B. ASSESSMENT OF NORTHEAST SKATE SPECIES COMPLEX

Report of the SAW Southern Demersal Working Group
(Members are listed at front of Report)

(EDITOR'S NOTE: In this skate assessment report, tables and figures are numbered according to Term of Reference, TOR. For example, Figure 3.1 would be the first figure for TOR 3.)

1.0 EXECUTIVE SUMMARY AND TERMS OF REFERENCE

TOR 1. Characterize the commercial and recreational catch including landings and discards.

The principal commercial fishing method in the directed skate fishery is otter trawling. Skates are frequently taken as bycatch during groundfish trawling and scallop dredge operations and discarded. Recreational and foreign landings are currently insignificant. There are few regulations governing the harvesting of skates in U.S. waters. Skates have been reported in New England fishery landings since the late 1800s. Reported commercial fishery landings, primarily from off Rhode Island, however, never exceeded several hundred metric tons until the advent of distant-water fleets and the industrial fishery during the 1950s and 1960s. Skate landings reached 9,500 mt in 1969 primarily from the distant water fleet, but declined quickly during the 1970s, falling to 800 mt in 1981. Since that time, landings have increased, partially in response to increased demand for lobster bait, and more significantly, to the increased export market for skate wings. Landings are not reported by species, with over 99% of the landings reported as "unclassified skates." Wings were likely taken from large-bodied skates (winter, thorny and barndoor), with winter and thorny skate currently known to be used for human consumption. Bait landings are presumed to be primarily from little skate, based on areas fished and known species distribution patterns. Landings increased to 12,900 mt in 1993 and then declined somewhat to 7,200 mt in 1995. Landings increased again and the 2004 reported commercial landings of 16,073 mt were the highest on record. Estimates of discards suggest they may be 2-4 times larger than the average landings. The commercial fishery discard mortality rates by species are unknown.

Aggregate recreational landings of the seven species in the skate complex are relatively insignificant when compared to the commercial landings, never exceeding 300 mt during the 1981-1998 time series of Marine Recreational Fishery Statistics Survey (MRFSS) estimates. The number of skates reported as released alive averages an order of magnitude higher than the reported landed number. Party/charter boats have historically been undersampled compared to the private/rental boat sector that accounts for most of the recreational catch, and may have a different discard rate. The recreational fishery release mortality rate of skates is unknown, but is likely comparable to that for flounders and other demersal species, which generally ranges from 10-15%. Assuming a 10-15% release mortality rate would suggest that recreational fishery discard mortality is of about the same magnitude as the recreational landings.

TOR 2. Estimate fishing mortality, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates. If possible, also include estimates for earlier years.

Fishing Mortality

(EDITOR'S NOTE: MODEL-BASED FISHING MORTALITY ESTIMATES WERE PROPOSED; BUT THEY WERE REJECTED BY THE REVIEW PANEL)

Total Biomass

NEFSC survey data were the primary source of information to index biomass of skate species. Indices of winter skate abundance and biomass from the NEFSC autumn surveys were stable, but below the time series mean, during the late 1960s and 1970s. Winter skate indices increased to the time series mean by 1980, and then reached a peak during the mid 1980s. Winter skates indices began to decline in the late 1980s. Current NEFSC indices of winter skate abundance are below the time series mean, at about the same value as during the early 1970s. Current NEFSC indices of winter skate biomass are about 20% of the peak observed during the mid 1980s. Indices of little skate abundance and biomass from the NEFSC spring were stable, but below the time series mean, during the 1970s. Little skate spring survey indices began to increase in 1982, reached a peak in 1999, and declined thereafter. Indices of barndoor skate abundance and biomass from the NEFSC autumn surveys were at the highest values during early to late 1960s, and then declined to 0 fish per tow during the early 1980s. Since 1990, autumn survey indices have steadily increased, with the survey nearing the peak values found in the 1960s. NEFSC autumn survey indices for thorny skate have declined continuously over the last 40 years. NEFSC indices of thorny skate abundance have declined steadily since the late 1970s, reaching a historically low value in 2005 is less than10% of the peak observed in the 1970s. Indices of smooth skate abundance and biomass from the NEFSC autumn survey were at a peak during the late 1970s. NEFSC survey indices declined during the 1980s, before stabilizing during the early 1990s at about 25% of the values of the 1970s. NEFSC spring and autumn survey indices for clearnose skate increased from the mid-1980s through 2000 and have since declined to about average values. Indices of rosette skate abundance and biomass from the NEFSC surveys were at a peak during 1975-1980, before declining through 1986. NEFSC survey indices for rosette skate increased from 1986 through 2001, declined slightly and recent indices are near the peak values of the late 1970s.

Spawning Stock Biomass:

Winter skate SSB generally follows the pattern of the autumn total biomass index with very low values in the 1970s followed by the large expansion of the size composition in the 1980s. The index of SSB declined in the mid- to late 1990s, increased slightly, and is currently at low values. Little skate SSB has been fairly stable through the time series with slightly higher values from 1999-2004 than in the 1980s and early 1990s. The pattern in barndoor skate SSB indices is much the same as that of total biomass with high values in the early 1960s, followed by very low to nonexistent values in the 1970s and

1980s, and then a consistent increase in the 1990s and 2000s. The decline in thorny skate SSB indices is more pronounced than for the total biomass index. Smooth skate SSB indices are very variable, but exhibit a slight decline over the time series. Clearnose skate SSB has increased over the time period. Rosette skate SSB has been variable but has generally increased.

TOR 3. *Either update or redefine biological reference points (BRPs; proxies for BMSY and FMSY), as appropriate. Comment on the scientific adequacy of existing and redefined BRPs.*

Existing Reference Points:

Biomass reference points (Figure B2) are based entirely on survey data because commercial catches are not available by species. For all species except barndoor, the B_{msy} proxy (B_{target}) is estimated as the 75th percentile of the appropriate survey series for that species (see Summary Status Table). For barndoor skate, the B_{msy} proxy is the average of the autumn survey biomass indices from a short period, 1963-1966. This period is used for barndoor skates because the survey captured few barndoor skates for a protracted period after these years. The stocks are declared to be overfished when the three-year moving average of the NMFS trawl survey index (mean weight per tow) is less than one half of the 75th percentile of mean weight per tow of the reference survey series for that species ($B_{threshold}$).

The overfishing definition is based on changes in survey biomass indices. In any year, if the three-year moving average of the survey biomass index for a skate species declines by more than a critical percentage from the previous year's moving average, then fishing mortality is assumed to be greater than F_{msy} and overfishing is assumed to be occurring for that skate species. The critical percentages for each species are given in the Summary Status Table (below).

Proposed Reference Points:

(EDITOR'S NOTE: NEW REFERENCE POINTS WERE PROPOSED; HOWEVER THEY WERE NOT ACCEPTED BY THE REVIEW PANEL)

TOR 4. *Evaluate current stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 3).*

Summary Status Table – Northeast Skate Species – Basis: **Existing Reference Points**

Species	Series	Btarget	Bthresh	Current	Status	Target Percent	Current	Status
Winter	GOM-MA Off Autumn 67-98	6.46	3.23	3.34	Not Overfished	-20	-22.9	Overfishing
Little	GOM-MA All Spring 82-99	6.54	3.27	4.59	Not Overfished	-20	-15.9	No Overfishing
Barndoor	GOM-SNE Off Autumn 63-66	1.62	0.81	0.96	Not Overfished	-30	9.8	No Overfishing
Thorny	GOM-SNE Off Autumn 63-98	4.41	2.20	0.56	Overfished	-20	-11.2	No Overfishing
Smooth	GOM-SNE Off Autumn 63-98	0.31	0.16	0.18	Not Overfished	-30	3.7	No Overfishing
Clearnose	MA All Autumn 75-98	0.56	0.28	0.63	Not Overfished	-30	-16.2	No Overfishing
Rosette	MA Offshore Autumn 67-98	0.029	0.015	0.049	Not Overfished	-60	9.7	No Overfishing

TOR 5. Review, evaluate and report on the status of the SARC/Working Group Research Recommendations offered in recent SARC-reviewed assessments.

Completed. See Section 5.

TOR 6. Examine the NEFSC Food Habits Database to estimate diet composition and annual consumptive demand for seven species of skates for as many years as feasible.

Most skates are benthivorous in their feeding habits. A clear prominence on *Cancer* crabs, other crabs, amphipods, polychaetes and similar benthic macrofauna and megafauna was apparent in the diets of these skates. Some of the larger skates- barndoor, thorny, and winter- can be piscivorous, particularly with ontogeny. The vast majority of fish (or fish-like) prey for these skates were small pelagic fishes and squids.

Save winter and little skates, overall consumption by most skate stocks is a relatively small amount of biomass flow. Most total consumption by any particular species of skate was scaled singularly by the abundance of that species. The vast majority of consumptive removals by all skates except little and winter was < 20 MT per year.

As an aggregate group, skates consume a very small fraction of the total energy flow in the ecosystem. Skate consumptive removal is two to three orders of magnitude lower than biomass or production of skate prey. When abundance estimates are scaled by gear efficiency, it is possible that skates could consume a notable fraction of forage fish and squid biomass relative to what is removed by a fishery. Yet most of those forage fish stocks are at relatively high levels of abundance.

2.0 INTRODUCTION

The seven species in the Northeast Region (Maine to Virginia) skate complex are distributed along the coast of the northeast United States from near the tide line to depths exceeding 700 m (383 fathoms). The species are: little skate (*Leucoraja erinacea*), winter skate (*L. ocellata*), barndoor skate (*Dipturus laevis)*, thorny skate (*Amblyraja radiata*), smooth skate (*Malacoraja senta*), clearnose skate (*Raja eglanteria*), and rosette skate (*L. garmani*).

In the Northeast region, the center of distribution for the little and winter skates is Georges Bank and Southern New England. The barndoor skate is most common in the Gulf of Maine, on Georges Bank, and in Southern New England. The thorny and smooth skates are commonly found in the Gulf of Maine. The clearnose and rosette skates have a more southern distribution, and are found primarily in Southern New England and the Chesapeake Bight. Skates are not known to undertake large-scale migrations, but they do move seasonally in response to changes in water temperature, moving offshore in summer and early autumn and returning inshore during winter and spring. Members of the skate family lay eggs that are enclosed in a hard, leathery case commonly called a mermaid's purse. Incubation time is 6 to 12 months, with the young having the adult form at the time of hatching (Bigelow and Schroeder 1953).

The last stock assessment for the skate complex was conducted in 1999 at SARC/SAW 30 (NEFSC 2000). At that time there was no Fishery Management Plan (FMP) in place. The National Marine Fisheries Service had been petitioned to list barndoor skate as endangered based on a paper published by Casey and Myers (1998) and was also asked to assess the other species in the complex. SARC 30 found no cause to list barndoor as endangered but recommended that the species remain on the candidate species list as well as to put thorny skate on the candidate species list. Biomass reference points were developed for all seven species and four were listed as overfished. Fishing mortality reference points were developed for winter and little skate and overfishing was occurring for winter skate.

Following SARC 30, an FMP was developed by the New England Fishery Management Council (NEFMC) when they were informed of the overfished status of thorny and barndoor (winter and smooth biomass increased in the 1999 autumn survey and were no longer considered overfished). The FMP was implemented in September of 2003 with a primary requirement for mandatory reporting of skate landings by species by both dealers and vessels. The FMP prohibited possession of barndoor and thorny skate, as well as smooth skate from the Gulf of Maine. A trip limit of 10,000 lbs was implemented for winter skate with a Letter of Authorization for the bait fishery (little skate) to exceed the trip limit. Biomass reference points developed at SARC 30 were maintained, but new fishing mortality reference points were developed.

3.0 TOR 1. Characterize the commercial and recreational catch including landings and discards

3.1 Commercial Fishery Landings

Skates have been reported in New England fishery landings since the late 1800s. However, commercial fishery landings, primarily from off Rhode Island, never exceeded several hundred metric tons until the advent of distant-water fleets and the industrial fishery during the 1950s and 1960s. Skate landings reached 9,500 mt in 1969, but declined quickly during the

1970s, falling to 800 mt in 1981 (Table B1.1, Figure B1.1). Landings then increased markedly, partially in response to increased demand for lobster bait, and more significantly, to the increased export market for skate wings. Landings increased to 12,900 mt in 1993 and then declined somewhat to 7,200 mt in 1995. Landings increased again and the 2004 reported commercial landings of 16,073 mt were the highest on record (Table B1.1, Figure B1.1).

United States landings of skates are reported in all months (Table B1.2). There is a relatively even distribution of landings across months, but the summer months do show a slightly higher percentage, probably due to the increased demand for lobster bait during those months.

Skate landings are primarily from Massachusetts and Rhode Island (mainly New Bedford and Point Judith) with 85-95% of the landings occurring in those two states (Table B1.3). Landings from other states did occur back through time and the table somewhat reflects better reporting as more states reported in the NMFS database. Also, the difference in total landings between Table B1.1 and B1.3 is likely the result of landings from the industrial fishery not included in the Weighout database. These landings were sampled during the 1960s and 1970s for species composition and prorated. Skates accounted for about 10% of those landings.

Otter trawls are the primary gear used to land skates in the United States, with some landings coming from sink gill nets (Table B1.4). In the last couple of years, landings from longline gear have increased slightly in importance. The increase in other gear reflects the new reporting system implemented in 2004.

Landings are generally not reported by species, with over 99% of the landings reported as Aunclassified skates@ until the FMP was implemented in September of 2003 (Table B1.5). Wings are most likely taken from winter and thorny skates, the two species currently known to be used for human consumption. Bait landings are presumed to be primarily from little skate, based on areas fished and known species distribution patterns. Landings of barndoor and thorny skate are being reported by the dealers even though there is a possession prohibition for those two species. There are also wings reported for rosette, little and smooth which are known to be too small for wings. The distribution of skate landings by state and species also shows that some species are landed in areas that they do not occur (Table B1.6). For example, in 2004, barndoor were landed in Virginia which is too far south for barndoor skate.

3.2 Commercial Fishery Discards

Discard estimates from SAW/SARC 30 were revised in this assessment. The previous method, which employed primary species groups to bin the discard data, was found to be a biased estimator (NEFSC 2006). Instead, the ratio-estimator used in this assessment is based on the methodology described in Rago et al. (2005). It relies on a d/k ratio where the kept component is defined as the total landings of all species within a "fishery". A fishery is defined as a homogeneous group of vessels with respect to gear type, season, and geographic region. Each of these attributes is an observable property and easily defined within existing data bases. Moreover, it is not dependent on ambiguous properties such as "target species" or imprecise self-reported attributes such as area fished.

The discard ratio for spiny dogfish in stratum h is the sum of discard weight over all trips divided by sum of kept weights over all trips:

$$\hat{R}_h = \frac{\sum_{i=1}^{n_h} d_{ih}}{\sum_{i=1}^{n_h} k_{ih}} \qquad (1)$$

where d_{ih} is the discards for dogfish within trip i in stratum h and k_{ih} is the kept component of the catch for all species. R_h is the discard rate in stratum h. The stratum weighted discard to kept ratio is obtained by weighted sum of discard ratios over all strata:

$$\hat{R} = \sum_{h=1}^{H} \left(\frac{N_h}{\sum_{h=1}^{H} N_h} \right) \hat{R}_h \qquad (2)$$

The total discard within a stratum is the product of the estimate discard ratio R and the total landings for the fishery in stratum h, i.e., $D_h = R_h K_h$.

Annual estimated discards by fishery for 1989-2005 are summarized in Table B1.7. Total discards in 1990 were estimated to be about 80,000 mt. Most of this came from the otter trawl fishery. However, in the first two years, there were no estimates of discards from the scallop dredge fishery, which represent a significant portion in later years. The peak in the estimates was in 1992 at almost 90,000 mt, almost half came from the scallop dredge fishery. Estimates have since declined except for 2002 which was inflated by one blue crab pot trip which is probably not representative of that fishery. Estimates in recent years are still higher than reported landings but are much lower than the estimates from the early 1990s. This is likely due to reduced effort in the multispecies groundfish fishery as well as the scallop dredge fishery. Sampling of the three main gear types (otter trawl, sink gill net, and scallop dredge) has improved in recent years (Tables B1.8-B1.10).

The discard estimates were not dis-aggregated to skate species because species identification is uncertain in the Domestic Observer Program. Catches of skates by species were mapped to determine if the data were potentially useful. Winter and little skate distributions look reasonable (Figures B1.2-B1.3). Barndoor distribution from the observer data shows fairly substantial amounts off Virginia and North Carolina (Figure B1.4). These are unlikely to be correctly identified. The distributions of thorny and smooth are also curious showing catches in the Mid-Atlantic (Figures B1.5-B1.6). The reverse is true for clearnose and rosette (Figures B1.7-B1.8). These two species have a southern distribution and the maps show considerable amounts of fish found in the Gulf of Maine. The length compositions of kept and discarded fish also show that there are identification problems (Figures B1.8-B1.15). In particular, the length frequency for kept little skate has fish that are 60 to 80 cm which is a larger size than this species can attain. The same thing occurs for smooth and rosette showing larger sizes than is possible.

3.3 Recreational Fishery Catch

Aggregate recreational landings of the seven species in the skate complex are relatively insignificant when compared to the commercial landings, never exceeding 300 mt during the 1981-1998 times series of Marine Recreational Fishery Statistics Survey (MRFSS) estimates. Little and clearnose skates are the most frequently landed species of the complex. For little skate, total landings varied between <1000 and 56,000 fish, equivalent to <1 to 15 mt, during 1981-1998. For clearnose skate, total landings varied between 2,000 and 145,000 fish, equivalent to 2 to 232 mt, during 1981-1998. The number of skates reported as released alive averages an order of magnitude higher than the reported landed number. Party/charter boats have historically been undersampled compared to the private/rental boat sector that accounts for most of the recreational catch, and may have a different discard rate. The recreational fishery release mortality rate of skates is unknown, but is likely comparable to that for flounders and other demersal species, which generally ranges from 10-15%. Assuming a 10-15% release mortality rate would suggest that recreational fishery discard mortality is of about the same magnitude as the recreational landings. Data from 1999 through 2005 were similar in magnitude.

4.0 TOR 2. Estimate fishing mortality, spawning stock biomass, and total stock biomass for the current year and characterize the uncertainty of those estimates. If possible, also include estimates for earlier years.

4.1 Research survey data – Total Stock Biomass

Indices of relative abundance from NEFSC bottom trawl surveys form the basis for most of the conclusions about status of the seven species in the skate complex. The NEFSC trawl survey has been conducted in the autumn from the Gulf of Maine to Southern New England since 1963 (Azarovitz 1981) and the Mid-Atlantic was added in 1967 (Figure B2.1). A spring survey was started in 1968 with stations <= 27 m added in 1975 (Figures B2.2-2.4). All statistically significant NEFSC gear, door, and vessel conversion factors were applied to little, winter, and smooth skate indices when applicable (Sissenwine and Bowman, 1978; NEFC 1991). Juvenile little and winter skates are not readily distinguished in the field. The numbers of juveniles were split between the two species based on the abundance of the adults in the same tow.

For the aggregate skate complex, the spring survey index of biomass was relatively constant from 1968 to 1980, but then increased to peak levels in the mid to late 1980s. The index of skate complex biomass then declined steadily until 1994, but increased until 2000 and has since decreased (Figure B2.5A). If the species in the complex are divided into large (barndoor, winter, and thorny) and small sized skates (little, clearnose, rosette, and smooth), it is evident that the large increase in skate biomass in the mid to late 1980s was dominated by winter and little skate (Figure B2.5B,C). The biomass of large sized skates steadily declined from the mid-1980s to the mid-1990s and has since been stable (Figure B2.5B). The increase in aggregate skate biomass from the mid-1990s to 2000 was due to an increase in little skate and the subsequent decline is also due to little skate (Figure B2.5C).

Indices of relative abundance for some of the species have also been developed from MADMF and CTDEP research surveys.

The previous SARC computed variance estimates for the survey indices assuming a normal error distribution. A recommendation was made to explore alternate error distributions since this assumption may not hold at very low stock sizes and results in confidence intervals which are below zero. Another alternative to assuming any error distribution is to use bootstrap methods. The bootstrap methodology of Smith (1997) was implemented using the Splus software written by Stephen Smith (DFO, Halifax). In order to bootstrap the NEFSC survey data, some strata had to be combined to ensure that at least two tows were made in each stratum during each year (Table B2.1). The second figure in each species section shows the stratified mean without combining strata, the mean combining strata and the bootstrapped mean.

Winter skate

NEFSC spring and autumn bottom trawl surveys indicate that winter skate are most abundant in the Georges Bank (GBK) and Southern New England (SNE) offshore strata regions, with few fish caught in the Gulf of Maine (GOM), or Mid-Atlantic (MA) regions (NEFSC 2000; Figure B2.6). In the NEFSC spring survey offshore strata (1968-2006), the annual total catch of winter skate has ranged from 160 fish in 1976 to 1,891 fish in 1985. In the NEFSC autumn survey offshore strata (1963-2005), the annual total catch of winter skate has ranged from 115 fish in 1975 to 1,187 fish in 1984. Calculated on a per tow basis, these spring survey catches equate to maximum stratified mean number per tow indices for the GOM-MA offshore strata of about 7.9 fish, or 16.4 kg, per tow during 1985; autumn maximum catches equate to indices of 3.7 fish, or 13.3 kg per tow, in 1984 (Tables B2.2-B2.3).

The catchability of winter skate in the NEFSC winter bottom trawl survey (which substitutes a chain sweep with small cookies for the large rollers used in the spring and autumn surveys, to better target flatfish) is significantly higher than in the spring and autumn series, especially for smaller winter skates. NEFSC winter survey (1992-2006) annual catches of winter skate have ranged from 841 fish in 1993 to 4,055 fish in 1996, equating to a maximum stratified mean catch per tow of 43.5 fish or 25.2 kg per tow in 1996 (Table B2.4). The winter survey is focused in the Southern New England and Mid-Atlantic offshore regions, with a limited number of samples on Georges Bank, and no sampling in the Gulf of Maine (Figure B2.7). The NEFSC scallop dredge survey also catches winter skates mostly on Georges Bank (Figures B2.8-B2.9). The scallop survey also does not sample in the Gulf of Maine and on the very shallowest portions of Georges Bank.

Indices of winter skate abundance and biomass from the NEFSC spring and autumn surveys were stable, but below the time series mean, during the late 1960s and 1970s (Figure B2.10). Winter skate indices increased to the time series mean by 1980, and then reached a peak during the mid 1980s. Winter skate indices began to decline in the late 1980s. Current NEFSC indices of winter skate abundance are below the time series mean, at about the same value as during the early 1970s. Current NEFSC indices of winter skate biomass are about 20% of the peak observed during the mid 1980s (Figures B2.10). The combining of strata did not have much impact on the stratified mean (Figures B2.11-B2.14).

The minimum length of winter skate caught in NEFSC surveys is 15 cm (6 in), and the largest individual caught was 116 cm (46 in) total length, during the 1985 spring survey on Georges Bank (Tables B2.2-B2.4). The median length of the survey catch has ranged from 28 cm in the 2003 winter survey to 79 cm in the 1978 spring survey and the 1985 autumn survey. The median length of the survey catch generally declined from 1979 to the mid-1990s in both the spring and autumn surveys, increased through 2002, and then declined slightly to currently remain about 45-52 cm (18-20 inches)(Figure B2.15). Length frequency distributions from the NEFSC spring and autumn surveys show several modes, most often at 40, 60, and 80 cm (Figures B2.16-B2.20). The spring survey length distributions show large modes at about 40 cm during the mid-1980s through the mid 1990s, suggesting strong recruitment during that period.

Truncation of the length distributions is evident in the NEFSC spring and autumn series since 1990.

The strata set used for bootstrapping the winter survey differed from the standard consistent strata set used for the information in Table 2.4. Given that the strata on Georges Bank were not sampled in some years, the set for bootstrapping was limited to Southern New England to the Mid-Atlantic (Table B2.1). This created more of a difference between the original mean, with usually a lower index when Georges Bank was included in the original (Figure B2.21-B2.22). The indices of both abundance and biomass fluctuated without trend through the series.

The difference between the original mean and the combined strata mean in the scallop survey was due to the bootstrapped mean consisting of only strata which caught some winter skate (Figures B2.23-B2.24) while the original was the entire scallop survey strata set. There are no biomass estimates from 1985 through 2000 since no weights were taken at sea and the survey in 1999 was completed on a commercial scalloper and therefore the data are not comparable. Abundance was high in the mid-1980s, declined through the 1990s, increased through 2000 and then declined.

Indices of abundance for winter skate are available from the Massachusetts Division of Marine Fisheries (MADMF) spring and autumn research trawl surveys in the inshore waters of Massachusetts for the years 1978-2006. MADMF biomass indices of winter skate were moderate to high from 1981 through 1987. Thereafter, both spring and autumn indices declined to time series lows in 1989-1991. The spring index rebounded to moderate levels during 1992-1996 before dropping again to low values in the late 1990s and remaining low through 2006 (Figure B2.25). The autumn index is more erratic, but generally shows the same pattern.

Indices of abundance for winter skate are available from the Connecticut Department of Environmental Protection (CTDEP) spring and autumn finfish trawl surveys in Long Island Sound for the years 1984-2006 (1992 and later only for biomass). Annual CTDEP survey catches have ranged from 0 to 115 skates. CTDEP survey indices suggest that after increasing to a time series high from 1984 through 1989, winter skate in Long Island Sound has declined slightly (Figure B2.26).

Little skate

NEFSC bottom trawl surveys indicate that little skate are abundant in the inshore and offshore strata in all regions of the northeast US coast, but are most abundant on Georges Bank and in Southern New England (NEFSC 2000, Figure B2.27). In the NEFSC spring surveys (1976-2006), the annual total catch of little skate has ranged from 3,512 fish in 1986 to 16,406 fish in 1999 (Table 2.5). In the NEFSC autumn surveys (1975-2005), the annual total catch of little skate has ranged from 1,124 fish in 1993 to 6,523 fish in 2003 (Table 2.6). Calculated on a per tow basis, these spring survey catches equate to maximum stratified mean number per tow indices for the GOM-MA inshore and offshore strata of about 28 fish, or 10 kg, per tow during 1999; autumn maximum catches equate to indices of 18 fish, or 7.7 kg, per tow in 2003 (Tables B2.5-B2.6).

The catchability of little skate in the NEFSC winter bottom trawl survey (which substitutes a chain sweep with small cookies for the large rollers used in the spring and autumn surveys, to better target flatfish) is significantly higher than in the spring and autumn series. NEFSC winter survey (1992-2006) annual catches of little skate have ranged from 8,870 fish in 2003 to 18,418 fish in 1992, equating to a maximum stratified mean catch per tow of 170 fish or 66 kg per tow in 1992 (Table B2.7). The winter survey is focused in the Southern New England and Mid-Atlantic offshore regions, with a limited number of samples on Georges Bank, and no sampling in the Gulf of Maine (Figure B2.28). The NEFSC scallop dredge survey also catches little skates in all areas of sampling (Figures B2.29-B2.30). The scallop survey also does not sample in the Gulf of Maine, on the very shallowest portions of Georges Bank and parts of Southern New England.

Indices of little skate abundance and biomass from the NEFSC spring and autumn surveys were stable, but below the time series mean, during the 1970s. Little skate spring survey indices began to increase in 1982, reached a peak in 1999, and declined thereafter (Figure B2.31). Autumn survey indices have been relatively stable over the duration of the time series, with a slight increase in recent years (Figure B2.31). The application of the NEFSC gear conversion factors to spring survey indices decreased the indices in 1981 and earlier years by 75 percent. The combining of strata had slightly more impact for little skate than for winter skate, since many of the inshore strata were combined (Figures B2.32-B2.35).

The minimum length of little skate caught in NEFSC surveys is 6 cm (3 in), and the largest individual caught was 62 cm (24 in) total length, during the 1978 autumn survey on Georges Bank. The median length of the survey catch has ranged from 31 cm in the 1979 and 1987 spring surveys to 44 cm, most recently in the 2005 autumn survey. The median length of the survey catch has been generally stable over the duration of the spring and autumn surveys and is currently about 42 cm in the spring and 43 cm in the autumn (17 inches)(Figure B2.36). Length frequency distributions from the NEFSC spring and autumn surveys show several modes, most often at 10, 20, 30, and 45 cm, which may represent ages 0, 1, 2, and 3 and older little skate (Figures B2.37-B2.40).

The strata set used for bootstrapping the winter survey differed from the standard consistent strata set used for the information in Table 2.7. Given that the strata on Georges Bank were not sampled in some years, the set for bootstrapping was limited to Southern New England to the Mid-Atlantic (Table B2.1). This created more of a difference between the original mean, with usually a higher index when Georges Bank was included in the original (Figure B2.41-B2.42). The indices of both abundance and biomass declined through 2000, increased for a few years and subsequently declined..

The difference between the original mean and the combined strata mean in the scallop survey was due to the bootstrapped mean consisting of only strata which caught some little skate (Figures B2.43-B2.44) while the original was the entire scallop survey strata set. There are only differences in the early part of the time series when more strata were sampled. There are no biomass estimates from 1985 through 2000 since no weights were taken at sea and the survey in 1999 was completed on a commercial scalloper and therefore the data are not comparable. Abundance indices increased to a peak in 2000 and have subsequently declined.

Indices of abundance for little skate are available from the Massachusetts Division of Marine Fisheries (MADMF) spring and autumn research trawl surveys in the inshore waters of Massachusetts for the years 1978-2006 (Figure B2.45). MADMF biomass indices of little skate declined through the 1980's to time series lows in 1989 (autumn) and 1991 (spring). Biomass indices quickly rose to high levels in the early 1990's, and have since fluctuated without trend.

Indices of abundance for little skate are available from the Connecticut Department of Environmental Protection (CTDEP) spring and autumn finfish trawl surveys in Long Island Sound for the years 1984-2006 (1992 and later only for biomass). Little skate are the most abundant species in the skate complex in Long Island Sound, with annual CTDEP survey catches ranging from 142 to 837 skates. CTDEP survey indices suggest an increase in abundance of little skate in Long Island Sound over the 1984-2006 time series followed by a decline (Figure B2.46).

Barndoor skate

NEFSC bottom trawl surveys (Figure B2.47) indicate that barndoor skate are most abundant in the Gulf of Maine, Georges Bank, and Southern New England offshore strata regions, with very few fish caught in inshore (< 27 meters depth) or Mid-Atlantic regions. Bigelow and Schroeder (1953), however, noted that historically barndoor skate were found in inshore waters to the tide-line, and in depths as great as 400 meters off Nantucket. In the NEFSC spring surveys (1968-2006), the annual total catch of barndoor skate has ranged from 0 fish (several years during the 1970s and 1980s) to 196 fish in 2006 (Table B2.8). In the NEFSC autumn surveys (1963-2005), the annual total catch of barndoor skate has ranged from 0 fish (several years in the 1970s and 1980s) to 120 fish in 1963 (Table B2.9). Calculated on a per tow basis, the autumn survey catches equate to maximum stratified mean number per tow indices for the GOM-SNE offshore strata of about 0.8 fish, or 2.6 kg, per tow in 1963 (Tables B2.8-B2.9).

The catchability of barndoor skate in the NEFSC winter bottom trawl survey (which substitutes a chain sweep with small cookies for the large rollers used in the spring and autumn surveys, to better target flatfish) is significantly higher than in the spring and autumn series and may be particularly higher for smaller skates as in winter skates. NEFSC winter survey (1992-2006) annual catches of barndoor skate have ranged from 0 fish in 1992 to 355 in 2006, equating to a maximum stratified mean catch per tow of 3.2 fish or 3.0 kg per tow in 1999 (Table B2.10). The winter survey is focused in the Southern New England and Mid-Atlantic offshore regions, with a limited number of samples on Georges Bank, and no sampling in the Gulf of Maine (Figure B2.48). The NEFSC scallop dredge survey also catches barndoor skates primarily on Georges Bank (Figure B2.48). The scallop survey also does not sample in the Gulf of Maine, on the very shallowest portions of Georges Bank and parts of Southern New England.

Indices of barndoor skate abundance and biomass from the NEFSC spring and autumn surveys were at their highest values during early to late 1960s, and then declined to 0 fish per tow during the early 1980s. Since 1990, both spring and autumn survey indices have steadily increased, with the spring survey at the highest value and the autumn survey nearing the peak values found in the 1960s (Figure B2.49). The combining of strata did not have much impact on the stratified mean (Figures B2.50-B2.53).

The minimum length of barndoor skate caught in NEFSC surveys is 20 cm (8 inches), and the largest individual caught was 136 cm (54 in) total length, during the 1963 autumn survey in the Gulf of Maine. The median length of the survey catch has ranged from 20 cm in the 1985 spring survey to 119 cm in the 1972 spring survey. The median length of the survey catch has been stable in recent years in both the spring and autumn surveys, and is currently 70-75 cm (28-30 in; Figure B2.54). Length frequency distributions from the NEFSC spring and autumn surveys illustrate the decline in abundance of barndoor skate to survey catches of zero during the 1980s (Figures B2.55-B2.59). Recent catches have included individuals as large as those recorded during the peak abundance of the 1960s, and the large number of fish between 40 and 80 cm evident during the 1960s is now apparent in recent surveys.

The strata set used for bootstrapping the winter survey differed from the standard consistent strata set used for the information in Table 2.10. Given that the strata on Georges Bank were not sampled in some years, the set for bootstrapping was limited to Southern New England to the Mid-Atlantic (Table B2.1). This created more of a difference between the original mean, with usually a lower index when Georges Bank was included in the original (Figure B2.60-B2.61). The indices of both abundance and biomass have increased substantially from 1993 to 2006. The NEFSC winter survey length frequency distributions for indicate a significant increase in the abundance of barndoor skate at lengths less than 80 cm (Figure B2.62).

The difference between the original mean and the combined strata mean in the scallop survey was due to the bootstrapped mean consisting of only strata which caught some barndoor skate (Figures B2.63-B2.64) while the original was the entire scallop survey strata set. There are no biomass estimates from 1985 through 2000 since no weights were taken at sea and the survey in 1999 was completed on a commercial scalloper and therefore the data are not comparable. Abundance indices increased consistently while the biomass indices have been more variable.

Thorny skate

NEFSC bottom trawl surveys indicate that thorny skate are most abundant in the Gulf of Maine and Georges Bank offshore strata regions, with very few fish caught in inshore (< 27 meters depth), Southern New England, or Mid-Atlantic regions (Figure B2.65). In the NEFSC spring surveys (1968-2006), the annual total catch of thorny skate has ranged from 29 fish in 2006 to 574 fish in 1973 (Table 2.11). In the NEFSC autumn surveys (1963-2005), the annual total catch of thorny skate has ranged from 35 fish in 2005 to 874 fish in 1978 (Table 2.12). Calculated on a per tow basis, these spring and autumn survey catches equate to maximum stratified mean number per tow indices for the GOM-SNE offshore strata of about 2 to 3 fish, or about 6.0 kg, per tow during the early 1970s (Tables B2.11-2.12).

The NEFSC scallop dredge survey also catches thorny skates primarily on the edges of Georges Bank (Figure B2.66). The scallop survey also does not sample in the Gulf of Maine, on the very shallowest portions of Georges Bank and parts of Southern New England. A summer shrimp survey is conducted in the Gulf of Maine which also catches thorny skate (Figure B2.66). Indices from this survey have not been updated.

NEFSC spring and autumn survey indices for thorny skate have declined continuously over the last 40 years. Indices of thorny skate abundance and biomass from the NEFSC spring and autumn surveys were at a peak during the early 1970s, reaching 2.9 fish per tow (5.3 kg per tow) in the spring survey and1.8 fish per tow (5.9 kg per tow) in the autumn survey. Kulka and Mowbray (1998) indicated a similar period of high abundance for thorny skate in Canadian waters. NEFSC indices of thorny skate abundance have declined steadily since the late 1970s, reaching historically low values in 2005 and 2006 that are less than10% of the peak observed in the 1970s (Figure B2.67). The combining of strata did not have much impact on the stratified mean (Figures B2.68-B2.71).

The minimum length of thorny skate caught in NEFSC surveys is about 10 cm (4 inches), and the largest individual caught was 111 cm (44 inches) total length, most recently during the 1977 spring survey on Georges Bank (Tables B2.11-B2.12). The median length of the survey catch has ranged from 23 cm in the 2003 autumn survey to 63 cm in the 1971 autumn survey. The median length of the survey catch has trended downward through most of the survey time series, but has been stable in recent years in autumn surveys, and is currently 40-50 cm (16-20 inches; Figure B2.72). Length frequency distributions from the NEFSC spring and autumn surveys show a pattern of decline in abundance of larger individuals consistent with an increase in total mortality over the survey time series (Figures B2.73-B2.77).

The difference between the original mean and the combined strata mean in the scallop survey was due to the bootstrapped mean consisting of only strata which caught some thorny skate (Figures B2.78-B2.79) while the original was the entire scallop survey strata set. There are no biomass estimates from 1985 through 2000 since no weights were taken at sea and the survey in 1999 was completed on a commercial scalloper and therefore the data are not comparable. Abundance indices declined from a peak in 1986 while the biomass indices declined since 2001.

Indices of abundance for thorny skate are available from the Massachusetts Division of Marine Fisheries (MADMF) spring and autumn research trawl surveys in the inshore waters of Massachusetts for the years 1978-2006. MADMF indices of thorny skate biomass have been variable over the time series, but there is a decreasing trend evident in both the spring and autumn time series. The spring index has stabilized around the median of 0.2 kg/tow throughout the 2000's, while the autumn index has been below the median of 0.6 kg/tow since 1994 except for 2001 and 2002 (Figure B2.80).

Smooth skate

NEFSC bottom trawl surveys indicate that smooth skate are most abundant in the Gulf of Maine and Georges Bank offshore strata regions, with very few fish caught in inshore (< 27 meters depth), Southern New England, or Mid-Atlantic regions (Figure B2.81). In the NEFSC spring surveys (1968-2006), the annual total catch of smooth skate has ranged from 12 fish in 1996 to 179 fish in 1973 (Table B2.13). In the NEFSC autumn surveys (1963-2005), the annual total catch of smooth skate has ranged from 10 fish in 1976 to 130 fish in 1978 (Table B2.14). Calculated on a per tow basis, these spring and autumn survey catches equate to maximum stratified mean number per tow indices for the GOM-MA offshore strata of 0.6 to 1.6 fish, or about 0.6 to 0.9 kg, per tow during the 1970s (Tables B2.13-B2.14).

The NEFSC scallop dredge survey also catches smooth skates primarily on the edges of Georges Bank (Figure B2.82). The scallop survey also does not sample in the Gulf of Maine, on the very shallowest portions of Georges Bank and parts of Southern New England. A summer shrimp survey is conducted in the Gulf of Maine which also catches smooth skate (Figure B2.82). Indices from this survey have not been updated.

Indices of smooth skate abundance and biomass from the NEFSC surveys were at a peak during the early 1970s for the spring series and the late 1970s for the autumn series (Figure B2.83). NEFSC survey indices declined during the 1980s, before stabilizing during the early 1990s at about 25% of the autumn and 50% of the spring survey index values of the 1970s. The combining of strata did not have much impact on the stratified mean (Figures B2.84-B2.87).

The minimum length of smooth skate caught in NEFSC surveys is about 8 cm (3 inches), and the largest individual caught was 73 cm (29 inches) total length, during the 2000 autumn survey on Georges Bank (Tables B2.13-B2.14). The median length of the survey catch has ranged from 26 cm in the 1993 autumn survey to 53 cm in the 1971 autumn survey. The median length of the survey catch in the GOM-SNE offshore region shows no trend over the full survey time series, and is currently at about 40 cm (16 in) (Figure B2.88). Length frequency distributions from the NEFSC spring and autumn surveys in the GOM offshore region show modes at 30 and 50 cm (Figures B2.89-B2.93). The relatively high abundances evident in the 1969-1983 spring surveys at the larger mode may represent the accumulated abundance at several older ages. Truncation of the larger mode is evident in the spring distributions during the 1980s and most of the 1990s. The 1999 spring survey length frequency distribution indicated strong recruitment in the region.

The difference between the original mean and the combined strata mean in the scallop survey was due to the bootstrapped mean consisting of only strata which caught some smooth skate (Figures B2.94-B2.95) while the original was the entire scallop survey strata set. There are no biomass estimates from 1985 through 2000 since no weights were taken at sea and the survey in 1999 was completed on a commercial scalloper and therefore the data are not comparable. Abundance indices were low at the beginning of the time series and have since increased.

Clearnose skate

NEFSC bottom trawl surveys indicate that clearnose skate are most abundant in the Mid-Atlantic offshore and inshore strata regions, with very few fish caught in Southern New England and no fish caught in other survey regions (Figure B2.96). In the NEFSC spring surveys (1976-2006), the annual total catch of clearnose skate has ranged from 9 fish in 1979 to 136 fish in 1993 (Table B2.15). In the NEFSC autumn surveys (1975-2005), the annual total catch of clearnose skate has ranged from 19 fish in 1983 to 221 fish in 2001 (Table B2.16). Calculated on a per tow basis, these spring and autumn survey catches equate to maximum stratified mean number per tow indices for the Mid-Atlantic offshore and inshore strata set of 1.2-1.6 fish, or about 0.8-0.9 kg, per tow during the mid 1990s and 2000s (Tables B2.15-B2.16).

The catchability of clearnose skate in the NEFSC winter bottom trawl survey (which substitutes a chain sweep with small cookies for the large rollers used in the spring and autumn surveys, to better target flatfish) is significantly higher than in the spring and autumn series. NEFSC winter survey (1992-2006) annual catches of clearnose skate have ranged from 343 fish in 1999 to 3,086 fish in 1996, equating to a maximum stratified mean catch per tow of 12 fish or 15 kg per tow in 1996 (Table B2.17). The winter survey is focused in the Southern New England and Mid-Atlantic offshore regions, with a limited number of samples on Georges Bank, and no sampling in the Gulf of Maine (Figure B2.97).

NEFSC spring and autumn survey indices for clearnose skate have been increased from the mid-1980s through 2000 and have since declined to about average values (Figure B2.98). The combining of strata had more impact for clearnose skate than for other species, since many of the inshore strata were combined and the most southern strata were combined into one stratum (Figures B2.99-B2.102).

The minimum length of clearnose skate caught in NEFSC surveys is about 10 cm (4 inches), and the largest individual caught was 93 cm (33 in) total length, during the 1992 and 2000 winter surveys in the Mid-Atlantic Bight region (Tables B2.15-B2.17). The median length of the survey catch has ranged from 41 cm in the 1980 spring survey to 67 cm in the 1995 spring survey. The median length of the spring survey catch has increased over the time series, from about 50 cm during the late 1970s to at about 60 cm in recent years (24 inches; Figure B2.103). The median length of the autumn survey catch has been stable over the time series, and is also at about 60 cm. Length frequency distributions from the NEFSC spring and autumn surveys show a consistent mode at 60-70 cm that may represent the accumulated abundance of several older ages (Figures B2.104-B2.107).

The strata set used for bootstrapping the winter survey differed from the standard consistent strata set used for the information in Table 2.17. Given that the strata on Georges Bank were not sampled in some years, the set for bootstrapping was limited to a few Southern New England strata and the Mid-Atlantic (Table B2.1). This created more of a difference between the original mean, with usually a lower index when Georges Bank was included in the original (Figure B2.108-B2.109). The indices of both abundance and biomass have generally fluctuated without trend.

Indices of abundance for clearnose skate are available from the Connecticut Department of Environmental Protection (CTDEP) spring and autumn finfish trawl surveys in Long Island Sound for the years 1984-1998 (1992 and later only for biomass). The CTDEP survey had caught very few clearnose skate, with annual catches ranging from 0 to 20 skates through 1998, but the indices have increased in Long Island Sound over the times series (Figure B2.110).

Rosette skate

NEFSC bottom trawl surveys indicate that rosette skate are most abundant in the Mid-Atlantic offshore strata region, with very few fish caught in Southern New England and Georges Bank and no fish caught in the Gulf of Maine or inshore (Figure B2.111). In the NEFSC spring surveys (1968-2006), the annual total catch of rosette skate has ranged from 0 fish, in 1970 and1984, to 70 fish in 1977 (Table B2.18). In the NEFSC autumn surveys (1967-2005), the annual total catch of rosette skate has ranged from 1 fish, most recently in 1982, to 46 fish in 1999 (Table B2.19). Calculated on a per tow basis, these spring survey catches equate to maximum stratified mean number per tow indices for the Mid-Atlantic offshore strata set of about 0.6 fish, or about 0.1 kg, per tow during 1977 (Tables B2.18-B2.19).

The catchability of rosette skate in the NEFSC winter bottom trawl survey (which substitutes a chain sweep with small cookies for the large rollers used in the spring and autumn surveys, to better target flatfish) is significantly higher than in the spring and autumn series. NEFSC winter survey (1992-2006) annual catches of rosette skate have ranged from 143 fish in 1993 to 1029 fish in 2003, equating to a maximum stratified mean catch per tow of 2.8 fish or 0.7 kg per tow in 2003 (Table B2.20). The winter survey is focused in the Southern New England and Mid-Atlantic offshore regions, with a limited number of samples on Georges Bank, and no sampling in the Gulf of Maine (Figure B2.112).

Indices of rosette skate abundance and biomass from the NEFSC surveys were at a peak during 1975-1980, before declining through 1986. NEFSC survey indices for rosette skate increased from 1986 through 2001, declined slightly and recent indices are near the peak values of the late 1970s (Figure B2.113). The combining of strata had more impact for rosette skate than for other species, since the deep offshore strata were combined with the next deepest stratum and the most southern strata were combined into one stratum (Figures B2.114-B2.117).

The minimum length of rosette skate caught in NEFSC surveys is about 7 cm (3 inches), and the largest individual caught was 57 cm (22 inches) total length, during the 1971 spring survey in the Mid-Atlantic Bight region (Tables B2.18-B2.20). The median length of the survey catch has ranged from 18 cm in the 1985 spring survey to 57 cm in the 1971 spring survey, during which only 1 rosette skate was caught. The median length of the survey catch has been stable over the spring and autumn time series at about 36-37 cm (14 inches; Figure B2.118). Length frequency distributions from the NEFSC spring and autumn surveys show a consistent mode at 30-40 cm (Figures B2.119-B2.123).

The strata set used for bootstrapping the winter survey differed from the standard consistent strata set used for the information in Table 2.17. Given that the strata on Georges Bank were not sampled in some years and the deepwater strata which are important for rosette skate were not sampled until 1998, the set for bootstrapping was limited to a few Southern New England strata and the Mid-Atlantic from 1998 on (Table B2.1). This created more of a difference between the original mean, with usually a lower index when Georges Bank was included in the original (Figure B2.124-B2.125). The indices of both abundance and biomass increased through 2002 and have subsequently declined.

4.2 Research survey data – Spawning Stock Biomass

Maturity information was available in some form for all species to split the survey length information into mature and immature animals (Table 2.21). The series chosen for each species was the same as chosen for reference points at SARC30. There is a protracted spawning as females likely lay eggs year round so there is no need to pick a season based on spawning time. As it is generally the longest running series, the autumn survey was used for all species except little skate. For little skate, the spring series from 1982 on was used; this date was chosen to avoid gear conversion issues.

Winter skate SSB generally follows the pattern of the autumn total biomass index with very low values in the 1970s followed by the large expansion of the size composition in the 1980s (Table B2.22; Figure B2.126). The index of SSB declined in the mid- to late 1990s, increased slightly, and is currently at low values. Little skate SSB has been fairly stable through the time series with slightly higher values from 1999-2004 than in the 1980s and early 1990s (Table B2.22; Figure B2.126). The pattern in barndoor skate SSB indices is much the same as that of total biomass with high values in the early 1960s, followed by very low to nonexistent values in the 1970s and 1980s, and then a consistent increase in the 1990s and 2000s (Table B2.22; Figure B2.126). The decline in thorny skate SSB indices is more pronounced than for the total biomass index (Table B2.22; Figure B2.126). Smooth skate SSB indices are very variable, but exhibit a slight decline over the time series (Table B2.22; Figure B2.126). Clearnose skate SSB has increased over the time period (Table B2.22; Figure B2.126). Rosette skate SSB has been variable but has generally increased (Table B2.22; Figure B2.126).

4.3 Fishing mortality estimates

The length-based mortality estimators of Beverton and Holt (1956) and Hoenig (1987) were considered for the estimation of fishing mortality rates for winter, little, barndoor, thorny, and clearnose skates from NEFSC spring and autumn length frequency distributions. Only these five species were analyzed since age and growth information is available for these species and unavailable for rosette and smooth (Table 2.21).

(EDITOR'S NOTE: MODEL-BASED FISHING MORTALITY ESTIMATES WERE PROPOSED; THEY ARE NOT SHOWN BECAUSE THEY WERE NOT ACCEPTED BY THE REVIEW PANEL)

4.3.1 Mortality from Mean Length Gedamke and Hoenig (2006) Method

Gedamke and Hoenig (2006) developed a method to estimate mortality from mean length data in nonequilibrium situations. It is an extension of the Beverton-Holt length-based mortality estimator that assumes constant recruitment throughout the time series and mortality at fixed levels for certain periods within the time series. The approach allows for the transitory changes in mean length to be modeled as a function of mortality rate changes. After an increase in mortality, mean length will gradually decrease due to larger animals being less prevalent in the population. After a decrease in mortality, mean length will increase slowly due to growth of the fish in the population. The rates of change in both cases depend on the von Bertalanffy growth parameters and the magnitude of change in the mortality rates. Since the method requires only a series of mean length above a user defined minimum size and the von Bertalanffy growth parameters, it can be applied in many data poor situations. Gedamke and Hoenig (2006) demonstrated the utility of this approach using both simulated data and an application to data for goosefish caught in the NEFSC fall groundfish survey.

(EDITOR'S NOTE: FISHING MORTALITY ESTIMATES WERE PROPOSED; THEY ARE NOT SHOWN BECAUSE THEY WERE NOT ACCEPTED BY THE REVIEW PANEL)

4.3.2 Thorny Skate Length Tuned Model (LTM)

Introduction

A forward projecting length tuned model (LTM) was modified to fit only survey abundance indices and survey size information for the estimation of fishing mortality rates. Results from this analysis were compared to the Hoenig length based estimates to help determine the influences of assuming equilibrium conditions. The LTM model does not assume equilibrium conditions since fishing mortality estimates in year n will influence the population size structure in year n+1. However the initial population in year one of the model is calculated assuming equilibrium conditions.

Herein we used a simple forward projecting age-based model tuned with age-3 recruitment (estimated from fish in the survey that were between 35 and 45 cm), survey numbers of 40+ cm fish and length frequency of the 40+ cm fish. The Length Tuned Model was developed in the AD model builder framework. The model estimates fishing mortality and relative recruitment changes each year, fishing mortality to produce the initial population length frequency (F_{start}), and Qs for each survey index. Initial population abundance was fixed since no catch information can be used to scale the model in terms of abundance.

(EDITOR'S NOTE: RESULTS FROM THIS MODEL ARE NOT SHOWN BECAUSE THEY WERE NOT ACCEPTED BY THE REVIEW PANEL)

5.0 TOR 3. Either update or redefine biological reference points (BRPs; proxies for BMSY and FMSY), as appropriate. Comment on the scientific adequacy of existing and redefined BRPs.

5.1 Current Reference Points

The existing biomass reference points were developed at SARC 30 (NEFSC 2000) with B_{msy}Proxy formulated as the 75th percentile of the given time series of each species, except barndoor (Table B3.1) and half that value for $B_{threshold}$. It was assumed that all species had at some time passed through B_{msy} at some point in the time series. For barndoor skate, the mean of the first four years of the autumn survey were used instead, given that biomass had been extremely low during most of the time series. To reduce the variability in the survey estimates, a three-year moving average of the survey indices was proposed to evaluate stock status for all species.

The fishing mortality reference points developed at SARC 30 were not accepted by the NEFMC and a different method for evaluating fishing mortality was developed by the Plan Development Team (PDT). The thresholds for fishing mortality are based on annual percentage declines of the three-year average of the NEFSC trawl survey time series chosen for the biomass reference points. The percentages are specified for each species individually based on historical variation within the survey. The thresholds also include what is termed a precautionary "backstop" that indicates that overfishing is occurring if the trawl survey mean weight per tow declines for three consecutive years. The main part of the definition is that overfishing is occurring when the three-year moving average of the given survey biomass index declines by more than the average CV of the time series.

5.2 Alternative Reference Points

(EDITOR'S NOTE: ALTERNATIVE REFERENCE POINTS WERE PRESENTED; THEY ARE NOT SHOWN BECAUSE THEY WERE NOT ACCEPTED BY THE REVIEW PANEL)

6.0 TOR 4. Evaluate current stock status with respect to the existing BRPs, as well as with respect to updated or redefined BRPs (from TOR 3).

6.1 Current Reference Points

For winter skate, the 2003-2005 NEFSC autumn survey biomass index average of 3.34 kg/tow is below the biomass target of 6.46 kg/tow but above the threshold reference point of 3.23 kg/tow (Figure B4.1). Winter skate is not overfished. The 2003-2005 average of 3.34 kg/tow was more than 20% below the 2002-2004 average of 4.34 kg/tow (Table B4.1), therefore overfishing is occurring for winter skate.

For little skate, the 2004-2006 NEFSC spring survey biomass index average of 4.59 kg/tow is below the biomass target of 6.54 kg/tow but above the threshold reference point of 3.27 kg/tow (Figure B4.1). Little skate is not overfished. The 2004-2006 average of 4.56 kg/tow was less than 20% below the 2003-2005 average of 5.65 kg/tow (Table B4.1), therefore overfishing is not occurring for little skate.

For barndoor skate, the 2003-2005 NEFSC autumn survey biomass index average of 0.96 kg/tow is below the biomass target of 1.62 kg/tow but above the threshold reference points of 0.81 kg/tow(Figure B4.1). Barndoor skate is not overfished. The 2003-2005 average of 0.96 kg/tow was above the 2002-2004 average of 0.88 kg/tow (Table B4.1), therefore overfishing is not occurring for barndoor skate.

For thorny skate, the 2003-2005 NEFSC autumn survey biomass index average of 0.56 kg/tow is below the biomass target and threshold reference points of 4.41 kg/tow and 2.20 kg/tow (Figure B4.1). Thorny skate is overfished. The 2003-2005 average of 0.56 kg/tow was less than 20% below the 2002-2004 average of 0.63 kg/tow (Table B4.1), therefore overfishing is not occurring for thorny skate.

For smooth skate, the 2003-2005 NEFSC autumn survey biomass index average of 0.18 kg/tow is below the biomass target of 0.31 kg/tow but above the threshold reference point of 0.16 kg/tow(Figure B4.1) . Smooth skate is not overfished. The 2003-2005 average of 0.18 kg/tow was above the 2002-2004 average of 0.17 kg/tow (Table B4.1), therefore overfishing is not occurring for smooth skate.

For clearnose skate, the 2003-2005 NEFSC autumn survey biomass index average of 0.63 kg/tow is above the biomass target and threshold reference points of 0.56 kg/tow and 0.28 kg/tow (Figure B4.1). Clearnose skate is not overfished. The 2003-2005 average of 0.63 kg/tow was less than 30% below the 2002-2004 average of 0.75 kg/tow (Table B4.1), therefore overfishing is not occurring for clearnose skate.

For rosette skate, the 2003-2005 NEFSC autumn survey biomass index average of 0.049 kg/tow is above the biomass target and threshold reference points of 0.029 kg/tow and 0.015 kg/tow (Figure B4.1) . Rosette skate is not overfished. The 2003-2005 average of 0.049 kg/tow was above the 2002-2004 average of 0.045 kg/tow (Table B4.1), therefore overfishing is not occurring for rosette skate.

7.0 TOR 5. Review, evaluate and report on the status of the SARC/Working Group Research Recommendations offered in recent SARC-reviewed assessments.

1) The commercial fishery statistics sampling programs should be adapted to report skates landings by species.

Since the implementation of the Skate Complex FMP, there is a requirement to report landings of skates by species. However, training is needed to improve the accuracy of the reporting.

2) Commercial fishery size composition data should be collected by species.

Observers are collecting landings and discarded size composition by species. However, more training is needed to improve the accuracy of the data.

3) Sea sampling of directed skate landings and skate bycatch should be increased, and the identification of the species composition of the skate catch improved.

Observer coverage was increased in 2004 and 2005 primarily for the multi-species groundfish fisheries which have a large bycatch of skates. Observer coverage of scallop fisheries has improved as well. More training is needed to improve the accuracy of the species identification.

4) Age and growth studies, for all seven species in the complex, are needed.

Studies have been conducted for five of the seven species (Frisk 2004,Gedamke 2006, Gedamke et al. 2005, Gelschleiter 1998, Sulikowski et al. 2005) and samples have been collected by NEFSC for the other two species.

5) Maturity and fecundity studies, for all seven species in the complex, are needed. Use of life history models requires these data, and may prove useful in establishing biological reference points for the skate species.

Maturity studies estimating L_{50} *have been conducted for barndoor (Gedamke 2005), winter and little (Frisk 2004), and thorny (Sulikowski et al. 2006). Sosebee (2005) estimated size at first maturity for all seven species.*

6) Estimates of commercial and recreational fishery discard mortality rates, for different fishing gears and coastal regions and/or bottom types, for all seven species in the complex, are needed.

Not completed.

7) Studies of the stock structure of the species in the skate complex are needed to identify unit stocks. Stock identification studies, especially for barndoor, thorny, winter, and little skate, are needed.

Not completed.

8) Explore possible stock-recruit relationships by examination of NEFSC survey data. A simultaneous examination of the species in the complex may prove a useful first step.

Stock-recruit relationships have been examined for five of the species in the complex. The second method is not appropriate for skates.

9) Investigate trophic interactions between skate species in the complex, and between skates and other groundfish.

Considerable progress has been made.

10) Further consideration of the validity of NEFSC trawl survey catchability conversion factors for skate species is needed (diel, gear, vessel).

Not completed.

11) Investigate the influence of annual changes in water temperature or other environmental factors on shifts in the range and distribution of the species in the skate complex. Establish the bathymetric distribution of the species in the complex off the U.S. Northeast coast.

Work has been done on winter skate to explore the changes in abundance between the Scotian Shelf and Georges Bank (Frisk et al, in review).

12) Investigate the SEAMAP survey data for clearnose and rosette skate.

Not completed.

13) Investigate historical NEFSC survey data from the Albatross III cruises during 1948-1962 when they become readily accessible, as they may provide valuable historical context for long term trends in skate biomass.

Not completed.

14) Recalculate the error distributions of the survey indices using alternative distributions.

Instead of assuming an error distribution, confidence intervals were derived using the bootstrap methods of Smith (1997).

8.0 TOR 6. Examine the NEFSC Food Habits Database to estimate diet composition and annual consumptive demand for seven species of skates for as many years as feasible.

8.1 Introduction

Skate food habits were evaluated for all seven species in the skate complex. The total amount of food eaten and the type of food eaten were the primary food habits data examined. From these basic food habits data, diet composition, per capita consumption, total consumption, and the amount of prey removed by skates were calculated. Contrasts to total energy flows in the ecosystem and fishery removals of commercially targeted skate prey were conducted to fully address the Term of Reference.

8.2 Methods

Each skate was analyzed separately; emphasizing at least two if not three size classes as appropriate (Table B6.1). These size classes correspond to notable changes in diet and life history and also minimized low data density (i.e., number of stomachs sampled) for each size class. Each skate was analyzed for a particular bottom trawl survey strata set germane for each case (Table B6.1). For all the estimates, small winter skates (< 30 cm) were grouped with immature little skates. Estimates were analyzed on an annualized basis for each species, save instances were data density of stomach samples was too low. In those cases data were evaluated across 5-year time blocks. Although the food habits data collections started quantitatively in 1973, not all species of skates were sampled during the full extent of this sampling program. For more details on the food habits sampling protocols and approaches, see Link and Almeida (2000). Where data are available, they are used except in the case of little skate (see above for discussion on why those estimates begin in 1982). This sampling program was a part of the NEFSC bottom trawl survey program; for background and context, further details of the survey program can be found in Azarovitz (1981) and NEFC (1988).

Basic Food Habits

To estimate mean stomach contents (S_i), each skate had the total amount of food eaten (as observed from food habits sampling) calculated for each size class, temporal and spatial scheme. The denominator in the mean stomach contents (i.e., the number of stomachs sampled) was inclusive of empty stomachs. These means were weighted by the number of tows in a temporal and spatial scheme as part of a two-stage cluster design. Further particulars of these estimators can be found in Link and Almeida (2000). Units for this estimate are in g.

To estimate diet composition (D_{ij}), the amount of each prey item was summed across all skate stomachs. These estimates were then divided by the total amount of food eaten in a size class, temporal and spatial scheme, totaling 100%. These estimates are proportions and were only presented for those major prey comprising >85% of the total for each size class, temporal and spatial scheme. Further particulars of these estimators can be found in Link and Almeida (2000).

Consumption Rates

To estimate per capita consumption, the gastric evacuation rate method was used (Eggers 1977, Elliott and Persson 1978). There are several approaches used for estimating consumption, but this approach was chosen as it was not overly simplistic (as compared to % body weight; Bajkov 1935) or overly complex (as compared to highly parameterized bioenergetics models; Kitchell et al. 1977). There has been extensive use of these models (Durbin et al. 1983, Ursin et al. 1985, Pennington 1985, Overholtz et al. 1991, 1999, 2000, Tsou & Collie 2001a, 2001b, Link & Garrison 2002, Link et al. 2002, 2006, Overholtz & Link 2007). Units are in g year^{-1}.

Using the evacuation rate model to calculate consumption requires two variables and two parameters. The per capita consumption rate, C_i is calculated as:

$$C_i = 24 \cdot E_i \cdot \overline{S_i}^{\gamma}$$

where 24 is the number of hours in a day and the evacuation rate E_i is:

$$E_i = \alpha e^{\beta T} \qquad ;$$

and is formulated such that estimates of mean stomach contents (S_i) and ambient temperature (T; here used as bottom temperature from the NEFSC bottom trawl surveys (Taylor and Bascunan 2000; Taylor et al. 2005) are the only data required. The parameters α and β are set as values chosen from the literature (Tsou and Collie 2001a, 2001b, Overholtz et al. 1999, 2000). The parameter γ is a shape function is almost always set to 1 (Gerking 1994).

To evaluate the performance of the evacuation rate method for calculating consumption, a simple sensitivity analysis was executed. The first phase of the sensitivity analysis fixed the two parameters and two variables, varying them one at a time. These varied across both the normal range from the data or literature and across proximal orders of magnitude to the normative range. The second phase varied all two pairs of values simultaneously, presented as surface plots to denote areas of rapid change and areas of relative stability (flat surfaces).

Scaling Consumption

After per capita consumption rates were estimated for each skate in a size class, temporal and spatial scheme, those estimates were scaled up to an annual and stock wide basis, C:

$$C = 365 \cdot C_i \cdot N_i$$

where N_i is the swept area estimate of abundance for each skate in each size class, temporal and spatial scheme and 365 is the number of days in a year.

This total consumption was partitioned for the major prey items of each skate by multiplying it by the diet composition of each prey (D_{ij}) to provide an estimate of prey removals by each skate. Both the total consumption and the amount of prey removed by each skate are presented as metric tons year^{-1}.

To evaluate the consumptive demands of a skate stock and the predatory removals of a skate stock in a broader ecosystem context, two contrasts were executed. First, comparisons of total consumption by each skate and by all skates combined were compared to the amount of energy flows for the entire ecosystem. These total energy flows were calculated in a recent energy budget (Link et al. 2006). Skate consumption is presented as a percentage of total energy flows in the ecosystem.

Second, the total amount of commercially targeted prey eaten by skates was treated as a removal and summed across all skates. These estimates were then compared to concurrently estimated fishery landings to provide an evaluation of potential competition between skates and fisheries on some of their major prey.

One concern of this approach is that the abundance estimates used to scale per capita skate consumption up to total population level consumption were not corrected for catchability or gear efficiency of the bottom trawl survey. To evaluate the potential effect of this factor, efficiencies of 100, 50, 25 and 10% were applied to estimates of total prey removal by all skates.

8.3 Results

Sensitivity analysis

The fixed values for all parameters were mean stomachs, S_i = 10, mean bottom temperature, T = 10, scaling coefficient α = 0.02, and exponent coefficient β = 0.111. The parameters are consistent with literature values for other elasmobranchs (Tsou and Collie 2001a, 2001b).

Examining the sensitivity to mean stomach contents demonstrates a clear linear relationship to per capita consumption across the full range of observed skate stomachs (Figure B6.1a). This is obvious the one factor that most highly data driven and represents an intuitive relationship- the more food measured that a skate eats, the higher the annual per capita consumption. The range of food consumed can be anywhere from 50 g to 60 kg, consistent with observed food habits for this species complex.

Examining the sensitivity to mean bottom temperature demonstrates a curvilinear relationship with per capita consumption (Figure B6.1b). The upper tail of the range (i.e., > 15^{o}C) represents an increase up to 10-20 kg consumed per year. However, the per capita consumption in the range of typical temperatures encountered by skates are on the order of 4-6 kg per year.

Examining the sensitivity to changes in α similarly demonstrates a curvilinear relationship with per capita consumption (Figure B6.2a), albeit with α presented on a logarithmic scale. This relationship is much more convex than with temperature, with consumption values where α ~ 0.1 approaching 30 kg per year. However, within the range of α typically reported from the literature (α = 0.01 to 0.05) results in a consumption on the order of 5-10 kg per year.

Examining the sensitivity to changes in β also demonstrates a curvilinear relationship with per capita consumption (Figure. B6.2b). At the upper tail of the analysis with > 0.2 results in a consumption estimate of 15-20 kg per year. However, within the range of β typically reported from the literature (β = 0.1 to 0.12) results in a consumption on the order of 5-7 kg per year.

The most sensitive factor, when within normal range, is mean stomach contents of these skates.

Examining some salient pairs, one sees that categorically when looking at the upper end of mean stomach contents versus β, α or T (Figures B6.3-B6.5) there is a clear spike at the upper range of any of those three factors with stomach contents. These peaks can result in per capita consumption estimates of over 300 kg per year. However, when one looks at the typical range of β, α or T the surfaces are much flatter and more stable, even at the upper range of S_i. A similar pattern emerges when comparing β and α (Figure B6.6). Yet even this maximum-maximum range is on the order of 120 kg per capita consumption per year, much less than when including S_i. This surface is also much flatter than the other ones that include S_i.

To put the sensitivity analysis in perspective, when both parameters were within the normal range, the change to per capita consumption was < half to one order of magnitude. The temperature variable across the maximum possible range only changes the per capita consumption by < an order of magnitude. Most observed temperature ranges are << quarter of an order of magnitude.

An order of magnitude change in the amount of food eaten results in an order of magnitude change in per capita consumption. Variance about any particular species of skate has a CV of ~50%. Thus, within any given species for each size class, temporal and spatial scheme, the variability of S_i is likely to only influence per capita consumption by half an order of magnitude or less.

Estimates of abundance, and changes in estimates thereof, are likely going to dominate the scaling of total consumption by a broader range of magnitudes than the parameters and variables requisite for an evacuation method of estimating consumption.

Winter Skate

The mean stomach contents for winter skate show a relatively stable amount of food eaten for both size classes (Figure B6.7a). Small winter skates (< 30 cm) were grouped with immature little skates. In instances with large error bars, there is an appearance of a major increase in food eaten during the early 1980s, yet this may be due to limited sample sizes during that period. Except the early 1980s, the number of empty stomachs has remained similar across the time period, averaging ~ 20% and ~25% for the medium and large size classes respectively (Figure B6.7b).

The mean length of skates sampled for stomach contents was consistent over time, averaging approximately 45 cm and 80 cm for medium and large size classes respectively (Figure B6.8a). There is a relationship between the size of skates and the amount of food eaten by skates, despite the wide variability in a few years (Figure B6.8b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 7 and 10^{o}C (Figure B6.9a).

The per capita consumption of this skate (Figure B6.9b) generally tracks the amount of food eaten (Figure B6.7a). Values average approximately 2 kg per year for the medium size class and between 9 kg per year for the large size class.

Total minimal estimates of swept area abundance (Figure B6.10a) are generally comparable to estimates noted above. There was generally no trend for all three size classes over the entire time period except the large size. The large winter skates class exhibited a peak in the 1980s followed by a notable decline in the 1990s, with some recovery now apparent in more recent years. This is one of the more abundant skate species.

Total consumption when scaled to the population level generally tracks abundance more than any other contributing factor (Figure B6.10b). Both size classes show a peak in the 1980s, consistent with the observed peak in the abundance of the larger size class (Figure B6.10a). Estimates here for total consumptive demand by this skate range between 20,000 and 180,000 MT per year.

The diet composition of winter skate is reflective of the generally benthivorous diet of all skates and the piscivorous nature of particularly larger skates (Table B6.2). Major prey of this skate are primarily forage fishes (herrings, hakes) or benthic megafauna (crabs, shrimp). The category other fish refers to those species that are not primarily commercially targeted. The category other crabs refers to those crabs that are not in the genus *Cancer* or Paguroidean family.

When allocating total consumption of winter skate proportionally to each prey item, forage fish, squids, and benthic macrofauna are clearly the major amount of prey removed by this skate (Figures B6.11-B6.12). Up to 80,000 MT of a particular prey item can be removed by this skate in any given year.

Little Skate

The mean stomach contents for Little Skate show an increasing amount of food eaten in the 1980s for the both size classes, followed by a more stable amount during the past 20 years (Figure B6.13a). The number of empty stomachs has remained mostly similar across the time period, averaging ~10% for both size classes (Figure B6.13b). Recall that small winter skates (< 30 cm) are grouped in with the immature little skates.

The mean length of skates sampled for stomach contents was consistent over time, averaging approximately 20 cm and 45 cm for immature and mature size classes (Figure B6.14a). There is a clear relationship between the size of skates and the amount of food eaten by skates (Figure B6.14b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 7 and 11°C (Figure B6.15a).

The per capita consumption of this skate (Figure B6.15b) generally tracks the amount of food eaten (Figure B6.13a). Values average approximately 500 g per year for immatures and 2.5 kg per year for matures.

Total minimal estimates of swept area abundance (Figure B6.16a) are generally comparable to estimates noted above. There were some fluctuations during the later 1990s and early 2000s, but these were centered about, and returned to, the long term average abundance. This was the most abundant skate species in the ecosystem.

Total consumption when scaled to the population level generally tracks abundance more than any other contributing factor (Figure B6.16b). Both size classes exhibit a reasonably stable amount of food eaten, but the total consumption is dominated by the mature size class (Figure B6.16a). Estimates here for total consumptive demand by this skate range between 100,000 and 350,000 MT per year.

The diet composition of little skate is reflective of the generally benthivorous nature of all skates (Table B6.3). Most of the major prey of this skate are comprised of benthic macrofauna (polychaetes, amphipods) or benthic megafauna (crabs, bivalves).

When allocating total consumption of little skate proportionally to each prey item, benthic invertebrates are clearly the major amount of prey removed by this skate (Figure B6.17). Up to 100,000 MT of a particular prey item can be removed by this skate in any given year.

Barndoor Skate

The mean stomach contents for barndoor skate show a relatively stable amount of food eaten for the immature size class (Figure B6.18a). In the larger size class there are instances with large error bars, giving an appearance of a major decline in food eaten circa 2002 to 2003. Yet this may be due to limited sample sizes during 2002. The number of empty stomachs has remained similar across the time period, averaging ~25% for both size classes (Figure B6.18b).

The mean length of skates sampled for stomach contents was consistent over time, averaging slightly less than 60 cm and slightly over 100 cm for immature and mature size classes respectively (Figure B6.19a). There is a clear relationship between the size of skates and the amount of food eaten by skates, despite the wide variability in a few years (Figure B6.19b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 7 and 9°C, declining slightly in more recent years (Figure B6.20a).

The per capita consumption of this skate (Figure B6.20b) generally tracks the amount of food eaten (Figure B6.18a). Values typically range approximately 5 kg per year for immatures and between 10 to 20 kg per year for matures.

Total minimal estimates of swept area abundance (Figure B6.21a) are generally comparable to estimates noted above. There was a generally increasing trend for both size classes over time, although numbers are still relatively low.

Total consumption when scaled to the population level generally tracks abundance more than any other contributing factor (Figure B6.21b). Both size classes show a peak in 2002, consistent with the observed peak in mean stomach contents (Figure B6.18.a). Estimates here for total consumptive demand by this skate range between 4,000 and 16,000 MT per year.

The diet composition of barndoor skate is reflective of the generally benthivorous nature of all skates and the piscivorous nature of particularly larger skates (Table B.6.4). Most of the major prey of this skate are comprised of forage fishes (herrings, hakes) or benthic megafauna (crabs, shrimp). The category other fish refers to those species that are not primarily commercially targeted. The category other crabs refers to those crabs that are not in the genus *Cancer* or Paguroidean family.

When allocating total consumption of barndoor skate proportionally to each prey item, herrings, Pandalid shrimps, and *Cancer* crabs are clearly the major amount of prey removed by this skate (Figure B6.22). Up to 8,000 MT of a particular prey item can be removed by this skate in any given year.

Thorny Skate

The mean stomach contents for thorny Skate show a relatively stable amount of food eaten for two of the three size classes, with medium skates exhibiting a slight increase (Figure B6.23a). Aside from the 1976 to 1980 time period (five year block), the number of empty stomachs has remained similar across the time period, averaging ~15 to 20% for all size classes (Figure B6.23b).

The mean length of skates sampled for stomach contents was consistent over time for all three size classes, averaging approximately 20 cm, 45 cm, and slightly less than 80 cm for the small, medium and large size classes respectively (Figure B6.24a). There is a clear relationship between the size of skates and the amount of food eaten by skates (Figure B6.24b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 7 and 9^{o}C, declining slightly in more recent years (Figure B6.25a).

The per capita consumption of this skate (Figure B6.25b) generally tracks the amount of food eaten (Figure B6.23a). Values average approximately 500 g per year for the small size class,1.5 kg per year for the medium size class, and 12 kg per year for the large size class.

Total minimal estimates of swept area abundance (Figure B6.26a) are generally comparable to estimates noted above. There was a clear declining trend for all size classes over time, although numbers are still relatively low.

Total consumption when scaled to the population level generally tracks abundance more than any other contributing factor (Figure B6.26b). All three size classes show a peak in the early 1980s, consistent with the observed peak in mean stomach contents (Figure B6.23a). Estimates here for total consumptive demand by this skate range between 10,000 and 40,000 MT per year.

The diet composition of thorny skate is reflective of the generally benthivorous nature of all skates and the piscivorous nature of particularly larger skates (Table B6.5). Most of the major prey of this skate are comprised of forage fishes (herrings, hakes) or benthic megafauna (crabs, euphasiids). The category other fish refers to those species that are not primarily commercially targeted. The category other crabs refers to those crabs that are not in the genus *Cancer* or Paguroidean family.

When allocating total consumption of thorny skate proportionally to each prey item, herrings, squids, polychaetes, silver hake and other fish are the major amount of prey removed by this skate (Figures B6.27-B6.28). Up to 8,000 MT of a particular prey item can be removed by this skate in any given year.

Smooth Skate

The mean stomach contents for Smooth Skate show a relatively stable amount of food eaten for both size classes (Figure B6.29a). The number of empty stomachs has remained stationary across the time period, albeit with a wide range of variability (particularly for immatures), averaging ~15 to 20% for both size classes (Figure B6.29b). There were no empties for one part of the time series.

The mean length of skates sampled for stomach contents was consistent over time, averaging around 20-25 cm and 50 cm for immature and mature size classes respectively (Figure B6.30a). There is a clear relationship between the size of skates and the amount of food eaten by skates (Figure B6.30b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 7 and 10^{o}C (Figure B6.31a).

The per capita consumption of this skate (Figure B6.31b) generally tracks the amount of food eaten (Figure B6.29a). Values typically range between 0.5 to 1 kg per year for immatures and 2 to 3 kg per year for matures. Because these stomachs were calculated in five year time blocks, these estimates reflect that periodicity.

Total minimal estimates of swept area abundance (Figure B6.32a) are generally comparable to estimates noted above. There was a lot of variability and the abundance of both size classes varied without trend.

Total consumption when scaled to the population level generally tracks abundance and amount of food consumed more than any other contributing factors (Figure B6.32b). Both size classes are highly variable, with the majority of the consumption for this population occurring in the mature size class.. Estimates for total consumptive demand by this skate range between 1,000 and 5,000 MT per year.

The diet composition of smooth skate is reflective of the generally benthivorous nature of all skates (Table B6.6). Most of the major prey of this skate are comprised of common benthic megafauna (pandalids, euphausiids).

When allocating total consumption of smooth skate proportionally to each prey item, pandalid shrimp and euphausiids are clearly the major amount of prey removed by this skate (Figure B6.33). Up to 2,000 MT of a particular prey item can be removed by this skate in any given year, but values are typically on the order of 500 to 1,000 MT.

Clearnose Skate

The mean stomach contents for Clearnose Skate show a relatively stable amount of food eaten for the immature size class (Figure B6.34a). The same is true for the larger size class. In the larger size class there may be a slightly increasing trend in the amount of food eaten. In the instance with large error bars there is an appearance of a major change in the amount of food eaten. Again this may be due to limited sample sizes during that 2005. The number of empty stomachs has remained stationary across the time period, albeit with a wide range of variability (particularly for immatures), averaging ~25 to 30% for both size classes (Figure B6.34b).

The mean length of skates sampled for stomach contents was consistent over time, averaging around 45-50 cm and 60-65 cm for immature and mature size classes respectively (Figure B6.35a). There is a clear relationship between the size of skates and the amount of food eaten by skates, despite the wide variability in one year (Figure B6.35b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 9 and 13^{o}C (Figure B6.36a).

The per capita consumption of this skate (Figure B6.36b) generally tracks the amount of food eaten (Figure B6.34a). Values typically range approximately 1 to 2 kg per year for immatures and 5 kg per year for matures. Because these stomachs were calculated in five year time blocks, these estimates are similar in that periodicity.

Total minimal estimates of swept area abundance (Figure B6.37a) are generally comparable to estimates noted above. There was a generally increasing trend for both size classes over time, although numbers are still relatively low.

Total consumption when scaled to the population level generally tracks abundance and amount of food consumed more than any other contributing factors (Figure B6.37b). Both size classes show a peak in 2002, consistent with the observed peak in abundance and mean stomach contents during that five year period (Figures B6.37a and B6.34a). Estimates here for total consumptive demand by this skate range between 2,000 and 18,000 MT per year.

The diet composition of clearnose skate is reflective of the generally benthivorous nature of all skates (Table B6.7). Most of the major prey of this skate are comprised of common benthic megafauna (crabs, misc. crustaceans). The category other crabs refers to those crabs that are not in the genus *Cancer* or Paguroidean family.

When allocating total consumption of clearnose skate proportionally to each prey item, other crabs, *Cancer* crabs, squids are clearly the major amount of prey removed by this skate (Figure B6.38). Up to 8,000-10,000 MT of a particular prey item can be removed by this skate in any given year, but values are typically on the order of 2,000 to 4,000 MT.

Rosette Skate

The mean stomach contents for Rosette Skate show a relatively stable amount of food eaten for both the immature and mature size classes (Figure B6.39a). The number of empty stomachs was again around 30%, but increased slightly in more recent years (Figure B6.39b).

The mean length of skates sampled for stomach contents was consistent over time, averaging approximately 22 cm and 38 cm for immature and mature size classes respectively (Figure B6.40a). There is a clear relationship between the size of skates and the amount of food eaten by skates (Figure B6.40b).

The temperature for these strata (and the environment which this skate was experiencing) ranged between 9 and 12^{o}C (Figure B6.41a).

The per capita consumption of this skate (Figure B6.41b) generally tracks the amount of food eaten (Figure B6.39a). Values average approximately 200 g per year for immatures and 800g per year for matures.

Total minimal estimates of swept area abundance (Figure B6.42a) are generally comparable to estimates noted above. There was a peak in 2001 for matures and 2002 for immatures. No major trend for both size classes was evident.

Total consumption when scaled to the population level generally tracks abundance more than any other contributing factor (Figure B6.42b). The mature size classes shows a peak in 2001 and the immatures show a peak in 2002, consistent with the observed abundances (Figure B6.42a). Estimates here for total consumptive demand by this skate range between 50 and 500 MT per year.

The diet composition of rosette skate is reflective of the generally benthivorous nature of all skates (Table B6.8). Most of the major prey of this skate are comprised of some form of benthic macrofauna (amphipods, polychaetes) or megafauna (crabs, shrimp). The category other crabs refers to those crabs that are not in the genus *Cancer* or Paguroidean family.

When allocating total consumption of rosette skate proportionally to each prey item, benthic macrofauna are clearly the major prey removed by this skate. Pandalid shrimps, squids, and *Cancer* crabs are also removed by this skate but in lesser amounts (Figure B6.43). Up to 70 MT of a particular prey item can be removed by this skate in any given year, but more typically 10-30 MT.

All Skates relative to the ecosystem and fisheries on major prey

The total amount of skate consumption across all skates has averaged around 230,000 MT over the past 25-30 years (Figure B6.44). This represents a relatively small amount of the total energy flow in the ecosystem. There is 3.9×10^9 MT of total throughput through the ecosystem (Link et al. 2006) and skate consumption represents less than 0.006% of that total energy flow in the system. The total removal of most major skate prey relative to their standing stock biomass (B) or annual production (P) is small (Table B.6.9). Estimates of B and P tend to be at least two to three orders of magnitude greater than C by all skates for any particular prey item.

Those prey which are commercially important species and which are also important skate prey can be removed by skates at a rate comparable to their fisheries (Figure B.6.44; Table B.6.10). In the minimum swept area scenario, most skate prey are on the order of one quarter or less of what is landed for those prey, with the exception of red hake. When decreasing gear efficiencies are incorporated, the relative removal by skate consumption compared with fishery removals becomes much higher. With gear efficiencies of 50%, about half of fishery removals are removed by skate consumption for the two squids and silver hake, with over double removed by skates relative to the fishery for red hake. The pattern continues with increasingly less efficient assumptions, with squids and silver hake removed by skates up to twice of what is removed by the fishery at the lowest assumed value (10%), while red hake is up to 10 times what is removed by the fishery. The only exception is herrings, which although have a large amount of biomass removed by skates, remain a relatively small amount of removals compared to those fishery removals.

Finally, it is worth noting that some of the potential species interactions of interest- e.g. skates eating yellowtail flounder, winter flounder, sea scallops, etc.- were not of sufficient magnitude to analyze. In fact, each of the species just mentioned as examples only comprised a very small (<<0.1% of the diet) for only one or two skate species.

8.4 Summary

Most skates are benthivorous in their feeding habits. A clear prominence on *Cancer* crabs, other crabs, amphipods, polychaetes and similar benthic macrofauna and megafauna was apparent in the diets of these skates. Some of the larger skates- barndoor, thorny, and winter- can be piscivorous, particularly with ontogeny. The vast majority of fish (or fish-like) prey for these skates were small pelagic fishes and squids.

Save winter and little skates, overall consumption by most skate stocks is a relatively small amount of biomass flow. Most total consumption by any particular species of skate was scaled singularly by the abundance of that species. The vast majority of consumptive removals by all skates except little and winter was < 20 MT per year.

As an aggregate group, skates consume a very small fraction of the total energy flow in the ecosystem. Skate consumptive removal is two to three orders of magnitude lower than biomass or production of skate prey. When abundance estimates are scaled by gear efficiency, it is possible that skates could consume a notable fraction of forage fish and squid biomass relative to what is removed by a fishery. Yet most of those forage fish stocks are at relatively high levels of abundance.

9.0 SOURCES OF UNCERTAINTY FOR ASSESSMENT

1) The species composition and size structure of landings are generally unknown.

2) The true level of discards and the discard mortality rate are unknown.

3) A lack of information on the stock structure of the species in the skate complex has increased the uncertainty of conclusions about historical trends in abundance, and recommendations of appropriate biological reference points.

4) Life history data are from localized areas for barndoor, thorny, and clearnose and incomplete or totally lacking for two other species.

5) Mortality estimates based on equilibrium assumptions which are only partially met for these stocks. A preferable approach for future assessments would be an age-based method for determining mortality rates and estimates of longevity. This will require several years of future adequate length and age sampling, both from the commercial and research survey catches.

6) The proposed SFA biomass reference points are based on selected time periods of survey indices, but it is unknown how these relate to true estimates of B_{MSY}.

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SKATE TABLES

Table B1.1. Total commercial landings of skate (mt) in NAFO subareas 5 and 6 by country from 1960-2005. U.S. landings are from NAFO database from 1964-1988, weighout from 1989-2005.

	US	USSR	Others	Total
1964	4081	0	2	4083
1965	2343	0	20	2363
1966	2738	0	106	2844
1967	2715	2121	62	4898
1968	2417	3974	92	6483
1969	3045	6410	7	9462
1970	1583	2544	1	4128
1971	900	5000	5	5905
1972	866	7957	0	8823
1973	1191	6754	18	7963
1974	2026	1623	2	3651
1975	752	3216	0	3968
1976	754	412	46	1212
1977	1143	240	35	1418
1978	1130	216	7	1353
1979	1280	79	1	1360
1980	1577	0	4	1581
1981	838	0	9	847
1982	878	0	0	878
1983	3603	0	0	3603
1984	4157	0	0	4157
1985	3984	0	0	3984
1986	4159	0	94	4253
1987	5078	0	0	5078
1988	7255	0	9	7264
1989	6707	0	0	6707
1990	11403	0	0	11403
1991	11332	0	0	11332
1992	12525	0	0	12525
1993	12904	0	0	12904
1994	8783	0	0	8783
1995	7217	0	0	7217
1996	14213	0	0	14213
1997	10945	0	0	10945
1998	13829	0	0	13829
1999	11684	0	0	11684
2000	13360			13360
2001	13120			13120
2002	13004			13004
2003	15005			15005
2004	16073			16073
2005	13885			13885

Table B1.2. U.S. commerical landings (mt, live wt) of skates (all species) by month from 1964-2005.

	Month													
year	0	1	2	3	4	5	6	7	8	9	10	11	12	Total
1964	4050.3	2.0	3.9	3.6	3.1	2.0	1.6	0.9	1.3	1.6	2.0	2.1	6.4	4081.0
1965	2304.4	5.4	7.2	7.5	4.3	2.4	0.4	0.6	1.2	0.6	2.3	2.6	4.2	2343.0
1966	2707.1	6.4	7.3	6.0	1.0	0.9	0.2	0.1	0.7	1.7	1.4	2.4	2.9	2738.0
1967	2643.3	15.1	7.3	18.1	7.7	3.0	1.6	0.6	0.4	1.8	6.1	2.9	7.1	2715.0
1968	2381.3	10.3	1.9	5.3	1.3	1.5	1.3	1.5	2.6	3.0	2.8	2.5	1.7	2417.0
1969	2993.4	4.1	6.2	5.7	6.2	2.5	2.3	3.1	3.2	3.0	5.0	5.7	4.6	3045.0
1970	1513.4	6.1	8.6	13.9	7.0	4.1	3.4	5.6	5.3	8.3	4.1	2.1	1.1	1583.0
1971	836.7	4.9	6.2	8.5	7.3	7.7	2.7	3.0	2.8	3.5	8.2	3.9	4.7	900.0
1972	780.1	7.2	6.9	12.1	12.3	9.1	4.9	5.7	7.8	4.3	4.2	5.9	5.5	866.0
1973	1104.1	8.3	3.9	10.4	12.4	7.1	6.7	7.1	7.0	8.1	7.1	4.7	4.1	1191.0
1974	1945.9	5.7	4.9	5.6	12.3	8.0	4.6	4.4	12.3	6.7	5.2	2.6	7.8	2026.0
1975	637.9	7.3	10.1	16.6	16.2	13.0	7.3	6.7	7.6	9.8	5.6	6.9	6.9	752.0
1976	641.8	8.4	12.5	19.2	22.4	9.6	4.3	8.1	4.7	6.9	3.1	6.3	6.8	754.0
1977	994.7	15.4	19.7	27.9	20.0	9.0	8.9	6.8	11.0	7.0	8.8	9.3	4.5	1143.0
1978	827.4	19.3	24.7	11.7	29.8	30.5	46.4	33.9	26.2	23.2	20.9	19.3	16.7	1130.0
1979	787.4	24.8	24.8	46.5	62.6	50.4	28.1	29.4	55.5	38.8	42.1	52.9	36.5	1279.6
1980	961.1	61.5	112.6	121.1	82.8	63.9	27.3	26.4	24.4	22.8	27.4	20.5	25.4	1577.2
1981	509.9	33.9	30.8	54.4	31.1	26.7	25.3	15.1	24.5	23.1	12.3	19.2	31.9	838.4
1982	449.5	30.4	23.3	54.0	47.5	58.2	18.9	25.3	35.1	32.3	34.4	31.3	38.2	878.1
1983	2720.3	84.1	95.9	134.0	95.4	102.3	76.3	44.1	66.1	53.3	37.0	56.6	37.5	3603.0
1984	3325.7	99.4	127.3	134.9	108.6	84.0	36.7	30.9	29.0	25.9	37.0	54.2	63.0	4156.5
1985	3220.7	85.4	85.5	150.6	142.7	31.6	29.9	33.2	29.9	28.8	37.7	59.3	48.6	3984.1
1986	3173.4	98.6	89.7	149.7	147.8	91.8	36.4	33.7	49.0	28.2	72.6	86.3	102.5	4159.5
1987	3638.7	83.8	114.3	207.7	227.0	245.3	106.2	40.3	53.0	33.8	87.6	101.5	139.1	5078.4
1988	5141.7	281.6	338.2	378.7	284.0	150.3	74.5	154.5	137.9	75.0	54.1	66.2	118.8	7255.5
1989	4157.8	240.1	150.3	227.1	454.3	292.6	102.6	142.2	272.3	221.9	174.8	173.0	98.4	6707.3
1990	4252.9	136.6	182.0	424.8	834.4	948.5	1174.9	763.8	818.7	624.4	265.9	542.3	433.4	11402.5
1991	4255.9	464.0	423.8	460.9	606.0	419.8	370.4	658.1	925.7	515.5	565.5	958.9	708.0	11332.3
1992	4782.2	517.3	457.7	510.1	567.1	564.3	816.2	764.4	718.2	862.3	639.1	771.1	555.4	12525.3
1993	4860.4	335.1	265.6	471.2	741.7	875.2	823.2	1005.6	859.1	712.4	535.5	864.0	555.0	12904.0
1994	175.5	338.2	309.8	291.7	501.5	855.1	1238.4	780.9	1263.7	960.6	937.7	787.3	342.9	8783.3
1995	1.0	183.7	285.7	413.6	515.5	752.0	915.7	768.4	752.2	557.7	724.8	897.2	449.7	7217.1
1996	2.3	224.6	229.3	206.5	360.1	1012.0	1389.7	1539.8	1577.6	1720.4	2440.4	2411.8	1098.4	14212.8
1997		530.8	469.9	597.5	395.5	969.4	1127.6	1181.8	1189.6	1062.3	1084.2	1305.2	1031.1	10944.8
1998		518.9	589.8	625.4	814.9	1403.4	1702.2	1643.9	1512.7	1551.5	1224.9	1277.1	964.5	13829.2
1999		511.2	401.0	591.8	678.6	1295.5	1436.2	1039.3	1137.7	1388.8	1055.8	1250.0	898.1	11683.9
2000		668.1	615.2	1024.2	826.2	1187.7	1594.2	1188.5	1534.6	1270.1	946.4	1583.6	921.1	13359.9
2001		802.4	588.6	956.2	967.3	984.0	1058.2	1150.5	1465.1	1197.3	1115.1	1692.1	1143.7	13120.5
2002		742.3	730.7	783.2	1093.9	773.5	1372.6	998.7	1488.6	1247.8	1352.1	1264.4	1156.3	13004.0
2003		548.3	447.6	857.4	1043.7	1006.6	1183.0	1632.9	1867.9	1889.1	1993.3	1563.3	971.9	15004.9
2004		538.3	1279.4	1305.0	1391.0	1155.1	1456.9	2008.7	1557.9	1573.6	1115.7	1541.6	1150.2	16073.4
2005		869.9	1201.7	1070.1	1187.4	1098.5	1289.7	1650.4	1585.9	1320.7	824.4	987.2	798.7	13884.6

Table B1.3. U.S. Commercial landings (mt, live wt) of skates (all species) by state from 1964-2005. Data are from weighout database.

	STATE											
year	CT	DE	ME	MD	MA	NH	NJ	NY	NC	RI	VA	Total
1964					28.2					2.4		30.7
1965					38.1					0.4		38.6
1966					30.1					0.8		30.9
1967					71.1					0.5		71.7
1968					35.7							35.7
1969					51.6							51.6
1970					69.0					0.6		69.6
1971					61.9					1.4		63.3
1972					85.2					0.7		85.9
1973			1.5		80.9					4.6		86.9
1974			8.8		67.2					4.1		80.1
1975			14.9		94.8					4.4		114.1
1976			36.2		74.9					1.1		112.2
1977			62.6		82.0					3.7		148.3
1978			86.9		161.8		2.9			50.9		302.6
1979			181.1		259.0		0.7			51.5		492.2
1980			197.5		297.5		0.4			120.7		616.1
1981			151.2		137.3	2.2	0.8			37.0		328.4
1982			175.0		210.4	3.9	0.1			39.3		428.7
1983			258.8		455.0	3.3	0.6			165.0		882.7
1984			230.8		445.4	2.6	0.7			150.8	0.5	830.8
1985			144.5		409.3	2.3	2.4			204.9		763.3
1986			107.6		363.8	1.1	10.8	55.0		447.2	0.6	986.1
1987			168.9		746.2	20.6	8.9	133.1		361.9		1439.7
1988			81.9		1376.2	51.9	10.5	172.2		420.9		2113.7
1989	12.2		99.8		2030.1	18.6	18.2	107.7		4420.0	0.7	6707.3
1990	146.9		47.1	1.7	5742.0	10.5	8.8	162.4		5282.1	1.1	11402.5
1991	113.3		16.9		5696.1	12.4	125.4	56.9		5310.7	0.6	11332.3
1992	97.0		45.1	0.6	5923.3	10.1	267.2	231.1		5950.1	0.8	12525.3
1993	237.9		167.1	4.1	6118.5	9.5	376.1	168.2		5820.3	2.3	12904.0
1994	175.5		442.9	46.6	6616.4	37.2	186.1	225.3		1047.1	6.4	8783.3
1995	309.3		349.2	45.6	2926.5	24.6	291.4	141.7		3111.5	17.3	7217.1
1996	432.0		267.4	55.8	9016.9	20.3	339.2	164.2		3908.8	8.3	14212.8
1997	357.5		221.0	97.8	3933.4	17.0	794.8	374.5	9.4	5131.4	8.1	10944.8
1998	441.9		162.2	95.6	6322.4	19.1	807.8	575.0	9.1	5372.5	23.6	13829.2
1999	518.3		218.8	63.5	4809.3	26.3	636.8	396.8	2.6	4911.9	99.6	11684.0
2000	493.8		138.0	65.6	6517.8	38.4	564.6	387.7	20.6	4825.3	308.2	13360.0
2001	618.9		138.2	55.5	6683.5	33.2	624.7	366.8	0.1	4536.2	63.4	13120.5
2002	367.6		137.2	52.0	6335.0	24.5	582.4	462.9	0.3	5029.6	12.7	13004.0
2003	433.7		76.4	26.9	8098.0	14.9	448.7	353.3	0.8	5516.6	35.7	15004.9
2004	441.7	0.0	13.3	6.2	10075.9	10.6	374.3	222.7	0.5	4882.6	45.7	16073.4
2005	47.6		10.9	8.4	8989.2	9.4	334.8	157.5	0.5	4296.0	30.3	13884.6

Table B1.4. U.S. Commercial landings (mt, live wt) of skates (all species) by gear type fromo 1964-2005. Landings are from weighout database.

	gear				
year	longline	otter trawl	other	sink gillnet	Total
1964	0.1	30.5		0.0	30.7
1965	0.3	38.2		0.0	38.6
1966		30.9			30.9
1967		71.7			71.7
1968		35.7			35.7
1969		51.5		0.0	51.6
1970	0.6	68.8	0.0	0.2	69.6
1971	1.1	62.0		0.1	63.3
1972	3.7	80.8	0.1	1.3	85.9
1973	7.0	77.9	1.9	0.2	86.9
1974	10.5	64.3	0.2	5.1	80.1
1975	11.7	101.4	0.1	0.8	114.1
1976	16.2	93.3	0.2	2.5	112.2
1977	13.4	126.8	0.9	7.2	148.3
1978	4.4	290.0	3.2	5.0	302.6
1979	18.4	456.0	5.8	12.0	492.2
1980	16.5	577.9	6.0	15.6	616.1
1981	5.1	311.7	1.2	10.4	328.4
1982	2.0	408.4	7.4	10.8	428.7
1983	3.4	846.2	22.5	10.6	882.7
1984	5.0	796.5	19.1	10.3	830.8
1985	3.7	721.5	17.8	20.3	763.3
1986	6.6	954.4	14.2	10.9	986.1
1987	22.4	1384.4	16.1	16.8	1439.7
1988	5.7	2070.7	22.2	15.2	2113.7
1989	30.6	6636.1	27.3	13.4	6707.3
1990	3.8	11339.6	47.7	11.5	11402.5
1991	24.3	11169.9	77.0	61.1	11332.3
1992	21.9	12242.5	35.1	225.8	12525.3
1993	63.4	11913.6	204.6	722.3	12904.0
1994	197.2	7194.4	357.4	1034.3	8783.3
1995	97.1	5777.2	400.7	942.1	7217.1
1996	51.8	12944.3	134.4	1082.3	14212.8
1997	47.7	8822.8	471.6	1602.8	10944.8
1998	53.2	11724.8	576.4	1474.8	13829.2
1999	48.5	10059.3	144.9	1431.3	11684.0
2000	34.9	11464.0	72.0	1789.0	13360.0
2001	12.0	10835.0	27.7	2245.9	13120.5
2002	32.8	9667.7	31.0	3272.4	13004.0
2003	97.1	10254.3	43.0	4610.6	15004.9
2004	136.9	10694.3	2217.0	3025.3	16073.4
2005	342.7	7744.3	2532.9	3264.7	13884.6

Table B1.5. U.S. landings (mt, live wt) of skates by species and markey category from 1964-2005. Landings are from weighout database.

	Species and Market Category																	
YEAR	Uncl.	Uncl.	Winter	Winter	Little	Little	Barndoor	Barndoor	Thorny	Thorny	Smooth	Smooth	Clearnose	Clearnose	Rose	Rose	Total	
	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings
1964	30.7																30.7	0.0
1965	38.6																38.6	0.0
1966	30.9																30.9	0.0
1967	71.7																71.7	0.0
1968	35.7																35.7	0.0
1969	51.6																51.6	0.0
1970	69.6																69.6	0.0
1971	63.3																63.3	0.0
1972	85.9																85.9	0.0
1973	86.9																86.9	0.0
1974	80.1		0.0														80.1	0.0
1975	114.1																114.1	0.0
1976	112.2																112.2	0.0
1977	148.3																148.3	0.0
1978	302.6																302.6	0.0
1979	492.2																492.2	0.0
1980	616.1																616.1	0.0
1981	328.4																328.4	0.0
1982	277.2	151.4															277.2	151.4
1983	169.6	713.0															169.6	713.0
1984	68.1	762.8															68.1	762.8
1985	68.3	695.0															68.3	695.0
1986	262.6	723.5															262.6	723.5
1987	87.5	1352.2															87.5	1352.2
1988	74.2	2039.6															74.2	2039.6
1989	4163.1	2544.2															4163.1	2544.2
1990	5002.9	6399.6															5002.9	6399.6
1991	5069.2	6262.5			0.6												5069.7	6262.5
1992	5860.5	6664.7															5860.5	6664.7
1993	5526.6	7377.5	0.0														5526.6	7377.5
1994	703.4	8079.9															703.4	8079.9
1995	3095.1	3985.5			136.6												3231.7	3985.5
1996	3981.5	10230.8	0.4		0.2												3982.0	10230.8
1997	5369.1	5575.6															5369.1	5575.6
1998	5391.8	8437.4			0.0												5391.8	8437.4
1999	5026.7	6655.2					2.1										5028.7	6655.2
2000	3633.4	8690.5	0.0		1036.0	0.1	0.0										4669.4	8690.6
2001	4399.5	8718.6	2.2		0.0	0.1						0.1					4401.7	8718.8
2002	4396.9	8606.9				0.1		0.1									4396.9	8607.1
2003	4327.8	10650.0	0.8	26.0	0.2						0.1						4328.8	10676.0
2004	998.5	8451.6	2.8	2697.5	2867.4	8.6	0.3	0.1	0.0	95.6	1.0	927.2	3.5	16.6		2.7	3873.6	12199.8
2005	142.2	6710.1	59.3	3301.4	3465.3	15.6	0.3	5.4	1.5	126.2	0.6	1.0	32.5		16.6	5.9	3718.3	10165.6

Table B1.6. U.S. landings (my, live wt) of skates by state, species and market category for 2004-2005.

		Species and Market Category																	
		Uncl.	Uncl.	Winter	Winter	Little	Little	Barndoor	Barndoor	Thorny	Thorny	Smooth	Smooth	Clearnose	Clearnose	Rosette	Rosette	Total	
YEAR	State	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings	Whole	Wings
2004	CT	369.9	71.8															369.9	71.8
	DE	0.0																0.0	0.0
	ME	0.0	12.2		1.2													0.0	13.3
	MD	1.0	2.4		2.7	0.1												1.1	5.1
	MA	17.7	6482.2	0.2	2467.9	97.5				0.0	83.4	0.1	926.8				0.1	115.5	9960.4
	NH		5.1		5.4						0.1							0.0	10.6
	NJ	1.5	131.2	0.3	135.5	103.0	2.7				0.1							104.8	269.5
	NY	23.3	183.6	1.2	0.6	0.7	0.1				12.0	1.0	0.3					26.1	196.7
	NC		0.5															0.0	0.5
	RI	584.1	1538.6	1.2	84.2	2666.1	5.8										2.6	3251.3	1631.3
	VA	1.1	24.1					0.3	0.1					3.5	16.6			4.9	40.8
	Total	998.5	8451.6	2.8	2697.5	2867.4	8.6	0.3	0.1	0.0	95.6	1.0	927.2	3.5	16.6		2.7	3873.6	12199.8
2005	CT	0.1	47.5															0.1	47.5
	ME		10.2		0.5		0.2											0.0	10.8
	MD	2.3	6.1															2.3	6.1
	MA	60.2	5699.4	21.7	3071.7	21.1			1.3	1.5	111.6	0.0	0.7					104.5	8884.8
	NH	0.0	9.4															0.0	9.4
	NJ	0.4	120.1	24.4	110.7	45.0	1.1	0.1				0.4		32.5				102.9	231.9
	NY	12.3	96.6	0.4	1.5	12.7	0.2	0.2	4.1		12.6	0.0	0.3			16.6		42.2	115.3
	NC		0.5															0.0	0.5
	RI	66.6	690.9	12.8	116.9	3386.5	14.1				2.0	0.2	0.1				5.9	3466.1	829.9
	VA	0.3	29.3															0.3	29.3
	Total	142.2	6710.1	59.3	3301.4	3465.3	15.6	0.3	5.4	1.5	126.2	0.6	1.0	32.5		16.6	5.9	3718.3	10165.6

Table B1.7. Discards (mt) of skates (all species) by gear type, empty cells not filled in. Dashes indicate no sampling.

year	Line Trawl	Longline	Otter Trawl	Scallop Trawl	Pair Trawl	Shrimp Trawl	Sink Gill Net	Scallop Dredge	Mid-Water	Lobster Pot	Blue Crab Pots	Scottish Seine	Grand Total
1989	-	-	56,622	-	-	85	127	-	-	-	-	-	56,834
1990	-	0	77,805	-	-	258	624	-	-	-	-	-	78,687
1991	865	0	45,775	-	-	283	289	6,391	0	0	-	-	53,602
1992	1,438	30	45,334	-	0	245	452	39,705	0	0	-	-	87,204
1993	45	0	28,388	-	188	36	375	22,866	0	31	-	-	51,929
1994	0	0	32,458	-	-	13	856	10,525	0	0	-	-	43,852
1995	0	0	37,564	-	-	9	767	18,074	0	0	-	-	56,414
1996	-	-	32,693	-	-	35	1,090	18,321	-	0	-	-	52,139
1997	-	0	10,032	-	-	1	537	15,606	-	0	-	-	26,176
1998	-	-	14,051	-	-	-	593	14,626	-	0	-	-	29,270
1999	-	-	16,827	-	-	-	1,057	15,901	0	5	-	-	33,789
2000	-	-	29,121	-	-	-	1,130	12,099	0	29	-	-	42,379
2001	-	-	42,461	365	-	0	609	6,070	0	-	-	18	49,523
2002	39	-	43,740	268	-	-	2,015	15,651	0	-	12,375	7	74,095
2003	15	-	32,370	-	-	11	946	14,977	0	0	-	1	48,320
2004	29	-	27,341	161	-	0	803	4,970	1	-	-	0	33,306
2005	825	-	13,824	35	-	2	2,180	2,794	0	0	-	-	19,660

Table B1.8. Discards of skates (all species) by year, quarter, region in the otter trawl fishery.

	Quarter	1			2			3			4		
year	Region	MA	NE	Total	MA	NE	Total	MA	NE	Total	MA	NE	Total
1989	ntrips	5	17	22	4	41	45	8	61	69	9	31	40
	dkratio	0.39	0.46	0.85	0.14	0.53	0.67	0.36	0.26	0.63	0.19	0.55	0.74
	mt kept	11518.8	26350.1	37868.9	6714.3	31405.5	38119.8	4064.5	25253.5	29317.9	7752.5	23253.9	31006.4
	mt discard	4512.8	12032.2	16545.1	959.5	16701.5	17660.9	1481.2	6645.4	8126.7	1451.5	12838.0	14289.5
1990	ntrips	6	19	25	14	21	35	7	19	26	9	31	40
	dkratio	0.19	1.07	1.25	0.27	0.31	0.57	0.55	0.09	0.65	0.53	0.83	1.36
	mt kept	10138.7	24999.5	35138.2	6461.9	34303.9	40765.8	6290.4	36062.4	42352.8	9441.0	30440.1	39881.1
	mt discard	1906.5	26639.7	28546.2	1721.8	10582.1	12303.9	3480.4	3307.3	6787.7	5040.2	25126.8	30166.9
1991	ntrips	14	33	47	16	32	48	4	50	54	26	70	96
	dkratio	0.00	0.44	0.45	0.27	0.36	0.63	0.30	0.13	0.43	0.50	0.28	0.78
	mt kept	16912.8	25727.2	42639.9	8472.2	36335.0	44807.2	7471.0	34737.4	42208.4	8531.8	28014.7	36546.5
	mt discard	75.6	11380.9	11456.5	2261.8	13125.6	15387.5	2224.1	4506.5	6730.6	4284.0	7916.4	12200.4
1992	ntrips	23	50	73	7	22	29	8	27	35	9	27	36
	dkratio	0.10	0.15	0.25	0.18	0.20	0.38	0.36	0.15	0.51	2.23	0.20	2.43
	mt kept	16904.2	25446.7	42350.9	9844.7	34956.2	44800.9	8824.5	32091.6	40916.1	8116.0	25267.4	33383.5
	mt discard	1685.7	3872.0	5557.7	1725.5	7039.5	8765.0	3174.9	4775.2	7950.1	18113.0	4947.9	23060.8
1993	ntrips	6	22	28	1	19	20	6	20	26	7	20	27
	dkratio	0.03	0.09	0.12	0.04	0.17	0.22	0.34	0.14	0.48	0.45	0.39	0.84
	mt kept	13935.0	21406.8	35341.9	7901.6	25493.7	33395.3	11231.0	32291.3	43522.3	8574.6	22867.3	31441.8
	mt discard	458.3	1949.5	2407.8	353.8	4454.8	4808.6	3796.3	4538.5	8334.8	3873.5	8963.0	12836.5
1994	ntrips	7	27	34	7	8	15	5	7	12	6	17	23
	dkratio	0.28	0.06	0.35	0.61	0.29	0.90	0.04	0.17	0.21	0.19	0.36	0.55
	mt kept	12155.0	19965.4	32120.4	9501.8	25000.2	34502.0	10347.3	30239.9	40587.2	8896.6	21156.9	30053.5
	mt discard	3458.5	1213.5	4672.0	5804.7	7197.6	13002.3	458.4	5012.0	5470.4	1684.6	7629.0	9313.5
1995	ntrips	14	28	42	24	14	38	55	34	89	23	36	59
	dkratio	0.59	0.24	0.83	0.37	0.57	0.93	0.19	0.08	0.26	0.61	0.17	0.78
	mt kept	10333.9	17824.5	28158.4	9046.2	22296.0	31342.2	9312.1	22265.7	31577.8	7927.5	18288.8	26216.3
	mt discard	6059.3	4257.9	10317.2	3305.4	12602.6	15908.0	1731.2	1696.9	3428.1	4867.7	3042.9	7910.6
1996	ntrips	7	13	20	23	27	50	38	37	75	27	30	57
	dkratio	0.74	0.20	0.95	0.02	0.42	0.44	0.05	0.02	0.07	0.13	0.20	0.32
	mt kept	16936.5	19091.2	36027.7	9961.4	22962.2	32923.6	7991.5	25032.9	33024.5	7188.8	23399.7	30588.5
	mt discard	12590.4	3877.6	16468.0	210.7	9573.8	9784.5	439.4	468.4	907.7	918.4	4614.4	5532.9
1997	ntrips	21	35	56	4	12	16	16	14	30	2	4	6
	dkratio	0.07	0.21	0.29	0.02	0.02	0.04	0.00	0.05	0.06	0.00	0.13	0.14
	mt kept	12575.2	20684.8	33260.0	6727.7	23291.1	30018.8	10470.8	23696.7	34167.6	8466.1	20440.2	28906.3
	mt discard	936.3	4430.1	5366.4	165.0	474.4	639.5	25.4	1277.5	1302.9	31.2	2691.8	2723.0
1998	ntrips	16	11	27	2	8	10	2	8	10	21	10	31
	dkratio	0.06	0.13	0.19	0.02	0.06	0.08	0.23	0.14	0.37	0.12	0.03	0.15
	mt kept	16831.8	22972.5	39804.3	14843.1	23525.3	38368.4	13115.2	25717.9	38833.1	8815.1	19348.0	28163.1
	mt discard	1023.2	2974.7	3997.9	342.0	1435.3	1777.3	3008.1	3663.3	6671.4	1035.4	569.4	1604.8
1999	ntrips		8	8	8	15	23	12	14	26	16	32	48
	dkratio		0.01	0.01	0.14	0.03	0.18	0.01	0.45	0.46	0.16	0.19	0.35
	mt kept	15344.9	18411.2	33756.1	8725.0	21760.3	30485.3	7118.7	21341.5	28460.2	7325.7	19526.1	26851.8
	mt discard	0.0	215.8	215.8	1243.8	713.5	1957.4	49.8	9699.1	9748.9	1137.6	3767.2	4904.8
2000	ntrips	26	39	65	12	64	76	18	34	52	10	39	49
	dkratio	0.05	0.10	0.15	0.02	0.27	0.29	0.01	0.21	0.22	1.15	0.42	1.56
	mt kept	14877.0	21346.9	36223.9	5950.7	21128.2	27078.9	8364.9	22829.2	31194.1	5876.9	20991.7	26868.6
	mt discard	688.1	2235.0	2923.1	126.9	5742.0	5868.9	75.2	4782.0	4857.2	6755.9	8715.7	15471.6
2001	ntrips	15	41	56	18	42	60	51	64	115	17	71	88
	dkratio	0.00	0.09	0.09	0.00	1.20	1.20	0.02	0.19	0.21	0.05	0.19	0.23
	mt kept	8094.4	24244.4	32338.8	4421.5	25921.7	30343.2	4140.7	23630.8	27771.5	6097.0	22826.9	28924.0
	mt discard	12.1	2263.5	2275.5	4.2	31189.8	31194.0	95.9	4377.6	4473.5	287.0	4230.5	4517.6
2002	ntrips	20	30	50	12	23	35	46	118	164	2	134	136
	dkratio	0.18	0.24	0.41	0.08	0.34	0.42	0.07	0.21	0.28	3.30	0.32	3.62
	mt kept	7526.3	24873.4	32399.7	3699.4	24286.7	27986.2	4023.8	22163.7	26187.5	5140.9	18687.4	23828.2
	mt discard	1329.2	5882.3	7211.5	295.0	8365.1	8660.0	295.8	4681.9	4977.6	16976.5	5914.2	22890.6
2003	ntrips	10	129	139	26	110	136	14	125	139	20	120	140
	dkratio	0.12	0.38	0.51	0.11	0.39	0.50	0.11	0.17	0.28	0.65	0.25	0.90
	mt kept	7393.9	25623.8	33017.7	2490.9	21671.6	24162.5	2985.1	20810.0	23795.1	5595.9	22225.4	27821.3
	mt discard	923.0	9743.7	10666.7	273.6	8408.8	8682.4	328.5	3576.2	3904.6	3664.6	5451.5	9116.0
2004	ntrips	64	108	172	45	95	140	68	172	240	105	206	311
	dkratio	0.08	0.25	0.33	0.06	0.40	0.46	0.02	0.11	0.14	0.13	0.12	0.25
	mt kept	7807.8	26579.0	34386.8	11345.3	27943.0	39288.2	15427.4	40193.4	55620.7	5445.7	21202.4	26648.2
	mt discard	621.8	6592.1	7213.9	675.4	11153.7	11829.1	377.0	4599.3	4976.4	695.9	2625.3	3321.1
2005	ntrips	49	122	171	22	86	108	39	386	425	45	244	289
	dkratio	0.07	0.08	0.15	0.11	0.15	0.26	0.16	0.20	0.37	0.16	0.15	0.31
	mt kept	6411.6	18855.5	25267.2	3799.1	18326.2	22125.3	4915.6	22562.7	27478.3	4081.5	18581.5	22663.0
	mt discard	423.1	1502.4	1925.5	432.6	2664.6	3097.3	802.6	4598.5	5401.1	651.7	2748.8	3400.5
Total	ntrips	303	732	1035	245	639	884	397	1190	1587	354	1122	1476

Table B1.9. Discards of skates (all species) by year, quarter, region in the sink gill net fishery.

	Quarter	1			2			3			4		
year	Region	MA	NE	Total	MA	NE	Total	MA	NE	Total	MA	NE	Total
1989	ntrips					1	1		46	46		57	57
	dkratio					0.003	0.003		0.007	0.007		0.010	0.010
	mt kept	431.8	2040.0	2471.9	1211.7	5244.3	6456.0	1170.4	8526.7	9697.1	463.4	5257.3	5720.7
	mt discard	0.00	0.00	0.00	0.00	16.94	16.94	0.00	58.32	58.32	0.00	51.68	51.68
1990	ntrips		25	25		48	48	1	31	32	1	38	39
	dkratio		0.130	0.130		0.053	0.053	0.000	0.004	0.004	0.000	0.013	0.013
	mt kept	700.9	1678.6	2379.5	954.8	5737.3	6692.1	837.9	10564.8	11402.6	892.6	4939.3	5831.9
	mt discard	0.00	218.63	218.63	0.00	303.91	303.91	0.00	38.67	38.67	0.00	62.98	62.98
1991	ntrips		16	16		176	176		489	489		277	277
	dkratio		0.041	0.041		0.013	0.013		0.011	0.011		0.009	0.009
	mt kept	828.6	1672.8	2501.3	1612.5	7011.9	8624.4	1767.8	7800.7	9568.5	1349.7	4459.2	5808.9
	mt discard	0.00	68.40	68.40	0.00	92.28	92.28	0.00	87.37	87.37	0.00	40.98	40.98
1992	ntrips	1	86	87		414	414		392	392		291	291
	dkratio	0.000	0.119	0.119		0.034	0.034		0.006	0.006		0.009	0.009
	mt kept	880.5	1455.1	2335.7	1951.2	5490.3	7441.5	1846.4	8376.8	10223.2	1012.4	5051.0	6063.5
	mt discard	0.00	173.48	173.48	0.00	184.36	184.36	0.00	48.00	48.00	0.00	45.86	45.86
1993	ntrips	1	68	69		282	282	7	140	147	11	260	271
	dkratio	0.000	0.032	0.032		0.030	0.030	0.001	0.010	0.011	0.002	0.007	0.010
	mt kept	1750.7	1252.2	3002.9	2380.1	6082.4	8462.5	2452.2	10138.7	12590.9	1787.7	5717.3	7505.0
	mt discard	0.00	39.72	39.72	0.00	183.08	183.08	1.57	105.34	106.91	4.22	41.34	45.55
1994	ntrips	55	68	123	39	15	54	50	23	73	74	57	131
	dkratio	0.009	0.037	0.047	0.008	0.029	0.036	0.001	0.034	0.035	0.014	0.044	0.058
	mt kept	1107.5	1172.4	2279.8	2461.1	6644.2	9105.3	3117.1	11326.8	14443.9	1680.3	4112.8	5793.1
	mt discard	10.40	43.62	54.02	18.85	191.22	210.07	2.93	383.98	386.91	24.28	180.55	204.83
1995	ntrips	153	18	171	78	42	120	46	51	97	99	30	129
	dkratio	0.013	0.084	0.096	0.019	0.036	0.056	0.000	0.009	0.009	0.014	0.028	0.042
	mt kept	1283.7	1348.9	2632.6	2788.3	8653.6	11441.9	2096.2	10745.0	12841.2	2785.1	4708.2	7493.3
	mt discard	16.30	112.75	129.06	53.23	315.16	368.39	0.25	97.67	97.92	39.99	131.74	171.73
1996	ntrips	134	12	146	81	24	105	51	18	69	70	17	87
	dkratio	0.014	0.020	0.034	0.018	0.103	0.121	0.004	0.017	0.021	0.009	0.003	0.012
	mt kept	3389.9	1098.8	4488.7	4764.0	6689.6	11453.6	2943.2	10938.8	13882.0	4167.8	5000.9	9168.7
	mt discard	47.76	21.98	69.74	84.08	689.16	773.25	12.77	182.35	195.12	36.47	15.30	51.77
1997	ntrips	147	10	157	73	23	96	40	18	58	57	14	71
	dkratio	0.015	0.006	0.021	0.047	0.010	0.058	0.000	0.003	0.003	0.010	0.010	0.020
	mt kept	8163.2	1359.3	9522.5	4616.8	6592.9	11209.7	3548.2	8536.0	12084.1	5667.0	3813.9	9480.8
	mt discard	125.63	7.54	133.18	218.51	68.90	287.41	1.35	22.53	23.88	55.03	37.64	92.67
1998	ntrips	188	10	198	35	37	72	9	32	41	40	54	94
	dkratio	0.008	0.006	0.014	0.023	0.007	0.030	0.009	0.018	0.027	0.017	0.009	0.025
	mt kept	8538.8	1382.1	9921.0	5875.8	5415.3	11291.1	3267.8	9226.5	12494.3	6232.9	5000.3	11233.2
	mt discard	71.21	8.40	79.62	135.85	38.88	174.73	30.65	161.65	192.30	103.78	43.00	146.78
1999	ntrips	32	16	48	21	30	51	13	35	48	24	35	59
	dkratio	0.017	0.015	0.032	0.074	0.023	0.098	0.002	0.002	0.004	0.017	0.059	0.077
	mt kept	8560.1	1761.6	10321.7	5777.6	5943.7	11721.2	2697.0	5512.7	8209.8	4082.3	3816.2	7898.5
	mt discard	146.98	26.51	173.49	430.14	138.43	568.57	4.15	13.23	17.38	70.38	226.76	297.14
2000	ntrips	31	23	54	21	51	72	9	32	41	31	37	68
	dkratio	0.001	0.012	0.013	0.005	0.034	0.039	0.000	0.149	0.149	0.010	0.057	0.067
	mt kept	7225.6	1805.9	9031.4	4500.2	4153.9	8654.0	3568.8	4576.9	8145.8	3835.0	3795.3	7630.3
	mt discard	4.70	22.23	26.93	22.14	140.94	163.08	0.00	684.21	684.21	38.04	218.04	256.08
2001	ntrips	24	19	43	27	30	57	6	21	27	24	17	41
	dkratio	0.002	0.058	0.060	0.008	0.048	0.055	0.000	0.036	0.036	0.005	0.020	0.025
	mt kept	5146.0	1447.6	6593.6	4217.9	4430.2	8648.1	2829.4	4197.0	7026.4	4360.6	4889.5	9250.1
	mt discard	9.11	84.05	93.16	33.07	210.43	243.50	0.00	153.06	153.06	22.72	96.42	119.14
2002	ntrips	12	18	30	12	16	28	5	25	30	17	31	48
	dkratio	0.001	0.013	0.014	0.067	0.079	0.146	0.000	0.034	0.034	0.004	0.278	0.282
	mt kept	4899.9	2547.1	7447.0	3913.9	4313.5	8227.4	2844.2	4080.2	6924.4	3560.2	4405.0	7965.2
	mt discard	2.84	33.09	35.93	261.06	341.15	602.21	0.00	137.38	137.38	14.85	1224.80	1239.65
2003	ntrips	6	18	24	18	109	127	11	172	183		122	122
	dkratio	0.004	0.135	0.138	0.019	0.030	0.049	0.000	0.023	0.023		0.048	0.048
	mt kept	5278.3	2351.2	7629.5	4951.6	4880.3	9831.9	2441.0	5653.1	8094.1	3972.1	5034.5	9006.7
	mt discard	19.27	316.30	335.57	93.44	147.82	241.26	0.81	128.49	129.30	0.00	239.49	239.49
2004	ntrips	1	107	108	1	133	134	1	341	342	26	269	295
	dkratio	0.000	0.036	0.036	0.000	0.032	0.032	0.000	0.018	0.018	0.064	0.024	0.088
	mt kept	4968.4	7776.7	12745.0	4123.3	4009.8	8133.2	2966.2	4649.4	7615.6	3577.1	3362.5	6939.7
	mt discard	0.00	281.90	281.90	0.00	126.71	126.71	0.00	85.87	85.87	229.51	79.49	309.00
2005	ntrips	8	133	141	24	45	69		389	389	8	197	205
	dkratio	0.030	0.182	0.212	0.209	0.088	0.296		0.035	0.035	0.043	0.018	0.062
	mt kept	5093.9	1299.4	6393.2	4760.1	4255.5	9015.6	2925.2	5756.6	8681.8	3739.0	3363.0	7102.0
	mt discard	151.75	236.98	388.72	993.77	372.65	1366.43	0.00	200.67	200.67	162.42	62.18	224.60
Total	ntrips	793	647	1440	430	1476	1906	249	2255	2504	482	1803	2285

Table B1.10. Discards of skates (all species) by year, quarter, region in the scallop dredge fishery.

	Quarter	1			2			3			4		
year	Region	MA	NE	Total	MA	NE	Total	MA	NE	Total	MA	NE	Total
1989	ntrips												
	dkratio												
	mt kept	10086.6	23291.0	33377.5	15880.9	28652.0	44532.8	10428.4	25176.9	35605.4	5278.9	18667.2	23946.0
	mt discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1990	ntrips												
	dkratio												
	mt kept	10987.0	17618.5	28605.6	14895.0	30679.0	45574.0	14342.6	30581.7	44924.2	7677.8	19732.3	27410.1
	mt discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1991	ntrips										1	1	2
	dkratio										0.56	0.18	0.74
	mt kept	10896.2	23586.6	34482.8	18918.4	31037.2	49955.5	10741.8	23977.9	34719.7	6046.7	16561.7	22608.4
	mt discard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3366.0	3024.7	6390.7
1992	ntrips	1	2	3	1	3	4	1	2	3	1	4	5
	dkratio	0.20	0.36	0.55	0.11	0.24	0.35	0.12	0.59	0.71	0.26	0.40	0.66
	mt kept	7389.5	17974.8	25364.3	12121.3	25380.6	37501.9	11000.5	24564.0	35564.6	5325.4	18270.0	23595.4
	mt discard	1452.4	6390.4	7842.8	1274.9	6192.9	7467.8	1322.4	14390.4	15712.7	1410.8	7270.6	8681.4
1993	ntrips	3	4	7	3	4	7	1	2	3	1	3	4
	dkratio	0.45	0.20	0.65	0.52	0.14	0.66	0.53	0.18	0.71	0.76	0.52	1.28
	mt kept	4536.8	13875.1	18412.0	6136.5	13124.9	19261.4	5650.6	11626.6	17277.2	3277.8	10498.7	13776.5
	mt discard	2030.6	2758.9	4789.6	3188.3	1795.5	4983.8	2989.8	2145.0	5134.8	2506.4	5451.2	7957.7
1994	ntrips	4	3	7	3	1	4		4	4	3	5	8
	dkratio	0.38	0.20	0.57	0.05	0.17	0.22		0.08	0.08	0.50	0.21	0.71
	mt kept	5189.9	7542.7	12732.6	10500.5	9248.8	19749.4	9023.3	9236.0	18259.3	4719.4	8918.3	13637.7
	mt discard	1958.8	1472.3	3431.1	551.3	1541.6	2092.9	0.0	765.9	765.9	2356.8	1878.8	4235.6
1995	ntrips	6	3	9	2	3	5	3	2	5		5	5
	dkratio	0.26	0.32	0.59	0.39	0.04	0.44	0.07	0.26	0.33		0.83	0.83
	mt kept	5765.1	7520.0	13285.1	11081.4	13823.0	24904.4	7007.7	10248.7	17256.4	2340.3	7278.6	9618.9
	mt discard	1522.5	2424.8	3947.3	4348.7	605.9	4954.5	520.6	2619.9	3140.5	0.0	6031.6	6031.6
1996	ntrips	6	7	13	4	5	9	3	4	7	4	5	9
	dkratio	0.24	0.13	0.38	0.46	0.10	0.56	0.23	0.14	0.38	1.11	0.41	1.52
	mt kept	3368.3	5907.8	9276.1	10880.0	13675.2	24555.2	6904.9	12142.7	19047.6	2663.1	9855.3	12518.4
	mt discard	823.5	782.0	1605.5	5022.2	1378.6	6400.8	1606.2	1738.1	3344.3	2959.9	4010.7	6970.6
1997	ntrips	6	6	12	5	2	7	4	3	7	1	2	3
	dkratio	0.55	0.26	0.81	0.55	0.14	0.69	0.33	0.36	0.69	0.10	0.10	0.20
	mt kept	3375.8	7265.0	10640.9	7523.7	11622.1	19145.8	5540.9	9175.7	14716.6	2206.1	7496.9	9703.0
	mt discard	1840.2	1890.2	3730.5	4153.4	1620.5	5773.9	1803.5	3314.1	5117.6	228.2	755.8	984.0
1998	ntrips	1		1	6	2	8	3	2	5	6	6	12
	dkratio	0.10		0.10	0.38	0.13	0.52	0.47	0.64	1.11	0.60	0.27	0.87
	mt kept	3212.1	6498.3	9710.4	6420.8	9324.1	15744.9	4168.5	7997.0	12165.5	2778.4	6975.2	9753.6
	mt discard	310.1	0.0	310.1	2455.6	1236.1	3691.7	1961.9	5089.6	7051.5	1656.4	1915.9	3572.2
1999	ntrips				1	2	3	4	1	5	2	5	7
	dkratio				0.29	0.10	0.38	0.56	0.33	0.89	0.04	0.09	0.14
	mt kept	3981.4	7393.9	11375.2	11211.7	16989.1	28200.8	6866.1	16967.2	23833.3	2229.0	15535.5	17764.5
	mt discard	0.0	0.0	0.0	3198.7	1638.8	4837.5	3833.0	5673.7	9506.7	92.6	1464.1	1556.6
2000	ntrips	4	3	7	6	25	31	11	107	118	7	93	100
	dkratio	0.05	0.22	0.26	0.15	0.18	0.33	0.03	0.06	0.09	0.14	0.03	0.17
	mt kept	5085.8	9377.8	14463.5	19064.4	22542.1	41606.5	14563.1	19221.4	33784.5	5843.4	16750.7	22594.0
	mt discard	232.5	2038.5	2271.0	2945.8	4008.4	6954.3	478.3	1117.1	1595.4	823.7	454.6	1278.3
2001	ntrips		17	17	22	18	40	8	17	25	12	11	23
	dkratio		0.02	0.02	0.03	0.03	0.07	0.06	0.04	0.09	0.04	0.06	0.10
	mt kept	7693.3	15218.8	22912.1	24272.2	31980.4	56252.7	22261.8	25588.2	47850.0	14665.1	19349.4	34014.4
	mt discard	0.0	366.6	366.6	847.8	995.2	1843.1	1241.1	899.7	2140.8	555.7	1163.9	1719.5
2002	ntrips	7	4	11	1	22	23	12	22	34	7	20	27
	dkratio	0.08	0.08	0.16	0.10	0.06	0.16	0.08	0.11	0.19	0.07	0.08	0.14
	mt kept	11123.6	17851.7	28975.3	30540.0	34154.5	64694.5	28493.7	30490.7	58984.4	14310.0	19683.6	33993.6
	mt discard	835.8	1509.2	2345.0	3015.8	2132.3	5148.1	2385.2	3304.9	5690.1	962.1	1506.2	2468.3
2003	ntrips	15	14	29	14	6	20	17	17	34	15	24	39
	dkratio	0.11	0.07	0.18	0.05	0.10	0.15	0.05	0.09	0.14	0.06	0.08	0.13
	mt kept	11318.7	16164.5	27483.3	35699.1	36028.7	71727.8	31001.4	30538.0	61539.3	19571.0	22027.6	41598.6
	mt discard	1214.6	1111.0	2325.6	1739.3	3689.0	5428.2	1538.6	2863.9	4402.4	1149.6	1670.8	2820.4
2004	ntrips	9	13	22	27	28	55	56	26	82	35	54	89
	dkratio	0.08	0.09	0.17	0.04	0.04	0.07	0.03	0.06	0.09	0.05	0.04	0.09
	mt kept	16614.0	18777.6	35391.5	11961.7	16771.9	28733.6	2262.9	6101.8	8364.7	1616.5	9072.8	10689.3
	mt discard	1353.9	1662.9	3016.8	447.6	619.9	1067.5	65.7	355.2	420.9	83.1	382.1	465.1
2005	ntrips	28	33	61	24	28	52	70	43	113	38	25	63
	dkratio	0.06	0.05	0.11	0.03	0.06	0.09	0.05	0.05	0.10	0.07	0.04	0.11
	mt kept	972.3	9753.4	10725.7	1958.8	17194.4	19153.2	2204.5	14651.3	16855.7	1129.5	6036.1	7165.6
	mt discard	55.6	528.7	584.4	54.5	996.4	1050.9	101.6	733.4	835.0	76.8	246.5	323.2
Total	ntrips	90	109	199	119	149	268	193	252	445	133	263	396

Table B2.1. Strata from the NMFS spring/fall, winter, and scallop surveys which were combined for bootstrapping.

Spring/Fall-Offshore	Spring/Fall-Inshore	Winter Survey	Winter Rosette	Scallop Survey
1010	3020+3030+3040+3050	1010	1020	6060
1020	3060+3070+3080	1020	1030	6070
1030 +1040	3090+3100+3110	1030	1100	6100
1050	3120+3130+3140	1050	1110+1120	6110
1060	3150+3160+3170	1060+1070	1610	6140
1070 +1080	3180+3190	1080	1620+1630+1640	6150
1090	3200	1090	1650	6180
1100	3210-3220	1100	1660	6190
1110+1120	3230	1110	1670+1680	6220
1130	3240+3250+3260	1610	1690	6230
1140	3270+3280+3290	1620+1630	1700	6240
1140+1150	3300+3310	1650	1710+1720	6250
1160	3320	1660+1670	1740	6260
1170	3330+3340	1690	1750+1760	6270
1170+1180	3350	1700+1710		6280+6290
1190	3360+3370	1730		6300
1200	3380	1740+1750		6310
1210	3390+3400			6330
1220	3410			6340
1230	3420+3430			6350
1240	3440			6460
1250	3450+3460			6470
1260	3550			6490
1270	3550+3560			6500
1280	3580+3590+3600+3610+			6510
1290+1300	3630+3640+3650+3660			6520
1330+1340+1350 (1)				6530
1360				6540
1370				6550
1380				6580
1390+1400				6590
1610+1620+1630+				6600
1640+1650 (clearnose/rosette)				6610
1650+1660 (winter/little)				6621+6622
1670				6631+6631+6640
1670+1680				6651+6652
1690				6661+6662
1700				6710+6720
1710+1720				6740
1730				
1740				
1750+1760				

Table B2.2. Abundance and biomass from NEFSC spring surveys for winter skate for the Gulf of Maine to Mid-Atlantic region (offshore strata 1-30,33-40,61-76). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1968-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1968	2.171	1.640	2.978	0.854	0.530	1.178	2.542	32	42	56	58.6	79	112	36	232
1969	5.913	4.283	7.543	2.790	1.907	3.672	2.119	15	25	53	53.5	79	111	68	640
1970	2.645	1.627	3.663	0.971	0.626	1.317	2.723	37	43	59	61.0	83	103	44	275
1971	3.387	2.066	4.708	1.894	0.873	2.915	1.788	15	30	48	51.8	76	103	41	513
1972	4.620	3.033	6.207	2.602	1.253	3.951	1.776	15	24	48	49.5	74	97	63	634
1973	2.905	2.024	3.786	1.257	0.824	1.689	2.311	21	32	55	55.5	79	100	49	347
1974	2.091	1.352	2.830	0.943	0.505	1.381	2.218	29	34	53	55.6	76	101	46	222
1975	2.395	1.521	3.269	0.893	0.556	1.230	2.682	17	38	59	59.4	79	99	46	227
1976	2.153	1.075	3.231	0.628	0.279	0.978	3.428	22	38	64	63.1	86	97	29	160
1977	3.111	1.815	4.408	0.838	0.513	1.163	3.712	20	29	69	64.7	93	106	35	204
1978	8.275	-0.327	16.877	1.355	0.121	2.589	6.108	43	62	79	78.5	89	96	41	395
1979	1.852	1.095	2.608	0.333	0.206	0.459	5.568	23	35	78	73.5	93	105	50	204
1980	2.990	1.751	4.229	0.538	0.331	0.745	5.559	22	45	78	74.8	97	104	49	187
1981	4.140	2.905	5.376	2.083	1.199	2.966	1.988	15	22	39	47.6	91	104	56	586
1982	5.773	3.876	7.670	2.137	1.195	3.080	2.701	15	26	46	54.9	95	109	64	707
1983	14.329	8.182	20.476	3.264	1.772	4.756	4.391	15	28	67	64.4	96	108	65	817
1984	10.480	6.816	14.144	2.948	1.694	4.201	3.555	15	22	60	59.0	94	106	59	753
1985	16.373	11.119	21.627	7.861	4.653	11.069	2.083	15	22	46	54.3	94	116	65	1891
1986	10.019	6.973	13.064	3.538	2.181	4.894	2.832	15	27	58	62.2	97	108	67	969
1987	13.126	8.428	17.824	4.821	2.926	6.716	2.723	15	29	56	60.8	97	108	69	1221
1988	14.543	10.508	18.577	7.409	4.736	10.082	1.963	15	25	43	53.4	95	107	73	1827
1989	10.141	7.736	12.546	4.252	3.095	5.409	2.385	15	25	59	61.4	94	109	74	1429
1990	7.183	5.184	9.183	5.087	2.657	7.517	1.412	15	27	41	49.9	91	105	67	1678
1991	6.965	4.012	9.918	3.239	1.979	4.499	2.150	17	29	54	58.6	93	107	57	1027
1992	5.988	3.369	8.607	5.208	0.635	9.780	1.150	15	23	42	46.2	82	106	51	1303
1993	4.761	3.392	6.131	4.305	2.561	6.049	1.106	15	25	42	46.5	82	103	62	1118
1994	1.421	0.990	1.852	1.673	1.150	2.196	0.849	20	32	43	46.5	69	99	49	519
1995	2.151	1.340	2.961	1.998	1.231	2.766	1.076	15	34	44	48.4	71	103	49	476
1996	4.547	2.499	6.594	4.470	2.384	6.556	1.017	15	34	46	49.0	68	96	56	1004
1997	3.065	1.325	4.806	1.834	0.987	2.680	1.672	15	23	51	53.5	78	93	39	458
1998	1.504	0.913	2.096	1.045	0.561	1.529	1.439	15	32	51	53.4	79	94	52	341
1999	2.968	1.303	4.632	1.876	0.870	2.883	1.582	16	27	54	54.9	79	100	52	482
2000	4.358	2.273	6.443	1.998	1.041	2.954	2.181	15	34	62	62.2	82	99	57	457
2001	3.496	1.889	5.103	2.350	0.912	3.787	1.488	20	27	44	52.1	82	100	48	556
2002	3.132	1.650	4.614	1.688	0.949	2.426	1.856	15	29	59	58.6	82	93	48	407
2003	2.799	1.471	4.127	2.047	1.164	2.931	1.367	15	29	49	53.4	82	100	61	606
2004	2.446	1.512	3.379	1.547	1.015	2.080	1.581	18	29	50	54.6	85	97	56	356
2005	1.757	0.869	2.645	1.672	0.470	2.874	1.051	15	30	45	48.6	75	97	52	375
2006	3.041	1.020	5.062	3.067	0.465	5.668	0.992	15	24	43	47.2	75	99	55	779

Table B2.3. Abundance and biomass from NEFSC autumn surveys for winter skate for the Gulf of Maine to Mid-Atlantic region (offshore strata 1-30,33-40,61-76). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1967-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1967	2.159	1.248	3.070	0.825	0.544	1.106	2.617	15	32	56	57.0	83	107	35	213
1968	1.865	1.264	2.466	0.928	0.573	1.284	2.009	15	25	51	51.8	80	100	56	227
1969	1.315	0.856	1.774	0.540	0.351	0.730	2.435	16	37	58	58.3	78	90	36	161
1970	2.996	1.663	4.328	1.357	0.576	2.138	2.208	21	33	54	56.0	77	97	53	331
1971	1.078	0.542	1.615	0.588	0.238	0.938	1.833	18	27	50	50.5	77	93	35	163
1972	2.958	2.113	3.804	2.071	1.413	2.728	1.429	15	24	42	46.9	74	96	64	592
1973	4.686	3.348	6.024	2.238	1.510	2.967	2.093	21	32	54	55.1	78	101	48	662
1974	2.097	1.418	2.777	1.024	0.672	1.376	2.048	17	30	52	53.6	77	103	39	262
1975	1.315	0.682	1.948	0.420	0.260	0.580	3.130	16	24	62	60.9	84	103	31	115
1976	2.655	0.918	4.392	0.766	0.257	1.274	3.468	19	22	70	59.9	83	98	21	190
1977	4.095	2.814	5.376	1.617	1.049	2.185	2.533	15	25	47	54.8	87	100	51	662
1978	4.989	3.778	6.199	1.042	0.777	1.307	4.787	15	36	77	73.6	94	105	94	762
1979	5.121	3.768	6.475	1.290	0.976	1.603	3.971	20	31	75	66.0	93	113	89	975
1980	6.233	3.806	8.660	1.558	1.015	2.100	4.002	15	37	66	66.4	95	108	60	602
1981	5.668	3.726	7.610	1.505	0.916	2.094	3.766	15	25	61	62.3	99	110	54	516
1982	8.306	4.780	11.831	3.889	0.502	7.275	2.136	15	22	35	46.7	92	112	45	950
1983	12.852	5.693	20.012	2.590	1.447	3.733	4.962	16	28	78	70.5	95	108	42	843
1984	13.323	8.465	18.181	3.653	2.450	4.857	3.647	15	21	55	59.0	95	110	52	1187
1985	9.182	6.552	11.811	2.665	1.842	3.488	3.446	15	32	79	69.7	97	107	37	827
1986	15.800	7.184	24.415	4.196	2.496	5.895	3.766	15	34	75	71.5	97	110	46	1089
1987	11.063	8.200	13.925	4.291	2.783	5.800	2.578	15	25	58	60.1	97	109	49	1165
1988	7.564	4.961	10.167	3.126	2.223	4.028	2.420	15	23	49	57.4	97	110	45	888
1989	5.081	3.288	6.874	2.084	1.422	2.745	2.439	15	27	59	61.0	96	106	48	720
1990	7.145	4.658	9.632	2.451	1.397	3.505	2.915	22	33	68	66.5	97	107	44	895
1991	4.724	3.627	5.821	2.631	1.866	3.396	1.796	17	31	48	56.3	94	106	58	941
1992	3.582	2.140	5.024	1.862	1.116	2.608	1.923	22	33	51	57.4	91	103	39	509
1993	1.905	1.280	2.530	1.458	0.965	1.951	1.307	16	33	48	52.8	88	104	50	452
1994	2.120	1.432	2.808	1.925	1.217	2.633	1.101	15	26	44	47.6	84	106	52	503
1995	1.985	1.214	2.757	1.769	1.047	2.491	1.122	17	31	46	49.4	77	102	43	424
1996	2.276	1.615	2.937	1.426	0.985	1.867	1.596	17	35	51	54.9	83	104	44	370
1997	2.455	1.150	3.760	1.611	0.738	2.484	1.524	19	34	54	55.5	79	101	55	415
1998	3.753	2.488	5.018	2.140	1.438	2.843	1.753	19	27	55	56.8	83	101	50	609
1999	5.089	2.080	8.098	2.642	1.320	3.963	1.927	15	31	58	58.0	80	111	53	966
2000	4.378	2.390	6.366	2.535	1.351	3.718	1.727	18	25	56	55.5	82	99	45	756
2001	3.887	2.442	5.333	2.165	1.415	2.914	1.796	15	32	58	57.8	83	98	53	601
2002	5.600	3.417	7.782	2.323	1.535	3.111	2.411	16	33	66	63.9	87	101	55	743
2003	3.386	2.111	4.662	1.498	0.928	2.068	2.260	16	33	62	63.0	87	104	43	435
2004	4.031	2.632	5.430	1.942	1.343	2.542	2.075	15	33	62	60.4	87	102	50	611
2005	2.615	1.791	3.439	1.671	1.005	2.337	1.565	18	31	52	55.1	81	98	54	475

Table B2.4. Abundance and biomass from NEFSC winter surveys for winter skate for the Georges Bank to Mid-Atlantic region (offshore strata 1-3,5-7,9-11,13-14,16,61-63,65-67,69-71,73-75). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1992-2006. Stratum 16 not sampled in 1993, 2000, 2002-2006. Strata 13 and 14 not sampled in 2003. Stratum 63 not sampled in 1993. Stratum 14 not sampled in 2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1992	31.571	21.666	41.476	39.759	23.811	55.707	0.794	15	24	38	42.4	74	105	62	4042
1993	10.261	6.052	14.469	10.676	2.331	19.021	0.961	15	23	41	44.1	81	106	47	841
1994	14.439	10.586	18.293	14.216	8.465	19.966	1.016	15	29	40	45.4	81	102	33	1079
1995	23.268	14.507	32.029	35.528	18.060	52.996	0.655	15	27	40	42.2	59	104	53	3773
1996	25.239	7.110	43.369	43.515	7.434	79.596	0.580	15	25	40	41.2	56	99	59	4055
1997	11.643	7.287	15.999	12.565	7.109	18.022	0.927	15	27	45	46.9	71	98	46	1414
1998	22.464	15.878	29.050	19.950	13.556	26.344	1.126	15	26	48	49.4	74	105	60	2092
1999	21.089	13.628	28.549	18.380	10.899	25.860	1.147	15	24	49	49.0	74	101	52	1932
2000	11.315	4.814	17.815	5.697	2.799	8.596	1.986	18	27	56	57.6	88	101	33	486
2001	28.634	19.682	37.585	15.555	9.234	21.875	1.841	16	30	58	57.5	84	100	76	2025
2002	28.733	17.246	40.220	15.982	6.565	25.400	1.798	15	24	49	55.1	88	107	53	1849
2003	17.425	7.871	26.979	29.540	-6.318	64.399	0.590	15	15	28	34.8	75	99	34	1662
2004	26.618	13.793	39.444	13.833	9.244	18.422	1.924	15	31	55	58.0	86	102	58	1342
2005	19.424	8.976	29.872	16.081	6.327	25.836	1.208	16	26	48	50.3	76	95	46	972
2006	32.411	12.125	52.697	18.233	9.593	26.874	1.778	15	30	56	57.4	86	102	60	1776

Table B2.5. Abundance and biomass from NEFSC spring surveys for little skate for the Gulf of Maine to Mid-Atlantic region (offshore strata 1-30,33-40,61-76, and inshore strata 1-66). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1976-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1976	1.308	0.861	1.755	3.218	2.136	4.301	0.406	8	12	40	36.9	48	58	172	4202
1977	1.347	0.882	1.811	3.336	2.177	4.494	0.404	6	19	41	38.7	48	57	160	4218
1978	1.391	0.962	1.821	3.286	2.363	4.209	0.423	8	11	42	37.5	48	62	160	3945
1979	0.650	0.501	0.799	2.182	1.429	2.934	0.298	4	12	31	32.7	48	56	204	5684
1980	2.206	1.705	2.707	5.898	4.384	7.413	0.374	8	12	37	36.0	48	57	224	9031
1981	1.501	1.200	1.803	3.426	2.714	4.137	0.438	6	15	41	38.3	49	55	175	4113
1982	3.627	2.644	4.611	7.214	5.351	9.076	0.503	9	18	43	40.7	49	55	153	3564
1983	5.718	4.017	7.420	13.024	9.215	16.832	0.439	6	16	42	37.9	48	57	167	6365
1984	4.094	2.615	5.574	10.023	6.787	13.258	0.409	7	11	40	35.8	48	55	139	4573
1985	6.265	4.628	7.901	15.175	10.575	19.775	0.413	8	11	40	36.8	48	57	148	6535
1986	2.753	1.712	3.795	8.554	3.399	13.709	0.322	6	14	33	34.5	48	57	153	3512
1987	4.625	3.149	6.102	16.031	10.222	21.839	0.289	8	12	32	33.1	47	55	145	9584
1988	5.083	3.444	6.721	14.593	9.688	19.498	0.348	8	11	36	34.5	48	55	130	4195
1989	6.634	3.434	9.834	21.643	9.844	33.441	0.307	8	13	34	33.4	46	55	144	10760
1990	4.993	2.397	7.589	14.979	5.250	24.708	0.333	8	11	37	34.7	47	56	132	7085
1991	5.990	4.672	7.308	18.731	14.059	23.403	0.320	8	13	34	34.2	47	58	178	11986
1992	5.297	2.477	8.118	16.793	5.234	28.352	0.315	8	16	33	34.1	46	57	136	6392
1993	7.524	5.187	9.862	22.361	15.110	29.611	0.336	9	12	36	35.0	47	54	160	9574
1994	3.622	2.425	4.819	9.365	6.297	12.434	0.387	9	19	39	37.3	46	54	154	8548
1995	2.872	2.024	3.720	7.574	5.215	9.933	0.379	8	10	39	36.1	47	59	148	3801
1996	7.574	5.522	9.626	18.185	12.647	23.722	0.417	7	17	41	38.3	48	58	168	9086
1997	2.708	2.231	3.184	6.671	5.504	7.837	0.406	9	13	40	37.8	48	54	151	4840
1998	7.471	6.156	8.787	20.938	16.232	25.644	0.357	7	17	37	35.8	47	56	195	15710
1999	9.978	7.688	12.267	28.377	20.345	36.409	0.352	8	12	38	35.4	47	56	157	16406
2000	8.596	6.647	10.545	19.677	15.270	24.083	0.437	9	21	41	38.9	47	57	179	15367
2001	6.835	4.297	9.372	15.347	9.900	20.794	0.445	8	18	42	39.5	48	58	154	6978
2002	6.444	4.546	8.341	16.280	11.306	21.254	0.396	8	11	42	37.7	48	57	154	11983
2003	6.486	4.505	8.486	15.116	10.195	20.036	0.429	9	22	42	40.1	48	55	169	6919
2004	7.219	5.374	9.064	17.039	11.917	22.162	0.424	7	25	42	39.9	47	57	147	9866
2005	3.241	2.305	4.177	7.328	5.515	9.141	0.442	8	13	43	38.9	48	53	138	3108
2006	3.323	1.892	4.753	7.878	4.544	11.211	0.422	7	11	42	38.4	48	55	138	2771

Table B2.6. Abundance and biomass from NEFSC autumn surveys for little skate for the Gulf of Maine to Mid-Atlantic region (offshore strata 1-30,33-40,61-76, and inshore strata 1-66). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1975-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1975	2.379	1.508	3.249	4.858	3.063	6.654	0.490	10	18	43	40.3	49	56	118	1386
1976	2.185	1.582	2.788	4.576	3.278	5.875	0.477	8	22	43	40.6	48	58	74	1421
1977	3.172	2.271	4.072	6.589	4.683	8.495	0.481	9	22	43	40.7	49	56	122	2438
1978	2.938	2.140	3.736	5.613	3.947	7.279	0.523	10	22	44	42.0	49	62	144	3171
1979	2.902	2.343	3.461	5.944	4.790	7.098	0.488	8	21	44	41.0	49	58	177	4597
1980	2.312	1.768	2.855	5.055	4.102	6.008	0.457	9	13	43	37.9	49	55	142	2451
1981	2.779	2.175	3.382	5.847	4.479	7.215	0.475	9	19	43	39.9	49	58	111	1728
1982	5.799	2.673	8.925	15.391	6.979	23.803	0.377	9	18	36	36.4	48	56	123	3848
1983	1.990	1.340	2.639	5.244	3.268	7.219	0.379	8	17	38	36.6	49	55	100	1313
1984	2.483	1.688	3.279	5.487	3.789	7.185	0.453	10	13	43	38.3	49	56	95	1350
1985	2.423	1.629	3.217	6.103	4.006	8.199	0.397	9	17	40	37.5	49	58	119	2761
1986	1.502	1.125	1.879	4.203	2.759	5.648	0.357	10	16	36	35.7	49	55	96	1240
1987	2.311	1.532	3.090	8.104	4.084	12.124	0.285	10	14	31	32.4	48	55	96	2093
1988	1.177	0.663	1.692	3.524	2.144	4.903	0.334	9	13	34	33.8	48	56	80	1128
1989	2.321	1.091	3.552	6.698	3.574	9.823	0.347	5	13	38	35.2	48	56	100	2288
1990	1.242	0.802	1.681	3.204	1.913	4.495	0.388	9	17	40	37.3	48	54	98	1183
1991	3.552	1.494	5.610	8.854	3.301	14.408	0.401	11	24	40	39.3	47	55	102	2866
1992	1.542	1.126	1.958	4.294	2.993	5.595	0.359	6	14	38	36.0	49	63	107	1460
1993	1.180	0.805	1.555	3.136	2.174	4.099	0.376	10	14	41	36.3	49	55	115	1124
1994	1.906	1.349	2.463	4.329	3.102	5.556	0.440	9	18	42	39.4	49	59	131	1729
1995	2.682	1.795	3.569	5.527	3.739	7.316	0.485	9	21	43	41.2	48	56	118	2058
1996	2.239	1.504	2.973	5.146	3.582	6.711	0.435	9	13	42	38.1	49	60	112	1878
1997	2.148	1.533	2.763	4.825	3.407	6.243	0.445	10	21	43	40.0	49	60	109	1757
1998	2.704	1.968	3.441	5.914	4.237	7.591	0.457	10	20	43	40.2	49	57	129	1713
1999	3.210	2.344	4.076	7.698	5.042	10.355	0.417	6	21	41	38.4	48	58	143	2289
2000	2.550	1.607	3.493	5.711	3.761	7.661	0.447	10	22	43	40.1	49	63	116	1759
2001	2.845	2.032	3.658	6.044	4.265	7.823	0.471	10	22	43	41.4	49	57	130	1985
2002	3.375	2.371	4.379	7.358	5.170	9.545	0.459	9	23	43	40.8	49	54	135	2515
2003	7.740	5.218	10.261	18.199	11.697	24.702	0.425	10	18	41	39.3	48	55	141	6523
2004	2.265	1.388	3.141	4.556	2.714	6.399	0.497	8	26	43	42.3	49	57	122	2270
2005	3.766	2.281	5.252	7.606	4.698	10.515	0.495	9	21	44	41.8	49	55	122	2437

Table B2.7. Abundance and biomass from NEFSC winter surveys for little skate for the Georges Bank to Mid-Atlantic region (offshore strata 1-3,5-7,9-11,13-14,16,61-63,65-67,69-71,73-75). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1992-2006. Stratum 16 not sampled in 1993, 2000, 2002-2006. Strata 13 and 14 not sampled in 2003. Stratum 63 not sampled in 1993. Stratum 14 not sampled in 2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1992	66.321	50.335	82.306	170.155	127.459	212.852	0.390	9	21	39	38.0	47	62	89	18418
1993	56.377	43.992	68.761	166.927	120.808	213.045	0.338	9	19	36	35.8	46	53	94	16026
1994	49.812	37.387	62.236	131.570	95.199	167.940	0.379	10	20	39	37.5	47	60	67	10113
1995	57.368	39.311	75.424	138.769	87.458	190.081	0.413	8	24	40	39.1	47	53	95	14530
1996	64.056	47.616	80.495	150.579	108.945	192.213	0.425	9	15	41	38.7	47	62	102	15701
1997	51.901	39.986	63.816	117.751	92.288	143.214	0.441	9	23	42	40.2	47	58	92	12084
1998	57.512	49.249	65.775	138.503	111.869	165.136	0.415	9	20	41	38.7	47	57	105	14492
1999	58.566	46.296	70.837	138.876	104.459	173.292	0.422	6	22	41	39.3	48	55	99	14740
2000	50.7247	37.806	63.643	115.572	87.597	143.547	0.439	8	20	42	39.5	47	53	92	10722
2001	47.429	38.584	56.274	105.749	85.050	126.447	0.449	8	11	42	39.7	48	63	120	12956
2002	63.3207	49.704	76.937	149.228	116.464	181.993	0.424	8	23	42	40.2	48	56	110	17329
2003	63.943	44.340	83.546	151.185	105.428	196.943	0.423	9	24	41	40.0	48	54	62	8870
2004	71.8027	50.398	87.208	162.456	128.807	196.106	0.442	10	25	41	40.5	47	54	94	13822
2005	64.149	45.820	82.478	140.444	93.239	187.648	0.457	9	25	42	40.9	47	54	68	9544
2006	59.2538	48.374	70.134	116.433	96.399	136.467	0.509	9	23	43	42.1	49	55	87	12687

Table B2.8. Abundance and biomass from NEFSC spring surveys for barndoor skate for the Gulf of Maine to Southern New England region (offshore strata 1-30, 33-40). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1968-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1968	0.374	0.075	0.673	0.138	0.026	0.249	2.716	41	46	61	71.7	115	118	10	21
1969	0.658	-0.364	1.681	0.145	-0.011	0.301	4.539	33	42	70	83.1	119	120	8	22
1970	0.111	0.033	0.188	0.047	0.017	0.078	2.350	45	44	62	68.2	104	105	9	10
1971	0.116	0.018	0.214	0.102	0.021	0.183	1.134	26	31	59	57.1	69	80	8	20
1972	0.222	0.028	0.416	0.023	0.005	0.041	9.617	63	62	119	104.7	123	124	6	6
1973	0.010	-0.001	0.022	0.017	0.000	0.034	0.621	51	51	51	54.1	59	60	3	3
1974	0.020	-0.005	0.045	0.017	-0.002	0.037	1.146	43	43	58	53.3	59	60	3	3
1975	0.001	-0.001	0.003	0.001	-0.001	0.003	0.900	60	60	60	60.0	60	60	1	1
1976	0.010	-0.010	0.030	0.006	-0.005	0.017	1.800	61	61	61	61.0	61	61	1	1
1977	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1978	0.015	-0.009	0.040	0.016	-0.006	0.039	0.933	51	50	55	56.3	61	62	2	3
1979	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1980	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1981	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1982	0.002	-0.001	0.005	0.002	-0.002	0.005	1.000	54	54	54	54.0	54	54	1	1
1983	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1984	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1985	0.001	0.000	0.002	0.007	-0.004	0.017	0.076	20	20	20	24.6	37	38	2	2
1986	0.003	-0.001	0.007	0.011	-0.004	0.026	0.250	33	33	41	37.5	41	42	2	2
1987	0.002	-0.002	0.006	0.007	-0.006	0.020	0.300	37	37	37	37.0	37	37	1	1
1988	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1989	0.007	-0.007	0.021	0.006	-0.006	0.019	1.100	60	60	60	60.0	60	60	1	1
1990	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1991	0.002	-0.002	0.006	0.007	-0.006	0.020	0.300	38	38	38	38.0	38	38	1	1
1992	0.136	-0.117	0.389	0.013	-0.006	0.032	10.397	41	41	117	98.2	124	125	2	4
1993	0.032	0.024	0.039	0.028	0.005	0.051	1.147	31	31	37	45.3	89	90	5	5
1994	0.084	-0.023	0.191	0.029	-0.001	0.059	2.926	46	46	65	70.1	120	121	4	6
1995	0.015	-0.007	0.037	0.012	-0.005	0.029	1.254	55	55	63	59.6	63	64	2	2
1996	0.062	-0.039	0.162	0.025	-0.003	0.054	2.465	23	23	66	63.2	111	112	4	6
1997	0.077	0.006	0.148	0.035	0.007	0.063	2.216	39	39	67	68.7	89	90	6	7
1998	0.169	-0.024	0.363	0.061	0.015	0.106	2.799	26	26	60	64.4	122	123	8	15
1999	0.279	-0.102	0.660	0.052	0.011	0.094	5.343	28	28	74	80.9	125	126	8	11
2000	0.473	0.246	0.699	0.138	0.076	0.200	3.419	19	20	68	71.4	125	127	14	29
2001	0.170	0.032	0.307	0.141	0.048	0.234	1.200	20	20	52	54.8	77	115	13	30
2002	0.477	0.233	0.721	0.129	0.047	0.212	3.690	35	35	66	77.3	127	133	13	26
2003	0.885	0.341	1.429	0.302	0.172	0.432	2.928	19	19	54	64.0	126	132	23	64
2004	0.103	0.039	0.167	0.111	0.032	0.189	0.928	19	19	55	50.6	81	89	12	24
2005	0.670	0.120	1.221	0.319	0.073	0.565	2.101	26	33	68	68.1	109	122	15	59
2006	1.706	-0.995	4.407	0.586	-0.087	1.260	2.910	19	19	69	69.9	123	134	22	196

Table B2.9. Abundance and biomass from NEFSC autumn surveys for barndoor skate for the Gulf of Maine to Southern New England region (offshore strata 1-30, 33-40). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1963-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1963	2.633	1.604	3.663	0.762	0.468	1.056	3.458	28	44	69	74.6	121	136	47	120
1964	1.212	0.489	1.934	0.400	0.229	0.570	3.030	40	41	69	72.7	112	122	32	63
1965	1.822	1.115	2.528	0.695	0.441	0.949	2.622	27	42	67	69.9	111	134	36	95
1966	0.811	0.394	1.229	0.459	0.243	0.675	1.767	23	38	60	63.0	88	115	26	62
1967	0.438	-0.025	0.901	0.064	0.017	0.111	6.844	45	52	65	81.0	119	120	10	14
1968	0.285	0.123	0.447	0.132	0.067	0.198	2.150	42	42	67	69.1	96	132	18	29
1969	0.054	-0.003	0.111	0.035	-0.006	0.076	1.551	51	51	62	62.0	73	74	5	8
1970	0.066	-0.046	0.178	0.011	-0.005	0.027	5.868	66	66	65	89.1	128	129	2	2
1971	0.170	-0.051	0.392	0.117	-0.077	0.311	1.455	35	35	53	54.6	63	120	6	19
1972	0.096	-0.073	0.265	0.012	-0.001	0.026	7.751	59	59	70	90.3	132	133	3	3
1973	0.004	-0.001	0.009	0.008	-0.003	0.019	0.474	41	41	47	48.7	52	53	2	3
1974	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1975	0.017	-0.016	0.049	0.010	-0.010	0.031	1.600	70	70	70	70.0	70	70	1	2
1976	0.047	0.002	0.091	0.058	-0.003	0.119	0.810	50	50	51	54.6	61	62	7	10
1977	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1978	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1979	0.009	-0.008	0.026	0.003	-0.003	0.009	3.000	78	78	78	78.0	78	78	1	1
1980	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1981	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1982	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1983	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1984	0.010	-0.004	0.024	0.003	0.000	0.007	2.900	61	61	84	73.0	84	85	2	2
1985	0.004	-0.004	0.012	0.002	-0.002	0.005	2.300	70	70	70	70.0	70	70	1	1
1986	0.029	-0.018	0.077	0.015	-0.002	0.032	2.008	22	22	52	51.0	90	91	3	3
1987	0.014	-0.005	0.032	0.012	-0.004	0.027	1.200	53	53	63	58.5	63	64	2	2
1988	0.007	-0.005	0.020	0.009	-0.005	0.022	0.850	34	34	33	44.8	76	77	2	2
1989	0.005	-0.005	0.014	0.002	-0.002	0.007	2.100	71	71	71	71.0	71	71	1	1
1990	0.028	-0.022	0.078	0.010	-0.005	0.024	2.964	60	60	66	76.3	95	96	2	3
1991	0.031	0.000	0.062	0.020	0.000	0.040	1.579	54	54	61	61.3	73	74	4	5
1992	0.002	-0.002	0.007	0.004	-0.004	0.013	0.550	46	46	51	49.0	51	52	1	2
1993	0.141	-0.040	0.321	0.023	0.004	0.042	6.180	45	45	74	86.6	127	128	5	6
1994	0.035	0.001	0.069	0.044	0.006	0.082	0.790	33	33	47	49.4	75	76	6	9
1995	0.111	-0.009	0.231	0.040	-0.006	0.085	2.810	48	48	62	70.9	113	114	4	10
1996	0.042	-0.020	0.104	0.023	0.000	0.046	1.841	25	25	61	59.8	92	93	4	5
1997	0.105	-0.024	0.234	0.026	0.004	0.047	4.065	36	36	79	73.3	124	125	5	5
1998	0.089	-0.036	0.214	0.026	0.002	0.050	3.453	48	48	71	73.9	120	121	4	5
1999	0.300	0.051	0.549	0.085	0.041	0.130	3.511	23	23	54	68.0	120	121	13	15
2000	0.288	0.054	0.521	0.054	0.023	0.085	5.360	29	29	89	85.5	121	122	12	15
2001	0.543	0.050	1.036	0.149	0.052	0.247	3.635	24	40	75	75.5	121	126	16	34
2002	0.778	0.351	1.205	0.269	0.130	0.407	2.893	26	27	59	68.0	119	129	24	59
2003	0.553	0.255	0.852	0.251	0.157	0.345	2.203	22	22	48	57.1	115	120	29	55
2004	1.295	0.677	1.913	0.229	0.122	0.336	5.662	42	47	80	90.1	124	128	23	58
2005	1.036	0.482	1.590	0.360	0.207	0.513	2.877	18	25	64	68.1	118	132	29	73

Table B2.10. Abundance and biomass from NEFSC winter surveys for barndoor skate for the Georges Bank to Mid-Atlantic region (offshore strata 1-3,5-7,9-11,13-14,16,61-63,65-67,69-71,73-75). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1992-2006. Stratum 16 not sampled in 1993, 2000, 2002-2006. Strata 13 and 14 not sampled in 2003. Stratum 63 not sampled in 1993. Stratum 14 not sampled in 2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1992	0.000	0.000	0.000	0.000	0.000	0.000	-	-			-		-	0	0
1993	0.123	-0.066	0.311	0.052	0.004	0.100	2.358	20	20	65	57.3	119	120	4	6
1994	0.185	-0.027	0.397	0.080	0.011	0.148	2.328	21	21	60	63.5	102	103	5	7
1995	0.362	0.121	0.603	0.198	0.056	0.340	1.828	33	33	62	63.6	88	109	11	24
1996	0.291	0.079	0.503	0.203	0.054	0.352	1.434	19	20	61	56.4	85	92	12	23
1997	0.618	0.208	1.028	0.275	0.032	0.519	2.247	35	38	65	67.7	112	117	10	28
1998	0.455	0.146	0.765	0.464	0.092	0.837	0.980	20	26	41	46.8	83	123	12	57
1999	1.053	0.347	1.760	0.709	0.318	1.099	1.486	23	27	46	53.2	113	124	22	81
2000	2.718	0.153	5.284	1.081	0.518	1.643	2.515	19	19	56	62.78	122	126	12	69
2001	1.373	0.375	2.370	0.929	0.168	1.691	1.477	19	30	60	58.7	95	127	21	107
2002	2.126	0.506	3.746	0.950	0.441	1.459	2.238	18	29	58	63.9	119	126	24	123
2003	0.872	0.429	1.316	0.776	0.227	1.324	1.125	26	31	46	52.0	90	131	11	47
2004	3.397	1.214	5.581	1.786	0.972	2.601	1.902	18	30	53	60.9	116	130	23	247
2005	1.061	0.542	1.581	1.23101	0.703	1.759	0.862	18	19	44	47.8	84	102	21	103
2006	3.015	1.519	4.511	3.171	1.622	4.719	0.951	20	29	51	52.9	78	111	37	355

Table B2.11. Abundance and biomass from NEFSC spring surveys for thorny skate for the Gulf of Maine to Southern New England region (offshore strata 1-30,33-40). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1968-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1968	3.181	2.137	4.225	1.600	1.067	2.134	1.987	12	16	44	47.8	91	105	60	252
1969	4.526	3.186	5.865	1.680	1.161	2.199	2.694	12	13	47	51.1	98	109	64	294
1970	4.202	3.229	5.174	1.990	1.478	2.502	2.112	12	16	41	48.2	95	110	84	363
1971	3.683	2.475	4.891	1.974	1.473	2.475	1.866	12	15	44	47.8	95	116	81	424
1972	4.984	3.757	6.212	2.219	1.773	2.665	2.246	12	16	47	50.7	94	110	91	443
1973	6.622	4.867	8.377	3.562	2.640	4.483	1.859	12	15	44	47.9	91	108	75	574
1974	3.774	2.939	4.608	2.450	1.938	2.962	1.540	9	14	43	45.8	87	106	81	376
1975	3.189	2.222	4.157	1.360	0.990	1.731	2.344	10	15	46	50.5	95	102	62	192
1976	2.895	2.041	3.750	1.671	1.281	2.060	1.733	13	15	43	47.2	90	106	79	339
1977	1.623	1.175	2.070	0.942	0.675	1.209	1.722	12	15	42	48.1	89	111	74	213
1978	1.250	0.806	1.695	0.800	0.579	1.020	1.564	10	15	49	46.8	83	97	71	191
1979	1.079	0.729	1.429	0.582	0.410	0.754	1.853	12	17	51	50.5	84	102	68	163
1980	2.105	1.308	2.901	1.319	0.880	1.757	1.596	11	13	37	43.6	92	100	60	250
1981	2.700	2.065	3.335	1.535	1.139	1.930	1.760	9	13	47	48.1	87	100	60	255
1982	2.345	1.685	3.004	1.144	0.878	1.411	2.049	10	17	53	52.4	85	97	62	218
1983	2.142	1.398	2.886	0.968	0.728	1.209	2.212	12	15	52	52.3	91	103	55	156
1984	1.453	0.818	2.087	0.608	0.462	0.755	2.389	12	16	51	53.0	96	100	40	97
1985	3.074	2.124	4.024	1.413	1.060	1.766	2.175	11	14	44	48.4	95	102	59	209
1986	2.619	1.974	3.263	1.718	1.377	2.058	1.525	10	15	38	44.0	83	98	69	276
1987	1.469	0.805	2.133	0.852	0.646	1.058	1.724	14	16	42	46.6	87	109	53	141
1988	1.173	0.735	1.612	1.106	0.766	1.446	1.061	11	14	32	38.5	82	98	59	176
1989	1.481	0.793	2.169	1.221	0.801	1.640	1.213	11	15	34	40.0	84	101	57	175
1990	1.565	0.833	2.296	1.097	0.688	1.506	1.427	14	16	39	44.5	82	99	49	167
1991	1.542	0.945	2.139	0.858	0.569	1.147	1.797	11	13	47	48.5	89	99	47	132
1992	1.092	0.621	1.564	0.612	0.384	0.840	1.784	14	15	47	48.4	89	102	31	86
1993	0.700	0.366	1.034	0.486	0.327	0.646	1.440	13	13	36	42.0	91	105	37	79
1994	0.435	0.242	0.629	0.439	0.270	0.609	0.991	12	12	37	39.3	67	92	39	80
1995	0.564	0.307	0.821	0.384	0.236	0.533	1.467	9	12	42	45.8	84	92	31	66
1996	0.371	0.178	0.563	0.321	0.106	0.535	1.156	12	12	36	40.8	80	93	24	63
1997	0.422	0.117	0.727	0.270	0.153	0.387	1.560	15	20	47	47.9	82	87	25	47
1998	0.480	0.209	0.752	0.334	0.236	0.431	1.440	12	14	35	40.8	89	98	42	85
1999	0.369	0.093	0.646	0.255	0.163	0.347	1.448	11	17	40	46.2	83	89	26	44
2000	0.423	0.166	0.680	0.470	0.013	0.927	0.900	12	12	24	34.0	82	89	28	103
2001	0.493	0.217	0.769	0.221	0.080	0.362	2.234	14	33	56	57.7	80	92	16	35
2002	0.333	0.138	0.529	0.248	0.127	0.369	1.340	13	15	38	42.0	88	93	24	53
2003	0.594	0.268	0.920	0.332	0.203	0.461	1.790	19	19	50	50.9	86	102	30	57
2004	0.368	0.178	0.557	0.212	0.128	0.296	1.731	15	15	47	49.3	91	95	22	48
2005	0.435	0.154	0.716	0.371	0.167	0.576	1.171	16	17	44	44.4	76	89	19	62
2006	0.201	0.035	0.366	0.186	0.020	0.352	1.079	12	14	41	41.9	83	87	15	29

Table B2.12. Abundance and biomass from NEFSC autumn surveys for thorny skate for the Gulf of Maine to Southern New England region (offshore strata 1-30, 33-40). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1963-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1963	5.371	3.788	6.954	1.672	1.305	2.039	3.213	10	15	60	60.4	99	107	65	297
1964	4.403	3.273	5.534	1.651	1.110	2.192	2.667	10	14	49	52.7	96	110	66	278
1965	4.474	3.268	5.681	1.825	1.243	2.408	2.451	10	14	45	49.6	95	107	55	352
1966	7.971	6.163	9.780	2.371	1.855	2.886	3.362	9	13	61	59.4	95	112	72	364
1967	2.712	1.422	4.001	0.982	0.383	1.580	2.763	12	14	49	52.5	95	100	54	165
1968	4.421	3.321	5.521	1.440	1.040	1.840	3.071	12	16	55	57.5	97	107	59	217
1969	5.715	4.320	7.110	1.833	1.359	2.307	3.117	12	14	55	56.7	97	106	72	289
1970	7.347	5.630	9.065	2.216	1.474	2.958	3.316	8	19	57	60.4	98	109	77	403
1971	5.357	4.149	6.565	1.434	1.095	1.774	3.735	12	18	63	64.1	99	111	69	284
1972	4.119	2.974	5.263	1.717	1.302	2.132	2.399	12	16	51	53.1	94	105	75	306
1973	4.564	3.227	5.902	1.536	1.134	1.939	2.971	12	17	59	61.2	95	111	72	274
1974	3.038	2.166	3.910	1.392	1.025	1.759	2.182	10	14	50	51.1	89	111	79	293
1975	2.474	1.483	3.464	1.027	0.716	1.338	2.409	10	12	47	50.0	94	106	70	232
1976	1.720	1.003	2.437	0.798	0.543	1.052	2.157	12	15	44	49.1	91	103	57	143
1977	3.221	2.513	3.928	1.548	1.223	1.874	2.080	10	13	49	50.7	89	107	108	446
1978	4.291	3.473	5.109	2.145	1.643	2.648	2.000	10	16	49	51.1	88	107	155	874
1979	3.612	2.750	4.474	1.283	0.864	1.702	2.815	11	21	59	59.5	89	101	134	486
1980	4.601	3.344	5.859	1.882	1.484	2.280	2.445	11	14	54	54.4	90	100	84	416
1981	3.339	2.551	4.127	1.305	0.957	1.653	2.559	12	15	55	57.1	90	103	71	223
1982	0.646	0.312	0.981	0.393	0.194	0.592	1.644	11	13	33	43.0	85	96	31	83
1983	2.409	1.553	3.266	0.833	0.589	1.077	2.892	15	20	56	58.8	93	108	49	121
1984	2.887	1.978	3.795	1.270	0.975	1.565	2.272	10	13	48	49.8	94	107	70	211
1985	2.877	1.765	3.988	1.438	1.094	1.783	2.000	12	16	49	49.6	87	103	66	260
1986	1.629	1.068	2.189	1.019	0.771	1.268	1.598	11	15	35	44.2	83	101	61	183
1987	0.944	0.590	1.297	0.841	0.600	1.082	1.123	12	14	36	40.2	78	92	49	143
1988	1.488	0.998	1.978	1.099	0.702	1.497	1.354	13	15	31	41.5	84	101	56	208
1989	1.883	0.980	2.786	1.129	0.787	1.471	1.668	12	14	40	46.2	85	101	63	198
1990	1.704	1.090	2.318	1.040	0.744	1.335	1.639	12	17	42	47.2	85	95	53	202
1991	1.632	0.519	2.745	0.921	0.591	1.251	1.772	13	15	47	49.5	86	108	54	153
1992	0.962	0.551	1.373	0.775	0.461	1.088	1.242	12	13	36	41.2	83	99	48	144
1993	1.658	0.639	2.676	0.901	0.440	1.361	1.840	12	13	47	47.8	91	101	50	157
1994	1.509	0.343	2.675	0.981	0.311	1.652	1.538	13	17	45	46.9	84	97	41	170
1995	0.783	0.331	1.235	0.639	0.183	1.095	1.226	13	14	39	42.2	72	99	37	107
1996	0.814	0.360	1.269	0.602	0.362	0.842	1.352	14	14	39	43.3	85	99	37	102
1997	0.849	0.405	1.293	0.404	0.241	0.567	2.101	12	20	50	52.3	83	99	33	79
1998	0.648	0.297	0.999	0.307	0.145	0.468	2.113	13	14	51	52.4	87	93	30	60
1999	0.479	0.249	0.710	0.326	0.195	0.457	1.469	13	14	41	46.3	87	94	38	72
2000	0.832	0.391	1.274	0.374	0.239	0.510	2.224	13	17	49	52.7	92	102	27	70
2001	0.332	0.087	0.577	0.294	0.157	0.430	1.129	16	17	44	44.1	74	82	23	60
2002	0.436	0.188	0.684	0.260	0.126	0.393	1.679	14	15	35	44.2	85	95	25	52
2003	0.742	0.450	1.035	0.930	0.168	1.691	0.798	12	14	23	34.2	74	89	34	175
2004	0.710	0.272	1.148	0.358	0.167	0.550	1.980	14	18	45	50.1	87	90	23	65
2005	0.224	0.092	0.357	0.205	-0.034	0.443	1.096	13	18	39	42.6	76	90	17	36

Table B2.13. Abundance and biomass from NEFSC spring surveys for smooth skate for the Gulf of Maine to Southern New England region (offshore strata 1-30,33-40). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1968-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1968	0.211	0.080	0.342	0.484	0.129	0.838	0.436	12	24	41	42.1	58	64	17	41
1969	0.377	0.193	0.562	0.834	0.521	1.147	0.452	11	19	48	43.3	58	63	28	82
1970	0.346	0.134	0.557	0.702	0.376	1.028	0.492	9	14	47	40.9	57	61	25	68
1971	0.800	0.395	1.205	1.185	0.650	1.719	0.675	9	20	51	48.2	61	63	40	114
1972	0.621	0.355	0.886	1.016	0.582	1.450	0.611	14	20	47	44.3	59	64	34	122
1973	1.000	0.745	1.255	1.907	1.401	2.414	0.524	9	24	45	44.2	59	65	51	179
1974	1.092	0.594	1.590	2.003	1.109	2.896	0.545	9	9	47	42.7	59	63	47	172
1975	0.240	0.133	0.346	0.383	0.224	0.543	0.626	19	25	49	46.8	59	61	22	37
1976	0.534	0.413	0.655	1.150	0.870	1.429	0.464	12	16	43	39.8	57	60	49	134
1977	0.122	0.066	0.178	0.302	0.158	0.445	0.405	15	18	40	41.4	57	60	28	45
1978	0.251	0.144	0.358	0.413	0.258	0.567	0.609	24	26	50	46.7	58	61	33	56
1979	0.218	0.097	0.340	0.410	0.163	0.657	0.533	15	19	39	40.2	54	61	27	54
1980	0.484	0.316	0.651	0.948	0.625	1.271	0.510	16	20	42	41.9	56	60	42	84
1981	0.358	0.227	0.489	0.782	0.513	1.050	0.458	8	13	38	37.2	57	65	38	70
1982	0.152	0.057	0.247	0.225	0.092	0.357	0.677	11	10	52	45.6	57	64	14	23
1983	0.363	0.219	0.507	0.531	0.335	0.727	0.683	11	21	50	47.9	57	69	25	50
1984	0.065	0.010	0.120	0.124	0.026	0.221	0.523	19	20	48	39.8	59	60	9	13
1985	0.211	0.136	0.286	0.450	0.298	0.602	0.469	18	20	41	40.4	57	63	31	59
1986	0.250	0.137	0.362	0.466	0.256	0.677	0.536	20	24	48	46.7	59	65	30	93
1987	0.069	0.029	0.108	0.105	0.044	0.166	0.655	43	42	48	50.2	59	62	12	15
1988	0.115	0.044	0.186	0.328	0.175	0.480	0.350	11	13	36	36.3	57	60	24	49
1989	0.225	0.107	0.343	0.620	0.402	0.838	0.363	13	15	37	38.8	60	63	30	88
1990	0.152	0.010	0.294	0.294	0.080	0.509	0.515	11	16	46	44.0	57	62	18	40
1991	0.137	0.073	0.200	0.237	0.136	0.337	0.576	11	17	49	47.1	59	62	22	34
1992	0.063	0.025	0.101	0.104	0.035	0.172	0.608	22	40	49	48.5	56	57	12	16
1993	0.086	0.021	0.151	0.214	0.020	0.408	0.403	21	23	42	41.2	56	58	14	35
1994	0.098	0.043	0.153	0.176	0.082	0.269	0.558	29	29	47	47.1	56	58	15	30
1995	0.101	0.050	0.152	0.234	0.119	0.349	0.432	9	20	42	41.9	55	59	18	33
1996	0.036	0.014	0.058	0.084	0.038	0.129	0.429	20	19	48	43.8	53	59	10	12
1997	0.037	0.015	0.059	0.122	0.035	0.208	0.307	17	20	36	38.9	55	58	11	22
1998	0.200	0.089	0.311	0.410	0.206	0.613	0.489	9	19	46	44.6	56	60	28	77
1999	0.243	0.068	0.418	0.925	-0.074	1.924	0.262	18	20	32	35.6	51	65	23	111
2000	0.060	0.025	0.095	0.220	-0.021	0.460	0.272	10	10	27	30.9	59	62	13	30
2001	0.058	0.020	0.096	0.125	0.058	0.192	0.466	19	28	46	44.6	57	60	16	25
2002	0.184	0.096	0.271	0.482	0.297	0.667	0.381	10	13	45	40.4	55	61	26	78
2003	0.224	0.161	0.287	0.642	0.429	0.348	0.348	14	19	40	40.4	55	59	36	95
2004	0.262	0.141	0.383	0.650	0.278	1.022	0.403	12	19	43	42.3	56	60	32	125
2005	0.457	0.125	0.788	1.207	0.288	2.126	0.378	10	27	42	42.4	53	60	22	178
2006	0.203	0.005	0.401	0.531	-0.009	1.072	0.382	19	21	41	41.3	56	62	22	71

Table B2.14. Abundance and biomass from NEFSC autumn surveys for smooth skate for the Gulf of Maine to Southern New England region (offshore strata 1-30,33-40). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1963-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1963	0.498	0.306	0.689	0.543	0.282	0.804	0.917	9	20	48	43.9	58	62	26	53
1964	0.326	0.152	0.501	0.360	0.209	0.512	0.906	9	20	42	41.7	59	64	19	35
1965	0.475	0.140	0.811	1.221	0.440	2.001	0.389	11	16	35	38.1	56	64	27	94
1966	0.323	0.175	0.471	0.867	0.519	1.216	0.372	13	17	37	38.6	58	59	28	60
1967	0.152	0.036	0.268	0.293	0.118	0.469	0.518	22	24	48	46.5	62	69	16	27
1968	0.385	0.211	0.559	0.665	0.375	0.955	0.579	17	20	48	45.9	58	62	24	56
1969	0.290	0.131	0.449	0.604	0.282	0.925	0.481	12	16	41	39.6	58	64	21	50
1970	0.232	0.121	0.343	0.530	0.289	0.771	0.437	9	13	45	38.3	59	62	25	50
1971	0.157	0.077	0.238	0.250	0.120	0.379	0.631	17	36	53	51.0	57	59	18	27
1972	0.332	0.185	0.478	0.499	0.285	0.713	0.664	16	24	49	49.8	62	64	30	52
1973	0.311	0.199	0.423	0.506	0.344	0.667	0.614	17	22	48	46.9	58	60	32	56
1974	0.123	0.055	0.192	0.180	0.088	0.273	0.684	11	11	50	48.5	60	63	13	21
1975	0.076	0.029	0.123	0.104	0.043	0.165	0.727	21	30	49	46.7	56	57	12	15
1976	0.039	0.004	0.074	0.077	0.020	0.135	0.501	17	36	41	43.9	52	60	9	10
1977	0.376	0.274	0.478	0.600	0.443	0.757	0.627	19	24	48	44.9	56	61	50	84
1978	0.450	0.240	0.661	0.635	0.359	0.912	0.709	8	25	50	48.0	59	66	49	130
1979	0.182	0.075	0.288	0.239	0.116	0.362	0.761	9	29	50	48.7	60	62	31	60
1980	0.343	0.167	0.519	0.522	0.254	0.789	0.658	15	23	52	46.4	58	62	37	60
1981	0.119	0.039	0.199	0.167	0.069	0.264	0.715	23	26	49	48.1	60	61	13	18
1982	0.039	0.007	0.071	0.074	0.025	0.123	0.521	9	9	49	41.9	63	64	11	11
1983	0.146	0.056	0.236	0.255	0.085	0.426	0.573	14	14	46	40.9	57	59	12	24
1984	0.199	0.106	0.292	0.389	0.171	0.607	0.512	14	22	37	39.2	58	71	23	39
1985	0.210	0.088	0.332	0.340	0.180	0.500	0.617	12	15	51	45.2	59	63	28	64
1986	0.209	0.118	0.300	0.392	0.216	0.567	0.534	13	21	47	45.0	63	66	24	63
1987	0.095	0.045	0.145	0.164	0.081	0.247	0.581	15	15	48	44.8	60	61	19	28
1988	0.284	0.103	0.465	0.446	0.223	0.670	0.637	20	20	51	48.3	59	65	27	90
1989	0.128	0.072	0.185	0.336	0.194	0.478	0.382	13	16	33	36.8	59	62	27	52
1990	0.194	0.120	0.268	0.332	0.202	0.462	0.584	16	23	48	46.4	58	62	27	45
1991	0.167	0.070	0.265	0.335	0.188	0.482	0.500	18	20	46	43.9	57	62	25	59
1992	0.126	0.024	0.228	0.316	0.120	0.511	0.400	12	18	43	40.0	58	60	16	56
1993	0.227	0.107	0.346	0.818	0.273	1.362	0.277	13	13	26	32.6	56	62	29	123
1994	0.099	0.030	0.169	0.269	0.105	0.433	0.370	11	11	36	38.0	57	59	17	36
1995	0.189	0.115	0.263	0.764	0.315	1.214	0.247	10	13	30	32.6	56	59	29	119
1996	0.176	0.093	0.260	0.421	0.249	0.594	0.418	15	18	46	41.6	56	59	26	55
1997	0.232	0.117	0.347	0.449	0.232	0.665	0.517	16	21	47	45.2	60	64	20	59
1998	0.028	0.005	0.051	0.108	0.021	0.194	0.263	18	17	29	35.2	51	53	11	18
1999	0.070	0.032	0.109	0.110	0.050	0.171	0.638	22	22	50	48.7	60	62	16	22
2000	0.154	0.083	0.226	0.318	0.190	0.447	0.485	10	11	45	42.3	59	73	27	55
2001	0.287	0.169	0.405	0.565	0.349	0.781	0.507	17	23	49	46.5	58	62	29	84
2002	0.111	0.067	0.155	0.209	0.140	0.278	0.533	15	24	50	46.2	60	62	25	32
2003	0.190	0.076	0.304	0.646	0.248	1.045	0.294	10	14	39	36.3	52	62	30	84
2004	0.214	0.126	0.303	0.467	0.283	0.652	0.458	18	24	47	45.3	55	59	29	58
2005	0.131	0.039	0.224	0.291	0.143	0.439	0.451	15	17	47	43.1	59	62	18	44

Table B2.15. Abundance and biomass from NEFSC spring surveys for clearnose skate for the Mid-Atlantic region (offshore strata 61-76, inshore strata 15-44). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1976-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1976	0.100	0.020	0.179	0.129	0.040	0.218	0.770	26	26	43	48.5	66	67	8	12
1977	0.509	0.297	0.722	0.500	0.260	0.741	1.017	23	23	56	52.5	63	64	17	41
1978	0.211	-0.094	0.516	0.237	-0.057	0.530	0.893	20	20	57	52.2	68	69	8	21
1979	0.109	0.010	0.209	0.125	0.004	0.247	0.875	25	25	42	50.3	77	78	6	9
1980	0.319	0.100	0.538	0.456	0.136	0.775	0.700	25	25	41	45.1	64	69	14	44
1981	0.891	-0.141	1.923	0.606	0.106	1.107	1.469	24	26	60	55.9	67	72	10	44
1982	0.328	0.165	0.491	0.368	0.126	0.610	0.892	30	32	52	53.6	66	71	14	40
1983	0.138	0.005	0.270	0.127	0.003	0.252	1.081	13	13	58	51.3	65	66	7	11
1984	0.380	0.103	0.658	0.288	0.018	0.557	1.321	48	48	62	60.7	70	74	11	25
1985	0.493	-0.166	1.151	0.436	-0.203	1.076	1.129	48	48	58	59.3	69	72	10	37
1986	0.155	0.035	0.274	0.232	0.038	0.427	0.666	27	27	44	44.8	68	69	11	15
1987	0.306	0.150	0.463	0.202	0.109	0.204	1.519	49	51	63	61.9	69	72	16	20
1988	0.340	0.171	0.508	0.300	0.097	0.502	1.134	44	44	58	57.1	67	71	11	19
1989	0.424	0.258	0.590	0.415	0.275	0.554	1.023	25	25	58	52.3	68	72	14	40
1990	0.501	0.283	0.719	0.420	0.243	0.597	1.192	30	30	59	56.2	67	72	15	52
1991	0.690	0.463	0.918	0.543	0.354	0.731	1.272	27	27	62	58.8	68	71	23	59
1992	0.748	0.324	1.172	0.489	0.218	0.760	1.529	46	46	63	63.0	68	80	23	47
1993	0.856	0.479	1.233	0.656	0.216	1.096	1.305	21	33	63	58.6	70	74	12	136
1994	0.319	0.052	0.585	0.188	0.043	0.333	1.699	51	57	65	66.0	73	74	8	24
1995	0.669	0.361	0.977	0.464	0.261	0.666	1.443	46	46	67	62.4	68	74	18	32
1996	1.224	0.194	2.254	0.948	0.255	1.641	1.291	13	27	62	59.8	70	75	30	95
1997	1.290	0.885	1.695	0.972	0.542	1.403	1.326	33	39	63	61.3	71	78	22	80
1998	0.903	0.674	1.133	0.667	0.369	0.964	1.355	26	38	62	60.2	70	74	29	81
1999	0.943	0.647	1.238	0.862	0.470	1.255	1.093	26	28	59	57.3	67	72	19	54
2000	1.391	1.046	1.736	1.140	0.789	1.491	1.221	24	40	59	59.4	70	76	31	126
2001	1.380	0.674	2.087	1.097	0.456	1.738	1.258	42	49	62	60.8	68	72	19	74
2002	0.836	0.281	1.392	0.617	0.241	0.993	1.355	29	42	62	60.5	69	74	23	59
2003	0.622	0.366	0.879	0.448	0.265	0.631	1.389	49	49	62	62.7	75	76	16	35
2004	0.433	0.050	0.815	0.376	0.049	0.703	1.151	35	35	59	56.2	70	72	9	23
2005	0.569	0.030	1.109	0.414	0.008	0.820	1.374	42	42	61	61.2	70	73	11	27
2006	0.567	0.189	0.946	0.420	0.179	0.661	1.350	36	41	63	60.7	68	72	18	39

Table B2.16. Abundance and biomass from NEFSC autumn surveys for clearnose skate for the Mid-Atlantic region (offshore strata 61-76, inshore strata 15-44). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1975-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1975	0.237	0.086	0.388	0.246	0.133	0.360	0.961	21	21	53	50.3	63	66	31	49
1976	0.302	0.189	0.415	0.348	0.236	0.459	0.869	18	34	52	52.1	64	69	26	54
1977	0.768	0.288	1.248	0.742	0.281	1.203	1.035	15	37	57	55.4	65	68	32	106
1978	0.156	0.073	0.240	0.224	0.086	0.363	0.697	10	10	44	40.8	64	66	14	23
1979	0.419	0.116	0.721	0.346	0.146	0.545	1.211	22	24	56	55.4	67	71	27	46
1980	0.685	0.408	0.961	0.549	0.322	0.775	1.248	33	37	59	58.1	69	72	32	80
1981	0.171	0.081	0.260	0.179	0.087	0.271	0.954	27	27	55	51.5	65	68	19	28
1982	0.213	0.099	0.326	0.183	0.095	0.271	1.163	32	43	59	58.3	67	72	26	37
1983	0.141	0.027	0.254	0.127	0.043	0.210	1.110	16	16	57	52.2	64	70	15	19
1984	0.178	0.064	0.293	0.189	0.063	0.315	0.945	34	37	53	54.0	67	83	20	32
1985	0.306	0.173	0.439	0.315	0.182	0.447	0.974	32	41	56	54.9	66	71	23	42
1986	0.545	-0.038	1.027	0.591	0.091	1.092	0.921	23	23	59	52.6	64	71	31	62
1987	0.320	0.176	0.465	0.289	0.167	0.412	1.107	15	41	56	55.5	69	70	23	42
1988	0.335	0.157	0.513	0.329	0.163	0.495	1.019	33	37	57	56.0	66	71	19	60
1989	0.273	0.075	0.471	0.324	0.064	0.584	0.843	37	37	52	52.7	63	70	20	39
1990	0.402	0.157	0.646	0.306	0.114	0.499	1.311	16	41	60	57.9	69	72	17	50
1991	0.922	0.279	1.566	0.816	0.339	1.294	1.130	35	39	58	57.1	69	71	35	119
1992	0.345	0.185	0.505	0.312	0.185	0.440	1.104	16	42	59	56.7	67	69	22	48
1993	0.495	0.145	0.844	0.474	0.188	0.759	1.044	35	40	57	56.8	66	73	27	104
1994	0.938	0.479	1.398	0.842	0.494	1.190	1.115	35	40	57	57.1	66	73	35	129
1995	0.331	0.189	0.473	0.426	0.233	0.618	0.777	14	14	51	45.5	66	72	25	63
1996	0.430	0.194	0.666	0.369	0.163	0.576	1.165	29	45	59	58.8	68	72	20	42
1997	0.614	0.296	0.932	0.484	0.281	0.688	1.269	43	43	61	60.2	69	77	27	60
1998	1.121	0.115	2.128	1.096	0.124	2.068	1.023	34	43	57	57.5	68	73	32	98
1999	1.053	0.536	1.570	0.928	0.525	1.332	1.134	15	32	61	57.8	69	71	41	84
2000	1.032	0.422	1.642	0.795	0.353	1.238	1.298	14	47	60	60.5	69	74	29	61
2001	1.614	1.092	2.136	1.494	0.984	2.004	1.081	13	15	59	55.2	68	73	41	221
2002	0.891	0.372	1.411	0.863	0.317	1.409	1.033	14	38	55	56.0	68	73	27	63
2003	0.661	0.417	0.906	0.640	0.456	0.823	1.034	15	30	54	54.5	71	78	38	81
2004	0.709	0.201	1.217	0.590	0.172	1.008	1.201	37	43	62	60.1	69	75	18	55
2005	0.524	0.192	0.855	0.452	0.207	0.697	1.159	26	37	62	59.6	71	74	30	71

Table B2.17. Abundance and biomass from NEFSC winter surveys for clearnose skate for the Georges Bank to Mid-Atlantic region (offshore strata 1-3,5-7,9-11,13-14,16,61-63,65-67,69-71,73-75). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1992-2006. Stratum 16 not sampled in 1993, 2000, 2002-2006. Strata 13 and 14 not sampled in 2003. Stratum 63 not sampled in 1993. Stratum 14 not sampled in 2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1992	5.622	3.247	7.997	5.247	2.974	7.519	1.072	23	26	59	54.7	67	93	22	551
1993	6.013	3.818	8.208	5.973	3.852	8.093	1.007	22	33	57	54.3	67	81	23	716
1994	8.854	4.037	13.672	7.692	2.152	13.233	1.151	27	33	60	57.5	69	77	16	639
1995	7.924	2.521	13.327	6.247	1.301	11.194	1.268	24	45	61	60.2	69	76	23	737
1996	14.725	8.266	21.183	11.555	6.347	16.762	1.274	22	40	61	60.0	69	77	32	3086
1997	5.522	3.154	7.890	5.069	2.158	7.980	1.089	22	35	59	56.2	70	76	32	682
1998	6.031	4.470	7.592	4.878	3.195	6.560	1.236	22	36	60	58.3	71	88	32	1091
1999	3.826	2.335	5.317	3.022	1.586	4.459	1.266	23	37	61	59.6	70	76	30	343
2000	10.102	5.693	14.510	8.864	4.579	13.150	1.140	25	42	59	58.2	69	93	43	1449
2001	8.316	5.624	11.008	6.599	4.240	8.957	1.260	25	43	61	60.6	69	86	41	1300
2002	12.223	8.343	16.102	8.864	5.886	11.843	1.379	23	39	63	61.6	70	74	51	1704
2003	19.637	13.819	25.455	15.769	10.902	20.635	1.245	23	39	62	59.1	70	81	36	2260
2004	11.566	7.743	15.389	10.162	6.344	13.979	1.138	20	35	60	58.1	70	80	38	1880
2005	6.036	3.837	8.235	5.078	2.425	7.731	1.189	24	44	60	59.1	70	82	26	1047
2006	11.723	4.862	18.585	11.085	4.693	17.477	1.058	23	35	57	56.7	70	77	41	1916

Table B2.18. Abundance and biomass from NEFSC spring surveys for rosette skate for the Mid-Atlantic region (offshore strata 61-76). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1968-2006.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1968	0.005	-0.002	0.012	0.014	0.000	0.029	0.356	33	33	33	34.4	35	36	3	3
1969	0.001	-0.001	0.002	0.003	-0.003	0.010	0.200	37	37	37	37.0	37	37	1	1
1970	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1971	0.005	-0.005	0.014	0.010	-0.009	0.028	0.500	57	57	57	57.0	57	57	1	1
1972	0.000	0.000	0.001	0.003	-0.003	0.010	0.100	35	35	35	35.0	35	35	1	1
1973	0.006	-0.001	0.012	0.023	-0.006	0.052	0.240	38	38	38	38.6	41	42	4	5
1974	0.005	-0.005	0.015	0.025	-0.024	0.074	0.200	41	41	41	41.0	41	41	1	1
1975	0.001	-0.001	0.003	0.005	-0.005	0.014	0.200	38	38	38	38.5	39	39	1	2
1976	0.007	0.000	0.015	0.035	-0.003	0.073	0.208	31	31	36	36.9	44	45	4	6
1977	0.102	0.019	0.186	0.552	0.107	0.998	0.185	20	26	32	33.6	37	42	11	70
1978	0.010	0.001	0.019	0.041	0.008	0.074	0.232	12	25	35	35.3	40	41	7	10
1979	0.007	0.005	0.009	0.040	0.031	0.048	0.171	13	13	34	31.6	40	41	4	10
1980	0.072	0.030	0.115	0.373	0.167	0.580	0.194	26	27	34	35.3	41	42	15	47
1981	0.013	0.001	0.025	0.057	0.006	0.109	0.231	19	28	37	36.3	41	42	6	17
1982	0.025	0.010	0.040	0.108	0.043	0.174	0.234	22	25	37	37.4	43	44	11	20
1983	0.002	-0.001	0.004	0.012	-0.006	0.029	0.147	29	29	34	34.2	35	36	2	5
1984	0.000	0.000	0.000	0.000	0.000	0.000	-	-	-	-	-	-	-	0	0
1985	0.005	-0.001	0.011	0.059	0.040	0.079	0.080	17	17	18	21.0	29	42	3	9
1986	0.002	-0.002	0.006	0.012	-0.008	0.031	0.182	32	32	35	35.3	35	36	2	2
1987	0.003	-0.002	0.009	0.017	-0.012	0.046	0.200	35	35	36	36.7	36	37	2	2
1988	0.020	-0.001	0.041	0.111	-0.002	0.223	0.180	26	26	35	32.8	35	36	4	6
1989	0.010	-0.004	0.025	0.051	-0.036	0.137	0.200	28	28	34	34.6	40	41	2	15
1990	0.010	-0.004	0.024	0.049	-0.022	0.121	0.200	36	36	35	36.0	35	36	3	3
1991	0.036	0.014	0.058	0.143	0.057	0.228	0.253	19	33	37	37.2	40	42	7	19
1992	0.014	-0.001	0.029	0.063	0.012	0.113	0.223	24	24	37	36.0	40	41	5	5
1993	0.009	0.007	0.011	0.037	0.030	0.043	0.255	38	38	37	38.6	39	40	2	5
1994	0.005	0.001	0.009	0.021	0.006	0.035	0.243	36	36	38	38.7	40	41	4	4
1995	0.010	0.000	0.020	0.056	0.003	0.110	0.173	19	19	35	32.9	36	37	3	5
1996	0.014	-0.011	0.039	0.095	-0.013	0.203	0.149	9	9	35	29.3	42	43	5	19
1997	0.028	0.022	0.033	0.138	0.091	0.186	0.200	30	30	34	35.6	41	42	4	25
1998	0.038	0.007	0.068	0.132	0.041	0.223	0.287	32	33	38	38.0	41	42	11	15
1999	0.043	0.003	0.083	0.206	0.012	0.399	0.211	15	29	37	36.7	42	43	9	16
2000	0.026	0.009	0.043	0.106	0.040	0.171	0.247	30	32	37	38.0	41	42	7	15
2001	0.010	-0.005	0.025	0.041	-0.012	0.095	0.244	21	21	40	38.2	40	41	4	4
2002	0.019	-0.007	0.045	0.076	-0.029	0.180	0.252	12	12	38	34.1	39	40	3	5
2003	0.028	-0.002	0.057	0.115	0.003	0.226	0.241	9	24	38	37.0	39	41	5	17
2004	0.023	-0.009	0.055	0.084	-0.025	0.193	0.276	30	32	39	39.2	40	41	3	7
2005	0.050	-0.029	0.128	0.216	-0.131	0.564	0.229	13	31	37	36.7	40	41	5	21
2006	0.012	0.007	0.016	0.051	0.020	0.081	0.230	25	25	39	35.5	40	41	5	8

Table B2.19. Abundance and biomass from NEFSC autumn surveys for rosette skate for the Mid-Atlantic region (offshore strata 61-76). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1967-2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1967	0.019	0.002	0.037	0.117	0.010	0.224	0.166	10	18	34	34.3	39	42	7	17
1968	0.003	-0.001	0.008	0.023	-0.019	0.065	0.135	28	28	28	28.9	37	38	2	2
1969	0.002	-0.002	0.006	0.010	-0.009	0.028	0.200	38	38	38	38.0	38	38	1	1
1970	0.009	-0.006	0.024	0.033	-0.025	0.090	0.276	39	39	39	39.5	39	40	2	3
1971	0.001	-0.001	0.004	0.006	-0.005	0.016	0.250	40	40	40	40.5	40	41	1	2
1972	0.016	0.001	0.032	0.058	0.021	0.094	0.285	12	12	34	34.2	40	41	7	8
1973	0.012	-0.008	0.032	0.053	-0.016	0.122	0.224	16	16	28	29.0	40	41	3	5
1974	0.012	-0.002	0.026	0.079	-0.014	0.171	0.156	23	23	34	33.8	40	41	4	11
1975	0.004	-0.001	0.009	0.034	-0.001	0.070	0.122	25	25	34	33.6	38	39	4	8
1976	0.024	0.003	0.045	0.149	0.016	0.281	0.163	28	28	33	33.7	37	40	7	21
1977	0.020	-0.002	0.043	0.087	-0.011	0.185	0.231	31	31	33	35.2	40	41	5	8
1978	0.007	-0.007	0.022	0.015	-0.014	0.043	0.500	39	39	39	39.0	39	39	1	1
1979	0.010	-0.004	0.025	0.043	-0.016	0.101	0.242	22	22	35	36.1	39	40	3	6
1980	0.090	0.042	0.138	0.312	0.120	0.505	0.287	14	25	38	36.6	41	42	10	24
1981	0.079	0.011	0.148	0.296	0.052	0.539	0.268	27	28	37	37.5	41	43	10	45
1982	0.006	-0.006	0.018	0.020	-0.019	0.059	0.300	39	39	39	39.0	39	39	1	1
1983	0.001	-0.001	0.003	0.010	-0.010	0.030	0.100	12	12	12	20.7	36	37	1	3
1984	0.029	0.005	0.053	0.128	0.033	0.223	0.229	13	26	36	35.6	39	40	7	16
1985	0.005	0.004	0.007	0.036	0.019	0.054	0.146	14	14	25	28.0	35	36	5	6
1986	0.003	0.001	0.004	0.009	0.005	0.013	0.300	37	37	37	38.2	39	40	3	3
1987	0.028	0.006	0.050	0.112	0.040	0.183	0.253	11	15	38	32.7	41	42	7	10
1988	0.021	0.000	0.043	0.093	-0.002	0.188	0.228	30	30	32	35.0	41	42	5	8
1989	0.018	-0.005	0.041	0.046	-0.012	0.105	0.378	33	33	33	33.5	36	37	3	4
1990	0.023	-0.004	0.049	0.099	0.001	0.198	0.228	32	32	37	37.7	41	42	5	10
1991	0.005	-0.004	0.014	0.021	-0.009	0.051	0.237	15	15	34	31.4	34	35	3	3
1992	0.035	0.006	0.064	0.170	0.033	0.308	0.203	25	25	35	35.3	41	42	9	11
1993	0.021	0.005	0.037	0.102	0.033	0.170	0.211	25	25	37	35.1	40	41	4	8
1994	0.073	0.000	0.146	0.301	0.006	0.597	0.242	27	27	37	36.8	42	43	6	21
1995	0.039	-0.005	0.084	0.174	-0.009	0.358	0.227	19	24	35	35.1	38	39	7	13
1996	0.043	-0.014	0.100	0.273	-0.127	0.674	0.158	7	19	32	31.6	38	42	7	21
1997	0.013	0.000	0.026	0.074	-0.014	0.162	0.176	31	31	33	34.0	42	43	4	6
1998	0.050	-0.008	0.108	0.208	-0.042	0.458	0.241	33	33	37	38.1	40	41	7	22
1999	0.067	0.038	0.096	0.380	0.182	0.578	0.177	12	18	34	32.6	41	42	8	46
2000	0.033	-0.006	0.073	0.134	-0.015	0.283	0.248	26	30	35	36.5	39	40	7	10
2001	0.121	-0.007	0.249	0.472	-0.016	0.961	0.257	11	34	39	38.6	43	44	10	28
2002	0.052	0.009	0.095	0.347	0.045	0.648	0.150	8	8	30	28.0	40	42	11	29
2003	0.033	0.016	0.051	0.136	0.071	0.200	0.247	33	33	36	37.4	39	41	7	18
2004	0.048	0.003	0.092	0.231	0.030	0.432	0.206	19	29	35	35.5	37	40	8	29
2005	0.065	0.001	0.129	0.286	-0.004	0.575	0.227	30	30	35	36.4	39	40	7	24

Table B2.20. Abundance and biomass from NEFSC winter surveys for rosette skate for the Georges Bank to Mid-Atlantic region (offshore strata 1-3,5-7,9-11,13-14,16,61-63,65-67,69-71,73-75). The mean index, 95% confidence intervals, individual fish weight, minimum, mean, and maximum length, 5th, 50th, and 95th percentiles of length, number of nonzero tows, and number of fish caught are presented for 1992-2006. Stratum 16 not sampled in 1993, 2000, 2002-2006. Strata 13 and 14 not sampled in 2003. Stratum 63 not sampled in 1993. Stratum 14 not sampled in 2005.

	weight/tow			number/tow				length						nonzero	
	mean	lower	upper	mean	lower	upper	ind wt	min	5%	50%	mean	95%	max	tows	no fish
1992	0.264	0.138	0.390	1.125	0.619	1.632	0.235	16	27	36	36.4	41	45	15	230
1993	0.149	0.048	0.251	0.663	0.197	1.130	0.225	26	29	36	36.7	39	41	9	143
1994	0.199	0.148	0.249	0.761	0.608	0.914	0.261	16	28	37	36.8	40	44	15	162
1995	0.195	0.066	0.323	0.774	0.273	1.275	0.252	19	32	37	37.9	41	42	23	197
1996	0.324	0.121	0.526	1.410	0.443	2.376	0.230	19	28	36	36.3	40	46	23	899
1997	0.258	-0.051	0.567	1.079	-0.194	2.353	0.239	13	30	36	36.9	40	44	21	238
1998	0.160	0.102	0.219	0.664	0.421	0.907	0.241	15	30	36	36.5	40	45	21	350
1999	0.271	0.043	0.500	1.151	0.082	2.220	0.236	24	27	37	36.6	41	44	25	228
2000	0.344	0.198	0.491	1.357	0.725	1.989	0.254	8	28	37	37.5	43	47	34	740
2001	0.437	0.185	0.690	1.718	0.797	2.640	0.254	9	24	38	37.6	41	46	36	790
2002	0.723	0.140	1.307	2.655	0.603	4.708	0.272	8	29	38	38.3	42	47	34	913
2003	0.670	0.195	1.144	2.774	0.802	4.745	0.242	8	26	37	36.9	41	47	28	1029
2004	0.300	0.171	0.429	1.192	0.653	1.730	0.252	16	31	37	37.8	41	46	29	784
2005	0.189	0.090	0.289	0.716	0.357	1.076	0.264	12	30	38	38.2	43	45	19	281
2006	0.437	0.209	0.665	1.738	0.821	2.654	0.251	8	31	37	37.7	42	45	28	513

Table B2.21. Estimates of size at 50% maturity, length-weight parameters (Wigley et al 2003) and Von Bertalanffy Parameter estimates used to estimate SSB and to calculate Hoenig mortality estimates. Clearnose data, in parentheses, refers to diak width.

Species (Study)	L50	ln(a)	b	Linf	K	t0
Winter (Frisk 2004)	76	-13.1531	3.3199	122.1	0.07	-2.06
Little (Frisk 2004)	44	-12.4462	3.128	56.1	0.19	-1.17
Barndoor (Gedamke et al. 2005)	116	-13.3224	3.2919	166.3	0.14	-1.2912
Thorny (Sulikowski 2005, 2006)	88	-12.088	3.1197	124.0	0.12	-0.35
Smooth (Sosebee 2005)	50	-13.0139	3.1812			
Clearnose(Gelsleichter 1998; Sosebee 2005)	66	-13.8683	3.4235	94.3(61.8)	0.17	-0.88
Rosette (Sosebee 2005)	34	-12.5504	3.0718			

Table B2.22 Estimates of spawning stock biomass indices from NEFSC surveys using sizes at 50% maturity as knife-edge cutpoints.

	Winter	Little	Barndoor	Thorny	Smooth	Clearnose	Rosette
1963			0.796	3.934	0.202		
1964			0.227	2.799	0.091		
1965			0.135	2.848	0.297		
1966			0.000	4.673	0.218		
1967	0.553		0.063	1.411	0.126		0.022
1968	0.338		0.073	2.857	0.229		0.001
1969	0.183		0.000	3.668	0.190		0.002
1970	0.534		0.060	5.155	0.152		0.009
1971	0.151		0.047	3.921	0.134		0.002
1972	0.464		0.077	2.593	0.244		0.010
1973	0.892		0.000	2.987	0.189		0.001
1974	0.377		0.000	1.368	0.080		0.013
1975	0.327		0.000	1.344	0.039	0.003	0.005
1976	1.117		0.000	0.943	0.015	0.019	0.020
1977	1.863		0.000	1.450	0.201	0.076	0.015
1978	3.008		0.000	1.514	0.288	0.007	0.004
1979	3.400		0.000	1.569	0.112	0.073	0.009
1980	3.663		0.000	1.972	0.217	0.166	0.070
1981	3.513		0.000	1.312	0.079	0.016	0.070
1982	4.203	2.744	0.000	0.261	0.035	0.038	0.005
1983	7.598	4.058	0.000	1.065	0.073	0.006	0.001
1984	7.253	2.655	0.000	1.480	0.095	0.041	0.024
1985	8.514	4.184	0.000	1.077	0.169	0.069	0.003
1986	12.279	1.599	0.000	0.653	0.152	0.030	0.002
1987	7.768	2.168	0.000	0.209	0.062	0.085	0.021
1988	5.594	2.936	0.000	0.521	0.207	0.072	0.011
1989	3.753	2.832	0.000	0.709	0.073	0.028	0.002
1990	6.129	2.983	0.000	0.790	0.122	0.072	0.023
1991	3.499	2.854	0.000	0.734	0.116	0.341	0.003
1992	2.083	2.384	0.000	0.292	0.079	0.080	0.033
1993	1.012	3.875	0.134	0.700	0.146	0.110	0.018
1994	0.841	1.742	0.000	0.434	0.072	0.184	0.063
1995	0.536	1.706	0.000	0.189	0.081	0.097	0.033
1996	0.793	4.551	0.000	0.318	0.128	0.083	0.029
1997	0.664	1.601	0.052	0.333	0.167	0.269	0.009
1998	1.576	3.634	0.062	0.319	0.016	0.234	0.051
1999	1.331	5.078	0.118	0.145	0.062	0.442	0.055
2000	1.753	4.424	0.048	0.420	0.102	0.371	0.028
2001	1.397	4.783	0.250	0.066	0.226	0.376	0.129
2002	3.154	4.858	0.366	0.196	0.094	0.261	0.034
2003	1.912	4.401	0.161	0.233	0.106	0.353	0.032
2004	2.222	4.340	0.773	0.365	0.146	0.259	0.043
2005	1.005	2.455	0.285	0.047	0.082	0.253	0.057
2006		2.472					

Table B.2.23.

(EDITOR'S NOTE: BASED ON THE REVIEWER'S COMMENTS, THIS TABLE WAS NOT INCLUDED IN THIS REPORT. THE TABLE HAD ESTIMATES OF FISHING MORTALITY RATE.)

Table B3.1. Current estimates of biomass-based reference points for skates. The estimates for barndoor skate are an average of 1963-1966 biomass estimates.

	75^{th} percentile through 1998/1999	
	Bmsy	Bthreshold
Winter	6.46	3.23
Little	6.54	3.27
Barndoor	1.62	0.81
Thorny	4.41	2.20
Smooth	0.31	0.16
Clearnose	0.56	0.28
Rosette	0.029	0.015

Tables B.3.2 – B.3.24.

(EDITOR'S NOTE: BASED ON THE REVIEWER'S COMMENTS, THESE TABLES WERE NOT INCLUDED IN THIS REPORT. THE TABLES HAD CALCULATIONS FOR ALTERNATIVE REFERENCE POINTS.)

Table B4.1. Fishing mortality overfishing definition for skates based on the average coefficient of variation in the survey. The percentages are percent change from one three-year moving average to the next.

	Winter	Little	Barndoor	Thorny	Smooth	Clearnose	Rosette
	-20%	-20%	-30%	-20%	-30%	-30%	-60%
1992	-8.8	-7.6	-3.8	-17.6	-0.4	4.5	37.7
1993	-33.9	15.6	180.7	-1.1	6.7	5.6	-2.0
1994	-25.5	-12.6	2.0	-2.9	-13.0	0.9	110.9
1995	-21.0	-14.8	61.3	-4.3	13.8	-0.8	3.8
1996	6.2	0.4	-34.3	-21.4	-9.8	-3.6	16.4
1997	5.3	-6.5	37.3	-21.2	28.6	-19.1	-38.4
1998	26.3	35.0	-8.6	-5.5	-26.9	57.5	11.1
1999	33.2	13.5	109.2	-14.5	-24.2	28.8	22.5
2000	17.0	29.2	37.1	-0.9	-23.6	15.0	15.3
2001	1.0	-2.4	66.0	-16.1	102.3	15.4	47.1
2002	3.8	-13.9	42.5	-2.6	8.1	-4.4	-6.9
2003	-7.2	-9.6	16.5	-5.6	6.5	-10.5	0.2
2004	1.1	1.9	40.7	25.0	-12.4	-28.6	-35.4
2005	-22.9	-15.9	9.8	-11.2	3.7	-16.2	9.7
2006		-18.7					

Table B6.1. The size class, temporal, and spatial scheme for each species of skate analyzed for food habits and consumptive demand. S = small, I = immature, M = medium if small and large used; M = mature if immature used, L = large. All size class cutoffs are in cm. * small winter skates were combined with immature little skates to account for potential identification concerns.

	Barndoor Skate	Clearnose Skate	Little Skate	Rosette Skate	Smooth Skate	Thorny Skate	Winter Skate
SVSPP Code	022	024	026	025	027	028	023
Survey Strata Set	01010-01300, 01330-01400, 01351	03150-03440, 01610-01760	01010-01300, 01330-01400, 01351, 01610-01760, 03010-03660	01610-01760	01010-01300, 01330-01400, 01351	01010-01300, 01330-01400, 01351	01010-01300, 01330-01400, 01351, 01610-01760
Temporal Resolution	2000-2005, annual	1977-2005, 5 year block	1982-2005, annual	1999-2005, annual	1977-2005, 5 year block	1977-2005, 5 year block	1977-2005, annual
Size Class:							
S or I	< 80	> 60	< 30*	< 30	< 30	< 30	< 30*
M	> 80	< 60	> 30	> 30	> 30	30-60	30-60
L						> 60	> 60

Table B6.2. Diet composition of Winter Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw

size	year	Ammodytes sp	AMPHIP	ANNELI	AR	Ocean Quahog	Bivlaves	Cancer Crabs	Cephalopods	CITARC	Herrings	CRAFAM	CRUSTA	DECAPO	Other Crabs
L	1977	34.7883	1.1151	16.1104	1.8018	0	31.6042	2.8984	0	0	0	0.6408	0.1664	0.0506	0.4563
	1978	9.1416	0.3733	6.1801	0.3855	0	75.5169	1.1059	0.1892	0	0	0.26554	0.0127	0.00827	0.26951
	1979	73.7314	0.0606	4.4508	0.3653	0	2.4664	0.2792	7.8195	0	0	0.1202	0.3049	0.0168	0.2862
	1980	74.8072	0.4227	5.7829	0.33	0	0.2152	0.101	6.8373	0	0	0.0082	0.0925	0	0
	1981	0	0	30	0	0	30	0	0	0	0	0	0	0	0
	1982	91.2966	0.2233	1.7462	0	0	2.9283	0.0339	0	0	0	0	0	0	0
	1983	57.2636	0.557	6.7124	0	0	0.7889	0.0158	28.4001	0	0	0.0394	0	0	0
	1984	38.6564	0.2036	9.6358	6.39	0	8.0751	0.3393	1.6964	0	0	0.8143	0.0679	0	9.6358
	1985	26.1441	0.1519	14.5265	7.8159	0	19.3497	0	0	0	0	0	3.6377	0	0.428
	1986	57.8759	0.161	8.1314	1.7104	0	6.6367	0.89008	0.174	0	0	0.08453	0	0.03978	0.56562
	1987	68.9832	0.9335	4.538	0.3145	0	4.9612	0.1444	2.5226	0	0	0.0845	0.5224	0	1.2535
	1988	14.1556	3.8149	18.2329	1.8148	0	18.681	2.9517	0.6408	0	1.0391	0.1583	3.9573	0	1.9275
	1989	57.8982	2.6138	10.5248	0.8638	0	6.5784	1.0156	2.5556	0	0.6985	0.1909	0.2027	0.1755	0.0873
	1990	61.5874	1.0104	10.7318	0.7482	0	2.94998	0.3936	4.00574	0	5.23715	0.05983	0.01749	0	0.08714
	1991	9.7544	1.993	21.9212	4.0085	0	13.7766	6.0475	5.3519	0	7.6393	0.0879	0.6008	0	0.9731
	1992	1.4303	0.6805	10.9025	5.0016	0	28.1566	1.3148	6.5655	0	3.7958	1.1828	1.3869	0.0487	3.4787
	1993	2.9578	0.9914	15.7606	2.4767	0	20.4295	1.1054	1.5599	0	3.9948	0.6027	0.0308	0	3.1099
	1994	0.3127	0.3522	11.5075	3.0172	0	15.7535	0.3412	0.1191	0	6.111	0.5105	0	0	2.2163
	1995	3.0589	4.3303	17.8107	2.9335	0	23.0905	0.3205	0.4261	0.1202	0	1.0186	0.2019	0	1.3034
	1996	10.2108	2.9927	17.9021	1.1398	0	17.0806	0.9197	0.6826	0	1.7574	0.2543	0	0	2.5581
	1997	3.6859	2.5315	18.5626	5.28	0	23.1485	0.3195	2.2127	0	0	1.2508	0.0062	0	0.5494
	1998	3.45	6.4344	11.8438	2.8744	0.1378	13.8658	0.55	1.5957	0	5.1224	0.8445	0.2941	0	1.0659
	1999	19.3976	1.4069	13.3698	1.4272	0	11.9809	0.5869	0.3011	0	23.3094	0.1833	0.00215	0.01791	0.24244
	2000	14.5178	0.4276	6.8924	1.3873	0	11.1621	0.7002	1.5818	0	12.6656	0.1447	0.0111	0.003	0.1402
	2001	1.191	1.8195	14.4265	4.5131	0	16.3827	0.1874	3.1485	0	10.8217	0.276	0.2548	0	0.337
	2002	4.0646	0.737	26.908	5.499	0	5.4904	0.7994	3.8507	0	9.3279	0.0904	0.5551	0	0.3932
	2003	0.1559	0.3344	14.1453	4.4303	0	11.0987	1.9911	5.1759	0.0786	0	1.1471	0.1441	0	3.4326
	2004	0.1282	0.2008	5.4805	2.4003	0	2.8519	0.138	0.8424	0.0092	1.3161	0.1687	0.9406	0	0.1515
	2005	2.1766	0.3827	18.8812	6.8834	0	8.089	3.1772	6.6144	0	2.6587	1.9086	0.0061	0	0.4223
L Total		25.61455172	1.284689655	12.88340345	2.614224138	0.004751724	14.93480276	0.98854069	3.271363448	0.007172414	3.292925862	0.418531034	0.462642759	0.012433103	1.219686552
M	1977	0	20.325	12.0142	0.28	0	1.0465	34.2272	0	0	0	6.0846	1.947	1.3594	7.4561
	1978	0	11.6814	29.486	0.8055	0	35.7206	4.7204	0	0	0	6.9526	1.1978	0.0042	0
	1979	0	16.7283	36.1091	0.4556	0	7.9411	4.7838	0.017	0	0	5.7755	3.2408	0	0.3236
	1980	38.7963	8.5821	9.6549	0.9287	0	0.8476	1.5162	0.1771	0	0	25.9766	2.4302	0	1.1897
	1982	15.4397	28.8344	10.4294	0	0	24.5399	8.998	0	0	0	3.0675	0	0	0
	1983	0	39.2857	7.1429	20.0549	0	0	0	0	0	0	0	13.7363	0	8.79121
	1984	0	3.0879	93.3492	0	0	0	0	0	0	0	0	3.5629	0	0
	1985	51.049	8.1185	18.4557	5.069	0	1.7341	0	0	0	0	0.95821	3.66462	0	0.22603
	1986	51.3168	18.745	2.9367	1.7842	0	4.6162	1.767	0	0	0	0.497	3.5146	0	0.2783
	1987	7.7234	39.6367	12.3679	2.964	0	2.5606	1.1097	0	0	0	4.0476	0.5465	0	0.1165
	1988	3.6755	38.7602	26.6014	3.9648	0	3.9932	0	0	0	0	0.785	14.6442	0	1.8877
	1989	8.3739	25.4202	19.6796	4.2656	6.2822	8.4461	0.6232	0	0	0	3.807	2.6209	0.0754	1.0442
	1990	36.4389	29.3789	12.222	0.8788	0	0.29943	0	0.0163	0	0.22566	1.4562	5.3126	0	0.3284
	1991	2.1857	51.4331	18.6345	3.5268	0	0.7188	0.74025	0.5427	0.09126	0	2.60541	2.89256	1.1256	4.02683
	1992	0.0469	34.4342	13.5198	5.7735	0	3.2513	0.1417	1.3798	0	0	12.8109	9.4805	0	3.7615
	1993	0	33.1032	16.7179	5.5919	0	5.3766	2.1322	1.0174	0.2539	0.0093	9.5566	1.4723	0	4.0628
	1994	0	41.543	14.5147	5.3447	0	8.654	2.7233	0.4492	0	0	10.3039	0.0281	0	3.5254
	1995	0.1835	51.212	13.9893	8.889	0	4.1136	1.8596	0.9826	0	0	4.5012	0.0974	0	2.5888
	1996	3.0931	36.3057	22.8254	4.1233	0	10.6487	0.5013	1.3918	0	0.3639	4.2009	0.4814	0	2.7452
	1997	5.0252	25.4724	20.8091	7.361	0	15.4438	0.7226	0.1474	0.1492	0	4.73991	1.09615	0	2.44478
	1998	1.5468	36.25	22.4302	7.4626	0	2.7811	5.5239	1.0114	0	1.5969	5.6768	0.1632	0	3.1289
	1999	2.9608	25.2697	25.3716	5.8763	0	7.7258	3.4833	0.3986	0	0	3.0559	0.3938	0	5.0842
	2000	8.2531	22.7353	12.2333	10.8327	0	12.6313	1.4515	0	0	0	2.56066	0.26953	0.04648	2.63823
	2001	0	33.2962	13.5332	11.661	0	8.7183	0.5397	0.8191	0	0	7.6341	0.9575	0.0385	2.4707
	2002	0	24.8558	12.6022	21.1887	0	0.2428	1.0147	5.4117	0	6.0709	4.5835	2.8388	0	1.1708
	2003	0	45.38	11.7798	9.9764	0	5.4389	0.487	0.1534	0	0	0.4552	1.7561	0	2.7126
	2004	0	22.1021	28.255	8.7639	0	2.16154	2.957	0.13625	0	0	4.4843	2.391	0.0409	0.3484
	2005	0.3733	13.9579	12.1404	14.8442	0	7.6895	4.013	0.3297	0	0	26.3045	1.61	0	1.7668
M Total		8.445782143	28.06910357	19.63590714	6.166682143	0.224364286	6.690763214	3.072733929	0.513623214	0.017655714	0.295237857	5.817199643	2.940955714	0.096088571	2.289917143

size	year	GADFAM	GADMOR	ISOPOD	MELAEG	Silver Hake	MOLLUS	OPHFA2	OTHFIS	PAGFAM	Pandalid Shrim	PARDEN	PECFA1	PENFAM	SCOFAM	Red Hake
L	1977	0.0647	0	1.473	0	0.0527	0.0015	0	2.6554	0	0.0258	0	0	0	0	0
	1978	2.4706	0	0.4958	0	0	0.01331	0	2.53288	0.13827	0.11665	0	1.88034	0	0	0
	1979	0	0	0.387	0	4.48973	0.03907	0	4.36516	0.22034	0.06912	0	0	0	0	0
	1980	0	0	0.1697	0	0	0.0027	0	7.8622	0.1241	0.3675	0	0	0	0	0
	1981	0	0	0	0	0	0	0	30	0	0	0	0	0	0	0
	1982	0	0	0.1837	0	0	0	0	3.4002	0	0.0037	0	0	0	0	0
	1983	0	0	0.7479	0	0	0	0	3.2187	0	0	0	0	0	0	0
	1984	0	0	4.3768	0	0	0.0679	0	11.5359	0	1.6286	0	0	0	0	0
	1985	0	0	10.915	0	7.0615	0.4211	0	8.107	1.2069	0	0	0	0	0	0
	1986	0	0	0.6222	0	0.3978	0	0	19.0138	0	0.0373	0	1.4918	0	0	0
	1987	0	0	0.2731	0	0	0	0	14.0074	0	0.1025	0	2.8792	0	0	0
	1988	0	0	0.2154	0	0.052	7.2938	0	8.366	0.8209	0.9629	0	0.8659	0	0	0.4546
	1989	1.1847	0	1.8933	0	0.8776	4.7325	0	6.4005	0.084	0.0439	0	0	0	0	0
	1990	0	0	0.99164	0	0.19601	2.4209	0	5.31306	0.42959	0.0246	0	0	0	1.57441	0
	1991	0	0	0.5654	0	1.18257	4.96174	0	8.22955	0	0.16043	0	3.47122	0	0.4074	0
	1992	0.1703	0	0.9135	0	3.7666	5.5066	7.6631	11.5003	0.0308	0.5998	0	2.8496	0	1.4599	0.2628
	1993	2.2536	0	1.5385	0	6.3264	2.3966	5.5658	10.3281	0	5.1837	3.6339	0	0.1461	0	0.0792
	1994	0	0	2.0271	0	4.0317	2.2	1.2833	18.7643	0	0.917	0	0	0	3.395	0.2089
	1995	0	0	2.4347	0	0	2.3794	3.2138	6.0422	0	2.5312	0	0	0.0481	16.2276	1.9563
	1996	0	0	1.2198	0	0	3.1095	10.5204	14.6408	0	0.64	0	0	0	0	4.22
	1997	0	0	4.24	0	0	0.2019	12.8603	19.0435	0	0.4899	0	0	0	0	0
	1998	0	0	1.6781	0	0.7253	0.7816	20.8517	25.1586	0	0.0986	0	0	0	1.175	0.0326
	1999	1.15164	0	1.5202	0	1.6703	0.79762	4.06758	4.85029	0.00681	0.60143	0	0.07678	0.20474	3.5215	0.4351
	2000	1.6967	0	1.9122	0	14.2754	3.0854	7.4485	14.5717	0.0771	0.3435	0	0.234	0	3.9276	0.0424
	2001	0	0	2.2309	0	0	4.8056	13.3988	9.3181	0	0.6114	0	0	0	2.7987	0
	2002	0	0	0.3608	0	0	6.343	7.1694	15.4211	0	0	0	0	0	0	0
	2003	2.1839	0	0.5019	2.0966	0.5241	2.5945	8.2898	24.7023	0	0.8976	0	0	0	0	11.3018
	2004	0.0733	0	2.607	0	0.1717	2.2956	39.0076	18.6994	0	0.0357	0	0	0	2.2953	3.2049
	2005	0	0	3.1069	0	0	0.716	3.3815	15.2547	0	0.1657	10.136	0	0.4711	0	7.7969
L Total		0.387911724	0	1.710397931	0.072296552	1.579358966	1.971304828	4.99039931	11.83803931	0.108234828	0.574432069	0.474824138	0.474097931	0.030001379	1.268358966	1.034327586
M	1977	0	0	4.0231	0	0	0.0374	0	0.1514	7.7749	0.7639	0	0	0	0	0
	1978	0	0	3.404	0	0	1.3175	0	2.2291	0.4246	0	0	0	0	0	0
	1979	0	0	10.914	0	0	0	0	6.8909	1.099	1.6892	0	0	0	0	0
	1980	0	0.3994	1.3768	0	0	0	0	1.4296	3.8875	1.5318	0	0	0	0	0
	1982	0	0	8.0777	0	0	0	0	0	0	0	0	0	0	0	0
	1983	0	0	0	0	0	0	0	0	2.1978	0	0	0	0	0	0
	1984	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1985	0	0	5.4765	0	0	0.17786	0	0	2.84573	0	0	0	0	0	0
	1986	0	0	0.8117	0	0	0	0	2.03753	0	0	0	4.50575	0	0	0
	1987	0	0	8.9806	0	0	0.4594	0	18.3097	0.688	0.1997	0	0	0	0	0
	1988	0	0	0.3517	0	0	1.3885	0	3.0459	0	0.0851	0	0	0	0	0
	1989	0	0	8.6089	0	0.10965	5.52411	0	0	3.78832	0.31411	0	0	0	0	0
	1990	0	0	5.94723	0	0	2.7858	0	0.8132	1.1968	0.2657	0	0	0	0	0
	1991	0	0	3.9855	0	0.09561	0	0	5.29823	0	0.6104	0	0	0	0	0
	1992	0	0	6.2407	0	1.8814	0.6017	0	0.32069	0	1.50877	0	0.63299	0	0	0
	1993	0	0	10.257	0	0	0.7154	0	1.2105	0	3.8077	0	0	0	0	0
	1994	0	0	9.6467	0	0	0.1512	0	0.683	0	0.7089	0	0	0	0	0
	1995	0	0	2.9405	0	0.27735	0.30902	0.38315	0.49529	0	1.75698	0	0	0	0	0.04291
	1996	0	0	8.0433	0	0	0.0073	1.0536	1.6231	0.0042	0.591	0	0	0	0	0
	1997	0	0	7.2351	0	0	1.09779	0	0.2202	0	0.31509	0	0	0	0	0.0098
	1998	0	0	4.8426	0	0	0.52459	0	3.24879	0.00719	1.58384	0	0	0	0	0.14372
	1999	0	0	6.624	0	0	1.0655	0	1.9777	0.0189	0.8801	0	0	0	0	0
	2000	0	0	5.5895	0	0	0.02912	0	8.9254	0.48245	0.23	0	0	0	0	0.353
	2001	0	0	11.9913	0	0	2.2278	0.5204	0.8336	0	0.2875	0	0.1927	0	0	0
	2002	0	0	2.0207	0	0	2.0063	0	7.3949	0.8673	0	0	0	0	0	0.0555
	2003	2.3998	0	2.9394	0	0	0	3.5591	10.9034	0	0.2302	0	0	0	0	0
	2004	0	0	5.41112	0	5.10939	3.09708	0	8.07624	0	0	0	1.88025	0	0	0.545
	2005	0	0	5.4483	0	1.4931	0.3621	0	3.4603	0.0995	0.0249	0	0.056	0.2488	0	0
M Total		0.085707143	0.014264286	5.399569643	0	0.320232143	0.8530525	0.197008929	3.199238214	0.906506786	0.620888929	0	0.259560357	0.008885714	0	0.041068929

Table B6.3. Diet composition of Little Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw															
size	year	Amphipods	Polychaetes	AR	Bivalves	Cancer Crabs	Crangon sp	CRUSTA	CUMACE	DECAPO	DECCRA	EUPFAM	ISOPOD	MOLLUS	OTHFIS
I	1973	75.5229	2.6145	0.7776	0	0	12.5426	5.9489	0.4893	0.0743	0.1311	0	0.6094	0	0
	1974	53.8589	3.1152	0.935	0	1.7517	18.68	11.7976	0.583	0	0	0	8.6485	0	0.1002
	1975	54.1678	10.2228	7.8196	0	0.2554	11.422	5.9236	4.103	0	0.0203	0	0.4973	0	0
	1976	24.2307	25.9101	22.9743	0.7039	0.7202	16.1323	5.3765	0.2278	0	0.53184	0	1.7507	0	0.2362
	1977	41.9874	1.95485	4.4916	0	3.7224	25.39845	4.3551	0.79	0	1.3751	0	14.2902	0	0
	1978	55.4855	10.74415	0.86475	0.62585	1.6998	18.693225	7.3281	1.44435	0	0.1645	0	0.4064	0	0.54185
	1979	86.2462	5.5332	0.3966	0	0.28609	0.09753	2.23667	5.0802	0	0	0	0.1235	0	0
	1980	56.686	0	0.8306	0	0	0	27.3463	14.7633	0	0	0	0	0	0
	1981	44.8052	0	22.72725	0	0	0	0	0	0	9.0909	14.2857	9.0909	0	0
	1982	45	25	0	0	0	30	0	0	0	0	0	0	0	0
	1983	0	0	0	0	0	100	0	0	0	0	0	0	0	0
	1984	100	0	0	0	0	0	0	0	0	0	0	0	0	0
	1985	5.2239	9.82145	0	0	0	0	55.1706	0	0	0	7.4627	5.80355	0	0
	1986	36.6921	3.36755	14.76355	0	0	15.44555	0.0639	18.02575	0	0	0	9.11225	0	0
	1987	75.42415	4.01755	3.3418	0.27705	0.2078	9.6629	5.065625	0	0	0.42115	0	0.3536	0	0
	1988	41.7981	3.01725	45.7329	0.79575	0	0.26525	7.09764	0.132625	0	0	0	0	1.160475	0
	1989	69.5313	0.1075	10.99075	0.19225	0.15685	12.21955	0.60265	2.81055	0	0.39998	0	0.8918	0.0683	0.04555
	1990	57.2468	29.92905	7.48655	0	0.1127	0.3522	1.85965	0	0	2.49645	0	0.28175	0	0.0939
	1991	62.4026	12.981	7.07065	0.38935	0.19695	2.6245	5.5276	0	0.0513	2.1173	0	0.1848	0.31845	0
	1992	72.6229	3.66295	8.57995	0.1877	0.0135	5.51245	0.6556	0	0	2.7367	0.04505	4.71735	0.07505	0.27625
	1993	52.7453	4.86995	13.20905	0.6045	0.8602	4.796245	1.055905	0.0408	0	2.059955	0.48765	15.35385	0.20965	0
	1994	59.329	3.827	18.3083	0.0301	1.8747	7.7217	0.65875	0.11025	0	2.25465	0.34625	0.67505	0.0852	1.6716
	1995	62.12805	5.29875	24.73045	0.352	0.412785	2.442755	0.04215	0.05615	0	0.21945	0.15955	0.280695	0	0.015
	1996	70.7763	8.3752	8.37785	1.1566	1.27135	5.3172	0.27785	1.13205	0.0198	0.97177	0.6309	1.30595	0.001	0.0619
	1997	49.87355	2.78135	10.8209	0.1444	1.24885	7.1385	0.76745	0.08995	0	23.33145	0.0093	2.0098	0	0.29435
	1998	75.65775	5.09465	12.44975	0	0.3068	3.5149	0.48865	0.007	0	0.2997	0.18885	1.38965	0	0.0653
	1999	66.70955	2.77175	15.82975	0.3519	0.16225	12.3963	0.01545	0.3654	0	0.61735	0	0.1799	0	0.07615
	2000	49.3828	7.4174	24.16185	0.2473	5.74685	8.3829	0.03755	0.053	0.02615	2.31195	0.16345	1.04335	0	0.1741
	2001	58.5002	7.2223	15.5369	0.26325	0.4521	10.4683	2.24915	0.01145	0.0372	0.4235	0.0458	2.1261	0	1.6139
	2002	23.5909	2.8502	53.4331	0.01245	0.20765	2.10295	11.75655	0.16825	0.00622	0.029535	0.58135	2.2788	0	0.4974
	2003	72.2283	3.10175	12.40965	0	0.2098	2.6736	8.8459	0	0	0.2535	0.11365	0.08305	0	0
	2004	46.1465	5.5776	34.7175	0	0.4078	5.3635	1.5543	0.9756	0	0.3741	0.3286	0.614	2.9487	0
	2005	9.9833	17.14165	10.1226	0	0	54.585975	2.393575	0.1451	0	0	4.87785	0.1554	0.00035	0
I Total		52.89664737	7.082173684	13.32159649	0.209908772	0.721892281	11.3626093	5.137099298	1.350658772	0.006239298	1.828195088	1.037275439	2.741610351	0.119046491	0.196331579
M	1973	9.3509	11.1866	9.3192	1.0927	30.2959	5.0624	2.8476	0.0052	0	6.6	0	0.9781	0.3301	0.6085
	1974	17.1761	16.6309	11.2079	0.7992	9.0957	10.0717	10.4175	0.0116	0.967	2.1131	0.0101	3.5639	0.3726	3.8615
	1975	22.7124	24.7736	11.3597	0.9527	10.8911	3.4751	4.9181	0.0198	0.2287	0.2484	0	1.5095	0.5572	1.4375
	1976	23.8271	11.2718	11.4467	8.5691	10.4906	12.0797	1.8459	0.0096	0	2.1834	0.0162	1.908	0.4204	4.0829
	1977	18.6095	7.0788	10.1578	7.0674	22.2862	4.2996	10.46	0.0178	0.0876	1.9611	0.0009	1.5844	3.7551	1.0402
	1978	10.001	15.9678	3.0209	1.5317	47.1393	3.0385	3.8204	0.0325	0.4166	1.53	0.0436	2.3264	0.0106	1.2833
	1979	26.9768	16.1419	1.8496	0.4133	6.8783	2.0777	10.4186	1.3448	0.0505	26.7253	0	1.6915	0	0.2096
	1980	20.713	18.7392	0.135	1.741	14.084	5.6156	3.1105	0.0198	7.4051	0	0	3.6154	0	1.0279
	1981	9.0732	8.301	4.8347	17.2959	0	6.4789	2.8569	0	0	15.929	0.847	0.1145	0.407	2.0145
	1982	13.748	17.8538	3.8492	8.7706	6.0323	21.2072	0.6762	0.9551	0	12.6041	0	0	0	3.5956
	1983	9.3336	6.9919	1.9744	0	5.7238	32.9915	0	0	0	12.8901	0	0.2792	3.7294	1.0637
	1984	24.4972	11.8478	0.574	25.6166	11.7104	11.1507	0	0	0	7.3559	0	2.1957	0	0
	1985	9.8352	16.1631	4.0668	2.6404	6.8996	6.9006	10.2332	0	0	9.7657	7.5867	2.2999	0.2965	11.7444
	1986	13.0858	11.1112	8.516	18.7736	6.8075	3.8616	3.3019	0.0104	0.1001	13.2322	0.0138	2.8538	3.3389	2.1192
	1987	26.1142	9.2215	9.2875	21.7286	6.0334	2.142	1.5492	0	0	6.3482	0	2.342	0.029	6.0675
	1988	17.4612	10.621	4.5013	0.8196	6.7101	1.2756	8.8327	0	0.2653	25.8005	0.2995	0.5592	13.2704	2.3217
	1989	27.2409	9.1444	1.1104	1.8631	16.4164	9.3337	3.0275	0.0048	0.2675	10.9219	0.121	1.8548	2.9981	1.7967
	1990	36.0534	12.7152	1.8785	2.5035	11.4366	2.93893	7.38857	0.004	0.11182	7.67882	0.9669	2.0682	1.8294	2.582
	1991	30.1916	9.1244	5.126	7.8619	5.6822	4.9042	1.6128	0.0115	0.1392	15.3101	0.4885	1.022	8.4123	3.6377
	1992	30.5949	10.5714	17.6521	4.0907	4.3544	3.8668	0.8229	0.043	0.0621	16.4467	0.2173	2.8541	0.8338	1.0494
	1993	21.8877	9.5611	9.0973	11.6482	6.2901	8.9296	3.0068	0.013	0.3711	13.4677	0.037	4.6828	0.6338	2.0133
	1994	23.9723	6.3579	10.3234	10.0049	19.4798	3.0517	0.3075	0.0046	0.0104	19.0023	0.0434	1.1038	0.1833	1.8394
	1995	38.5002	13.2905	9.9274	6.5699	9.982	4.0476	0.0763	0.062	0	7.9769	0.8879	0.6827	0.2901	1.3379
	1996	21.6962	13.6588	7.5195	19.7085	11.2168	4.1527	0.2882	0.6391	0.0274	8.7263	0.4264	2.8277	0.1238	2.352
	1997	29.826	9.9631	11.0365	6.1268	4.22	9.2365	0.8049	0.0138	0.007	11.4907	0.1122	7.1647	0.0142	3.8194
	1998	20.8384	14.9168	12.5857	15.2282	7.43693	6.39932	0.29927	0.0108	0.00218	8.68967	0.3426	2.1366	2.6693	2.7892
	1999	27.6761	11.0634	11.1705	9.171	15.6743	3.6304	0.3067	0.006	0.1306	10.0349	0.1904	2.7536	0.2061	2.3035
	2000	49.5482	8.1924	5.4309	3.9251	9.0629	4.0032	0.4877	0.0041	0.0833	9.3371	0.1197	3.3216	0.104	1.7645
	2001	33.5795	12.0391	12.7589	5.821	5.7128	8.5728	0.4321	0.0745	0.5667	5.978	0.3053	2.6175	0.7551	4.5832
	2002	11.269	15.3683	17.7477	2.123	8.90261	5.05613	8.3787	0.0331	0.06293	6.17648	0.652	3.568	3.948	5.7482
	2003	18.39	10.9124	14.1008	15.0199	7.7451	4.90148	1.04514	0.0345	0	8.85857	0.2362	0.5602	0.0745	5.0066
	2004	33.1495	10.3471	15.4235	1.953	9.4717	4.3574	1.69	0.1804	1.2372	4.0855	2.8807	3.1308	1.3602	3.7031
	2005	12.8203	17.8528	15.2943	1.4071	13.4348	5.6494	7.2221	0.0891	0.022	8.2928	1.294	1.9324	0.6805	4.77939
M Total		22.41664848	12.39336364	8.311639394	7.358733333	11.13932242	6.81091697	3.40866303	0.110754545	0.382494848	9.629134545	0.549675758	2.184939394	1.564657576	2.835863333

Table B6.4. Diet composition of Barndoor Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw																					
size	year	Amphipods	Polychaetes	AR	Cancer Crabs	Cephalopods	Gulf Stream Fl	Herrings	Sculpins	Crangon sp.	Misc. Crustace	Other Decapo	Other Crabs	Other Shrimp	Other Gadids	Haddock	Silver Hake	Other Fish	Pandalid Shrin	4-Spot Flound	Red Hake
I	2000	0.7427	0.2991	2.8809	22.6514	1.5297	0	0	0.8498	6.2149	2.0871	0.5099	18.3763	0	0	0	0	7.8522	35.3804	0	0
	2001	0.7133	0	5.9933	12.8295	0	0	0	0	13.36	1.951	0	37.7268	1.0691	0	0	0	4.0691	16.133	0	2.0516
	2002	0	0.4252	0	99.5748	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2003	2.0959	0	6.0816	19.9694	1.5536	3.1072	0	0	4.1445	8.0505	0	3.884	0	0	6.5251	0	8.2623	34.3112	0	0
	2004	6.8	0	6.6	0	0	0	0	0	0	86.6	0	0	0	0	0	0	0	0	0	0
	2005	1.8177	2.1368	17.3875	2.5964	7.8348	0	0	0	4.4682	0.4986	2.3742	14.9872	0	0	0	28.49	2.018	13.2241	0	0
I Total		2.028266667	0.47685	6.49055	26.27025	1.819683333	0.517866667	0	0.141633333	4.697933333	16.5312	0.480683333	12.49571667	0.178183333	0	1.087516667	4.748333333	3.700266667	16.50811667	0	0.341933333
M	2000	0	0	2.1777	42.2249	0	0	0	6.5494	0	2.3578	0	35.3696	0.6942	1.9648	0	0	4.5846	1.4409	0	0
	2001	0	0	2.6148	0	0.3486	0	13.0738	0	0.3051	0.3922	0	17.2138	0	0	0	19.1168	46.0198	0.9152	0	0
	2002	0	0	0.5464	0	0	0	76.5027	22.9508	0	0	0	0	0	0	0	0	0	0	0	0
	2003	0	0	0	0.6912	0	0.6912	0	0	0	0	0	14.1705	0	0	4.3779	0	31.682	1.7281	40.7834	0
	2005	0	0	0	0	0	0	0	0	0	0	0	10.5556	0	0	0	0	55.5556	33.8889	0	0
M Total		0	0	1.06778	8.58322	0.06972	0.13824	17.9153	5.90004	0.06102	0.55	0	15.4619	0.13884	0.39296	0.87558	3.82336	27.5684	7.59462	8.15668	0

Table B6.5. Diet composition of Thorny Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw																						
size	yr5block	AMPHIP	Polychates	AR	CANFAM	Cephalopods	Herrings	COTFAM	CRUSTA	DECAPO	Other Crabs	DECSHR	Euphasiids	GADFAM	ISOPOD	Silver Hake	MYXFAM	Other Fish	PAGFAM	PANFAM	Eelpouts
L	1980	0.0045	6.8735	4.6104	0	25.8802	14.0075	1.4822	0.4429	0.2638	4.1529	0.0806	7.5955	0	0.051	0	0	18.1005	0.4854	2.7318	0
	1985	0.0025	12.1353	0	0	3.3438	19.0013	0	11.9558	0	2.8931	1.4711	6.5125	0	0.1042	0.1226	0	24.4413	0.7355	0.0245	0
	1990	0.1046	21.9766	2.2966	2.9578	1.5085	0	4.1685	2.4911	0.0605	1.6456	0.562	2.6139	0	0.1446	1.1174	18.0884	26.6331	1.0775	7.3239	1.6761
	1995	0.1301	18.4137	2.7967	0.621	5.7432	13.7189	1.0417	0.4895	0.0033	3.1396	2.0259	1.2446	0	0.1757	4.9213	4.7583	31.3286	0.058	2.825	0.9996
	2000	0.0022	17.6495	3.9802	8.7956	9.3973	5.5025	0	0.6662	0	1.0237	0.8359	2.7579	4.1981	0.097	4.0945	1.1167	26.2667	0.0323	3.3883	0.089
	2005	0.057	15.492	4.4218	2.2763	0.738	7.967	0.1294	2.8677	0	4.8401	1.3736	0.7067	0	0.1337	4.6365	5.7187	34.3856	0	4.7184	5.511
L Total		0.05015	15.42343333	3.017616667	2.441783333	7.7685	10.03286667	1.136966667	3.1522	0.0546	2.949166667	1.058183333	3.57185	0.699683333	0.1177	2.48205	4.947016667	26.8593	0.398116667	3.501983333	1.379283333
M	1980	2.9141	31.5092	3.9862	0.0198	20.2259	0	0	4.815	0	0.1237	8.3622	21.6269	0	0.0934	0	0	0.079	0.5478	2.1649	0
	1985	3.753	45.8674	4.899	0	3.4379	0	0	30.3753	0	0	0	6.9403	0	2.1773	0	0	1.2892	0	0	0
	1990	3.1013	48.021	7.3477	0	3.7721	0	0.4541	5.6863	1.3622	0.9415	2.1101	7.3214	0	0.8013	3.2053	0.2003	7.4659	0.1669	1.3868	0.0267
	1995	5.6257	47.7582	7.5481	0.0282	8.431	0.3173	0.3172	1.41974	0	4.57394	2.75967	2.9876	0.02256	2.3586	1.00584	0.2714	3.5945	0.01974	7.3759	1.4439
	2000	3.983	39.7988	11.3891	1.7119	2.4382	2.8684	1.5803	1.6588	0	8.0853	0.7252	3.7284	0	0.9931	0	0	1.6316	0	8.5634	1.3476
	2005	1.8674	30.532	15.1764	1.7059	5.0556	0	0	9.5489	0.0415	8.3613	6.439	2.8705	0	0.84	0	1.6612	5.9285	0	7.4606	0.0831
M Total		3.54075	40.5811	8.391083333	0.577633333	7.226783333	0.53095	0.391933333	8.91734	0.23395	3.680956667	3.399361667	7.579183333	0.00376	1.210616667	0.701856667	0.355483333	3.33145	0.122406667	4.491933333	0.48355
S	1980	21.8678	38.5983	19.375	0.2323	2.8162	0	0	5.6664	0.01936	0	0	1.3162	0	1.8194	0	0	0	0.37743	0	0
	1985	7.1084	51.4458	0.7229	0	0	0	0	0.9639	0	0	0	29.1165	0	7.6305	0	0	0	0	0	0
	1990	13.9988	37.7039	15.6824	0	4.5051	0	0	5.7283	0	6.0819	0	3.3789	0	3.8519	0	0	3.1761	0	0.6758	0
	1995	26.1389	29.1592	21.9225	0	1.3807	0	0	2.5174	0	1.0872	0	5.6218	0	4.0207	0	0	3.0276	0	1.4438	0
	2000	38.4094	24.136	14.7403	0	0	0	0	0.4074	1.52775	0.45833	0.6493	3.8381	0	4.4152	0	0	0	0	2.64811	0.1731
	2005	12.9264	21.8365	27.2561	0	0	0	0	15.0627	0	0.109	0	13.3842	0	1.7657	0	0	0.218	0	4.52316	0
S Total		20.07495	33.81328333	16.61653333	0.038716667	1.450333333	0	0	5.057683333	0.257851667	1.289405	0.108216667	9.442616667	0	3.917233333	0	0	1.070283333	0.062905	1.548478333	0.02885

Table B6.6. Diet composition of Smooth Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw																
size	yr5block	AMPHIP	ANNELI	AR	Cancer Crabs	Crangon sp.	Misc. Crustace	Other Decapo	Other Crabs	Decapod Shrin	Euphasiids	GADFAM	MERBIL	MYSIDA	Pandalid Shrin	OTHFIS
	1980															
I	1985	0	0	0	0	0	0	0	0	0	100	0	0	0	0	0
	1990	25.5072	0	17.3913	0	0	11.014	0	0	0	38.8406	0	0	5.7971	0	0
	1995	0	0	14.9425	0	0	21.7241	17.2414	0	0	0	40.3448	0	5.7471	0	0
	2000	33.7185	2.395	38.1688	0	3.7815	4.2017	0	0	0	6.8277	0	0	2.1008	5.8298	0
	2005	9.9932	2.435	44.1366	0	1.2784	19.298	0	1.8263	5.4788	7.0768	0	0	2.1306	4.8853	0
I Total		13.84378	0.966	22.92784	0	1.01198	11.24756	3.44828	0.36526	1.09576	30.54902	8.06896	0	3.15512	2.14302	0
M	1980	0	0	0.974	3.8277	9.2047	7.288	16.192	0	16.6234	0	0	0	0.1065	42.4603	0.0572
	1985	1.0017	11.5192	10.0167	0	4.0067	4.5075	0	0	0	34.5576	0	0	0	30.384	4.0067
	1990	1.3291	0.217	9.1141	0	1.9169	9.8085	0.2713	1.4955	3.0923	49.0786	0.7053	2.4955	0	4.8102	11.8357
	1995	0.3283	1.4304	6.8296	0	0.4072	13.2809	0	2.794	1.5244	7.963	0	22.8866	0.0693	26.0084	8.634
	2000	2.2124	0.6341	10.6603	2.4559	3.1884	3.1664	0	8.62	3.2415	5.4317	0	11.5312	0.2531	34.2183	4.923
	2005	1.3192	1.5846	13.3123	2.3746	1.9784	27.6493	0.0916	2.6112	3.7497	5.5229	0.0458	1.0535	0.3893	26.5792	5.5011
M Total		1.031783333	2.564216667	8.4845	1.443033333	3.450383333	10.9501	2.75915	2.586783333	4.705216667	17.0923	0.125183333	6.3278	0.136366667	27.41006667	5.826283333

Table B6.7. Diet composition of Clearnose Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw		analcat												
size	yr5block	AMMFAM	ANNELI	AR	BIVALV	Cancer Crabs	Cephalopods	Misc. Crustace	DECAPO	Other Crabs	OPHFA2	Other Fish	SERFA2	SOLFAM
I	1980	0	0.497	1.7597	0.3006	30.6196	3.2767	0.2182	2.0069	34.9254	0	12.5642	0	0
	1985	0.80335	1.06525	2.02465	1.0842	22.74435	1.63835	8.00895	1.00345	33.2557	0	11.34335	0	0
	1990	1.6067	1.6335	2.2896	1.8678	14.8691	0	15.7997	0	31.586	0	10.1225	0	0
	1995	0	5.0256	0.6391	0	32.2353	0	12.5359	0	2.2386	33.5783	1.8737	6.0441	0
	2000	0	5.8414	5.973	4.1183	9.3624	6.3996	5.5937	0.1422	32.9217	0.7901	12.5543	0.2844	0
	2005	0	0	0	5.5127	14.8842	23.1533	0.3308	0	18.7431	4.9614	13.5612	0	0
I Total		0.32134	2.5995	2.13228	2.35988	20.39412	6.56592	6.89566	0.42982	24.08296	7.86596	10.13518	1.2657	0
M	1980	0	0	0	0	0	0	0	0	0	0	100	0	0
	1985	0	0	0	16.667	33.3333	0	0	0	0	0	50	0	0
	1990	5.9811	0.2723	0	0	27.3371	3.104	3.7212	0	26.9831	10.8913	7.5876	0	0
	1995	0	0.4189	0.3491	0	13.5727	0	0	0	9.6008	5.1204	66.7183	0	0
	2000	0.9146	0.3593	0.4717	0.7186	6.2759	0	0.8493	0	21.273	16.332	35.1313	1.5056	3.6487
	2005	0	0.6081	0.827	1.4975	15.4281	55.3925	0.2737	0	8.1955	0	5.4731	0	0.608116667
M Total		1.149283333	0.276433333	0.274633333	3.147183333	15.99118333	9.749416667	0.807366667	0	11.00873333	5.390616667	44.15171667	0.250933333	0.3317

Table B6.8. Diet composition of Rosette Skate. All values are expressed as whole numbers rather than percentages. Relmsw = relative mean stomach weight, on average for the size class and time period given. AR = animal remains, a well-digested, highly unresolved category.

Average of relmsw																
size	year	Amphipods	Polychates	AR	Cancer Crabs	Cephalopods	Crangon sp.	CRUSTA	DECAPO	DECCRA	EUPFAM	ISOPOD	MYSIDA	OPHFA2	OTHFIS	Pandalid Shrim
I	1999	39	0	25	0	0	36	0	0	0	0	0	0	0	0	0
	2000	7.5949	68.3544	3.7975	0	0	0	0	0	0	7.5949	0	0	0	12.6582	0
	2001	20.5231	14.3538	32.3077	0.5077	0	1.5385	0	0	9.2308	10	0	0	0	0	0
	2002	41.6667	0	55.5556	0	0	2.7778	0	0	0	0	0	0	0	0	0
	2003	1.476	0	15.4982	0	0	0	0	0	0	3.69	9.2251	70.1107	0	0	0
	2004	27.4396	4.8352	19.3407	16.4396	15.956	15.3846	0	0	0	0.6044	0	0	0	0	0
	2005	33.3333	33.3333	0	0	33.3333	0	0	0	0	0	0	0	0	0	0
I Total		24.43337143	17.2681	21.64281429	2.421042857	7.041328571	7.957271429	0	0	1.318685714	3.127042857	1.317871429	10.01581429	0	1.808314286	0
M	1999	4.9591	2.7248	16.1035	0	6.812	28.0109	6.1308	0	6.485	10.8992	0	0	1.7166	2.0436	13.5695
	2000	10.8001	19.2824	5.781	3.6232	2.4155	2.8986	0.3019	1.4493	41.3225	3.1099	2.5403	0.0141	0.6341	4.1969	1.3285
	2001	3.8652	11.6428	34.2567	7.7999	1.8569	3.8175	4.1822	1.1543	4.5416	5.2278	8.2474	3.3291	2.5227	1.0874	1.2045
	2002	1.2109	35.4328	19.8984	10.6054	4.3681	0.9143	0.8127	0	2.7631	1.0402	1.2475	1.796	7.3141	4.1447	6.1764
	2003	3.9116	2.5885	26.1675	7.7745	0	7.6681	2.9048	0	30.7168	5.3685	8.5319	0	0	3.0903	0.6692
	2004	10.1379	6.0664	19.3729	8.6131	2.7056	2.2766	4.6414	0	36.5099	1.3206	0.2416	0.51	1.3206	2.3218	3.8651
	2005	12.5	11.8532	18.8578	0.4212	8.7244	19.3542	0.4091	0	1.1211	3.3895	1.8051	0.0722	12.6354	0.0722	2.4067
M Total		6.769257143	12.7987	20.06254286	5.548185714	3.840357143	9.277171429	2.768985714	0.371942857	17.63714286	4.336528571	3.230542857	0.817342857	3.734785714	2.422414286	4.174271429

Table B6.9. Comparison of total skate consumptive removal of major skate prey relative to standing biomass and production estimates of those prey (from Link et al. 2006); these estimates are integrated across the entire ecosystem for the period 1996-2000. All values are in MT. C = consumptive removal of the prey by skates, as averaged during the period 2000-2006; B = biomass, P = production.

	C	B	P
Polychaetes	3.23×10^4	4.30×10^6	1.08×10^7
Molluscs	3.24×10^4	2.80×10^6	9.27×10^6
Cephalopods	5.91×10^3	3.13×10^5	3.03×10^5
Herrings & Mackerel	5.09×10^3	2.04×10^6	7.55×10^5
Euphasiids and similar crustaceans	2.12×10^3	1.89×10^6	2.69×10^7

Table B6.10. Comparison of fishery landings of major skate prey with total skate consumptive removal of major commercially targeted skate prey across different assumed gear efficiencies used to estimate skate abundance. All values represent an average from 2000-2005 and are in MT. The C/L ratio contrasts the consumption to the fishery landings as a unitless scalar; values > 1 indicate more of the prey is consumed by skates than is removed by the fishery..

	Fishery Landings	100% Efficiency	50%	25%	10%
Illex and Loligo	2.53×10^4	5.91×10^3	1.18×10^4	2.36×10^4	5.91×10^4
C/L ratio	-	0.23	0.47	0.93	2.33
Silver Hake	9.37×10^3	2.15×10^3	4.30×10^3	8.59×10^3	2.15×10^4
C/L ratio	-	0.23	0.46	0.92	2.29
Red Hake	9.95×10^2	1.15×10^3	2.29×10^3	4.58×10^3	1.15×10^4
C/L ratio	-	1.15	2.30	4.60	11.51
Herrings	1.16×10^5	5.09×10^3	1.02×10^4	2.04×10^4	5.09×10^4
C/L ratio	-	0.04	0.09	0.18	0.44

SKATE FIGURES

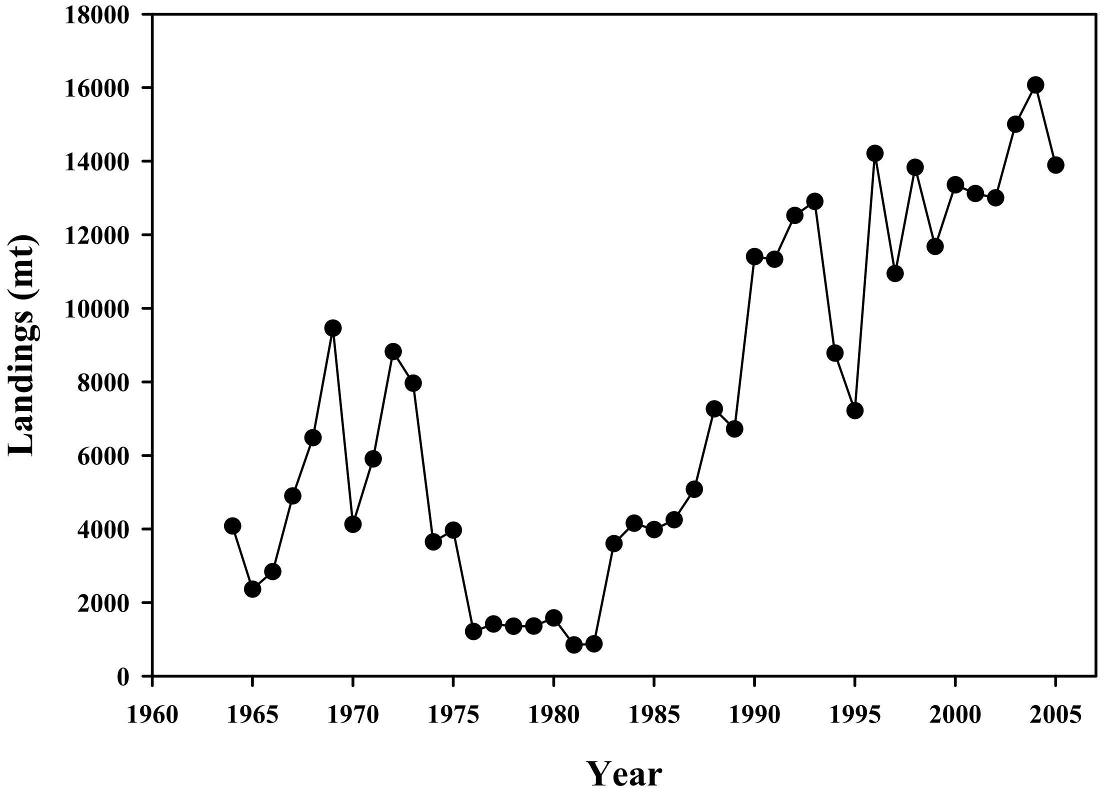


Figure B1.1. Total landings of skates in NAFO subareas 5 and 6.

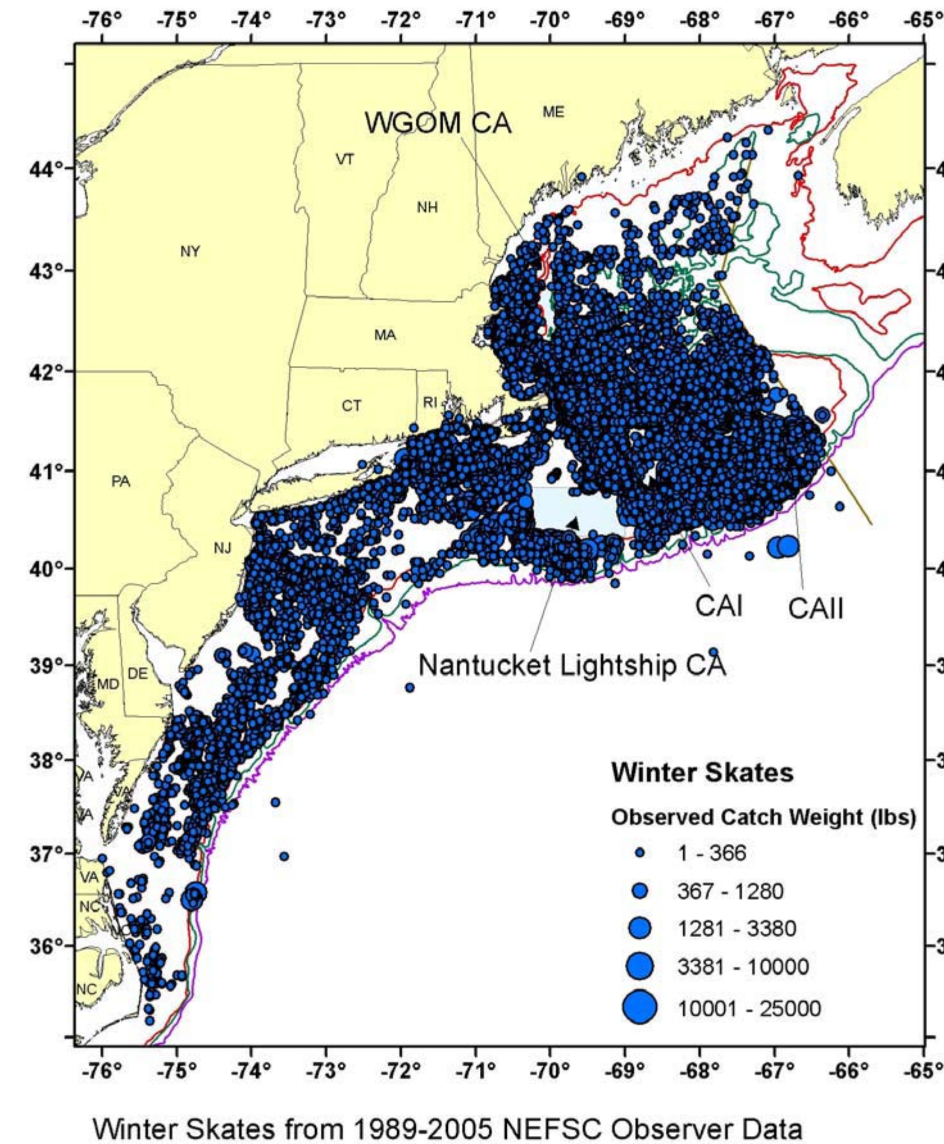


Figure B1.2. Distribution of winter skates from the Observer Program, 1989-2005.

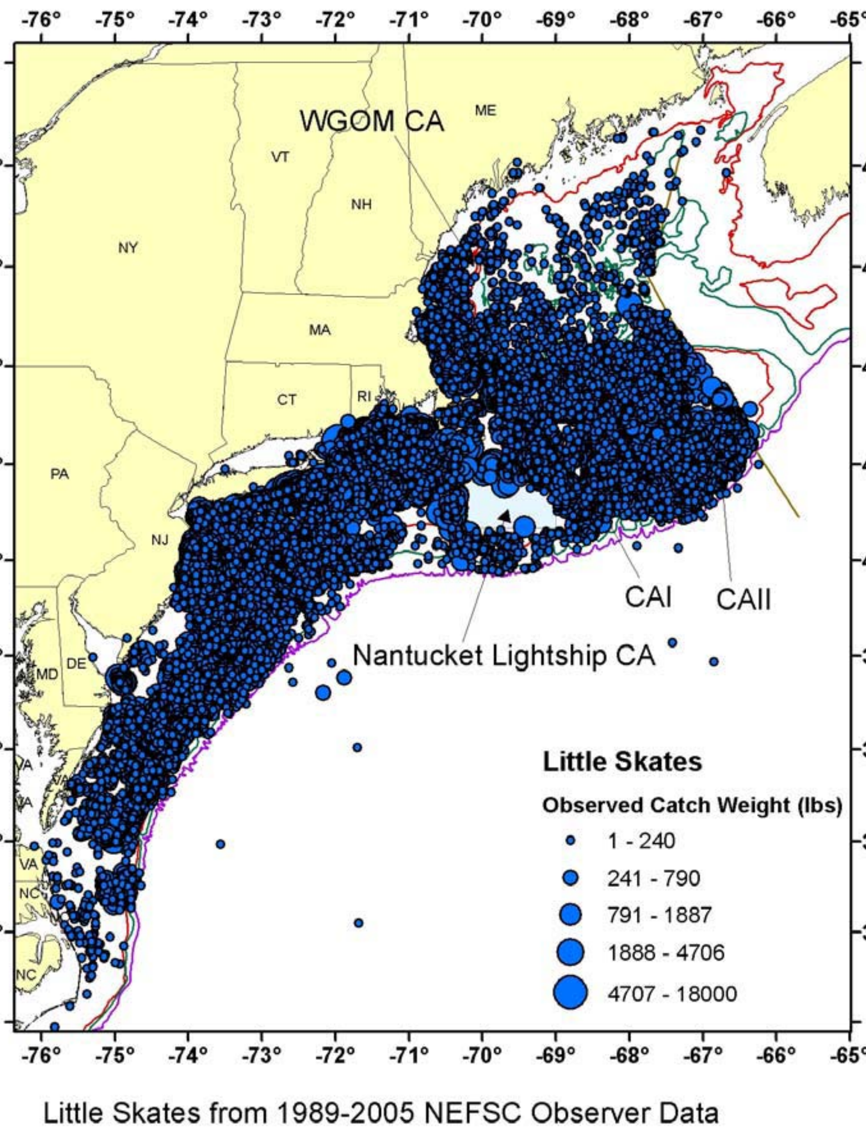


Figure B1.3. Distribution of little skates from the Observer Program, 1989-2005.

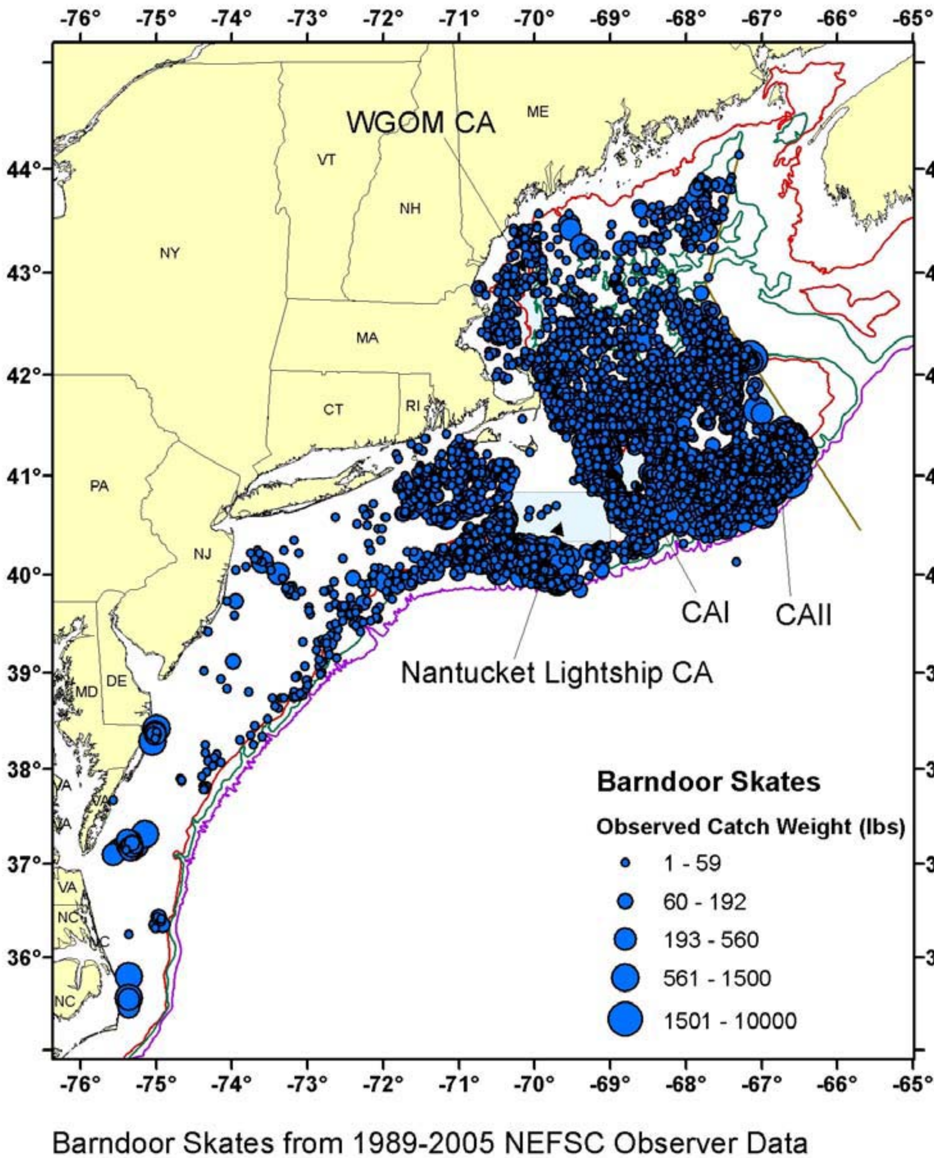


Figure B1.4. Distribution of barndoor skates from the Observer Program, 1989-2005.

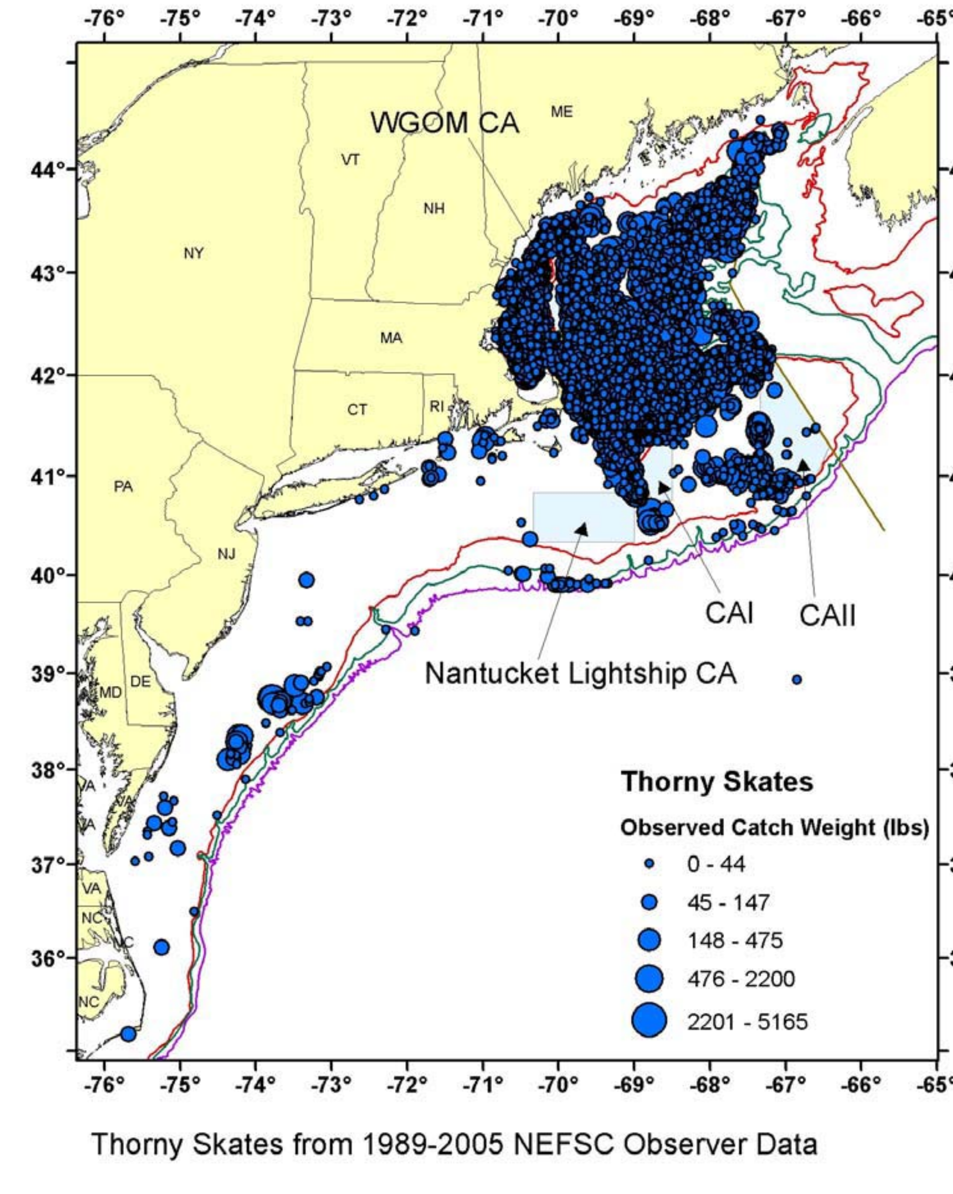


Figure B1.5. Distribution of thorny skates from the Observer Program, 1989-2005.

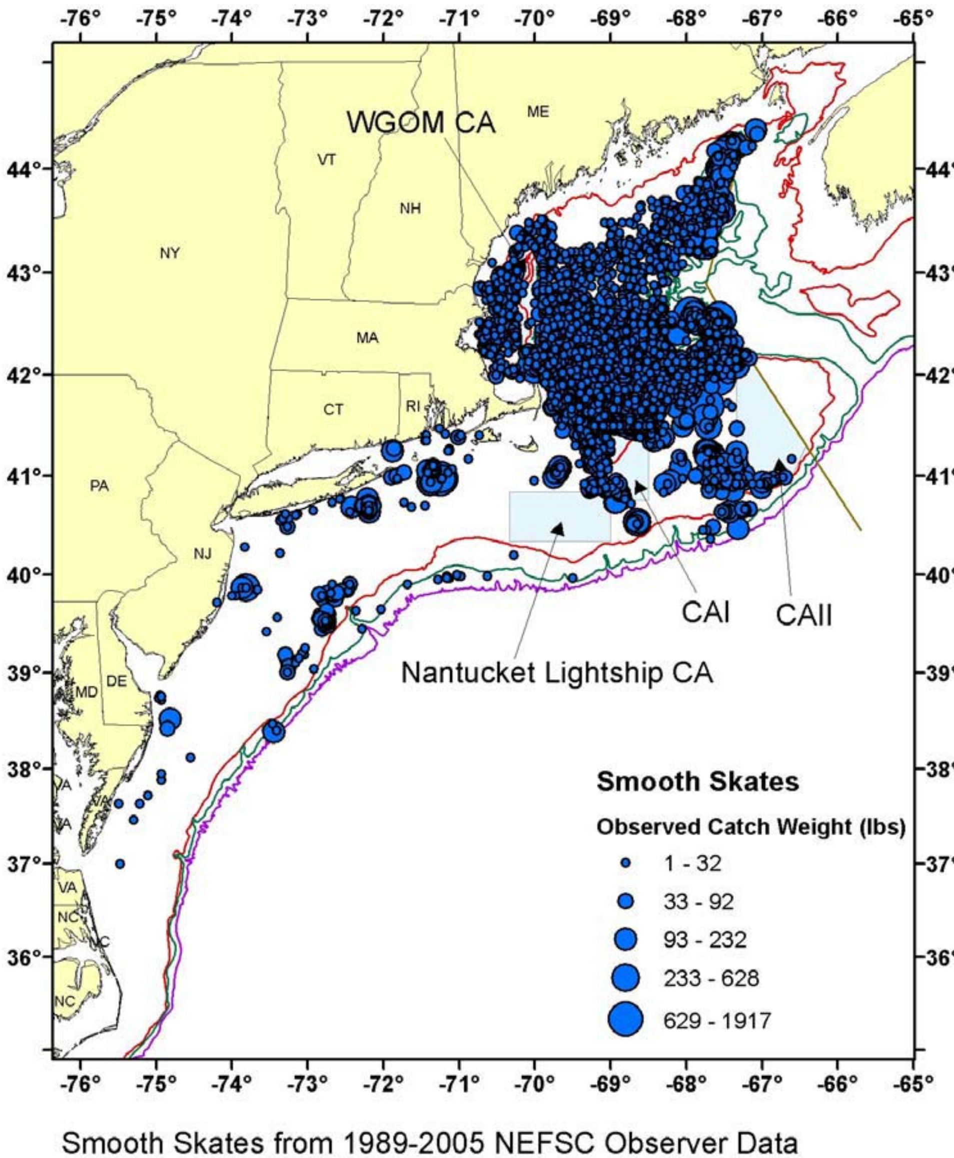


Figure B1.6. Distribution of smooth skates from the Observer Program, 1989-2005.

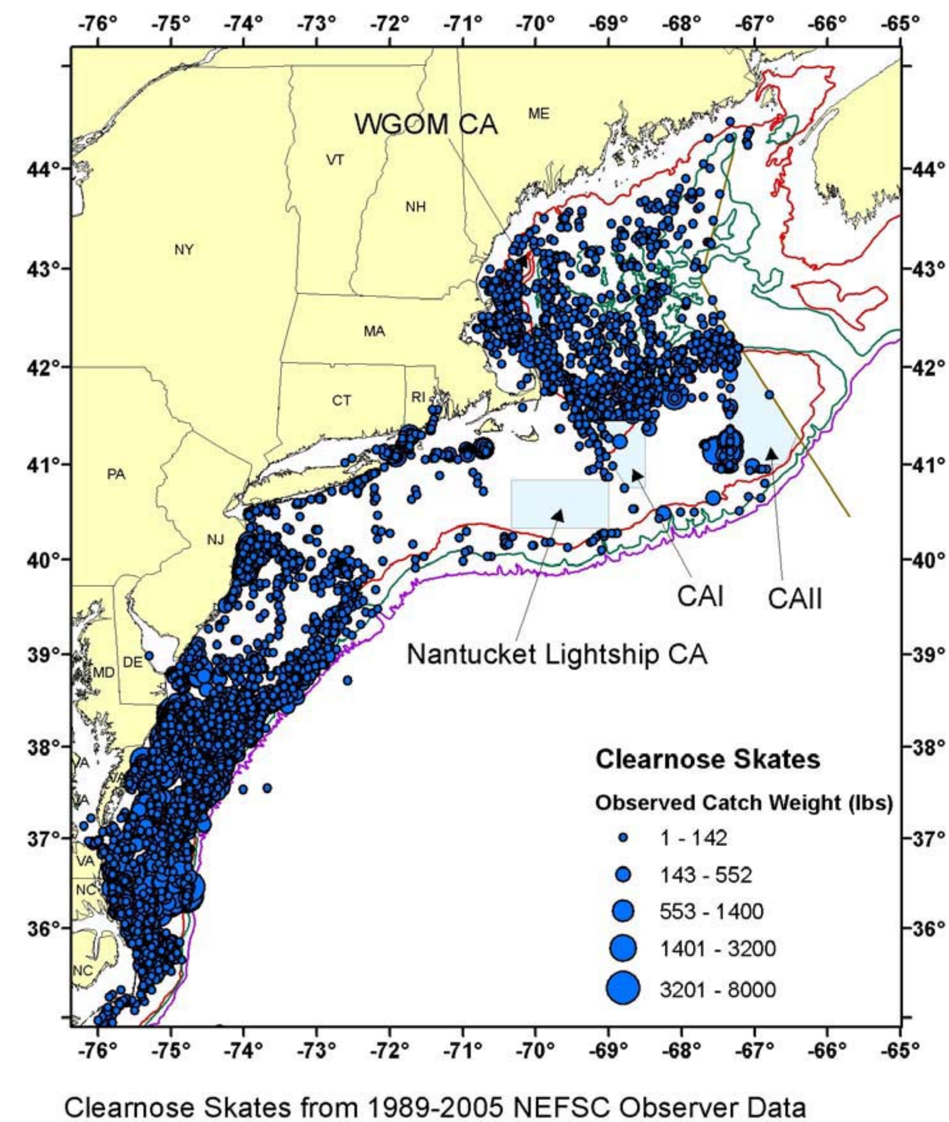


Figure B1.7. Distribution of clearnose skates from the Observer Program, 1989-2005.

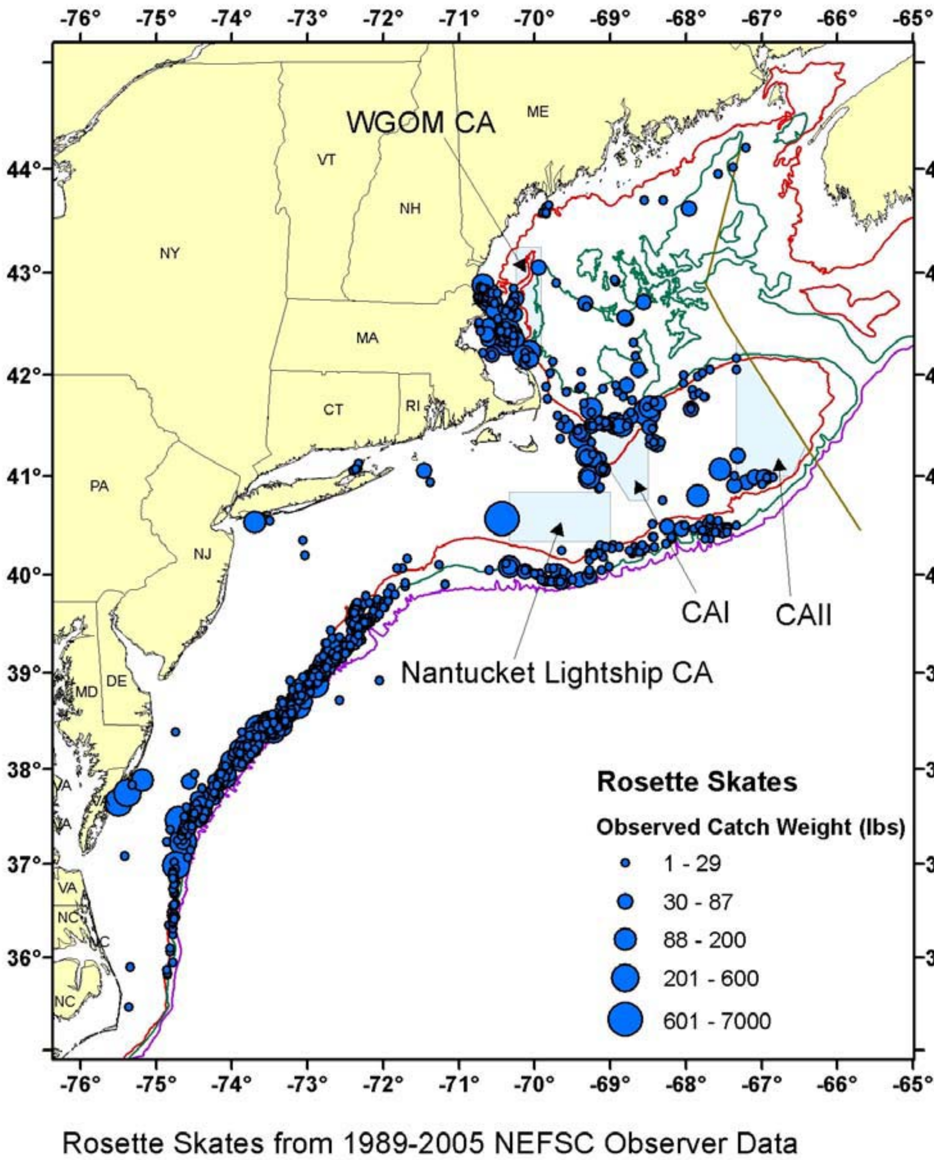


Figure B1.8. Distribution of rosette skates from the Observer Program, 1989-2005.

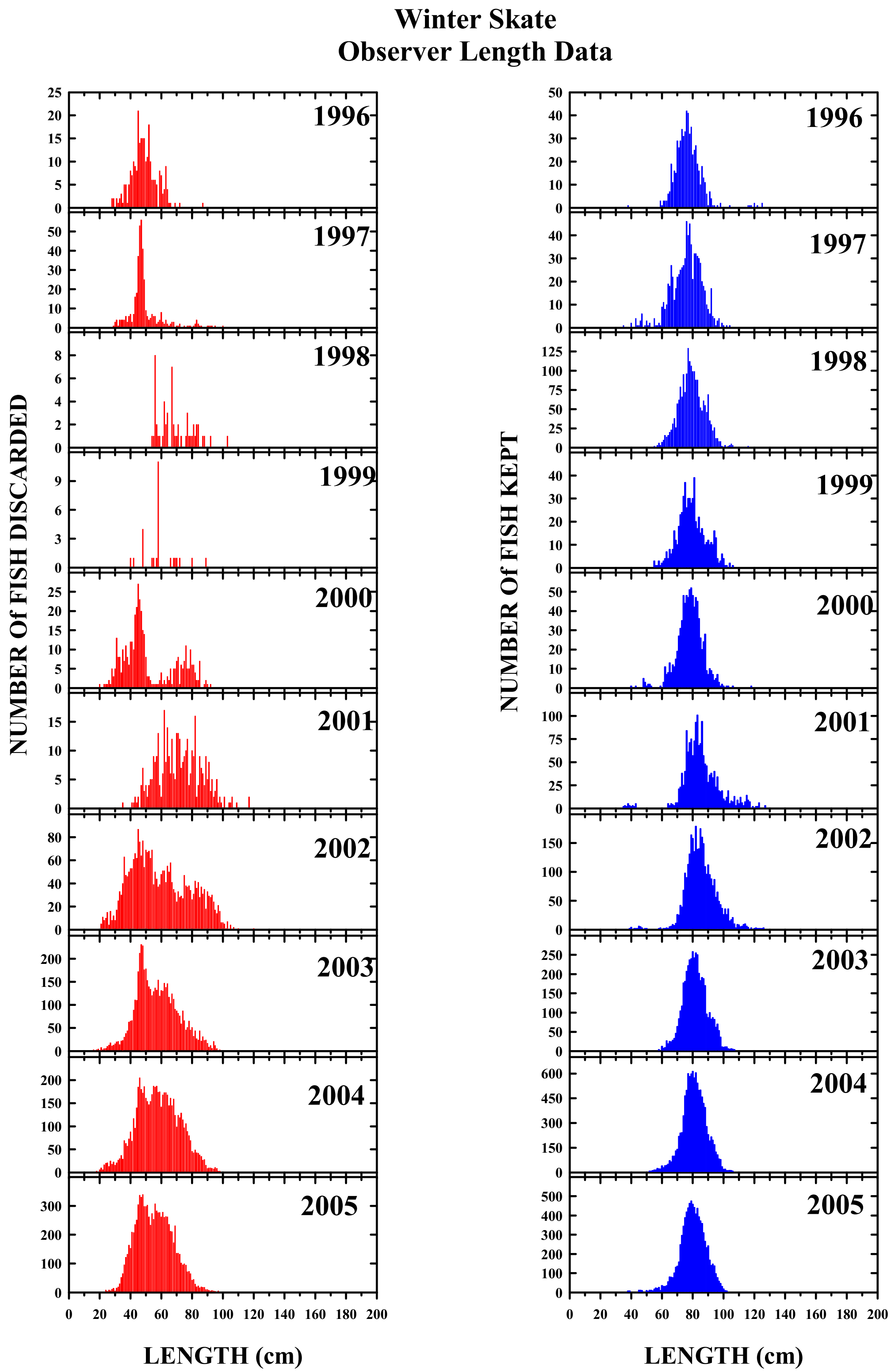


Figure B1.9. Winter skate length composition from the NEFSC observer program 1996-2005.

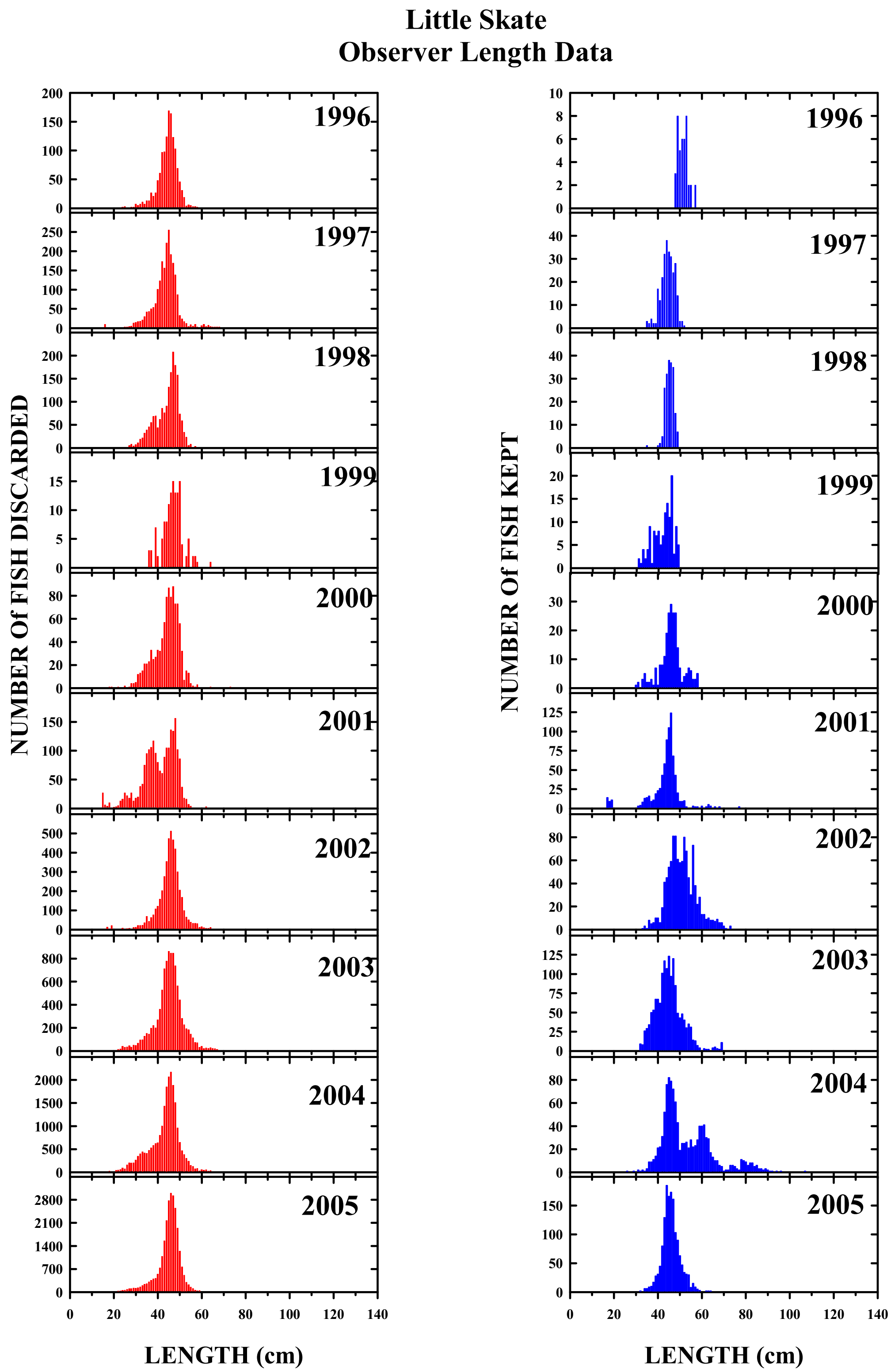


Figure B1.10. Little skate length composition from the NEFSC observer program 1996-2005.

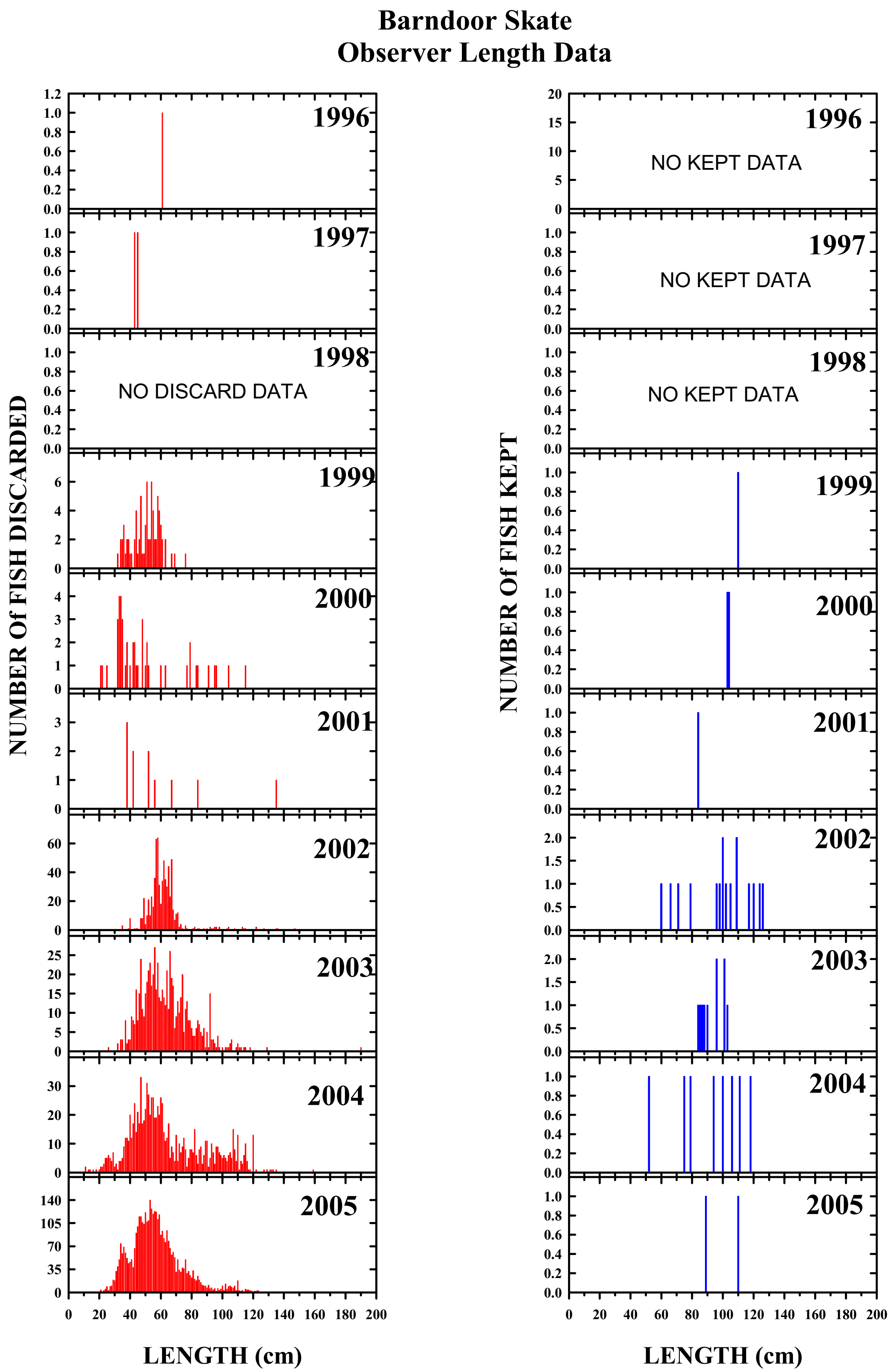


Figure B1.11. Barndoor skate length composition from the NEFSC observer program 1996-2005.

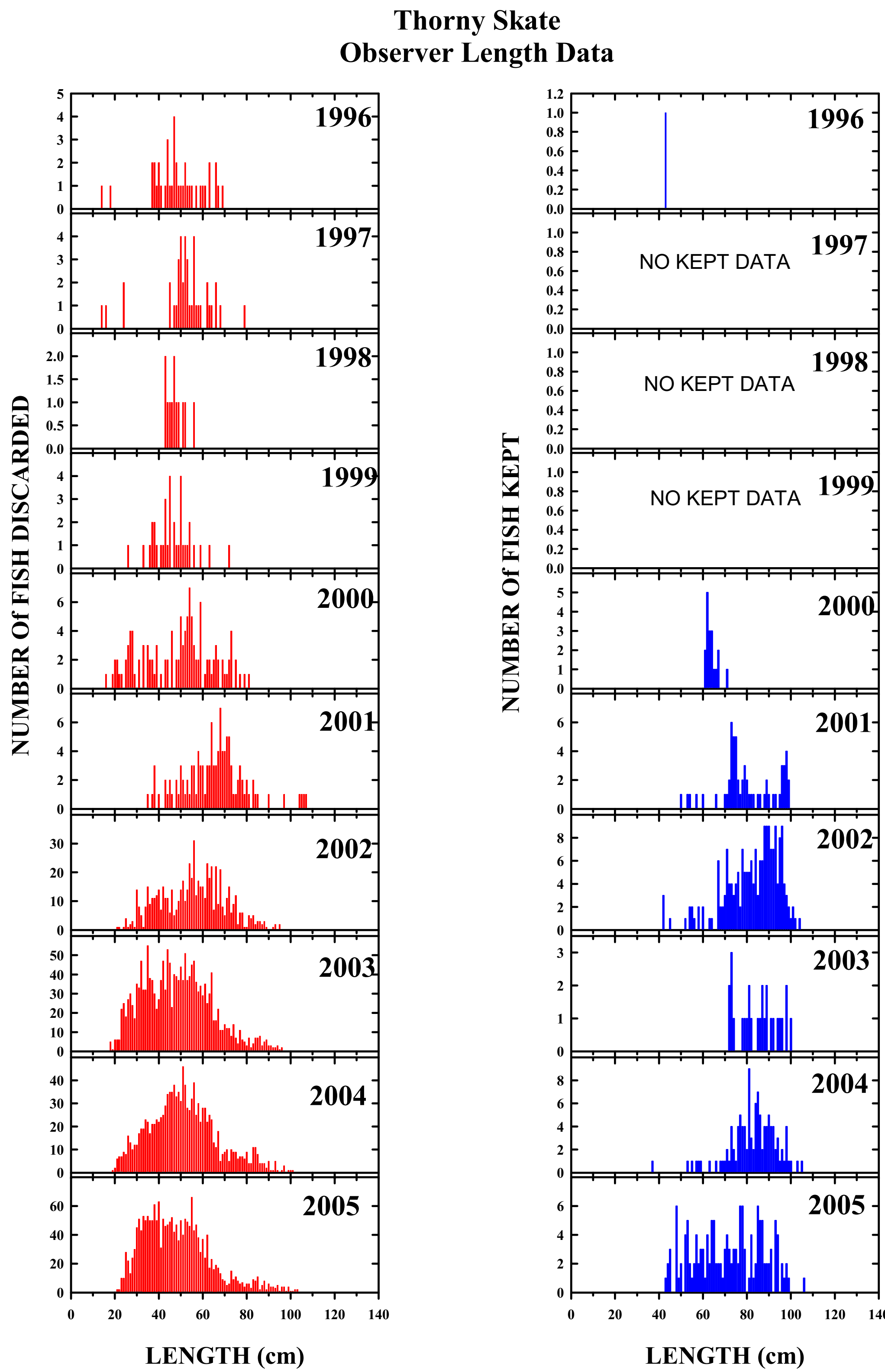


Figure B1.12. Thorny skate length composition from the NEFSC observer program 1996-2005.

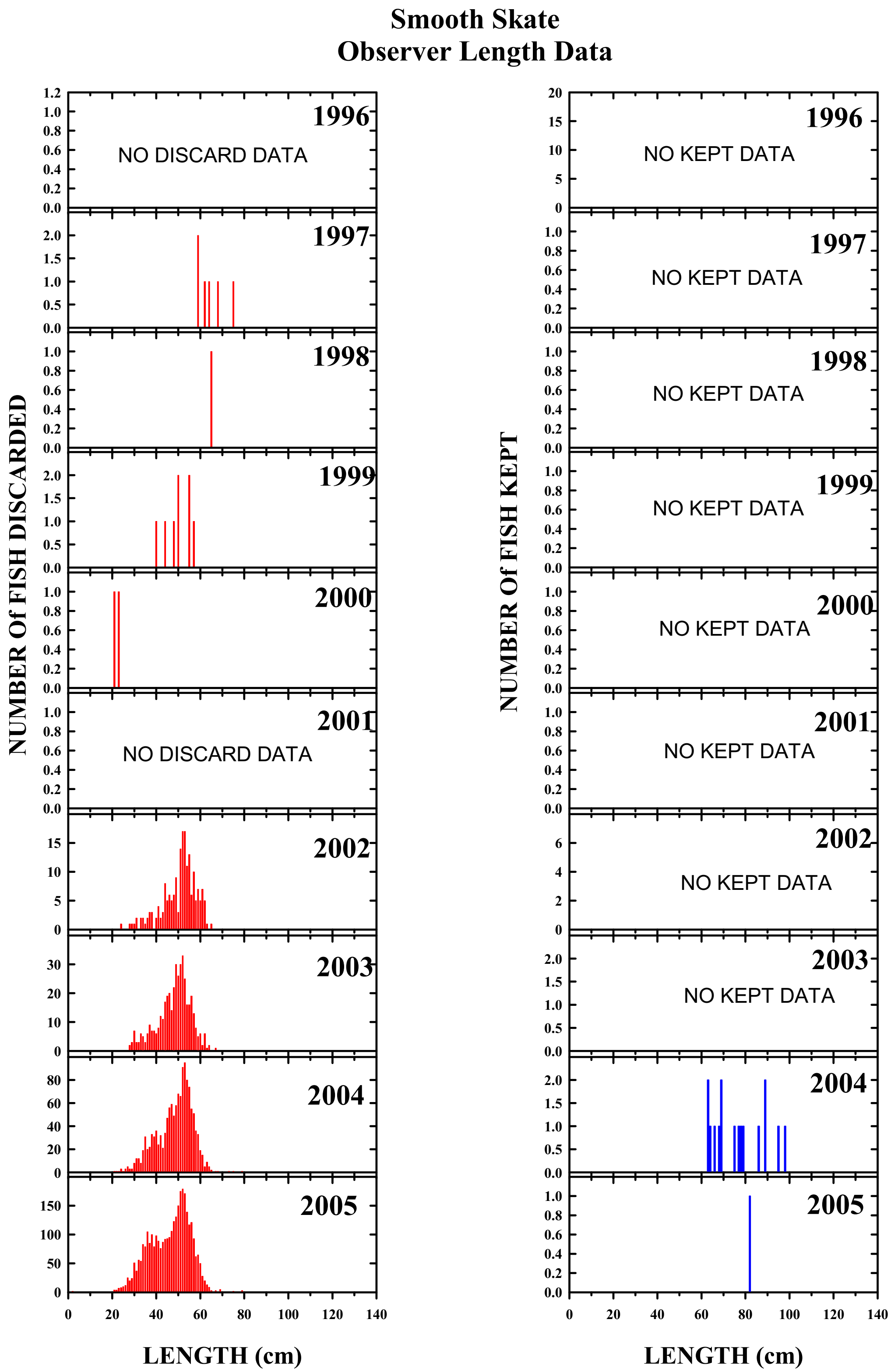


Figure B1.13. Smooth skate length composition from the NEFSC observer program 1996-2005.

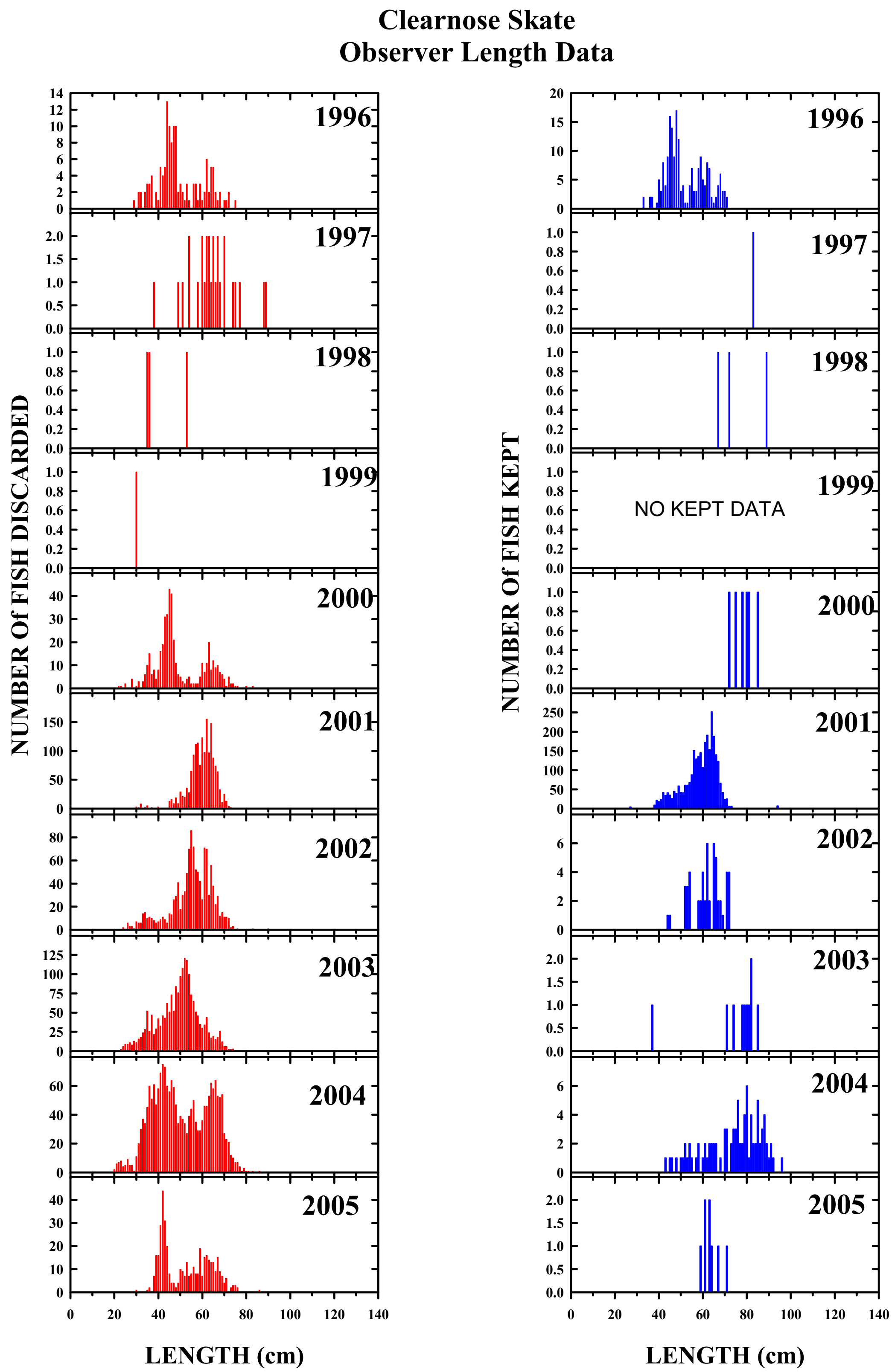


Figure B1.14. Clearnose skate length composition from the NEFSC observer program 1996-2005.

Rosette Skate
Observer Length Data

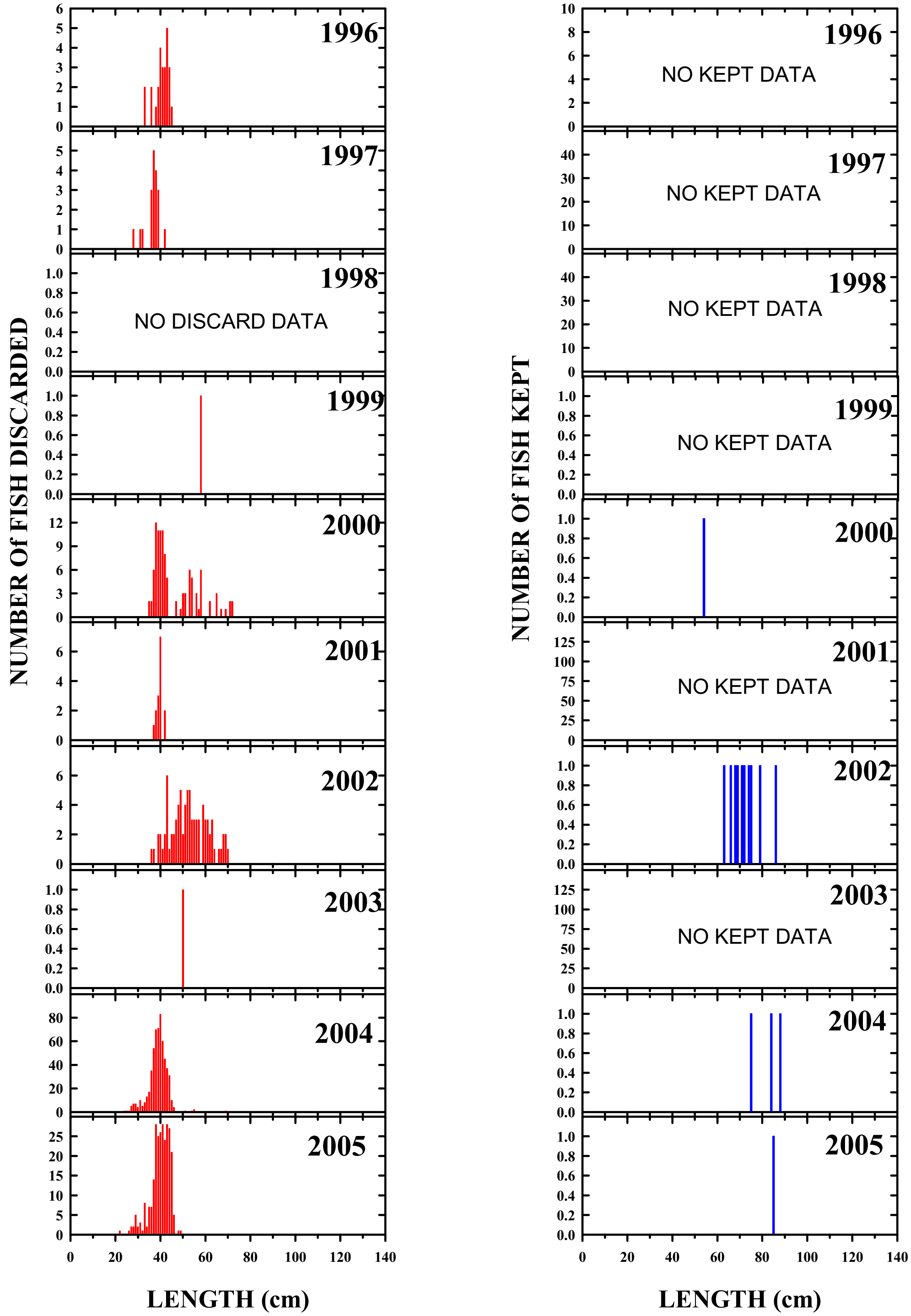


Figure B1.15. Rosette skate length composition from the NEFSC observer program 1996-2005.

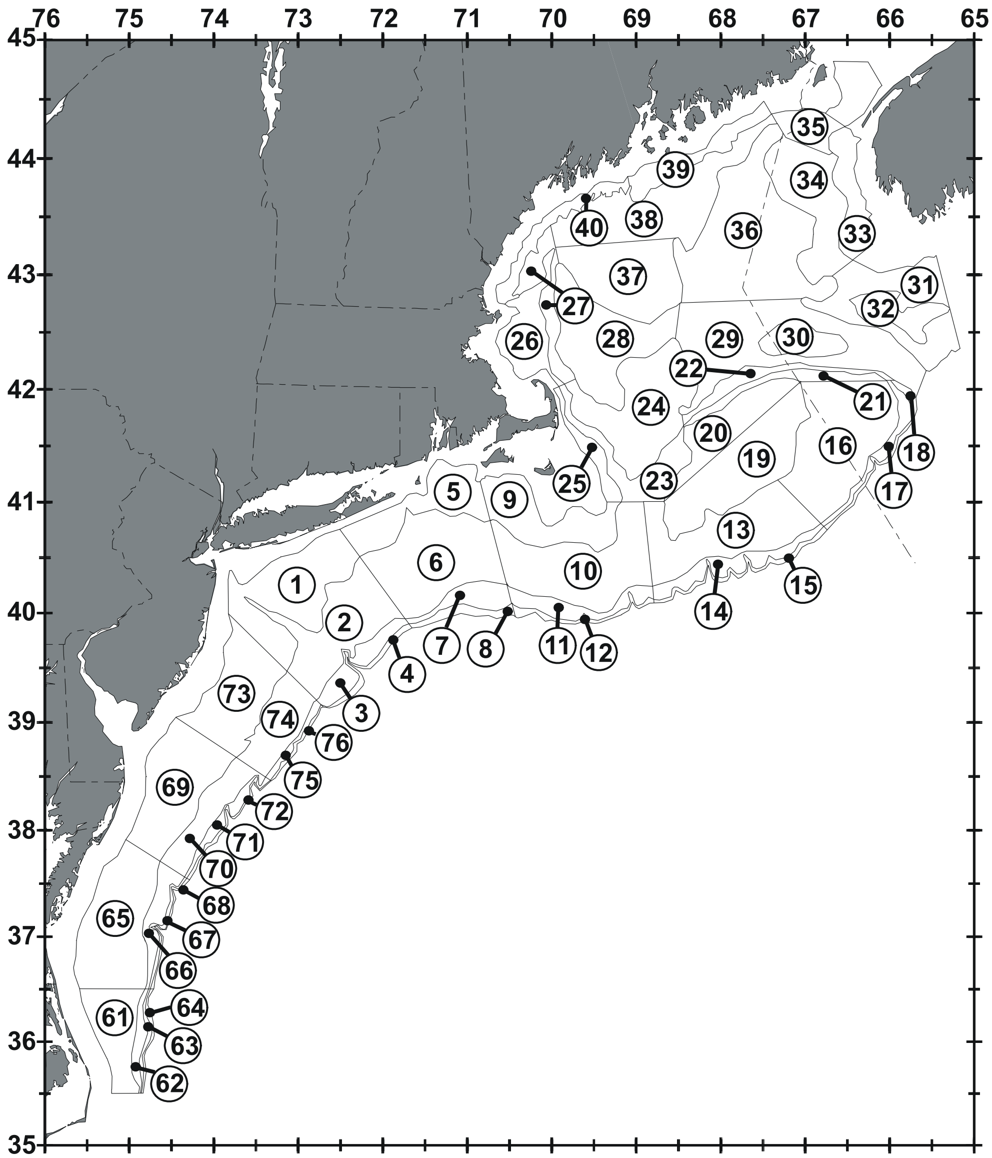


Figure B2.1. Map of offshore strata sampled in the NEFSC spring, autumn, and winter surveys.

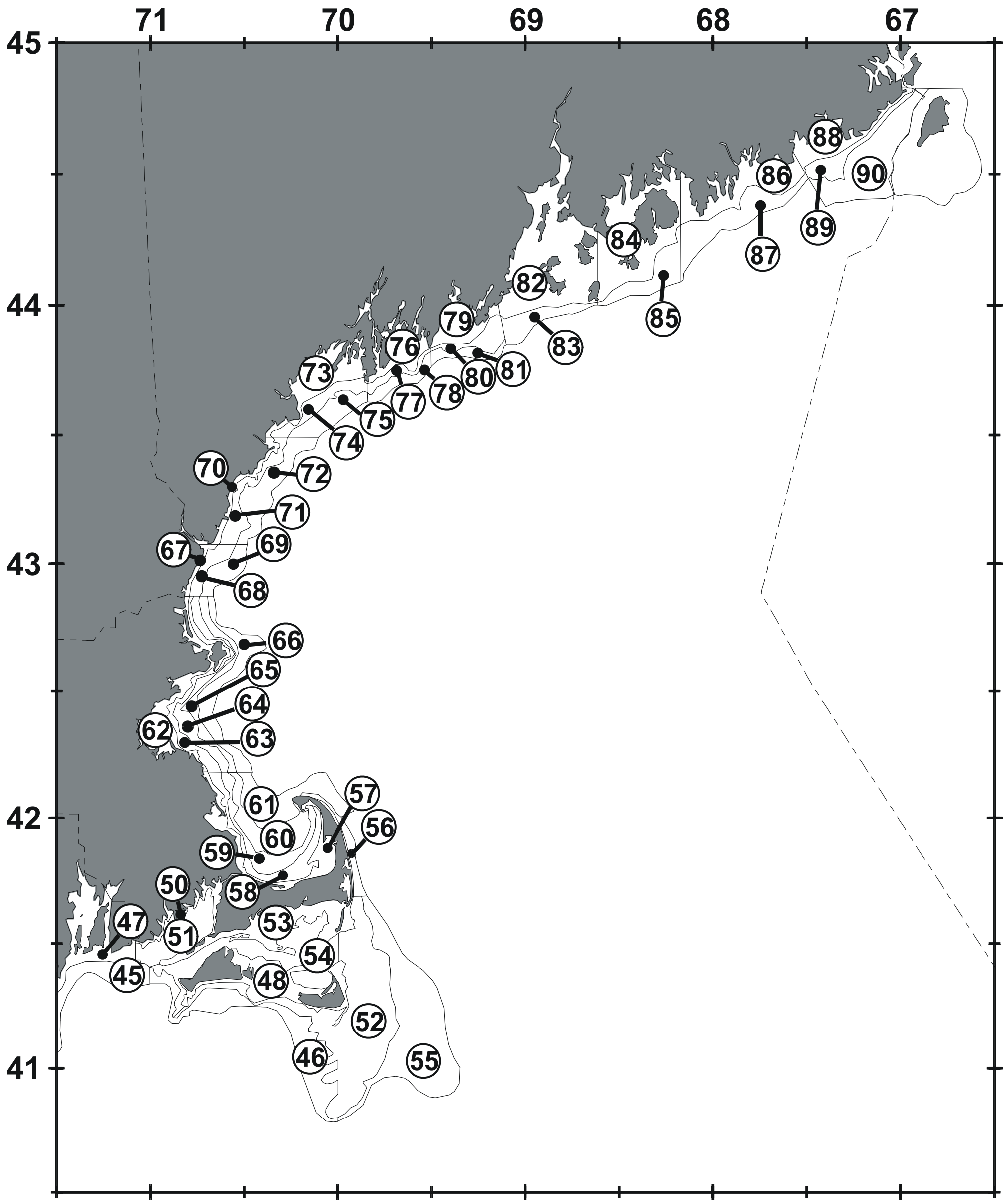


Figure B2.2. Map of inshore strata sampled in the NEFSC spring and autumn surveys in the Gulf of Maine.

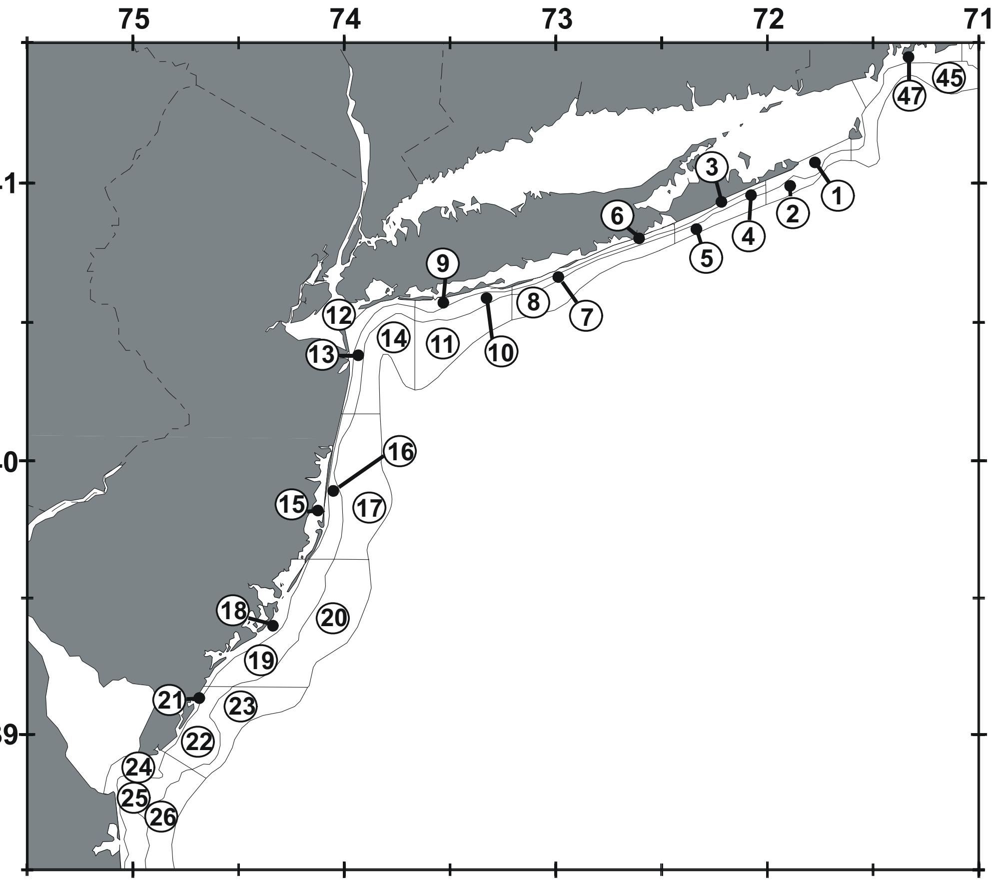


Figure B2.3. Map of inshore strata sampled in the NEFSC spring and autumn surveys in Southern New England.

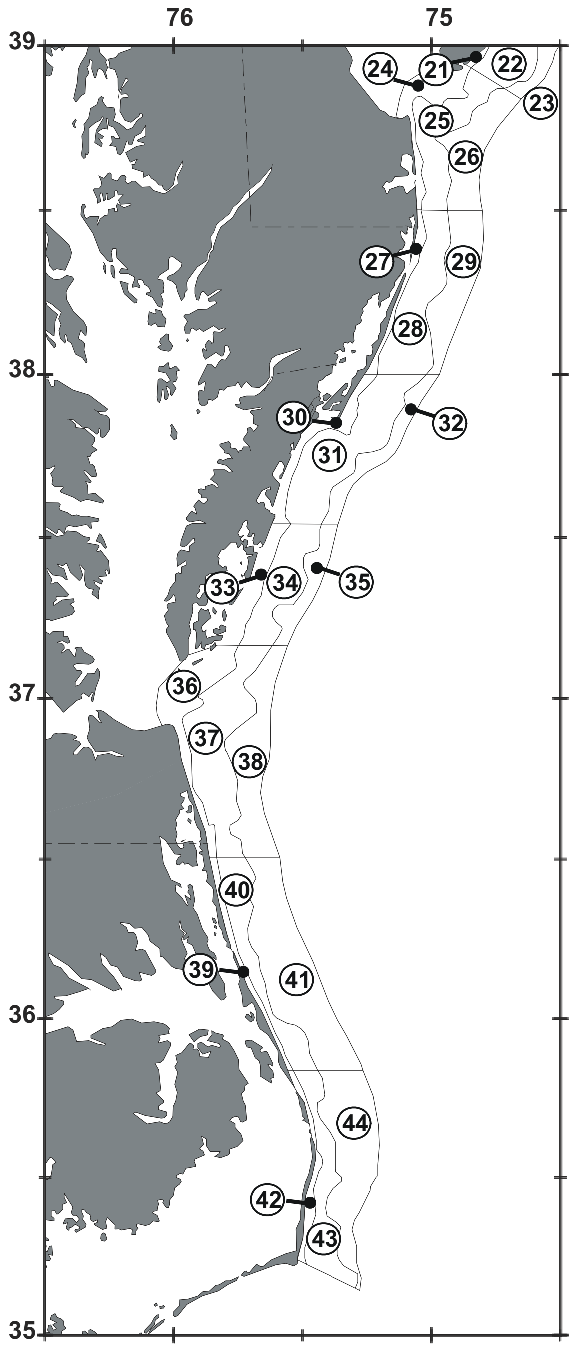


Figure B2.4. Map of inshore strata sampled in the NEFSC spring and autumn surveys in the Mid-Atlantic.

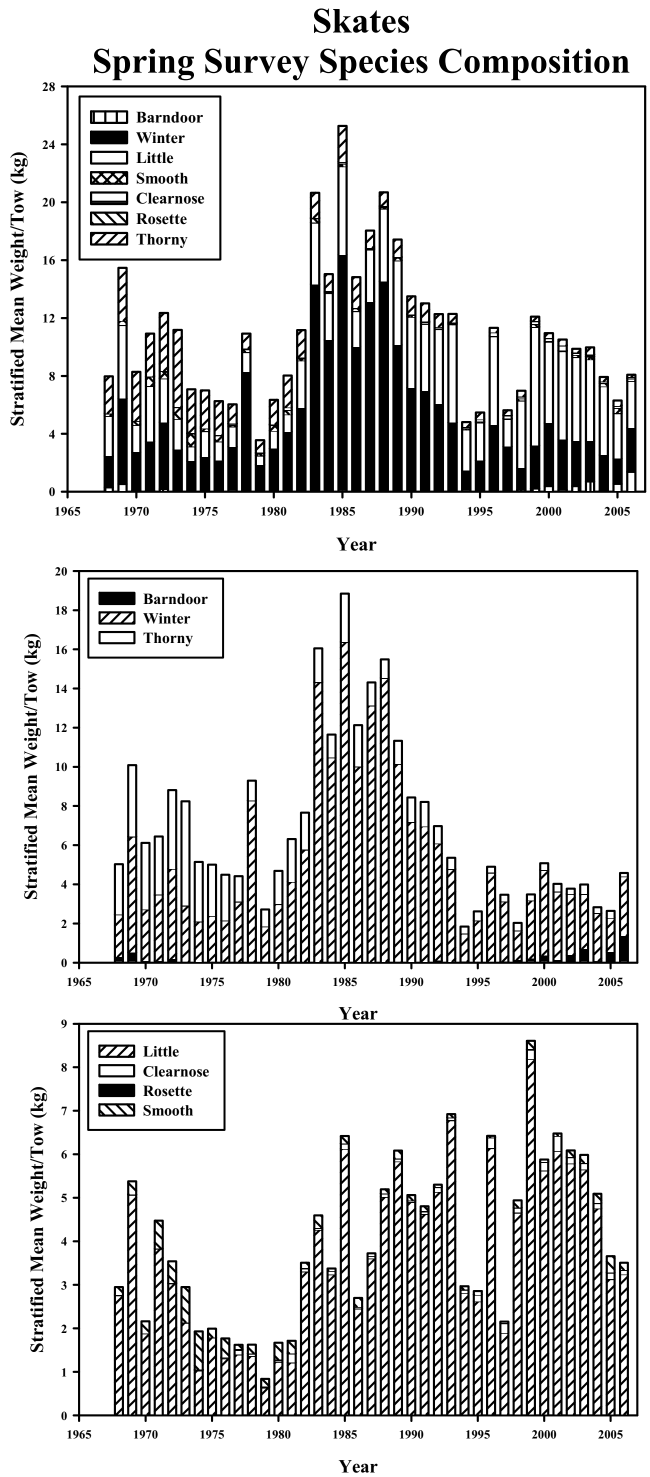


Figure B2.5. Species composition of skates from the spring survey. Panel A shows the composition of all species, panel B shows the composition of large species (>100 cm maximum length), and panel C shows the composition of the small species (maximum length < 100cm).

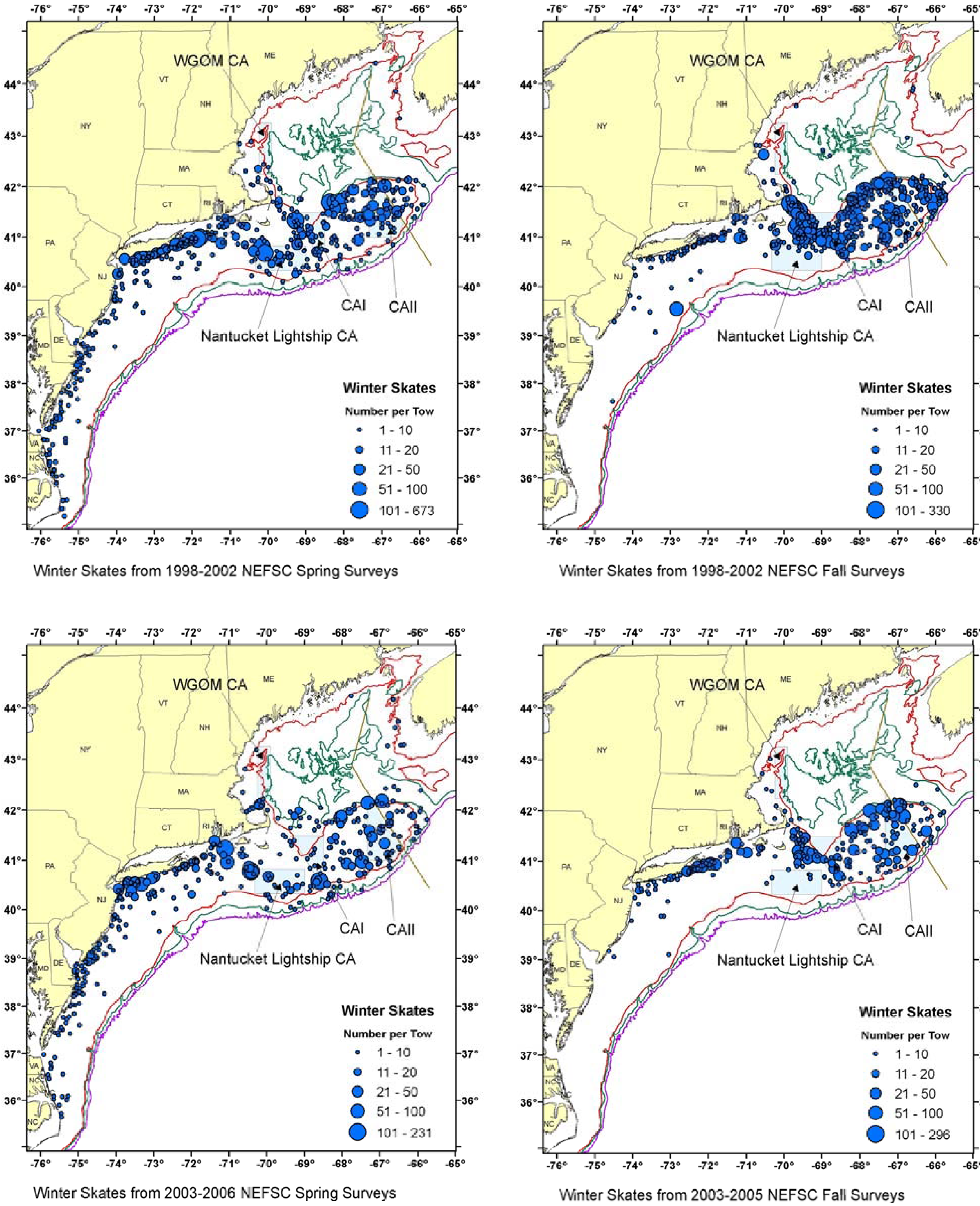
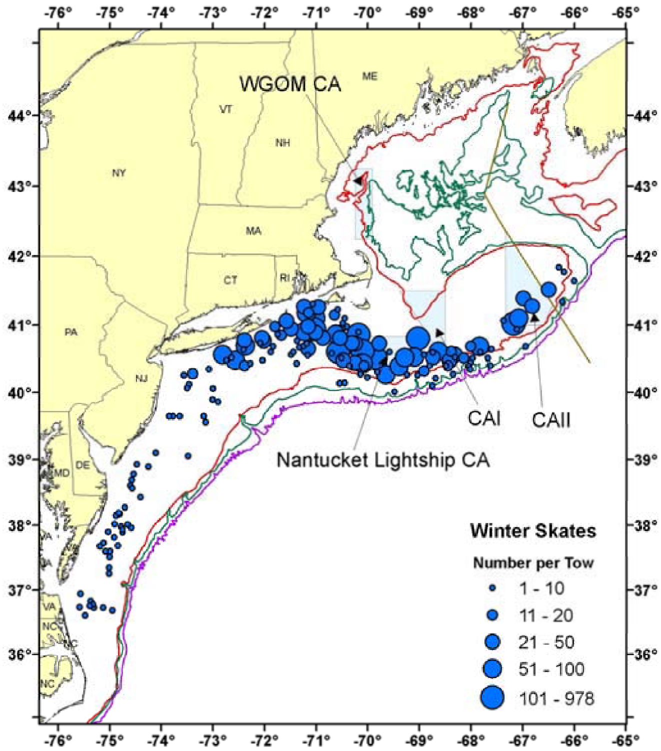
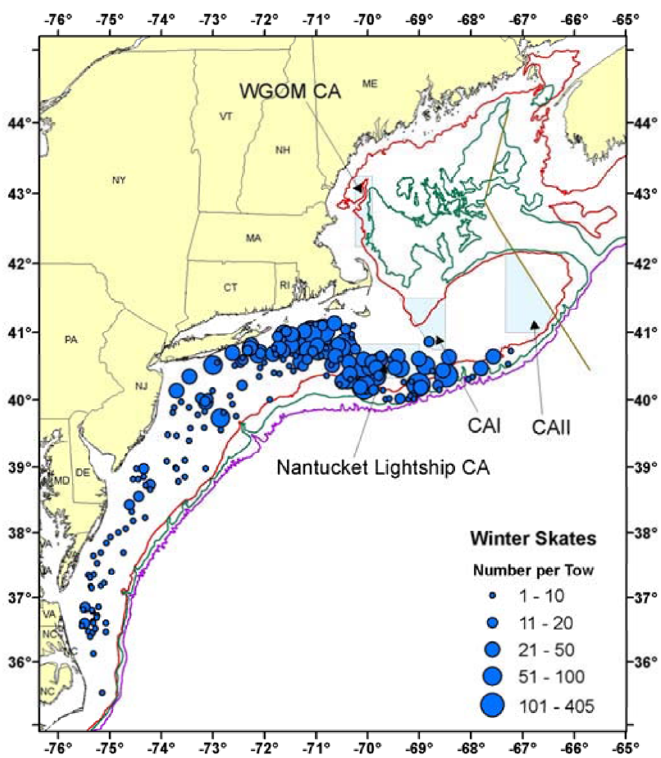


Figure B2.6. Distribution of winter skate from the spring and autumn NEFSC surveys from 1998-2006.

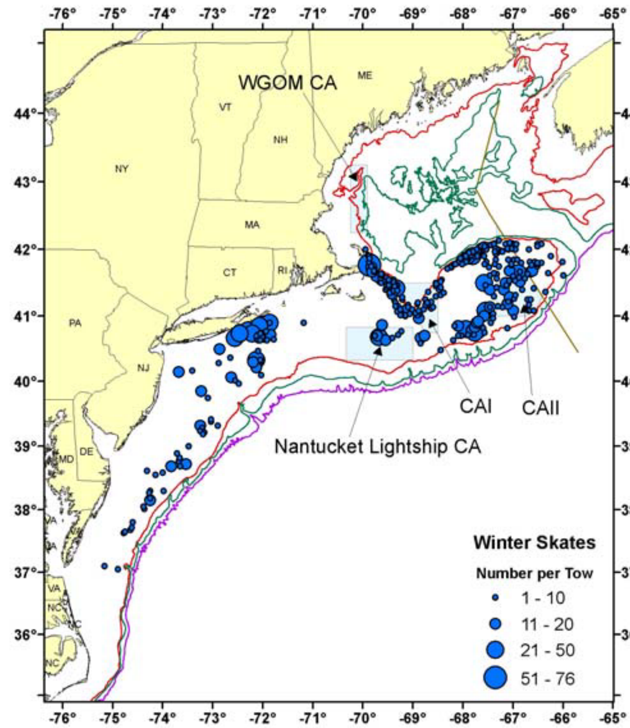


Winter Skates from 2000-2002 NEFSC Winter Surveys

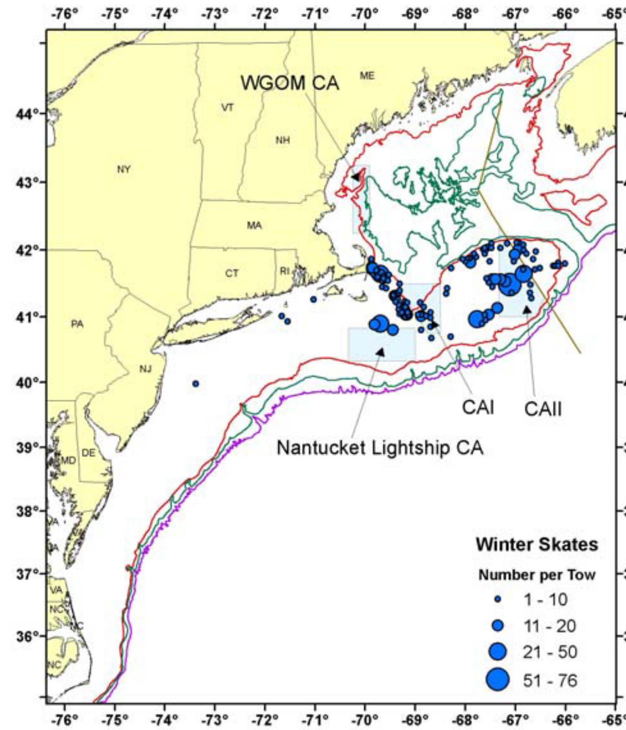


Winter Skates from 2003-2006 NEFSC Winter Surveys

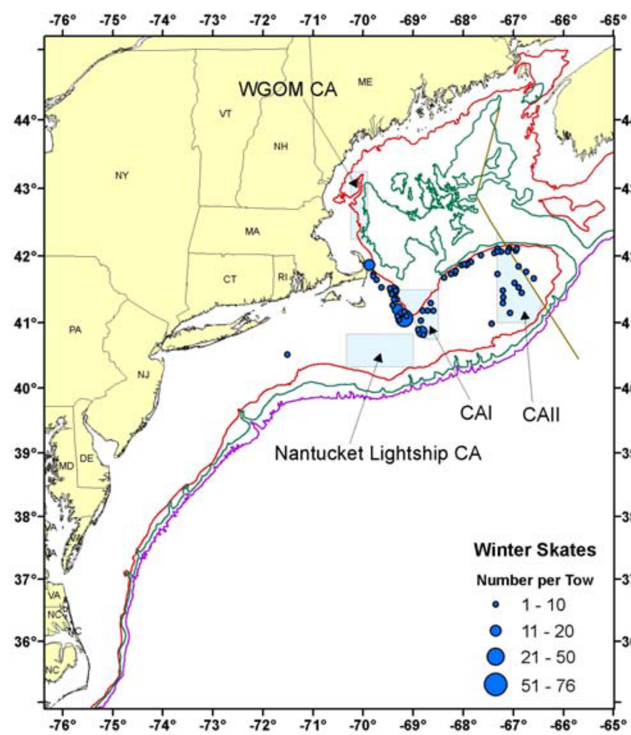
Figure B2.7. Distribution of winter skate from the NEFSC winter surveys from 2000-2006.



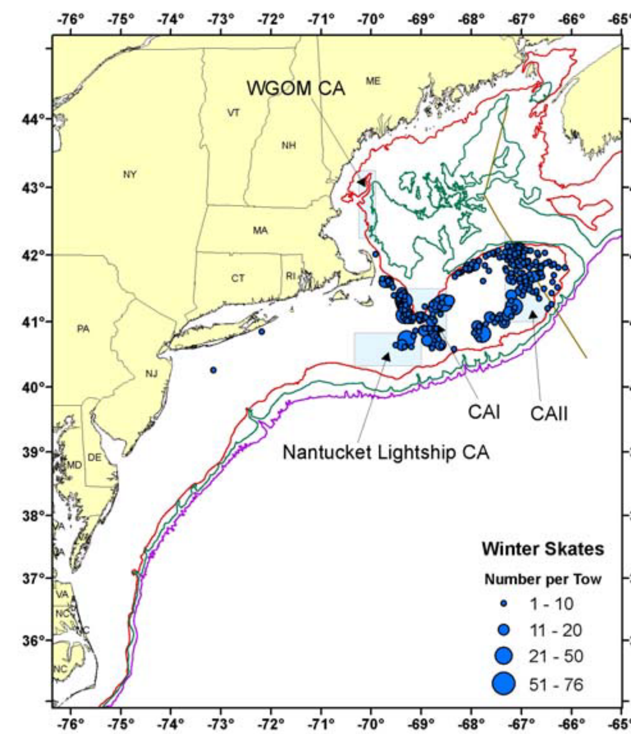
Winter Skates from 1985-1987 NEFSC Scallop Surveys



Winter Skates from 1988-1990 NEFSC Scallop Surveys



Winter Skates from 1991-1993 NEFSC Scallop Surveys



Winter Skates from 1994-1996 NEFSC Scallop Surveys

Figure B2.8. Distribution of winter skate from the NEFSC scallop surveys from 1985-1996.

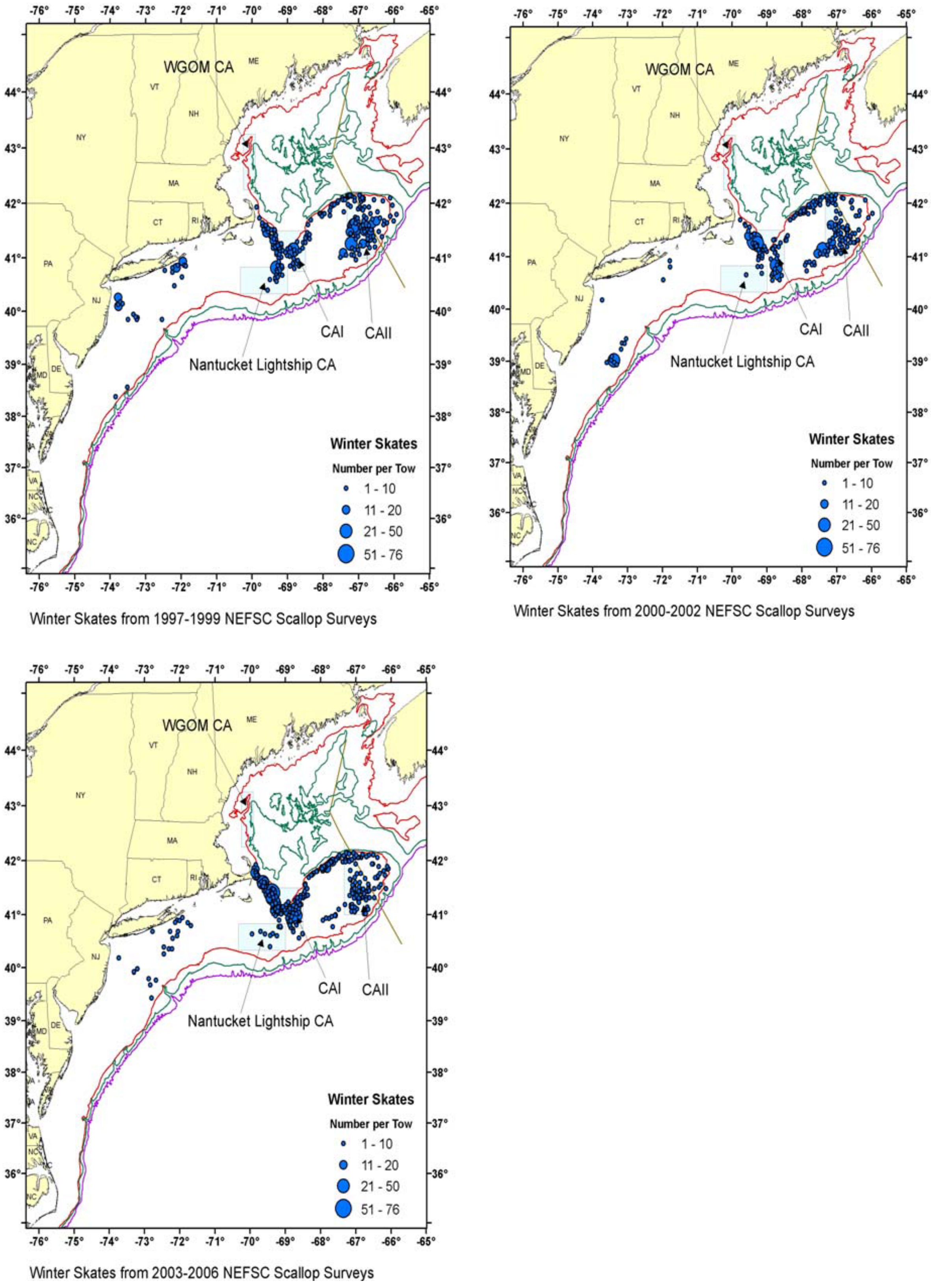


Figure B2.9. Distribution of winter skate from the NEFSC scallop surveys from 1997-2006.

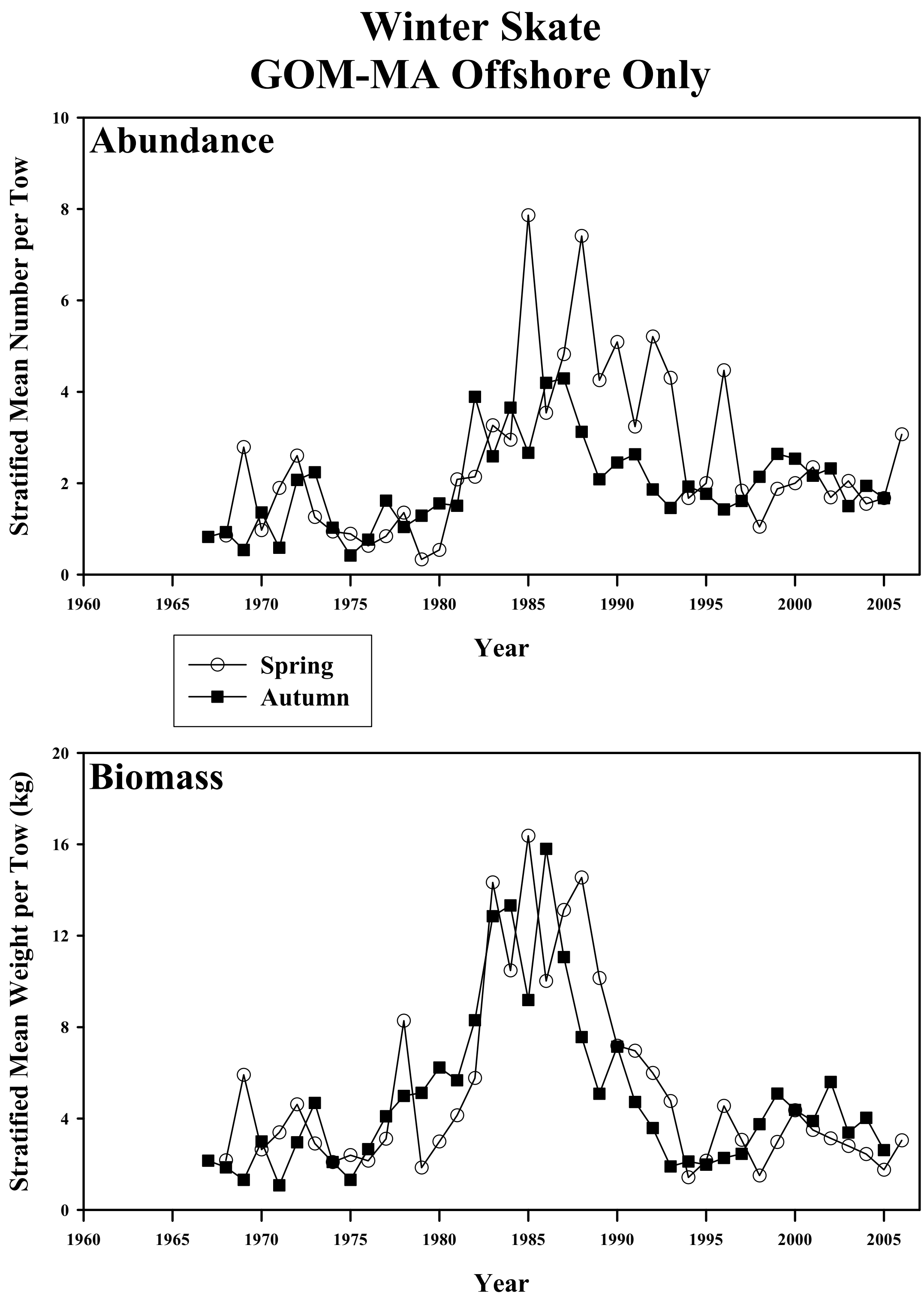


Figure B2.10. Abundance and biomass of winter skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1967-2006 in the Gulf of Maine to Mid-Atlantic offshore region.

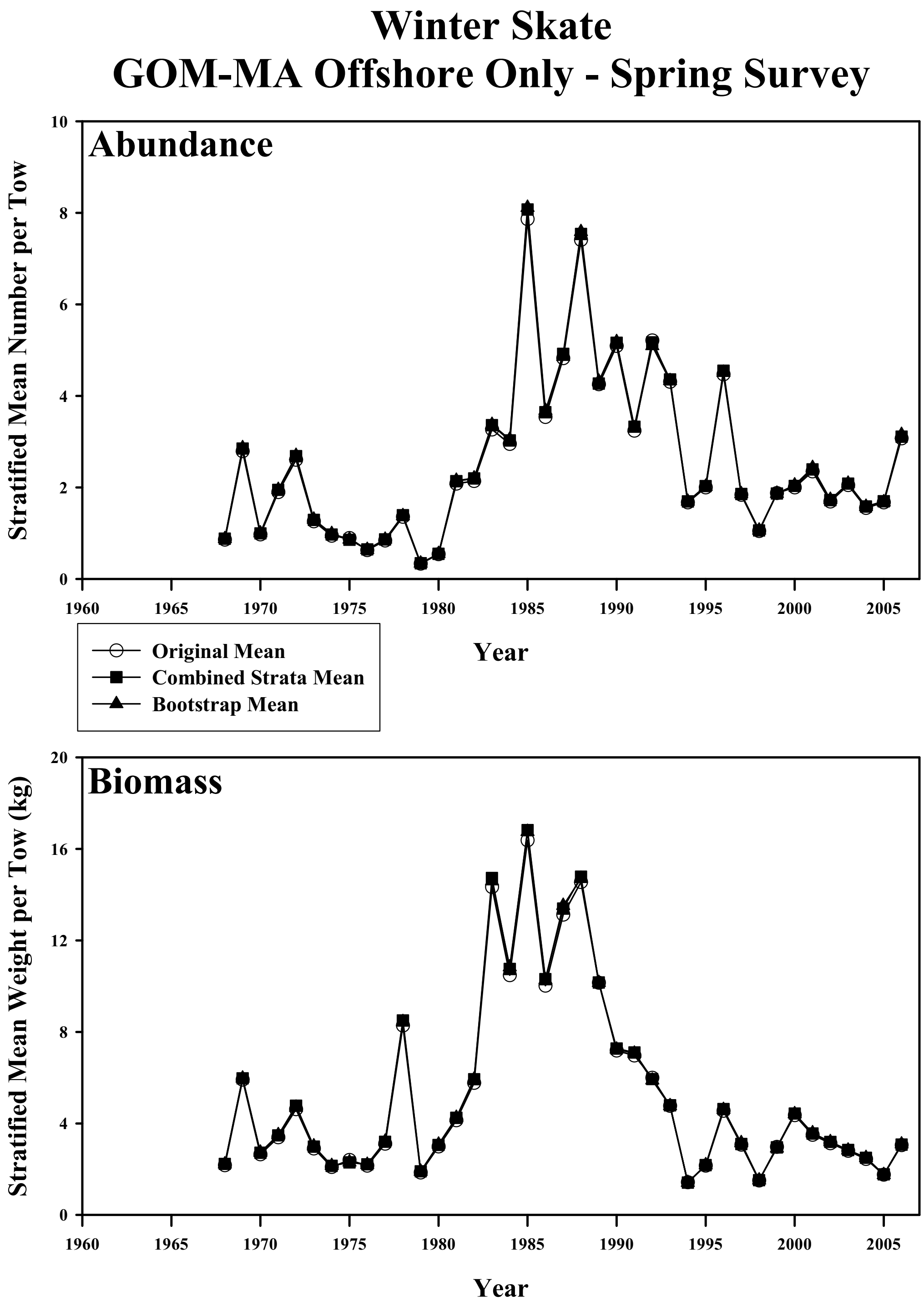


Figure B2.11. Abundance and biomass of winter skate from the NESFC spring bottom trawl surveys from 1968-2006 in the Gulf of Maine to Mid-Atlantic offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

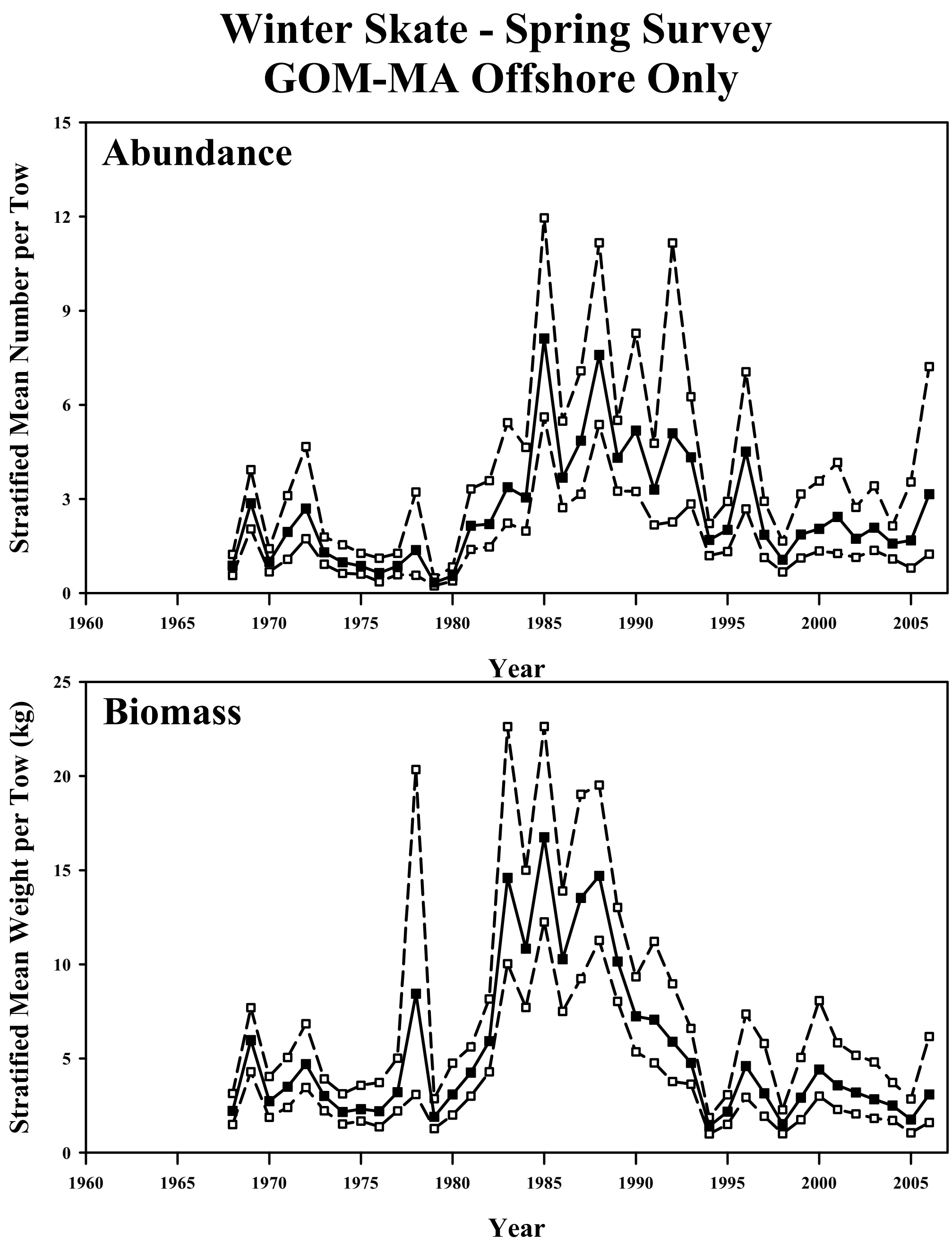


Figure B2.12. Bootstrapped abundance and biomass of winter skate from the NESFC spring bottom trawl survey in the Gulf of Maine to Mid-Atlantic region, offshore strata only. Mean index in solid squares, 95% confidence interval in open squares.

Winter Skate
GOM-MA Offshore Only - Autumn Survey

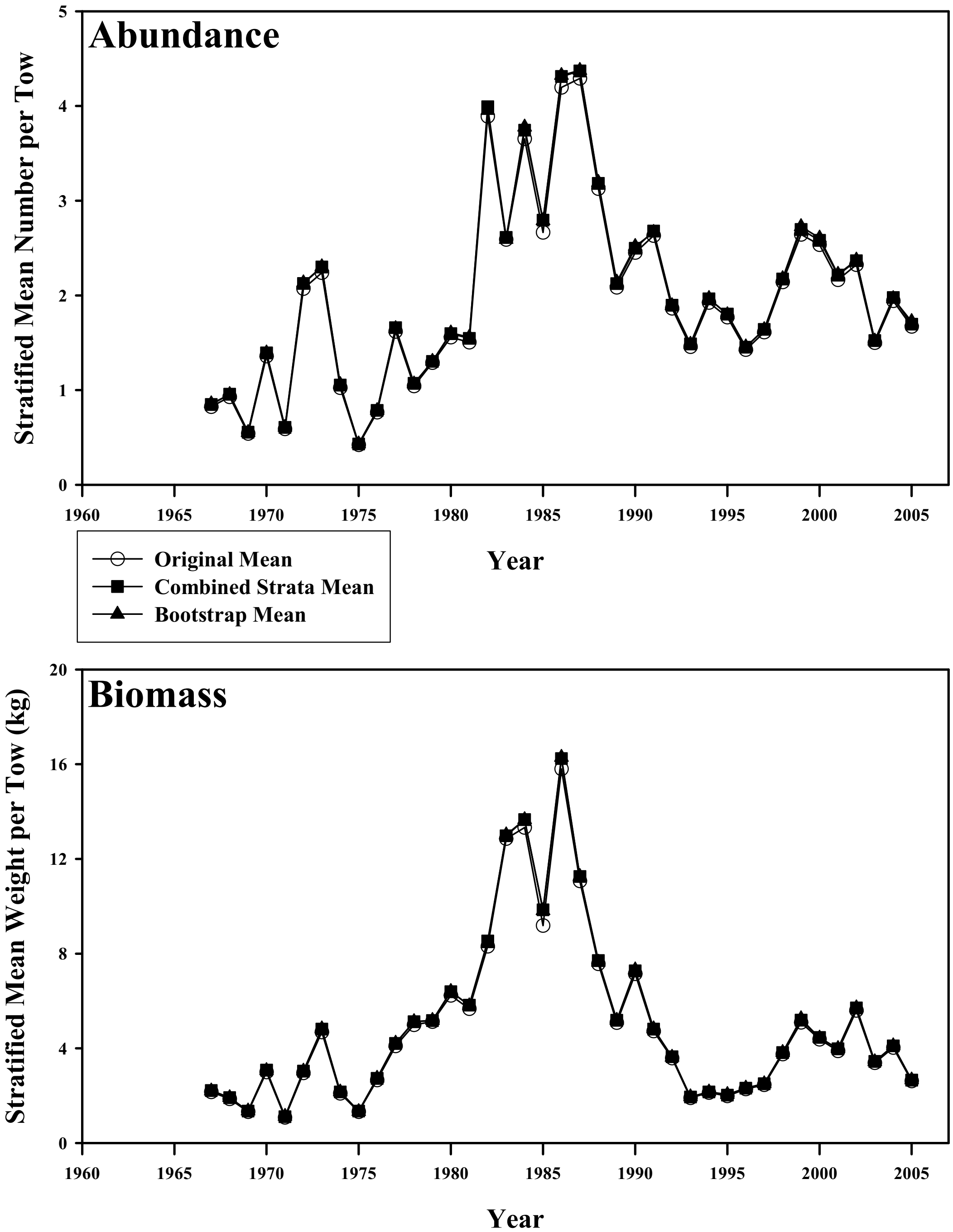


Figure B2.13. Abundance and biomass of winter skate from the NESFC autumn bottom trawl surveys from 1967-2005 in the Gulf of Maine to Mid-Atlantic offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

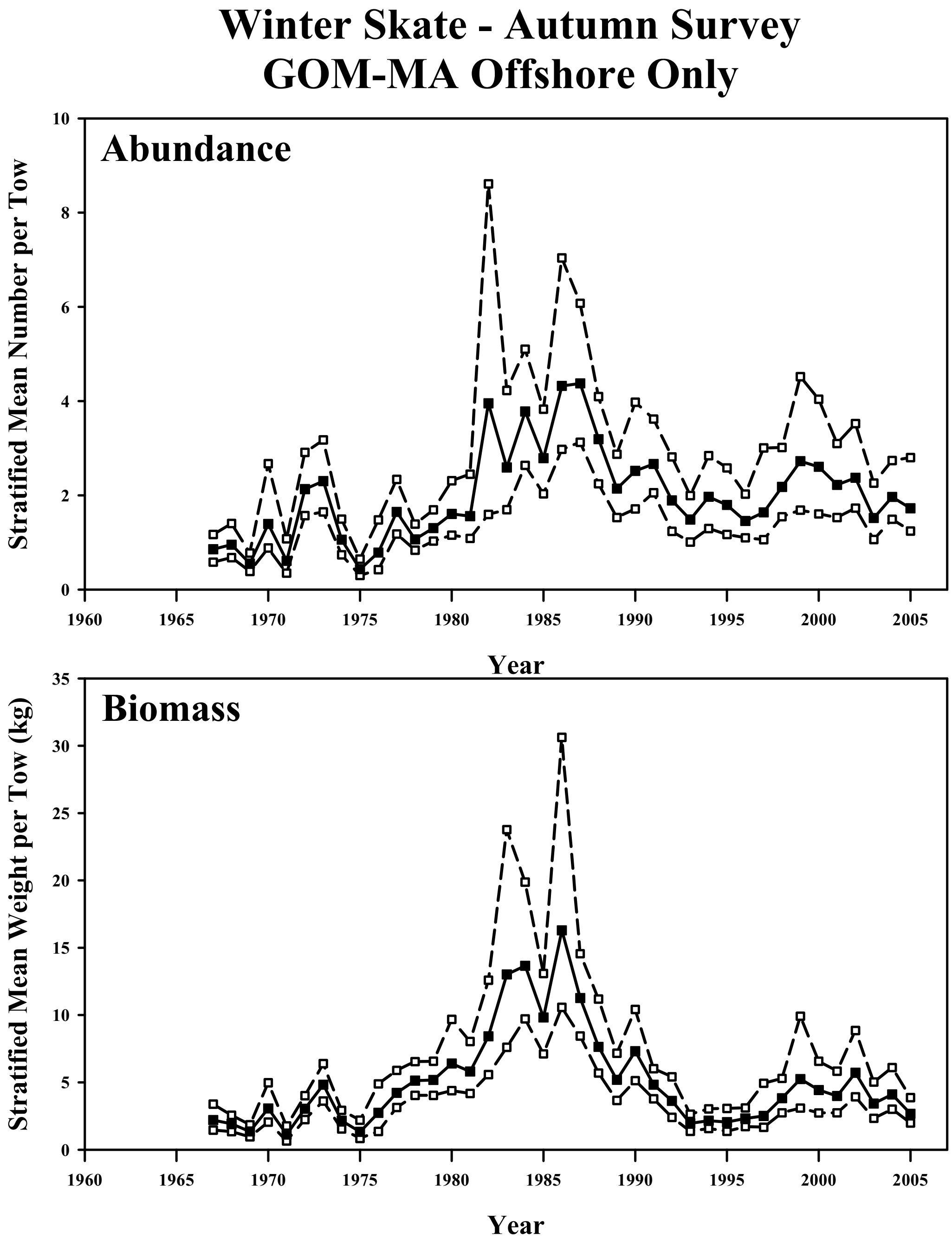
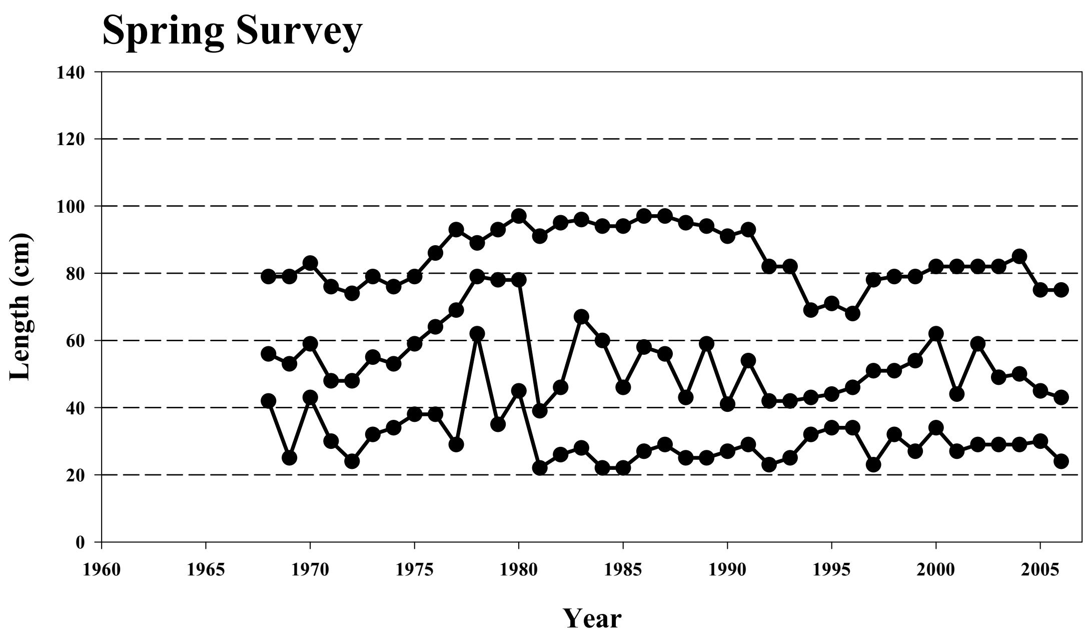


Figure B2.14. Bootstrapped abundance and biomass of winter skate from the NESFC autumn bottom trawl survey in the Gulf of Maine to Mid-Atlantic region, offshore strata only. Mean index in solid squares, 95% confidence interval in open squares.

Winter Skate
Percentiles of Length Composition



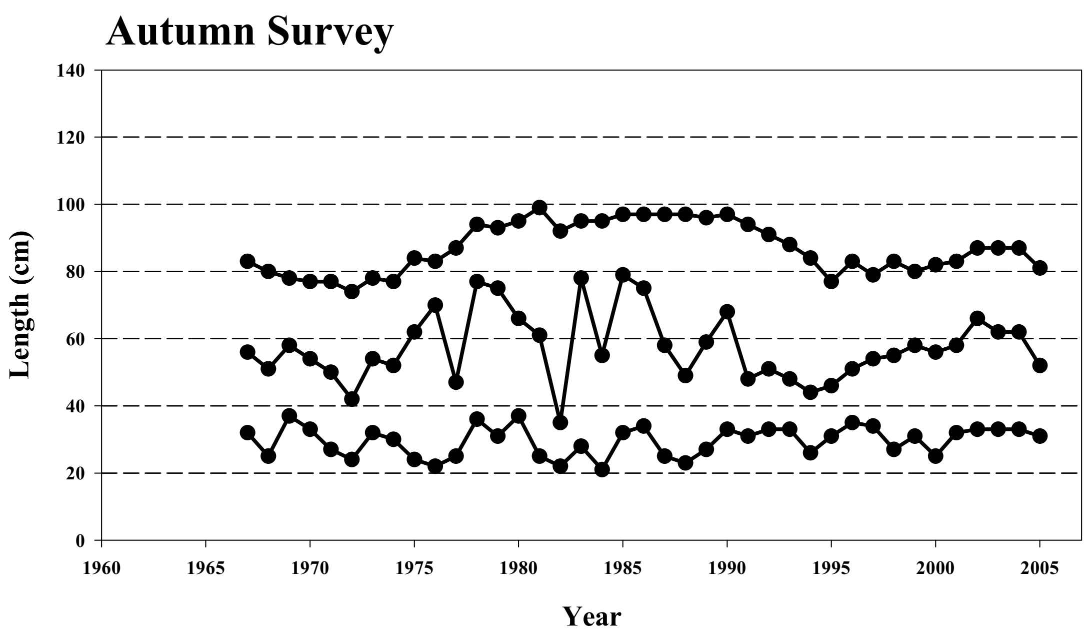


Figure B2.15. Percentiles of length composition (5, 50, and 95) of winter skate from the NESFC spring and autumn bottom trawl surveys from 1967-2006 in the Gulf of Maine to Mid-Atlantic offshore region.

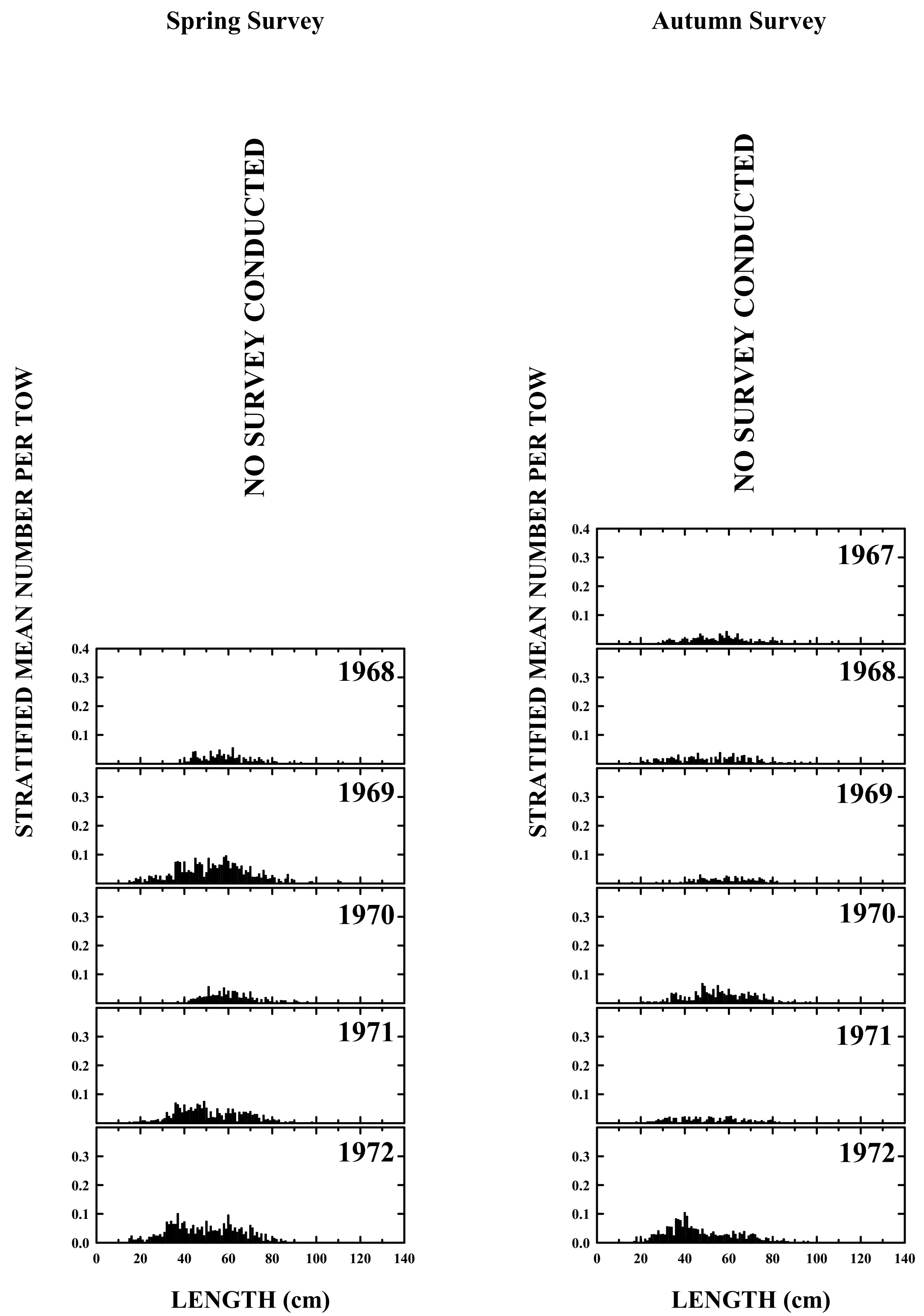


Figure B2.16. Winter skate length composition from the NEFSC spring and autumn trawl surveys in the Gulf of Maine to Mid-Atlantic offshore regions, 1967-1972.

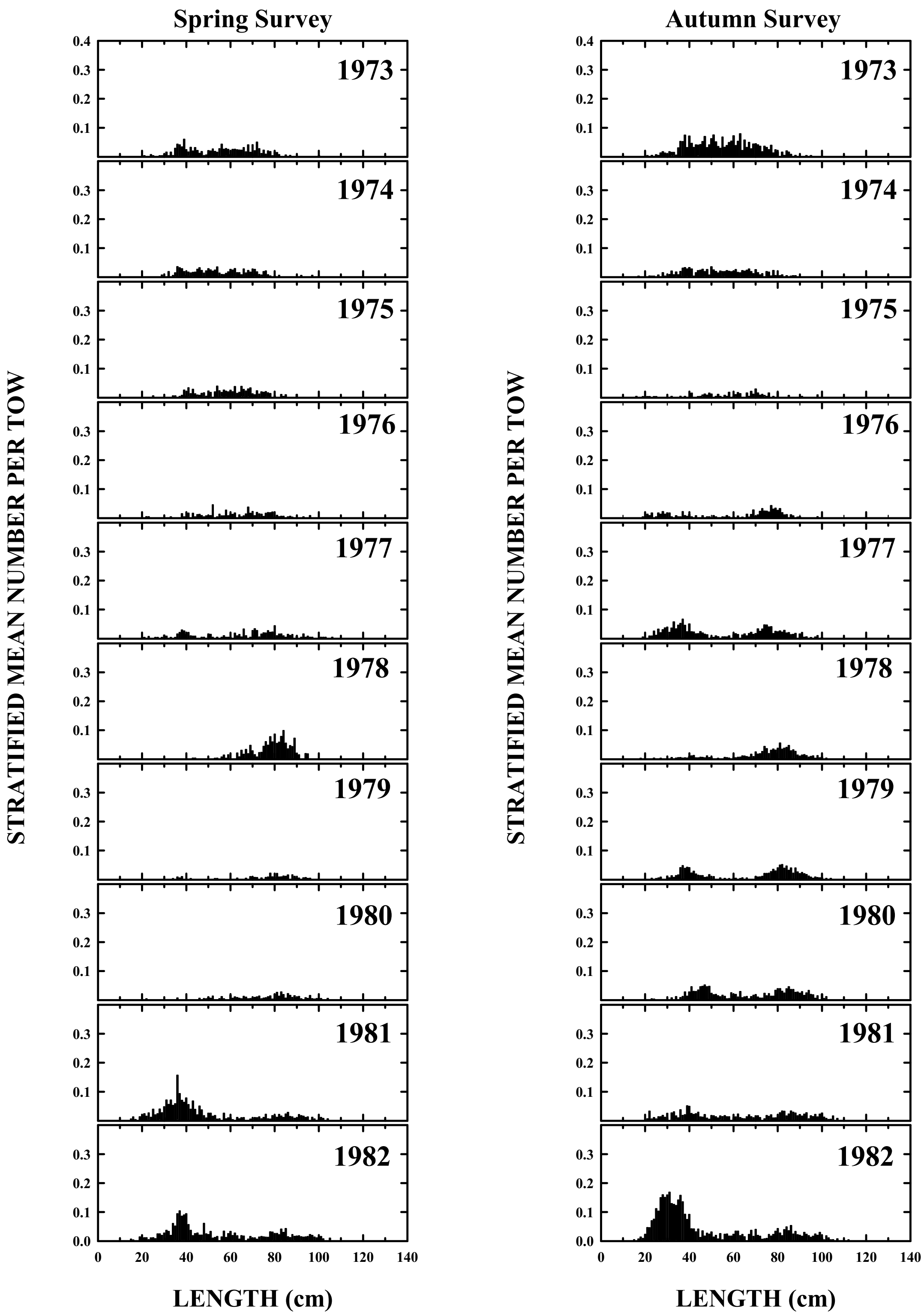


Figure B2.17. Winter skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic offshore regions, 1973-1982.

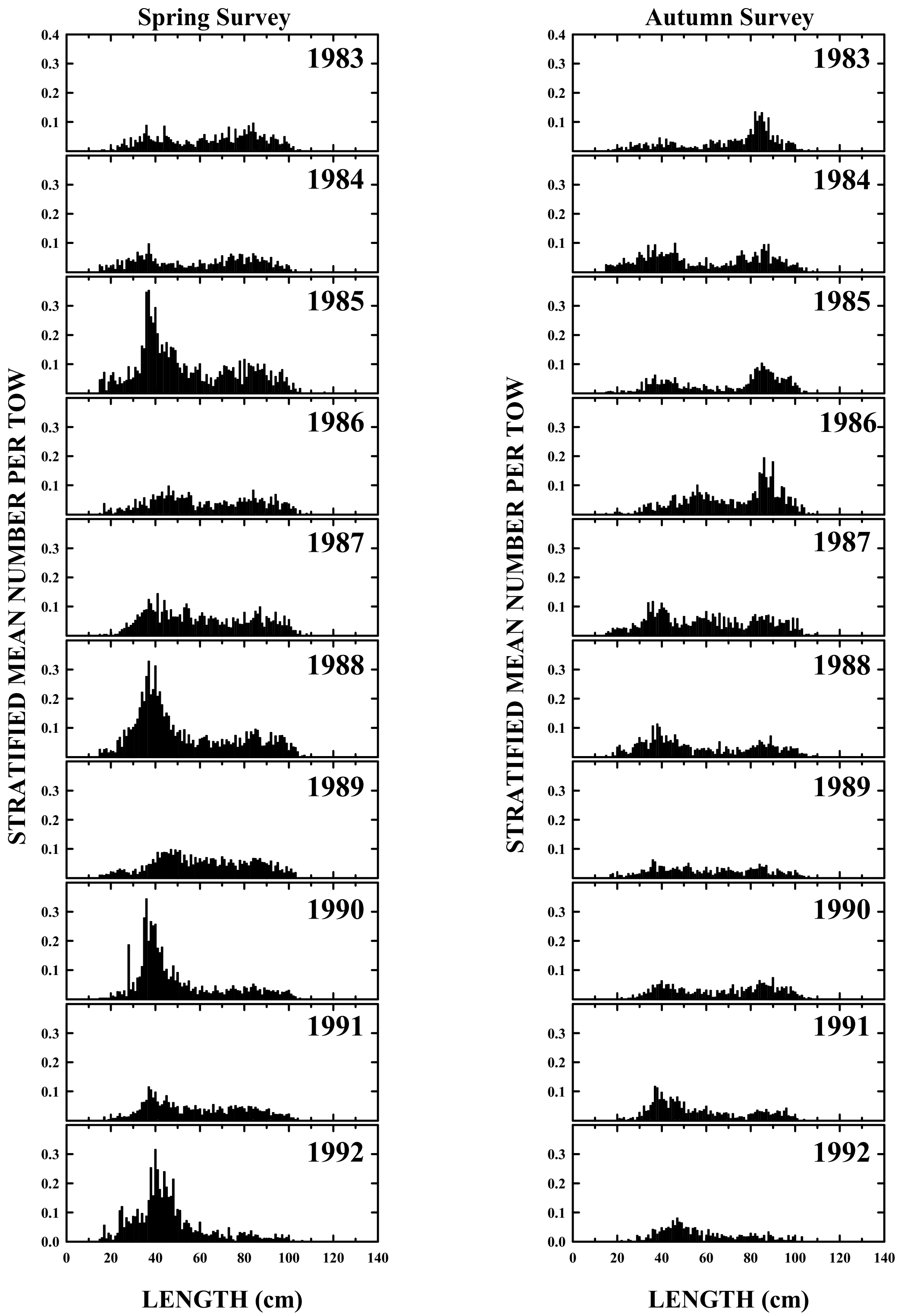


Figure B2.18. Winter skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic offshore regions, 1983-1992.

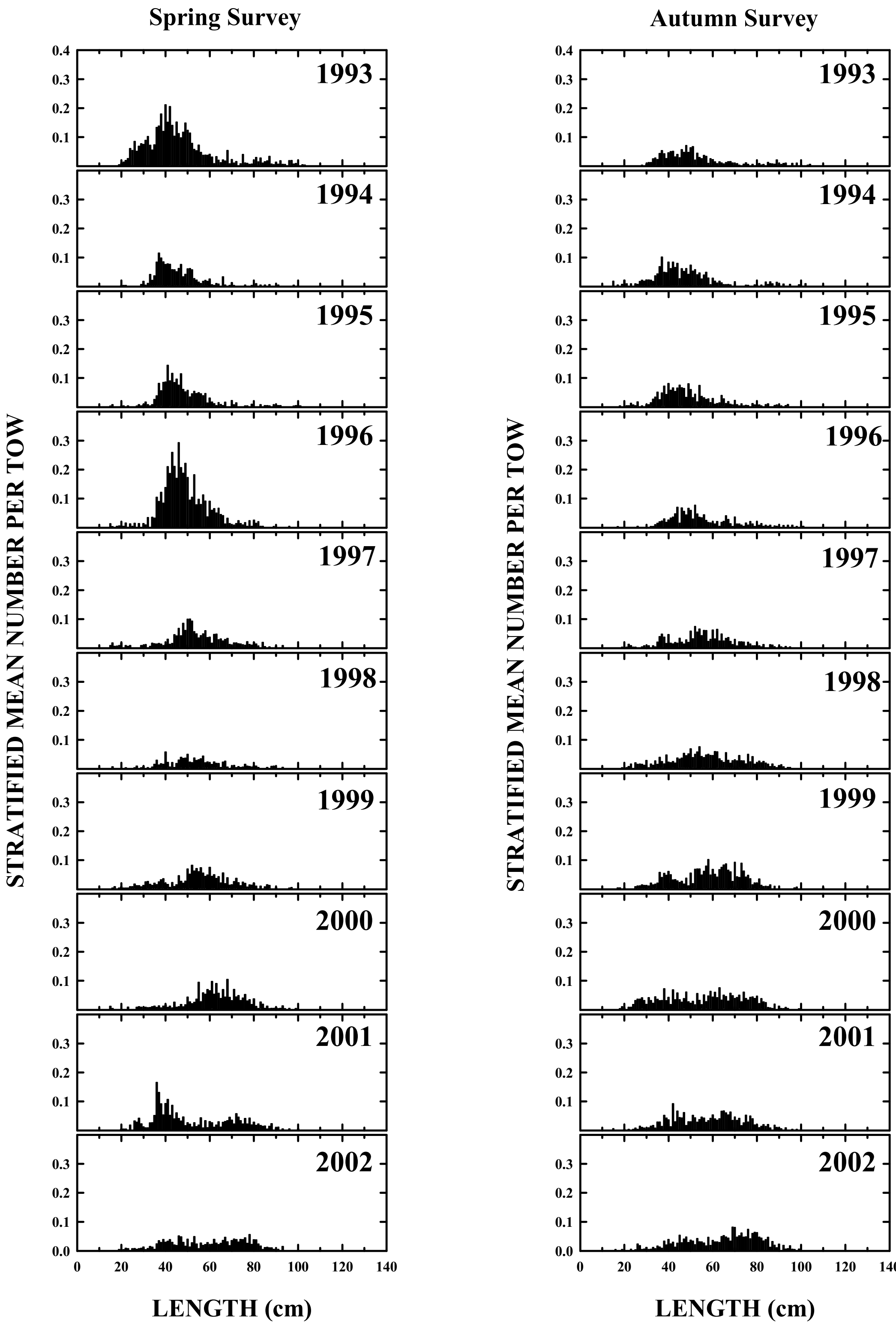


Figure B2.19. Winter skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic offshore regions, 1993-2002.

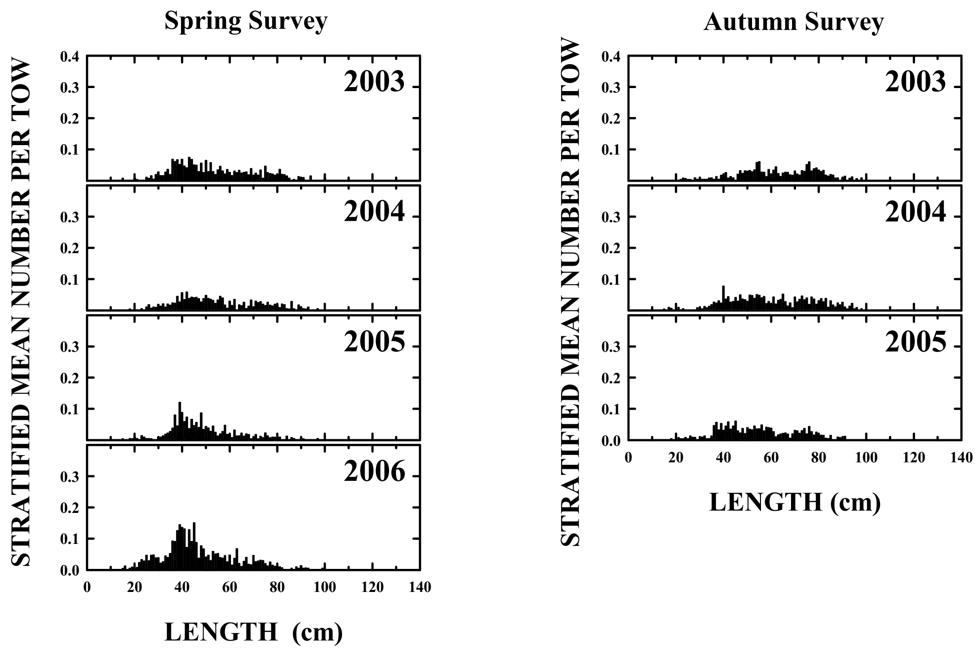


Figure B2.20. Winter skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic offshore regions, 2003-2006.

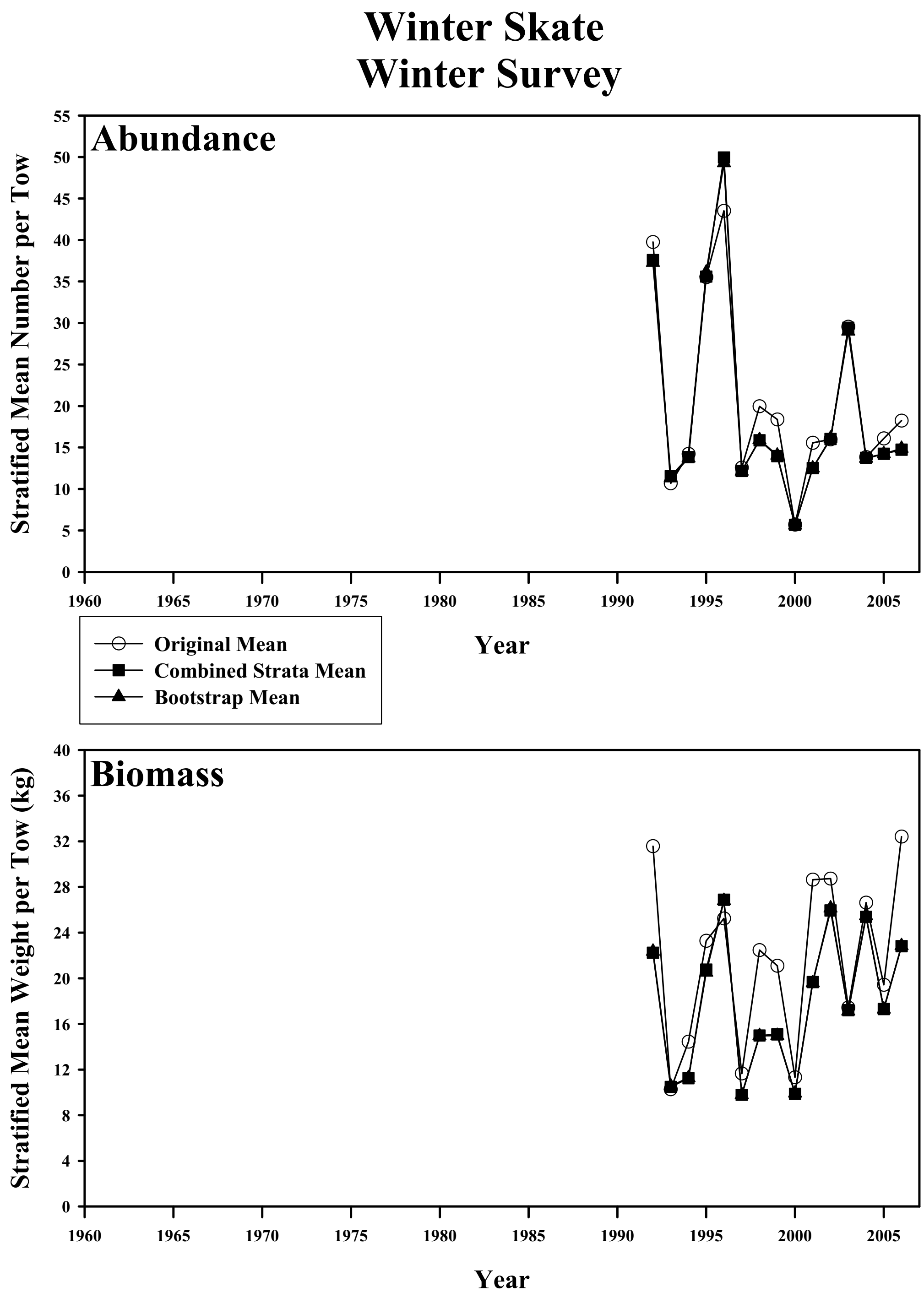


Figure B2.21. Abundance and biomass of winter skate from the NESFC winter bottom trawl surveys from 1992-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

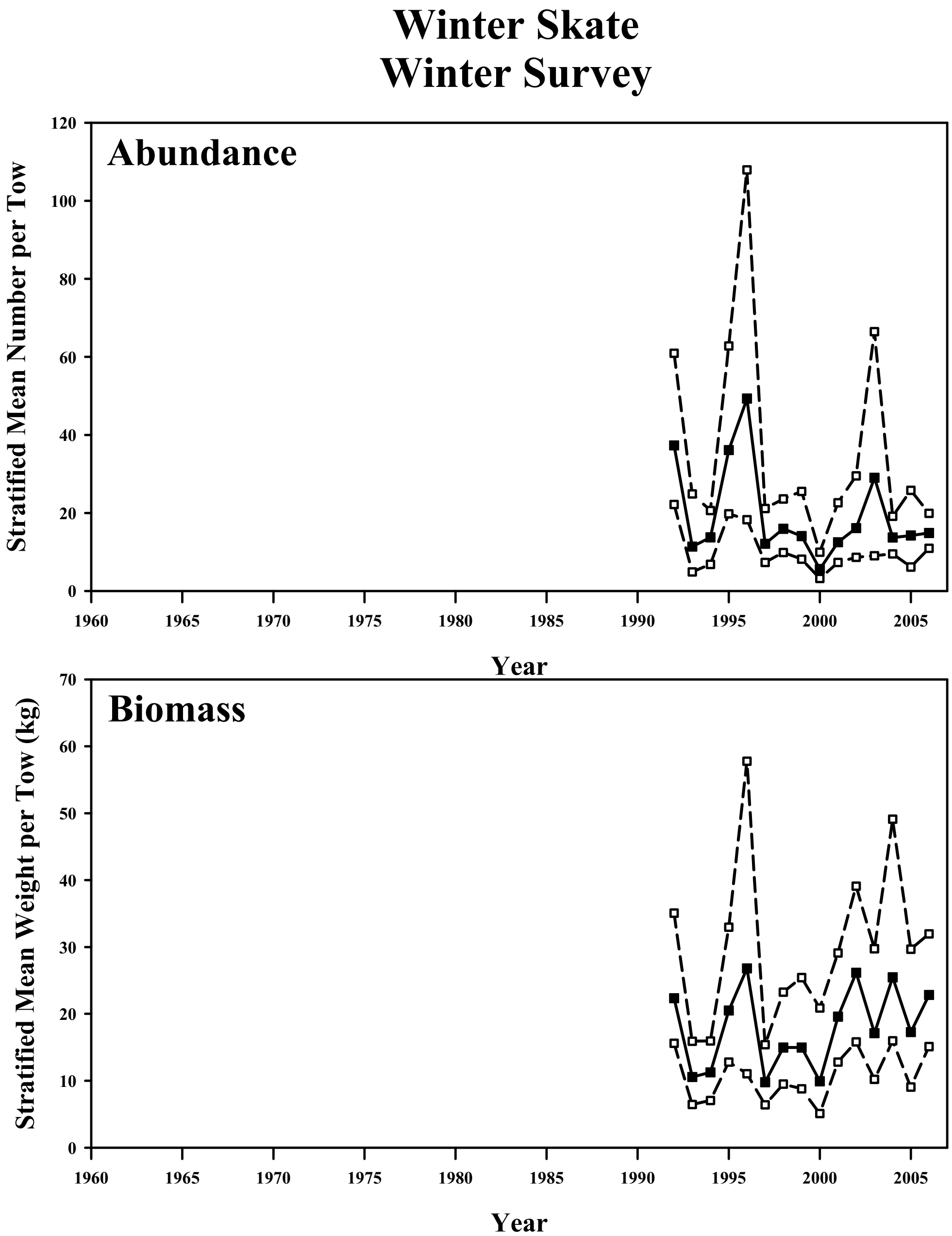


Figure B2.22. Bootstrapped abundance and biomass of winter skate from the NESFC winter bottom trawl survey. Mean index in solid squares, 95% confidence interval in open squares.

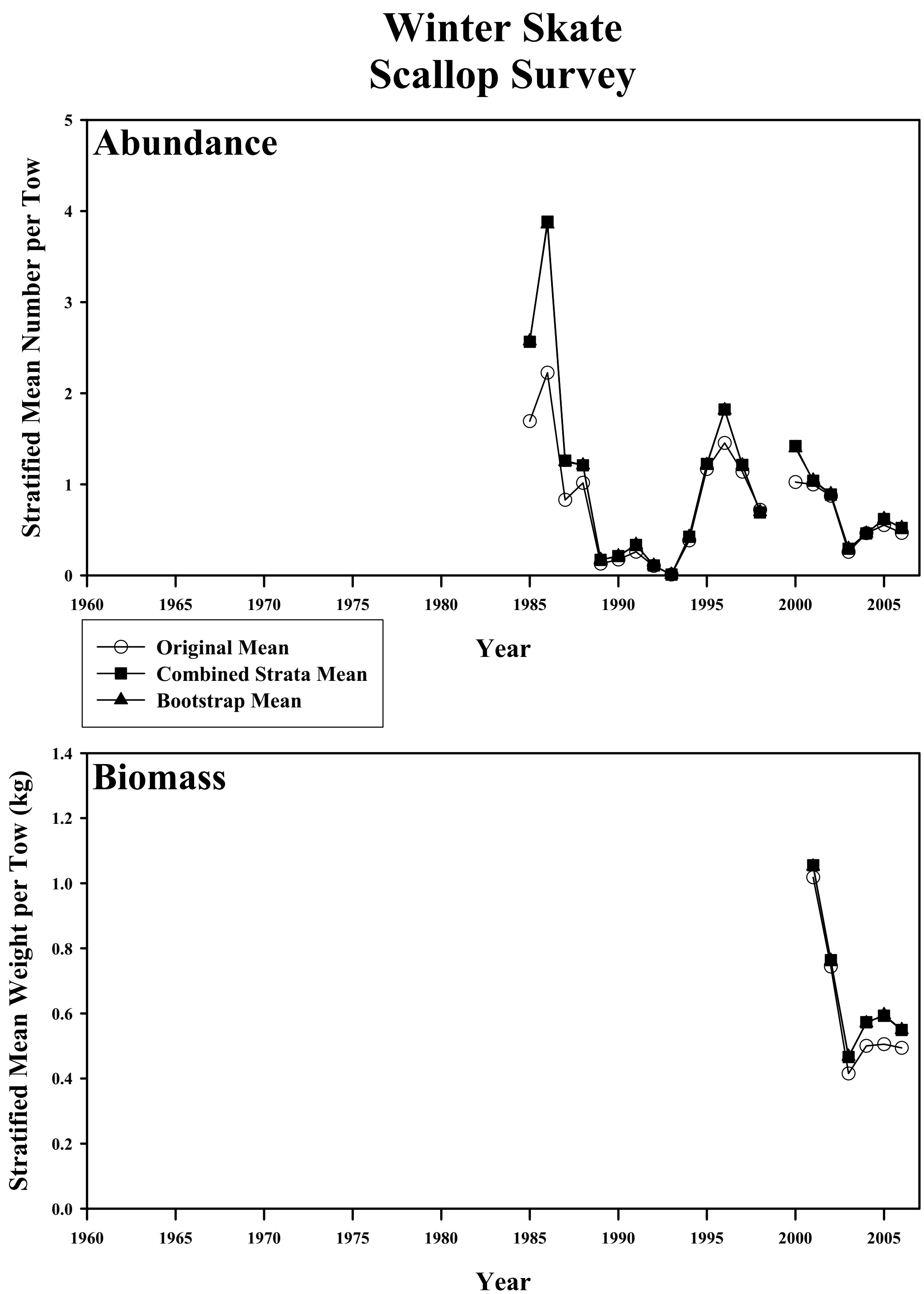


Figure B2.23. Abundance and biomass of winter skate from the NESFC scallop surveys from 1985-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

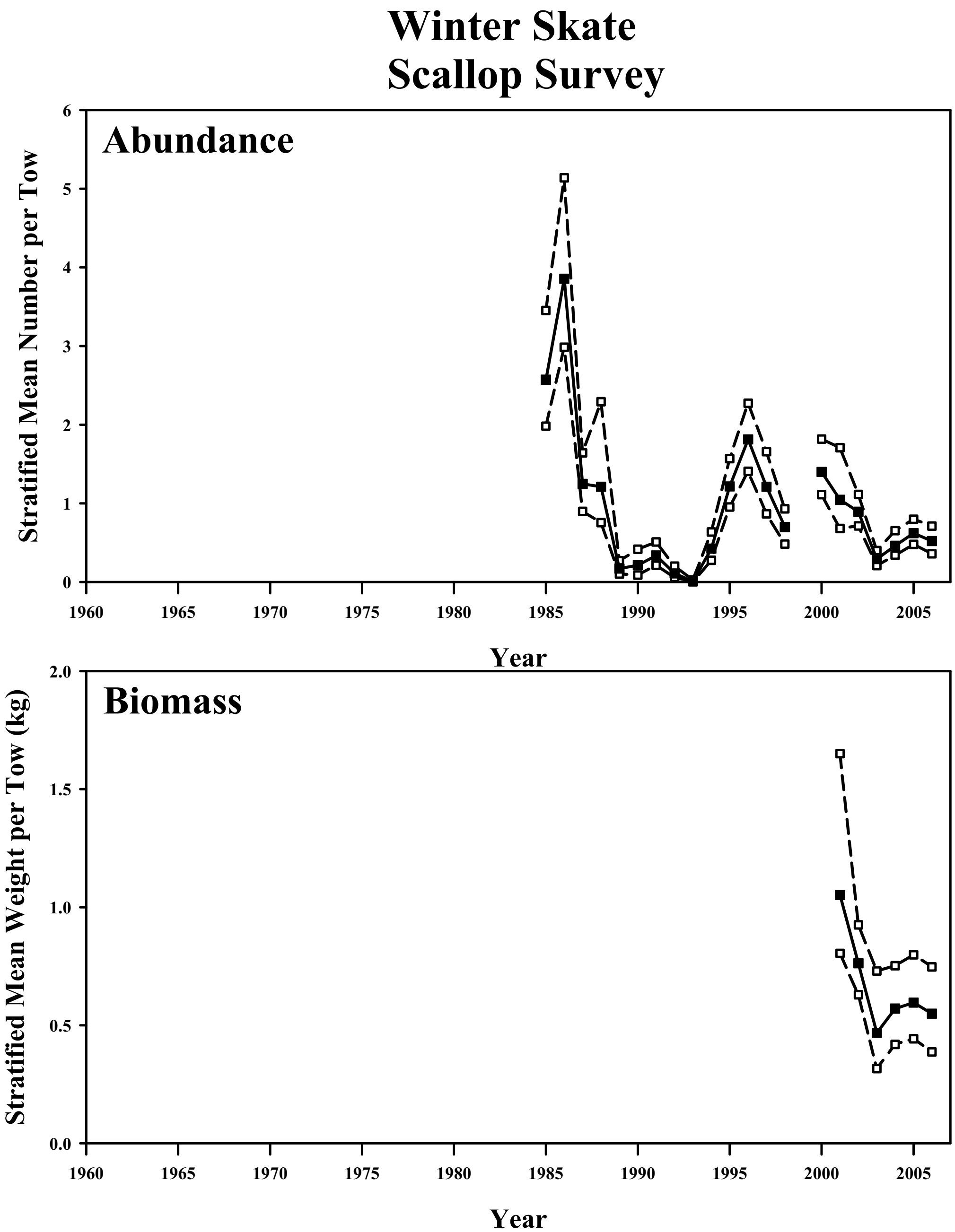


Figure B2.24. Bootstrapped abundance and biomass of winter skate from the NESFC scallop survey. Mean index in solid squares, 95% confidence interval in open squares.

Winter Skate - Massachusetts Trawl Survey

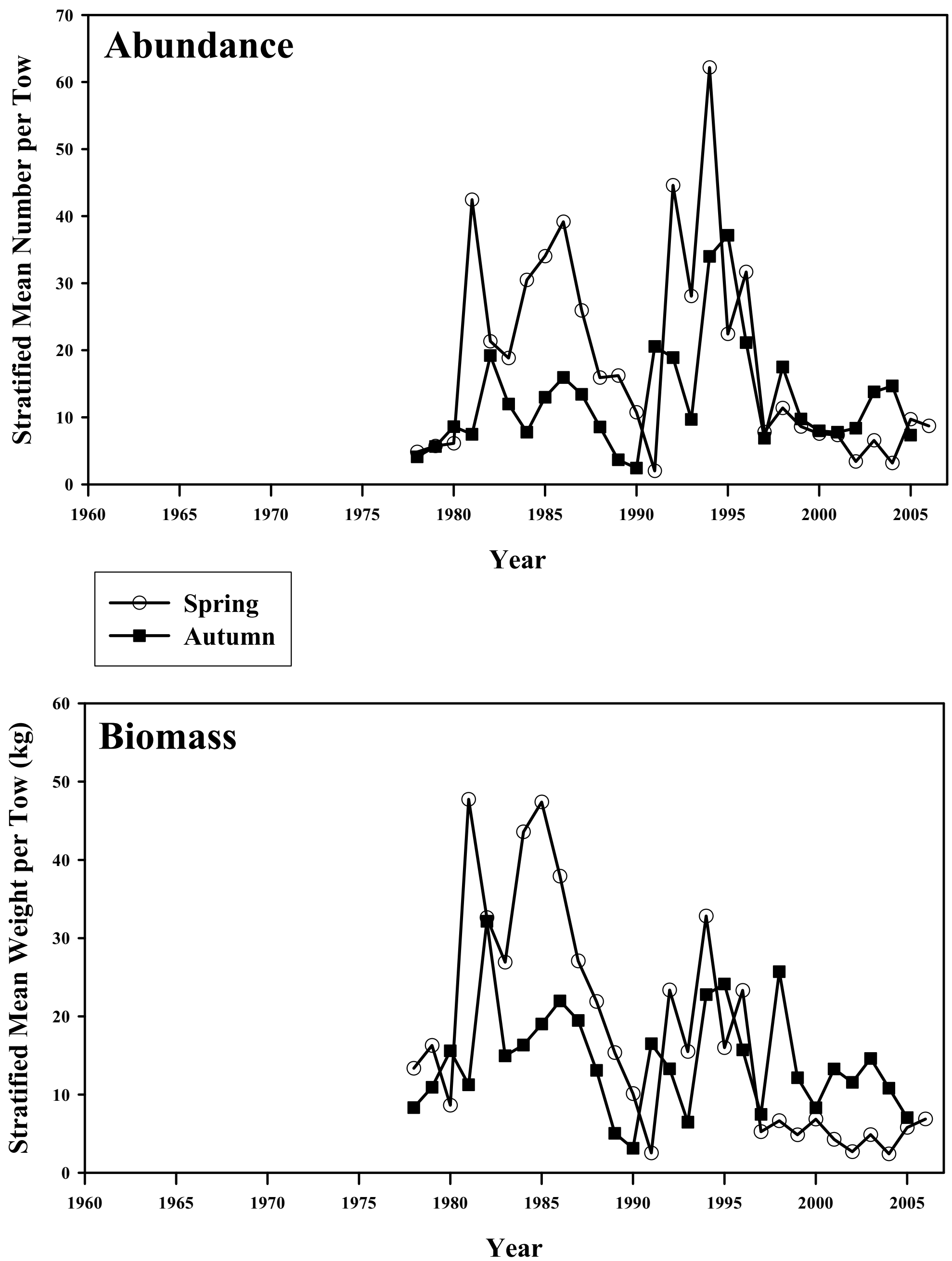


Figure B2.25. Abundance and biomass of winter skate from the Massachusetts spring and autumn finfish bottom trawl survey in state waters (strata 11-36).

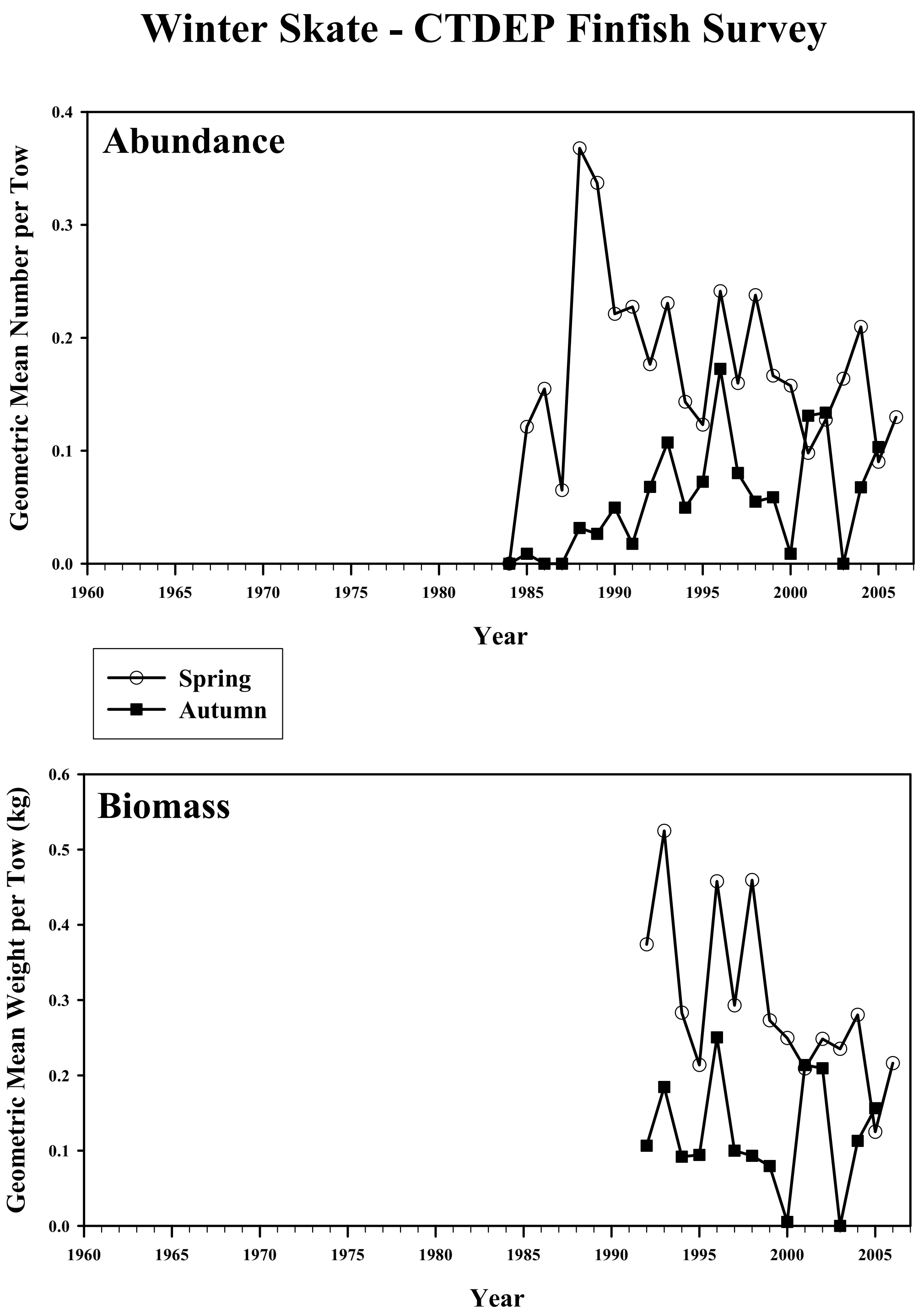
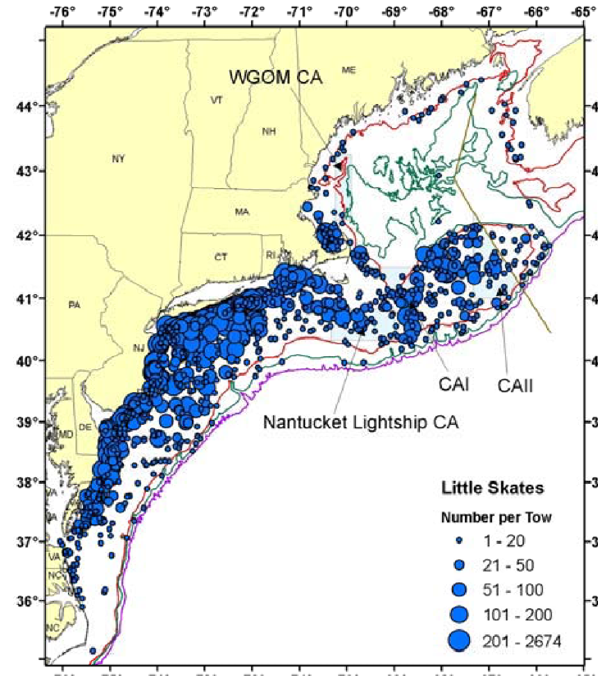
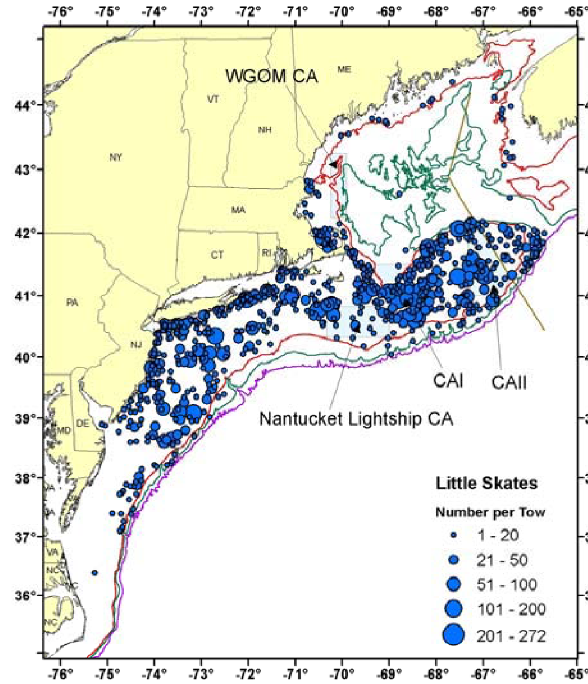


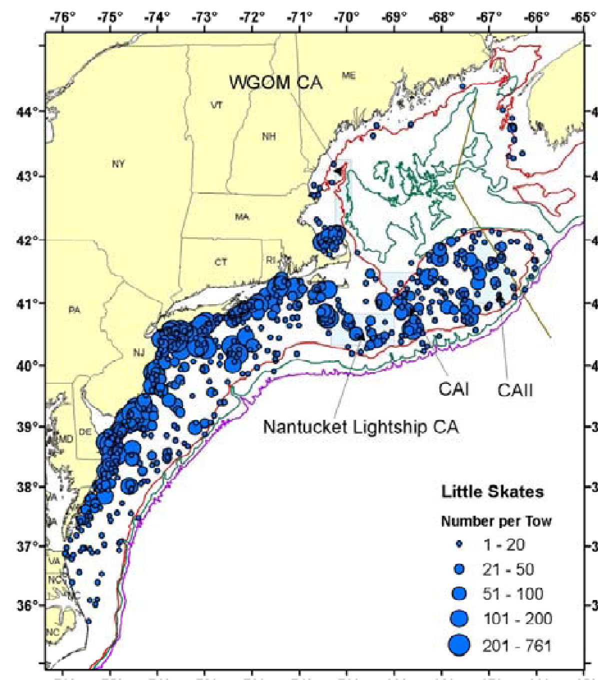
Figure B2.26. Abundance and biomass of winter skate from the CTDEP spring and autumn finfish bottom trawl survey in Connecticut state waters, 1984-2006.



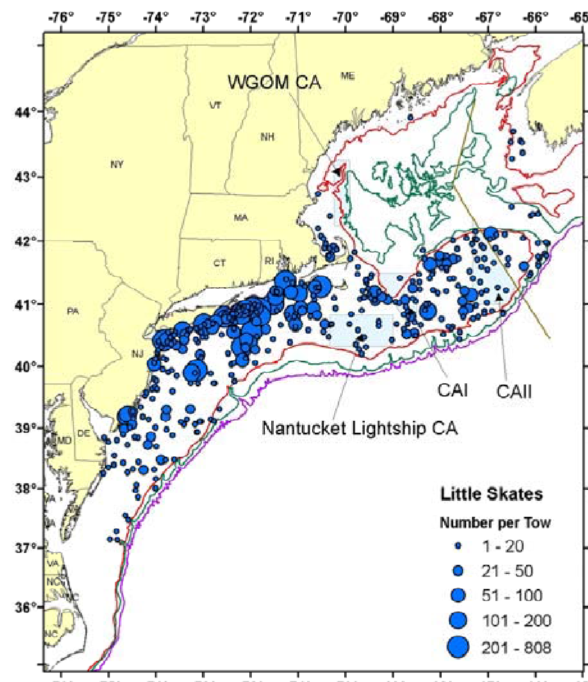
Little Skates from 1998-2002 NEFSC Spring Surveys



Little Skates from 1998-2002 NEFSC Fall Surveys

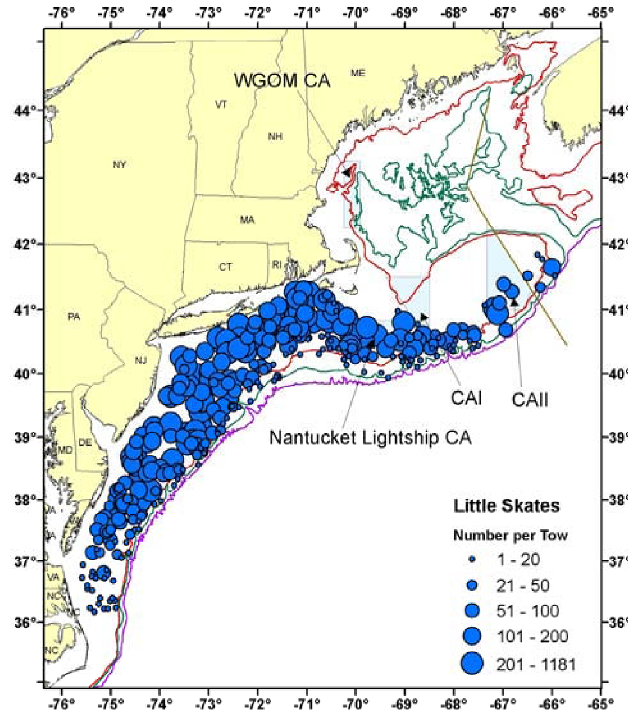


Little Skates from 2003-2006 NEFSC Spring Surveys

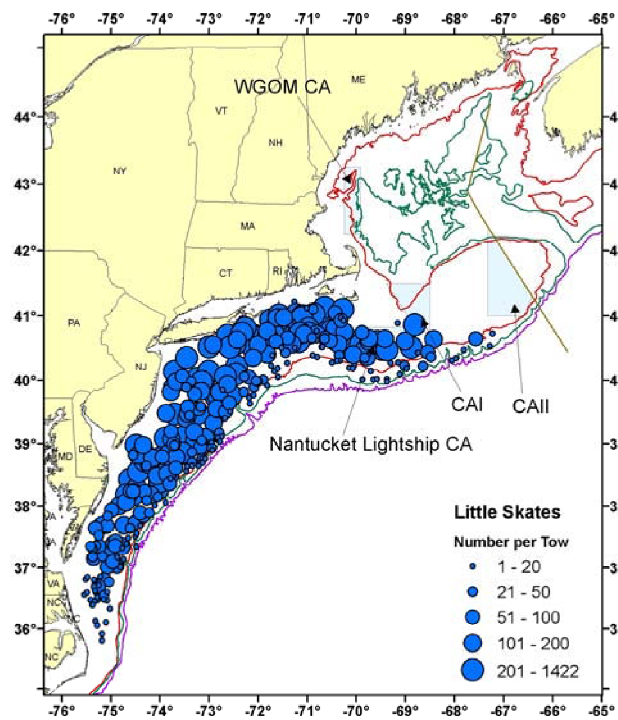


Little Skates from 2003-2005 NEFSC Fall Surveys

Figure B2.27. Distribution of little skate from the spring and autumn NEFSC surveys from 1998-2006.

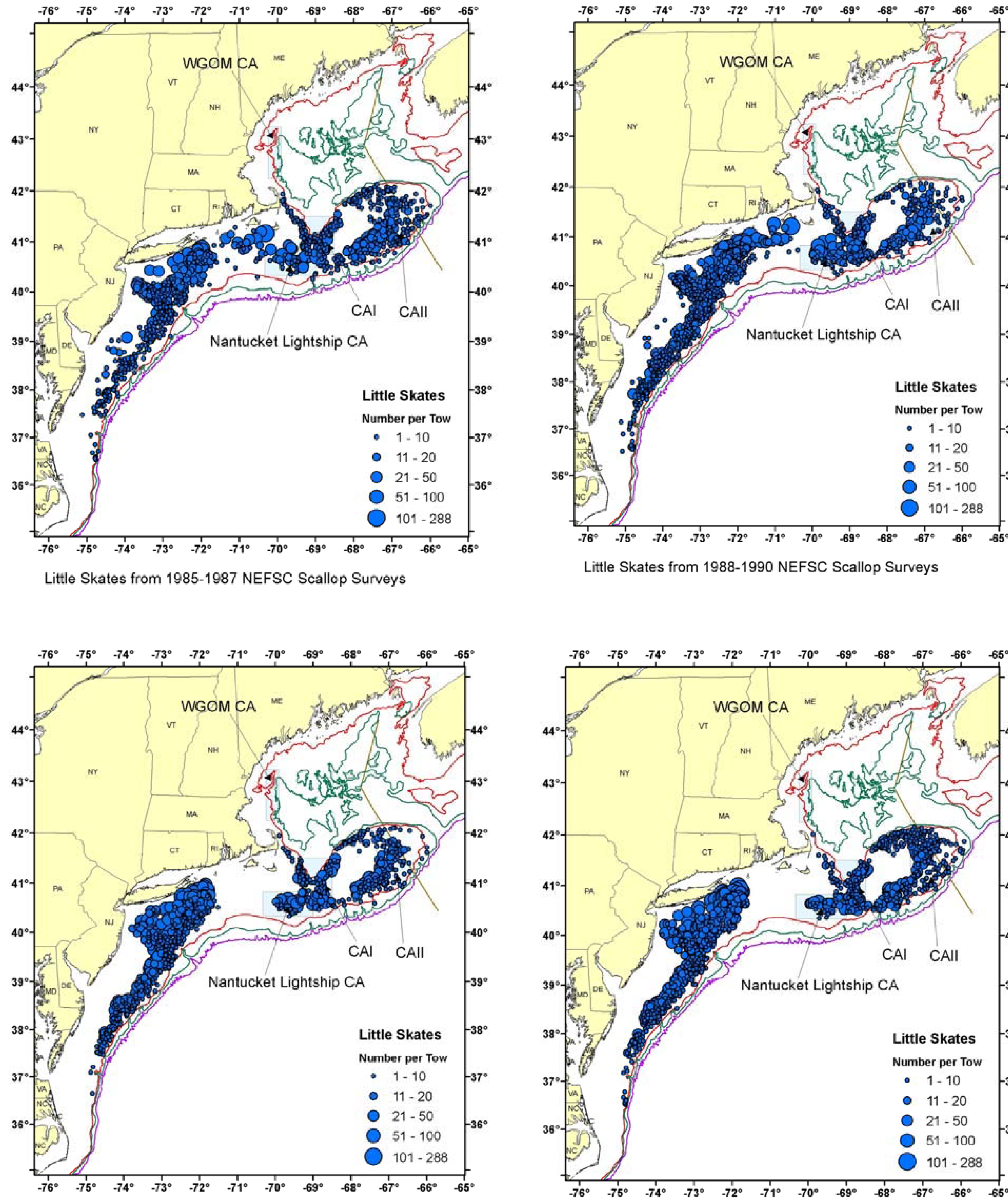


Little Skates from 2000-2002 NEFSC Winter Surveys



Little Skates from 2003-2006 NEFSC Winter Surveys

Figure B2.28. Distribution of little skate from the NEFSC winter surveys from 2000-2006.



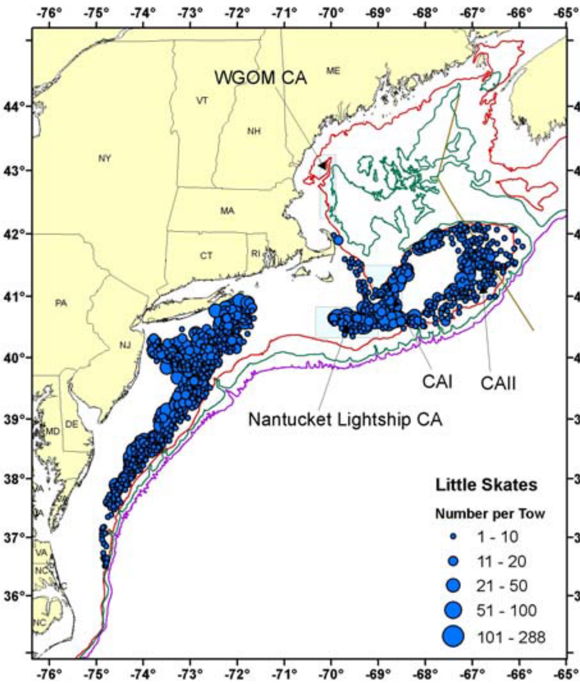
Little Skates from 1985-1987 NEFSC Scallop Surveys

Little Skates from 1988-1990 NEFSC Scallop Surveys

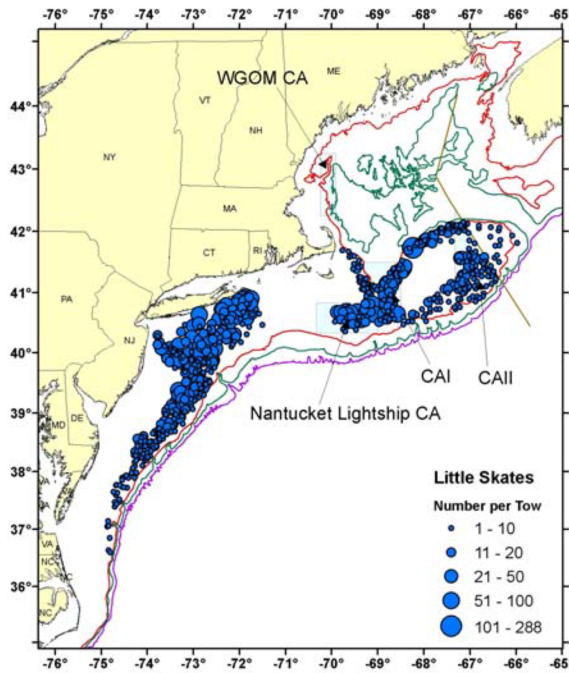
Little Skates from 1991-1993 NEFSC Scallop Surveys

Little Skates from 1994-1996 NEFSC Scallop Surveys

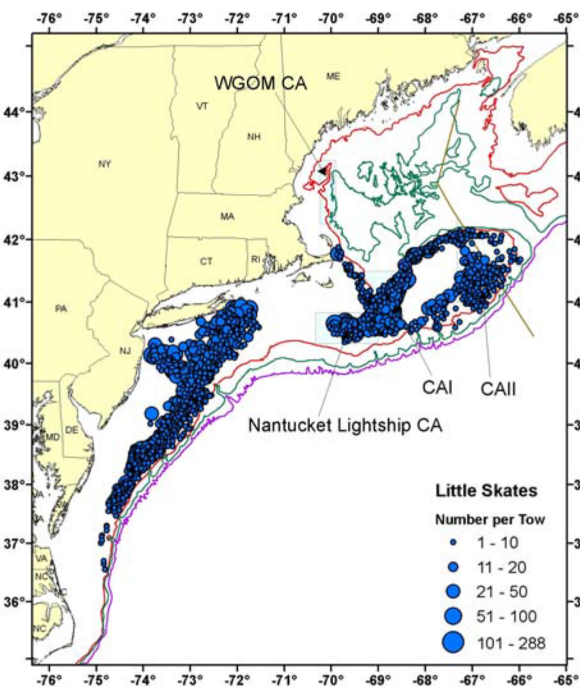
Figure B2.29. Distribution of little skate from the NEFSC scallop surveys from 1985-1996.



Little Skates from 1997-1999 NEFSC Scallop Surveys



Little Skates from 2000-2002 NEFSC Scallop Surveys



Little Skates from 2003-2006 NEFSC Scallop Surveys

Figure B2.30. Distribution of little skate from the NEFSC scallop surveys from 1997-2006.

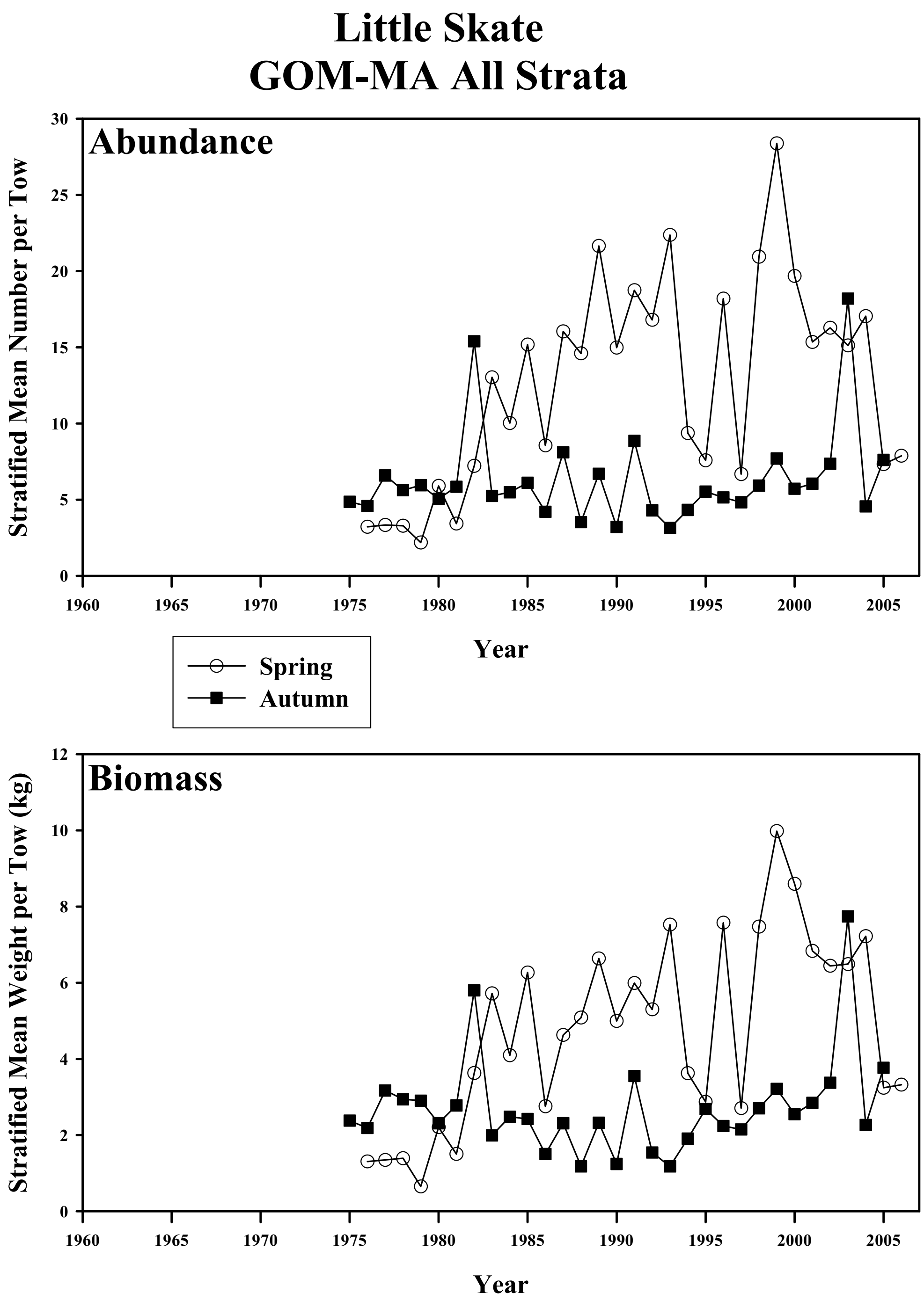


Figure B2.31. Abundance and biomass of little skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1975-2006 in the Gulf of Maine to Mid-Atlantic (all strata).

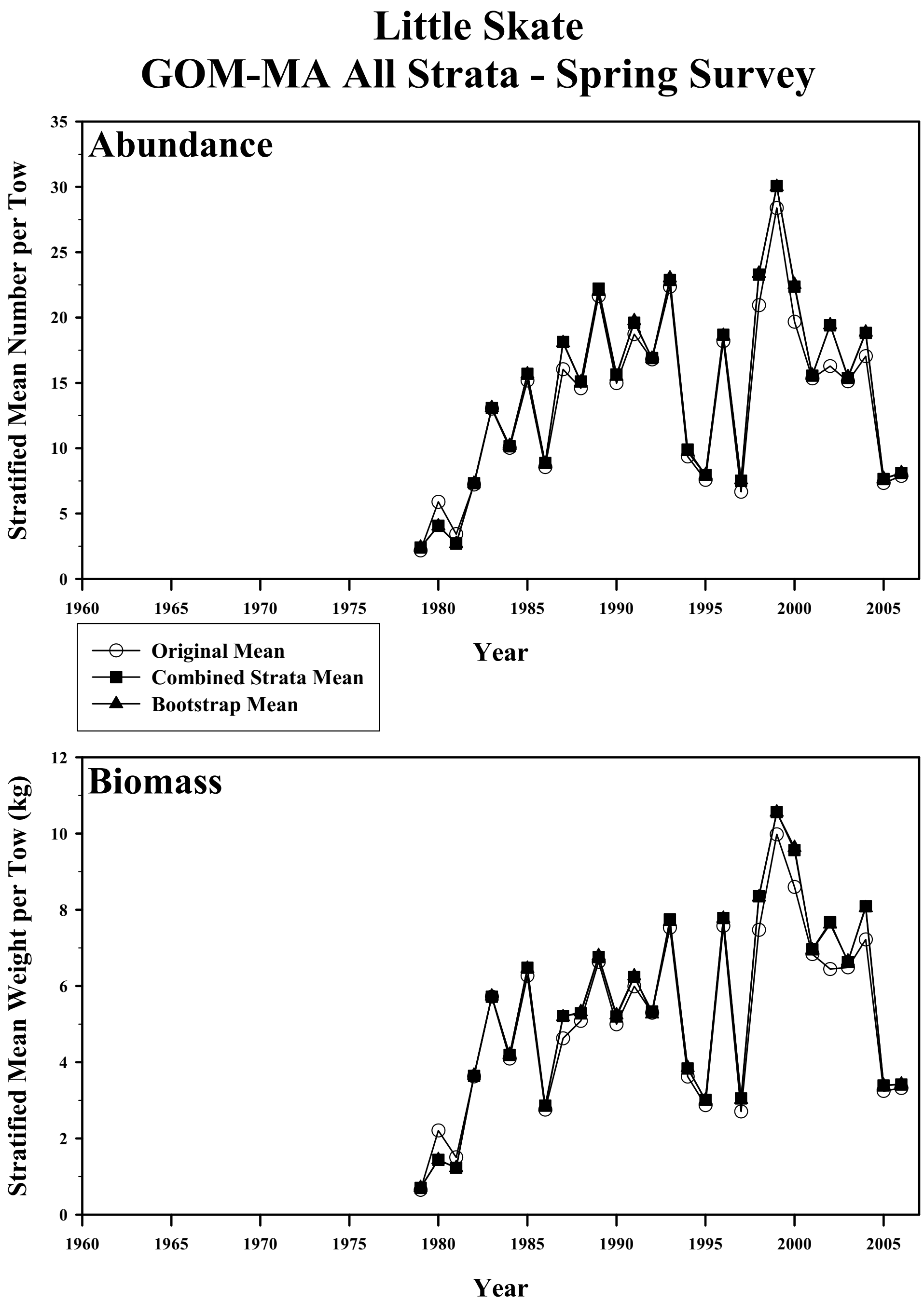


Figure B2.32. Abundance and biomass of little skate from the NESFC spring bottom trawl surveys from 1979-2006 in the Gulf of Maine to Mid-Atlantic (all strata). The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

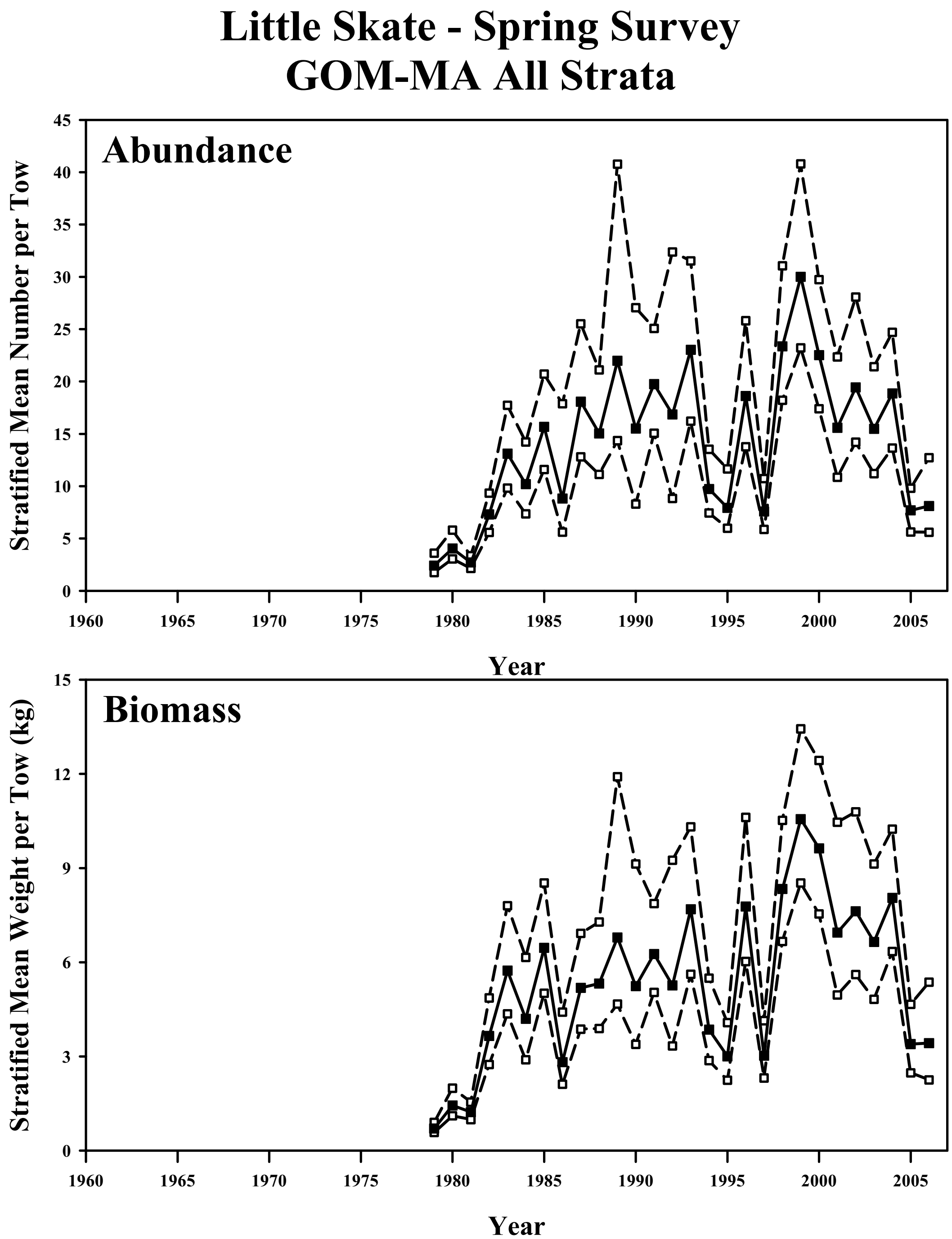


Figure B2.33. Bootstrapped abundance and biomass of little skate from the NESFC spring bottom trawl survey in the Gulf of Maine to Mid-Atlantic region (all strata). Mean index in solid squares, 95% confidence interval in open squares.

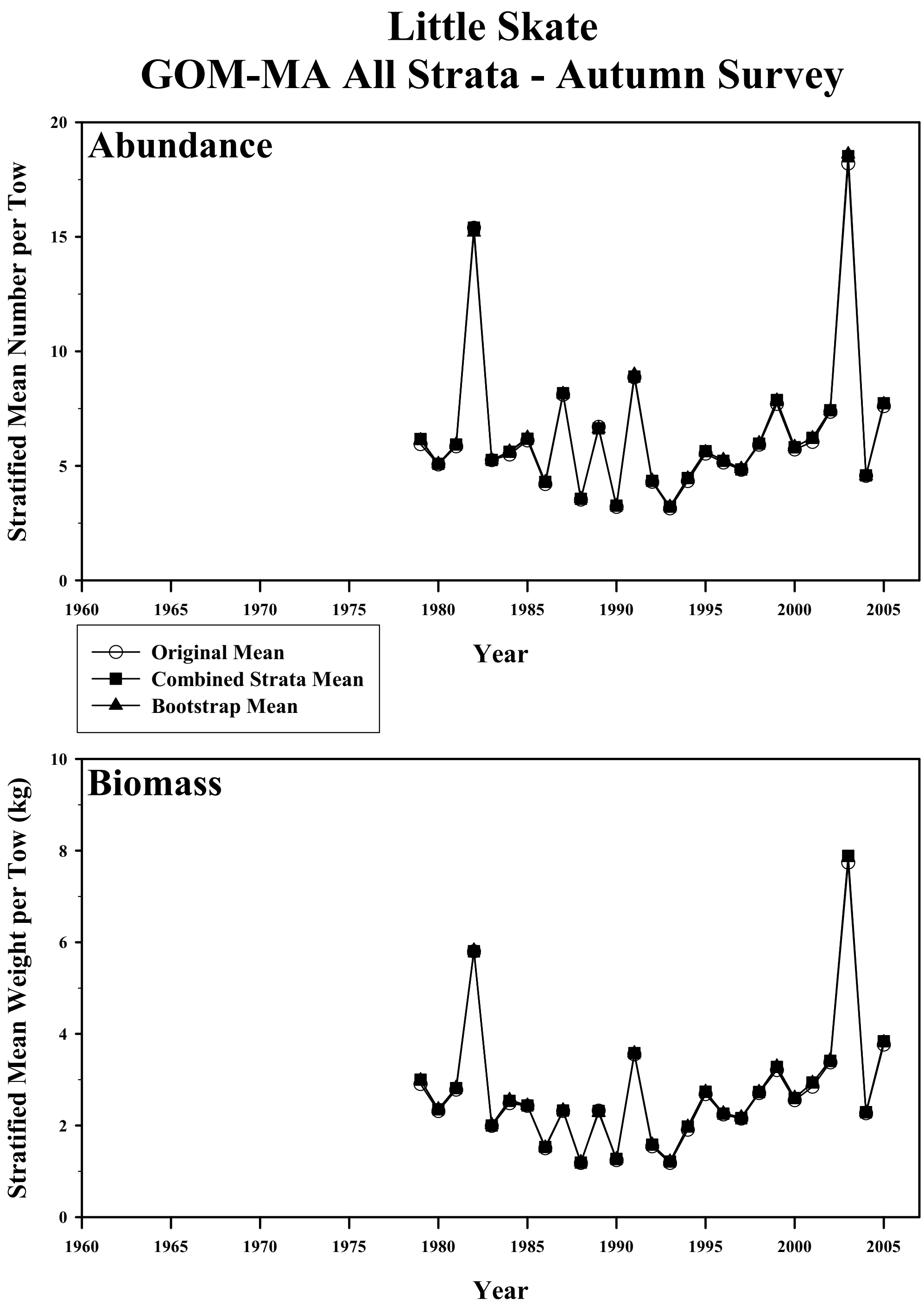


Figure B2.34. Abundance and biomass of little skate from the NESFC autumn bottom trawl surveys from 1979-2005 in the Gulf of Maine to Mid-Atlantic (all strata). The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

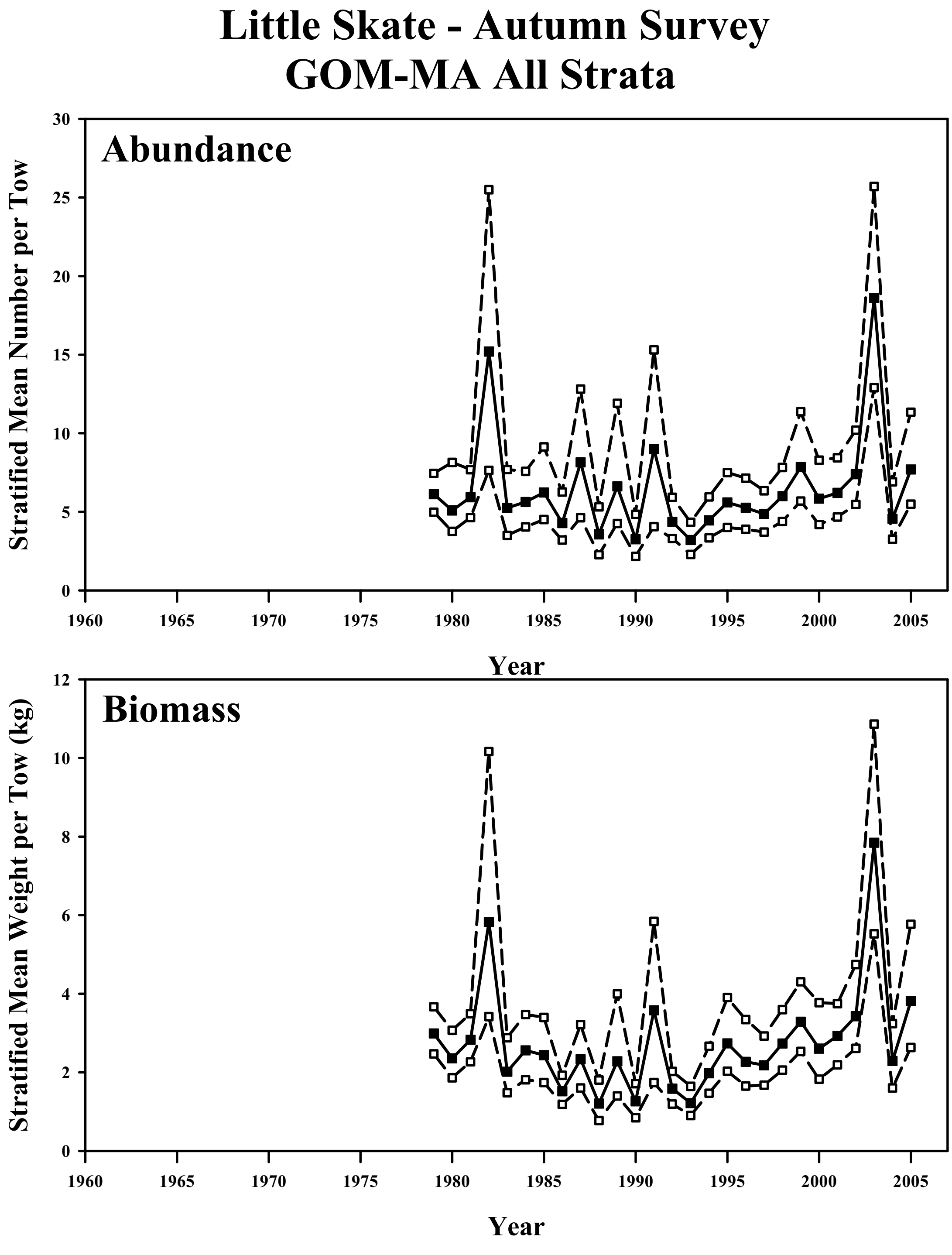


Figure B2.35. Bootstrapped abundance and biomass of little skate from the NESFC autumn bottom trawl survey in the Gulf of Maine to Mid-Atlantic region (all strata). Mean index in solid squares, 95% confidence interval in open squares.

Little Skate: GOM-MA All strata
Percentiles of Length Composition

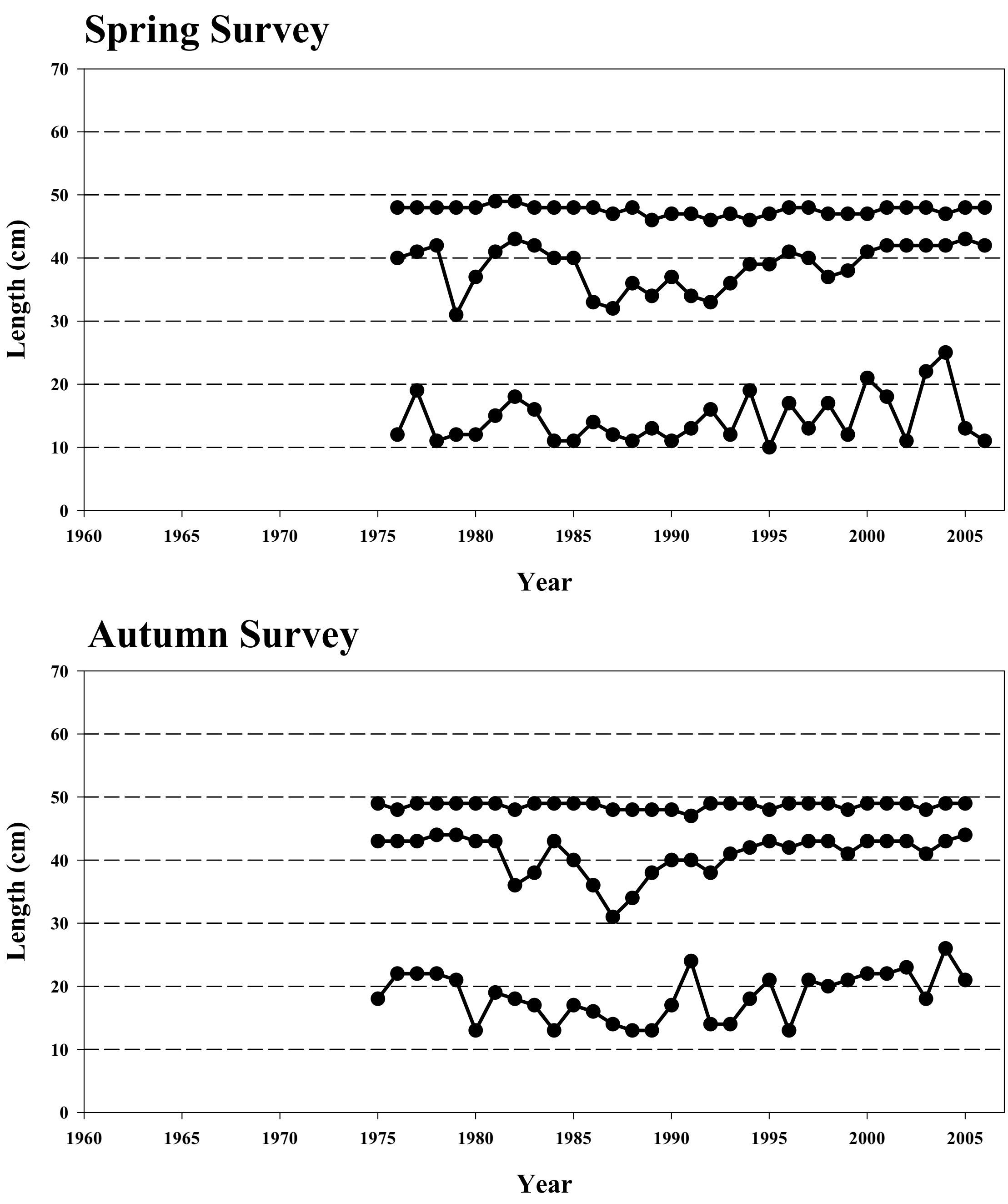


Figure B2.36. Percentiles of length composition (5, 50, and 95) of little skate from the NESFC spring and autumn bottom trawl surveys from 1975-2006 in the Gulf of Maine to Mid-Atlantic region (all strata).

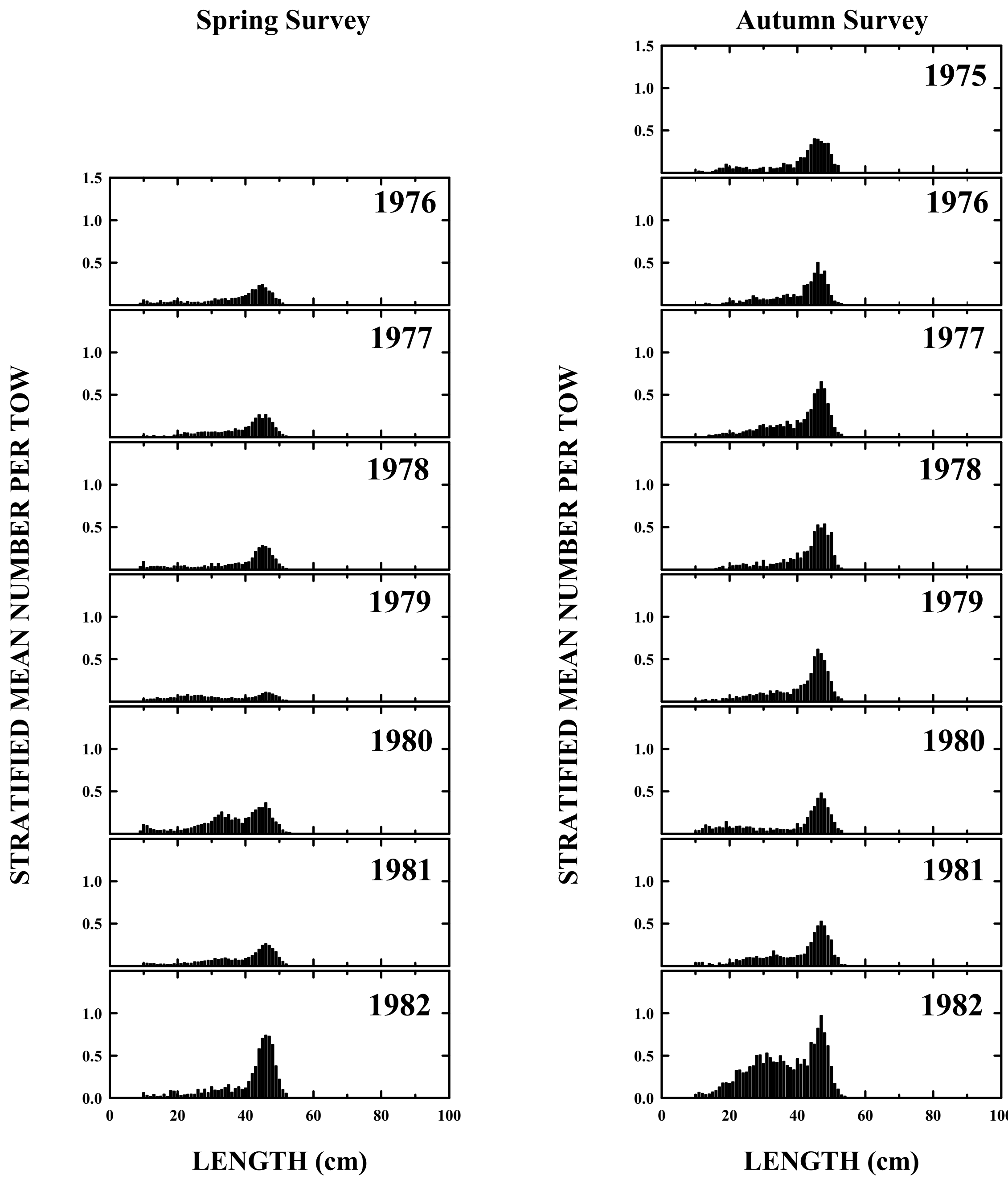


Figure B2.37. Little skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic (all strata), 1975-1982.

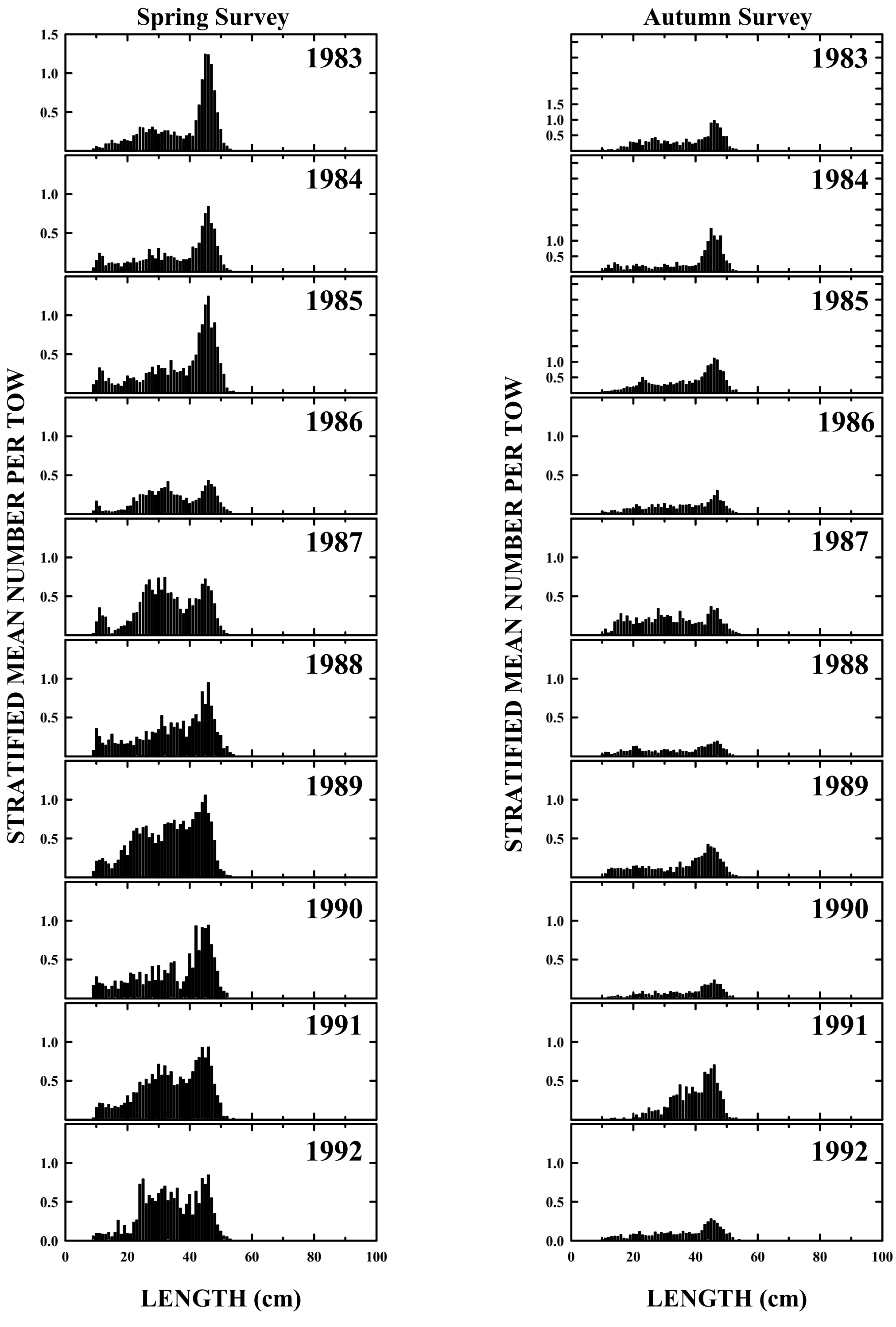


Figure B2.38. Little skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic (all strata), 1983-1992.

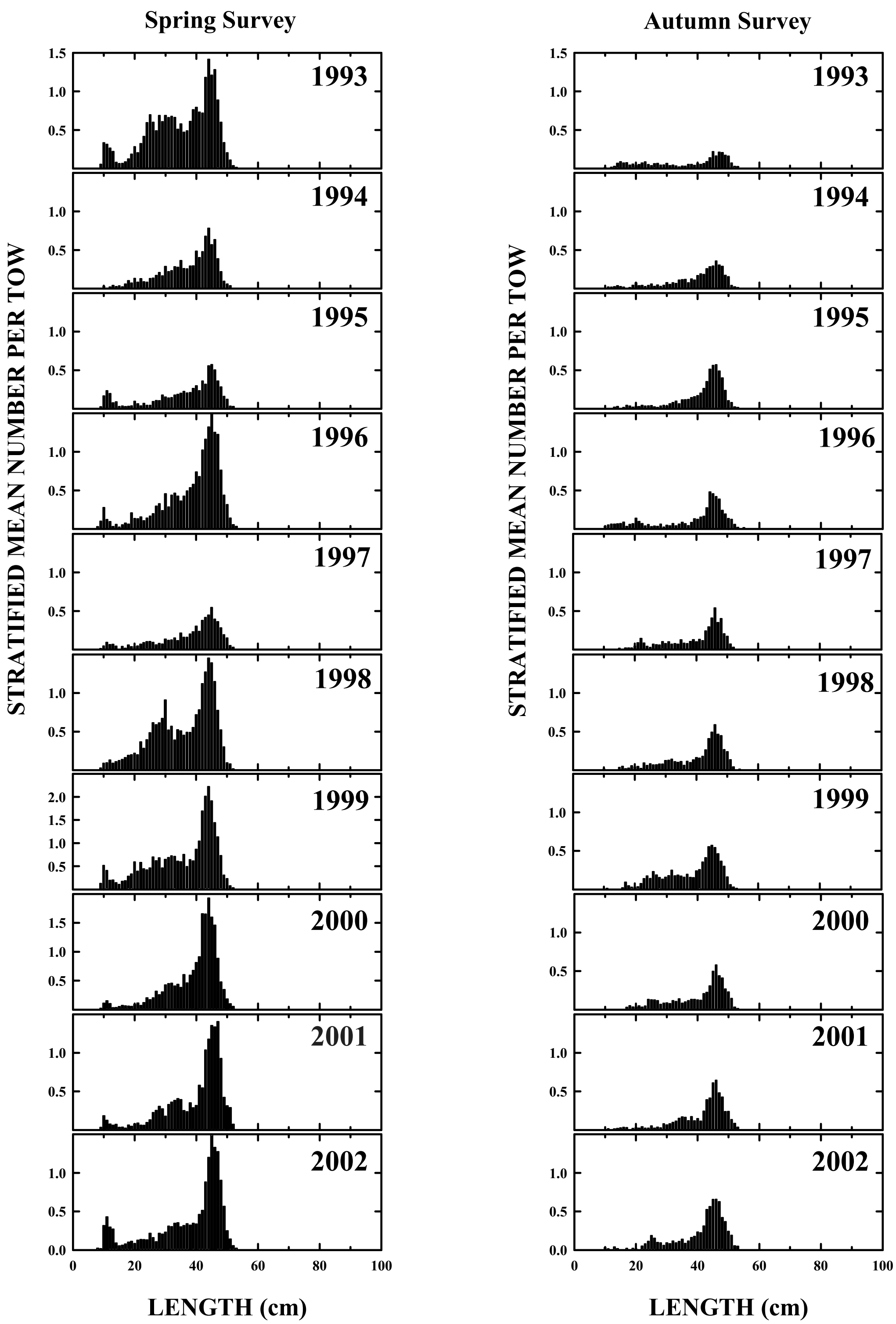


Figure B2.39. Little skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic (all strata), 1993-2002.

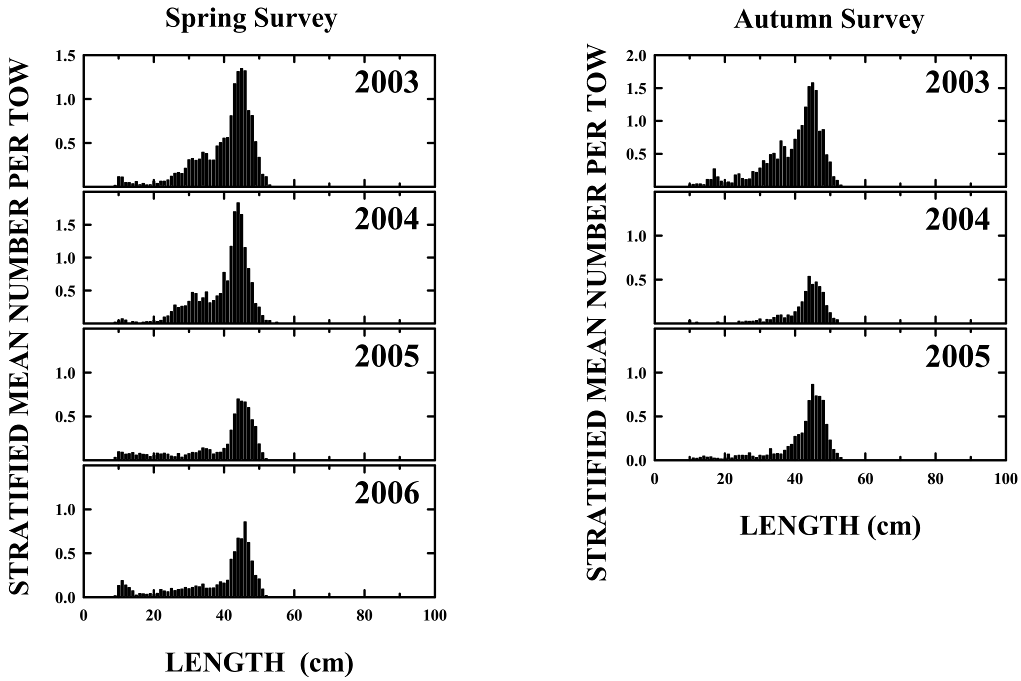


Figure B2.40. Little skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Mid-Atlantic (all strata), 2003-2006.

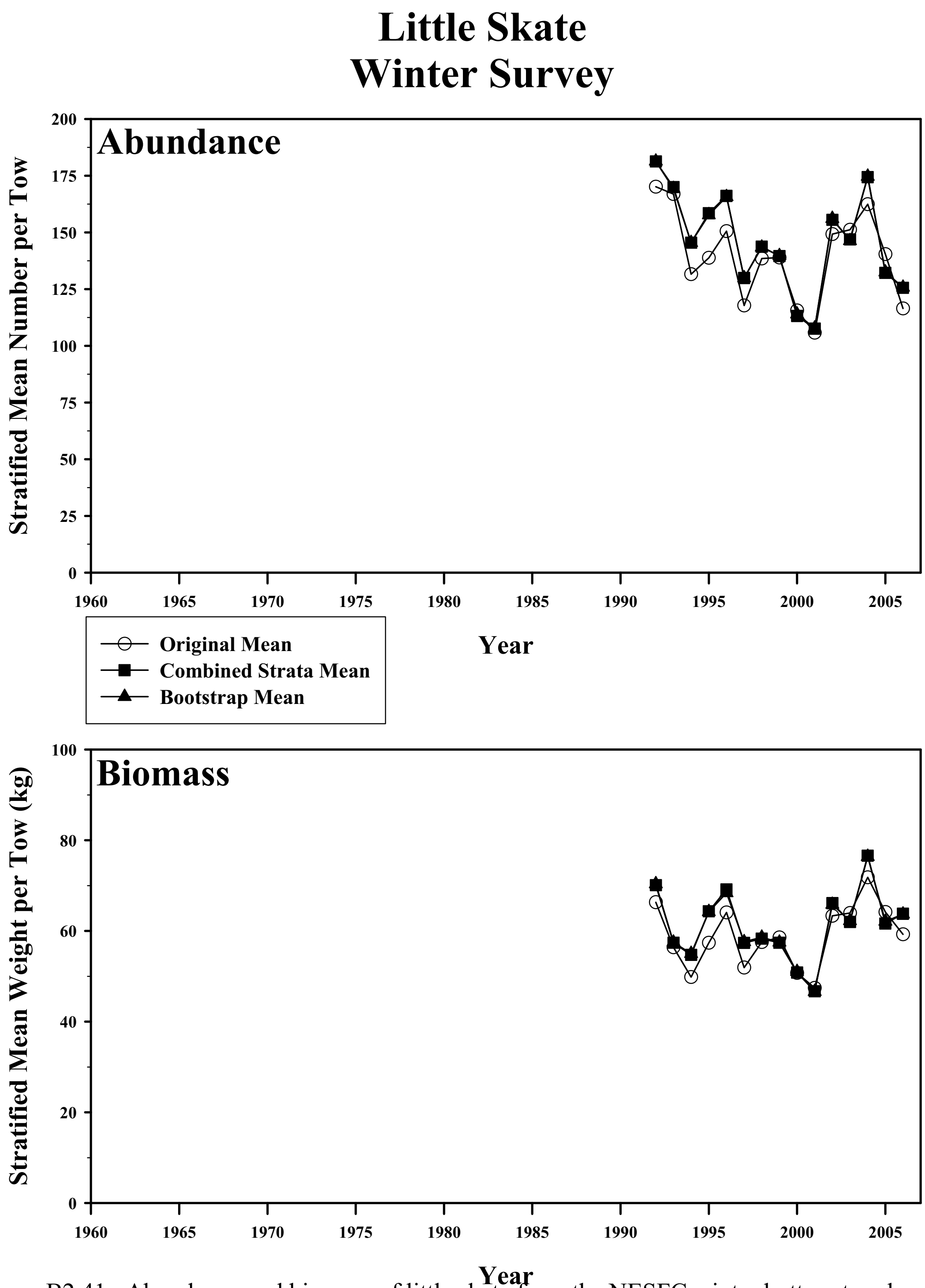


Figure B2.41. Abundance and biomass of little skate from the NESFC winter bottom trawl surveys from 1992-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

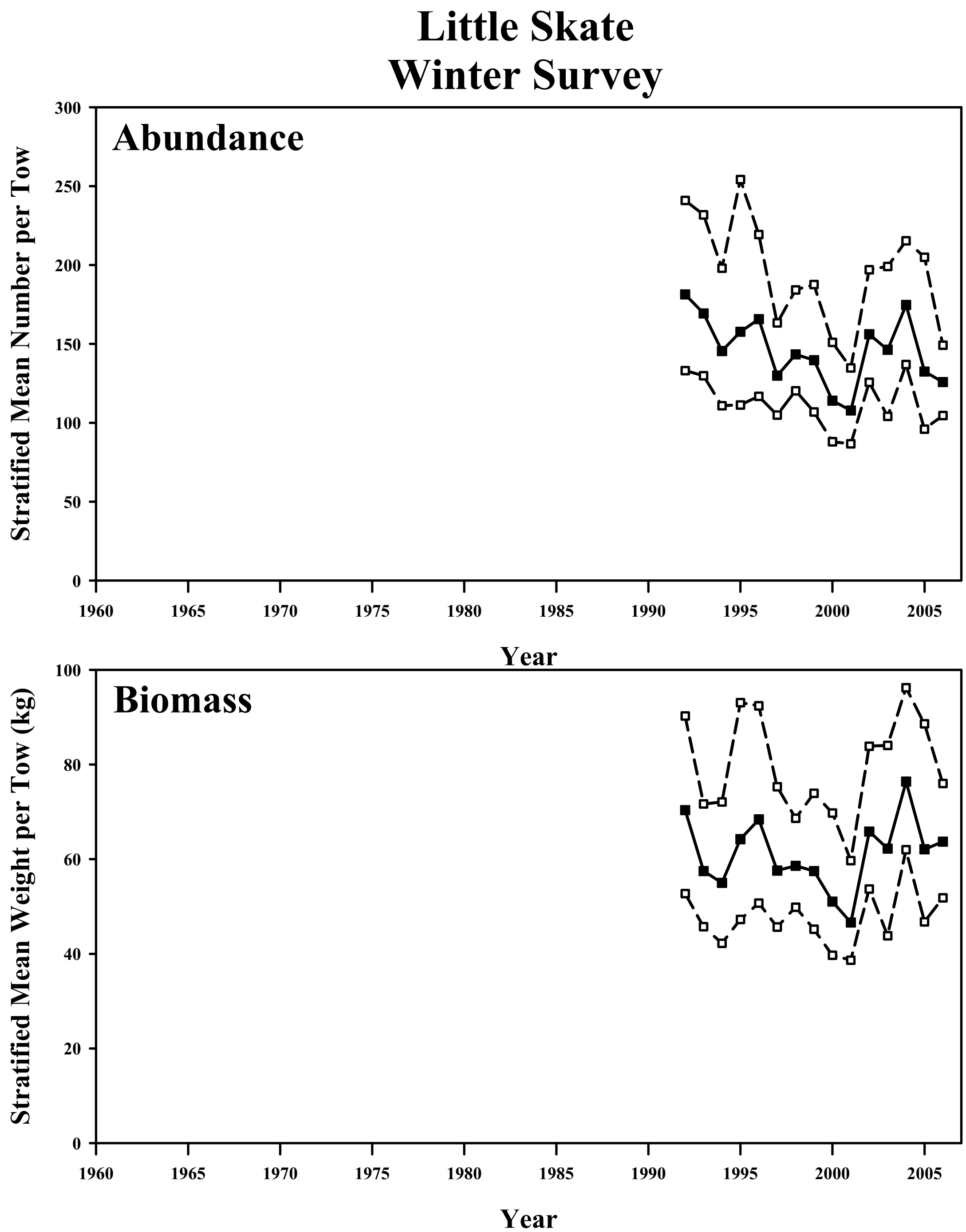


Figure B2.42. Bootstrapped abundance and biomass of little skate from the NESFC winter bottom trawl survey. Mean index in solid squares, 95% confidence interval in open squares.

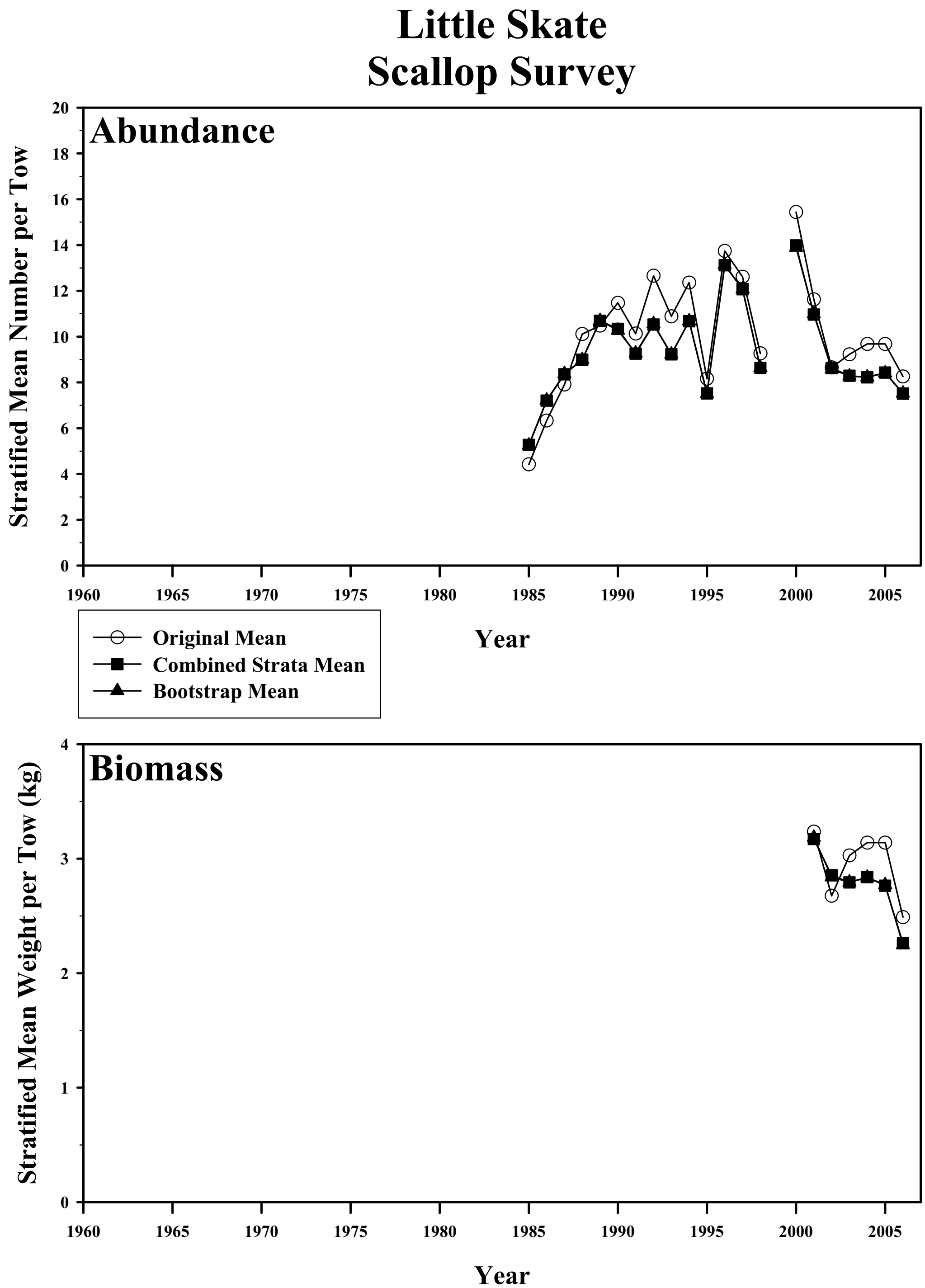


Figure B2.43. Abundance and biomass of little skate from the NESFC scallop surveys from 1985-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

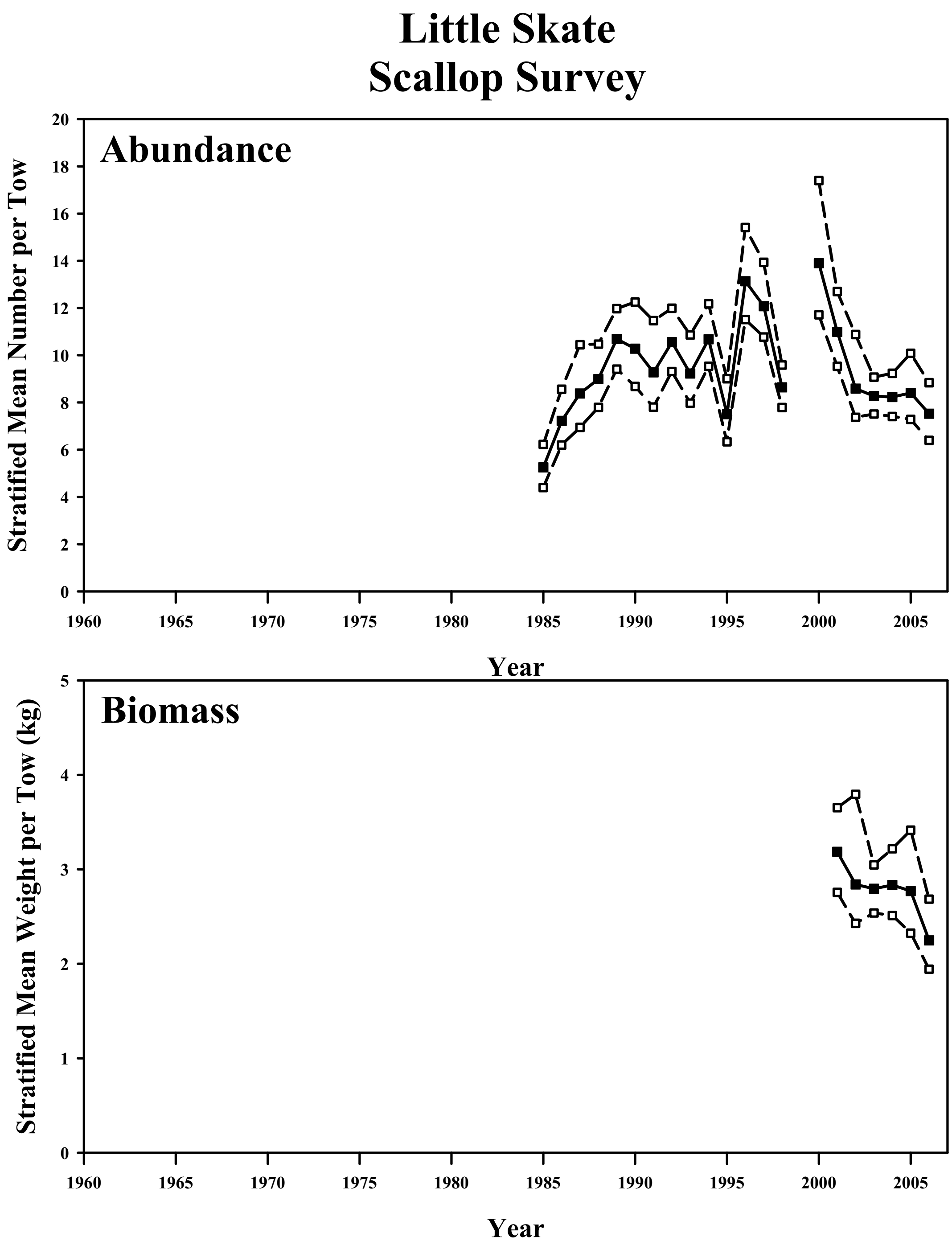


Figure B2.44. Bootstrapped abundance and biomass of little skate from the NESFC scallop survey. Mean index in solid squares, 95% confidence interval in open squares.

Little Skate - Massachusetts Trawl Survey

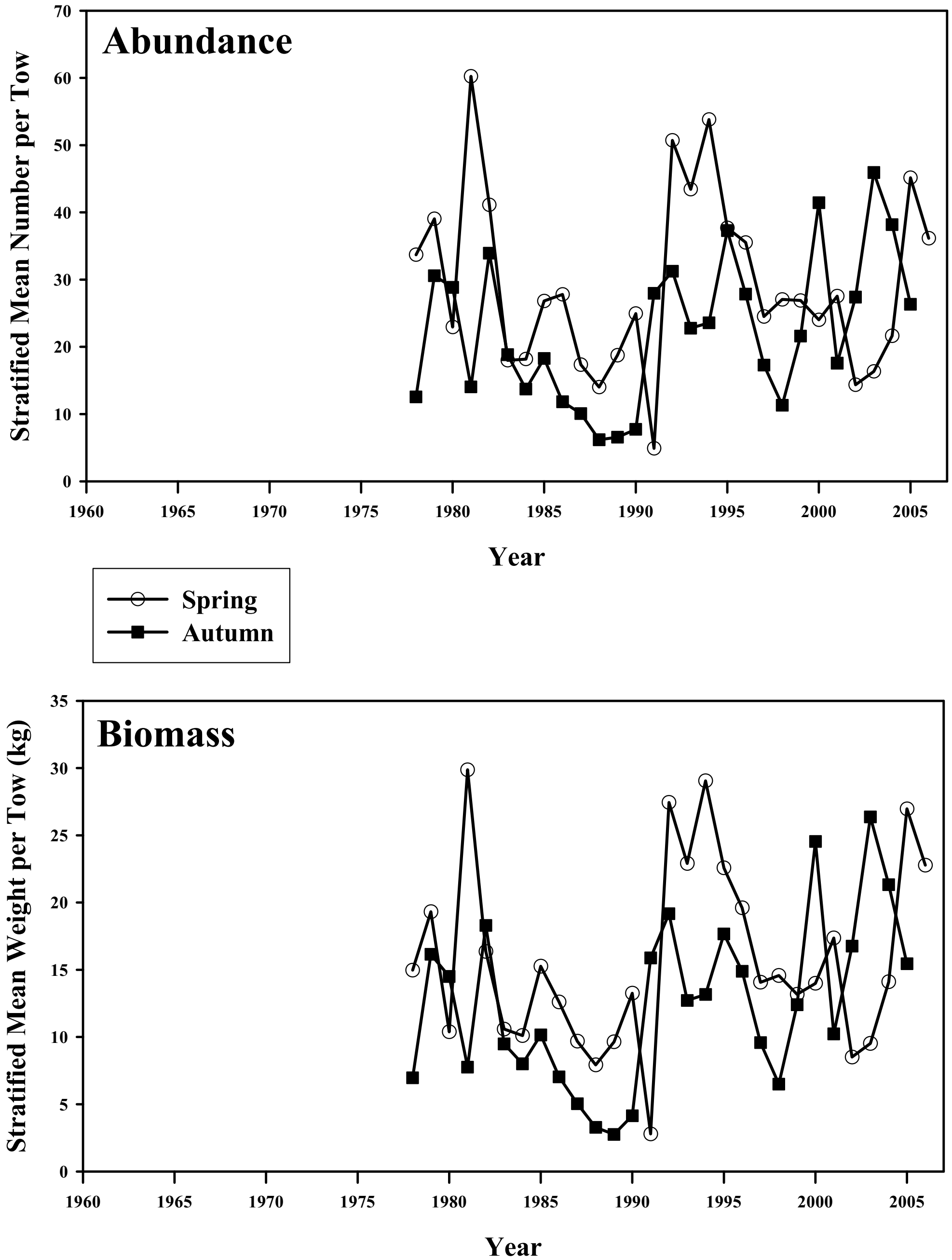


Figure 2.45. Abundance and biomass of little skate from the Massachusetts spring and autumn finfish bottom trawl survey in state waters (strata 11-36).

Little Skate - CTDEP Finfish Survey

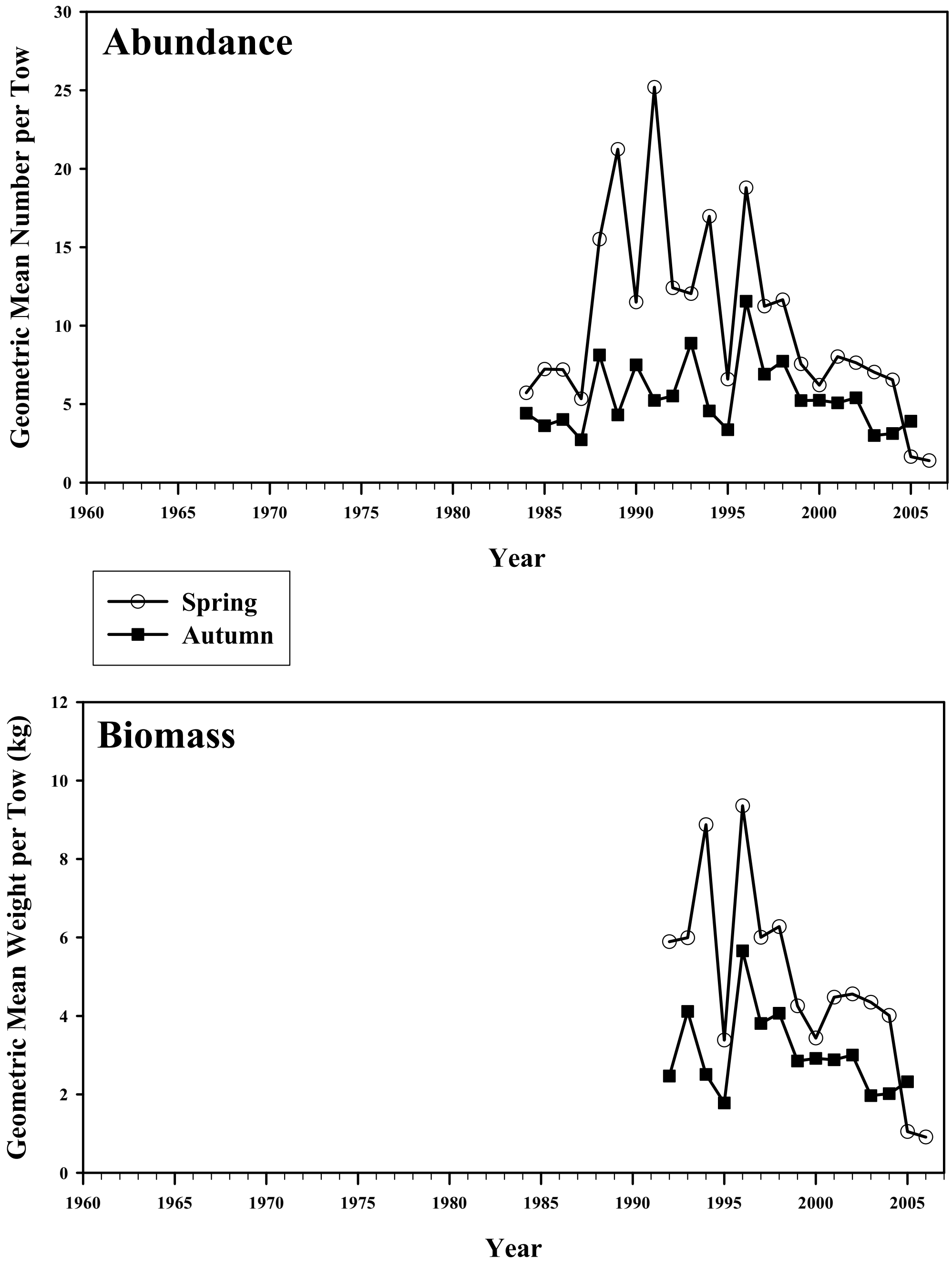


Figure B2.46. Abundance and biomass of little skate from the CTDEP spring and autumn finfish bottom trawl survey in Connecticut state waters, 1984-2006.

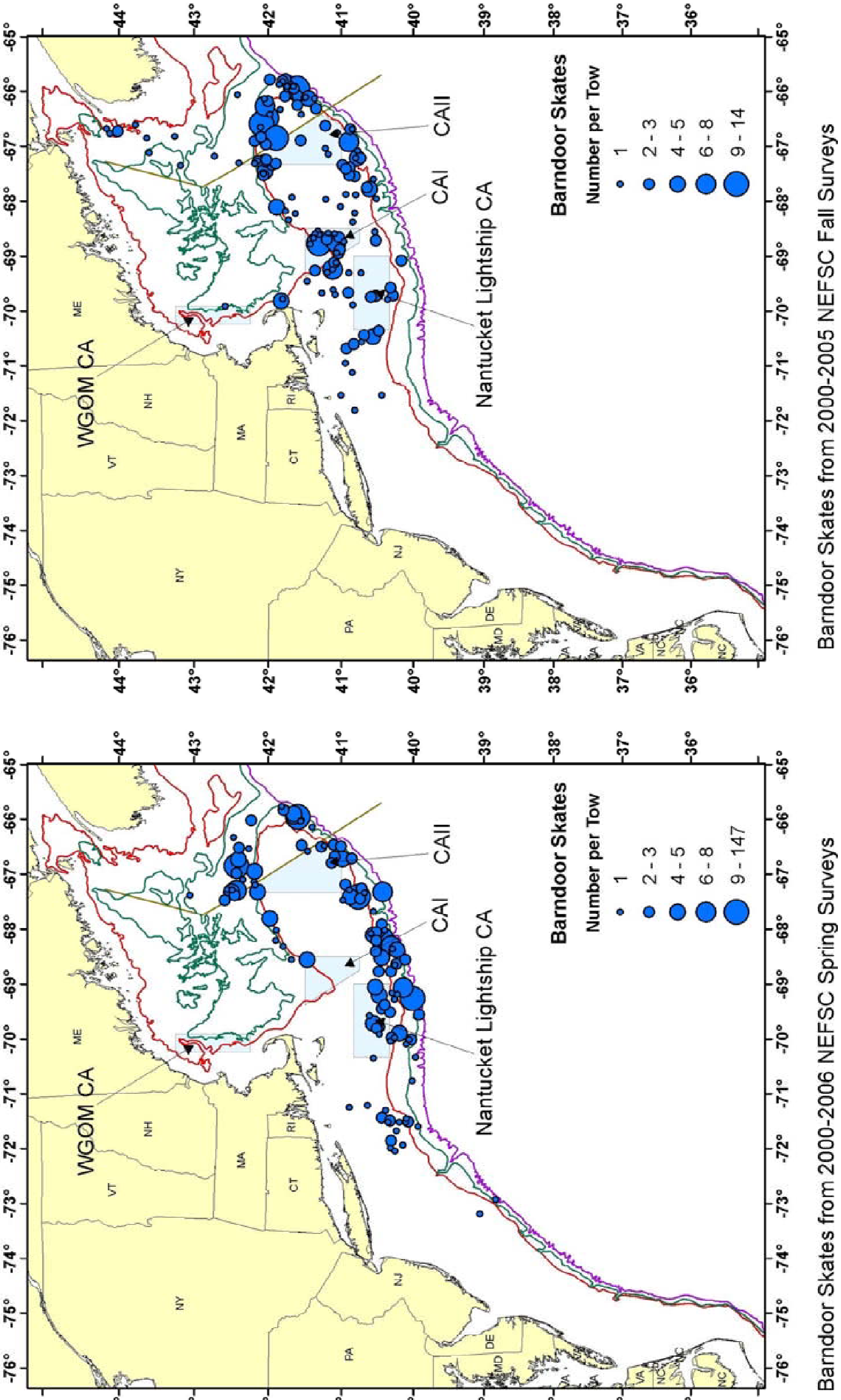


Figure B2.47. Distribution of barndoor skate from the spring and autumn NEFSC surveys from 2000-2006.

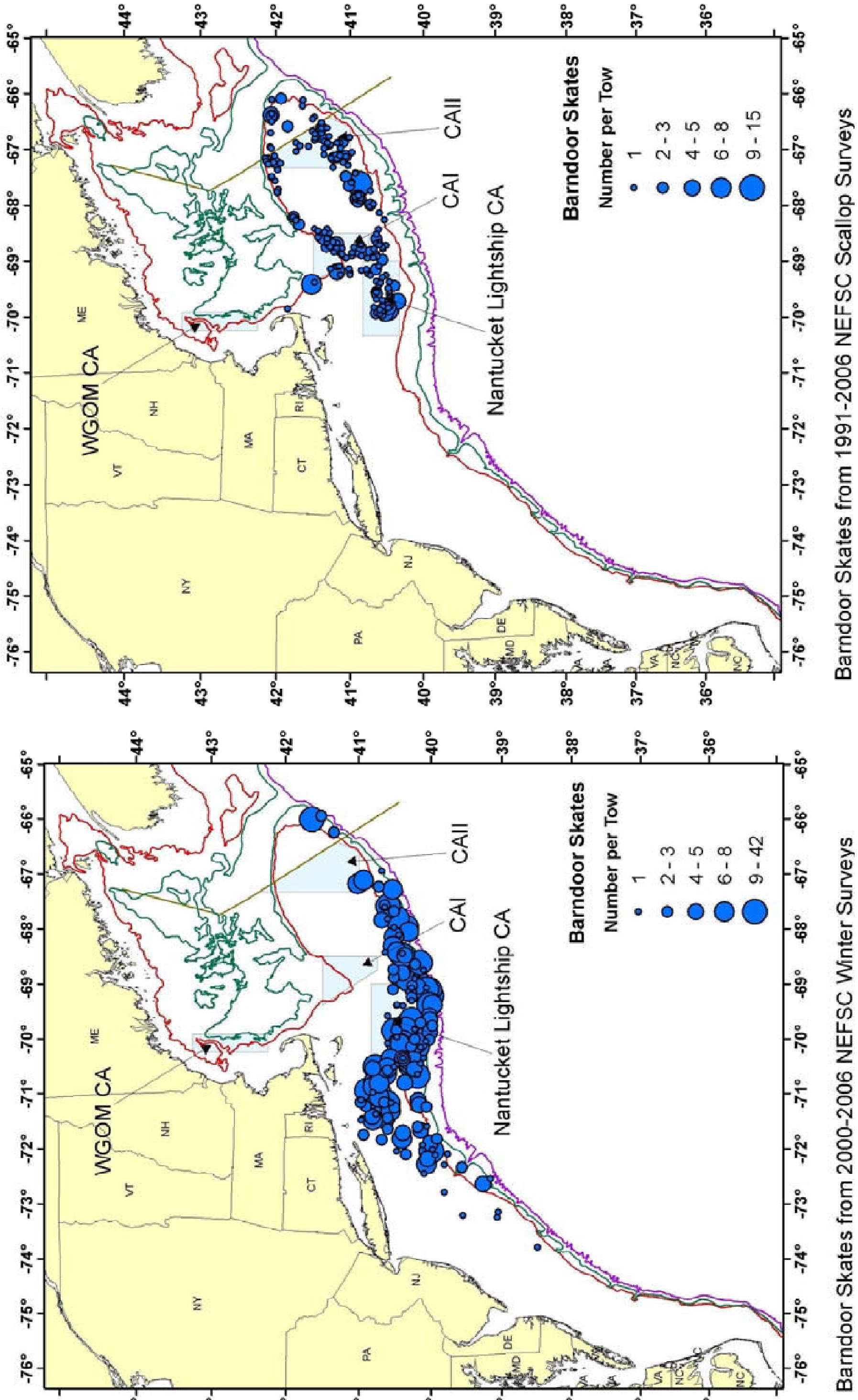


Figure B2.48. Distribution of barndoor skate from the winter NEFSC surveys from 2000-2006 and the NEFSC scallop surveys from 1991-2006.

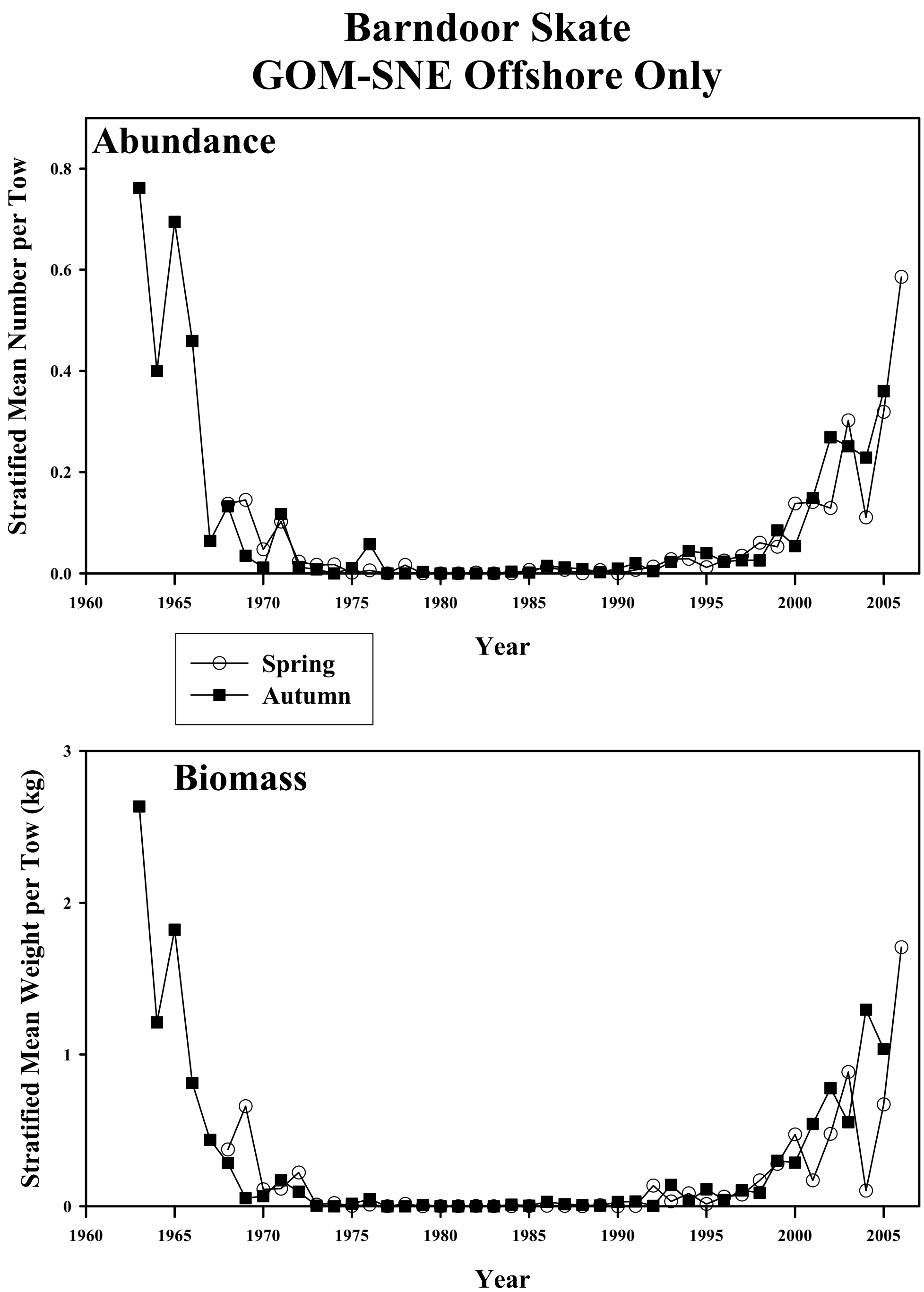


Figure B2.49. Abundance and biomass of barndoor skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region.

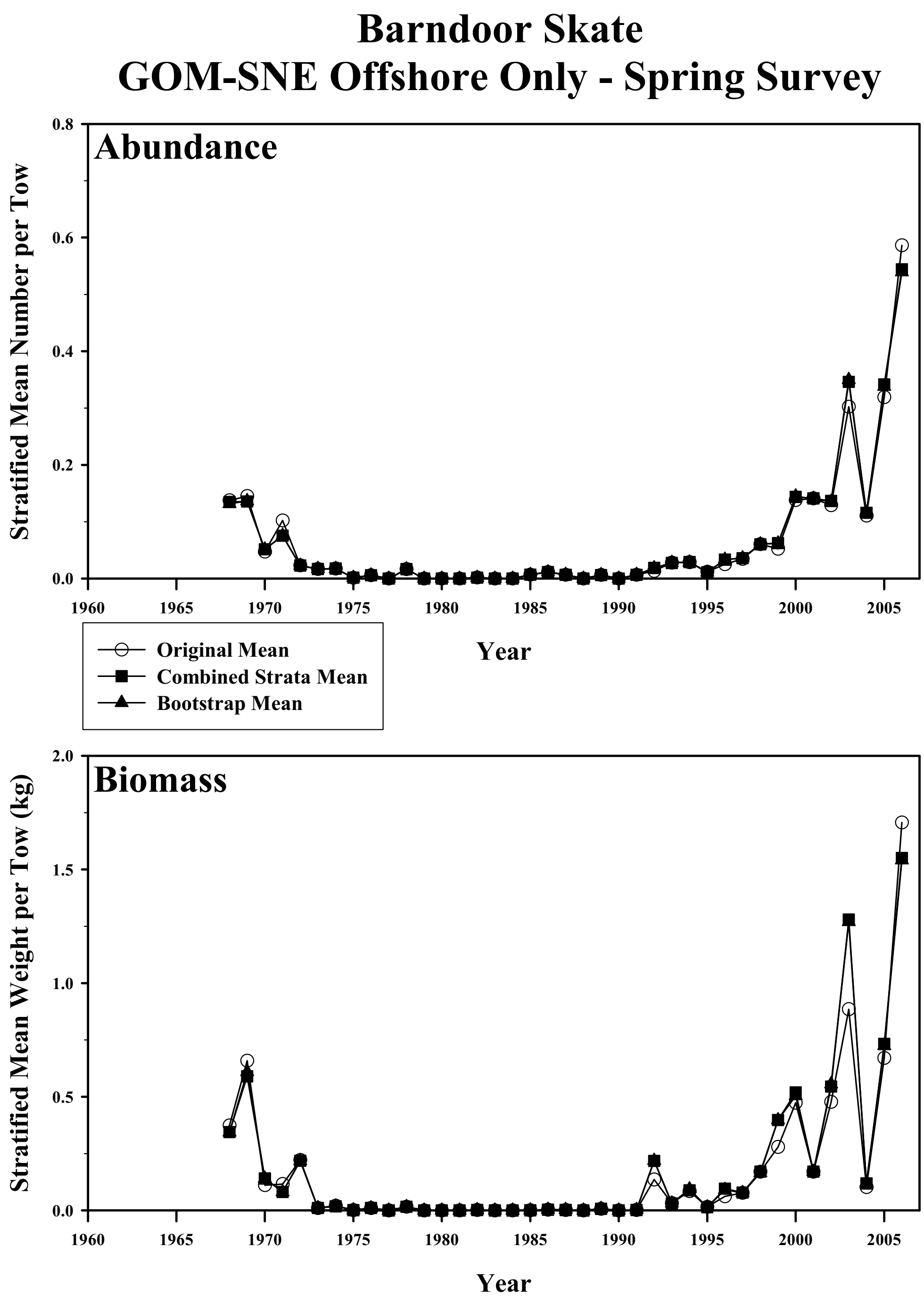


Figure B2.50. Abundance and biomass of barndoor skate from the NESFC spring bottom trawl surveys from 1968-2006 in the Gulf of Maine to Southern New England offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

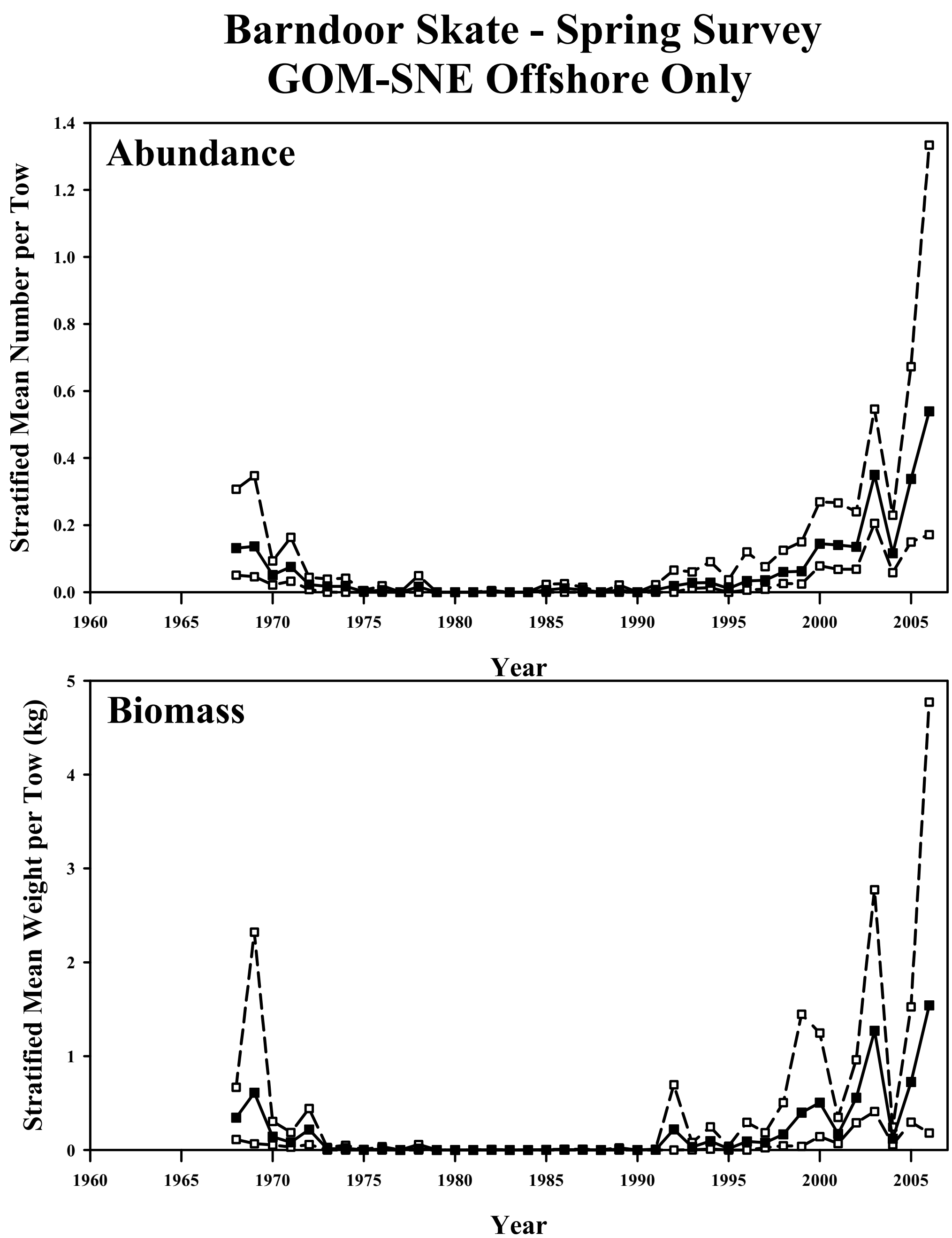


Figure B2.51. Bootstrapped abundance and biomass of barndoor skate from the NESFC spring bottom trawl survey in the Gulf of Maine to Southern New England offshore region. Mean index in solid squares, 95% confidence interval in open squares.

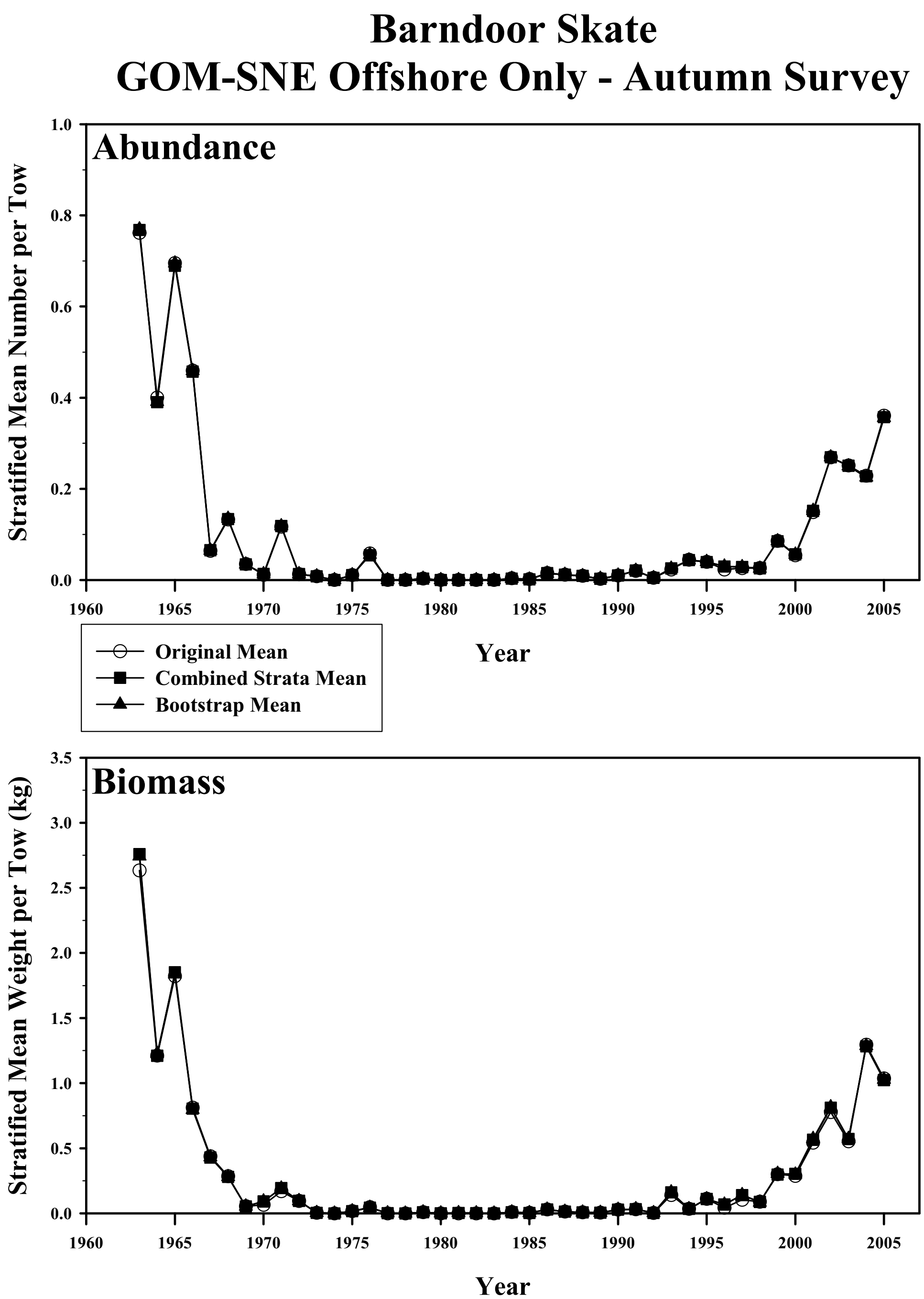


Figure B2.52. Abundance and biomass of barndoor skate from the NESFC autumn bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

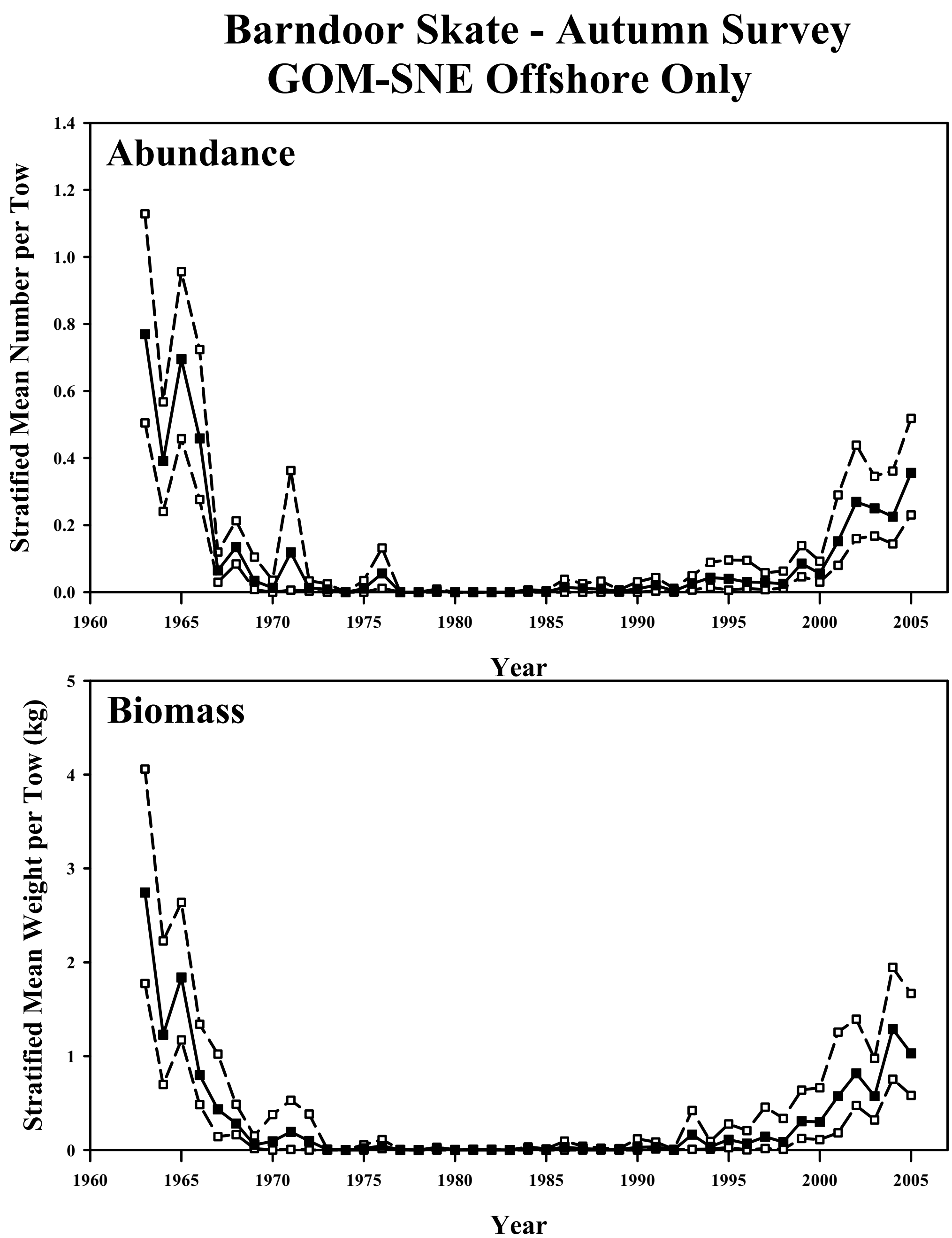


Figure B2.53. Bootstrapped abundance and biomass of barndoor skate from the NESFC autumn bottom trawl survey in the Gulf of Maine to Southern New England offshore region. Mean index in solid squares, 95% confidence interval in open squares.

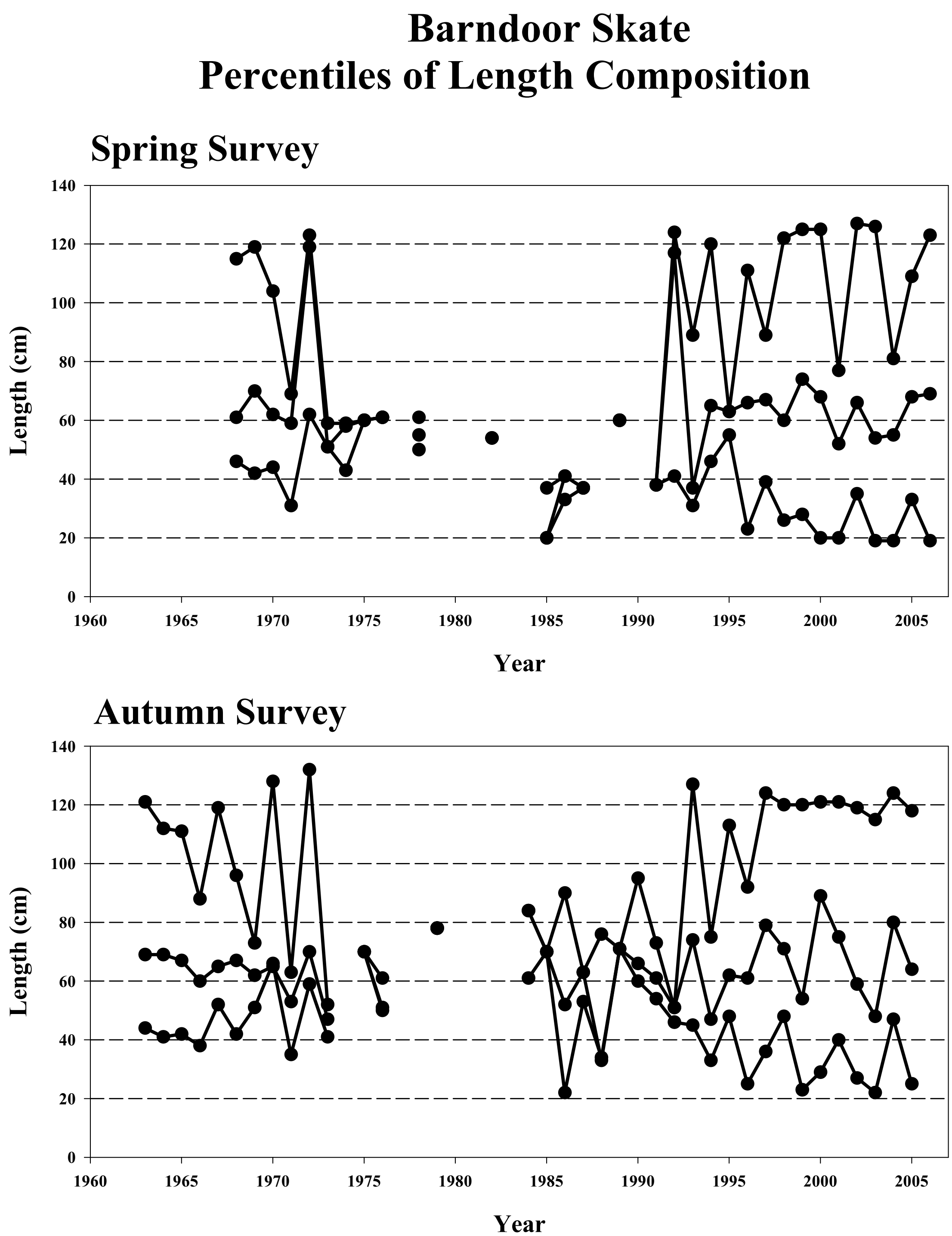


Figure B2.54. Percentiles of length composition (5, 50, and 95) of barndoor skate from the NESFC spring and autumn bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region.

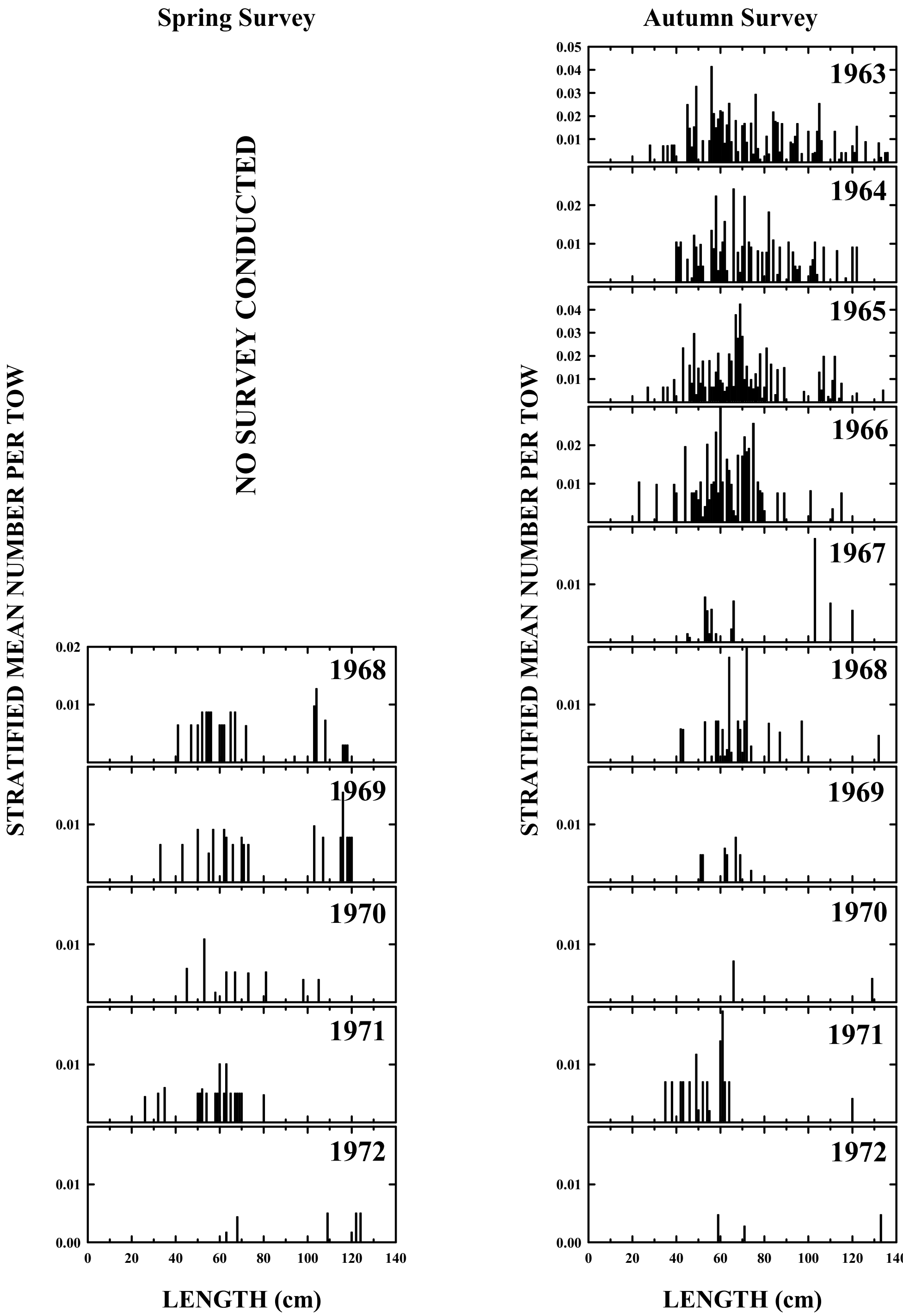


Figure B2.55. Barndoor skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1963-1972.

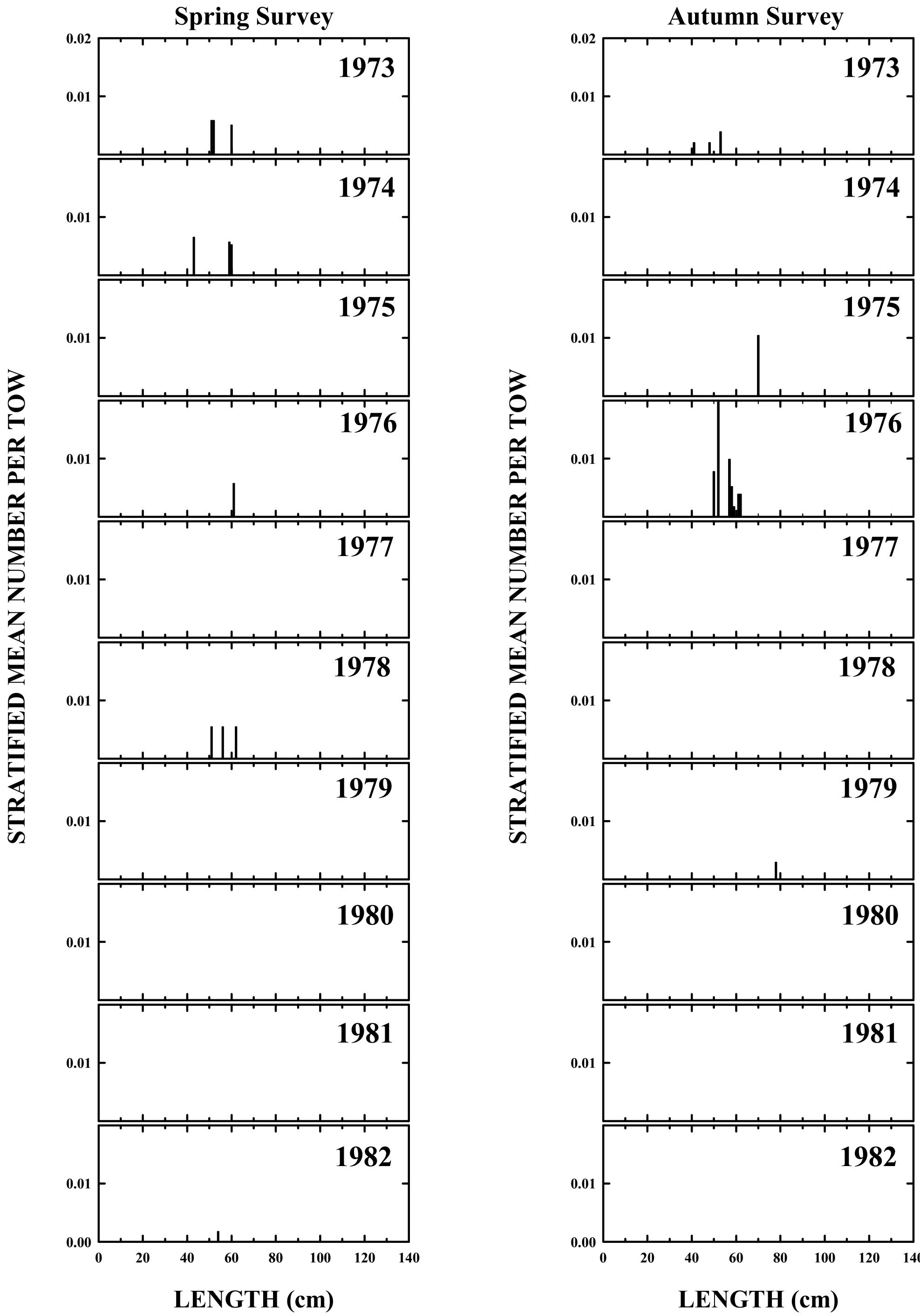


Figure B2.56. Barndoor skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1973-1982.

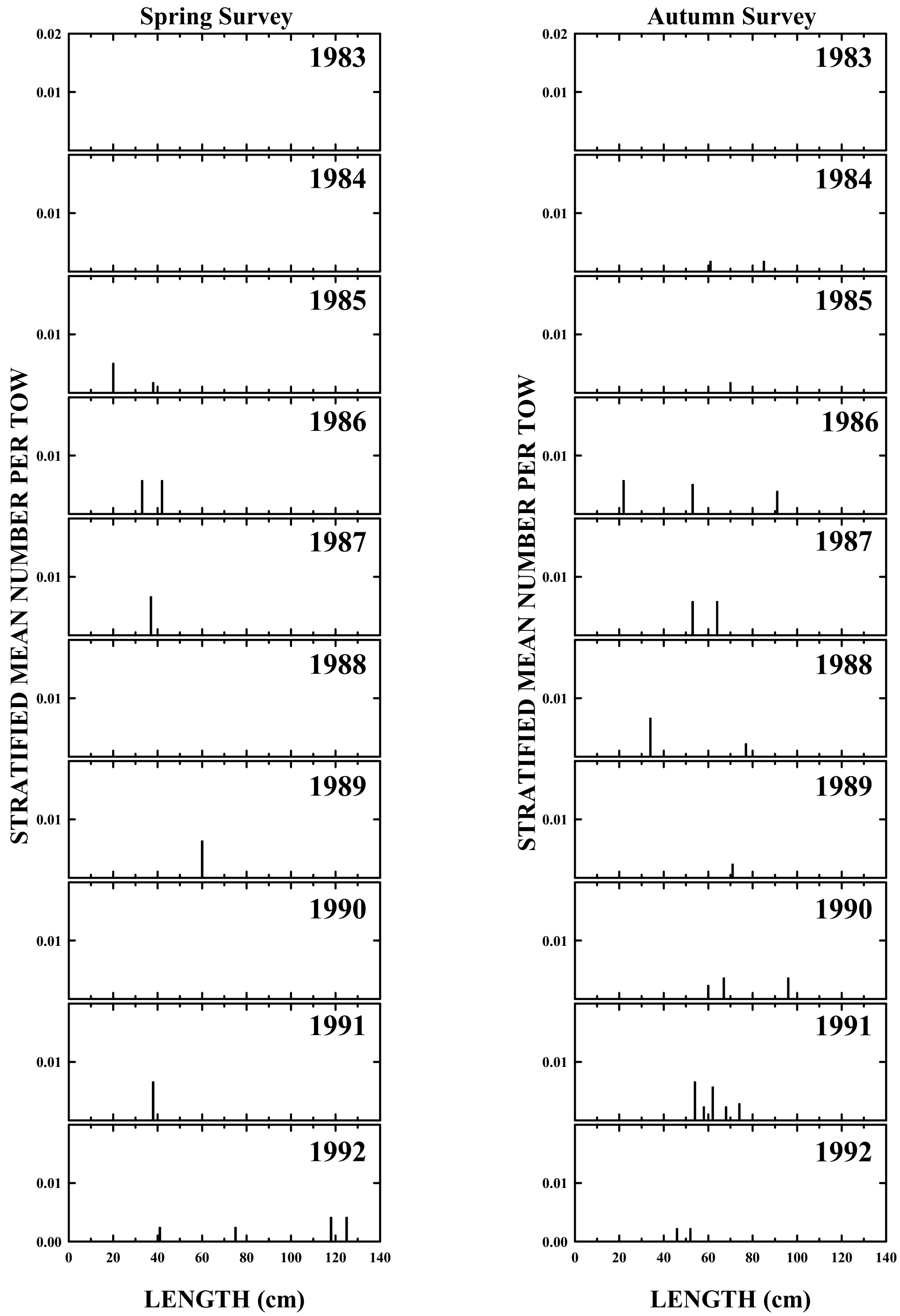


Figure B2.57. Barndoor skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1983-1992.

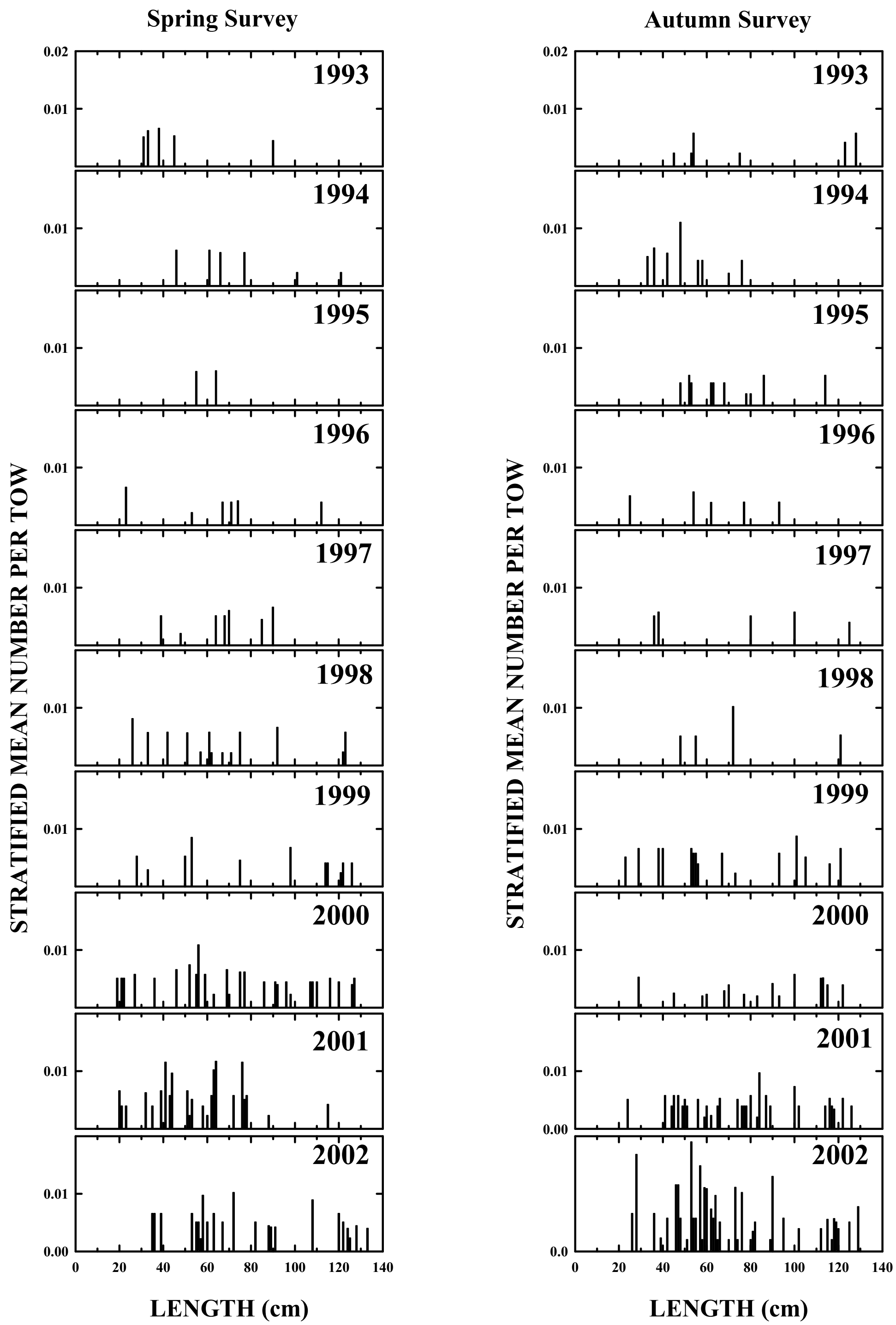


Figure B2.58. Barndoor skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1993-2002.

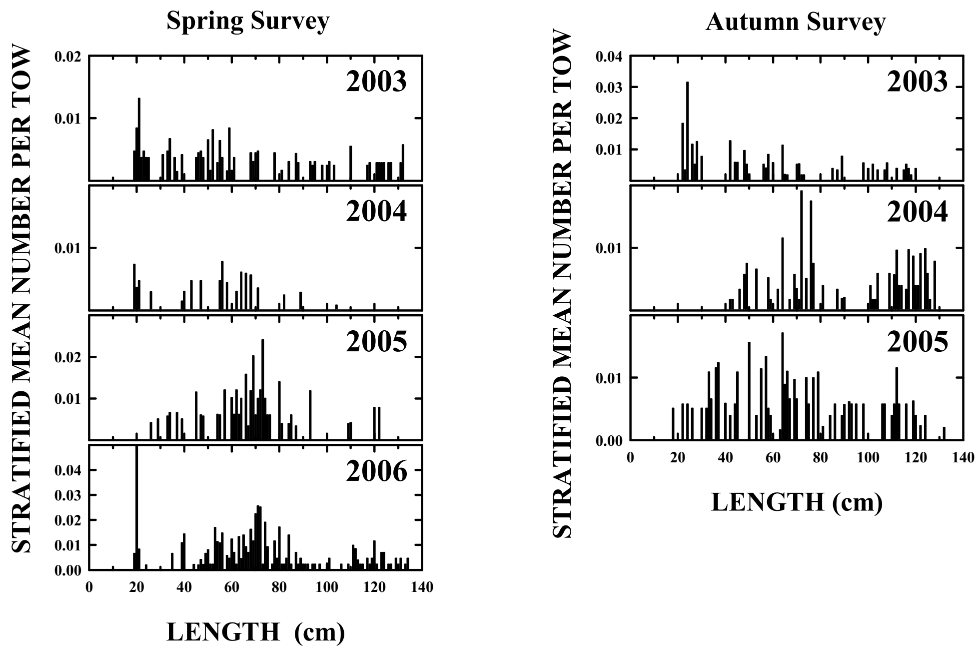


Figure B2.59. Barndoor skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 2003-2006.

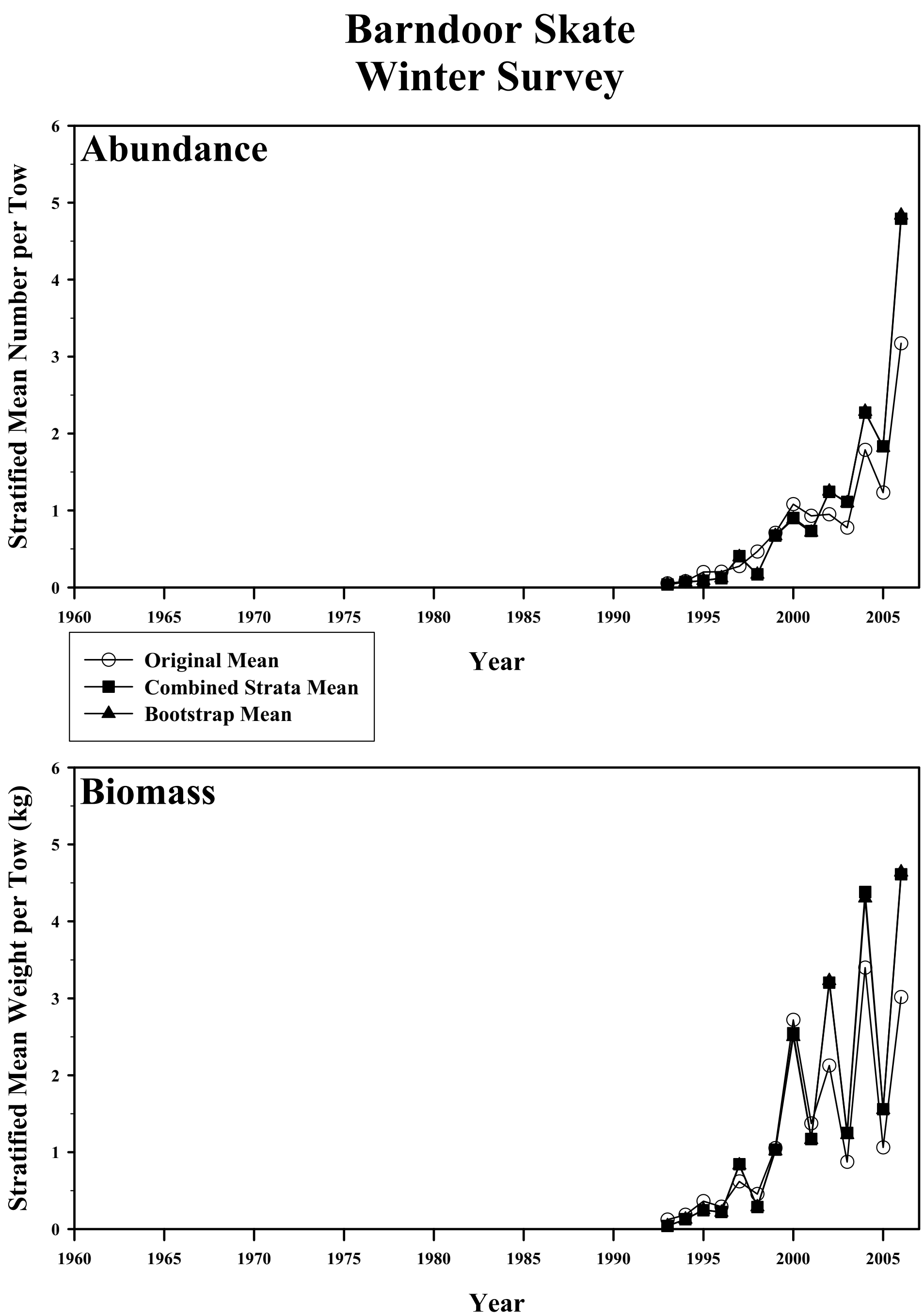


Figure B2.60. Abundance and biomass of barndoor skate from the NESFC winter bottom trawl surveys from 1993-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

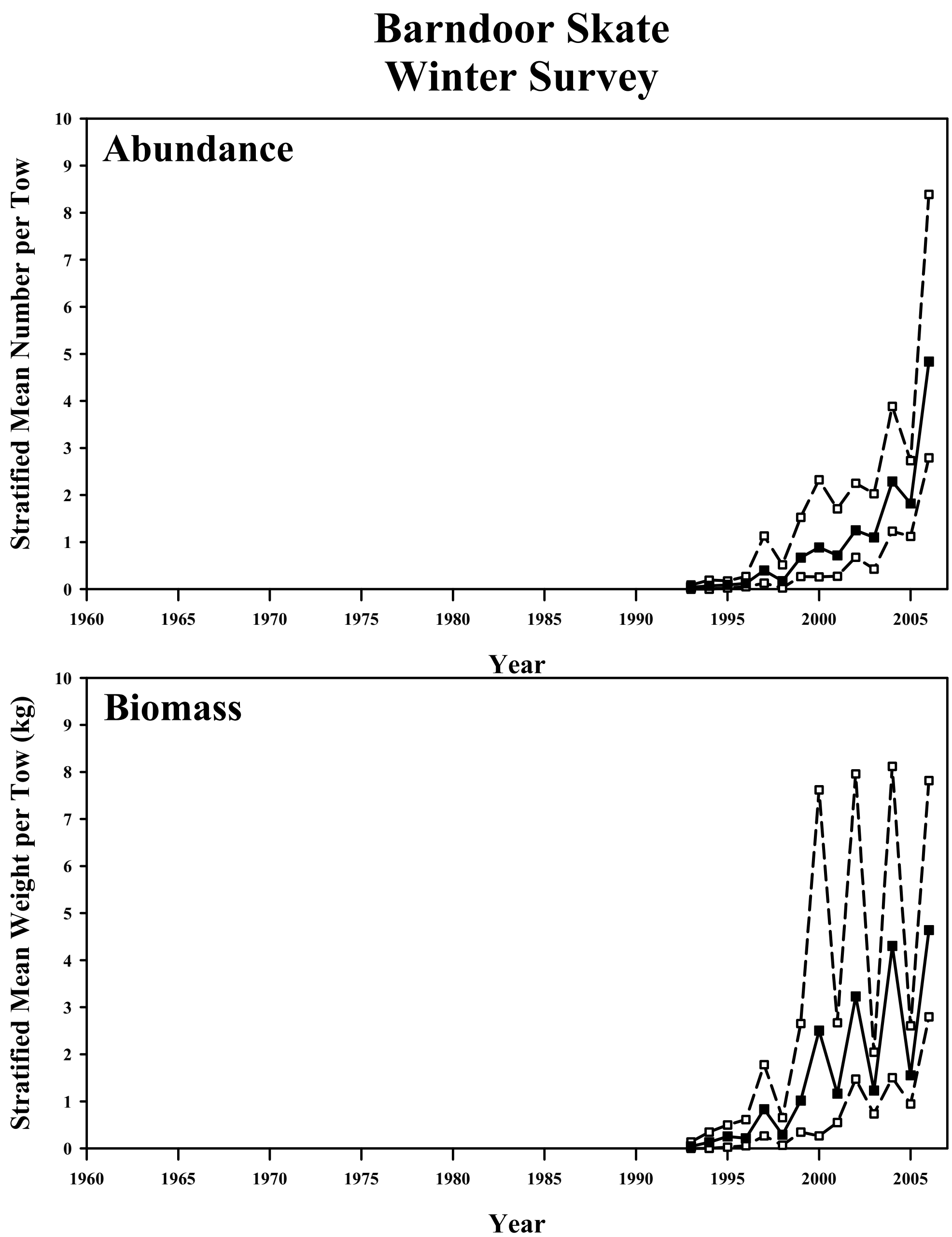


Figure B2.61. Bootstrapped abundance and biomass of barndoor skate from the NESFC winter bottom trawl survey. Mean index in solid squares, 95% confidence interval in open squares.

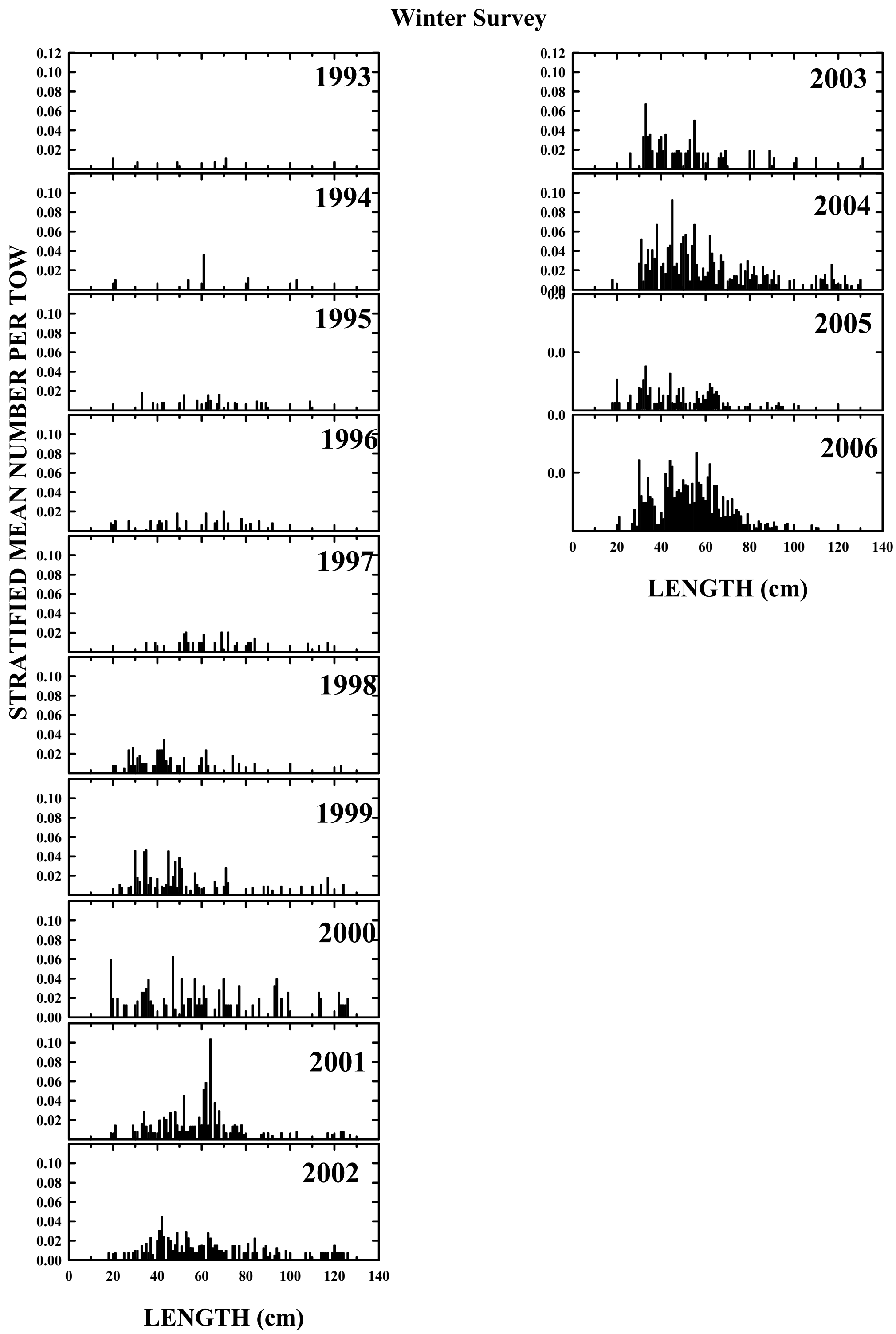


Figure B2.62. Barndoor skate length composition from the NEFSC winter flatfish surveys, 1993-2006.

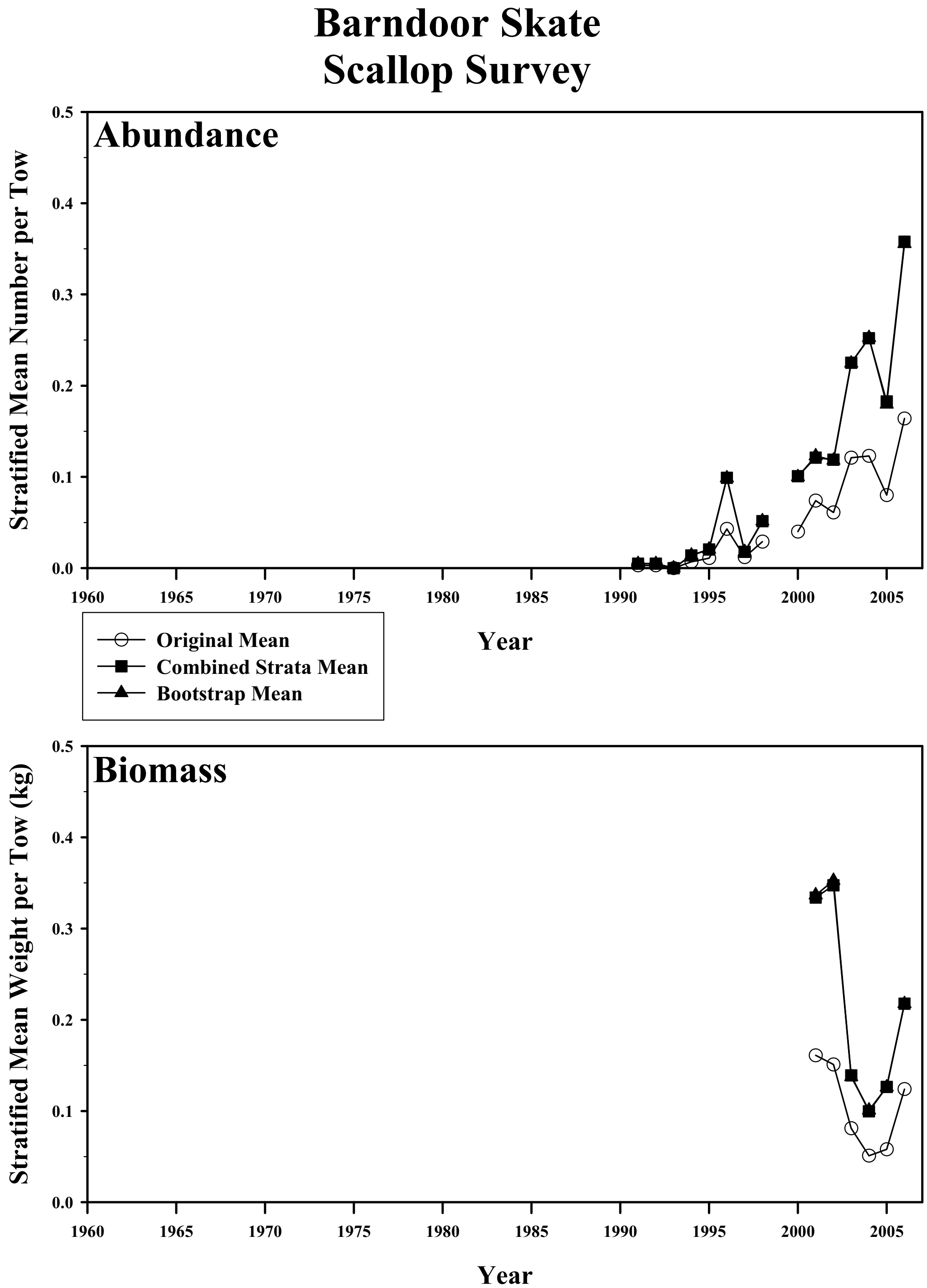


Figure B2.63. Abundance and biomass of barndoor skate from the NESFC scallop surveys from 1991-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

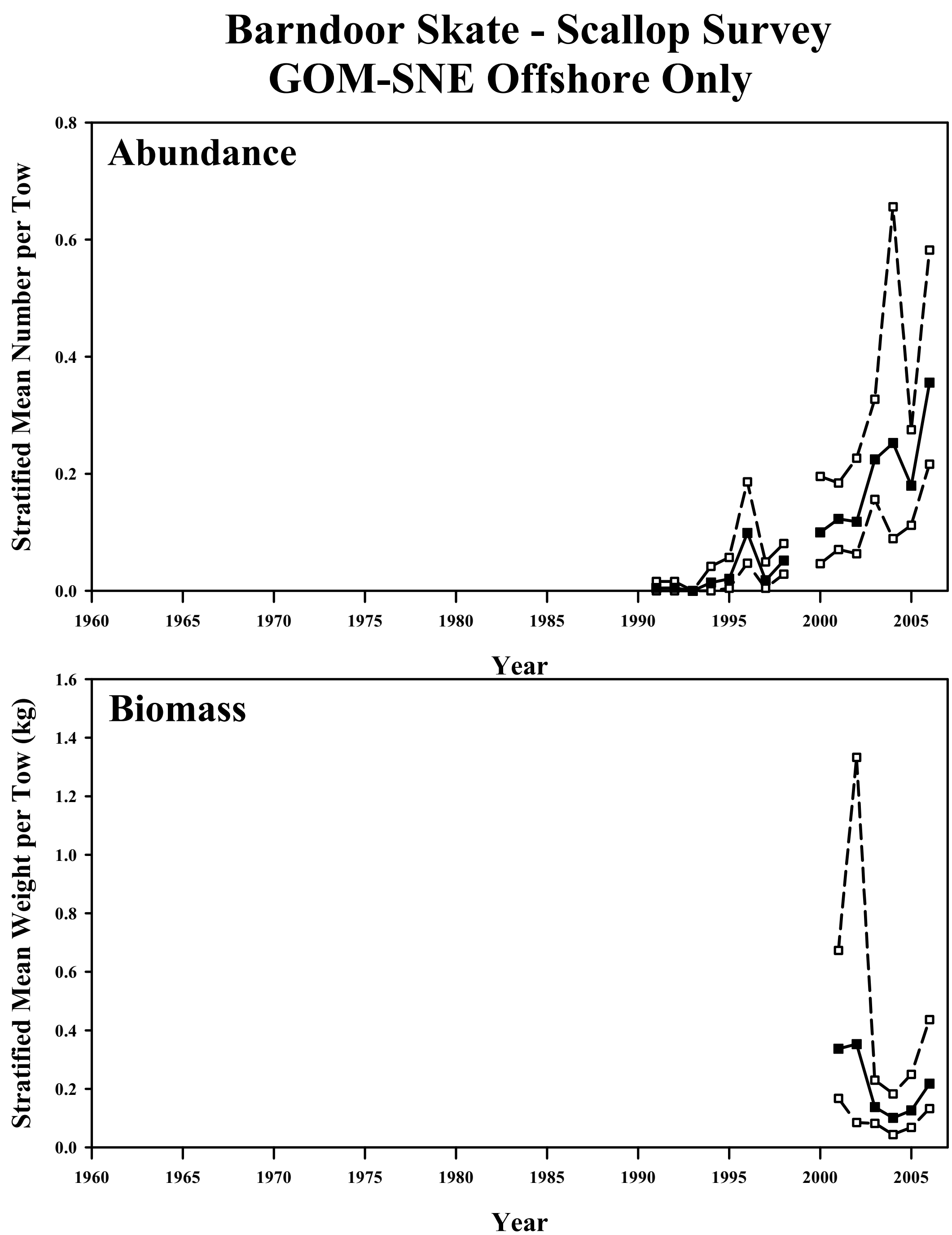


Figure B2.64. Bootstrapped abundance and biomass of barndoor skate from the NESFC scallop survey. Mean index in solid squares, 95% confidence interval in open squares.

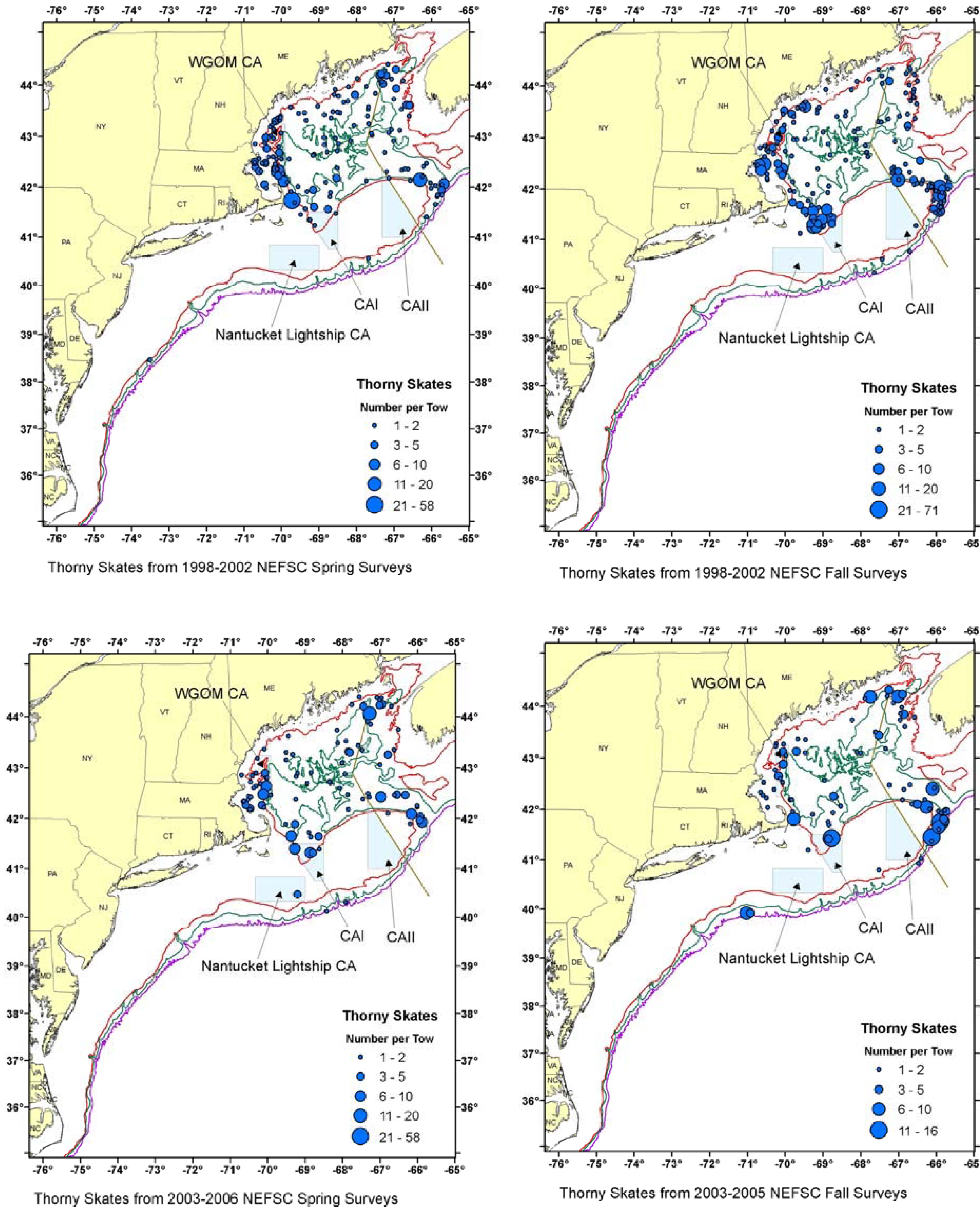
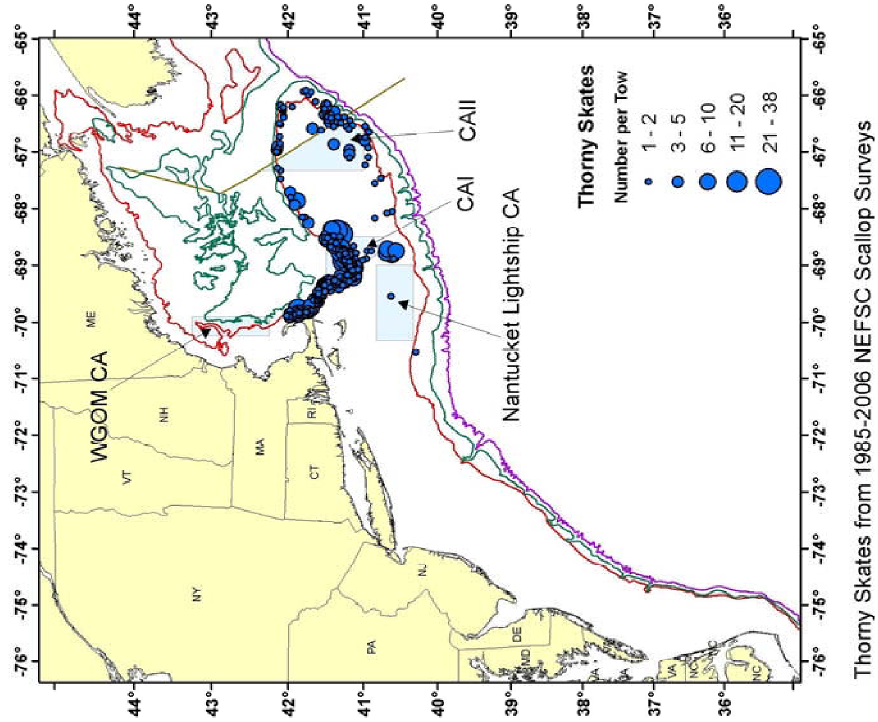


Figure B2.65. Distribution of thorny skate from the spring and autumn NEFSC surveys from 1998-2006.



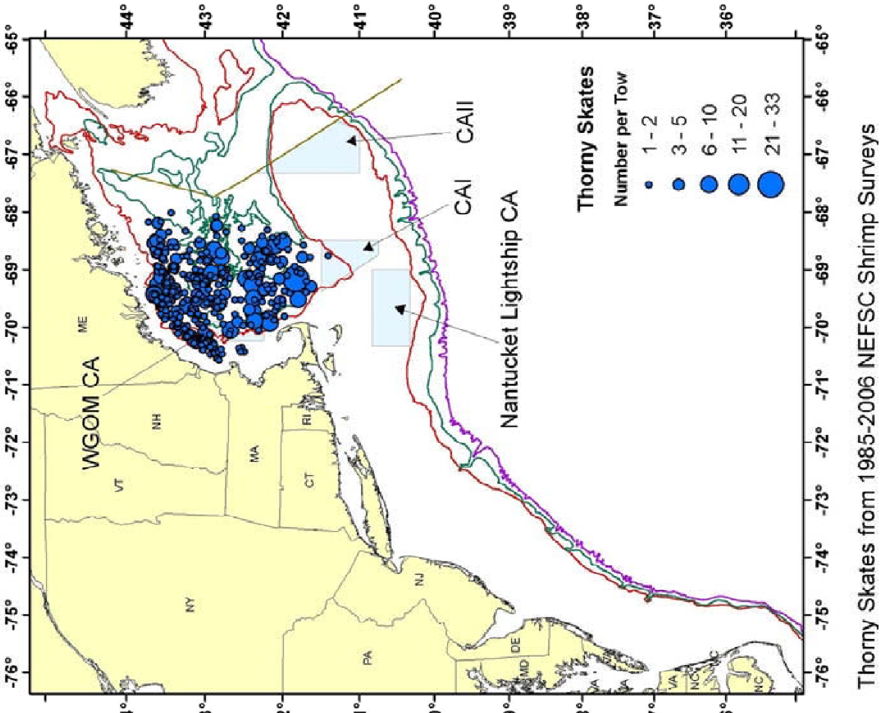


Figure B2.66. Distribution of thorny skate from the NEFSC scallop and shrimp surveys from 1985-2006.

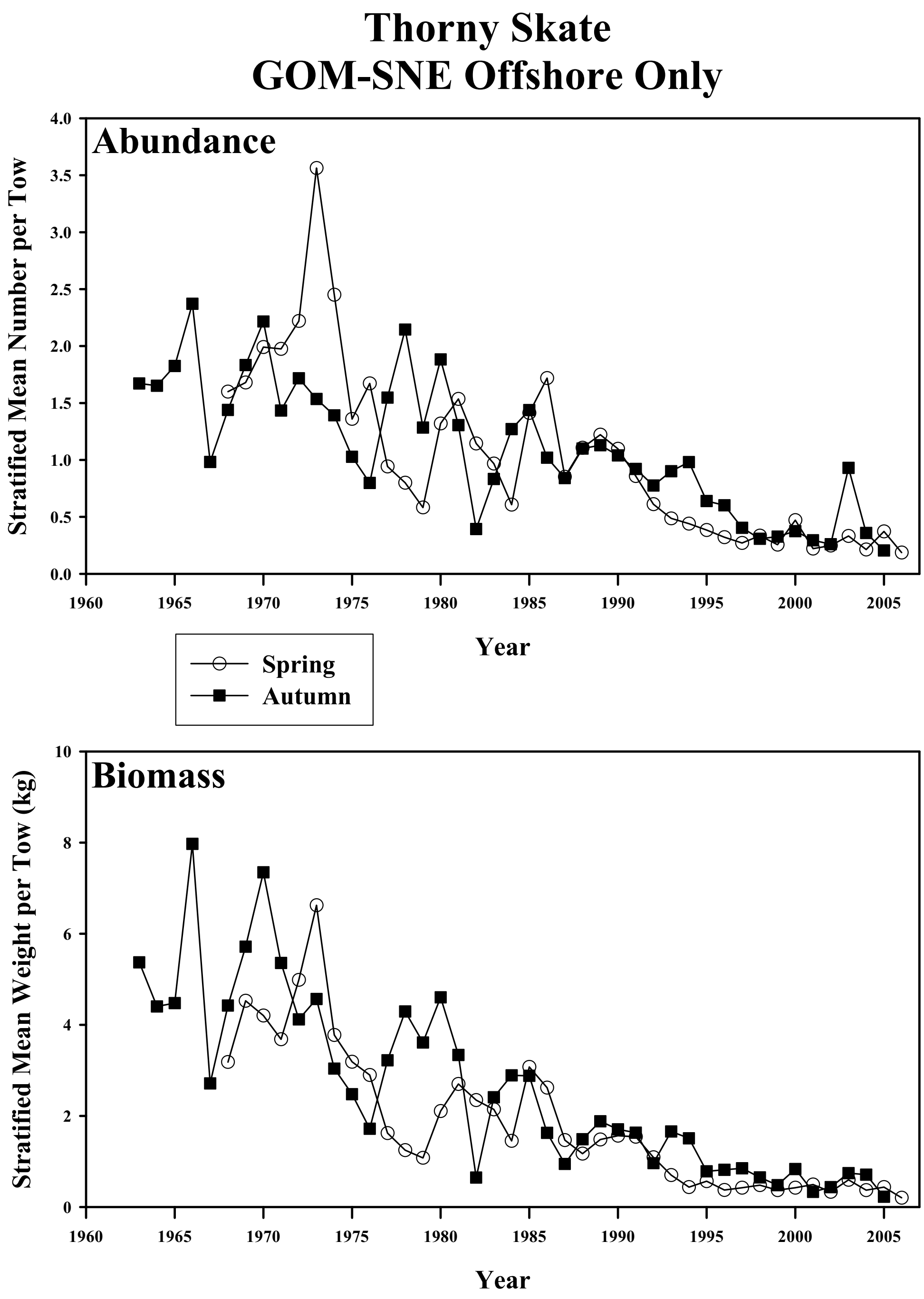


Figure B2.67. Abundance and biomass of thorny skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region.

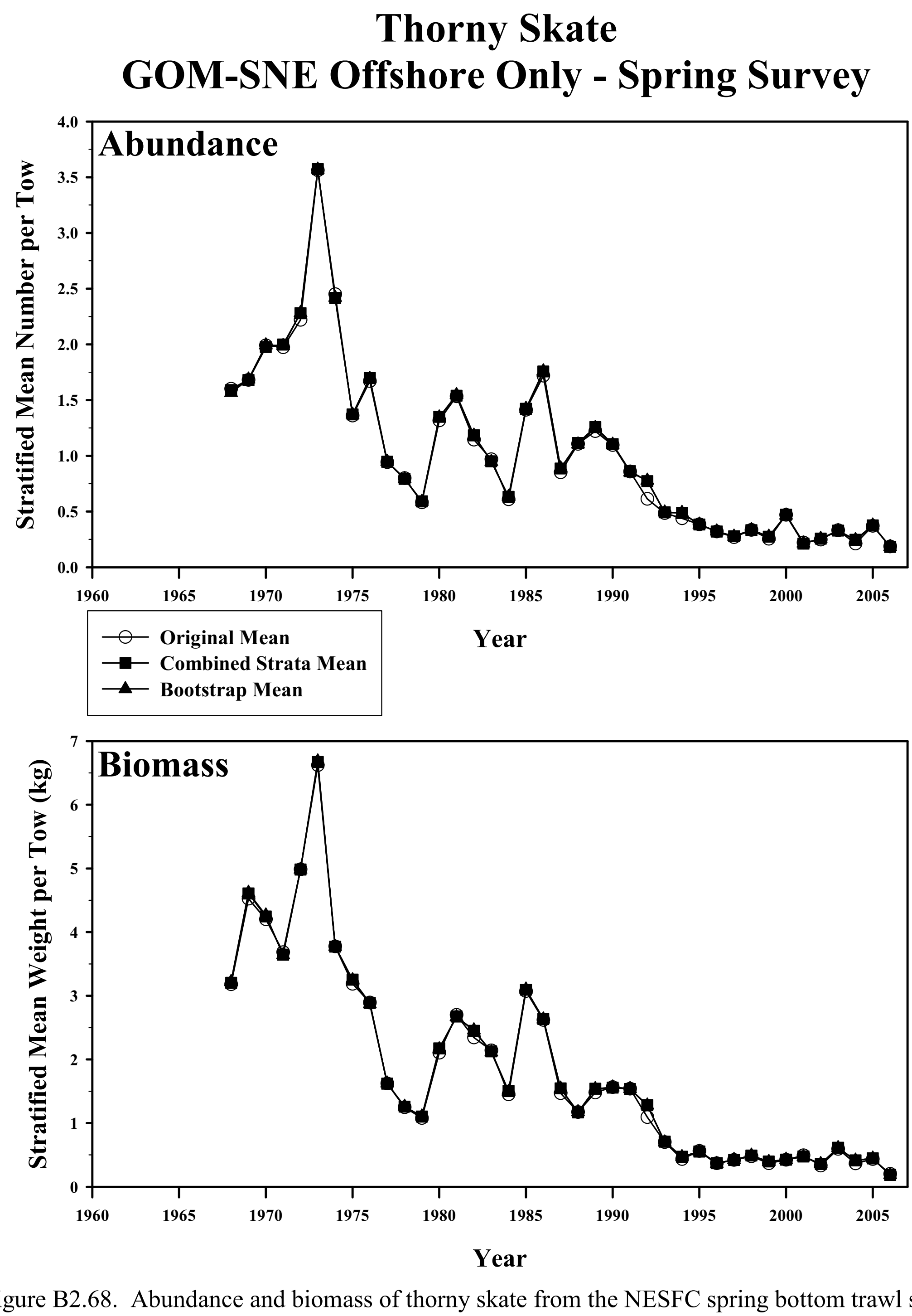


Figure B2.68. Abundance and biomass of thorny skate from the NESFC spring bottom trawl surveys from 1968-2006 in the Gulf of Maine to Southern New England offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

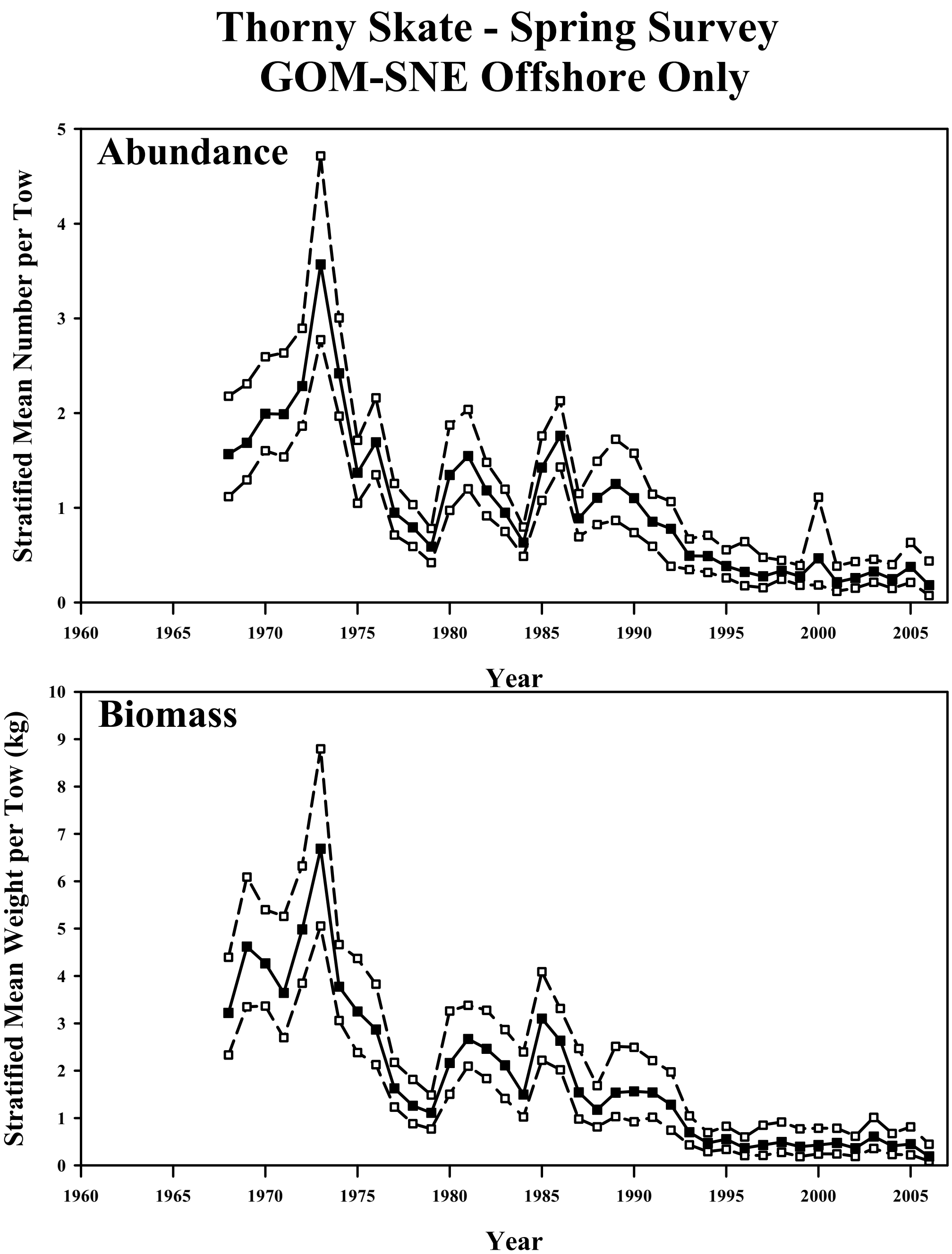


Figure B2.69. Bootstrapped abundance and biomass of thorny skate from the NESFC spring bottom trawl survey in the Gulf of Maine to Southern New England offshore region. Mean index in solid squares, 95% confidence interval in open squares.

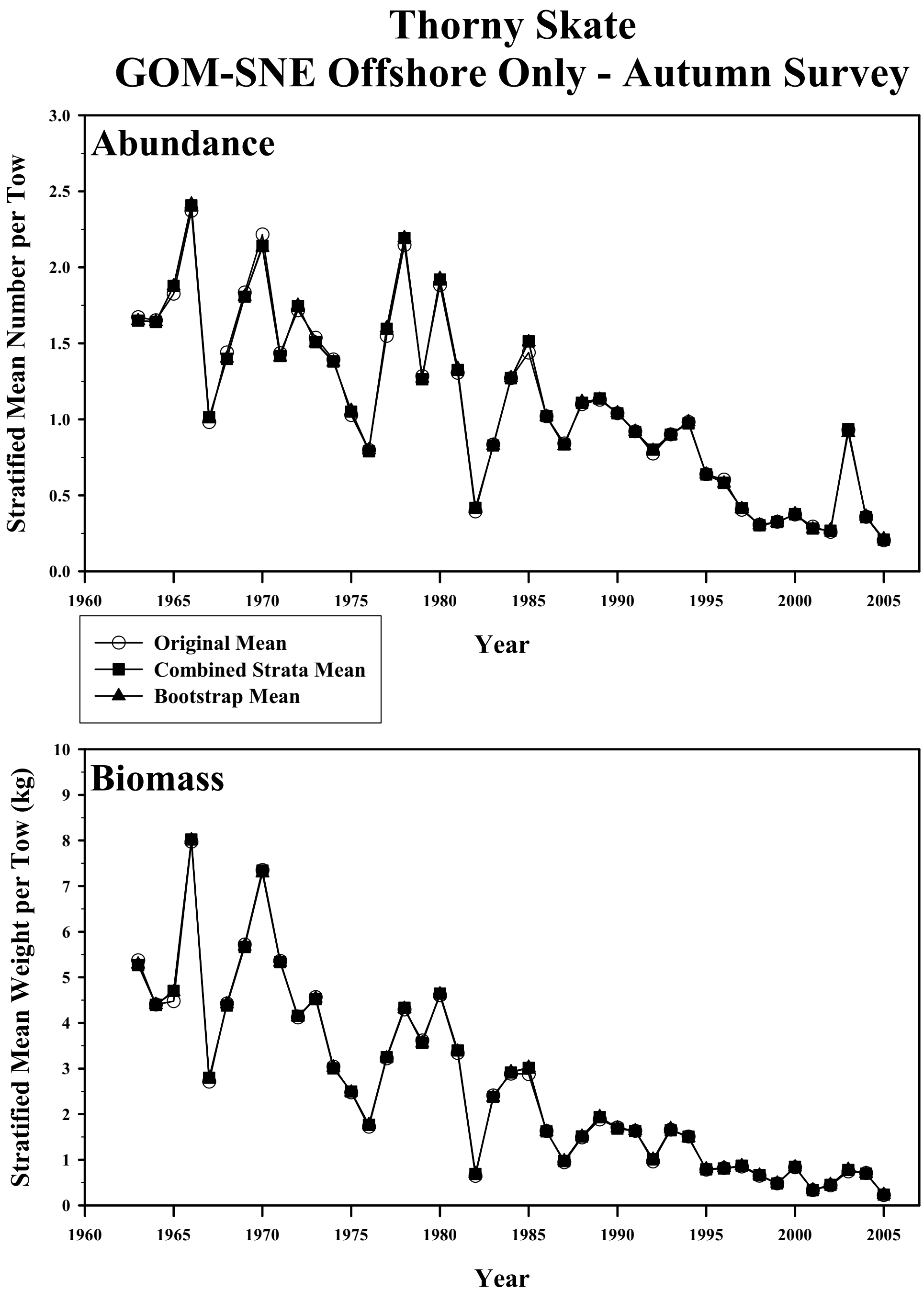


Figure B2.70. Abundance and biomass of thorny skate from the NESFC autumn bottom trawl surveys from 1968-2006 in the Gulf of Maine to Southern New England offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

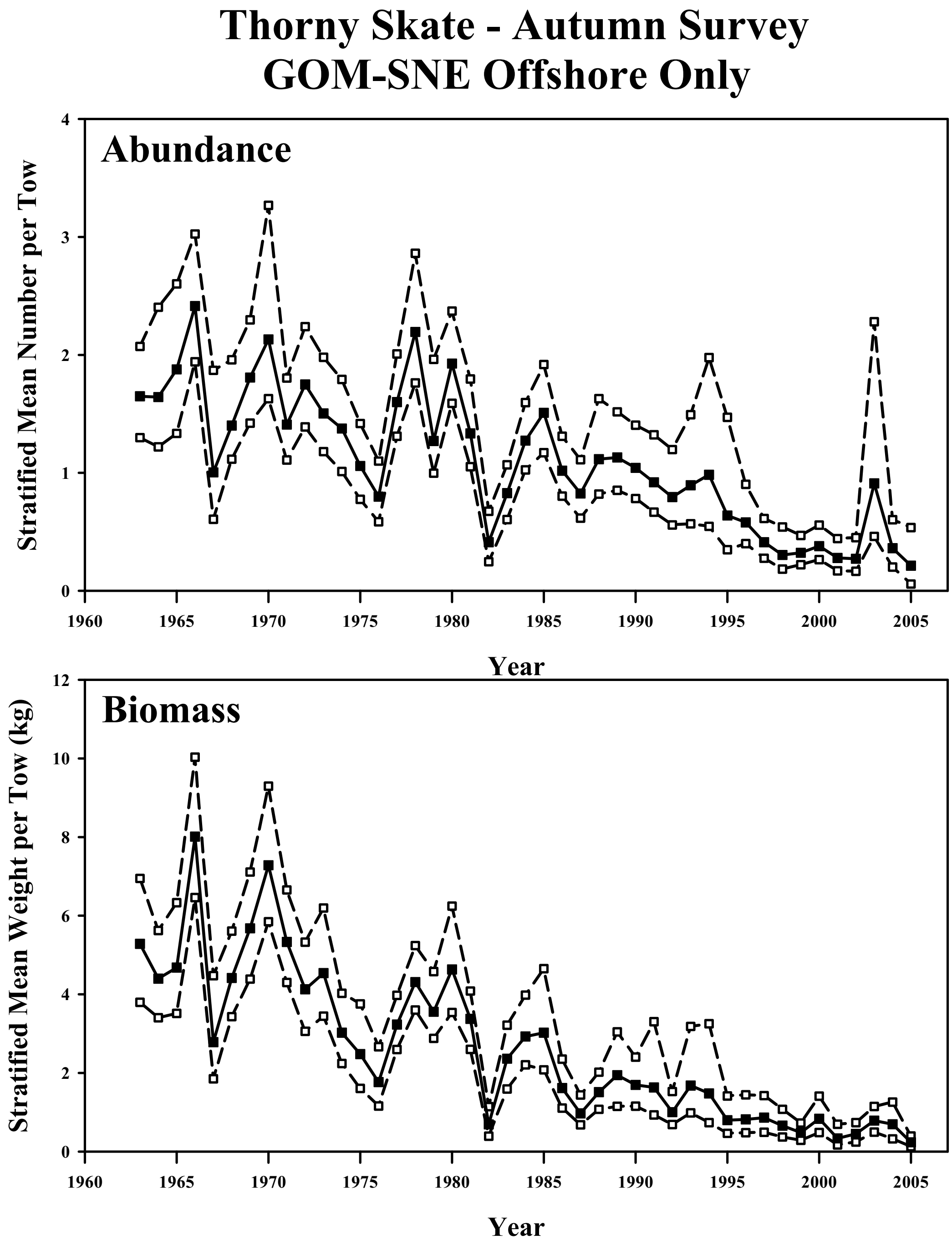
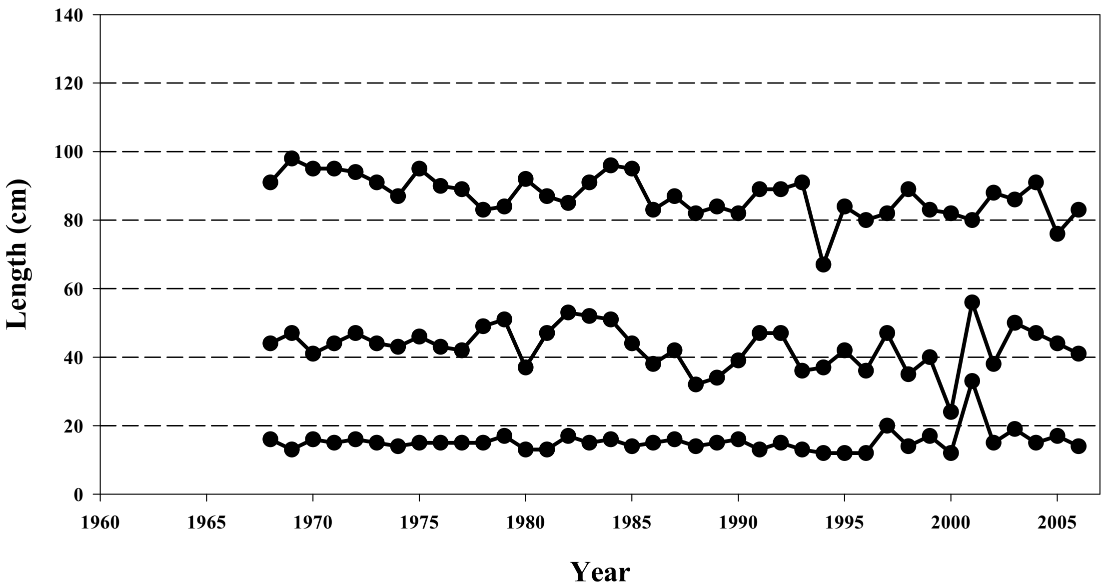


Figure B2.71. Bootstrapped abundance and biomass of thorny skate from the NESFC autumn bottom trawl survey in the Gulf of Maine to Southern New England offshore region. Mean index in solid squares, 95% confidence interval in open squares.

Thorny Skate: GOM-SNE Offshore
Percentiles of Length Composition

Spring Survey



Autumn Survey

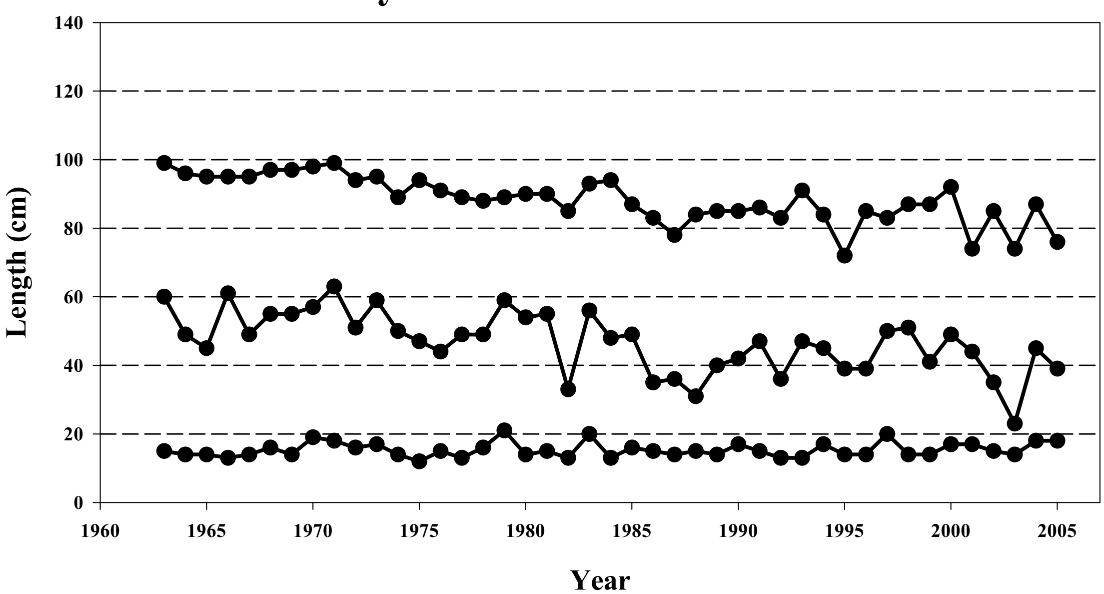


Figure B2.72. Percentiles of length composition (5, 50, and 95) of thorny skate from the NESFC spring and autumn bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region.

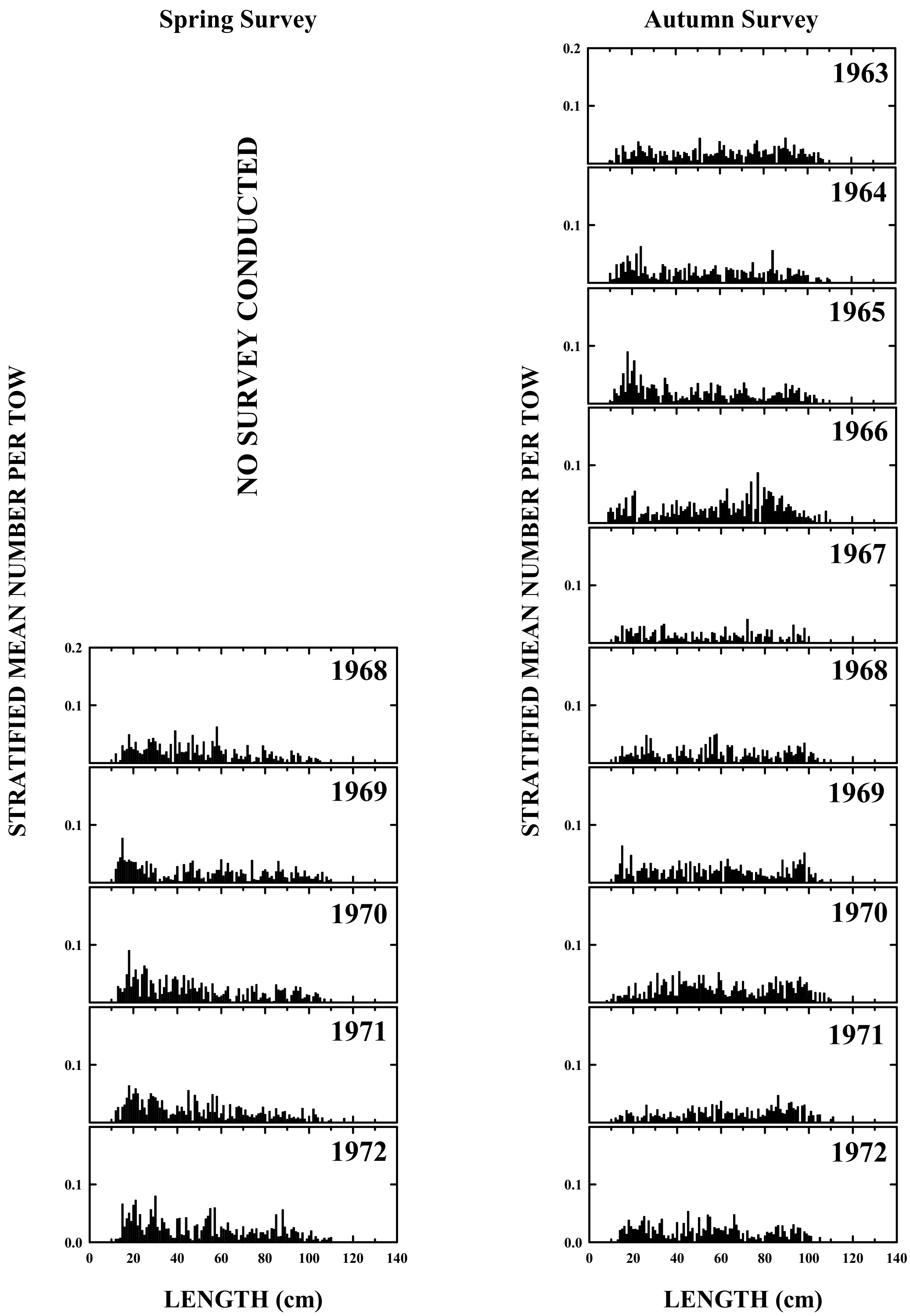


Figure B2.73. Thorny skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1963-1972.

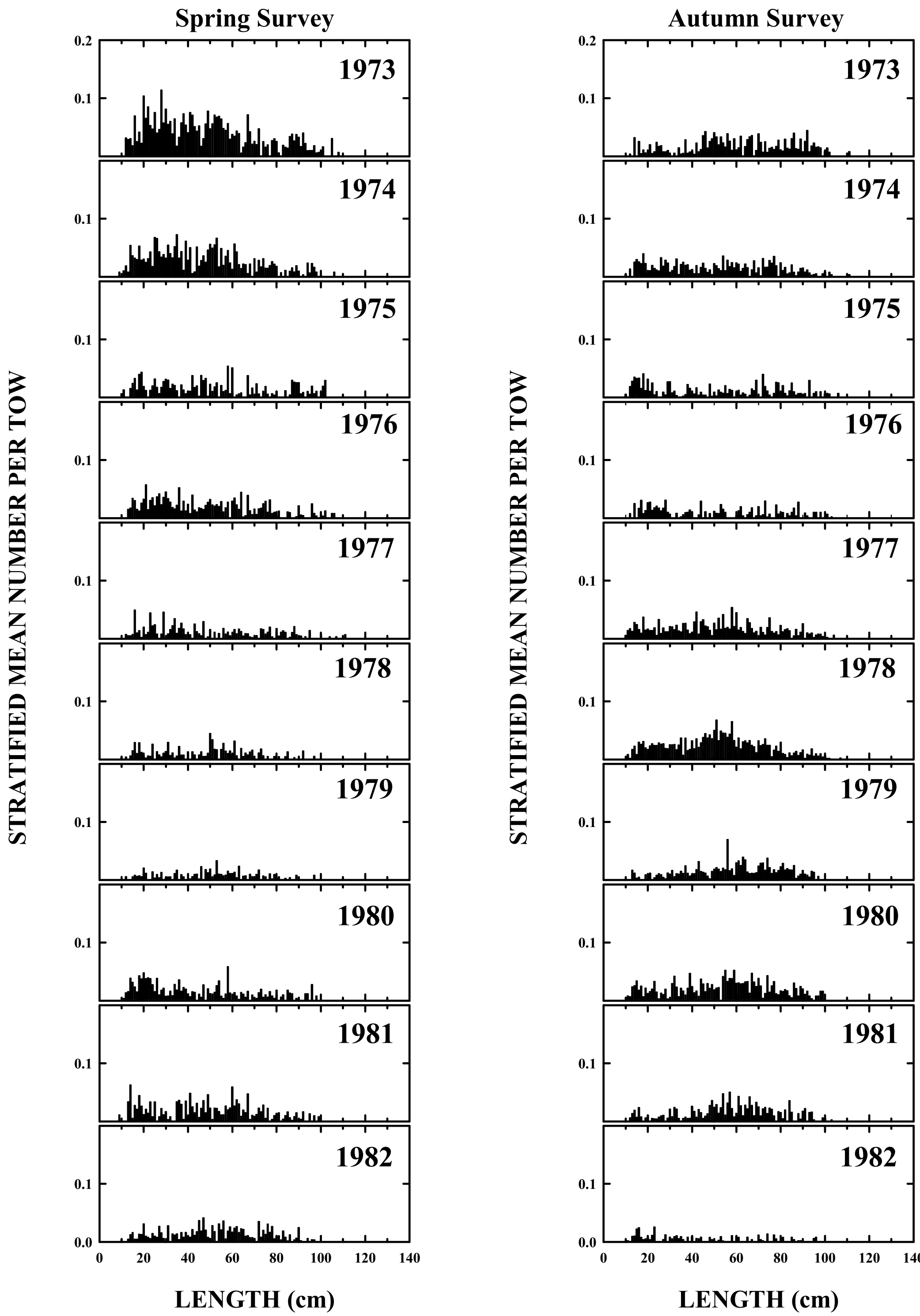


Figure B2.74. Thorny skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1973-1982.

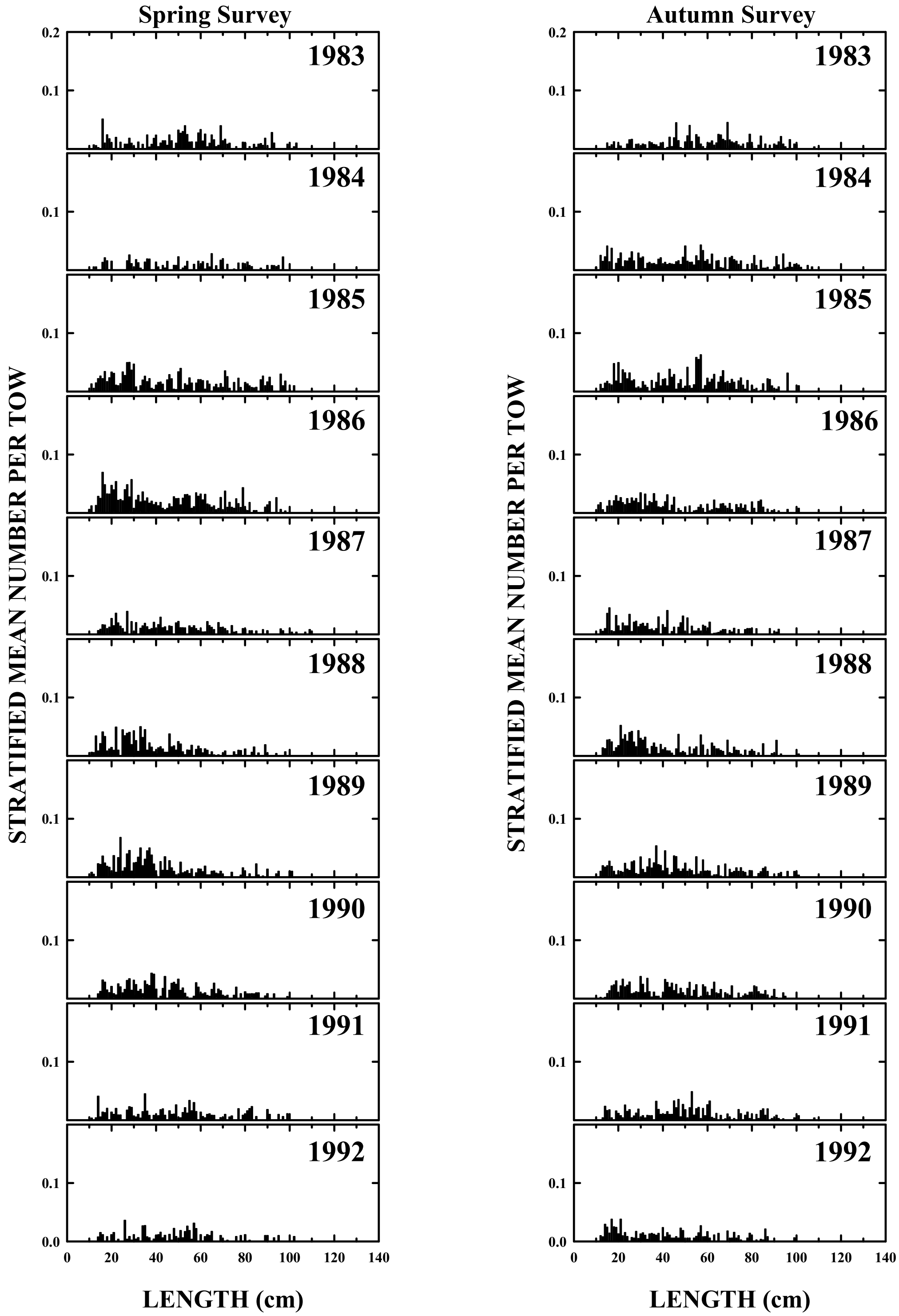


Figure B2.75. Thorny skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1983-1992.

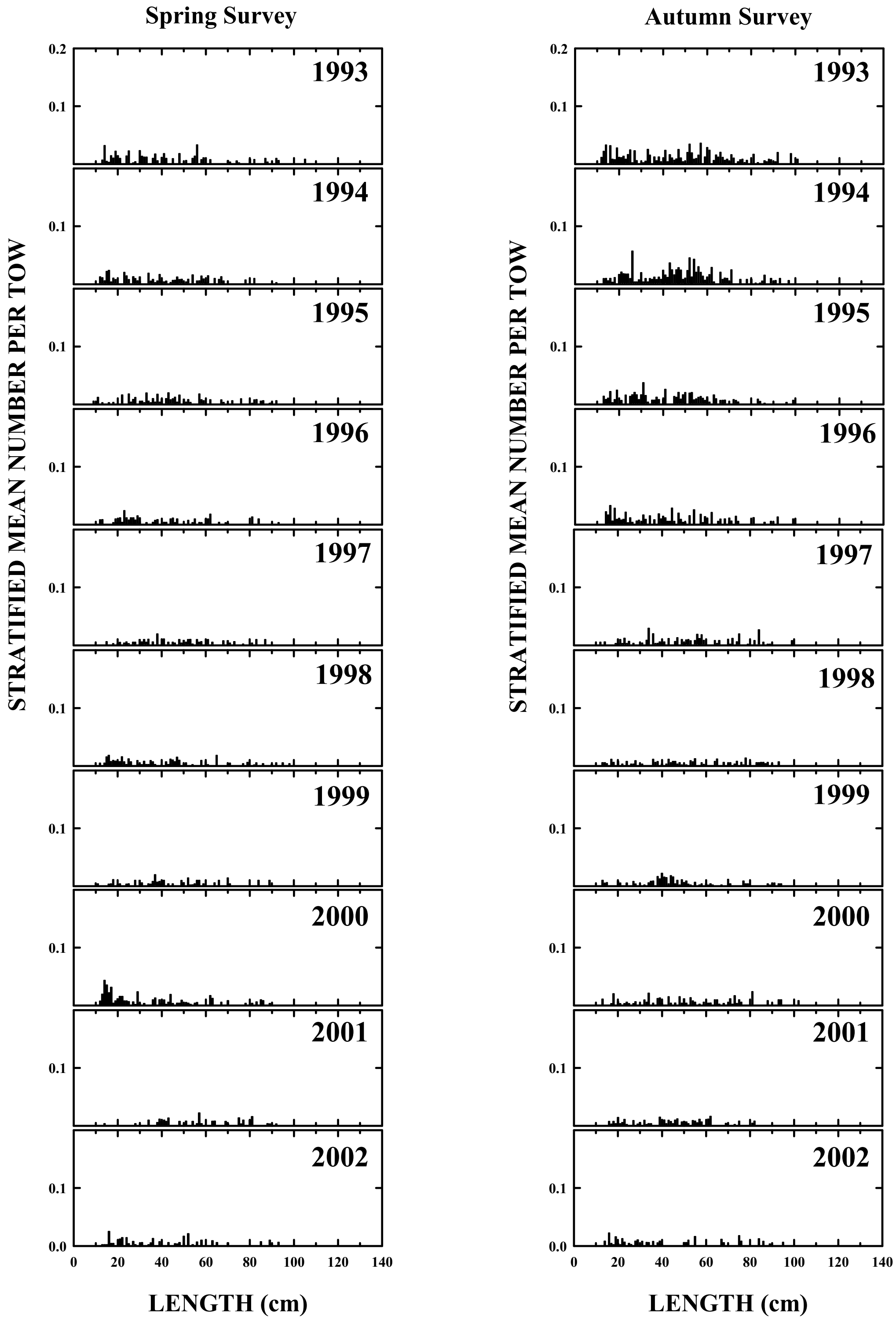


Figure B2.76. Thorny skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1993-2002.

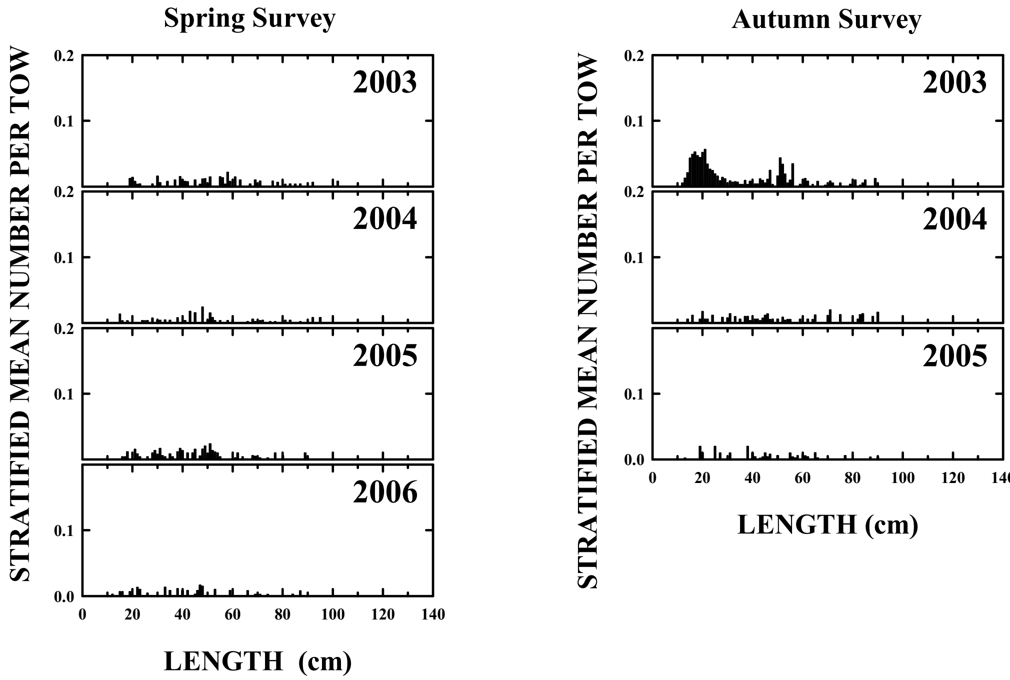


Figure B2.77. Thorny skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 2003-2006.

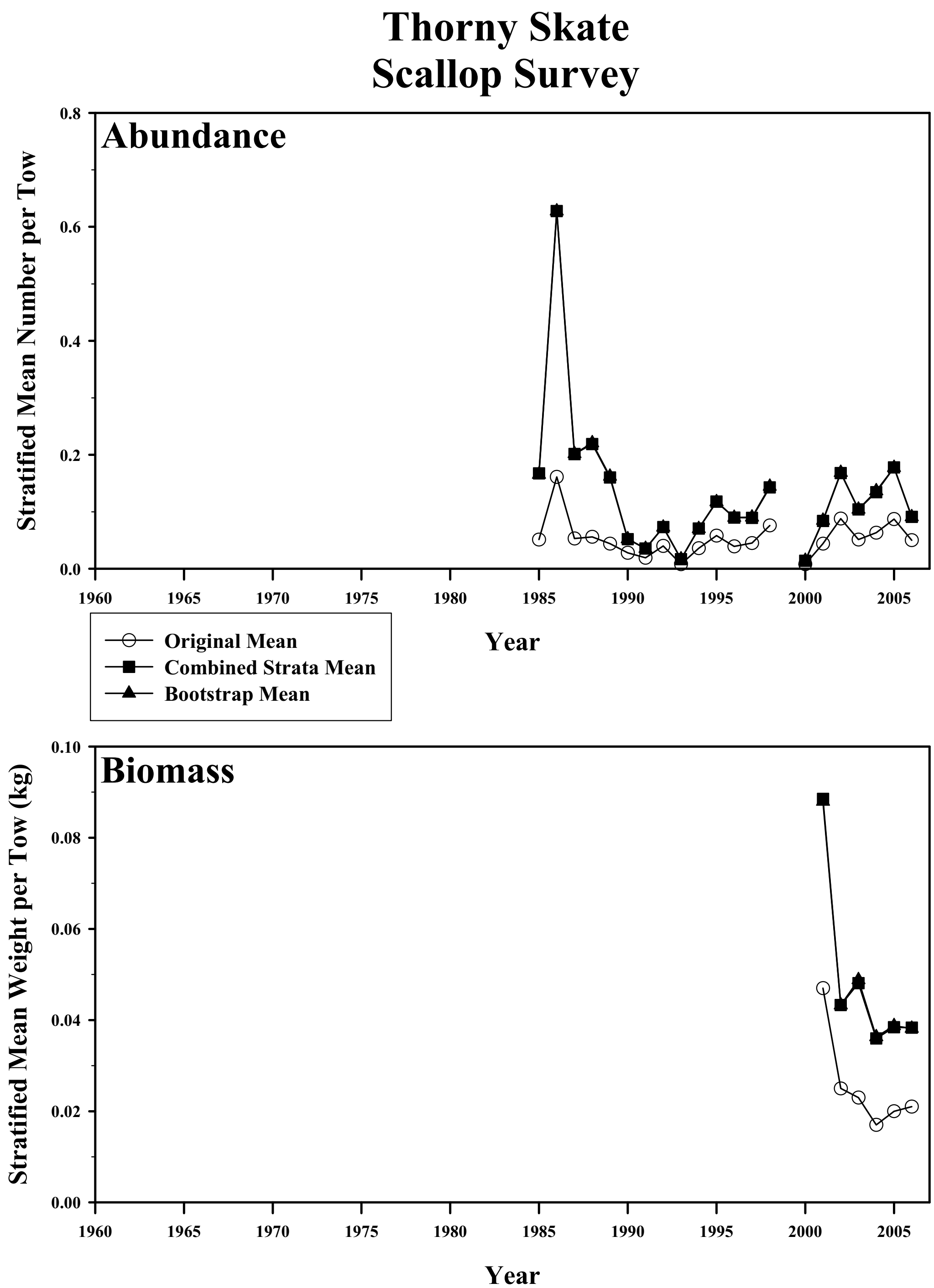


Figure B2.78. Abundance and biomass of thorny skate from the NESFC scallop surveys from 1985-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

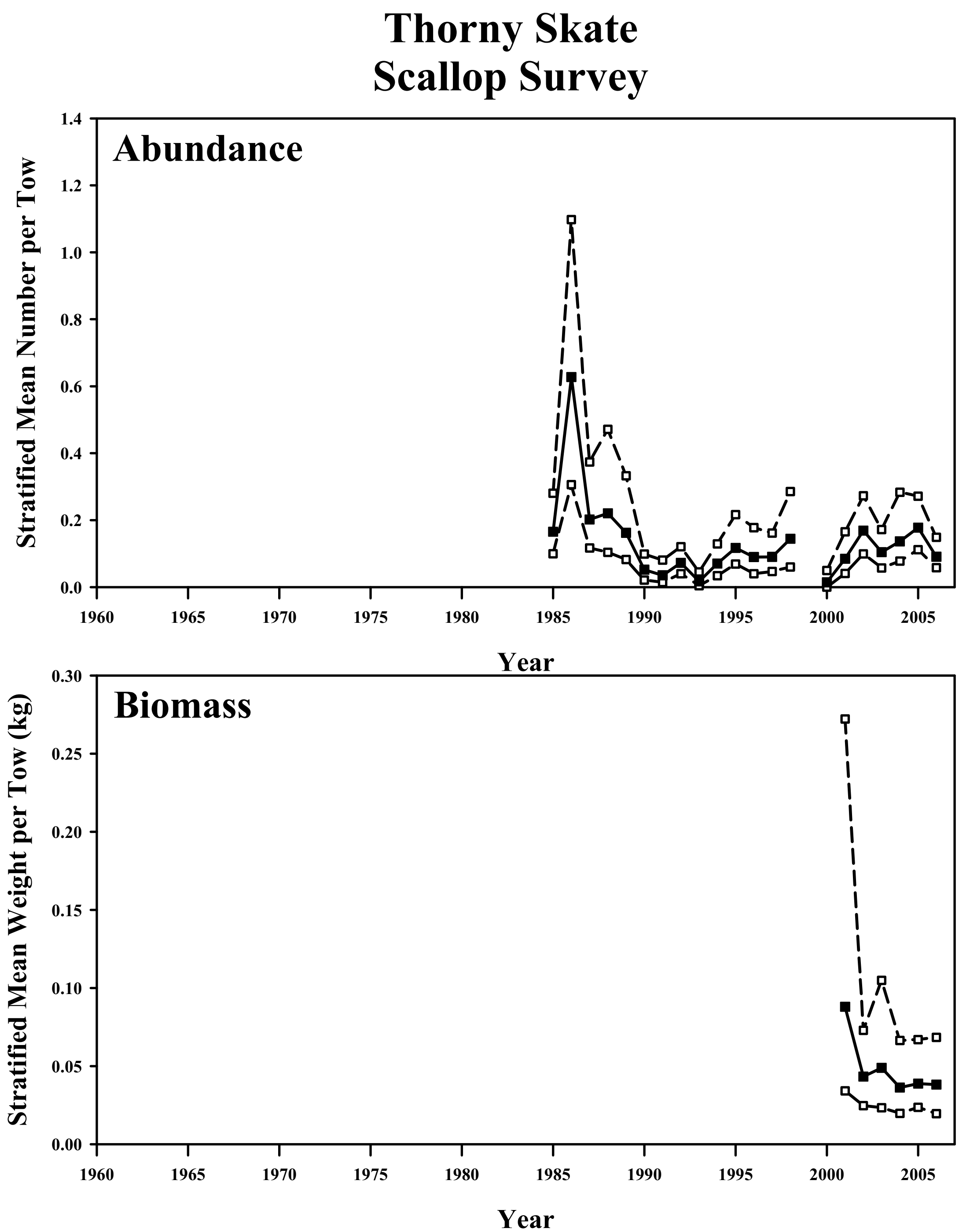


Figure B2.79. Bootstrapped abundance and biomass of thorny skate from the NESFC scallop survey. Mean index in solid squares, 95% confidence interval in open squares.

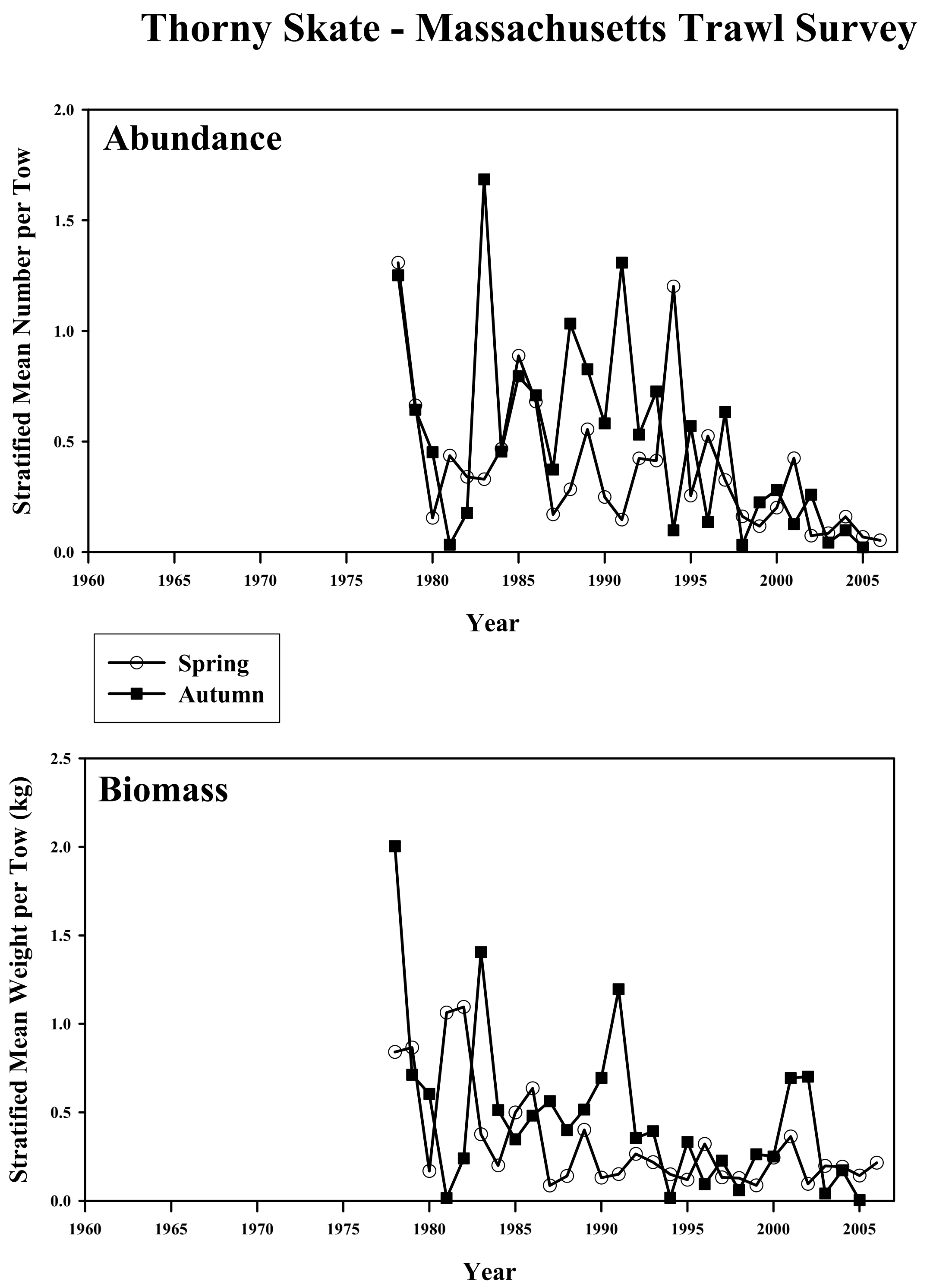


Figure B2.80. Abundance and biomass of thorny skate from the Massachusetts spring and autumn finfish bottom trawl survey in state waters (strata 25-36).

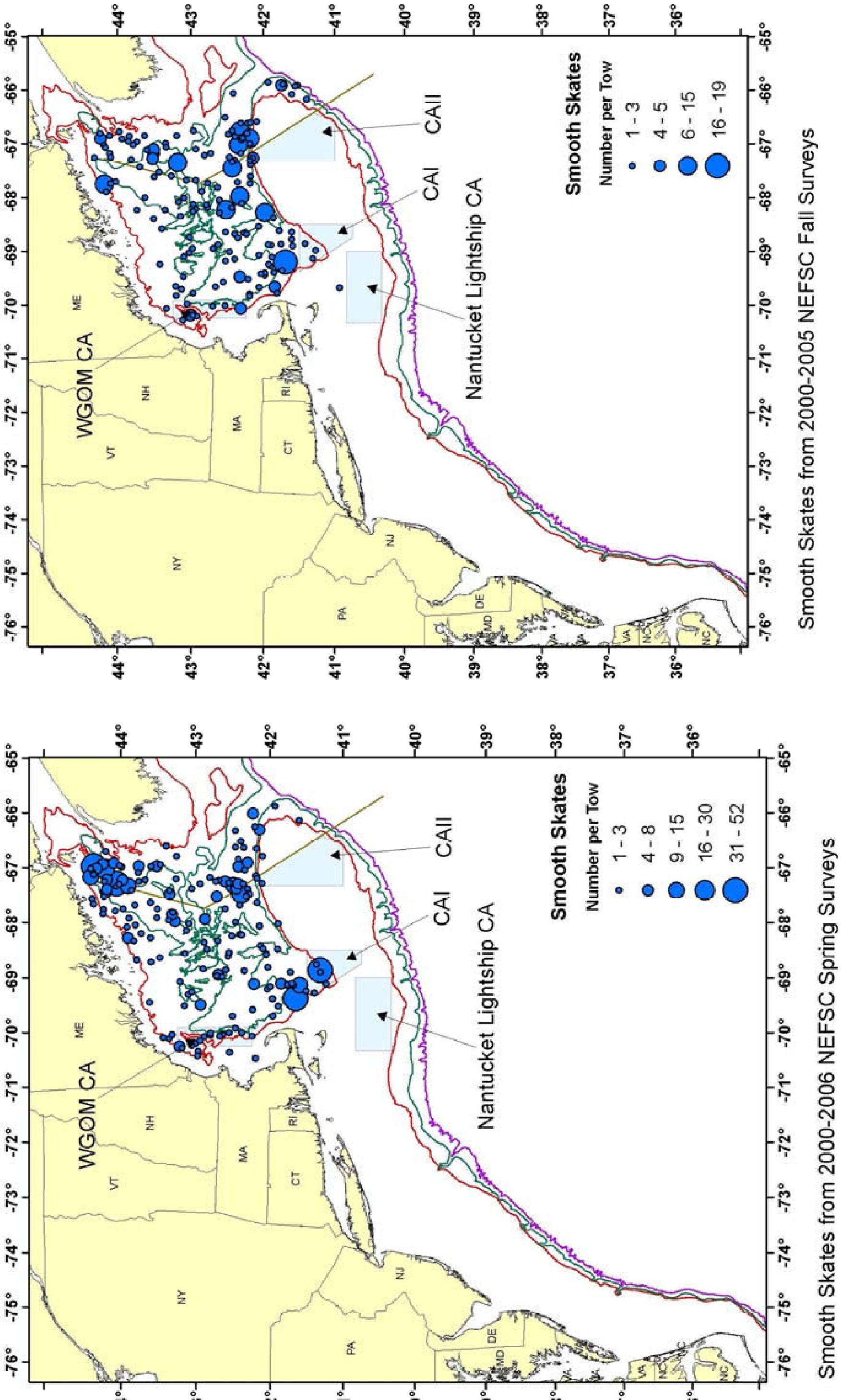
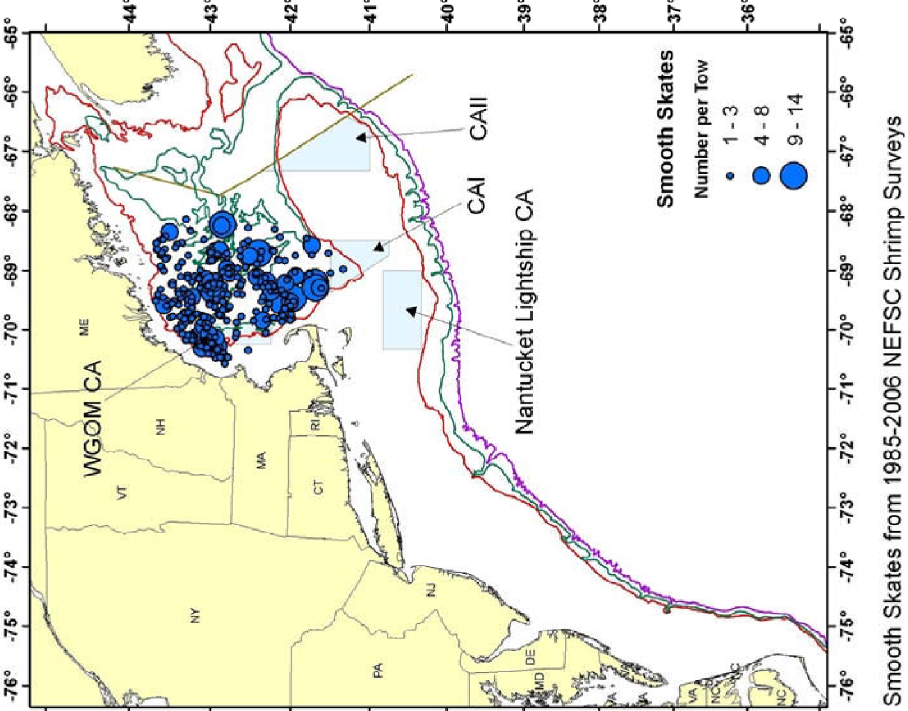


Figure B2.81. Distribution of smooth skate from the spring and autumn NEFSC surveys from 2000-2006.



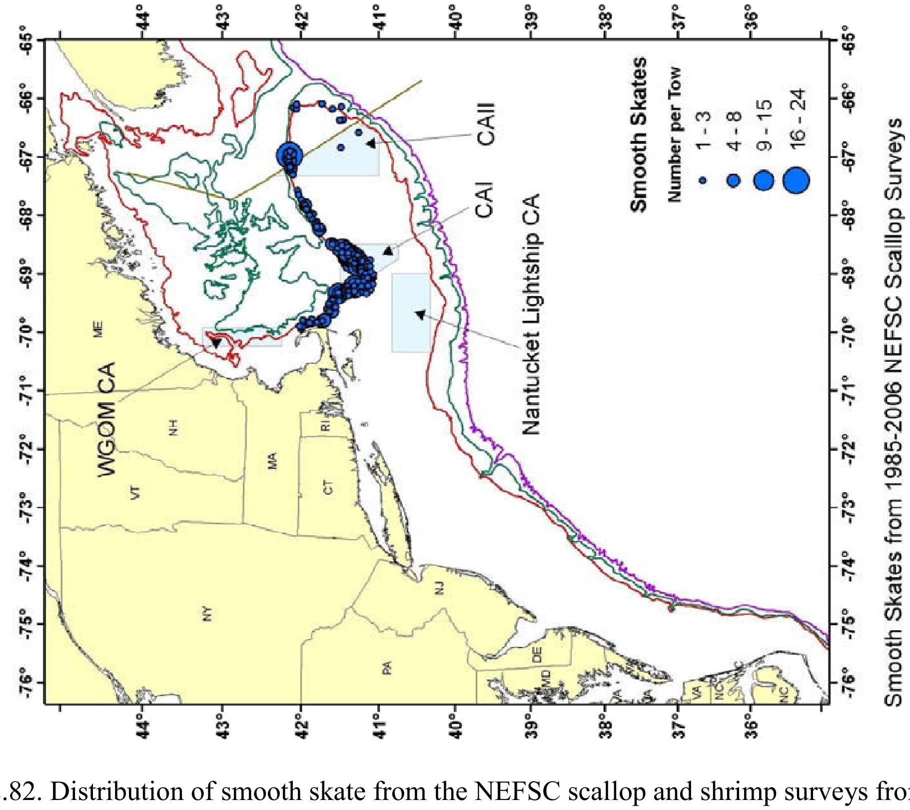


Figure B2.82. Distribution of smooth skate from the NEFSC scallop and shrimp surveys from 1985-2006.

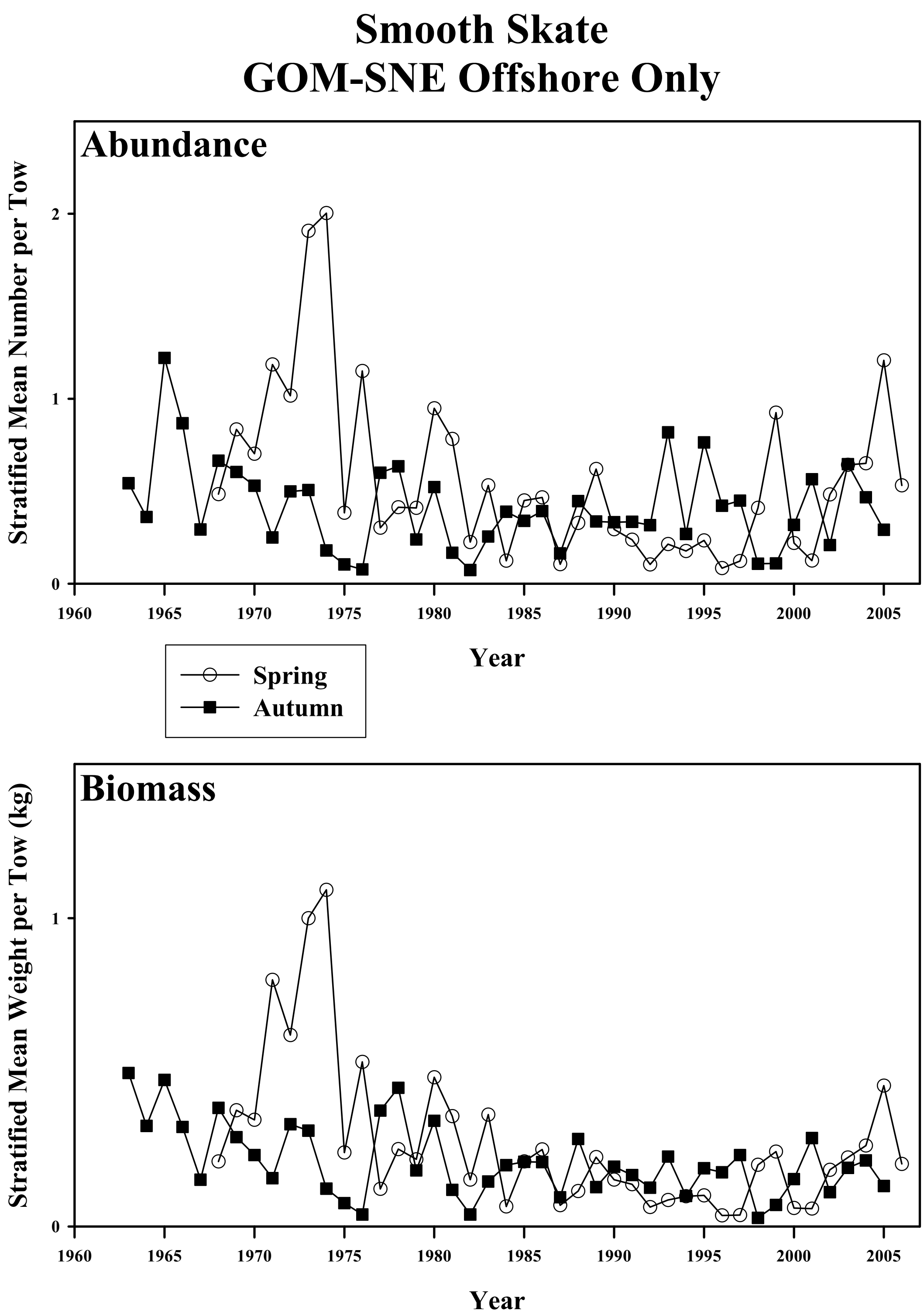


Figure B2.83. Abundance and biomass of smooth skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region.

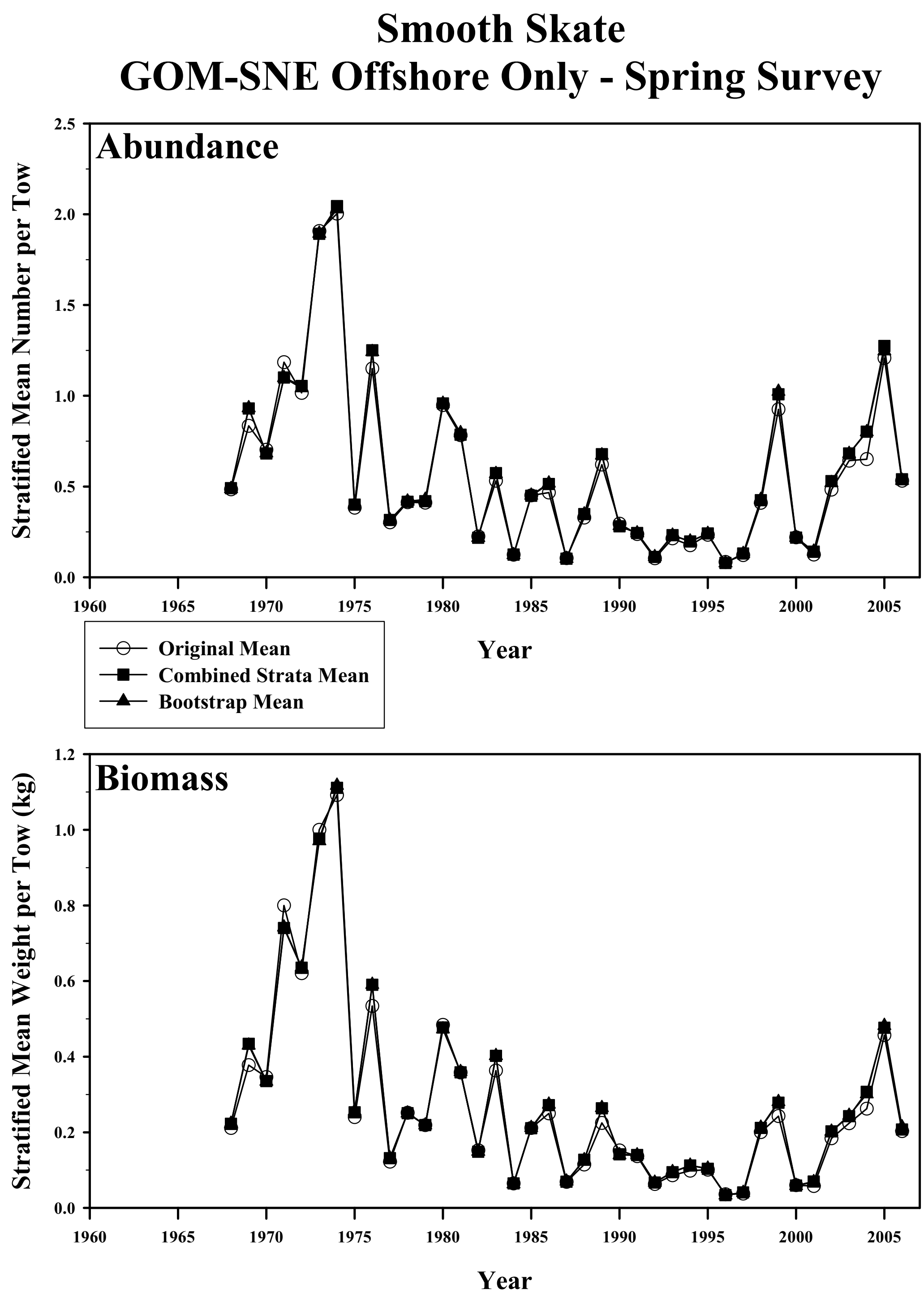


Figure B2.84. Abundance and biomass of smooth skate from the NESFC spring bottom trawl surveys from 1968-2006 in the Gulf of Maine to Southern New England offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

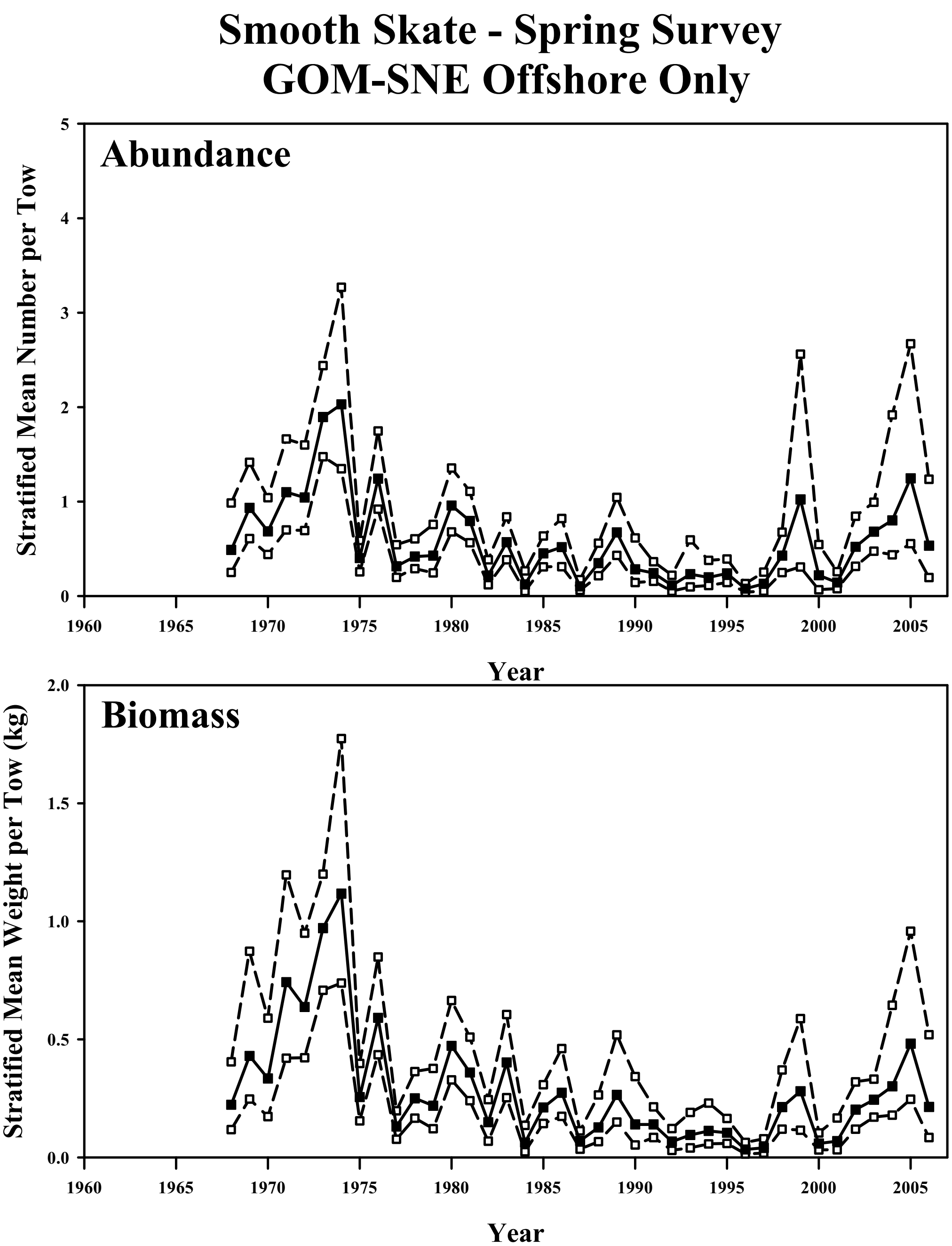


Figure B2.85. Bootstrapped abundance and biomass of smooth skate from the NESFC spring bottom trawl survey in the Gulf of Maine to Southern New England offshore region. Mean index in solid squares, 95% confidence interval in open squares.

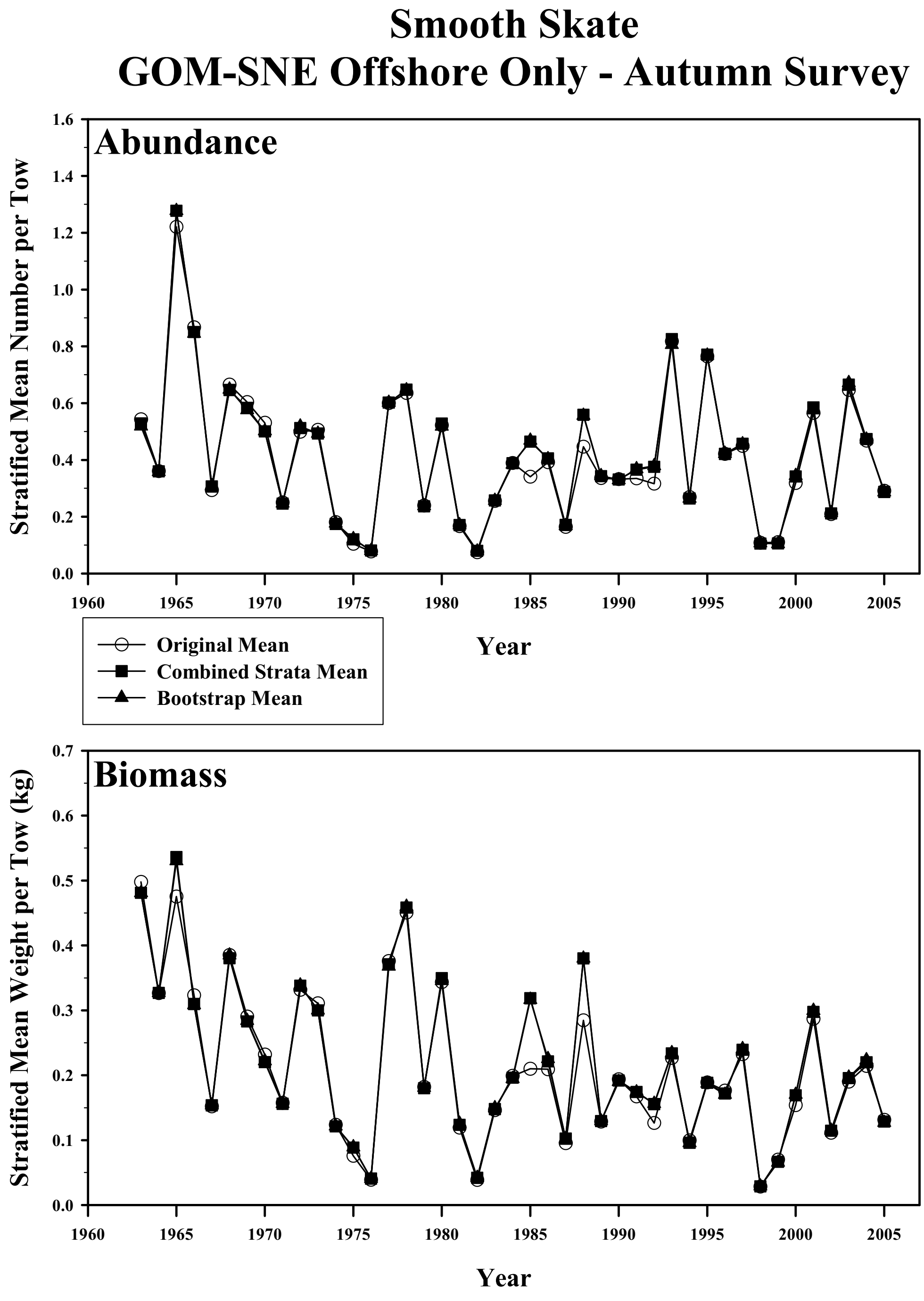


Figure B2.86. Abundance and biomass of smooth skate from the NESFC autumn bottom trawl surveys from 1968-2006 in the Gulf of Maine to Southern New England offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

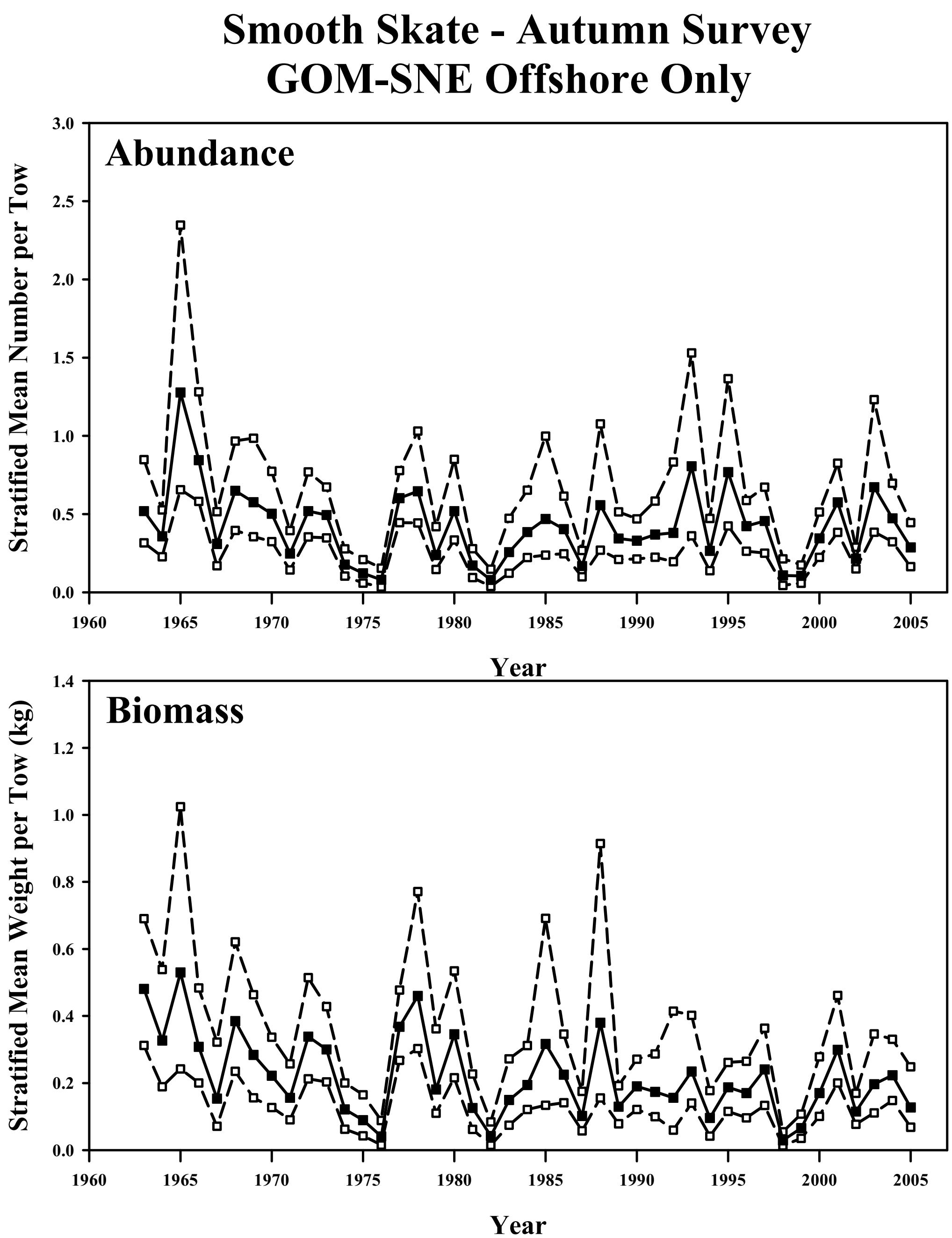


Figure B2.87. Bootstrapped abundance and biomass of smooth skate from the NESFC autumn bottom trawl survey in the Gulf of Maine to Southern New England offshore region. Mean index in solid squares, 95% confidence interval in open squares.

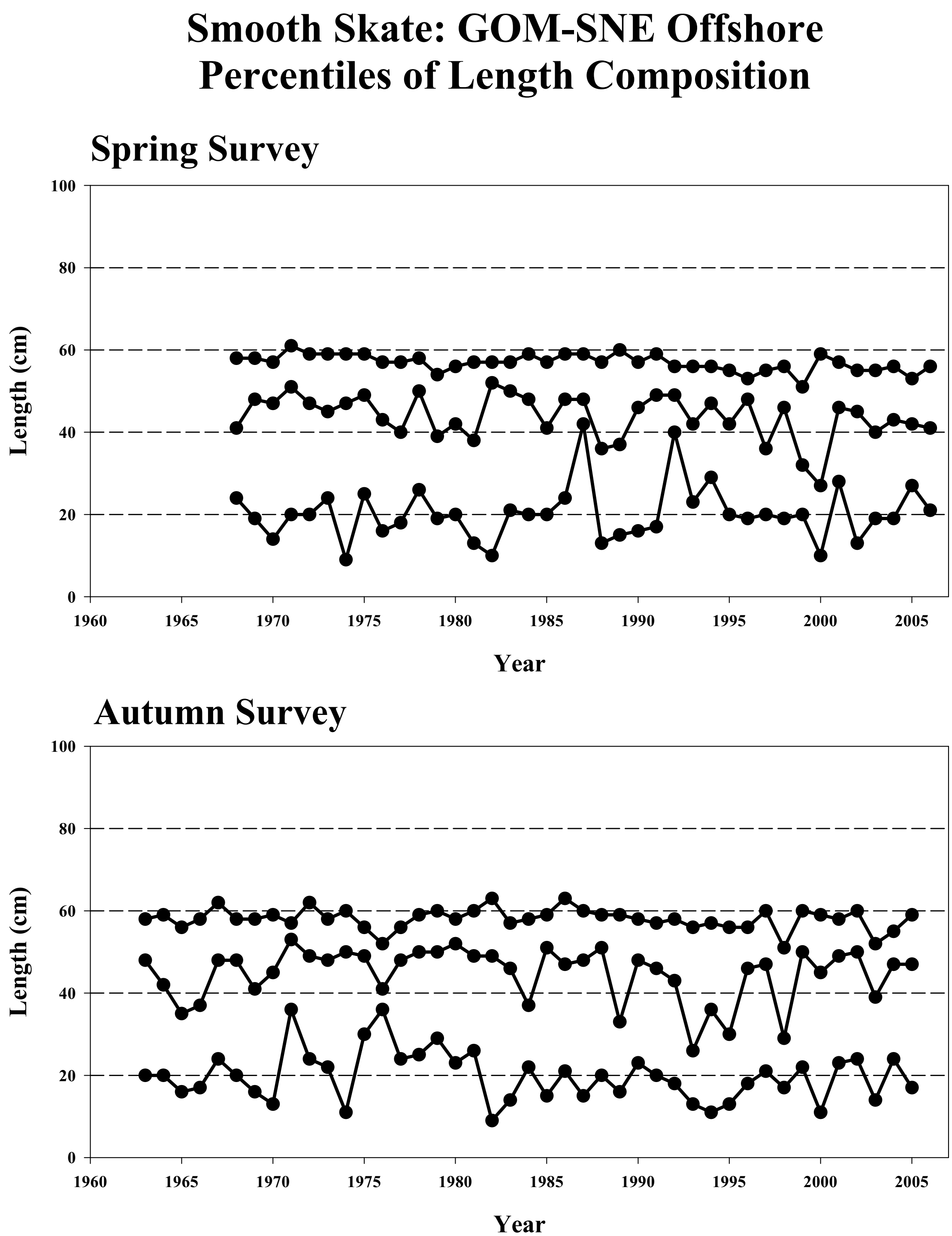


Figure B2.88. Percentiles of length composition (5, 50, and 95) of smooth skate from the NESFC spring and autumn bottom trawl surveys from 1963-2006 in the Gulf of Maine to Southern New England offshore region.

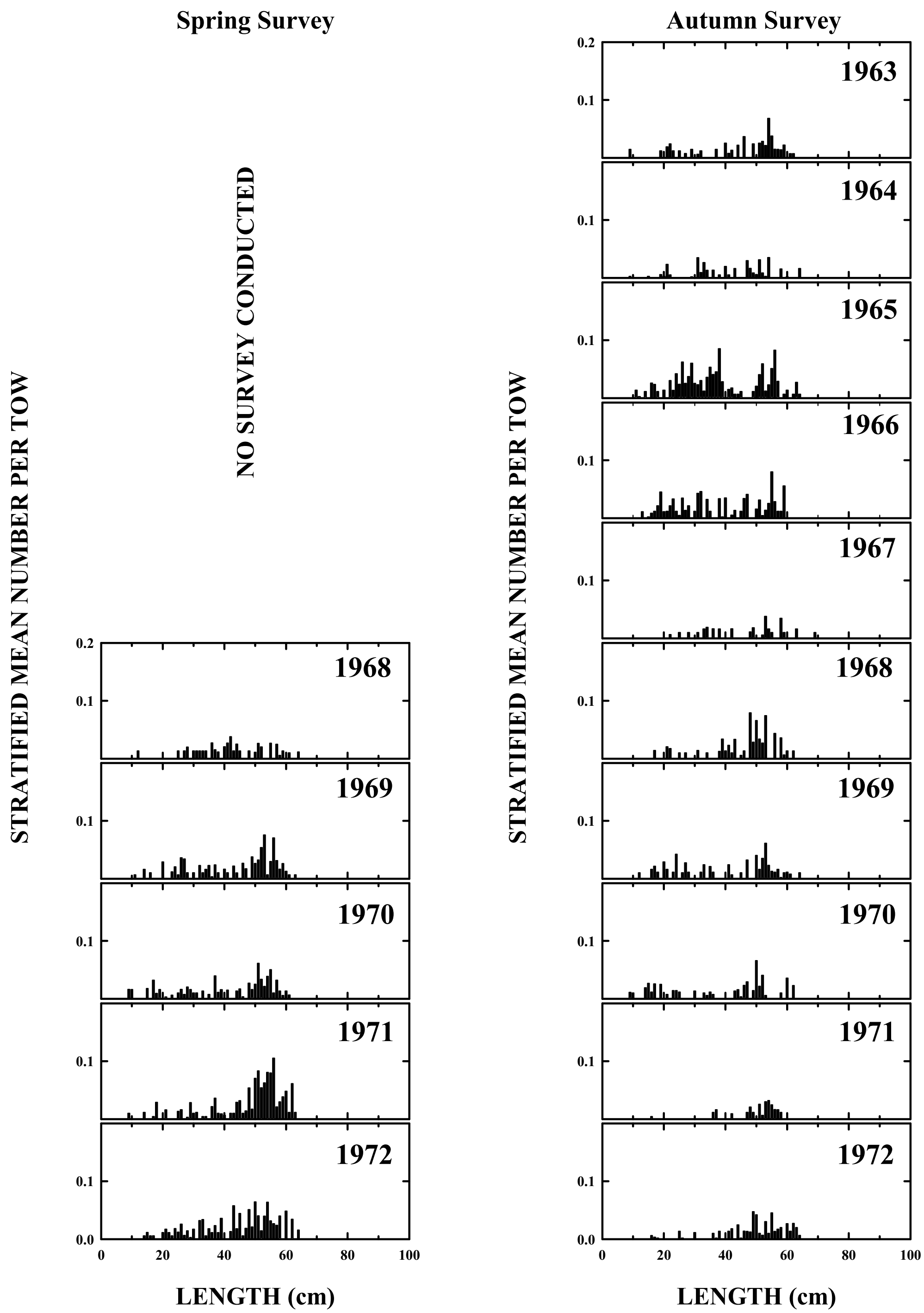


Figure B2.89. Smooth skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1963-1972.

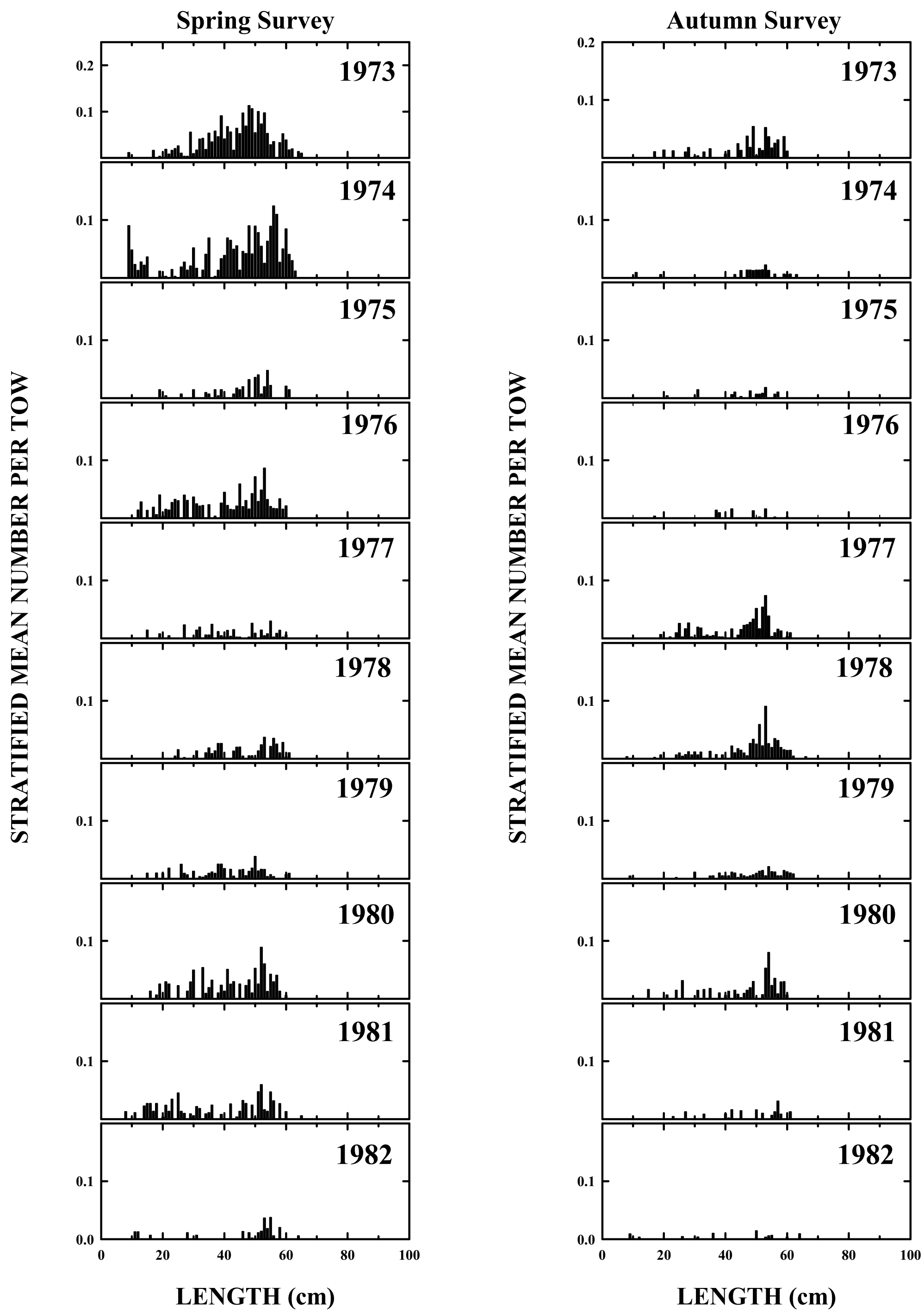


Figure B2.90. Smooth skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1973-1982.

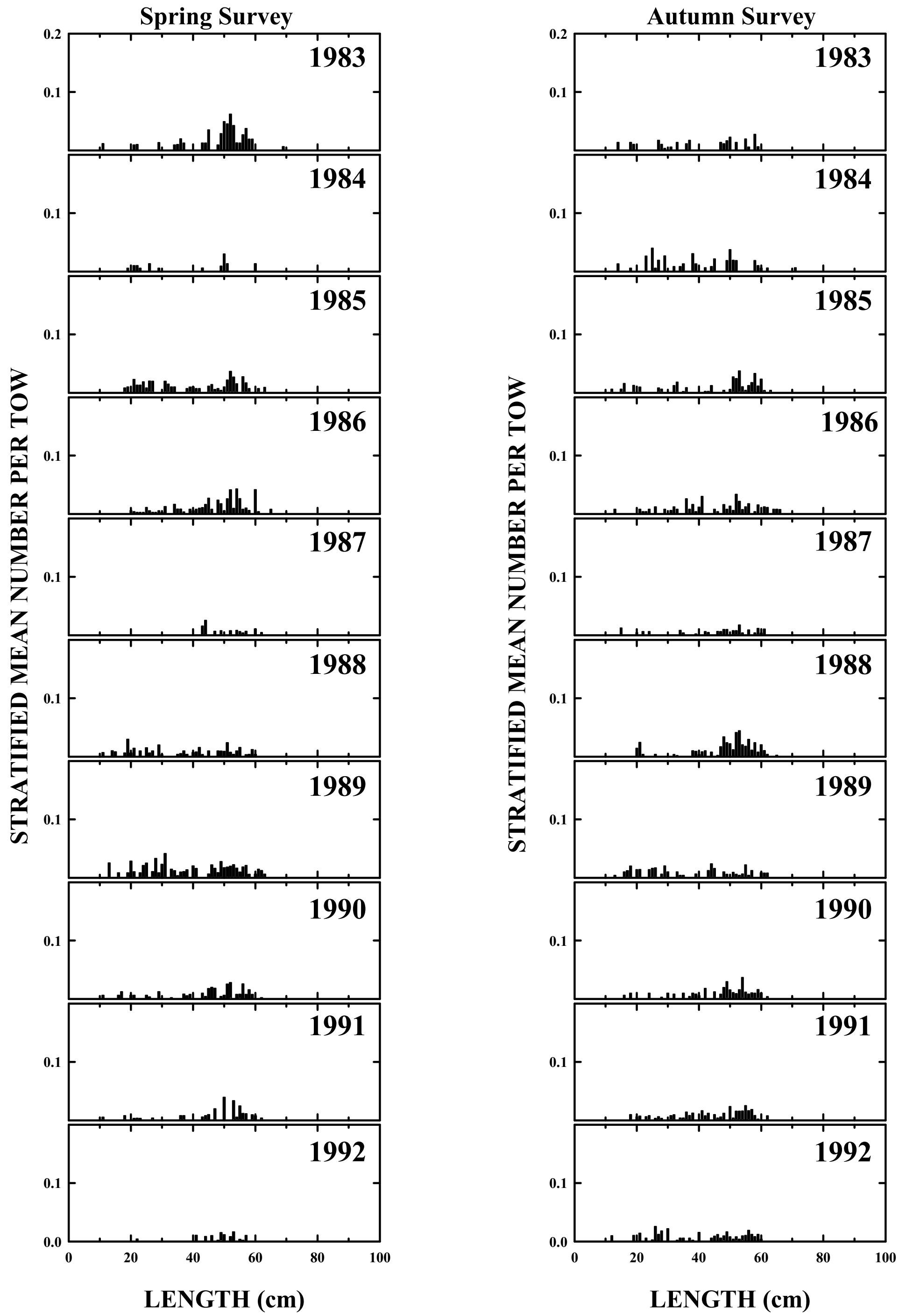


Figure B2.91. Smooth skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1983-1992.

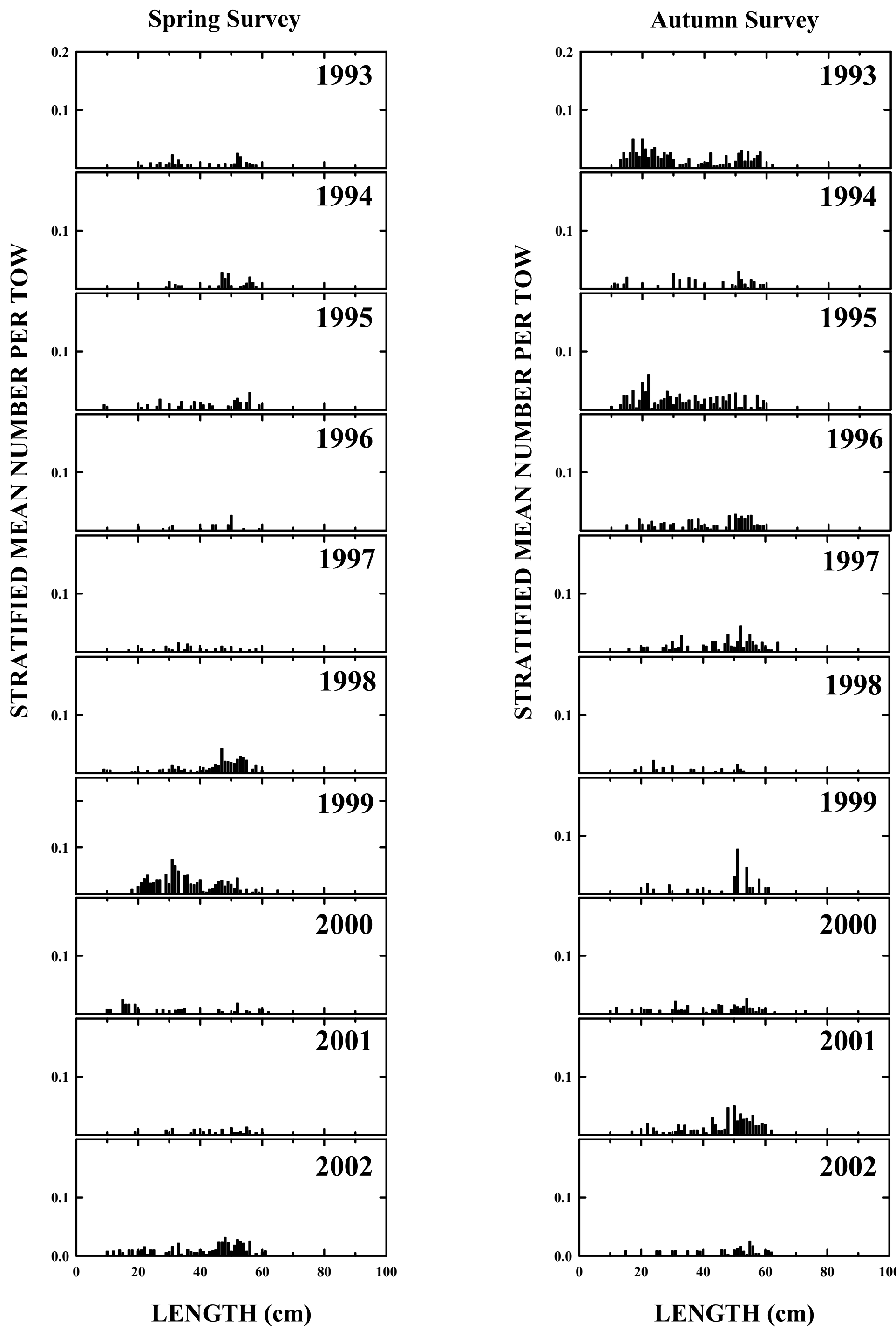


Figure B2.92. Smooth skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 1993-2002.

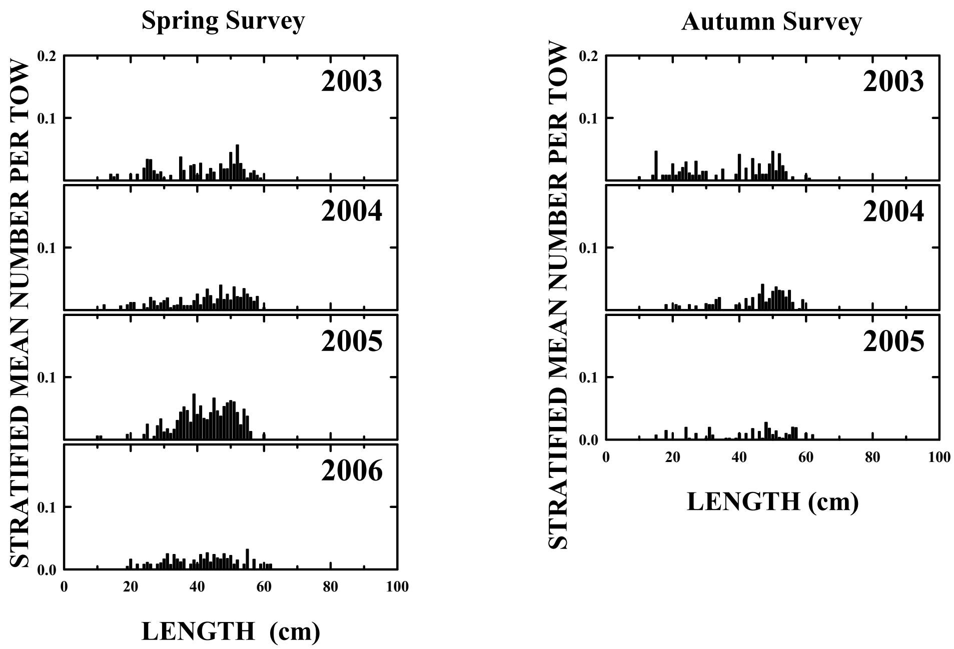


Figure B2.93. Smooth skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Gulf of Maine to Southern New England offshore region, 2003-2006.

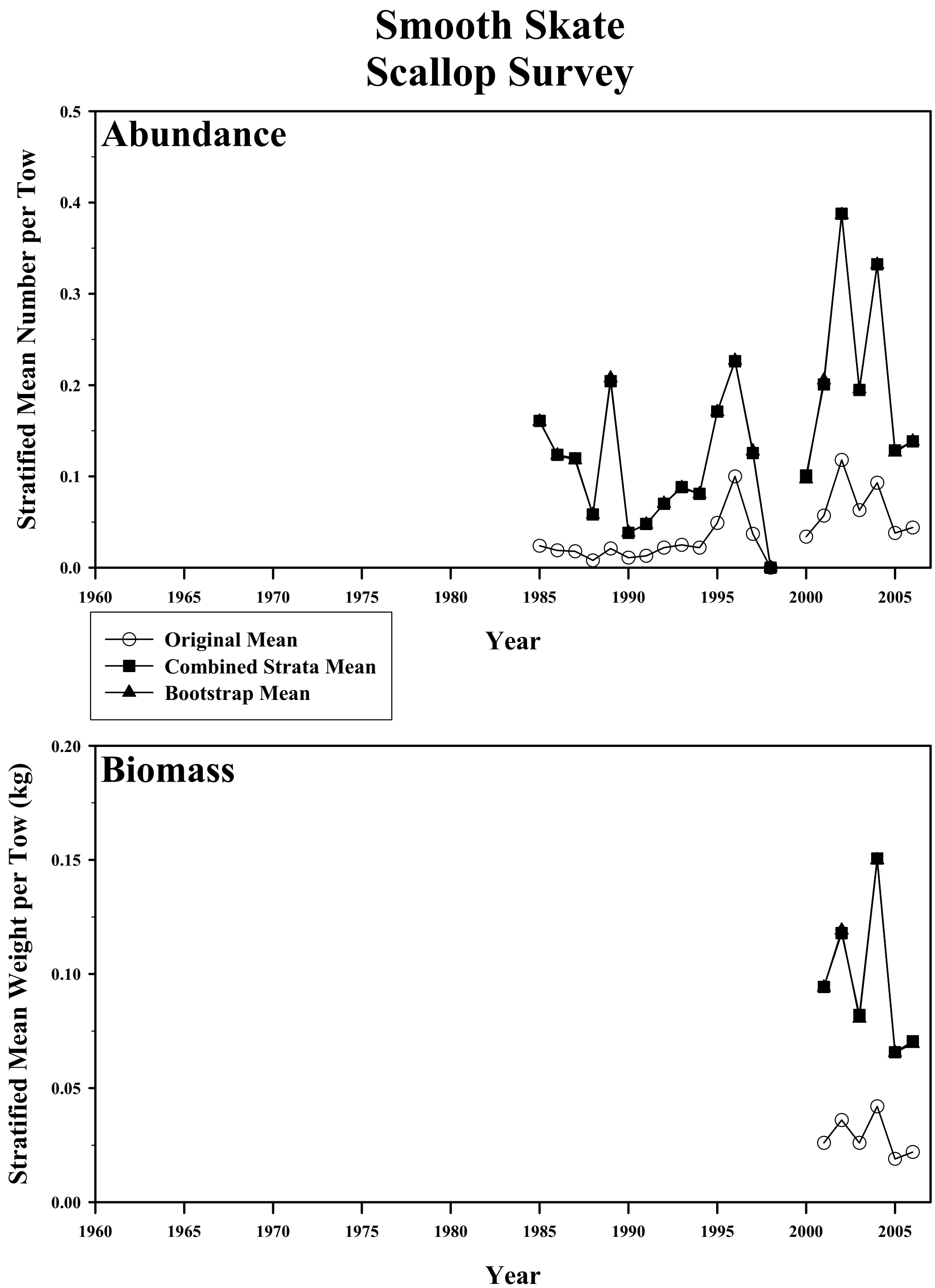


Figure B2.94. Abundance and biomass of smooth skate from the NESFC scallop surveys from 1985-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

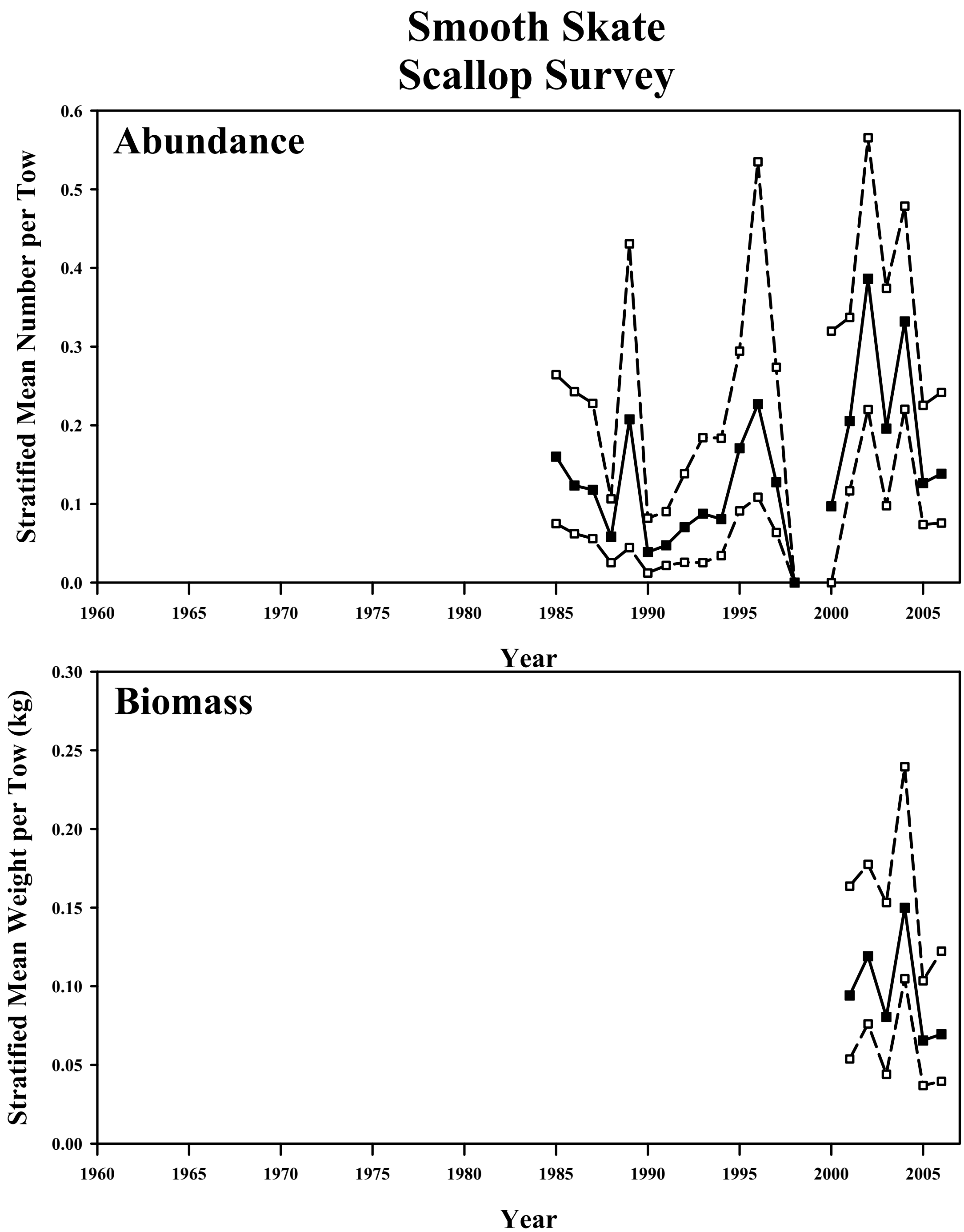


Figure B2.95. Bootstrapped abundance and biomass of smooth skate from the NESFC scallop survey. Mean index in solid squares, 95% confidence interval in open squares.

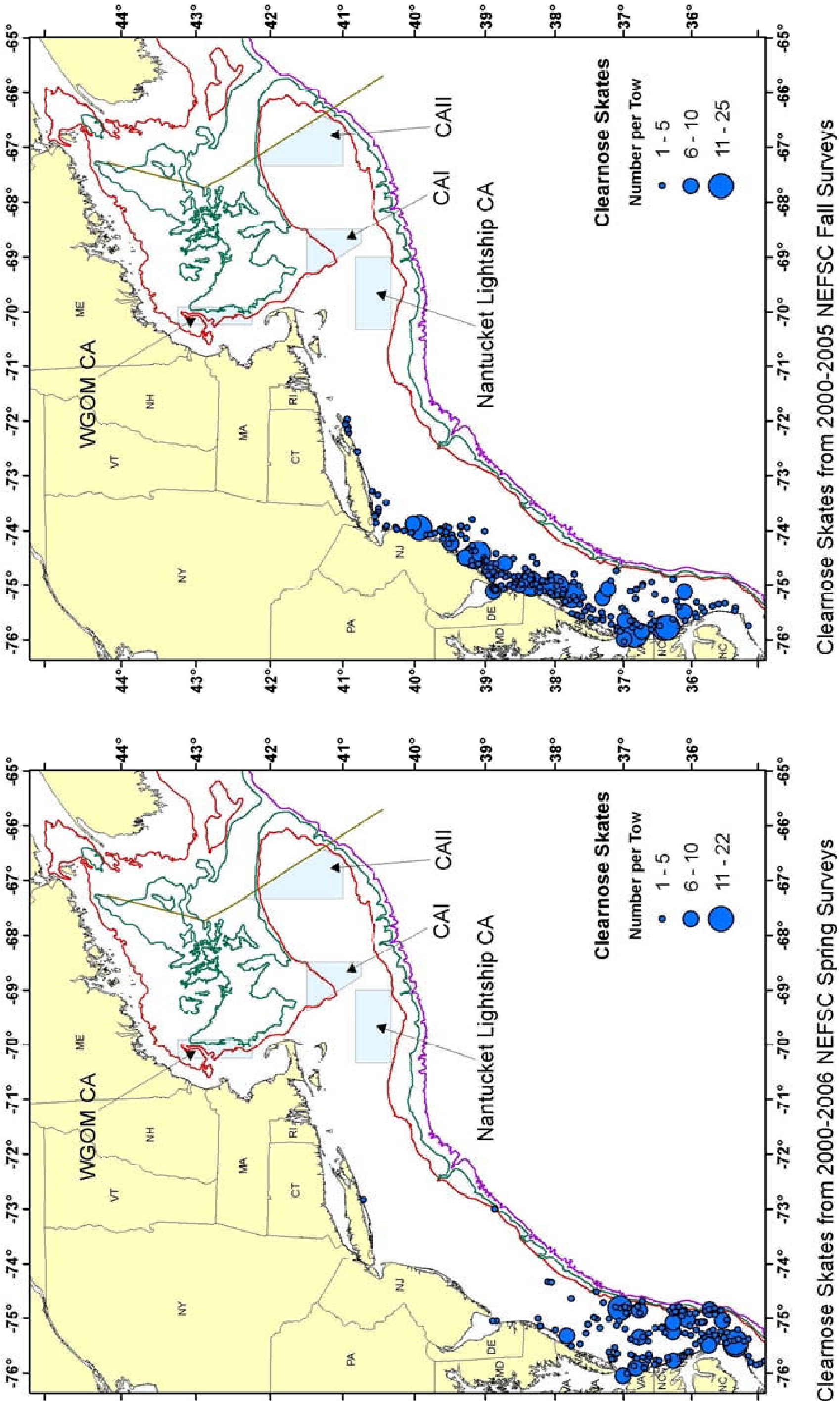


Figure B2.96. Distribution of clearnose skate from the spring and autumn NEFSC surveys from 2000-2006.

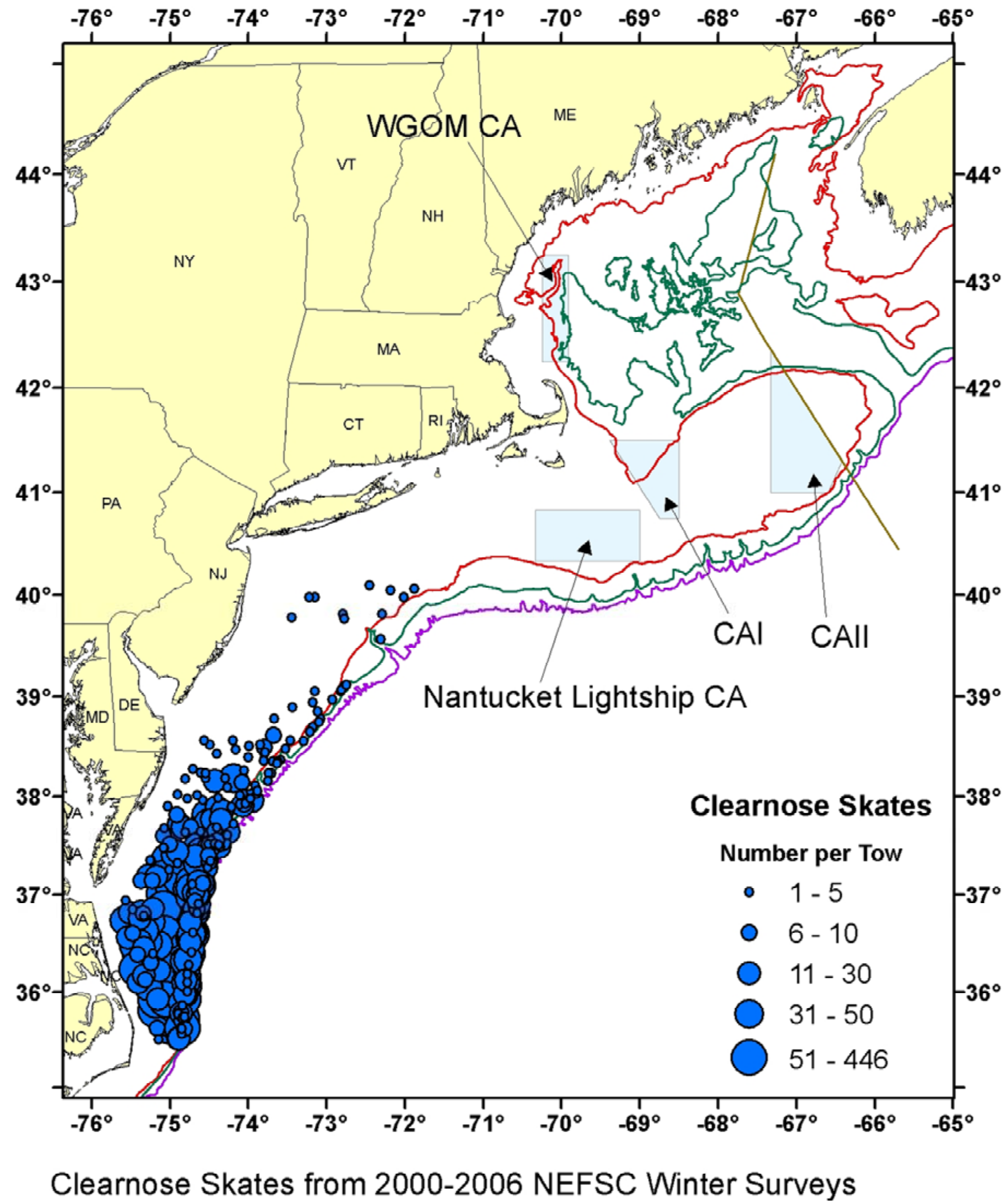


Figure B2.97. Distribution of clearnose skate from the winter NEFSC surveys from 2000-2006.

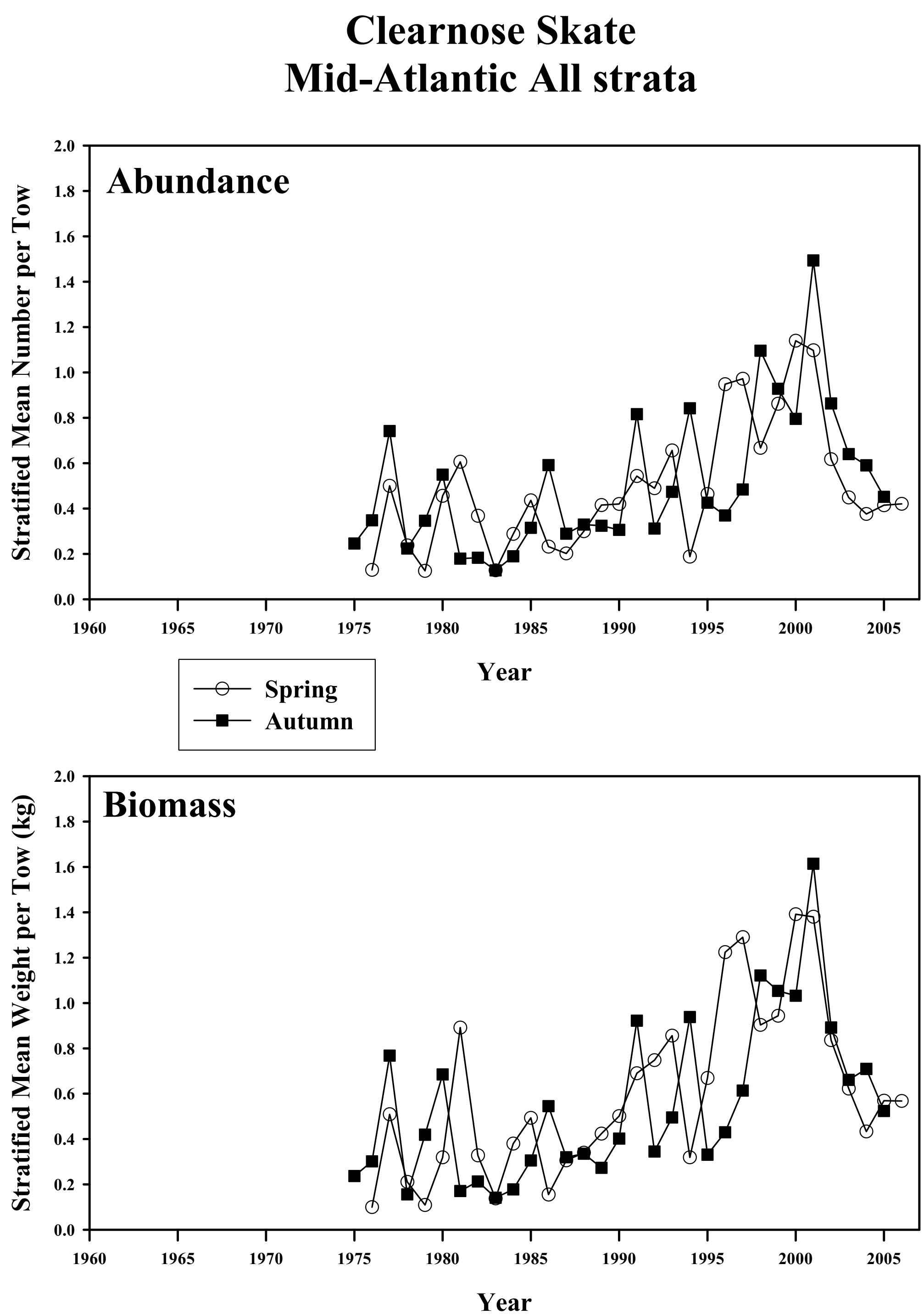


Figure B2.98. Abundance and biomass of clearnose skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1975-2006 in the Mid-Atlantic (all strata).

Clearnose Skate
Mid-Atlantic All Strata - Spring Survey

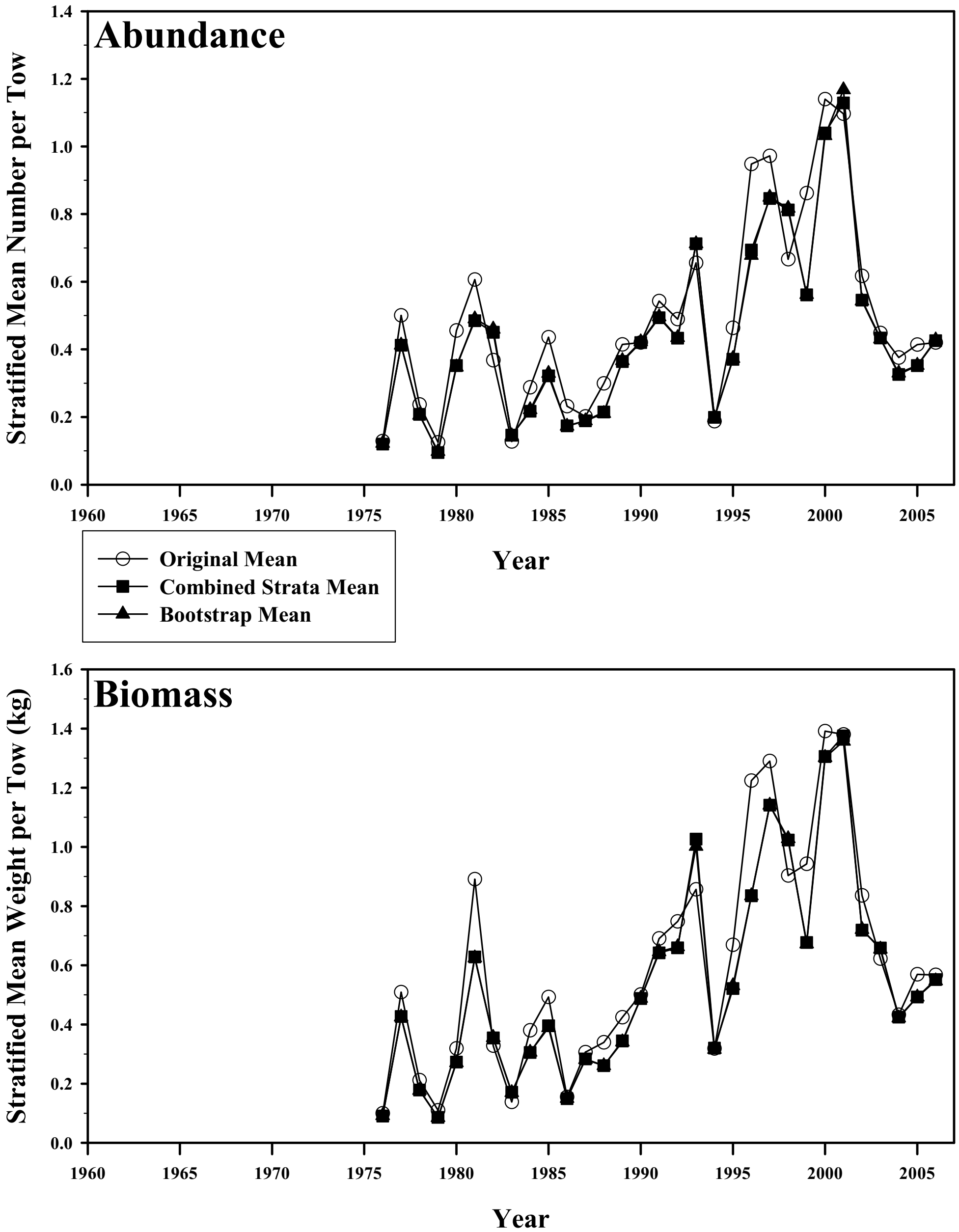


Figure B2.99. Abundance and biomass of clearnose skate from the NESFC spring bottom trawl surveys from 1976-2006 in the Mid-Atlantic (all strata). The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

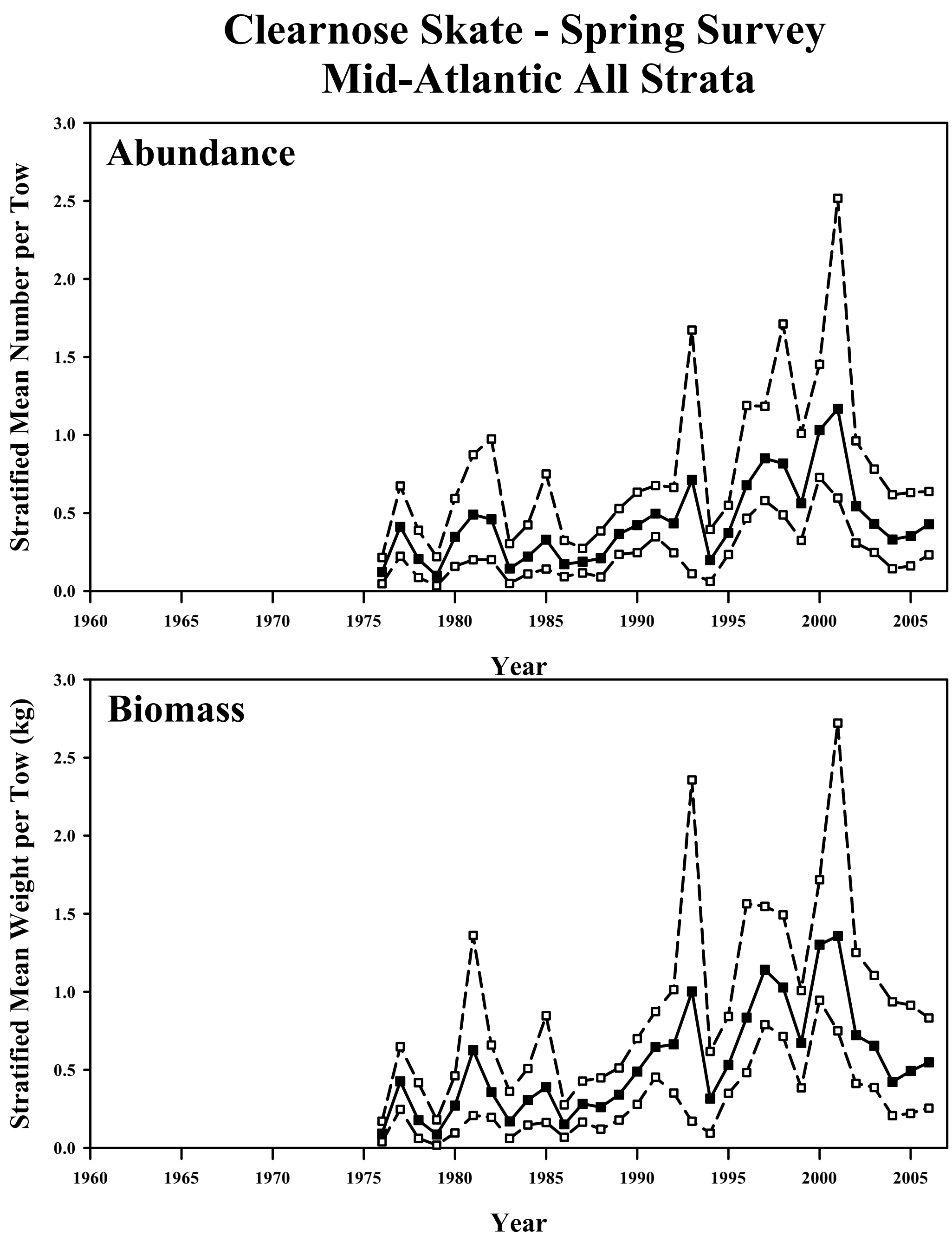


Figure B2.100. Bootstrapped abundance and biomass of clearnose skate from the NESFC spring bottom trawl survey in the Mid-Atlantic region (all strata). Mean index in solid squares, 95% confidence interval in open squares.

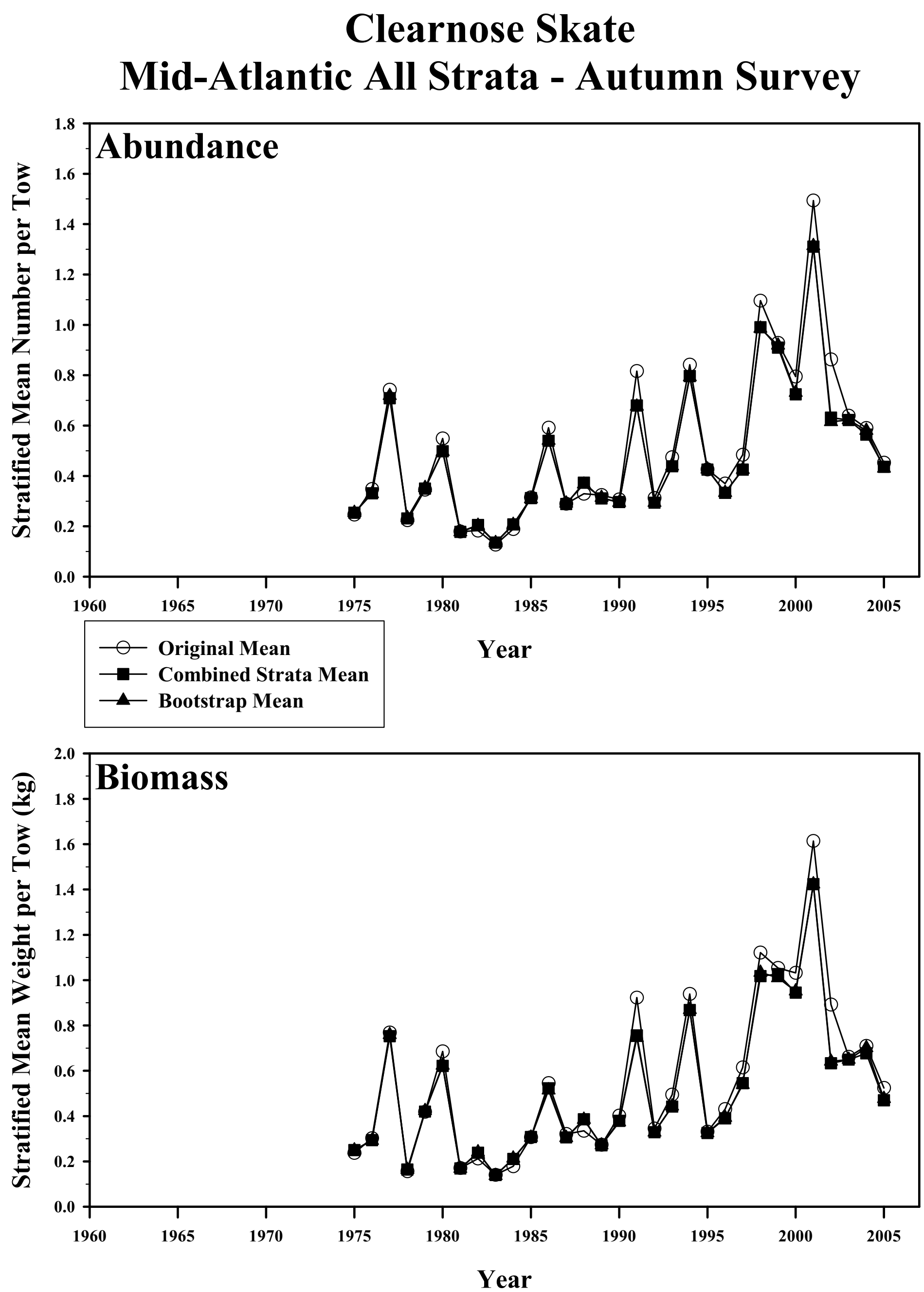


Figure B2.101. Abundance and biomass of clearnose skate from the NESFC autumn bottom trawl surveys from 1976-2006 in the Mid-Atlantic (all strata). The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

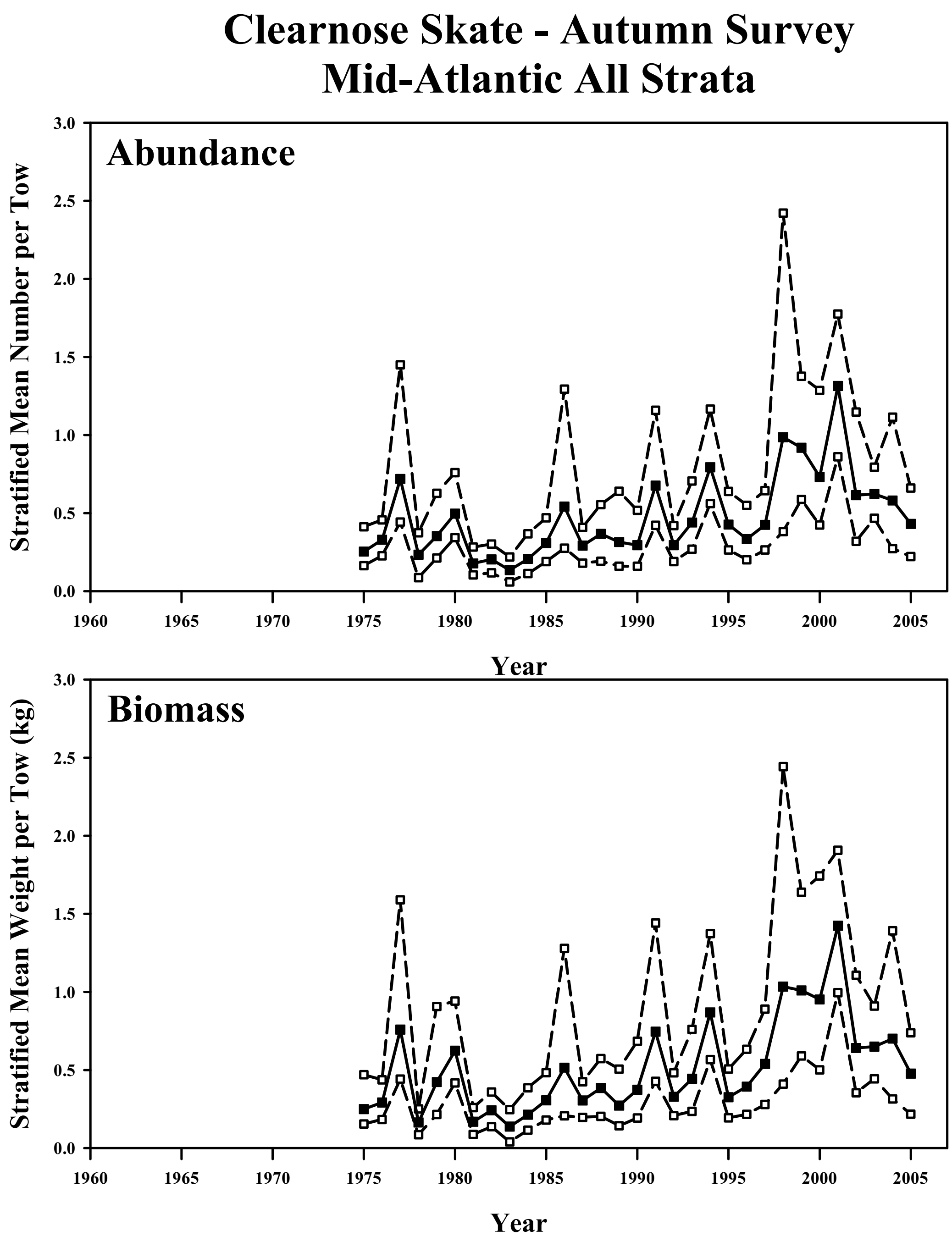
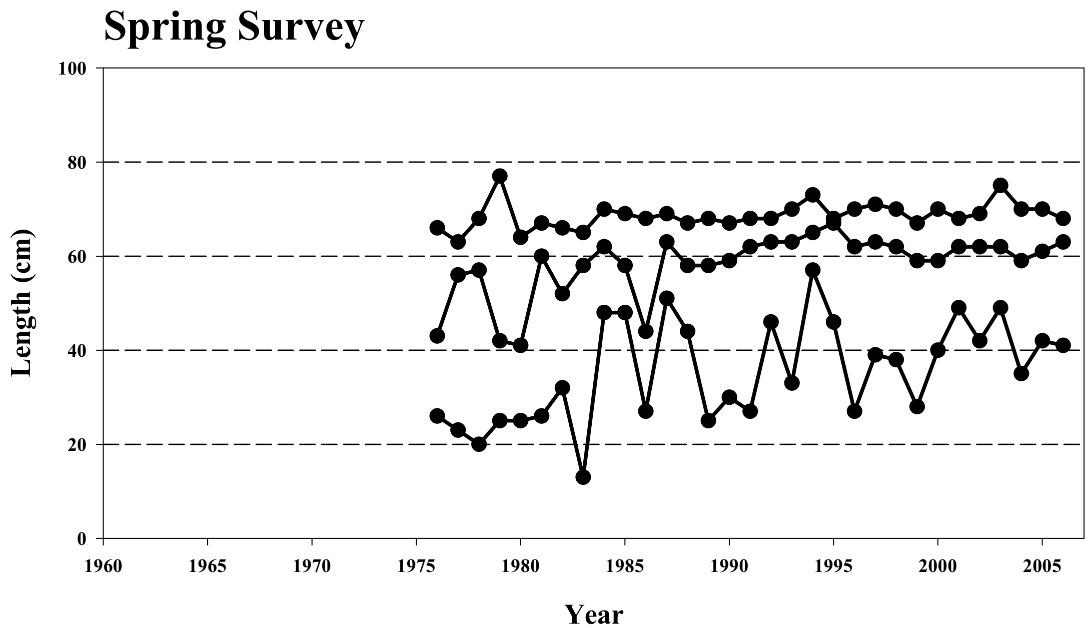


Figure B2.102. Bootstrapped abundance and biomass of clearnose skate from the NESFC autumn bottom trawl survey in the Mid-Atlantic region (all strata). Mean index in solid squares, 95% confidence interval in open squares.

Clearnose Skate
Percentiles of Length Composition



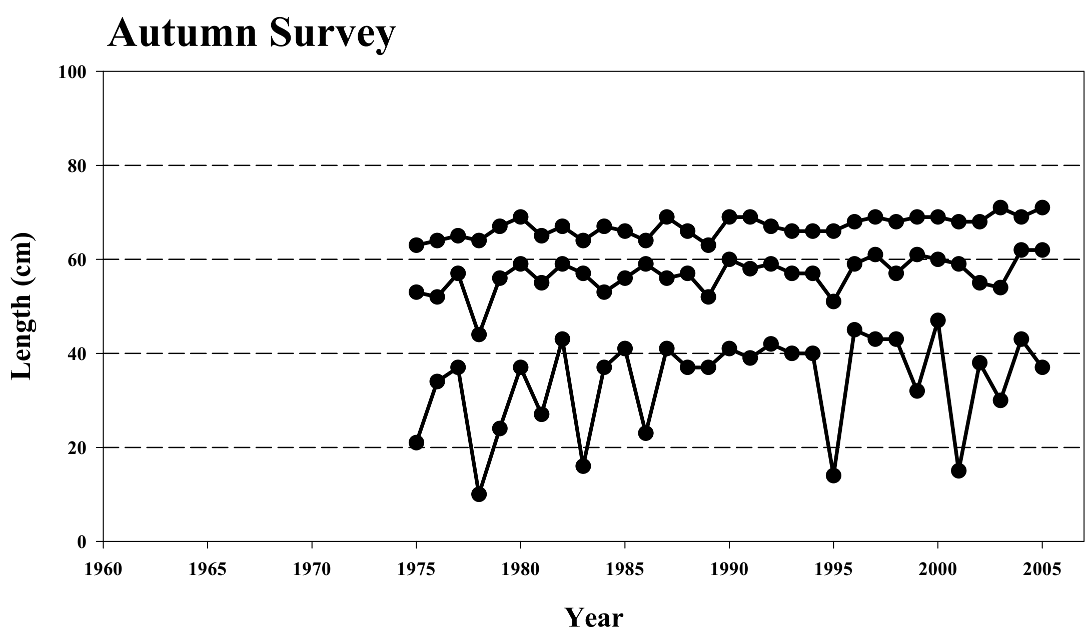


Figure B2.103. Percentiles of length composition (5, 50, and 95) of clearnose skate from the NESFC spring and autumn bottom trawl surveys from 1975-2006 in the Mid-Atlantic region (all strata).

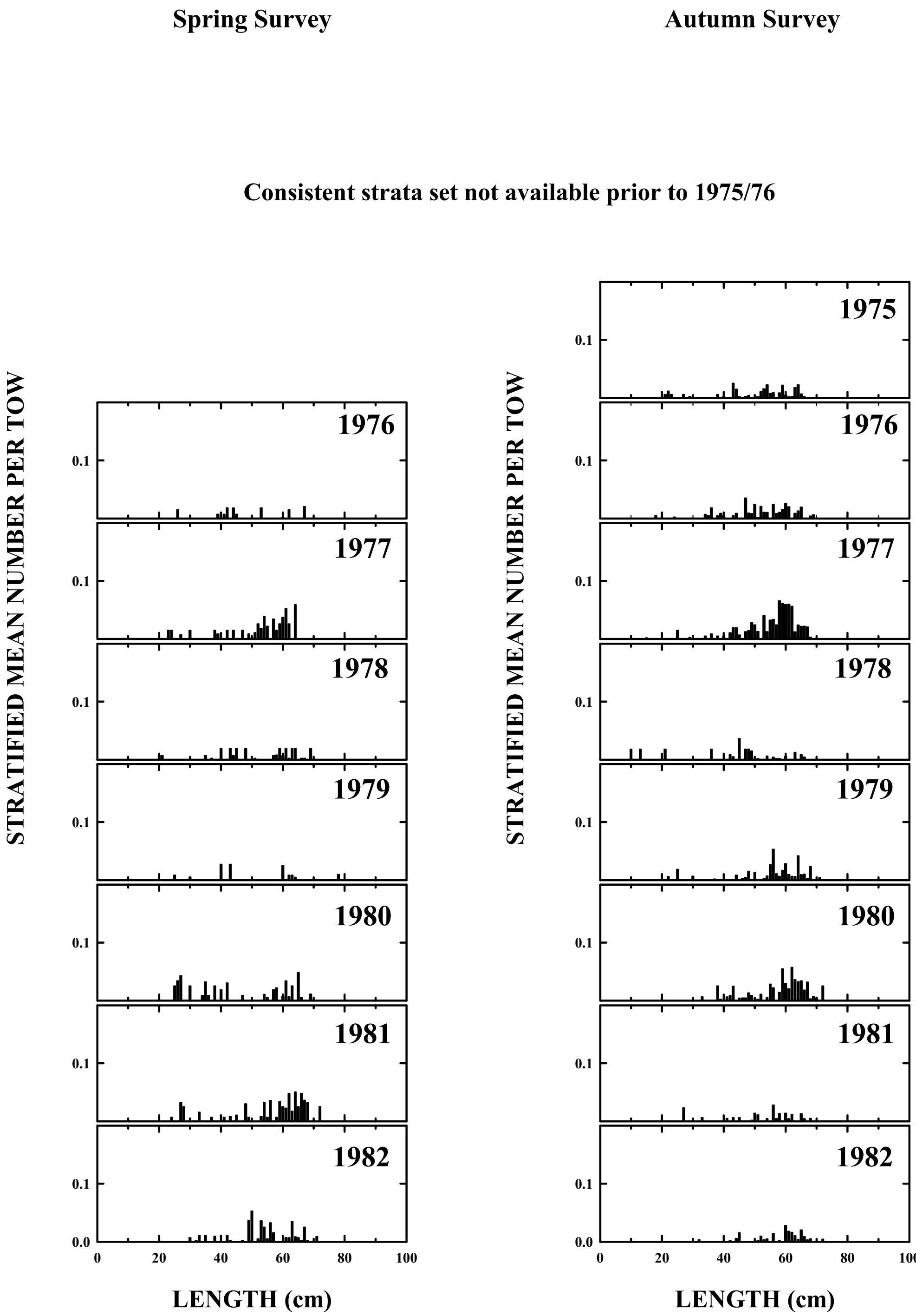


Figure B2.104. Clearnose skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic (all strata), 1975-1982.

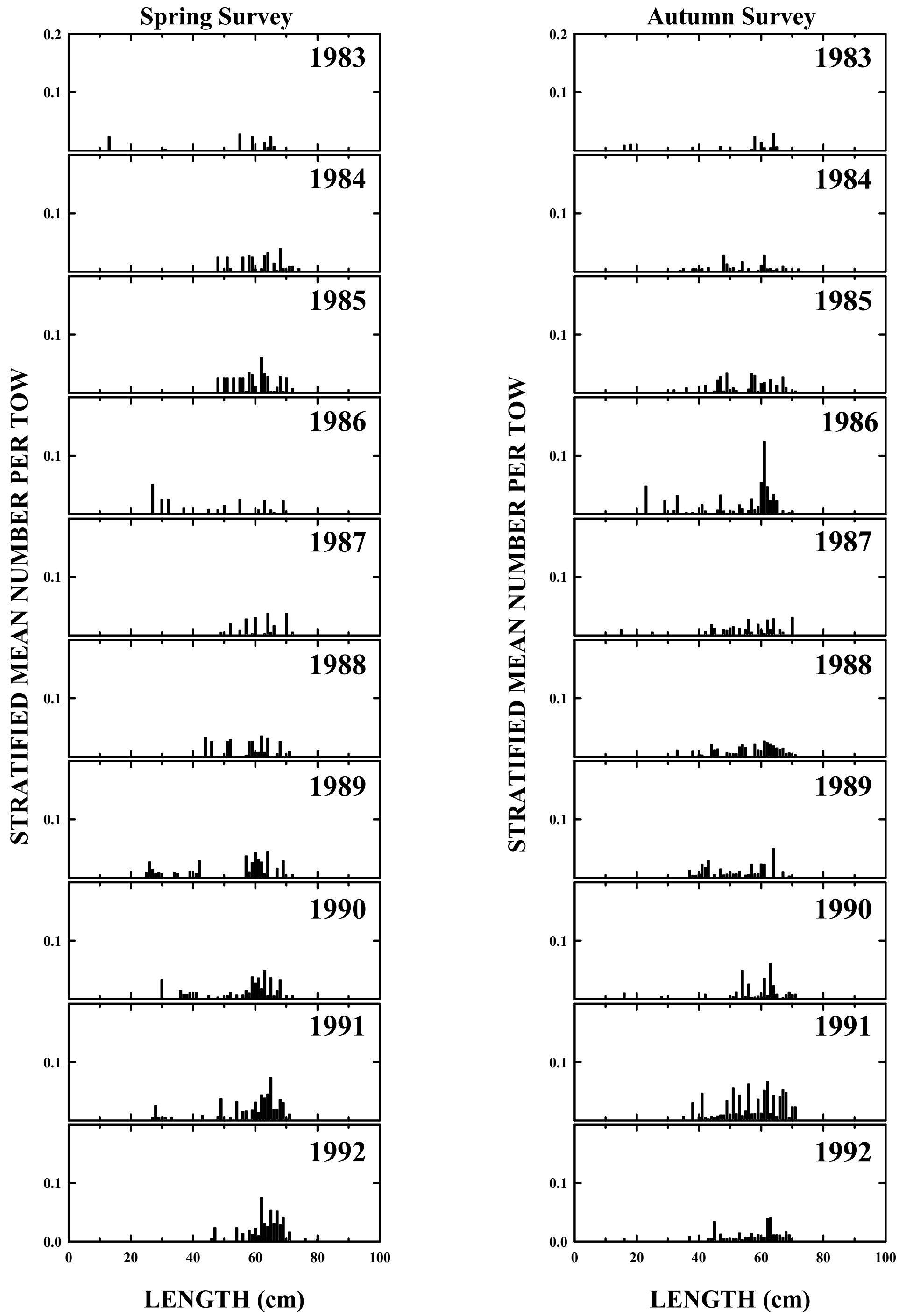


Figure B2.105. Clearnose skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic (all strata), 1983-1992.

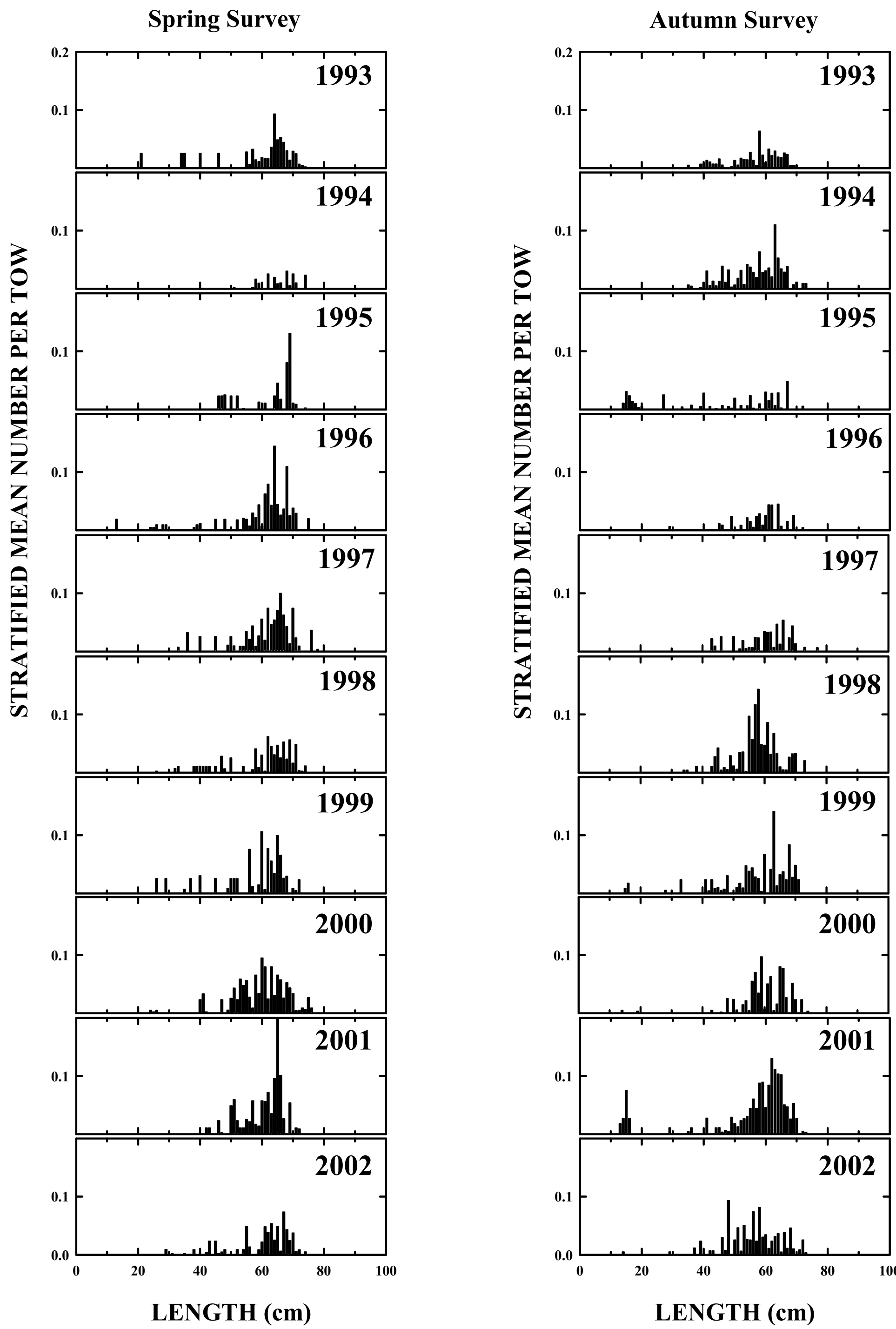


Figure B2.106. Clearnose skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic (all strata), 1993-2002.

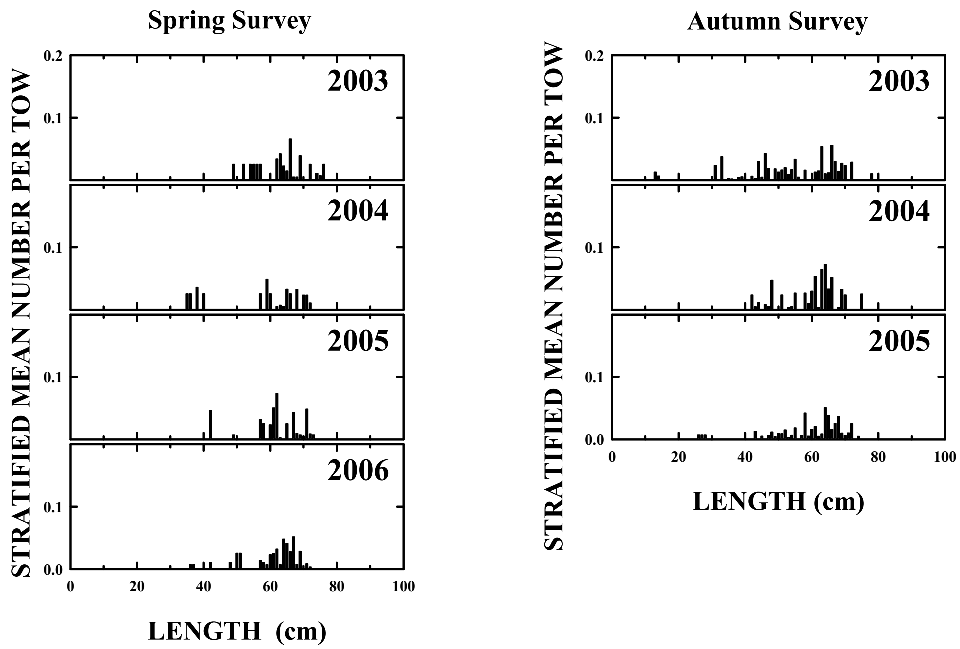


Figure B2.107. Clearnose skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic (all strata), 2003-2006.

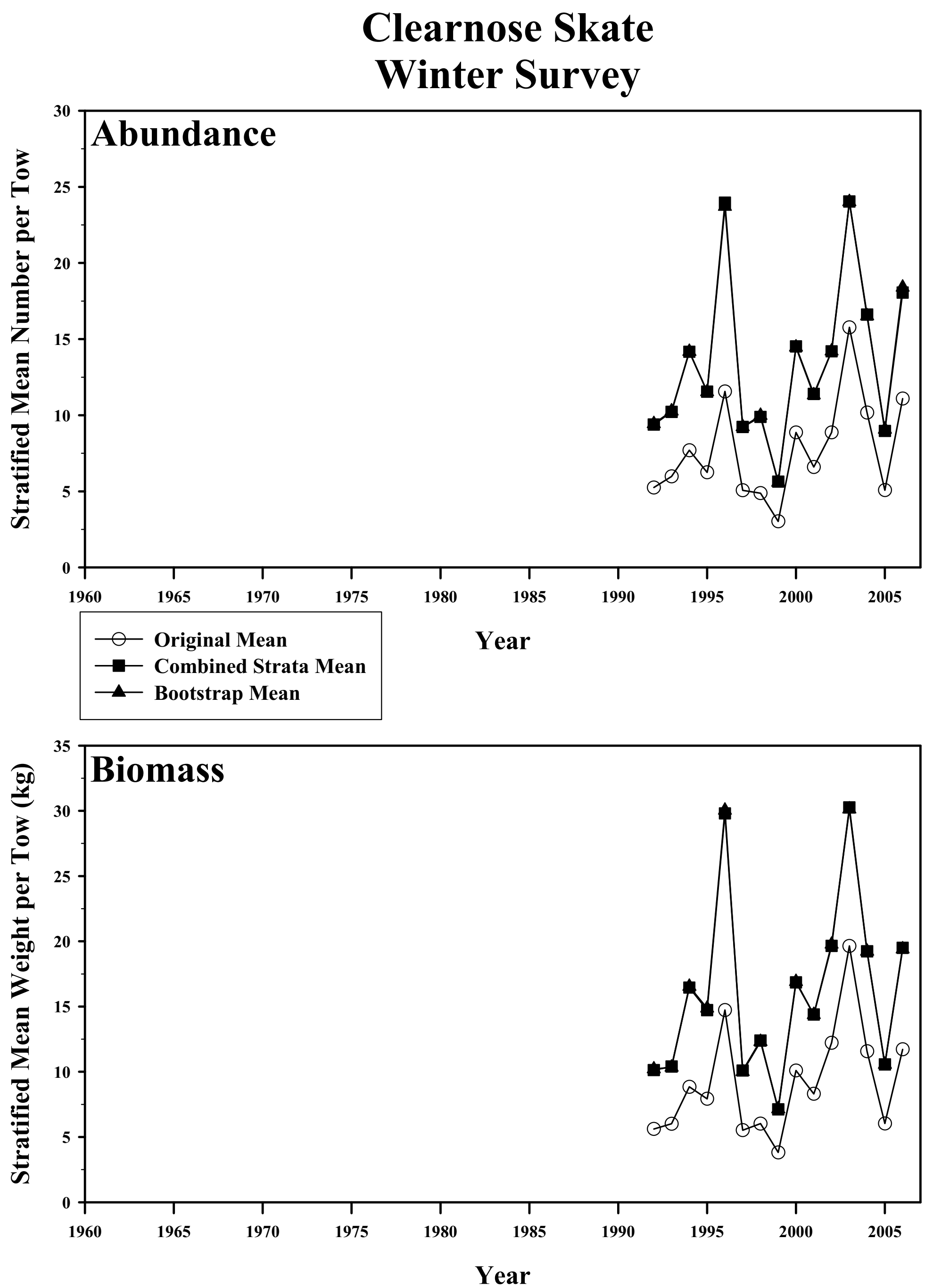


Figure B2.108. Abundance and biomass of clearnose skate from the NESFC winter bottom trawl surveys from 1992-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

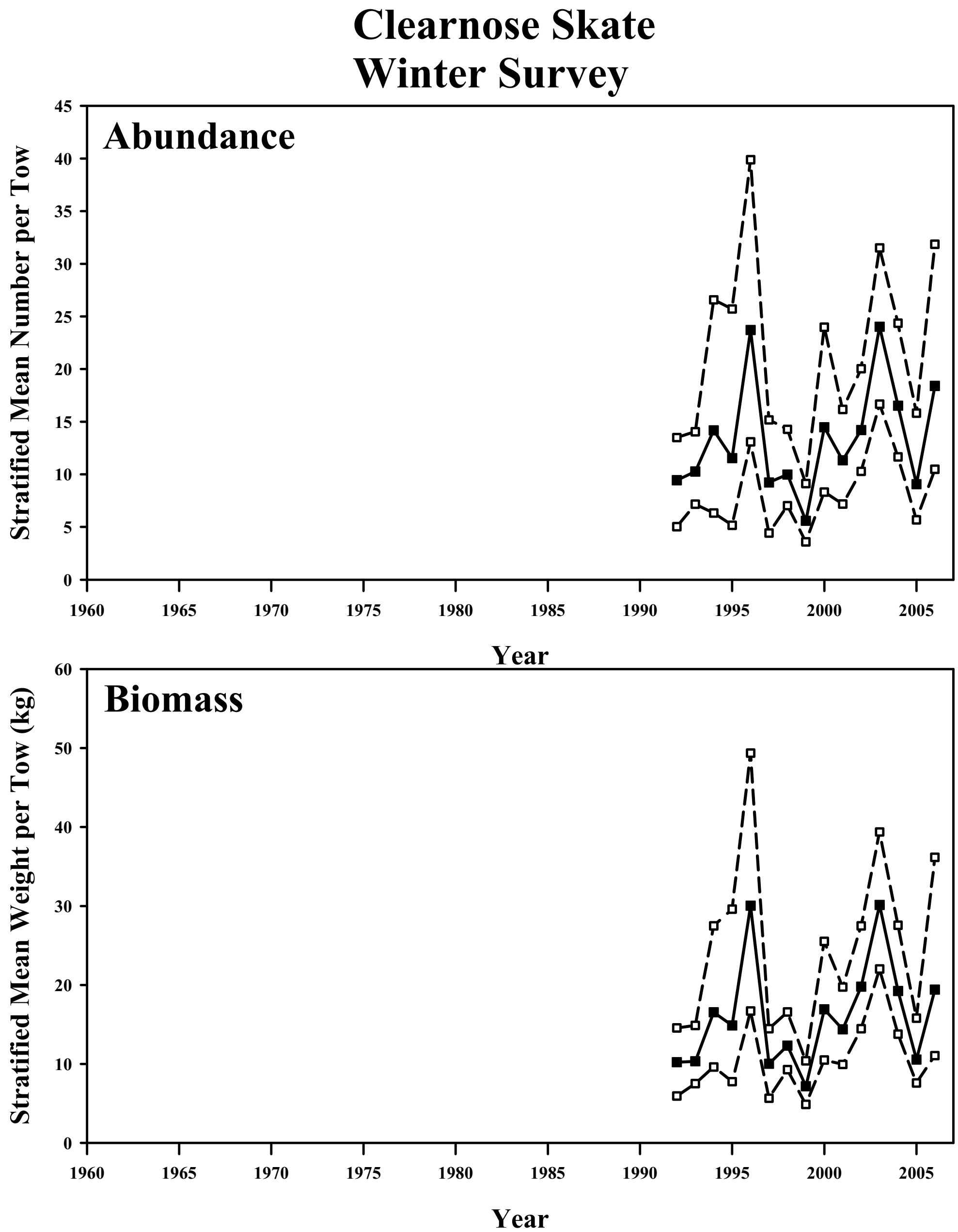


Figure B2.109. Bootstrapped abundance and biomass of clearnose skate from the NESFC winter bottom trawl survey. Mean index in solid squares, 95% confidence interval in open squares.

Clearnose Skate - CTDEP Finfish Survey

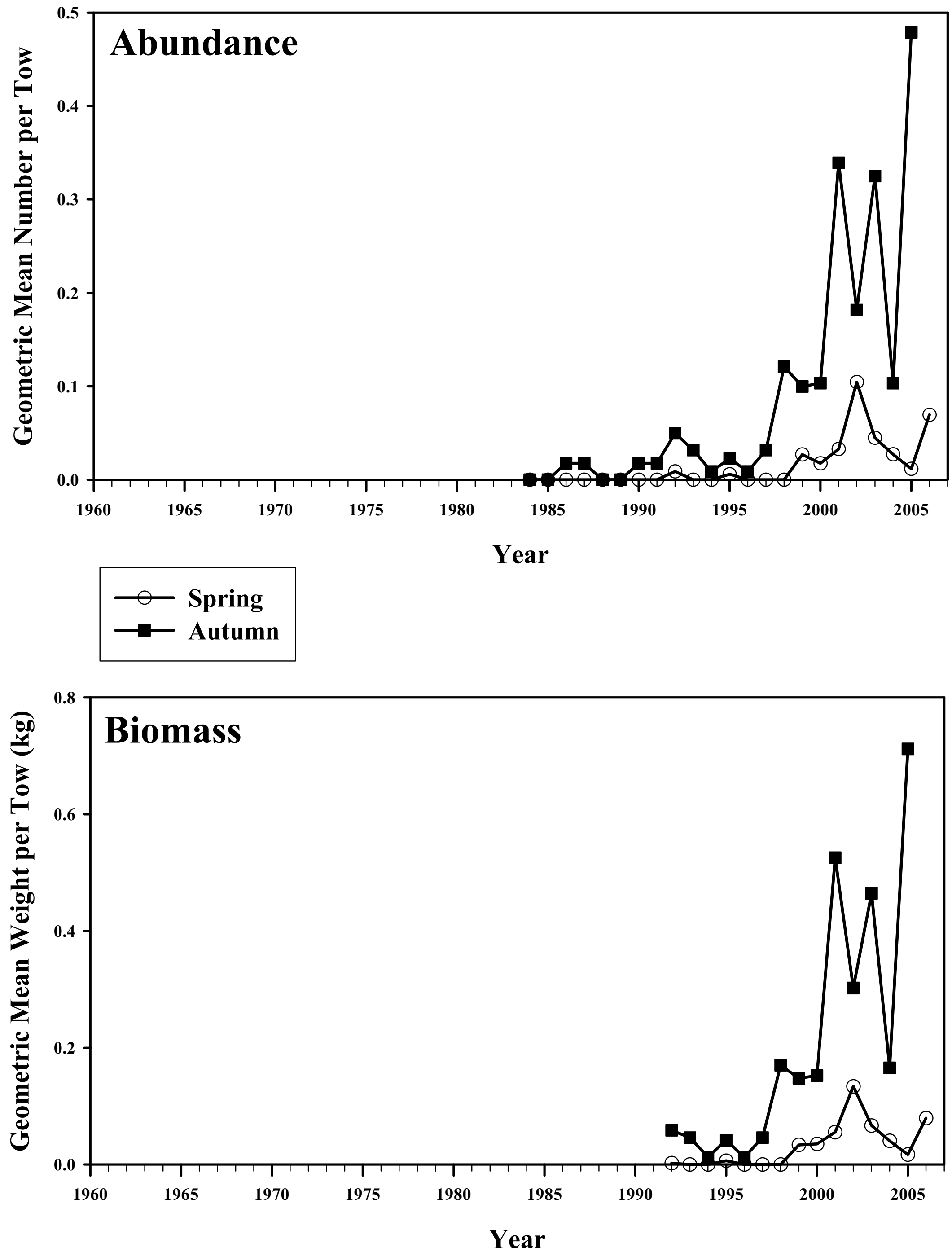
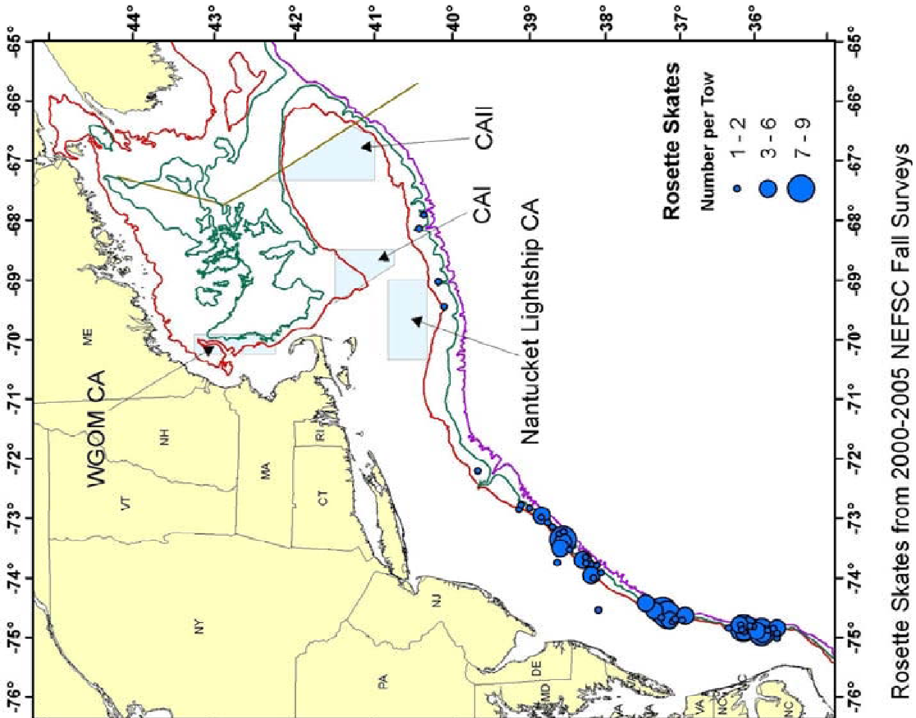


Figure B2.110. Abundance and biomass of clearnose skate from the CTDEP spring and autumn finfish bottom trawl survey in Connecticut state waters, 1984-2006.



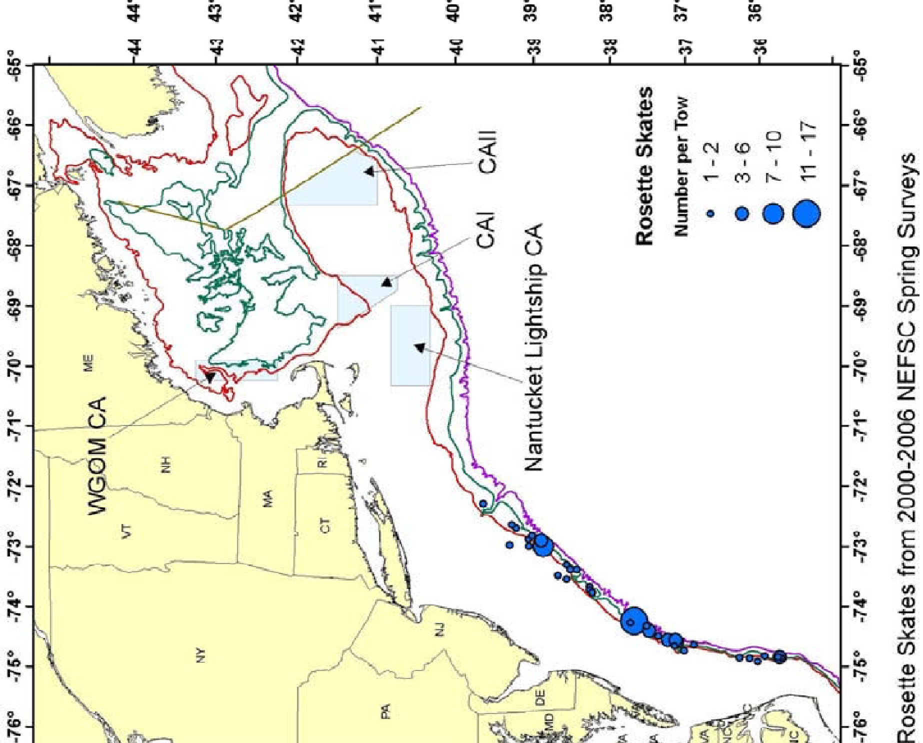


Figure B2.111. Distribution of rosette skate from the spring and autumn NEFSC surveys from 2000-2006.

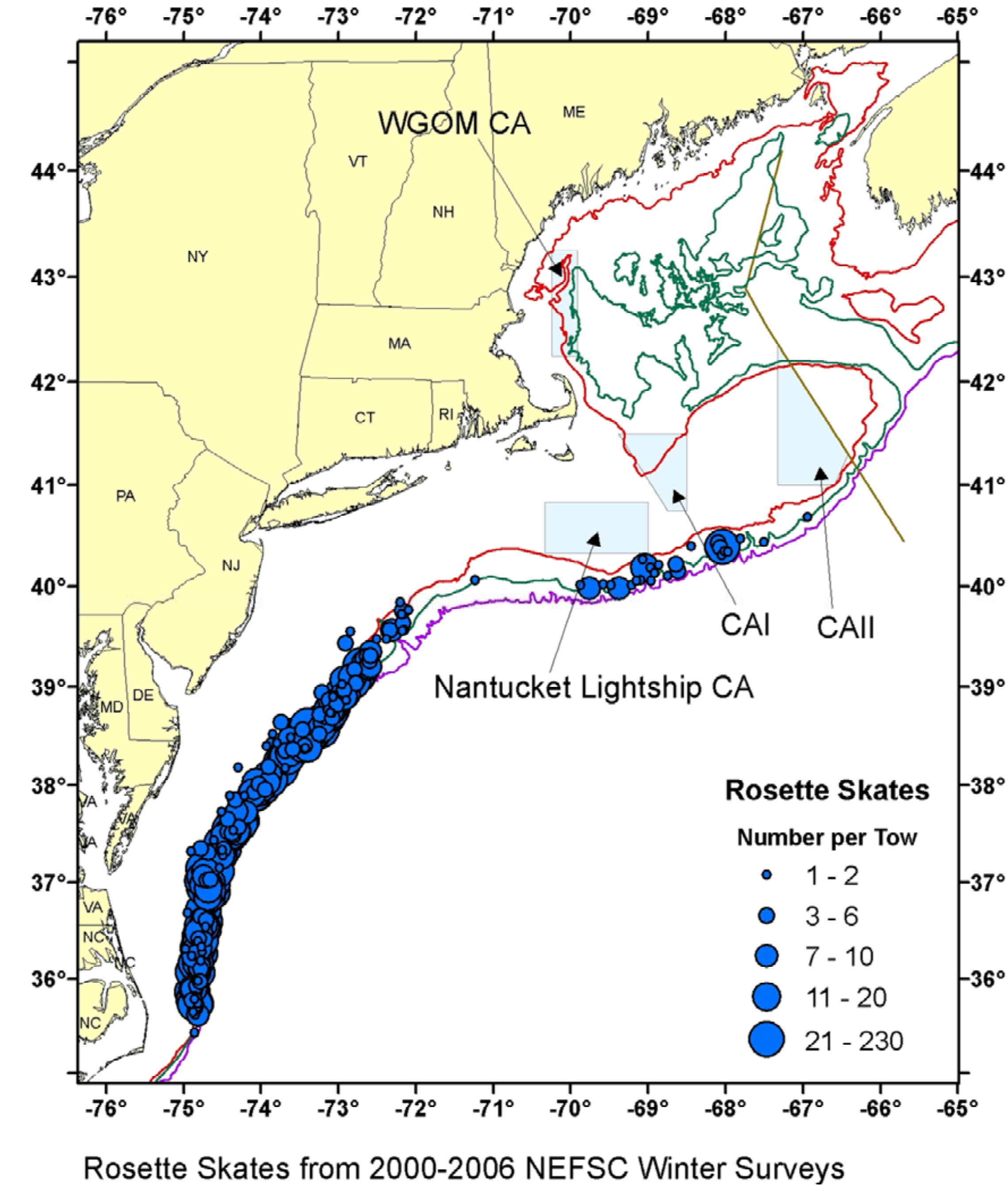


Figure B2.112. Distribution of rosette skate from the winter NEFSC surveys from 2000-2006.

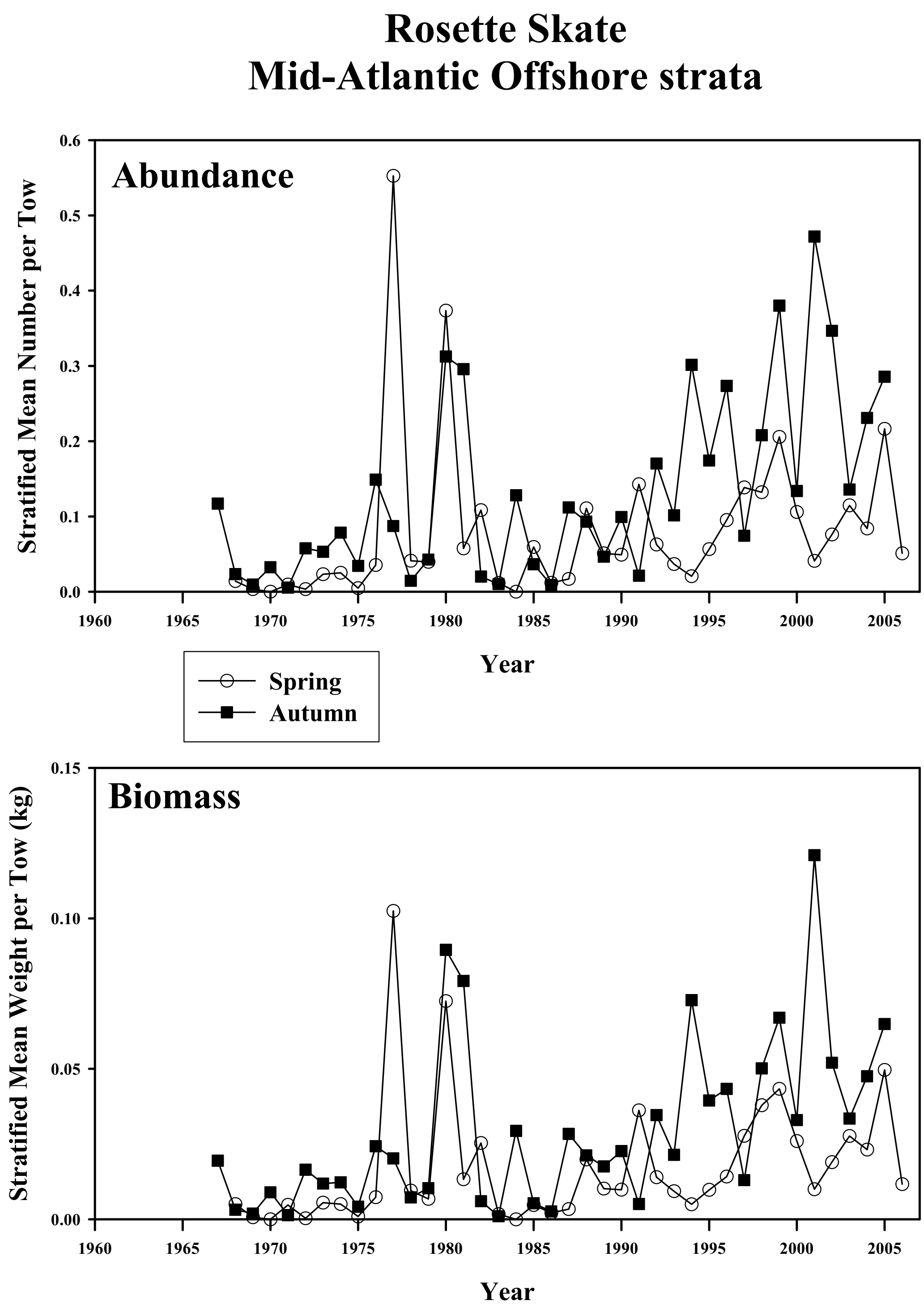


Figure B2.113. Abundance and biomass of rosette skate from the NESFC spring (circles) and autumn (squares) bottom trawl surveys from 1967-2006 in the Mid-Atlantic offshore region.

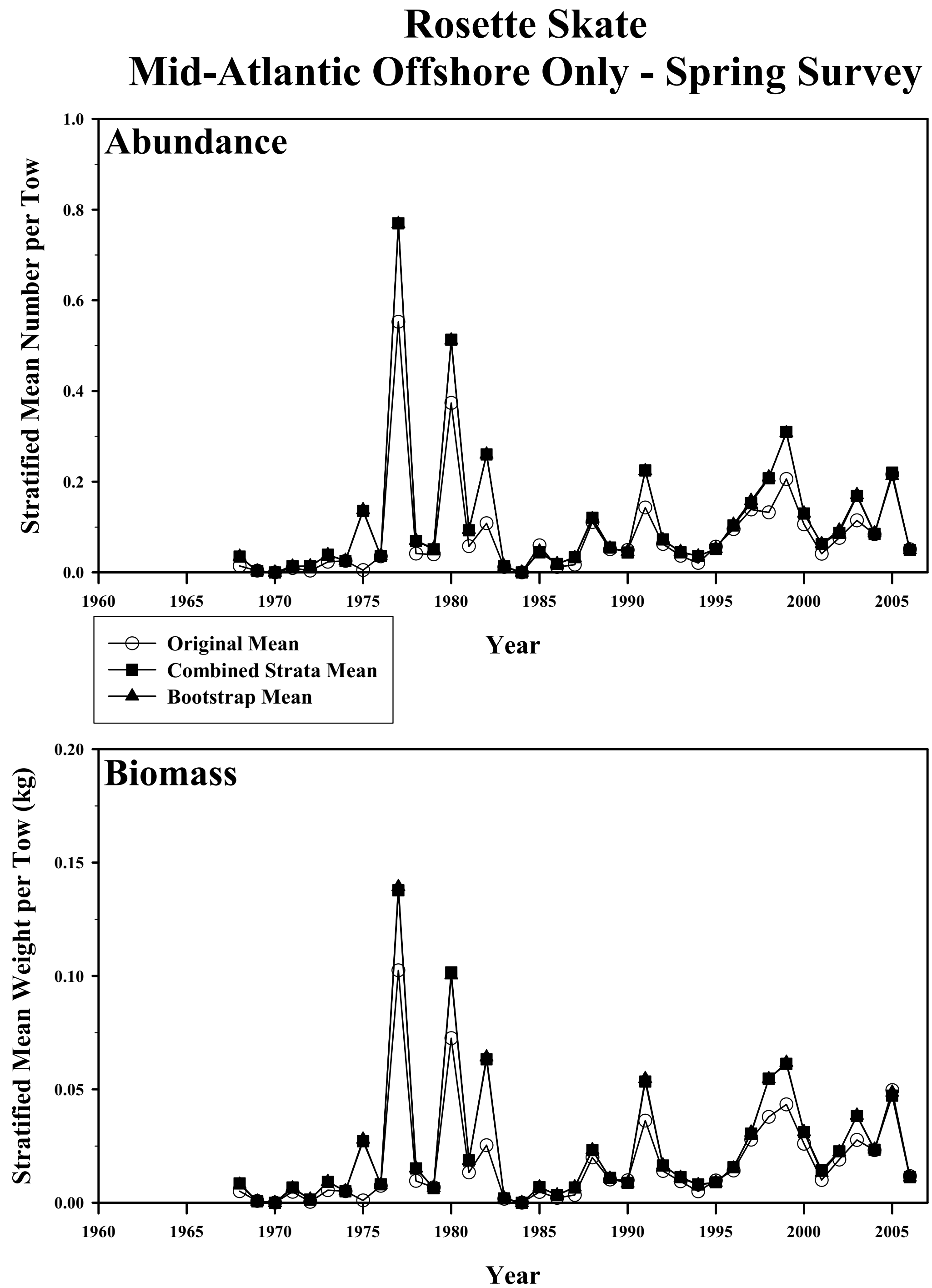


Figure B2.114. Abundance and biomass of rosette skate from the NESFC spring bottom trawl surveys from 1968-2006 in the Mid-Atlantic offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

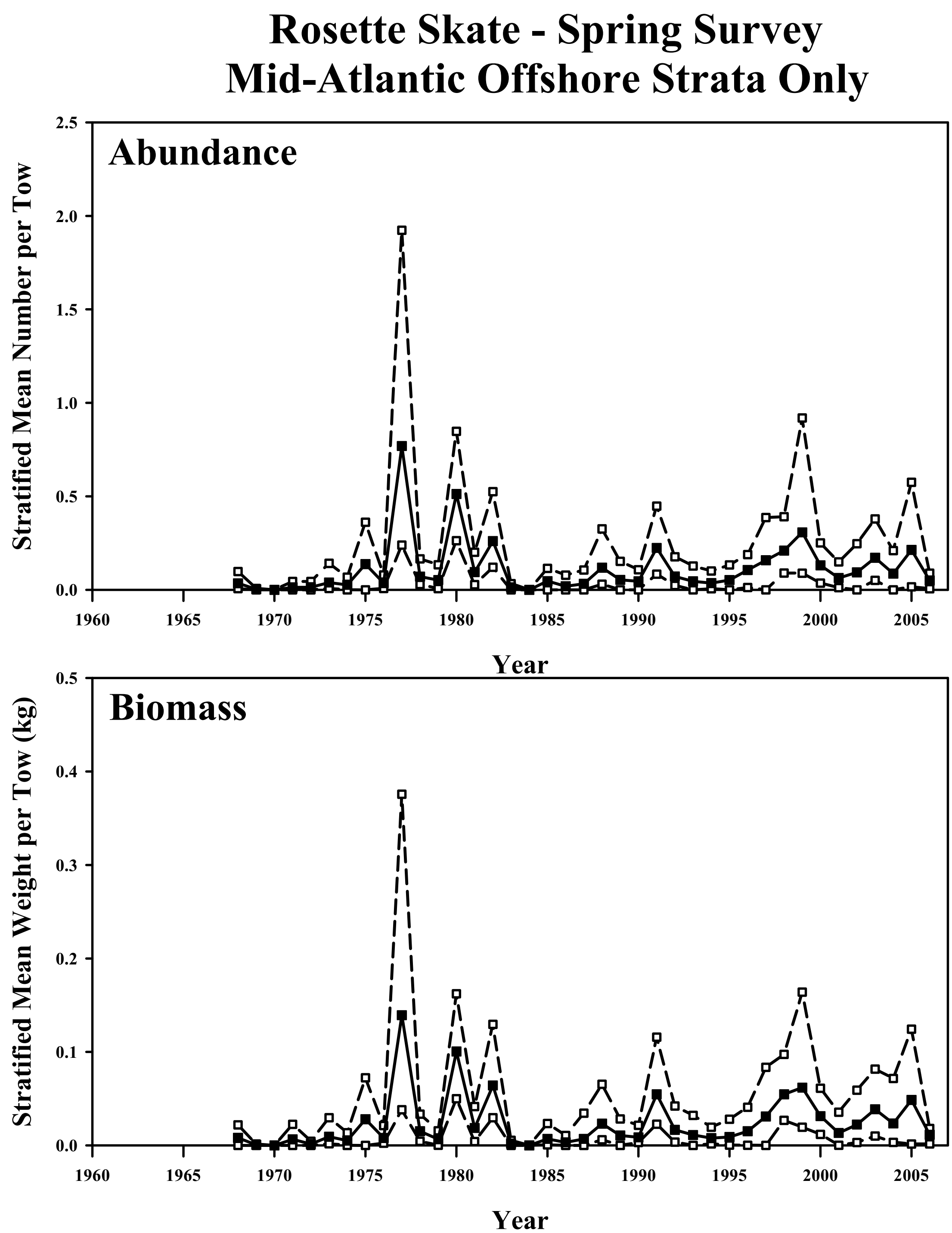


Figure B2.115. Bootstrapped abundance and biomass of rosette skate from the NESFC spring bottom trawl survey in the Mid-Atlantic offshore region. Mean index in solid squares, 95% confidence interval in open squares.

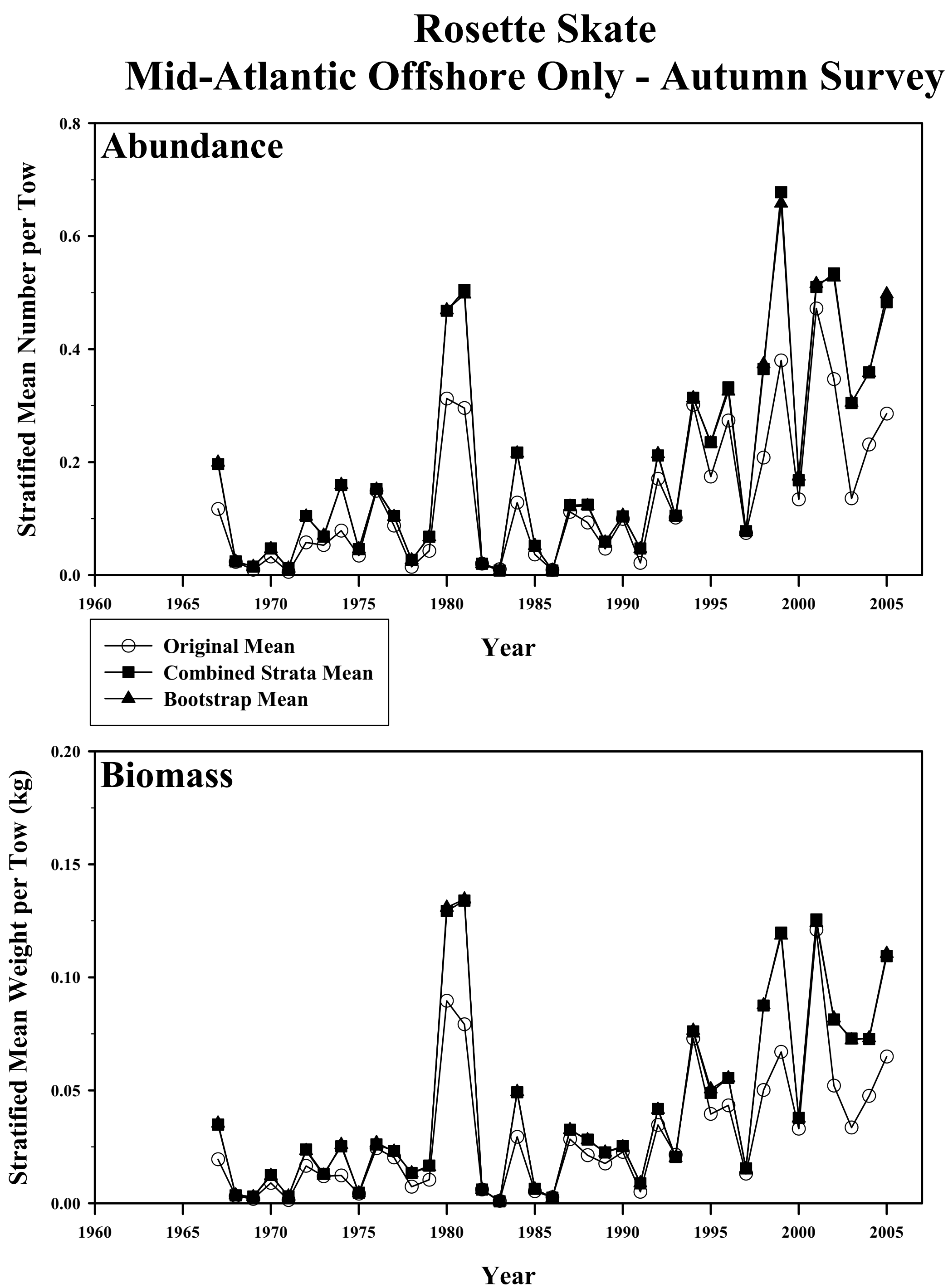


Figure B2.116. Abundance and biomass of rosette skate from the NESFC autumn bottom trawl surveys from 1967-2005 in the Mid-Atlantic offshore region. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

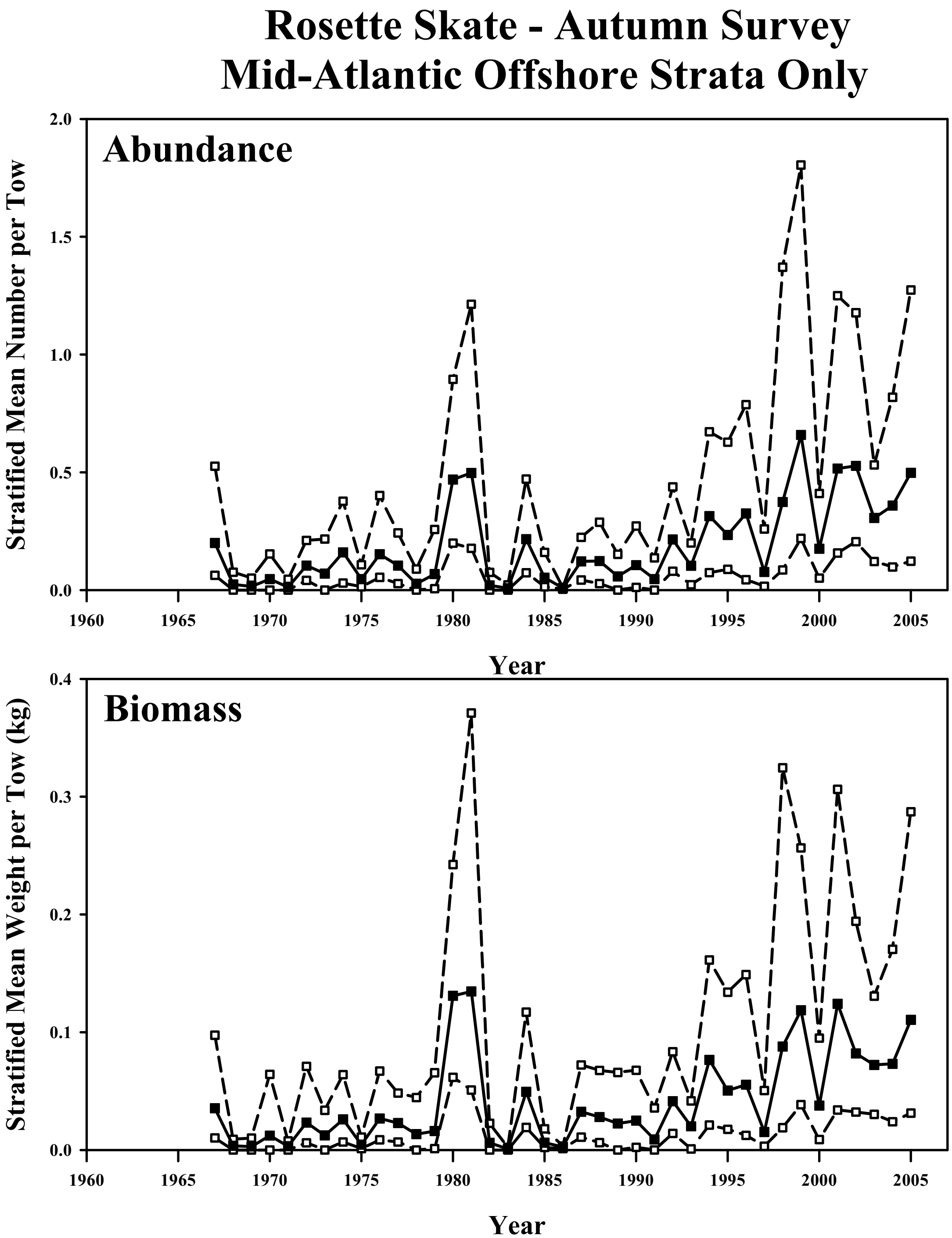


Figure B2.117. Bootstrapped abundance and biomass of rosette skate from the NESFC autumn bottom trawl survey in the Mid-Atlantic offshore region. Mean index in solid squares, 95% confidence interval in open squares.

Rosette Skate
Percentiles of Length Composition

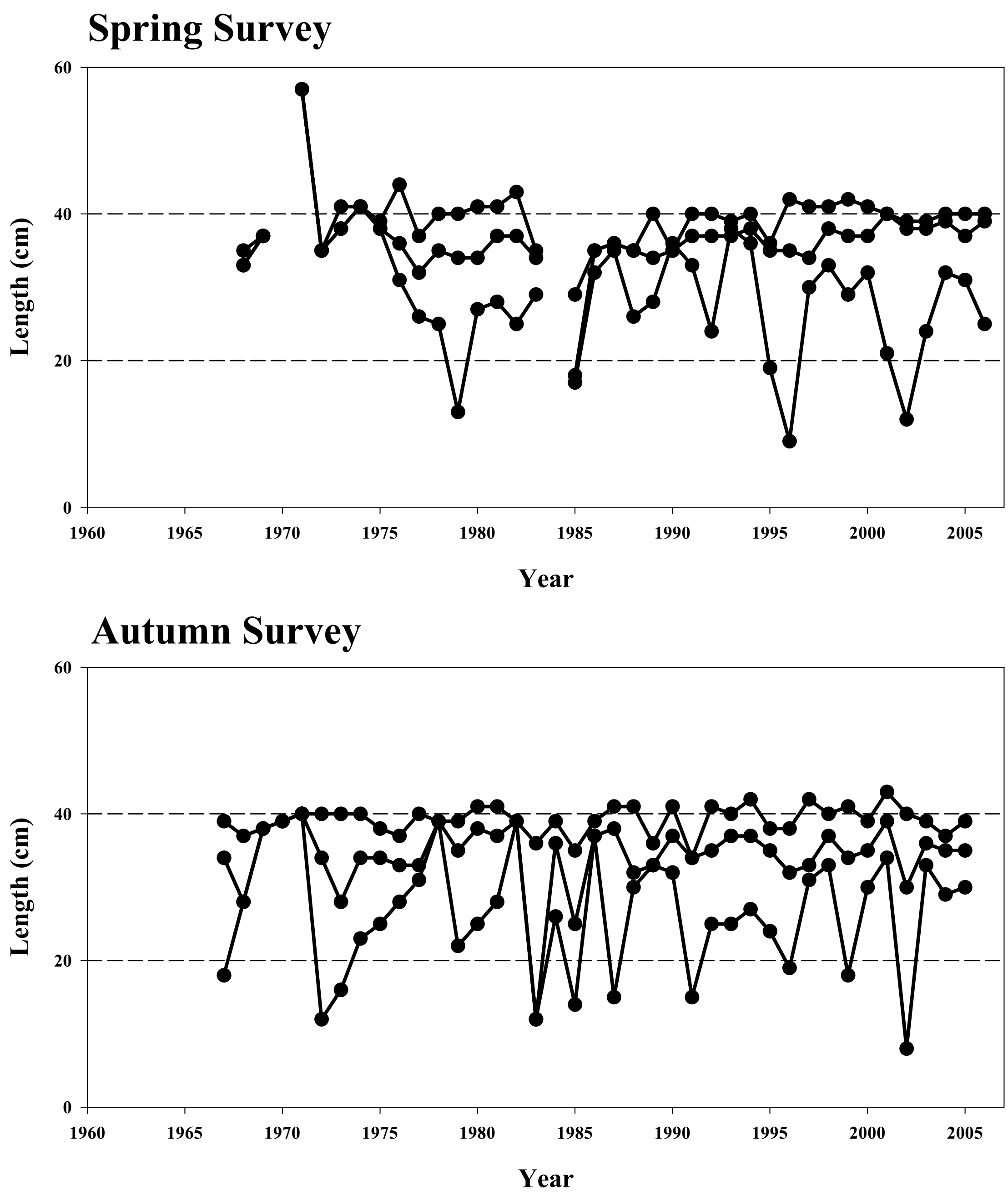


Figure B2.118. Percentiles of length composition (5, 50, and 95) of rosette skate from the NESFC spring and autumn bottom trawl surveys from 1967-2006 in the Mid-Atlantic offshore region.

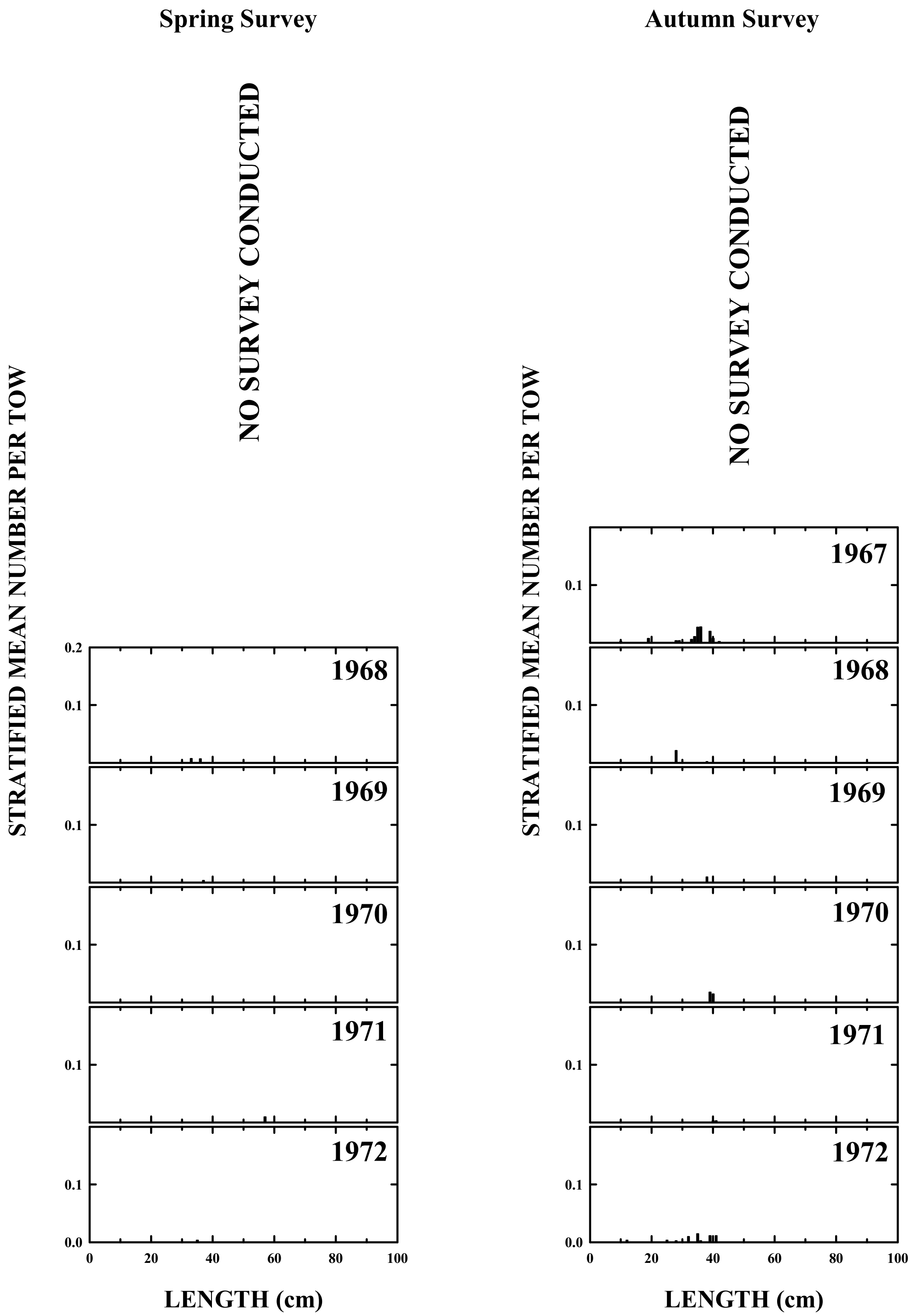


Figure B2.119. Rosette skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic offshore region, 1967-1972.

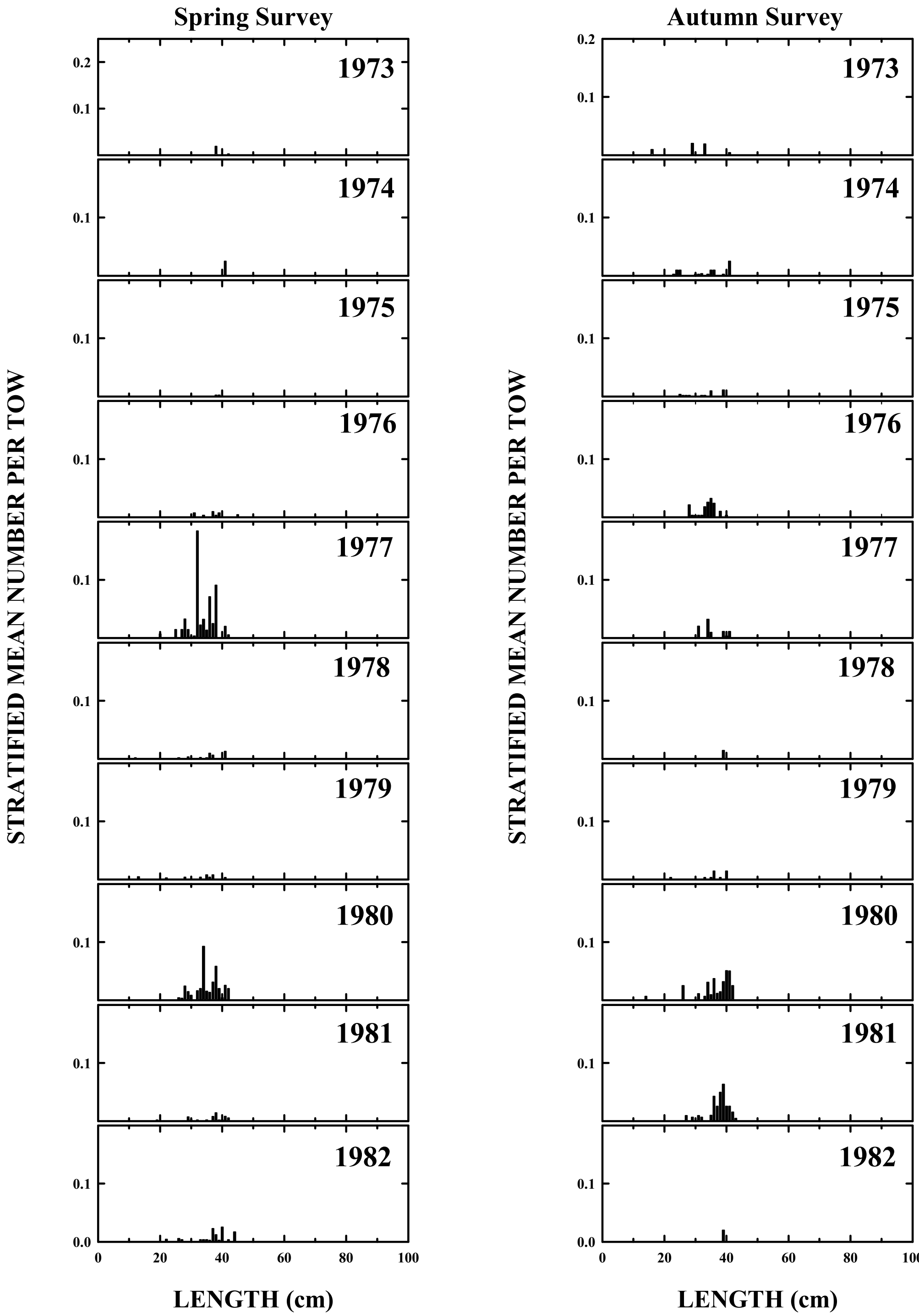


Figure B2.120. Rosette skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic offshore region, 1973-1982.

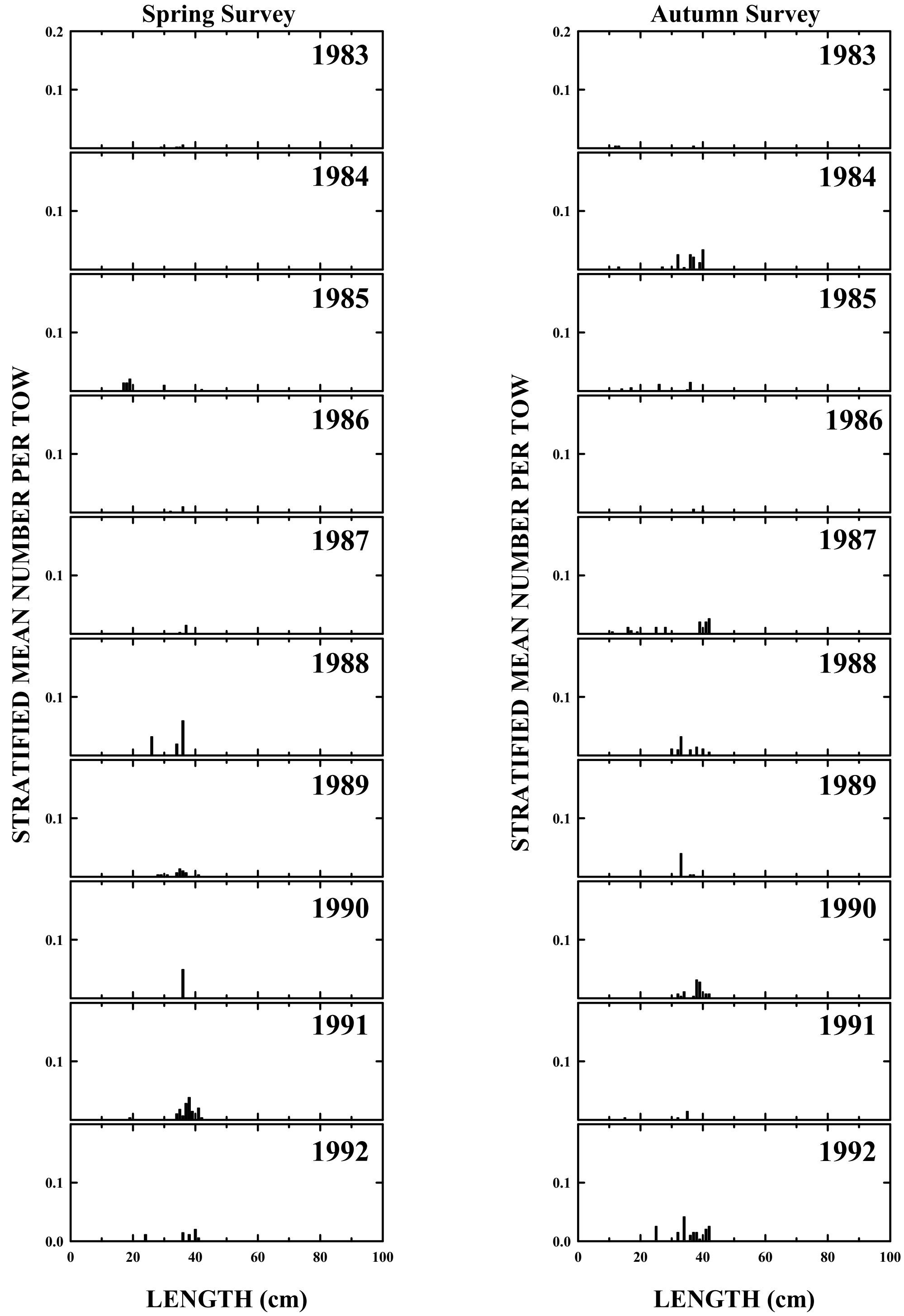


Figure B2.121. Rosette skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic offshore region, 1983-1992.

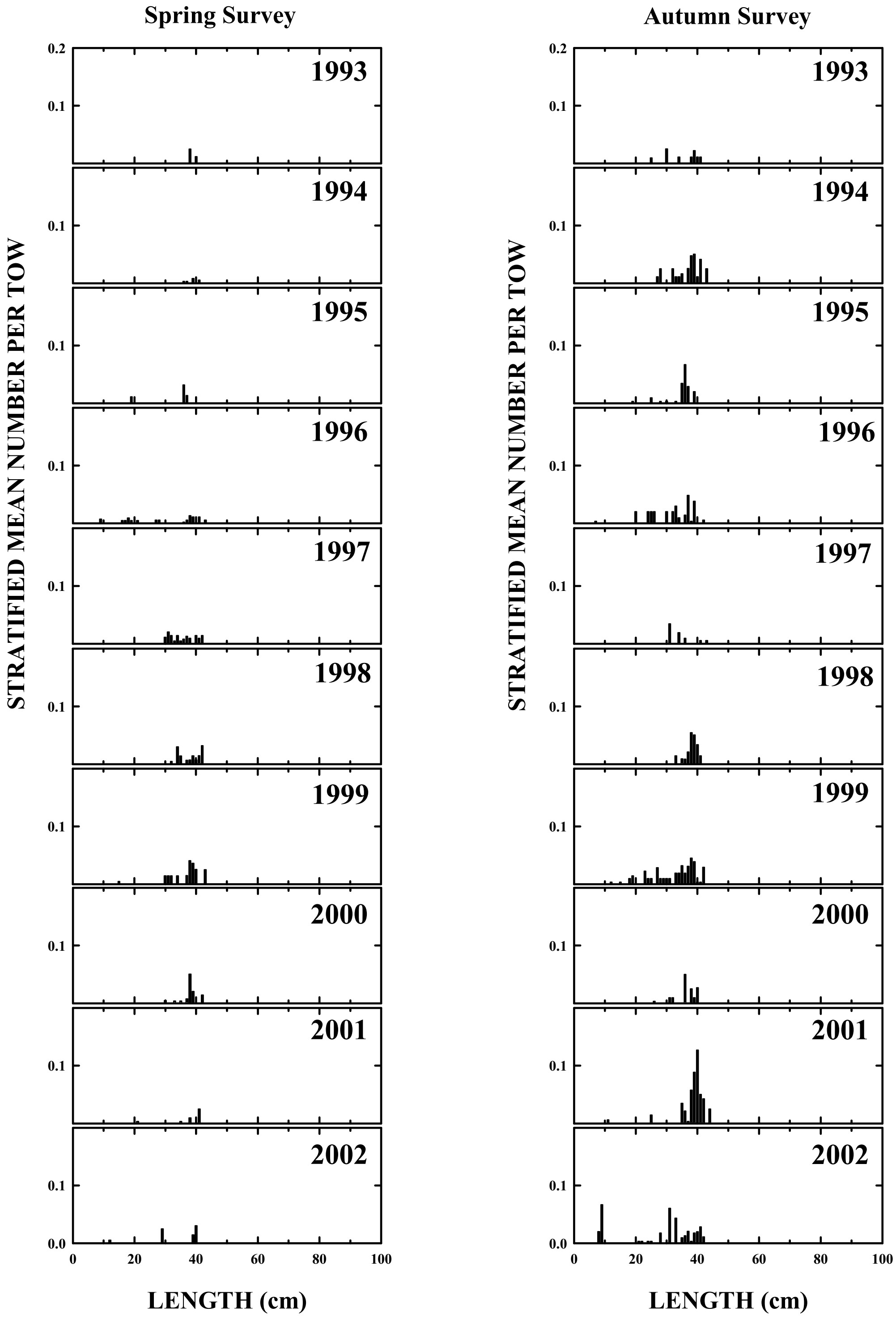


Figure B2.122. Rosette skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic offshore region, 1993-2002.

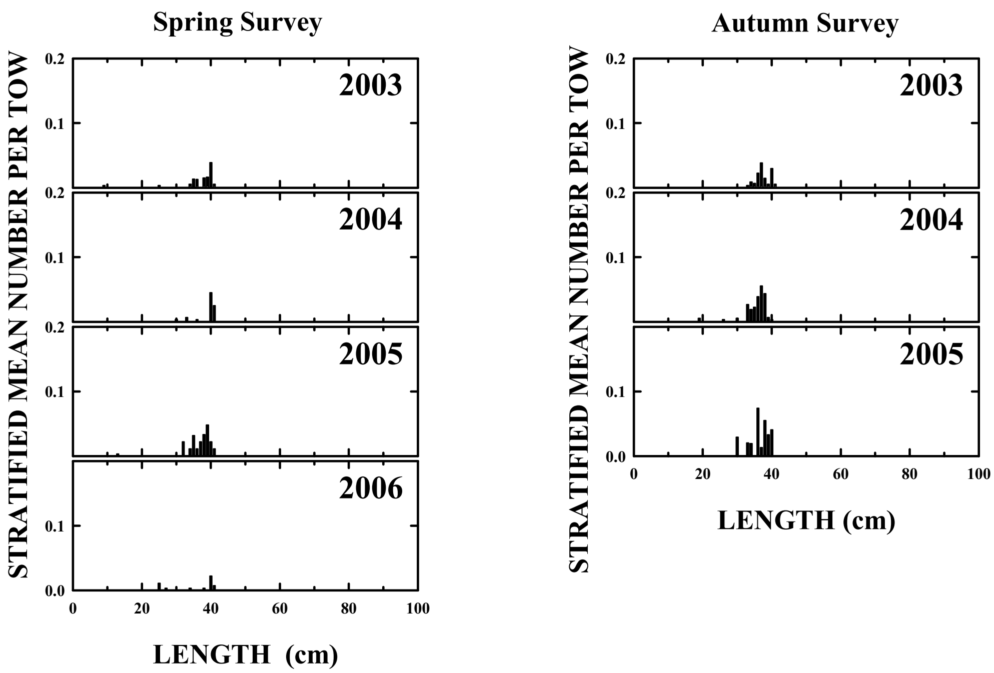


Figure B2.123. Rosette skate length composition from the NEFSC spring and autumn bottom trawl surveys in the Mid-Atlantic offshore region, 2003-2006.

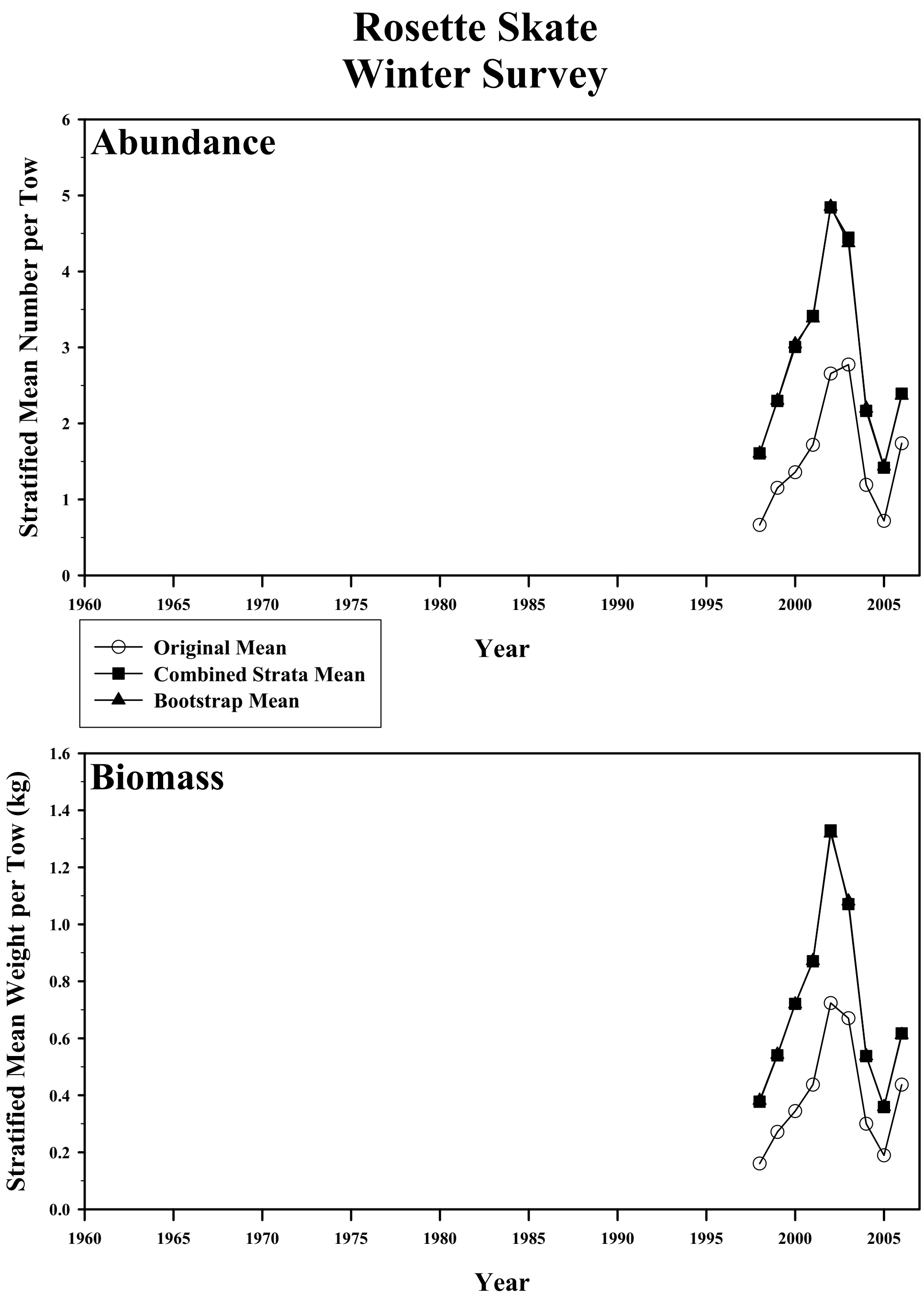


Figure B2.124. Abundance and biomass of rosette skate from the NESFC winter bottom trawl surveys from 1998-2006. The circles represent the original stratified mean, the squares represent the mean combining strata for bootstrapping, and the triangles represent the bootstrapped mean.

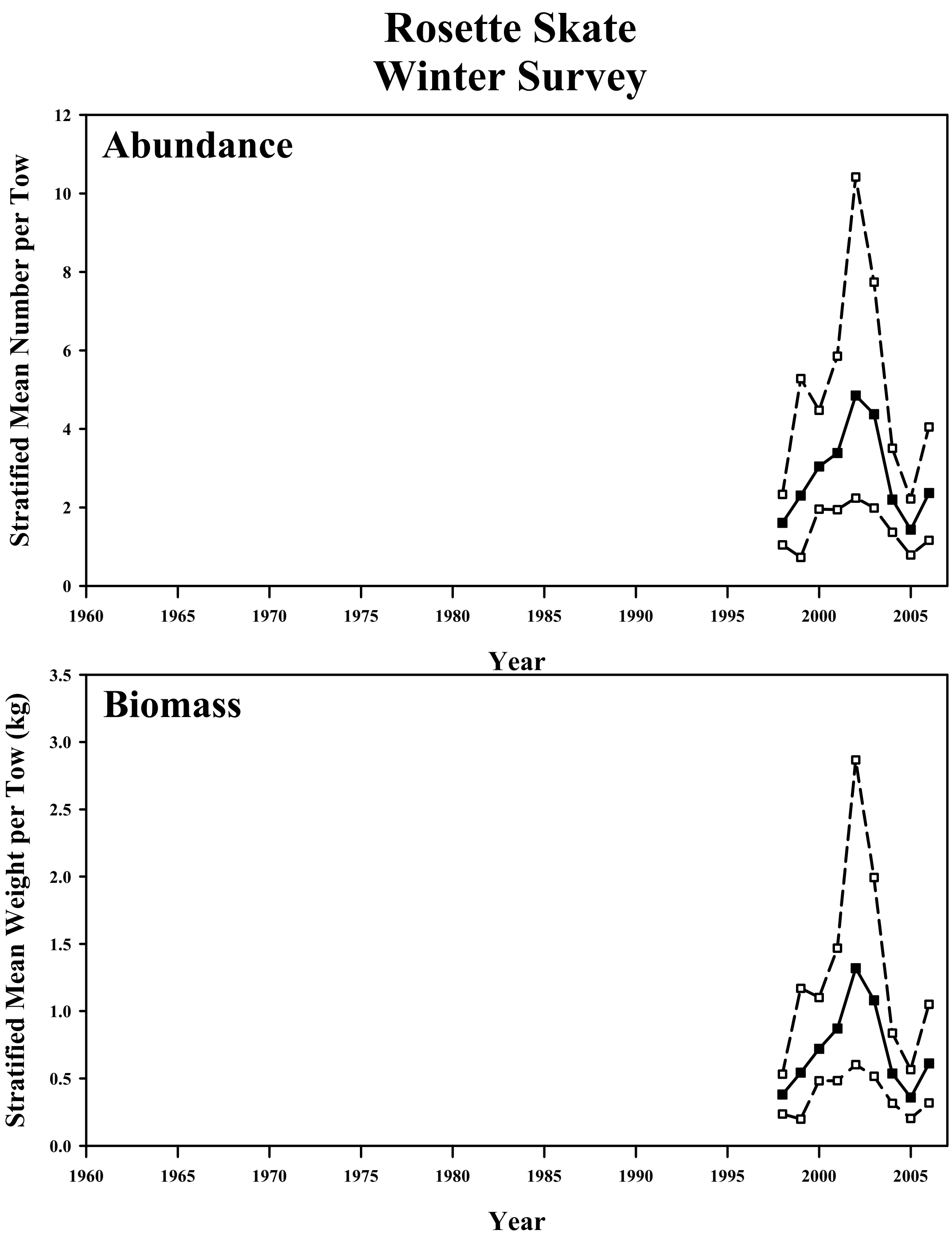


Figure B2.125. Bootstrapped abundance and biomass of rosette skate from the NESFC winter bottom trawl survey. Mean index in solid squares, 95% confidence interval in open squares.

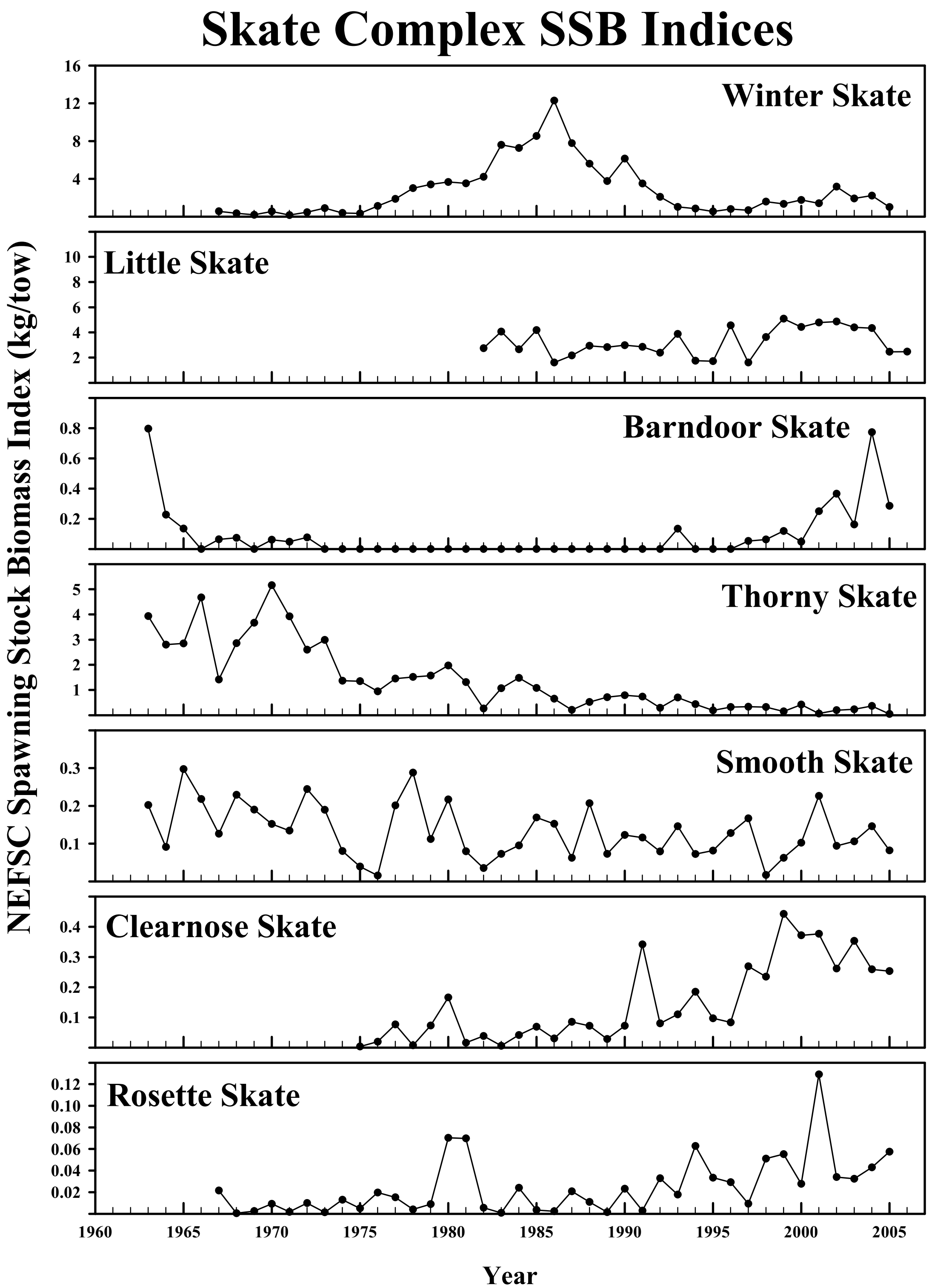


Figure B2.126. Trends in spawning stock biomass indices for seven species of skates.

FIGURES B2.127-B2.141.

(EDITOR'S NOTE: BASED ON THE REVIEWER'S COMMENTS, THESE FIGURES WERE NOT INCLUDED IN THIS REPORT. THE FIGURES DEALT WITH ESTIMATES OF FISHING MORTALITY RATE.)

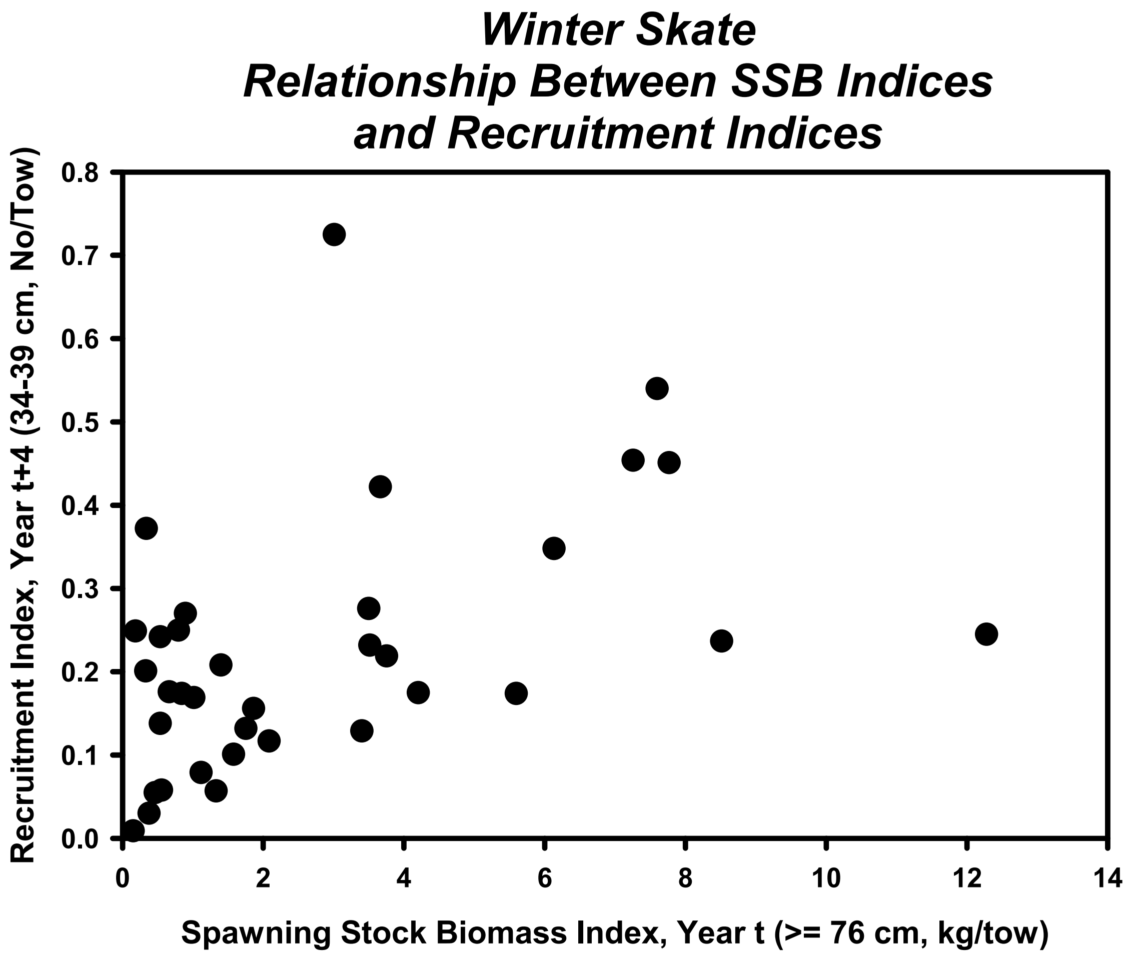
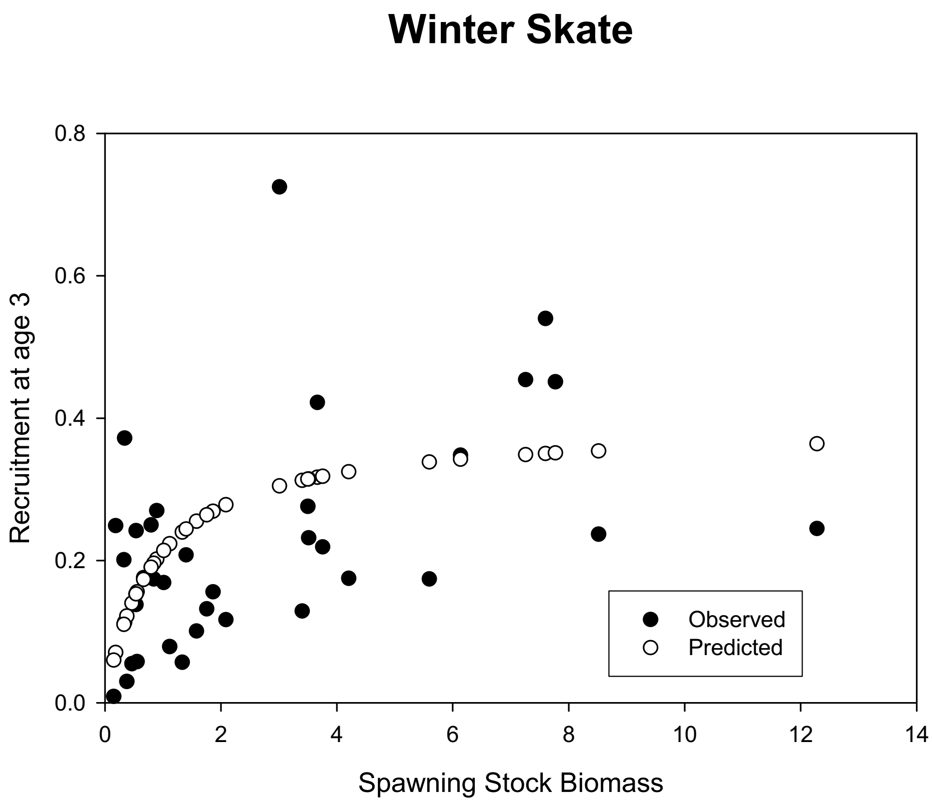


Figure B3.1. Relationship between spawning stock biomass indices (>= 76 cm) and recruitment indices (no/tow, 34-39 cm) for winter skate. The time lag between SSB and recruitment accounts for the assumed age 3 at recruitment plus one year for hatching time.



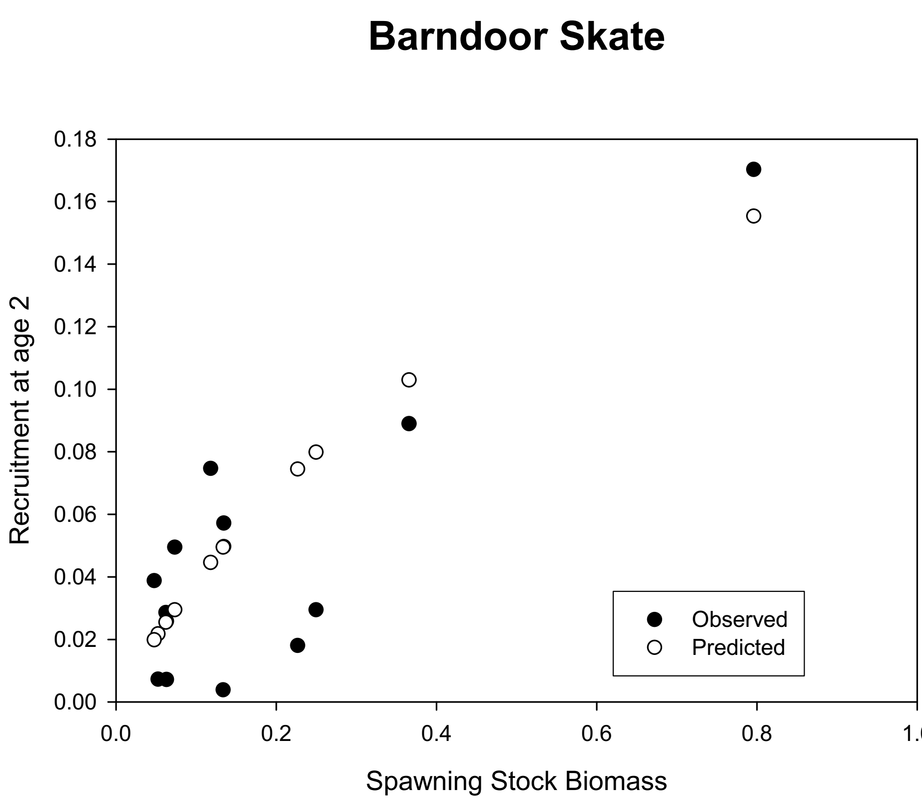


Figure B3.2. Stock-recruitment plots for winter skate and barndoor skate with the Beverton-Holt function plotted.

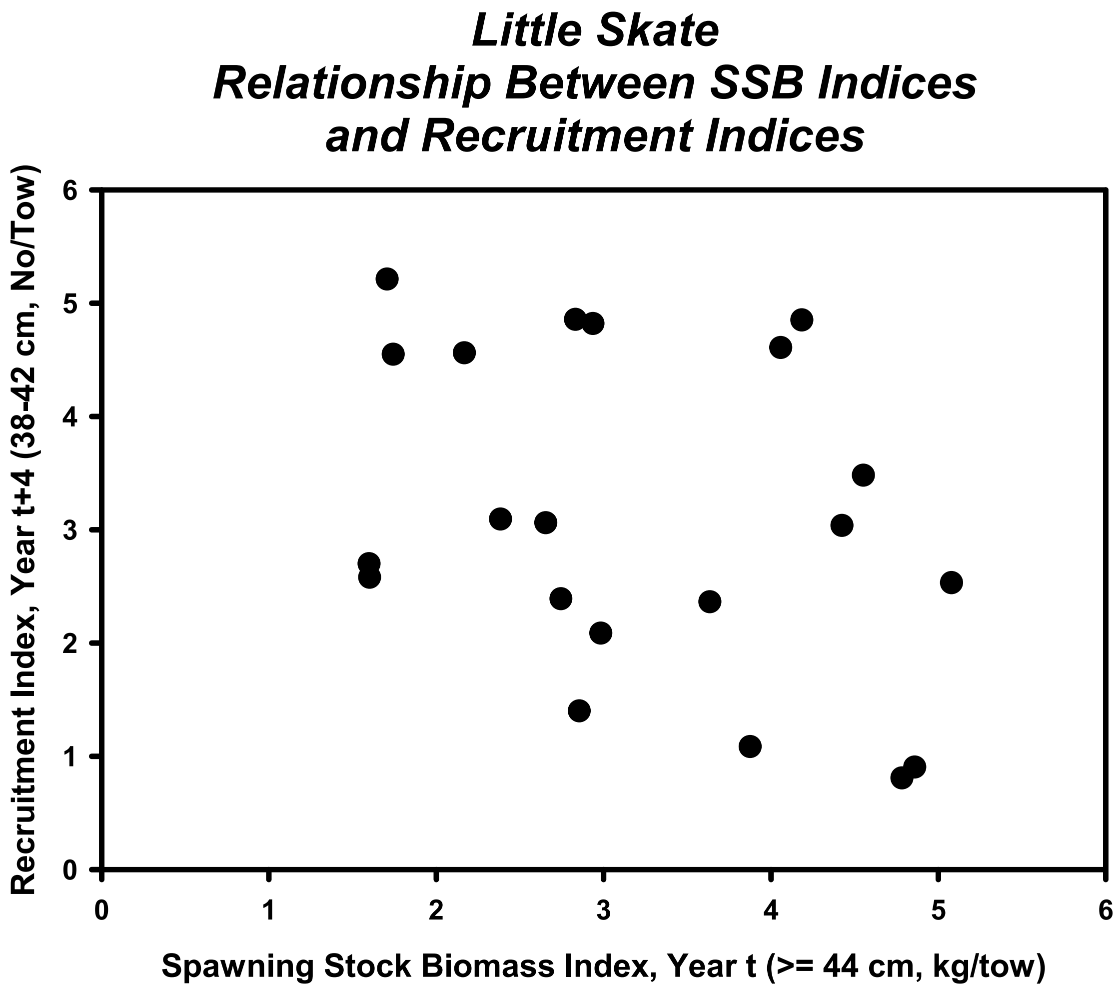


Figure B.3.3. Relationship between spawning stock biomass indices (>= 44 cm) and recruitment indices (no/tow, 38-42 cm) for little skate. The time lag between SSB and recruitment accounts for the assumed age 3 at recruitment plus one year for hatching time.

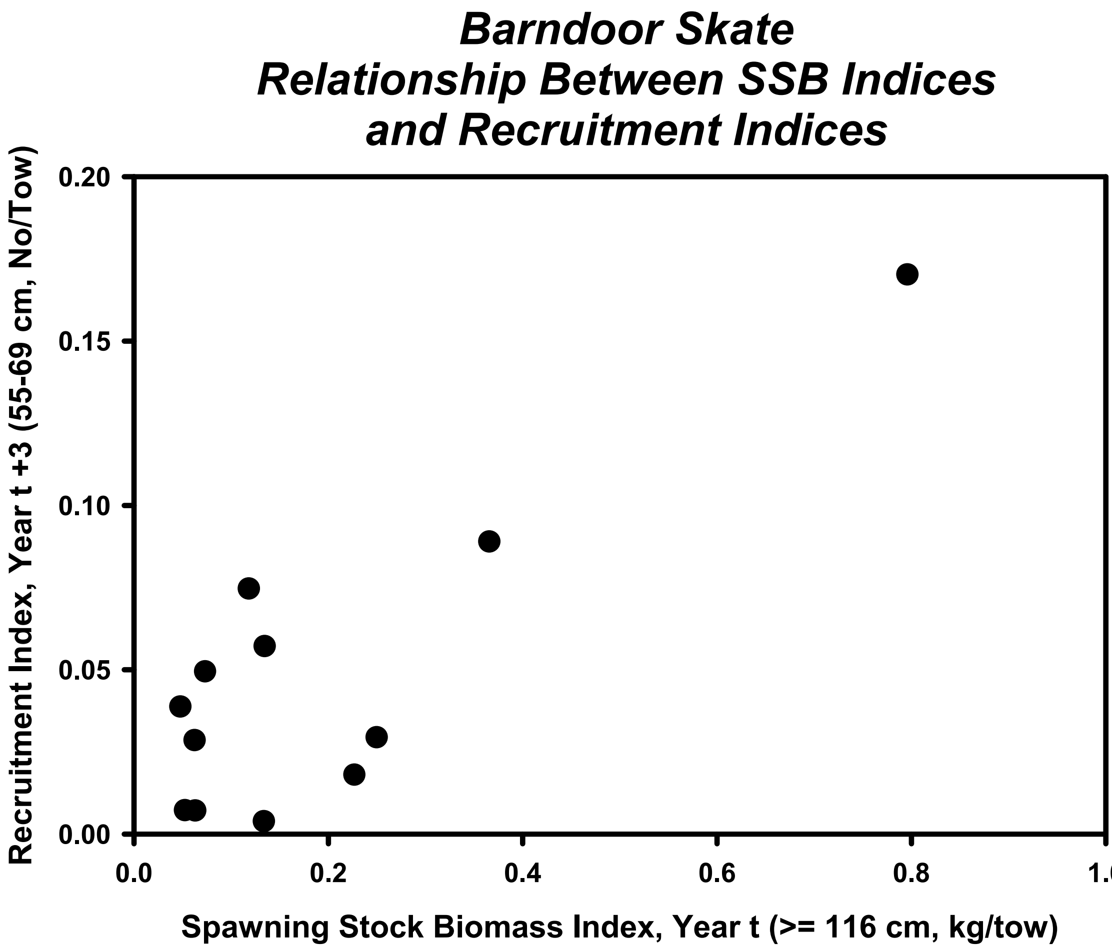


Figure B3.4. Relationship between spawning stock biomass indices (>= 116 cm) and recruitment indices (no/tow, 55-69 cm) for barndoor skate. The time lag between SSB and recruitment accounts for the assumed age 2 at recruitment plus one year for hatching time.

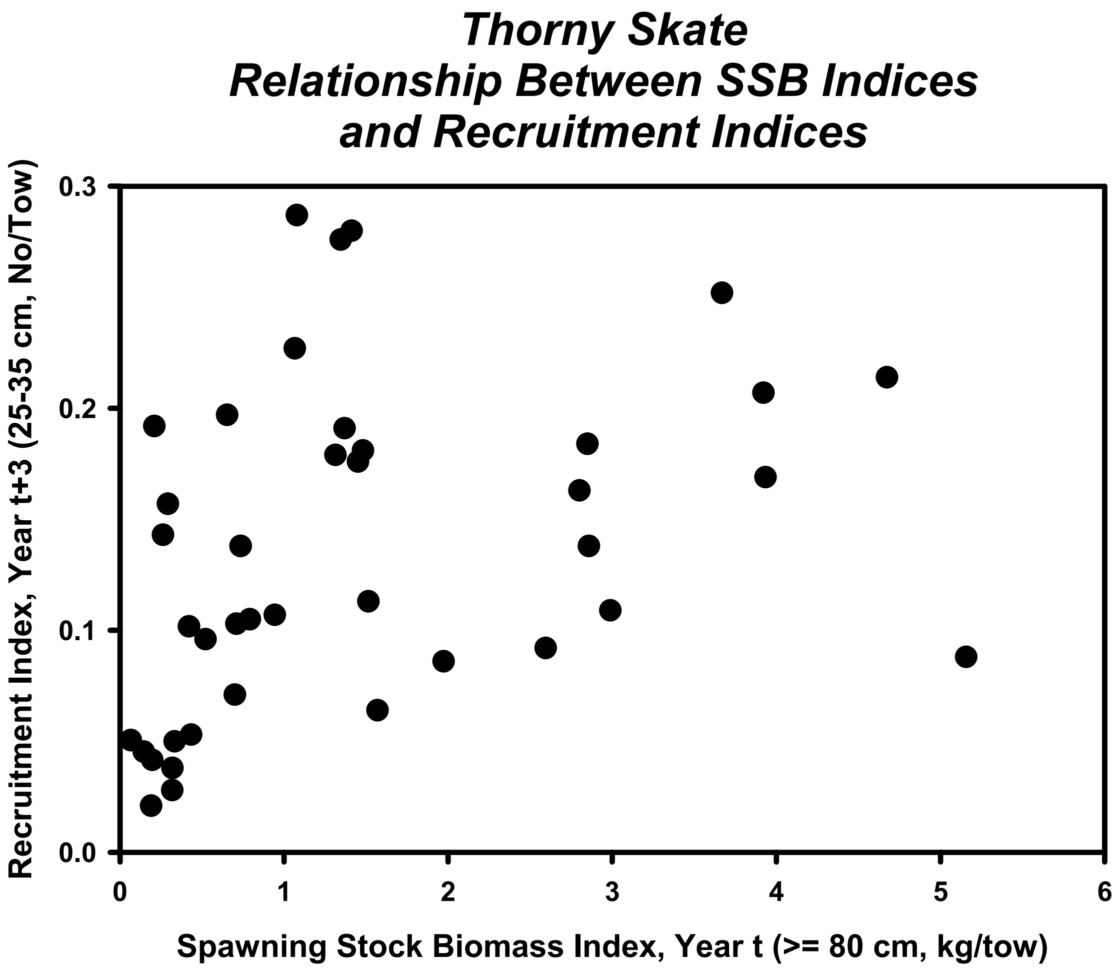
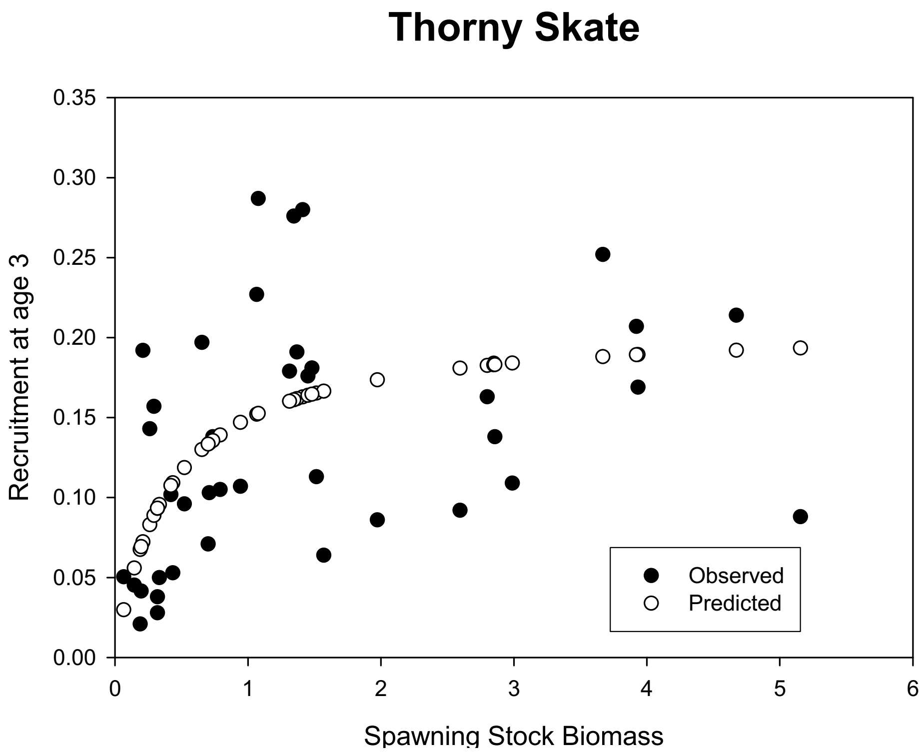


Figure B3.5. Relationship between spawning stock biomass indices (>= 80 cm) and recruitment indices (no/tow, 25-35 cm) for thorny skate. The time lag between SSB and recruitment accounts for the assumed age 2 at recruitment plus one year for hatching time.



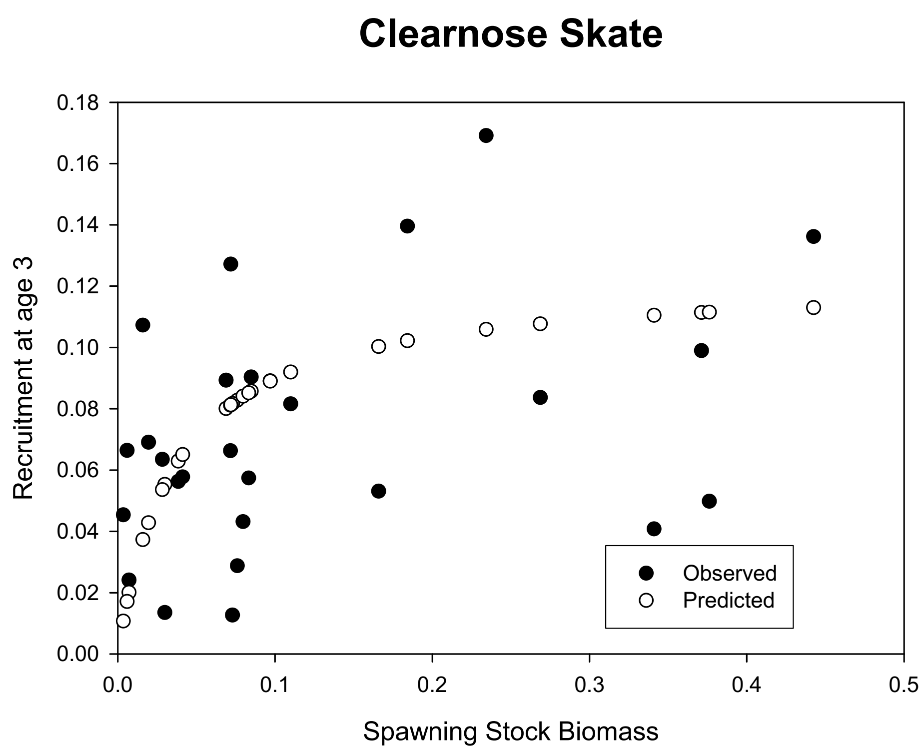


Figure B3.6. Stock-recruitment plots for thorny skate and clearnose skate with the Beverton-Holt function plotted.

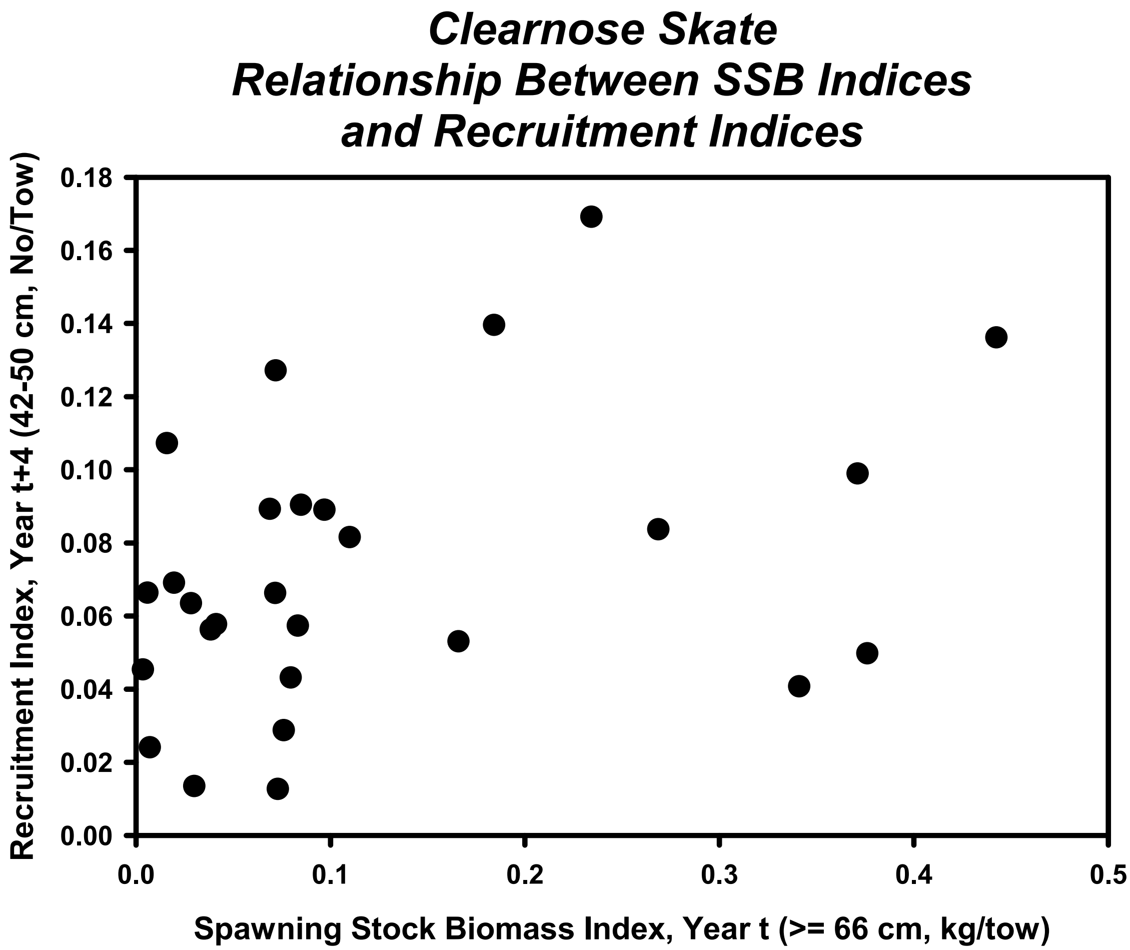


Figure B3.7. Relationship between spawning stock biomass indices (>= 66 cm) and recruitment indices (no/tow, 42-50 cm) for clearnose skate. The time lag between SSB and recruitment accounts for the assumed age 3 at recruitment plus one year for hatching time.

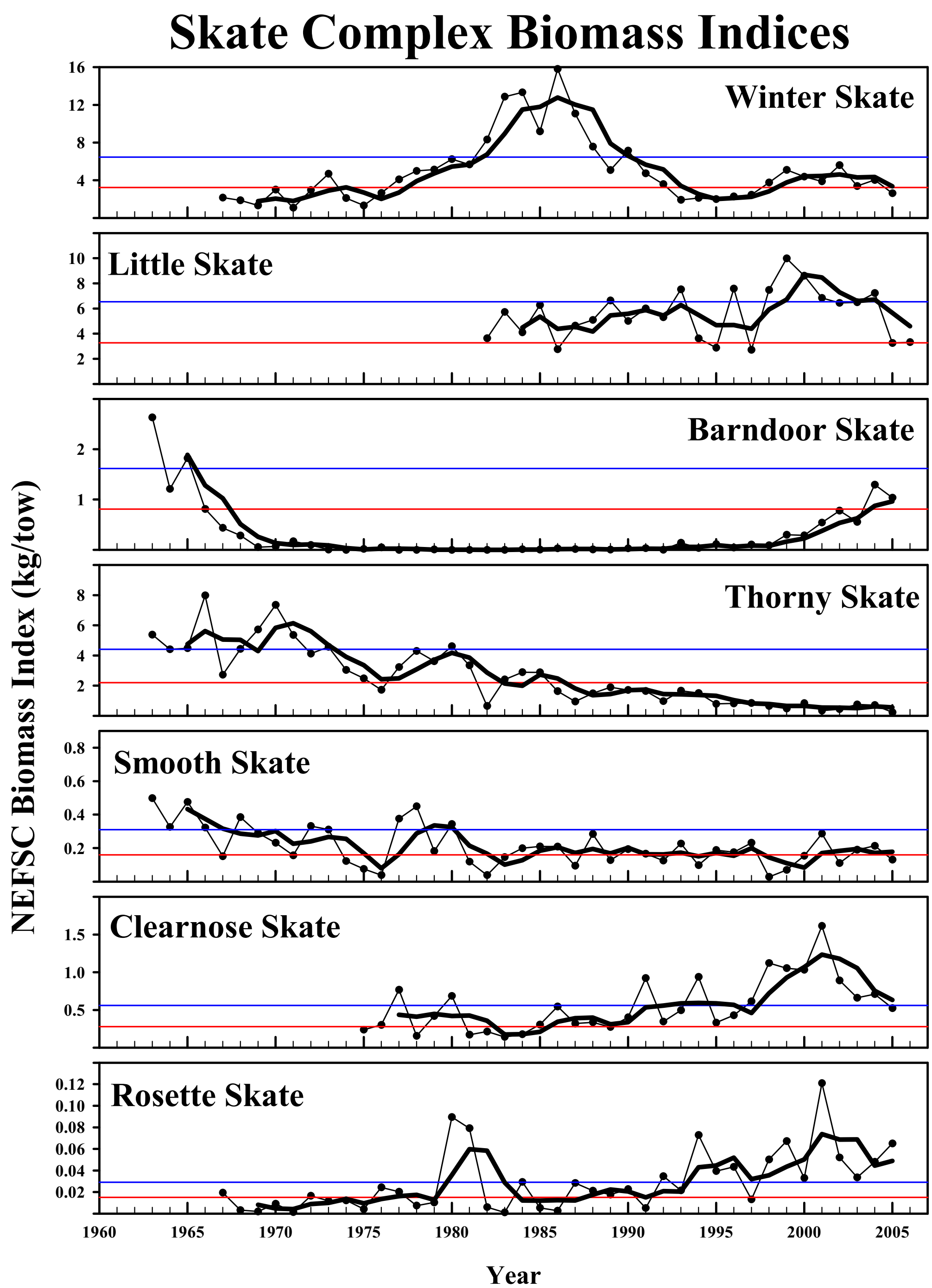


Figure B4.1. NEFSC survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, the thin horizontal lines are the current biomass targets and thresholds.

FIGURES B4.2 – B4.21.

(EDITOR'S NOTE: BASED ON THE REVIEWER'S COMMENTS, THESE FIGURES WERE NOT INCLUDED IN THIS REPORT. THE FIGURES DEALT WITH ESTIMATES OF ALTERNATIVE BIOLOGICAL REFERENCE POINTS FOR SKATES.)

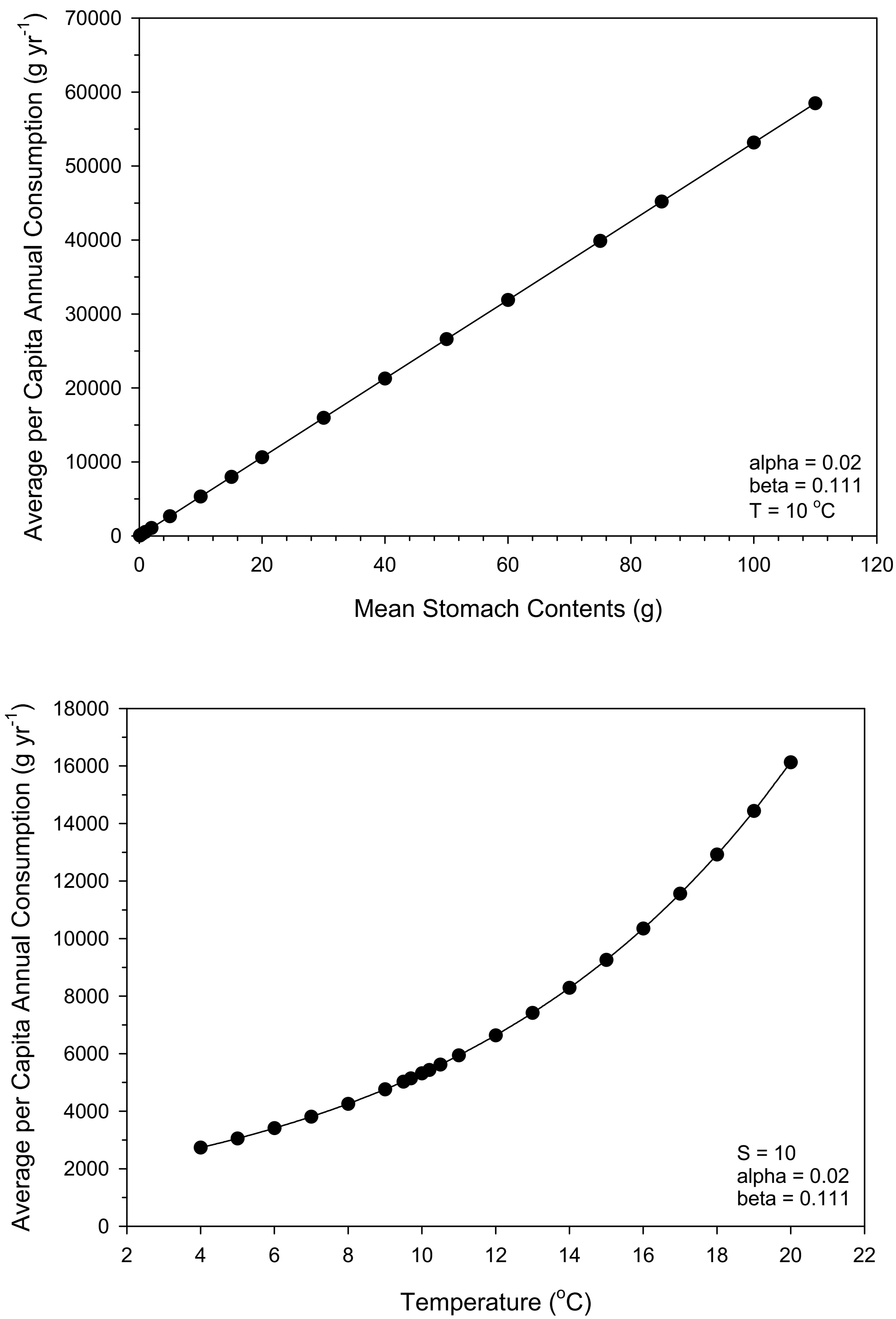


Figure B6.1. Sensitivity of Average per Capita Annual Consumption to a) mean stomach contents and b) temperature.

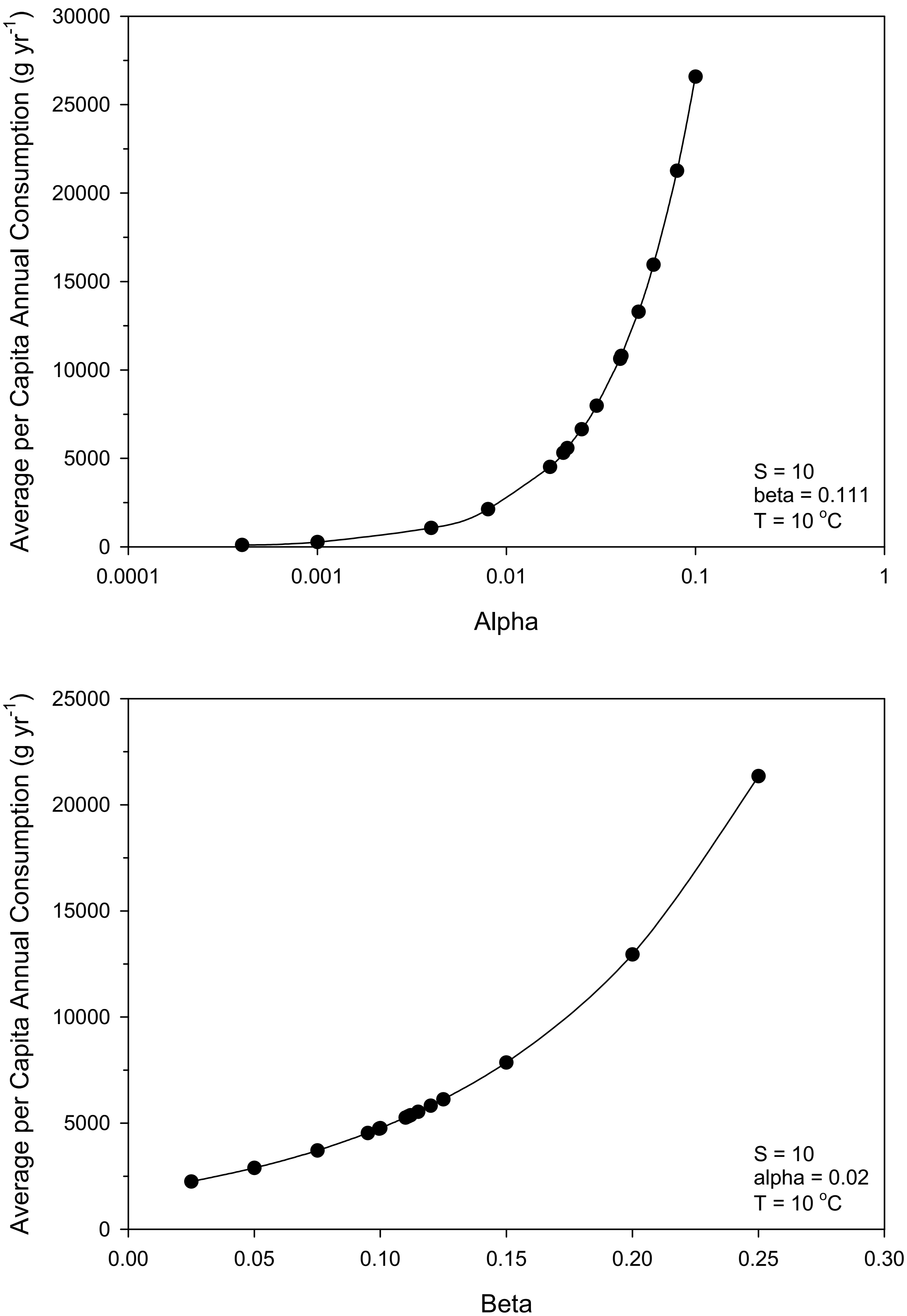


Figure B6.2. Sensitivity of Average per Capita Annual Consumption to the parameters a) alpha and b) beta.

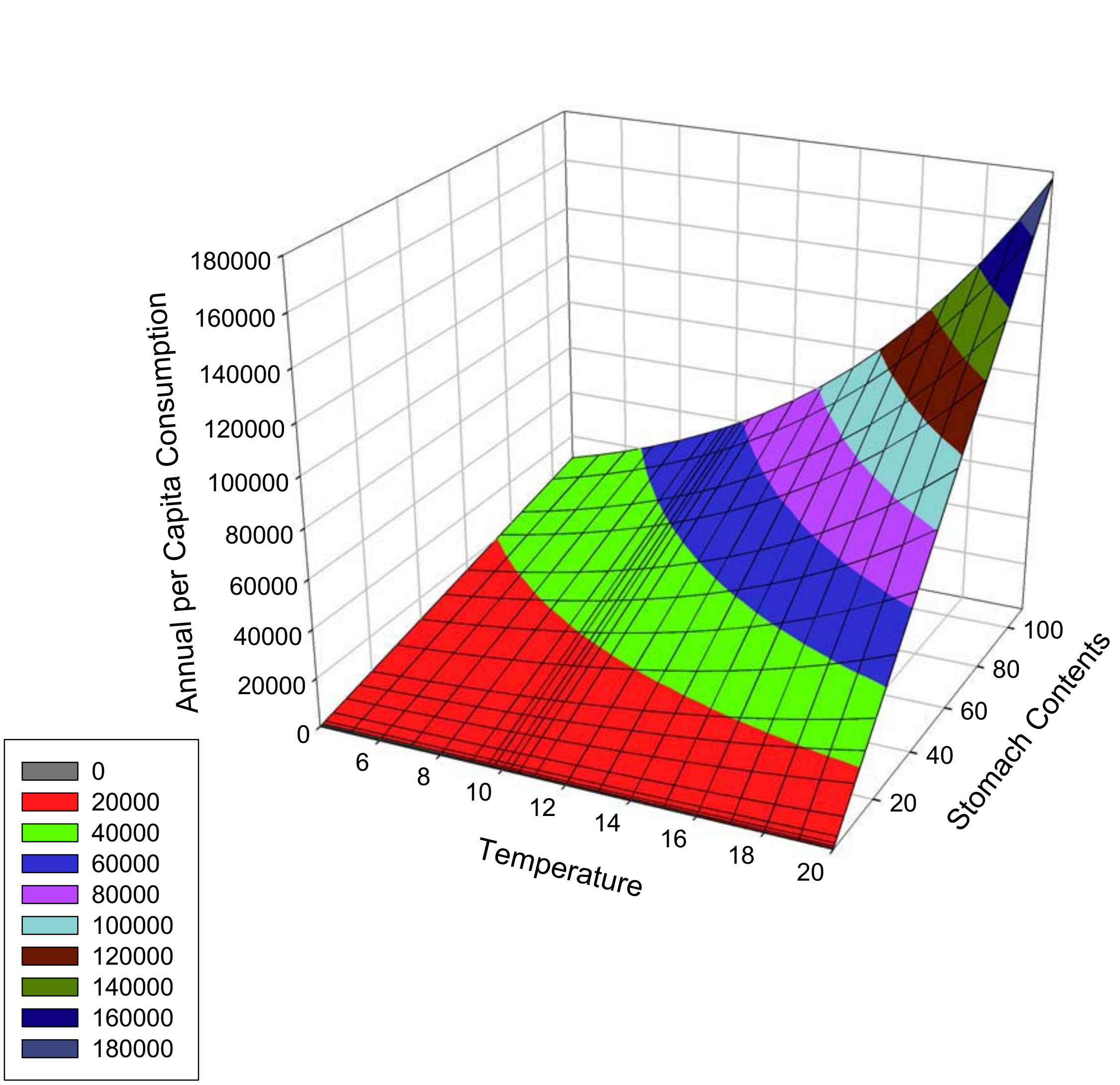


Figure 6.3. Sensitivity of Annual per Capita Consumption variation in both temperature and mean stomach contents.

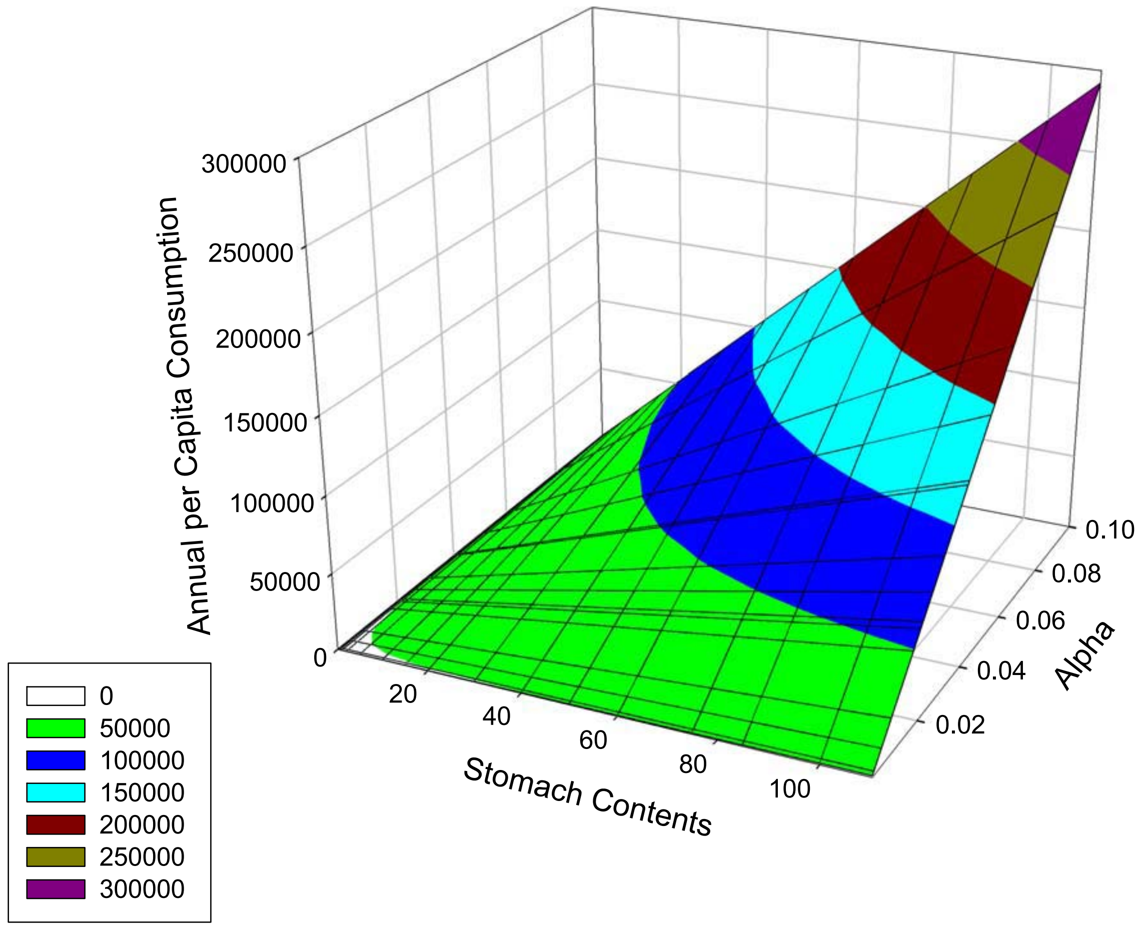


Figure 6.4. Sensitivity of Annual per Capita Consumption variation in both alpha and mean stomach contents.

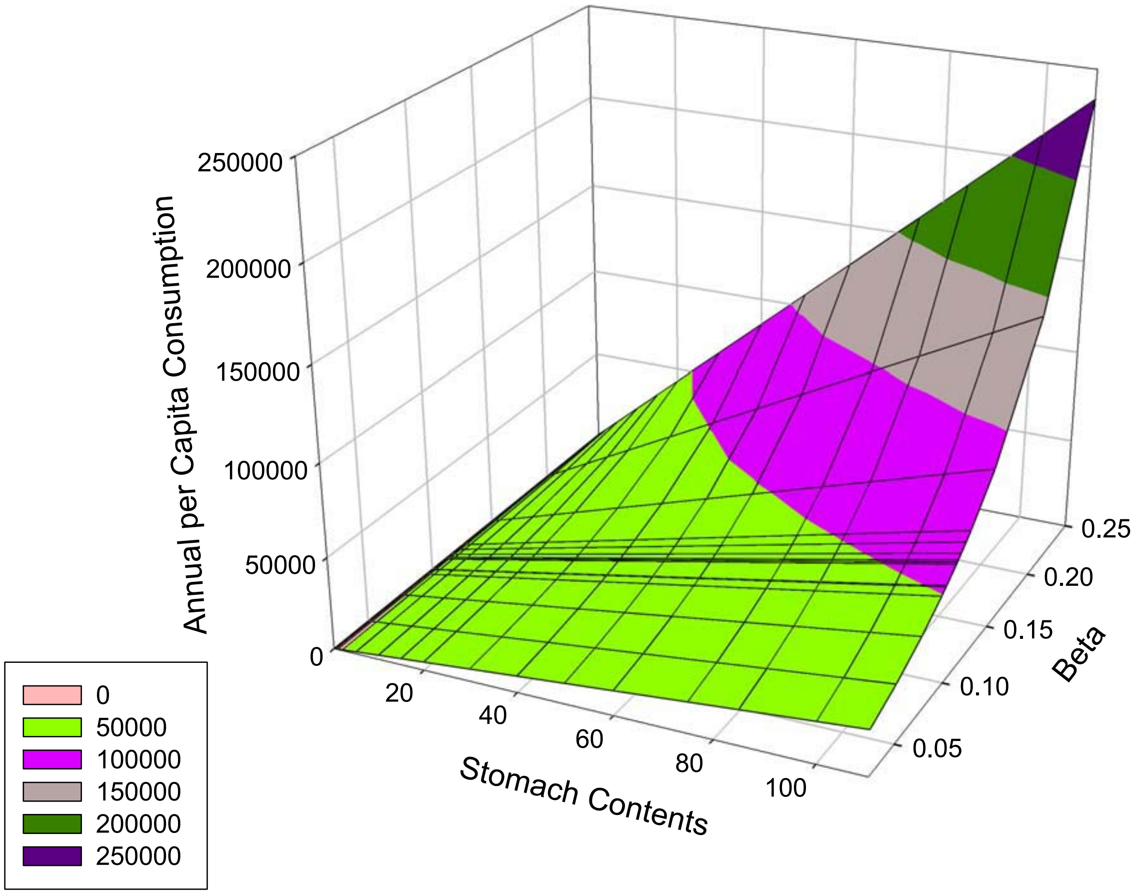


Figure 6.5. Sensitivity of Annual per Capita Consumption variation in both beta and mean stomach contents.

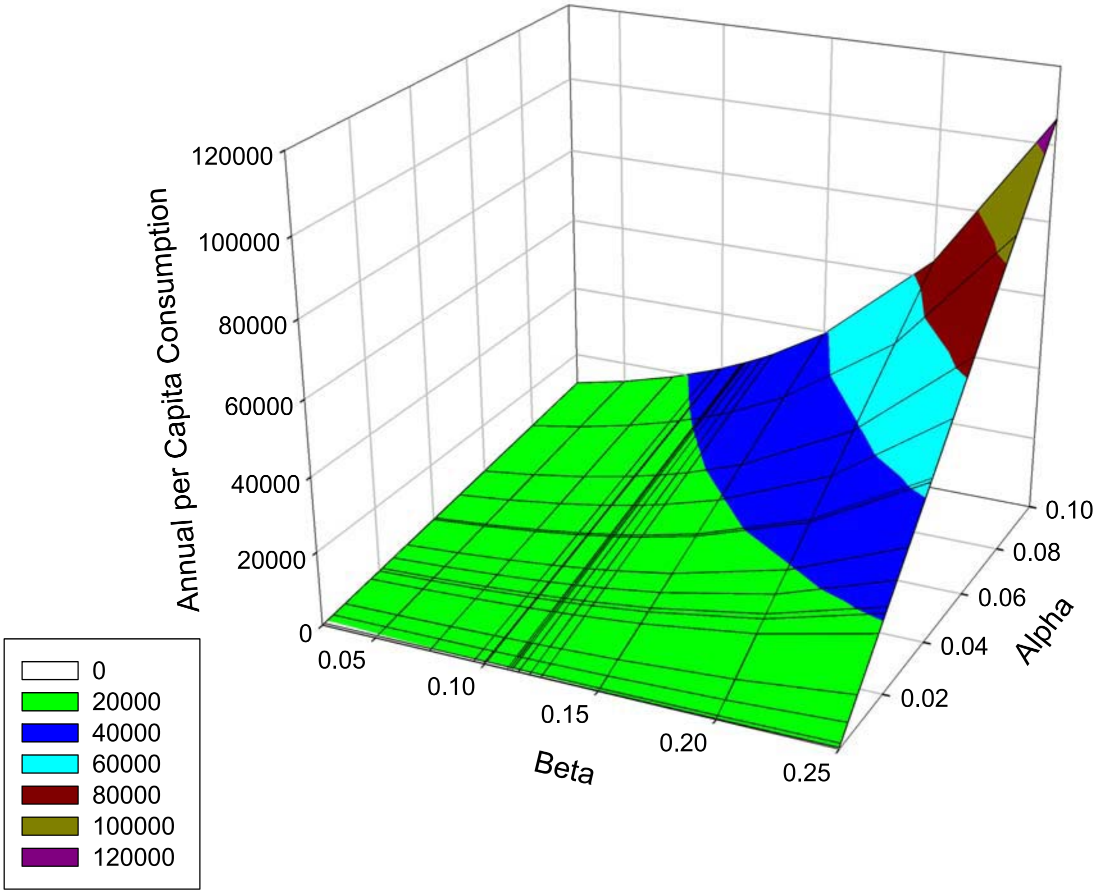


Figure 6.6. Sensitivity of Annual per Capita Consumption variation in both beta and alpha.

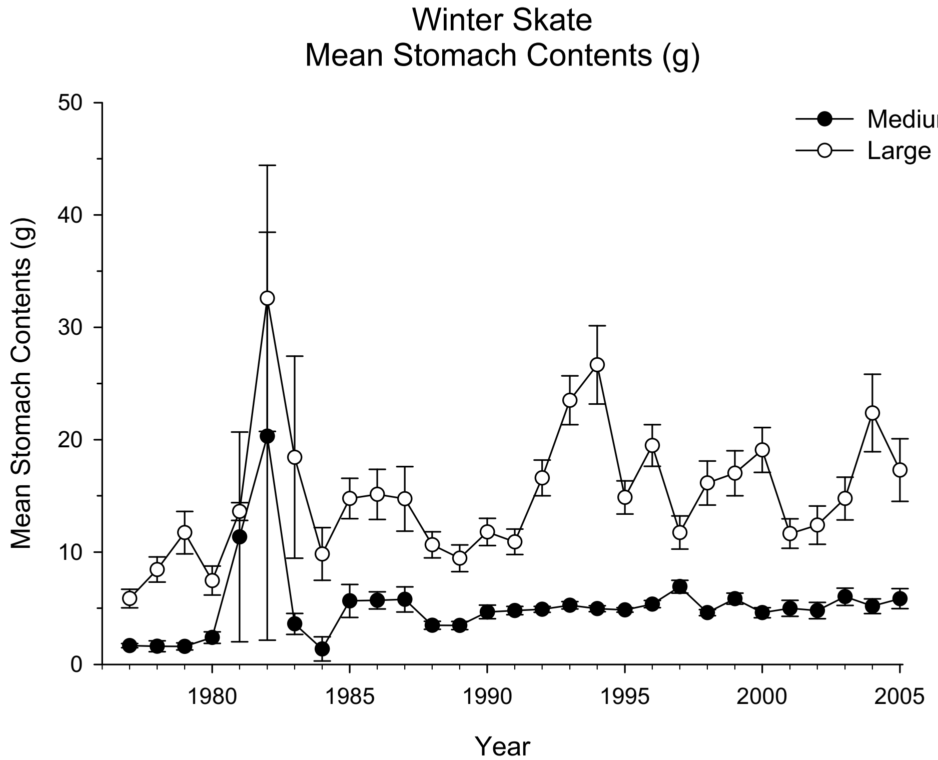


Figure B6.7a. The annual mean stomach contents (0.1 g) of winter skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

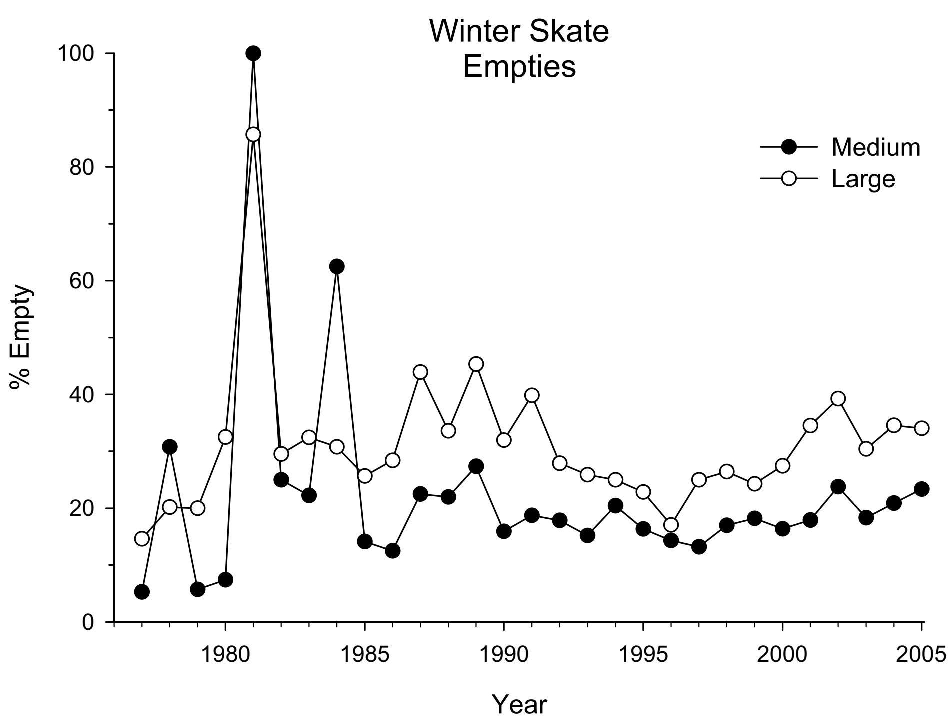


Figure B6.7b. The percentage of stomachs that were empty (i.e., containing no prey) of Winter skate for the strata set and time period noted. Each size class is noted

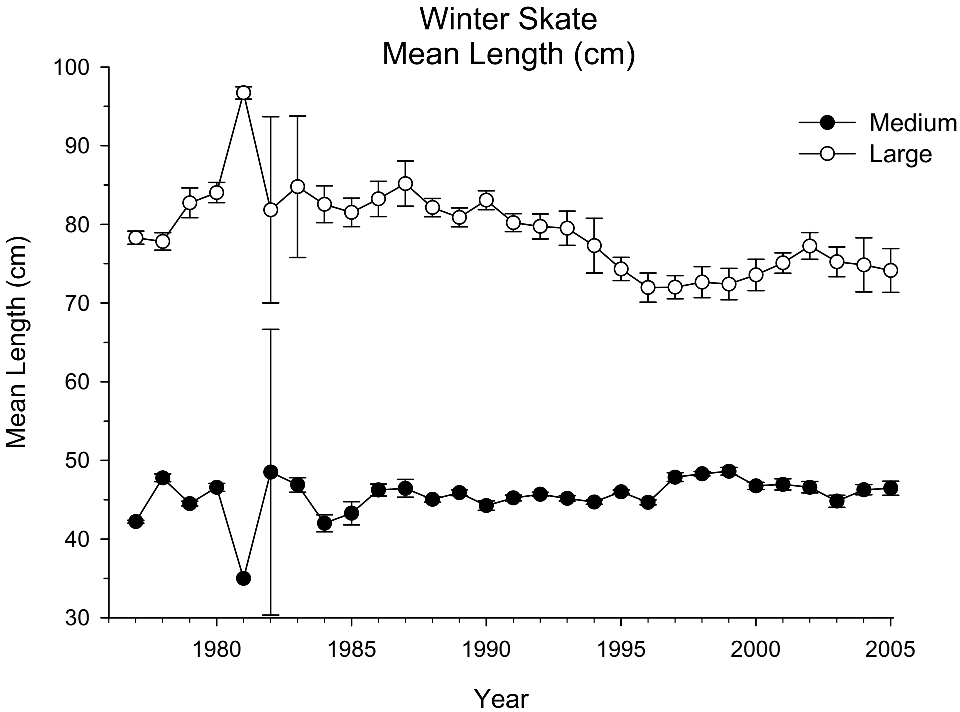


Figure B6.8a. The mean length (1 cm) of Winter skate from which stomach samples were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

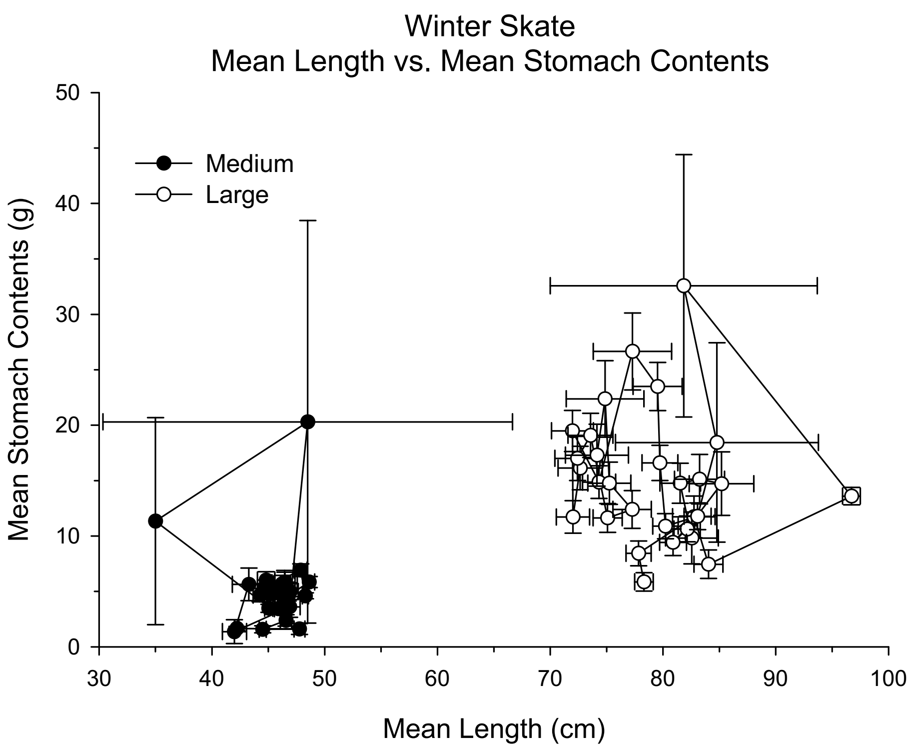


Figure B6.8b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Winter skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

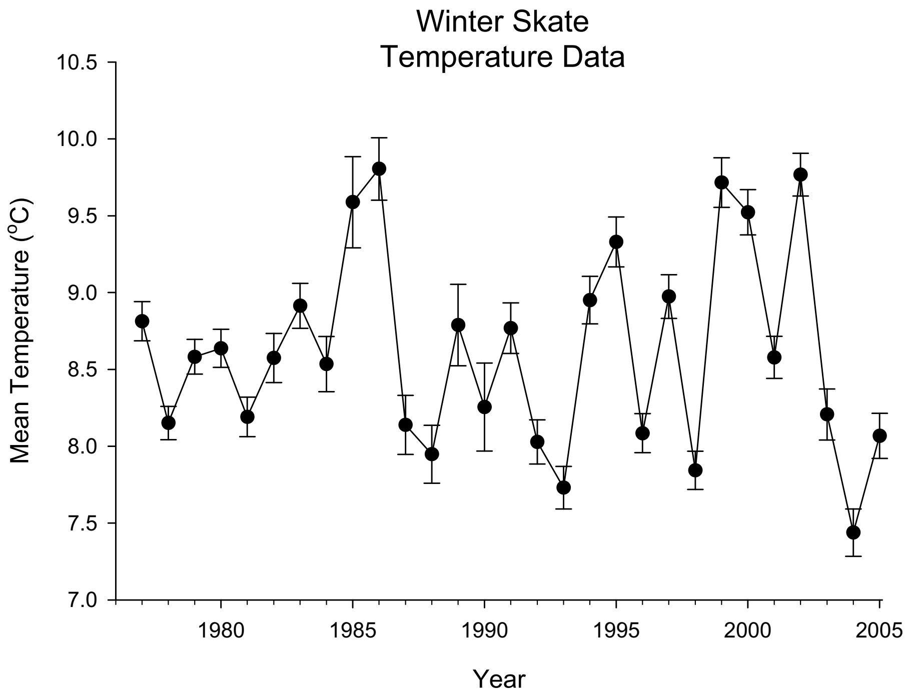


Figure B6.9a. The annual mean bottom temperature (0.1 °C) for the selected strata set, as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

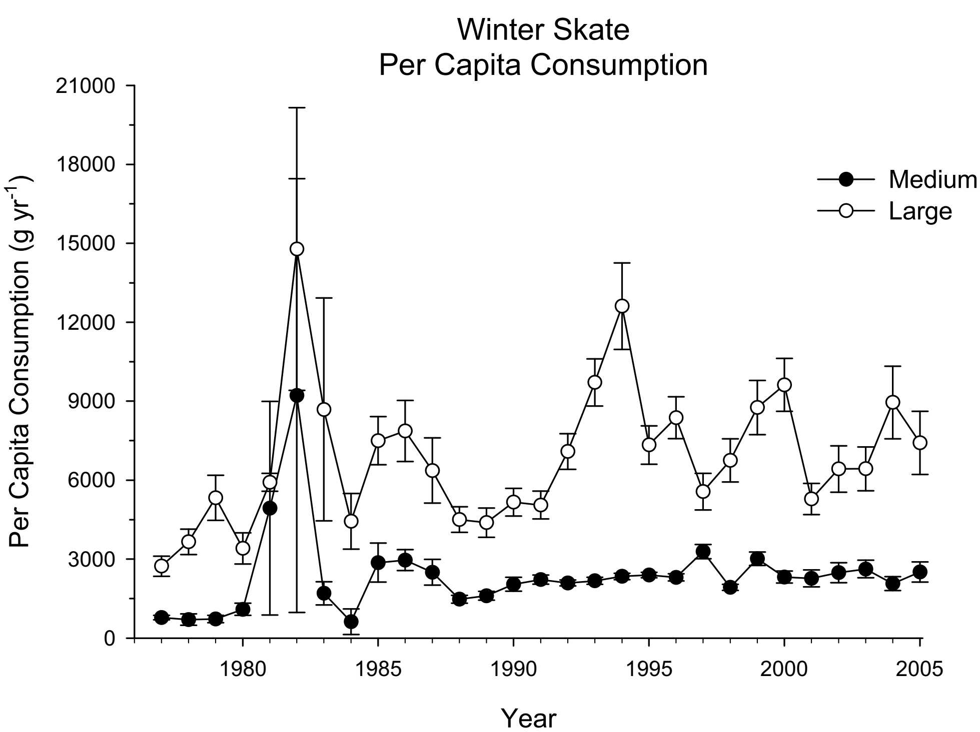


Figure B6.9b. The annual per capita consumption (g yr^{-1}) of Winter skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

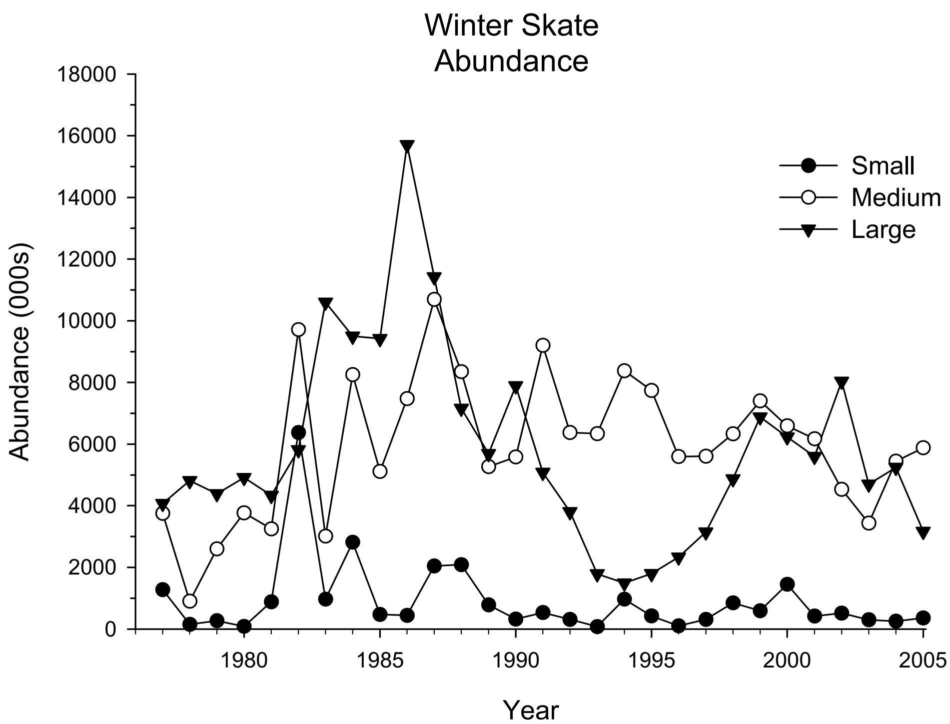


Figure B6.10a. The annual mean swept area abundance of winter skate for the strata set and time period noted. Each size class is noted.

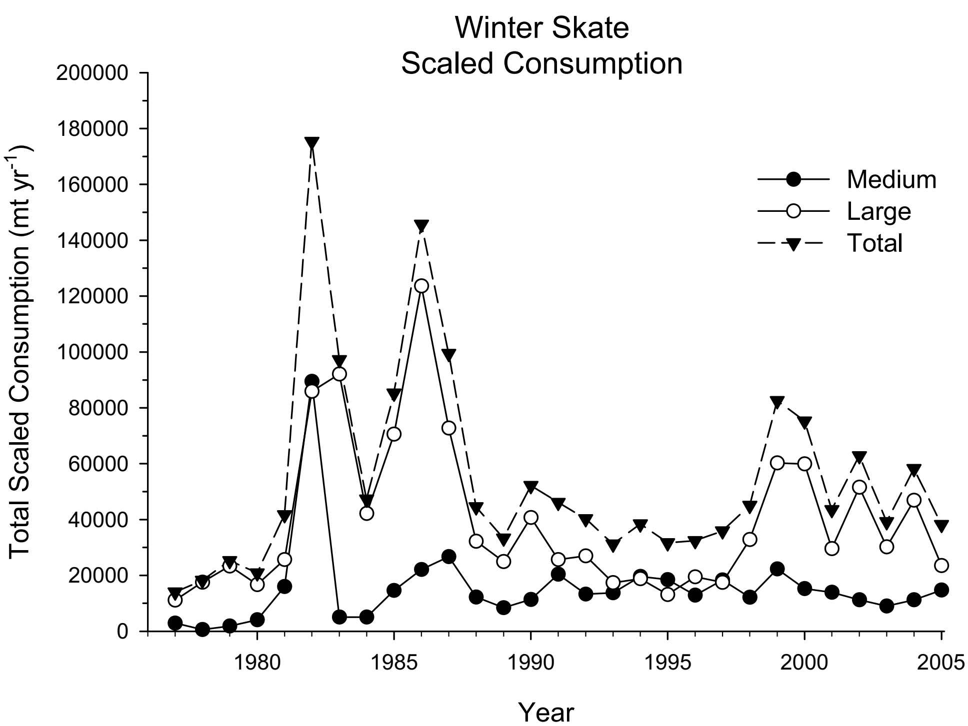


Figure B6.10b. The annual total consumption (MT yr^{-1}) of Winter skate for the strata set and time period noted.

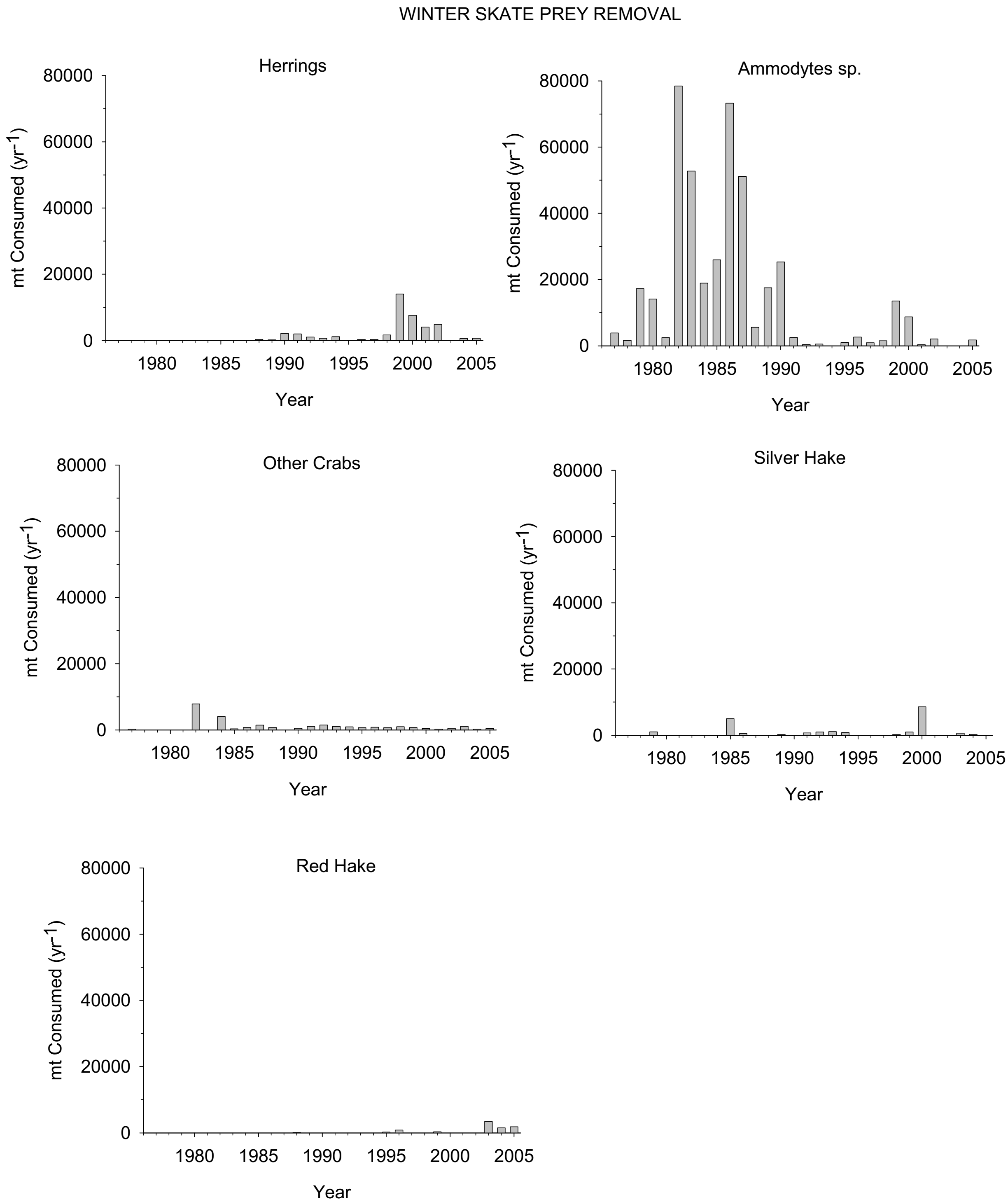


Figure B6.11. The amount of prey consumed (MT yr^{-1}) by Winter skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Winter skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Winter skate.

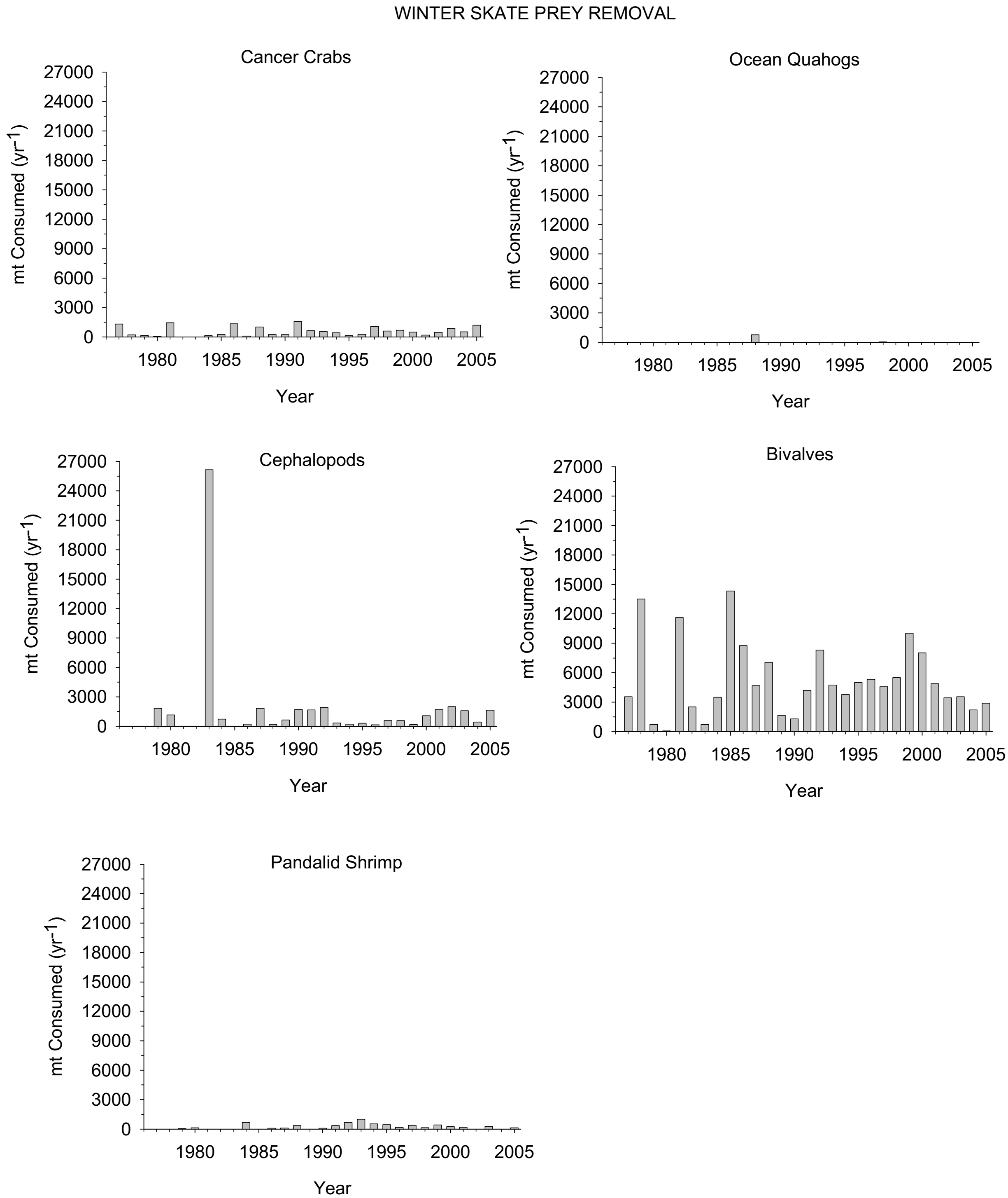


Figure B6.12. The amount of prey consumed (MT yr^{-1}) by Winter skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Winter skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Winter skate.

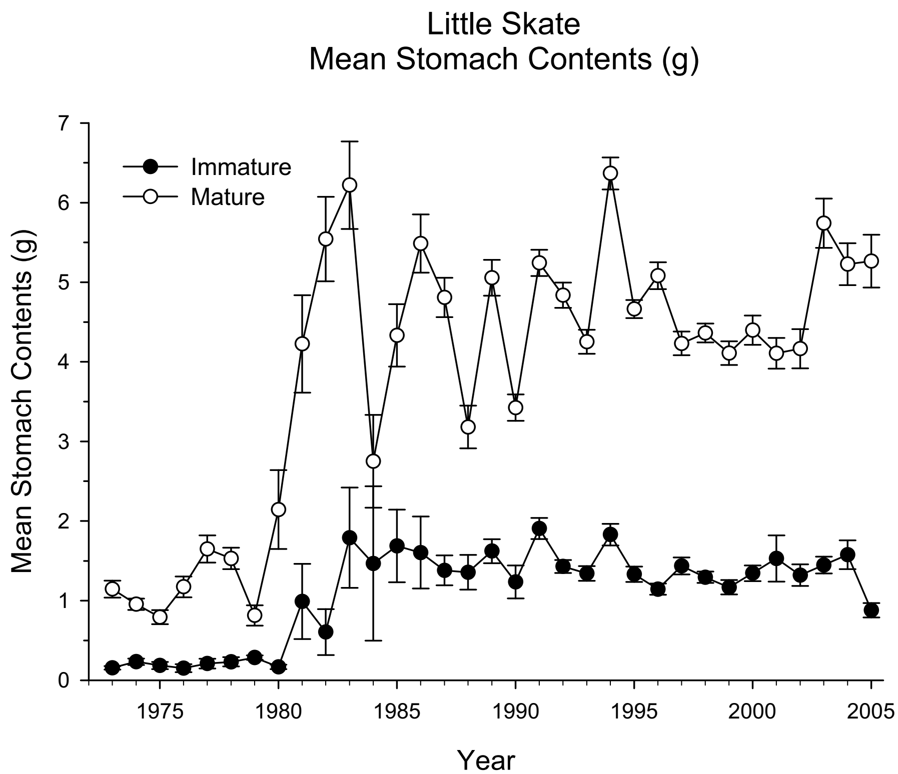


Figure B6.13a. The annual mean stomach contents (0.1 g) of Little skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

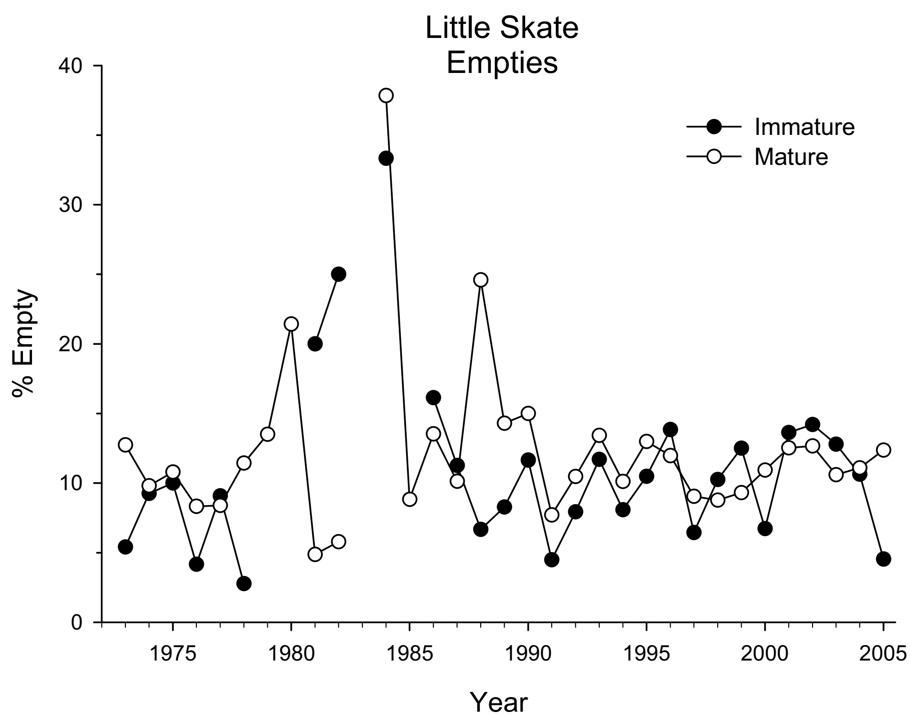


Figure B6.13b. The percentage of stomachs that were empty (i.e., containing no prey) of Little skate for the strata set and time period noted. Each size class is noted.

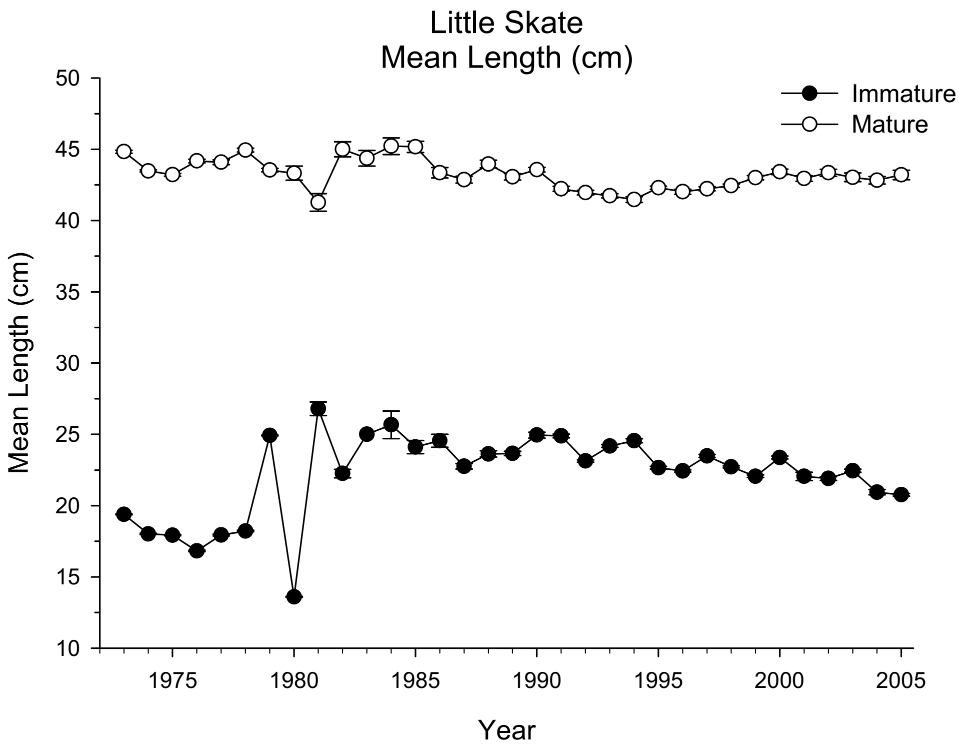


Figure B6.14a. The mean length (1 cm) of Little skate from which stomach samples were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

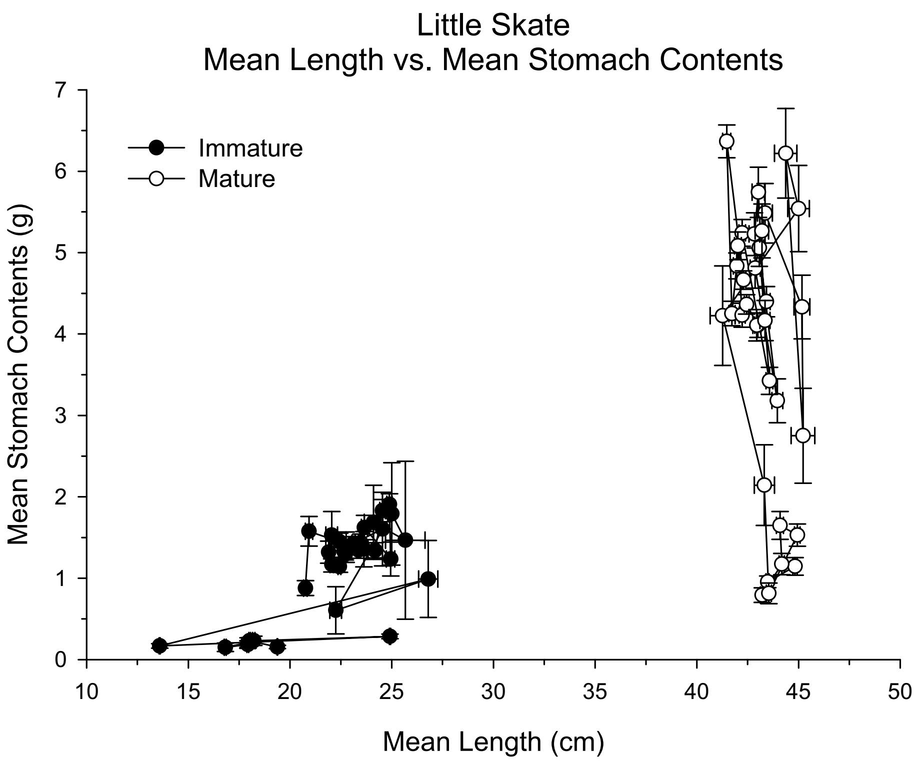


Figure B6.14b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Little skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

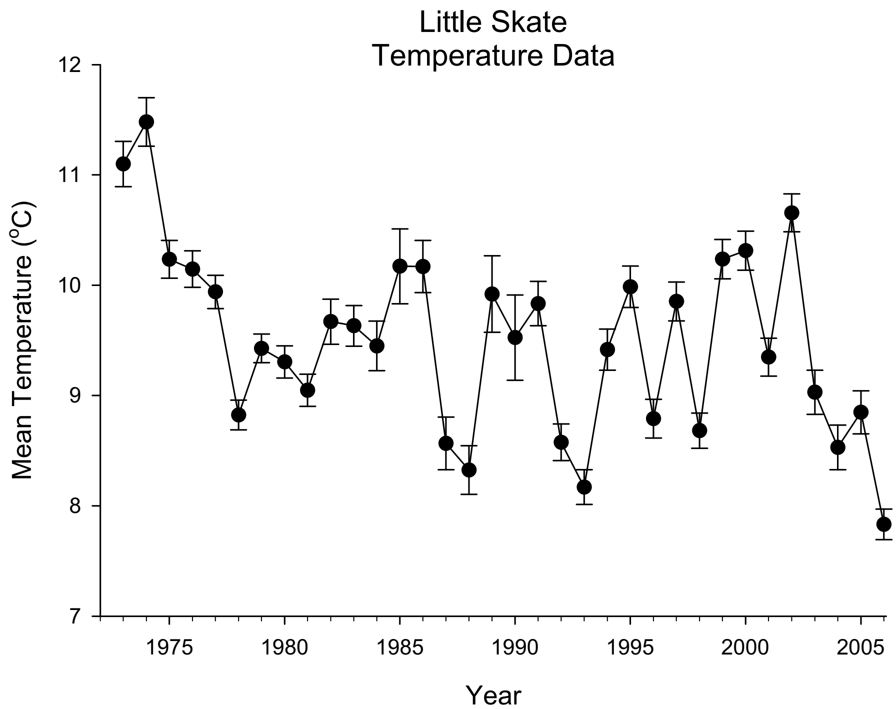


Figure B6.15a. The annual mean bottom temperature (0.1 oC) for the selected strata set, as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

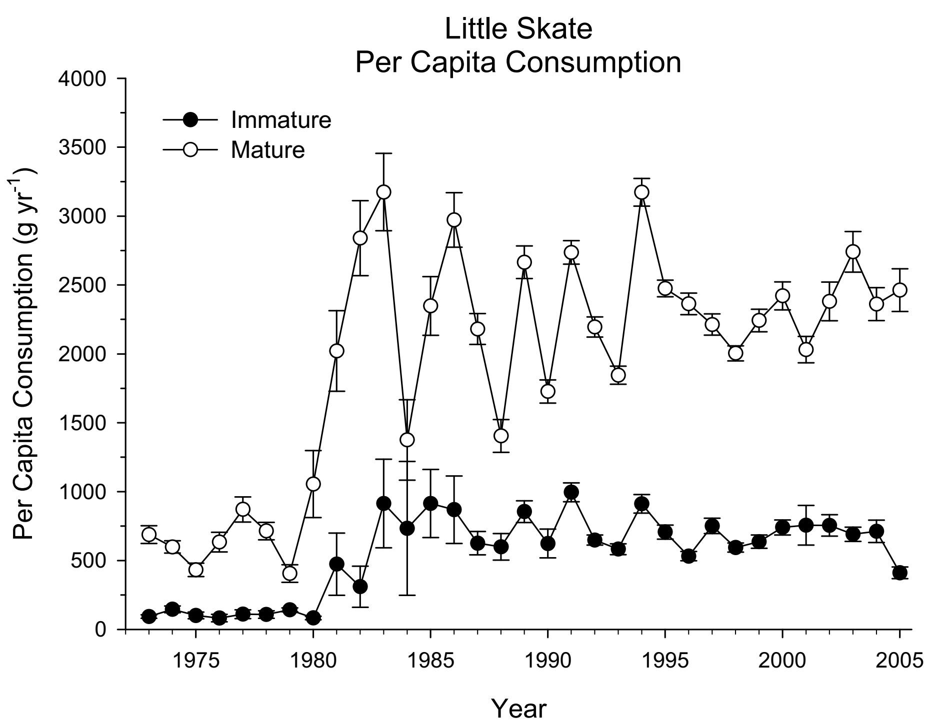


Figure B6.15b. The annual per capita consumption (g yr^{-1}) of Little skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

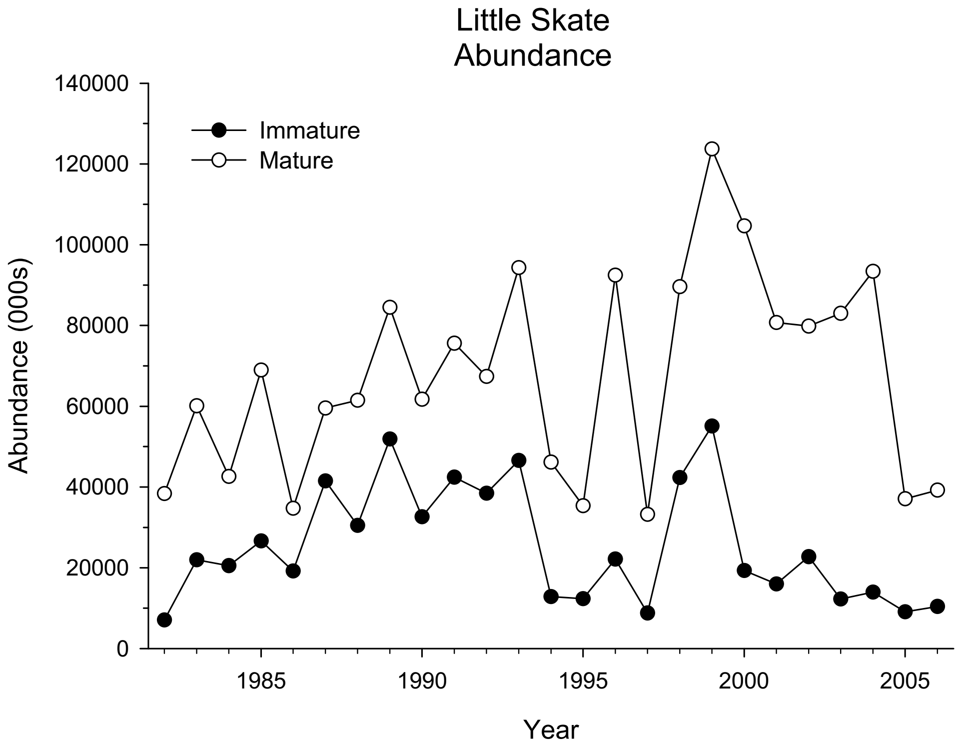


Figure B6.16a. The annual mean swept area abundance of Little skate for the strata set and time period noted. Each size class is noted.

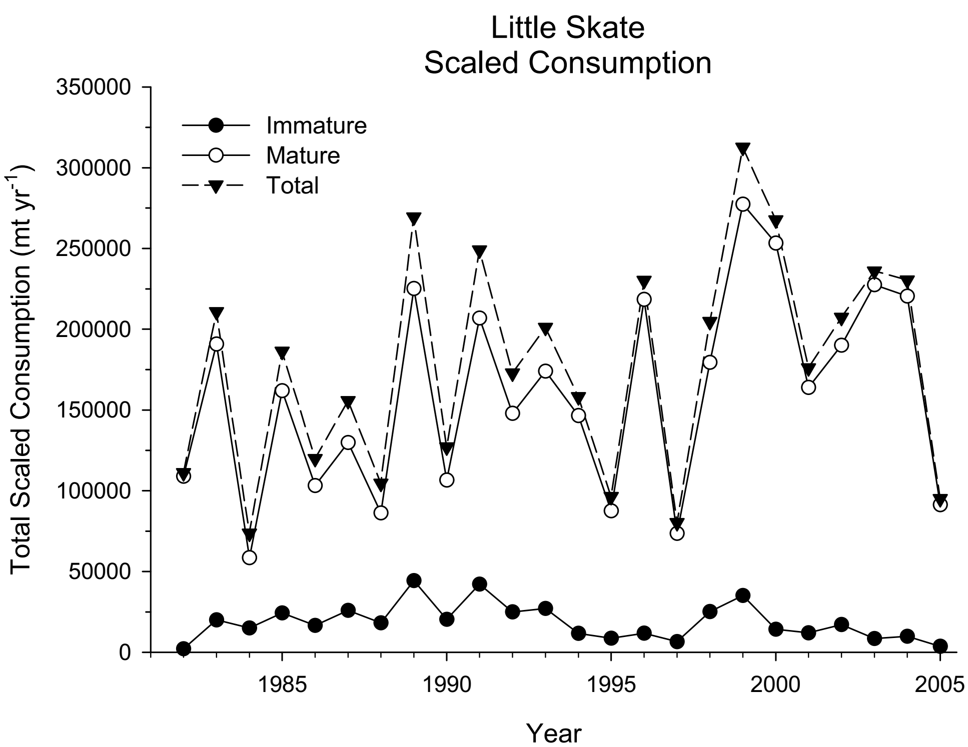


Figure B6.16b. The annual total consumption (MT yr^{-1}) of Little skate for the strata set and time period noted.

LITTLE SKATE PREY REMOVAL

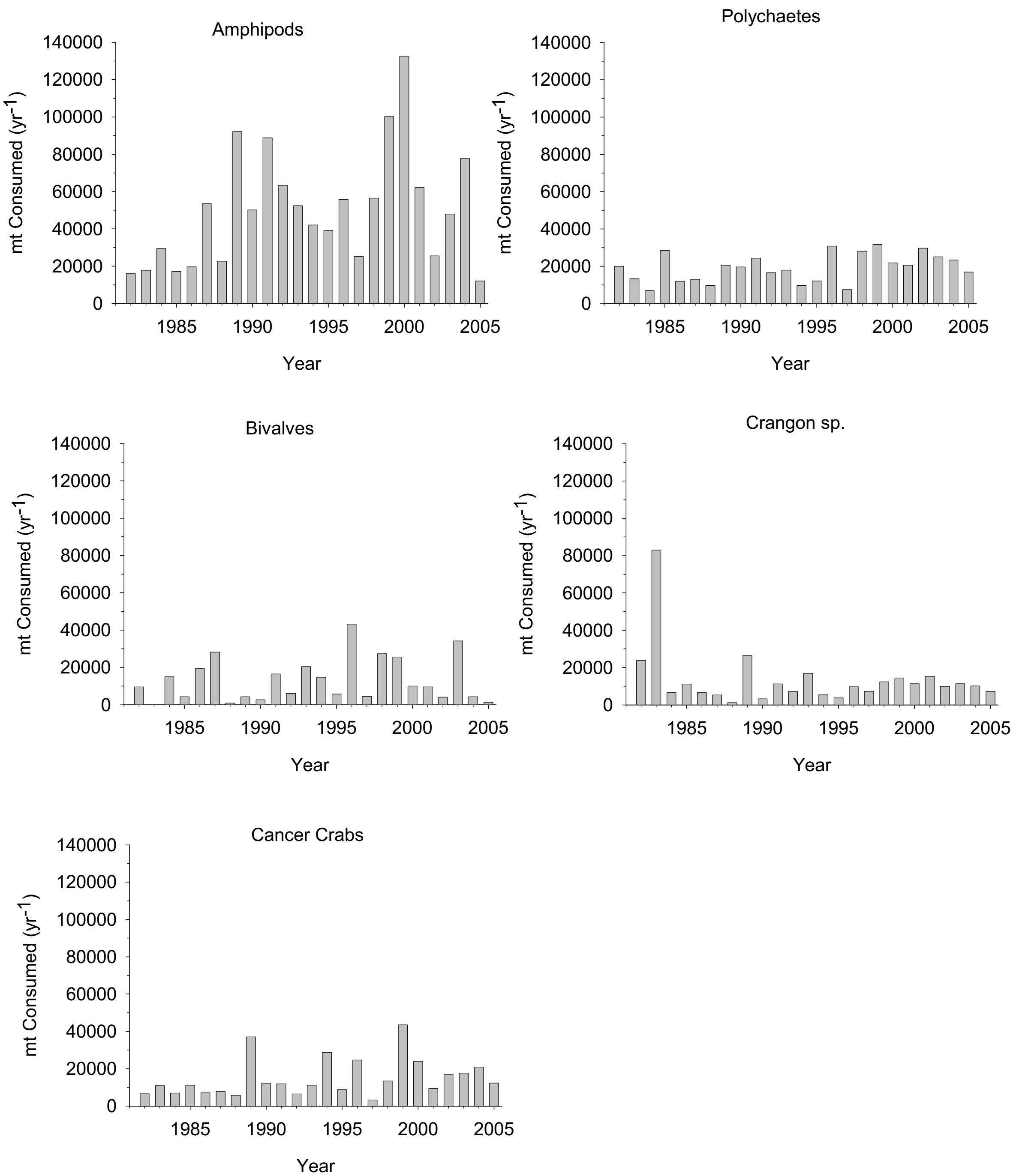


Figure B6.17. The amount of prey consumed (MT yr-1) by Little skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Little skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Little skate.

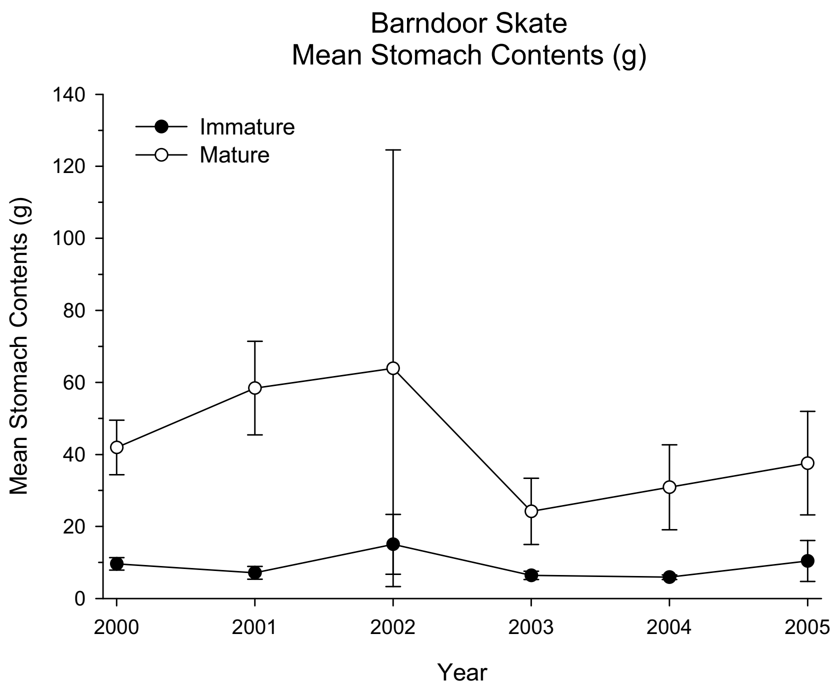


Figure B6.18a. The annual mean stomach contents (0.1 g) of barndoor skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

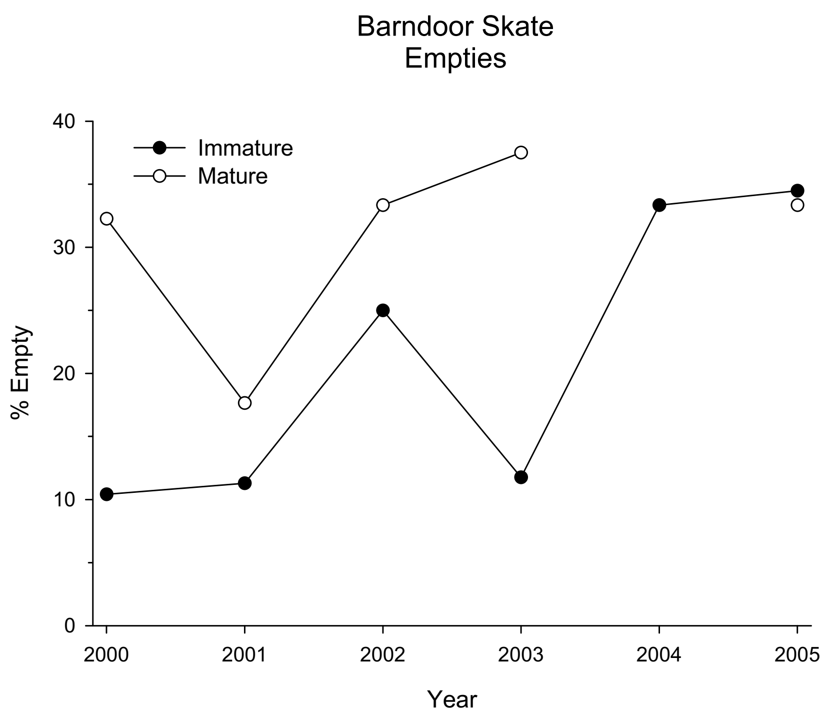


Figure B6.18b. The percent of barndoor skates that had empty stomachs, by year and size class.

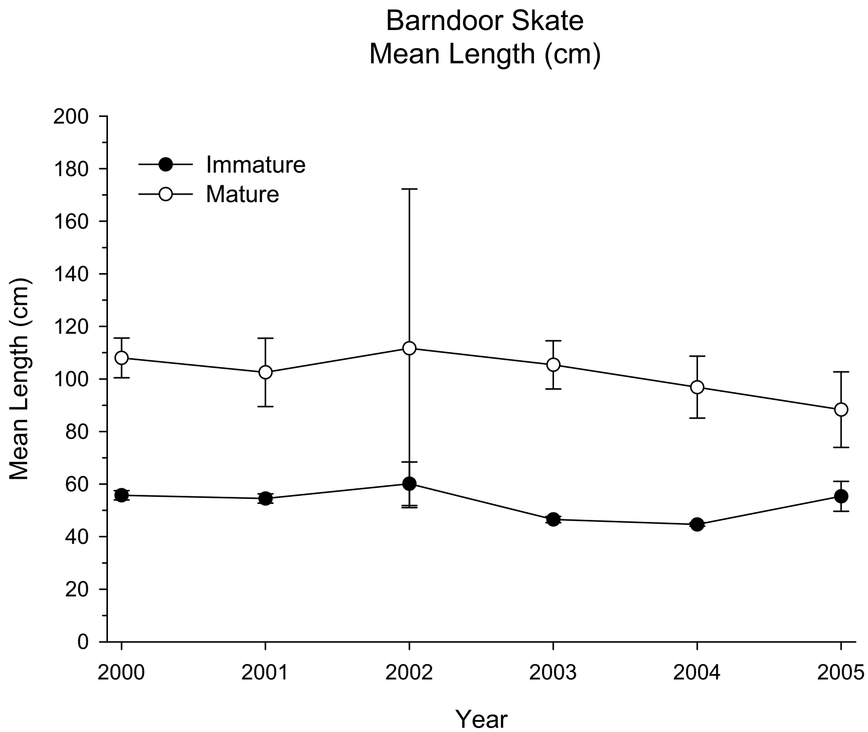


Figure B6.19a. The mean length (1 cm) of Barndoor skate from which stomach samples were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

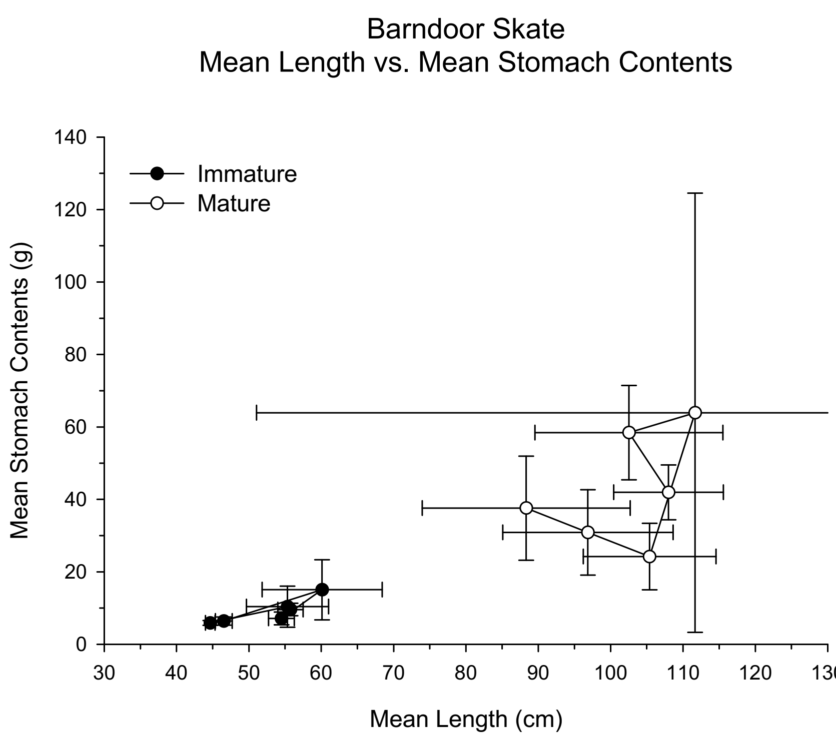


Figure B6.19b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Barndoor skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

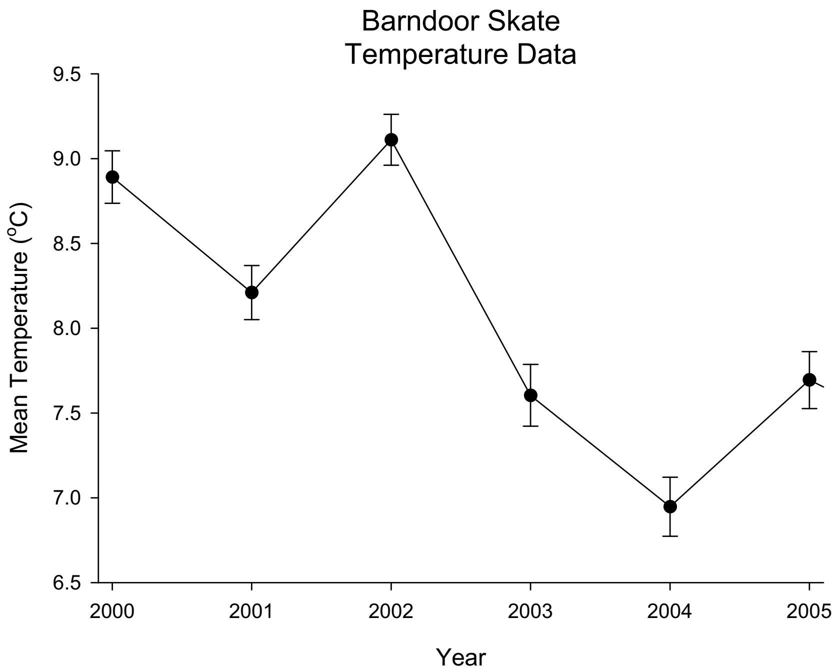


Figure B6.20a. The annual mean bottom temperature (0.1 ^{O}C) for the selected strata set, as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

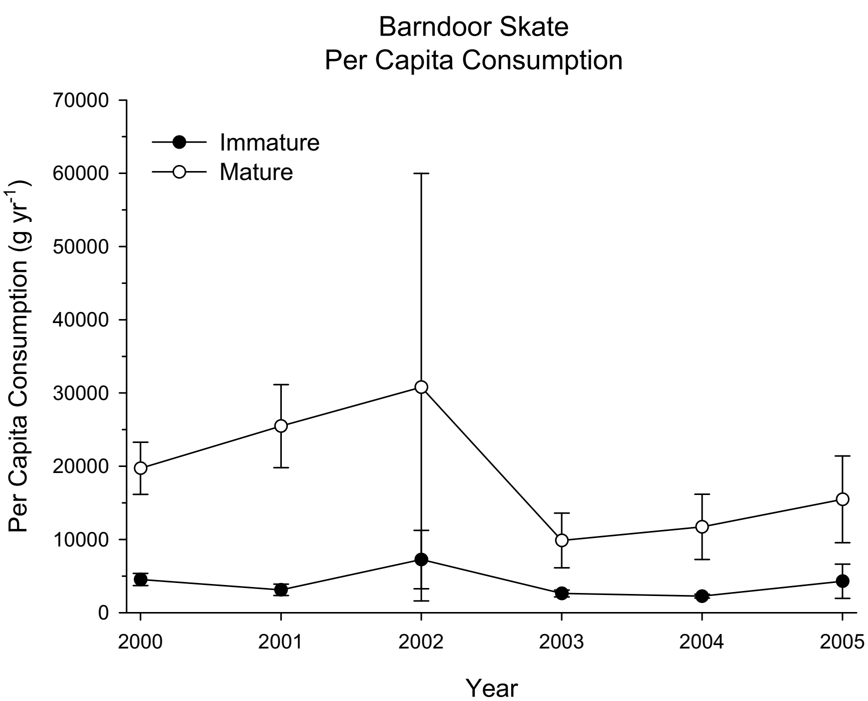


Figure B6.20b. The annual per capita consumption (g yr^{-1}) of Barndoor skate for the strata set and time period noted. Each size class is noted.

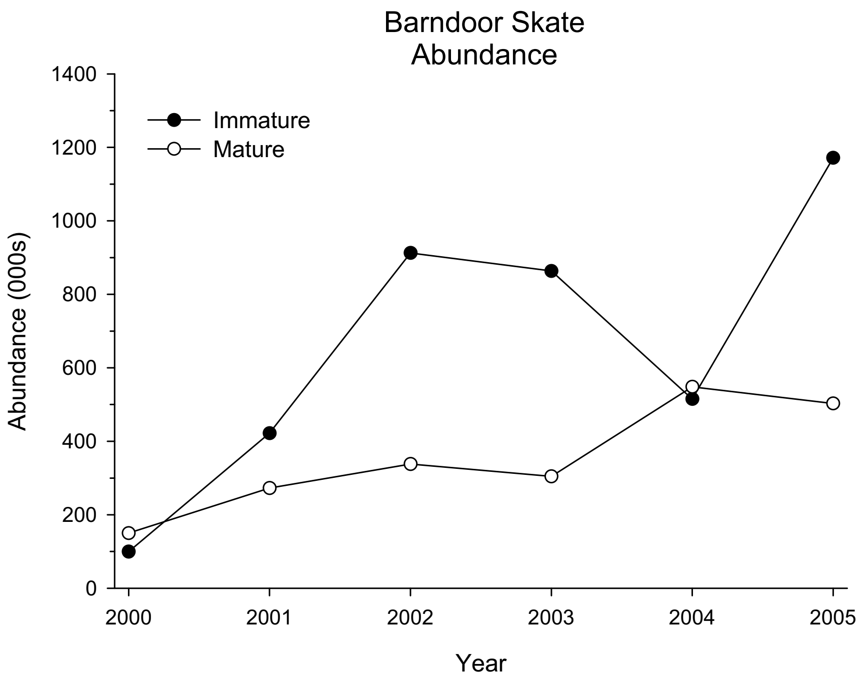


Figure B6.21a. The annual mean swept area abundance of Barndoor skate for the strata set and time period noted. Each size class is noted.

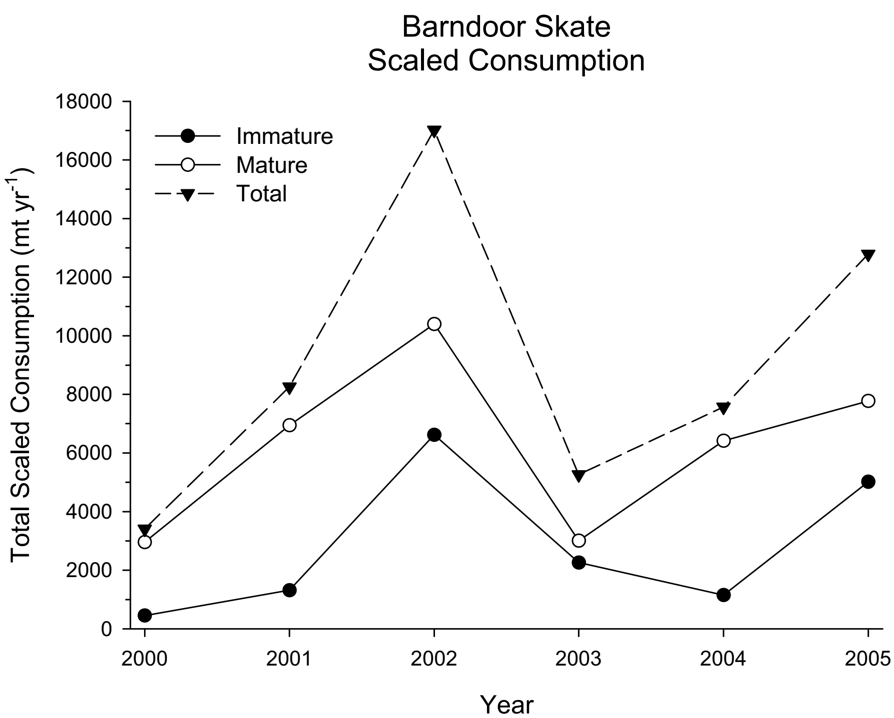


Figure B6.21b. The annual total consumption (MT yr^{-1}) of Barndoor skate for the strata set and time period noted.

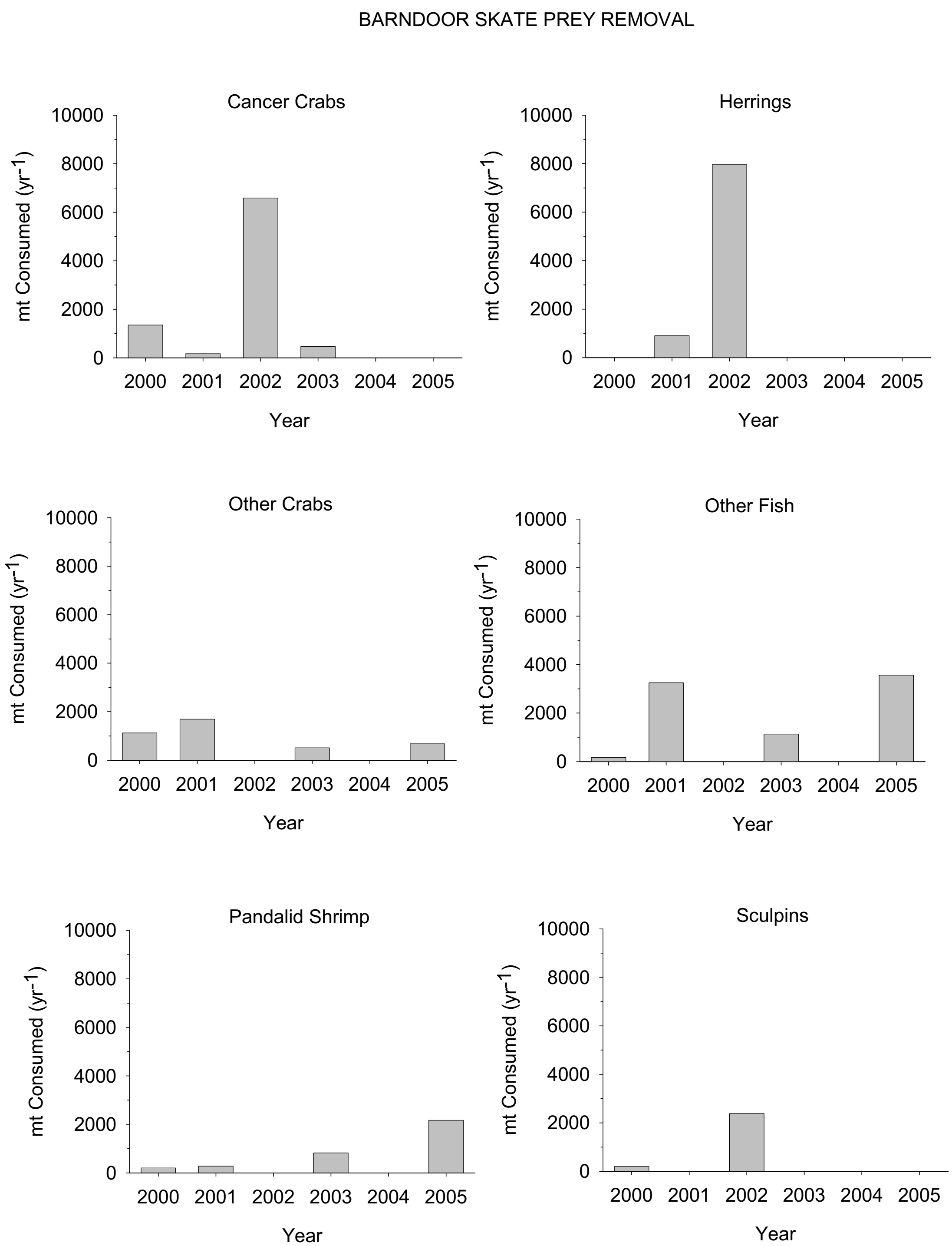


Figure B6.22. The amount of prey consumed (MT yr^{-1}) by Barndoor skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Barndoor skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Barndoor skate.

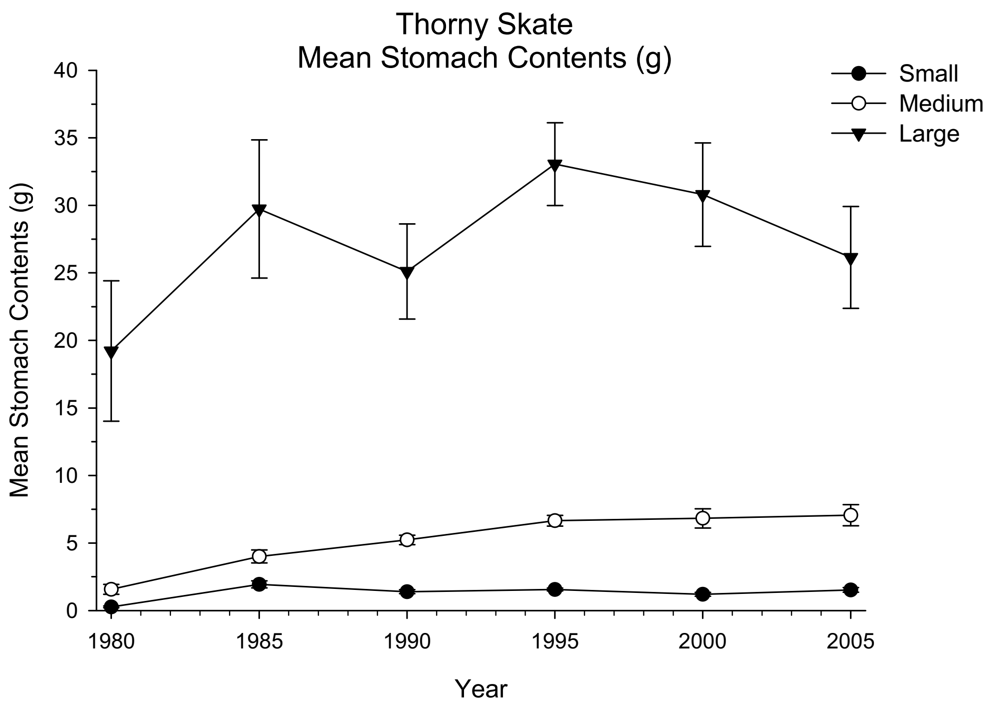


Figure B6.23a. The annual mean stomach contents (0.1 g) of Thorny skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

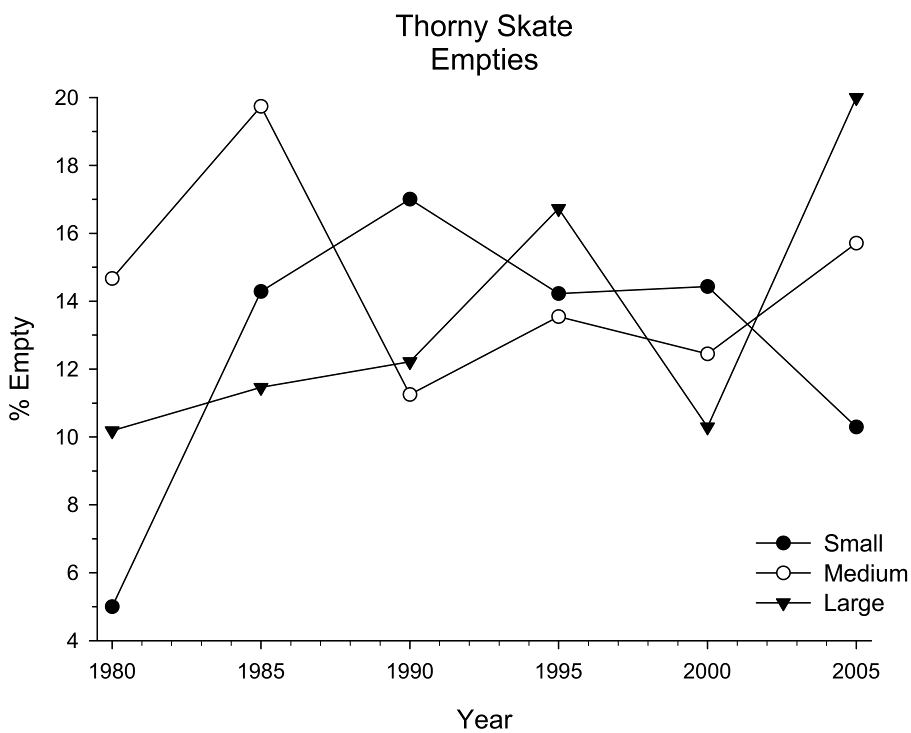


Figure B6.23b. The percentage of stomachs that were empty (i.e., containing no prey) of Thorny skate for the strata set and time period noted. Each size class is noted

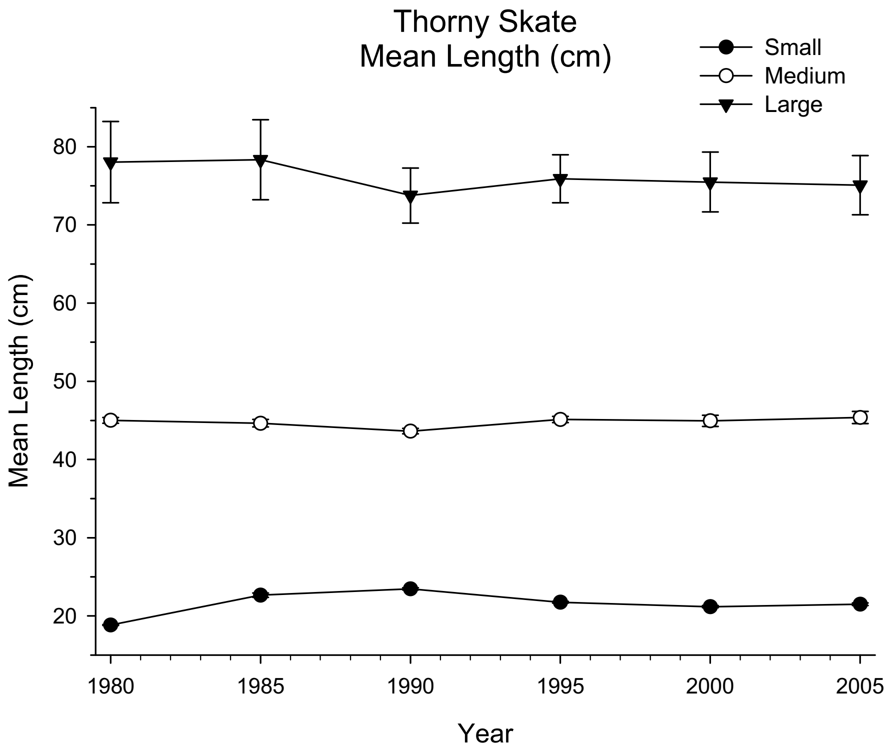


Figure B6.24a. The mean length (1 cm) of Thorny skate from which stomach samples were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

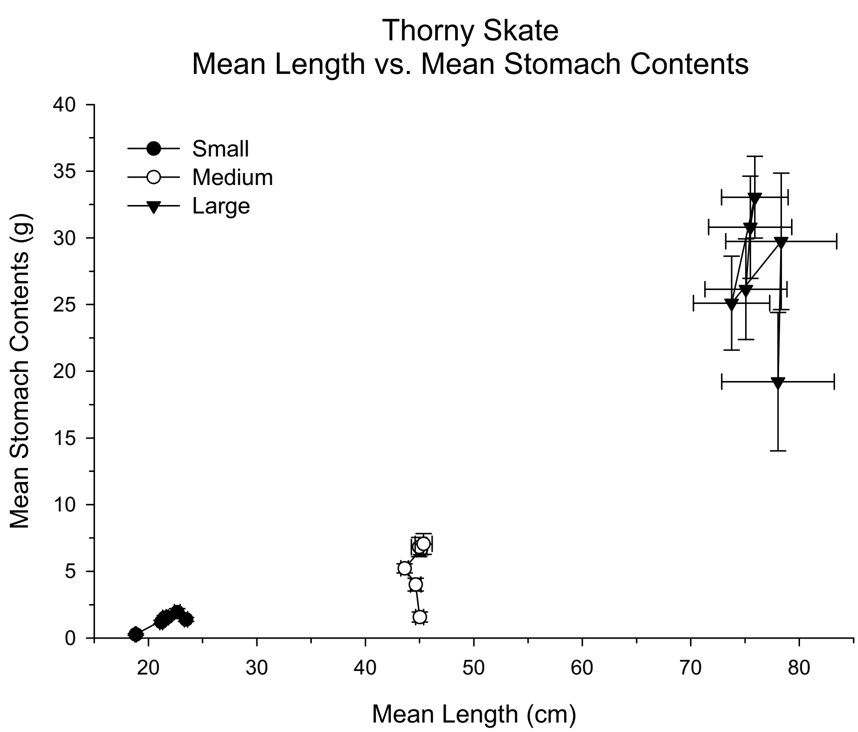


Figure B6.24b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Thorny skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

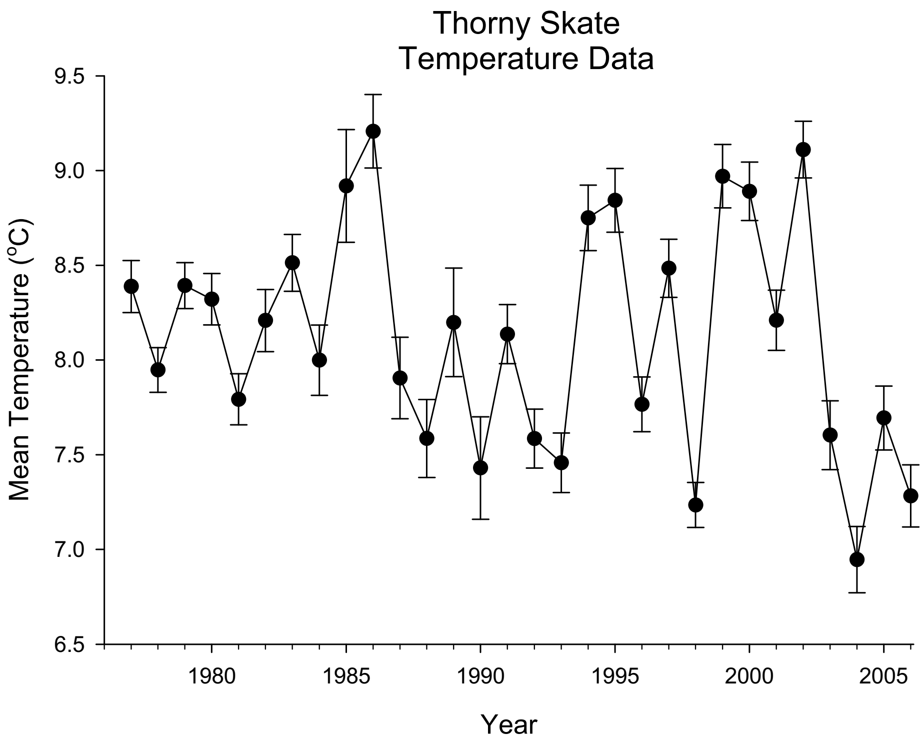


Figure B6.25a. The annual mean bottom temperature (0.1 ^{O}C) for the selected strata set, as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

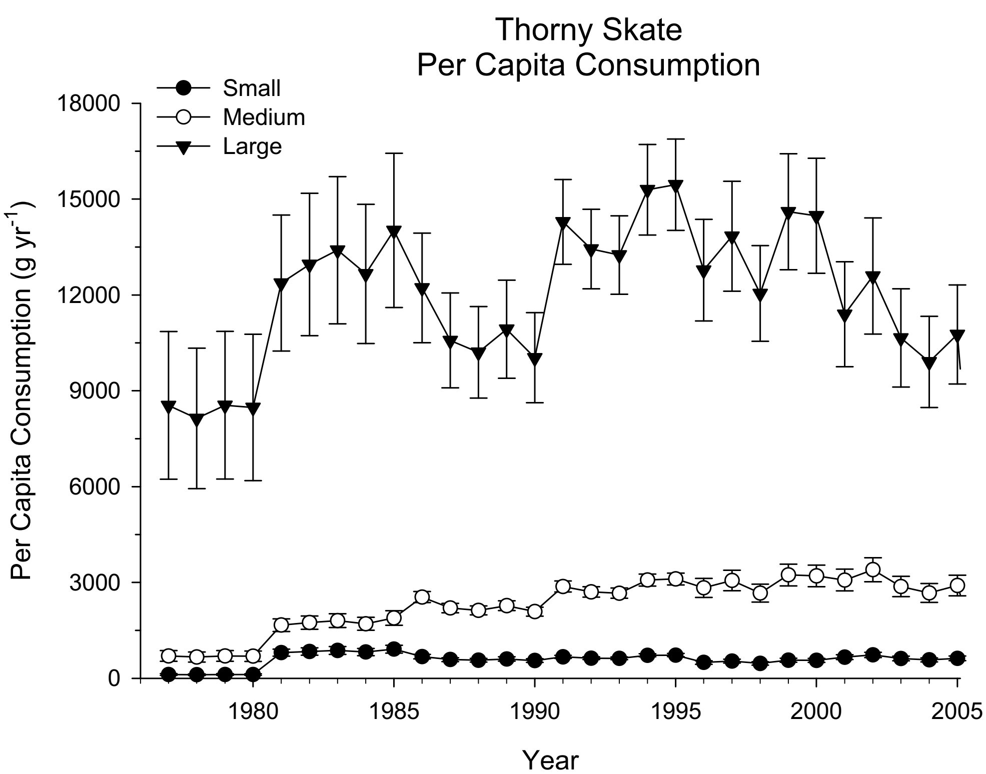


Figure B6.25b. The annual per capita consumption (g yr^{-1}) of Thorny skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

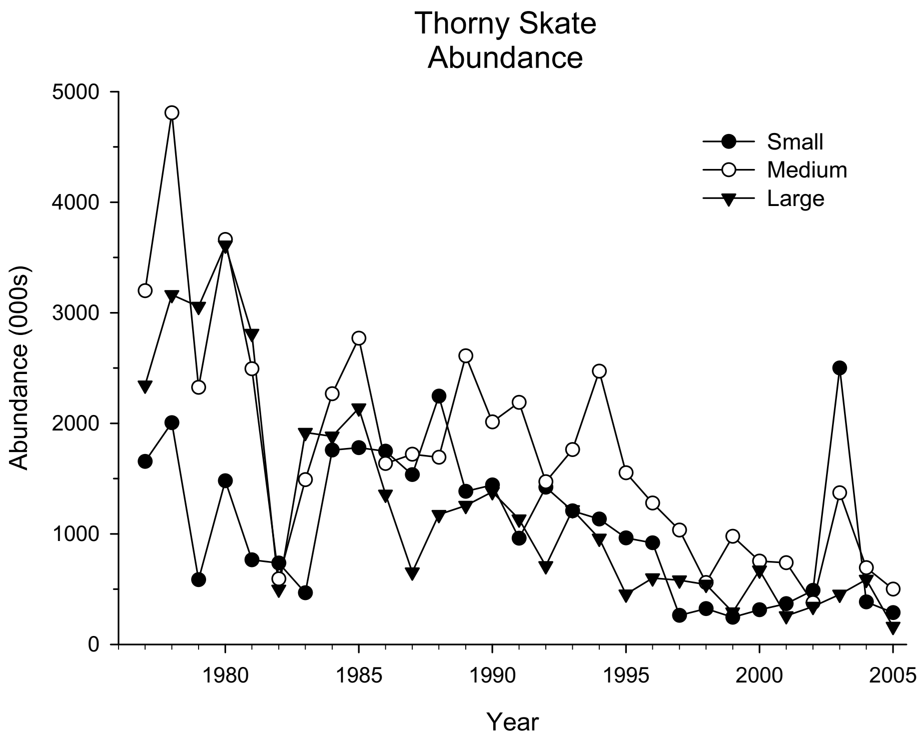


Figure B6.26a. The annual mean swept area abundance of Thorny skate for the strata set and time period noted. Each size class is noted.

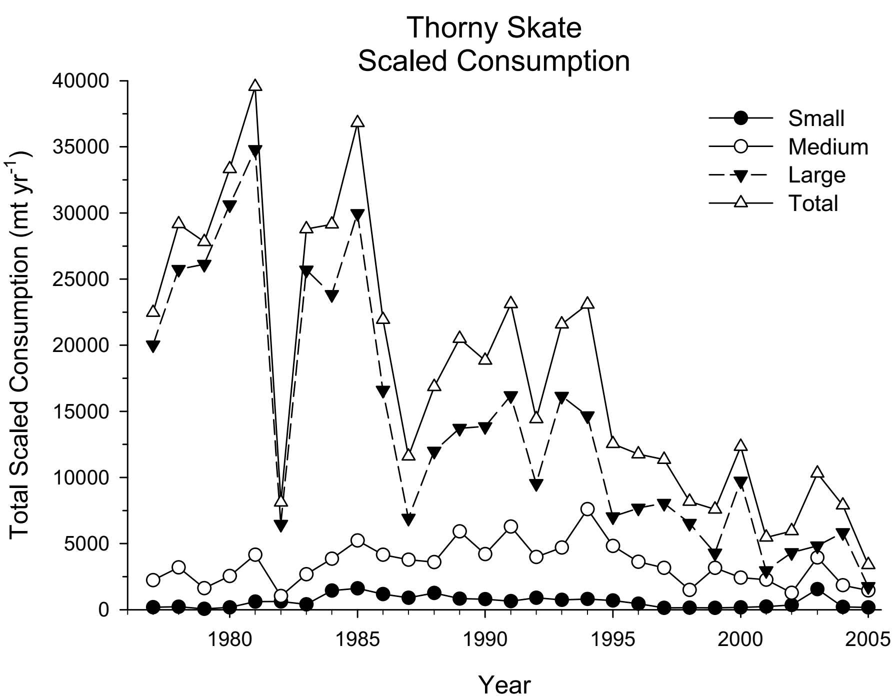


Figure B6.26b. The annual total consumption (MT yr^{-1}) of Thorny skate for the strata set and time period noted.

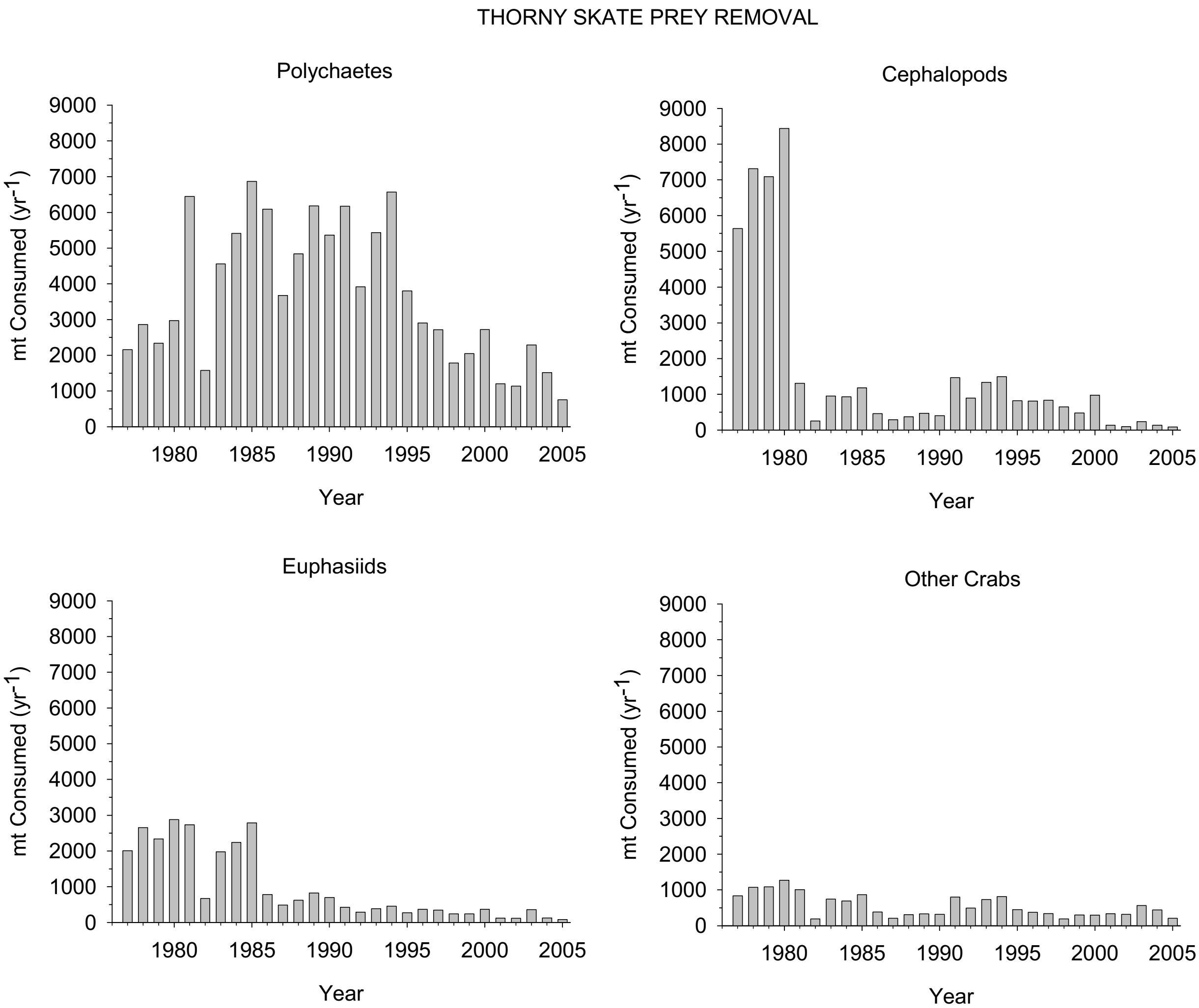


Figure B6.27. The amount of prey consumed (MT yr-1) by Thorny skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Thorny skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Thorny skate.

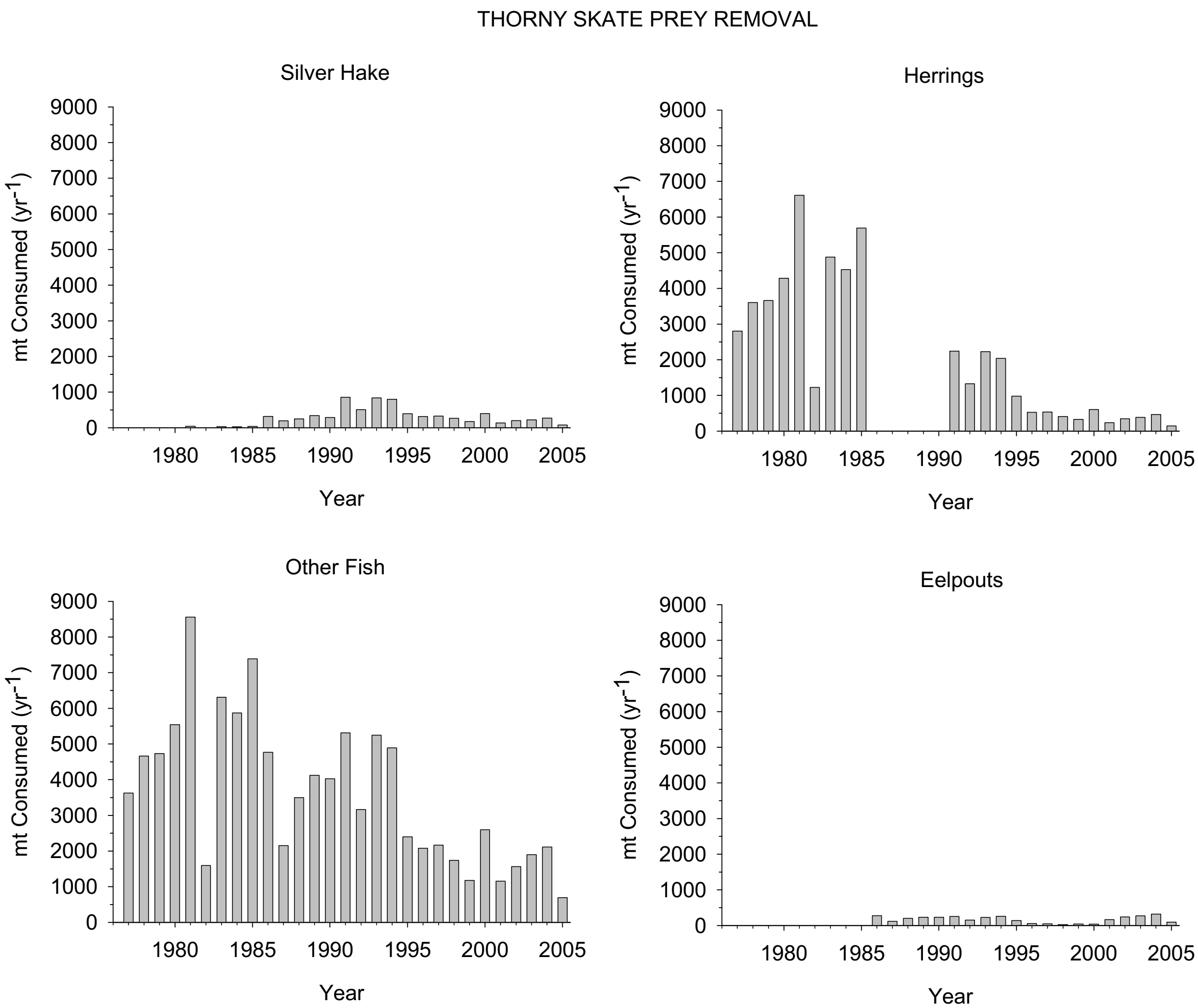


Figure B6.28. The amount of prey consumed (MT yr-1) by Thorny skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Thorny skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Thorny skate.

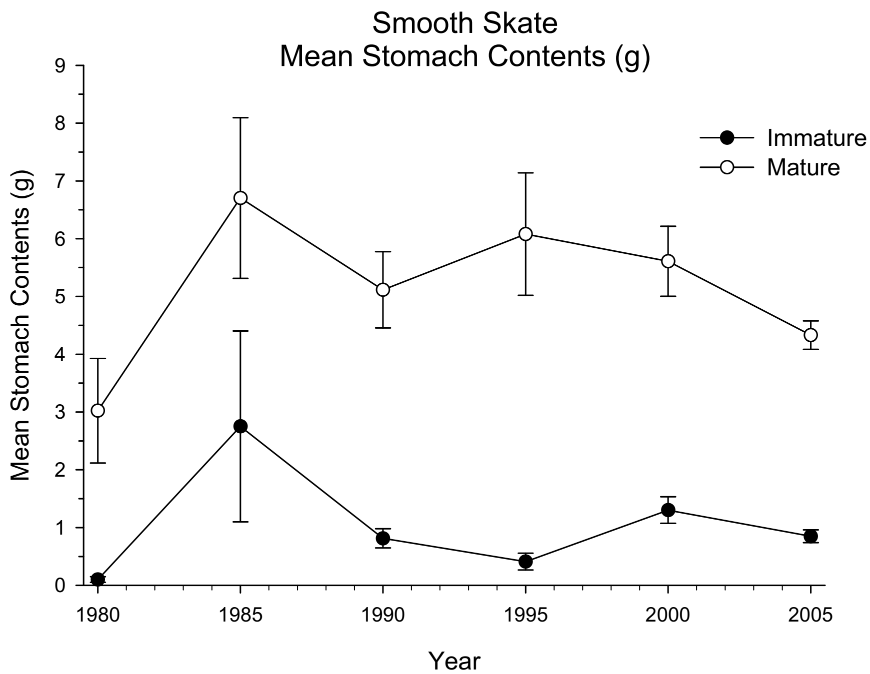


Figure B6.29a. The annual mean stomach contents (0.1 g) of Smooth skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

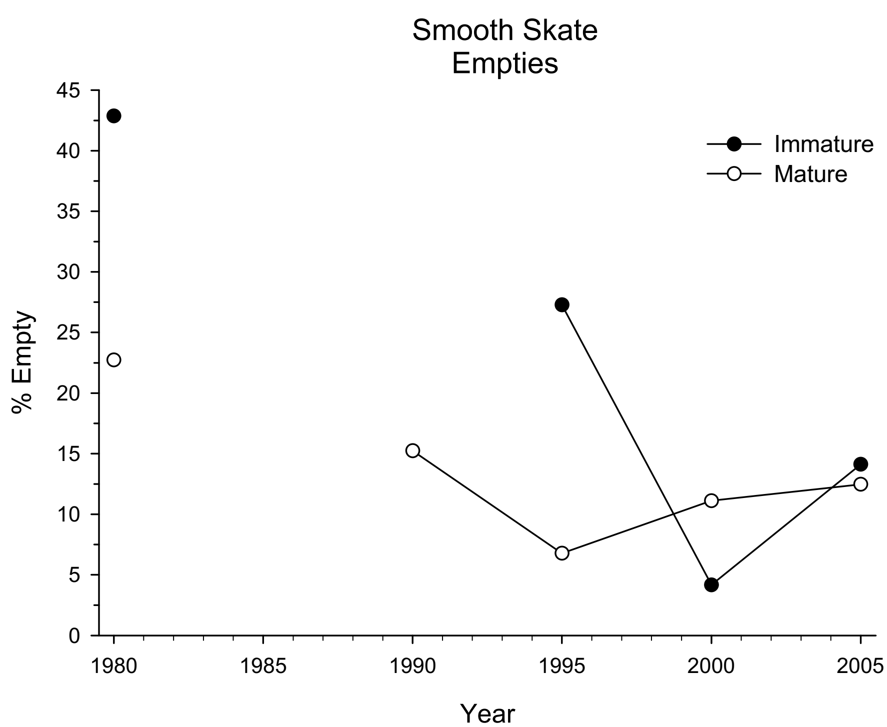


Figure B6.29b. The percentage of stomachs that were empty (i.e., containing no prey) of smooth skate for the strata set and time period noted. Each size class is noted

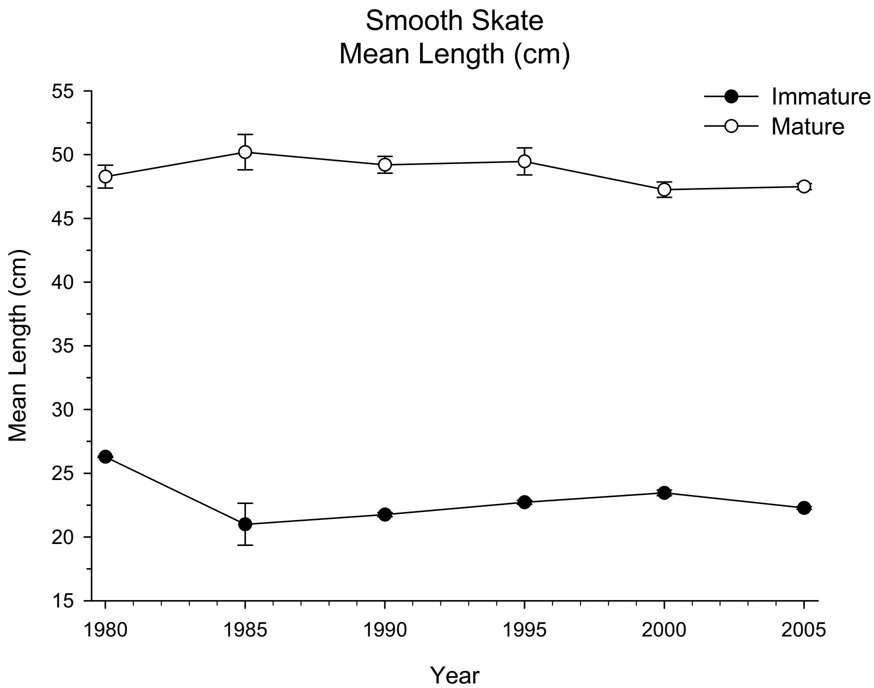


Figure B6.30a. The mean length (1 cm) of Smooth skate from which stomach samples were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

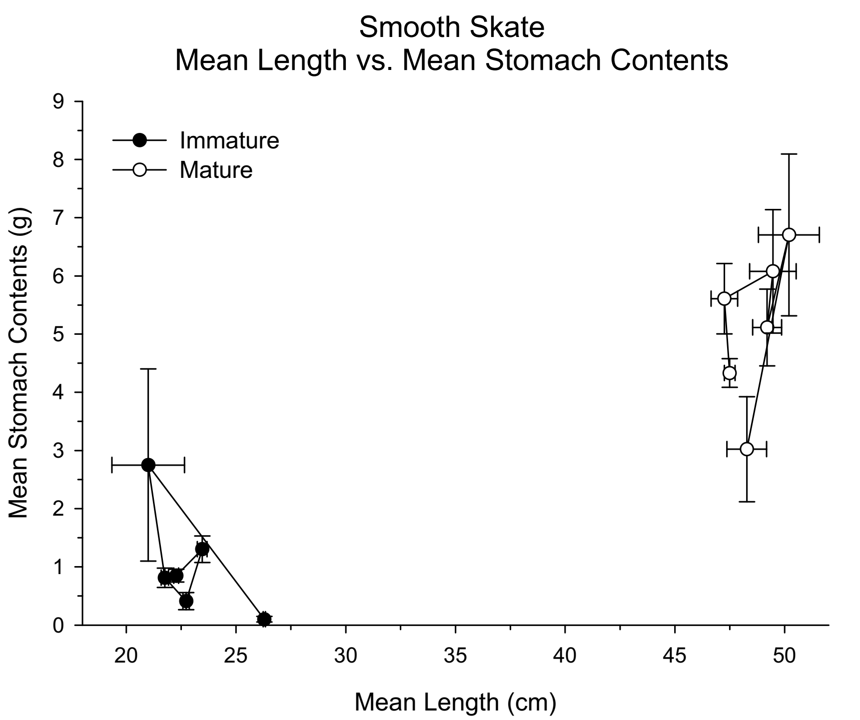


Figure B6.30b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Smooth skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

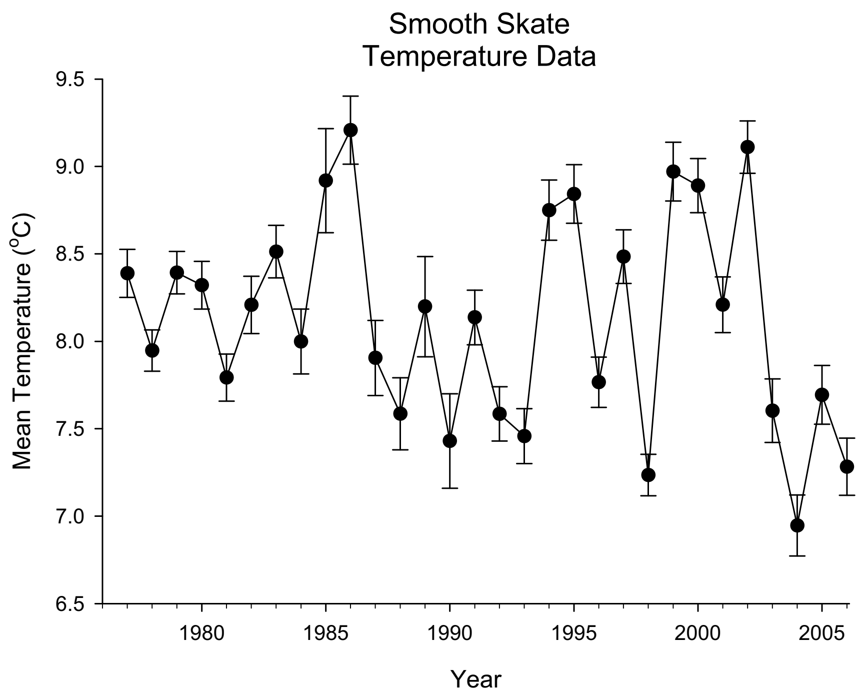


Figure B6.31a. The annual mean bottom temperature (0.1 ^{O}C) for the selected strata set, as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

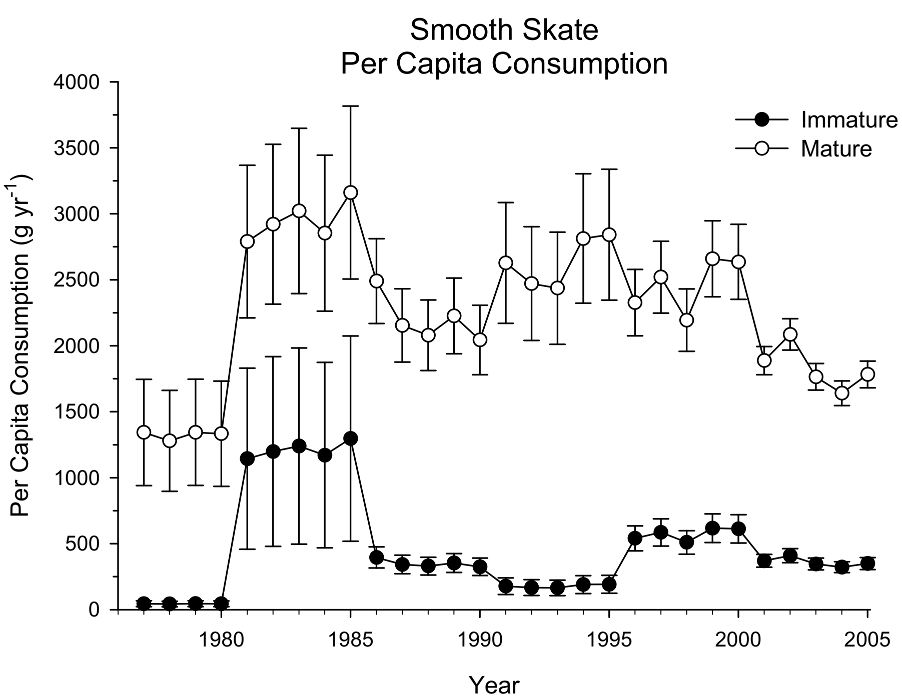


Figure B6.31b. The annual per capita consumption (g yr^{-1}) of Smooth skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

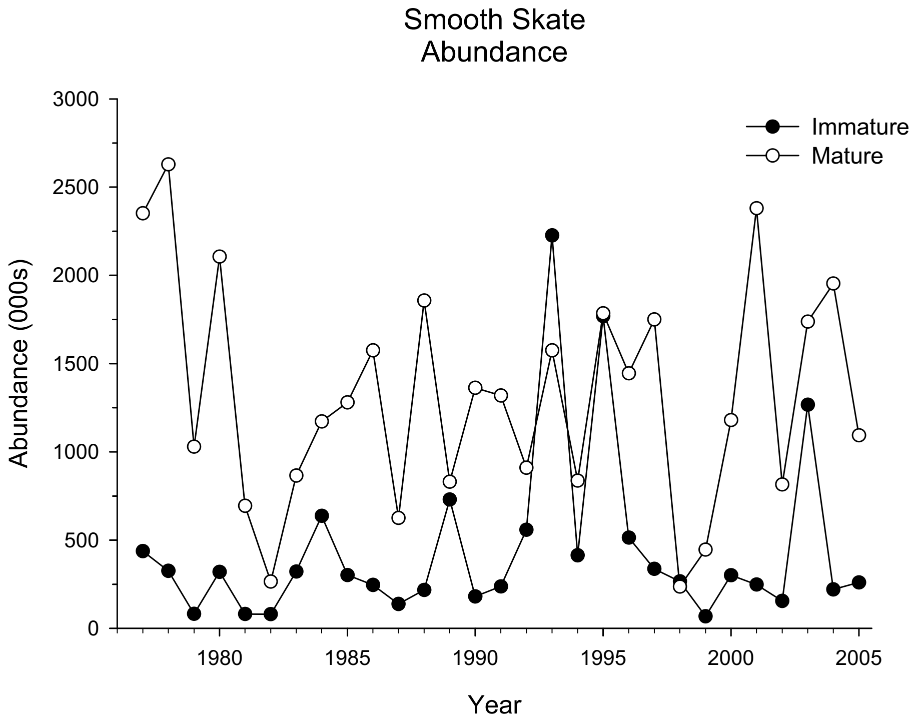


Figure B6.32a. The annual mean swept area abundance of Smooth skate for the strata set and time period noted. Each size class is noted.

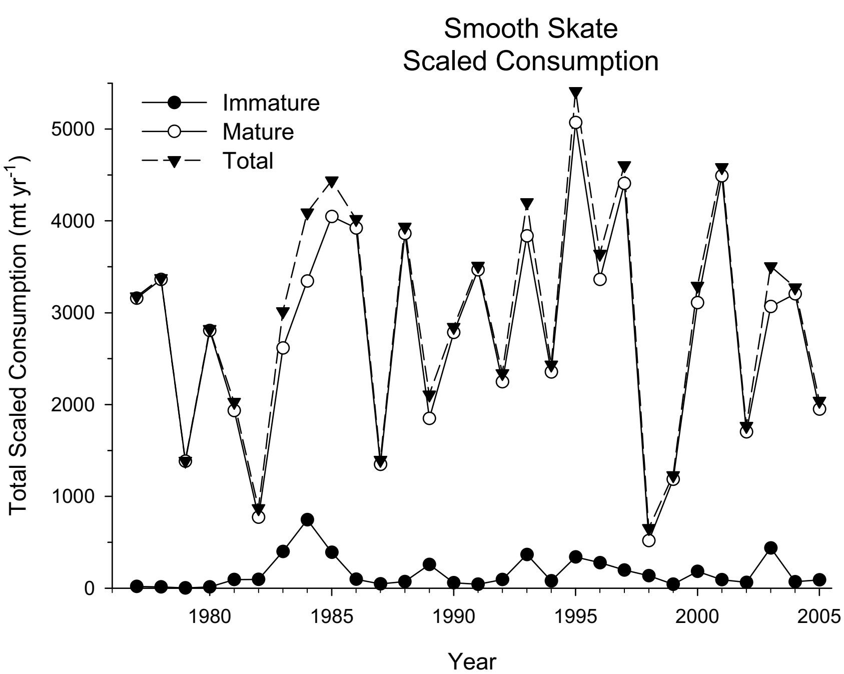


Figure B6.32b. The annual total consumption (MT yr^{-1}) of Smooth skate for the strata set and time period noted.

SMOOTH SKATE PREY REMOVAL

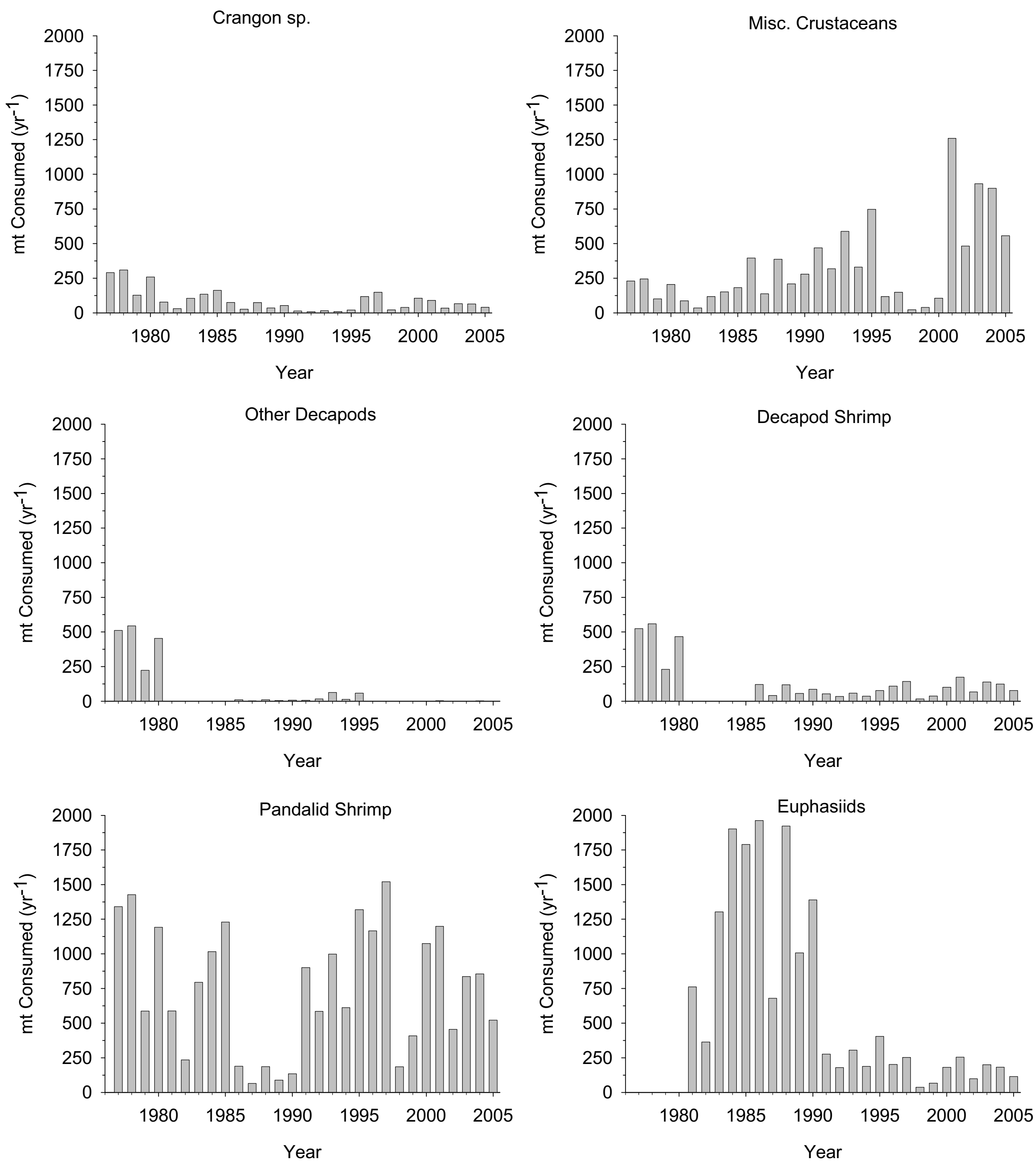


Figure B6.33. The amount of prey consumed (MT yr-1) by Smooth skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Smooth skate. These prey were selected as some of the major prey (>>5 % of diet com osition of Smooth skate.

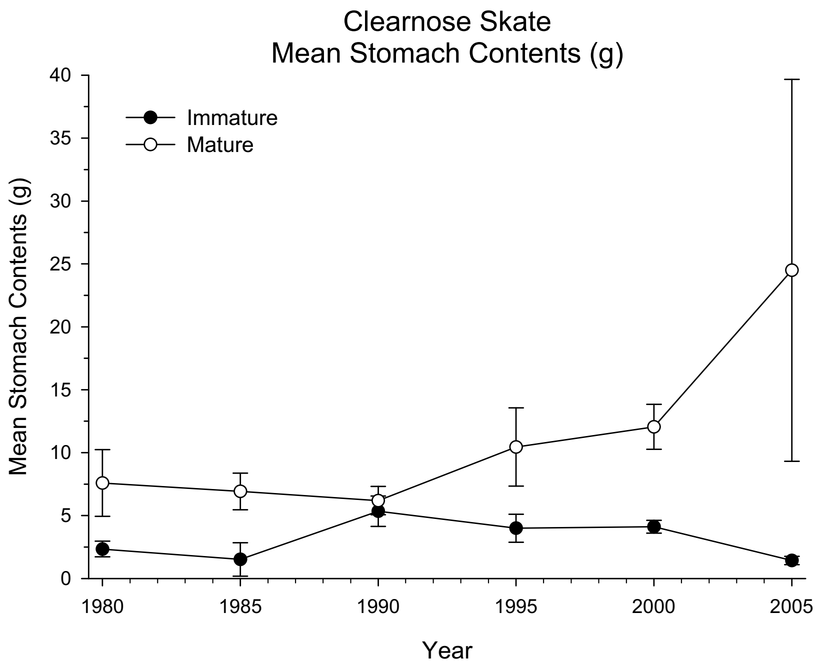


Figure B6.34a. The annual mean stomach contents (0.1 g) of Clearnose skate for the strata and time period noted. Each size class is noted. Error bars are ± 1 S.E.

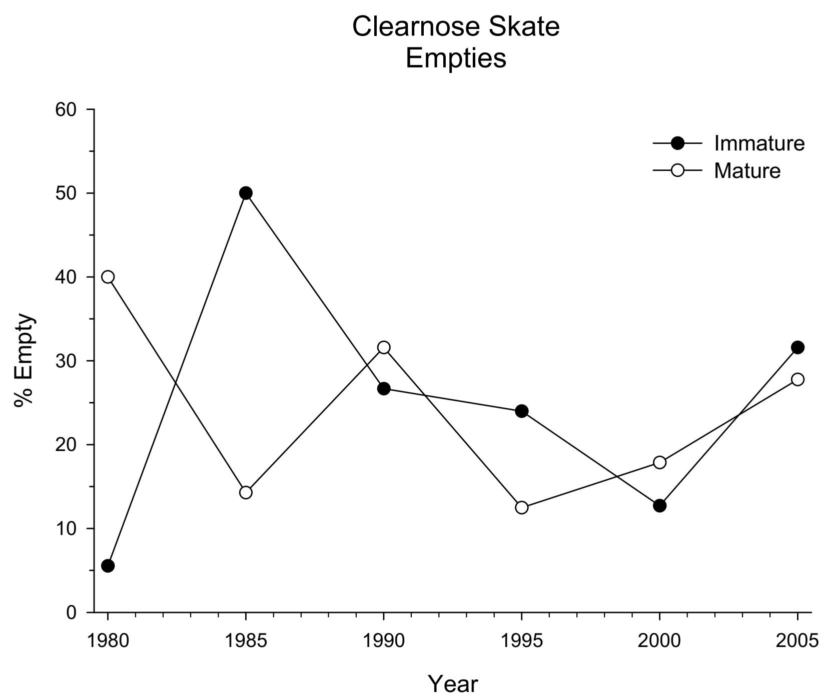


Figure B6.34b. The percentage of stomachs that were empty (i.e., containing no prey) of Clearnose skate for the strata set and time period noted. Each size class is noted

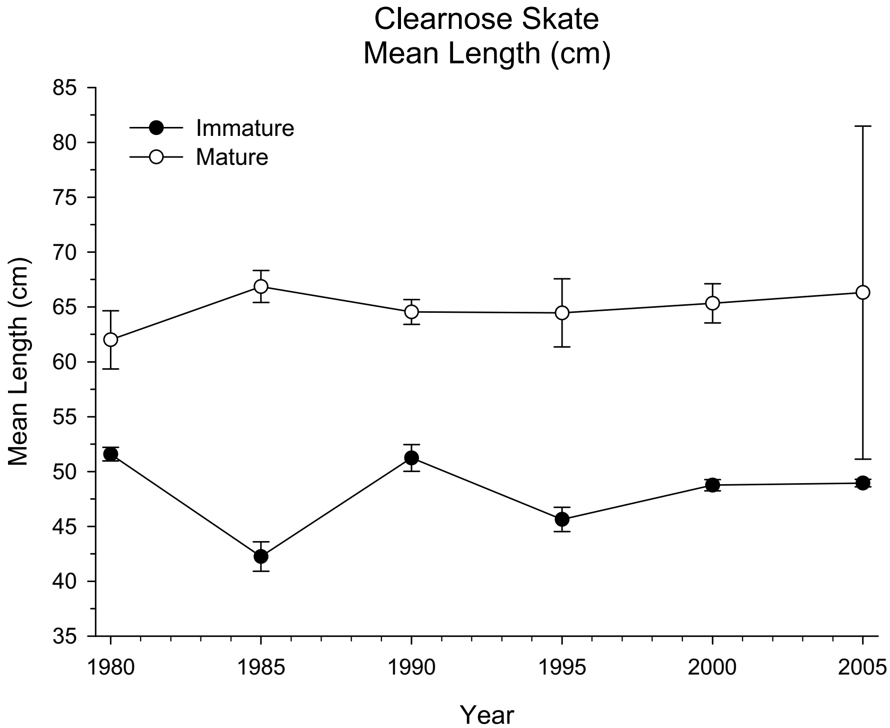


Figure B6.35a. The mean length (1 cm) of Clearnose skate from which stomach sample were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

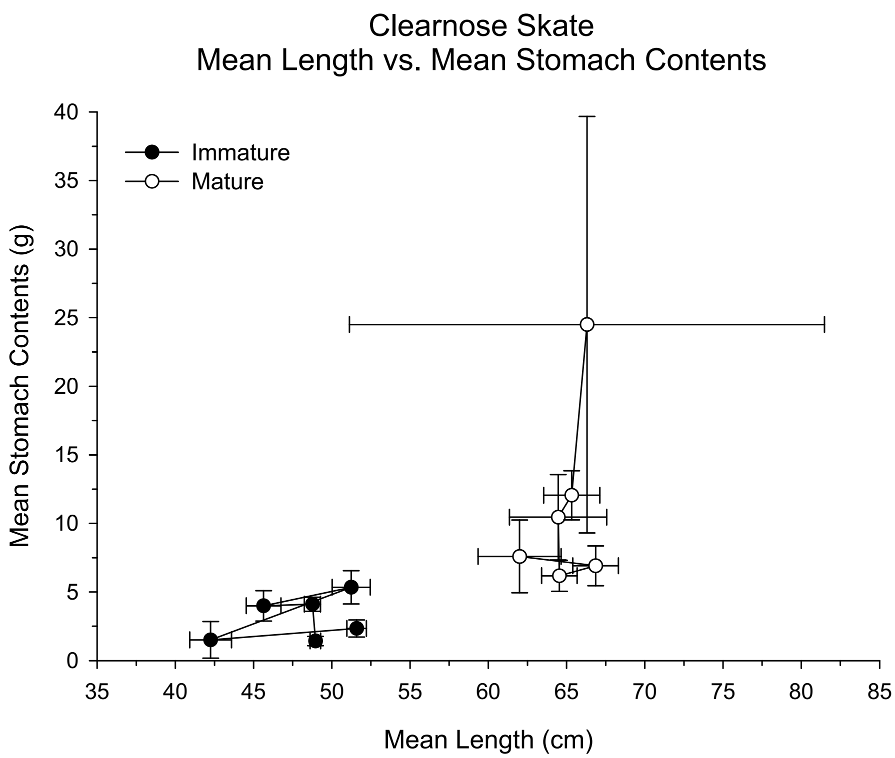


Figure B6.35b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Clearnose skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

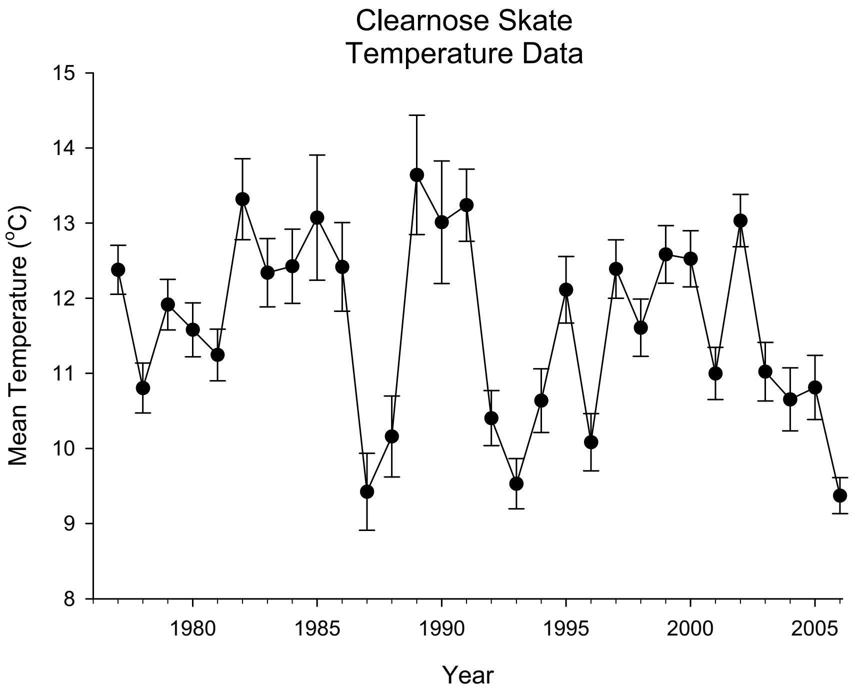


Figure B6.36a. The annual mean bottom temperature (0.1 °C) for the selected strata set as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

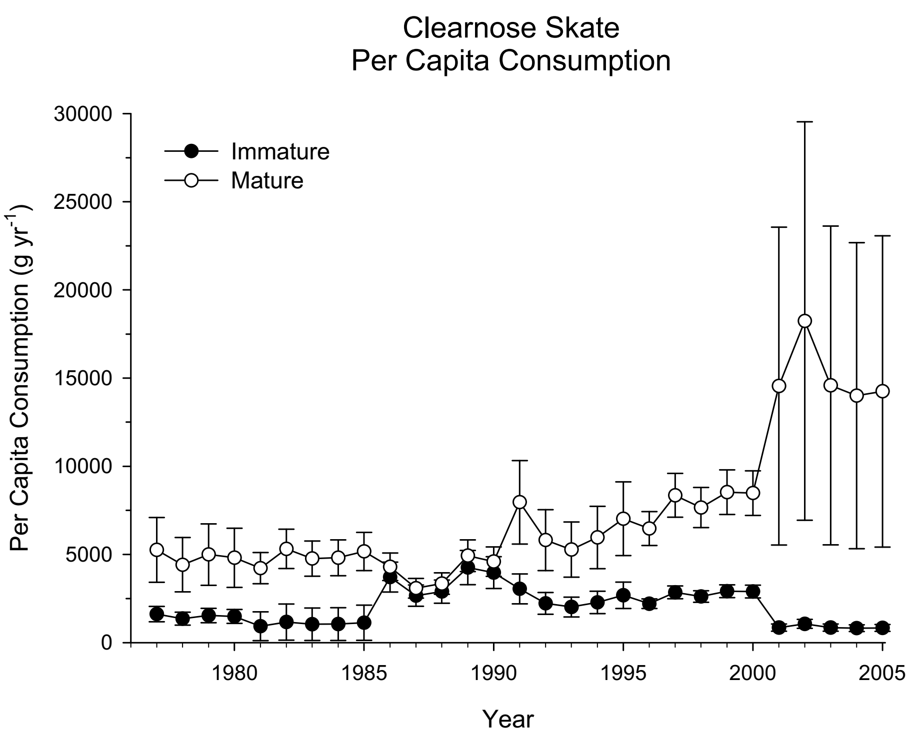


Figure B6.36b. The annual per capita consumption (g yr^{-1}) of Clearnose skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

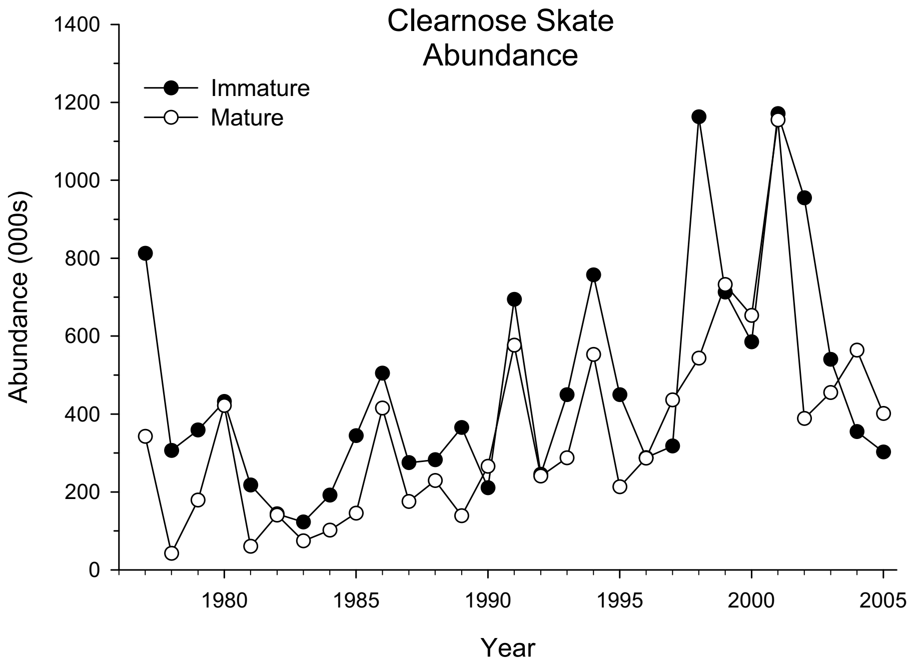


Figure B6.37a. The annual mean swept area abundance of Clearnose skate for the strata set and time period noted. Each size class is noted.

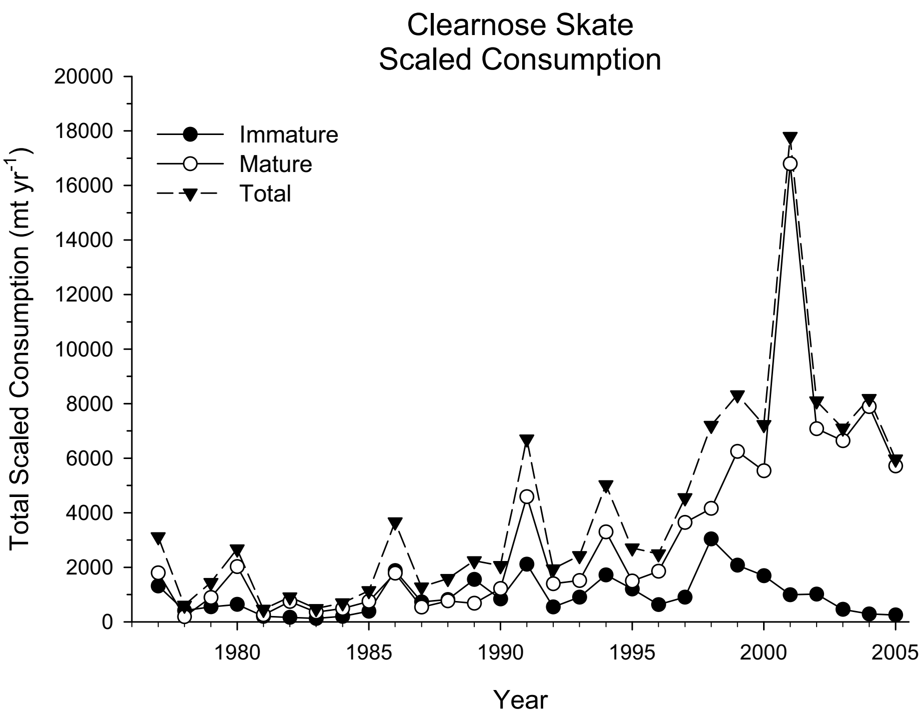


Figure B6.37b. The annual total consumption (MT yr^{-1}) of Clearnose skate for the stra set and time period noted.

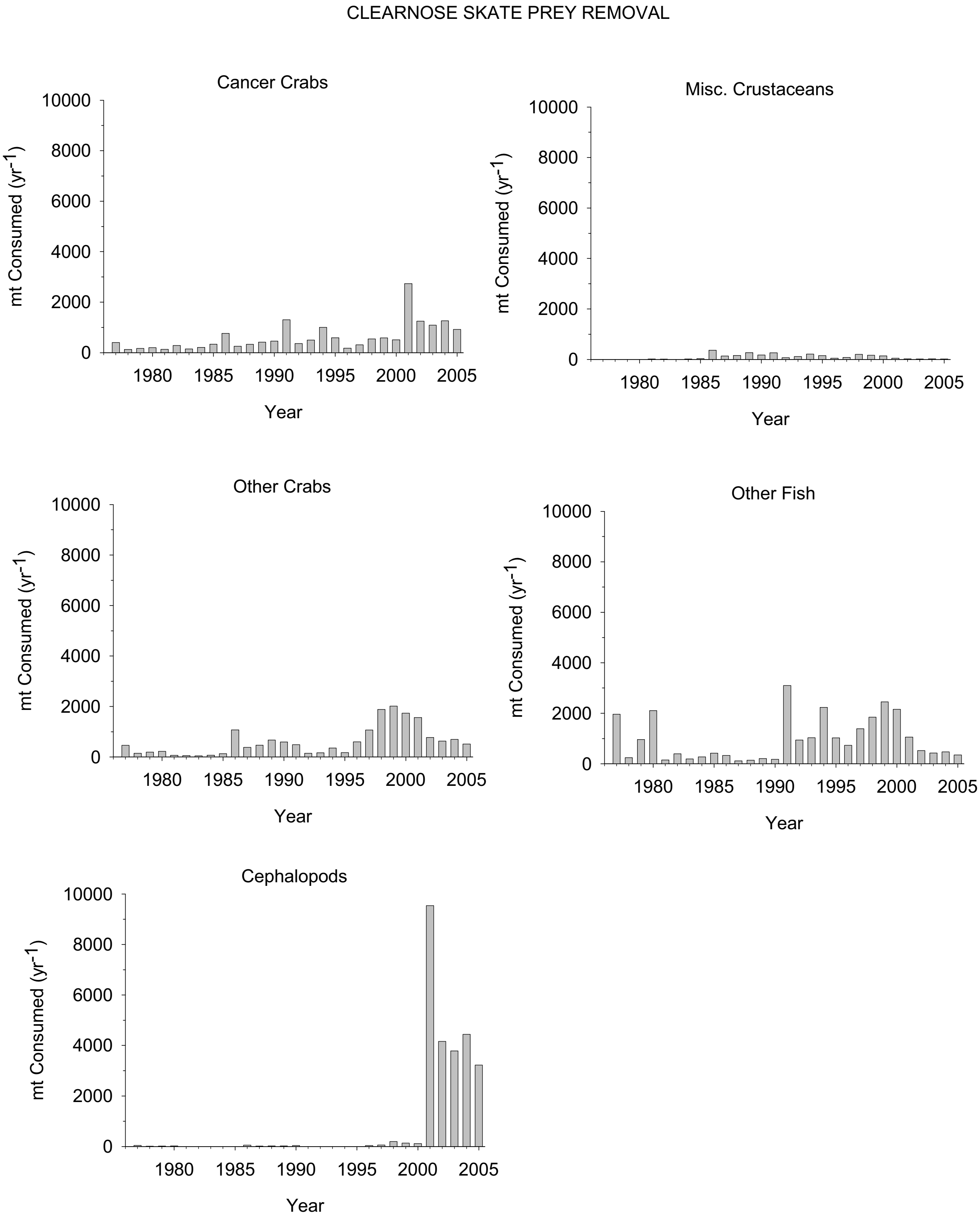


Figure B6.38. The amount of prey consumed (MT yr-1) by Clearnose skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Clearnose skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Clearnose skate.

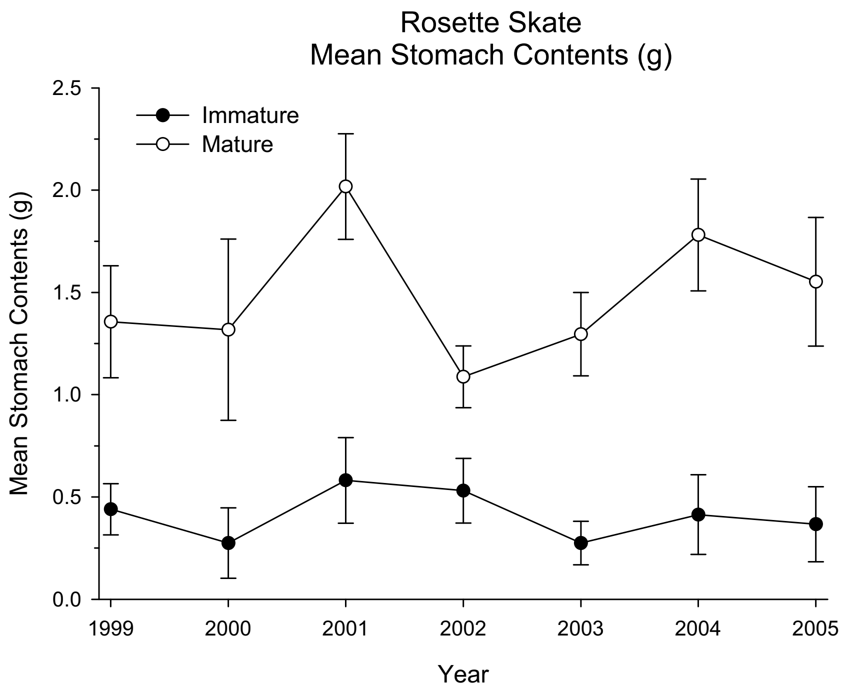


Figure B6.39a. The annual mean stomach contents (0.1 g) of Rosette skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

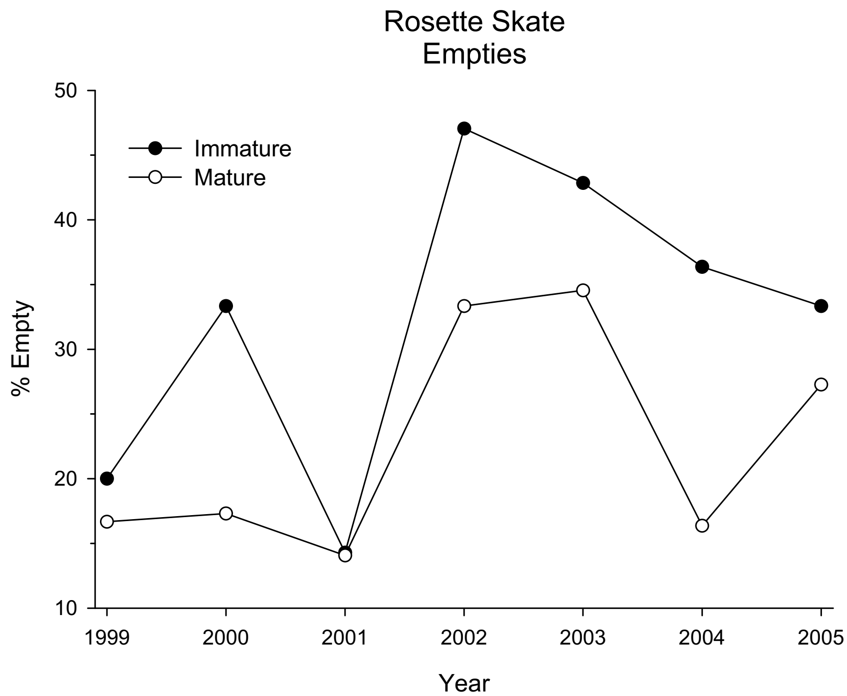


Figure B6.39b. The percentage of stomachs that were empty (i.e., containing no prey) of Rosette skate for the strata set and time period noted. Each size class is noted

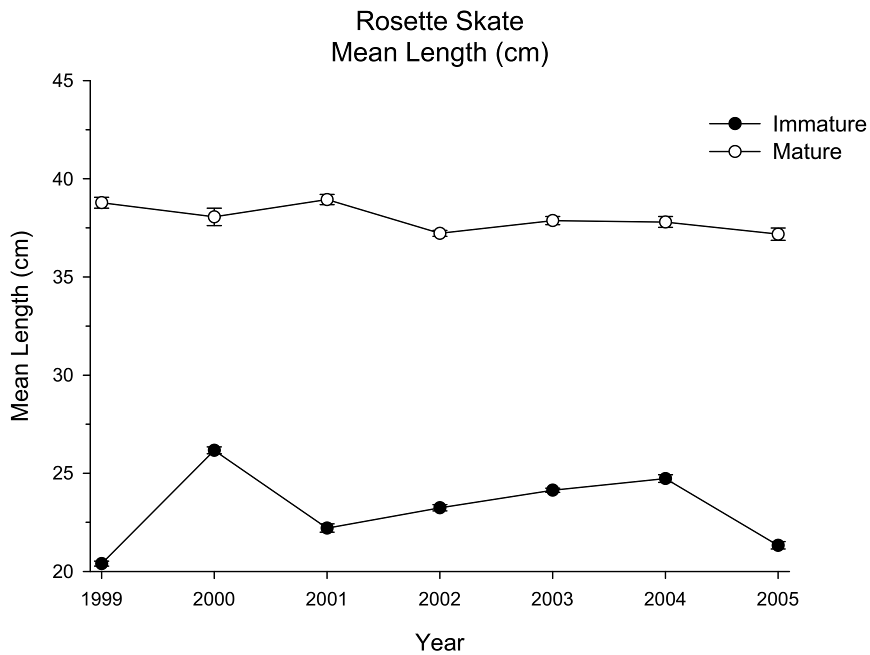


Figure B6.40a. The mean length (1 cm) of Rosette skate from which stomach samples were collected, for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

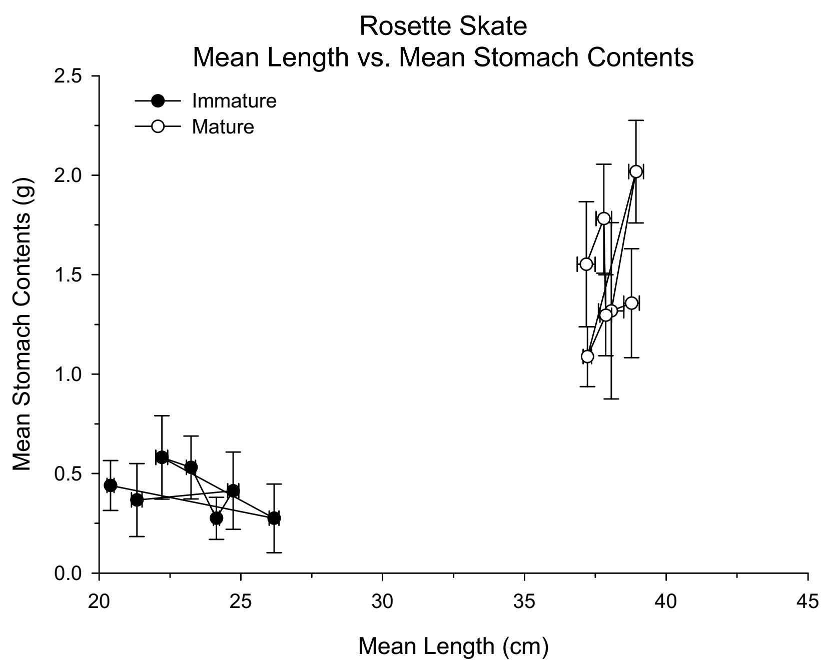


Figure B6.40b. The annual mean stomach contents (0.1 g) and the mean length (1 cm) of Rosette skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

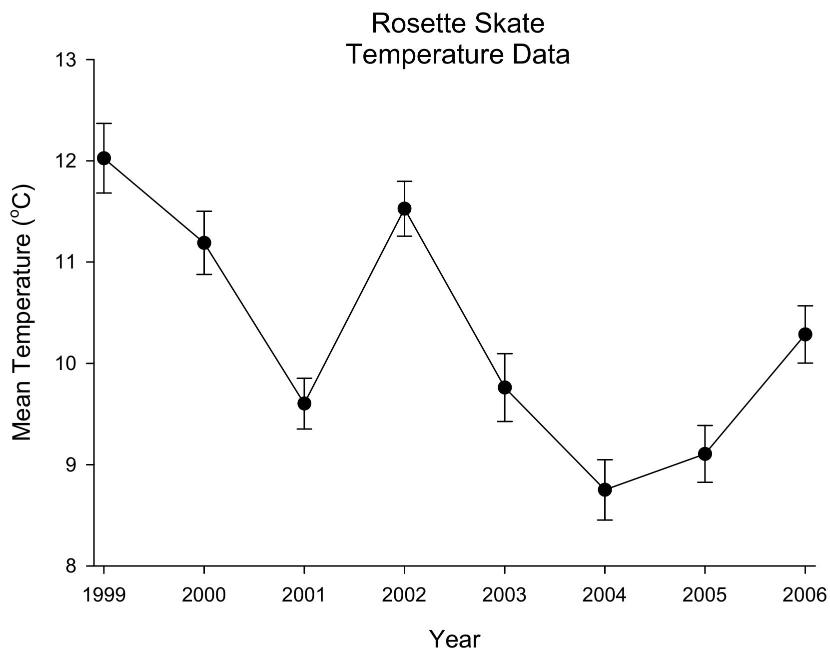


Figure B6.41a. The annual mean bottom temperature (0.1 ^{o}C) for the selected strata set, as taken from the bottom trawl survey over the time period noted. Error bars are ± 1 S.E.

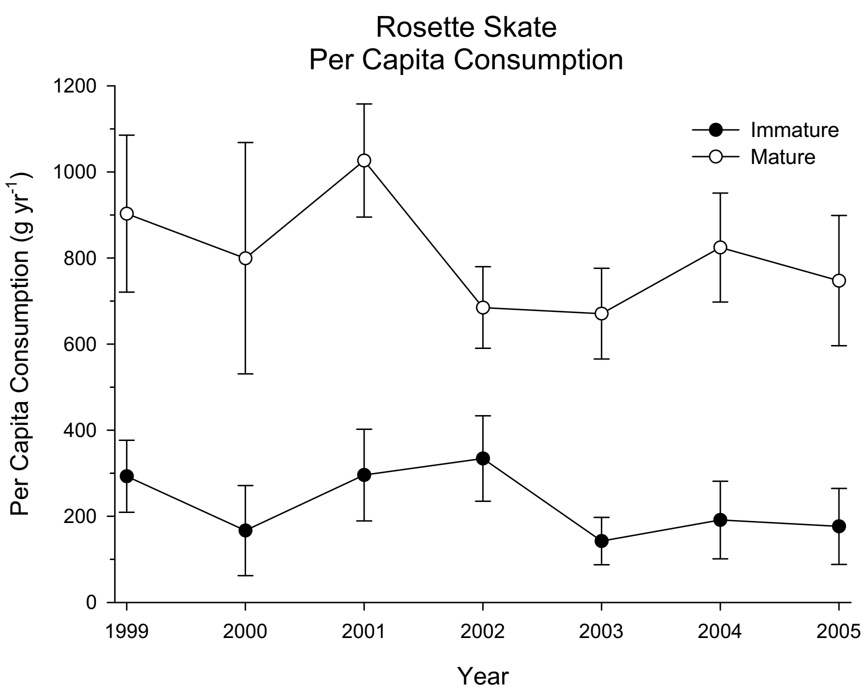


Figure B6.41b. The annual per capita consumption (g yr^{-1}) of Rosette skate for the strata set and time period noted. Each size class is noted. Error bars are ± 1 S.E.

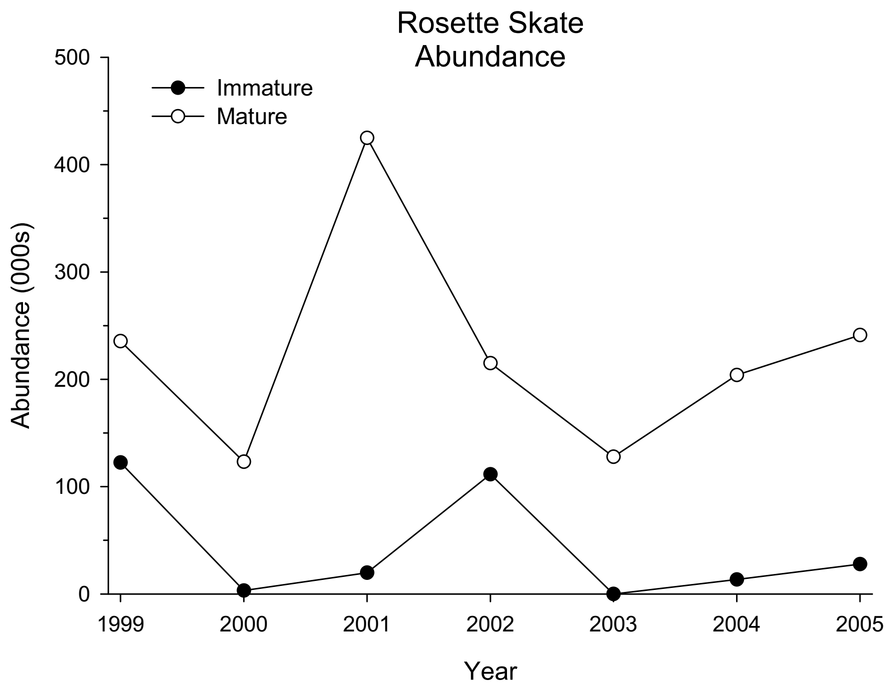


Figure B6.42a. The annual mean swept area abundance of Rosette skate for the strata set and time period noted. Each size class is noted.

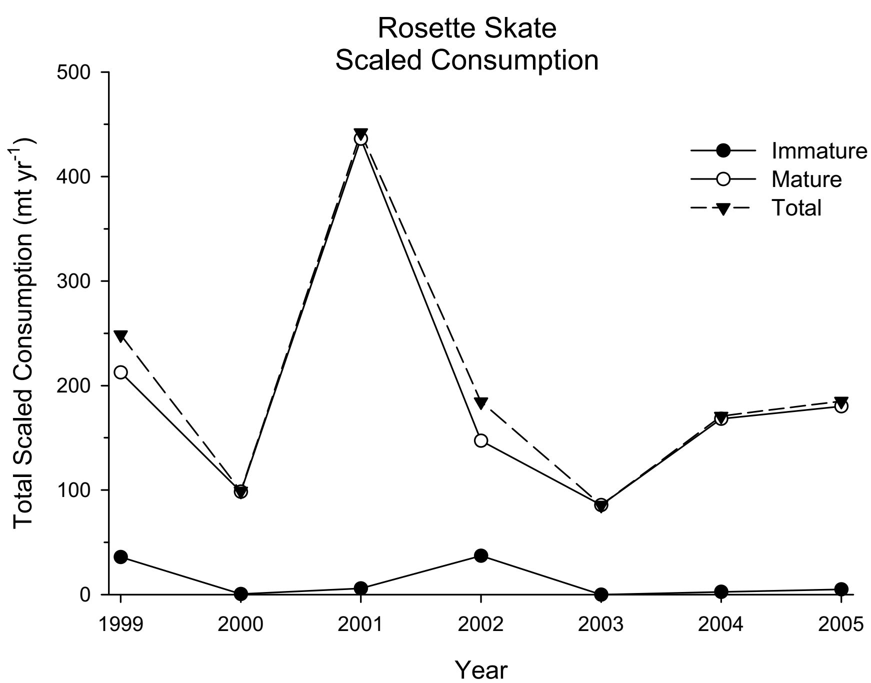


Figure B6.42b. The annual total consumption (MT yr^{-1}) of Rosette skate for the strata set and time period noted.

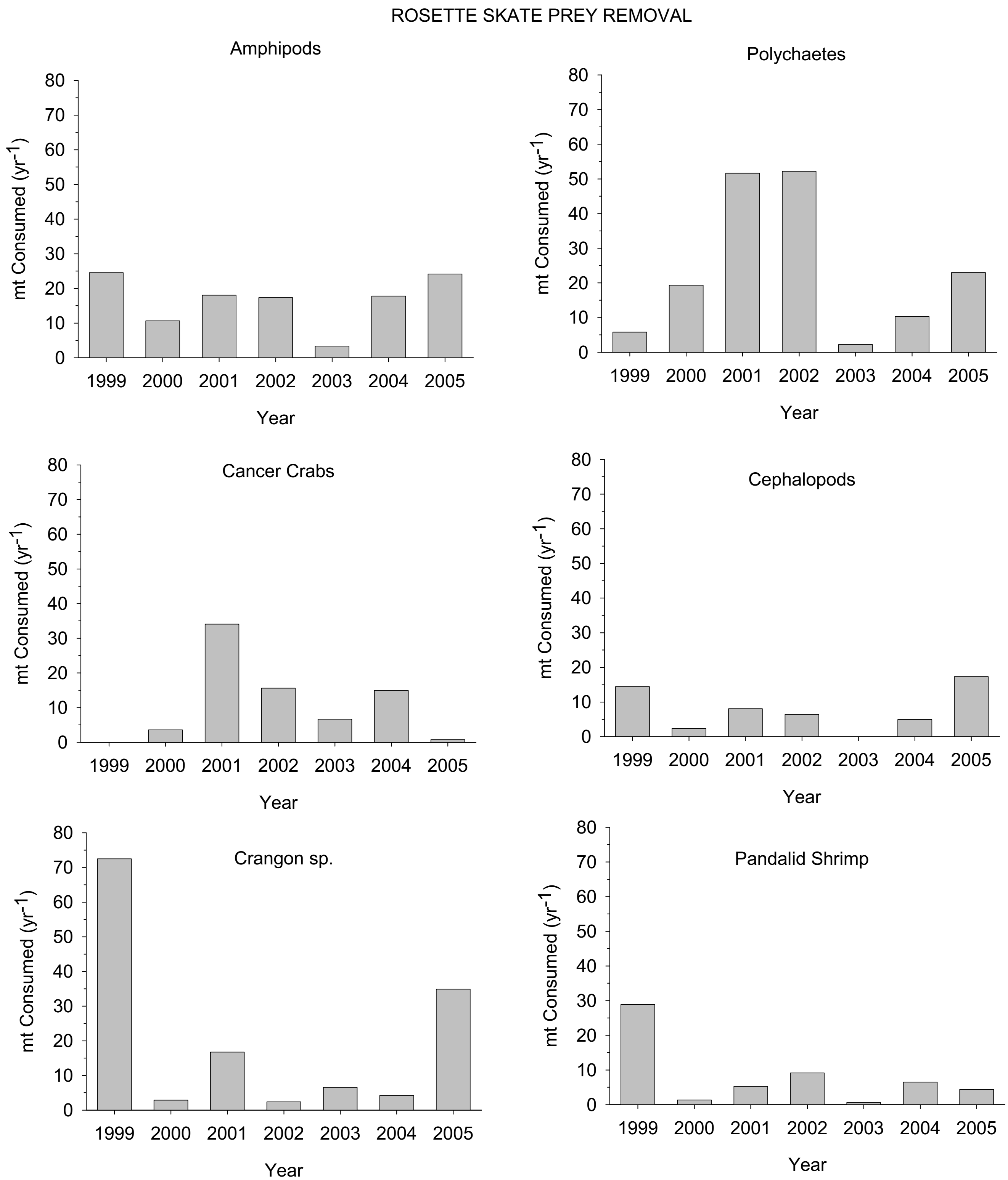
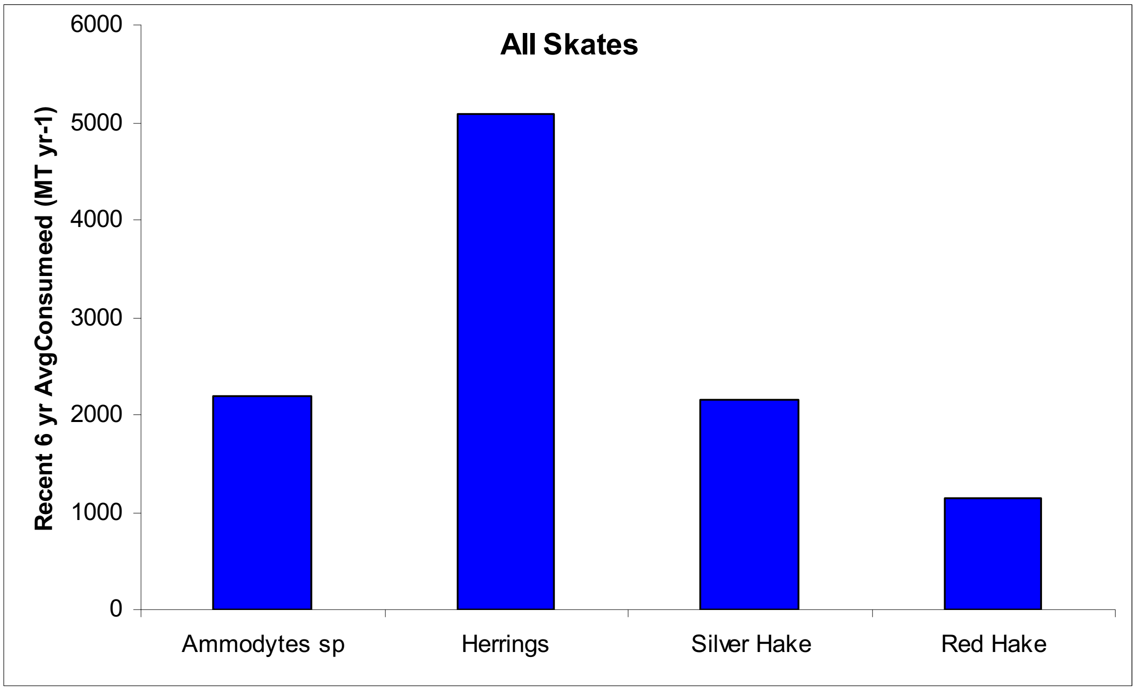


Figure B6.43. The amount of prey consumed (MT yr^{-1}) by Rosette skate for the strata set and time period noted. These estimates represent the combination of total annual total consumption and the diet compositions of Rosette skate. These prey were selected as some of the major prey (>>5 % of diet composition) of Rosette skate.



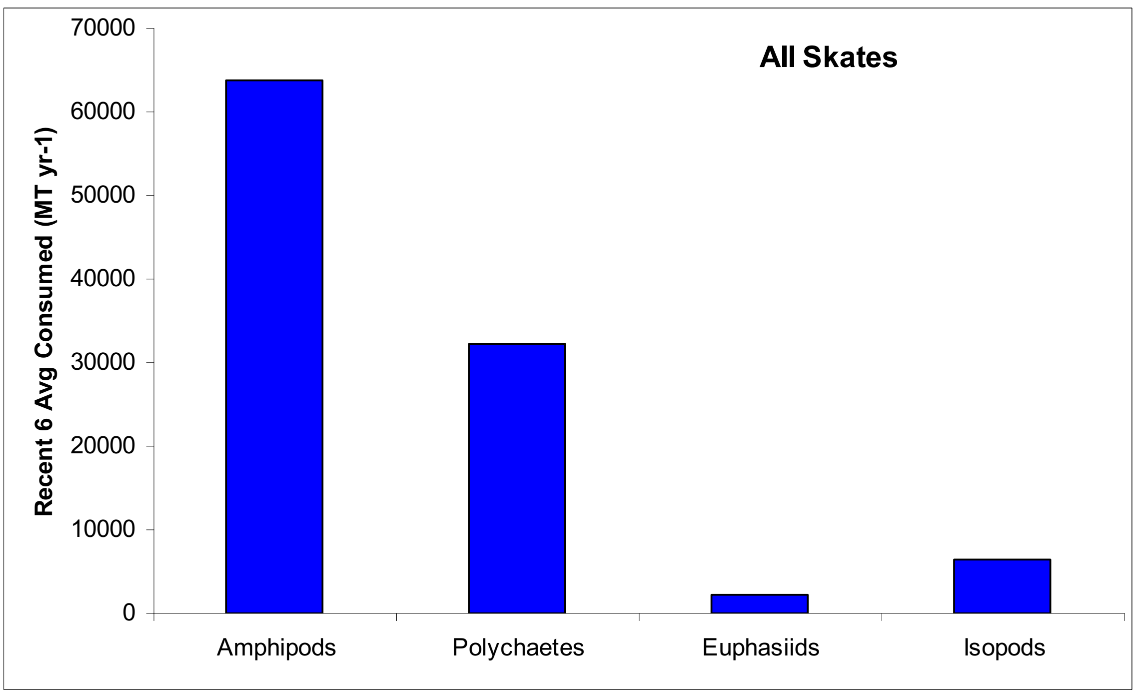


Figure B6.44. Average amount of major prey consumed by all skates from 2000-2005. A. fish prey. B. invertebrate prey.