V. HUMAN METRICS

A. Recreational Fishing

We recognize that recreational fishing is an important part of this ecosystem. Although there is data available, no one from the group provided data for this report. Certainly this is an important issue to consider for some species, and merits further examination in the future.

B. Fishing Communities

What are the relevant communities of fishermen, what is the relation of communities at sea to communities on land, what are the social relations embodied in particular regional fishing practices? Are there appropriate indices of communities, people, and cultures that can provide insight into how this ecosystem functions and how the products and services and of this ecosystem are used beyond economics? Are there indices for other ecosystem goods and services?

Additionally, what about "anecdotal" or cultural environmental knowledge; e.g., do fishermen's notions of space and environment coincide with scientific ones? If not, what are the implications for management structures? What environmental knowledge can/would fishermen contribute? What informal rules for resource access and use would or do fishermen or groups of fishermen regularly employ?

C. Commercial Fisheries

1. New England Otter Trawl Landings

Time: 1964-2000

Spatial: Shelf wide

Contributed by: Edwards

Figure H.1

Methodology and Data Source

These data are from the weighout database reported by dealers to NMFS. Annual landings by species (live weight) were combined according to the species managed by individual fishery management plans. Data are restricted to U.S. bottom trawl vessels that landed in Maine, New Hampshire, Massachusetts, or Rhode Island.

Key Points and Major Observations

New England otter trawl landings declined by two-thirds between 1964 and 2000. U.S. annual landings were higher before the Magnuson-Stevens Fisheries Conservation and Management Act was implemented in 1977 (MSFCMA). Landings peaked during the early 1980s after the MFCMA, but the overall trend has been downwards since that time. The traditional targets of otter trawl fishermen - i.e., Atlantic cod, haddock, yellowtail flounder - have declined in absolute and relative importance from about 240 million pounds or 44 percent of total trawl landings in 1964 to 36 million pounds or 20 percent. Other species managed by the New England Council's Multispecies Groundfish Plan have likewise declined in amount and importance. Otter trawlers now also significantly target monkfish and skates.

2. New England Otter Trawl Revenues

Time: 1964-2000

Spatial: Shelf wide

Contributed by: Edwards

Figure H.2

Methodology and Data Source

These data are from the weighout database reported by dealers to NMFS. Annual dockside revenues by species were combined according to the species managed by individual fishery management plans. Data are restricted to U.S. bottom trawl vessels that landed in Maine, New Hampshire, Massachusetts, or Rhode Island. Revenues were adjusted to 2000-dollars using the GDP implicit price deflator.

Key Points and Major Observations

Revenues were flat, averaging $150 million, until the New England fleet expanded following the MSFCMA. Revenues peaked during the early1980s at over $240 million and then declined to less than pre-MSFCMA levels since about 1995, averaging $130 million. The absolute and relative importance of the traditional target species declined from over $100 million and 60 percent during the mid-1960s to $24 million and less than 20 percent during the mid 1990s. Revenues from cod, haddock, and yellowtail flounder have since increased moderately. Despite a decline in landings, revenues have been supported by increases in consumer demand (population of seafood consumers and their income) which in turn increases dockside prices.

3. Total Number of Otter Trawl Vessels

Time: 1964-2000

Spatial: Shelf wide

Contributed by: Edwards

Figure H.3

Methodology and Data Source

These data are from the weighout database reported by dealers to NMFS. Number of U.S. otter trawl vessels with landings reported in Maine, New Hampshire, Massachusetts, or Rhode Island. Vessels are binned by tonnage class (5-50 gross registered tons in ton class 2, 51-150 grt in TC3, >150 in TC4)

Key Points and Major Observations

The total number of otter trawl vessels increased gradually up to 1977, particularly in TC3 and TC4. Vessel numbers increased quickly after the MSFCMA into the early 1980s from about 600 to 1000. There were increases in each vessel class. The total number of active otter trawl vessels has vacillated around 750 during the 1990s.

4. Total Income of NE Otter Trawl Fisherman (Profit)

Time: 1964-2000

Spatial: Shelf wide

Contributed by: Edwards

Figure H.4

Methodology and Data Source

These data are from the weighout database reported by dealers to NMFS. and NMFS cost data. Annual dockside revenues by species were combined according to the species managed by individual fishery management plans. Data are restricted to U.S. bottom trawl vessels that landed in Maine, New Hampshire, Massachusetts, or Rhode Island. Revenues were adjusted to 2000-dollars using the GDP implicit price deflator. Costs (also adjusted to 2000-dollars) are sample estimates from CMER (Cooperative Marine Education and Research) survey projects by the University of Rhode Island. Costs are for trip (e.g., fuel), repair and maintenance, and fixed (except unknown loan and depreciation) expenses. See Lallemand et al. (1998, 1999) for further details.

Key Points and Major Observations

Results should be considered rough approximations due to incomplete nature of cost data.

Total income vacillated around $80 million before the MSFCMA. Income peaked during the late1970s/early1980s and then trended downwards until 1996. Income has improved since 1996, but at less than $60 million it remains substantially below the pre-MSFCMA average. Income of crew averaged 40-50 percent of total income. Recent income is depressed relative to revenues because of the costs of excess harvest capacity.

5. Adjusted Average Income of NE Otter Trawl Fisherman

Time: 1964-2000

Spatial: Shelf wide

Contributed by: Edwards

Figure H.5

Methodology and Data Source

These data are from the weighout database reported by dealers to NMFS. and NMFS cost data. Annual dockside revenues by species were combined according to the species managed by individual fishery management plans. Data are restricted to U.S. bottom trawl vessels that landed in Maine, New Hampshire, Massachusetts, or Rhode Island. Revenues were adjusted to 2000-dollars using the GDP implicit price deflator. Costs (also adjusted to 2000-dollars) and crew size are sample estimates from CMER (Cooperative Marine Education and Research) survey projects by the University of Rhode Island. Costs are for trip (e.g., fuel), repair and maintenance, and fixed (except unknown loan and depreciation) expenses. Income was averaged over the number of vessels and approximate number of crew (2 crew in TC2, 4 in TC3, 5 in TC4). See Lallemand et al. (1998, 1999) for further details.

Key Points and Major Observations

Results should be considered rough approximations due to incomplete nature of cost and crew data. Average income per vessel and crew fluctuated considerably prior to the MSFCMA without trend. Average income trended downward since the late 1970s to lows of $25,000 per vessel and $8,000 per crew in 1996. Average income for vessel owners and crew has improved since 1996 but still remains below the pre-MSFCMA averages of about $80,000 and $20,000, respectively.

6. Standardized fishing effort on Georges Bank

Time: 1960-1987

Spatial: Georges Bank

Contributed by: Brodziak

Figure H.6

Methodology and Data Source

The multispecies and multifleet catch and effort data are reported to NAFO, standardized to account for differences in effective fishing effort using information on vessel size, gear, and country of origin using a general linear modeling approach. See Mayo et al. (1992) and Brodziak and Link (2002) for further details.

Key Points and Major Observations

Fishing effort was very high during the mid 1960s to mid 1970s when foreign distant water fleets were (over)harvesting fish on Georges Bank. Fishing effort declined by about 2/3 after passage of the Magnuson Stevens Fishery Conservation Act of 1976. This act extended the USAs Exclusive Economic Zone (EEZ) to include Georges Bank. Domestic fishing effort increased from 1977-1987, although this increase was moderate compared to the increase in distant water fleet effort in the 1960s.

7. Standardized catch-per-unit effort (CPUE) for Georges Bank fisheries

Time: 1960-1987

Spatial: GB

Contributed by: Brodziak

Figure H.7

Methodology and Data Source

Multispecies and multifleet catch and effort data reported to NAFO were used to compute standardized CPUE based on differences in vessel size, gear, and country of origin using a general linear model estimation approach. See Mayo et al. (1992) and Brodziak and Link (In press) for further details.

Key Points and Major Observations

Standardized CPUE declined from the early 1960s to mid 1970s as fish stocks were depleted. There was a short-term increase in CPUE after passage of the Magnuson Act in the late 1970s followed by a sharp decline through the mid 1980s. Fishery CPUE is not expected to be proportional to aggregate fish stock biomass. Instead, CPUE is likely a nonlinear function of fish biomass. In this context, the observed declines in CPUE are expected to underestimate the actual declines in fish stock biomass on Georges Bank.

8. Fishery harvest rate in relation to spawning biomass for Georges Bank haddock

Time: Composite picture, 1931-1998

Spatial: Georges Bank

Contributed by: Brodziak

Figure H.8

Methodology and Data Source

Under the current management approach, a target and a threshold harvest rate have been determined for Georges Bank haddock. The target and threshold depend on the current spawning biomass. The graph shows the observed fishing mortality and spawning biomass from an assessment of the Georges Bank haddock stock in relation to the target and threshold harvest rate lines. See Brodziak and Link (2002) for further details.

Key Points and Major Observations

Harvest rates on the Georges Bank haddock stock have generally exceeded target rates during 1931-98. Thus, management measures have generally not been effective to ensure that the harvest rate has been near its target for this stock. Spawning stock biomass of Georges Bank haddock has begun to increase as harvest rates have been reduced in the 1990s. The 1998 data point shows the status of the spawning biomass is still well below target spawning biomass.

9. Georges Bank cod, haddock and yellowtail flounder yields

Time: 1935 - 2000

Spatial: Georges Bank

Contributed by: Brodziak

Figure H.9

Methodology and Data Source

Time series of total fishery landings for Georges Bank cod, haddock, and yellowtail flounder stocks were gathered from historical databases. These figures do not include discarded catches. See Brodziak and Link (2002) for further details.

Key Points and Major Observations

Yields were high during the 1930s-1950s, peaked in the 1960s, declined in the 1970s, peaked again in the early 1980s, and then declined. Georges Bank cod, haddock, and yellowtail yields have increased moderately in recent years after reaching record lows in the mid 1990s. Landings of the three primary groundfish stocks on Georges Bank have been below the estimated long-term potential yield (LTPY) for most of the observed time series. One causal factor leading to the lack of achievement of the long-term potential yield from these three primary stocks has been chronic overfishing, e.g., fishermen catching fish faster than the stocks can replenish themselves.

10. Fishing Activity, by state (North)

Time: 1999

Spatial: Shelf wide

Contributed by: Olson

Figure H.10

Methodology and Data Source

These data were derived from the 1999 logbook dataset. Latitude-longitude coordinates from converted loran observations were used to locate fishing activity by state in various regions of the shelf. Coordinates were truncated to two decimal points for visual display. Only New England and upper Mid-Atlantic are displayed.

Key Points and Major Observations

Fishing-activity is in terms of both a proxy for total days/location (total days absent, except fractions thereof for trips recording multiple locations) summed over all commercial trips and vessels (size of dots) and by state of landing (color of dots). Coastal areas are dominated by their respective states, but there is considerably more mixing in more distant waters. What then is the relation between "community" and "territory"? Are there different kinds of communities? Are there kinds of informal management regimes operant in some of these territories-of-use? Different places show different practices: why, what different kinds of social relations are enabled in these different ways of fishing, and with what different kinds of implications?

11. Fishing Activity, by state (South)

Time: 1999

Spatial: Shelf wide

Contributed by: Olson

Figure H.11

Methodology and Data Source

These data were derived from the 1999 logbook dataset. Latitude-longitude coordinates from converted loran observations were used to locate fishing activity by state in various regions of the shelf. Coordinates were truncated to two decimal points for visual display. Only Mid-Atlantic waters are displayed.

Key Points and Major Observations

Fishing-activity is in terms of both a proxy for total days/location (total days absent, except fractions thereof for trips recording multiple locations) summed over all commercial trips and vessels (size of dots) and by state of landing (color of dots). Coastal areas are dominated by their respective states, but there is considerably more mixing in more distant waters. What then is the relation between "community" and "territory"? Are there different kinds of communities? Are there kinds of informal management regimes operant in some of these territories-of-use? Different places show different practices: why, what different kinds of social relations are enabled in these different ways of fishing, and with what different kinds of implications?

12. Summer Flounder Catch

Time: 1999

Spatial: Shelf wide

Contributed by: Olson

Figure H.12

Methodology and Data Source

These data were derived from the 1999 logbook dataset. Latitude-longitude coordinates from converted loran observations were used to locate fishing activity by state in various regions of the shelf. Coordinates were truncated to two decimal points for visual display. Only Mid-Atlantic waters are displayed.

Key Points and Major Observations

Fishing-activity is in terms of both a proxy for total days/location (total days absent, except fractions thereof for trips recording multiple locations) summed over all commercial trips and vessels that caught at least 300 pounds fluke. The size of the pie chart was determined by size of the total fluke catch, the color of the pie chart slices was determined by state of landing, and the size of the slice was determined by that state's total days at that location. This is a single-species representation. How does the management system in place (here, quotas by state of landing) affect the spatiality of fishing–are the bands of activity on fishing grounds by state of landing more clear-cut than the previous figures? If so, to what extent is that attributable to the management, to the bio-ecosystemic properties of fluke, and to fishing practices of fluke fishermen (Who is targeting fluke and who are generalists? Questions of seasonality, "community" and "territory" emerge again.)

13. New England landed value, by county

Time: 1994-2000

Spatial: Shelf wide

Contributed by: Olson

Figure H.13

Methodology and Data Source

These data are from dealer weigh-out records, including all vessels landing in New England counties, 1994-2000. The landed value is summed across all species by county of landing, joined with census county maps.

Key Points and Major Observations

Coupled with next figure (H.14), these data seem to show an "uneven" spatiality to temporal changes in fishing. Although changes in the number of vessels were similar over all counties, changes in landed value were not. Are there changes in landing practices, changes in social/spatial relations, etc.? An answer would require additional ethnographic research, as well as knowledge of other regional differences in fishing practices (targeted species, if any; type of fleet; etc.).

14. New England number of permitted vessels, by county

Time: 1997-2001

Spatial: Shelf wide

Contributed by: Olson

Figure H.14

Methodology and Data Source

These data are from permit data, 1997-2001 (application years). Distinct vessel numbers were counted and summed by homeport county, for New England only.

Key Points and Major Observations

Coupled with previous figure (H.13), these data seem to show an "uneven" spatiality to temporal changes in fishing. Although changes in the number of vessels were similar over all counties, changes in landed value were not. Are there changes in landing practices, changes in social/spatial relations, etc.? An answer would require additional ethnographic research, as well as knowledge of other regional differences in fishing practices (targeted species, if any; type of fleet; etc.).

15. Average days absent

Time: 1999

Spatial: Shelf wide

Contributed by: Olson

Figure H.15

Methodology and Data Source

These data were derived from the 1999 logbook dataset. Latitude-longitude coordinates from converted loran observations were used to locate fishing activity by state in various regions of the shelf. Coordinates were truncated to two decimal points for visual display. New England and Mid-Atlantic areas are displayed. All trips were summed by truncated locations; crew size averaged over trips at that location (not vessels). Does not account for "popularity" of sites.

Key Points and Major Observations

This graphical summary provides another way of displaying qualitative differences in use of fishing space, in terms of reading heterogeneity into fishing practices. Coastal waters are, unsurprisingly, dominated by day-trippers; trips in offshore waters vary in length. This isn't related solely or simply to biomass. Day-boat fishing is not practiced simply because the fish are close by and may as well be caught first, but because fishing as a day-boat is a social practice that is valued because of the other sorts of relations it enables (e.g. family, community on land etc.). If so, and especially in an "ecosystem-based fishery management" context, the effect of qualitative factors on ecosystem processes should also be considered.

16. Groundfish Landings

Time: 1995-2000

Spatial: Shelf wide

Contributed by: Olson

Figures H.16 and H.17

Methodology and Data Source

These data were derived from the 1995-2000 logbook dataset. The quantity kept of groundfish was summed by statistical area. Groundfish included: Atlantic cod, winter flounder, witch flounder, yellowtail flounder, American plaice, haddock, white hake, redfish, pollock, red hake, ocean pout, silver hake, monkfish, cusk, and wolffish

Key Points and Major Observations

These data show the temporal *and* spatial distribution of groundfish catches. To what extent do these variations correspond to species abundances, and to what extent do they correspond with social practices (as in previous graphs)?

17. Pelagic Landings

Time: 1995-2000

Spatial: Shelf wide

Contributed by: Olson

Figures H.18 and H.19

Methodology and Data Source

These data were derived from the 1995-2000 logbook dataset. The quantity kept of pelagic species was summed by statistical area. Pelagics included: bluefish, butterfish, Atlantic herring, Atlantic mackerel, and menhaden.

Key Points and Major Observations

These data show the temporal *and* spatial distribution of groundfish catches. To what extent do these variations correspond to species abundances, and to what extent do they correspond with social practices (as in previous graphs)?

18. Bigeye Tuna Landings and Value

Time: 1993-1997

Spatial: Atlantic

Contributed by: Link

Figure H.20

Methodology and Data Source

These data were obtained from NMFS "Status of the Stocks" indicating the total value and biomass of tuna landed. See NMFS (1999) for further details.

Key Points and Major Observations

Although a short time series, there is a decline in recent years. This represents information from large, apex predators.

19. Atlantic Cod Landings and Value

Time: 1993-1997

Spatial: Atlantic

Contributed by: Link

Figure H.21

Methodology and Data Source

These data were obtained from NMFS "Status of the Stocks" indicating the total value and biomass of cod landed. See NMFS (1999) and NEFSC (1998) for further details.

Key Points and Major Observations

Although a short time series, there is a decline in recent years. This represents information from a culturally, ecologically, and economically important species in this ecosystem.

20. Swordfish Landings and Value

Time: 1993-1997

Spatial: Atlantic

Contributed by: Link

Figure H.22

Methodology and Data Source

These data were obtained from NMFS "Status of the Stocks" indicating the total value and biomass of tuna landed. See NMFS (1999) and NEFSC (1998) for further details.

Key Points and Major Observations

Although a short time series, there is a decline in recent years. This represents information from large, apex predators.

D. Fisheries Management (Governance)

1. Fraction of Georges Bank closed year-round to fishing

Time: 1977-2000

Spatial: Georges Bank

Contributed by: Brodziak

Figure H.23

Methodology and Data Source

Several large areas of Georges Bank were closed year-round to fishing in 1995 to help conserve and rebuild depleted groundfish stocks. Fishing vessels can transit through these areas but cannot fish there. See Brodziak and Link (2002) for further details.

Key Points and Major Observations

Over 25% of Georges Bank was closed to fishing in the mid 1990s. Prior to these closures, some areas were closed on a seasonal basis.

2. Minimum mesh size regulations for trawl fishing nets

Time: 1977-2000

Spatial: Northeast USA shelf fisheries

Contributed by: Brodziak

Figure H.24

Methodology and Data Source

Minimum trawl mesh sizes for large-mesh otter trawl fisheries have been adjusted since 1977 to help to conserve groundfish under the New England Fishery Management Multispecies Fishery Management Plan. See Brodziak and Link (2002) for further details.

Key Points and Major Observations

Minimum mesh sizes were increased in 1983 and 1994 to help conserve groundfish. Larger mesh sizes retain fewer small, unmarketable fish in the codend of the trawl net. Thus, a larger minimum mesh leads to less bycatch of juvenile fishes.

3. Days-at-sea restrictions for groundfish vessels

Time: 1977-2000

Spatial: Northeast USA groundfish fisheries

Contributed by: Brodziak

Figure H.25

Methodology and Data Source

The total number of days a fishing vessel can spend at sea were regulated in 1996 for the purpose of reducing fishing effort directed at depleted New England groundfish stocks. This effort regulation applies to New England groundfish fisheries. See Brodziak and Link (2002) for further details.

Key Points and Major Observations

Prior to 1996, there was no restriction on the number of days domestic fishing vessels could be fishing. Some large vessels received more than 120 days at sea based on their fishing history - the graph shows the default allocation that most vessels received.

E. Summary of Human Metrics

There has been a clear change in the effort, landings, and profit of the fishing fleet over the past four decades. Major events include a shift in targeted species, a decline in the poundage and value of landings, and an increase in the number of vessels after the late 1970s. This corresponds to the passage and implementation of the MSFCMA. Landings of two apex predators and Atlantic cod in more recent years show, although short term, a similar decline during the 1990s, perhaps due to changes in regulation of these species.

The patterns of spatial allocation of fishing effort and landings are logical given the logistic and cultural constraints in the region. Although these maps are relatively short time-series, historical data may be available to extend this analysis back for approximately 30 years. What is the role of other non-fishing sources of income in the decision-making process of whether to fish?

Regulations on the fisheries have become increasingly restrictive in recent years, with changes in closed areas, mesh size, and days at sea all much less lenient than in the 1960s and 1970s.

F. References

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Lallemand, P., Gates, J.M., Dirlam, J. and Cho, J-H. 1999. The cost of large trawlers in the Northeast. Final Report, Cooperative Marine Education and Research Program, Department of Environmental and Natural Resource Economics, University of Rhode Island.

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Figure H.1. ***New England Otter Trawl Landings***

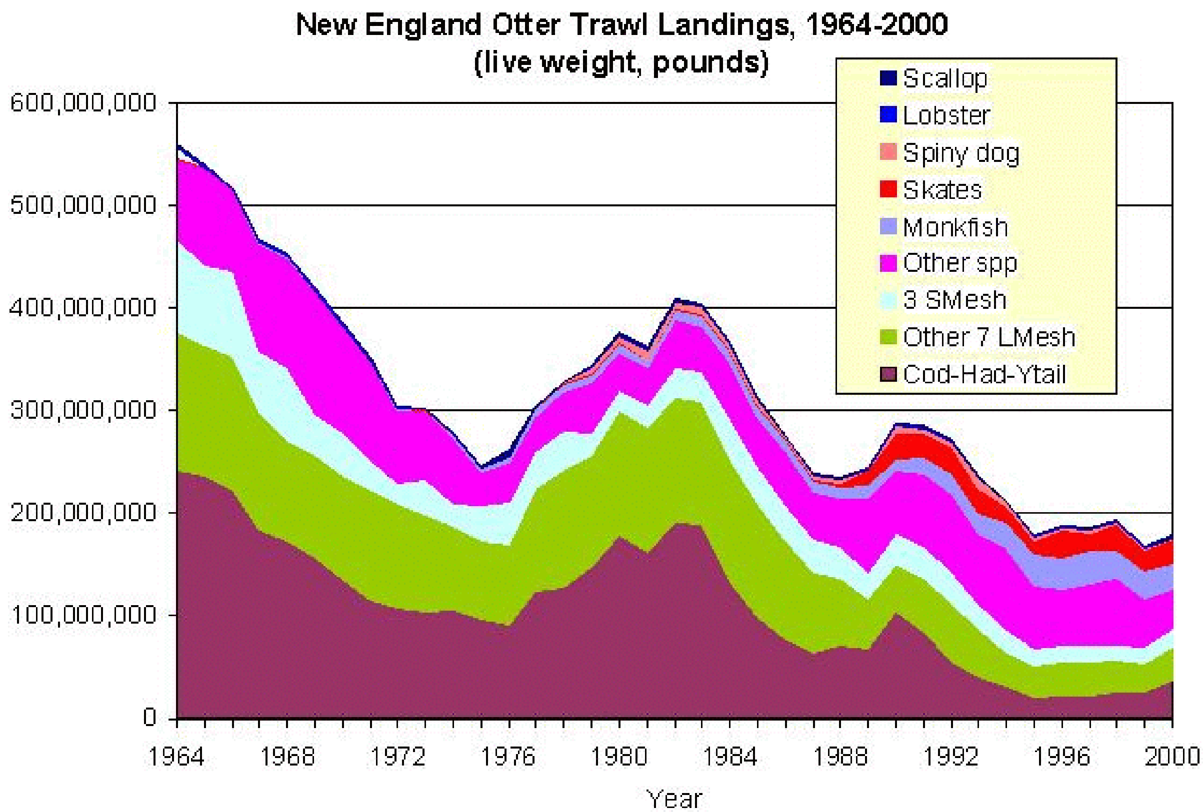


Figure H.2. ***New England Otter Trawl Revenues***

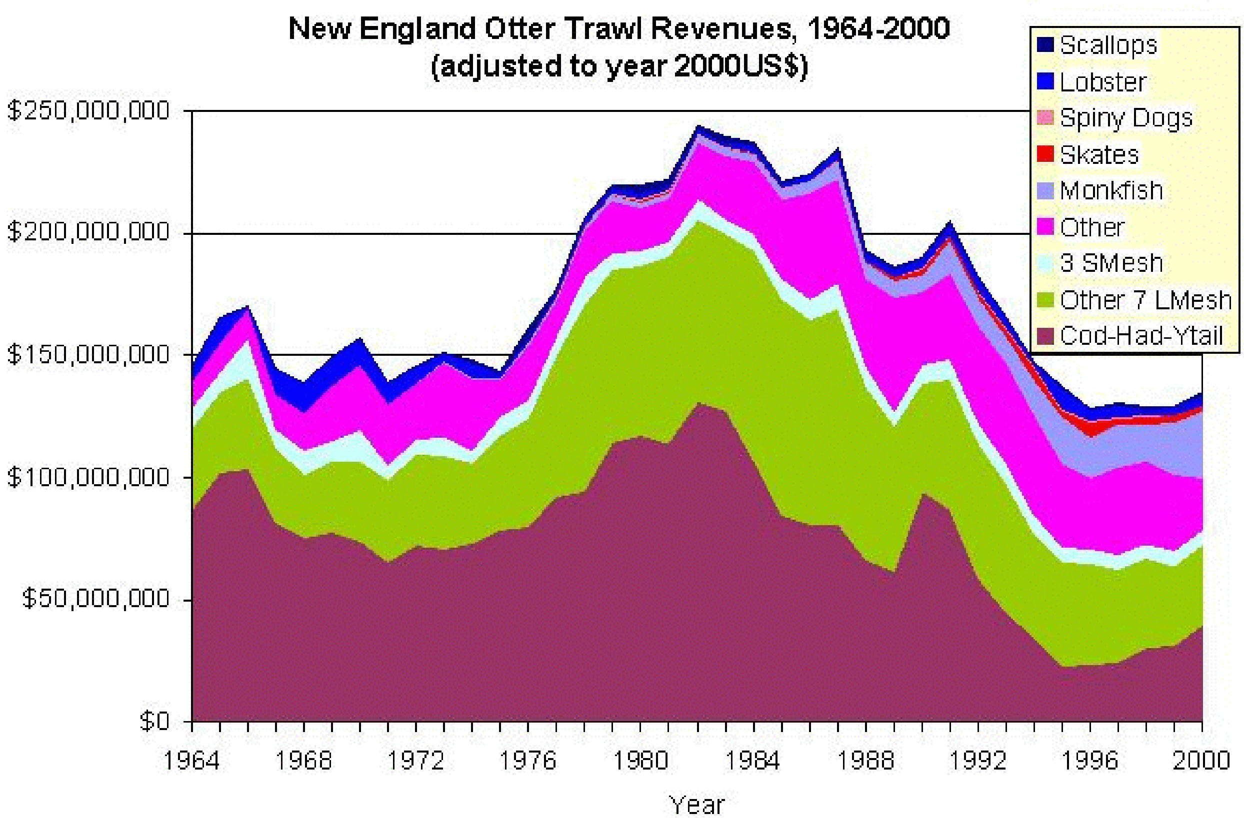


Figure H.3. ***Total Number of Otter Trawl Vessels***

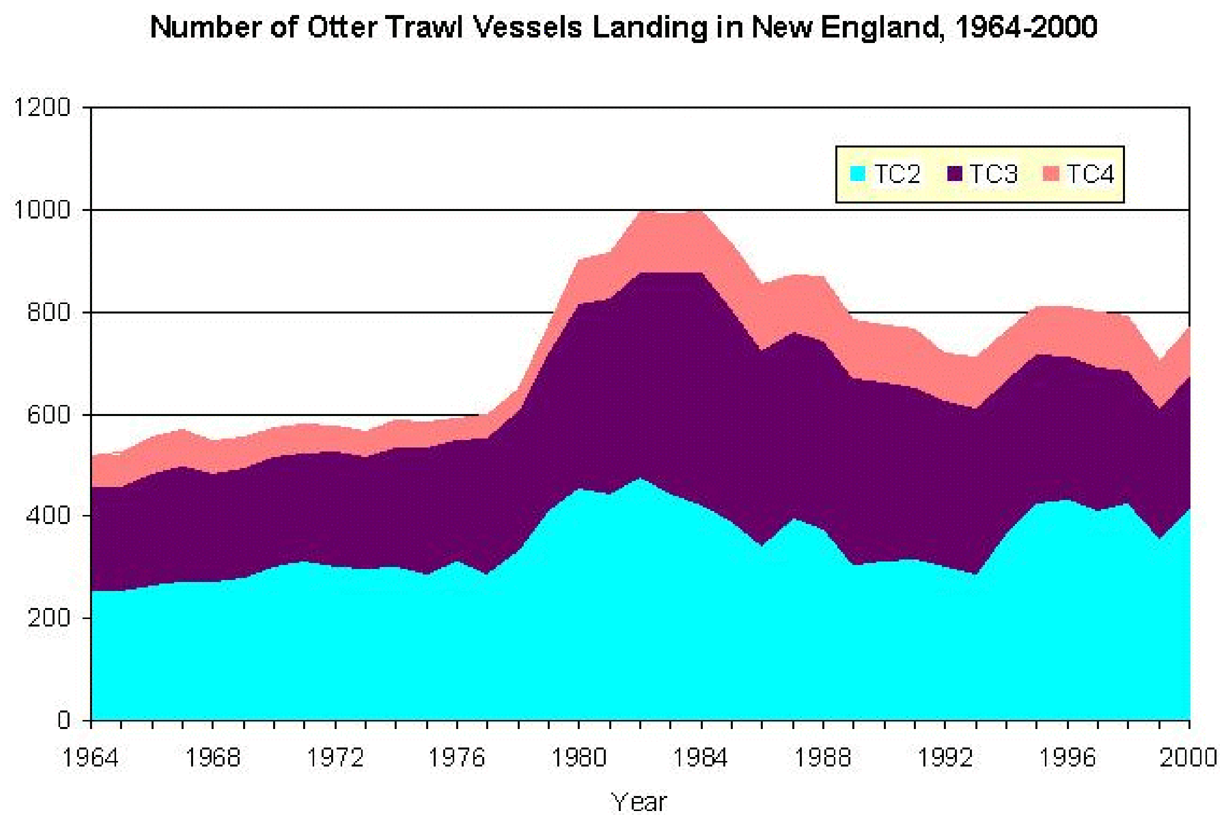


Figure H.4. ***Total Income of NE Otter Trawl Fisherman (Profit)***

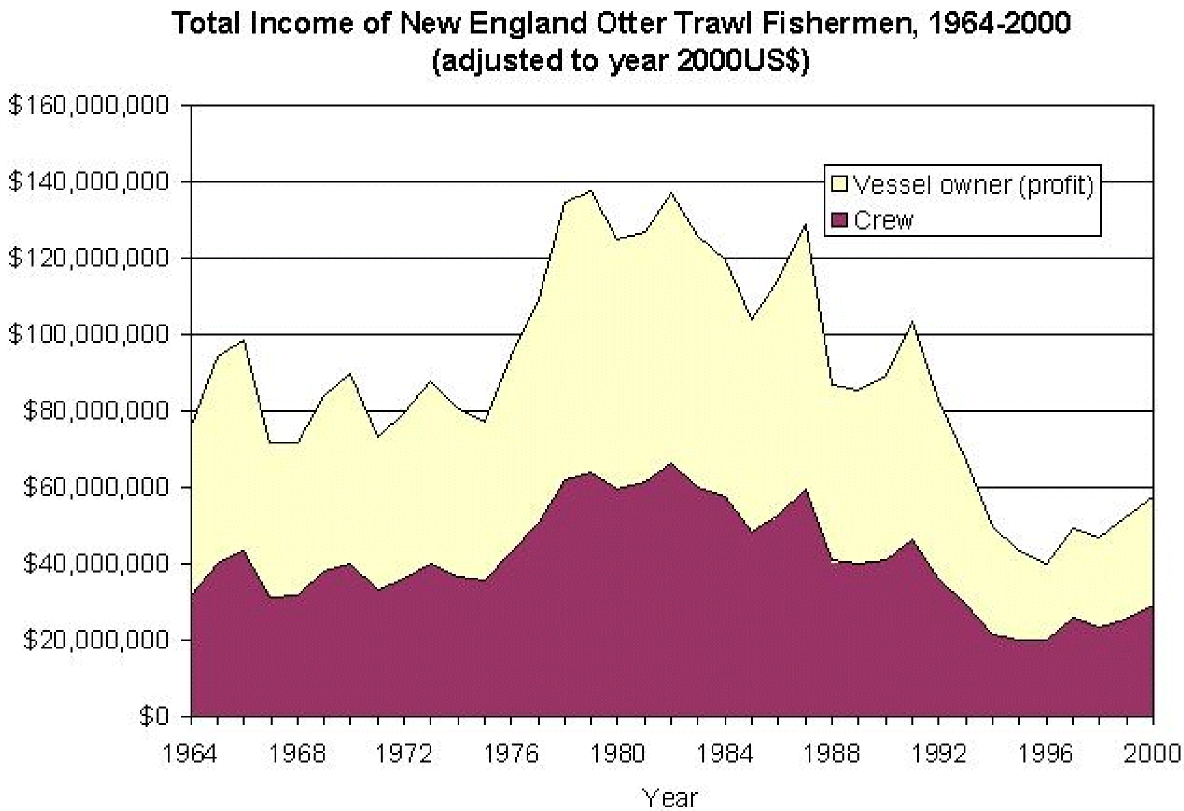


Figure H.5. ***Adjusted Average Income of NE Otter Trawl Fisherman***

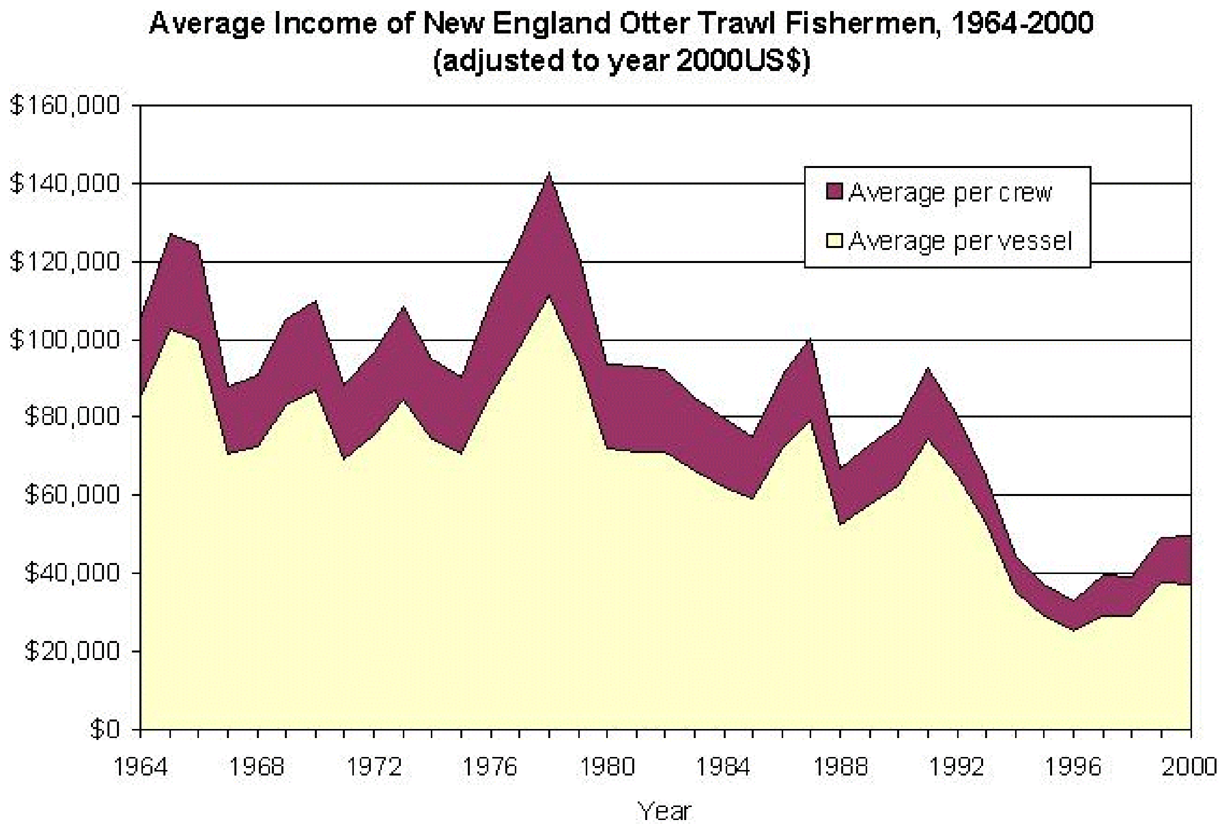


Figure H.6. ***Standardized fishing effort on Georges Bank***

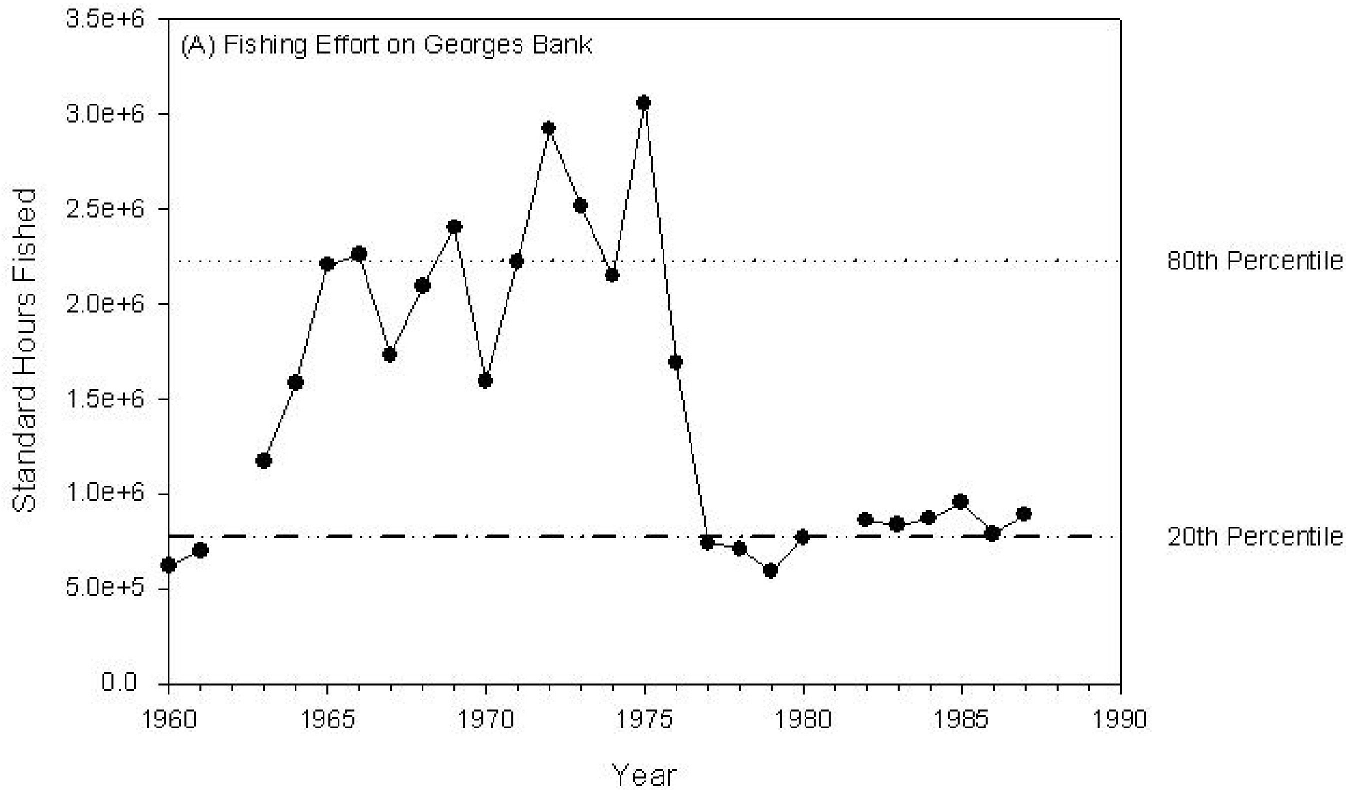


Figure H.7. ***Standardized catch-per-unit effort (CPUE) for Georges Bank fisheries***

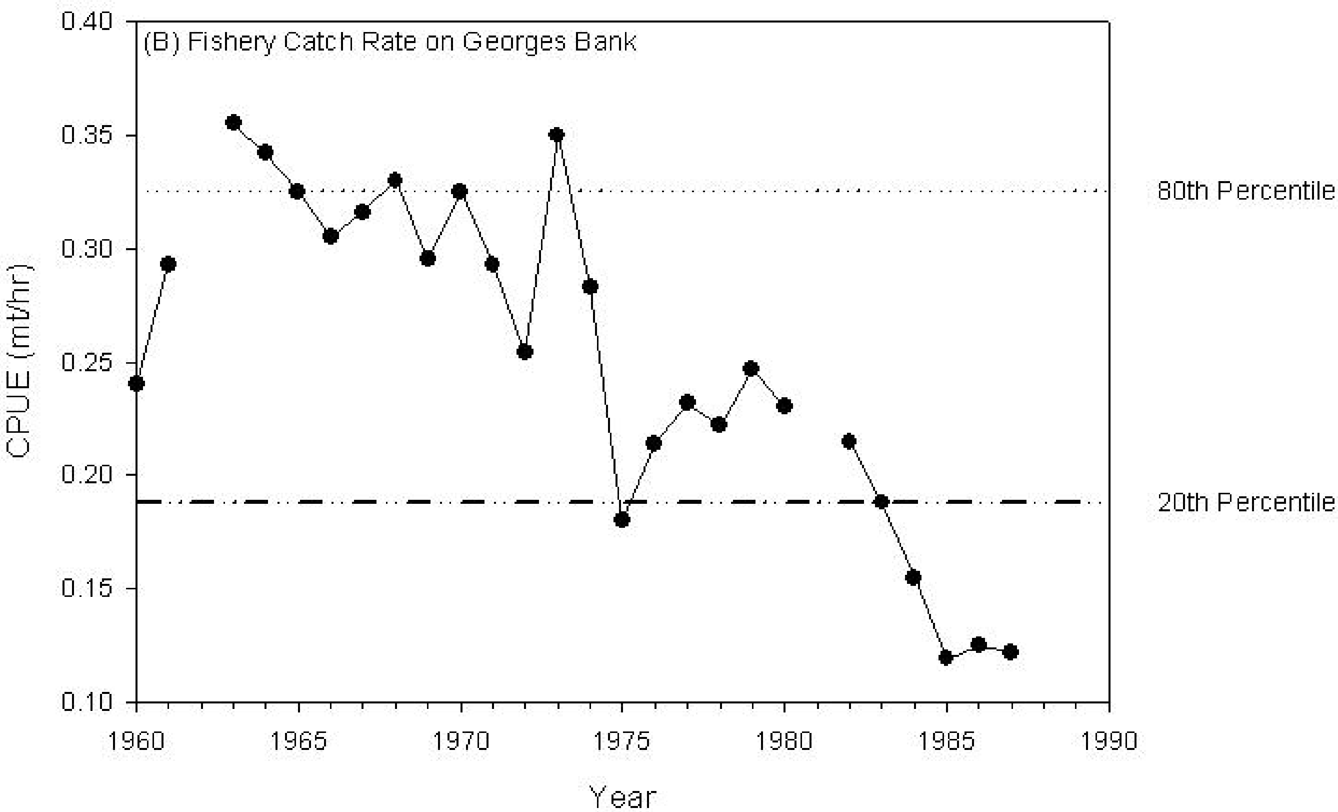


Figure H.8. ***Fishery harvest rate in relation to spawning biomass for Georges Bank haddock***

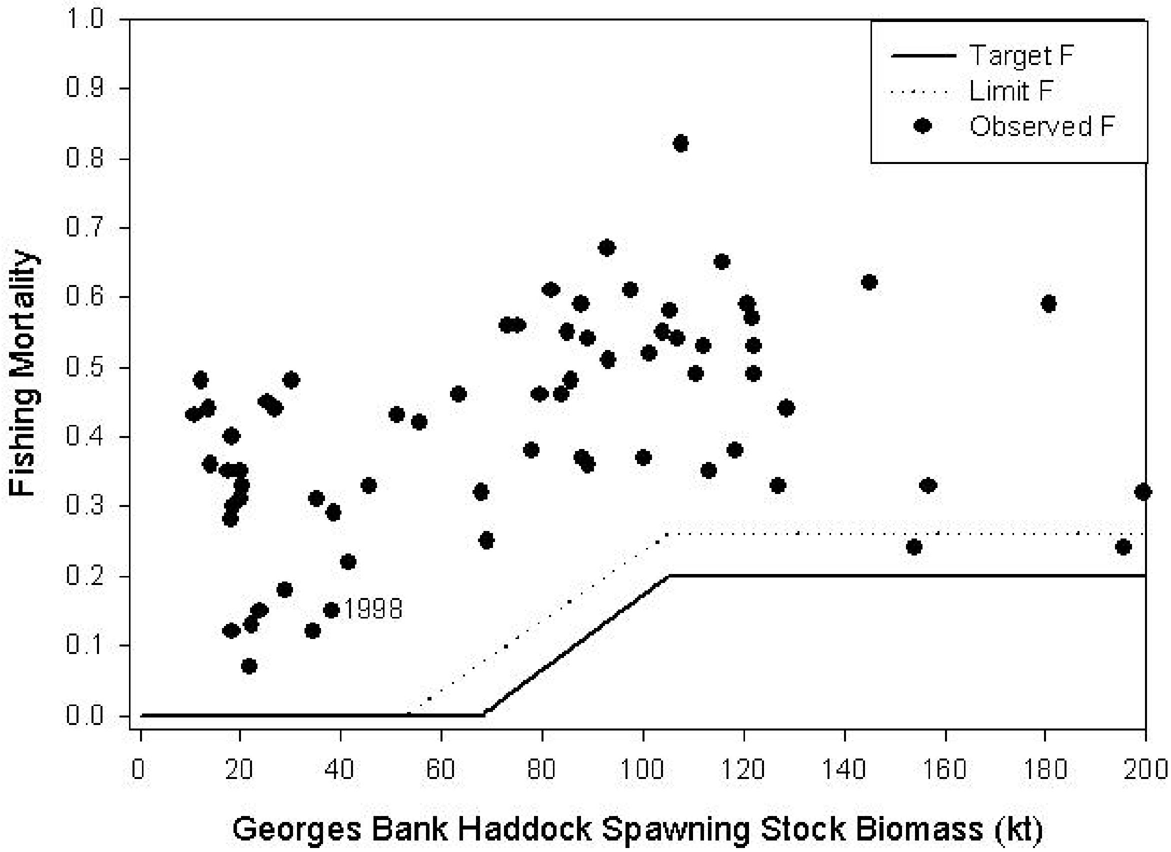


Figure H.9. ***Georges Bank cod, haddock and yellowtail flounder yields***

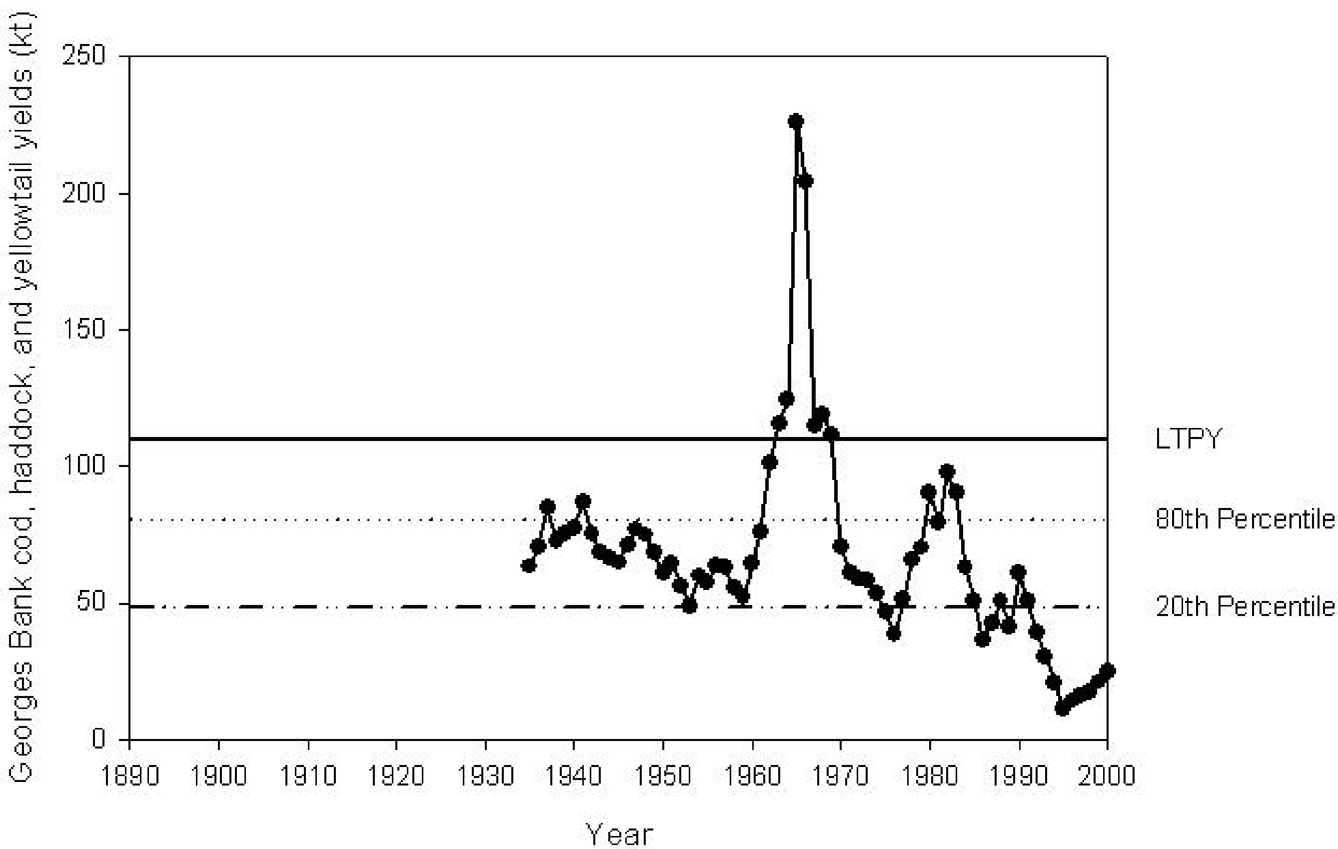
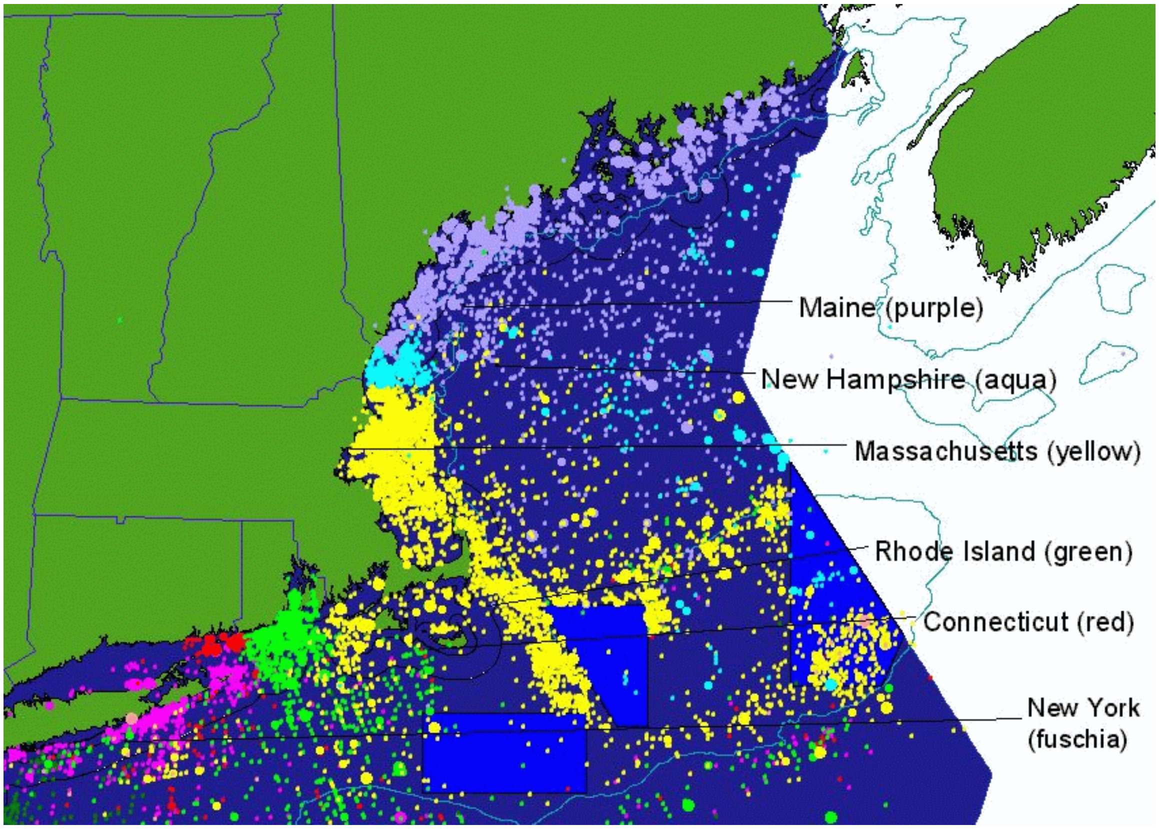
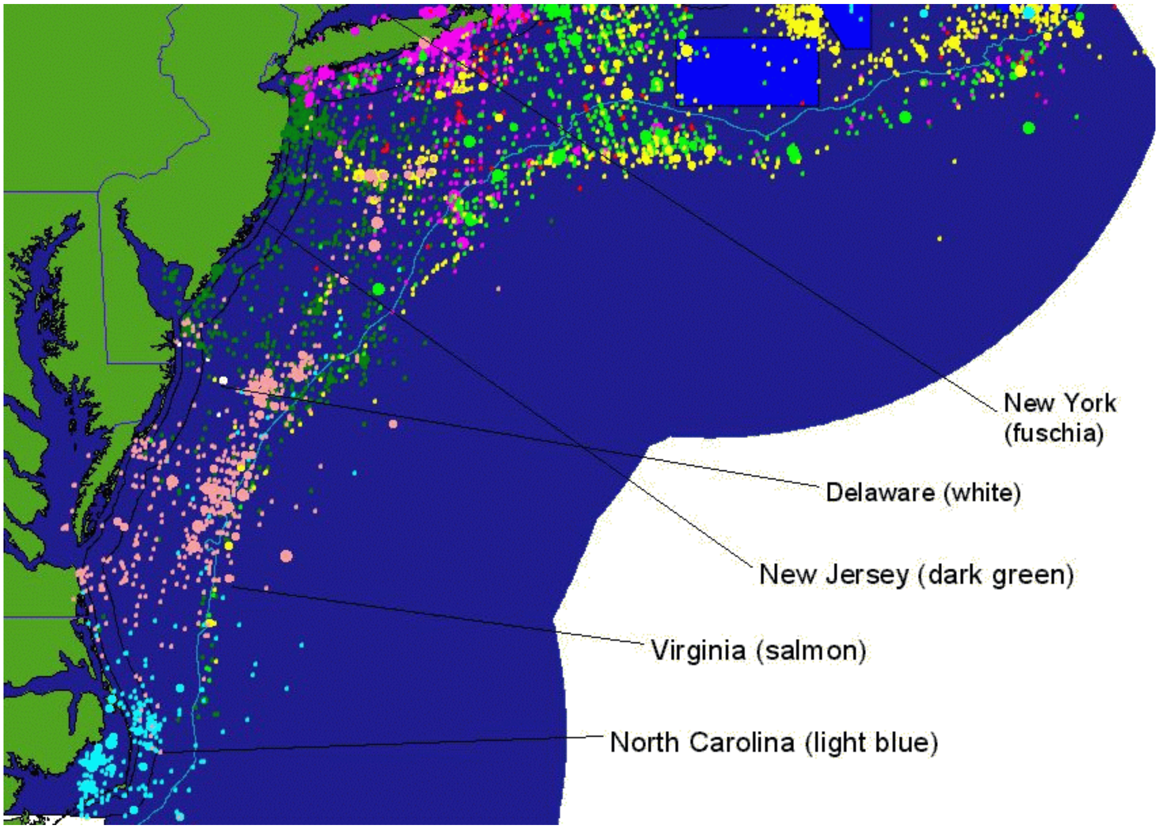


Figure H.10. ***Fishing Activity, by state (North)***



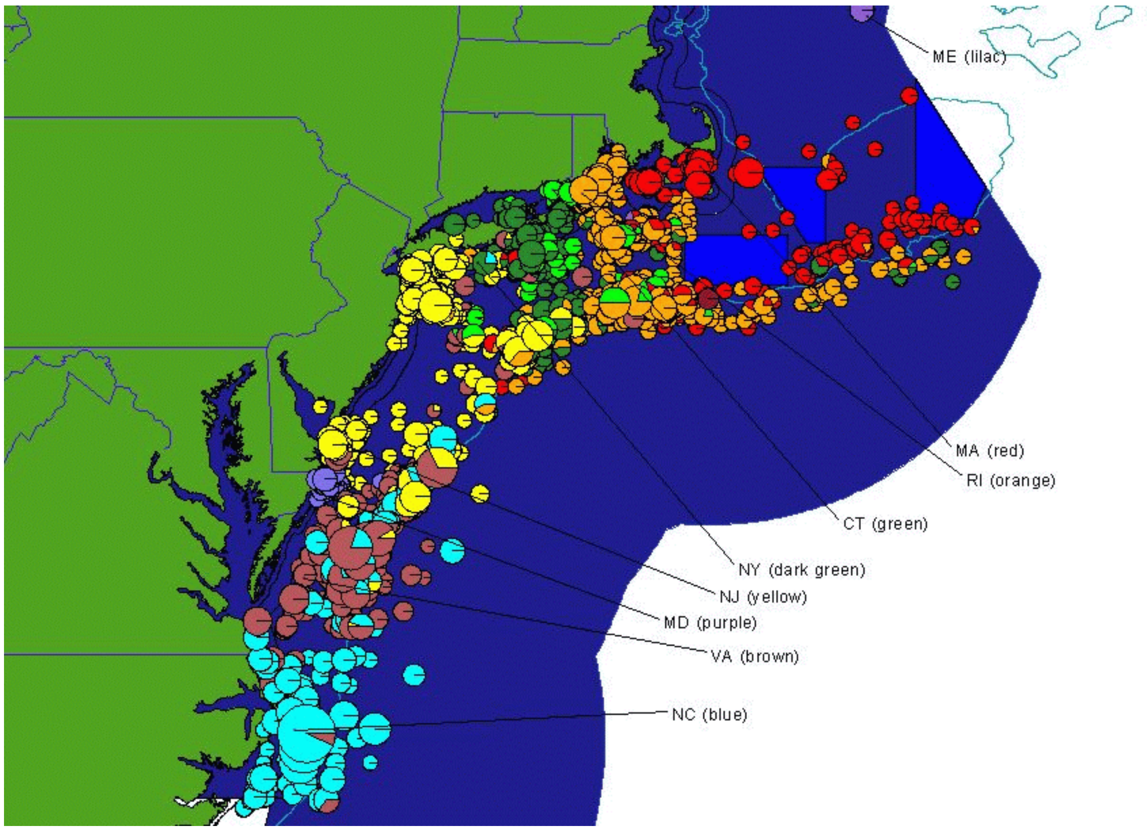
Fishing activity (total days absent) by state of landing, 1999. Source: 1999 logbook data, loran conversions.

Figure H.11. ***Fishing Activity, by state (South)***



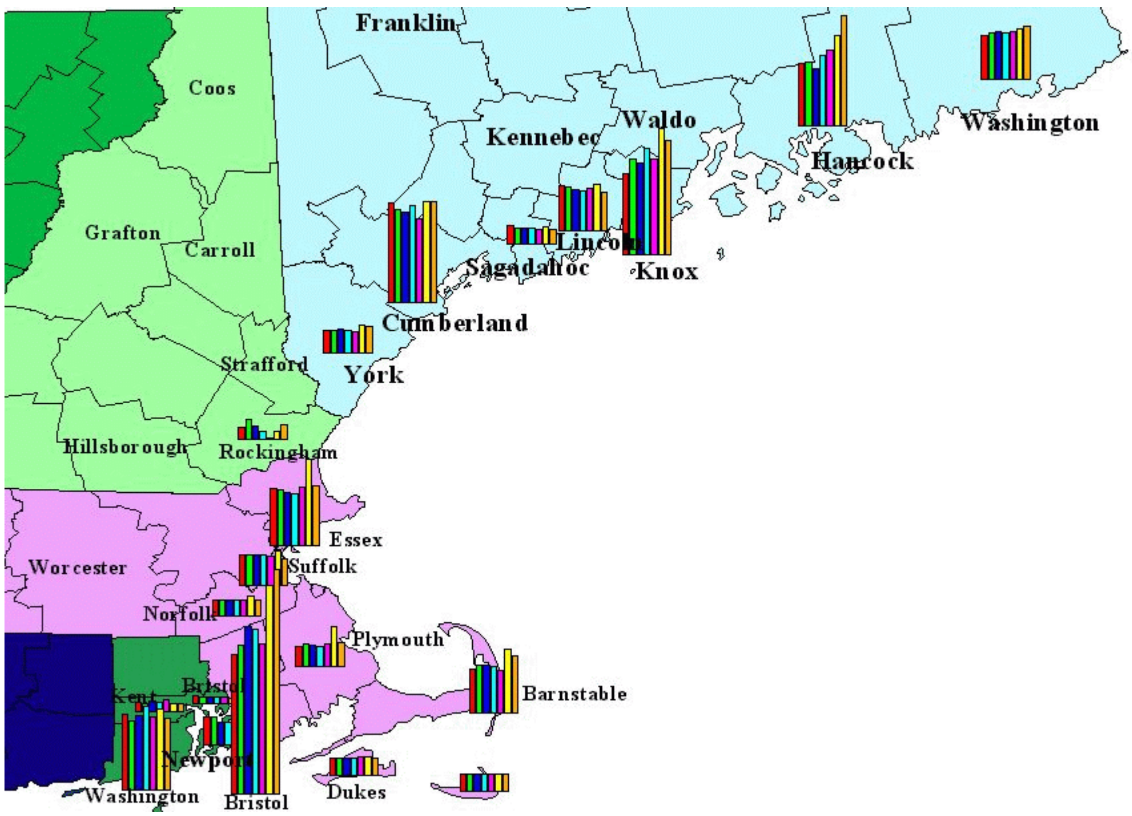
Fishing activity (total days absent) by state of landing, 1999. Source: 1999 logbook data, loran conversions.

Figure H.12. ***Summer Flounder Catch***



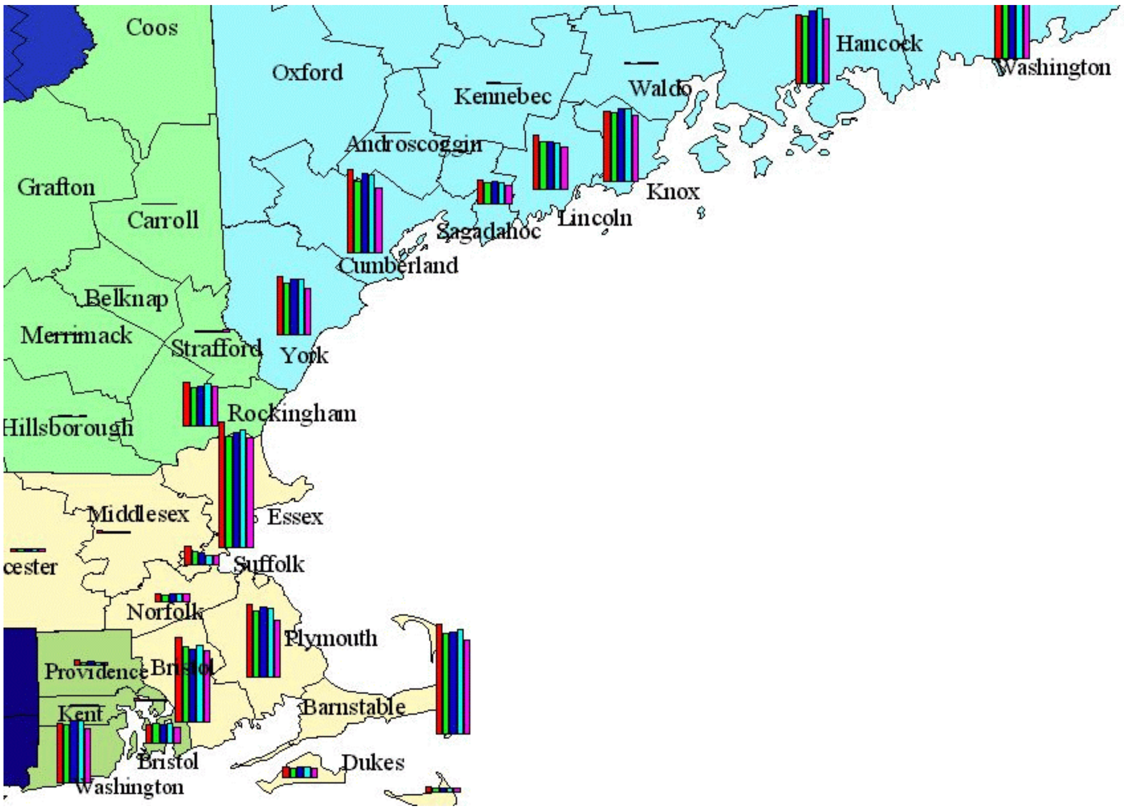
1999 Summer Flounder catch sites (greater than 300 pounds). Dots represent sites of fishing activity by state of landing (color of pie chart) and size of catch (size of pie chart). Source: 1999 vessel logbooks, loran conversions.

Figure H.13. ***New England landed value, by county***



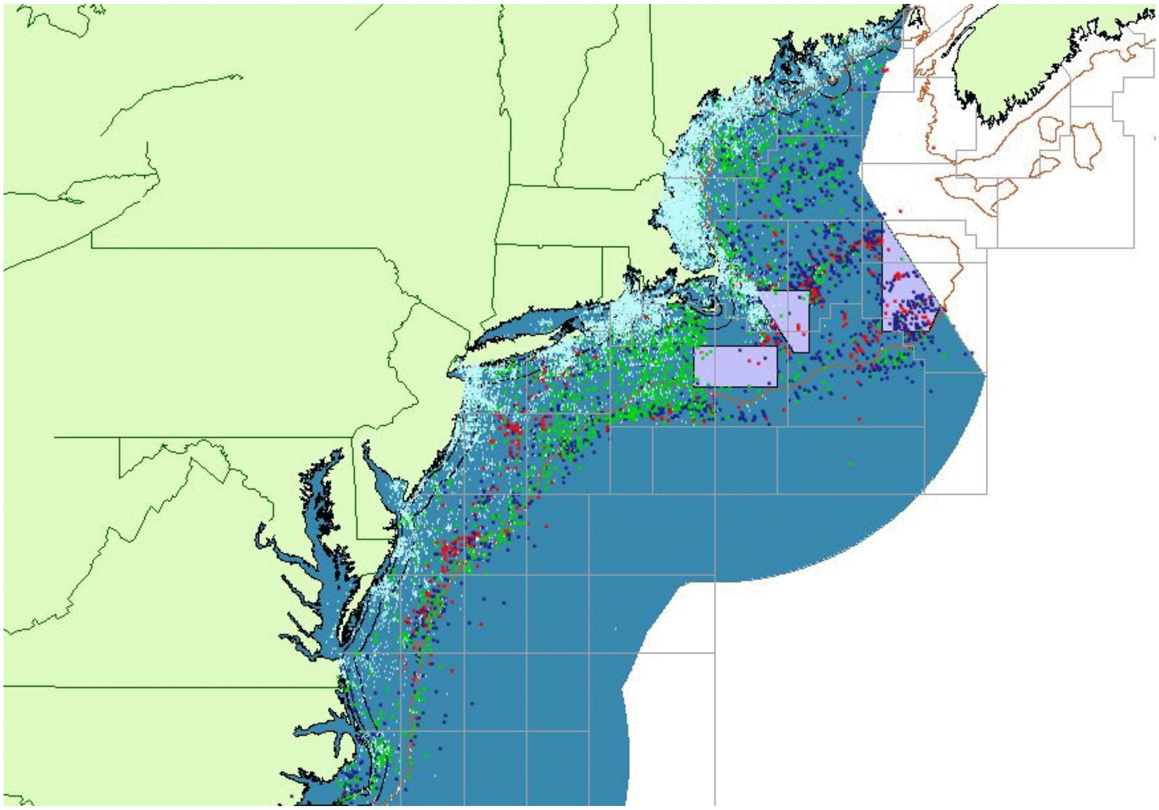
New England landed value by county, 1994-2000. Source: dealer weigh-out records.

Figure H.14. ***New England # permitted vessels, by county***



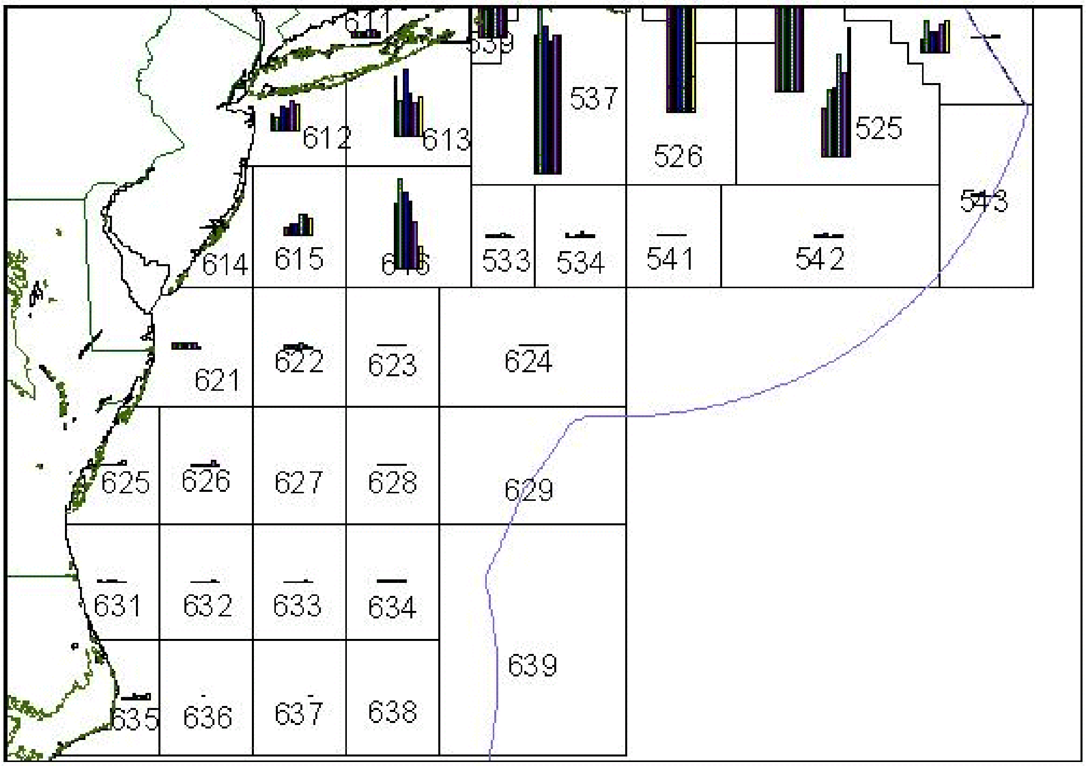
Number of federally permitted vessels by county, 1997-2001. Source: Northeast permit data.

Figure H.15. ***Average days absent***



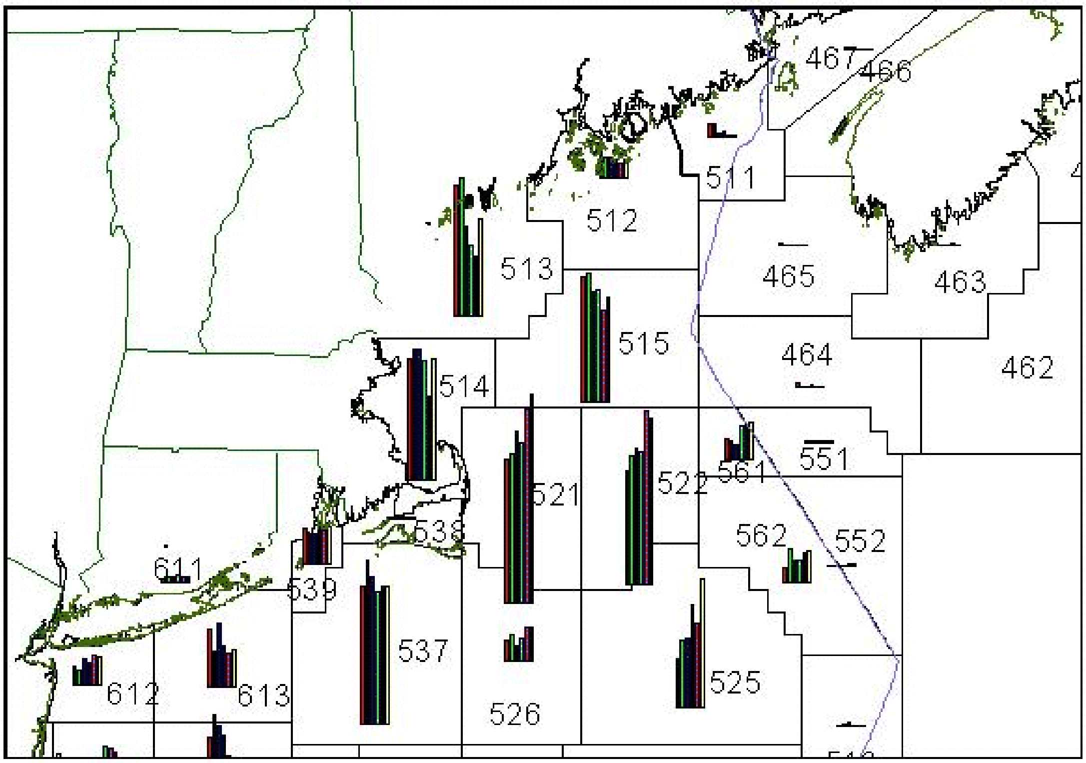
Average days absent per location. (Light blue = 1-2 days absent; green = 2.1-4 days absent; dark blue = 4.1-9 days absent; red = 9.1+ days absent). Source: 1999 logbook data, loran conversions.

Figure H.16. ***Groundfish Landings***



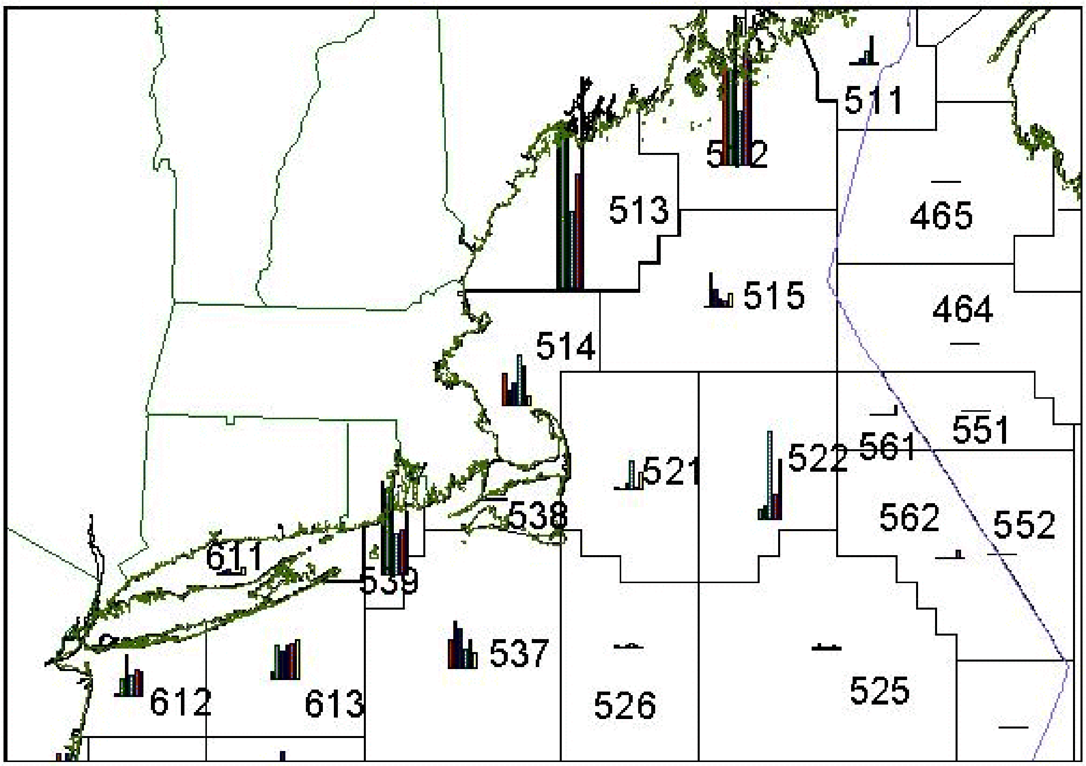
Groundfish landings in pounds, by statistical area (1995-2000). Source: logbook data.

Figure H.17. ***Groundfish Landings***



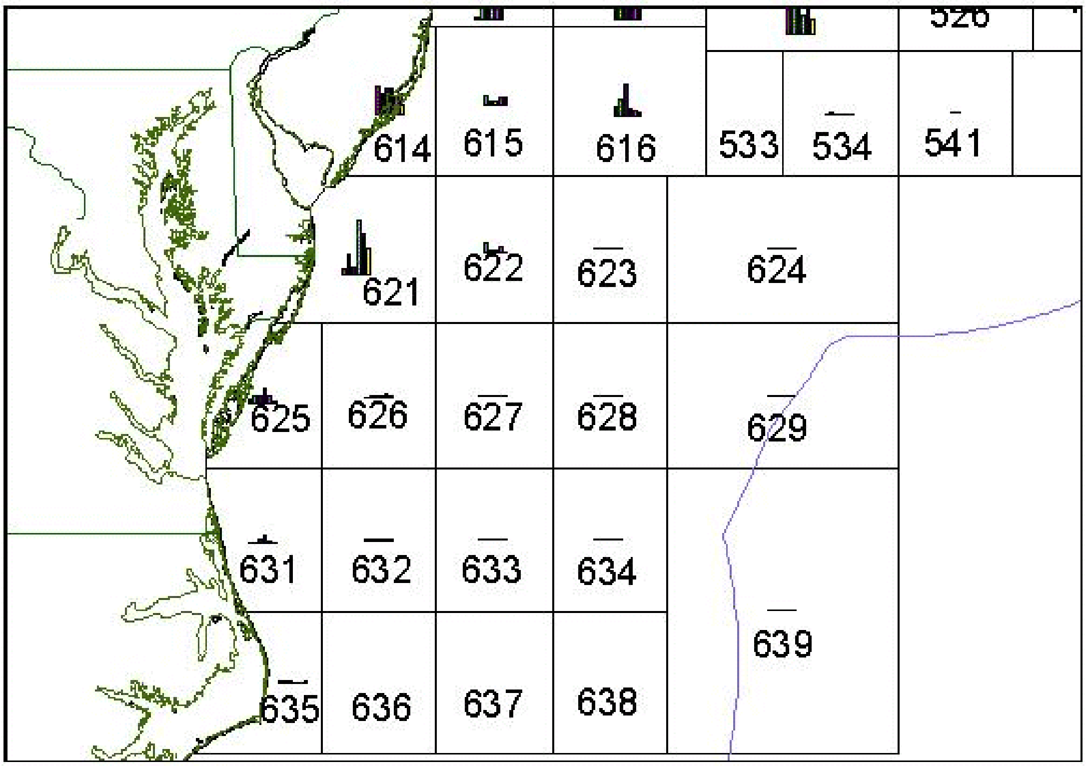
Groundfish landings in pounds, by statistical area (1995-2000). Source: logbook data.

Figure H.18. ***Pelagic Landings***



Landings of pelagic species in pounds, by statistical area (1995-2000). Source: logbook data.

Figure H.19. ***Pelagic Landings***



Landings of pelagic species in pounds, by statistical area (1995-2000). Source: logbook data.

Figure H.20. ***Bigeye Tuna Landings and Value***

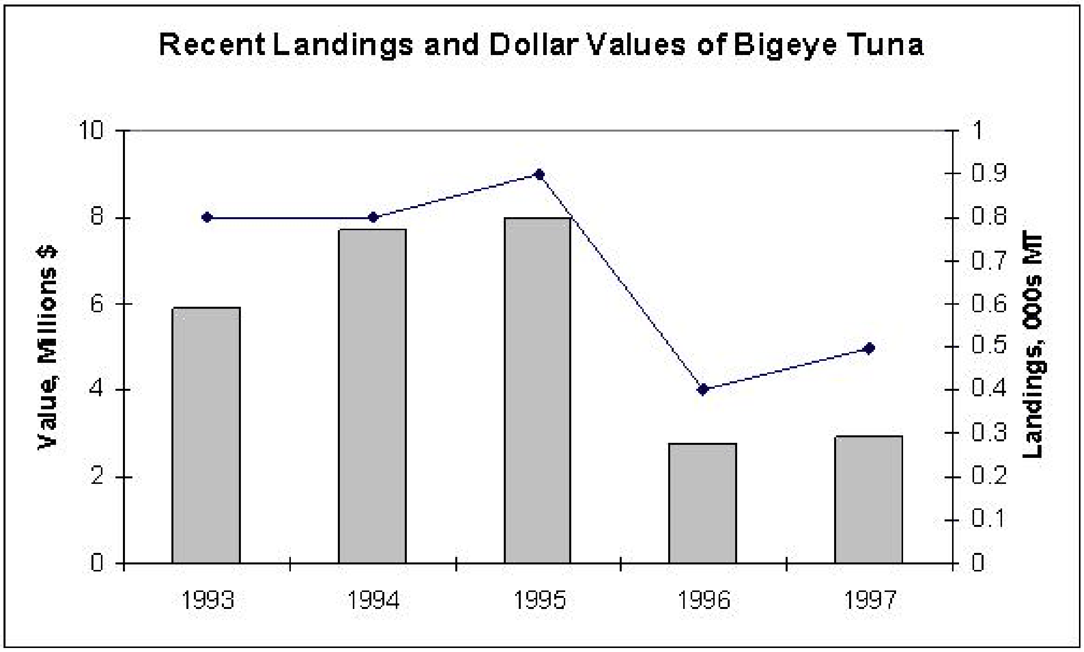


Figure H.21. ***Atlantic Cod Landings and Value***

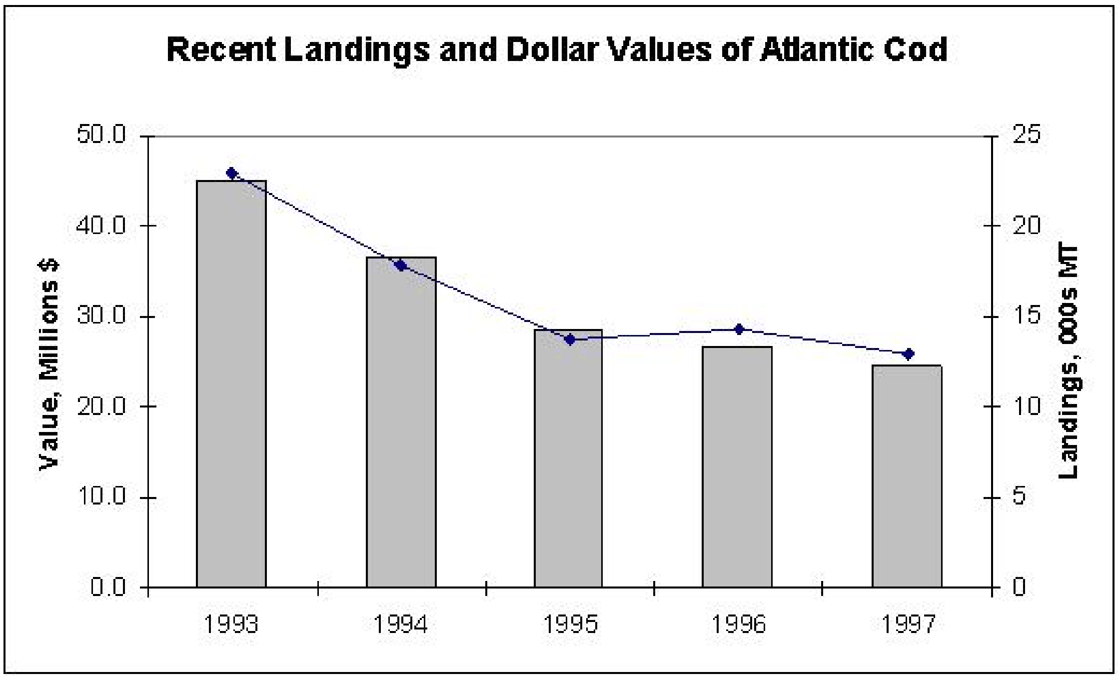


Figure H.22. ***Swordfish Landings and Value***

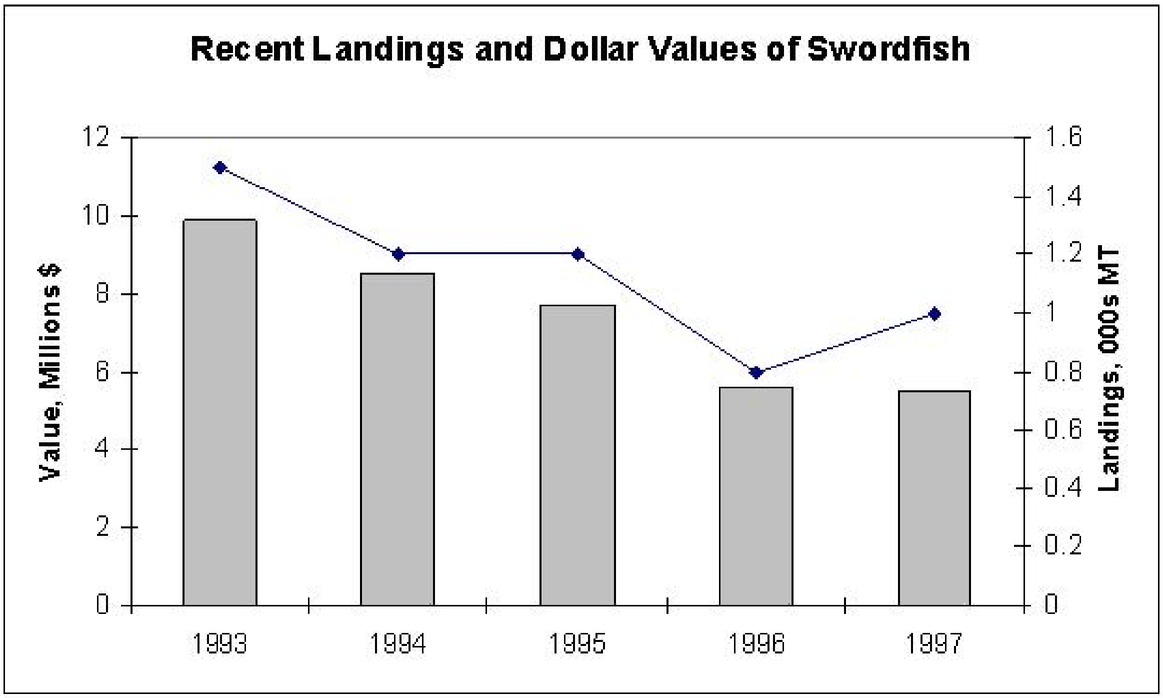


Figure H.23. ***Fraction of Georges Bank closed year-round to fishing***

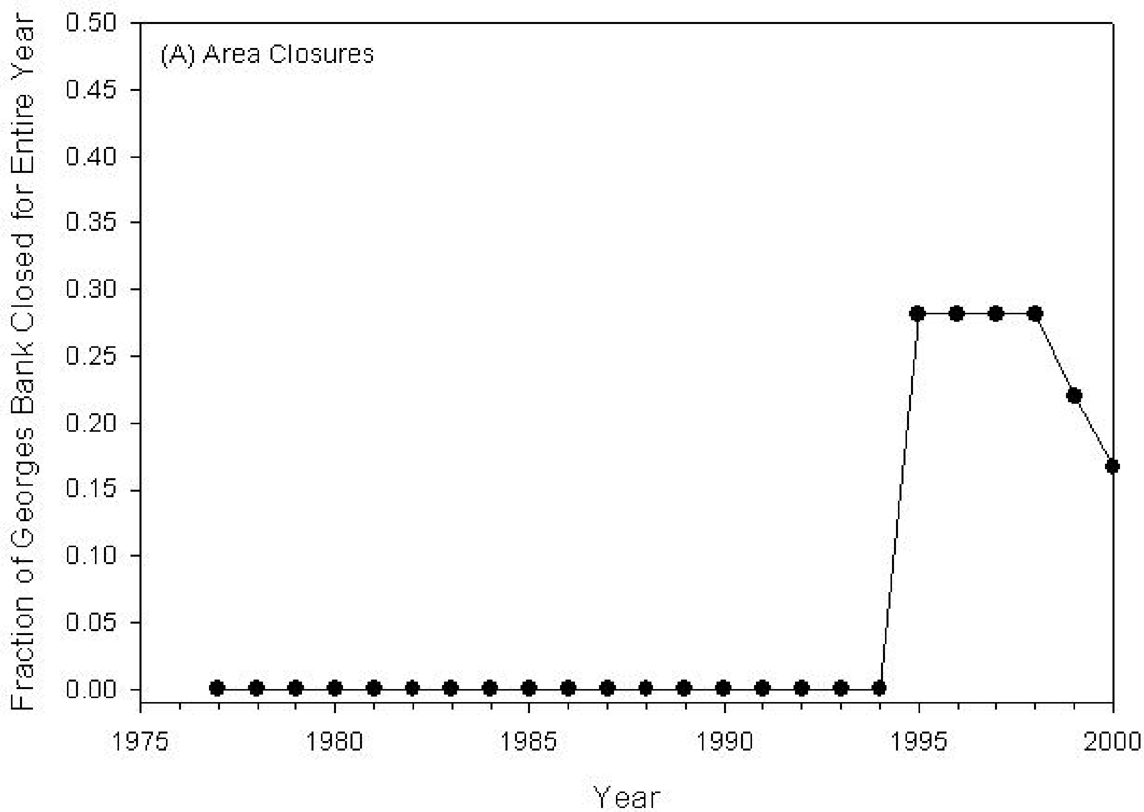


Figure H.24. ***Minimum mesh size regulations for trawl fishing nets***

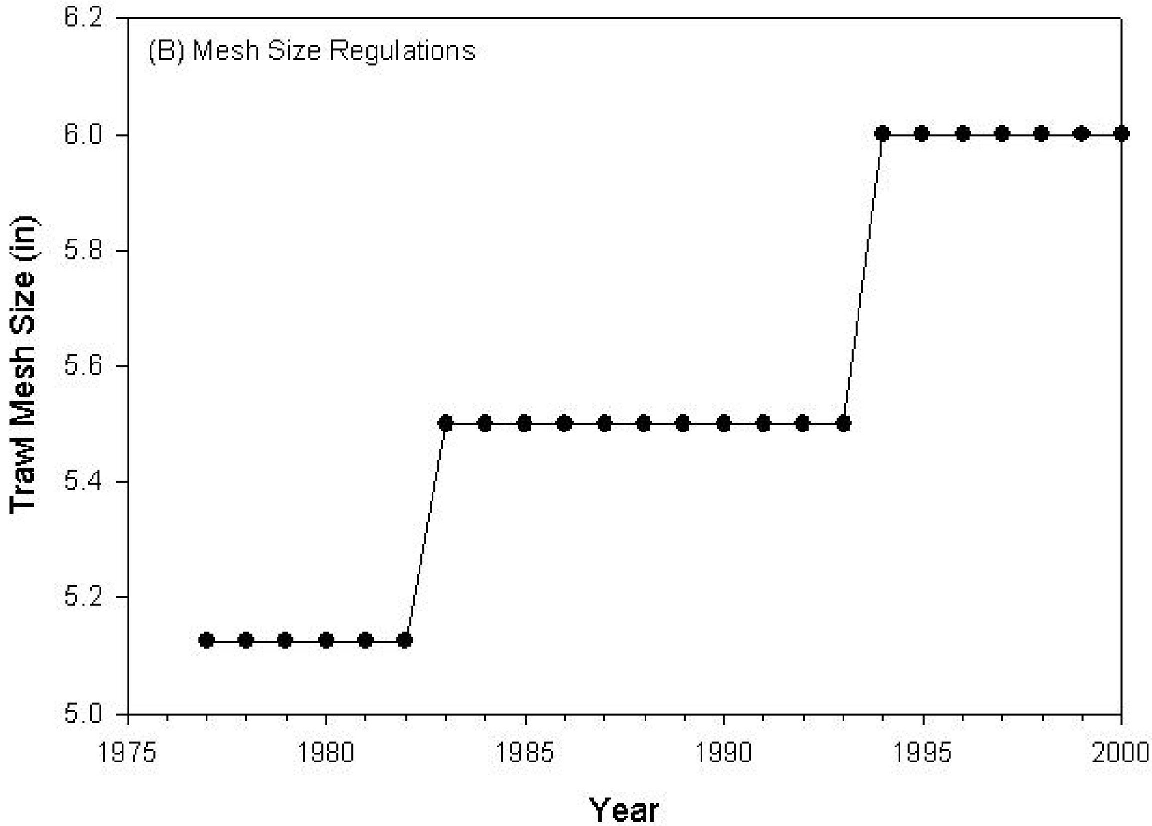


Figure H.25. ***Days-at-sea restrictions for groundfish vessels***