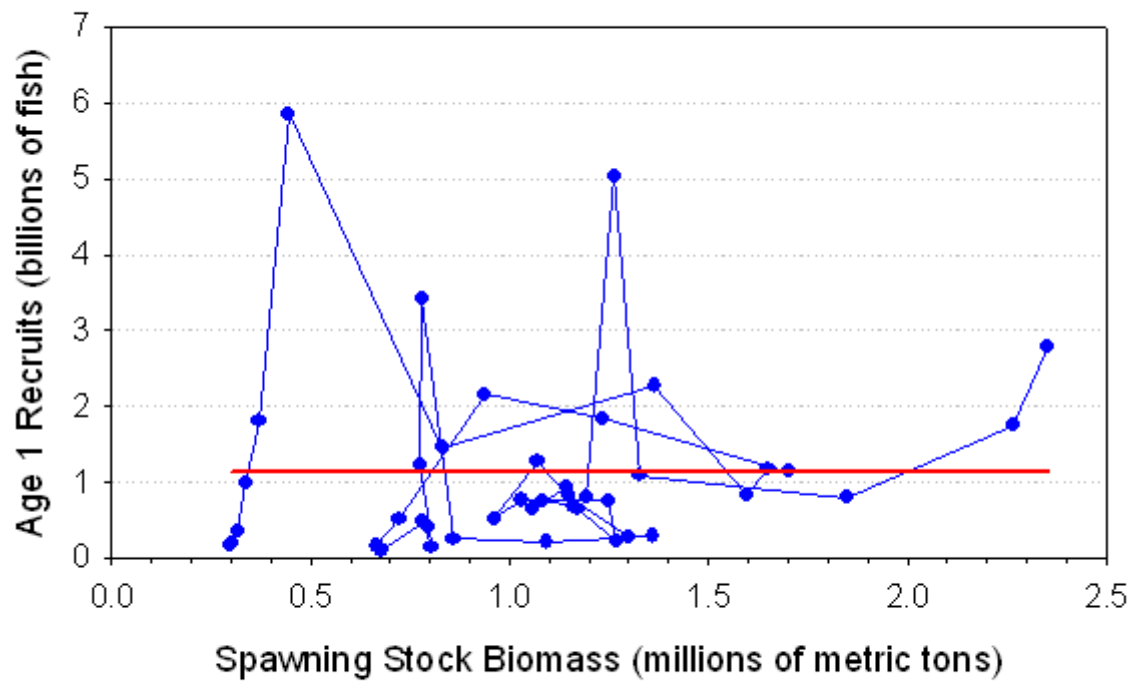


Figure 23.8. Spawning stock-recruitment scatter plot for Atlantic mackerel. The solid horizontal line represents the geometric mean recruitment (1.1 billion fish at age 1).

Atlantic Mackerel R/SSB Survival Ratios

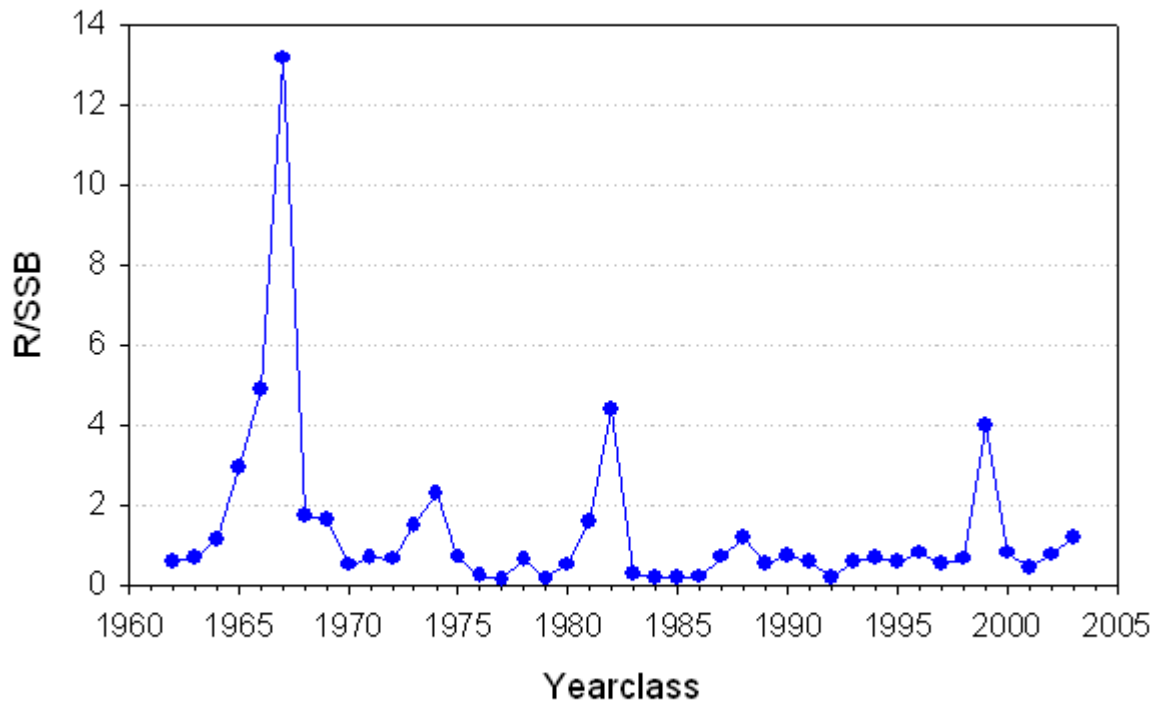


Figure 23.9. Trends in survival ratios (R/SSB) for Atlantic mackerel.