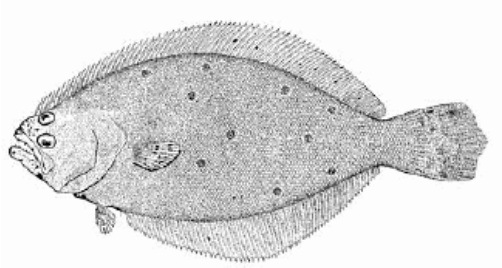

Last Revised: December 2006

Summer flounder

by

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Distribution, Biology and Management

The summer flounder or fluke, *Paralichthys dentatus*, is a demersal flatfish distributed from the southern Gulf of Maine to South Carolina. Important commercial and recreational fisheries exist from Cape Cod to Cape Hatteras. The resource is managed as a unit stock from North Carolina to Maine (Figure 8.1). Summer flounder are concentrated in bays and estuaries from late spring through early autumn, when an offshore migration to the outer continental shelf is undertaken. Spawning occurs during autumn and early winter, and the larvae are transported toward coastal areas by prevailing water currents. Development of post-larvae and juveniles occurs primarily within bays and estuarine areas, notably Pamlico Sound and Chesapeake Bay (Packer et al. 1999). Most fish are sexually mature by age 2 (O'Brien et al. 1993). Female summer flounder may live up to 20 years, but males rarely live for more than 10 years (Bolz et al. 2000). Growth rates differ appreciably between the sexes with females attaining weights up to 11.8 kg (26 lb).

U.S. commercial and recreational fisheries for summer flounder are managed under the Summer Flounder, Scup and Black Sea Bass Fishery Management Plan (FMP) administered jointly by the Atlantic States Marine Fisheries Commission (ASMFC) and the Mid-Atlantic Fishery Management Council (MAFMC). Amendment 2 to the Summer Flounder FMP implemented several major regulatory provisions, including annual commercial quotas, recreational harvest limits, a commercial vessel permit moratorium, minimum fish size and gear restrictions, and a recreational fishery possession limit. The target/threshold fishing mortality reference point of F_{MSY} is defined to be F_{max}, currently at F = 0.28, and the target and threshold spawning stock biomass (SSB) reference points are currently estimated to be 89,411 mt and 44,706 mt, respectively.

The Fishery

Total combined commercial and recreational landings peaked at 26,100 mt in 1983, averaged 13,100 mt annually during 1986-1995, and have since ranged between 8,600 mt (in 1999) and 12,500 mt (in 2004) (Table 8.1). The principal gear used in commercial fishing for summer

flounder is the otter trawl. After peaking at 17,900 mt in 1979, commercial landings of summer flounder averaged 8,500 mt annually during 1986-1995, and ranged between 4,000 mt and 7,800 mt during 1996-2005 (Figure 8.2). The recreational rod-and-reel fishery for summer flounder harvests a significant proportion of the total catch, and in some years recreational landings have exceeded commercial landings. After peaking at 12,700 mt in 1983, recreational landings of summer flounder averaged 4,600 mt annually during 1986-1995, and ranged between 3,800 mt 7,100 mt during 1996-2005.

Summer flounder total catch in numbers have generally been dominated by age 1 to age 3 fish (Figure 8.3). The proportion of ages 0 and 1 summer flounder in the commercial and recreational catch has been greatly reduced over the last decade.

Research Vessel Survey Indices

NEFSC spring and autumn biomass indices for summer flounder have exhibited similar trends throughout the survey time series (Figure 8.4). Biomass indices declined through the late 1970s into the early 1990s, but increased during the early 1990s and are currently at about the level of the mid-1970s. As stock biomass declined in the 1980s, the age structure of the summer flounder population became truncated, with a low proportion of fish at ages 3 and older (Figure 8.5). Since 1990, the age structure of the population has expanded to approximate that observed in the mid-1970s.

Assessment Results

Average fishing mortality (F, ages 3-5, unweighted) ranged between 1.0 to 2.0 during the 1980s and mid 1990s, but has steadily declined since 1997 and was F = 0.4 in 2005 (Figure 8.6). SSB declined from 24,400 mt in 1983 to 7,000 mt in 1989, but with improved recruitment and decreased fishing mortality increased to 47,500 mt by 2005 (Figure 8.7). Since 1982, recruitment at age 0 has ranged from 13 million fish (1988) to 80 million fish (1983 year class) (Figure 8.7). Average recruitment was 37 million fish during 1982-2005.

Biological Reference Points

Biological reference points for summer flounder (Figure 8.8) were updated in 2006 (Terceiro 2006) and are presented in Table 8.2. The relationship between SSB and recruitment for summer flounder during 1983-2005 is illustrated in Figure 8.9. The stock-recruitment trajectory indicates that recent levels of SSB and recruitment are on the far-right side of the plot. Survival ratios, recruits per unit of SSB (Figure 8.10), illustrate the relatively low survival of recent year classes despite the relatively high level of the spawning stock.

Summary

Summer flounder SSB has increased substantially from 7,025 mt in 1989 to 47,498 mt in 2005, about 6% above the biomass threshold of ½ B_{MSY}. Fully recruited fishing mortality was estimated to be 0.41 in 2005, about 45% above the fishing mortality threshold of $F_{msy} = F_{max} =$ 0.28. Thus, the stock is not in an overfished condition but overfishing continues to occur.

Table 8.1 Recreational and commercial landings of summer flounder (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	4.6	4.7	5.4	5.7	3.8	7.1	5.3	5.6	5.3	4.8	4.6
Commercial											
United States	8.5	5.9	4.0	5.1	4.8	5.1	5.0	6.6	6.5	7.7	7.8
Canada	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	13.1	10.6	9.4	10.8	8.6	12.2	10.3	12.2	11.8	12.5	12.4

Table 8.2 Yield and SSB per Recruit and MSY Based Reference Points for summer flounder.

Yield and SSB per Recruit-based Reference Points

$F_{0.1}$ = 0.16

$F_{msy} = F_{max}$ = 0.28

$F_{40\%}$ = 0.18

MSY Based Reference Points

$MSY = Y_{max}$ = 21,444 mt

$B_{msy} = SSBmax$ = 89,411 mt

For further information

Bolz, G.R., J.P. Monaghan Jr., K.L. Land, R.W.Gregory, and J.M. Burnett, Proceedings of the summer flounder aging workshop, 1-2 February 1999, Woods Hole, Massachusetts. NOAA Tech. Mem. NMFS-NE-156, 15 p.

O'Brien, L., J. Burnett, and R.K. Mayo. 1993. Maturation of nineteen species of finfish off the northeast coast of the United States, 1985-1990. NOAA Tech. Report. NMFS 113, 66 p.

Packer, D.B., S.J. Griesbach, P.L.Berrien, C.A.Zetlin, D.L. Johnson, and W.W. Morse. Essential fish habitat source document: summer flounder, (Paralichthys dentatus), life history and habitat characteristics. NOAA Tech. Mem. NMFS-NE-151, 88 p.

Terceiro, M. 2006. Summer flounder assessment and biological reference point update for 2006. http://www.nefsc.noaa.gov/nefsc/saw/2006FlukeReview/BRP2006_Review.pdf. 64 p.

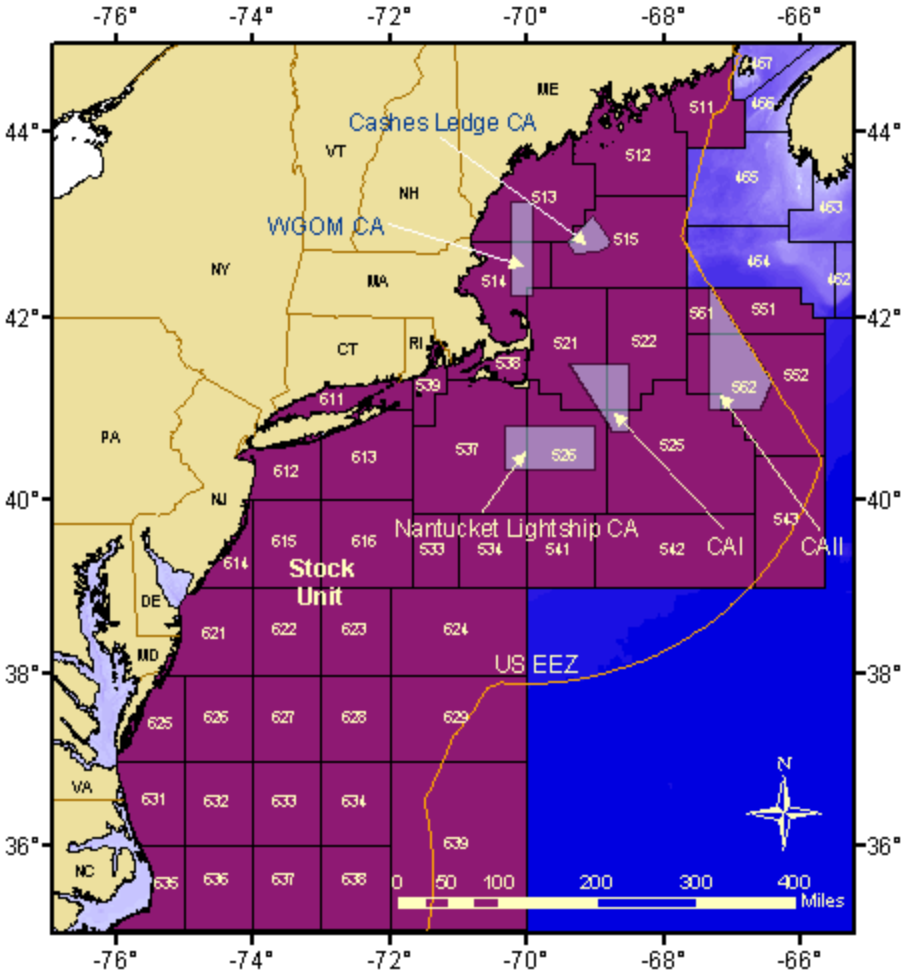

Figure 8.1. Statistical areas used to define the summer flounder stock.

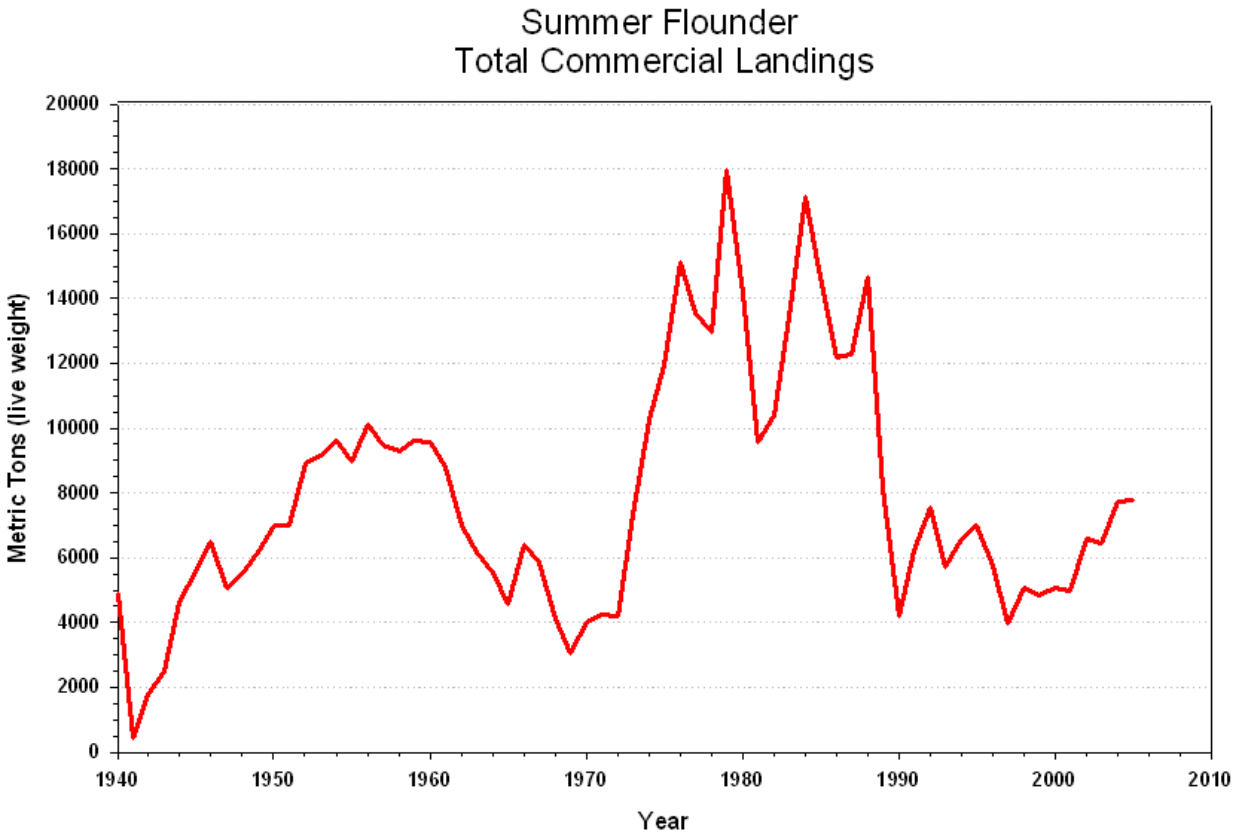

Figure 8.2. Total commercial landings of summer flounder, 1940-2005.

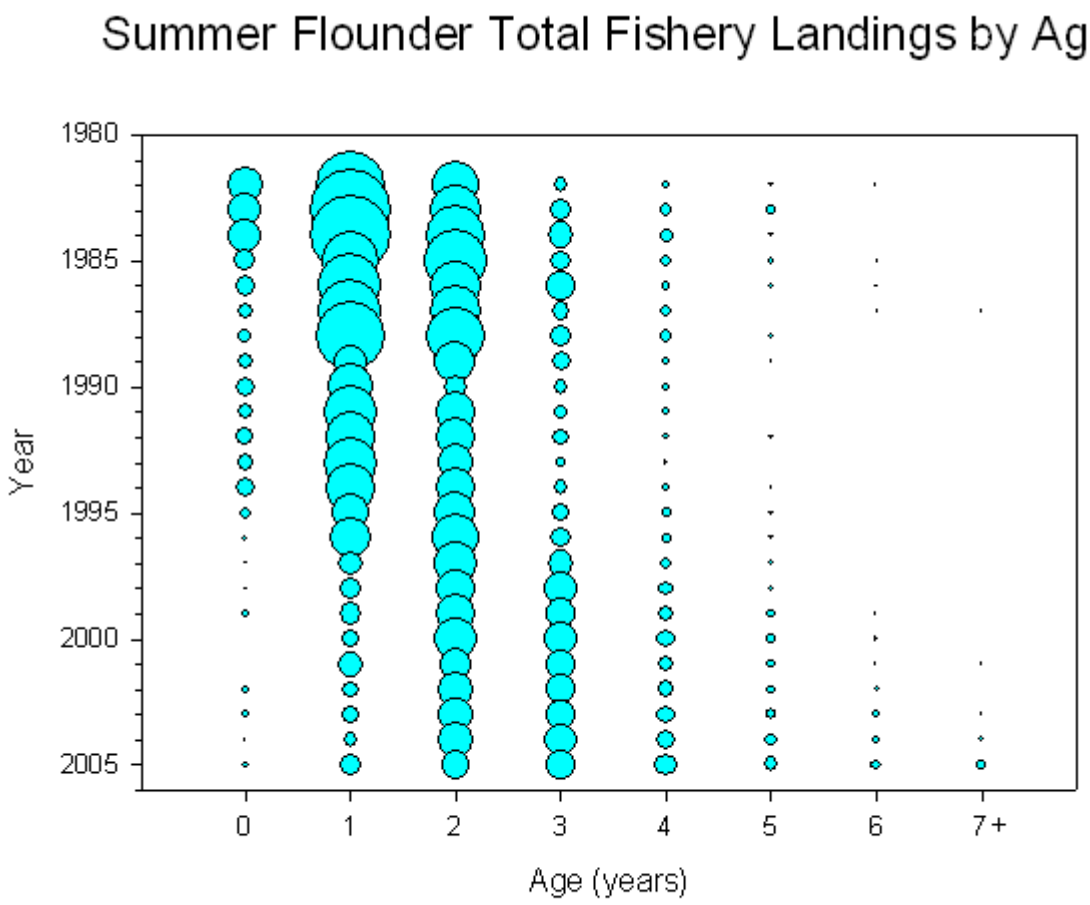

Figure 8.3. Age structure of summer flounder landings, 1982-2005.

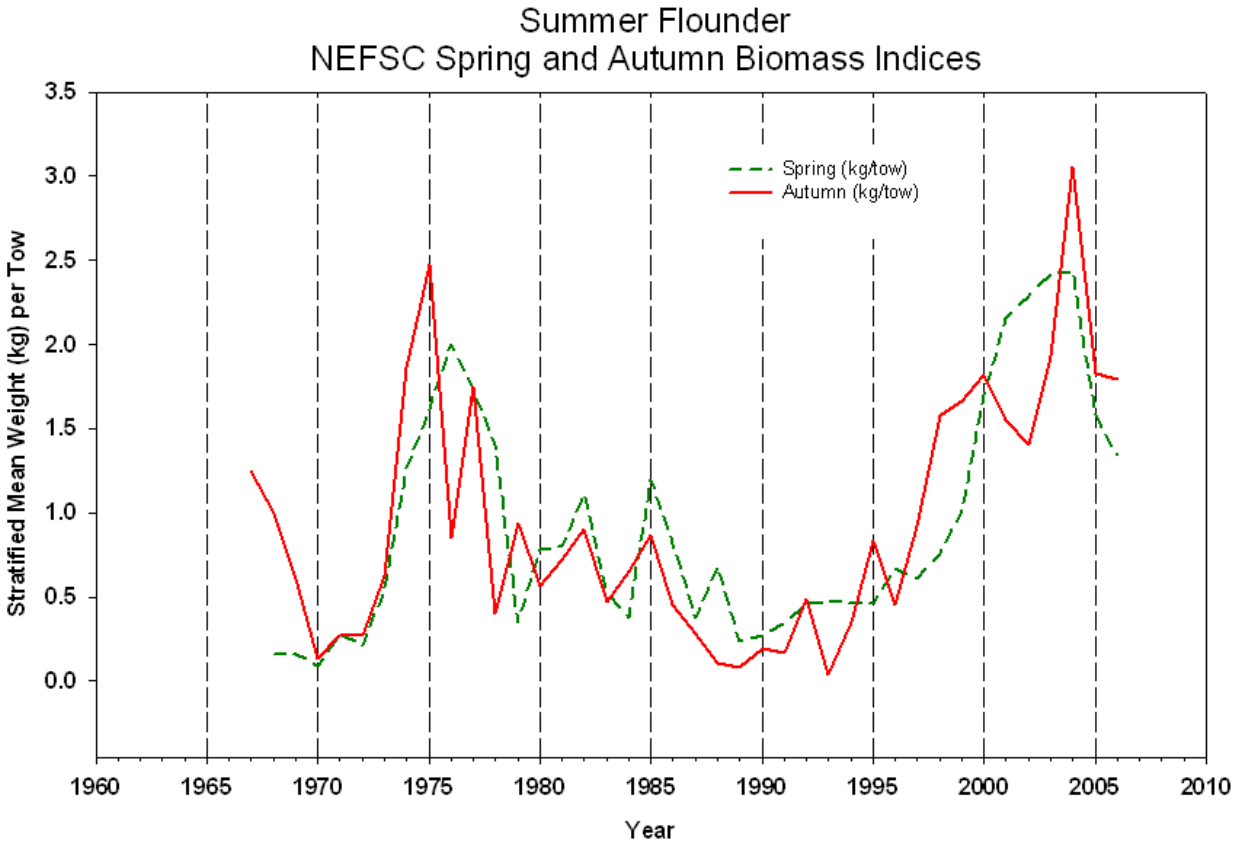

Figure 8.4. Biomass indices (stratified mean weight per tow) for summer flounder from NEFSC research vessel surveys.

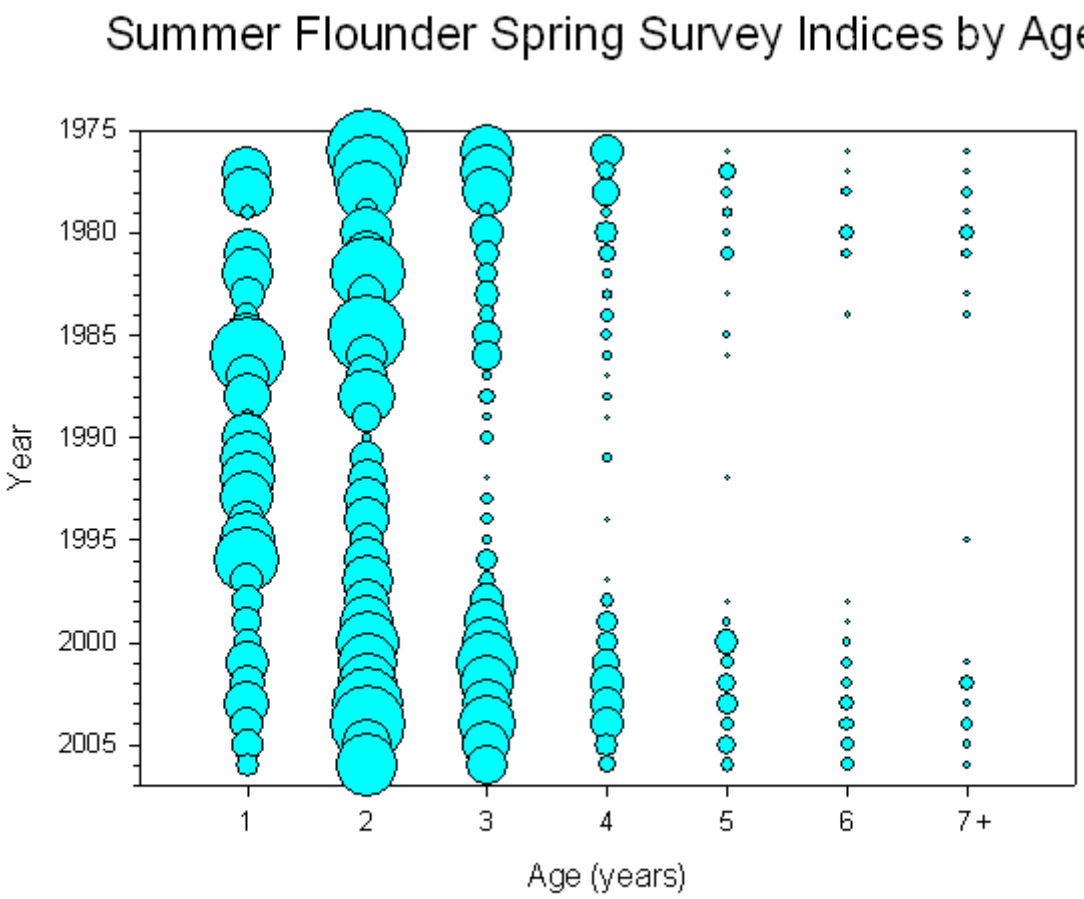

Figure 8.5. Age 1+ structure of the summer flounder population, 1976-2006.

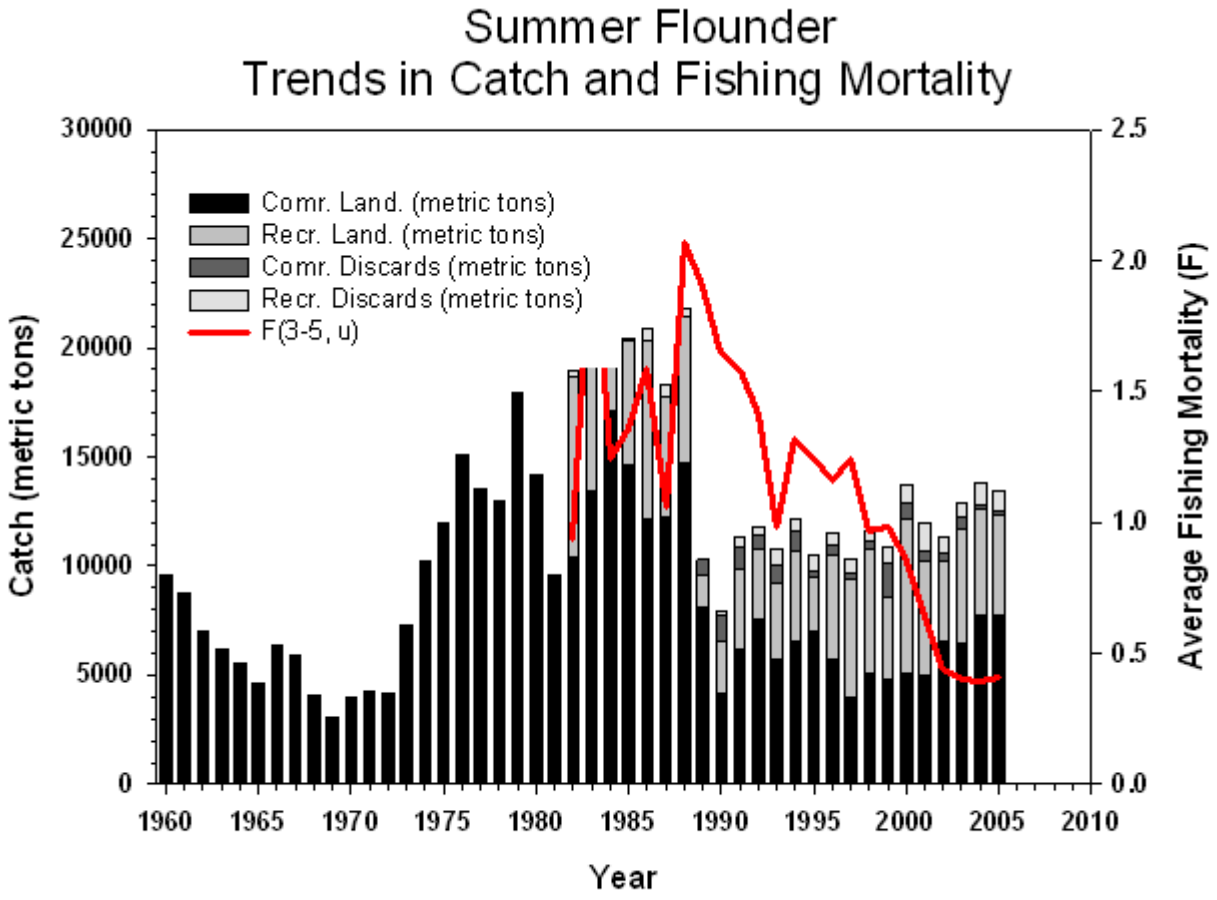

Figure 8.6. Trends in catch and fishing mortality for summer flounder.

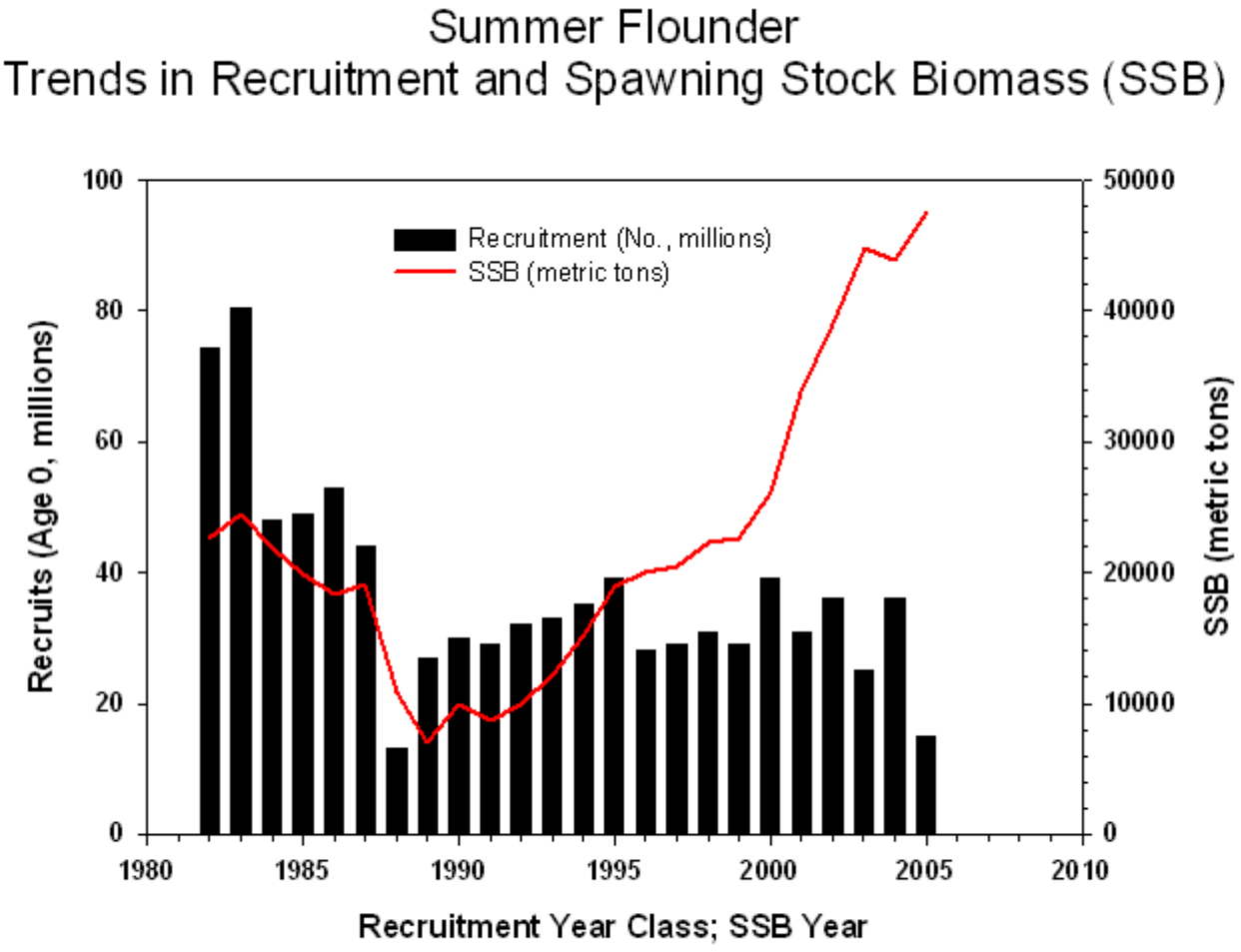

Figure 8.7. Trends in recruitment (age 0) and SSB for summer flounder.

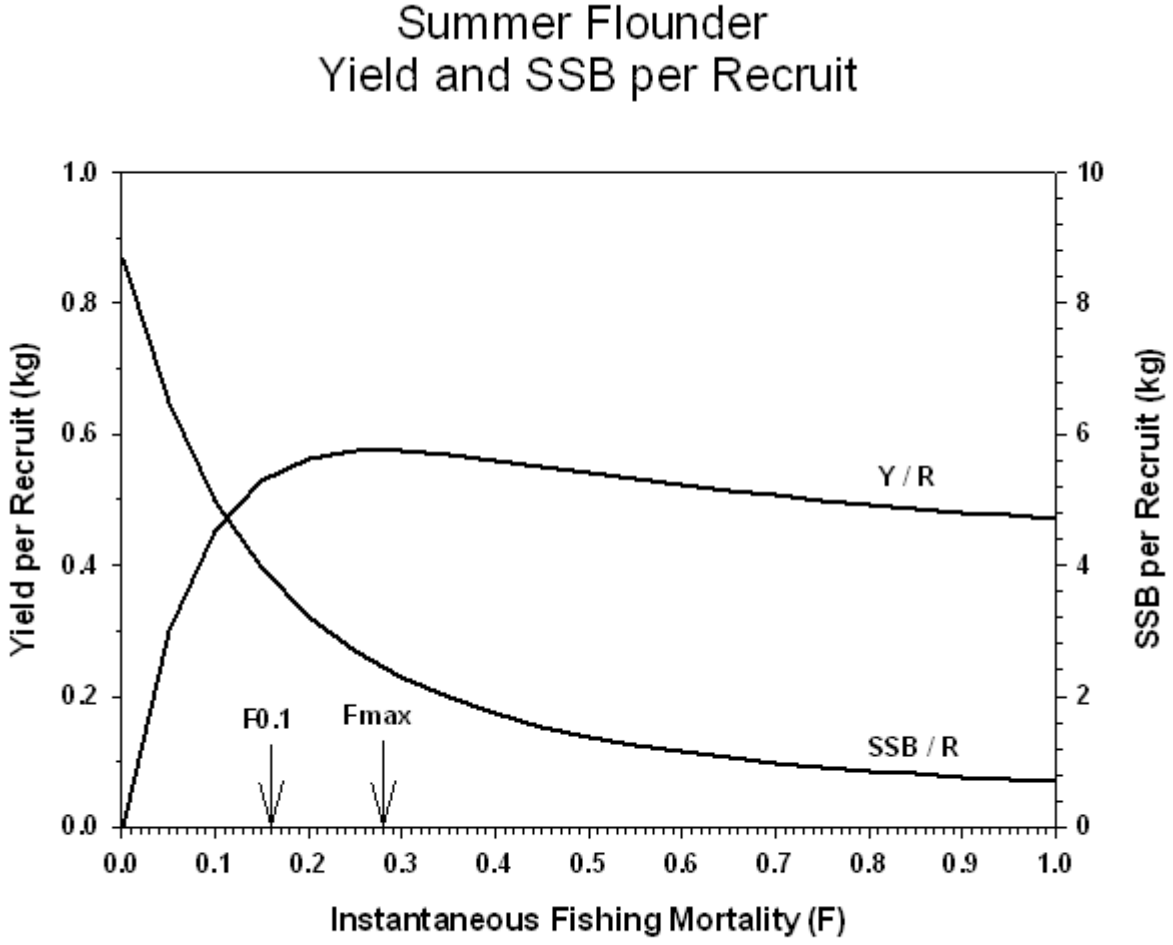

Figure 8.8. Yield and SSB per recruit results for summer flounder.

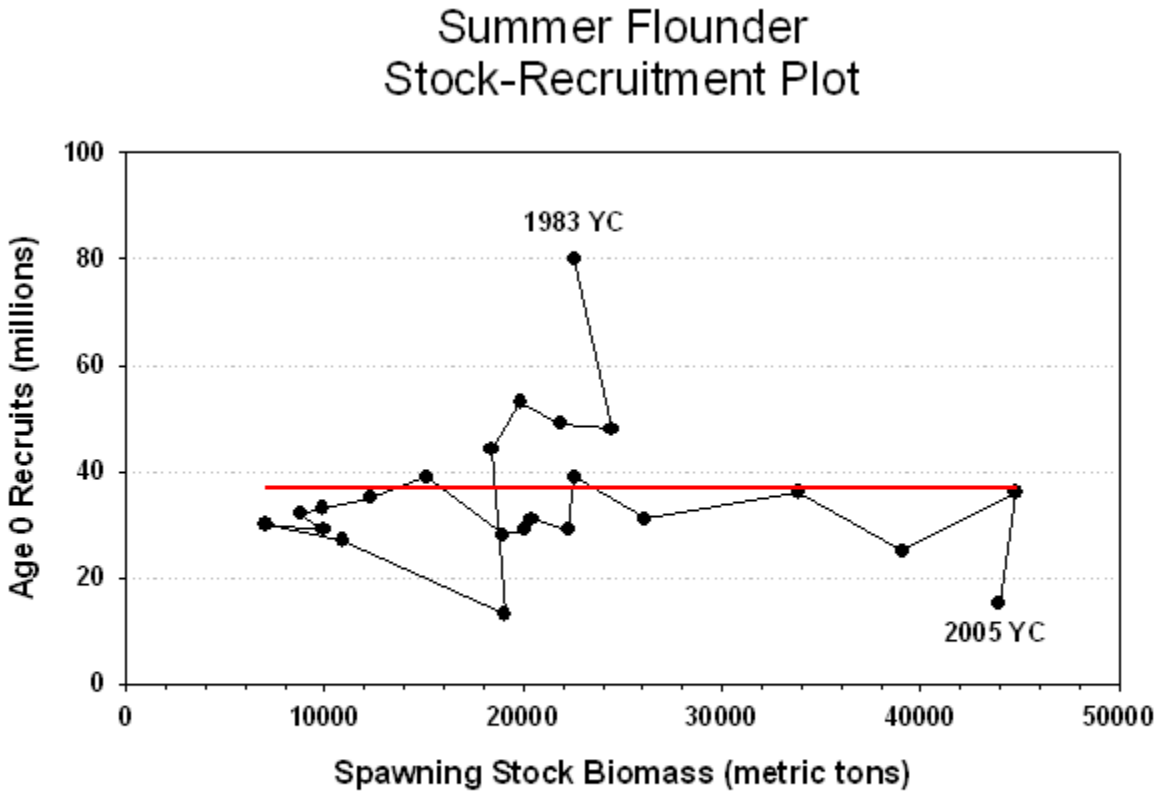

Figure 8.9. Spawning stock-recruitment scatterplot for summer flounder. The solid horizontal line represents the mean recruitment.

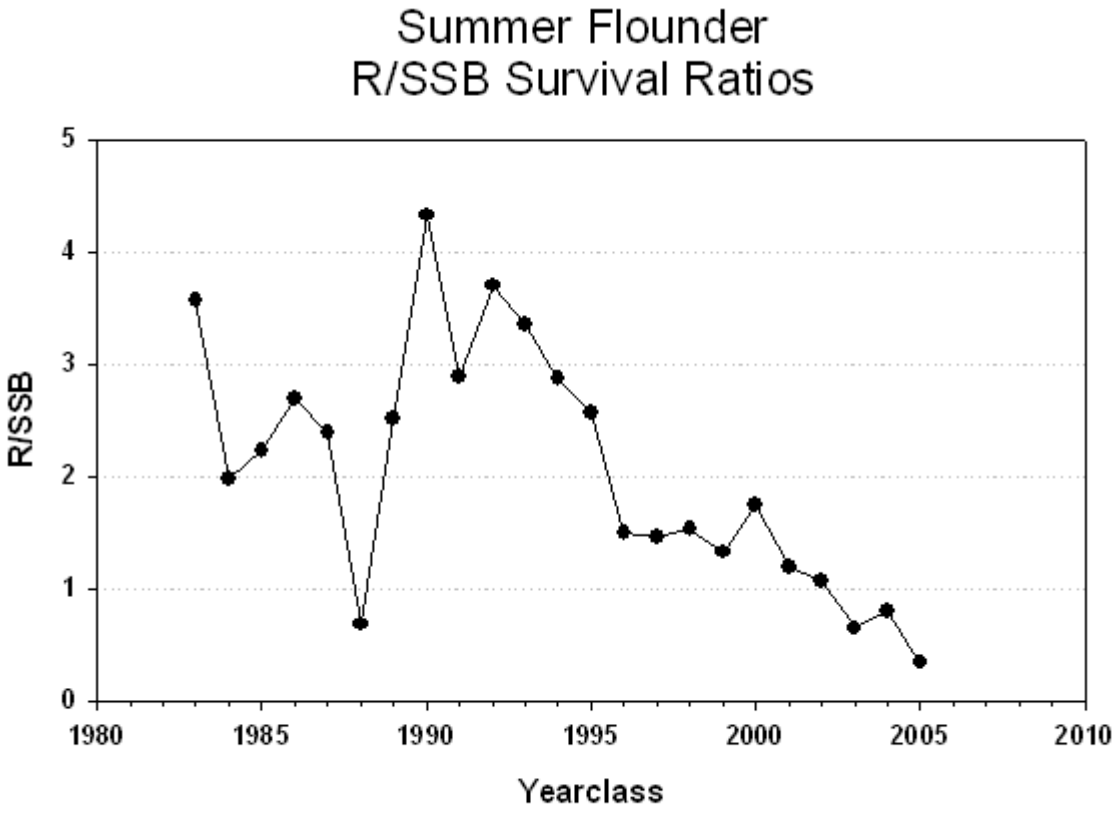

Figure 8.10. Trends in survival ratios (R/SSB) for summer flounder.