

Last Revised: December 2006

American Lobster

by

Josef Idoine

Distribution, Biology and Management

The American lobster, *Homarus americanus*, is distributed in the Northwest Atlantic from Labrador to Cape Hatteras, from coastal waters out to depths of 700 m (400 fathoms). Lobsters are locally abundant in coastal regions within the Gulf of Maine as well as in southern New England. Coastal lobsters are concentrated in rocky areas where shelter is readily available, although occasional high densities occur in mud substrates suitable for burrowing. Offshore populations are most abundant along the continental shelf edge in the vicinity of submarine canyons. Lobsters exhibit a complex life cycle in which mating occurs following molting of the female. Eggs (7,000 to 80,000) are extruded and carried under the female's abdomen during a 9 to 11 month incubation period. The eggs hatch during late spring or early summer and the pelagic larvae undergo four molts before attaining adult characteristics and settling to the bottom. Lobsters molt approximately 20 times (in 5 to 8 years) before reaching minimum legal size.

Tagging experiments in coastal waters suggest that small lobsters undertake rather limited movement, although larger individuals may travel extensively. In contrast, offshore lobsters show well-defined shoalward migrations during the spring, regularly 80 km (50 mi), and often as much as 300 km (186 mi). Lateral movements along the shelf edge occur as well. For assessment purposes, based on differences in biological attributes and exploitation patterns, three stock areas are recognized: Gulf of Maine, Georges Bank and Southern New England (Figure 32.1).

The principal fishing gear used to catch lobsters is the trap. Lobsters are also taken as bycatch in otter trawls. Recreational fishing occurs in coastal waters, but catch estimates are not available. The fishery is managed by the Atlantic States Marine Fisheries Commission's (ASMFC) Interstate Fishery Management Plan for American Lobster. There are seven management areas which, in most cases, overlap the stock areas (Figure 32.1). Complementary regulations in offshore Federal waters have been implemented by NMFS under the Atlantic Coastal Fisheries Cooperative Management Act (ACFCMA). Primary regulatory measures include carapace

length (CL) limits, protection of ovigerous females, gear restrictions, and nominal effort control measures. Of these measures, notably, the minimum size varies between management areas and therefore differ within stock areas.

Total annual landings of lobster averaged 17,600 mt during 1977-1986 increased to 28,900 mt in 1991 and then slightly declined in 1992-1993. Landings peaked at 41,000 mt in 1999 and landings in 2005 were 38,000 mt. The majority of landings are from the near-shore trap fishery.

GULF OF MAINE LOBSTER

The Fishery

Commercial landings in 2005 were 34,200 mt, slightly below series high of 36,500 in 2004 (Table 32.1, Figure 32.2). Since 1981 landings have steadily increased and more than doubled. The majority of landings come from the near-shore trap fishery in Maine, and are comprised of lobsters within one molt of minimum size (based on management area, currently between 83 - 87 mm CL). From 1981 to the present, the average size of lobsters in the landings has been about 89 mm carapace length (CL), indicating a continued reliance on annual recruitment.

Research Vessel Survey Indices

Historically, NEFSC research vessel abundance indices developed for lobsters have been derived separately for males and females. NEFSC autumn survey indices for Gulf of Maine lobsters have exhibited similar trends for both sexes throughout the time series (Figure 32.3). The female index increased from 0.1 to 3.2 from 1981 to 1999. The male index increased from 0.1 to 2.9 from 1981 to 1996. Since these peaks, the indices have declined and in 2005 were 0.84 and 0.81 for females and males respectively. The average size (≥ 83 mm) of both sexes in the surveys are virtually identical (Figure 32.4). For both males and females, the indices of sub-legal (currently < 83 mm) are higher compared to those for larger lobsters. The median of legal size lobsters in the survey (≥ 83 mm) varies from 92 mm to 102 mm over the series.

Additional data (from Massachusetts trawl surveys) describing Gulf of Maine lobsters (from Massachusetts) have been used in recent lobster assessments. These data are presented in the 2005 assessment report (ASMFC 2006), and are discussed below.

Assessment Results

Fishing mortality (sexes combined) fluctuated around 0.9 during the 1980s and early 1990s, but then declined to 0.4 in 2002 (Figure 32.5). Fishing mortality in 2003 was estimated to be 1.05. The current value is above the reference point threshold (0.76), however the current status is based on a three year average. By this measure, the current fishing mortality is estimated as 0.69, below the threshold, but above the target. Abundance varied between 42 and 65 million lobsters between 1982 and 1993, before increasing steadily to 102 million in 2002 (Figure 32.6). Abundance in 2003 was estimated to be around 100 million lobsters. The three year average abundance is estimated as 123.1 million, above both the threshold and target reference points.

Between 1982 and 1993, the reported number of traps fished was around 2.3 million (Figure 32.7). From that point until the present the trap numbers have increased to 3.6 million in 2003. The number of reported traps compared to landings show a similar trends .

The recent assessment concluded: “The good conditions in the Gulf of Maine stock indicate that recent mortality rates are sustainable. However, effort indicators are negative. This high effort is concurrent with high stock abundance, and is not likely to be supportable if abundance returns to median levels”.

The current assessment also looked at the southern portion of the Gulf of Maine (SA 514). Using these assessed trends and the same criteria to estimate reference points for SA 514, fishing mortality above and abundance below their respective thresholds (Figure 32.8).

Biological Reference Points

The most recent assessment for American lobster (ASMFC 2006) rejected the use of the percent maximum egg production reference point (ASMFC 2000; NEFSC 1996). The replacement threshold is now based on the median of estimates of abundance and biomass derived from Collie-Sissenwine Analyses (CSA), sexes combined, during a reference period from 1982 through 2003 (Table 32.2). Targets are defined as one standard deviation below (biomass) and above (fishing mortality) those medians.

Summary

The Gulf of Maine lobster stock has shown an increase in abundance over the last 10 – 15 years, mirroring by a similar increase throughout the range in the US and Canada. The response of the fishery has been an equal or greater increase in effort, including expansion into areas with previous low or no exploitation. There continues to be an excess of effort. Additionally, the states report a substantial number of latent licenses that create the potential to increase that effort even further.

Table 32.1. Recreational and commercial landings of Gulf of Maine Lobster (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	18.2	22.2	26.7	25.8	30.0	31.8	26.5	33.8	29.2	36.5	34.2
Canada	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	18.2	22.2	26.7	25.8	30.0	31.8	26.5	33.8	29.2	36.5	34.2

Table 32.2 Fishing Mortality and Abundance Reference Points for Gulf of Maine American lobster.

	F	Abundance (millions)
Threshold	0.76	65.58
Target	0.67	69.62

GEORGES BANK LOBSTER

The Fishery

In general, commercial landings were relatively stable, averaging 1,380 mt annually between 1981 and 2003. Since then landings have risen to a series high of 2,300 mt in 2005 (Table 32.3, Figure 32.9). From 1981 to the present, the average size of lobster in the landings has varied between 99 mm and 105 mm carapace length (CL). Average size in landings from Georges Bank is relatively high because fishing mortality rates are lower than the other stocks. Consequently, the lobster fishery on Georges Bank, compared to other stocks, is less dependent on new recruits which have molted to legal size (currently 87 mm CL).

Research Vessel Survey Indices

Historically, NEFSC research vessel abundance indices developed for lobsters have been derived separately for males and females. NEFSC autumn survey indices for Georges Bank lobsters have exhibited similar trends for both sexes throughout the time series (Figure 32.10). The female index increased from 0.72 to 1.51 from 1981 to 2002. The male index increased from 0.62 to 0.98 from 1981 to 2002. Since these peaks, the indices have declined and in 2006 were 1.04 and 0.23 for females and males respectively. The Size composition data for both sexes (Figure 32.11) shows females larger than males. For females, indices of sub-legal (< 83mm) animals are lower compared to those for larger lobsters. For males the opposite situation persists. The median carapace length of legal sized lobsters in the surveys (≥ 83 mm) varies from 105 mm to 124 mm.

Assessment Results

Fishing mortality (sexes combined) was low compared to other areas and fluctuated around 0.34 throughout the period 1981 to 2003 (Figure 32.12). Fishing mortality in 2003 was estimated to be 0.27. The current status, based on a three year average, is 0.29, below the reference point target (0.31). Abundance varied between 6.2 and 9.3 million lobsters between 1982 and 2003 (Figure 32.13). Abundance in 2003 was estimated to be around 9.1 million lobsters. The three year average abundance is estimated as 9.0 million, above the target reference points.

Between 1982 and 1992, the reported number of traps fished was around 35 thousand (Figure 32.14). During the mid to late 1990 trap numbers increased to a peak of 108 thousand million in 1999, and have declined to 97 thousand in 2003. The number of reported traps compared to landings show a similar trends.

The recent assessment concluded: “The good conditions in the Georges Bank stock indicate that recent mortality rates are sustainable. However, effort indicators are negative. This high effort is concurrent with high stock abundance, and is not likely to be supportable if abundance returns to median levels”.

Biological Reference Points

The most recent assessment for American lobster (ASMFC 2006) rejected the use of the percent maximum egg production reference point (ASMFC 2000; NEFSC 1996). The replacement threshold is now based on the median of estimates of abundance and biomass derived from Collie-Sissenwine Analyses (CSA), sexes combined, during a reference period from 1982 through 2003 (Table 32.4). Targets are defined as one standard deviation either below, for biomass or above for fishing mortality the respective thresholds.

Summary

The Georges Bank lobster stock though relatively stable, has shown an modest increase in abundance over the last 10 – 15 years, mirroring by a similar increase throughout the range in the US and Canada and the response of the fishery has been an increase in effort. The current efforts to limit and actually reduce effort should be continued.

Table 32.3. Recreational and commercial landings of Gulf of Maine lobster (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	1.4	1.1	1.2	1.2	1.5	1.2	1.4	1.6	1.4	2.0	2.3
Canada	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	1.4	1.1	1.2	1.2	1.5	1.2	1.4	1.6	1.4	2.0	2.3

Table 32.4 Fishing Mortality and Abundance Reference Points for Georges Bank American lobster.

	F	Abundance (millions)
Threshold	0.34	7.95
Target	0.31	8.61

SOUTHERN NEW ENGLAND LOBSTER

The Fishery

Commercial landings increased steadily from 2.6 thousand mt in 1982 to 10.1 thousand mt in 1997. Since then landings have declined and in 2005 were 2.8 thousand, slightly above the 1982 level (Table 32.5, Figure 32.15). The majority of landings come from the near-shore trap fishery in , and are comprised of lobsters within one molt of minimum size (based on management area, currently between 83 - 87 mm CL). From 1981 to the present, the average size of lobsters in the landings has been about 89 mm carapace length (CL), indicating a continued reliance on annual recruitment.

Research Vessel Survey Indices

Three trawl surveys occur within the Southern New England stock area, NEFSC as well as the state surveys conducted by Connecticut and Rhode Island. The majority of landings in SOUTHERN NEW ENGLAND, as well as effort, are inshore, the trawl survey conducted by Connecticut (CT) is most representative of this area. The survey abundance indices derived separately for males and females have exhibited similar trends (Figure 32.16). Both the female and male indices fluctuated with little trend from 1984 to the late 1990s, averaging 4.5 for females and 9.0 for males. In 1997 the indices increased to series highs, 12.8 for females and 25.1 for males. Since then, indices declined to a series lows in 2002, 0.74 for females and 2.58 for males before minimally increasing in 2004 to 1.31 and 2.88 for females and males respectively. Data for later years are not available at this time.

The average size (≥ 83 mm CL) of both sexes in the surveys are similar, and declining (Figure 32.17). Over the series, female average size has declined from 89.8 to 84.6 mm CL, while male average size declined from 89.7 to 87.4 mm CL. For both males and females, the indices of sub-legal (currently < 83 mm) are higher compared to those for larger lobsters. The median of legal size lobsters in the survey (≥ 83 mm) varies from 92mm to 102mm mm over the series.

Assessment Results

Fishing mortality (sexes combined) fluctuated around 0.8 during the 1980s and early 1990s, increased to 1.3 in 1994 and then declined to 0.8 in 2003 (Figure 32.18). The current status, based on a three year average, is 0.83, at or above the threshold. Abundance varied between 16 and 28 million lobsters between 1982 and 1995, before increasing to a series high 45 million in 1997 (Figure 32.19). Abundance sharply declined to 14 Million lobsters in 2004. Abundance in 2003 was estimated to be around 12.3 million. The current status, a three year average, is estimated as 14.0 million, below both the threshold and target reference points. Based on these criteria, overfishing is occurring in the SOUTHERN NEW ENGLAND stock, and the stock is depleted.

Between 1982 and 1999, the reported number of traps fished were increased steadily from 206 thousand to 846 thousand (Figure 32.20). From that point the number of traps have decreased to 314 thousand in 2004. The number of reported traps compared to landings show a similar trends,

however, the number of traps fished continued to increase until 1999, two years after the beginning of the decline in abundance and landings.

Biological Reference Points

The most recent assessment for American lobster (ASMFC 2006) rejected the use of the percent maximum egg production reference point (ASMFC 2000; NEFSC 1996). The replacement threshold is now based on the median of estimates of abundance and biomass derived from Collie-Sissenwine Analyses (CSA), sexes combined, during a reference period from 1982 through 2003 (Table 32.6). Targets are defined as one standard deviation below (biomass) and above (F) those medians.

Summary

The Southern New England lobster stock increased in abundance from 1982 until 1997. The response of the fishery has been an equal or greater increase in effort which continued beyond the point that abundance and landings began to decline. There continues to be an excess of effort. Additionally, the states report a substantial number of latent licenses that create the potential to increase that effort even further.

Table 32.5. Recreational and commercial landings of Southern New England lobster (thousand metric tons).

Category	1986-95 Average	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
U. S. Recreational	-	-	-	-	-	-	-	-	-	-	-
Commercial											
United States	6.1	9.1	10.1	9.8	9.5	6.2	4.4	3.6	2.8	2.3	2.3
Canada	-	-	-	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	-	-	-	-
Total Nominal Catch	6.1	9.1	10.1	9.8	9.5	6.2	4.4	3.6	2.8	2.3	2.3

Table 32.6 Fishing Mortality and Abundance Reference Points for Southern New England lobster.

	F	Abundance (millions)
Threshold	0.82	22.31
Target	0.74	23.90

For further information

Atlantic States Marine Fisheries Commission (ASMFC) 2000. American lobster stock

assessment report. NO. 00-01.

Atlantic States Marine Fisheries Commission (ASMFC). 2006. American Lobster Stock Assessment for Peer Review. Atlantic States Marine Fisheries Commission Special 06-03 (Supplement).

NEFSC [Northeast Fisheries Science Center]. 1996. [Report of the] 22nd Northeast Regional Stock Assessment Workshop (22nd SAW), Stock Assessment Review Committee (SARC), consensus summary of assessments. Woods Hole, MA: NOAA/NMFS/NEFSC. NEFSC Ref. Doc. 96-13.

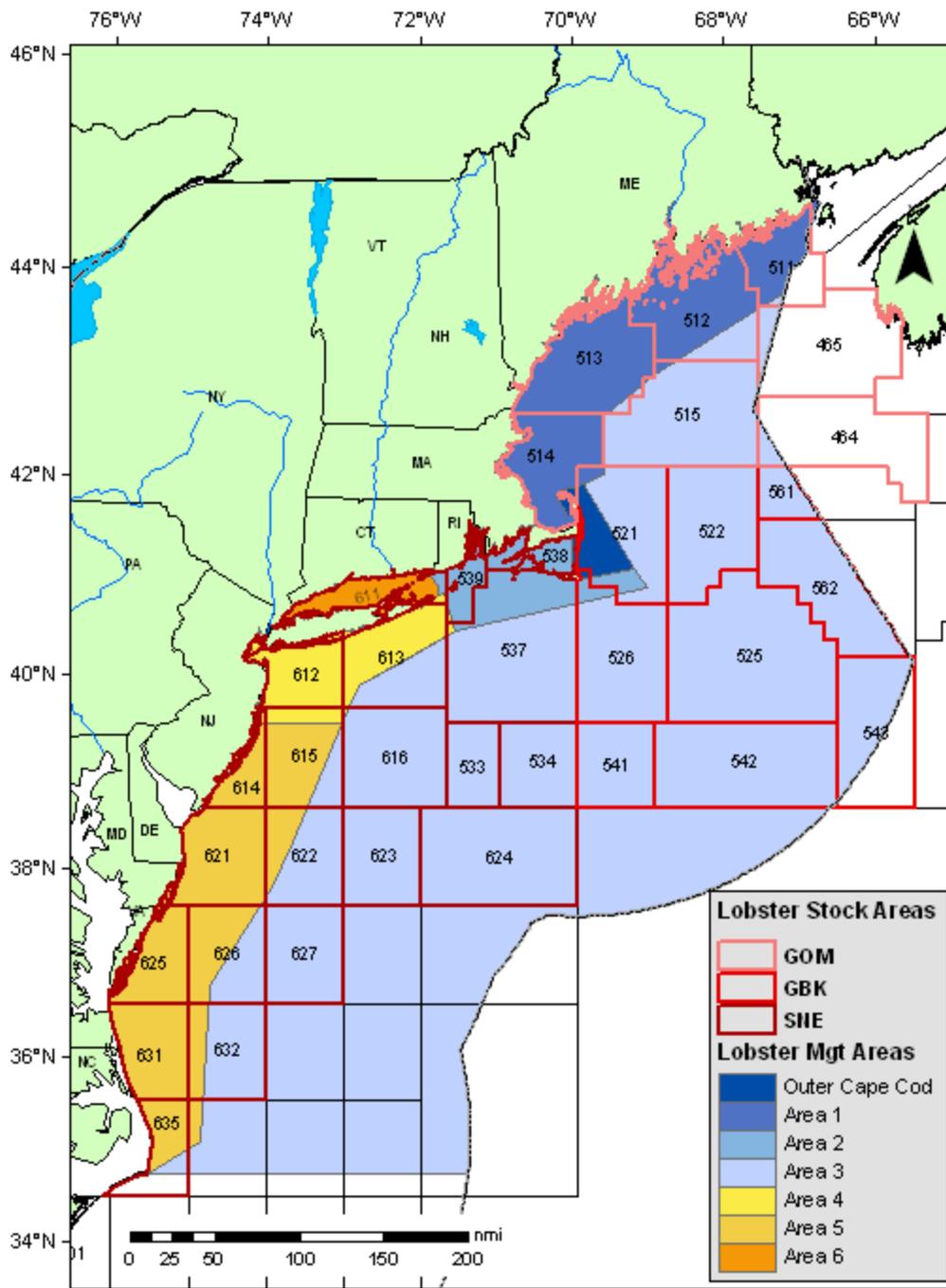


Figure 32.1. Statistical Areas used to define American Lobster Gulf of Maine, Georges Bank and Southern New England Stocks and Regions defining 7 ASMFC Management Areas.

Gulf of Maine American Lobster Landings

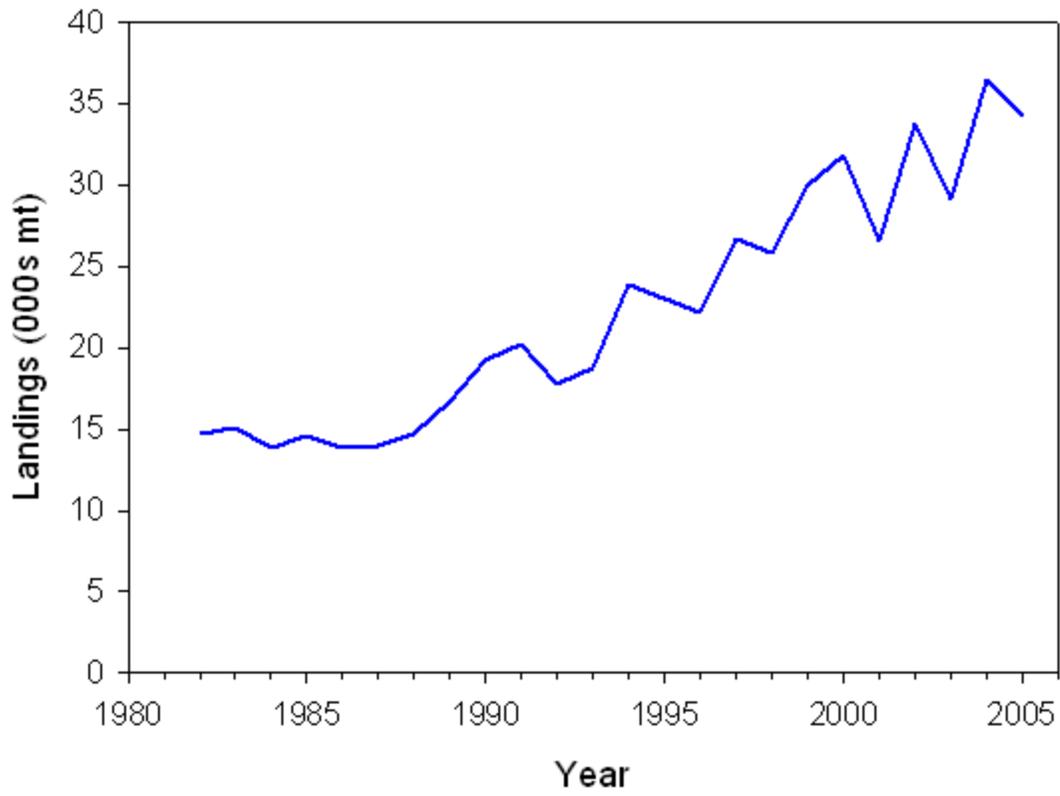


Figure 32.2. Gulf of Maine American lobster total landings 1982-2005.

Gulf of Maine American Lobster Survey Number per Tow

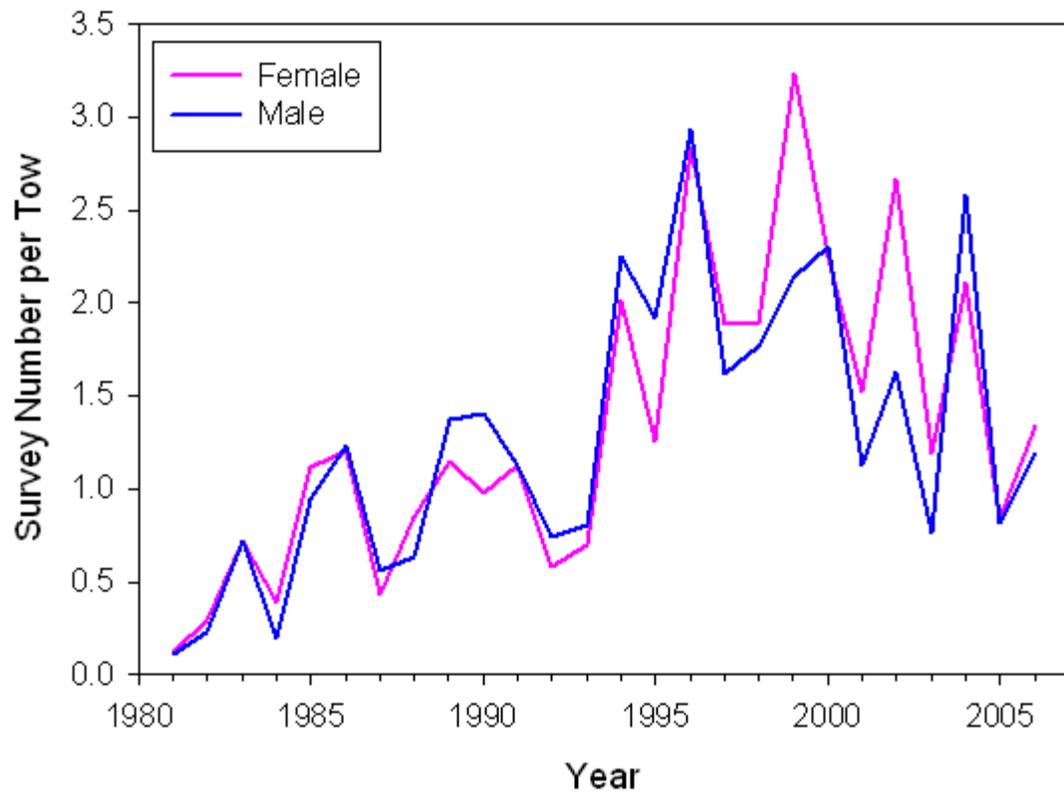


Figure 32.3. Abundance indices (stratified mean number per tow) for Gulf of Maine American lobster from NEFSC autumn bottom trawl surveys.

Gulf of Maine American Lobster Mean Length

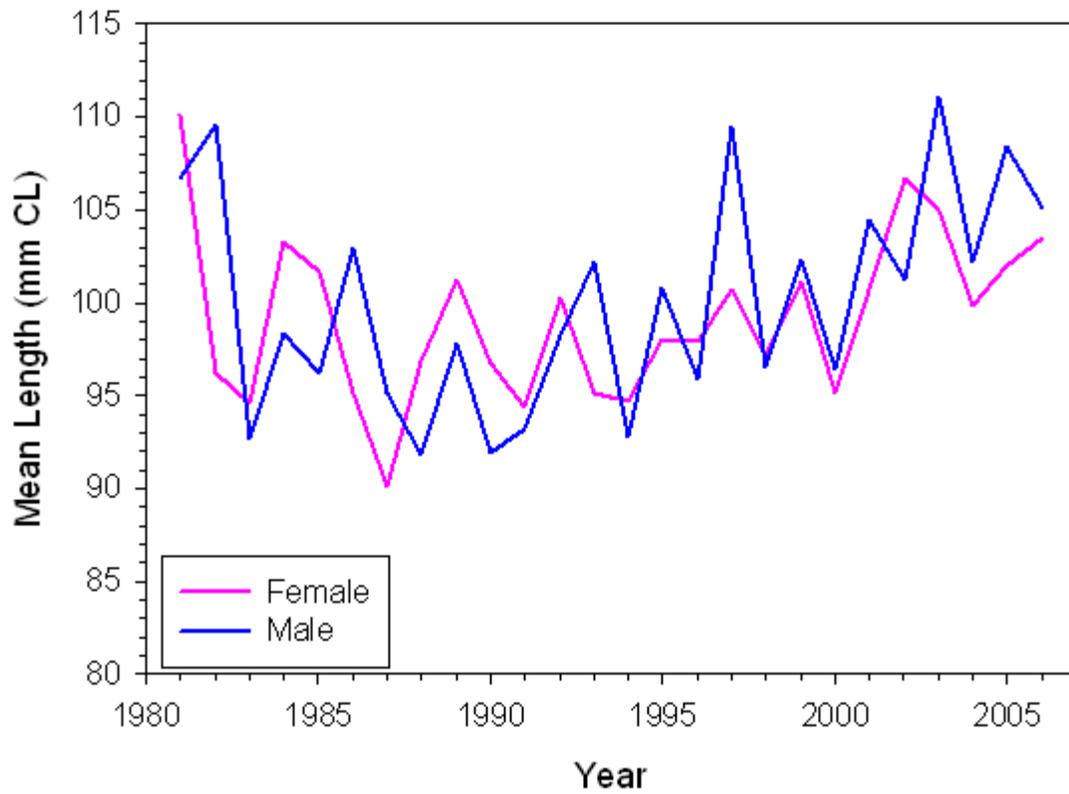


Figure 32.4. Average size (≥ 83 mm CL) of American lobsters by sex from NEFSC autumn bottom trawl surveys.

Gulf of Maine Fishing Mortality Relative to Biological Reference Points

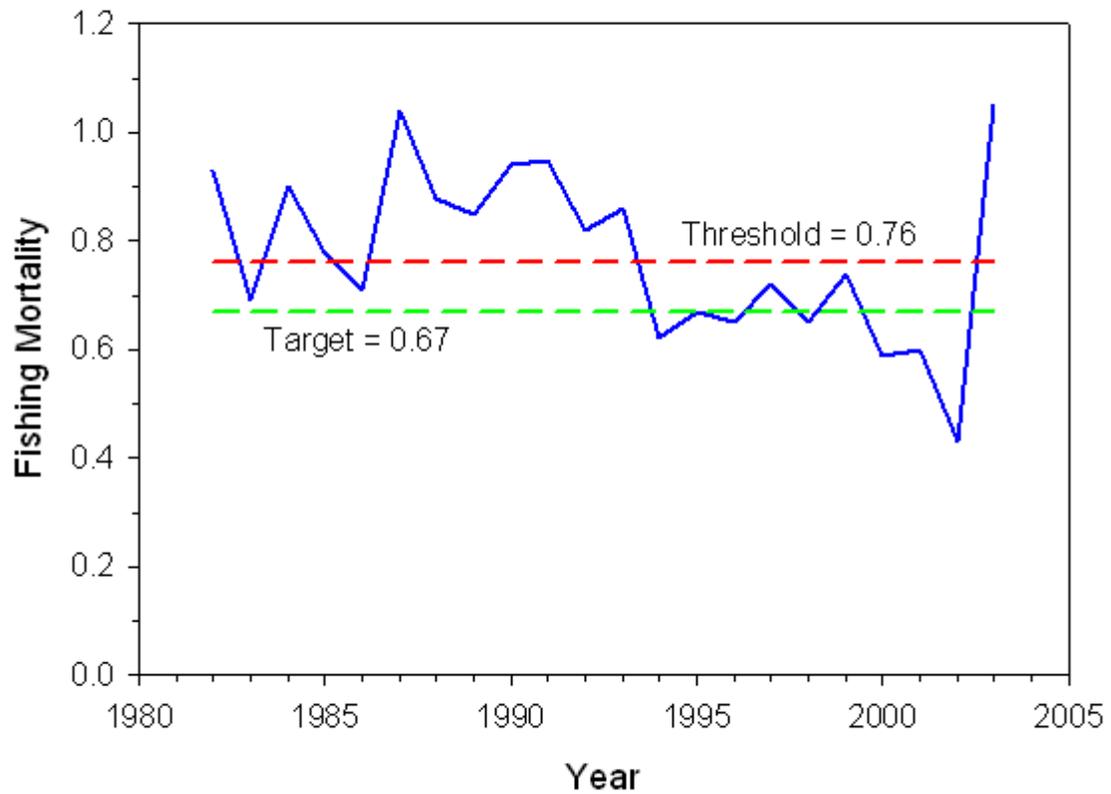


Figure 32.5. Fishing mortality relative to reference points for Gulf of Maine American lobster.

Gulf of Maine Abundance Relative to Biological Reference Points

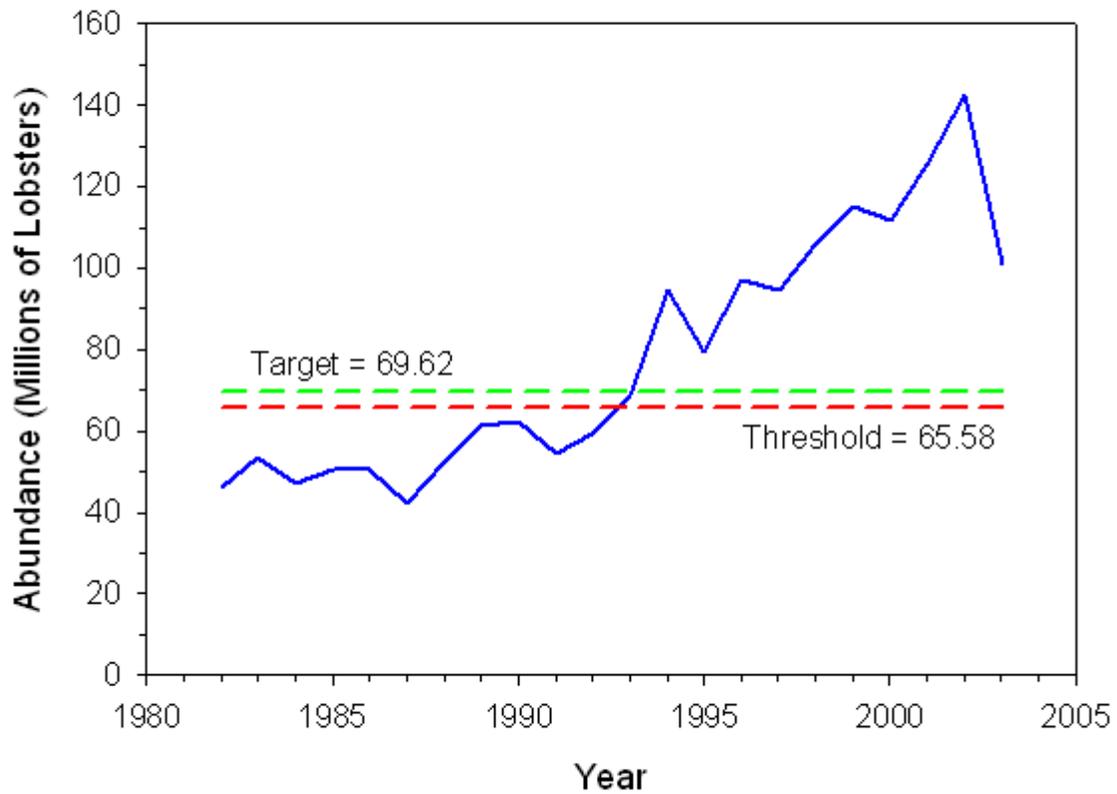


Figure 32.6. Abundance relative to reference points for Gulf of Maine American lobster.

Gulf of Maine American Lobster Landings and Number of Traps Fished

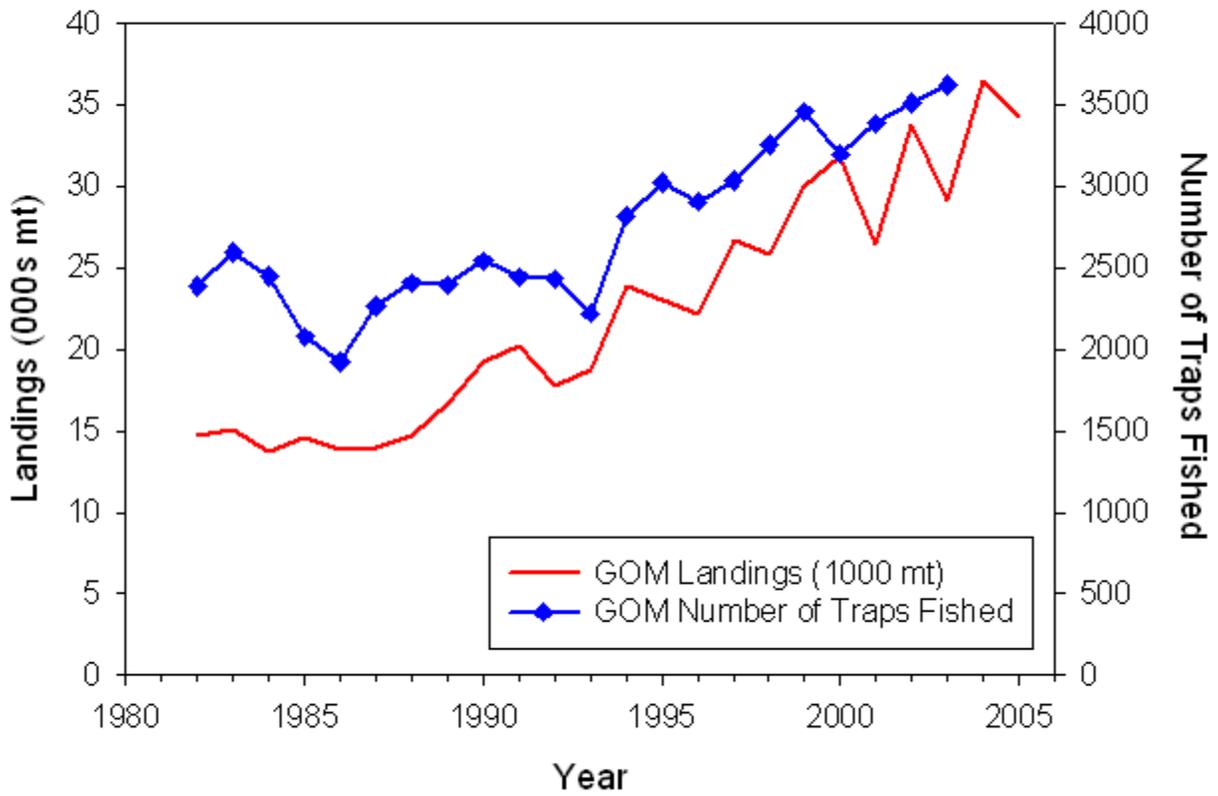


Figure 32.7. Abundance relative to reference points for Gulf of Maine American lobster.

Gulf of Maine (Area 514) American Lobster Fishing Mortality and Abundance Relative to Biological Reference Points

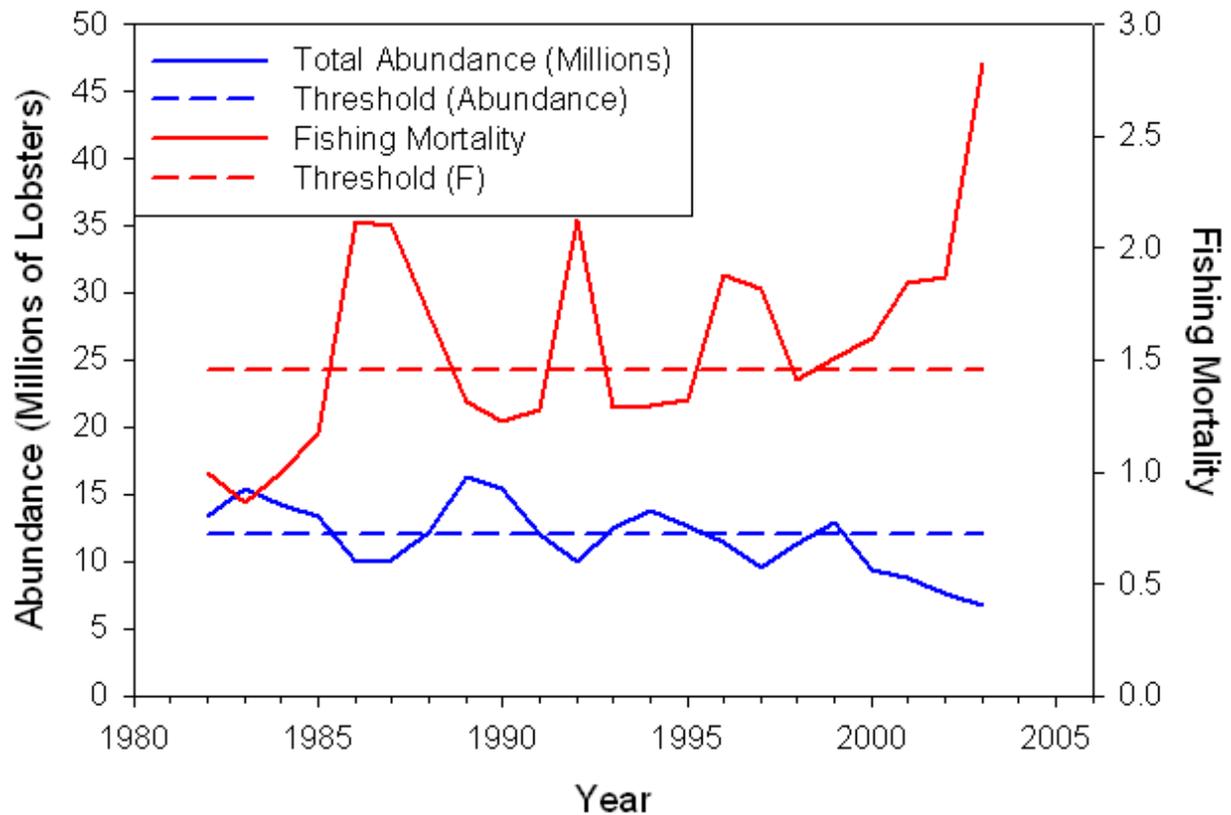


Figure 32.8. Fishing mortality and abundance relative to threshold reference points for Gulf of Maine American lobster (SA 514).

Georges Bank American Lobster Landings

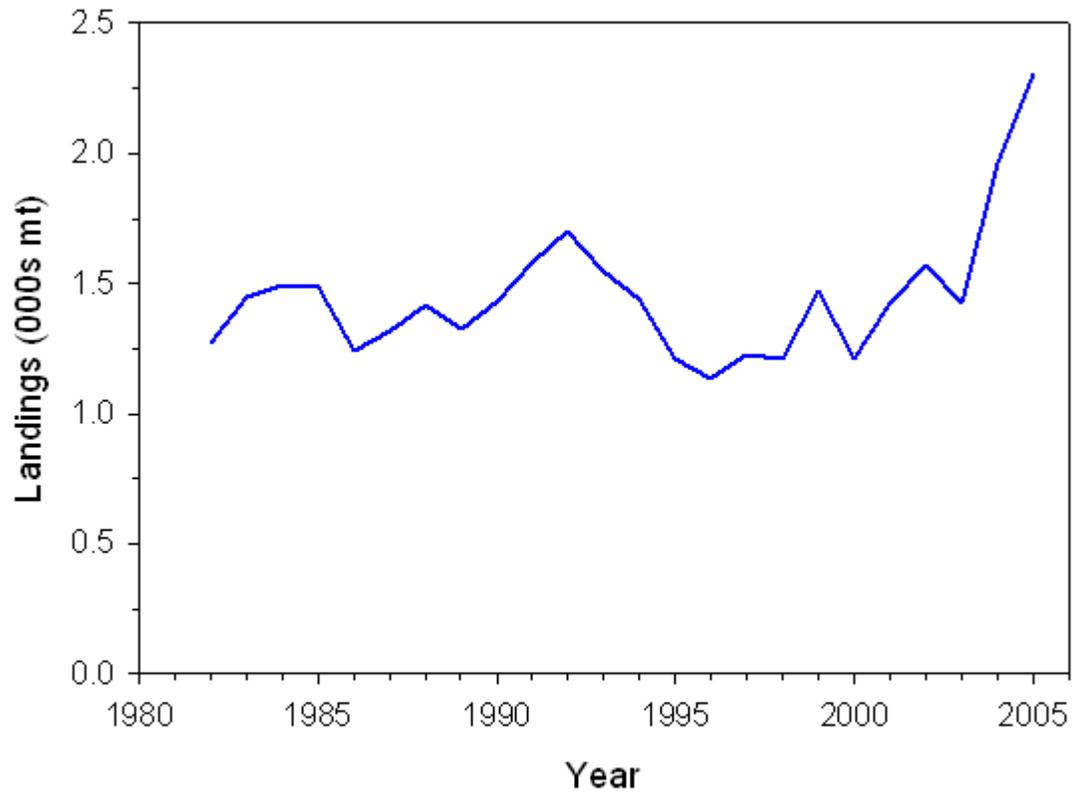


Figure 32.9. Georges Bank American lobster total landings 1982-2005.

Georges Bank American Lobster Survey Number per Tow

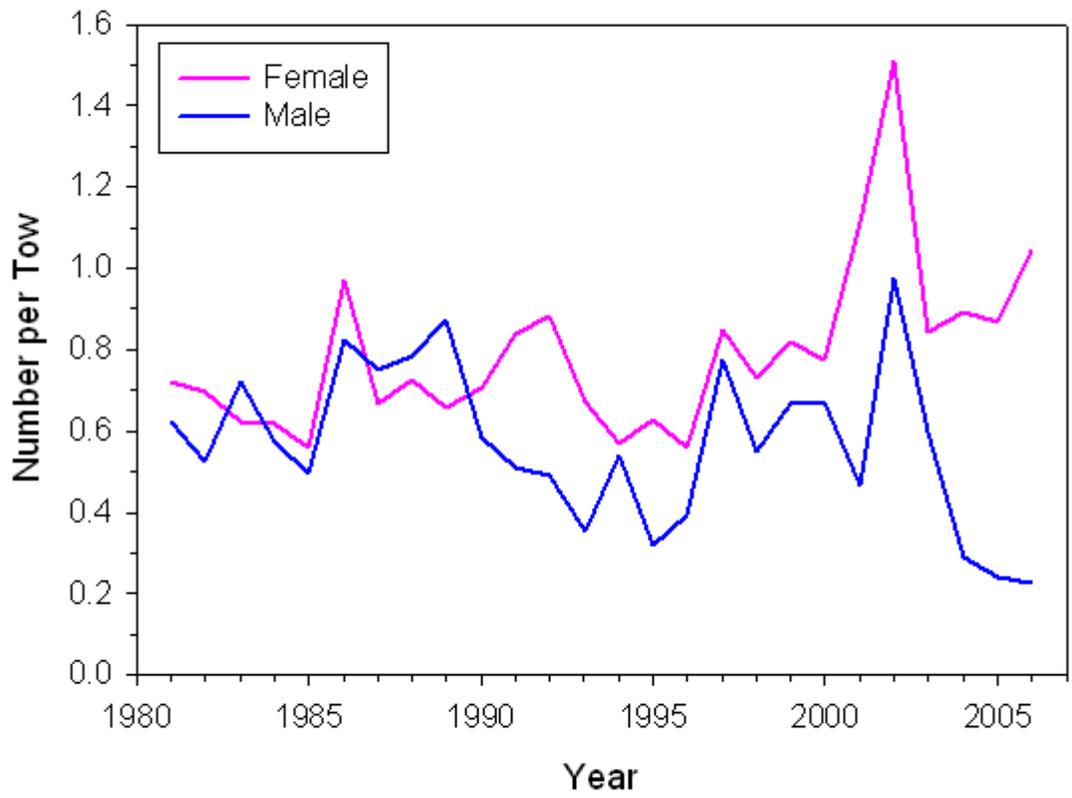


Figure 32.10. Abundance indices (stratified mean number per tow) for Georges Bank American lobster from NEFSC autumn bottom trawl surveys.

Georges Bank American Lobster Mean Length

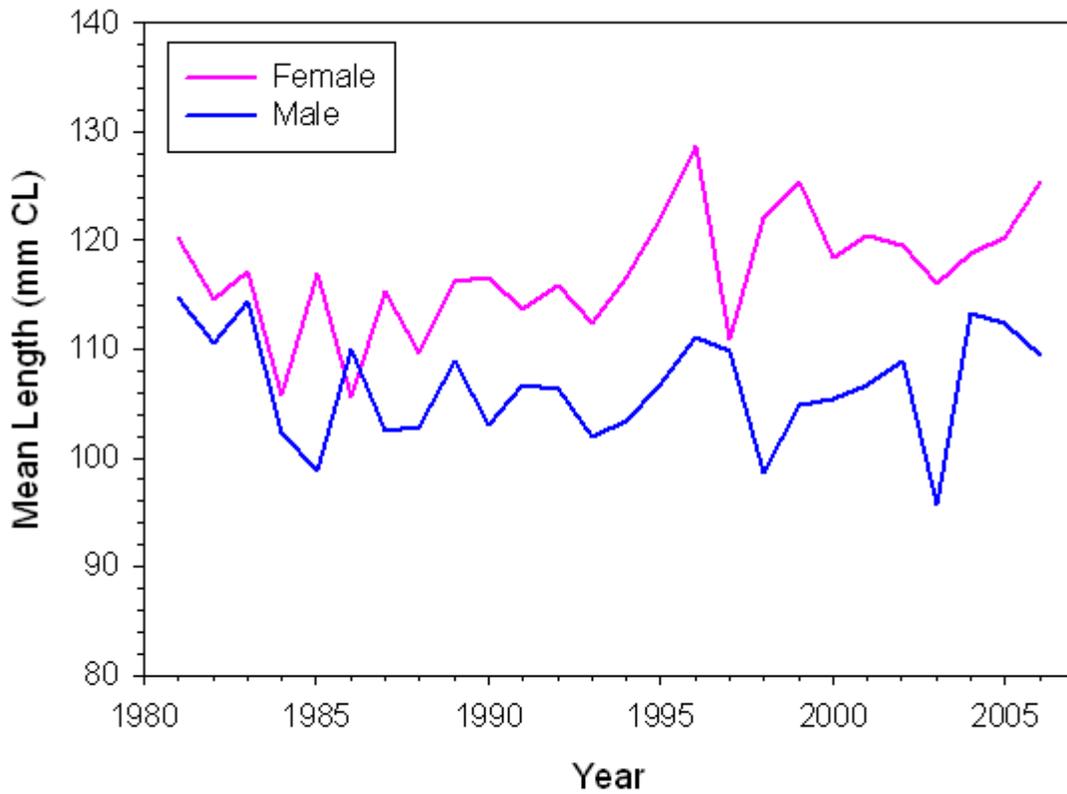


Figure 32.11. Average size (≥ 83 mm CL) of American lobsters by sex from NEFSC autumn bottom trawl surveys.

Georges Bank American Lobster Fishing Mortality Relative to Reference Points

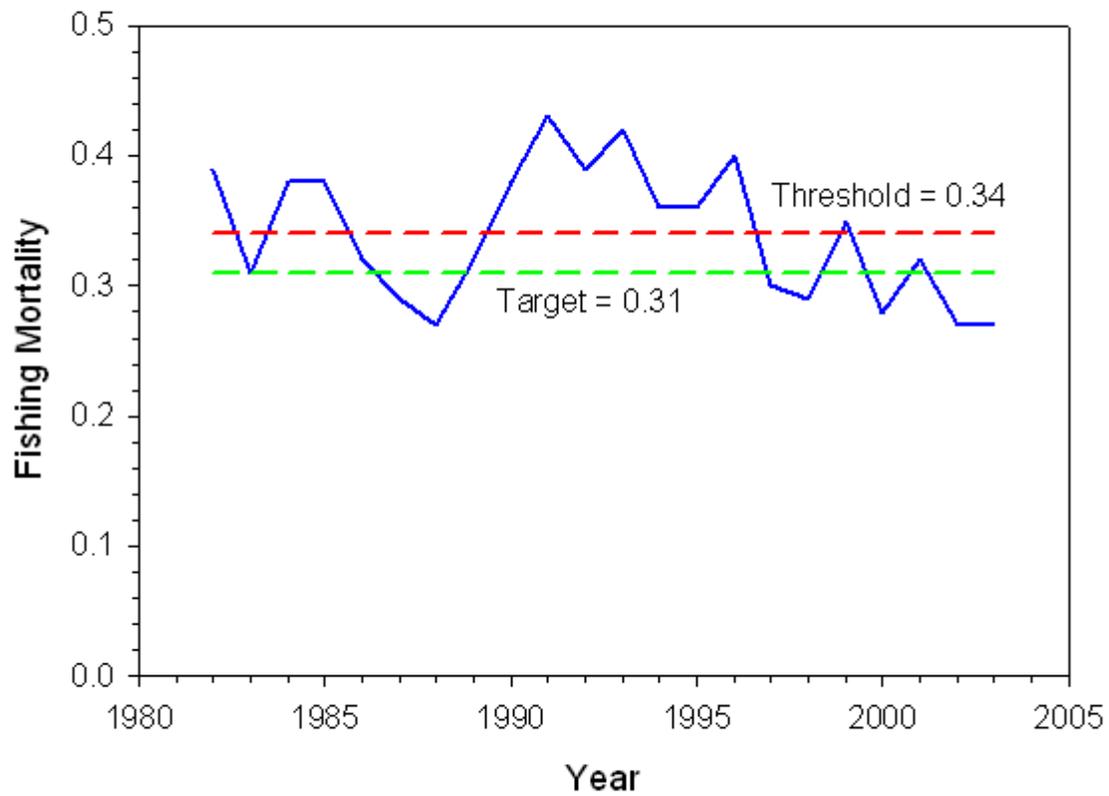


Figure 32.12. Fishing mortality relative to reference points for Georges Bank American lobster.

Abundance Relative to Biological Reference Points for Georges Bank American Lobster

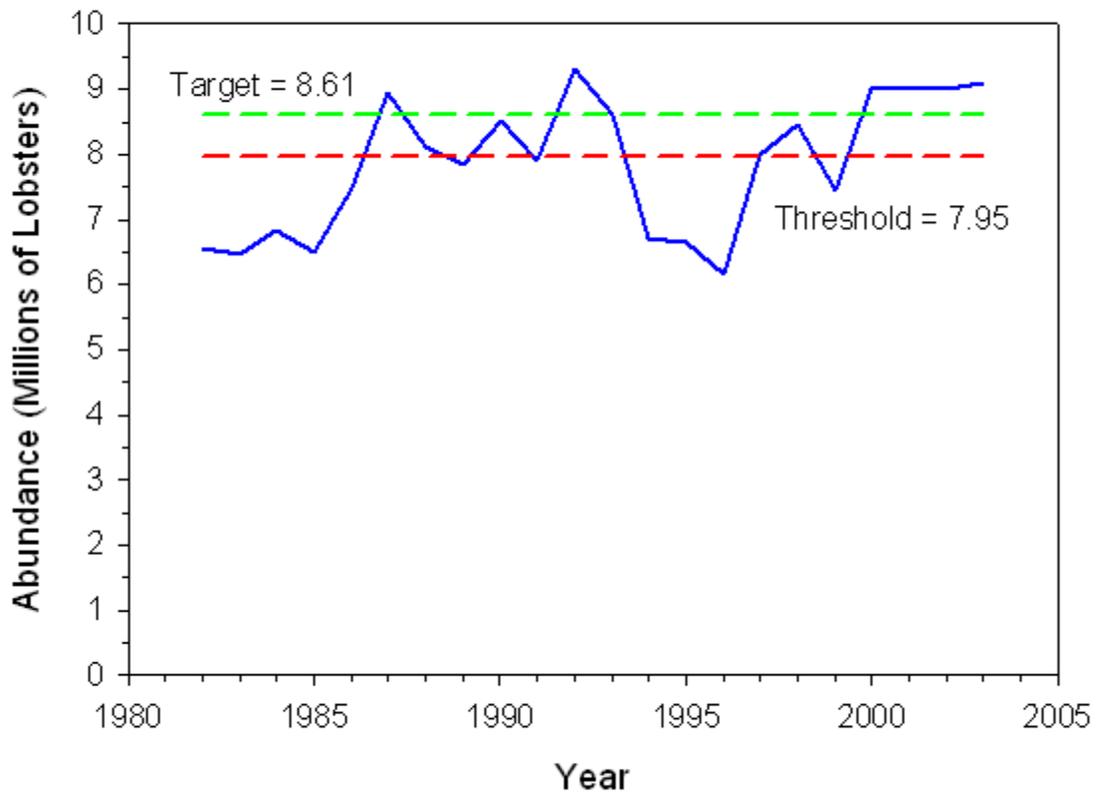


Figure 32.13. Abundance relative to reference points for Georges Bank American lobster.

Georges Bank American Lobster Landings and Number of Traps Fished

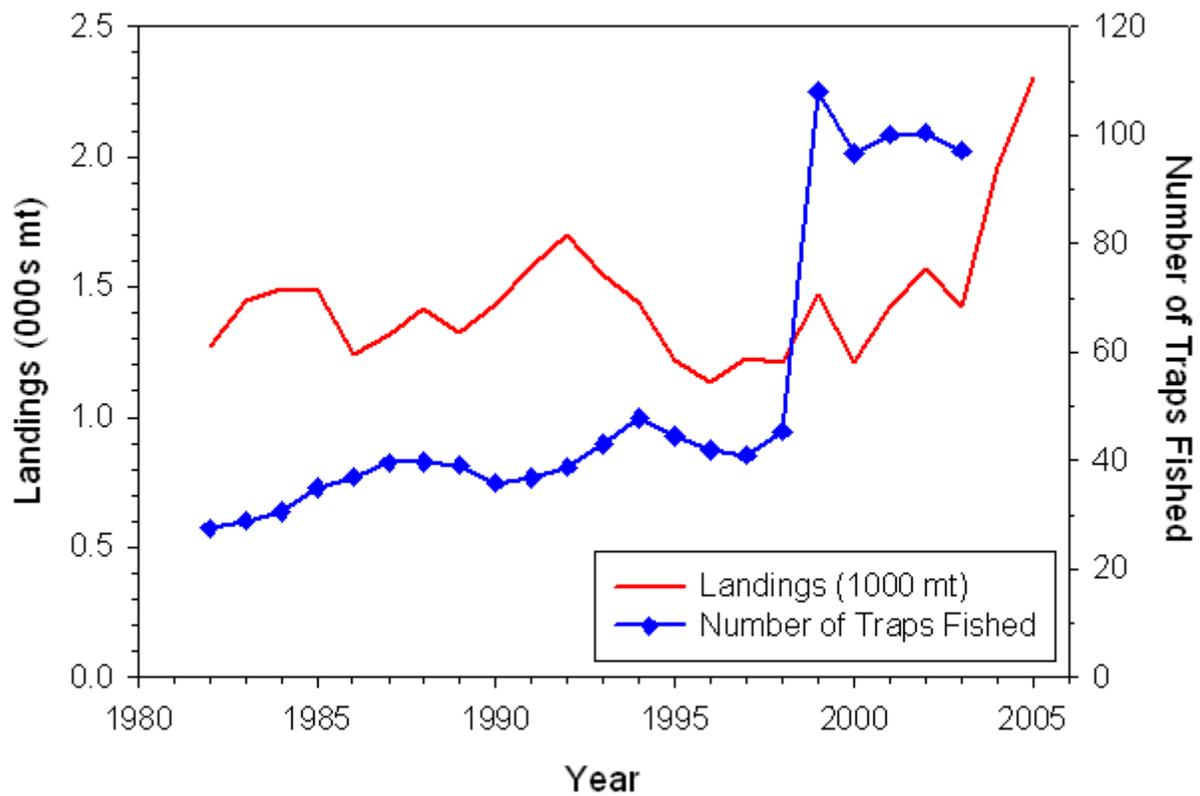


Figure 32.14. Landings and effort (number of traps fished) for Georges Bank American lobster.

Southern New England American Lobster Landings

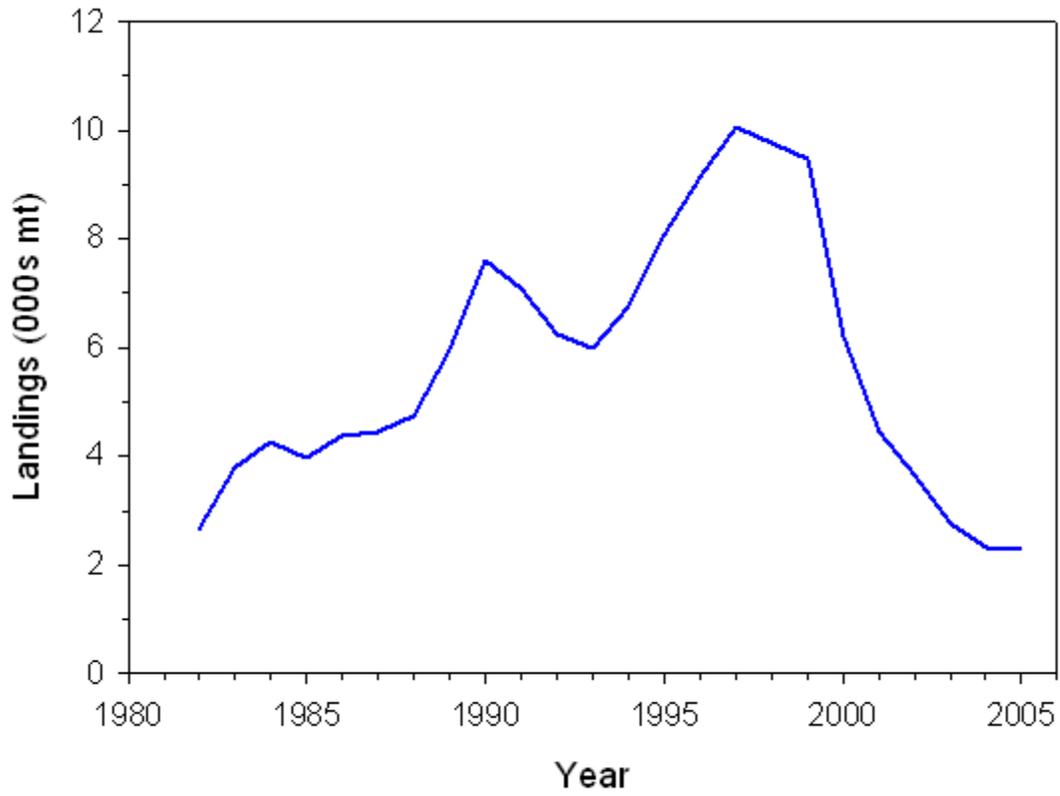


Figure 32.15. Southern New England American lobster total landings, 1982-2005.

Southern New England American Lobster Survey Number per Tow

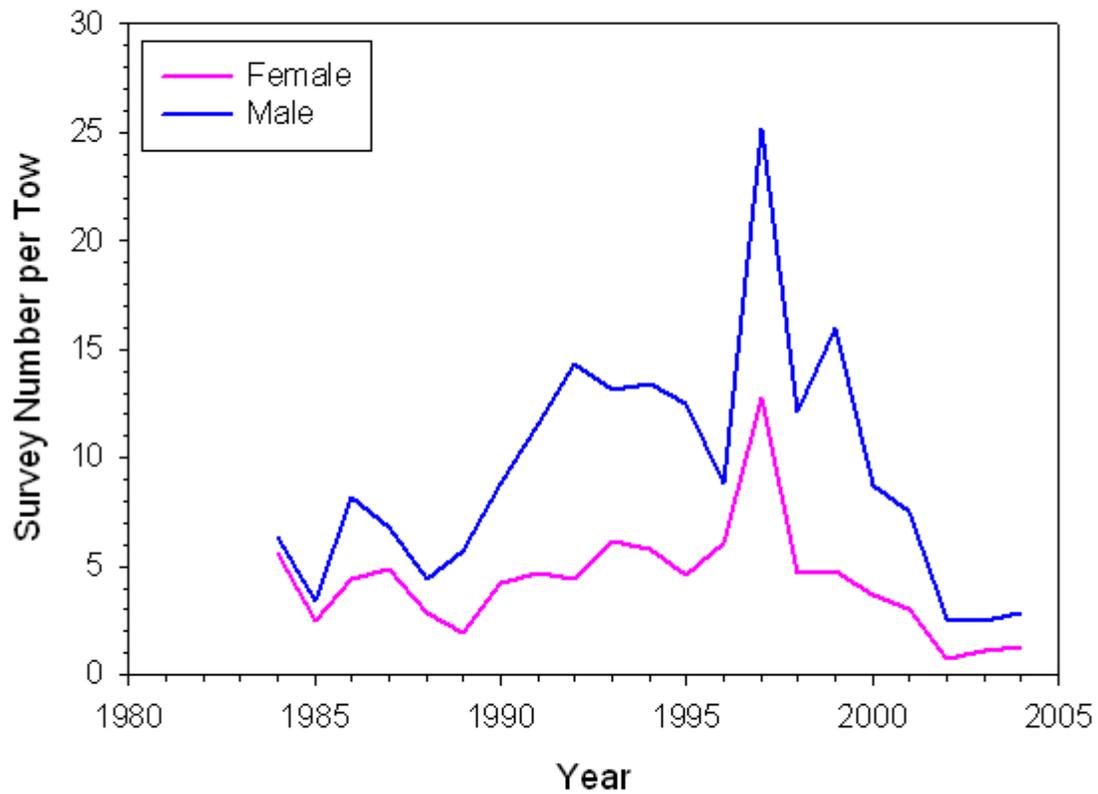


Figure 32.16. Abundance indices (stratified mean number per tow) for Southern New England American lobster from CT autumn bottom trawl surveys.

Southern New England American Lobster Mean Length

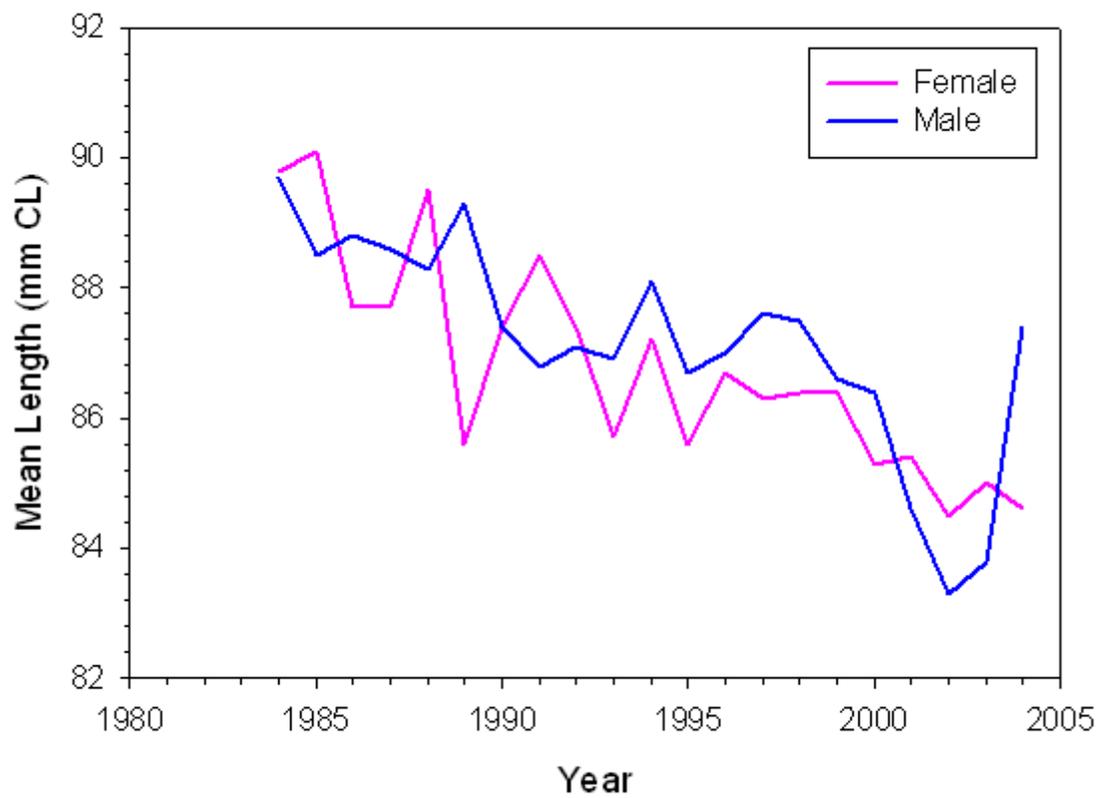


Figure 32.17. Average size (≥ 83 mm CL) of American lobsters by sex from CT autumn bottom trawl surveys.

Southern New England American Lobster Fishing Mortality Relative to Reference Points

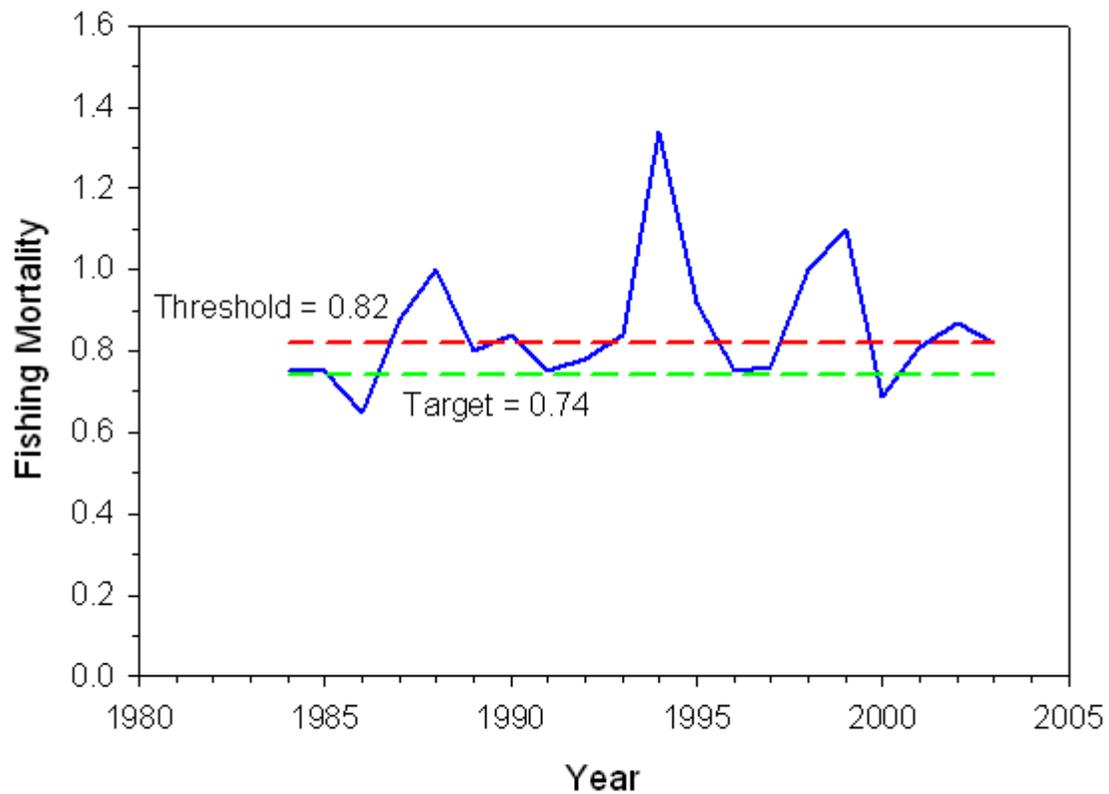


Figure 32.18. Fishing mortality relative to reference points for Southern New England American lobster.

Abundance Relative to Biological Reference Points for Southern New England American Lobster

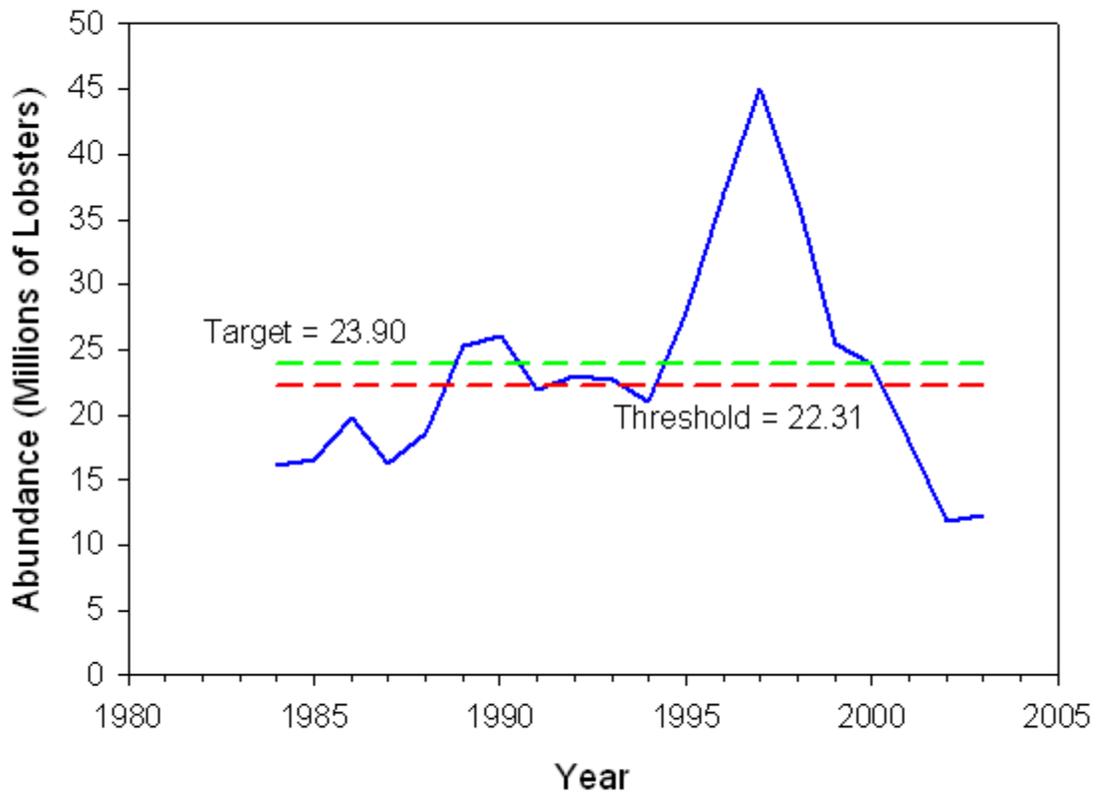


Figure 32.19. Abundance relative to reference points for Southern New England American lobster.

Southern New England American Lobster Landings and Number of Traps Fished

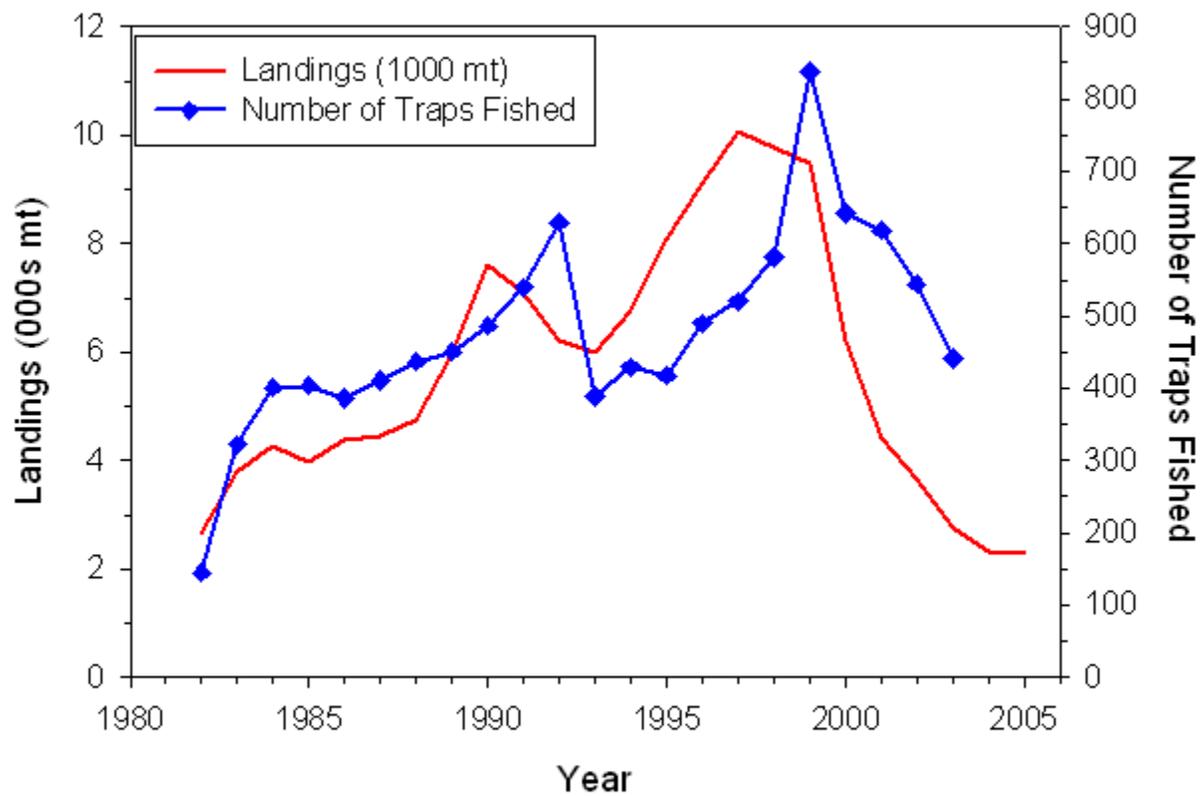


Figure 32.20. Landings and effort (number of traps fished) for Southern New England American lobster.