Commercial and Recreational Data Collection and Analysis

Anthony Wood, NOAA Fisheries

TOR#2: Estimate catch from all sources including landings and discards. Describe the spatial and temporal distribution of landings, discards, and fishing effort. Characterize the uncertainty in these sources of data.

1.1 Commercial Data

1.1.1 Commercial Data Information

Historical commercial landings (1950 to present) for all species on the Atlantic coast are maintained in the Atlantic Coastal Cooperative Statistics Program (ACCSP) Warehouse. The Data Warehouse is an online database of fisheries dependent data provided by the ACCSP state and federal partners. The Data Warehouse was queried on 31 May 2022 for all commercial bluefish landings (monthly summaries by state, gear and market category) from 1985-2021 for Florida (east coast), Georgia, South Carolina, North Carolina, Virginia, Maryland, Delaware, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. Data sources and collection methods are illustrated by state in Figure 1, and annual landings summaries were used when trip level data or monthly summaries were not available. The gear categories were decided upon by the working group based on knowledge of the fisheries and reporting tendencies. The specific ACCSP gears included in each category can be found in Table 1.

After review of the commercial landings data by ACCSP state partners during the benchmark assessment in 2015, differences in the annual landings from 1996-2014 were identified between the Virginia Fishery Mandatory Reporting Program Trip (FSMRPT) historical landings database and the ACCSP data warehouse. Issues such as duplicate state and federal reporting of landings, and failure to sync data across programs when records are updated in local databases, may be responsible for the discordance across the federally reported and state reported commercial bluefish landings, and the Potomac River Fisheries Commission (PRFC) data, between the Virginia historical landings database and the ACCSP data warehouse. The difference in total commercial bluefish landings between the ACCSP data warehouse and Virginia historical landings database was approximately 1.5% from 1982-2014. At this time, ACCSP provided two datasets as options to be used in the assessment model for the Virginia commercial landings data for bluefish. Option 1 consisted of commercial bluefish landings where each year of data from 1982-2014 was chosen from either the ACCSP data warehouse or the VA historical landings database, depending on which of these two had the greater annual landings total. Option 2 consisted of commercial bluefish landings where the annual federal dealer landings, the annual state dealer landings, and the PRFC data were compared separately for each year from 1982-2014, and the greater selected from either the ACCSP data warehouse or the VA historical landings database. Both of the options tended towards the creation of larger datasets in order to avoid underrepresenting the Virginia commercial bluefish landings data in the assessment. The 2015 benchmark working group decided to move forward with the option 1 calculations for Virginia landings. Option 1 has been maintained since 2015 and was maintained for the 2022 bluefish research track assessment to derive commercial bluefish landings for Virginia.

Prior to the SARC 60 benchmark in 2015, the commercial landings data had been provided by the Northeast Fisheries Science Center (NEFSC) Commercial Fisheries Database (CFDBS) area allocation (AA) tables, and supplemented with state data supplied directly from several local state collection programs. For past bluefish assessment updates, the NEFSC CFDBS AA tables were queried for the federal dealer reported landings and length data from Maine to Maryland, and occasionally for Virginia landings data for some years. However, these NEFSC CFDBS data did not capture the commercial bluefish landings reported by state dealers without federal reporting requirements. Therefore, it was necessary that additional state

dealer reported landings and length data would be supplied by the Virginia Marine Resources Commission (VMRC), the North Carolina Department of Marine Fisheries (NCDMF) trip ticket program, and the Florida Fish and Wildlife Conservation Commission (FWC). To improve on the consistency and reproducibility of the data collection for future bluefish assessments, it was decided for SARC 60 that the commercial bluefish landings would be supplied by the ACCSP data warehouse, which maintains fisheries dependent data for all Atlantic coast species across all ACCSP state and federal partners.

In 2019, the NEFSC and partners initiated the development of a new Catch Accounting and Monitoring System (CAMS) which could be used to provide bluefish commercial landings going forward. The Catch Accounting and Monitoring System (CAMS) is designed to provide a single, comprehensive source for all US commercial catch (landings and discards) for quota monitoring, stock assessment, protected resource estimation, ecosystem modeling, and other needs of GARFO and NEFSC in a fully documented relational database with appropriate user views and tables. As of 2020, the NEFSC has halted production of the CFDBS AA tables and landings are now provided by the new CAMS system. The entire CAMS system will undergo a full peer review in 2023.

At present, there exists single year of overlap (2019) where comparisons between the old AA table algorithms and the new CAMS system is possible. A comparison of 2019 bluefish commercial landings from the CFDBS_AA tables, CAMS, and ACCSP shows consistency across the sources for most of the State landings data. Differences in FL, NC, and VA persist between information in CAMS and ACCSP. Both NC and FL have provided additional state dealer reported landings which may not be accounted for by the new CAMS process. In addition, Virginia state landings have historically shown the greatest disparity when compared to the AA table landings. This disparity is still present in the 2019 comparison with both the AA table and CAMS results (Table 2, Figure 2). For the 2022 RT the WG decided to maintain the use of ACCSP to provide commercial landings data. CAMS will be considered in the future following its peer review, and when more years of comparison are available.

Commercial fisheries landings data for states between North Carolina and Maine are collected via the NMFS dealer mandatory reporting system. Beginning in June 2004, an electronic dealer reporting was initiated in the northeast. The states of Florida, Georgia, and South Carolina use a trip ticket system.

1.1.2 Commercial Landings

Over the last 40 years, commercial landings from the bluefish fishery ranged from a high of 7,166 MT (15.8 million pounds) in 1983 and have steadily declined to a low of 1,089 MT (2.4 million pounds) in 2021 (Table 3, Figure 3). During this time commercial landings have been consistently lower than the recreational catch and accounted for on average ~XX% of the total catch on (Figure X). Amendment 1 to the bluefish FMP was implemented in the year 2000 and the commercial fishery has been regulated by quota since this time. Gill nets are the dominant commercial gear used to target bluefish and account for an average of over 50% of the bluefish commercial landings from 1982 to 2021, with primary use in the Mid-Atlantic and Florida. Other commercial gears including hook & line, pound nets, seines, and trawls, collectively account for approximately 50% of the commercial landings (Table 4).

Regional variations in commercial fishing activity are linked to the seasonal migration of bluefish. The majority of commercial fishing activity in the North and Mid-Atlantic occurs from late spring to early fall when bluefish are most abundant in these areas. As water temperatures decrease in late fall and winter, bluefish migrate south. Peak landings in the South Atlantic occur in late fall and winter. The majority of commercial landings over the time series (1950-present) have been taken in the Mid-Atlantic region (New York, New Jersey, and North Carolina), with the exception of Florida which accounted for a larger percent

historically (early 1980s) and a diminishing proportion of landings over time (Table 3). Since 1982, approximately 65% of the coast-wide total landings have been taken in this from these 3 states.

The Northeast Region is divided into 46 statistical areas for Federal fisheries management. According to VTR data, bluefish were commercially harvested in 36 statistical areas in 2021. Six statistical areas, however, collectively accounted for more than 75 % of VTR-reported landings in 2021, with individual areas contributing 6% to 18% of the total (Table X). This trend is supported through time by VTR trip and catch data over the last 29 years (Figures 4-8). These areas also represented 70% of the trips that landed bluefish suggesting that resource availability as expressed by catch per trip is fairly consistent through the range were harvest occurs. In addition, the distribution maps of VTR number of trips and catch over time show a decline in both trips and catch that is consistent with the landings data (Figures 4-8).

1.1.3 Revenue

In 2021, commercial vessels landed about 1,090 mt (2.4 million lbs.) of bluefish valued at approximately $2.3 million in 2020 constant dollars. The average annual ex-vessel price of bluefish, coast-wide, was $0.93/lb ($2.05/kg) in 2021. The relative value of bluefish is very low among commercially landed species, approximately 0.081% of the total 2021 value of all federally sold finfish and shellfish landed along the U.S. Atlantic coast. A time series of commercial bluefish landings, revenue, and ex-vessel price from 2000 to 2021 is provided in Figure 9.

1.1.4 Commercial Biological Sampling

1.1.4.1 Maine to Virginia

Commercial fisheries from Maine to Virginia were sampled as part of the NEFSC data collection program. In addition, the Virginia Marine Resources Commission's (VMRC) Stock Assessment Program (SAP) has collected finfish biological data (length, weight, sex, and age) since 1988. At most sites, bluefish are sampled from 50-pound boxes of landed fish that have been graded, boxed, and iced. At sites associated with pound net or haul seine landings, bluefish are intercepted after they have been graded by market category and weighed. A 50-pound box (or partial box) of graded fish from all available species market categories (i.e. small, medium, large, and unclassified) are chosen for determination of length, weight, and sex information. In most cases, the entire 50-pound box of fish graded by species market category is sampled to account for within-box variation (see Chittenden and Barbieri 1990).

Each fish is measured for size (total length and usually weight). Weight is measured to the nearest 0.1 lbs; total length is measured to the nearest millimeter (mm), accurate to 2.5 mm, using electronic Fish Measuring Boards. Fork length is measured on a subsample basis. All fish, except those with damaged tails, are measured for total length from the tip of the snout to the end of the tail fin.

For ME-VA bluefish, the numbers of fish sampled has ranged from a low in 1995 of 189 fish to a maximum of 8,022 fish in 2012 (Table 5). Sampling has averaged just over 3000 fish per year since the year 2000. Expansion of length data was completed by market category and quarter of the year, with the results merged into half year periods. Market category/quarters with inadequate length samples were filled with length information from adjacent quarters within the same market category. Market category/quarters with landings and no associated lengths were combined with landings information from adjacent quarters.

1.1.4.2 North Carolina

Commercial bluefish landings are monitored through the North Carolina trip ticket program (1994-present). Under this program, licensed fishermen can only sell commercial catch to licensed North Carolina Division of Marine Fisheries (NCDMF) fish dealers. The dealer is required to complete a trip ticket every time licensed fishermen land fish. Trip tickets capture data on gears used, area fished, species harvested, and

total weights of each individual species landed, by market grade. Trip tickets are submitted to NCDMF monthly.

Fishery-dependent sampling of NC commercial fisheries has been ongoing since 1982. Predominant gears sampled include: ocean sink nets, estuarine gill nets, winter trawls, long haul seines/swipe nets, beach haul seines, and pound nets. From the fishery-dependent data, NCDMF derives length and weight estimates by market grade for almost all of the commercial landings except catches by shrimp trawls, pots, long line, gigs, fyke nets, hand harvest, trolling, and rod & reel. Landings from these unsampled or 'other' commercial gears combined represent 0.2-1.1% of the 1997-2004 landings. Length frequency distributions from all sampled commercial gear were combined to represent landings by these other gears.

Bluefish length frequency samples, by gear, market category and year were obtained from dealers with a sample representing the landings from an individual trip. Sampling was done by market category as fish were culled at the dealers. Length distributions (and aggregate weights) from sampled trips by gear and market grade were expanded by respective landings, gear, and market grade. Length frequency distributions were combined to represent total landings, market grade, quarter, and year.

The number of bluefish sampled by NCDMF has ranged from a low in 2021 of 296 fish to a maximum of 11112 fish in 2001 (Table 5). The very low number of length samples in 2021 likely reflects the impact of COVID on sampling. Sampling has averaged 6,774 fish per year since the year 2000. Expansion of length data was completed by market category and quarter of the year, with the results merged into half year periods. Market category/quarters with inadequate length samples were filled with length information from adjacent quarters within the same market category. Market category/quarters with landings and no associated lengths were combined with landings information from adjacent quarters.

1.1.4.3 Florida

Biological data collection for the bluefish fishery from Florida to North Carolina is sparse. FWC has collected an average of 322 lengths per year from 1992 to 2021. However, there is a large range of values depending on year, from a minimum of 5 fish in 1994, to a maximum of 889 fish in 2015. There is no market category or quarter information associated with the FL lengths and lengths are provided by half year. For years 1985-1991 Florida landings were expanded using NC length information. For 1992-2021, expansion of FL length data was completed by half year. If half year information for length or landings were inadequate, expansion was carried out at an annual level.

1.1.5 Commercial length frequency distribution

The length frequency distribution from the commercial fisheries is characterized by a bi-modal distribution for much of the time-series. In the more recent years (2012-2021), the larger mode is reduced, leading to a skewed distribution with a peak around 35 cm (Figure 10). This pattern in bluefish length frequency has been observed to a lesser degree in some years of the recreational landings length frequencies (Figure 25), and the recreational discard length frequencies (Figure X). The bi-modal pattern is likely a result of low availability to the fisheries of age 3 to age 4 bluefish. Bluefish are known to school by size class and it is speculated that movement dynamics at this age/size range affects availability of these fish. This size cohort could be staying in the south (SC-FL) or offshore each in certain years and since the dominant fisheries for bluefish are coastal, and north of Cape Hatteras, North Carolina, this would account for a reduced availability of this size/age class.

1.1.6 Commercial Discards

Previous bluefish technical committees and working groups have concluded that commercial discards for bluefish along the Atlantic coast were insignificant, and historically this portion of the commercial catch has been ignored. The 2022 RT WG concluded that although commercial discards are a small fraction of the total catch, they should still be estimated and included in the commercial catch totals. To estimate

commercial discards for bluefish, the Standardized Bycatch Reporting Method (SBRM) approach (Wigley et al. 2008) was applied, using the combined (D2) estimator. Commercial discard rates from 1989-2021 were calculated by half-year, gear (Long-lines, Hand-lines, Trawls, Gillnets, and Midwater Trawls), mesh (SM, LG, XLG) and region, NE (Stat Areas: '464', '465', '510', '511', '512', '513', '514', '515', '520', '521', '522', '525', '526', '561', '562', '551', '552', '530', '533', '534', '537', '538', '539', '541', '542', '543') and MA (Stat Areas: '600', '610', '611', '612', '613', '614', '615', '616', '620', '621', '622', '623', '624', '625', '626', '627', '628', '629', '630', '631', '632', '633', '634', '635', '636', '637', '638', '639', '640'). A commercial discard mortality estimate of 0.32 was estimated via meta-analysis of similar species and gears and applied to the annual discards (Appendix 1). Commercial landed lengths were used for the dead discards.

Commercial bluefish dead discards have ranged from a high of 166 MT in 1996, to a low of 7 MT in 2017 (Table 13, Figure 13). Trawl and gillnet fisheries account for almost all of the discards, with small contributions from handline, longline, and midwater fisheries (Figure 14). Observed trips average around 1800 per year over the time series (Figure 15), with regional and temporal trends shown in Figures 16-18. Commercial bluefish discards average 1.5% of the commercial catch, and 0.2% of the total catch. While this portion of the catch is insignificant, the inclusion of these data will allow future shifts in magnitude to be monitored and accounted for in the assessment.

1.1.7 Commercial CAA and WAA

Seasonal length-weight parameters (Working Paper 5 Truesdell et al. 2022) used to calculate numbers at length for the commercial catch are presented in Table 5. Final commercial catch-at-age and weight-at-age matrices calculated using the seasonal multinomial age length keys (Working Paper 14 Celestino et al. 2022b) are presented in Tables 6 and 7.

1.2 Recreational Data (MRFSS/MRIP)

1.2.1 Recreational Data Information

The main source of information on catch, harvest, release numbers, harvest weights, and sizes for bluefish in the recreational fishery come from the National Marine Fisheries Service's Marine Recreational Information Program (MRIP), which was formerly the Marine Recreational Fisheries Statistical Survey (MRFSS). The MRFSS data collection program began in 1979, though estimates of recreationally caught Bluefish are not available until 1981. In 2005, the National Academy of Sciences' Natural Research Council was commissioned to review the MRFSS and provide recommendations for improving recreational fishing estimates. A major finding of the Council was that intercept methods resulted in a non-representative sample of recreational anglers and their catch-per-trip was not accounted for in the estimation methodology, resulting in potentially biased catch estimates and overestimated precision (MRIP website). Interviewers were instructed to maximize the number of intercepts made and site selection was at the interviewer's discretion. Interviewers were more likely to obtain intercepts from high pressure sites and disregard low pressure sites and the catch-per-trip at the low pressure sites was not adequately represented. The Council's review contributed to the implementation of the MRIP and a new estimation methodology. MRIP uses the same basic data as MRFSS but implements a new catch estimate methodology that better matches the sampling design used in the dockside intercept survey. The MRIP methodology is intended to account for the clustered sample design and the non-equal weighting used to select sample sites.

For a thorough review of the Recreational Data changes over the time-series (e.g., methodology comparisons, calibration changes, etc.) see Working Paper 9 (Drew 2022a).

For a thorough review of the Spatial Distribution of Bluefish from an analysis of the MRIP data see Working Paper 10 (Drew 2022b).

1.2.2 Recreational Harvest (AB1)

Recreational harvest estimates of bluefish have averaged around 20,000 MT (44.1 million pounds) annually since 1985. From the 1980s to the early 1990s, recreational harvest declined by about 60% [avg. 1985-1989 = 52,064 MT (114.8 million pounds); avg. 1990-1994 = 22,285 MT (49.1 million pounds)]. Recreational harvest estimates continued to decline at a somewhat slower rate until reaching a low of 10,695 MT (23.6 million pounds) in 1999, increasing to 21,269 MT (46.9 million pounds) in 2010, and steadily decreasing since then to a value of 5,471 MT (12.1 million lbs) in 2021 (Table 8). In 2021, recreational anglers along the Atlantic Coast caught 6.2 million bluefish, a 34% decrease from 2020. Recreational harvest has decreased over the last 8 years, from a peak of 21.5 million fish in 2014, to the lowest harvest in the time series in 2021 of 6.2 million fish (Table 9). The majority of recreational activity occurred from May to October, with the peak activity in July and August. Most of the recreational activity occurs from July to October, when almost 70% of the bluefish harvest is taken.

1.2.2.1 Recreational Harvest by Mode

Figure 19 reflects recreational harvest (AB1) estimates of total removals by mode and indicates that the primary catch modes for bluefish are private boats and shore-based fishing. Less than 10 % of the catch came from for-hire boats over the time-series.

1.2.2.2 Recreational Harvest by Area

MRIP classifies catch into three fishing areas: inland, near-shore ocean (< 3 mi), and offshore ocean (> 3 mi). About 51% of the catch of bluefish on a coast-wide basis came from inland waters, followed by near-shore ocean (42%) (Figure 20). Offshore ocean is only about 7% of the total catch. The inland portion of the harvest has been decreasing in recent years, with a concurrent increase in near-shore ocean harvest (Figure 20). For a detailed analysis of the spatial distribution of bluefish based on MRIP catch information see Working Paper 10 (Drew 2022b).

1.2.3 Recreational Releases (B2)

MRIP recreational release estimates have ranged from a low of 5.2 million fish (1988) to a high of 42.5 million fish (2001) from 1985-2021 (Table 10). Recreational release estimates have generally increased in proportion to harvested fish over the time series, increasing from approximately 19% of the total coast-wide catch in 1985 to over approximately 80% in 2021. Recreational discards in 2021 were estimated at 14,792 MT and after adjusting for a 9.4% mortality rate the resulting discard loss was 1,391 MT. Recreational discard loss in weight has ranged from a low of 905 MT in 1988, to a high of 7,270 MT in 2001.

1.2.3.1 Recreational Releases by Mode

Figure 21 reflects recreational releases (B2) by mode and indicates that the primary release modes for bluefish are private boats and shore-based fishing. Less than 10 % of the releases came from for-hire boats over the time-series. These trends mimic the mode patterns seen in the harvest.

1.2.3.2 Recreational Releases by Area

MRIP classifies catch into three fishing areas: inland, near-shore ocean (< 3 mi), and offshore ocean (> 3 mi). About 48% of recreational bluefish releases on a coast-wide basis came from inland waters, and 48% from nearshore waters (Figure 22). Offshore ocean is only about 4% of the total releases. For a detailed analysis of the spatial distribution of bluefish harvest and releases based on MRIP data see Working Paper 10 (Drew 2022b).

1.2.4 Recreational Discard Mortality

Since the 1997 assessment (23rd SAW), recreational discard mortality was estimated at 15%. This was based on estimates calculated in a study by Malchoff (1995), and modified by the ASMFC Bluefish Technical Committee. Prior estimates used in 1994 (18th SAW), estimated a hooking mortality rate of 25% and was based on analogy with species such as striped bass (Diodati 1991), black sea bass (Bugley and Shepherd 1991), and Pacific halibut (IPHC 1988).

The SAW60 WG in 2015 conducted a thorough analysis to estimate recreational discard mortality for bluefish. Four methods to calculate a point estimate of post release mortality were conducted, resulting in a range of estimates between 14% and 17%. The TC and WG approved a 15% (SD=0.143%) discard mortality estimate for use in SAW60 based on bluefish specific estimates from five known studies using Bartholomew and Bohnsack (2005) meta-analysis methodology. Supporting analysis using 70 studies and 21 different species from Bartholomew and Bohnsack (2005) (16% post release mortality) and an equal weighted estimate from bluefish specific papers (14% post release mortality) assisted the decision by the WG and TC.

The 2022 research track working group re-visited and updated the recreational discard mortality meta-analysis that was carried out in 2015. The recreational discard mortality was changed from 15% to 9.4% based on this updated analysis. See Working Paper 11 (Valenti 2022b) for full details of how this new estimate was derived.

1.2.5 Recreational Biological Sampling

Recreational landings are sampled for length as part of the MRIP program. The MRIP length samples were used to expand recreational landings per half year. Seasonal and annual length frequency distributions for the recreational harvest are presented in Figures 23-25. In some years of the time-series bluefish harvest lengths exhibit a bi-modal distribution, with a peak of fish around 35 cm, and a smaller peak around 70 cm. This trend has diminished in recent years but is consistent with trends seen in the commercial length frequency distributions. The bi-modal pattern is a result of an apparent low availability to the fisheries of age 3 to age 4 bluefish. Bluefish are known to school by size class and it is likely that unobserved movement dynamics at this age/size range affects availability of the population. It is possible a larger portion of the population at these sizes are staying south or offshore each year. Since the dominant fisheries for bluefish are coastal and north of Cape Hatteras, North Carolina, this would account for a reduced available of this size/age class.

Recreational discards were characterized using lengths from MRIP intercept data, bluefish tagged and released in the American Littoral Society (ALS) tagging program (by definition B2 catches), as well as information provided by volunteer angler programs in RI, CT, and NJ, and SC.

1.2.5.1 MRIP i9 release lengths

The MRIP i9 intercept data includes release length information collected from headboats from 2004-2021. In total, 11,140 release lengths have been collected over the time-series, with 2,135 in the Spring and 9,005 in the Fall (Table 11, Figure 26). The disparity in seasonal sample numbers can be attributed to sampling intensity in the northern states along with bluefish availability later in the season. Seasonal and annual length frequency distributions for MRIP release lengths are presented in Figures 27-29.

1.2.5.2 American Littoral Society Tagging Program

The American Littoral Society (ALS) has been using volunteer anglers to tag, release, and recapture recreationally important fish species along the US East coast since 1965. The program was originally focused on tagging coastal Atlantic sharks. However, during the drastic decline of striped bass in the early 1970's the program shifted its focus to striped bass, and other coastal species like bluefish. Bluefish are among the top recoded species in the ALS database and over the time series account for over 30,000 observed release lengths (Table 12). Seasonal and annual length frequency distributions for ALS releases are presented in Figures 30-33.

1.2.5.3 Rhode Island Volunteer Angler Survey

The Rhode Island Department of Environmental Management Division of Fish and Wildlife (RIDFW) implemented a voluntary on-line angler logbook (eLOGBOOK) in 2010. The eLOGBOOK application, housed by the Atlantic Coastal Cooperative Statistics Program (ACCSP), enables recreational fishers to enter complete trip level catch and effort data online. Information collected includes trip date, fishing mode (party, charter, private, shore), area fished, number of fishers, number of lines, gear type, hours fished, species, disposition, length and quantity.

1.2.5.4 Connecticut Volunteer Angler Survey

The Connecticut DEEP Marine Fisheries Division has conducted a Volunteer Angler Survey (VAS) since 1979. This survey supplements the National Marine Fisheries Service, Marine Recreational Information Program (MRIP) by providing additional length measurement data particularly for fish that are released. The survey's initial objective was to collect marine recreational fishing information concerning finfish species with special emphasis on striped bass. In 1994, the collection of bluefish length measurements was added to the survey to enhance understanding of the bluefish fishery in Connecticut. In 1997, length measurement information for other marine finfish was added to the survey design.

The CT VAS is designed to collect trip and catch information from marine recreational (hook and line) anglers who volunteer to record their fishing activities by logbook. The logbook format consists of recording fishing effort, target species, fishing mode (boat and shore), area fished (subdivisions of Long Island Sound and adjacent waters), catch information concerning finfish kept (harvested) and released, and length measurements of striped bass (since 1979), bluefish (since 1994), and other common species (since 1997). Instructions for volunteers are provided on the inside cover of all postage paid logbooks. Each participating angler is assigned a personal numeric code for confidentiality purposes. After the logbook data are entered into a database, logbooks are returned to each volunteer for their own personal records.

1.2.5.5 New Jersey Programs

Recreational discard data were available from several New Jersey programs: the New Jersey volunteer angler survey (VAS) is an online, open access survey that began in 2006. The intent of the survey is to complement and supplement the MRIP survey. Two main objectives of the VAS are to allow anglers to submit data to increase buy-in to management measures as well as address sample size concerns of MRIP, and to collect additional length frequency data of discarded fish. The survey was designed based on the MRIP intercept survey, collecting effort, catch, and length information from marine recreational (hook and line) anglers in New Jersey waters. The survey is available online at http://www.njfishandwildlife.com/marinesurvey.htm.

The NJ Tournament and Party/Charter Boat biological sampling program is designed to collect marine recreational (hook and line) fishing information concerning finfish species. Tournament sampling consists

of staff collecting biological data (length, weight, age, sex) of finfish kept (harvested) and released during fishing tournaments. In 2014, logbooks were created for tournament anglers who volunteered to record their fishing activities. The logbook format consists of recording fishing location, number of hours fished, fishing mode (surf or boat), number of anglers reporting on log, water temperature, catch information concerning finfish kept and released, and length measurements.

NJ Party/charter boat sampling consists of staff collecting biological data of finfish kept and released during fishing trips aboard party/charter boats. Party/charter boats can submit trip and catch information by logbook when staff are not present. The logbook format consists of recording fishing location, number of hours fished, number of anglers, water temperature, weather conditions, catch information concerning finfish kept and released, and length measurements.

Length frequencies from the recreational catch and discards show a similar trend to the commercial length frequency. While previous years were characterized by a bimodal distribution, more recent years reveal a skewed distribution, with a main peak around 28 cm and a flat/slightly-decreasing distribution out to 90 cm (Figure B4.10A & B). Total length frequency distribution by season of the recreational landings and discards are presented in Figure B4.11. The average size of the recreationally released bluefish is larger than the average size of retained fish, an uncommon pattern most likely due to bluefish's unpalatability at larger sizes.

1.2.5.6 South Carolina Volunteer Angler Program

Recreational release length information from SC comes from the Marine Gamefish Tagging Program. This program was sponsored by the South Carolina Department of Natural Resources. This program has not focused on bluefish, however, anglers have tagged and released almost 3,000 bluefish since 1978. The release length information from these 300 fish was used in the current assessment. This tagging program has diminished in recent years as SCDNR has actively discouraged anglers from tagging bluefish in addition to other species.

1.2.6 Recreational dead discard (B2) weight estimation

The recreational dead discard component of the catch was calculated using the season/region length frequency distributions developed from all of the recreational biological sampling data (Table 12, Figure 50). For each year, expanded lengths were calculated by season/region and summed to get a seasonal total length distribution. Seasonal length-weight parameters (Table 5) were then used to calculate total seasonal weight and summed for a total annual release weight. A discard mortality estimate of 9.4% (Working Paper 11 Valenti 2022b) was applied to calculate the weight of dead discards for the total catch.

1.3 Total Catch

Total bluefish catch by component is presented in Table 13 and Figure 51. Overall, total catch has declined since the beginning of the time series. There was a slow increase in catch from 1996 to 2010, but the declining trend has continued to the lowest values in the time-series in recent years (Figure 51). On average, commercial landings account for 14% of the total catch with commercial discards averaging only 0.2%. The total catch is dominated by the recreational fishery with landings accounting for 71%, and discards averaging 14.8%.

Tables

Table 1. ACCSP Gears included in each of the 2022 Bluefish RT Assessment Gear Categories

BF_2022_RT	ACCSP Gear Types	
Gear Category	Type Code	Gear Type
Gill Nets	006	GILL NETS
Hook and Line	014	BY HAND
Hook and Line	013	HAND LINE
Hook and Line	007	HOOK AND LINE
Pound Nets	003	FIXED NETS
Seines	001	HAUL SEINES
Seines	002	PURSE SEINES
Trawls	004	TRAWLS
Other	010	DIP NETS AND CAST NETS
Other	009	DREDGE
Other	008	LONG LINES
Other	015	OTHER GEARS
Other	005	POTS AND TRAPS
Other	011	RAKES, HOES, AND TONGS
Other	012	SPEARS AND GIGS
Not Coded	000	NOT CODED

Table 2. Comparison of 2019 commercial landings (kg) between data sources

2019 Bluefish Commercial Landings (kg)			
State	Commercial Data Source		
	AA	ACCSP	CAMS
CT	15,147	16,126	15,570
DE	2,043	7,786	7,786
FL	97,222	129,136	97,222
MA	83,547	83,539	83,543
MD	10,612	10,331	9,262
NC	424,056	502,673	423,967
NJ	92,096	92,203	92,100
NY	270,774	269,816	269,905
RI	188,629	188,608	188,622

VA	81,316	58,882	87,288
Total	1,265,443	1,359,098	1,275,266

Table 3. Bluefish Atlantic coast commercial landings (MT) by state or state group (grouped for confidentiality). Data Source ACCSP

Year	ME-MD	VA	NC	SC-FL	Total (MT)
1982	2,961	1,176	1,946	916	6,999
1983	2,732	689	3,060	685	7,166
1984	2,521	525	1,615	720	5,381
1985	3,450	750	1,635	289	6,124
1986	3,872	686	1,565	533	6,657
1987	3,269	536	2,069	705	6,579
1988	3,090	1,187	2,286	600	7,162
1989	2,443	349	1,493	454	4,740
1990	3,189	495	2,077	489	6,250
1991	3,336	374	1,778	651	6,138
1992	3,154	269	1,288	497	5,208
1993	2,744	295	1,227	552	4,819
1994	2,787	285	808	426	4,306
1995	1,790	244	1,366	229	3,629
1996	2,375	280	1,496	62	4,213
1997	1,829	339	1,816	129	4,113
1998	1,897	361	1,327	156	3,741
1999	1,698	227	1,252	158	3,335
2000	1,816	252	1,528	64	3,660
2001	1,679	369	1,844	63	3,956
2002	1,806	219	1,054	37	3,116
2003	1,569	174	1,574	45	3,361

2004	1,680	230	1,708	56	3,673
2005	1,617	238	1,287	71	3,213
2006	1,662	381	1,266	45	3,354
2007	1,924	333	1,057	77	3,390
2008	1,521	267	876	68	2,731
2009	1,746	206	1,071	97	3,119
2010	1,517	184	1,459	144	3,304
2011	1,367	115	861	111	2,454
2012	1,553	234	344	81	2,212
2013	1,247	137	526	68	1,977
2014	1,157	110	916	69	2,251
2015	1,356	87	365	109	1,917
2016	1,225	90	521	109	1,946
2017	966	89	700	121	1,876
2018	505	44	413	144	1,105
2019	668	59	503	129	1,359
2020	456	76	505	75	1,112
2021	505	57	477	51	1,090

Table 4. Bluefish Atlantic coast commercial landings (MT) by gear category. Data source: ACCSP.

Year	Gillnet	Hook/Line	Not Coded	Other	Pound Net	Seine	Trawl	Total
1982	2,514	512	0	913	948	494	1,619	6,999
1983	2,308	533	0	682	729	427	2,488	7,166
1984	1,989	440	0	719	573	380	1,279	5,381
1985	2,185	454	0	391	822	588	1,684	6,124
1986	2,802	436	528	14	782	576	1,519	6,657
1987	3,306	513	702	15	678	283	1,081	6,579
1988	3,130	482	597	5	1,395	332	1,222	7,162
1989	2,510	295	453	2	232	170	1,078	4,740
1990	3,409	441	488	6	515	310	1,082	6,250
1991	3,129	384	587	6	383	443	1,207	6,138
1992	2,637	350	88	30	376	276	1,451	5,208
1993	2,902	372	14	17	438	190	885	4,819
1994	2,576	168	301	24	286	130	821	4,306
1995	2,216	145	84	21	308	99	757	3,629
1996	2,611	389	28	11	243	90	840	4,213
1997	2,789	151	27	13	241	115	778	4,113
1998	2,427	169	42	32	291	80	699	3,741
1999	2,084	167	12	16	224	145	687	3,335
2000	2,573	130	12	8	220	59	660	3,660
2001	2,822	149	28	12	363	55	527	3,956
2002	2,020	158	18	18	325	44	533	3,116
2003	2,413	170	0	32	311	43	392	3,361
2004	2,274	145	651	177	99	34	295	3,673

2005	1,681	136	654	155	196	57	333	3,213
2006	1,948	169	689	40	210	50	249	3,354
2007	1,816	153	815	50	347	70	140	3,390
2008	1,464	136	624	38	181	57	231	2,731
2009	1,782	145	761	46	128	64	193	3,119
2010	2,117	235	523	58	147	35	190	3,304
2011	1,344	175	631	30	44	27	203	2,454
2012	911	189	725	36	63	24	264	2,212
2013	907	174	635	35	64	12	151	1,977
2014	1,205	219	541	13	140	16	116	2,251
2015	857	244	542	42	107	5	119	1,917
2016	1,003	179	533	28	68	4	132	1,946
2017	983	176	461	24	97	11	126	1,876
2018	576	109	316	18	29	3	54	1,105
2019	759	117	297	23	51	7	104	1,359
2020	703	84	140	7	31	9	138	1,112
2021	729	61	207	6	34	14	39	1,090

Table 5. Seasonal length-weight coefficients used to expand the numbers at length for the commercial catch.

Semester	beta0	beta1	a	b
NA	-11.3173	3.010	0.0000122	3.010
1	-11.2596	2.984	0.0000129	2.984
2	-11.3033	3.019	0.0000123	3.019

Table 6. Final commercial CAA in thousands (Fleet 1 in the assessment model)

	Age						
Years	A0	A1	A2	A3	A4	A5	A6
1985	1110.91	6925.73	601.31	70.39	57.96	64.26	104.72
1986	717.03	2630.26	1274.92	436.36	194.83	144.17	243.11
1987	630.52	4002.70	1223.49	530.46	166.64	108.18	190.68
1988	588.48	3121.58	1487.21	286.65	294.03	231.61	341.66
1989	814.85	1468.22	345.36	147.14	295.92	243.50	176.65
1990	810.86	2357.27	1879.32	716.02	116.26	113.42	126.92
1991	1043.97	2973.55	650.73	60.61	85.37	84.45	733.99
1992	166.31	6066.87	1515.69	469.85	39.09	22.60	58.35
1993	176.85	3882.88	2152.02	311.40	85.75	27.57	119.12
1994	74.48	1961.59	289.95	58.09	247.01	240.19	234.67
1995	268.92	3715.88	1132.94	26.56	18.12	66.61	120.48
1996	216.08	1233.53	460.99	226.05	128.96	157.47	351.70
1997	93.72	1014.48	607.58	257.29	94.85	66.74	367.73
1998	38.01	999.07	1558.59	271.74	92.35	53.81	98.08
1999	35.20	976.78	1296.54	114.13	94.29	62.60	141.80
2000	24.61	1042.05	674.35	205.99	102.45	168.26	184.23
2001	3.73	404.83	1586.94	187.98	108.37	114.37	189.57

2002	7.29	677.07	641.06	129.90	98.73	190.13	134.93
2003	5.28	287.22	1021.01	51.35	210.73	232.30	186.70
2004	12.26	362.09	1110.27	206.36	630.87	40.08	80.55
2005	67.72	427.44	1182.86	179.09	136.17	114.65	113.88
2006	19.27	435.31	500.25	222.88	274.25	207.77	307.16
2007	50.24	615.66	1010.90	265.94	161.72	117.54	280.41
2008	18.89	272.53	625.26	295.21	125.26	123.92	153.98
2009	9.07	260.46	407.66	525.43	244.57	119.23	248.72
2010	12.09	188.42	383.73	614.52	355.42	142.59	236.08
2011	9.53	179.64	383.14	639.78	243.41	82.22	165.56
2012	30.95	261.04	521.58	439.04	178.16	45.21	137.24
2013	51.01	385.56	694.69	261.37	113.32	62.53	58.97
2014	59.06	499.95	467.07	170.67	158.73	113.72	113.40
2015	106.60	423.53	527.09	103.81	67.06	69.44	132.78
2016	21.80	717.26	544.74	178.94	43.55	46.22	88.22
2017	39.38	356.69	756.20	164.53	67.96	16.99	71.56
2018	27.60	394.71	290.18	106.67	46.74	44.24	25.99
2019	22.78	442.44	721.89	108.32	55.29	20.08	22.38
2020	45.63	191.86	552.23	302.48	47.70	18.90	10.13
2021	25.04	158.52	285.00	288.34	110.47	17.44	12.00

Table 7. Final commercial WAA in kg (Fleet 1 in the assessment model)

	Age						
Years	A0	A1	A2	A3	A4	A5	A6
1985	0.196	0.618	0.797	1.589	2.928	4.495	5.518
1986	0.172	0.440	1.493	2.198	3.167	4.367	5.214
1987	0.160	0.528	1.099	2.014	2.936	4.245	5.268
1988	0.225	0.540	0.830	1.770	3.143	4.068	5.077
1989	0.202	0.537	1.177	3.038	3.735	4.122	4.835
1990	0.214	0.504	1.258	1.630	2.744	3.962	4.890
1991	0.192	0.280	0.619	1.799	4.117	4.756	5.389
1992	0.172	0.527	0.691	1.054	2.212	4.214	5.088
1993	0.191	0.247	1.176	1.330	2.000	4.243	5.249
1994	0.294	0.457	0.720	2.270	3.559	4.174	5.650
1995	0.316	0.481	0.745	0.985	2.989	4.433	5.126
1996	0.211	0.488	1.179	2.125	3.100	3.943	4.796
1997	0.269	0.482	0.980	2.066	3.045	4.315	5.295
1998	0.317	0.662	1.047	1.715	3.016	4.499	5.323
1999	0.287	0.508	1.053	2.026	3.163	4.117	5.327
2000	0.232	0.591	1.181	2.451	3.363	3.776	4.560
2001	0.270	0.478	1.051	2.350	3.238	3.869	4.642
2002	0.292	0.641	1.435	2.251	2.711	3.334	4.474
2003	0.294	0.541	1.175	1.966	2.390	2.880	4.033
2004	0.242	0.511	0.859	1.508	2.779	3.917	4.624

2005	0.323	0.648	1.068	2.067	2.938	3.533	4.405
2006	0.326	0.515	0.898	1.584	2.154	2.899	3.786
2007	0.277	0.460	0.696	1.662	2.635	3.234	4.167
2008	0.302	0.523	1.000	1.989	2.812	3.343	4.066
2009	0.259	0.436	0.703	1.223	2.545	3.417	4.333
2010	0.255	0.435	0.683	1.019	2.229	3.686	4.660
2011	0.243	0.457	0.681	0.938	1.686	4.064	5.184
2012	0.184	0.464	0.669	1.037	2.265	3.700	5.282
2013	0.323	0.495	0.801	1.426	2.564	3.857	5.446
2014	0.248	0.486	0.791	1.679	2.749	3.463	4.635
2015	0.220	0.482	0.739	1.550	2.877	3.719	5.281
2016	0.242	0.527	0.897	1.677	3.106	4.328	5.132
2017	0.233	0.550	0.861	2.079	3.353	4.266	5.373
2018	0.289	0.552	0.850	1.614	3.275	4.023	5.275
2019	0.240	0.572	0.832	1.311	2.910	4.334	5.343
2020	0.272	0.511	0.784	1.287	2.387	3.862	5.312
2021	0.217	0.581	0.765	1.371	2.456	3.402	4.982

Table 8. Recreational harvest (A+B1) weight (MT) by State from 1985-2021. Based on MRIP AB1 seasonal length frequencies and L-W coefficients.

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	Total
1985	207	0	2,556	2,974	7,311	10,321	5,643	126	5,594	6,864	3,197	433	12	2,516	47,754
1986	509	250	7,957	6,082	7,645	13,809	20,186	336	4,305	3,467	8,133	684	18	2,089	75,470
1987	2,246	434	4,399	1,873	6,202	16,011	20,275	400	4,675	970	4,091	221	107	2,256	64,160
1988	546	143	3,375	1,952	2,770	6,326	8,666	301	6,549	1,271	2,340	50	25	2,161	36,475
1989	266	60	3,094	2,018	3,197	8,211	10,772	312	2,047	1,103	3,398	311	15	1,660	36,464
1990	382	144	3,371	1,582	3,526	6,774	6,758	221	1,131	962	4,794	263	23	1,620	31,553
1991	581	147	3,834	1,241	2,494	6,396	5,483	278	1,203	889	2,071	47	18	2,082	26,766
1992	371	84	1,921	1,334	2,529	6,431	5,179	509	692	328	1,217	46	16	1,874	22,533
1993	131	157	2,478	643	2,113	3,805	1,432	324	345	177	873	65	15	3,839	16,396
1994	581	90	3,625	402	2,051	3,151	1,484	154	343	187	399	128	2	1,580	14,176
1995	69	55	2,501	538	2,283	2,549	2,826	207	254	174	372	156	8	1,391	13,381
1996	17	22	1,582	649	1,015	1,076	3,804	392	431	343	627	46	34	723	10,760
1997	62	106	1,872	751	1,310	1,259	3,132	161	1,018	720	1,106	78	2	1,061	12,638
1998	22	29	1,251	1,057	1,235	1,974	5,114	267	831	358	885	166	23	2,202	15,414
1999	22	21	769	601	674	1,276	4,200	219	245	292	525	23	15	1,813	10,695
2000	0	7	1,186	1,104	615	1,920	2,424	176	720	231	821	107	17	1,812	11,141
2001	136	37	1,805	1,016	861	2,206	4,161	199	519	411	1,456	170	10	2,134	15,121
2002	118	113	974	1,031	813	2,674	2,530	165	387	192	1,056	122	2	3,728	13,904
2003	67	25	1,484	769	1,390	3,120	3,078	239	449	367	847	61	1	3,156	15,053
2004	106	65	1,213	1,071	1,617	5,106	3,506	118	266	357	1,312	204	0	2,629	17,570
2005	162	56	1,775	609	1,013	3,337	6,576	219	331	366	1,397	216	7	1,880	17,945
2006	24	29	3,271	1,030	1,919	3,085	2,887	164	656	562	1,243	132	3	1,906	16,912
2007	186	72	1,727	732	2,602	4,393	3,638	208	750	365	1,652	212	7	1,837	18,382

2008	202	27	2,015	989	2,492	3,834	3,509	113	479	357	1,148	94	6	2,144	17,410
2009	14	2	1,722	291	1,547	4,001	3,928	154	968	142	1,606	207	2	3,755	18,339
2010	53	13	3,918	258	2,841	4,138	2,762	53	466	659	1,463	449	10	4,184	21,269
2011	4	4	2,443	321	1,564	4,050	2,084	65	399	72	1,450	455	2	2,791	15,706
2012	40	28	2,290	836	2,643	3,128	2,877	47	193	159	1,350	228	4	1,469	15,291
2013	101	0	2,862	987	2,392	3,381	2,808	29	61	146	1,609	278	5	1,075	15,732
2014	2	4	1,555	495	1,049	2,289	2,496	137	221	100	1,715	211	14	2,035	12,324
2015	6	40	1,450	234	1,324	3,702	2,684	176	207	254	1,712	212	11	1,712	13,725
2016	0	0	451	167	478	2,220	3,693	263	134	184	1,477	311	2	1,253	10,634
2017	0	0	644	253	370	2,998	3,402	876	162	165	1,770	239	2	4,740	15,620
2018	0	0	270	93	150	618	886	139	218	117	1,161	178	31	1,997	5,857
2019	0	0	314	407	508	1,539	726	182	68	254	1,316	220	10	1,257	6,800
2020	0	1	241	222	259	645	789	41	94	133	926	67	4	2,500	5,923
2021	2	2	366	316	91	1,033	1,474	4	52	67	453	47	6	1,560	5,471

Table 9. Recreational harvest (A+B1) numbers (000s) by State from 1985-2021

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	Tot
1985	79	0	891	2,308	5,848	10,802	4,867	146	4,352	2,243	3,707	940	49	4,762	40,
1986	175	53	2,774	2,616	4,719	12,361	10,608	453	2,242	1,450	5,185	519	36	4,307	47,
1987	501	84	1,935	2,758	5,826	8,993	8,934	225	2,691	833	3,248	664	65	3,553	40,
1988	93	30	991	1,383	2,132	3,191	2,943	324	1,639	396	3,131	230	18	3,180	19,
1989	76	13	876	2,216	3,515	12,503	7,548	389	1,306	1,788	4,844	1,026	42	2,708	38,
1990	76	31	986	1,529	2,844	7,666	4,147	440	1,066	1,390	6,839	602	133	3,188	30,
1991	145	36	1,803	803	4,558	8,445	4,272	240	1,122	912	2,424	117	39	2,402	27,
1992	81	18	578	543	3,033	2,195	3,413	401	575	334	1,563	67	18	7,361	20,
1993	38	32	870	391	1,227	2,710	1,327	233	200	121	1,620	222	12	6,366	15,
1994	125	20	874	603	927	3,587	1,557	258	622	508	673	289	6	3,014	13,
1995	18	12	861	352	1,171	2,256	2,353	410	296	365	661	455	20	2,304	11,
1996	20	7	608	1,065	1,451	1,386	2,299	424	695	870	632	240	22	1,406	11,
1997	23	26	581	1,098	1,376	2,275	1,616	278	879	630	1,476	251	7	1,884	12,
1998	5	8	402	642	1,135	2,291	2,028	286	646	509	1,530	567	70	3,278	13,
1999	15	8	709	1,115	1,210	3,176	3,826	343	290	354	1,775	132	59	3,865	16,
2000	0	2	402	664	658	1,854	2,248	231	641	352	2,326	461	66	2,975	12,
2001	36	11	740	1,273	1,187	2,811	3,055	219	705	448	3,410	430	34	3,691	18,
2002	52	34	397	951	1,247	2,088	3,055	259	329	432	2,485	428	5	5,846	17,
2003	31	9	846	723	848	2,907	3,418	244	398	344	2,162	190	2	4,290	16,
2004	37	26	517	528	1,013	4,919	3,357	289	543	524	2,825	482	1	3,571	18,
2005	79	21	853	649	419	4,244	4,408	285	298	659	3,005	667	17	2,737	18,
2006	14	13	1,194	1,091	854	5,231	2,186	220	1,079	956	2,843	716	8	2,994	19,
2007	86	29	934	576	794	3,484	3,202	376	1,146	806	3,750	751	22	3,234	19,
2008	78	9	788	457	833	2,606	2,048	160	1,075	914	2,855	288	17	2,717	14,
2009	10	1	688	395	564	2,907	2,161	301	1,517	381	3,190	461	6	5,502	18,
2010	26	4	1,361	406	1,482	2,878	3,036	98	739	1,018	3,692	1,115	27	6,046	21,

2011	2	1	684	414	697	3,344	3,934	124	731	246	3,614	1,439	10	5,575	20,
2012	22	33	977	2,312	1,399	3,785	3,133	95	349	525	2,684	924	21	2,319	18,
2013	67	0	1,520	658	3,476	2,830	2,322	57	119	479	4,288	2,106	17	2,037	19,
2014	1	2	739	463	1,179	4,847	4,557	333	396	424	4,419	820	70	3,262	21,
2015	1	8	693	90	501	2,438	1,765	235	287	532	4,123	921	49	2,081	13,
2016	0	0	977	145	554	2,078	3,282	110	212	425	4,489	1,123	12	1,492	14,
2017	0	0	595	419	586	3,063	3,047	261	176	173	3,173	752	9	1,591	13,
2018	0	0	182	120	312	1,204	1,421	76	275	443	3,305	765	91	2,052	10,
2019	0	0	266	380	670	3,037	742	151	112	757	2,753	877	26	2,366	12,
2020	0	0	162	221	298	886	595	54	174	396	2,108	289	11	4,142	9,3
2021	1	1	117	141	264	861	922	14	106	216	982	173	14	2,374	6,1

Table 10. Recreational release (B2) numbers (000s) by State from 1985-2021

Year	ME	NH	MA	RI	CT	NY	NJ	DE	MD	VA	NC	SC	GA	FL	Tot
1985	19	14	410	253	424	3,342	1,990	157	421	326	1,281	497	93	600	9,8
1986	45	20	1,788	112	229	2,941	2,331	104	661	506	1,234	188	50	502	10,
1987	373	13	1,118	727	473	4,291	3,389	181	734	353	1,402	163	40	468	13,
1988	39	2	559	88	60	1,202	697	33	367	530	1,002	123	12	474	5,1
1989	6	12	411	437	339	3,828	4,093	372	852	642	2,314	816	54	625	14,
1990	43	7	739	820	697	3,300	2,021	214	664	585	2,428	351	360	730	12,
1991	246	33	1,193	607	767	3,167	3,686	106	1,032	833	1,479	73	117	760	14,
1992	87	26	850	593	809	1,349	1,445	235	210	320	1,958	66	63	1,258	9,2
1993	19	47	899	408	497	2,193	1,483	170	448	241	1,825	189	39	3,599	12,
1994	63	11	645	467	557	2,735	1,856	141	361	747	3,236	390	44	4,307	15,
1995	11	9	1,114	206	370	1,221	1,410	360	452	543	2,345	723	123	4,666	13,
1996	85	14	1,116	1,313	714	2,068	2,475	293	892	842	1,614	251	114	2,949	14,
1997	87	4	1,391	859	1,112	3,066	2,059	384	1,581	1,128	2,286	588	37	3,465	18,
1998	0	2	1,192	652	999	1,816	2,339	496	1,041	754	1,530	555	240	3,499	15,
1999	18	14	1,379	3,086	1,780	5,731	7,141	1,019	852	439	2,749	335	45	11,128	35,
2000	2	2	1,289	1,625	1,577	7,883	4,900	649	1,728	629	5,232	729	173	7,806	34,
2001	72	21	2,728	3,140	2,825	8,378	5,282	563	1,373	1,109	6,756	525	124	9,567	42,
2002	74	26	1,352	2,704	1,216	2,724	5,008	1,304	891	727	4,358	815	74	10,930	32,
2003	39	24	2,098	1,891	983	2,779	3,717	292	1,014	663	3,433	437	34	3,931	21,
2004	103	19	2,088	1,686	1,677	7,321	5,161	1,028	1,382	1,290	3,781	1,303	28	3,741	30,
2005	98	68	3,121	1,118	916	8,477	6,094	437	555	885	4,418	976	81	2,896	30,
2006	111	40	3,005	1,093	2,762	6,200	4,236	807	1,676	1,059	5,213	2,262	67	6,382	34,
2007	150	24	1,782	1,354	1,416	4,867	5,622	1,341	1,784	2,051	6,740	2,610	358	7,024	37,
2008	134	5	2,153	1,054	1,599	7,771	3,883	484	2,906	1,355	5,147	788	301	3,618	31,
2009	58	13	3,064	459	654	5,218	6,408	751	1,813	945	6,448	621	163	5,169	31,
2010	22	3	3,060	173	1,552	5,079	6,367	210	572	1,100	7,420	1,160	249	13,455	40,
2011	10	3	1,877	1,185	1,958	5,001	6,867	396	1,037	470	7,150	2,911	124	8,484	37,
2012	144	16	1,808	1,356	1,495	7,100	6,407	400	521	723	3,268	615	148	8,079	32,

2013	65	0	1,644	2,000	1,594	4,248	3,540	161	723	535	7,051	1,914	42	10,002	33,
2014	0	9	2,888	257	1,062	6,228	7,411	802	491	548	5,863	1,470	261	6,293	33,
2015	0	0	479	1,412	890	5,090	4,001	464	662	684	6,356	2,597	427	5,361	28,
2016	0	0	1,059	587	818	3,368	7,084	359	556	566	6,803	1,583	96	4,751	27,
2017	0	0	528	116	1,763	3,936	7,677	612	197	384	8,256	3,105	30	1,716	28,
2018	0	0	532	152	505	2,702	2,512	536	418	428	7,912	1,530	295	3,161	20,
2019	0	0	471	612	820	3,339	2,569	430	227	1,125	7,162	5,571	247	3,920	26,
2020	0	0	744	869	1,109	2,816	2,777	166	320	777	6,558	1,898	176	3,135	21,
2021	5	0	738	634	916	2,705	1,973	166	211	503	3,539	550	123	11,502	23,

Table 11. Recreational release numbers (B2 000s) by season and region (North = ME-VA, South = NC-FL) 1985-2021

Year	Spring South	Spring North	Fall South	Fall North	Total
1985	992	331	1,480	7,024	9,827
1986	1,096	1,128	879	7,610	10,712
1987	899	945	1,175	10,706	13,725
1988	703	903	909	2,673	5,187
1989	630	376	3,180	10,616	14,802
1990	1,339	1,552	2,529	7,538	12,958
1991	898	1,177	1,530	10,493	14,098
1992	1,859	971	1,486	4,951	9,267
1993	2,090	626	3,563	5,779	12,058
1994	3,732	1,066	4,245	6,518	15,561
1995	4,661	1,152	3,196	4,542	13,551
1996	2,784	1,490	2,143	8,321	14,738
1997	2,192	1,511	4,184	10,160	18,047
1998	3,587	1,012	2,238	8,278	15,114
1999	5,632	1,312	8,626	20,148	35,717
2000	9,939	2,489	4,001	17,795	34,223
2001	7,002	2,083	9,970	23,408	42,464
2002	10,662	2,633	5,514	13,393	32,203
2003	3,612	3,066	4,223	10,434	21,334
2004	4,378	2,983	4,474	18,772	30,607
2005	3,471	7,002	4,901	14,768	30,141
2006	7,291	3,976	6,634	17,012	34,913
2007	9,066	5,760	7,666	14,632	37,124
2008	4,433	4,835	5,421	16,510	31,200
2009	5,427	3,137	6,972	16,245	31,781
2010	13,361	5,921	8,922	12,216	40,421
2011	6,726	1,872	11,944	16,934	37,476
2012	7,450	2,617	4,660	17,352	32,080
2013	11,869	3,679	7,140	10,813	33,501
2014	6,588	1,633	7,299	17,967	33,486
2015	6,416	3,556	8,326	10,022	28,320

2016	4,738	2,344	8,494	12,053	27,629
2017	4,305	1,887	8,801	13,324	28,317
2018	4,783	1,285	8,115	6,500	20,683
2019	13,253	2,091	3,649	7,502	26,495
2020	7,437	1,425	4,331	8,153	21,346
2021	11,196	2,147	4,518	5,705	23,566

Table 12. Recreational release length samples by source and season 1985-2021

Year	ALS		CT		i9		NJ		RI		SC		Total	Total	Total
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	ALL
1985											3	3	3	3	6
1986											4	16	4	16	20
1987		1									7	7	7	8	15
1988		1									19	26	19	27	46
1989	5	58									32	81	37	139	176
1990	282	827									59	69	341	896	1,237
1991	313	832									23	64	336	896	1,232
1992	684	1,084									43	100	727	1,184	1,911
1993	315	699									22	67	337	766	1,103
1994	306	473	196	776							20	64	522	1,313	1,835
1995	394	609	341	1,186							26	113	761	1,908	2,669
1996	433	920	219	1,107							12	139	664	2,166	2,830
1997	223	974	180	1,461							86	271	489	2,706	3,195
1998	170	1,101	290	1,906							235	377	695	3,384	4,079
1999	232	464	226	1,074							84	120	542	1,658	2,200
2000	192	724	265	1,339							30	127	487	2,190	2,677
2001	221	817	83	1,414							17	72	321	2,303	2,624
2002	330	1,411	188	1,951							32	113	550	3,475	4,025
2003	652	1,176	223	1,353							26	27	901	2,556	3,457
2004	501	1,867	136	1,833	290	243					3	53	930	3,996	4,926
2005	527	761	187	1,276	1,395	1,035					8	92	2,117	3,164	5,281
2006	277	1,028	133	1,439	10	212					12	49	432	2,728	3,160
2007	489	1,126	236	1,311	37	248					28	37	790	2,722	3,512
2008	315	579	299	1,310	8	1,534	94	128			22	2	738	3,553	4,291
2009	245	530	153	497	111	290	46	47			1	2	556	1,366	1,922
2010	301	629	65	538	13	1,073	64	62	87	200		12	530	2,514	3,044
2011	133	436	52	582	4	587	64	165	98	444		3	351	2,217	2,568
2012	203	511	207	956	12	1,193	51	86	35	111			508	2,857	3,365
2013	211	532	135	498	11	428	19	56	15	54	1		392	1,568	1,960
2014	183	254	41	566	28	853	40	106	2	6	3		297	1,785	2,082
2015	200	108	94	324	7	124	199	206	1	35			501	797	1,298
2016	103	100	27	845	180	242	81	101	16	67	2		409	1,355	1,764

2017	223	72	53	291	2	210	47	62	3	158			328	793	1,121
2018	86	86	4	146	4	226	20	105					114	563	677
2019	64	93	75	474	9	223	16	128	6	8			170	926	1,096
2020	22	29	29	130	9	254	29	106	29	59			118	578	696
2021	8	33	55	126	5	30	5	42		19			73	250	323
Total	8,843	20,945	4,192	26,709	2,135	9,005	775	1,400	292	1,161	860	2,106	17,097	61,326	78,423

Table 13. Annual total bluefish catch (MT) by component from 1985-2021

Year	Com Land	Com Disc	Rec Land	Rec Disc	Total Catch
1985	6,124		47,754	1,045	54,923
1986	6,657		75,470	1,611	83,738
1987	6,579		64,160	2,012	72,750
1988	7,162		36,475	905	44,542
1989	4,740	29	36,464	1,279	42,511
1990	6,250	32	31,553	1,976	39,811
1991	6,138	116	26,766	2,486	35,506
1992	5,208	38	22,533	1,769	29,548
1993	4,819	32	16,396	2,369	23,617
1994	4,306	162	14,176	3,140	21,783
1995	3,629	81	13,381	2,516	19,607
1996	4,213	166	10,760	2,756	17,895
1997	4,113	53	12,638	3,640	20,444
1998	3,741	74	15,414	2,995	22,224
1999	3,335	79	10,695	6,863	20,972
2000	3,660	83	11,141	6,289	21,174
2001	3,956	23	15,121	7,271	26,370
2002	3,116	37	13,904	4,581	21,638
2003	3,361	22	15,053	2,120	20,556
2004	3,673	62	17,570	4,744	26,050
2005	3,213	26	17,945	4,055	25,239
2006	3,354	34	16,912	5,708	26,009
2007	3,390	27	18,382	5,815	27,614
2008	2,731	22	17,410	5,428	25,591
2009	3,119	33	18,339	4,767	26,258
2010	3,304	87	21,269	6,384	31,044
2011	2,454	95	15,706	3,815	22,070
2012	2,212	14	15,291	2,833	20,350
2013	1,977	12	15,732	2,472	20,194
2014	2,251	18	12,324	2,880	17,473
2015	1,917	14	13,725	3,689	19,345
2016	1,946	14	10,634	1,837	14,431
2017	1,876	7	15,620	1,793	19,297
2018	1,105	8	5,857	1,579	8,548

2019	1,359	10	6,800	1,702	9,871
2020	1,112	9	5,923	1,253	8,296
2021	1,090	12	5,471	1,391	7,963

Figures

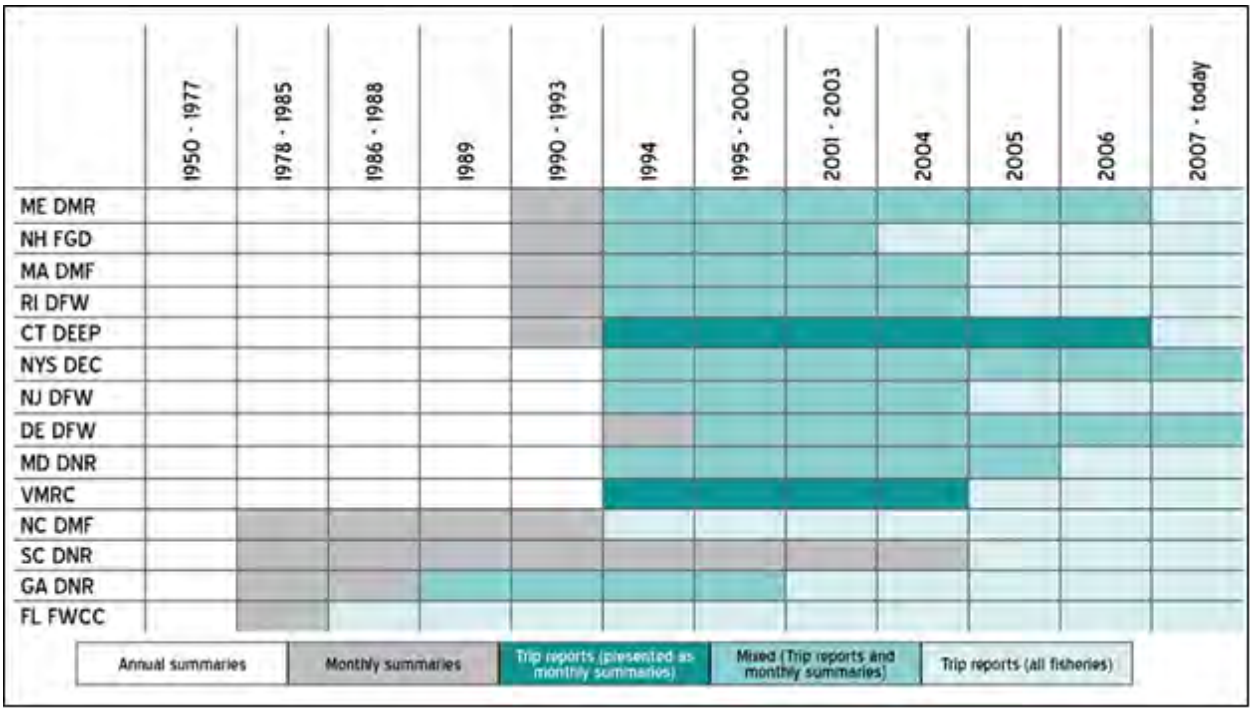

Figure 1. ACCSP data sources and collection methods.

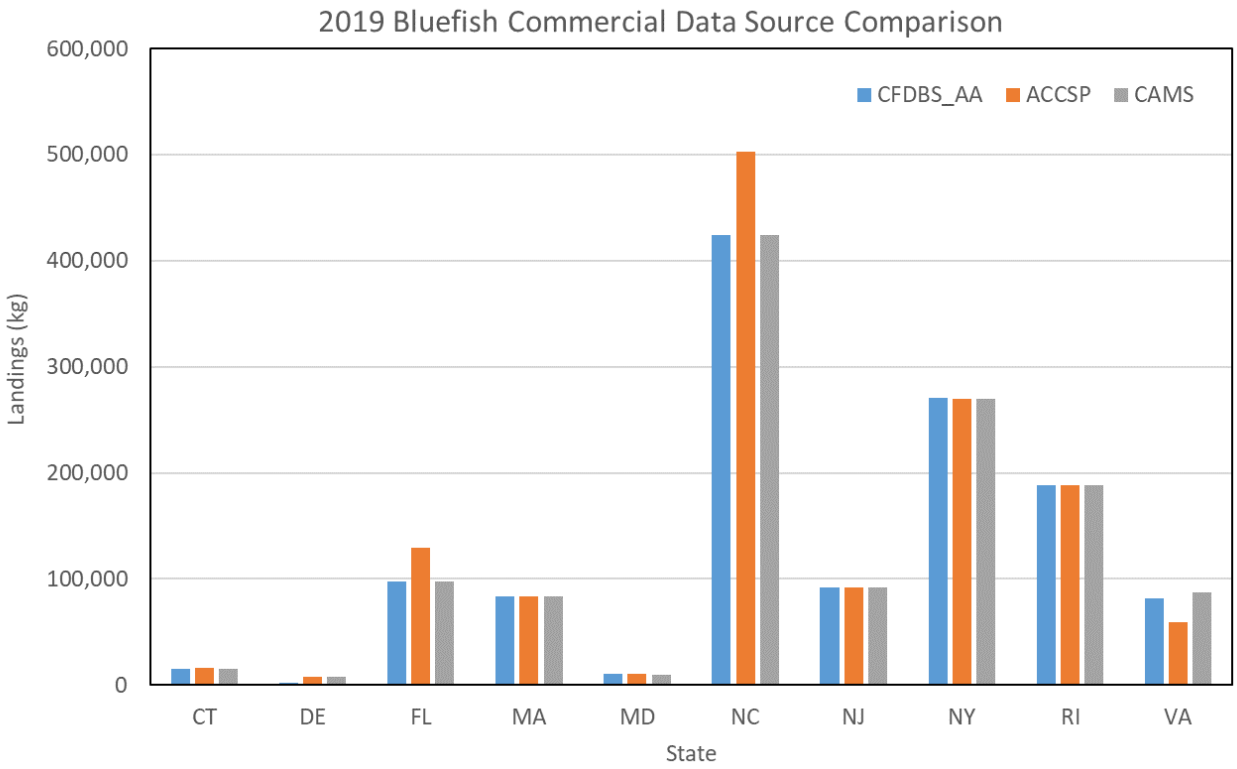

Figure 2. Comparison of commercial landings by data source (CAMS, CFDBS_AA, and ACCSP) and state for 2019

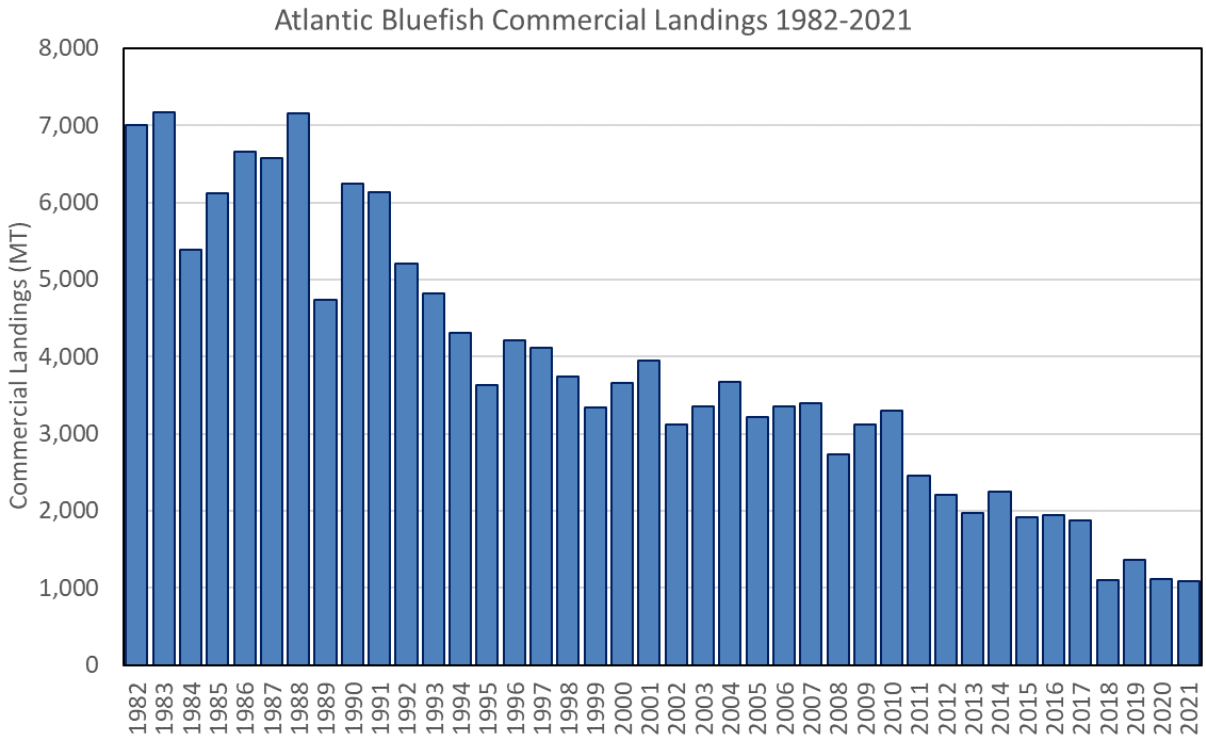

Figure 3. Atlantic bluefish commercial landings along the East coast of the USA from 1982 to 2021.

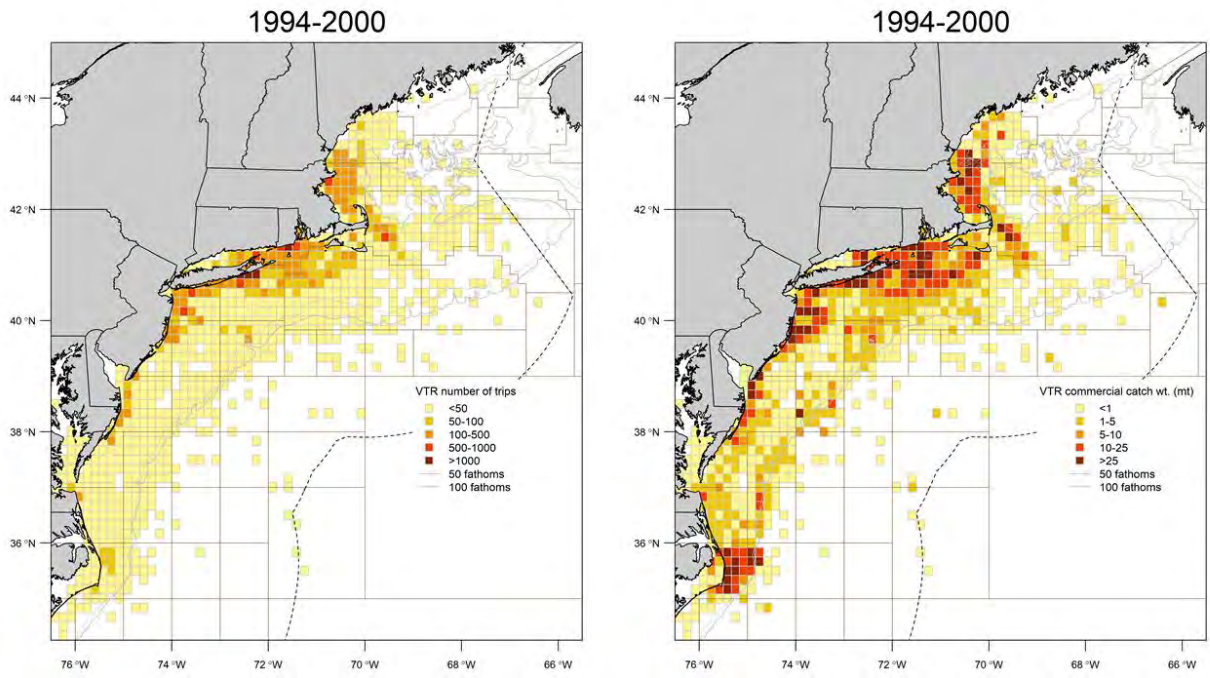

Figure 4. Spatial distribution of bluefish commercial number of trips and catch (1994-2000) as reported through Vessel Trip Reports (VTR). Source: NEFSC

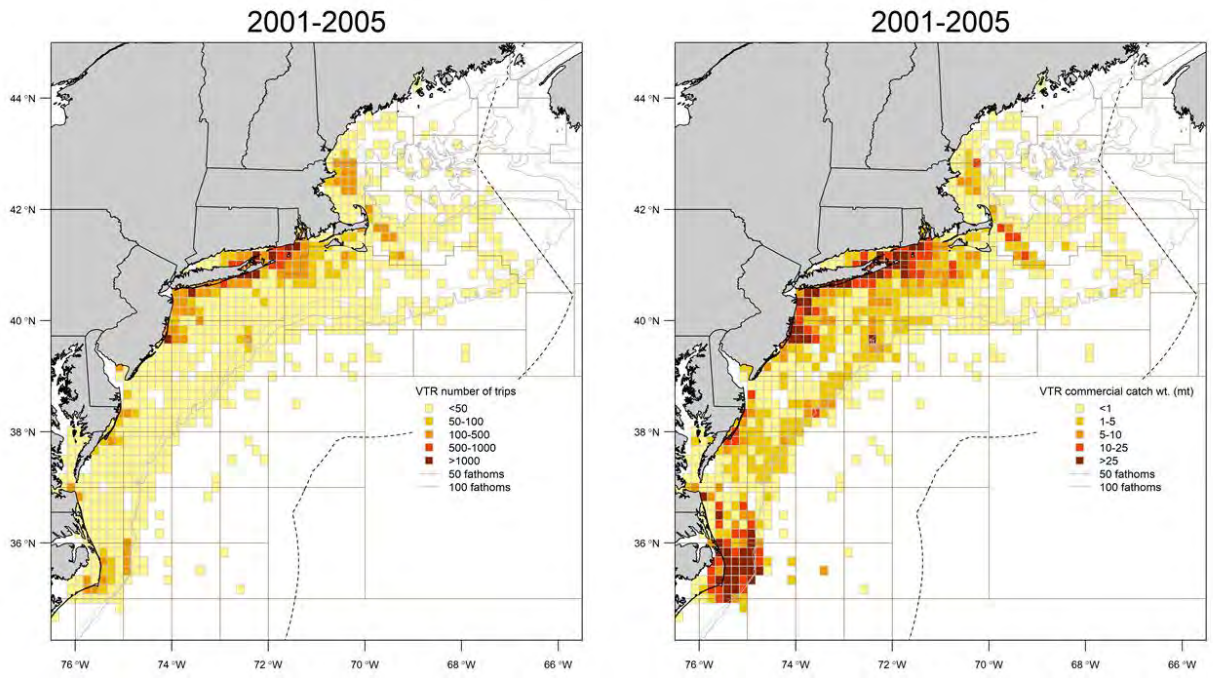

Figure 5. Spatial distribution of bluefish commercial number of trips and catch (2001-2005) as reported through Vessel Trip Reports (VTR). Source: NEFSC

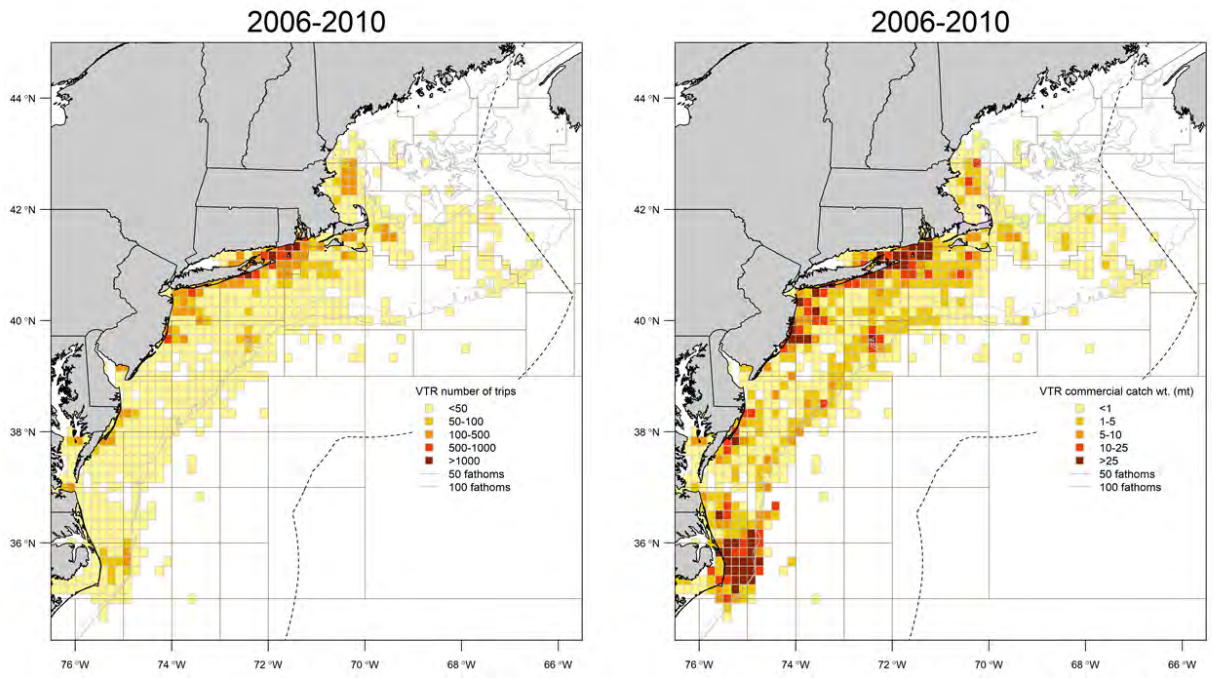

Figure 6. Spatial distribution of bluefish commercial number of trips and catch (2006-2010) as reported through Vessel Trip Reports (VTR). Source: NEFSC

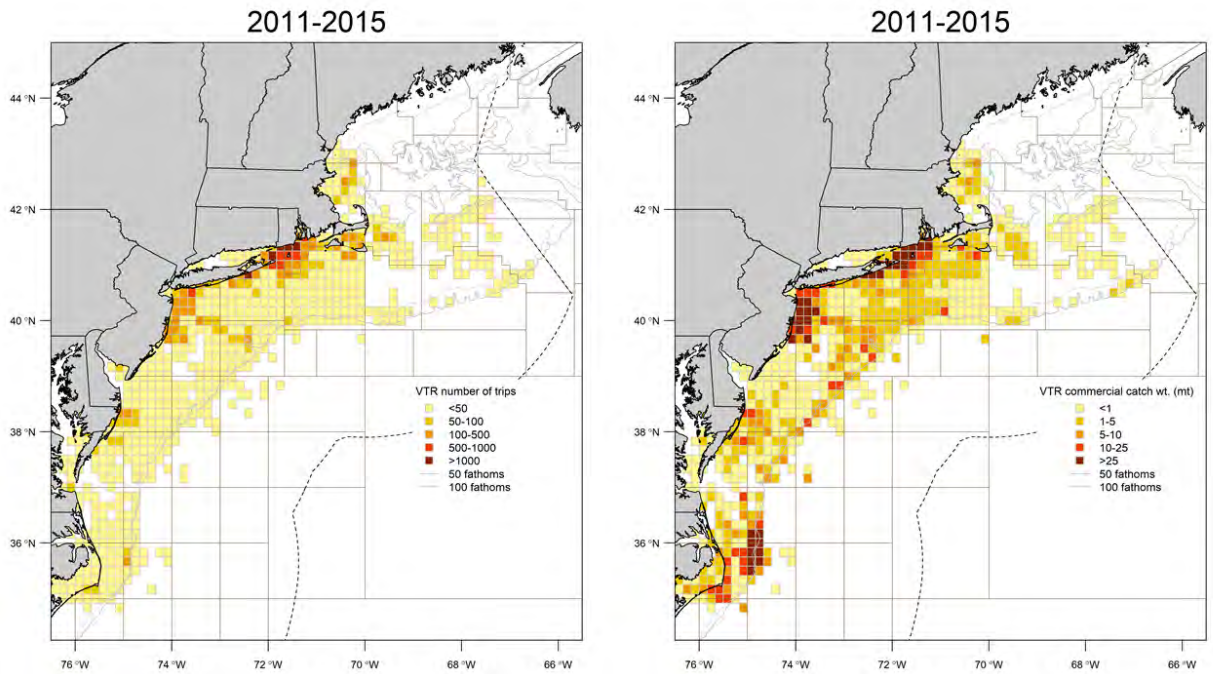

Figure 7. Spatial distribution of bluefish commercial number of trips and catch (2011-2015) as reported through Vessel Trip Reports (VTR). Source: NEFSC

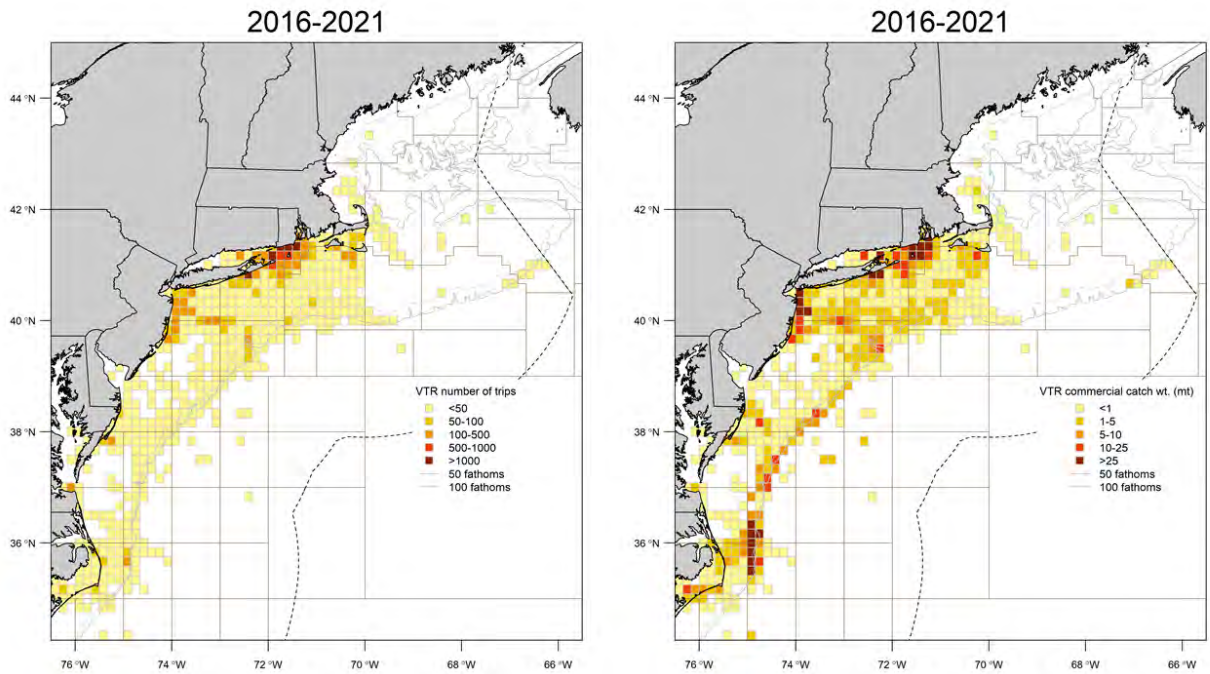

Figure 8. Spatial distribution of bluefish commercial number of trips and catch (2016-2021) as reported through Vessel Trip Reports (VTR). Source: NEFSC

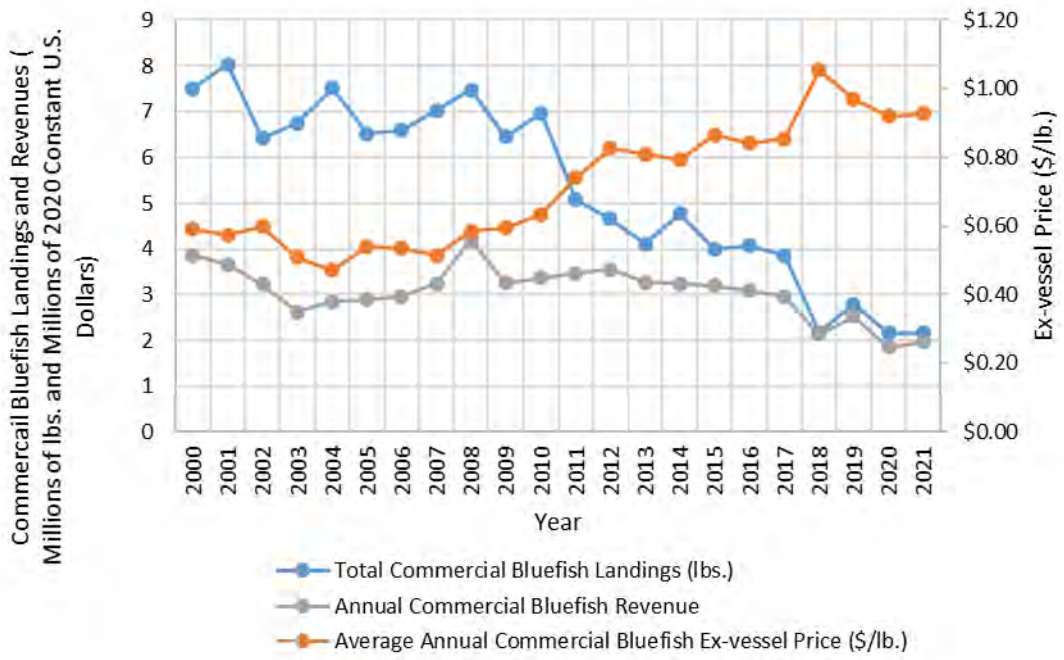

Figure 9. Landings, ex-vessel value, and price for bluefish, 2000-2021. Source: ACCSP Data Warehouse. Prices are not adjusted for inflation.

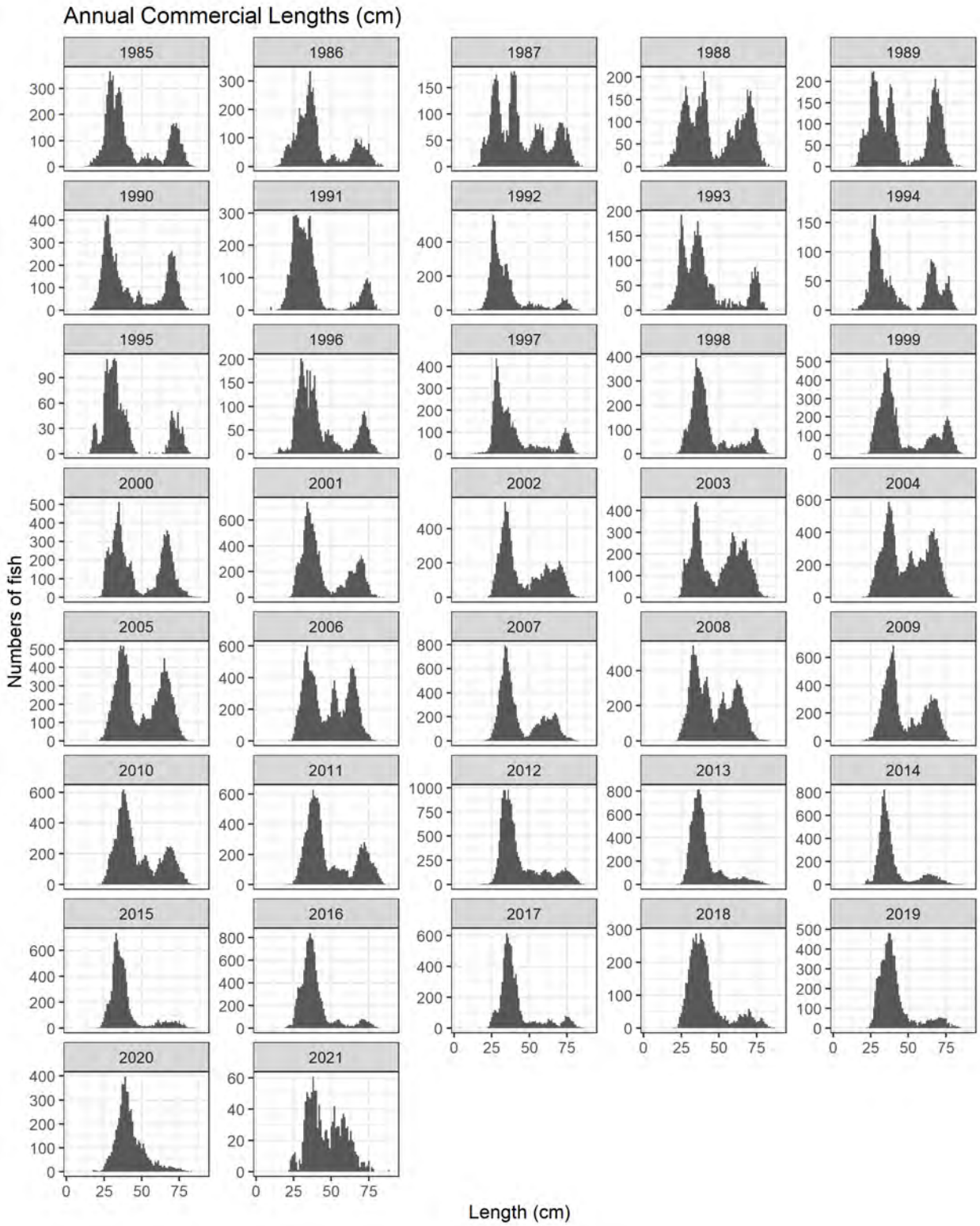

Figure 10. Annual commercial bluefish length distributions from 1985 to 2021.

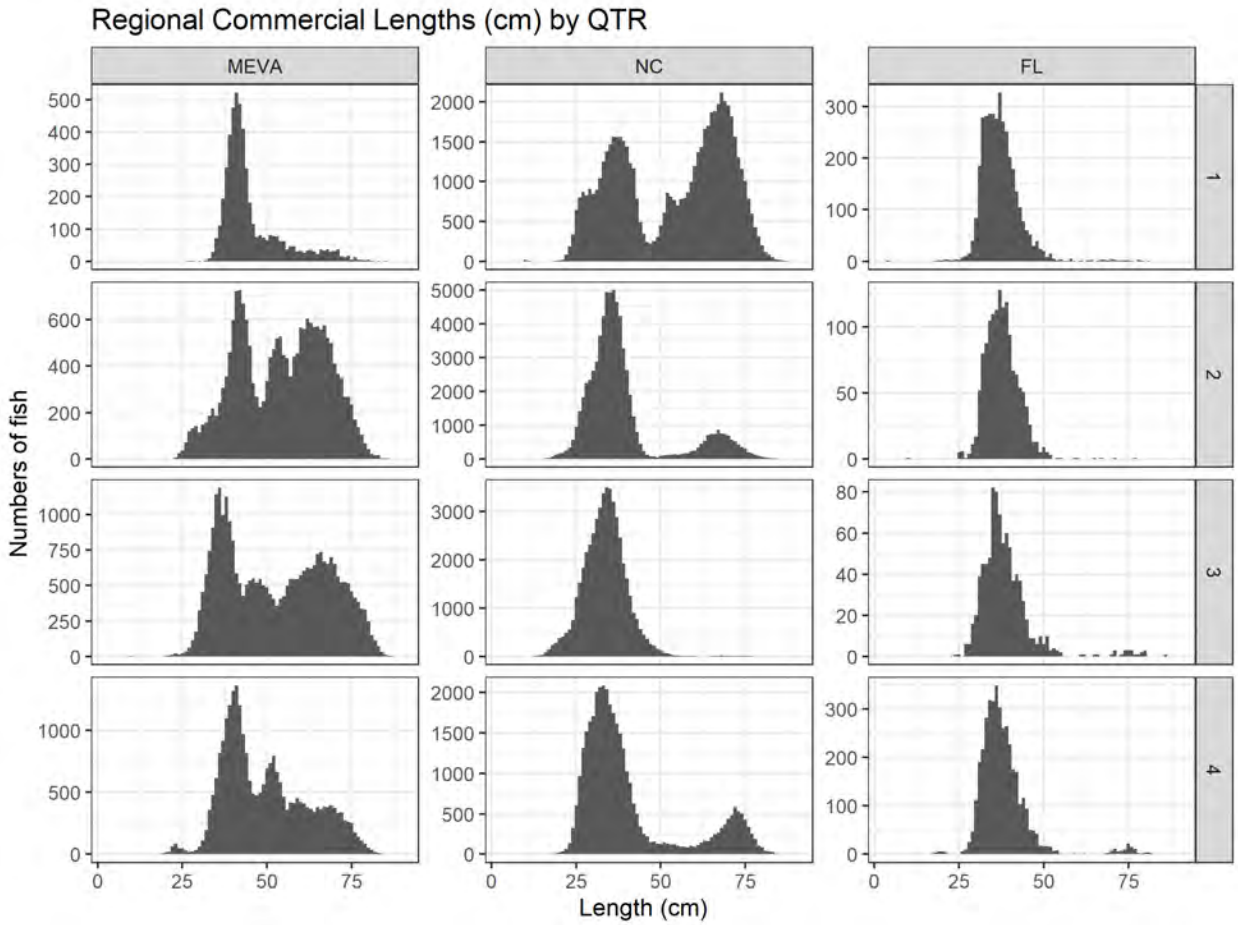

Figure 11. Commercial bluefish length distributions by regional group (MEVA = Maine to Virginia, NC = North Carolina, and FL = Florida) and quarter of year

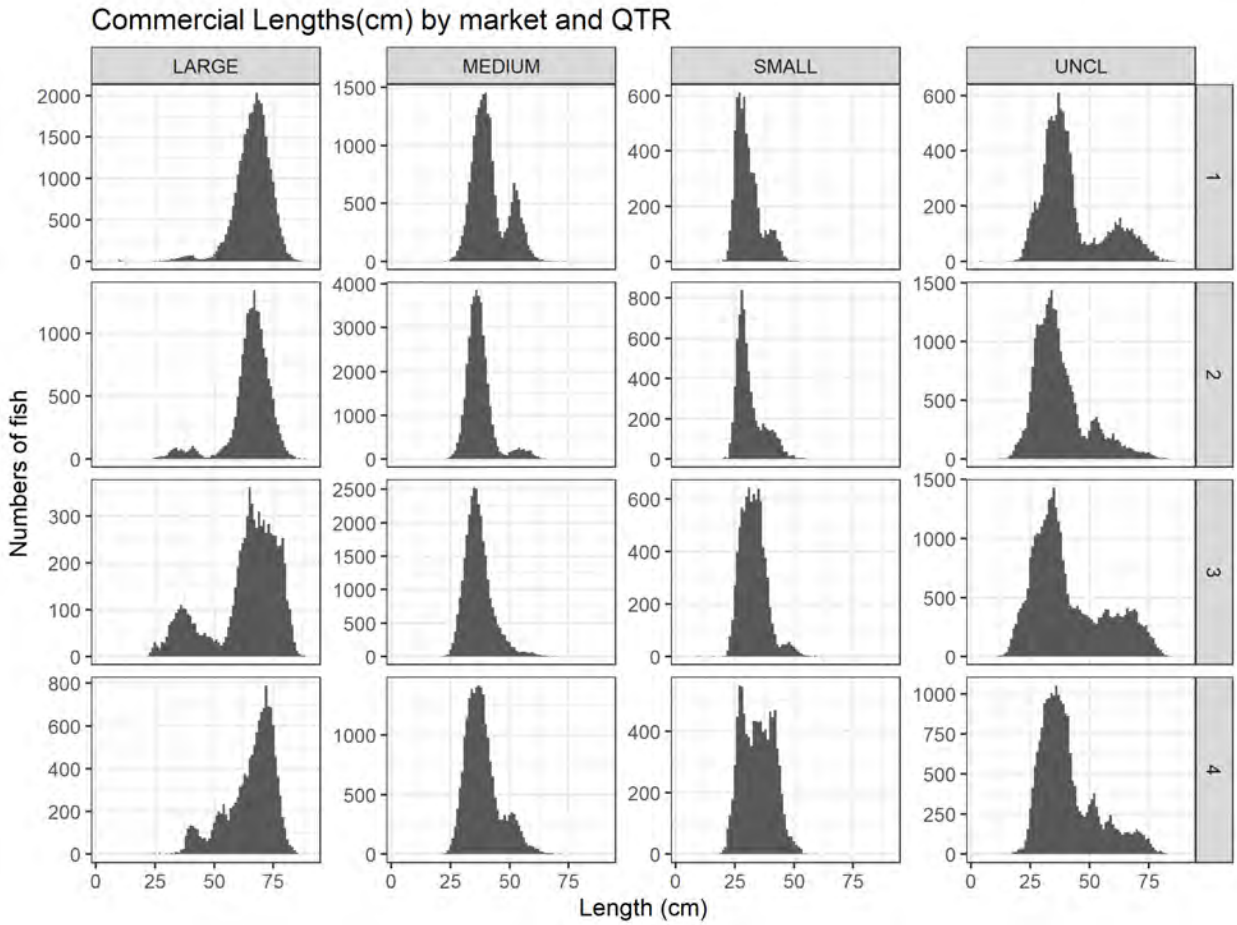

Figure 12. Commercial bluefish length distributions by market category and quarter of year

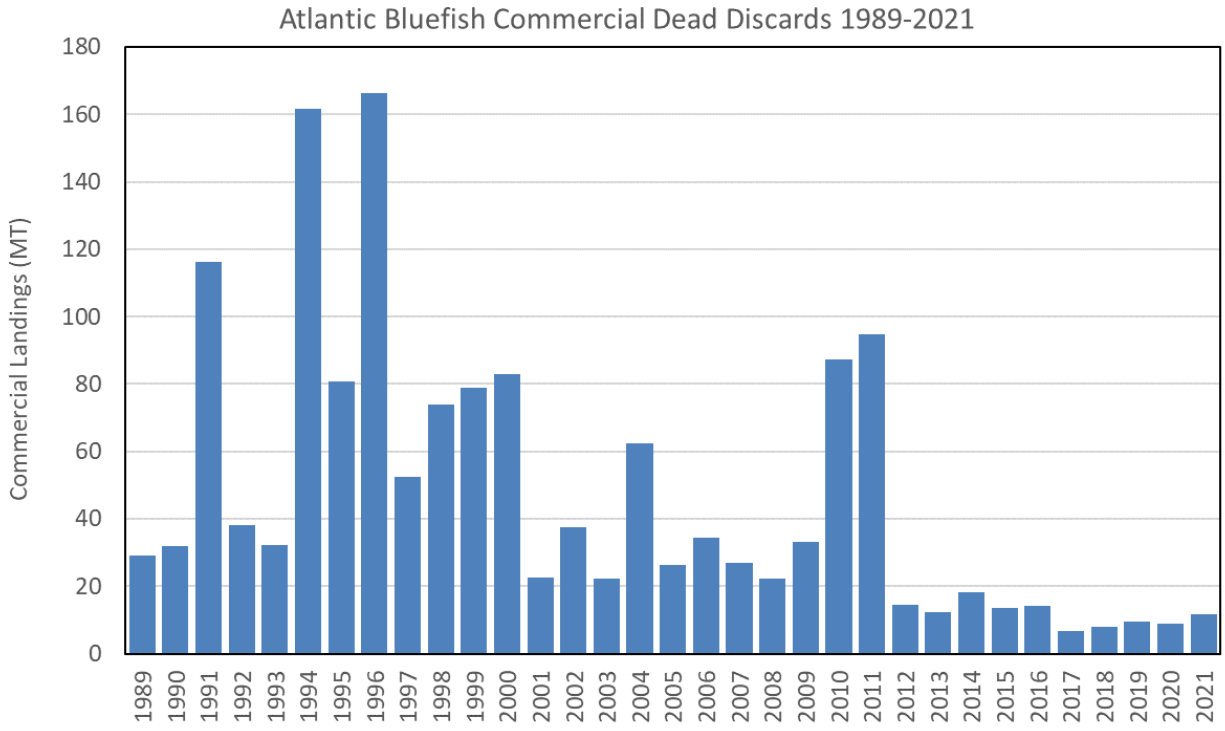

Figure 13. Commercial dead discards for bluefish from 1989-2021

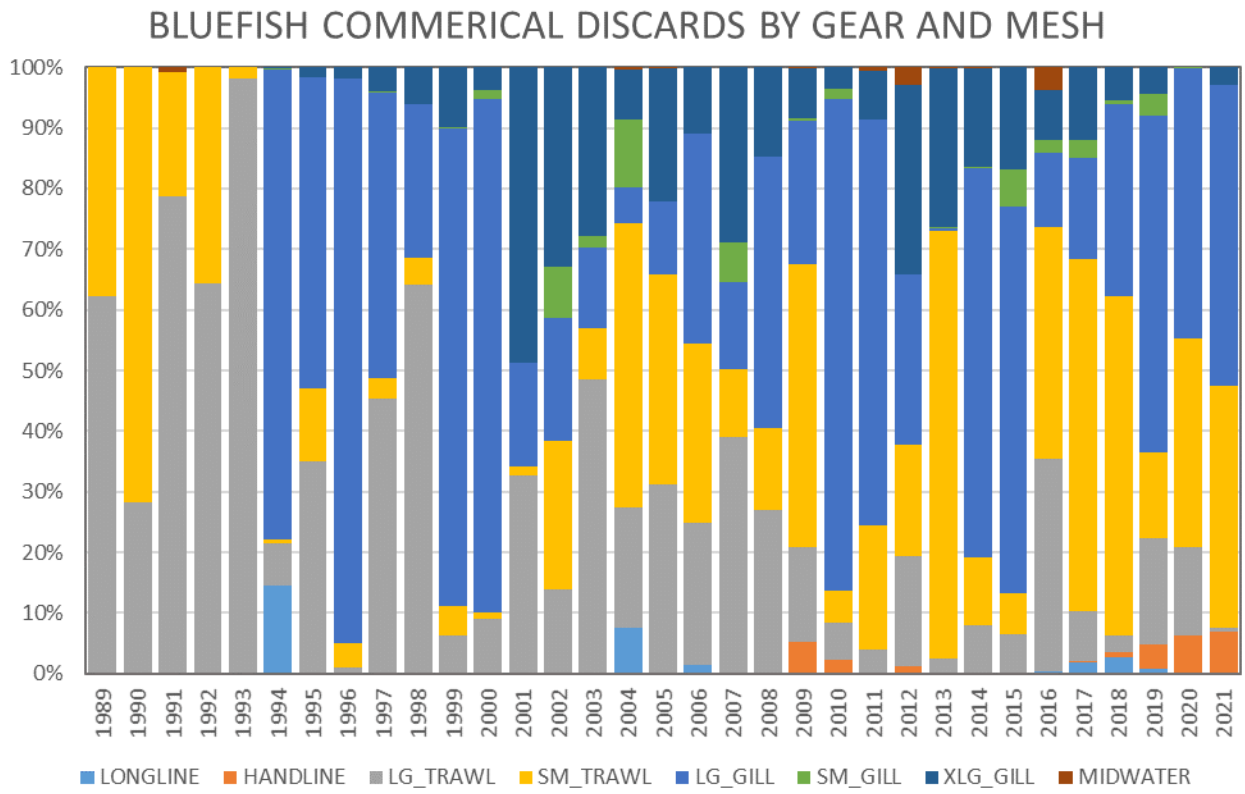

Figure 14. Commercial discards for bluefish by gear from 1989-2021

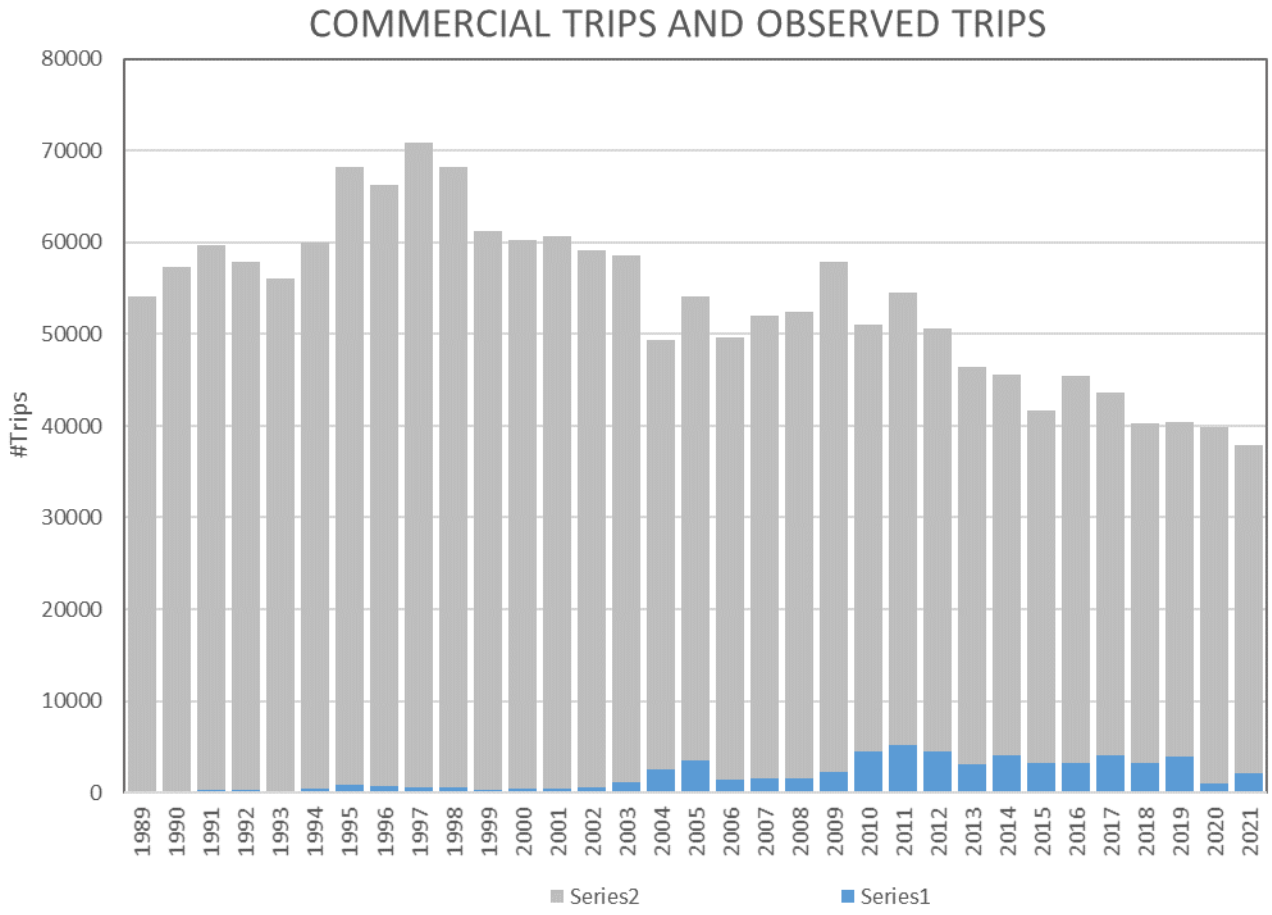

Figure 15. Commercial bluefish trips and observed trips from 1989-2021

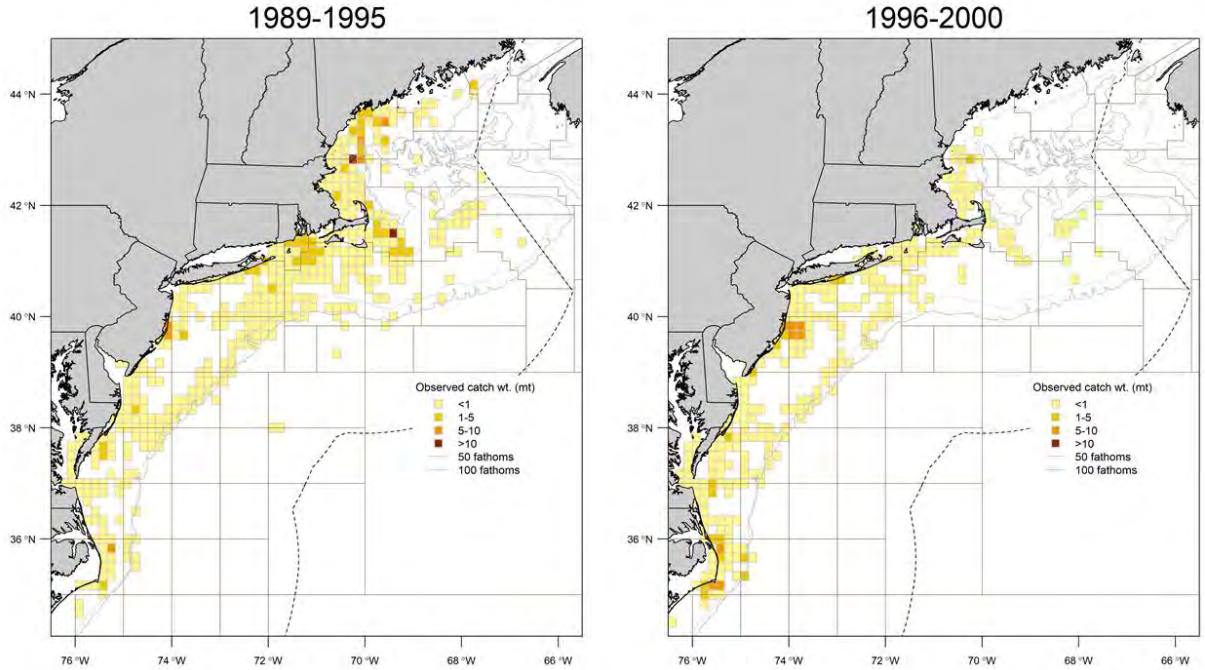

Figure 16. Commercial bluefish observed trips grouped from 1989-1995, and 1996-2000

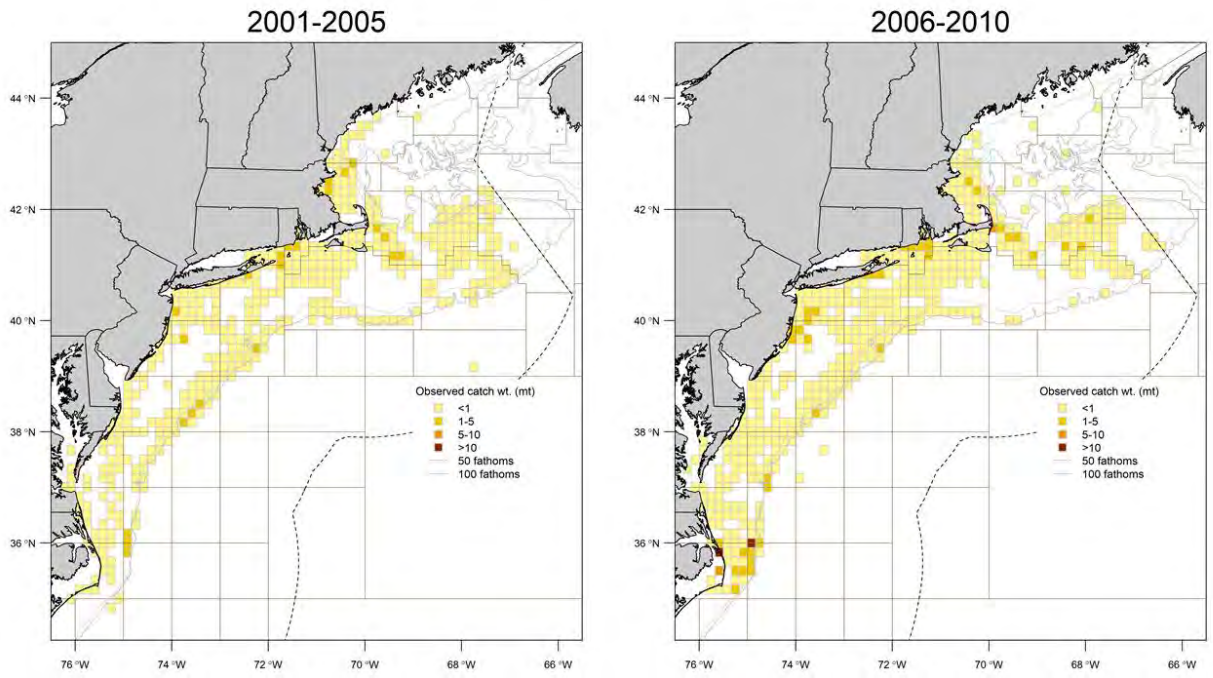

Figure 17. Commercial bluefish observed trips grouped from 2001-2005, and 2006-2010

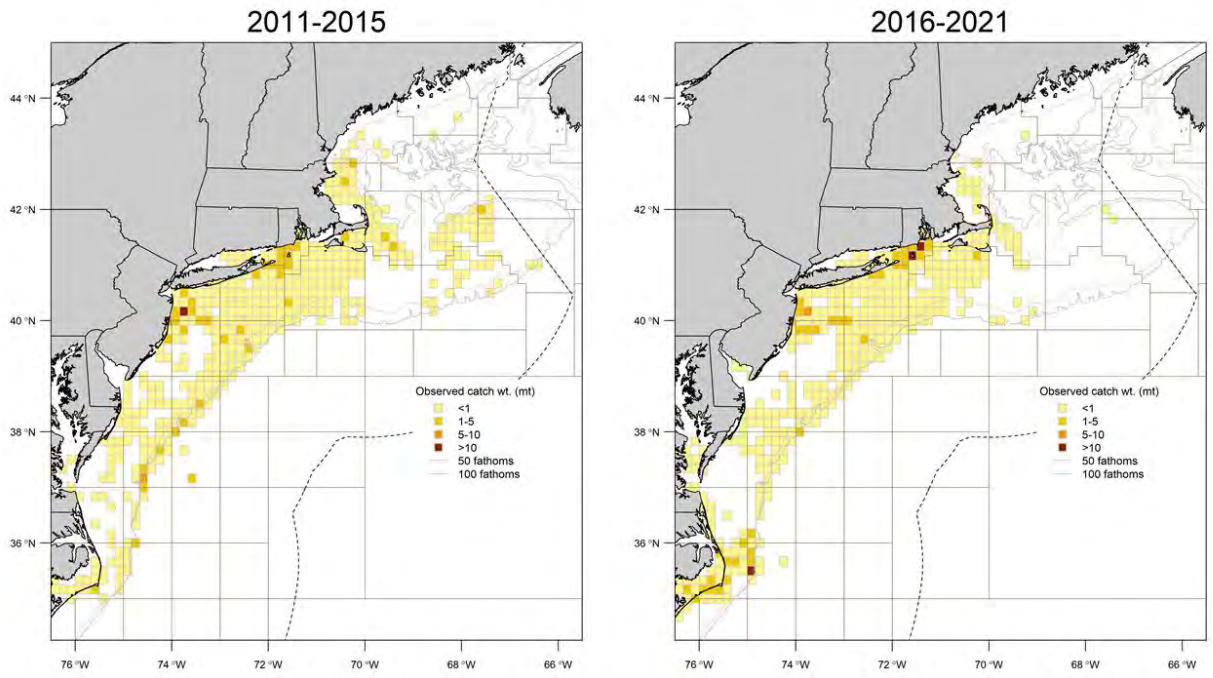

Figure 18. Commercial bluefish observed trips grouped from 2011-2015, and 2016-2021

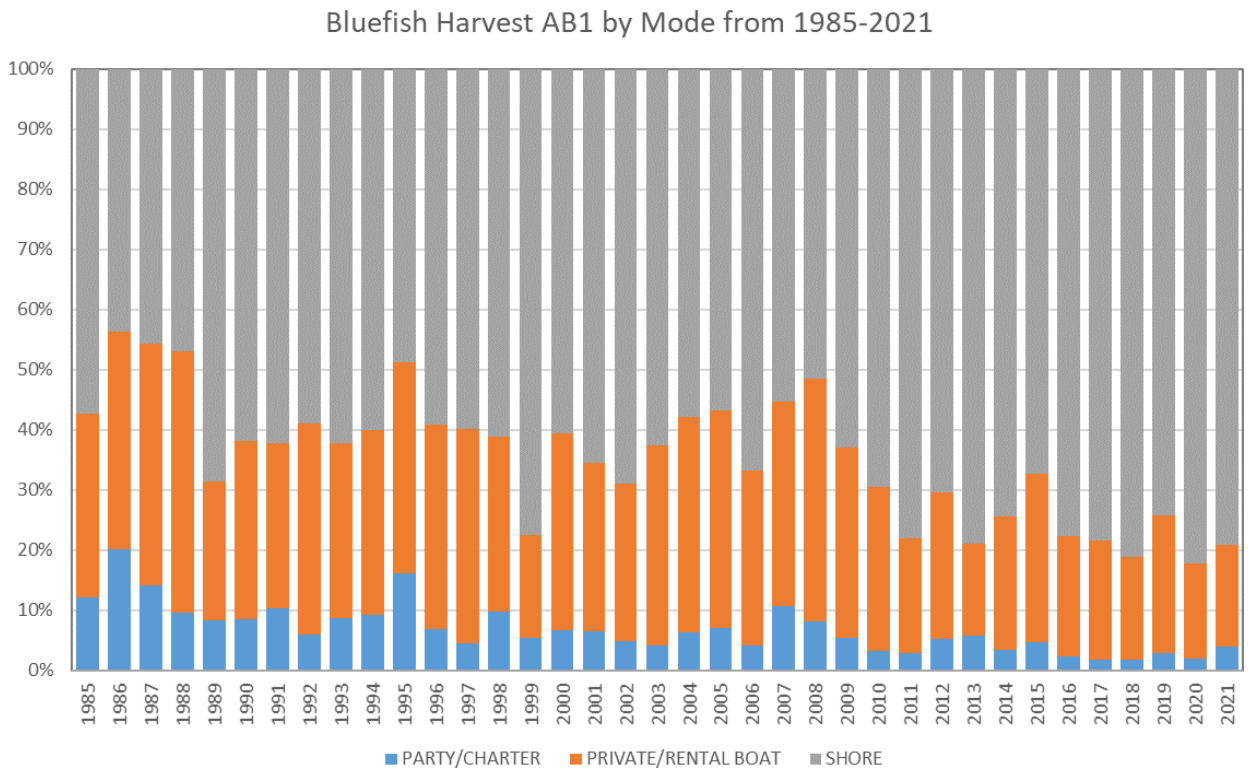

Figure 19. Bluefish harvest by mode for 1985-2021

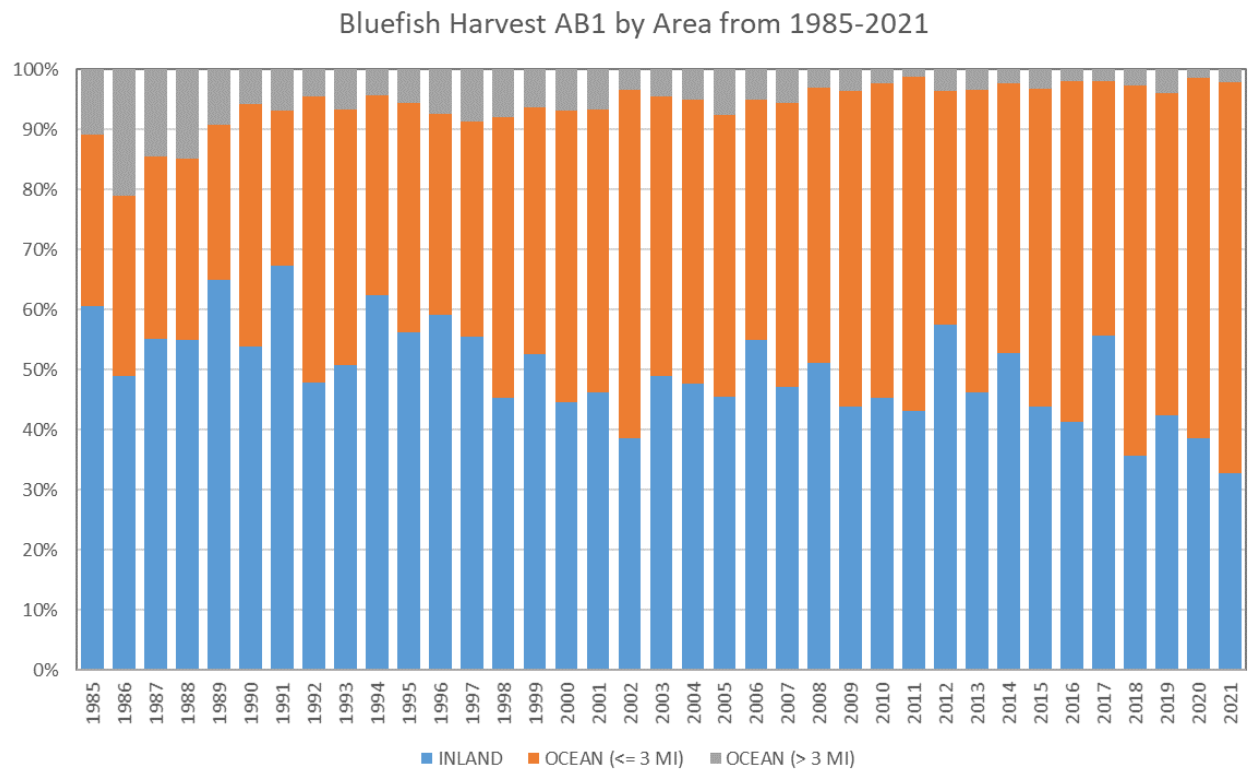

Figure 20. Bluefish harvest by area fished for 1985-2021

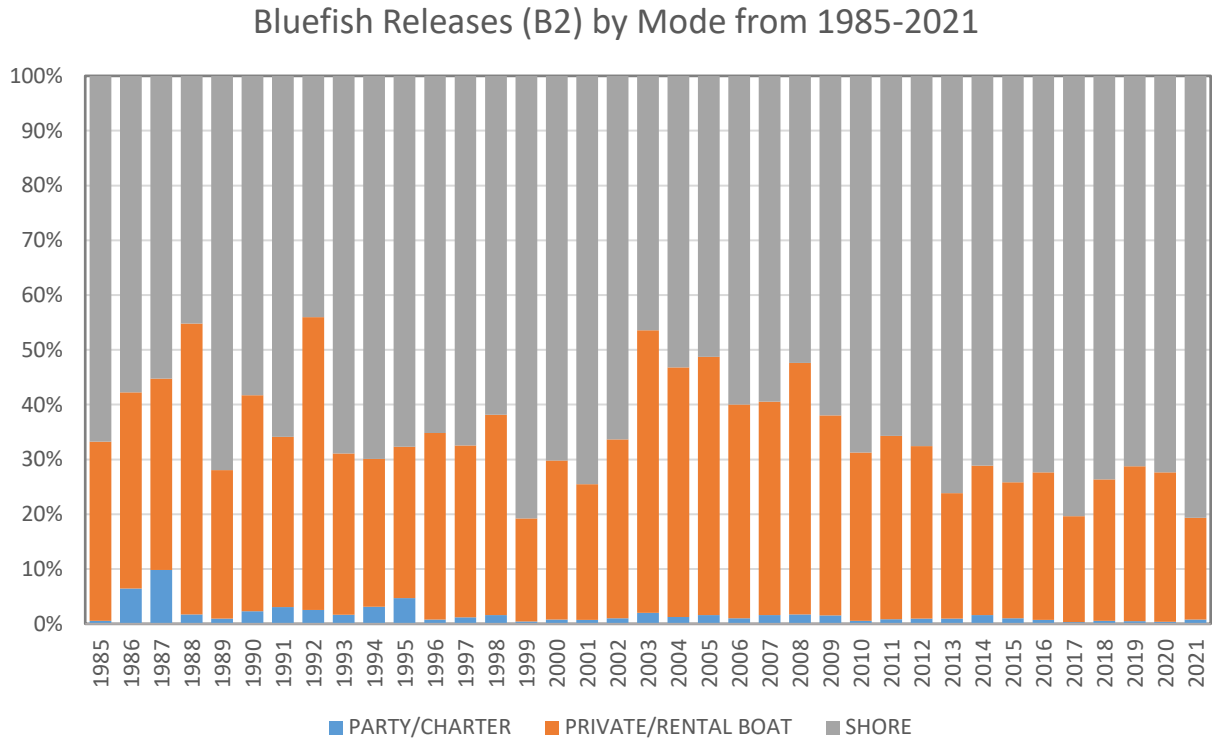

Figure 21. Bluefish Releases by mode for 1985-2021

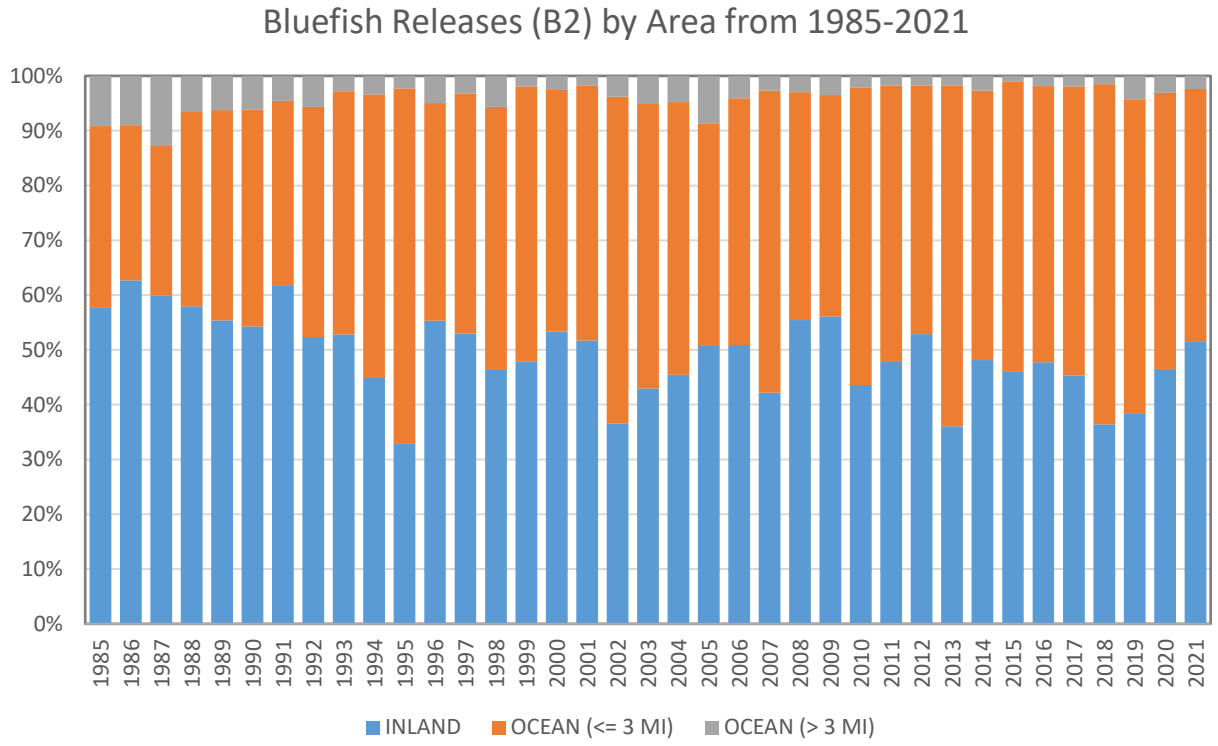

Figure 22. Bluefish Releases by area fished for 1985-2021

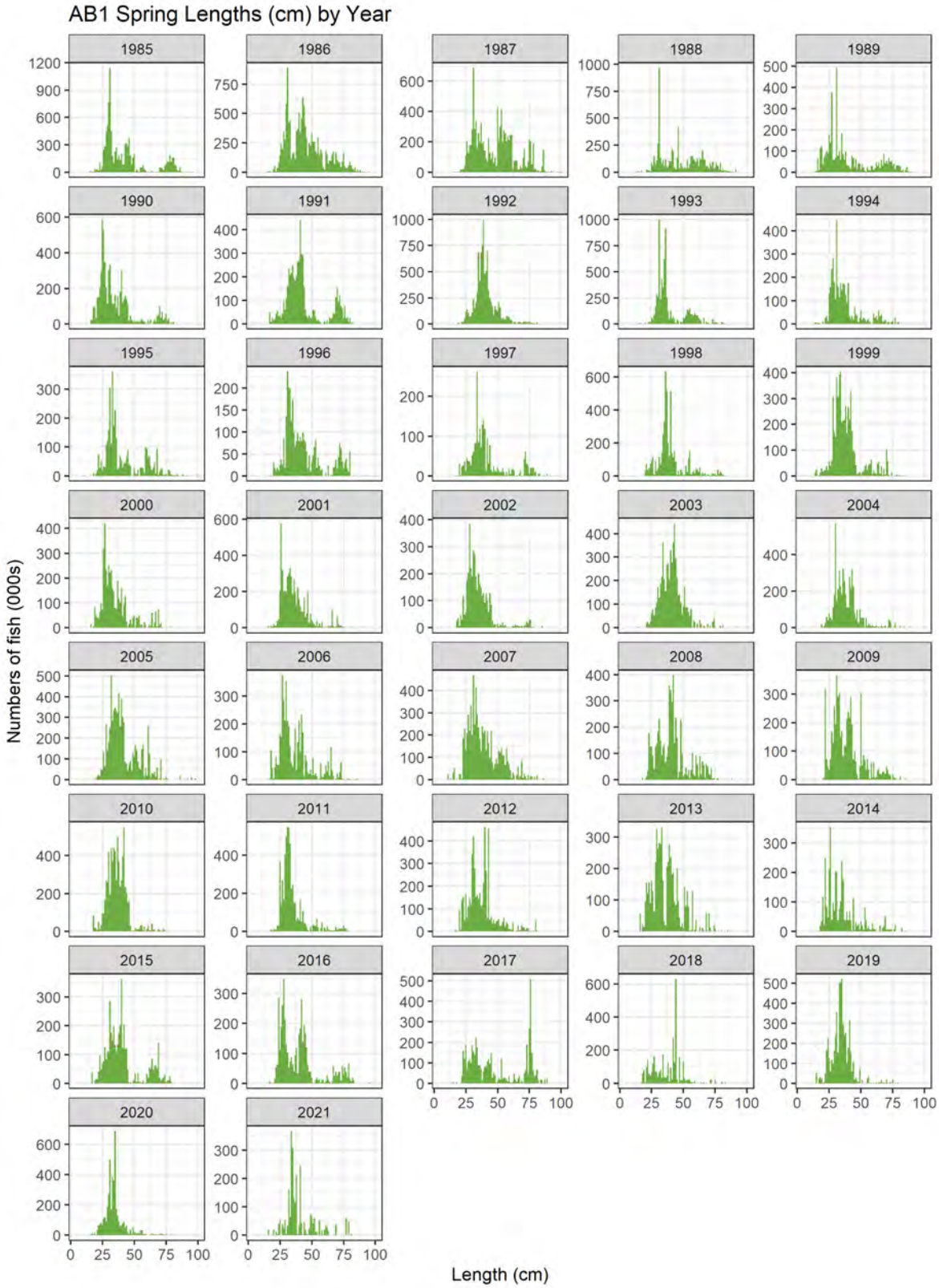

Figure 23. Recreational harvest (AB1) length distribution for the spring season from 1985-2021

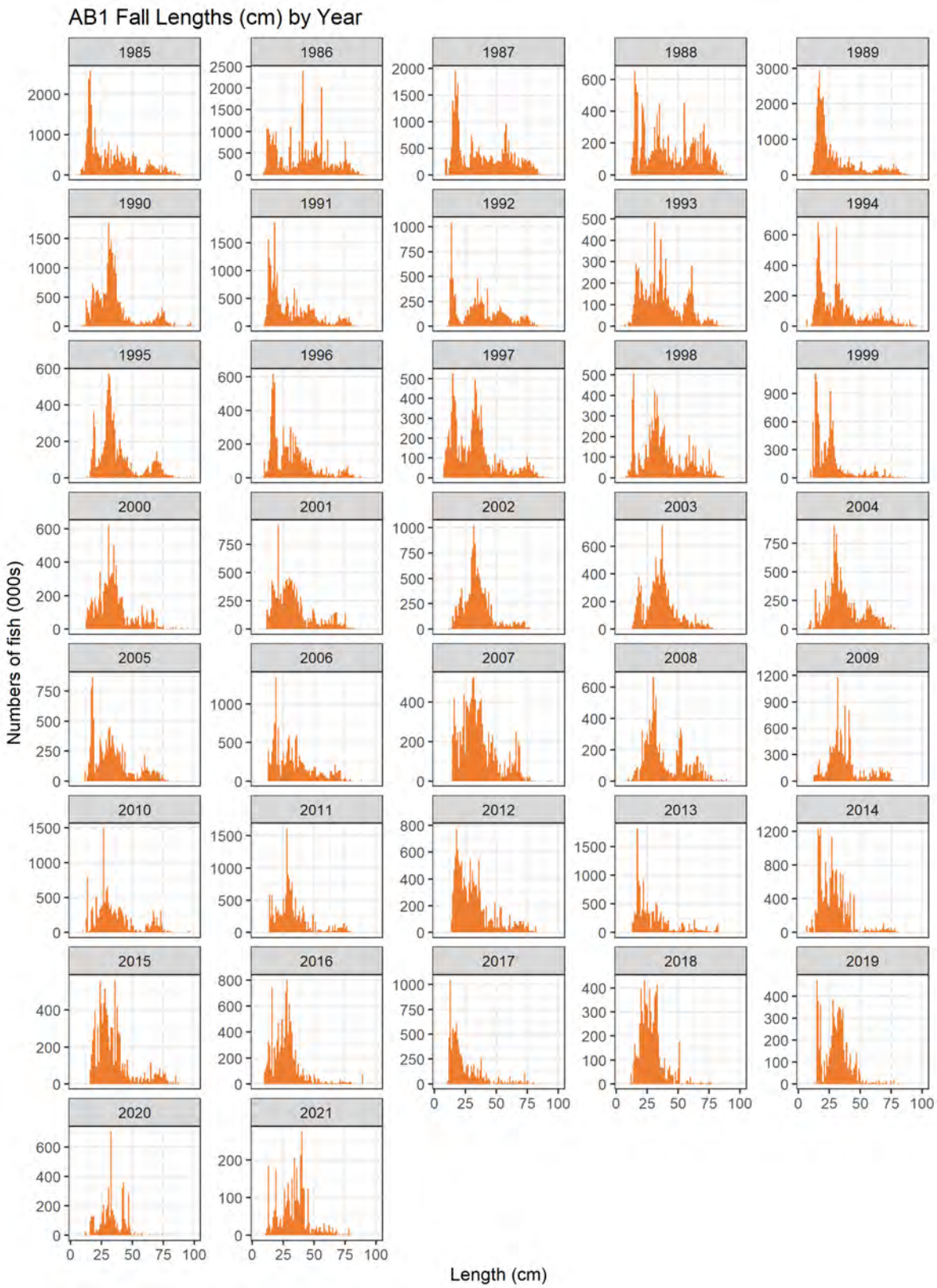

Figure 24. Recreational harvest (AB1) length distribution for the fall season from 1985-2021

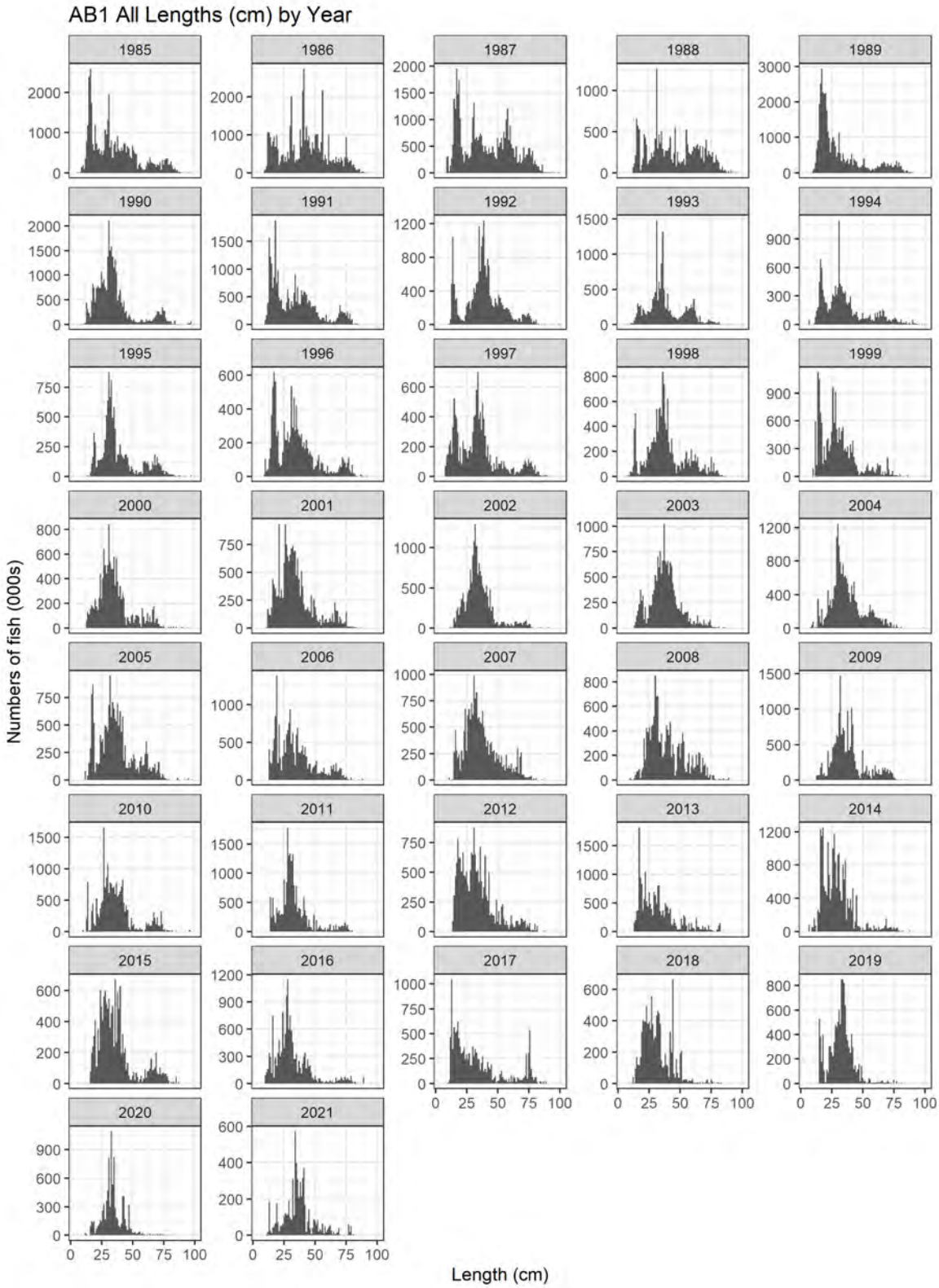

Figure 25. Annual recreational harvest (AB1) length distribution from 1985-2021

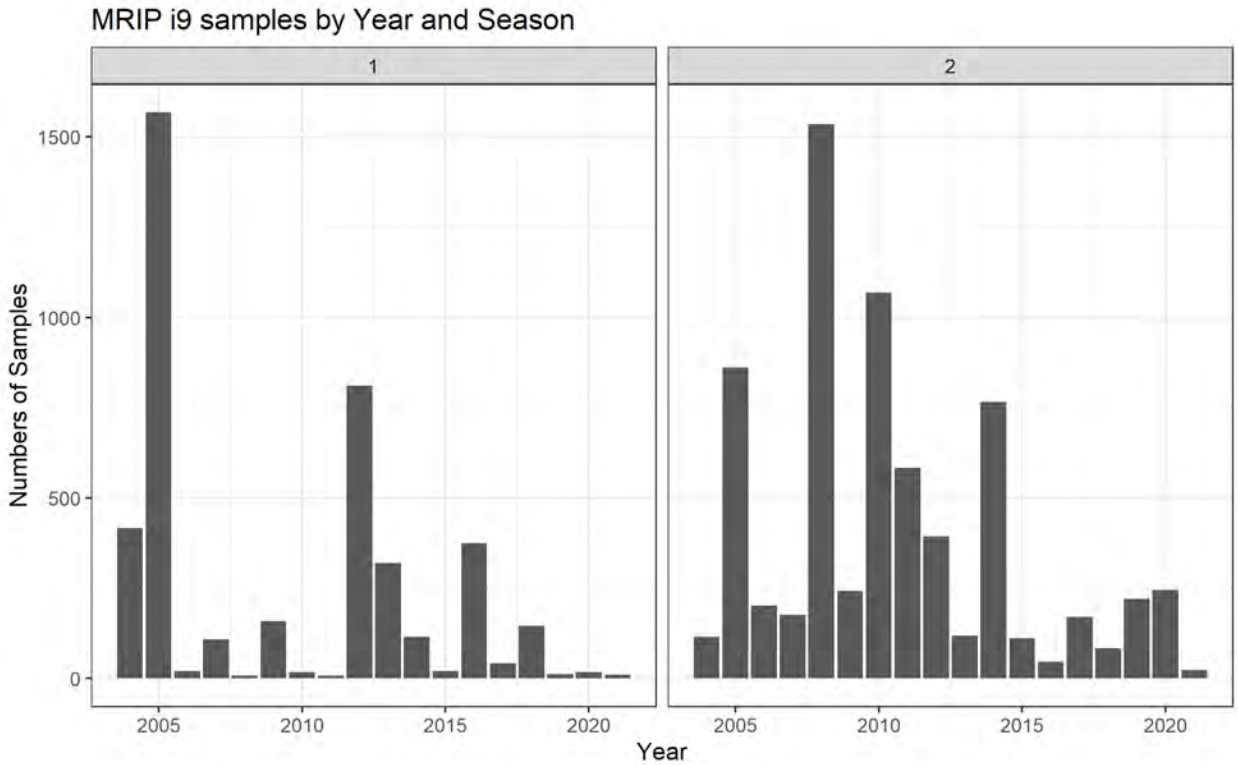

Figure 26. Annual MRIP i9 (B2) total length samples by season from 2004-2021

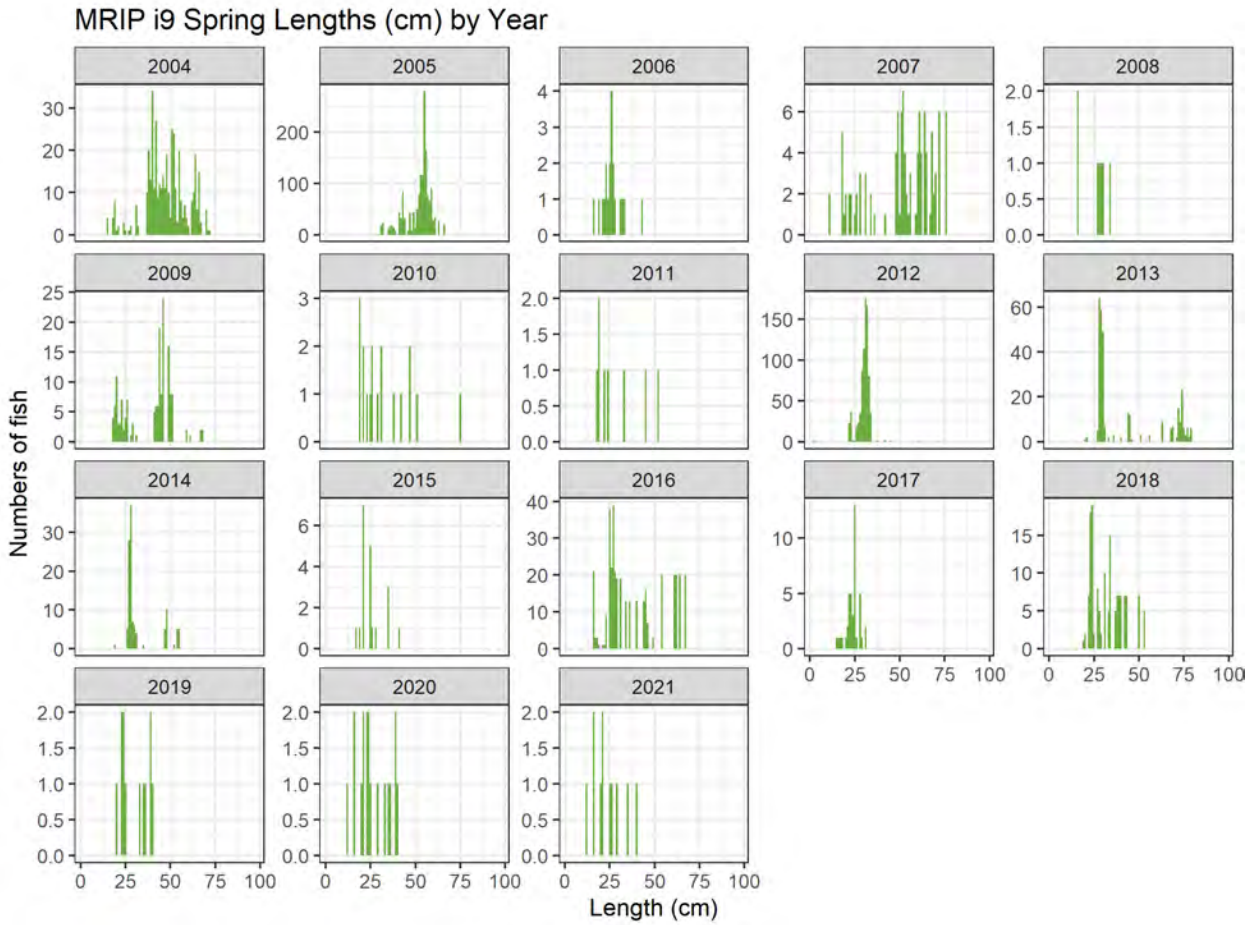

Figure 27. MRIP i9 intercept lengths frequency for spring releases (B2) from 2004-2021

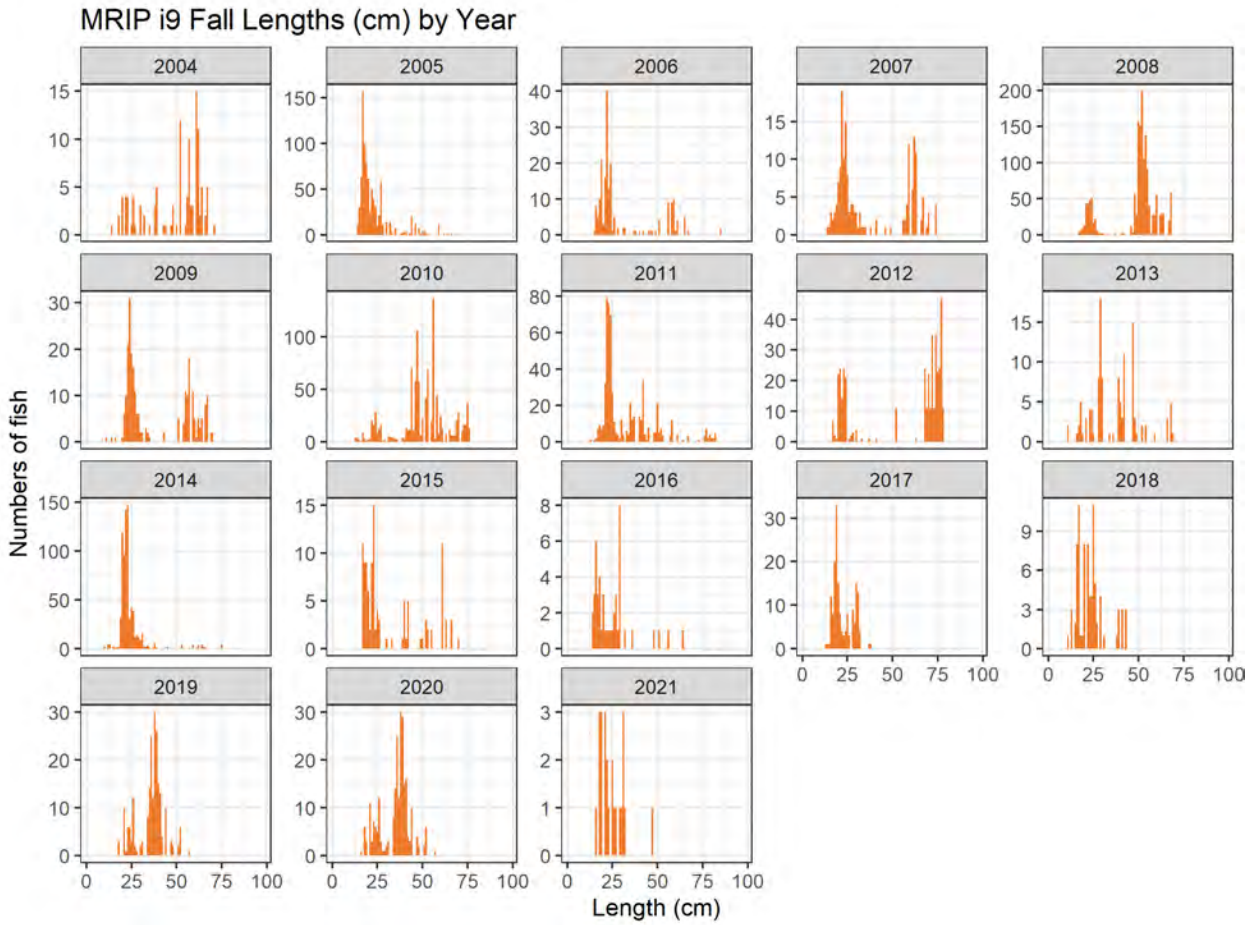

Figure 28. MRIP i9 intercept lengths frequency for fall releases (B2) from 2004-2021

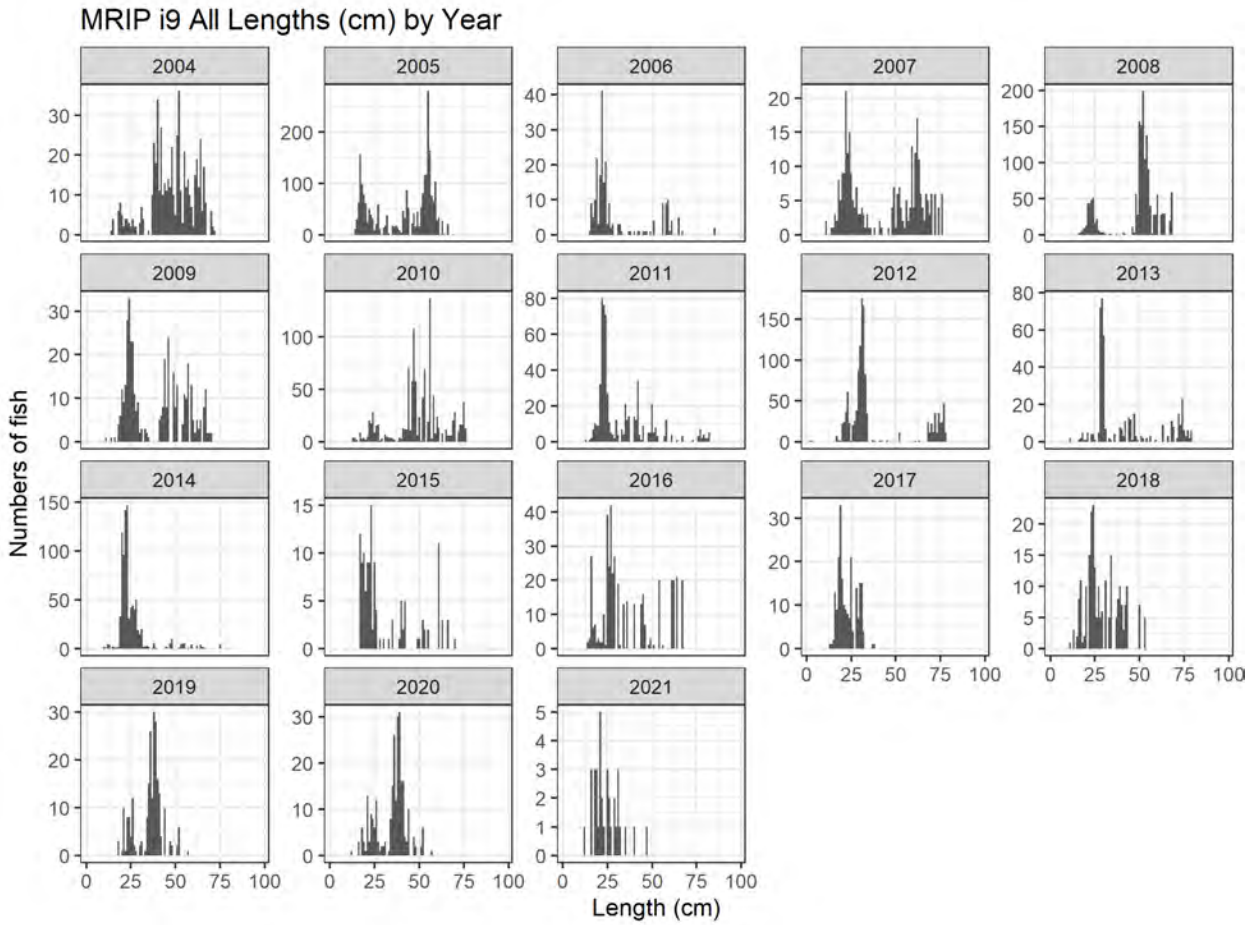

Figure 29. Annual recreational release (B2) length distribution from 2004-2021

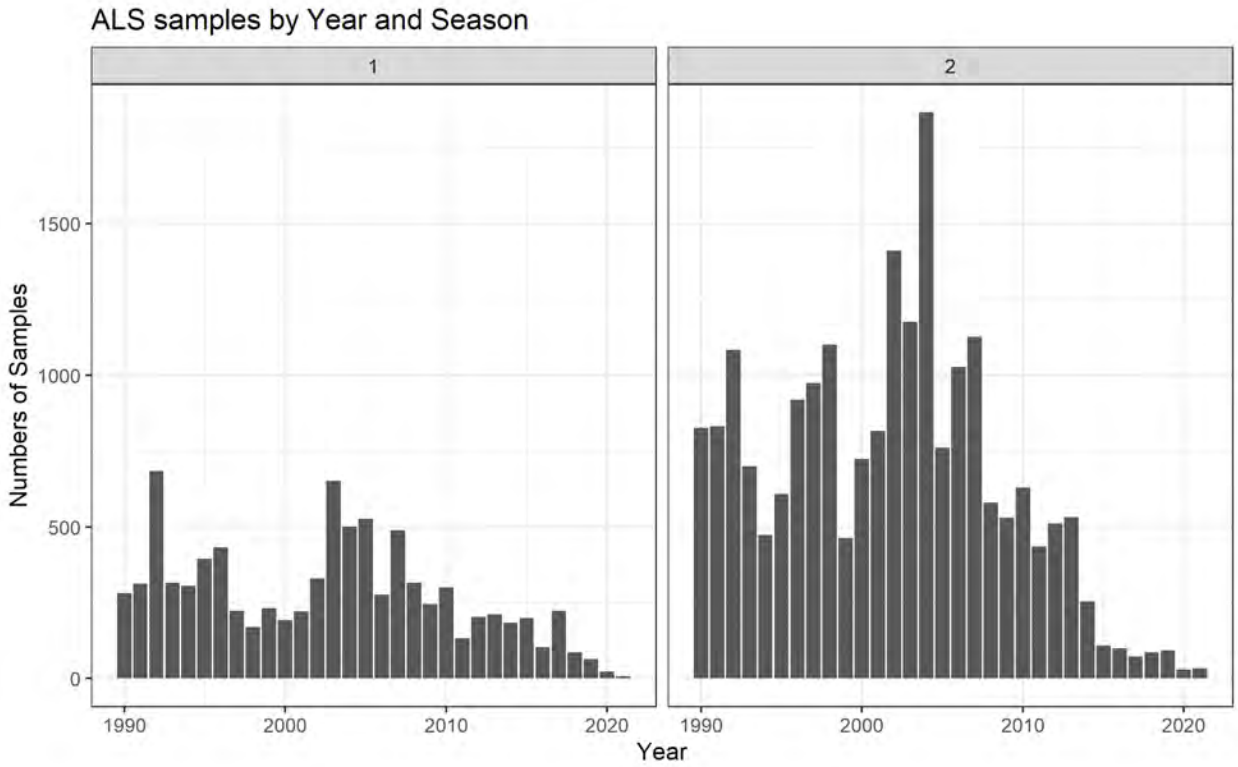

Figure 30. Annual ALS length samples by season from 1990-2021

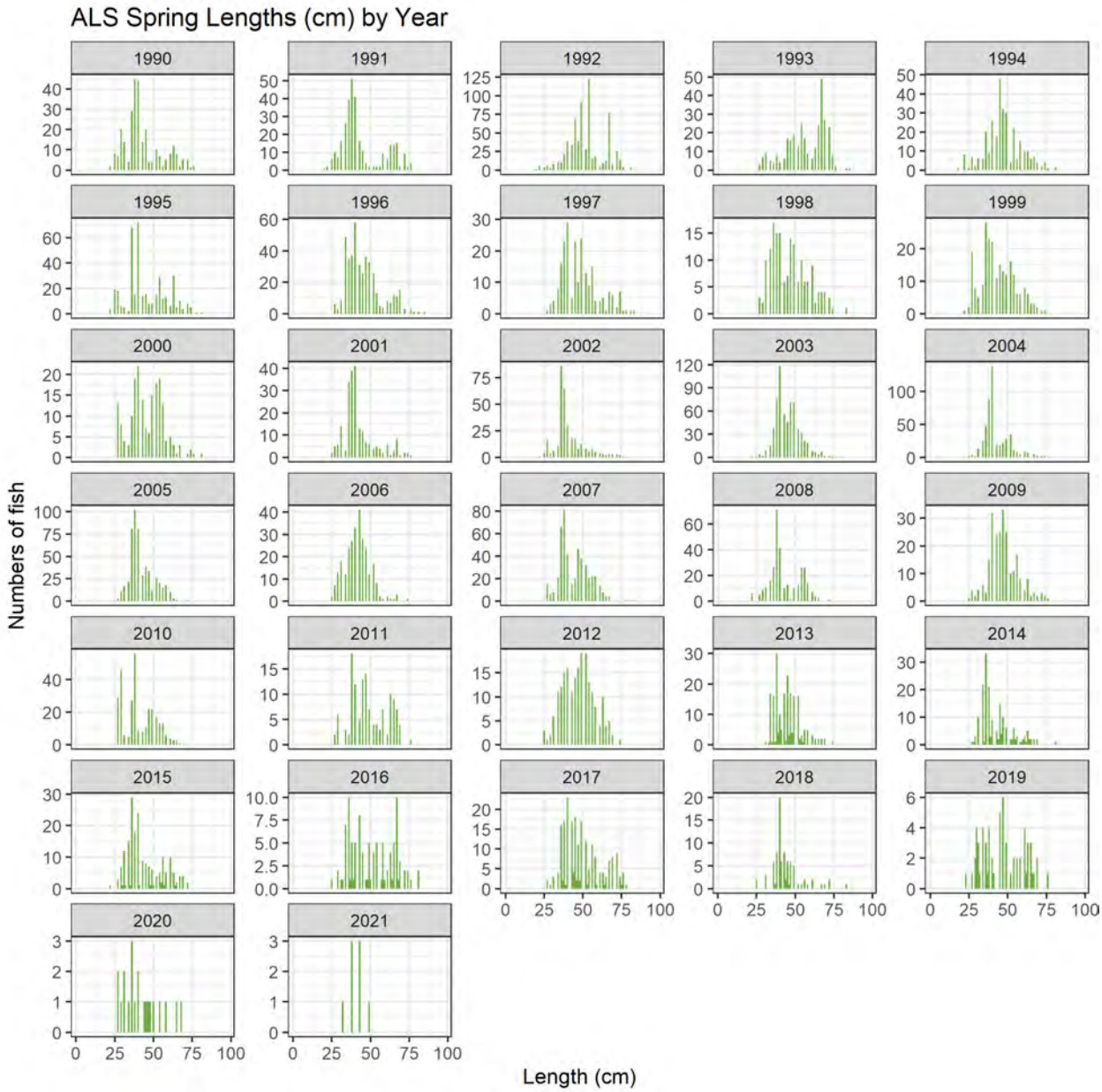

Figure 31. ALS length frequency for spring releases from 1990-2021

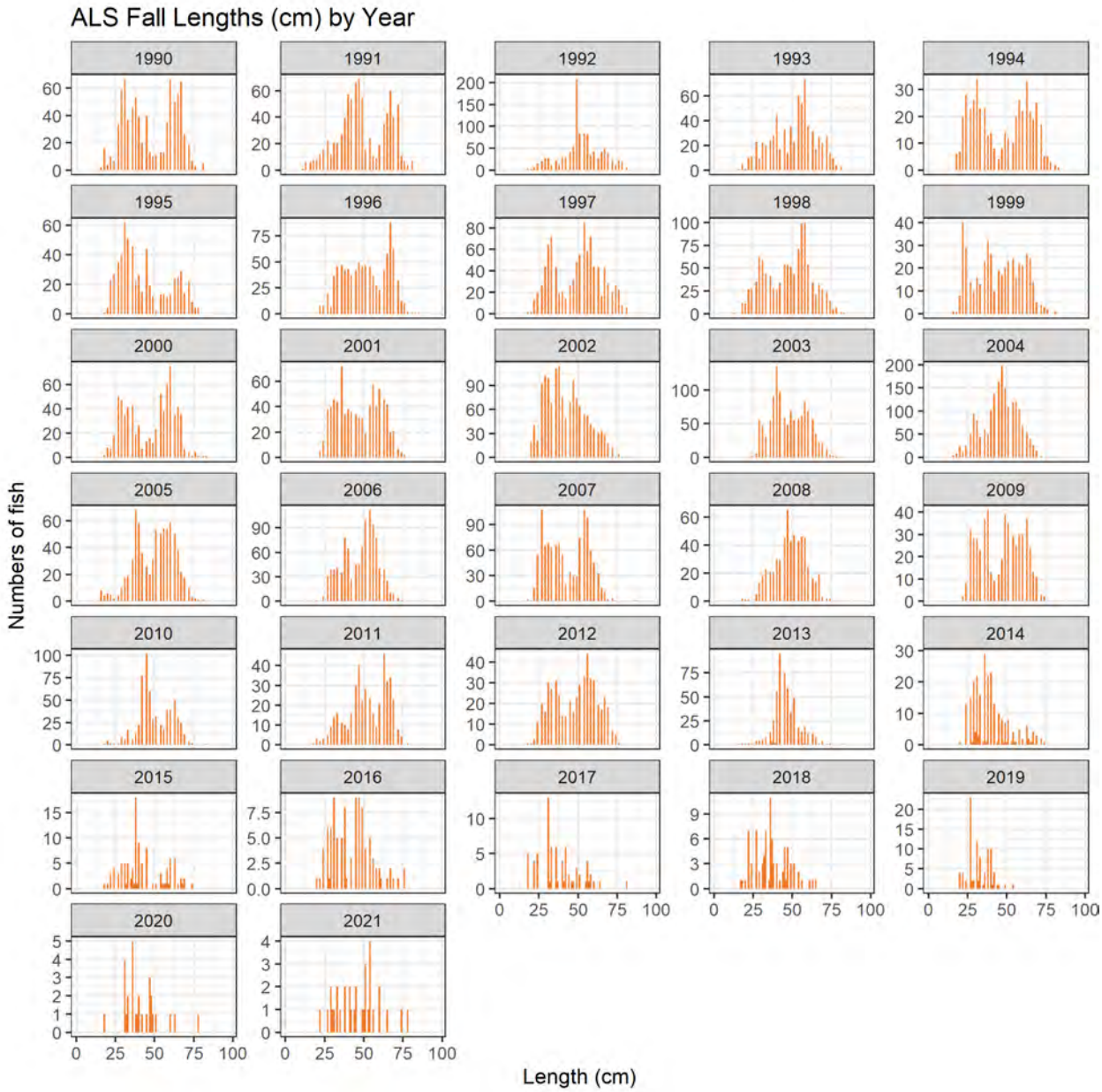

Figure 32. ALS length frequency for fall releases from 1990-2021

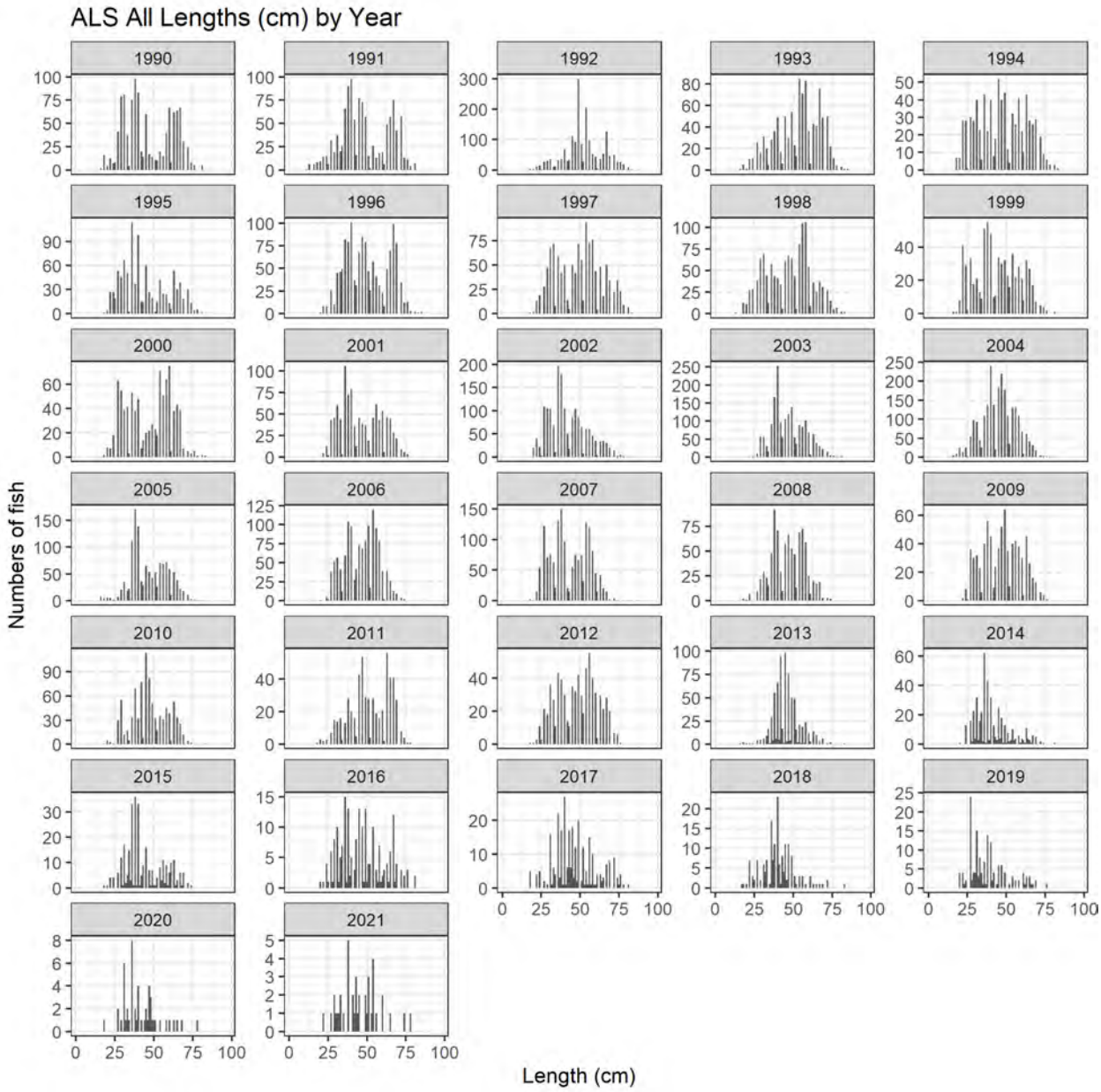

Figure 33. ALS length frequency for all releases from 1990-2021

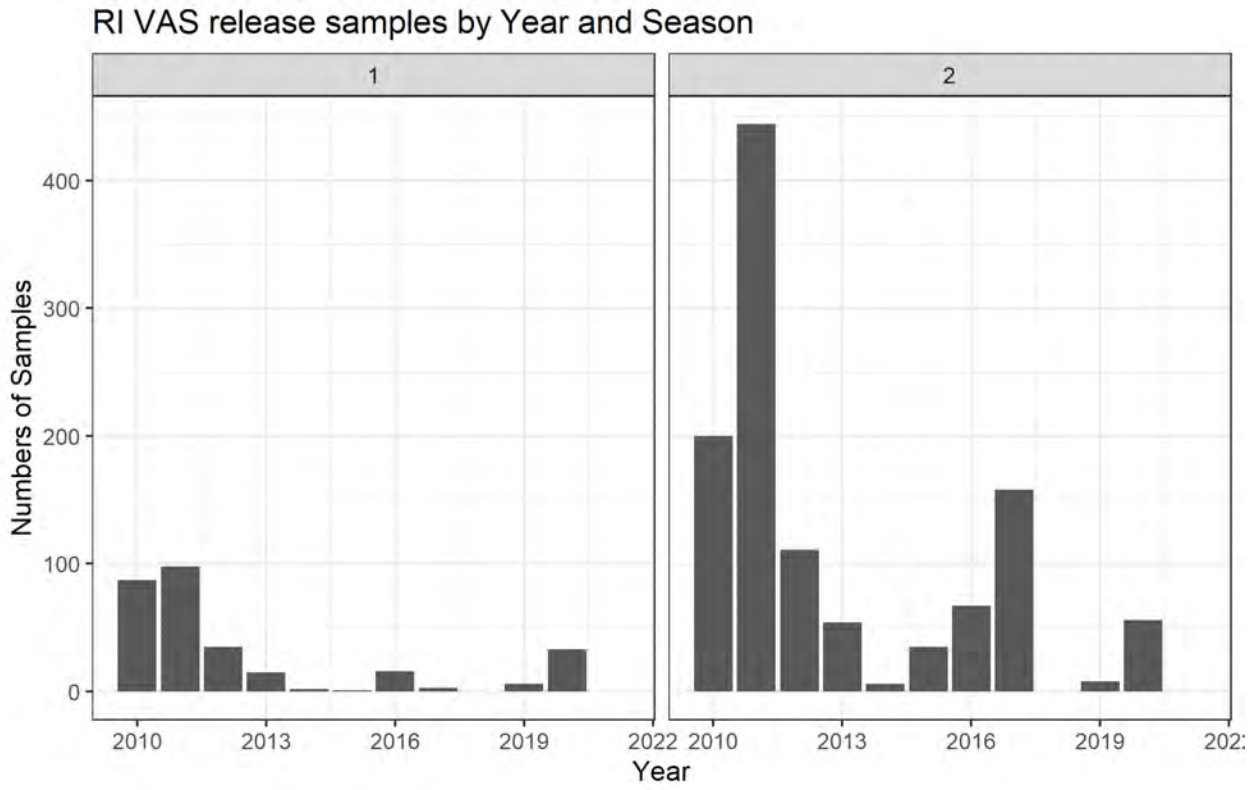

Figure 34. Annual RI VAS length samples by season from 2010-2021

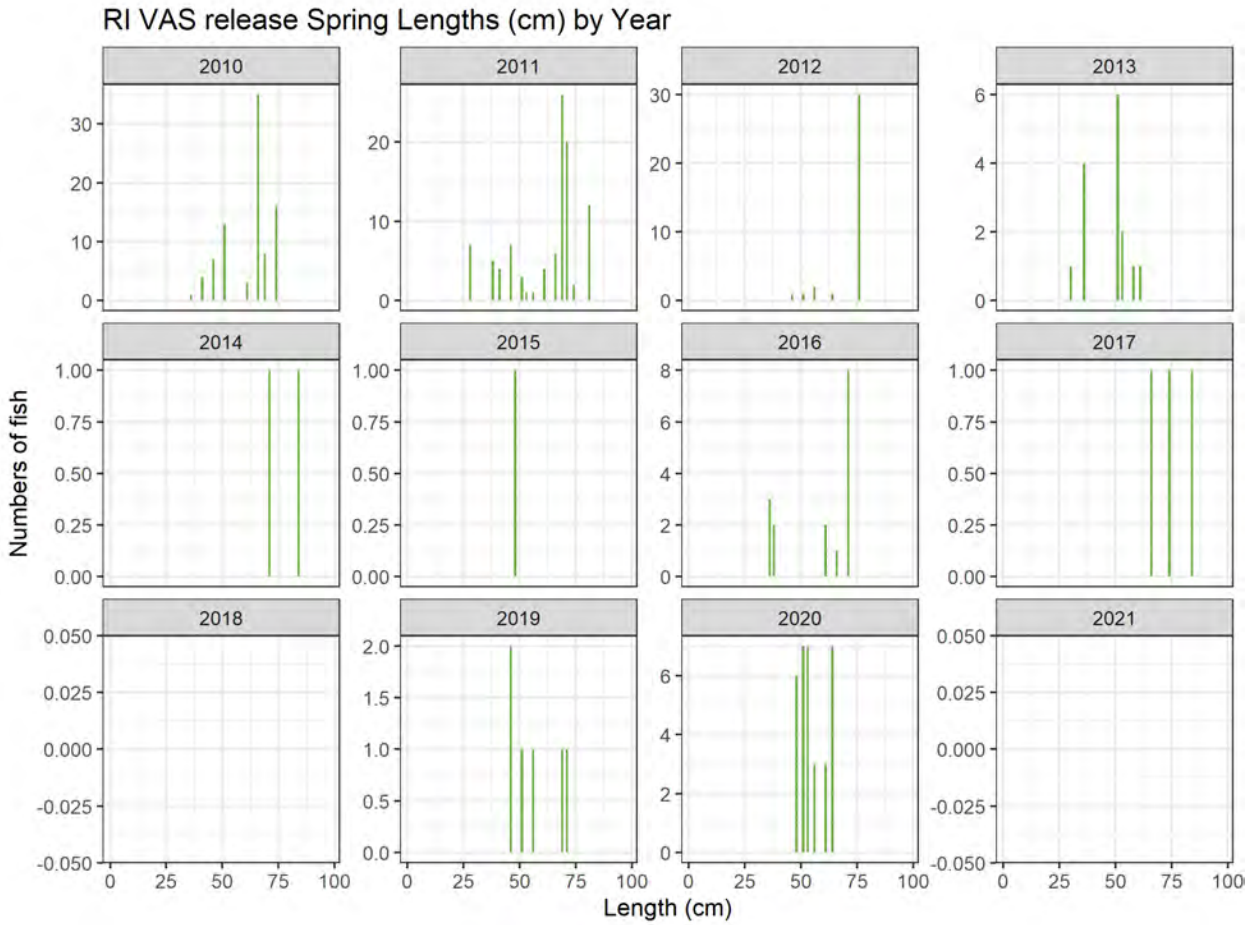

Figure 35. RI VAS length frequency for spring releases from 2010-2021

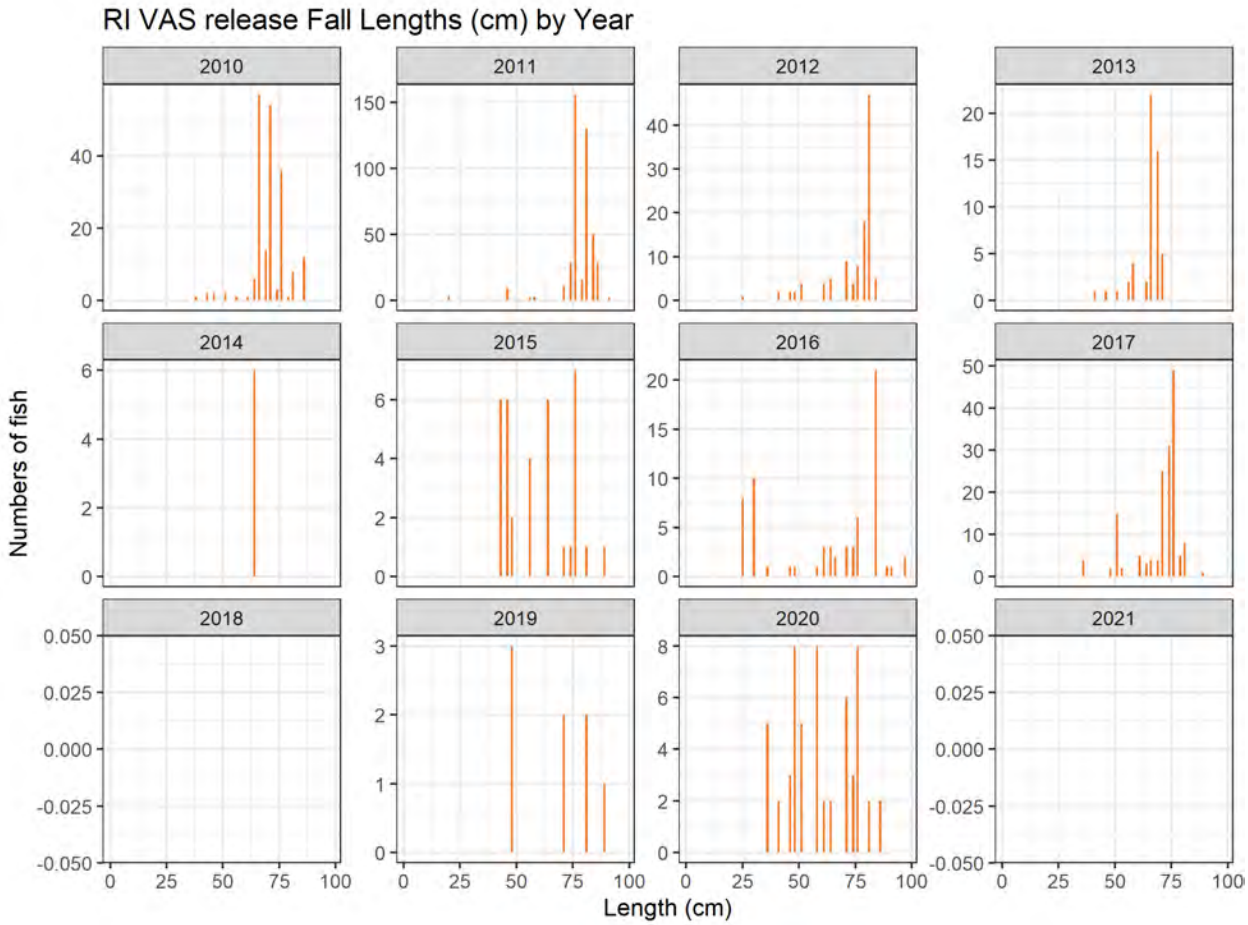

Figure 36. RI VAS length frequency for fall releases from 2010-2021

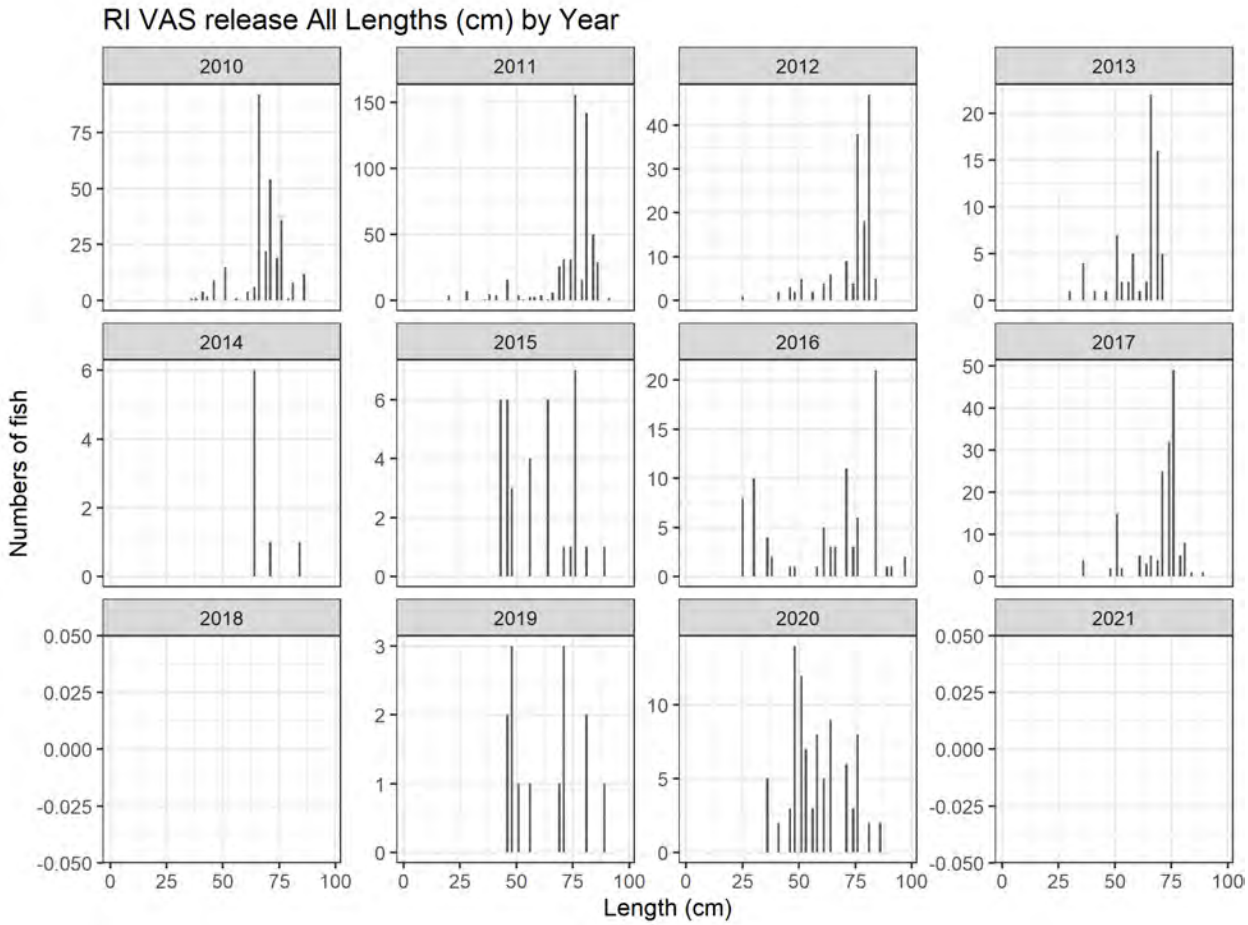

Figure 37. RI VAS length frequency for all releases from 2010-2021

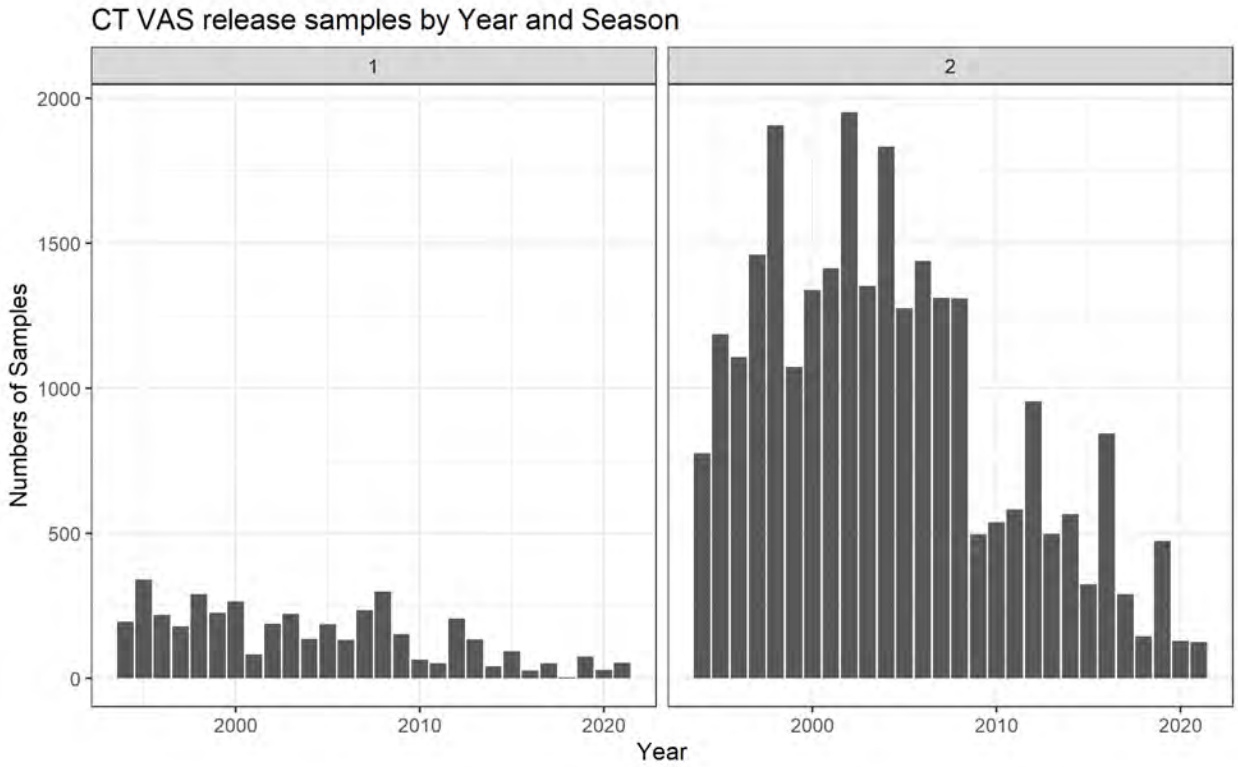

Figure 38. Annual CT VAS length samples by season from 1994-2021

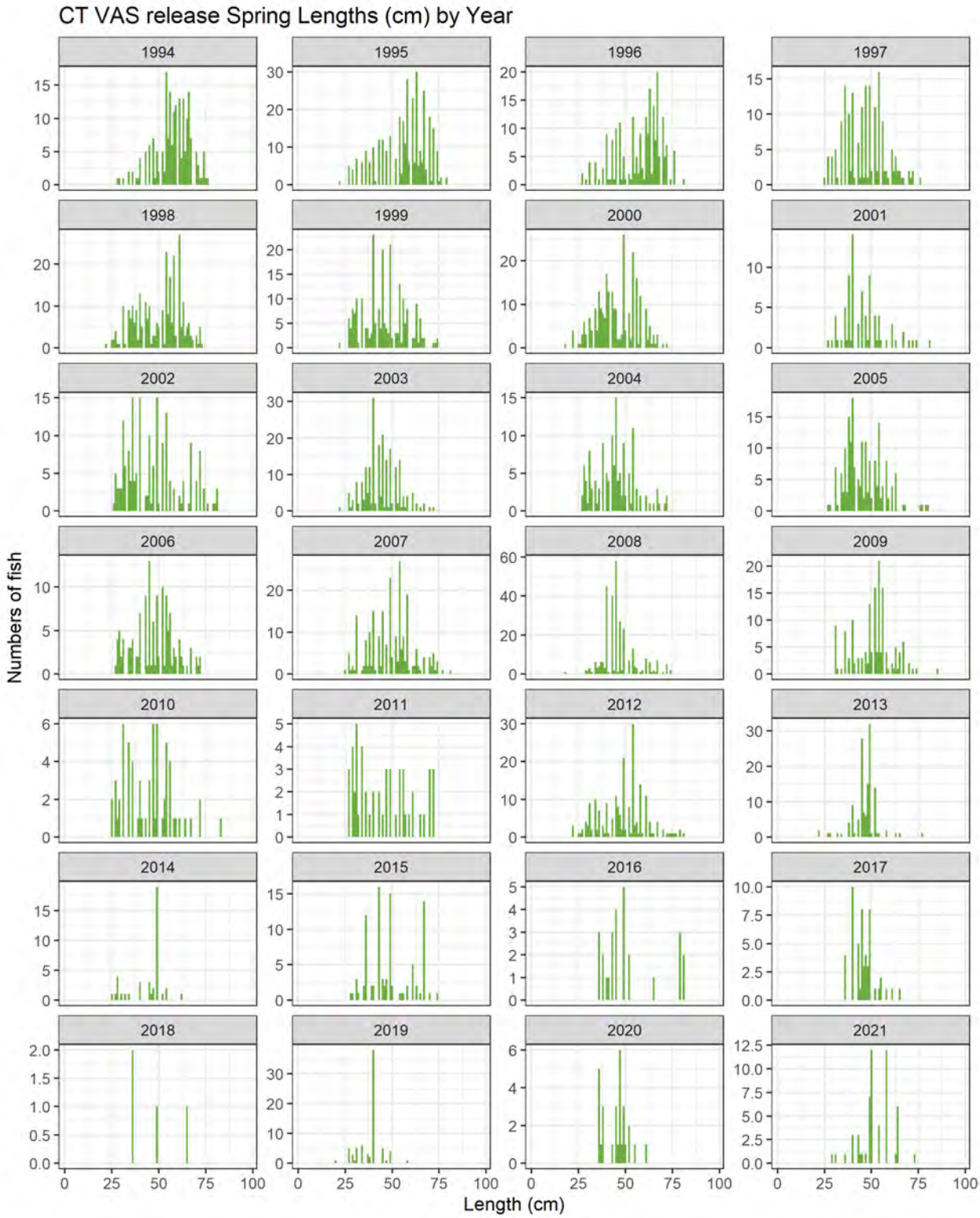

Figure 39. CT VAS length frequency for spring releases from 1994-2021

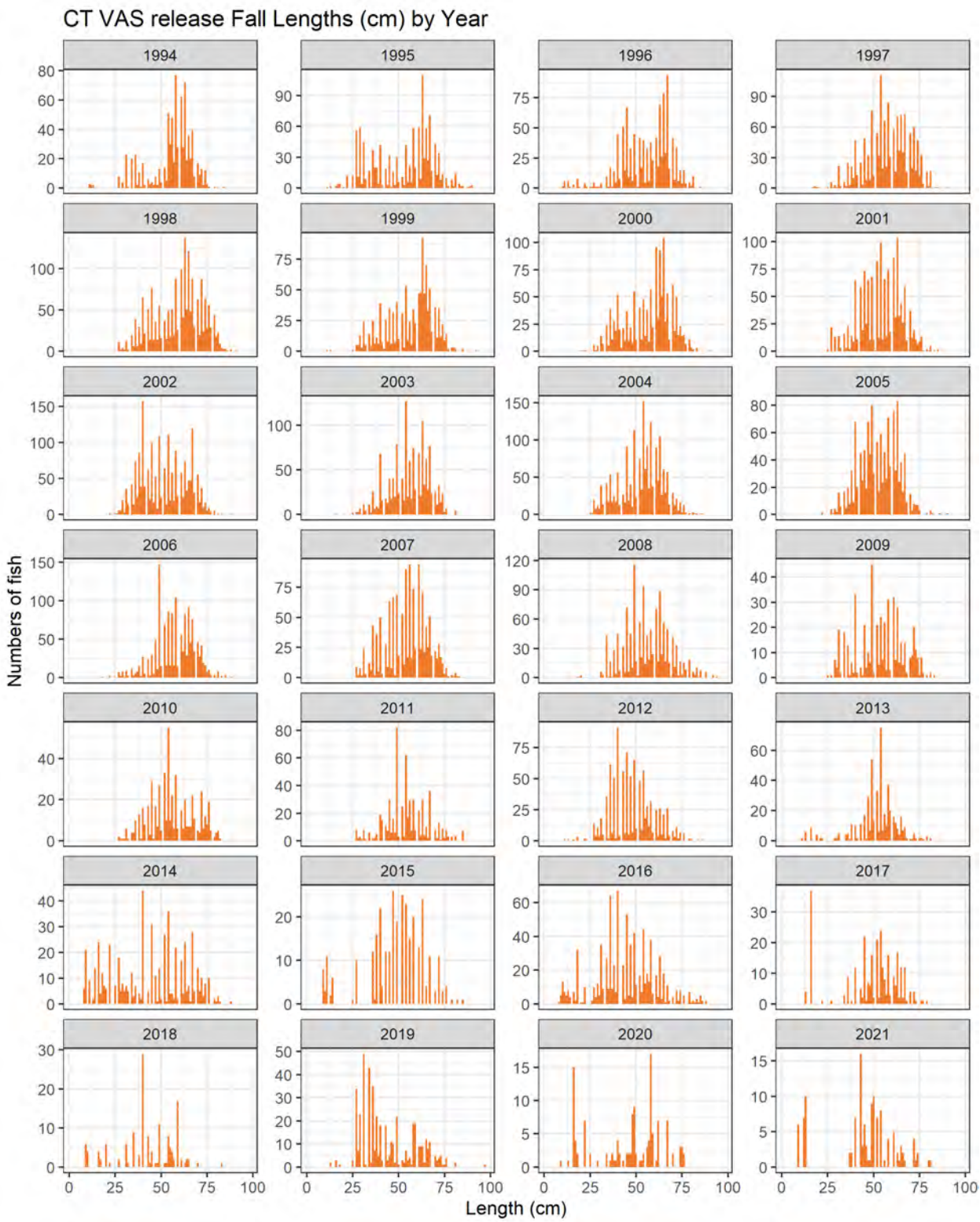

Figure 40. CT VAS length frequency for fall releases from 1994-2021

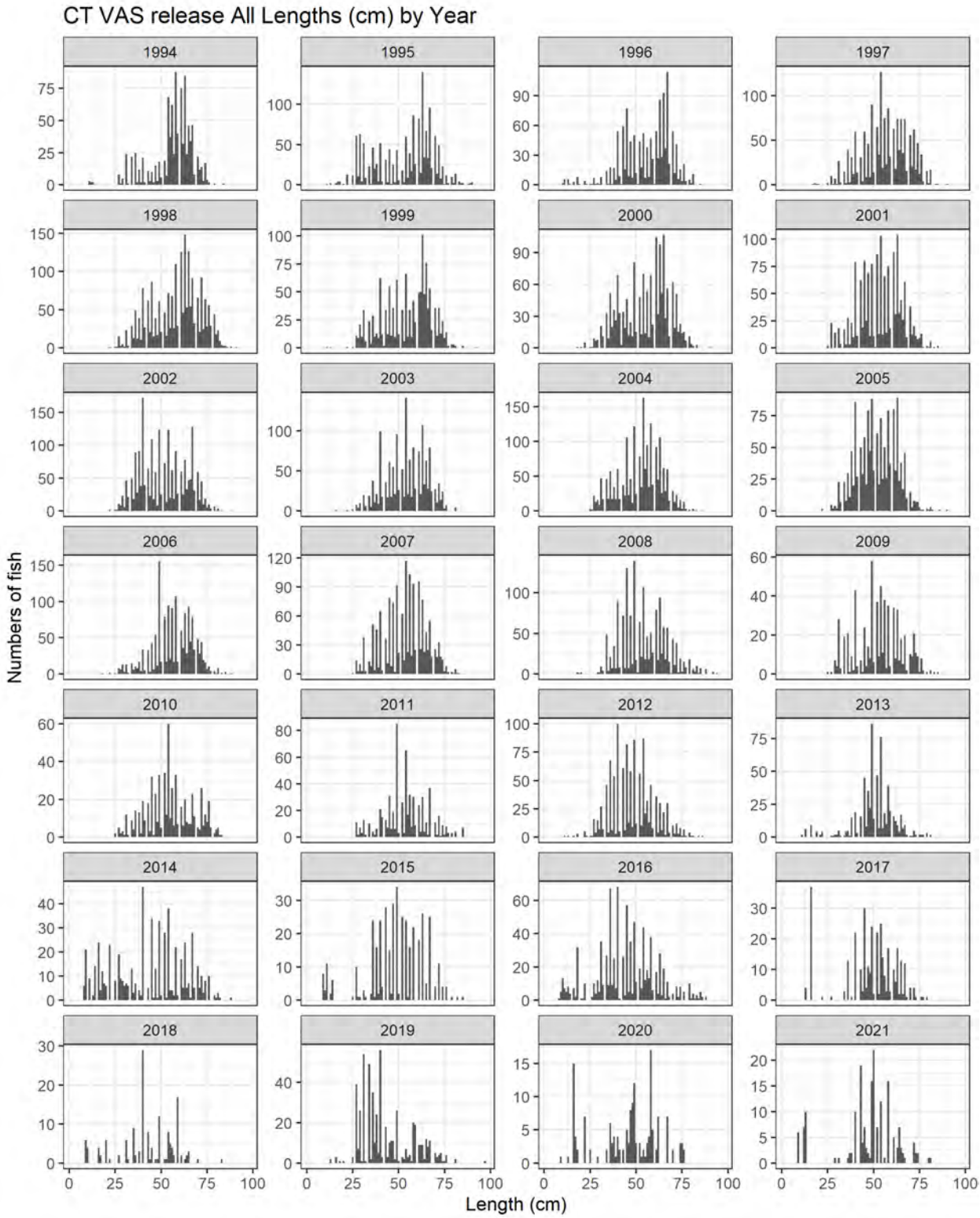

Figure 41. CT VAS length frequency for all releases from 1994-2021

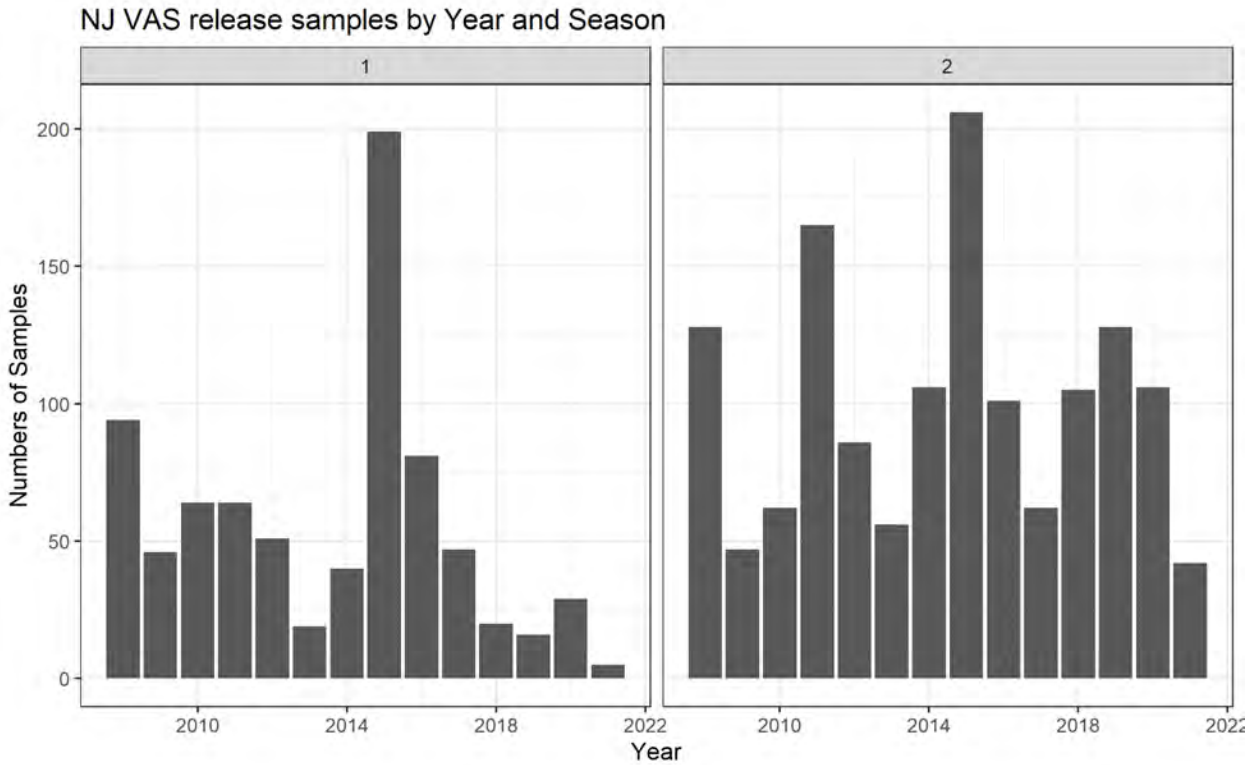

Figure 42. Annual NJ VAS length samples by season from 2007-2021

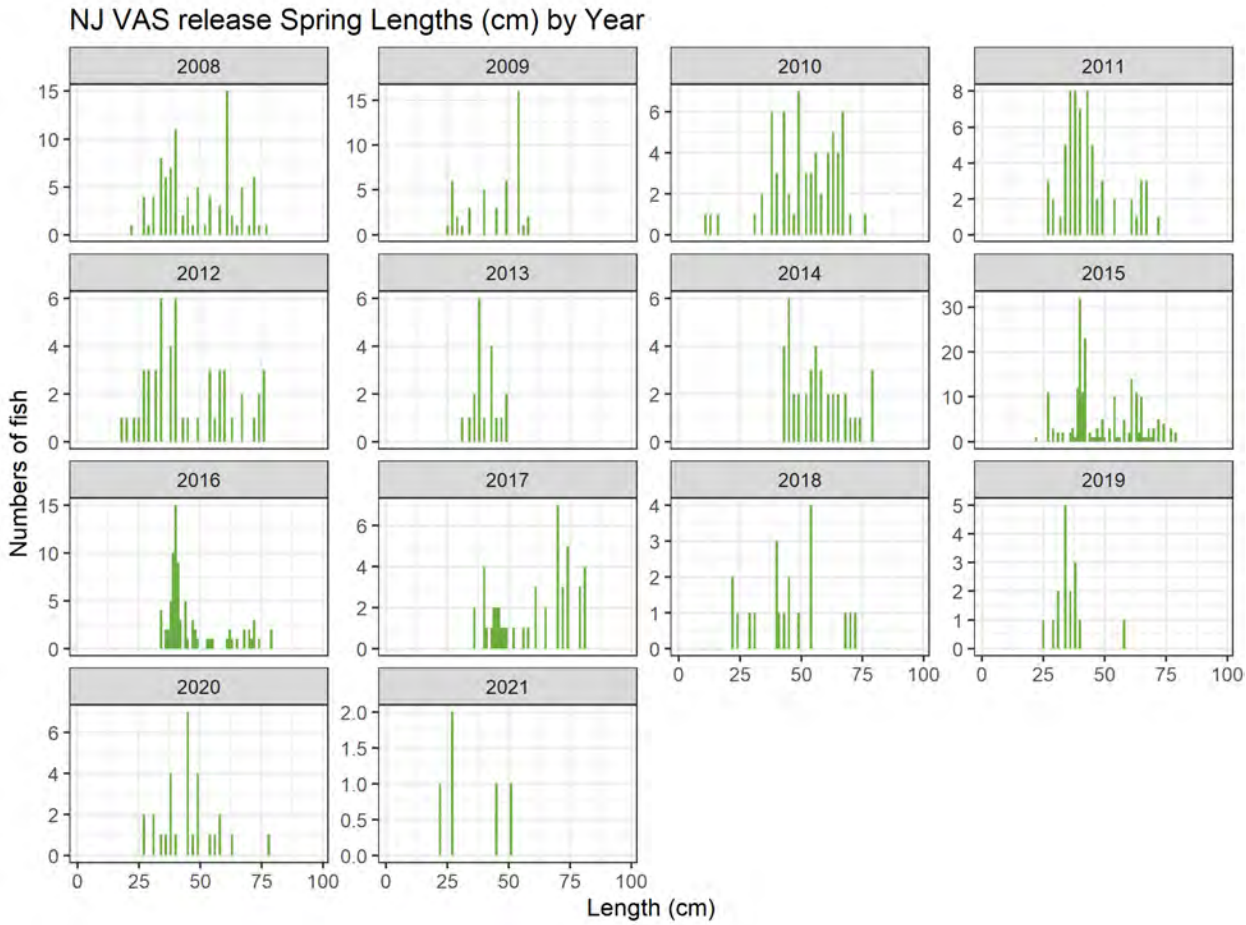

Figure 43. NJ VAS length frequency for spring releases from 2007-2021

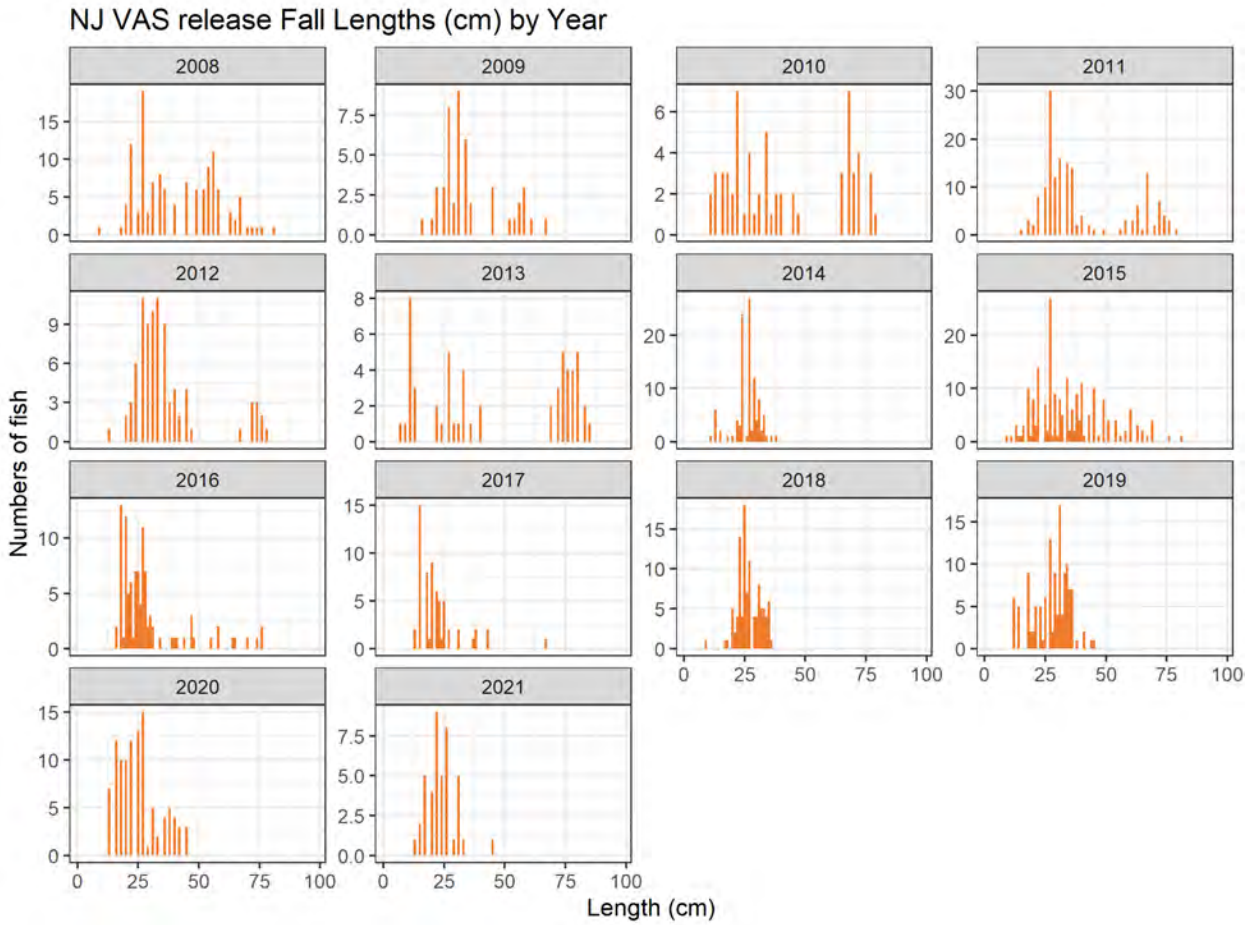

Figure 44. NJ VAS length frequency for fall releases from 2007-2021

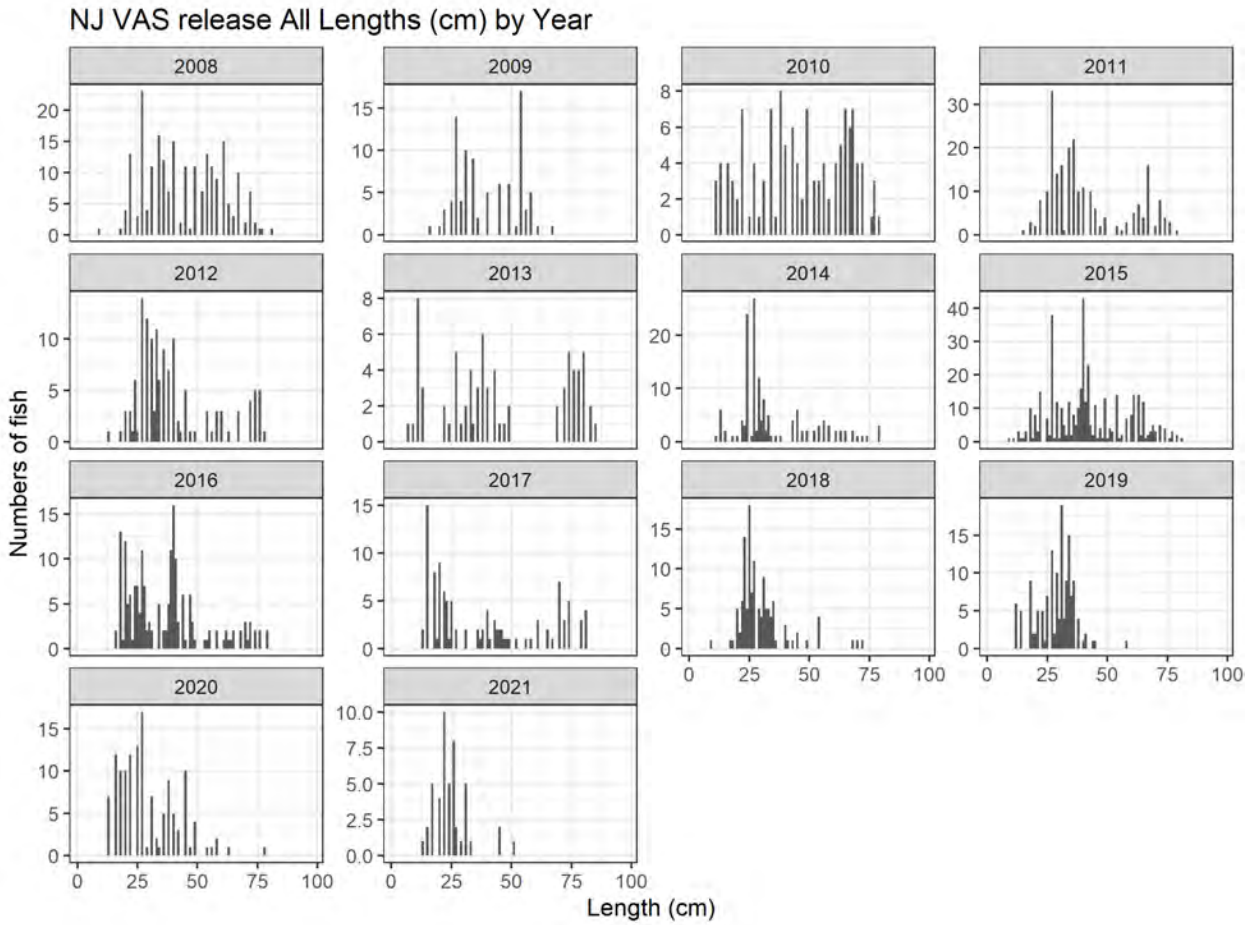

Figure 45. NJ VAS length frequency for all releases from 2007-2021

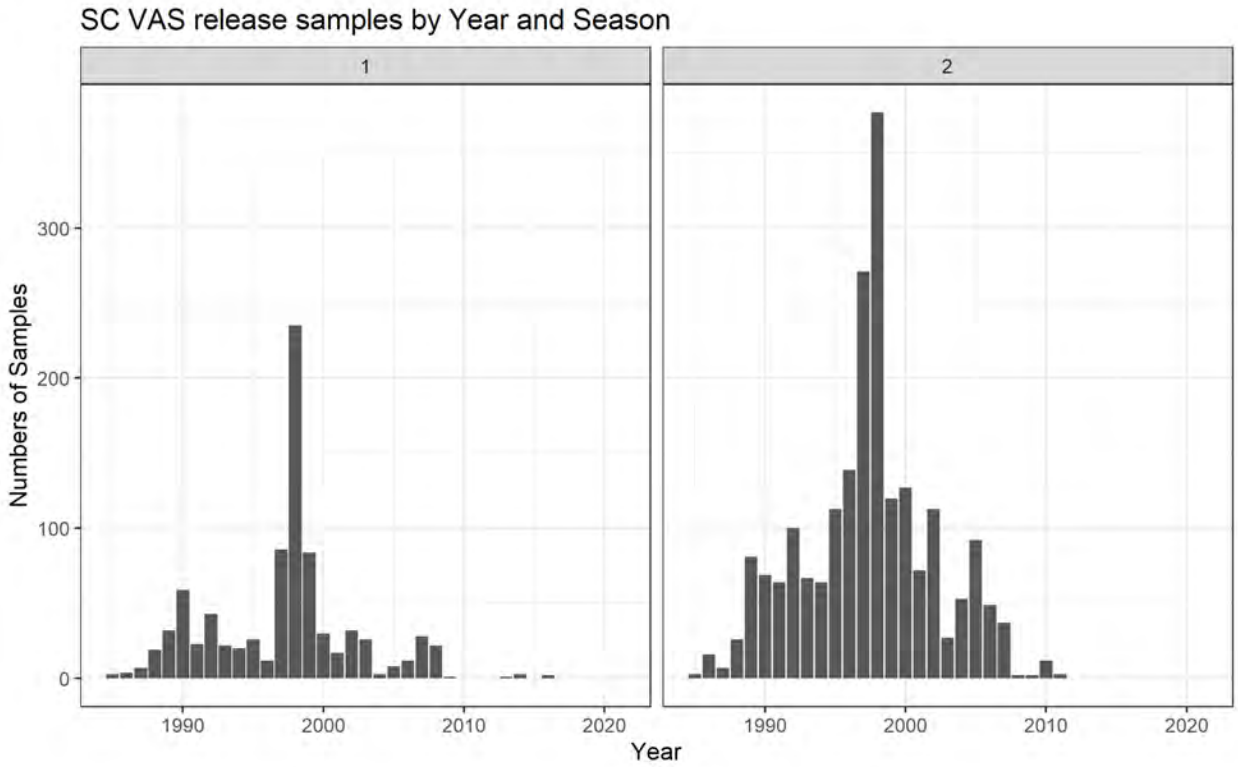

Figure 46. Annual SC VAS length samples by season from 2007-2016

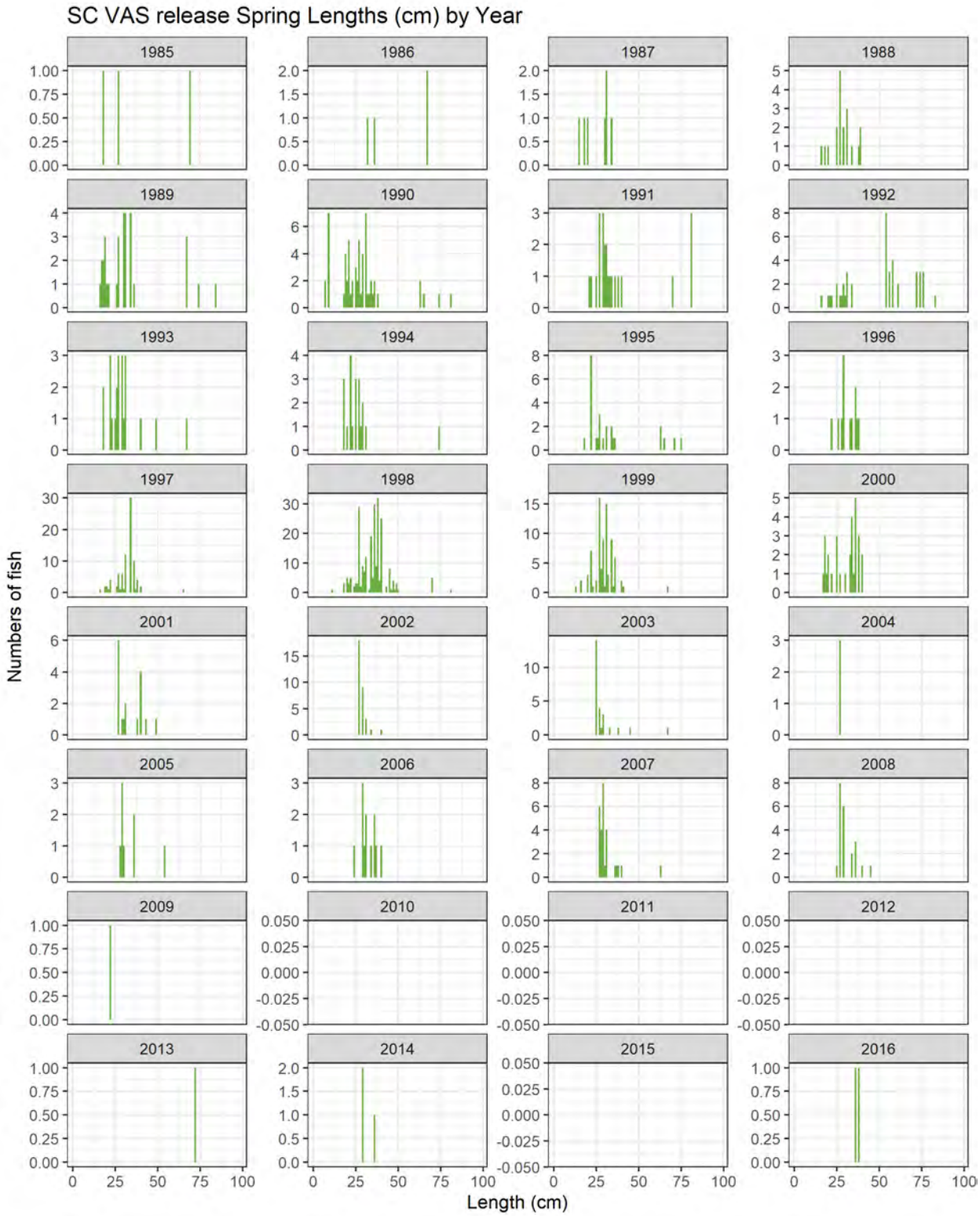

Figure 47. SC VAS length frequency for spring releases from 1985-2016

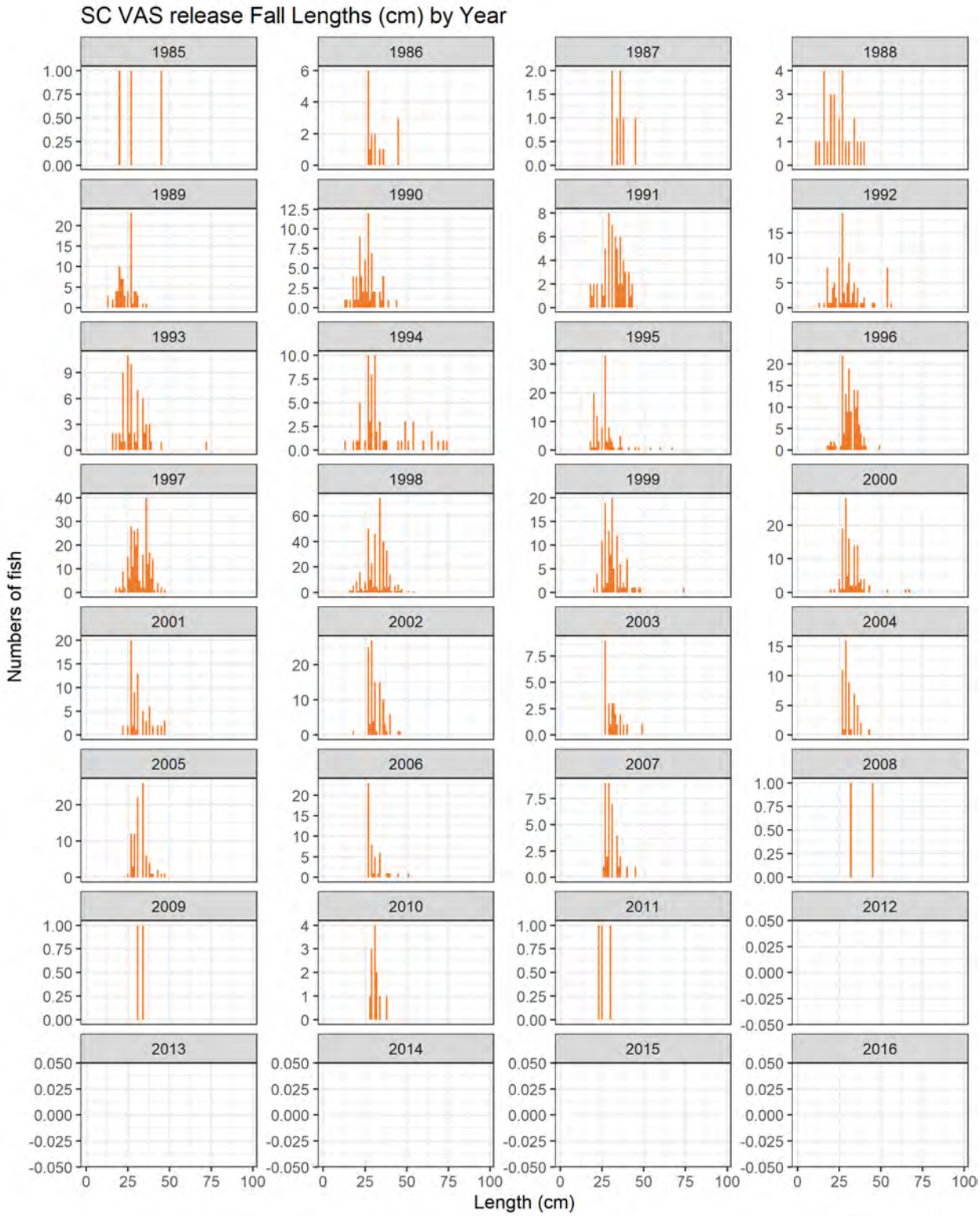

Figure 48. SC VAS length frequency for fall releases from 1985-2016

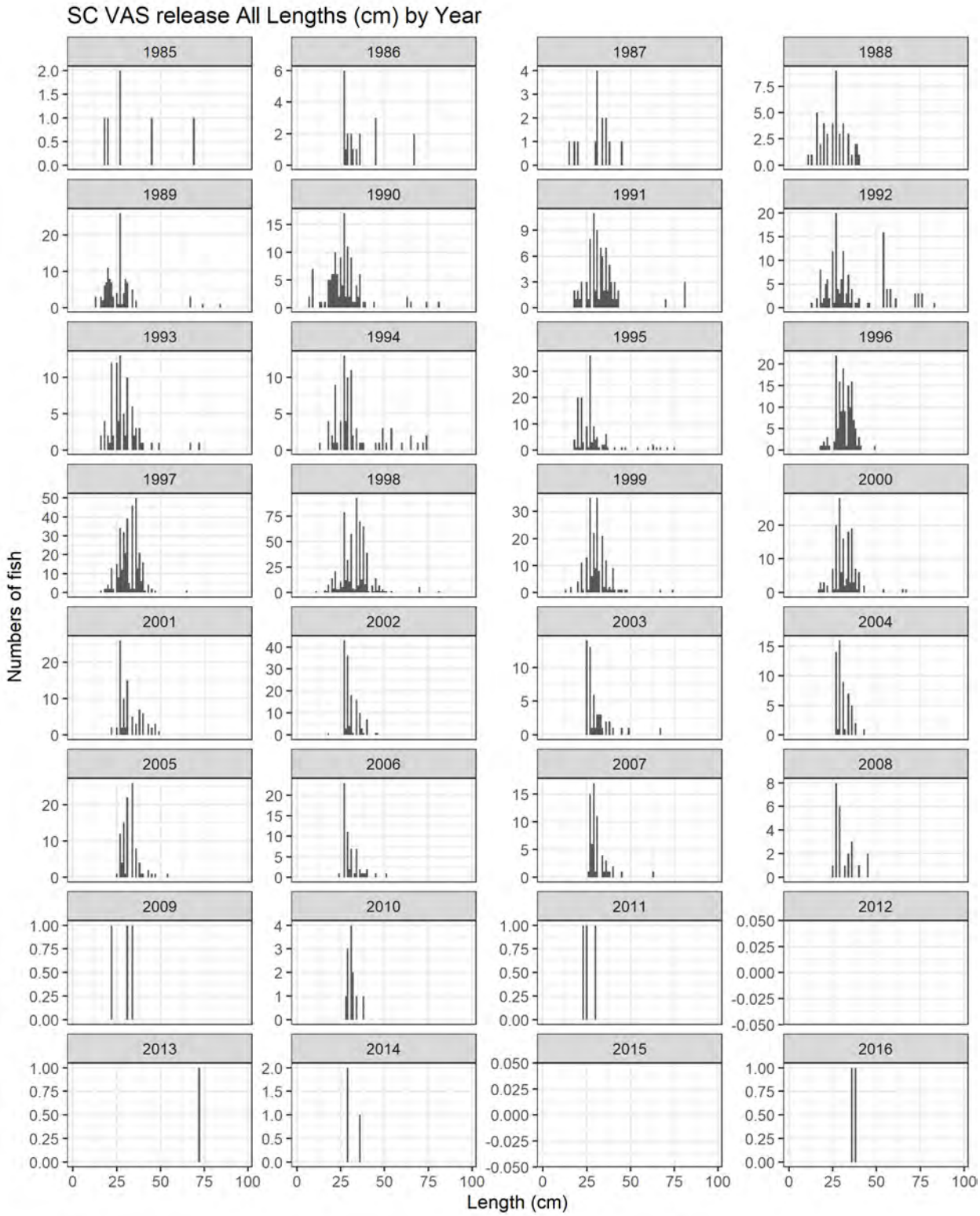

Figure 49. SC VAS length frequency for all releases from 1985-2016

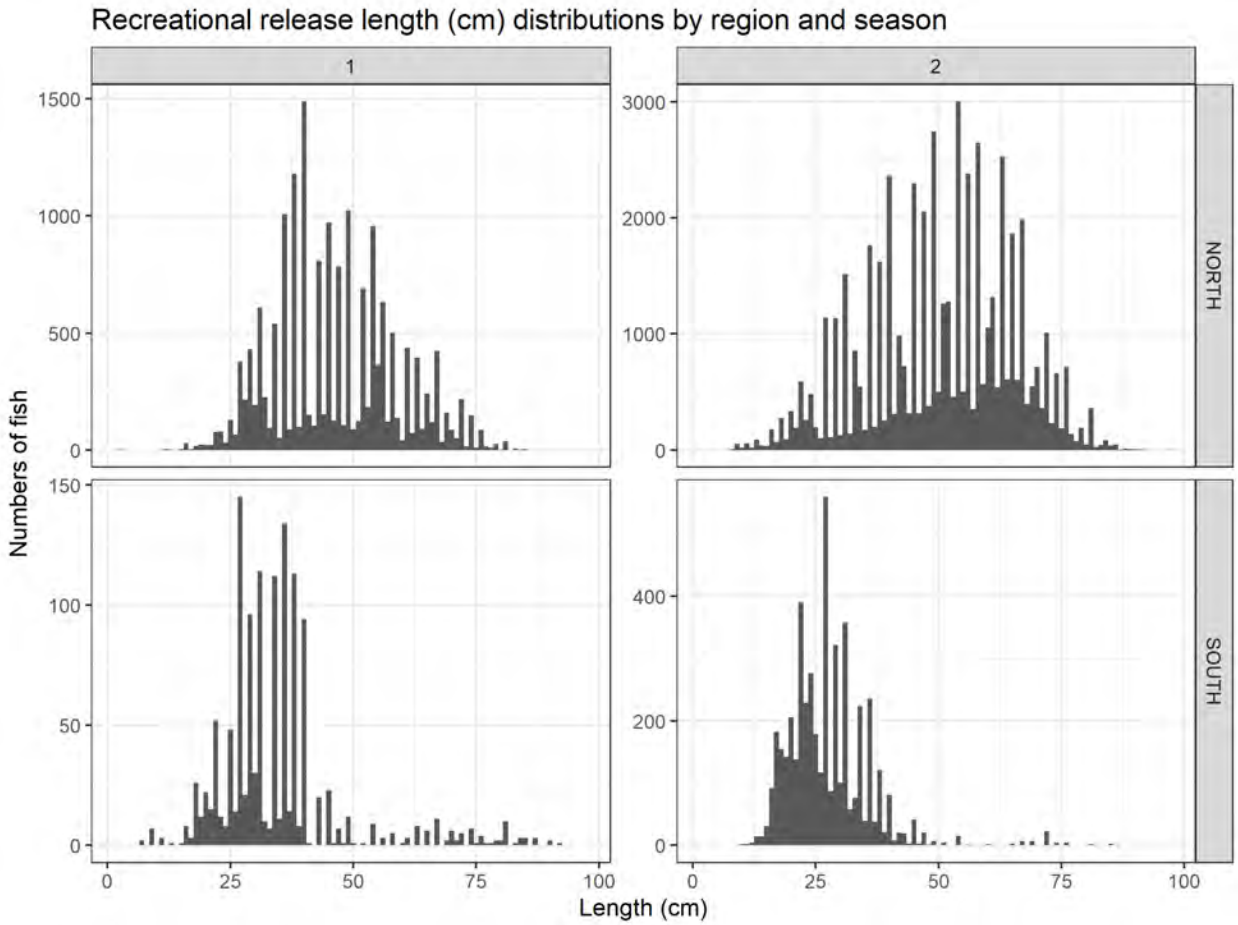

Figure 50. Total recreational release lengths (B2) by region and season

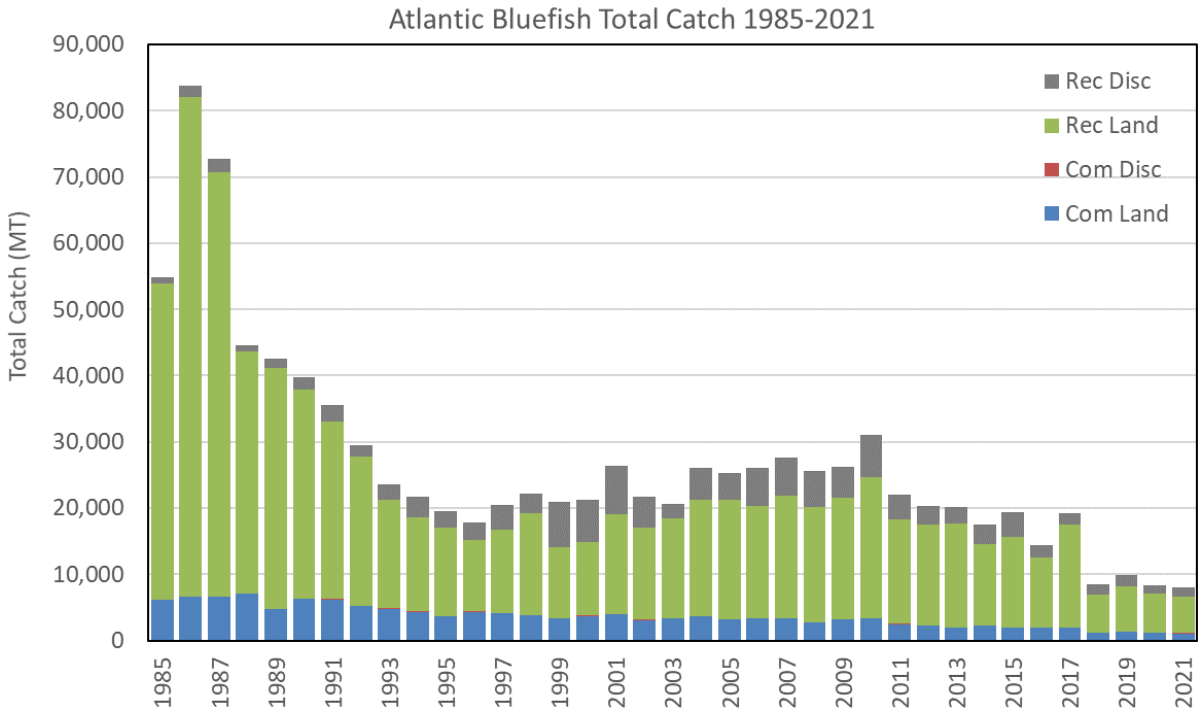

Figure 51. Bluefish total catch by component from 1985-2021

Appendix 1: Commercial discard mortality rate

M. Celestino
August 2022

Introduction

The 2015 bluefish working group (WG) assumed that commercial discards were minimal for a variety of reasons set forth in NEFSC (2015). However, in subsequent years, this assumption was increasingly questioned by technical advisory groups. As an example, some New England states began reporting that their commercial quotas were being reached, and were struggling to find donor states from which quota could be transferred. This lack of quota led to commercial fleets in some states to discard their catches of bluefish. Additionally, the assumption of minimal commercial discards was viewed by the MAFMC's SSC as a significant source of scientific uncertainty in the determination of OFL and ABC (NEFSC 2015).
The present WG re-evaluated this assumption, and while the scale of commercial discards appears to be modest relative to commercial and recreational landings (and recreational discards), the WG reasoned that its estimation would resolve a source of uncertainty in the assessment and management of bluefish. In order to include an estimate of dead commercial discards in the bluefish assessment, an estimate of discard mortality was required.

Methods & Discussion

A search of the literature for "bluefish commercial discard mortality" through Google Scholar resulted in no studies specific to bluefish. Initial discussion centered on an assumed 100% commercial discard mortality rate. The WG acknowledged that given the scale of commercial dead discards relative to other sources of fishing mortality the decision was unlikely to influence the model results. Estimates of 100% have been used for other species where information is lacking (e.g., *Stenotomus chrysops*, NEFSC 2015). The WG also considered that an estimate of 100% would not seem credible to the commercial industry and so in an effort to increase stakeholder assessment buy in, sought to develop a meta-analysis estimate from comparable species that included striped bass and gillnet dominated fisheries that school by size and migrate long distances (C. Power, NJFW pers. comm, Florida Museum 2022a, 2022b, SEDAR39 2015).

Striped bass were considered as a candidate species from which to calculate bluefish discard mortality rates due to life history similarities and availability of gear-specific commercial discard mortality estimates. Spiny dogfish are found epibenthically, but do move throughout the water column, up to the surface (Florida Museum, 2022b; Rago et al. 2014). They swim in large schools with individuals of the same size class staying together as they grow. Additionally, they are highly migratory species, found primarily north of Cape Cod in the summer, they move to Long Island in the fall and as far south as North Carolina in the winter. Smooth dogfish have a similar geographic range as bluefish, are somewhat physically larger than bluefish, and perhaps more demersal (SEDAR 39). This species migrates north in the spring and south in the fall; prefers shallow waters of less than 60 feet (18 meters), but may be found to depths of 200 m (Florida Museum, 2022a).

Only species for which experimentally based or informed discard mortality estimates were available were considered. The WG noted that the values for spiny dogfish were round (Table 1), but further investigation indicated that while the estimates for gillnets and trawls were 'arbitrarily assumed' for SAW 18, some preliminary studies were used to lower the estimate on gillnets for SAW 42, and maintain the estimate for trawls. Information indicated that mortality from gillnets may be much lower than previously assumed, so an estimate of 0.30 was assumed for the SAW 42 assessment; information from trawls indicated much

lower mortality too, but dogfish in the various unpublished studies were all captured in relatively small tows (not representative of the otter trawl fishery), therefore 0.50 was retained.

Gear specific mortality estimates were tabled for each species (Table 2; Rago et al. 2014, SEDAR 39 2014; ASMFC 2018, NEFSC 2006). Bluefish commercial discard totals by gear were queried and pooled over the entire duration of the NMFS observer program (1989-2022) to develop weights for a weighted average (Table 2). The weighted average was 32% and this was the value used in the present bluefish assessment.

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SEDAR 39. 2015. HMS Atlantic Smooth Dogfish Shark, SEDAR 39 Stock Assessment Report. 273 pp. https://sedarweb.org/docs/sar/S39_Atl_smooth_dog_SAR.pdf

Tables

Table 1. Changes in spiny dogfish commercial discard mortality estimates at various stock assessment workshops (SAWs).

SAW	Trawl	Gillnet
SAW18	0.50	0.75
SAW42	0.50	0.30

Table 2. Gear-specific discard mortality rates (expressed as fractions) for species considered in calculation of weighted average bluefish discard mortality rate.

Species	Otter trawl	Anchored gillnet	Drift gillnet	Longline	Hook and line	Pound nets	Other
Spiny dogfish	0.50	0.30		0.10	0.20		
Striped bass	0.35	0.4275	0.08		0.09	0.05	0.20
Smooth dogfish	0.19	0.27		0.135	0.17		
Average	0.35	0.33	0.08				0.14*
CV	0.45	0.25	-				0.43
Weight	0.54	0.38	0.06				0.02

*: The average of 'other' was calculated from longline, hook and line, pound nets and other gears.