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A SURVEY FOR THE GULF STURGEON IN THE MOBILE AND PERDIDO BASINS, ALABAMA

OPEN-FILE REPORT 0903

by
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of Conservation and Natural Resources

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CONTENTS

ILLUSTRATIONS

TABLES

A SURVEY FOR THE GULF STURGEON IN THE MOBILE AND PERDIDO BASINS, ALABAMA

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ABSTRACT

The Critical Habitat of the Gulf sturgeon *Acipenser oxyrinchus desotoi*, an anadromous species listed as threatened by the U.F. Fish and Wildlife Service and National Marine Fisheries Service, extends from the eastern half of Lake Pontchartrain and the Pearl River in Louisiana to the Suwannee River in Florida. The Mobile and Perdido Basins were excluded from the list of Critical Habitats due to a lack of recent data on sturgeon occurrence, movements, and spawning in Alabama waters. In 2005, the State Wildlife Grant office of the Wildlife and Freshwater Fisheries Division contracted the Geological Survey of Alabama to sonic tag Gulf sturgeon in coastal Alabama and monitor the movements into the Alabama and Tombigbee Rivers, compile information on recent Gulf sturgeon collections in state waters, collect Gulf sturgeon tissues for DNA analysis, and sample for Gulf sturgeon eggs in the lower Alabama and Tombigbee Rivers. Gulf sturgeon collections are rare in Alabama waters, so the time period covered by this report was expanded to include Gulf sturgeon and associated species data collected by the GSA, other government agencies, and anglers in the study area from 2000 to 2008. The collection database for this study includes records of 7,391 fishes representing 57 species and the palmetto bass (*Morone chrysops* x *M. saxatilis*) caught at 51 locations in the Mobile and Perdido Basins. We collected two Gulf sturgeons in Mobile Bay near Fairhope during this study and we compiled information on 19 Gulf sturgeons collected in coastal Alabama, 20 sonic tagged Gulf sturgeons detected between Mobile and Perdido Bays, and five Gulf sturgeons collected in the lower Alabama and Tombigbee Rivers. Gulf sturgeon eggs were not collected during the study, but we did document the first records of Atlantic needlefish *Strongylura marinus* eggs in the Alabama and Tombigbee Rivers. Analyses of five sets of Gulf sturgeon tissues collected in Alabama suggested two fish originated from Choctawhatchee Bay, Florida, one from Escambia Bay, Florida, and the remaining two came from the Pearl River in Louisiana.

INTRODUCTION

The Gulf sturgeon *Acipenser oxyrinchus desotoi* is a long-lived, anadromous species that spawns in freshwater rivers and spends the remainder of its time feeding on amphipods, lancelets, polychaetes, ghost shrimp, gastropods, crustaceans, and mollusks in marine and estuarine environments (Huff, 1975; Mason and Clugston, 1993; Carr and others, 1996; Fox and others, 2002). The freshwater spawning range of this "living fossil" (Bemis and Kynard, 1997) extends from Lake Pontchartrain and the Pearl River in Louisiana to the Suwannee River in Florida (Barkuloo, 1988; Chapman and others, 1997; Craft and others, 2001; Foster and Clugston, 1997; Fox and others, 2000; Heise and others, 2004). A few individuals have been reported from as far west as the Rio Grande River between Texas and Mexico and as far east as Florida Bay, Florida (Wooley and Crateau, 1985; Reynolds, 1993).

Gulf sturgeon abundance and distribution have been adversely affected over the past 100 years by several factors, including overfishing, the completion of high-lift hydroelectric and navigation dams which blocked migration routes to important upstream spawning habitats, the destruction of potential spawning habitats by long-term dredging operations to maintain authorized navigation channel depths, increased sedimentation from upland development, unnatural river discharges from peaking hydroelectric dams, and decreased in-stream water quality from domestic and industrial discharges (Mettee and others, 1996). Overfishing was the first and most devastating of these factors. Sturgeon fisheries, known as "boom and bust" industries, flourished and quickly disappeared in Alabama, Florida, and Mississippi following the 1902 harvest of 212,450 kilograms (kg) of Gulf sturgeon flesh valued at $13,662 and 5,048 kg of caviar valued at $5,836 (Alexander, 1905). These were the only records of Gulf sturgeon harvest included in U. S. Commission of Fish and Fisheries Reports from 1872 to 1979. The following excerpts from Alexander (1905) provide some interesting insights into the magnitude of Gulf sturgeon harvest in Alabama and Mississippi in 1902.

> *The fishery for sturgeon* [in Alabama], *in which much activity has been shown recently, is prosecuted from Mobile and vicinity, the product amounting to 100,000 pounds* (45,455 kg) *of sturgeon, valued at $3,930, and 5,000 pounds* (2,273 kg) *of caviar, valued at $2,000. The catch was obtained chiefly in the Mobile River by vessels and boats with gill nets.*

> *The capture of sturgeon in the fisheries of this state* [Mississippi] *is of recent date, none being taken in any previous year for which statistics are available. The great scarcity of this species in the northern sections of the country is no doubt leading to the development of the fishery along the gulf coast. Sturgeons are quite plentiful in Mississippi water, the Pascagoula being especially well stocked with them. The fishery is being prosecuted for a distance of 60 miles up this river by the use of gasoline launches. In 1902, a sturgeon was caught measuring 8 feet 10 inches in length and 4 feet 8 inches in diameter. It is said that one measuring 14 feet in length was killed in the Pascagoula River by a tug boat, three to four years ago, Its weight was estimated between 500 and 600 pounds* (227 and 273 kg).

Gulf sturgeon that escaped gill net capture in 1902 encountered a second major challenge when the U. S. Corps of Engineers (USCOE) began modifying Alabama's rivers to improve navigation between Mobile and inland ports at Tuscaloosa and Birmingham on the Black Warrior River and Selma and Montgomery on the Alabama River. The first series of 17 locks and dams, completed from 1896 to1915 as part of the Black Warrior-Tombigbee Waterway (BWT), probably didn't adversely affect Gulf sturgeon migration success because the 2.8- to 3.4-meter-high spillways were routinely submerged by winter floods and most of the dams had fish ladders constructed along their outer lock walls (Mettee and others, 1987). Access to upstream spawning habitats completely changed from 1939 to 1969 when the USCOE began replacing existing low-lift dams with fewer, higher lift dams to reduce barge travel time between Mobile and inland ports. Coffeeville, Demopolis, Seldon, Oliver, and Holt Locks and Dams replaced Locks 1 through 16. Spill gates and a hydroelectric generating facility were added to Lock and Dam 17 and the name of this facility was changed to Bankhead Lock and Dam. The Alabama, Cahaba, and lower sections of the Coosa and Tallapoosa Rivers provided free-flowing access to spawning habitat for Gulf sturgeon and other migratory species until Claiborne, Millers Ferry, and R.F. Henry Locks and Dams were completed in the late 1960s and early 1970s.

Four Gulf sturgeon records exist from the Black Warrior River. Three fish collected at the downstream end of Tuscaloosa Shoals near Tuscaloosa in April and May included a 91-kg specimen caught in 1872, a 96-kg specimen landed in 1889, and a 46-kg specimen caught in 1897 (Jim Ezell, 2008, personal communication). A 61-kg fish was caught in the Black Warrior

River near Eutaw, Alabama, in 1894. Gulf sturgeons probably spawned in the Alabama River and lower reaches of the Cahaba, Coosa, and Tallapoosa Rivers as late as the 1940s. The November 8, 1984, edition of *The Centreville Press* republished an earlier article that detailed the capture of a 164-kg Gulf sturgeon on a trotline in the Cahaba River at Centreville on April 23, 1941. John P. Kennedy, one of the anglers that landed the fish, related his father told him of catching 27 Gulf sturgeons weighing from 140 and 386 kg in a fish trap in the Cahaba River years earlier. Most were so heavy they had to be dragged from the river with a team of mules. The sizes of these fish may be debatable, but landing 27 fish suggests the Fall Line section of the Cahaba River probably provided an important Gulf sturgeon spawning habitat in the late 1800s.

The May 1940 issue of the *Alabama Game and Fish News* contained a photo and article that described the recent landing of a 160-kg Gulf sturgeon about a mile downstream of Wetumpka in the Coosa River. It also mentioned many large sturgeons had been landed in the Alabama River in previous years. The Elmore County Historical Society is a treasure for old Gulf sturgeon photos, including one of a 182-kg fish taken from the Coosa River near Coopers in 1924 and several others showing 91- to 182-kg fish caught in the lower Tallapoosa River in the 1920s and 1930s. These and other records not included herein suggest that Gulf sturgeon routinely spawned in downstream sections of the Alabama, Black Warrior, Cahaba, Coosa, and Tallapoosa Rivers as late as the 1940s. Recent information from Dr. Ken Sulak (2008, personal communication) indicates these Alabama specimens may be the largest Gulf sturgeon ever collected throughout the species range and their collection locations may be the most upstream collection records for the species. No Gulf sturgeons have been reported from the upper Alabama, Cahaba, Coosa, and Tallapoosa Rivers since Claiborne, Millers Ferry, and R.F. Henry Locks and Dams were completed.

Gulf sturgeons still spawn in Alabama sections of the Choctawhatchee, Yellow and Escambia Rivers (Fox and others, 2000; Frank Parauka, 2006, personal communication). Recent anecdotal records also exist from the Alabama River below Claiborne Lock and Dam, Tombigbee River below Coffeeville Lock and Dam, Tensaw and Blakeley Rivers above the Mobile Causeway, Fish River tributary to Weeks Bay, and the Gulf of Mexico near Gulf Shores and Bayou La Batre (Hastings and Parauka, 2004).

The Gulf sturgeon was listed as a threatened species by the U. S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) in 1991. Collection and

possession of all sturgeon species are prohibited in Alabama by the Wildlife and Freshwater Fisheries Division (WFFD) Rules and Regulations of the Alabama Department of Conservation and Natural Resources (ADCNR). The Gulf sturgeon was listed as a Priority 2 (High Conservation Concern) species in Alabama by Mirarchi and others (2004), an endangered species in Mississippi by Ross (2001), and a threatened species in the United States by Jelks and others (2008).

The USFWS and NMFS designated Critical Habitat for the Gulf sturgeon in 1993. The Pearl, Pascagoula, Escambia, Yellow, Choctawhatchee, Apalachicola, and Suwannee Rivers and their adjoining bays (fig. 1), were identified as Critical Habitat because they provide important freshwater spawning habitats for the species. Several coastal regions and near-shore areas along the northern Gulf of Mexico were also included because they provide important staging and feeding grounds for the species. These areas include the eastern half of Lake Pontchartrain, Mississippi Sound in eastern Louisiana and Mississippi, coastal Gulf of Mexico areas from the Alabama-Florida State Line to east of Apalachicola Bay, and a section of Gulf of Mexico coastal beach on either side of the Suwannee River. Several areas where Gulf sturgeons have been previously collected were not identified as Critical Habitat because insufficient data were available to conclude these areas were essential to the conservation and future survival of the species. Areas excluded from the Critical Habitat list included Mobile Bay, the Alabama and

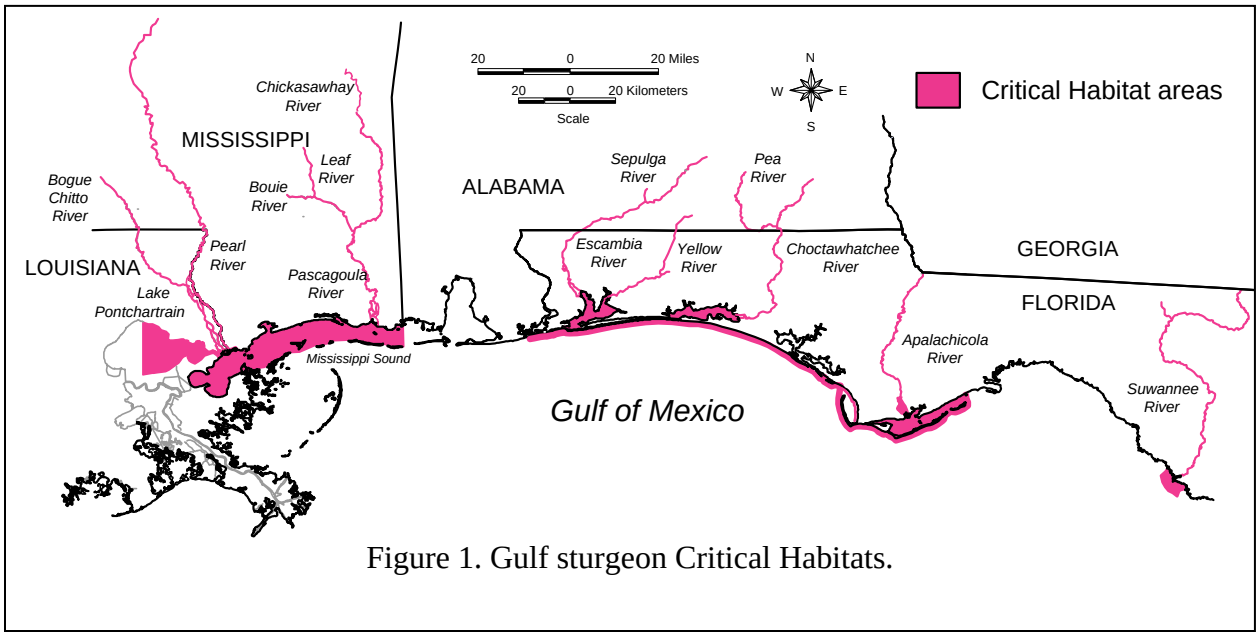

Figure 1. Gulf sturgeon Critical Habitats.

Tombigbee Rivers, Murder Creek (Escambia River tributary in Alabama), Perdido Bay, and the Perdido River.

In 2005, the State Wildlife Grant office of WFFD contracted the Geological Survey of Alabama (GSA) to conduct a status survey of the Gulf sturgeon in the Mobile and Perdido Basins. The major goals of this study were to sonic tag Gulf sturgeon in coastal areas of Alabama and monitor their upstream movements into the Alabama and Tombigbee Rivers, compile information on recent Gulf sturgeon collections in Alabama, collect Gulf sturgeon fin tissues for DNA analysis at the University of Southern Mississippi, and collect Gulf sturgeon eggs in potential spawning habitats in the lower Alabama and Tombigbee Rivers. Gulf sturgeon collections are rare in Alabama waters, so the time period covered by this report was expanded to include Gulf sturgeon and associated species data collected by the GSA, other government agencies, and anglers in the study area from 2000 to 2008.

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We thank Jim McHugh, State Wildlife Grant Coordinator, for the WFFD of the Alabama Department of Conservation and Natural Resources and Dr. Berry H. (Nick) Tew, State Geologist at the GSA, for funding this cooperative study. Several individuals and agencies worked diligently during the field sampling phase of this work, including Anne Wynn, Justin Bagley, and W. Everett Smith (retired) (GSA); Dave Armstrong, Kevin Bryars, Mike Holley, Jerry Moss, Travis Powell, Tom Ringenberg, Steve Rider, Ben Ricks, and Ken Weathers (WFFD), and Frank Parauka, Bob Jarvis (retired), and Jeff Powell (USFWS). Gulf sturgeon collection records were supplied by Jim Ezell (Tuscaloosa, Alabama), John Mariska and Trey Posey (Alabama Marine Resources Division (AMRD)), and Matthew Ajemian (Dauphin Island Sea Lab). We thank Dave Armstrong (WFFD) for storing the GSA deck boat at the WFFD Spanish Fort office and Glenn Kornegay, John Mariska, and Vern Menton (AMRD) for field oversight during gill netting operations in Alabama's coastal areas. John Knight and Dick Krause (Florida Fish and Wildlife Conservation Commission) served as state resource contacts during gill netting operations in Perdido River and Bay. Darrell Synder (Larval Fish Laboratory at Colorado State University) identified Atlantic needlefish eggs from our 2006 samples and confirmed our unsuccessful efforts to collect Gulf sturgeon eggs. Ms. Patricia Kelley (USFWS) supplied a list of references from the USFWS Gulf sturgeon Critical Habitat proposal. We would

also like to acknowledge the contributions of several GSA staff members whose constructive comments improved the quality of this report.

STUDY AREA

The study area includes the Mobile and Perdido Basins (fig. 2). The Mobile Basin section included Mobile Bay, the 2,486 square kilometer (km^2) Mobile-Tensaw River Delta (MTRD)(shaded area in fig. 2), 224 km of the Alabama River from Millers Ferry Lock and Dam its junction with the Tombigbee River, and 113 km of the Tombigbee River from Coffeeville Lock and Dam to its junction with the Alabama River. The Perdido Basin included Alabama sections of Perdido Bay, Perdido, Blackwater and Styx Rivers, and several smaller tributaries that collectively drain about 2,178 km^2 west and north of the Alabama-Florida State Line.

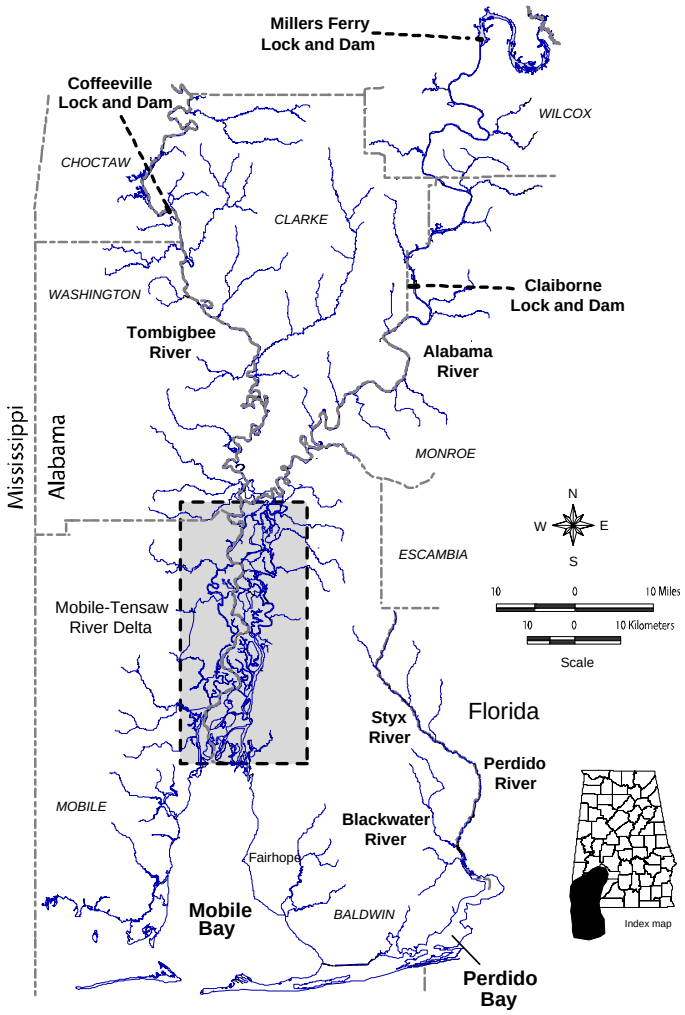

Figure 2. The study area.

The Mobile Basin drains about 113,960 km^2 in Alabama, Georgia, Mississippi, and Tennessee. Two-thirds of the drainage area is located within Alabama. The average daily discharge of the Mobile Basin, 0.016 cubic meters per second per square kilometer (cms/km^2), is larger than either the Mississippi Basin (0.006 cms/km^2) or the Columbia Basin (0.012 cms/km^2). About 47 percent of the Mobile Basin discharge is contributed by the Tombigbee River and 52 percent is contributed by the Alabama River (O'Neil and Mettee, 2008). This sustained discharge, flowing through 123,893 km of rivers and stream, was an important factor in the development and longevity of Alabama's rich fish fauna.

Coffeeville Lock and Dam, located at Tombigbee River kilometer (TRK) 116, includes a 34 meter (m)-wide x 185 m-long lock chamber and a combination gated spillway consisting of eight 19-m spill gates and a 197 m-long crested spillway. Claiborne Lock and Dam, located at Alabama River kilometer (ARK) 116, has a 26 m-wide x 185 m-long lock chamber and a combination gated spillway containing six 19-m spill gates and a 154 m-long crested spillway. Millers Ferry Lock and Dam, located at ARK 214, includes a 26 m-wide x 185 m-long lock chamber and a gated spillway containing seventeen 15-m spill gates. A hydroelectric powerhouse, containing three 25,000 kilowatt generating units, is located about 405 m downstream of the lock and dam on the east bank of the river. Hydroelectric generation capacity is directly influenced by the discharge of the Alabama River. Increased generation capacity occurs from November through March when the river is in flood stage. Much smaller generation capacity, sometimes restricted to only four to six hours per day, occurs from May through October when river levels are lowest.

METHODS

GILL NETTING AND BOAT ELECTROFISHING EFFORTS

Fish samples were collected with monofilament and multifilament sinking and floating gill nets that were 46 to 62 m long, 2.5 to 6.1 m high, and had a 5.1- to 12.0-centimeter (cm) bar measure mesh. Sinking gill nets had a foamcore float line and a #30 lead core line. Floating gill nets had either a foamcore float line or single #5 floats spaced at about 2-m intervals along a float line and small amounts of lead weight spaced along the bottom line to keep the net vertical in the water column but not sink either the foamcore line or individual floats. Sinking gill nets were fished for 2 to 8 hours and collected fishes were removed at 1- to 2-hour intervals. Fishes

were removed from floating nets as soon as they were detected. Non-target fishes were identified, tabulated, and immediately released.

Each Gulf sturgeon collected was measured and weighed, and the area near the dorsal fin base on both sides of the body was examined and scanned to detect previously inserted pit tags. A Betadine-soaked Sonotronics ultrasonic tag (Model CT-82-3) having an advertised 48-month operating life was surgically implanted into the abdominal cavity through a 3.0- to 4.0-cm-long incision made near the ventral midline. The incision was sutured and the area was treated with Betadine. A numbered anchor tag (Floy FM-95W) was inserted through each pectoral fin and pelvic fin near its base. Each sturgeon was placed in a livewell and observed for several minutes to ensure recovery before release.

Efforts to detect sonic-tagged fish were completed with a Sonotronics DH-2 directional hydrophone and USR-5W sonic receiver. During each tracking trip, the boat was stopped at about 600-m intervals, the directional hydrophone was lowered into the water, and two or three 360° sweeps were completed to detect the 69 to 83 kilohertz (kHz) sonic tags used during the study. If a tagged fish was detected, its precise location was determined and georeferenced when the sonic signal was equally audible in all directions.

FIN TISSUE ANALYSIS

A small section of tissue was removed from each pectoral fin of each sturgeon collected and placed in a scintillation vial containing buffered preservative. Scintillation vials and collection data were sent to Dr. Brian Kreiser at the University of Southern Mississippi for DNA analysis.

Total genomic DNA was extracted from each fin tissue with the DNeasy Tissue Kit (QIAGEN, Inc., Valencia, CA), and the individual was genotyped for eight microsatellite loci using the methods described in Dugo and others (2004). Microsatellite alleles were visualized on acrylamide gels with LICOR 4300 DNA sequencer and scored using Gene Image IR v. 3.55 (LICOR Co.). An assignment test was conducted using GENALEX v. 6.1 (Peakall and Smouse 2005) where each individual was considered to be of unknown origin. Baseline data for this assignment test were described in Dugo and others (2004).

WATER-QUALITY SAMPLING

Water-quality data were collected at many fish and egg sampling sites during the study. Water temperature (degrees Centigrade (°C)), dissolved oxygen (milligrams per Liter (mg/L)), pH, specific conductance (microsiemens per centimeter (μS/cm)), and salinity (parts per thousand (ppt)) measurements were taken with a Horiba U-10 instrument. Water depth and substrate type were recorded at each water-quality data collection site.

EGG SAMPLING

About 60 egg sampling devices were fabricated for this phase of the project. Each sampler included a bottom grapple, a porous buffer pad which was attached to a ring located at the surface-pointing end of the grapple with a short rope, a 6- to 12-m-long nylon rope attached to a bottom ring on the grapple, and two round styrofoam floats attached to the surface end of the grapple rope (Marchant and Shutters, 1996).

All egg samplers were checked at 3- to 4-day intervals. Each sampling device was removed from the river. The buffer pad was separated from the grapple and carefully placed in an oblong plastic tank. Each buffer pad was carefully examined for eggs by one or more workers. Attached eggs were removed and placed in a scintillation vial containing buffered preservative. All sample vials were stored until eggs could be examined in the lab. Egg samples collected in 2006 were sent to Dr. Darrell Snyder at the Colorado State University Larval Fish Laboratory for examination. Eggs collected in 2007 and 2008 was examined in the GSA Fish Lab using methods described in Marchant and Shutters (1996), Sulak and Clugston (1998), and Wooley and Crateau (1982).

RESULTS AND DISCUSSION

GILL NETTING AND BOAT ELECTROFISHING EFFORTS

A total of 7,391 fishes representing 57 species and the palmetto bass (*Morone chrysops* x *M. saxatilis*) (table 1) were collected in 165 gill net and boat electrofishing samples (table 2) taken at 51 sites in the Perdido and Mobile Basins (fig. 3) from 2000 to 2008. Thirty-two samples (19 percent) were collected at 14 sites in Perdido Bay and Perdido River (table 2). Twenty-eight samples (17 percent) were collected at six sites in Mobile Bay. Thirty-two samples (19 percent) were collected at 16 sites in the MTRD. Six samples (4 percent) were collected at two sites in the lower Tombigbee River and 67 samples (41 percent) were collected at 13 sites in the Alabama River.

Table 1. Number (N), percent relative abundance (PRA), and total fishes (TN) collected in the Mobile and Perdido Basins, 2000-08.

Family, scientific, and common species names	Mobile Bay		Perdido Bay		
	N	PRA	N	PRA	TN
Dasyatidae – stingrays					
Dasyatis sabina – Atlantic stingray	92	1.4	8	1.3	100
Myliobatidae – eagle rays					
Rhinoptera bonasus – cownose ray			30	5.0	30
Acipenseridae					
Acipenser oxyrinchus desotoi – Gulf sturgeon	2	0.0	1	0.2	3
Polyodontidae – paddlefish					
Polyodon spathula – paddlefish	560	8.2			560
Lepisosteidae – gars					
Atractosteus spathula – alligator gar	2	0.0			2
Lepisosteus oculatus – spotted gar	31	0.5	4	0.7	35
L. osseus – longnose gar	120	1.8	102	16.9	222
Amiidae – bowfin					
Amia calva – bowfin	8	0.1			8
Anguillidae – freshwater eels					
Anguilla rostrata – American eel			1	0.2	1
Clupeidae – herrings and shads					
Alosa chrysochloris – skipjack herring	13	0.2	1	0.2	14
Brevoortia patronus – Gulf menhaden	350	5.2	17	2.8	367
Dorosoma cepedianum – gizzard shad	116	1.7			116
Dorosoma petenense – threadfin shad	313	4.6			313
Engraulidae – anchovies					
Anchoa mitchilli – bay anchovy	1	0.0			1
Esocidae – pikes and pickerels					
Esox niger – chain pickerel			2	0.3	2
Hiodontidae – mooneyes					
Hiodon tergisus – mooneye	1	0.0			1
Cyprinidae – carps and minnows					
Ctenopharyngodon idella – grass carp	1	0.0			1
Cyprinus carpio – common carp	31	0.5			31
Hypopthalmichthys nobilis – bighead carp	3	0.0			3
Catostomidae – suckers					
Carpiodes cyprinus – quillback	141	2.1			141
C. velifer – highfin carpsucker	881	13.0			881
Cycleptus meridionalis – southeastern blue sucker	584	8.6			584
Erimyzon sucetta – lake chubsucker			4	0.7	4
E. tenuis – sharpfin chubsucker			7	1.2	7
Ictiobus bubalus – smallmouth buffalo	1,149	16.9			1,149
Minytrema melanops – spotted sucker	2	0.0	6	1.0	8
Moxostoma carinatum – river redhorse	106	1.6			106
M. poecilurum – blacktail redhorse	46	0.7	33	5.5	79
Ictaluridae – bullhead catfishes					
Ameiurus nebulosus – brown bullhead			1	0.2	1
Ictalurus furcatus – blue catfish	369	5.4			369
I. punctatus – channel catfish	91	1.3	3	0.5	94
Pylodictis olivaris – flathead catfish	157	2.3			157

Table 1. Number (N), percent relative abundance (PRA), and total fishes (TN) collected in the Mobile and Perdido Basins, 2000-08–cont'd.

Family, scientific, and Common names	Mobile Bay		Perdido Bay		
	N	PRA	N	PRA	TN
Ariidae – ariid catfishes					
Ariopsis felis – hardhead catfish	96	1.4	111	18.4	207
Bagre marinus – gafftopsail catfish			134	22.2	134
Belonidae – needlefishes					
Strongylura marinus – Atlantic needlefish	20	0.3			20
Moronidae – striped basses					
Morone chrysops – white bass	38	0.6			38
Morone saxatilis – striped bass	17	0.3			17
Morone chrysops x *M. saxatilis* – palmetto bass	597	8.8	1	0.2	598
Centrarchidae – sunfishes					
Ambloplites ariommus – shadow bass			1	0.2	1
Lepomis gulosus – warmouth	4	0.1	6	1.0	10
L. macrochirus – bluegill	79	1.2	44	7.3	123
L. marginatus – dollar sunfish			2	0.3	2
L. megalotis – longear sunfish	9	0.1	30	5.0	39
L. microlophus – redear sunfish	3	0.1			3
L. miniatus – redspotted sunfish	22	0.3	15	2.5	37
Micropterus punctulatus – spotted bass	157	2.3	3	0.5	160
M. salmoides – largemouth bass	55	0.8	27	4.5	82
Pomoxis annularis – white crappie	6	0.1			6
P. nigromaculatus – black crappie	46	0.7			46
Carangidae – jacks					
Caranx hippos – jack crevalle	1	0.0			1
Sparidae – porgies					
Archosargus probatocephalus – sheepshead	28	0.4	1	0.2	29
Sciaenidae – drums					
Aplodinotus grunniens – freshwater drum	365	5.4			365
Cynoscion arenarius – sand sea trout	1	0.0			1
Micropogonias undulates – Atlantic croaker	3	0.0			3
Pogonias cromis – black drum	4	0.1			4
Sciaenops ocellatus – red drum	9	0.1			9
Mugilidae – mullets					
Mugil cephalus – striped mullet	9	0.1	7	1.2	17
Paralichthyidae – large-tooth flounders					
Paralichthys lethostigma – southern flounder	49	0.7	1	0.2	50
Total species	49		29		58
Total specimens	6,788		603		7,391

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
Perdido River Basin							
P-1	Perdido Bay @ Bear Point	sec. 37 T. 8 S. R. 6 E.	30.2986 87.5166	2144	February 1, 2006	1400-1600	8 gill nets
				2164	December 13, 2006	0900-1145	7 gill nets
P-2	Perdido Bay @ Ross Point	sec. 25 T. 8 S. R. 5 E.	30.3195 87.5156	2152	March 2, 2006	1030-1230	8 gill nets
P-3	Perdido Bay @ Grassy Point	sec. 19 T. 7 S. R. 7 E.	30.4282 87.3924	2641	May 18, 2005	0900-1200	13 gill nets
				2175	February 8, 2007	0900-1400	9 gill nets
				2181	February 28, 2007	0830-1200	9 gill nets
P-4	Perdido Bay	sec. 17 T. 7 S. R. 7 E.	30.4361 87.3865	2676	April 5, 2005	0900-1025	4 gill nets
				2679	April 5, 2005	0900-1125	4 gill nets,
P-5	Perdido River @ Perdido Bay	sec. 8 T. 7 S. R. 7 E.	30.4496 87.3878	2621	April 4, 2005	1400-1700	5 gill nets
				2671	April 4, 2005	1325-1530	4 gill nets
				2153	March 2, 2006	1430-1630	8 gill nets
				2137	March 26, 2008	0900-1230	7 gill nets
P-6	Perdido River 2 miles upstream of Perdido Bay	sec. 1 T. 7 S. R. 7 E.	30.4882 87.4314	2801	April 24, 2004	1300-1615	4 gill nets
				2677	April 5, 2005	1045-1230	4 gill nets
				2675	April 5, 2005	1200-1430	4 gill nets
				2639	May 18, 2005	0915-1700	5 gill nets
				2154	March 21, 2006	0930-1630	8 gill nets
				2182	February 28, 2007	1230-1630	6 gill nets
P-7	Perdido-Blackwater River junction	sec. 35 T. 6 S. R. 6 E.	30.4809 87.4354	2802	April 22, 2004	0830-1030	5 gill nets
				2673	April 6, 2005	0845-1120	4 gill nets
				2157	March 30, 2006	0910-1235	8 gill nets
P-8	Perdido River	sec. 26 T. 6 S. R. 6 E.	30.4875 87.4292	2993	April 20, 2004	1430-1500	Electroboat
				2994	April 20, 2004	1400-1730	5 gill nets
				2995	April 21, 2004	1500-1600	5 gill nets
				2672	April 4, 2005	1450-1645	4 gill nets
				2188	April 25, 2007	0900-1630	6 gill nets
P-9	Perdido River	sec, 23 T. 6 S. R. 6 E.	30.4965 87.4309	2997	April 21, 2004	0900-1100	5 gill nets
P-10	Styx River	sec. 17 T. 6 S. R. 6 E.	30.5290 87.4859	2805	May 11, 2004	1550-1620	Electroboat

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08–cont'd.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
P-11	Styx River	sec. 7 T. 6 S. R. 6 E.	30.5456 87.4998	2803	May 11, 2004	1404-1515	Electroboat
P-12	Perdido River	sec. 15 T. 6 S. R. 6 E.	30.5221 87.4472	2813	May 12, 2004	1500-1515	Electroboat
P-13	Perdido River	sec. 11 T. 6 S. R. 6 E.	30.5427 87.4353	2811	May 12, 2004	1230-1330	Electroboat
P-14	Perdido River	sec. 1 T. 6 S. R. 6 E.	30.3472 87.4253	2809	May 12, 2004	1025-1125	Electroboat
Mobile Bay Basin							
MB-1	Mobile Bay @ Weeks Bay	sec. 2 T. 7 S. R. 2 E.	30.3693 87.8612	2128	February 20, 2008	0845-1600	10 gill nets
MB-2	Mobile Bay near Weeks Bay	sec. 4 T. 7 S. R. 2 E.	30.3722 87.8463	2143	January 25, 2006	0915-1630	16 gill nets
				2170	January 18, 2007	0800-1600	8 gill nets
MB-3	Mobile Bay @ Mullet Point	sec. 30 T. 7 S. R. 2 E.	30.4074 87.9086	2156	March 27, 2006	0900-1640	8 gill nets
MB-4	Mobile Bay @ Point Clear	sec. 24 T. 7 S. R. 2 E.	30.3050 87.9296	2146	February 15, 2006	0830-1600	5 gill nets
				2173	February 2, 2007	0800-1100	7 gill nets
MB-5	Mobile Bay @ Fairhope	sec. 18 T. 6 S. R. 2 E.	30.5177 87.9235	2145	February 14, 2006	0830-1600	8 gill nets
				2148	February 21, 2006	0830-1800	8 gill nets
				2149	February 22, 2006	0830-1600	8 gill nets
				2150	February 28, 2006	1305-1700	8 gill nets
				2151	March 1, 2006	0900-1630	9 gill nets
				2155	March 28, 2006	1300-1630	8 gill nets
				2159	April 5, 2006	0830-1400	8 gill nets
				2167	January 10, 2007	0900-1530	7 gill nets
				2169	January 17, 2007	1300-1600	7 gill nets
				2174	February 7, 2007	1100-1600	8 gill nets
				2176	February 21, 2007	1330-1720	9 gill nets
				2180	February 27, 2007	1300-1700	10 gill nets
				2183	March 20, 2007	1330-1630	6 gill nets
				2127	February 19, 2008	0845-1615	8 gill nets
				2130	February 28, 2008	0835-1600	6 gill nets
				2131	February 29, 2008	0815-1100	5 gill nets

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08–cont'd.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
MB-5	Mobile Bay @ Fairhope—continued	sec. 18 T. 6 S. R. 2 E.	30.5177 87.9235	2132	March 11, 2008	1345-1655	6 gill nets
				2133	March 12, 2008	0845-1645	6 gill nets
				2134	March 13, 2008	0818-1615	7 gill nets
				2136	March 25, 2008	0830-1600	8 gill nets
				2138	March 27, 2008	0800-1200	6 gill nets
MB-6	Mobile Bay @ Ragged Point	sec. 31 T. 5 S. R. 2 E.	30.5586 87.9073	2147	February 2006	081501600	5 gill nets
Mobile-Tensaw River Delta							
MT-1	Blakeley River mouth	T. 5 S. R. 1 E.	30.6120 87.9303	2126	April 4, 2006	1315-1700	8 gill nets
				2158	April 6, 2006	0930-1220	8 gill nets
				2160	February 6, 2007	1400-1700	8 gill nets
				2172	February 18, 2008	1415-1700	4 gill nets
				2124	February 7, 2008	1015-1700	5 gill nets
				2125	February 8, 2008	0830-1100	5 gill nets
				2126	April 4, 2008	1315-1700	8 gill nets
MT-2	Blakeley River @ I-10	sec. 36 T. 4 S. R. 1 E.	30.6583 87.9262	2162	April 11, 2006	0845-1445	8 gill nets
				2165	December 14, 2006	0900-1030	7 gill nets
				2171	January 19, 2007	0800-1130	8 gill nets
				2129	February 27, 2008	1330-1640	5 gill nets
MT-3	Blakeley River	sec. 23 T. 4 S. R. 1 E.	30.9084 87.9383	2123	February 6, 2008	1400-1650	5 gill nets
MT-4	Apalachee/Blakeley River junction	sec. 36 T. 3 S. R. 1 E.	30.7046 87.9380	2161	April 10, 2006	1000-1730	8 gill nets
MT-5	Tensaw River @ south end of Gravine Island	sec. 42 T. 3 S. R. 1 E.	30.7692 87.9263	2119	October 31, 2007	0830-1400	7 gill nets
MT-6	Tensaw River @ north end of Gravine Island	sec. 1 T. 3 S. R. 1 E.	30.7999 87.9317	2821	May 13, 2004	1000-1230	5 gill nets
MT-7	Tensaw River @ CSXRR crossing	sec, 30 T. 2 S. R. 2 E.	30.8416 87.9317	2118	November 20, 2007	1300-1500	5 gill nets
				2122	November 30, 2007	0800-1115	5 gill nets
MT-8	The Basin @ McReynolds Lake	sec. 13 T. 2 S. R. 2 E.	30.8608 87.9259	2840	May 19, 2004	0800-1300	5 gill nets
				2178	February 22, 2007	1400-1600	8 gill nets
MT-9	Tensaw River @ McReynolds Lake	sec. 20 T. 2 S. R. 2 E.	30.8740 87.8955	2120	November, 27, 2007	1230-1630	5 gill nets

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08–cont'd.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
MT-10	Tensaw/Middle River junction	sec. 36 T. 1 S. R. 2 E.	30.8540 87.9138	2842	May 20, 2004	0840-1300	5 gill nets
				2185	March 27, 2007	0830-1130	6 gill nets
MT-11	Mifflin Lake	sec. 19 T. 1 S. R. 2 E.	30.9528 87.9056	2166	January 9, 2007	1300-1500	8 gill nets
				2168	January 11, 2007	0800-1200	8 gill nets
MT-12	Tensaw River 5 km downstream of Liveoak Landing	sec. 48 T. 1 S. R. 2 E.	30.9437 87.8928	2838	May 21, 2004	0930-1030	13 gill nets
MT-12	Tensaw River 2.5 km downstream of Liveoak Landing	sec. 48 T. 1 S. R. 2 E.	30.9437 87.8928	2135	March 28, 2008	1320-1704	6 gill nets
MT-13	Tensaw River near Liveoak Landing	sec. 42 T. 1 S. R. 2 E.	30.9209 87.9116	2121	November 28, 2007	0745-1600	9 gill nets
MT-14	Tensaw River/Briar Lake junction	sec. 39 T. 1 S. R. 2 E.	30.9907 87.8797	2179	May 18, 2004	1130-1600	5 gill nets
				2839	February 23, 2007	0915-1145	7 gill nets
MT-15	Middle River @ Bottle Creek	sec. 24 T. 1 S. R 1 E.	30.9473 87.9339	2836	May 20, 2004	1210-1305	Electroboat
MT-16	Mobile River @ 12-mile Island	sec. 17 T. 3 S. R. 1 W.	30.7845 87.0113	2184	February 21, 2007	0930-1630	8 gill nets
				2177	February 22, 2007	0900-1300	7 gill nets
Lower Tombigbee River System							
LT-1	Tombigbee River near Duck Lake	sec. 6 T. 4 N. R. 2 E.	31.3394 87.9138	2142	April 16, 2008	0915-1500	2 gill nets
Lt-2	Tombigbee River @ old Lock 1	sec. 29 T. 7 N. R. 1 W.	31.5731 87.0414	2163	May 9, 2006	1030-1640	5 gill nets
				2186	March 27, 2007	1430-1700	4 gill nets
				2139	April 1, 2008	1400-1700	2 gill nets
				2140	April 2, 2008	0835-1445	5 fill nets
				2141	April 7, 2008	0940-1040	2 gill nets
Alabama River System							
AL-1	Alabama River @ river mile 46	sec. 11 T. 5 N. R. 4 E.	31.4233 87.6397	2906	March 14, 2000	1200-1400	4 gill nets
				2907	March 15, 2000	1100-1400	4 gill nets
				2910	March 29, 2000	0830-0930	4 gill nets
AL-2	Alabama River @ Mistress Gray's Bar	sec. 1 T. 6 N. R. 4 E.	31.5103 87.6173	2925	April 11, 2002	1100-1400	4 gill nets
				2389	May 10, 2006	0800-1400	7 gill nets
				2393	April 4, 2007	0900-1030	2 gill nets
				2278	April 2, 2008	0930-1045	5 gill nets

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08–cont'd.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
AL-2	Alabama River @ Mistress Gray's Bar—continued	sec. 1 T. 6 N. R. 4 E.	31.5103 87.6173	2280	April 23, 2008	1130-1750	5 gill nets
				2282	May 8, 2008	1130-1750	5 gill nets
				2284	June 9, 2008	1130-1750	5 gill nets
AL-3	Alabama River @ river mile 60	sec. 31 T. 7 N. R. 5 E.	31.5236 87.6074	2385	October 5, 2005	0800-1530	4 gill nets
AL-4	Alabama River @ river mile 63	sec. 29 T. 7 N. R.5 E.	31.5403 87.5846	2281	April 5, 2008	0845-1715	5 gill nets
AL-5	Alabama River @ U. S. Highway 84	sec. 25 T. 7 N. R. 5 E.	31-5091 87 6158	2918	April 26, 2001	0900-1300	2 gill nets
				2390	March 27, 2007	0900-1640	4 gill nets
AL-5	Alabama River @ U. S. Highway 84	sec. 25 T. 7 N. R. 5 E.	31-5091 87. 6158	2392	April 3, 2007	1100-1700	3 gill nets
				2395	April 10, 2007	0820-1100	5 gill nets
AL-6	Alabama River @ Gosport Landing	sec. 28 T. 7 N. R. 5 E.	31.5091 87.6187	2283	May 9, 2008	0900-1710	5 gill nets
AL-7	Alabama River @ Claiborne Lock and Dam	sec. 34 T. 8 N. R. 5 E.	31.6128 87.5507	2937	October 27-28, 2003	0800-1600	2 gill nets
				2383	January 22, 2004	0830-1600	2 gill nets
				2384	January 23, 2004	0830-1400	2 gill net
				2377	April 14, 2004	0830-1400	1 gill net
				2378	April 15, 2004	0830-16-0	1 gill net
				2394	April 4, 2007	1100-1630	4 gill nets
				2285	June 10, 2008	0800-1600	6 gill nets
				2286	June 11, 2008	0700-0925	6 gill nets
AL-8	Alabama River @ Haines Island	sec. 29 T. 9 N. R. 6 E.	31.7273 87. 4853	2396	April 10, 2007	0800-1600	3 gill nets
AL-9	Alabama River @ Stein Island	sec. 20 T. 10 N. R. 6 E.	31.8189 87.4880	2387	May 22, 2007	0930-1600	5 gill nets
AL-10	Alabama River @ Dunn's Creek	sec. 7 T. 11 N. R. 7 E.	31.9367 87.4049	2397	April 11, 2007	0930-1145	3 gill nets
AL-11	Alabama River @ Yellow Jacket Bar	sec. 5 T. 11 N. R. 7 E.	31.9349 87.3967	2386	May 21, 2007	1015-1700	6 gill nets
AL- 12	Alabama River @ Dixon Creek	sec. 2 T. 12 N. R. 6 E.	32.0337 87.4443	2381	May 4, 2004	1540-1610	Electroboat
				2388	May 23, 2007	0800-1145	4 gill nets

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08–cont'd.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
AL-13	Alabama River @ Millers Ferry Lock and Dam	sec. 20 T. 13 N. R. 7 E.	32.0892 87.3988	2903	March 6, 2000	0915-1145	5 gill nets
				2904	March 7, 2000	0940-1108	5 gill nets
				2905	March 13, 2000	0930-1130	5 gill nets
				2908	March 27, 2000	0930-1030	5 gill nets
				2909	March 28, 2000	0920-1120	5 gill nets
				2911	April 3, 2001	0915-1130	5 gill nets
				2912	April 16, 2001	0915-1145	5 gill nets
				2913	April 17, 2001	0815-1100	5 gill nets
				2916	April 24, 2001	0830-1130	5 gill nets
				2919	March 12, 2002	0800-1145	5 gill nets
				2920	March 19, 2002	0915-1130	5 gill nets
				2921	March 20, 2002	0920-1120	5 gill nets
				2922	March 27, 2002	0900-1045	5 gill nets
				2923	April 9, 2002	0920-1145	5 gill nets
				2924	April 10, 2002	0920-1200	5 gill nets
				2926	March 26, 2003	0915-1015	5 gill nets
				2927	March 27, 2003	0915-1200	5 gill nets
				2928	March 28, 2003	0920-1150	5 gill nets
				2929	April 1, 2003	0915-1145	5 gill nets
				2930	April 2, 2003	0915-1200	5 gill nets
				2398	March 15, 2005	0900-1115	5 gill nets
				2399	March 16, 2004	0920-1030	5 gill nets
				2200	March 23, 2004	0815-1030	5 gill nets
				2201	March 24, 2004	0930-1045	5 gill nets
				2202	March 30, 2004	0920-1100	5 gill nets
				2203	March 31, 2004	0915-1045	5 gill nets
				2204	April 6, 2004	0920-1050	5 gill nets
				2205	April 7, 2004	0915-1015	5 gill nets
				2379	May 4, 2004	1115-1350	1 gill net
				2380	May 5, 2004	1115-1724	1 gill net

Table 2. Locations, dates, and methods used to collect 165 fish samples in the Mobile and Perdido Basins, 2000-08–cont'd.

Site no.	Site name	Location		GSA no.	Date	Sample time	Method
		Section, Township, Range	Longitude, Latitude (decimal degrees)				
AL– 13	Alabama River @ Millers Ferry Lock and Dam—continued	sec. 20 T. 13 N. R. 7 E.	32.0892 87.3988	2206	March 7, 2005	0900-1015	5 gill nets
				2007	March 8, 2005	0815-1600	5 gill nets
				2008	March 14, 2005	0900-1100	5 gill nets
				2009	March 15, 2005	0930-1045	5 gill nets
				2010	March 21, 2005	0900-1045	5 gill nets
				2391	March 29, 2007	0815-1030	3 gill nets

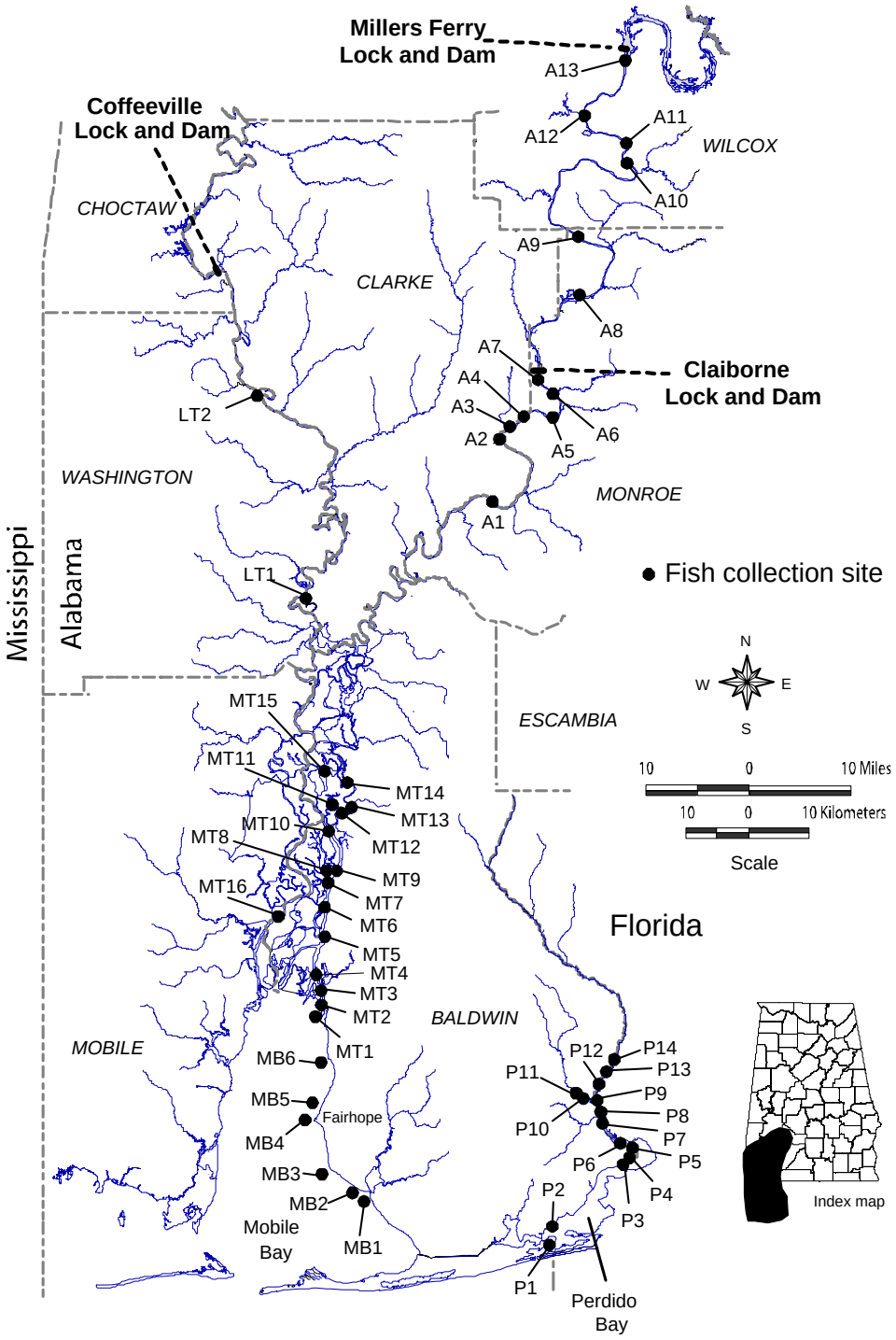

Figure 3. Fish sampling locations in the Mobile and Perdido Basins, 2000-08.

The five most abundant species collected in all samples were the smallmouth buffalo *Ictiobus bubalus* (16 percent), highfin carpsucker *Carpiodes velifer* (12 percent), palmetto bass (8 percent), southeastern blue sucker *Cycleptus meridionalis* (9 percent), and paddlefish *Polyodon spathula* (8 percent). Forty-eight species, the palmetto bass, and 6,788 specimens (table 1) were collected at Mobile Basin sample sites and 28 species, the palmetto bass, and 603 specimens were collected at Perdido Basin sites. Twenty-nine species were collected in the Mobile Basin but not the Perdido Basin. Nine species were collected in the Perdido Basin but not the Mobile Basin, and 20 species were collected in both basins. Distribution maps for all species collected during this study are included in the appendix to provide a database for future sturgeon and other fisheries studies in southwest Alabama.

Mobile Bay at Fairhope was selected as a potential Gulf sturgeon sampling area based on reports of previous sturgeon collections in the immediate area. One local resident gave us copies of several undated black and white photos of Gulf sturgeon that were caught near the present Fairhope public pier. A local angler told us that he routinely caught small Gulf sturgeon, which he called “honeycutts,” south of the Fairhope Public Pier. He cleaned and saved these small but tasty fishes in his freezer until sufficient numbers were collected to have a neighborhood fish fry. Three Gulf sturgeons were collected just south of the Fairhope Public Pier in 1957 (Joe Addison, 2006, personal communication).

We collected two Gulf sturgeons in Mobile Bay near Fairhope (Station MB-5 on fig. 3) during the study. The first fish, a 223-cm fork length (FL) female weighing 72 kilograms (kg), was collected in Mobile Bay on February 21, 2006. An identifying number obtained from a pit tag imbedded near the left dorsal fin base revealed the USFWS originally collected this fish in the lower Choctawhatchee River in November 1999. A tissue sample was obtained from each pectoral fin. A 77 kilohertz (kHz) sonic tag (beep sequence 446) was implanted in the abdominal cavity, a numbered Floy tag was implanted at the base of each pectoral fin, and the fish was released near its collection site. We never found this fish following its release, but it was detected in the lower Choctawhatchee River, near its original collection location, in November 2007 (Frank Parauka, 2007, personal communication). The estimated distance from Choctawhatchee Bay to Mobile Bay and then back to Choctawhatchee Bay is 960 km (fig. 4).

The second fish, a gender undetermined, 127-cm FL individual weighing 36 kg, was caught on February 28, 2008. A pit tag reader was not available when this fish was collected

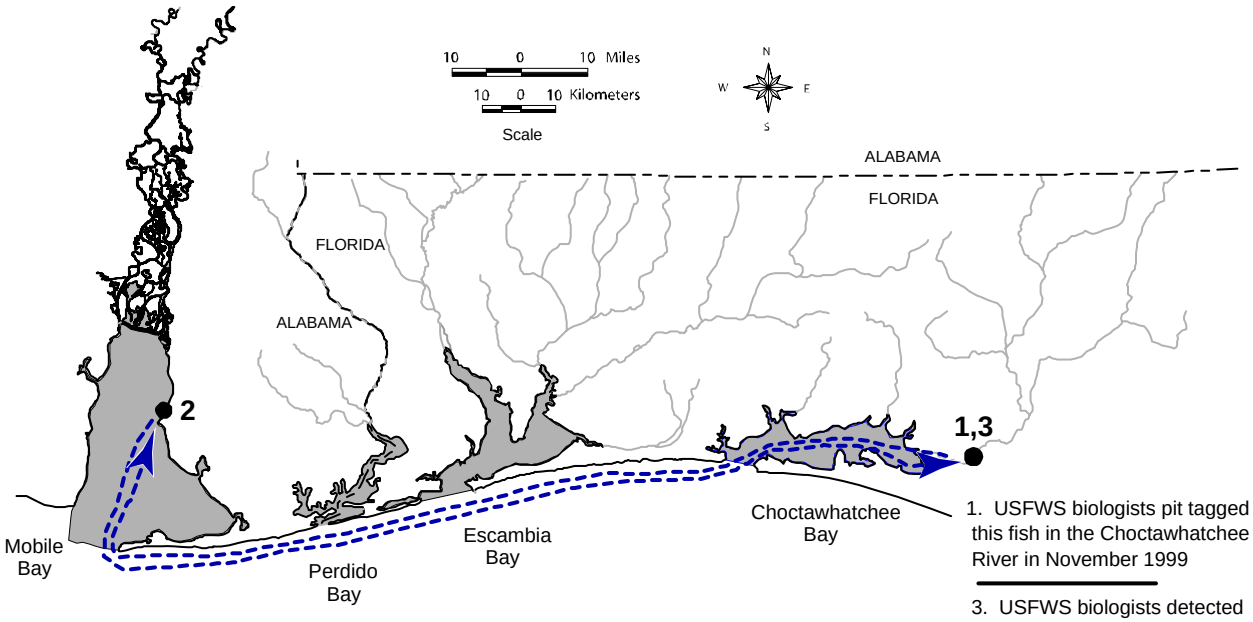

Figure 4. Movements of a Gulf sturgeon between Choctawhatchee Bay and Mobile Bay, 1999-2007.

so its origin is unknown. A 70 kHz sonic tag (No. 899) was implanted in the abdomen. Anchor tags were inserted through each pectoral fin base. We never detected the sonic signal from this fish following its release.

Gill netting operations were completely disrupted in 2007 when a brown tide developed near Weeks Bay on February 9 and moved up the eastern shore of Mobile Bay to the Mobile Bay Causeway. Fishing success abruptly ended as thick clouds of brown tide, apparently extending from surface to bottom, moved upstream past our nets at Point Clear on the morning of February 9 and near Pier Street Public Pier at Fairhope later the same afternoon. The adverse effect of the brown tide on our sampling success is evident by comparing species and specimens collected in six days of sampling at Fairhope (Station MB-5) in 2006, three days of sampling before and three days of sampling after the brown tide appeared in 2007, and six days of sampling in 2008 (table 3). A total of 233 fishes representing 11 species were collected at this site in 2006, 196 fishes and 8 species were collected prior to the brown tide in 2007, and 239 fishes representing

Table 3. Number (N), and percent relative abundance (PRA) of fish species collected at Fairhope, Station MB-5, in Mobile Bay.

Species	2006 6 samples February 14-March 2		2007				2008 6 samples February 19-March 13	
			3 samples January 10-February 7		3 samples February 21-March 20			
	N	PRA	N	PRA	N	PRA	N	PRA
Dasyatis sabina	2	0.9			12	57.1	4	1.7
Acipenser oxyrinchus desotoi	1	0.4					1	0.4
Polyodon spathula	53	22.7	4	2.0			116	48.5
Lepisosteus osseus			2	1.0			1	0.4
Alosa chrysochloris			1	0.5				
Brevoortia patronus	66	28.3	49	25.0	8	38.1	30	12.6
Anchoa mitchilli			1	0.5				
Ictiobus bubalus	70	30.0	22	11.2			41	17.2
Ictalurus furcatus	29	12.4	105	53.6			43	18.0
Ariopsis felis	3	1.3			1	4.8	1	0.4
Archosargus probatocephalus	5	2.1	12	6.1				
Pogonias cromis	1	0.4						
Sciaenops ocellatus	1	0.4					1	0.4
Paralichthys lethostigma	2	0.9					1	0.4
Total species	11		8		3		10	
Total specimens	233		196		21		239	

10 species were collected in 2008. In contrast, only 21 fishes in three species were collected here after the brown tide moved through the area in 2007. Most of the species and fishes usually found at this sight in 2006, early 2007, and 2008 probably escaped the brown tide by moving toward the middle of Mobile Bay. Gill netting operations were suspended at Station MB-5 on March 20, 2007 after several days of continued poor fishing success.

The Gulf sturgeon database for this report was improved by recent collection records supplied by various agencies and individuals. Shrimpers contracted by the USCOE to remove Gulf sturgeon near channel dredging operations collected one sturgeon in the Gulf of Mexico in December 2004, one in January and one in February 2005, and one in January 2006 (fig. 5). Shrimpers, contracted by the USCOE to remove onshore debris swept into shallow water during recent hurricanes, collected four fish near Perdido Key in February 2005 and five fish in the same area in March and April 2006. An AMRD biologist collected a Gulf sturgeon near Bear

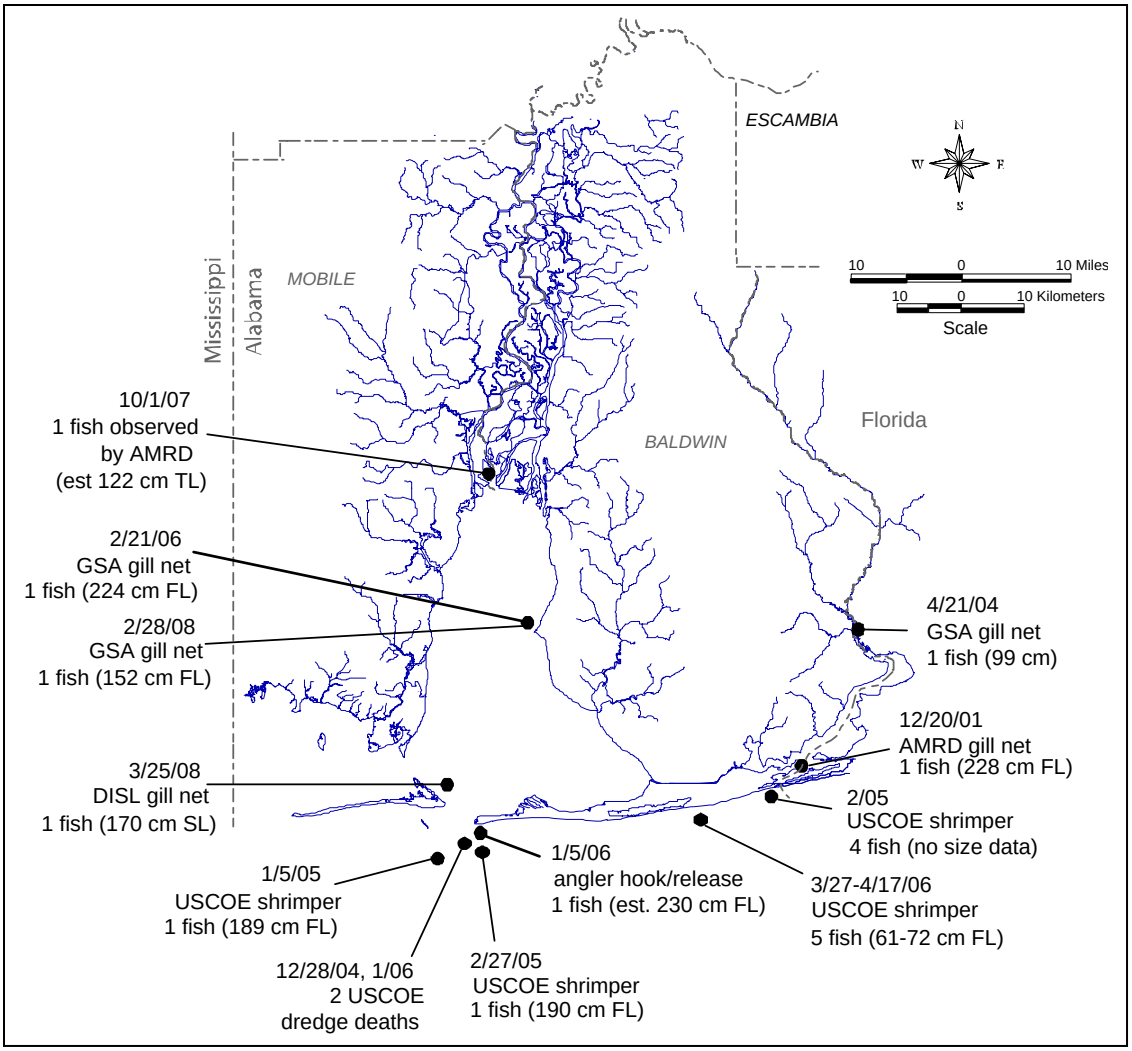

Figure 5. Gulf sturgeon collection sites in coastal Alabama, 2000-08.

Point in Perdido Bay in December 2001. A private angler hooked and released a Gulf sturgeon while fishing for redfish on Dixie Bar near the mouth of Mobile Bay in January 2006. A Dauphin Island Sea Lab student conducting research on the near-shore movements of coastal fish species collected a Gulf sturgeon inside the eastern end of Dauphin Island in March 2008. A game warden for the AMRD observed a Gulf sturgeon above the Mobile Bay Causeway near Polecat Bay in October 2007. Twenty additional individuals, originally sonic tagged in the Escambia, Yellow, and Choctawhatchee Rivers by the USFWS, were detected along Gulf beaches between Mobile and Perdido Bays from 2004 to 2005 (Frank Parauka, 2005, personal communication).

In addition to these coastal records, five Gulf sturgeons were collected or observed in the Alabama and Tombigbee Rivers from the mid-1990s through 2001. The USFWS collected two fish downstream of Claiborne Lock and Dam in the Alabama River in 2001 and it electrofished another fish in the Tombigbee River, a few kilometers upstream of its junction with the Alabama River, in the late 1990s. A contractor hired by Alabama Pulp and Paper Company to sample fish populations upstream and downstream of their paper mill on the Alabama River electrofished a Gulf sturgeon in Claiborne tailwater in the early 1990s. A commercial fisherman with >20 years of fishing experience in the lower Tombigbee River found a dead Gulf sturgeon floating downstream of Coffeeville Lock and Dam in the late 1990s. The identification of the fish was confirmed by a WFFD game warden.

FIN TISSUE ANALYSIS

Pectoral fin tissues removed from five Gulf sturgeon collected in Alabama were analyzed to determine their natal river system. Two tissue sets came from the fish we collected in Mobile Bay in 2006 and 2008, and three sets were submitted by Frank Parauka of the USFWS. One of these tissues came from a fish collected in the Alabama River in 2001and two tissues came from fish collected in Mobile Bay (B. Kreiser, 2008 personal communication). Assignment tests suggested both of our fish came from the Choctawhatchee River. The Alabama River fish and one Mobile Bay fish probably originated from the Pearl River, and the second Mobile Bay fish came from the Escambia River population. These results are considered provisional since they were based on incomplete genotypes (B. Kreiser, 2008, personal communication).

Analysis of tissue samples taken from Gulf sturgeon collected in eight coastal drainages (Stabile and others, 1996; Wirgin and others, 1997, 2000; King and others, 2001), supplemented with information from tagging and sonic tracking studies (Foster and Clugston, 1997; Heise and others, 2004; Fox and others, 2000), suggest Gulf sturgeons return to one of five natal areas to spawn. These areas include, from west to east, Lake Pontchartrain and Pearl River; Pascagoula River; Escambia and Yellow Rivers; Choctawhatchee River; and Apalachicola, Ochlocknee, and Suwannee Rivers. Gene exchange between these areas is very low, usually less than one female per generation (Waldman and Wirgin, 1998). Documented high river fidelity has played an important role in defining drainage management units for Gulf sturgeon recovery efforts (Dugo and others, 2004).

Almost all Gulf sturgeons return to the same natal river system to spawn, but some individuals visit non-natal river systems and a few make round trips between natal and non-natal systems during their non-reproductive periods. Examples include movements from the Suwannee to the Choctawhatchee drainage (Sulak and Clugston, 1998), Choctawhatchee to Yellow drainage (Fox and others, 2002), and the Yellow to the Choctawhatchee drainage (Craft and others, 2001). One female tagged in the Yellow River was detected in a Louisiana estuarine area and it subsequently returned to the Yellow River (Craft and others, 2001). A fish tagged in the Choctawhatchee River was captured and released in the Apalachicola River and it subsequently returned to the Choctawhatchee River (Frank Parauka, 2004, personal communication, Dugo and others, 2004). The fish we collected in Mobile Bay in 2006 had been pit tagged in the Choctawhatchee River in 1999 and the USFWS detected its sonic tag signal near its original tagging location in the Choctawhatchee River in 2007 (fig, 4).

WATER-QUALITY SAMPLING

Water-quality measurements (Table 4) were taken 75 times at 35 stations during November through June fish sampling and March through April egg collection activities. Water temperature ranged from 13.1 to 21.5°C in the Perdido Basin and 10.6° to 29.6°C in the Mobile Basin. Dissolved oxygen ranged from 0.7 to 18.0 mg/L in the Perdido and from 0.3 to 19.0 mg/L in the Mobile. Specific conductance was higher in the Perdido Basin (140 to 33,000 μS/cm) than the Mobile Basin (127 to 13,000 μS/cm). Salinity was also higher in the Perdido (0.0 to 2.1 ppt) than the Mobile (0.0 to 1.3 ppt). Slight but consistent differences in the two measurements probably reflected differences in watershed size, freshwater river discharge, and its interaction with saltwater tides. Measurements of pH ranged from 6.6 to 8.3 in the Perdido Basin and from 5.6 to 9.6 in Mobile Bay. Water-quality conditions were fairly similar on the two days, February 21, 2006, and February 28, 2008, we collected Gulf sturgeon in Mobile Bay. Water temperature ranged from 12.4 to 13.0°C, dissolved oxygen from 8.3 to 9.1 mg/L, specific conductance from 6,100 to 13,600, salinity from 0.3 to 0.7 ppt, and pH ranged from 7.5 to 7.6.

The dramatic decline in gill netting success at Station MB-5 near Fairhope in February and March 2007 was probably affected by the lingering effects of the previously discussed brown tide that developed near Weeks Bay in the southeastern corner of Mobile Bay on February 9, 2007, and moved northward along the eastern shore toward the Mobile Bay Causeway.

Table 4. Water-quality data collected at GSA fish (GSA no.) and egg (Egg) collection locations in the Mobile and Perdido Basins.

Site no.	Site name	Location		GSA no. or Egg sampling location	Date	Depth (feet)	Water-quality measurements				
		Section, Township, Range	Longitude, Latitude (decimal degrees)				Water temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	Salinity (ppt)	pH
Perdido Bay and River											
P-1	Perdido Bay @ Bear Point	sec. 37 T. 8 S. R. 6 E.	30.2986 87.5166	2144	February 1, 2006	7	15.9	9.5	24,500	1.5	8.2
				2164	December 13, 2006	6	13.1	10.8	2,820	1.7	8.2
P-2	Perdido Bay @ Ross Point	sec. 25 T. 8 S. R. 5 E.	30.3195 87.5156	2152	March 2, 2006	6	18.0	9.4	33,000	1.7	8.3
P-3	Perdido Bay @ Grassy Point	sec. 19 T. 7 S. R. 7 E.	30.4282 87.3927	2175	February 8, 2007	6	13.2	0.7	29,000	1.5	7.8
				2181	February 28, 2007	12	20.0	9.4	140	0.0	6.6
P-5	Perdido River @ Perdido Bay	sec. 8, T. 7 S. R. 7 E.	30.4496 87.3878	2153	March 2, 2006	6	18.0	9.4	33,000	2.1	8.3
				2137	March 26, 2008	6.5	16.8	5.8	21,000	1.3	7.0
P-6	Perdido River 2 miles upstream of Perdido Bay	sec. 1 T. 7 S. R. 7 E.	30.4882 87.4314	2154	March 21,2006	15.5	21.0	6.1	32,000	2.1	7.7
				2182	February 28, 2007	5.5	16.5	18.0	17,000	1.0	8.3
P-7	Perdido-Blackwater River junction	sec. 35 T. 6 S. R. 6 E.	30.4809 87.4354	2157	March 10, 2006	22	18.5	2.6	30,400	1.9	7.0
P-8	Perdido River	sec. 26 T. 6 S. R. 6 E.	30.4875 87.4292	2188	April 25, 2007	15	21.5	7.5	2,110	0.1	6.6
Mobile Bay											
MB-1	Mobile Bay @ Weeks Bay	sec. 2 T. 7 S. R. 2 E.	30.3693 87.8612	2128	February 20, 2008	5	15.8	8.0	19,600	1.2	7.5
MB-2	Mobile Bay @ Weeks Bay	sec. 4 T. 7 S. R. 2 E.	30.3722 87.8463	2143	January 25, 2006	5	16.2	9.6	21,000	1.3	9.6
				2170	January 18, 2007	4	12.4	9.8	20,600	1.2	7.3
MB-3	Mobile Bay @ Mullet Point	sec. 30, T. 7 S. R. 2 E.	30.4074 87.9086	2156	March 27, 2006	7	18.0	9.9	9,630	0.5	8.5
MB-4	Mobile Bay @ Point Clear	sec. 24 T. 7 S. R. 2 E.	30.3050 87.9296	2146	February 15, 2007	7	11.4	10.6	4,900	0.3	7.7
				2173	February 2, 2007	6	12.0	9.3	14,000	1.3	8.2
MB-5	Mobile Bay @ Fairhope	sec. 18 T. 6 S. R. 2 E.	30.5030 87.9296	2145	February 14, 2006	9	11.2	11.2	2,600	0.1	7.4
				2148	February 21, 2006	5	13.0	9.1	6,100	0.3	7.6
				2149	February 22, 2006	8	13.5	7.4	8,960	0.5	7.4
				2150	February 28, 2006	9	14.8	12.0	8,030	0.4	8.3
				2151	March 1, 2006	10	14.4	9.8	12,500	0.7	8.0
				2155	March 28, 2006	10	16.4	9.8	8,280	0.4	8.4
				2159	April 5, 2006	9	20.7	8.3	1,660	0.1	8.3
				2167	January 10, 2007	4	11.7	9.7	5,330	0.3	7.9
				2169	January 17, 2007	4	12.6	10.6	5,222	0.3	5.9
				2174	February 7, 2007	10	12.6	11.0	5,630	0.4	8.5

Table 4. Water-quality data collected at GSA fish (GSA no.) and egg (Egg) collection locations in the Mobile and Perdido Basins–cont'd.

Site no.	Site name	Location		GSA no. or Egg sampling location	Date	Depth (feet)	Water-quality measurements				
		Section, Township, Range	Longitude, Latitude (decimal degrees)				Water temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	Salinity (ppt)	pH
MB-5	Mobile Bay @ Fairhope-continued	sec. 18 T. 6 S. R. 2 E.	30.5030 87.9296	2176	February 21, 2007	5	12.6	16.5	13,900	0.8	7.1
				2180	February 27, 2007	6	17.4	19.0	17,000	1.0	8.3
				2183	March 20, 2007	9	19.3	14.0	14,000	0.8	8.7
				2127	February 1, 2008	8	14.4	9.2	13,700	0.8	7.7
				2130	February 28, 2008	5	12.4	8.3	13,600	0.7	7.5
				2131	February 29, 2008	6	12.8	8.5	12,400	0.7	7.3
				2132	March 11, 2008	5	14.6	10.3	2,070	0.1	7.7
				2133	March 12, 2008	9	14.6	6.4	13,000	0.8	7.1
				2134	March 13, 2008	10	14.7	7.0	13,300	0.8	7.0
				2136	March 25, 2008	5	14.2	7.6	8,560	0.5	7.7
				2138	March 27, 2008	6	15.6	9.1	10,400	0.6	8.1
MB-6	Mobile Bay at Ragged Point	sec. 18 T. 6 S. R. 2 E.	30.5030 87.9296	2147	February 16, 2006	8	11.4	10.6	4,900	0.3	7.7
Mobile-Tensaw River Delta											
MT-1	Blakeley River mouth	T. 5 S R. 1 E.	30.6120 87.9303	2158	April 6, 2006	10	20.8	9.2	204	0.0	7.0
				2160	February 6, 2007	6	21.0	NA	237	0.0	6.5
				2172	February 18, 2008	10	10.6	11.8	165	0.0	7.1
				2124	February 7, 2008	7	13.3	8.5	321	0.0	6.4
				2125	February 8, 2008	8	12.6	9.6	274	0.0	6.6
				2126	April 4, 2008	4	15.0	11.1	396	0.0	6.6
MT-2	Blakeley River @ U. S. Interstate 10	sec. 36 T. 5 S. R. 1 E.	30.6583 87.9262	2162	April 11, 2006	12	20.0	8.9	140	0.0	7.1
				2165	December 14, 2006	6	13.2	9.3	894	0.5	7.6
				2171	January 19, 2007	10	12.3	8.1	142	0.0	6.0
				2129	February 27, 2008	10	12.4	0.3	198	0.0	6.6
MT-3	Blakeley River	sec. 23 T. 4 S. R. 1 E.	30.9084 87.9383	2123	February 6, 2008	30	13.7	10.5	238	0.0	6.7
MT-4	Apalachee-Blakeley River junction	sec. 36 T. 3 S. R. 1 E.	30.7046 87.9380	2161	April 10, 2006	12	21.0	9.6	134	0.0	7.7
MT-5	Tensaw River @ south end of Gravine Island	sec. 42 T. 3 S. R. 1 E.	30.7692 87.9263	2119	October 31, 2007	20	20.6	7.3	3,880	0.2	7.2
MT-7	Tensaw River @ CSXRR crossing	sec. 30 T. 2 S. R. 2 E.	30.8416 87.9142	2118	November 20, 2007	13	21.3	6.8	2,600	0.1	7.4
				2122	November 30, 2007	31	17.5	7.1	5,630	0.3	7.2

Table 4. Water-quality data collected at GSA fish (GSA no.) and egg (Egg) collection locations in the Mobile and Perdido Basins–cont'd.

Site no.	Site name	Location		GSA no. or Egg sampling location	Date	Depth (feet)	Water-quality measurements				
		Section, Township, Range	Longitude, Latitude (decimal degrees)				Water temperature (°C)	Dissolved oxygen (mg/L)	Specific conductance (µS/cm)	Salinity (ppt)	pH
MT-8	The Basin at McReynolds Lake	sec. 13 T. 2 S. R. 2 E.	30.8608 87.9259	2178	February 22, 2007	25	10.6	13.2	145	0.0	8.5
MT-9	Tensaw River above McReynolds Lake	sec. 20 T. 2 S. R. 2 E.	30.8740 87.8955	2120	November 27, 2007	15	17.7	7.5	4,080	0.2	7.3
MT-10	Tensaw River-Middle River junction	sec. 36 T. 1 S. R. 2 E.	30. 8540 87.9138	2185	March 22, 2007	10	17.8	10.5	156	0.0	6.7
MT-11	Mifflin Lake	sec. 19 T. 1 S. R. 2 E.	30.9528 87.9056	2166	January 9, 2007	12	16.3	6.2	158	0.0	6.4
				2168	January 11, 2007	20	12.7	6.3	138	0.0	6.5
MT-12	Tensaw River below Liveoak Landing	sec. 48 T. 1 S. R. 2 E.	30.9437 87.8928	2135	March 24, 2008	28	16.7	9.3	153	0.0	6.3
MT-13	Tensaw River near Liveoak Landing	sec. 42 T. 1 S. R. 2 E.	30.9209 87.9116	2121	November 28, 2007	32	16.8	7.6	776	0.0	7.4
MT-14	Tensaw River-Briar Lake junction	sec. 39 T. 1 S. R. 2 E.	30.9907 87.8797	2179	February 23, 2007	40	11.1	12.1	150	0.0	8.5
MT-16	Mobile River at 12-mile Island	sec. 17 T. 3 S. R. 1 W.	30.7845 87.0113	2177	February 22, 2007	18	11.2	11.4	363	0.0	7.5
				2184	March 22, 2007	6	17.4	10.8	472	0.0	7.4
Lower Tombigbee River											
LT-3	Tombigbee River below Coffeeville Lock and Dam	sec. 7 T. 9 N. R. 1 W.	31.7588 87.1252	Egg	April 18, 2006	15	23.4	9.8	160	0.0	7.0
					April 25, 2006	18	24.5	10.0	161	0.0	6.9
Alabama River											
AL-2	Alabama River at Mistress Gray's Bar	sec. 1, T. 6 N. R. 4 E.	31.5103 87.6173	Egg	April 19, 2006	6	22.5	8.7	127	0.0	7.0
				2284	June 9, 2008	16	29.6	11.1	187	0.1	7.6
AL-3	Alabama River @ river mile 60	sec. 31 T. 7 N. R. 5 E.	31.5236 87.6074	Egg	April 19, 2006	11	22.6	NA	122	0.0	7.8
AL-5	Alabama River near U.S. Highway 84	sec. 25 T. 7 N. R. 5 E.	31.5091 87.6158	2392	April 3, 2007	17	22.2	8.2	144	0.0	5.6
AL-7	Alabama River at Claiborne Lock and Dam	sec. 34 T. 8 N. R. 5 E.	31.6128 87.5507	2285	June 10, 2008	12	29.4	13.1	170	0.1	7.8
				2286	June 11, 2008	15	29.5	11.5	171	0.1	7.6
AL-9	Alabama River @ Stein Island	sec. 20 T. 10 N. R. 6 E.	31.8189 87.4880	2387	May 22, 2007	8	24.9	7.2	160	0.0	7.3
AL-11	Alabama River at Yellow Jacket Bar	sec. 5, T. 11 N. R. 7 E.	31.9493 87.3967	2386	May 21, 2007	5	24.7	6.8	170	0.0	7.2
AL-12	Alabama River- Dixon Creek junction	sec. 2 T. 12 N. R. 6 E.	32.0337 87.4443	2388	May 23, 2007	12	24.6	5.2	151	0.0	7.2

Water temperature at Fairhope was 12.6°C on February 7 and February 21, but it increased to 17.4°C on February 27 and 19.3°C on March 20 after the brown tide moved through the area (table 4). Dissolved oxygen measured 11.0 mg/L on February 7 before the brown tide arrived, but it increased to 16.5 mg/L on February 21 and 19.0 mg/L on February 27, probably due to increased algal density in the water column. We did not measure water clarity, but general observations indicated the brown tide extended throughout the water column and its effects on clarity remained in the area for almost a month after February 9. Water temperature ranged from 11.2 to 14.8°C during the same time period in 2006 and from 12.4 to 14.4°C in 2008. Dissolved oxygen levels ranged from 9.1 to 12.0 mg/L in 2006 and from 8.3 to 9.2 mg/L in 2008.

EGG SAMPLING

Egg samplers were deployed at two stations below Coffeeville Lock and Dam in the lower Tombigbee River (fig. 6) and three stations in the Alabama River below Claiborne Lock and Dam in March and April from 2006 to 2008. Station TE-1 was located along a limestone outcrop on the west bank of the river and directly across from the entrance to Old Lock 1 at Tombigbee River km (TRK 124). Station TE-2 was located on the river side of the lower lock chamber approach wall downstream of Coffeeville Lock and Dam at TRK 186. Station AE-1was near a shallow gravel bar on the east bank of the river and just upstream of Mistress Gray's Bar at Alabama River km (ARK) 94. Station AE-2 was near a limestone outcrop on the west side of the river at ARK 104. Station AE-3 was located near a limestone outcrop on the west bank of the river at ARK 112.

A total of 37 buffer pads from the Tombigbee River were examined in 2006, 24 in 2007, and 51 in 2008. Sixty-three pads from the Alabama River were examined in 2006, 31 in 2007, and 71 in 2008. Fish eggs were collected once in the lower Tombigbee River and four times in the Alabama River in 2006, twice in the Tombigbee River and six times in the Alabama River in 2007, and four times in the Tombigbee River and three times in the Alabama River in 2008. Eggs from each sample collected in 2006 were shipped to Dr. Darrell Snyder at the Colorado State University Larval Fish Lab for identification.

None of the eggs collected were spawned by Gulf sturgeons. Most were identified as spawning products of the Atlantic needlefish *Strongylura marinus*, based on the presence of numerous elongated filaments originating from the outside of the egg. The heads of several well

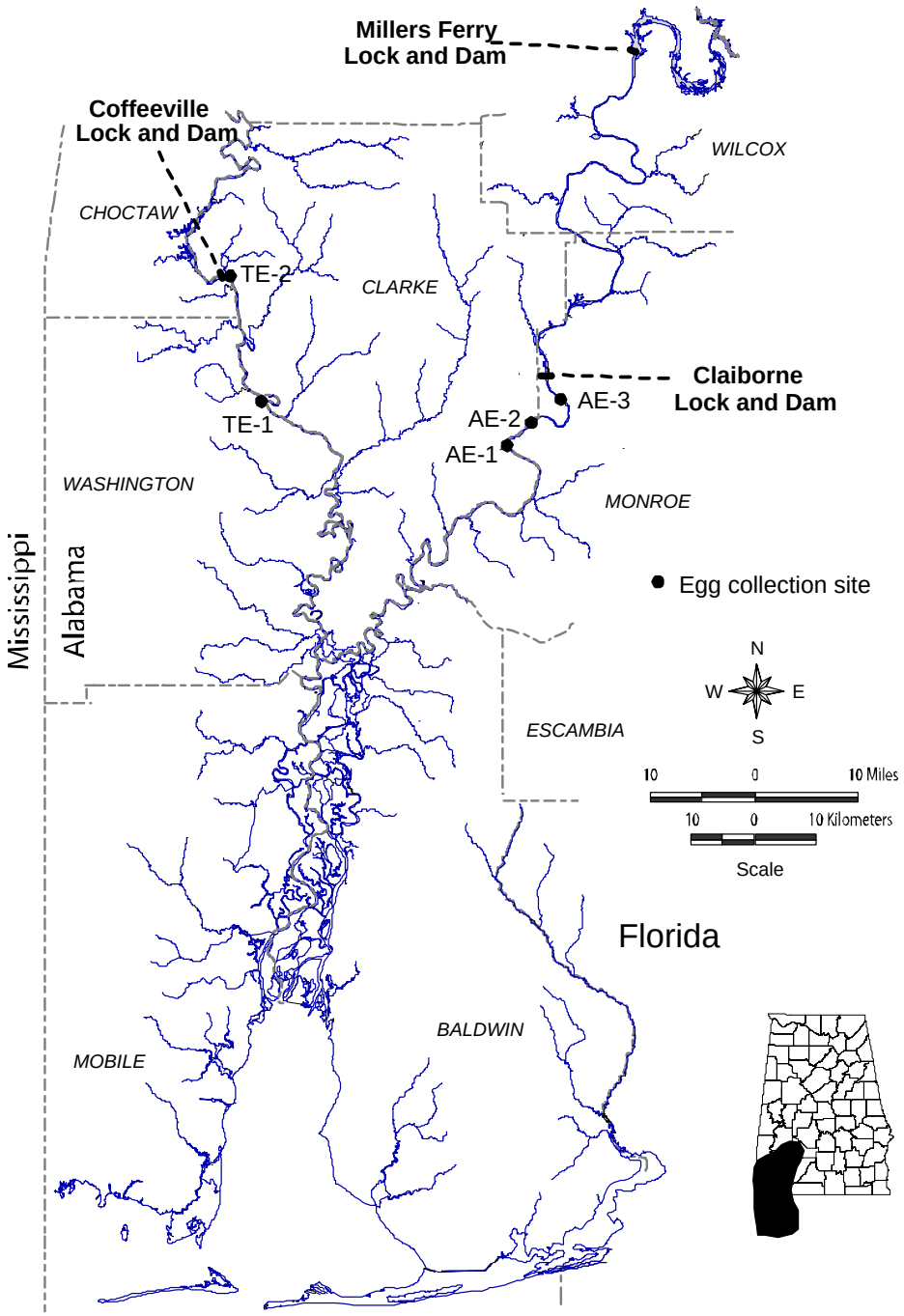

Figure 6. Fish egg collection sites in the Alabama and Tombigbee Rivers.

developed pre-hatch needlefish larvae were well rounded with primitive brains beneath their craniums. Optic placodes, some with a darkened iris, were present on either side of the head. Myomere counts varied from 18 to 25 along either side of the body. Primordial caudal and pectoral fins and pectoral fin buds were visible on a few individuals. A visible primitive heart and rudimentary circulatory system were present in most living larvae. The heart was observed pumping light-pink-colored blood through vessels in the head, a dorsal aorta located near the ventral side of the spinal column in the abdominal cavity, and through a primitive vena cava vein that extended along the ventral midline from the anal area to the heart.

CONCLUSIONS

The major goals of this study were to sonic tag Gulf sturgeon in coastal Alabama and monitor their movements into the Alabama and Tombigbee Rivers, compile information on recent Gulf sturgeon collections in Alabama, collect Gulf sturgeon tissues for DNA analysis, and sample for Gulf sturgeon eggs in the lower Alabama and Tombigbee Rivers. Gulf sturgeons collections are rare in Alabama waters, so the time period covered by this report was expanded to include Gulf sturgeon and associated species data collected by the GSA, other government agencies, and anglers in the study area from 2000 to 2008.

We collected two Gulf sturgeons in Mobile Bay. Neither individual moved upstream, but the fish collected in Mobile Bay in 2006 fish did return to the Choctawhatchee River where it had been pit tagged seven years earlier. Assignment tests of DNA results obtained from two sets of fin tissues collected by the GSA and three sets obtained from Alabama fish by the USFWS suggested two individuals came from the Choctawhatchee River in Florida, one from the Escambia River in Florida, and the remaining two came from the Pearl River in Louisiana. Gulf sturgeon eggs were not collected in either the lower Alabama or Tombigbee River during the study, but we did collect the first records of Atlantic needlefish *Strongylura marinus* eggs from the Alabama and Tombigbee Rivers.

Recent collection and detection records suggest Gulf sturgeons still utilize marine and freshwater habitats in southwestern Alabama. Twenty-one fish, including our three specimens, were collected or observed in nearshore areas of the Gulf of Mexico, Mobile Bay, Perdido River, and Perdido Bay from 2000 to 2008. Twenty additional individuals, originally sonic tagged in the Escambia, Yellow, and Choctawhatchee Rivers by the USFWS, were detected along Gulf beaches between Mobile and Perdido Bays from 2004 to 2005 (Frank Parauka, 2005, personal

communication). Five Gulf sturgeons were collected or observed in the lower Alabama and Tombigbee Rivers from the mid 1990s through 2001.

We did not document Gulf sturgeon spawning during this study, but this finding does not necessarily indicate the species no longer spawns in Alabama. Two additional studies are needed before resources managers consider this conclusion. Several years of gill netting operations are needed in the lower reaches of the lower Alabama and Tombigbee Rivers in March and April when Gulf sturgeons are involved in upstream spawning migrations. Similarly, several years of gill netting studies should be completed in downstream areas of the Mobile, Middle, and Tensaw Rivers in October and November where Gulf sturgeon might congregate before entering Mobile Bay. The USFWS has used this procedure to collect large numbers of Gulf sturgeon in order to calculate population estimates in several adjacent Critical Habitat drainages.

Documenting the life history of the Gulf sturgeon in Alabama will be a long term, labor intensive process. Recent conversations with several noted Gulf sturgeon researchers, including Jim Barkuloo (retired USFWS), Dr. Brian Kreiser (University of Southern Mississippi), Phil Kirk (USCOE Vicksburg Office), Frank Parauka (USFWS), Bobby Reed (Louisiana Game and Fish Division) and Dr. Ken Sulak (U.S. Geological Survey-Gainesville, Florida), indicated 10 to 20 years of intensive sampling were needed to determine Gulf sturgeon presence, movements, and spawning habitats in the Suwannee, Apalachicola, Choctawhatchee, Escambia, Pearl, and Pascagoula Rivers. Without exception, all of these workers concluded the same or perhaps even more time would be needed to complete Gulf sturgeon studies in the Mobile Basin. The funding and time investments in these studies will be more than justified by the discovery of a spawning population of the Gulf sturgeon in the Mobile Basin.

The genotype of the Gulf sturgeon that originally spawned in the Mobile Basin has never been documented because no one has searched for dried individuals or other body parts saved from fish collected before high-lift dams were completed on our state rivers. Recent inquiries have produced a possible record of a large dried Gulf sturgeon collected in the Alabama River before Claiborne, Millers Ferry, and Henry Locks and Dams were completed. The senior author will contact the present owners of this specimen to obtain collection information and possibly obtaining a small tissue sample which, when analyzed by Dr. Brian Kreiser at the University of Southern Mississippi, might identify the Mobile Basin genotype for the Gulf sturgeon.

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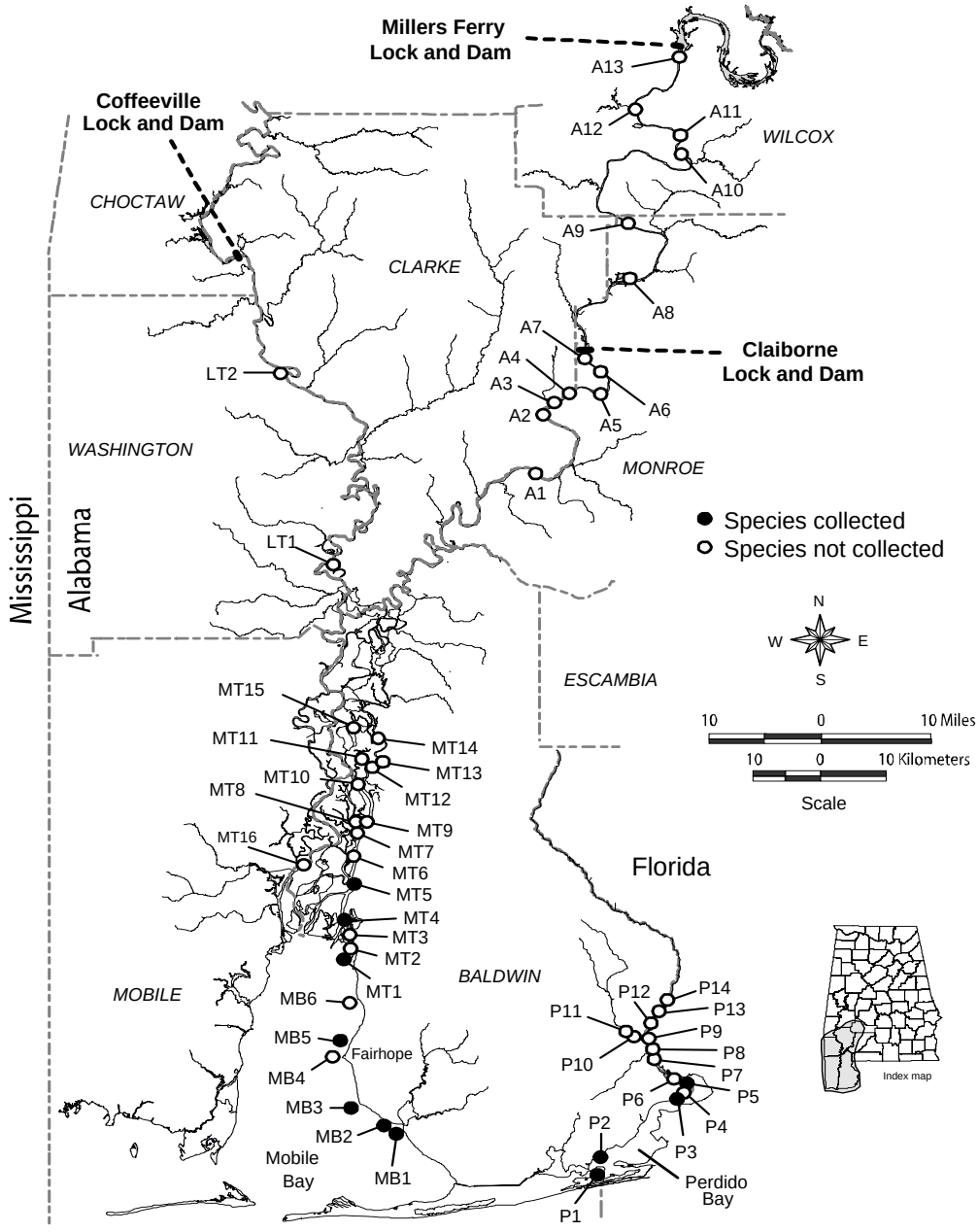
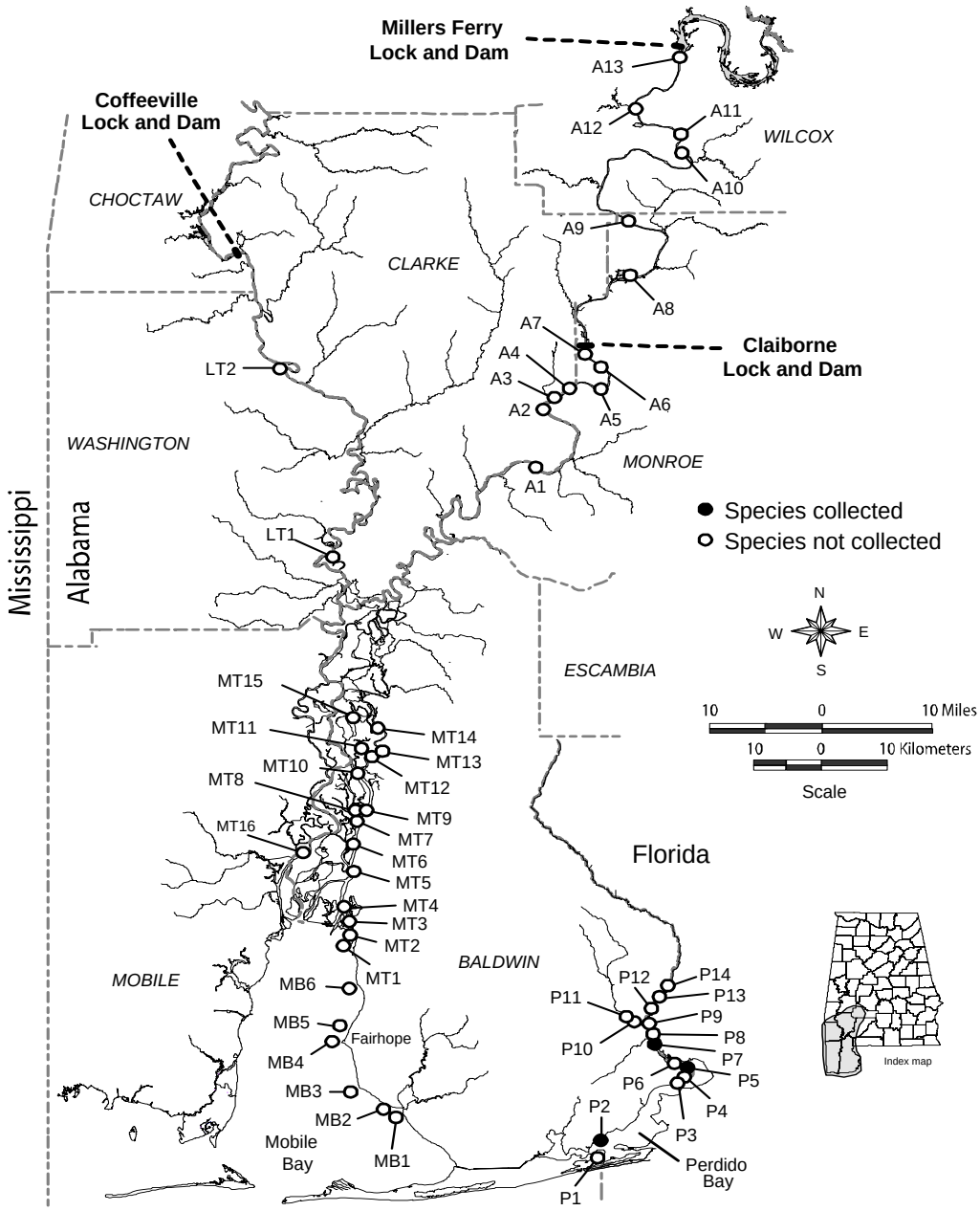
APPENDIX

Distribution maps for 57 fish species and the palmetto bass collected in the Mobile and Perdido Basins, 2000-08.



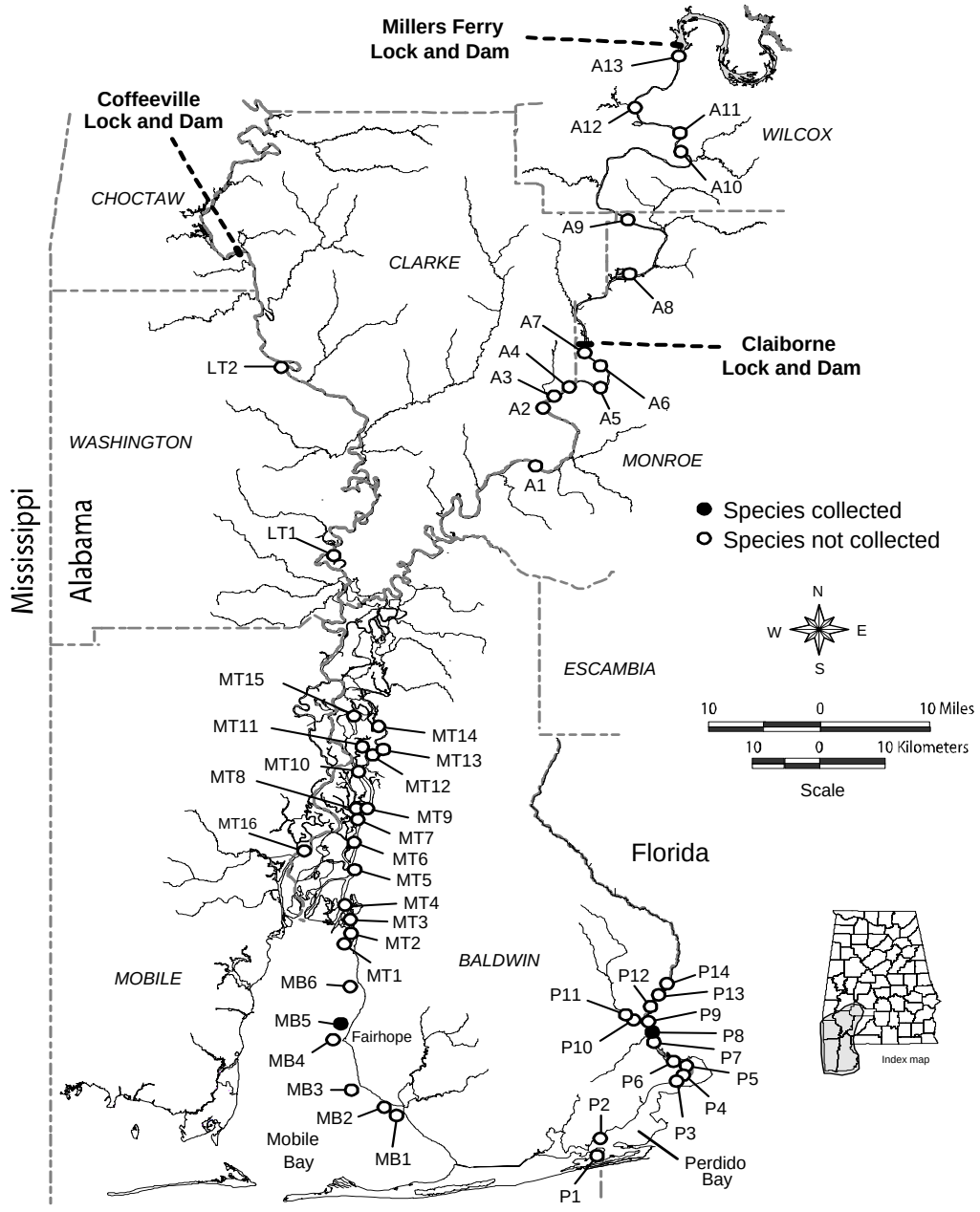
Dasyatis sabina
Atlantic stingray
100 specimens
20 collections

A-1. Collection locations for the Atlantic stingray *Dasyatis sabina* in the lower Mobile and Perdido Basins, 2000-08.



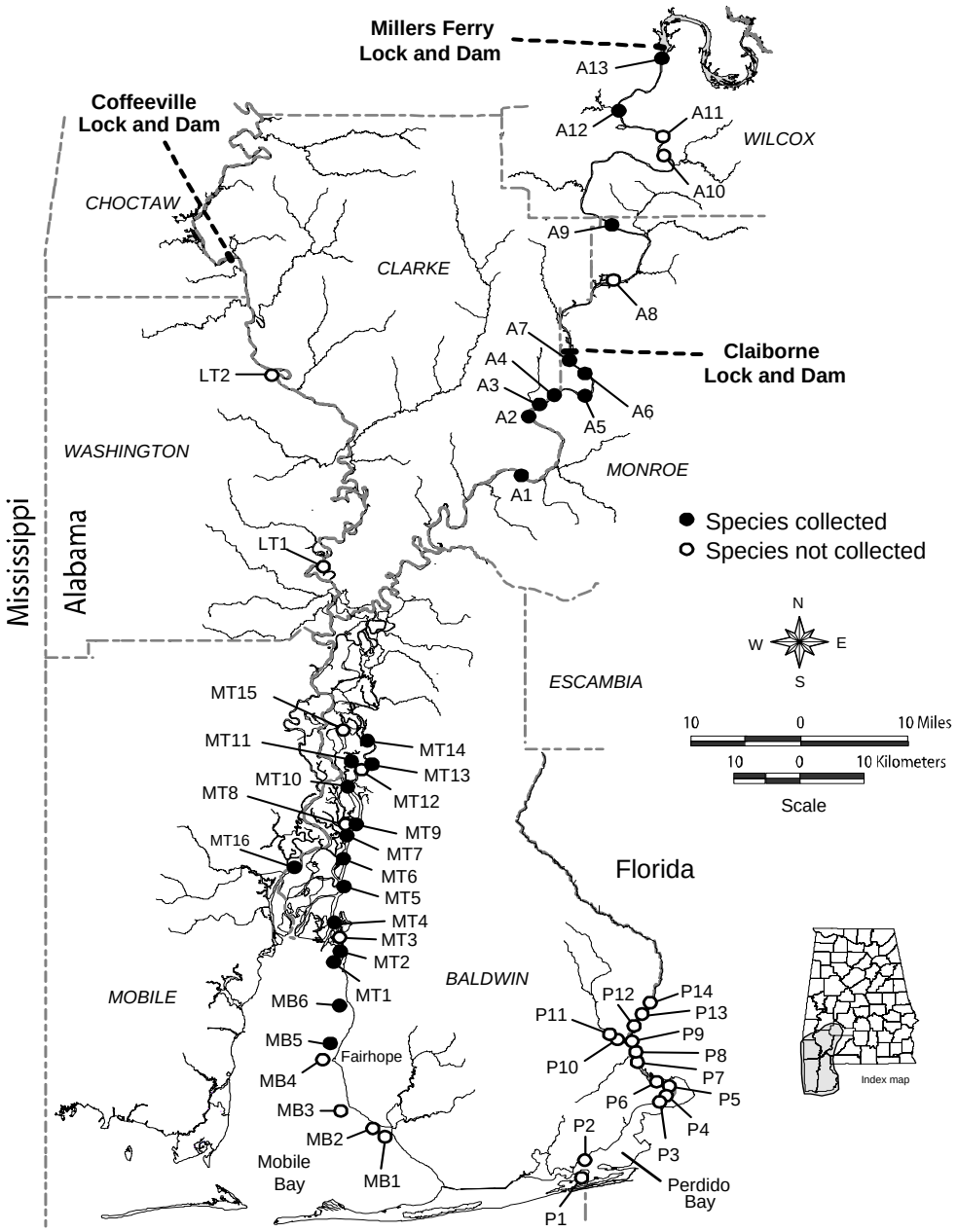
Rhinoptera bonasus
cownose ray
30 specimens
3 collections

A-2. Collection locations for the cownose ray *Rhinoptera bonasus* in the lower Mobile and Perdido Basins, 2000-08.



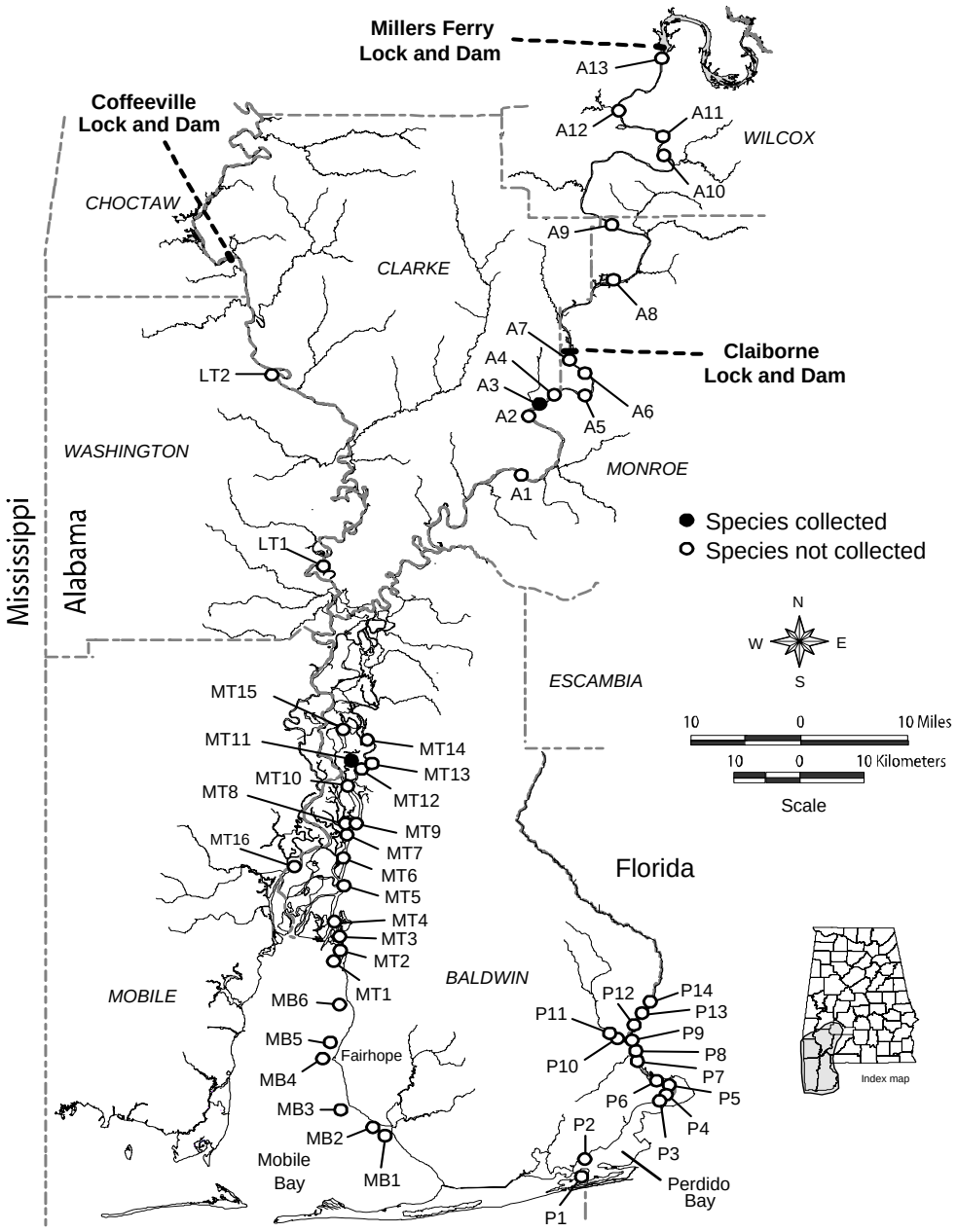
Acipenser oxyrinchus desotoi
Gulf sturgeon
3 specimens
3 collections

A-3. Collection locations for the Gulf sturgeon *Acipenser oxyrinchus desotoi* in the lower Mobile and Perdido Basins, 2000-08.



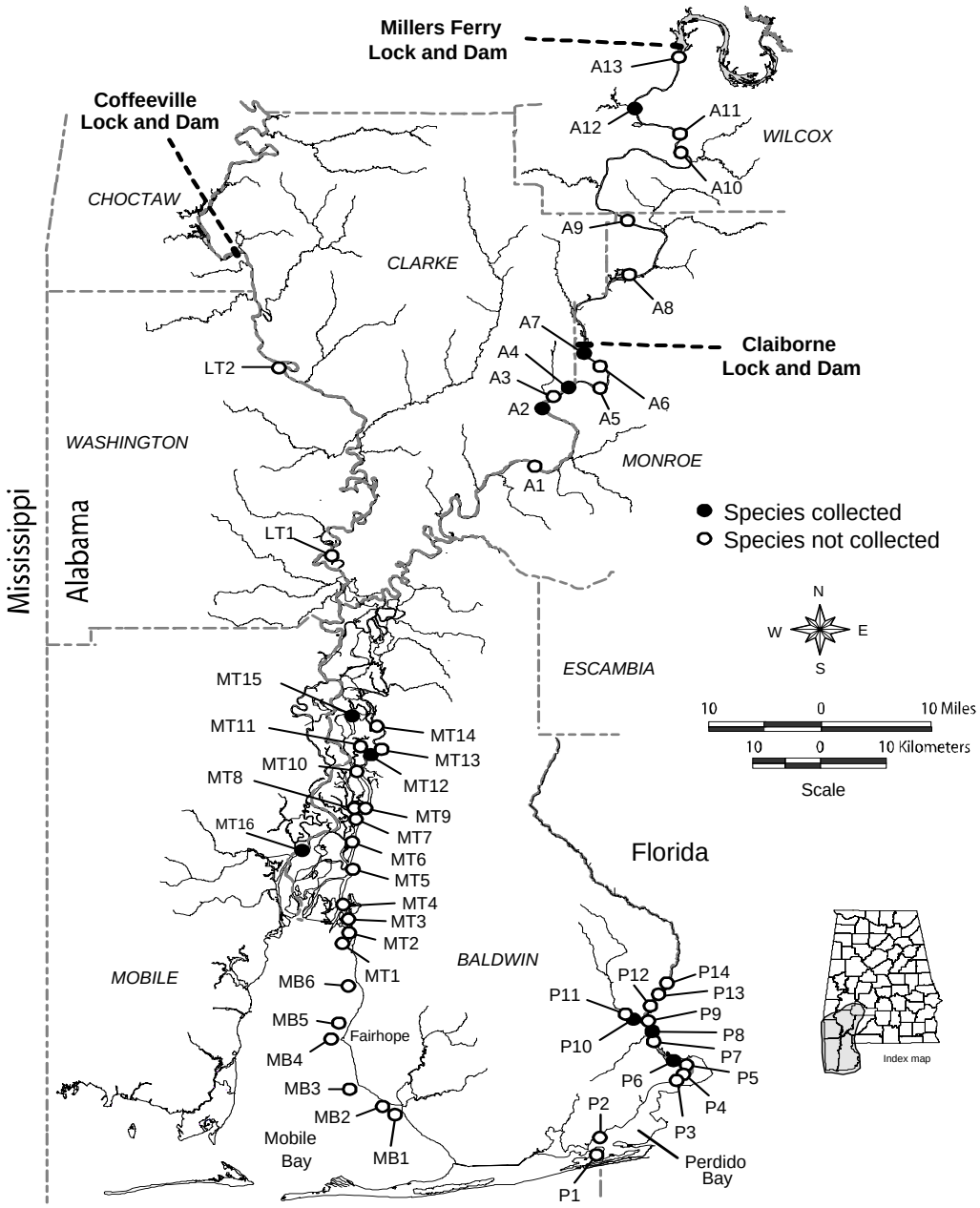
Polyodon spathula
paddlefish
560 specimens
79 collections

A-4. Collection locations for the paddlefish *Polyodon spathula* in the lower Mobile and Perdido Basins, 2000-08.



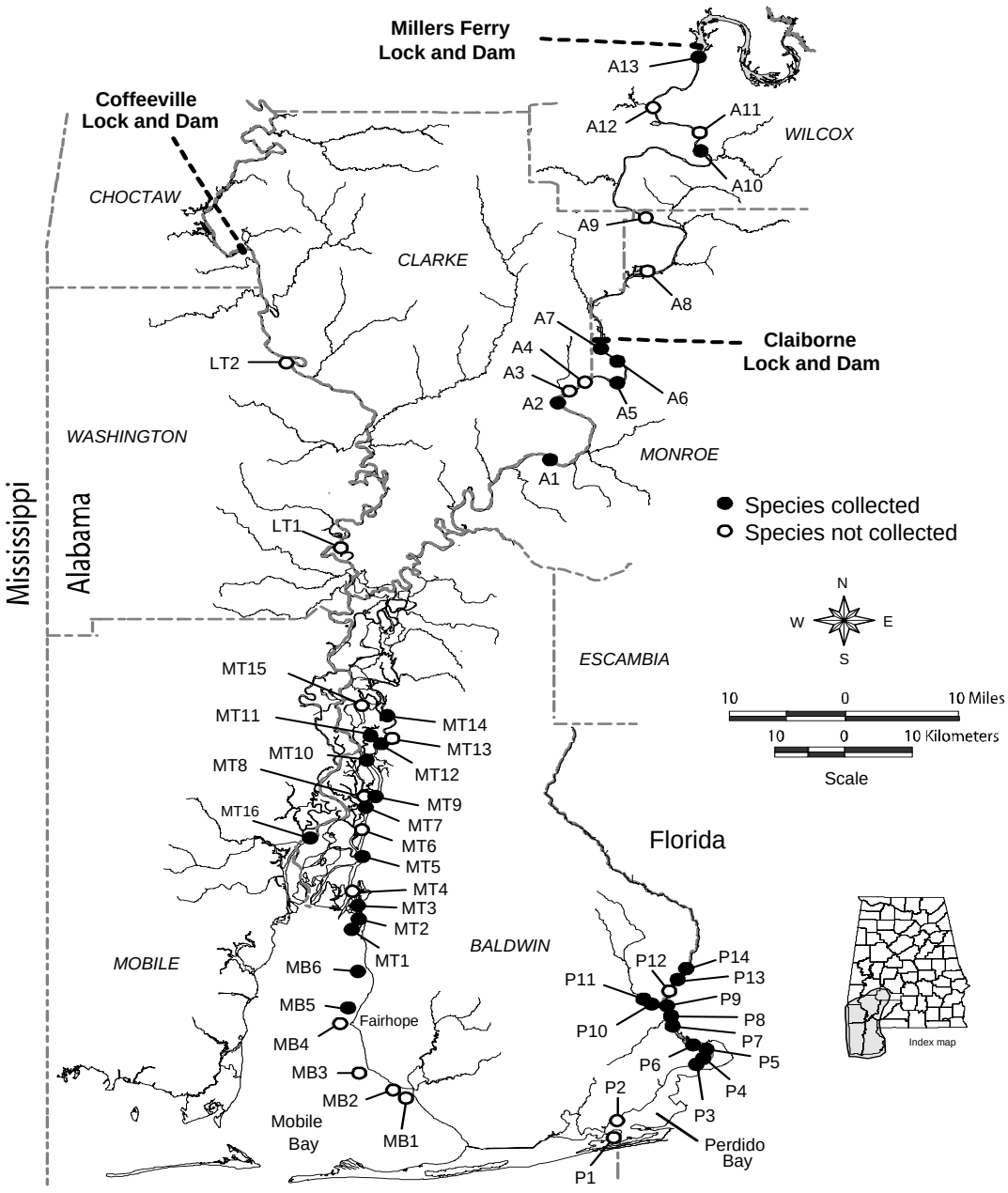
Atractosteus spatula
alligator gar
2 specimens
2 collections

A-5. Collection locations for the alligator gar *Atractosteus spatula* in the lower Mobile and Perdido Basins, 2000-08.



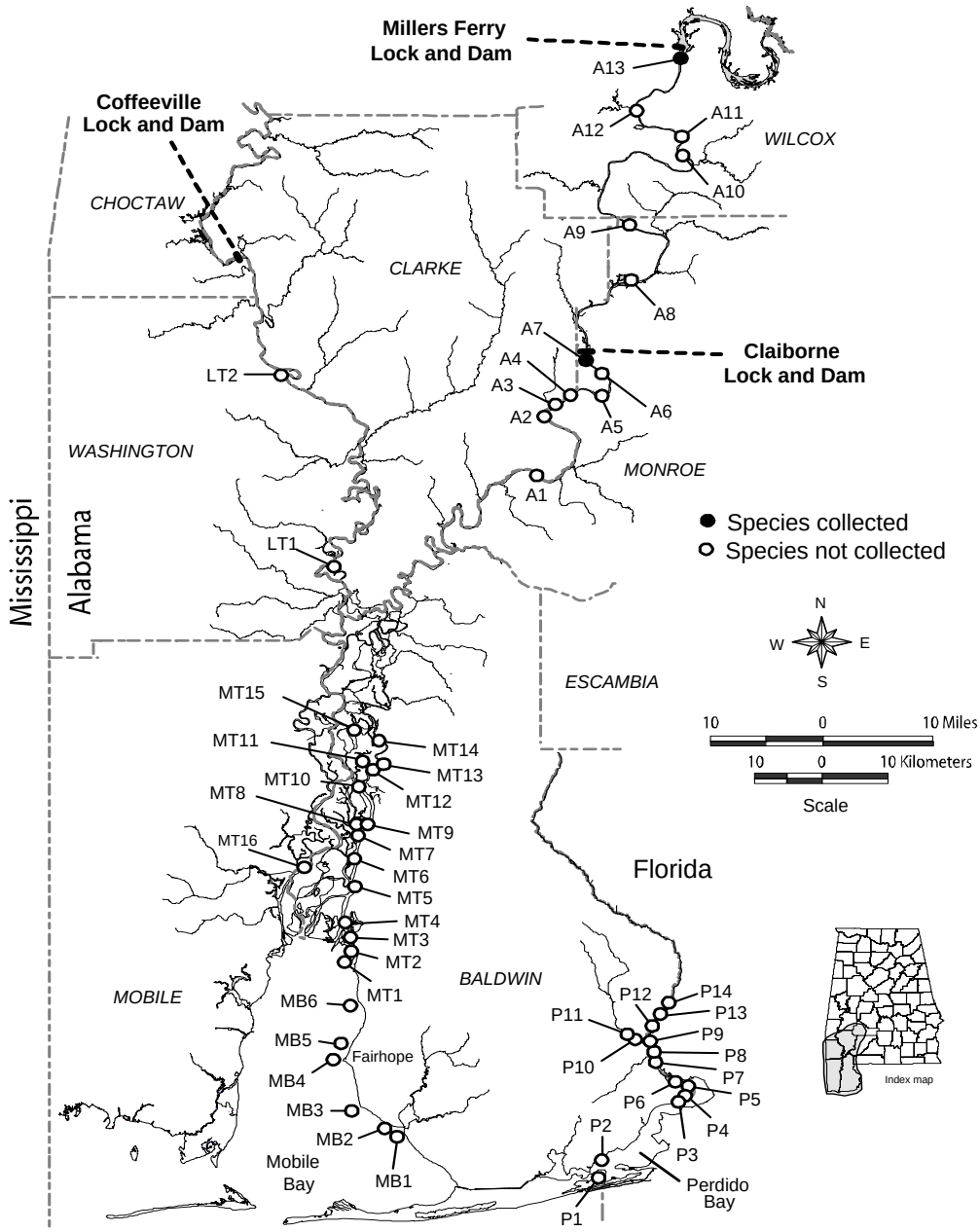
Lepisosteus oculatus
spotted gar
35 specimens
11 collections

A-6. Collection locations for the spotted gar *Lepisosteus oculatus* in the lower Mobile and Perdido Basins, 2000-08.



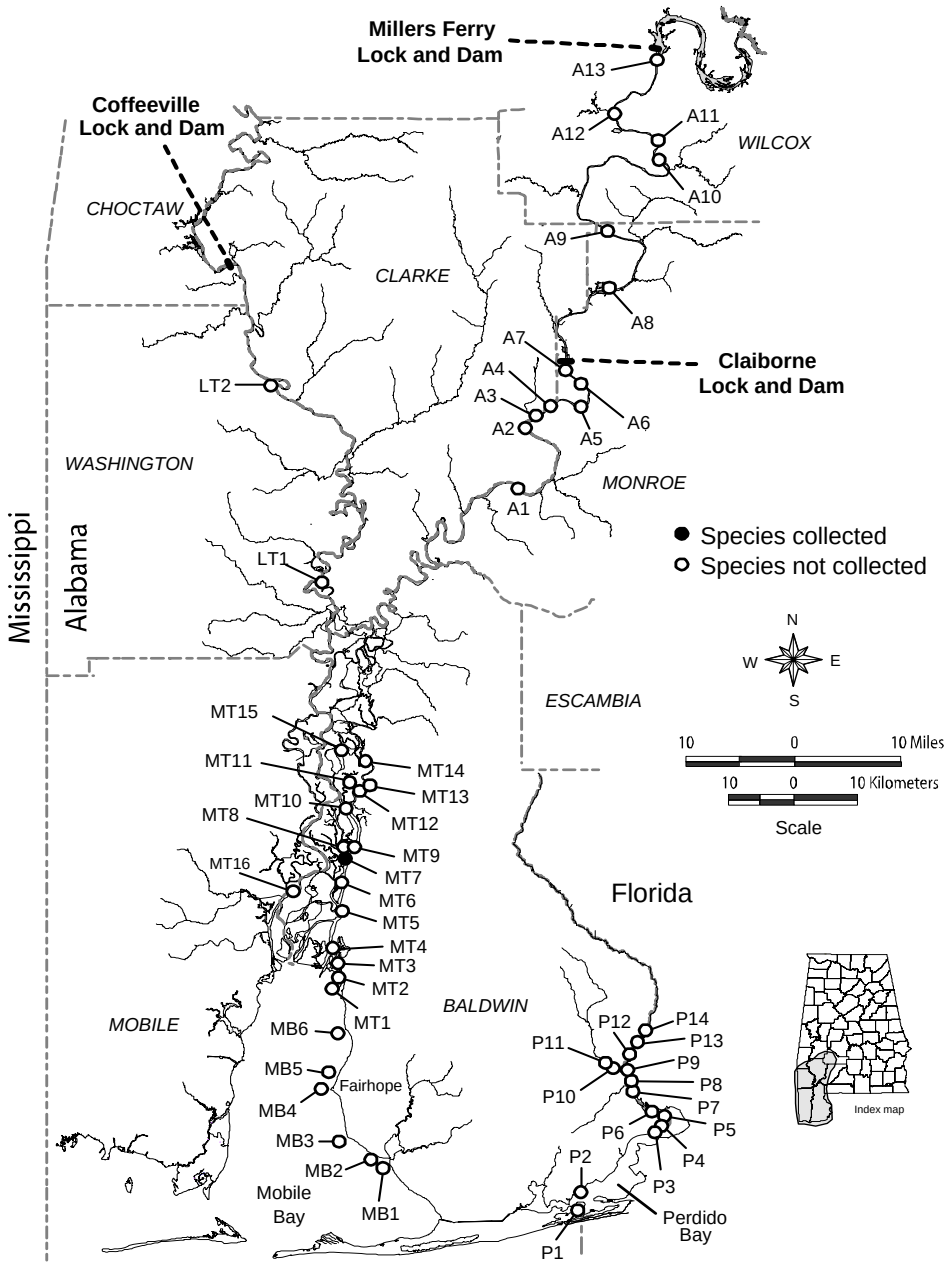
Lepisosteus osseus
longnose gar
222 specimens
66 collections

A-7. Collection locations for the longnose gar *Lepisosteus osseus* in the lower Mobile and Perdido Basins, 2000-08.



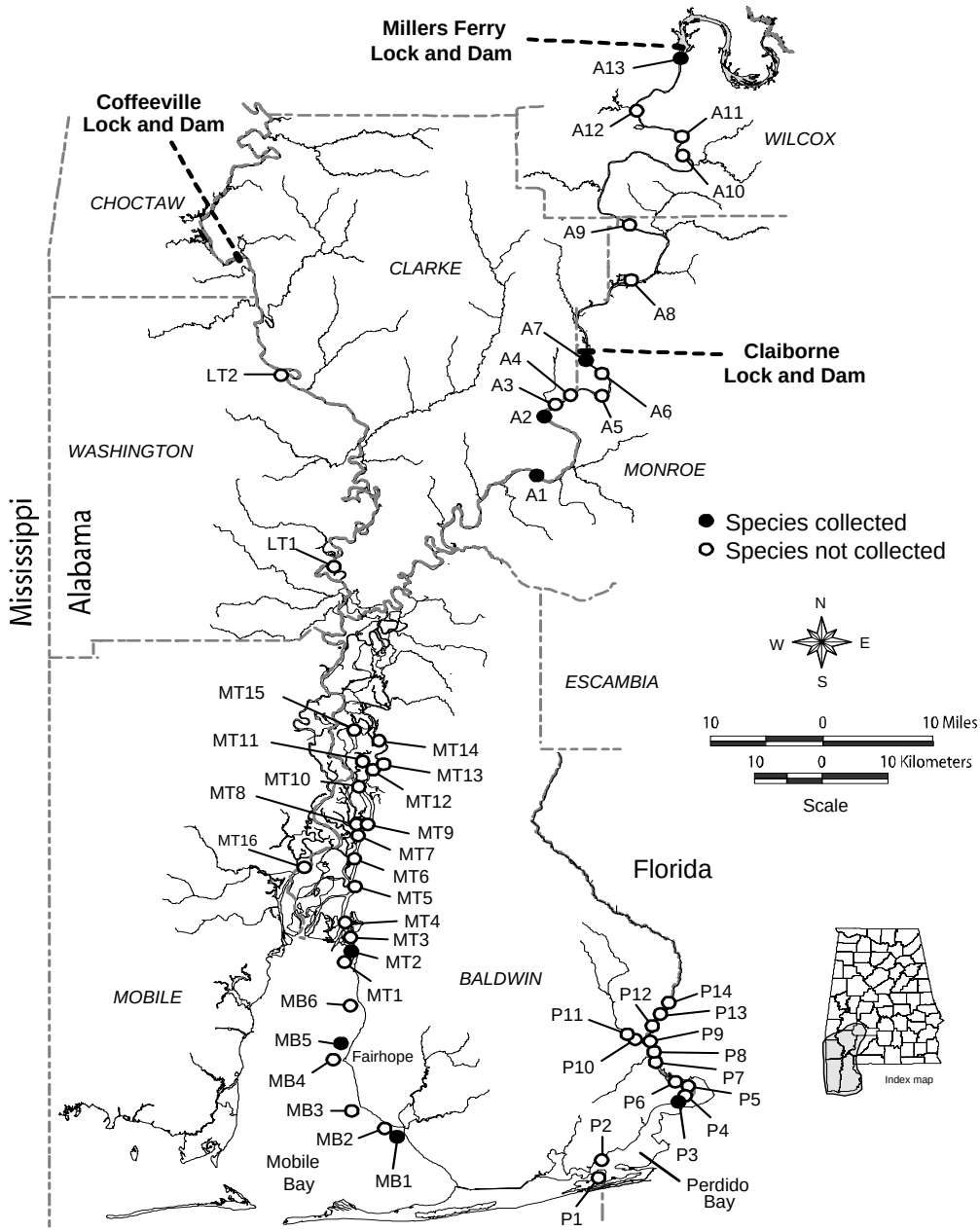
Amia calva
bowfin
8 specimens
6 collections

A-8. Collection locations for the bowfin *Amia calva* in the lower Mobile and Perdido Basins, 2000-08.



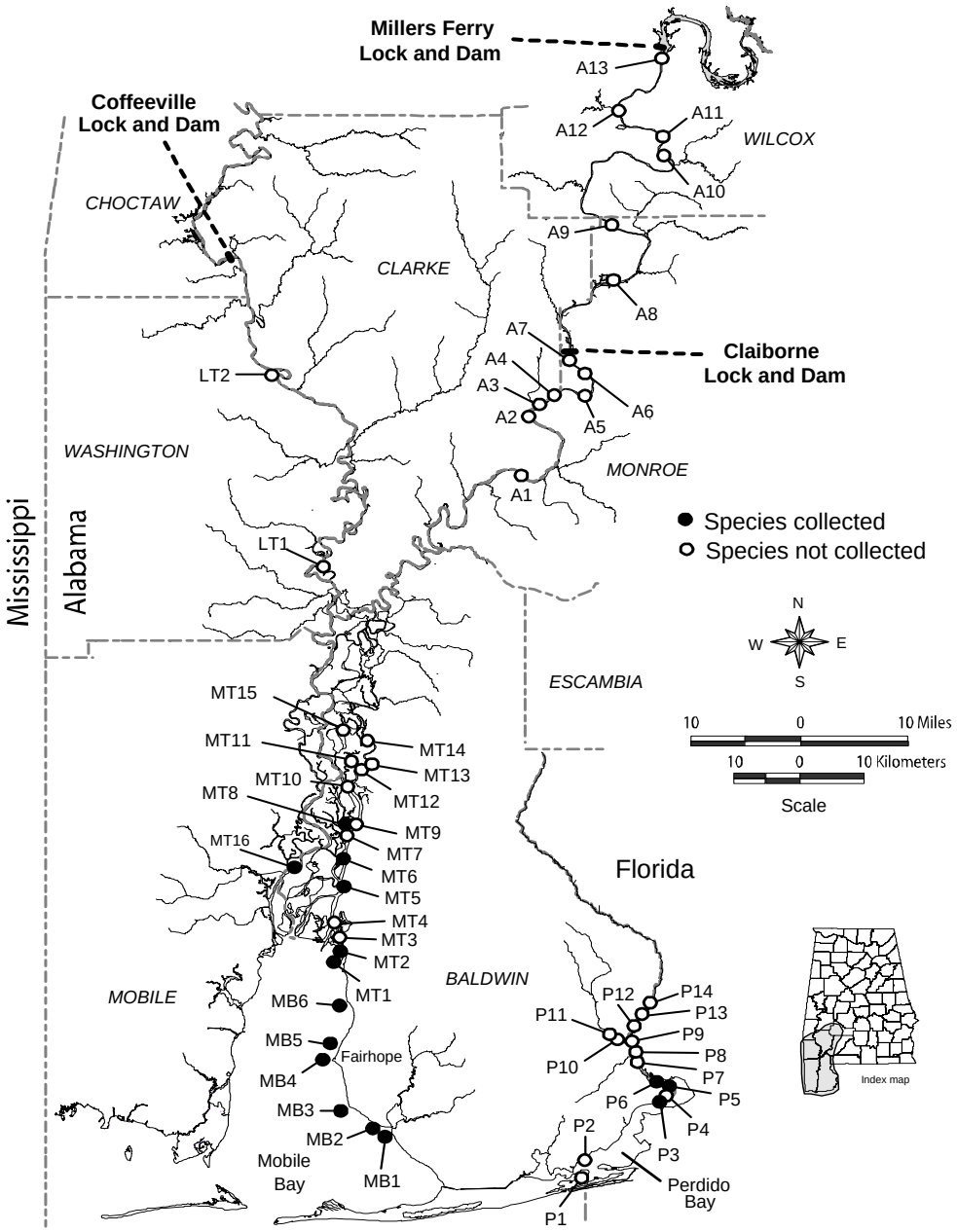
Anguilla rostrata
American eel
1 specimen
1 collection

A-9. Collection location for the American eel *Anguilla rostrata* in the lower Mobile and Perdido Basins, 2000-08.



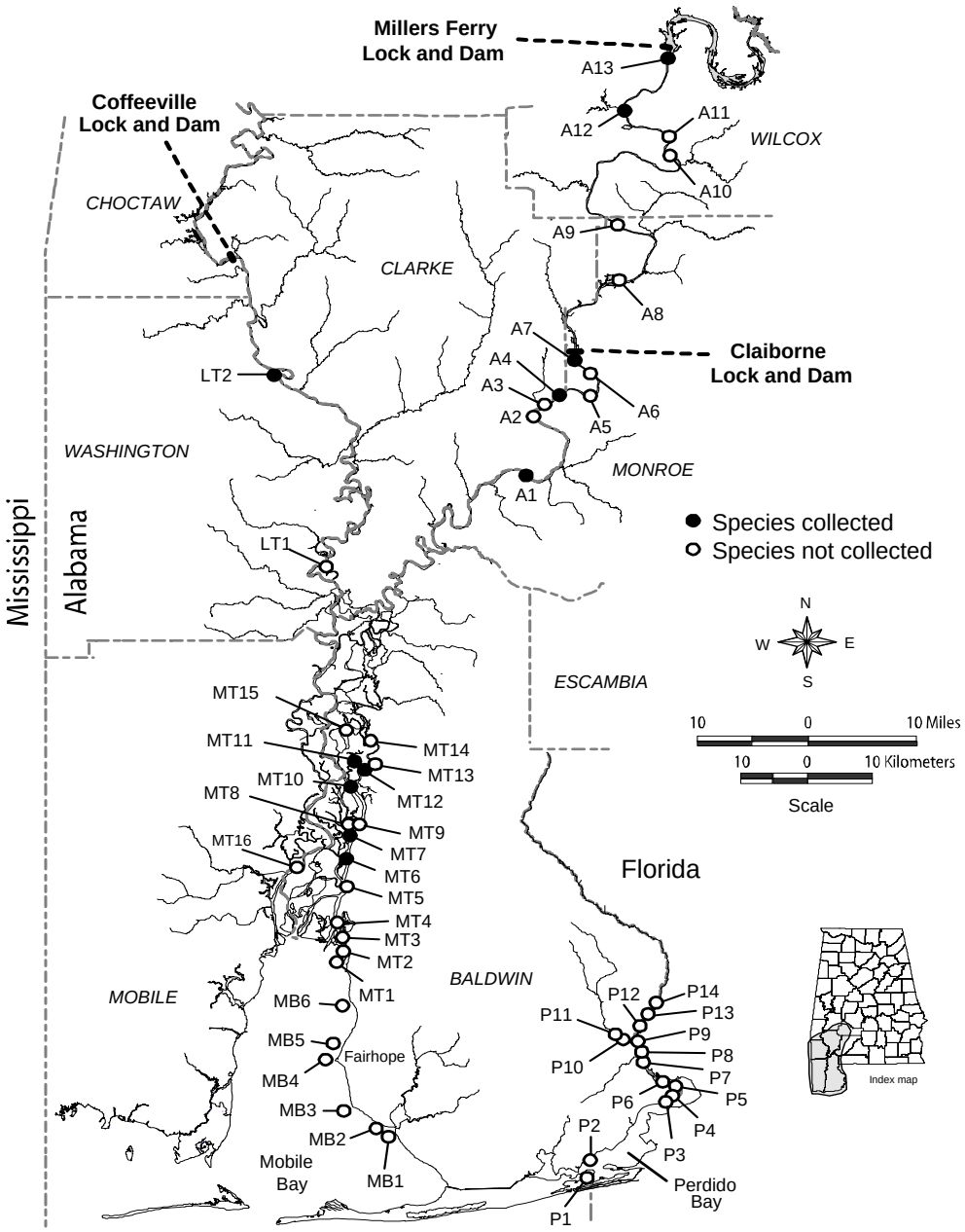
Alosa chrysochloris
skipjack herring
14 specimens
12 collections

A-10. Collection locations for the skipjack herring *Alosa chrysochloris* in the lower Mobile and Perdido Basins, 2000-08.



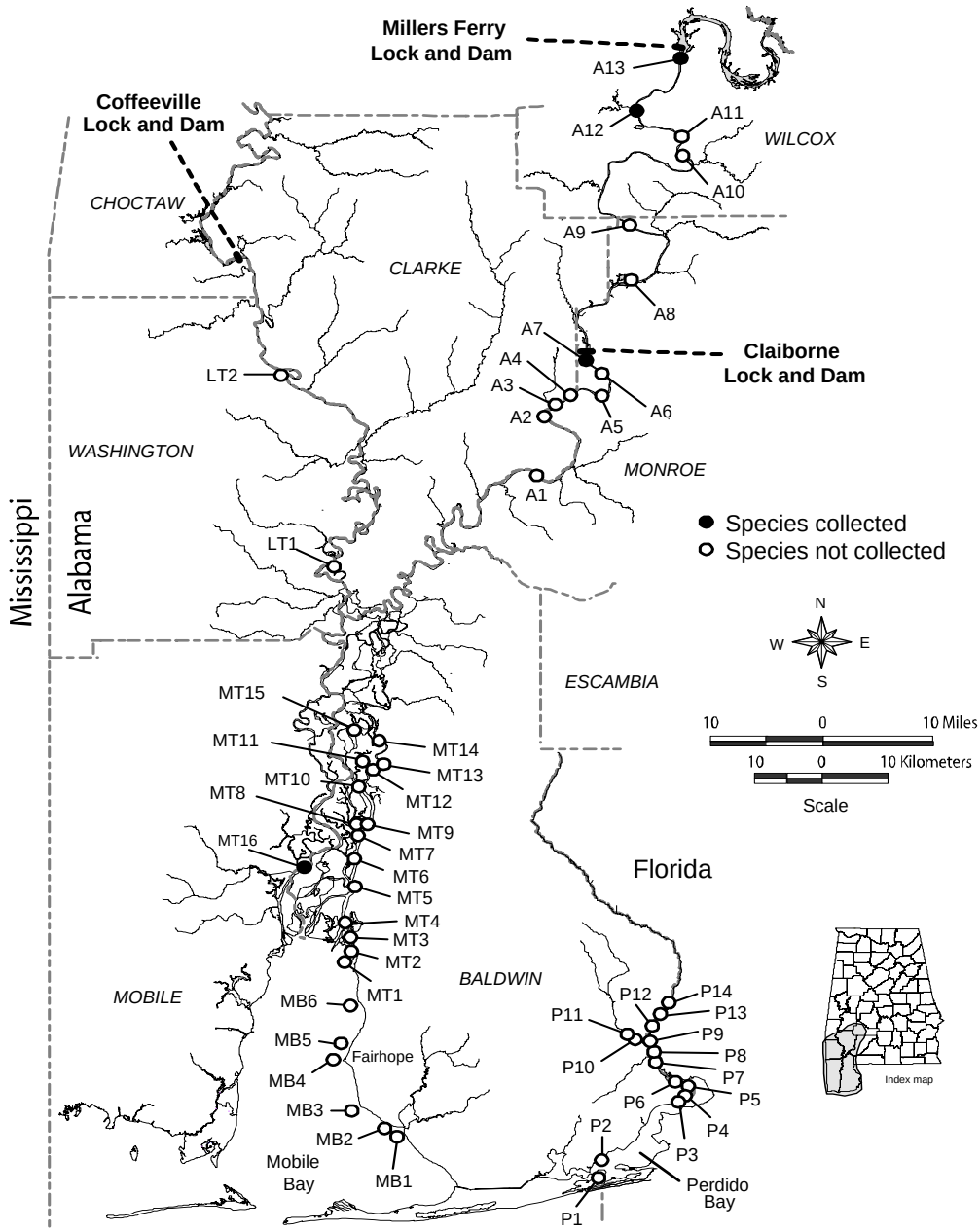
Brevoortia patronus
Gulf menhaden
367 specimens
35 collections

A-11. Collection locations for the Gulf menhaden *Brevoortia patronus* in the lower Mobile and Perdido Basins, 2000-08.



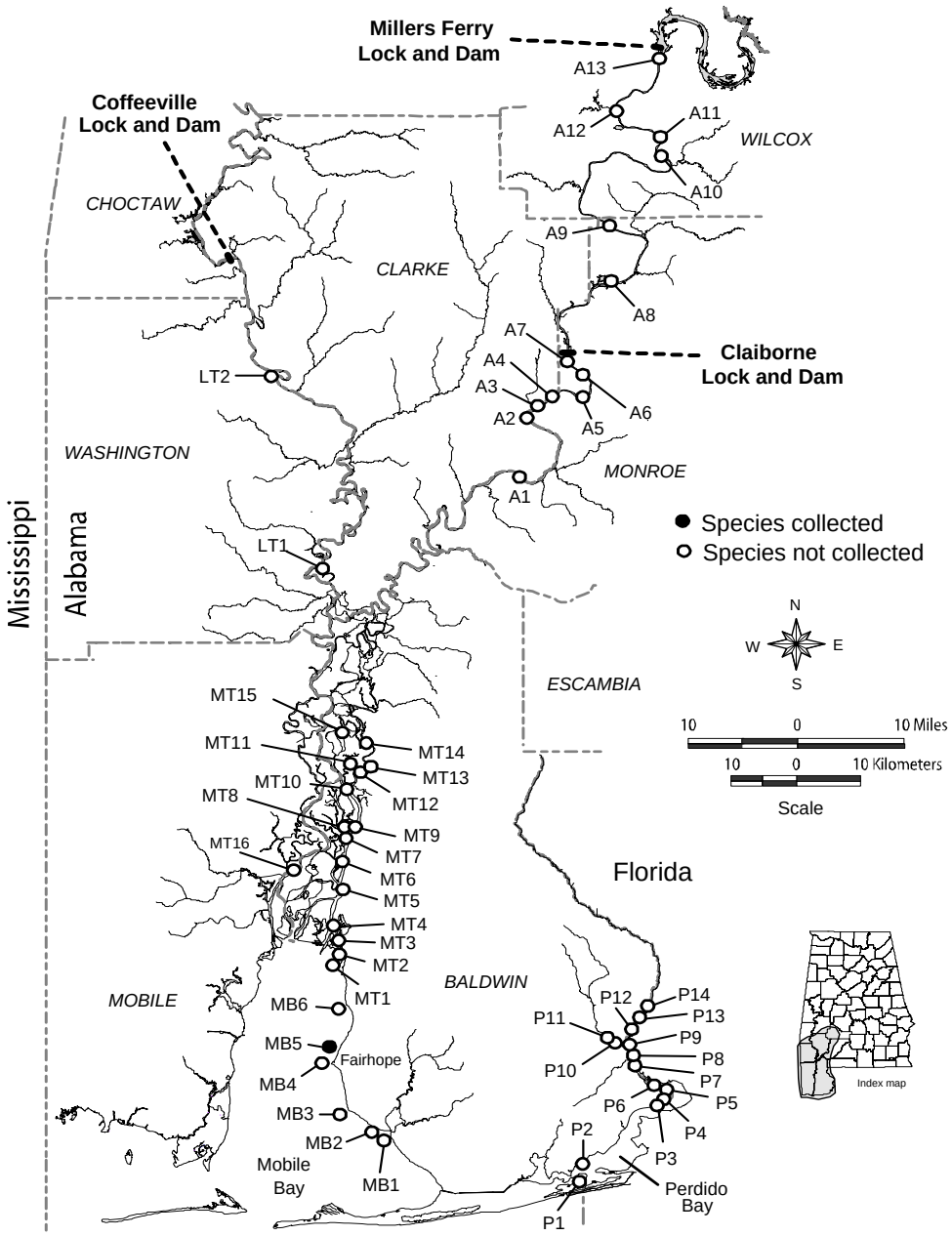
Dorosoma cepedianum
gizzard shad
116 specimens
21 collections

A-12. Collection locations for the gizzard shad *Dorosoma cepedianum* in the lower Mobile and Perdido Basins, 2000-08.



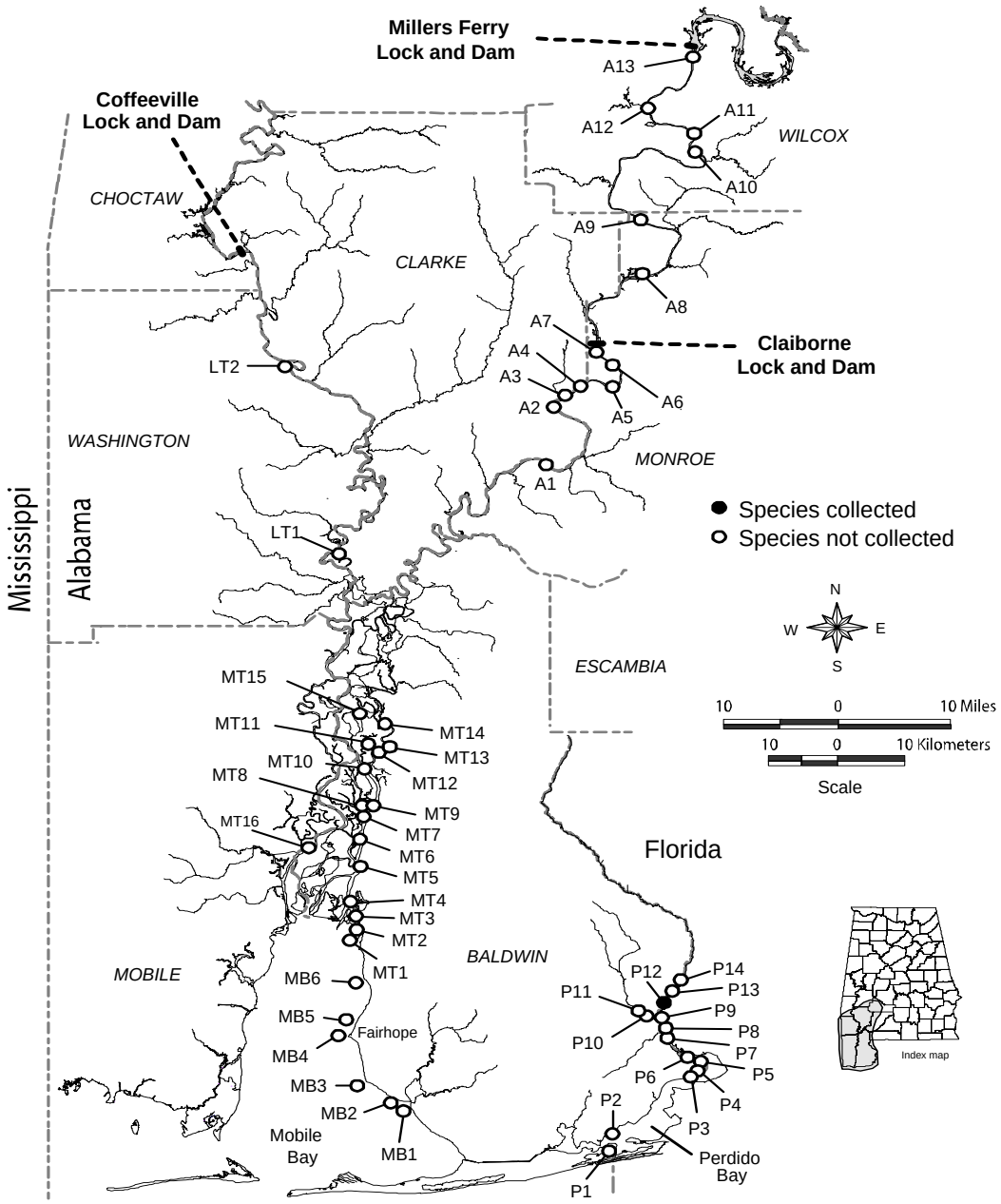
Dorosoma petenense
threadfin shad
313 specimens
5 collections

A-13. Collection locations for the threadfin shad *Dorosoma petenense* in the lower Mobile and Perdido Basins, 2000-08.



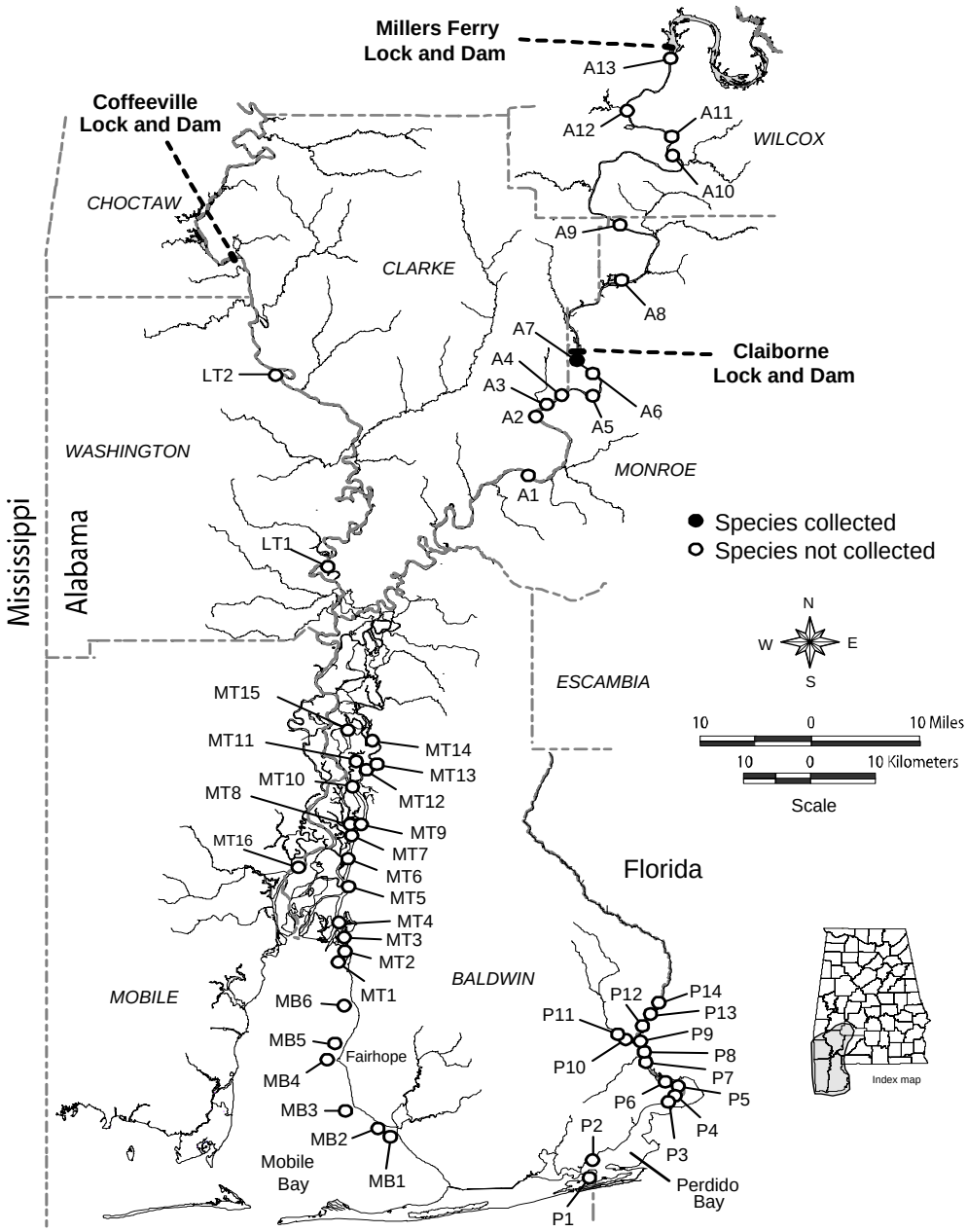
Anchoa mitchilli
bay anchovy
1 specimen
1 collection

A-14. Collection location for the bay anchovy *Anchoa mitchilli* in the lower Mobile and Perdido Basins, 2000-08.



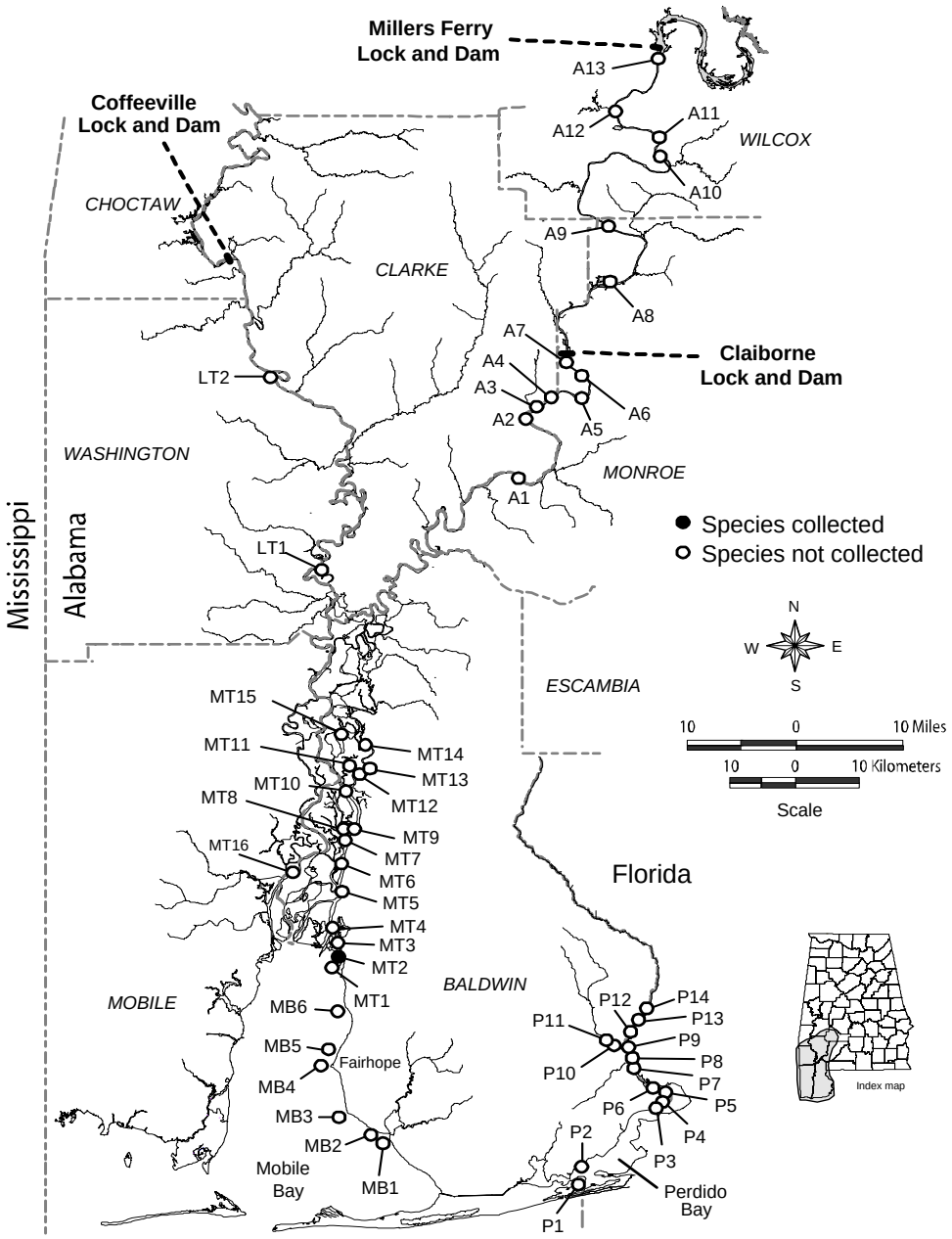
Esox niger
chain pickerel
2 specimen
1 collection

A-15. Collection location for the chain pickerel *Esox niger* in the lower Mobile and Perdido Basins, 2000-08.



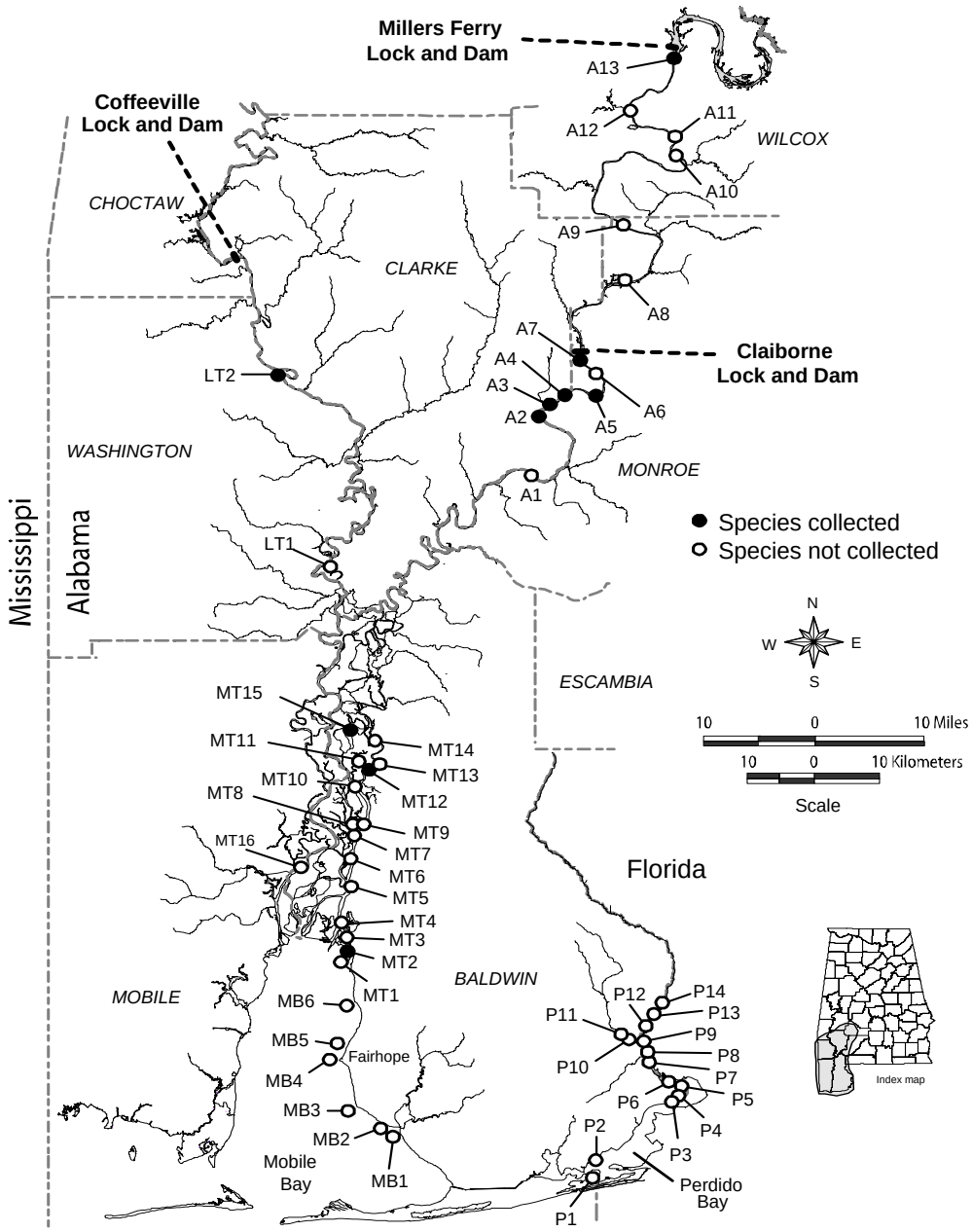
Hiodon tergisus
mooneye
1 specimen
1 collection

A-16. Collection location for the mooneye *Hiodon tergisus* in the lower Mobile and Perdido Basins, 2000-08.



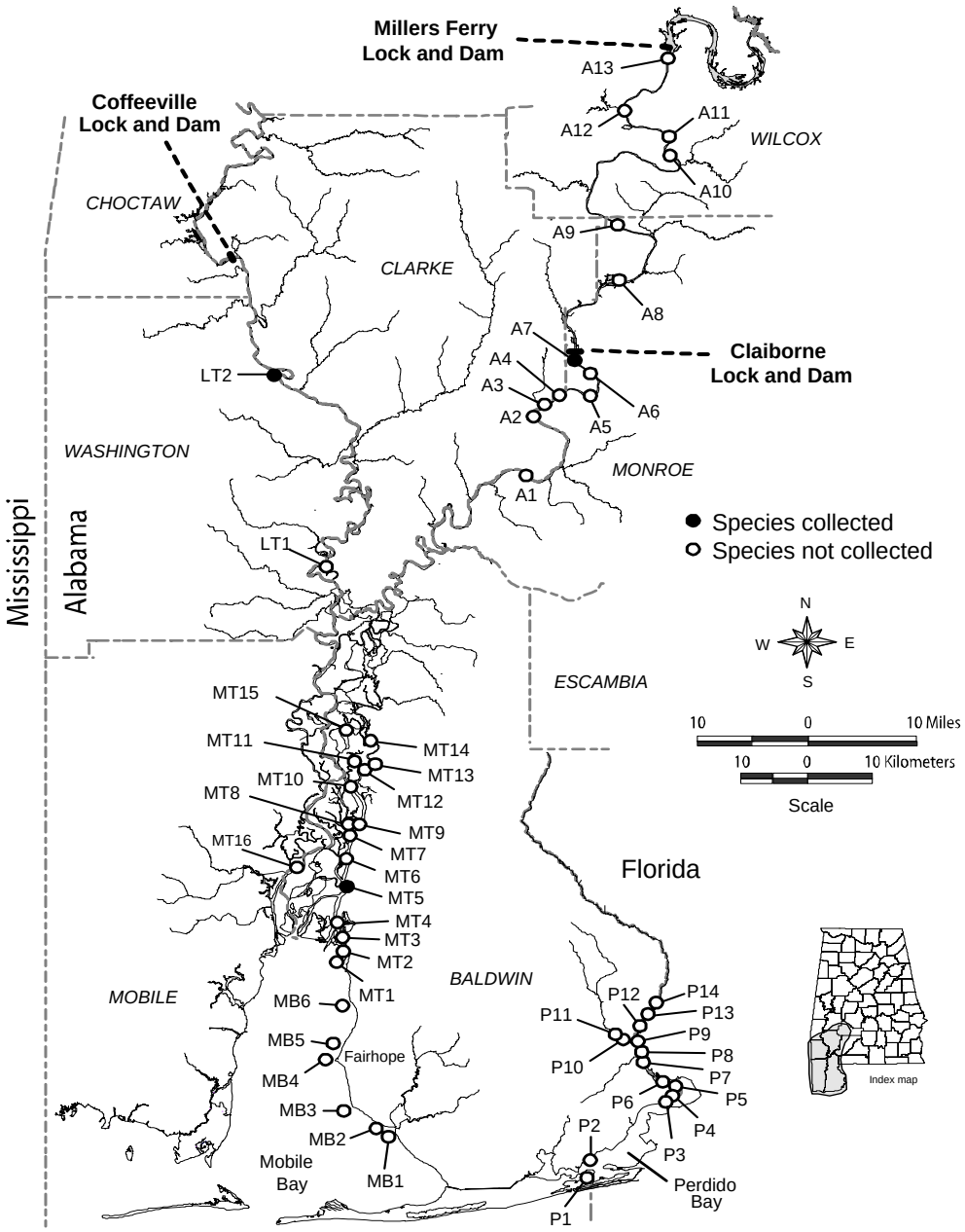
Ctenopharyngodon idella
grass carp
1 specimen
1 collection

A-17. Collection location for the grass carp *Ctenopharyngodon idella* in the lower Mobile and Perdido Basins, 2000-08.



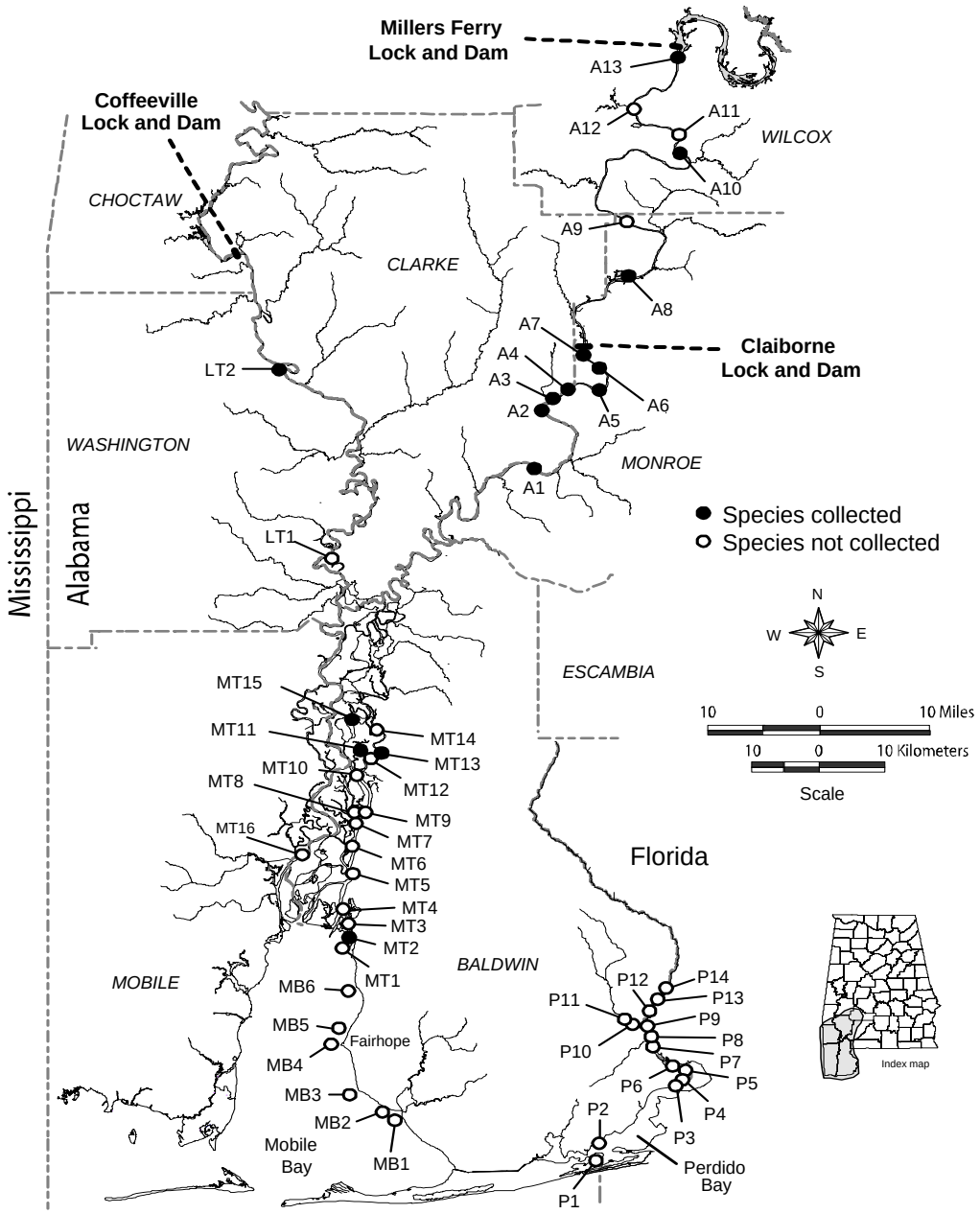
Cyprinus carpio
common carp
31 specimens
16 collections

A-18. Collection locations for the common carp *Cyprinus carpio* in the lower Mobile and Perdido Basins, 2000-08.



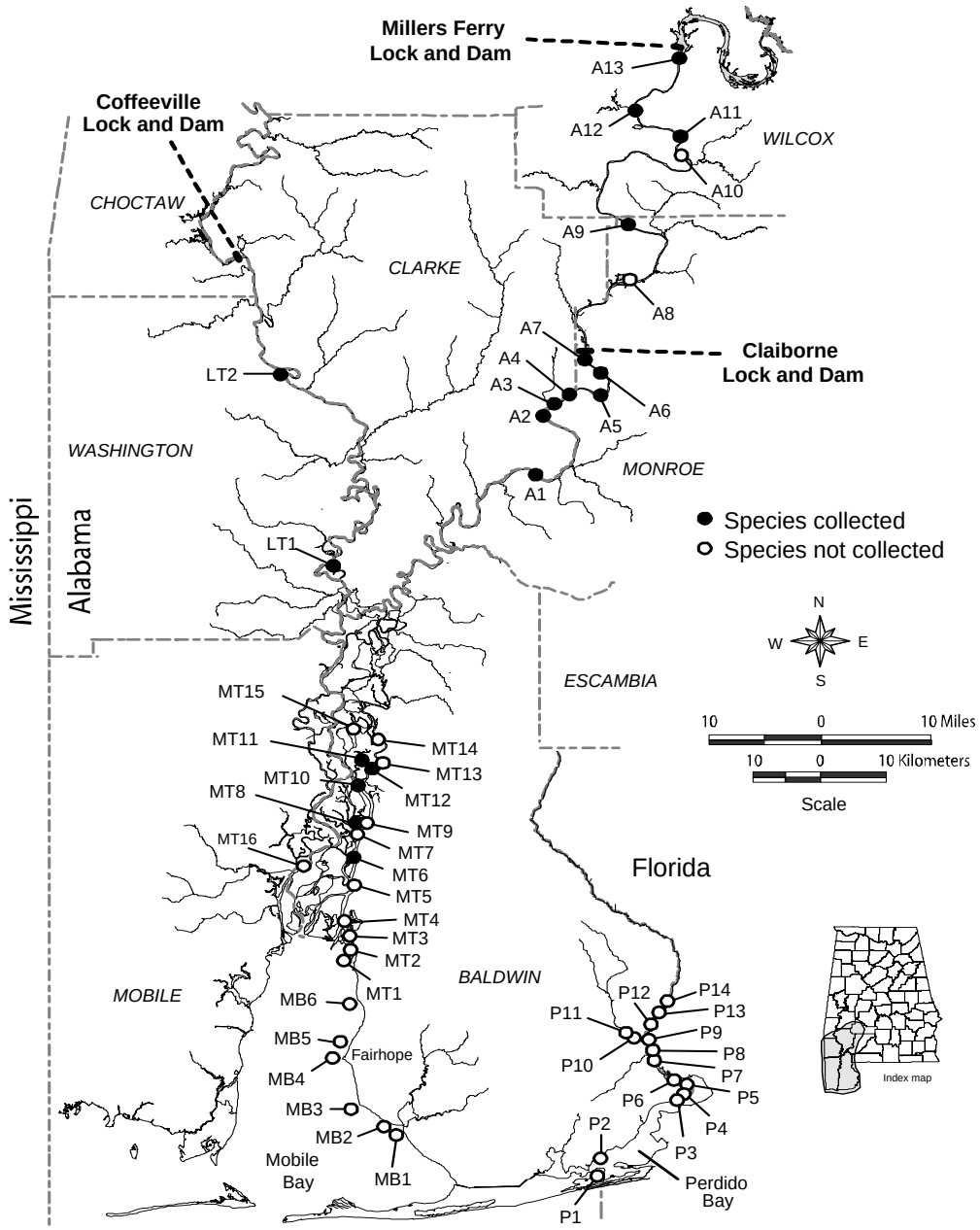
Hypopthalmichthys nobilis
bighead carp
3 specimens
3 collections

A-19. Collection locations for the bighead carp *Hypopthalmichthys nobilis* in the lower Mobile and Perdido Basins, 2000-08.



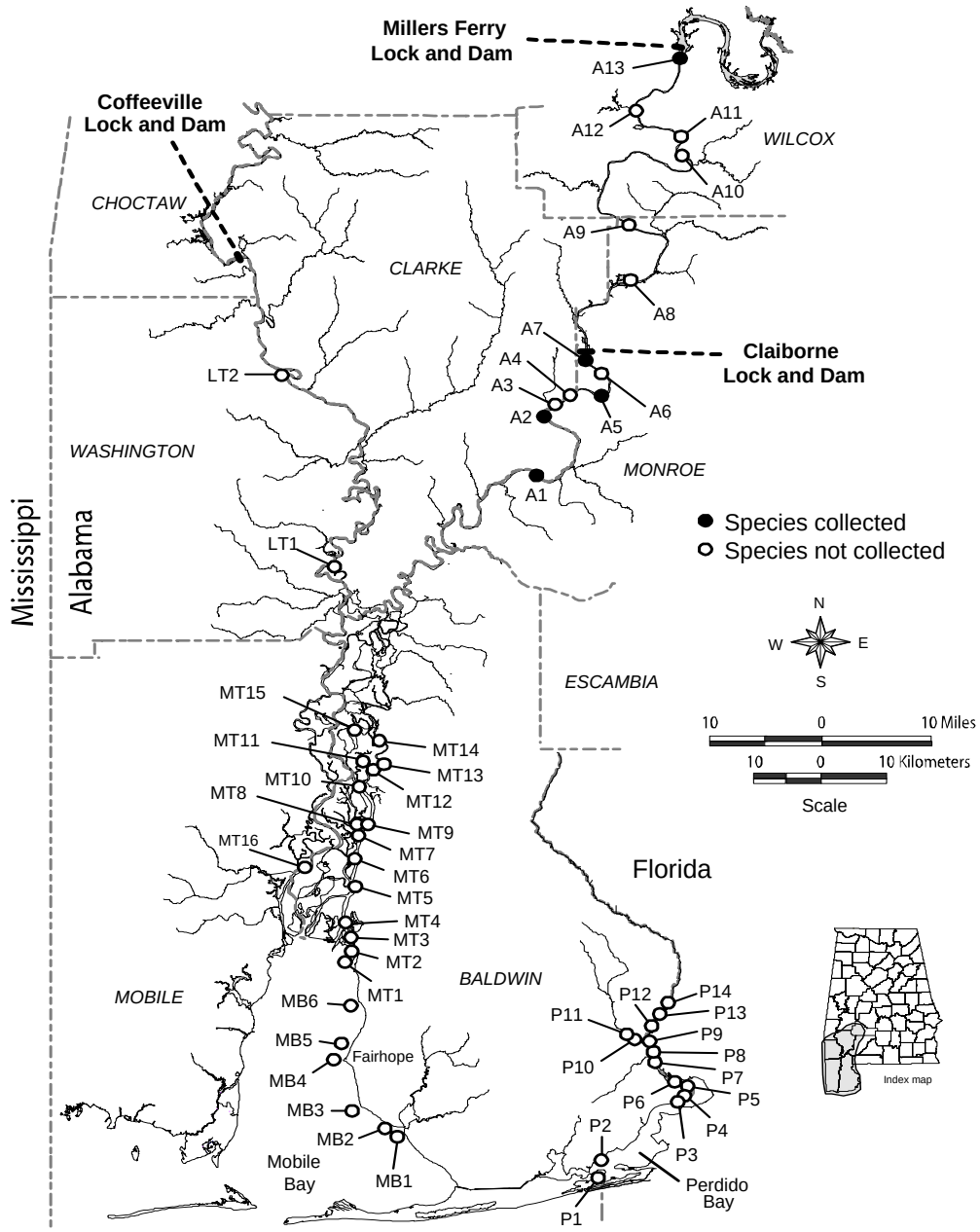
Carpiodes cyprinus
quillback
141 specimens
35 collections

A-20. Collection locations for the quillback *Carpiodes cyprinus* in the lower Mobile and Perdido Basins, 2000-08.



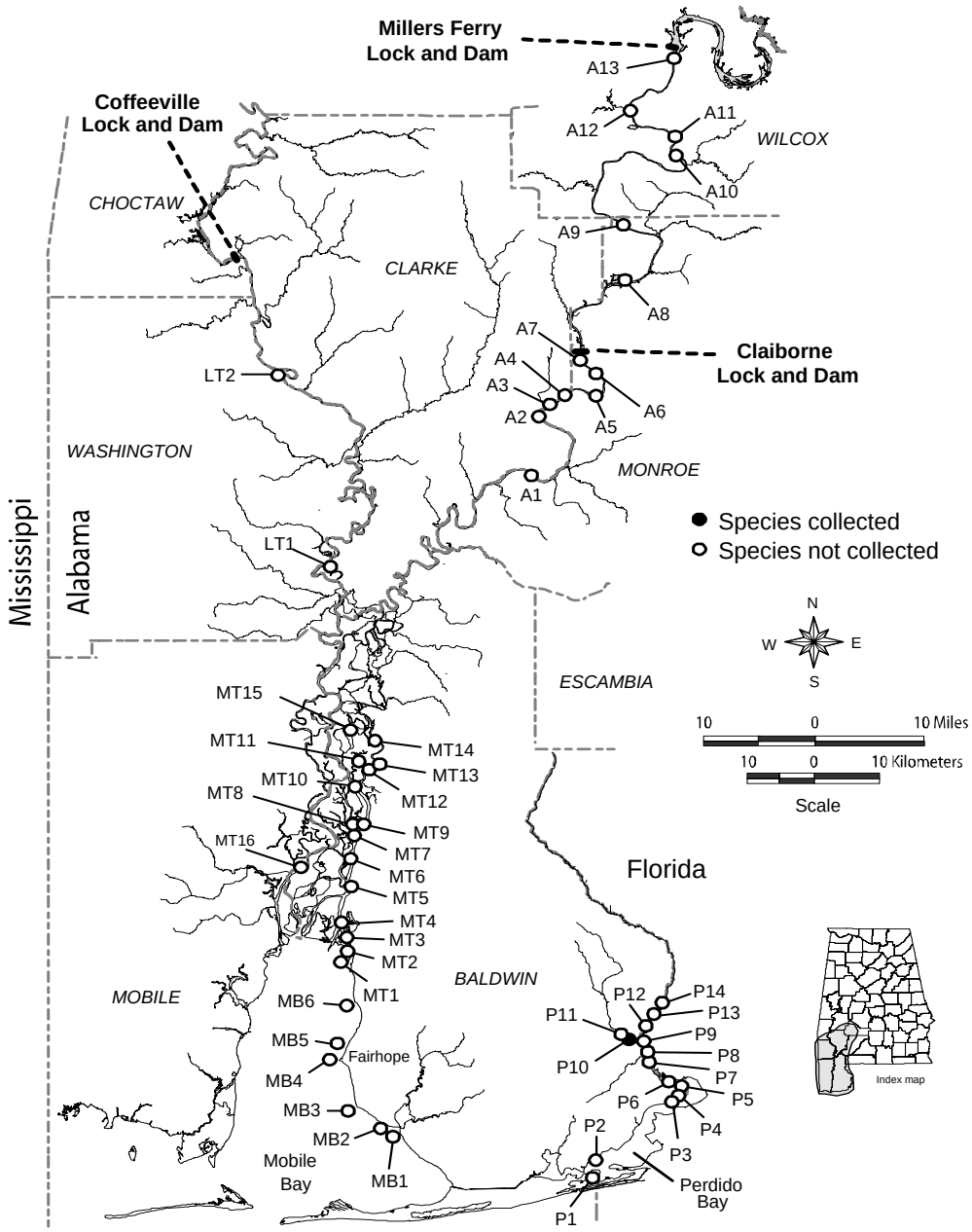
Carpiodes velifer
highfin carpsucker
881 specimens
69 collections

A-21. Collection locations for the highfin carpsucker *Carpiodes velifer* in the lower Mobile and Perdido Basins, 2000-08.



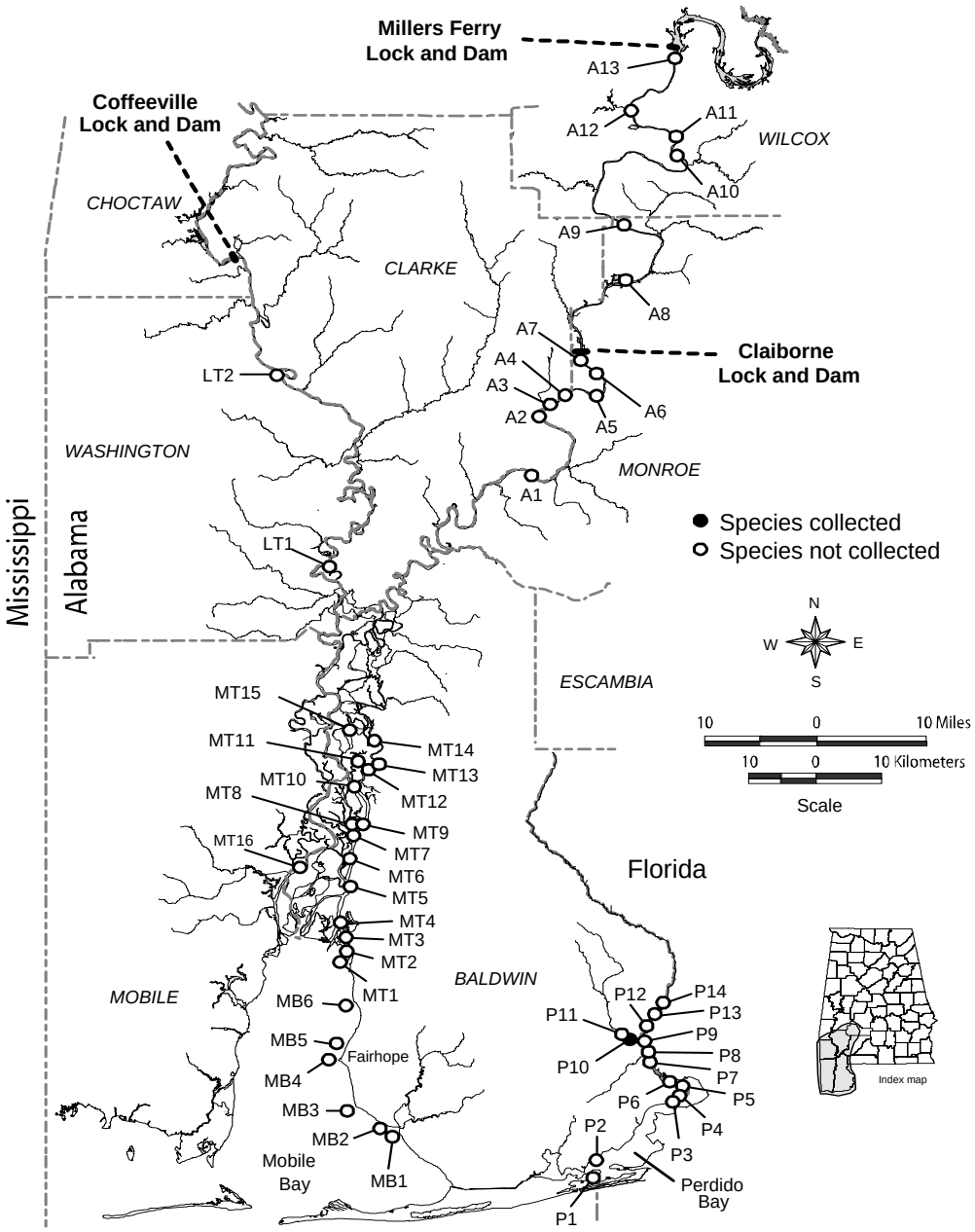
Cycleptus meridionalis
southeastern blue sucker
584 specimens
43 collections

A-22. Collection locations for the southeastern blue sucker *Cycleptus meridionalis* in the lower Mobile and Perdido Basins, 2000-08.



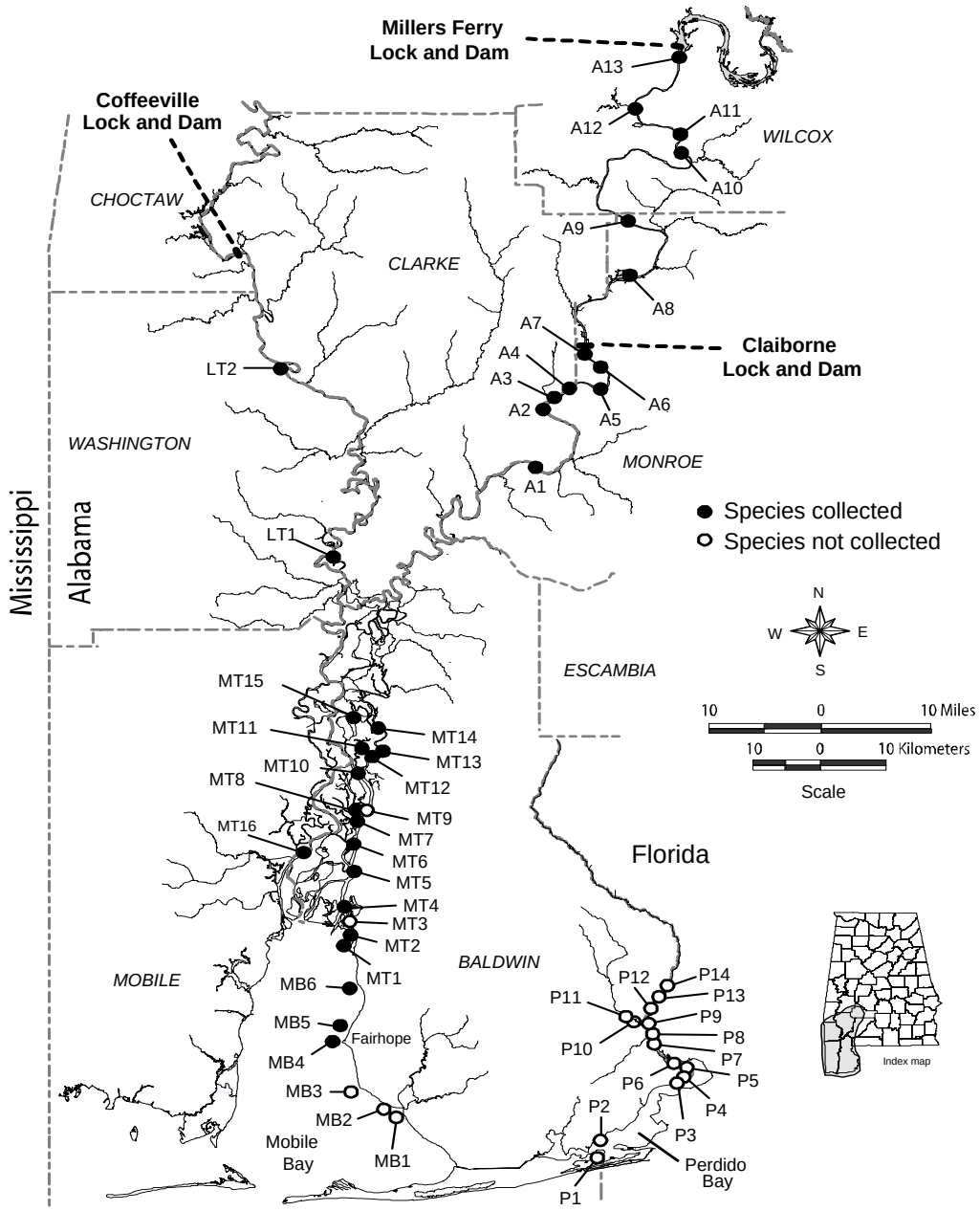
Erimyzon sucetta
lake chubsucker
4 specimens
1 collection

A-23. Collection location for the lake chubsucker *Erimyzon sucetta* in the lower Mobile and Perdido Basins, 2000-08.



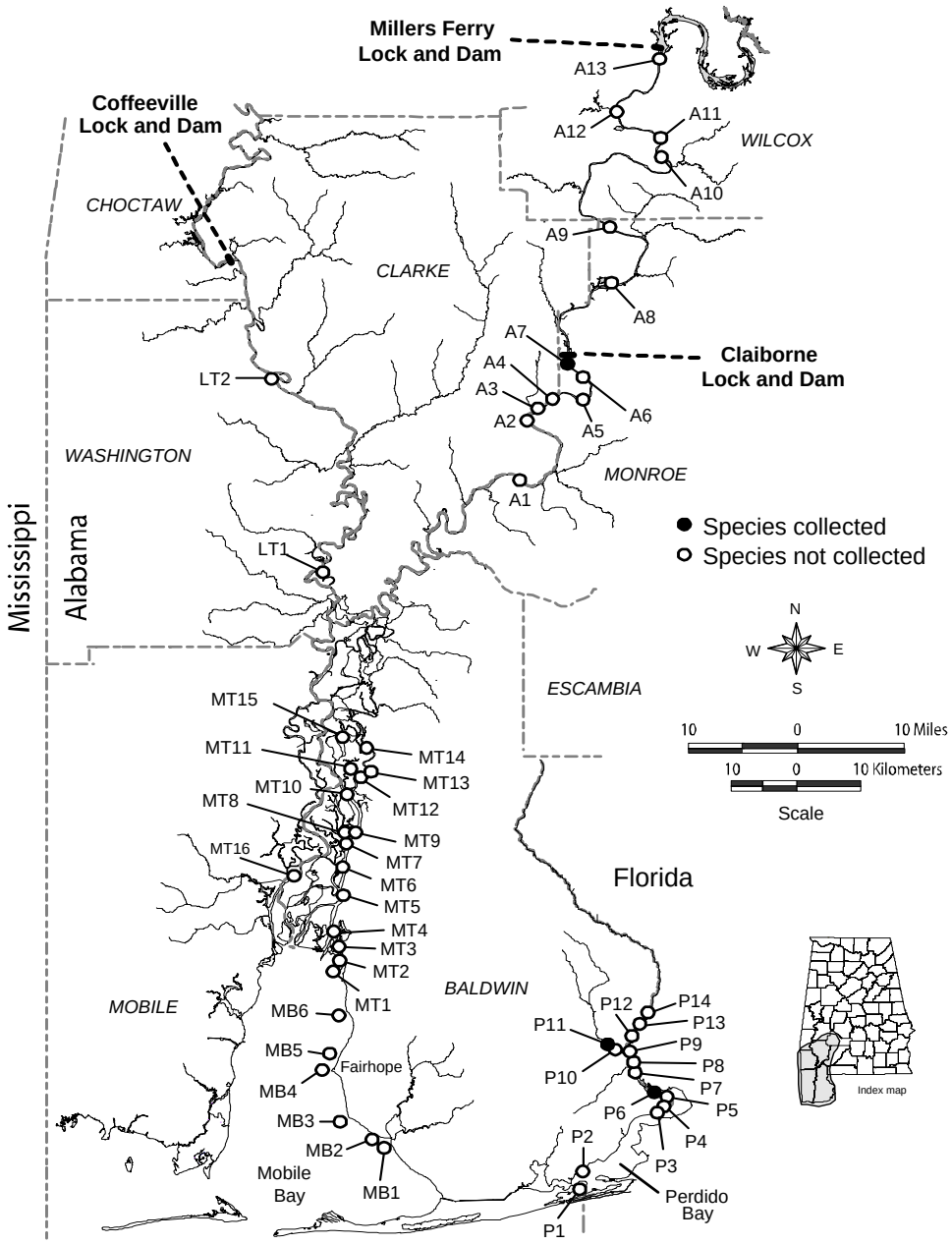
Erimyzon tenuis
sharpfin chubsucker
7 specimens
1 collection

A-24. Collection location for the sharpfin chubsucker *Erimyzon tenuis* in the lower Mobile and Perdido Basins, 2000-08.



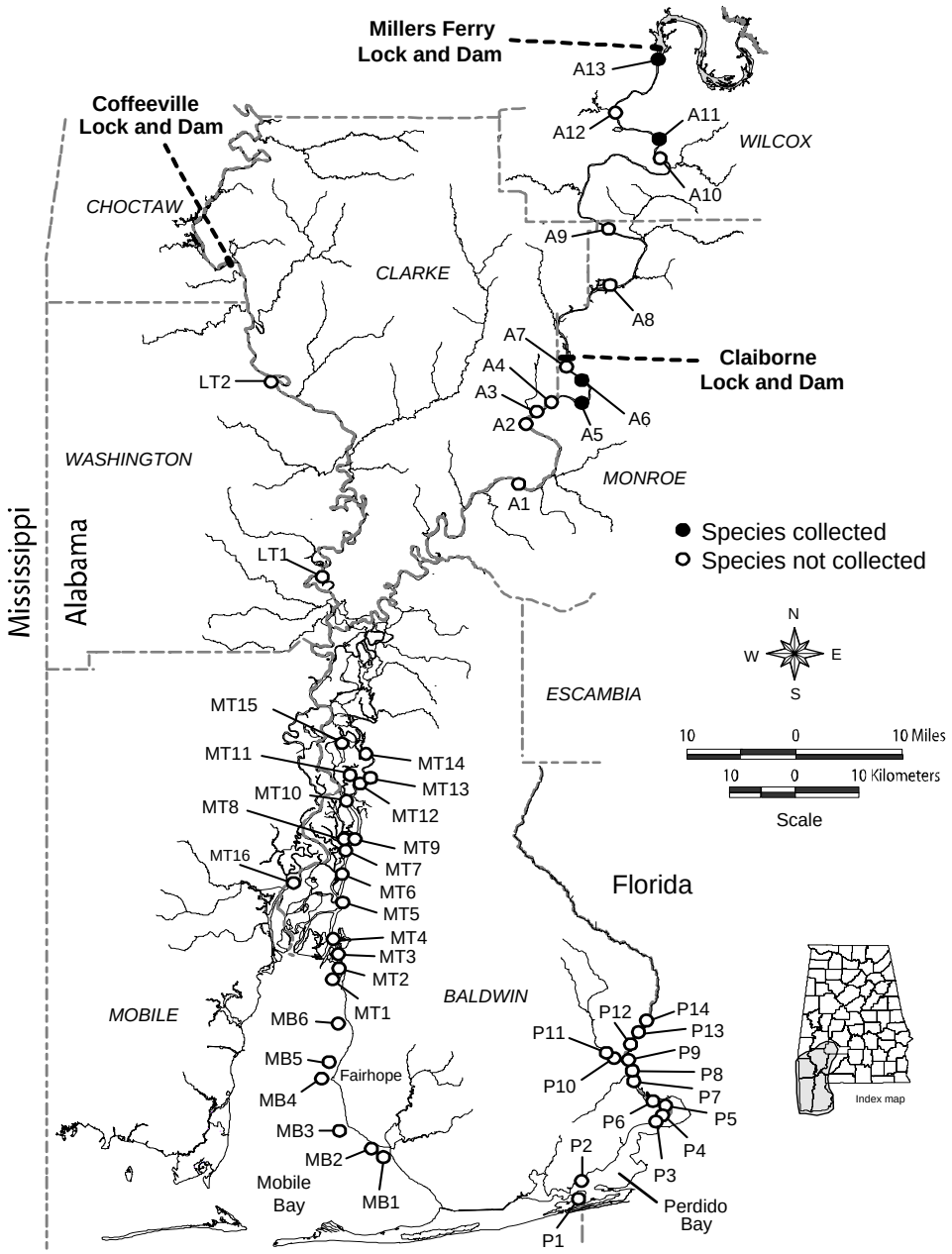
Ictiobus bubalus
smallmouth buffalo
1,149 specimens
108 collections

A-25. Collection locations for the smallmouth buffalo *Ictiobus bubalus* in the lower Mobile and Perdido Basins, 2000-08.



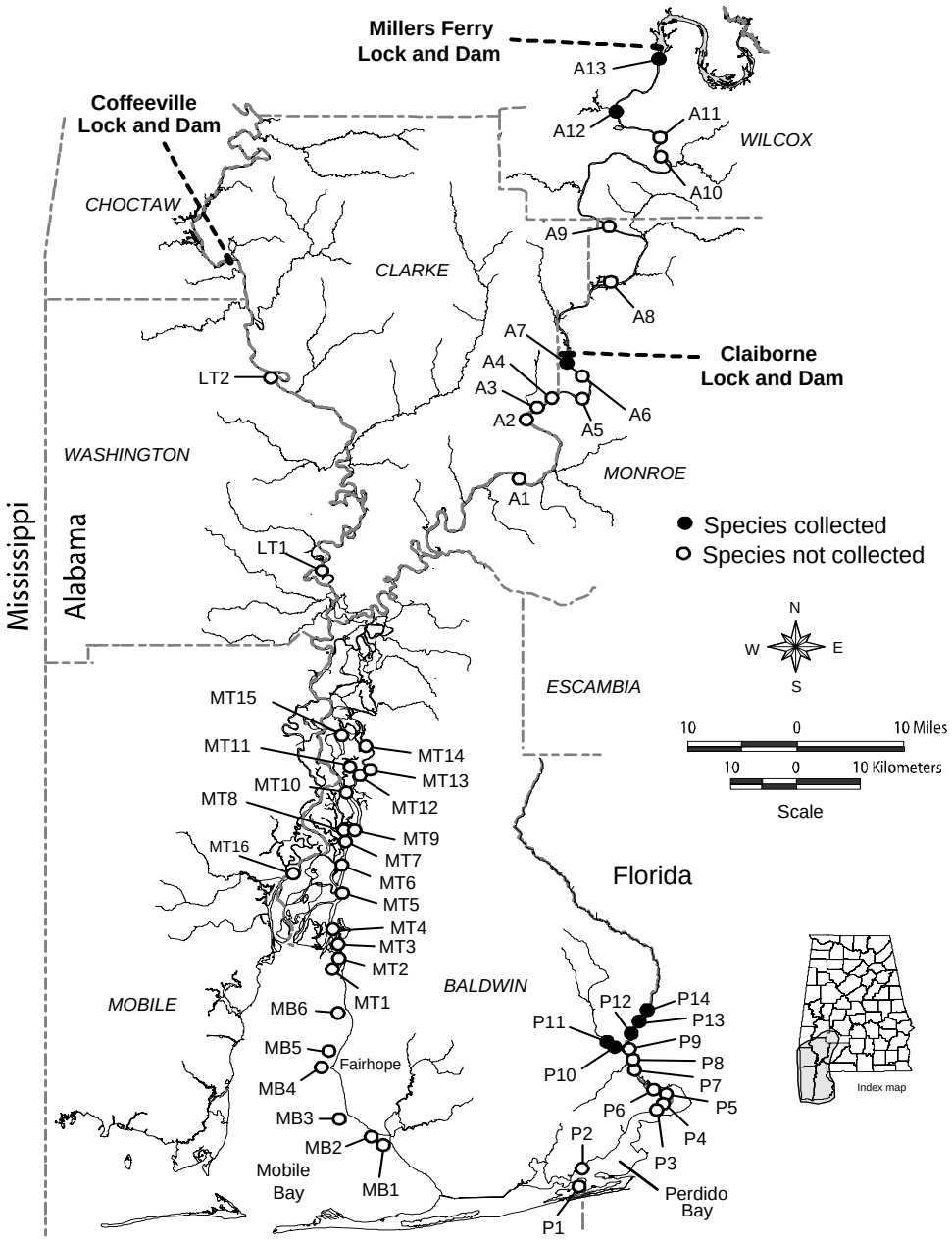
Minytrema melanops
spotted sucker
8 specimens
4 collections

A-26. Collection locations for the spotted sucker *Minytrema melanops* in the lower Mobile and Perdido Basins, 2000-08.



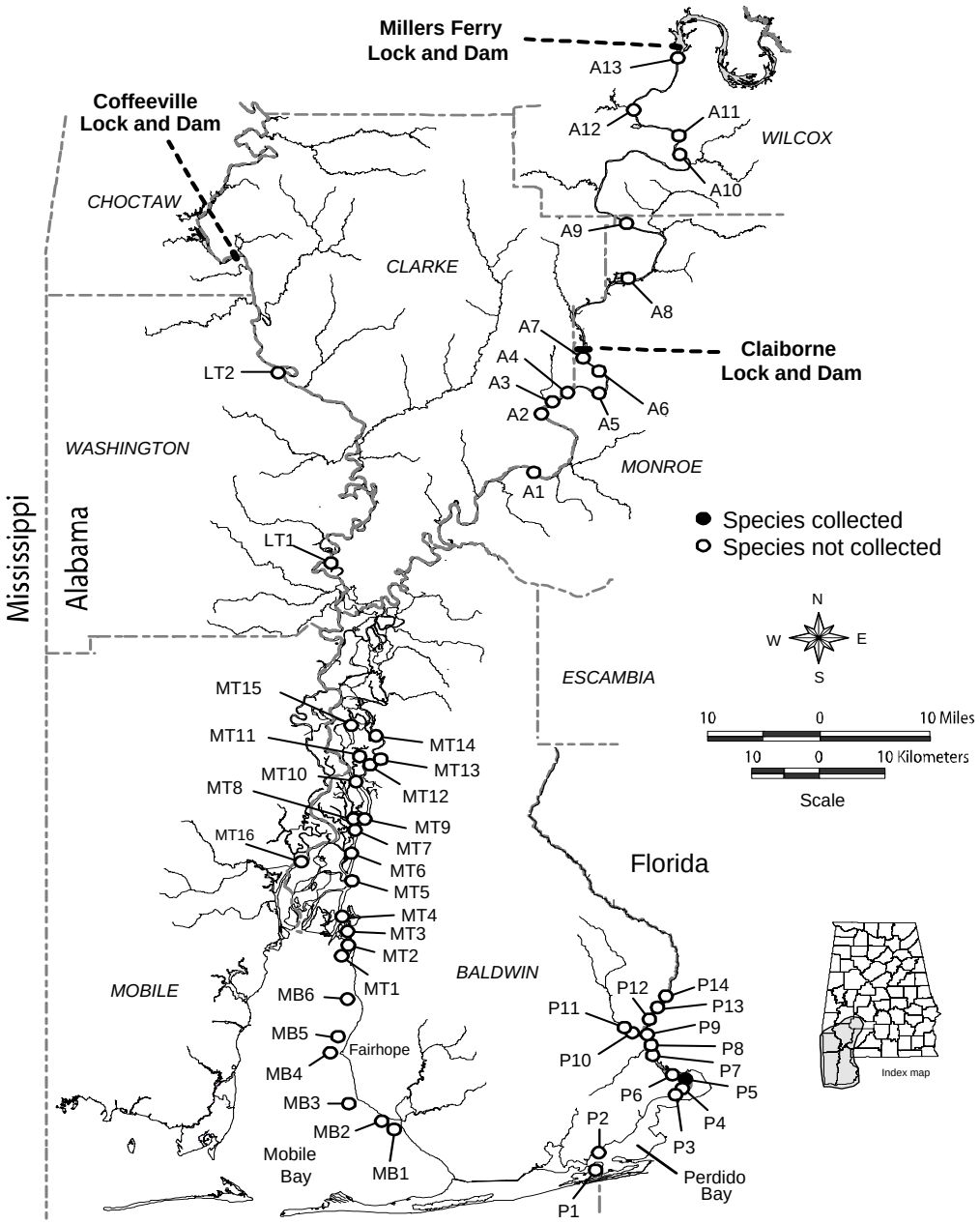
Moxostoma carinatum
river redhorse
106 specimens
25 collections

A-27. Collection locations for the river redhorse *Moxostoma carinatum* in the lower Mobile Mobile and Perdido Basins, 2000-08.



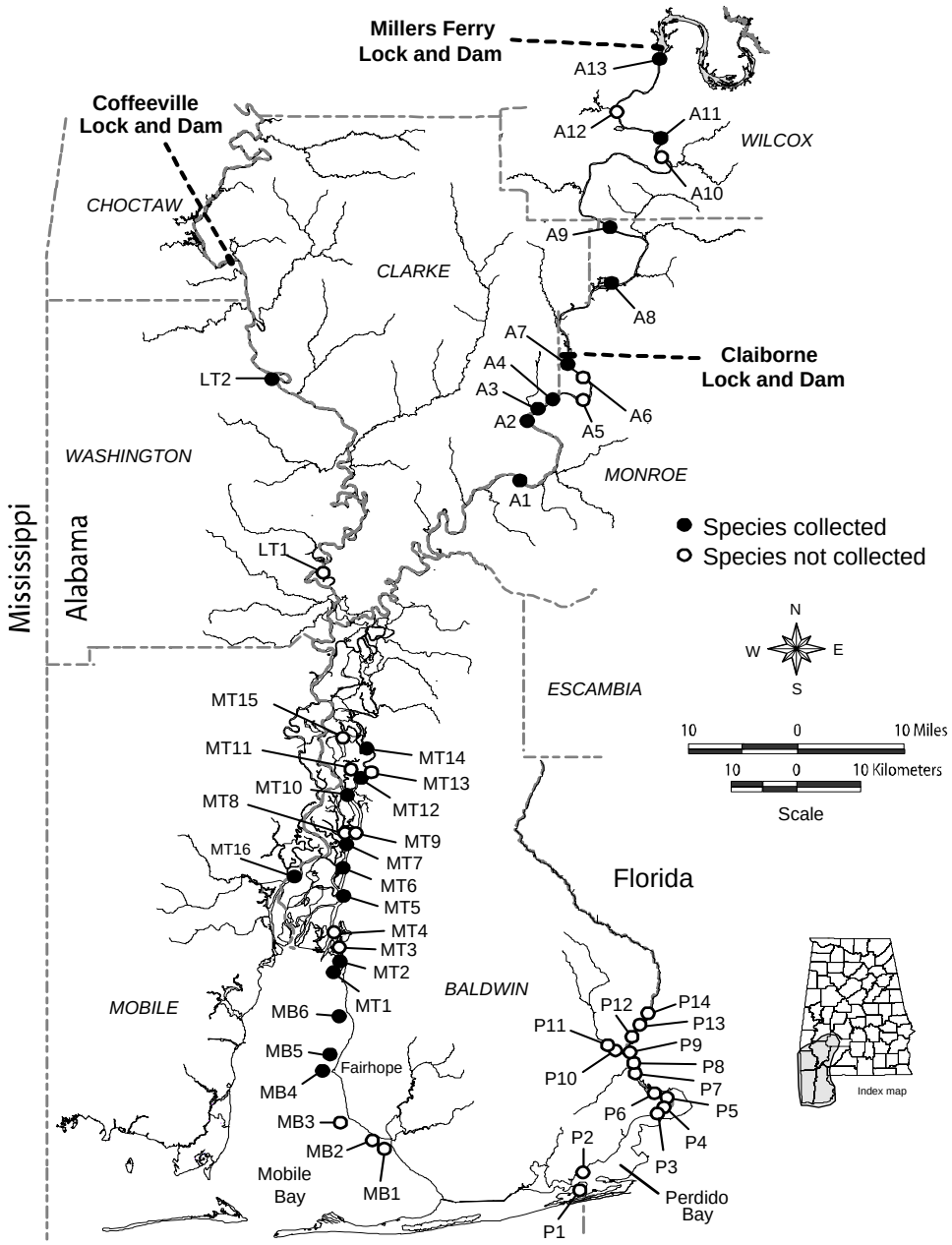
Moxostoma poecilurum
blacktail redhorse
79 specimens
13 collections

A-28. Collection locations for the blacktail redhorse *Moxostoma poecilurum* in the lower Mobile and Perdido Basins, 2000-08.



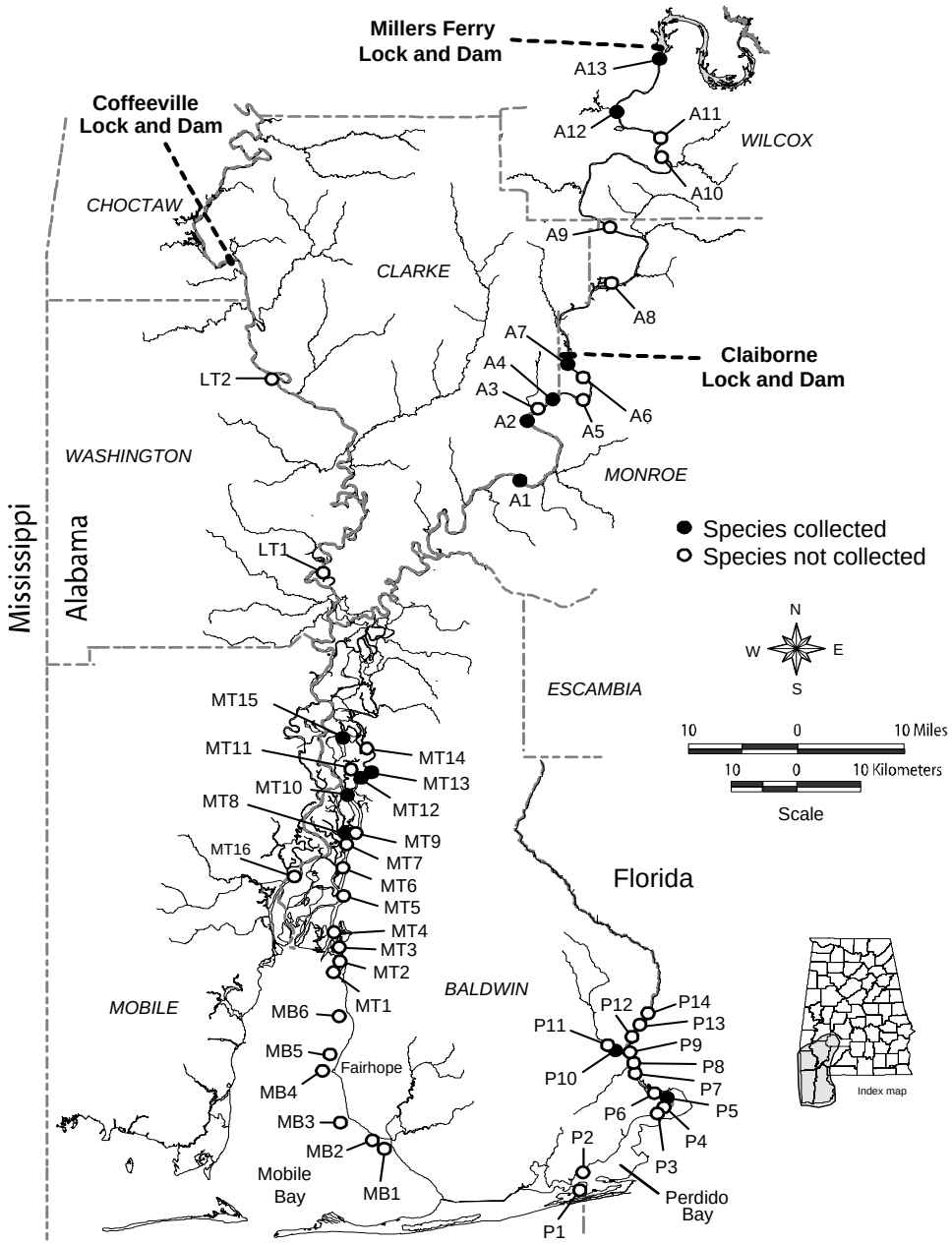
Ameiurus nebulosus
brown bullhead
1 specimen
1 collection

A-29. Collection location for the brown bullhead *Ameiurus nebulosus* in the lower Mobile and Perdido Basins, 2000-08.



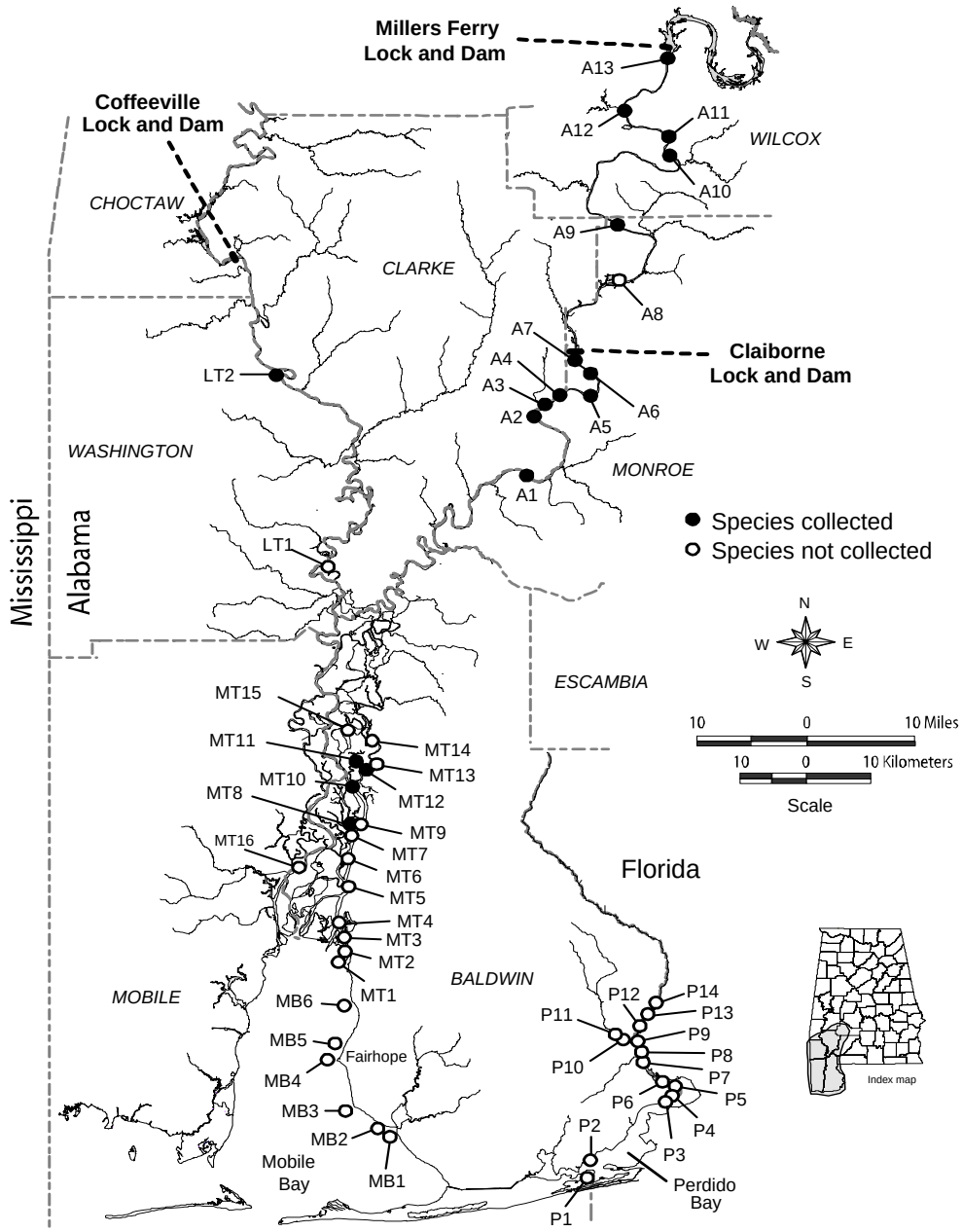
Ictalurus furcatus
blue catfish
369 specimens
77 collections

A-30. Collection locations for the blue catfish *Ictalurus furcatus* in the lower Mobile and Perdido Basins, 2000-08.



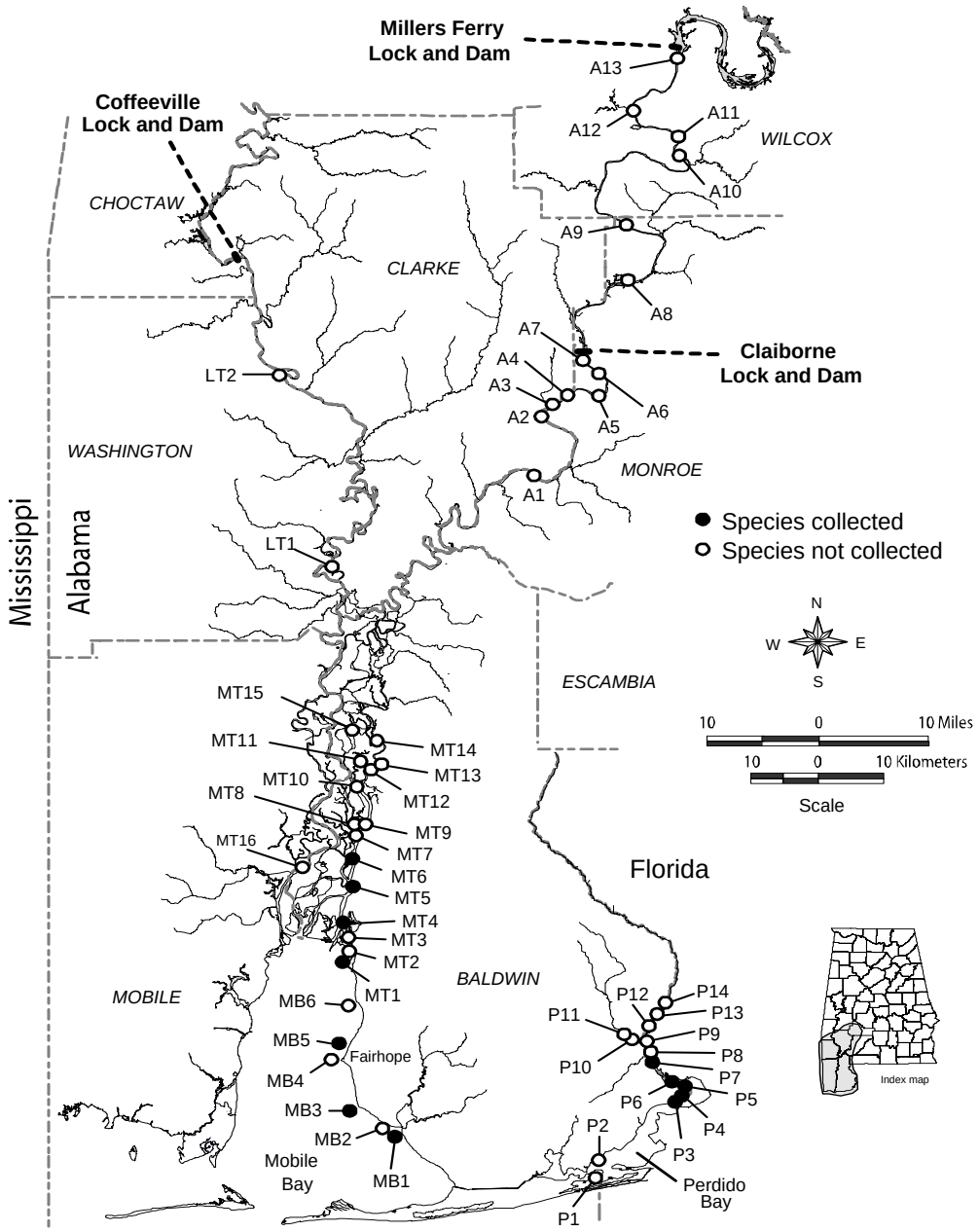
Ictalurus punctatus
channel catfish
94 specimens
31 collections

A-31. Collection locations for the channel catfish *Ictalurus punctatus* in the lower Mobile and Perdido Basins, 2000-08.



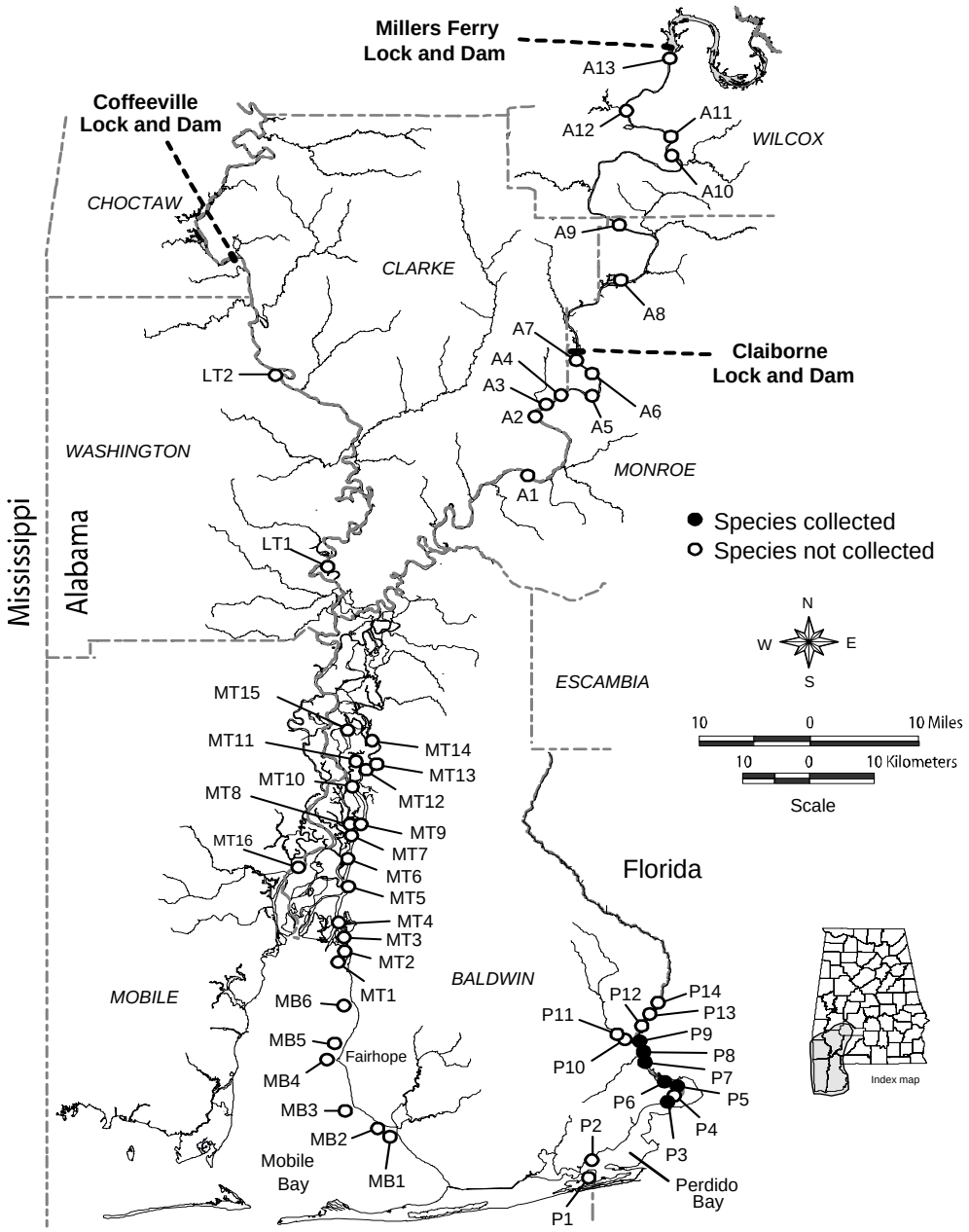
Pylodictis olivaris
flathead catfish
157 specimens
50 collections

A-32. Collection locations for the flathead catfish *Pylodictis olivaris* in the lower Mobile and Perdido Basins, 2000-08.



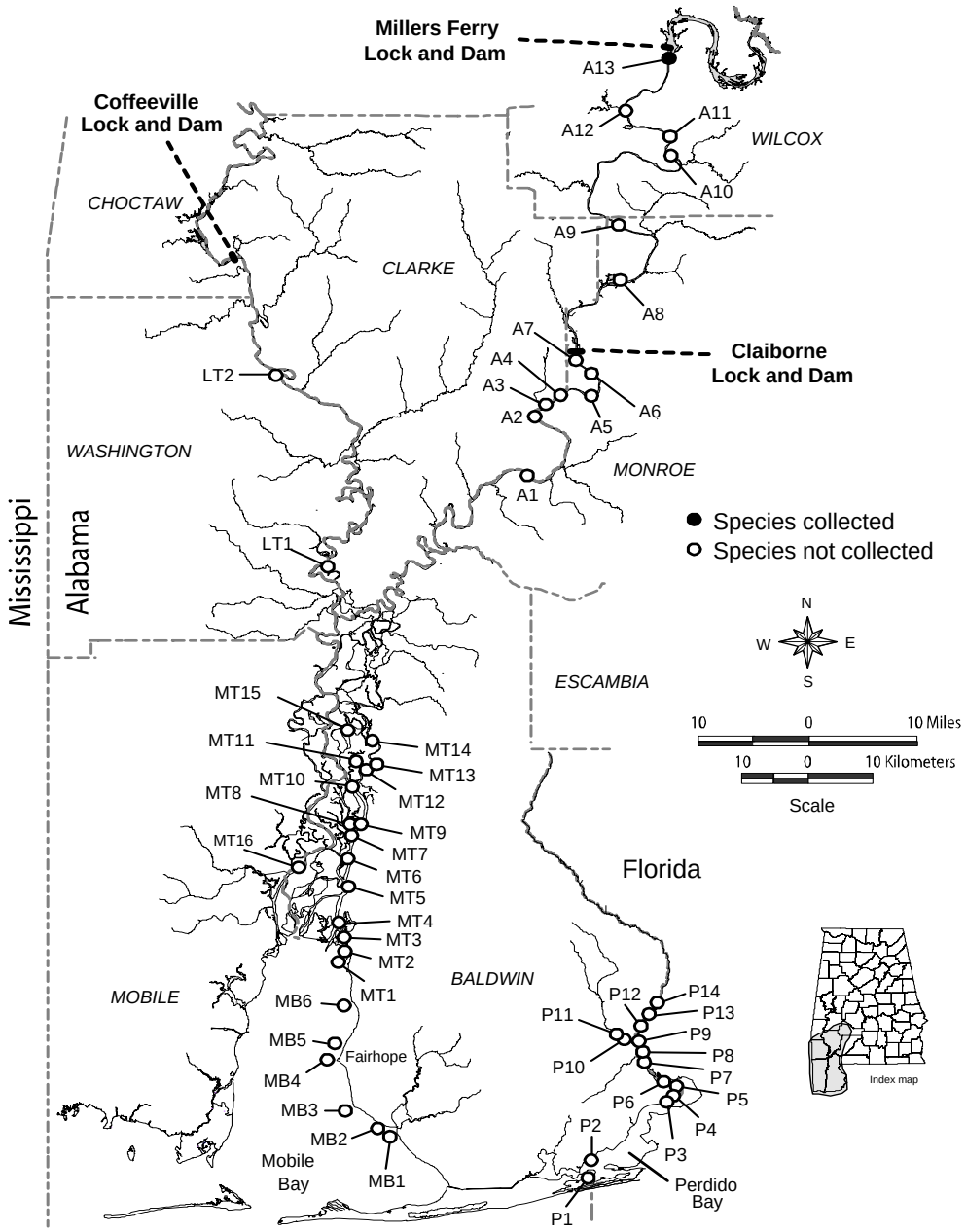
Ariopsis felis
hardhead catfish
207 specimens
22 collections

A-33. Collection locations for the hardhead catfish *Ariopsis felis* in the lower Mobile and Perdido Basins, 2000-08.



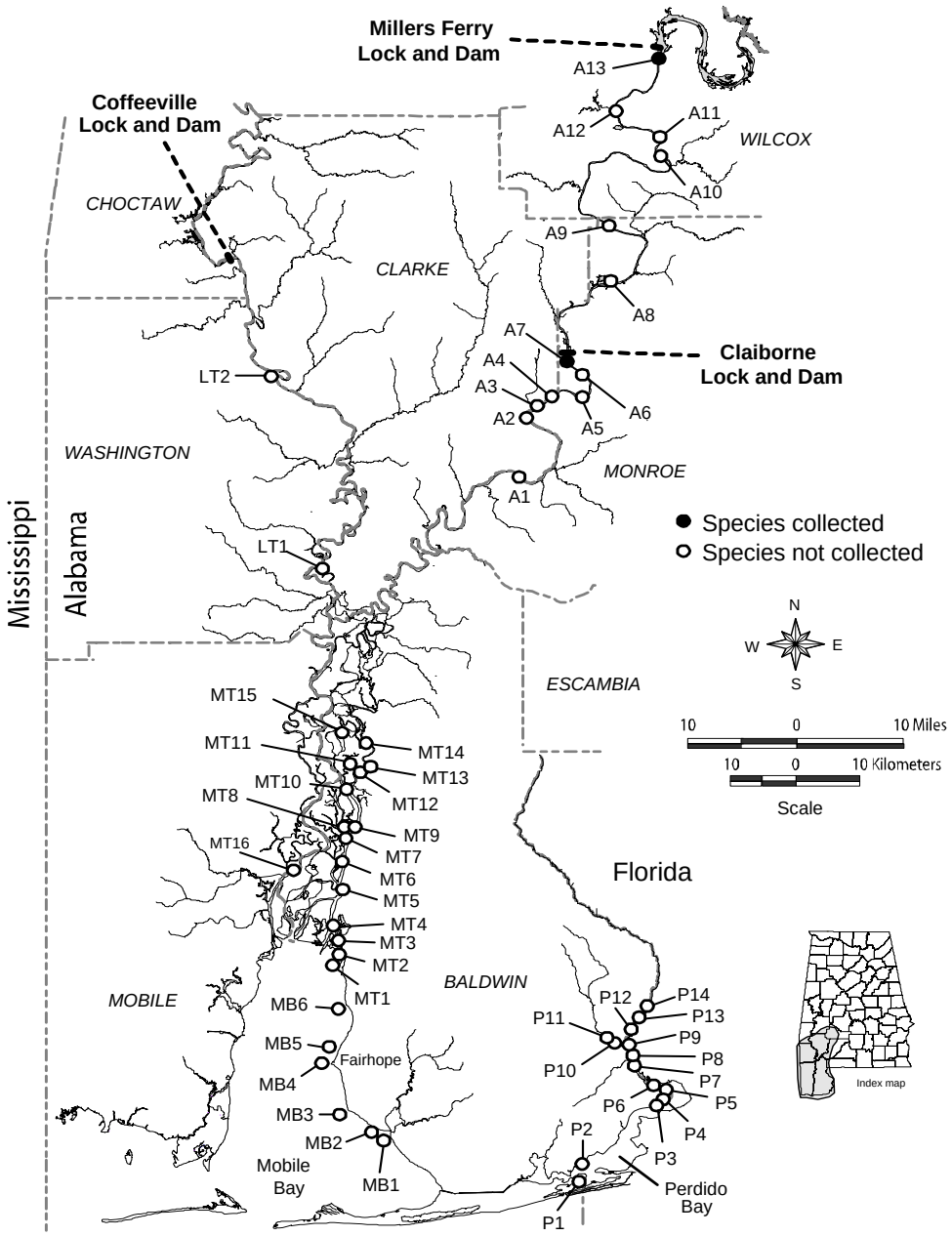
Bagre marinus
gafftopsail catfish
134 specimens
9 collections

A-34. Collection locations for the gafftopsail catfish *Bagre marinus* in the lower Mobile and Perdido Basins, 2000-08.



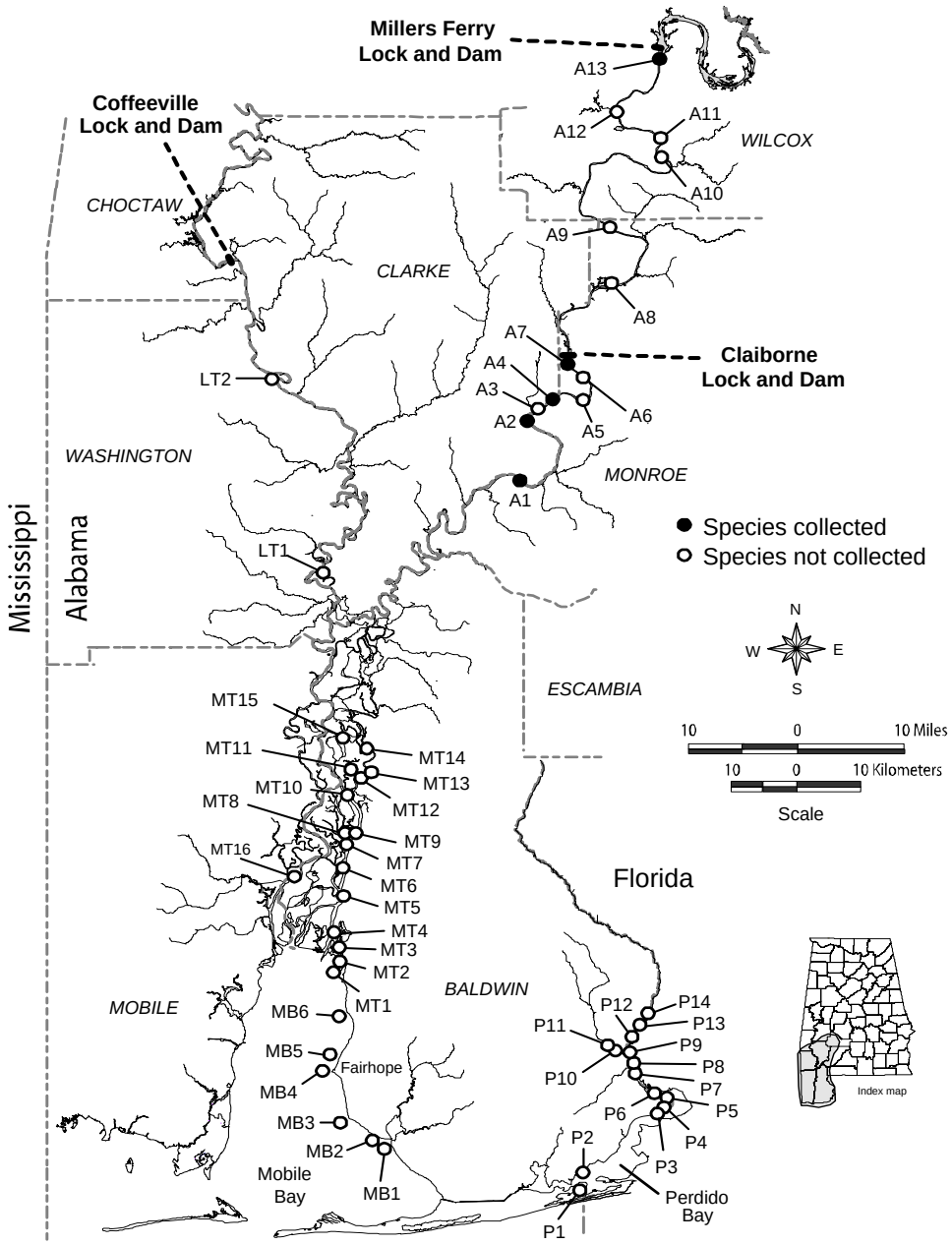
Strongylura marinus
Atlantic needlefish
20 specimen
1 collection

A-35. Collection location for the Atlantic needlefish *Strongylura marinus* in the lower Mobile and Perdido Basins, 2000-08.



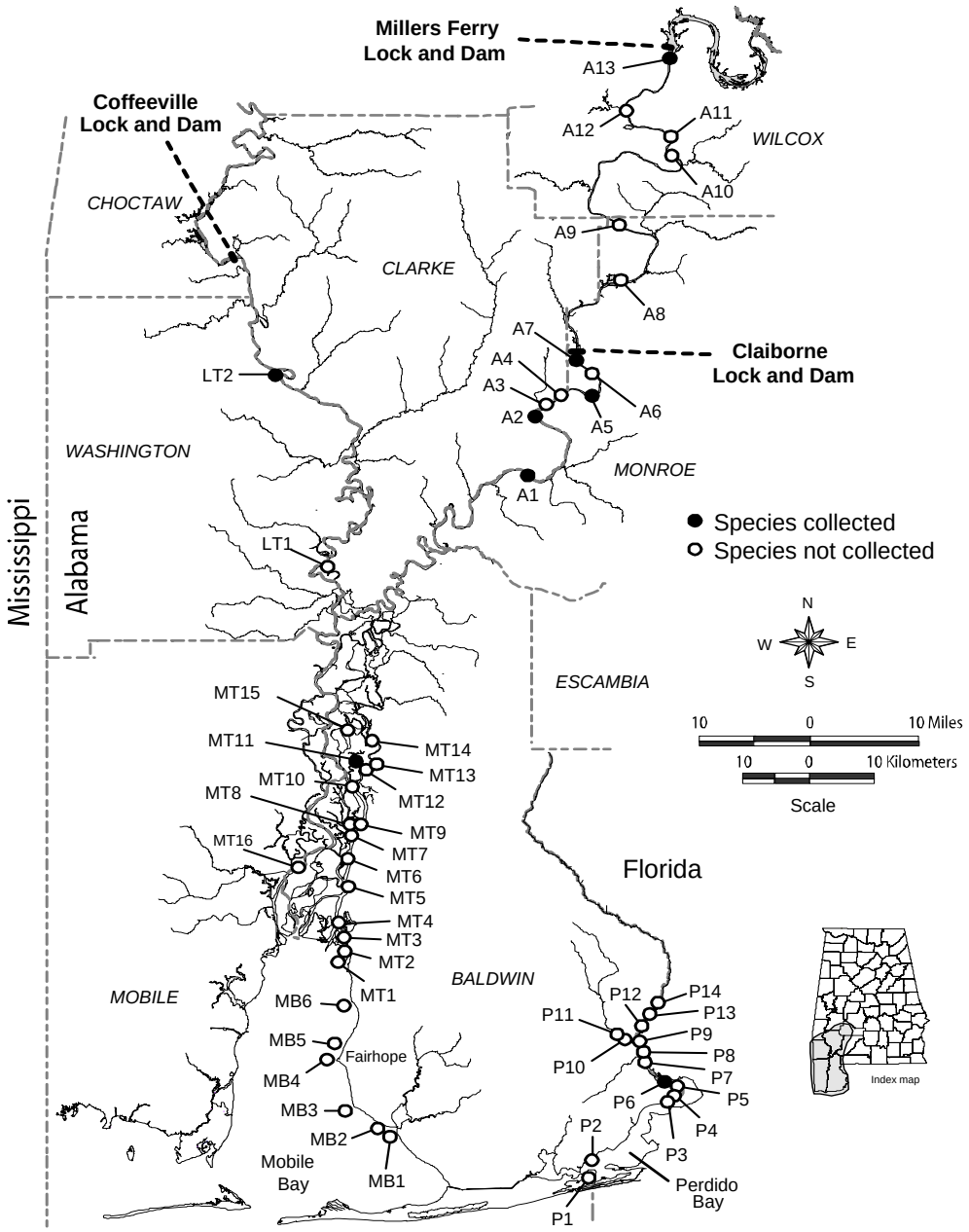
Morone chrysops
white bass
38 specimens
17 collections

A-36. Collection locations for the white bass *Morone chrysops* in the lower Mobile and Perdido Basins, 2000-08.



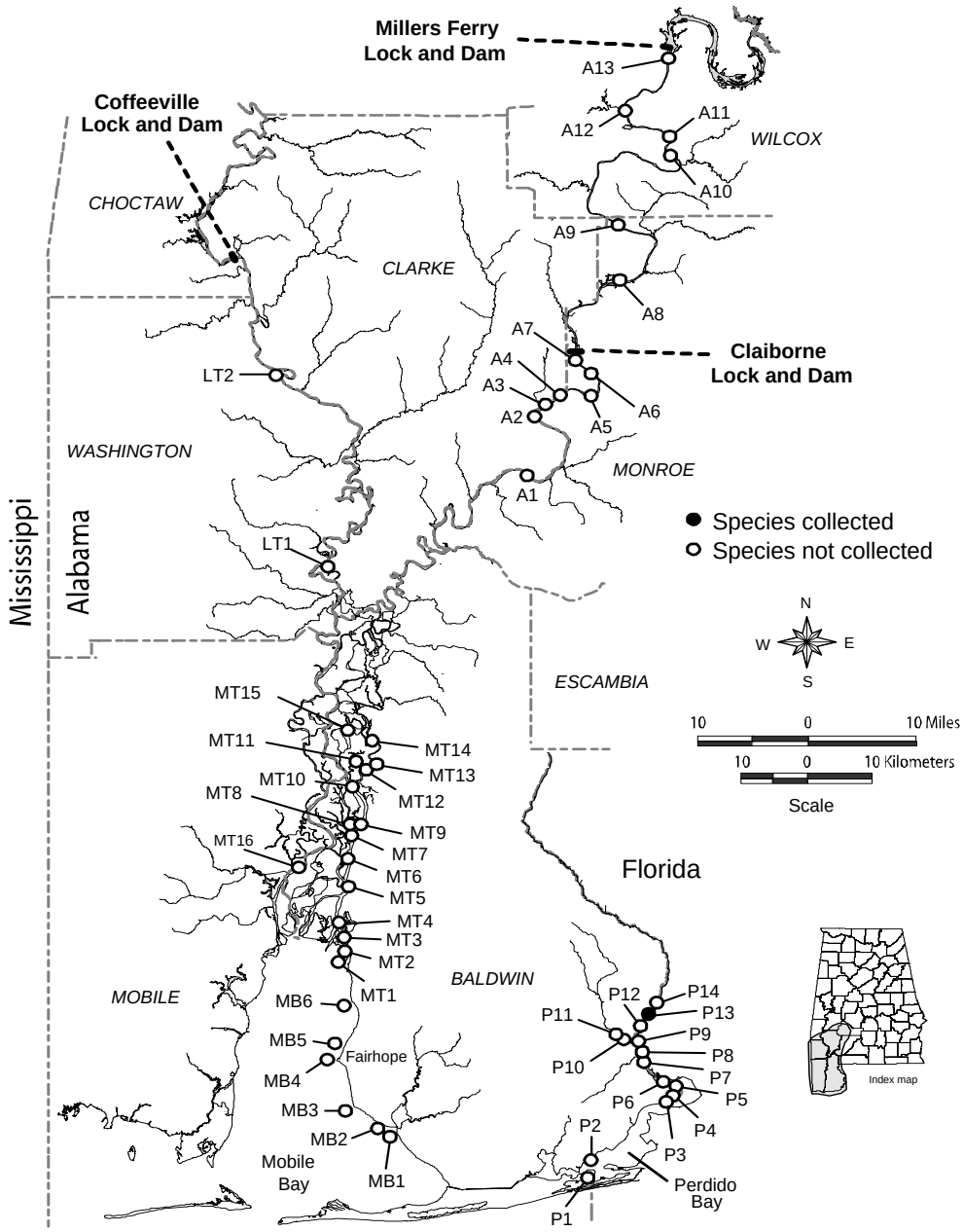
Morone saxatilis
striped bass
17 specimens
6 collections

A-37. Collection locations for the striped bass *Morone saxatilis* in the lower Mobile and Perdido Basins, 2000-08.



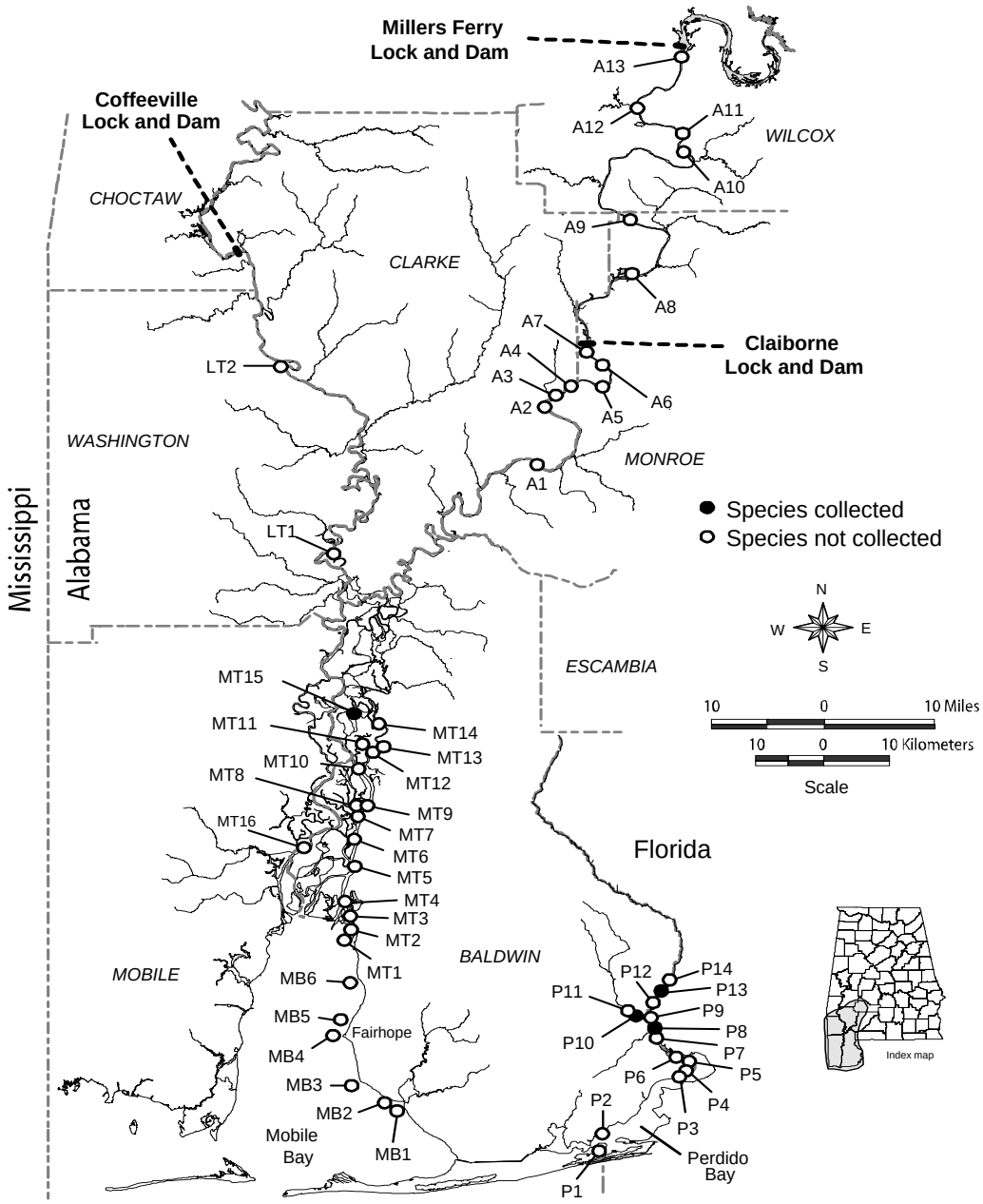
Morone chrysops x *saxatilis*
palmetto bass
598 specimens
46 collections

A-38. Collection locations for the palmetto bass *Morone chrysops* x *saxatilis* in the lower Mobile and Perdido Basins, 2000-08.



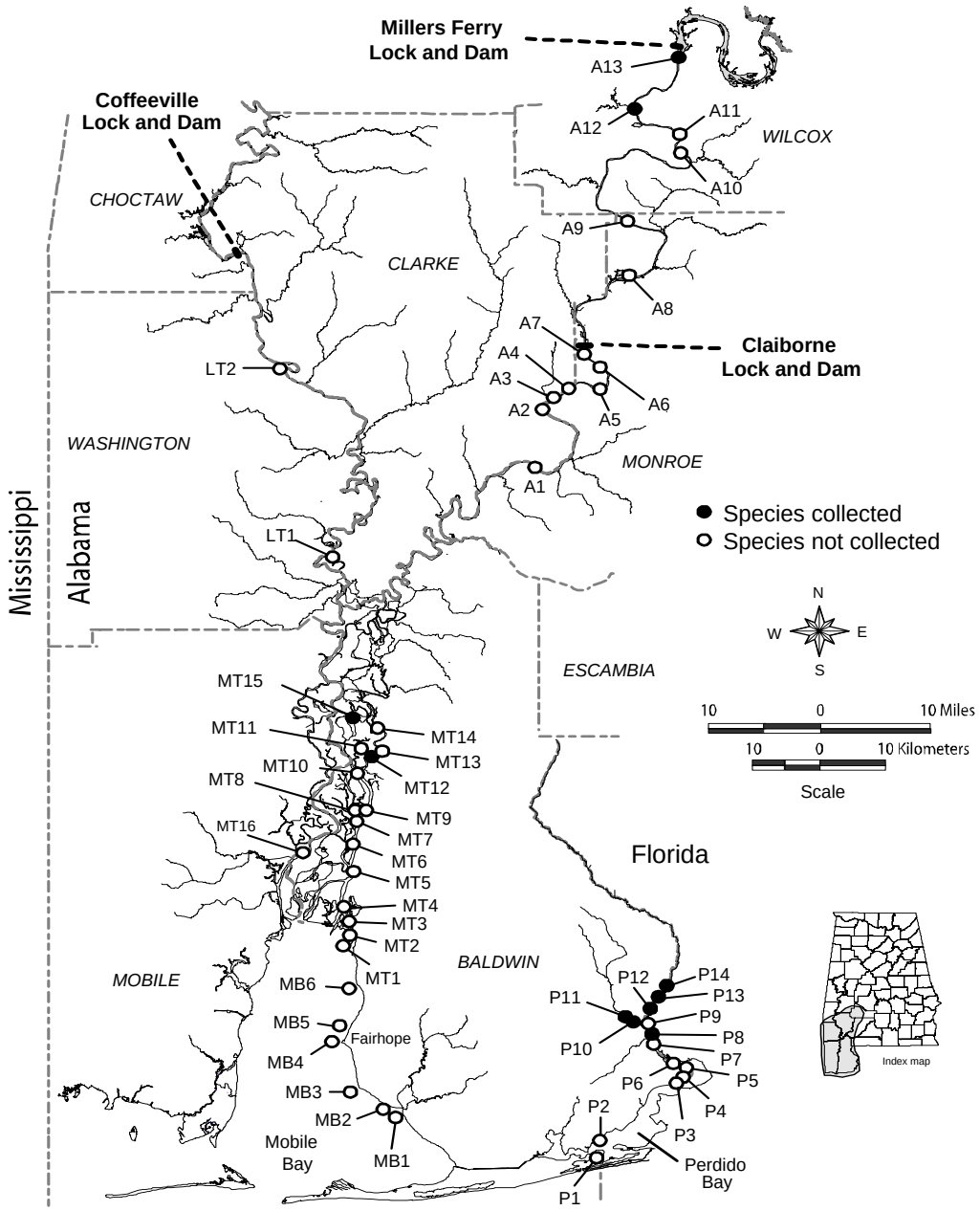
Ambloplites ariommus
shadow bass
1 specimen
1 collection

A-39. Collection location for the shadow bass *Ambloplites ariommus* in the lower Mobile and Perdido Basins, 2000-08.



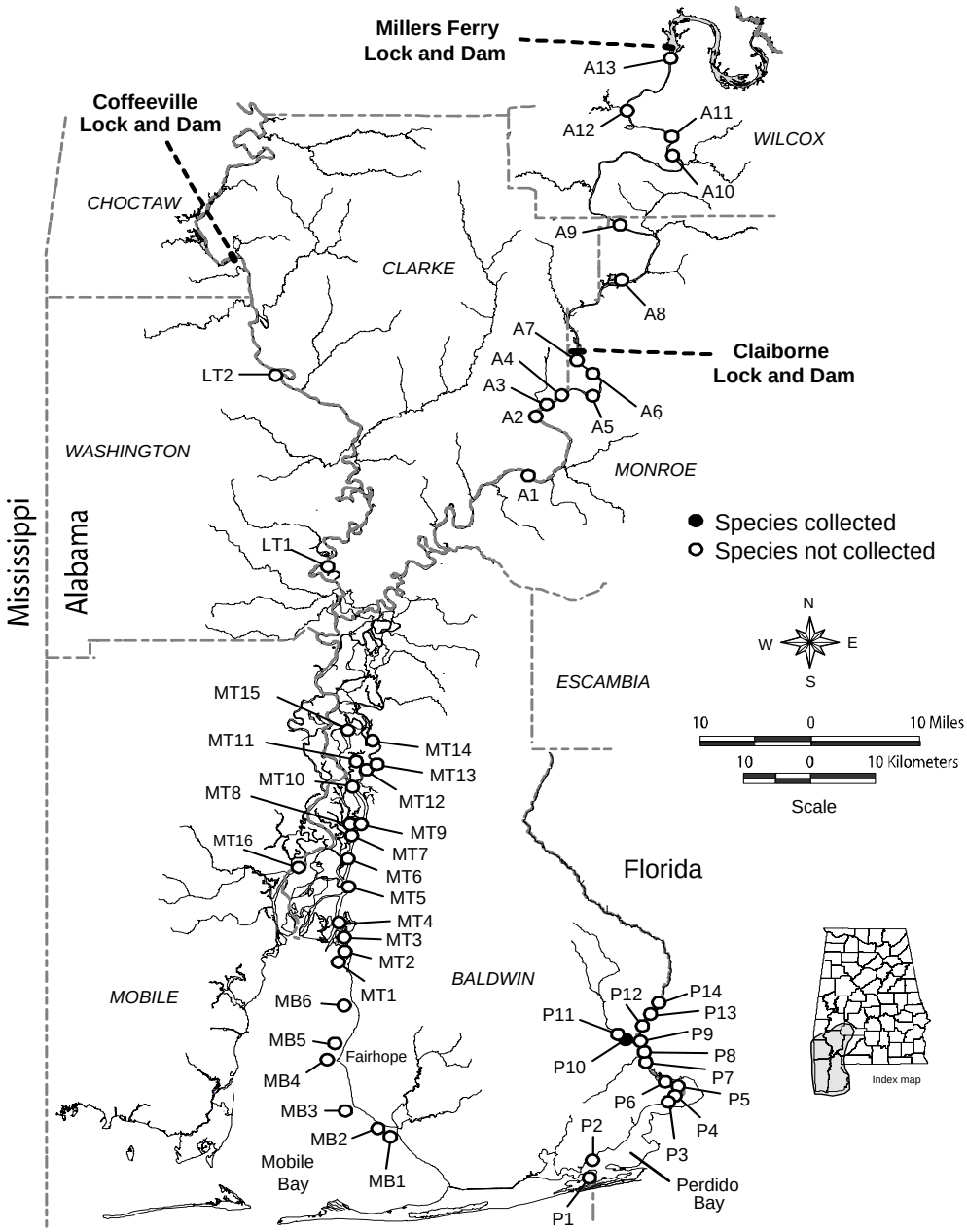
Lepomis gulosus
warmouth
10 specimens
4 collections

A-40. Collection locations for the warmouth *Lepomis gulosus* in the lower Mobile and Perdido Basins, 2000-08.



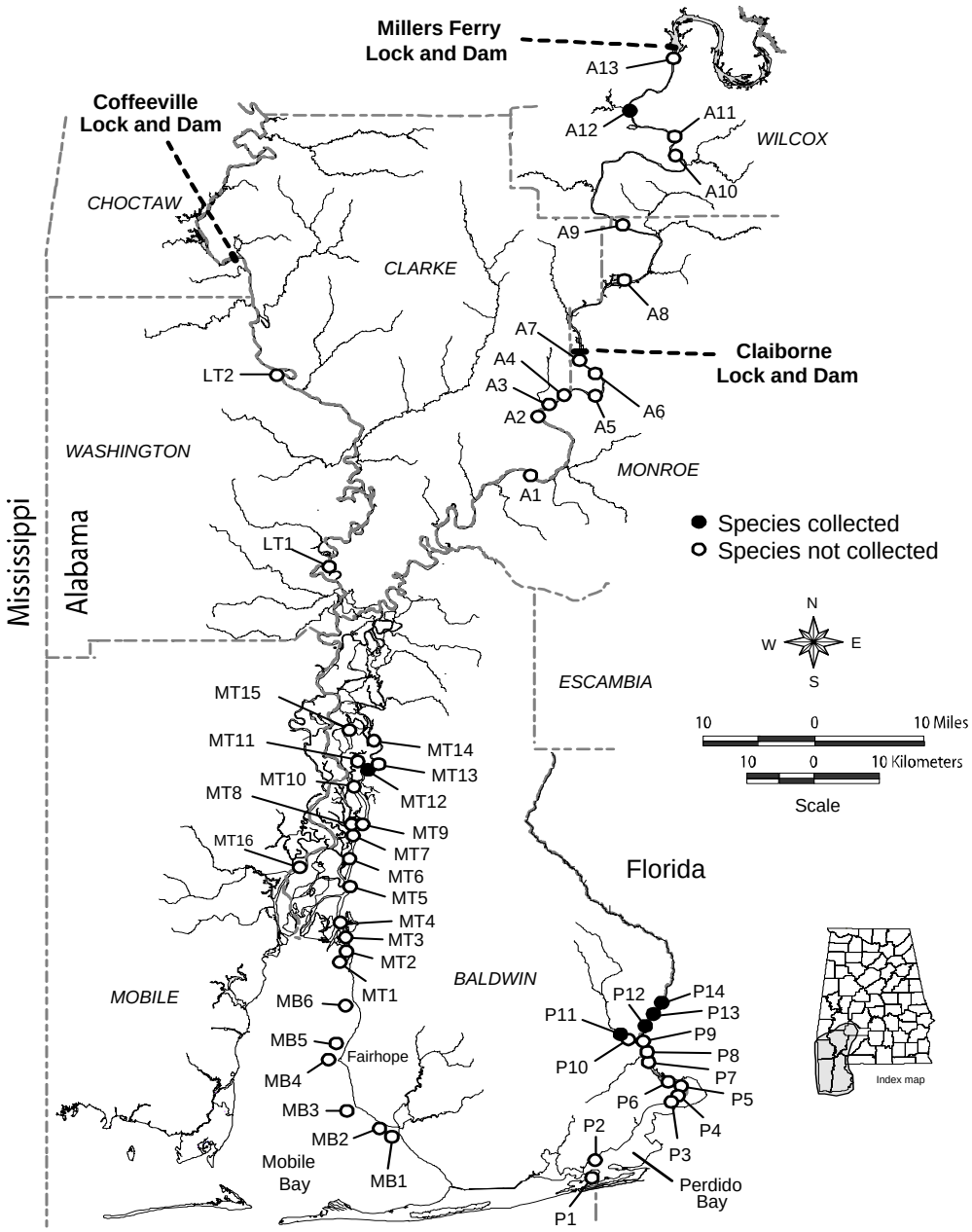
Lepomis macrochirus
bluegill
123 specimens
10 collections

A-41. Collection locations for the bluegill *Lepomis macrochirus* in the lower Mobile and Perdido Basins, 2000-20.



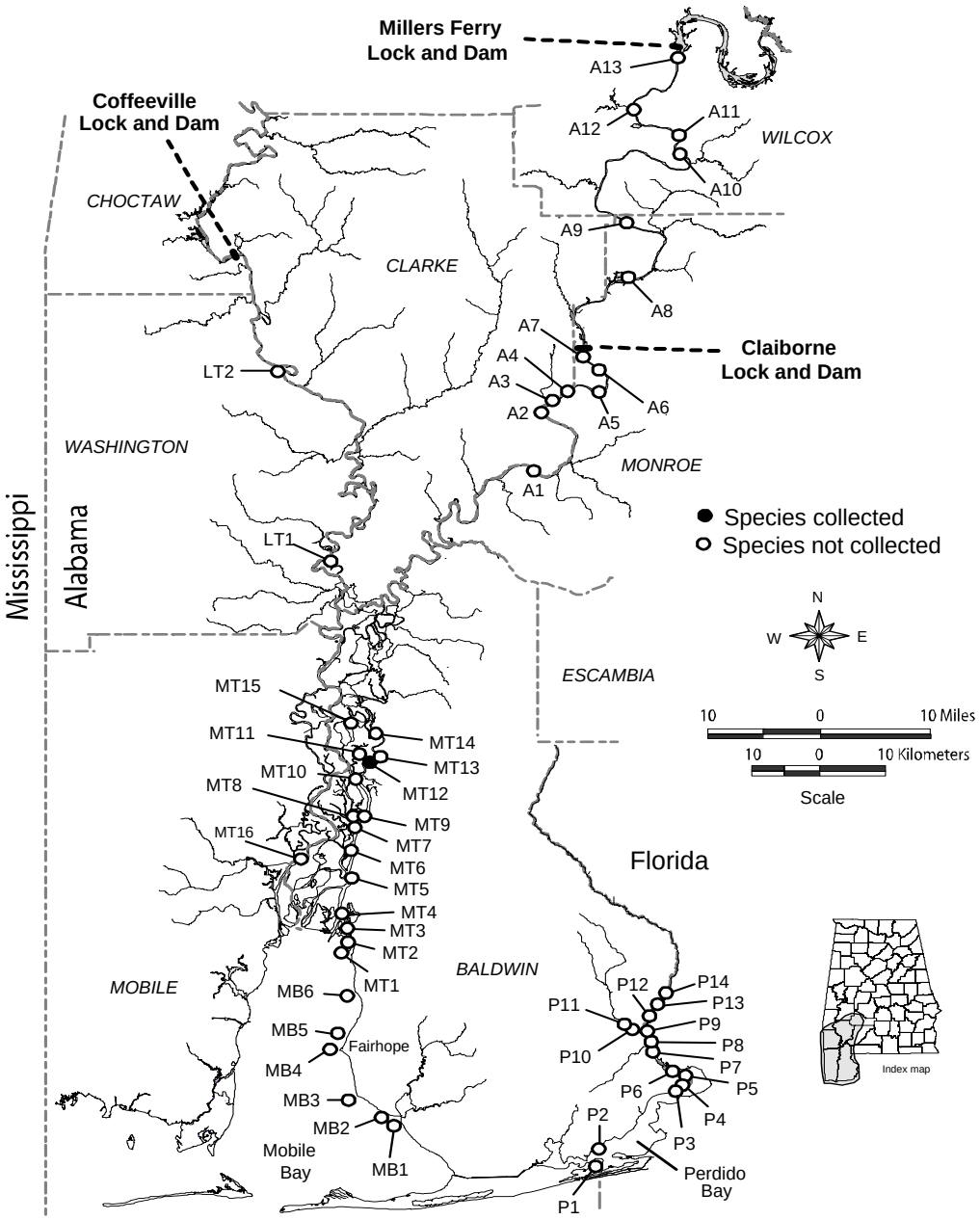
Lepomis marginatus
dollar sunfish
2 specimens
1 collection

A-42. Collection location for the dollar sunfish *Lepomis marginatus* in the lower Mobile and Perdido Basins, 2000-08.



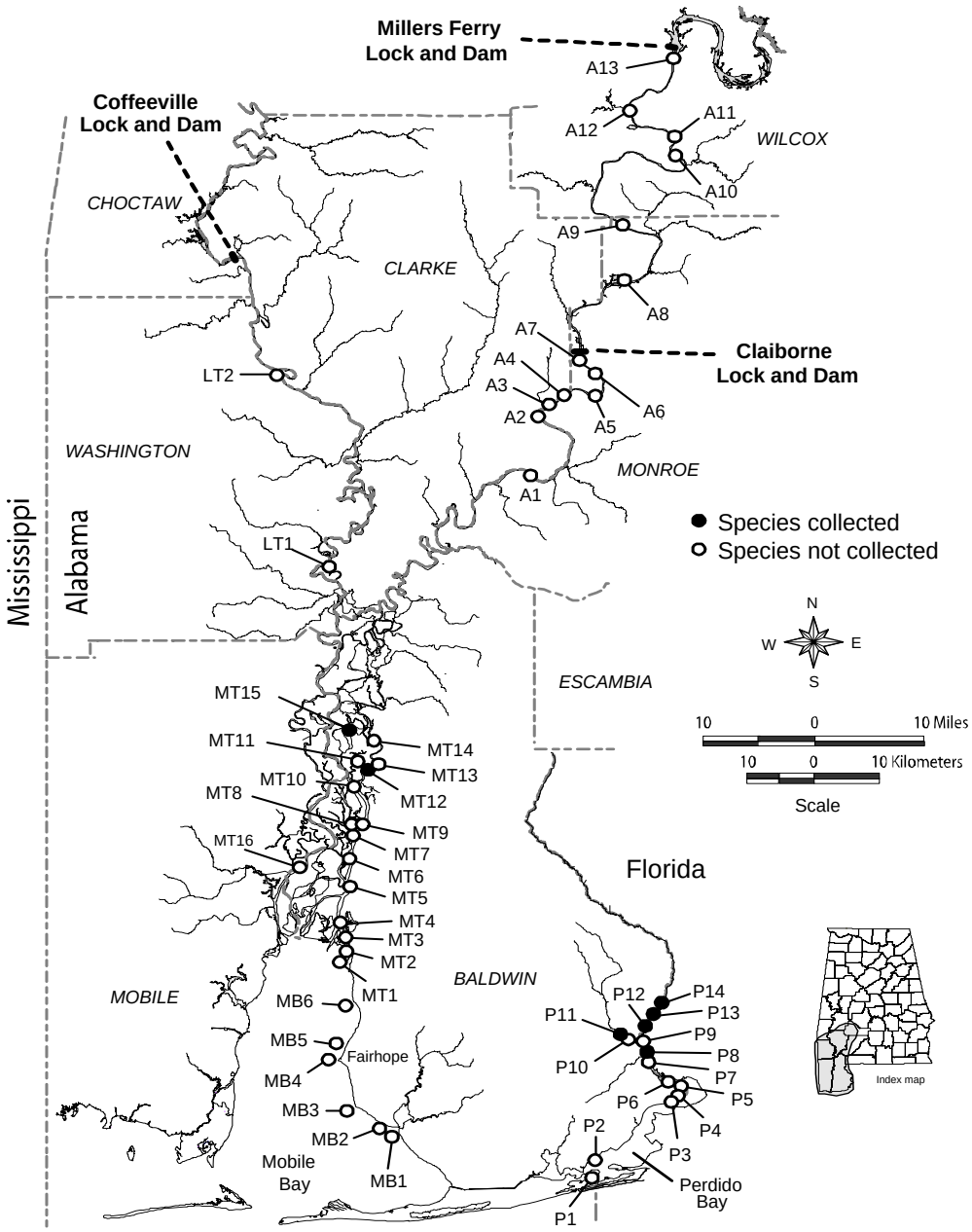
Lepomis megalotis
longear sunfish
39 specimens
6 collections

A-43. Collection locations for the longear sunfish *Lepomis megalotis* in the lower Mobile and Perdido Basins, 2000-08.



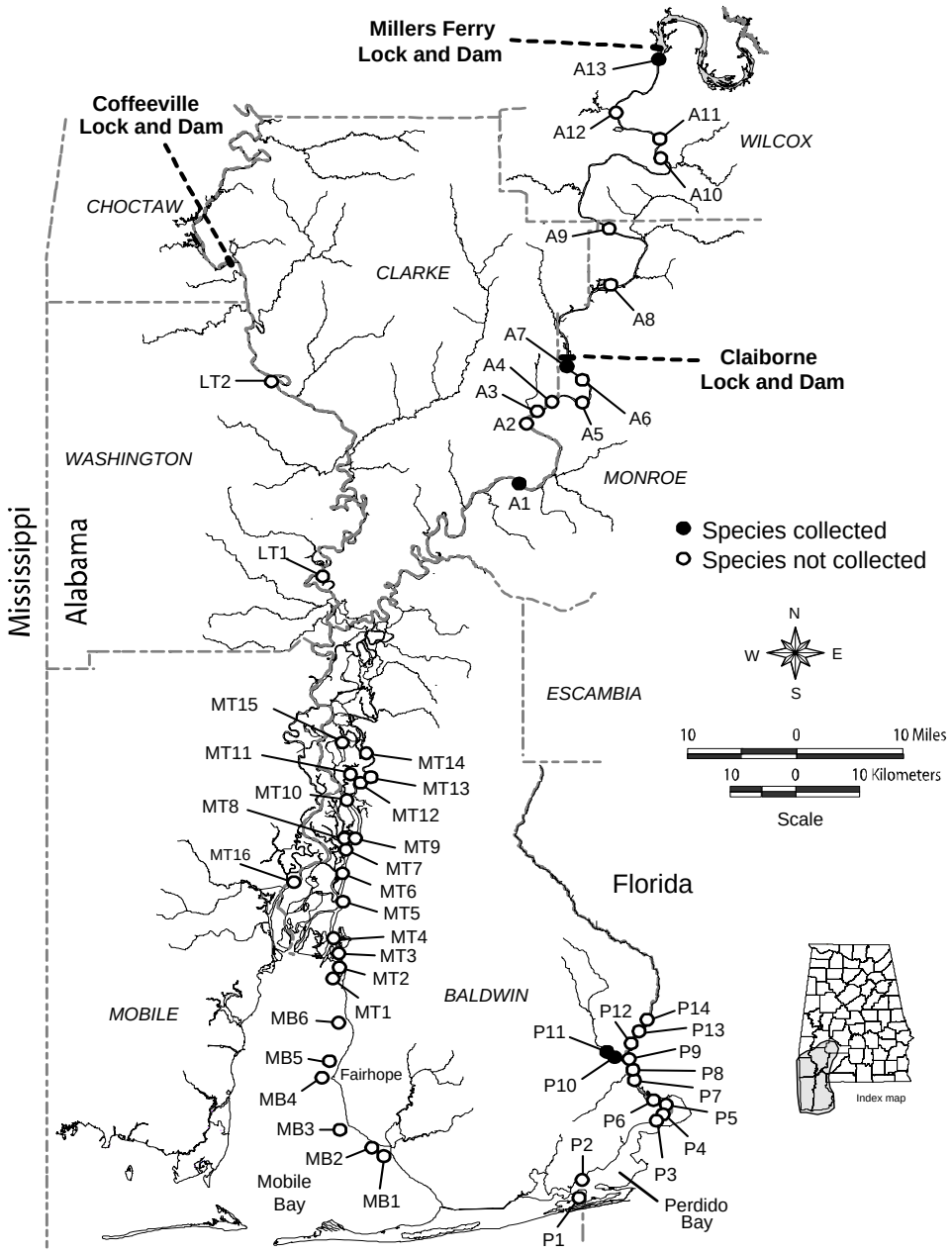
Lepomis microlophus
redear sunfish
3 specimen
1 collection

A-44. Collection location for the redear sunfish *Lepomis microlophus* in the lower Mobile and Perdido Basins, 2000-08.



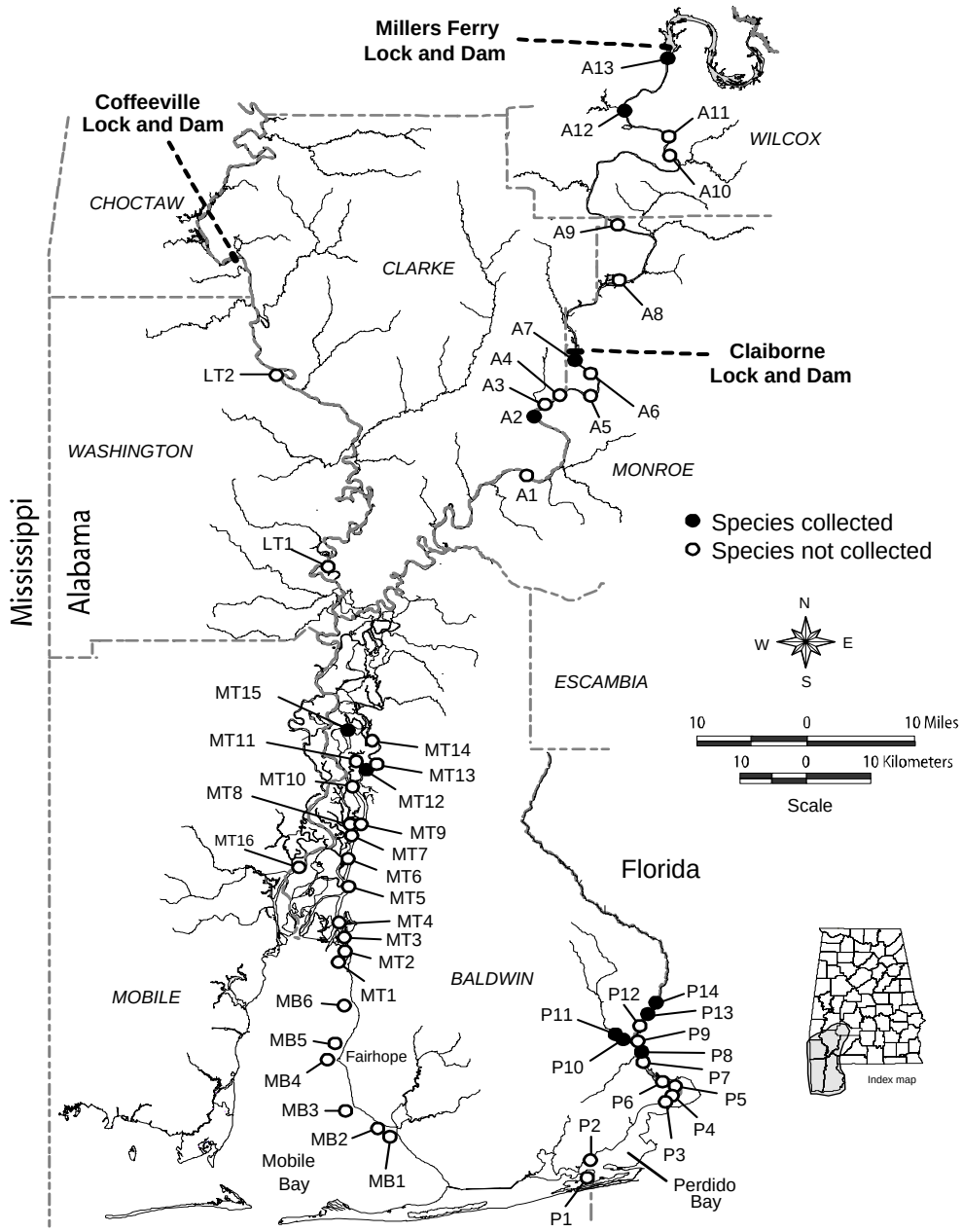
Lepomis miniatus
redspotted sunfish
37 specimens
7 collections

A-45. Collection locations for the redspotted sunfish *Lepomis miniatus* in the lower Mobile and Perdido Basins, 2000-08.



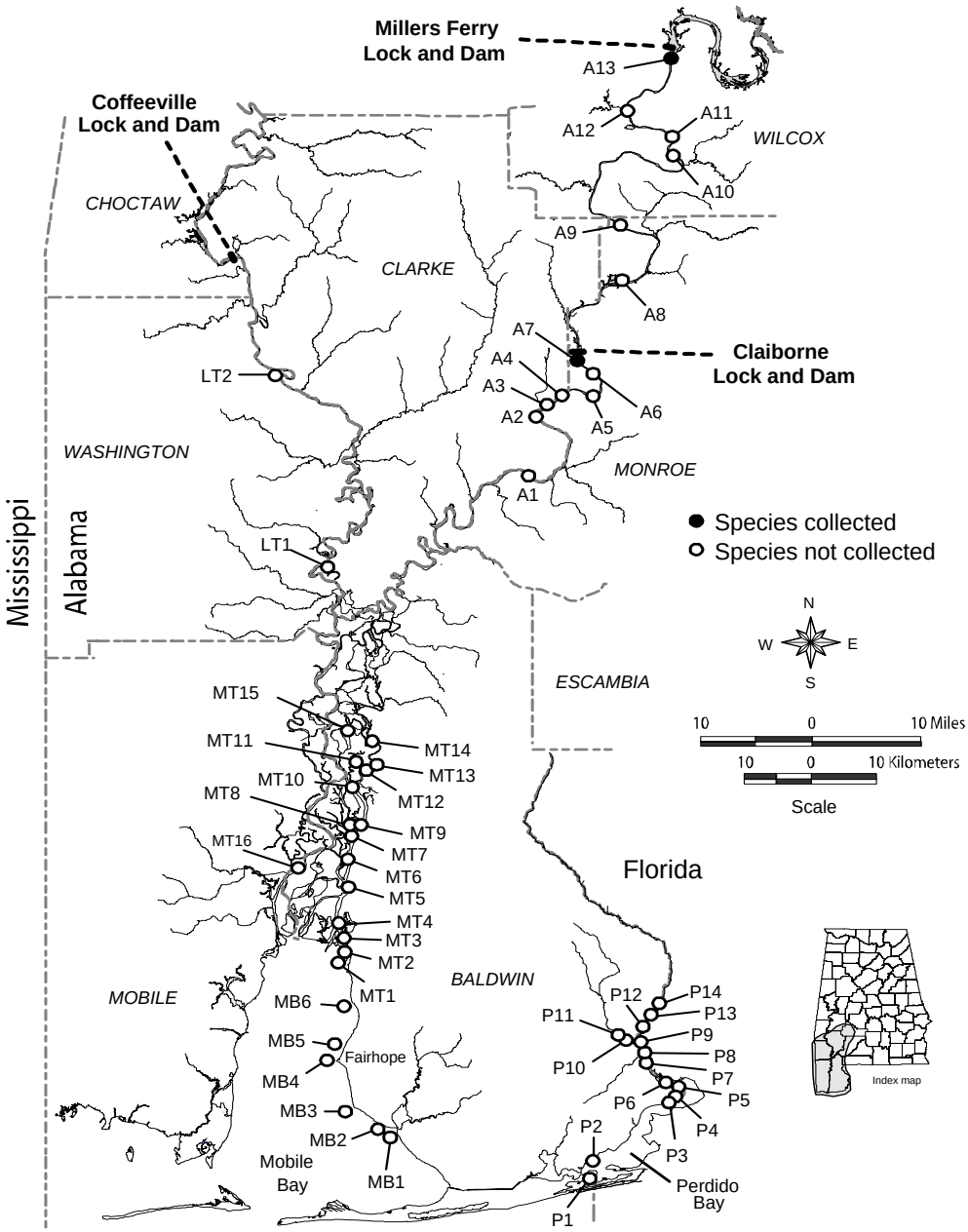
Micropterus punctulatus
spotted bass
160 specimens
33 collections

A-46. Collection locations for the spotted bass *Micropterus punctulatus* in the lower Mobile and Perdido Basins, 2000-08.



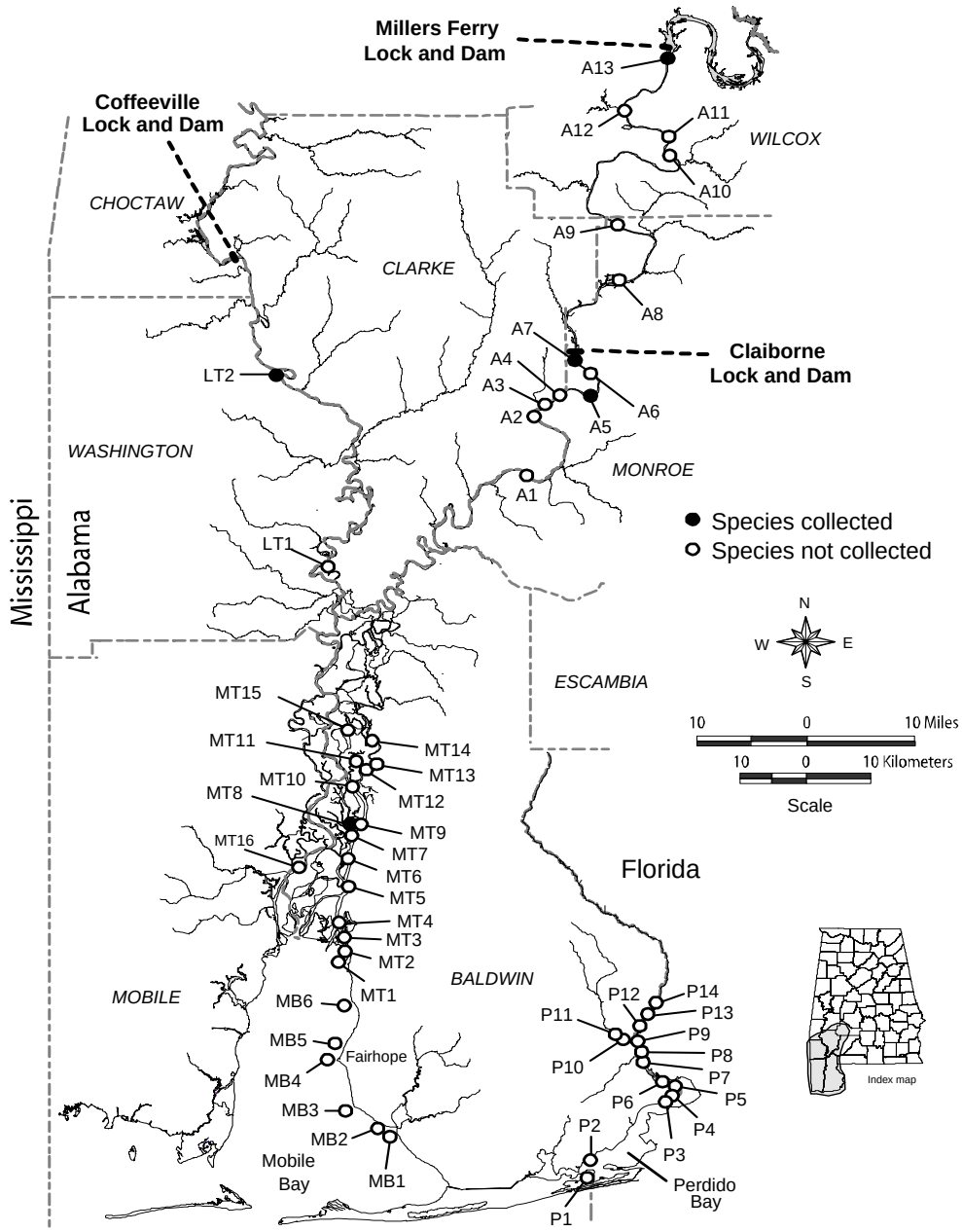
Micropterus salmoides
largemouth bass
82 specimens
15 collections

A-47. Collection locations for the largemouth bass *Micropterus salmoides* in the lower Mobile and Perdido Basins, 2000-08.



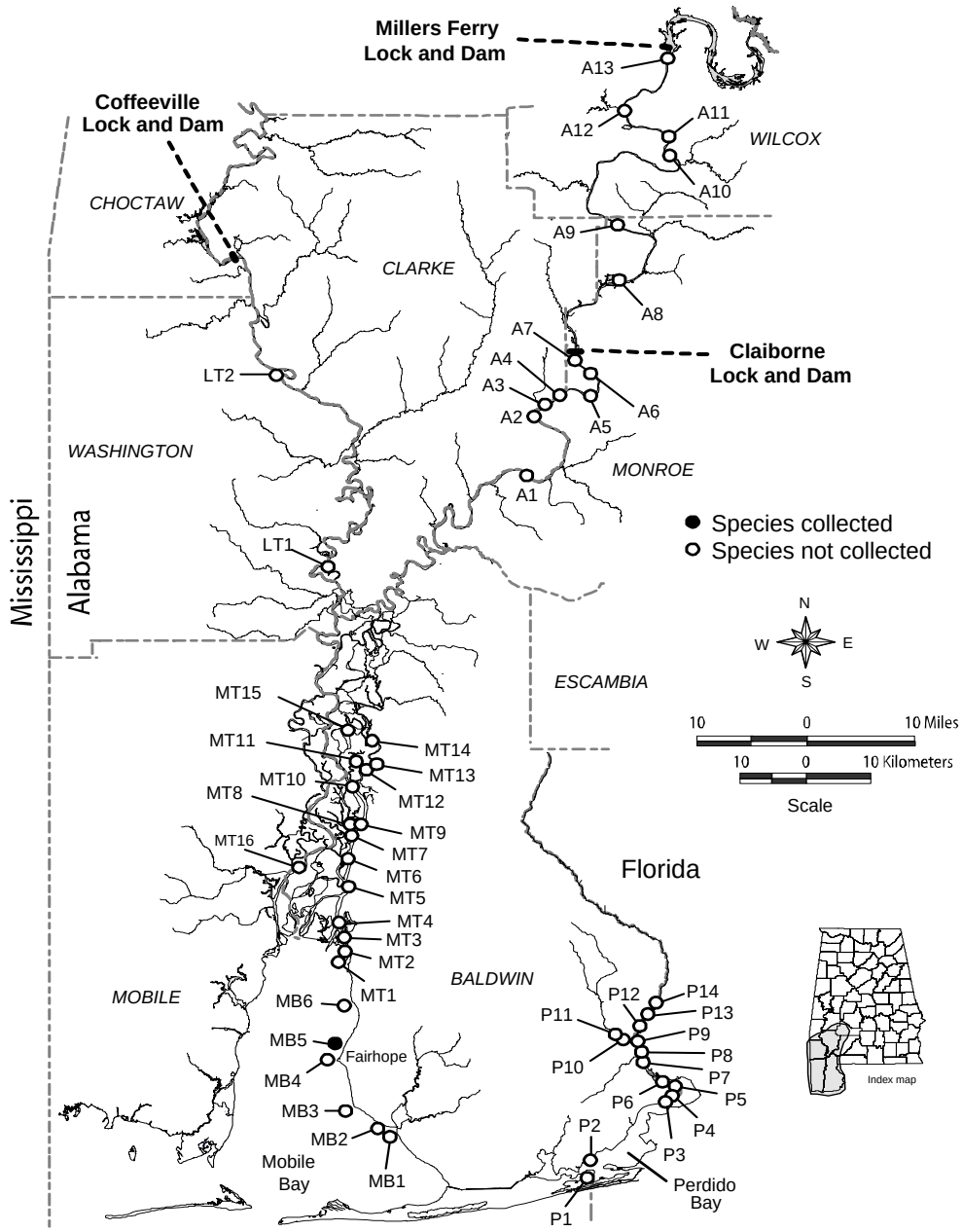
Pomoxis annularis
white crappie
6 specimens
4 collections

A-48. Collection locations for the white crappie *Pomoxis annularis* in the lower Mobile and Perdido River Basins, 2000-08.



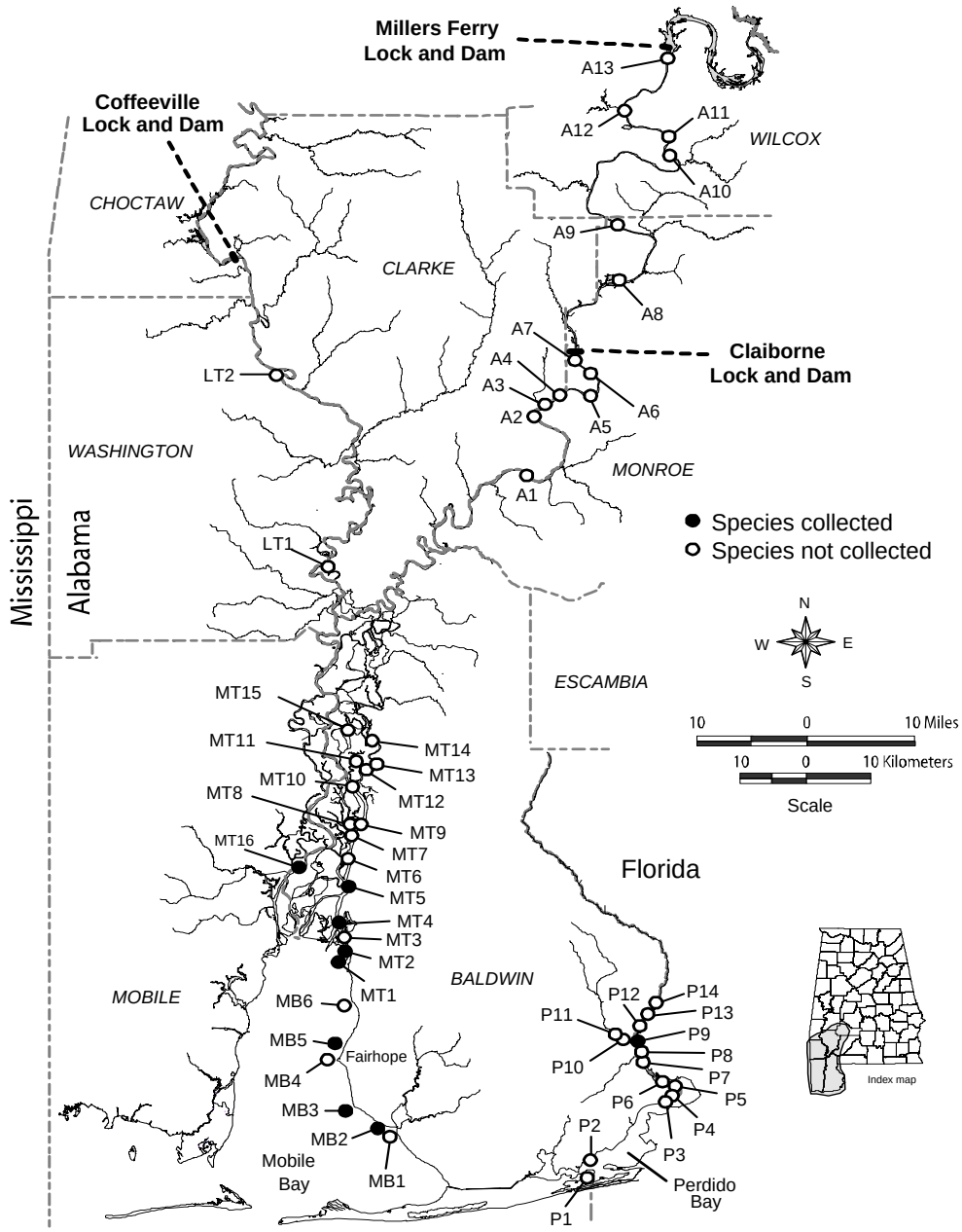
Pomoxis nigromaculatus
black crappie
46 specimens
17 collections

A-49. Collection locations for the black crappie *Pomoxis nigromaculatus* in the lower Mobile and Perdido Basins, 2000-08.



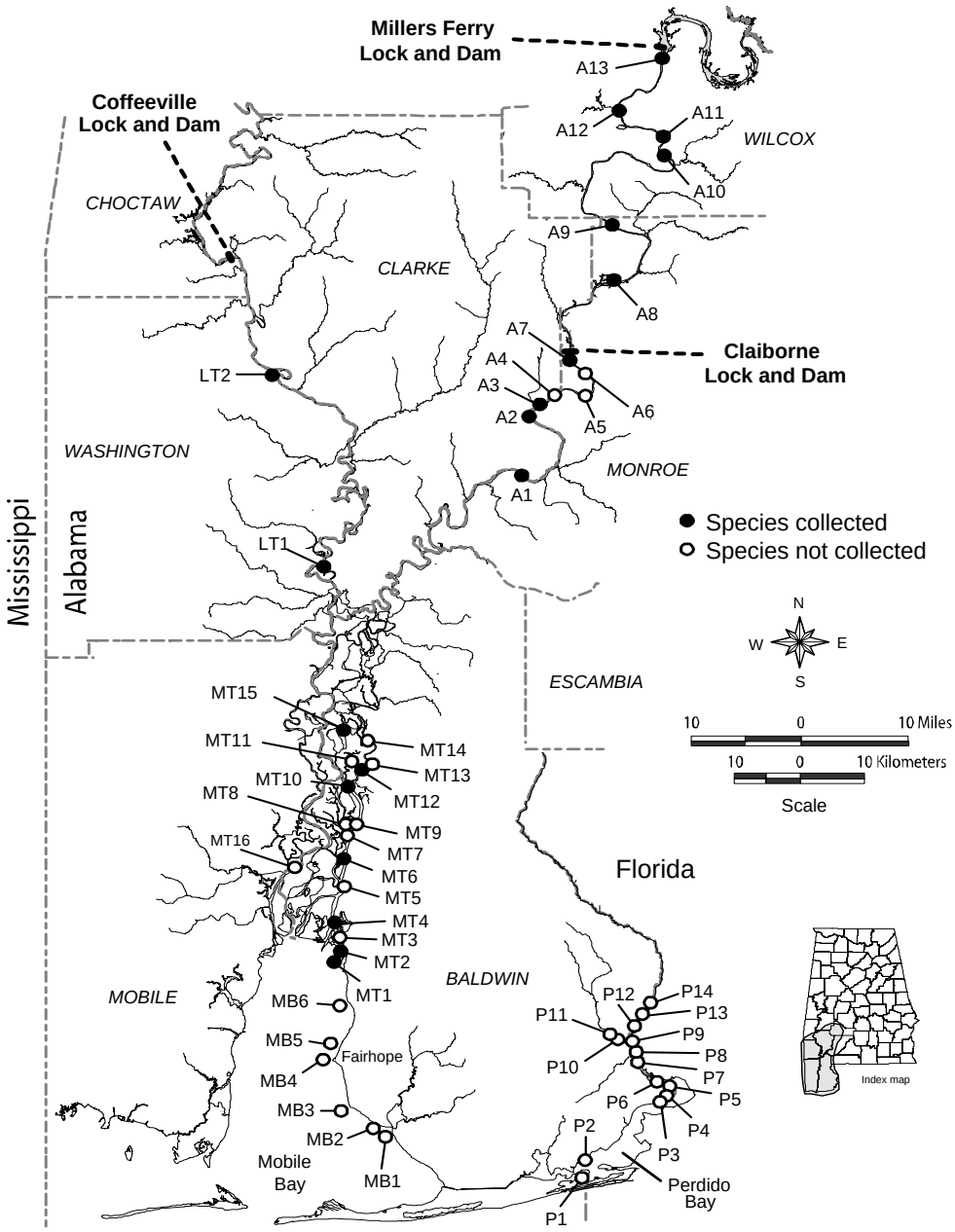
Caranx hippos
crevalle jack
1 specimen
1 collection

A-50. Collection location for the crevalle jack *Caranx hippos* in the lower Mobile and Perdido Basins, 2000-08.



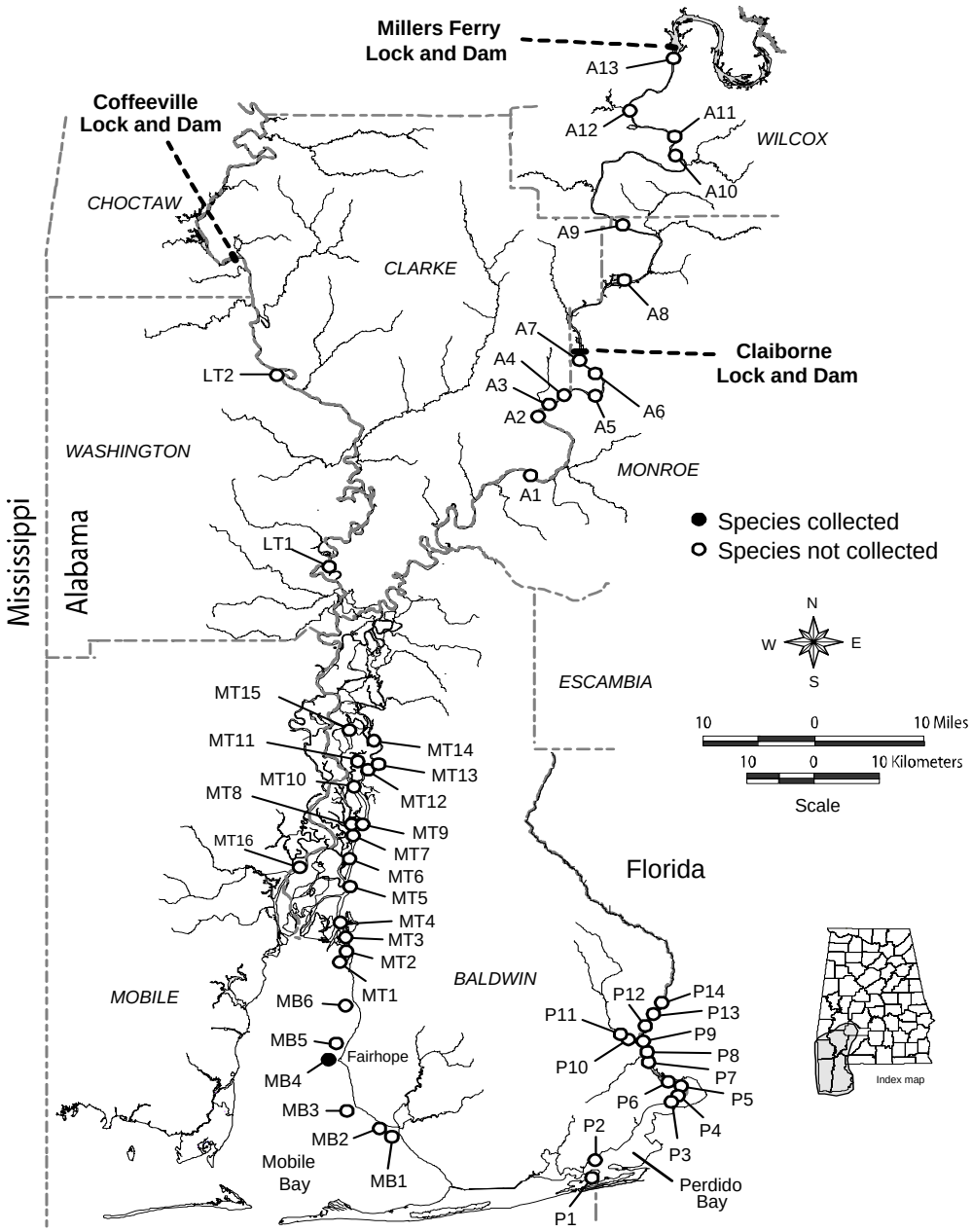
Archosargus probatocephalus
sheepshead
29 specimens
14 collections

A-51. Collection locations for the sheepshead *Archosargus probatocephalus* in the lower Mobile and Perdido Basins, 2000-08.



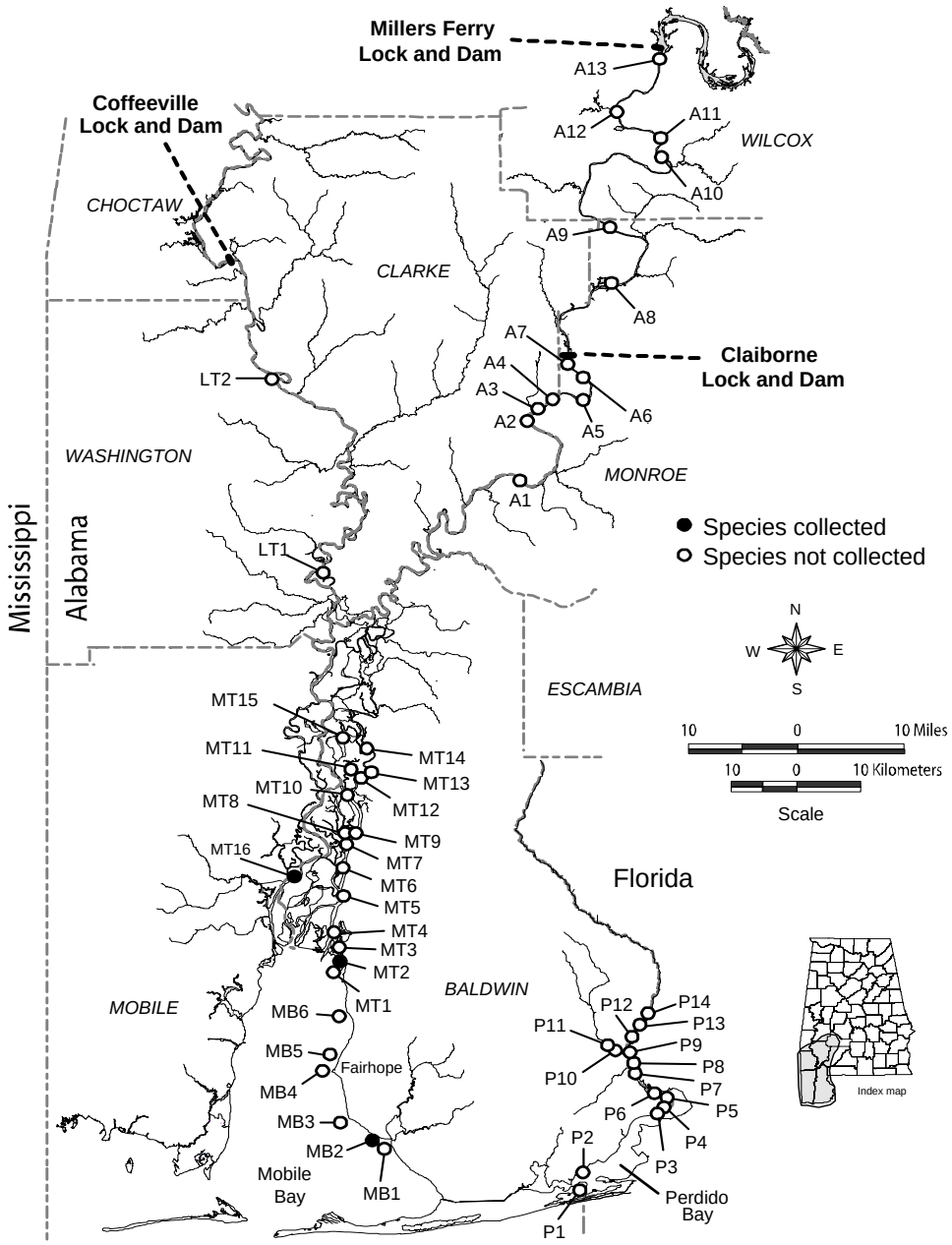
Aplodinotus grunniens
freshwater drum
365 specimens
59 collections

A-52. Collection locations for the freshwater drum *Aplodinotus grunniens* in the lower Mobile and Perdido Basins, 2000-08.



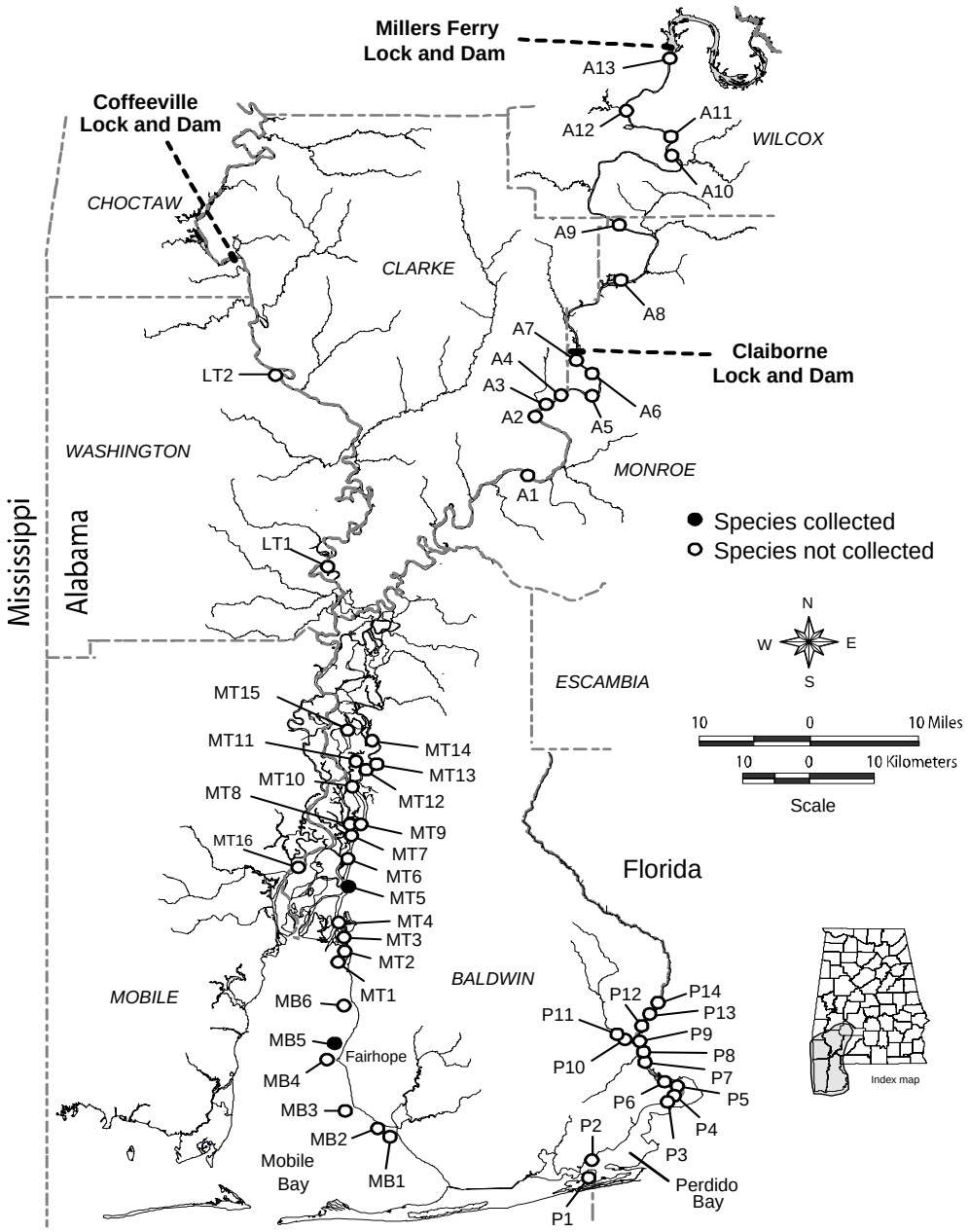
Cynoscion arenarius
sand seatrout
1 specimen
1 collection

A-53. Collection location for the sand seatrout *Cynoscion arenarius* in the lower Mobile and Perdido Basins, 2000-08.



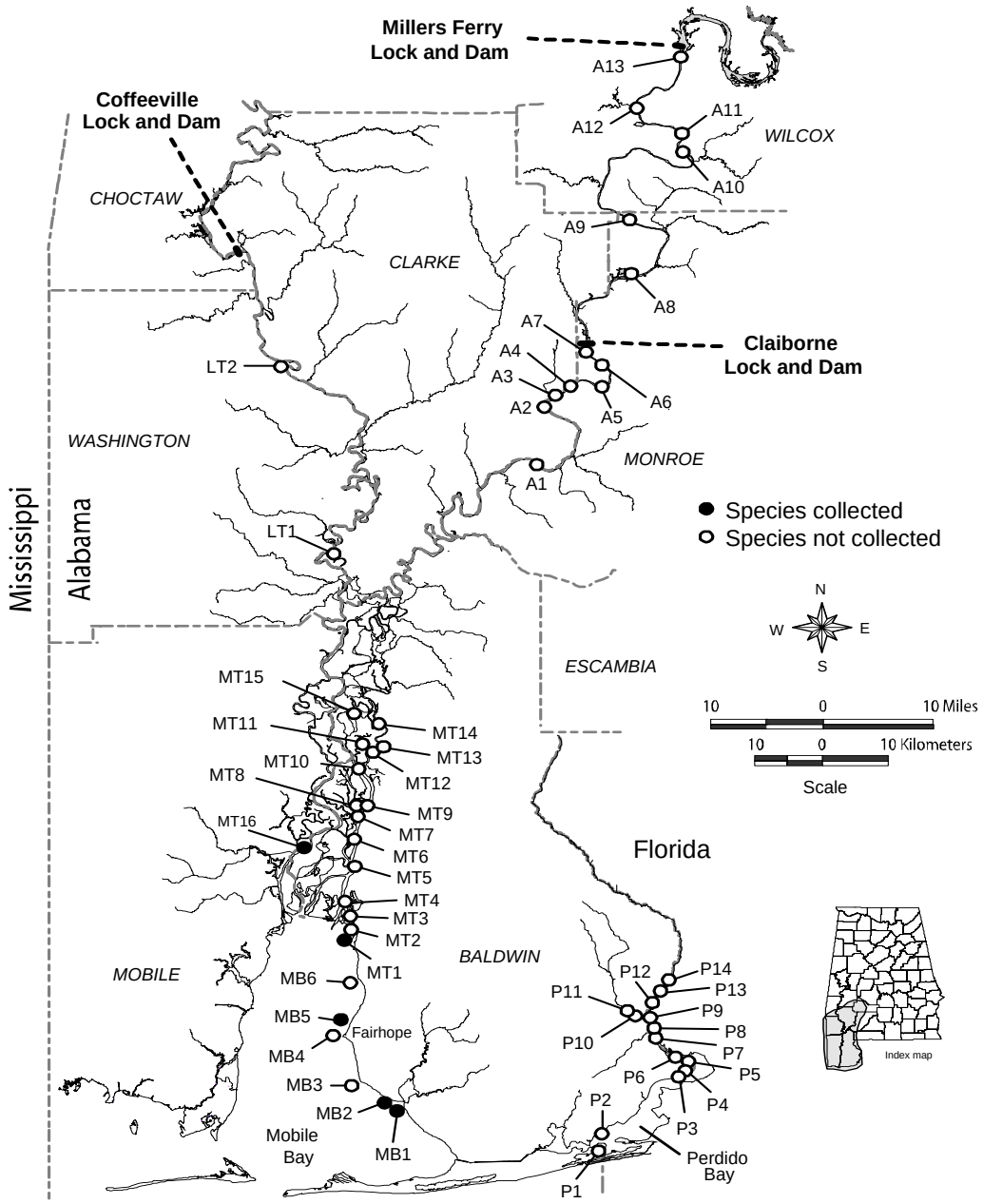
Micropogonias undulatus
Atlantic croaker
3 specimens
3 collections

A-54. Collection locations for the Atlantic croaker *Micropogonias undulatus* in the lower Mobile and Perdido Basins, 2000-08.



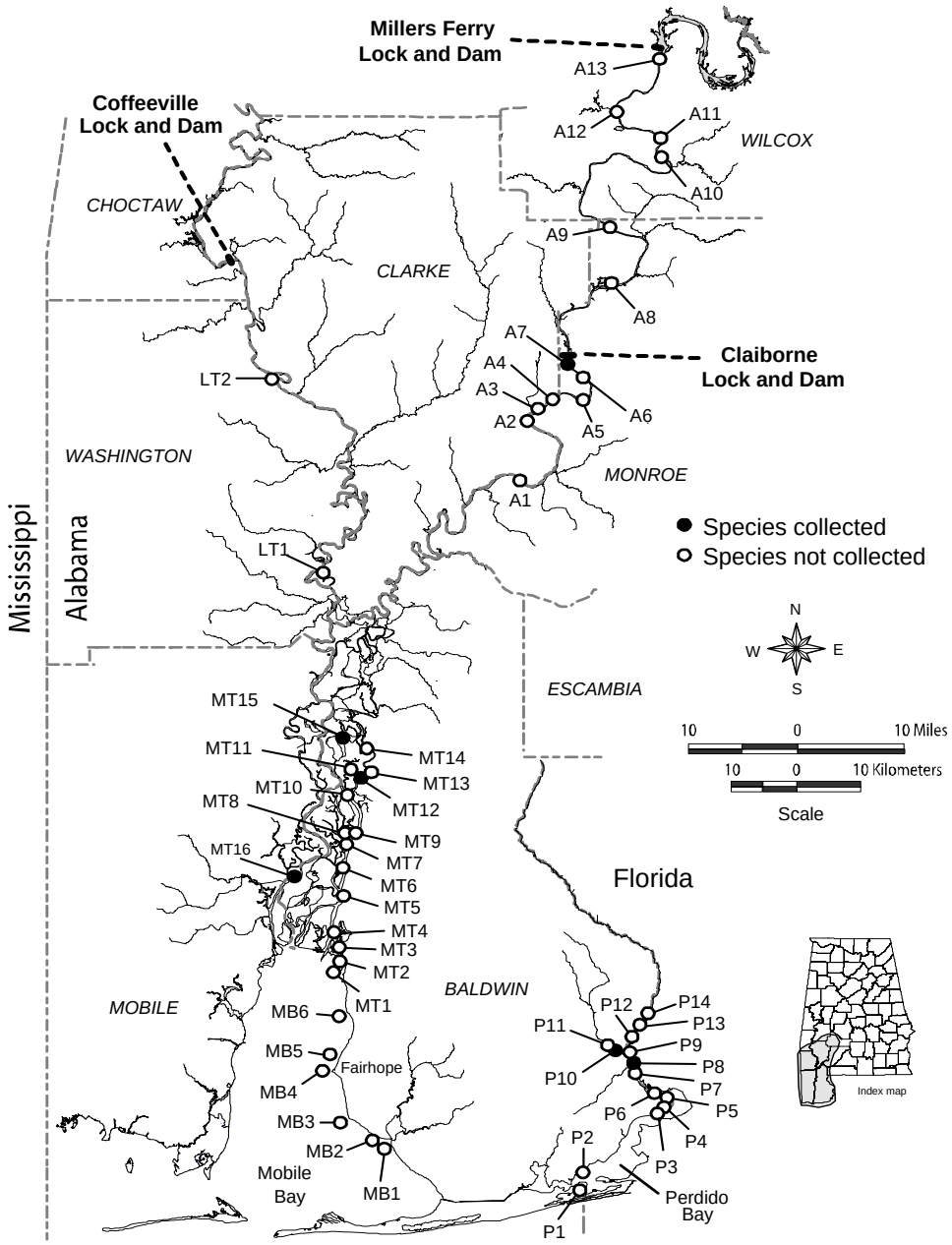
Pogonias cromis
black drum
4 specimens
3 collections

A-55. Collection locations for the black drum *Pogonias cromis* in the lower Mobile and Perdido Basins, 2000-08.



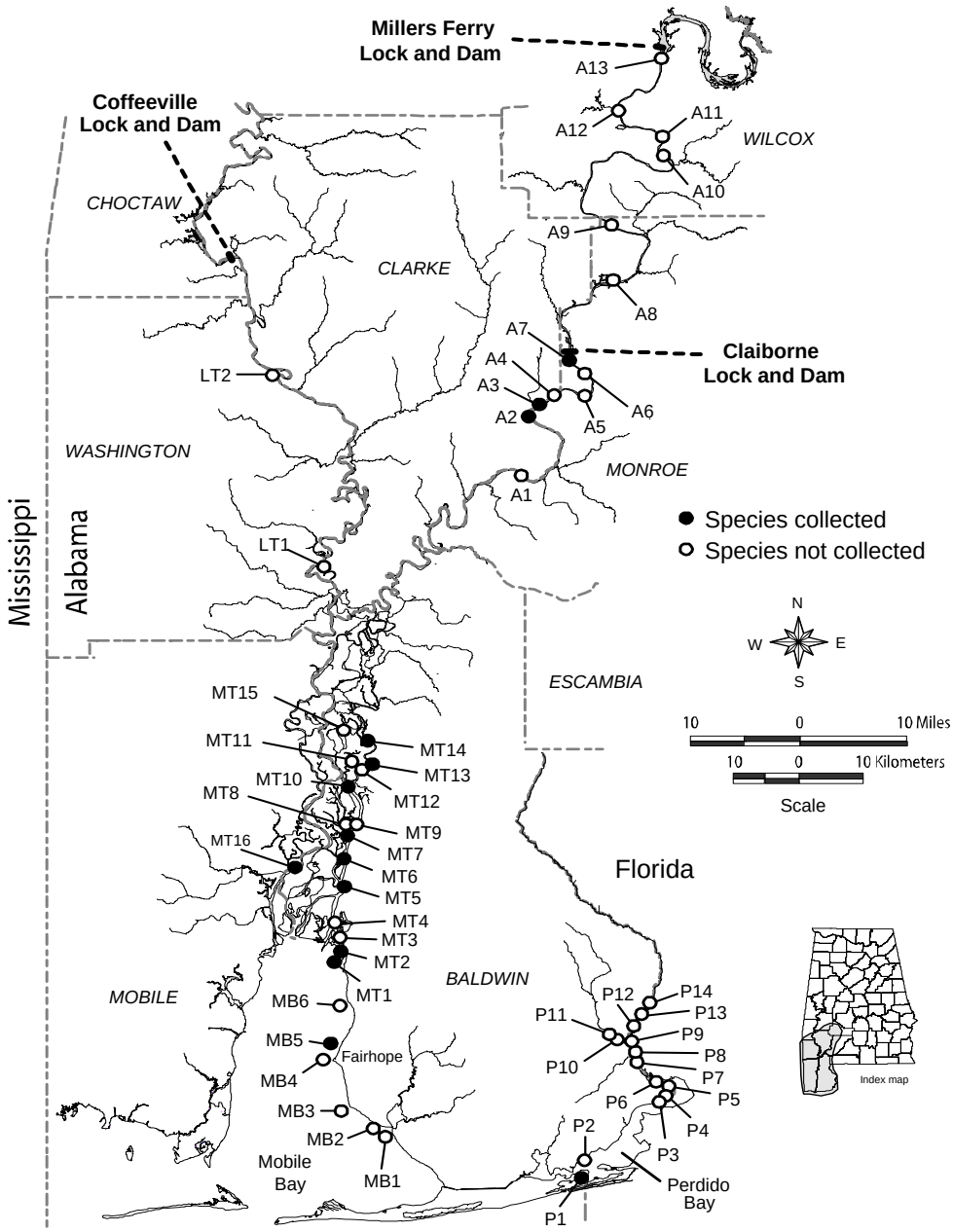
Sciaenops ocellatus
red drum
9 specimens
8 collections

A-56. Collection locations for the red drum *Sciaenops ocellatus* in the lower Mobile and Perdido Basins, 2000-08.



Mugil cephalus
striped mullet
16 specimens
8 collections

A-57. Collection locations for the striped mullet *Mugil cephalus* in the lower Mobile and Perdido Basins, 2000-08.



Paralichthys lethostigma
southern flounder
50 specimens
23 collections

A-58. Collection locations for the southern flounder *Paralichthys lethostigma* in the lower Mobile and Perdido Basins, 2000-08.

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