Saltwater License Project Summary

Tournament and Fish Wrack Recycle Programs: Fishery Dependent Data 2002 to 2007

Christopher J. McDonough

Marine Resources Research Institute
South Carolina Dept. of Natural Resources
217 Fort Johnson Rd.
Charleston, SC 29412

Introduction

South Carolina lacks significant commercial fin fisheries, thus the major fishery impact results from recreational fishing pressure. While fishery independent monitoring of economically valuable recreational fish species is important in order to assess relative stock levels and population health, understanding the impact of recreational fishing has on these same species is also vital. Fishery dependent monitoring provides important information on overall fishing effort, species targeted, species caught, number caught, size of the catch (length, weight), location, date, and other data that describe the fishery. Additionally it acts as a check on fishery independent data. If collected in a sound manner, these observations can be used to characterize the recreational fishery.

Much of the fishery dependent data used to describe recreational fisheries in the United States is collected through creel census surveys conducted by the National Marine Fisheries Service (NMFS) through its Marine Recreational Fisheries Statistics Survey (MRFSS) and various state creel census survey programs that work in conjunction with the MRFSS. Although the data provided good information on the types of species caught along with general size (length or weight) estimates, they are limited to angler reports and questionable surveys. Actual biological information taken by the creel clerks or other individuals, such as accurate morphometrics and life history traits (age, sex, maturity, food) is rare.

The South Carolina Dept. of Natural Resources (SCDNR) utilizes two sources to collect fishery dependent biological data for species harvested by marine recreational anglers in South Carolina for comparison with data collected by the MRFSS in South Carolina. These collections were obtained from fishing tournaments and the fish wrack recycling program, and they supplement both the fishery independent surveys and the MRFSS data by providing verifiable biological data on species utilized by anglers in South Carolina. Additionally, this sampling provides opportunities for interactions between SCDNR employees and anglers on a regular basis. This communication is extremely beneficial in fostering good relationships between fishery biologists and the angling community.

Methods

The fishery dependent work consisted of two parts. During the spring, summer and fall months, we sampled a minimum of six inshore fishing tournaments held in the Charleston, S.C. area. Species that were typically observed were red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), sheepshead (*Archosaurgus probatocephalus*), spotted sea trout (*Cynoscion nebulosus*), bluefish (*Pomatomus saltatrix*), and southern flounder (*Paralichthys lethostigma*). We obtained total length (L_T) standard length (L_S), total weight, sex and gonad condition, and otoliths were removed for age determination. Small pieces of tissue from gonads were taken for histological confirmation of sex and maturity and whole ovaries were taken from sheepshead and spotted sea trout for fecundity estimates.

The other fishery dependent collections were obtained from voluntary contributions of fish "wracks" (the remains of fish after filleting). Throughout the remainder of this report, any reference to the fish collected from the "fish wrack program" will be referred to as freezer fish since they were collected and stored in freezers. A minimum of four freezers were maintained at locations convenient for anglers throughout the Charleston area where fish wracks could be dropped off. Additional freezers were located at retail tackle shops in Georgetown and Hilton Head, South Carolina from 2002 to 2004, but had to be removed due to changes in management at the collection locations or non-participation by anglers. Anglers recorded the date and location of where the fish were caught and included this information with the fish wracks. Only length measurements (L_T and L_S) were taken for freezer fish since total weight could not be obtained. Sex and maturity were determined through gross morphological examination and otoliths were removed for aging. Histological samples were not taken since the specimens had been frozen and cellular integrity of the gonad tissue was compromised. The species collected for the freezer fish program included red drum, spotted sea trout, sheepshead, black drum, and southern flounder. Specimens were collected monthly from January 2002 through December 2007.

Data were analyzed separately for the tournament and freezer fish. The analysis was conducted separately because the different data sources, although very similar, did not provide the same information so it was difficult to combine the two sets in a meaningful way. The primary recreational species (red drum, black drum, spotted sea trout, sheepshead, and southern flounder) were each examined separately for length and age frequencies, as well as weight. In the tournament fish, specimen weight was regressed against total length using a non-linear regression in the form $W_T = a\ L_T^{\ b}$, where W_T = specimen weight, L_T = total length, a = y-intercept, and b = regression coefficient (slope). If sample size was sufficiently robust within each species group, comparisons were made between sexes using an analysis of covariance (ANCOVA). Generalized comparisons were also made between the MRFSS data and the present data for mean size by year and species, as well as general catch trends during this time period. Annualized comparisons of the MRFSS data were made using Sampling Waves 2 through 5 (March through October) which represented the same general time frame as the tournaments and the bulk of the freezer fish collections. The MRFSS sampling is carried out in six Waves annually during a calendar year with each Wave representing a two-month period.

Results

Tournament Summary:

In total, 3,434 specimens were collected at 38 different recreational fishing tournaments from February through November. Most collections (84.1%) occurred from April through August. The total number of specimens examined at tournaments each year decreased from 2002 (620 specimens) to 2007 (440 specimens). The most numerous species were spotted seatrout, sheepshead, and southern flounder, which made up 90.2% of all the fish examined (Table 1). The drum family (Pisces: Sciaenidae) made up the largest taxonomic group (44.9% of specimens) with three species represented (spotted seatrout, black drum, and red drum). The remaining species all came from separate taxonomic families (Bothidae, Sparidae, and Pomatomidae).

Freezer Fish Program Summary:

The number of freezers varied from a high of 8 in 2002 to 6 from 2003 to 2004, and 4-5 in 2006 and 2007. The decrease in the number of freezers was due to either decreasing participation by anglers at a particular location or changes in management at the location of the freezer that required its removal. Although the numbers of anglers participating in the freezer fish program decreased from 2002 to 2004 (which reflected the decrease in freezers), both the relative number of anglers per freezer and the number of fish collected per freezer actually increased after 2004 (Fig. 1).

In total, 2,689 specimens were collected from January 2002 through December 2007 (Table 2). Biological data were collected on 8 species, with the same 5 species examined at the tournaments analyzed for this report. Spotted seatrout were most abundant in the freezer samples, followed by red drum, sheepshead, and southern flounder (Table 2). As with the tournament fish, the Sciaenidae were the most abundant family, with 4 species (spotted seatrout, weakfish, red drum, black drum) followed by Sparidae (sheepshead) and two species of Bothidae (southern flounder and gulf flounder). All of the primary species were seen every month of the year except southern flounder in January.

The freezer fish were captured with six different gear types (Table 3). The majority of specimens were caught using hook & line (85.2%) and gigging (14.1%). The remaining gear types represented only a small percentage of the total catch (0.7%). Spotted seatrout were captured mostly with hook & line with very few specimens captured with gig and gill net. Red drum were also primarily caught with hook & line, but almost 20% were gigged as well. Almost all of the sheepshead (97.4%) were caught using hook & line, with the remaining specimens coming from spear gun, gig, and cast net. The spear gun and gig specimens were caught on offshore reef sites by SCUBA divers. Southern flounder were captured more frequently by gigging (60.4%) than by hook & line (38.6%). The remainder came from cast nets (0.7%) as well as a single specimen that came from a crab pot. Black drum were collected mostly with hook & line (99.5%) with a few specimens resulting from SCUBA divers using spear guns (0.5%).

Species Summaries: Spotted Seatrout

Tournament and freezer fish spotted seatrout had a similar size ranges (313 – 652 mm L_T = tournament, 312 – 645 mm L_T = freezer fish) (Fig. 2); however, tournament fish had significantly greater mean size (428 mm L_T) than the freezer fish (394 mm L_T) ($F = 465.5$, at $p = 0.001$). Tournament trout weighed from 347 to 1235 g with a mean of 640.2 g, and the weight - L_T relationship was highly significant ($r^2 = 0.937$, $p < 0.0001$) (Fig. 3). No significant differences in the length - weight relationships between males and females ($F = 2.186$, $p = 0.140$) were seen. The overall model for weight at length for the combined data was: $W_T = 0.000014 (L_T)^{2.926}$. The ages of tournament fish ranged from 0 to 7 years (Fig. 4A) and 1 to 6 years for the freezer fish (Fig. 4B). The mean age for tournament fish was 2 while the freezer fish had a mean age of 1. The additional age class and the greater mean total length in the tournament data was probably due to the tendency of anglers to bring larger fish to tournament weigh-ins, even though the maximum size of the tournament trout was not much larger than the freezer fish (652 mm L_T versus 645 mm L_T respectively). This is evident in figure 2 where the percent frequency of spotted seatrout greater than 500 mm L_T in the tournament group made up approximately 17% of the specimens versus 7% of the specimens in the freezer fish group. The sex ratios indicated a greater number of females than males in both the tournament fish (4:1) and the freezer fish (3:1). The higher number of females resulted from sexually dimorphic growth in spotted seatrout, as females have a greater mean L_T at age than males (Roumillat and Brouwer, 2004) and anglers were likely to keep larger fish for either tournaments or to eat.

The number of spotted seatrout seen in both tournament and freezer fish collections varied annually without trends. The annual number of freezer fish trout decreased from 2002 to 2004, after which it increased. This was not seen in the tournament trout. The decrease could be directly attributed fewer anglers participating in the freezer fish program during these years. Although the decrease in participants accounts for most of the decline in trout catches, there was a biological component that could have

contributed. A decrease in the catch per unit effort (CPUE) for spotted seatrout numbers in 2002 and 2003 was seen in fishery independent trammel net surveys in South Carolina and was attributed to a low temperature winter fish kill that occurred in 2001 (Unpublished Data). In contrast, the MRFSS data showed an approximately 98% increase in the annual catches of spotted seatrout between 2002 and 2003. During this same time period there was an overall increase of 118% in the number of angler trips, so the reported increase in catches from the MRFSS more likely reflected the increasing effort levels. This inconsistency between the MRFSS and localized surveys indicate the unreliability of the use of MRFSS data to assess stock condition.

Sheepshead:

Sheepshead sizes ranged from 208 to 658 mm L_T in the tournament fish (Fig. 5A) and 235 to 660 mm L_T in the freezer fish (Fig. 5B). Tournament fish were slightly larger (418.3 mm L_T) than the freezer fish (406.6 mm L_T), but the difference was not significant ($F = 0.007$, $p = 0.935$). Specimen weight in the tournament sheepshead ranged from 195 to 5630 g with a mean of 1777 g. The relationship between total length and weight was highly significant ($F = 25510$, $p < 0.001$) with no significant differences between males and females ($F = 0.167$, $p = 0.683$). This produced an overall regression model of specimen weight to total length such that: $W_T = .00003 (L_T)^{2.927}$ ($r^2 = 0.964$, $p < 0.001$) (Fig. 6). Ages ranged from 1 to 19 in the tournament sheepshead (Fig. 7A) and 1 to 18 in the freezer fish (Fig. 7B). Both males and females were found for the entire age range in both data sets. The mean age differed between males (4) and females (5). Sex ratios of fish from both sources were similar (1:1 males to females). Both male and female sheepshead captured from February through May showed signs of reproductive activity with developed testes and ovaries. Specimens collected during the rest of the year were either inactive or spent.

Sheepshead annual catches showed a similar decrease in the freezer fish data which reflected the reduction in participating anglers for 2002 to 2004, but continued to decrease from 2005 to 2007. The tournament sheepshead numbers varied annually but

overall did not vary significantly ($p = 0.05$) from the long-term mean. The MRFSS data indicated relative stability during these years, with a slight overall decreasing trend in the catch of sheepshead.

Southern Flounder

Flounder sizes ranged from 299 to 625 mm L_T in tournament fish(Fig. 8A) and 313 to 777 mm L_T for the freezer fish (Fig. 8B). The mean size of the tournament and freezer fish (404 mm L_T versus 392 mm L_T) was not significantly different ($t = 2.672$, $p = 0.002$). Specimen weight in the tournament flounder ranged from 271 to 3026 g with a mean of 776.8 g. As with spotted seatrout and sheepshead, specimen weight had a highly significant relationship with total length ($r^2 = 0.967$, $p < 0.001$) (Fig. 9). There was no significant difference between males and females ($F = 0.679$, $p = 0.410$) for the length to weight regression, so the combined model for size at age was: $W_T = 0.000006 (L_T)^{3.12}$. The age range for southern flounder was 1 to 6 years for both the tournament and freezer fish (Fig. 10). One and two year olds were the most common ages and the mean age was two in both groups. Sex ratios were also the same between the two data groups with females greatly outnumbering males 9:1. This was due to sexually dimorphic growth in southern flounder since females reach much larger sizes at a given age than males. Based on the combination of a minimum size limit and a tendency by anglers to keep larger fish for consumption and to bring larger fish to tournament weigh-ins, one would expect to see a greater number of female flounder versus males. Some reproductive development was observed during the fall, but no actively spawning individuals were observed. During the rest of the year, southern flounder were all either immature or reproductively inactive.

Southern flounder numbers in the tournament data were relatively consistent annually from 2002 to 2005, but then declined in 2006 and 2007. The freezer fish data showed a decline from 2002 to 2005 attributed to fewer contributing anglers, however, the decline was only slight or leveled off after 2005. The MRFSS annual catch did show an overall increase from 2002 to 2006 with a smaller mean L_T (Fig. 11). In contrast, both

tournament and freezer fish mean L_T increased during the same time period and was significantly higher ($p < 0.05$) from 2004 to 2006 (Fig. 11). The difference in mean size between the data sets is likely due to sampling differences. Error estimates (percent standard error) from the MRFSS data were lacking. In all probability, the actual number of flounder measured by the MRFSS was likely smaller than the numbers from both the tournaments and freezer fish program. This inconsistency, again, points out the unreliability of the MRFSS data for stock analysis. Another explanation for the increased mean size of southern flounder in both tournament and freezer data sets may be the anglers themselves. Anglers that fish on a regular basis and participate in either tournaments or the freezer fish program were likely to be more skilled at targeting and catching these fish than more casual anglers.

Red Drum

The size range of red drum in tournaments was 382 to 637 mm L_T, (Fig. 12A) which corresponded closely to the slot size minimum and maximum for this species (381 to 584 mm L_T). The current maximum legal size of 584 mm L_T became effective in 2007; prior to that the maximum size was 610 mm L_T. The mean size for the tournament red drum was 496 mm L_T. The size range of freezer fish was similar (380 to 670 mm L_T), with a mean size of 485 mm L_T (Fig. 12B). There was no significant difference in mean size for red drum between the tournament and freezer fish groups ($F = 2.156$, $p = 0.068$). The weight range for the tournament red drum was 543 to 5405 g (mean weight = 1300 g). All of the red drum observed in both tournament and freezer fish groups were all sexually immature. Sex ratios in the tournament fish were approximately 2:1 female to male and 1:1 females to males in the freezer fish. The age range was 1-2 in both data sets with a mean age of 1 for both as well. The limited age range of red drum reflected the age classes that were available for harvest through the recreational slot limit. The regression of specimen length to total weight was highly significant ($r^2 = 0.953$, $p < 0.001$) and there was no significant difference in the mean size of males and females ($F = 0.001$, $p = 0.988$). The combined model for specimen weight at size was: $W_T = 0.00001 (L_T)^{3.003}$. Given the small age range from either data set, and the long life span (50+ years) of red

drum, the weight at size model is relatively limited in its use to those harvested recreationally.

Fewer red drum (8-25 fish per year) were sampled at tournaments than the other species. The main reason for this was that most tournaments did not include red drum as a target species due to the size slot limit. Most tournaments rate fish by either the largest (weight) single fish or the combined weight of a pair of fish. The harvested catch of red drum in the MRFSS data showed a threefold increase from 2002 to 2003 but then declined by almost the same amount from 2003 though 2006. The high percent standard error in the harvest numbers (15.2 – 23.4%) preclude any direct comparisons with our data.

Black Drum

The number of black drum seen at tournaments was low compared to the other species with little year to year variability (18-40 specimens per year). The range in size was 270 to 1210 mm L_T for the tournament fish (Fig. 13A) and 252 to 1203 mm L_T for the freezer fish (Fig. 13B). The mean size of the tournament fish (532 mm L_T) was significantly larger ($F = 82.12$, $p < 0.001$) than the freezer fish (432 mm L_T). Despite the similar overall size range between the two data sets, the larger mean size of the tournament fish again demonstrated the tendency of anglers to bring larger fish to tournament weigh-ins compared to the fish commonly seen in the freezer fish group. This was particularly evident in Fig. 13 when one compares the occurrence of fish greater than 600 mm L_T between the two data sets. Most of the size categories greater than 600 mm L_T in the tournaments had specimens, versus the freezer fish which had specimens present in only 3 size categories. However, it is important to note that most anglers who catch black drum don't target them. Black drum are usually caught on shrimp when fishing for other species (C. Wenner, personal communication). Tournament fish weighed from 285 to 25,818 g, with a mean of 3,430 g. The length to weight regression (Fig. 12) was highly significant ($r^2 = 0.987$, $p < 0.001$) with a significant difference between males and

females (F = 6.442, p = 0.042). Since there was a difference in the length to weight relationship between the sexes, two separate models were done:

Males: $W_T = 0.0000114\ (L_T)^{3.044}$ $r^2 = 0.993$, $p < 0.001$

Females: $W_T = 0.0000116\ (L_T)^{3.043}$ $r^2 = 0.992$, $p < 0.001$

Given the similarities in the regression equations for both sexes, a likelihood ratio test was also run and F-values indicated there was indeed a statistical difference ($F_{critical}$ = 1.605 versus $F_{0.05(2)82, 68} = 1.702$). Despite the statistically significant difference in the length to weight regressions for males and females, there was no apparent biological significance. Sex ratios were approximately 1:1 in both sets of data for black drum.

The catch data from the MRFSS data for black drum showed relatively stable numbers from year to year. However, the MRFSS numbers are poor because of the low rates of encounter with this species. Overall numbers of black drum seen in the freezer fish data showed the same decrease attributed to the decrease in participating anglers.

Summary

The overall trends in the freezer fish data reflected the changes in both the number of participants and available freezers. The overall number of anglers decreased with the number of freezers. However, after 2004, the number of anglers participating in the program was relatively stable. There was a reward program to offer an incentive to anglers to participate in the program, but in discussing the program with anglers, many contributed out of a sense of conservation in order to participate in the management of the gamefish species that are important to them. The only species that showed any increase after 2004 were spotted seatrout. This was likely due to rebounding numbers of fish coming back after a severe winter die off that occurred in 2001 and took until 2004 before relative numbers began to increase. All of the other species followed a similar trend of decreasing from 2002 to 2004 and then a relative leveling off from 2004 to 2007.

The tournament data reflected similar numbers of fish observed annually ($\pm$ 50 fish each year) until 2007 when the number of tournament fish dropped significantly. There was no real decrease in the number of tournaments sampled that year, so the decrease in fish

number was likely due to either reduced angler participation or a reduction in the relative numbers of fish available to the anglers. One explanation for reduced angler participation could have been weather, since inclement conditions often reduce the number of anglers who actually fish or show up at tournament weigh-ins. The MRFSS angler trip per year data indicated an approximate doubling of the number of angler trips in South Carolina from 2002 to 2006, so there was at least some circumstantial evidence of increasing fishing pressure. The relative annual numbers of each species sampled at tournaments varied according to general abundance, level of fishing effort, species targeted by the tournament, and general skill level of the anglers.

The data collected from fishing tournaments as well as the freezer fish program offer an important fishery dependent data source for economically valuable recreational finfish species in South Carolina. Both provide access to a greater range of animals at a relatively low cost for life history studies to supplement data collection from fishery independent monitoring efforts. This was particularly useful in accessing larger specimens that were not often encountered by fishery independent means. In the case of a few species, such as sheepshead or black drum, these data sources frequently are more reliable and provided a greater range of specimens than fishery independent sources. When evaluating a fish species for either stock assessments or developing best management practices, having access to as wide a size and age range of a given population will provide a better view of what is occurring within the entire group. Fishery dependent sources such as tournaments and the freezer fish provide valuable checks on fishery independent data, as well as verifiable biological data that can serve as a check on other fishery dependent data sources such as creel census surveys and the MRFSS. These different data sources, used in conjunction, provide a baseline of data on both recreational important finfish species and the general behavior of South Carolina's angling public and the different fish species they target. Additionally, the interactions between SCDNR biologists and the angling public through these activities provide an important educational outreach for the department's ongoing research activities. The angler's get an opportunity to both see and hear what we do with the fish species they consider important and can actively participate in ongoing fisheries research.

Cited Literature

Roumillat, W.A. & M.C. Brouwer. (2004). Reproductive dynamics of female spotted seatrout (*Cynoscion nebulosus*) in South Carolina. Fish. Bull. 102:473-487.

Table 1. Species composition, percent contribution, mean total length, mean weight, age range by sex and mean age for common estuarine game fish from recreational fishing tournaments in South Carolina from 2002 to 2007.

Species	Number (percent freq.)	Mean Total Length (mm)	Mean Weight (g)	Age Range	Mean Age (years)
Spotted Seatrout	1265 (36.8%)	428 ± 59	782 ± 122	M: 1-7	
				F: 1-7	2
Sheepshead	937 (27.3%)	434 ± 87	1776 ± 147	M: 1-19	
				F: 1-19	5
Southern Flounder	896 (26.1%)	404 ± 57	776 ± 102	M: 1-3	
				F: 1-6	2
Black Drum	168 (4.9%)	532 ± 196	3429 ± 254	M: 1-7	
				F: 1-5	2
Red Drum	110 (3.2%)	496 ± 54	1300 ± 186	M: 0-2	
				F: 0-2	1
Bluefish	57 (1.7%)	406 ± 47	640 ± 87	-	-

Table 2. Species composition, percent contribution, mean total length, age range by sex and mean age for common estuarine game fish from the South Carolina Dept. of Natural Resource's Fish Wrack Recycling Program 2002 to 2007.

Species	Number (percent freq.)	Mean Total Length ± SD (mm)	Age Range	Mean Age (years)
Spotted Seatrout	873 (32.4%)	394 ± 47	M: 1-6 F: 1-6	1
Red Drum	682 (25.3%)	485 ± 74	M: 1-2 F: 1-2	1
Sheepshead	502 (18.6%)	418± 90	M: 1-18 F: 1-18	4
Southern Flounder	402 (14.9%)	392 ± 62	M: 1-3 F: 1-4	2
Black Drum	216 (8.0%)	432 ± 94	M: 1-3 F: 1-5	2
Weakfish	10 (0.5%)	-	-	-

Table 3. Species frequency of occurrence by gear type for common estuarine game fish from the South Carolina Dept. of Natural Resource's Fish Wrack Recycling Program 2002 to 2007.

Gear Type	Total Number	Percent Total (all gears)	*Spotted Seatrout* % Freq. of total	*Red Drum* % Freq. of total	*Sheepshead* % Freq. of total	*Southern Flounder* % Freq. of total	*Black Drum* % Freq. of total
Hook & Line	2294	85.2%	99.5%	80.6%	97.4%	38.6%	99.5%
Gig	380	14.1%	0.1%	19.4%	0.6%	60.4%	-
Spear Gun	11	0.4%	-	-	1.8%	-	0.5%
Cast Net	4	0.1%	-	-	0.2%	0.7%	-
Gill Net	3	0.07%	0.3%	-	-	-	-
Crab Pot	1	0.03%	-	-	-	0.2%	-

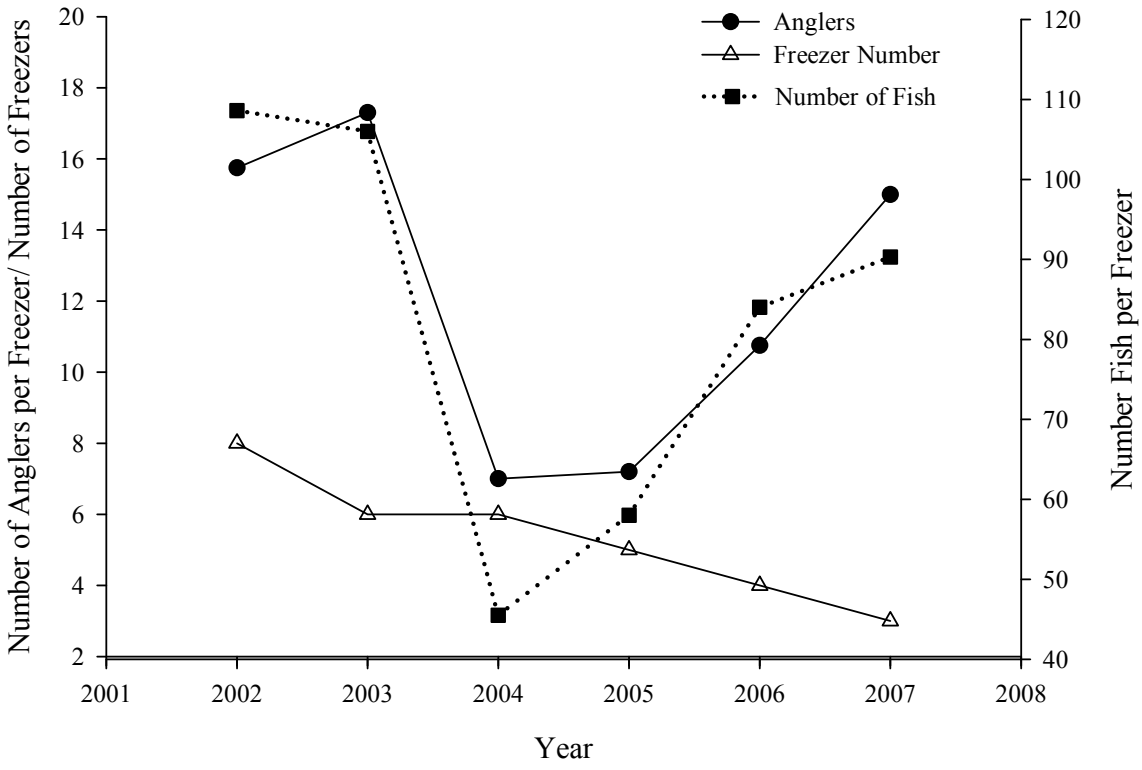

Fig. 1. Number of anglers per freezer and number of fish per freezer per year with the number of freezers available each year for SCDNR's Fish Wrack Recycling Program 2002 to 2007.

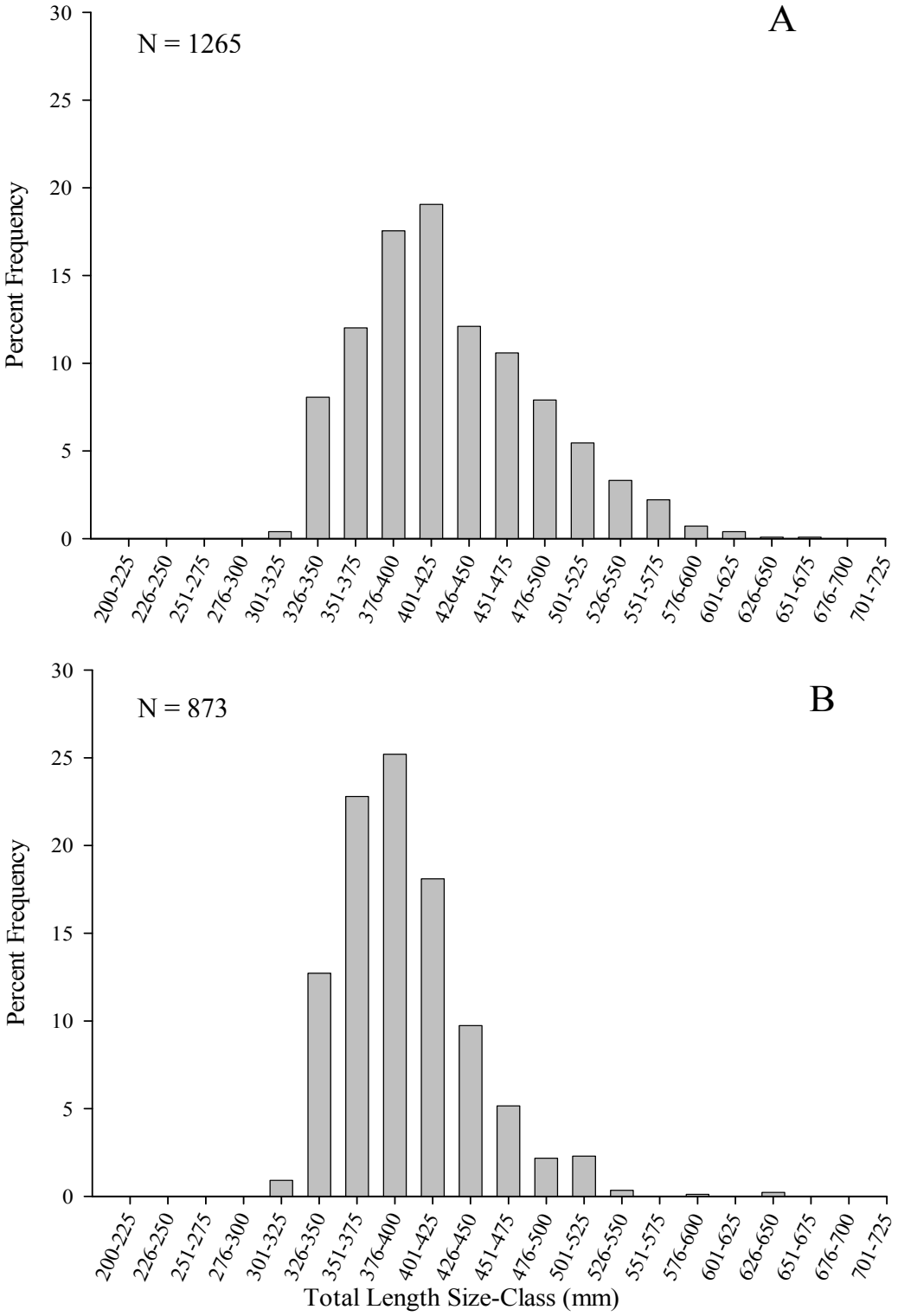

Fig. 2. Size frequency distribution of spotted seatrout from inshore fishing tournaments (A) and the Freezer Fish Program (B) in South Carolina 2002 to 2007.

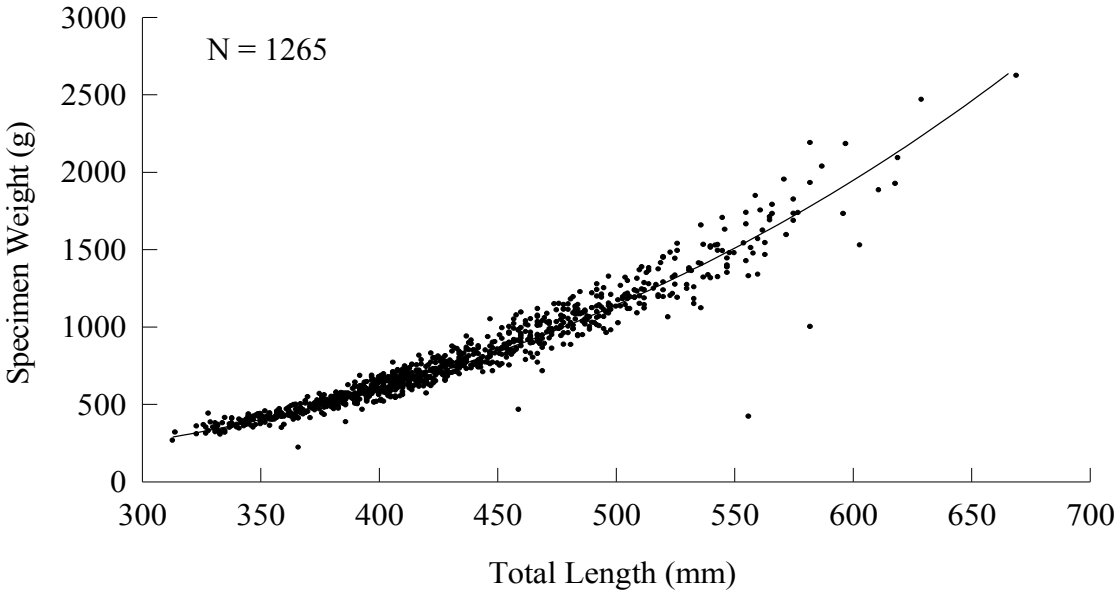

Fig. 3. Regression model for specimen weight versus total length for spotted seatrout from recreational fishing tournaments in South Carolina from 2002 to 2007.

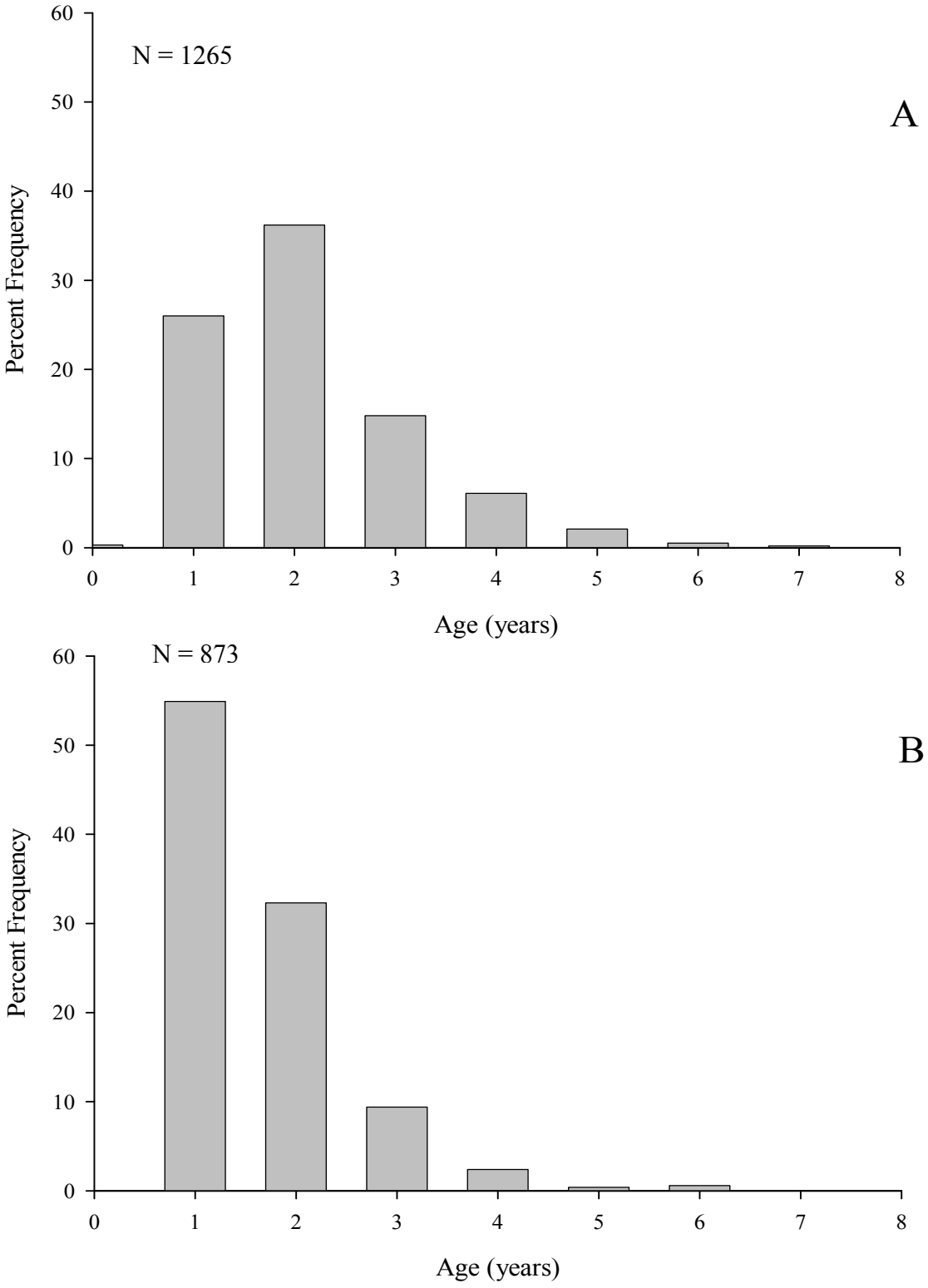

Fig. 4. Age frequency distribution for spotted seatrout from South Carolina inshore fishing tournaments (A) and the freezer fish program (B) 2002 to 2007.

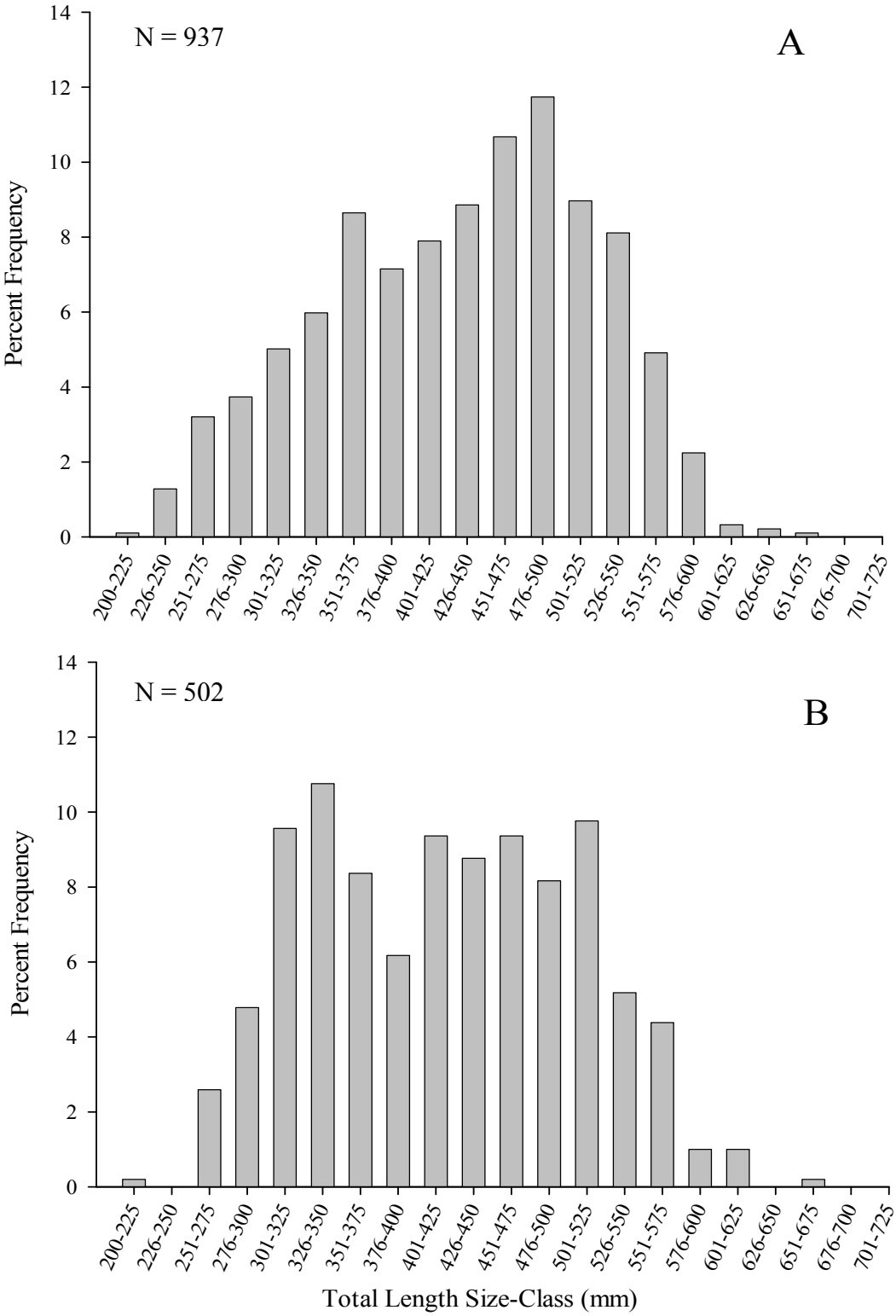

Fig. 5. Size frequency distribution for sheepshead from South Carolina inshore fishing tournaments (A) and the Freezer Fish Program (B) 2002 to 2007.

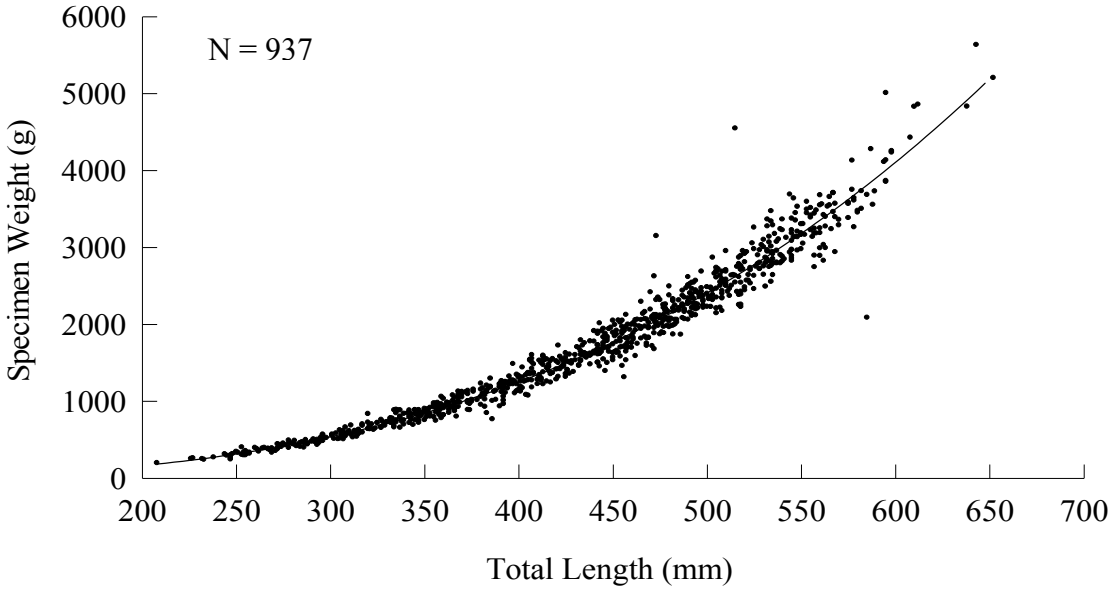

Fig. 6. Regression model for specimen weight versus total length for sheepshead from recreational fishing tournaments in South Carolina from 2002 to 2007.

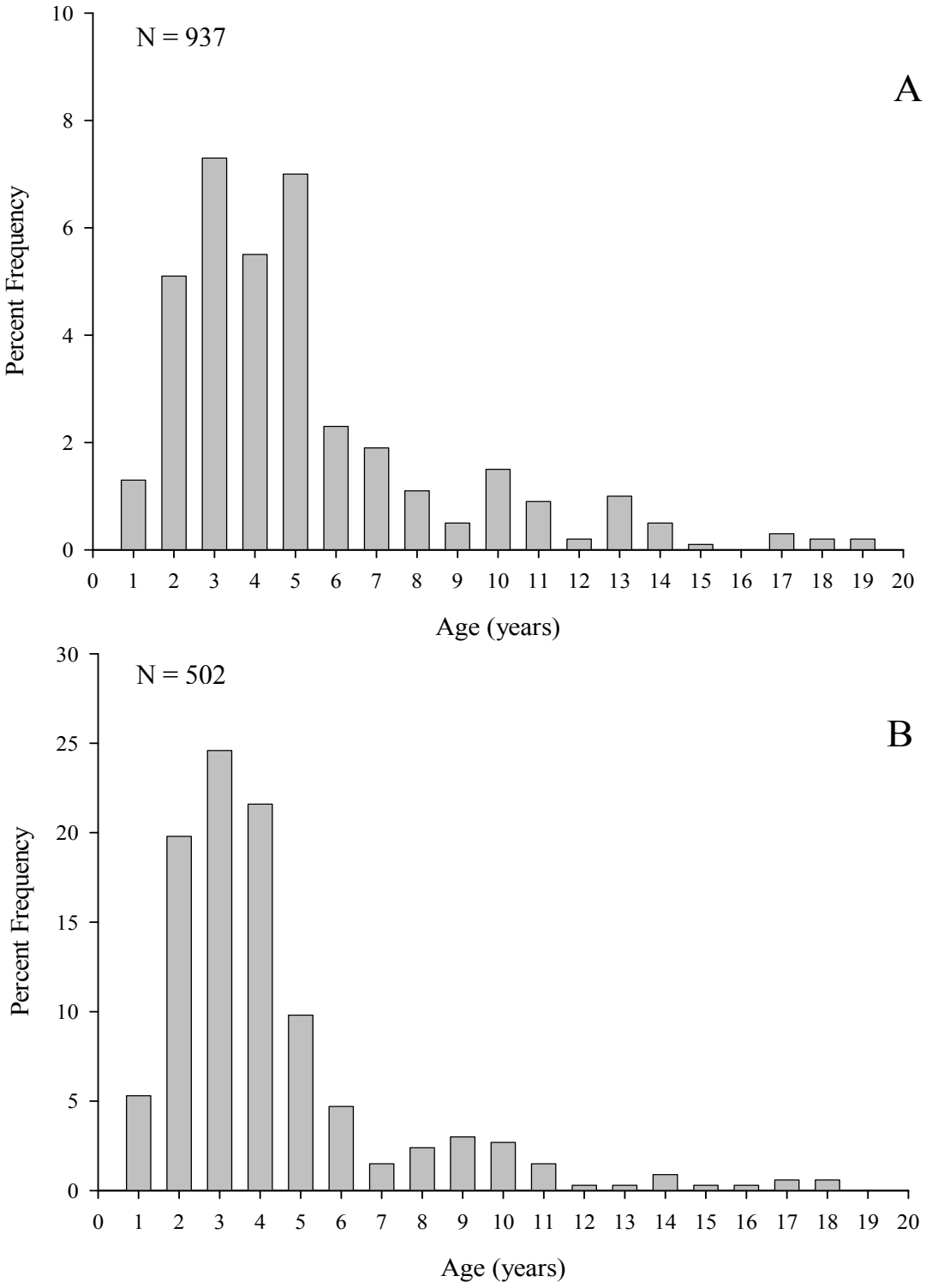

Fig. 7. Age frequency distribution for sheepshead from South Carolina inshore fishing tournaments (A) and the freezer fish program (B) 2002 to 2007.
*note: different y-axis scales between these two figures.

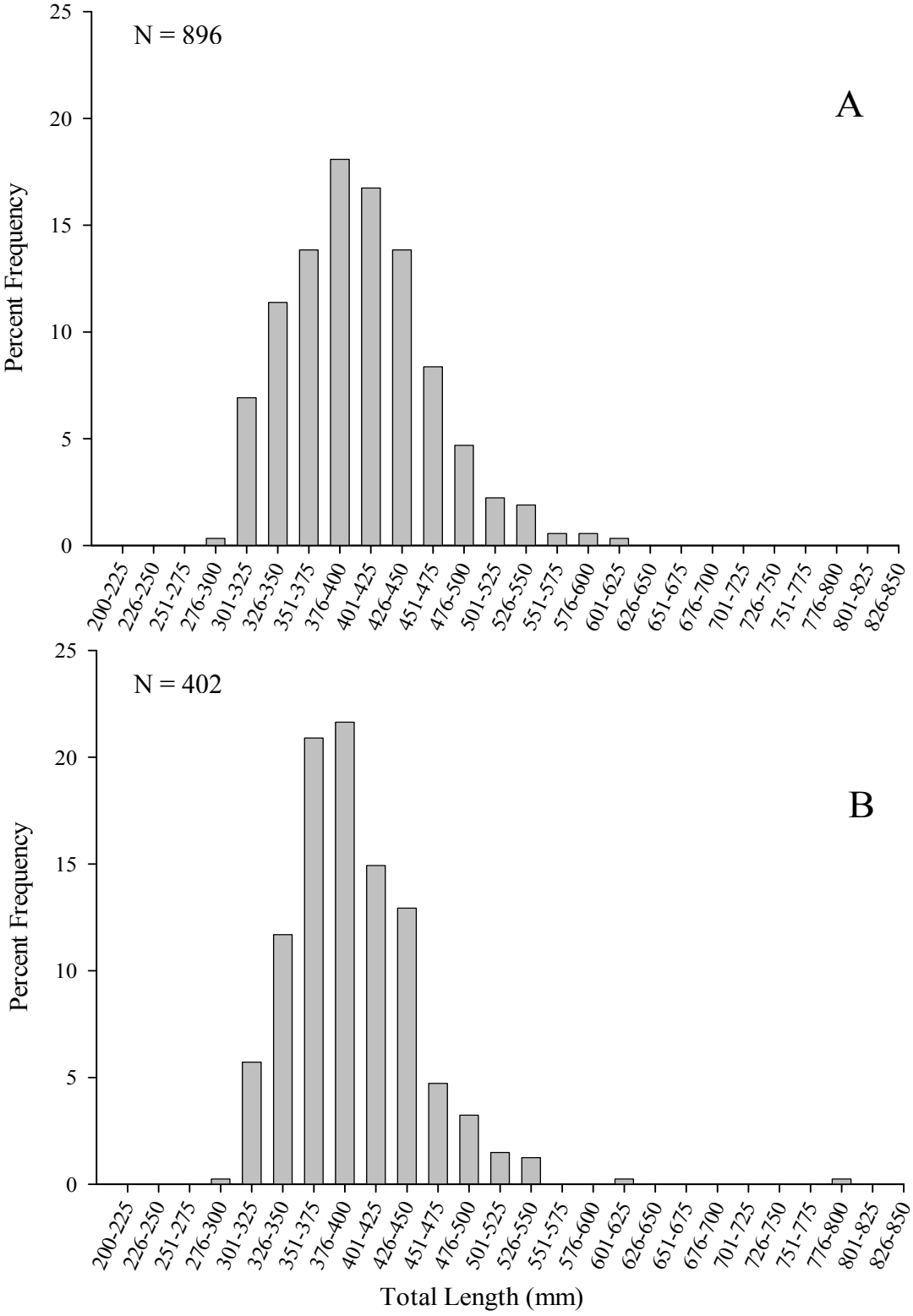

Fig. 8. Size frequency distribution of southern flounder from inshore fishing tournaments (A) and the Freezer Fish Program (B) in South Carolina 2002 to 2007.

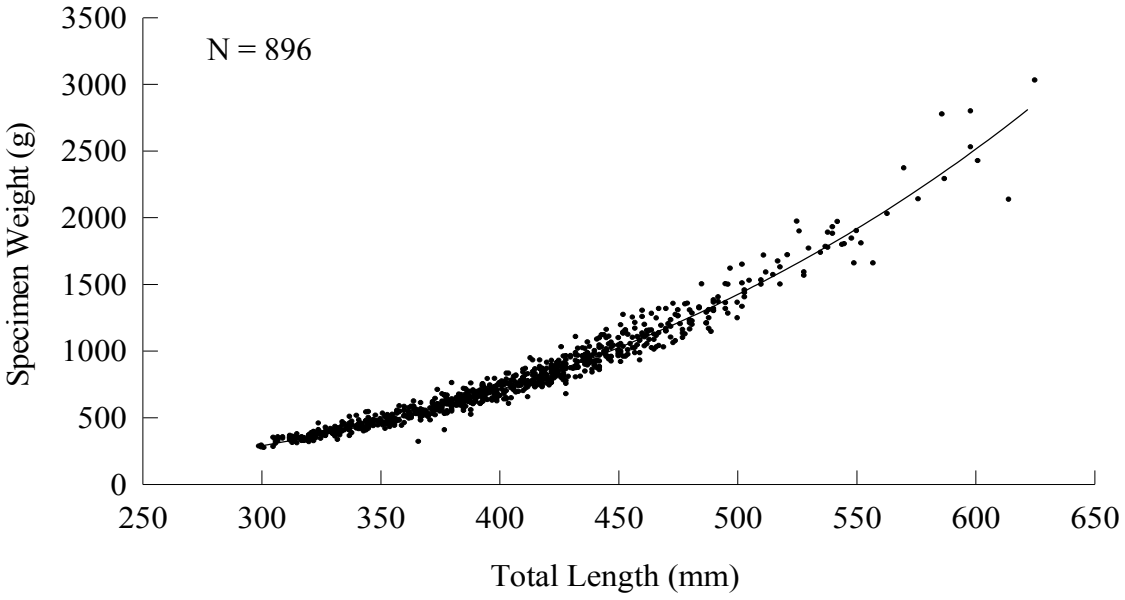

Fig. 9. Regression model for specimen weight versus total length for southern flounder from recreational fishing tournaments in South Carolina from 2002 to 2007.

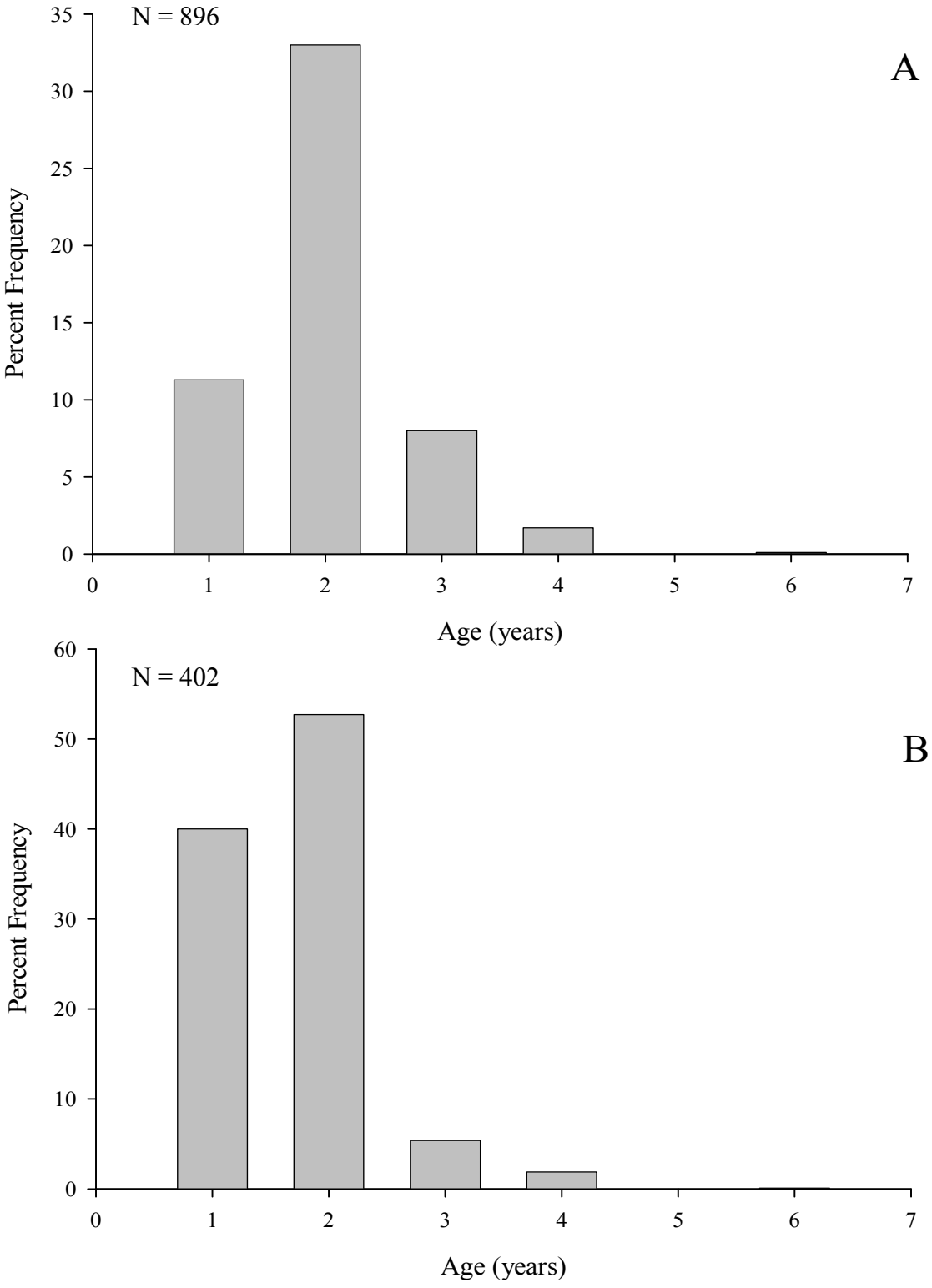

Fig. 10. Age frequency distribution for southern flounder from South Carolina inshore fishing tournaments (A) and the freezer fish program (B) 2002 to 2007. *Note: different y-axis between figures A and B.

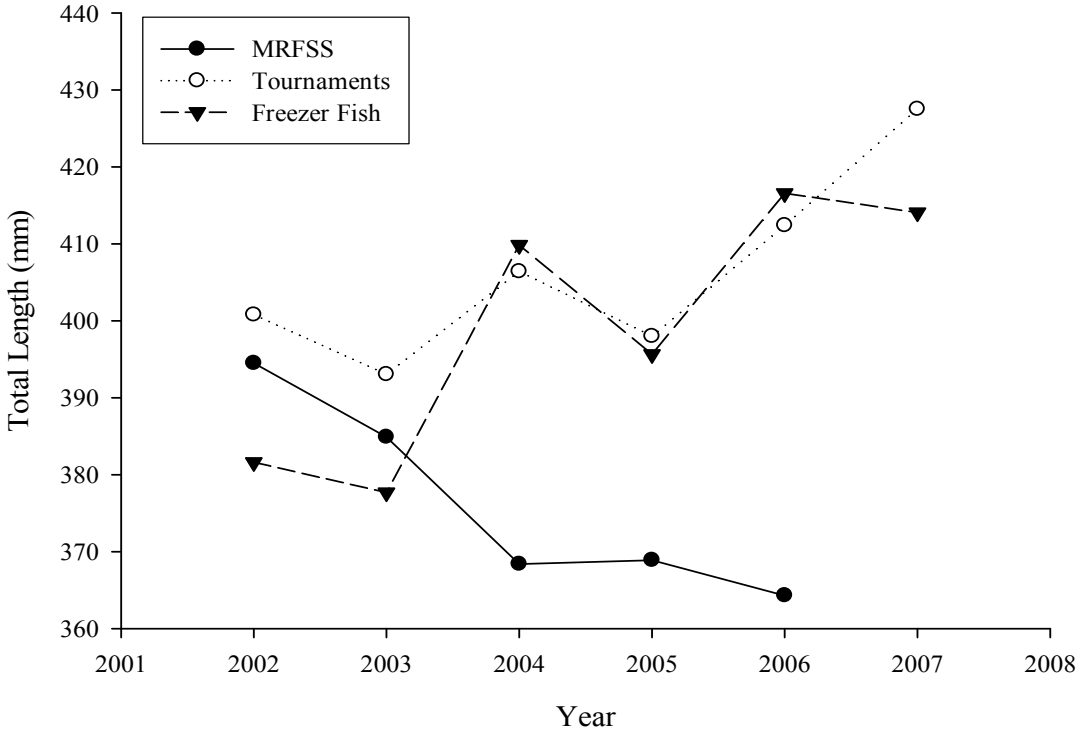

Fig. 11. Mean annual total length for southern flounder (Paralichthys lethostigma) in South Carolinafrom Marine Recreational Fishery Statistical Survey (NMFS), inshore fishing tournaments, and the SCDNR's Freezer Fish Program.

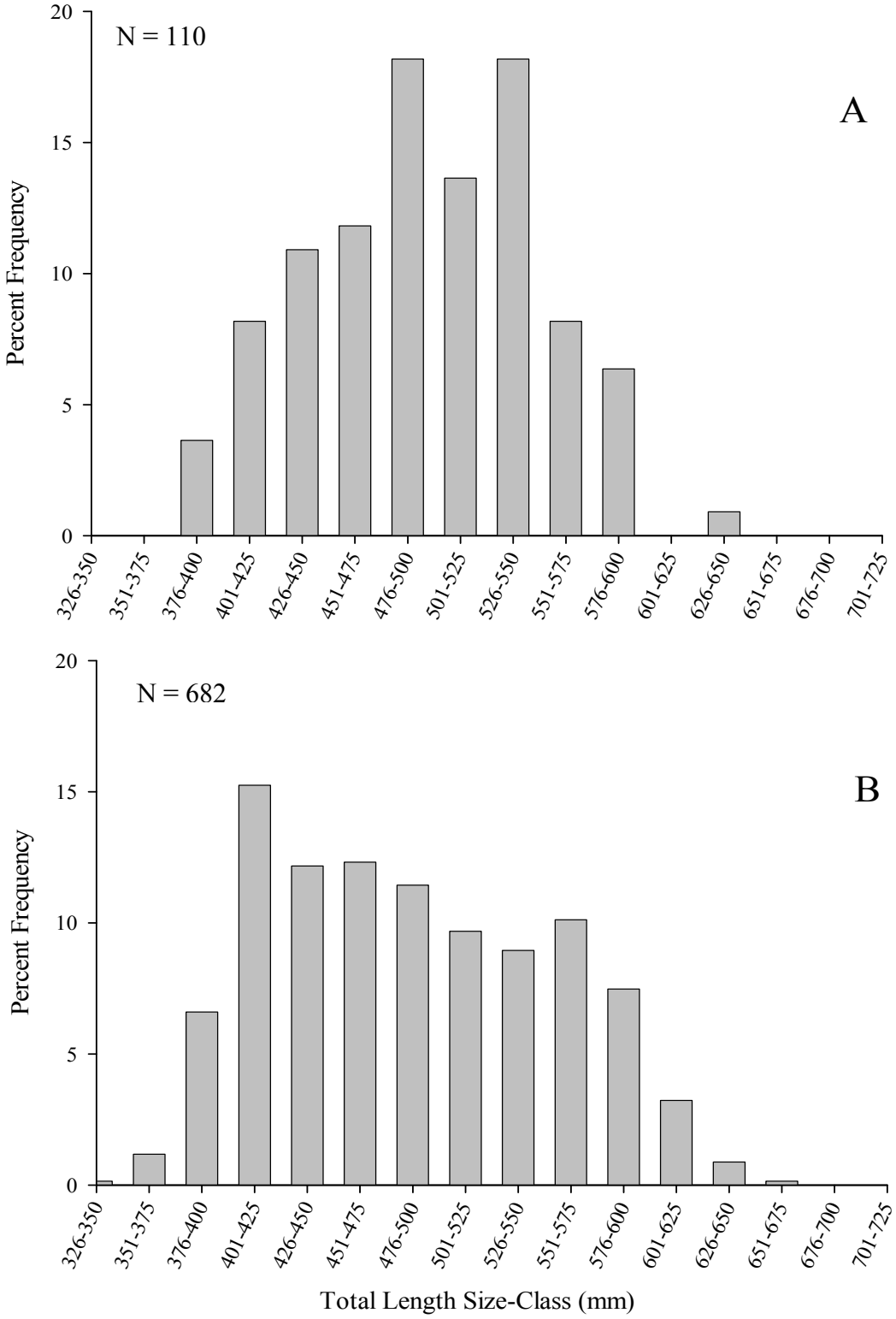

Fig. 12. Size frequency distribution for Red Drum from inshore fishing tournaments (A) and the Freezer Fish Program (B) in South Carolina 2002 to 2007.

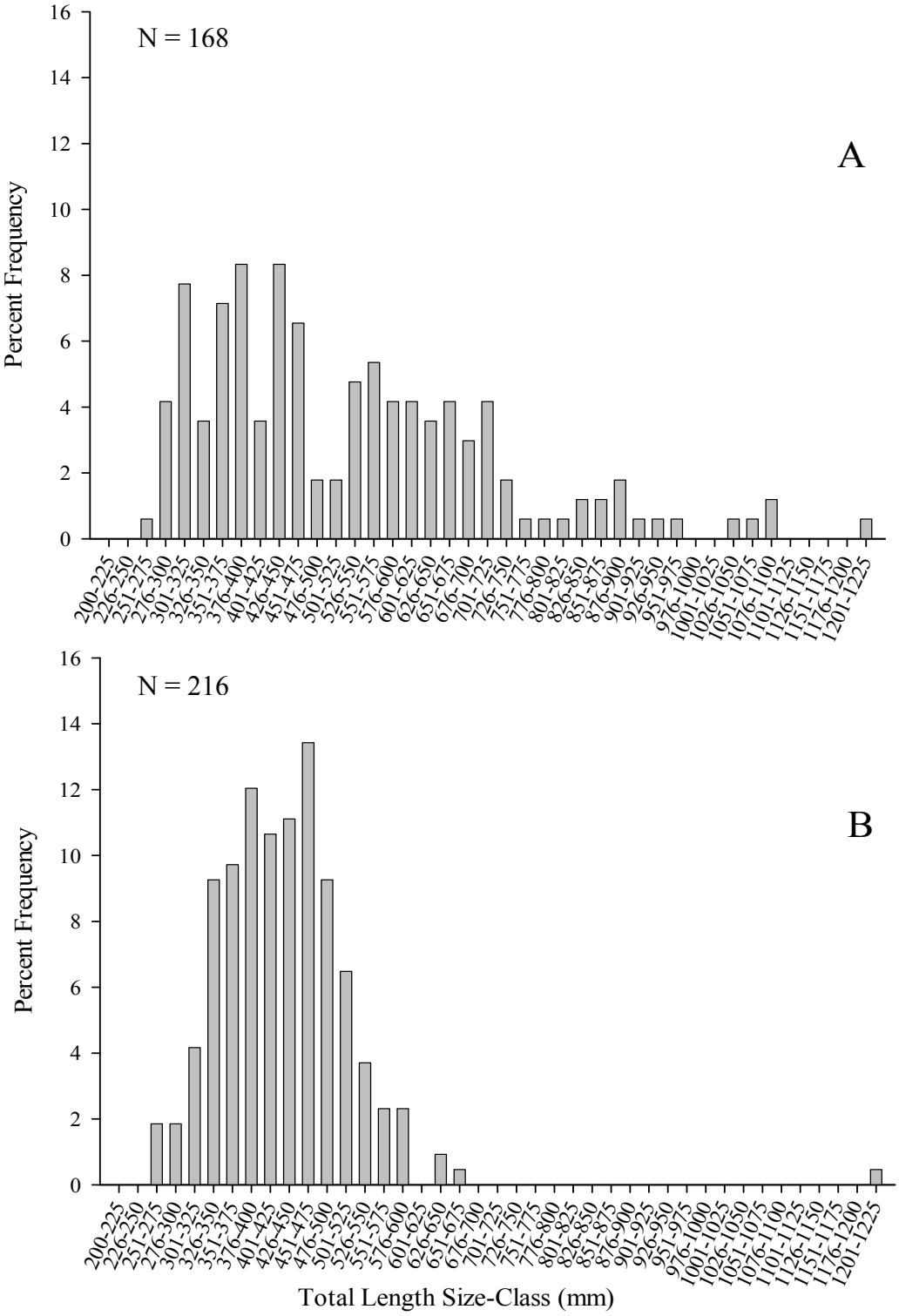

Fig. 13. Size frequency distribution for black drum from inshore fishing tournaments (A) and the Freezer Fish Program (B) in South Carolina from 2002 to 2007.

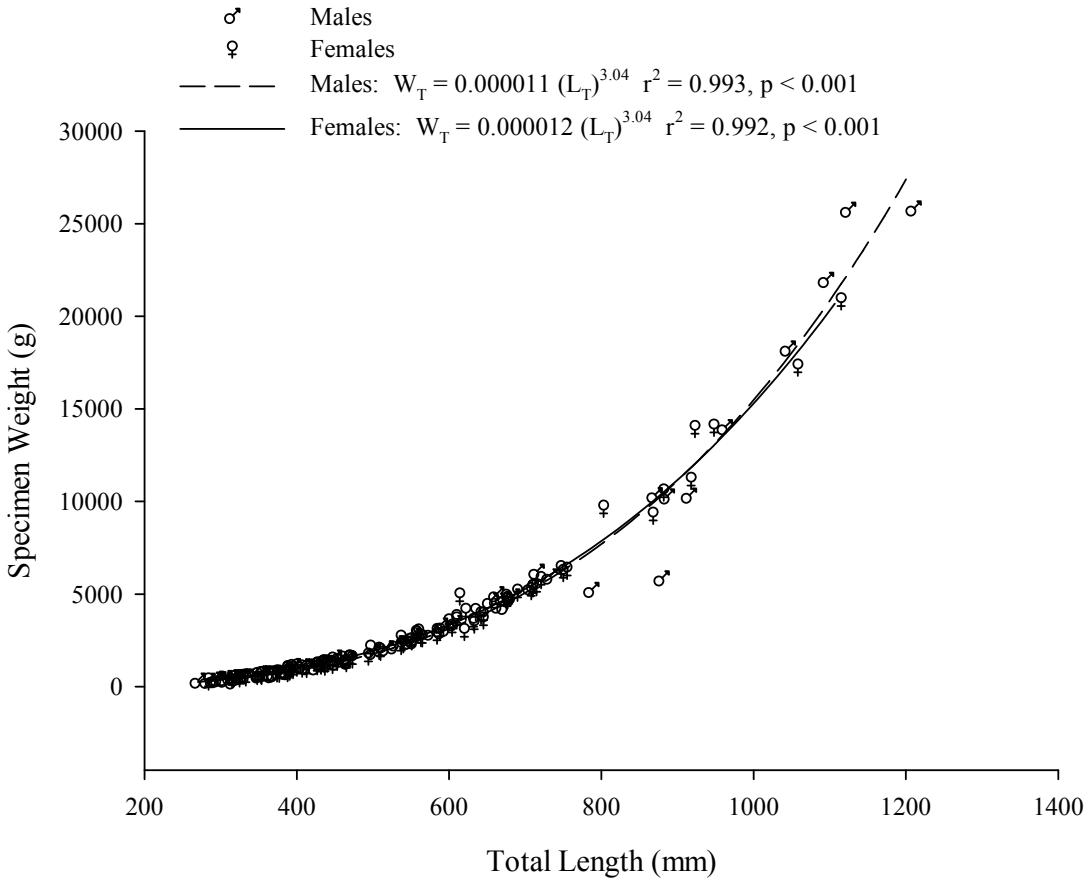

Figure 14. Regression models for specimen weight (WT) versus total length (LT) in male and female black drum from recreational fishing tournaments in South Carolina from 2002 to 2007. Male n = 85, Female n = 82.