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Hawkins, Jess H.

ANADROMOUS FISHERIES RESEARCH PROGRAM

TAR-PAMLICO RIVER

By

Jess H. Hawkins

North Carolina Department of Natural Resources

and Community Development

Division of Marine Fisheries

Morehead City, NC 28557

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ABSTRACT

Investigations into several aspects of the life histories of blueback herring, alewife, hickory shad, American shad, striped bass, and Atlantic sturgeon were continued during 1977-79, according to procedures initiated by anadromous studies during 1974-76 in the Tar-Pamlico River. Nursery areas of anadromous juveniles were monitored, as was growth, movement, and relative abundance. Year class composition and spawning repetition were determined for adult blueback herring and American shad, 1978-79.

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INTRODUCTION

The 1977-79 Tar-Pamlico River anadromous investigation represents work conducted under Job 5 of Project AFCS-13 "Anadromous Fisheries Research Program-Neuse River." Activities included investigation of juvenile anadromous fish year class, strength, adult year class composition, and spawning repetition, when feasible. Marshall (1976) provided a complete introduction and description of the previous Tar-Pamlico River investigation (Project AFCS-10, 1974-76) after which this study was modeled.

STUDY AREA

Marshall (1976) provided a detailed description of the Tar-Pamlico River basin (Figure 1).

MATERIALS AND METHODS

Nursery Area Sampling

Monthly nursery area sampling was conducted on the Tar-Pamlico River during May-December, 1977-79. A total of 23 stations (22 trawl, 1 seine) were chosen in 1977 for juvenile monitoring from the 54 established by Marshall (1976). Sampling locations are shown in Figure 2. In 1978, 28 trawl and seven seine stations were selected as juvenile monitoring sites for the Tar-Pamlico River.

All seine stations during 1977-79 were pulled with the 60 ft (18.3 m) seine described earlier in this report. One seine haul equaled one unit-of-effort. All 1977 trawl stations were sampled with the 26 ft (7.9 m) head rope wing trawl, also described previously. During 1978-79 only inland trawl stations (7) were pulled with the wing trawl. The other 1978-79 trawl stations were monitored with a 1/4 in (primary stations) and 3/4 in (secondary stations) stretched mesh flat trawls described previously in the report. Primary stations were sampled for one minute at 1800 rpm and secondary stations, five minutes at 2200 rpm. A one minute tow was considered one unit-of-effort.

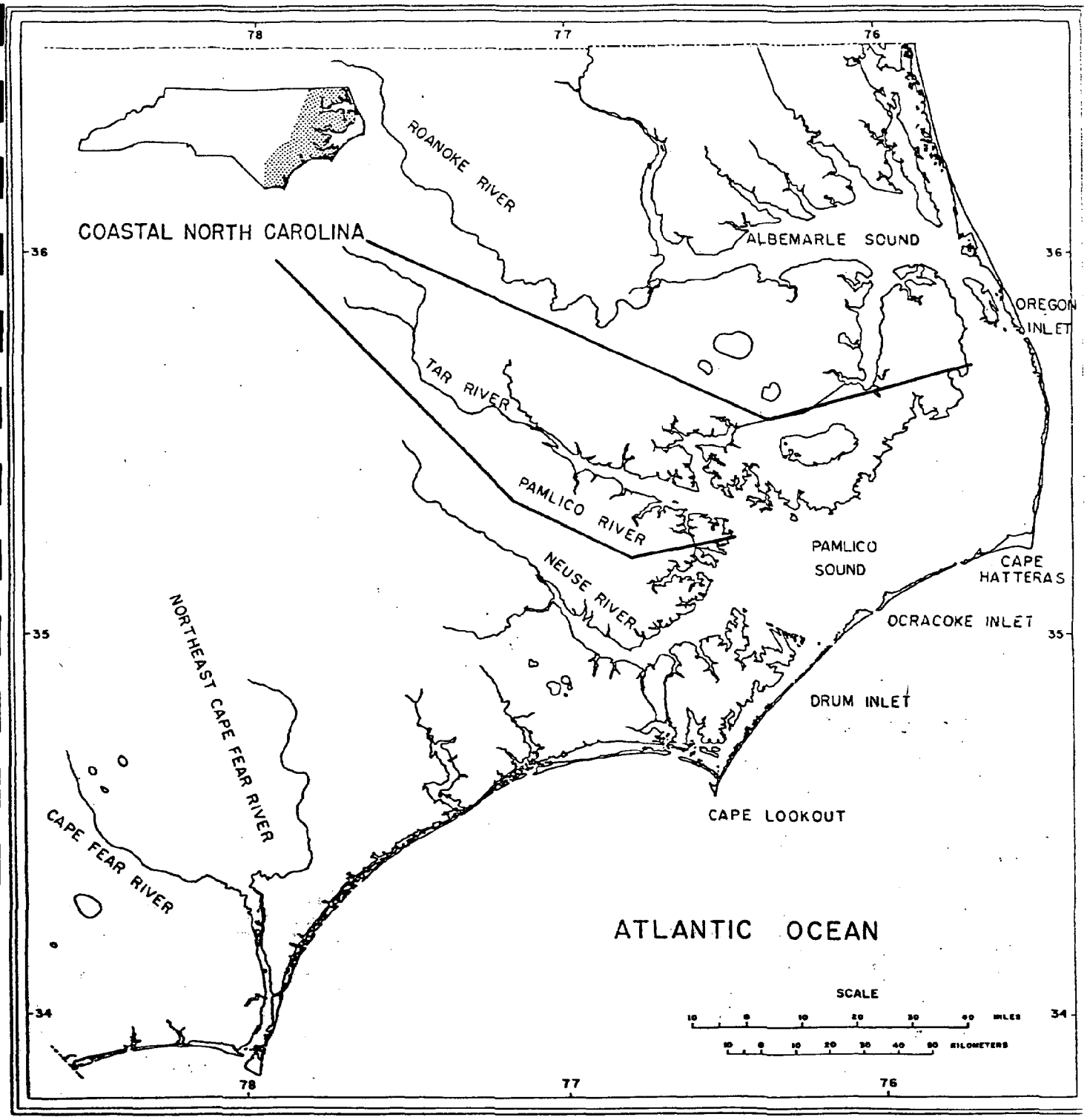

Figure 1. - Pamlico River basin.

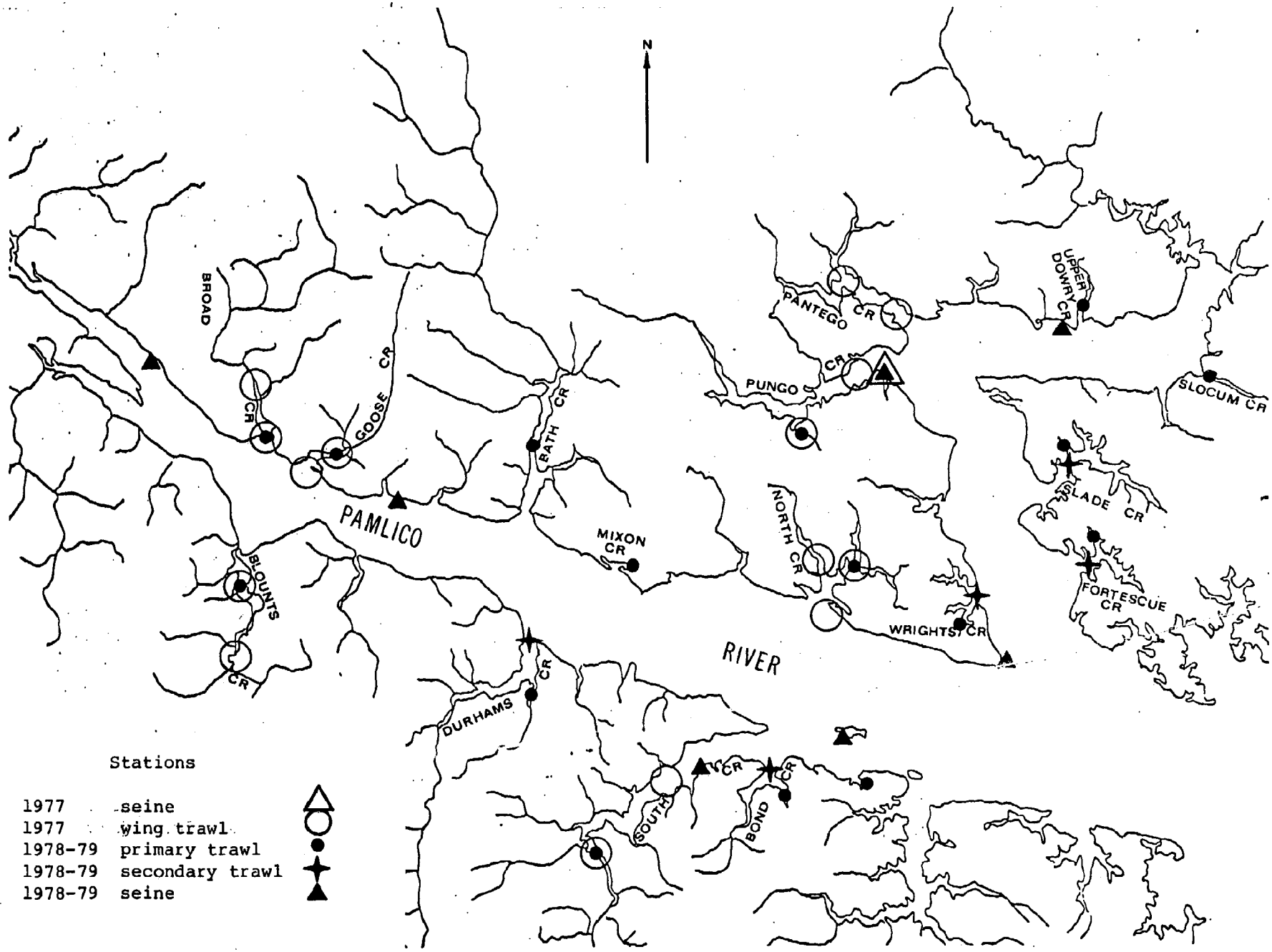

Figure 2. - Monthly (May-December) juvenile sampling stations in the Pamlico River, 1977-1979.

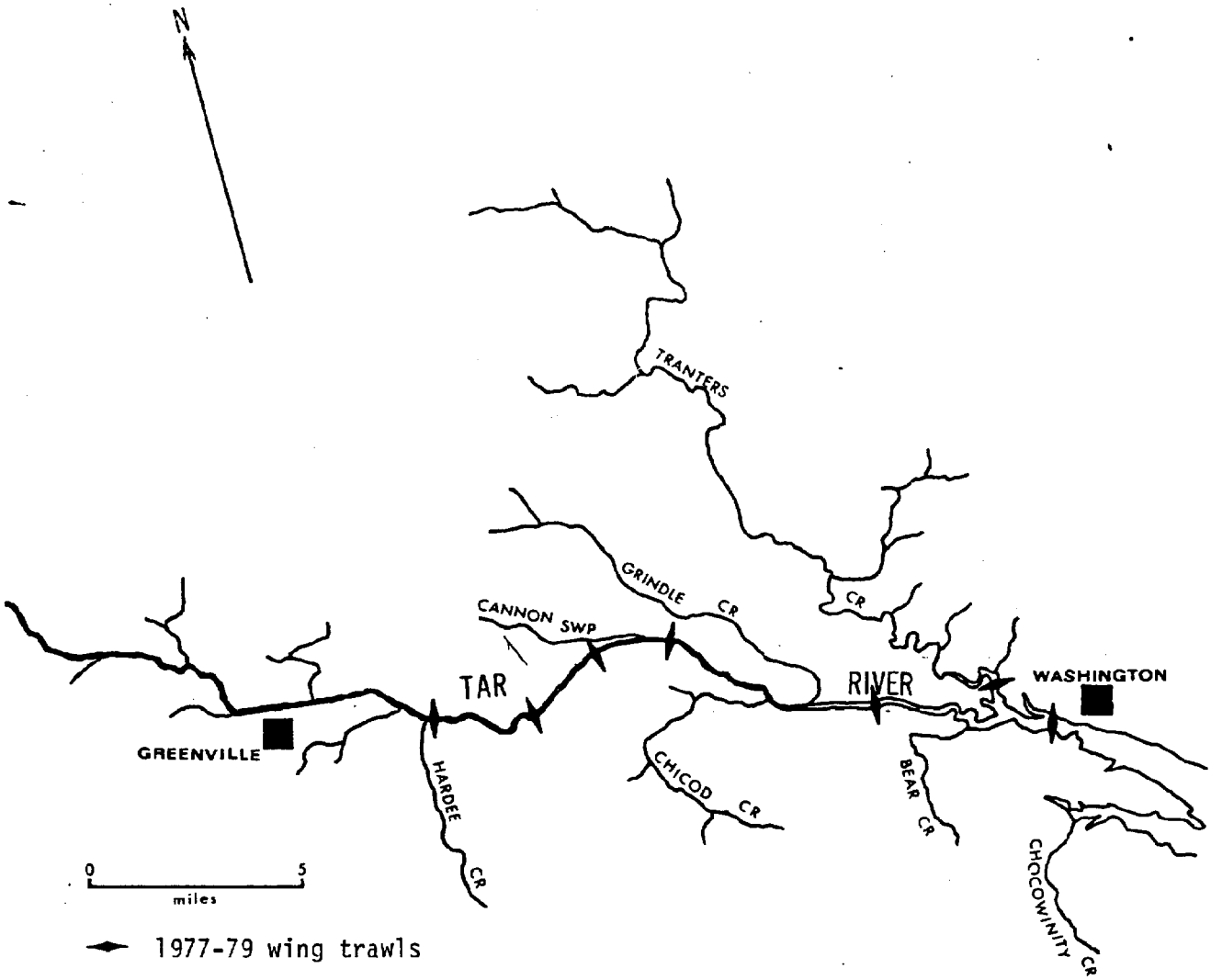

Figure 2. - continued.

Adult Fish Sampling

Adult anadromous fish commercial landings were sampled at six locations in Pamlico River and northern Pamlico Sound to determine species composition and age-class structure of anadromous fishes during 1978-79 (Figure 3). Each sample site was visited weekly beginning in mid-February and continued until catches became insignificant. Gill nets of various mesh sizes were also set in the main stem and tributaries to collect adults. Fork lengths of adults were measured to the nearest millimeter. Scales of clupeids were taken from 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 were taken from each fish, and the scales were read on a microfiche reader.

RESULTS AND DISCUSSION

Nursery Area Sampling

During May-December, 1977-79, a total of 14,974 juvenile anadromous fishes were captured in the Tar-Pamlico River. The most abundant juvenile anadromous fish caught was blueback herring (14,541), far surpassing American shad (207), alewife (189), hickory shad (6), and striped bass (37). Juveniles were captured with wing trawls, seines, flat trawls and other supplemental gears. As on the Neuse River, wing trawls and seines were more effective than flat trawls as juvenile anadromous sampling devices (Table 1). The wing trawl was by far the most effective sampling gear, catching 99% of the total juveniles sampled in the Tar-Pamlico River. Wing trawl stations were located furthest upstream near areas frequently inhabited by anadromous juveniles. This characteristic probably influenced the high catch-per-unit-effort values obtained with the wing trawl.

Blueback herring

The large number (14,541) of juvenile blueback herring captured permitted verification of the nursery areas described by Marshall (1976). Juvenile blueback herring were caught throughout the Tar-Pamlico River (Figure 4), but

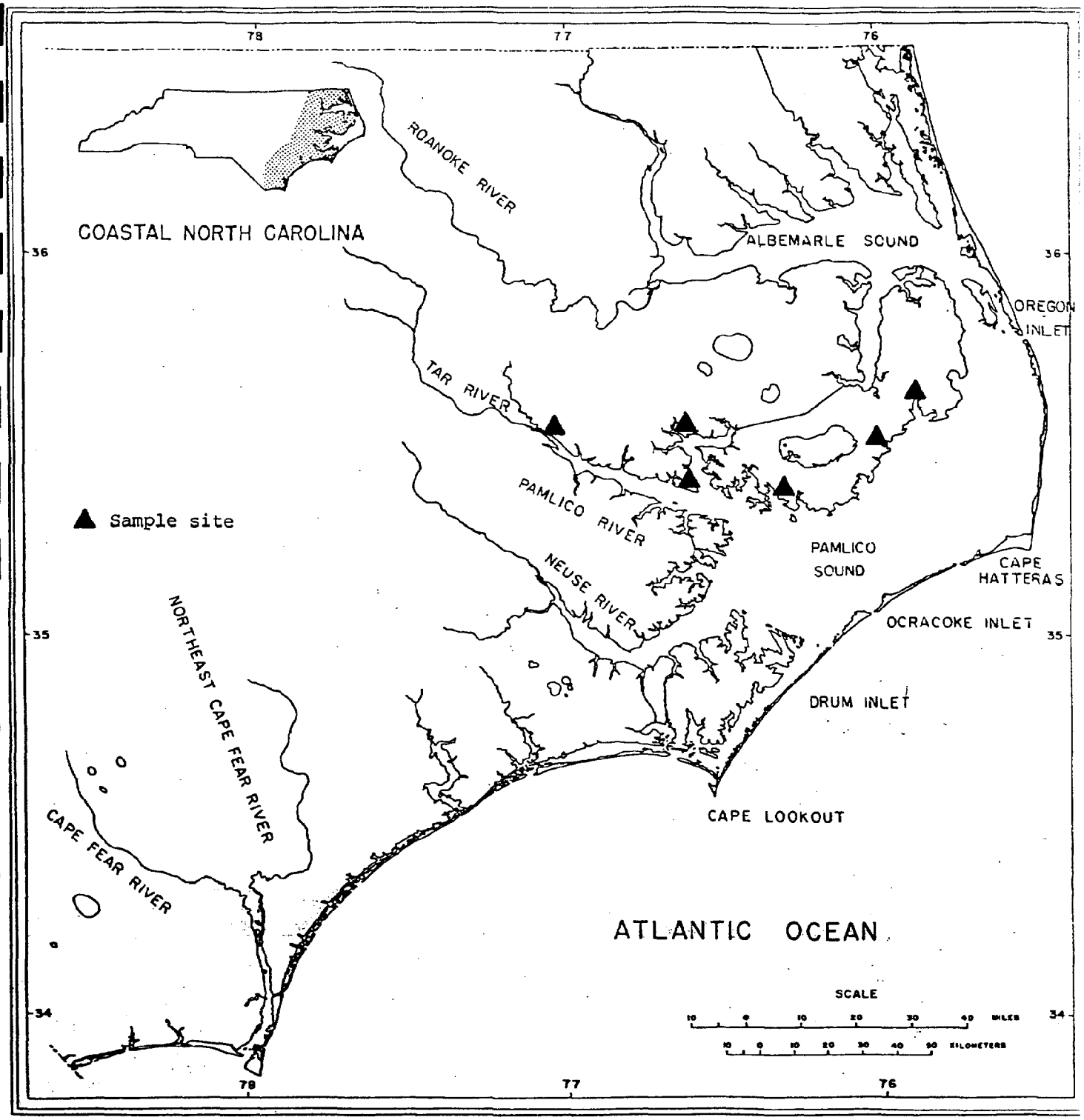

Figure 3. - Commercial adult fish sampling sites in the Pamlico River, NC, 1978-79.

Table 1. - Relative catch of juvenile anadromous fish by gear for Tar-Pamlico River, NC, 1977-1979.

Gear	Wing trawl				1/4" Flat trawl				Seine			
Year	1977	1978	1979	1977-79	1977	1978	1979	1977-79	1977	1978	1979	1977-79
Effort	354	175	190	719	0	166	9	175	3	34	31	68
Blueback herring												
Catch	5927	2397	6	8330	0	7	0	7	0	11	0	11
CPUE	16.7	13.7	.03	11.6	0.0	.04	0	.04	0.0	.32	0.0	.16
Percent	100	99	100	99	0	<1	0	<1	0	<1	0	<1
American shad												
Catch	36	153	6	195	0	0	0	0	0	0	0	0
CPUE	.1	.9	.03	.27	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent	100	100	100	100	0	0	0	0	0	0	0	0
Alewife												
Catch	0	0	0	0	0	18	0	18	0	0	0	0
CPUE	0.0	0.0	0.0	0.0	0	.1	0.0	.1	0.0	0.0	0.0	0.0
Percent	0	0	0	0	0	100	0	100	0	0	0	0
Hickory shad												
Catch	0	0	0	0	0	0	0	0	0	0	0	0
CPUE	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent	0	0	0	0	0	0	0	0	0	0	0	0
Striped bass												
Catch	0	0	0	0	0	5	0	5	0	26	0	26
CPUE	0.0	0.0	0.0	0.0	0.0	.03	0.0	.03	0.0	.76	0.0	.38
Percent	0	0	0	0	0	16	0	16	0	84	0	84
Total Catch				8525				30				37
CPUE				11.9				0.2				.5
Percent by Gear				99				.4				.5

favored the area from Blounts Creek to Greenville. These areas are characterized by deep, black swamp water drainage, mud bottoms, and low salinity, all of which were noted by Marshall (1976).

Juvenile blueback herring were generally distributed throughout the nursery areas after spawning. Juveniles were caught both in tributaries and the main stem, apparently utilizing the main section as a migration route to estuarine waters. Juvenile movement from inland areas appeared to begin in August when catch-per-unit-effort values dropped significantly (Figure 5). Marshall (1976) also noted juvenile movement into estuarine waters in the fall, and documented movement into Pamlico Sound during December, January, and February.

Growth curves for the 1977, 1978, and 1979 year classes of juvenile blueback herring in the Tar-Pamlico River have been plotted (Figure 6). Growth curves for the 1977 and 1978 year classes appear very similar, both being generally flat after July. The growth curves were considerably flatter than those found by Marshall (1976) and also those plotted for blueback herring in the Neuse River during 1977-79. Juvenile blueback herring from the Tar-Pamlico River were consistently smaller than those sampled in the Neuse River during corresponding time periods. The average difference in juvenile size for each corresponding month was about 6 mm. This difference could be related to variations in food availability, feeding selectivity, differing growth efficiencies, length of stay in the nursery areas or other factors.

Juvenile wing trawl sampling was conducted according to standard procedures in order to compare relative numbers of juveniles each year. Table 2 exhibits relative abundance of juvenile blueback herring in the Tar-Pamlico River, 1977-1979. Strong juvenile year classes are evident in 1977 and 1978 relative to 1979. Juvenile blueback herring catches in 1979 indicate that that particular year produced one of the poorer blueback herring year classes since juvenile sampling began in 1974.

Alewife

Only 181 juvenile alewife were collected from the Tar-Pamlico River during 1977-79. Most of these juveniles were caught in the lower Pamlico and Pungo River area during the fall (Figure 7). These estuarine waters are characteristically much saltier than the upstream areas of the Tar-Pamlico. The alewife

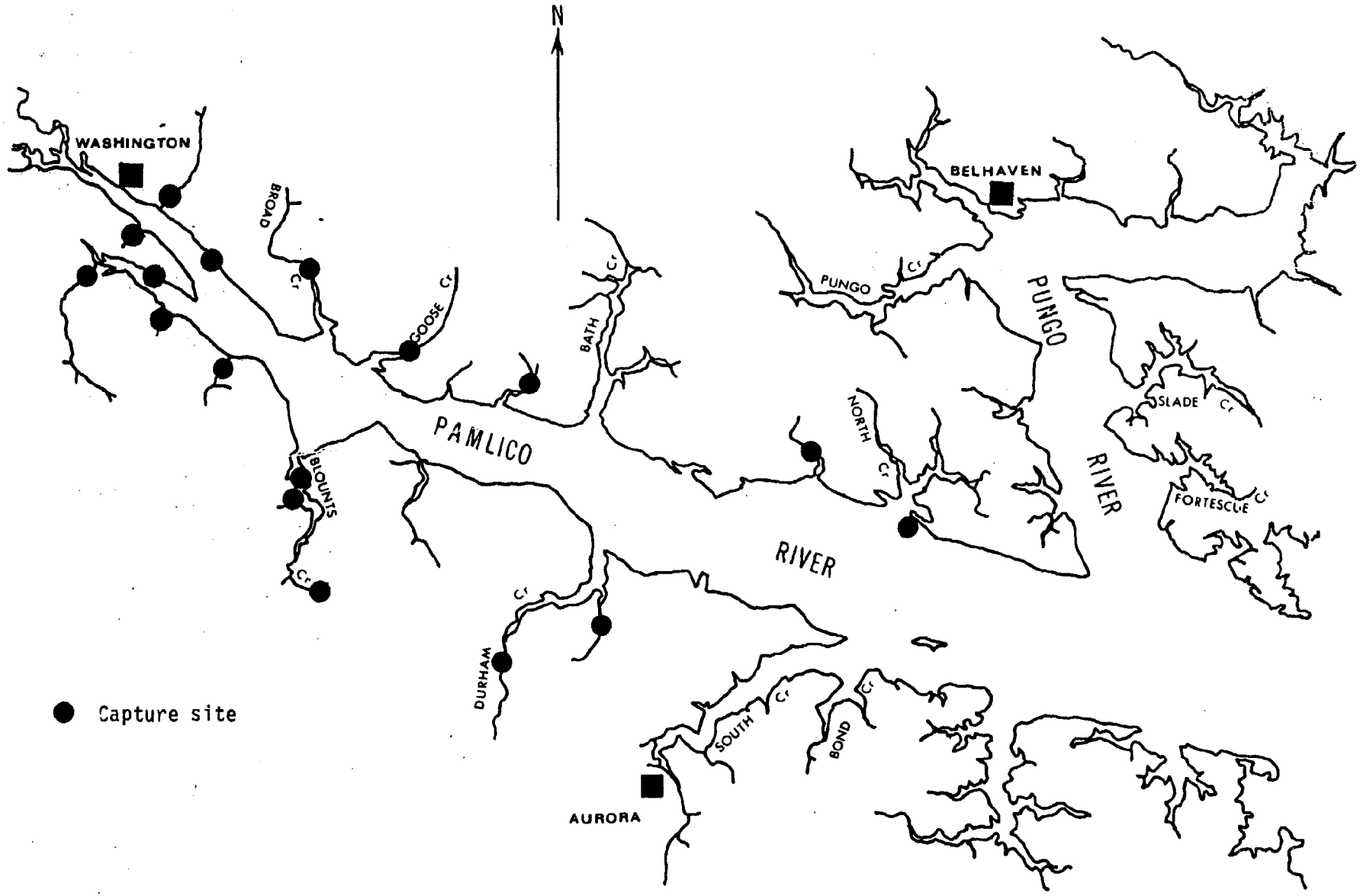

Figure 4. - Capture sites of juvenile blueback herring in the Tar-Pamlico River, 1977-1979.

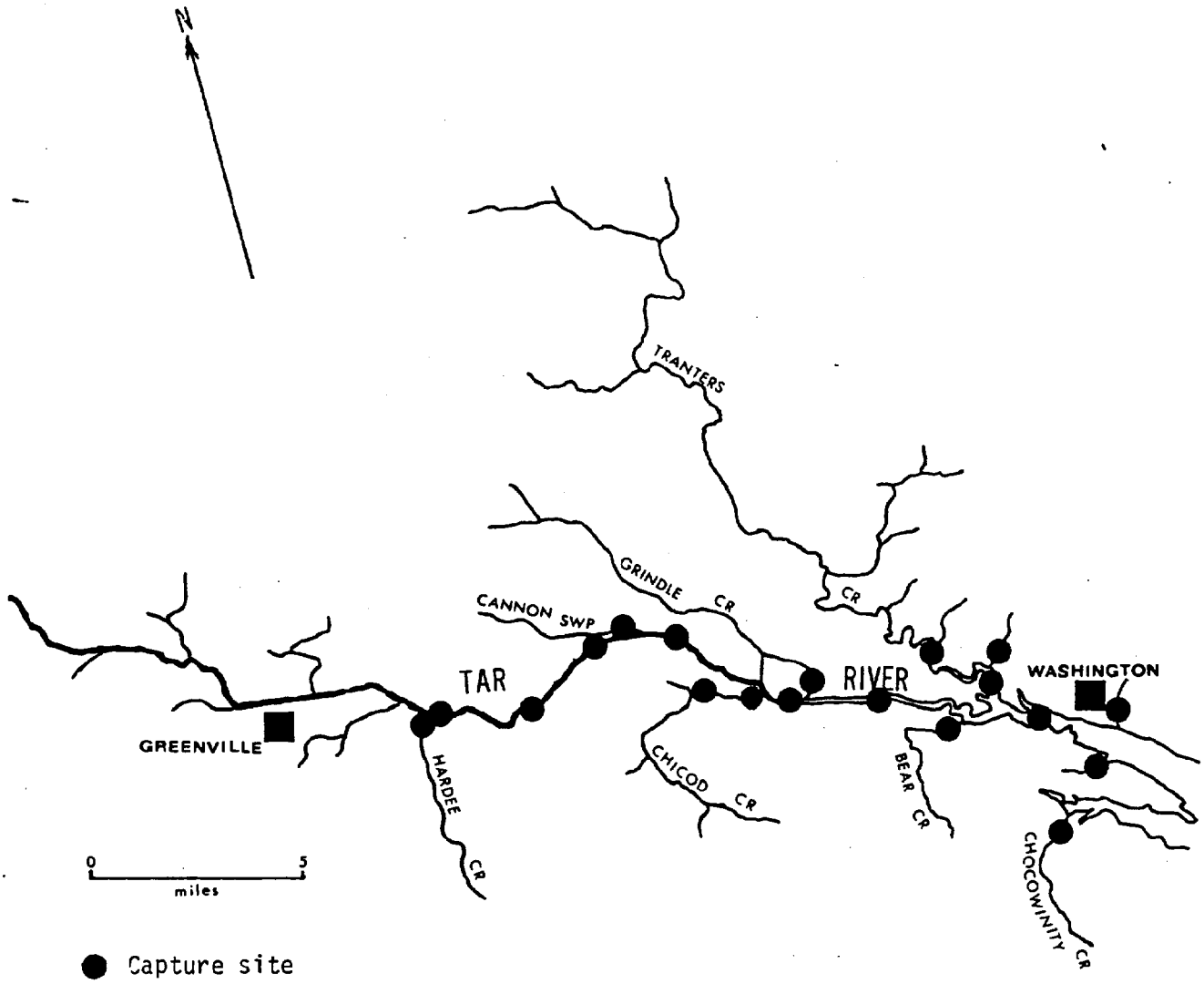

Figure 4. - continued.

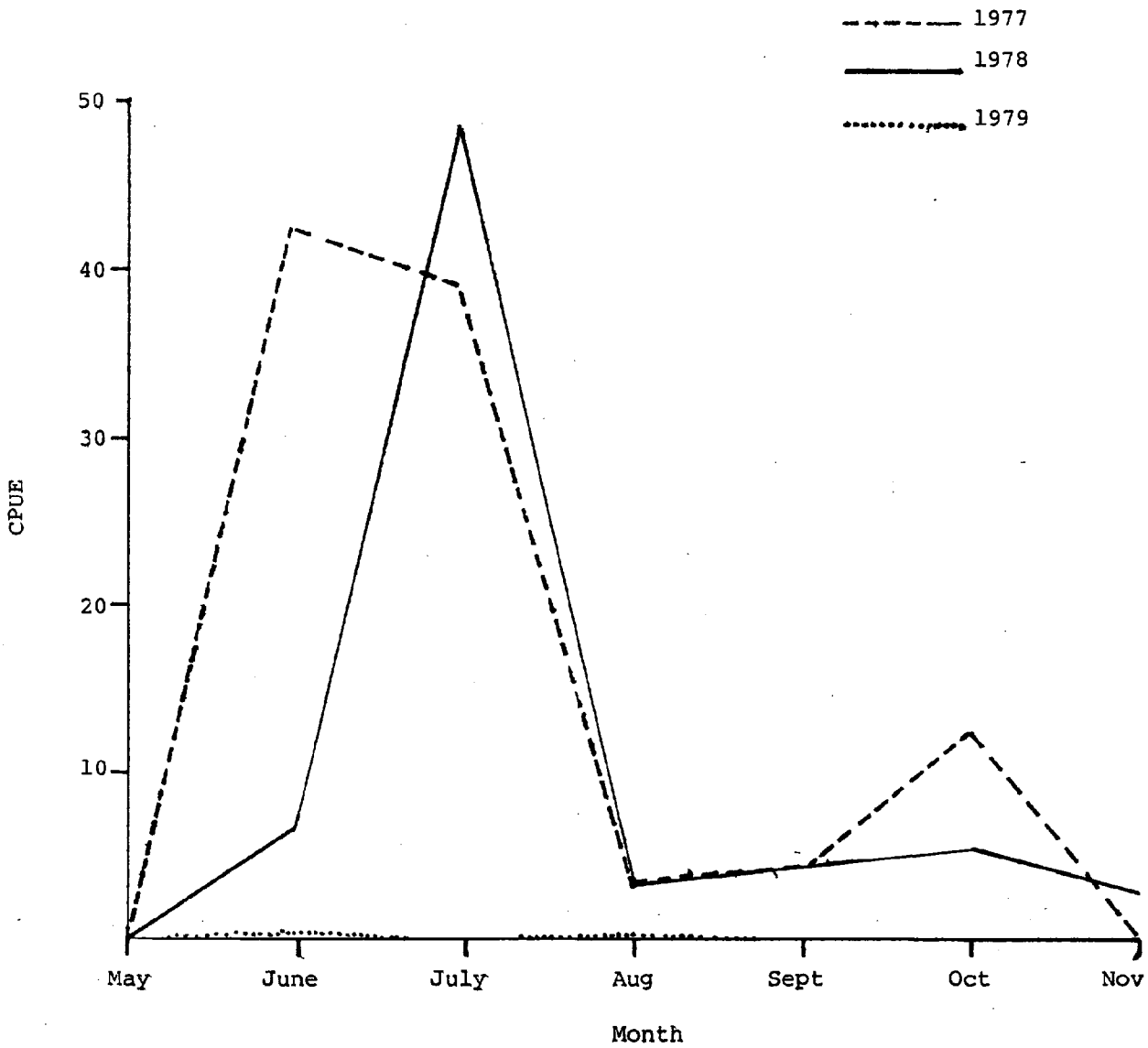

Figure 5. - Juvenile blueback herring catch-per-unit-effort by month (May-Nov) in the Tar-Pamlico River, NC, 1977-79.

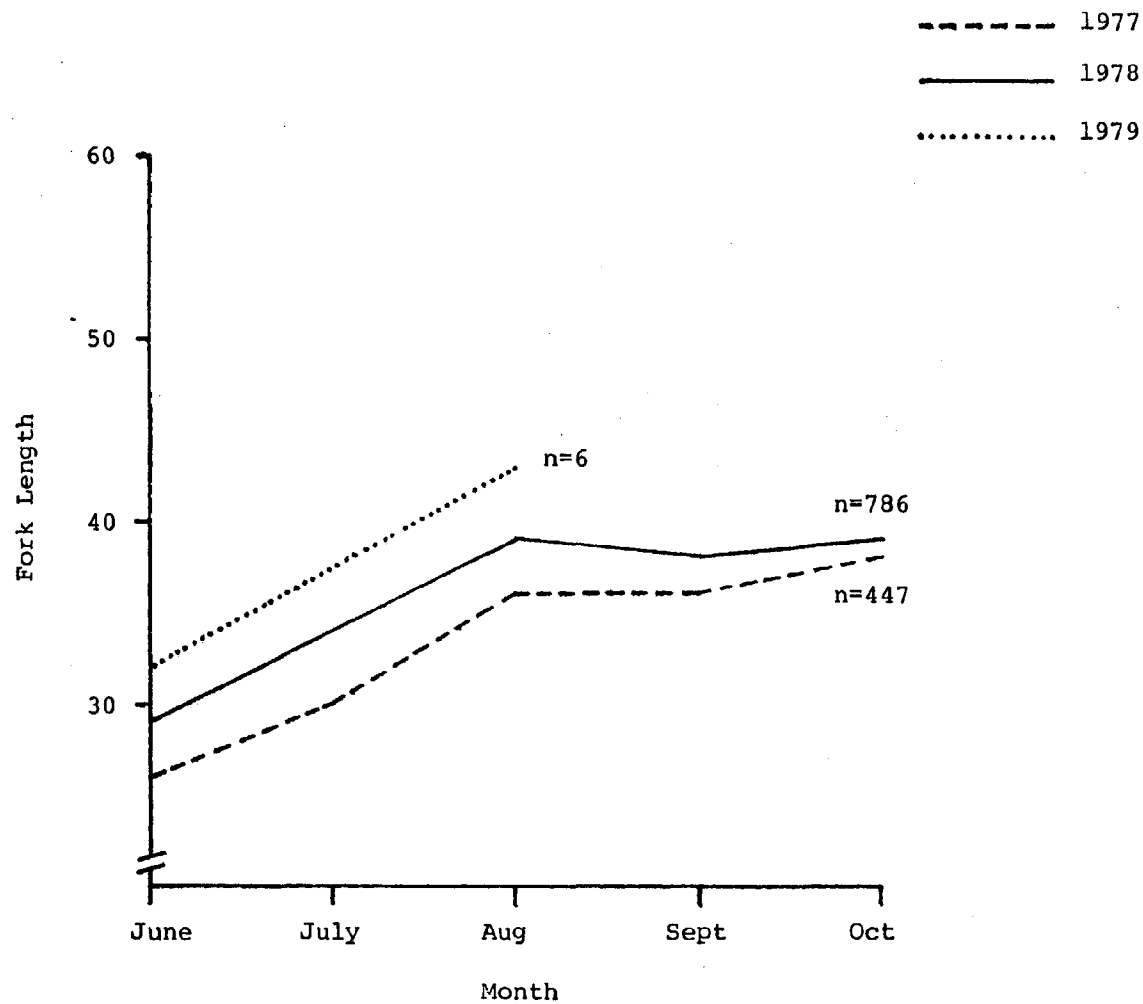

Figure 6. - Mean fork length of juvenile blueback herring by month, June-Oct, in the Tar-Pamlico River, NC, 1977-79.

Table 2. - Relative abundance of juvenile blueback herring captured by wing trawls in the Tar-Pamlico River, NC, May-October, 1977-1979.
(Only similar 1977-1979 wing trawl stations are used for data)

	Tar-Pamlico River					
	1977		1978		1979	
	N	CPUE	N	CPUE	N	CPUE
May	0*	0.0	0	0.0	0*	0.0
June	1575	42.6	232	6.62	4	.11
July	2775	39.1	1712	48.91	0*	0.0
August	324	3.9	116	3.31	2	.06
September	369	4.1	150	4.28	0	0.0
October	884	12.3	187	5.34	0	0.0
Total	5927	16.7	2397	11.4	6	.03

* No sampling performed

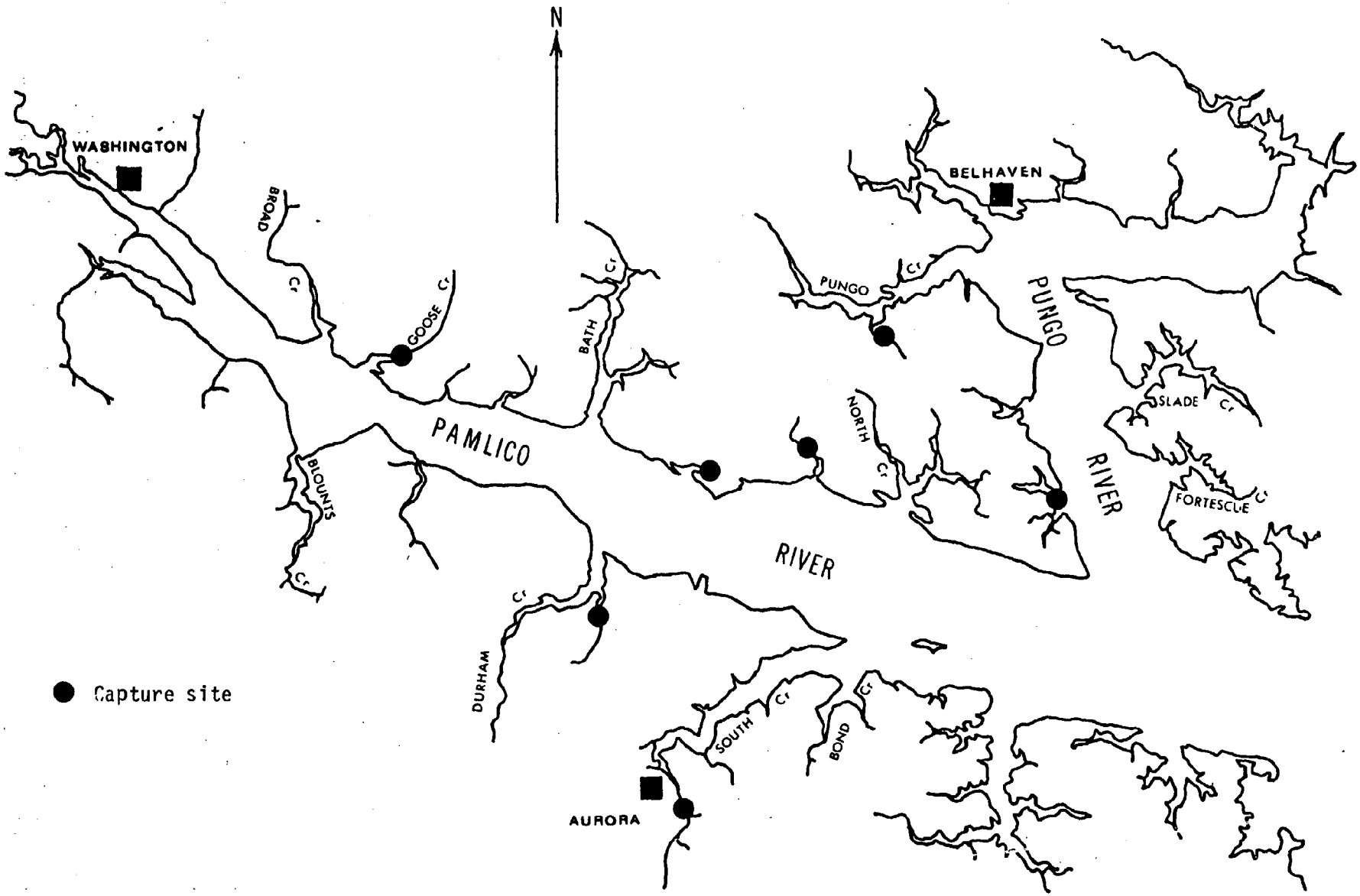

Figure 7. - Capture sites of juvenile alewife in the Tar-Pamlico River, NC, 1977-79.

ranged in size from 35-125 mm and were caught from June through November. One yearling male alewife (125 mm) with developed gonads were captured 12 May 1978 near Broad Creek on the Tar-Pamlico, a phenomenon previously reported by Foerster and Goodbred (1978)in Upper Chesapeake Bay and also noticed in Albemarle Sound (Harrel B. Johnson, personal communication).

American shad

Marshall (1976) reported capturing juvenile American shad in the Tar-Pamlico River from Hardee Creek to Tranter's Creek; however, only 11 juveniles were caught, preventing nursery area identification. Far more juvenile American shad (204) were caught in the Tar-Pamlico River during 1977-79, which allowed delineation of nursery areas for the first time. Approximately 90% of the shad were caught from Hardee Creek to the Cannon Swamp area during July and August. Juvenile shad were also caught in the lower reaches of the Tar River and in the Pamlico River near Washington (Figure 8). The juvenile American shad ranged in size from 29-67 mm, with most of the fish being caught during July and August.

Hickory shad

Only six juvenile hickory shad were caught in the Tar-Pamlico River during 1977-79. All juveniles were caught upstream from Chocowinity Creek (Figure 9). Fork lengths ranged from 36-62 mm, with all the juveniles being caught in June.

Striped bass

Monthly juvenile sampling during 1977-79 yielded 37 striped bass juveniles, with a size range of 35-165 mm. All the young striped bass were caught in 1978 and 1979. A majority (88%) of these fish were caught in July at a size range of 35-65 mm. Four were caught in August (range: 75-85 mm), and one in November (165 mm). In addition, two yearling stripers were caught near Bath Creek during May 1979 at 245 and 275 mm. Juvenile stripers were caught from above Washington in the Tar River to the Pungo Creek area in the Pungo River (Figure 10) at salinities of 0-4.5 ppt. Highest catches were recorded from Broad Creek and South Creek.

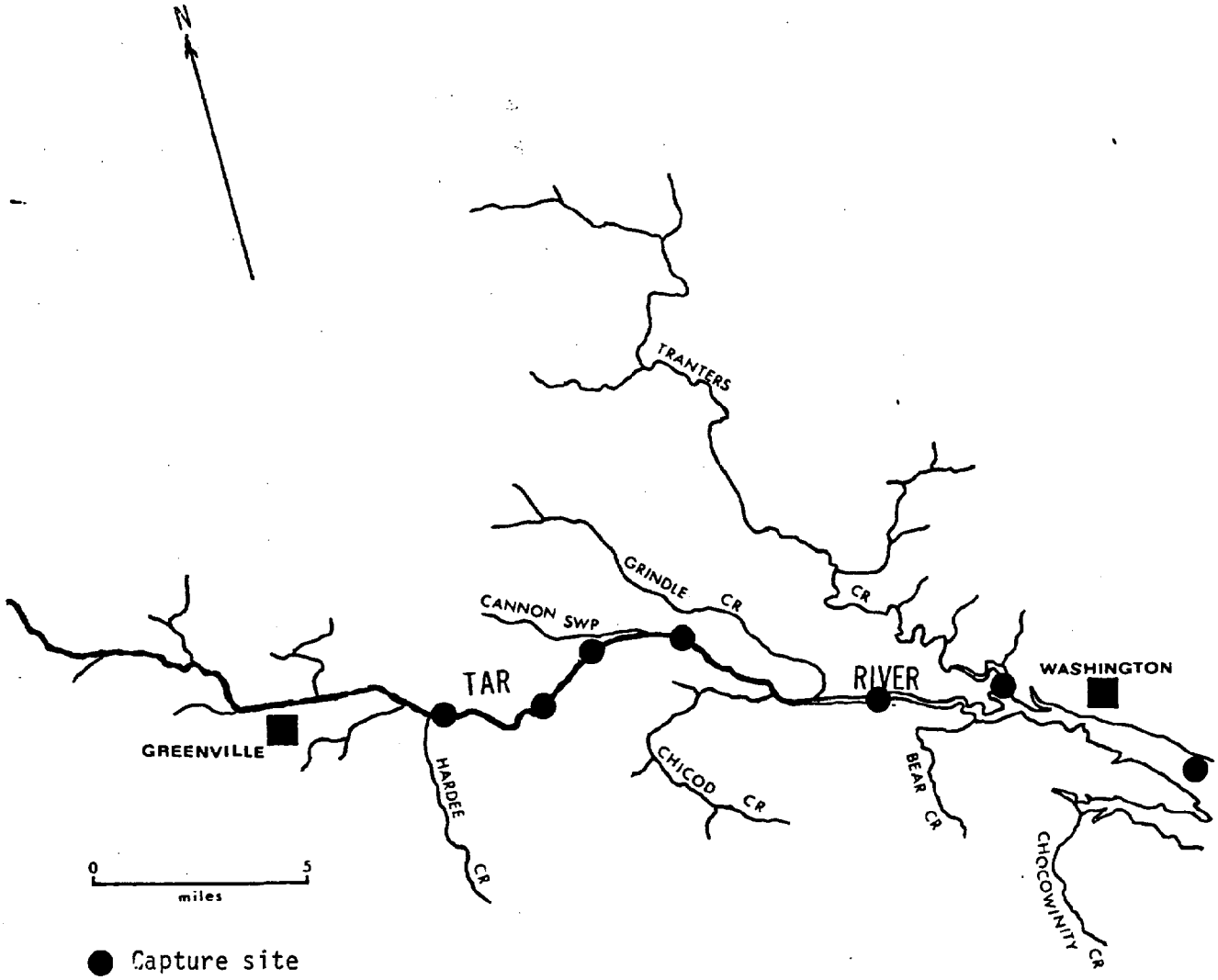

Figure 8. - Capture sites of juvenile American shad in the Tar-Pamlico River, NC, 1977-1979.

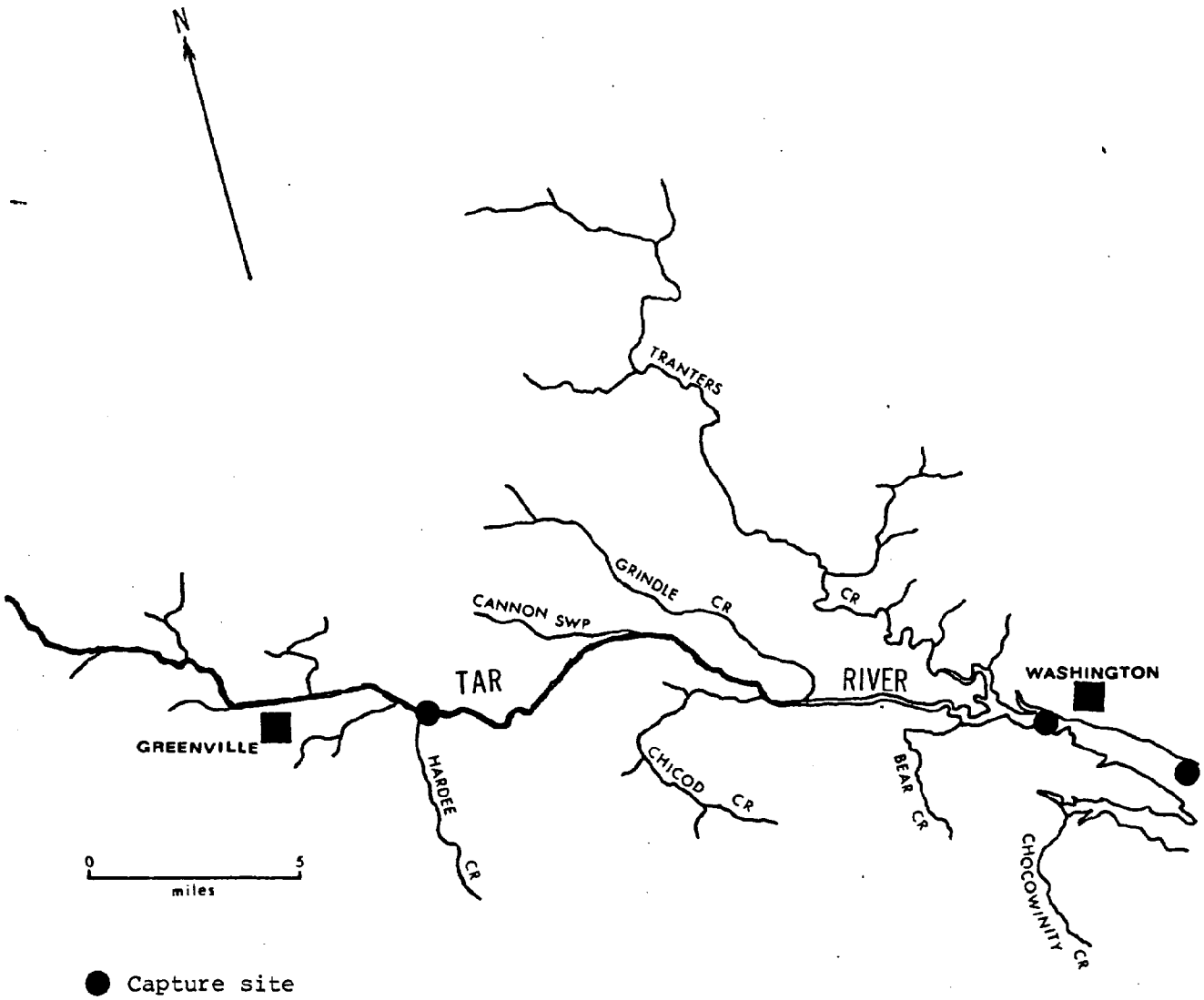

Figure 9. - Capture sites of juvenile hickory shad in the Tar-Pamlico River, NC, 1977-79.

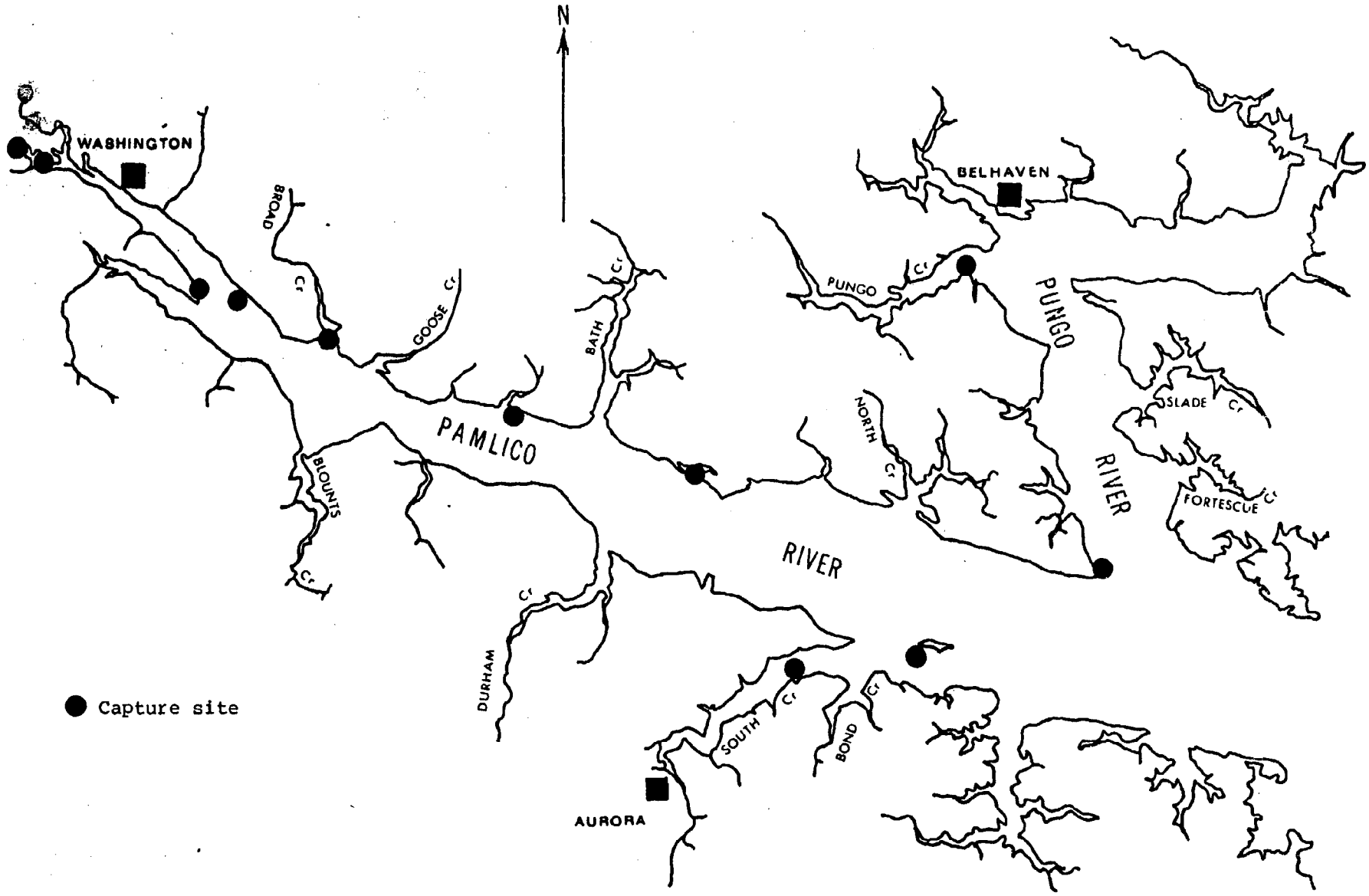

Figure 10. - Capture sites of juvenile and young-of-the-year striped bass in the Tar-Pamlico River, NC, 1977-79.

The juvenile striped bass appeared to show no preference for fresh or brackish water. Interestingly, most (70%) of the young striped bass from the Tar-Pamlico River were caught with seine, usually over sandy bottoms and near grass beds. Although striped bass juvenile numbers were low, the catch in 1978 appears to be significant. No young striped bass had been reported since 1974, when a stocking program influenced juvenile catches. The capture of juvenile striped bass in 1978 provides the first possible picture of young striped bass nursery areas in the Tar-Pamlico River. The juvenile catches in the Tar-Pamlico appear indicative of a successful spawning season in 1978, relative to previous years and 1979.

Atlantic sturgeon

No young Atlantic sturgeon were caught in the study area during 1977-79.

Adult Fish Sampling

Blueback herring

Gill net sampling and commercial fish house sampling produced 245 blueback herring scale samples for age examination. Results from 1979 are shown in Tables 3 and 4, while Tables 5 and 6 show the results from 1978-79. No blueback herring were sampled for age analysis in 1977. Age structure closely resembles that from the Neuse River and previous Tar-Pamlico River studies. The predominant male ages were four and five, and the females, four, five and six. Fifty-five percent of the female blueback herring were repeat spawners, while only 22 percent of the males spawned previously. Reasons for the discrepancy between sexes are unknown, for Marshall (1976) found that 59 percent of the females and 71 percent of the males showed evidence of repeat spawning in the Tar-Pamlico River after examining 1,099 blueback herring scale samples.

Alewife

Very few alewife (35) were examined for age analysis during 1977-79. The majority of the fish sampled were four and five years old and had not spawned previously. Alewife were very rarely encountered when sampling commercial fish houses on the Tar-Pamlico River.

Table 3. - Age and spawning frequency of blueback herring in the Tar-Pamlico River, 1979.

Spawning marks	0		1		2		3		4		Total	
Sex	M	F	M	F	M	F	M	F	M	F	M	F
Age												
III	1										1	0
IV	66	13									66	13
V	38	13	24	5	2						64	18
VI			6	4	10	13	1	1			17	18
VII					2	1	3	4			5	5
VIII										1	0	1
Total	105	26	30	9	14	14	4	5	0	1	153	55
Percent	69	47	20	16	9	26	2	9	0	2		

Table 4. - Size and age composition of blueback herring in the Tar-Pamlico River, 1979.

Age	Total number		Percent of samples		Mean fork length(mm)		Length range(mm)	
	M	F	M	F	M	F	M	F
III	1	0	1	0	232	-	-	-
IV	66	13	43	24	242	253	229-268	245-282
V	64	18	42	33	255	259	235-270	247-277
VI	17	18	11	33	261	270	240-274	242-288
VII	5	5	3	9	264	285	242-274	278-292
VIII	0	1	0	2	-	290	-	-
	153	55						

Table 5. - Age and spawning frequency of blueback herring in the Tar-Pamlico River, 1978-1979.

Spawning marks	0		1		2		3		4		Total	
Sex	M	F	M	F	M	F	M	F	M	F	M	F
Age												
III	1										1	0
IV	81	19									81	19
V	43	26	8	12	4	1					55	39
VI			7	4	11	15	1	1			19	21
VII					2	1	3	4			5	4
VIII								1			0	1
Total	125	45	15	16	17	17	4	6			161	84
Percent	78	54	9	19	11	20	2	7				

Table 6. - Size and age composition of blueback herring in the Tar-Pamlico River, 1978-1979.

Age	Total number		Percent of samples		Mean fork length(mm)		Length range(mm)	
	M	F	M	F	M	F	M	F
III	1	0	1	0	232	-	-	-
IV	81	19	50	23	244	254	229-268	245-282
V	55	39	34	46	256	264	235-270	247-282
VI	19	21	12	25	261	270	240-268	242-274
VII	5	4	3	5	264	285	242-274	278-292
VIII	0	1	0	1	-	290	-	-
	161	84						

American shad

A total of 280 American shad were sampled for age determination in the Tar-Pamlico River during 1978-79. Results from 1979 are presented in Tables 7 and 8, and the results from 1978-79 are presented in Tables 9 and 10. Age structure is very similar to that found in the Pamlico River area by Marshall (1976) and also to that seen in the Neuse River. Most (82%) of the male shad were four and five years old, while the majority (90%) of the females were five and six. Two percent of the total sample were repeat spawners, much smaller than the 19% reported by Marshall (1976).

Hickory shad

Very few hickory shad (30) were sampled for age determination on the Tar-Pamlico River. The commercial fishery for hickory shad is insignificant on the Tar-Pamlico. The majority of the fish sampled were three and four years old.

Striped bass

The number of striped bass encountered in the commercial fish house sampling were too small to make any statement pertaining to age structure in the Tar-Pamlico River.

Table 7. - Age and spawning frequency of American shad in Pamlico Sound and River, 1979.

Spawning marks	0		1		2		3		Total	
Sex	M	F	M	F	M	F	M	F	M	F
Age										
IV	19	20							19	20
V	19	148		4					19	152
VI	8	56		3					8	59
VII		1		1				1	0	3
Total	46	225	0	8	0	0	0	1	46	234
Percent	100	96	0	3	0	0	0	1		

Table 8. - Size and age composition of American shad in Pamlico Sound and River, 1979.

Age	Total number		Percent of samples		Mean fork length(mm)		Length range(mm)	
	M	F	M	F	M	F	M	F
IV	19	20	41	9	404	429	360-435	340-458
V	19	152	41	65	425	464	390-490	420-506
VI	8	59	17	25	452	486	430-510	450-575
VII	0	3	0	1	-	523	-	510-530
	46	234						

Table 9. - Age and spawning frequency of American shad in Pamlico Sound and River, 1978-1979.

Spawning marks	0		1		2		3		Total	
Sex	M	F	M	F	M	F	M	F	M	F
Age										
III	2								2	0
IV	32	28	1						33	28
V	84	257	6	9					90	266
VI	12	87	1	3	2				15	90
VII		2		1				1	0	4
Total	130	374	8	13	2	0	0	1	140	388
Percent	93	96	6	3	1	0	0	1		

Table 10. -Size and age composition of American shad in Pamlico Sound and River, 1978-1979.

Age	Total number		Percent of samples		Mean fork length(mm)		Length range(mm)	
	M	F	M	F	M	F	M	F
III	2	0	1	0	395	-	375-415	-
IV	33	28	24	7	408	435	350-435	340-371
V	90	266	64	69	428	464	390-490	417-520
VI	15	90	11	23	451	478	430-510	439-524
VII	0	4	0	1	-	515	-	490-530
	140	388						

SUMMARY

1. Nursery areas for juvenile blueback herring in the Tar-Pamlico River ranged from the Hardee Creek area to Blounts Creek.
2. Catch-per-unit-effort values indicate that juvenile blueback herring in the Tar-Pamlico River appeared to initiate movement into estuarine waters during August, 1977 and 1978.
3. Growth curves were plotted for juvenile blueback herring year-classes in the Tar-Pamlico River during 1977-79, being much flatter than those found previously in the Tar-Pamlico and also in the Neuse River during the corresponding time period.
4. Catch-per-unit-effort data indicate that the 1977 and 1978 year classes of juvenile blueback herring were significantly larger than the year class of 1979.
5. A majority of the juvenile alewife sampled in the Tar-Pamlico River came from the Pungo River, apparently preferring the higher salinity areas of the river system.
6. One sexually mature male alewife (125 mm)was captured in the Tar-Pamlico River in 1978, a phenomena also reported in Chesapeake Bay.
7. Juvenile American shad nursery areas were identified in the Tar-Pamlico River for the first time, extending from the Hardee Creek area to Washington.
8. Tentative juvenile striped bass nursery areas were identified in the Tar-Pamlico River during 1978, based on the distribution of 37 juveniles. These striped bass represent the first collection of naturally-occurring juveniles in the Tar-Pamlico River. Highest catches were recorded at Broad and South Creeks.
9. Adult blueback herring sampled in the Tar-Pamlico River during 1978-79 ranged in age from three to eight years. Males were predominantly four and five, and females, four, five, and six. Twenty-two percent of the males and 55% of the female blueback herring were repeat spawners.
10. Adult American shad sampled in the Tar-Pamlico River during 1978-79 ranged in age from three to seven years. Males were dominated (82%) by four and five year olds and females (90%) by five and six year old fish. Two percent of the total sample were repeat spawners.

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