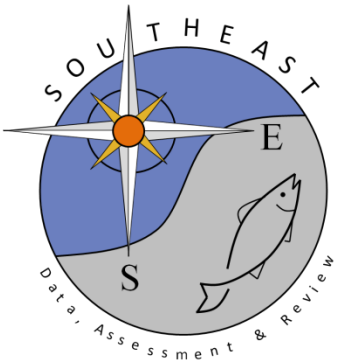
Length and age composition of Red Snapper, *Lutjanus campechanus*, collected in association with fishery-dependent projects along Florida's Atlantic Coast

Maria McGirl, Jessica Carroll, Genine McClair, and Bridget Cermak

SEDAR90-DW-21

April 2025



Please cite this document as:

McGirl, Maria, Carroll, Jessica, Genine McClair and Bridget Cermak. 2025. Length and age composition of Red Snapper, *Lutjanus campechanus*, collected in association with fishery-dependent projects along Florida's Atlantic Coast. SEDAR90-DW-21. SEDAR, North Charleston, SC. 24 pp.

Length and age composition of Red Snapper, *Lutjanus campechanus*, collected in association with fishery-dependent projects along Florida's Atlantic Coast

Maria McGirl, Jessica Carroll, Genine McClair, and Bridget Cermak

Florida Fish and Wildlife Conservation Commission, Fish and Wildlife Research Institute, 100 8th Avenue SE, St. Petersburg, FL 33701

Introduction

The Fishery-Dependent Monitoring subsection (FDM) of the Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI) monitors commercial and recreational fishing in marine environments along the Florida coast in association with several fishery-dependent research and monitoring projects. FDM administers three federal surveys: the Marine Recreational Information Program (MRIP) and The Southeast Region Headboat Survey (SRHS) for the recreational sector, and the Trip Interview Program (TIP) for the commercial sector. Additionally, FDM conducts several unique surveys of recreational anglers that allow for the collection of supplemental biological data. Each fishery-dependent research or monitoring project that contributed age and length data to the Life History Group is detailed below. During these surveys, priority was given to collecting the left otolith when removing both otoliths was not feasible, to ensure the prompt return of fish to anglers.

Commercial Fishery Data

Trip Interview Program (TIP)

The commercial fishery is sampled through the NOAA Trip Interview Program (TIP), in which Florida actively participates. The TIP program primarily focuses on collecting random size-frequency data and biological samples from commercially harvested marine species. Samplers gather information from fish offloaded from commercial fishing vessels, including fork length and natural total length (measured in millimeters). Weight measurements are recorded as whole weight or gutted weight (measured in kilograms), depending on the fish's condition upon landing. To

preserve fillet integrity, a single otolith is typically extracted from beneath the operculum. Length and weight data are submitted as part of a unified federal dataset.

Recreational Fishery Data

Recreational Mini-Season Sampling

Since 2012, FWRI has enhanced fishery-dependent monitoring efforts to collect biological data, including lengths, weights, and ages of Red Snapper landed in the private boat and charter fisheries during short recreational harvest seasons in the South Atlantic. Samples were collected through two methods:

1. Randomized Catch and Effort Survey

   FWRI conducts a specialized fishery-dependent survey aimed at providing more precise catch estimates for private boat mode during Red Snapper recreational mini-seasons, which also provides an opportunity to collect biological data from harvested fish. This survey includes dockside sampling at randomly selected angler intercept sites adjacent to major inlets from Cumberland Sound to Port St. Lucie. These inlets serve as egress points to Red Snapper fishing grounds in the Atlantic Ocean. Very few Red Snapper are landed south of this region along the east coast of Florida. Private anglers returning from offshore recreational boat-based fishing trips are intercepted, and harvested Red Snapper were measured (at midline in mm), weighed (kg), and an otolith was extracted when permitted by the angler. Landings estimates may be used to apply sample weights to each fish sampled. Beginning in 2017, charter vessels intercepted at private access point sites were also interviewed.

2. Supplemental Biological Sampling

   During 2012-2014 mini-seasons, targeted biological sampling was conducted to supplement size-at-age data collected through the randomized catch and effort survey, described above. Red Snapper were targeted for biological sampling at private boat landings sites, including fish cleaning stations and boat ramps, and at charter and headboat landing sites from Cumberland Sound to Port St. Lucie. Sampling sites were not randomly selected; instead, biologists went to sites where Red Snapper trips were known to occur

because of the short window of opportunity to collect samples. Returning vessels were sampled in order that they arrived, and biologists did not target any particular size of fish.

Additionally, during 2012 and 2013, Red Snapper carcasses were collected at select locations on the east coast of Florida, from all three recreational fishing modes. It is impossible to determine whether biological samples collected from donated carcasses are biased or if they are representative of the harvested population. Nevertheless, data from targeted biological sampling and carcass donations may be able to provide additional size-at-age data for older fish and fish caught in deeper depths that are in other randomly selected, fishery dependent samples (SEDAR 41-RD15). These targeted biological sampling collections were largely discontinued after 2014 in favor of more representative sampling.

From 2017-2019, a randomized sample design was employed for supplemental biological sampling as part of a three-year MARFIN grant awarded to FWRI. This dockside intercept sampling was aimed at collecting representative biological data to improve stock assessments in the data-poor region of the South Atlantic. Biological samples collected include lengths (at the midline in mm), weights (kg), and otoliths. A randomized draw was used to select angler intercept sites in close proximity to navigable egress points that allow boating access to the Atlantic Ocean. Private and charter anglers returning from offshore recreational boat-based fishing trips were intercepted. Unlike the randomized catch and effort survey, this supplemental biological survey was conducted year-round and coast-wide (including south of St. Lucie inlet to Key West). Additional assignments were scheduled during the South Atlantic Red Snapper mini-seasons to enhance data collection during the short sampling windows, but Red Snapper were among the priority species sampled year-round. Headboats were not sampled as part of this project, since NOAA Fisheries conducts extensive dockside sampling for this segment of the recreational fishery.

<u>For-Hire At-Sea Observer Sampling</u>

Gulf Coast of Florida

From 2005-2007, at-sea observer survey coverage on headboats operating from Alabama and the Gulf coast of Florida, from the panhandle through the Keys, was funded by the Gulf Fisheries Information Network (Gulf FIN). There was a gap in funding from January 2008 through May 2009. In June 2009, the state of Florida secured alternative funds to continue at-sea observer

coverage in the northwest panhandle and central peninsula, including both the charter and headboat fleet. In 2014, coverage on headboats was limited to a small number of vessels participating in a pilot study for IFQ shares. Thus, data from this year are not considered representative of the fishery as a whole. Since 2015, there has been consistent coverage of both charter and headboats from the panhandle through the Florida Keys.

South Atlantic coast of Florida

On the South Atlantic coast, at-sea headboat sampling has been conducted continuously since 2005 funded by the Atlantic Coast Cooperative Statistic Program (ACCSP), with this report including data collected between 2005 and 2024. At-sea sampling on Atlantic coast charter boats was funded with a 3-year MARFIN grant from 2013-2015, and there was a gap in funding from January 2016-May 2020. In July 2020, the state of Florida secured funds through the State Reef Fish Survey to expand coverage to east Florida, but trips were not observed through this funding until April 2021 due to the COVID-19 pandemic. There has been consistent coverage of charter boats since sampling coverage was re-initiated in April 2021.

Florida Keys (KEYS)

Headboat observer surveys were conducted in the Florida Keys from 2005 to 2007, funded by the Gulf Fisheries Information Network (GulfFIN) along with the Gulf coast. In 2010, headboat sampling coverage in the Florida Keys was re-initiated, along with the initiation of charter boat sampling. In 2014, representative at-sea observer data was only collected from charter vessels in the Florida Keys. Since 2015, there has been consistent coverage of both charter and headboats in the Florida Keys.

Collection Method

For the survey, both headboats and charter boats were randomly selected on a weekly basis throughout the year. Biological data was collected from harvested Red Snapper dockside after observed trips, including midline length (mm), whole weight (kg), and whenever possible, a left otolith was extracted from sampled fish. Measurements and otoliths collected from observer

coverage represent supplemental sampling separate of the dockside sampling conducted for the Southeast Regional Headboat Survey (SRHS).

State Reef Fish Survey of Recreational Fishers

The State Reef Fish Survey (SRFS) has run continuously on the Florida Gulf coast since May 2015 when it was previously named Gulf Reef Fish Survey. Expanding state-wide in 2020, it was renamed to SRFS. This survey is a directed effort to collect data from offshore private recreational anglers who target reef fish species. Anglers wishing to harvest certain reef fish species, including Red Snapper, on Florida's coast are required to have a State Reef Fish Angler designation on their fishing license. The State Reef Fish Survey is composed of two survey components: a mail-in survey and a dockside intercept survey. The mail-in survey is sent to randomly selected anglers with the State Reef Fish Angler designation to collect data on angler effort. The dockside intercept survey stations biologists at sampling sites to interview anglers on angler catches and fishing practices. Interview assignments are drawn from a subset of sampling sites known to have offshore fishing activity to intercept fishers that target reef fish. Data collected during dockside assignments include information regarding fishing depths, distances from shore while fishing for offshore species, number of harvested fish, and self-reported estimates of fish released during the fishing day. A subset of harvested fish are measured (fork length in mm) and weighed (in kilograms) during the survey.

Opportunistic Biological Sampling

Between 2000 and 2018 opportunistic biological sampling was conducted at angler intercept sites along the Gulf and Atlantic Coast of Florida, supported by a limited amount of funding from GulfFIN. Sampling assignments were conducted opportunistically to maximize the number of biological samples collected, primarily from busy charter landing sites. While the sampling sites were not selected using a randomized methodology, the fish sampled were not sampled in a biased manner. Biological sampling of intercepted fish included collection of length measurements (midline length in mm), whole weight (in kg) and collection of aging structures (otoliths or spines).

Representative Biological Sampling Program

The Representative Biological (RepBio) sampling program conducts supplemental biological sampling along the Gulf coast of the Florida peninsula (Escambia to Collier County) and the Florida Keys (Monroe). The survey began a pilot phase in 2018 and was fully implemented by 2019 along the entire Gulf coast of Florida. A randomized draw process is used to ensure representative collection of biological samples, along with a species list that prioritizes collection of biological samples from data-poor, state-managed, and federally managed species when encountered. Interviews of recreational anglers are conducted at fishing access points identified via the MRIP Site Register and assigned via a weekly draw by sub-region. Biological sampling of harvested species includes collection of length measurements (midline length in mm), whole weight (in kg) and collection of aging structures (otoliths or spines). RepBio expanded to the Atlantic coast in November 2020. From January 1st, 2024, to August 1st, 2024, RepBio experienced a funding gap. No biological samples were collected during this period.

Atlantic Red Snapper Exempted Fishing Permit Projects

The Atlantic Red Snapper Exempted Fishing Permit Projects are three projects that began in August 2024 aimed at collaborating with recreational anglers to test alternative management strategies and collect better catch and discard data for the snapper grouper complex through mandatory electronic reporting. The Hot Spot Fleet Project occurs in the area extending from the Florida/Georgia line south to Cape Canaveral. Participants are selected by random lottery draw to participate as part of the 1) experimental group testing out an alternative management strategy and may keep up to 3 Red Snapper per trip (100 participants per quarter) or the 2) control group that must fish under all current state and federal regulations and may not keep any Red Snapper (100 participants per quarter). Each participant can take up to three trips per quarter. For each trip, the participant must hail out/hail in, report detailed information about their fishing trip in the reporting system and allow a biologist to sample their catch when they return. The Southeast Fleet Project is very similar to the Hot Spot Fleet Project, except it is conducted in the area extending from Cape Canaveral to the Florida Keys, and participants are only allowed two trips per quarter. Biologists attempt to sample as many trips taken by participants in each of these projects as possible, with a goal of 20% of trips intercepted. In 2024, an average of 49% of trips were intercepted when they returned to the dock. During the dockside intercept, all harvested Red Snapper are measured (fork length in mm) and an otolith extracted. The third project is the Hot Spot Full Retention Study Fleet.

Five charter captains and five private boat captains are selected to participate each quarter and can take up to four trips per quarter. Participants for this project are selected based on several criteria including the area intended to be fished, vessel type, homeport of the vessel, as well as comprehensive answers to application questions. All participants in this project must fish under the alternative management strategy. Participants are instructed to keep all Red Snapper (full retention) while fishing under the alternative management strategy and must stop bottom fishing when they reach 36 Red Snapper per vessel per trip or if they reach the alternative management strategy snapper grouper bag limit, whichever comes first. Participating private boat captains are required to hail out/hail in and report detailed fishing information in the reporting system for each trip. They also record every trip using a temporary electronic monitoring system (i.e. two cameras, GPS, and recording device) and a biologist samples all harvested fish when they return to the dock. Participating charter captains have the same requirements, also record their trips using a temporary electronic monitoring system and carry observers for all trips taken as part of the project. The observers also sample all harvested fish when they return to the dock. Like the other two projects, all harvested Red Snapper are measured (fork length in mm) and an otolith extracted.

Ageing Protocols

Sagittal otoliths were removed from the head, cleaned, dried, and stored in vials. The left otolith was processed for age determination unless it was broken through the core, in which case the right otolith was processed. The core of the otolith was marked with pencil and the whole otolith was mounted on card stock using hot glue. Otoliths were processed on a four-bladed Buehler Isomet low speed saw. With this multi-blade technique, one transverse cut yields three ~400µm thick sections that encompass both the core and the entire region surrounding the core (VanderKooy et al., 2020). After processing, sections were mounted on glass slides with Shandon mount (previously called Flo-texx), a chemical mounting medium.

Sectioned otoliths were examined on a stereo microscope using either reflected or transmitted light, which was at the reader's discretion. The number of opaque zones (annuli) were counted from the core to the edge on the dorsal lobe of the otolith along an axis near the sulcal groove. Each otolith was examined at least twice and if the two reads disagreed, a third read was conducted to determine consensus age.

Calendar ages were calculated using annulus count, degree of marginal completion, average date of otolith increment deposition, and date of capture. This traditional method is based

on a calendar year instead of time since spawning (Jearld, 1983; VanderKooy et al., 2020). Previous studies have found that Red Snapper off the southeastern US complete annulus formation by late spring to early summer (White and Palmer 2004; Allman et al., 2005). Using these criteria, age was advanced by one year if a large translucent zone was visible on the margin and the capture date was between January 1 and June 30. For all fish collected after June 30, age was assigned to be annulus count, since opaque zone formation is typically complete (Allman et al., 2005). Calendar ages were converted to fractional, or monthly biological, ages by adding or subtracting the fraction of a year calculated between the assumed July 1 birth date and month of capture.

The total number of 31,518 otoliths were aged from FWRI sampling along the southeastern Atlantic coast of Florida for SEDAR90. Given the timespan of otolith collections and turnover in the FWRI ageing lab, 11 individual readers contributed to ageing these otoliths. Prior to ageing any batch of Red Snapper collections, each individual reader aged through an in-house reference set of Red Snapper otoliths representing a range of age classes, seasons, sexes and collection locations to calibrate ageing technique, particularly identification and interpretation of the first annulus and margin type (Campana, 2001). Quality control subsets were read each sampling year by all active readers to estimate precision. Readers were assigned different portions of the collections for individual reading. The average percent error on all first and second reads of the entire dataset was 0.96%, which is considered highly precise (Campana, 2001); moreover, there was an 91% age agreement between all first and second reads, and a 99% agreement ± 1 year. All age data provided for SEDAR90 included increment count, calendar age and fractional age; however, the summaries including ages in this report were based on adjusted calendar age.

Results:

Fishery-Dependent Results: Age and length composition

All fishery-dependent age data have been provided to the life history workgroup; what follows is a summary of the calendar ages and lengths of aged Red Snapper. Age data are summarized for a total of 30,597 individuals. The majority of age samples were obtained from the private sector, accounting for 13,509 samples (44.19% of samples). Recreational surveys included 8,389 samples from commercial trips, 6,505 from charter trips, and 1,792 from headboats. In addition, 403 aged fish were from tournaments and unknown sources (Table 1). Over 99.7% of fish aged from the private boat fishery were collected between 2012 and 2024 with total otolith collections being above 400 per year every year since 2012 (Table 2). In 2014, 1,260 otoliths were

collected from charter vessels, the most annual for the time series (Table 2). Commercial samplers collected over 81% of the commercial otoliths between 2017-2024 (Table 2). Headboat samples were heavily concentrated in 2009 and 2012, with these two years accounting for more than half (57.81%) of the total aged fish within the headboat sector (Table 2).

Approximately 18.02% (5,514 fish) were female, 18.35% (5,615 fish) were male, and 63.63% (19,468 fish) were unsexed. Over the full time series, the mean ages varied by fleet. The lowest mean age was 3.6 ± 1.89 y in the headboat fishery. The highest mean age was 5.73 ± 3.08 y in the charter fishery. The oldest fish aged was from the commercial fishery which was aged at 39 years. The next oldest fish were two 32-year-olds which were sampled from the commercial fishery. A total of 70 fish were aged over 20 years old within the delivered data (Figure 1).

Literature Cited:

Allman RJ, Fitzhugh GR, Starzinger KJ, Farsky RA (2005) Precision of age estimation in red snapper (Lutjanus campechanus). Fisheries Research 73:123-133

Campana SE, Thorrold SR (2001) Otoliths, increments, and elements: keys to a comprehensive understanding of fish populations? Canadian Journal of Fisheries and Aquatic Sciences 58:30-38

Jearld A, Jr. (1983) Age determination. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland

VanderKooy S, Carroll J, Elzey S, Gilmore J, Kipp J (2020) A Practical Handbook for Determining the Ages of Gulf of Mexico and Atlantic Coast Fishes. Gulf States Marine Fisheries Commission and Atlantic States Marine Fisheries Commission, Ocean Springs, MS

White DB, Palmer SM (2004) Age, growth, and reproduction of the red snapper, Lutjanus campechanus, from the Atlantic waters of the southeastern US. Bull Mar Sci 75:335-360

Table 1. Numbers of fish aged, mean (± SD) age, and length landed by fishing fleet (2002-2024).

Fishing Fleet	# Fish	Mean Age (y)	Mean FL (mm)
Charter	6505	5.73 ± 3.08	657.13 ± 130.54
Commercial	8389	4.78 ± 3.08	578.47 ± 136.32
Headboat	1792	3.6 ± 1.89	539.12 ± 126.01
Private	13508	5.52 ± 3.03	639.98 ± 136.25
Tournament	322	6.51 ± 3.23	720.63 ± 108.87
Unknown	81	5.49 ± 2.03	671.59 ± 112.31

Table 2. Numbers of fish aged, mean (± SD) age, and length landed by fishing fleet by year (2002-2024.

	# Fish	Mean Age (y)	SD AGE	Mean FL (mm)	SD FL
Charter					
2022	23	3.13	546.13	0.757	63.623
2003	83	3.855	570.173	1.668	88.964
2004	35	3.714	586.211	1.045	83.679
2005	128	4.227	625.3	2.017	112.603
2006	178	5.287	622.927	2.487	112.809
2007	30	4.9	622.533	1.185	99.085
2009	283	3.742	588.593	1.028	73.364
2012	703	5.24	656.484	2.175	126.706
2013	444	6.146	694.675	2.721	124.577
2014	1260	6.443	688.66	3.161	145.934
2017	230	4.34	629.17	2.81	112.56
2018	638	5.88	663.54	3.55	126.92
2019	538	5.84	665.69	3.39	133.90
2020	162	5.85	633.01	3.68	138.29
2021	479	5.76	635.62	3.29	125.42
2022	181	6.16	660.96	3.12	112.23
2023	271	6.59	684.00	3.28	100.24
2024	839	6.03	646.27	3.19	135.31

Table 2. Continued.

	# Fish	Mean Age (y)	SD AGE	Mean FL (mm)	SD FL
Commercial					
2004	3	6	673.333	2.646	165.561
2007	1	6.00	730.00	.	.
2008	34	3.00	545.34	0.25	41.27
2009	749	4.72	633.60	2.87	106.03
2010	36	4.67	562.39	0.68	42.62
2012	62	5.92	670.19	2.89	113.93
2013	361	4.52	608.38	2.20	126.61
2014	288	4.81	622.81	2.46	140.88
2017	453	3.29	556.79	1.73	118.72
2018	861	3.83	551.31	2.49	133.40
2019	660	5.20	594.56	3.66	148.85
2020	1336	6.02	600.24	4.17	152.25
2021	1079	4.36	539.47	2.74	134.80
2022	728	4.10	530.19	2.11	113.56
2023	744	4.71	571.05	2.76	134.59
2024	994	5.46	585.46	2.97	128.96
Headboat					
2004	7	3.00	535.57	0.00	22.17
2005	55	3.42	549.84	1.05	63.56
2006	143	3.88	579.40	0.98	73.00
2007	37	4.16	592.60	1.21	86.77
2008	7	3.29	542.59	0.95	59.34
2009	542	3.77	581.72	1.82	79.40
2011	1	4.00	632.45	.	.
2012	494	3.17	487.61	1.76	126.33
2013	88	4.52	571.97	2.05	149.22
2014	310	3.60	515.04	2.46	168.78
2016	2	2.5	405.61	0.707	9.079
2017	25	1.92	404.358	0.64	65.674
2018	33	2.97	490.172	1.237	136.409
2024	48	4.85	617.29	1.69	119.12

Table 2. Continued.

	# Fish	Mean Age (y)	SD AGE	Mean FL (mm)	SD FL
Private					
2002	10	3.10	557.20	0.32	44.16
2003	1	3.00	517.00	.	.
2004	1	4.00	548.00	.	.
2005	2	3.00	416.50	0.00	40.31
2007	2	5.00	661.50	1.41	190.21
2009	20	3.85	603.66	0.88	77.17
2012	949	4.91	630.39	2.05	133.72
2013	1037	5.98	681.15	2.77	140.48
2014	2577	6.43	689.42	3.10	143.86
2017	497	3.86	588.34	2.66	123.04
2018	1335	5.08	622.83	3.16	128.63
2019	1594	5.68	648.95	3.35	128.99
2020	587	5.52	615.78	3.55	149.66
2021	1526	5.22	603.56	3.06	130.52
2022	1010	5.54	628.19	3.16	125.94
2023	1140	5.49	633.83	2.66	116.02
2024	1220	5.08	610.55	2.60	126.58
Tournament					
2003	1	5.00	672.00	.	.
2012	224	6.02	711.79	2.84	107.11
2013	62	6.97	723.30	3.93	129.07
2018	35	8.86	773.89	3.21	57.10
Unknown					
2012	48	5.71	693.24	1.70	96.65
2013	25	5.24	647.26	2.73	138.93
2024	8	5.00	617.74	1.20	81.41

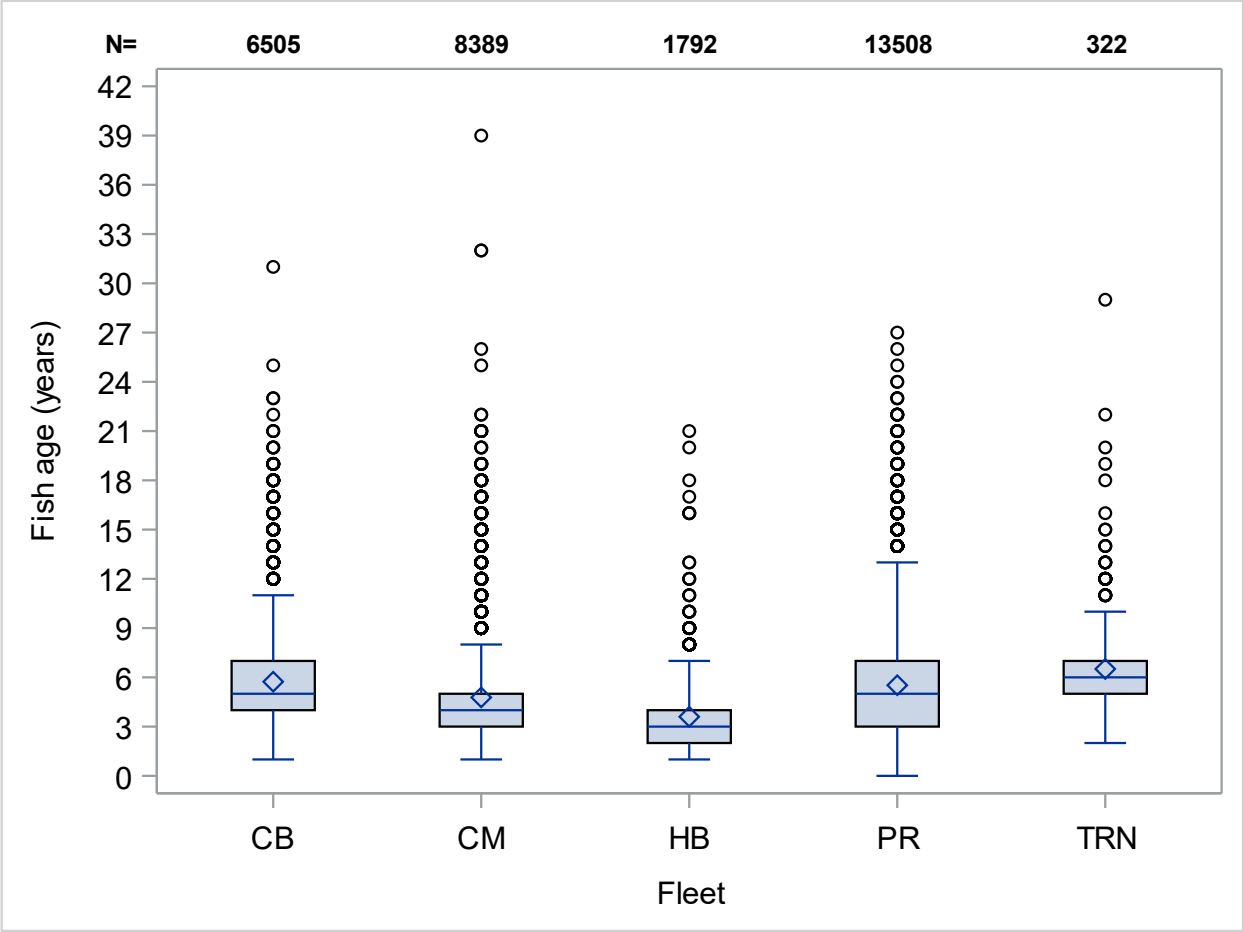


Figure 1. Age distribution by fishing fleet. N = total numbers of samples included in each box. CB= Charter, CM= Commercial, HB= Headboat, PR= Private, TRN= Tournament.

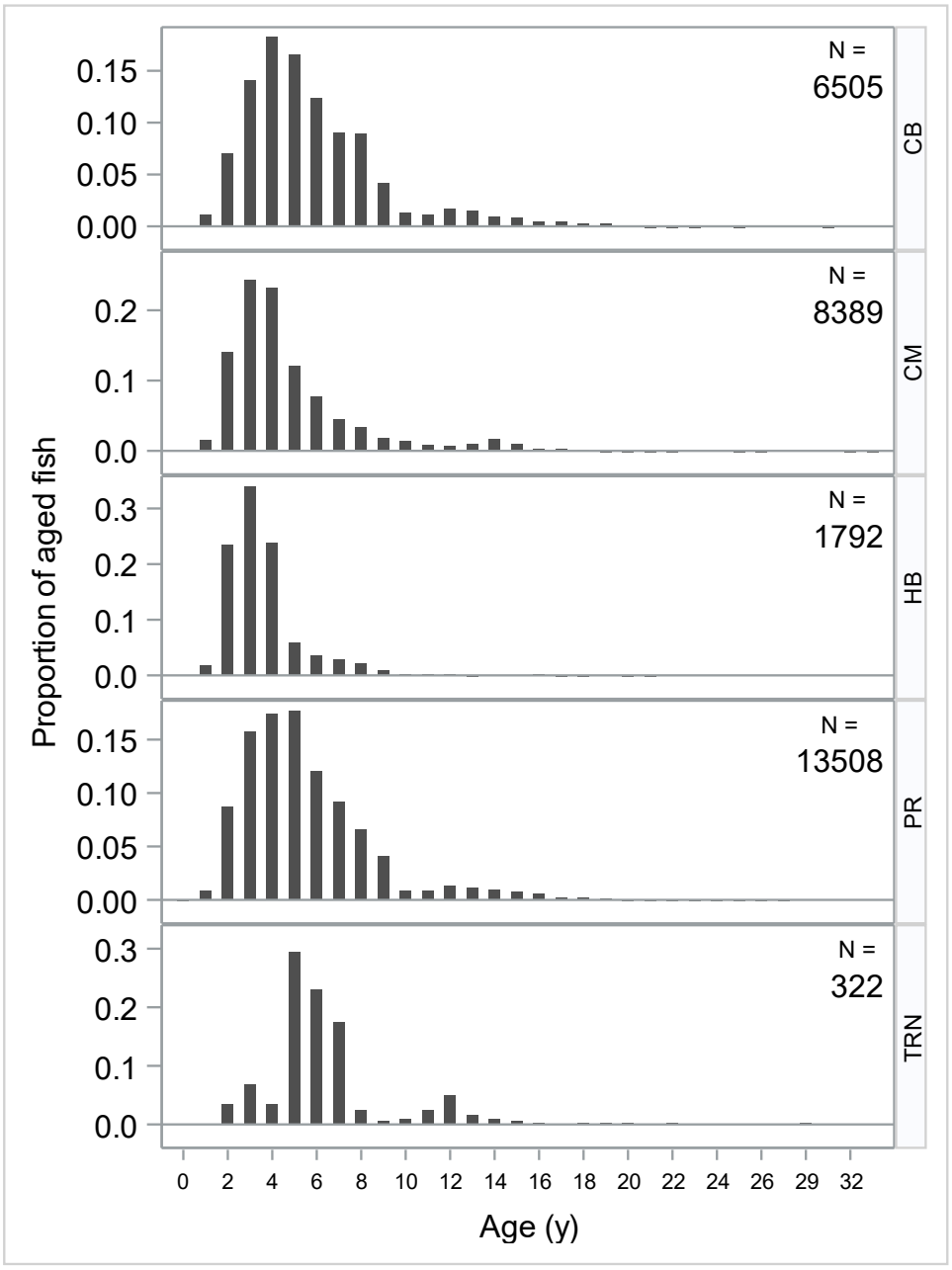


Figure 2. Age distribution of fish across entire time series in each fishery. CB= Charter, CM= Commercial, HB= Headboat, PR= Private, TRN= Tournament.

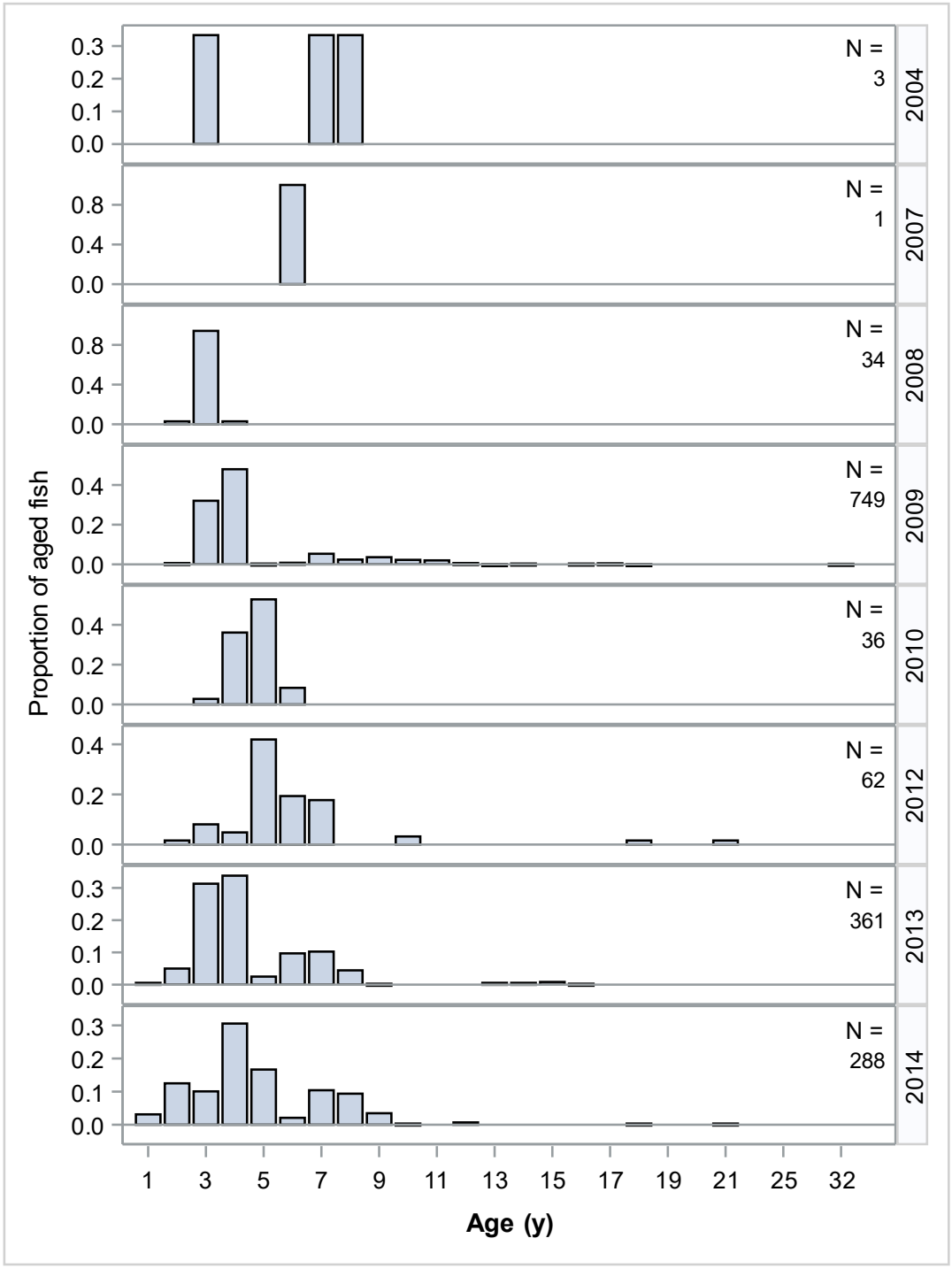


Figure 3. Proportion of total fish aged by year and region from the **COMMERCIAL** fishery.

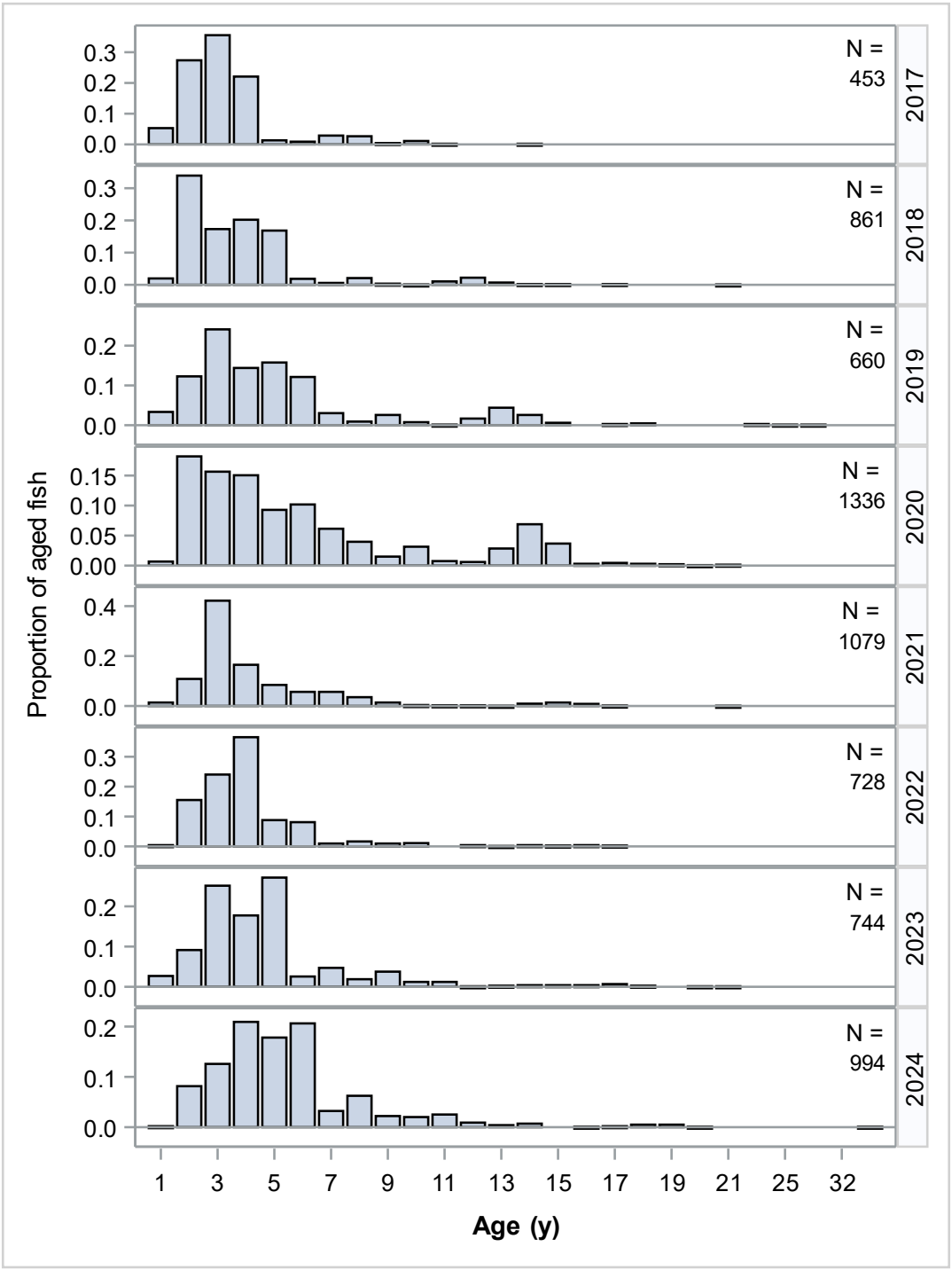


Figure 3 (cont). Proportion of total fish aged by year and region from the **COMMERCIAL** fishery.

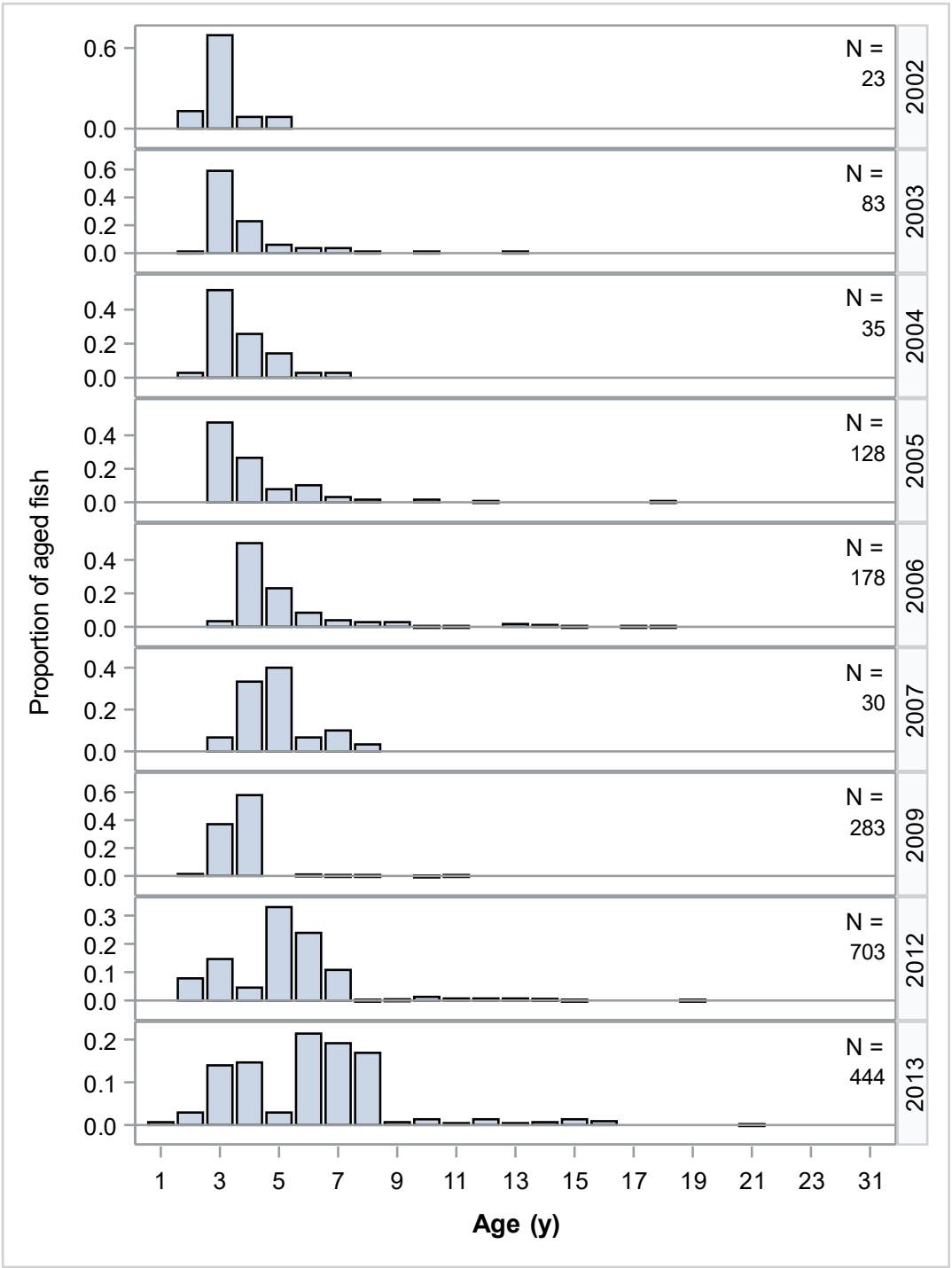


Figure 4. Proportion of total fish aged by year and region from the **CHARTER** fishery.

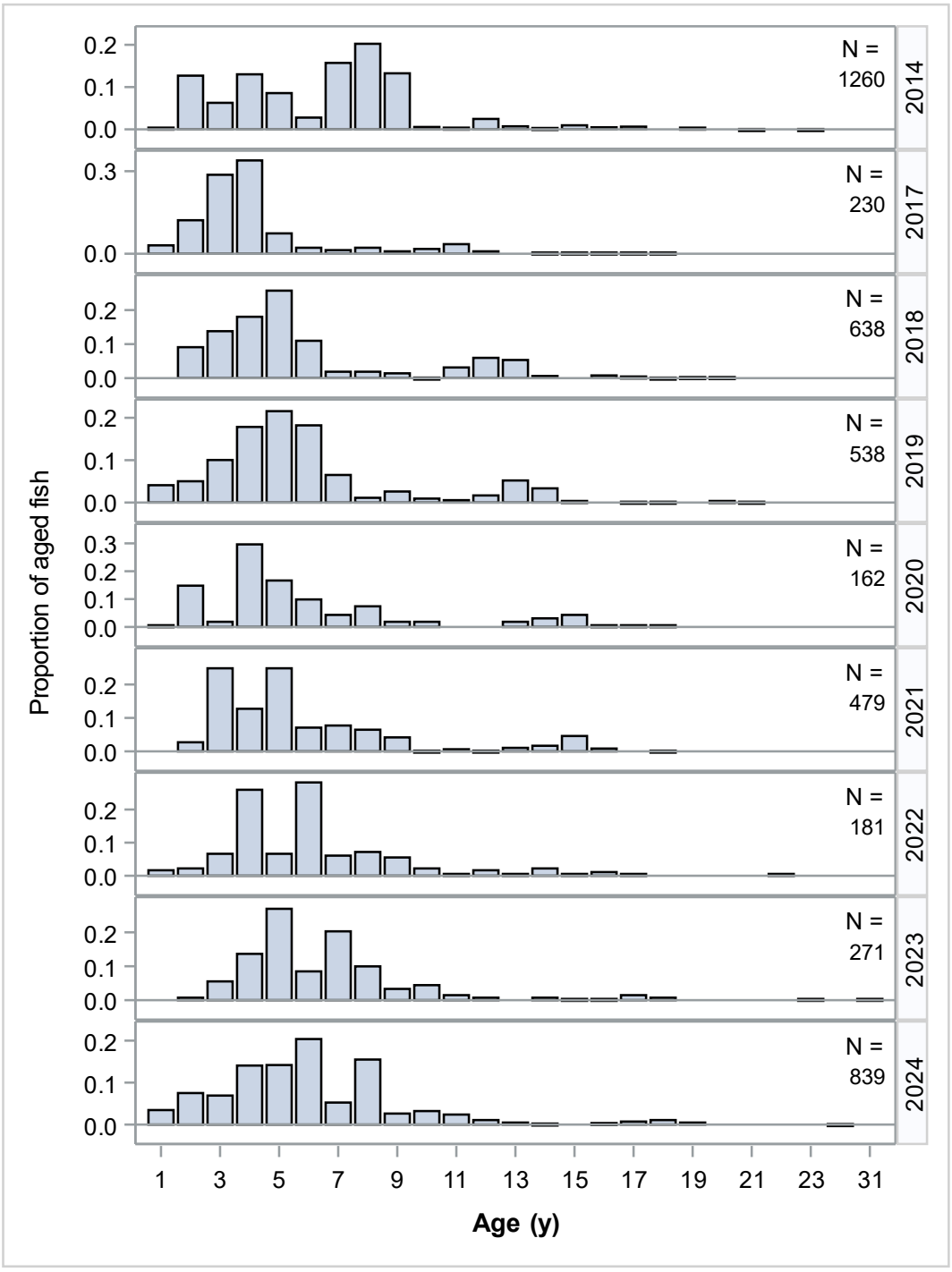


Figure 4 (cont). Proportion of total fish aged by year and region from the **CHARTER** fishery.

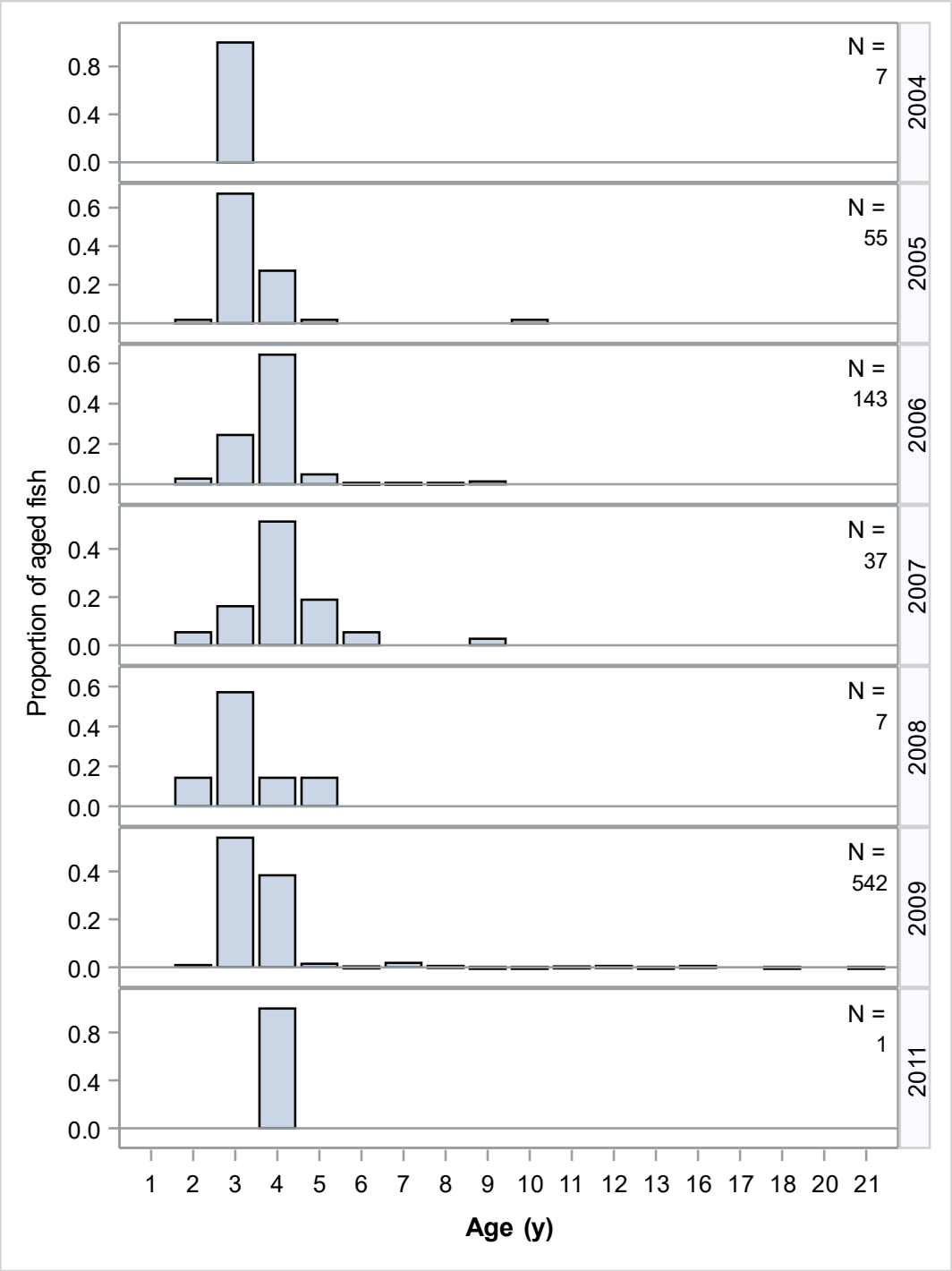


Figure 5. Proportion of total fish aged by year and region from the **HEADBOAT** fishery.

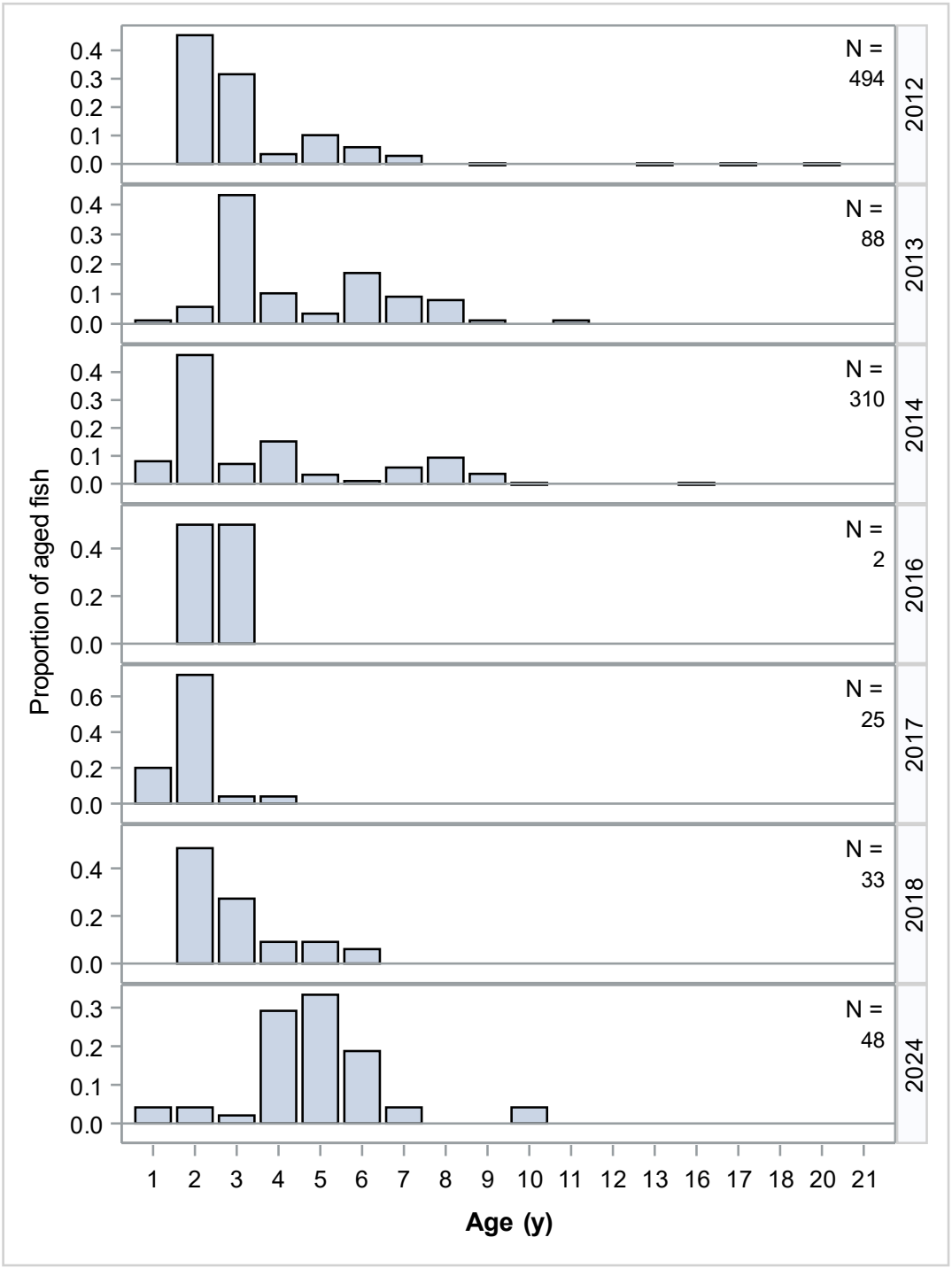


Figure 5 (cont). Proportion of total fish aged by year and region from the **HEADBOAT** fishery.

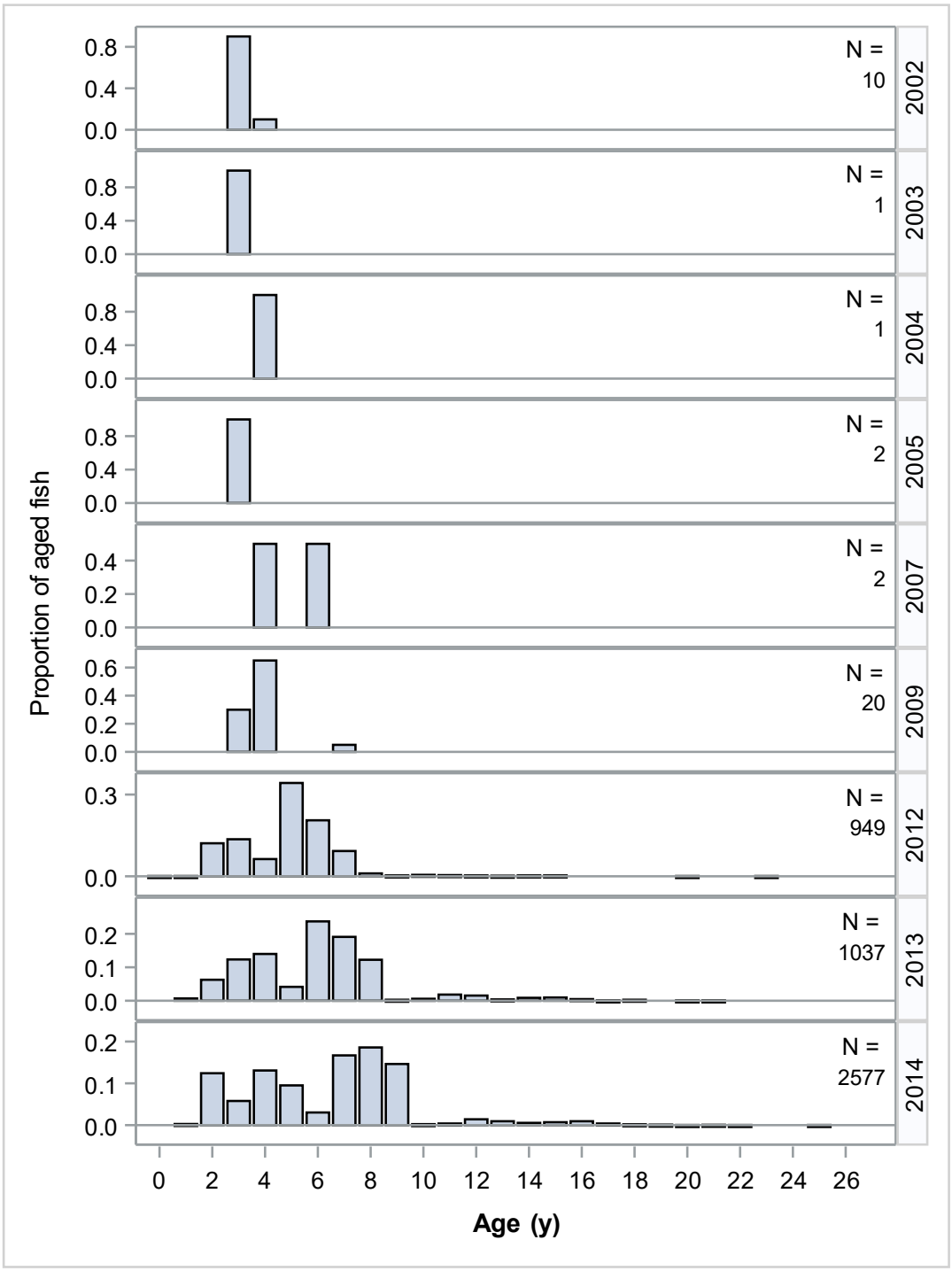


Figure 6. Proportion of total fish aged by year and region from the **PRIVATE** fishery.

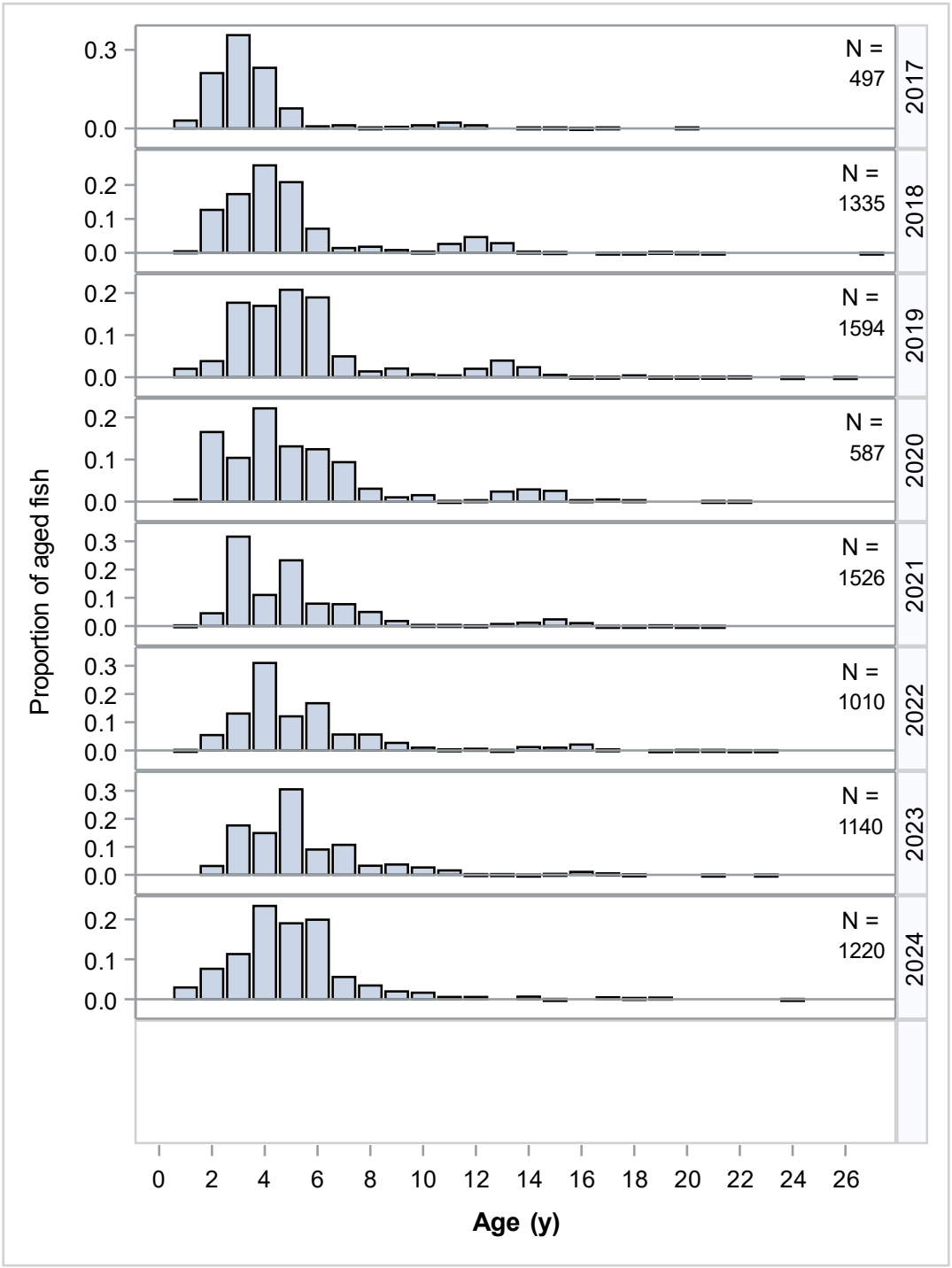


Figure 6 (cont). Proportion of total fish aged by year and region from the **PRIVATE** fishery.

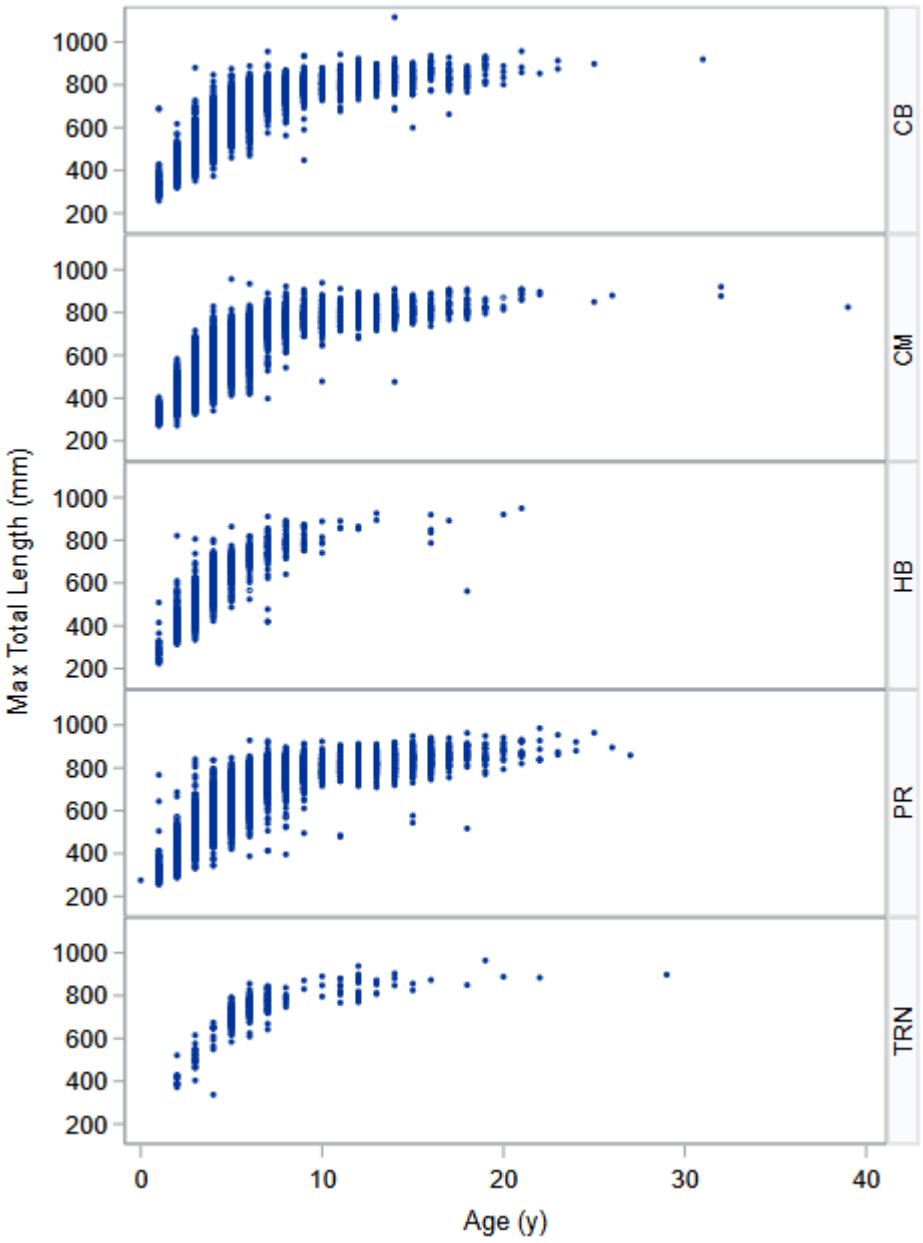


Figure 7. Max Total Length as a function of age in each fleet. Instances where max total length was not observed, fork length, natural total length, or standard length were converted to max total length (SEDAR41). CB= Charter, CM= Commercial, HB= Headboat, PR= Private, TRN= Tournament.