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Goosefish

by

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Distribution, Biology and Management

Goosefish (*Lophius americanus*), also called monkfish, are distributed in the Northwest Atlantic from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina. Goosefish may be found from inshore areas to depths of at least 900 m (500 fathoms). Seasonal onshore-offshore migrations occur and appear to be related to spawning and possibly food availability (Collette and Klein-MacPhee 2002).

Goosefish rest partially buried on soft bottom substrates and attract prey using a modified first dorsal fin ray that resembles a fishing pole and lure. Goosefish are piscivorous and commonly eat prey as large as themselves. Growth is rapid at about 10 cm per year, and is similar for both sexes up to age 6 and lengths of around 60 cm (24 in.). Few males are found older than age 7, but females can live to 12-14 years or older (NEFSC 2002, 2005). Goosefish as large as 138 cm (54 in.) have been captured in NEFSC bottom trawl surveys.

Female goosefish begin to mature at age 4 and 50% of females are mature by age 5 (about 43 cm or 17 in.). Males mature at slightly younger ages and smaller sizes (50% maturity at age 4.2 or 36 cm (14 in.)) (NEFSC 2002). Spawning takes place from spring through early autumn, progressing from south to north, with most spawning occurring during the spring and early summer. Females lay a buoyant mucoid egg raft or veil which can be as large as 12 m (39 ft) long and 1.5 m (5 ft) wide and only a few mm thick. The eggs are arranged in a single layer in the veil, and the larvae hatch after about 1-3 weeks, depending on water temperature. The larvae and juveniles spend several months in a pelagic phase before settling to a benthic existence at a size of about 8 cm (3 in.) (Collette and Klein-MacPhee 2002).

Genetic studies have revealed a genetically homogeneous population of goosefish off the U.S. east coast (Chikarmane et al. 2000) and survey information indicates little or no difference in growth and maturation rates between goosefish from southern and northern management regions

(NEFSC 2002, 2005). However, because of differences in how the fisheries in these two regions are prosecuted, goosefish are managed separately as two “stocks”: the "northern stock" (Gulf of Maine and northern Georges Bank) and the "southern stock" (southern Georges Bank and Middle Atlantic (Figure 14.1)).

Commercial fisheries for goosefish occur year round using gillnets, trawls and scallop dredges. No significant recreational fishery exists. The primary goosefish products are tails, livers and whole gutted fish. Peak fishing activity occurs during November through June, and value of the catch is highest in the fall due to the high quality of livers during this season.

Most goosefish catch went unreported until the mid-1970s (Figure 14.2). Annual USA commercial landings (live weight) increased to 6,000 mt in 1978 (NEFSC 2005), remained stable at 8,000-10,000 mt during the 1980s, and then increased rapidly in the 1990s, peaking at 28,300 mt in 1997 (Table 14.1). Landings in 2004 were 21,100 mt, and averaged 22,800 mt during 2000-2004.

U.S. fisheries for goosefish are managed under the Monkfish Fishery Management Plan (FMP) by the New England and Mid-Atlantic Fishery Management Councils. The primary goals of the Monkfish FMP are to end and prevent overfishing and to optimize yield and economic benefits to various fishing sectors involved with the goosefish fisheries (NEFMC and MAFMC 1998). Current regulatory measures vary with type of permit but include limited access, limitations on days at sea, mesh size restrictions, trip limits, minimum size limits and other measures.

The information provided in this section reflects the results of the most recent peer-reviewed assessment for goosefish in the northern and southern management areas (NEFSC 2005).

NORTHERN MANAGEMENT REGION

The Fishery

In the northern management area, bottom trawls are the dominant gear type and account for 80% of the landings. Gillnets account for most of the rest of the landings, with scallop dredges accounting for less than 1% in recent years. Most landings of goosefish in the north are taken as bycatch in the multispecies groundfish fishery. Northern goosefish landings increased from less than 1,000 mt per year in the early 1970s to over 10,000 mt in the mid-1990s (Figure 14.2). Landings peaked at 15,100 mt in 2003 and were 10,200 mt in 2005 (Table 14.1).

Fishery-Independent Surveys

NEFSC autumn bottom trawl survey biomass indices of goosefish in the northern area peaked in the late 1970s and then declined through the mid-1990s (Figure 14.3), accompanied by decline in the average and maximum sizes of goosefish in the survey (Figure 14.4). In 2005, the biomass index was 1.1 kg/tow, a record-low. The age structure since the early 1990s has been dominated by goosefish less than 6 years old (Figure 14.5).

Biological Reference Points

The median of the three-year moving average of the NEFSC autumn survey biomass index during 1965-1981 has been defined as a proxy for B_{MSY} (2.496) for goosefish in the northern area (Table 14.2). Goosefish in the northern management area are defined as being overfished when the three-year moving average of the NEFSC autumn biomass index falls below one half of B_{MSY} (i.e. below 1.25) (NEFMC and MAFMC 1998). The most recent 3-year average of the biomass index (2003-2005) was 1.21.

F_{max} is the F_{MSY} proxy in the FMP and is currently estimated as $F=0.2$ based on yield-per-recruit analyses (Figure 14.6) (NEFMC and MAFMC 2003). Recent estimates of F have exceeded F_{max} .

SOUTHERN MANAGEMENT REGION

The Fishery

In the southern management area, bottom trawls and scallop dredges each accounted for roughly half of the landings until the early 1990s. Since then, most of the landings have been by gillnets; in 2003, about 66% of goosefish landings were taken in gillnets, 18% in trawls and 16% by scallop dredges (NEFSC 2005). Southern goosefish landings increased in the late 1970s, exceeded landings from the north during the 1990s, and reached a peak of 19,300 mt in 1998 (Figure 14.2). Subsequently, southern goosefish landings have declined and were 8,600 mt in 2005 (Table 14.1).

Fishery-Independent Surveys

NEFSC autumn bottom trawl survey biomass indices of goosefish in the southern area declined during the early 1980s, stabilized at a low level between 1987 and 1999, and have since been somewhat higher (Figure 14.7). Declines in abundance were also accompanied by declines in the average and maximum sizes of goosefish in the NEFSC autumn survey (Figure 14.8). During 2000-2004, the autumn survey biomass index averaged 0.8 kg/tow, which is also the value of the 2005 index (Figure 14.7). The age structure since the early 1990s has been dominated by goosefish less than 6 years old (Figure 14.9).

Biological Reference Points

The median of the three-year moving average of the NEFSC autumn survey biomass index during 1967-1981 (1.846 kg/tow) has been defined as the B_{MSY} proxy for goosefish in the southern area (Table 14.2). Goosefish in the southern area are defined as being overfished when the three-year moving average of the NEFSC autumn biomass index falls below one half of B_{MSY} (i.e. below 0.9). F_{MSY} is the same as in the north (i.e., equal to F_{max} , $F=0.2$). The 2003-2005 average survey index was 0.78. Recent estimates of F have tended to exceed F_{max} .

Summary

Goosefish increased in commercial importance during the 1980s and 1990s, and by the mid-1990s was the highest valued finfish in the northeastern U.S. However, biomass indices and mean fish size of goosefish declined as landings increased. In 2005, goosefish in both the northern and southern management areas remained overfished. Status with respect to fishing mortality rates is uncertain, although overfishing may be occurring.

Table 14.1 Recreational and commercial landings of northern and southern goosefish (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States-North	11.4	10.8	9.8	7.4	9.3	10.7	13.5	14.0	15.1	13.2	10.2
United States-South	12.6	16.0	18.5	19.3	16.0	10.2	9.8	8.9	11.0	7.9	8.6
Canada	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.3	0.3	n/a	n/a
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	24.2	27.0	28.5	26.9	25.4	21.1	23.5	23.2	26.4	21.1	18.8

Table 14.2 MSY-based reference points for goosefish in the northern and southern management regions.

MSY-based Reference Points

	North	South
MSY	= unknown	= unknown
B_{msy} proxy ¹	= 2.496 kg/tow	= 1.846 kg/tow
F_{msy} proxy ²	= 0.2	= 0.2

¹ B_{msy} proxy is 1965-1981 average in north, 1967-1981, in south, 1967-1981 3-year moving average NEFSC autumn R/V survey catch per tow in each management region

² F_{max} as proxy

For further information

Armstrong, M.P., J.A. Musick, and J.A. Colvocoresses. 1992. Age, growth and reproduction of the goosefish *Lophius americanus* (Pisces:Lophiiformes). Fish. Bull. 90:217-230.

Collette, B., and G. Klein-MacPhee, (eds). 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, Third edition. Smithsonian Institution Press. 748 p.

Chikarmane, H.M., A. Kuzirian, R. Kozlowski, M. Kuzirian, and T. Lee. 2000. Population genetic structure of the goosefish, *Lophius americanus*. Biol. Bull. 199: 227-228.

NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 1998. Monkfish Fishery Management Plan.

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NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 2003. Framework Adjustment 2 to the Monkfish Fishery Management Plan. <http://www.nefmc.org/monk/index.html>

NEFSC [Northeast Fisheries Science Center]. 2002. [Report of the] 34th Northeast Regional Stock Assessment Workshop (34th SAW) Stock Assessment Review Committee (SARC) Consensus Summary of Assessments. Northeast Fish. Sci. Cent. Ref. Doc. 02-06.

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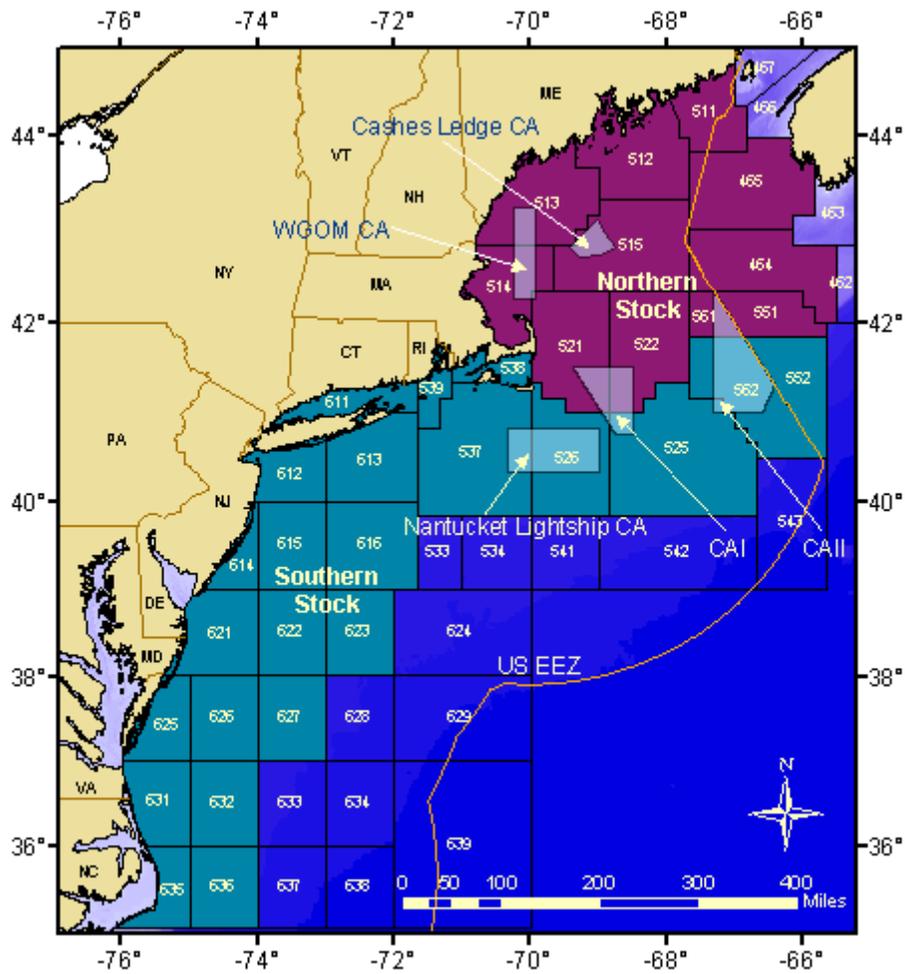


Figure 14.1. Statistical areas used to define the northern and southern goosefish stocks.

Monkfish Commercial Landings

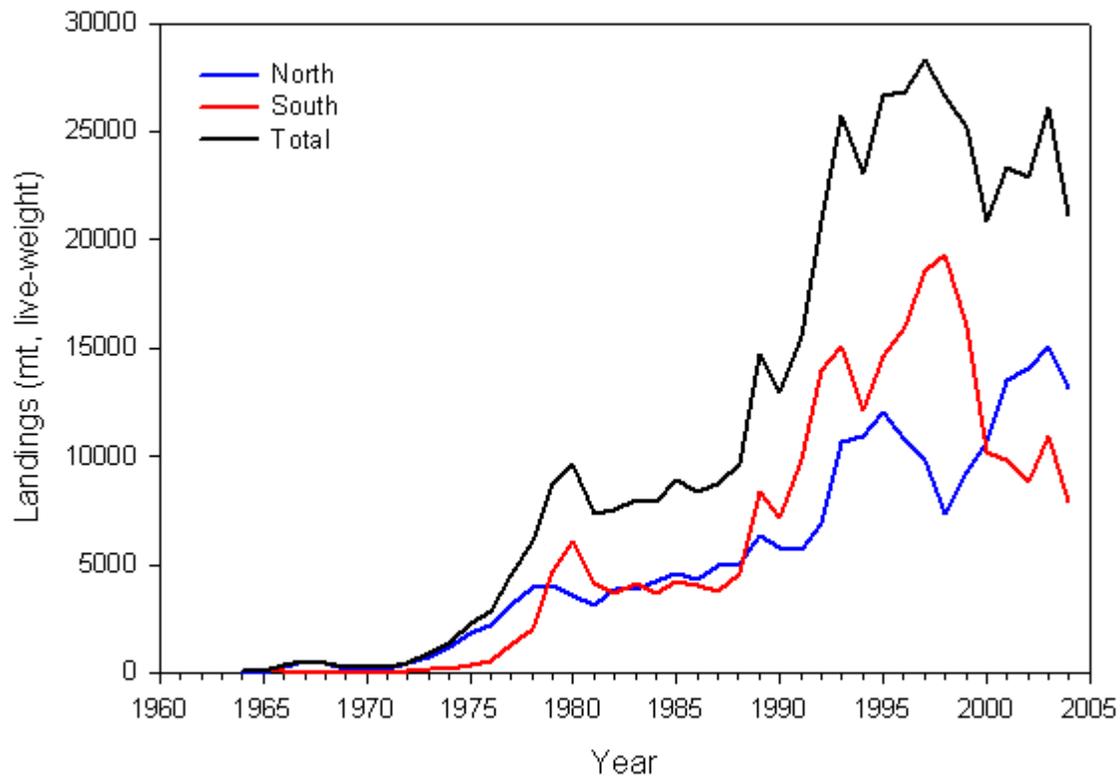


Figure 14.2. Total U.S. commercial landings (metric tons, live) of monkfish from the northern and southern fishery management regions.

Monkfish - Northern Area NEFSC Autumn Biomass Indices and Landings

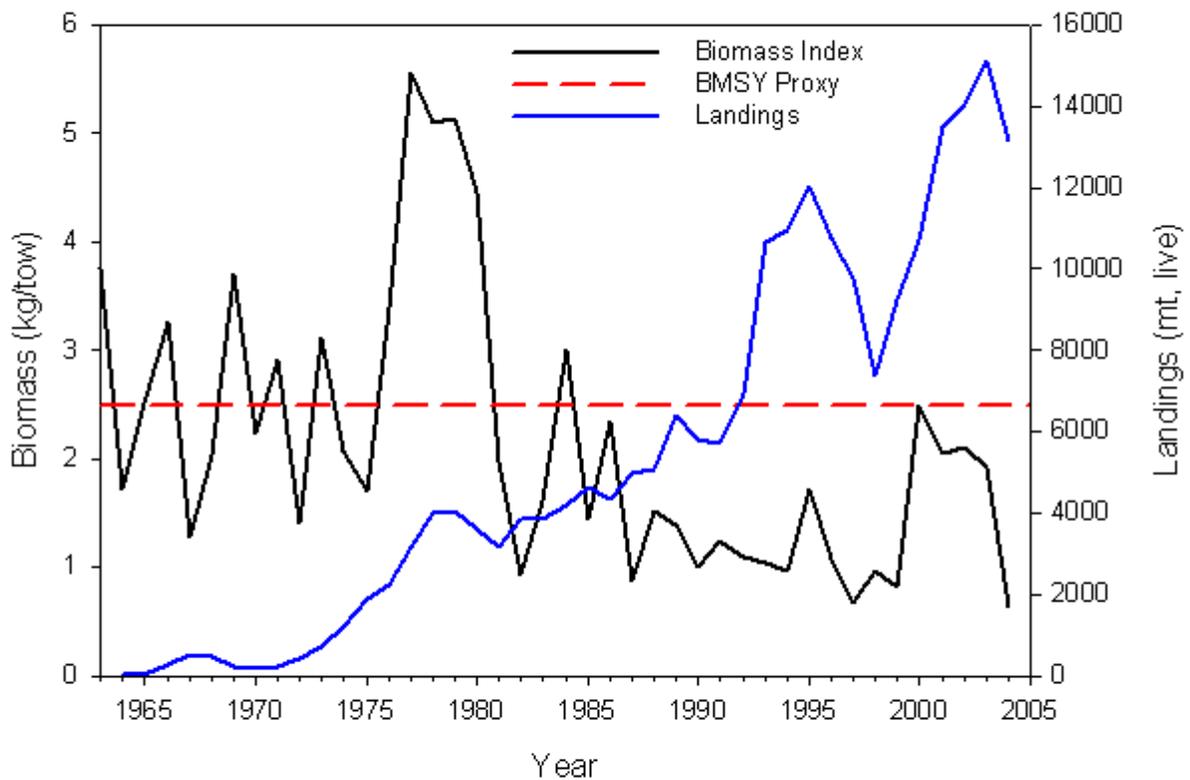


Figure 14.3. Trends in commercial landings (metric tons, live) and NEFSC autumn survey biomass indices (kg/tow) for monkfish in the northern fishery management region. The dashed line represents the B_{MSY} proxy (2.496) based on historical survey trends.

Monkfish - Northern Area
Minimum, Mean, and Maximum Lengths in
NEFSC Autumn Surveys

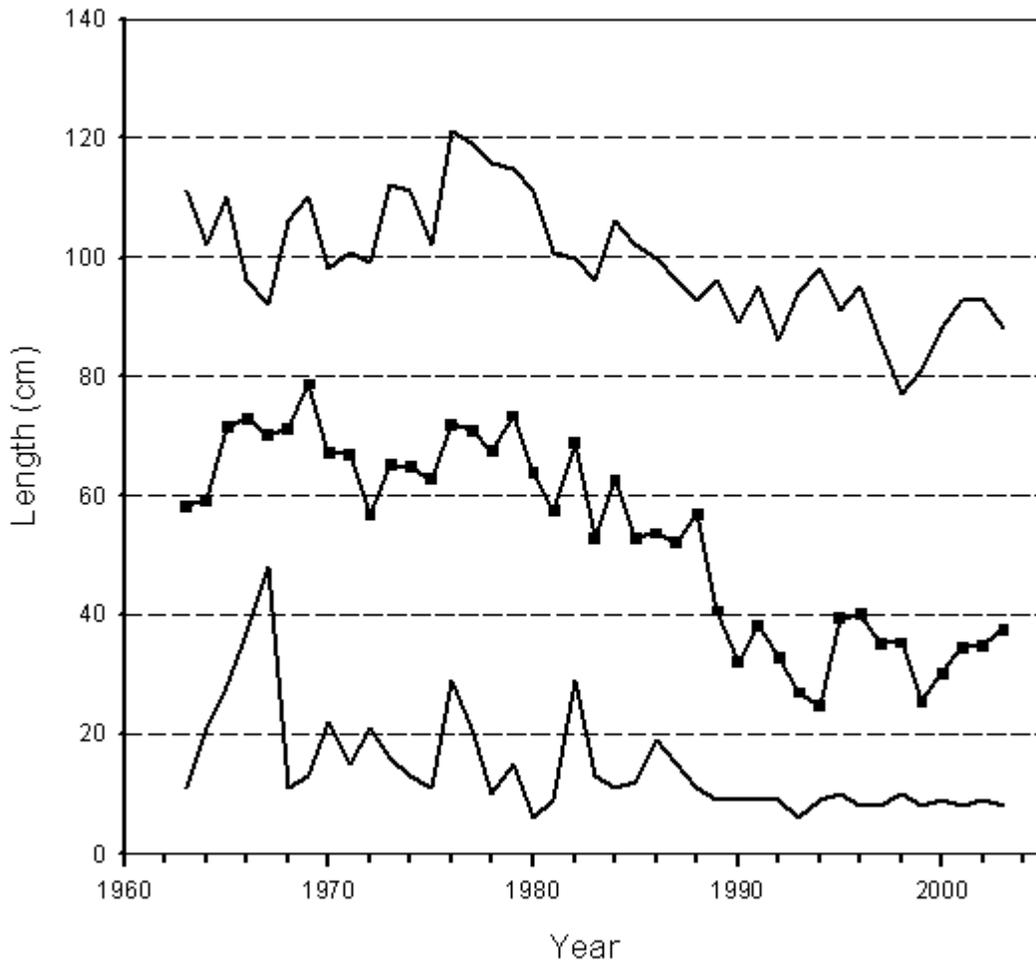


Figure 14.4. Minimum, mean, and, maximum lengths of monkfish in northern area sampled during NEFSC autumn surveys.

Monkfish - Northern Area Autumn Survey Indices by Age

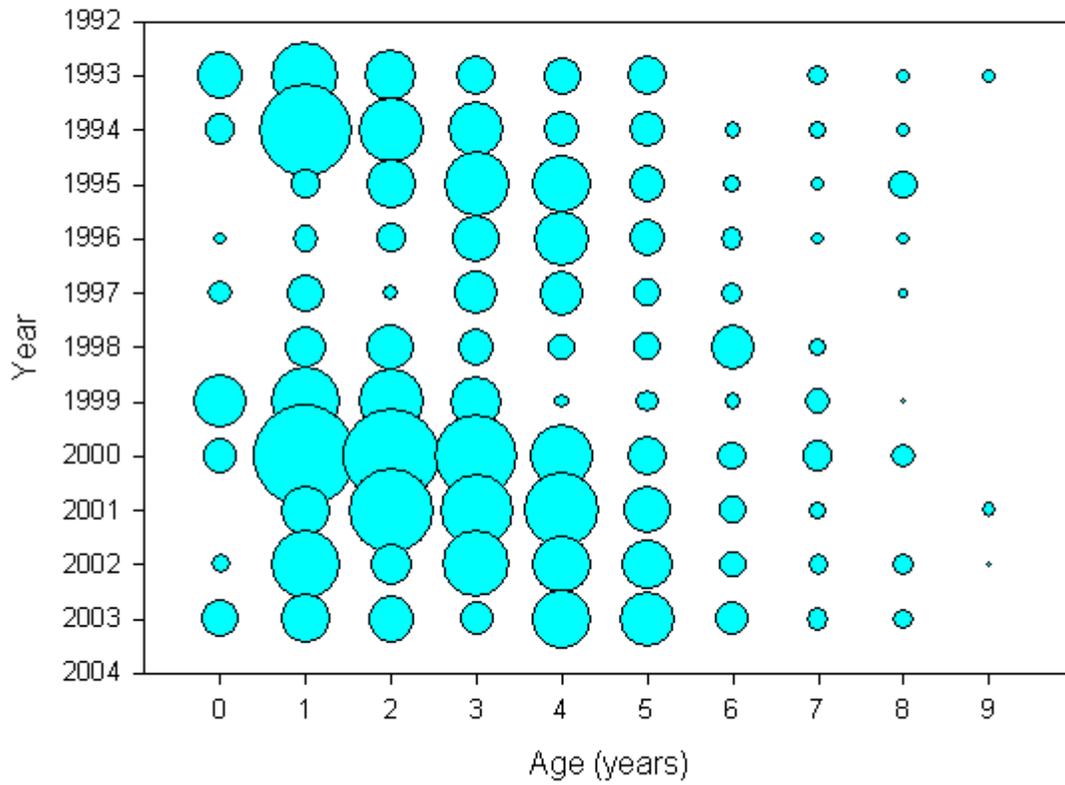


Figure 14.5. Age structure of monkfish in the northern management areas, 1993-2003.

Monkfish Fishing Mortality and Yield per Recruit

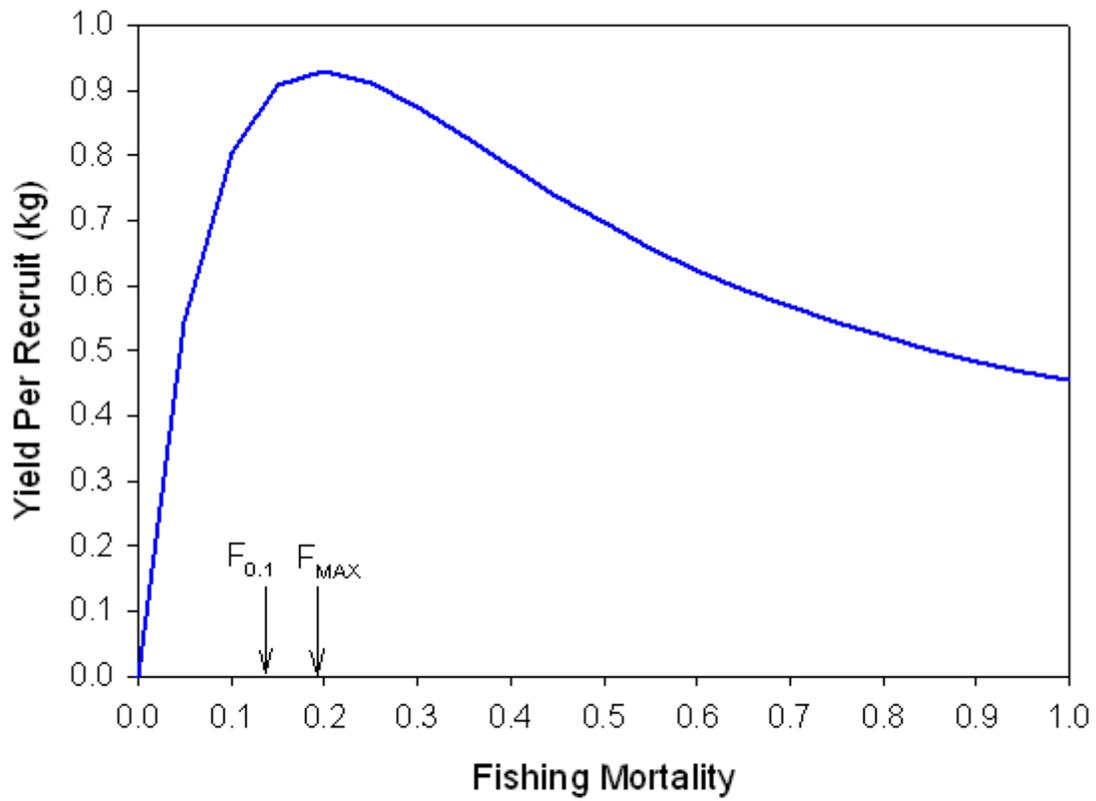


Figure 14.6 Fishing mortality and yield per recruit reference points for Monkfish.

Monkfish - Southern Area Autumn Biomass Indices and Landings

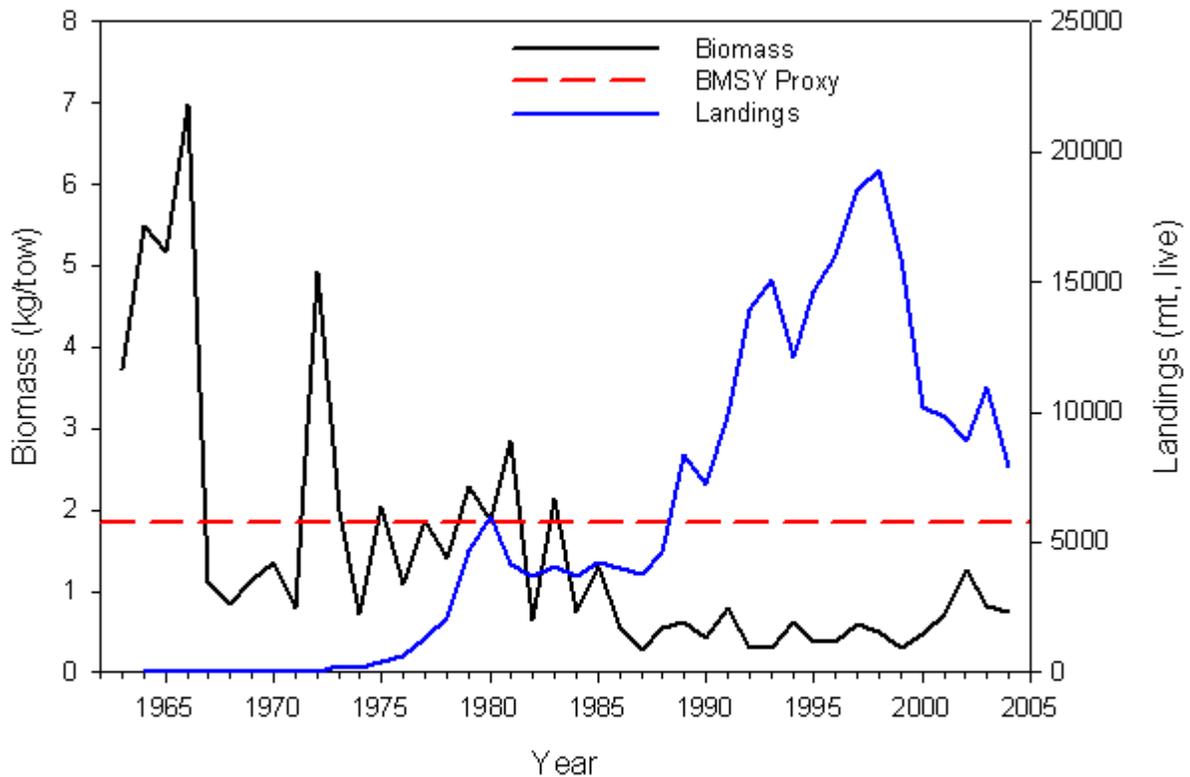


Figure 14.7. Trends in commercial landings (metric tons, live) and NEFSC autumn survey biomass indices (kg/tow) for monkfish in the southern fishery management region. The dashed line represents the B_{MSY} proxy (1.848) based on historical survey trends.

Monkfish - Southern Area
Minimum, Mean, and Maximum Lengths in
NEFSC Autumn Surveys

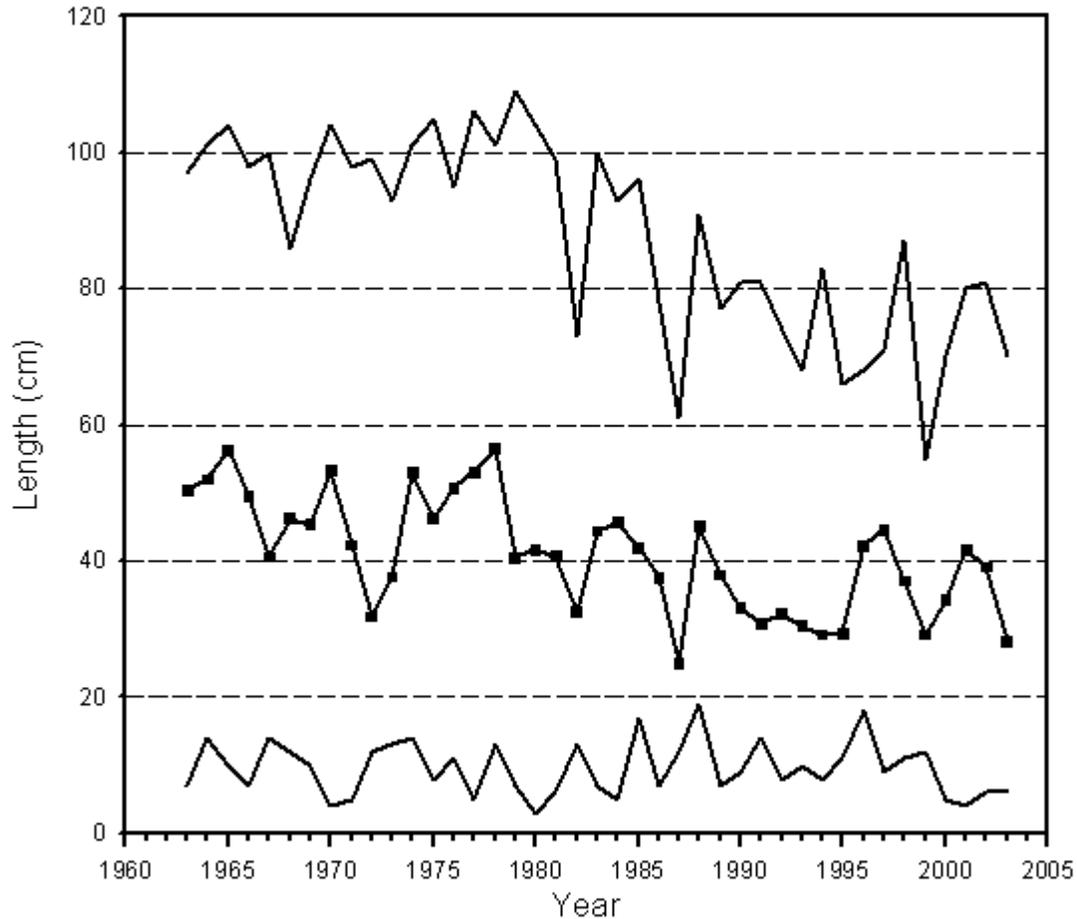


Figure 14.8. Minimum, mean, and, maximum lengths of monkfish in southern area sampled during NEFSC autumn surveys.

Monkfish - Southern Area Autumn Survey Indices by Age

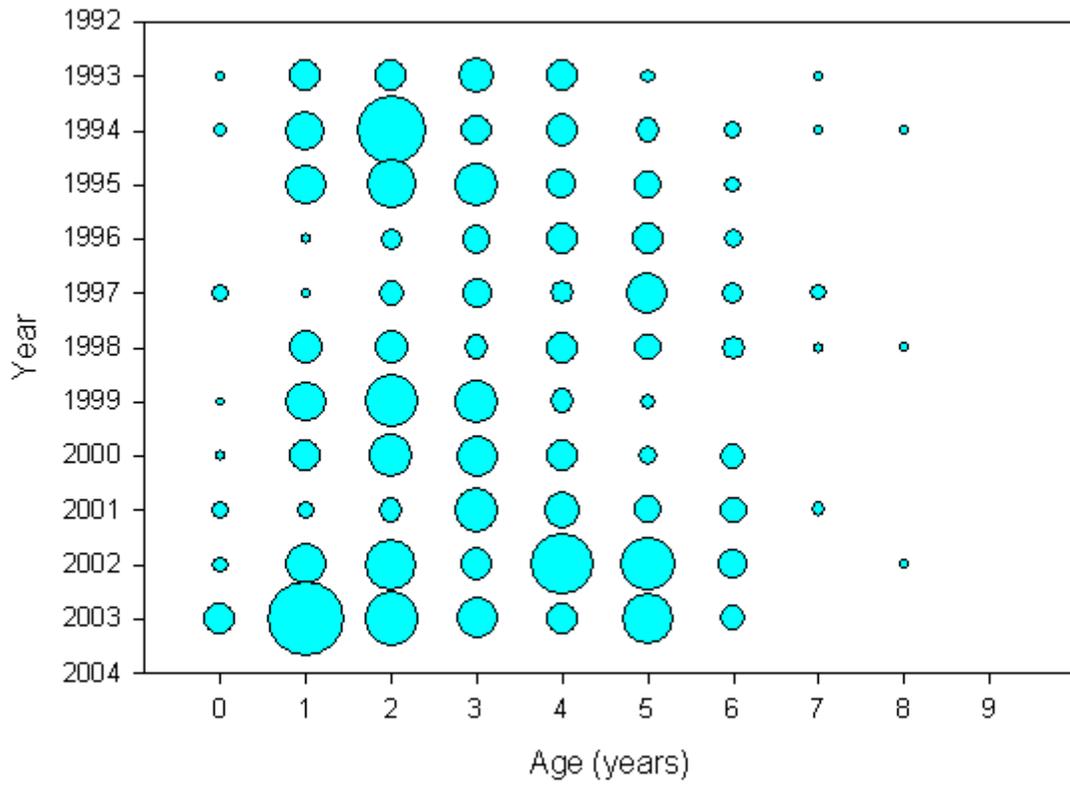


Figure 14.9. Age structure of monkfish in the southern management area, 1993-2003.