

# NORTHEAST SKATE COMPLEX FISHERY MANAGEMENT PLAN

## Annual Monitoring Report for Fishing Year 2019



**September 17, 2020**

Prepared by the  
New England Fishery Management Council  
In consultation with the  
National Marine Fisheries Service



## ***1. INTRODUCTION***

The regulations implementing the management measures for the Northeast Skate Complex Fishery Management Plan (FMP) state that the Skate Plan Development Team (PDT) shall meet at least annually to review the status of the species in the skate complex (§648.320). Based on this review, the Skate PDT is then to provide guidance to the Skate Committee and the Council on the need to adjust measures in the Skate FMP to better achieve the FMP objectives. At a minimum, this review includes:

- Annual updates to survey indices, fishery landings and discards;
- Re-evaluation of stock status based on the updated survey indices and the FMP's overfishing definitions;
- Determination of whether any of the accountability measures (AMs) specified under §648.323 were triggered (i.e., if a wing or bait total allowable landings (TAL) was exceeded by >5% or the annual catch limit (ACL) was exceeded); and
- Changes to other FMPs (e.g., Northeast Multispecies, Monkfish, Atlantic Scallops, Herring, Spiny Dogfish, Longfin Squid, Summer Flounder/Scup/Black Sea Bass, Habitat) that may impact skate stocks, and describe the anticipated impacts of those changes on the skate fishery.

This report summarizes this review, which focused on Fishing Year (FY) 2019. In addition, the report summarizes recent research on thorny skate.

## ***2. SURVEY INDICES AND STOCK STATUS***

This section updates survey indices and re-evaluates stock status for the skate species based on survey indices and overfishing definitions. Appendix I, a memo from the Northeast Fisheries Science Center (NEFSC), has more detail on surveys and stock status, updated through spring 2020.

### Survey Indices

Indices of relative abundance for all seven skate species are derived from the NEFSC bottom trawl survey. In recent years, the survey has had delays and incomplete coverage of the survey area. Appendix I details the potential impacts on the survey indices. These issues, particularly the missing 2017 clearnose and rosette survey indices and the missing 2020 little skate survey index because of COVID-19, impact setting specifications, because stock status is uses a 3-year moving average of survey indices and catch estimates.

### Stock Status

Stock status is determined based on a three-year moving average of survey indices. The spring survey is used for little skate and the fall survey for all other skate species. Because the spring 2020 survey only covered a small portion of the survey area, this report does not update the stock status for little skate; 2017-2019 spring survey data are used. Because of missed strata in fall 2017, clearnose and rosette are updated with just a two-year average (2018-2019 fall).

For all skate species, stock status remains unchanged from last year. One skate species remains overfished (thorny). Overfishing is not occurring for any of the seven skate species.

For **thorny skate**, the 3-year average (2017-2019) survey biomass index (0.18 kg/tow) increased 11.4% from the previous 3-year average, but was less than the  $B_{\text{threshold}}$  (2.06 kg/tow) and is only 4.3% of the  $B_{\text{MSY}}$  target (4.13 kg/tow). The rebuilding deadline for this stock is 2028 (25 years from implementation of the Skate FMP), yet 17 years into the rebuilding period, the survey biomass has continued to decline overall with no significant signs of rebuilding. The stock has, however, experienced a small uptick in biomass index from 0.14 in FY 2018 to 0.18 in FY 2019.

Due to consistent decreasing biomass and the overfished status, thorny skate has been a species/stock of concern to management and was previously petitioned for listing under the Endangered Species Act (ESA) in 2011. NOAA Fisheries determined that a status review was not warranted at that time (76 FR 78891). However, a new ESA petition was submitted by Defenders of Wildlife and Animal Welfare Institute in May

2015. An extinction risk workshop, in May 2016, determined there were no distinct population segments of thorny skate and thorny skate was not currently in danger of extinction throughout all, or a significant portion, of its range (see [final report](#)). Despite this conclusion, thorny skate biomass remains low throughout the U.S. management area, according to the survey.

In June 2020, when the Council approved its list of research priorities for 2020-2024, the Council clarified the priority “Investigate age, growth, maturity, and fecundity of managed skate species” by adding “(esp. thorny and rosette).” This research may provide insights into the cause of the ongoing biomass decline of thorny skate, most notably from 1963 to 1983.

### ***3. FISHERY LANDINGS, DISCARDS AND ACCOUNTABILITY MEASURES***

This section has fishery landings, discards, and a determination of whether any of the accountability measures were triggered, i.e., if a wing or bait TAL was exceeded by >5% or the ACL was exceeded.

#### ***Methods for In-season Quota Monitoring and Year-end Catch Accounting***

During the fishing year, the Greater Atlantic Regional Fisheries Office (GARFO) monitors skate landings against the wing and bait TALs, which are managed in season, and produces weekly landing reports on-line (Table 1). This in-season skate landings tally includes skate landings sold to a Federal dealer or reported solely via VTRs from commercial trips (i.e., vessel-to-vessel transfers). These landings must be made by vessels with a Federal fishing permit on the day of landing. Skate landings are excluded from TAL monitoring if a vessel does not have a Federal fishing permit on the day of landing. Landings from research and recreational trips are also excluded.

At the end of the fishing year, GARFO tabulates skate catches and compares to the annual catch limit (ACL, Table 2). This includes all skate landings by a vessel with a Federal fishing permit at any time of the year. Thus, the landings sold to a Federal dealer that are excluded from the in-season tally could be included in the year-end accounting if the vessel had a Federal fishing permit at another time in the year. Also included in the year-end accounting are landings from non-federally permitted vessels that were reported to the federal database, catches from the recreational (private angler and party/charter) skate fishery and research landings. Excluded from the year-end accounting are the vessel-to-vessel skate transfers reported via VTRs, skate for personal use/home consumption, and skate landings by state-only permitted vessels not reported to the Federal database.

#### ***FY 2019 Fishery Performance***

The ABC/ACL specifications for FY 2019 were set using the specification process established by Amendment 3 to the Skate FMP, implemented in July 2010. To set the Annual Catch Target (ACT, 28,194 mt), the ABC/ACL (31,327 mt) was reduced by 10% to account for management uncertainty. The TAL (15,788 mt) was calculated by reducing the ACT by estimated dead discards (averaged over 2014-2016 using observer and ASM data)<sup>1</sup> and by the average state permit landings over 2014-2016. The TAL was split 66.5% to the wing fishery TAL (10,499 mt) and 33.5% to the bait fishery TAL (5,289 mt).

It appears that no TAL or ACL overages occurred in FY 2019 (Table 1, Table 2). Therefore, no reactive AMs were triggered. Estimated total skate catch for FY 2019 was 20,696 mt (66% of the ACL, 73% of the ACT). Dead discards were estimated to be 5,962 mt, or 29% of total catch.

Total wing landings for FY2019, according to in-season quota monitoring, were 19,038,306 lb (82% of Wing TAL) and skate bait landings were 8,515,179 lb (73% of Bait TAL, Table 1). Most dealer-reported landings and revenue were from wing (67% of landings, 77% of revenue), followed by bait (31% of landings, 20% of revenue, Table 3). Landings without a disposition code (“unknown”) were small (1.4% of landings, 3.5% of revenue), while personal use, no market, packing were minor (<1% of landings, no reported revenue).

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<sup>1</sup> This is how the NEFSC calculates skate dead discards and differs from how GARFO estimates skate dead discards in year-end catch accounting, described in Table 2

**Table 1. FY 2019 in-season monitoring of Northeast skate wing and bait landings.**

Disposition	Live Landings		TAL		Percent of TAL Landed
	(lb)	(mt)	(lb)	(mt)	
<b>Wing</b>	19,038,306	8,636	23,146,333	10,499	82.3%
<b>Bait</b>	8,515,179	3,862	11,660,249	5,289	73.0%
<b>Total</b>	<b>27,553,485</b>	<b>12,498</b>	<b>34,806,582</b>	<b>15,788</b>	<b>79.2%</b>

*Source:* cfders2019 and cfders2020, Vessel Trip Reports, and permit databases, accessed 7/01/2020.  
*Notes:*

- “Live Landings” aggregates landings from the weekly, in-season quota monitoring reports. Although this is a year-end tally, it only includes the skate landings sold to a Federal dealer or reported solely via VTRs (this includes vessel-to-vessel transfers) by vessels with a Federal fishing permit on the day of landing.
- “Live Landings” excludes all commercial landings from vessels without a Federal fishing permit on the day of landing and research landings.

**Table 2. FY 2019 year-end Northeast skate complex annual catch limit (ACL) accounting.**

	Live weight		Percent of ACL (31,327 mt)
	(lb)	(mt)	
Northeast skate commercial landings	29,869,783	13,549	43.2%
Northeast skate state-permitted only vessel landings	383,529	174	0.6%
Northeast skate estimated dead discards	13,144,115	5,962	19.0%
Northeast skate recreational catch	2,229,125	1,011	3.2%
<b>Total Northeast skate catch</b>	<b>45,626,552</b>	<b>20,696</b>	<b>66.1%</b>

*Source:* Commercial fisheries dealer database and Northeast Fishery Observer Program database, accessed 7/01/2020; and Marine Recreational Information Program reports, accessed 7/06/2020.  
*Notes:*

- Live weight is used instead of landed weight to make Table 1 and 2 data more comparable.
- “Northeast skate commercial landings” are landings by vessels that had a Federal permit any time during the fishing year (including landings by vessels without a Federal permit on the day of landing but who later picked up a Federal permit at some point in the fishing year). These commercial landings also include research landings.
- “Northeast skate state-permitted only vessel landings” are landings sold to a Federal dealer by vessels without a Federal fishing permit at any time during the year. This may include state permitted landings from state-only dealers provided to GARFO from states.
- “Northeast skate estimated dead discards” is based on landings of all species and skate discards on observed trips extrapolated to all commercial landings of all species (weighted by area, gear, etc.) to calculate total skate discards. Then, a discard mortality rate is applied to the calculated total skate discards (discard estimation method differs from how discards are estimated during specifications setting, which uses the NEFSC method).
- “Northeast skate recreational catch” is private angler and party/charter landings and dead discards from MRIP).
- Not included in the year-end ACL accounting:
  - Vessel-to-vessel skate transfers (210 mt, reported via VTRs).
  - Skate for personal use/home consumption (unknown, not reported to a Federal dealer).
  - Skate landings by state-only permitted vessels not reported to the Federal database (unknown)

**Table 3. FY 2019 Skate complex dealer-reported landings, revenue, and average price per pound by disposition.**

Disposition	Live landings		Revenue	Average price per lb
	(lb)	(mt)		
Wing	19,593,641	8,888	\$5,273,210	\$0.56 <sup>1</sup>
Bait	9,048,036	4,104	\$1,348,609	\$0.15
Unknown	403,120	183	\$241,885	\$0.60
Personal use/No market/Packing, only	1,135	0.5	n/a	n/a
<b>Total</b>	<b>29,045,932</b>	<b>13,176</b>	<b>\$6,863,704</b>	<b>n/a</b>

<sup>1</sup>Average price per pound for wing was calculated based on reported landed weight.

Source: cfders2019 and cfders2020 and permits databases, accessed 7/01/2020.

*Notes:*

- “Live Landings” are from the Federal dealer database only and include landings by Federal permitted vessels (i.e., any vessel that had a Federal permit any time during the fishing year) and state-only permitted landings and research landings that were either sold to a federal dealer and/or were batched landings grouped together and sent to GARFO by a state.
- “Bait Landings” are dealer-reported landings, thus, do not include VTR bait/home consumption landings or the vessel-to vessel transfers that are reported only via VTRs.
- “Personal use/No market/Packing, only” is the sum of the three individual disposition codes; no revenues were reported.

#### **4. OTHER FISHERY MANAGEMENT PLANS**

This section reviews changes in the past year or two to other FMPs that may impact skate stocks or the skate fishery. This year, this section was expanded to include the Mid-Atlantic fisheries that interact with the skate fishery.

##### Northeast Multispecies FMP

*Framework Adjustment 59*, implemented July 28, 2020, set FY 2020 TACs for U.S./Canada management units of Eastern GB cod, Eastern GB haddock, and GB yellowtail flounder stock, set 2020-2022 specifications for 15 other groundfish stocks, addressed commercial/recreational allocation issues if needed, and revised the GB cod incidental catch TAC. With the increase in groundfish catch under this action due to increases in annual catch limits for several groundfish stocks, catches of skates are likely to increase.

*Amendment 23*, which the Council plans to take final action on in September 2020, includes measures that would adjust the groundfish monitoring program to improve the reliability and accountability of catch reporting in the commercial groundfish fishery and to ensure the monitoring program is providing accurate catch information. Higher monitoring in the groundfish fishery, depending on the Council’s final preferred alternatives (e.g., some trips could have exemptions), could lead to improved catch accounting and more accurate discard information in this fishery improving data quality, reducing uncertainty, and ensuring sustainability for the skate resource as well.

##### Scallop FMP

*Framework 32*, which the Council took final action on in December 2019, established scallop specifications for FY 2020 and 2021 and measures to mitigate scallop fishery impacts to Georges Bank yellowtail flounder. Mortality and effort controls such as Scallop Days at Sea and scallop rotational management help control and reduce catch of non-target species, including skates, which are primarily caught as bycatch. With the

decrease in scallop catch under this action due to the decreases in the annual catch limit, catches of skates are likely to decrease.

*Amendment 21*, which the Council expects to take final action on in September 2020, addresses 1) measures related to the Northern Gulf of Maine Management Area that will support a growing directed scallop fishery in federal waters, 2) possession limit increases to the Limited Access General Category individual fishing quota to improve the economic performance of this component of the fishery, and 3) limited access quota transfers to Limited Access General Category individual fishing quota vessels to ensure this component of the fishery remains profitable. While final preferred alternatives have not been selected, impacts to non-target species would likely be negligible to low positive across the range of alternatives. Establishing monitoring and research set-asides in the NGOM management area will allow data collection in this portion of the resource which has historically been relatively data poor. Allowing increased observer compensation for LAGC IFQ trips lasting longer than 24 hours will reduce incentives for monitoring bias and may enhance fishery-dependent data streams used for assessment and management of scallops and non-target species.

#### Monkfish FMP

*Framework 12*, which the Council took final action on in September 2019, sets specifications for FYs 2020-2022, and will be effective October 19, 2020. The primary non-target species in the monkfish fishery are skates and spiny dogfish, but because Framework 12 increases the Total Allowable Landings (TAL) by only 10% in the Northern Fishery Management Area and maintains the previous fishing year's TAL in the southern area, the impacts to skate likely will not substantially increase.

*Discard Methodology Review*, which a Council contractor helped with in early 2020, investigated potential improvements to calculating discards for Total Allowable Landings, given the large change in discards estimates for 2020-2022 in the southern area. The Council received a report and presentation at its June meeting and learned that an especially large 2015-year class of monkfish led to higher than normal discards. The Council sent the report to its Monkfish Committee and Monkfish Advisory Panel for further discussion and consideration of "next steps while developing fishing year 2021 priorities this fall." This is not likely to have an appreciable impact on the skate resource unless the new discard methodology changes how skate discards are estimated in the monkfish fishery.

#### Herring FMP

The lobster fishery uses a variety of bait including herring. It is not possible to predict how a limited supply of herring bait might affect the skate bait fishery. The 2016-2018 herring specifications reduced the ABC slightly to 111,000 mt and, effective from August 22, 2018 through December 31, 2018, an in-season adjustment reduced the 2018 ACL from 104,800 mt to 49,900 mt to reduce overfishing risk. The 2019 specifications were revised, effective February 8, 2019, to 21,266 mt based on the results of SAW/SARC 65. Herring are often used as lobster bait in the Gulf of Maine and the Area 1A TAC increased to 30,300 mt in 2018. If the supply of herring bait for the lobster fishery declines, it could result in increased demand for skate bait. The following framework action could result in further restrictions on the herring fishery, possibly resulting in a decline in herring available for use as bait in the lobster fishery:

*Framework 8*, which the Council plans to take final action on in September 2020, is being developed to set specifications for 2021-2023 fishing year and adjusts herring measures that may inhibit the Atlantic mackerel fishery from achieving its optimum yield. New information from the Atlantic Herring Management Track Assessment will influence the specifications. Herring catch limits will likely remain low, potentially increasing demand for bait skate relative to recent years.

#### Spiny Dogfish FMP

*2019-2021 Specifications*, finalized in May 2019, set specifications and management measures for spiny dogfish for fishing years 2019 – 2021. The 2019 specifications were lower than what was in place in FY2018 because the stock was lower than previously thought, however, the quota increases slightly over the three-year specification period. On spiny dogfish trips that retain at least 100 pounds of dogfish, skates account for about a third of the discards in the fixed sink gill net gear (mostly winter and little skate) and almost half of

the discards in the bottom long line gear (mostly barndoor and winter skate). These discards could have an impact on the TAL calculations for the skate fishery because discards are estimated by observed discard/kept-all ratios to total based on landings by gear and quarter, derived from the Northeast Fisheries Observer Program and At Sea Monitoring programs.

#### Longfin (*Loligo*) Squid FMP

*Squid Amendment 20*, finalized in December 2018, considered measures to reduce latent squid fishery permits and modify trimester longfin squid management to help determine the appropriate number of vessels in the directed and incidental longfin squid and *Illex* squid fisheries to avoid disruptive fishery closures. Winter and little skate (which are not overfished or subject to overfishing) are caught as non-target species in substantial amounts of > 200,000 pounds per year in the longfin squid fishery (based on extrapolated catches). Because the longfin squid fishery has substantial bycatch, the skate fishery will be negatively impacted by this amendment, even with any reductions in latent effort.

#### Summer Flounder, Scup, Black Sea Bass FMP

*Summer Flounder, Scup, and Black Sea Bass Commercial/Recreational Allocation Amendment*, developed by the Mid-Atlantic Fishery Management Council and Atlantic States Marine Fisheries Commission, re-evaluates the commercial and sector allocations in the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan to account for the updated Marine Recreational Information Program data. In August 2020, the Council approved a final range of alternatives for inclusion in public hearing documents. Winter and little skate are commonly caught on observed commercial trips targeting summer flounder, scup, and black sea bass, thus, the amendment could impact the skate resource if more skates, a non-target species, is discarded. On summer flounder directed trips, skates, especially little skate, generally make up a larger portion of the overall catch of >40% during 2013-2017.

#### Habitat Management Plan

*Clam Dredge Framework Adjustment*, which was implemented on June 18, 2020, would allow surfclam and mussel dredging under restrictive conditions in the Great South Channel Habitat Management Area (GSC HMA). The action implements three dredge exemption areas (McBlair, Old South, and Fishing Rip) within the GSC HMA that would allow for surfclam and blue mussel fishing. Vessels need to comply with revised monitoring requirements outlined in the framework document. The document states “the impacts on other fisheries (i.e., groundfish, skate, scallop, herring, lobster) of Alternative 5 are likely low positive. The GSC HMA provides habitat protection for other managed species, so their respective fisheries are expected to fare better with reduced fishing activity for surfclams and mussels in the GSC HMA.”

### **5. SKATE RESEARCH**

Several recently-completed and ongoing research projects have focused on thorny skates including:

- Evaluation of post-release discard mortality rate in the Gulf of Maine groundfish bottom trawl fishery, which was estimated at 24.5%, funded by the Bycatch Reduction Engineering Program (BREP). PI: Dr. John Mandelman, New England Aquarium ([jmandelman@neaq.org](mailto:jmandelman@neaq.org)). Paper: <https://academic.oup.com/icesjms/article/77/1/256/5599855>
- Assessment of the horizontal movements and habitat use of thorny skate in the Gulf of Maine, funded by Saltonstall-Kennedy, BREP, and Northeast Consortium, which found linear movements of 1-47 km, depth range of 27-201 m, and a temperature range of 2.5-12.5°C (manuscript in press at *ICES Journal of Marine Science*). PI: Dr. Jeff Kneebone, New England Aquarium ([jkneebone@neaq.org](mailto:jkneebone@neaq.org)).
- Projection of the effects of climate change on thorny skate in the Northeast US shelf using trawl and longline surveys (manuscript in review). PI: Dr. Jon Hare, NEFSC ([jon.hare@noaa.gov](mailto:jon.hare@noaa.gov)).
- Identification of thorny skate bycatch hotspots in the Gulf of Maine (manuscript in prep), funded by BREP. PI: Dr. John Mandelman, New England Aquarium ([jmandelman@neaq.org](mailto:jmandelman@neaq.org)).

- Use of high-resolution genomics to explore spatial population structure of the thorny skate population in the North Atlantic, funded by the Lenfest Ocean Program with research ongoing. PI: Dr. Gavin Naylor, University of Florida ([gnaylor@flmnh.ufl.edu](mailto:gnaylor@flmnh.ufl.edu)).

## **6. *PDT GUIDANCE***

This section contains Skate PDT guidance to the Skate Committee and Council on the need to adjust measures in the Skate FMP to better achieve the FMP objectives:

- There is a need for clearer skate quota monitoring and catch accounting.
  - In part, this is a matter of improved communication, which is why the report this year details the in-season quota monitoring and year-end catch accounting methods.
  - There are a few catch components not included in year-end ACL accounting (Table 2). While these catches are small, they do contribute to skate mortality and could be more explicitly included in specifications, such as within management uncertainty.
  - The 2021 skate assessment will reexamine methods for ensuring that all catch components are included in the assessment.
- The skate regulations at §648.320(a)(3) require the Council to take management action when an overfished species declines in biomass to ensure that it will achieve target levels. The Council should consider management measures, beyond the continuing possession prohibition such as addressing thorny skate discards, that will foster rebuilding.



**APPENDIX I**

**2019 NE Skate Stock Status Update (NEFSC, Lead Analyst: K. Sosebee, 7/10/2020)**

Seven species of skates occur along the North Atlantic coast of the United States: barndoor skate (*Dipturus laevis*), clearnose skate (*Raja eglanteria*), little skate (*Leucoraja erinacea*), rosette skate (*L. garmani*), smooth skate (*Malacoraja senta*), thorny skate (*Amblyraja radiata*), and winter skate (*L. ocellata*). Skates are currently managed under the New England Fishery Management Council's Northeast Skate Complex Fishery Management Plan implemented in 2003. This plan has been changed over time and now includes mandatory reporting by species, possession prohibitions on thorny, and smooth skates, trip limits for the wing and bait fisheries, and Annual Catch Limits (ACL) for the wing and bait fisheries.

Indices of relative abundance (stratified mean weight/tow) have been developed from Northeast Fisheries Science Center's (NEFSC) bottom trawl surveys for the seven species in the skate complex. These indices and their rates of change form the basis for all of the conclusions about the status of the complex. All statistically significant NEFSC gear, door, and vessel (RV *Delaware II* to RV *Albatross IV*) conversion factors were applied to little, winter, and smooth skate indices when applicable. The calibration coefficients (FSV *Henry B. Bigelow* to RV *Albatross IV*) below represent changes in overall catch rates expressed in terms of average weight per tow and these were accepted by the New England Fishery Management Council's (NEFMC) Scientific and Statistical Committee (SSC). All values for survey catch/tow in **Table 1** and **Figure 1** are expressed in "Albatross" units. The survey, range of years, and survey strata sets used as the basis of biological reference points for each species are given in **Table 1**. These strata sets were revised and accepted by the NEFMC SSC in 2011. The changes to the strata sets resulted in changes to biomass reference point values for all species except rosette skate, as well as a change to the overfishing reference point value for clearnose skate.

Calibration coefficients for seven skate species captured during NEFSC bottom trawl surveys:

Species	Calibration Coefficient (Std Err)*	Comment
Little <i>Leucoraja erinacea</i>	2.785519 (0.32)	Spring Survey
Winter <i>Leucoraja ocellata</i>	2.174334 (0.31)	Fall Survey
Barndoor <i>Dipturus laevis</i>	3.661128 (0.51)	Fall Survey
Thorny <i>Amblyraja radiata</i>	3.626359 (0.58)	Fall Survey
Smooth <i>Malacoraja senta</i>	4.449518 (0.67)	Fall Survey
Clearnose <i>Raja eglanteria</i>	6.189401 (0.81)	Fall Survey
Rosette <i>Leucoraja garmani</i>	8.813973 (0.98)	Based on the calibration coefficient for little skate in the fall survey comparisons

\*Calibration coefficients represent the ratio of *Bigelow* to *Albatross* catch weight per tow.

Biomass reference points are based entirely on NEFSC survey data, as reliable landings and discard information are not available by species. For all species except barndoor, the B<sub>MSY</sub> proxy is defined as the 75<sup>th</sup> percentile of the appropriate survey biomass index time series for that species through fall 2007 or spring 2008 (**Table 1**). For barndoor skate, the B<sub>MSY</sub> proxy is defined as the average of 1963-1966 fall survey biomass indices since the survey did not catch barndoor for a protracted period.

Bottom trawl surveys in spring 2015-2019 were complete. However, ship problems delayed the start of the 2014 spring survey until late March and a decision was made, for that survey only, to drop any strata south of Delaware (Offshore 61-68; Inshore 32, 35, 38, 41, and 44; **Figures 2 and 3**). The consequences of the delay were relatively minor for assessment of the skate complex overall because only the little skate assessment relies on the spring survey. The time series trends without the southern strata are very similar to the full assessment strata set and are generally within the 95% confidence limits of each series (**Figure 4**). Based on survey data from multiple years, the ratio between the survey indices from the smaller (truncated) strata set and the full strata set is 1.091 kg/tow. Therefore, the estimated little skate index for spring 2014 was adjusted downward (i.e., divided) by this factor to account for the difference in spatial coverage that year. Some caution should be exercised when interpreting this value.

The spring 2016 survey was complete but delayed by several weeks. The mean Julian Day from 1982-2013 ranged from 80-103. In 2014-2016, the mean Julian Days were 121, 99, and 130. It is unknown what impact this has on the little skate survey results.

Bottom trawl surveys in fall 2014-2016 and 2019 were complete. The 2017 fall survey was incomplete and only strata from the Gulf of Maine and Georges Bank were completed (Offshore Strata 13-30, 36-40; **Figures 2 and 3**). This has major consequences for the skate complex. For two species, clearnose skate and rosette skate, there is no survey index for fall 2017. Thus, a two-year average (2016 and 2018) was used in 2019 for the 2018 stock status update, even though alternatives were run in 2019 (**Figures 5 and 6**). For the remaining species which use the fall survey, a ratio like that used for little skate in 2014 was used to adjust the survey indices to account for the missing strata. For these species, most of the stock happens to occur in the strata that were sampled, so the consequences were not as great as for the other two species.

For barndoor skate, smooth skate, thorny skate, and winter skate, the lack of coverage in the Southern New England and the Mid-Atlantic strata described above for fall 2017 was analyzed for the entire time series to show the difference between including and excluding these strata on the estimate of mean biomass. In general, all four species of skate are more abundant in the northern strata. Thus, relative biomass estimates (kg/tow) based on the northern strata only will be higher than estimates based on the entire strata set. Over the entire time series (1967-2016 or 1963-2016) the ratios of the time series without the southern strata to the full strata set, 1.223, 1.418, 1.423, and 1.610, respectively (**Figures 7-10**). To adjust the observed 2017 value for these average ratios, the 2017 values of 1.888, 0.476, 0.305, and 13.527 were divided by 1.223, 1.418, 1.423, and 1.610 yielding values of 1.54, 0.34, 0.21, and 8.40.

In fall 2018, offshore strata 30, 34, and 35 were not sampled and offshore stratum 36 only had 1 tow. This impacts barndoor skate, smooth skate, thorny skate, and winter skate. The same method as used for 2017 was used. The ratios were 0.998, 0.860, 0.996, and 1.051, respectively (**Figures 11-14**). Even though the values for barndoor and thorny skate were near one, these 4 factors were still applied to index values of 2.798, 0.214, 0.141, and 6.740 to yield modified values of 2.804, 0.249, 0.142 and 6.415, for consistency with previous years.

This update also used three-year averages except as follows. Because the spring 2020 survey only covered a small portion of the survey area due to the COVID-19 pandemic, there is no update of stock status for little skate; 2017-2019 spring survey data are used. Because of missed strata in fall 2017, clearnose and rosette are updated with a two-year average (2018-2019 fall).

The fishing mortality reference points are based on changes in survey biomass indices. If the three-year moving average of the survey biomass index for a skate species declines by more than the

average CV of the survey time series, then fishing mortality is assumed to be greater than  $F_{MSY}$  and overfishing is occurring for that skate species. The average CVs of the indices are given (as percent change for overfishing status determination in FMP) by species in **Table 1**.

For barndoor skate, the 2017-2019 NEFSC fall average survey biomass index of 2.02 kg/tow is above the biomass threshold reference point (0.78 kg/tow) and the  $B_{MSY}$  proxy (1.57 kg/tow). The 2017-2019 average index is above the 2016-2018 index by 11.4%. It is recommended that this stock is not overfished, and overfishing is not occurring.

For clearnose skate, the 2017-2019 NEFSC fall average biomass index (no data for 2017) of 1.05 kg/tow is above the biomass threshold reference point (0.33 kg/tow) and the  $B_{MSY}$  proxy (0.66 kg/tow). The 2017-2019 index is above the 2016 and 2018 index by 73.1%. It is recommended that this stock is not overfished, and overfishing is not occurring.

For little skate, there was little 2020 survey coverage, therefore stock status cannot be updated. For little skate, the 2017-2019 NEFSC spring average biomass index of 5.32 kg/tow is above the biomass threshold reference point (3.07 kg/tow) but below the  $B_{MSY}$  proxy (6.15 kg/tow). The 2017-2019 average index is above the 2016-2018 average by 13.4%. It was recommended in 2019 that this stock is not overfished, and overfishing is not occurring.

For rosette skate, the 2017-2019 NEFSC fall average biomass index (no data for 2017) of 0.050 kg/tow was above the biomass threshold reference point (0.024 kg/tow) and above the  $B_{MSY}$  proxy (0.048 kg/tow). The 2017-2019 index is above the 2016 and 2018 index by 6.4%. It is recommended that this stock is not overfished, and overfishing is not occurring.

For smooth skate, the 2017-2019 NEFSC fall average biomass index of 0.27 kg/tow is above the biomass threshold reference point (0.134 kg/tow) and at the  $B_{MSY}$  proxy (0.27 kg/tow). The 2017-2019 index is about equal to the 2016-2018 index. It is recommended that this stock is not overfished and is rebuilt, and overfishing is not occurring.

For thorny skate, the 2017-2019 NEFSC fall average biomass index of 0.18 kg/tow is well below the biomass threshold reference point (2.06 kg/tow). The 2017-2019 index is above the 2016-2018 index by 11.4%. It is recommended that this stock is overfished, but overfishing is not occurring.

For winter skate, the 2017-2019 NEFSC fall average biomass index of 8.61 kg/tow is above the biomass threshold reference point (2.83 kg/tow) and above the  $B_{MSY}$  proxy (5.66 kg/tow). The 2017-2019 average index is above the 2016-2018 index by 19.2%. It is recommended that this stock is not overfished, and overfishing is not occurring.

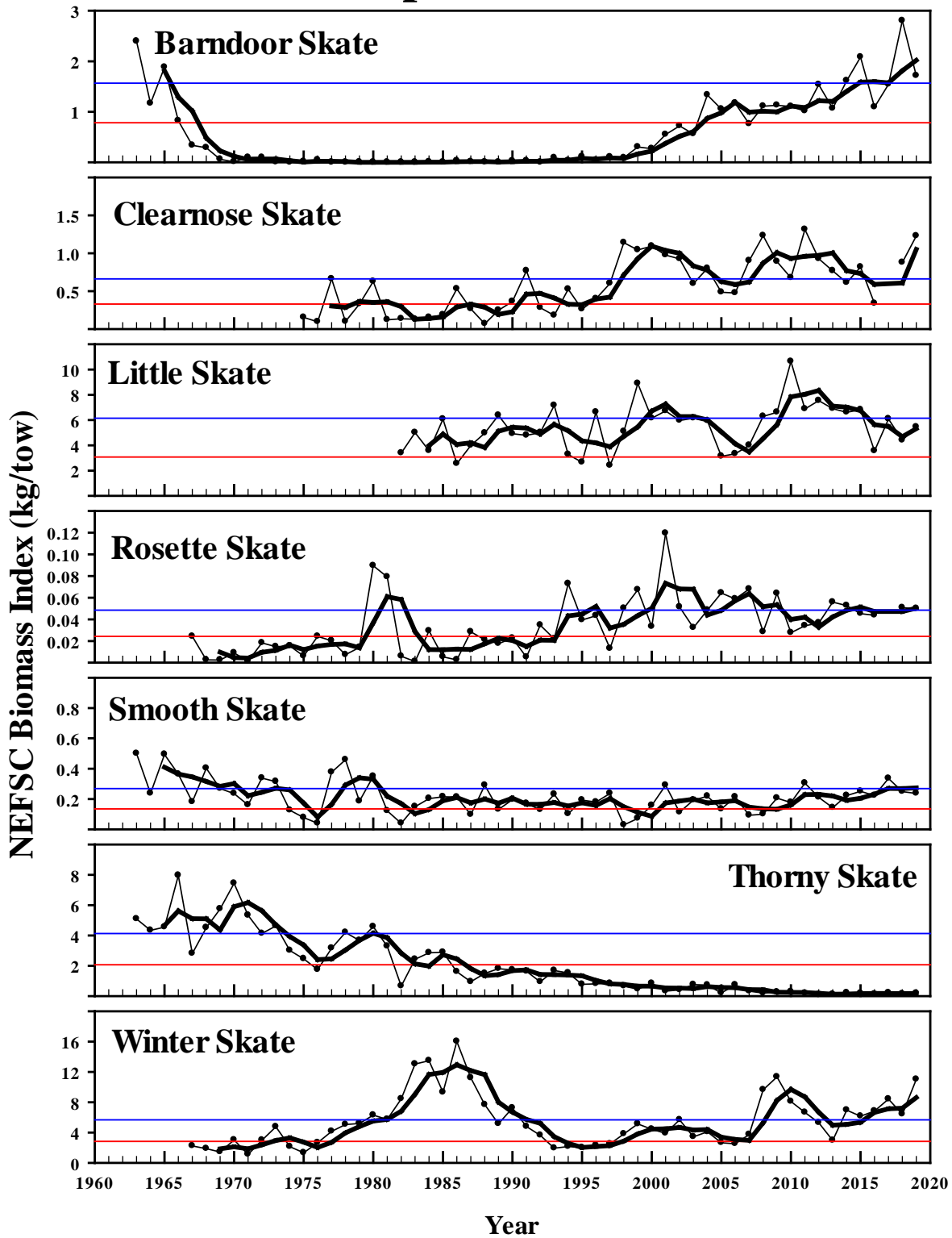
## References

- Miller TJ, Das C, Politis PJ, Miller AS, Lucey SM, Legault CM, Brown RW, Rago PJ. 2010. Estimation of Albatross IV to Henry B. Bigelow calibration factors. Northeast Fish Sci Cent Ref Doc. 10-05; 233 p.
- Sosebee K, Miller A, O'Brien L, McElroy D, Sherman S. 2016. Update of Thorny Skate, *Amblyraja radiata*, Commercial and Survey Data. Northeast Fish Sci Cent Ref Doc. 16-08; 145 pp.
- Sosebee, K. 2018. 2017 NE Skate Stock Status Update. Memo to Greater Atlantic Regional Fisheries Office; 15 pp.

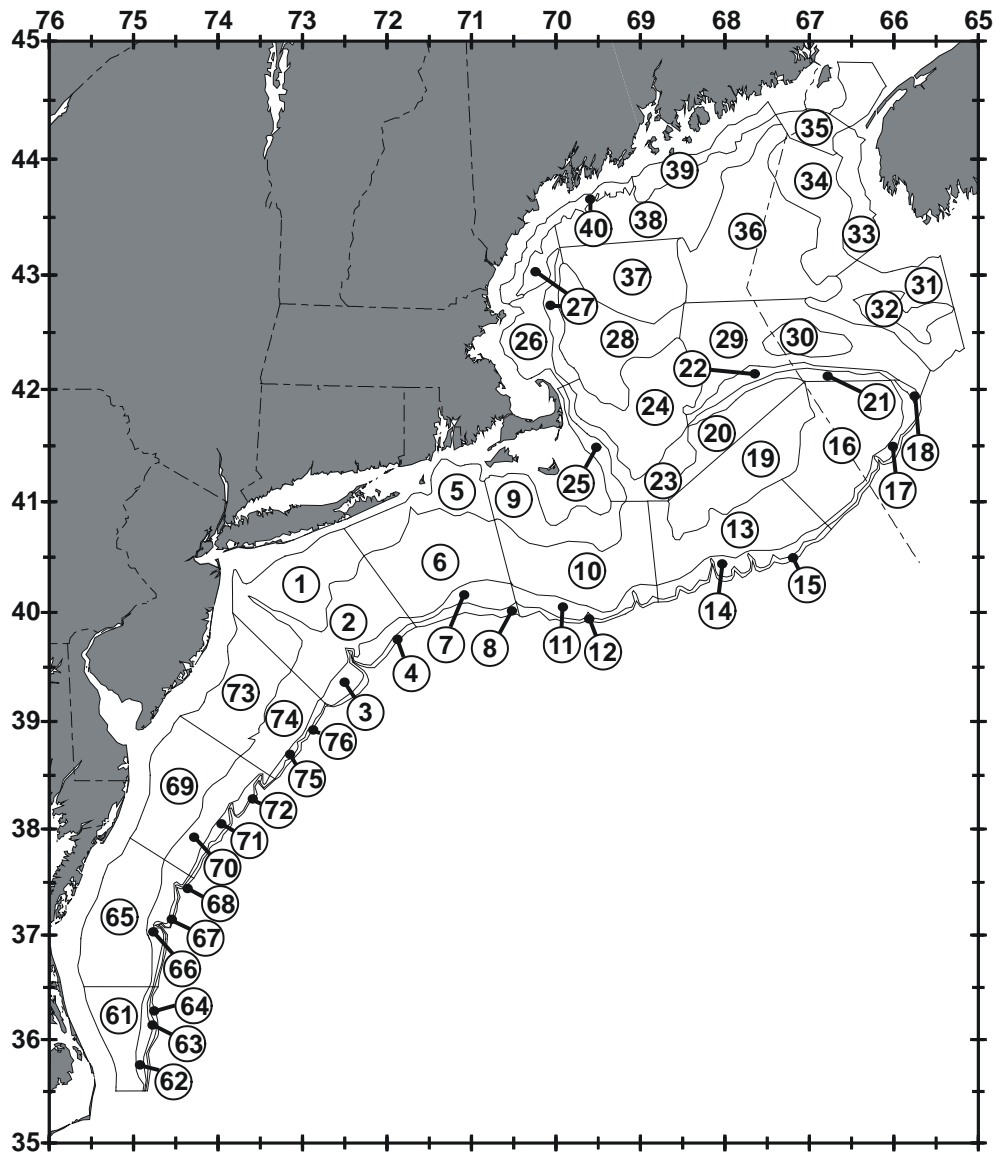
	BARNDOOR	CLEARNOSE	LITTLE	ROSETTE	SMOOTH	THORNY	WINTER
Survey (kg/tow)	Autumn	Autumn	Spring	Autumn	Autumn	Autumn	Autumn
Time Series Basis	1963-1966	1975-2007	1982-2008	1967-2007	1963-2007	1963-2007	1967-2007
Strata Set	Offshore 1-30, 34-40	Offshore 61-76, Inshore 17,20,23,26,29,32,35, 38,41,44	Offshore 1-30, 34-40, 61-76, Inshore 2,5,8,11,14,17,20,23,2 6,29,32,35,38,41,44- 46,56,59-61,64-66	Offshore 61-76	Offshore 1-30, 34-40	Offshore 1-30, 34-40	Offshore 1-30, 34- 40, 61-76
<b>2012</b>	1.54	0.93	7.54	0.040	0.21	0.08	5.29
<b>2013</b>	1.07	0.77	6.90	0.056	0.14	0.11	2.95
<b>2014</b>	1.62	0.61	6.54 <sup>a</sup>	0.053	0.22	0.21	6.95
<b>2015</b>	2.08	0.82	6.82	0.045	0.25	0.19	6.15
<b>2016</b>	1.09	0.34	3.56 <sup>b</sup>	0.044	0.27	0.13	6.84
<b>2017</b>	1.54 <sup>c</sup>	°	6.09	°	0.34 <sup>c</sup>	0.21 <sup>c</sup>	8.40 <sup>c</sup>
<b>2018</b>	2.80 <sup>e</sup>	0.88	4.41	0.051	0.25 <sup>e</sup>	0.14 <sup>e</sup>	6.41 <sup>e</sup>
<b>2019</b>	1.71	1.23	5.45	0.050	0.24	0.18	11.00
2012-2014 3-year average	1.41	0.77	6.99 <sup>a</sup>	0.048	0.19	0.13	5.06
2013-2015 3-year average	1.59	0.73	6.75 <sup>a</sup>	0.051	0.21	0.17	5.35
2014-2016 3-year average	1.60	0.59	5.64 <sup>a,b</sup>	0.047	0.23	0.176	6.65
2015-2017 3-year average	1.57 <sup>c</sup>	°	5.49 <sup>b</sup>	°	0.27 <sup>c</sup>	0.18 <sup>c</sup>	7.13 <sup>c</sup>
2016-2018 3-year average	1.81 <sup>c,e</sup>	0.61 <sup>d</sup>	4.69 <sup>b</sup>	.047 <sup>d</sup>	0.27 <sup>c,e</sup>	0.16 <sup>c,e</sup>	7.22 <sup>c,e</sup>
2017-2019 3-year average	2.02 <sup>c,e</sup>	1.05 <sup>d</sup>	5.32	0.050 <sup>d</sup>	0.27 <sup>c,e</sup>	0.18 <sup>c,e</sup>	8.61 <sup>c,e</sup>
Percent change 2013-2015 compared to 2012-2014	+12.9	-4.8	-3.4	+6.0	+6.8	+26.3	+5.7
Percent change 2014-2016 compared to 2013-2015	+0.5	-19.5	-16.8	-7.9	+13.2	+3.7	+24.2
Percent change 2015-2017 compared to 2014-2016	-0.1.5		-2.6		+16.3	-0.6	+7.3
Percent change 2016-2018 compared to 2015-2017	+15.3	+3.1 <sup>d</sup>	-14.6	+0.1 <sup>d</sup>	-0.2	-8.4	+1.2
Percent change 2017-2019 compared to 2016-2018	+11.4	+73.1	+13.4	+6.4	+1.7	+11.4	+19.2
Percent change for overfishing status determination in FMP	-30	-40	-20	-60	-30	-20	-20
Biomass Target	1.57	0.66	6.15	0.048	0.27	4.13	5.66
Biomass Threshold	0.78	0.33	3.07	0.024	0.13	2.06	2.83

**Table 1.** a. No survey tows completed south of Delaware in spring 2014. Values for 2014 were adjusted for missing strata (Offshore 61-68, Inshore 32, 35, 38, 41, 44) but may not be fully comparable to other surveys which sampled all strata. b. The 2016 spring survey was later than usual. c. No survey tows completed south of Georges Bank in fall 2017. Values either missing or were adjusted for missing strata (Offshore 1-12, 61-76). d. Two-year average due to missing 2017 survey. e. Values were adjusted for missing Offshore strata 30, 34 and 35.

# Skate Complex Biomass Indices



**Figure 1.** NEFSC survey biomass indices (kg/tow). Thin lines with symbols are annual indices, thick lines are 3-year moving averages, and the thin horizontal lines are the biomass thresholds and targets developed through 2007/2008 with consistent strata sets.



**Figure 2.** Offshore strata from the NEFSC spring and fall surveys.

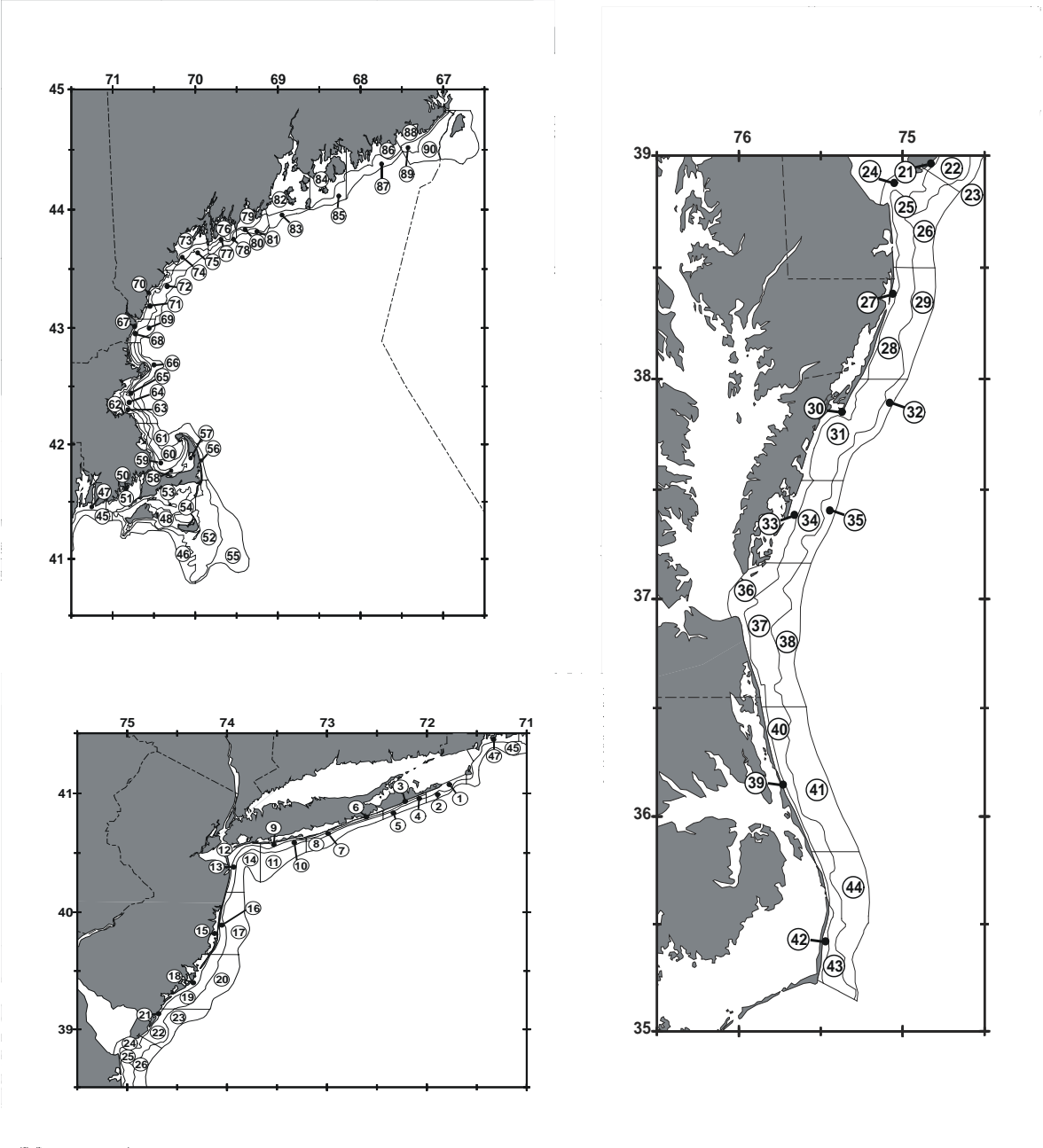
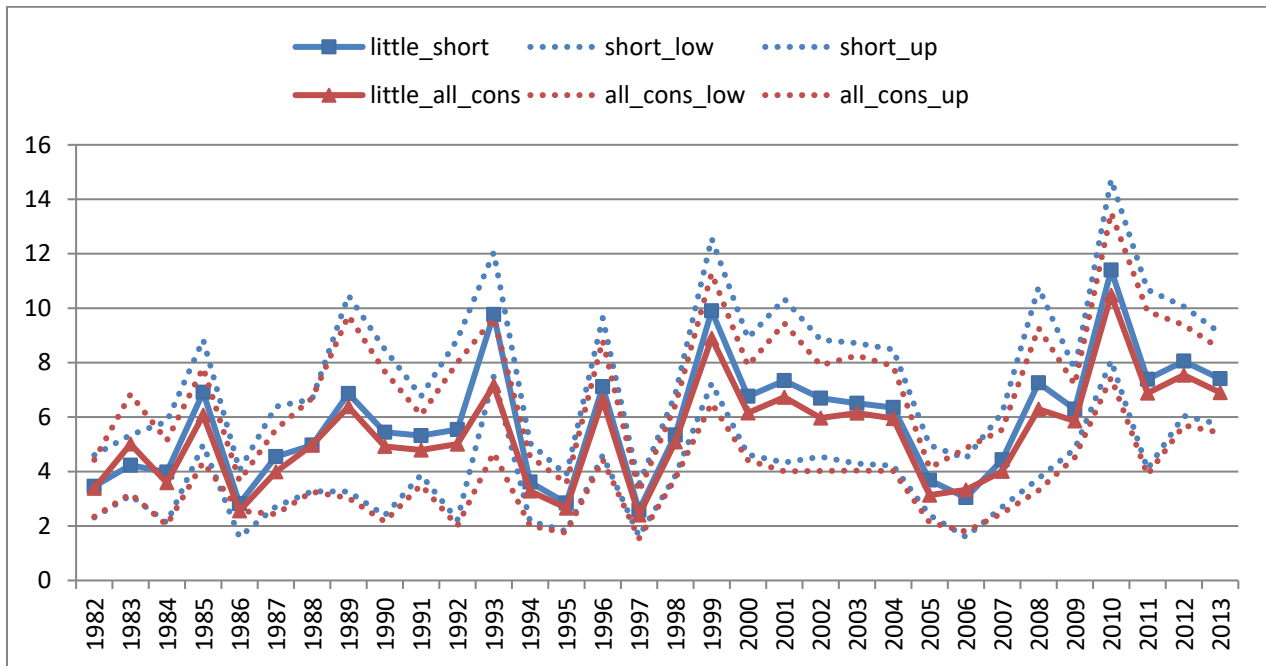
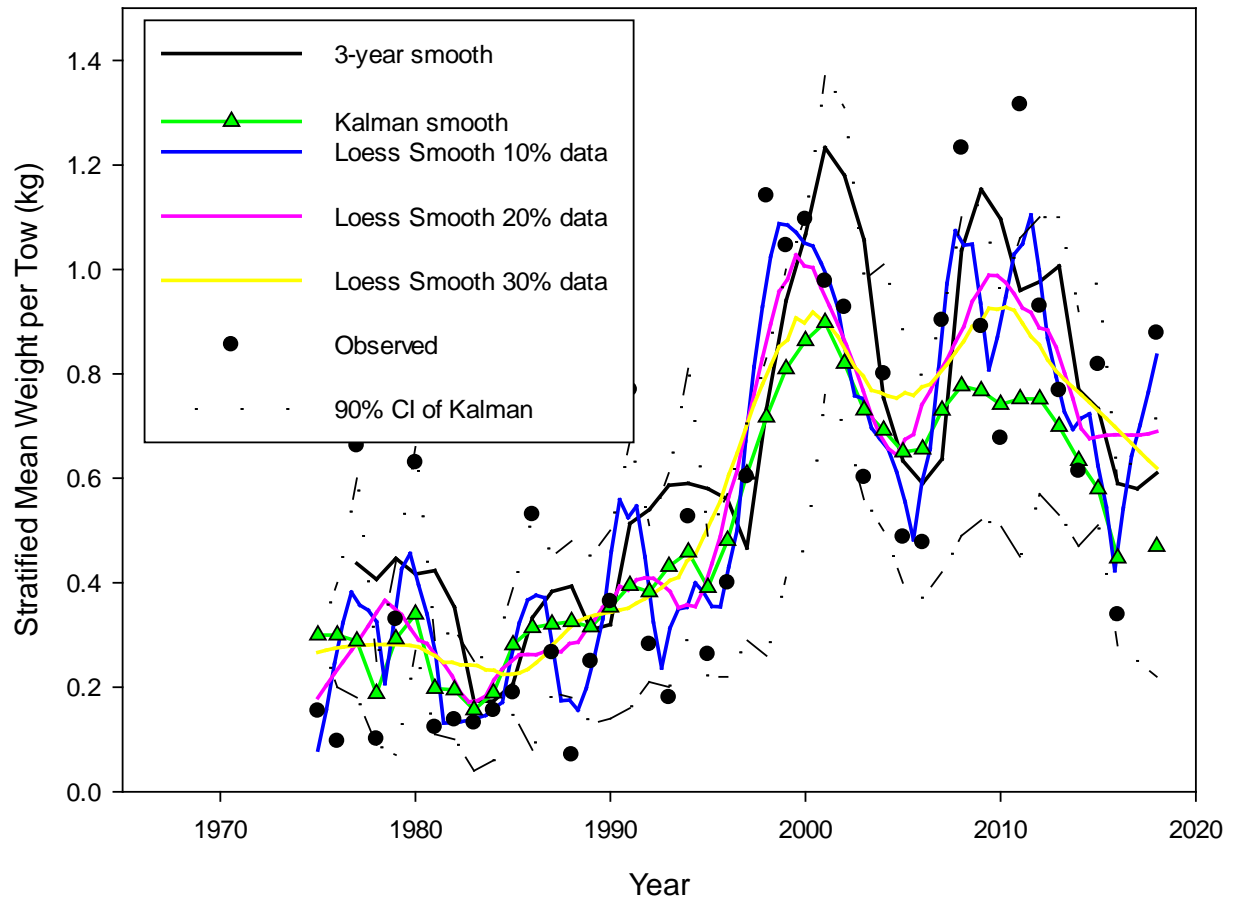


Figure 3. Inshore strata from the NEFSC spring and fall surveys.

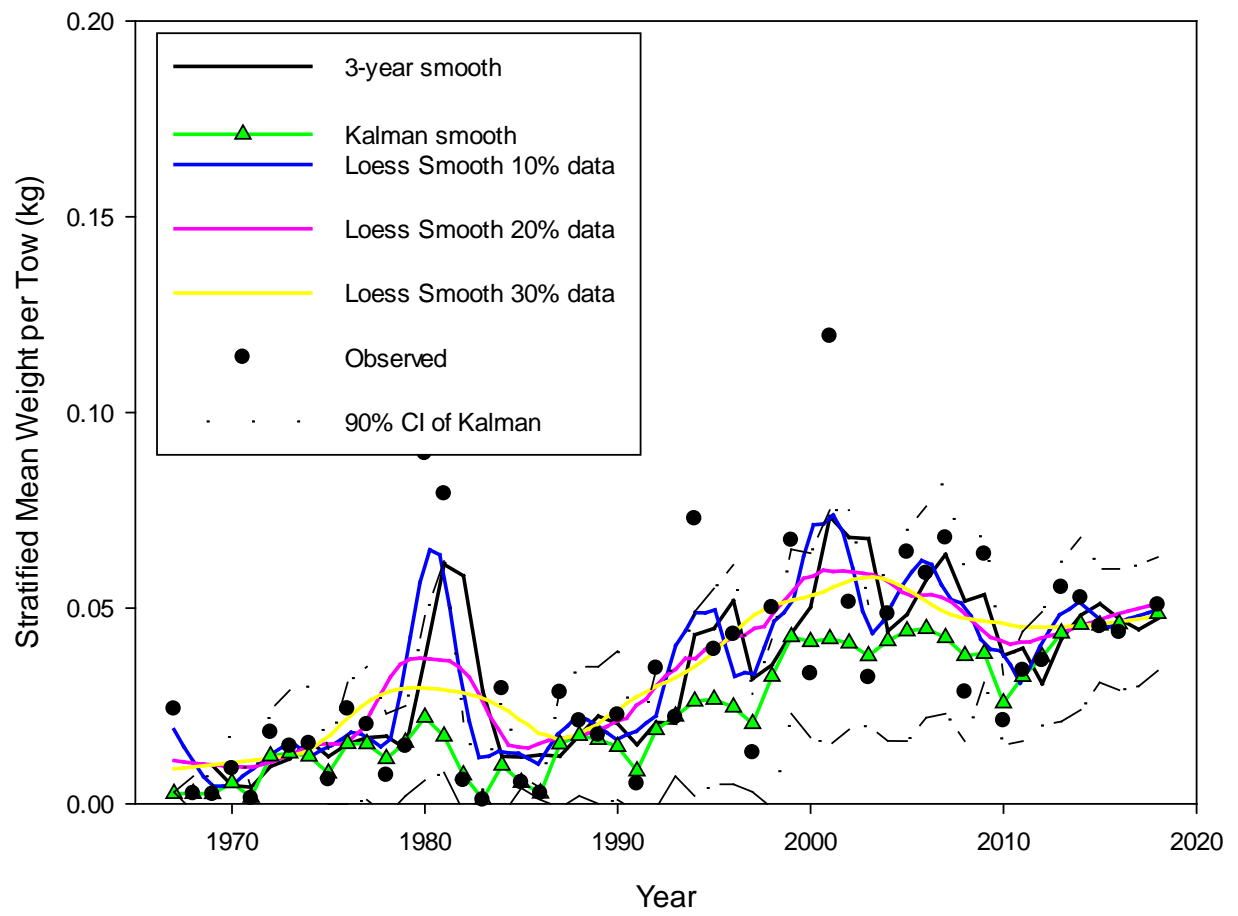


**Figure 4.** Little skate spring indices (kg/tow) based on all strata (i.e., full strata set; red triangles) and based on truncated strata set (i.e., strata south of Delaware Bay were removed; blue squares) from 1982-2013. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 1.091 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).

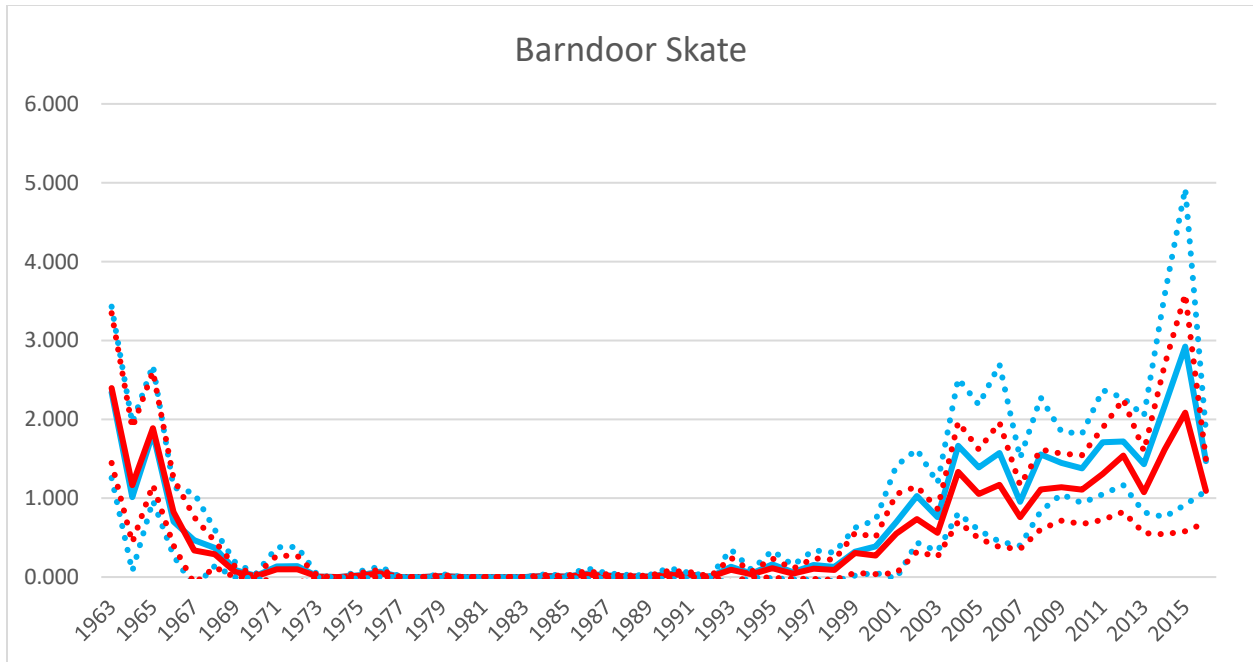




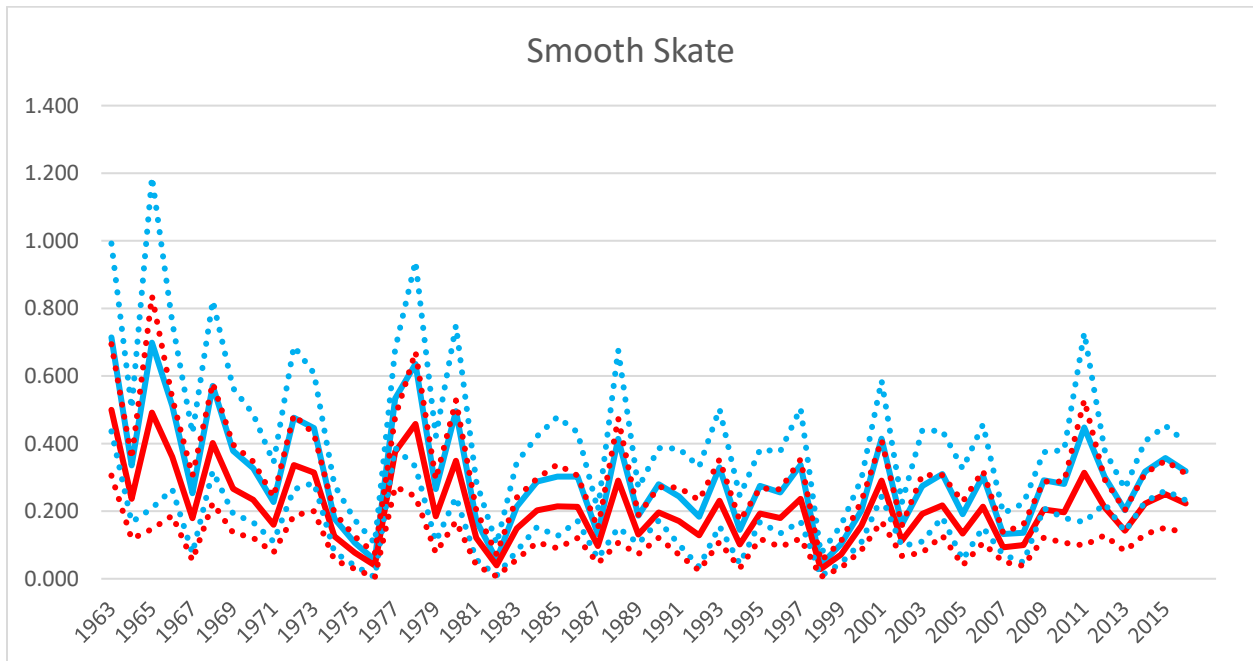
**Figure 5.** Comparison of smoothers for clearnose skate.



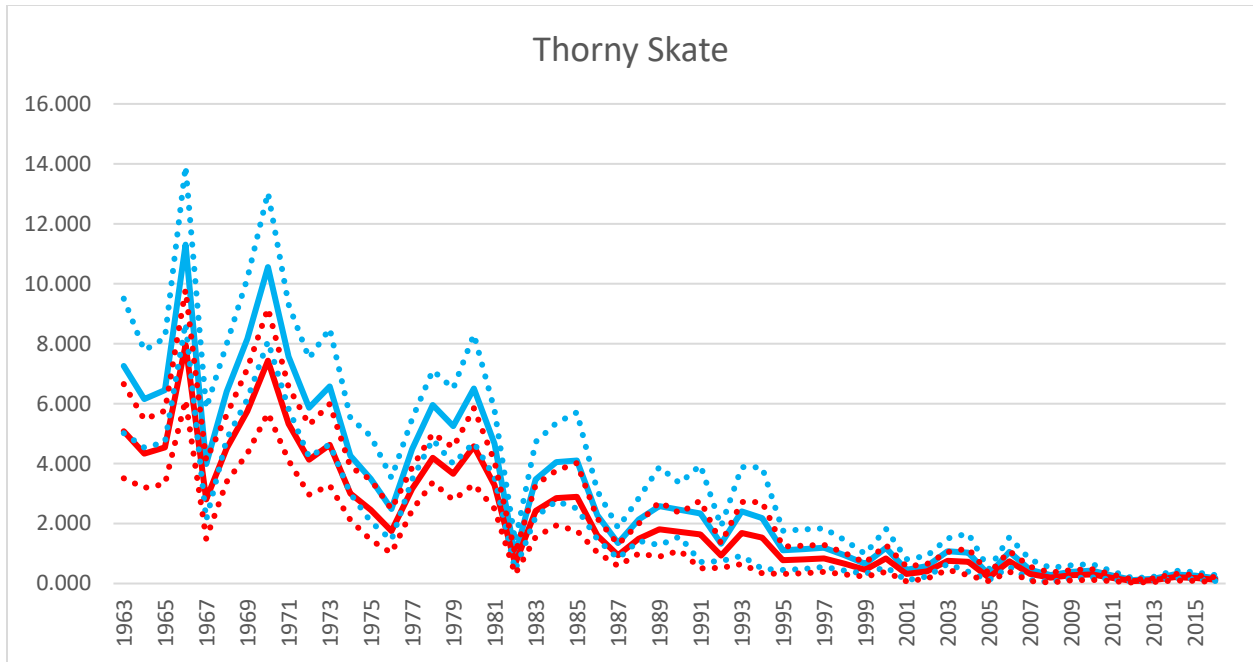
**Figure 6.** Comparison of smoothers for rosette skate.



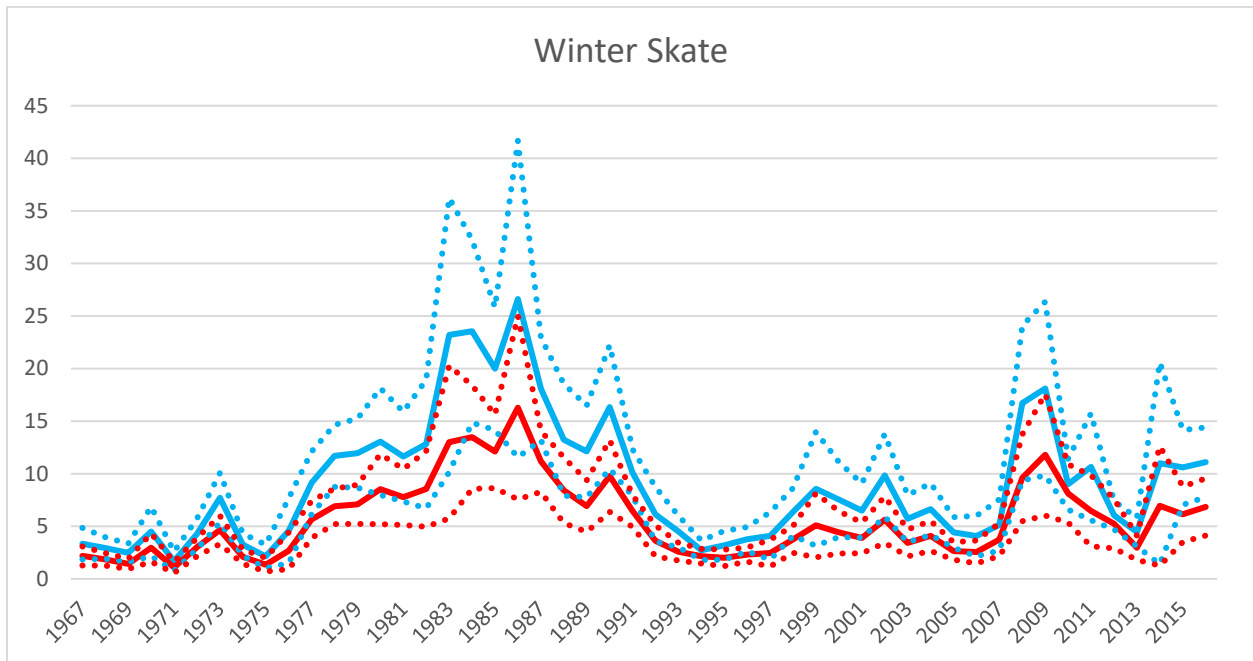
**Figure 7.** Barndoor skate autumn indices (kg/tow) based on offshore strata from Gulf of Maine to Southern New England (full strata set; red) and based on truncated strata set (strata south of Georges Bank were removed; blue) from 1963-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 1.222 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



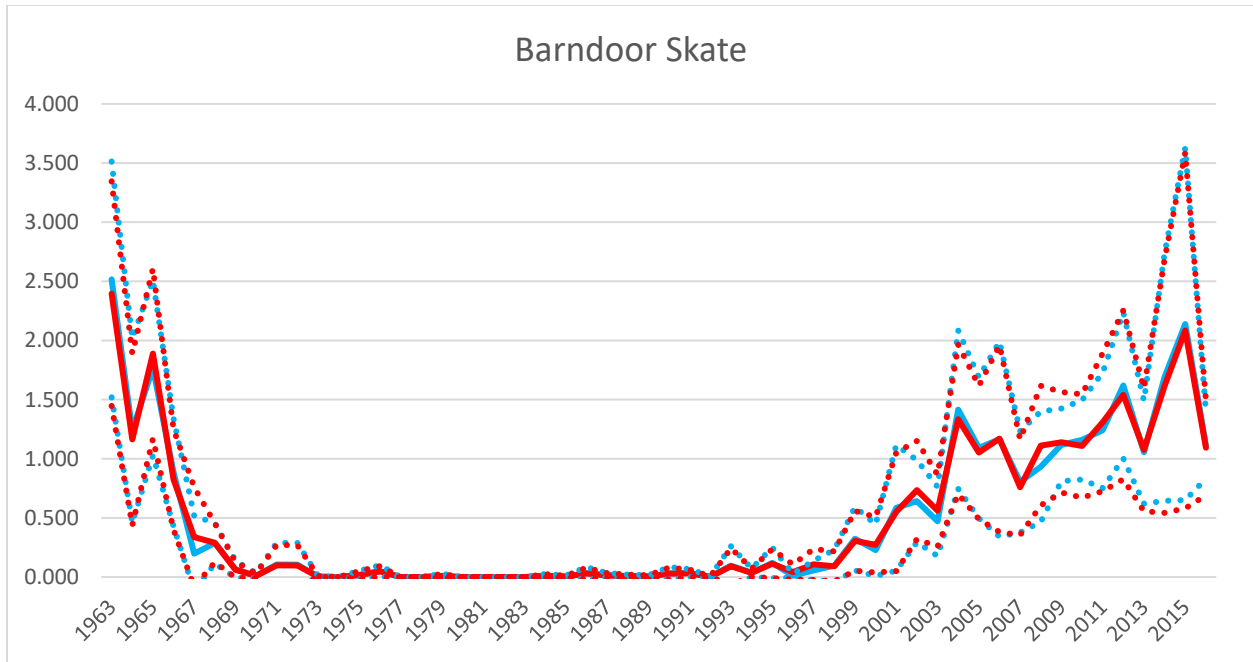
**Figure 8.** Smooth skate autumn indices (kg/tow) based on offshore strata from Gulf of Maine to Southern New England (full strata set; red) and based on truncated strata set (strata south of Georges Bank were removed; blue) from 1963-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 1.418 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



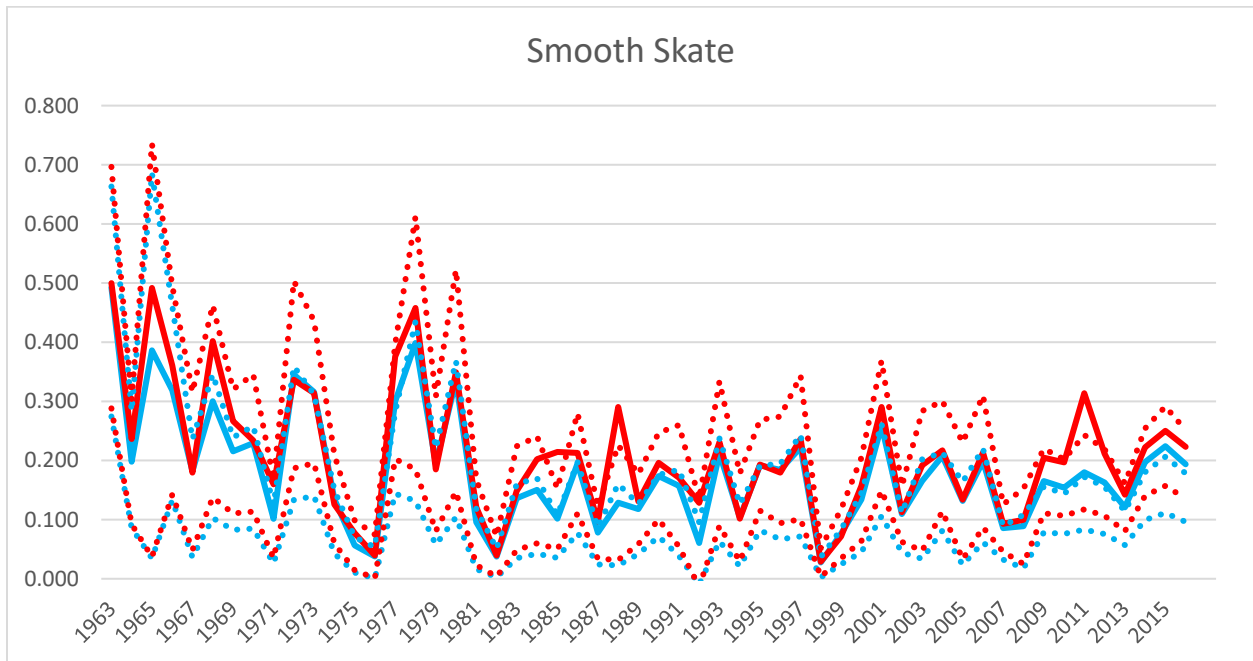
**Figure 9.** Thorny skate autumn indices (kg/tow) based on offshore strata from Gulf of Maine to Southern New England (full strata set; red) and based on truncated strata set (strata south of Georges Bank were removed; blue) from 1963-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 1.423 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



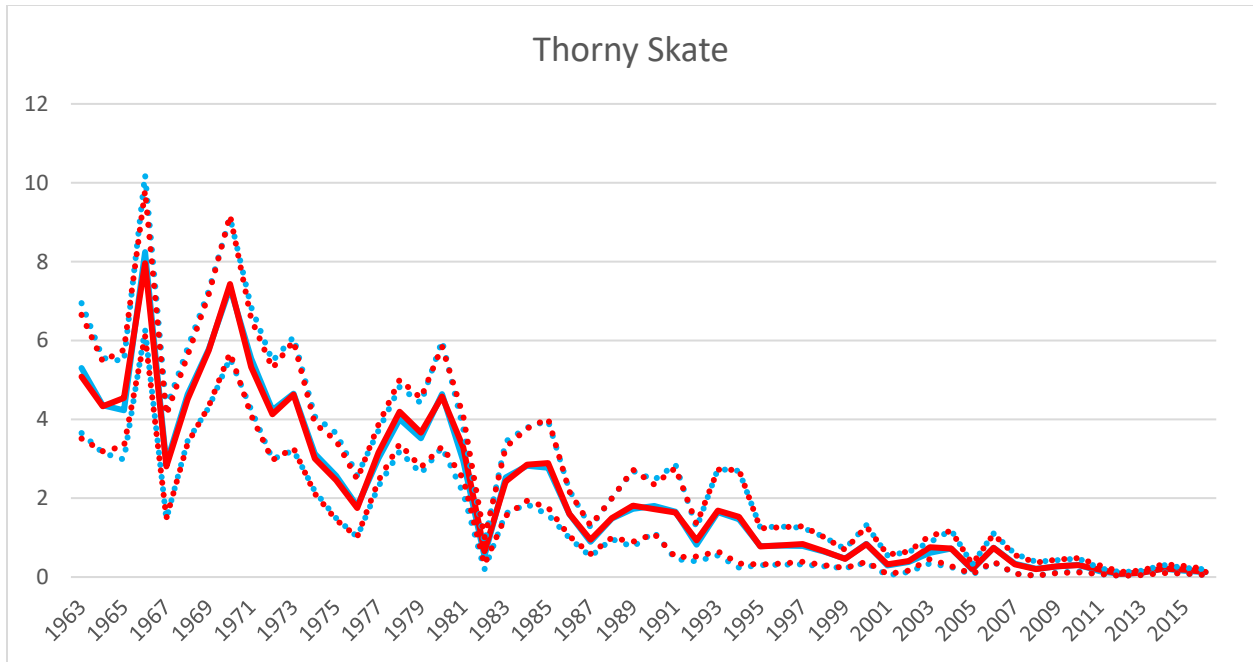
**Figure 10.** Winter skate autumn indices (kg/tow) based on all offshore strata (full strata set; red) and based on truncated strata set (strata south of Georges Bank were removed; blue) from 1967-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 1.610 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



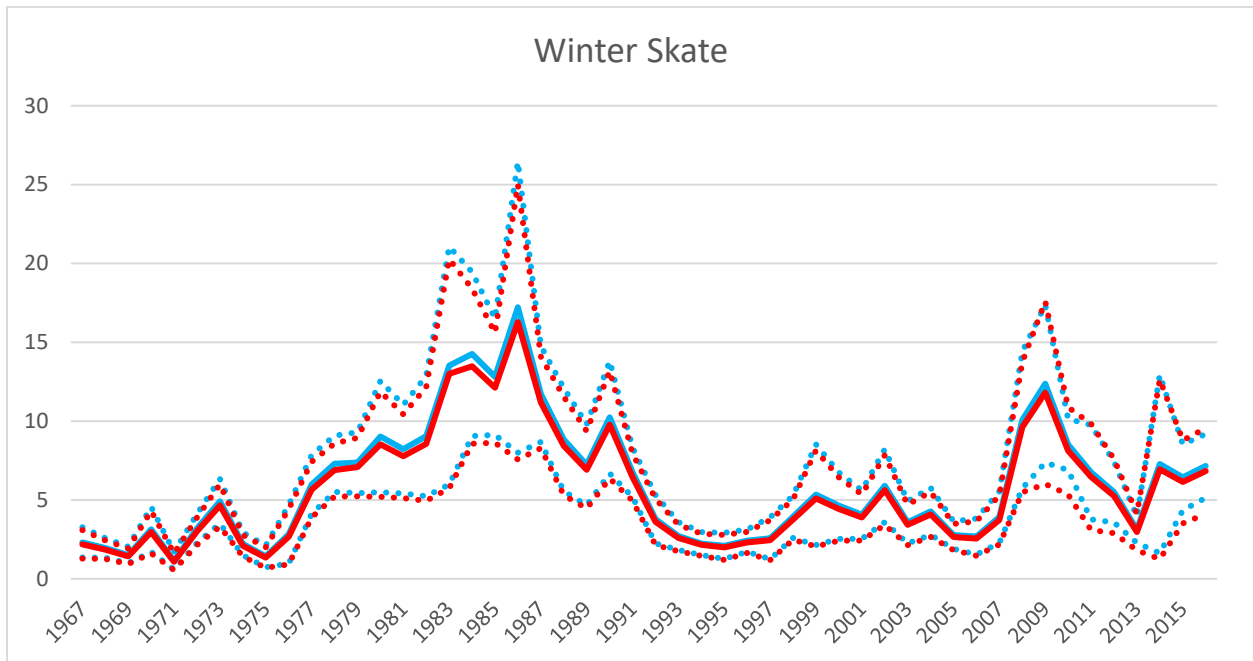
**Figure 11.** Barndoor skate autumn indices (kg/tow) based on offshore strata from Gulf of Maine to Southern New England (full strata set; red) and based on truncated strata set (offshore strata 01300, 01340, and 01351 were removed; blue) from 1963-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 0.998 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



**Figure 12.** Smooth skate autumn indices (kg/tow) based on offshore strata from Gulf of Maine to Southern New England (full strata set; red) and based on truncated strata set (offshore strata 01300, 01340, and 01351 were removed; blue) from 1963-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 0.860 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



**Figure 13.** Thorny skate autumn indices (kg/tow) based on offshore strata from Gulf of Maine to Southern New England (full strata set; red) and based on truncated strata set (offshore strata 01300, 01340, and 01351 were removed; blue) from 1963-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 0.996 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).



**Figure 14.** Winter skate autumn indices (kg/tow) based on all offshore strata (full strata set; red) and based on truncated strata set (offshore strata 01300, 01340, and 01351 were removed; blue) from 1967-2016. The 95% confidence limits for each series are shown as dotted lines in the same color. The survey catch ratio of the truncated strata set to the full strata set is 1.051 (based on a ratio estimator = sum across years of survey estimates based on truncated series divided by sum of estimates based on full strata set).