ANADROMOUS FISHERIES RESEARCH PROGRAM

TAR RIVER, PAMLICO RIVER, AND NORTHERN PAMLICO SOUND

By

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ABSTRACT

Sampling of the Tar-Pamlico River and northern Pamlico Sound was carried out using wing trawls, seines, gill nets, and egg nets from June, 1974 through June, 1976. Field data from 126 monthly stations and numerous seasonal sampling sites were taken to determine spawning and nursery areas. Spawning areas were identified for river herring, American shad, hickory shad and striped bass in the Tar River. Spawning areas were also found for river herring in tributaries of Pamlico River. Nursery areas were determined for blueback herring, alewife, striped bass, and American shad. Tagging studies revealed that striped bass populations in the Pamlico River remain in the area between Washington and Wades Point except for spawning migrations up the Tar River. Commercial catches were sampled and a creel census was conducted to determine the extent of the commercial and recreational fisheries, respectively. Drift gill nets accounted for 98 percent of the effort in the recreational fishery. Other methods used were hook-and-line for shad and striped bass and dip nets for river herring in creeks near Washington. Commercial samples of blueback herring and hickory shad showed the highest percentages of repeat spawners. American shad samples were dominated by four and five year old fish and repeat spawning was moderate for both sexes. Virgin fish also dominated catches of alewife, particularly those captured entering Lake Mattamuskeet. Catches of striped bass were dominated by four and five year olds in 1975 and by two and three year olds in 1976.

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INTRODUCTION

Anadromous fish resources have been and continue to be valuable to both the commercial and recreational fisheries of North Carolina. Anadromous species accounted for approximately 45 percent of the annual edible finfish landings reported in North Carolina from 1960-73, and, although no estimates are available, this group of fish must be considered to contribute significantly to the value of the recreational fishery in the estuaries and tributaries of coastal North Carolina. Also important is their ecological role in serving as forage for other fish and as a means of energy transfer from the estuarine to the marine environment.

Seven species are considered to be anadromous in North Carolina: American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), blueback herring (*A. aestivalis*), alewife (*A. pseudoharengus*), striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrhynchus*), and shortnose sturgeon (*Acipenser brevirostrum*). The shortnose sturgeon is rare and probably contributes very little to the fishery of North Carolina. All the major tributaries of North Carolina's sounds - in particular the Neuse and Tar-Pamlico Rivers and tributaries of Albemarle Sound - support both commercial and recreational fisheries for all species except, possibly, the shortnose sturgeon.

Information available on anadromous fish resources in North Carolina prior to the beginning of the studies by the North Carolina Division of Marine Fisheries in Albemarle Sound was very general and limited in its usefulness for management purposes. North Carolina's anadromous fish research program was designed to provide for optimum utilization and maintenance of anadromous fish stocks. The objectives were to identify spawning and nursery areas, determine migration periods and routes, investigate distribution and relative abundance, determine year-class composition of adults, and monitor the activities of foreign vessels which might capture anadromous fishes while fishing in the ocean off North Carolina. The program began in Albemarle Sound in 1971. The results of a three-year study in that area have been reported by Street, Pate, Holland, and Powell (1975).

The results presented herein are from a two-year project in the Tar-Pamlico River system located in the central portion of coastal North Carolina (Figure 1).

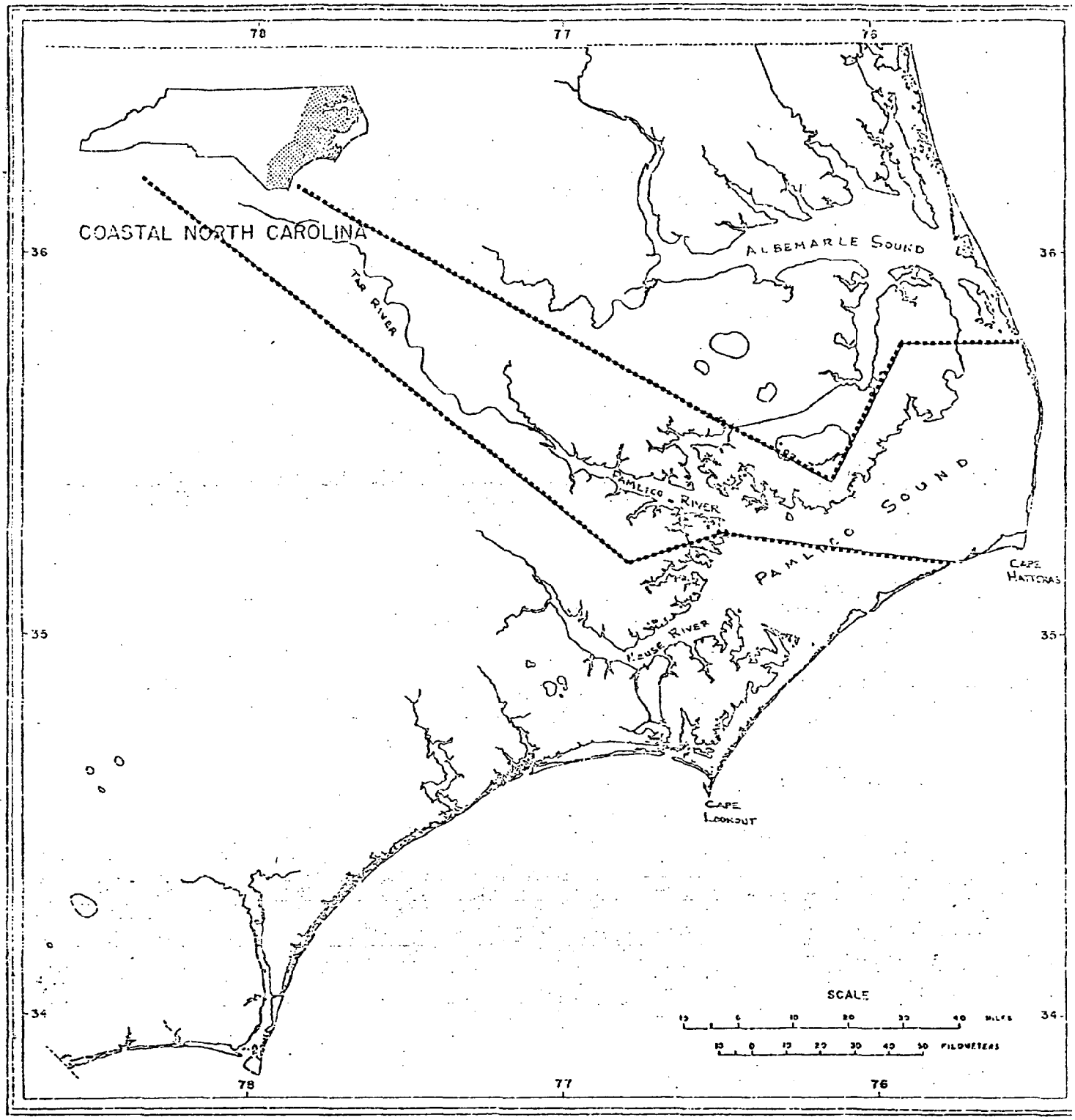


Figure 1 - Map showing relative location of study area.

LITERATURE REVIEW

A bibliography of literature concerning anadromous fish in North Carolina (Street and Hall, 1973) provided reference to all previous research that has been conducted in the Tar-Pamlico River system on these species. Additional information on nursery areas of anadromous fish in Pamlico River appeared in a report by Spitsbergen and Wolff (1974). In a series of stream survey reports (Smith and Bayless, 1964 and Bayless and Shannon, 1965), the North Carolina Wildlife Resources Commission reported all areas in the Tar-Pamlico River and tributaries in which anadromous fish - both juveniles and adults - were found. Maps showing locations of samples and tables with relative abundance of all species were included.

Baker (1968) discussed the general distribution of striped bass, American and hickory shad, blueback herring and alewife in North Carolina. An estimate of harvest of anadromous species from Tar River and Pamlico River by sport fishermen was made for the 1967-68 season. Results of a preliminary survey of anadromous fish spawning areas in Tar River were presented.

More detailed studies of the spawning areas of striped bass in Tar River have been made (Humphries, 1966 and Hassler, 1970). Spawning areas and periods of peak spawning activity were discussed. Tobaben (1971) made a preliminary report of the biology of striped bass populations spawning in Tar River.

A detailed study of utilization of Chicod Creek, a tributary of Tar River, by anadromous fish was made by the U.S. Soil Conservation Service (Edwards and Bland, 1973) to gather information for inclusion in an environmental impact statement prepared for a proposed stream channelization project.

STUDY AREA

The Tar River rises in the west-central part of Person County about seven miles west of Roxboro. It flows in a generally southeasterly direction through Granville, Franklin, Nash, Edgecombe, and Pitt Counties to Washington, county seat of Beaufort County, where it empties into Pamlico River at sea level. The

total length is 179 miles (288 km). The area of its drainage basin is approximately 3100 square miles (802,893 ha). The elevation of the source of the stream is approximately 550 feet (167.2 m) above sea level.

Physical and chemical characteristics of the Tar River vary considerably from the headwaters to the mouth, being determined mostly by stream gradient and soil characteristics. Conditions range from swift, highly turbid waters in the Piedmont to the dark, slow-moving waters in the Coastal Plain. In the Piedmont, water levels are subject to rapid variation in response to rainfall and run-off. Water levels of the main river and its tributaries in the Coastal Plain portion are influenced by wind tides for a considerable distance from the mouth.

The principal tributaries of the Tar River, as it is ascended, are as follows: Tranters Creek, which joins it from the right bank near its mouth; Town Creek, which joins it from the left bank at Old Sparta about eight miles (1.29 km) south of Tarboro; Fishing Creek, its largest tributary, which joins it on the right bank about three miles (4.83 km) northwest of Tarboro; and Swift Creek which has its confluence with the main stream about seven miles (11.26 km) above the mouth of Fishing Creek.

The Pamlico River is actually a continuation of the Tar River with the name change occurring at the US 17 bridge near Washington, North Carolina. It flows southeasterly about 33 miles (53.10 km) and empties into Pamlico Sound about 32 miles (51.49 km) west of Ocracoke Inlet. It drains an area of approximately 1,220 square miles (315,967.8 ha) including parts of Beaufort, Hyde, Pamlico, and Washington Counties. Stream gradients of the Pamlico River are slight, and, water levels rise and fall with shifting winds.

The principal tributaries of the Pamlico River, in addition to Tar River, include Pungo River; Rose, Swanquarter, Juniper, and Chocowinity Bays; and Broad, Bath, Blount, Durham, North, Goose, South, and Upper Goose Creeks.

MATERIALS AND METHODS

Spawning Area Sampling

Sampling for fish entering the spawning areas began in mid-March and lasted until late May. Ten and 20 m units of 63.5 mm, 72.9 mm, 82.6 mm, 123.7 mm, and

140 mm stretched mesh sizes of gill net were set for 24 hour periods. Nets were set in virtually all creeks and many of their upper tributaries to determine stream selectivity and limits of upstream migration. Capture of running ripe adult females was used as one criterion for classifying a stream as a spawning area. Fork length (FL, mm) measurements were taken on all captured adults. All fish were examined to determine sex and spawning condition and scale samples were taken for age determination.

Plankton net sampling for eggs and larvae was conducted from late March to late May. A 0.5 m plankton net made of 00 Nitex mesh with a wide mouth jar attached at the cod end was used for all samples. Fifteen minute, stationary samples were taken whenever sufficient current flow existed. However, when there was insufficient current, nets were towed for five minutes at very low speed. One unit of sampling effort consisted of either a 15 minute stationary sample or a 5 minute towed sample. Temperature, salinity, pH, and dissolved oxygen data were also taken with each sample. Samples were preserved in 5 percent formalin and returned to the laboratory where eggs and larvae were sorted, identified, counted, and measured. All measurements of eggs and larvae were made under a binocular microscope fitted with an ocular micrometer.

Nursery Area Sampling

Preliminary nursery area sampling was conducted during May and June, 1974 using a 3.95 m headrope shrimp trawl, 18.29 m bag seines, and an 8 m headrope Carolina wing trawl which was a scaled-down version of the net described by Street, et. al. (1975). Both trawls and seines were fitted with bags of 3.18 mm bar mesh to allow for the capture of prejuvenile fishes.

One hundred and twenty-six stations chosen from the initial survey were sampled monthly from July, 1974 to June, 1975 (Figure 2). This number was reduced to 54 stations which were sampled from July, 1975 to June, 1976. Trawls were fished on the bottom where there was little vegetation and few obstructions. Surface trawling gear was used in Tranters Creek and Tar River stations. Sample time varied from one to five minutes depending on the area being sampled and the season. A one minute tow was considered one unit-of-effort. Seines were pulled in a maximum depth of 0.91 m to 1.52 m for a distance of 45.7 m at each station. One seine tow was considered one unit-of-effort.

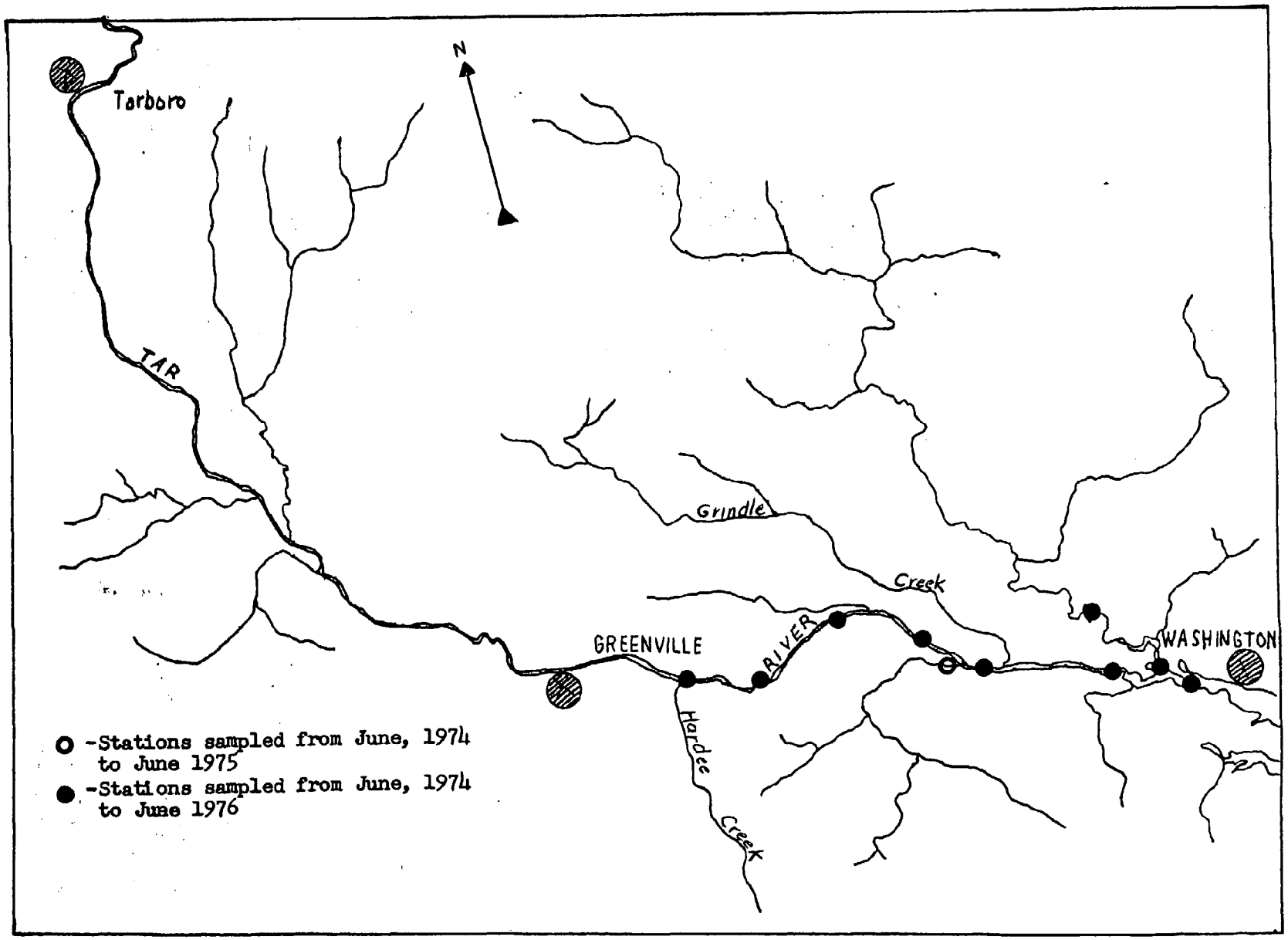
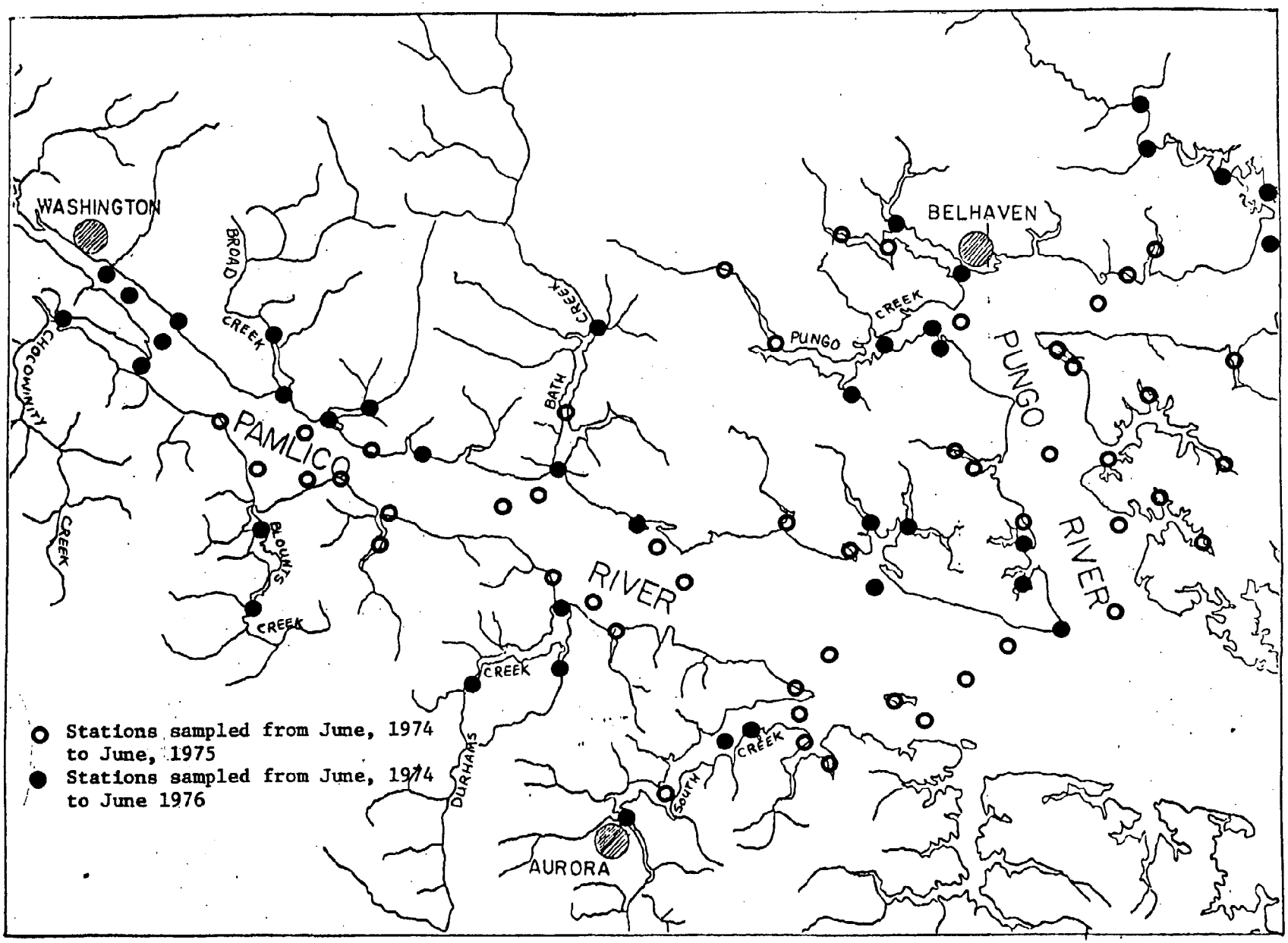


Figure 2- Map showing monthly sampling stations



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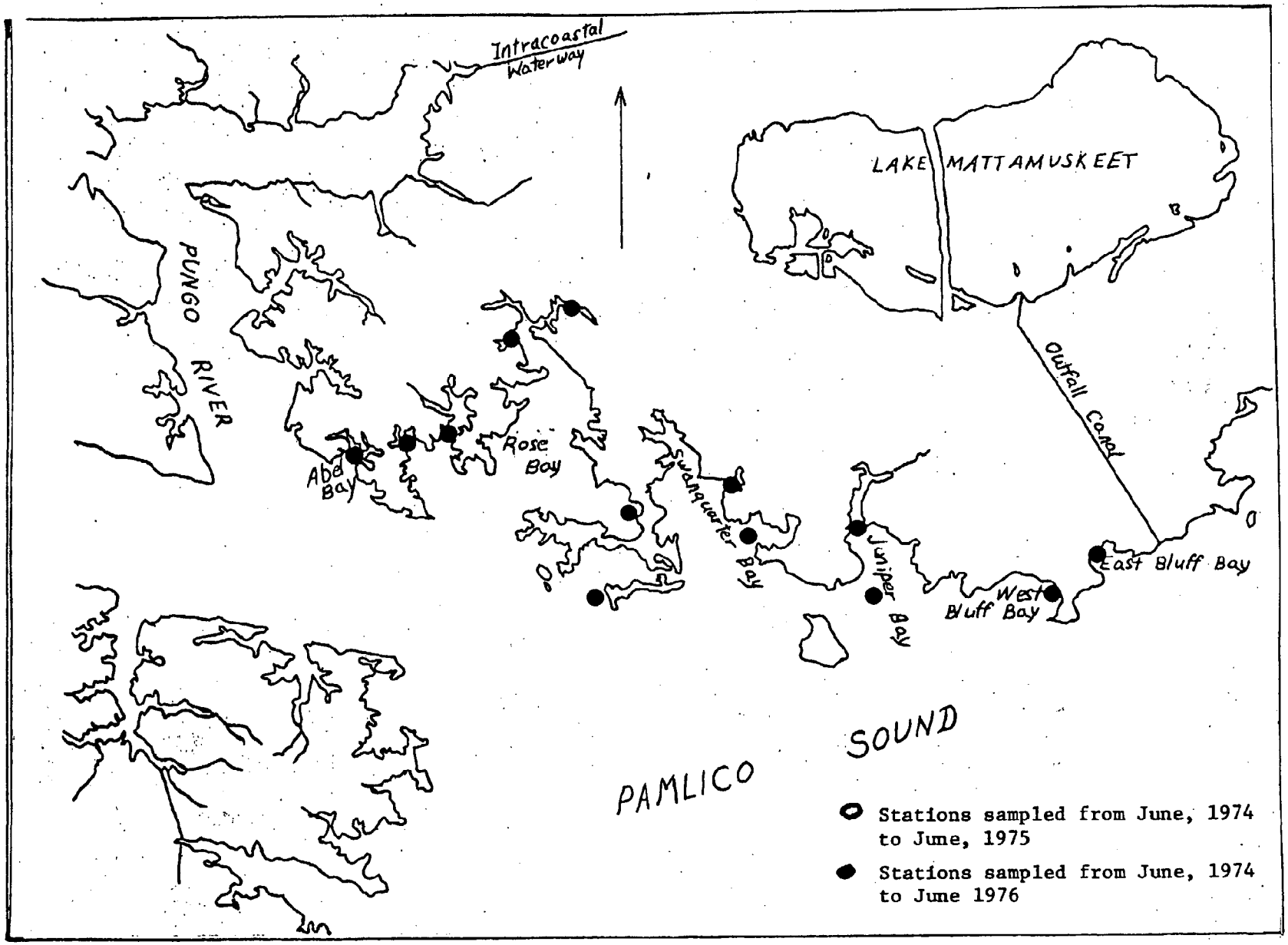

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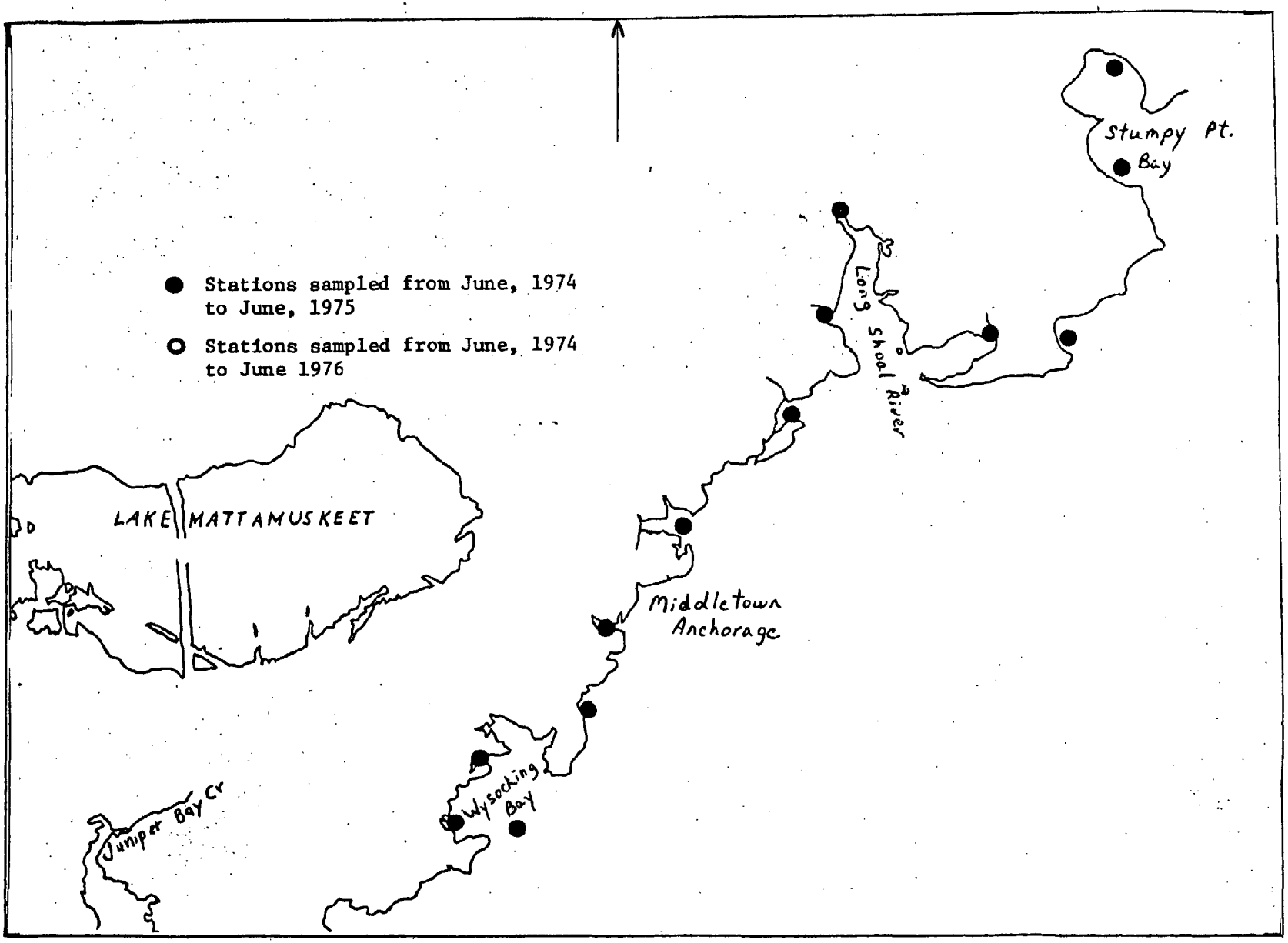

Figure 2--Continued

All species were identified and counted in each sample. A maximum of 30 fish per species were measured at each station. All samples were worked up in the field. Unknown specimens were returned to the laboratory for identification. Water temperature and salinity were measured with each sample with a YSI salinity-conductivity meter. Depth and bottom type were also noted at each station.

Commercial Harvest

Commercial landings were sampled at six locations in western Pamlico Sound and Pamlico River to determine species composition, sex ratios, and age class structure of anadromous fishes. The principal gear used in the study area was gill nets set primarily for American shad and striped bass. Few hickory shad and river herring were sampled at the dealer sites. Samples taken at these six locations were considered to be representative of the entire study area.

Unculled catches were sampled whenever thay were available. However, most samples were taken after culling had taken place to limit interference with the daily operations of fishermen and dealers. Sample size varied with the number of fish available on a given day and the time permitted for sampling.

Data were recorded in fork lengths (FL), measured to the nearest millimeter, and sex of each fish. Scales of Alosids were taken on the left side, below the insertion of the dorsal fin, and just above the mid-line as suggested by Rothschild (1963) and Marcy (1969). Striped bass scales were taken just behind the tip of the pectoral fin. Approximately 20 scales were taken from each fish to avoid loss of data due to a high incidence of regenerated scales.

Scales were read on an Eberbach scale projector. At least three of the most legible scales were read by two observers. Agreement was reached on all samples used in the data. The scale edge was counted as a year mark as it was assumed that each fish had completed a full year's growth at the time of capture.

Tagging

Tagging efforts were begun in September, 1974, using a 16 m Carolina wing trawl to capture striped bass (Street, et. al., 1975). However, open water trawling with this gear failed to produce any specimens for tagging, and it was abandoned

in favor of a drop net. This method of capturing striped bass had been used successfully by local fishermen in the Pamlico River and by Tobaben (1971) in the Neuse River. The drop net was 365.7 m long and made of 101.6 mm stretched mesh nylon webbing hung on 12.7 mm polypropylene float line. The net was deployed in a U-shaped pattern encircling a point of land. The set was accomplished by dropping the net from the bow of a boat traveling in reverse. Both ends of the net were anchored near shore, thus encircling the fish. The striped bass were then driven into the net by producing a disturbance within the encircled area. This tagging method was used most effectively during October, November, and December. Drops were made at night when there was little wind, and in areas where there was little current.

Tagging during the spring spawning run was accomplished by the capture of anadromous fish in stake gill nets in the Pamlico River below Washington. Nets were set perpendicular to the shoreline in 20 m units. Six sizes of stretched mesh monofilament webbing were used: 63.5 mm, 72.90 mm, 82.55 mm, 101.60 mm, 123.70 mm, and 139.70 mm. Nets were fished daily during the period February through March. The nets were checked as early as possible each day to ensure maximum survival. Only fish in good condition were tagged and released.

The presence of numerous river herring in good tagging condition in our spawning area samples provided an additional opportunity for tagging these fish. Spawning area nets were also fished every 24 hours and only vigorous specimens were tagged. Herring were tagged in this manner from mid-March through April during our 1976 sampling.

All fish were tagged with Floy FD-68B anchor tags inserted below the dorsal fin. Each fish was measured (FL, mm) and scales were taken from striped bass, American shad, and hickory shad for age determination. Alewife and bluebacks were not hardy enough to withstand excessive handling. Therefore, no scale samples were taken from tagged river herring and only sex and spawning condition were noted. Sex and spawning condition were also noted for American shad and hickory shad.

The tagging program was publicized by press releases, posters, and personal communications throughout the study area. Rewards of $1.00, $5.00, $10,00 and $25.00 were offered for returned tags.

RESULTS AND DISCUSSION

Spawning Areas

Spawning areas of anadromous fish in Tar and Pamlico Rivers were identified based on any one or all of the following criteria: (1) capture of eggs or recently hatched larvae, (2) capture of running-ripe females, and (3) observation of actual spawning activity. Eggs and larvae were identified based on criteria established by Mansuetti and Hardy (1967) and Lippson and Moran (1974). Eggs and larvae of alewife and blueback herring are reported together as river herring since eggs of these two species cannot be differentiated. However, most of the eggs and larvae taken in Tar River samples were probably blueback herring since this species comprised almost 100 percent of our gill net catches in that area. Eggs and larvae taken in Pamlico River tributaries are more mixed and probably follow a distribution similar to that discussed under adult fish sampling.

Results of egg net sampling in Tar River, Pamlico River, and all tributaries are summarized in Table 1.

River Herring

Tar River

Blueback herring were found to spawn between 25 March and 7 May at a temperature range of 12° - 19°C. Collections of river herring eggs and larvae did not indicate penetration of the Tar River system as far as that reported by Baker (1968). Relying on personal interviews with area residents, Baker reported herring migrations as far as the resevoir dam at Rocky Mount. However, we collected no eggs or larvae beyond Town Creek at river mile 42. Herring eggs and larvae were collected in nearly all tributaries between the mouth of Tar River and Town Creek (Figure 3).

Tranters Creek, the largest tributary entering the Tar River in the lower Coastal Plain, was by far the most important spawning area for river herring. Thirty samples were taken at ten locations (Figure 3) for a total sampling time of 1515 minutes.

One herring egg was collected in the first sample (25 March) when the water temperature was 15°C. The temperature fell sharply after this, and no other eggs were collected until the temperature rose to 13°C. Highest catch-per-unit-of-effort (CPUE) values occurred on 23 April at 18°C.

Below N.C. 33, Tranters Creek flowed through a well-defined channel with little or no flooding of the adjacent lands. Above N.C. 33, the creek left its banks and flooded the low-lying hardwood swamps, often making the main channel indistinguishable. Herring were able to migrate through this area to a point approximately four miles above the bridge where their upstream progress seemed to be impeded by numerous log jams.

The flooded portion of Tranters Creek apparently provided the most favorable spawning habitat for river herring. CPUE values of herring eggs at N.C. 33 were consistently higher than those in the downstream areas indicating that most of the spawning activity was upstream of the bridge.

The only running-ripe females captured in Tranters Creek were taken above N.C. 33. These were caught in gill nets which were set in the flowing water adjacent to the natural channel at temperatures of 12° to 18°C.

Cherry Run, a tributary of Tranters Creek, was also an important spawning area even though there was little flooding or stream flow during the spawning period. No eggs were collected in this creek - probably due to low flow which hampered plankton net sampling - however, it produced the largest catches of herring larvae. The highest CPUE value was 187 larvae/min. at a water temperature of 17°C. The highest value in Tranters Creek was 58 larvae/min. in a sample taken near its mouth at a water temperature of 18°C.

Running-ripe female herring were also collected from upper Bear Creek at temperatures of 12°, 13°, and 18°C - the earliest captured on 28 March; and Chicod Creek just below US 264 (14°C).

River herring eggs and larvae were collected in other tributaries of Tar River but not in sufficient numbers to indicate a spawning peak or spawning duration (Table 1).

The exact location of spawning areas of alewife could not be determined since alewife eggs and very early larvae cannot be accurately separated from those of blueback herring. Only two adult alewife were captured in the spawning areas in Tar River even though they were frequently captured in the Pamlico River below Washington. Edwards and Bland (1973) collected alewife from Chicod Creek from mid-May to late May only. Frankensteen (personal communication)[1] also found that alewife do not enter Chicod Creek until late May.

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[1]David Frankensteen, U.S. Army Corps of Engineers, Wilmington District

TABLE 1.--Location and results of egg net samples in Tar River, Tar River tributaries and Pamlico River tributaries. Unless otherwise indicated Tar River Samples were taken in 1975, Pamlico River/Sound samples were taken 1976.

SAMPLE SITE	TOTAL SAMPLE TIME (MIN.)		SPECIES	EGGS N		EGGS/MIN.		LARVAE N	LARVAE/MIN.
TAR RIVER (main Stem)									
HWY 97	90		Striped bass	3		0.03			
			American shad	5		0.06		3	0.03
SR 1243	105		American shad	2		0.02		4	0.04
	1975	1976		1975	1976	1975	1976		
SR 1252	285	45	Striped bass		5		0.11		
			American shad	33	1	0.12	0.02	2	0.01
			Hickory shad	3	2	0.01	0.04		
NC 44, Tarboro	360	45	Striped bass	269	210	0.75	4.67		
			American shad	41	2	0.11	0.04	4	0.01
Business US 64, Tarboro	285	45	Striped bass		19		0.42		
			American shad	25		0.09		3	0.01
			Hickory shad		1	0.02			
NC 42	180	45	Striped bass	323	166	1.79	3.69	3	0.02
			American shad	10	4	0.06	0.09		
			Hickory shad	1	30	0.006	0.67		
			Herring	1	18	0.006	0.40		
SR 1400, Falkland	45	45	Striped bass	5	60	0.11	1.33		
			American shad	3	22	0.07	0.49	1	0.02
			Herring		1		0.02		
US 264 Bypass, Greenville	60		Hickory shad	13		0.22			
			American shad	3		0.05			
			Herring	5		0.08			
			Striped bass	4		0.07			
SR 1565	45		Hickory shad	2		0.04			
			Herring	6		0.13			
Channel Marker 32	75		American shad	3		0.04			
			Striped bass	2		0.03		31	0.41
			Herring	4		0.05			
Bear Creek (Mouth)	15		No catch						
Channel 7,8,9	30		No catch						

TABLE 1.--Continued

SAMPLE SITE	TOTAL SAMPLE TIME (MIN.)	SPECIES	EGGS N	EGGS EGGS/MIN.	LARVAE N	LARVAE LARVAE/MIN.
SWIFT CREEK						
SR 1404	60	No catch				
SR 1409	120	American shad	3	0.03		
		Hickory shad	1	0.001		
HWY 97	105	American shad	2	0.02		
SR 1253	255	American shad	7	0.03		
		Hickory shad	2	0.01		
FISHING CREEK						
US 301	135	American shad	5	0.04	1	0.01
SR 1418	210	American shad	4	0.02	4	0.02
SR 1429	165	American shad	7	0.04	2	0.01
HWY 97	210	American shad	7	0.03	8	0.04
		Hickory shad	3	0.01		
SR 1500	165	American shad	16	0.10	7	0.04
		Hickory shad	4	0.02		
DEEP CREEK						
SR 1506	30	No catch				
SR 1505	30	American shad	1	0.03		
US 258	105	No catch				
TOWN CREEK						
HWY 43	30	No catch				
SR 1202	75	No catch				
SR 1200	120	Herring	1	0.01		
HWY 258	15	No catch				
SR 1601	225	Hickory shad	3	0.01		
OTTER CREEK						
HWY 43	90	Hickory shad	5	0.06		
		Herring	6	0.07		
KITTEN CREEK						
SR 1251	60	No catch				
CONETOE CREEK						
SR 1001	30	No catch				
SR 1407	30	No catch				

TABLE 1.--Continued

SAMPLE SITE	TOTAL SAMPLE TIME (MIN.)	SPECIES	EGGS N	EGGS/MIN.	LARVAE N	LARVAE/MIN.
TYSON CREEK						
HWY 43	15	No catch				
SR 1255	60	Herring	3	0.05		
HARDEE CREEK						
HWY 264	45	Herring	12	0.27		
HORSEPEN SWAMP						
SR 1001	15	No catch				
CANNONS SWAMP						
Mouth	6	No catch				
CHICOD CREEK						
SR 1760	30	No catch				
HWY 264	105	Herring	2	0.03	10	0.33
¼ mile from mouth	60	Herring			4	0.07
GRINDLE CREEK						
Mouth	75	Herring	1	0.01		
New Grindle-NC 33 Bridge	60	No catch				
BEAR CREEK						
Upper portion	120	Herring	22	0.18	9	0.08
Mouth	30	No catch				
TRANTERS CREEK						
Mouth	45	Herring	1	0.02	1753	38.96
SR 1157	30	No catch				
SR 1549	15	Herring	3	0.20		
SR 1416	45	No catch				
SR 1414	60	No catch				
3 miles above HWY 33	30	Herring	20	0.67		
½ mile above HWY 33	1095	Herring	5	0.005		
½ mile below RR		Hickory shad	16	0.12		
	30	Herring	1	0.03		
		American shad	1	0.03		
NC 33	135	Herring	480	3.56	4	0.03
5 miles below NC 33	30	Herring			52	1.73

TABLE 1.—Continued

SAMPLE SITE	TOTAL SAMPLE TIME (MIN.)	SPECIES	EGGS N	EGGS/MIN.	LARVAE N	LARVAE/MIN.
AGGIE RUN						
SR 1410	90	Herring	37	0.41		
	45	Herring	16	0.36		
CHERRY RUN						
All locations	75	Herring			2918	38.91
		Hickory shad			3	0.04
PAMLICO RIVER						
RUNYON CREEK						
US 264	28	Herring	1	0.04		
CHOCOWINITY CREEK						
Upper portion	33	Herring	20	0.61	3	0.09
HILLS CREEK						
Upper portion	35	No catch				
BROAD CREEK						
1 mile above SR 1325	26	Herring	45	1.73	8	0.31
BLOUNTS CREEK						
Below SR 1110	47	Herring			4	0.09
Herring run	45	Herring	183	4.10	9	0.2
Nancy run	38	Herring			3	0.08
Sheppard run	35	No catch				
UPPER GOOSE CREEK						
Upper portion	38	Herring	26	0.68		
NEVIL CREEK						
Upper portion	45	Herring	93	2.07	4	0.09
MALLARD CREEK						
Upper portion	20	No catch				
DUCK CREEK						
¼ mile above SR 1336	14	No catch				
BATH CREEK						
Tankard Creek	15	No catch				
Harvey Creek	10	No catch				
Boyd Creek	5	No catch				
Rowland Creek	13	No catch				

TABLE 1.--Continued

SAMPLE SITE	TOTAL SAMPLE TIME (MIN.)	SPECIES	EGGS N	EGGS/MIN.	LARVAE N	LARVAE/MIN.
DURHAM CREEK						
Upper portion	55	Herring	40	0.73	6	0.11
Tan Swamp	13	No catch				
ST. CLAIR CREEK						
Below HWY 92	39	No catch				
NORTH CREEK						
Bailey Creek	39	No catch				
SOUTH CREEK						
Above SR 1924	10	No catch				
PAMLICO SOUND						
ROSE BAY						
Canal to lake	10	No catch				
JUNIPER BAY						
Upper portion	10	No catch				
WYSOCKING BAY						
Lake Landing Canal	10	No catch				
FAR CREEK						
Waupoppin Canal	10	No catch				

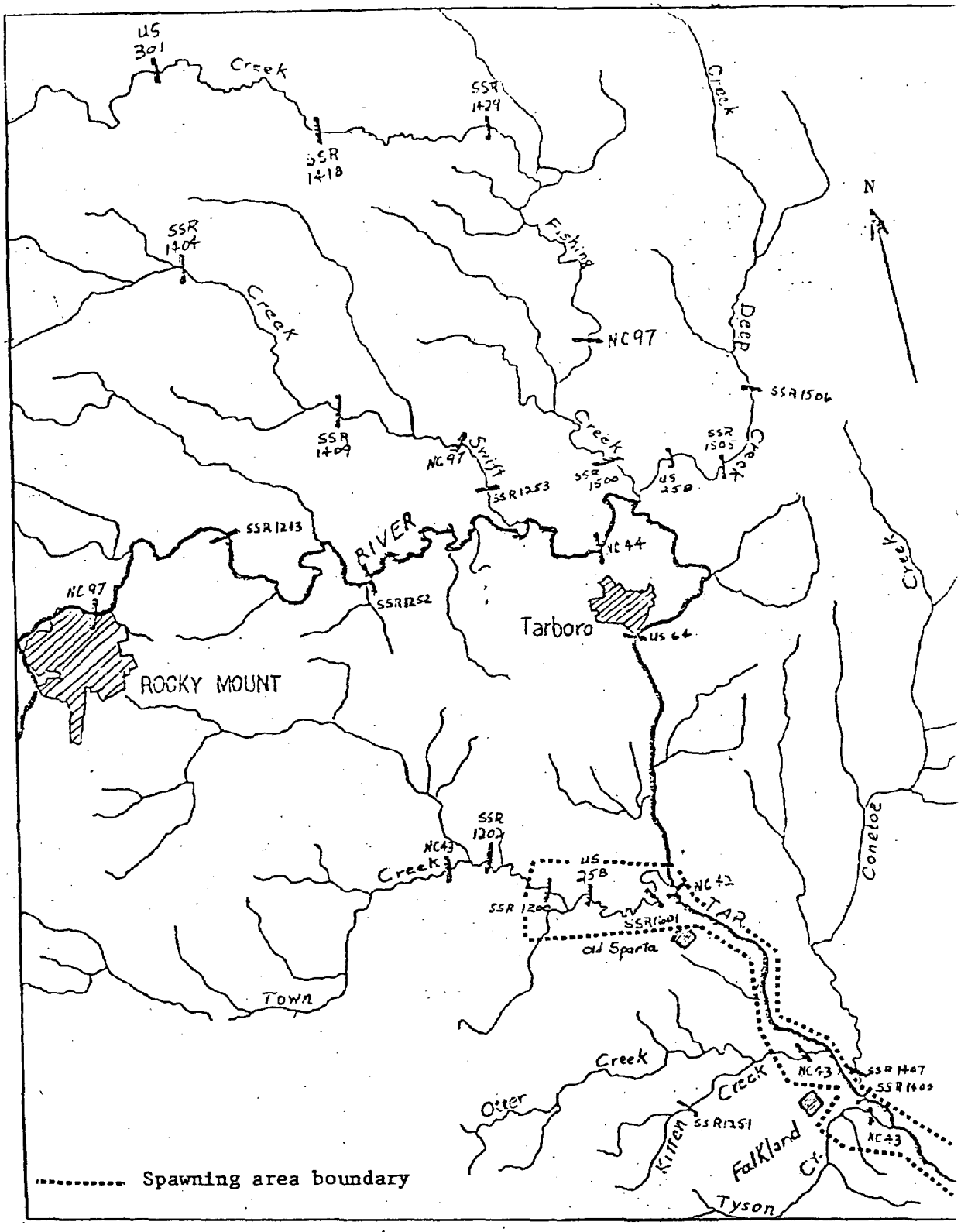


Figure 3.– Spawning areas of river herring in Tar River as indicated by collections of eggs and larvae (Numbers indicate highway bridges where samples were taken)

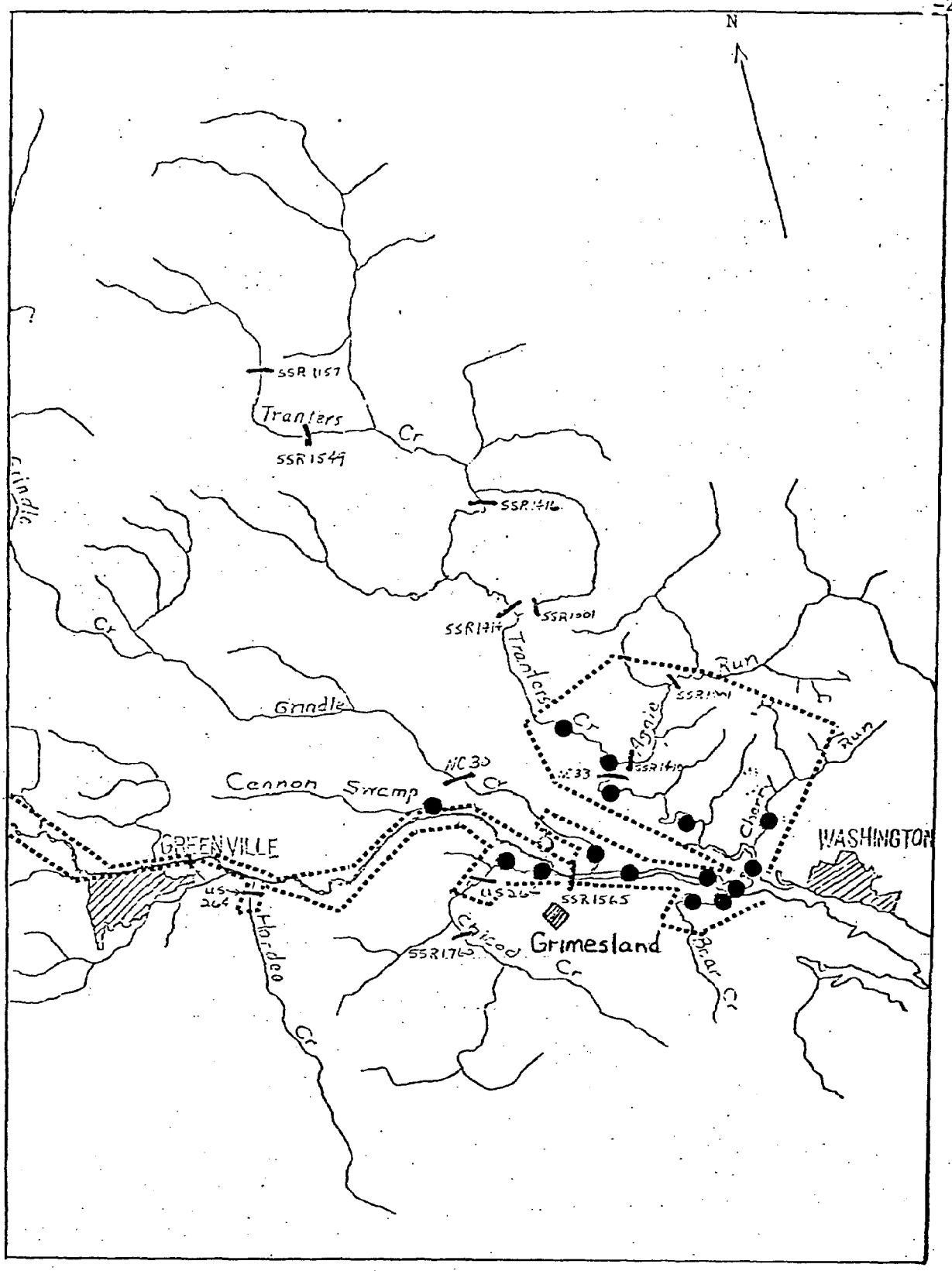


Figure 3. - Continued (Dots show locations of sample sites other than bridges)

Pamlico River

River herring spawned in Pamlico River tributaries at a temperature range of 13° to 25°C. The first indication of spawning activity was the capture of a running-ripe blueback herring in Durhams Creek on 23 March 1976. However, our first river herring egg was not collected until 7 April in Chocowinity Creek at a temperature of 15°C. No river herring eggs were collected after 3 May 1976.

Egg and larval sampling with towed ½ meter plankton nets in the still waters of the Pamlico River tributaries did not prove to be a very effective quantitative indicator of spawning activity (Figure 4). The eggs tended to settle rapidly in vegetation near the bank, often under brush where it was impossible for us to sample. Our best CPUE was 163 herring eggs in a five minute tow through vigorously spawning fish in Herring Run. A quart jar half full of vegetation from under the bank in the same area produced 1360 eggs.

Highest CPUE values occurred on 9 April in Durhams Creek (7 eggs/min. at 14°C), on 15 April in Broad Creek and Herring Run (5.2 and 32.6 eggs/min. at 16° and 19°C, respectively), and on 20 April in Nevil Creek (8.8 eggs/min. at 17°C) (Figure 4).

Only 37 river herring larvae were captured in 130 plankton net samples taken in the Pamlico River system. Highest CPUE values occurred on 29 April in Broad Creek (1.4 larvae/min. at 18°C) and on 27 May in Herring Run (1.8 larvae/min. at 18°C).

No eggs or larvae were taken from samples in tributaries of northern Pamlico Sound. Tyus (1971) found alewife that enter the canals that drain Lake Mattamuskeet spawned in the lake (Figure 5). He also found that juveniles may remain in the area until they are ready to migrate to the ocean. The lack of eggs and larvae in these tributaries and the capture of juveniles in this area during January and February agree closely with his findings.

Runing-ripe river herring were captured from 23 March until 21 April. Running-ripe blueback herring were captured in Durham Creek at water temperatures of 13°, 17°, and 19°C; in upper Blounts Creek at 14°C; in Nancy Run at 17°C; in Herring Run at 14°C; and in Nevil Creek at 18°C. Herring Run and Nancy Run are both tributaries of Blounts Creek.

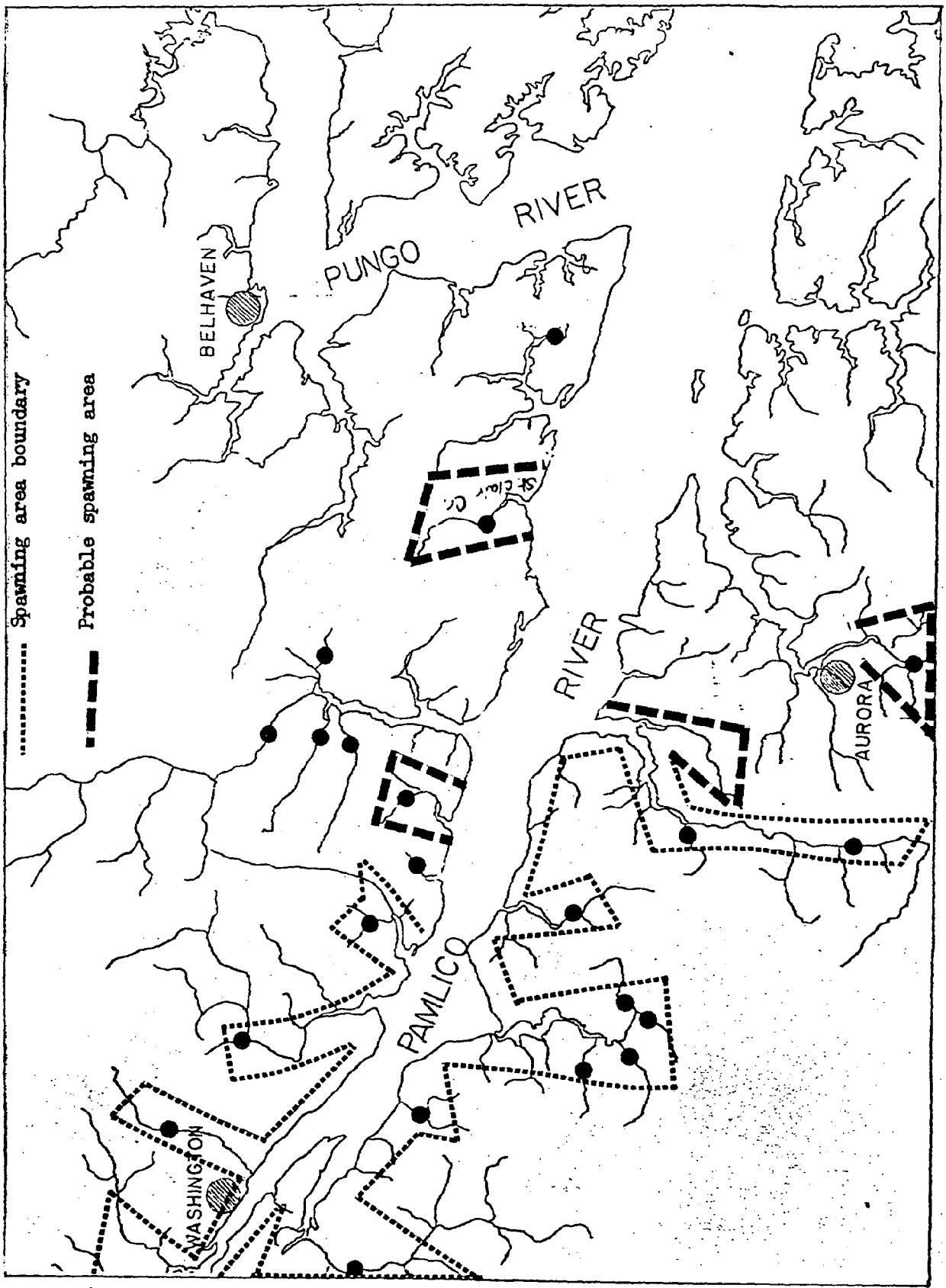
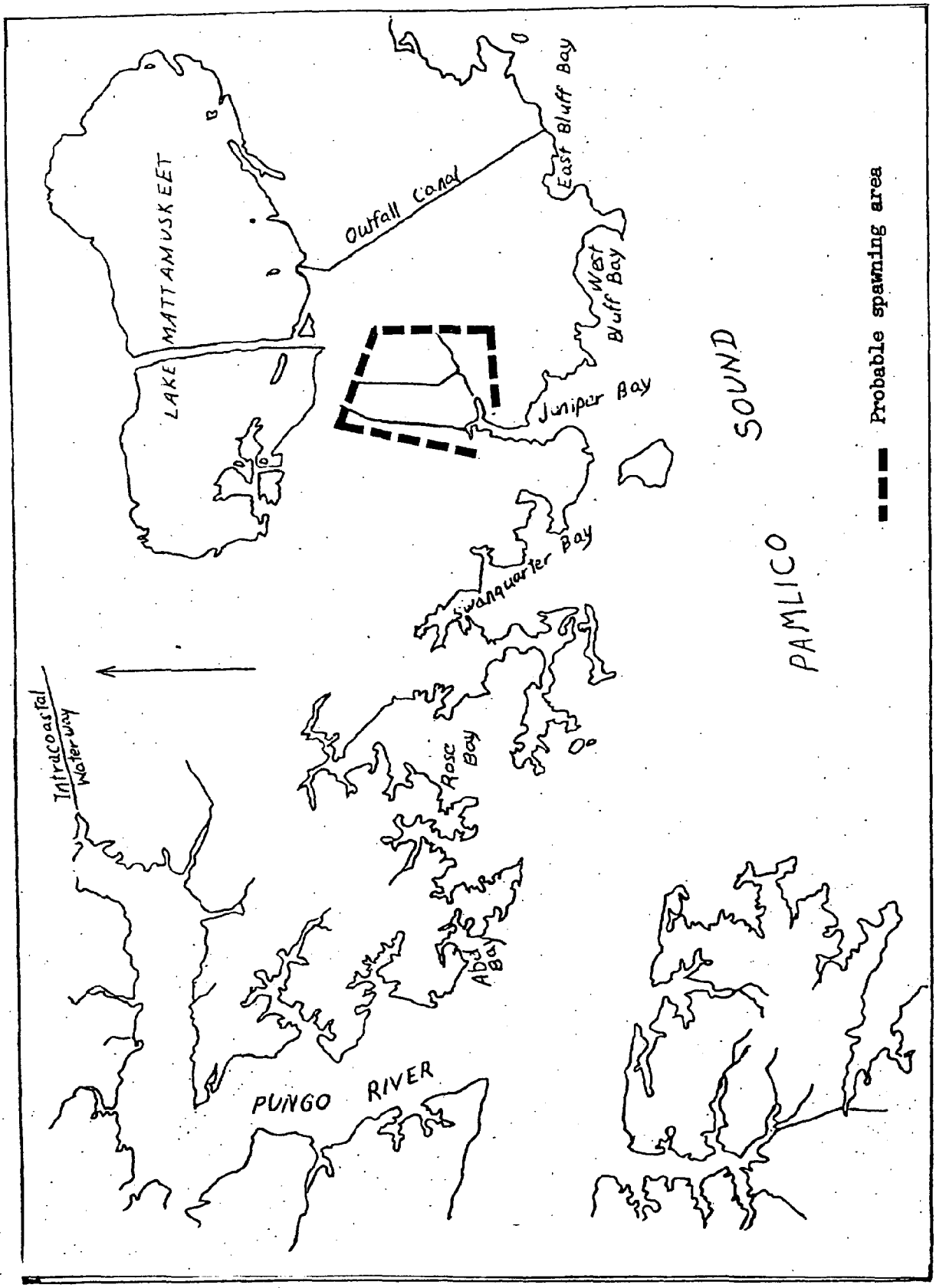


Figure 4.-Spawning areas of river herring in Pamlico River and Sound as indicated by all methods. Dots show sampling sites.



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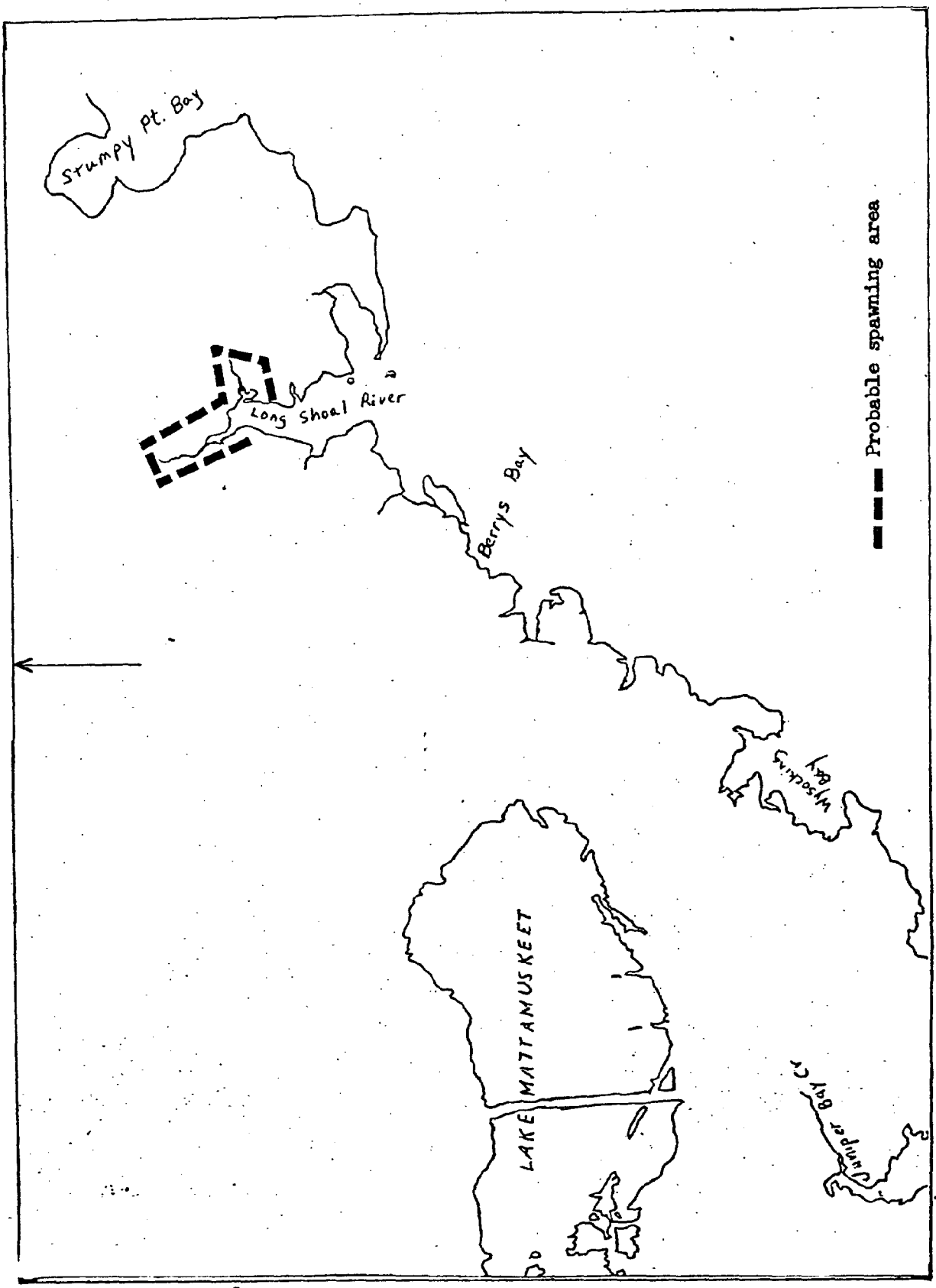

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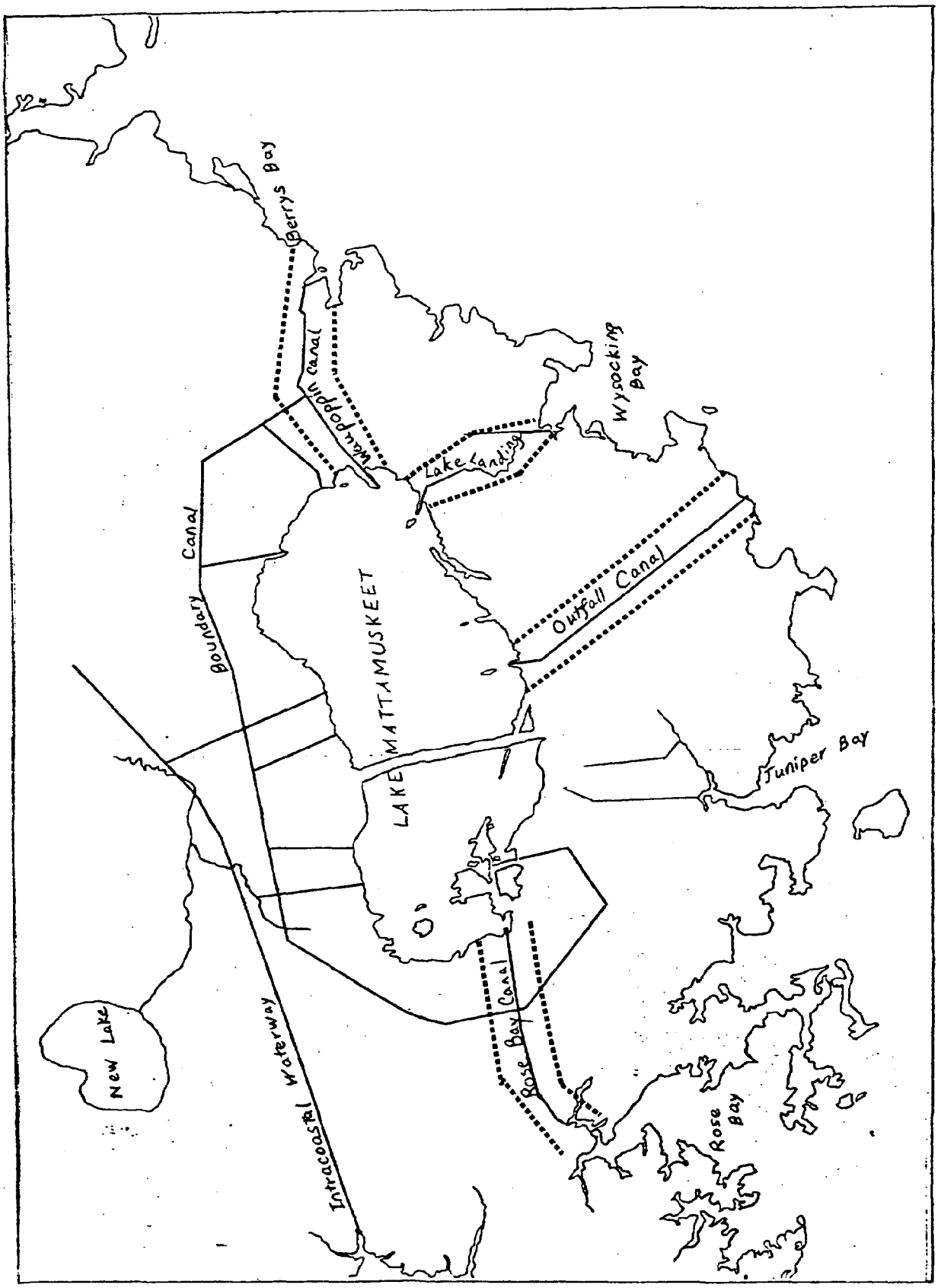

Figure 5.--Canals draining Lake Mattamuskeet that serve as passageways for spawning river herring.

Runing-ripe alewife were captured in three tributaries of Pamlico River. One was taken in Durham Creek on 1 April, one in Blounts Creek on 6 April, and one in Chocowinity Creek on 14 April. All were taken at a water temperature of 16°C. (Figure 4).

Spawning activity of river herring was observed on 13-15 April in Blounts Creek from a point about 200 yards below Herring Run to the NC 1110 bridge near Cox Crossroads. Spawning occurred during the late morning hours from around ten until 12 o'clock at a water temperature of 19°C. Spawning activity was also noted in Broad Creek on 23 April at a water temperature of 22°C. Spawning occurred from about 2000 yards above the NC 1325 bridge in a section of the creek that diverges from the channelized portion to a point where it was blocked by numerous fallen trees and log jams. No fish were observed spawning in the channelized portion of the creek.

Both of the spawning sites in Blounts and Broad Creek offer the black, swamp-water drainage that characterize spawning areas of river herring in Tar River. These two observed spawning sites as well as those that are indicated by our sampling show a preference for deep water creeks draining hardwood swamps. These creeks are also characterized by low salinity (0-2%), a slight acidity (pH 6.4-6.8), and little current.

American Shad

American shad were found to spawn mainly in Tar River from Rocky Mount to Tarboro, in Fishing Creek below US 301 and in Swift Creek below SSR 1409 (Figure 6). American shad eggs were first collected at SR 1252 from Tar River on 31 March at a water temperature of 12°C. This was the date of our first sample and some spawning could have occurred prior to this time. Spawning continued until 14 May when the water temperature was 23°C.

Samples taken at ten locations on Tar River from Rocky Mount to Grimesland yielded 125 American shad eggs in a total sampling time of 1530 minutes. Egg catches were relatively low - 10 was the maximum in any one sample - making recognition of a spawning peak difficult. The highest CPUE (0.66 eggs/min.) occurred at NC 44 on 21 March at a temperature of 16°C.

No shad larvae were caught in Tar River until 17 April when one was collected at NC 97 at a water temperature of 15°C. Shad larvae were collected through 14 May when the water temperature was 19°C. No larvae were collected above SR 1252 on Tar River.

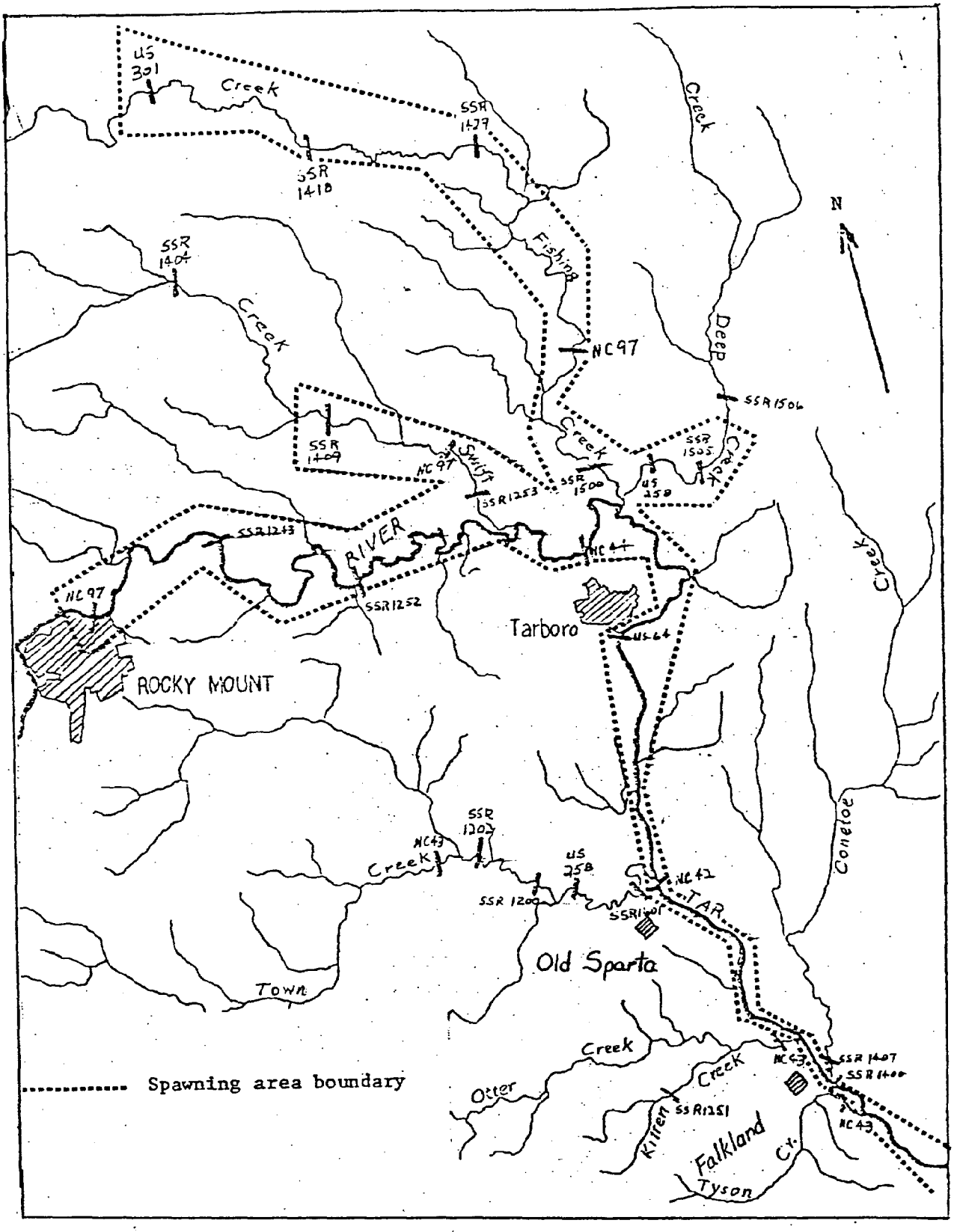

Figure 6.- Spawning areas of American shad based on collections of eggs and larvae (Numbers indicate highway bridges where samples were taken)

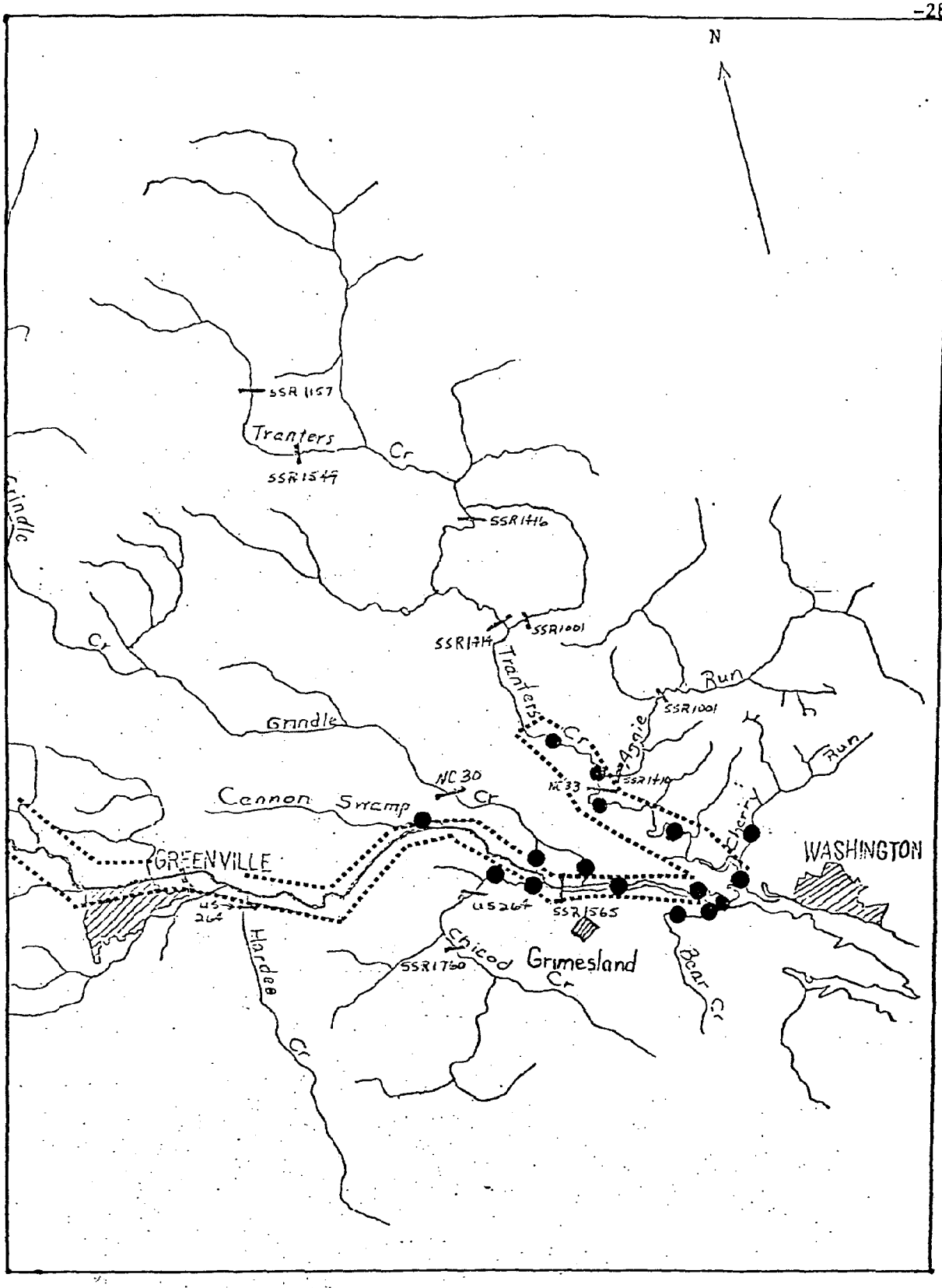

Figure 6.— Continued (Dots show location of sample sites other than bridges).

Shad eggs were collected at all stations in Fishing Creek (Figure 6) from 1 April to 7 May when water temperatures ranged from 14° to 18°C. Peak catches occurred at 12°C on 16 April. No larvae were collected in Fishing Creek until 21 April when waters had warmed to 17°C. Larvae were collected through 29 May.

Shad eggs were collected at all stations on Swift Creek except the uppermost station at SR 1404. Eggs first appeared in samples on 31 March at 14°C. Water temperature dropped to 10°C one week later; however, we continued to catch shad eggs through this period of cold weather. Larvae were collected only at the lowest station (SR 1253), the first being collected when the water had warmed to 17°C. No eggs or larvae were collected after 12 May.

One shad egg was collected from Deep Creek (SR 1505) on 1 April at 14°C. This was the only shad egg collected from this tributary in nine 15-minute samples taken from 1 April to 30 April. Water levels were higher during early April allowing shad to ascend this small tributary and spawn. Waters soon receded exposing physical barriers which prevented any further migrations by shad.

One shad egg was collected from Tranters Creek on 27 March at 14°C. This was the only egg collected from 30 samples taken from 25 March to 21 May even though shad were present on the spawning grounds throughout this period. Local fishermen reported taking male and female shad in skim nets from an area of Tranters Creek approximately one mile upstream from NC 33.

Hickory Shad

Egg sampling in Tar River and tributaries yielded only 55 eggs and 3 identiable larvae of hickory shad. Based on these collections the spawning areas of hickory shad in Tar River have been identified (Figure 7).

Spawning occurred principally in Tar River from SSR 1252 to US 264 east of Greenville. Eggs were also collected from Swift Creek at all stations below and including SSR 1409; Fishing Creek at all stations below and including NC 97; Town Creek at SSR 1601; Otter Creek at NC 43; and Tranters Creek at NC 33. The only hickory shad larvae collected were found at the mouth of Cherry Run, a tributary of Tranters Creek. These fish were probably spawned in Tranters Creek since the flow of Cherry Run was probably never sufficient to encourage migration of hickory shad.

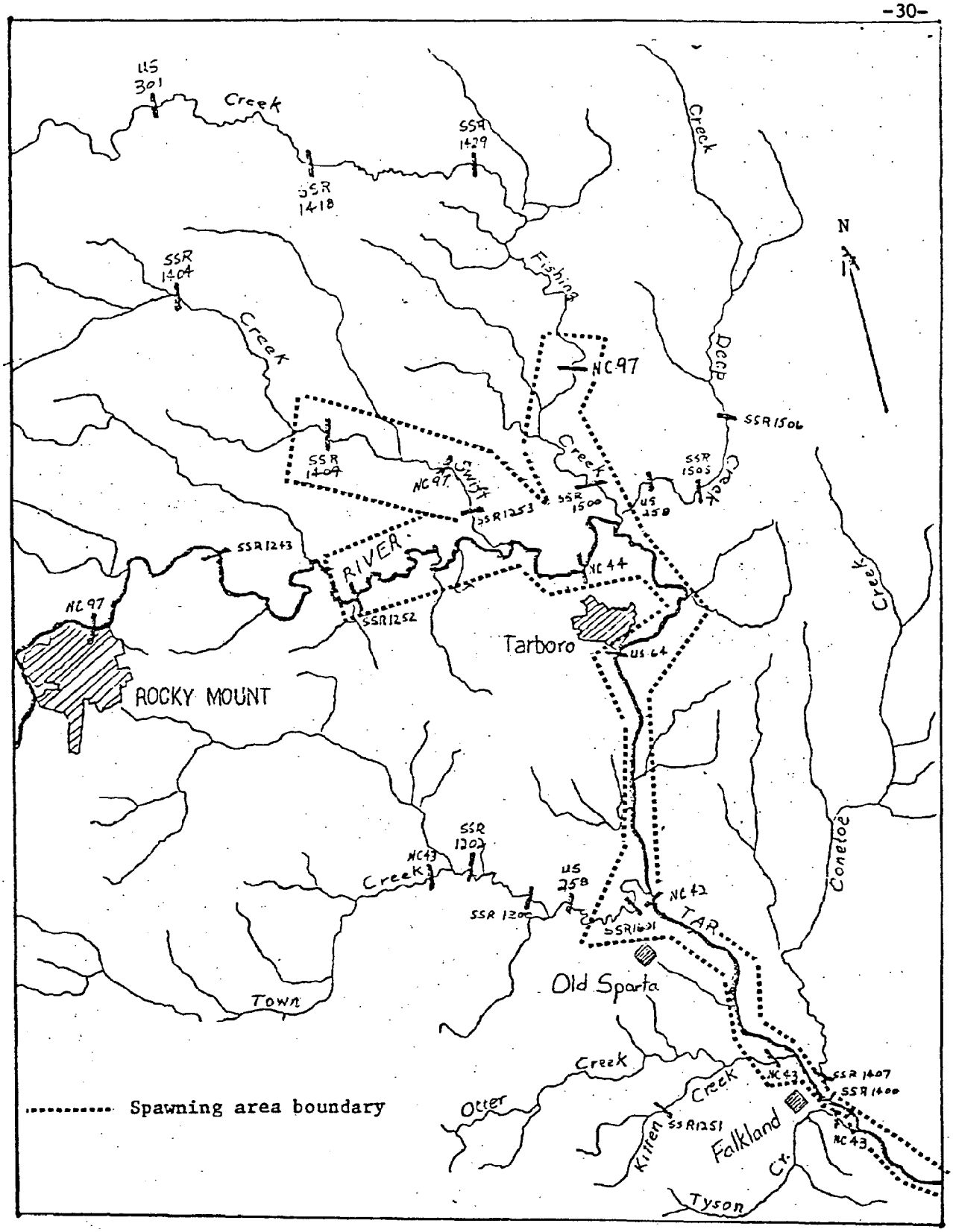

Figure 7.- Spawning area of hickory shad based on collections of eggs and larvae (Numbers indicate highway bridges where samples were taken)

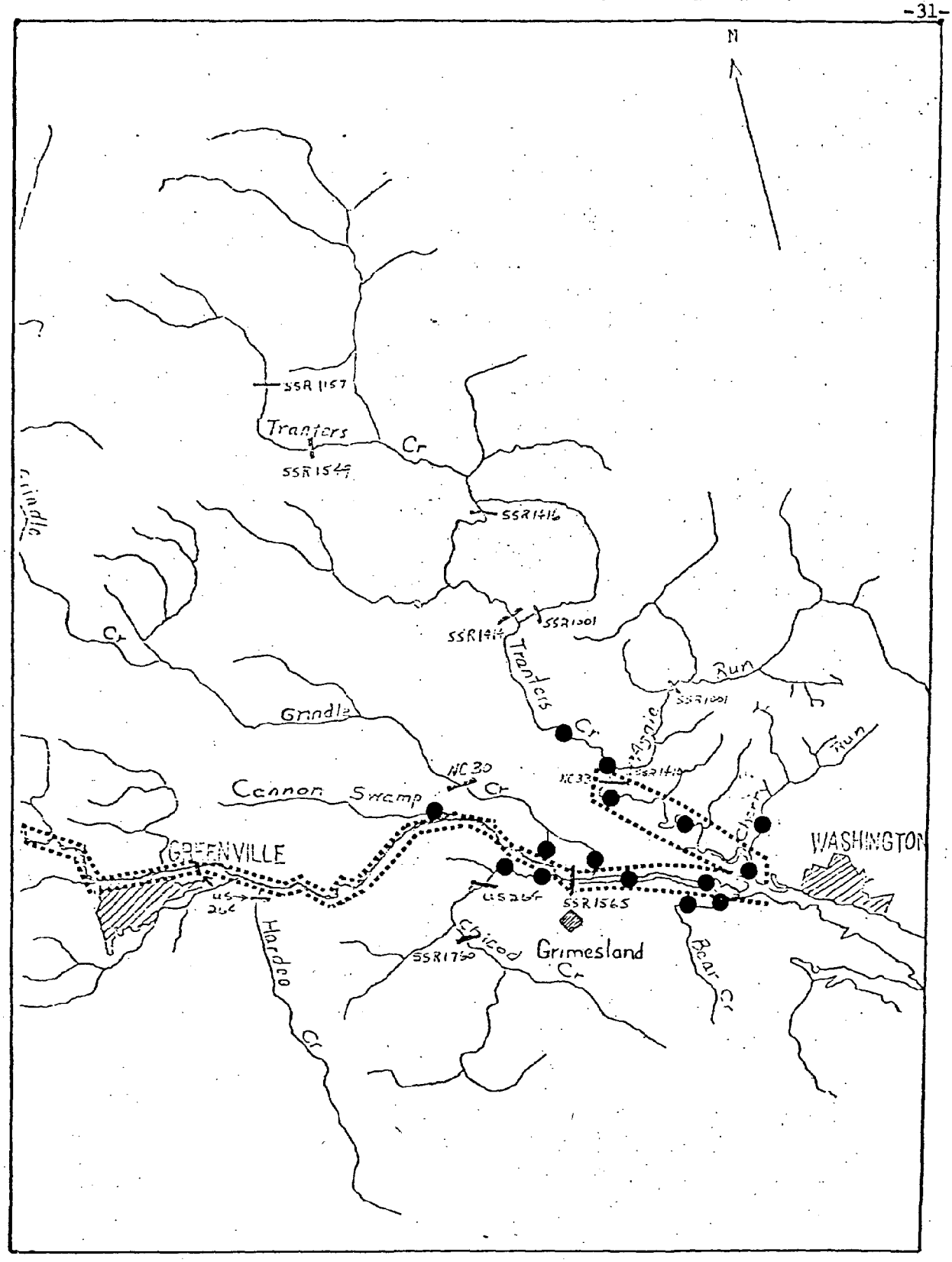

Figure 7.— Continued (Dots show location of sample sites other than bridges)

Hickory shad spawning occurred from 28 March to 6 May at temperatures of 14°- 19°C. Temperatures are similar to those reported by Street, et. al. (1975), but the spawning duration was approximately two weeks shorter than that in Albemarle Sound. Pate (1972) reported hickory shad spawning in Neuse River, N.C. to occur from early April through early May at 9.5° - 20.6°C.

Striped Bass

Even though Tar River ranks second only to Roanoke River in striped bass production in North Carolina, little information is available on spawning populations and harvest rates during spawning migrations.

The location of spawning grounds of striped bass in Tar River was first reported by Humphries (1966). By backstaging eggs in relation to age and transport rate, he concluded that spawning occurred upstream from SSR 1400 at river mile 30 to a point approximately 50 miles upstream. Peak spawning activity was estimated to occur in a 20 mile area centered around the NC 44 bridge when water temperatures were 18° to 21°C.

We collected striped bass eggs at every station from NC 97 at Rocky Mount to one mile below SSR 1565 at Grimesland (Figure 8). Spawning began 1 April at a surface water temperature of 14°C. Temperatures declined to 12°C shortly after this, and, no eggs were collected until 15 April when waters warmed to 16°C. Spawning continued until 29 May when one egg was collected at US 64 at a temperature of 24°C.

Samples taken at SR 1252, NC 44, and US 64 are used as a comparison to data collected by Humphries who sampled spawning activity at NC 44 and US 64 in 1965[1]. Spawning duration and times of peak spawning activity are similar to those found in 1965 (Figures 9 and 10). Generally, spawning peaked earlier in 1965 because water temperatures were consistently higher than on corresponding dates in 1975. Since 1965, egg production in Tar River appears to have increased significantly. The best sample in 1965 produced approximately 74 eggs per minute at NC 44 and 8.5 eggs per minute at US 64. The best samples in 1975 produced 183.6 eggs per minute at NC 44 and 48.4 eggs per minute at US 64.

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[1]Comparative data presented herein were collected by James W. Kornegay, student, NC Wesleyan College, and presented in an unpublished report entitled "Spawning Grounds of the Striped Bass (*Morone saxatilis*) in the Tar River, N.C. A Ten-year Comparative Study", 22p.

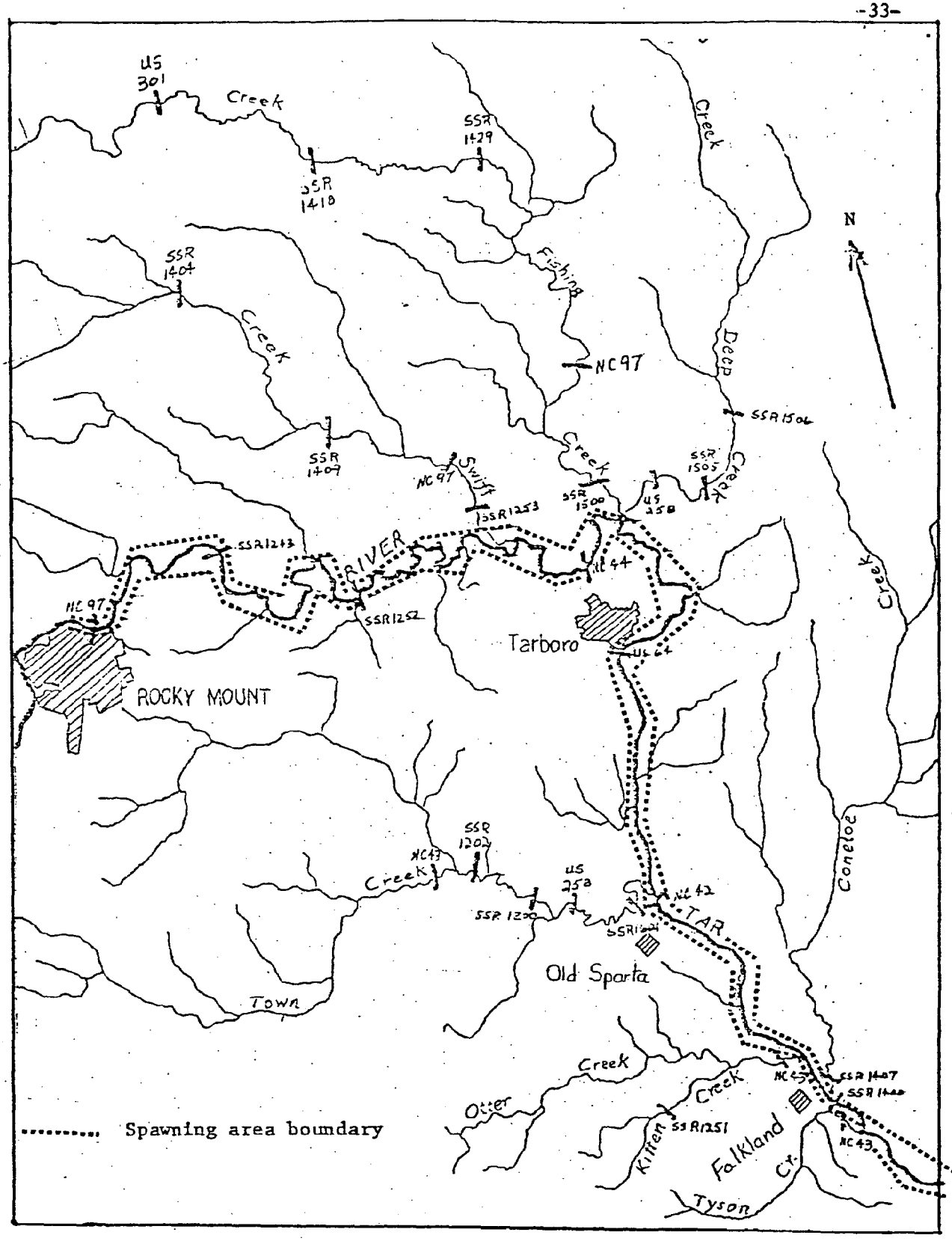


Figure 8. - Spawning areas of striped bass in Tar River based on collections of eggs and larvae (Numbers indicate highway bridges where samples were taken)

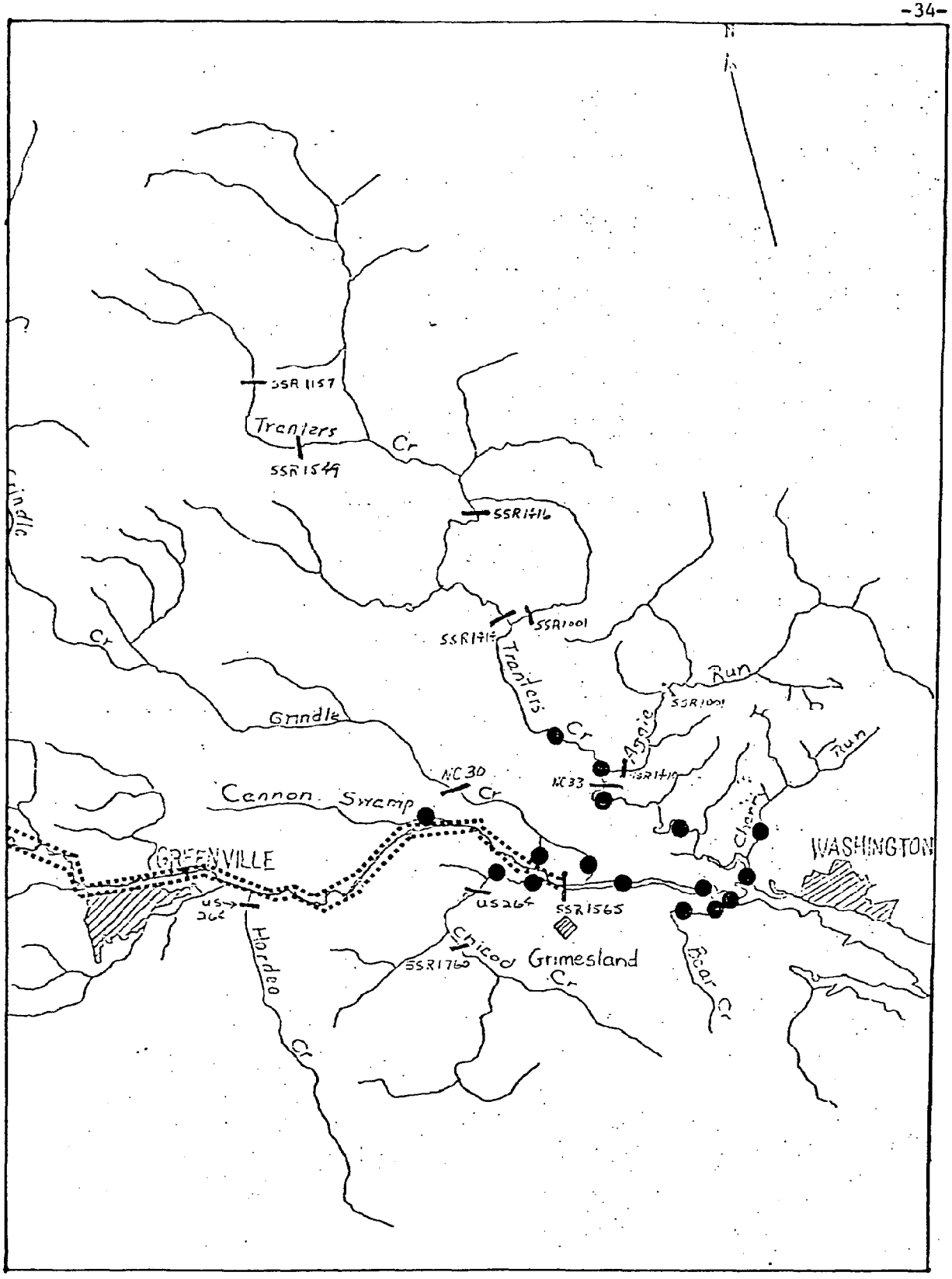


Figure 8.--Continued (Dots show location of sample sites other than bridges)

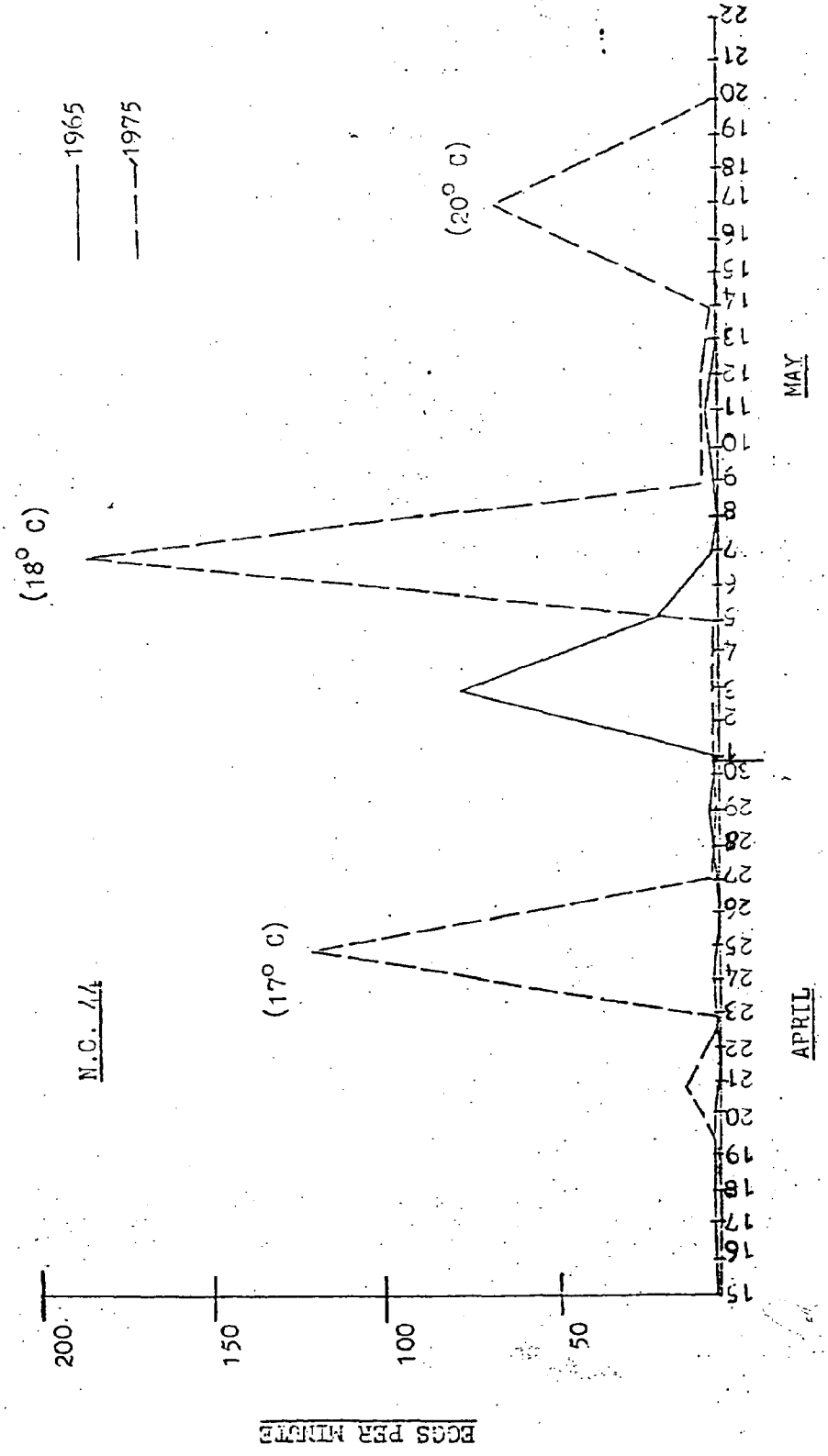


Figure 9.- Comparison of striped bass spawning activity in Tar River at NC 44 after a ten-year interval.

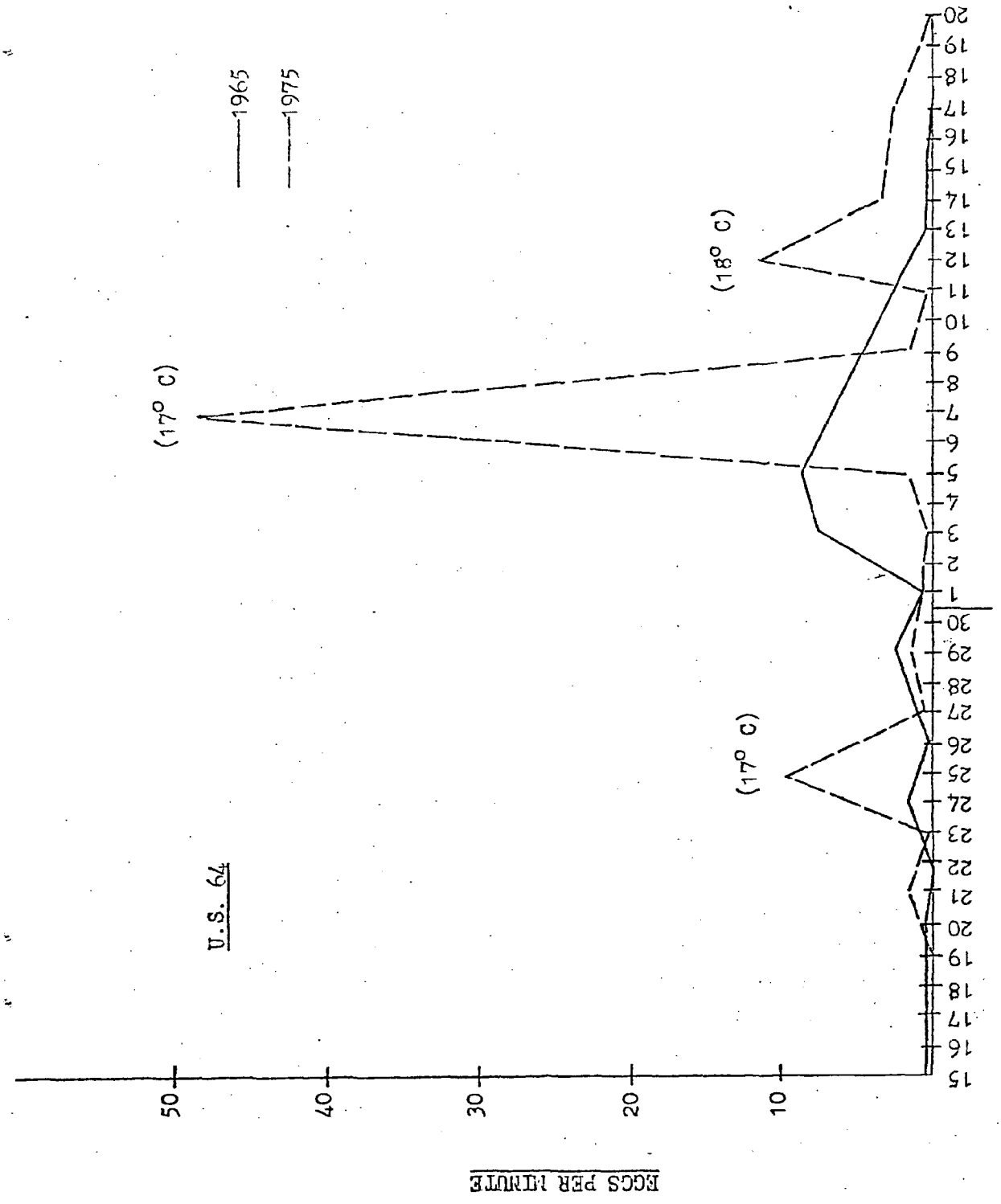


Figure 10- Comparison of spawning activity in Tar River at US 64 after a ten-year interval

Three spawning peaks were detected at NC 44 in 1975. One at 118.6 eggs/min. occurred on 25 April at 17°C; 183.6 eggs/min. on 7 May at 18°C; and 62.1 eggs/min. on 17 May at 20°C. Corresponding peaks occurred at US 64 except that the catch per minute was considerably lower. One peak of 9.3 eggs/min. occurred on 25 April at 17°C; one of 48.5 eggs/min. occurred on 7 May at 17°C; and one of 11.2 eggs/min. occurred on 12 May at 18°C.

Spawning began at all three stations on 21 April when surface water temperatures reached 15.5°C. This corresponds closely to the starting date reported by Humphries for 1965 (15 April and 16°C). Spawning in Roanoke River, NC generally occurs from mid-April through early June at temperatures of 15° - 21°C (McCoy, 1959).

Quantitative estimates of egg production have increased significantly since 1965. Estimates of eggs passing NC 44 were made using methods described by Humphries (1965) and flow data supplied by U.S. Geological Survey from their flow gauging station at the NC 44 bridge. The only variation in methods is the net used in this study had an opening of 0.5 meter instead of an opening of 15 inches used in 1965.

Estimates of eggs flowing past NC 44 ranged from 1320/hr to 444,960/hr in 1965 and 4380 to 1,036,560 in 1975. This indicates a substantial increase in egg production by striped bass in Tar River.

Hassler (1970) made quantitative estimates of striped bass spawning in Tar River for three seasons (1967-1969). An estimated 170,000,000 eggs were spawned in 1967; 28,645,568 in 1968; and 1,202,777 in 1969. During this same period, egg viability declined from 85 percent - a value typical for this species - in 1967 and 1968 to 58 percent in 1969 which is well below the range observed in other areas. No reason was presented for the precipitous decline in either egg production or viability.

An indication that conditions of low egg viability persist is the scarcity of recently hatched larvae in our samples. Striped bass larvae were collected in only two samples even though sampling was frequent in areas well below the spawning grounds. Thirty-one larvae were taken on 22 April one mile below SR 1565 at 18°C and three larvae were taken on 24 April at NC 42 at 18°C. All these larvae were collected prior to the three peak spawning periods indicating that survival of eggs and larvae during periods of peak production could be extremely low.

Nursery Areas

Blueback herring

Juvenile blueback herring generally used as nursery areas the tributaries of Tar River below Greenville and those portions of the tributaries of Pamlico River which provided a freshwater habitat similar to that of Tar River tributaries. These areas are characterized by waters from 3 to 15 feet deep, black, swamp-water drainage, little if any salinity, mud and detritus bottom, and no current except that produced by wind tides. The tributaries drain low-lying hardwood swamps with little or no marsh vegetation bordering the stream.

Tributaries of Pamlico River west of Bath Creek generally drain hardwood swamp areas whereas those east of Bath Creek and the tributaries of Pamlico Sound drain low-lying areas dominated by marsh grasses. Salinities were generally higher than 5 ppt in the marsh areas, which could be an important factor in determining suitable nursery habitat for blueback herring. Juvenile herring were not collected in any significant numbers in areas where salinity exceeded 5 ppt.

A total of 8,771 blueback herring were collected from May, 1974, through June, 1976. The largest catches were made in the months of May through August. Based on these catches, the nursery areas of blueback herring have been mapped (Figure 11).

Growth curves for the 1974, '75, and '76 year classes of juvenile blueback herring have been plotted (Figure 12). Preliminary samples from the 1976 year class seem to conform more closely to samples taken in 1974 than 1975. Samples from 1975 showed that mean fork lengths were considerably smaller during each month than in 1974. However, growth rates seem to be fairly consistent for both 1974 and 1975.

Juvenile blueback herring appeared in the tributaries of northern Pamlico Sound only during the months of December, January, and February. These ranged in fork length from 55 to 135 mm with a mean of 61 mm. A similar trend was found by nursery area sampling in Croatan Sound (Street, et. al., 1975) and Neuse River (Spitsbergen and Wolff, 1974). Juvenile herring move into the high salinity (10-20 ppt) tributaries of Pamlico Sound during winter months and remain until the spring spawning migration of adults begins at which time the remaining juveniles migrated to the ocean.

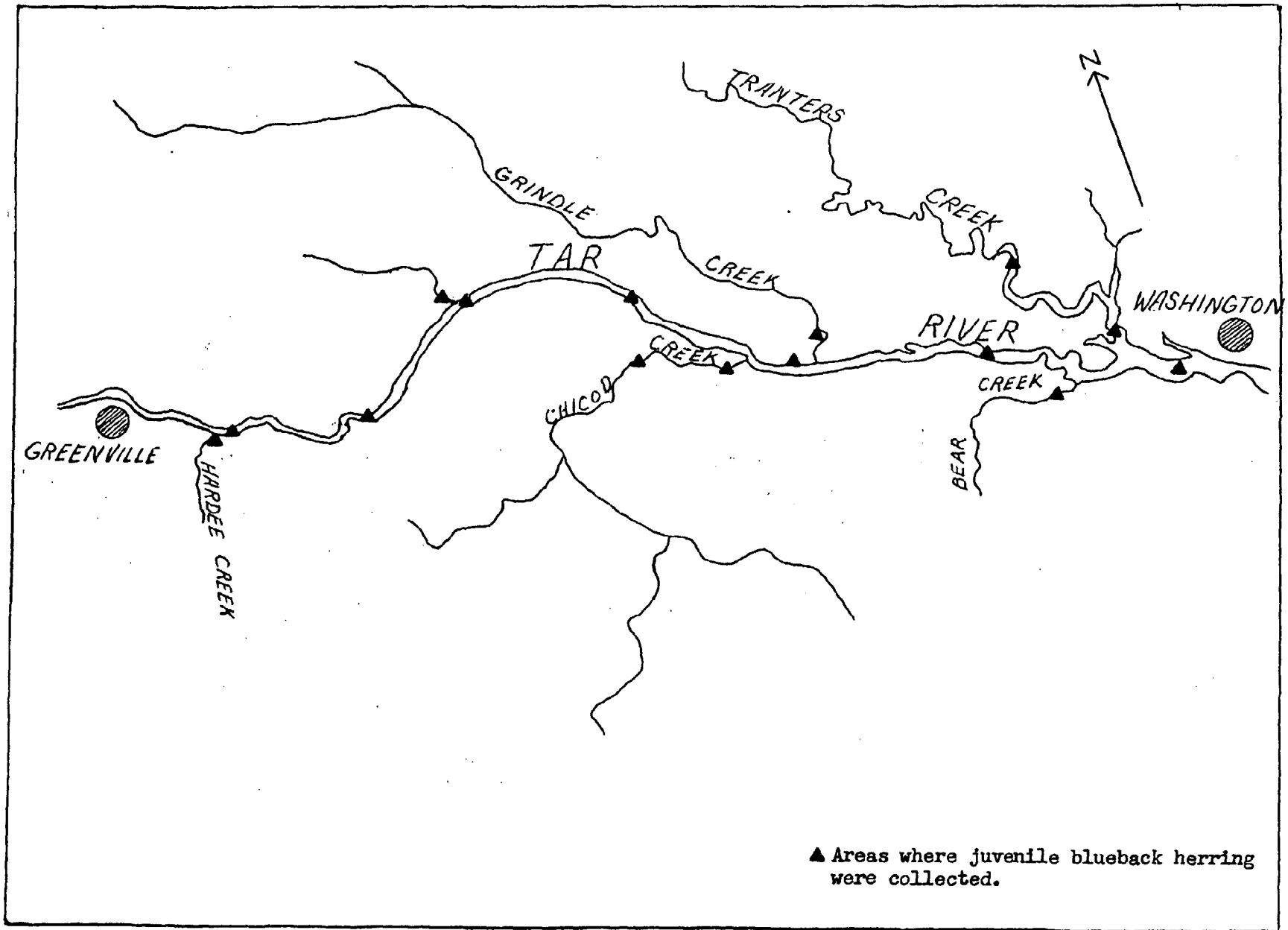
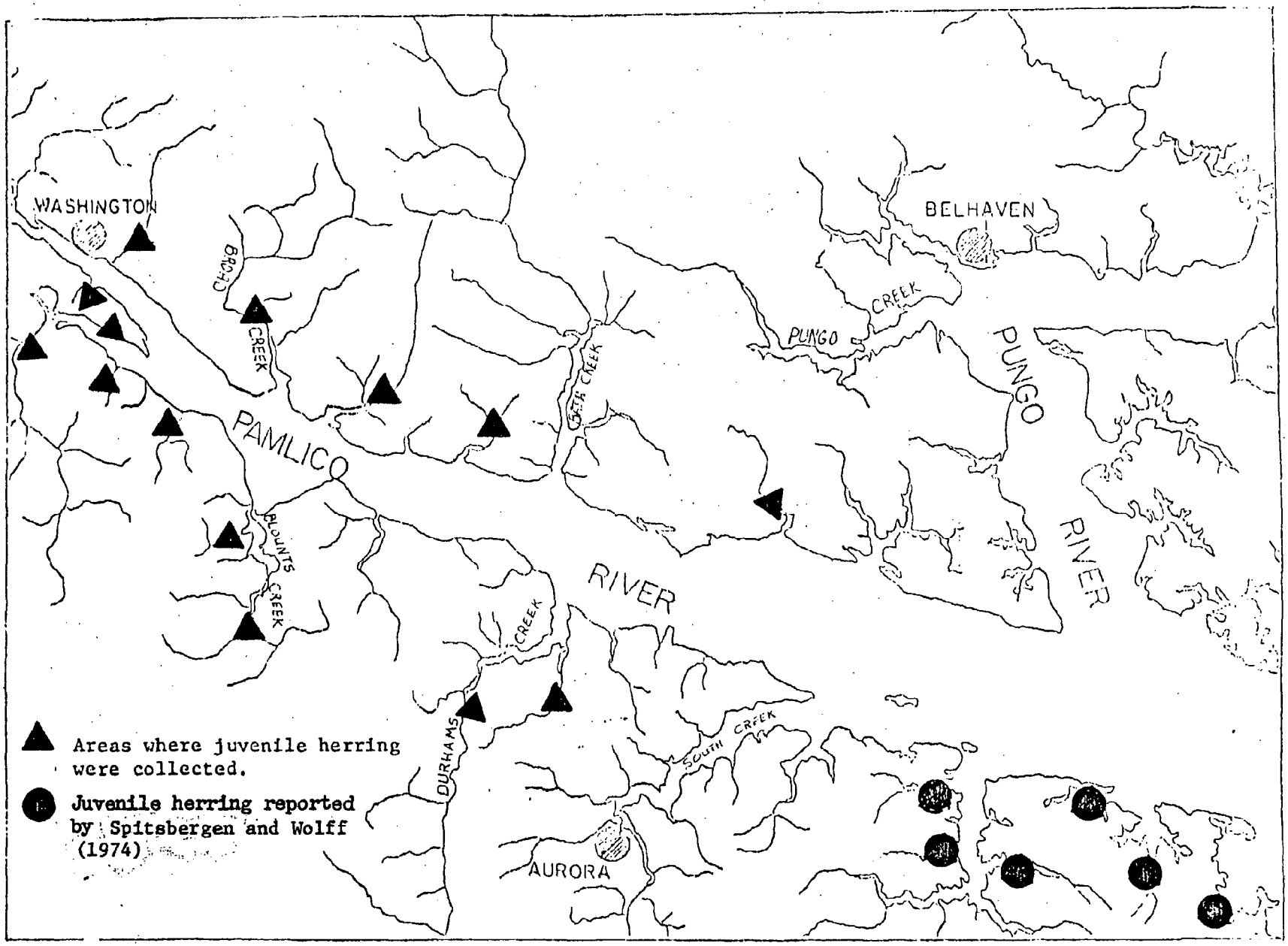


Figure 11.-Nursey areas of juvenile blueback herring in the Tar and Pamlico Rivers



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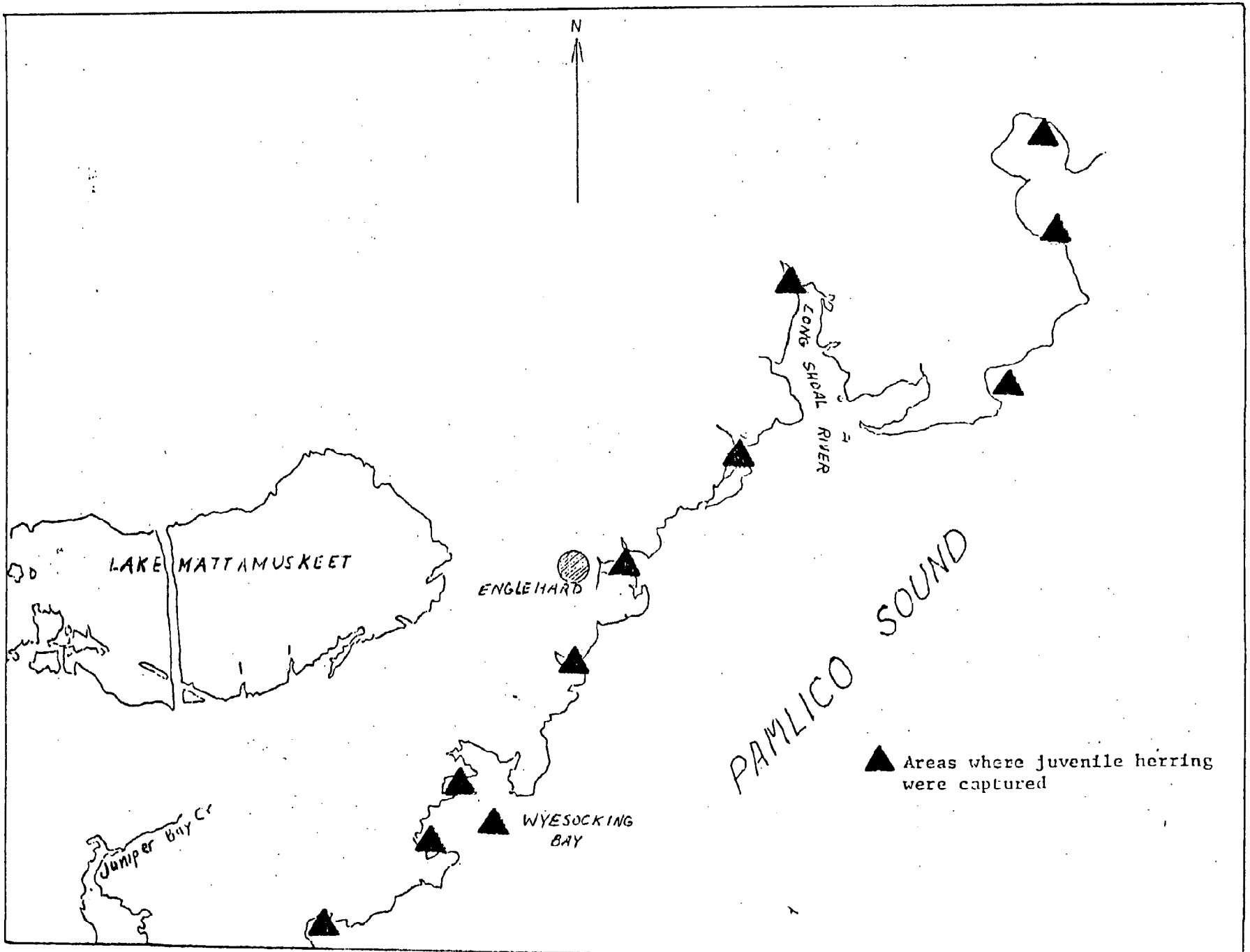

N
LONG SHOAL RIVER
LAKE MATTAMUSKEET
ENGLEHARD
PAMLICO SOUND
Areas where juvenile herring were captured
WYESOCKING BAY
Juniper Bay C

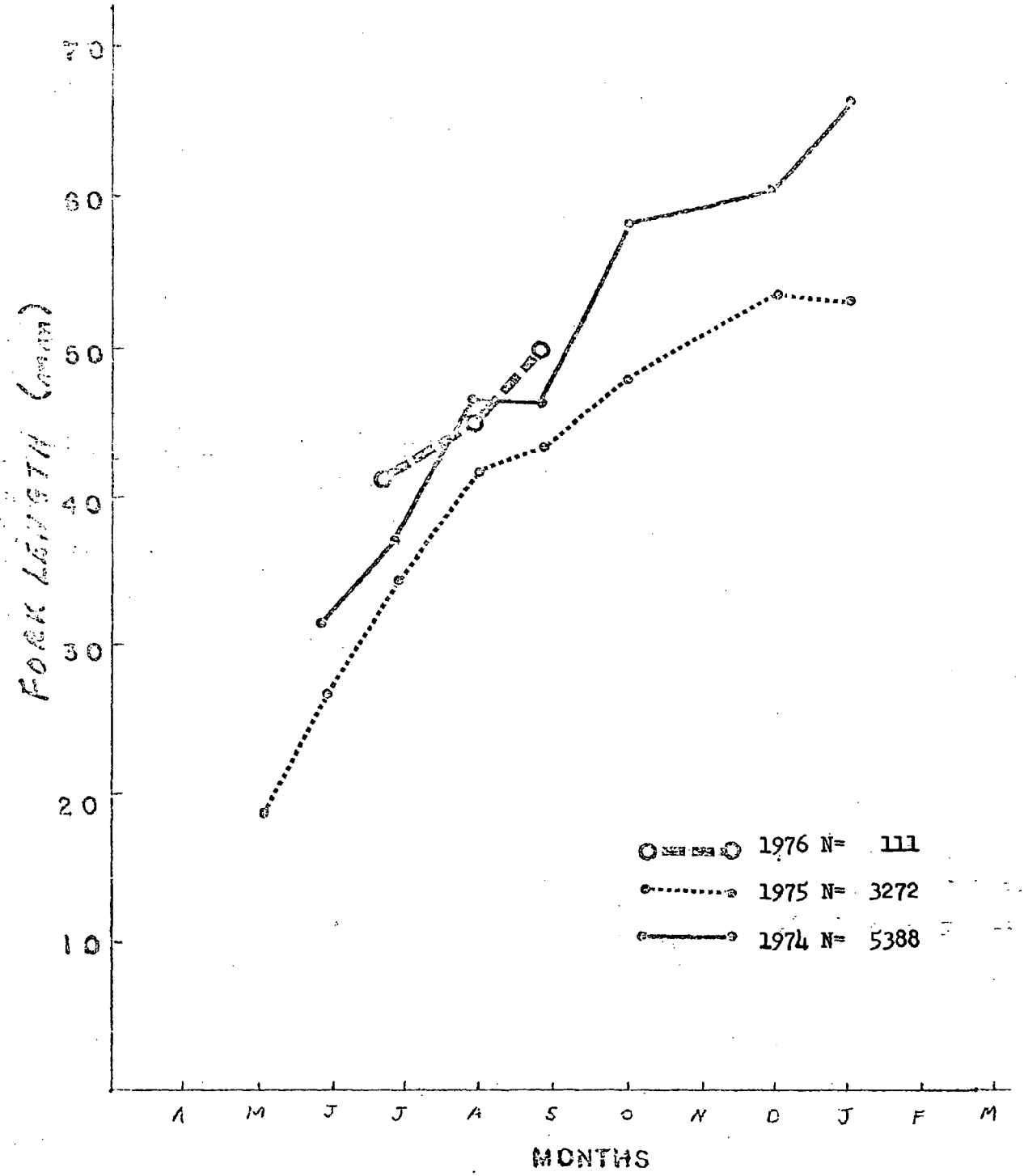


Figure 12.--Mean fork length of juvenile blueback herring by year class and month, April through March.

The main channels of Tar River and Pamlico River and their major tributaries serve as migration routes away from the principal nursery zones. Sampling throughout the year produced no river herring except in the areas delineated in Figure 11, thus, movement from the creeks must be rapid once the juveniles begin to leave the nurseries in late September and early October.

Alewife

Only 109 juvenile alewife were collected during nursery area sampling. Most of these were collected from tributaries of northern Pamlico Sound during November, December, and January (Figure 13). Fork length range was 27 to 149 mm with a mean of 87 mm. The areas of capture in northern Pamlico Sound are believed to be overwintering areas for alewife as well as blueback herring. It would seem that these areas would be important nursery areas for alewife which are spawned in Lake Mattamuskeet and migrate to the sound as juveniles. However, no juvenile alewife were caught in these areas during the summer.

American shad

Juvenile American shad were not captured in sufficient numbers to accurately map nursery areas for this species. Eleven juveniles were collected from Tar River and the mouth of Tranters Creek (Figure 14). All were caught in June, July, and August, except for one specimen which was collected in November. However, this specimen had a deformed caudal peduncle which could have prevented it from conforming to normal migration patterns. Four more juveniles were collected in tributaries of northern Pamlico Sound in January, 1976. Fork length range of juveniles was 47 to 136 mm.

Hickory shad

Four hickory shad were collected from tributaries of Tar River in June, 1975 (Figure 15). Fork lengths ranged from 44-61 mm. No juvenile hickories were collected after mid-June; further evidence to support the theory that hickory shad migrate from the nursery areas early in the summer as suggested by Pate (1972).

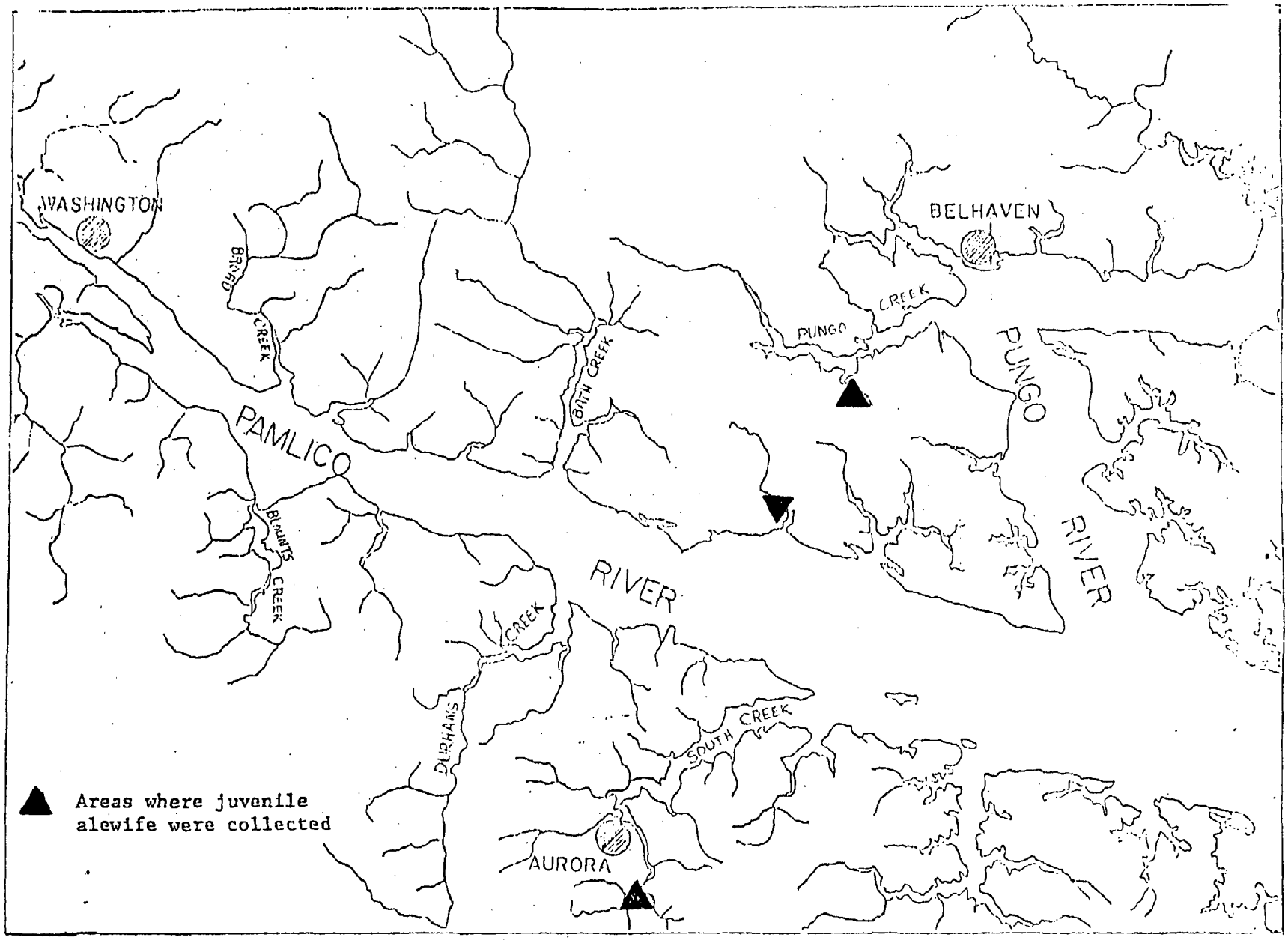
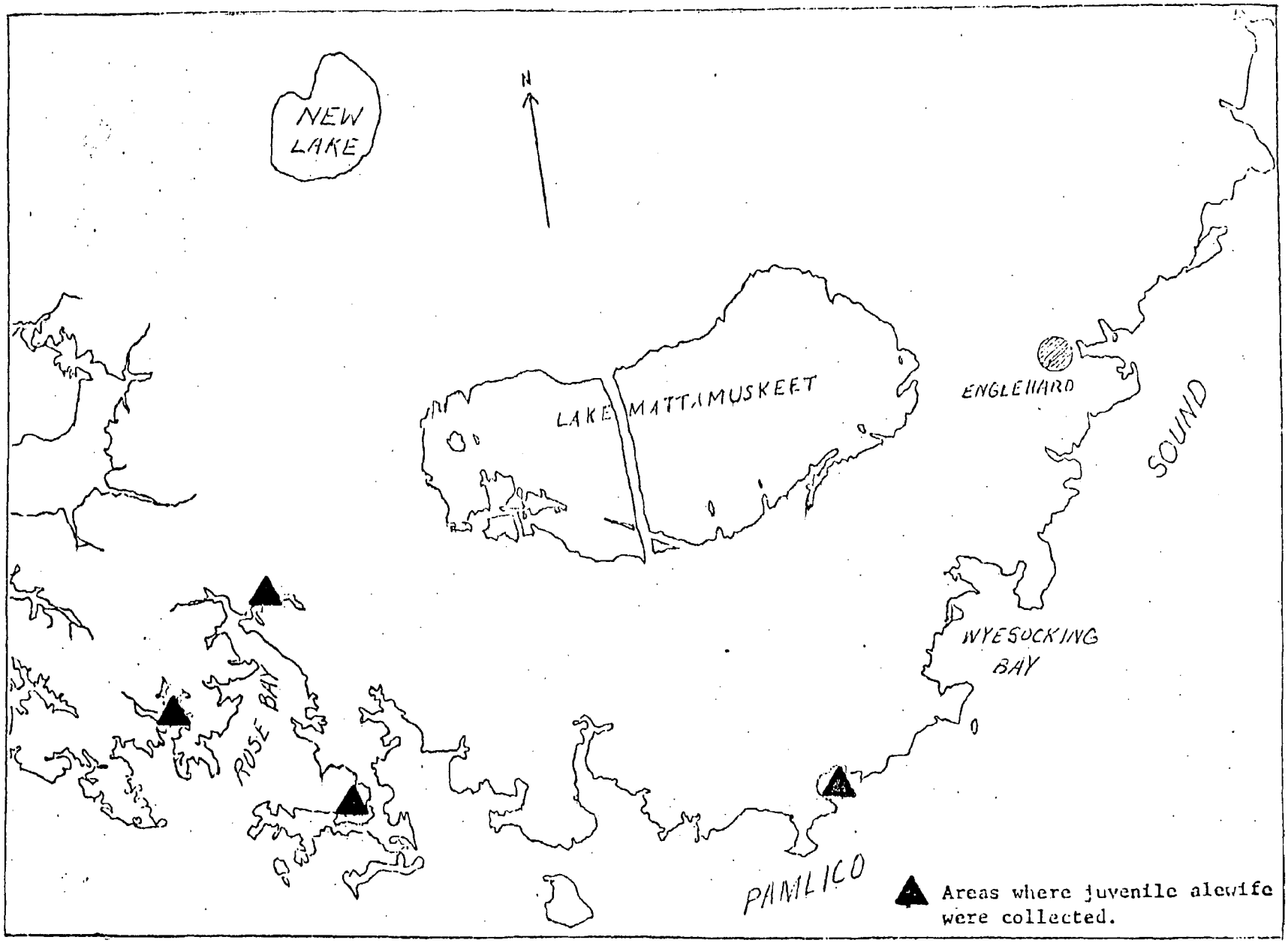


Figure 13.-Areas in Pamlico River, Pungo River, and northern Pamlico Sound where juvenile alewife were collected.



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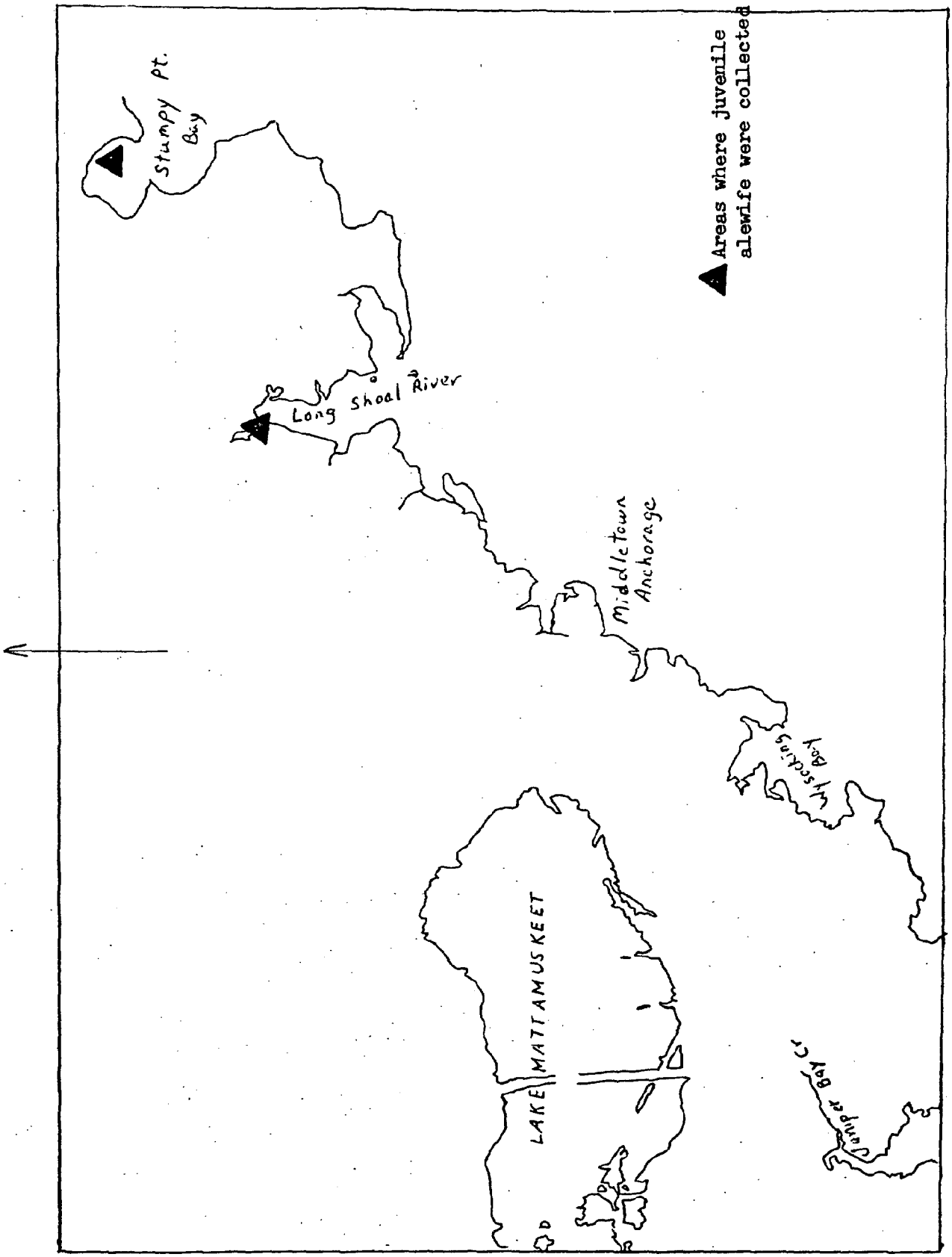

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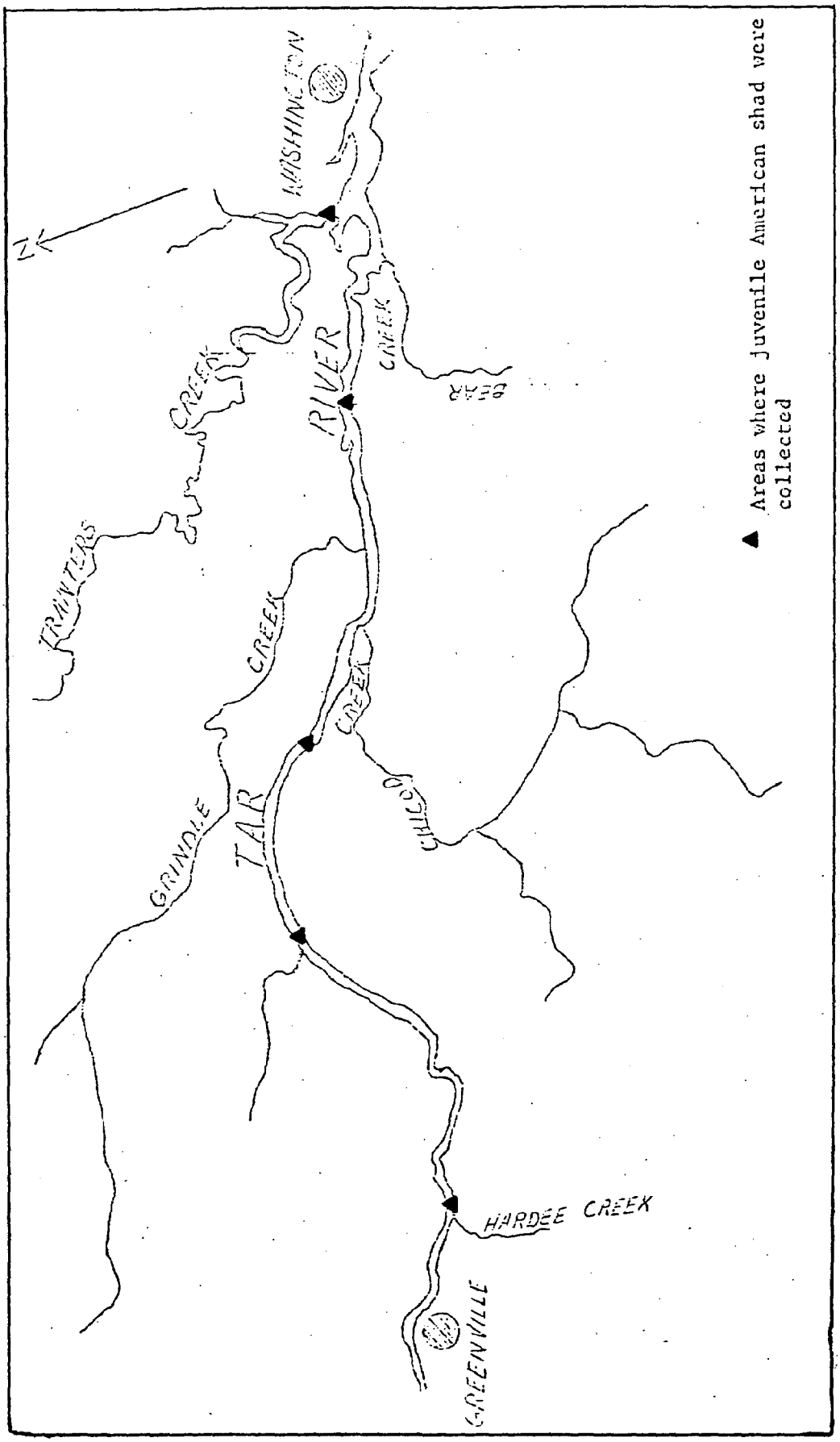
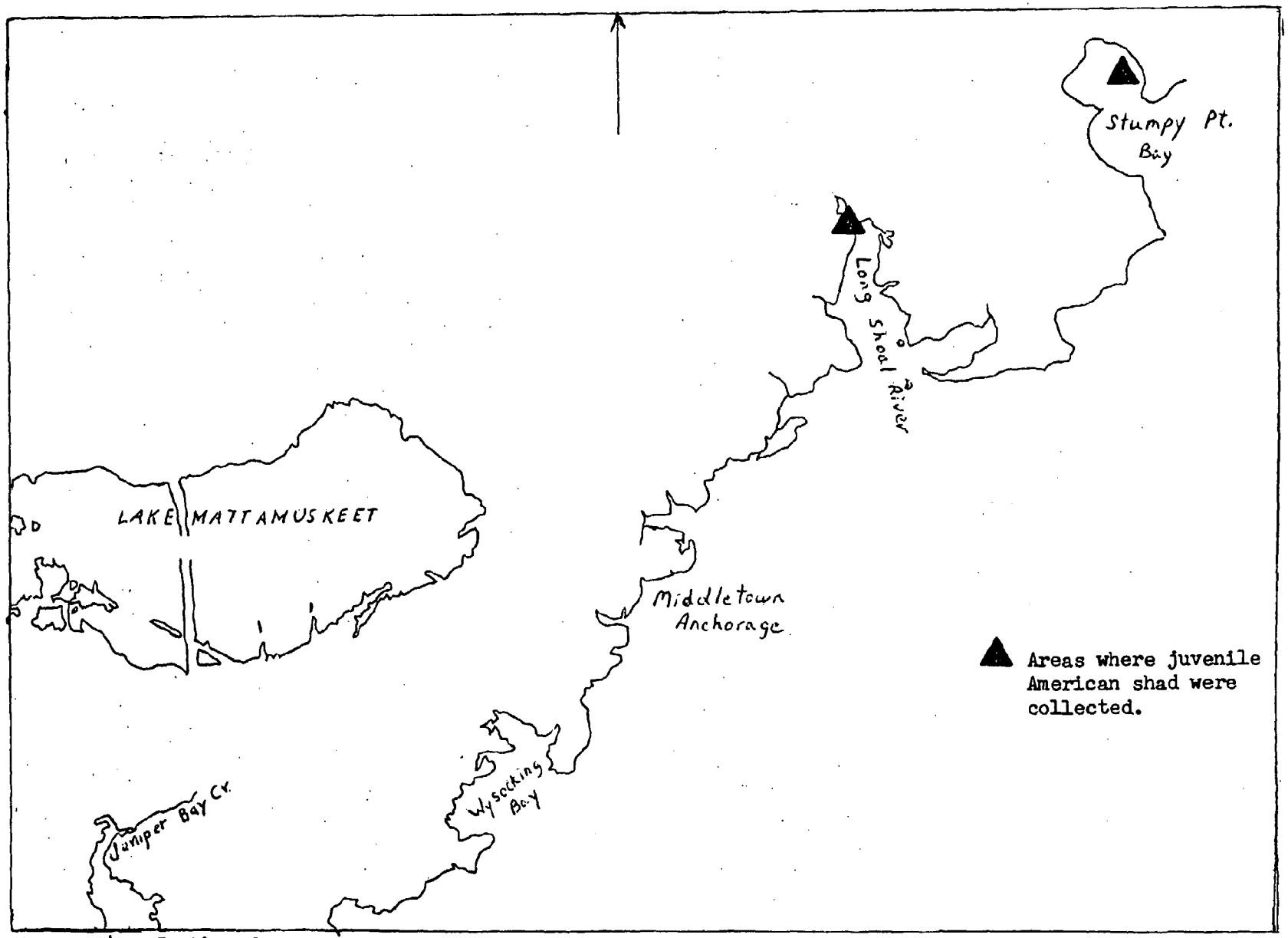


Figure 14.--Locations of collections of juvenile American shad in Tar River



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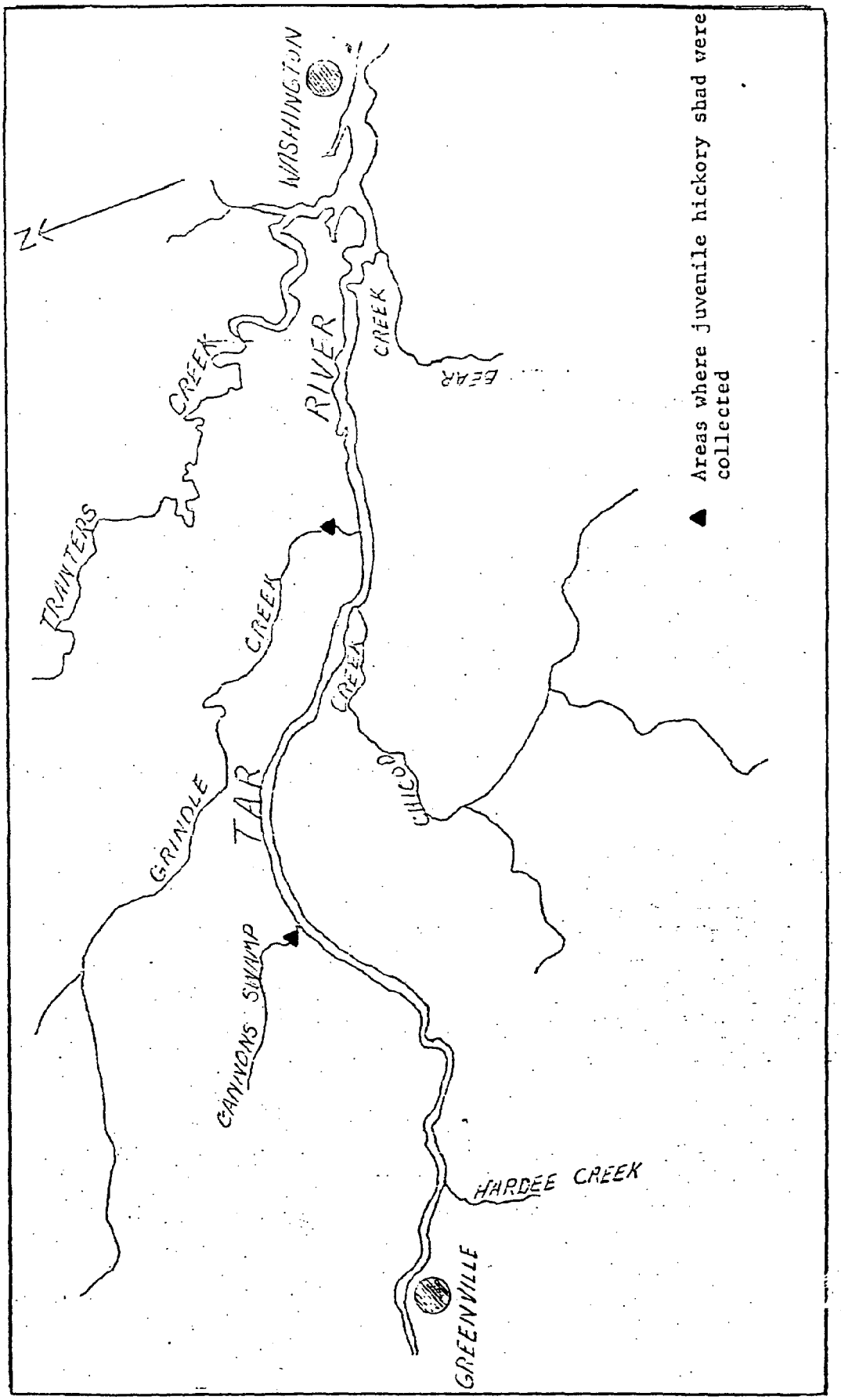

Figure 15--Locations of collections of juvenile hickory shad from Tar River

Striped bass

Juvenile striped bass were collected only from Tar River and upper Pamlico River (Figure 16). A total of 167 were collected from June through December, 1974 with 165 being collected in June, July, and August.

Our collections of juvenile stripers were probably greatly influenced by a stocking program of the North Carolina Wildlife Resources Commission. They were stocking juvenile striped bass in the Tar River above Greenville at the same time we were sampling nursery areas below Greenville. One-hundred thirteen stripers were caught in Tar River in July, shortly following stocking activities in the Falkland area.

This particular stocking program was not continued in 1975 since it was confusing our attempts to estimate production by naturally spawning stocks. Since the stocking stopped, no juvenile striped bass have been collected.

Sturgeon

One young Atlantic sturgeon (460 mm) was collected in July from the Pamlico River near the mouth of Blounts Bay (Figure 17). Bottom and surface temperature was 26°C and salinity was 4 ppt.

Adult Fish Sampling

Tar River

Gill net sampling for adult anadromous fish was restricted to tributaries of Tar River below Greenville. Tributaries upstream from Greenville proved to be too swift and loaded with debris to sample with gill nets. It was necessary to rely on interviews with local people and collection of spawned eggs to determine spawning activities in tributaries which were not sampled with gill nets. Contacts were made with local fishermen during egg netting activities and questions were asked pertaining to anadromous fish runs into each area.

Generally, distribution of adults is the same as the designated spawning areas, and a detailed discussion appears in the section dealing with spawning. The occurrence of American and hickory shad in Chicod Creek and striped bass in Fishing Creek could not be verified by collection of eggs even though Baker (1968)

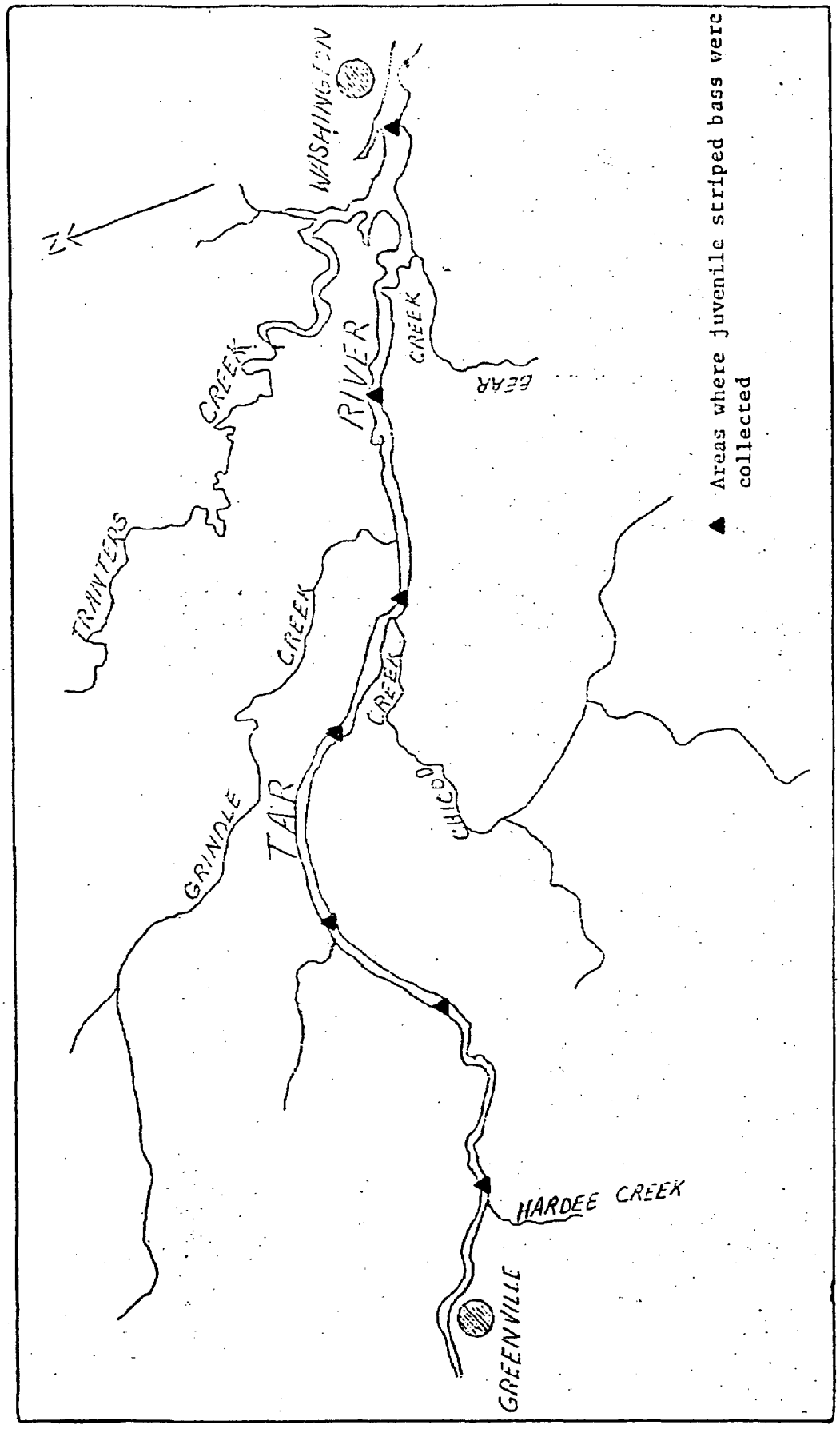

Figure 16. - Locations of collections of juvenile striped bass from Tar River and upper Pamlico River

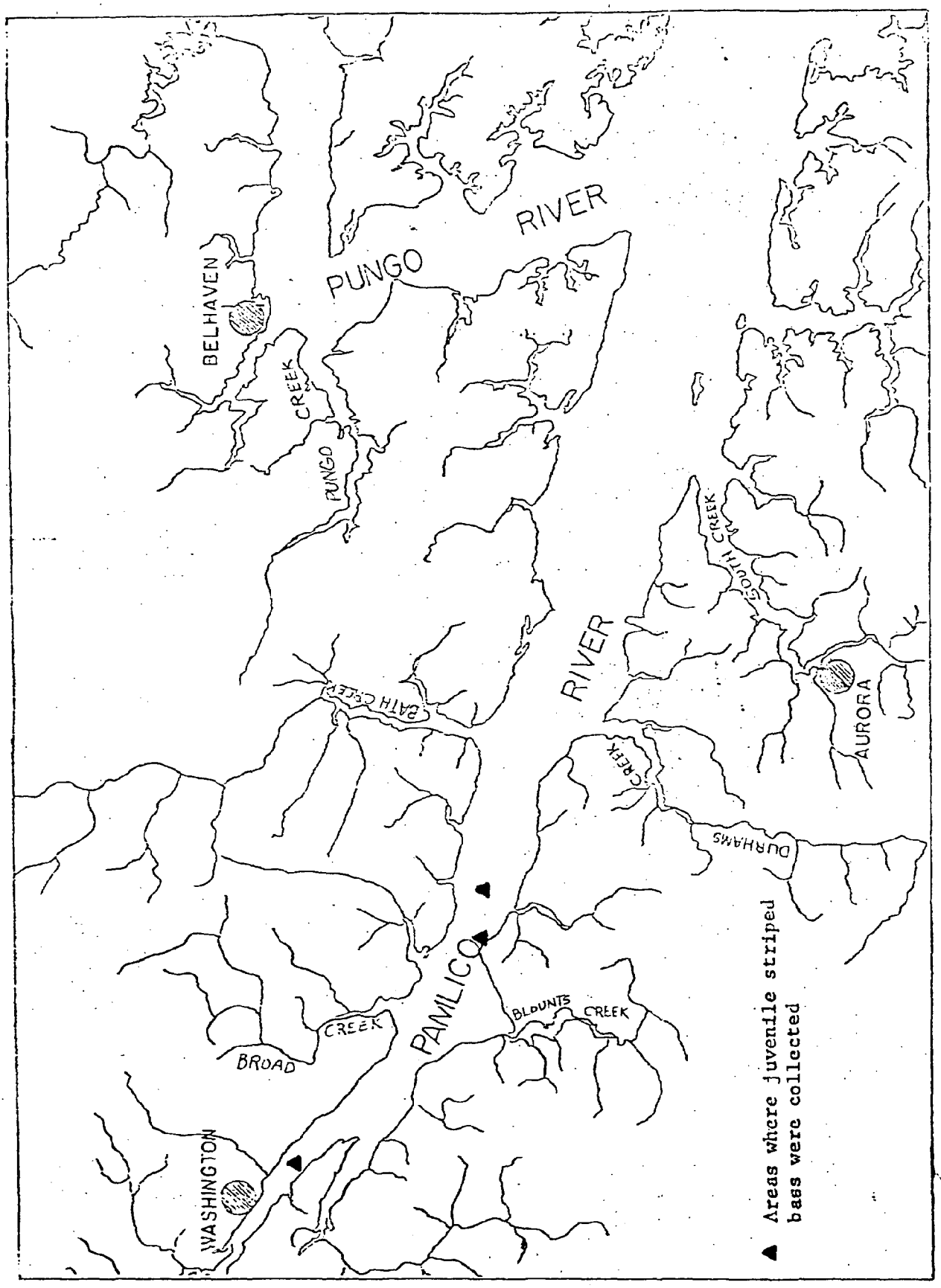

Figure 16 -- Continued

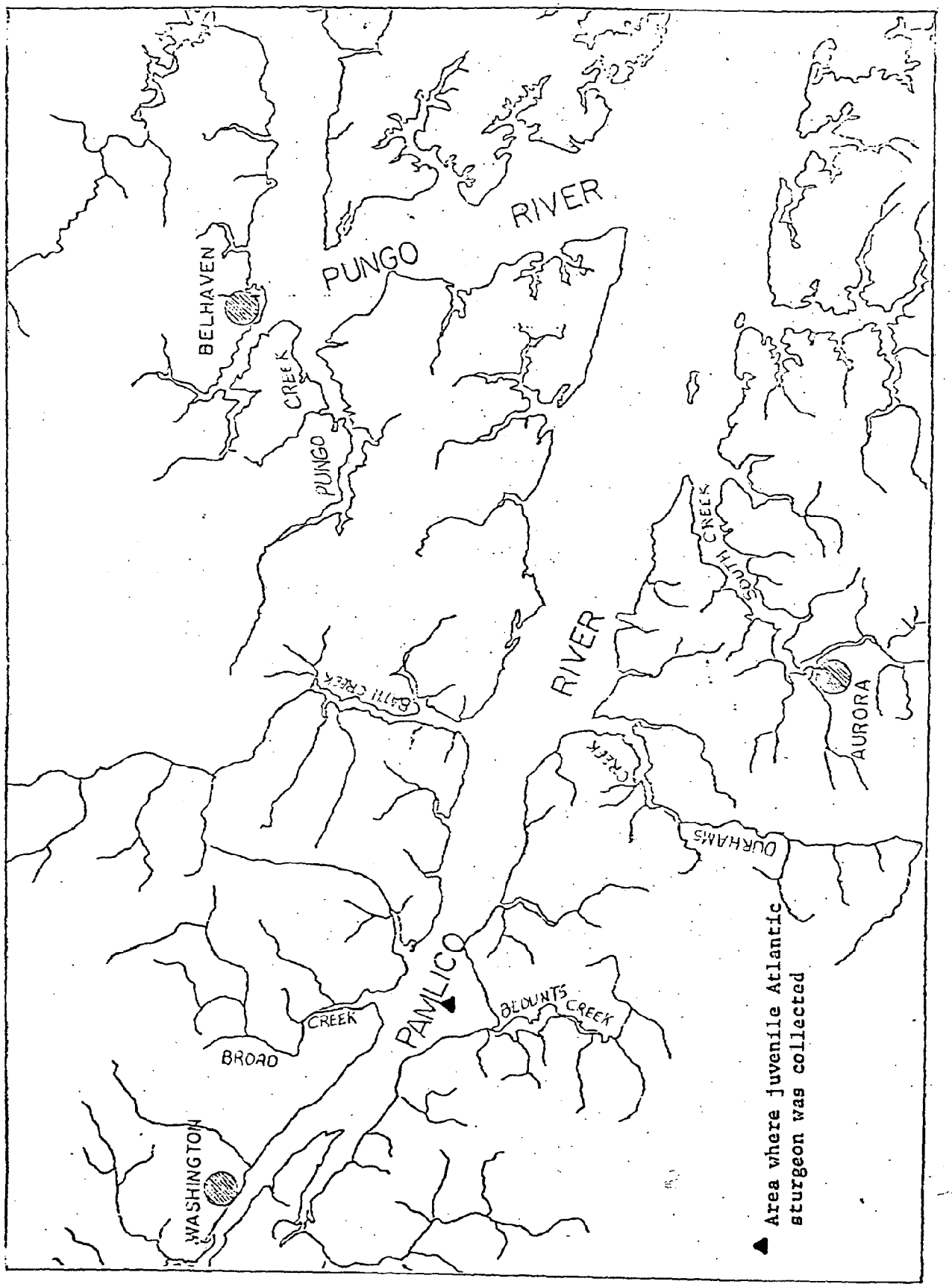

Figure 17. - Location of the capture of one juvenile Atlantic sturgeon in Pamlico River

reported these tributaries to be in the range of these species. Striped bass were caught in both Bear and Chicod Creeks (one each) in early spring. Movement of this species into small tributaries is probably for feeding rather than spawning. Neither creek met the flow requirements necessary for successful striped bass spawning.

Four hickory shad were taken from Bear Creek on 28 March, at 12°C. Three were males and one was a female; all were two years old. At the time these fish were caught, Bear Creek was flooded and had considerable current to act as an attractant for hickory shad. No hickories were caught in Bear Creek after the water receded and the current slowed to little or no movement.

Blueback herring was by far the most abundant species taken in tributaries of Tar River. A total of 528 herring were aged, measured, and examined for spawning condition. Age groups five and six were predominant for both males and females; however, it is probable that the gill nets were selective for the larger, older fish (Table 2). The percent of repeat spawners occurring in samples was high. Of the fish sampled, 71.6 percent of the males and 62.7 percent of the females showed evidence of a previous spawning run. Males had as many as three spawning marks and females had as many as four (Table 3).

The highest catches of herring per net hour were in Tranters Creek in an area approximately one mile north of NC 33. This area probably serves as the most important herring spawning area in the Tar River drainage. The second highest catches per net hour were made in Chicod Creek, approximately ¼ mile downstream from US 64. This area also produced the highest catches of postlarval herring during early stages of juvenile sampling in 1975.

Only two alewife were captured in tributaries of Tar River: one each in Tranters and Chicod Creek. This species apparently does not utilize Tar River as one of its major spawning areas. Frankensteen (personal communication) did not observe alewife entering Chicod Creek until late May.

Pamlico River and Northern Pamlico Sound

Virtually all of the tributaries of Pamlico River were sampled with gill nets during the 1976 spawning season. Sampling was also conducted in tributaries of northern Pamlico Sound with particular attention given to the canals that drain Lake Mattamuskeet (Figure 5). Adult river herring were captured in all of

these tributaries except Bath Creek and Swanquarter Bay. Goose Creek and Abels Bay were not sampled. No other *Alosa* were captured in these tributaries.

The most abundant species captured in Pamlico River tributaries was blueback herring. However, alewife did contribute significantly to our catches in Chocowinity Creek and those tributaries east of Core Point. Alewife were also taken in Upper Goose, Nevil, and Blounts Creeks.

Blounts Creek was by far the most important spawning area for blueback herring in the Pamlico River system. Catches per net hour in upper Blounts Creek and Herring Run, a tributary of Blounts Creek, were much greater than any of the other tributaries. Durham Creek and Nevil Creek were second in importance, far behind Blounts Creek as spawning areas for blueback herring.

All total of 571 blueback herring scale samples from the Pamlico River area were found to be suitable for age determination. Age groups four and five were predominant for both males and females. The percent of repeat spawners was high and nearly equalled that of the Tar River (Table 4). Data show that 71 percent of the males and 56 percent of the females had made previous spawning runs. One male was seven years old and had four spawning marks while two females were eight years old and also had four spawning marks (Table 5). Tables 6 and 7 summarize all blueback herring adult size, age, and spawning repetition data for 1975-76.

The Pamlico River system is not utilized by alewife as a major spawning area. Alewife do make up a significant part of the spawning population in some creeks but they outnumbered the bluebacks only in South and North Creeks. The size of the spawning population in the Pamlico area is insignificant when compared to the number of alewives that utilize Lake Mattamuskeet.

Only 125 alewife scale samples were found suitable for age determination. Eighty-five percent of the males taken were spawning for the first time and 75 percent of the females were also virgins. Age groups four and five were clearly dominant for both sexes (Tables 8 and 9).

Forty-five of the samples shown in Table 9 were alewife captured entering Lake Mattamuskeet. Twenty-nine were males ranging from three to five years of age. Sixteen were females four and five years old. None were repeat spawners. Tyus (1971) reported an age range of two to four years for alewife entering Lake Mattamuskeet with age class three dominating.

Street, et. al. (1975) reported that alewife in North Carolina may begin spawning at age three - earlier than any location north of this state. However, they also found that 4.6 percent of the alewife sampled spawned more than twice with some specimens reaching eight years of age.

Tyus (1971) concluded that the age structure of alewife in Lake Mattamuskeet might indicate overfishing. The presence of older fish and repeat spawners in samples from other areas indicates that this may have been the case. Based on recommendations from his report, restrictions were made prohibiting dipping of alewife on Sunday, Tuesday, and Thursday nights from 1 March until 15 May in canals leading to the lake. The presence of more four and five year old fish in our samples may be attributed to reduced fishing pressure caused by these regulations. However, spawning runs into Lake Mattamuskeet are still well below their former levels and the reason for the lack of repeat spawners is unknown. At any rate, overfishing of this population may still be a problem and failure of the predominant year class to spawn could severely reduce the fishery.

Only six adult blueback herring were captured in tributaries of northern Pamlico Sound during the 1976 sampling season. This represents less than one percent of the river herring taken in our nets during sampling in this area, and is almost a complete reversal from the composition of river herring catches in the Tar River, where only two alewife were captured. It appears from our data that the spawning population of river herring in the study area is almost exclusively blueback herring above Washington and almost exclusively alewife in spawning areas of northern Pamlico Sound, with an intermingling of the two species in spawning areas between Washington and Wades Point.

Tyus (1971) found that the canals used by alewife migrating into Lake Mattamuskeet were utilized preferentially. He reported in 1971 that-97.9 percent of the alewife entering Lake Mattamuskeet used the Lake Landing Canal. Although our sampling was not carried out through the peak of the spawning run, our results generally agree with his findings.

TABLE 2.--Size and age composition of adult blueback herring taken during a spawning area survey of Tar River, 1975.

AGE	NUMBER IN SAMPLE		PERCENT OF SAMPLE		MEAN FORK LENGTH (MM)		LENGTH RANGE (MM)	
	M	F	M	F	M	F	M	F
IV	59	34	20	14	238	244	228-266	282-260
V	118	103	41	44	250	255	231-266	232-269
VI	104	68	35	29	258	266	240-276	248-282
VII	11	26	4	10	264	275	255-271	260-290
VIII		4		2		279		270-285
IX		1		<1		291		
	292	236						

TABLE 3.--Age and spawning frequency of blueback herring sampled from Tar River, 1975. Numbers in parenthesis are percents of totals.

TIMES SPAWNED	0		1		2		3		4		5		TOTAL	
AGE	M	F	M	F	M	F	M	F	M	F	M	F	M	F
IV	56	34	3										59	34
V	26	53	91	50	1								118	103
VI	1	1	21	33	82	34							104	68
VII				2	2	9	9	15					11	26
VIII								3		1				4
IX										1				1
TOTAL	83	88	115	85	85	43	9	18		2			292	236
PERCENT	(28)	(37)	(39)	(36)	(26)	(18)	(4)	(8)		(<1)				

TABLE 4.--Size and age composition of adult blueback herring taken during a spawning area survey of Pamlico River, 1976.

AGE	NUMBER IN SAMPLE		PERCENT OF SAMPLE		MEAN FORK LENGTH (MM)		LENGTH RANGE (MM)	
	M	F	M	F	M	F	M	F
III	2	4	1	1	239	242	235-243	235-255
IV	77	122	34	35	242	251	230-260	237-276
V	97	159	43	46	252	259	235-268	241-275
VI	43	39	19	11	255	266	239-279	250-278
VII	7	19	3	6	262	274	257-272	261-288
VIII		2		<1		283		281-284
	226	345						

TABLE 5.--Age and spawning frequency of blueback herring sampled from Pamlico River, 1976. Numbers in parenthesis are percents of totals.

TIME SPAWNED	0		1		2		3		4		TOTAL	
AGE	M	F	M	F	M	F	M	F	M	F	M	F
III	2	4									2	4
IV	52	107	24	15							77	122
V	11	40	48	110	38	9					97	159
VI	1	2	3	3	32	33	7	1			43	39
VII						3	6	16	1		7	19
VIII										2		2
IX												
X												
TOTAL	66	153	75	128	70	45	13	17	1	2	226	345
PERCENT	(29)	(44)	(33)	(37)	(31)	(13)	(6)	(5)	(1)	(1)		

TABLE 6.--Size and age composition of blueback herring taken during spawning area surveys in the Tar-Pamlico River, 1975-76.

AGE	IN SAMPLE		PERCENT OF SAMPLES		MEAN FORK LENGTH (MM)		LENGTH RANGE (MM)	
	M	F	M	F	M	F	M	F
III	2	4	<1	<1	239	242	235-243	235-255
IV	136	155	26	27	240	249	228-266	228-270
V	215	262	41	45	251	257	231-268	232-275
VI	147	107	28	18	257	266	239-279	248-282
VII	18	45	4	8	263	275	255-272	260-290
VIII		6		1		280		270-285
IX		1		<1		291		
	518	581						

TABLE 7.--Age and spawning frequency of blueback herring sampled in the Tar-Pamlico River, 1975-76. Numbers in parenthesis are percents of totals.

TIMES SPAWNED	0		1		2		3		4		TOTAL	
AGE	M	F	M	F	M	F	M	F	M	F	M	F
III	2	4									2	4
IV	108	141	28	15							136	156
V	37	93	139	160	39	9					215	262
VI	2	3	24	36	114	67	7	1			147	107
VII				2	2	12	15	31	1		18	45
VIII								3		3		6
IX										1		1
TOTAL	149	241	191	213	155	88	22	35	1	4	518	581
PERCENT	(29)	(41)	(37)	(37)	(30)	(15)	(4)	(6)	(<1)	(<1)		

TABLE 8.--Size and age composition of alewife taken during a spawning area survey of Pamlico River and northern Pamlico Sound, 1976.

AGE	NUMBER IN SAMPLE		PERCENT OF SAMPLE		MEAN FORK LENGTH (MM)		LENGTH RANGE (MM)	
	M	F	M	F	M	F	M	F
III	3		4		225		214-230	
IV	41	16	53	33	244	244	232-260	232-257
V	27	26	35	54	249	259	233-261	240-279
VI	4	4	5	7	263	267	251-275	260-272
VII	2	2	3	6	268	273	268-268	265-280
	77	48						

TABLE 9.--Age and spawning frequency of alewife sampled in Pamlico River and northern Pamlico Sound, 1976. Numbers in parenthesis are percents of totals.

TIMES SPAWNED	0		1		2		3		TOTAL	
AGE	M	F	M	F	M	F	M	F	M	F
III	3								3	
IV	40	16	1						41	16
V	21	20	5	6	1				27	26
VI	1		1	3	2	1			4	4
VII					2	1		1	2	2
TOTAL	65	36	7	9	5	2		1	77	48
PERCENT	(85)	(75)	(9)	(19)	(6)	(4)		(2)		

Recreational Fishery

The recreational fishery supported by anadromous fishes in Tar and Pamlico Rivers may be the most valuable aspect of this fishery resource. Baker (1968) estimated that 1,087 and 3,604 fishermen fished for striped bass in Pamlico and Tar Rivers, respectively, in the period 1 April 1967 to 31 March 1968. A total of 1,401 striped bass were landed from Pamlico River and 2,088 from Tar River during the same period.

The hook-and-line fishery for striped bass is concentrated in the upper Pamlico and lower Tar Rivers in the area from Greenville to Washington during fall and winter. The fishery extends to Tarboro during the spawning run with fishing pressure being heaviest in the area near NC 42.

Recreational fishing for American and hickory shad usually begins in late February when fishermen begin using drift gill nets in the Tar River near Grimesland. The hook-and-line fishery begins in early March in Fishing and Swift Creeks and in Tar River near Rocky Mount. Baker (1968) estimated that 11,040 fishermen fished for American and hickory shad during the period 1 April 1967 - 31 March 1968. During this same period, 1,087 American shad and 6,178 hickory shad were landed from Tar River. Various types of nets (bow, dip, and skim nets, drift and stake gill nets) account for the largest proportion of anadromous fish (mostly river herring and American shad) taken each year from Tar River. A total of 1,493 fishermen used nets in 1967-68 to take 50,546 anadromous fish (excluding herring) and 312,291 pounds of herring from Tar River (Baker, 1968).

Eight locations were chosen on Tar River, Swift, and Fishing Creeks to conduct a creel census of fishing activity for anadromous fish during the period 20 March to 12 May 1975. Information was requested from all boat and individual bank fishermen who could be contacted during each site visit. Information was requested concerning location fished, gear, effort, and catch.

A total of 47.6 percent of the fishermen contacted responded with useful information (Table 10). Drift netting for river herring, shad, and striped bass was concentrated in Tar River near Grimesland. Ninety-eight percent of the Grimesland fishermen interviewed during the study period were drift netting, with American shad being the principal species sought. The mean fishing time for this

Table 10.-Summary of creel census conducted in Tar River during spring of 1975

Location	Number of Contacts	Number of Responses	Summary of Activity
Rocky Mount	14	9	Hook-and-line fishing for shad and striped bass
NC 44 Bridge	15	7	Hook-and-line fishing for shad and striped bass
US 64 Bridge	11	3	Hook-and-line fishing for shad and striped bass
Old Sparta	33	18	Hook-and-line fishing for shad and striped bass
Grimesland	51	30	Drift netting for shad and herring
Swift Creek	58	21	Hook-and-line fishing for shad
Fishing Creek	3	0	

type gear was 5.2 hr/trip resulting in a mean catch of 1.4 American shad per hour and 5.2 river herring per hour. Only 22 hickory shad and four striped bass were reported. One large Atlantic sturgeon - approximately 85 pounds - was taken in a small mesh net being drifted for herring. This was the only report of a sturgeon being taken in Tar River, although smaller specimens were caught in Pamlico River during spring.

Recreational fishing in upper Tar River - from Old Sparta to Rocky Mount and its tributaries - was limited to hook-and-line fishing for American shad, hickory shad, and striped bass as well as "skimming" for American shad. Skimming may be best described as using a fine-meshed net attached to a hoop, approximately 2 m in diameter, forming a bag-like trap. The net is suspended just below the surface as the boat drifts downstream with the current. Fish are felt as they enter the net and the net is pulled up.

Although we did not encounter much use of skim or bow nets - another method very similar to skim nets - in the upper Tar River, their use is quite popular and wide-spread in the coastal area. Baker (1968) reported 70,440 American shad and 47,073 hickory shad taken by these methods in North Carolina in one spawning season. Fishermen who responded to our inquiries reported a total fishing time of 7.5 hours with this type gear and a catch of 36 American shad and one hickory shad. Use of, and the harvest of shad by this gear in Tar River is probably more important than our results indicate. The season during which skim nets are used is very short and constant surveillance would be required to get an accurate estimate of the true extent of this fishery.

The major hook-and-line fisheries for American shad are located in Tarboro, just below Rocky Mount, Fishing Creek, and Swift Creek. Referring to Fishing Creek, Smith and Bayless (1964:13) stated. . ."American shad ascend this tributary in great numbers to the Fishing Creek Mill Dam (near Enfield), and are subjected to heavy fishing pressure downstream from this point." The results of our spawning area survey indicate that this is the major spawning area for American shad in Tar River; hence, it should attract the heaviest fishing pressure. Creel census results from this tributary showed an average fishing time of 2.5 hours per trip and an average catch of 0.78 American shad per hour. Only five hickory shad were reported as being caught in Fishing Creek.

Fishing pressure for American shad is also heavy on Swift Creek, particularly at SSR 1253 and at its confluence with Tar River. Forty-one fishermen reported a total fishing time of 143.6 hours (3.5 hrs/trip) and a total catch of 86 American shad (.60 shad/hr). Only nine hickory shad were reported as caught in Swift Creek. One Rocky Mount resident has caught a total of 3,624 American shad in Tar River on hook-and-line since 1953[1]. His best year was 1968 when he caught 366.

We were unable to confirm the presence of striped bass in Fishing and Swift Creeks. No eggs of this species were collected, nor were any catches of adults reported during our creel census. Baker (1968) reported that stripers ascended Fishing Creek to the confluence of Rocky Creek. Being the largest tributary of Tar River, it seems likely that some stripers should ascend it during the spring even if not in great numbers. Effort by hook-and-line for striped bass is concentrated generally in the area from Old Sparta to Rocky Mount. Sport fishing reports showed an average catch of 0.18 striped bass/hr.

Dip-netting for river herring is a socially-significant activity which occurs seasonally in the major tributaries of the lower Tar River and upper Pamlico River. This activity is limited; however, by the number of tributaries which serve as spawning areas for river herring and by access to these same streams - access meaning bridge crossing where most of this fishing is done. We were able to locate only five locations used by dip-netters: Chicod Creek at US 264 bridge, upper Bear Creek, Blounts Creek at SSR 1110 bridge, Chocowinity Creek at NC 33 bridge, and Tranters Creek north of NC 33 bridge (Figure 18). Attempts were made to obtain biological data from dip net catches of river herring; however, the contacts with these fishermen were sporadic - as were the catches - and insufficient data were obtained to reflect the characteristics of the harvest by this fishery.

Commercial Harvest

The commercial fishery of Pamlico River has historically contributed only slightly to the total landings of anadromous fish in North Carolina. The majority of fish taken are American shad which are caught in gill nets in the

[1]Raleigh News and Observer, March 16, 1975

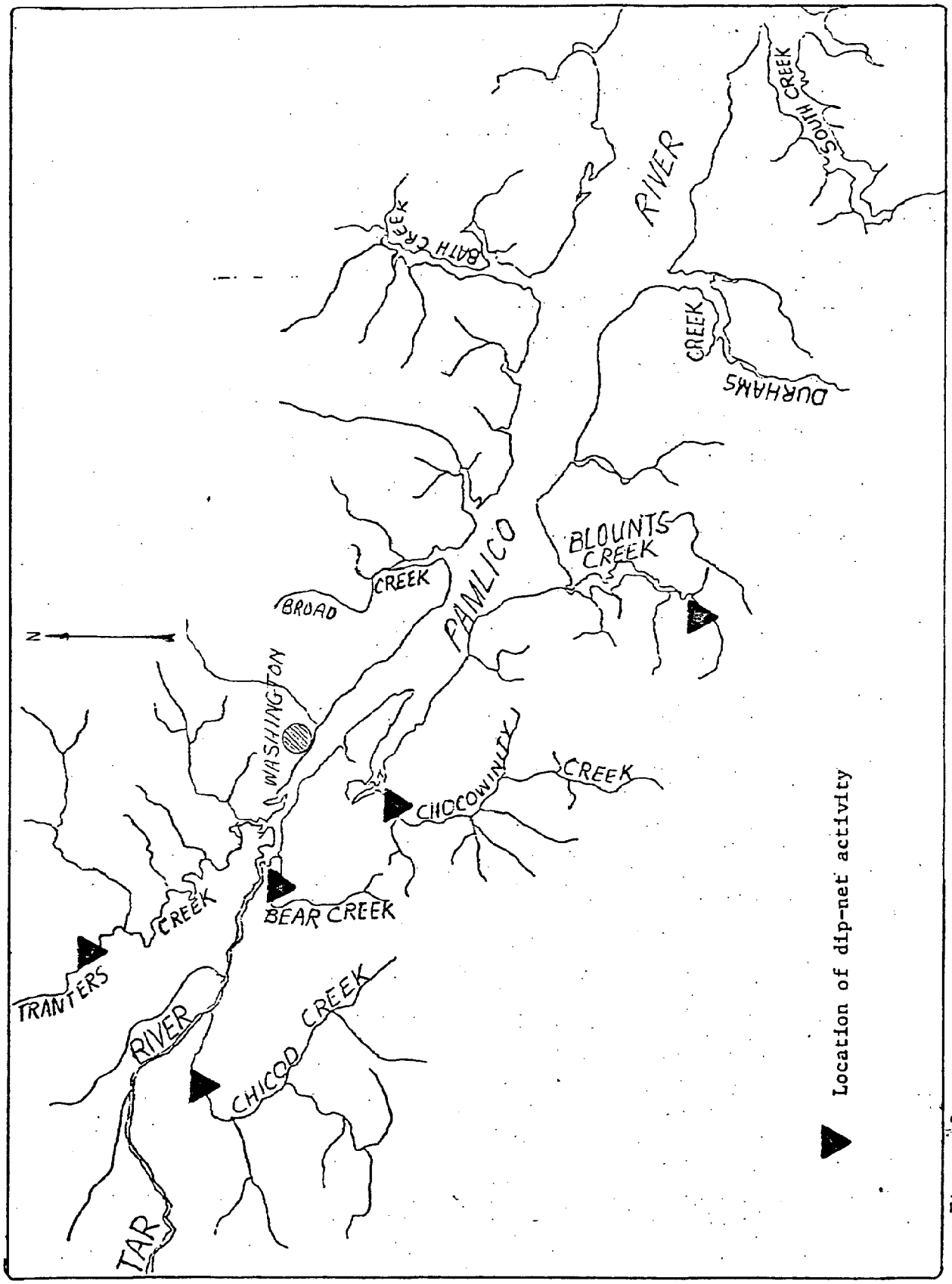

Figure 18. - Location of dip-net activity in Tar and Pamlico Rivers

lower Pamlico River and northern Pamlico Sound. A few American shad, hickory shad, and striped bass are caught each year in Tar River. The season for this fishery is short however, and the landings are insignificant relative to the commercial harvest in Pamlico River.

Isolating the annual commercial landings of anadromous fish in this study region is not practical based on available statistics compiled by the National Marine Fisheries Service. Statistics compiled on a county-by-county basis - particularly Beaufort and Hyde Counties - include many fish which are actually caught in Albemarle Sound, but are sold to dealers within the Pamlico River basin and often reported to have been caught there.

The reported landings of American shad from Beaufort County, which includes almost the entire Pamlico River basin, have comprised from less than one to 22 percent of the state total from 1889 to 1968 (Chestnut and Davis, 1975). Percent of total landings from Beaufort County has increased since 1945 (Figure 19). However, this is probably more a result of improved marketing facilities than of increased catches. The upper waters of the Tar-Pamlico River system formerly contained important shad fisheries (Taylor, 1951), but today most of the state's production comes from Pamlico Sound and Neuse River.

Commercial landings of river herring in Tar-Pamlico River are insignificant when compared to that of Albemarle Sound. Catch statistics are misleading as to the actual pounds of river herring taken commercially in this system. The most important fishery is located in the canals draining Lake Mattamuskeet where alewife are taken by commercial and recreational fishermen using wire dip nets. Characteristics of this fishery and its harvest were reported by Tyus (1971). The commercial fishery for river herring in Pamlico River is limited to a few fishermen using stake gill nets and pound nets. A haul seine once operated in Tar River near Grimesland, but it has not been fished for several years.

Characteristics of the commercial fishery for striped bass are similar to those of the American shad. Most stripers are taken in the spring and fall by fishermen using gill nets in Pamlico River and northern Pamlico Sound. As with American shad, catch statistics report many fish which are caught in Albemarle and Croatan Sounds but are sold to dealers in Beaufort and Hyde County.

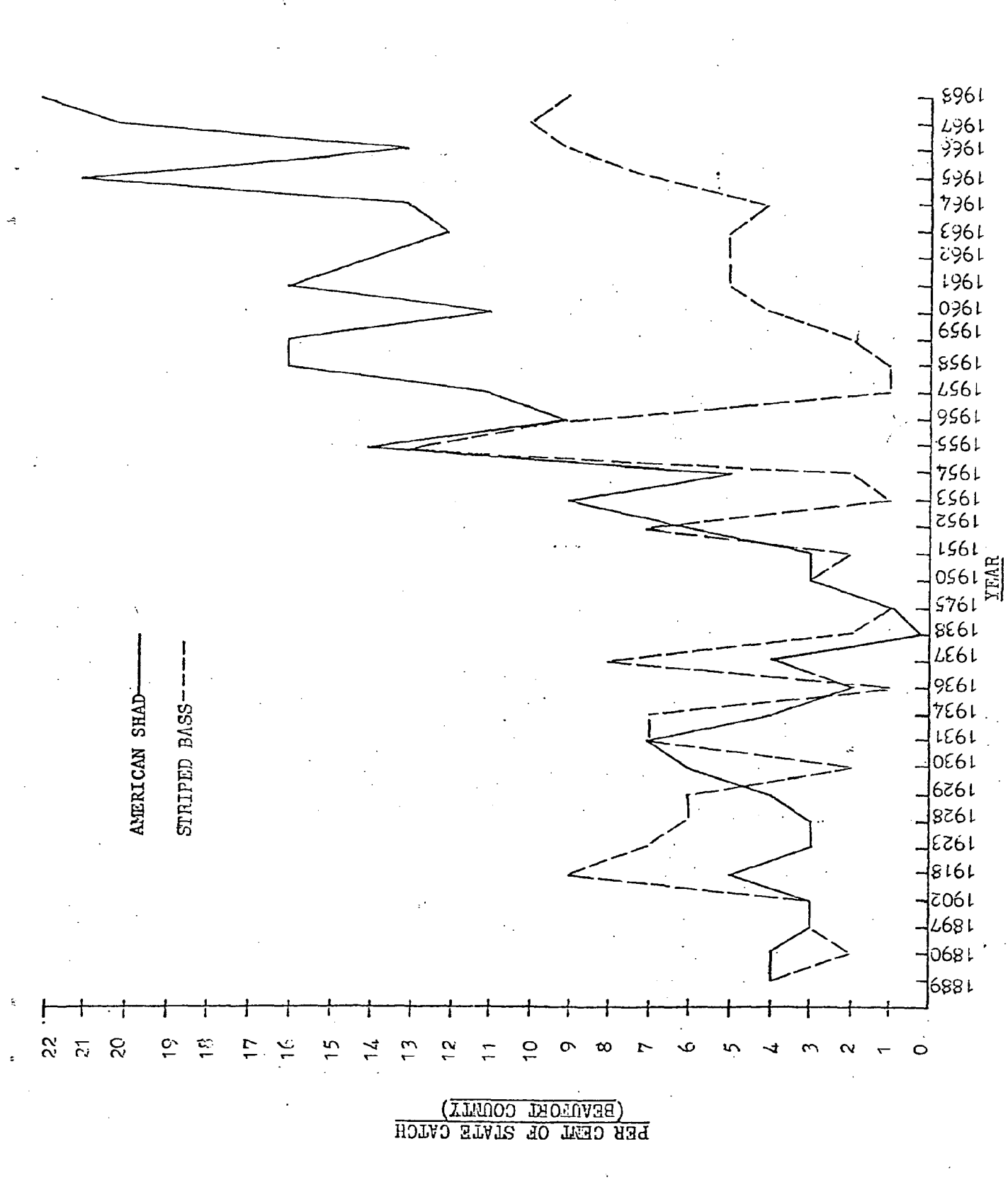

Figure 19 - Percent of total state catch of striped bass and American shad reported from dealers in Beaufort

American shad

Samples of the commercial harvest of American shad from northern Pamlico Sound and Pamlico River were taken at several landings throughout the study area each year (Figure 20). The gill net fishery in Pamlico Sound and River accounts for approximately 95 percent of the American shad taken in that system, the remainder being taken in pound nets.

A total of 1,013 scale samples were found suitable for age determination (Table 11). Ages ranged from three to eight years for males and four to nine for females. Age groups four and five comprised 90 percent of the males sampled and 78 percent of the females sampled.

Mean lengths of age groups are compared to results of shad investigations in Albemarle Sound and Neuse River, North Carolina and offshore North Carolina (Table 12). Data from Albemarle Sound and Pamlico River appear to agree quite closely. However, almost all of the older fish, over six years of age, came from sampling sites along northern Pamlico Sound during the early spring. Mean length and age data from Pamlico River more closely resemble the data from the Neuse River area; that it, there is a distinct lack of fish over six years of age. This difference suggests that the older fish are probably entering Albemarle Sound and that they are subject to lower mortality rates than fish entering the Neuse and Pamlico River systems.

The proportion of repeat spawners is fairly consistent between the Neuse, Pamlico, and Albemarle areas. Nineteen percent of the American shad sampled in the Pamlico River had spawned previously while 19 and 18.6 percent repeat spawners have been estimated for the Albemarle Sound (Street, et. al., 1975) and Neuse River[1], respectively.

Hickory shad

Scales from a total of 104 hickory shad were found suitable for age determination. Age frequency, percent frequency, mean fork lengths, and fork length range are presented in Table 13.

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[1]Hassler, W.W. and P.P. Pate, Jr., Unpublished data, Zoology Department, N.C. State University at Raleigh

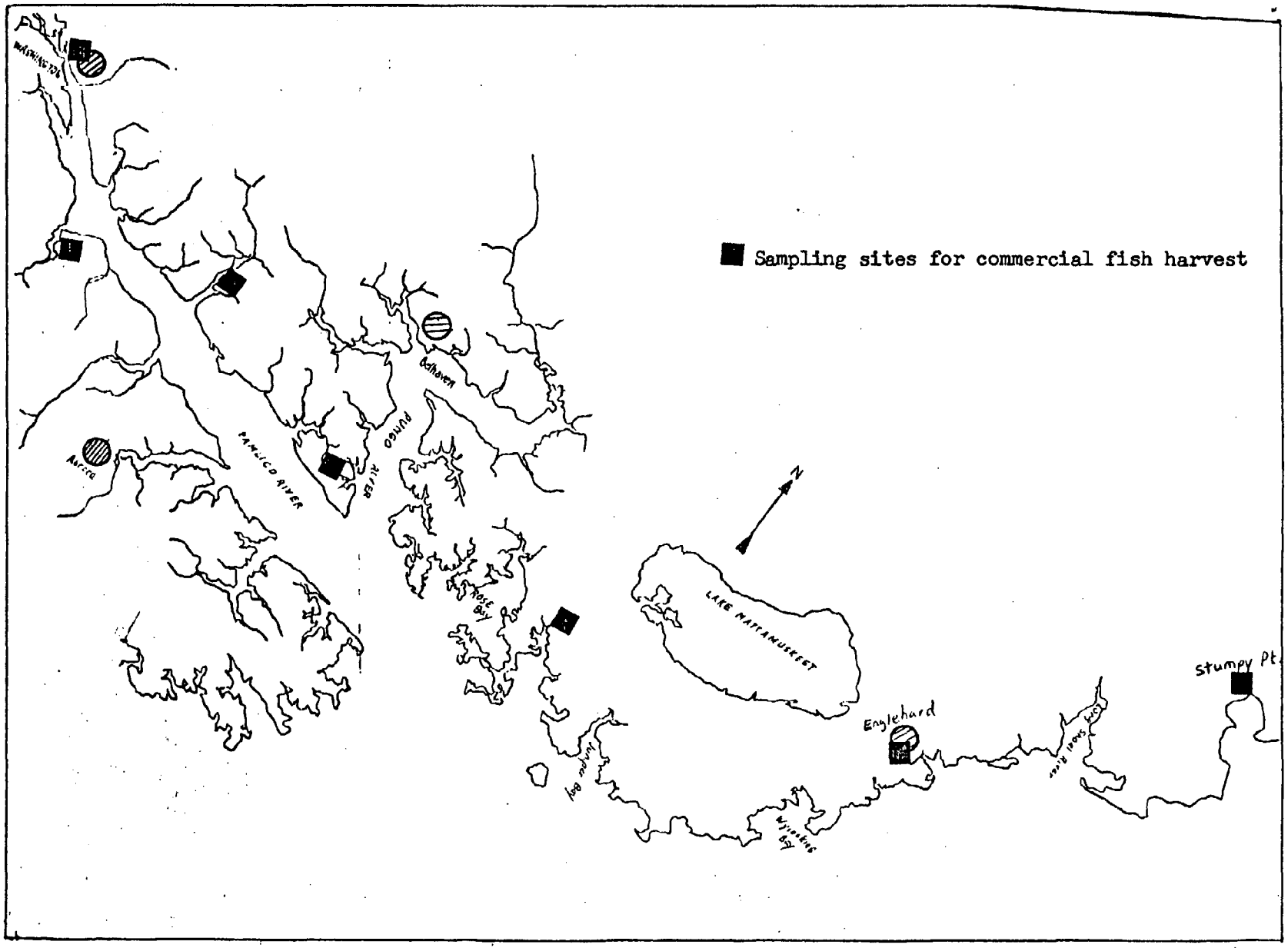


Figure 20.-Location of sampling sites for commercial fish harvest

TABLE 11.--Age and spawning frequency of American shad sampled in Pamlico River and Pamlico Sound for 1975-76 combined. Numbers in parenthesis are percents of totals.

TIMES SPAWNED	0		1		2		3		4		5		TOTAL	
AGE	M	F	M	F	M	F	M	F	M	F	M	F	M	F
III	3												3	
IV	128	124	21	3									149	127
V	88	366	40	48	5	4							133	418
VI	4	90	4	17	10	12							18	119
VII	3	11		3	3	7	3	5					9	26
VIII					1	1		1	2	1			3	3
IX						2				2		1		5
TOTAL	226	591	65	71	19	26	3	6	2	3		1	315	698
PERCENT	(72)	(85)	(21)	(10)	(6)	(4)	(<1)	(<1)	(<1)	(<1)		(<1)		

TABLE 12.--Age and mean lengths of American shad compared to investigations in other areas in North Carolina.

AGE	3		4		5		6		7		8		9	
SEX	M	F	M	F	M	F	M	F	M	F	M	F	M	F
Location														
Pamlico Sound and River	334		415	445	437	481	456	494	470	489	485	522		549
Albemarle Sound, NC[1]	359		400	437	432	473	450	498	461	540	476	509		571
Neuse River, NC[2]	368	376	422	429		472		513						
Neuse River, NC[3]	393		420	448	445	450		503						
Offshore, NC[4] (sexes combined)			459		451		458		467		486		488	

[1]Street, Pate, Holland, and Powell (1975)

[2]LaPointe, 1958, calculated fork lengths in inches converted to mm

[3]Hassler, W.W. and Pate, P.P., Jr. (unpublished data, Zoology Department, NC State University at Raleigh)

[4]Holland and Yelverton, 1973

TABLE 13.--Total number, percent of total sample, mean fork length, and length range for each age group by sex for hickory shad, 1975-76 combined.

SEX	AGE	TOTAL NUMBER	PERCENT OF TOTAL SAMPLE	MEAN FORK LENGTH(MM)	LENGTH RANGE (MM)
Female	II	2	2	290	290
	III	23	27	324	294-366
	IV	24	29	354	321-398
	V	21	25	376	345-400
	VI	11	13	413	388-432
	VII	3	4	427	418-442
		84			
Male	II	7	35	286	268-307
	III	7	35	297	271-308
	IV	2	10	341	338-343
	V	3	15	355	338-380
	VI	1	5	395	395
		20			

TABLE 14.--Age and spawning frequency of hickory shad sampled in Pamlico River and Sound 1975-76 combined. Numbers in parenthesis are percents in totals.

TIMES SPAWNED	0		1		2		3		TOTAL	
AGE	M	F	M	F	M	F	M	F	M	F
II	7	2							7	2
III	6	22	1	1					7	23
IV	1	13	1	9		2			2	24
V		2		2	3	16		1	1	21
VI							1	11	1	11
VII						2		1		3
TOTAL	14	39	2	12	3	20	1	13	20	84
PERCENT	(70)	(46)	(10)	(14)	(15)	(24)	(5)	(16)		

Ages ranged from two to six years for males and two to seven years for females. Repeat spawning was high among hickory shad. Fifty percent of the hickories sampled had made from one to three previous spawning runs (Table 14). Females began spawning predominately at age three. Males also appeared to begin spawning at age three although the sample is too small to be certain. Mean fork lengths for each sex and age group are compared with previous investigations in Albemarle Sound and Neuse River, North Carolina (Table 15).

Striped bass

A total of 202 scale samples were found suitable for age determination. Ninety-five scale samples were read from the 1975 season. Ages ranged from two to eleven years with age groups four and five predominating (Table 16). The 107 samples used for age determination during the 1976 season showed an age structure similar to that from Albemarle Sound as reported by Street, et. al. (1975). The large fish appearing in the 1975 sample were taken from the Stumpy Point sampling site and were captured in Pamlico Sound. The smaller fish in both the 1975 and 1976 samples are more representative of the gill net fishery for striped bass in the Pamlico River.

Tagging

Tagging of anadromous fish in Pamlico River began in late September, 1974, with efforts directed toward capturing striped bass by using the drop-net method. Based on suggestions offered by local commercial fishermen, our efforts were concentrated in tributaries of upper Pamlico River which in the past have consistently yielded good catches of striped bass during the fall season. The best catches were made at night in areas where large numbers of menhaden were congregated - particularly on shoals and around points of land - and when water temperature was 17°C.

Striped bass could usually be captured if the menhaden could be encircled by the drop-net. Loss of fish to suffocation was frequent due to the time they remained in the gill nets. We tagged and released only those fish which were vigorous and showed little signs of stress.

TABLE 15.--Age and mean lengths of hickory shad compared to investigations in other areas in North Carolina.

AGE	2		3		4		5		6		7	
SEX	M	F	M	F	M	F	M	F	M	F	M	F
Location												
Pamlico Sound and River	286	290	297	324	341	354	355	376	395	413		427
Albemarle Sound[1] NC	289	341	325	341	350	355	371	387	360	384	365	390
Neuse River[2]	294	311	332	354	346	376	356	395	357	409	369	420

[1]Street, Pate, Holland, and Powell, 1975

[2]Pate, 1972

TABLE 16.--Age frequency, mean length and length range of striped bass from Pamlico River and Sound, 1975-76.

AGE	TOTAL NUMBER		PERCENT OF SAMPLE		MEAN FORK LENGTH		LENGTH RANGE	
	1975	1976	1975	1976	1975	1976	1975	1976
II	7	51	7	48	356	378	311-387	287-428
III	14	32	15	30	434	408	410-452	315-508
IV	28	19	29	17	499	507	442-545	470-585
V	30	3	32	3	545	523	508-595	500-545
VI	6	2	6	2	585	539	522-630	538-540
VII	2		3		614		557-670	
VIII	1		1		668			
IX	2		2		840		833-846	
X	4		4		872		845-890	
XI	1		1		973			
	95	107						

The drop-net method was used from late September until early December each year. Eighty-eight striped bass were tagged and released during the fall tagging period in 1974. Sixty-eight were tagged during the same period in 1975. Age distribution of the fish tagged during 1974 was 32 I+, 37 II+, 8 III+, 10 IV+, and 1 VI+. The age distribution for 1975 taggings was 53 I+, 8 II+, 4 III+, 1 IV+, 1 V+, and 1 X+. These fish were considered to still be in a growth period since there was no evidence of annulus formation on the scale edge.

Spring tagging was begun in late December with gill nets of six varying mesh sizes set in lower Chocowinity Bay. The sampling site was visited as soon as possible each morning to get fish in the best condition possible. Spring tagging was conducted from late December until mid-March each year. All fish in good condition were tagged and released after they were measured and scale samples were taken.

During the 1975 spring tagging period 51 striped bass, 28 American shad, 12 hickory shad, 30 blueback herring, and seven alewife were tagged. Forty-nine striped bass, four American shad, three hickory shad, one alewife, and one blueback herring were tagged at the Chocowinity Bay site during the following spring. In addition, 237 blueback herring and 55 alewife were tagged from spawning area nets set in Pamlico River tributaries in 1976.

Striped bass

Returns from striped bass were insufficient to show any real pattern of movement. Only 15 tags were returned from the 138 fish released in 1974-75, and only nine were returned from the 117 fish released in 1975-76 (10.9 and 8.1 percent, respectively). Most of the recaptures were made in the Pamlico River within 15 miles of the tagging sites (Figure 21). Seven returns came from the 100 fish tagged in early spring - all came from Pamlico River. Stripers tagged during the fall showed movement up the Tar River during the spawning season - one tag was returned from near Old Sparta and one from near Tarboro at river mile 90.

Generally, the tagged stripers appeared to remain in the vicinity of Washington during the winter. Fish which were captured within ten miles of the tagging site were at large from 2 to 406 days indicating that there was little

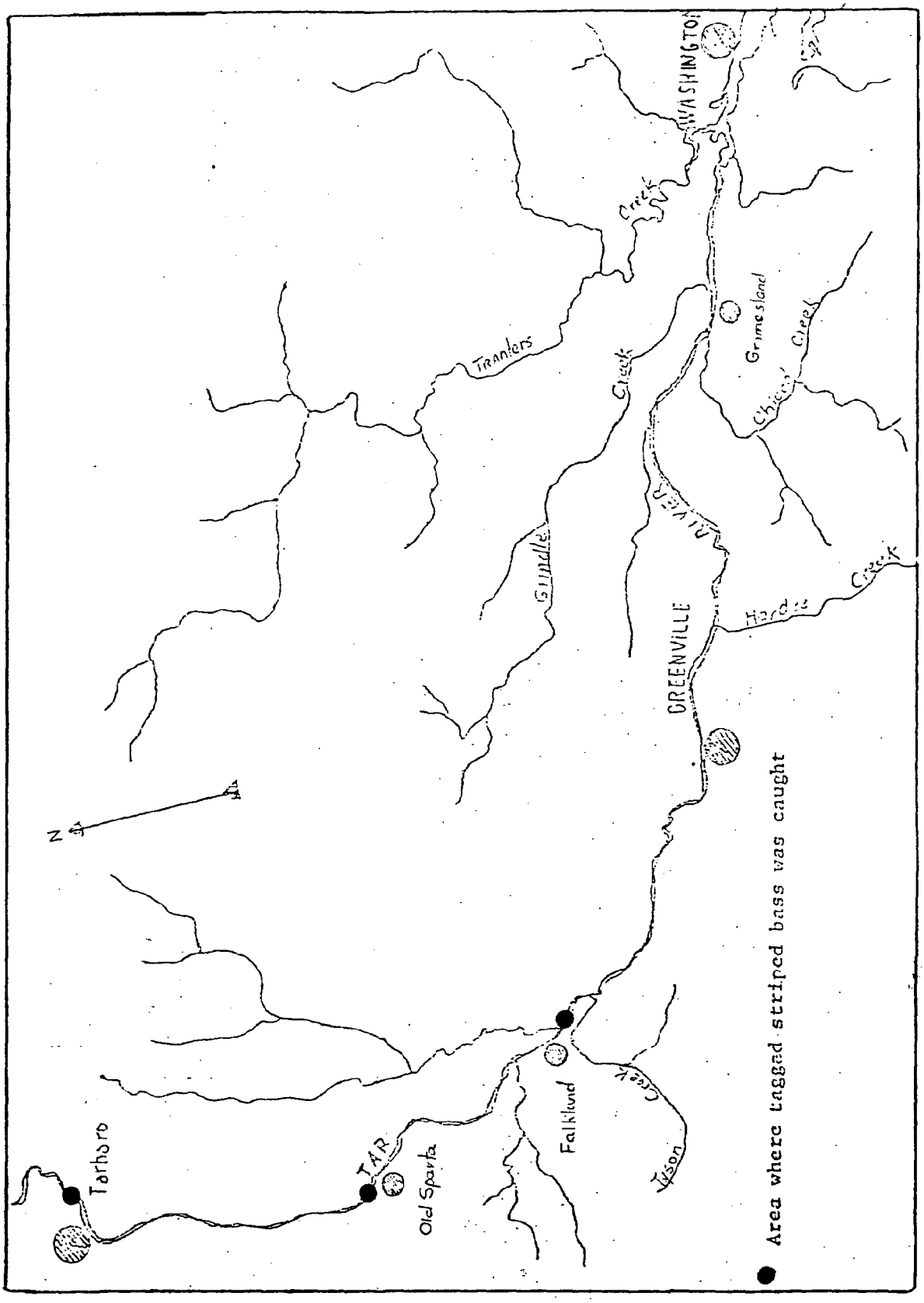


Figure 21. - Location of tagging sites and striped bass tag returns in Tar and Pamlico Rivers

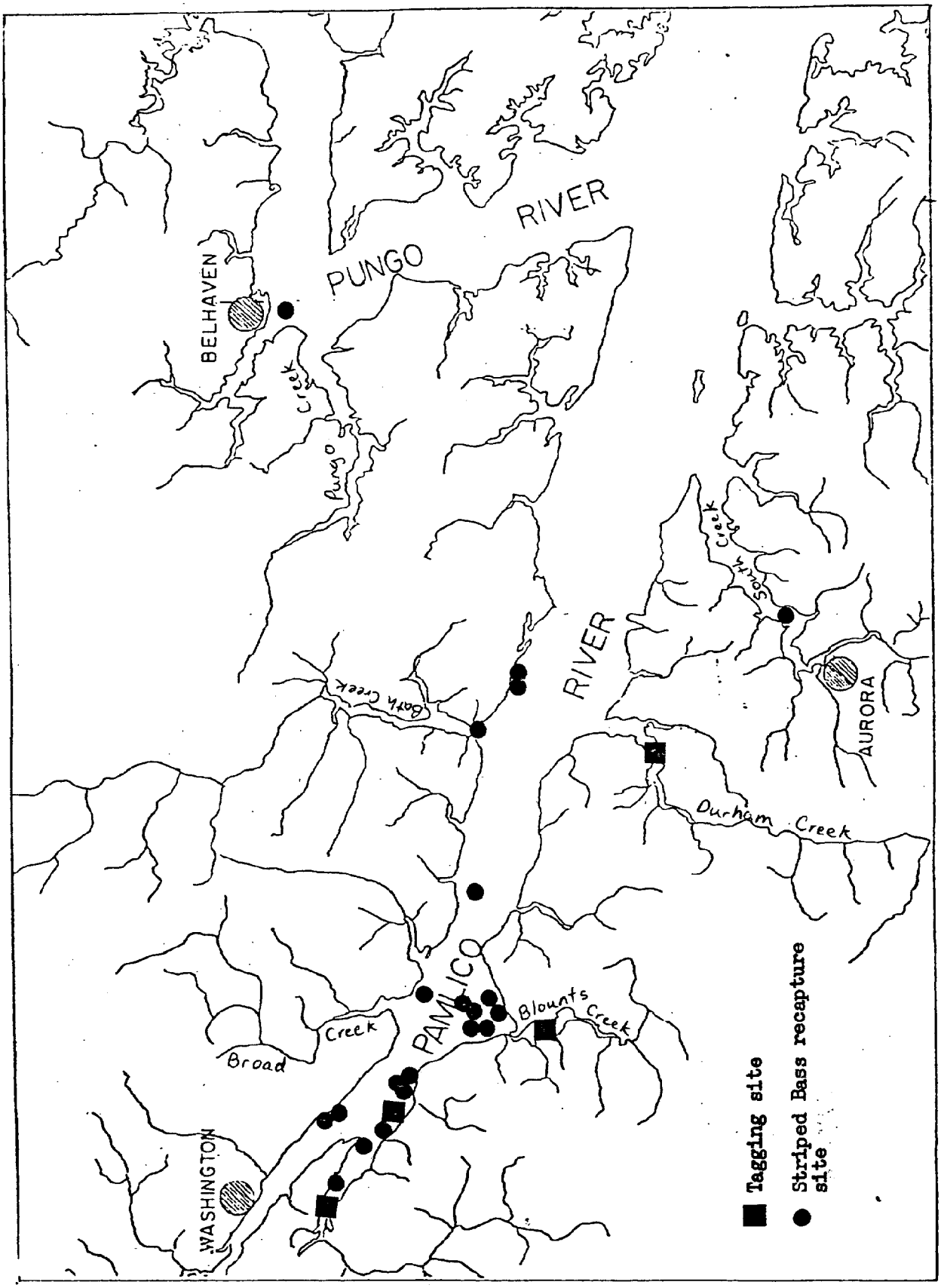


Figure 21.--Continued

movement from Pamlico River except around mid-April when tagged fish began appearing in Tar River during the spawning run. However, one fish tagged in the fall was recaptured in the Pungo River near Belhaven in March.

American shad

American shad were tagged in Pamlico River just below Washington and in Tar River near Grimesland. Eight of the 28 shad tagged in 1975 were returned from gill net catches in Pamlico River; one was caught at the tagging site near Grimesland (Figure 22). The most significant fact about these returns is that all but one showed movement away from the major spawning areas of Tar River. Six of the returns were from fish tagged in Tar River and recaptured from 7 to 21 miles downstream. These fish were usually at large only 1 to 2 days. Even those fish tagged in Pamlico River were captured downstream from the tagging site. None of the tagged fish were at large more than 26 days. Their movement downstream was probably a reaction to handling and tagging, and does not represent a normal migration pattern for these fish. No returns were received from the four fish tagged in 1976.

Hickory shad

Two of the fifteen hickory shad tagged were recaptured near the tagging site (Figure 23). Neither of these fish was at large more than one day.

River herring

Only two of the 237 blueback herring and two of the 55 alewife tagged in our spawning area sampling were recaptured. However, these returns show a different pattern from the American shad returns. All four returns showed movement away from the tagging site and into other spawning areas (Figures 24 and 25). These fish were at large for one to 14 days and traveled up to 64 miles. River herring were handled less than any other species tagged. No scale samples were taken from tagged fish to ensure better survival.

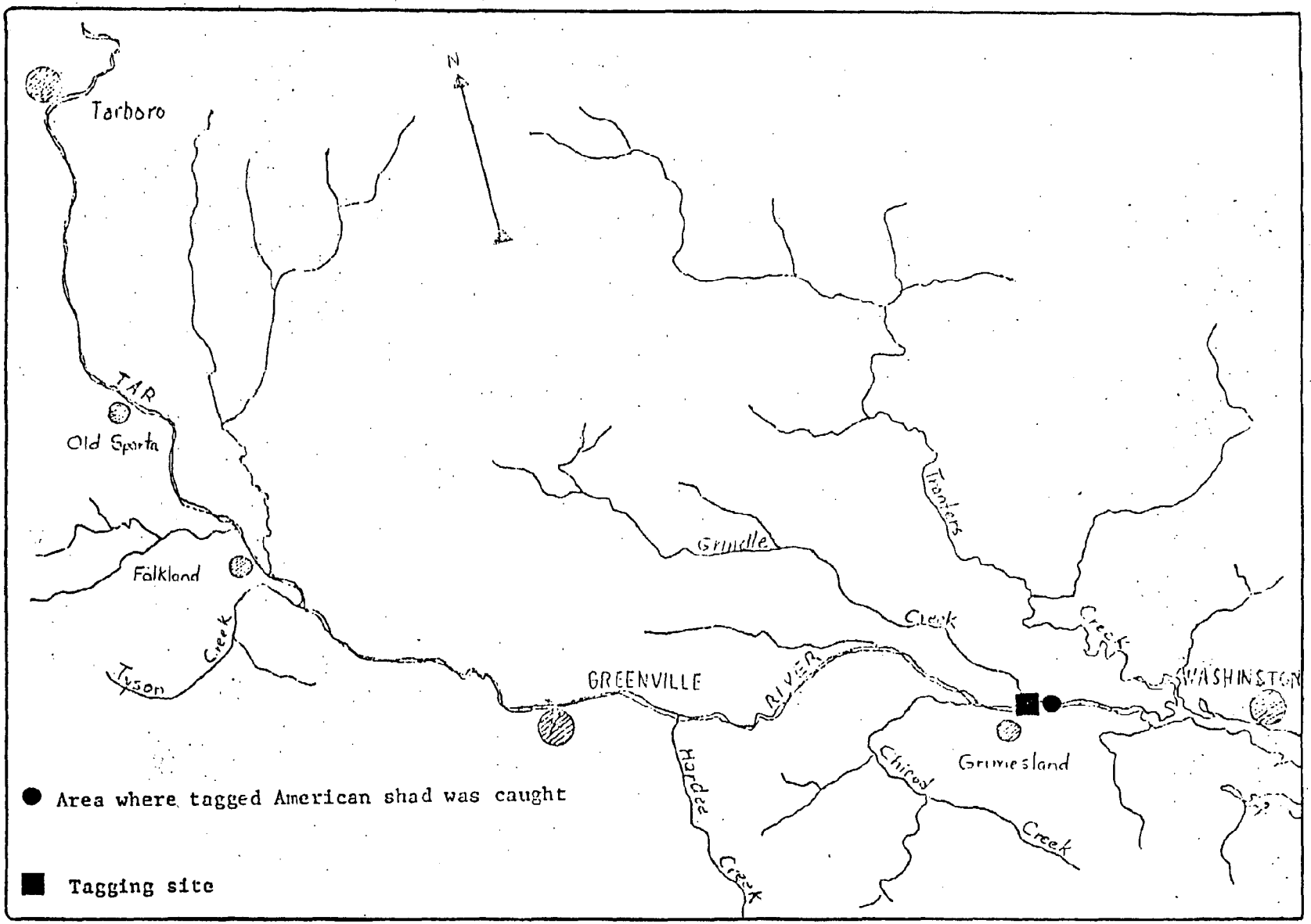
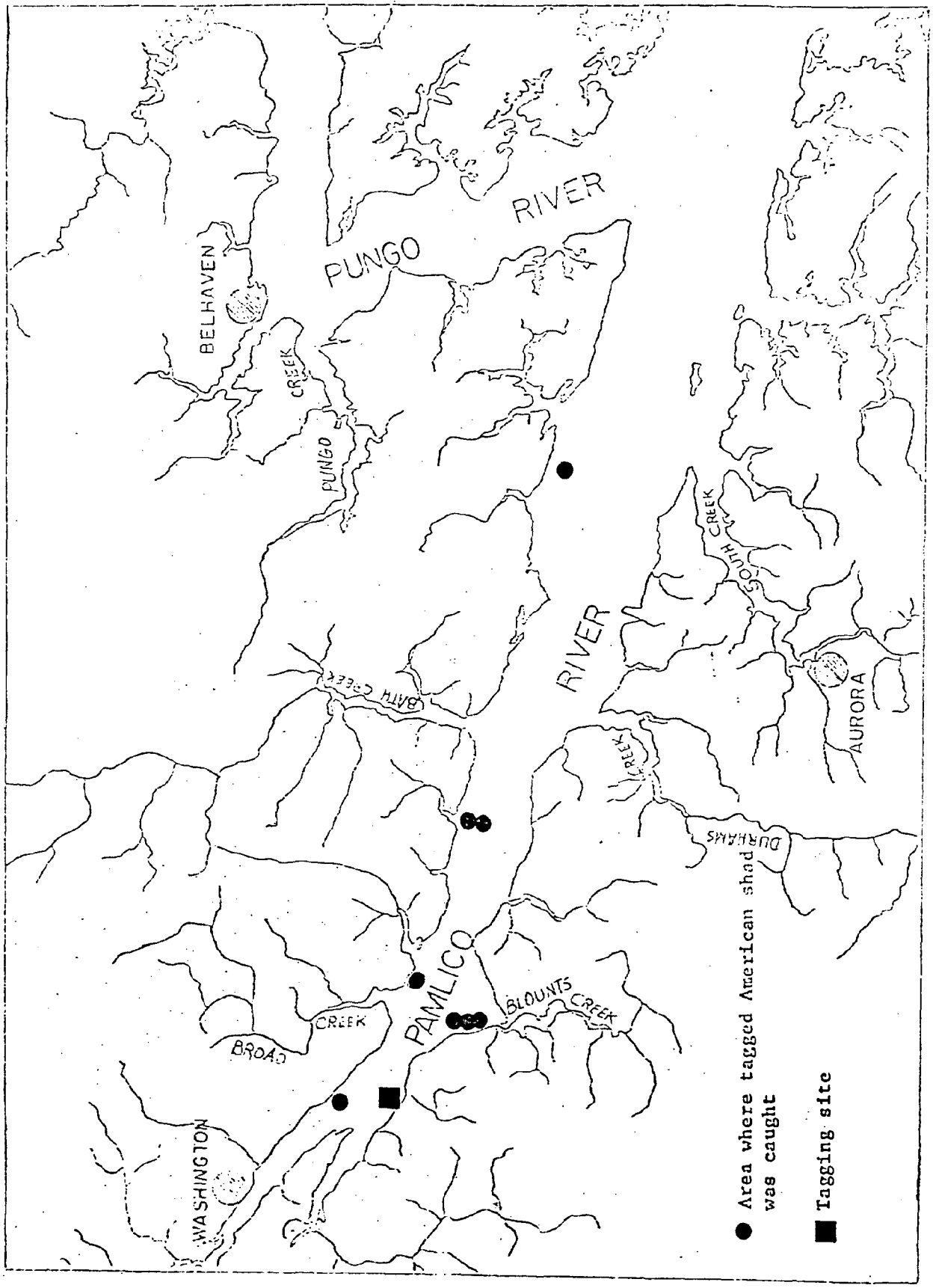


Figure 22.- Location of tagging sites and American shad tag returns in Tar and Pamlico Rivers


BELHAVEN
PUNGO RIVER
CREEK
PUNGO
SOUTH CREEK
RIVER
AURORA
DURHAMS
CREEK
BROAD
CREEK
PAMLICO
BLOUNTS CREEK
WASHINGTON
● Area where tagged American shad was caught
■ Tagging site

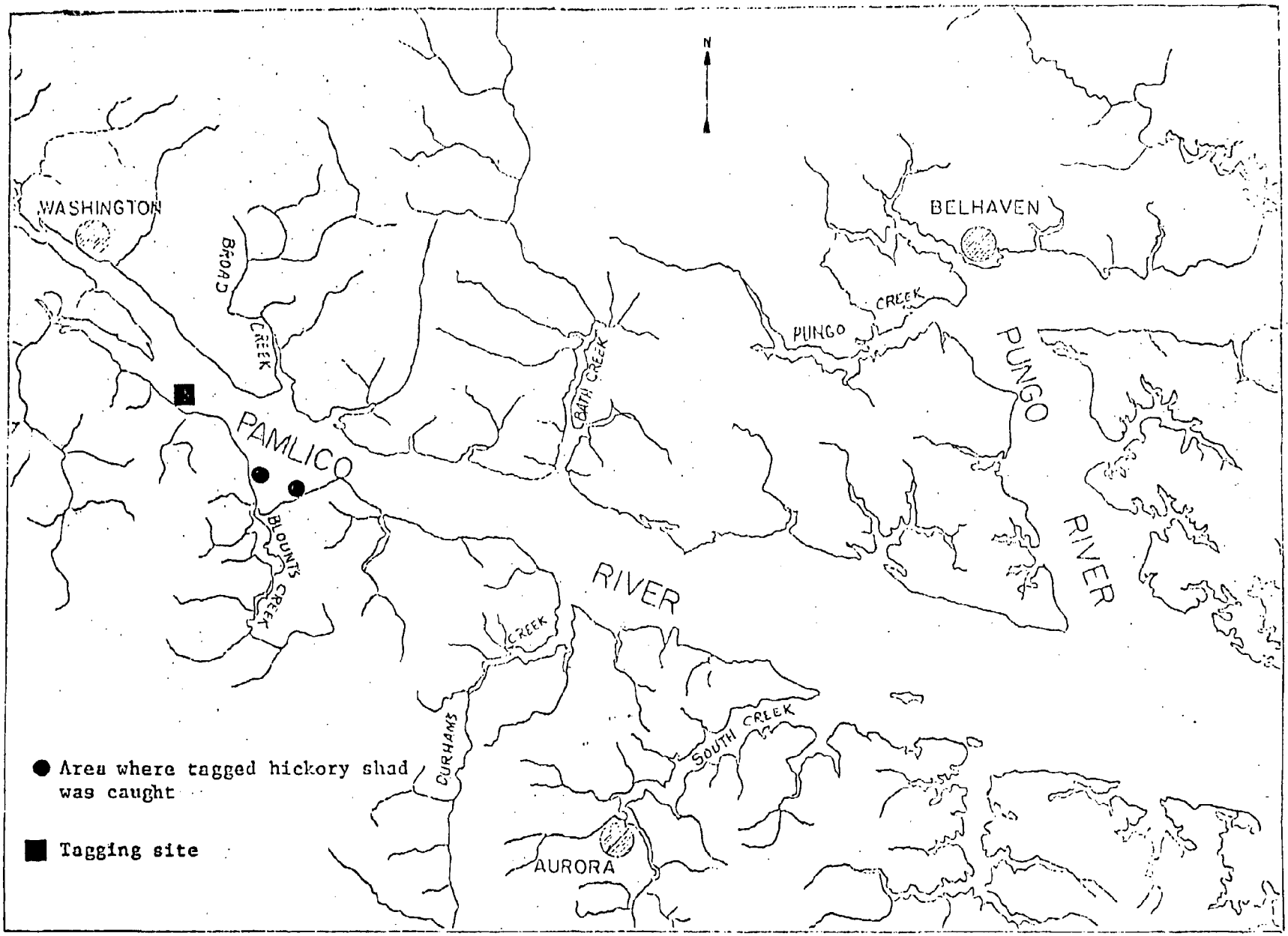


Figure 23.— Location of tagging site and hickory shad tag returns in Pamlico River

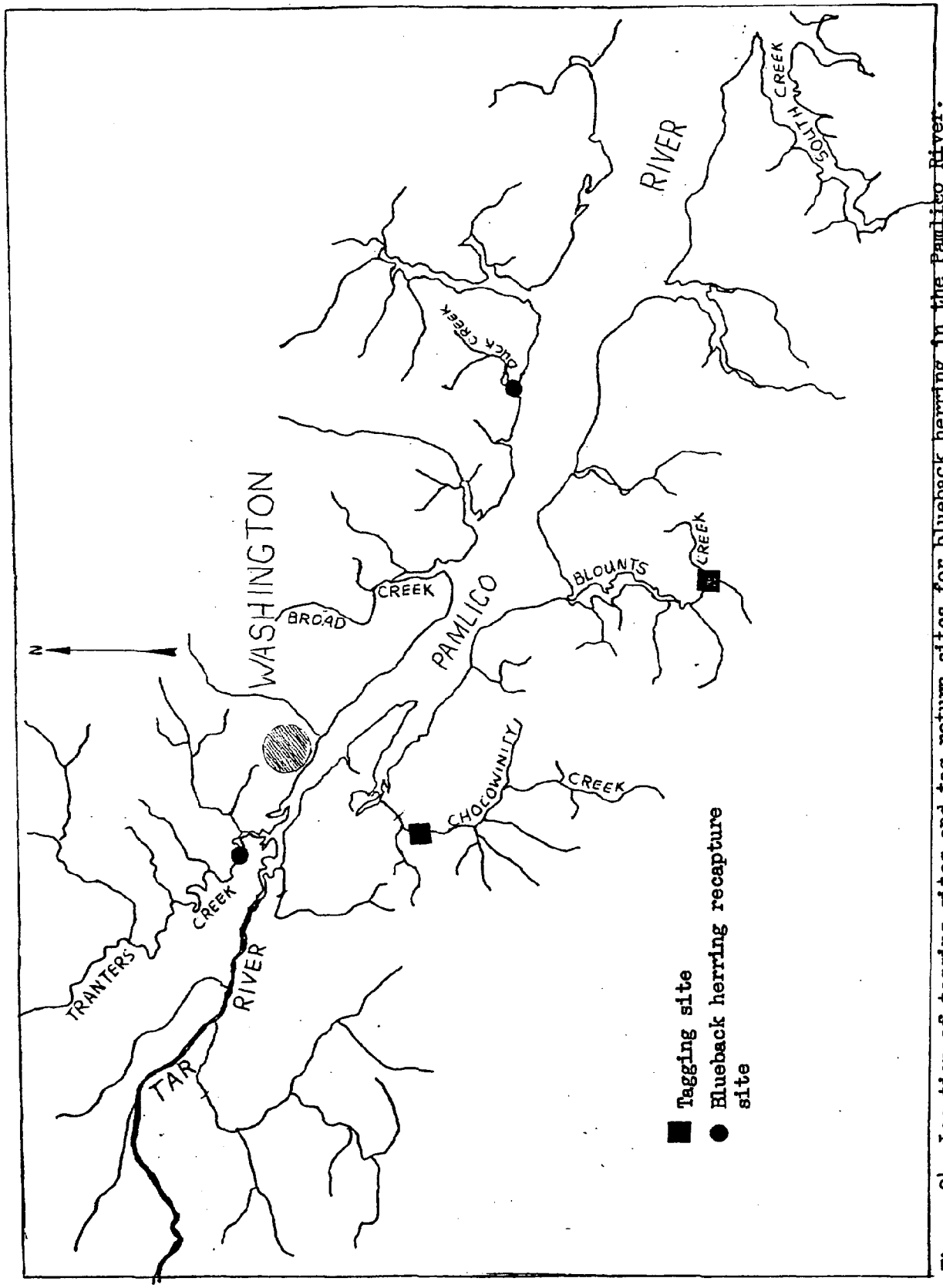


Figure 24.-Location of tagging sites and tag return sites for blueback herring in the Pamlico River.

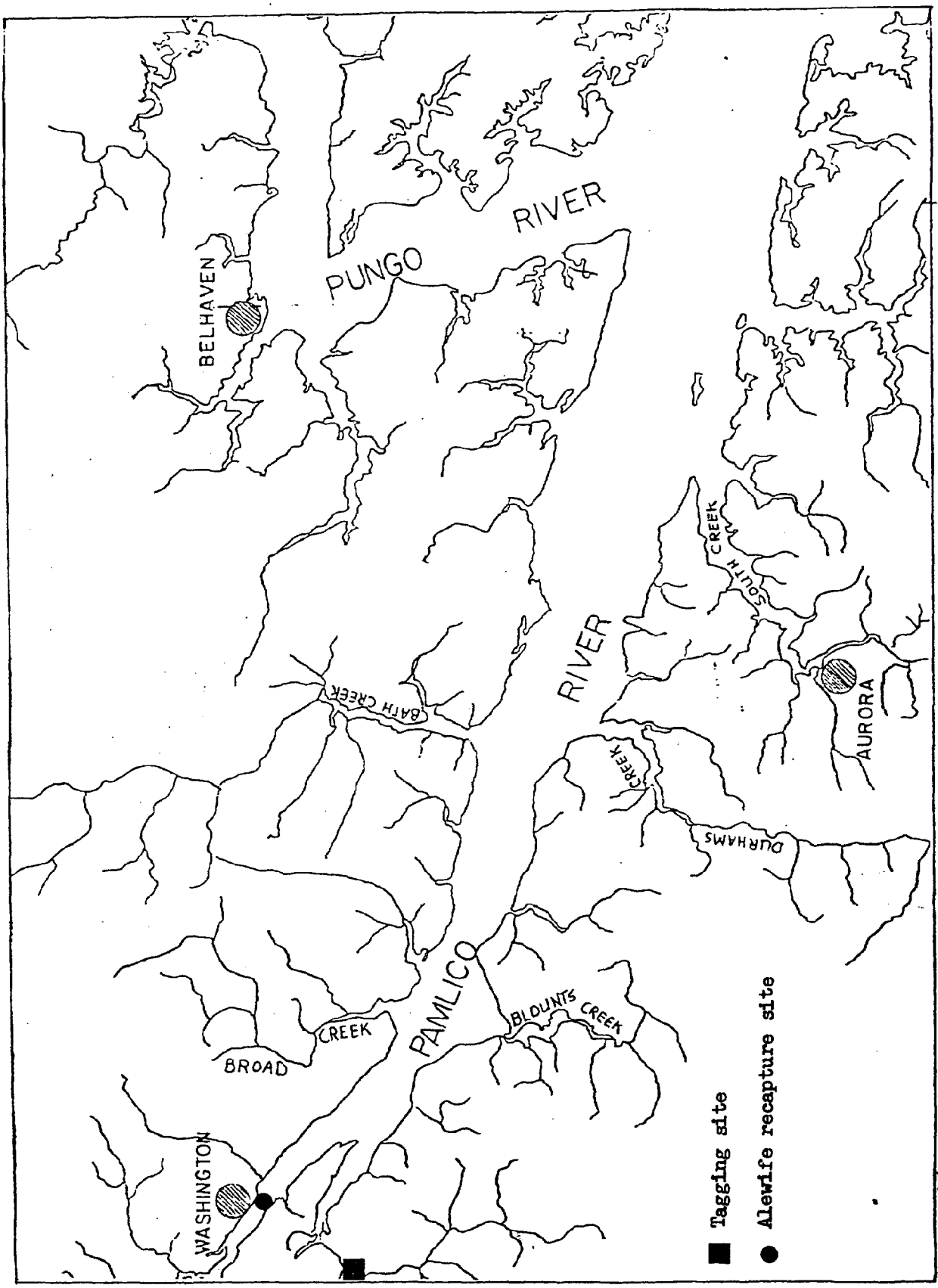


Figure 25.-Location of tagging sites and tag return sites for alewife in Pamlico River and Sound.

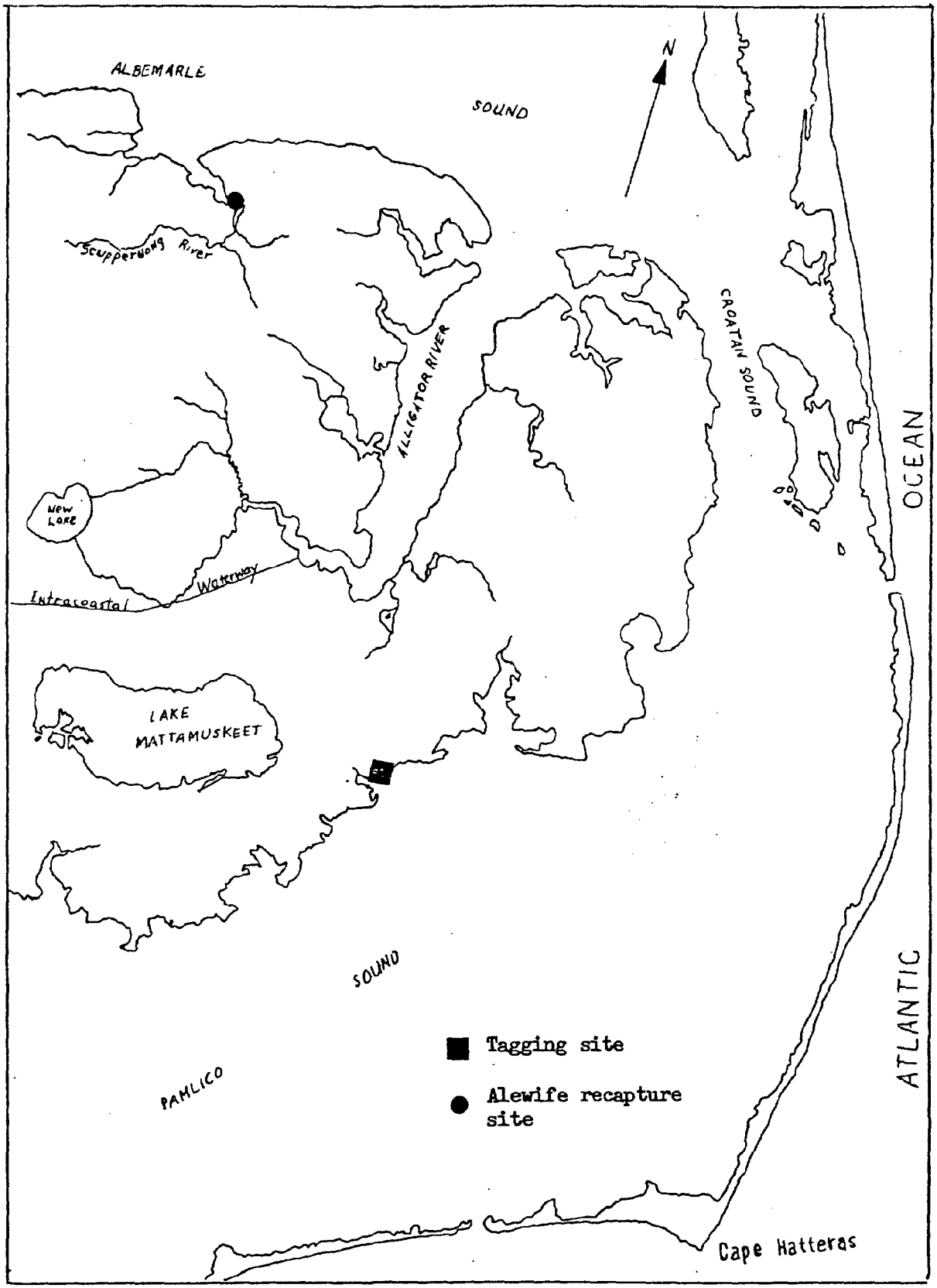


Figure 25.-Continued.

SUMMARY

1. Blueback herring spawned at a temperature range of 12° to 19°C in the Tar River and 13° to 25°C in Pamlico River tributaries. Spawning areas were found to be the Tar River and all its tributaries from Town Creek to Washington and tributaries of the Pamlico River including Runyon, Broad, upper Goose, Chocowinity, Hills, Blount, Nevil, and Durham Creeks.

2. American shad eggs and larvae were collected from upper Tar River, Swift Creek, and Fishing Creek. Spawning occurred mostly at temperatures of 14° to 18°C.

3. Hickory shad eggs and larvae were collected from Tranters Creek, Tar River above Greenville, and Tar River tributaries above Otter Creek. Spawning occurred at temperatures of 14° to 19°C.

4. Striped bass eggs and larvae were collected only from that portion of Tar River from Grimesland to Rocky Mount. Three spawning peaks were detected: one at 17°, one at 18°, and one at 20°C. Egg production by striped bass in Tar River showed a large increase since a comparable study was made in 1965, but survival of young was probably quite low.

5. Nursery areas for blueback herring were found to be the tributaries of Tar River below Greenville and, generally, those tributaries of Pamlico River west of Bath Creek. Juvenile blueback were found to utilize tributaries of northern Pamlico Sound during winter months.

6. Of the 109 juvenile alewife collected, most came from tributaries of northern Pamlico Sound during November, December, and January.

7. Eleven juvenile American shad were captured in Tar River and Tranters Creek. Four more were captured in tributaries of northern Pamlico Sound during January, 1976.

8. Four juvenile hickory shad were collected from tributaries of Tar River.

9. Juvenile striped bass were collected from Tar River and upper Pamlico River.

10. Blueback herring were by far the most abundant species of river herring spawning in the Tar-Pamlico River system.

11. Age group five dominated gill-net samples of adult blueback herring. Approximately 65 percent of all adults were repeat spawners. Apparent year-class composition data were probably biased by the sampling gear utilized - gill nets.

12. The major sport fishery for striped bass and American shad is located in upper Tar River, Fishing Creek, and Swift Creek. Dip-netting for river herring was done mainly in tributaries of upper Pamlico River and lower Tar River.

13. The major commercial fishery for anadromous species in Pamlico River is the gill-net fishery for American shad and striped bass. Age groups four and five dominated landings of American shad.

14. In 1975, age groups four and five dominated the striped bass harvest. Ages two and three were most frequent in 1976.

15. Two-hundred forty-nine striped bass, 32 American shad, 15 hickory shad, 55 alewife, and 267 blueback herring were tagged. Tag returns from striped bass indicated that these fish remained in the general area of upper Pamlico River until migrating up Tar River to spawn. Returns from other species were insufficient for meaningful analysis.

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