

# **SCDNR**

## **Inshore Fisheries Section**



# **DNR**

Five Year Report to the  
Saltwater Recreational Fisheries Advisory Committee

October 2013



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## List of Species Figure Numbers (in Part 2)

SPECIES	Monthly Trammel Net Catch Rates	Annual Trammel Net Catch Rates	Monthly Electrofishing Catch Rates	Annual Electrofishing Catch Rates	Quarterly Size Distribution Data
Atlantic Croaker	2.1	2.2	2.3	2.4	2.5
Black Drum	2.6	2.7	2.8	2.9	2.10
Red Drum	2.11	2.12	2.13	2.14	2.15
Silver Perch	2.16	2.17	2.18	2.19	2.20
Southern Kingfish	2.21	2.22	-	-	2.23
Spot	2.24	2.25	2.26	2.27	2.28
Spotted Seatrout	2.29	2.30	2.31	2.32	2.33
Southern Flounder	2.34	2.35	2.36	2.37	2.38
Sheepshead	2.39	2.40	2.41	2.42	2.43
Pinfish	2.44	2.45	2.46	2.47	2.48
Striped Bass	-	-	2.49	2.50	2.51
Ladyfish	2.52	2.53	2.54	2.55	2.56
Hardhead Catfish	2.57	2.58	-	-	2.59
Striped Mullet	2.60	2.61	2.62	2.63	2.64
American Eel	-	-	2.65	2.66	2.67
Atlantic Menhaden	2.68	2.69	2.70	2.71	2.72
American Harvestfish	2.73	2.74	-	-	2.75
Mummichog	-	-	2.76	2.77	2.78
Longnose Gar	2.79	2.80	2.81	2.82	2.83
Atlantic Sharpnose Shark	2.84	2.85	-	-	2.86
Bonnethead	2.87	2.88	-	-	2.89
Atlantic Stingray	2.90	2.91	-	-	2.92
Horseshoe Crab	2.93	2.94	-	-	2.95
Diamondback Terrapin	2.96	2.97	-	-	-

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## EXECUTIVE SUMMARY

The primary mission of the SCDNR Inshore Fisheries Section is to monitor fish populations in the estuarine and near-shore waters of South Carolina. Collected information is stored in electronic databases at SCDNR and used for science based management of fishery stocks, which are important for the state's coastal economy.

Over the last five years, funds received from the Saltwater Recreational Fisheries Advisory Committee (SRFAC) have helped support a variety of long-term fishery surveys. These surveys are essential for monitoring changes in fish populations over time and for understanding natural and anthropogenic forces that influence them.

The Inshore Fisheries Section performs four fishery independent surveys designed to cover different habitats and multiple life history stages of target species. The surveys include a trammel net survey, an electrofishing survey, a longline survey and a trawl survey. The section also performs two fishery dependent surveys that record biological information from fish that have been harvested by recreational anglers. Harvested fish are sampled by a freezer drop-off program, which collects filleted fish carcasses donated by anglers, and a fishing tournament program, which takes samples from fish at weigh-ins.

Part two of this report presents long-term populations trends and size composition data for twenty-four commonly encountered species in the trammel net and electrofishing surveys. It is intended as a quick look-up reference source for species of interest. The Table of Contents page has a list of the species presented.

An analysis of population trends indicates that the abundance of some species declines dramatically after severe winters. Examples include Spotted Seatrout and Silver Perch. Historically, population numbers have rebounded within a few years, but responses to natural mortality events need to be closely monitored to ensure that increasing angler pressure over time does not impede stock recovery.

Species with notable long-term population declines include Southern Flounder, Hardhead Catfish, and American Eel. Striped Bass numbers have also declined, except in the Ashley River where SCDNR's Mariculture Section has maintained a focused stock enhancement program.

Survey data from the Inshore Fisheries Section have been used in several multi-state stock assessments since 2008, including those for Red Drum, Black Drum, Bonnethead, Atlantic Menhaden and American Eel.

Long-term survey data are essential for stock assessments and for sustainably managing economically important fisheries.





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# PART 1: Overview of Inshore Fisheries Projects Supported by SRFAC Funds

## INTRODUCTION

The Inshore Fisheries Section of SCDNR is based at the Marine Resources Research Institute at Fort Johnson, Charleston, SC. The group currently consists of approximately a dozen scientists dedicated to the long-term monitoring and management of the state's inshore fisheries.



**Fig. 1.1** The inshore waters of South Carolina sustain highly productive fisheries.

Most of the work performed by the section focuses on the estuaries and sheltered bays of South Carolina. The shoreline of these systems is dominated by salt marsh, which is among the most productive biological habitats on earth, rivaling tropical rainforests. Salt marshes play an important role in sustaining vast numbers of small fish, which in turn provide food for larger fish and ecologically important animals such as dolphins and seabirds.

South Carolina has a very active inshore recreational fishery that is embedded within the culture and economy of the region. Fishing

opportunities draw people to the area, either as tourists or as residents, and they play an important role in driving economic development and expansion along the coast. This rapid pace of development presents a major threat to the health of coastal ecosystems and poses challenges for sustaining productive fisheries and supporting coastal economies.

In order to sustainably manage inshore fisheries, it is important to understand how fish populations and their environment change over time. Anecdotal evidence of change comes from people who have spent their lives on the water, although this information is often subjective, making it difficult to quantify the magnitude of change or rigorously determine the forces that drive it. Individual experiences also differ and people tend to remember unusual or extreme events rather than noticing gradual, perhaps imperceptible, changes. This causes our reference point of 'pristine' conditions to shift from one generation to the next, which can obscure very slow changes, even if their cumulative long-term effects are very large.

### *The need for long-term monitoring*

In order to reliably track fish populations and the habitats they live in over time, it is necessary to use a scientific approach that allows data to be continually measured and recorded using consistent methodology. This enables data from one time period to be directly compared against data from another so that real changes can be identified and distinguished from apparent changes.

This principle lies at the heart of the fishery surveys performed by the Inshore Fisheries

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Section. Most the section's work is dedicated to so-called fishery-independent surveys, which monitor fish populations on a monthly basis in order to quantify and record long-term fluctuations in fish population numbers. The data enable us to identify changes in fish populations and examine what factors might be driving any changes that are detected.



**Fig. 1.2** Staff of the SCDNR Inshore Fisheries Section measuring, tagging and releasing Red Drum captured in the trammel net survey.

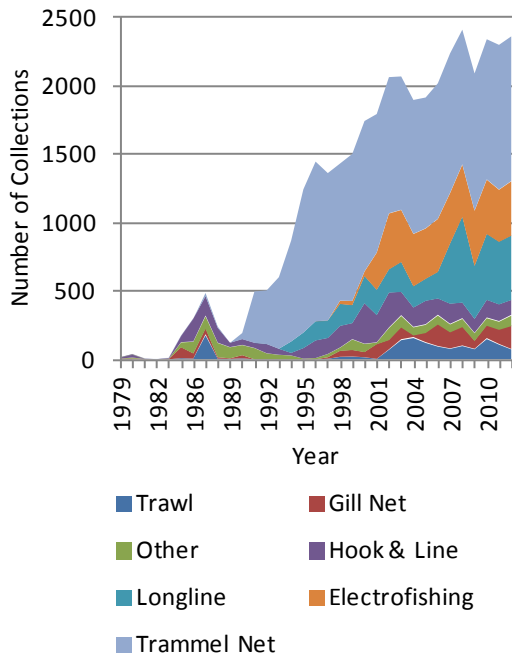
A smaller portion of the section's work falls under the category of fishery-dependent surveys, which gather biological information on fish that are caught and harvested by anglers. This information complements other fishery-dependent surveys performed by SCDNR as well as national organizations.

Fishery-dependent surveys are essential for measuring exploitation rates of a species, but it is important to realize that (unlike the fishery-independent surveys), they do not necessarily provide a good index of actual fish population numbers. This is because angler behavior changes over time, usually with the goal of maximizing catches. For example: certain areas may be lightly exploited some years, but heavily exploited at other times; new types of equipment become available that make it easier to catch fish; numbers of anglers changes over time; or angler behavior may change. All of these factors mean that the numbers of fish caught, and the

rate at which they are caught, may change over time in a manner not necessarily related to the actual number of fish in the sea. Fishery-independent surveys are therefore necessary, since their methodology is kept constant over time as best as possible.

The section's fishery-dependent and fishery-independent surveys both provide essential information for stock assessments, which is a mathematical modeling procedure that brings together various types of information on a fish population. The fishery-dependent data are used for understanding aspects such as how many fish are being harvested, and their size, age and reproductive condition. The fishery-independent data are used for generating standardized indices of fish abundance, ideally resolved by age and reproductive condition. Together, these data allow stock assessment scientists to estimate the overall abundance of fish over time, their survival rates, and how successfully they are able to reproduce. These values are then compared against reference points (based on that species' particular life history) to determine whether exploitation rates are sustainable or not.

The fishery-independent and fishery-dependent information that is gathered by the Inshore Fisheries Section is stored in electronic databases housed at SCDNR. An analysis of these databases shows that the number of collections (i.e. number of occasions a piece of fishing gear was deployed in the water to collect fish) increased dramatically from 1990 until around 2007, since when the numbers have leveled off at ~2,300 sets per year, or on average ~9 sets per weekday per year (**Figure 1.3**). Together, these collections have caught over three and a half million fish, with individual length measurements and other biological information having been recorded from over three quarters of a million of these fish.



**Fig. 1.3** Number of collections (i.e. deployments of fishing gear) by the SCDNR Inshore Fisheries Section.

The data from the surveys are used for a wide variety of purposes. One of the principle roles is in stock assessments, which are usually performed by multi-state working groups because many of the stocks span state boundaries, so a holistic integration of data is needed in order to understand the dynamics of the population as a whole. In addition, SCDNR's Office of Fisheries Management consults with the Inshore Fisheries Section for advice on the status of a population if regulation changes are being proposed or debated. The section also has many targeted projects aimed at answering specific research needs, and these projects usually rely on fish or other animals caught by existing long-term surveys.

### FISHERY-INDEPENDENT SURVEYS

The Inshore Fisheries Section performs several types of fishery-independent surveys. This is necessary, partly because certain target species occur in some habitats but not others, but

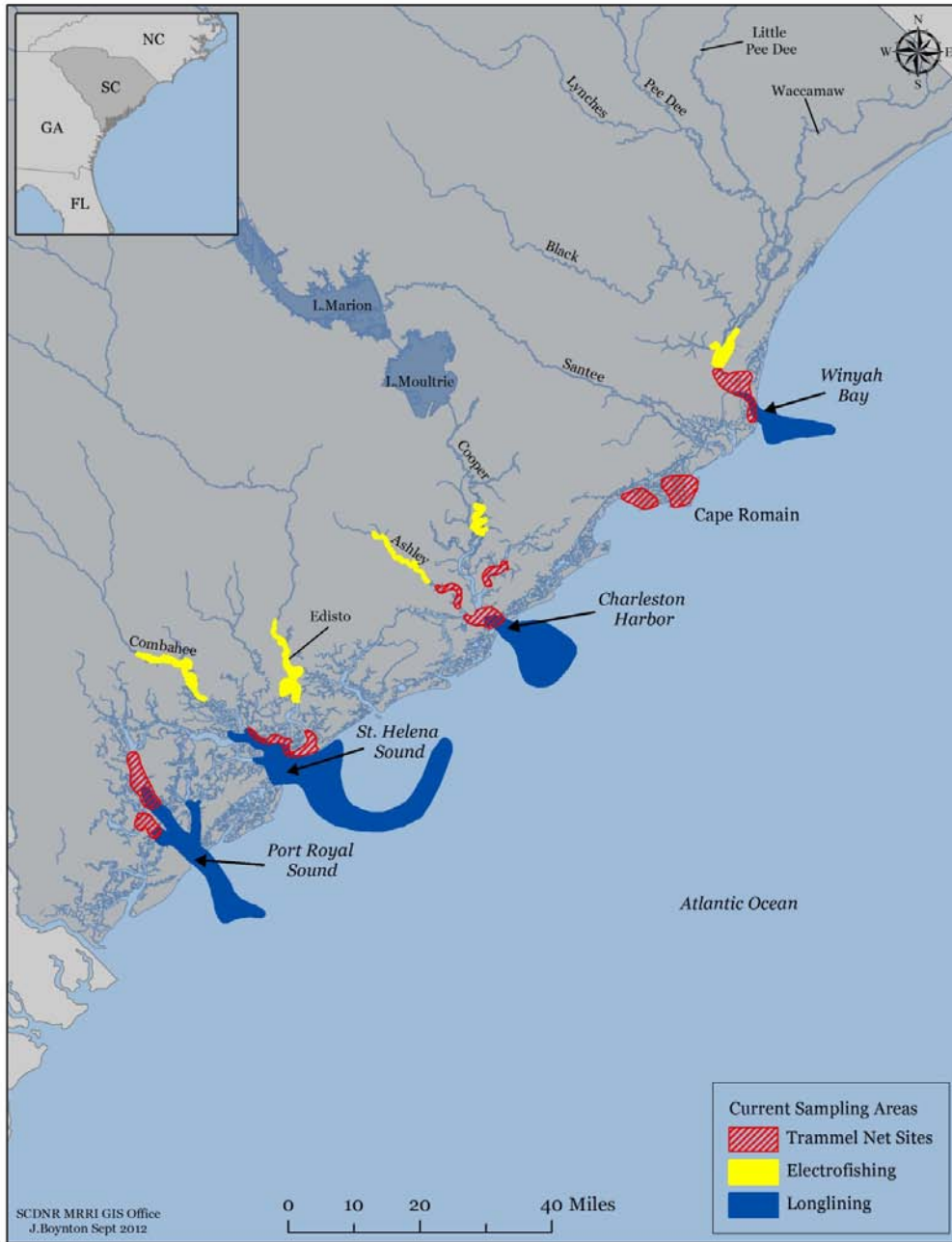
also because many of the species studied have different life stages spread across multiple habitats.

For example, Red Drum, which is an iconic fish of the southeast and an important target species for recreational anglers, has tiny larvae that enter small tidal creeks in the upper reaches of estuaries during the fall. By the time they reach one year old, many of them will have moved downstream towards lower estuarine habitats such as marsh front and oyster flats. They remain in these shallow estuarine areas until they are three to five years old, after which they move into deeper coastal waters, where they may live for up to forty years as part of the reproductive stock.

In order to understand the entire life cycle of species such as Red Drum, it is necessary to study all of the areas they inhabit. This requires a mix of surveys suited to different habitats and life stages. For example, trammel nets are excellent for capturing lower estuarine fish along marsh front and oyster reefs, but they are poorly suited to upper estuarine river banks and creeks because the water currents are too strong and submerged obstacles, such as trees, entangle the nets. Instead, we use electrofishing gear in the upper estuaries (whereas we cannot electrofish the lower estuaries because the water is too conductive). Neither of the gear types is suited to the deeper waters inhabited by larger fish, so instead baited longline gear is used for sampling adult Red Drum.

Funds received from the Saltwater Recreational Fisheries Advisory Committee over the last five years have helped support four fishery-independent surveys. These include (in order of how long the surveys have been running), our trammel net survey (1990 – present), electrofishing survey (2001 – present), longline survey (2007 – present) and monitoring of fish bycatch in the SCDNR Crustacean

Management Trawl Survey (2010 – present). The areas sampled by the trammel, electrofishing and long-line surveys are shown in **Figure 1.4** (the Crustacean Trawl Survey, not shown, covers areas along the coast from Charleston Harbor to Calibogue Sound near the border with Georgia).



**Fig. 1.4** Areas monitored by the trammel net, electrofishing and long-line surveys of the SCDNR Inshore Fisheries Section

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### *Trammel net survey*

The trammel net survey is SCDNR's longest running monitoring program of estuarine fish. After initially testing the gear during the late 1980s, the first 'official' set was performed along the shores of Crab Bank in Charleston Harbor on November 13<sup>th</sup>, 1990.



**Fig. 1.5** One of the three SCDNR trammel net boats.

Trammel net samples are collected using Florida mullet skiffs, which have an outboard engine mounted towards the bow (**Figure 1.5**). This design enables the boat to operate over very shallow oyster bars and marsh flats, and allows the net to run off the stern of the boat unimpeded by the engine. Each set is made by first anchoring one end of the net on shore or in shallow marsh. The boat then quickly throttles onto a plane, moving initially away from shore and then parallel to it before eventually returning to shore about 150 yards from the starting point, where the other end of the net is anchored. Once the net has been deployed, the boat enters the encircled area and fish are driven into the net by the boat crew banging the water surface with poles. The net is then slowly retrieved and any entangled fish are removed and placed in a live-well filled with oxygenated seawater. From there, fish are identified, counted and have their length measured before they are returned to the sea alive. Environmental data such as temperature, salinity and dissolve oxygen are also recorded.

Some species such as Red Drum, Black Drum and Sheepshead are tagged before they are released. When these fish are recaptured, either by our own surveys or by anglers, valuable information on their size, location and fate (harvested or released by anglers) is recorded. This allows us to study aspects such as fish movement, growth and survival rates, which are important parameters needed for stock assessments.

In order to study the biology of certain key species, it is necessary to sacrifice a small portion of fish so that tissue samples can be taken. These fish are returned on ice to the laboratory where they are dissected and studied to determine their age, sex and reproductive condition. In most cases, age is determined from an otolith ear bone, which is extracted from the fish's skull and embedded in resin so it can be sectioned with a diamond blade saw. A very thin slice is taken through the middle of the bone and viewed under a microscope. This reveals a series of rings, and since each one is typically associated with one year of life, the age and growth of the fish can be calculated. Relationships between size and age are then applied to all of the fish length data (including those fish that were released) to infer the age composition of the total catch.

The gonads are also removed from the sacrificed fish in order to study their reproductive biology. They are examined either by naked eye or under a microscope after being sectioned and stained. This reveals the sex of the animal, as well as its reproductive condition (e.g. immature or mature). Females in ripe spawning condition are also used for studying the number of eggs produced by fish of different sizes.

As of the end of June 2013, a total of 20,168 sets had been made by the trammel net survey, catching more 380,000 fish (**Table 1.1**).

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From 2008 through 2012, the top ten most numerically abundance fish species caught by the trammel net survey were:

1. Red Drum (19.8% of all fish caught)
2. Spotted Seatrout (19.4%)
3. Striped Mullet (16.6%)
4. Spot (14.0%)
5. Atlantic Croaker (5.2%)
6. Southern Flounder (4.2%)
7. Longnose Gar (2.9%)
8. Pinfish (2.2%)
9. American Harvest Fish (1.3%)
- 10 Atlantic Menhaden (1.2%)

Population trends for these, and other major species, are described in Part 2 of this report.

#### *Electrofishing Survey*

The electrofishing survey began operating in May 2001. Like the trammel net survey, it uses a stratified random design in which sites are selected for sampling at random from a larger pool of potential sites. The survey currently covers six upper estuarine areas across the state per month, with ~6 sites being sampled in each area per month. The six electrofishing areas include the Combahee River, Edisto River, Ashley River, Cooper River and Waccamaw River. Two areas are covered in the Ashley River (lower and upper parts) in order to assist the SCDNR Mariculture Section in monitoring stocked Striped Bass in that system. Together with the Ashley River trammel net survey (further downstream), this gives us very complete coverage of the Ashley system.

Electrofishing is performed using a specially designed Smith-Root boat fitted with an on-board generator that passes electricity into the water through a pair anode arrays suspended from bow-mounted booms (**Figure 1.6**). The electricity is adjusted by the helmsman according to salinity conditions. It temporarily stuns fish, causing them to float to the surface,

which allows them to be netted by crew members standing on the bow of the boat. Fish are placed in a live-well and at the end of each fifteen minute set they are identified, counted and measured. As with the trammel net survey, most fish are then released alive, with certain species such as Red Drum, Black Drum, Striped Bass and Sheepshead receiving external tags that allow their movement and growth to be studied.



**Fig. 1.6** SCDNR's Smith-Root electrofishing boat sampling fish in upper estuary habitat

The electrofishing survey has collected well over one hundred species of fish during the time it has been in operation (**Table 1.2**). In particular, it encounters large number of newly settled juveniles of recreationally important fish such as Spot, Red Drum and Southern Flounder, as well as other important prey species such as Striped Mullet, Atlantic Menhaden, Bay Anchovies and Mummichog. The survey has also been important for monitoring American Eels, and is the only long-term data set of 'yellow eel' (immature eels > 6 inches long) and 'silver eel' (mature) stages in the southeast United States.

Population trends of major species encountered by the electrofishing survey are presented in Part 2 of this report.

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### *Longline Survey*

The SCDNR longline survey is performed during the fall each year with the primary goal of monitoring adult Red Drum, as well as coastal sharks. The survey was initiated in the 1990s but was redesigned in 2007 so that data could be gathered in a manner more compliant with stock assessment requirements. The main differences between the early and recent survey periods are that the new design: (i) covers more areas (Winyah Bay, Charleston Harbor, St. Helena Sound and Port Royal – see **Figure 1.4**, (ii) covers a large number of sampling locations within each area, (iii) incorporates a stratified random sampling design, and (iv) uses shorter longlines with fewer hooks (1/3<sup>rd</sup> mile with forty hooks compared to 1 mile with one hundred hooks). The shorter gear allows more longline sets to be performed per day so that variation in catch between sets can be quantified more rigorously.



**Fig. 1.7** An adult Red Drum caught by the SCDNR longline survey

Between 2007 and 2012, the longline survey encountered forty-four species, with ~20% of the catch comprising Red Drum (see **Table 1.3**). All fish caught by the longline survey are brought on board and measured, except for some of the very large sharks, which are measured while in the water. Most of the Red Drum are released alive after being tagged,

but a portion are sacrificed for ageing and reproductive analysis. This is done at the request of the Atlantic States Marine Fisheries Commission, which oversees management of the species, since the age structure of adult Red Drum is poorly understood. In the past, this aspect has a major obstacle in fitting reliable stock assessment models.

Between 2007 and 2012, almost four hundred adult Red Drum were aged from the longline survey allowing us, for the first time, to analyze population data across the entire life cycle of the species. This has revealed that years with strong juvenile recruitment (as seen in the electrofishing and trammel net surveys) subsequently show strong representation among the adults many years later. The corroboration of data across multiple surveys and life history stages gives us a high degree of confidence that the trends we are detecting are real and meaningful.

### *Crustacean Trawl Survey*

Since the 1970s, SCDNR has performed a trawl survey along the coastline of South Carolina to monitor commercially important populations of shrimp, blue crab and horseshoe crab. The survey also encounters large numbers of fish which, historically, were not enumerated or recorded. Since 2010, however, the Inshore Fisheries Section has recorded data from these incidental fish catches since they provide valuable information on recreational fish not caught by our other surveys (e.g. Weakfish), as well as important prey species (e.g. Atlantic Menhaden).

Interestingly, the stations sampled by the crustacean trawl survey have a longer history of monitoring. From 1950 – 1969, the Bears Bluff Laboratory operated a similar trawl survey that recorded both crustacean and fish information. These historic fishery records fill more than fifty

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large binders that take up more than eight feet of shelf space. Recently, staff in the Inshore Fisheries Section has been copying these records into an electronic database that can be sorted, queried and analyzed. This will allow us to compare valuable historic data against contemporary catches by the crustacean trawl survey.

### **FISHERY-DEPENDENT SURVEYS**

The Inshore Fisheries Section oversees two fishery-dependent monitoring programs, both designed to collect biological information on fish caught by recreational anglers. This is important because many stock assessment models require data on size, age and sex composition of harvested fish, as well as reproductive condition.

To do this, we collect fish samples donated by anglers, either at drop-off freezers (where carcasses of filleted fish are deposited) or at fishery tournament weigh-ins.

With the freezer program, donated carcasses are collected from drop-off locations each month and returned to the laboratory for workup. With tournaments, which usually occur on week-ends, five or six SCDNR staff members typically attend the weigh-in and sample fish from cooperating anglers' coolers. Each fish is measured and weighed and its otoliths and gonads are removed before returning the rest of the fish to the angler. These occasions are useful for outreach, since it gives us the opportunity to explain to anglers how we take samples and what the information is used for.

The major species we focus on for our fishery-dependent samples include Spotted Seatrout, Red Drum, Black Drum, Southern Flounder and Bluefish. Between 2008 and 2013, over four thousand specimens were sampled as part of this program (**Table 1.4**).



**Table 1.1** Numbers of each species caught by the SCDNR trammel net survey

Common Name	Scientific Name	NUMBERS CAUGHT			RANK		
		1990-2007	2008-2013	TOTAL	1990-2007	2008-2013	TOTAL
1) Striped Mullet	<i>Mugil cephalus</i>	58,443	13,439	71,882	1	3	1
2) Red Drum	<i>Sciaenops ocellatus</i>	54,684	16,021	70,705	2	1	2
3) Spotted Seatrout	<i>Cynoscion nebulosus</i>	43,783	15,698	59,481	3	2	3
4) Spot	<i>Leiostomus xanthurus</i>	34,868	11,338	46,206	4	4	4
5) Diamondback Terrapin	<i>Malaclemys terrapin centrata</i>	15,888	4,886	20,774	6	6	5
6) Southern Flounder	<i>Paralichthys lethostigma</i>	16,839	3,410	20,249	5	8	6
7) Atlantic Menhaden	<i>Brevoortia tyrannus</i>	12,134	1,001	13,135	7	12	7
8) Blue Crab	<i>Callinectes sapidus</i>	3,520	7,990	11,510	13	5	8
9) Atlantic Croaker	<i>Micropogonias undulatus</i>	7,236	4,199	11,435	9	7	9
10) Hardhead Catfish	<i>Ariopsis felis</i>	10,109	148	10,257	8	29	10
11) Pinfish	<i>Lagodon rhomboides</i>	6,249	1,810	8,059	10	10	11
12) Longnose Gar	<i>Lepisosteus osseus</i>	3,726	2,353	6,079	11	9	12
13) Atlantic Stingray	<i>Dasyatis sabina</i>	3,712	990	4,702	12	13	13
14) Black Drum	<i>Pogonias cromis</i>	3,463	989	4,452	14	14	14
15) Ladyfish	<i>Elops saurus</i>	2,354	840	3,194	15	17	15
16) Atlantic Sharpnose Shark	<i>Rhizoprionodon terraenovae</i>	1,949	864	2,813	16	16	16
17) Bonnethead	<i>Sphyrna tiburo</i>	1,224	964	2,188	20	15	17
18) American Harvestfish	<i>Peprilus paru</i>	884	1,082	1,966	24	11	18
19) Sheepshead	<i>Archosargus probatocephalus</i>	1,327	585	1,912	18	19	20
20) Gizzard Shad	<i>Dorosoma cepedianum</i>	1,641	277	1,918	17	26	19
21) Striped Burrfish	<i>Chilomycterus schoepfii</i>	1,326	435	1,761	19	22	21
22) Southern Kingfish	<i>Menticirrhus americanus</i>	1,003	552	1,555	21	20	22
23) Horseshoe Crab	<i>Limulus polyphemus</i>	745	657	1,402	25	18	25
24) Silver Perch	<i>Bairdiella chrysoura</i>	985	505	1,490	22	21	23
25) Bluefish	<i>Pomatomus saltatrix</i>	978	433	1,411	23	23	24
26) Cownose Ray	<i>Rhinoptera bonasus</i>	662	291	953	26	25	26
27) Bluntnose Stingray	<i>Dasyatis say</i>	515	298	813	27	24	27
28) Northern Puffer	<i>Sphoeroides maculatus</i>	394	153	547	28	28	28
29) White Mullet	<i>Mugil curema</i>	270	187	457	31	27	29
30) Atlantic Spadefish	<i>Chaetodipterus faber</i>	297	143	440	30	30	30
31) Crevalle Jack	<i>Caranx hippos</i>	303	124	427	29	32	31
32) Finetooth Shark	<i>Carcharhinus isodon</i>	219	135	354	33	31	32
33) Summer Flounder	<i>Paralichthys dentatus</i>	266	56	322	32	38	33
34) Pigfish	<i>Orthopristis chrysoptera</i>	163	124	287	36	32	34
35) Hogchoker	<i>Trinectes maculatus</i>	164	114	278	35	35	35
36) Green Sea Turtle	<i>Chelonia mydas</i>	124	121	245	39	34	36
37) Lookdown	<i>Selene vomer</i>	191	44	235	34	39	37
38) Atlantic Tripletail	<i>Lobotes surinamensis</i>	132	37	169	38	42	38
39) Smooth Butterfly Ray	<i>Gymnura micrura</i>	102	57	159	42	37	39
40) Atlantic Bumper	<i>Chloroscombrus chrysurus</i>	79	80	159	46	36	39

Continued...

Note: Horseshoe crabs were only recorded from 1995 onwards and blue crabs from 2006 onwards

**Table 1.1** Numbers of each species caught by the SCDNR trammel net survey

....Continued

Common Name	Scientific Name	NUMBERS CAUGHT			RANK		
		1990-2007	2008-2013	TOTAL	1990-2007	2008-2013	TOTAL
41) White Catfish	<i>Ameiurus catus</i>	146	7	153	37	58	41
42) Lemon Shark	<i>Negaprion brevirostris</i>	117	32	149	41	45	42
43) Gafftopsail Catfish	<i>Bagre marinus</i>	124	24	148	39	46	43
44) Butterfish	<i>Peprilus triacanthus</i>	81	42	123	44	40	44
45) Weakfish	<i>Cynoscion regalis</i>	96	17	113	43	47	46
46) Permit	<i>Trachinotus falcatus</i>	81	33	114	44	44	45
47) Blacktip Shark	<i>Carcharhinus limbatus</i>	68	40	108	48	41	47
48) Gulf of Mexico Ocellated Fl	<i>Ancylosetta ommata</i>	78	17	95	47	47	48
49) Blueback Herring	<i>Alosa aestivalis</i>	25	35	60	55	43	50
50) Bighead Searobin	<i>Prionotus tribulus</i>	54	14	68	49	49	49
51) Spanish Mackerel	<i>Scomberomorus maculatus</i>	43	12	55	50	50	51
52) Gulf Flounder	<i>Paralichthys albigutta</i>	29	11	40	51	52	52
53) Inshore Lizardfish	<i>Synodus foetens</i>	29	10	39	51	54	53
54) Bay Whiff	<i>Citharichthys spilopterus</i>	26	11	37	54	52	54
55) Southern Stingray	<i>Dasyatis americana</i>	22	4	26	56	63	58
56) Blue Catfish	<i>Ictalurus furcatus</i>	27	4	31	53	63	55
57) Tarpon	<i>Megalops atlanticus</i>	18	12	30	58	50	56
58) Atlantic Needlefish	<i>Strongylura marina</i>	19	9	28	57	55	57
59) American Shad	<i>Alosa sapidissima</i>	10	8	18	65	56	59
60) Striped Bass	<i>Morone saxatilis</i>	12	5	17	62	62	61
61) Striped Anchovy	<i>Anchoa hepsetus</i>	14	4	18	60	63	59
62) Sandbar Shark	<i>Carcharhinus plumbeus</i>	11	4	15	64	63	62
63) Atlantic Thread Herring	<i>Opisthonema oglinum</i>	15	0	15	59	-	62
64) Oyster Toadfish	<i>Opsanus tau</i>	12	3	15	62	69	62
65) Yellowfin Menhaden	<i>Brevoortia smithi</i>	13	0	13	61	-	65
66) Live Loggerhead Turtle	<i>Caretta caretta</i>	10	2	12	65	72	67
67) Florida Pompano	<i>Trachinotus carolinus</i>	9	4	13	67	63	65
68) Spotted Eagle Ray	<i>Aetobatus narinari</i>	4	8	12	77	56	67
69) Cobia	<i>Rachycentron canadum</i>	5	7	12	74	58	67
70) White Perch	<i>Morone americana</i>	8	3	11	68	69	70
71) Atlantic Ridley Turtle	<i>Lepidochelys kempii</i>	2	7	9	87	58	72
72) Gray Snapper	<i>Lutjanus griseus</i>	3	7	10	79	58	71
73) Fringed Flounder	<i>Etropus crossotus</i>	7	2	9	69	72	72
74) Hickory Shad	<i>Alosa mediocris</i>	6	1	7	72	77	74
75) Bull Shark	<i>Carcharhinus leucas</i>	5	2	7	74	72	74
76) Sharksucker	<i>Echeneis naucrates</i>	7	0	7	69	-	74
77) Gag	<i>Mycteroperca microlepis</i>	6	1	7	72	77	74
78) Striped Searobin	<i>Prionotus evolans</i>	7	0	7	69	-	74
79) Spinner Shark	<i>Carcharhinus brevipinna</i>	5	0	5	74	-	79
80) Scalloped Hammerhead	<i>Sphyrna lewini</i>	1	3	4	94	69	80

Continued...

**Table 1.1** Numbers of each species caught by the SCDNR trammel net survey

....Continued

Common Name	Scientific Name	NUMBERS CAUGHT			RANK		
		1990-2007	2008-2013	TOTAL	1990-2007	2008-2013	TOTAL
81) Threadfin Shad	<i>Dorosoma petenense</i>	4	0	4	77	-	80
82) Smooth Dogfish	<i>Mustelus canis</i>	0	4	4	-	63	80
83) Windowpane	<i>Scophthalmus aquosus</i>	1	1	2	94	77	94
84) Atlantic Sturgeon	<i>Acipenser oxyrinchus</i>	2	1	3	87	77	83
85) American Eel	<i>Anguilla rostrata</i>	3	0	3	79	-	83
86) Blue Runner	<i>Caranx crysos</i>	2	1	3	87	77	83
87) Horse-Eye Jack	<i>Caranx latus</i>	3	0	3	79	-	83
88) Common Snook	<i>Centropomus undecimalis</i>	1	2	3	94	72	83
89) Rock Sea Bass	<i>Centropristis philadelphica</i>	3	0	3	79	-	83
90) Irish Pompano	<i>Diapterus auratus</i>	3	0	3	79	-	83
91) Naked Goby	<i>Gobiosoma bosc</i>	1	1	2	94	77	94
92) Leatherjack	<i>Oligoplites saurus</i>	3	0	3	79	-	83
93) Atlantic Guitarfish	<i>Rhinobatos lentiginosus</i>	3	0	3	79	-	83
94) Star Drum	<i>Stellifer lanceolatus</i>	3	0	3	79	-	83
95) Chain Pipefish	<i>Syngnathus louisiana</i>	2	1	3	87	77	83
96) Shortnose Sturgeon	<i>Acipenser brevirostrum</i>	1	1	2	94	77	94
97) Bay Anchovy	<i>Anchoa mitchilli</i>	0	2	2	-	72	94
98) Common Carp	<i>Cyprinus carpio</i>	2	0	2	87	-	94
99) Atlantic Silverside	<i>Menidia menidia</i>	2	0	2	87	-	94
100) Bullnose Eagle Ray	<i>Myliobatis freminvillei</i>	2	0	2	87	-	94
101) Clearnose Skate	<i>Raja eglanteria</i>	1	1	2	94	77	94
102) Orange Filefish	<i>Aluterus schoepfii</i>	1	0	1	94	-	102
103) Bowfin	<i>Amia calva</i>	1	0	1	94	-	102
104) Blacknose Shark	<i>Carcharhinus acronotus</i>	0	1	1	-	77	102
105) Grass Carp	<i>Ctenopharyngodon idella</i>	1	0	1	94	-	102
106) Roughtail Stingray	<i>Dasyatis centroura</i>	1	0	1	94	-	102
107) Silver Jenny	<i>Eucinostomus gula</i>	1	0	1	94	-	102
108) Trunkfish	<i>Lactophrys trigonus</i>	1	0	1	94	-	102
109) White shrimp	<i>Litopenaeus setiferus</i>	0	1	1	-	77	102
110) Schoolmaster	<i>Lutjanus apodus</i>	1	0	1	94	-	102
111) Largemouth Bass	<i>Micropterus salmoides</i>	1	0	1	94	-	102
112) Speckled Worm Eel	<i>Myrophis punctatus</i>	1	0	1	94	-	102
113) Leopard Searobin	<i>Prionotus scitulus</i>	0	1	1	-	77	102
114) Blackcheek Tonguefish	<i>Symphurus plagiusa</i>	1	0	1	94	-	102
115) Northern Pipefish	<i>Syngnathus fuscus</i>	1	0	1	94	-	102
116) Gulf Pipefish	<i>Syngnathus scovelli</i>	1	0	1	94	-	102
117) Syngnathus species	<i>Syngnathus sp.</i>	1	0	1	94	-	102
<b>TOTAL:</b>		<b>294,261</b>	<b>93,853</b>	<b>388,114</b>			

**Table 1.2.** Numbers of each species caught by the SCDNR electrofishing survey

Common Name	Scientific Name	NUMBER CAUGHT			RANK		
		2001-2007	2008-2013	Total	2001-2007	2008-2013	Total
1) Striped Mullet	<i>Mugil cephalus</i>	78,375	71,352	149,727	1	1	1
2) Atlantic Menhaden	<i>Brevoortia tyrannus</i>	49,880	9,922	59,802	2	4	2
3) Spot	<i>Leiostomus xanthurus</i>	31,719	22,932	54,651	3	2	3
4) Inland Silverside	<i>Menidia beryllina</i>	30,659	10,338	40,997	4	3	4
5) Bay Anchovy	<i>Anchoa mitchilli</i>	15,450	7,343	22,793	5	5	5
6) Mummichog	<i>Fundulus heteroclitus</i>	5,376	5,119	10,495	6	6	6
7) Red Drum	<i>Sciaenops ocellatus</i>	5,058	5,029	10,087	7	7	7
8) American Eel	<i>Anguilla rostrata</i>	4,878	2,849	7,727	9	8	8
9) Silver Perch	<i>Bairdiella chrysoura</i>	4,966	1,451	6,417	8	15	9
10) Southern Flounder	<i>Paralichthys lethostigma</i>	3,886	2,043	5,929	11	13	10
11) White Catfish	<i>Ameiurus catus</i>	4,487	1,186	5,673	10	20	11
12) Blue Catfish	<i>Ictalurus furcatus</i>	3,382	2,235	5,617	12	10	12
13) Longnose Gar	<i>Lepisosteus osseus</i>	3,198	2,147	5,345	14	12	13
14) Largemouth Bass	<i>Micropterus salmoides</i>	2,747	2,514	5,261	17	9	14
15) Redbreast Sunfish	<i>Lepomis auritus</i>	3,207	1,211	4,418	13	18	15
16) Threadfin Shad	<i>Dorosoma petenense</i>	3,017	1,284	4,301	16	16	16
17) Bluegill	<i>Lepomis macrochirus</i>	1,779	2,160	3,939	21	11	17
18) Pinfish	<i>Lagodon rhomboides</i>	3,049	492	3,541	15	25	18
19) Atlantic Croaker	<i>Micropogonias undulatus</i>	1,783	1,279	3,062	20	17	19
20) Spotted Seatrout	<i>Cynoscion nebulosus</i>	1,876	864	2,740	19	22	20
21) Western Mosquitofish	<i>Gambusia holbrooki</i>	1,663	874	2,537	23	21	21
22) Gizzard Shad	<i>Dorosoma cepedianum</i>	836	1,593	2,429	29	14	22
23) Minnow - Species	<i>Minnow sp</i>	2,153	253	2,406	18	32	23
24) Common Carp	<i>Cyprinus carpio</i>	1,636	467	2,103	24	26	24
25) Freshwater Goby	<i>Ctenogobius shufeldti</i>	1,732	289	2,021	22	29	25
26) Striped Bass	<i>Morone saxatilis</i>	673	1,192	1,865	31	19	26
27) Tidewater Mojarra	<i>Eucinostomus harengulus</i>	1,366	395	1,761	25	28	27
28) White Mullet	<i>Mugil curema</i>	858	609	1,467	28	24	28
29) Bowfin	<i>Amia calva</i>	1,004	418	1,422	26	27	29
30) Redear Sunfish	<i>Lepomis microlophus</i>	646	652	1,298	32	23	30
31) Hogchoker	<i>Trinectes maculatus</i>	746	279	1,025	30	30	31
32) Blueback Herring	<i>Alosa aestivalis</i>	963	56	1,019	27	46	32
33) Channel Catfish	<i>Ictalurus punctatus</i>	554	205	759	33	35	33
34) Sheepshead Minnow	<i>Cyprinodon variegatus</i>	354	275	629	36	31	34
35) Flathead Catfish	<i>Pylodictis olivaris</i>	529	92	621	34	42	35
36) American Shad	<i>Alosa sapidissima</i>	488	108	596	35	39	36
37) Sailfin Molly	<i>Poecilia latipinna</i>	340	201	541	38	36	37
38) Black Crappie	<i>Pomoxis nigromaculatus</i>	198	210	408	43	34	38
39) Brook Silverside	<i>Labidesthes sicculus</i>	341	65	406	37	45	39
40) Sheepshead	<i>Archosargus probatocephalus</i>	141	247	388	47	33	40

continued....

**Table 1.2** Numbers of each species caught by the SCDNR electrofishing survey

...continued

Common Name	Scientific Name	NUMBER CAUGHT			RANK		
		2001-2007	2008-2013	Total	2001-2007	2008-2013	Total
41) Bay Whiff	<i>Citharichthys spilopterus</i>	266	111	377	39	38	41
42) Speckled Worm Eel	<i>Myrophis punctatus</i>	252	95	347	40	41	42
43) Rainwater Killifish	<i>Lucania parva</i>	166	168	334	45	37	43
44) Goldern Shiner	<i>Notemigonus crysoleucas</i>	252	48	300	40	47	44
45) Gray Snapper	<i>Lutjanus griseus</i>	226	37	263	42	49	45
46) Spotted Sunfish	<i>Lepomis punctatus</i>	164	80	244	46	43	46
47) Pumpkinseed	<i>Lepomis gibbosus</i>	141	102	243	47	40	47
48) Eucinostomus species	<i>Eucinostomus sp.</i>	180	2	182	44	85	48
49) Warmouth	<i>Lepomis gulosus</i>	131	37	168	49	49	49
50) Black Drum	<i>Pogonias cromis</i>	85	75	160	54	44	50
51) Chain Pickerel	<i>Esox niger</i>	126	10	136	50	66	51
52) Bluefish	<i>Pomatomus saltatrix</i>	111	24	135	51	54	52
53) White Perch	<i>Morone americana</i>	88	44	132	53	48	53
54) Highfin Goby	<i>Gobionellus oceanicus</i>	80	24	114	55	54	54
55) Irish Pompano	<i>Diapterus auratus</i>	104	10	114	52	66	54
56) Ladyfish	<i>Elops saurus</i>	57	34	91	58	52	56
57) Spotted Sucker	<i>Minytrema melanops</i>	71	10	81	56	66	57
58) Spottail Shiner	<i>Notropis hudsonius</i>	62	14	76	57	59	58
59) Spinycheek Sleeper	<i>Eleotris pisonis</i>	57	18	75	58	57	59
60) Atlantic Needlefish	<i>Strongylura marina</i>	39	35	74	62	51	60
61) Naked Goby	<i>Gobiosoma bosc</i>	48	19	67	60	56	61
62) Crevalle Jack	<i>Caranx hippos</i>	31	25	56	65	53	62
63) Pirate Perch	<i>Aphredoderus sayanus</i>	47	2	49	61	85	63
64) Striped Anchovy	<i>Anchoa hepsetus</i>	35	5	40	64	77	64
65) Hardhead Catfish	<i>Ariopsis felis</i>	37	1	38	63	92	65
66) Flier	<i>Centrarchus macropterus</i>	29	8	37	66	73	66
67) Weakfish	<i>Cynoscion regalis</i>	26	11	37	68	64	66
68) Atlantic Silverside	<i>Menidia menidia</i>	20	14	34	71	59	68
69) Leatherjack	<i>Oligoplites saurus</i>	27	7	34	67	74	68
70) Caranx species	<i>Caranx sp.</i>	26	7	33	68	74	70
71) Spanish Mackerel	<i>Scomberomorus maculatus</i>	24	9	33	70	71	70
72) Blackcheek Tonguefish	<i>Symphurus plagiusa</i>	16	13	29	72	62	72
73) Grass Carp	<i>Ctenopharyngodon idella</i>	8	18	26	83	57	73
74) Redfin Pickerel	<i>Esox americanus</i>	16	10	26	72	66	73
75) Gulf Pipefish	<i>Syngnathus scovelli</i>	12	12	24	78	63	75
76) Fat Sleeper	<i>Dormitator maculatus</i>	14	9	23	76	71	76
77) Tarpon	<i>Megalops atlanticus</i>	16	5	21	72	77	77
78) Atlantic Bumper	<i>Chloroscombrus chrysurus</i>	9	11	20	81	64	78
79) Hickory Shad	<i>Alosa mediocris</i>	6	14	20	88	59	78
80) Brown Bullhead	<i>Ameiurus nebulosus</i>	13	5	18	77	77	80

continued...

**Table 1.2** Numbers of each species caught by the SCDNR electrofishing survey

...continued

Common Name	Scientific Name	NUMBER CAUGHT			RANK		
		2001-2007	2008-2013	Total	2001-2007	2008-2013	Total
81) Horse-Eye Jack	<i>Caranx latus</i>	15		15	75	-	81
82) Chain Pipefish	<i>Syngnathus louisianae</i>	12	2	14	78	85	82
83) Lyre Goby	<i>Evorthodus lyricus</i>	12	2	14	78	85	82
84) Lepomis species	<i>Lepomis sp.</i>	8	4	12	83	81	84
85) Opossum Pipefish	<i>Microphis brachyurus lineatus</i>	7	4	11	86	81	85
86) Oyster Toadfish	<i>Opsanus tau</i>	9	2	11	81	85	85
87) Star Drum	<i>Stellifer lanceolatus</i>	6	5	11	88	77	85
88) Tilapia species	<i>Tilapia sp.</i>		10	10	-	66	88
89) Green Sunfish	<i>Lepomis cyanellus</i>	2	7	9	95	74	89
90) Northern Pipefish	<i>Syngnathus fuscus</i>	8		8	83	-	90
91) Violet Goby	<i>Gobioides broussonetii</i>	7	1	8	86	92	90
92) Lookdown	<i>Selene vomer</i>	3	4	7	92	81	92
93) Syngnathus species	<i>Syngnathus sp.</i>	5	1	6	90	92	93
94) Common Snook	<i>Centropomus undecimalis</i>	4	1	5	91	92	94
95) Atlantic Stingray	<i>Dasyatis sabina</i>	1	3	4	103	84	95
96) Summer Flounder	<i>Paralichthys dentatus</i>	2	2	4	95	85	95
97) Atlantic Thread Herring	<i>Opisthonema oglinum</i>	3		3	92	-	97
98) Striped Burrfish	<i>Chilomycterus schoepfii</i>	2	1	3	95	92	97
99) Yellow Perch	<i>Perca flavescens</i>	3		3	92	-	97
100) Atlantic Cutlassfish	<i>Trichiurus lepturus</i>		2	2	-	85	100
101) Least Killifish	<i>Heterandria formosa</i>	1	1	2	103	92	100
102) Permit	<i>Trachinotus falcatus</i>	2		2	95	-	100
103) Planehead Filefish	<i>Stephanolepis hispidus</i>	2		2	95	-	100
104) Southern Hake	<i>Urophycis floridana</i>	2		2	95	-	100
105) Southern Kingfish	<i>Menticirrhus americanus</i>	2		2	95	-	100
106) Tadpole Madtom	<i>Noturus gyrinus</i>	2		2	95	-	100
107) American Harvestfish	<i>Peprilus paru</i>	1		1	103	-	107
108) Atlantic Spadefish	<i>Chaetodipterus faber</i>	1		1	103	-	107
109) Atlantic Tripletail	<i>Lobotes surinamensis</i>	1		1	103	-	107
110) Banded Pygmy Sunfish	<i>Elassoma zonatum</i>		1	1	-	92	107
111) Eastern Mudminnow	<i>Umbra pygmaea</i>	1		1	103	-	107
112) Enneacanthus species	<i>Enneacanthus sp.</i>		1	1	-	92	107
113) Flat Bullhead	<i>Ameiurus platycephalus</i>		1	1	-	92	107
114) Fringed Flounder	<i>Etropus crossotus</i>	1		1	103	-	107
115) Great Barracuda	<i>Sphyraena barracuda</i>		1	1	-	92	107
116) Green Goby	<i>Microgobius thalassinus</i>	1		1	103	-	107
117) Mud Sunfish	<i>Acantharchus pomotis</i>	1		1	103	-	107
118) Sea Lamprey	<i>Petromyzon marinus</i>	1		1	103	-	107
119) Shrimp Eel	<i>Ophichthus gomesii</i>	1		1	103	-	107
120) Smooth Butterfly Ray	<i>Gymnura micrura</i>		1	1	-	92	107
121) Spotfin Killifish	<i>Fundulus luciae</i>	1		1	103	-	107
122) Spotted Hake	<i>Urophycis regia</i>	1		1	103	-	107
123) Striped Killifish	<i>Fundulus majalis</i>	1		1	103	-	107
124) Tiger shrimp	<i>Penaeus monodon</i>		1	1	-	92	107
125) White Crappie	<i>Pomoxis annularis</i>		1	1	-	92	107
<b>TOTAL:</b>		<b>279,243</b>	<b>163,472</b>	<b>442,725</b>			

**Table 1.3** Numbers of each species caught by the SCDNR longline survey

Common Name	Scientific Name	NUMBER CAUGHT							TOTAL	RANK						
		2007	2008	2009	2010	2011	2012	2007		2008	2009	2010	2011	2012	TOTAL	
1) Shark, Atlantic Sharpnose	<i>Rhizoprionodon terraenovae</i>	661	1,280	814	557	571	727	4,610	1	1	1	1	1	1	1	1
2) Red Drum	<i>Sciaenops ocellatus</i>	119	166	314	429	414	667	2,109	5	4	2	2	2	2	2	2
3) Shark, Sandbar	<i>Carcharhinus plumbeus</i>	158	253	146	140	70	57	824	3	2	3	3	3	4	3	3
4) Shark, Blacktip	<i>Carcharhinus limbatus</i>	143	204	83	49	58	55	592	4	3	4	6	5	5	4	4
5) Shark, Blacknose	<i>Carcharhinus acronotus</i>	160	152	61	61	67	52	553	2	5	5	5	4	7	5	5
6) Shark, Finetooth	<i>Carcharhinus isodon</i>	61	43	54	97	40	44	339	6	10	6	4	8	8	6	6
7) Sea Bass, Black	<i>Centropristis striata</i>	26	85	34	47	38	55	285	8	7	7	7	10	5	7	7
8) Skate, Clearnose	<i>Raja eglanteria</i>	48	55	25	20	47	15	210	7	9	8	11	6	11	8	8
9) Stingray, Southern	<i>Dasyatis americana</i>		9	7	31	39	70	156	-	15	14	8	9	3	9	9
10) Dogfish, Smooth	<i>Mustelus canis</i>	1	94	5	2	45		147	19	6	16	21	7	-	-	10
11) Bonnethead	<i>Sphyrna tiburo</i>	11	11	22	28	18	24	114	10	13	9	9	12	9	11	11
12) Toadfishes	<i>Batrachoididae</i>	7	21	22	19	25	19	113	12	12	9	12	11	10	12	12
13) Stingray, Bluntnose	<i>Dasyatis say</i>		63	14	18		4	99	-	8	11	13	-	14	13	13
14) Shark, Spinner	<i>Carcharhinus brevipinna</i>	12	7	5	26	11	10	71	9	16	16	10	13	12	14	14
15) Stingray, Atlantic	<i>Dasyatis sabina</i>	3	7	10	12	9	1	42	15	16	12	14	14	19	15	15
16) Dogfish, Spiked	<i>Squalus acanthias</i>		35				1	36	-	11	-	-	-	19	16	16
17) Hammerhead, Scalloped	<i>Sphyrna lewini</i>	8	11	4	7	2	2	34	11	13	19	16	18	16	17	17
18) Shark, Nurse	<i>Ginglymostoma cirratum</i>	3	5	3	10	6	7	34	15	20	21	15	15	13	17	17
19) Shark, Lemon	<i>Negaprion brevirostris</i>	6	7	8	5		2	28	13	16	13	17	-	16	19	19
20) Shark, Tiger	<i>Galeocerdo cuvier</i>	4	6	5	2	3		20	14	19	16	21	16	-	20	20
21) Southern Kingfish	<i>Menticirrhus americanus</i>	2	4	3	2	1	1	13	17	21	21	21	22	19	21	21
22) Ray, Cownose	<i>Rhinoptera bonasus</i>		1	4	1	2	2	10	-	27	19	26	18	16	22	22
23) American Conger	<i>Conger oceanicus</i>	1	4		2	1	1	9	19	21	-	21	22	19	23	23
24) Bluefish	<i>Pomatomus saltatrix</i>		4		1	3	1	9	-	21	-	26	16	19	23	23
25) Stingray, Roughtail	<i>Dasyatis centroura</i>		1	6	2			9	-	27	15	21	-	-	23	23
26) Amberjack, Greater	<i>Seriola dumerili</i>	1		3	3		1	8	19	-	21	18	-	19	26	26
27) Horseshoe Crab	<i>Limulus polyphemus</i>			3	3	2		8	-	-	21	18	18	-	26	26
28) Ray, Smooth Butterfly	<i>Gymnura micrura</i>		2		1	1	4	8	-	25	-	26	22	14	26	26
29) Catfish, Gafftopsail	<i>Bagre marinus</i>	1	1	3		1		6	19	27	21	-	22	-	29	29
30) Hammerhead, Great	<i>Sphyrna mokarran</i>	1		2			1	4	19	-	26	-	-	19	30	30
31) Shark, Bull	<i>Carcharhinus leucas</i>		2		1	1		4	-	25	-	26	22	-	30	30
32) Shark, Sand Tiger	<i>Carcharias taurus</i>		4					4	-	21	-	-	-	-	30	30
33) Barracuda, Great	<i>Sphyrna barracuda</i>				3			3	-	-	-	18	-	-	33	33
34) Tarpon	<i>Megalops atlanticus</i>	1			1	1		3	19	-	-	26	22	-	33	33
35) Weakfish	<i>Cynoscion regalis</i>	1				1	1	3	19	-	-	-	22	19	33	33
36) Flounder, Southern	<i>Paralichthys lethostigma</i>	2						2	17	-	-	-	-	-	36	36
37) Ray, Bullnose Eagle	<i>Myliobatis freminvillii</i>					2		2	-	-	-	-	18	-	36	36
38) Bighead Searobin	<i>Prionotus tribulus</i>		1					1	-	27	-	-	-	-	38	38
39) Croaker, Atlantic	<i>Micropogonias undulatus</i>	1						1	19	-	-	-	-	-	38	38
40) Devil Ray	<i>Mobila hypostoma</i>		1					1	-	27	-	-	-	-	38	38
41) Ladyfish	<i>Elops saurus</i>				1			1	-	-	-	26	-	-	38	38
42) Lizardfish, Inshore	<i>Synodus foetens</i>				1			1	-	-	-	26	-	-	38	38
43) Remora	<i>Remora remora</i>						1	1	-	-	-	-	-	19	38	38
44) Snake Eel, Spotted	<i>Ophichthus ophis</i>				1			1	-	-	-	26	-	-	38	38
<b>TOTAL</b>		<b>1,488</b>	<b>2,650</b>	<b>1,706</b>	<b>1,646</b>	<b>1,558</b>	<b>1,883</b>	<b>10,931</b>								

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**Table 1.4** Number of angler-caught recreational fish sampled by the SCDNR Inshore Fisheries Section between 2008 and 2013

<b>Common Name</b>	<b>Scientific Name</b>	<b>Freezer</b>	<b>Tournament</b>	<b>TOTAL</b>
Spotted Seatrout	<i>Cynoscion nebulosus</i>	208	760	968
Sheepshead	<i>Archosargus probatocephalus</i>	806	836	1,642
Southern Flounder	<i>Paralichthys lethostigma</i>	124	518	642
Red Drum	<i>Sciaenops ocellatus</i>	357	175	532
Black Drum	<i>Pogonias cromis</i>	47	58	105
Bluefish	<i>Pomatomus saltatrix</i>	1	132	133
<b>TOTAL</b>		<b>1,543</b>	<b>2,479</b>	<b>4,022</b>



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## **PART 2: Status of Some Major Species Caught by the SCDNR Trammel Net and Electrofishing Surveys**

### **INTRODUCTION**

This section presents data from SCDNR's trammel net and electrofishing surveys, concentrating on a sub-set of twenty-four species that are commonly encountered (and therefore have good datasets). It is designed as look-up reference for species of interest.

For each species, a very brief overview is given of their basic biology, as well as a general description of trends seen in each of the surveys. Most species are caught by both the electrofishing and trammel net survey, but some are only encountered by one or the other. This latter case arises if the species is absent from one of the survey habitats, or is not captured by a particular gear type (even if it is present).

The datasets presented have been plotted for each of the nine areas covered by the trammel net survey and five of the six areas covered by the electrofishing survey (the area furthest upstream in the Ashley River has been omitted

due to its short period of coverage and greater freshwater species composition). Monthly catch rates have been plotted to show seasonal changes in habitat use, whereas annual catch rates have been plotted to show long-term changes in population abundance since 1991 (for the trammel net survey) or 2002 (electrofishing survey). The annual catch rates have also been summarized into a statewide abundance index by averaging data across areas (after first expressing catch rates of each area in terms of standard deviations around its long-term average, which scales data similarly across areas). Finally, the size distributions of catches have been plotted to show the different sizes and life history stages caught by each survey at different times of the year.

**Note that the Table of Contents on page i (at the very beginning of the report) has a list of page numbers for each species. Figure numbers of plotted datasets for each species are also listed on page ii.**

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**Common name:** Atlantic Croaker  
**Scientific name:** *Micropogonias undulatus*  
**Family:** Sciaenidae (drums & croakers)



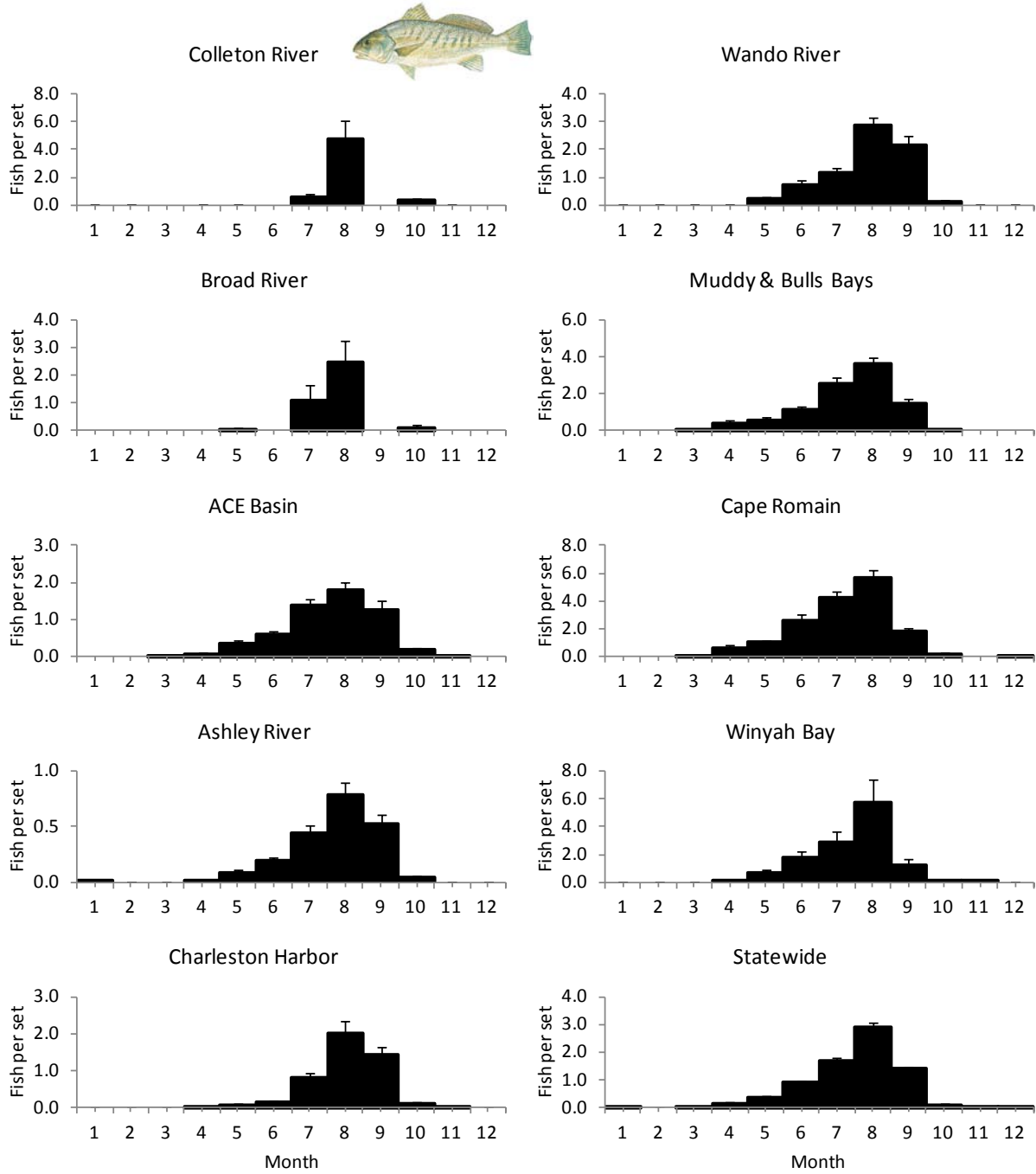
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

Atlantic Croaker occur in the trammel net survey primarily from May through September, moving into deeper waters at other times of the year. Catch rates are typically highest in the Bulls Bay, Muddy Bay and Cape Romain areas, and they have fluctuated in a reasonably synchronous manner between areas. Catch rates were high in the early 1990s and low during the late 1990s and early 2000s, but there was a general increase after 2005 before declining again in 2010. Maximum sizes are around 10 inches in South Carolina, although larger individuals are encountered in more northerly states

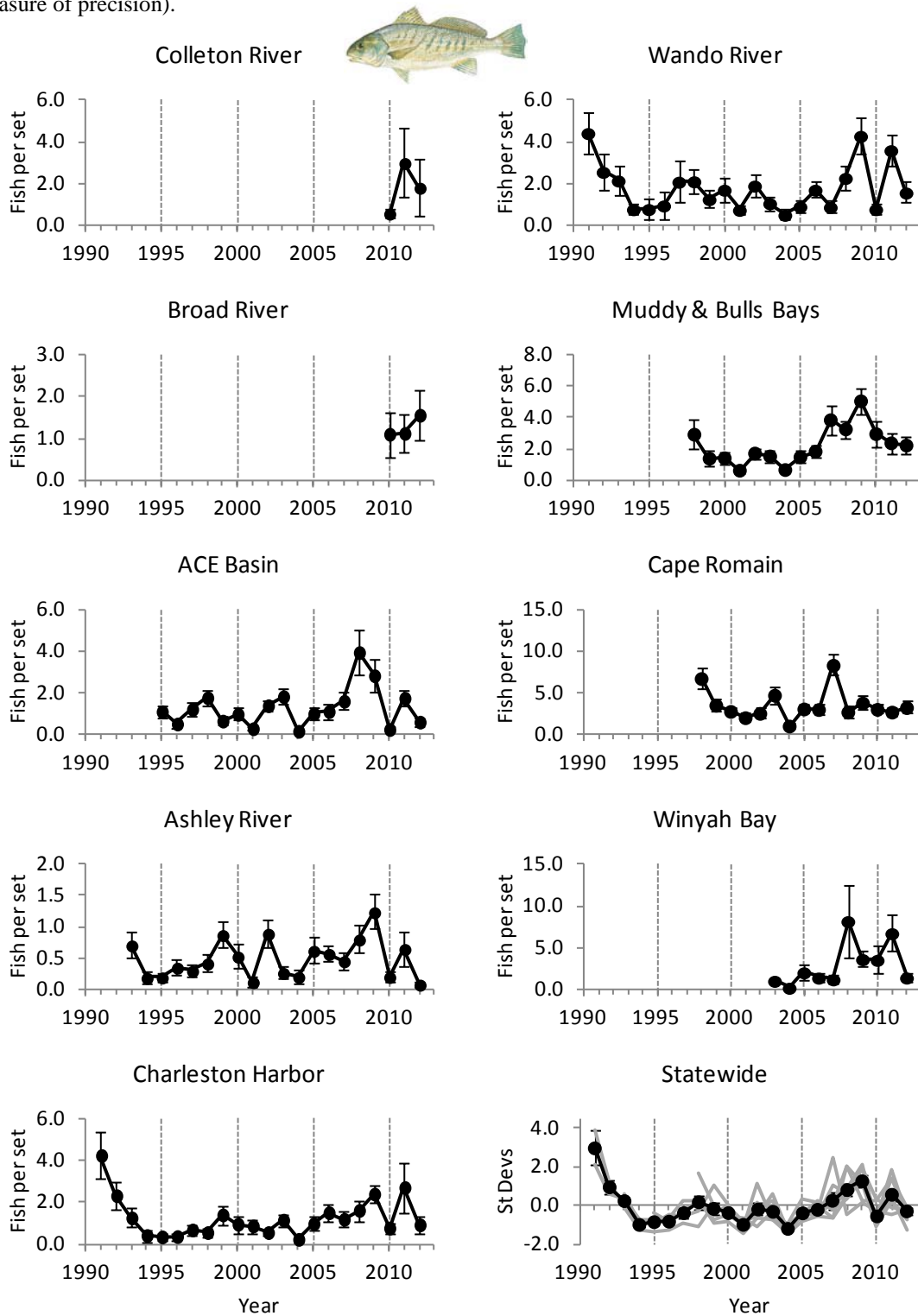
The majority of Atlantic Croaker caught by the electrofishing survey consists of newly settled juveniles, which begin to recruit to estuaries late in the year and continue through spring. Catch rates have fluctuated since 2002, but a separate more detailed analysis has shown a correlation between electrofishing data one year and trammel net data the following year. This implies that most of the Atlantic Croaker caught by the trammel net survey are one year old fish.

Additional species information: <http://www.dnr.sc.gov/cwcs/pdf/Croaker.pdf>

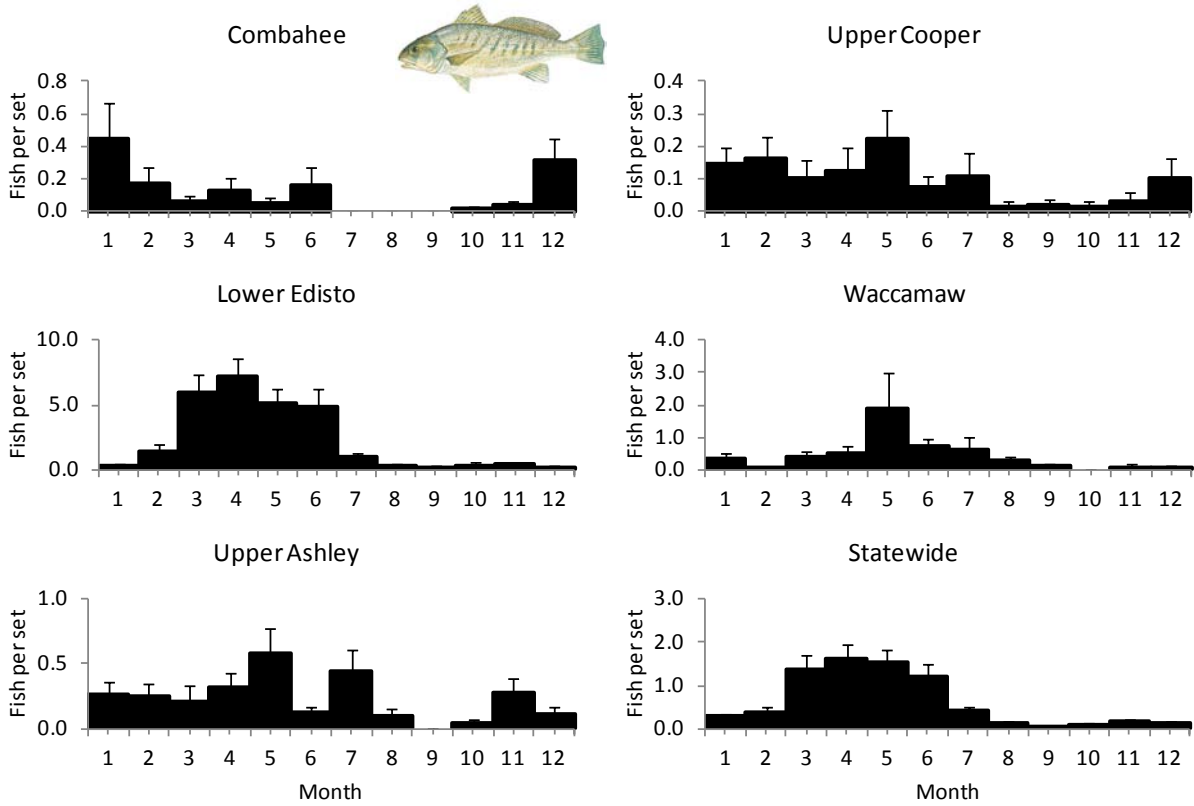
**Fig 2.1 Atlantic Croaker:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



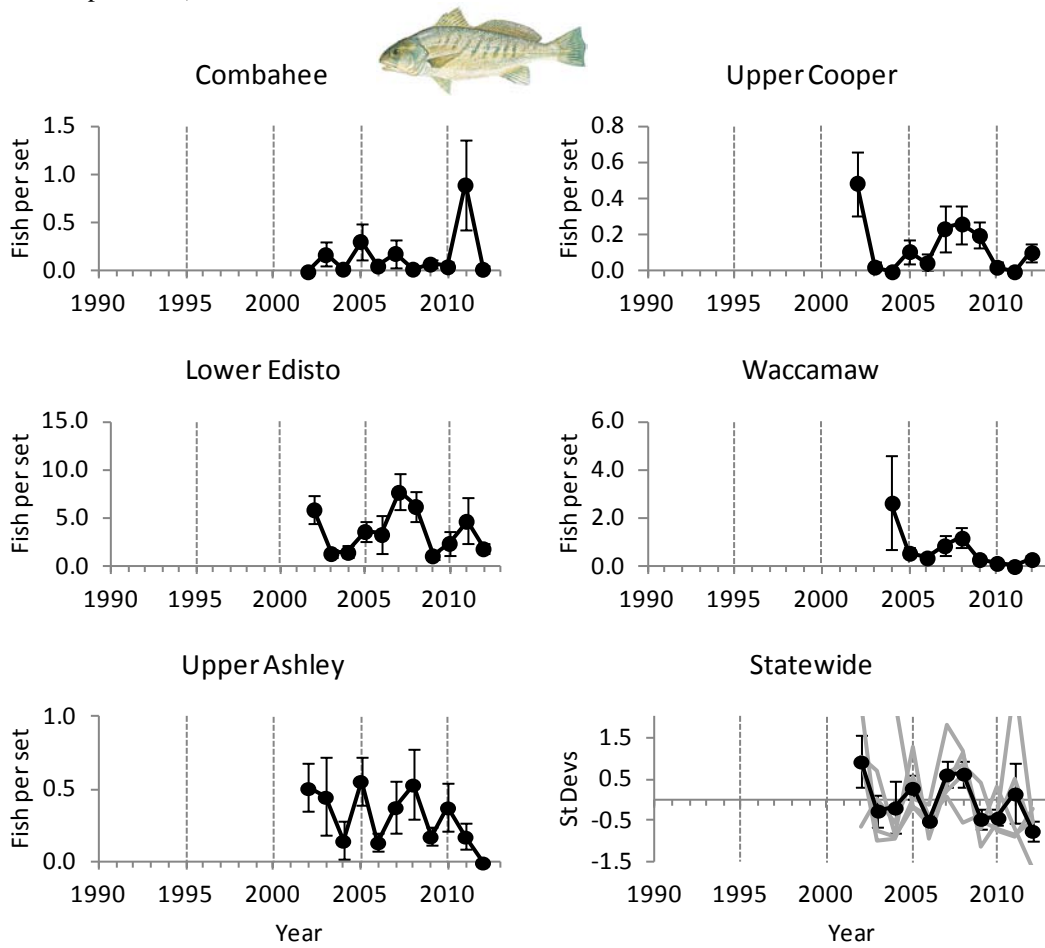
**Fig. 2.2 Atlantic Croaker:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jun-Sep data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



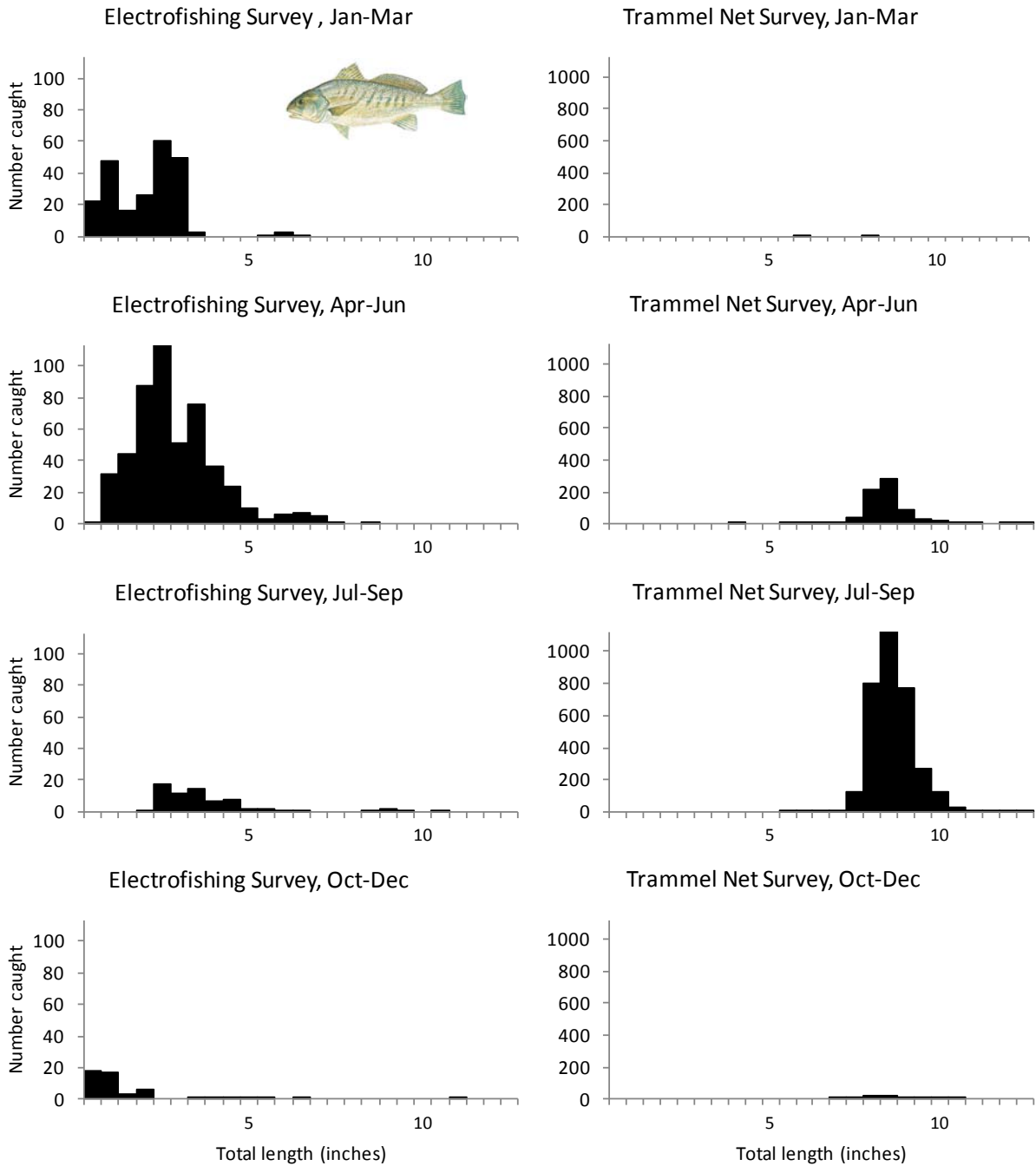
**Fig 2.3 Atlantic Croaker:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.4 Atlantic Croaker:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan – Jul data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.5 Atlantic Croaker:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. (Note: logarithmic scale used for electrofishing survey due to very high numbers of small fish). Black bars: legal size fish (2013 regulations: no size restriction or bag limit).

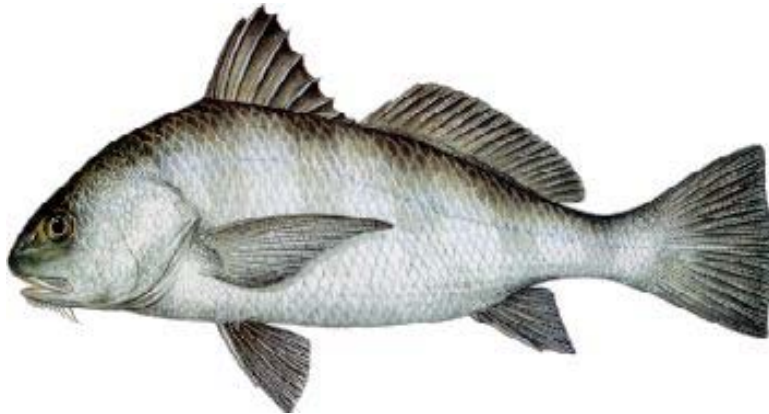


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**Common name:**        **Black Drum**

**Scientific name:**    *Pogonias cromis*

**Family:**                **Sciaenidae (drums & croakers)**



### **Occurrence in the Trammel Net & Electrofishing Surveys**

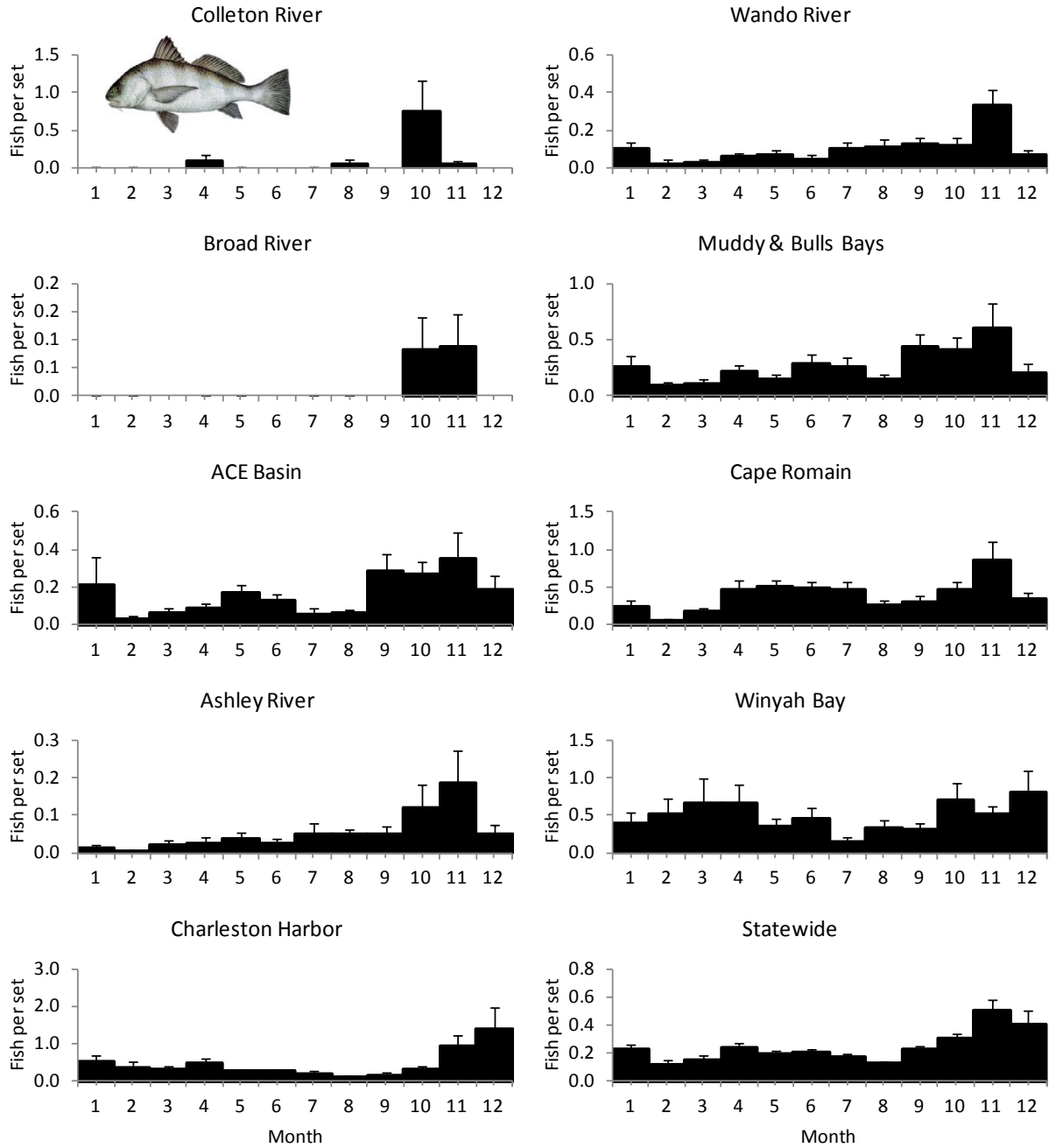
Black drum occur in the trammel net survey during all months of the year, but their numbers are usually highest from October through December, when the young of the year fish (born in spring) become large enough to be captured by the gear. In 1999 there was an exceptionally strong year class of black drum, which was evident in all of the areas covered by the trammel net survey. Catch rates in the electrofishing survey are generally very low, with the highest catches usually occurring in the Winyah Bay system.

Black drum juveniles remain in the trammel net survey areas until they are around two to three years old, after which they move into deeper waters where they may reach ages of approximately fifty years or more. Our tagging data has shown that black drum also move long distances along the coastline. For example, among those black drum that were recaptured by anglers five or more years after they had been tagged, at least 50% had moved more than 450 miles from their tagging location.

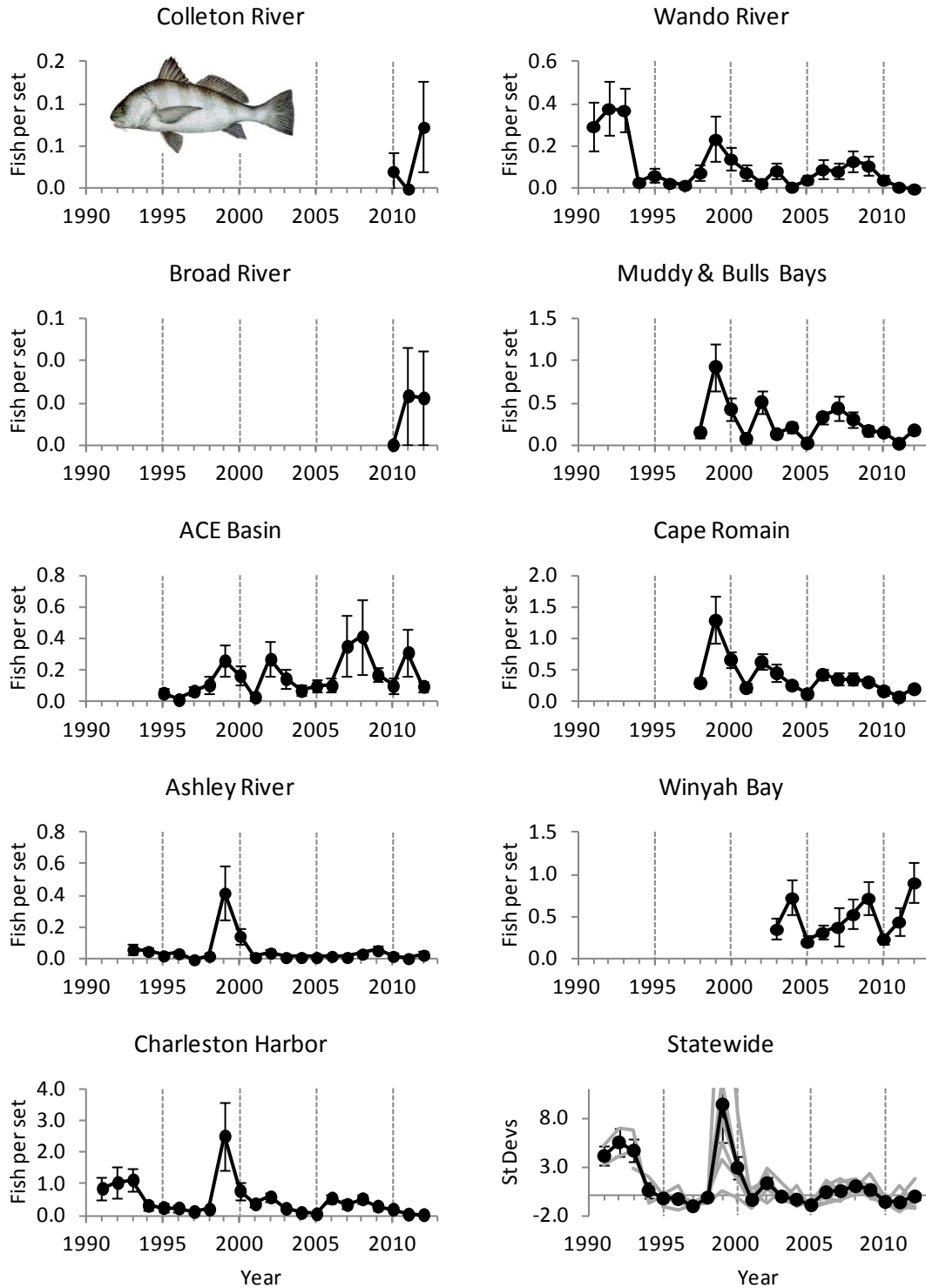
Our black drum data are currently being used as part of an ongoing stock assessment, and genetic samples from the fish we catch are being used by the SCDNR Genetics Section to examining population structure along the Atlantic and Gulf of Mexico coastlines.



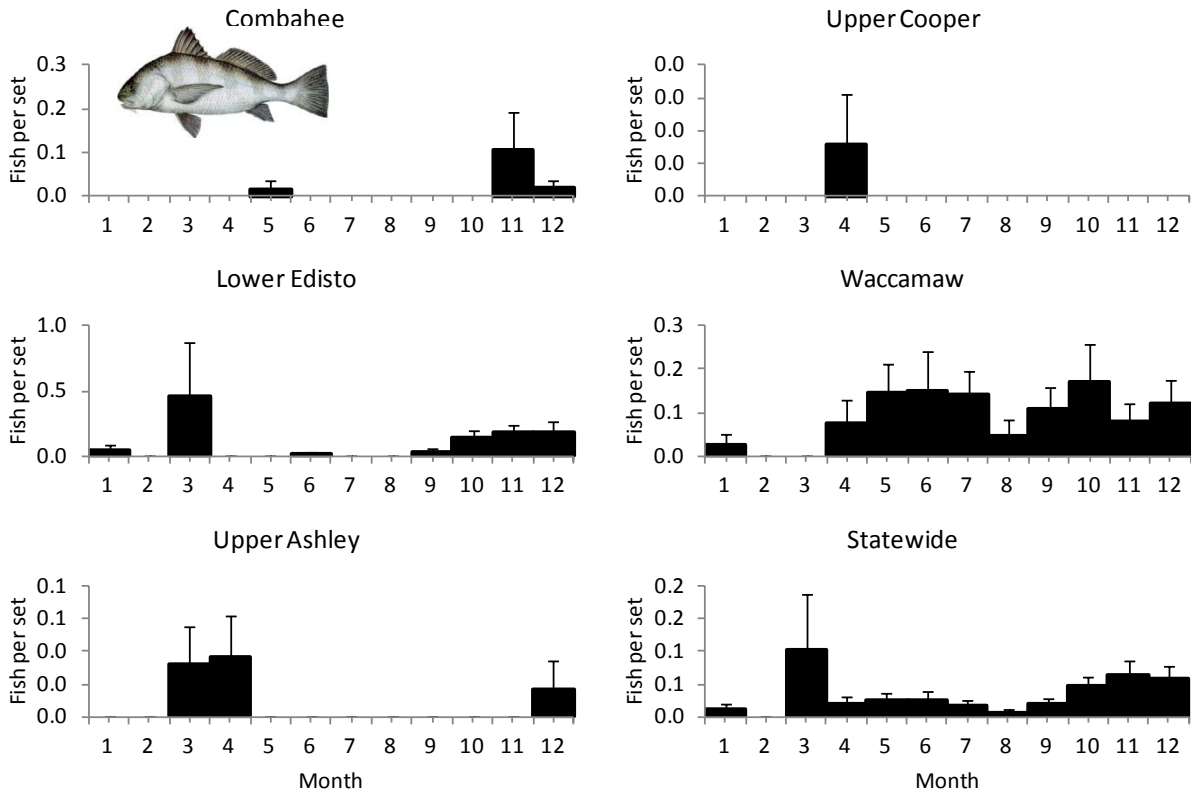
**Fig 2.6 Black Drum:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



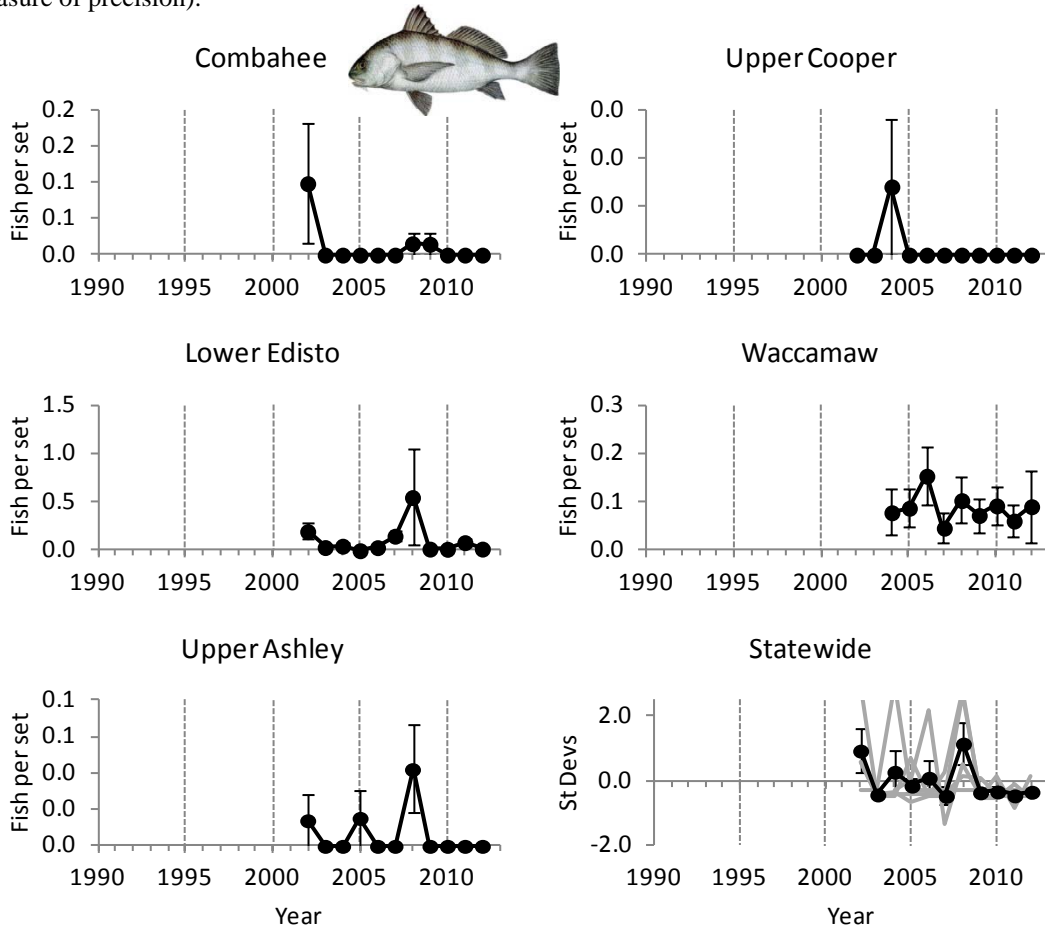
**Fig. 2.7 Black Drum:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



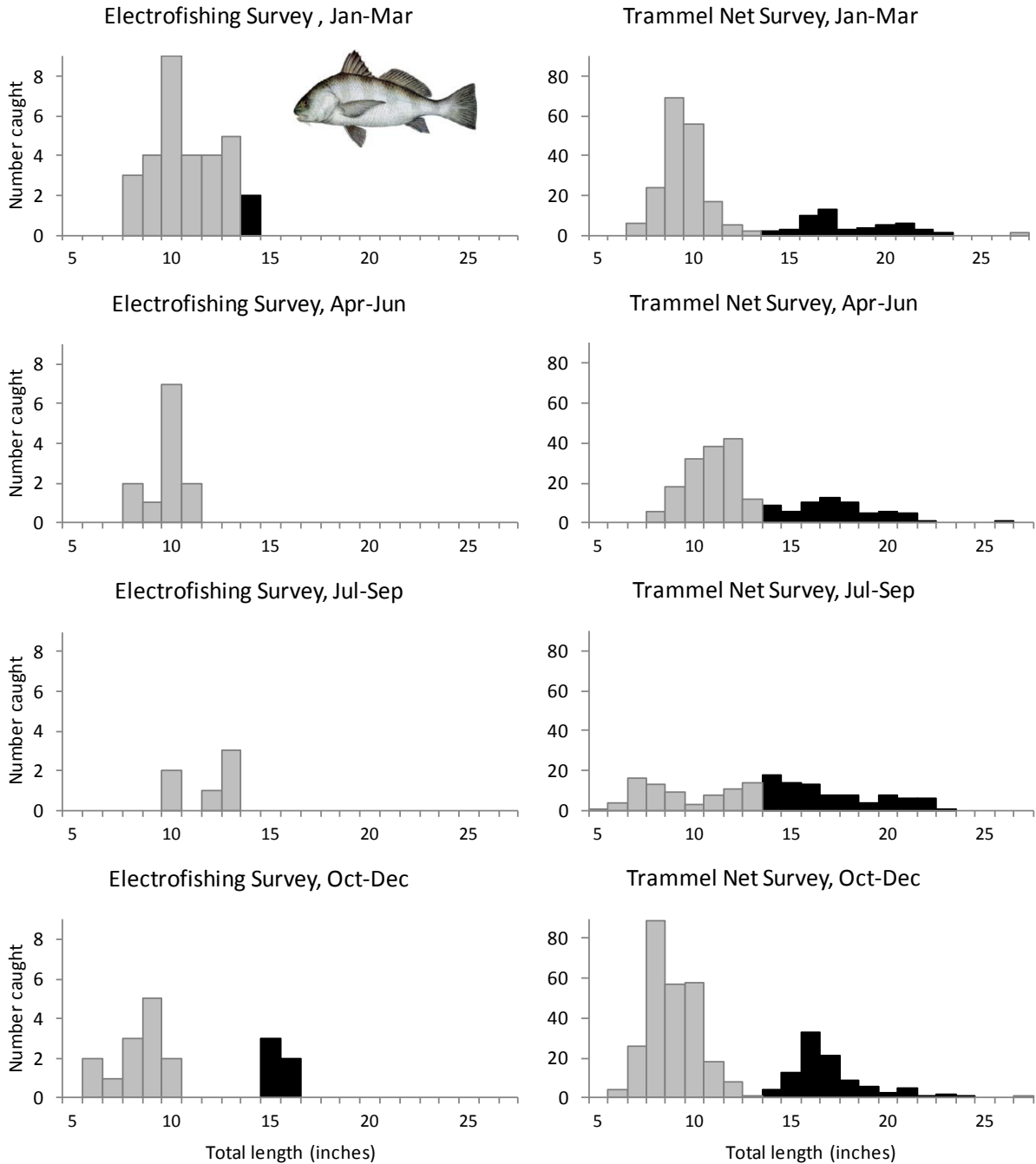
**Fig 2.8 Black Drum:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.9 Black Drum:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.10 Black Drum:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal size fish; Black bars: legal size fish (2013 regulations: 14"-27" slot, 5 per person per day).



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**Common name:** Red Drum

**Scientific name:** *Sciaenops ocellatus*

**Family:** Sciaenidae (drums & croakers)



### **Occurrence in the Trammel Net & Electrofishing Surveys**

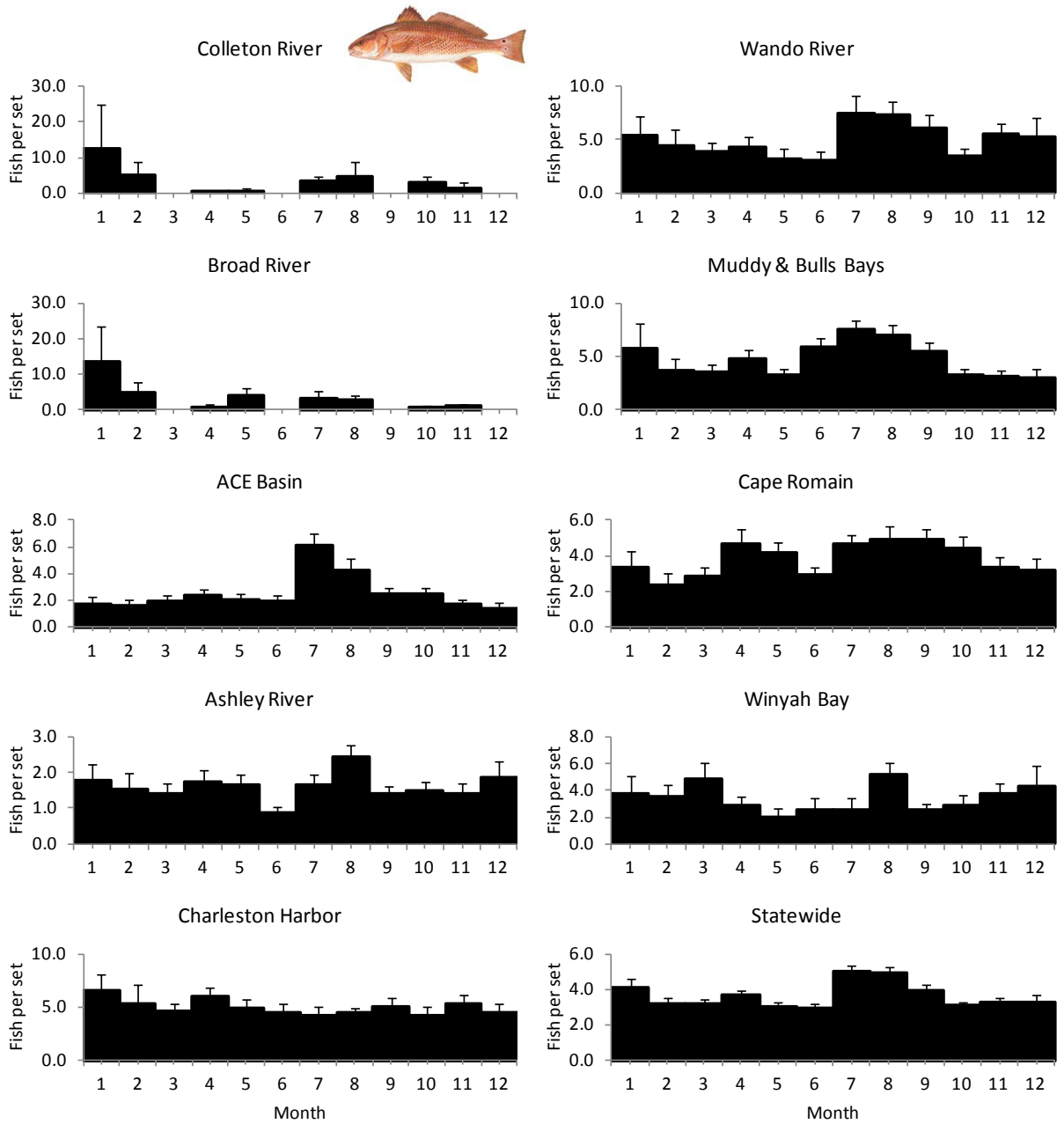
Red Drum is a major component of the trammel and electrofishing surveys year round. Catch rates in the trammel net survey tend to increase between July and September as one year old juveniles (born in fall of the preceding year) grow large enough to be caught by the gear. This juvenile cohort appears earlier in the year within the electrofishing survey, which is capable of catching much smaller fish.

The SCDNR Inshore Fisheries Section ages survey-caught Red Drum by removing some scales and counting rings on them under a microscope. This shows that Red Drum in upper estuary (electrofished) areas are mostly two years old or less, whereas those in lower estuary (trammel net) areas may reach ages of three to five years old. After that, Red Drum move into deeper waters off the coast of South Carolina, returning to estuary mouths in the fall to spawn. Tagging has shown that South Carolina Red Drum rarely move distances greater than 150 miles along the coast, even ten years or more after being tagged, although greater distances have been recorded.

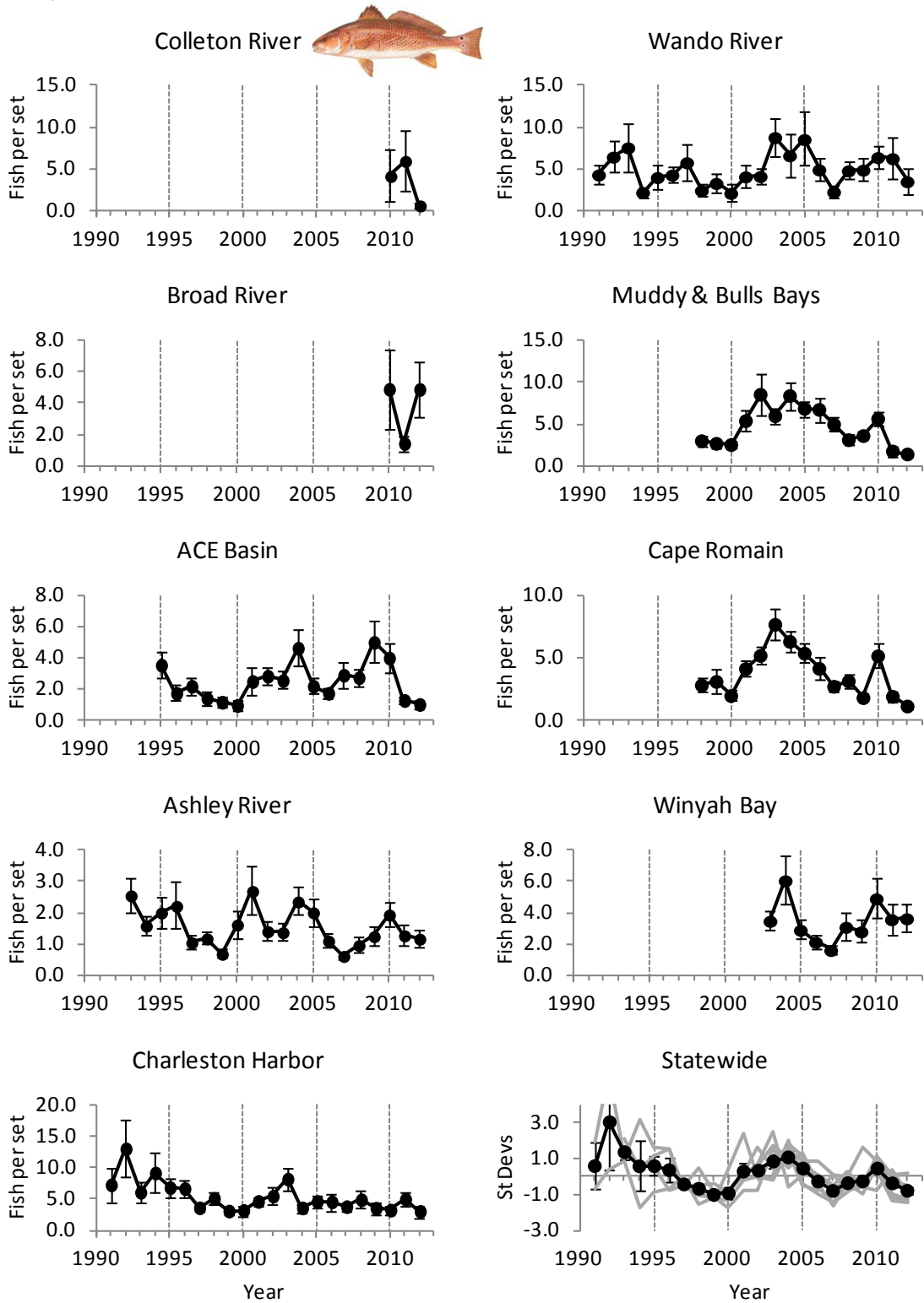
Analysis of adult Red Drum caught by our long-line surveys has shown that they can live to at least thirty-nine years old. Furthermore, year classes that are well represented in the adult population coincide with strong juvenile recruitment years seen in the trammel net and electrofishing surveys (as well as other historical, now discontinued, surveys). This gives us a high degree of confidence that the population fluctuations we see across our different surveys are real and meaningful.

Additional species information: [http://www.dnr.sc.gov/marine/mrri/insh\\_fish/reddrum.pdf](http://www.dnr.sc.gov/marine/mrri/insh_fish/reddrum.pdf)

**Fig. 2.11 Red Drum:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

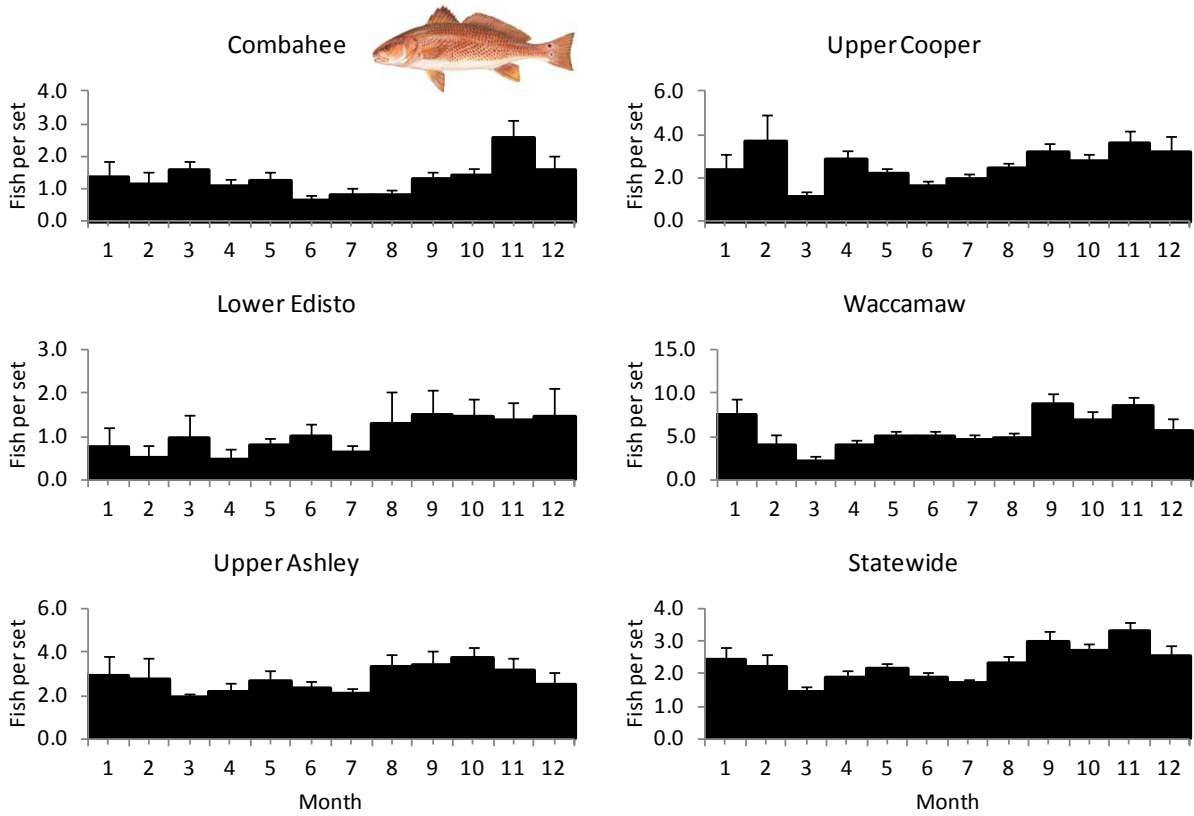


**Fig. 2.12 Red Drum:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).

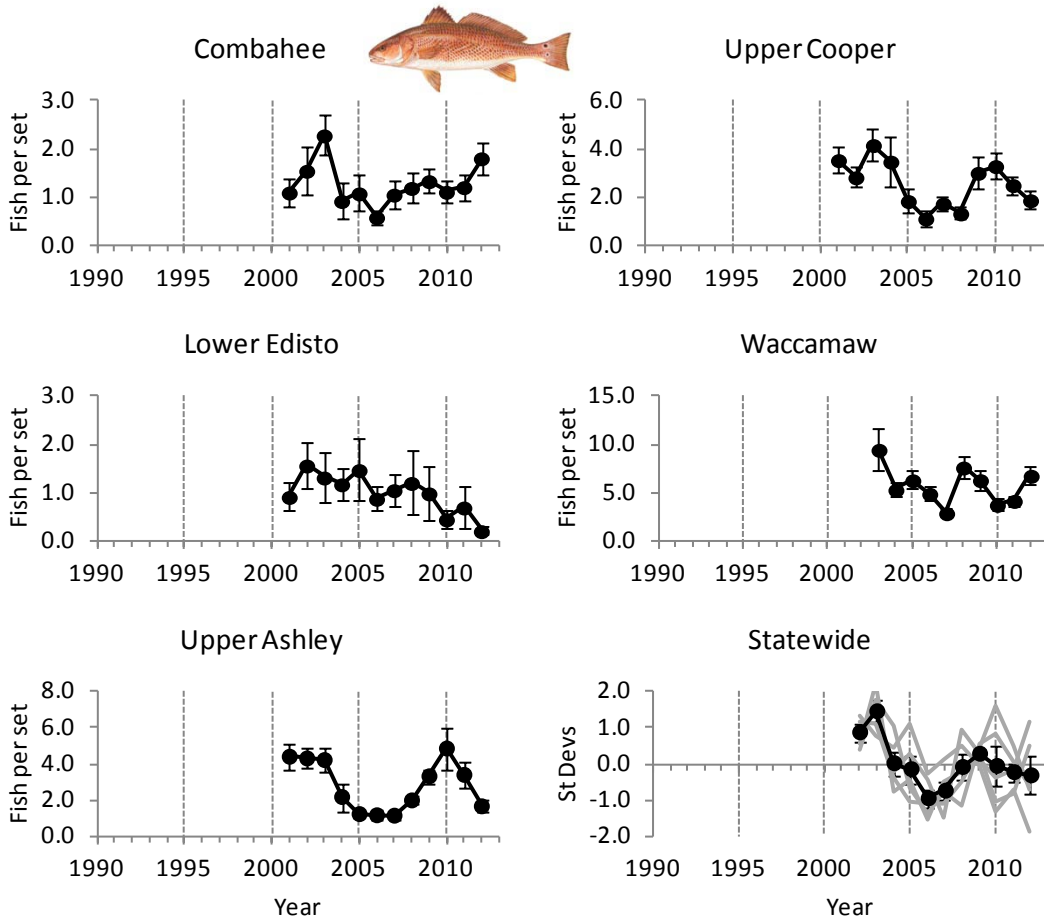




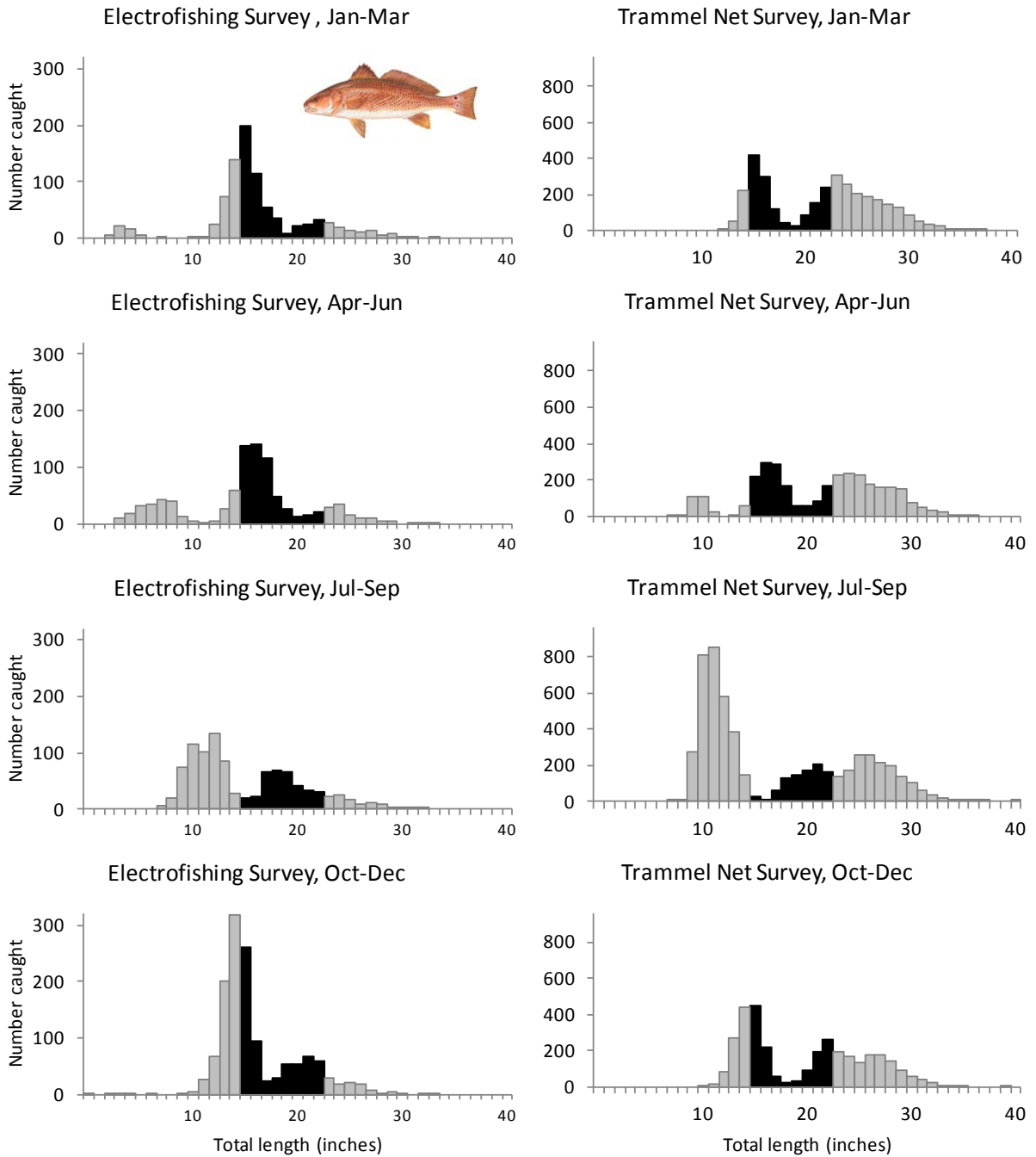
**Fig 2.13 Red Drum:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.14 Red Drum:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).

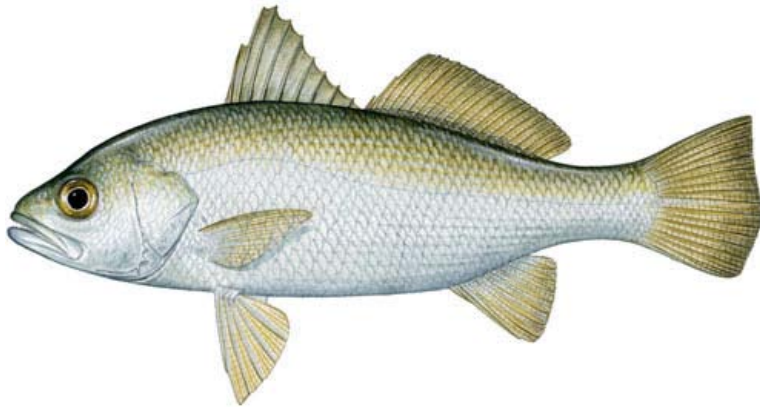


**Fig 2.15 Red Drum:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal size fish; Black bars: legal size fish (2013 regulations: 15"-23" size slot, 3 per person per day in state waters).



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**Common name:** Silver Perch  
**Scientific name:** *Bairdiella chrysoura*  
**Family:** Sciaenidae (drums & croakers)

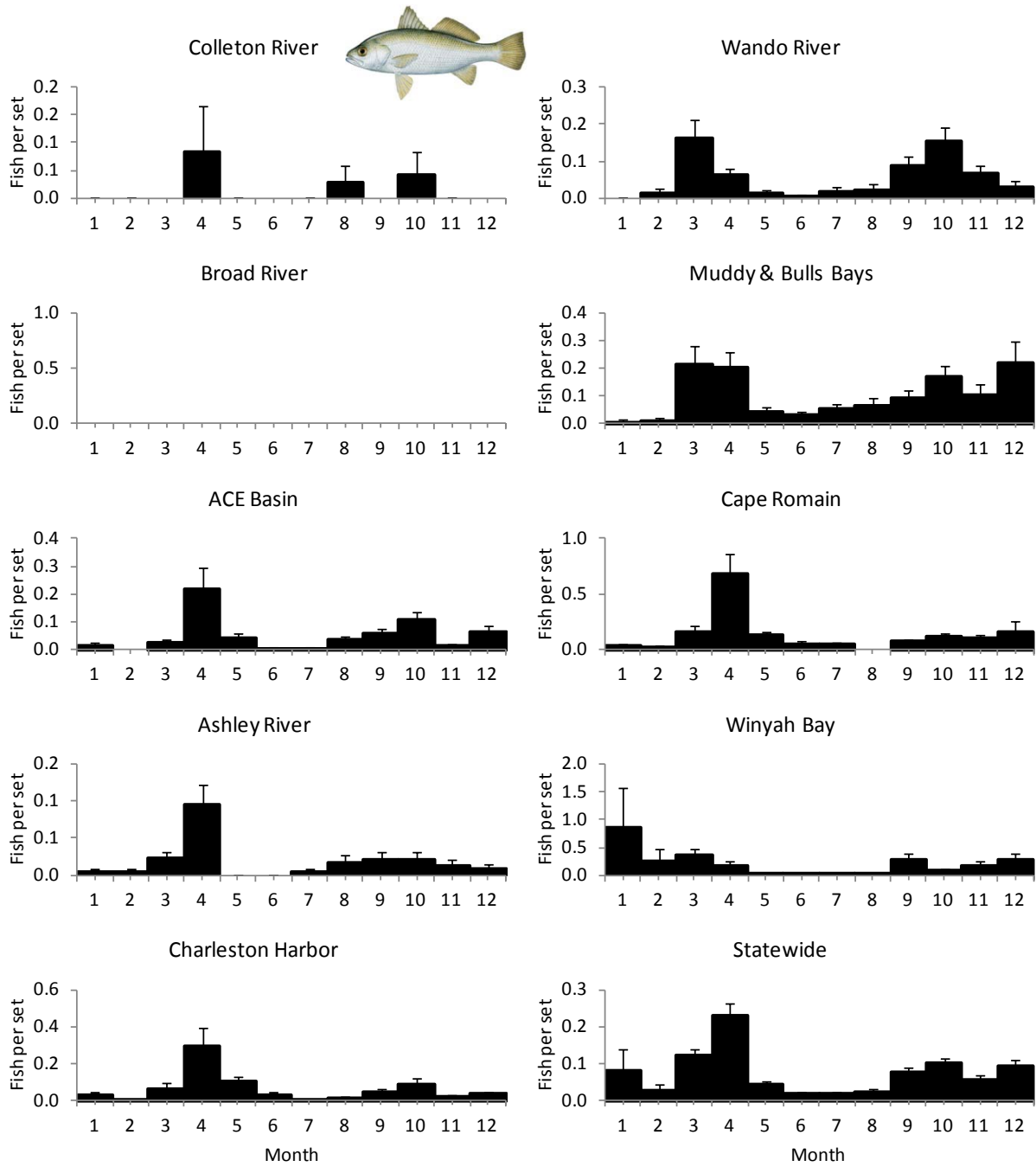


#### **Occurrence in the Trammel Net & Electrofishing Surveys**

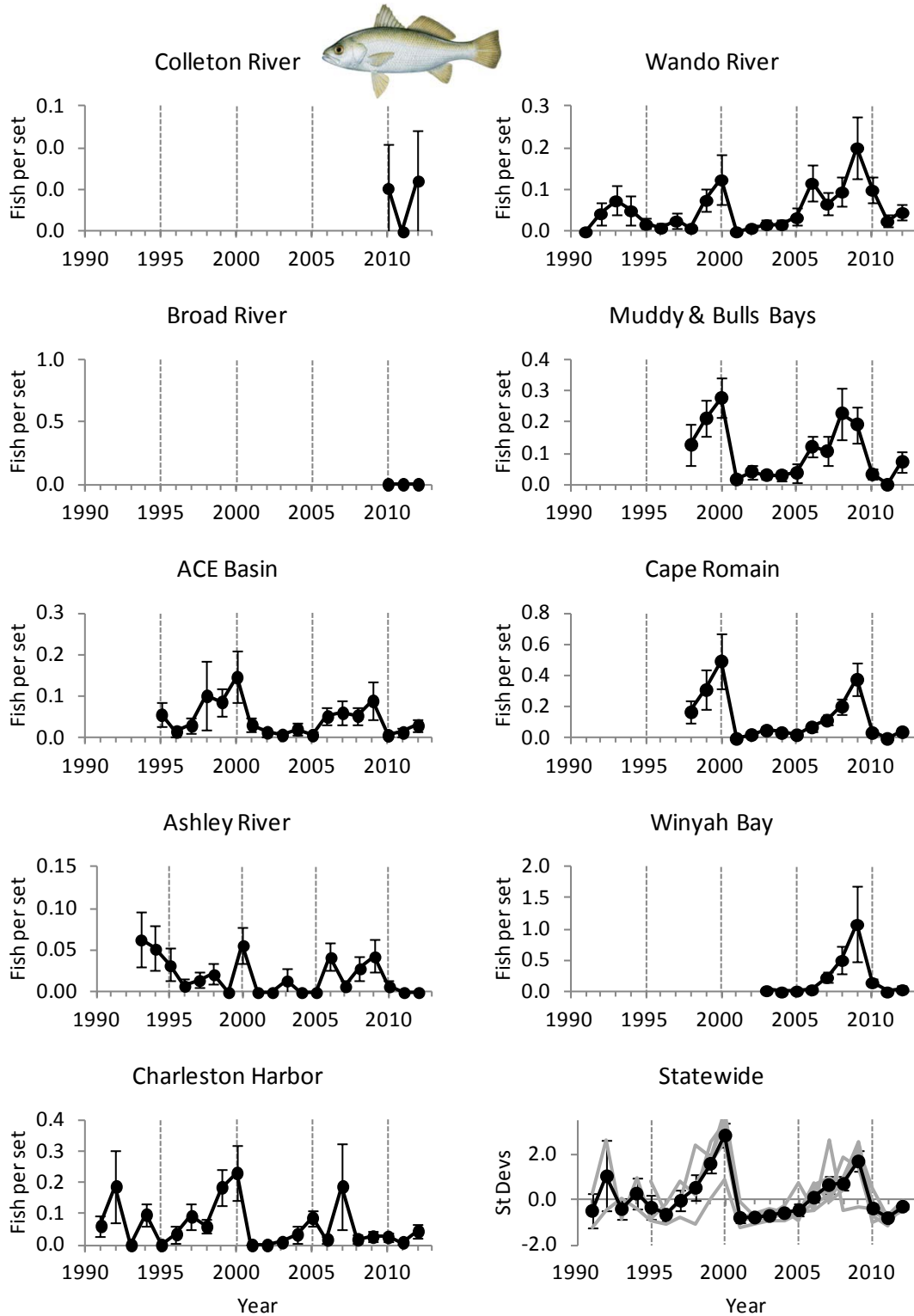
Silver Perch is a small, short-lived drum species. Spawning occurs within estuaries during the spring, resulting in 2-5 inch fish being caught in the electrofishing survey by late summer. Catch rates are highest in the trammel net survey during March and April, with a smaller peak in fall as young of the year become large enough to be captured.

Although Silver Perch are not usually targeted by anglers, they are an important prey species for larger fish. Like Spotted Seatrout, their population numbers tend to fluctuate with winter conditions, declining sharply after severe winters. This was evident in 2001 as well as 2010 and 2011.

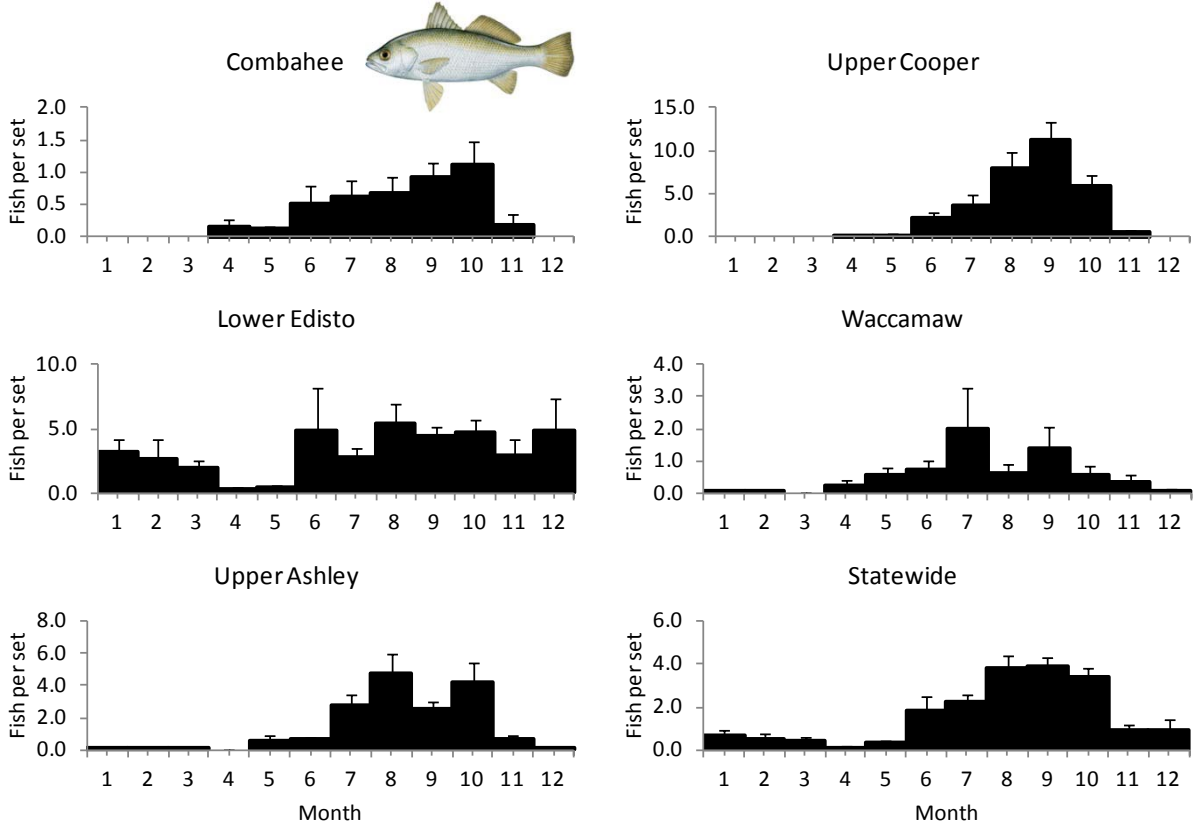
**Fig 2.16 Silver Perch:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



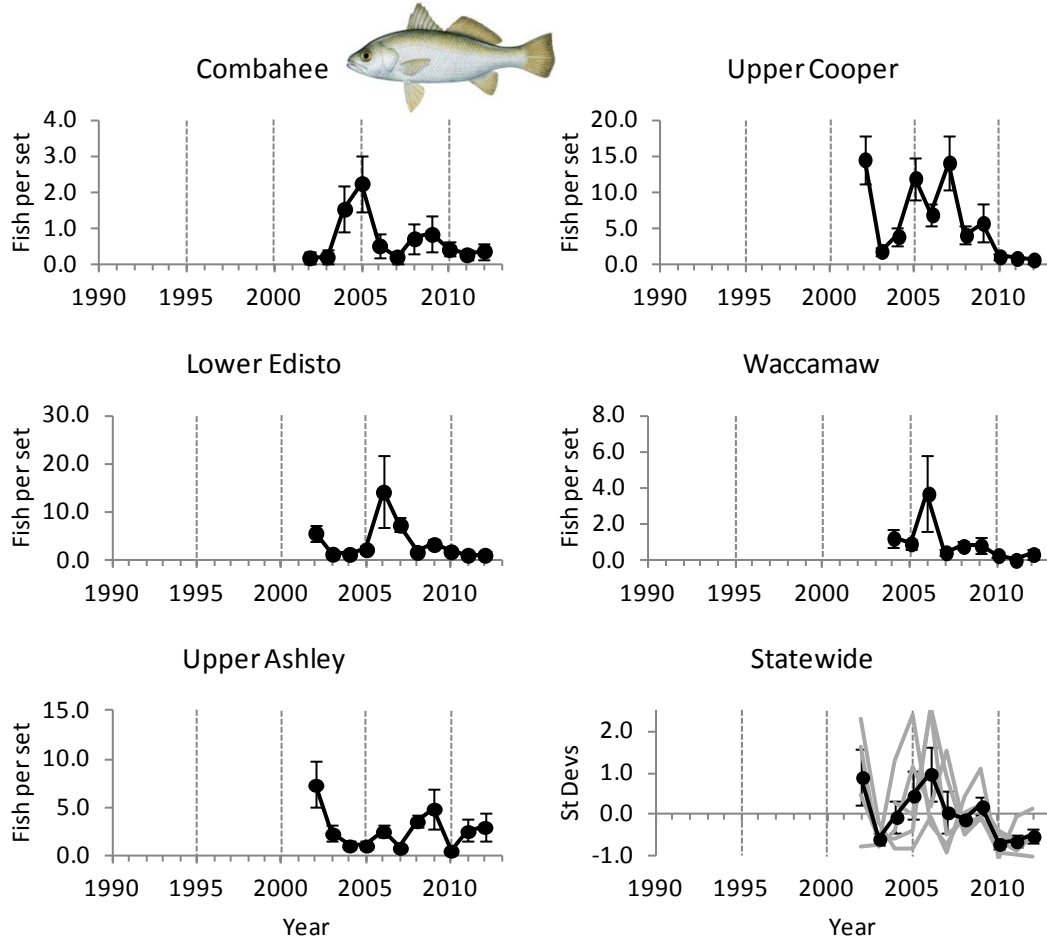
**Fig. 2.17 Silver Perch:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan-Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.18 Silver Perch:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

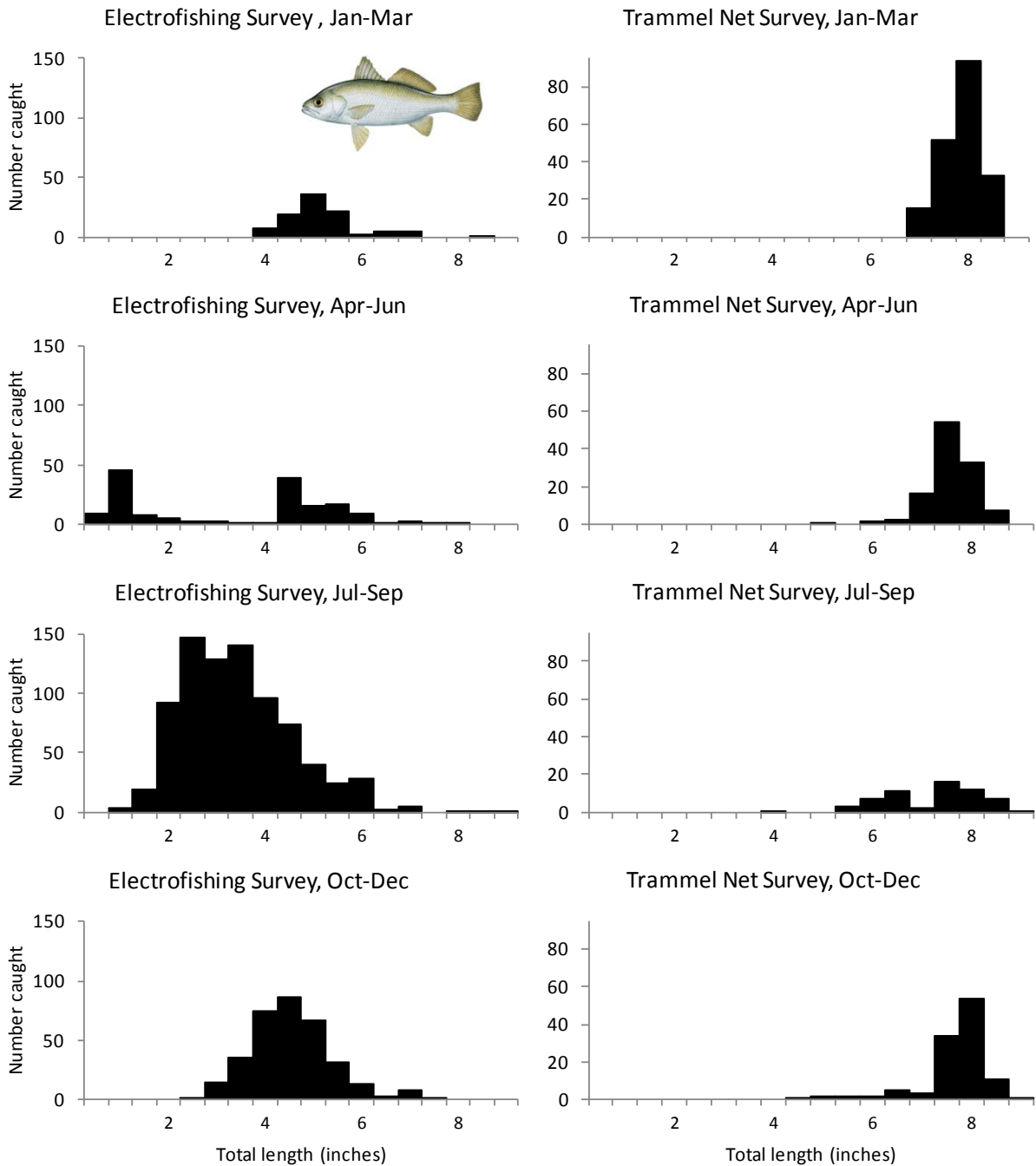


**Fig. 2.19 Silver Perch:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jun-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).





**Fig 2.20 Silver Perch:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size restriction or bag limit).

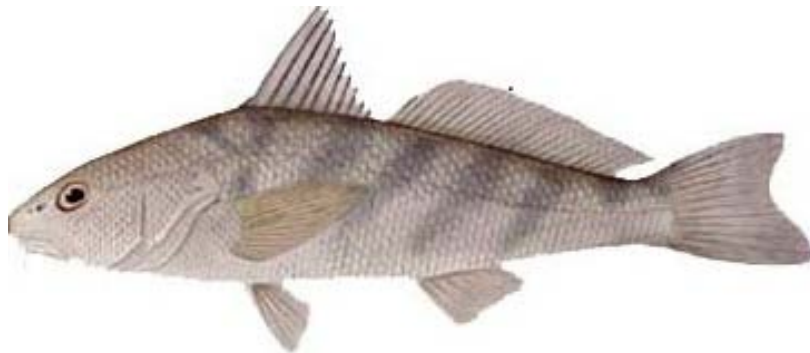


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**Common name:** Southern Kingfish (Whiting)

**Scientific name:** *Menticirrhus americanus*

**Family:** Sciaenidae (drums & croakers)

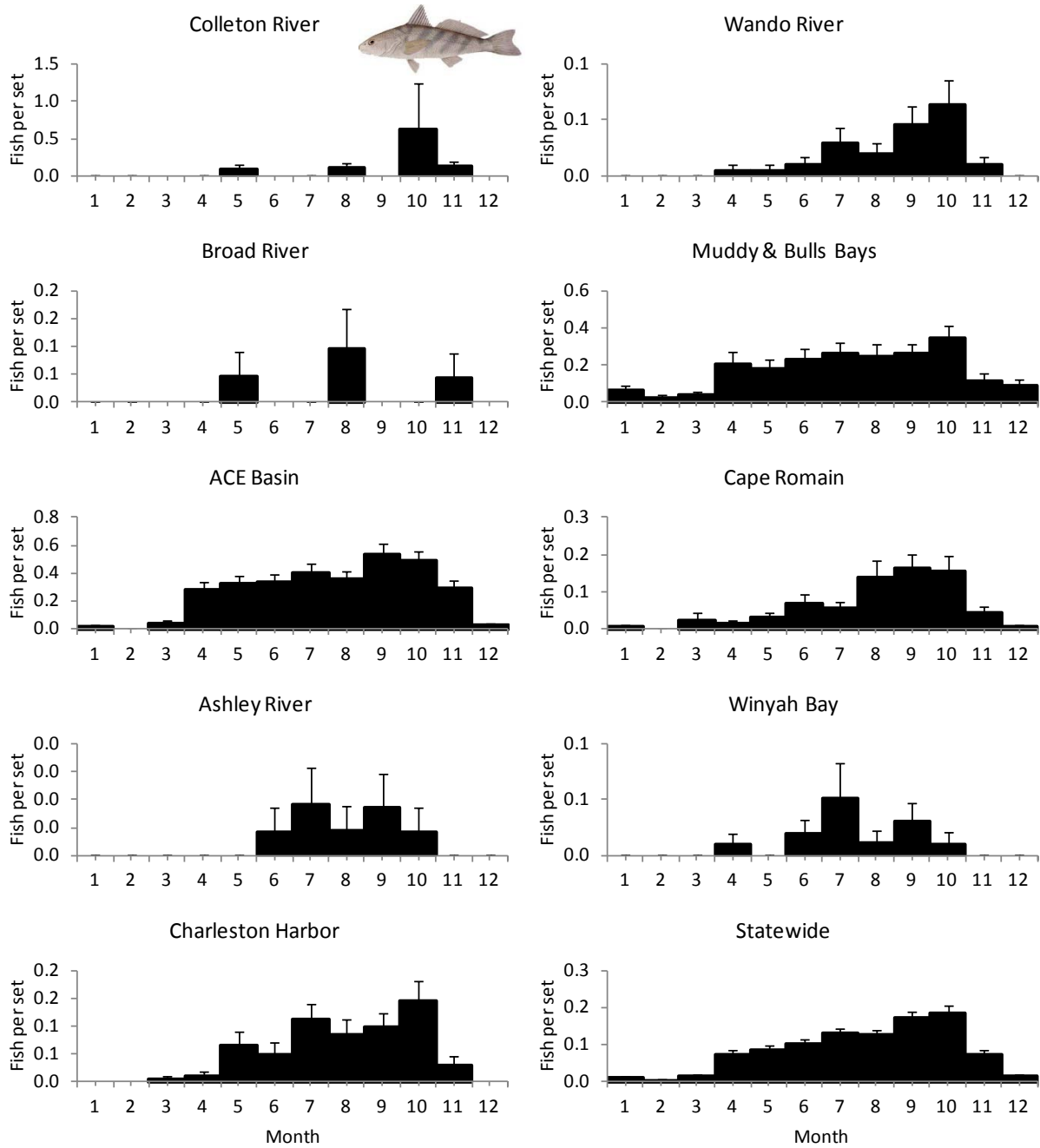


#### **Occurrence in the Trammel Net & Electrofishing Surveys**

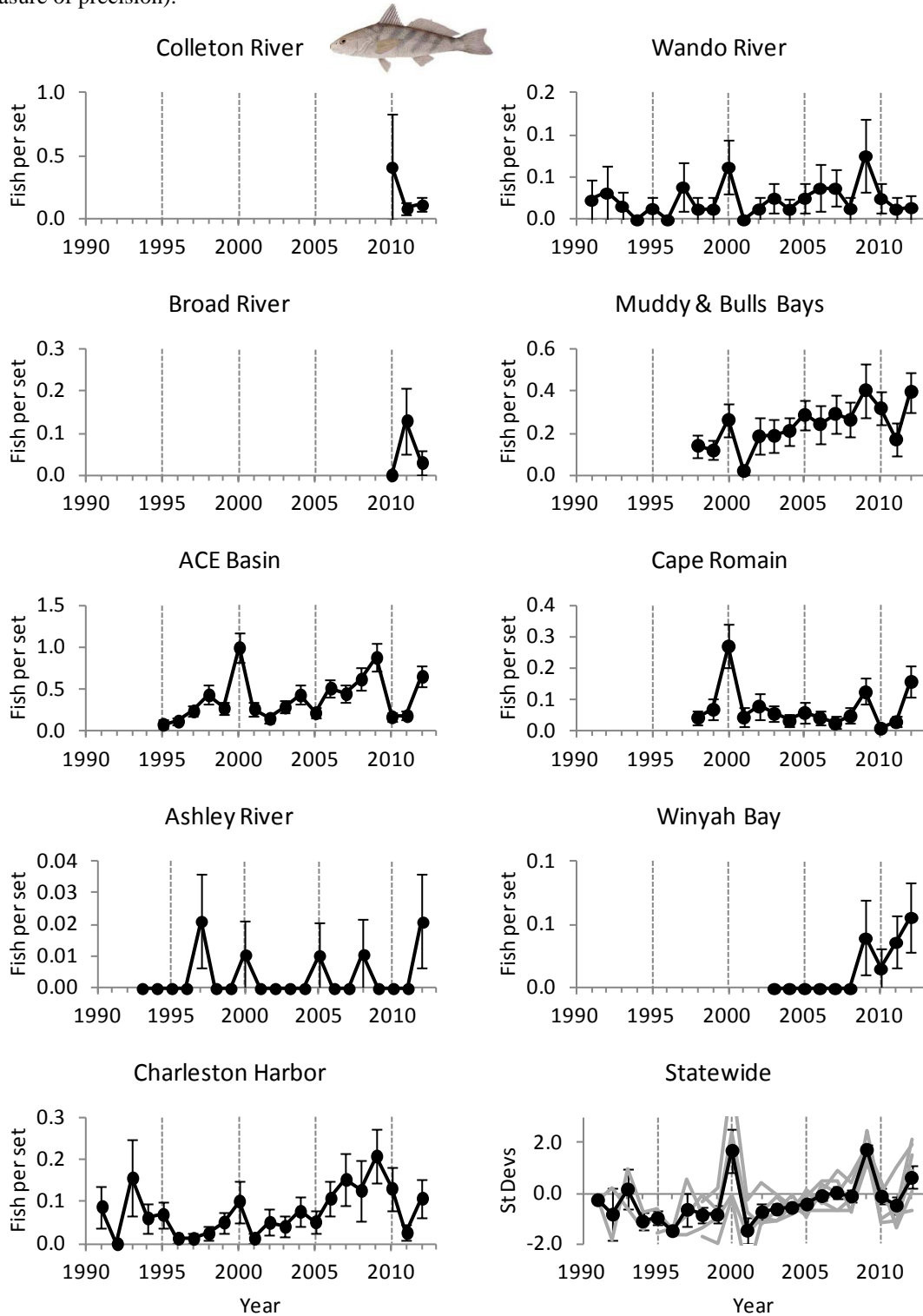
Three species of kingfish are caught in South Carolina, but the Southern Kingfish is by far the most common (the others being the Gulf Kingfish and the Northern Kingfish). Southern Kingfish are virtually absent from the electrofishing survey, so only trammel net data are presented here.

Most fish caught are between four and six inches long. Catch rates tend to increase as the year progresses, peaking around October before declining as fish presumably move into deeper waters. The highest numbers are typically encountered in Muddy Bay, Bulls Bay and ACE Basin. The population has undergone a general increase since the early 1990s with prominent peaks in 2000 and 2009.

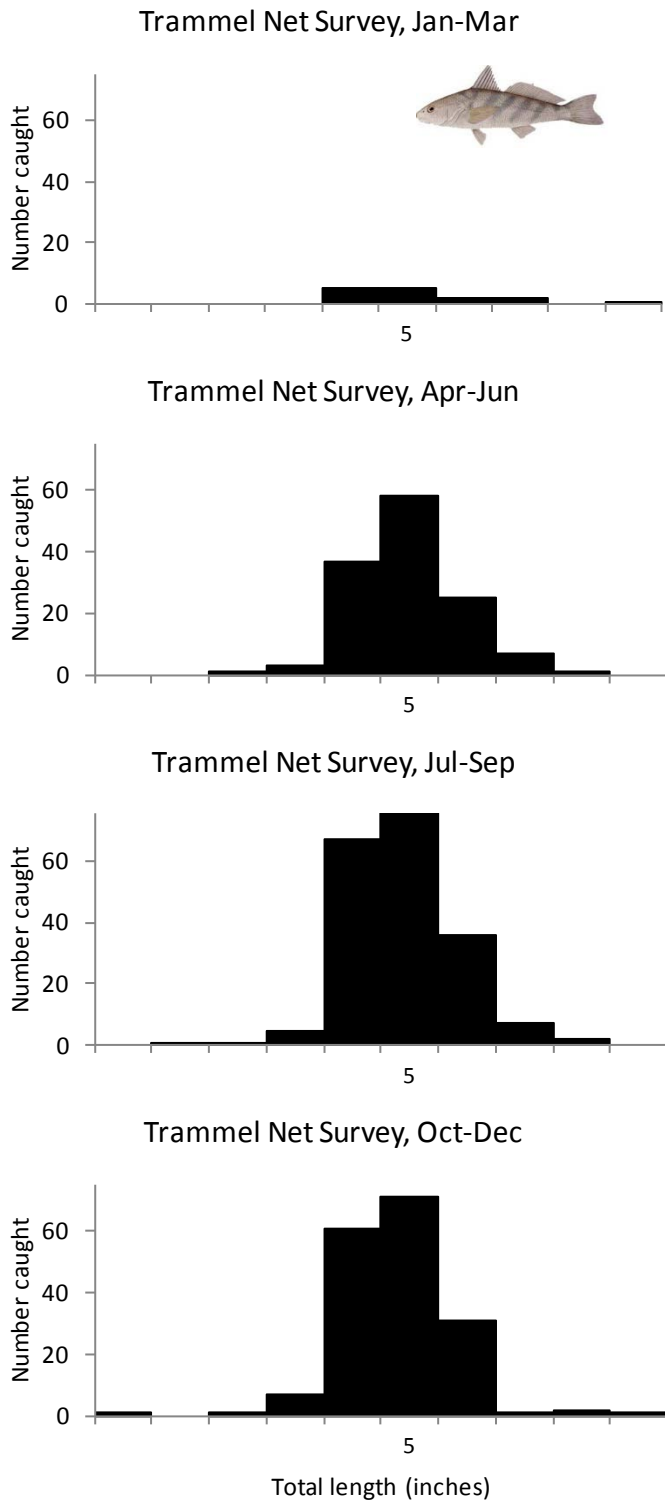
**Fig 2.21 Southern Kingfish:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.22 Southern Kingfish:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Apr-Nov data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.23 Southern Kingfish:** Size-frequency distribution of fish caught in the SCDNR survey in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. (Note: Southern Kingfish are not caught by the electrofishing survey). Black bars: legal size fish (2013 regulations: no size restriction).

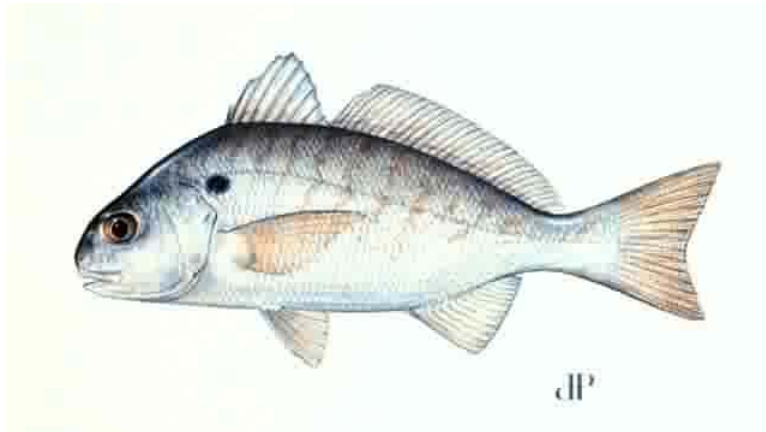


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**Common name:** Spot

**Scientific name:** *Leiostomus xanthurus*

**Family:** Sciaenidae (drums & croakers)

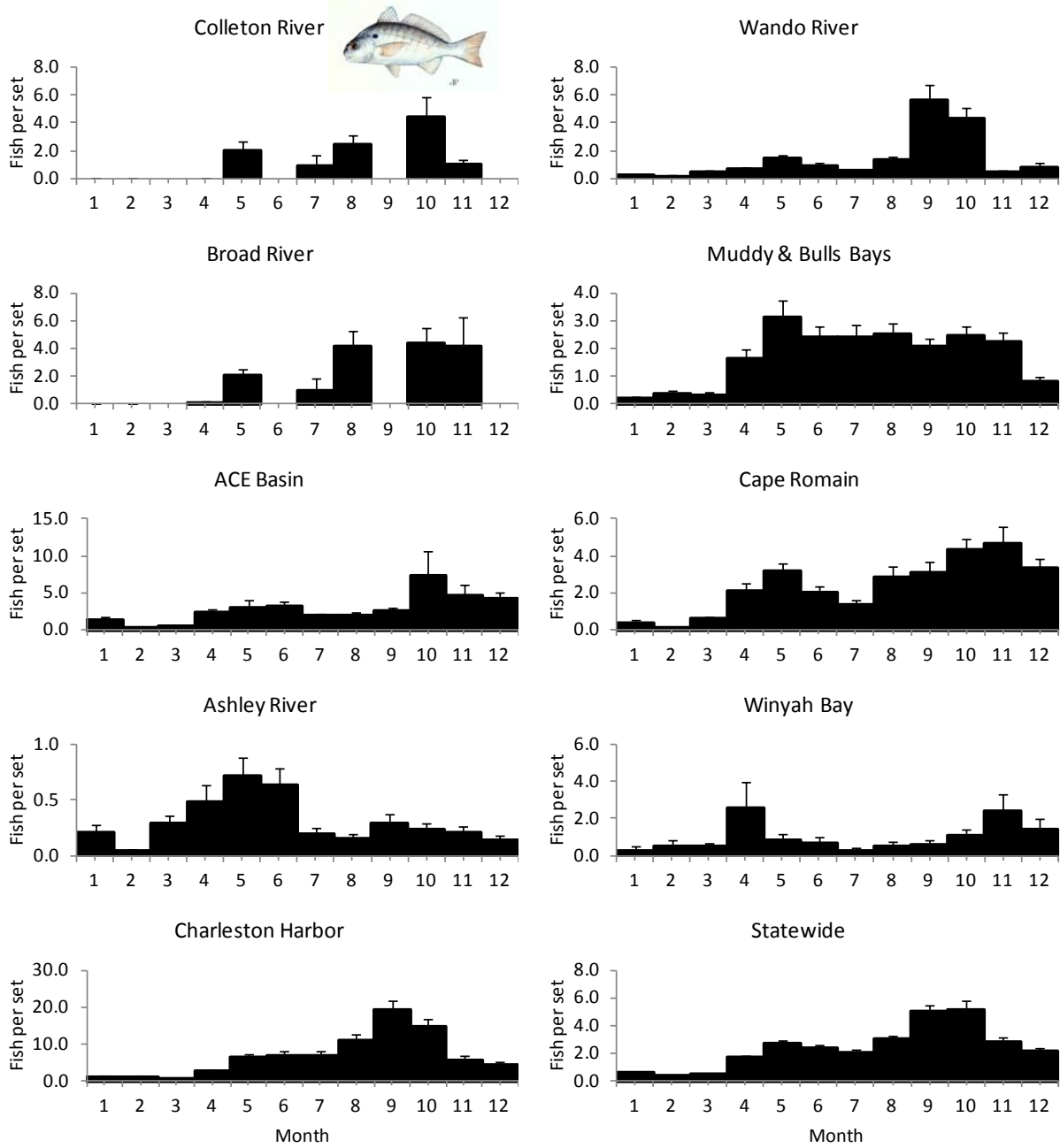


### **Occurrence in the Trammel Net & Electrofishing Surveys**

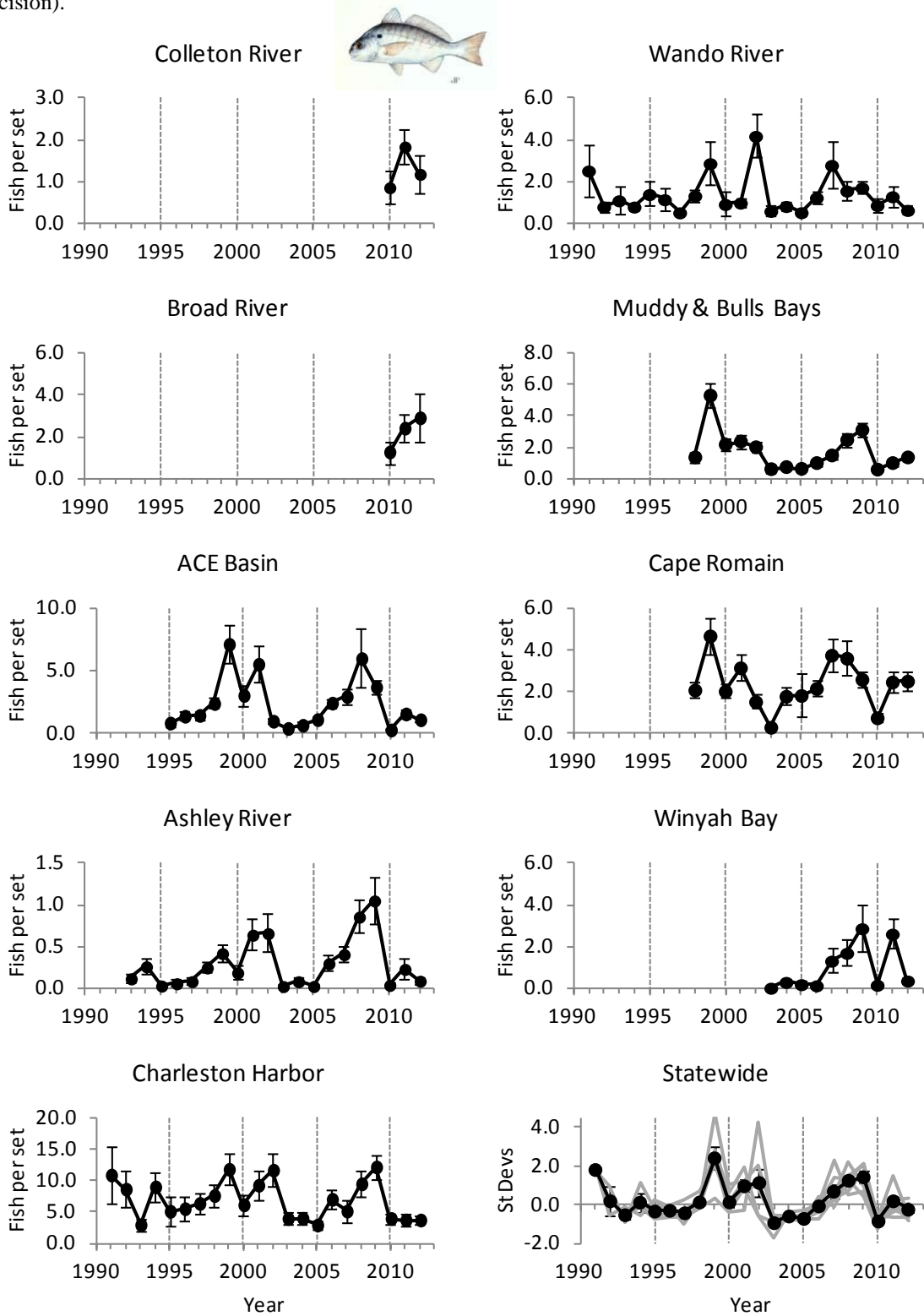
Spot is an important prey species for larger fish, such as adult Red Drum, and is also heavily targeted by some anglers during their southerly migration along the coast during fall. Spawning occurs offshore during late fall and winter, resulting in large numbers of newly settled juveniles around an inch or less in the electrofishing survey during the first few months of the year. Some of these fish grow large enough to be captured by the trammel net gear later the same year, but most of the trammel catch comprises Spot a year older. This was recently verified by a Masters student working in the Inshore Fisheries Section, who studied their age composition and reproduction.

Spot are caught in all of our trammel areas year-round, but they are most abundant in fall or spring, depending on the area. The trammel net survey indicates that population numbers have oscillated over time, peaking in 1991, 1999, 2001 and 2002, and again in 2008 and 2009.

**Fig 2.24 Spot:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

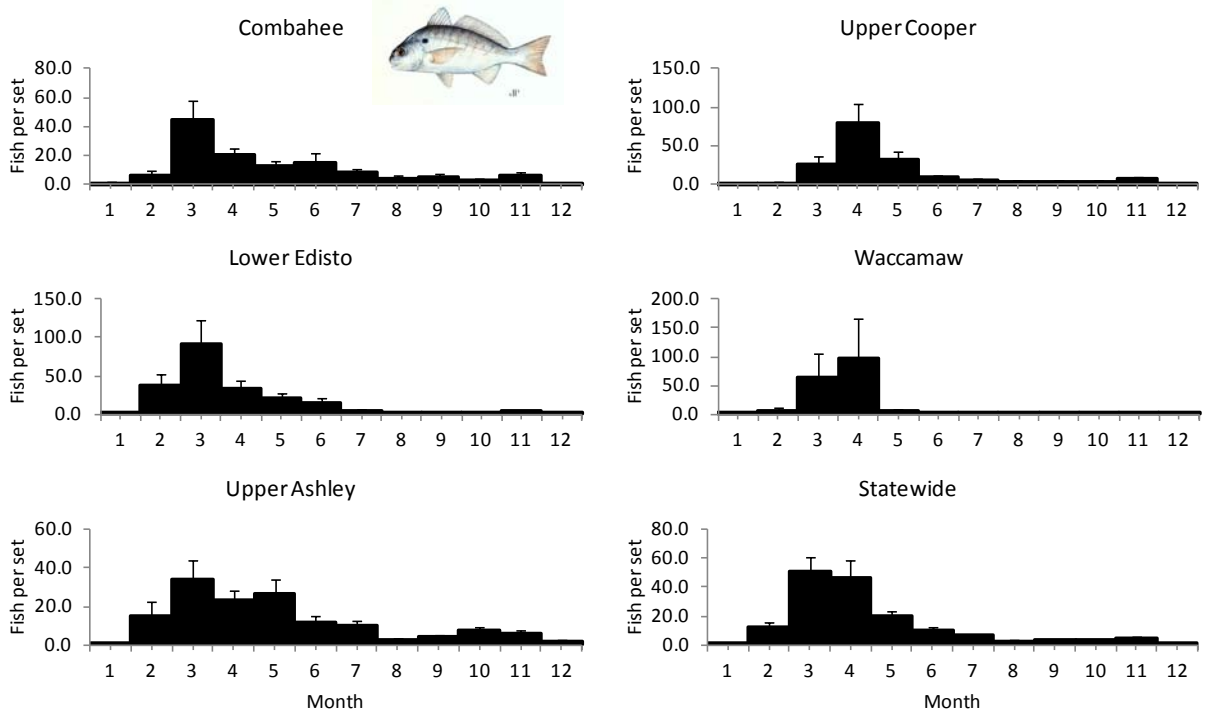


**Fig. 2.25 Spot:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).

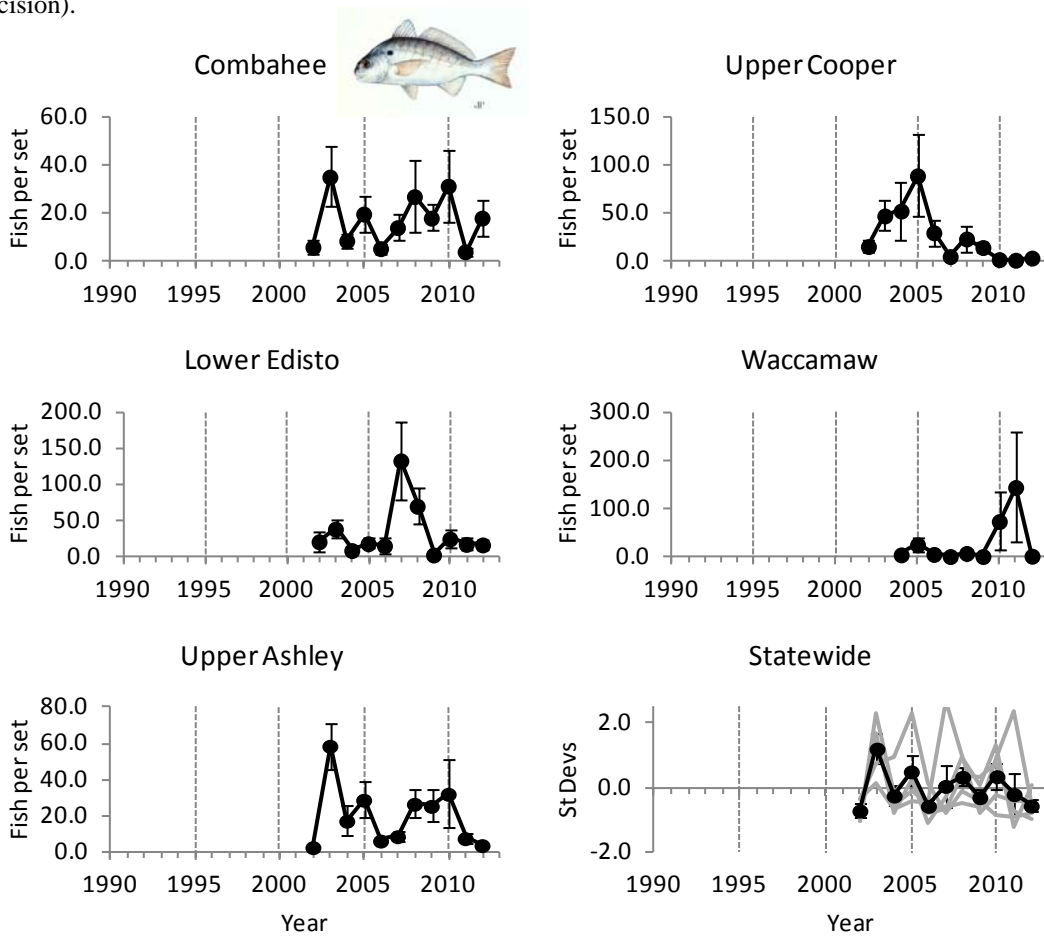




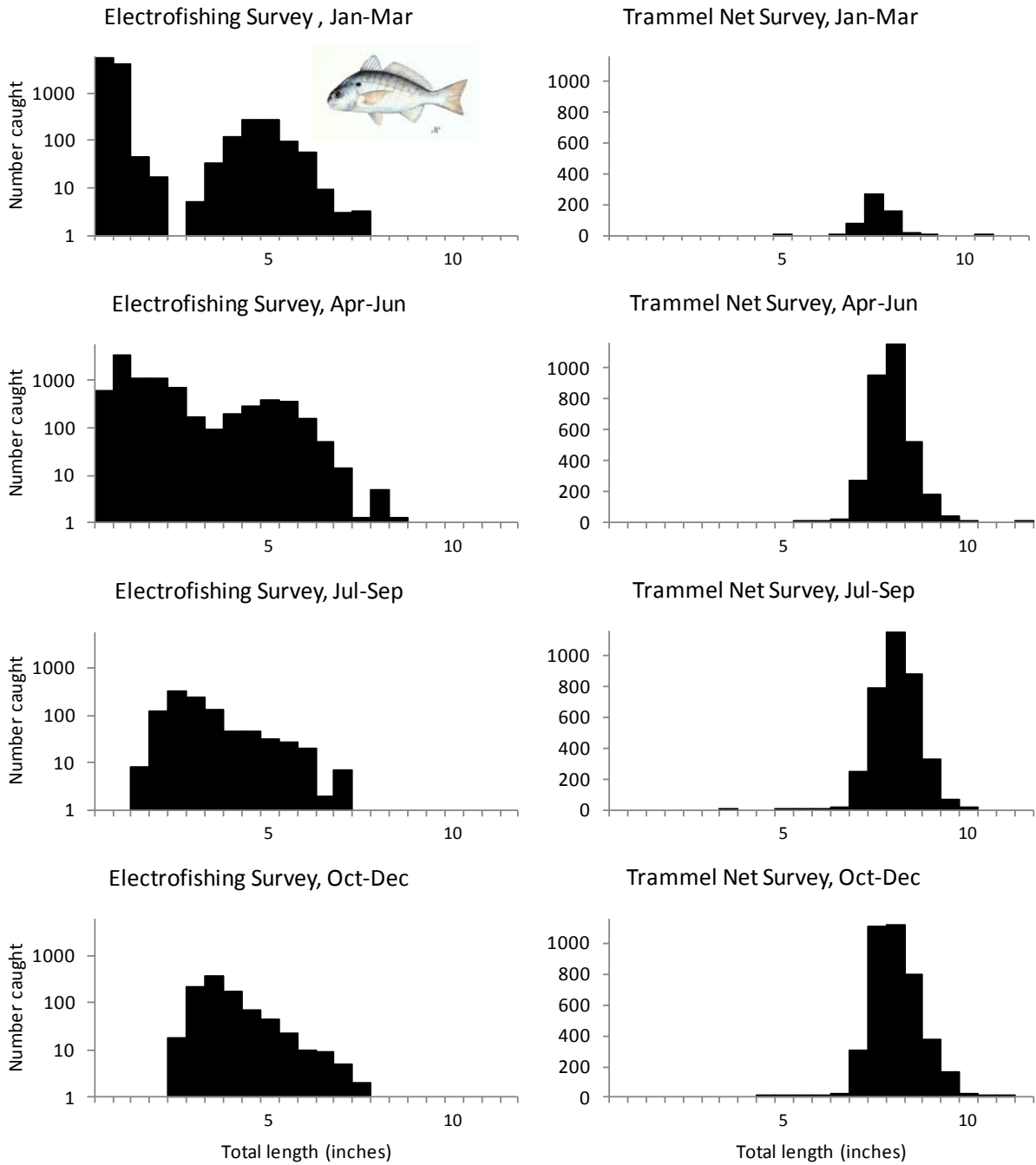
**Fig 2.26 Spot:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.27 Spot:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Feb – Jul data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.28 Spot:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag restrictions). Note that a log-scale axis has been used for the electrofishing survey to accommodate the large number of newly settled small fish.

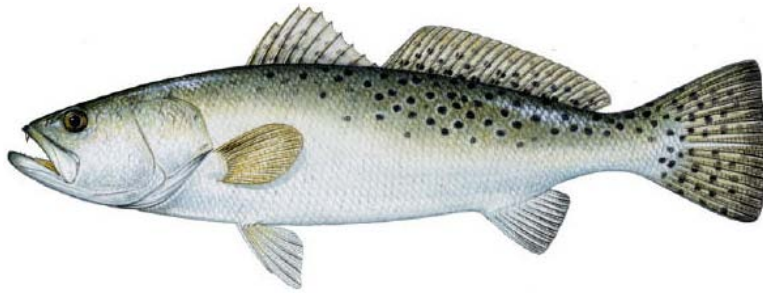


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**Common name:** Spotted Seatrout

**Scientific name:** *Cynoscion nebulosus*

**Family:** Sciaenidae (drums & croakers)



### **Occurrence in the Trammel Net & Electrofishing Surveys**

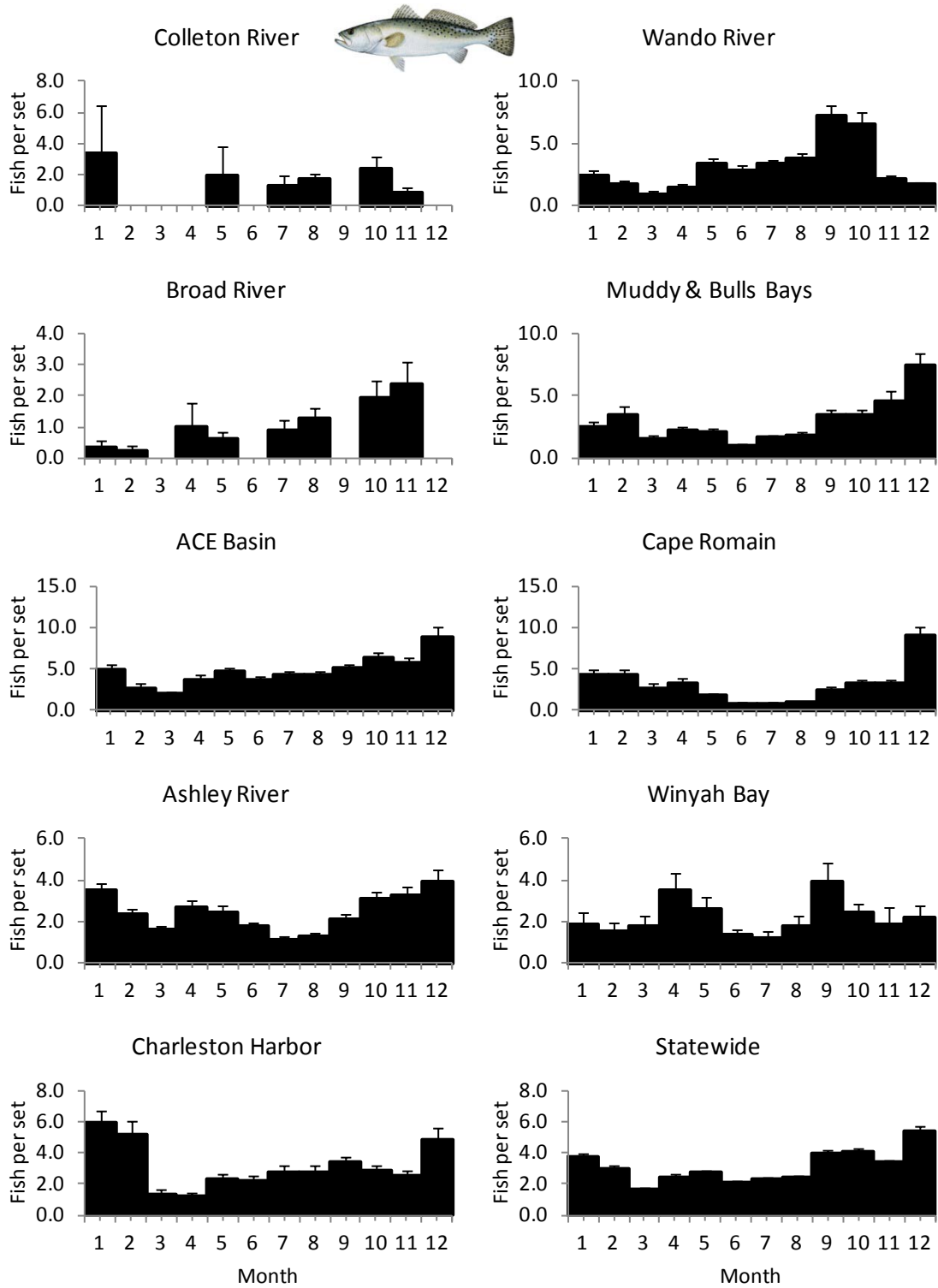
Spotted Seatrout generally complete their entire life cycle within estuarine waters. Therefore, the species is encountered throughout the year in both the electrofishing and trammel net surveys. Spawning occurs from spring through late summer, which results in small fish of five inches or less being caught by the electrofishing survey during most months. Some of these juveniles grow large enough to be caught by the trammel net survey during their first year of life, but most are not large enough to be retained by the net until the following year. SCDNR ageing studies using otoliths indicate that Spotted Seatrout may live up to 10 year olds in South Carolina, but most are much younger. Their longevity is therefore shorter than the larger related Red Drum (up to ~40 years) and black drum (~50 years), but longer than the smaller drum species such as Spot and Croaker (~3 years).

Annual fluctuations in Spotted Seatrout catch rates are very synchronous across areas covered by the trammel net survey. Sharp declines in numbers have occurred after severe winters, as evidenced by the dips seen in 2001, 2010 and 2011. In 2011, SCDNR asked anglers to voluntarily catch and release Spotted Seatrout rather than harvest them, giving larger fish the chance to spawn and contribute to population recovery. Since then, population numbers have increased, probably also in large part due to the ensuing relatively mild winters.

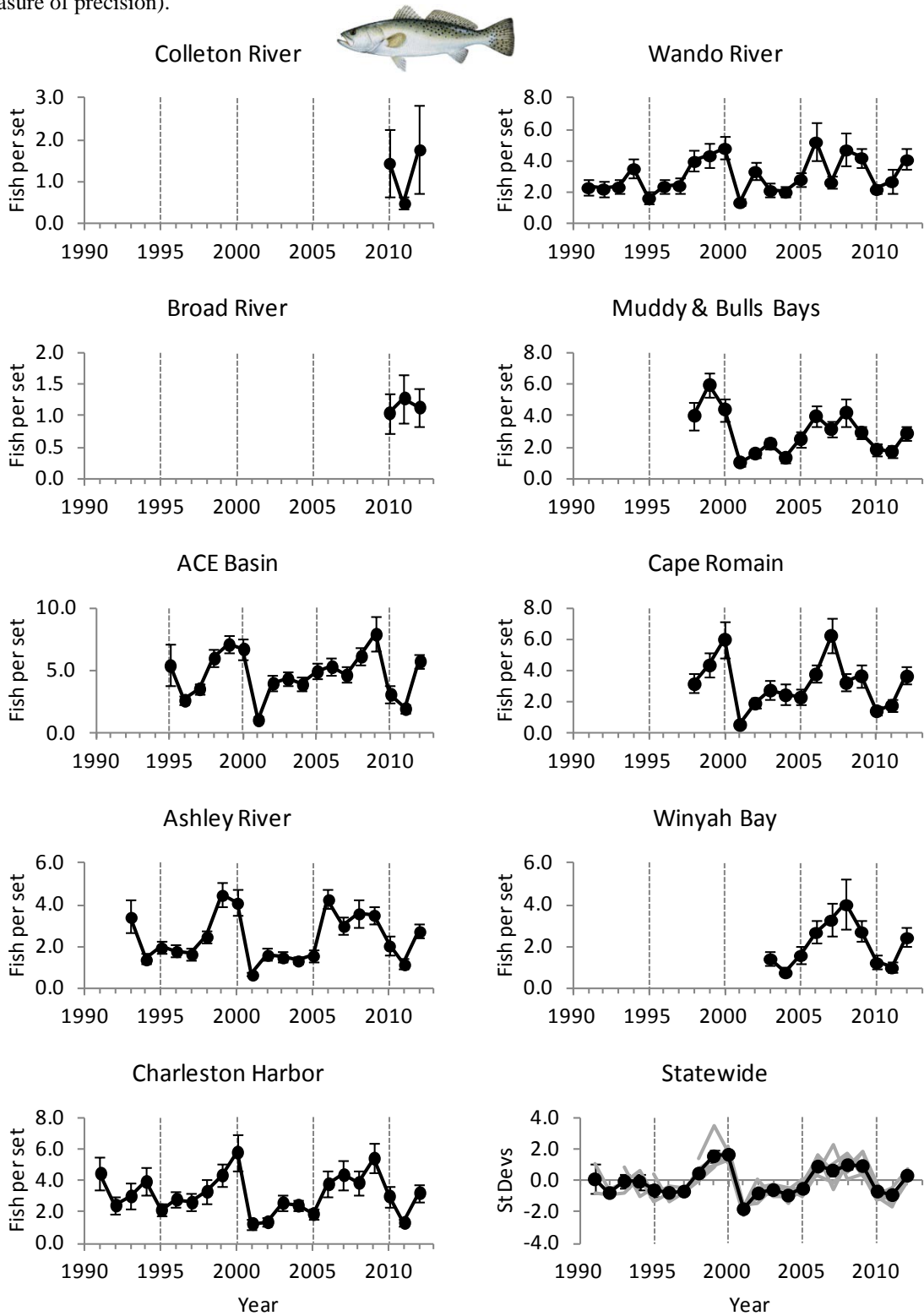
The SCDNR Mariculture Section began stocking Spotted Seatrout in the Charleston Harbor system during 2012. The contribution of the stocked fish has not yet been determined, but their numbers are not reflected in the trammel data presented here because they were mostly still too small to be captured by the gear.

Additional species information: [http://www.dnr.sc.gov/marine/mrri/insh\\_fish/seatrout.pdf](http://www.dnr.sc.gov/marine/mrri/insh_fish/seatrout.pdf)

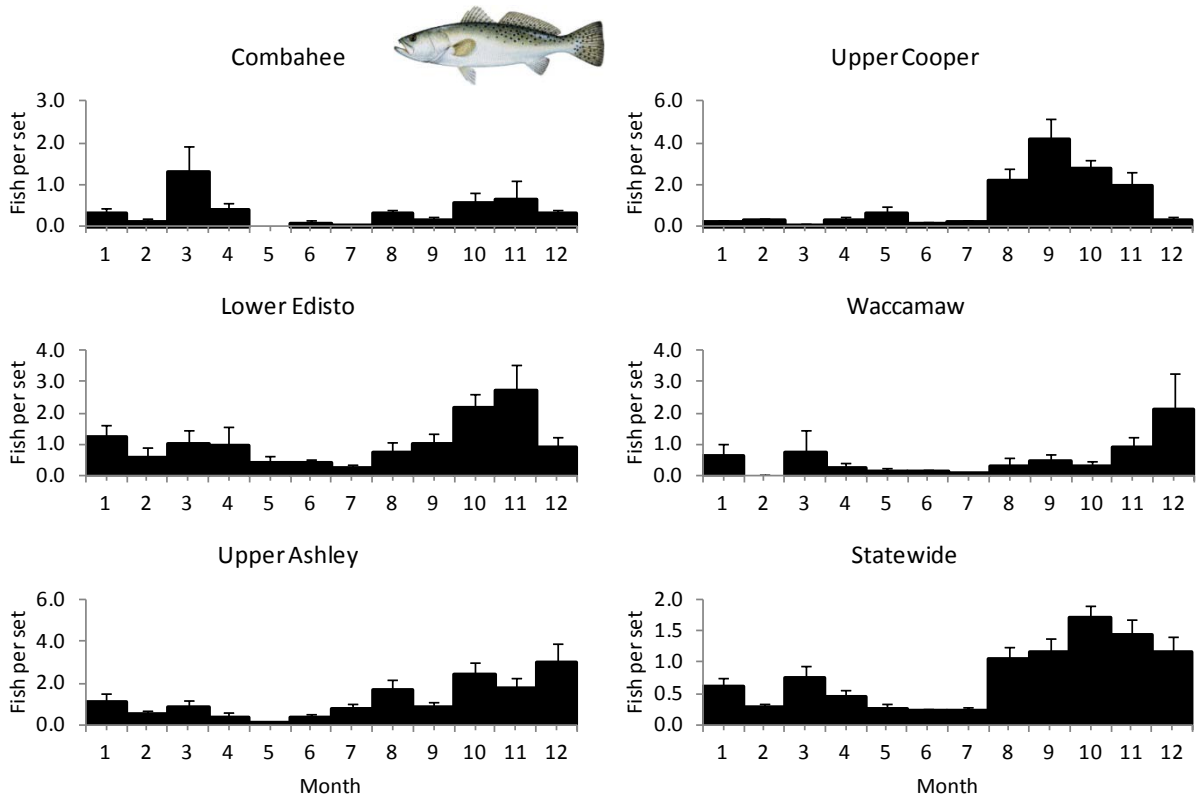
**Fig 2.29 Spotted Seatrout:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



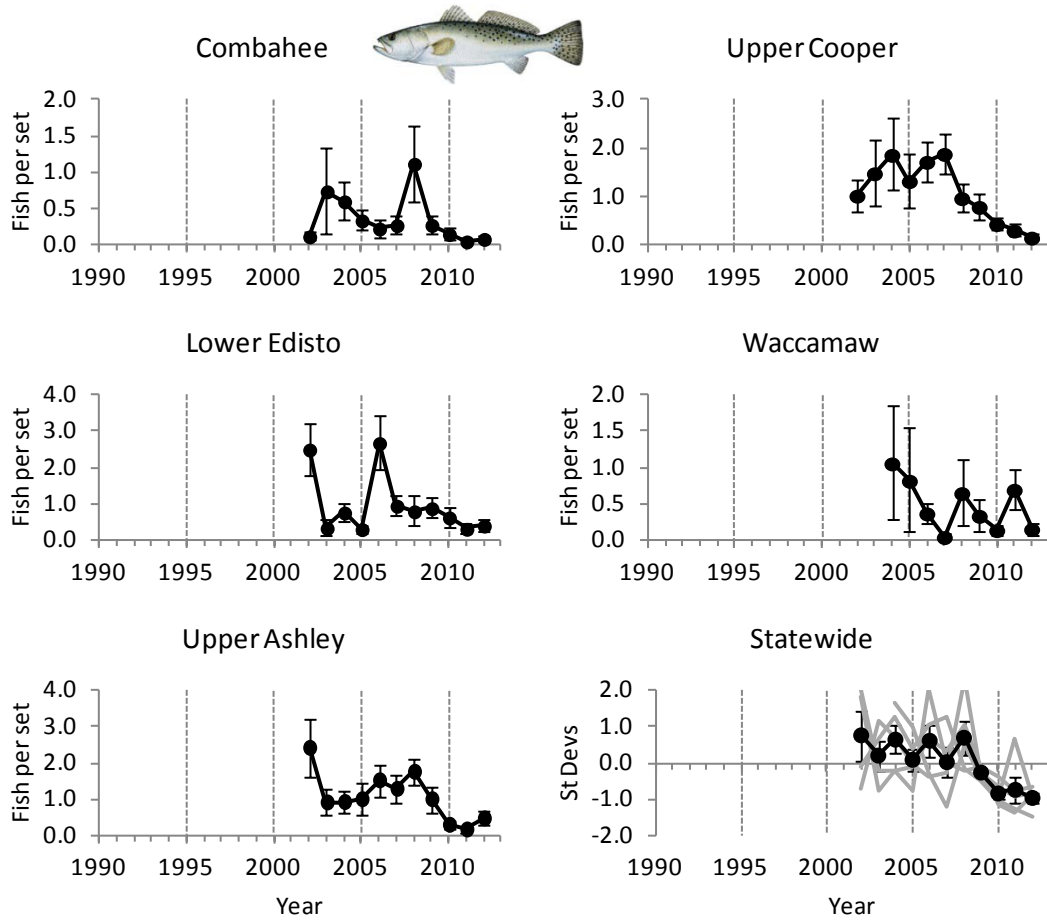
**Fig. 2.30 Spotted Seatrout:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.31 Spotted Seatrout:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

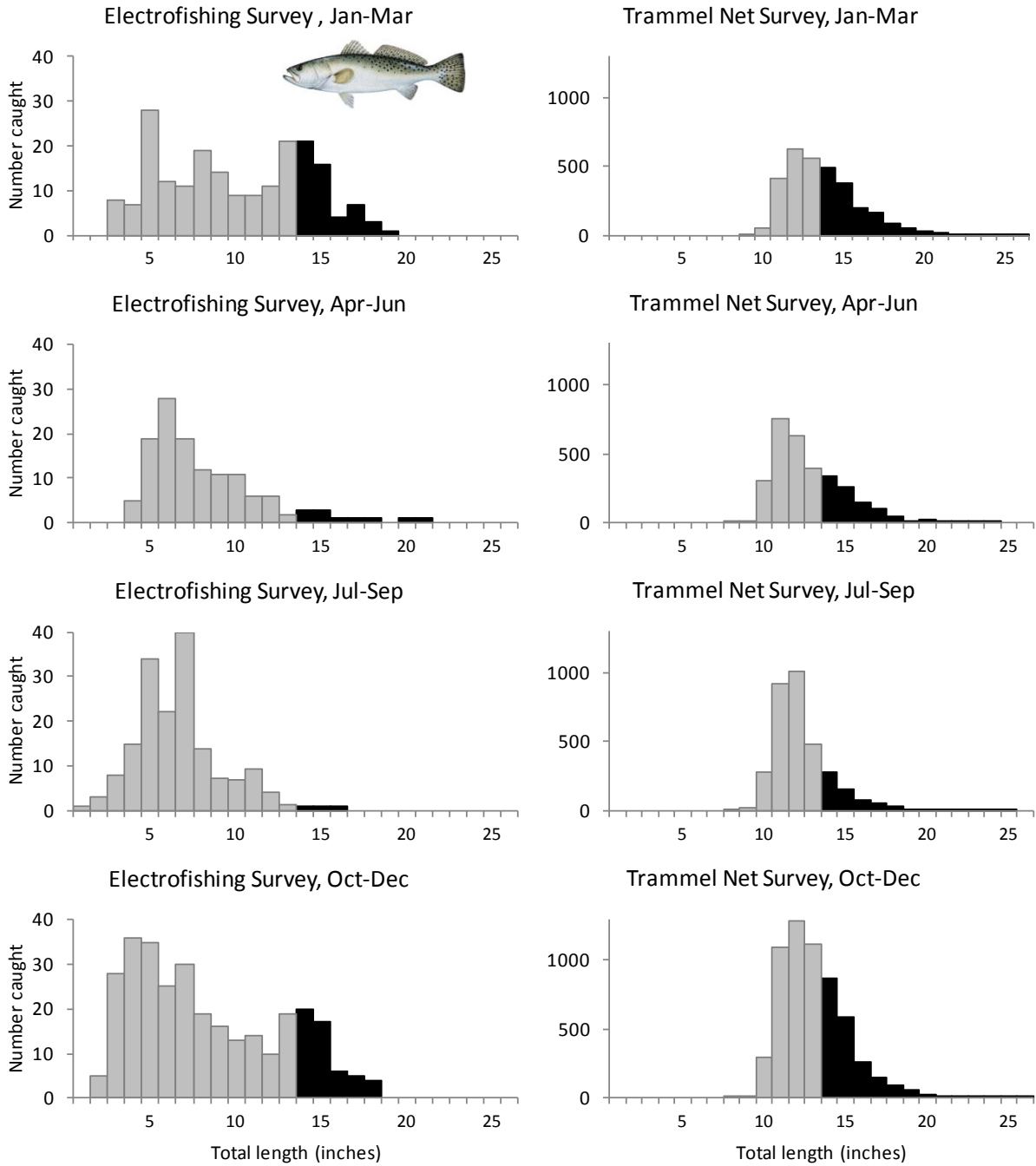


**Fig. 2.32 Spotted Seatrout:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).





**Fig 2.33 Spotted Seatrout:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal size fish; Black bars: legal size fish (2013 regulations: 14" minimum, 10 per person per day).

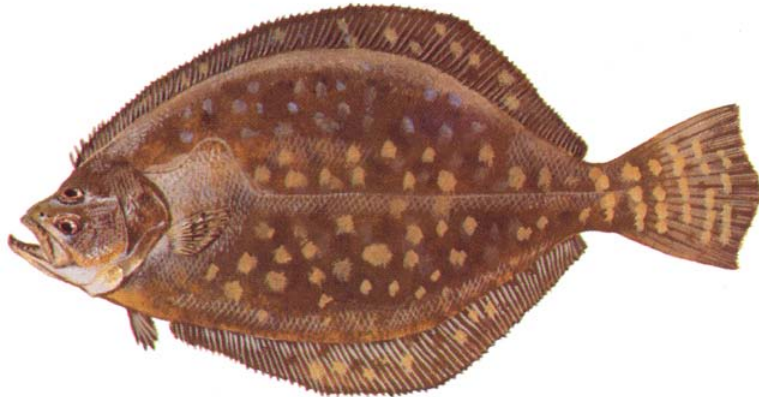


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**Common name:** Southern Flounder

**Scientific name:** *Paralichthys lethostigma*

**Family:** Paralichthyidae (large-tooth flounders)



### **Occurrence in the Trammel Net & Electrofishing Surveys**

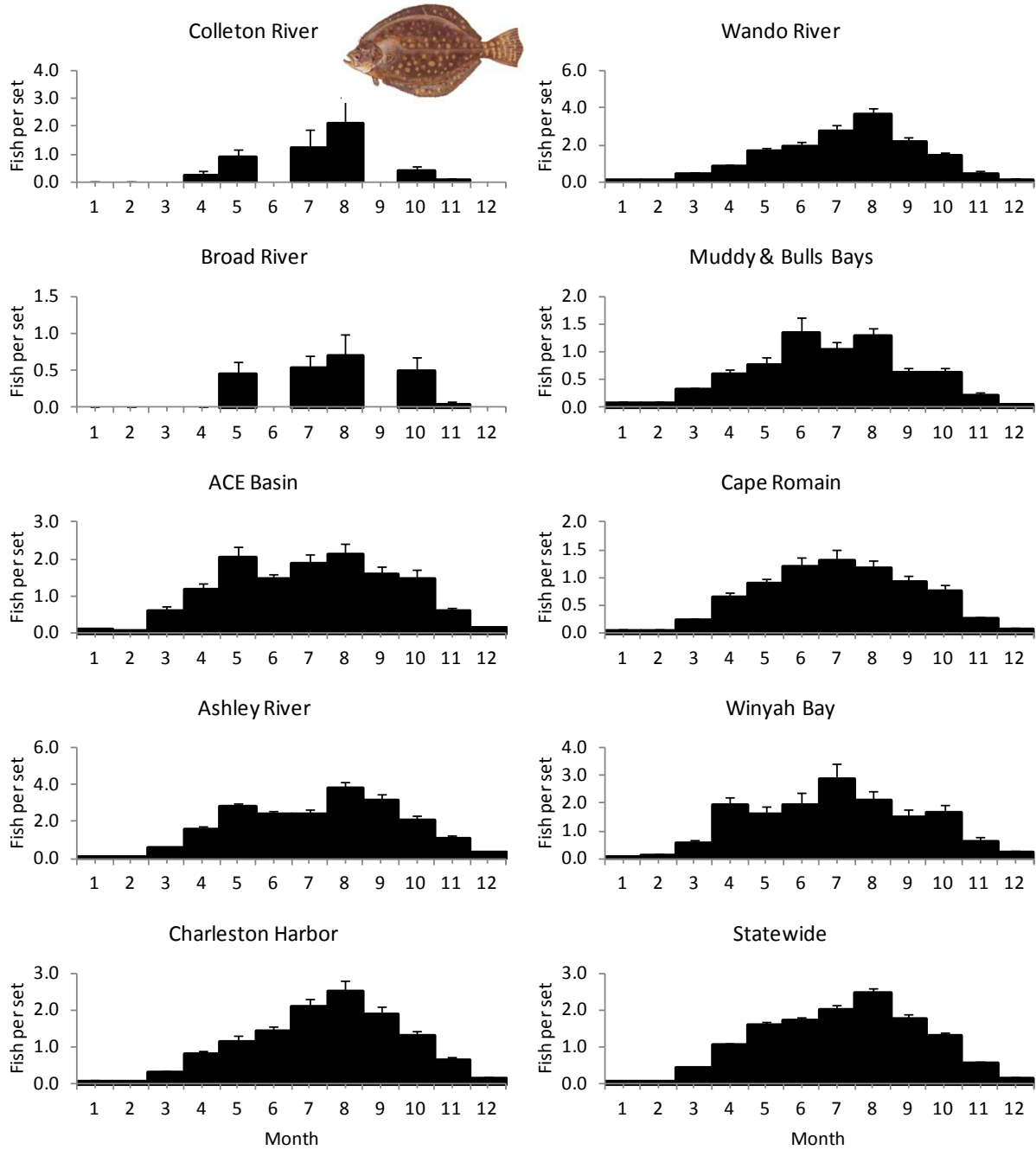
Three species of flounder occur in the estuaries of South Carolina, but Southern Flounder is by far the most common. Catch rates in the trammel net survey typically peak around August, after which fish move offshore into deeper waters to spawn in late fall. The electrofishing survey captures flounders of all sizes, including newly recruited young of the year, whereas the trammel net survey only retains fish around six inches and larger.

Catch rates of flounder in the trammel net survey have declined steadily since the early 1990s, mirroring trends observed in parts of the Gulf of Mexico. No stock assessment has been performed for the species, but the decline suggests that management measures are necessary to reduce mortality.

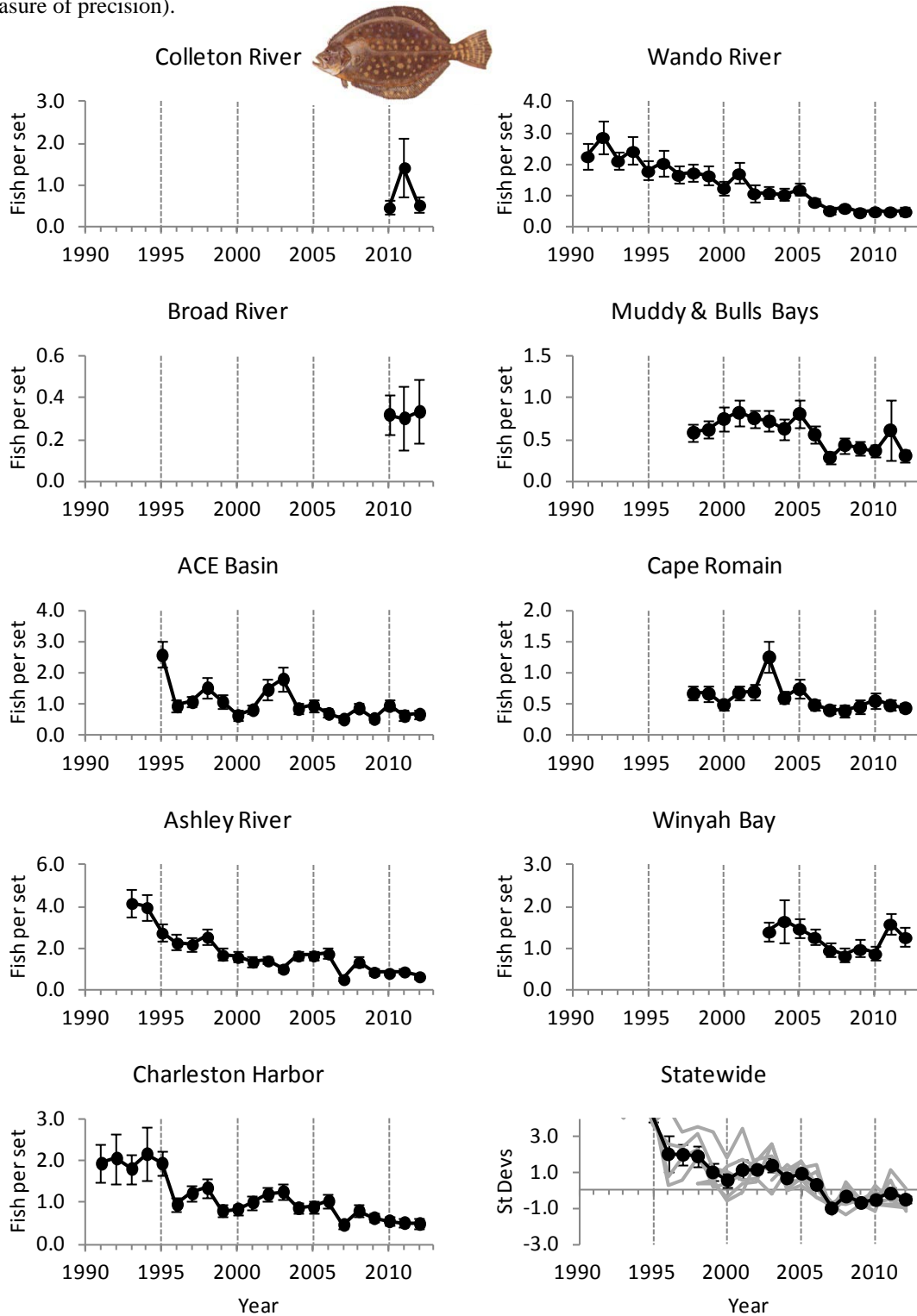
Tagging of flounder by SCDNR has revealed that Southern Flounder are highly mobile, traveling distances of over 900 miles, including movements between the Atlantic and Gulf of Mexico coast.

Additional species information: [http://www.dnr.sc.gov/marine/mrri/insh\\_fish/southernflounder.pdf](http://www.dnr.sc.gov/marine/mrri/insh_fish/southernflounder.pdf)

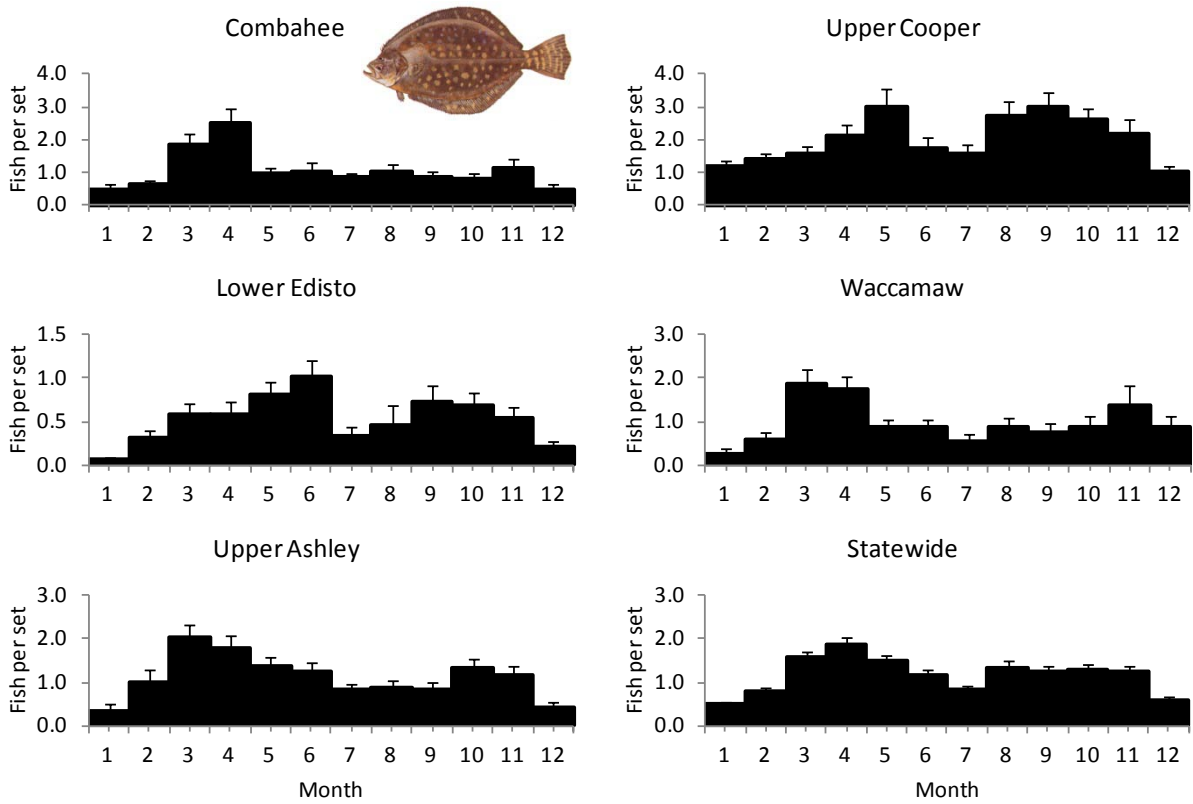
**Fig 2.34 Southern Flounder:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



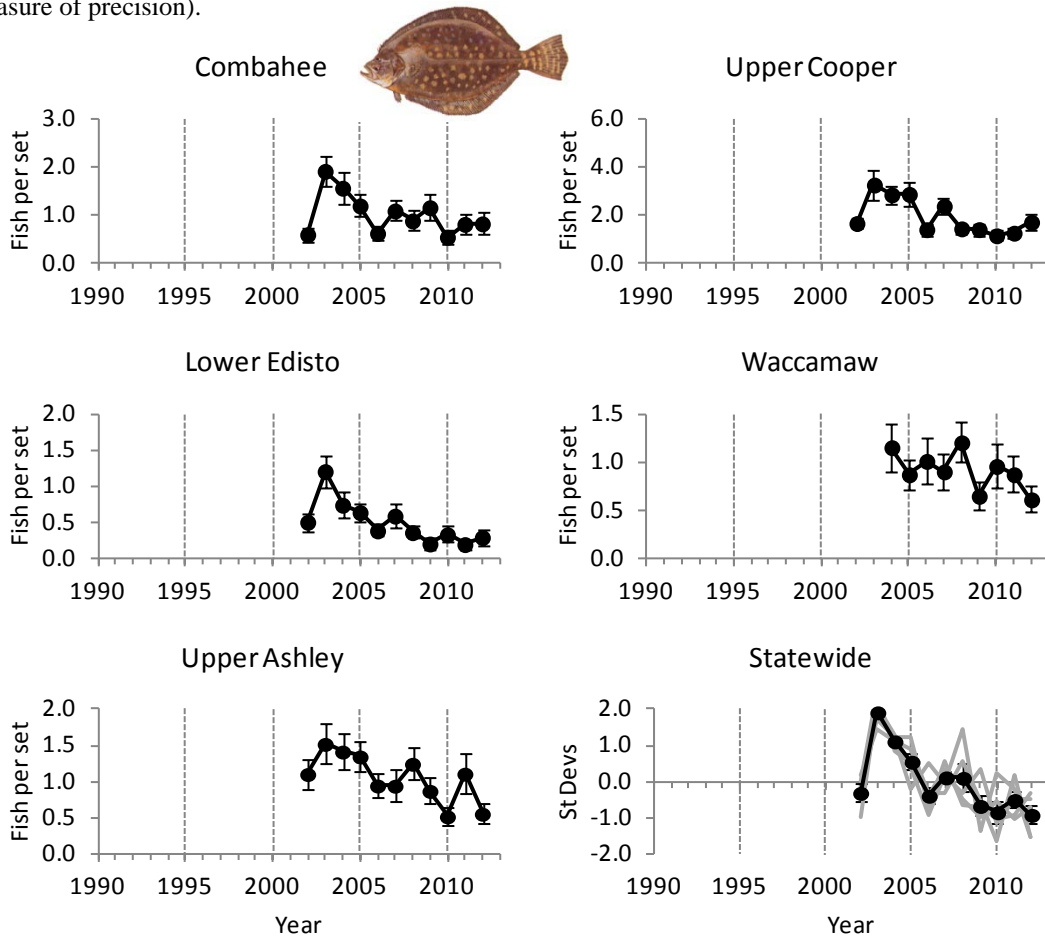
**Fig. 2.35 Southern Flounder:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



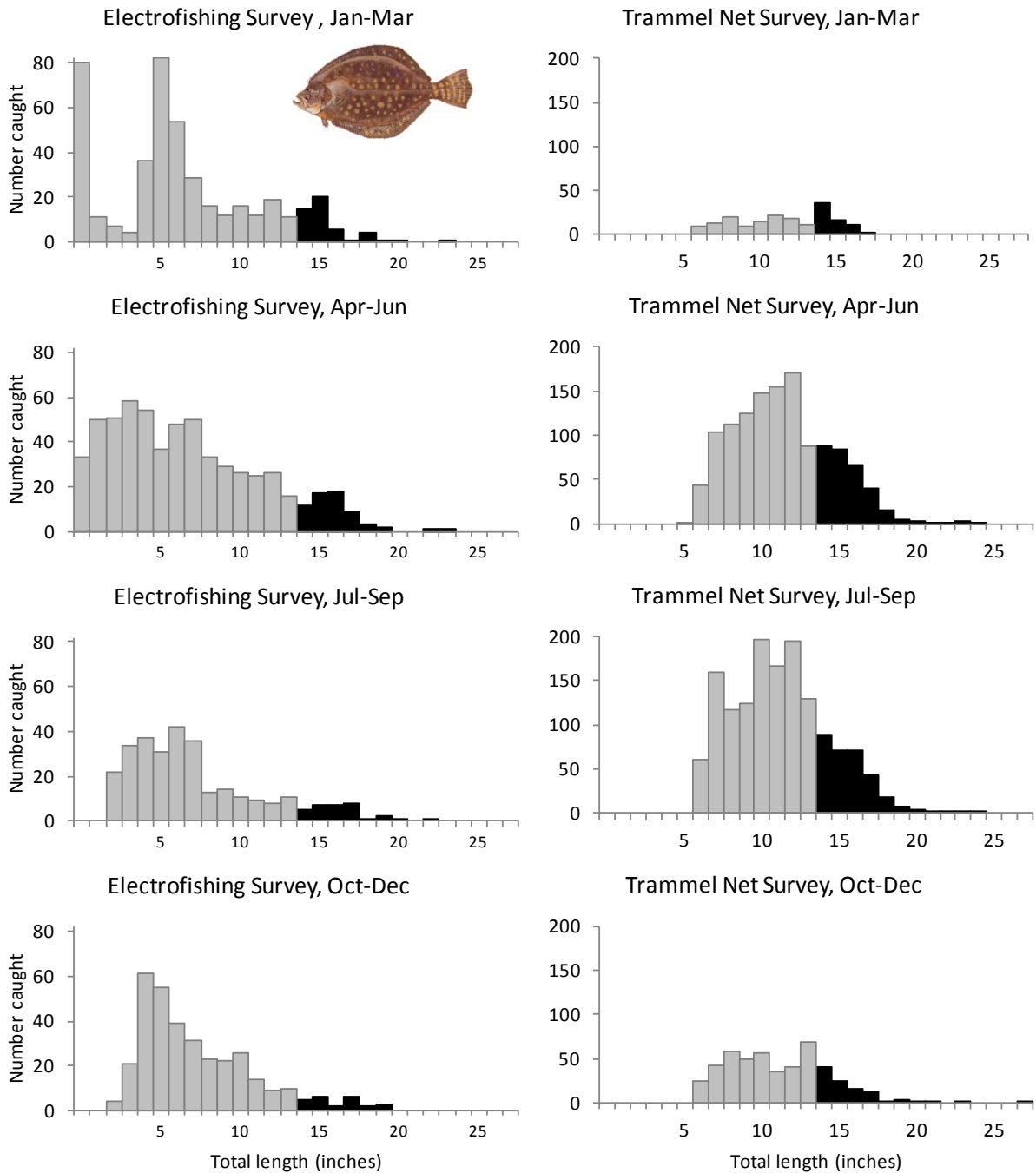
**Fig 2.36 Southern Flounder:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.37 Southern Flounder:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.38 Southern Flounder:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal size fish; Black bars: legal size fish (2013 regulations: 14” minimum, 15 per person per day in most areas).



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**Common name:** Sheepshead  
**Scientific name:** *Archosargus probatocephalus*  
**Family:** Sparidae (Porgies)



#### **Occurrence in the Trammel Net & Electrofishing Surveys**

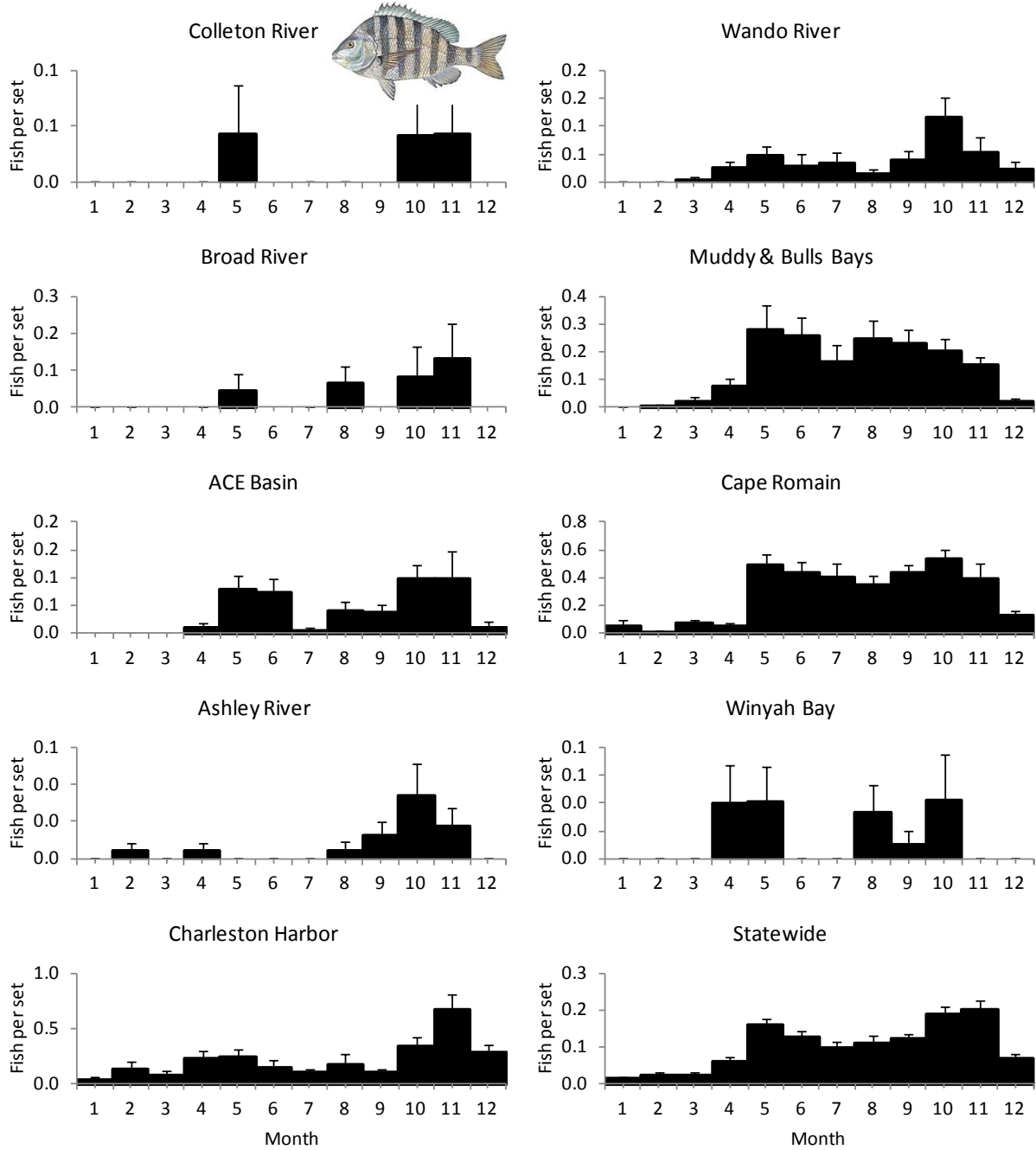
Sheepshead is a common estuarine and coastal reef species found year round in South Carolina. Spawning occurs during late winter and spring, when larger fish are generally further offshore or in areas deeper than those sampled by the trammel net survey. The electrofishing survey mostly catches juvenile Sheepshead less than ten inches long, whereas the trammel survey catches larger individuals up to twenty-five inches.

Numbers in the trammel net survey tend to peak in late spring as fish move closer to shore, and again during fall before they move back offshore. Trends in the trammel net survey show that the population decreased during the early 1990s, but between 2000 and 2010 there was a general rebound. Ageing studies from our programs that collect angler-caught fish show that Sheepshead may live for 20 years or more, but the majority of fish are less than 10 years old.

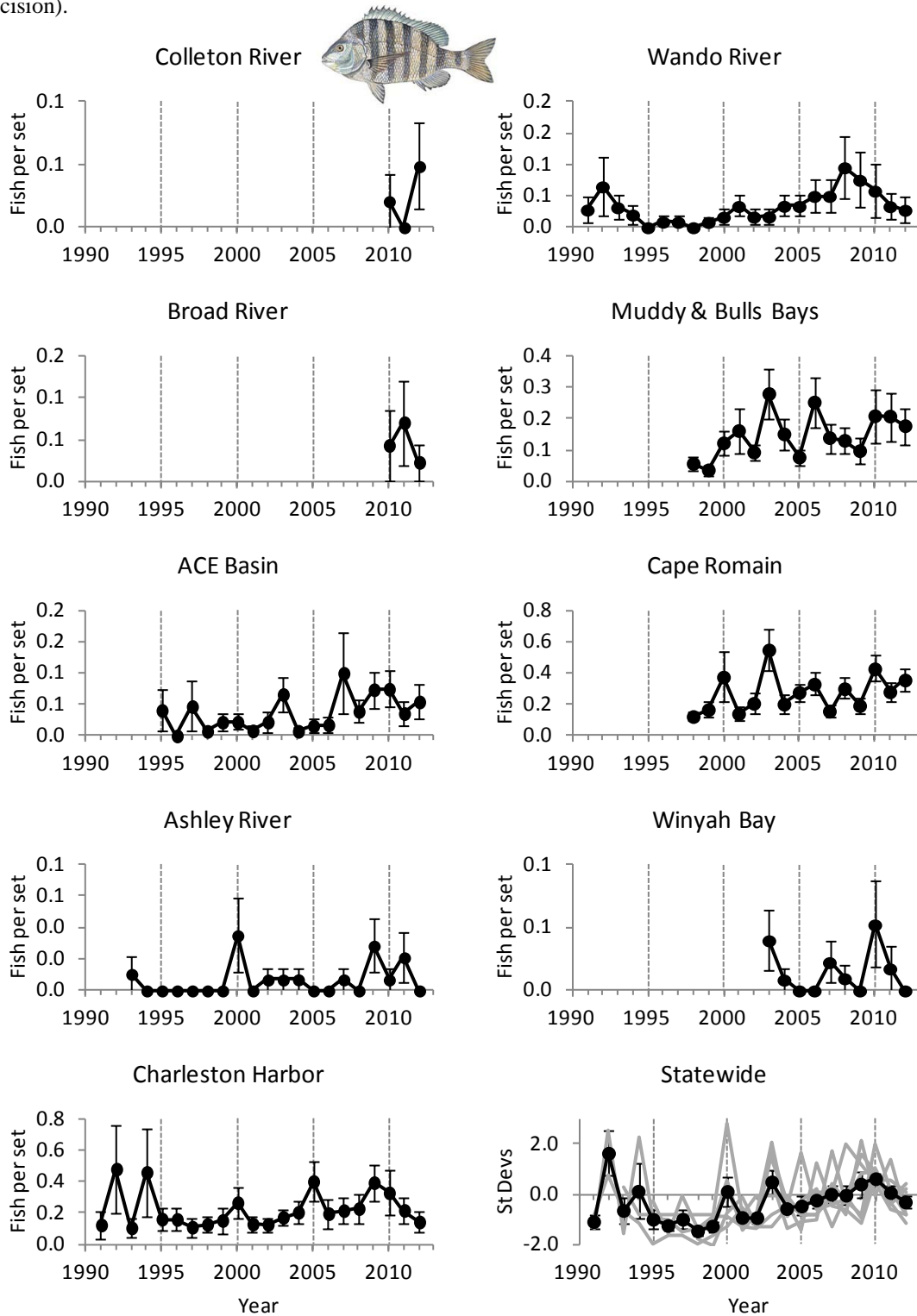
Additional species information: [http://www.dnr.sc.gov/marine/mrri/insh\\_fish/sheepshead.pdf](http://www.dnr.sc.gov/marine/mrri/insh_fish/sheepshead.pdf)



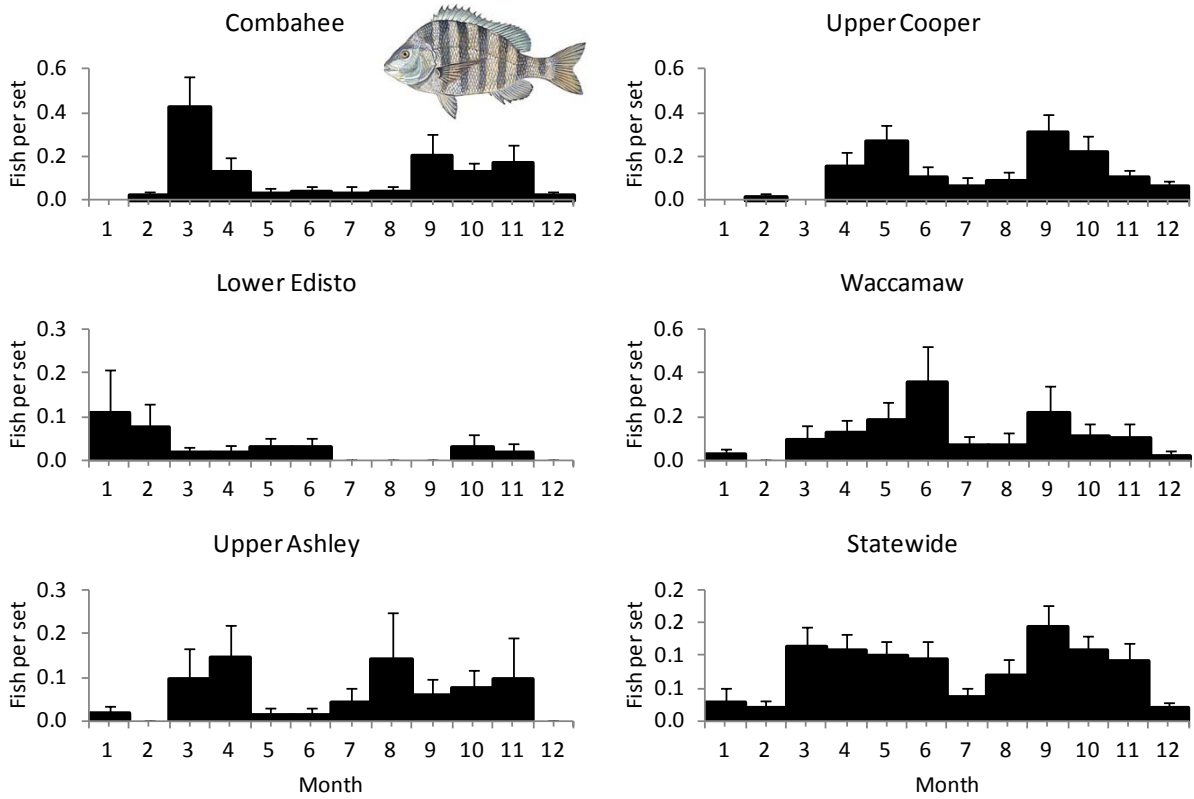
**Fig 2.39 Sheepshead:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



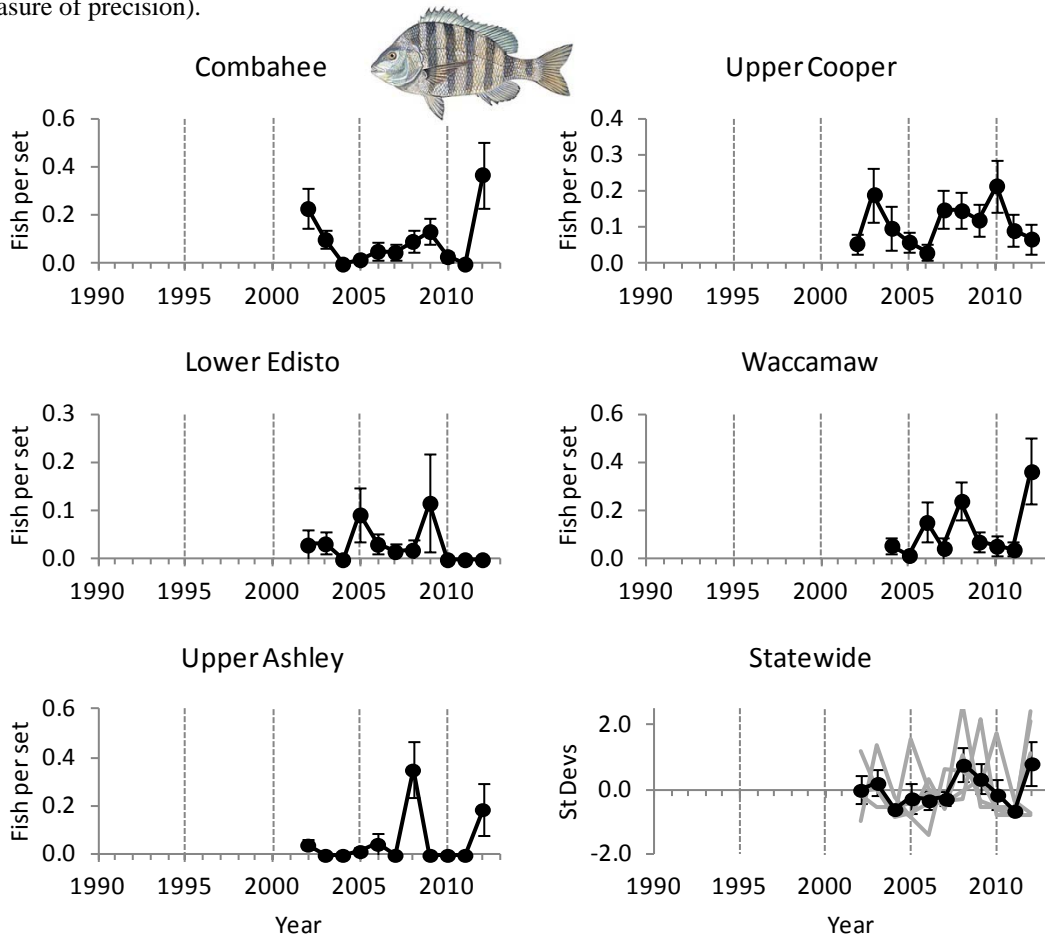
**Fig. 2.40 Sheepshead:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



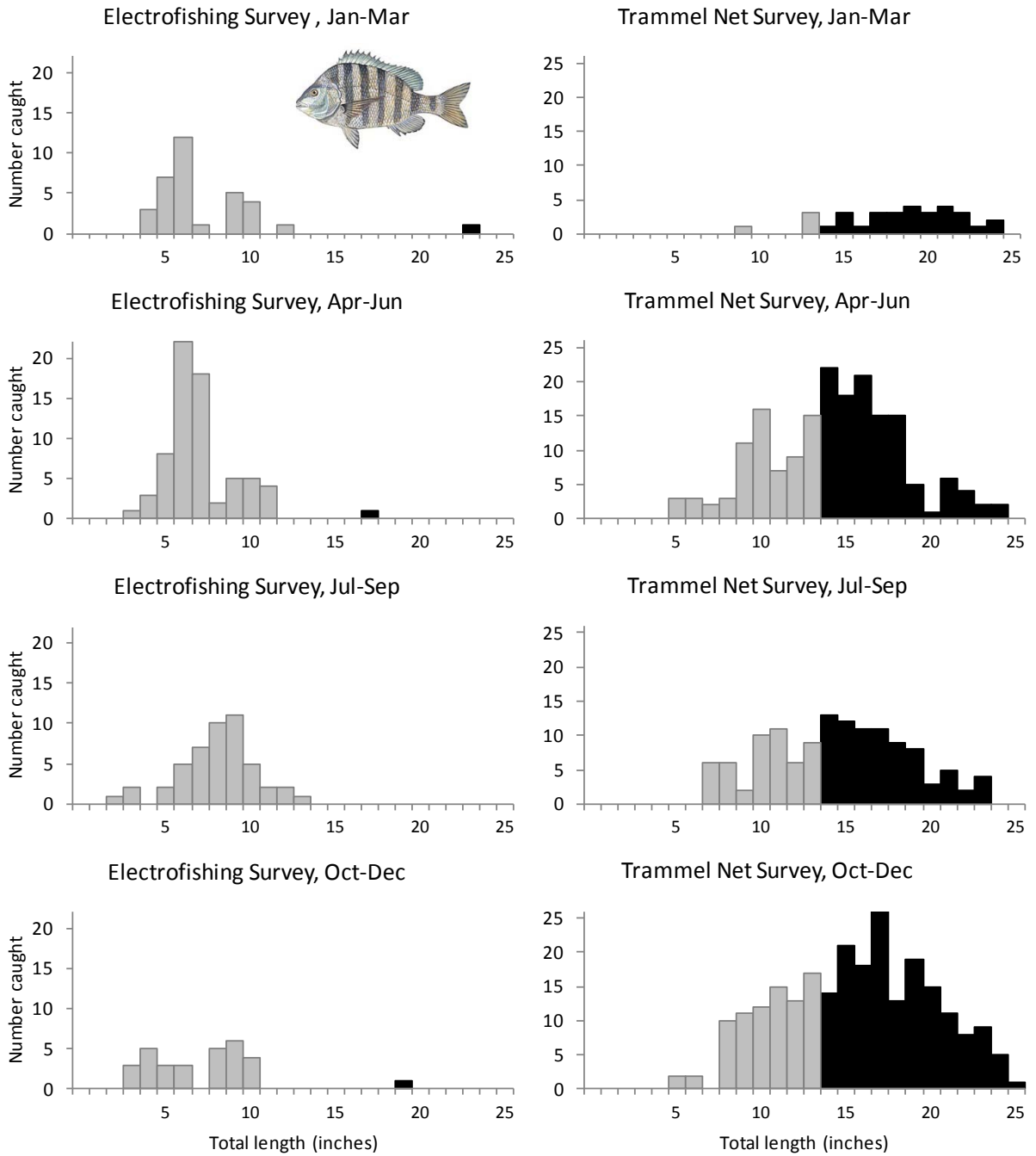
**Fig 2.41 Sheepshead:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.42 Sheepshead:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan – Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.43 Sheephead:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal size fish; Black bars: legal size fish (2013 regulations: 14" minimum, 10 per person per day, 30 per boat).



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**Common name:** Pinfish

**Scientific name:** *Lagodon rhomboides*

**Family:** Sparidae (Porgies)

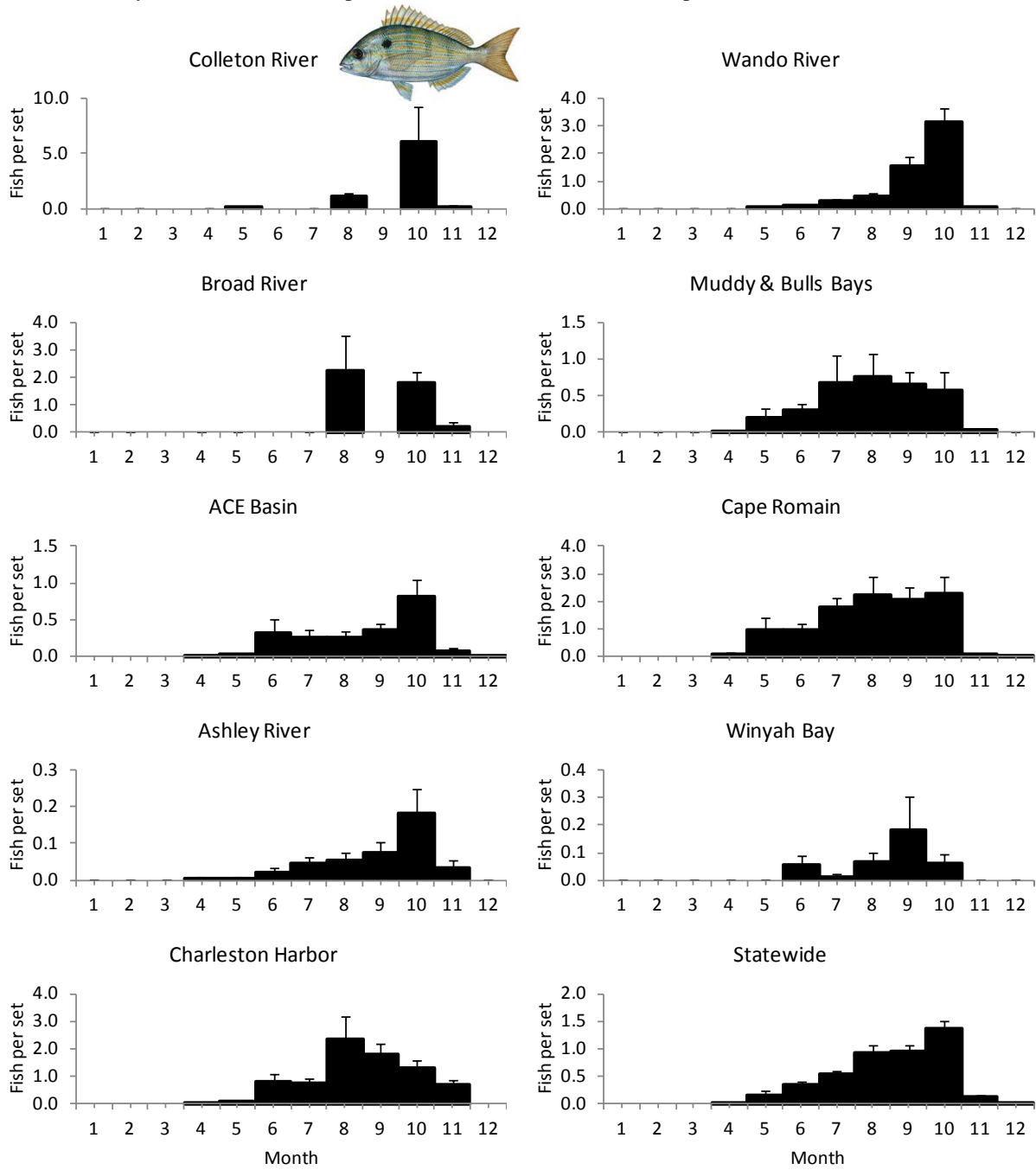


#### **Occurrence in the Trammel Net & Electrofishing Surveys**

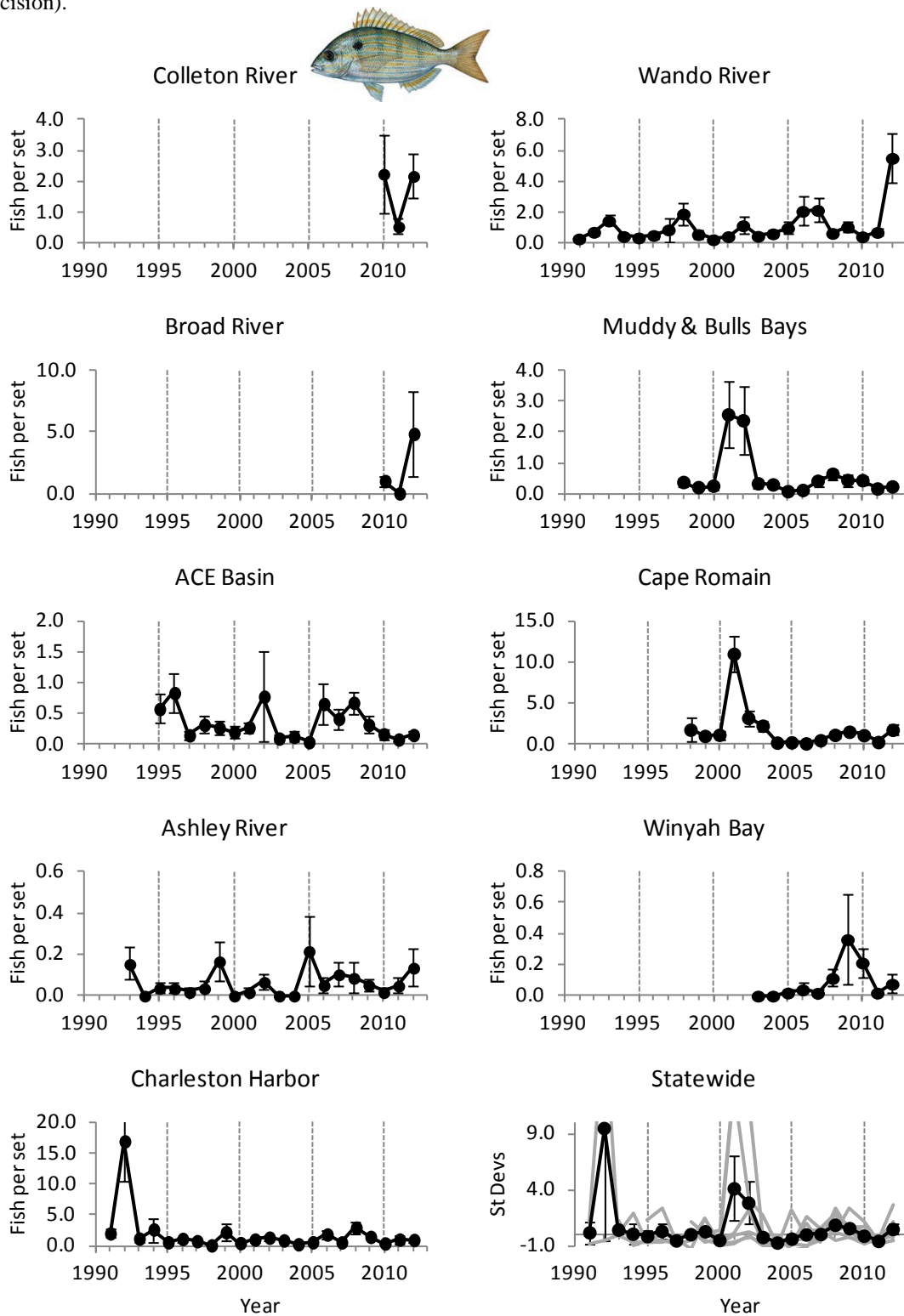
Pinfish is a small, short-lived (1-3 years) member of the porgy family that spawns offshore during winter. The electrofishing survey shows that newly settled juveniles recruit to South Carolina estuaries from January through April, growing to four or five inches by the end of the year. The trammel net survey catches larger fish up to seven or eight inches during summer and fall before their offshore migration occurs.

Among the juveniles, the electrofishing survey shows high catch rates between 2002 and 2005 and again in 2011, with low catch rates during the period in between. In the trammel net survey, some areas have shown transient spikes in population numbers, but these spikes did not necessarily occur in all of the survey areas. For example, a large increase in catch rates occurred in Muddy Bay, Bulls Bay and Cape Romain during 2001 and 2002, but this was not observed in some other areas. Also, a large increase in catch rates occurred in the Wando River during 2012, but not elsewhere.

**Fig 2.44 Pinfish:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

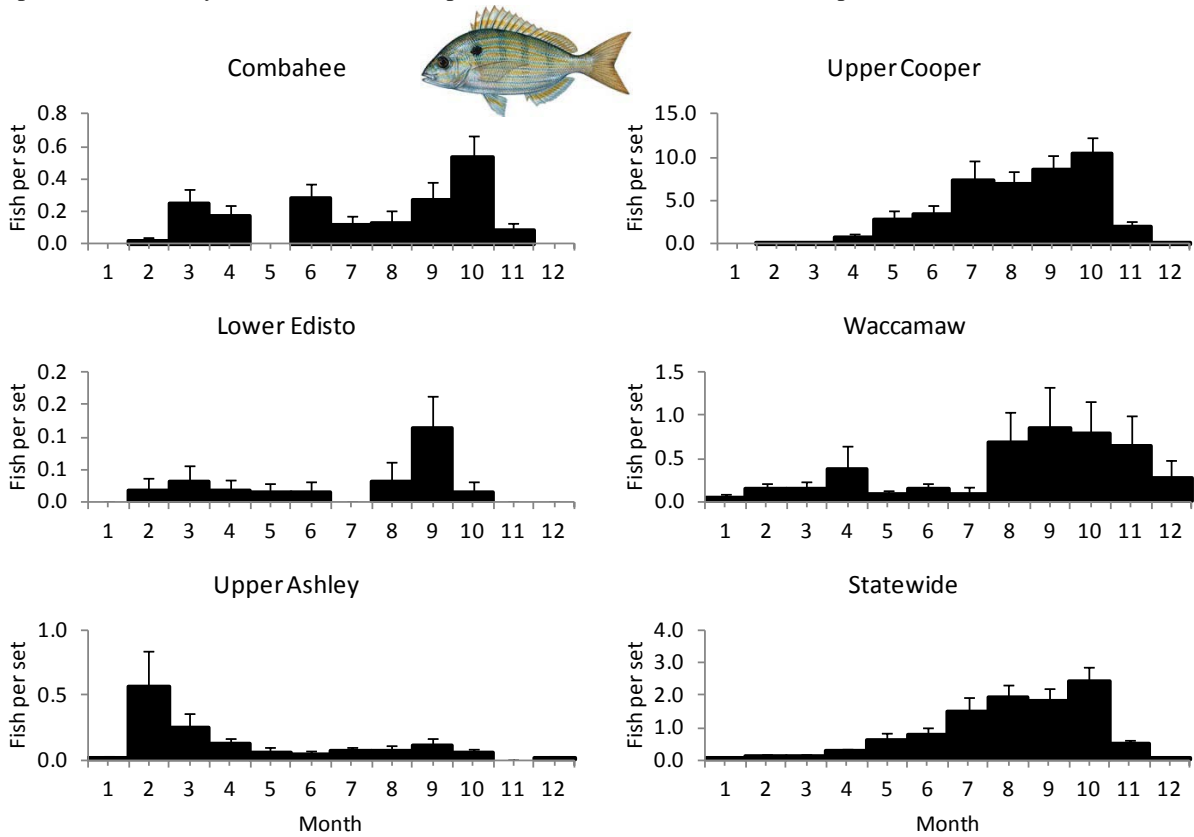


**Fig. 2.45 Pinfish:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jun-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).

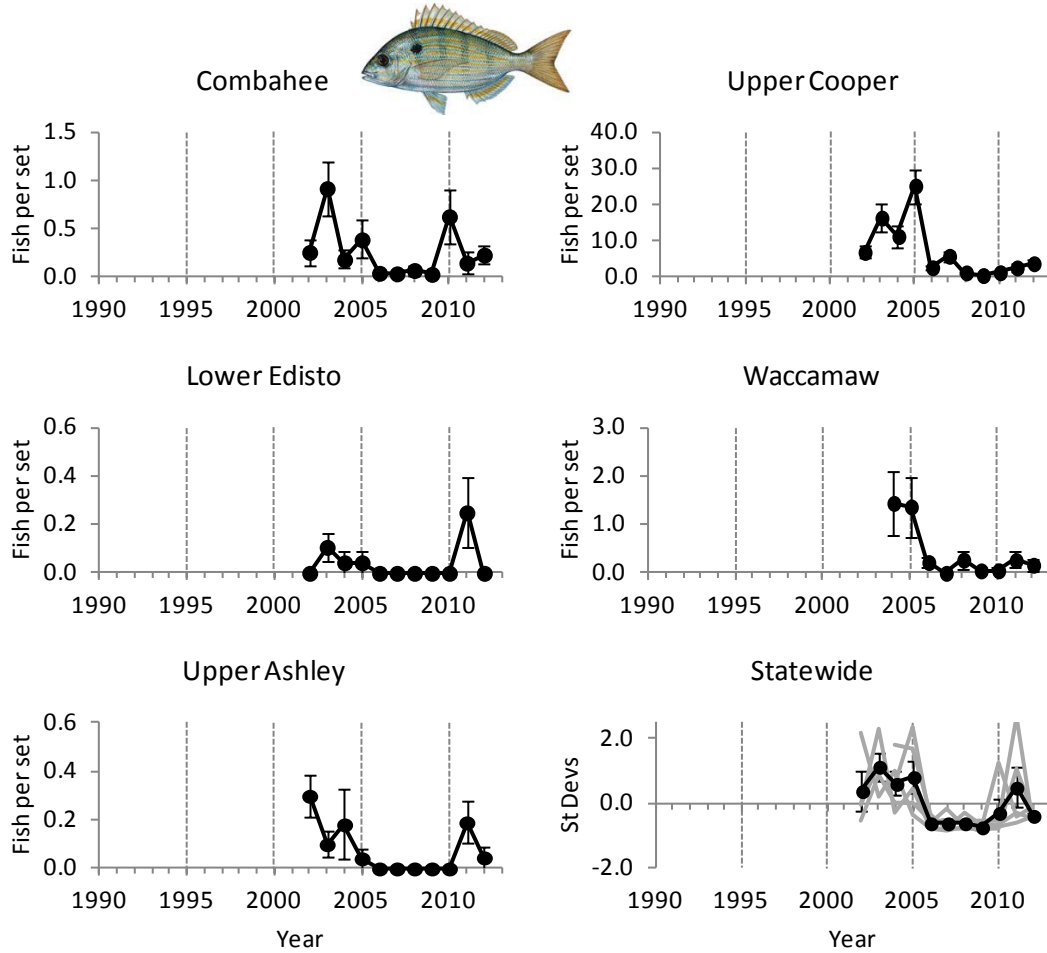




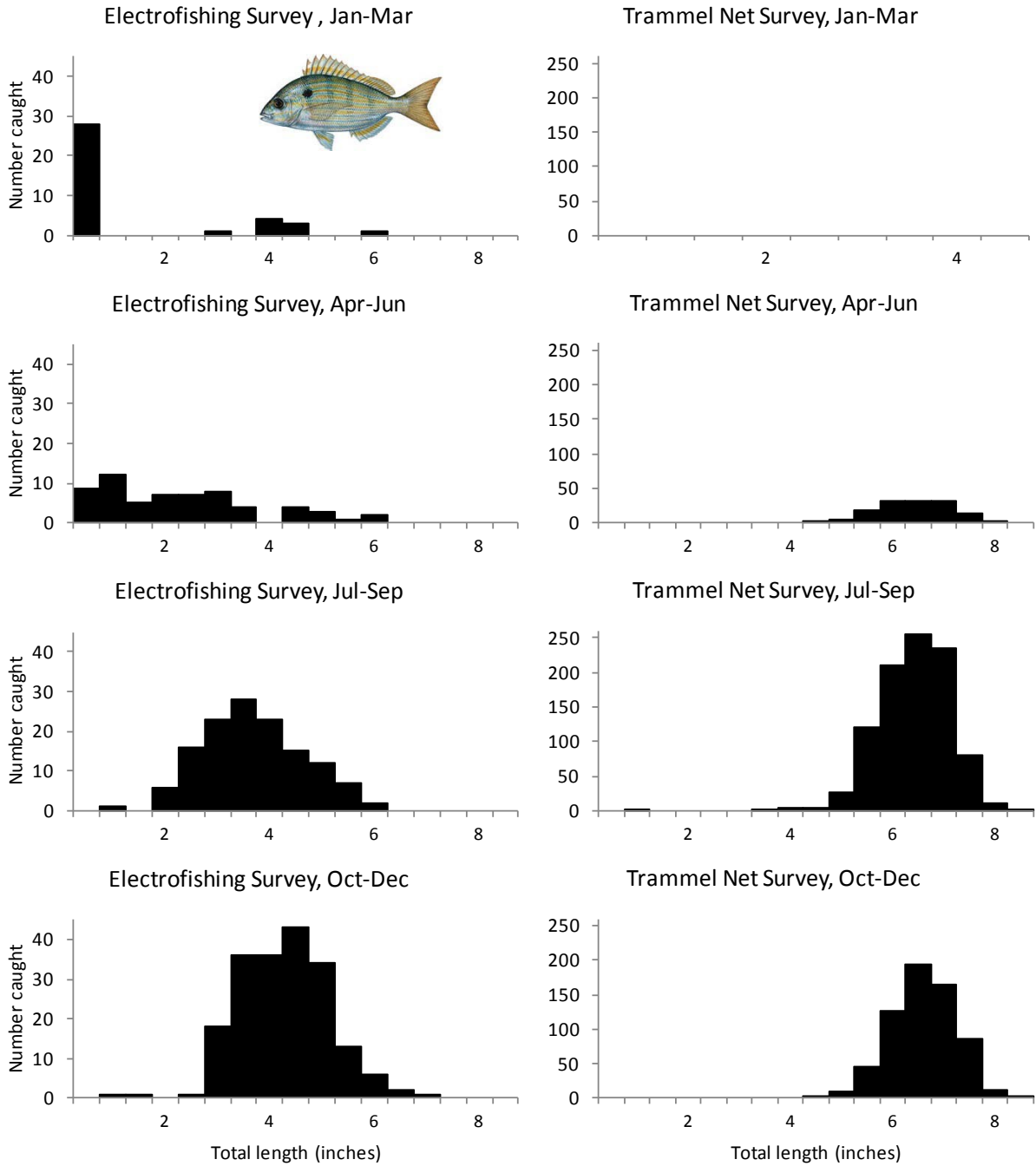
**Fig 2.46 Pinfish:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.47 Pinfish:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jun-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.48 Pinfish:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag restrictions).



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**Common name:**           **Striped Bass**  
**Scientific name:**       *Morone saxatilis*  
**Family:**                   **Moronidae (Temperate basses)**



#### **Occurrence in the Trammel Net & Electrofishing Surveys**

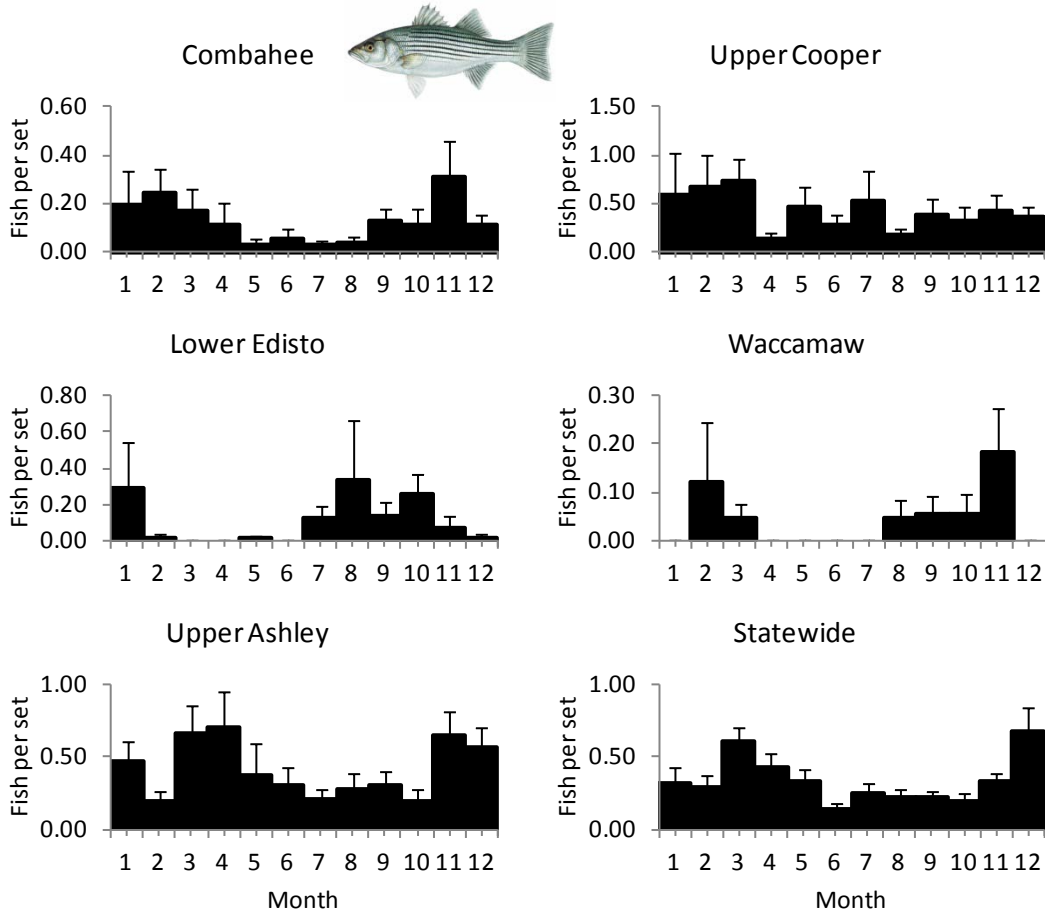
Striped bass occur along the Atlantic coast from Canada through Florida, as well as parts of the Gulf of Mexico. While they are anadromous in northerly parts of their range, moving from the ocean into rivers to spawn, South Carolina Striped Bass are only rarely found along the open coastline. The species has been introduced to many freshwater lakes and reservoirs, either by stocking or by dams blocking their seaward migration.

In South Carolina, very few Striped Bass are caught in our trammel survey. The electrofishing survey captures Striped Bass in all of the rivers we cover, with numbers generally peaking early in the year and again towards the end of the year. The SCDNR Mariculture Section has been heavily involved in stocking Striped Bass, especially in the Ashley River, where historically a Striped Bass fishery existed. All of the Striped Bass we capture are fin-clipped for genetic analysis, which has revealed that nearly all those caught in the Ashley are in fact stocked. The Mariculture Section's research has also shown that Striped Bass lose body condition over the hot summer months and probably suffer mortality during this period, likely a result of being near the southern part of the species' distribution.

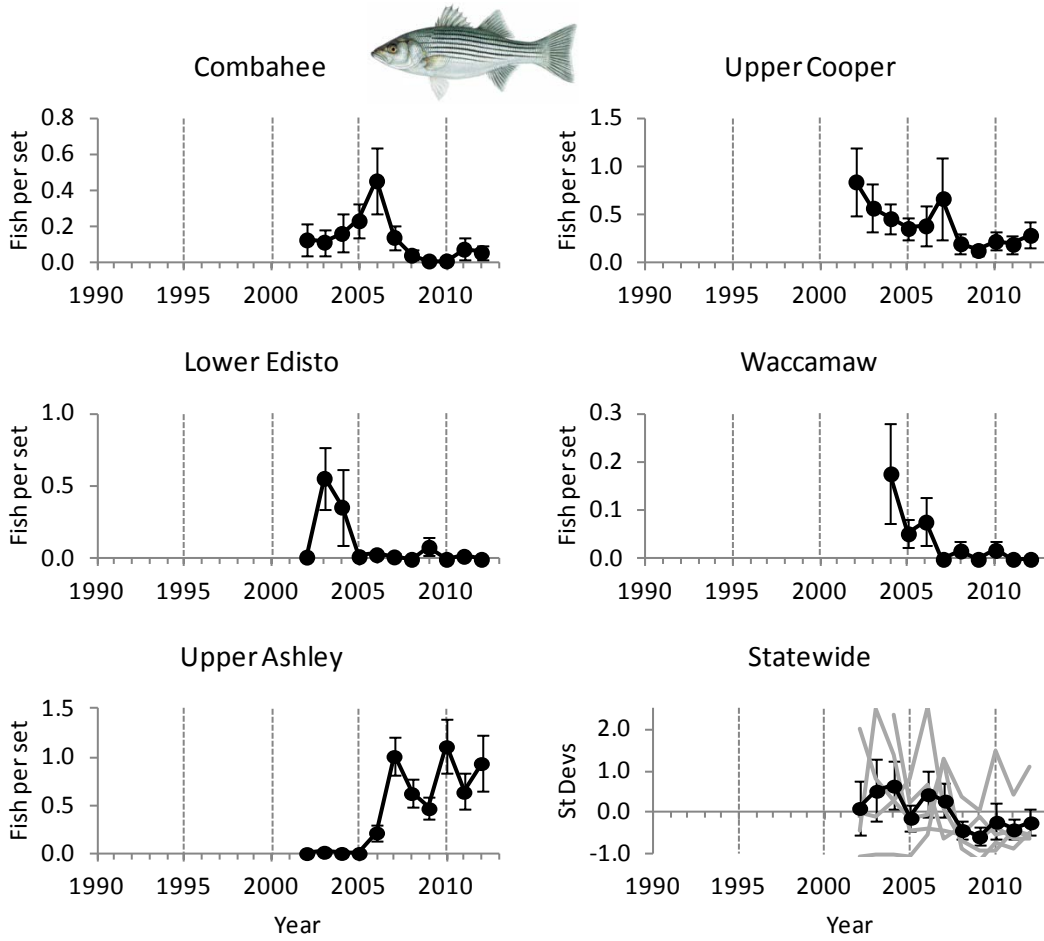
Most of the areas covered by the electrofishing survey show declines in Striped Bass numbers, with the exception of Ashley River, where stocking has been most intense. In winter and spring, most of the fish caught are less than twelve inches long and were spawned the previous year. By late fall, a second peak of small fish appears, which comprises young of the year (often, fish that have just been stocked). Very few legal-size fish ( $\geq 26$  inches) are caught in the survey.

Additional species information: <http://www.dnr.sc.gov/marine/mrri/acechar/specgal/stribass.htm>

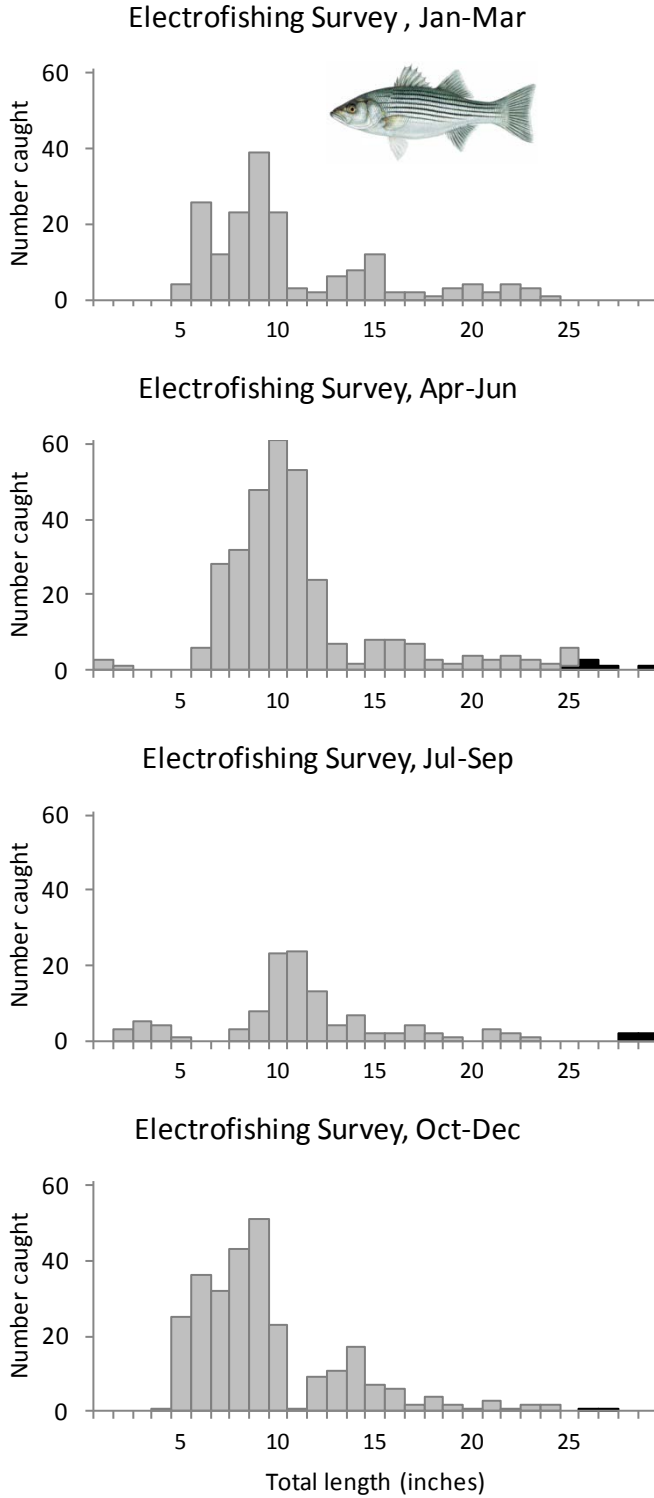
**Fig 2.49 Striped Bass:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.50 Striped Bass:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan-Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.51 Striped Bass:** Size-frequency distribution of fish caught in the SCDNR electrofishing survey in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars, non-legal size fish; black bars: legal size fish (2013 regulations: 26 inch size limit, 3 fish per day from Oct 1 – May 31; special rules in the Savannah River).



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**Common name:** Ladyfish

**Scientific name:** *Elops saurus*

**Family:** Elopidae (Ladyfishes)



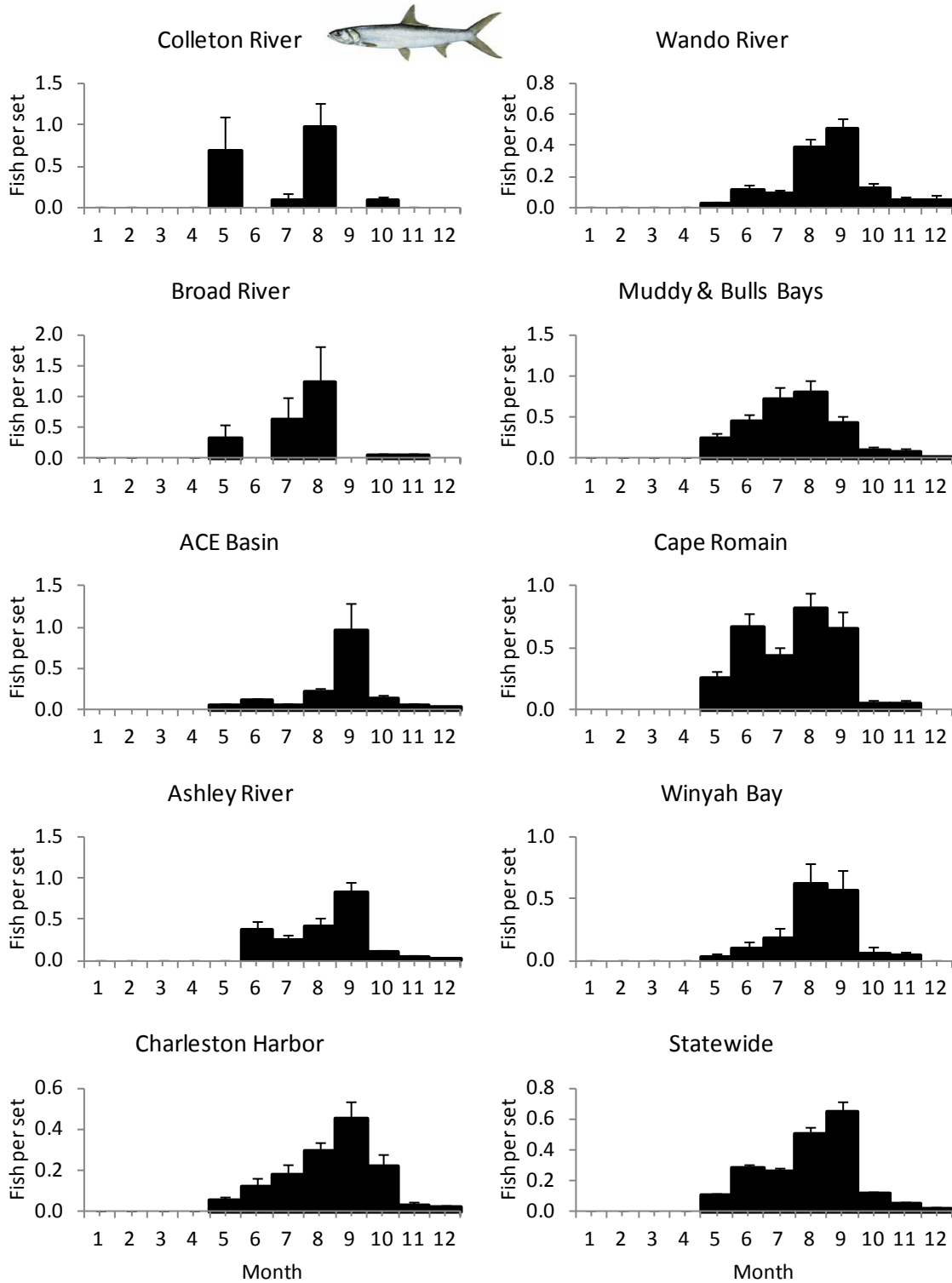
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

Ladyfish is a species related to Tarpon that inhabits warm coastal waters from Massachusetts to Brazil. The electrofishing survey catches juvenile fish around 10 inches long during the second half of the year, mostly in July and August, and the trammel net survey captures larger fish from April through November with a peak in August and September. Before July, most of the trammel caught fish comprise larger individuals of around 20 inches, but later in the year a prominent cohort of smaller fish around thirteen to fourteen inches also recruits to the gear.

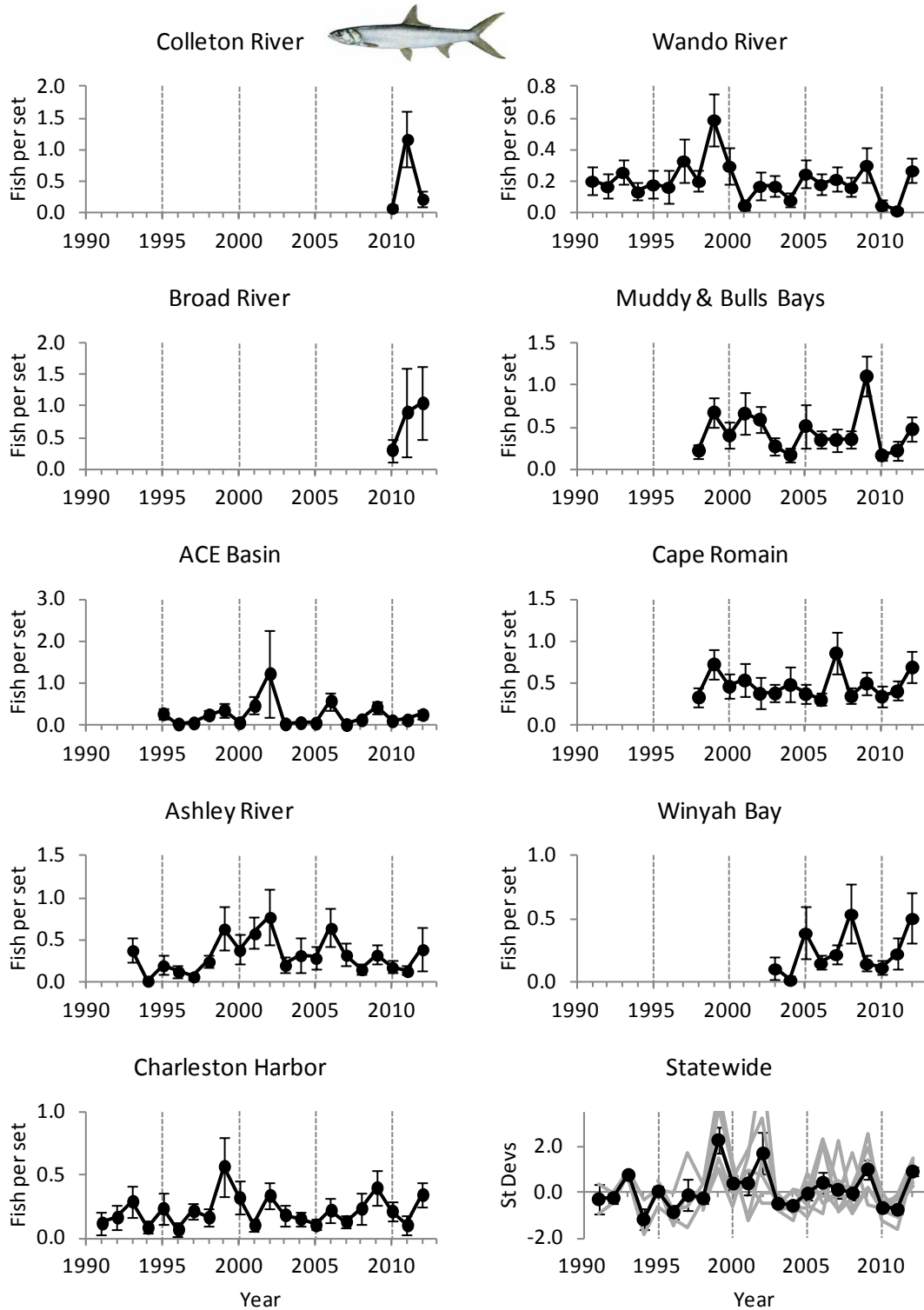
Population trends for ladyfish are relatively synchronized manner across areas, showing a fairly stable long-term trend with periods of intermittent high abundance, particularly in 1999 and 2002. Trends in the electrofishing survey are more variable between areas and also show a reasonably stable long-term trend.



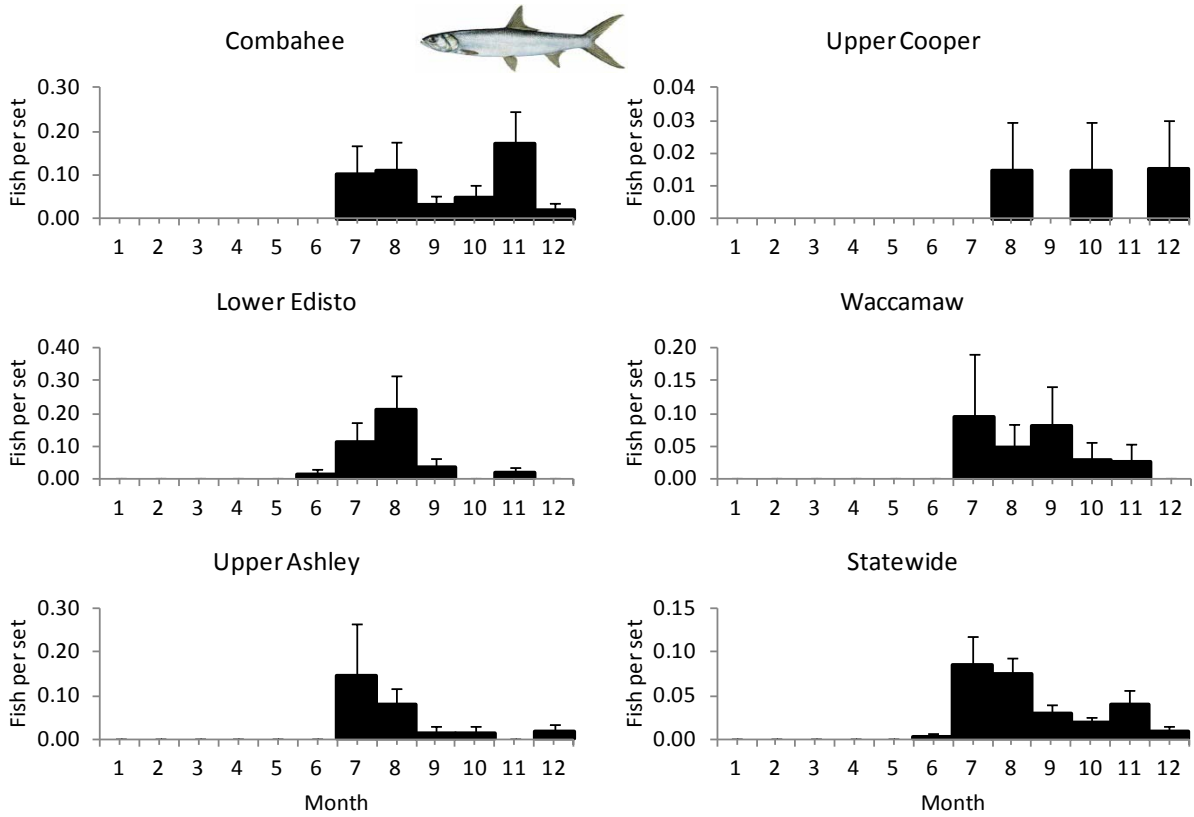
**Fig 2.52 Ladyfish:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



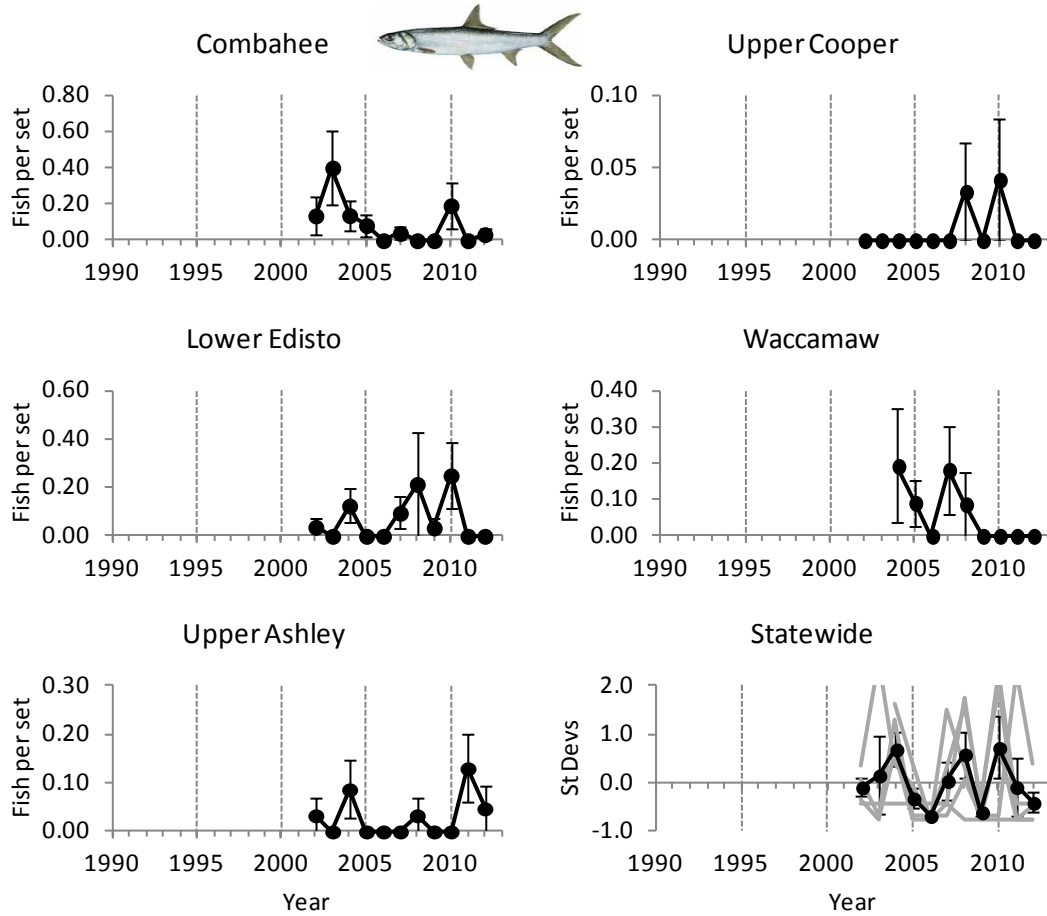
**Fig. 2.53** Ladyfish: Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jun-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



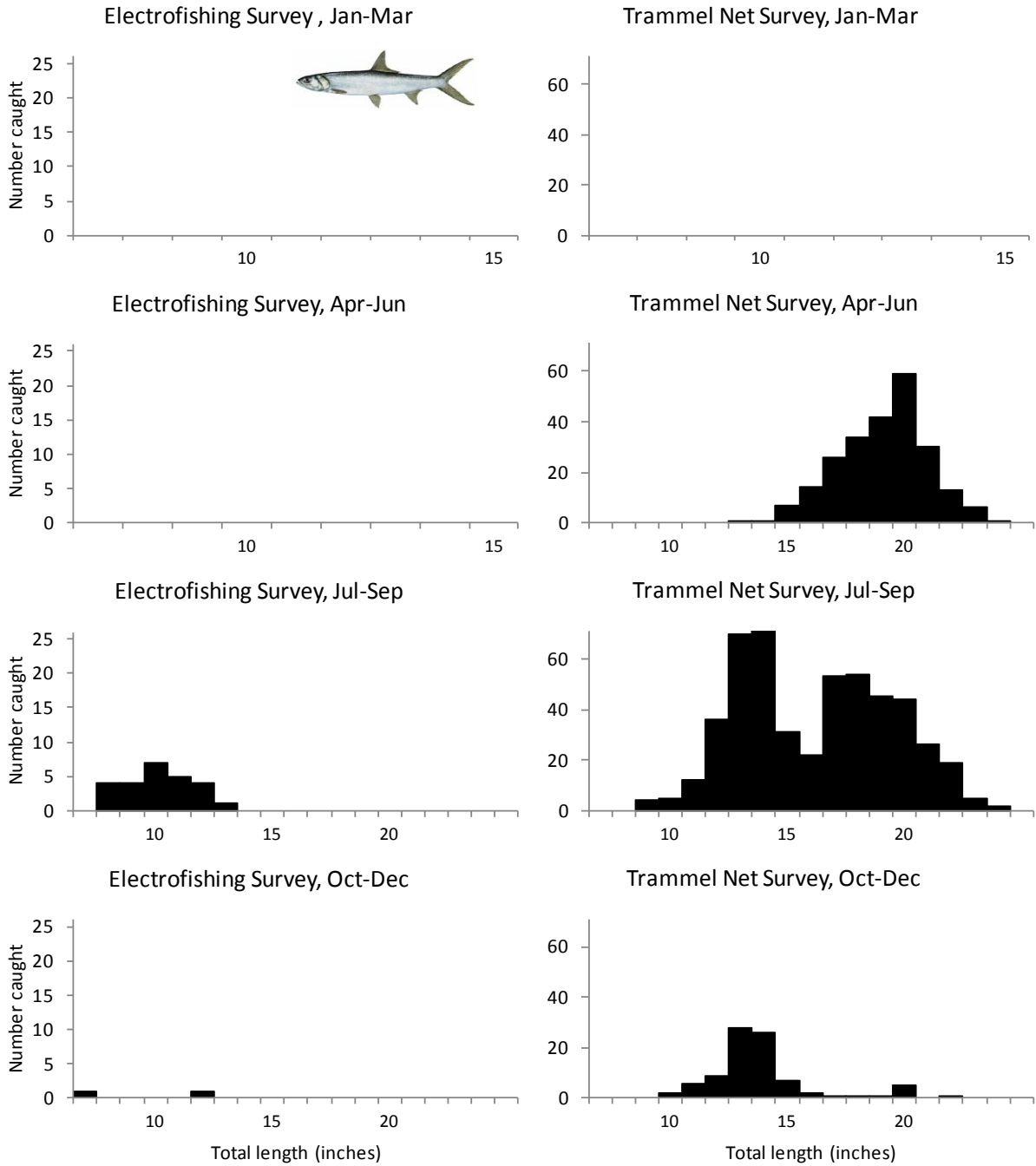
**Fig 2.54 Ladyfish:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.55 Ladyfish:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jul-Nov data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).

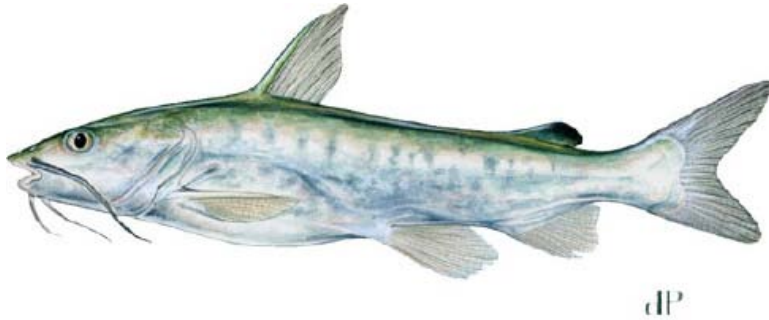


**Fig 2.56 Ladyfish:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag limit).



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**Common name:**       **Hardhead Catfish**  
**Scientific name:**    *Ariopsis felis*  
**Family:**               **Ariidae (Fork-tailed catfish)**



#### **Occurrence in the Trammel Net & Electrofishing Surveys**

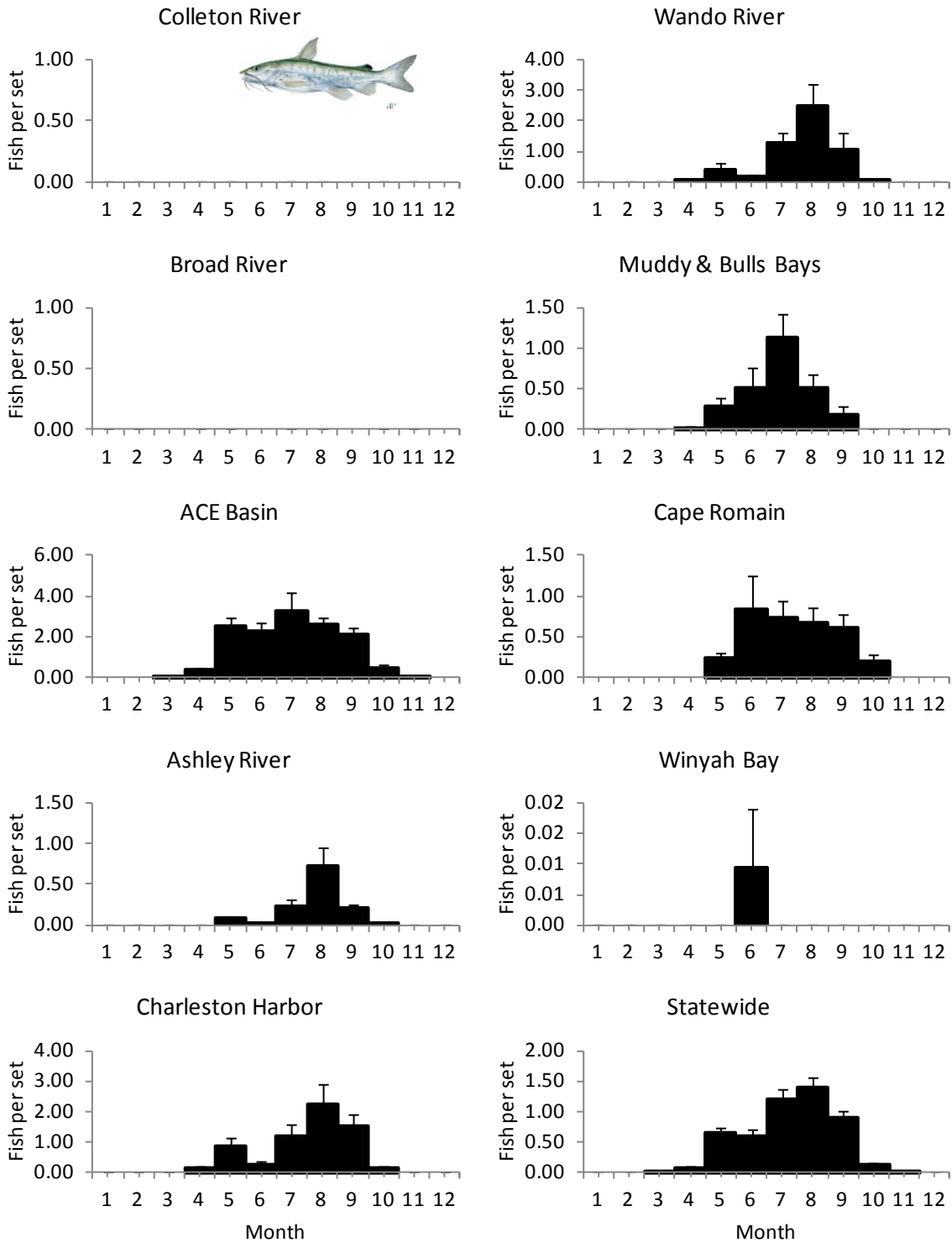
The Hardhead Catfish is a marine species of catfish. It has an unusual reproductive strategy, with males brooding eggs in their mouth and retaining the larvae once they have hatched for a couple of weeks until the yolk sac has been absorbed.

Hardhead Catfish are very rarely caught by the electrofishing survey, but during the early 1990s they were one of the most abundance species caught by the trammel net survey. From the mid-1990s onwards, however, a massive decline in the population occurred that has persisted to the present day.

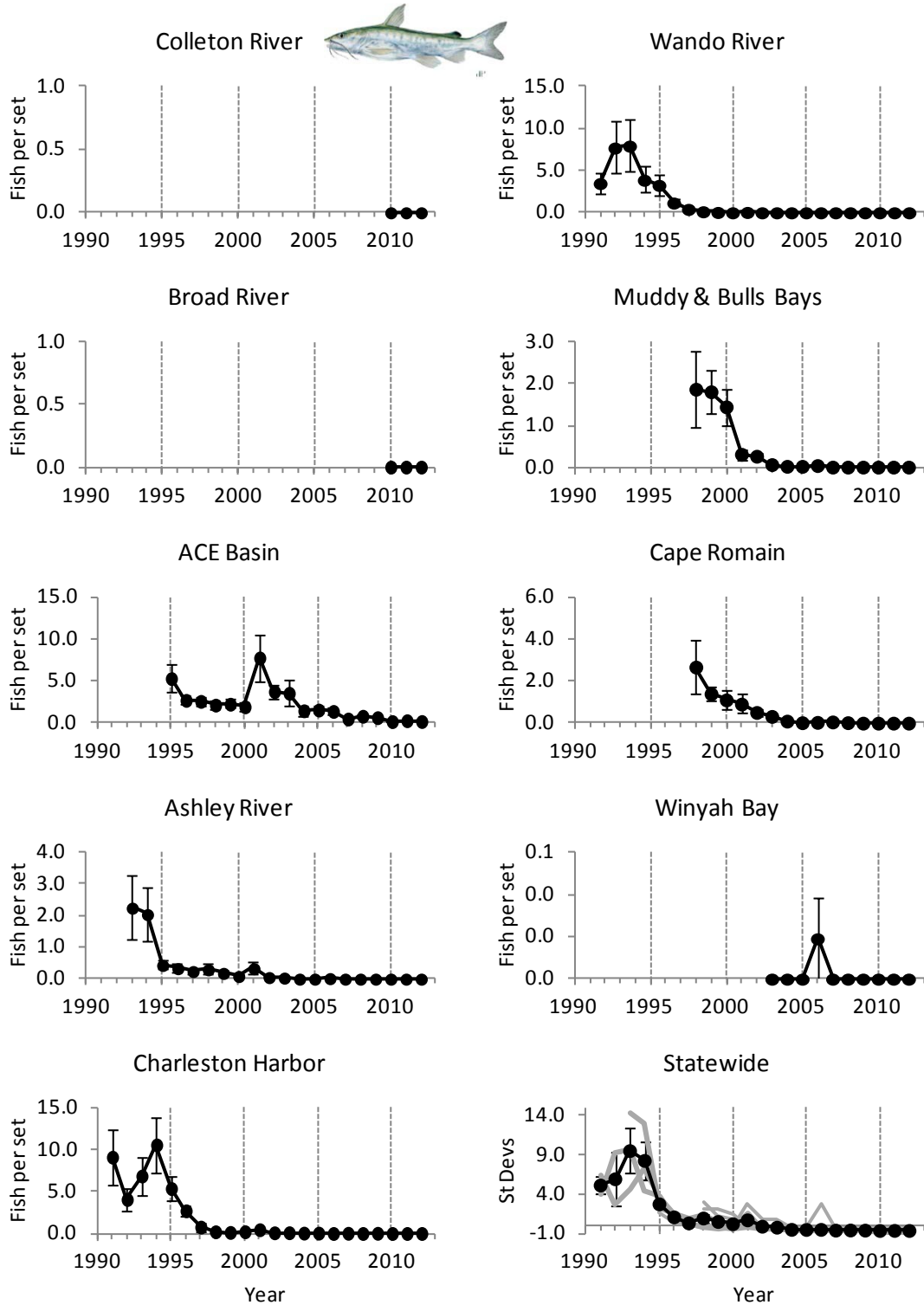
Analysis of trawl data from SCDNR's SEAMAP survey has shown that this decline was coast-wide from North Carolina to Florida, but the reason for decline has not been identified. For this reason, harvesting of Hardhead Catfish has been banned in South Carolina.

Additional species information: <http://www.dnr.sc.gov/cwcs/pdf/Hardheadcatfish.pdf>

**Fig 2.57** Hardhead Catfish: Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

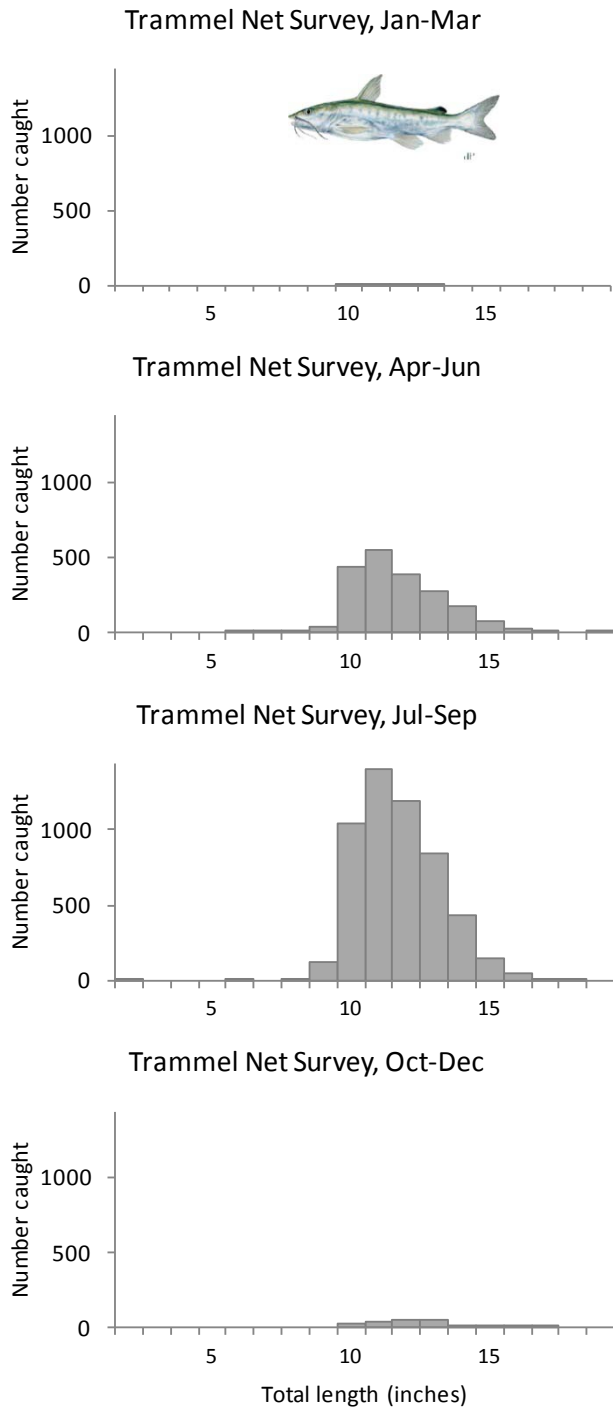


**Fig. 2.58** Hardhead Catfish: Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; May - Sept data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



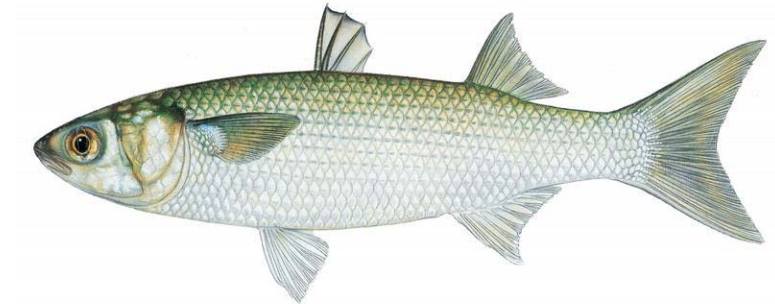


**Fig 2.59** Hardhead Catfish: Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata and available years (since only 122 have been caught since 2008). Gray bars: non-legal fish (2013 regulations: no harvest allowed).



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**Common name:** Striped Mullet  
**Scientific name:** *Mugil cephalus*  
**Family:** Mugilidae (Mulletts)



#### **Occurrence in the Trammel Net & Electrofishing Surveys**

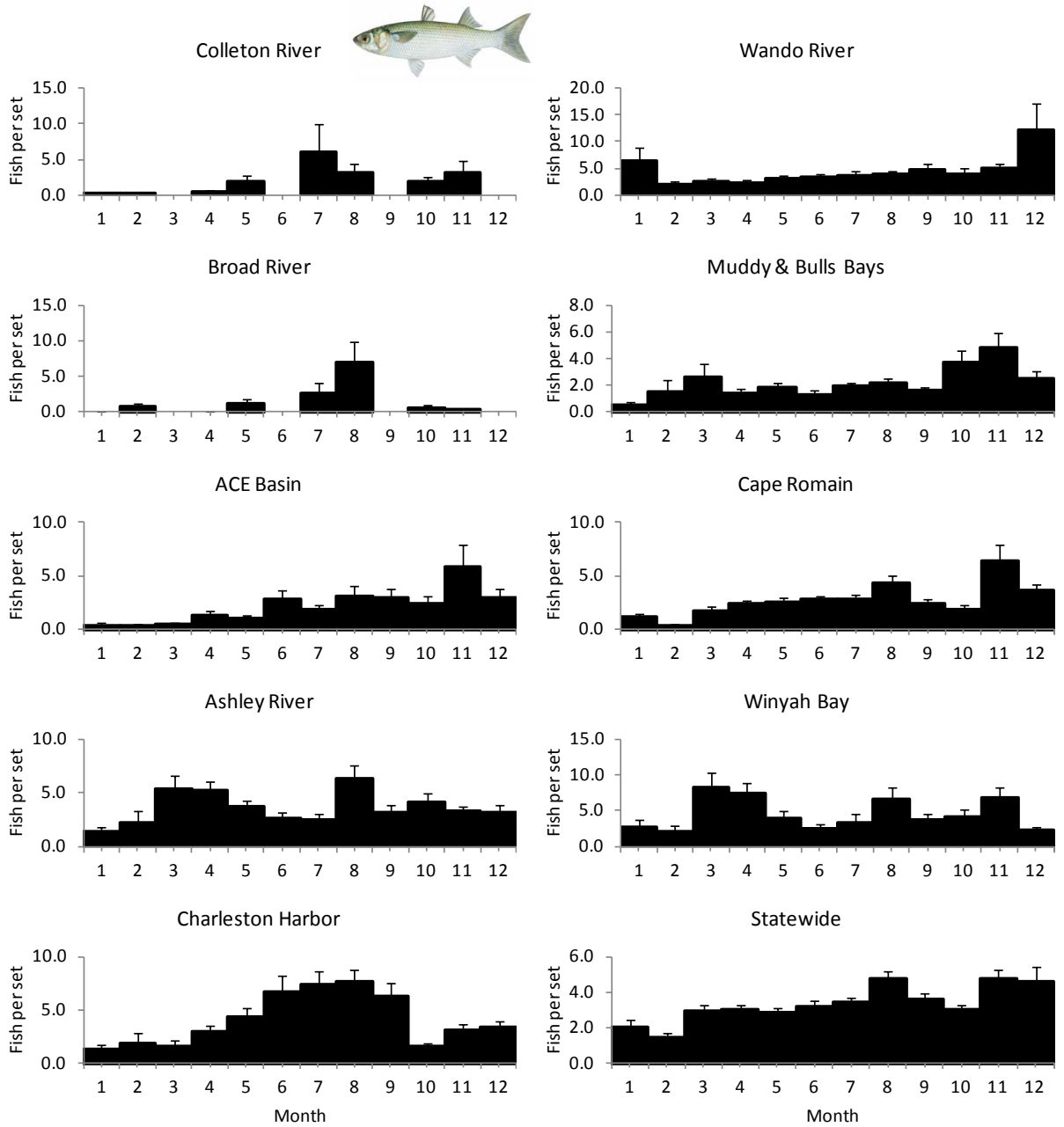
Striped Mullet is a very abundant species along the coast of South Carolina and is an important prey item for many larger fish-eating species. It spawns offshore along the edge of continental shelf between October and April, peaking in December through February. The eggs and larvae move inshore and the juveniles use estuaries as nursery areas..

Striped Mullet is one of the most commonly encountered species year-round in both the electrofishing and trammel net survey. The electrofishing survey catches large numbers of newly settled one-two inch fish during winter and early spring, as well as large individuals that occasionally reach up to 20 inches long. The trammel net survey only catches larger mullet due to the gear's selectivity. Peak numbers occur during fall and winter in the electrofishing survey, but in the trammel net survey peak periods vary between areas, probably due to their extensive migratory behavior.

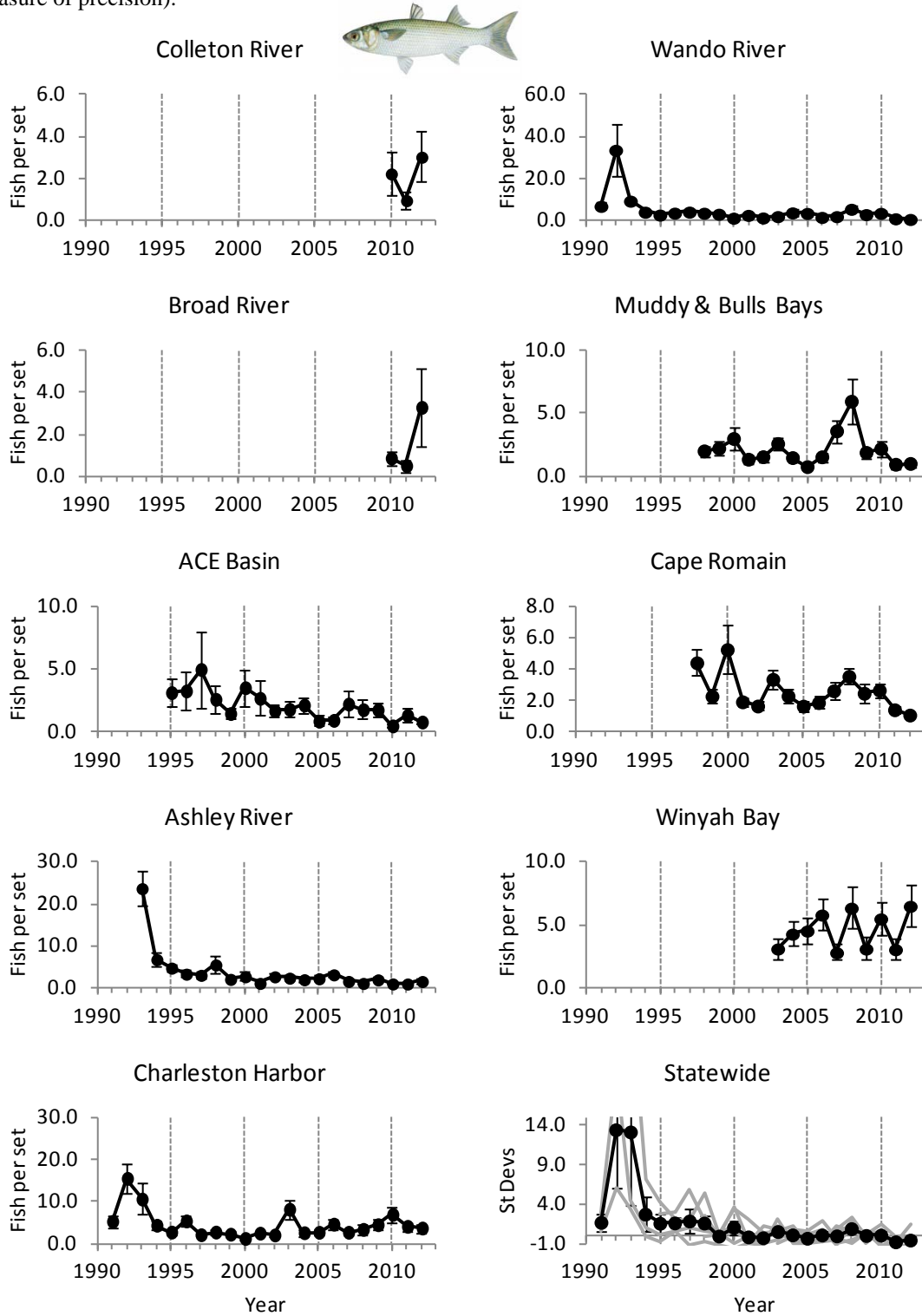
During 1992 and 1993, catch rates of Striped Mullet in the trammel net survey were exceptionally high. Discounting these two years, there nevertheless appears to have been a decline in trammel catch rates in several areas, as well as a decline in some of the electrofishing areas.

Additional species information: <http://www.dnr.sc.gov/cwcs/pdf/Stripedmullet.pdf>

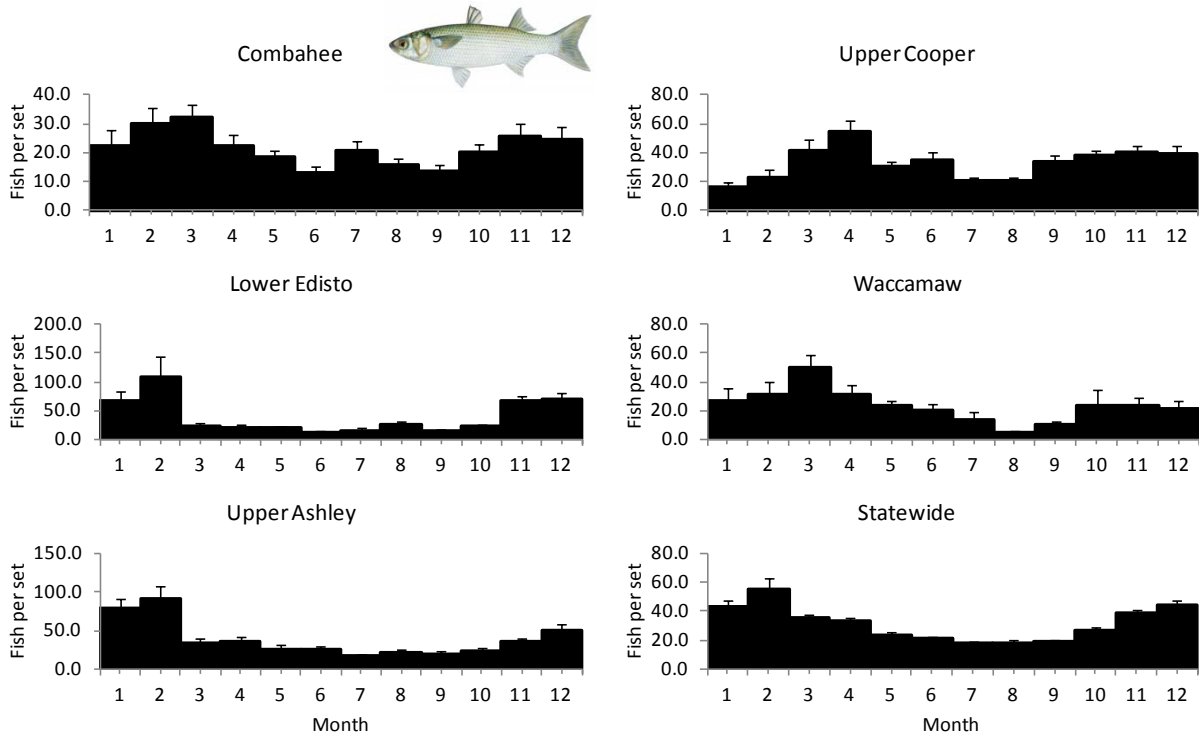
**Fig 2.60 Striped Mullet:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



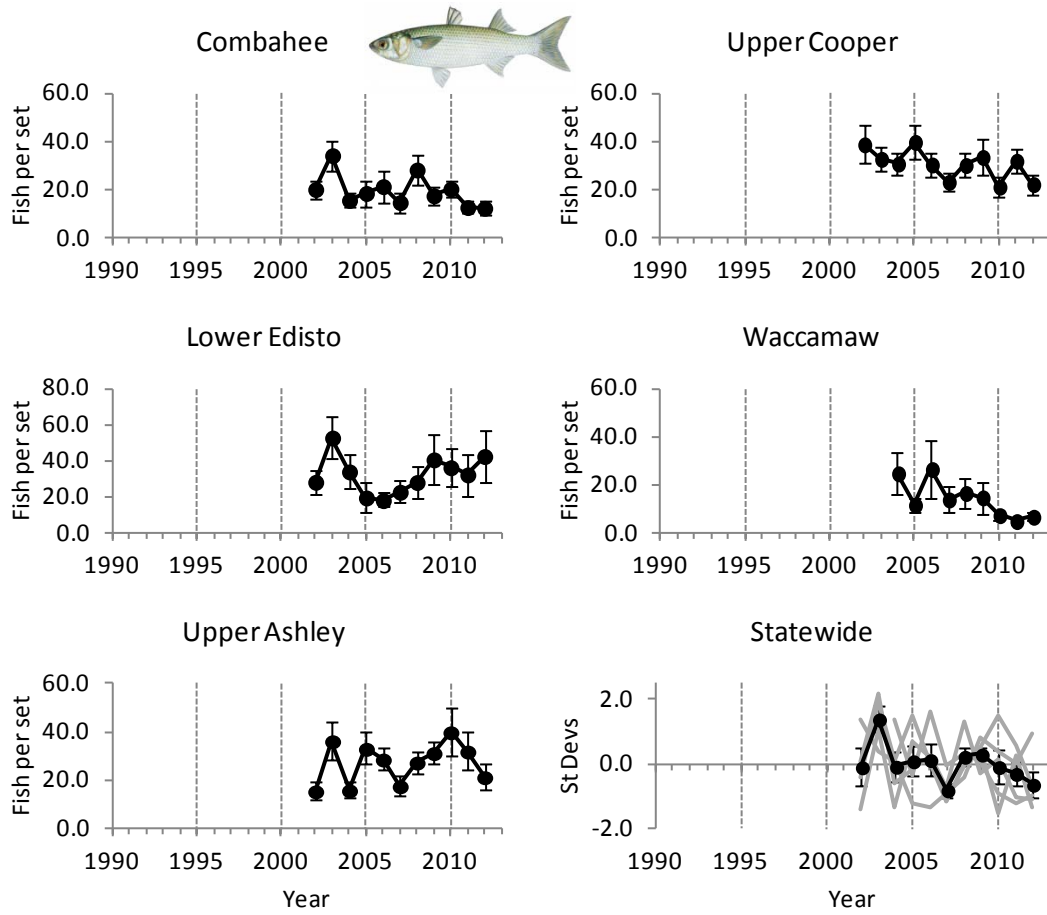
**Fig. 2.61 Striped Mullet:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jan-Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



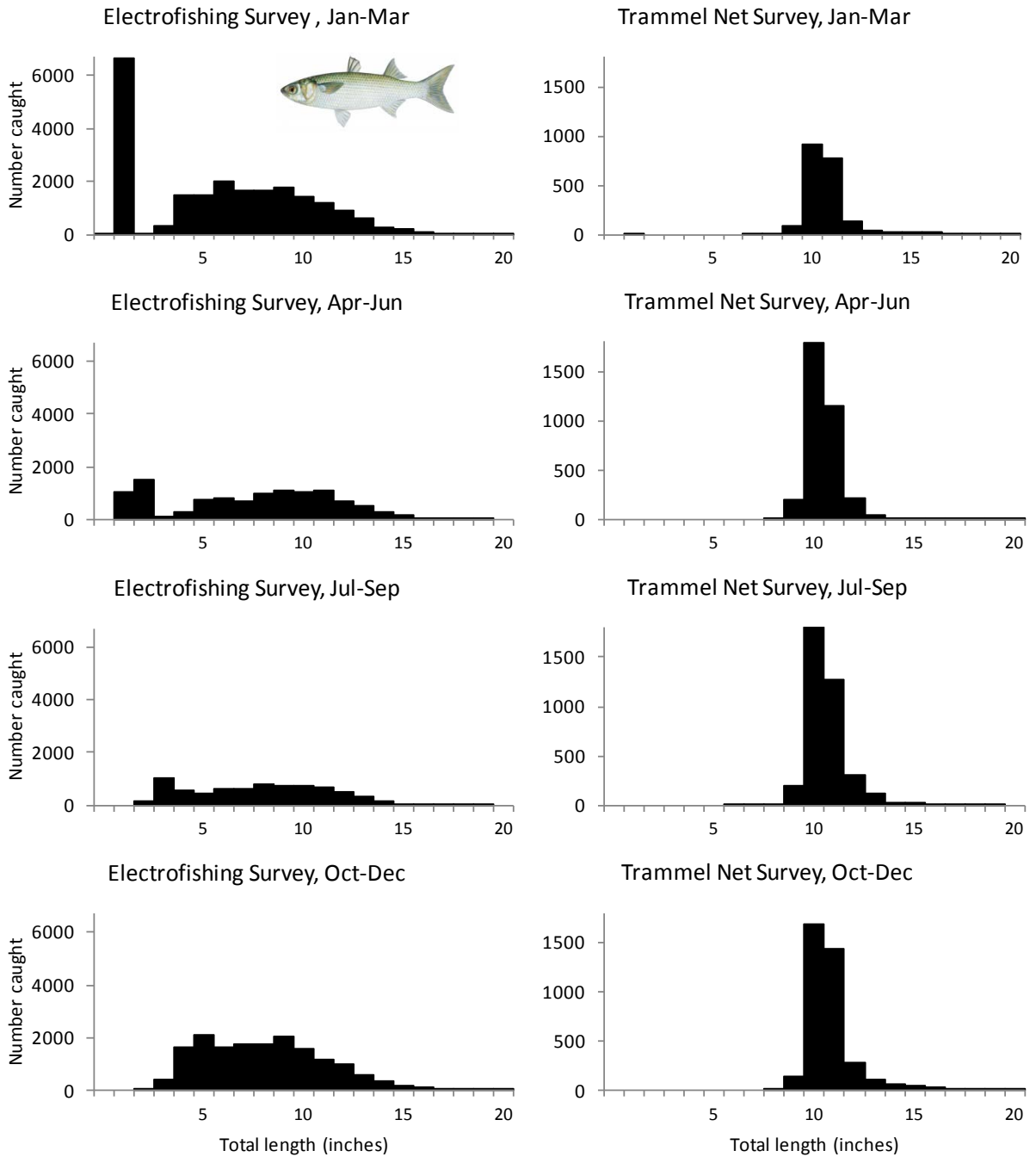
**Fig 2.62 Striped Mullet:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.63 Striped Mullet:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jul-Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.64 Striped Mullet:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. (Note: logarithmic scale used for electrofishing survey due to very high numbers of small fish). Black bars: legal size fish (2013 regulations: no size or restrictions).



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**Common name:** American Eel

**Scientific name:** *Anguilla rostrata*

**Family:** Anguillidae (freshwater eels)



### **Occurrence in the Trammel Net & Electrofishing Surveys**

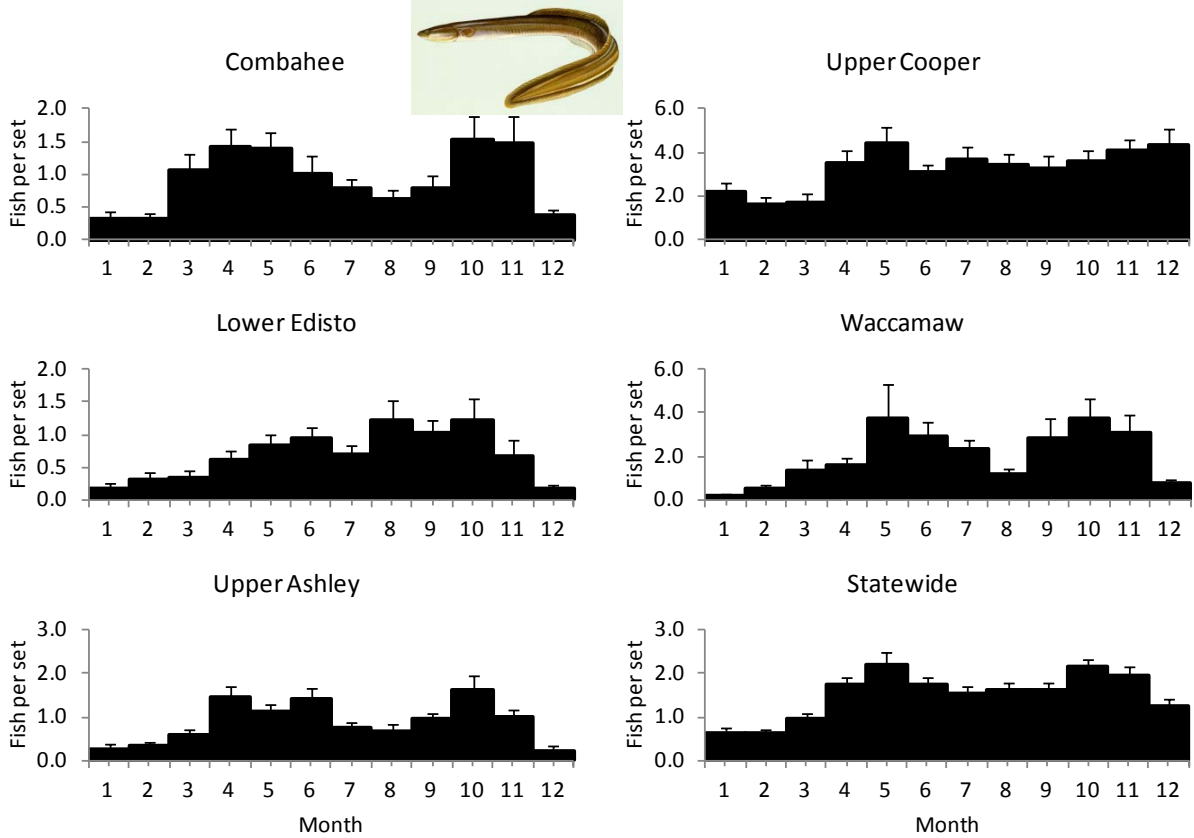
The American Eel has an extraordinary life cycle that poses unique management challenges. Adults migrate just once during their life to spawn in the Sargasso Sea (middle of the Atlantic Ocean) before dying. There, their eggs hatch into an unusual larval form that called a leptocephalus drifts in the ocean for a year or more before the juveniles move into estuaries and rivers and undergo a series of transformations that results in the ‘yellow’ eel stage most typically encountered by anglers.

American Eels occur in coastal waters and river catchments from Greenland and Canada through to northern parts of South America. The population has declined in recent years across its range, as have closely related eel species in other parts of the world. The decline of American Eels has resulted into two (unsuccessful) petitions in recent years to have the species listed under the US Endangered Species Act. Reasons for the decline have not been fully resolved, but may be related to a combination of factors including overfishing, habitat loss, food web alterations, predation, turbine mortality at dams, environmental changes, toxins and contaminants, and infection by a non-native worm parasite introduced from Asia. The SCDNR Inshore Fisheries Section has been monitoring this parasite closely in recent years and has found high levels of infection throughout the state’s estuarine waters.

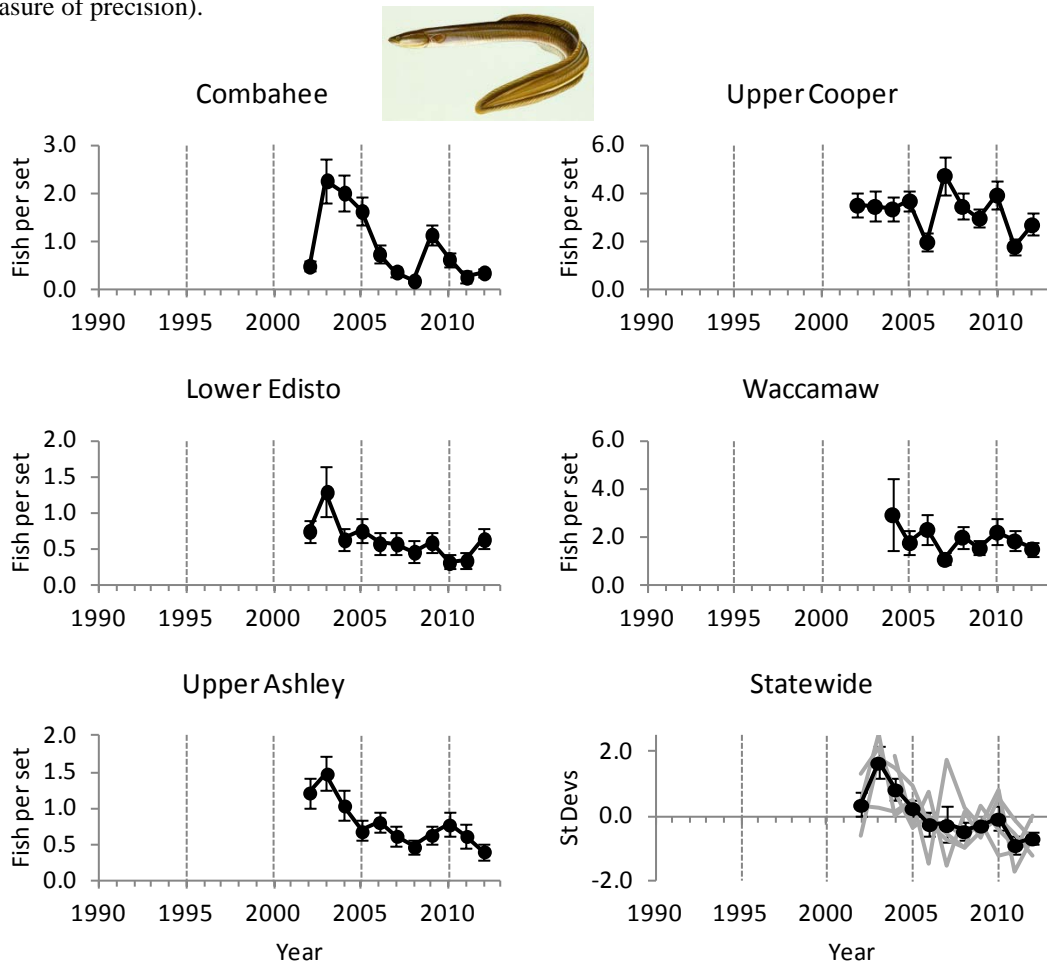
American Eels are not captured by the trammel net survey, but they are captured throughout the year by the electrofishing survey. During the first half of the year, the catch is predominantly eels less than 15 inches long, but later in the year a higher proportion of larger eels is caught as adults prepare to move offshore to spawn. Catch rates have generally declined since the survey began, in line with surveys further north along the Atlantic coast. The SCDNR electrofishing data were used in the most recent 2012 stock assessment of American Eels, which concluded that the stock was depleted and near historically low levels.



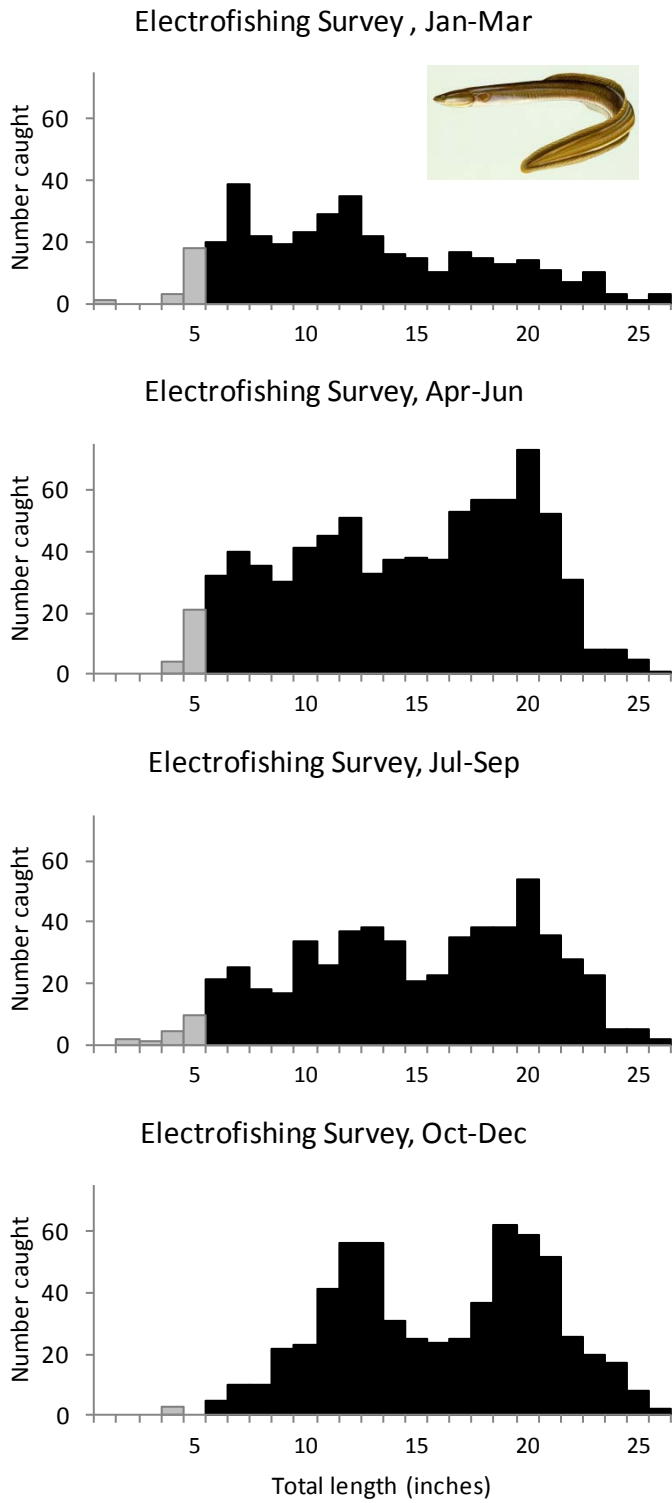
**Fig 2.65 American Eel:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.66 American Eel:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan - Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.67 American Eel:** Size-frequency distribution of fish caught in the SCDNR electrofishing net survey in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal size fish; Black bars: legal size fish (2013 regulations: 6 inch minimum, 50 fish bag limit).

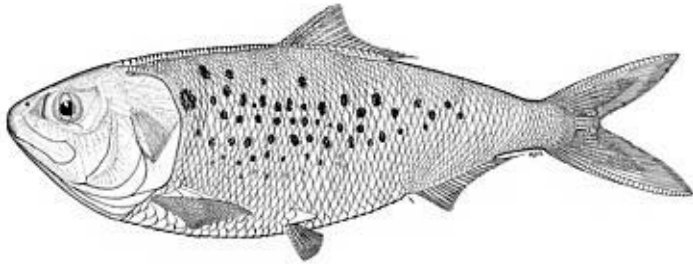


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**Common name:** Atlantic Menhaden

**Scientific name:** *Brevoortia tyrannus*

**Family:** Clupeidae (Herrings, shads, sardines, menhadens)



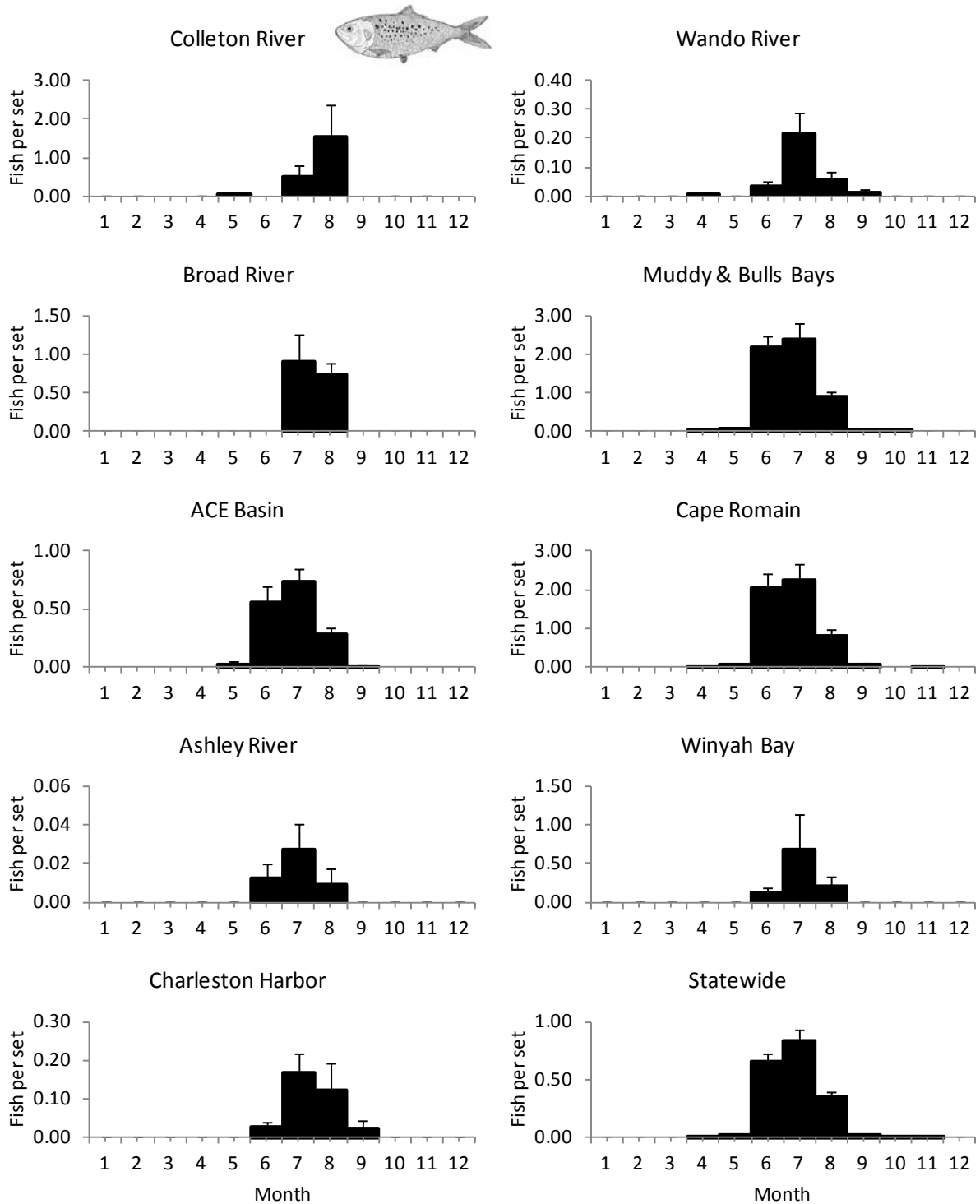
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

Atlantic Menhaden is found in estuarine and coastal waters from Nova Scotia to Florida and is an important prey species for many fish, sea birds and marine mammals. An examination of adult Red Drum stomachs taken by the SCDNR long-line survey has shown that they are an important diet item.

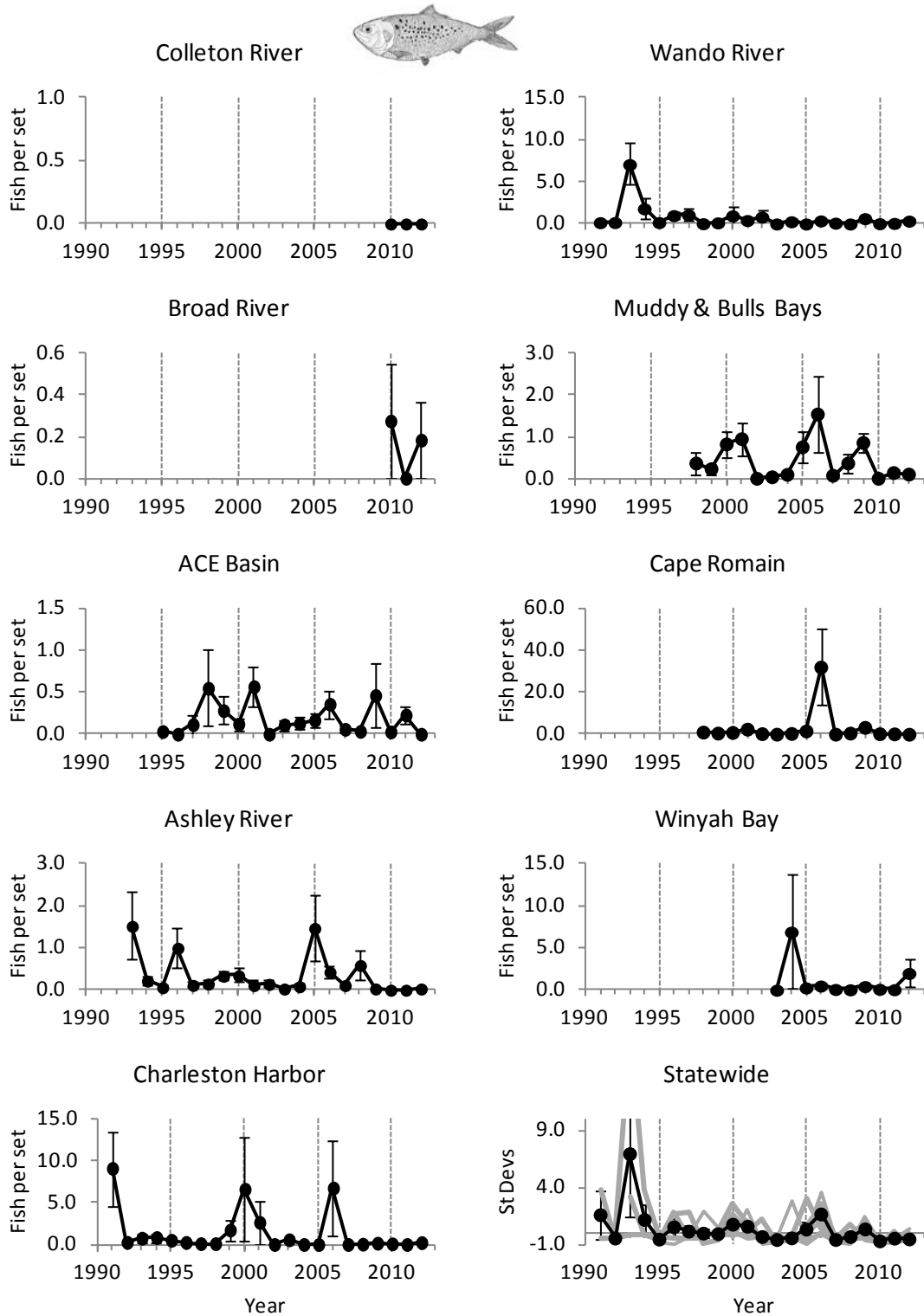
Adult and juvenile menhaden form large, near-surface schools in coastal waters from early spring through early winter. By summer, Atlantic Menhaden schools stratify by size and age along the Atlantic coast, with older and larger menhaden found farther north. During fall and early winter, fish of all sizes and ages move south to spawn in offshore waters.

During winter and spring, the electrofishing survey catches large number of young-of-the-year fish, with the rest of the catch probably comprising fish around one year old. The trammel net survey only catches Atlantic Menhaden larger than around five inches. It has shown a general decline in catch rates over time with occasional large variations, which are probably in part caused by the species' schooling behavior and wide ranging movement patterns. These data are being examined in more detail for use in an upcoming U.S. Atlantic coast stock assessment.

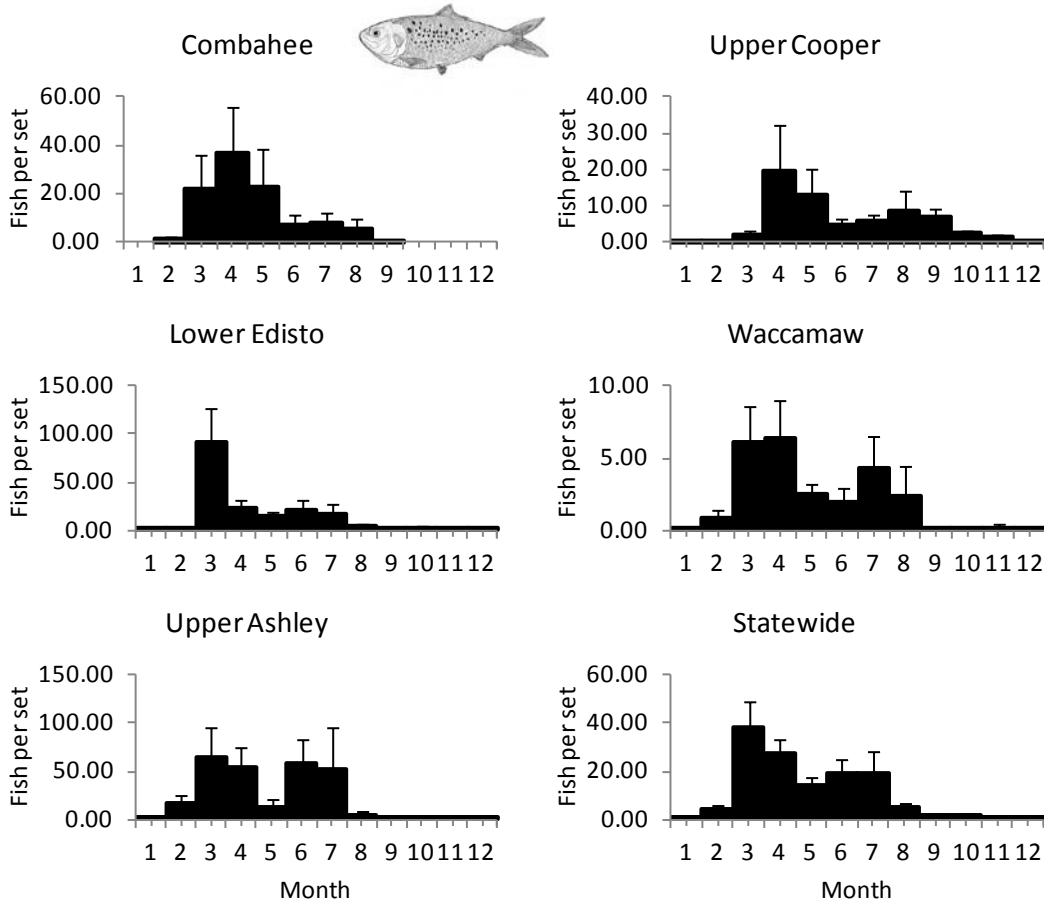
**Fig 2.68 Atlantic Menhaden:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



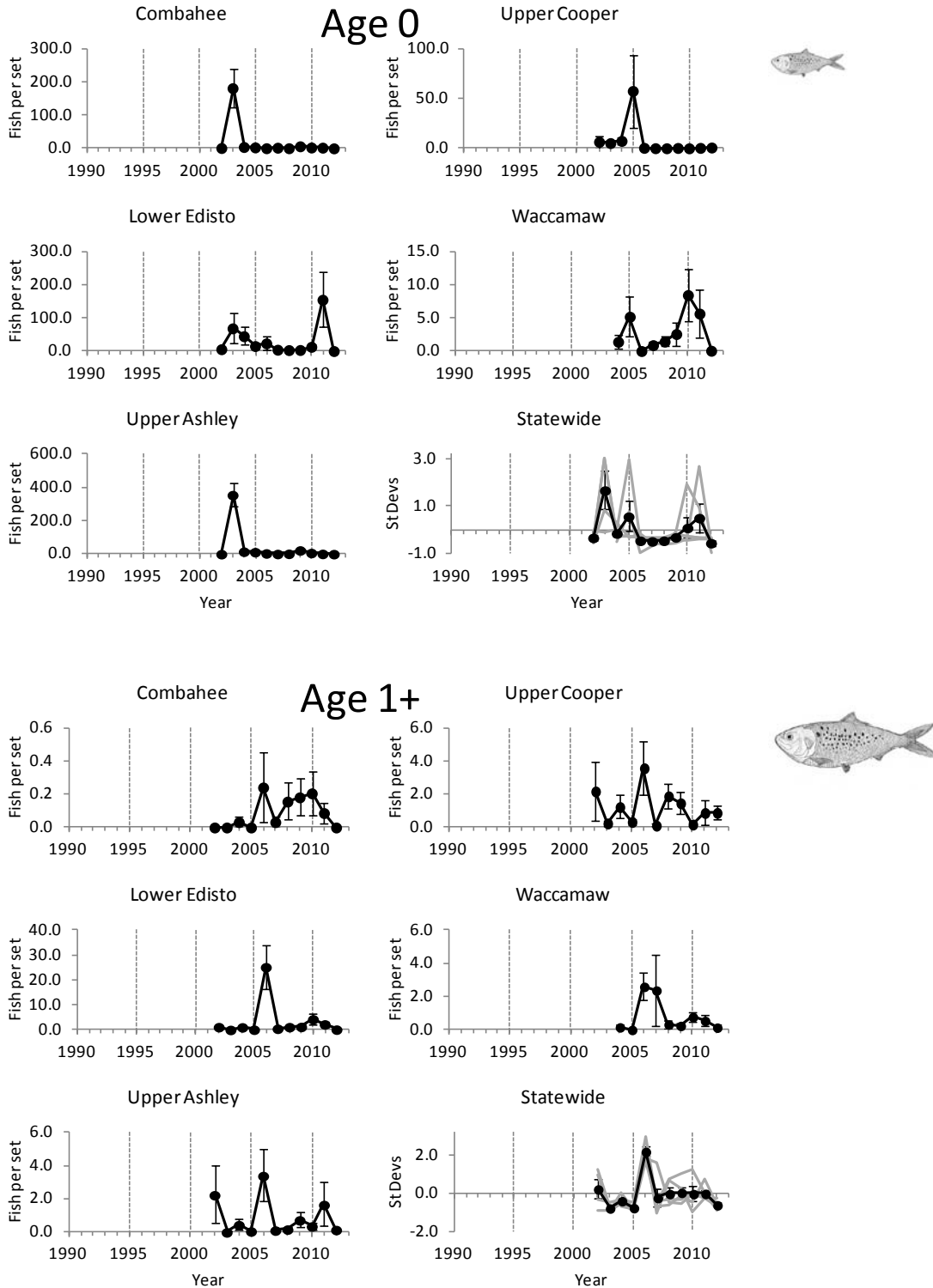
**Fig. 2.69 Atlantic Menhaden:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jun-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.70 Atlantic Menhaden:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

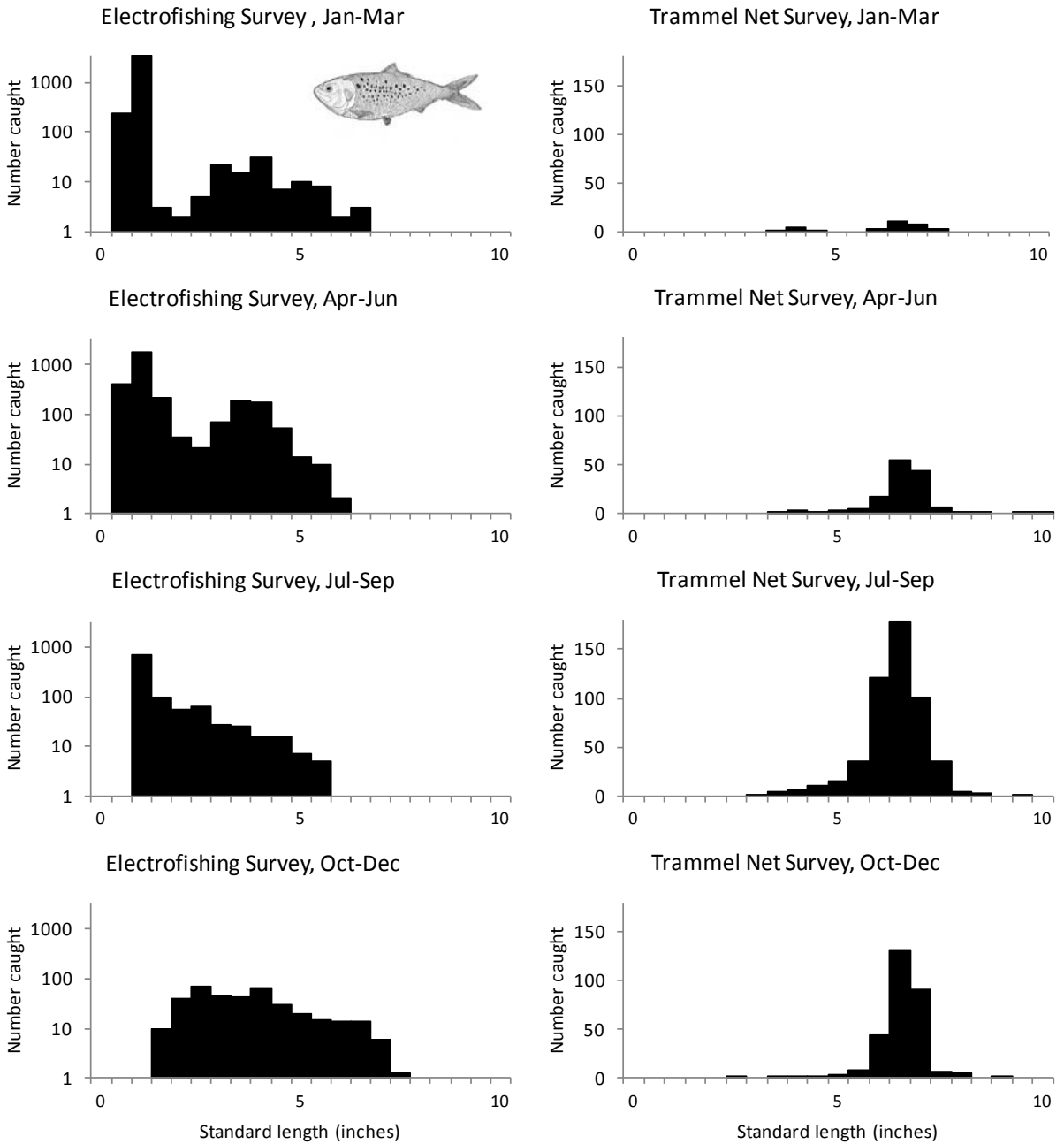


**Fig. 2.71 Atlantic Menhaden:** Annual catch rates of fish in the SCDNR electrofishing survey, split into ages 0 (average number of fish  $SL \leq 63.5\text{mm}$  per set; Feb-Jun data pooled) and age 1+ ( $SL > 68\text{mm}$ ; Feb-Jul). The statewide indices are expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).





**Fig 2.72 Atlantic Menhaden:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag limit). Note the use of a log-scale vertical axis for the electrofishing survey to accommodate large numbers of juveniles.



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**Common name:** American Harvestfish  
**Scientific name:** *Peprilus paru*  
**Family:** Stromateidae (Butterfishes)



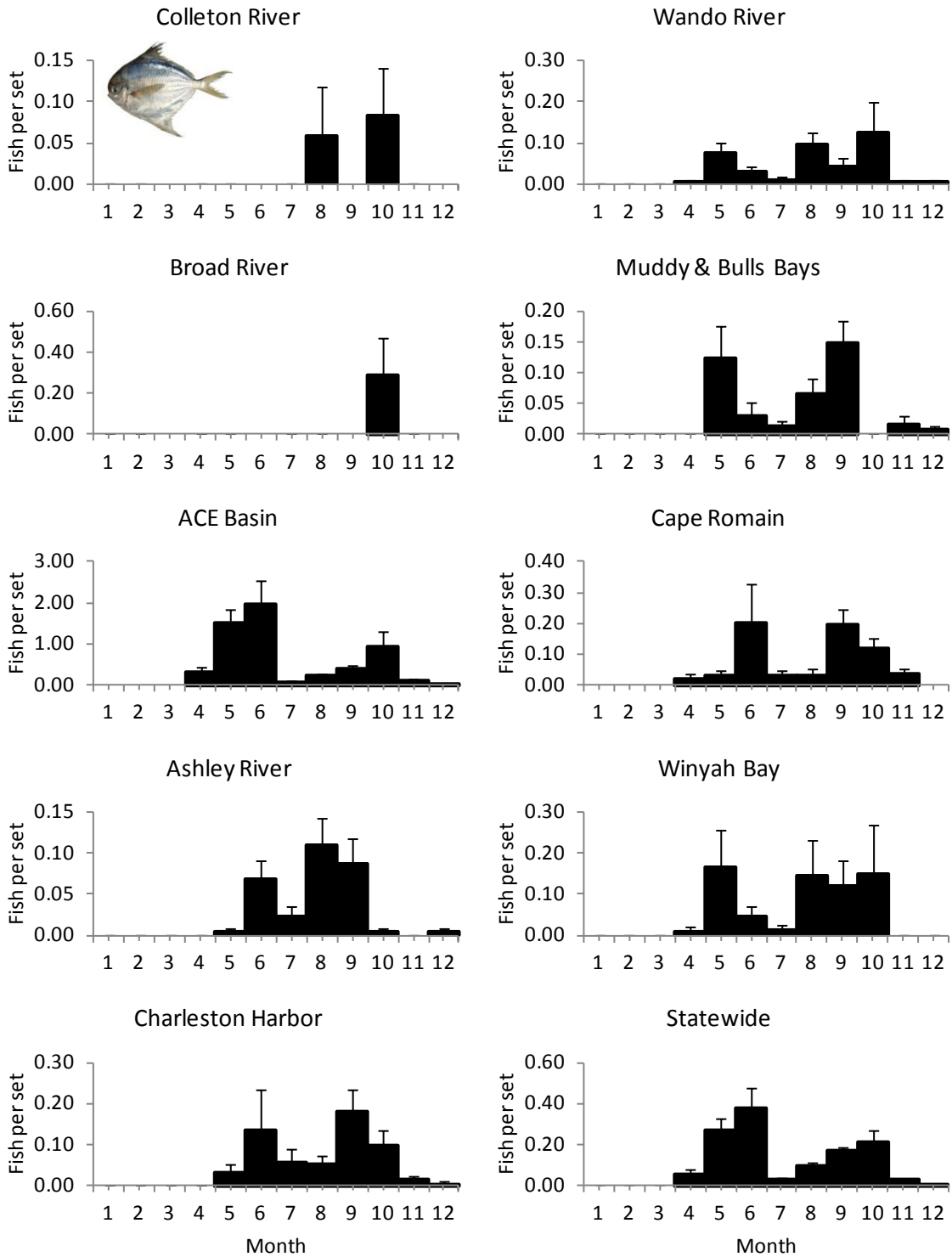
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

The American Harvestfish ranges throughout the western Atlantic from the northeastern U.S. to the Gulf of Mexico and as far south as Argentina. Juvenile Harvestfish are found in shallow coastal bays and estuaries while the adults are found in both near shore and pelagic habitats where they are commercially harvested as a food source, mainly by otter trawls, and marketed in both the United States and Japan.

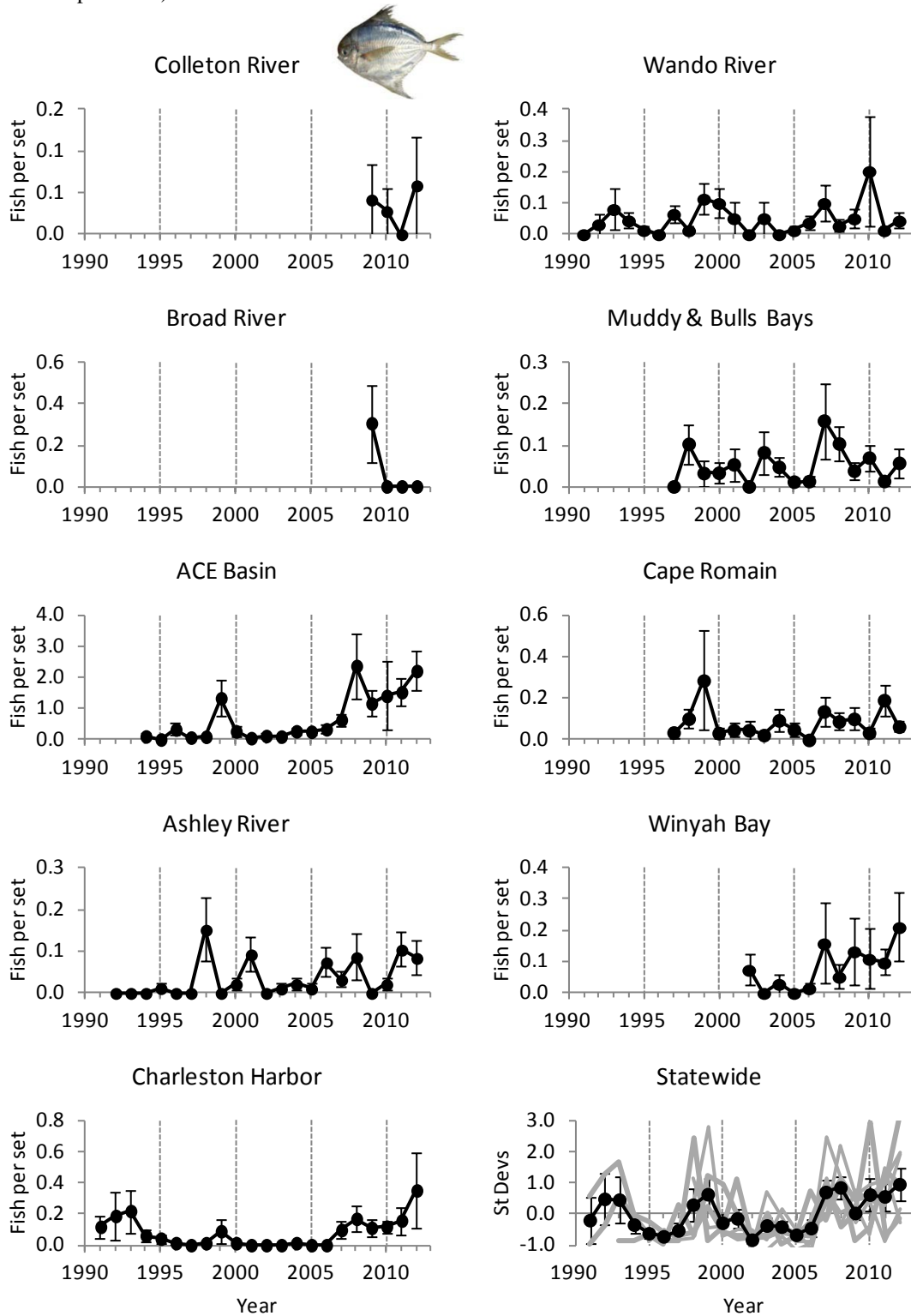
Harvestfish are captured in the trammel net survey from April through December, with larger individuals caught from April through June and smaller individuals from July through December. The species occurs in all nine strata sampled by the trammel net survey, with the highest catches in recent years occurring in ACE Basin. Statewide trends have been increasing since 2005.

Only one Harvestfish has ever been captured by the electrofishing survey, indicating that this species primarily inhabits higher salinity areas.

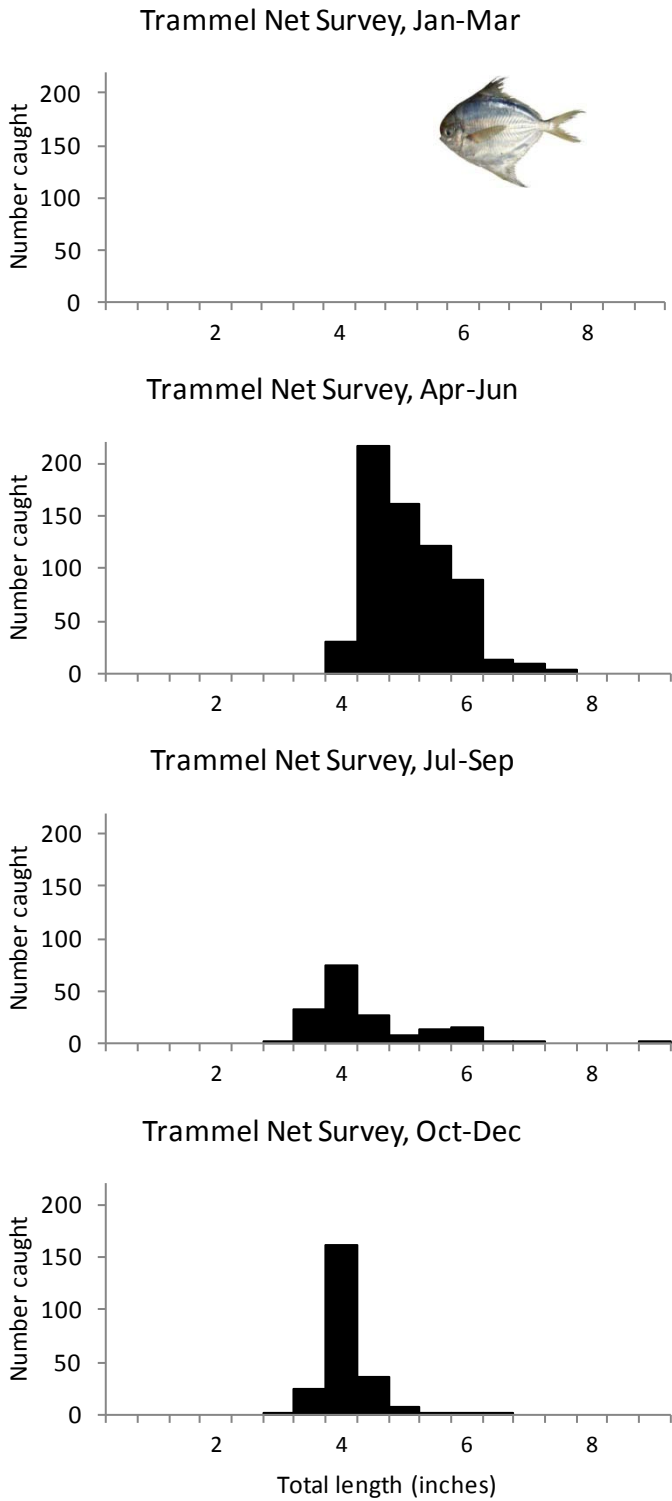
**Fig 2.73 Harvestfish:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.74 Harvestfish:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; April-November data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.75 Species:** Size-frequency distribution of fish caught in the SCDNR trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag limit).

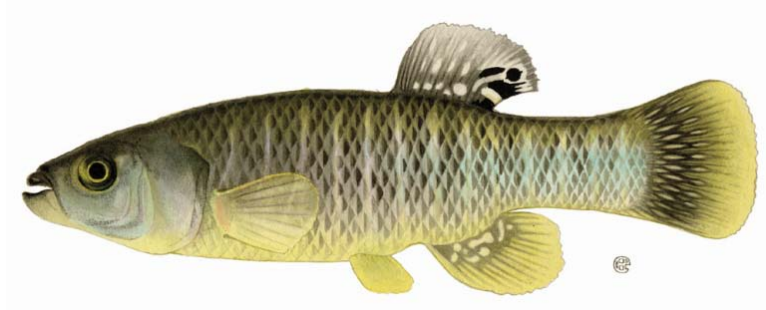


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**Common name:** Mummichog

**Scientific name:** *Fundulus heteroclitus*

**Family:** Fundulidae (Topminnows and killifishes)

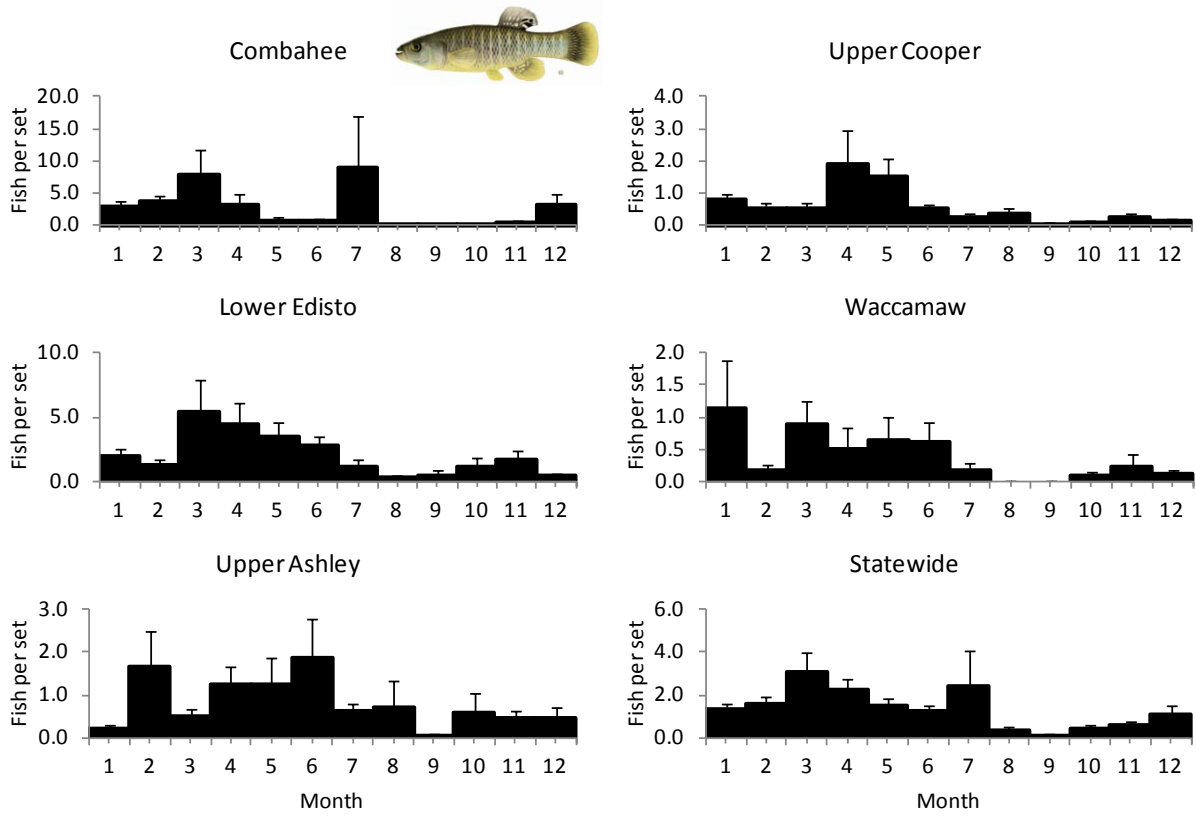


### **Occurrence in the Trammel Net & Electrofishing Surveys**

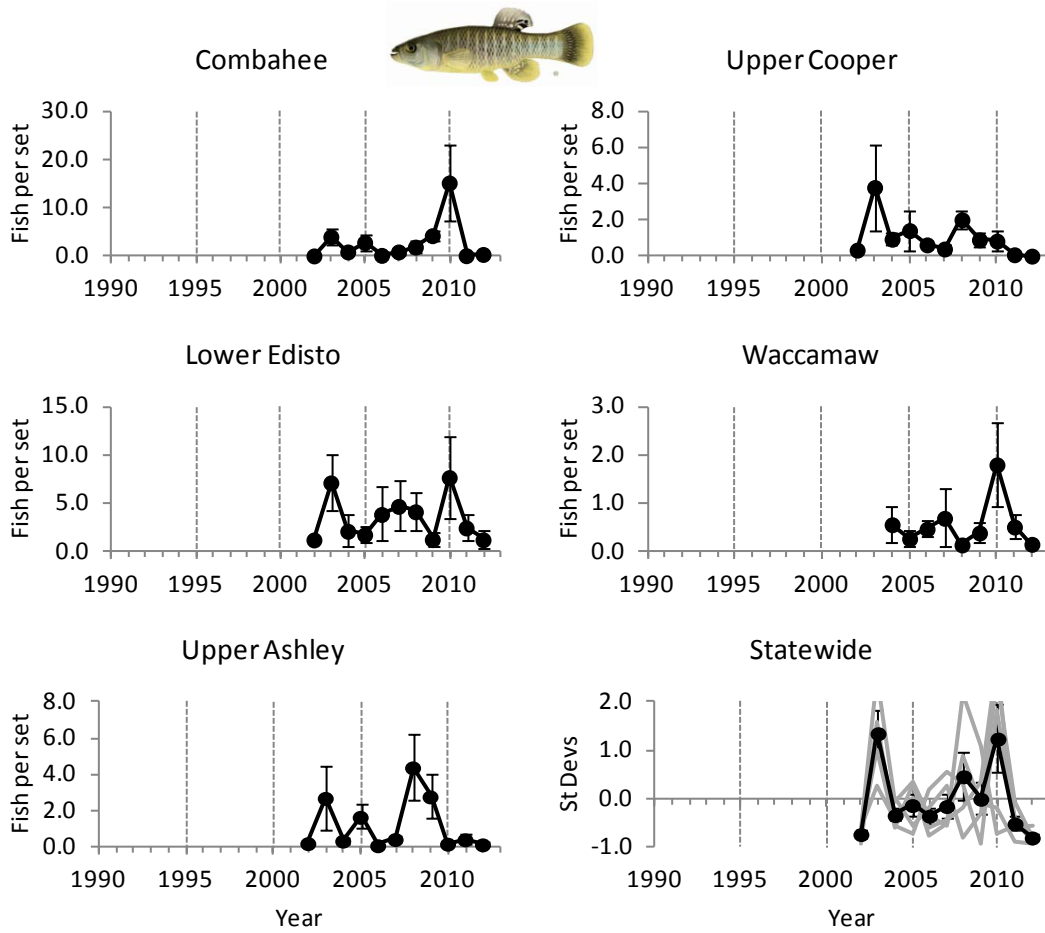
Mummichog occur in the western north Atlantic, ranging from the Gulf of St. Lawrence south to the Gulf of Texas. The species occurs in intertidal salt marshes and can be found in a range of salinities from hyper saline tidal pools to completely fresh water. Mummichog are an important prey item for many fish and bird species and are caught commercially as bait for recreational fisherman. They can survive in systems that are heavily polluted or severely anoxic, and have therefore been used in various studies as a sentinel species to examine ecosystem health.

Due to gear selectivity and their small size, Mummichog are not caught in the trammel net survey. The electrofishing survey has captured mummichog in all areas that are sampled, with the greatest numbers and sizes found during the first half of the year. The statewide population trend has been quite variable, with a decline occurring since 2010.

**Fig 2.76 Mummichog:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).

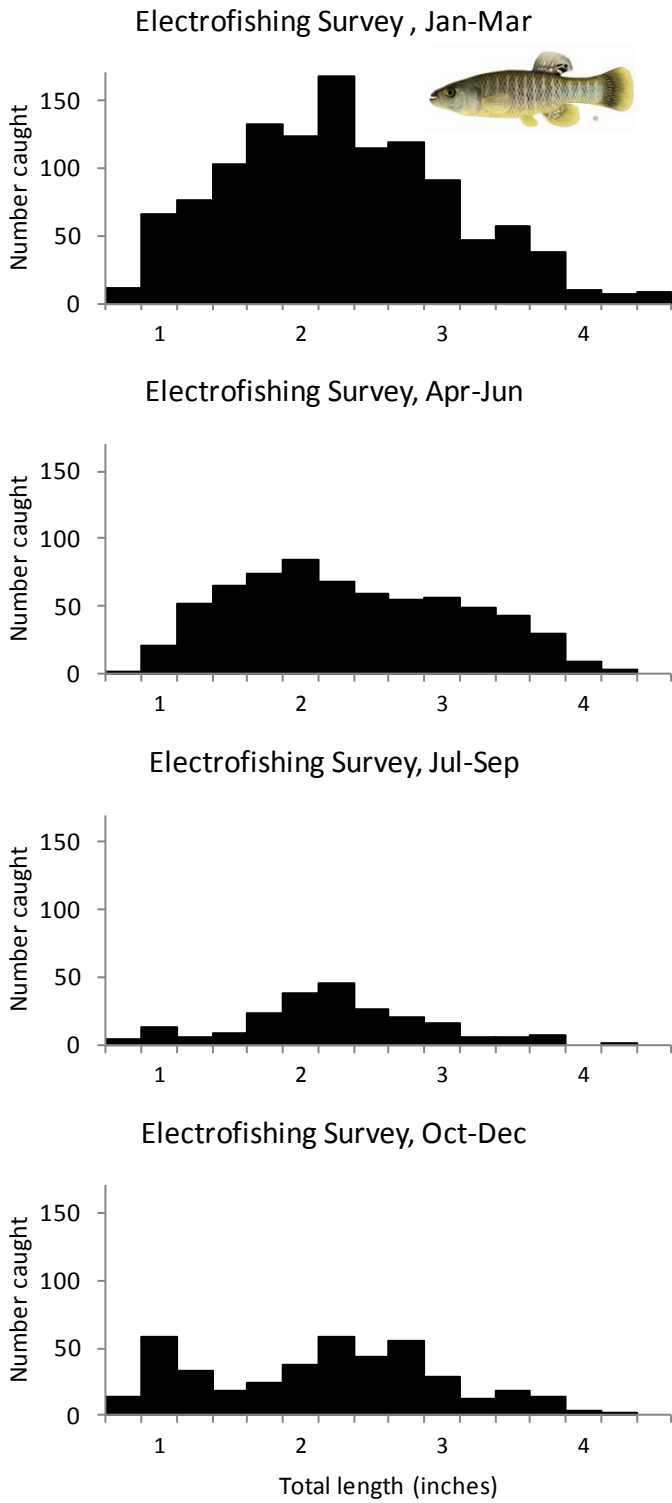


**Fig. 2.77 Mummichog:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Feb-Jun data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).





**Fig 2.78 Mummichog:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag limit).



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**Common name:** Longnose Gar

**Scientific name:** *Lepisosteus osseus*

**Family:** Lepisosteidae (Gars)



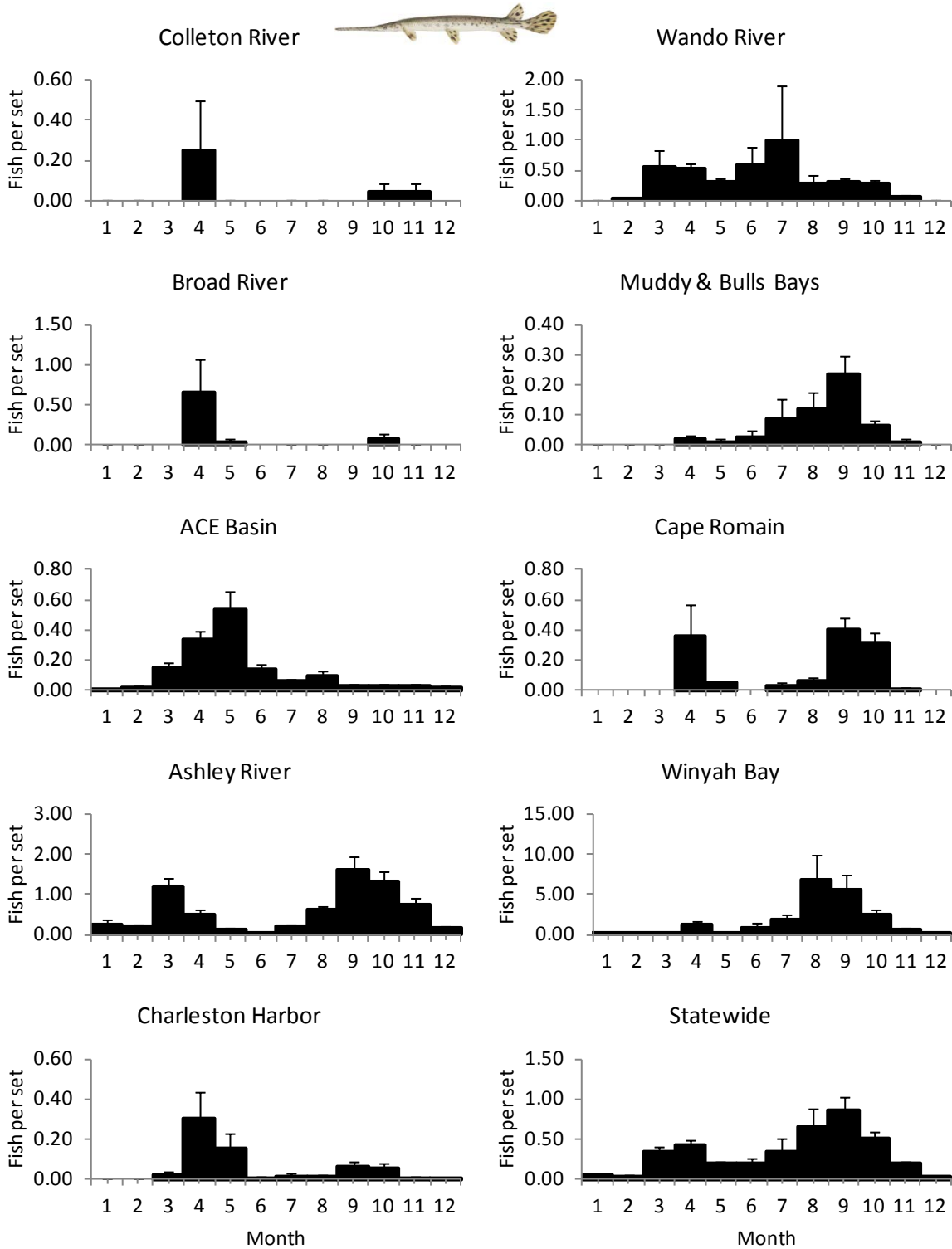
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

Longnose Gar belongs to a primitive family of fish. It occurs throughout the much of the state's freshwater bodies, but also inhabits estuarine areas. Although it is unpopular with anglers, it probably plays an important ecological role as a piscivorous predator.

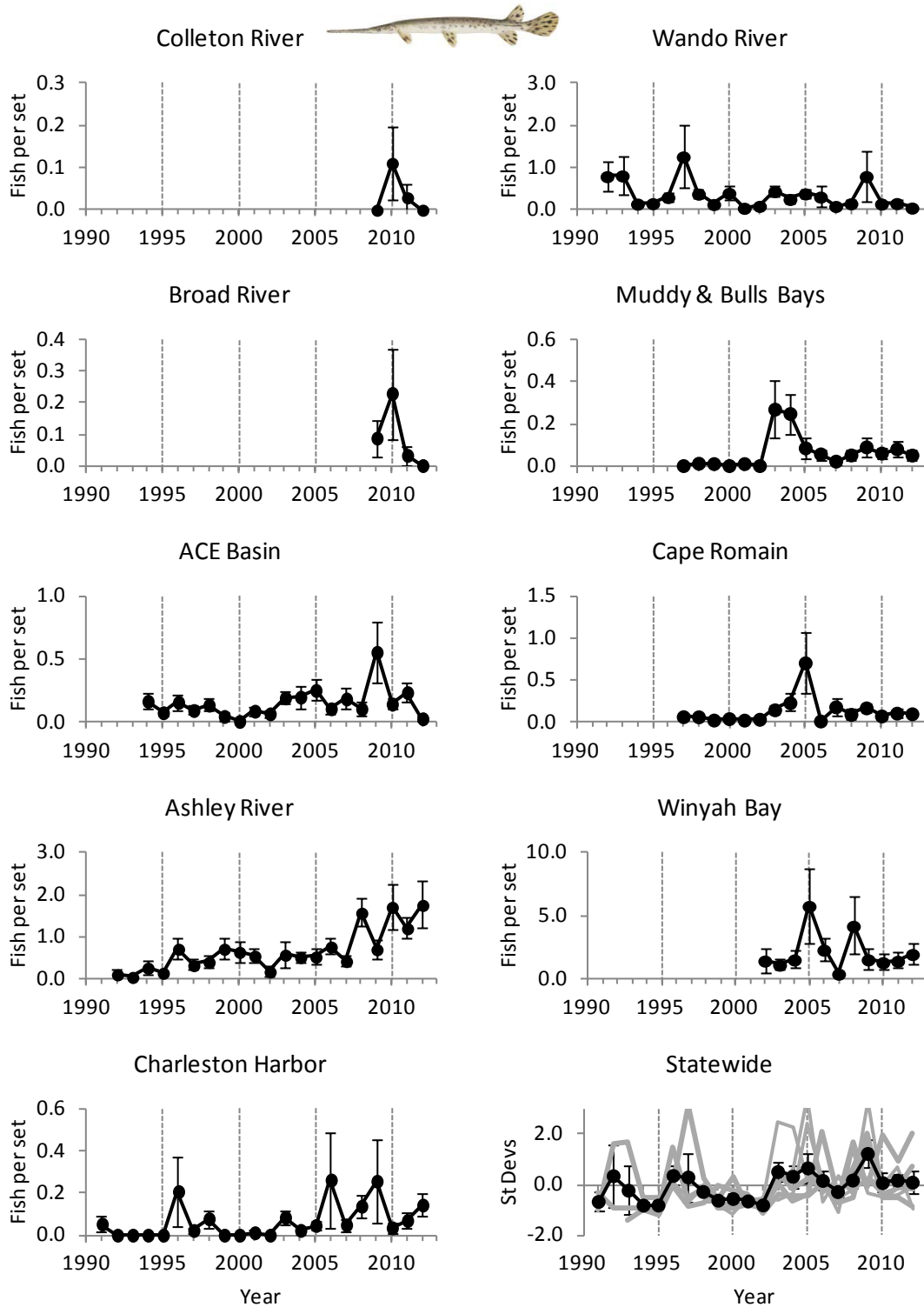
In the trammel net survey, Longnose Gar are more commonly caught in lower salinity areas such as the Ashley River and Winyah Bay. Peaks in abundance occur during spring and fall. Catches early in the year mostly comprise large fish of thirty inches or more, whereas catches later in the year contain a prominent cohort of smaller fish. Although catch rates have generally increased at a statewide level, the upward trend is mainly attributable to Charleston Harbor, Ashley River and ACE Basin, rather than the more northerly areas.

The electrofishing survey catches Longnose Gar in all of the areas surveyed, with numbers tending to be higher from April through September. There has been a slight downward trend at the statewide level, although there is high level of variability between areas.

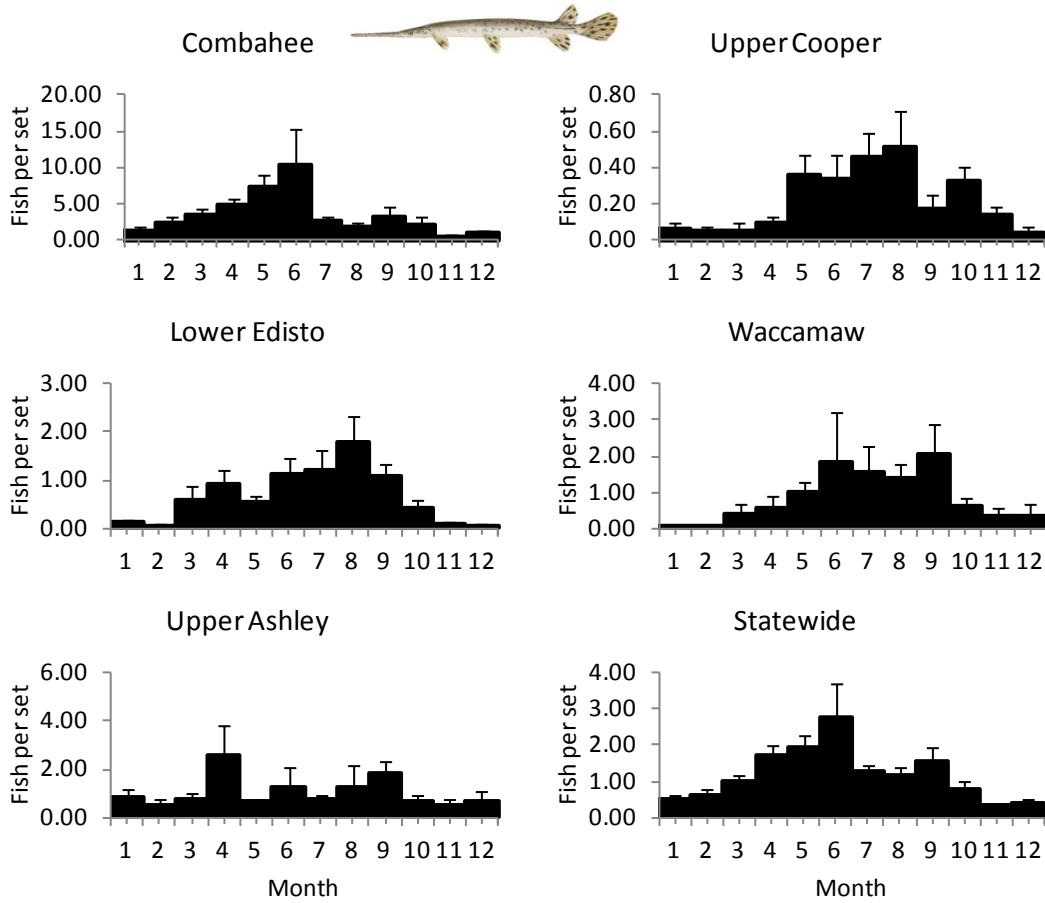
**Fig 2.79 Species:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



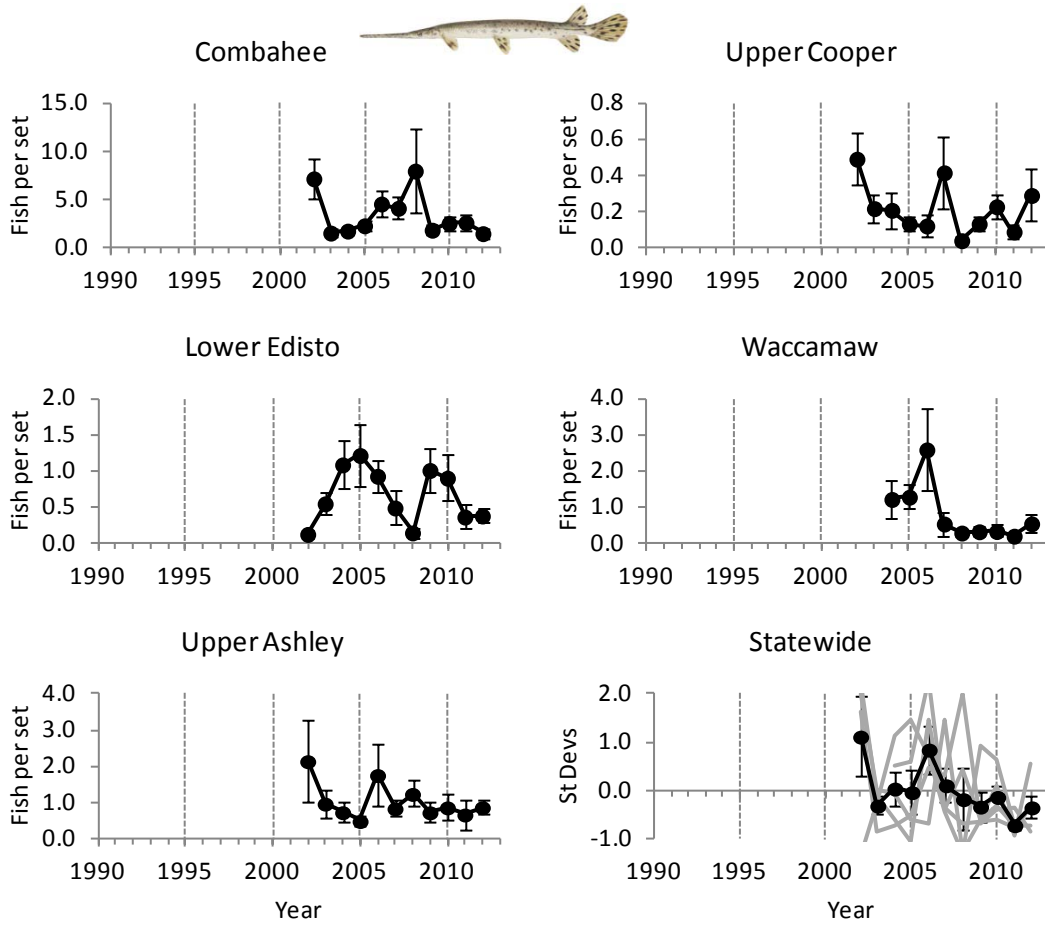
**Fig. 2.80 Longnose Gar:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Feb-Nov data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



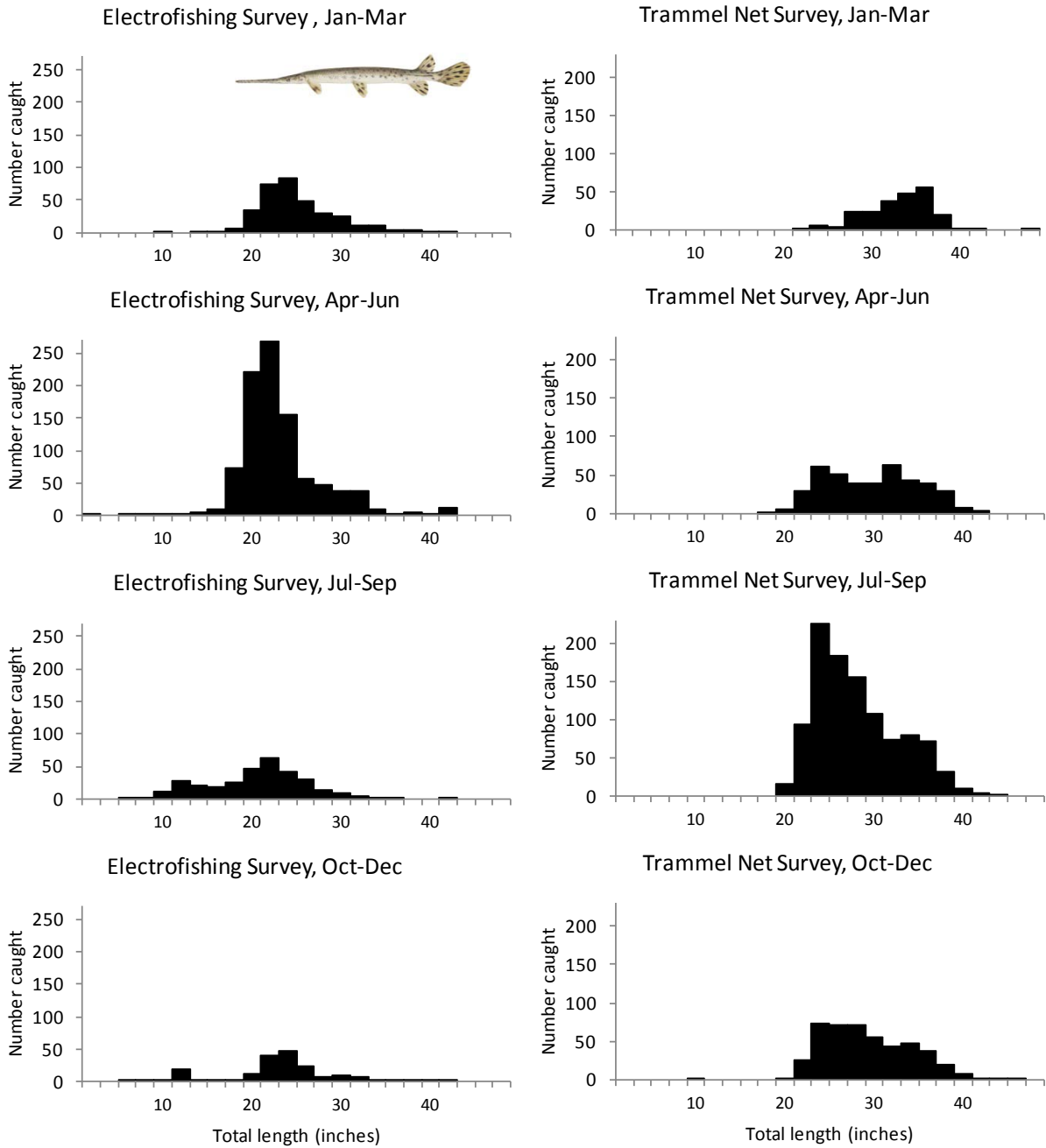
**Fig 2.81 Longnose Gar:** Monthly catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.82 Longnose Gar:** Annual catch rates of fish in the SCDNR electrofishing survey (average number of fish per set; Jan-Dec data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).

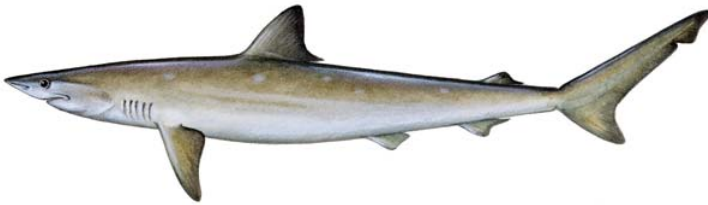


**Fig 2.83 Longnose Gar:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size or bag limit).



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**Common name:** Atlantic Sharpnose Shark  
**Scientific name:** *Rhizoprionodon terraenovae*  
**Family:** Carcharhinidae (Requiem sharks)



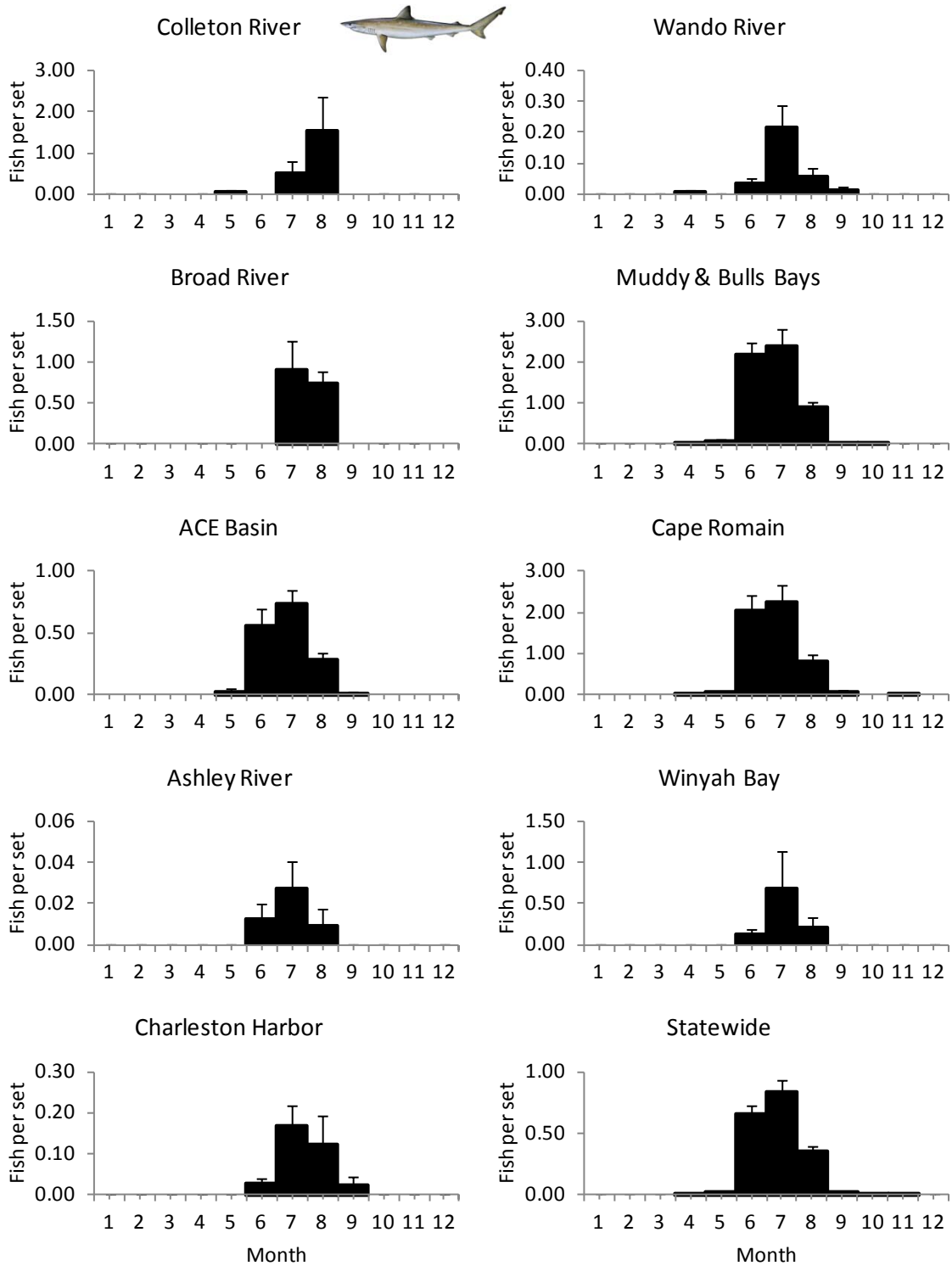
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

The Atlantic Sharpnose Shark inhabits the western Atlantic from New Brunswick, Canada through the Gulf of Mexico and south to the coast of Brazil. They prefer subtropical waters near the continental shelf and are found from the intertidal zone to depths of 920 feet (280 meters). They are able to tolerate a wide range of salinities.

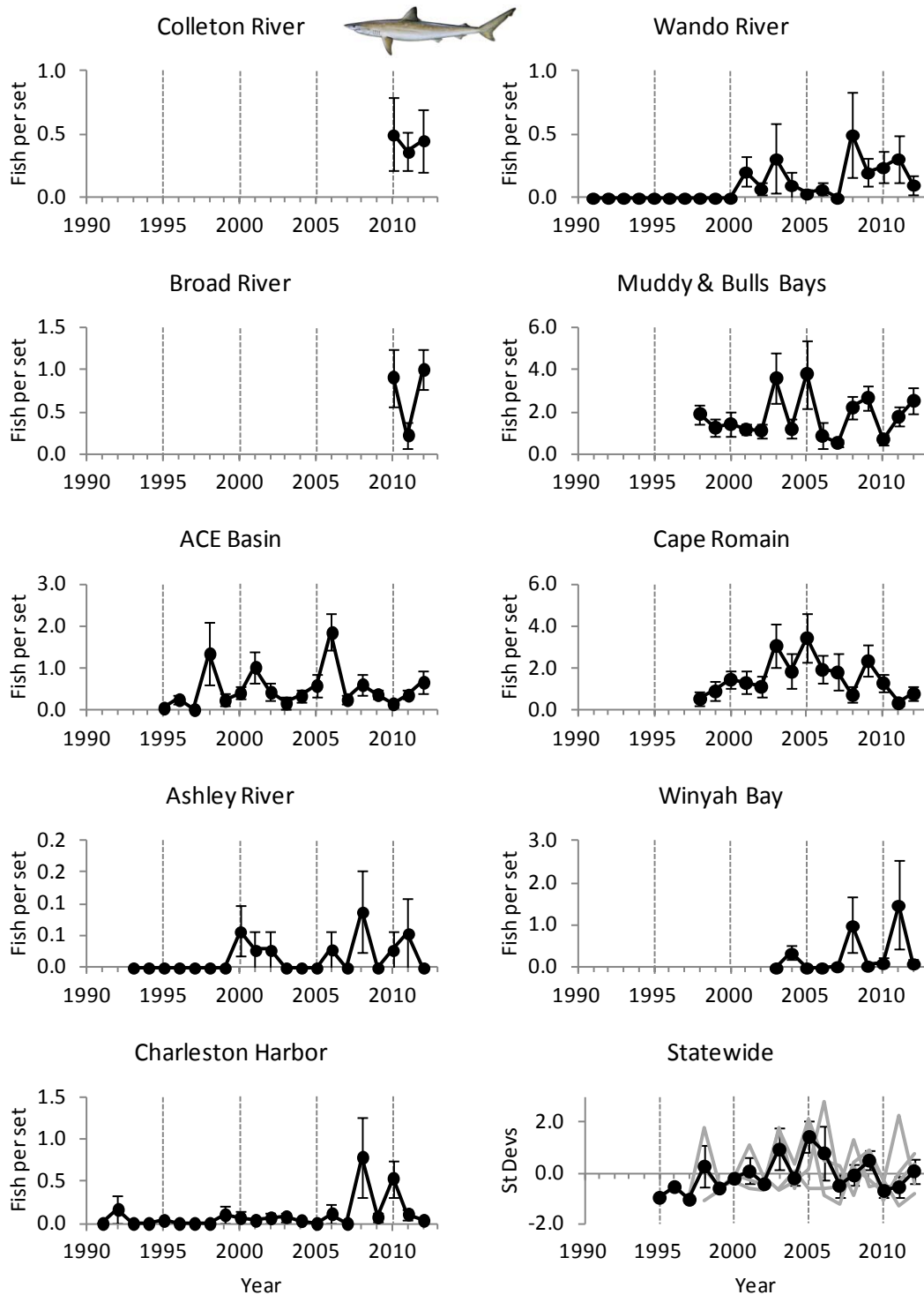
Atlantic Sharpnose Sharks are not caught by the electrofishing survey, but it is the most abundant of the shark species caught by the trammel net survey. It is mainly caught during July – August in higher salinity areas (Port Royal Sound, ACE Basin, Muddy Bay, Bulls Bay and Cape Romain), but its occurrence in other areas has increased in recent years, probably due to low rainfall and associated increases in salinity. Within the high salinity areas, catch rates generally increased between 1995 and 2005, but they have declined again since then.



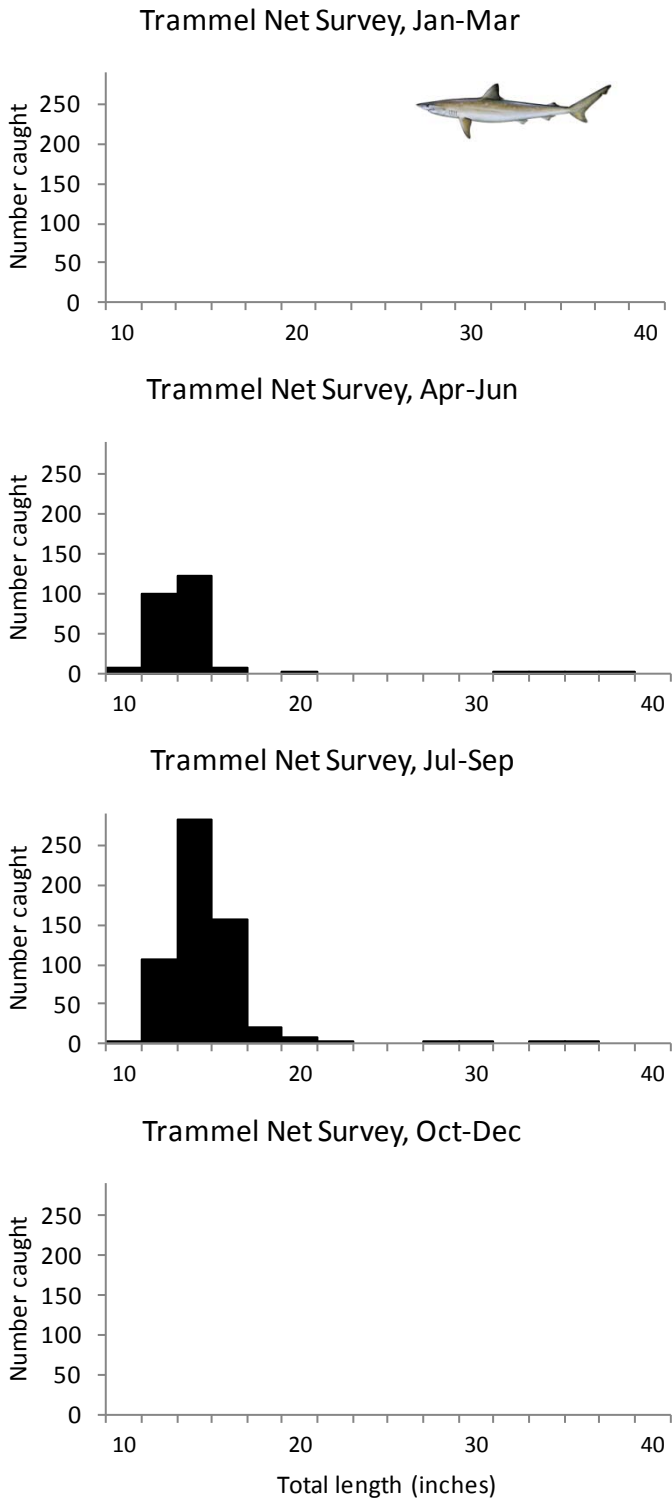
**Fig 2.84 Atlantic Sharpnose Shark:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.85 Atlantic Sharpnose Shark:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Jun-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Note that the statewide index was compiled from just ACE Basin, Muddy & Bulls Bay, and Cape Romain (due to low catch rates in other systems). Vertical bars represent standard error (a measure of precision).



**Fig 2.86 Atlantic Sharpnose Shark:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size limit, one per day).

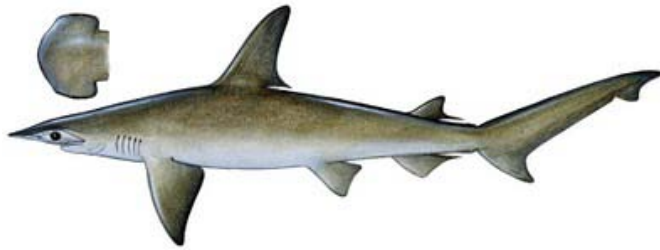


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**Common name:** Bonnethead

**Scientific name:** *Sphyrna tiburo*

**Family:** Sphyrnidae (Hammerhead, bonnethead, or scoophead sharks)



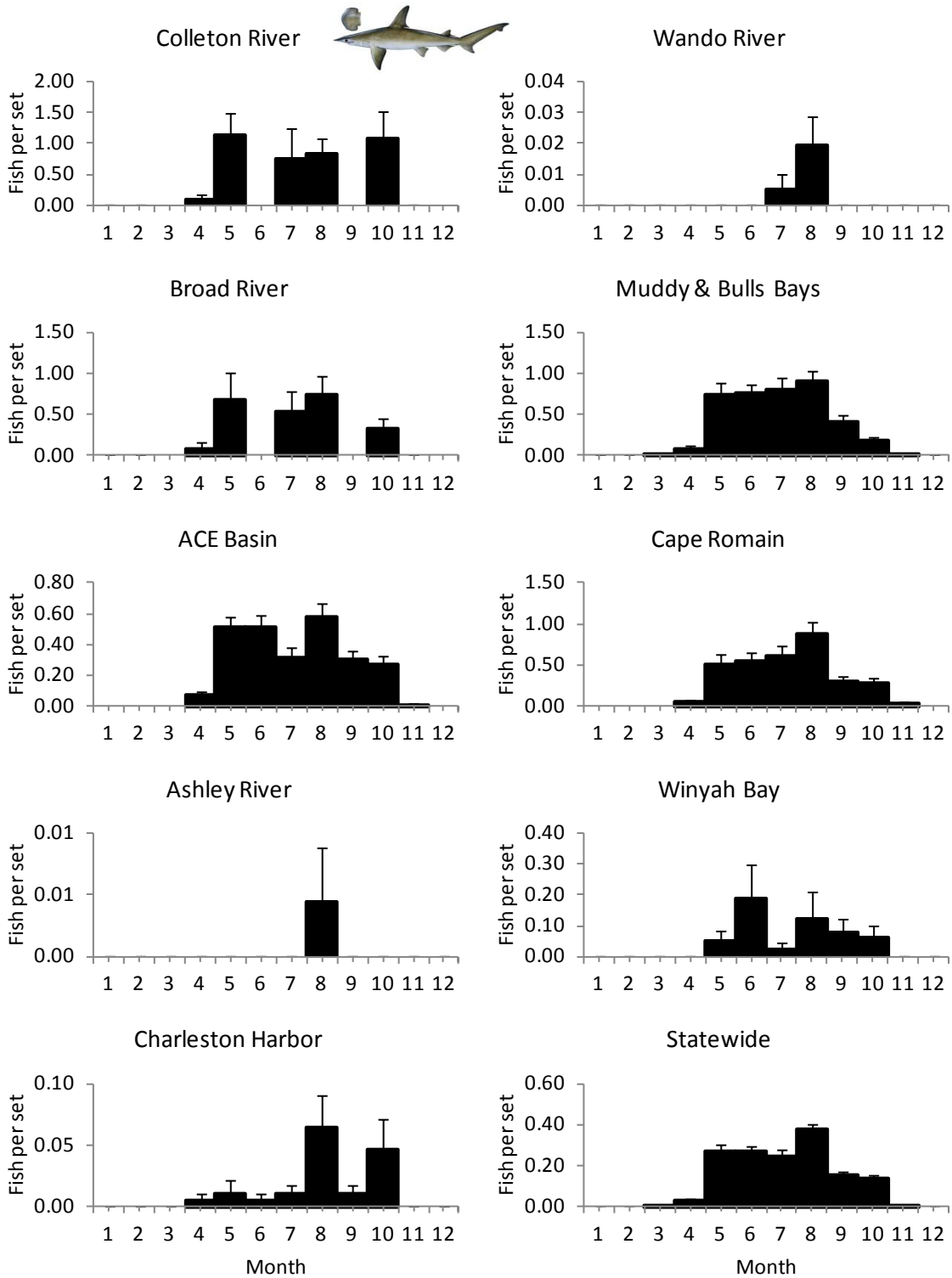
### **Occurrence in the Trammel Net & Electrofishing Surveys**

Bonnethead is limited to warm waters of the Northern Hemisphere, ranging in the western Atlantic from New England south to the Gulf of Mexico and Brazil. They are found in South Carolina inshore waters during the spring and summer months, when pupping occurs, and move further south during the winter. Management of Bonnethead in the U.S. has historically considered the Atlantic and Gulf of Mexico as a single stock, but this may change in future assessments because tagging has shown little movement between the two regions, and recent research at SCDNR has shown that they differ in life history characteristics. Females mature at around six years old and may live as long as eighteen years, whereas the smaller males mature at around four years and live for up to twelve years.

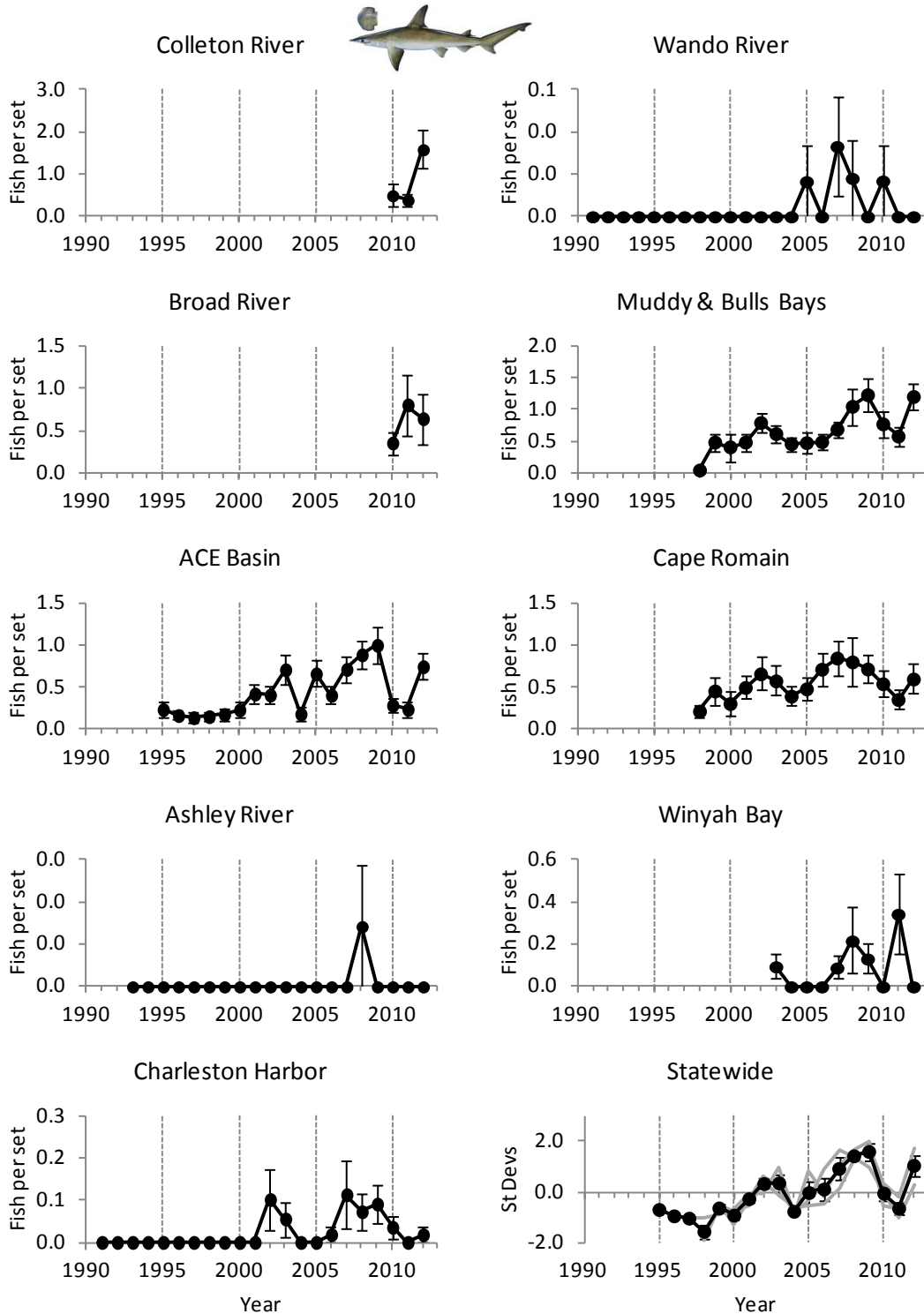
Bonnethead are not captured by the electrofishing survey, but they occur in the trammel net survey from March through November, with peak catch rates around August. Most of those caught are around forty inches long or more, but a small number of juveniles are also captured. The species is caught primarily in higher salinity areas (Port Royal Sound, ACE Basin, Muddy Bay, Bulls Bay and Cape Romain), but its occurrence in other areas has increased in recent years, probably due to low rainfall and associated increases in salinity.

In those areas where it is commonly encountered, catch rates of Bonnethead have increased since 2000, possibly associated with reductions of the species as bycatch in the shrimp trawl fishery. The data from the trammel net survey were used in the most recent stock assessment of Bonnethead, which was completed in 2012.

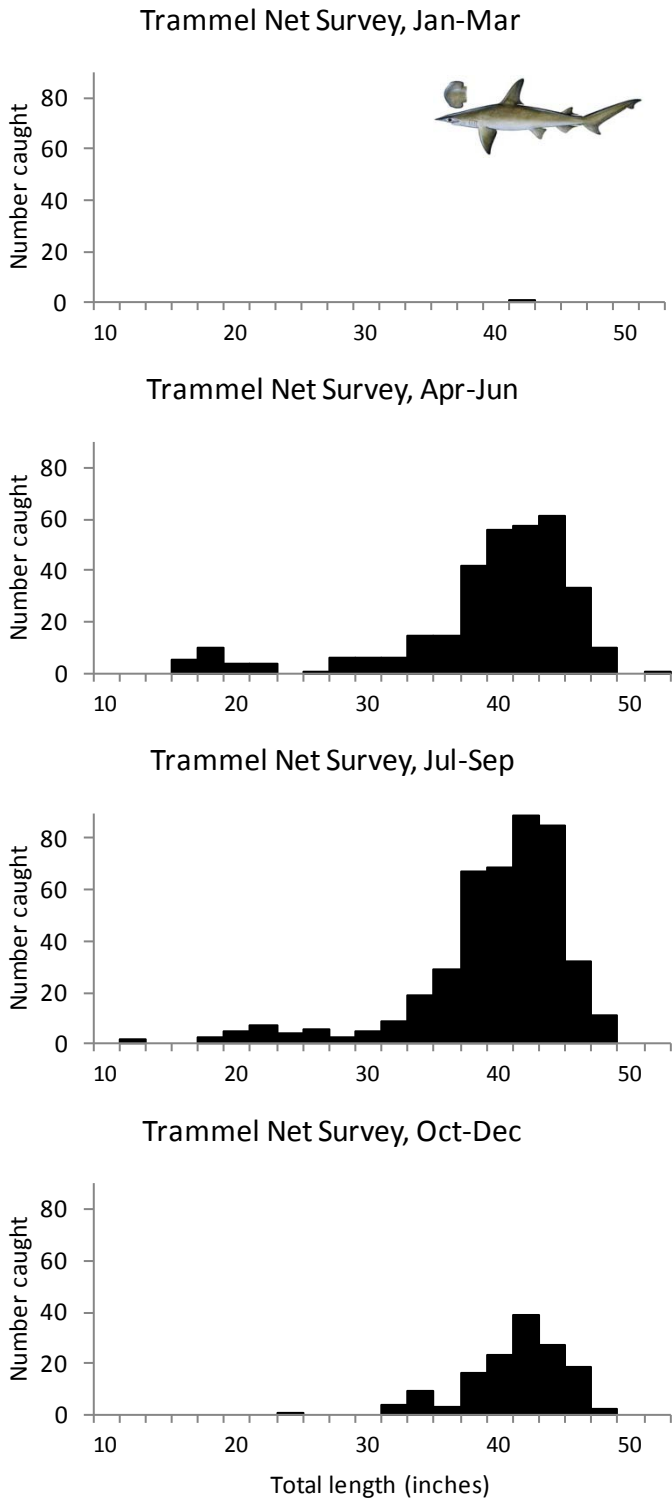
**Fig 2.87 Bonnethead:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.88 Bonnethead:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; May-Oct data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Note that the statewide index for Bonnethead was compiled from just ACE Basin, Muddy & Bulls Bay, and Cape Romain (due to low catch rates in other systems). Vertical bars represent standard error (a measure of precision).



**Fig 2.89 Bonnethead:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size limit, one per person day).



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**Common name:** Atlantic Stingray  
**Scientific name:** *Dasyatis sabina*  
**Family:** Dasyatidae (Stingrays)



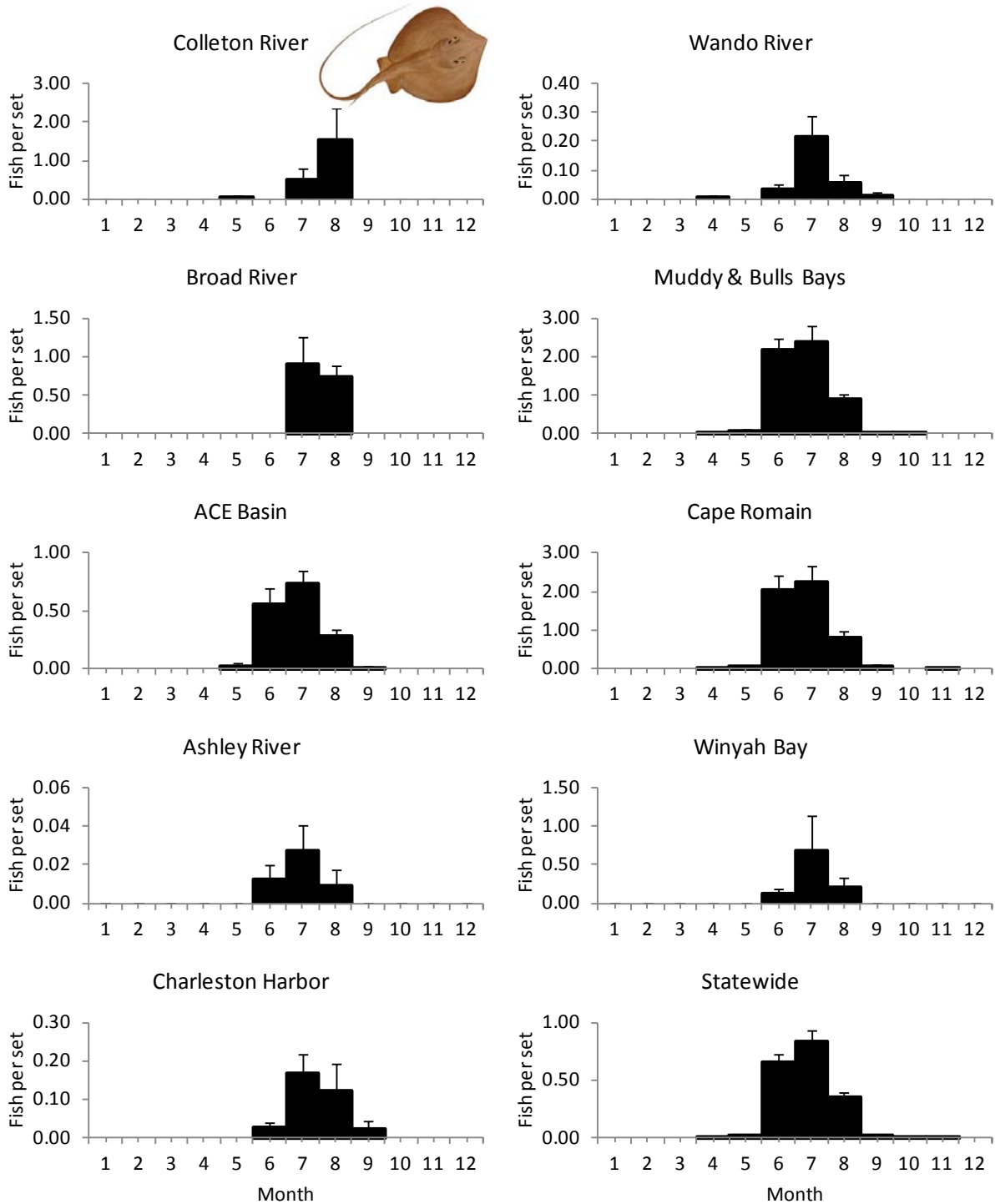
#### **Occurrence in the Trammel Net & Electrofishing Surveys**

Several species of rays occur in the waters of South Carolina, but the Atlantic Stingray is the most commonly encountered by the inshore surveys. The species occurs from Chesapeake Bay to Central America, moving either southward or into deeper waters during the colder winter months.

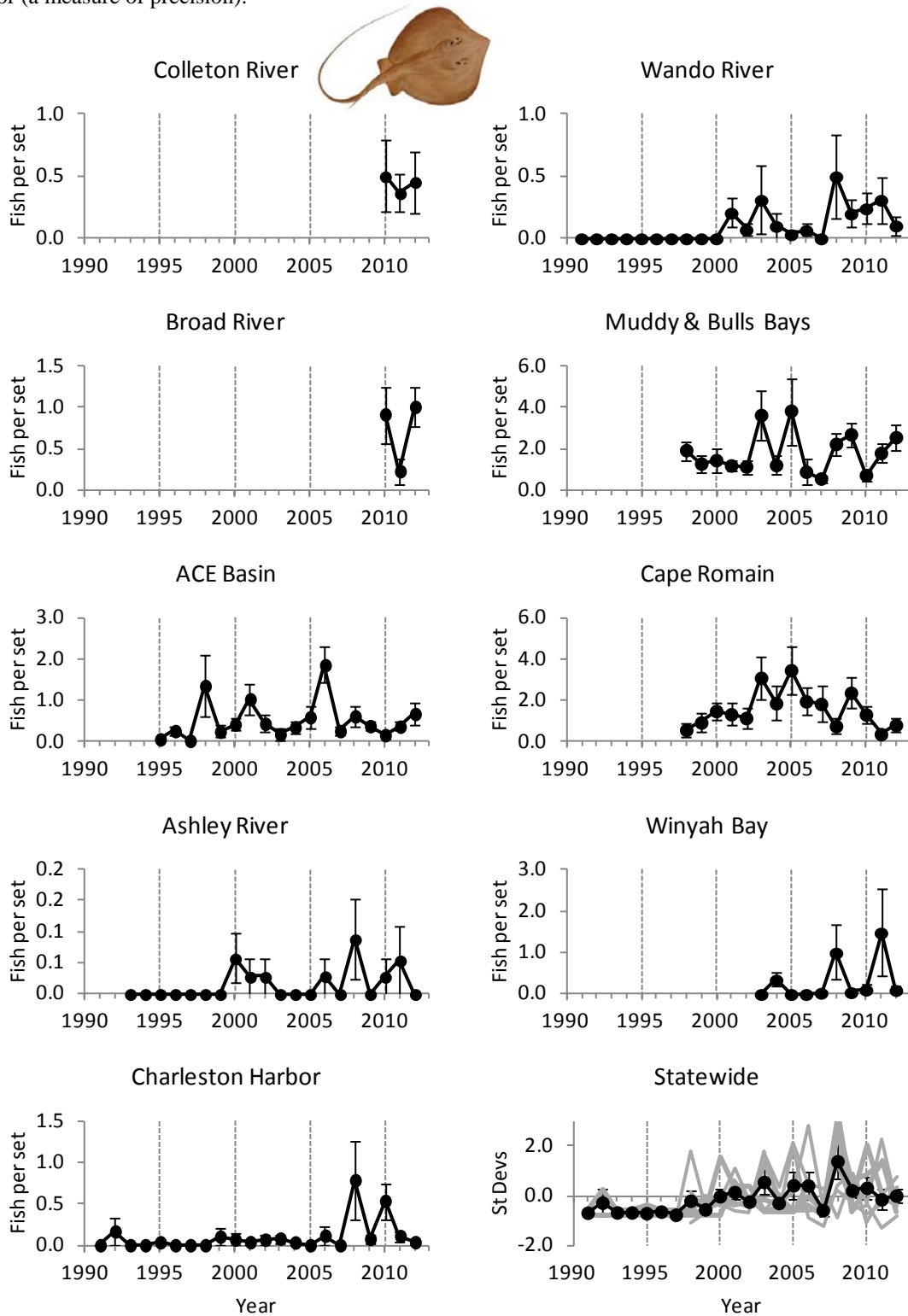
Atlantic Stingray is not typically caught by the electrofishing survey, but it is caught in all of the trammel net areas during the summer months. It is more prevalent in higher salinity areas, although it can tolerate low salinity conditions. Statewide, there has been a general increase in catch rates since the 1990s, but variation between areas is evident. Cape Romain, Muddy Bay and Bulls Bay have seen declines since 2005, whereas catch rates in the Ashley River, Wando River and Charleston Harbor have increased. Increases in the latter areas may be related to increasing salinities associated with low rainfall in recent years.



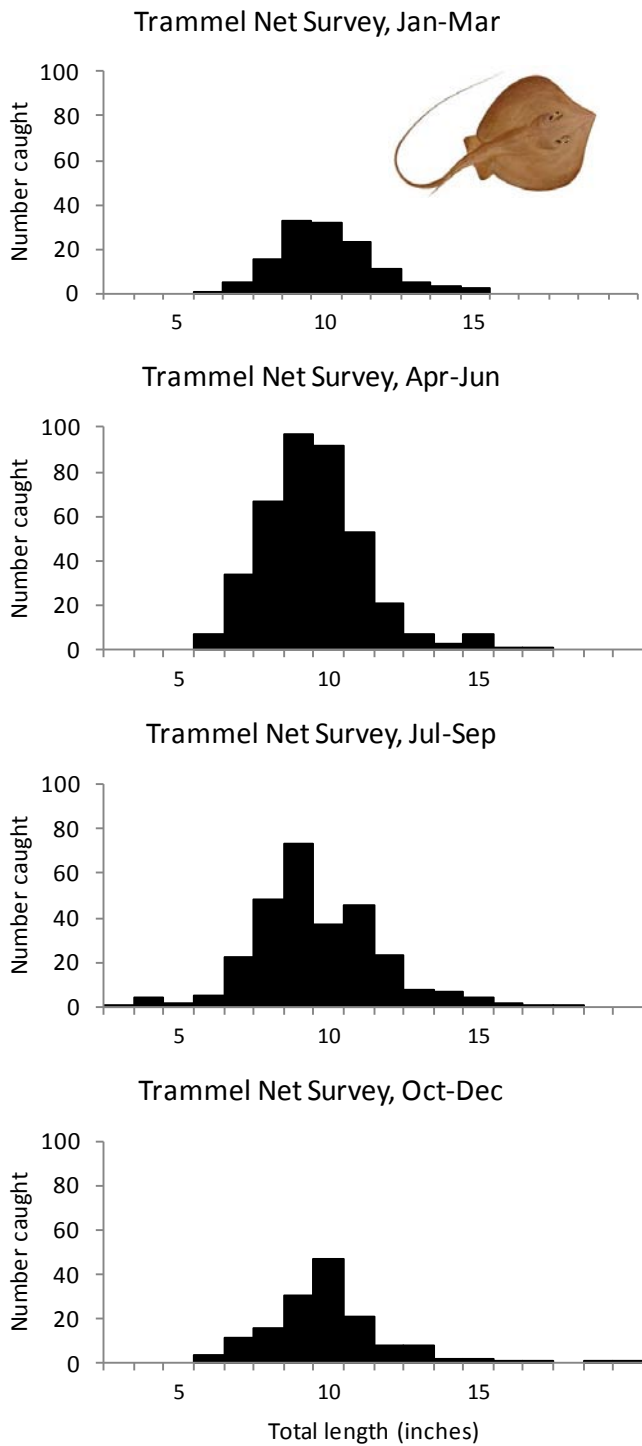
**Fig 2.90 Atlantic Stingray:** Monthly catch rates of fish in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.91 Atlantic Stingray:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; June - August data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.92 Atlantic Stingray:** Size-frequency distribution of fish caught in the SCDNR trammel net survey in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Black bars: legal size fish (2013 regulations: no size restriction or bag limit).



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**Common name:**       Horseshoe Crab  
**Scientific name:**    *Limulus polyphemus*  
**Family:**                Limulidae



#### **Occurrence in the Trammel Net & Electrofishing Surveys**

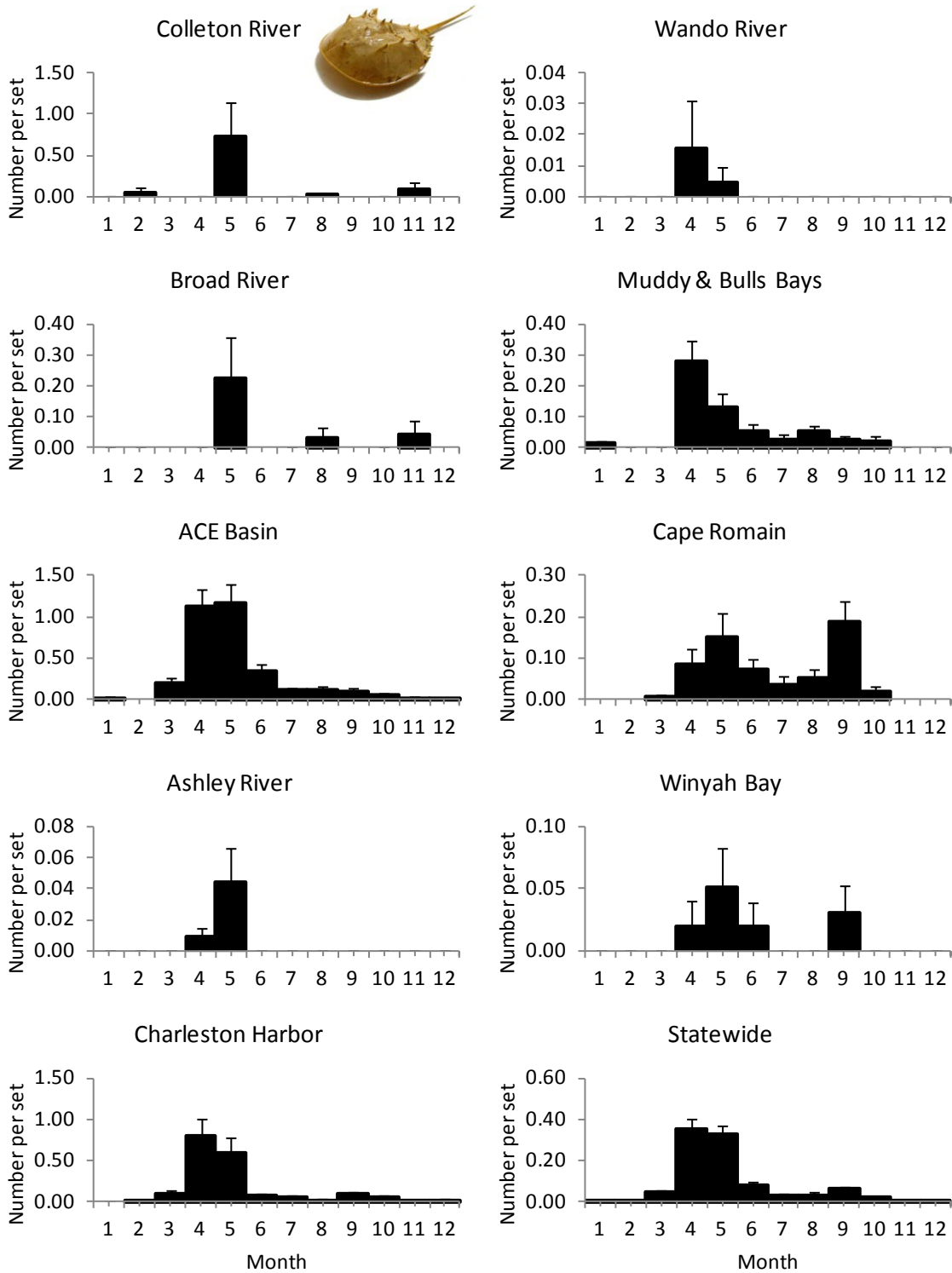
Horseshoe Crabs belong to an ancient group of animals related to spiders and scorpions. They are represented in fossils records dating back 450 million years.

The species lays its eggs on intertidal beaches during spring, which provide an important food source for numerous species of migratory shore birds. Horseshoe Crabs are also commercially valuable because a clotting agent in its blood is used for detecting microbial pathogens in medical supplies. Possession of Horseshoe Crabs has been prohibited in South Carolina since 1991, except with a special commercial license that allows animals to be collected, bled and then returned to the sea alive.

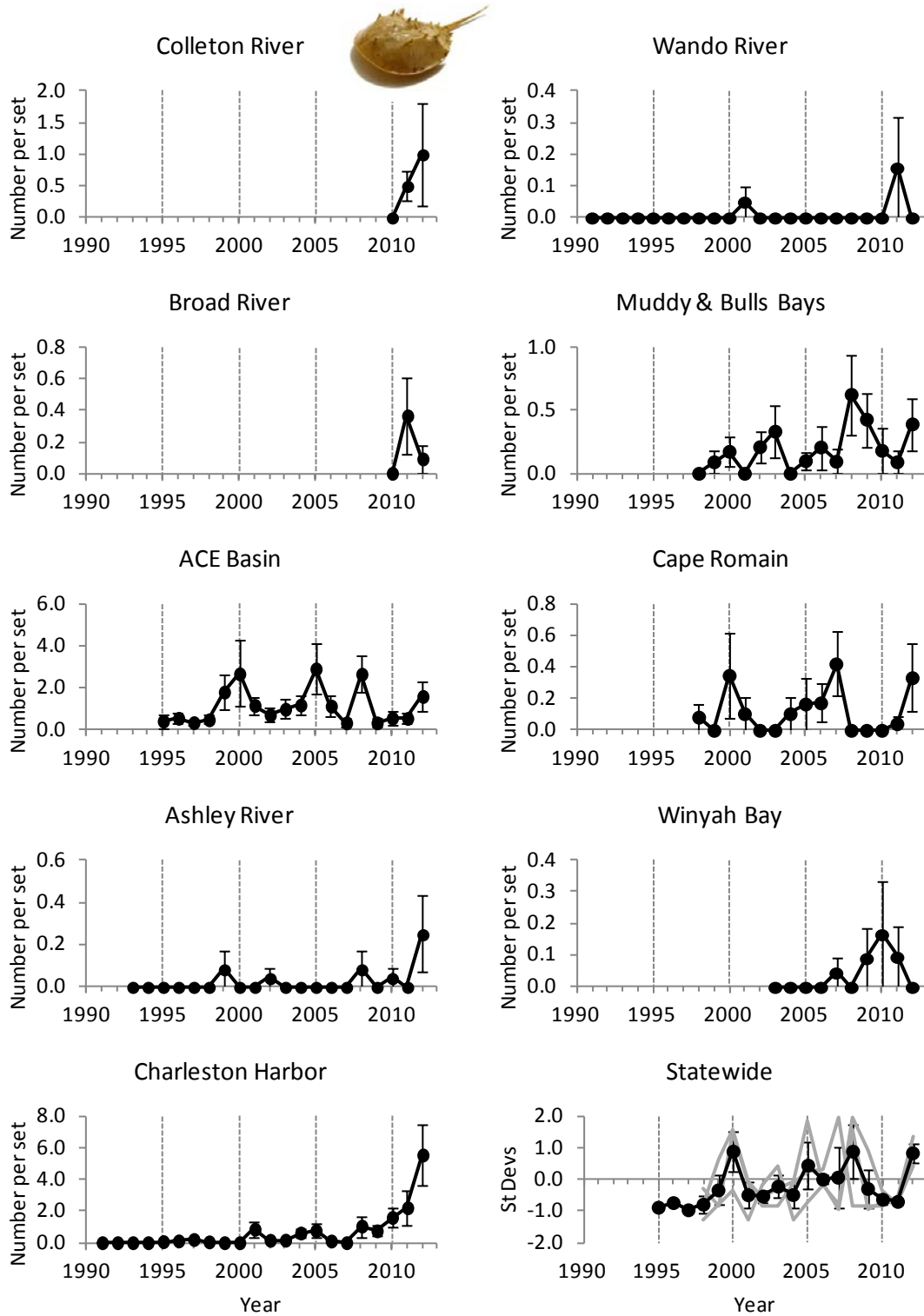
Horseshoe Crabs are not caught by the electrofishing survey, but they are commonly encountered by the trammel net survey in higher salinity areas, especially during the spring. Two main size cohorts are evident, with the smaller cohort comprising mainly males and the larger comprising females. Catch rates have oscillated since 1995, with a recent peak occurring in 2012.

Additional species information: <http://www.dnr.sc.gov/cwcs/pdf/Horseshoecrab.pdf>

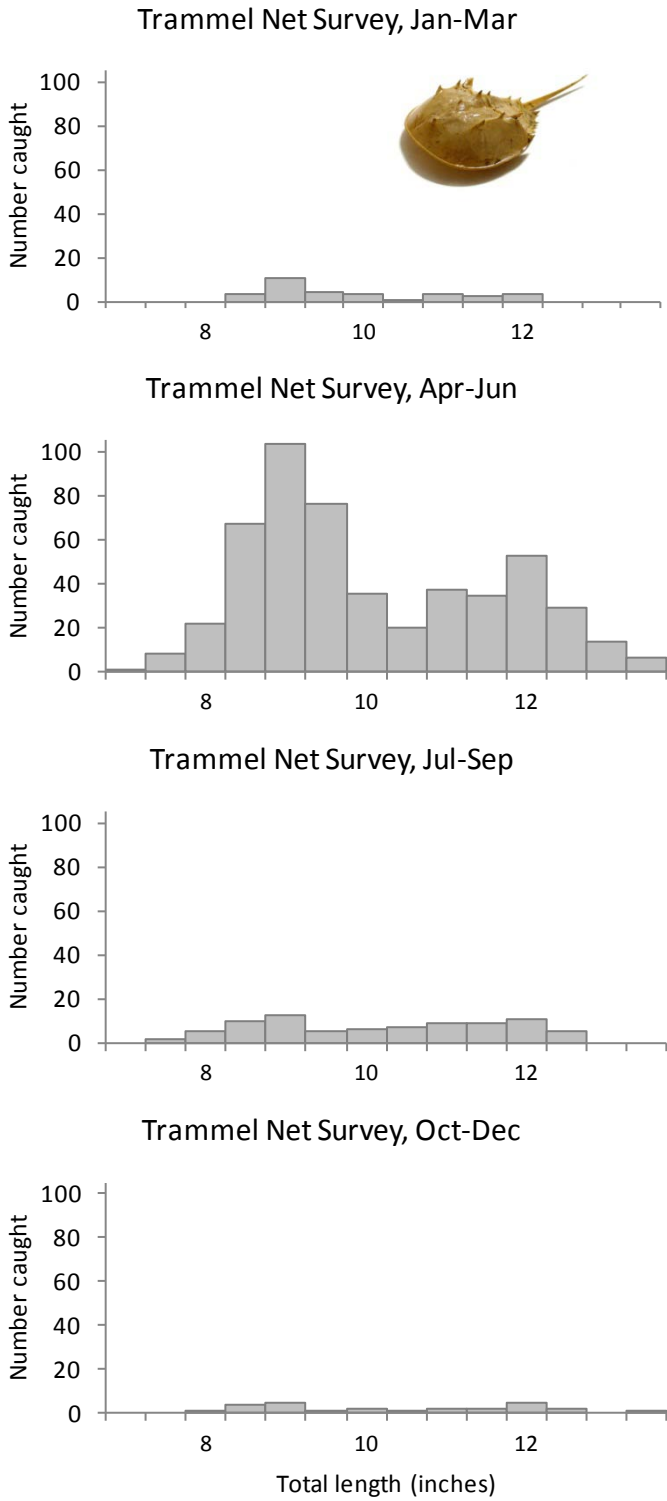
**Fig 2.93 Horseshoe Crab:** Monthly catch rates in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.94 Horseshoe Crab:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; April-May data pooled). The statewide index is derived using just the ACE Basin, Muddy & Bulls Bays, and Cape Romain areas, and is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision).



**Fig 2.95 Horseshoe Crab:** Size-frequency distribution of fish caught in the SCDNR electrofishing and trammel net surveys in different quarters of the year. Data have been pooled from all strata over the period 2008-2012. Gray bars: non-legal sizes (2013 regulations: no recreational harvest allowed).



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**Common name:** Diamondback Terrapin

**Scientific name:** *Malaclemys terrapin*

**Family:** Emydidae



#### **Occurrence in the Trammel Net & Electrofishing Surveys**

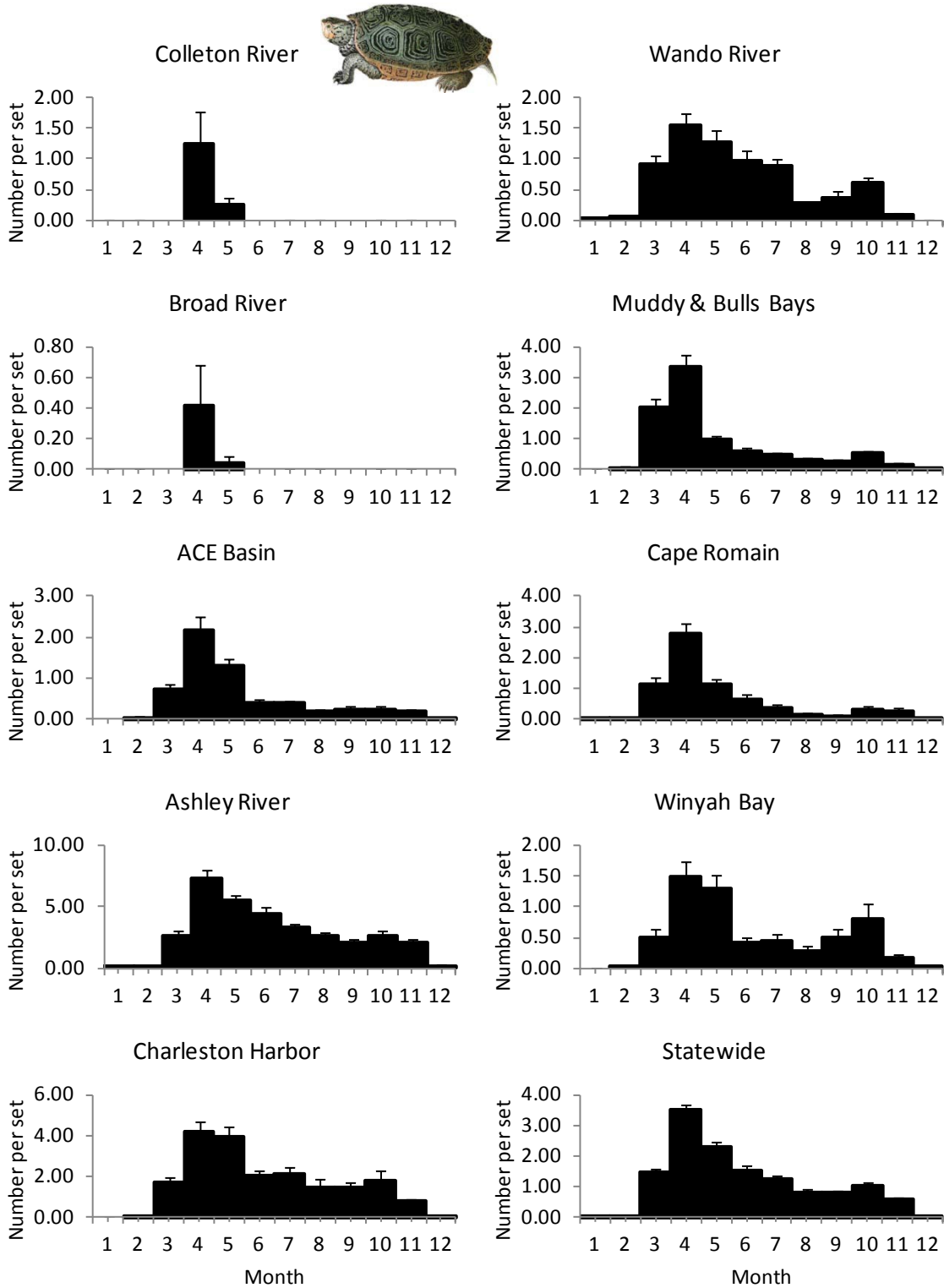
Diamondback terrapins are the only species of turtle in the family Emydidae that are found strictly in estuarine ecosystems. Historically, terrapins were considered a delicacy and highly sought after for turtle soup, leading to population declines throughout their range.

In the trammel net survey, capture rates tend to increase in the spring (March – May), and in some locations a small increase in the fall (October) also occurs. These seasonal peaks tend to correspond with the terrapin's breeding season, when individuals congregate. The cause of the decreased capture rates throughout the summer is unknown; however, it may partially be explained by female terrapins leaving to find suitable nesting areas, which can involve movements of up to 4 km. During the winter, diamondback terrapins hibernate in mud creeks and marshes, where they are unavailable to the trammel net gear.

Capture rates in the trammel net survey are highest in the Ashley River and Charleston Harbor. Statewide trends suggest a decline has occurred since 2005, although trends differed between areas. Catch rates in the Ashley River have remained fairly steady since 1995, whereas those in the Wando River, ACE Basin and Cape Romain have declined notably.



**Fig 2.96 Diamondback Terrapin:** Monthly catch rates in the SCDNR trammel net survey (average number of fish per set; data pooled across all years). Vertical bars represent standard error (a measure of precision).



**Fig. 2.97 Diamondback Terrapin:** Annual catch rates of fish in the SCDNR trammel net survey (average number of fish per set; Mar-Nov data pooled). The statewide index is expressed as standard deviations about the 10-year average (bottom right panel - gray: individual strata; black: all strata combined). Vertical bars represent standard error (a measure of precision). Note that terrapin catches were only recorded from 1995 onwards.

