

D. Monkfish Operational Assessment for 2019

Northeast Fisheries Science Center

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Executive Summary

Assessment data for northern and southern management units of monkfish were updated with minimal changes to the approaches of the previous index-based assessment (NEFSC 2016). No age data are available for monkfish, and the assessment does not include analytic models.

TOR 1. Update fishery-dependent and fishery-independent data from previous assessment.

Commercial fishery statistics for monkfish were updated for 2015-2018. In the north, landings and catch have fluctuated around a steady level since 2009, but increased after 2015. In the south, landings and catch had been declining since around 2000, but catch increased after 2015 due to discarding of a strong 2015 year class.

Survey data updated through 2018 indicate an increasing trend in biomass in both management areas since 2014; exploitable biomass (43+cm total length) indices have more than doubled in both areas since 2015, reflecting growth of the strong 2015 year class. Abundance also increased, and remains relatively high but has been decreasing in most series since 2016. Recruitment indices were high in the north in 2015 and 2016, and in the south in 2015.

New estimates of area-swept minimum biomass and abundance were developed using results from a study of relative efficiency of chain and rock-hopper sweeps on the net used for NEFSC bottom trawl surveys. The area-swept estimates are approximately 5 times higher than the unadjusted estimates, but follow the same trends.

TOR 2. Prepare an approach to providing scientific advice to management in the absence of an analytical model.

The monkfish assessment does not include an analytical model because the aging method has been invalidated, thus invalidating the growth model that is the foundation for the previously-approved model.

A simple model-free method previously used to derive Georges Bank cod catch limits was applied to current monkfish data. The method calculates the proportional rate of change in smoothed survey indices over the most recent 3 years for potential application to revising catch limits. In the NMA, the estimated rate of change was 1.2-1.3 depending on which surveys were included, and in the SMA, the estimated rate of change was 0.96-1.04.

TOR 3. Update the values of biological reference points (BRPs) for this stock.

BRPs defined in the management plan are dependent on output from the now-invalidated population model, therefore they have not been updated.

TOR 4. Include qualitative descriptions of stock status based on simple indicators/metrics.

Strong recruitment in 2015 fueled an increase in stock biomass in 2016-2018, though abundance has since declined as recruitment returned to average levels. Biomass increases were greater in the northern area than in the southern area, and biomass has declined somewhat in the south.

TOR 5. Perform short-term (2-year) population projections.

Not relevant to this assessment.

6. Comment on research areas or data issues that might lead to improvements in future stock assessments.

Development of a growth curve and/or an accurate aging method would allow application of age-based models. A better understanding of stock structure and movement patterns, especially mixing between management areas, would be helpful.

Introduction

Life History

The monkfish (*Lophius americanus*), also called goosefish, is distributed in the Northwest Atlantic from the Grand Banks and northern Gulf of St. Lawrence south to Cape Hatteras, North Carolina (Collette and Klein-MacPhee 2002). Monkfish 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).

Monkfish rest partially buried on soft bottom substrates and attract prey using a modified first dorsal fin ray that resembles a fishing pole and lure. Monkfish are piscivorous and can eat prey as large as themselves. Despite the behavior of monkfish as a demersal ‘sit-and-wait’ predator, recent information from electronic tagging suggests seasonal off-bottom movements which may be related to migration (Rountree et al. 2006).

Growth rates of monkfish are not well understood and recent studies call into question the growth curves used in prior assessments (2007, 2010, 2013). One recent study has shown that the method currently used to age monkfish in the U.S. (counting rings on vertebrae) does not consistently identify the correct number of presumed-annual rings at the margin of the vertebra (Bank 2016). Further work conducted at the NEFSC has confirmed this using samples from the strong 2015 yearclass at presumed ages 1, 2 and 3 (Sandy Sutherland, NEFSC, personal communication). In addition, it appears that growth of immature monkfish may be much faster than previously understood. Growth estimated by modal progression of the 2015 yearclass suggests that monkfish may grow to ~25 cm by age 1 and reach the size at maturity (approximately 40 cm) by age two (Figure 1).

The estimated size at 50% maturity of monkfish is 41 cm for females and 37 cm for males (Richards et al. 2008). Few males are found larger than 70 cm, but females can reach sizes greater than 130 cm. Spawning takes place from spring through early autumn, progressing from south to north, with most spawning occurring during the spring and early summer (Richards et al. 2008). Females lay a buoyant mucoid egg raft or veil which can be as large as 12 m long and 1.5 m 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. Females likely produce more than one egg veil per year (McBride et al. 2017). The larvae and juveniles spend several months in a pelagic phase before settling to a benthic existence at a size of about 8 cm (Collette and Klein-MacPhee 2002).

Stock Structure

The Fishery Management Plan (FMP) defines two management areas for monkfish (northern management area (NMA) and southern management area (SMA)), divided roughly by a line bisecting Georges Bank (Figure 2). The two assessment and management areas for monkfish were defined in the 1999 FMP based on differences in temporal patterns of recruitment (estimated from NEFSC surveys), perceived differences in growth patterns, and differences in the contribution of fishing gear types (mainly trawl, gill net, and dredge) to the landings. Since then, genetic studies using mitochondrial DNA have suggested a homogeneous population of monkfish off the U.S. east coast (Chikarmane et al. 2000; Johnson et al. in prep.); however research in progress using microsatellite DNA suggests a possible delination off Delaware Bay in the Mid-Atlantic Bight (Housbrouck et al. 2015).

Monkfish larvae are distributed over deep (< 300 m) offshore waters of the Mid-Atlantic Bight in March-April, and across the continental shelf (30 to 90 m) later in the year, but relatively few larvae have been sampled in the northern management area (Steimle et al. 1999). NEFSC surveys continue to indicate different recruitment patterns in the two management units in recent years.

The perceived differences in growth in the two management areas were based on studies about 10 years apart and under different stock conditions (Armstrong et al. 1992: Georges Bank to Mid-Atlantic Bight, 1982-1985; Hartley 1995: Gulf of Maine, 1992-1993). Age, growth, and maturity information from the NEFSC surveys and the 2001, 2004 and 2009 cooperative monkfish surveys indicated only minor differences in age, growth, and maturity between the areas (Richards et al., 2008; Johnson et al., 2008). However these growth studies used the vertebral aging method which is now called into question.

The southern deepwater extent of the range of American monkfish (*L. americanus*) overlaps with the northern extent of the range of blackfin monkfish (*L. gastrophysus*; Caruso 1983). These two species are morphologically similar, which may create a problem in identification of survey catches and landings from the southern extent of the range of monkfish. The potential for a problem however is believed to be small. The NEFSC closely examined winter and spring 2000 survey catches for the presence of blackfin monkfish and found none. The cooperative monkfish survey conducted in 2001 caught only eight blackfin monkfish of a total of 6,364 monkfish captured in the southern management area.

Fisheries Management

Commercial fisheries for monkfish occur year-round using gillnets, trawls and scallop dredges. No significant recreational fishery exists. The primary monkfish 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.

U.S. fisheries for monkfish are managed in the Exclusive Economic Zone (EEZ) through a joint New England Fishery Management Council - Mid-Atlantic Fishery Management Council Monkfish Fishery Management Plan (FMP). 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 monkfish fisheries (NEFMC and MAFMC 1998; Haring and Maguire 2008).

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 annual catch limits (Tables 1 and 2).

Biological reference points for monkfish were established in the original Fishery Management Plan (FMP), but were revised after SAW 34 (NEFSC 2002), after the Data Poor Stocks Working Group (DPSWG) in 2007 (NEFSC 2007a), and after SAW 50 in 2010. The overfishing definition on record is F_{max} . Prior to 2007, $B_{threshold}$ was defined as one-half of the median of the 1965-1981 3-year average NEFSC autumn trawl survey catch (kg) per tow). After acceptance of an analytical assessment in 2007 (NEFSC 2007a), B_{target} was redefined as the average of total biomass for the model time period (1980-2006) and $B_{threshold}$ as the lowest observed value in the total biomass time series from which the stock had then increased (termed “ B_{Loss} ”). According to the earlier (survey index-based) reference points, monkfish were overfished and overfishing status could not be determined (NEFSC 2005); however, with adoption of the analytical assessment in 2007, monkfish status was changed to no longer overfished and overfishing was not occurring. Assessments in 2010 and 2013 (NEFSC 2010; 2013) also concluded that both stocks were not overfished and overfishing was not occurring, while recognizing the continuing significant uncertainty in the determination. With the invalidation of the growth curve and analytic assessment model, the estimated BRPs are no longer relevant.

TOR 1.

TOR 1. Update fishery-dependent data (landings, discards, catch-at-age, etc.) and fishery-independent data (research survey information) that had been used in the previous accepted assessment. Also, describe and present any new or revised data sets that are being used in the assessment.

Fishery-Dependent Data

Landings

Landings of monkfish tails are converted from landed weight to live weight, because a substantial fraction of the landings occur as tails only (or other parts). The conversion of landed weight of tails to live weight of monkfish in the NEFSC weigh-out database is made by multiplying landed tail weight by a factor of 3.32.

Early catch statistics (before ~1980) are uncertain, because much of the monkfish catch was sold outside of the dealer system or used for personal consumption until the mid-1970s. For 1964 through 1989, there are two potential sources of landings information for monkfish; the NEFSC ‘weigh-out’ database, which consists of fish dealer reports of landings, and the ‘general canvass’ database, which contains landings data collected by NMFS port agents (for ports not included in the weigh-out system) or reported by states not included in the weigh-out system (Table 3). All landings of monkfish are reported in the general canvass data as ‘unclassified tails.’

Consequently, some landed weight attributable to livers or whole fish in the canvass data may be inappropriately converted to live weight. This is not an issue for 1964-1981 when only tails were recorded in both databases. For 1982-1989, the weigh-out database contains market category information that allows for improved conversions from landed to live weight. The two data

sources produce the same trends in landings, with general canvass landings slightly greater than weigh-out landings. It is not known which of the two measures more accurately reflects landings, but the additional data sources suggest that the general canvass is most reliable for 1964-1981 landings, whereas the availability of market category details suggests that the weigh-out database is most reliable for 1982-1989.

Beginning in 1990, most of the extra sources of landings in the general canvass database were incorporated into the NEFSC weigh-out database. However, North Carolina reported landings of monkfish to the Southeast Fisheries Science Center and until 1997 these landings were not added to the NEFSC general canvass database. Since these landings most likely come from the southern management area, they have been added to the weigh-out data for the southern management area for 1977-1997 for the landings statistics used for stock assessment.

Beginning in July 1994, the NEFSC commercial landings data collection system was redesigned to consist of vessel trip reports (VTR) and dealer weigh-out records. The VTRs include area fished for each trip which is used to apportion dealer-reported landings to statistical areas. The northern management area includes statistical areas 511-515, 521-523 and 561; and the southern management area includes areas 525-526, 562, 537-543 and 611-636 (Figure 2).

Total U.S. landings (live weight) remained at low levels until the mid-1970s, increasing from less than 1,000 mt to around 6,000 mt in 1978 (Table 3, Figure 3). Annual landings remained stable at between 8,000 and 10,000 mt until the late 1980s. Landings increased from the late 1980s to over 20,000 mt per year during 1992-2004, peaking at 28,500 mt in 1997. Landings declined steadily after 2003, and stabilized around an average of 8,600 mt during 2009-2015. During 2008-2015, fishing year landings in the NMA remained well below the TAL, but during 2016-2018 were close to or higher than the TAL (Table 2). In the SMA, fishing year landings have been below the TAL since 2009. The most recent TALs are ~50% higher in the SMA than in the NMA.

Monkfish landings began to increase in the northern management region in the mid-1970s and in the late 1970s in the southern area. Most of the increase in landings during the late 1980s through mid-1990s was from the southern area. Historical under-reporting of landings should be considered in the interpretation of this series.

Trawls, scallop dredges and gill nets are the primary gear types that land monkfish (Table 4, Figure 4). Trawls have been the predominant gear in the north, accounting for approximately 75% of the landings on average. In the south, trawls and dredges dominated the landings before about 2002, but were subsequently replaced by gillnets as regulations changed. Gillnets accounted for about 75% of the landings from the southern management area during 2016-2018. Until the late 1990s, total U.S. landings were dominated by landings of monkfish tails. From 1964 to 1980 landings of tails rose from 19mt to 2,302mt, and peaked at 7,191mt in 1997 (Tables 5, 6). Landings of tails declined after 1997, but are still an important component of the landings. Landings of gutted whole fish have increased steadily since the early 1990s and are now the largest market category on a landed-weight basis. On a regional basis, more tails were landed from the northern area than the southern area prior to the late 1970s (Tables 5 and 6). From 1979

to 1989, landings of tails were about equal from both areas. In the 1990's, landings of tails from the south predominated, but since 2000, landings of tails have been greater in the north. Beginning in 1982, several market categories were added to the system (Tables 5, 6). Tails were broken down into large (> 2.0 lbs), small (0.5 to 2.0 lbs), and unclassified categories and the liver market category was added. In 1989, unclassified round fish were added, in 1991 peewee tails (< 0.5 lbs) and cheeks, in 1992 belly flaps, and in 1993 whole gutted fish were added. Landings of unclassified round (whole) or gutted whole fish jumped in 1994 to 2,045 mt and 1,454 mt, respectively; landings of gutted fish continued to increase through 2003. The tonnage of peewee tails landed increased through 1995 to 364 mt and then declined to 153 mt in 1999 and 4 mt in 2000 when the category was essentially eliminated by regulations.

Foreign Landings

Landings (live wt) from NAFO areas 5 and 6 by countries other than the US are shown in Table 3 and Figure 3. Reported landings were high but variable in the 1960s and 1970s with a peak in 1973 of 6,818 mt. Landings were low but variable in the 1980s, declined in the early 1990s, and have generally been below 300 mt since 1996. NAFO data for monkfish were not updated for this assessment update.

Discard Estimates

Catch data from the fishery observer, dealer and VTR databases were used to investigate discarding frequencies and rates using standardized bycatch reporting methodology (SBRM, Rago et al. 2005; Wigley et al. 2007). The number of trips with monkfish discards available for analysis varied widely among management areas and gear types (Tables 7, 8). As in previous monkfish assessments (NEFSC 2007a, NEFSC 2010, NEFSC 2013, NEFSC 2016), monkfish discards were estimated on a gear, half-year and management area basis using observed discard-per-kept-monkfish to expanded to total discards for otter trawls and gillnets, and observed discard-per-all-kept-catch to expand for scallop dredges and shrimp trawls. Discards for 1980-1988 (before observer sampling) were estimated by applying average discard ratios by management area and gear type (trawl, shrimp trawl, gillnet, dredge) from 1989-1991 to landings for 1980-1988 as follows:

| Area | Shrimp Trawls | Trawls | Gillnets | Dredges |
|-----------------|---------------|-----------|-----------|-----------|
| North | | | | |
| Years included | 1989-1991 | 1989-1991 | 1989-1991 | 1992-1997 |
| Number of trips | 124 | 253 | 1191 | 54 |
| South | | | | |
| Years included | n/a | 1989-1991 | 1991-1992 | 1991-1993 |
| Number of trips | | 334 | 177 | 32 |

The proportion of discards in the northern area catch was about 13% in the 1980s, 7% during 2002-2006, became slightly higher on average (12%) during 2007-2009, was 14% for 2010-2015 and 18% during 2016-2018 (Table 9, Figures 5, 6). The proportion of discards in the southern area catch has generally increased since the 1980s (average 16% 1980-1989), with an annual average of 29% during 2002-2006, 24% during 2007-2009, and 27% in 2010-2015 (Table 9,

Figures 5 and 6). During 2016-2018, the proportion of discards in the catch was 51%, and estimated discards (mt) exceeded landings in 2017 and 2018. These high discard rates are due primarily to regulatory discards in the scallop dredge fishery (Table 8). Gill nets consistently have had the lowest discard ratios in both areas.

Overall, discarding has increased steadily in both management areas since 2015 (Table 9). In 2015, a large increase in discarding of small fish was observed in southern area dredge and trawl fisheries (Figure 8), reflecting the strong 2015 recruitment event. This yearclass now appears to have grown into the exploitable size range (43+cm) (Figure 1).

Size Composition of U.S. Catch

Tail lengths were converted to total lengths using relations developed by Almeida et al. (1995). As in previous assessments, (NEFSC 2007a and later), length composition of landings and discard were estimated from fishery observer samples by management area, gear-type (trawls, dredges and gillnets), catch disposition (kept or discarded) and variable time periods (Table 11). Landings in unknown gear categories were allocated proportionately to the 3 major gear types before assigning lengths. The estimated length composition of landings and discard is shown in Figures 7-10. Age composition of the catch was not estimated.

Effort and CPUE

Evaluating trends in effort or catch rates in the monkfish fishery is difficult for several reasons. Much of the catch is taken in multi-species fisheries, and defining targeted monkfish trips is difficult. There have been programmatic changes in data collection from port interviews (1980-1993) to logbooks (1994-2009), and comparison of effort statistics among programs is difficult. Catch rates may not reflect patterns of abundance, because they have been affected by regulatory changes (e.g., 1994 closed areas, 2000 trip limits, 2006 reductions in trip limits).

CPUE data have not been used in the assessment model for monkfish, therefore they were not examined for this assessment update.

Fishery-Independent Data

Resource surveys used in the 2016 assessment were updated, including NEFSC spring and autumn offshore surveys, ASMFC northern shrimp surveys (NFMA only), ME/NH spring and fall inshore surveys, and scallop dredge surveys conducted by NEFSC and Virginia Institute of Marine Science (VIMS) (SMA only). Very few strata in the SMA were sampled during the 2017 fall survey, so indices were not calculated for the 2017 fall survey in the SMA.

The NEFSC survey strata used to define the northern and southern management areas are:

| Survey | Northern Area | Southern Area |
|-----------------------------|---------------|---------------------------------|
| NEFSC offshore bottom trawl | 20-30, 34-40 | 1-19, 61-76 |
| ASMFC Shrimp | 1,3,5-8 | 6,7,10,11,14,15,18,19,22-31,33- |
| Shellfish | | 35,46,47,55,58-61,621,631 |

NEFSC spring and autumn bottom trawl survey indices for 1963-2008 were standardized to adjust for statistically significant effects of trawl type (Sissenwine and Bowman 1977) on catch rates. The trawl conversion coefficients apply only to the spring survey during 1973-1981.

NEFSC indices derived from surveys on the FSV Henry Bigelow (starting spring 2009) were adjusted using calibration coefficients estimated during experimental work (Miller et al. 2009). The FSV *Henry B. Bigelow*, which became the main platform for NEFSC research surveys in spring 2009, has significantly different size, towing power, and fishing gear characteristics than the previous survey platform (*Albatross IV*), resulting in different fishing power and catchability for most species. Calibration experiments to estimate these differences were conducted during 2008 (Brown 2009, NEFSC 2007b,). Following guidelines developed by a peer-review panel (Anonymous 2009), monkfish catches were converted using a simple ratio estimator without a seasonal (spring vs. fall) or length-specific correction. The low catch rates of monkfish in the Albatross series made development of more detailed coefficients infeasible. The overall coefficients for monkfish were 7.1295 for numbers and 8.0618 for biomass (kg) (Anonymous 2009; Miller et al. 2009). The Bigelow time series is also presented as an independent, uncalibrated series.

NEFSC spring and fall survey estimates of minimum biomass and abundance were derived using relative efficiency estimates for monkfish from a set of paired-tow experiments comparing chain sweep (industry standard on soft bottom) vs. rock hopper gear (used on all tows on the FSV Bigelow) (Miller et al. 2017a, 2017b, 2018).

Northern Management Area (NMA)

Biomass indices from NEFSC autumn and spring research trawl surveys fluctuated without trend between 1963 and 1975, increased briefly in the late 1970's, but declined thereafter to near historic lows during the 1990's (Tables 12-13, Figures 11 and 12). From 2000 to 2003, indices increased, reflecting recruitment of a relatively strong 1999 yearclass. Subsequently, biomass indices declined and remained relatively low until 2016, when both biomass and abundance began to increase. Abundance declined slightly in 2017 and 2018 but biomass indices continued to increase in the fall survey (Figure 12). Exploitable biomass (43+cm) has increased steadily since 2014 (fall survey) or 2016 (spring survey) (Figure 13). ME-NH survey data has shown similar trends in total biomass and abundance as the NEFSC surveys (Figure 14).

Length composition of NEFSC and ME/NH fall survey catches (Figures 15 and 18) suggest production of relatively strong yearclasses in 2015 and 2016; however, strong recruitment was not apparent in the spring or summer shrimp surveys (Figures 16 and 17).

Recruitment indices (abundance) were estimated for monkfish of lengths corresponding to presumed young-of-year (YOY, age 0). The size ranges used were based on length frequencies observed for the strong 2015 yearclass, and were adopted in the 2016 assessment, as follows:

| | 2013 | | 2016 | |
|-----------------------|----------|----------|----------|----------|
| | Putative | Putative | Putative | Putative |
| North | age | cm range | age | cm range |
| Fall NEFSC | 1 | 11-19 | 0 | 6-18 |
| Fall ME-NH | 1 | 11-19 | 0 | 8-18 |
| <hr/> | | | | |
| South | | | | |
| Spring/summer scallop | 1 | 11-19 | 0 | 7-18 |
| Fall NEFSC | 1 | 11-17 | 0 | 12-28 |

Based on the recruitment indices (Figure 20), the frequency of recruitment events in the northern area has increased since the late 1980s, with strong yearclasses produced in 1993, 1994, 2000, 2015 and 2016. There appears to be a negative relationship between recruitment and size of monkfish in the NMA (Figure 20). One possible interpretation is that cannibalism plays a role in stock dynamics. Armstrong et al (1996) and Johnson et al. (2008) both found higher rates of cannibalism in relatively large monkfish.

Additional surveys that catch monkfish in portions of the northern area include the ASMFC shrimp survey, the Massachusetts Division of Marine Fisheries fall and spring surveys, and ME/NH inshore surveys (Table 15, Figures 11, 14, 17-19). The shrimp survey samples the western Gulf of Maine during summer and caught more monkfish than the spring or fall surveys prior to 2009 (when the FSV Bigelow survey series began). Patterns of abundance and biomass have been relatively consistent among the NEFSC spring and fall, ME-NH, and shrimp surveys (Figure 21). The Massachusetts surveys catch few monkfish and were not considered to reflect patterns of abundance for the entire management area (NEFSC 2007a); therefore have not been included in recent assessments.

Figure 22 shows the distribution of monkfish in surveys in the northern management area.

Southern Management Area

Inconsistent geographic coverage should be considered in the interpretation of southern survey indices. The NEFSC fall survey did not sample south of Hudson Canyon until 1967. The NEFSC scallop dredge survey has been limited to the southern flank of Georges Bank since 2014, and NEFSC sampling intensity over the entire mid-Atlantic Bight declined starting in 2011. The Virginia Institute of Marine Science VIMS is now conducting the scallop dredge survey in the areas south of Georges Bank (beginning in 2012), but the data are not incorporated into the NEFSC survey data base. In addition, the timing of the scallop dredge survey shifted in 2009 from mid-summer to late spring. NEAMAP inshore surveys in the Mid-Atlantic catch relatively few monkfish, so are not included here.

Biomass and abundance indices from NEFSC spring and autumn research surveys were high during the mid-1960s, fluctuated around an intermediate level during the 1970s-mid 1980s, and have been relatively low since the late 1980s (Tables 16-17, Figures 23 and 24). A sharp increase in abundance was observed in the 2015 scallop and fall surveys and in the 2016 spring survey (Tables 16-18 Figure 23), reflecting an apparent recruitment event in 2015. Exploitable biomass

(43+cm) increased in the spring survey in 2017 and 2018, likely as a result of the growth of the 2015 yearclass (Figure 25). The fall survey also showed elevated exploitable biomass in 2018 (no survey in 2017).

Length distributions from the southern area show truncation over time but somewhat less dramatically than in the north (Figures 25-27). As in the northern area, fish greater than 60 cm have been rare since the 1980s, especially when compared to the 1960s. Recruitment indices (presumed YOY) (Figure 29) indicate two exceptional recruitment events in the south, occurring in 1972 and 2015. The negative relationship between median size in the population and recruitment seen in the north is not evident in the SMA (Figure 29); however, the median size has generally been lower in the south than in the north. Distribution plots suggest that the 2015 recruits were broadly distributed in the SMA (Figure 32).

TOR 2a.

TOR 2a.) Estimate annual fishing mortality, recruitment, and stock size for the time series (“Plan A”). Include estimates of uncertainty, retrospective analyses (both historical and within-model), and bridge runs to sequentially document any changes from the previously accepted model to the updated model proposed for this peer review.

In the absence of an approved model, this TOR was not addressed through modeling efforts; however relative exploitation rates were calculated from landings or catch and survey estimates of minimum area-swept abundance or biomass estimated using adjustments for the rockhopper sweep (Miller et al. 2017a, 2017b, 2018) (Table 19, Figures 33-34). The area-swept estimates do not account for missed strata and assume that 100% of the monkfish encountered by the trawl are captured. Missing strata in monkfish assessment areas and total area of sampled strata during 2009-2018 were the following:

| North Missing strata | Area surveyed nmi ² | South | | Area surveyed nmi ² |
|-------------------------|-----------------------------------|----------------|------------------|-----------------------------------|
| | | Missing strata | nmi ² | |
| 2009 | 26,265 | 68 | | 37,029 |
| 2010 | 26,265 | | | 37,081 |
| 2011 | 20, 25 | 24,654 | 17, 66 | 36,166 |
| 2012 | 25 | 25,875 | | 37,081 |
| 2013 | 25 | 25,875 | 18 | 36,909 |
| 2014 | 20, 40 | 24,466 | 8 | 36,851 |
| 2015 | | 26,265 | | 37,081 |
| 2016 | | 26,265 | | 37,081 |
| 2017 | | 26,265 | 1-12, 61-76 | 9,226 |
| 2018 | 30, 34, 351,39 | 22,617 | | 37,081 |

TOR 2b.

TOR 2b.) Prepare a “Plan B” assessment that would serve as an alternate approach to providing scientific advice to management. “Plan B” will be presented for peer review only if the “PlanA” assessment were to not pass review.

A model-free method used to derive Georges Bank cod catch limits in 2015 (NEFSC 2015) was applied to monkfish in the northern and southern management areas in the 2016 assessment (NEFSC 2016) and is updated here. The method calculates the rate and direction of change in survey indices using the slope of a log-linear regression of LOESS-smoothed survey indices during the most recent three years. In the case of cod, the proportional change in the indices (re-transformed slope, “catch multiplier”) was applied to average cod catch in the three previous years to derive new cod catch limits.

The monkfish analysis calculated the catch multiplier using biomass indices from either the NEFSC fall survey only or the average of the NEFSC spring and fall surveys. The missing 2017 fall survey index for the south was interpolated by averaging 2016 and 2018 biomass indices for the south. The spring survey may be affected more strongly than the fall survey by availability of monkfish to the gear due to timing of seasonal migrations. Biomass indices for 1986-2018 in each area were LOESS-smoothed (smoothing parameter=0.30, 9.9 year smoothing window) before being entered into a log-linear regression to estimate the proportional change during 2016-2018. The estimated proportional change (catch multiplier) for monkfish in the north was 1.26 (fall survey only, 26% increase) or 1.22 (spring and fall surveys combined, 22% increase). In the south, the proportional change was 0.96 (fall survey only, 4% decrease) or 1.04 (spring and fall surveys combined, 4% increase) (Figure 35).

TOR 3. Update the values of biological reference points (BRPs) for this stock.

Biological reference points specified in the management plan are no longer relevant due to invalidation of the growth model, therefore they were not updated for this assessment update.

TOR 4a.

TOR 4a. Recommend what stock status appears to be based on comparison of assessment results to BRP estimates.

This TOR was not addressed because monkfish BRPs have been invalidated.

TOR 4b.

TOR 4b. Include qualitative descriptions of stock status based on simple indicators/metrics (e.g., age- and size-structure, temporal trends in population size or recruitment indices, etc.).

Based on trends in survey results, monkfish stock status has been improving (north) or remained steady (south) in both management regions in the past three years, likely due primarily to the 2015 recruitment event. Biomass continued to increase in the north in 2018 while abundance dropped, reflecting an increase in the proportion of large individuals in the population (likely of the 2015 year class). In the south, biomass increased after the 2015 recruitment event, but was lower in 2018 (fall 2017 data missing), as abundance of the 2015 year class declined.

Recruitment has returned to average levels in the south, and in the north, to average levels observed since the late 1980s. Abundance and biomass patterns may be influenced by movement of monkfish between the management areas, which is poorly understood.

TOR 5.

TOR 5. Perform short-term (2-year) population projections. The projection results should include an estimate of the catch at FMSY or at an FMSY proxy (i.e. this catch represents the overfishing level, OFL) as well as its statistical distribution (i.e., probability density function).

Not relevant to this assessment.

TOR 6.

TOR 6. Comment on research areas or data issues to consider that might lead to improvements when this stock is assessed again in the future.

A benchmark assessment should consider the feasibility of using both observer and port samples in estimating length composition of commercial landings.

Ongoing research on age and growth of monkfish may lead to an acceptable growth curve, even if not an aging method that could be used for routine aging. If so, age structured models could be explored assuming static growth.

A better understanding of monkfish movements and stock structure would be helpful to interpretation of monkfish population data.

Future modeling efforts may want to consider the possible role of cannibalism in stock dynamics of monkfish in light of the strong negative relationship observed in the north between median size of monkfish in the population and recruitment indices.

References:

- Almeida FP, Hartley DL, Burnett J. 1995. Length-weight relationships and sexual maturity of monkfish off the northeast coast of the United States. *N Am J Fish Manage.* 15:14-25.
- Anonymous. 2009. Independent Panel review of the NMFS Vessel Calibration analyses for FSV/ Henry B. Bigelow/ and R/V/ Albatross IV/. August 11-14, 2009. Chair's Consensus report. 10 p.
- Armstrong MP, Musick JA, Colvocoresses JA. 1992. Age, growth and reproduction of the monkfish *Lophius americanus* (Pisces:Lophiiformes). *Fish Bull.* 90: 217-230.
- Armstrong, M. P., Musick, J. A., and Colvocoresses, J. A. 1996. Food and ontogenetic shifts in feeding of the goosefish, *Lophius americanus*. *Journal of Northwest Atlantic Fishery Science*, 18: 99–103.

- Azarovitz TR. 1981. A brief historical review of the Woods Hole Laboratory trawl survey time series. Pages 62-67 in W.G. Doubleday and D. Rivard, editors. Bottom trawl surveys. Can Spec Pub Fish Aquat Sci. 58.
- Bank, C. 2016. Validation of age determination methods for monkfish (*Lophius americanus*). Master of Science Thesis, School of Marine Science and Technology, Univ. Mass.
- Brown R. 2009. Design and field data collection to compare the relative catchabilities of multispecies bottom trawl surveys conducted on the NOAA ship *Albatross IV* and the FSV *Henry B. Bigelow*. NEFSC Bottom Trawl Survey Calibration Peer Review Working Paper. NEFSC, Woods Hole, MA. 19 p.
- Caruso JH. 1983. The systematics and distribution of the lophiid angler fisher: II. Revision of the genera *Lophiomus* and *Lophius*. Copeia 1: 11-30.
- Collette B, Klein-MacPhee G, (eds). 2002. Bigelow and Schroeder's Fishes of the Gulf of Maine, Third edition. Smithsonian Institution Press. 748 p.
- Chikarmane HM, Kuzirian A, Kozlowski R, Kuzirian M, Lee T. 2000. Population genetic structure of the monkfish, *Lophius americanus*. Biol Bull. 199: 227-228.
- Cook RM. 1997. Stock trends in six North Sea stocks as revealed by an analysis of research vessel surveys. ICES J Mar Sci. 54: 924-933.
- Durbin EG, Durbin AG, Langton RW, Bowman RE. 1983. Stomach contents of silver hake, *Merluccius bilinearis*, and Atlantic cod, *Gadus morhua*, and estimation of their daily rations. Fish Bull. 81: 437-454.
- Eggers DM. 1977. Factors in interpreting data obtained by diel sampling of fish stomachs. J Fish Res Board Can. 34: 290-294.
- Elliot JM, Persson L. 1978. The estimation of daily rates of food consumption for fish. J Anim Ecol. 47: 977-991.
- Haring P, Maguire JJ, 2008. The monkfish fishery and its management in the northeastern USA. ICES J Mar Sci. 65: 1370 – 1379.
- Hartley D. 1995. The population biology of the monkfish, *Lophius americanus*, in the Gulf of Maine. M. Sc. Thesis, University of Massachusetts, Amherst. 142 p.
- Hasbrouck, E., J. Scotti, T. Froehlich, K. Gerbino, J. Stent, J. Costanzo, I. Wirgin. 2015. Coastwide stock structure of monkfish using microsatellite DNA analysis. Completion report, Monkfish RSA Grant NA12NMF4540095.
- Johnson AK, Richards RA, Cullen DW, Sutherland SJ, 2008. Growth, reproduction, and feeding of large monkfish, *Lophius americanus*. ICES J Mar Sci. 65: 1306 – 1315.
- Johnson, A.K., Allen R. Place, Belita S. Nguluwe, R. Anne Richards, Ernest Williams. In prep. Stock Discrimination of American Monkfish using a Mitochondrial DNA Marker.
- Kleisner KM, Fogarty MJ, McGee S, Barnett A, Fratantoni P, Greene J, et al. (2016) The Effects of Sub-Regional Climate Velocity on the Distribution and Spatial Extent of Marine Species Assemblages. PLoS ONE 11(2): e0149220. doi:10.1371/journal.pone.0149220
- Link JS, Col L, Guida V, Dow D, O'Reilly J, Green J, Overholtz W, Palka D, Legault C, Vitaliano J, Griswold C, Fogarty M, Friedland K. 2009. Response of Balanced Network Models to Large-Scale Perturbation: Implications for Evaluating the Role of Small Pelagics in the Gulf of Maine. Ecol Model. 220: 351-369.
- Link J, Overholtz W, O'Reilly J, Green J, Dow D, Palka D, Legault C, Vitaliano J, Guida V, Fogarty M, Brodziak J, Methratta E, Stockhausen W, Col L, Waring G, Griswold C. 2008. An Overview of EMAX: The Northeast U.S. Continental Shelf Ecological Network. J Mar Sys. 74: 453-474.

- Link JS, Griswold CA, Methratta EM, Gunnard, J. (eds). 2006. Documentation for the Energy Modeling and Analysis eXercise (EMAX). NEFSC Ref Doc. 06-15: 166 p.
- Link JS, Sosebee K. 2008. Estimates and implications of Skate Consumption in the northeastern US continental shelf ecosystem. N Amer J Fish Manage. 28: 649-662.
- Link JS, Idoine J. 2009. Predator Consumption Estimates of the northern shrimp *Pandalus borealis*, with Implications for Estimates of Population Biomass in the Gulf of Maine. N. Am J Fish Manage. 29:1567-1583.
- Link JS, Garrison LP. 2002. Changes in piscivory associated with fishing induced changes to the finfish community on Georges Bank. Fish Res. 55: 71-86.
- Link JS, Garrison LP, Almeida FP. 2002. Interactions between elasmobranchs and groundfish species (*Gadidae* and *Pleuronectidae*) on the Northeast U.S. Shelf. I: Evaluating Predation. N Am J Fish Manage. 22: 550-562.
- Link JS, Almeida FP. 2000. An overview and history of the food web dynamics program of the Northeast Fisheries Science Center, Woods Hole, Massachusetts. NOAA Tech Memo. NMFS-NE-159. 60 p.
- McBride, R., A. Johnson, E. Lindsay, H. Walsh, A. Richards. 2017. Goosefish *Lophius americanus* fecundity and spawning frequency, with implications for population reproductive potential. Journal of Fish Biology 90(5): 1861-1882. doi:10.1111/jfb.13272
- Miller TJ, Das C, Politis P, Long A, Lucey S, Legault C, Brown R, Rago P. 2009. Estimation of */Henry B. Bigelow/* calibration factors. NEFSC Bottom Trawl Survey/ /Calibration Peer Review Working Paper. NEFSC, Woods Hole, MA. 376 p.
- Miller, T. J., Richardson, D. E., Politis, P. Blaylock, J. 2017a. NEFSC bottom trawl catch efficiency and biomass estimates for 2009-2017 for 8 flatfish stocks included in the 2017 North-east Groundfish Operational Assessments. Working paper. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. September 11-15, 2017.
- Miller, T. J., Martin, M. Politis, P., Legault, C. M., Blaylock, J. 2017b. Some statistical approaches to combine paired observations of chain sweep and rockhopper gear and catches from NEFSC and DFO trawl surveys in estimating Georges Bank yellowtail flounder biomass. TRAC Working Paper 2017/XX. 36. pp.
- Miller, T. J., Politis, P., Blaylock, J., Richardson, D., Manderson, J., Roebuck, C. 2018. Relative efficiency of a chain sweep and the rockhopper sweep used for the NEFSC bottom trawl survey and chainsweep-based swept area biomass estimates for 11 flatfish stocks. SAW 66 summer flounder Data/Model/Biological Reference Point (BRP) meeting. National Marine Fisheries Service, Northeast Fisheries Science Center, Woods Hole, MA. September 17-21, 2018.
- Moustahfid H, Tyrrell MC, Link JS. 2009a. Accounting explicitly for predation mortality in surplus production models: an application to longfin inshore squid. N Am J Fish Manage. 29: 1555-1566.
- Moustahfid H, Link JS, Overholtz WJ, Tyrell MC. 2009b. The advantage of explicitly incorporating predation mortality into age-structured stock assessment models: an application for Northwest Atlantic mackerel. ICES J Mar Sci. 66: 445-454.
- NEFC (Northeast Fisheries Center). 1988. An evaluation of the bottom trawl survey program of the Northeast Fisheries Center. NOAA Technical Memorandum NMFS-F/NEC52.83 pp.

- NEFMC [New England Fishery Management Council] and MAFMC [Mid-Atlantic Fishery Management Council]. 1998. Monkfish Fishery Management Plan. <http://www.nefmc.org/monk/index.html>
- 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. NEFSC Ref Doc. 02-06: 346p
- NEFSC [Northeast Fisheries Science Center]. 2005. 40th Northeast Regional Stock Assessment Workshop (40th SAW) Assessment Report. NEFSC Ref Doc. 05-04:146 p
- NEFSC [Northeast Fisheries Science Center]. 2006. 42nd Northeast Regional Stock Assessment Workshop. (42nd SAW) stock assessment report, part B: Expanded Multispecies Virtual Population Analysis (MSVPA-X) stock assessment model. NEFSC Ref Doc. 06-09b: 308 p.
- NEFSC [Northeast Fisheries Science Center]. 2007a. Northeast Data Poor Stocks Working Group Monkfish assessment report for 2007. NEFSC Ref Doc. 07-21: 232 p.
- NEFSC [Northeast Fisheries Science Center]. 2007b. Proposed vessel calibration studies for NOAA Ship *Henry B. Bigelow*. NEFSC Ref. Doc. 07-12: 26 p.
- NEFSC [Northeast Fisheries Science Center]. 2007c. Assessment Report (45th SARC/SAW). Section A.10. [TOR 6]. NEFSC Ref Doc. 07-16: 13-138.
- NEFSC [Northeast Fisheries Science Center]. 2007d. Assessment Report (44th SARC/SAW). Section B.8. [TOR 6]. NEFSC Ref Doc. 07-10: 332-344, 504-547.
- NEFSC [Northeast Fisheries Science Center]. 2008. Assessment of 19 Northeast Groundfish Stocks through 2007 Report of the 3rd Groundfish Assessment Review Meeting (GARM III), Northeast Fisheries Science Center, Woods Hole, Massachusetts, August 4-8, 2008. Section 2.1. NEFSC Ref Doc. 08-15: 855-865.
- NEFSC [Northeast Fisheries Science Center]. 2010. Assessment Report (50th SARC/SAW). NEFSC Ref Doc. 10-17: 15-392.
- NEFSC [Northeast Fisheries Science Center]. 2013. 2013 Monkfish Operational Assessment. NEFSC Ref Doc. 13-23: 116 p.
- NEFSC [Northeast Fisheries Science Center]. 2015. Operational Assessment of 20 Northeast Groundfish Stocks, Updated Through 2014. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 15-24; 251 p.
- NEFSC [Northeast Fisheries Science Center]. 2016. 2016 Monkfish Operationsl Assessment. US Dept Commer, Northeast Fish Sci Cent Ref Doc. 16-09; 109 p.
- Overholtz WJ, Link JS. 2009. A simulation model to explore the response of the Gulf of Maine food web to large scale environmental and ecological changes. Ecol Model. 220: 2491-2502.
- Overholtz WJ, Jacobson LD, Link JS. 2008. Developing an ecosystem approach for assessment advice and biological reference points for the Gulf of Maine-Georges Bank herring complex: adding the impact of predation mortality. N Am J Fish Manag. 28: 247-257.
- Overholtz WJ, Link JS. 2007. Consumption impacts by marine mammals, fish, and seabirds on the Gulf of Maine-Georges Bank Atlantic Herring (*Clupea harengus*) complex during 1977-2002. ICES J Mar. Sci. 64: 83-96.
- Overholtz W, Link JS, Suslowicz LE. 2000. The impact and implications of fish

- predation on pelagic fish and squid on the eastern USA shelf. ICES J Mar Sci. 57: 1147-1159.
- Overholtz W, Link JS, Suslowicz LE. 1999. Consumption and harvest of pelagic fishes in the Gulf of Maine-Georges Bank ecosystem: Implications for fishery management. Proceedings of the 16th Lowell Wakefield Fisheries Symposium-Ecosystem Considerations in Fisheries Management. AK-SG-99-01:163-186.
- Overholtz WJ, Murawski SA, Foster KL. 1991. Impact of predatory fish, marine mammals, and seabirds on the pelagic fish ecosystem of the northeastern USA. ICES Mar Sci Symposia 193: 198-208.
- Pennington M. 1985. Estimating the average food consumption by fish in the field from stomach contents data. Dana 5: 81-86.
- Pennington, M. 1986. Estimating the mean and variance from highly skewed marine data. Fishery Bulletin 47: 1623-1624.
- Rago PJ, Wigley SE, Fogarty MJ. 2005. NEFSC bycatch estimation methodology: allocation, precision, and accuracy. NEFSC Ref Doc. 05-09: 44 p
- Rago PJ, Weinberg JR, Weidman C. 2006. A spatial model to estimate gear efficiency and animal density from depletion experiments. Can J Fish Aquat Sci: 63: 2377-2388.
- Raymond M, Glass C. 2006. A Project to define monkfish trawl gear and areas that reduce groundfish bycatch and to minimize the impacts of monkfish trawl gear on groundfish habitat. Final Report, NOAA NERO CRPP Contract EA-133-F-03-CN-0049.
- Richards A. 2006. Goosefish (*Lophius americanus*). In Status of Fishery Resources off the Northeastern US (www.nefsc.noaa.gov/sos/spsyn/og/goose).
- Richards RA, Nitschke P, Sosebee K. 2008. Population biology of monkfish *Lophius americanus*. ICES J Mar Sci. 65: 1291-1305.
- Richards, RA, Grabowski, J and Sherwood, G. 2012. Archival Tagging Study of Monkfish, *Lophius americanus*. Final Report to Northeast Consortium, Project Award 09-042.
- Rountree RA, Gröger JP, Martins D. 2006. Extraction of daily activity pattern and vertical migration behavior from the benthic fish, *Lophius americanus*, based on depth analysis from data storage tags. ICES CM 2006/Q:01.
- Sissenwine MP, Bowman EW. 1977. Fishing power of two bottom trawls towed by research vessels off the northeast coast of the USA during day and night. ICES CM. 1977: B30.
- Steimle FW, Morse WW, Johnson DL. 1999. Essential fish habitat source document: monkfish, *Lophius americanus*, life history and habitat characteristics. NOAA TechMemoNMFS-NE-127.
- Syrjala, S. 2000. Critique on the use of the delta distribution for the analysis of trawl survey data. ICES J. Mar. Sci. 57:831-842.
- Taylor MH, Bascuñán C, Manning JP. 2005. Description of the 2004 Oceanographic Conditions on the Northeast Continental Shelf. NEFSC Ref Doc. 05-03: 90 p.
- Tsou TS, Collie JS. 2001a. Estimating predation mortality in the Georges Bank fish community. Can J Fish Aquat Sci. 58: 908-922.
- Tsou TS, Collie JS. 2001b. Predation-mediated recruitment in the Georges Bank fish community. ICES J Mar Sci. 58: 994-1001.
- Tyrrell MC, Link JS, Moustahfid H, Overholtz WJ. 2008. Evaluating the effect of predation mortality on forage species population dynamics in the Northwest Atlantic continental shelf ecosystem: an application using multispecies virtual population analysis. ICES J Mar Sci. 65: 1689-1700.

- Tyrrell MC, Link JS, Moustahfid H, Smith BE. 2007. The dynamic role of goosefish (*Pollachius virens*) as a predator in the Northeast US Atlantic ecosystem: a multi-decadal perspective. *J Northwest Atl Fish Sci.* 38: 53-65.
- Ursin E, Pennington M, Cohen EB, Grosslein MD. 1985. Stomach evacuation rates of Atlantic cod (*Gadus morhua*) estimated from stomach contents and growth rates. *Dana* 5: 63-80.
- Wigley SE, Rago PJ, Sosebee KA, Palka DL. 2007. The Analytic Component to the Standardized Bycatch Reporting Methodology Omnibus Amendment: Sampling Design, and Estimation of Precision and Accuracy. NEFSC Ref Doc. 07-09: 156 p
- Weinberg KL, Kotwicki S. 2008. Factors influencing net width and sea floor contact of a survey bottom trawl. *Fish Res.* 93: 265-279.

Tables

Table 1. Timeline of fishery management actions for monkfish.

(<http://www.greateratlantic.fisheries.noaa.gov/sustainable/species/monkfish/>)

1999 – [Monkfish FMP](#) was implemented which included a limited access permit program, a DAS management system, trip limits, and minimum size limits.

1999 – [Amendment 1 \(FR Notice\)](#) approved to ensure compliance with essential fish habitat requirements of the [Magnuson-Stevens Act](#).

2002 – [Framework Adjustment 1 \(FR Notice\)](#) was disapproved by NMFS. NMFS instead published an emergency rule that implemented measures based upon the best available science to temporarily suspend the restrictive Year 4 default management measures that would have become effective May 1, 2002.

2003 – [Framework Adjustment 2 \(FR Notice\)](#) modified the overfishing definition and implemented annual adjustments to the management measures.

2003 - [Final rule](#) implemented a series of seasonal closures that prohibited the use of large mesh gillnets in Federal waters off the coast of Virginia and North Carolina to reduce the impact of the monkfish fishery on endangered and threatened species of sea turtles.

2005 – Amendment 2 ([FR Notice](#)) addressed essential fish habitat, bycatch concerns, and issues raised by public comments.

2006 – [Framework Adjustment 3 \(FR Notice\)](#) implemented to prohibit targeting monkfish on Multispecies B-regular DAS.

2007 – Interim management measures [Framework 4 \(FR Notice\)](#) adopted in May to address overfishing while NMFS conducted a stock assessment. Framework 4 was implemented in October to establish 3-year target total allowable catches (TACs), a target TAC backstop provision, and adjustments to DAS allocations and trip limits.

2007 – [Amendment 3 \(FR Notice\)](#) was implemented as an Omnibus Amendment to standardize bycatch reporting methodology for monkfish and other fisheries.

2008 – NMFS implemented [Framework 5 \(FR Notice\)](#) to ensure the Monkfish FMP succeeds in keeping landings within the target total allowable catch levels. Measures include reduction in carryover DAS, reduction in bycatch or incidental catch limits, and revision in the biological reference points used to determine if the stock is overfished.

2008 – [Framework 6 \(FR Notice\)](#) eliminated the backstop provision adopted in Framework Adjustment 4 to the FMP, October 2007.

Table 1, continued.

2011 – [Amendment 5 \(FR Notice\)](#) implemented a suite of measures including annual catch limits and accountability measures, measures to promote efficiency and reduce waste, and bring the biological reference points into compliance.

2011 – [Framework Adjustment 7 \(FR Notice\)](#) implemented measures that were disapproved in Amendment 5 due to newly available science. Specifically, DAS allocations, trip limits, and an annual catch target for the Northern Area.

2012 – Amendment 6 is still being developed in considering a catch shares management system for the fishery. Information on Amendment 6 is located [here](#).

2013 - NMFS implements an [emergency action \(FR Notice\)](#) to suspend the monkfish possession limits in the Northern Fishery Management Area for monkfish permit categories C and D under a monkfish DAS.

2014 - [Framework Adjustment 8 \(FR Notice\)](#) implemented measures to incorporate results of latest stock assessment, increase monkfish day-at-sea allocations and landing limits to better achieve optimum yield, and increase operational flexibility by allowing all limited access monkfish vessels to use an allocated monkfish-only day-at-sea at any time throughout the fishing year and Category H vessels to fish throughout the Southern Fishery Management Area.

2016 – [Framework Adjustment 9 \(FR Notice\)](#) implemented measures to increase landings in the NFMA by eliminating the possession limit while fishing under both a NE multispecies and monkfish day-at-sea and increasing flexibility in the SFMA by reducing the minimum mesh size for roundfish gillnets.

2017 – [Framework Adjustment 10 \(FR Notice\)](#) implemented measures to incorporate results of the 2016 operational assessment, increase monkfish day-at-sea allocations and possession limits.

Table 2. Management measures for monkfish, fishing years 2000-2018. Regulations pertain to fishing years (FY, May 1- April 30), thus landings do not correspond to calendar year landings in Table 3. Trip limits apply to vessels fishing on declared monkfish days at sea.

Northern Fishery Management Area

| Fishing Year | Target TAC/TAL | Trip Limits* | Trip Limits* | DAS Restrict | FY Landings (mt) | Percent of TAC |
|---------------------|-----------------------|---------------------|---------------------|---------------------|-------------------------|-----------------------|
| | | Cat. A & C | Cat. B & D | | | |
| 2000 | 5,673 | n/a | n/a | 40 | 11,859 | 209% |
| 2001 | 5,673 | n/a | n/a | 40 | 14,853 | 262% |
| 2002 | 11,674 | n/a | n/a | 40 | 14,491 | 124% |
| 2003 | 17,708 | n/a | n/a | 40 | 14,155 | 80% |
| 2004 | 16,968 | n/a | n/a | 40 | 11,750 | 69% |
| 2005 | 13,160 | n/a | n/a | 40 | 9,533 | 72% |
| 2006 | 7,737 | n/a | n/a | 40 | 6,677 | 86% |
| 2007 | 5,000 | 1,250 | 470 | 31 | 5,050 | 101% |
| 2008 | 5,000 | 1,250 | 470 | 31 | 3,528 | 71% |
| 2009 | 5,000 | 1,250 | 470 | 31 | 3,344 | 67% |
| 2010 | 5,000 | 1,250 | 470 | 31 | 2,834 | 57% |
| 2011 | 5,854 | 1,250 | 600 | 40 | 3,699 | 63% |
| 2012 | 5,854 | 1,250 | 600 | 40 | 3,920 | 67% |
| 2013 | 5,854 | 1,250 | 600 | 40 | 3,596 | 61% |
| 2014 | 5,854 | 1,250 | 600 | 45 | 3,403 | 58% |
| 2015 | 5,854 | 1,250 | 600 | 45 | 4,080 | 70% |
| 2016 | 5,854 | 1,250 | 600 | 45 | 5,447 | 93% |
| 2017 | 6,338 | 1,250 | 600 | 45 | 6,807 | 107% |
| 2018 | 6,338 | 1,250 | 600 | 45 | 6,168 | 97% |

Southern Fishery Management Area

| Fishing Year | Target TAC/TAL | Trip Limits* | Trip Limits* | DAS Restrict | FY Landings (mt) | Percent of TAC |
|---------------------|-----------------------|---------------------|---------------------|---------------------|-------------------------|-----------------------|
| | | Cat. A,C,G | Cat. B, D, H | | | |
| 2000 | 6,024 | 1,500 | 1,000 | 40 | 7,960 | 132% |
| 2001 | 6,024 | 1,500 | 1,000 | 40 | 11,069 | 184% |
| 2002 | 7,921 | 550 | 450 | 40 | 7,478 | 94% |
| 2003 | 10,211 | 1,250 | 1,000 | 40 | 12,198 | 119% |
| 2004 | 6,772 | 550 | 450 | 28 | 6,223 | 92% |
| 2005 | 9,673 | 700 | 600 | 39.3 | 9,656 | 100% |
| 2006 | 3,667 | 550 | 450 | 12 | 5,909 | 161% |
| 2007 | 5,100 | 550 | 450 | 23 | 7,180 | 141% |
| 2008 | 5,100 | 550 | 450 | 23 | 6,751 | 132% |
| 2009 | 5,100 | 550 | 450 | 23 | 4,800 | 94% |
| 2010 | 5,100 | 550 | 450 | 23 | 4,484 | 88% |
| 2011 | 8,925 | 550 | 450 | 28 | 5,801 | 65% |
| 2012 | 8,925 | 550 | 450 | 28 | 5,184 | 58% |
| 2013 | 8,925 | 550 | 450 | 28 | 5,088 | 57% |
| 2014 | 8,925 | 610 | 500 | 32 | 5,415 | 61% |
| 2015 | 8,925 | 610 | 500 | 32 | 4,733 | 53% |
| 2016 | 8,925 | 700 | 575 | 37 | 4,345 | 49% |
| 2017 | 9,011 | 700 | 575 | 37 | 3,802 | 42% |
| 2018 | 9,011 | 700 | 575 | 37 | 4,600 | 51% |

Table 3. Landings (calculated live weight, mt) of monkfish as reported in NEFSC weigh-out data base (1964-1993) and vessel trip reports (1994-2014) (North = SA 511-523, 561; South = SA 524-639 excluding 551-561 plus landings from North Carolina for years 1977-1995); General Canvas database (1964-1989, North = ME, NH, northern weigh out proportion of MA; South = Southern weigh-out proportion of MA, RI-VA); Foreign landings from NAFO database areas 5 and 6. Shaded cells denote suggested source for landings which are used in the total column at the far right (see text for details).

| Year | Weigh Out Plus NC | | | General Canvas | | | | Foreign | Total |
|------|-------------------|----------|----------|----------------|----------|----------|-------|---------|-------|
| | US North | US South | US Total | US North | US South | US Total | | | |
| 1964 | 45 | 19 | 64 | 45 | 61 | 106 | 0 | 106 | |
| 1965 | 37 | 17 | 54 | 37 | 79 | 115 | 0 | 115 | |
| 1966 | 299 | 13 | 312 | 299 | 69 | 368 | 2,397 | 2,765 | |
| 1967 | 539 | 8 | 547 | 540 | 59 | 598 | 11 | 609 | |
| 1968 | 451 | 2 | 453 | 449 | 36 | 485 | 2,231 | 2,716 | |
| 1969 | 258 | 4 | 262 | 240 | 43 | 283 | 2,249 | 2,532 | |
| 1970 | 199 | 12 | 211 | 199 | 53 | 251 | 477 | 728 | |
| 1971 | 213 | 10 | 223 | 213 | 53 | 266 | 3,659 | 3,925 | |
| 1972 | 437 | 24 | 461 | 437 | 65 | 502 | 4,102 | 4,604 | |
| 1973 | 710 | 139 | 848 | 708 | 240 | 948 | 6,818 | 7,766 | |
| 1974 | 1,197 | 101 | 1,297 | 1,200 | 183 | 1,383 | 727 | 2,110 | |
| 1975 | 1,853 | 282 | 2,134 | 1,877 | 417 | 2,294 | 2,548 | 4,842 | |
| 1976 | 2,236 | 428 | 2,663 | 2,256 | 608 | 2,865 | 341 | 3,206 | |
| 1977 | 3,137 | 830 | 3,967 | 3,167 | 1,314 | 4,481 | 275 | 4,756 | |
| 1978 | 3,889 | 1,384 | 5,273 | 3,976 | 2,073 | 6,049 | 38 | 6,087 | |
| 1979 | 4,014 | 3,534 | 7,548 | 4,068 | 4,697 | 8,765 | 70 | 8,835 | |
| 1980 | 3,695 | 4,232 | 7,927 | 3,623 | 6,035 | 9,658 | 132 | 9,790 | |
| 1981 | 3,217 | 2,380 | 5,597 | 3,171 | 4,142 | 7,313 | 381 | 7,694 | |
| 1982 | 3,860 | 3,722 | 7,582 | 3,757 | 4,492 | 8,249 | 310 | 7,892 | |
| 1983 | 3,849 | 4,115 | 7,964 | 3,918 | 4,707 | 8,624 | 80 | 8,044 | |
| 1984 | 4,202 | 3,699 | 7,901 | 4,220 | 4,171 | 8,391 | 395 | 8,296 | |
| 1985 | 4,616 | 4,262 | 8,878 | 4,452 | 4,806 | 9,258 | 1,333 | 10,211 | |
| 1986 | 4,327 | 4,037 | 8,364 | 4,322 | 4,264 | 8,586 | 341 | 8,705 | |
| 1987 | 4,960 | 3,762 | 8,722 | 4,995 | 3,933 | 8,926 | 748 | 9,470 | |
| 1988 | 5,066 | 4,595 | 9,661 | 5,033 | 4,775 | 9,809 | 909 | 10,570 | |
| 1989 | 6,391 | 8,353 | 14,744 | 6,263 | 8,678 | 14,910 | 1,178 | 15,922 | |
| 1990 | 5,802 | 7,204 | 13,006 | | | | 1,557 | 14,563 | |
| 1991 | 5,693 | 9,865 | 15,558 | | | | 1,020 | 16,578 | |
| 1992 | 6,923 | 13,942 | 20,865 | | | | 473 | 21,338 | |
| 1993 | 10,645 | 15,098 | 25,743 | | | | 354 | 26,097 | |
| 1994 | 10,950 | 12,126 | 23,076 | | | | 543 | 23,619 | |
| 1995 | 11,970 | 14,361 | 26,331 | | | | 418 | 26,749 | |
| 1996 | 10,791 | 15,715 | 26,507 | | | | 184 | 26,691 | |
| 1997 | 9,709 | 18,462 | 28,172 | | | | 189 | 28,361 | |
| 1998 | 7,281 | 19,337 | 26,618 | | | | 190 | 26,808 | |
| 1999 | 9,128 | 16,085 | 25,213 | | | | 151 | 25,364 | |
| 2000 | 10,729 | 10,147 | 20,876 | | | | 176 | 21,052 | |
| 2001 | 13,341 | 9,959 | 23,301 | | | | 142 | 23,443 | |
| 2002 | 14,011 | 8,884 | 22,896 | | | | 294 | 23,190 | |
| 2003 | 14,991 | 11,095 | 26,086 | | | | 309 | 26,395 | |
| 2004 | 13,209 | 7,978 | 21,186 | | | | 166 | 21,352 | |
| 2005 | 10,140 | 9,177 | 19,317 | | | | 206 | 19,523 | |
| 2006 | 6,974 | 7,980 | 14,955 | | | | 279 | 15,234 | |
| 2007 | 4,953 | 7,388 | 12,341 | | | | | 12,341 | |
| 2008 | 3,942 | 7,250 | 11,192 | | | | | 11,192 | |
| 2009 | 3,210 | 5,532 | 8,742 | | | | | 8,742 | |
| 2010 | 2,424 | 4,996 | 7,420 | | | | | 7,420 | |
| 2011 | 3,227 | 5,371 | 8,599 | | | | | 8,599 | |
| 2012 | 4,033 | 5,724 | 9,757 | | | | | 9,757 | |
| 2013 | 3,332 | 5,253 | 8,586 | | | | | 8,586 | |
| 2014 | 3,402 | 5,135 | 8,537 | | | | | 8,537 | |
| 2015 | 4,027 | 4,609 | 8,636 | | | | | 8,636 | |
| 2016 | 4,633 | 4,422 | 9,055 | | | | | 9,055 | |
| 2017 | 7,008 | 3,893 | 10,901 | | | | | 10,901 | |
| 2018 | 5,954 | 4,465 | 10,419 | | | | | 10,419 | |

Table 4. U.S. landings of monkfish (calculated live weight, mt) by gear type.

| Year | North | | | | | South | | | | | Regions Combined | | | | |
|------|--------|----------|----------------|-------|--------|-------|----------|----------------|-------|--------|------------------|----------|----------------|-------|--------|
| | Trawl | Gill Net | Scallop Dredge | Other | Total | Trawl | Gill Net | Scallop Dredge | Other | Total | Trawl | Gill Net | Scallop Dredge | Other | Total |
| 1964 | 45 | 0 | | | 45 | 19 | | | | 19 | 64 | 0 | | | 64 |
| 1965 | 36 | 0 | | | 37 | 17 | | | | 17 | 53 | 0 | | | 53 |
| 1966 | 299 | 0 | | 0 | 299 | 13 | | | 0 | 13 | 311 | 0 | | 0 | 312 |
| 1967 | 532 | | 8 | | 539 | 8 | | | | 8 | 540 | | 8 | | 547 |
| 1968 | 447 | | 4 | | 451 | 2 | | | | 2 | 449 | | 4 | | 453 |
| 1969 | 253 | 1 | 4 | | 258 | 4 | | | | 4 | 257 | 1 | 4 | | 262 |
| 1970 | 198 | 0 | | 0 | 199 | 12 | | | | 12 | 210 | 0 | | 0 | 211 |
| 1971 | 213 | | 0 | | 213 | 10 | | | | 10 | 223 | | 0 | | 223 |
| 1972 | 426 | 8 | 1 | 2 | 437 | 24 | | | | 24 | 451 | 8 | 1 | 2 | 461 |
| 1973 | 661 | 29 | 12 | 8 | 710 | 132 | | 5 | 1 | 137 | 794 | 29 | 17 | 9 | 848 |
| 1974 | 1,060 | 105 | 7 | 25 | 1,197 | 98 | | 0 | | 98 | 1,160 | 105 | 7 | 25 | 1,297 |
| 1975 | 1,712 | 123 | 10 | 9 | 1,853 | 265 | 0 | 2 | 2 | 269 | 1,990 | 123 | 12 | 10 | 2,135 |
| 1976 | 2,031 | 143 | 47 | 15 | 2,236 | 333 | | 7 | 0 | 340 | 2,459 | 143 | 54 | 15 | 2,670 |
| 1977 | 2,737 | 230 | 142 | 28 | 3,137 | 508 | | 57 | 26 | 591 | 3,487 | 230 | 202 | 53 | 3,973 |
| 1978 | 3,255 | 368 | 212 | 54 | 3,889 | 605 | 0 | 507 | 26 | 1,138 | 4,016 | 368 | 774 | 80 | 5,238 |
| 1979 | 2,967 | 393 | 584 | 71 | 4,014 | 944 | 6 | 1,015 | 16 | 1,981 | 3,989 | 399 | 2,070 | 87 | 6,545 |
| 1980 | 2,526 | 518 | 596 | 56 | 3,696 | 1,139 | 10 | 1,274 | 7 | 2,429 | 3,723 | 528 | 2,276 | 62 | 6,589 |
| 1981 | 2,266 | 461 | 443 | 47 | 3,217 | 1,100 | 16 | 782 | 105 | 2,003 | 3,483 | 477 | 1,399 | 152 | 5,512 |
| 1982 | 3,040 | 421 | 367 | 32 | 3,860 | 1,806 | 12 | 1,507 | 27 | 3,352 | 4,998 | 433 | 2,061 | 60 | 7,551 |
| 1983 | 3,233 | 314 | 266 | 37 | 3,849 | 1,819 | 11 | 2,119 | 17 | 3,966 | 5,166 | 325 | 2,431 | 56 | 7,977 |
| 1984 | 3,648 | 315 | 196 | 43 | 4,202 | 1,714 | 15 | 1,704 | 18 | 3,452 | 5,513 | 330 | 1,968 | 61 | 7,871 |
| 1985 | 3,982 | 315 | 264 | 55 | 4,616 | 1,739 | 17 | 2,347 | 3 | 4,106 | 5,757 | 332 | 2,611 | 58 | 8,758 |
| 1986 | 3,412 | 326 | 553 | 36 | 4,327 | 1,841 | 32 | 2,068 | 12 | 3,954 | 5,318 | 358 | 2,621 | 48 | 8,345 |
| 1987 | 3,853 | 374 | 695 | 38 | 4,960 | 1,680 | 26 | 1,997 | 3 | 3,707 | 5,561 | 400 | 2,692 | 41 | 8,694 |
| 1988 | 3,554 | 304 | 1,172 | 36 | 5,066 | 1,828 | 58 | 2,594 | 3 | 4,483 | 5,399 | 363 | 3,765 | 39 | 9,567 |
| 1989 | 3,429 | 349 | 2,584 | 30 | 6,391 | 3,240 | 17 | 5,036 | 3 | 8,297 | 6,679 | 366 | 7,620 | 33 | 14,698 |
| 1990 | 3,298 | 338 | 2,141 | 25 | 5,802 | 2,361 | 32 | 4,744 | 5 | 7,142 | 5,697 | 372 | 6,885 | 30 | 12,984 |
| 1991 | 3,299 | 338 | 2,033 | 24 | 5,694 | 5,515 | 363 | 3,907 | 16 | 9,800 | 8,847 | 700 | 5,941 | 39 | 15,528 |
| 1992 | 4,330 | 359 | 2,211 | 24 | 6,923 | 6,528 | 977 | 6,409 | 11 | 13,925 | 10,860 | 1,336 | 8,619 | 35 | 20,850 |
| 1993 | 5,890 | 695 | 4,034 | 26 | 10,645 | 5,987 | 1,722 | 7,158 | 192 | 15,059 | 11,879 | 2,417 | 11,192 | 218 | 25,707 |
| 1994 | 7,574 | 1,571 | 1,808 | 86 | 11,039 | 5,233 | 2,342 | 3,995 | 556 | 12,126 | 12,707 | 3,884 | 5,759 | 638 | 22,988 |
| 1995 | 9,119 | 1,531 | 1,266 | 54 | 11,970 | 5,785 | 3,800 | 4,030 | 746 | 14,361 | 14,905 | 5,331 | 5,296 | 800 | 26,331 |
| 1996 | 8,445 | 1,389 | 913 | 45 | 10,791 | 7,141 | 4,211 | 4,330 | 33 | 15,715 | 15,586 | 5,599 | 5,243 | 78 | 26,507 |
| 1997 | 7,363 | 988 | 1,318 | 40 | 9,709 | 8,161 | 5,203 | 4,890 | 208 | 18,462 | 15,524 | 6,192 | 6,208 | 249 | 28,172 |
| 1998 | 5,421 | 885 | 948 | 27 | 7,281 | 7,815 | 6,198 | 5,190 | 134 | 19,337 | 13,236 | 7,083 | 6,138 | 161 | 26,618 |
| 1999 | 7,037 | 1,470 | 598 | 24 | 9,128 | 6,364 | 6,187 | 3,481 | 54 | 16,085 | 13,401 | 7,656 | 4,079 | 78 | 25,213 |
| 2000 | 8,234 | 2,102 | 316 | 76 | 10,729 | 4,018 | 4,005 | 1,975 | 150 | 10,147 | 12,252 | 6,107 | 2,291 | 226 | 20,876 |
| 2001 | 9,990 | 2,959 | 381 | 11 | 13,341 | 3,091 | 5,119 | 1,719 | 30 | 9,959 | 13,081 | 8,078 | 2,100 | 41 | 23,301 |
| 2002 | 10,839 | 2,978 | 181 | 13 | 14,011 | 1,584 | 5,410 | 1,847 | 43 | 8,884 | 12,423 | 8,389 | 2,028 | 56 | 22,896 |
| 2003 | 12,028 | 2,488 | 222 | 254 | 14,991 | 2,034 | 7,262 | 1,717 | 83 | 11,095 | 14,062 | 9,750 | 1,939 | 336 | 26,086 |
| 2004 | 9,918 | 2,866 | 14 | 411 | 13,209 | 1,228 | 4,605 | 671 | 1,474 | 7,978 | 11,145 | 7,471 | 685 | 1,885 | 21,186 |
| 2005 | 6,876 | 2,567 | 99 | 598 | 10,140 | 1,706 | 4,673 | 1,581 | 1,216 | 9,177 | 8,582 | 7,241 | 1,680 | 1,814 | 19,317 |
| 2006 | 5,054 | 1,573 | 185 | 162 | 6,974 | 1,457 | 3,970 | 1,532 | 1,022 | 7,980 | 6,511 | 5,542 | 1,717 | 1,184 | 14,955 |
| 2007 | 3,482 | 1,172 | 243 | 56 | 4,953 | 1,084 | 3,782 | 1,594 | 928 | 7,388 | 4,566 | 4,954 | 1,837 | 984 | 12,341 |
| 2008 | 3,055 | 802 | 52 | 34 | 3,942 | 1,041 | 4,098 | 1,370 | 741 | 7,250 | 4,095 | 4,900 | 1,422 | 775 | 11,192 |
| 2009 | 2,491 | 651 | 21 | 47 | 3,210 | 721 | 3,117 | 826 | 868 | 5,532 | 3,212 | 3,768 | 847 | 915 | 8,742 |
| 2010 | 1,947 | 460 | 12 | 6 | 2,424 | 590 | 2,738 | 579 | 1,089 | 4,996 | 2,537 | 3,198 | 590 | 1,094 | 7,420 |
| 2011 | 2,696 | 482 | 45 | 5 | 3,227 | 1,178 | 3,480 | 565 | 149 | 5,371 | 3,874 | 3,962 | 609 | 153 | 8,599 |
| 2012 | 3,551 | 347 | 134 | 1 | 4,033 | 1,144 | 3,688 | 739 | 153 | 5,724 | 4,695 | 4,035 | 873 | 154 | 9,757 |
| 2013 | 2,799 | 421 | 112 | 0 | 3,332 | 1,112 | 3,366 | 599 | 176 | 5,253 | 3,911 | 3,787 | 711 | 176 | 8,586 |
| 2014 | 2,950 | 418 | 33 | 0 | 3,402 | 1,028 | 3,142 | 879 | 86 | 5,135 | 3,978 | 3,560 | 912 | 87 | 8,537 |
| 2015 | 3,256 | 670 | 100 | 1 | 4,027 | 673 | 3,308 | 538 | 91 | 4,610 | 3,929 | 3,978 | 638 | 92 | 8,637 |
| 2016 | 3,937 | 608 | 86 | 2 | 4,633 | 578 | 3,332 | 349 | 162 | 4,421 | 4,515 | 3,940 | 435 | 164 | 9,054 |
| 2017 | 6,030 | 946 | 32 | 0 | 7,008 | 550 | 2,832 | 400 | 112 | 3,894 | 6,580 | 3,778 | 432 | 112 | 10,902 |
| 2018 | 4,935 | 860 | 151 | 8 | 5,954 | 496 | 3,404 | 471 | 93 | 4,464 | 5,431 | 4,264 | 622 | 101 | 10,418 |

Table 5. Landed weight (mt) of monkfish by market category for the northern management area.

| Year | Belly Flaps | Cheeks | Livers | Head on, Gutted | Round | Dressed | Heads | Tails Unc. | Tails Large | Tails Small | Tails Peewee | All Tails |
|------|-------------|--------|--------|-----------------|-------|---------|-------|------------|-------------|-------------|--------------|-----------|
| 1964 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 14 |
| 1965 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 11 |
| 1966 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 90 | 0 | 0 | 0 | 90 |
| 1967 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 163 | 0 | 0 | 0 | 163 |
| 1968 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 136 | 0 | 0 | 0 | 136 |
| 1969 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 | 0 | 0 | 0 | 78 |
| 1970 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 0 | 0 | 0 | 60 |
| 1971 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 | 0 | 0 | 0 | 64 |
| 1972 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 132 | 0 | 0 | 0 | 132 |
| 1973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 214 | 0 | 0 | 0 | 214 |
| 1974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 360 | 0 | 0 | 0 | 360 |
| 1975 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 558 | 0 | 0 | 0 | 558 |
| 1976 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 673 | 0 | 0 | 0 | 673 |
| 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 945 | 0 | 0 | 0 | 945 |
| 1978 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,171 | 0 | 0 | 0 | 1,171 |
| 1979 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,209 | 0 | 0 | 0 | 1,209 |
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,113 | 0 | 0 | 0 | 1,113 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 969 | 0 | 0 | 0 | 969 |
| 1982 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 1,146 | 15 | 2 | 0 | 1,163 |
| 1983 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 1,152 | 5 | 2 | 0 | 1,159 |
| 1984 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 1,262 | 4 | 0 | 0 | 1,266 |
| 1985 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 1,386 | 2 | 3 | 0 | 1,390 |
| 1986 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 1,303 | 0 | 0 | 0 | 1,303 |
| 1987 | 0 | 0 | 24 | 0 | 0 | 0 | 0 | 1,492 | 2 | 1 | 0 | 1,494 |
| 1988 | 0 | 0 | 47 | 0 | 0 | 0 | 0 | 1,517 | 6 | 3 | 0 | 1,526 |
| 1989 | 0 | 0 | 59 | 0 | 11 | 0 | 0 | 1,465 | 327 | 130 | 0 | 1,922 |
| 1990 | 0 | 0 | 78 | 0 | 30 | 0 | 0 | 1,174 | 411 | 154 | 0 | 1,738 |
| 1991 | 0 | 3 | 70 | 0 | 0 | 0 | 0 | 1,014 | 539 | 153 | 9 | 1,715 |
| 1992 | 0 | 1 | 83 | 0 | 0 | 0 | 0 | 911 | 590 | 505 | 79 | 2,085 |
| 1993 | 0 | 1 | 208 | 98 | 351 | 0 | 0 | 1,034 | 868 | 1,062 | 103 | 3,067 |
| 1994 | 0 | 1 | 208 | 533 | 981 | 0 | 0 | 403 | 1,206 | 1,075 | 136 | 2,820 |
| 1995 | 0 | 1 | 46 | 1,224 | 1,113 | 0 | 0 | 362 | 1,180 | 1,003 | 304 | 2,850 |
| 1996 | 0 | 0 | 65 | 1,116 | 745 | 0 | 0 | 90 | 930 | 1,399 | 224 | 2,643 |
| 1997 | 0 | 0 | 51 | 634 | 244 | 0 | 0 | 26 | 1,126 | 1,361 | 119 | 2,633 |
| 1998 | 0 | 0 | 24 | 551 | 144 | 0 | 0 | 16 | 1,055 | 810 | 79 | 1,960 |
| 1999 | 0 | 0 | 40 | 1,701 | 511 | 0 | 0 | 28 | 996 | 848 | 139 | 2,012 |
| 2000 | 0 | 0 | 94 | 3,213 | 912 | 0 | 0 | 17 | 783 | 1,050 | 3 | 1,853 |
| 2001 | 0 | 0 | 93 | 3,084 | 231 | 0 | 0 | 128 | 1,115 | 1,647 | 0 | 2,890 |
| 2002 | 0 | 0 | 75 | 3,789 | 24 | 0 | 0 | 80 | 1,055 | 1,777 | 0 | 2,912 |
| 2003 | 0 | 0 | 61 | 2,364 | 14 | 0 | 0 | 95 | 1,573 | 2,032 | 0 | 3,699 |
| 2004 | 0 | 0 | 56 | 647 | 960 | 0 | 0 | 3 | 1,883 | 1,580 | 1 | 3,467 |
| 2005 | 0 | 0 | 42 | 1,706 | 22 | 0 | 0 | 3 | 1,440 | 1,017 | 2 | 2,462 |
| 2006 | 0 | 0 | 22 | 1,622 | 20 | 0 | 0 | 9 | 899 | 627 | 3 | 1,538 |
| 2007 | 0 | 0 | 13 | 682 | 0 | 0 | 1 | 9 | 870 | 378 | 1 | 1,258 |
| 2008 | 0 | 0 | 5 | 391 | 0 | 4 | 0 | 1 | 739 | 311 | 0 | 1,051 |
| 2009 | 0 | 0 | 2 | 290 | 0 | 11 | 0 | 2 | 560 | 299 | 0 | 861 |
| 2010 | 0 | 0 | 1 | 208 | 0 | 0 | 0 | 2 | 396 | 261 | 0 | 658 |
| 2011 | 0 | 17 | 72 | 187 | 44 | 0 | 8 | 1 | 527 | 367 | 1 | 896 |
| 2012 | 0 | 24 | 89 | 142 | 0 | 0 | 3 | 1 | 609 | 556 | 2 | 1,168 |
| 2013 | 0 | 0 | 76 | 137 | 0 | 0 | 4 | 1 | 549 | 407 | 3 | 960 |
| 2014 | 0 | 0 | 71 | 117 | 0 | 0 | 25 | 2 | 560 | 423 | 4 | 988 |
| 2015 | 0 | 0 | 73 | 179 | 0 | 0 | 31 | 2 | 594 | 556 | 0 | 1,151 |
| 2016 | 0 | 0 | 86 | 105 | 0 | 0 | 127 | 4 | 672 | 683 | 0 | 1,359 |
| 2017 | 0 | 0 | 114 | 151 | 0 | 0 | 140 | 13 | 1006 | 1041 | 0 | 2,060 |
| 2018 | 0 | 0 | 73 | 195 | 1 | | 174 | 3 | 931 | 792 | 0 | 1,726 |

Table 6. Landed weight (mt) of monkfish by market category for the southern management area.

| Year | Belly | | | Head on, | | | | Tails | | Tails | | Tails | | All Tails |
|------|-------|--------|--------|----------|-------|---------|-------|-------|-------|-------|--------|-------|---|--------------|
| | Flaps | Cheeks | Livers | Gutted | Round | Dressed | Heads | Unc. | Large | Small | Peewee | | | |
| 1964 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1965 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5 |
| 1966 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| 1967 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1968 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1969 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1970 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 4 |
| 1971 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 3 |
| 1972 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 7 |
| 1973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 42 | 0 | 0 | 0 | 0 | 0 | 42 |
| 1974 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1975 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 85 | 0 | 0 | 0 | 0 | 0 | 85 |
| 1976 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 129 | 0 | 0 | 0 | 0 | 0 | 129 |
| 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 250 | 0 | 0 | 0 | 0 | 0 | 250 |
| 1978 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 403 | 0 | 0 | 0 | 0 | 0 | 403 |
| 1979 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,016 | 0 | 0 | 0 | 0 | 0 | 1,016 |
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,189 | 0 | 0 | 0 | 0 | 0 | 1,189 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 685 | 0 | 0 | 0 | 0 | 0 | 685 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 912 | 138 | 51 | 0 | 0 | 0 | 1,102 |
| 1983 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 858 | 237 | 136 | 0 | 0 | 0 | 1,231 |
| 1984 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 860 | 183 | 45 | 0 | 0 | 0 | 1,087 |
| 1985 | 0 | 0 | 17 | 0 | 0 | 0 | 0 | 1,081 | 85 | 71 | 0 | 0 | 0 | 1,237 |
| 1986 | 0 | 0 | 23 | 0 | 0 | 0 | 0 | 1,063 | 76 | 52 | 0 | 0 | 0 | 1,191 |
| 1987 | 0 | 0 | 330 | 0 | 0 | 0 | 0 | 972 | 138 | 6 | 0 | 0 | 0 | 1,116 |
| 1988 | 0 | 0 | 65 | 0 | 0 | 0 | 0 | 1,129 | 190 | 32 | 0 | 0 | 0 | 1,350 |
| 1989 | 0 | 0 | 88 | 0 | 5 | 0 | 0 | 2,037 | 230 | 230 | 0 | 0 | 0 | 2,498 |
| 1990 | 0 | 0 | 102 | 0 | 187 | 0 | 0 | 1,428 | 443 | 223 | 0 | 0 | 0 | 2,095 |
| 1991 | 0 | 5 | 200 | 0 | 415 | 0 | 0 | 1,215 | 1,123 | 461 | 28 | 0 | 0 | 2,827 |
| 1992 | 0 | 3 | 239 | 0 | 386 | 0 | 0 | 1,868 | 1,318 | 788 | 104 | 0 | 0 | 4,078 |
| 1993 | 0 | 1 | 252 | 0 | 178 | 0 | 0 | 2,469 | 1,065 | 789 | 159 | 0 | 0 | 4,483 |
| 1994 | 0 | 4 | 251 | 921 | 1,064 | 0 | 0 | 854 | 1,025 | 989 | 122 | 0 | 0 | 2,989 |
| 1995 | 2 | 0 | 451 | 1,529 | 1,539 | 0 | 0 | 518 | 1,341 | 1,419 | 59 | 0 | 0 | 3,337 |
| 1996 | 0 | 0 | 504 | 2,352 | 318 | 0 | 0 | 996 | 1,160 | 1,629 | 46 | 0 | 0 | 3,830 |
| 1997 | 0 | 0 | 577 | 2,559 | 551 | 0 | 0 | 647 | 1,924 | 1,913 | 32 | 0 | 0 | 4,516 |
| 1998 | 0 | 0 | 582 | 3,036 | 438 | 0 | 0 | 842 | 1,952 | 1,840 | 16 | 0 | 0 | 4,650 |
| 1999 | 0 | 0 | 558 | 4,047 | 621 | 0 | 0 | 509 | 1,393 | 1,352 | 14 | 0 | 0 | 3,268 |
| 2000 | 0 | 4 | 530 | 3,701 | 179 | 0 | 0 | 276 | 797 | 657 | 2 | 0 | 0 | 1,732 |
| 2001 | 0 | 0 | 466 | 3,944 | 300 | 0 | 0 | 217 | 844 | 494 | 0 | 0 | 0 | 1,555 |
| 2002 | 0 | 0 | 433 | 4,013 | 551 | 0 | 0 | 167 | 629 | 336 | 0 | 0 | 0 | 1,132 |
| 2003 | 0 | 1 | 426 | 4,959 | 667 | 0 | 0 | 242 | 790 | 405 | 1 | 0 | 0 | 1,438 |
| 2004 | 0 | 2 | 355 | 2,758 | 1,066 | 8 | 0 | 186 | 671 | 274 | 0 | 0 | 0 | 1,130 |
| 2005 | 0 | 55 | 330 | 3,695 | 187 | 18 | 0 | 105 | 771 | 550 | 2 | 0 | 0 | 1,428 |
| 2006 | 0 | 108 | 293 | 3,351 | 27 | 20 | 5 | 69 | 658 | 506 | 1 | 0 | 0 | 1,233 |
| 2007 | 0 | 44 | 258 | 3,030 | 107 | 12 | 0 | 88 | 727 | 329 | 1 | 0 | 0 | 1,145 |
| 2008 | 0 | 5 | 253 | 3,008 | 44 | 13 | 1 | 61 | 768 | 300 | 0 | 0 | 0 | 1,130 |
| 2009 | 1 | 0 | 199 | 2,540 | 4 | 9 | 11 | 47 | 505 | 235 | 0 | 0 | 0 | 788 |
| 2010 | 0 | 0 | 188 | 2,117 | 9 | 4 | 27 | 61 | 476 | 235 | 0 | 0 | 0 | 772 |
| 2011 | 0 | 0 | 154 | 2,195 | 491 | 6 | 31 | 47 | 422 | 243 | 0 | 0 | 0 | 713 |
| 2012 | 0 | 0 | 110 | 2,921 | 0 | 4 | 40 | 44 | 405 | 269 | 1 | 0 | 0 | 720 |
| 2013 | 1 | 0 | 130 | 2,247 | 5 | 4 | 106 | 58 | 462 | 286 | 2 | 0 | 0 | 809 |
| 2014 | 0 | 0 | 111 | 2,049 | 2 | 14 | 116 | 45 | 540 | 250 | 3 | 0 | 0 | 837 |
| 2015 | 0 | 0 | 99 | 2,339 | 2 | 18 | 96 | 43 | 358 | 174 | 0 | 0 | 0 | 574 |
| 2016 | 0 | 0 | 86 | 2,399 | 1 | 10 | 104 | 56 | 295 | 151 | 0 | 0 | 0 | 502 |
| 2017 | 0 | 0 | 72 | 2020 | 6 | 10 | 83 | 45 | 246 | 180 | 0 | 0 | 0 | 471 |
| 2018 | 0 | 0 | 93 | 2022 | 10 | 10 | 105 | 84 | 406 | 152 | 0 | 0 | 0 | 642 |

Table 7. Estimated monkfish discards (live weight) in the northern management region. Dredge and shrimp trawl discards are based on SBRM monkfish discards relative to kept of all species; trawl and gillnet are based on monkfish discards relative to monkfish kept.

| North | | | | | | | | | | | | | | | | | | | | | |
|-------|------|-----------|-----------|-------------|--------------|-----------|-----------|-------------|--------------|----------------|-----------|----------------|--------------|--------------|-----------|----------------|--------------|-------|-------|-------|-----|
| | | Trawl | | | | Gillnet | | | | Scallop Dredge | | | | Shrimp Trawl | | | | | | | |
| Year | Half | No. trips | D/K ratio | Dir monk CV | Discard (mt) | No. trips | D/K ratio | Dir monk CV | Discard (mt) | No. trips | D/K ratio | Dir all spp CV | Discard (mt) | No. trips | D/K ratio | Dir all spp CV | Discard (mt) | | | | |
| 1989 | 1 | 30 | 0.037 | 0.58 | 1,550 | 58 | 1 | 0.036 | 84 | 3 | 0.001 | 18,213 | 17 | 31 | 0.002 | 0.33 | 3,412 | 5.5 | | | |
| | 2 | 63 | 0.141 | 0.44 | 1,830 | 257 | 103 | 0.027 | 0.32 | 265 | 7 | 0.008 | 24,053 | 185 | 9 | 0.001 | 0.62 | 931 | 1.2 | | |
| 1990 | 1 | 16 | 0.082 | 0.60 | 1,562 | 128 | 73 | 0.036 | 0.41 | 121 | 4 | 0.001 | 9,864 | 9 | 27 | 0.002 | 0.34 | 4,494 | 8.1 | | |
| | 2 | 36 | 0.039 | 0.45 | 1,690 | 66 | 65 | 0.029 | 0.37 | 219 | 6 | 0.008 | 19,293 | 149 | 4 | 0.058 | 1.01 | 620 | 35.8 | | |
| 1991 | 1 | 27 | 0.042 | 0.45 | 1,233 | 52 | 191 | 0.030 | 0.47 | 120 | 4 | 0.001 | 16,608 | 16 | 46 | 0.004 | 0.19 | 3,536 | 12.8 | | |
| | 2 | 81 | 0.167 | 0.25 | 1,999 | 334 | 758 | 0.036 | 0.10 | 213 | 8 | 1 | 0.002 | 21,312 | 40 | 7 | 0.046 | 0.40 | 340 | 15.7 | |
| 1992 | 1 | 51 | 0.122 | 0.30 | 1,674 | 203 | 403 | 0.065 | 0.16 | 105 | 7 | 3 | 0.000 | 9.8 | 14,179 | 1 | 76 | 0.003 | 0.23 | 3,285 | 9.6 |
| | 2 | 35 | 0.224 | 0.43 | 2,624 | 587 | 618 | 0.040 | 0.24 | 248 | 10 | 6 | 0.001 | 0.41 | 20,033 | 26 | 6 | 0.003 | 0.28 | 161 | 0.4 |
| 1993 | 1 | 19 | 0.067 | 0.30 | 2,821 | 189 | 271 | 0.086 | 0.21 | 119 | 10 | 7 | 0.002 | 0.26 | 13,702 | 25 | 78 | 0.001 | 0.26 | 1,890 | 2.5 |
| | 2 | 19 | 0.084 | 0.26 | 3,032 | 254 | 338 | 0.032 | 0.24 | 560 | 18 | 4 | 0.018 | 0.45 | 12,674 | 230 | 4 | 0.001 | 0.70 | 316 | 0.3 |
| 1994 | 1 | 18 | 0.035 | 0.29 | 3,273 | 115 | 65 | 0.065 | 0.29 | 270 | 18 | 2 | 0.001 | 1.21 | 5,486 | 5 | 71 | 0.002 | 0.38 | 2,443 | 5.9 |
| | 2 | 6 | 0.024 | 0.59 | 4,385 | 107 | 44 | 0.055 | 0.19 | 779 | 43 | 5 | 0.010 | 0.38 | 6,230 | 59 | 6 | 0.001 | 0.44 | 906 | 0.7 |
| 1995 | 1 | 30 | 0.164 | 0.36 | 4,643 | 762 | 38 | 0.141 | 0.30 | 469 | 66 | 1 | 0.014 | 2,318 | 32 | 64 | 0.000 | 0.23 | 4,452 | 1.8 | |
| | 2 | 48 | 0.090 | 0.31 | 4,478 | 403 | 69 | 0.088 | 0.23 | 1,023 | 90 | 5 | 0.018 | 0.50 | 6,544 | 119 | 9 | 0.001 | 0.43 | 1,377 | 0.7 |
| 1996 | 1 | 21 | 0.190 | 0.23 | 4,294 | 814 | 28 | 0.137 | 0.43 | 340 | 47 | 8 | 0.003 | 0.94 | 5,338 | 14 | 30 | 0.000 | 0.34 | 7,580 | 0.8 |
| | 2 | 49 | 0.132 | 0.57 | 4,057 | 534 | 34 | 0.132 | 0.19 | 934 | 123 | 5 | 0.022 | 0.40 | 11,375 | 246 | 5 | 0.000 | 0.79 | 1,418 | 0.4 |
| 1997 | 1 | 13 | 0.100 | 0.49 | 3,795 | 378 | 19 | 0.036 | 0.32 | 329 | 12 | 4 | 0.004 | 0.48 | 10,567 | 42 | 17 | 0.000 | 0.61 | 5,416 | 0.9 |
| | 2 | 7 | 0.076 | 0.23 | 3,225 | 244 | 26 | 0.194 | 0.84 | 742 | 144 | 4 | 0.020 | 0.76 | 9,148 | 180 | 1 | 0.001 | 0.64 | 649 | 0.4 |
| 1998 | 1 | 7 | 0.124 | 0.37 | 3,150 | 392 | 39 | 0.028 | 0.41 | 238 | 7 | 2 | 0.004 | 0.32 | 7,482 | 28 | 1 | 0.001 | 0.005 | 3,095 | 2.7 |
| | 2 | 3 | 0.093 | 0.10 | 2,398 | 223 | 72 | 0.043 | 0.28 | 606 | 26 | 7 | 0.014 | 0.16 | 6,400 | 90 | 1 | 0.001 | 0.001 | 168 | 0.1 |
| 1999 | 1 | 3 | 0.098 | 0.04 | 3,947 | 388 | 36 | 0.067 | 0.65 | 282 | 19 | 2 | 0.004 | 0.65 | 8,347 | 29 | 1 | 0.001 | 0.001 | 1,407 | 1.2 |
| | 2 | 42 | 0.069 | 0.21 | 3,011 | 207 | 66 | 0.036 | 0.51 | 1,051 | 38 | 6 | 0.004 | 0.44 | 6,797 | 30 | 1 | 0.001 | 0.001 | 33 | 0.0 |
| 2000 | 1 | 80 | 0.069 | 0.32 | 3,916 | 271 | 58 | 0.041 | 0.30 | 501 | 21 | 1 | 0.004 | 0.89 | 6,993 | 31 | 1 | 0.001 | 0.001 | 2,068 | 1.8 |
| | 2 | 61 | 0.088 | 0.31 | 3,798 | 333 | 65 | 0.077 | 0.24 | 2,033 | 157 | 95 | 0.004 | 0.13 | 13,019 | 56 | 1 | 0.001 | 0.001 | 35 | 0.0 |
| 2001 | 1 | 61 | 0.102 | 0.20 | 5,088 | 518 | 41 | 0.061 | 0.69 | 880 | 53 | 17 | 0.003 | 0.42 | 14,926 | 41 | 3 | 0.000 | 0.14 | 813 | 0.1 |
| | 2 | 113 | 0.066 | 0.10 | 4,588 | 303 | 33 | 0.108 | 0.93 | 2,208 | 238 | 1 | 0.005 | 0.52 | 11,525 | 60 | 1 | 0.001 | 0.001 | 0 | 0.0 |
| 2002 | 1 | 47 | 0.076 | 0.25 | 5,634 | 428 | 33 | 0.045 | 0.39 | 760 | 34 | 1 | 0.005 | 0.72 | 8,712 | 45 | 1 | 0.001 | 0.001 | 308 | 0.3 |
| | 2 | 274 | 0.100 | 0.10 | 4,532 | 455 | 67 | 0.053 | 0.27 | 2,230 | 118 | 10 | 0.008 | 0.97 | 11,533 | 88 | 1 | 0.001 | 0.001 | 0 | 0.0 |
| 2003 | 1 | 206 | 0.101 | 0.14 | 6,642 | 671 | 112 | 0.037 | 0.24 | 628 | 23 | 5 | 0.001 | 0.89 | 16,053 | 9 | 15 | 0.000 | 1.01 | 855 | 0.0 |
| | 2 | 218 | 0.055 | 0.12 | 4,721 | 261 | 273 | 0.058 | 0.13 | 1,570 | 91 | 8 | 0.015 | 0.41 | 10,361 | 157 | 1 | 0.001 | 0.001 | 0 | 0.0 |
| 2004 | 1 | 163 | 0.042 | 0.12 | 5,307 | 225 | 212 | 0.021 | 0.22 | 739 | 16 | 3 | 0.000 | 0.69 | 5,633 | 0 | 12 | 0.000 | 0.25 | 1,069 | 0.1 |
| | 2 | 377 | 0.036 | 0.10 | 4,039 | 147 | 728 | 0.059 | 0.09 | 1,788 | 105 | 19 | 0.096 | 0.48 | 3,705 | 355 | 1 | 0.001 | 0.001 | 44 | 0.0 |
| 2005 | 1 | 500 | 0.047 | 0.07 | 3,971 | 187 | 153 | 0.098 | 0.26 | 516 | 51 | 20 | 0.001 | 0.57 | 5,745 | 6 | 17 | 0.000 | 0.52 | 836 | 0.1 |
| | 2 | 601 | 0.057 | 0.10 | 3,038 | 174 | 660 | 0.074 | 0.12 | 1,450 | 108 | 39 | 0.008 | 0.21 | 23,131 | 184 | 1 | 0.001 | 0.001 | 40 | 0.0 |
| 2006 | 1 | 292 | 0.055 | 0.08 | 2,852 | 158 | 93 | 0.063 | 0.41 | 262 | 17 | 5 | 0.001 | 0.42 | 20,833 | 14 | 17 | 0.000 | 0.56 | 847 | 0.0 |
| | 2 | 201 | 0.071 | 0.11 | 2,285 | 162 | 80 | 0.080 | 0.17 | 1,025 | 82 | 39 | 0.021 | 0.32 | 14,291 | 305 | 3 | 0.000 | 0.10 | 449 | 0.2 |
| 2007 | 1 | 221 | 0.050 | 0.10 | 2,075 | 104 | 42 | 0.061 | 0.32 | 228 | 14 | 28 | 0.002 | 0.22 | 11,600 | 26 | 14 | 0.001 | 0.72 | 1,899 | 1.0 |
| | 2 | 303 | 0.072 | 0.10 | 1,448 | 104 | 190 | 0.062 | 0.16 | 693 | 43 | 68 | 0.021 | 0.18 | 23,644 | 487 | 1 | 0.001 | 0.001 | 333 | 0.2 |
| 2008 | 1 | 277 | 0.088 | 0.10 | 1,821 | 160 | 61 | 0.076 | 0.28 | 141 | 11 | 25 | 0.001 | 0.22 | 7,065 | 11 | 16 | 0.000 | 0.77 | 1,834 | 0.9 |
| | 2 | 383 | 0.082 | 0.10 | 1,045 | 86 | 156 | 0.051 | 0.22 | 541 | 28 | 22 | 0.011 | 0.34 | 3,696 | 42 | 3 | 0.001 | 0.90 | 167 | 0.1 |
| 2009 | 1 | 351 | 0.166 | 0.13 | 1,666 | 276 | 129 | 0.209 | 0.46 | 149 | 31 | 7 | 0.001 | 0.47 | 1,960 | 3 | 7 | 0.001 | 0.61 | 998 | 0.8 |
| | 2 | 408 | 0.079 | 0.11 | 832 | 66 | 195 | 0.119 | 0.27 | 467 | 55 | 22 | 0.003 | 0.26 | 11,642 | 34 | 5 | 0.000 | 0.92 | 347 | 0.0 |
| 2010 | 1 | 339 | 0.097 | 0.08 | 1,537 | 149 | 305 | 0.056 | 0.15 | 112 | 6 | 16 | 0.001 | 0.80 | 3,350 | 4 | 11 | 0.000 | 1.00 | 2,911 | 0.1 |
| | 2 | 671 | 0.090 | 0.07 | 857 | 77 | 1364 | 0.102 | 0.07 | 303 | 31 | 25 | 0.003 | 0.31 | 15,930 | 50 | 4 | 0.000 | 0.91 | 780 | 0.0 |
| 2011 | 1 | 671 | 0.120 | 0.07 | 1,461 | 175 | 554 | 0.050 | 0.10 | 120 | 6 | 23 | 0.002 | 0.80 | 6,660 | 16 | 1 | 0.000 | 0.000 | 3,745 | 0.0 |
| | 2 | 743 | 0.058 | 0.08 | 1,174 | 69 | 1244 | 0.080 | 0.10 | 361 | 29 | 81 | 0.004 | 0.13 | 35,600 | 158 | 1 | 0.001 | 0.001 | 78 | 0.0 |
| 2012 | 1 | 739 | 0.057 | 0.06 | 1,901 | 108 | 548 | 0.047 | 0.17 | 93 | 4 | 54 | 0.003 | 0.31 | 21,717 | 67 | 19 | 0.000 | 0.49 | 1,761 | 0.2 |
| | 2 | 664 | 0.078 | 0.05 | 1446 | 112 | 900 | 0.060 | 0.07 | 184 | 11 | 90 | 0.010 | 0.24 | 28,609 | 300 | 1 | 0.000 | 0.000 | 132 | 0.0 |
| 2013 | 1 | 471 | 0.125 | 0.07 | 1669 | 208 | 172 | 0.044 | 0.14 | 98 | 4 | 131 | 0.003 | 0.22 | 43,664 | 118 | 24 | 0.001 | 0.79 | 195 | 0.1 |
| | 2 | 440 | 0.097 | 0.10 | 1073 | 104 | 567 | 0.083 | 0.11 | 323 | 27 | 67 | 0.010 | 0.35 | 12,980 | 128 | 1 | 0.000 | 0.000 | 0 | 0.0 |
| 2014 | 1 | 405 | 0.143 | 0.07 | 1908 | 272 | 278 | 0.090 | 0.30 | 82 | 7 | 66 | 0.000 | 0.33 | 10,688 | 4 | 1 | 0.000 | 0.000 | 0 | 0.0 |
| | 2 | 528 | 0.100 | 0.09 | 927 | 93 | 830 | 0.062 | 0.11 | 336 | 21 | 61 | 0.029 | 0.21 | 5,406 | 155 | 1 | 0.000 | 0.000 | 0 | 0.0 |
| 2015 | 1 | 298 | 0.155 | 0.10 | 1,891 | 294 | 87 | 0.056 | 0.21 | 120 | 7 | 77 | 0.002 | 0.49 | 12,489 | 28 | 1 | 0.000 | 0.000 | 0 | 0.0 |
| | 2 | 381 | 0.117 | 0.11 | 1223 | 143 | 475 | 0.063 | 0.12 | 549 | 34 | 50 | 0.020 | 0.16 | 4,912 | 96 | 1 | 0.000 | 0.000 | 0 | 0.0 |
| 2016 | 1 | 253 | 0.121 | 0.09 | 2058 | 249 | 82 | 0.064 | 0.32 | 94 | 6 | 79 | 0.013 | 0.37 | 12,841 | 170 | 1 | 0.000 | 0.000 | 0 | 0.0 |
| | 2 | 237 | 0.141 | 0.10 | 1702 | 241 | 201 | 0.094 | 0.21 | 514 | 48 | 43 | 0.038 | 0.27 | 4,300 | | | | | | |

Table 8. Estimated monkfish discards (live weight) in the southern management region. Dredge discards are based on SBRM monkfish discards relative to kept of all species; trawl and gillnet are based on monkfish discards relative to monkfish kept.

| South | | Trawl | | | | | Gillnet | | | | | Scallop Dredge | | | | |
|-------|------|-----------|-----------|------|---------------|--------------|-----------|-----------|------|---------------|--------------|----------------|-----------|-------|------------------|--------------|
| Year | Half | No. trips | D/K ratio | CV | Dlr monk (mt) | Discard (mt) | No. trips | D/K ratio | CV | Dlr monk (mt) | Discard (mt) | No. trips | D/K ratio | CV | Dlr all spp (mt) | Discard (mt) |
| 1989 | 1 | 46 | 0.709 | 0.50 | 2,195 | 1,556 | 3 | 0.031 | 0.31 | 12 | 0 | 2 | 0.010 | 0.010 | 59,696 | 577 |
| | 2 | 53 | 0.169 | 0.59 | 733 | 124 | | 0.054 | | 5 | 0 | | 0.015 | 0.015 | 35,498 | 528 |
| 1990 | 1 | 50 | 0.064 | 0.26 | 1,567 | 100 | 1 | 0.031 | 0.31 | 14 | 0 | 7 | 0.010 | 0.010 | 64,314 | 622 |
| | 2 | 35 | 0.118 | 0.32 | 759 | 90 | | 0.054 | | 18 | 0 | | 0.015 | 0.015 | 53,040 | 789 |
| 1991 | 1 | 73 | 0.258 | 0.30 | 1,257 | 324 | 3 | 0.031 | 0.31 | 209 | 2 | 2 | 0.010 | 0.010 | 67,829 | 656 |
| | 2 | 77 | 0.020 | 0.39 | 3,831 | 78 | | 0.000 | | 154 | 0 | | 0.001 | 0.07 | 36,015 | 19 |
| 1992 | 1 | 62 | 0.061 | 0.38 | 3,947 | 239 | 94 | 0.011 | 0.31 | 786 | 8 | 7 | 0.001 | 0.69 | 48,686 | 29 |
| | 2 | 41 | 0.028 | 0.83 | 2,135 | 60 | | 0.020 | | 176 | 3 | | 0.012 | 0.50 | 39,126 | 460 |
| 1993 | 1 | 40 | 0.092 | 0.68 | 2,598 | 238 | 78 | 0.034 | 0.70 | 1,306 | 44 | 12 | 0.008 | 0.30 | 23,971 | 197 |
| | 2 | 34 | 0.028 | 0.49 | 1,301 | 36 | | 0.061 | | 341 | 21 | | 0.032 | 0.53 | 18,379 | 587 |
| 1994 | 1 | 43 | 0.095 | 0.29 | 2,925 | 277 | 124 | 0.079 | 0.33 | 1,565 | 124 | 10 | 0.020 | 0.26 | 26,657 | 538 |
| | 2 | 30 | 0.323 | 0.56 | 2,027 | 655 | | 0.056 | | 967 | 55 | | 0.015 | 0.29 | 24,222 | 370 |
| 1995 | 1 | 61 | 0.175 | 0.55 | 2,789 | 488 | 260 | 0.044 | 0.20 | 2,758 | 121 | 14 | 0.030 | 0.17 | 34,108 | 1,011 |
| | 2 | 103 | 0.115 | 0.57 | 2,946 | 340 | | 0.050 | | 1,172 | 59 | | 0.050 | 0.45 | 18,456 | 917 |
| 1996 | 1 | 56 | 0.164 | 0.36 | 3,187 | 523 | 226 | 0.077 | 0.27 | 2,615 | 202 | 19 | 0.020 | 0.23 | 27,505 | 547 |
| | 2 | 85 | 0.095 | 0.18 | 4,021 | 380 | | 0.052 | | 1,434 | 75 | | 0.029 | 0.26 | 19,621 | 562 |
| 1997 | 1 | 60 | 0.025 | 0.47 | 4,130 | 102 | 238 | 0.067 | 0.34 | 3,089 | 206 | 16 | 0.028 | 0.18 | 19,067 | 543 |
| | 2 | 29 | 0.089 | 0.15 | 4,215 | 374 | | 0.015 | | 1,313 | 20 | | 0.041 | 0.39 | 14,997 | 612 |
| 1998 | 1 | 31 | 0.108 | 0.33 | 3,991 | 431 | 228 | 0.070 | 0.20 | 3,606 | 252 | 8 | 0.008 | 0.24 | 17,094 | 136 |
| | 2 | 28 | 0.027 | 0.52 | 3,946 | 108 | | 0.062 | | 2,053 | 128 | | 0.012 | 0.57 | 15,300 | 177 |
| 1999 | 1 | 39 | 0.045 | 0.30 | 4,370 | 195 | 52 | 0.052 | 0.34 | 4,207 | 220 | 13 | 0.010 | 0.26 | 30,059 | 291 |
| | 2 | 34 | 0.214 | 0.57 | 2,306 | 494 | | 0.046 | | 1,917 | 88 | | 0.004 | 0.16 | 34,102 | 150 |
| 2000 | 1 | 67 | 0.786 | 0.32 | 2,255 | 1,773 | 60 | 0.063 | 0.30 | 2,683 | 170 | 38 | 0.014 | 0.16 | 47,847 | 666 |
| | 2 | 47 | 0.107 | 0.62 | 1,709 | 182 | | 0.051 | | 1,157 | 59 | | 0.009 | 0.16 | 43,879 | 382 |
| 2001 | 1 | 61 | 0.946 | 0.47 | 1,703 | 1,611 | 57 | 0.030 | 0.42 | 2,248 | 67 | 42 | 0.015 | 0.11 | 64,029 | 972 |
| | 2 | 96 | 0.404 | 0.73 | 1,348 | 545 | | 0.033 | | 2,788 | 92 | | 0.014 | 0.15 | 70,044 | 973 |
| 2002 | 1 | 50 | 0.338 | 0.38 | 1,123 | 379 | 34 | 0.017 | 0.80 | 3,590 | 61 | 34 | 0.019 | 0.09 | 83,888 | 1,571 |
| | 2 | 94 | 0.327 | 0.39 | 566 | 185 | | 0.063 | | 1,967 | 124 | | 0.018 | 0.10 | 81,620 | 1,475 |
| 2003 | 1 | 120 | 0.331 | 0.36 | 1,172 | 388 | 50 | 0.016 | 0.35 | 4,452 | 69 | 46 | 0.014 | 0.15 | 82,660 | 1,192 |
| | 2 | 99 | 0.406 | 0.45 | 1,177 | 478 | | 0.070 | | 2,849 | 199 | | 0.017 | 0.12 | 91,638 | 1,542 |
| 2004 | 1 | 237 | 0.240 | 0.44 | 1,012 | 243 | 78 | 0.073 | 0.22 | 3,441 | 252 | 82 | 0.014 | 0.08 | 107,728 | 1,543 |
| | 2 | 436 | 0.300 | 0.31 | 733 | 220 | | 0.089 | | 1,043 | 93 | | 0.015 | 0.10 | 95,117 | 1,432 |
| 2005 | 1 | 534 | 0.175 | 0.14 | 945 | 165 | 100 | 0.104 | 0.22 | 3,217 | 334 | 108 | 0.014 | 0.18 | 99,628 | 1,419 |
| | 2 | 654 | 0.064 | 0.11 | 1,588 | 102 | | 0.081 | | 1,372 | 111 | | 0.019 | 0.19 | 67,548 | 1,290 |
| 2006 | 1 | 327 | 0.180 | 0.19 | 1,008 | 181 | 43 | 0.054 | 0.19 | 2,865 | 155 | 43 | 0.009 | 0.31 | 87,842 | 767 |
| | 2 | 277 | 0.055 | 0.15 | 1,010 | 56 | | 0.082 | | 967 | 79 | | 0.022 | 0.14 | 99,456 | 2,210 |
| 2007 | 1 | 335 | 0.125 | 0.25 | 741 | 93 | 59 | 0.220 | 0.37 | 2,139 | 471 | 138 | 0.010 | 0.14 | 103,992 | 1,083 |
| | 2 | 420 | 0.159 | 0.40 | 657 | 104 | | 0.054 | | 1,569 | 84 | | 0.013 | 0.15 | 68,914 | 920 |
| 2008 | 1 | 343 | 0.098 | 0.19 | 744 | 73 | 54 | 0.108 | 0.25 | 2,882 | 311 | 374 | 0.006 | 0.11 | 106,134 | 686 |
| | 2 | 316 | 0.017 | 0.31 | 594 | 10 | | 0.104 | | 993 | 104 | | 0.010 | 0.13 | 74,506 | 717 |
| 2009 | 1 | 414 | 0.080 | 0.30 | 646 | 52 | 62 | 0.052 | 0.19 | 2,438 | 128 | 370 | 0.006 | 0.08 | 122,576 | 725 |
| | 2 | 529 | 0.088 | 0.31 | 280 | 25 | | 0.074 | | 610 | 45 | | 0.009 | 0.15 | 73,175 | 652 |
| 2010 | 1 | 569 | 0.248 | 0.24 | 474 | 118 | 114 | 0.060 | 0.21 | 2,034 | 122 | 132 | 0.010 | 0.11 | 108,617 | 1,098 |
| | 2 | 545 | 0.190 | 0.51 | 369 | 70 | | 0.077 | | 695 | 54 | | 0.008 | 0.12 | 81,139 | 648 |
| 2011 | 1 | 573 | 0.123 | 0.13 | 634 | 78 | 178 | 0.078 | 0.12 | 2,357 | 185 | 156 | 0.010 | 0.13 | 107,870 | 1,132 |
| | 2 | 601 | 0.088 | 0.11 | 598 | 53 | | 0.122 | | 1,066 | 130 | | 0.010 | 0.12 | 62,873 | 623 |
| 2012 | 1 | 476 | 0.147 | 0.13 | 812 | 119 | 203 | 0.051 | 0.13 | 3,015 | 153 | 205 | 0.016 | 0.08 | 98,241 | 1,545 |
| | 2 | 337 | 0.180 | 0.18 | 366 | 66 | | 0.058 | | 576 | 33 | | 0.017 | 0.15 | 46,675 | 797 |
| 2013 | 1 | 594 | 0.117 | 0.24 | 720 | 84 | 60 | 0.058 | 0.15 | 2,142 | 124 | 154 | 0.017 | 0.17 | 49,832 | 864 |
| | 2 | 500 | 0.053 | 0.28 | 447 | 24 | | 0.101 | | 1,168 | 118 | | 0.016 | 0.13 | 45,168 | 709 |
| 2014 | 1 | 633 | 0.171 | 0.22 | 616 | 105 | 126 | 0.056 | 0.16 | 2,249 | 127 | 174 | 0.014 | 0.09 | 62,720 | 892 |
| | 2 | 700 | 0.107 | 0.15 | 518 | 56 | | 0.030 | | 861 | 26 | | 0.012 | 0.14 | 44,960 | 518 |
| 2015 | 1 | 563 | 0.179 | 0.15 | 487 | 87 | 225 | 0.022 | 0.16 | 2,403 | 52 | 227 | 0.008 | 0.12 | 56,595 | 464 |
| | 2 | 527 | 0.521 | 0.12 | 318 | 165 | | 0.027 | | 823 | 22 | | 0.008 | 0.14 | 58,643 | 444 |
| 2016 | 1 | 557 | 0.381 | 0.26 | 521 | 198 | 361 | 0.023 | 0.15 | 2,627 | 62 | 306 | 0.018 | 0.1 | 60,595 | 1,100 |
| | 2 | 854 | 0.838 | 0.24 | 227 | 191 | | 0.041 | | 564 | 23 | | 0.017 | 0.13 | 69,514 | 1,204 |
| 2017 | 1 | 819 | 1.155 | 0.25 | 510 | 589 | 448 | 0.036 | 0.16 | 2,211 | 79 | 337 | 0.025 | 0.12 | 95,113 | 2,364 |
| | 2 | 1088 | 0.402 | 0.23 | 245 | 98 | | 0.065 | | 543 | 35 | | 0.025 | 0.13 | 83,173 | 2,084 |
| 2018 | 1 | 591 | 0.594 | 0.21 | 39 | | | | | | | | | | | |

Table 9. Estimated annual catch (landings plus discards) of monkfish by management region and combined.

| Year | North | | | South | | | Areas Combined | | | | |
|------|----------|---------|------------|----------|---------|------------|----------------|---------|------------|---------|------------|
| | Landings | Discard | Total (mt) | Landings | Discard | Total (mt) | Landings | Discard | Total (mt) | Foreign | Total (mt) |
| 1980 | 3,623 | 635 | 4,258 | 6,035 | 563 | 6,598 | 9,658 | 1,197 | 10,855 | 132 | 10,987 |
| 1981 | 3,171 | 754 | 3,925 | 4,142 | 451 | 4,593 | 7,313 | 1,204 | 8,517 | 381 | 8,898 |
| 1982 | 3,860 | 699 | 4,559 | 3,722 | 586 | 4,308 | 7,582 | 1,285 | 8,867 | 310 | 9,177 |
| 1983 | 3,849 | 664 | 4,513 | 4,115 | 659 | 4,774 | 7,964 | 1,323 | 9,287 | 80 | 9,367 |
| 1984 | 4,202 | 616 | 4,818 | 3,699 | 684 | 4,383 | 7,901 | 1,301 | 9,202 | 395 | 9,597 |
| 1985 | 4,616 | 640 | 5,256 | 4,262 | 636 | 4,898 | 8,878 | 1,276 | 10,154 | 1,333 | 11,487 |
| 1986 | 4,327 | 548 | 4,875 | 4,037 | 618 | 4,655 | 8,364 | 1,166 | 9,530 | 341 | 9,871 |
| 1987 | 4,960 | 766 | 5,726 | 3,762 | 1,039 | 4,801 | 8,722 | 1,805 | 10,527 | 748 | 11,275 |
| 1988 | 5,066 | 784 | 5,850 | 4,595 | 1,030 | 5,625 | 9,661 | 1,814 | 11,475 | 909 | 12,384 |
| 1989 | 6,391 | 534 | 6,925 | 8,353 | 2,786 | 11,139 | 14,744 | 3,320 | 18,064 | 1,178 | 19,242 |
| 1990 | 5,802 | 406 | 6,208 | 7,204 | 1,602 | 8,806 | 13,006 | 2,008 | 15,014 | 1,557 | 16,571 |
| 1991 | 5,693 | 481 | 6,174 | 9,865 | 1,080 | 10,945 | 15,558 | 1,561 | 17,119 | 1,020 | 18,139 |
| 1992 | 6,923 | 844 | 7,767 | 13,942 | 801 | 14,743 | 20,865 | 1,644 | 22,509 | 473 | 22,982 |
| 1993 | 10,645 | 730 | 11,375 | 15,098 | 1,123 | 16,221 | 25,743 | 1,853 | 27,596 | 354 | 27,950 |
| 1994 | 10,950 | 353 | 11,303 | 12,126 | 2,019 | 14,145 | 23,076 | 2,372 | 25,448 | 543 | 25,991 |
| 1995 | 11,970 | 1,475 | 13,445 | 14,361 | 2,935 | 17,297 | 26,331 | 4,410 | 30,741 | 418 | 31,159 |
| 1996 | 10,791 | 1,780 | 12,572 | 15,715 | 2,289 | 18,004 | 26,507 | 4,069 | 30,576 | 184 | 30,760 |
| 1997 | 9,709 | 1,002 | 10,712 | 18,462 | 1,856 | 20,318 | 28,172 | 2,858 | 31,030 | 189 | 31,219 |
| 1998 | 7,281 | 769 | 8,050 | 19,337 | 1,231 | 20,568 | 26,618 | 2,000 | 28,618 | 190 | 28,808 |
| 1999 | 9,128 | 713 | 9,841 | 16,085 | 1,438 | 17,523 | 25,213 | 2,151 | 27,364 | 151 | 27,515 |
| 2000 | 10,729 | 871 | 11,599 | 10,147 | 3,232 | 13,379 | 20,876 | 4,103 | 24,979 | 176 | 25,155 |
| 2001 | 13,341 | 1,213 | 14,554 | 9,959 | 4,260 | 14,219 | 23,301 | 5,473 | 28,773 | 142 | 28,915 |
| 2002 | 14,011 | 1,169 | 15,180 | 8,884 | 3,796 | 12,680 | 22,896 | 4,964 | 27,860 | 294 | 28,154 |
| 2003 | 14,991 | 1,212 | 16,203 | 11,095 | 3,869 | 14,964 | 26,086 | 5,080 | 31,167 | 309 | 31,476 |
| 2004 | 13,209 | 847 | 14,056 | 7,978 | 3,782 | 11,760 | 21,186 | 4,629 | 25,816 | 166 | 25,982 |
| 2005 | 10,140 | 711 | 10,851 | 9,177 | 3,421 | 12,597 | 19,317 | 4,132 | 23,449 | 206 | 23,655 |
| 2006 | 6,974 | 738 | 7,712 | 7,980 | 3,448 | 11,428 | 14,955 | 4,186 | 19,140 | 279 | 19,419 |
| 2007 | 4,953 | 778 | 5,732 | 7,388 | 2,755 | 10,143 | 12,341 | 3,533 | 15,875 | 8 | 15,883 |
| 2008 | 3,942 | 338 | 4,280 | 7,250 | 1,901 | 9,151 | 11,192 | 2,240 | 13,432 | 2 | 13,434 |
| 2009 | 3,210 | 465 | 3,675 | 5,532 | 1,626 | 7,158 | 8,742 | 2,092 | 10,833 | | |
| 2010 | 2,424 | 317 | 2,741 | 4,996 | 2,109 | 7,105 | 7,420 | 2,426 | 9,846 | | |
| 2011 | 2,362 | 452 | 2,814 | 6,344 | 2,200 | 8,545 | 8,707 | 2,652 | 11,359 | | |
| 2012 | 4,033 | 602 | 4,635 | 5,724 | 2,714 | 8,438 | 9,757 | 3,316 | 13,073 | | |
| 2013 | 3,332 | 589 | 3,922 | 5,253 | 1,922 | 7,176 | 8,586 | 2,512 | 11,097 | | |
| 2014 | 3,402 | 552 | 3,954 | 5,135 | 1,724 | 6,859 | 8,537 | 2,276 | 10,813 | | |
| 2015 | 4,027 | 603 | 4,630 | 4,609 | 1,235 | 5,844 | 8,636 | 1,838 | 10,474 | | |
| 2016 | 4,633 | 875 | 5,508 | 4,422 | 2,777 | 7,199 | 9,055 | 3,652 | 12,707 | | |
| 2017 | 7,008 | 886 | 7,894 | 3,893 | 5,250 | 9,143 | 10,901 | 6,136 | 17,037 | | |
| 2018 | 5,954 | 2161 | 8,115 | 4,465 | 5,150 | 9,615 | 10,419 | 7,311 | 17,730 | | |

Table 10. Number of length samples available for kept and discarded monkfish from observer database.

| Trawl | North | | | | | | South | | | | | | | |
|-------|-----------|--------------|-----------|-------------|-----------------|-----------|-------------|-----------|--------------|-------------|-----------|-----------------|-------------|------|
| | Half-year | Kept Lengths | | | Discard Lengths | | | No. trips | Kept Lengths | | | Discard Lengths | | |
| | | No. trips | No. hauls | No. lengths | No. trips | No. hauls | No. lengths | | No. hauls | No. lengths | No. trips | No. hauls | No. lengths | |
| | 2000 | 1 | 16 | 54 | 751 | 24 | 65 | 1393 | 14 | 27 | 86 | 11 | 22 | 216 |
| | | 2 | 19 | 57 | 548 | 19 | 46 | 1046 | 16 | 32 | 306 | 14 | 40 | 181 |
| | 2001 | 1 | 14 | 41 | 578 | 11 | 40 | 487 | 12 | 26 | 126 | 12 | 56 | 338 |
| | | 2 | 26 | 74 | 659 | 28 | 45 | 1621 | 9 | 13 | 42 | 2 | 4 | 103 |
| | 2002 | 1 | 7 | 28 | 391 | 12 | 32 | 342 | 16 | 37 | 85 | 2 | 4 | 11 |
| | | 2 | 77 | 274 | 3452 | 153 | 388 | 7038 | 22 | 54 | 367 | 10 | 32 | 255 |
| | 2003 | 1 | 74 | 333 | 4648 | 100 | 361 | 6340 | 62 | 196 | 1397 | 36 | 123 | 975 |
| | | 2 | 72 | 308 | 4193 | 81 | 363 | 4387 | 38 | 141 | 740 | 23 | 43 | 359 |
| | 2004 | 1 | 67 | 226 | 3156 | 81 | 294 | 4278 | 98 | 304 | 2301 | 66 | 275 | 2051 |
| | | 2 | 141 | 505 | 6122 | 179 | 657 | 5059 | 129 | 494 | 2983 | 124 | 444 | 3406 |
| | 2005 | 1 | 177 | 751 | 8255 | 238 | 1426 | 14806 | 234 | 794 | 5760 | 184 | 759 | 8029 |
| | | 2 | 214 | 841 | 7698 | 228 | 827 | 8134 | 218 | 982 | 9097 | 203 | 656 | 4960 |
| | 2006 | 1 | 100 | 403 | 4960 | 126 | 672 | 7238 | 154 | 574 | 5490 | 126 | 498 | 4184 |
| | | 2 | 71 | 333 | 2828 | 100 | 529 | 5615 | 92 | 337 | 3501 | 87 | 299 | 2330 |
| | 2007 | 1 | 60 | 257 | 2580 | 98 | 555 | 4507 | 121 | 467 | 3078 | 72 | 426 | 1648 |
| | | 2 | 118 | 554 | 3432 | 140 | 714 | 4992 | 102 | 236 | 1658 | 76 | 207 | 1198 |
| | 2008 | 1 | 75 | 320 | 2973 | 121 | 657 | 6748 | 97 | 291 | 3024 | 88 | 265 | 2018 |
| | | 2 | 98 | 341 | 2244 | 154 | 664 | 5705 | 77 | 239 | 2567 | 36 | 87 | 529 |
| | 2009 | 1 | 70 | 194 | 1869 | 113 | 502 | 4978 | 64 | 190 | 1286 | 36 | 118 | 694 |
| | | 2 | 83 | 181 | 1474 | 99 | 257 | 1762 | 68 | 161 | 1036 | 49 | 105 | 629 |
| | 2010 | 1 | 55 | 224 | 2875 | 68 | 303 | 3736 | 65 | 166 | 1265 | 72 | 187 | 1777 |
| | | 2 | 23 | 72 | 906 | 42 | 140 | 960 | 40 | 113 | 585 | 50 | 160 | 694 |
| | 2011 | 1 | 35 | 83 | 1076 | 73 | 259 | 3389 | 47 | 109 | 569 | 66 | 165 | 1145 |
| | | 2 | 34 | 82 | 795 | 60 | 147 | 1311 | 41 | 86 | 823 | 64 | 167 | 2160 |
| | 2012 | 1 | 25 | 60 | 853 | 76 | 262 | 2460 | 36 | 100 | 732 | 65 | 212 | 2250 |
| | | 2 | 23 | 44 | 556 | 87 | 203 | 2270 | 13 | 31 | 176 | 19 | 63 | 342 |
| | 2013 | 1 | 12 | 31 | 260 | 38 | 102 | 1253 | 19 | 34 | 411 | 32 | 99 | 823 |
| | | 2 | 13 | 47 | 307 | 60 | 154 | 1552 | 17 | 33 | 204 | 33 | 88 | 463 |
| | 2014 | 1 | 32 | 61 | 596 | 79 | 227 | 2993 | 28 | 54 | 235 | 69 | 158 | 1143 |
| | | 2 | 12 | 20 | 190 | 40 | 103 | 925 | 27 | 60 | 314 | 46 | 144 | 949 |
| | 2015 | 1 | 8 | 13 | 116 | 73 | 198 | 3021 | 23 | 44 | 210 | 59 | 125 | 758 |
| | | 2 | 9 | 30 | 185 | 64 | 173 | 1244 | 22 | 45 | 200 | 52 | 171 | 1405 |
| | 2016 | 1 | 5 | 6 | 42 | 19 | 46 | 853 | 24 | 61 | 224 | 87 | 226 | 1476 |
| | | 2 | 11 | 26 | 204 | 24 | 59 | 573 | 23 | 51 | 115 | 82 | 283 | 2047 |
| | 2017 | 1 | 8 | 15 | 96 | 39 | 167 | 1864 | 50 | 104 | 334 | 120 | 284 | 1944 |
| | | 2 | 13 | 35 | 435 | 54 | 163 | 1859 | 46 | 104 | 304 | 82 | 225 | 838 |
| | 2018 | 1 | 14 | 29 | 429 | 67 | 198 | 3061 | 60 | 107 | 448 | 113 | 240 | 881 |
| | | 2 | 10 | 21 | 90 | 32 | 92 | 720 | 45 | 94 | 289 | 115 | 412 | 2539 |
| | Gillnet | | | | | | | | | | | | | |
| | 2000 | 1 | 37 | 49 | 311 | 9 | 14 | 59 | 70 | 94 | 2854 | 7 | 18 | 95 |
| | | 2 | 66 | 110 | 2708 | 8 | 16 | 87 | 22 | 42 | 952 | 3 | 4 | 47 |
| | 2001 | 1 | 27 | 45 | 362 | 4 | 8 | 12 | 216 | 253 | 8634 | 3 | 4 | 9 |
| | | 2 | 50 | 76 | 1940 | 4 | 12 | 27 | 20 | 38 | 1543 | | | |
| | 2002 | 1 | 29 | 50 | 976 | 10 | 18 | 60 | 58 | 88 | 2981 | 2 | 6 | 65 |
| | | 2 | 60 | 115 | 2493 | 25 | 47 | 198 | 13 | 15 | 391 | 2 | 3 | 39 |
| | 2003 | 1 | 51 | 163 | 2564 | 30 | 72 | 321 | 45 | 112 | 3937 | 6 | 14 | 35 |
| | | 2 | 131 | 341 | 5099 | 58 | 121 | 696 | 60 | 192 | 6047 | 13 | 35 | 113 |
| | 2004 | 1 | 70 | 220 | 2212 | 27 | 49 | 133 | 130 | 335 | 11691 | 36 | 103 | 747 |
| | | 2 | 434 | 1314 | 15334 | 138 | 243 | 672 | 68 | 195 | 4337 | 11 | 20 | 174 |
| | 2005 | 1 | 29 | 54 | 459 | 8 | 10 | 32 | 113 | 253 | 8853 | 14 | 31 | 215 |
| | | 2 | 399 | 1251 | 14565 | 81 | 129 | 413 | 90 | 253 | 6705 | 16 | 31 | 120 |
| | 2006 | 1 | 43 | 102 | 651 | 5 | 8 | 15 | 153 | 216 | 7833 | 10 | 15 | 30 |
| | | 2 | 57 | 152 | 1404 | 12 | 15 | 26 | 25 | 36 | 1290 | 5 | 7 | 10 |
| | 2007 | 1 | 14 | 27 | 262 | 4 | 10 | 16 | 115 | 189 | 4789 | 15 | 35 | 245 |
| | | 2 | 134 | 415 | 3442 | 22 | 28 | 45 | 52 | 96 | 1966 | 2 | 3 | 3 |
| | 2008 | 1 | 19 | 55 | 320 | 6 | 7 | 22 | 94 | 179 | 3976 | 9 | 24 | 333 |
| | | 2 | 75 | 174 | 909 | 13 | 17 | 35 | 40 | 90 | 1485 | 6 | 9 | 14 |
| | 2009 | 1 | 9 | 32 | 48 | 4 | 7 | 13 | 89 | 189 | 3819 | 7 | 13 | 45 |
| | | 2 | 67 | 128 | 899 | 11 | 12 | 30 | 23 | 62 | 938 | 4 | 11 | 58 |
| | 2010 | 1 | 31 | 88 | 677 | 8 | 9 | 11 | 69 | 154 | 3398 | 4 | 4 | 20 |
| | | 2 | 63 | 120 | 773 | 22 | 32 | 78 | 43 | 95 | 1883 | 5 | 7 | 9 |
| | 2011 | 1 | 9 | 13 | 38 | 3 | 4 | 4 | 56 | 125 | 2775 | 5 | 11 | 29 |
| | | 2 | 65 | 123 | 583 | 14 | 22 | 37 | 15 | 27 | 605 | 2 | 4 | 75 |
| | 2012 | 1 | 20 | 44 | 118 | 11 | 18 | 22 | 42 | 78 | 1304 | 4 | 4 | 14 |
| | | 2 | 52 | 87 | 331 | 25 | 33 | 58 | 13 | 39 | 425 | 4 | 5 | 7 |
| | 2013 | 1 | 13 | 29 | 163 | 7 | 8 | 9 | 41 | 75 | 1480 | 3 | 3 | 5 |
| | | 2 | 64 | 125 | 469 | 27 | 41 | 64 | 18 | 39 | 414 | 0 | 0 | 0 |
| | 2014 | 1 | 27 | 72 | 148 | 11 | 25 | 35 | 101 | 205 | 2463 | 5 | 10 | 30 |
| | | 2 | 64 | 113 | 542 | 32 | 47 | 72 | 48 | 98 | 819 | 2 | 2 | 6 |
| | 2015 | 1 | 13 | 26 | 164 | 7 | 10 | 12 | 117 | 244 | 2903 | 15 | 31 | 84 |
| | | 2 | 69 | 149 | 1501 | 19 | 42 | 121 | 51 | 99 | 820 | 4 | 5 | 7 |
| | 2016 | 1 | 10 | 20 | 142 | 5 | 6 | 8 | 153 | 287 | 3255 | 8 | 9 | 31 |
| | | 2 | 52 | 68 | 474 | 8 | 14 | 29 | 75 | 152 | 1595 | 13 | 15 | 24 |
| | 2017 | 1 | 6 | 9 | 82 | 2 | 3 | 6 | 180 | 383 | 4134 | 31 | 49 | 120 |
| | | 2 | 83 | 162 | 1306 | 8 | 10 | 14 | 72 | 122 | 1366 | 4 | 5 | 22 |
| | 2018 | 1 | 10 | 12 | 66 | 5 | 15 | 30 | 119 | 252 | 2382 | 12 | 17 | 48 |
| | | 2 | 50 | 76 | 396 | 6 | 10 | 17 | 44 | 85 | 641 | 3 | 7 | 16 |

Table 10, continued

| Dredge Year | Half- year | North | | | | | | South | | | | | | |
|----------------|---------------|--------------|-----------|-------------|-----------------|-----------|-------------|--------------|-----------|-------------|-----------------|-----------|-------------|------|
| | | Kept Lengths | | | Discard Lengths | | | Kept Lengths | | | Discard Lengths | | | |
| | | No. trips | No. hauls | No. lengths | No. trips | No. hauls | No. lengths | No. trips | No. hauls | No. lengths | No. trips | No. hauls | No. lengths | |
| 2000 | 1 | | | | | | | 12 | 415 | 2481 | 9 | 340 | 2317 | |
| | 2 | 3 | 29 | 89 | 3 | 19 | 29 | 7 | 49 | 186 | 10 | 90 | 464 | |
| 2001 | 1 | 1 | 2 | 8 | 1 | 3 | 4 | 5 | 52 | 215 | 6 | 65 | 303 | |
| | 2 | | | | | | | 3 | 14 | 33 | 3 | 14 | 250 | |
| 2002 | 1 | | | | | | | 7 | 60 | 155 | 16 | 141 | 675 | |
| | 2 | 4 | 66 | 191 | 4 | 9 | 28 | 16 | 171 | 395 | 24 | 250 | 1115 | |
| 2003 | 1 | | | | | | | 18 | 100 | 268 | 34 | 270 | 1215 | |
| | 2 | 5 | 48 | 161 | 4 | 49 | 321 | 33 | 449 | 1205 | 50 | 767 | 5615 | |
| 2004 | 1 | | | | | | | 63 | 1010 | 2962 | 157 | 2500 | 15145 | |
| | 2 | 4 | 10 | 13 | 11 | 42 | 120 | 51 | 697 | 1782 | 67 | 901 | 5268 | |
| 2005 | 1 | 1 | 18 | 27 | 5 | 29 | 109 | 88 | 377 | 1300 | 111 | 929 | 6274 | |
| | 2 | 6 | 25 | 113 | 27 | 192 | 979 | 12 | 49 | 341 | 26 | 125 | 794 | |
| 2006 | 1 | 2 | 4 | 4 | 2 | 18 | 26 | 57 | 465 | 1607 | 92 | 741 | 4625 | |
| | 2 | 15 | 76 | 356 | 29 | 170 | 711 | 46 | 318 | 746 | 98 | 804 | 3384 | |
| 2007 | 1 | 4 | 20 | 25 | 16 | 58 | 106 | 48 | 308 | 1144 | 116 | 900 | 4386 | |
| | 2 | 23 | 212 | 1094 | 50 | 368 | 2082 | 96 | 443 | 1137 | 272 | 1492 | 4593 | |
| 2008 | 1 | 1 | 3 | 3 | 9 | 48 | 70 | 60 | 370 | 1053 | 175 | 1131 | 3702 | |
| | 2 | 6 | 22 | 96 | 15 | 45 | 158 | 109 | 727 | 1796 | 219 | 1549 | 4461 | |
| 2009 | 1 | | | | 3 | 7 | 12 | 34 | 235 | 808 | 62 | 502 | 2364 | |
| | 2 | 5 | 9 | 90 | 12 | 77 | 219 | 50 | 360 | 615 | 89 | 915 | 4094 | |
| 2010 | 1 | | | | | 3 | 7 | 10 | 41 | 283 | 703 | 117 | 898 | 3612 |
| | 2 | 1 | 8 | 12 | 8 | 41 | 100 | 36 | 342 | 940 | 104 | 951 | 5053 | |
| 2011 | 1 | 2 | 2 | 3 | 3 | 6 | 27 | 38 | 167 | 565 | 110 | 536 | 2622 | |
| | 2 | 14 | 44 | 120 | 57 | 178 | 559 | 58 | 257 | 855 | 162 | 1160 | 7150 | |
| 2012 | 1 | 1 | 1 | 1 | 24 | 134 | 481 | 28 | 106 | 634 | 75 | 328 | 2549 | |
| | 2 | 27 | 107 | 294 | 56 | 280 | 1340 | 41 | 139 | 438 | 91 | 483 | 2264 | |
| 2013 | 1 | 3 | 4 | 9 | 44 | 203 | 495 | 75 | 286 | 948 | 108 | 531 | 2398 | |
| | 2 | 7 | 24 | 53 | 28 | 73 | 213 | 72 | 255 | 630 | 119 | 704 | 3868 | |
| 2014 | 1 | 4 | 4 | 5 | 13 | 25 | 34 | 63 | 238 | 746 | 123 | 720 | 3014 | |
| | 2 | 4 | 8 | 23 | 35 | 79 | 349 | 56 | 189 | 463 | 127 | 659 | 2362 | |
| 2015 | 1 | 3 | 5 | 11 | 19 | 38 | 105 | 46 | 226 | 557 | 134 | 831 | 3218 | |
| | 2 | 9 | 29 | 70 | 34 | 102 | 409 | 59 | 208 | 405 | 59 | 208 | 405 | |
| 2016 | 1 | 7 | 42 | 118 | 7 | 42 | 118 | 36 | 211 | 472 | 36 | 211 | 472 | |
| | 2 | 10 | 41 | 87 | 10 | 41 | 87 | 59 | 173 | 441 | 59 | 173 | 441 | |
| 2017 | 1 | 2 | 5 | 7 | 2 | 5 | 7 | 36 | 79 | 244 | 36 | 79 | 244 | |
| | 2 | 4 | 7 | 26 | 4 | 7 | 26 | 38 | 105 | 428 | 38 | 105 | 428 | |
| 2018 | 1 | 4 | 5 | 15 | 4 | 5 | 15 | 34 | 68 | 222 | 34 | 68 | 222 | |
| | 2 | 6 | 14 | 46 | 6 | 14 | 46 | | | | | | | |

Table 11. Temporal stratification used in expanding landings and discards to length composition of the monkfish catch. Unless otherwise indicated, sampling was expanded within gear type and area.

| North | Trawl | | Gillnet | | Dredge | |
|--------------|--------------|------------------|----------------|------------------|---------------|------------------|
| | Kept | Discarded | Kept | Discarded | Kept | Discarded |
| 1994 | annual | annual | 1994-1999 | 1994-1999 | 1994-1999 | 1994-1999 |
| 1995 | annual | annual | 1994-1999 | 1994-1999 | 1994-1999 | 1994-1999 |
| 1996 | annual | annual | 1994-1999 | 1994-1999 | 1994-1999 | 1994-1999 |
| 1997 | annual | annual | 1994-1999 | 1994-1999 | 1994-1999 | 1994-1999 |
| 1998 | annual | annual | 1994-1999 | 1994-1999 | 1994-1999 | 1994-1999 |
| 1999 | annual | annual | 1994-1999 | 1994-1999 | 1994-1999 | 1994-1999 |
| 2000 | annual | annual | annual | 2000-2002 N+S | annual N+S | annual N+S |
| 2001 | annual | annual | annual | 2000-2002 N+S | annual N+S | annual N+S |
| 2002 | annual | annual | annual | 2000-2002 N+S | annual N+S | annual N+S |
| 2003 | half-year | half-year | annual | annual N+S | annual N+S | annual N+S |
| 2004 | half-year | half-year | annual | annual N+S | annual N+S | annual N+S |
| 2005 | half-year | half-year | annual | annual N+S | annual N+S | annual N+S |
| 2006 | half-year | half-year | annual | 2006-2008 N+S | annual N+S | annual N+S |
| 2007 | half-year | half-year | annual | 2006-2008 N+S | annual N+S | annual N+S |
| 2008 | half-year | half-year | annual | 2006-2008 N+S | annual N+S | annual N+S |
| 2009 | half-year | half-year | annual | 2009-2011 N+S | annual N+S | annual N+S |
| 2010 | half-year | half-year | annual | 2009-2011 N+S | annual N+S | annual N+S |
| 2011 | half-year | half-year | annual | 2009-2011 N+S | annual N+S | annual N+S |
| 2012 | half-year | half-year | annual | 2012-2014 N+S | annual N+S | annual N+S |
| 2013 | half-year | half-year | annual | 2012-2014 N+S | annual N+S | annual N+S |
| 2014 | half-year | half-year | annual | 2012-2014 N+S | annual N+S | annual N+S |
| 2015 | annual N+S | half-year | annual | annual N+S | annual N+S | annual N+S |
| 2016 | annual N+S | half-year | annual | annual N+S | annual N+S | annual N+S |
| 2017 | annual N+S | half-year | annual | annual N+S | annual N+S | annual N+S |
| 2018 | annual N+S | half-year | annual | annual N+S | annual N+S | annual N+S |
| South | | | | | | |
| 1994 | annual | | annual | annual | annual | annual |
| 1995 | annual | | annual | annual | annual | annual |
| 1996 | annual | | annual | annual | annual | annual |
| 1997 | annual | | annual | annual | annual | annual |
| 1998 | annual | | annual | annual | annual | annual |
| 1999 | annual | | annual | annual | annual | annual |
| 2000 | annual N+S | annual N+S | annual | 2000-2002 N+S | annual | annual |
| 2001 | annual N+S | annual N+S | annual | 2000-2002 N+S | 2000-2002 | 2000-2002 |
| 2002 | annual N+S | annual N+S | annual | 2000-2002 N+S | 2000-2002 | 2000-2002 |
| 2003 | annual | half-year | annual | annual N+S | annual | annual |
| 2004 | annual | half-year | annual | annual N+S | annual | annual |
| 2005 | annual | half-year | annual | annual N+S | annual | annual |
| 2006 | annual | half-year | annual | 2006-2008 N+S | annual | annual |
| 2007 | annual | half-year | annual | 2006-2008 N+S | annual | annual |
| 2008 | annual | half-year | annual | 2006-2008 N+S | annual | annual |
| 2009 | annual | half-year | annual | 2009-2011 N+S | annual | annual |
| 2010 | annual | half-year | annual | 2009-2011 N+S | annual | annual |
| 2011 | annual | half-year | annual | 2009-2011 N+S | annual | annual |
| 2012 | annual | half-year | annual | 2012-2014 N+S | annual | annual |
| 2013 | annual | half-year | annual | 2012-2014 N+S | annual | annual |
| 2014 | annual | half-year | annual | 2012-2014 N+S | annual | annual |
| 2015 | annual | half-year | annual | annual N+S | annual | annual |
| 2016 | annual | half-year | annual | annual N+S | annual | annual |
| 2017 | annual | half-year | annual | annual N+S | annual | annual |
| 2018 | annual | half-year | annual | annual N+S | annual | annual |

Table 12a. Survey results from NEFSC offshore autumn bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|------|------|-----------------|------|------|------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 1963 | 3.79 | 0.17 | 2.79 | 4.87 | 0.81 | 0.15 | 0.62 | 1.02 |
| 1964 | 1.89 | 0.21 | 1.30 | 2.54 | 0.39 | 0.20 | 0.26 | 0.52 |
| 1965 | 2.52 | 0.20 | 1.73 | 3.41 | 0.35 | 0.15 | 0.26 | 0.44 |
| 1966 | 3.33 | 0.15 | 2.52 | 4.16 | 0.51 | 0.14 | 0.39 | 0.64 |
| 1967 | 1.24 | 0.33 | 0.65 | 1.96 | 0.19 | 0.26 | 0.11 | 0.27 |
| 1968 | 2.05 | 0.34 | 1.01 | 3.41 | 0.29 | 0.27 | 0.17 | 0.41 |
| 1969 | 3.69 | 0.23 | 2.36 | 5.15 | 0.42 | 0.15 | 0.31 | 0.53 |
| 1970 | 2.32 | 0.26 | 1.33 | 3.42 | 0.40 | 0.20 | 0.27 | 0.53 |
| 1971 | 2.90 | 0.21 | 1.93 | 3.93 | 0.49 | 0.17 | 0.36 | 0.63 |
| 1972 | 1.39 | 0.25 | 0.87 | 2.02 | 0.32 | 0.18 | 0.22 | 0.42 |
| 1973 | 3.19 | 0.20 | 2.16 | 4.36 | 0.53 | 0.19 | 0.38 | 0.72 |
| 1974 | 2.02 | 0.21 | 1.38 | 2.78 | 0.32 | 0.19 | 0.22 | 0.44 |
| 1975 | 1.71 | 0.19 | 1.20 | 2.25 | 0.30 | 0.18 | 0.21 | 0.39 |
| 1976 | 3.22 | 0.21 | 2.16 | 4.41 | 0.42 | 0.20 | 0.28 | 0.56 |
| 1977 | 5.43 | 0.17 | 3.94 | 6.99 | 0.76 | 0.12 | 0.50 | 0.75 |
| 1978 | 4.73 | 0.13 | 3.77 | 5.84 | 0.70 | 0.13 | 0.47 | 0.71 |
| 1979 | 4.91 | 0.14 | 3.83 | 6.04 | 0.55 | 0.11 | 0.39 | 0.57 |
| 1980 | 4.04 | 0.20 | 2.75 | 5.48 | 0.64 | 0.14 | 0.41 | 0.67 |
| 1981 | 1.98 | 0.18 | 1.39 | 2.59 | 0.45 | 0.13 | 0.32 | 0.49 |
| 1982 | 0.94 | 0.25 | 0.57 | 1.32 | 0.14 | 0.22 | 0.09 | 0.19 |
| 1983 | 1.61 | 0.19 | 1.11 | 2.13 | 0.47 | 0.18 | 0.34 | 0.61 |
| 1984 | 2.82 | 0.20 | 1.95 | 3.82 | 0.49 | 0.14 | 0.38 | 0.59 |
| 1985 | 1.48 | 0.33 | 0.75 | 2.40 | 0.37 | 0.22 | 0.24 | 0.52 |
| 1986 | 2.23 | 0.22 | 1.47 | 3.10 | 0.61 | 0.17 | 0.45 | 0.78 |
| 1987 | 0.88 | 0.33 | 0.42 | 1.38 | 0.26 | 0.26 | 0.16 | 0.38 |
| 1988 | 1.53 | 0.31 | 0.78 | 2.40 | 0.31 | 0.27 | 0.18 | 0.47 |
| 1989 | 1.32 | 0.30 | 0.77 | 2.03 | 0.51 | 0.18 | 0.31 | 0.55 |
| 1990 | 1.01 | 0.28 | 0.56 | 1.48 | 0.71 | 0.15 | 0.44 | 0.74 |
| 1991 | 1.20 | 0.24 | 0.75 | 1.67 | 0.70 | 0.17 | 0.42 | 0.74 |
| 1992 | 1.12 | 0.23 | 0.74 | 1.57 | 0.94 | 0.17 | 0.67 | 1.21 |
| 1993 | 1.10 | 0.34 | 0.58 | 1.80 | 1.23 | 0.16 | 0.75 | 1.31 |
| 1994 | 0.90 | 0.23 | 0.58 | 1.26 | 1.34 | 0.12 | 1.08 | 1.61 |
| 1995 | 1.60 | 0.23 | 1.00 | 2.20 | 0.93 | 0.12 | 0.74 | 1.11 |
| 1996 | 1.07 | 0.25 | 0.66 | 1.55 | 0.63 | 0.17 | 0.46 | 0.81 |
| 1997 | 0.67 | 0.23 | 0.43 | 0.92 | 0.50 | 0.18 | 0.36 | 0.66 |
| 1998 | 0.96 | 0.20 | 0.65 | 1.26 | 0.62 | 0.19 | 0.44 | 0.82 |
| 1999 | 0.78 | 0.22 | 0.51 | 1.06 | 1.08 | 0.15 | 0.82 | 1.36 |
| 2000 | 2.41 | 0.20 | 1.66 | 3.22 | 2.34 | 0.14 | 1.84 | 2.88 |
| 2001 | 1.84 | 0.16 | 1.38 | 2.33 | 1.61 | 0.11 | 1.31 | 1.91 |
| 2002 | 1.83 | 0.17 | 1.35 | 2.34 | 1.28 | 0.13 | 1.01 | 1.56 |
| 2003 | 1.81 | 0.18 | 1.30 | 2.33 | 1.07 | 0.12 | 0.86 | 1.28 |
| 2004 | 0.64 | 0.27 | 0.38 | 0.96 | 0.52 | 0.19 | 0.36 | 0.68 |
| 2005 | 1.01 | 0.23 | 0.64 | 1.38 | 0.60 | 0.18 | 0.42 | 0.79 |
| 2006 | 1.04 | 0.23 | 0.66 | 1.46 | 0.77 | 0.15 | 0.58 | 0.98 |
| 2007 | 1.08 | 0.28 | 0.62 | 1.62 | 0.64 | 0.15 | 0.48 | 0.80 |
| 2008 | 0.99 | 0.29 | 0.54 | 1.48 | 0.79 | 0.21 | 0.53 | 1.10 |
| 2009 | 0.44 | 0.17 | 0.32 | 0.57 | 0.39 | 0.10 | 0.32 | 0.45 |
| 2010 | 0.64 | 0.14 | 0.49 | 0.78 | 0.51 | 0.09 | 0.44 | 0.58 |
| 2011 | 0.88 | 0.15 | 0.68 | 1.10 | 0.67 | 0.07 | 0.60 | 0.74 |
| 2012 | 0.81 | 0.12 | 0.65 | 0.96 | 0.68 | 0.07 | 0.61 | 0.76 |
| 2013 | 0.62 | 0.11 | 0.50 | 0.73 | 0.73 | 0.07 | 0.65 | 0.81 |
| 2014 | 0.76 | 0.08 | 0.66 | 0.86 | 0.95 | 0.09 | 0.81 | 1.09 |
| 2015 | 1.14 | 0.11 | 0.92 | 1.34 | 1.22 | 0.09 | 1.03 | 1.39 |
| 2016 | 1.50 | 0.10 | 1.25 | 1.76 | 1.84 | 0.07 | 1.63 | 2.07 |
| 2017 | 1.78 | 0.09 | 1.52 | 2.04 | 1.47 | 0.09 | 1.25 | 1.68 |
| 2018 | 2.16 | 0.07 | 1.92 | 2.42 | 1.29 | 0.06 | 1.16 | 1.42 |

Table 12b. Survey results from NEFSC offshore autumn bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|-------|-------|-----------------|------|-------|-------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 2009 | 3.55 | 0.18 | 2.51 | 4.58 | 2.78 | 0.10 | 2.33 | 3.22 |
| 2010 | 5.13 | 0.15 | 3.88 | 6.38 | 3.65 | 0.09 | 3.13 | 4.17 |
| 2011 | 7.09 | 0.15 | 5.32 | 8.86 | 4.77 | 0.06 | 4.26 | 5.28 |
| 2012 | 6.50 | 0.11 | 5.33 | 7.68 | 4.88 | 0.07 | 4.34 | 5.41 |
| 2013 | 4.97 | 0.11 | 4.05 | 5.90 | 5.21 | 0.07 | 4.64 | 5.79 |
| 2014 | 6.11 | 0.09 | 5.23 | 6.98 | 6.79 | 0.09 | 5.82 | 7.76 |
| 2015 | 9.20 | 0.11 | 7.47 | 10.93 | 8.71 | 0.09 | 7.41 | 10.02 |
| 2016 | 12.11 | 0.10 | 10.08 | 14.14 | 13.09 | 0.07 | 11.52 | 14.66 |
| 2017 | 14.38 | 0.09 | 12.30 | 16.46 | 10.45 | 0.08 | 9.01 | 11.88 |
| 2018 | 17.39 | 0.07 | 15.33 | 19.45 | 9.20 | 0.06 | 8.23 | 10.17 |

Table 13a. Survey results from NEFSC offshore spring bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values from 2009 forward are adjusted for change in survey methods. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|-------|-------|-----------------|------|-------|-------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 1968 | 1.007 | 0.33 | 0.503 | 1.585 | 0.168 | 0.29 | 0.092 | 0.252 |
| 1969 | 1.341 | 0.42 | 0.536 | 2.373 | 0.18 | 0.36 | 0.087 | 0.302 |
| 1970 | 2.02 | 0.26 | 1.166 | 2.943 | 0.344 | 0.18 | 0.243 | 0.443 |
| 1971 | 1.048 | 0.29 | 0.612 | 1.585 | 0.162 | 0.29 | 0.093 | 0.249 |
| 1972 | 4.626 | 0.15 | 3.445 | 5.846 | 0.651 | 0.15 | 0.499 | 0.812 |
| 1973 | 1.885 | 0.21 | 1.228 | 2.53 | 0.437 | 0.23 | 0.274 | 0.598 |
| 1974 | 1.492 | 0.20 | 1.044 | 1.992 | 0.44 | 0.14 | 0.348 | 0.55 |
| 1975 | 0.942 | 0.17 | 0.687 | 1.208 | 0.341 | 0.15 | 0.26 | 0.426 |
| 1976 | 2.507 | 0.13 | 1.942 | 3.017 | 0.667 | 0.13 | 0.531 | 0.814 |
| 1977 | 0.932 | 0.18 | 0.656 | 1.194 | 0.259 | 0.19 | 0.185 | 0.342 |
| 1978 | 0.565 | 0.20 | 0.38 | 0.749 | 0.141 | 0.16 | 0.105 | 0.178 |
| 1979 | 0.671 | 0.21 | 0.446 | 0.917 | 0.139 | 0.14 | 0.109 | 0.171 |
| 1980 | 1.434 | 0.18 | 1 | 1.868 | 0.383 | 0.13 | 0.296 | 0.471 |
| 1981 | 1.669 | 0.20 | 1.16 | 2.246 | 0.376 | 0.12 | 0.301 | 0.444 |
| 1982 | 2.968 | 0.25 | 1.802 | 4.258 | 0.345 | 0.25 | 0.217 | 0.498 |
| 1983 | 1.53 | 0.31 | 0.846 | 2.383 | 0.418 | 0.24 | 0.269 | 0.596 |
| 1984 | 1.567 | 0.27 | 0.928 | 2.313 | 0.331 | 0.22 | 0.219 | 0.459 |
| 1985 | 2.119 | 0.22 | 1.388 | 2.942 | 0.346 | 0.20 | 0.239 | 0.46 |
| 1986 | 2.128 | 0.26 | 1.212 | 3.094 | 0.341 | 0.20 | 0.238 | 0.454 |
| 1987 | 1.727 | 0.27 | 0.949 | 2.476 | 0.245 | 0.20 | 0.168 | 0.33 |
| 1988 | 2.03 | 0.23 | 1.297 | 2.892 | 0.607 | 0.17 | 0.443 | 0.79 |
| 1989 | 1.604 | 0.30 | 0.895 | 2.462 | 0.619 | 0.21 | 0.413 | 0.814 |
| 1990 | 1.014 | 0.30 | 0.563 | 1.561 | 0.283 | 0.21 | 0.184 | 0.384 |
| 1991 | 1.611 | 0.24 | 0.986 | 2.233 | 0.592 | 0.18 | 0.416 | 0.767 |
| 1992 | 0.886 | 0.57 | 0.236 | 1.916 | 0.493 | 0.31 | 0.267 | 0.765 |
| 1993 | 1.157 | 0.19 | 0.823 | 1.554 | 0.681 | 0.13 | 0.527 | 0.822 |
| 1994 | 0.979 | 0.30 | 0.505 | 1.424 | 0.453 | 0.18 | 0.313 | 0.583 |
| 1995 | 1.835 | 0.28 | 1.035 | 2.721 | 1.009 | 0.16 | 0.753 | 1.286 |
| 1996 | 0.976 | 0.24 | 0.597 | 1.364 | 0.666 | 0.22 | 0.43 | 0.918 |
| 1997 | 0.546 | 0.36 | 0.248 | 0.91 | 0.342 | 0.25 | 0.212 | 0.496 |
| 1998 | 0.445 | 0.27 | 0.257 | 0.652 | 0.416 | 0.14 | 0.318 | 0.518 |
| 1999 | 1.15 | 0.19 | 0.796 | 1.529 | 0.827 | 0.16 | 0.616 | 1.039 |
| 2000 | 1.399 | 0.18 | 1.026 | 1.829 | 1.132 | 0.12 | 0.912 | 1.359 |
| 2001 | 1.851 | 0.28 | 1.07 | 2.83 | 1.669 | 0.12 | 1.358 | 2.008 |
| 2002 | 1.927 | 0.13 | 1.538 | 2.348 | 1.743 | 0.10 | 1.456 | 2.039 |
| 2003 | 1.874 | 0.20 | 1.295 | 2.508 | 0.813 | 0.20 | 0.563 | 1.092 |
| 2004 | 2.263 | 0.26 | 1.313 | 3.307 | 0.907 | 0.17 | 0.667 | 1.153 |
| 2005 | 1.472 | 0.21 | 0.994 | 2.018 | 0.718 | 0.16 | 0.534 | 0.918 |
| 2006 | 0.93 | 0.40 | 0.393 | 1.613 | 0.367 | 0.27 | 0.219 | 0.531 |
| 2007 | 1.047 | 0.41 | 0.394 | 1.815 | 0.548 | 0.23 | 0.355 | 0.766 |
| 2008 | 1.286 | 0.30 | 0.697 | 1.903 | 0.674 | 0.17 | 0.485 | 0.864 |
| 2009 | 0.472 | 0.15 | 0.361 | 0.58 | 0.331 | 0.10 | 0.274 | 0.388 |
| 2010 | 0.631 | 0.14 | 0.49 | 0.778 | 0.382 | 0.14 | 0.301 | 0.469 |
| 2011 | 0.893 | 0.15 | 0.69 | 1.125 | 0.465 | 0.13 | 0.373 | 0.571 |
| 2012 | 0.607 | 0.13 | 0.475 | 0.743 | 0.538 | 0.14 | 0.425 | 0.671 |
| 2013 | 0.583 | 0.11 | 0.477 | 0.691 | 0.551 | 0.07 | 0.488 | 0.613 |
| 2014 | 0.629 | 0.16 | 0.46 | 0.806 | 0.614 | 0.12 | 0.501 | 0.737 |
| 2015 | 0.732 | 0.16 | 0.555 | 0.933 | 0.537 | 0.09 | 0.459 | 0.623 |
| 2016 | 0.744 | 0.09 | 0.639 | 0.845 | 0.685 | 0.07 | 0.612 | 0.764 |
| 2017 | 1.134 | 0.13 | 0.888 | 1.393 | 0.681 | 0.10 | 0.574 | 0.793 |
| 2018 | 1.65 | 0.07 | 1.474 | 1.833 | 1.041 | 0.08 | 0.91 | 1.168 |
| 2019 | 1.323 | 0.08 | 1.159 | 1.511 | 0.874 | 0.08 | 0.759 | 0.996 |

Table 13b. Survey results from NEFSC offshore spring bottom trawl surveys in the northern management region (strata 20-30, 34-40). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|-------|-------|-----------------|------|------|------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 2009 | 3.80 | 0.14 | 2.91 | 4.70 | 2.36 | 0.10 | 1.96 | 2.76 |
| 2010 | 5.08 | 0.14 | 3.89 | 6.27 | 2.72 | 0.13 | 2.12 | 3.32 |
| 2011 | 7.20 | 0.16 | 5.31 | 9.08 | 3.31 | 0.14 | 2.55 | 4.07 |
| 2012 | 4.90 | 0.14 | 3.79 | 6.00 | 3.83 | 0.13 | 3.00 | 4.67 |
| 2013 | 4.70 | 0.11 | 3.82 | 5.57 | 3.93 | 0.07 | 3.48 | 4.38 |
| 2014 | 5.07 | 0.16 | 3.77 | 6.38 | 4.38 | 0.12 | 3.52 | 5.23 |
| 2015 | 5.90 | 0.16 | 4.33 | 7.47 | 3.83 | 0.09 | 3.24 | 4.41 |
| 2016 | 6.00 | 0.08 | 5.21 | 6.79 | 4.88 | 0.06 | 4.37 | 5.40 |
| 2017 | 9.14 | 0.14 | 7.03 | 11.25 | 4.86 | 0.10 | 4.08 | 5.64 |
| 2018 | 13.30 | 0.07 | 11.81 | 14.79 | 7.42 | 0.07 | 6.52 | 8.32 |
| 2019 | 10.66 | 0.08 | 9.26 | 12.07 | 6.23 | 0.08 | 5.41 | 7.05 |

Table 14. Survey results from ASMFC summer shrimp surveys in the northern management region (strata 1, 3, 5, 6-8). Indices are arithmetic stratified means with bootstrapped variance estimates.

| Year | Mean | Biomass Index | | | Abundance Index | | | |
|------|-------|---------------|-------|-------|-----------------|------|------|-------|
| | | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 1991 | 1.88 | 0.17 | 1.40 | 2.45 | 2.88 | 0.10 | 2.45 | 3.36 |
| 1992 | 2.69 | 0.16 | 2.04 | 3.46 | 2.90 | 0.10 | 2.45 | 3.42 |
| 1993 | 3.07 | 0.25 | 1.85 | 4.39 | 3.70 | 0.13 | 2.93 | 4.52 |
| 1994 | 1.66 | 0.21 | 1.11 | 2.25 | 3.42 | 0.13 | 2.70 | 4.20 |
| 1995 | 1.55 | 0.23 | 0.95 | 2.15 | 2.08 | 0.18 | 1.44 | 2.71 |
| 1996 | 3.36 | 0.31 | 1.83 | 5.30 | 2.99 | 0.13 | 2.37 | 3.69 |
| 1997 | 2.08 | 0.21 | 1.36 | 2.84 | 1.57 | 0.14 | 1.21 | 1.94 |
| 1998 | 2.27 | 0.29 | 1.24 | 3.36 | 2.12 | 0.13 | 1.70 | 2.58 |
| 1999 | 6.26 | 0.09 | 5.56 | 7.57 | 6.75 | 0.08 | 6.00 | 7.89 |
| 2000 | 3.84 | 0.16 | 2.87 | 4.84 | 5.72 | 0.13 | 4.49 | 7.09 |
| 2001 | 7.27 | 0.11 | 6.02 | 8.58 | 10.89 | 0.09 | 9.29 | 12.54 |
| 2002 | 12.44 | 0.10 | 10.25 | 14.51 | 11.65 | 0.09 | 9.99 | 13.33 |
| 2003 | 7.36 | 0.16 | 5.68 | 9.74 | 5.80 | 0.12 | 4.82 | 7.23 |
| 2004 | 4.45 | 0.10 | 3.70 | 5.17 | 3.38 | 0.10 | 2.85 | 3.92 |
| 2005 | 7.25 | 0.13 | 5.73 | 8.87 | 5.25 | 0.10 | 4.45 | 6.08 |
| 2006 | 6.54 | 0.12 | 5.29 | 7.77 | 4.31 | 0.07 | 3.82 | 4.80 |
| 2007 | 4.10 | 0.21 | 2.69 | 5.52 | 4.46 | 0.13 | 3.53 | 5.37 |
| 2008 | 3.79 | 0.19 | 2.62 | 5.03 | 2.82 | 0.12 | 2.29 | 3.37 |
| 2009 | 3.21 | 0.19 | 2.23 | 4.25 | 3.12 | 0.11 | 2.57 | 3.72 |
| 2010 | 2.76 | 0.21 | 1.89 | 3.76 | 2.54 | 0.15 | 1.96 | 3.14 |
| 2011 | 2.66 | 0.15 | 2.04 | 3.37 | 2.25 | 0.09 | 1.93 | 2.62 |
| 2012 | 3.14 | 0.16 | 2.34 | 3.97 | 3.55 | 0.12 | 2.85 | 4.31 |
| 2013 | 4.07 | 0.16 | 3.05 | 5.20 | 4.13 | 0.13 | 3.30 | 5.12 |
| 2014 | 3.31 | 0.15 | 2.57 | 4.19 | 4.94 | 0.09 | 4.23 | 5.68 |
| 2015 | 1.45 | 0.23 | 0.91 | 2.00 | 2.76 | 0.21 | 1.79 | 3.69 |
| 2016 | 5.01 | 0.13 | 3.98 | 6.17 | 6.61 | 0.07 | 5.83 | 7.43 |
| 2017 | 4.78 | 0.16 | 3.56 | 5.99 | 4.63 | 0.10 | 3.90 | 5.39 |
| 2018 | 5.36 | 0.25 | 3.34 | 7.83 | 4.88 | 0.13 | 3.86 | 6.02 |

Table 15. Monkfish indices from Maine-New Hampshire inshore surveys, strata 1-4, regions 1-5.

| Fall | | | | | | | | | |
|--------|--------|------|------|------|--------|------|------|------|--|
| Year | Mean | | | | Mean | | | | |
| | Weight | CV | L95% | U95% | Number | CV | L95% | U95% | |
| 2000 | 1.6 | 0.39 | 1.1 | 2.2 | 4.8 | 0.29 | 3.6 | 6.0 | |
| 2001 | 4.7 | 0.20 | 3.9 | 5.6 | 10.7 | 0.21 | 8.5 | 13.0 | |
| 2002 | 3.4 | 0.66 | 1.2 | 5.7 | 4.1 | 0.56 | 1.8 | 6.3 | |
| 2003 | 3.6 | 0.38 | 2.0 | 5.2 | 3.7 | 0.31 | 2.4 | 5.0 | |
| 2004 | 3.6 | 0.41 | 1.9 | 5.3 | 2.9 | 0.31 | 1.9 | 4.0 | |
| 2005 | 2.0 | 0.35 | 1.1 | 3.0 | 1.8 | 0.22 | 1.3 | 2.3 | |
| 2006 | 1.8 | 0.23 | 1.4 | 2.2 | 2.9 | 0.22 | 2.3 | 3.5 | |
| 2007 | 2.1 | 0.32 | 1.4 | 2.8 | 3.1 | 0.26 | 2.3 | 4.0 | |
| 2008 | 2.9 | 0.27 | 2.1 | 3.8 | 4.1 | 0.33 | 2.7 | 5.5 | |
| 2009 | 1.9 | 0.59 | 0.9 | 3.0 | 2.0 | 0.45 | 1.2 | 2.8 | |
| 2010 | 0.7 | 0.35 | 0.5 | 0.9 | 1.0 | 0.32 | 0.7 | 1.4 | |
| 2011 | 1.1 | 0.38 | 0.7 | 1.5 | 1.0 | 0.37 | 0.6 | 1.3 | |
| 2012 | 0.5 | 0.51 | 0.2 | 0.8 | 0.8 | 0.35 | 0.5 | 1.1 | |
| 2013 | 0.6 | 0.59 | 0.3 | 1.0 | 0.8 | 0.39 | 0.5 | 1.1 | |
| 2014 | 0.3 | 0.43 | 0.2 | 0.4 | 1.0 | 0.32 | 0.8 | 1.3 | |
| 2015 | 1.6 | 0.30 | 1.2 | 2.1 | 7.0 | 0.33 | 4.9 | 9.1 | |
| 2016 | 1.3 | 0.33 | 0.9 | 1.7 | 6.8 | 0.21 | 5.4 | 8.1 | |
| 2017 | 2.2 | 0.33 | 1.6 | 2.8 | 4.1 | 0.30 | 3.2 | 5.1 | |
| 2018 | 2.3 | 0.31 | 1.6 | 3.1 | 2.9 | 0.24 | 2.2 | 3.5 | |
| Spring | | | | | | | | | |
| Year | Mean | | | | Mean | | | | |
| | Weight | CV | L95% | U95% | Number | CV | L95% | U95% | |
| 2000 | | | | | | | | | |
| 2001 | 1.0 | 0.35 | 0.7 | 1.3 | 6.0 | 0.35 | 4.2 | 7.9 | |
| 2002 | 1.1 | 0.37 | 0.8 | 1.5 | 2.4 | 0.31 | 1.7 | 3.0 | |
| 2003 | 0.6 | 0.52 | 0.3 | 1.0 | 1.0 | 0.26 | 0.7 | 1.2 | |
| 2004 | 0.4 | 0.60 | 0.2 | 0.6 | 1.4 | 0.23 | 1.1 | 1.7 | |
| 2005 | 0.8 | 0.35 | 0.5 | 1.1 | 1.1 | 0.22 | 0.8 | 1.4 | |
| 2006 | 0.1 | 0.45 | 0.1 | 0.2 | 0.3 | 0.42 | 0.2 | 0.4 | |
| 2007 | 0.4 | 0.49 | 0.2 | 0.6 | 1.1 | 0.30 | 0.8 | 1.5 | |
| 2008 | 0.5 | 0.30 | 0.3 | 0.7 | 1.4 | 0.26 | 1.0 | 1.7 | |
| 2009 | 0.2 | 0.44 | 0.1 | 0.3 | 0.8 | 0.31 | 0.6 | 1.0 | |
| 2010 | 0.2 | 0.49 | 0.1 | 0.3 | 0.6 | 0.41 | 0.4 | 0.8 | |
| 2011 | 0.2 | 0.69 | 0.1 | 0.3 | 0.3 | 0.35 | 0.2 | 0.4 | |
| 2012 | 0.3 | 0.95 | 0.0 | 0.5 | 0.4 | 0.36 | 0.2 | 0.5 | |
| 2013 | 0.2 | 1.01 | 0.0 | 0.3 | 0.4 | 0.45 | 0.2 | 0.5 | |
| 2014 | 0.2 | 0.97 | 0.0 | 0.4 | 0.9 | 0.39 | 0.6 | 1.1 | |
| 2015 | 0.2 | 0.32 | 0.1 | 0.2 | 1.1 | 0.28 | 0.8 | 1.3 | |
| 2016 | 0.5 | 0.31 | 0.4 | 0.6 | 2.5 | 0.28 | 1.9 | 3.0 | |
| 2017 | 0.4 | 0.64 | 0.2 | 0.6 | 1.2 | 0.28 | 0.9 | 1.4 | |
| 2018 | 0.3 | 0.36 | 0.2 | 0.4 | 1.5 | 0.27 | 1.2 | 1.8 | |

Table 16a. Survey results from NEFSC offshore autumn bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967; survey sampled only a small portion of the southern management area in 2017, therefore indices were not calculated for 2017. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|------|------|-----------------|------|------|------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 1963 | 3.60 | 0.24 | 2.30 | 5.09 | 1.20 | 0.18 | 0.87 | 1.58 |
| 1964 | 5.50 | 0.17 | 3.89 | 7.19 | 1.64 | 0.15 | 1.17 | 1.98 |
| 1965 | 4.90 | 0.17 | 3.60 | 6.41 | 1.15 | 0.15 | 0.90 | 1.44 |
| 1966 | 7.01 | 0.12 | 5.71 | 8.61 | 1.93 | 0.14 | 1.53 | 2.41 |
| 1967 | 1.14 | 0.22 | 0.74 | 1.56 | 0.52 | 0.17 | 0.37 | 0.66 |
| 1968 | 0.91 | 0.22 | 0.60 | 1.25 | 0.40 | 0.21 | 0.28 | 0.56 |
| 1969 | 1.34 | 0.30 | 0.75 | 2.06 | 0.54 | 0.21 | 0.37 | 0.76 |
| 1970 | 1.29 | 0.22 | 0.79 | 1.77 | 0.35 | 0.16 | 0.26 | 0.44 |
| 1971 | 0.79 | 0.36 | 0.38 | 1.30 | 0.28 | 0.21 | 0.18 | 0.37 |
| 1972 | 4.89 | 0.14 | 3.83 | 6.05 | 4.11 | 0.22 | 2.48 | 5.26 |
| 1973 | 1.83 | 0.16 | 1.33 | 2.27 | 1.18 | 0.11 | 0.95 | 1.35 |
| 1974 | 0.72 | 0.26 | 0.43 | 1.06 | 0.22 | 0.21 | 0.15 | 0.30 |
| 1975 | 2.00 | 0.16 | 1.50 | 2.54 | 0.75 | 0.16 | 0.50 | 0.84 |
| 1976 | 1.00 | 0.18 | 0.72 | 1.30 | 0.31 | 0.19 | 0.23 | 0.43 |
| 1977 | 1.88 | 0.18 | 1.37 | 2.45 | 0.45 | 0.14 | 0.29 | 0.46 |
| 1978 | 1.40 | 0.18 | 1.00 | 1.83 | 0.31 | 0.16 | 0.19 | 0.33 |
| 1979 | 1.93 | 0.16 | 1.45 | 2.45 | 0.84 | 0.13 | 0.55 | 0.85 |
| 1980 | 1.85 | 0.17 | 1.35 | 2.38 | 0.87 | 0.16 | 0.51 | 0.87 |
| 1981 | 2.26 | 0.17 | 1.66 | 2.90 | 1.16 | 0.16 | 0.72 | 1.23 |
| 1982 | 0.65 | 0.21 | 0.43 | 0.88 | 0.61 | 0.18 | 0.44 | 0.79 |
| 1983 | 1.76 | 0.21 | 1.18 | 2.40 | 0.78 | 0.17 | 0.57 | 0.99 |
| 1984 | 0.77 | 0.40 | 0.34 | 1.36 | 0.31 | 0.31 | 0.17 | 0.49 |
| 1985 | 1.29 | 0.19 | 0.93 | 1.72 | 0.62 | 0.16 | 0.40 | 0.68 |
| 1986 | 0.55 | 0.27 | 0.33 | 0.81 | 0.36 | 0.23 | 0.22 | 0.46 |
| 1987 | 0.28 | 0.29 | 0.16 | 0.42 | 0.48 | 0.18 | 0.35 | 0.63 |
| 1988 | 0.55 | 0.28 | 0.32 | 0.83 | 0.23 | 0.26 | 0.14 | 0.33 |
| 1989 | 0.62 | 0.25 | 0.37 | 0.87 | 0.46 | 0.22 | 0.24 | 0.51 |
| 1990 | 0.37 | 0.32 | 0.20 | 0.58 | 0.35 | 0.27 | 0.17 | 0.43 |
| 1991 | 0.77 | 0.29 | 0.45 | 1.19 | 0.83 | 0.28 | 0.40 | 1.08 |
| 1992 | 0.32 | 0.22 | 0.22 | 0.44 | 0.34 | 0.16 | 0.25 | 0.43 |
| 1993 | 0.27 | 0.34 | 0.14 | 0.44 | 0.35 | 0.23 | 0.19 | 0.41 |
| 1994 | 0.55 | 0.23 | 0.35 | 0.75 | 0.60 | 0.19 | 0.42 | 0.79 |
| 1995 | 0.39 | 0.27 | 0.23 | 0.57 | 0.49 | 0.21 | 0.33 | 0.68 |
| 1996 | 0.39 | 0.21 | 0.26 | 0.53 | 0.23 | 0.21 | 0.16 | 0.32 |
| 1997 | 0.59 | 0.19 | 0.42 | 0.79 | 0.31 | 0.17 | 0.23 | 0.39 |
| 1998 | 0.50 | 0.24 | 0.32 | 0.72 | 0.33 | 0.24 | 0.21 | 0.46 |
| 1999 | 0.30 | 0.15 | 0.23 | 0.38 | 0.45 | 0.12 | 0.36 | 0.54 |
| 2000 | 0.47 | 0.20 | 0.32 | 0.63 | 0.42 | 0.17 | 0.31 | 0.54 |
| 2001 | 0.65 | 0.18 | 0.47 | 0.85 | 0.38 | 0.17 | 0.27 | 0.49 |
| 2002 | 1.25 | 0.18 | 0.88 | 1.61 | 0.83 | 0.14 | 0.64 | 1.02 |
| 2003 | 0.82 | 0.15 | 0.61 | 1.04 | 0.95 | 0.17 | 0.71 | 1.24 |
| 2004 | 0.74 | 0.18 | 0.53 | 0.97 | 0.47 | 0.20 | 0.32 | 0.62 |
| 2005 | 0.77 | 0.23 | 0.50 | 1.09 | 0.58 | 0.20 | 0.41 | 0.80 |
| 2006 | 0.76 | 0.24 | 0.49 | 1.07 | 0.45 | 0.19 | 0.33 | 0.60 |
| 2007 | 0.50 | 0.24 | 0.31 | 0.71 | 0.20 | 0.22 | 0.12 | 0.27 |
| 2008 | 0.41 | 0.35 | 0.19 | 0.68 | 0.20 | 0.25 | 0.12 | 0.29 |
| 2009 | 0.24 | 0.12 | 0.19 | 0.28 | 0.22 | 0.13 | 0.17 | 0.27 |
| 2010 | 0.36 | 0.17 | 0.27 | 0.47 | 0.40 | 0.19 | 0.29 | 0.54 |
| 2011 | 0.30 | 0.12 | 0.24 | 0.36 | 0.62 | 0.13 | 0.48 | 0.75 |
| 2012 | 0.43 | 0.14 | 0.33 | 0.54 | 0.28 | 0.14 | 0.22 | 0.34 |
| 2013 | 0.27 | 0.15 | 0.21 | 0.34 | 0.29 | 0.17 | 0.21 | 0.37 |
| 2014 | 0.15 | 0.18 | 0.11 | 0.19 | 0.16 | 0.12 | 0.13 | 0.19 |
| 2015 | 0.37 | 0.22 | 0.25 | 0.51 | 1.96 | 0.28 | 1.20 | 3.05 |
| 2016 | 0.42 | 0.23 | 0.27 | 0.59 | 0.63 | 0.20 | 0.44 | 0.84 |
| 2017 | | | | | | | | |
| 2018 | 0.26 | 0.13 | 0.21 | 0.32 | 0.47 | 0.17 | 0.35 | 0.62 |

Table 16b. Survey results from NEFSC offshore autumn bottom trawl surveys in the southern management region (strata 1-19, 61-76). Values are indices calculated without adjustment for change in survey methods in 2009. Only a small portion of the southern management area was sampled in 2017, therefore indices were not calculated for 2017. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | | |
|------|---------------|------|------|------|-----------------|-------|------|------|-------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% | |
| 2009 | 1.92 | 0.13 | 1.52 | 2.33 | | 1.56 | 0.15 | 1.18 | 1.93 |
| 2010 | 2.92 | 0.18 | 2.04 | 3.79 | | 2.87 | 0.21 | 1.89 | 3.85 |
| 2011 | 2.42 | 0.13 | 1.89 | 2.95 | | 4.36 | 0.15 | 3.27 | 5.44 |
| 2012 | 3.50 | 0.18 | 2.46 | 4.53 | | 1.96 | 0.16 | 1.45 | 2.47 |
| 2013 | 2.19 | 0.17 | 1.58 | 2.81 | | 2.07 | 0.18 | 1.44 | 2.69 |
| 2014 | 1.20 | 0.23 | 0.75 | 1.65 | | 1.14 | 0.15 | 0.86 | 1.42 |
| 2015 | 2.96 | 0.23 | 1.82 | 4.10 | | 13.96 | 0.31 | 6.85 | 21.06 |
| 2016 | 3.37 | 0.22 | 2.14 | 4.61 | | 4.46 | 0.19 | 3.06 | 5.85 |
| 2017 | | | | | | | | | |
| 2018 | 2.13 | 0.13 | 1.66 | 2.60 | | 3.38 | 0.17 | 2.45 | 4.31 |

Table 17a. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Strata 61-76 were not sampled until 1967. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|------|------|-----------------|------|------|------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 1968 | 1.16 | 0.23 | 0.77 | 1.61 | 0.21 | 0.19 | 0.15 | 0.28 |
| 1969 | 0.92 | 0.23 | 0.58 | 1.31 | 0.23 | 0.20 | 0.15 | 0.30 |
| 1970 | 1.00 | 0.25 | 0.58 | 1.40 | 0.18 | 0.19 | 0.12 | 0.23 |
| 1971 | 0.76 | 0.29 | 0.43 | 1.15 | 0.21 | 0.25 | 0.13 | 0.29 |
| 1972 | 1.88 | 0.18 | 1.36 | 2.47 | 0.36 | 0.12 | 0.29 | 0.44 |
| 1973 | 1.82 | 0.08 | 1.59 | 2.06 | 1.04 | 0.08 | 0.91 | 1.17 |
| 1974 | 1.16 | 0.16 | 0.87 | 1.47 | 0.49 | 0.11 | 0.40 | 0.57 |
| 1975 | 0.91 | 0.15 | 0.70 | 1.15 | 0.44 | 0.12 | 0.36 | 0.54 |
| 1976 | 1.13 | 0.11 | 0.91 | 1.33 | 0.41 | 0.12 | 0.33 | 0.48 |
| 1977 | 1.16 | 0.14 | 0.90 | 1.45 | 0.30 | 0.10 | 0.25 | 0.35 |
| 1978 | 0.73 | 0.13 | 0.58 | 0.89 | 0.34 | 0.09 | 0.28 | 0.39 |
| 1979 | 0.70 | 0.17 | 0.51 | 0.90 | 0.27 | 0.15 | 0.21 | 0.34 |
| 1980 | 0.74 | 0.15 | 0.56 | 0.92 | 0.45 | 0.10 | 0.38 | 0.53 |
| 1981 | 1.74 | 0.15 | 1.33 | 2.20 | 0.77 | 0.12 | 0.62 | 0.92 |
| 1982 | 2.60 | 0.17 | 1.92 | 3.33 | 0.93 | 0.12 | 0.75 | 1.11 |
| 1983 | 0.95 | 0.26 | 0.58 | 1.35 | 0.27 | 0.16 | 0.20 | 0.35 |
| 1984 | 0.74 | 0.31 | 0.36 | 1.12 | 0.18 | 0.23 | 0.11 | 0.25 |
| 1985 | 0.33 | 0.32 | 0.17 | 0.52 | 0.16 | 0.25 | 0.10 | 0.23 |
| 1986 | 0.83 | 0.28 | 0.48 | 1.23 | 0.28 | 0.27 | 0.18 | 0.43 |
| 1987 | 0.50 | 0.48 | 0.17 | 0.95 | 0.11 | 0.23 | 0.07 | 0.15 |
| 1988 | 0.43 | 0.13 | 0.34 | 0.52 | 0.44 | 0.16 | 0.33 | 0.55 |
| 1989 | 0.36 | 0.16 | 0.27 | 0.47 | 0.20 | 0.23 | 0.13 | 0.28 |
| 1990 | 1.00 | 0.20 | 0.67 | 1.34 | 0.21 | 0.11 | 0.17 | 0.24 |
| 1991 | 0.58 | 0.24 | 0.37 | 0.82 | 0.32 | 0.25 | 0.20 | 0.46 |
| 1992 | 0.22 | 0.33 | 0.11 | 0.34 | 0.18 | 0.25 | 0.11 | 0.25 |
| 1993 | 0.26 | 0.28 | 0.15 | 0.39 | 0.20 | 0.23 | 0.12 | 0.28 |
| 1994 | 0.33 | 0.28 | 0.19 | 0.50 | 0.11 | 0.23 | 0.07 | 0.16 |
| 1995 | 0.52 | 0.39 | 0.20 | 0.90 | 0.20 | 0.20 | 0.13 | 0.27 |
| 1996 | 0.28 | 0.20 | 0.19 | 0.38 | 0.14 | 0.20 | 0.09 | 0.18 |
| 1997 | 0.13 | 0.22 | 0.09 | 0.18 | 0.12 | 0.21 | 0.08 | 0.16 |
| 1998 | 0.28 | 0.15 | 0.22 | 0.35 | 0.25 | 0.14 | 0.20 | 0.31 |
| 1999 | 0.64 | 0.20 | 0.44 | 0.86 | 0.34 | 0.14 | 0.26 | 0.42 |
| 2000 | 0.30 | 0.18 | 0.21 | 0.39 | 0.24 | 0.17 | 0.18 | 0.31 |
| 2001 | 0.26 | 0.31 | 0.14 | 0.41 | 0.24 | 0.20 | 0.16 | 0.31 |
| 2002 | 0.38 | 0.30 | 0.21 | 0.60 | 0.32 | 0.33 | 0.18 | 0.52 |
| 2003 | 1.38 | 0.15 | 1.03 | 1.72 | 0.31 | 0.16 | 0.23 | 0.39 |
| 2004 | 0.18 | 0.27 | 0.11 | 0.27 | 0.12 | 0.25 | 0.07 | 0.17 |
| 2005 | 0.37 | 0.16 | 0.28 | 0.47 | 0.26 | 0.27 | 0.16 | 0.39 |
| 2006 | 0.54 | 0.27 | 0.32 | 0.78 | 0.17 | 0.20 | 0.12 | 0.23 |
| 2007 | 0.55 | 0.22 | 0.37 | 0.77 | 0.26 | 0.16 | 0.20 | 0.33 |
| 2008 | 0.39 | 0.31 | 0.22 | 0.60 | 0.19 | 0.31 | 0.11 | 0.29 |
| 2009 | 0.30 | 0.15 | 0.23 | 0.38 | 0.16 | 0.14 | 0.12 | 0.19 |
| 2010 | 0.22 | 0.19 | 0.15 | 0.29 | 0.16 | 0.21 | 0.11 | 0.22 |
| 2011 | 0.42 | 0.11 | 0.34 | 0.50 | 0.28 | 0.14 | 0.22 | 0.34 |
| 2012 | 0.35 | 0.11 | 0.29 | 0.42 | 0.30 | 0.09 | 0.26 | 0.34 |
| 2013 | 0.34 | 0.14 | 0.27 | 0.44 | 0.20 | 0.17 | 0.15 | 0.26 |
| 2014 | 0.25 | 0.19 | 0.17 | 0.33 | 0.14 | 0.13 | 0.11 | 0.17 |
| 2015 | 0.20 | 0.18 | 0.14 | 0.26 | 0.11 | 0.16 | 0.08 | 0.14 |
| 2016 | 0.28 | 0.11 | 0.23 | 0.32 | 0.46 | 0.10 | 0.38 | 0.54 |
| 2017 | 0.49 | 0.16 | 0.37 | 0.62 | 0.46 | 0.18 | 0.33 | 0.59 |
| 2018 | 0.63 | 0.16 | 0.46 | 0.78 | 0.33 | 0.16 | 0.24 | 0.41 |
| 2019 | 0.36 | 0.10 | 0.30 | 0.42 | 0.29 | 0.11 | 0.24 | 0.34 |

Table 17b. Survey results from NEFSC offshore spring bottom trawl surveys in the southern management region (strata 1-19, 61-76). Values are indices calculated without adjustment for change in survey methods in 2009. Indices are arithmetic stratified means with bootstrapped variance estimates.

| | Biomass Index | | | | Abundance Index | | | |
|------|---------------|------|------|------|-----------------|------|------|------|
| | Mean | CV | L90% | U90% | Mean | CV | L90% | U90% |
| 2009 | 2.45 | 0.16 | 1.81 | 3.09 | 1.11 | 0.15 | 0.85 | 1.38 |
| 2010 | 1.73 | 0.19 | 1.19 | 2.28 | 1.15 | 0.22 | 0.73 | 1.56 |
| 2011 | 3.41 | 0.11 | 2.80 | 4.01 | 1.99 | 0.14 | 1.54 | 2.44 |
| 2012 | 2.86 | 0.11 | 2.36 | 3.35 | 2.14 | 0.09 | 1.83 | 2.45 |
| 2013 | 2.76 | 0.14 | 2.10 | 3.42 | 1.43 | 0.17 | 1.03 | 1.82 |
| 2014 | 2.03 | 0.19 | 1.41 | 2.65 | 1.03 | 0.13 | 0.80 | 1.25 |
| 2015 | 1.58 | 0.17 | 1.14 | 2.02 | 0.77 | 0.15 | 0.58 | 0.97 |
| 2016 | 2.22 | 0.10 | 1.85 | 2.59 | 3.25 | 0.11 | 2.68 | 3.82 |
| 2017 | 3.93 | 0.16 | 2.92 | 4.94 | 3.25 | 0.18 | 2.26 | 4.24 |
| 2018 | 5.04 | 0.16 | 3.72 | 6.36 | 2.36 | 0.16 | 1.73 | 2.99 |
| 2019 | 2.89 | 0.10 | 2.42 | 3.36 | 2.07 | 0.11 | 1.70 | 2.43 |

Table 18. Survey results from NEFSC (1984-2011) and NEFSC and VIMS (2012-2018) offshore scallop dredge surveys in the southern management region (shellfish strata 6, 7, 10, 11, 14, 15, 18, 19, 22-31, 33-35, 46, 47, 55, 58-61, 621, 631). The survey vessel used by NEFSC and survey timing change in 2009. VIMS conducted an increasing portion of the survey starting in 2012. Indices are arithmetic stratified means with bootstrapped variance estimates (where available).

| Abundance Index | | | | |
|-----------------|------|------|------|------|
| | Mean | CV | L90% | U90% |
| 1984 | 1.34 | 0.1 | 1.17 | 1.51 |
| 1985 | 1.57 | 0.1 | 1.37 | 1.79 |
| 1986 | 1.29 | 0.1 | 1.12 | 1.46 |
| 1987 | 3.17 | 0.1 | 2.89 | 3.46 |
| 1988 | 1.69 | 0.1 | 1.49 | 1.89 |
| 1989 | 1.00 | 0.1 | 0.88 | 1.13 |
| 1990 | 1.53 | 0.1 | 1.40 | 1.69 |
| 1991 | 2.26 | 0.1 | 2.05 | 2.46 |
| 1992 | 1.95 | 0.1 | 1.75 | 2.18 |
| 1993 | 2.83 | 0.0 | 2.62 | 3.06 |
| 1994 | 3.33 | 0.1 | 3.06 | 3.62 |
| 1995 | 2.26 | 0.1 | 2.03 | 2.49 |
| 1996 | 2.01 | 0.1 | 1.80 | 2.23 |
| 1997 | 1.12 | 0.1 | 0.99 | 1.26 |
| 1998 | 1.06 | 0.1 | 0.95 | 1.18 |
| 1999 | 2.57 | 0.1 | 2.28 | 2.89 |
| 2000 | 2.29 | 0.1 | 2.04 | 2.58 |
| 2001 | 1.73 | 0.1 | 1.56 | 1.92 |
| 2002 | 1.70 | 0.1 | 1.54 | 1.86 |
| 2003 | 2.75 | 0.1 | 2.48 | 3.01 |
| 2004 | 2.89 | 0.1 | 2.59 | 3.23 |
| 2005 | 2.01 | 0.1 | 1.81 | 2.21 |
| 2006 | 1.44 | 0.1 | 1.31 | 1.57 |
| 2007 | 0.83 | 0.1 | 0.73 | 0.94 |
| 2008 | 1.03 | 0.1 | 0.89 | 1.17 |
| 2009 | 0.78 | 9.8 | 0.65 | 0.92 |
| 2010 | 0.74 | 9.9 | 0.61 | 0.87 |
| 2011 | 0.94 | 12.5 | 0.73 | 1.12 |
| 2012 | 1.00 | | | |
| 2013 | 0.81 | | | |
| 2014 | 0.55 | | | |
| 2015 | 2.29 | | | |
| 2016 | 2.17 | | | |
| 2017 | 1.62 | | | |
| 2018 | 0.99 | | | |

Table 19. Area-swept estimates of minimum abundance and biomass, and relative exploitation indices for monkfish from NEFSC fall surveys. Estimates are adjusted for sweep type (adjusted to chain sweep), assume that 100% of monkfish encountered by the trawl are captured and do not account for missed strata in some years.

| North | Catch (millions of fish) | Landings (millions of fish) | Catch mt | adjusted AS total abund | adjusted AS 43 cm+ abund | adjusted AS Biomass mt | C/Total N | L/43+cm | C mt/ B mt | Rel F | Rel F | Rel F |
|-------|-----------------------------|--------------------------------|-------------|----------------------------|-----------------------------|---------------------------|-----------|---------|------------|-------|-------|-------|
| 2009 | 1.559 | 1.066 | 3,675 | 36,717,874 | 8,662,877 | 32,406 | 0.04 | 0.12 | 0.11 | | | |
| 2010 | 1.169 | 0.819 | 2,741 | 40,524,791 | 10,999,269 | 42,178 | 0.03 | 0.07 | 0.06 | | | |
| 2011 | 1.445 | 0.970 | 2,814 | 51,328,487 | 14,797,117 | 49,936 | 0.03 | 0.07 | 0.06 | | | |
| 2012 | 1.995 | 1.390 | 4,635 | 57,008,552 | 13,828,353 | 51,063 | 0.04 | 0.10 | 0.09 | | | |
| 2013 | 1.724 | 1.109 | 3,922 | 60,967,483 | 8,414,414 | 40,838 | 0.03 | 0.13 | 0.10 | | | |
| 2014 | 1.865 | 1.139 | 3,954 | 84,100,939 | 13,314,746 | 54,125 | 0.02 | 0.09 | 0.07 | | | |
| 2015 | 2.137 | 1.395 | 4,630 | 105,281,189 | 17,990,848 | 77,578 | 0.02 | 0.08 | 0.06 | | | |
| 2016 | 2.552 | 1.670 | 5,508 | 174,643,487 | 26,516,683 | 103,686 | 0.01 | 0.06 | 0.05 | | | |
| 2017 | 3.222 | 2.478 | 7,894 | 115,927,590 | 39,300,789 | 113,147 | 0.03 | 0.06 | 0.07 | | | |
| 2018 | 3.210 | 2.090 | 8,115 | 100,164,292 | 35,993,154 | 140,801 | 0.03 | 0.06 | 0.06 | | | |
| South | Catch (millions of fish) | Landings (millions of fish) | Catch mt | adjusted AS total abund | adjusted AS 43 cm+ abund | adjusted AS Biomass mt | C/Total N | L/43+cm | C mt/ B mt | Rel F | Rel F | Rel F |
| 2009 | 2.14 | 1.282 | 7,158 | 26,947,935 | 4,900,883 | 20,592 | 0.08 | 0.26 | 0.35 | | | |
| 2010 | 2.64 | 1.095 | 7,105 | 47,905,108 | 8,873,105 | 32,509 | 0.06 | 0.12 | 0.22 | | | |
| 2011 | 2.66 | 1.236 | 8,545 | 62,976,941 | 6,254,672 | 25,878 | 0.04 | 0.20 | 0.33 | | | |
| 2012 | 3.35 | 1.439 | 8,438 | 24,635,364 | 7,309,501 | 31,016 | 0.14 | 0.20 | 0.27 | | | |
| 2013 | 2.46 | 1.398 | 7,176 | 36,089,410 | 7,908,464 | 23,849 | 0.07 | 0.18 | 0.30 | | | |
| 2014 | 2.49 | 1.243 | 6,859 | 25,860,088 | 4,769,114 | 20,359 | 0.10 | 0.26 | 0.34 | | | |
| 2015 | 2.29 | 1.057 | 5,844 | 298,342,595 | 3,536,976 | 50,510 | 0.01 | 0.30 | 0.12 | | | |
| 2016 | 4.51 | 0.971 | 7,199 | 77,586,702 | 5,136,276 | 52,014 | 0.06 | 0.19 | 0.14 | | | |
| 2017 | 2.96 | 0.934 | 9,143 | | | | | | | | | |
| 2018 | 2.98 | 1.112 | 9,615 | 67,592,308 | 6,726,308 | 26,619 | 0.04 | 0.17 | 0.36 | | | |

Figures

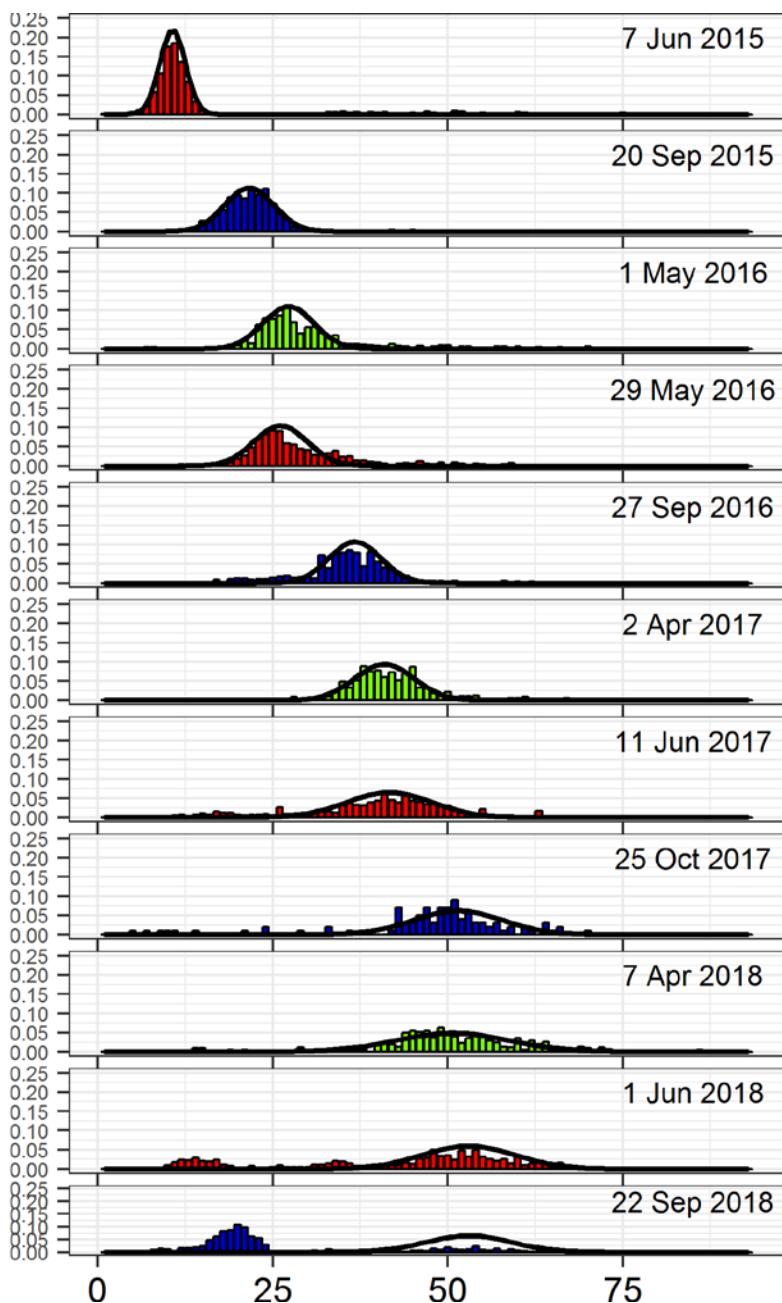


Figure 1. Length frequency distributions of monkfish in southern management area from NEFSC spring (green), scallop dredge (NEFSC and VIMS, red), and NEFSC fall surveys (blue) illustrating growth rates of presumed 2015 year class of monkfish. Normal curves fit using NORMSEP. Monkfish settle to the benthos at about 8 cm. Geographic scope of sampling was limited to southern flank of Georges Bank in fall 2017.

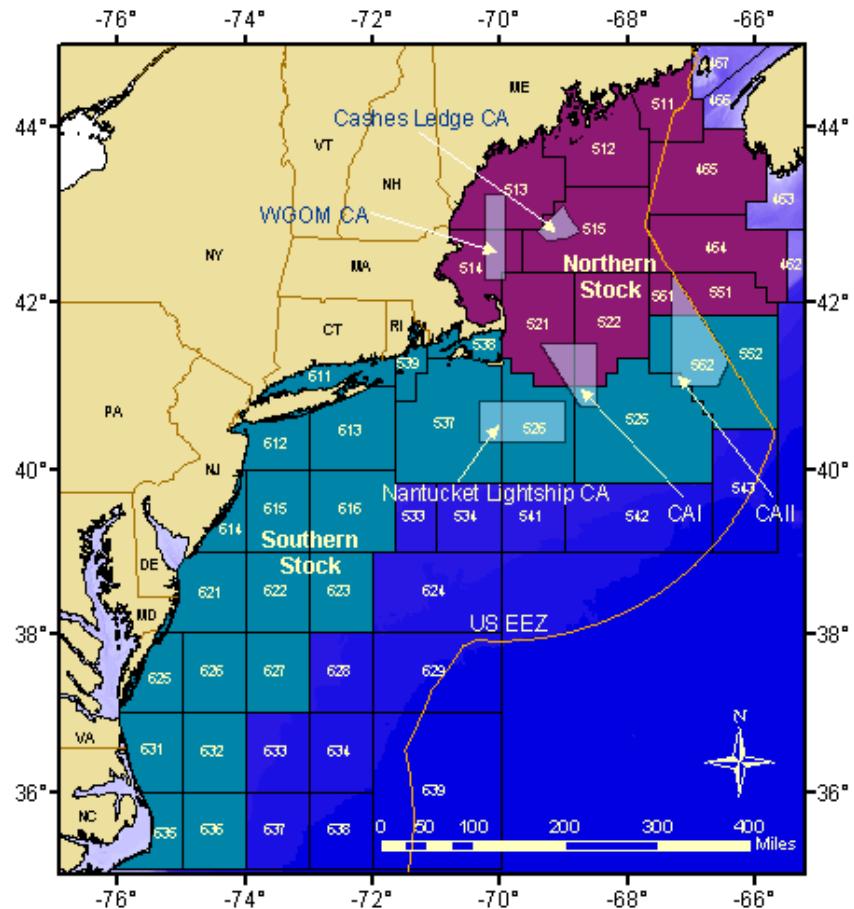


Figure 2. Fishery statistical areas used to define northern and southern monkfish management areas.

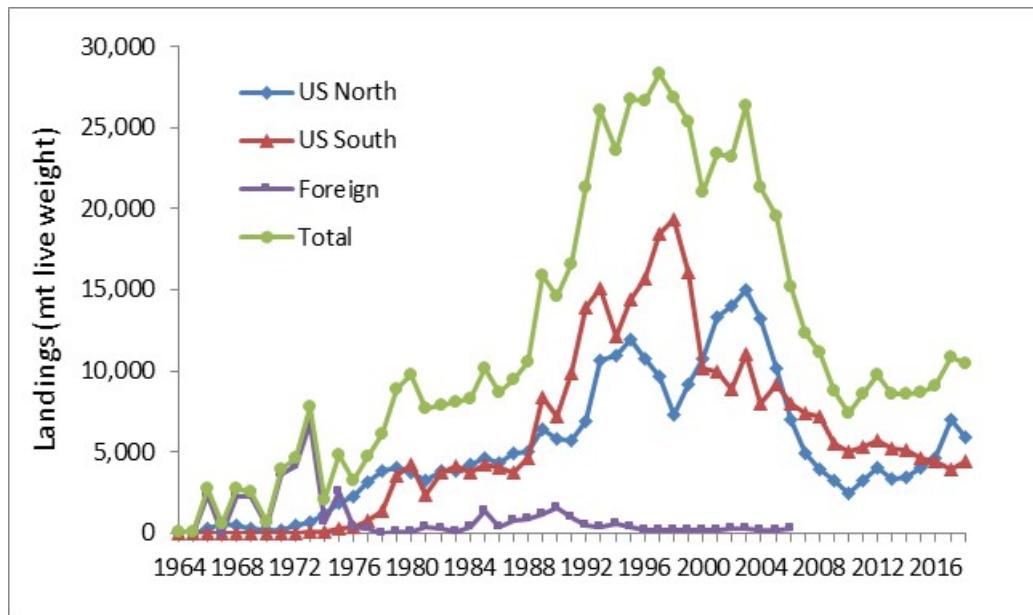


Figure 3. Monkfish landings by management area and combined areas, 1964-2018.

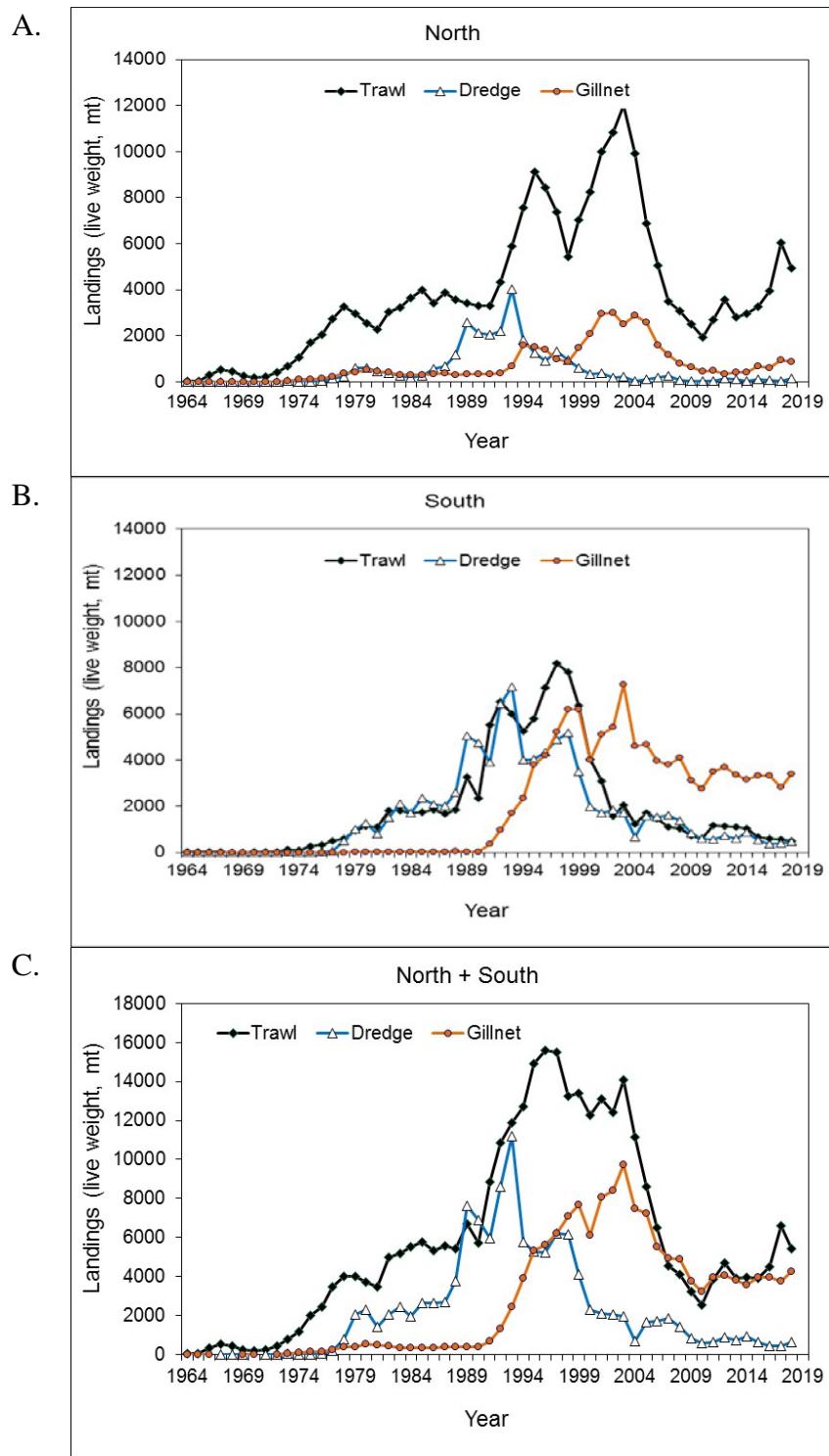
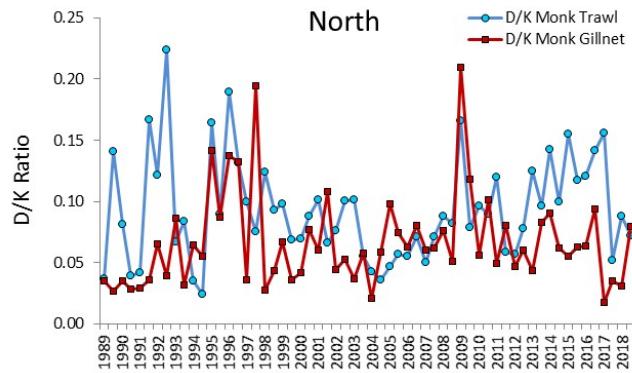
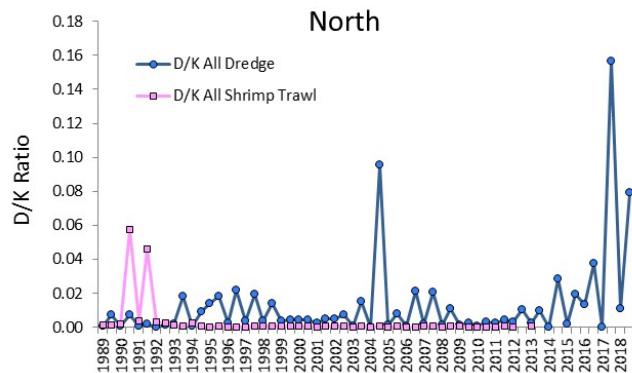


Figure 4. Commercial landings of monkfish by gear type and management area, 1964-2018. A. Northern management area, B. Southern management area, C. Management areas combined.

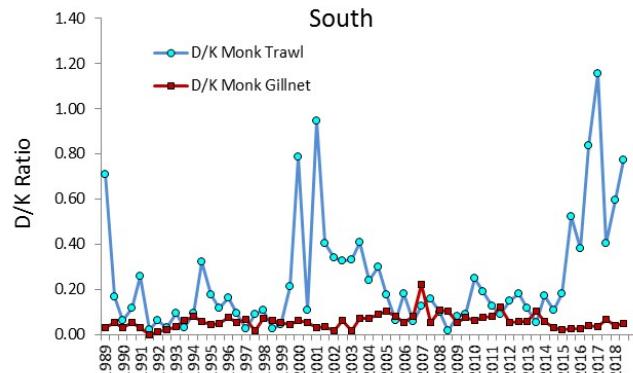
North



North



South



South

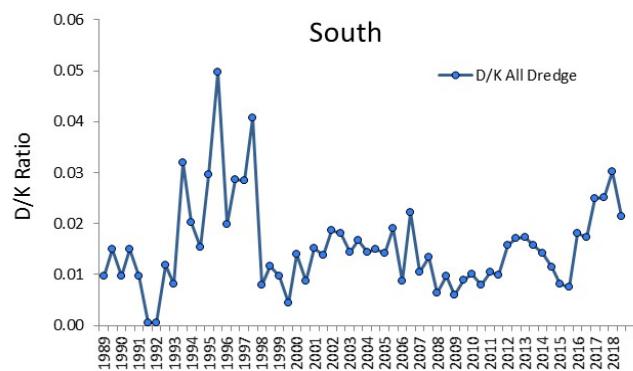


Figure 5. Discard ratios by half year for trawls and gillnets (top panels), and dredges and shrimp trawls (bottom panels) for North (left column) and South (right column). Trawls and gillnets ratios were based on kept monkfish; dredge and shrimp trawl were based on kept of all species.

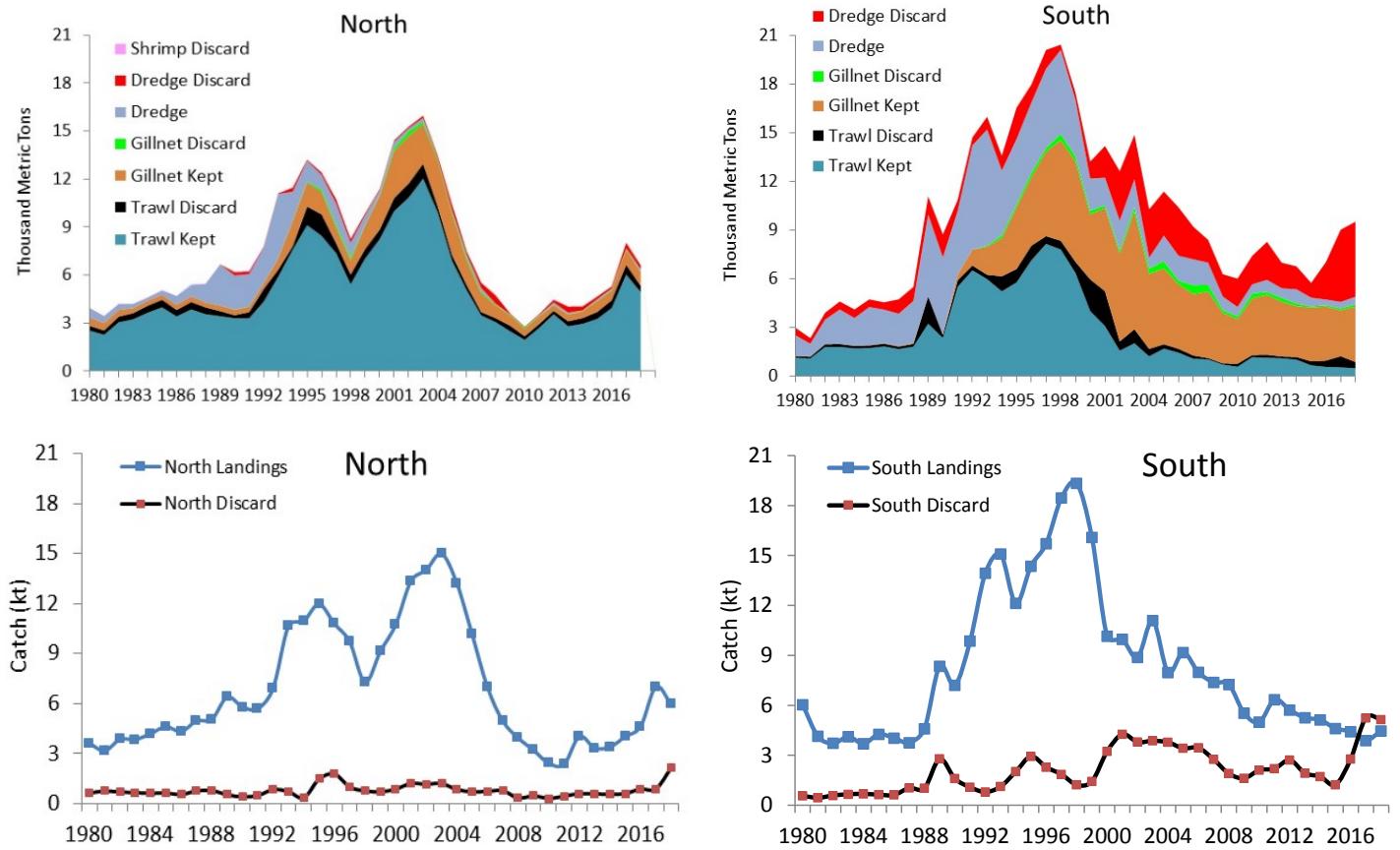


Figure 6. Monkfish landings and discard by gear type (top panels) and total (bottom panels) for North (left) and South (right).

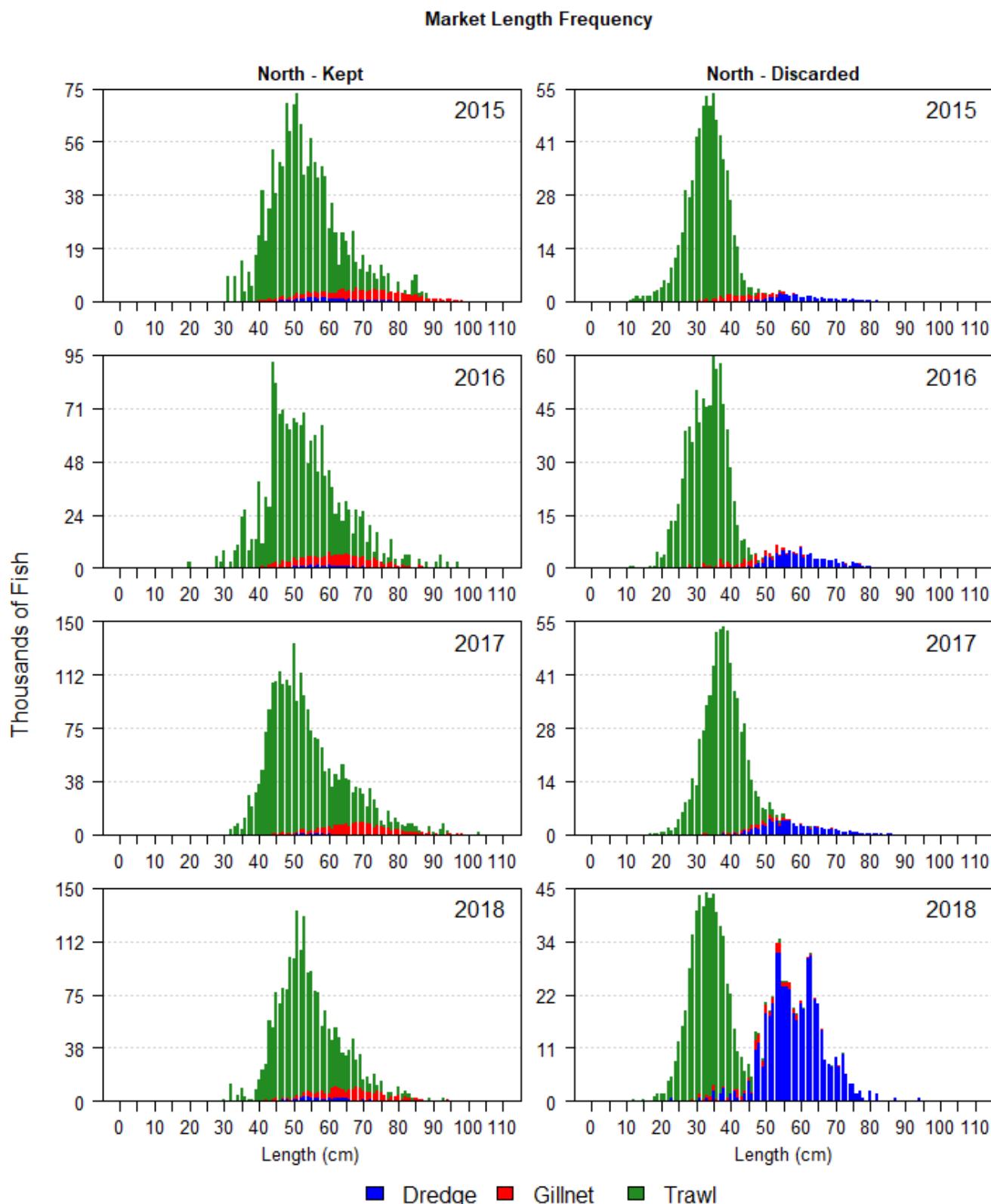


Figure 7. Estimated length composition of kept and discarded monkfish by gear type in the northern management area.

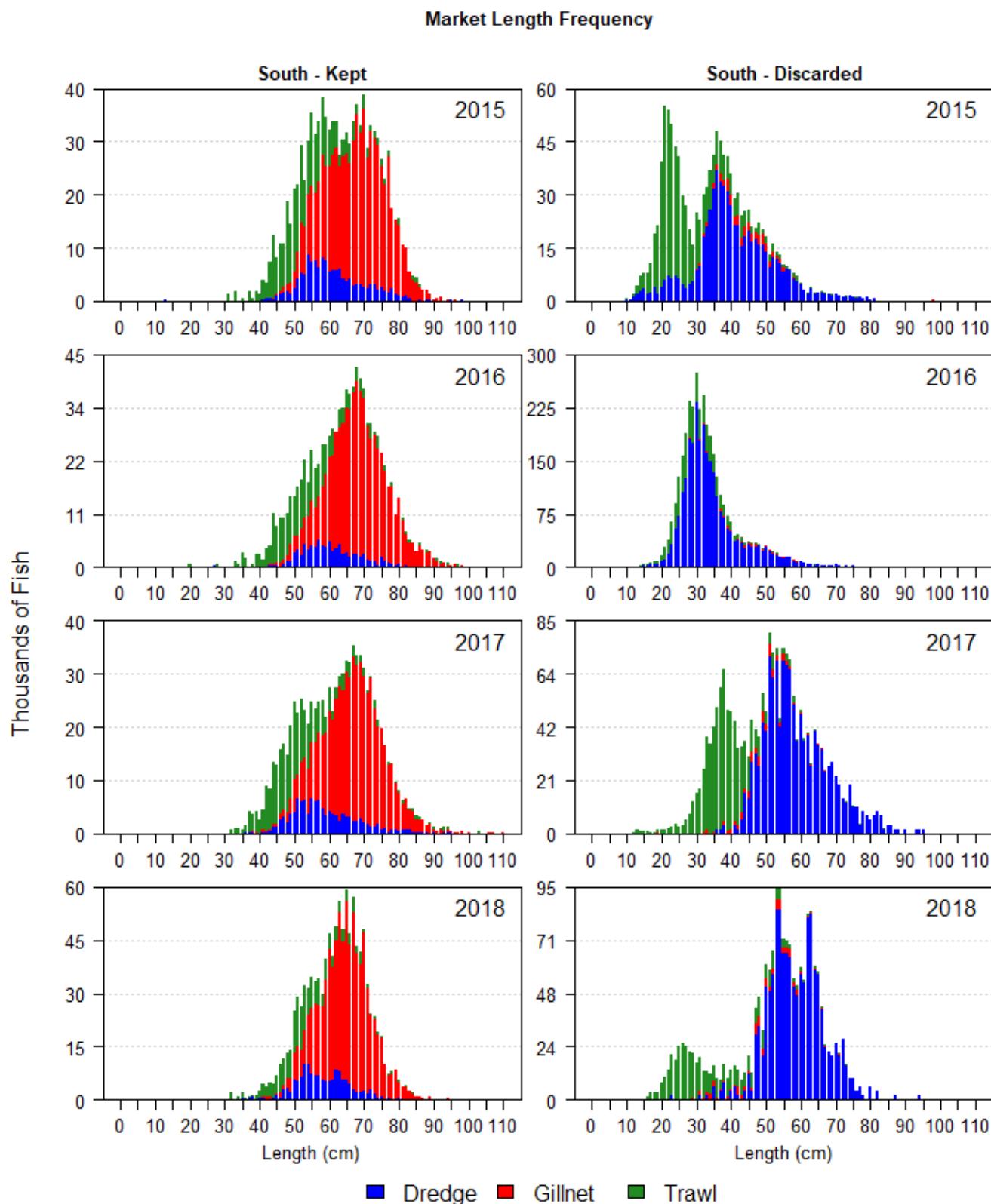


Figure 8. Estimated length composition of kept and discarded monkfish by gear type in the southern management area.

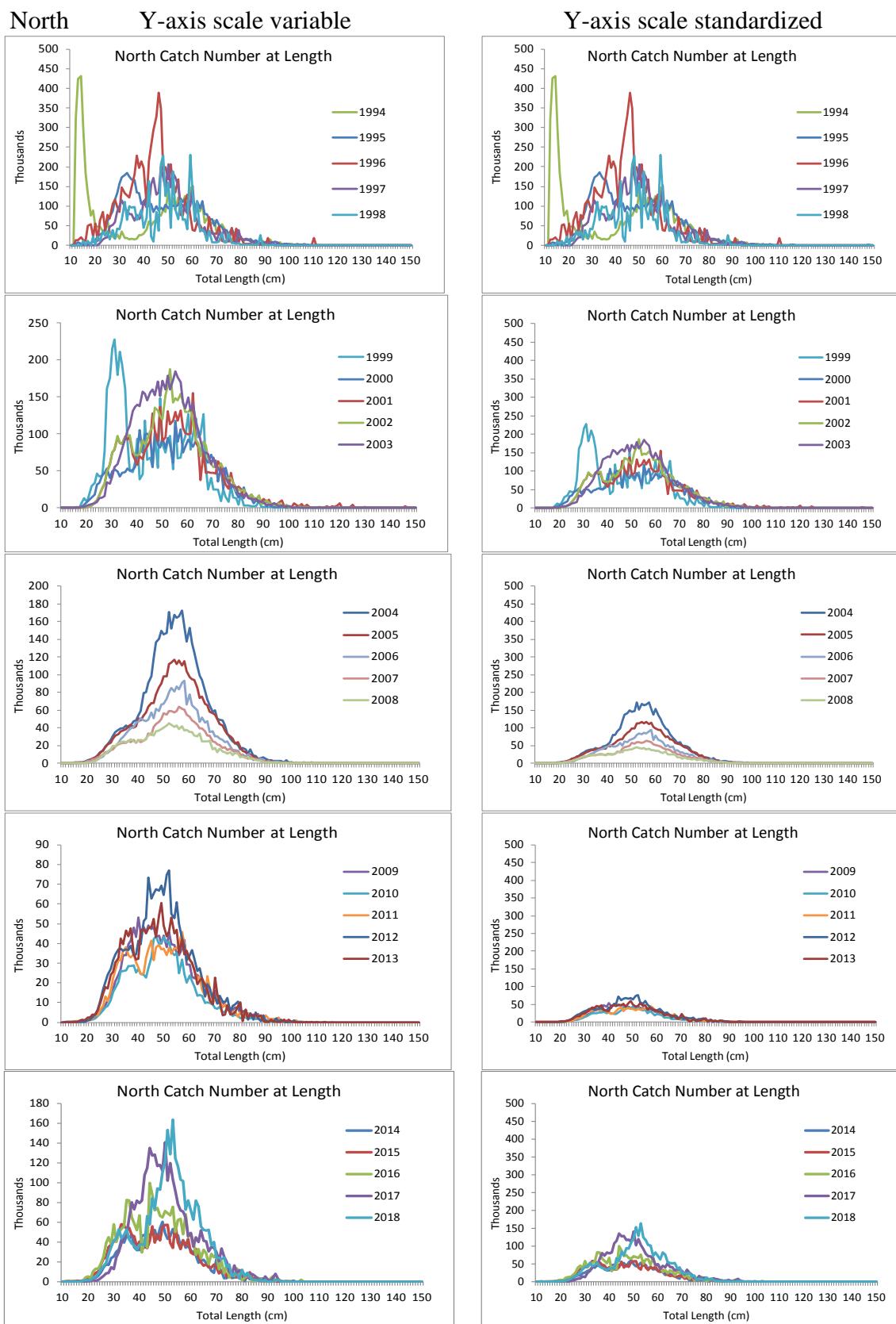


Figure 9. Estimated length composition of commercial monkfish catch, northern management area.

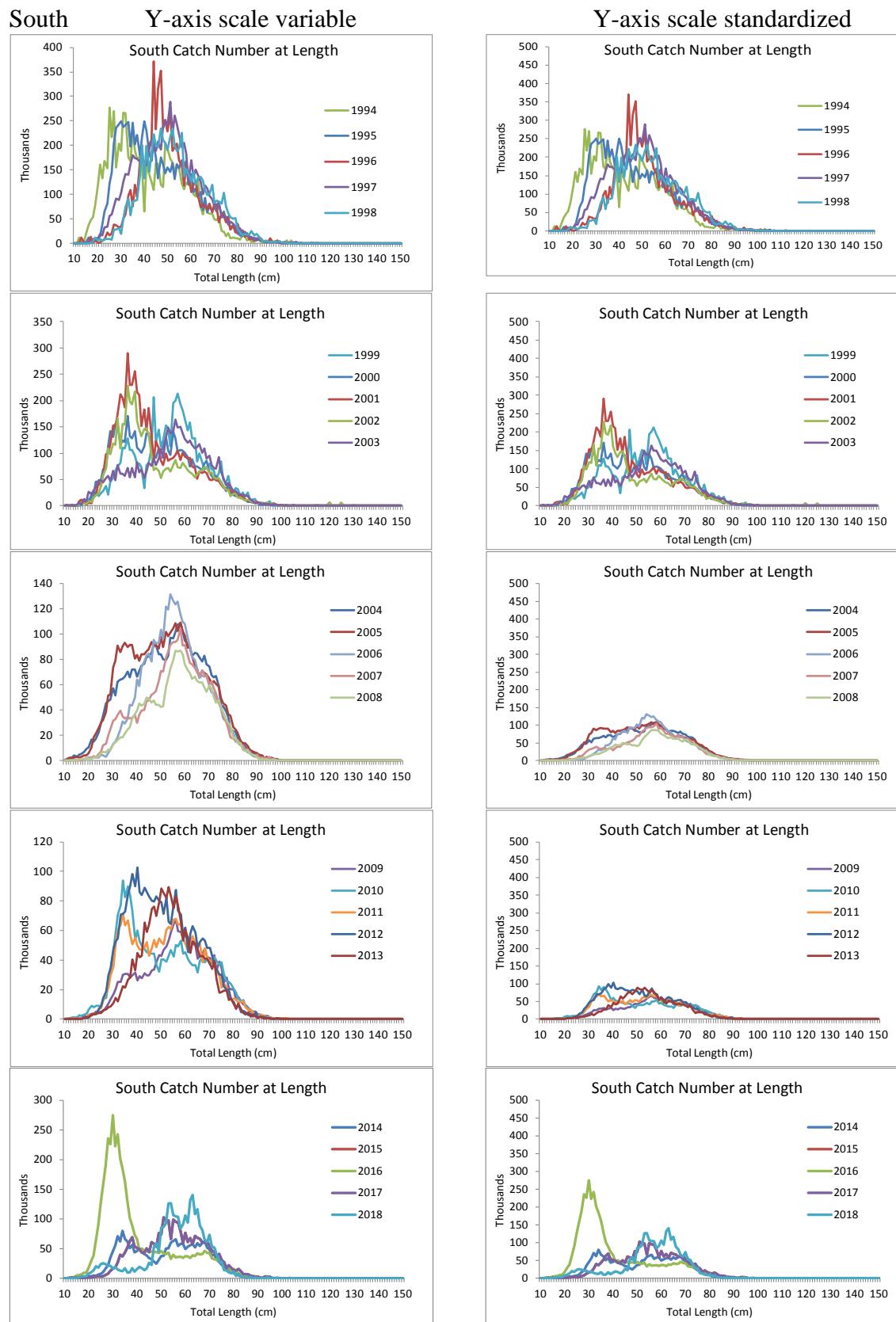
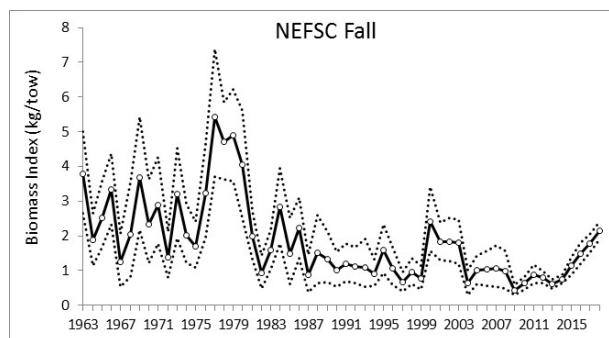


Figure 10. Length composition of monkfish commercial catch estimated using length frequency data collected by fishery observers in the southern management area.

Biomass



Abundance

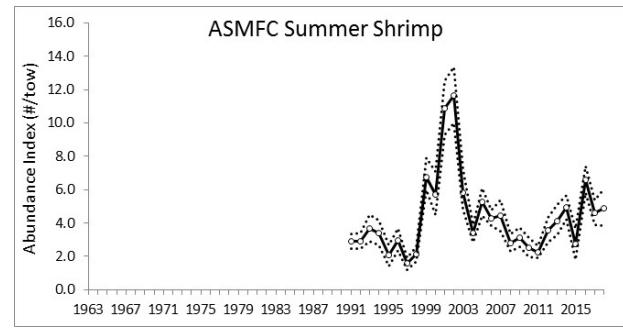
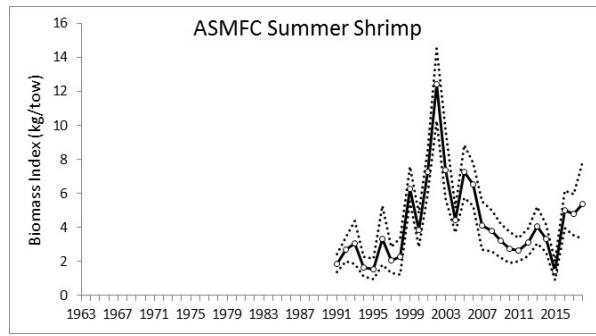
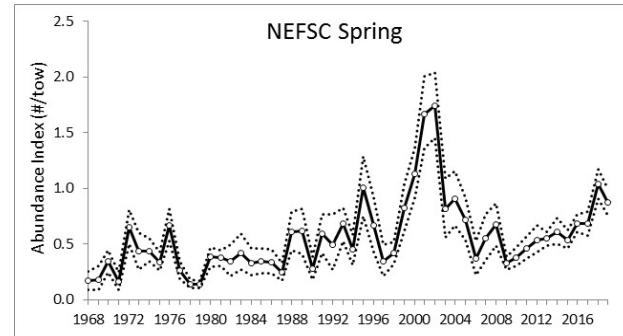
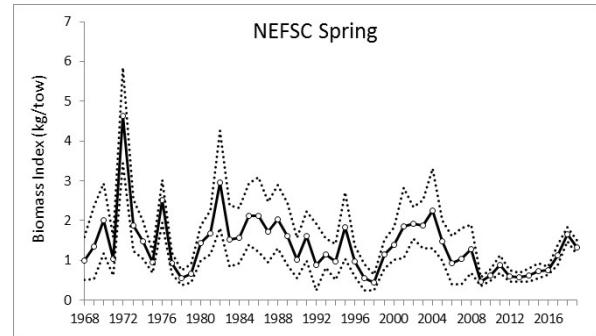
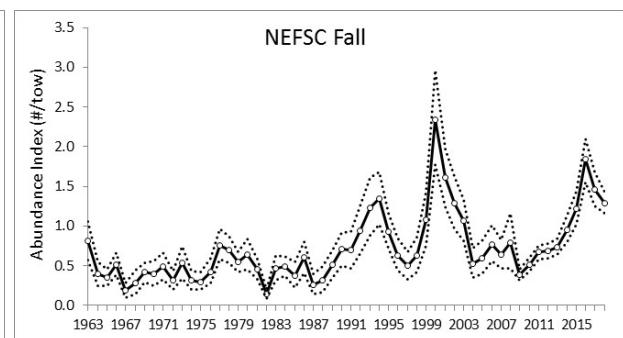


Figure 11. Survey indices for monkfish in the northern management area. Points after 2008 in spring and fall surveys are from surveys conducted on the FSV Bigelow, converted to Albatross units as described in the text.

North

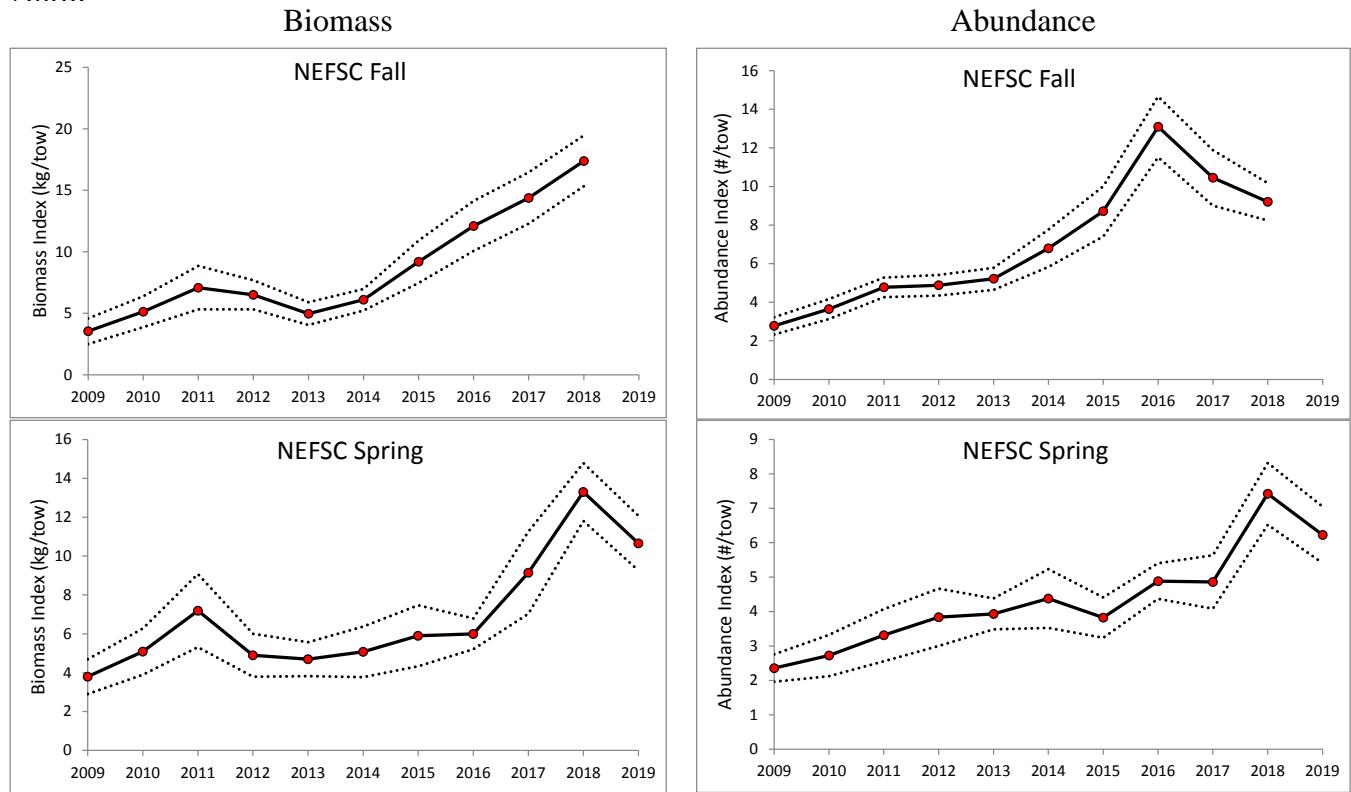


Figure 12. Survey indices from surveys conducted on the FRSV Bigelow in the northern management area, not converted to Albatross units. Note: y-axis scale varies.

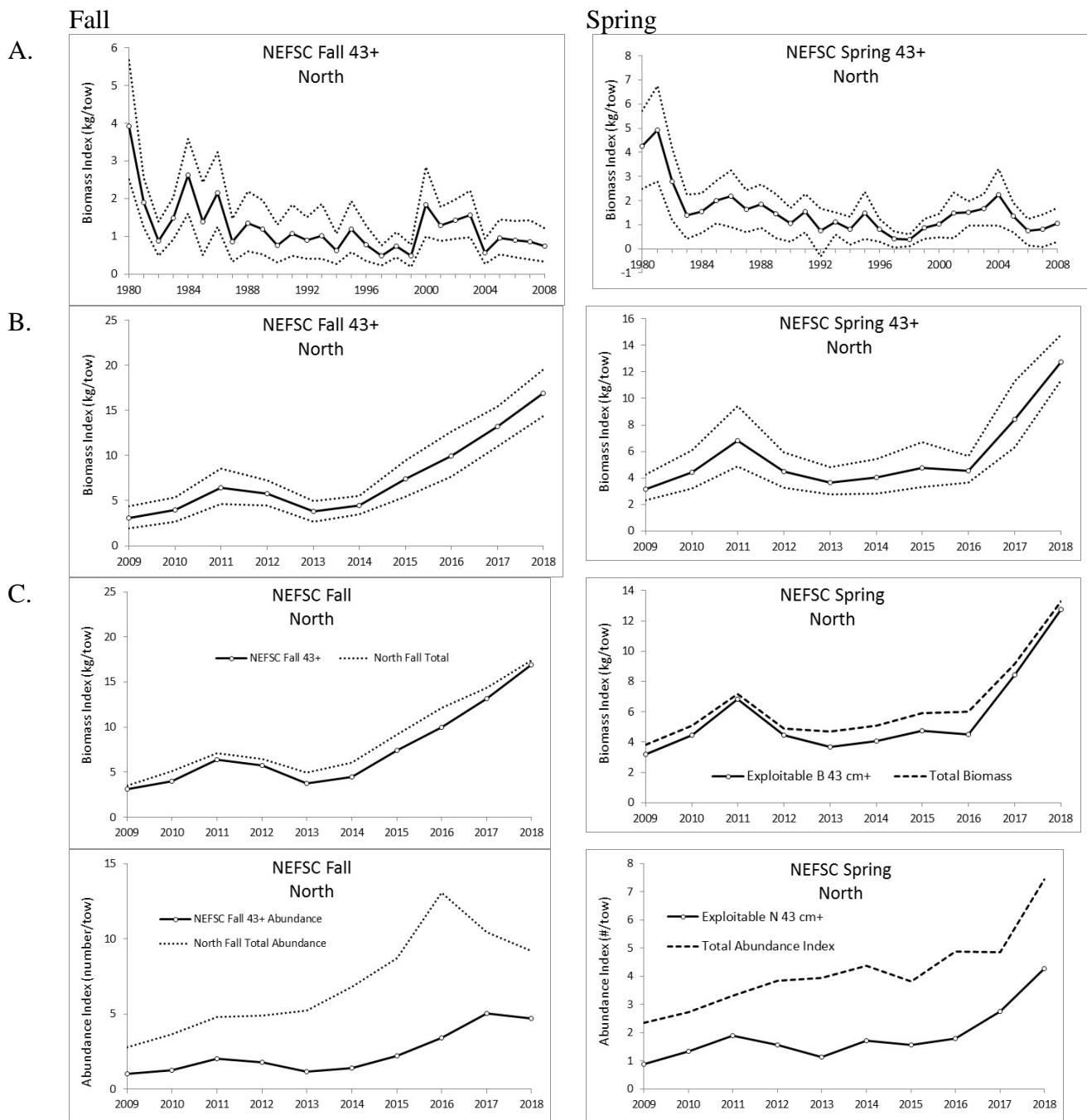


Figure 13. Exploitable biomass (≥ 43 cm total length) indices for monkfish from fall and spring surveys in the NMA. A. Exploitable biomass indices with 95% confidence intervals, 1980-2008 (surveys conducted on RV Albatross). B. Exploitable biomass indices with 95% confidence intervals, 2009-2018 (surveys conducted on RV H.B. Bigelow) C. Total biomass vs. exploitable biomass indices, 2009-2018, D. total abundance vs. exploitable abundance, 2009-2018.

North

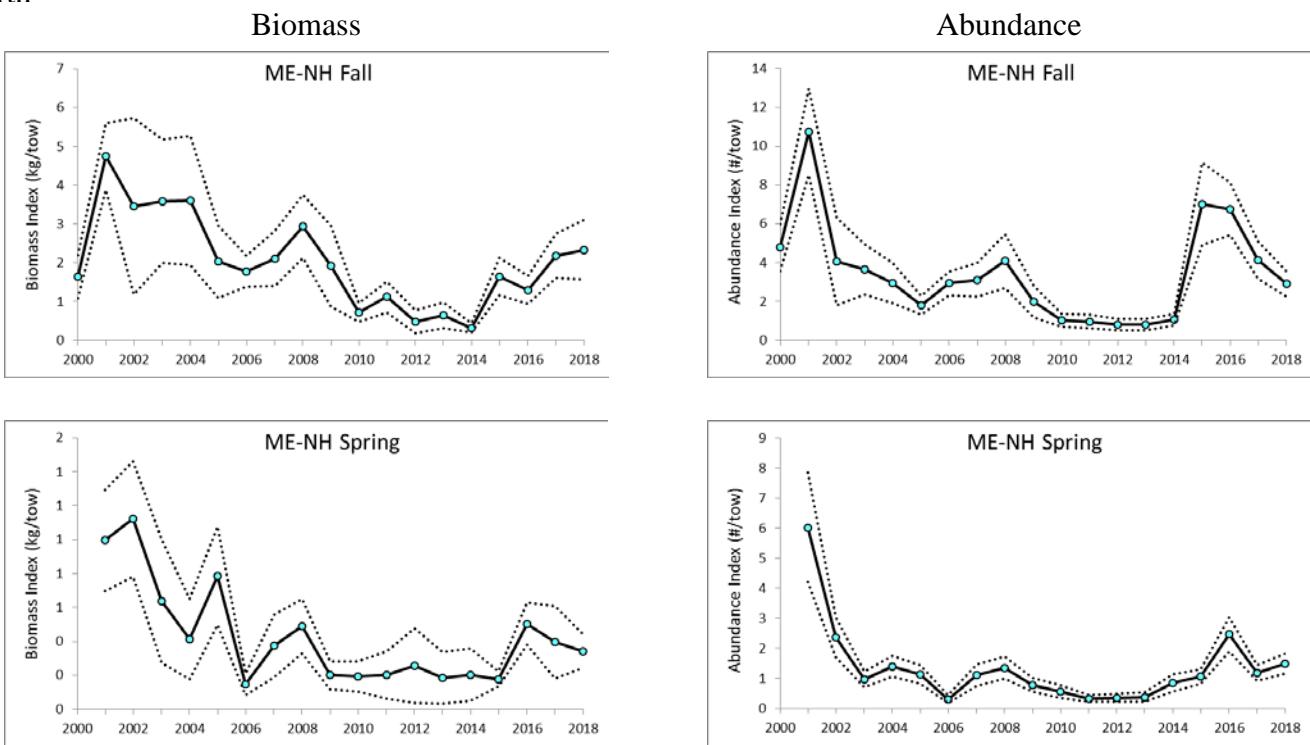


Figure 14. Survey indices for monkfish from Maine-New Hampshire inshore surveys. Data courtesy of Maine Department of Marine Resources.

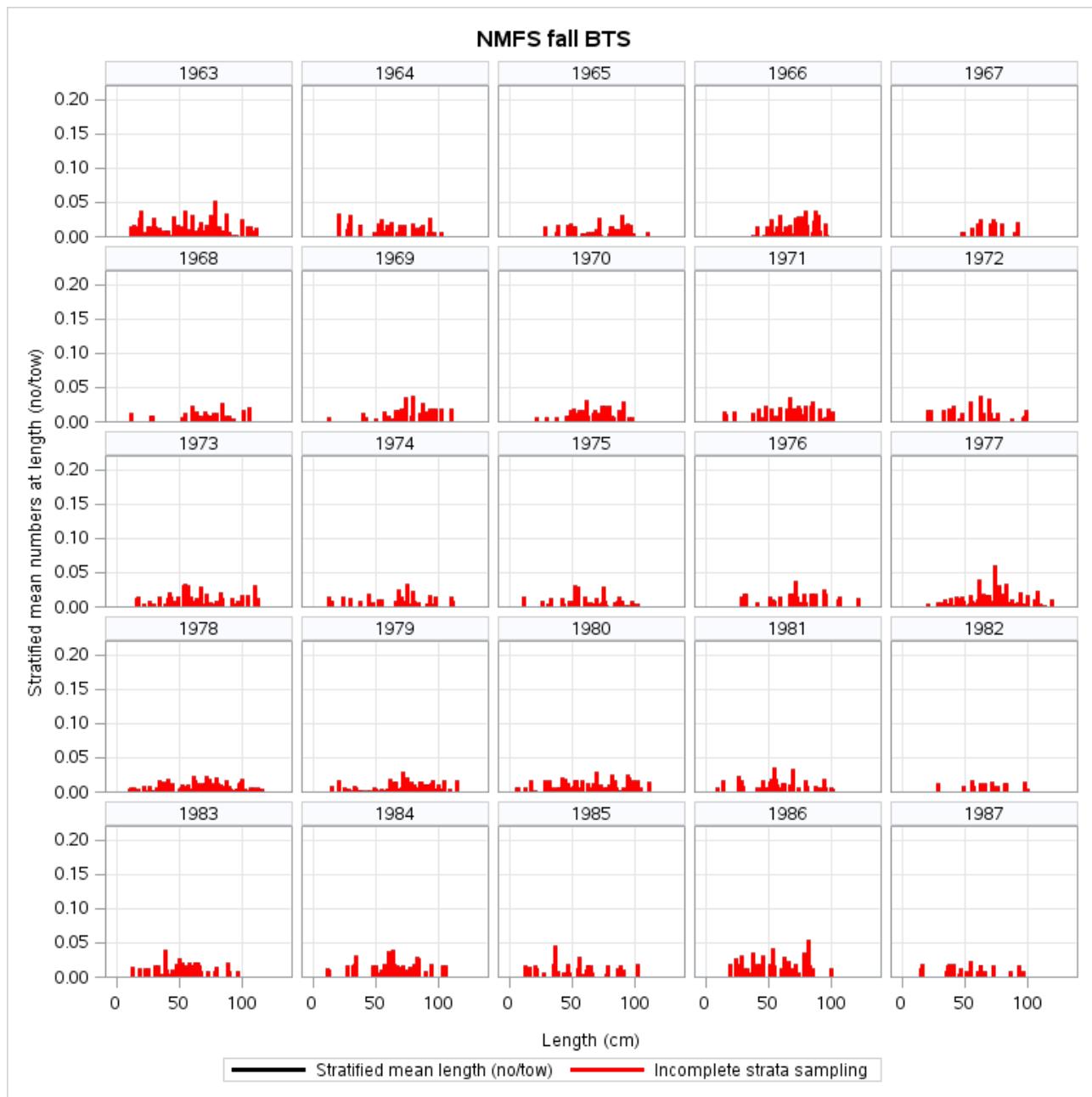


Figure 15. Abundance at length from NEFSC fall surveys in the northern management area.

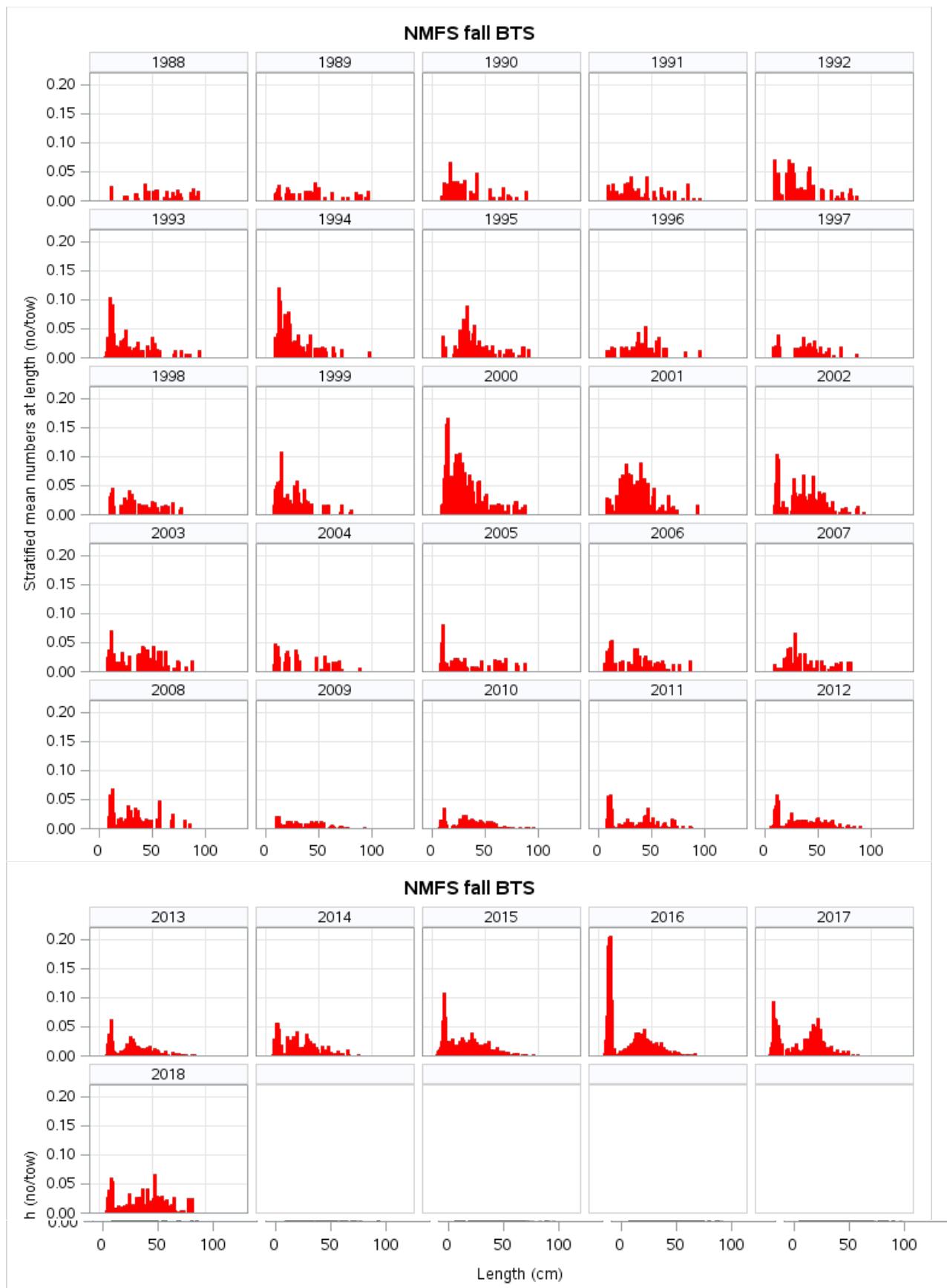


Figure 15, cont'd. (fall surveys, north)

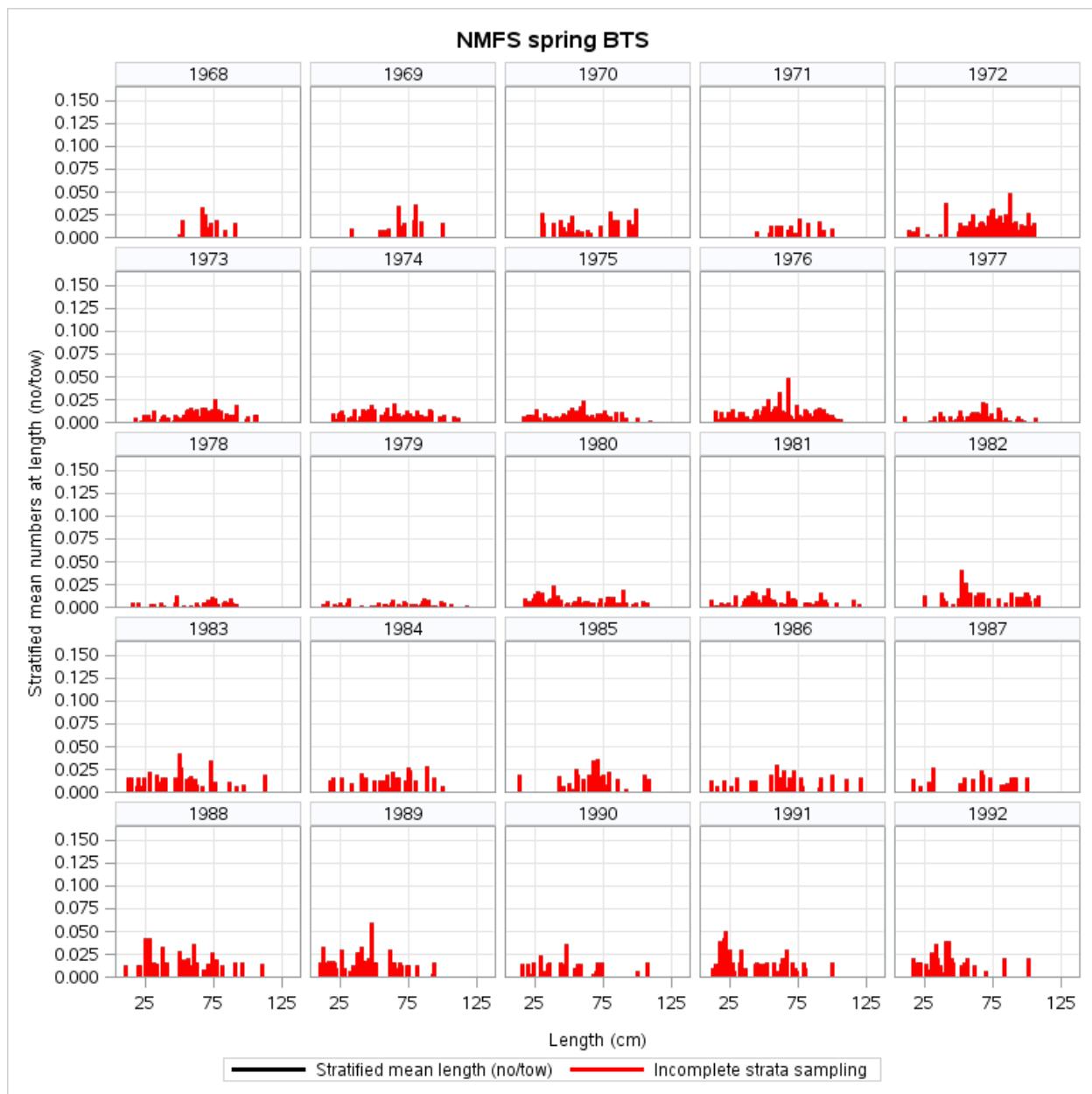


Figure 16. Abundance at length from NEFSC spring surveys in the northern management area.

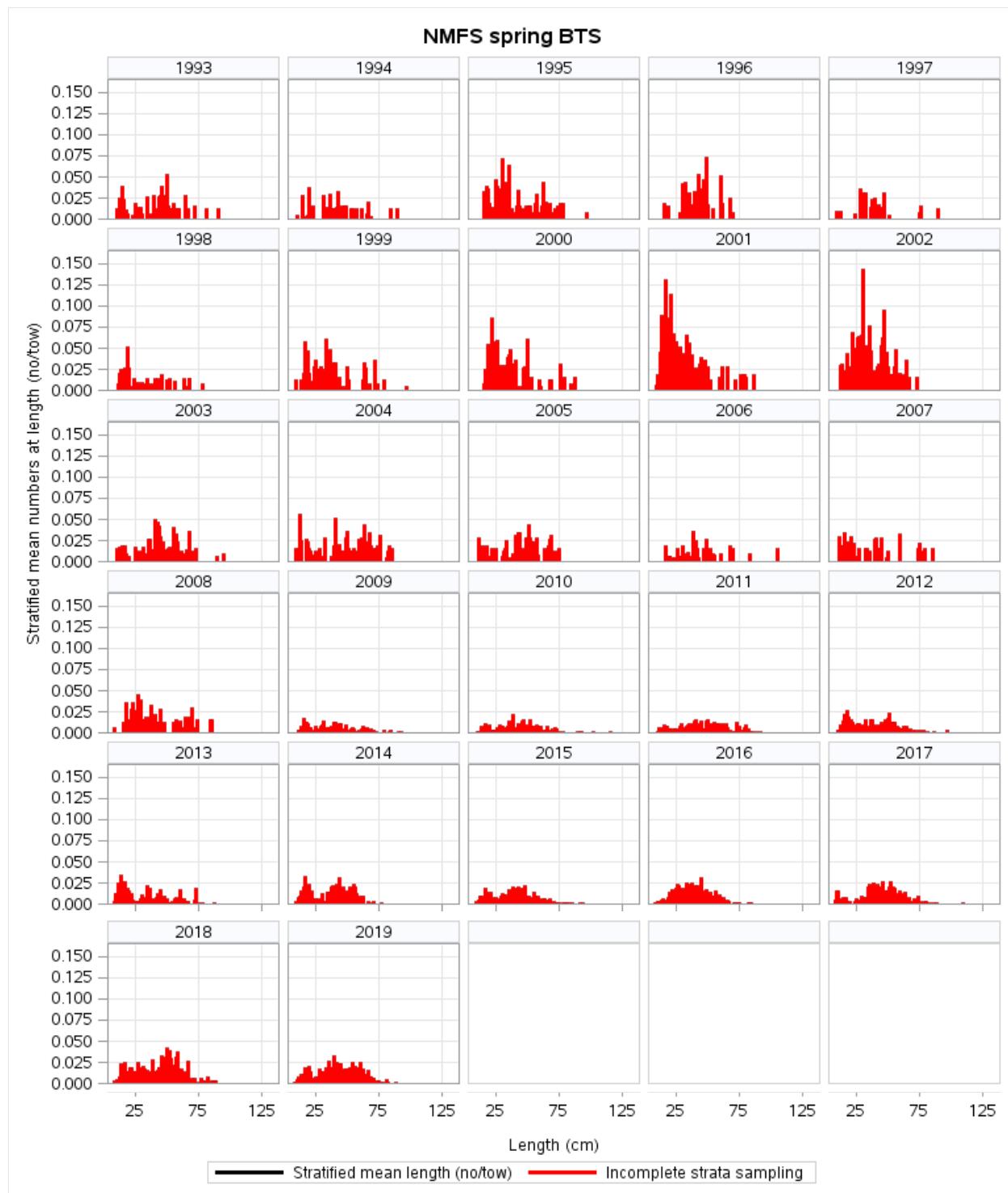


Figure 16, cont'd. (spring surveys, north)

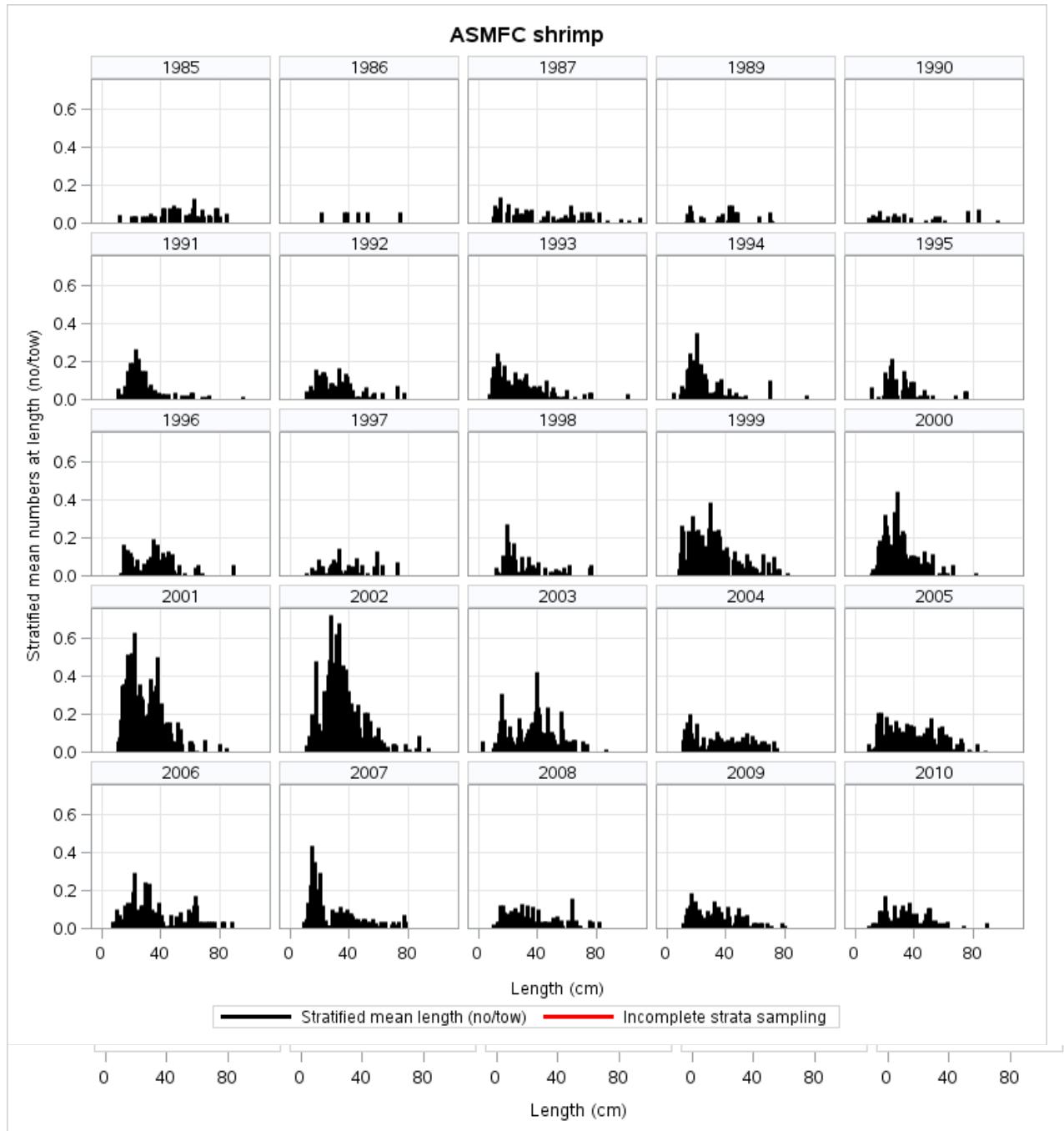


Figure 17. Abundance at length from ASMFC summer shrimp surveys in the northern management area.

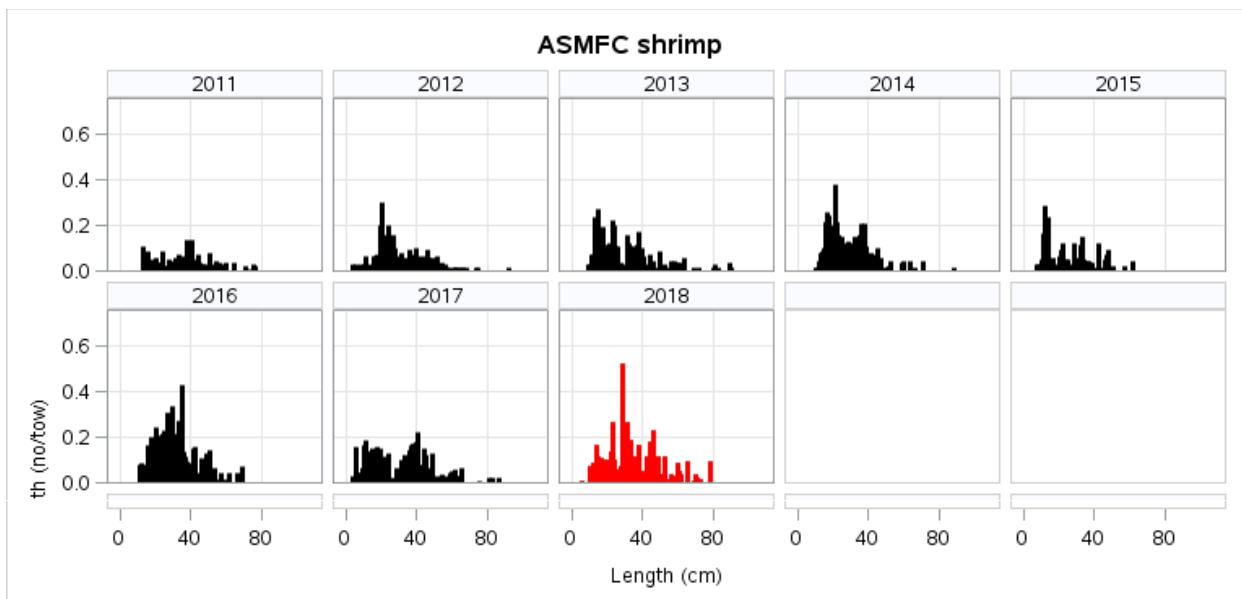


Figure 17, continued (shrimp surveys, north)

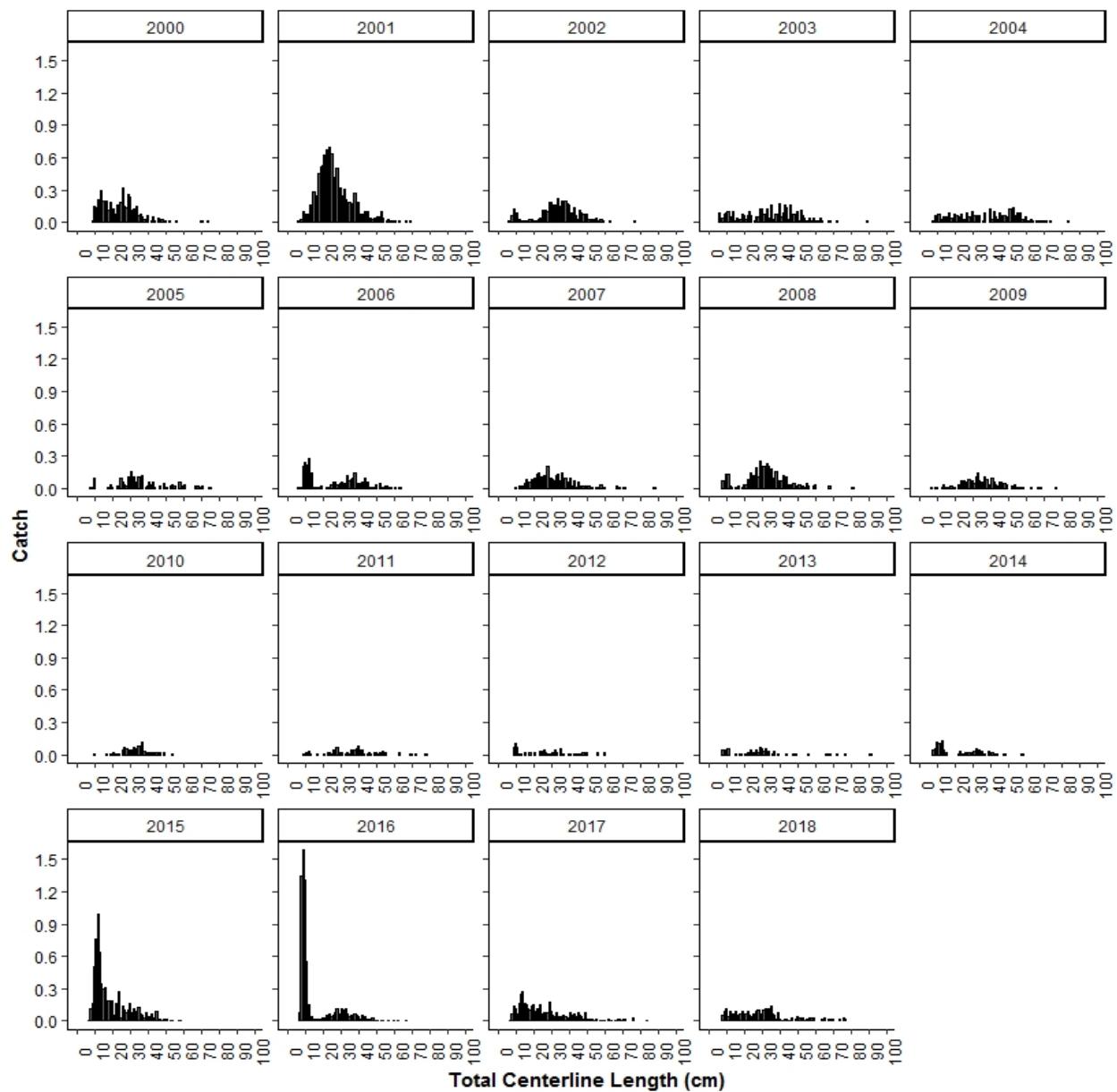


Figure 18. Abundance at length from ME/NH fall inshore trawl surveys in the northern management area. Data courtesy of Maine Department of Marine Resources.

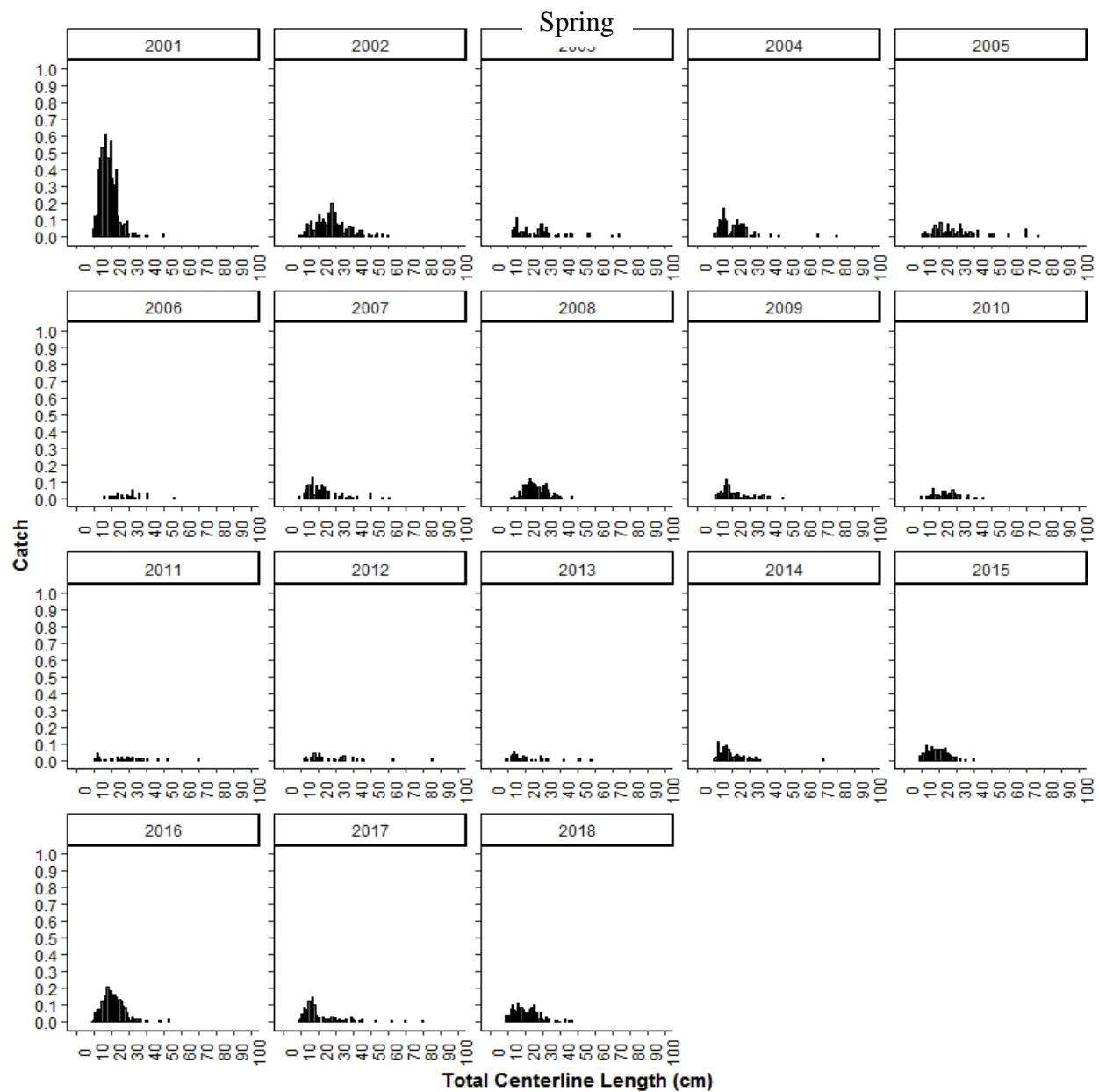
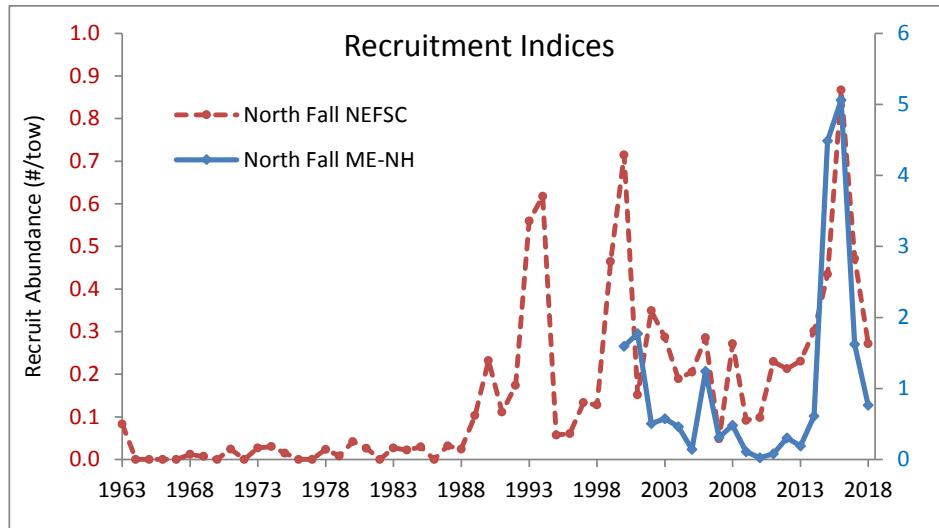


Figure 19. Abundance at length from ME/NH spring inshore trawl surveys in the northern management area. Data courtesy of Maine Department of Marine Resources.

A.



B.

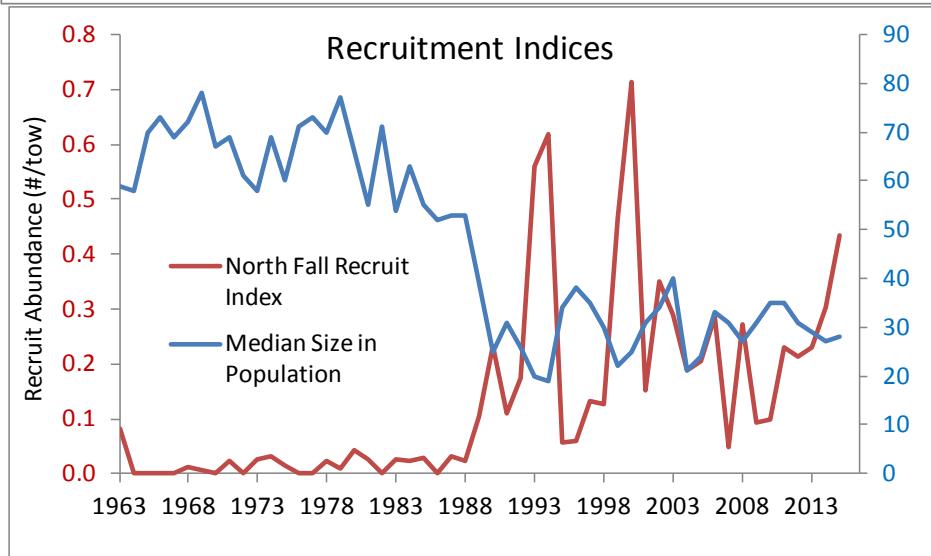


Figure 20. A. Recruitment indices for monkfish in the northern management area. Indices include monkfish in size ranges thought to represent young-of-year (age 0) in each area and season. B. Recruitment indices vs. median size of monkfish in the population (based on NEFSC fall surveys).

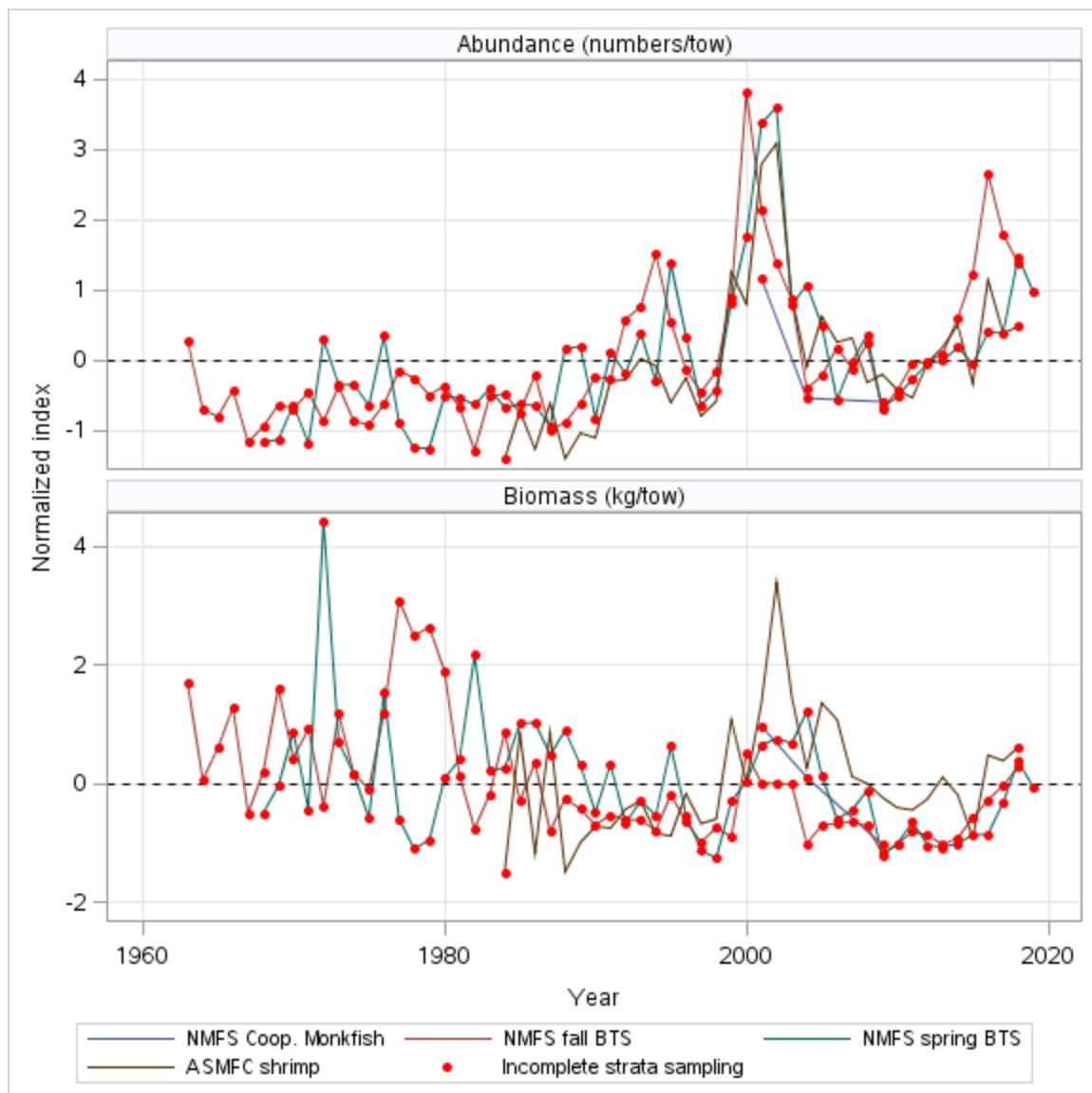
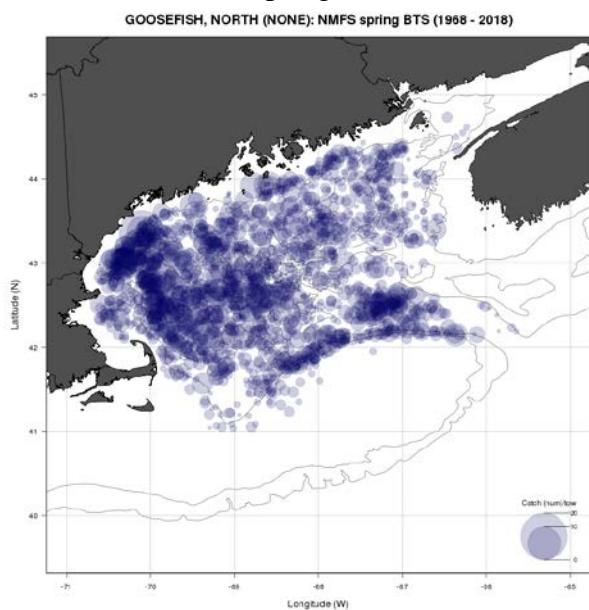
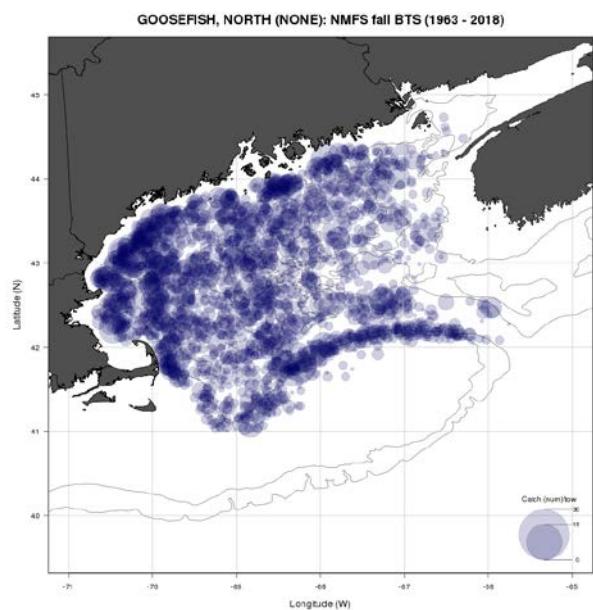


Figure 21. Normalized surveys for monkfish in the NMA.

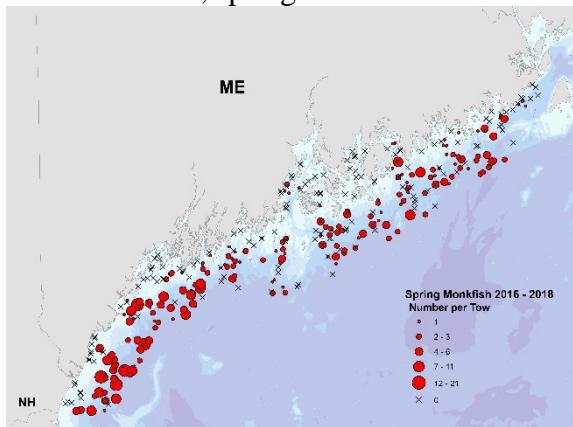
Spring



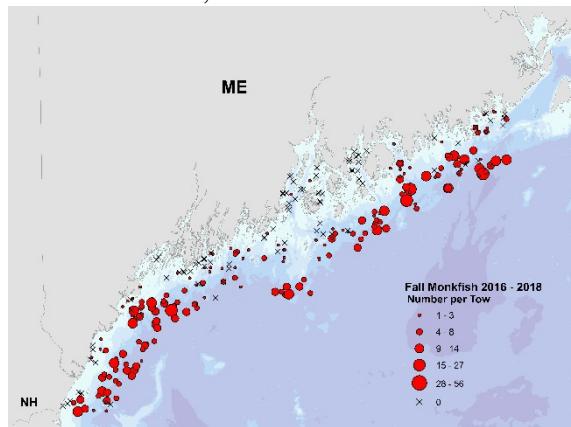
Fall



ME-NH inshore, spring



ME-NH inshore, fall



Summer shrimp

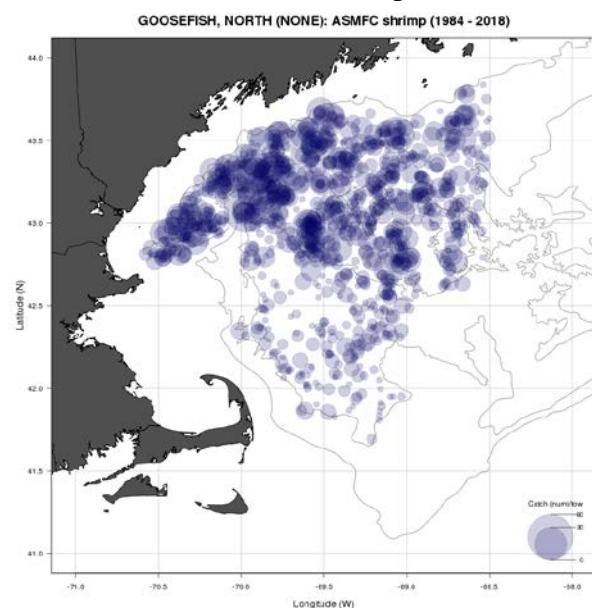


Figure 22. Distribution of monkfish in surveys in the northern management area.

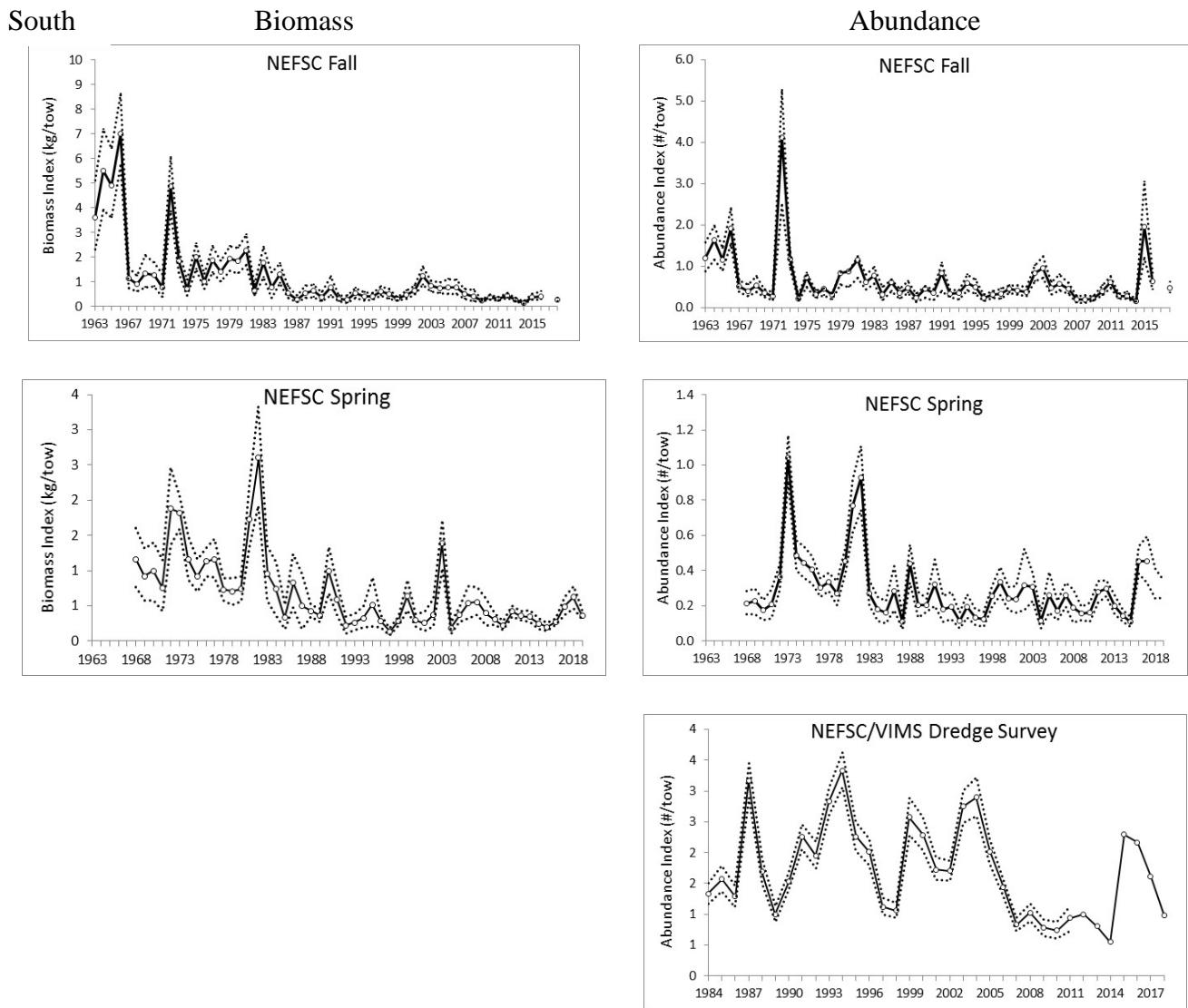


Figure 23. Survey indices for monkfish in the southern management area. Points after 2008 for NEFSC trawl surveys were conducted on the FSV Bigelow, converted to Albatross units as described in the text. Scallop dredge survey indices after 2011 were calculated from combined data from surveys conducted by NEFSC and Virginia Institute of Marine Science.

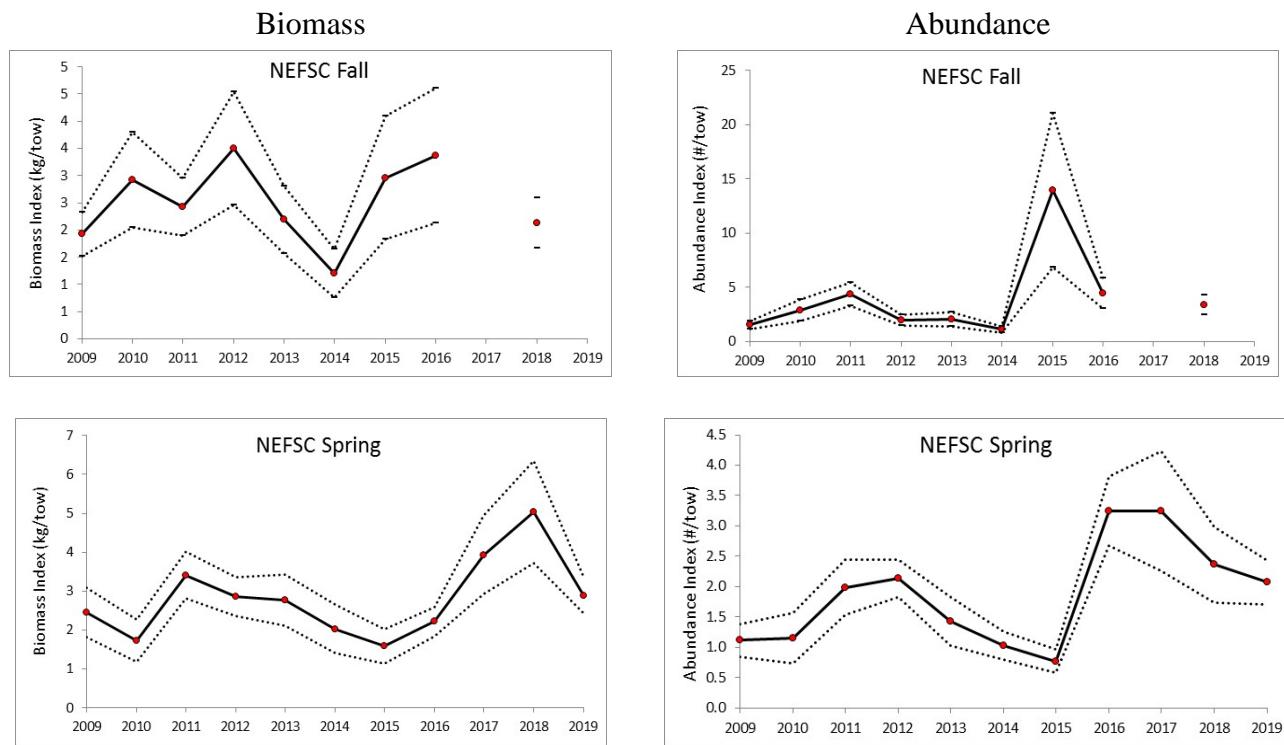


Figure 24. Survey indices from surveys conducted on the FRSV Bigelow in the southern management area, not converted to Albatross units.

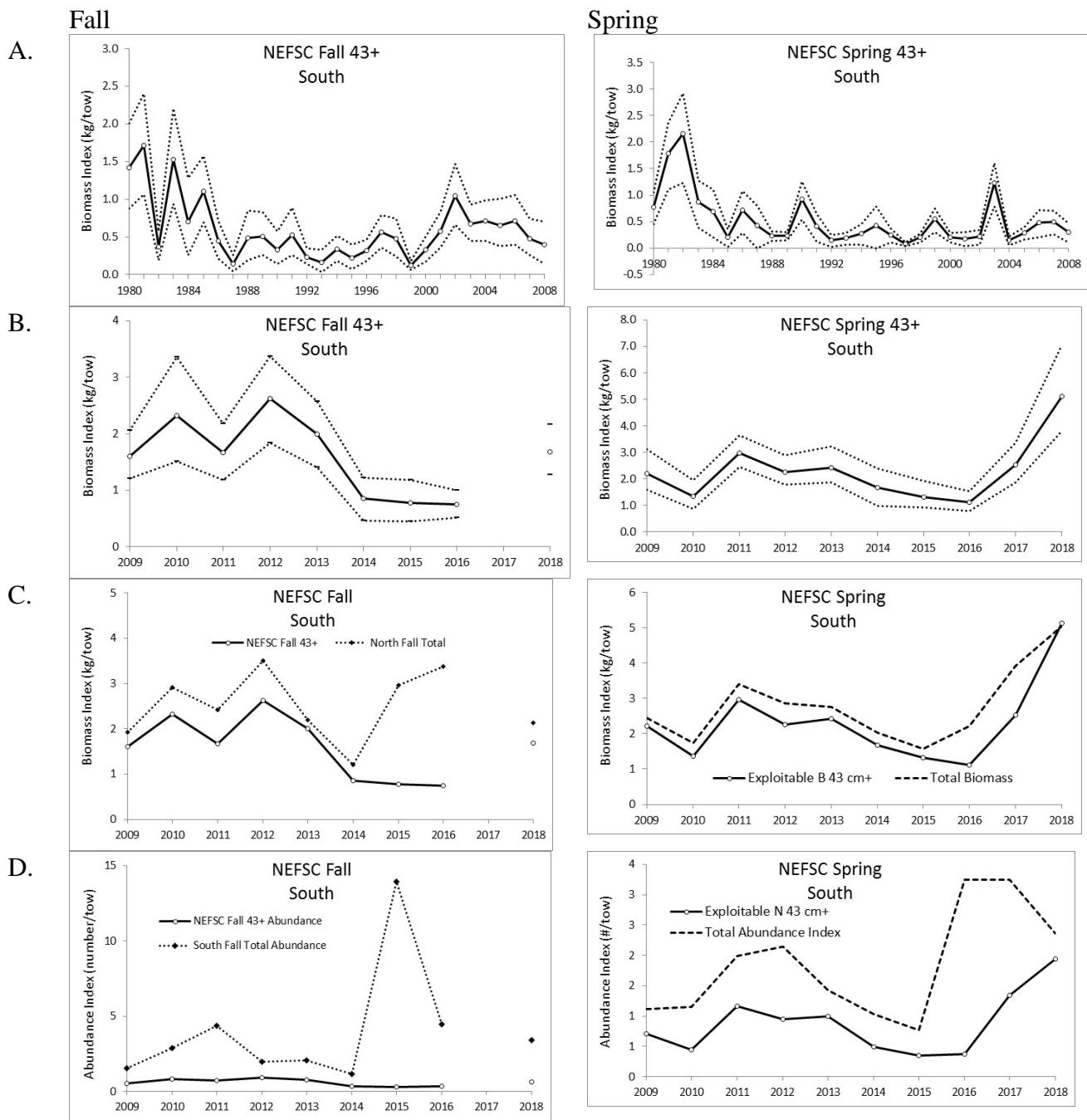


Figure 25. Exploitable biomass (≥ 43 cm total length) indices for monkfish from fall and spring surveys in the SMA. A. Exploitable biomass indices with 95% confidence intervals, 1980-2008 (surveys conducted on RV Albatross). B. Exploitable biomass indices with 95% confidence intervals, 2009-2018 (surveys conducted on RV H.B. Bigelow) C. Total biomass vs. exploitable biomass indices, 2009-2018, D. total abundance vs. exploitable abundance, 2009-2018.

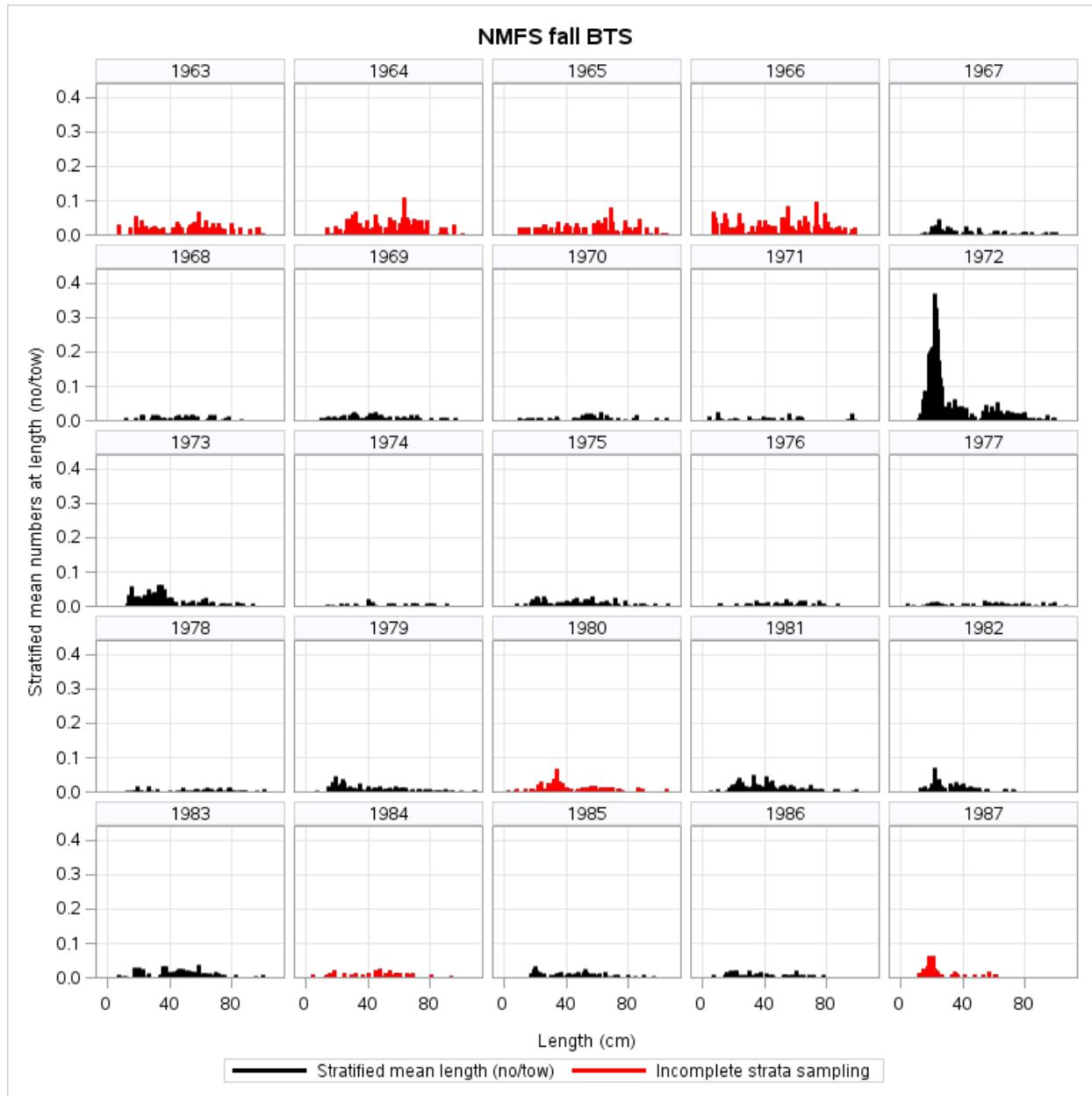


Figure 26. NEFSC fall survey indices of abundance at length, southern management area.

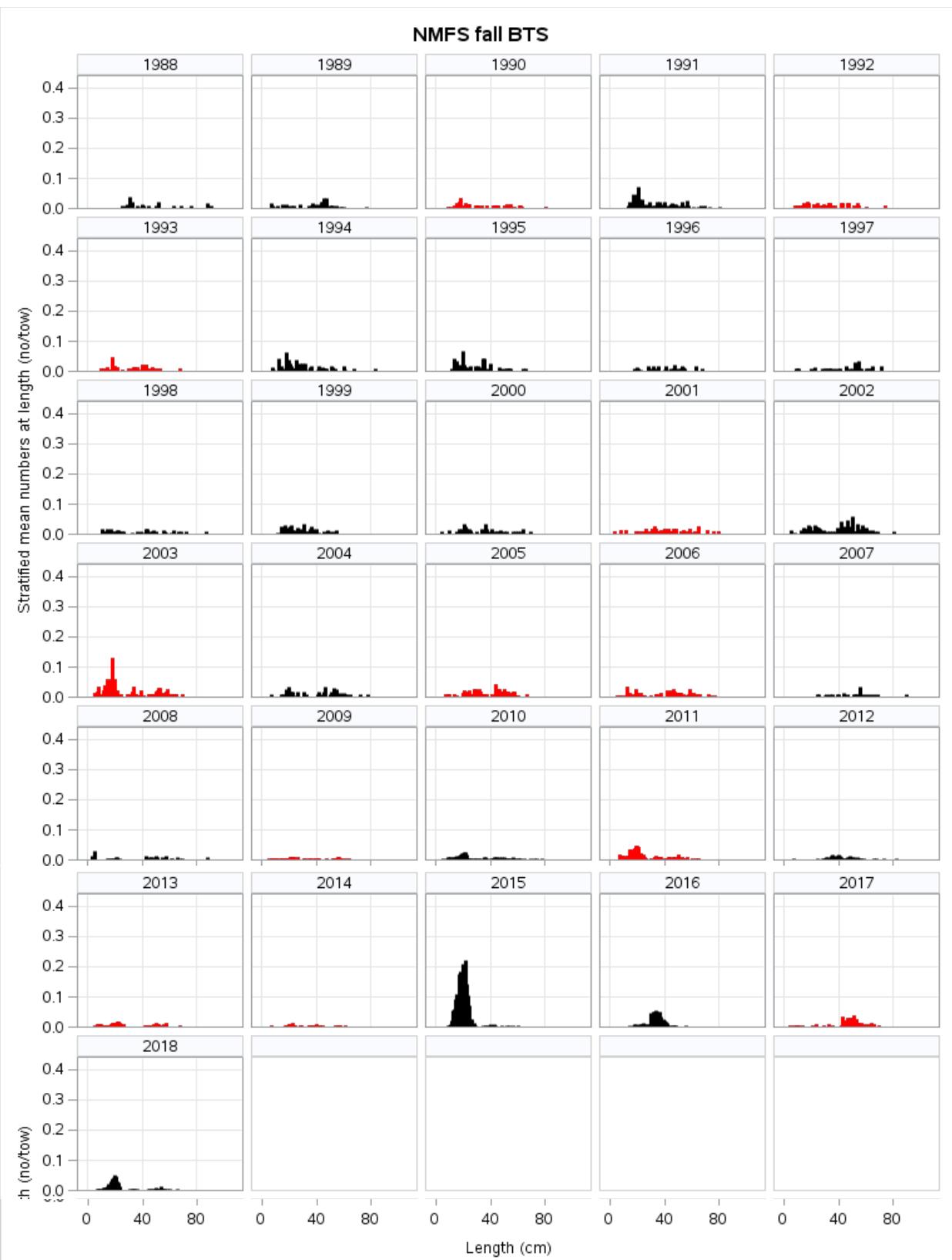


Figure 26, cont'd. (fall survey, south)

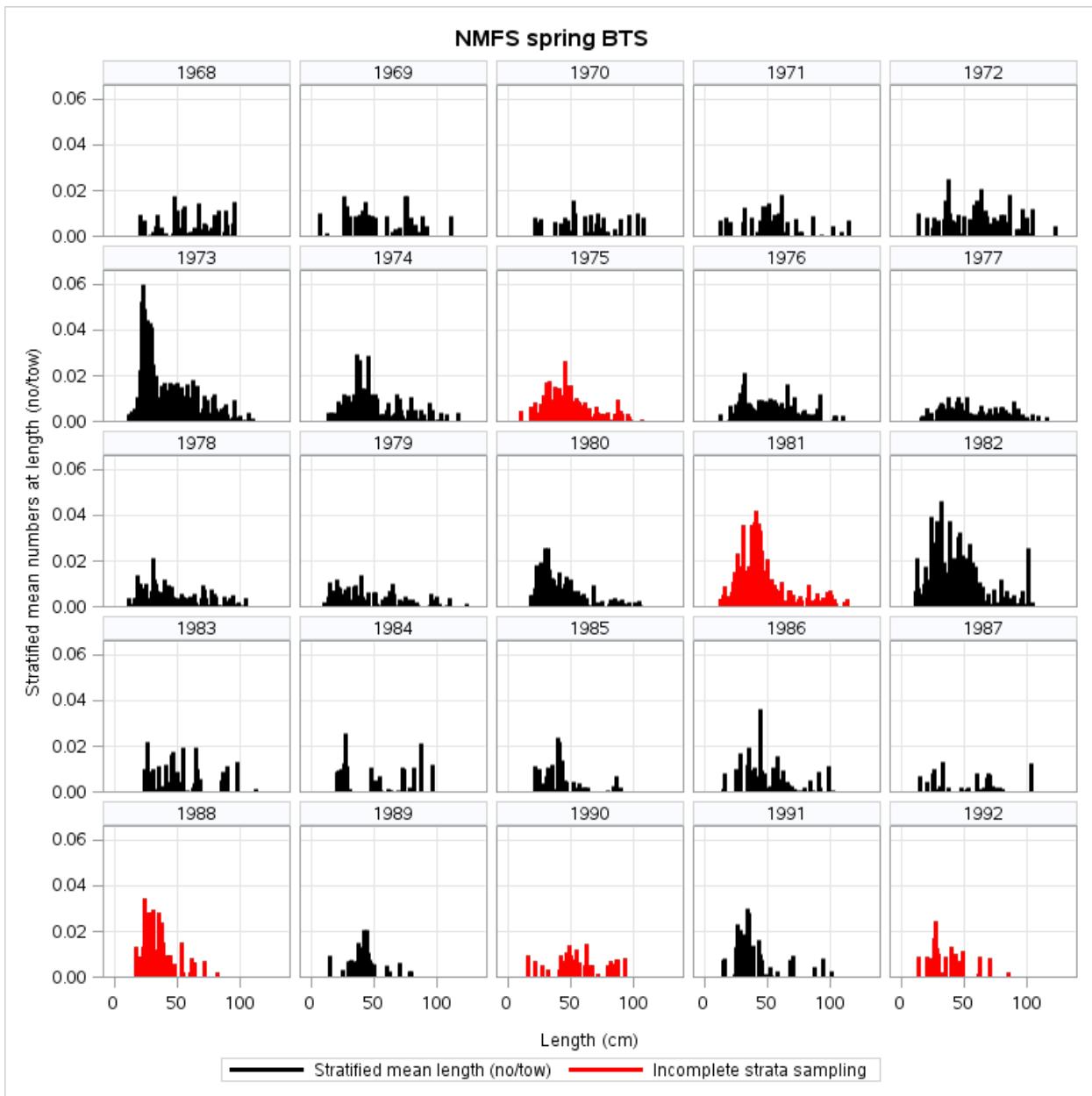


Figure 27. NEFSC spring survey indices of abundance at length, southern management area.

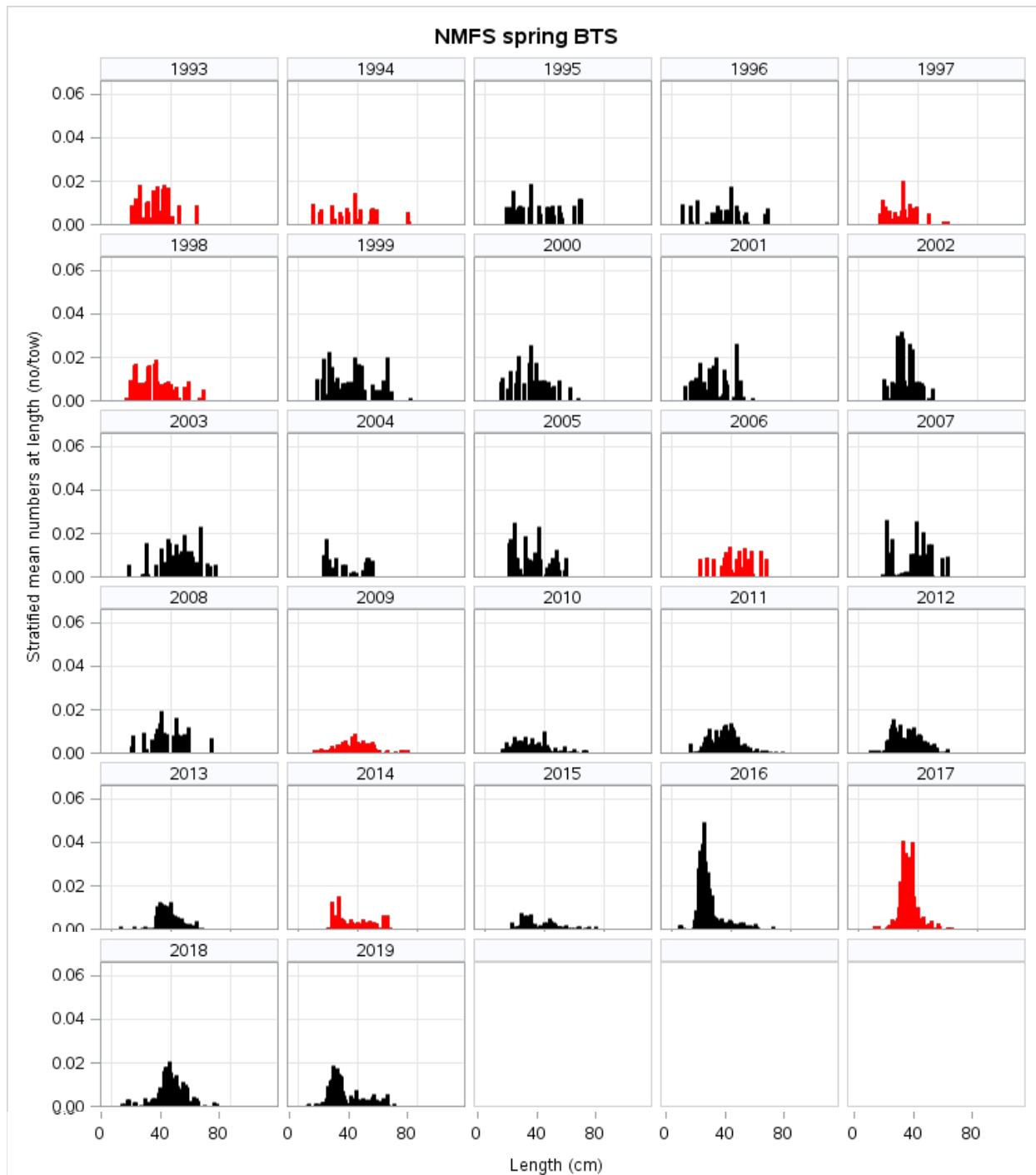


Figure 27, cont'd. (spring survey, south)

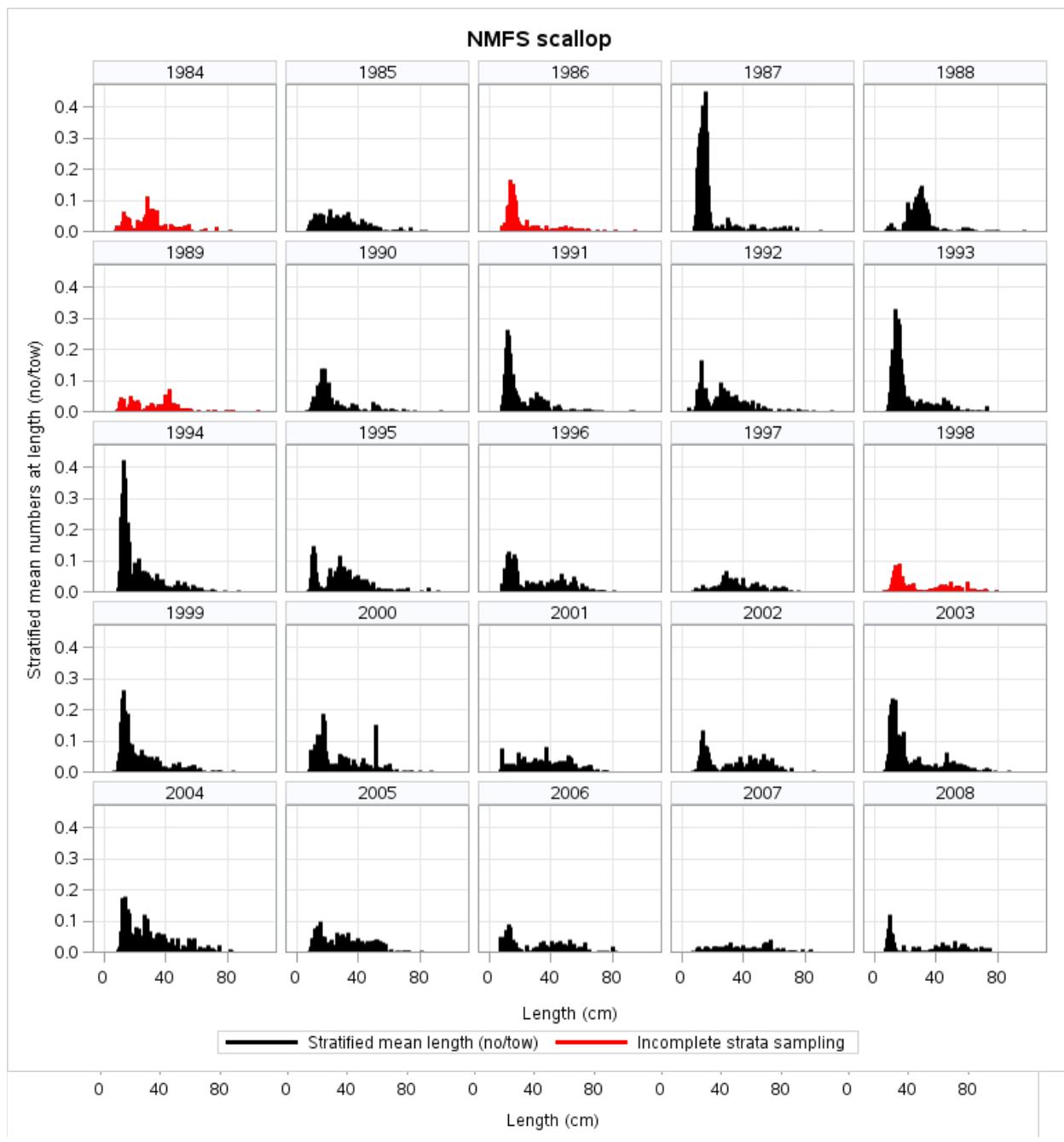


Figure 28. NEFSC spring/summer scallop dredge surveys. Survey timing shifted from summer to spring in 2009. These plots do not include sampling conducted by VIMS after 2011 (see Figure 23).

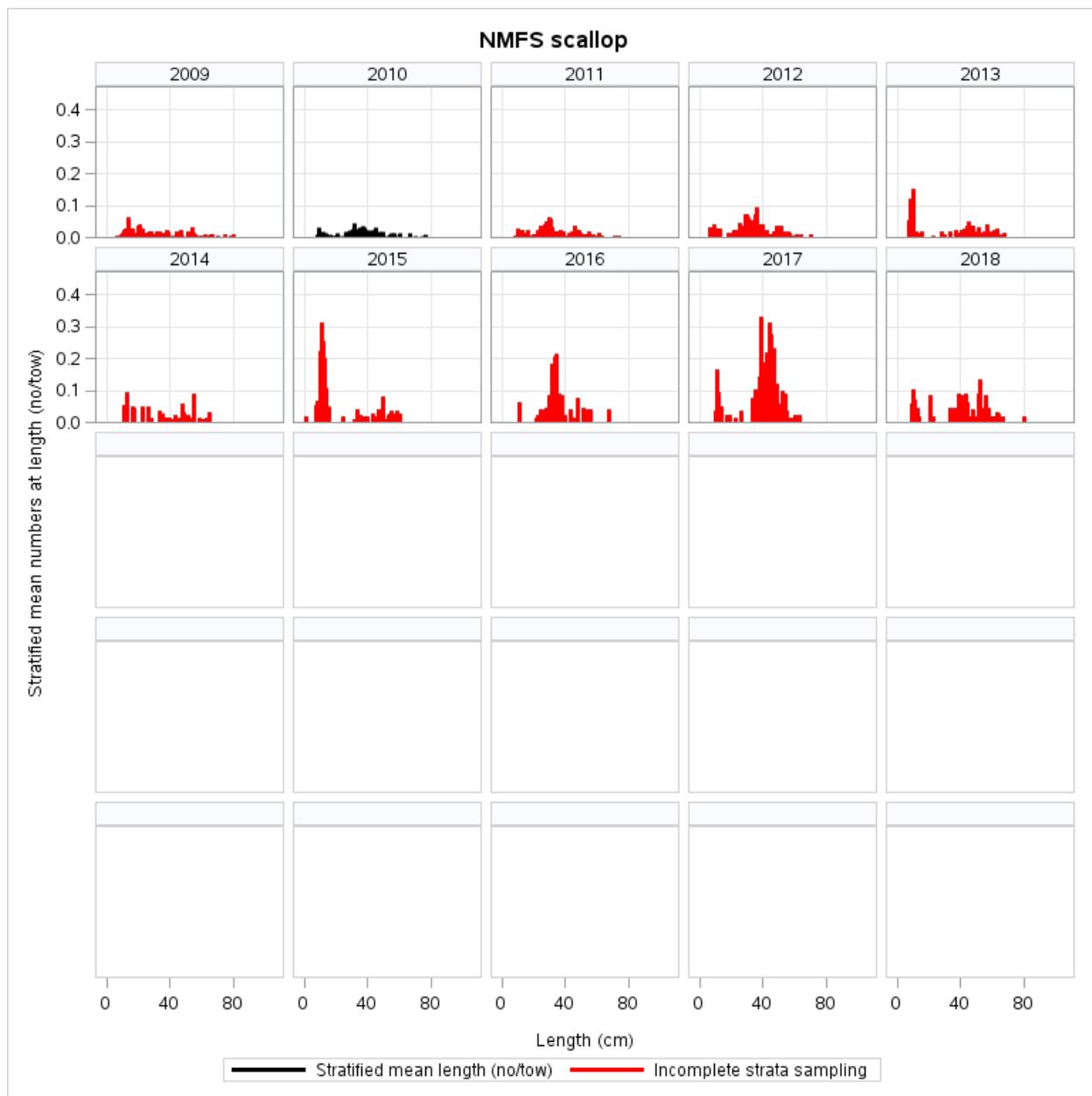


Figure 28, continued (NEFSC scallop dredge survey, south)

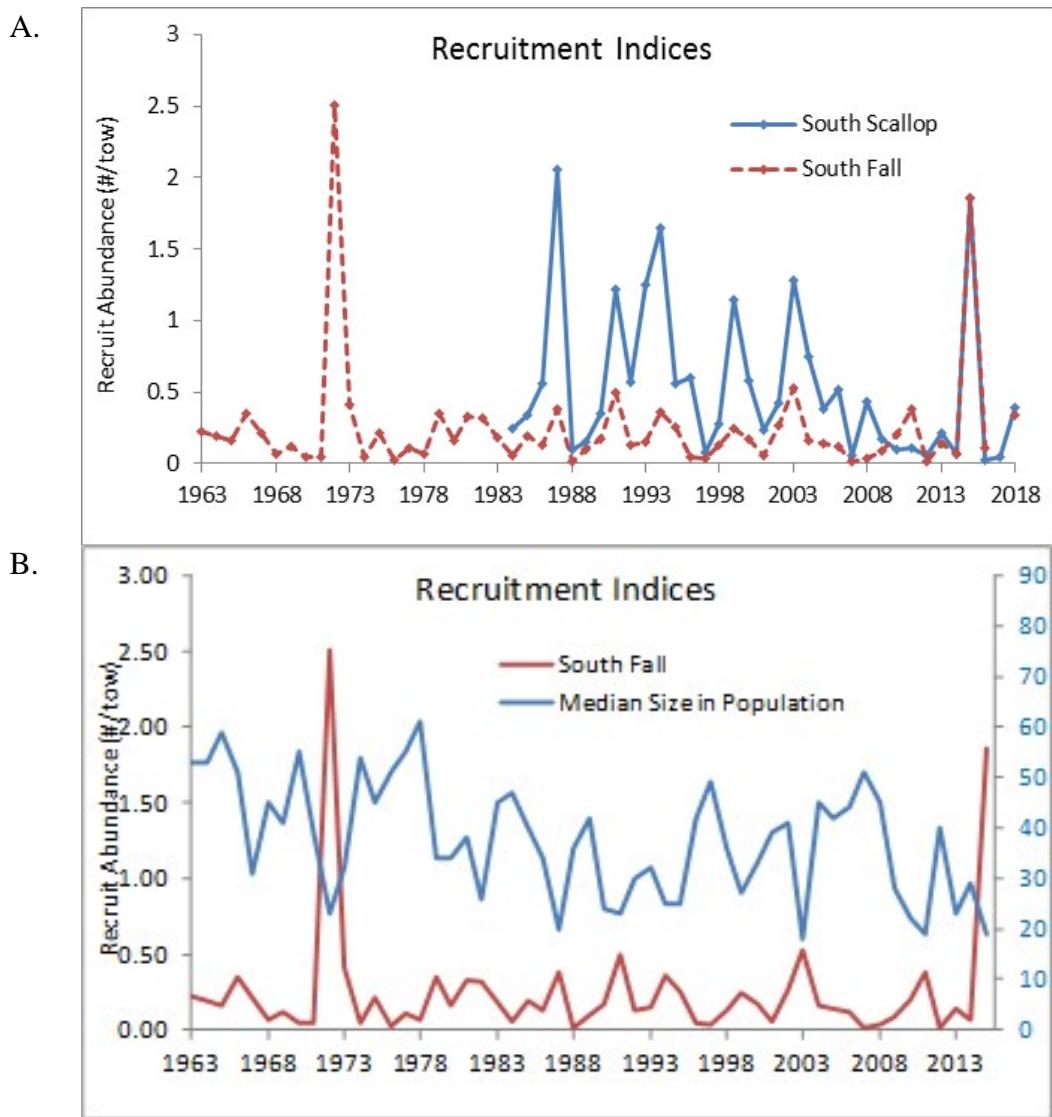


Figure 29. A. Recruitment indices for monkfish in the southern management area. Indices include monkfish in size ranges currently thought to represent young-of-year (age 0) in each season. There are no data for the fall survey in 2017 for the SMA. B. Recruitment indices vs. median size of monkfish in the population (based on NEFSC fall surveys).

D. Monkfish

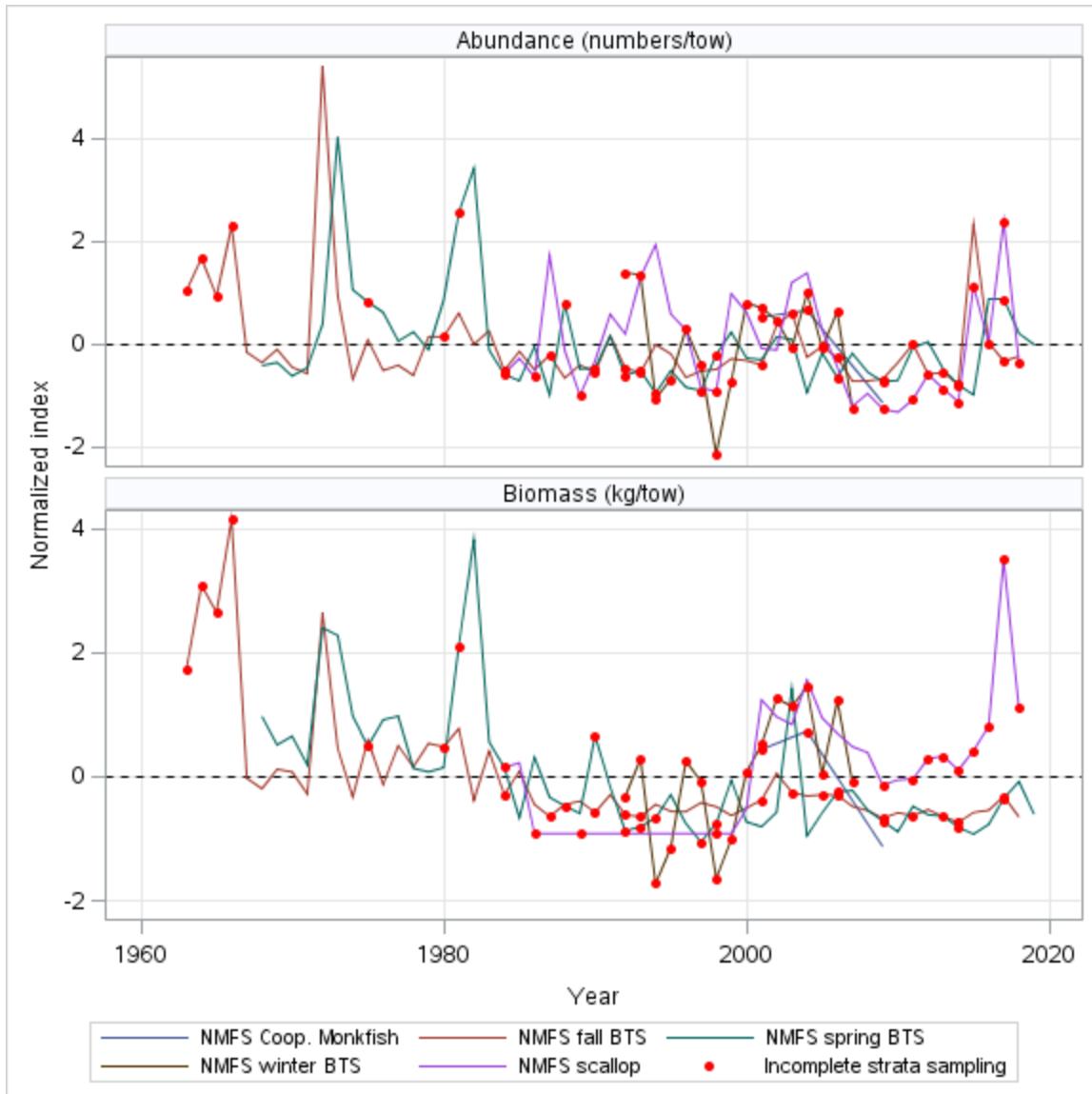


Figure 30. Normalized survey indices for monkfish in the southern management area. Scallop survey indices do not include VIMS portion of the survey starting in 2012.

D. Monkfish

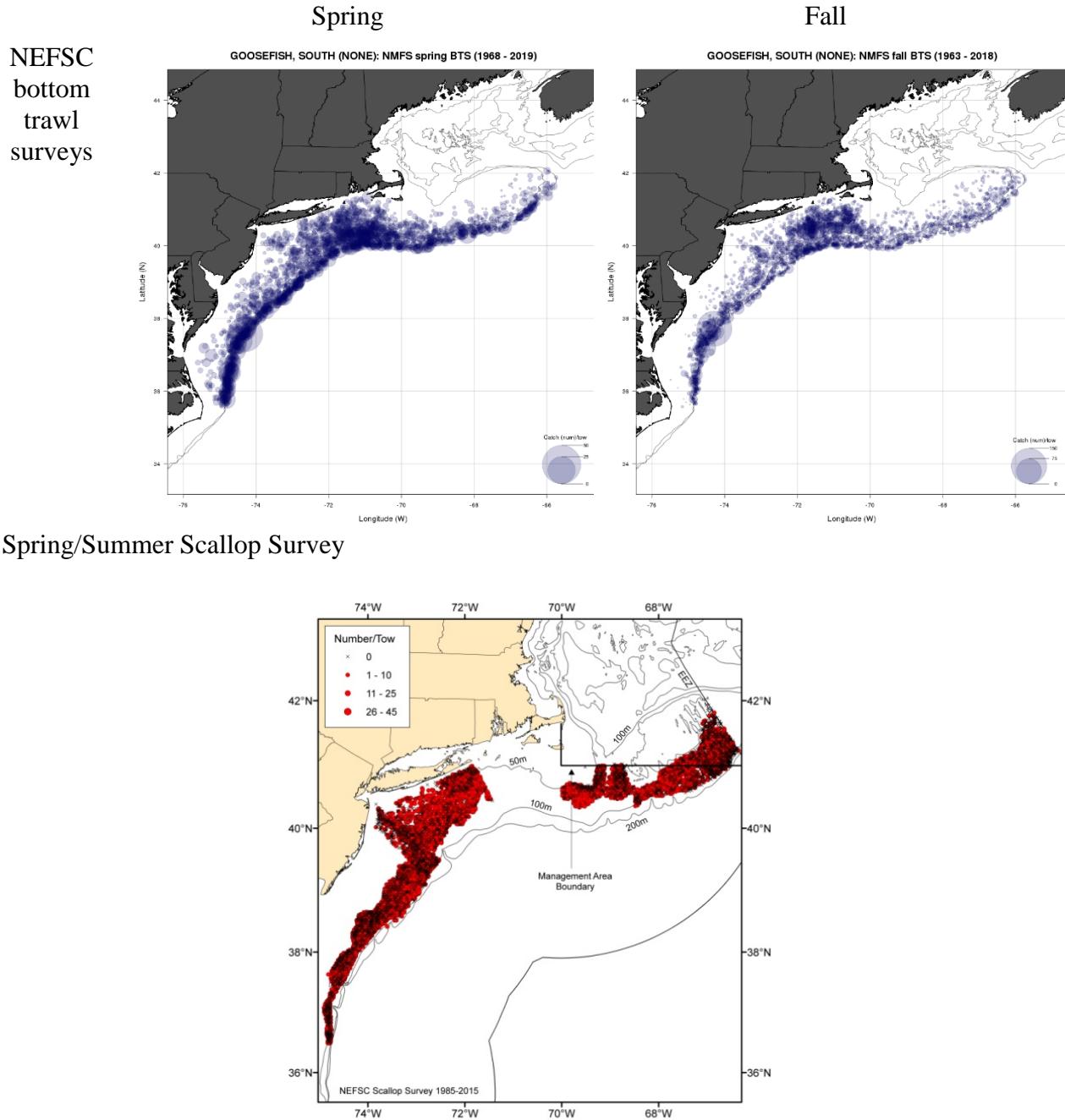


Figure 31. Distribution of monkfish in the southern management area from NEFSC spring (1968-2019) and fall (1963-2018) bottom trawl surveys and NEFSC and NEFSC/VIMS spring/summer scallop dredge surveys (1984-2015).

D. Monkfish

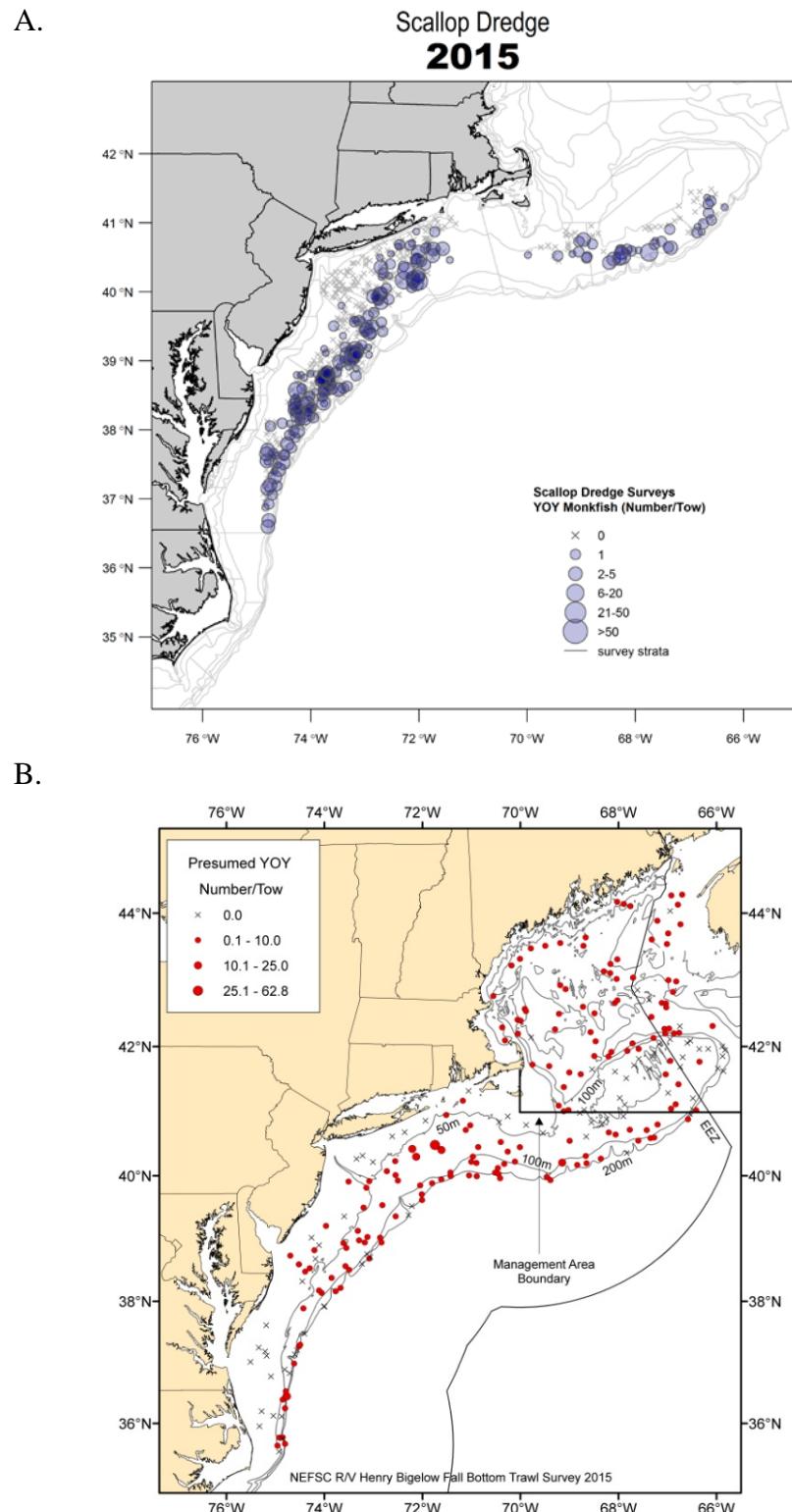


Figure 32. Distribution of presumed young-of-year monkfish in 2015 in (A.) NEFSC and VIMS scallop dredge survey tows (late spring), and (B.) NEFSC fall surveys.

D. Monkfish

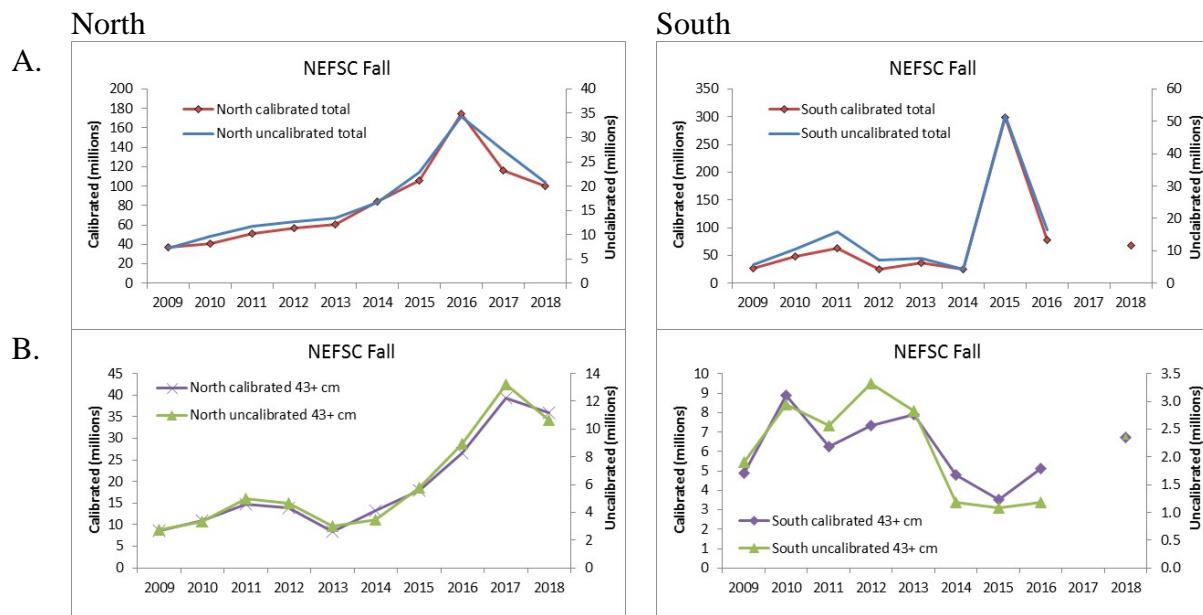


Figure 33. Area-swept abundance estimated from NEFSC fall surveys using adjustments from chain-sweep study compared to unadjusted estimates. A. total abundance, B. exploitable abundance (43+ cm).

D. Monkfish



Figure 34. Estimates of relative exploitation from NEFSC fall surveys using minimum area-swept numbers or biomass adjusted for sweep type (adjusted to chain sweep), assuming that 100% of monkfish encountered by the trawl are captured and not accounting for missed strata in some years.

D. Monkfish

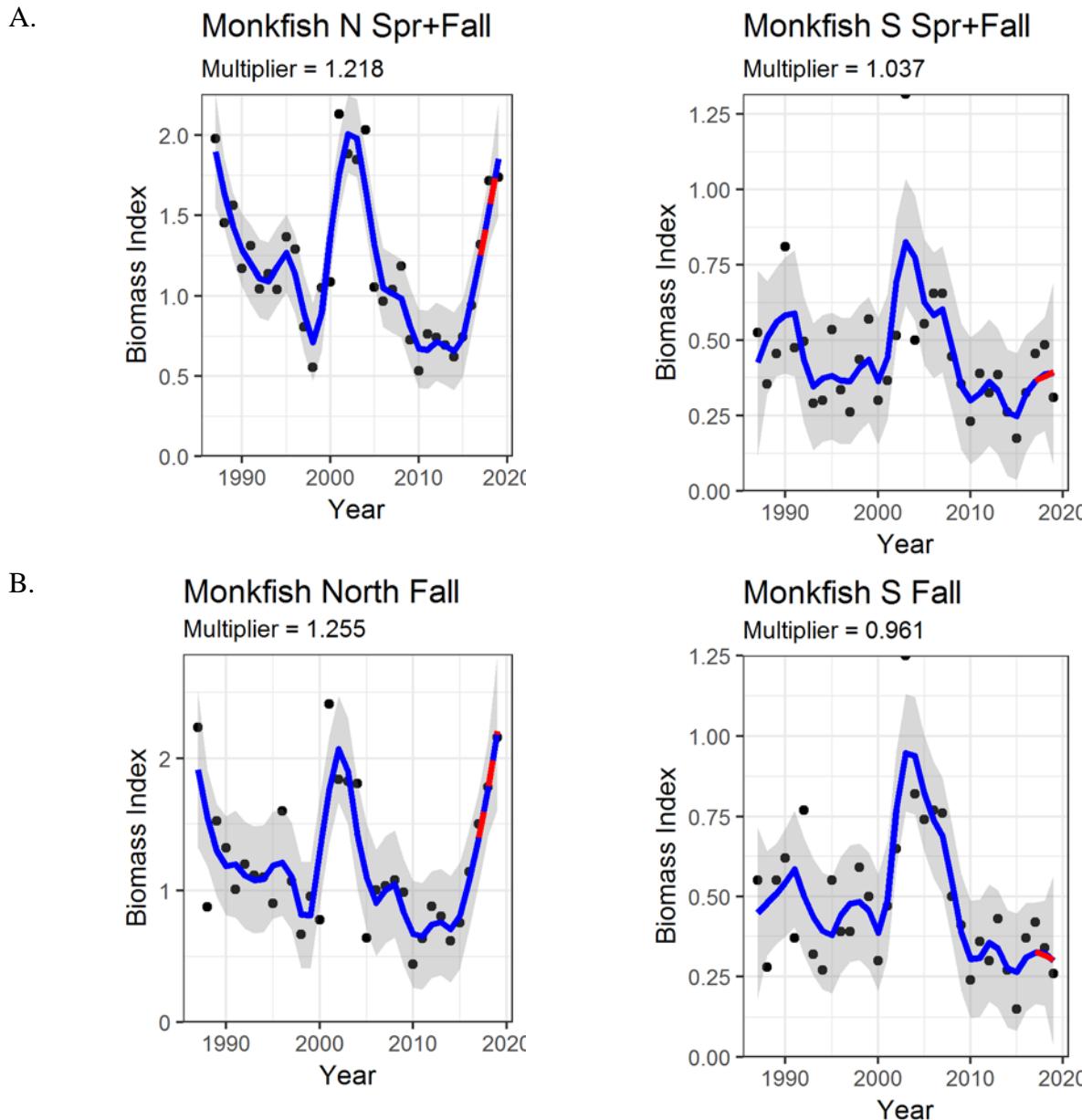


Figure 35. Results of “Plan B” analysis. Points are observed biomass indices, lines are loess-smoothed indices, “multiplier” is slope of log-linear regression through terminal three smoothed points. A. Results using both spring and fall indices, B. Results using fall survey indices only.