1988 Survey & Inventory of the Fishes in the Anacostia River Basin, Maryland

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ABSTRACT

Fish populations in the Maryland portions of the Anacostia River Basin were studied during spring, summer and fall of 1988. Assessments of fishery conditions were conducted to provide information necessary for incorporating aquatic resource concerns into ongoing restoration efforts in the Anacostia Basin.

A survey to document the extent of migration of anadromous fishes into the basin was performed during the spring. Eight blockages to migration were monitored using electrofishing techniques. Two blockages were found which prevented anadromous fish migration into significant portions of potential spawning areas in the basin. Seventeen additional structures located upstream from current final blockages remain as potential blockages to migration. Four migratory fish species, alewife herring (Alosa pseudoharengus), blueback herring (Alosa aestivalis), white perch (Morone americanus), and striped bass (Morone saxatilis) were collected during the survey. Of these species, alewife herring and white perch were the most abundant species. Striped bass were rare with just two non-spawning individuals being collected. No yellow perch (Perca flavescens) were captured at the sampling areas.

Shore seining and electrofishing collections of resident fish populations were conducted at twenty-six sampling sites within the Anacostia Basin during the spring, summer, and fall. Included in these sample locations are twenty-three sites which were sampled in 1948 and again in 1972. Trend assessments of resident fish populations found significant increases in species diversity with a concurrent increase in the number of pollution intolerant species and decrease in pollution tolerant species, indicating that fisheries' habitat has improved since the two prior studies. Fifty two species were collected including seventeen species which were not collected in the 1948 or 1972 studies.

Although most tributaries in the basin have shown signs of improvements, Sligo Creek continues to exhibit low species diversity. Lower Beaverdam Creek, which was not sampled in 1948 or 1972, was found to have a fish species assemblage primarily composed of pollution tolerant fishes and is characterized as poor in terms of current fisheries habitat.

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INTRODUCTION

The Anacostia River is a tributary to the Potomac River which flows through large metropolitan communities in Maryland and the District of Columbia. In the 1800's, the Anacostia River was the site of a major east coast agricultural port which received tall sailing ships of commerce. Unfortunately, the Anacostia River has suffered a history of abuse and neglect which has left many areas of the watershed in very poor shape. Currently, the river channel, which once permitted the deep keels of tall sailing ships, has silted to less than two feet in depth at some areas.

Maryland's portion of the Anacostia basin comprises 145 of the 170 square miles, approximately 70% of the watershed. Its ecological habitats are diverse and include steep running piedmont streams, falls, meandering coastal floodplain streams, marshes, wetlands and tidal waters. One of the Anacostia's headwaters, Paint Branch, supports the last naturally reproducing trout population in the Washington metropolitan area, found just outside of the Washington beltway. However, large portions of the watershed have undergone urbanization and the remaining rural areas are increasingly subject to development. The water quality of the Anacostia as it runs to its confluence with the Potomac River in Washington, D.C., becomes poor due to the effects of urbanization . A study by Deitemann (1972) found a significant decline in fish populations since 1948. Deitemann concluded that "If current fish diversity trends continue into the future, it would be reasonable to expect only a few small species of minnow and the American eel to be present in the upper basin by 1985".

The recent efforts directed at restoring the Chesapeake Bay have helped to focus attention upon the plight of urban watersheds such as the Anacostia. As part of a new commitment to clean up the Anacostia River, the Interstate Commission on the Potomac River Basin, under the funding of the Maryland Department of Natural Resources, is conducting a two year study of the fisheries resources in the Anacostia. The purpose of this study is to incorporate an improved understanding of fisheries and other aquatic resources into the restoration efforts of the watershed. Information obtained from this study will help to provide guidance for improvements in the habitat quality of the river, providing the Anacostia community with a more desirable fishery resource and creating more opportunities for the enjoyment of a productive urban recreational fishery. This document is a presentation of the first year's findings of fish distributions and abundances.

MIGRATORY FISH STUDY

Materials and Methods

Two different categories of fishes, migratory (anadromous only) and resident (non-anadromous) fishes are found in Maryland portions of the Anacostia. Each of these types of fishes have different habitat criteria and require different management strategies and therefore different sampling criteria. Therefore, sampling for fishes was partitioned into two major areas of effort; Migratory and Resident.

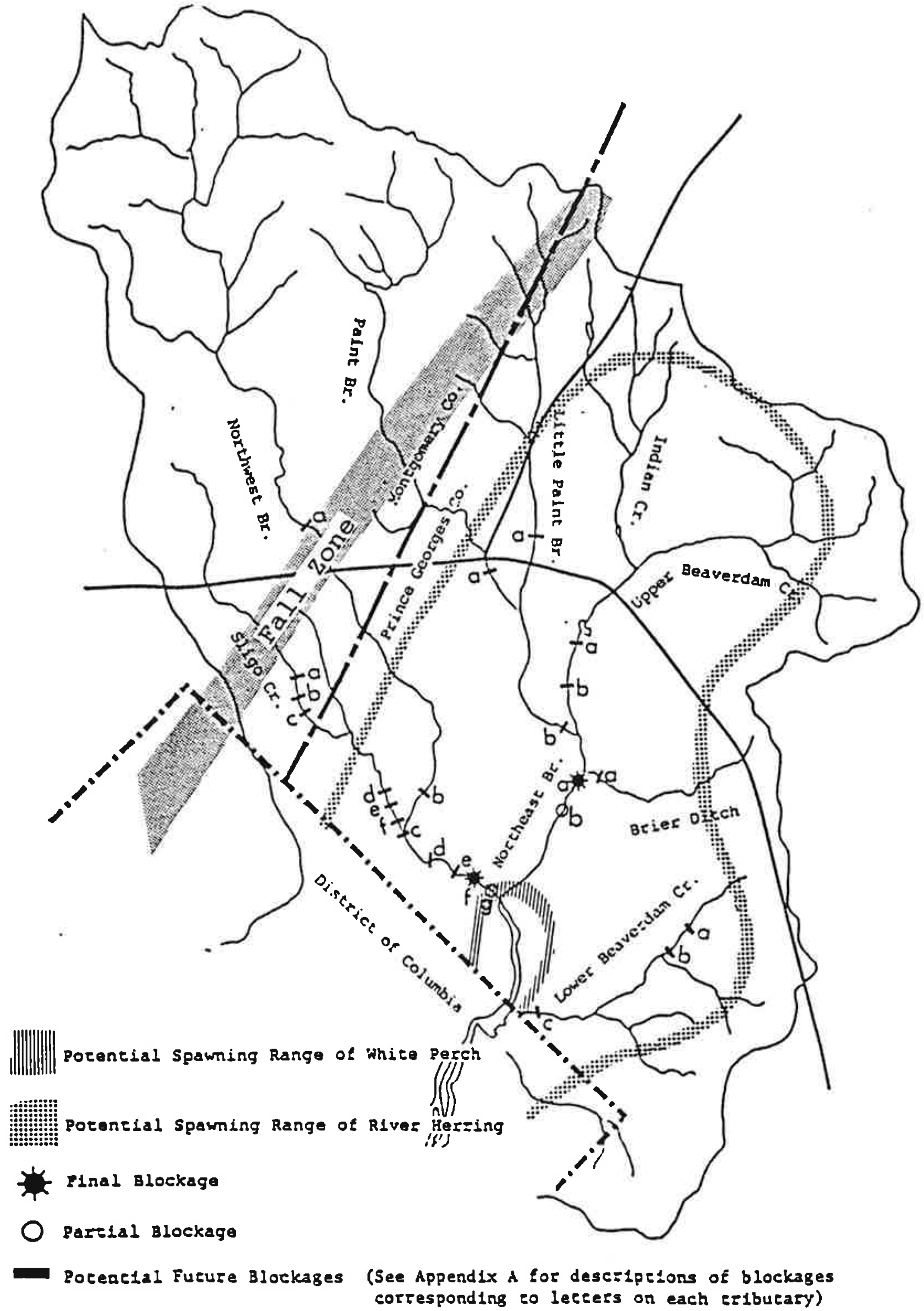
The major goals of the migratory survey were to determine what migratory fish were found in the Maryland tributaries of the Anacostia and to document the apparent limits to migration currently encountered by these fishes.

During January and February of 1988 an extensive field screening was performed along the ten major tributaries of the watershed. Stream walks along Sligo Creek, North West Branch, Paint Branch, Little Paint Branch, Indian Creek, Upper and Lower Beaverdam Creeks, Brier Ditch, and the North East Branch (Figure 1) were conducted to inventory potential blockages to fish migration. In the spring, sampling at these potential stream blockages was conducted to determine the extent of migratory runs. Sampling was initiated before the predicted start of any migratory runs, in an attempt to document the complete window of time during which migratory fishes were using the resource. The predicted arrival time of migratory fish was mid-March. This prediction was based upon the author's experience in the area (Cummins, 1985) combined with information gathered from fisheries personnel (personal communication, Jean Fulton, Marta Namack) working for the District of Columbia who have been studying migratory fishes in waters downstream from the Maryland portions of the watershed since 1986.

Blockages were sampled twice weekly from March 8th until May 5th. All sampling occurred during daylight hours using a Smith-Root Model 15-A generator powered backpack electrofishing unit operating with direct current. One person operated the electrofisher while one other person netted stunned fish with a Smith-Root Model EDB-83-TD dip net with a 11" x 17" (27.9 cm. x 43.2 cm.) opening, 10" (25.4 cm.) bag, 0.25" (6.4 mm.) knotless mesh bag mounted on a six foot pole. Sampling areas at the blockages were intermittently shocked for a total duration of approximately six minutes. The output power was field adjusted to account for variation in stream conductivity.

A major object of each collection trip was to determine the extent of upstream migration occurring on that particular day. Therefore, on each sampling day the collections were initiated at the most downstream blockage of the tributaries. Each potential stream blockage was then electrofished on the

Figure 1. Map of Blockages to Migratory Fishes in the Anacostia Basin in Maryland with Potential Spawning Ranges.



downstream side. Sampling was then repeated at the next upstream blockage and thus proceeded until a blockage was reached at which no migratory fishes were captured at either side of that blockage. Blockages above these points were not sampled.

Collected fish were counted, measured for length and weight, sexed by evidence of row or milt, notes were taken on their general condition, dorsal fins were clipped to identify that they had been captured, and then they were released. Attempts were made to capture all fish sighted during electrofishing. When schools were so large that capture of all individuals was not possible or desirable they were subsampled and records were kept on the estimated size of the school observed responding to electrofishing. Water temperature, clarity, and general flow and weather conditions were recorded at each site.

Results of Migratory Fish Sampling

An inventory and description of potential blockages to migration is available in Appendix A. Figure 1 shows the locations of the twenty-five potential blockages inventoried during the spring of 1988. This map also includes the estimated natural or potential range of migratory fish species in the Maryland portions of the basin. The final blockages shown on the N.E. and N.W. Branches were at two weir-like drop structures constructed by the U. S. Army Corps of Engineers (Baltimore District COE, 1975) which are intended for velocity dissipation. A total of eight of these twenty-five blockages were sampled for migratory fish. The remaining seventeen blockages were at least one blockage above the final migratory blockage for a particular tributary.

Although sampling of the spawning runs of migratory fishes was initiated on March 8th, the first migratory fish, in this case alewives, were not collected until March 25th. This was somewhat later than the March 15th estimated time of arrival, and may have been due to reduced flow attraction resulting from an extended period of dry weather which occurred in March.

Two major blockages to migration were documented. In the N.W. Branch a metal weir-shaped drop structure immediately upstream from the 38th Street bridge prevented any upstream migration to other portions of that tributary and Sligo Creek. Herring were captured during four of thirteen sampling events at this weir yet no migratory fish were ever collected at the gabion dam located approximately 1000′ upstream. In the N.E. Branch, a similar drop structure, just downstream from Brier Ditch near the Maryland National Capitol Parks and Planning Commission headquarters, prevented upstream migration further into the N.E. Branch, including Paint Branch, Little Paint Branch, Indian Creek, Upper Beaverdam Creek, and Brier Ditch. Herring were collected at the base of this weir during five of fourteen sampling events yet no migratory fishes were collected at the next upstream blockage in Paint Branch or Brier Ditch.

No migratory fishes were captured in Lower Beaverdam Creek above or below the first potential migratory blockage at Kenilworth Avenue. The absence of migratory fish at this blockage was unexpected since no physical impediments to migration exist before this blockage and it is less than a mile from the mouth of Lower Beaverdam Creek at the tidal rivers mainstem.

Sampling was concluded on May 20th, at the end of the migratory runs. Figures 2-4 show the number of individuals of alewives, blueback herring and white perch, respectively, captured during the course of spring migratory sampling.

Figure 2: Numbers of Alewife Herring (*Alosa pseudoharengus*) Captured During Sampling in the Maryland Portions of the Anacostia River in 1988

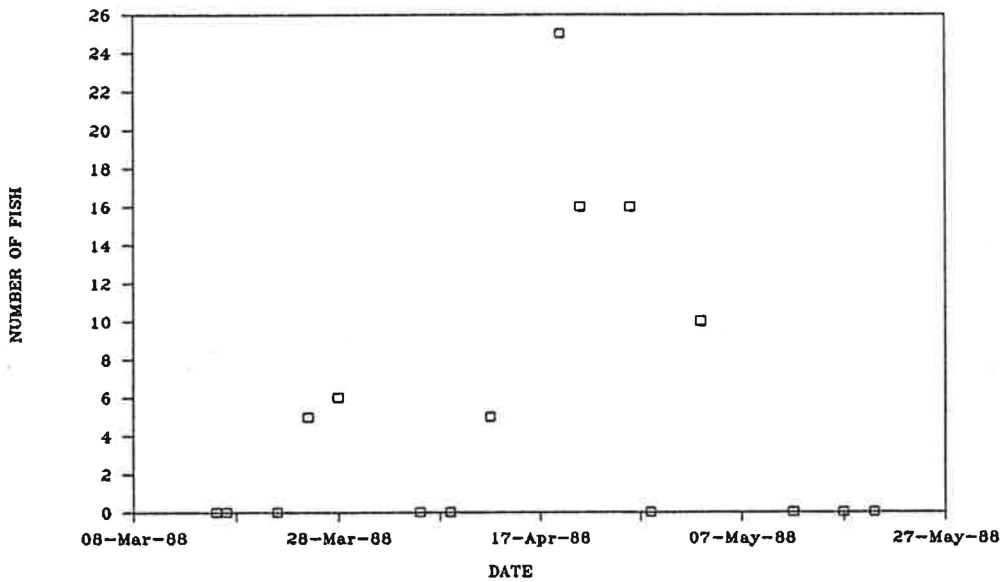


Figure 3: Numbers of Blueback Herring (*Alosa aestivalis*) Captured During Sampling in the Anacostia River in 1988

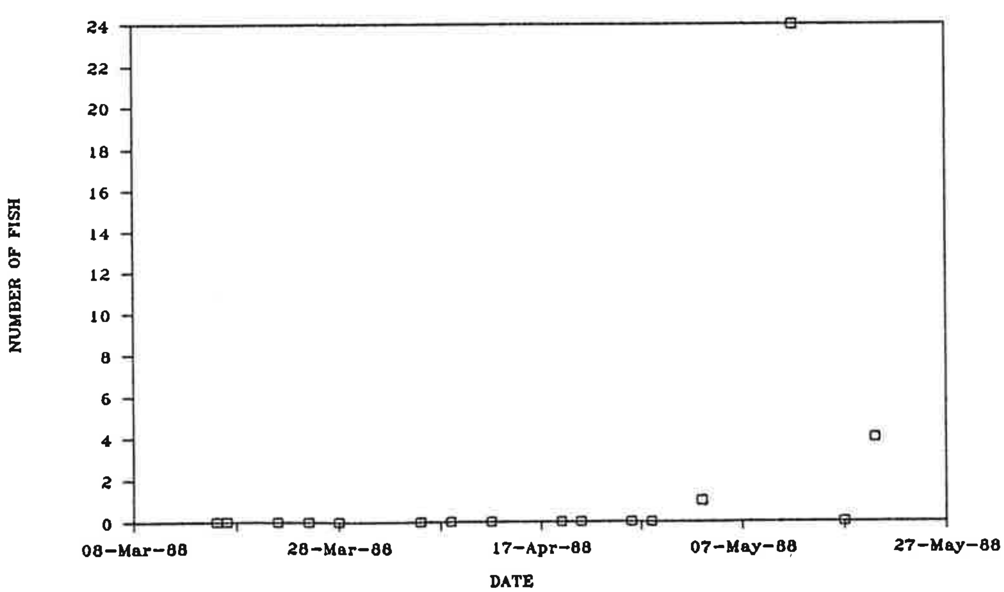
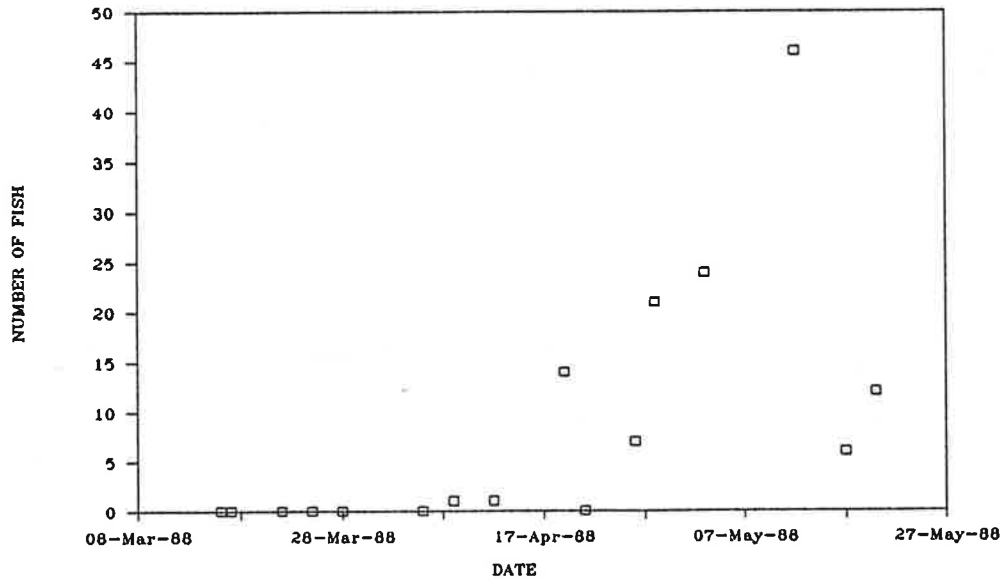


Figure 4: Numbers of White Perch (*Morone americanus*) Captured During Sampling in the Maryland Portions of the Anacostia River in 1988



Figures 5-7 give the lengths, weights, and sexes of alewives, blueback herring and white perch, respectively, captured during the course of spring migratory sampling.

Figure 5: Lengths, Weights, and Sexes of Alewife Herring (*Alosa pseudoharengus*) Captured During Sampling in the Maryland Portions of the Anacostia River in 1988

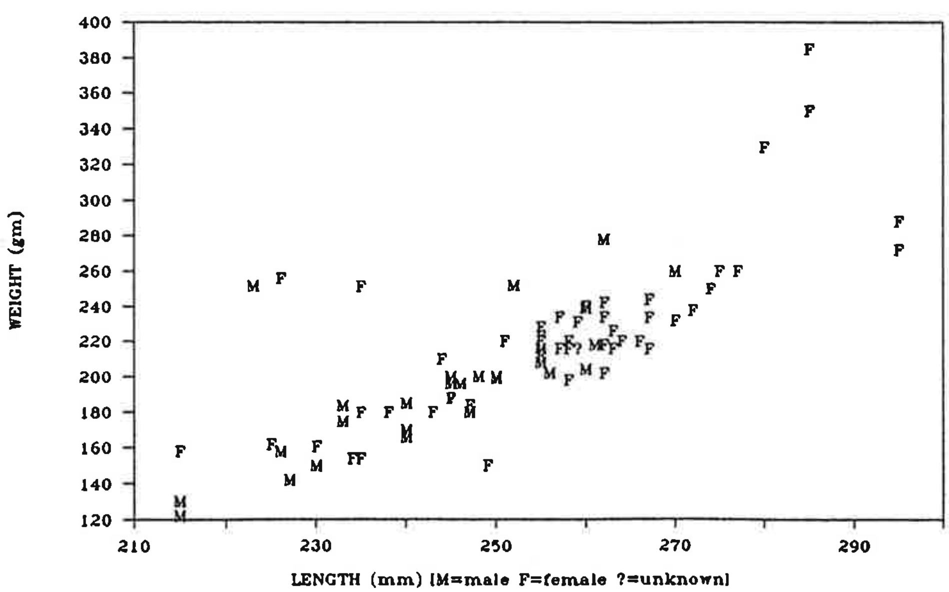


Figure 6: Lengths, Weights, and Sexes of Blueback Herring (Alosa aestivalis) Captured During Sampling in the Maryland Portions of the Anacostia River in 1988

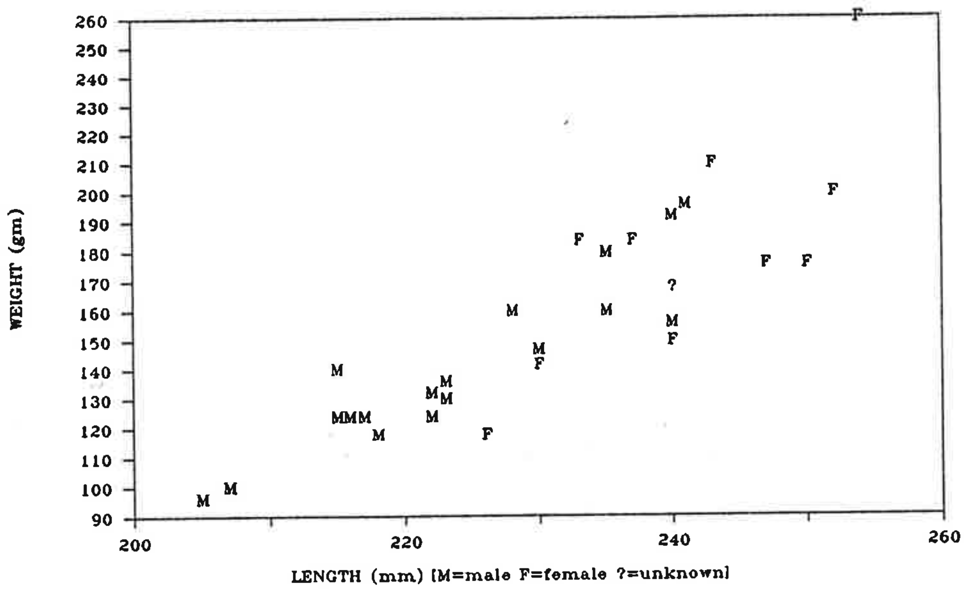
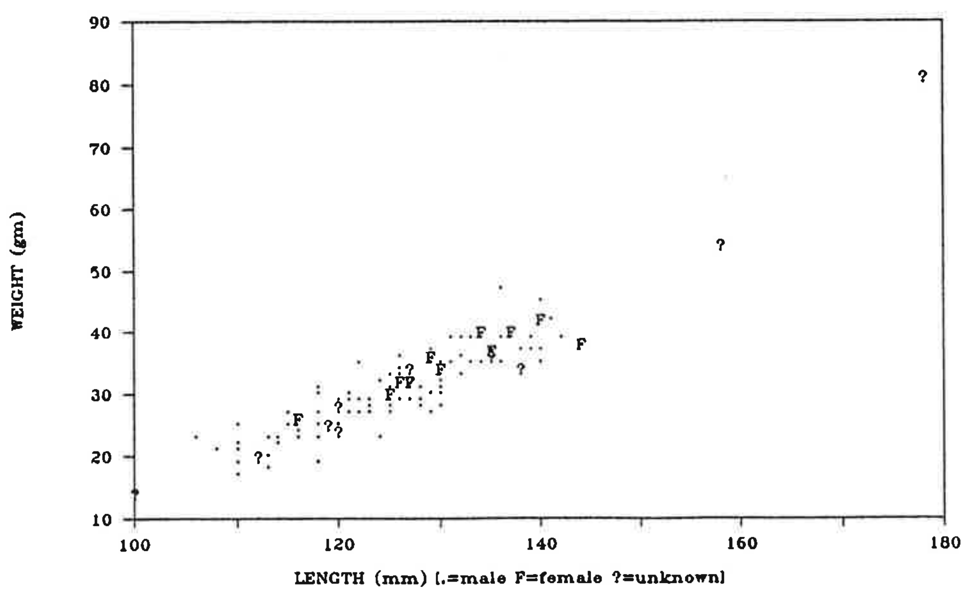


Figure 7: Lengths, Weights, and Sexes of White Perch (Morone americanus) Captured During Sampling in the Maryland Portions of the Anacostia River in 1988



No large schools of alewife herring, blueback herring or white perch were observed during sampling. Therefore, the current abundance of these species can be characterized as low to moderate. No yellow perch were collected this spring during any part of our sampling. Striped bass were very rare, with only two being captured on May 20th near the Route 1 Bridge on the North West Branch.

Herring numbers were too low to draw any strong inferences on sex distribution but white perch populations were predominately male. Of all fish in which sex was established, the alewife sex ratio was 38% male to 62% female (n = 81), the blueback herring sex ratio was 64% male to 36% female (n = 28) and the white perch populations were 90% male to 10% female (n = 119). All fish appeared healthy except for a few which had snagging scars. No fin clipped fish were recaptured.

Discussion of Migratory Fish Sampling

Large blockages, such as hydroelectric or reservoir dams, tend to be absolute, i.e. fish are simply not able to pass them unless a modification is made to allow for fish passage. Small blockages, such as road culverts, pipeline caps, or weirs are not always so absolute. These types of small blockages may or may not permit fish passage depending on a variety of factors including tide, flow, or the ability of a particular migrating fish to swim or leap. There are no large blockages within the potential migratory range of anadromous fishes in the Anacostia. However, a series of small blockages does exist in the Anacostia which is limiting migration into the area. An understanding of the complex nature of small blockages is critical to understanding the problems faced by migratory fishes in the Anacostia.

The migratory spawning habitat of the Anacostia is dynamic and is affected by tidal amplitudes and meteorological events which can temporarily change flow and channel depth considerably. Also, the migratory fishes in the Anacostia are not avid jumpers. Herring and white perch are less inclined to leap over small structures the way other fish, such as the salmonids, will. Therefore, the combination of dynamic flow characteristics and the poor leaping ability of local migratory fishes presents more complex problems in the characterization and identification of small blockages. The restrictive nature of small blockages can be a matter of inches. Several types of small blockages were considered for inventory purposes. In order to clarify blockage descriptions and reduce confusion, a classification system of blockages was established;

1. The final blockage to migration of a particular species is defined for the purposes of this study as the most upstream blockage at which that species is found. Although not mutually exclusive, two conditions of this type of blockage can exist; current and natural limits to migration. The current final limit to migration was determined for 1988 when repeated evidence of a species are encountered below a blockage with no evidence of this species being encountered above that blockage. The natural final limit to migration had to be estimated because historical information on migration in the basin predating the construction of many of the blockages could not be found. Rough natural boundary estimates were derived by selecting areas where gradients on U.S.G.S. topographic maps appeared too restrictive for migration.

2. Conditional blockages to migration were considered to occur when migration was normally limited at a particular blockage but was not limited when the flow increased and/or head decreased at that blockage.

Changes in blockage height can occur due to a range of conditions caused by tidal and/or rainfall events. These changes are important in the freshwater tidal spawning areas of the Anacostia where tidal amplitude ranges about 2.5 feet. Conditional limits were not as readily derived in the field as final blockages, but in this study they were roughly determined to occur when a species was encountered above a blockage only after a significant change in flow conditions occurred at that blockage.

3. Partial blockages to migration were considered as blockages where passage was possible but was difficult, thereby significantly reducing the number of fish passing beyond that blockage point. A good example of this type of blockage existed this year on the Anacostia River below the Route 1 bridge over the North West Branch. At this point a 50' concrete apron covers the branch which alters the flow conditions. The average depth we encountered above the apron was about 18 inches while water flowing over the apron was reduced to about 2-3 inches depth. Thirty-four herring were collected downstream from this apron on seven out of fifteen sampling events, however, only nineteen herring were collected at the next blockage above this apron during four of thirteen sampling events (at 38th Street). Apparently, this abrupt reduction in depth made passage by herring during this year's average spring flow conditions difficult. Spawning herring are about 2.5 to 3.5 inches measured dorsal-ventrally. To pass over this apron the fish would either have to wait for higher flow conditions or swim over the apron on their sides. We found fairly large schools of herring bunched up below this apron but had only limited success in capturing fish above the apron during average flows. Therefore during the spring of 1988's average flow this apron was a partial blockage, permitting only a small percentage of herring over it.

Combinations of these types of blockages can occur at the same structure depending upon the fish species which encounters it. White perch were also concentrated at the foot of the N.W. Branch and Route 1 blockage (just described under partial blockages), yet no white perch were found above this blockage. Therefore, this blockage is species specific, i.e. it was both a partial blockage to herring and a final blockage to white perch.

The following is a list of the documented migratory fish blockages and a description of their designated type:

1. In the N.W. Branch at Route 1, we found a partial blockage to herring with a final blockage to migration of white perch, although this area probably represents the natural migratory limit to white perch spawning.

The two striped bass collected during this survey were also found below this obstruction.

2. At 38th Street we found a final blockage to all species.

3. In the N.E. Branch at Riverdale Road, we found no blockage evident at what was an obstruction in the 1970's which had since been modified for fish passage.

4. Above the East-West Highway we found no blockage evident until we reached the weir behind the Maryland National Capitol Parks and Planning Commission (MNCPPC) headquarters. This weir was a final blockage to all species.

5. In Lower Beaverdam Creek at Kenilworth Avenue we sampled a probable conditional blockage. Although no fish were collected in Lower Beaverdam Creek, this blockage would probably not be an obstacle during high flows or at the high end of spring tides. After witnessing the disgraceful conditions of this tributary, with junk automobiles, tires and a multitude of miscellaneous junk covering the banks and stream bed, with black oily residue marking the high tide line, the apparent absence of migratory fish in this tributary is easy to speculate upon, yet hard to understand.

In the 1970's attempts to modify the final blockages shown on Figure 1 for the N.E. and N.W. Branches and several other blockages on the Anacostia were performed to permit passage of migratory fishes (Jay O'Dell, Maryland Department of Natural Resources, personal communication). The modifications to the drop structure below Riverdale Road (now referred to as the Pierce Wilson Fishway) were successful in 1988. The modifications to the two final blockages were not effective in 1988. It is apparent from Figure 1 that in 1988 a very significant portion of potential spawning habitat in the Anacostia watershed was closed to migratory fishes.

The seventeen blockages which were not sampled remain as potential migratory blockages until downstream blockages are removed or modified to permit fish passage. At that time these potential blockages can be field evaluated to determine if they represent actual blockages. However, due to their heights, there is a high probability that most of the potential blockages listed will not permit fish passage in their current condition.

Resident Fish Sampling

Materials and Methods of Resident Fish Sampling

The resident fish survey was primarily based upon temporal comparisons of current fish populations with those collected during two prior fisheries surveys of the watershed (Howden, 1948, Deitemann and Geraldi, 1972). In the spring and fall of 1948, Howden conducted a fisheries study at twenty-five stations in the Anacostia. Subsequently, in 1973 Deitemann & Giraldi re-sampled these sites again and compared their collections with Howden's. In the current study the same sites sampled in the 1948 and 1972 surveys were again re-sampled. This re-sampling permitted further temporal comparisons of fish communities in the Anacostia Basin which could be used to assess general conditions of the tributaries.

Resident fish sampling methodology was primarily a replicate of that used in earlier studies (Howden, 1948 and Deitemann and Geraldi, 1972), relying primarily upon shore haul seining. Sites were sampled in the following manner; 100 foot (30 meter) stream lengths were blocked at the upstream and downstream boundaries with 1/4" (6.3 mm) knotless mesh seines. A minimum of ten seine hauls employing a 20' x 4' x 1/4" (6.1 m. x 1.2 m. x 6.3 mm. knotless mesh) seine were then conducted within the blocked area. Collected fishes were kept in containers on the shore for identification and meristic tabulations.

With the exception of the use of block nets at each end of the sampling areas and a reduction in sampling area, this shore haul seining replicates the two prior studies sampling methodologies. Additional information was obtained following shore seining with the collection of fish remaining in the sampling areas using electrofishing.

Electrofishing was conducted using a Smith-Root Model 15-A generator powered backpack electrofishing unit operating with direct current. One person operated the electrofisher while one other person netted stunned fish with a Smith-Root Model EDB-83-TD dip net with a 11" x 17" (27.9 cm. x 43.2 cm.) opening, 10" (25.4 cm.) bag, 1/4" (6.4 mm.) knotless mesh bag mounted on a six foot pole. The areas within the blocked streams were shocked for a total duration of approximately six minutes. The output power was field adjusted to account for variation in stream conductivity.

It is important to note that <u>only</u> counts of fish collected by shore haul seine were used for temporal comparisons. The purpose of using backpack electrofishing was to improve the certainty of collecting a reliable sample of all fishes at each station and to provide a better understanding of the current fishery communities which could be used as a baseline for future studies.

Collected fish were identified to species, counted and placed in live wells. Fish not readily identifiable in the field were preserved and identified later in the laboratory. Length/weight measurements of selected game fishes (black basses, other sunfishes, pickerel, catfishes, and trout) collected by either method were also recorded. A voucher collection was kept of all species, excluding striped bass. Reasonable and conscientious attempts were made to live-release, in as good a condition as possible, all fish not kept for identification or voucher collection.

Figure #8 shows the approximate locations of the twenty-six[1] sites which were monitored. Twenty-three of the twenty-five original sites used in 1948 and 1972 were re-sampled at the same locations. Determinations of these locations was based upon descriptions provided by Howden and Deitemann in their earlier studies. These site descriptions were adequate enough to identify the general areas of the earlier sites. However, these descriptions were often not complete enough to identify the precise locations of the sampling sites. As an example, Site #13 was described as being "Paint Branch at Powdermill Road" (Deitemann, 1972). The preposition "at" does not tell you if the location is above or below the bridge. Neither does it describe how far upstream or downstream. Therefore, the general location of the sites was first identified by following as closely as possible the original descriptions, then the exact upstream and downstream boundaries of each site was set by this study. Site boundaries were marked in the field by painting landmarks and were resampled each season at these marked locations. All sites were sampled once during each spring, summer and fall season but were not sampled in the winter. All sampling was performed during daylight hours. Site descriptions and locations are provided in Appendix B.

Due to their close proximity to each other, two of the sites sampled in the prior studies, sites #15 and #16 on the Northwest Branch, were combined into one site located approximately midway between the two previous locations, now designated as Site #15/16. This reduction in effort was designed to help eliminate redundancies and to better allocate manpower resources. This helped to permit inclusion of two additional unstudied sites. One of these unstudied sites was located in the upper section of Sligo Creek (Site #26) and the other was in Lower Beaverdam Creek (Site #27). These additional sites were studied in order to improve the resolution of the conditions in the watershed.

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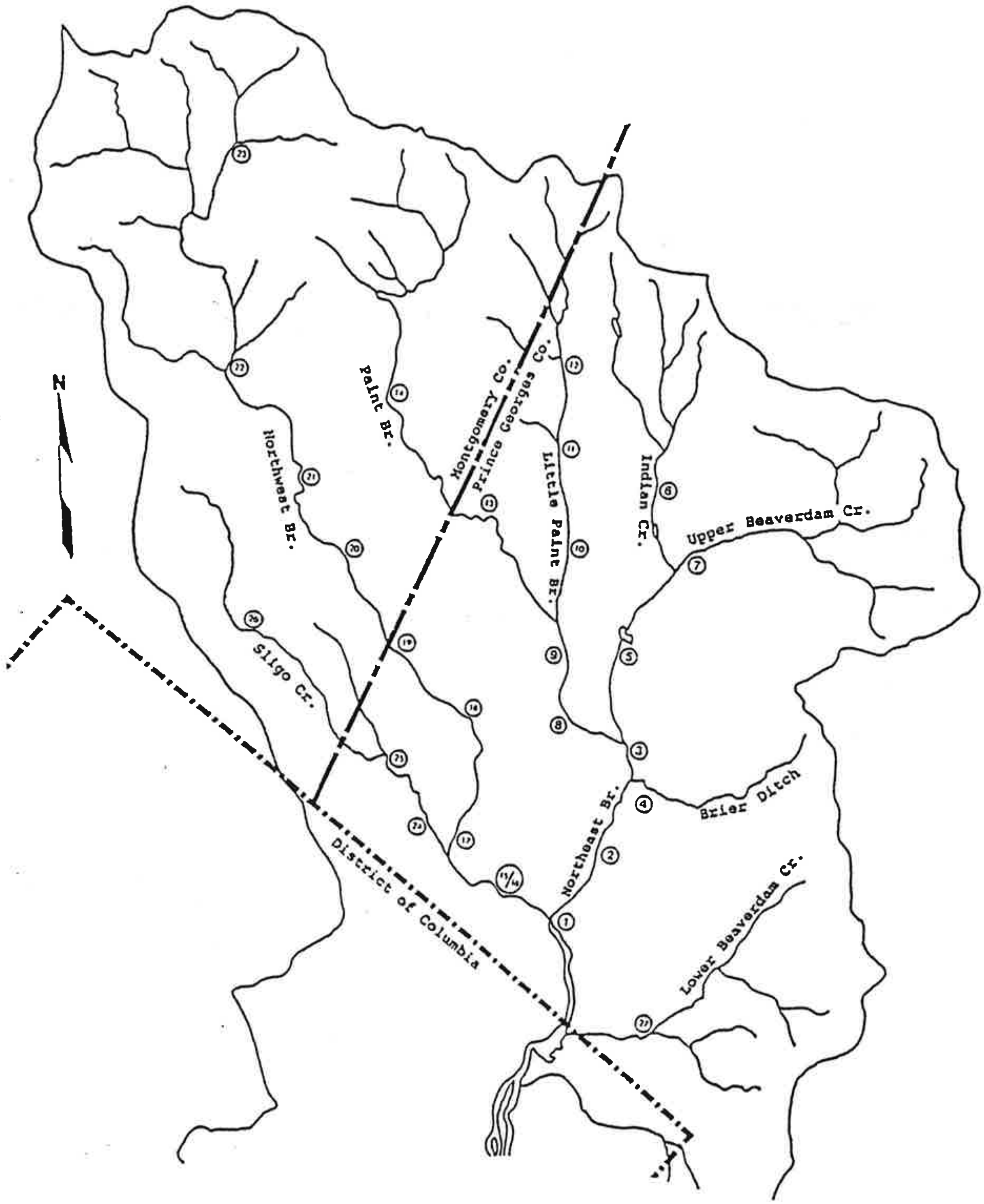
[1] Please note, although there are twenty six sites, site numbers run to twenty-seven due to the combining of Sites #15 and #16 into one site (#15/16). This allowed retention of the same site numbers as those used in the 1948 and 1972 studies, thereby reducing confusion when performing temporal comparisons.

Figure 8. Map of the Maryland Portion of the Anacostia River showing the approximate locations of the Twenty-six resident fish sampling sites.



Anacostia Basin, Maryland
Resident Fish Sampling Sites

Results of Resident Fish Sampling

Sampling of resident fishes was conducted between May 23 and November 15, 1988. A total of 26,971 individuals, representing 51 species and 15 families were collected, identified, and counted at the 26 sampling locations. (See Appendix C.)

A list of the fish species and the number of individuals captured by the two sampling methodologies can be seen in Table #1.

Table 1

Anacostia River: Resident Fishes Collected, 1988.

Species	Shore Seining # Ind.	Shore Seining # Sites		Electrofishing # Ind.	Electrofishing # Sites
1. A. Brook Lamprey	1	1		3	2
2. American Eel	1	1		204	23
3. Blueback Herring	5	1		3	1
4. Gizzard Shad	18	1		11	1
5. Rainbow Trout	1	1			
6. Eastern Mudminnow	4	2		10	2
7. Chain Pickerel	12	4		9	4
8. Common Carp	4	2		12	4
9. Goldfish	18	3		24	5
10. Silverjaw Minnow	538	13		24	7
11. Cutlips Minnow	417	18		205	16
12. River Chub	3	1			
13. Golden Shiner	304	11		6	2
14. Rosyside Dace	659	11		48	6
15. Ironcolor Shiner	80	14		30	3
16. Bridle Shiner	370	17		5	2
17. Swallowtail Shiner	7318	22		357	20
18. Rosyface Shiner	76	7		1	1
19. Spotfin Shiner	299	20		31	9
20. Satinfin Shiner	4582	22		329	22
21. Common Shiner	2142	19		40	9
22. Spottail Shiner	2987	20		238	18
23. E. Silvery Minnow	30	10		17	3
24. Bluntnose Minnow	324	8		93	7
25. Blacknose Dace	1120	21		379	17
26. Longnose Dace	36	6		19	6
27. Northern Creek Chub	44	7		62	9
28. Fallfish	57	9		11	6
29. Creek Chubsucker	64	4		24	5
30. White Sucker	69	13		351	19
31. Northern Hog Sucker	54	6		27	8
32. Channel Catfish				1	1
33. Yellow Bullhead	1	1		11	7
34. Brown Bullhead	7	3		28	8
35. Margined Madtom	3	3		11	5
36. Inland Silversides	389	1		19	1
37. Sheepshead Minnow	1	1		1	1
38. Mosquitofish	1	1		1	1
39. Banded Killifish	239	3		41	5
40. Mummichog Killifish	193	3		205	3
41. Bluespotted Sunfish	1	1		1	1
42. Green Sunfish	2	2		7	3
43. Bluegill Sunfish	28	13		68	16
44. Redbreast Sunfish	24	11		109	18
45. Longear Sunfish	168	19		283	21
46. Pumpkinseed Sunfish	131	8		164	13
47. Largemouth Bass	51	11		12	8
48. Black Crappie				1	1
49. Fantail Darter				6	1
50. Tesselated Darter	394	20		87	12
51. White Perch	14	1		7	1
Totals	23282	26		3689	26
Total # of Species	48			49	

Seining collected 23,282 individuals representing 48 species and 15 families. An average of 9.4 seine hauls were performed at each station, generally 10 seine hauls were performed at each site; however on a few occasions, notably at Site #26 in Sligo Creek, collections were halted after no species were collected on three consecutive seine hauls within the collection area.

Electrofishing collections, which followed seining, resulted in the collection of 3,689 individuals representing 49 species and 14 families, approximately 14% of the total number of individuals captured. An average of 633 seconds (S.D. of 115) of electrofishing runs through the sites were conducted. Conductivity ranged from 105 um to 550 um (mean of 236 um). Output voltage ranged from 500 to 700 volts (median of 500 volts) at 60 Hertz.

Water temperature, pH, dissolved oxygen and conductivity values recorded during sampling are presented in Table #2.

TABLE #2

ANACOSTIA BASIN, 1988

WATER QUALITY PARAMETERS MEASURED AT RESIDENT FISH SAMPLING SITES

SPRING						SUMMER						FALL					
DATE	SITE	TEMP	pH	DO	COND	DATE	SITE	TEMP	pH	DO	COND	DATE	SITE	TEMP	pH	DO	COND
5/23	1	22.8	7.0	8.9	226	7/14	1	34.5	8.8	6.0	385	10/24	1	12.5	-	no data	
5/23	2	26.8	7.2	8.0	230	7/13	2	26.5	8.4	12.6	300	10/24	2	9.5	-	available	
5/26	3	16.0	6.5	8.7	183	7/15	3	31.0	8.3	5.1	240	10/25	3	10.5	7.2		
5/23	4	24.4	6.7	7.4	310	7/13	4	27.0	8.0	4.6	300	10/25	4	7.0	-		
5/26	5	16.2	6.6	8.4	264	7/15	5	29.0	7.7	5.0	305	10/25	5	9.0	6.2		
5/27	6	15.5	6.4	7.9	-	7/18	6	27.0	6.4	2.0	290	10/26	6	8.5	-		
5/27	7	16.2	5.8	6.4	140	7/18	7	28.5	6.6	2.9	520	10/26	7	7.0	-		
5/31	8	22.3	7.2	8.9	190	7/18	8	31.0	6.9	4.2	250	10/27	8	6.0	-		
5/27	9	20.4	7.0	8.6	184	7/19	9	27.0	6.4	3.5	210	10/27	9	6.0	6.5		
5/27	10	22.2	6.5	7.9	188	7/19	10	27.5	6.4	3.2	240	10/28	10	6.5	6.5		
6/1	11	22.3	7.3	9.4	184	7/19	11	28.0	6.2	3.4	228	10/28	11	9.0	6.9		
5/27	12	13.0	6.7	9.3	140	7/20	12	24.8	6.7	2.4	200	10/31	12	5.5	6.3		
6/2	13	18.1	8.0	9.2	192	7/20	13	26.0	6.2	3.0	200	10/31	13	5.0	-		
6/3	14	18.9	7.8	9.1	140	7/20	14	26.0	7.0	3.6	140	11/2	14	4.9	6.2		
6/3	15/16	18.8	8.5	8.8	261	7/21	15/16	26.3	6.9	3.0	200	11/3	15/16	9.0	7.0		
6/3	17	16.5	8.3	10.5	212	7/25	17	27.0	6.5	2.2	190	11/7	17	9.0	6.6		
6/6	18	19.5	8.2	10.1	105	7/26	18	26.0	6.6	10.2	185	11/8	18	8.0	6.8		
6/6	19	19.7	8.9	9.2	200	7/26	19	28.0	6.9	8.9	190	11/9	19	6.5	7.5		
6/7	20	24.0	8.7	7.4	184	7/29	20	26.5	6.4	10.4	165	11/9	20	8.0	7.0		
6/7	21	22.6	7.4	7.6	169	7/29	21	32.0	6.6	9.2	180	11/2	21	5.0	6.3		
6/8	22	20.0	7.2	7.3	166	7/29	22	27.5	6.8	9.8	195	11/15	22	6.5	6.5		
6/8	23	17.1	7.0	7.6	123	8/1	23	26.0	6.1	9.4	110	11/15	23	6.0	6.5		
6/7	24	24.7	8.3	7.6	414	7/27	24	24.5	6.5	9.6	220	11/8	24	7.0	6.8		
6/7	25	23.3	8.3	8.1	423	7/26	25	29.5	7.7	10.1	410	11/7	25	9.0	7.1		
6/7	26	21.5	7.2	7.8	351	7/25	26	24.5	6.9	12.0	285	11/3	26	9.0	6.6		
5/27	27	19.0	5.6	5.9	153	7/14	27	25.2	7.6	2.8	550	11/10	27	9.0	6.7		

TEMP - Water Temperature in Degrees Centigrade
pH - -log [H+]
DO - Dissolved Oxygen Concentration in mg/L
COND - Conductivity in Micro mhos per Centimeter

No values of pH or conductivity were observed which would have been deleterious to native aquatic life. Water temperatures high enough to cause severe stress to fish populations were found to occur at Site #1 during the summer. High water temperatures at Sites #3, #8 and #21 approached or equaled Maryland's maximum water temperature standard of 32^{o} centigrade. At Site #1 the water was 34.5^{o} C (95^{o} F). This is very warm and captured fish did not survive well during containment and identification, an indication of their levels of stress.

Dissolved oxygen concentrations were below the Maryland water quality standard of 4.0 mg/l at 11 stations during the summer months.

Two species, rainbow trout and river chub, were captured by seining that were not captured by electrofishing. Three species, channel catfish, black crappie, and fantail darters were captured by electrofishing and not by seining. Differences existed in the ratios of numbers of individuals collected by the two methods, but basically each method collected similar species assemblages.

Discussion of Resident Fish Sampling

Many areas of the Anacostia River are in poor condition in terms of fisheries habitat. All of the Anacostia's tributaries suffer from man-made perturbations. Excessive stream bank erosion from abnormally high storm water discharges continues to be a major problem, influenced by increased runoff from impervious surfaces such as highways and parking lots (COG, 1986). Sediment entering the stream not only is detrimental to aquatic life, its deposition downstream further alters stream flows, further compounding erosion problems due to increased stream meandering. Erosion due to illegal use of all terrain vehicles (ATV) was observed to be widespread, with almost every stream bed being used as a corridor. This activity is contributing a less visible yet highly destructive influence upon stream life in the basin.

Sewer lines which once crossed the streams below ground are currently above the stream bed, evidence of the highly changed nature of these streams. Several broken and leaking sewer lines were found during the course of this year's work which contaminated the streams. In a forested and fairly remote section of the N.W. Branch, just below the Washington beltway, we found a sewer line break which had blown off a manhole cover along with a good portion of the stand pipe. A two foot hole discharged raw sewage into the Branch and had apparently been doing so for some time. To the credit of the Washington Suburban Sanitation Commission maintenance crews, this break and several others we reported were repaired rapidly. Nonetheless, undiscovered leaks such as this existed and were introducing heavy pollutant burdens into the streams.

To further exacerbate its ecological problems, many areas of the Anacostia watershed have been channelized in order to rapidly dissipate storm waters and reduce flooding. This "fast flush" management of storm waters further increases stream velocities resulting in more bank erosion and stream channel sedimentation. Many stream bed's original pool and riffle characteristics necessary for fishery habitat have become relatively featureless chutes with bare banks and scoured stream beds. In addition, we observed that riparian habitats are continually degraded by maintenance practices in which stream banks are routinely denuded and/or contoured. Examples of this abuse can be found at large sections of Paint Branch and Little Paint Branch which run through U.S. Department of Agriculture, National Agricultural Research Center properties and along several stream miles of the N.E. and N.W. Branches at the flood control levee areas near the tidal portions of the basin.

The loss of stream cover has produced water temperature problems. Water temperatures fluctuate rapidly with air temperatures when there is no cover to insulate them from heat gain or loss. The very high temperature observed at Site #1 probably resulted from cover loss. Upstream at Site #2, where the N.E. Branch has been running along shaded banks, the water temperature was well below the 34.5° C recorded at Site #1 during the same period. The air temperature during that high temperature reading at Site #1 was 34.5° C also.

Several streams in the watershed show evidence of severe problems. Sligo Creek has very low species diversity with some areas almost devoid of fish. While most of the tributaries are showing good signs of improvement, Sligo has remained in poor shape. The causes for Sligo's condition are unclear. The water parameters measured do not indicate any severe problems. The stream is well shaded and runs primarily along good rock and gravel substrate. Aeration does not appear to be a problem either.

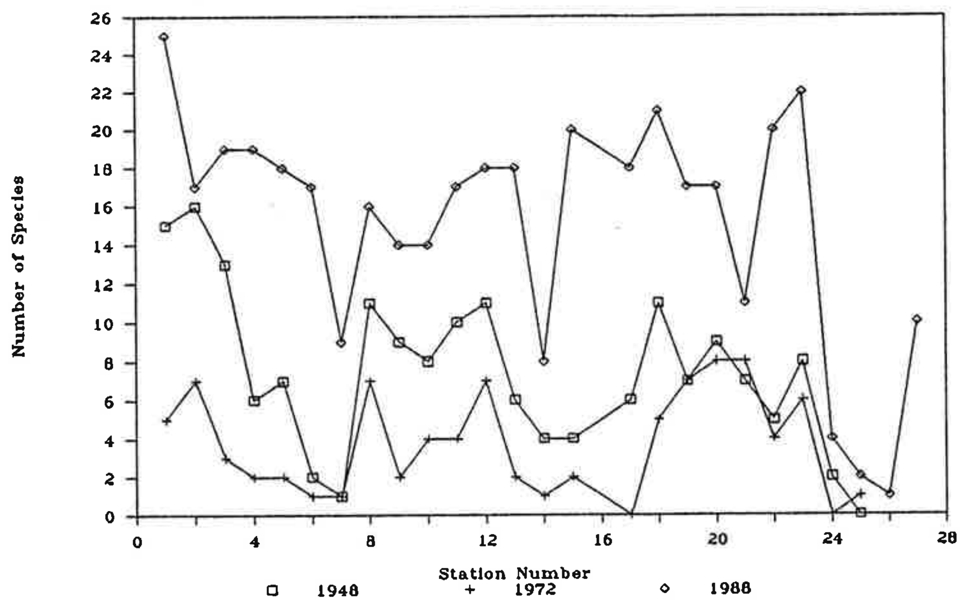
The headwaters to Sligo were recently impacted by a pollutant discharge (Montgomery County Journal, March 24, 1988). Episodic pollution events such as this are difficult to document yet evidently impact this watershed. The very low diversity of fish in Sligo Creek, such as occurred at Site #26, is unusual for a stream of its size or character and may be an indication of a toxic problem. On the other hand, fish populations in Sligo Creek might not have had enough time to recover from past problems. Scouring, lethal dissolved oxygen levels or toxics may have, at one time, eliminated fish from this watershed and it may be taking a long time to recover, possibly due to stream blockages that prevent immigration of fish from other watersheds.

Lower Beaverdam Creek is very abused with only highly tolerant fish species being present. The area near Kenilworth Avenue is in particularly poor shape. Commendable efforts by the Maryland National Guard, The Maryland Departments of Natural Resources and Environment, Prince Georges County Department of Environmental Resources, and the Washington Suburban Sanitation Commission this last fall have helped to clean this tributary of some of the junk cars and large debris, but much more needs to be done. Siltation due to increased development upon the tributary's highly erodible soils is an ongoing problem in this watershed. Compliance with runoff control practices and their enforcement is essential.

The upper Paint Branch tributaries which contain naturally reproducing brown trout populations were purposely not included in this study. Since this area was not sampled in the 1948 or 1972 studies and Maryland Department of Natural Resources fisheries biologists are concurrently conducting research specifically on the wild trout areas of Paint Branch, it was determined that inclusion in this study was unnecessary. It was felt that increased stress to these sensitive fish populations due to sampling disturbances would probably not justify the duplicative information gathered. It is strongly recommended that this unique and interesting fish population be kept deserving of special attention and protection.

This study also provides some encouraging and much needed good news. The distribution and abundance of fishes has increased considerably since the previous studies. Forty-eight species were captured by shore seining at the twenty-three sites which were previously sampled in 1948 and 1972. This compares with thirty-one species captured in 1948 and twenty-five species captured in 1972. Figure 9, which shows a comparison of the number of species captured at each of the sites during the three studies, clearly demonstrates this substantial change in fish communities.

Figure 9: Number of Species at Sites



In addition, Table #3 provides a list of seventeen fish species collected in 1988 which were not collected in the 1948 or 1972 studies.

1. Blueback Herring
2. Rainbow Trout
3. Goldfish
4. Silverjaw Minnow
5. Ironcolor Shiner
6. Bridle Shiner
7. Spotfin Shiner
8. River Chub
9. Bluntnose Minnow
10. Longnose Dace
11. Channel Catfish
12. Yellow Bullhead
13. Inland Silversides
14. Sheepshead Minnow
15. Bluespotted Sunfish
16. Longear Sunfish
17. White Perch

The following is a discussion of the different species collected in 1988. It is useful to supplement this discussion with the species distribution maps 1 - 52 available in Appendix D.

1. American Brook Lamprey: A small non-parasitic filter feeding fish found in quiet streams, usually over organic debris. This species is intolerant to pollution, especially suspended sediments which tend to clog their buccal feeding mechanisms. Although not found in the N.W. Branch in 1988 as it

was in 1948, this species is apparently making a recovery from its 1972 distribution. The habitat of Upper Beaverdam Creek is particularly well suited for these species. This rare and interesting fish, which may not have the "attractive" qualities of many fish, should still be considered a valuable species to protect in the basin since it is an indicator species of good water quality.

2. American Eel: A very pollution tolerant species, this catadromous fish's migration into the watershed does not appear to be limited by stream blockages, as it was found at twenty-three sites. Known to crawl overland to bypass obstructions, even the tall dam at Burnt Mills on the N.W. Branch (Site #21) did not stop the eel's upstream migration, as eels were collected by electrofishing at two stations above this dam. The eel was collected at only one site by seining in 1988 as opposed to six sites in 1972 and five sites in 1948. This apparent decrease in relative abundance may be due to improved water quality, as any survival advantage this species has for living in polluted waters may not be as important a factor as in the past. The sizes of the individuals varied, but several large individuals were collected, the largest was 79.0 cm. (30.8 in.) in length and weighed 1300 g (2.8 lb.) and was collected at Site #22.

3. Blueback Herring: A migratory species not collected in 1948 or 1972. In 1988, one adult was captured during spring sampling and four young-of-the-year (YOY) were captured during fall sampling at Site #1 near the confluence of the N.E. and N.W. Branches. As evidenced by these captures, this species used Maryland's tidal portion of the Anacostia both for spawning (see also section on migratory fishes) and as a nursery area. Alewives, a very similar migratory fish, were captured by seining at Site #1 in 1948 but not in 1972 or 1988. The collection of either migratory species during resident fish sampling can be considered a fairly large product of chance, since only one site below blockages to migration was sampled. Year to year variations in spawning times may account for differences in species captured during the spring sampling in 1948 and 1972, since alewives tend to spawn earlier in the spring than bluebacks. No spring sampling was performed in 1972, limiting the probability of capturing either species to the single fall collection of 1972.

4. Gizzard Shad: This planktonic and bottom feeder is fairly tolerant to pollution and has been captured near the confluence of the N.E. and N.W. Branches since 1972. Young individuals of this species are good forage for game fish such as largemouth bass.

5. Rainbow Trout: One 28.5 cm. (11.4 in.) individual was captured during 1988 in the N.W. Branch (Site #17) near Agar Road. It is highly probable that this fish was in the tributary due to stocking in 1988 by Maryland Department of Natural Resources.

6. Eastern Mudminnow: Collected at two sites, this pollution tolerant species has returned to a distribution similar to its distribution recorded in 1948. It was not collected in 1972.

7. Chain Pickerel: This native game fish has shown an increase in distribution since 1948 and 1972. One individual captured in the fall at Site #6 was 35.5 cm. (14.2 in.), although most individuals captured were small juveniles only a few inches long.

8. Carp: The 1988 distribution of this pollution tolerant exotic was similar to 1948 and 1972 collections except that no carp were collected in the N.W. Branch. All specimens in the 1988 collections were small juveniles (<6" TL). This species is probably more common than seining collections would indicate since it is a shy species which tends to flee an area during disturbances such as the approach of humans. Large adults were sighted in Upper Beaverdam Creek at Site #7 during an investigation of a waste water spill in July.

9. Goldfish: This pollution tolerant exotic was not collected in 1948 or 1972 but was collected at six sites in 1988. This may be due to its recent introduction, since it probably would have survived well and been collected if present in 1948 or 1972. A commercial goldfish operation was reported to have existed at one time near the confluence of Paint Branch and Indian Creek. The introduction of this species could have been from escapes from this facility, discarded fishing bait, or the ever popular naval burials in porcelain water closets.

10. Silverjaw Minnow: Oddly, this moderately pollution tolerant minnow was not collected before 1988, when it was found to be widely distributed and abundant. Its absence in earlier collections is hard to understand. It is an unusual and interesting fish due to the large sensory channels on the ventral and lower sides of its head.

11. Cutlips Minnow: Extremely rare in 1972 but common in 1948 and 1988, this species prefers clear, gravel-boulder streams. The rebounding of its distribution can be interpreted as a sign that habitat has improved since 1972.

12. Golden Shiner: A pollution tolerant minnow which prefers quiet vegetated waters, this species is a good food source for game fish. This minnow was fairly common in the coastal floodplain sites, especially Site #6 where 90% of the individuals were captured.

13. Rosyside Dace: This pollution intolerant minnow was abundant in 1948, rare in 1972 and has rebounded to being fairly common in 1988. Its distribution has also expanded since 1972 as it is again found in the N.W. Branch. This minnow's recovery can also be interpreted as a good sign that fishery habitat has improved since 1972.

14. <u>Ironcolor Shiner</u>: This minnow prefers clean open water. Although uncommon at any particular site, this minnow was fairly widely distributed.

15. <u>Bridle Shiner</u>: A very small minnow (2-5 cm. total length) which prefers slack water areas over mud and detritus. This minnow was also uncommon at any one site but was widely distributed in the basin.

16. <u>Swallowtail Shiner</u>: This shiner prefers warm streams and rivers. It was the most common fish species collected in 1988, with 1,043 being captured during one collection (Fall, Site #15/16). This minnow has made a tremendous increase in abundance since 1948 and 1972. Its current distribution resembles that of 1948, being found at all fifteen sites it was collected in at that time plus five additional sites. It was only collected at six sites in 1972.

17. <u>Rosyface Shiner</u>: This pollution tolerant minnow prefers clear fast water over gravel bottoms. It was not collected in 1972. The 1988 distribution resembles that found in 1948.

18. <u>Spotfin Shiner</u>: Closely resembling the satinfin shiner, varying by one less anal ray and a more slender body, this moderately pollution intolerant species was widely distributed in 1988. This minnow may have been overlooked in 1948 or 1972 since they did not report its presence.

19. <u>Satinfin Shiner</u>: This pollution tolerant minnow prefers moderately sized streams and rivers with sand or gravel substrate. It was the second most common fish species collected in 1988 and 1972 and the most common species collected in 1948.

20. <u>Common Shiner</u>: A pollution intolerant minnow which prefers clear, cool small to mid-sized streams. Although its abundance declined substantially from 1948 to 1972, it has recovered to the point were it was an abundant and widely distributed species in 1988. This is another good indication that fishery habitats have improved since 1972.

21. <u>Spottailed Shiner</u>: A moderately pollution tolerant minnow with a variable habitat preference. This minnow was very abundant and widely distributed in 1948, 1972 and 1988.

22. <u>Eastern Silvery Minnow</u>: This minnow was not collected in 1972 and Deitemann questioned its occurrence in 1948 at that time. Although not common in 1988, it was widely distributed. Its current distribution resembles that of 1948.

23. <u>River Chub</u>: This large minnow was not found in 1948 or 1972 collections, one individual was collected at Site #13 in 1988.

24. Bluntnose Minnow: This pollution tolerant minnow was not collected in 1948 or 1972. In 1988, its distribution was basically restricted to the N.W. Branch where it was fairly common.

25. Northern Creek Chub: This highly pollution tolerant minnow was generally found in piedmont streams. It was one of two species captured by electrofishing in the upper portions of Sligo Creek (Site #26).

26. Fallfish: This minnow prefers cool, clear rapid streams. Found at only one site in 1972 (Site #11), its 1988 distribution resembles its 1948 distribution, although it was not found to occur as far downstream as it was in 1948.

27. Blacknose Dace: This highly pollution tolerant minnow was widely distributed, being found everywhere except Indian Creek and Upper Beaverdam Creek. One individual of this species was the only fish captured by seining in the upper portion of Sligo Creek (Site #26). The abundance of this minnow has declined significantly since 1972. 3,145 individuals were collected in the fall of 1972 while only 295 individuals were collected in the fall of 1988.

28. Longnose Dace: This pollution intolerant minnow was found at eight sites in 1988. It was not collected in 1948 or 1972. Its appearance in collections indicates that habitat improvements have occurred.

29. Creek Chubsucker: Only collected at Site #5 in 1948, absent from 1972 collections, this minnow has increased in distribution and abundance by 1988. True to its preference for low gradient streams, this fish was found in the coastal floodplain sites in Indian Creek, Lower Beaverdam Creek, Brier Ditch and Site #5 in the N.E. Branch.

30. White Sucker: Tolerant to pollution, this fish was collected at two sites in 1948, three sites in 1972, and thirteen sites by seining alone in 1988. When disturbed, this species will seek cover, making it fairly difficult to capture with seines. Electrofishing was a better capture method for this species, collecting 78% of the white suckers collected at nineteen sites. Electrofishing documented that this fish is widely distributed in the basin.

31. Northern Hog Sucker: This silt intolerant species prefers riffles and pools in streams. As in 1972, seining collections found it restricted to the N.W. Branch, although it increased in abundance by 1988. Electrofishing collections in 1988 reflected the 1948 distribution of this species in Little Paint Branch. Dispersal of this species into other portions of the watershed may be impaired by stream blockages to migration.

*Shorthead Redhorse: Absent from collections in 1948, collected at one site in 1972 (Site #2), this was the only non-migratory species which was not collected in 1988 that was collected in the earlier studies.

32. Channel Catfish: One individual was collected by electrofishing at Site #1 during the summer. A moderately pollution tolerant species which prefers medium to large rivers, it is unlikely that the channel catfish will increase its range outside of the tidally influenced Anacostia.

33. Yellow Bullhead: Not collected in 1948 or 1972 but collected at Site #4 in Brier Ditch by seining and seven other sites by electrofishing in 1988. This relatively small catfish prefers small, slow moving streams. It is highly tolerant of pollution, but is elusive and difficult to capture by seining, possibly explaining its absence in earlier collections.

34. Brown Bullhead: A relatively small catfish, similar to yellow bullhead except it prefers deeper and less turbid waters. This species has increased in distribution since 1948 and 1972. It was found most often in coastal floodplain areas.

35. Margined Madtom: Prefers gravel-rubble riffles in streams and is intolerant to silt and turbidity. This species was generally found in peidmont streams, excluding Sligo Creek. Not found in 1972, this species was collected at three sites by seining and three additional sites by electrofishing in 1988.

36. Inland Silversides: A schooling species collected only at Site #1 in 1988 where it was abundant.

37. Mosquitofish: A very pollution tolerant species which has been widely introduced for mosquito control. Two individuals were collected in 1988, sixty-eight in 1972 and one in 1948. In part due to its introduction no trends on this species are apparent other than it appears to remain restricted to the lower portion of the watershed near tidal waters.

38. Sheepshead Minnow: Not collected in 1948 or 1972. Very rare in 1988 with the collection of two individuals.

39. Banded Killifish: Generally associated with quiet tidal freshwater, this species has slightly increased in distribution since 1972. In 1988 it was abundant at Site #1. It was not collected in 1948.

40. Mummichog Killifish: Closely associated with tidal waters. Collected in 1948 at one site (#1), absent from 1972 collections, appearing at sites similar to the banded killifish in 1988, it remains close to tidal waters. Both killifish species were found at Site #15/16 on the N.W. Branch. This site is above the 1988 final blockage for migratory fish. That the killifishes were found above the blockage indicates that it is possible to negotiate this barrier.

41. Bluespotted Sunfish: This hardy little sunfish was not collected in 1948 or 1972 but was reported to be very common at Roaches Run, a tributary to the Potomac River above National Airport, in 1898 (Bean and Weed, 1898). Two individuals were collected this year. This is the only collection of this species in the Washington metropolitan area that I am aware of in recent times.

42. Green Sunfish: This highly pollution tolerant species was fairly rare in 1988 collections, being found only in the N.E. Branch, Paint Branch and Indian Creek. It has not been reported in the N.W. Branch since 1948.

43. Bluegill Sunfish: This moderately pollution tolerant game fish was found to be widely distributed in the basin during 1988 collection where it was found in every tributary except Sligo Creek. It has increased dramatically in distribution and abundance since 1948 and 1972.

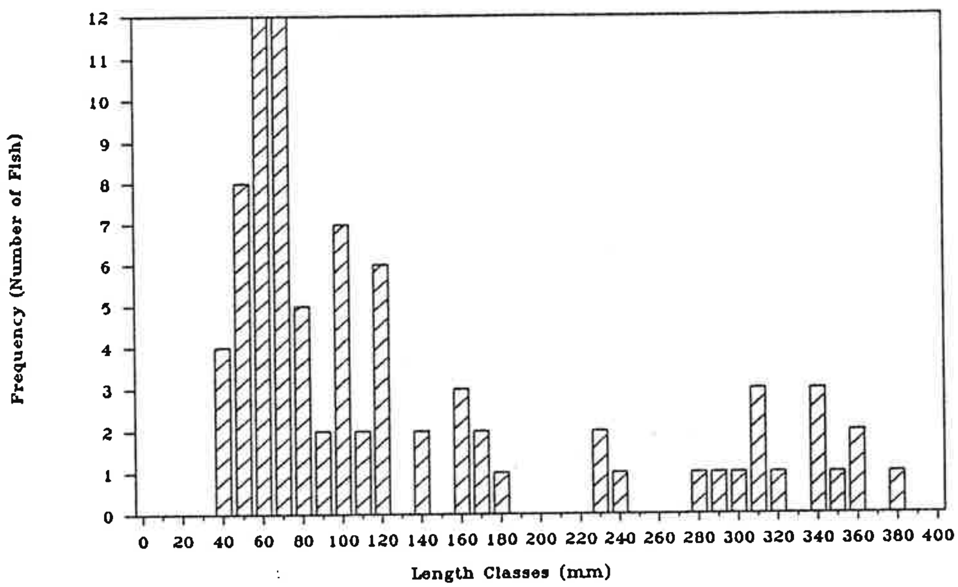
44. Redbreast Sunfish: Collected at one site (#2) in 1948 and absent from collections in 1972. In 1972 Deitemann stated that, if then current stream degradation trends continued, he felt this species would be exterminated from the basin. This game fish has rebounded to the point that it was widely distributed in 1988 collections, although it was absent from Sligo Creek.

45. Longear Sunfish: Not collected in 1948 or 1972, this close look-alike to the redbreast sunfish was widely distributed, found in all tributaries but Sligo Creek in 1988.

46. Pumpkinseed Sunfish: Captured at one site in 1948 (35), absent in 1972, this moderately pollution tolerant species has become widely distributed by 1988, were it was found in all tributaries except Paint Branch. The pumpkinseed sunfish has the dubious distinction of being the only sunfish species captured in Sligo Creek, where its distribution was apparently limited to areas near its mouth.

47. Largemouth Bass: Absent from 1948 collections and rare in 1972, this important game fish was found to be widely distributed in 1988. Collections made at sites in the lower portions of the N.W. Branch (Sites #17-20) during the summer produced 24 young-of-the-year. Figure 10 shows the length frequency distribution of largemouth bass collected in 1988. The largest specimen was collected during the fall at Site #6 on Indian Creek.

Figure 10: Length Frequency Distribution of Largemouth Bass (Micropterus salmoides) Captured in Maryland Portions of the Anacostia River in 1988



No smallmouth bass were captured in 1988 and none were reported in 1948 or 1972. Both species of bass are not native species and it is possible that smallmouth bass have never been introduced into this portion of the basin. Young-of-the-year smallmouth bass have been collected downstream in the tidal portions of the Anacostia in the District of Columbia. One would expect that these fish came from upstream spawning. Smallmouth may indeed be present in the basin but were not collected.

48. Black Crappie: Very rare, one specimen was collected at Site #11.

49. Fantail Darter: Rather tolerant to pollution, this attractive species was not collected in 1948. It was rare in 1972 and 1988, apparently restricted to the upper portions of the N.W. Branch.

50. Tesselated Darter: This moderately pollution tolerant darter was found at nineteen sites in 1948, decreased to eight sites in 1972, but was again widely distributed in 1988, being collected at twenty sites. The rebounding of this species is another sign that fisheries habitat has improved since 1972.

51. White Perch: Collected for the first time in 1988, this migratory species was found at Site #1 during the spring and fall. Its distribution is somewhat limited by blockages upstream (refer to the migratory section of this report).

Between-method capture differences were not particularly relevant to this study, since the two methods were used to complement each other, however, a certain degree of capture selectivity was apparent. The best example of gear selectivity was the capture of American eels. Shore haul seining captured one eel at one site while electrofishing at the same sites following seining resulted in the capture of two-hundred and four eels at twenty-three sites. Electrofishing was useful in capturing several fishes which tend to be able to elude capture by shore haul seining. Electrofishing was also very productive at capturing white suckers and centrachids.

Assuming that relative abundances, i.e. the proportion each species represents in the collected population, should remain similar among different researchers using the same sampling gear, comparisons of relative abundances can be used to help eliminate variability which may be due to unknown differences in sampling procedures. The twelve most abundant species in all three studies are shown in Table #4.

Table #4 also includes pollution tolerance indexes (Ohio EPA, 1987) for most of these species. The changes occurring in this table are interesting. Two species intolerant to pollution, the common and rosyface shiners, have increased in relative abundance. The common shiner has made a substantial increase from <1% in 1972 to 9.2% in 1988. Although less substantial, the rosyface shiner has increased from an absence in 1972 collections to <1% (actually .3%) of the collections in 1988. This increase in abundance can be taken as a good sign since it is unlikely that these species would have increased in abundance if habitat quality had not improved since 1972. At the same time the pollution tolerant minnow, the blacknose dace, which was the most common species in 1972 when it represented 54.0% of all fish captured, has significantly decreased in abundance to represent only 4.8% of the population at the present time. This decrease also indicates that some factor has changed which has greatly reduced a pollution tolerant species competitive edge.

The increase in distribution and abundance of the sunfishes is also a good sign. Juvenile white perch and herring were captured in the fall at Site #1 indicating that this area of the river is being used as more than a spawning area but also a nursery for migratory fishes.

Table 4

CHANGE IN RELATIVE ABUNDANCE OF THE MOST NUMEROUS MINNOW & SHINER SPECIES

Species*	Pollution Tolerance**	# Individuals 1948	1972	1988	Relative Abundance % of Population 1948	1972	1988
1. Swallowtail Shiner *Notropis procne*	N	425	293	7,318	5%	5%	31.4%
2. Satinfin Shiner *Notropis analostanus*	N	495	1,959	4,582	17%	34%	19.7%
3. Spottail Shiner *Notropis hudsonius*	P	91	186	2,987	3%	3%	12.8%
4. Common Shiner *Notropis cornutus*	I	456	28	2,142	15.7%	>1	9.2%
5. Blacknose Dace *Rinichthys atratulus*	T	379	3,154	1,120	13%	54%	4.8%
6. Rosyside Dace *Clinostomus funduloides*	S	213	8	659	7%	<1	2.8%
7. Silverjaw Minnow *Ericymba buccata*	P	0	0	538	0	0	2.3%
8. Cutlips *Exoglossum maxillingua*	N	34	0	417	1.2%	0	1.8%
9. Tessellated Darter *Etheostoma olmstedi*	M	200	49	394	7%	1%	1.7%
10. Golden Shiner *Notemigonus crysoleucas*	T	243	12	304	8%	<1	1.3%
11. Rosyface Shiner *Notropis rubellus*	I	101	0	76	3%	0	<1
12. Mudminnow *Umbra pygmaea*	T	104	(1)	4	4%	<1	<1

S = Special Intolerant
I = Common Intolerant
M = Moderately Intolerant
P = Moderately Tolerant
T = Highly Tolerant
N = Not Available

* Species are listed in decreasing relative abundance from 1988 collection.
** Ohio EPA, 1987

Changes in the nature of the fish community can also be seen in Table #5 which shows the percentage of the population represented by the combined number of individuals of the four most abundant species of each years collections:

Table 5

	1948	1972	1988
#Ind. of top 4 Species	1755	5592	17,029
Total #Ind.	2909	5842	23,282
Percent of Total	60	96	73

This figures shows that there has been a decline in abundance domination from 96% in 1972 to 73% in 1988. In general, a spreading out of dominance is indicative of a more stable environment.

The increases in species composition and general abundance between the previous studies and present is dramatic but it is not readily explainable. Increased urbanization, such as that which has occurred in the Anacostia watershed since 1972, usually contributes to stream degradation and therefore fewer fish species being present. It is unlikely that the changes described were a product of sampling methodologies. Shore seining is very simple to perform, the collection nets were the same size, there was an actual reduction in sample area during current sampling (100 foot stream length in 1988 versus an approximate 300 foot stream length in 1948 and 1972) which, if anything, should reduce capture potential.

Table #6 provides an overview of the numbers of species captured at each site during the 1948, 1972 and 1988 studies. Changes in species diversity were used for the assessment of general trends in habitat.

Table 6

Comparisons of Anacostia Tributaries' Species Diversity

STATION NUMBER	# SPECIES/YEAR 1948	1972	1988		General Trends in Habitat
1	15	5	25		
2	16	7	17	} - N.E. Branch	improving
3	13	3	19		
4	6	2	19	} -- Brier Ditch	improving
5	7	2	18	— Indian Creek	improving
6	2	1	17		
7	1	1	9	} -- Upper Beaverdam Creek	stable[2]
8	11	7	16		
9	9	2	14		
10	8	4	14	Little	
11	10	4	17	} - Paint } -Paint Branch	improving
12	11	7	18	Branch	
13	6	2	18		
14	4	1	8		
15/16	4	2	20		
17	6	0	18		
18	11	5	21		
19	7	7	17	— N.W. Branch	improving
20	9	8	17		
21	7	8	11		
22	5	4	20		
23	8	6	22		
24	2	0	4		no change
25	0	1	2	} --- Sligo Creek	(still poor)
26	-	-	1		
27	-	-	10	} ---- Lower Beaverdam Creek	N.A.
mean	7.4	2.6	15.9	} ---- Overall Watershed	improving

1948 = sampled in spring and fall.
1972 = sampled in fall only.
1988 = although sampled in spring, summer and fall, this table reflects only spring and fall sampling.

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2 The increase in species diversity for this site may be misleading. The low number of species collected during any of the three studies may reflect difficulties in capturing fish in the shallow, swampy habitat of this site and not poor habitat.

CONCLUSIONS

Improved land and water use practices which have been implemented since 1970 have probably contributed to the more diverse fish communities now found in the Anacostia. As examples, the Maryland General Assembly passed the Wetlands Act in 1970. In 1972 the Federal Government enacted the Clean Water Act which has been updated by several revisions with tighter controls. By 1983 Montgomery County has enacted restrictive changes in zoning which have protected habitat (Galli, 1983). In 1984 the State of Maryland and the District of Columbia signed the Anacostia Watershed Restoration Strategy Agreement which stipulated that improvements were to be made to sewage systems, urban runoff control, mining practices, and stream restoration. A significant reduction in turbidity in the Anacostia from 1974 to 1984 was reported in the Potomac River Water Quality Statement and Trend Analysis (ICPRB, 1984). Continued acquisition of stream banks by the two counties for parkland and greenways has provided buffer zones which help to filter runoff, reducing the burden of increased development.

Fish communities have rebounded considerably since 1972 and are even more diverse than reported in 1948. Erosion and pollution abatement measures implemented in the Anacostia Basin have apparently begun to pay off. However, it should be emphasized that there is still much work remaining before the Anacostia River is restored and can once again be an object of pride.

RECOMMENDATIONS

A. As called for in the 1987 Chesapeake Bay Agreement, remove or modify existing barriers to fish migration and prevent their establishment.

B. Intra-basin transplant stocking of fishes into upper reaches of Sligo Creek in order to reestablish fish communities.

C. Reduce polluting and erosive effects of urban runoff. Reductions can be accomplished through the use of methods such as storm water retention basins, porous pavement, and treatment of parking lot and highway runoff.

D. Modify stream beds to permit meandering of stream channels. In many areas flat, shallow stream "chutes" created for single purpose fast-flush storm water removal can be further modified to include aquatic habitat concerns such as riffle-pool systems necessary for healthy aquatic communities.

E. Reduce thermal burdens and extreme temperature fluctuations in Anacostia streams by increasing shade. Reduce or eliminate the use of solid concrete stream bank armoring to prevent erosion. Protect and reestablish riparian habitats. Continue to acquire parklands along stream corridors which can serve as buffer strips.

F. Improve monitoring of N.P.D.E.S. discharges, construction, and mining activities. Create a comprehensive system to check for sewer line breaks and overflows. Continue to upgrade the quality of sewer lines.

G. Increase enforcement of water quality standards and prosecution of violators, including all terrain vehicle abuses.

H. Create, upgrade, and integrate trails to improve access to Anacostia streams.

I. Establish limited access at sensitive areas such as the brown trout spawning areas of Paint Branch or the American brook lamprey habitat of Upper Beaverdam Creek.

J. It is interesting to note that, although habitat improvements have been made in the Anacostia watershed, many of the recommendations expressed so far were also expressed in the 1948 and 1972 reports. In some respects this repetition of recommendations can be attributed to the complex nature of environmental problems inherent to urbanization. On the other hand, many of the water quality and aquatic habitat problems of the Anacostia Basin may not have been aggressively addressed by its residents. The Anacostia has been the recipient of unjustified neglect precipitated by past abuses. An abused system becomes easier to further abuse, the problem feeds upon itself and becomes a mind-set. Therefore, of all of the recommendations which can be made, the strongest will be to endeavor to change the public's perception of the Anacostia River. It is important that the public understand the Anacostia's realized and potential values.

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Appendices

A. Inventory of Potential Migratory Fish Blockages

B. Site descriptions and locations of the twenty-six resident fish sampling stations in 1988

C. Anacostia River: 1988 Shore Seining and Electrofishing Collections

D. Maps of the Distribution of Resident Fishes in the Anacostia Basin, Maryland: 1948, 1972, and 1988

APPENDIX A.

INVENTORY OF POTENTIAL MIGRATORY FISH BLOCKAGES

Appendix A

INVENTORY OF POTENTIAL MIGRATORY FISH BLOCKAGES

Tributary	Location	General Description	Estimated Height
Sligo Creek	A. 700' downstream from Piney Branch Road	Uncapped pipe	16"
	B. 1500' upstream from Carroll Avenue	Uncapped pipe	16"
	C. 250' upstream from Carroll Avenue	Uncapped pipe	12"
	D. 1000' upstream from Riggs Road	Concrete cap	24"
	E. At Riggs Road	Concrete channel with apron	FA*
	F. Four drop structures which step down to the confluence with the N.W. Branch.	Concrete steel, and rip-rap dams	To 24" each
N.W. Branch	A. 2000' upstream from 495	Concrete cap	12"
	B. 200' upstream from East-West Highway	Concrete cap	8"
	C. At the confluence with Sligo Creek	Gabion dam	12"
	D. 700' downstream from Queens Chapel Road	Gabion dam	18"
	E. 1000' upstream from 38th Street	Gabion dam	18"
	F. 100' upstream from 38th Street	Metal weir	8"
	G. At Route #1	Concrete apron	FA*
Paint Branch	A. Bridge at inner loop of I-495	Bridge culvert	4"
	B. 1000' upstream from the confluence with Indian Creek	Metal weir	12"
Little Paint Branch	A. 3000' downstream from Selman Road	Two concrete dams	12" each
Indian Creek	A. 1000' upstream from Branchville Road	Sand & gravel settling ponds	FA*
	B. 3000' upstream from the confluence with Paint Branch	Concrete cap	4"
Brier Ditch	A. At Kenilworth Avenue	Bridge culvert	6"
N.E. Branch	A. Behind MNCPPC building on Kenilworth Avenue	Metal weir	12"
	B. 3000' upstream from East-West Highway	Gabion dam	6"
	C. 500' downstream from Riverdale Road	Rip-rap chute	FA*
Lower Beaverdam Creek	A. 2000' upstream from Landover Road at the confluence of small concrete stream	Concrete splash	8"
	B. At Landover Road	Bridge culvert	16"
	C. At Kenilworth Avenue	Concrete spillway	6"

* FA = Flow alteration (example = spillway)

APPENDIX B.

SITE DESCRIPTIONS AND LOCATIONS OF THE TWENTY-SIX RESIDENT FISH SAMPLING STATION IN 1988

Appendix B

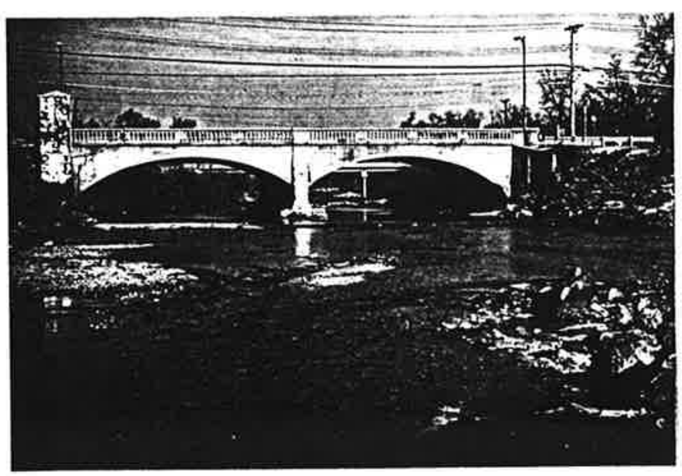
Site Descriptions and Locations of the Twenty-Six Resident Fish Sampling Stations in 1988

Site 1. Northeast Branch, downstream from Baltimore Ave. approximately 100 yards upstream from the confluence of Northeast and Northwest Branches:

This is the only tidally influenced site, with a tidal amplitude of around 2.5 feet. The Branch is fairly shallow (about 2 feet average) with a gravel bottom. A deeper channel (about four feet maximum at low tide) runs along the west bank. The banks are large rip rap and unshaded. The stream is about seventy five feet wide at high tide at this point.

Site 2. Northeast Branch, at Riverdale Rd. about fifty yards downstream from the bridge:

The site is just below a pipeline capped with concrete which crosses the stream. It is just upstream from a rip rap drop structure. The stream is about seventy five feet wide here and shallow with most areas being less than eighteen inches, with deeper spots being about three feet at typical flows. The banks here are armored with large rip-rap and are unshaded.



Site 3. Northeast Branch, about fifty yards below the confluence of Paint Branch and Indian Creek:

The stream is about fifty feet wide with a rock and gravel bottom and some sandy areas. It averages about eighteen inches in depth with a deeper channel along the east bank which is about three feet deep. The east bank is armored with large rip-rap and is well vegetated providing shade to the stream. The west bank has a gradual gravel slope and a well vegetated rip-rap bank.

Site 4. Brier Ditch, about thirty yards downstream from the Kenilworth Avenue Bridge:

The stream is about ten feet wide here and very shallow (less than two feet). The bottom is mostly sand and mud with gravelly areas. This site has steep, well vegetated banks shading the stream. The deep pool immediately below the bridge culvert was above the sampling area.

Site 5. Indian Creek, Kenilworth Ave. downstream from University Blvd. at the end of 56th Avenue:

This site is fairly flat, with a sandy-mud bottom. The average depth was about two feet. The banks are steep and covered with shrubs and small trees. The stream is well shaded and is about ten yards across.

Site 6. Indian Creek, at the end of a dirt road running along the east bank of the creek, about 150 yards downstream from Powdermill Road:

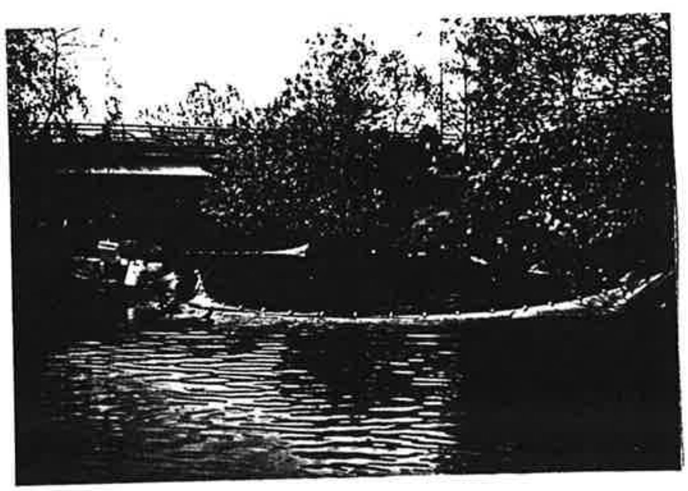
At this point Indian Creek is about twenty feet across and has a flat bed with steep sides. The bottom is mostly firm and with some gravel. The depth averaged around three feet and the area was well shaded by trees and shrubs on both banks.

Site 7. Beaverdam Creek, immediately upstream of the Edmonston Road Bridge:

This site was moved from the Research Road site used in 1948 and 1972. A pool had formed around the Research Road Bridge which was about 8' deep with very steep banks making it too difficult to sample. The stream is about ten feet wide with a firm mud, sand, and detritus bottom. This is a swampy forested area with a lot of tree limbs and similar debris in the water. The water is about two to three feet deep and usually stained with tannin.

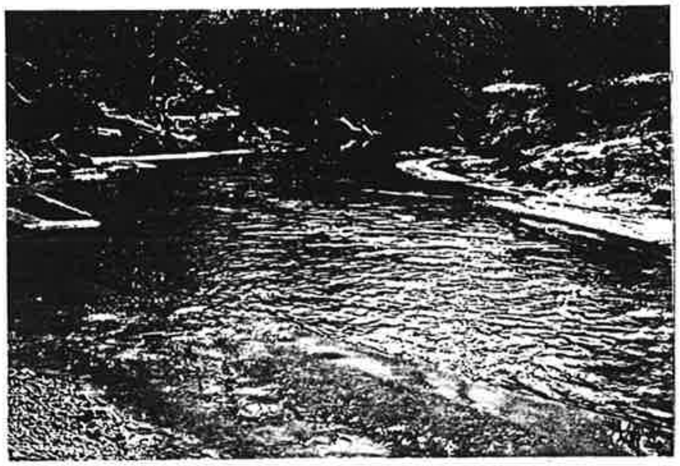
Site 8. Paint Branch, about thirty yards upstream from the Route 1 Bridge at the University of Maryland:

This site has a very deeply undercut bank on the south shore overgrown with bamboo and trees. The depth approaches four feet along the south shore. The opposite bank has a gradually sloping gravel bottom. The width is about forty feet.



Site 9. Paint Branch, about forty yards upstream from Metzerott Road:

This site had a downed tree on the deeper (to 3 feet) eastern side of the stream with many branches in the water. The bottom was sandy. The width was about thirty five feet and the site was well shaded.

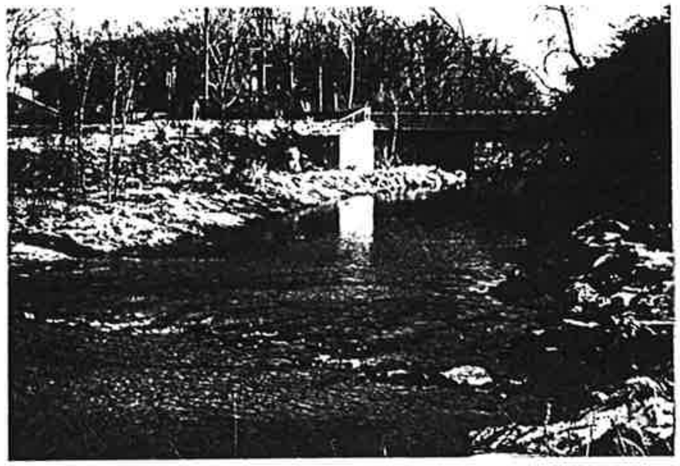


Site 10. Little Paint Branch, about ten yards upstream from the Cherry Hill Road Bridge:

The bottom was mostly gravel and the depth was shallow with most places being less than two feet. The stream is about thirty feet across with willows, other trees and shrubs shading the edges.

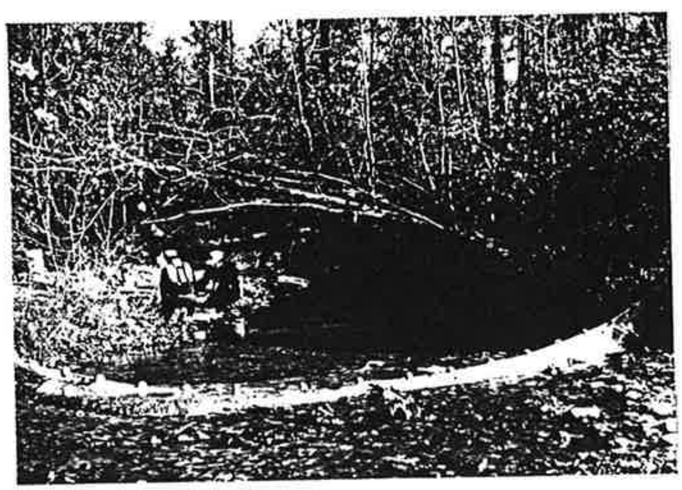
Site 11. Little Paint Branch, about forty yards upstream from the Sellman Road Bridge:

This site has a gravelly bottom with a narrow channel running down the east bank. The maximum depth is about three feet. The width of the stream is about twenty five feet and both banks are well covered with trees and shrubs.



Site 12. Little Paint Branch, approximately two hundred yards downstream from the end of Masters Lane (formerly part of Bigelow Road, presently meeting Briggs Chaney Road about a mile from Gunpowder Road):

At this location Little Paint Branch is about ten feet across with a fairly swift flow. The bottom is gravelly and the maximum depth is about three feet. There was a downed tree at the upper end of the site and a lot of growth on the banks.



Site 13. Paint Branch, about 125 yards downstream from the Powder Mill Road Bridge and just upstream from a twenty foot vertical rockface:

This area has a very deeply furrowed rock bottom with a maximum depth of about five feet, which occurs at the most downstream boundary. The depth averages about three feet. The width is about thirty feet and the area is dominated by mature hardwoods.

Site 14. Paint Branch, approximately 50 feet downstream from the closed off Old Columbia Road Bridge:

This site is at the bottom of a deep ravine. The bed is rock and the width is about twenty feet. The average depth is about 1 foot with some deeper pools to four feet deep. The sampling area's upstream boundary was at the upstream edge of the footer to the oldest of the three Columbia Road bridges. The remains of this old bridge no longer spans the tributary. The area is well covered with mature hardwood forest. Seining is very difficult at this site due to the rock substrate.

Site 15-16. This site is between sites 15 and 16 sampled by Howden. It is on Northwest Branch about 150 yards upstream from the pumping station and about 75 yards downstream from a gabion drop structure:

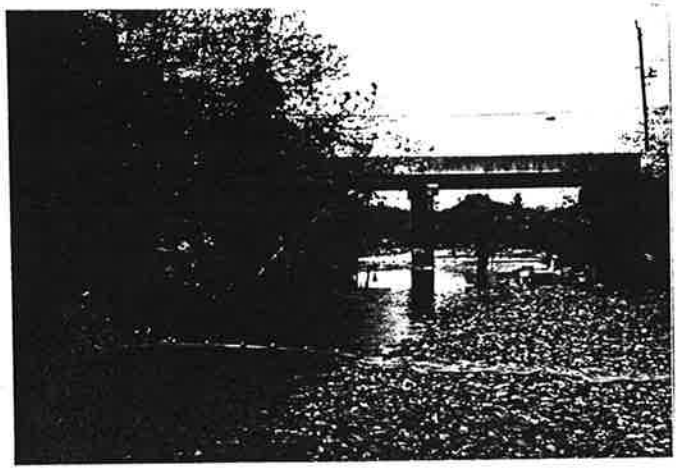
This is a wide section of stream about forty-five to sixty feet across. The bottom is sand, mud and gravel. The depth averages about three feet. The deepest portion is along the west bank where there are a few large rocks. This area is in a flood control levee area which is used as a park. The area is kept mowed, leaving mostly grasses and annuals on the banks with some perennial shrubs and small trees.

Site 17. Northwest Branch, about a quarter mile downstream from Ager Road near the intersection of Nicholson Street and a road named The Mall:

This location has a deep pool at the upstream boundary with a depth of up to five feet. Except for this pool, the rest of the site (about seventy-five stream feet) is fairly shallow averaging about two feet. The bottom is gravelly and the banks are well covered with shrubs and small trees growing right to the waters edge. The width is about thirty-five feet.

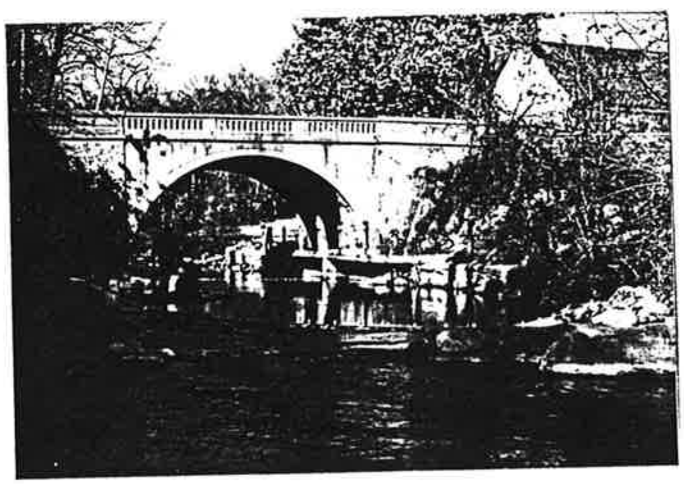
<u>Site 18</u>. Northwest Branch, about fifteen yards downstream from the University Boulevard Bridge:

At this point the stream is about twenty-five feet across and three feet deep. The bottom is sand and mud. The banks are well covered with shrubs and small trees.



<u>Site 19</u>. Northwest Branch, immediately downstream from the Riggs Road Bridge at Adelphi Mill:

This section of stream is about twenty-five feet across and has a very rocky bottom. About forty feet of the east bank on the upstream end of the site is made up of a vertical stone retaining wall. The rest of the area has shrubs and small trees growing right down to the water. The depth here is about three feet on average with a maximum of about four feet.

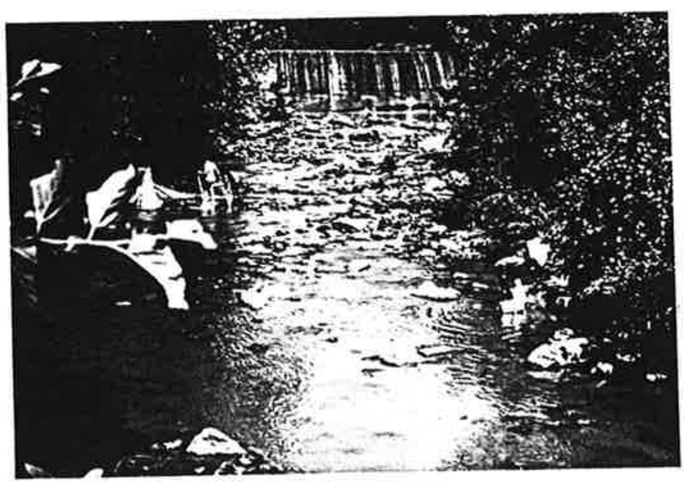


Site 20. Northwest Branch, about two hundred yards downstream from New Hampshire Avenue:

This site has a gravel and rock bottom with some muddy areas. The site has a fairly uniform depth of about two to three feet. The area is forested and the banks are covered with undergrowth. The width of the stream is about twenty five feet.

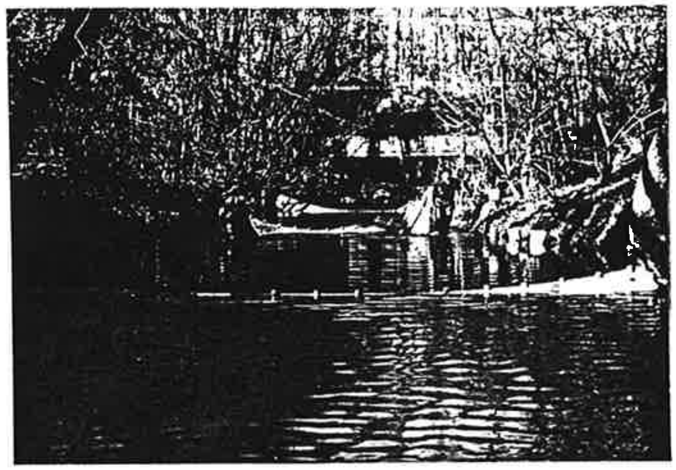
Site 21. Northwest Branch, immediately upstream from Route 29, below the dam at Burnt Mills:

The downstream boundary to this site was about 15 feet upstream from the Route 29 bridge. This is a very shallow rocky site. The average depth is less than a foot with the maximum being about 22 feet. The width is about forty feet. The banks are well covered with shrubs. On the east bank about ten yards back from the edge of the stream is a stone retaining wall. The pool at the bottom of the dam was not part of the sample area because it was too deep (over six feet) and the bottom consisted of large rocks which made seining difficult or ineffective.



<u>Site 22</u>. Northwest Branch, about fifty yards downstream from the 1972 Randolph Road Bridges. (The bridge currently in use and the abandoned Old Randolph Road bridge are located about five hundred yards apart):

This site is shallow and has a sand and mud bottom with some gravelly areas. The depth averages about two feet with a maximum of about three feet. The width of the stream is about thirty feet. Both banks have a good covering of shrubs and the west bank is well forested.



<u>Site 23</u>. Northwest Branch, about seventy five yards upstream from Norwood Road on property belonging to the Patton family:

This location encompasses a winding segment of stream with one five foot deep hole adjacent to an undercut bank with small trees growing on it. The stream is only about fifteen feet across here and in most areas is only a foot or two deep. The bottom is sandy mud with some gravel sections. The banks are steep, consisting of loose soil or clay, and eroding in several spots. The Pattons' lawn reaches down to the west bank of the stream. The east bank and some of the west bank has shrubs and small trees growing above the stream.

Site 24. **Sligo Creek, about twenty yards upstream from the Riggs Road Bridge:**

This site is fairly shallow averaging about two feet with some areas being about three feet deep. The bottom is muddy with some stone and a number of large rocks. The width is about thirty feet and the banks are well covered with shrubs and small trees.

Site 25. **Sligo Creek, about twenty yards upstream from New Hampshire Avenue:**

This site is very shallow with a maximum depth of about eighteen inches. The bed is rocky with outcroppings of bedrock. The banks are steep and forested. The Sligo Creek Parkway roadbed lies about ten yards from the western edge of the Creek. The width of the stream here is about fifteen feet.

Site 26. Sligo Creek, about two hundred yards downstream from the entrance to the Sligo Creek Golf Course on the Sligo Creek Parkway:

The Sligo Creek parkway is about one hundred yards to the east of the stream across a large grass field. The bed here is composed of rock and sandy gravel. The area is well shaded with the east bank being covered with mature forest. The depth averages about two feet with a maximum of about three and one half feet. The width is around fifteen feet.

Site 27. Lower Beaverdam Creek, about one hundred yards east (downstream) of the end of 61st Avenue:

The width of the stream at this point is only about five feet, although the stream bed is about thirty five feet wide. The depth is about a foot. The bottom is firm mud and gravel. The banks are forested. At the downstream end of the site is a pool about three feet deep and twenty feet across.

Total Swallowtail individuals for site #15/16, Fall sampling = 1043

Total Individuals for site #8, Fall samplig = 1545

Total Individuals for site #13, Fall sampling = 1553

Total Individuals for site #15/16, Fall sampling = 2005

At site #7, during summer sampling, three other lampreys were collected by hand near the shroe. These lampreys may have been seeking refuge from low D.O. conditions due to an apparent animal waste spill.

APPENDIX C.

ANACOSTIA RIVER: 1988 SHORE SEINING AND ELECTROFISHING COLLECTIONS

Appendix C.

Anacostia River

1988 Shore Seining and Electrofishing Collections
Spring -Sp., Summer - Su., Fall - Fa.
Stations

	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
1.	American Brook Lamprey																												
Sp.	)-Shore Seining						1																					1	1
Su.																													
Fa.																													
Sp.	)-Electrofishing							1					1															2	2
Su.													1															1	1
Fa.																													
2.	American Eel																												
Sp.	)-Shore Seining																		1									1	
Su.																													
Fa.																													
Sp.	)-Electrofishing	1	4		4	4		2	4		2	3	2		2	6	3	3	8	3	10			1	1		4	67	20
Su.		14	3	4	1	6		2	1	3	3	3	1		4	2	3	2	6	1	11	2	1	2			2	77	22
Fa.		3	5	5		6		3	3	4	1	4			1	1	1	6	8	3	6							60	16
3.	Blueback Herring																												
Sp.	)-Shore Seining	1																										1	1
Su.																													
Fa.		4																										4	1
Sp.	)-Electrofishing	3																										3	1
Su.																													
Fa.																													
4.	Gizzard Shad																												
Sp.	)-Shore Seining	12																										12	1
Su.																													
Fa.		6																										6	1
Sp.	)-Electrofishing	10																										10	1
Su.																													
Fa.		1																										1	1
5.	Rainbow Trout																												
Sp.	)-Shore Seining																1											1	1
Su.																													
Fa.																													
Sp.	)-Electrofishing																												
Su.																													
Fa.																													

Anacostia River

1988 Shore Seining and Electrofishing Collections
Spring -Sp., Summer - Su., Fall - Fa.
Stations

	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
6.	Eastern Mudminnow																												
Sp.	)-Shore Seining					1																						1	1
Su.						1																						1	1
Fa.						1		1																				2	2
Sp.	)-Electrofishing					2		6																				8	2
Su.								2																				2	1
Fa.																													
7.	Chain Pickerel																												
Sp.	)-Shore Seining					3		1																				4	2
Su.				1		1	1	1																				4	4
Fa.						2		2																				4	2
Sp.	)-Electrofishing							3																				3	1
Su.						2		2	1																			5	3
Fa.							1																					1	1
8.	Common Carp																												
Sp.	)-Shore Seining																												
Su.					3																						1	4	2
Fa.																													
Sp.	)-Electrofishing								5																			5	1
Su.				1	2	1																					1	5	4
Fa.				1		1																						2	2
9.	Goldfish																												
Sp.	)-Shore Seining																												
Su.					11		6																				1	18	3
Fa.																													
Sp.	)-Electrofishing					1																		1				2	2
Su.		1			2	1	1																					5	4
Fa.					12		5																					17	2
10.	Silverjaw Minnow																												
Sp.	)-Shore Seining								2	14				3		2	4	1				32	22					80	8
Su.				1						1	3					21	3	28		1		32	29					119	9
Fa.		2		6					44	1	13	7		25		50	9	97		6		22	57					339	13
Sp.	)-Electrofishing																					2	1					3	2
Su.																	1					2	3					6	3
Fa.									4			1				4	1			1		3	1					15	7

Anacostia River

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Stations

	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
11.	Cutlips Minnow																												
Sp.	)-Shore Seining			1			1		10	14	6	9	6	14	8		2	9	5	3		2	5					89	15
Su.			5	91	1				3	11		14	2	9	3		2	6	7	5		2	3					164	15
Fa.			1	37	3	4	1		27	15	1	24	9	8	6		1	2	5	18			2					164	17
Sp.	)-Electrofishing					1			4	7		1	5	7	2		2		5	8			5					47	11
Su.			4	1	6	3			2	4		12	10	2	10		2	1	9	3		1	4					74	16
Fa.			4	13					1	7		23	5	7	6				10	4			4					84	11
12.	River Chub																												
Sp.	)-Shore Seining													3														3	1
Su.																													
Fa.																													
Sp.	)-Electrofishing																												
Su.																													
Fa.																													
13.	Golden Shiner																												
Sp.	)-Shore Seining				1	1	20												1									23	4
Su.					1		18							1		1											2	23	5
Fa.		3		3	3	1	236	1								10					1							258	8
Sp.	)-Electrofishing			1																								1	1
Su.																													
Fa.							5																					5	1
14.	Rosyside Dace																												
Sp.	)-Shore Seining											4	19	21	35							37	151					267	6
Su.													11	17	28		9	9	3		1	19	133					230	9
Fa.				4									17	31	37				1			4	68					162	7
Sp.	)-Electrofishing												1	1	6							2	15					25	5
Su.																					1		6					7	2
Fa.													4		4						1	4	3					16	5
15.	Ironcolor Shiner																												
Sp.	)-Shore Seining										1					3		20	8	8		2	1					43	7
Su.		2	6	8	1				7				1			5											7	37	8
Fa.																													
Sp.	)-Electrofishing										2								27									29	2
Su.																													
Fa.			1																									1	1

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	Species		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
16.	Bridle Shiner																													
	Shore Seining	Sp.				18	35			3	4										74	1	21	4				12	172	9
		Su.	6	14	134	6	5			3							1	3					2					5	179	10
		Fa.	1							6	3	1	2						3				3						19	7
	Electrofishing	Sp.				1				1													3						5	2
		Su.																												
		Fa.																												
17.	Swallowtail Shiner																													
	Shore Seining	Sp.		6		89	31	1		59	72	32	11	5	26		20	110	82	21	31		11	4				4	615	18
		Su.	97	28	238	23	233	1		94	109	181	118	4	17		133	211	124	5	59		53	9				28	1760	20
		Fa.	121	35	110	31	679	17		985	451	99	375	53	420	2	xxx	32	312	9	74	1	61	32				1	4943	22
	Electrofishing	Sp.		17	1	34	8	1				9	2	1	3			5		18			2	1				1	103	14
		Su.		1			4	1				9						8	1		3		2	3					32	9
		Fa.		5	2	6	4	3		13	2	7	56		2		82	16	1	4	11	1	7						222	17
18.	Rosyface Shiner																													
	Shore Seining	Sp.															2	5	1	1									9	4
		Su.			8													2											10	2
		Fa.	1		16												6	27	5		2								57	6
	Electrofishing	Sp.																												
		Su.																												
		Fa.																1											1	1
19.	Spotfin Shiner																													
	Shore Seining	Sp.		2	7	8	3			9	8	11	3	2	4		10	21	19	4	14		2	1	28			3	159	19
		Su.	2	5	8		6			5	4	7	2		2		3	14	1		6		3		40			2	110	16
		Fa.	3	1	1					8	3		4				9						1						30	8
	Electrofishing	Sp.		5	12	3	2					1			2													1	26	7
		Su.										1																	1	1
		Fa.		2							1							1											4	3
20.	Satinfin Shiner																													
	Shore Seining	Sp.	3	34	12	35	29			61	79	79	72	20	36		61	147	95	43	138		25	5	72			14	1060	20
		Su.	13	159	175	44	44			71	52	138	83	6	32		45	154	138	23	74		30	3	230			26	1540	20
		Fa.	15	97	154	234	120		83	118	15	32	117	19	56		633	37	134	15	36		10	6	46	1		4	1982	22
	Electrofishing	Sp.	1	14	24	9	10				1	10						8		2	2				1			1	83	12
		Su.		1	3							7					1			1	1		1					2	17	8
		Fa.		27	4	21	2		2	16			18	3			30	11	1	3	5	5	2	1	77	1			229	18

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Species		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
21. Common Shiner																													
Shore Seining	Sp.								6	18			8	141	5			8	13	12		14	44					270	10
	Su.		1	16		2			1	1	11	11	7	67				4		9		14	47					191	13
	Fa.		1	28	7	2	2		111	44	19	42	2	990	67	7	14	180		58		1	106					1681	18
Electrofishing	Sp.											3		3								1	4					11	4
	Su.											1								1		1	6					9	4
	Fa.	1							9	2		2		2	1								4					21	7
22. Spottailed Shiner																													
Shore Seining	Sp.	1	30	27	4	98			109	39	4	4	5	29			25	90	27	43		61	14				1	611	18
	Su.	256	78	129	6	13	1		52	7	13	15	7	32		297	91	114	32	11		22	23				3	1202	20
	Fa.	110	26	53	8	28	5		240	94	28	20	24	18		120	118	196	3	36		10	36				1	1174	20
Electrofishing	Sp.		9		3	9			4			1	1					1		3		3	5					39	10
	Su.		1			6					1	3	1			4	5	4	3	2	1	6	5				1	43	14
	Fa.		12	9	4				83	4	1	4	1			7	19	1		6		4	1					156	14
23. Eastern Silvery Minnow																													
Shore Seining	Sp.								2	1		3					1	1				1						9	6
	Su.	1											2			1		1										5	4
	Fa.	4																10		1		1						16	4
Electrofishing	Sp.													1								6						7	2
	Su.																												
	Fa.																				3	7						10	2
24. Bluntnose Minnow																													
Shore Seining	Sp.																9					28						37	2
	Su.															1	28	3	2			9	2					47	6
	Fa.	2														113	8	11		1		52	53					240	7
Electrofishing	Sp.																	1	6			21						28	3
	Su.																3		2			3	2					10	4
	Fa.															7	5	2			5	33	3					55	6
25. Blacknose Dace																													
Shore Seining	Sp.		4	2	4				1	3	97	9	95	1	15					8	1	8	23	35	69		22	397	17
	Su.		9		1				1	2	122	4	36				1	2		14	3	43	14	54	104		18	428	16
	Fa.		3	5	16						55	23	45	1	8			3	1	3	4	3	47	52	21	1	4	295	18
Electrofishing	Sp.			1							11	3	7	3	19		1		1			4	21		52			123	11
	Su.		2								8	7	3		4						5	8	14	6	40	1	1	99	12
	Fa.		2	1							2	3	2		7	1					19	1	13	59	35	11	1	157	14

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Spring -Sp., Summer - Su., Fall - Fa.
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	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
26.	Longnose Dace																												
Sp.	Shore Seining										2		1										2					5	3
Su.	Shore Seining		1								2										2		7					12	4
Fa.	Shore Seining		4	1							4		9								1							19	5
Sp.	Electrofishing										2												4				2	8	3
Su.	Electrofishing		2								1												3					6	3
Fa.	Electrofishing		2								1		1									1						5	4
27.	Northern Creek Chub																												
Sp.	Shore Seining											1		5														6	2
Su.	Shore Seining									1		1	1	5								3	10					21	6
Fa.	Shore Seining													1	1								15					17	3
Sp.	Electrofishing											2	4	1								4	7			2		20	6
Su.	Electrofishing				1						1	2										3	3			3		13	6
Fa.	Electrofishing				1							4									1	2	1			20		29	6
28.	Fallfish																												
Sp.	Shore Seining					2	1				2	4		1							1		3					14	7
Su.	Shore Seining									1		12	2	6														21	4
Fa.	Shore Seining										1	1		20														22	3
Sp.	Electrofishing				2		1					3		1									1					8	5
Su.	Electrofishing													1														1	1
Fa.	Electrofishing												2															2	1
29.	Creek Chubsucker																												
Sp.	Shore Seining						2																					2	1
Su.	Shore Seining						3																					3	1
Fa.	Shore Seining					1	35	22	1																			59	4
Sp.	Electrofishing				1		2	1																				4	3
Su.	Electrofishing				2																							2	1
Fa.	Electrofishing					5	7	2	4																			18	4
30.	White Sucker																												
Sp.	Shore Seining													3			1	1					2					7	4
Su.	Shore Seining				1								1	8		1	30		3			4	2					50	8
Fa.	Shore Seining						5		1						1			1			1	1	2					12	7
Sp.	Electrofishing	1		1			3		9	2		8	8	10	6			10	1		2	27	2	21				111	15
Su.	Electrofishing			1		3			16		1	6	9	2			18	14	1	1	1	14	10	3				100	15
Fa.	Electrofishing			1		1	2		13	1	1	1		18	10		1	57	7	1	4	8	11	13				140	17

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Species		#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
31. Northern Hog Sucker																													
)-Shore Seining	Sp.																	1										1	1
	Su.																	22	4	9		2	11					48	5
	Fa.																	1			1		3					5	3
)-Electrofishing	Sp.										1						3	1										5	3
	Su.											1						1		1			2					5	4
	Fa.																		8	2	4		3					17	4
32. Channel Catfish																													
)-Shore Seining	Sp.																												
	Su.																												
	Fa.																												
)-Electrofishing	Sp.																												
	Su.	1																										1	1
	Fa.																												
33. Yellow Bullhead																													
)-Shore Seining	Sp.																												
	Su.																												
	Fa.				1																							1	1
)-Electrofishing	Sp.									1												1						2	2
	Su.									1	3					1												5	3
	Fa.	1				2												1										4	3
34. Brown Bullhead Catfish																													
)-Shore Seining	Sp.		1				4																1					6	3
	Su.						1																					1	1
	Fa.																												
)-Electrofishing	Sp.		1																									1	1
	Su.	2	2			3							1			16												24	5
	Fa.			1			1					1																3	3
35. Margined Madtom																													
)-Shore Seining	Sp.												1			1												2	2
	Su.																						1					1	1
	Fa.																												
)-Electrofishing	Sp.														1				1				1					3	3
	Su.												2	1	2													5	3
	Fa.												1										2					3	2

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	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
36.	Inland Silversides																												
Sp.	)-Shore Seining	12																										12	1
Su.		10																										10	1
Fa.		367																										367	1
Sp.	)-Electrofishing	1																										1	1
Su.																													
Fa.		18																										18	1
37.	Sheepshead Minnow																												
Sp.	)-Shore Seining				1																							1	1
Su.																													
Fa.																													
Sp.	)-Electrofishing																												
Su.						1																						1	1
Fa.																													
38.	Mosquitofish																												
Sp.	)-Shore Seining																												
Su.																													
Fa.		1																										1	1
Sp.	)-Electrofishing																												
Su.																													
Fa.		1																										1	1
39.	Banded Killifish																												
Sp.	)-Shore Seining	6														13												19	2
Su.		157														15												172	2
Fa.		46			1											1												48	3
Sp.	)-Electrofishing																											5	1
Su.																4												4	1
Fa.		2	3		1											24											2	32	5
40.	Mummichog Killifish																												
Sp.	)-Shore Seining	9	2																								84	95	3
Su.		39	2													8											30	79	3
Fa.		10																									9	19	2
Sp.	)-Electrofishing	22	3													3											56	84	4
Su.		2	3													3											14	22	4
Fa.		7	10																								82	99	3

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	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
41.	Bluespotted Sunfish																												
Sp. Su. Fa.	)-Shore Seining							1																				1	1
Sp. Su. Fa.	)-Electrofishing					1																						1	1
42.	Green Sunfish																												
Sp. Su. Fa.	)-Shore Seining	1					1																					1 1	1 1
Sp. Su. Fa.	)-Electrofishing			1			2 3		1																			3 4	2 2
43.	Bluegill Sunfish																												
Sp. Su. Fa.	)-Shore Seining	1 2	1	1		1	3	1 1	2		1	1	2	2								1 1	1 5 1					4 14 10	4 7 7
Sp. Su. Fa.	)-Electrofishing	1 1 6	4 1 1	2 1 1	5 5	2	2 2	1 3	3 3 3	1	2	1	2 2								1	4	1				1	26 22 20	11 8 9
44.	Redbreast Sunfish																												
Sp. Su. Fa.	)-Shore Seining	1	1		9	4	2				1	1				1 1		1			1	1						3 21	3 9
Sp. Su. Fa.	)-Electrofishing	21	3 5 1	2 3	1	4	4	5	5	3		2		5		1 2 3	2	11	3 9	3 1	1 1 1		5					12 16 81	5 5 17
45.	Longear Sunfish																												
Sp. Su. Fa.	)-Shore Seining	3	2 7	31 2	13	4 25 1	2 7		22	1 1		1 4	1	7		1 13	1 5 2	2	1	1		5	1 1				1	14 127 27	9 14 7
Sp. Su. Fa.	)-Electrofishing	1 1 22	12 12	7 24 4	2 6 4	2 13 3		3 2	6	1 7	2 1	2 7 1		4 1 7	1 1	7 5	3 27 2	5 14 6	7 9	12 9	1	2 5	2				4 1	77 153 53	17 19 11

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	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
46.	Pumpkinseed Sunfish																												
Sp.	)-Shore Seining	2				1	2																					5	3
Su.		36	2		2	8	1	1								4												54	7
Fa.		19	2		6	11	21	2								3		8										72	8
Sp.	)-Electrofishing	16	9			2	3	4								2				2				1			2	41	9
Su.		2	16		6	3	1		3								1				1						1	32	9
Fa.		37	15		15	8	9	3								7												94	7
47.	Largemouth Bass																												
Sp.	)-Shore Seining	2																										2	2
Su.		4					4										9	2	9	6								34	6
Fa.		5		1	1	3	2					1		1						1								15	8
Sp.	)-Electrofishing					1																						1	1
Su.																				1	2	1						4	3
Fa.		1	1			1	1					1								2								7	6
48.	Black Crappie																												
Sp.	)-Shore Seining																												
Su.																													
Fa.																													
Sp.	)-Electrofishing											1																1	1
Su.																													
Fa.																													
49.	Fantail Darter																												
Sp.	)-Shore Seining																												
Su.																													
Fa.																													
Sp.	)-Electrofishing																						4					4	1
Su.																							1					1	1
Fa.																							1					1	1
50.	Tessellated Darter																												
Sp.	)-Shore Seining					6		1	2	1							13	14	1	13			7	5				63	10
Su.				13	1	38			4	1				1	1	8	5	27	7	11		7	14					138	13
Fa.		3	3	14	9	72		13	4	14			3			9	1	7	7	15	1	8	10					193	17
Sp.	)-Electrofishing							2						2			4	4	4	4		4	4					28	8
Su.																	21	1	6	2	1	1	8					40	7
Fa.			1	2		2													3	3		5	3					19	7

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Stations

	Species	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
51.	White Perch																												
Sp. Su. Fa.	\ )-Shore Seining /	14																										14	1
Sp. Su. Fa.	\ )-Electrofishing /	5 2																										5 2	1 1

Totals For All Sites
Stations

	Shore Seining	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
Sp. Su. Fa.	Total Individuals	62 628 726	81 319 173	49 853 436	160 101 342	214 376 928	30 39 338	2 3 126	264 265 ***	254 191 640	234 477 255	122 264 617	162 82 182	287 206 ***	63 32 122	113 558 ***	340 567 249	342 483 971	124 96 41	345 206 251	3 6 11	252 252 177	288 315 438	135 324 98	69 104 22	0 0 1	140 123 20	4147 6868 12267	25 25 26
Sp. Su. Fa. Sp. + Fa.	Total Species	10 15 21 25	8 15 10 17	5 13 16 19	8 13 14 19	12 11 15 18	8 9 14 17	2 3 9 9	11 12 11 16	12 12 9 14	9 8 12 14	12 10 12 17	10 13 10 18	13 14 11 18	4 3 7 8	9 17 13 20	13 16 10 18	13 15 16 21	10 11 7 17	11 12 12 17	3 3 8 11	15 18 13 20	17 18 14 22	3 3 2 4	1 1 2 2	0 0 1 1	7 11 6 10	39 38 38	25 25 26

Stations

	Electrofishing	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
Sp. Su. Fa.	Total Individuals	67 27 123	83 53 92	52 35 47	64 31 65	53 48 39	15 3 43	22 7 20	45 23 150	14 15 25	39 37 16	29 43 121	31 30 20	38 7 41	37 21 29	22 58 166	30 89 60	24 38 86	80 40 52	34 30 39	16 25 51	86 51 77	75 73 56	25 11 149	53 40 36	2 4 31	68 26 86	1104 2352 1720	26 26 26
Sp. Su. Fa.	Total Species	12 8 14	12 13 16	10 7 13	10 9 9	12 13 12	8 3 12	8 4 7	10 5 11	6 4 9	9 11 8	11 10 14	9 9 9	12 5 6	7 5 6	6 10 10	9 10 11	6 8 9	12 9 8	7 13 11	5 10 12	15 15 12	14 16 15	5 3 3	2 1 2	1 2 2	8 8 4	43 37 41	26 26 26

Stations

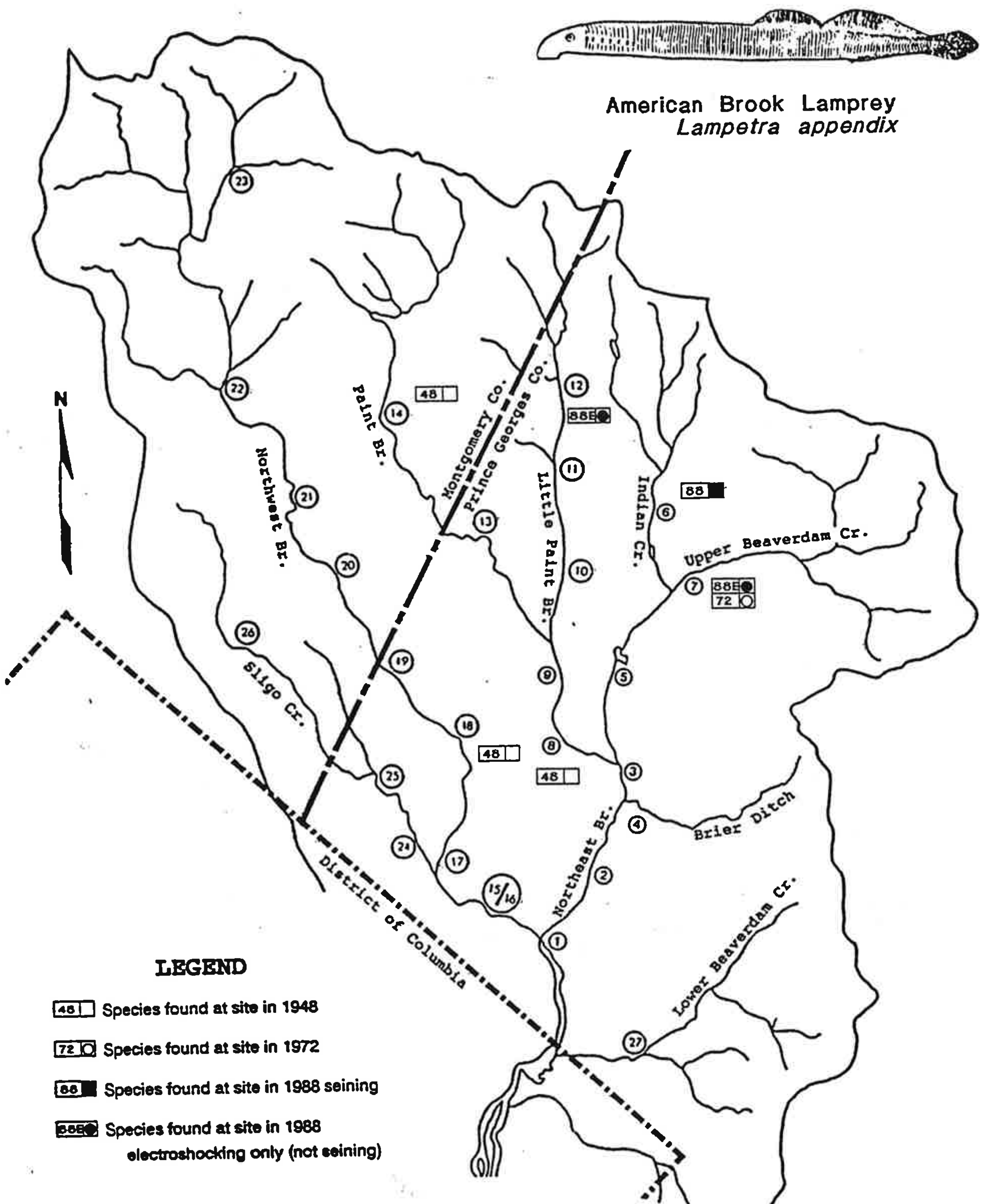
	All Methods	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15 & #16	#17	#18	#19	#20	#21	#22	#23	#24	#25	#26	#27	Total # of Ind.	Total # of Sites
	All Three Seasons	32	20	25	26	26	18	13	20	20	20	22	21	21	11	24	22	23	20	21	21	24	25	8	3	2	17		

APPENDIX D.

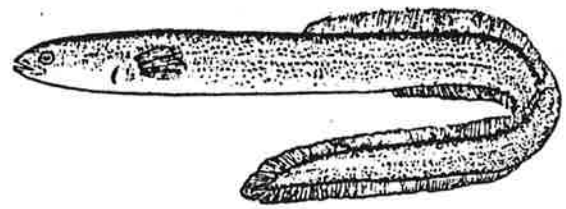
MAPS OF THE DISTRIBUTION OF RESIDENT FISHES IN THE ANACOSTIA BASIN, MARYLAND: 1948, 1972, AND 1988.

LEGEND

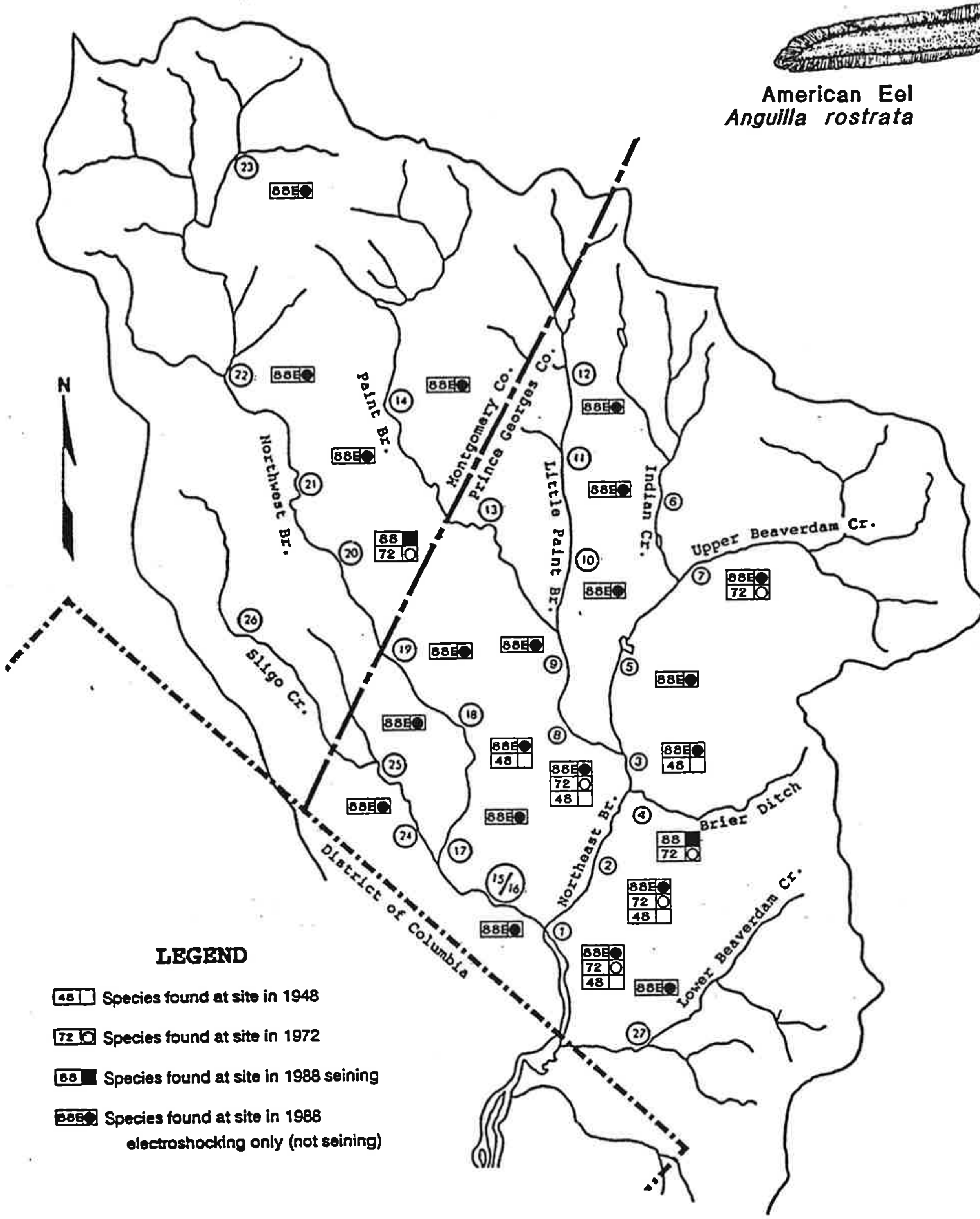
48 □	Species found at site in 1948
72 ○	Species found at site in 1972
88 ■	Species found at site in 1988 seining
88E ●	Species found at site in 1988 electroshocking only (not seining)



Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



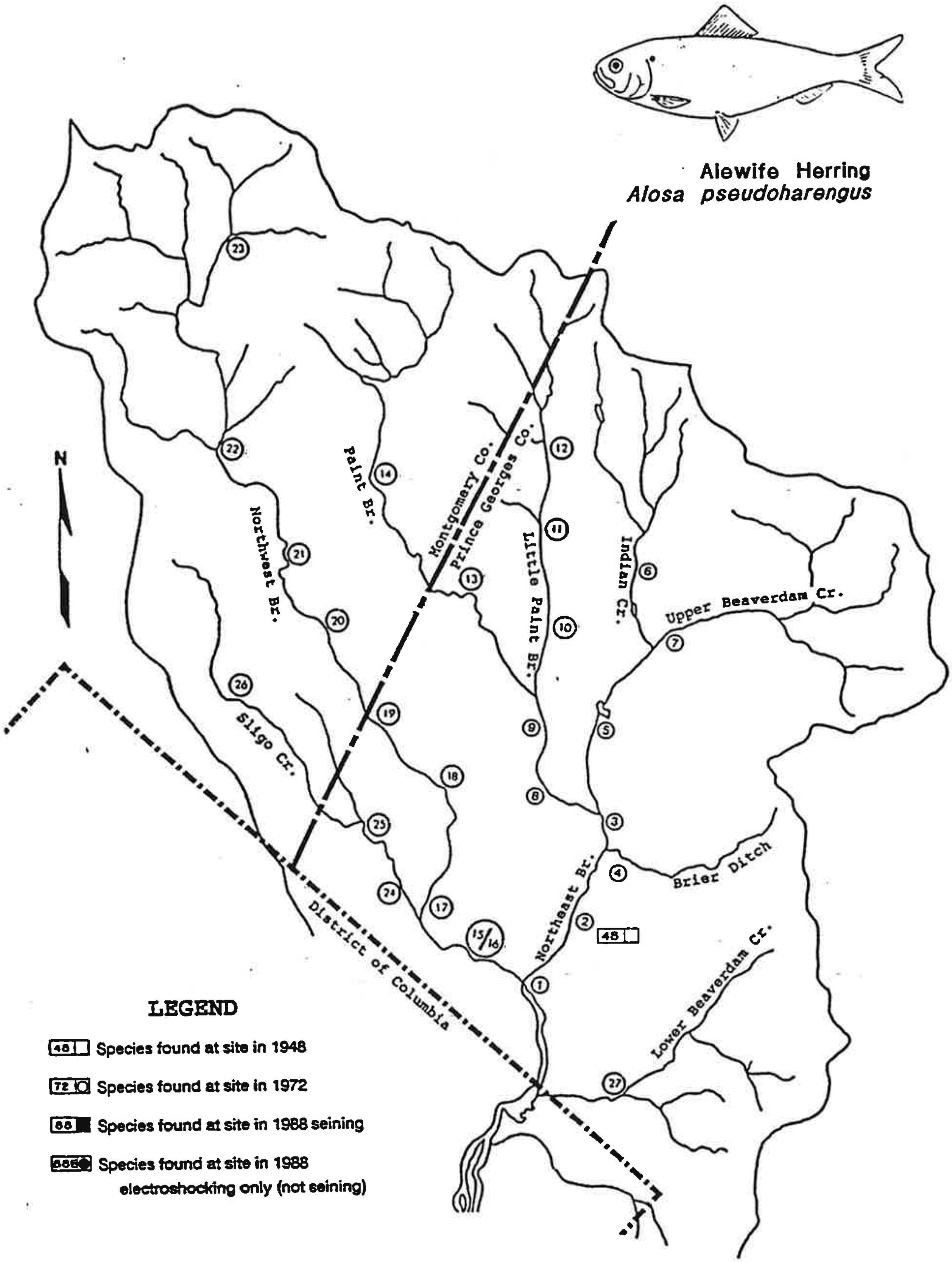
American Eel
Anguilla rostrata



Anacostia Basin, Maryland

Fish Distribution

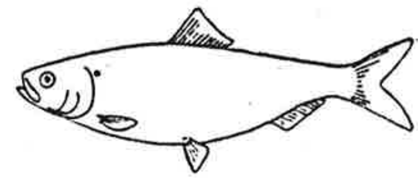
1948, 1972, and 1988



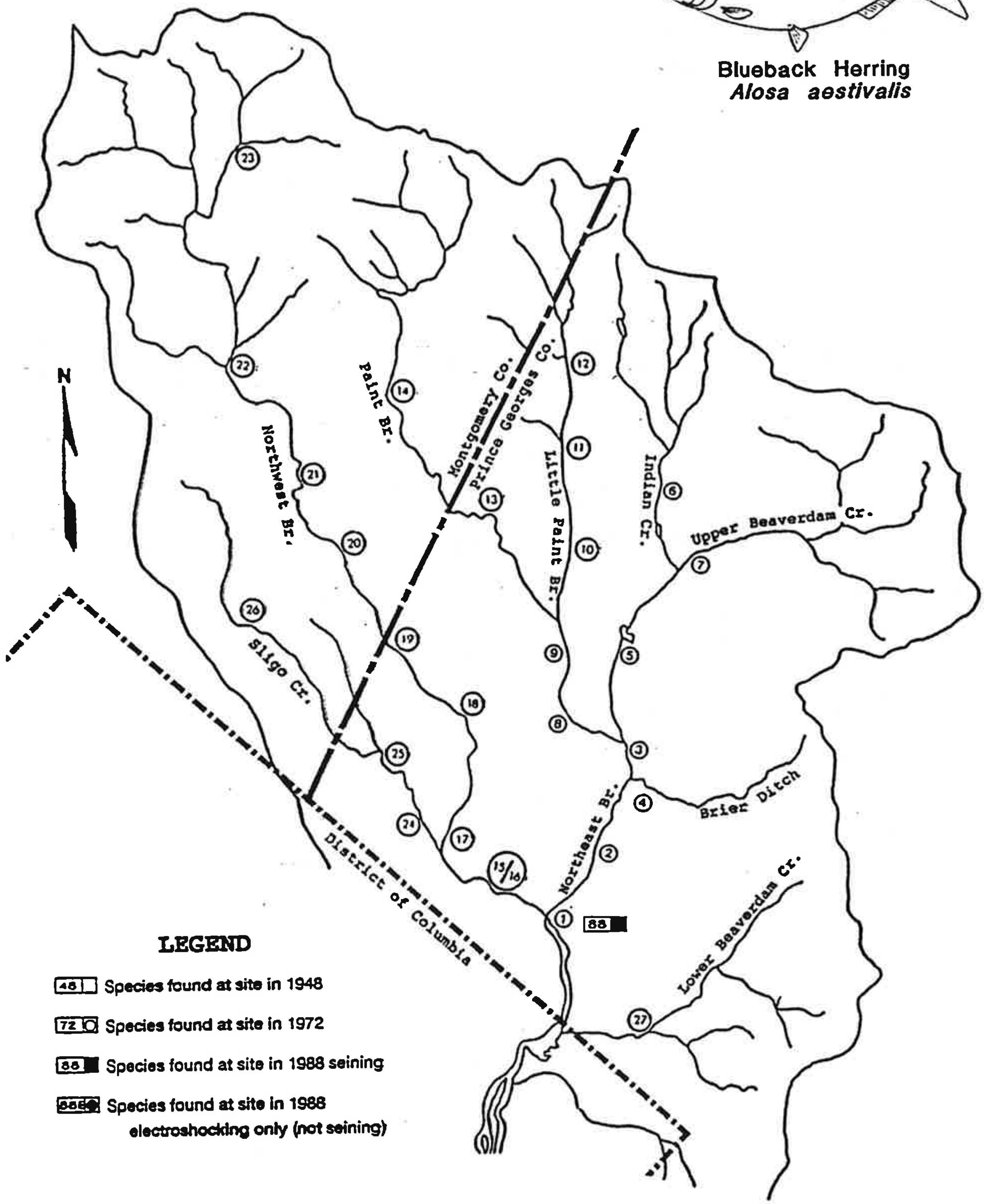
Anacostia Basin, Maryland

Fish Distribution

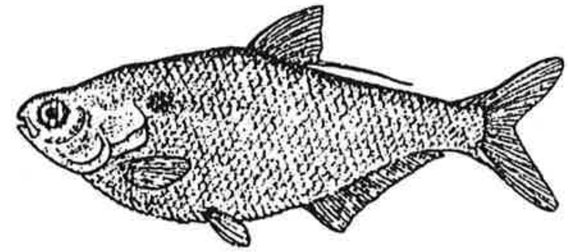
1948, 1972, and 1988



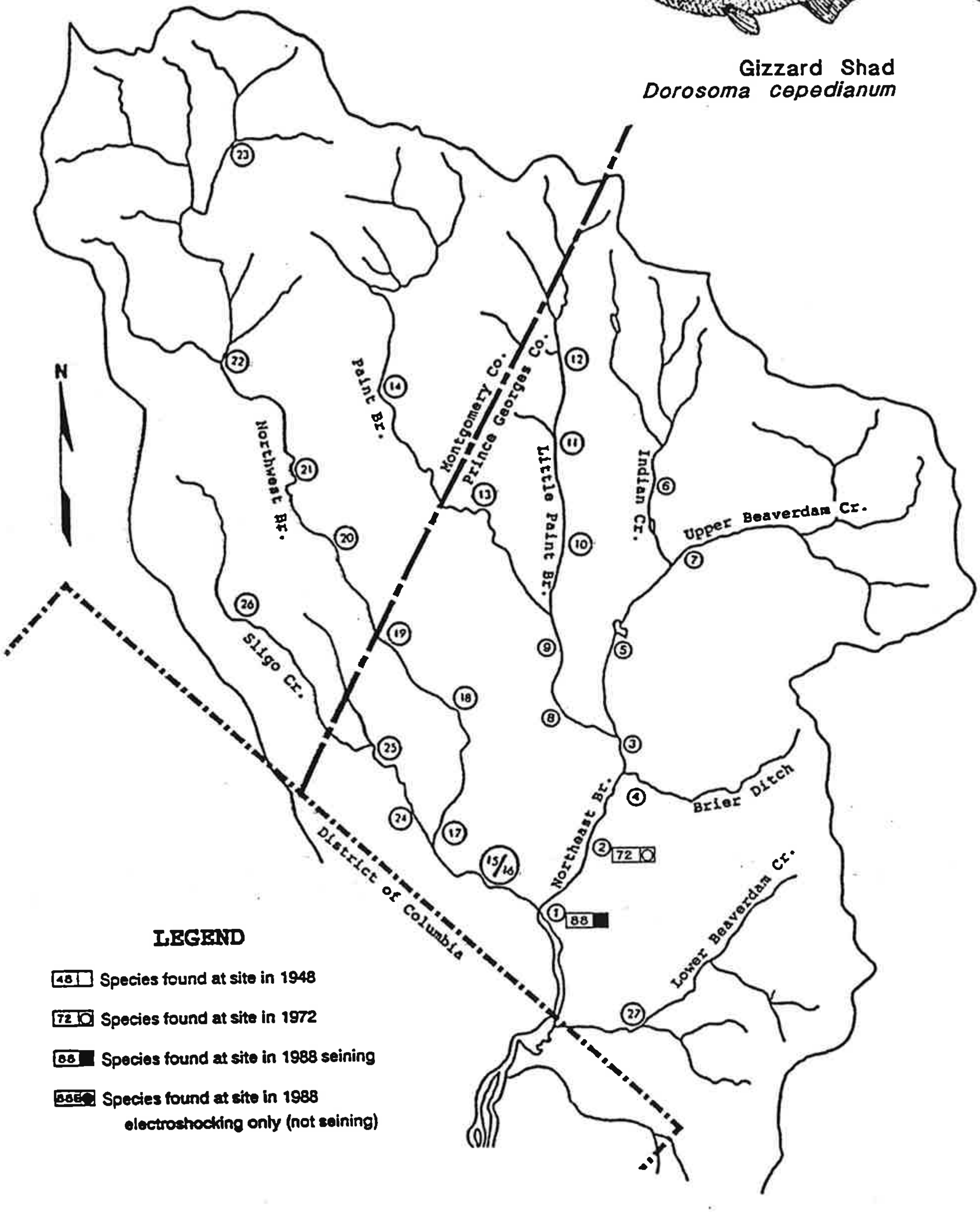
Blueback Herring
Alosa aestivalis



Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



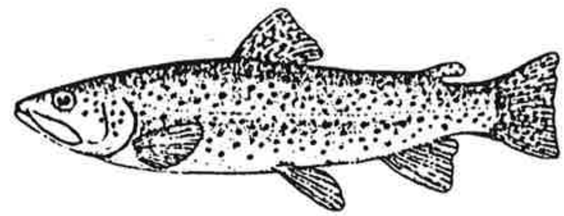
Gizzard Shad
Dorosoma cepedianum



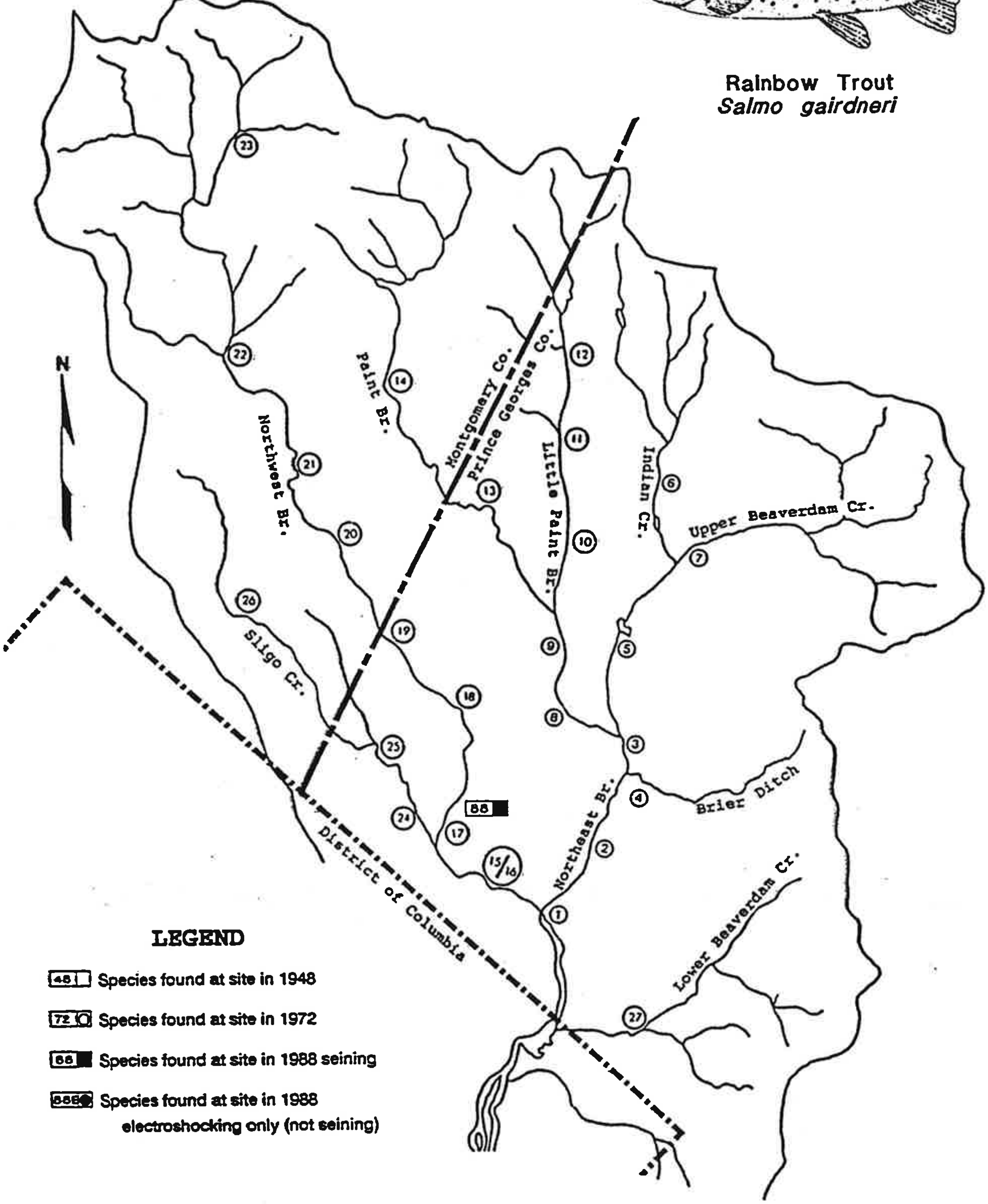
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



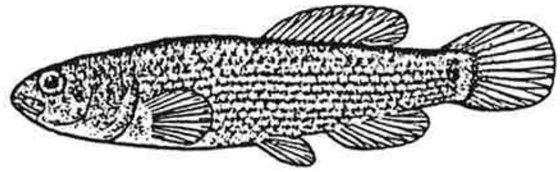
Rainbow Trout
Salmo gairdneri



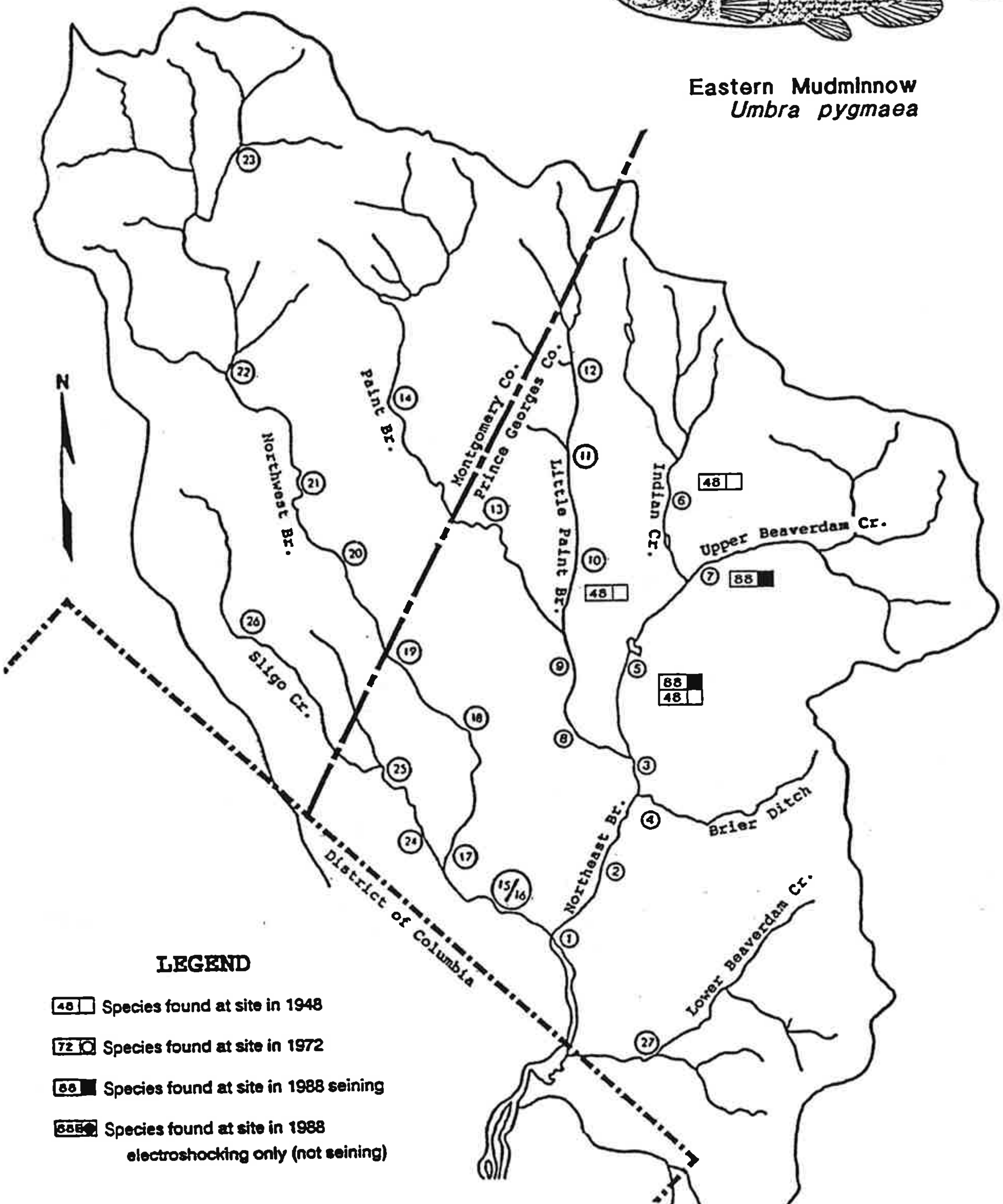
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



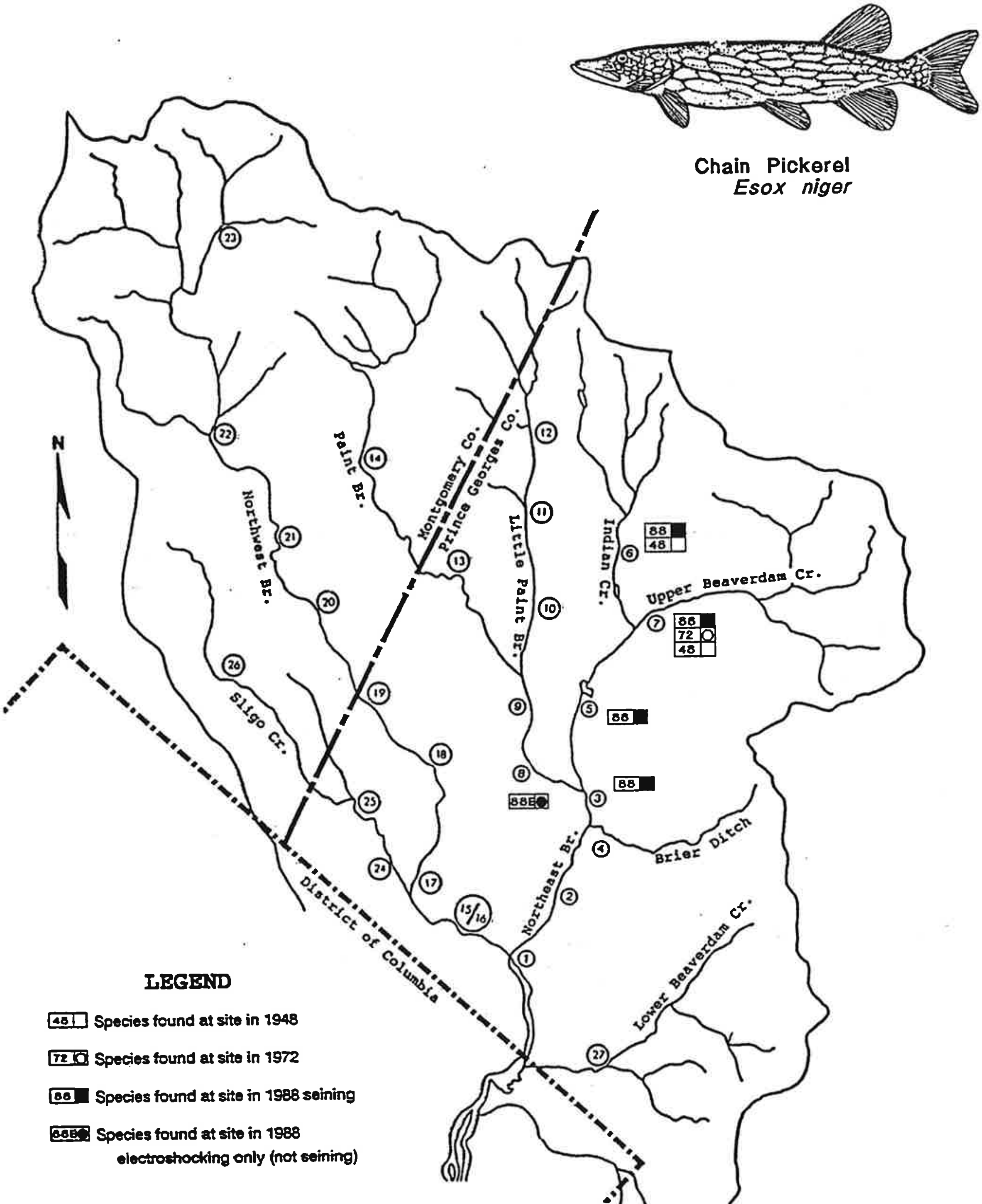
Eastern Mudminnow
Umbra pygmaea



Anacostia Basin, Maryland

Fish Distribution

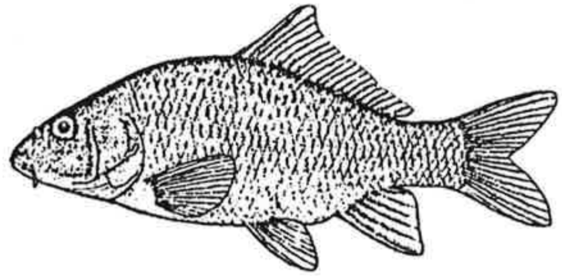
1948, 1972, and 1988



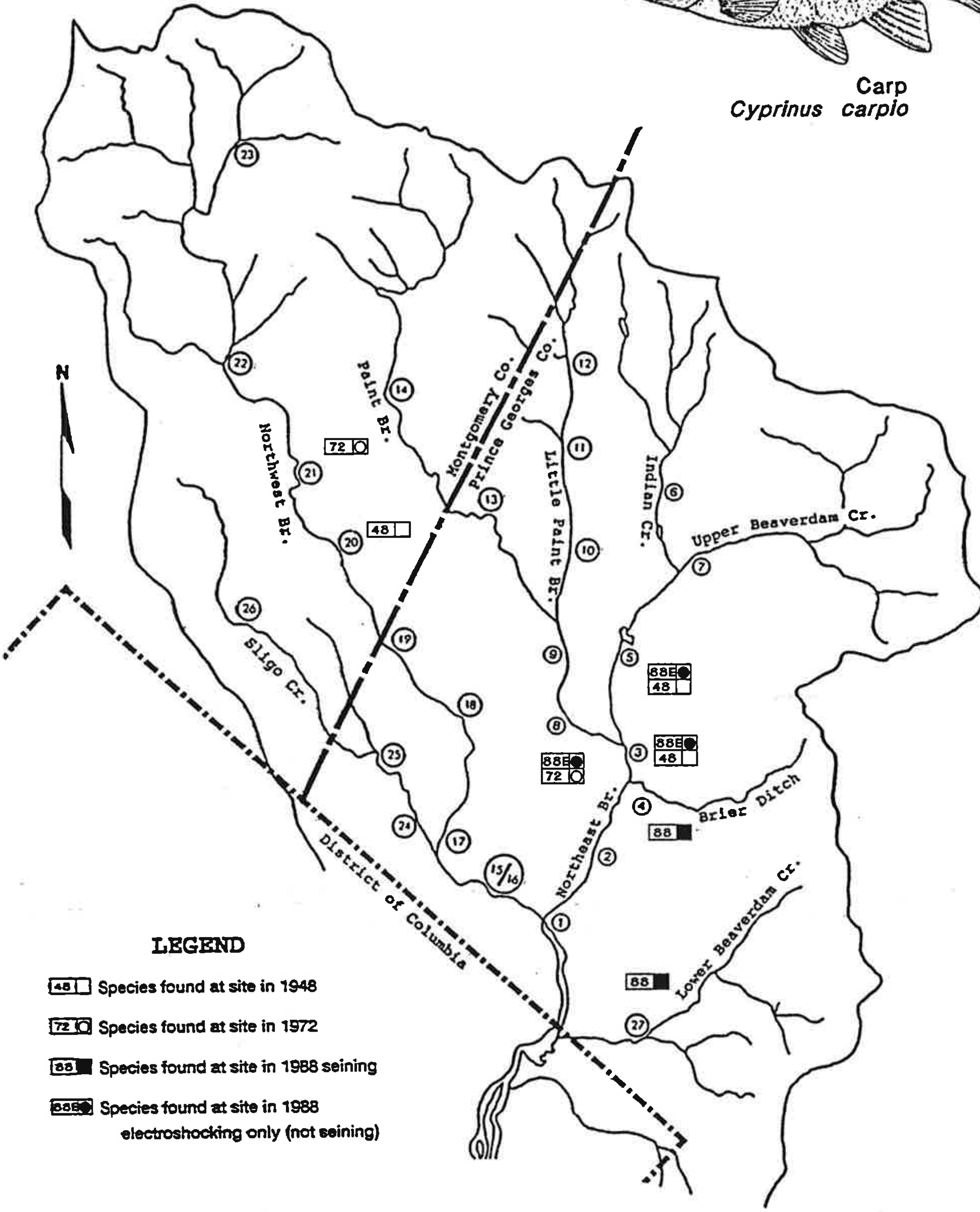
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



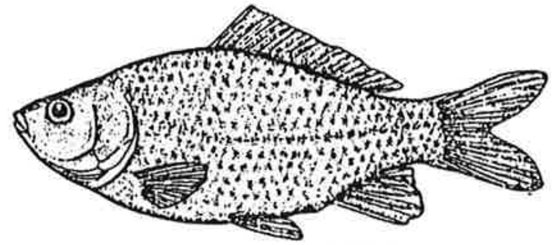
Carp
Cyprinus carpio



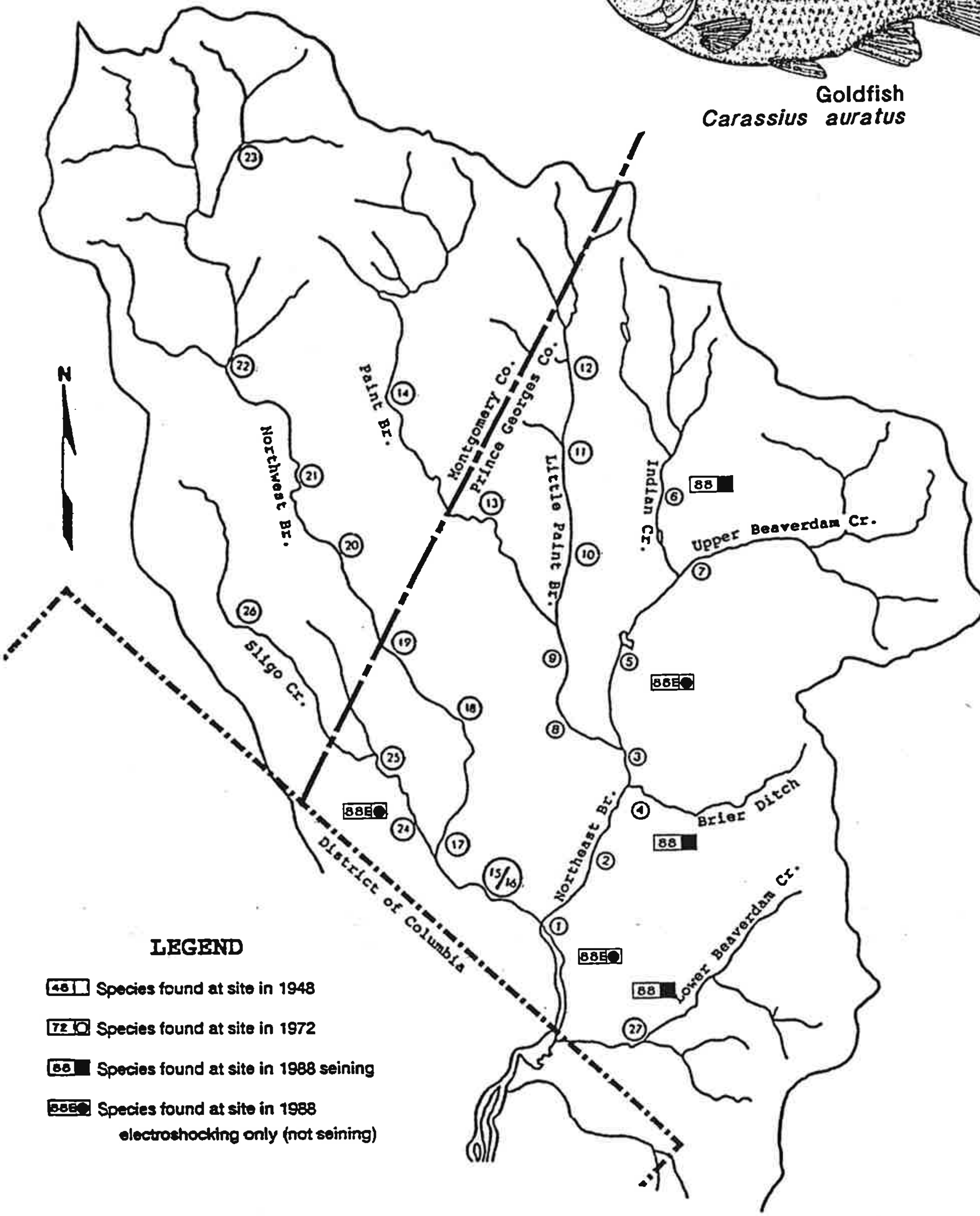
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



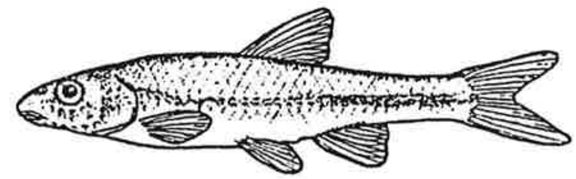
Goldfish
Carassius auratus



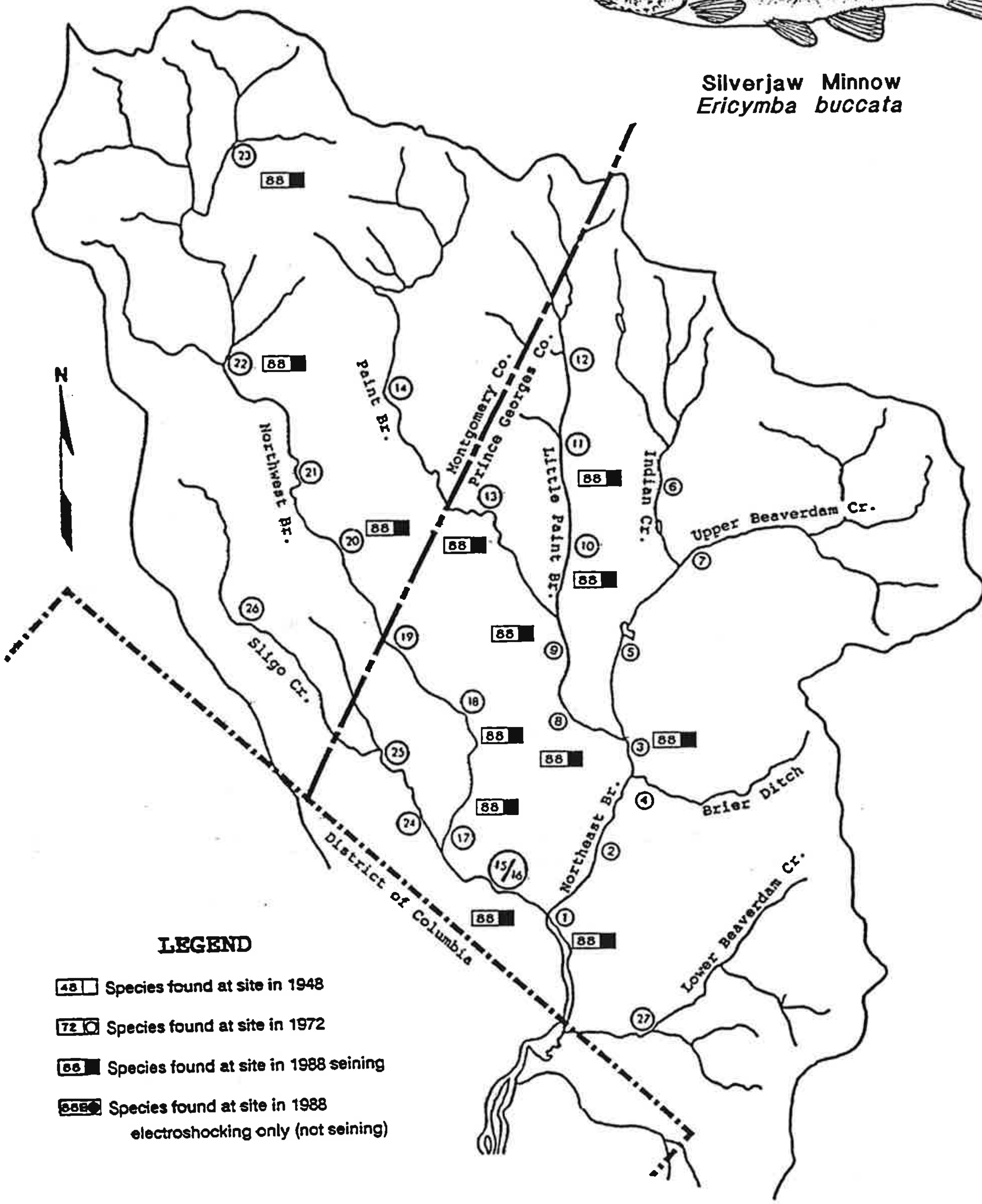
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



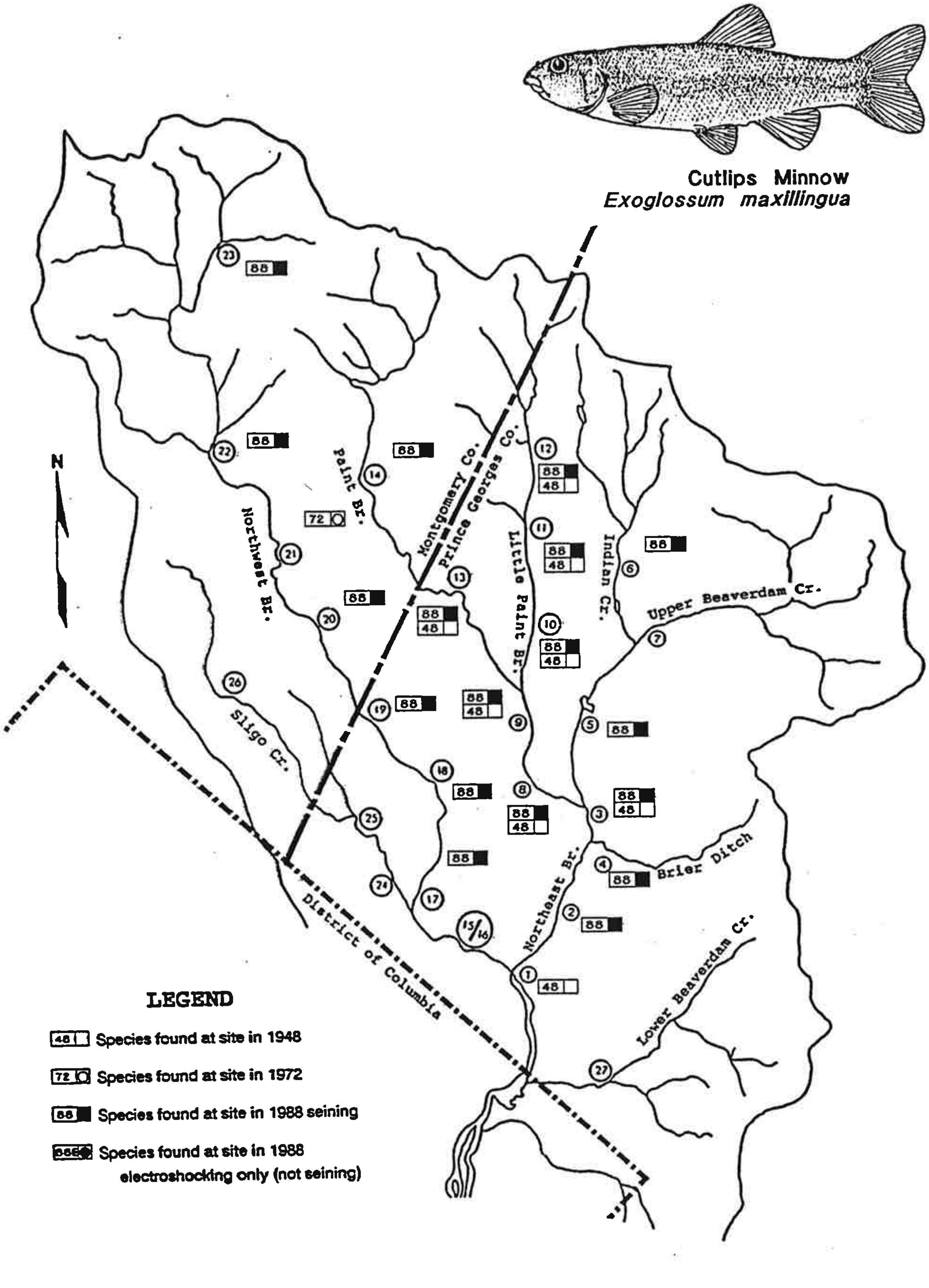
Silverjaw Minnow
Ericymba buccata



Anacostia Basin, Maryland

Fish Distribution

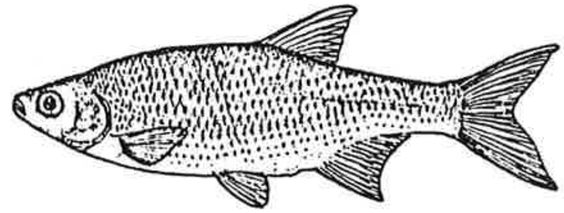
1948, 1972, and 1988



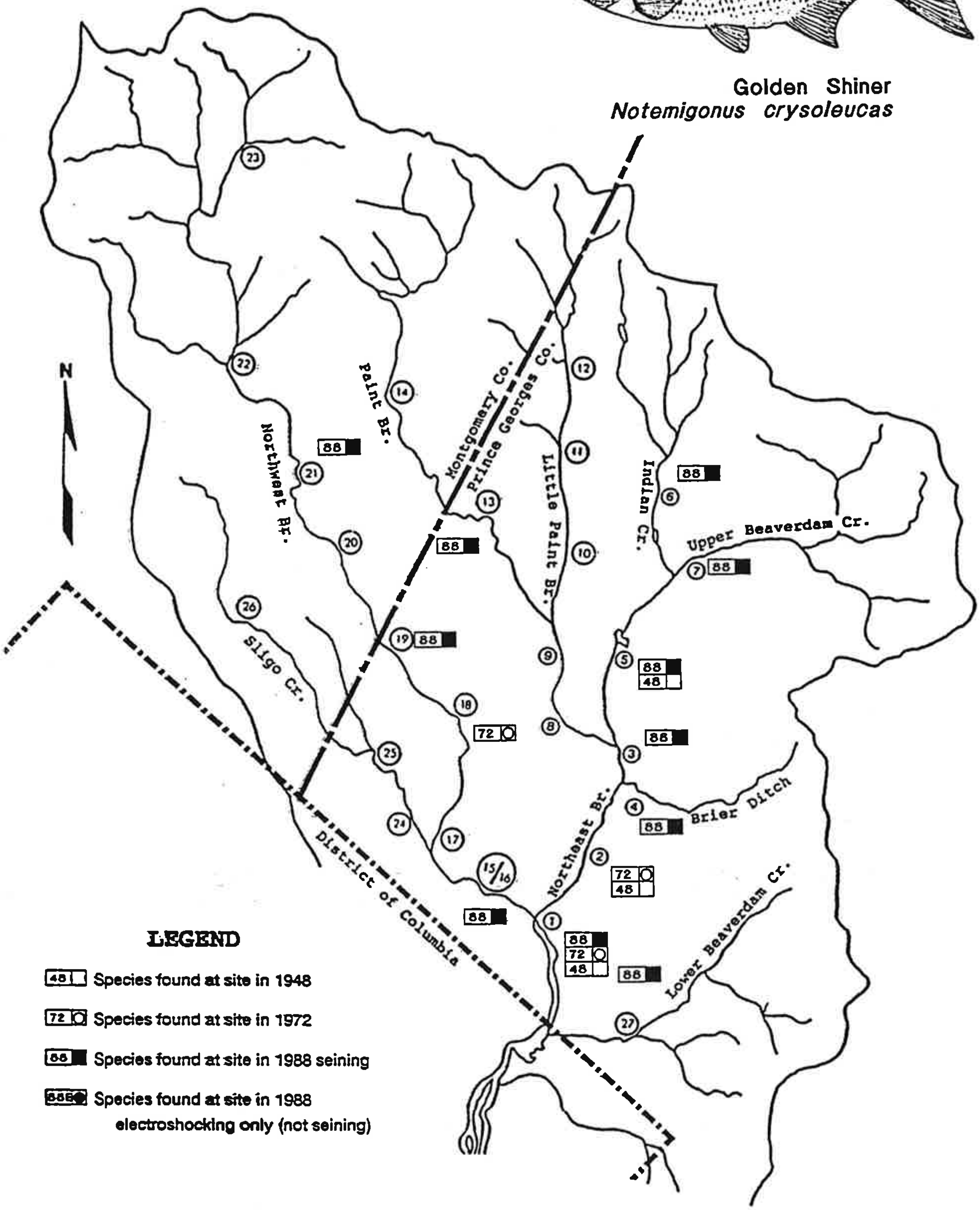
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



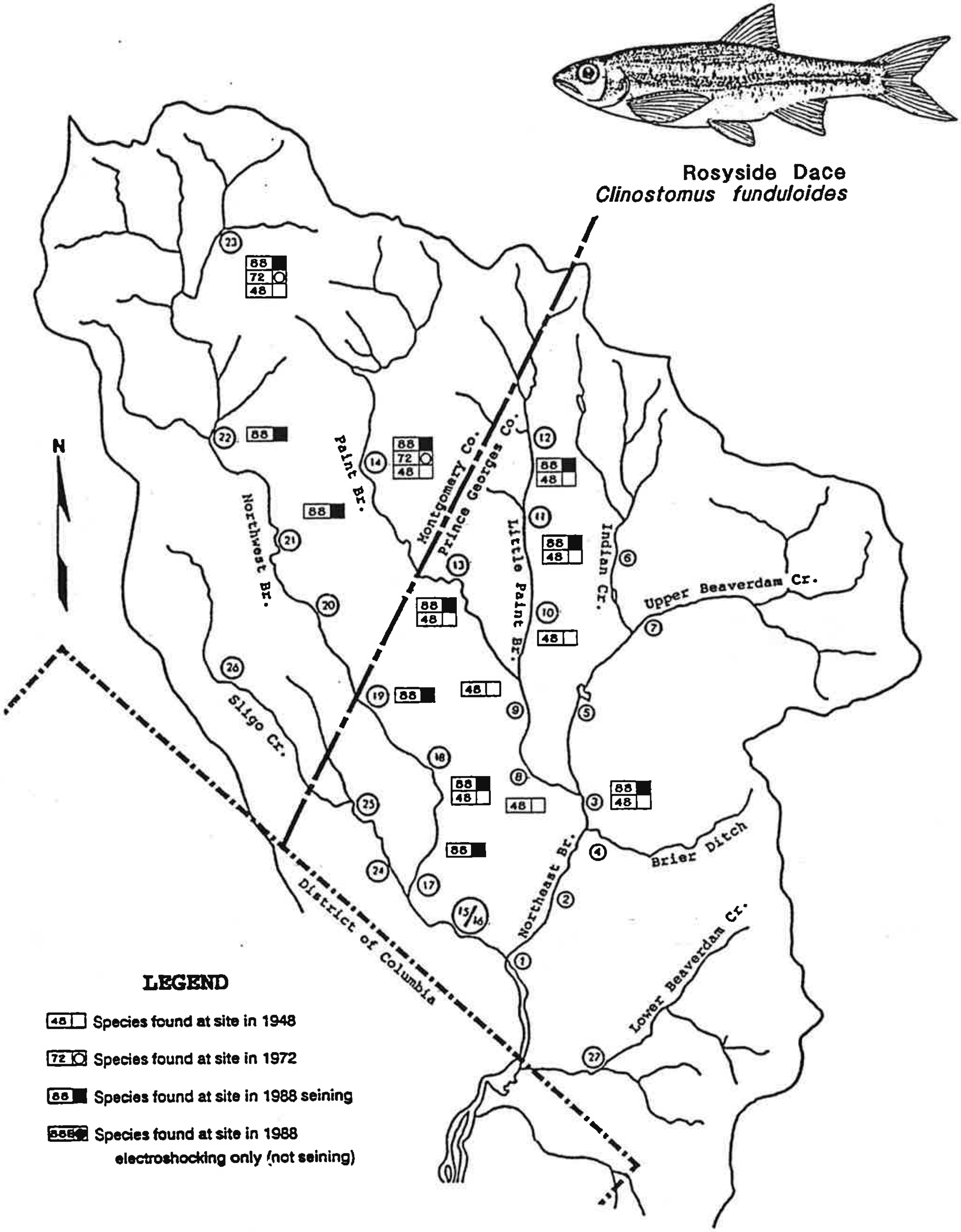
Golden Shiner
Notemigonus crysoleucas



Anacostia Basin, Maryland

Fish Distribution

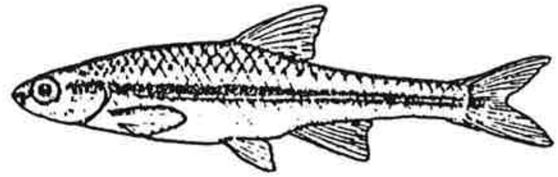
1948, 1972, and 1988



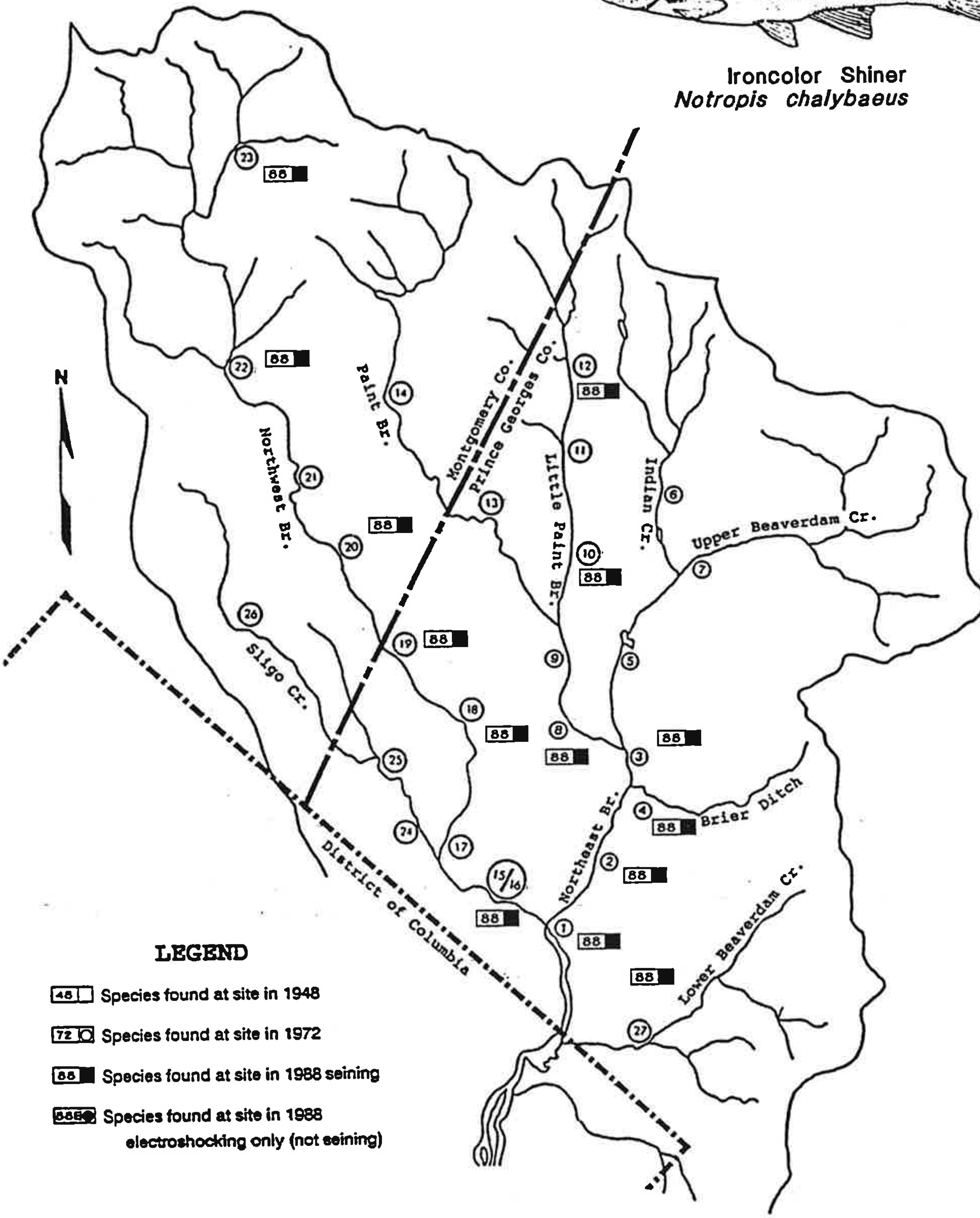
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



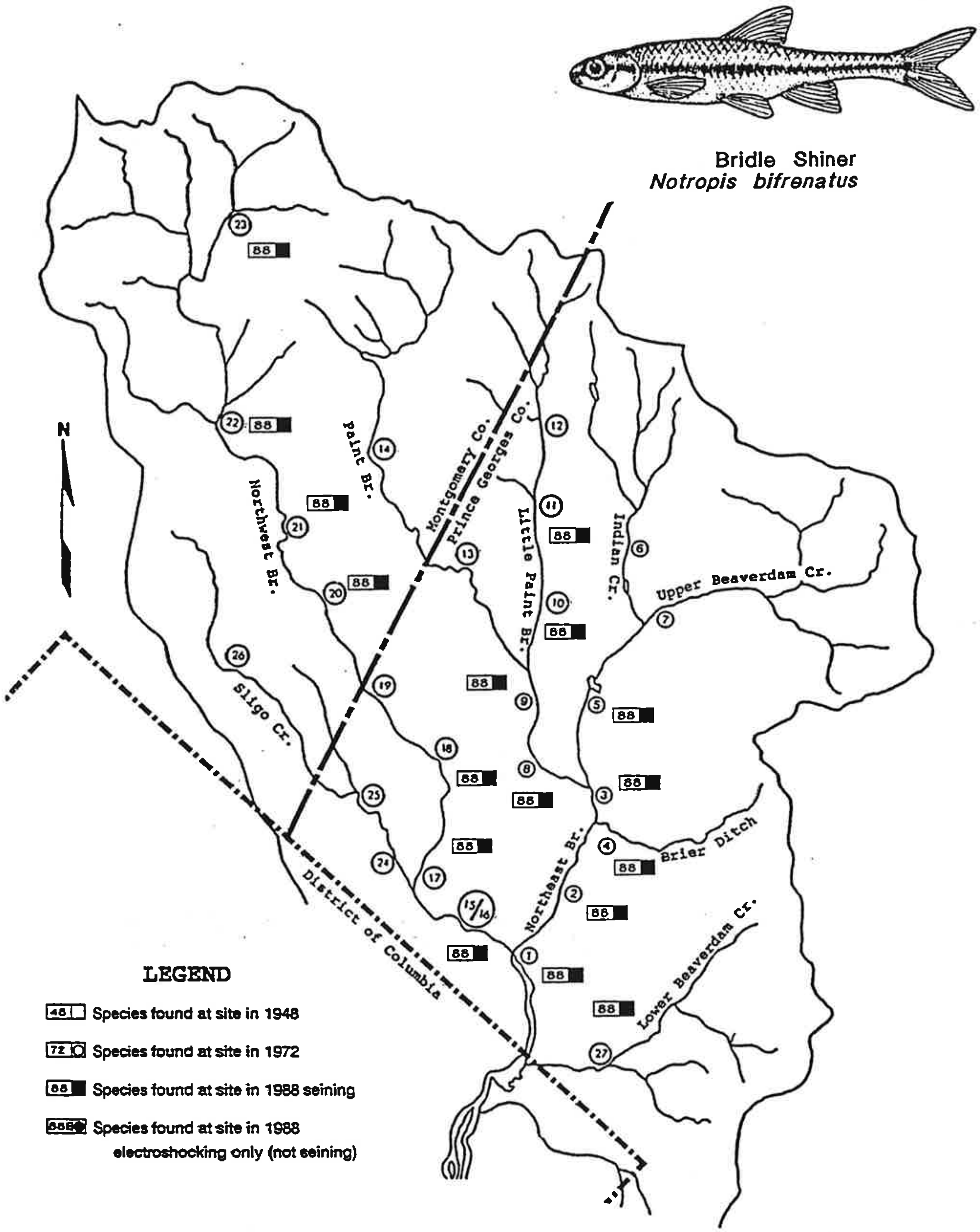
Ironcolor Shiner
Notropis chalybaeus



Anacostia Basin, Maryland

Fish Distribution

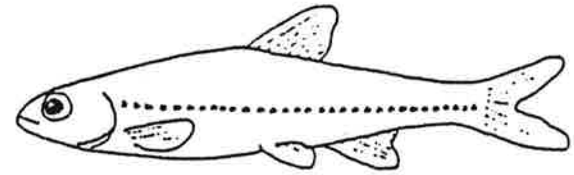
1948, 1972, and 1988



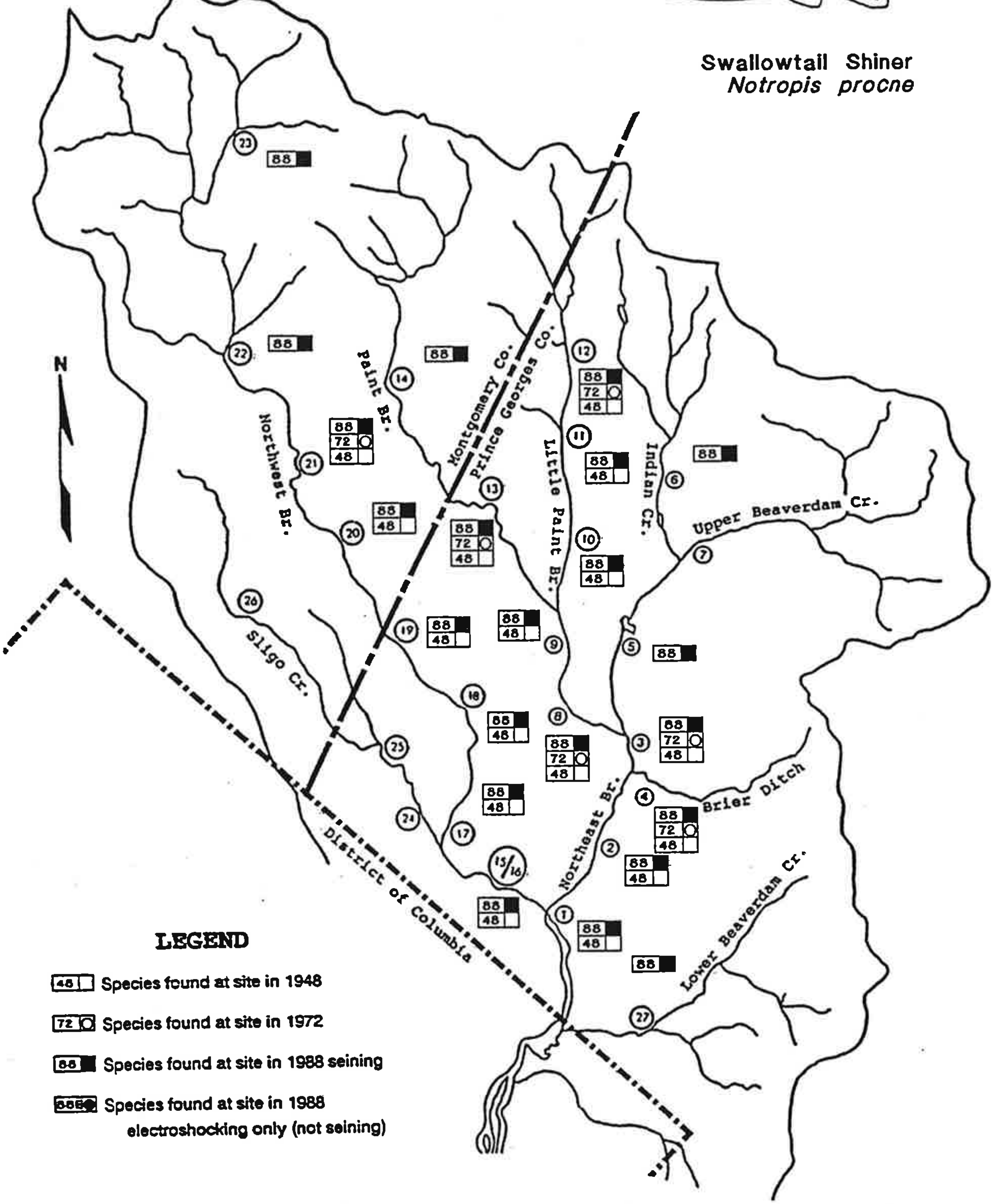
Anacostia Basin, Maryland

Fish Distribution

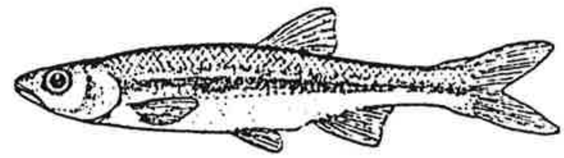
1948, 1972, and 1988



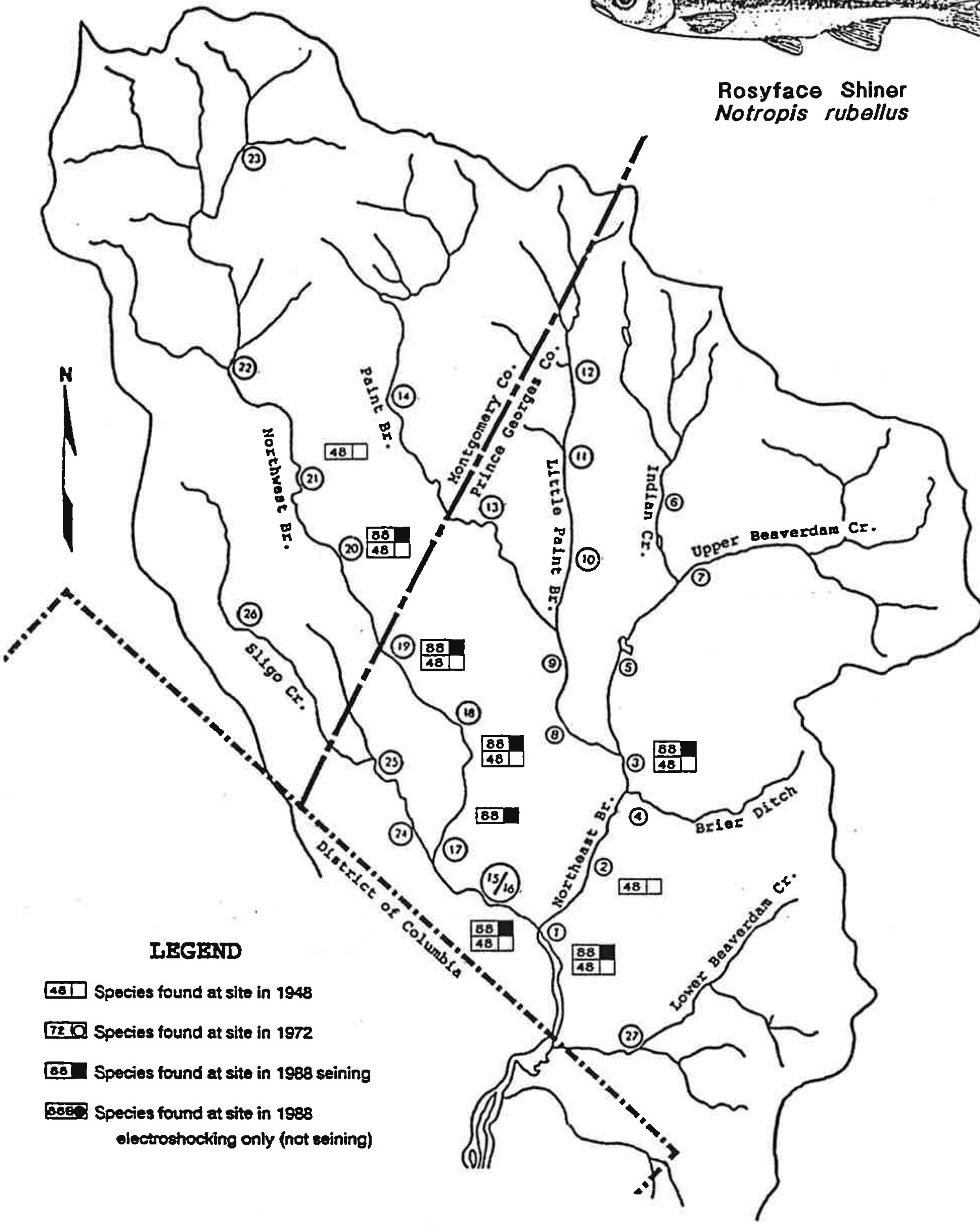
Swallowtail Shiner
Notropis procne



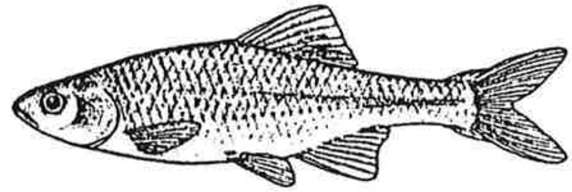
Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



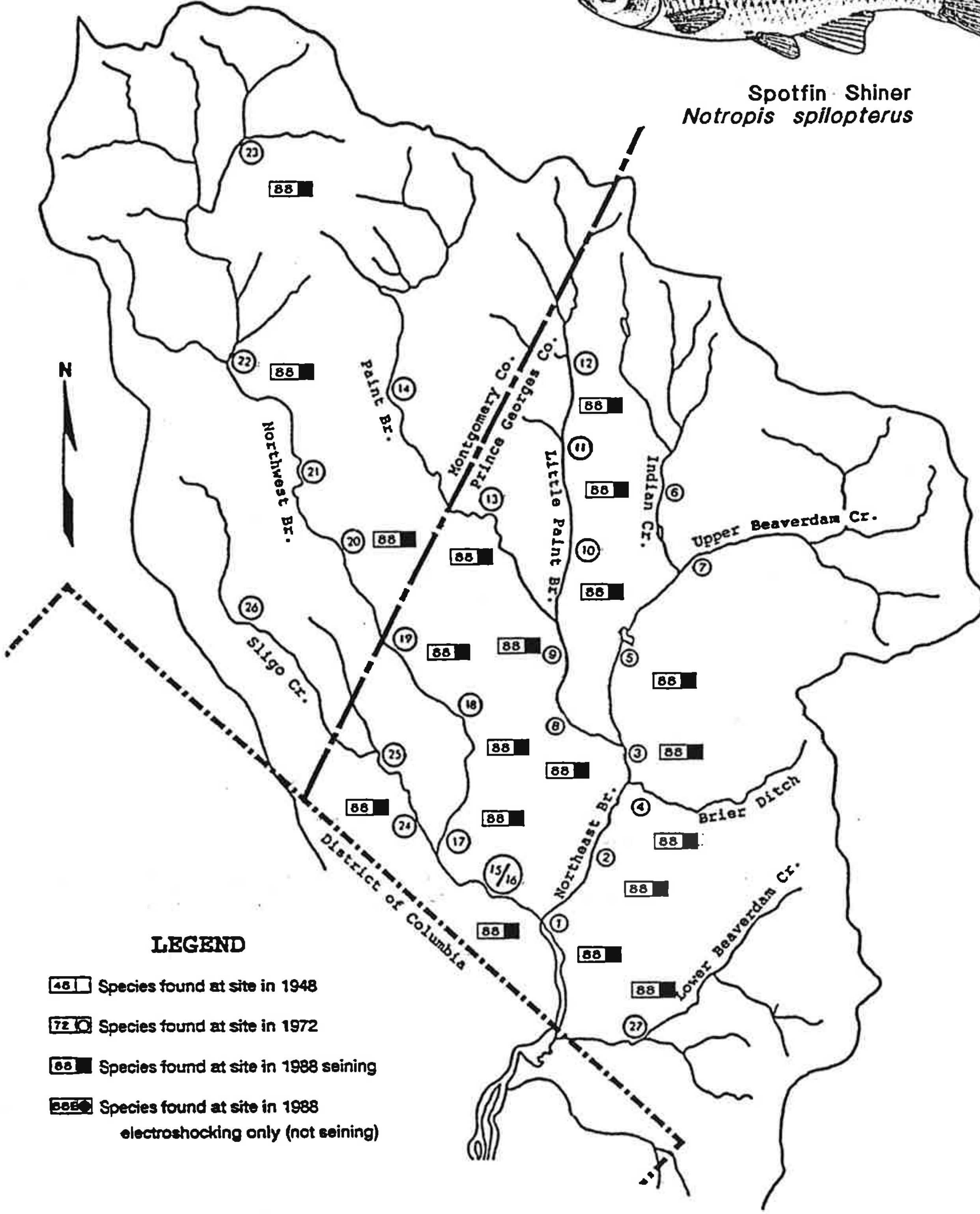
Rosyface Shiner
Notropis rubellus



Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



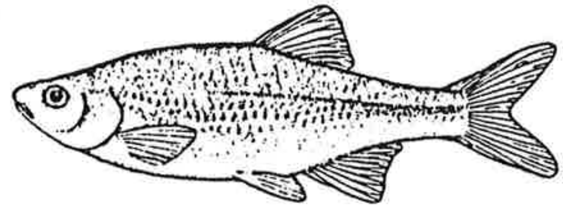
Spotfin Shiner
Notropis spilopterus



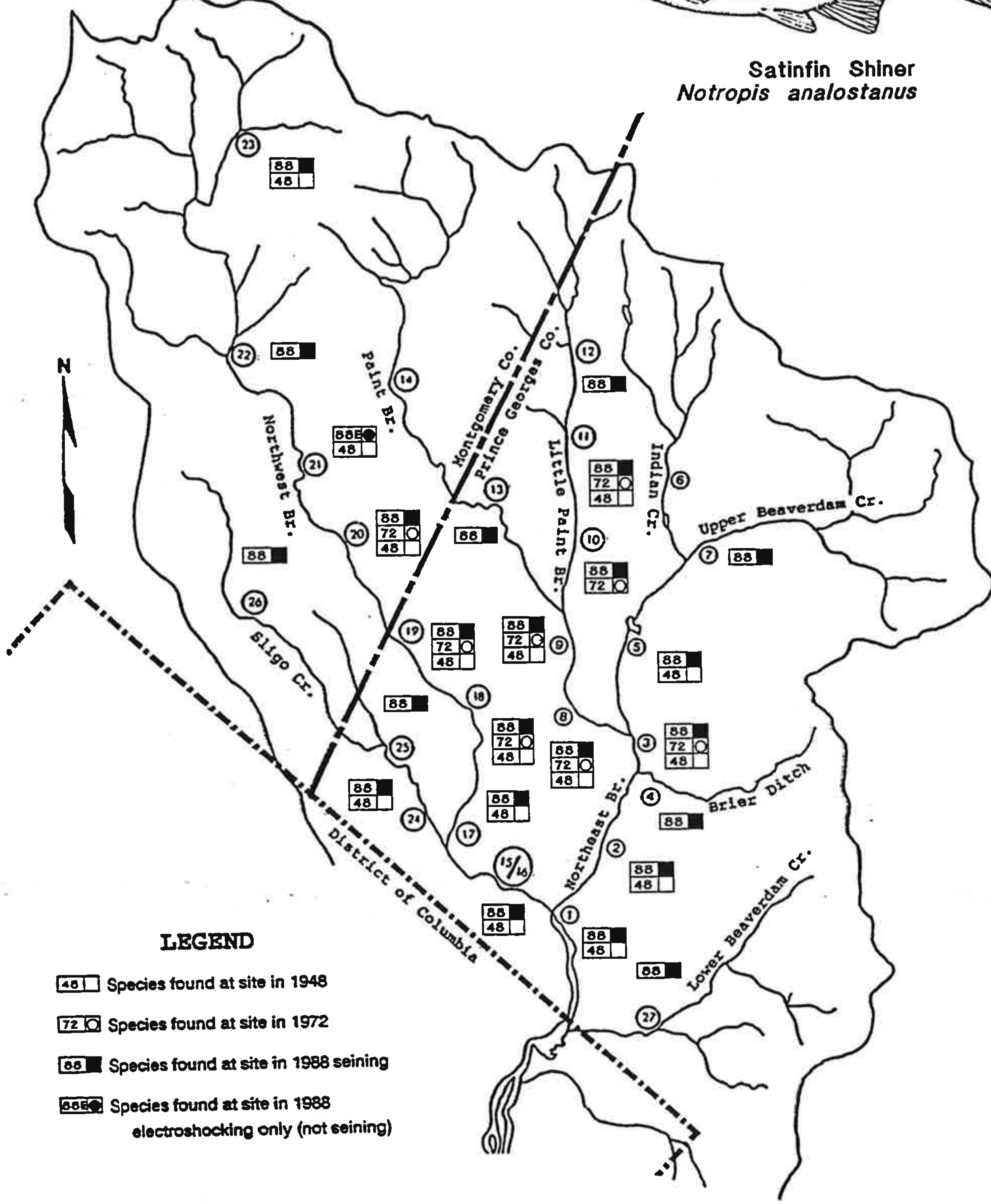
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



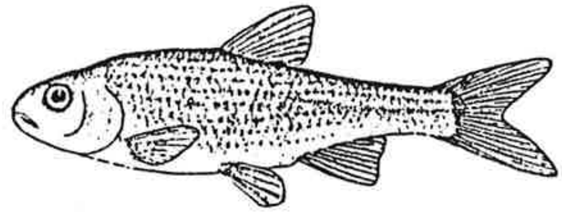
Satinfin Shiner
Notropis analostanus



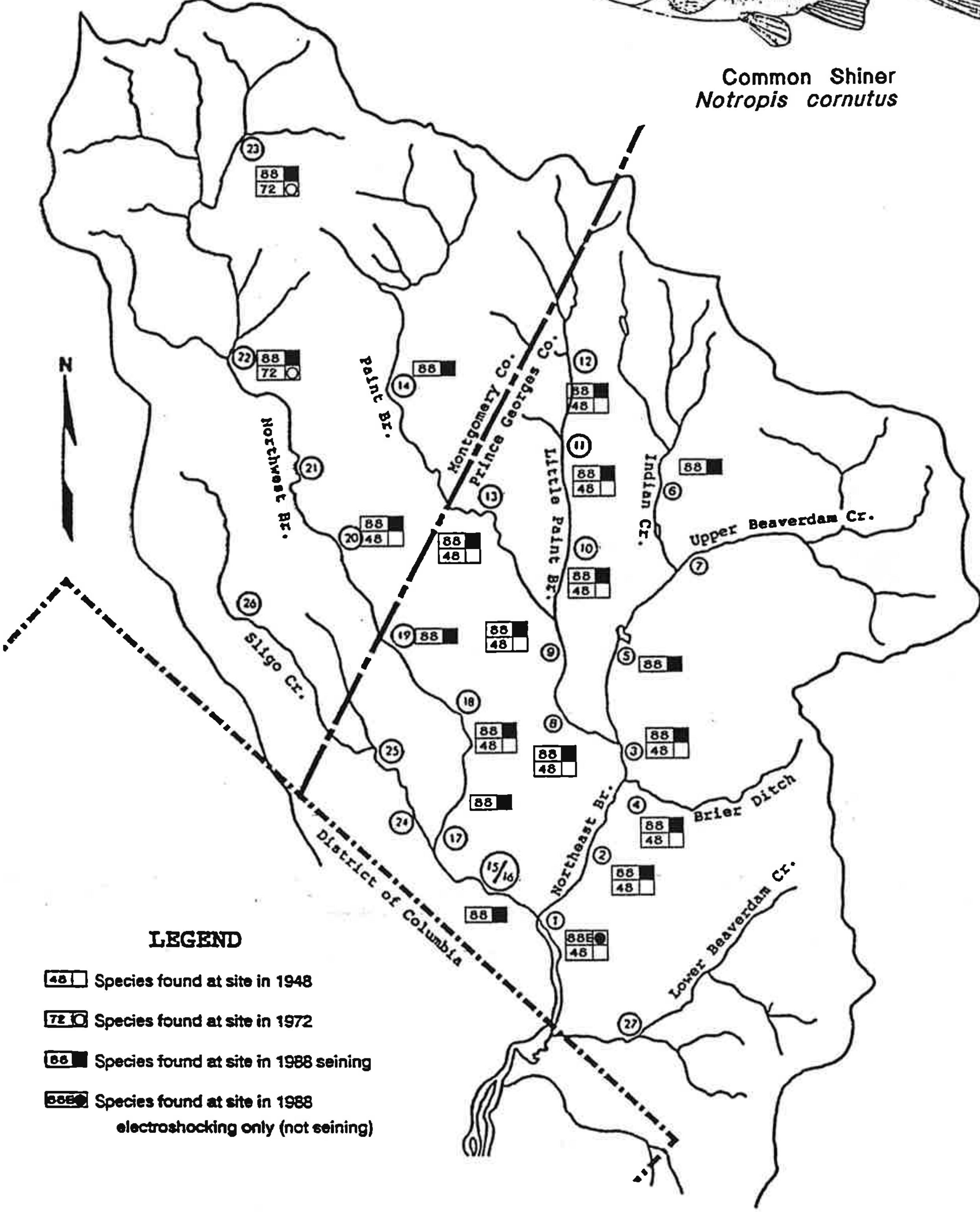
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



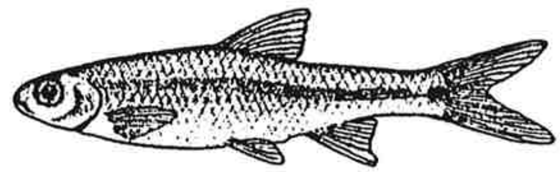
Common Shiner
Notropis cornutus



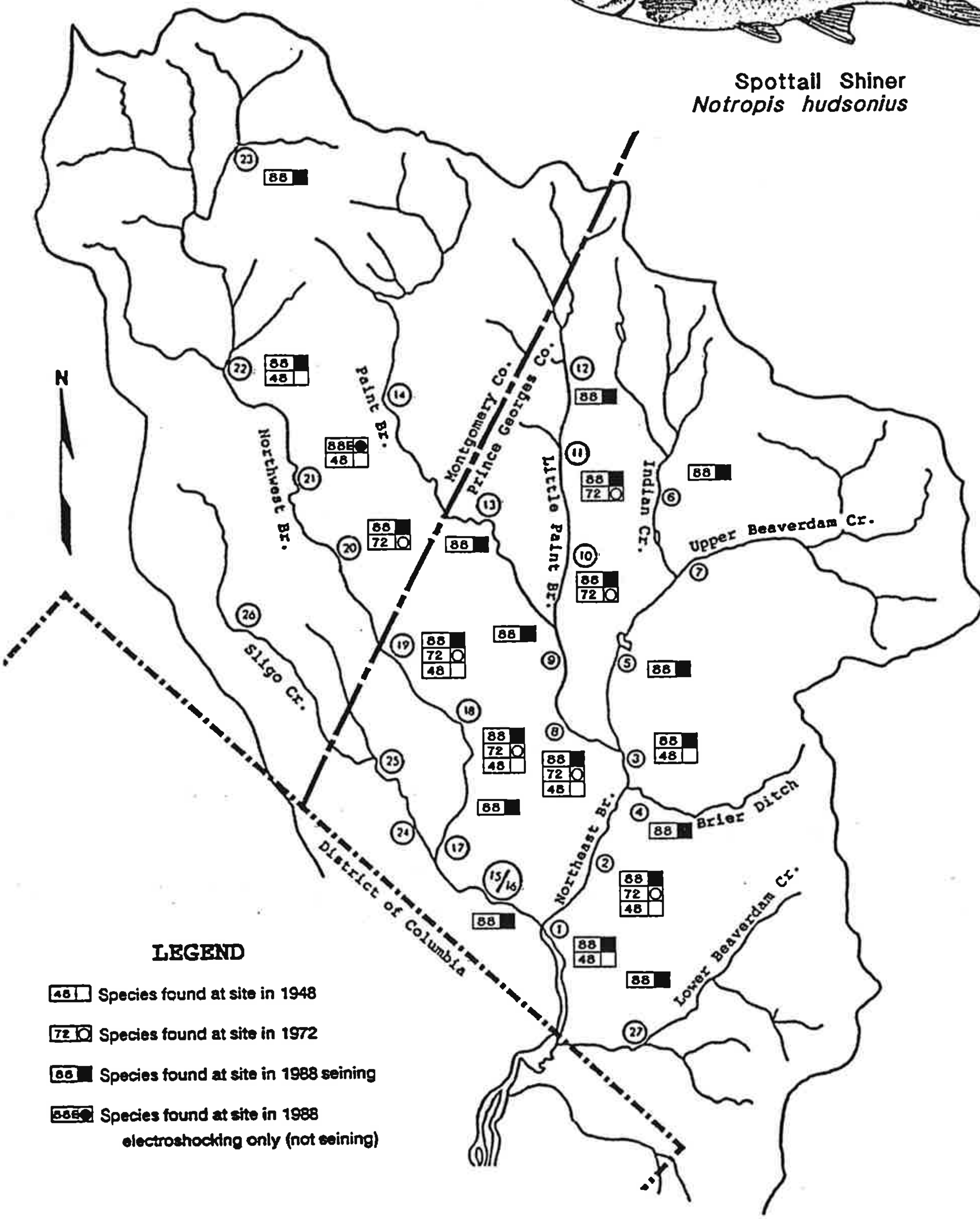
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



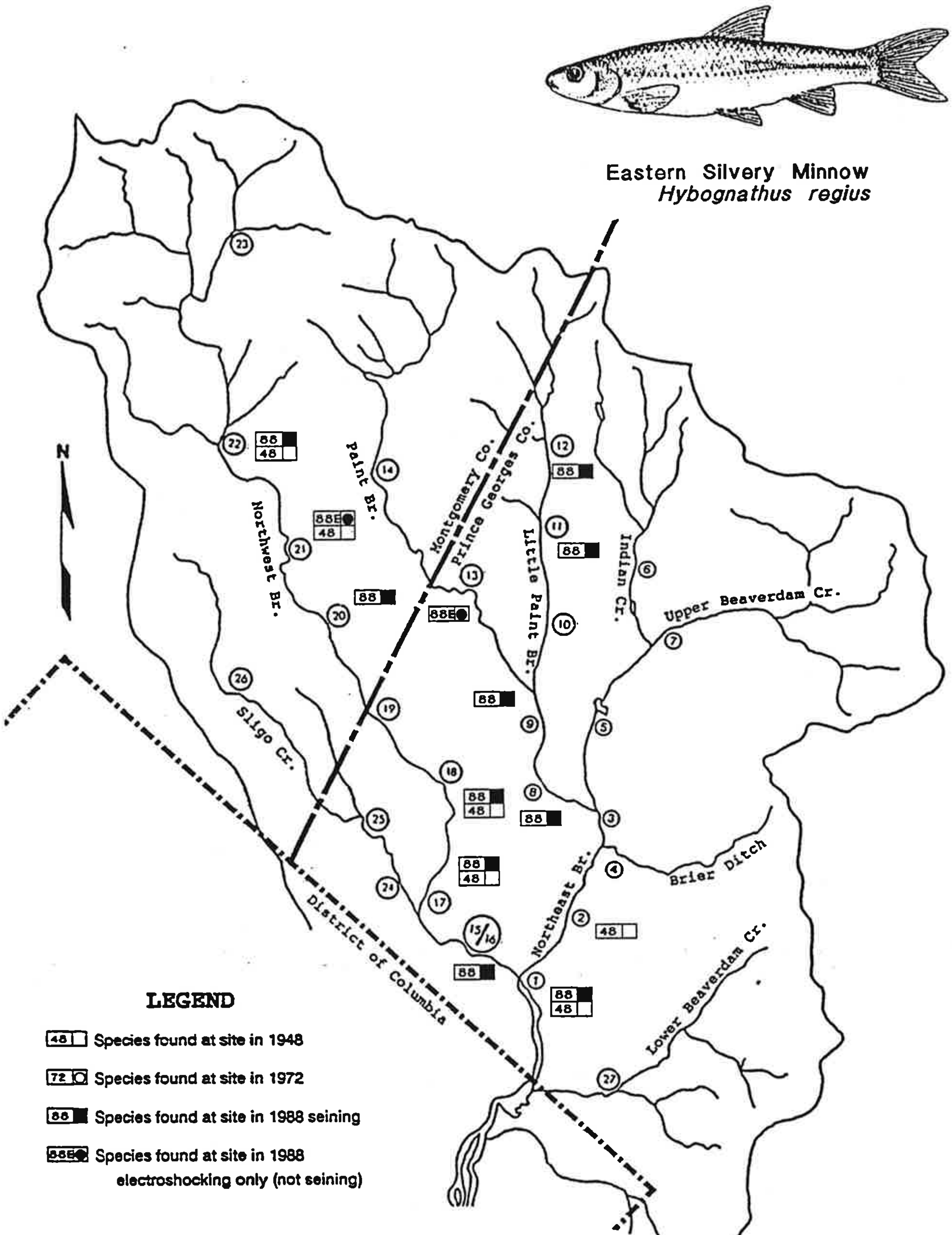
Spottail Shiner
Notropis hudsonius



Anacostia Basin, Maryland

Fish Distribution

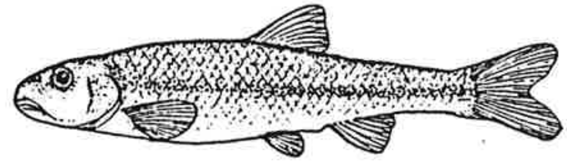
1948, 1972, and 1988



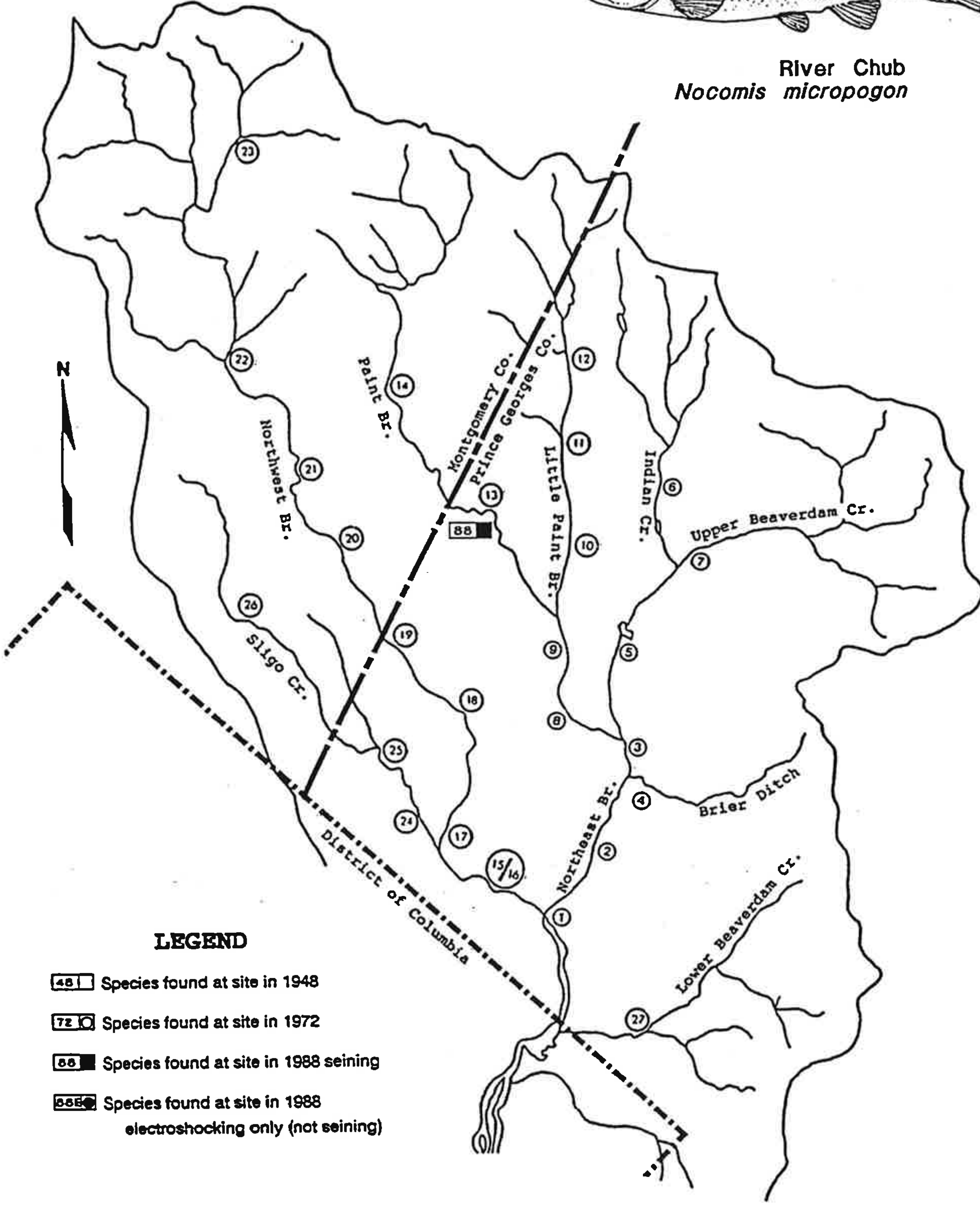
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



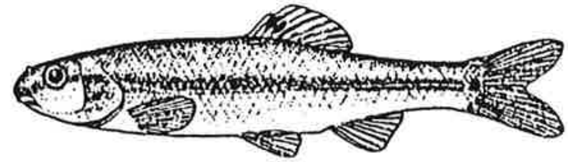
River Chub
Nocomis micropogon



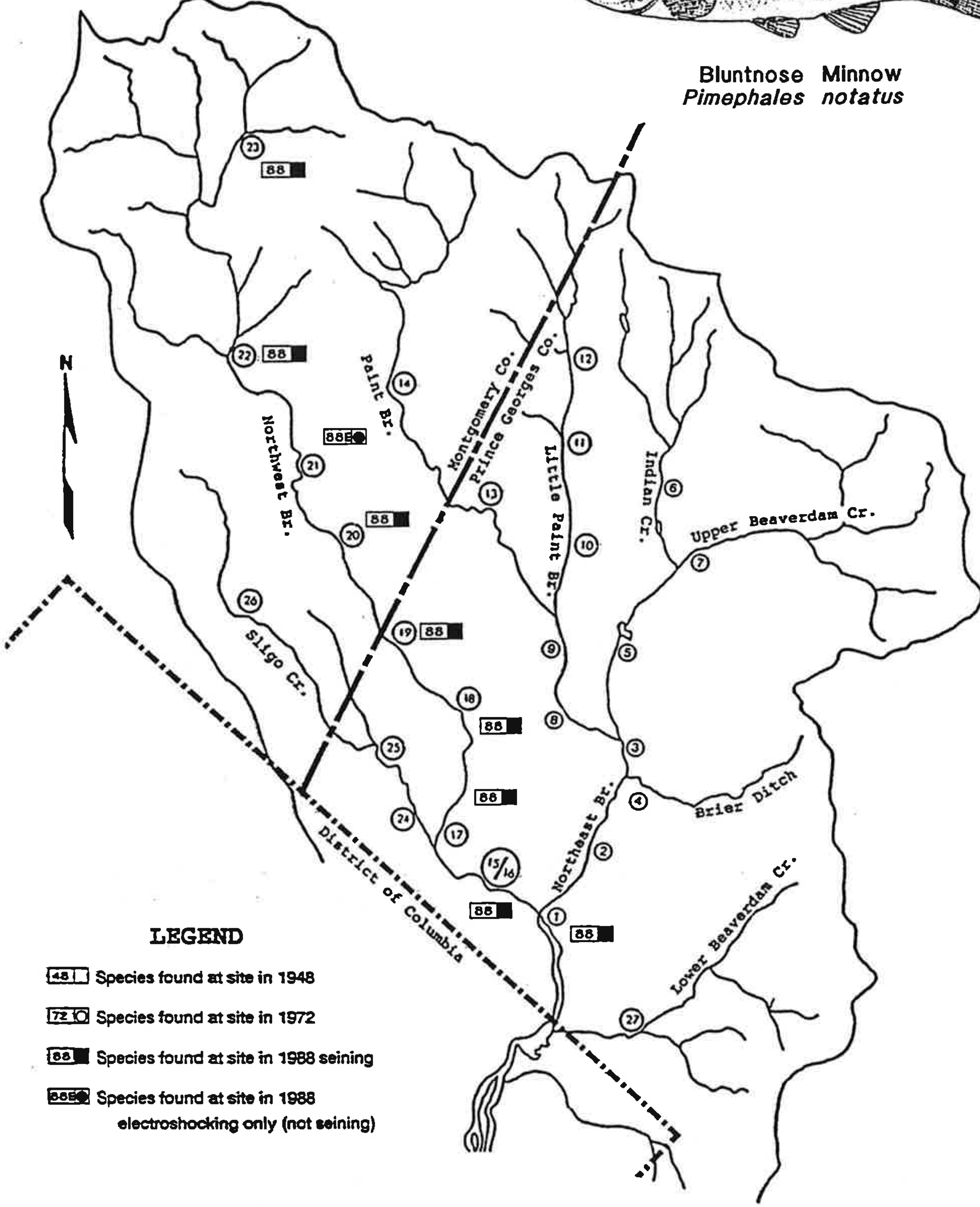
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



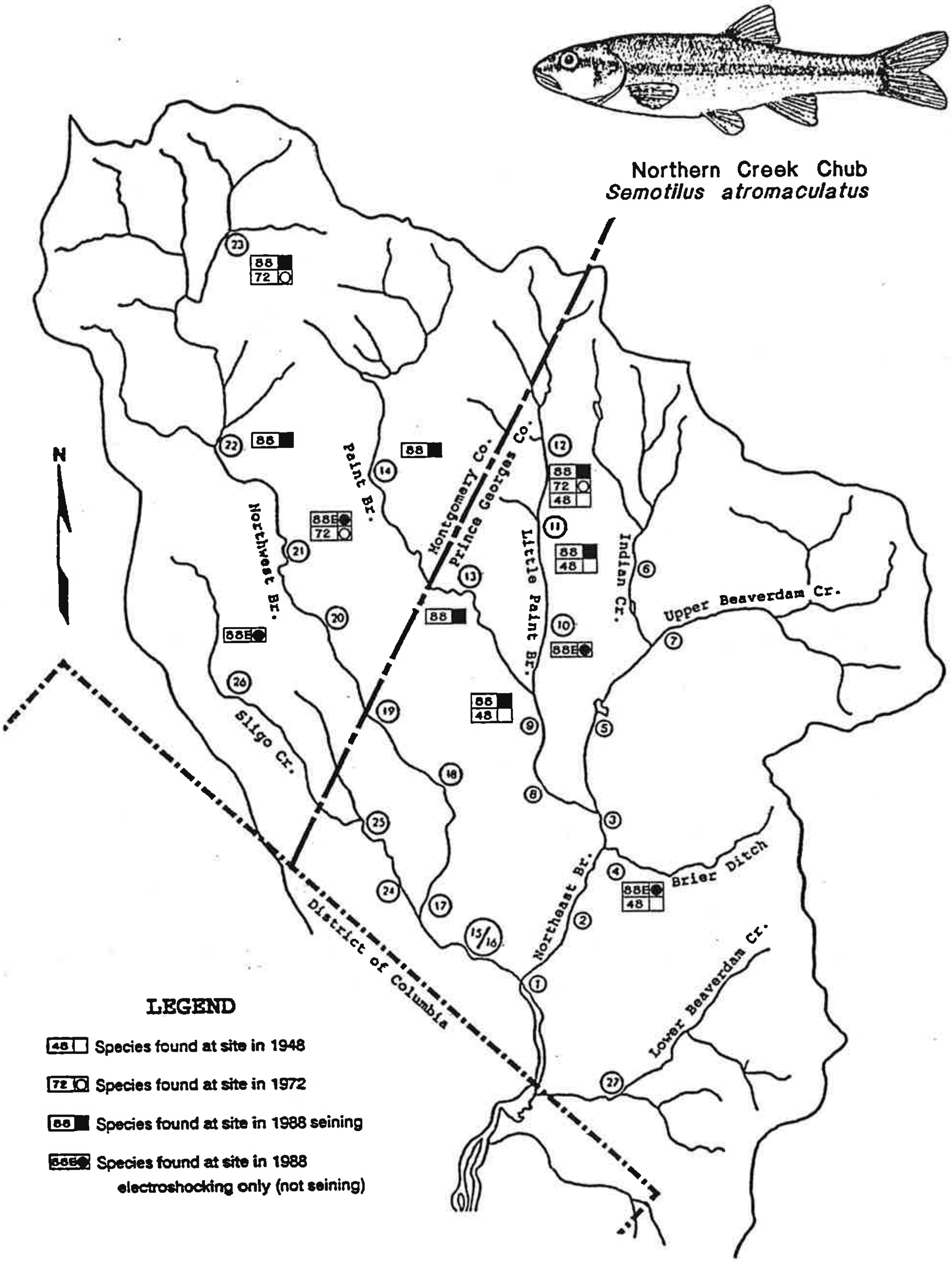
Bluntnose Minnow
Pimephales notatus



Anacostia Basin, Maryland

Fish Distribution

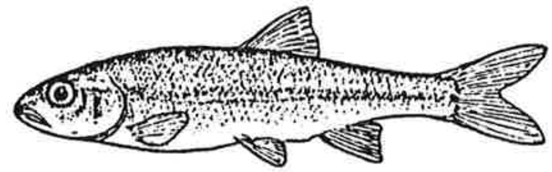
1948, 1972, and 1988



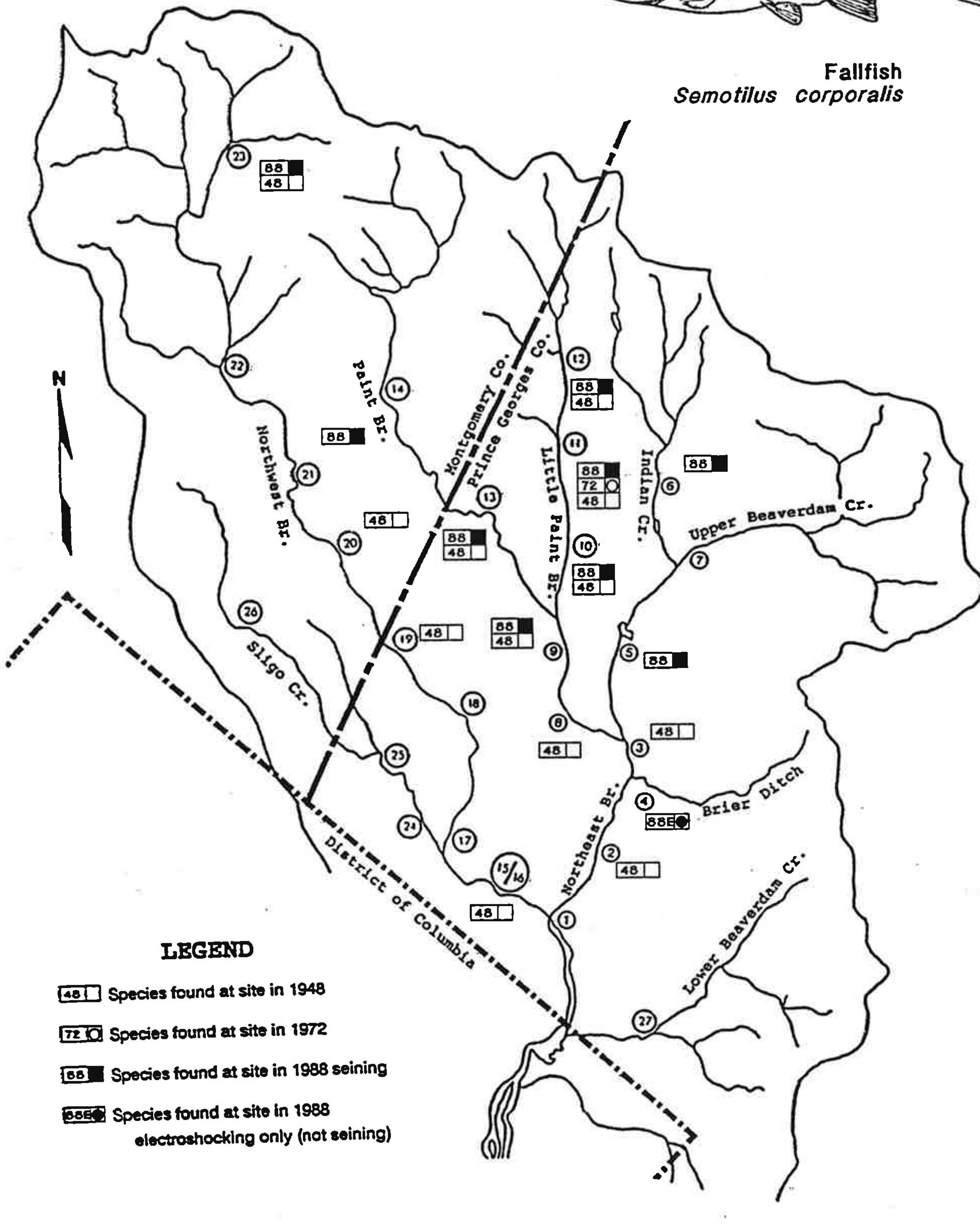
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



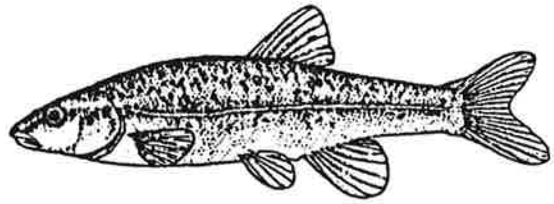
Fallfish
Semotilus corporalis



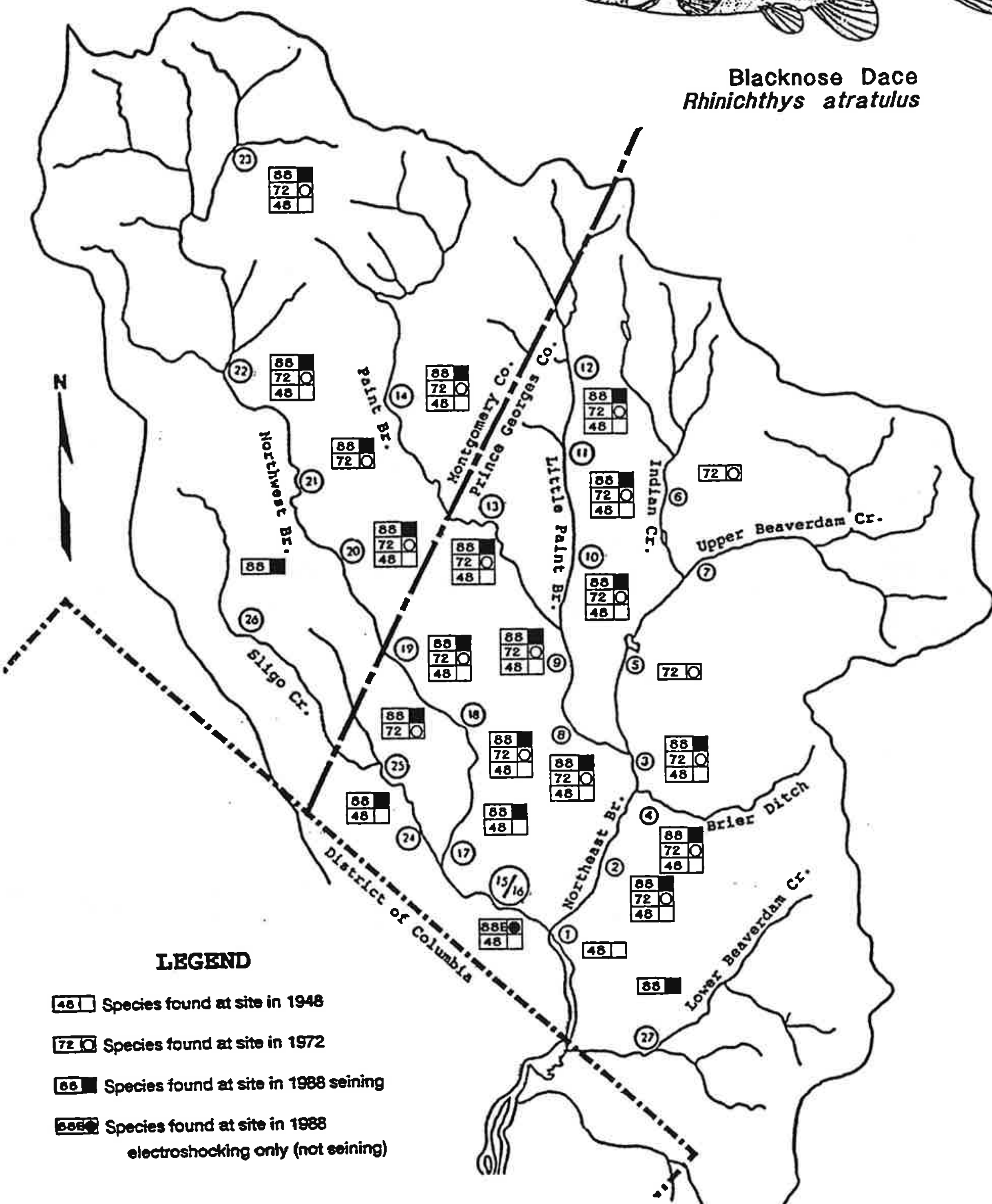
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



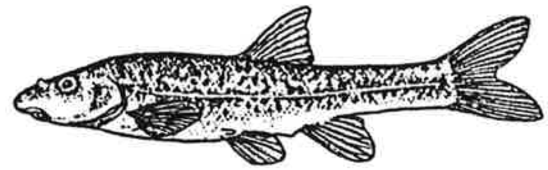
Blacknose Dace
Rhinichthys atratulus



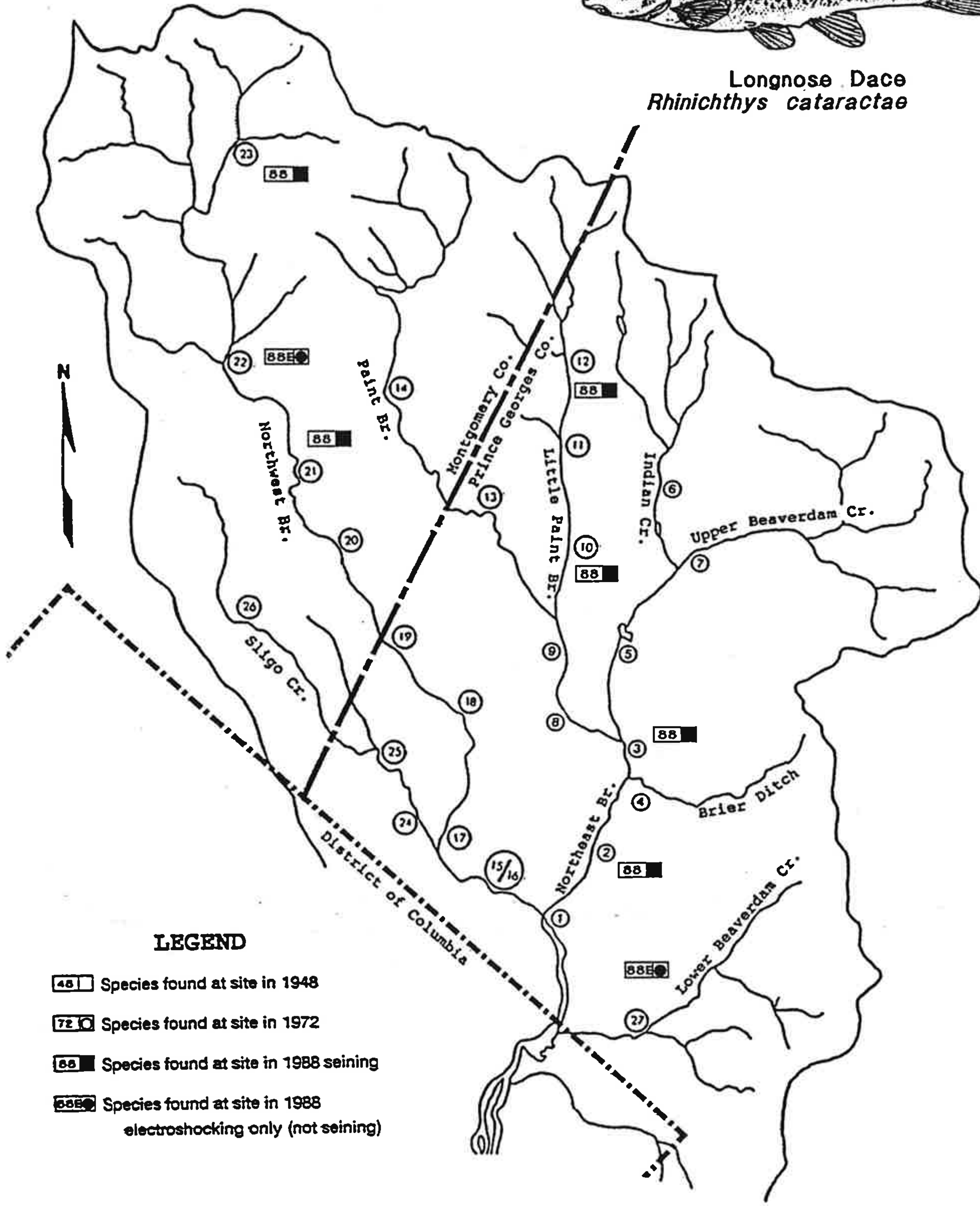
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



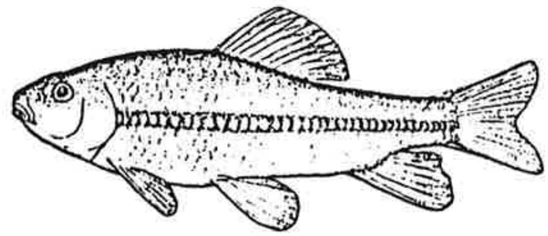
Longnose Dace
Rhinichthys cataractae



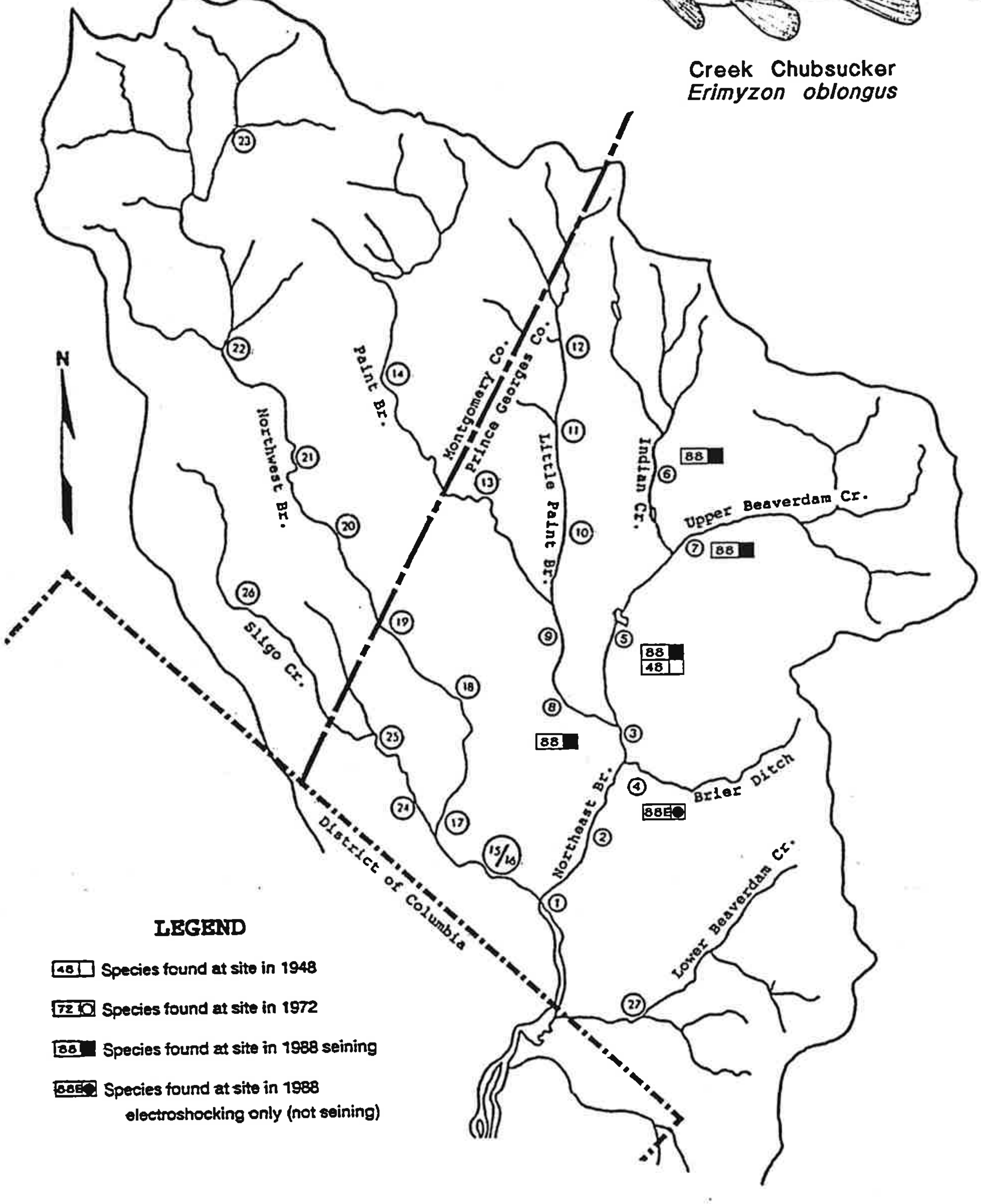
Anacostia Basin, Maryland

Fish Distribution

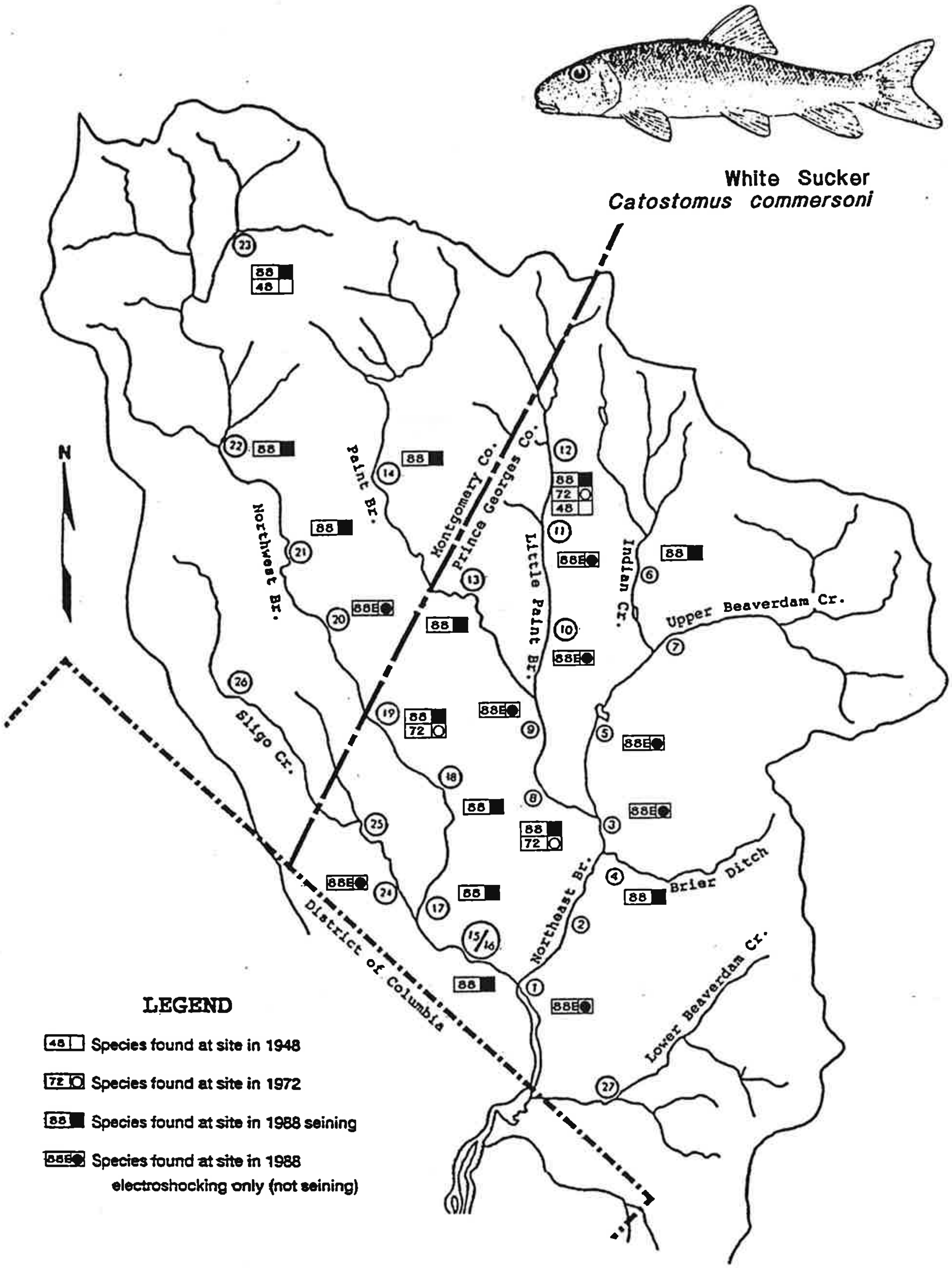
1948, 1972, and 1988



Creek Chubsucker
Erimyzon oblongus



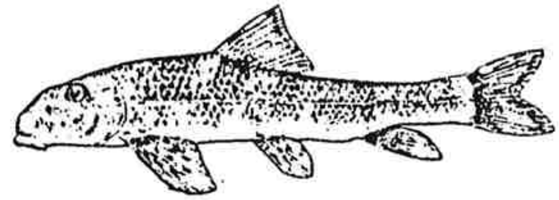
Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



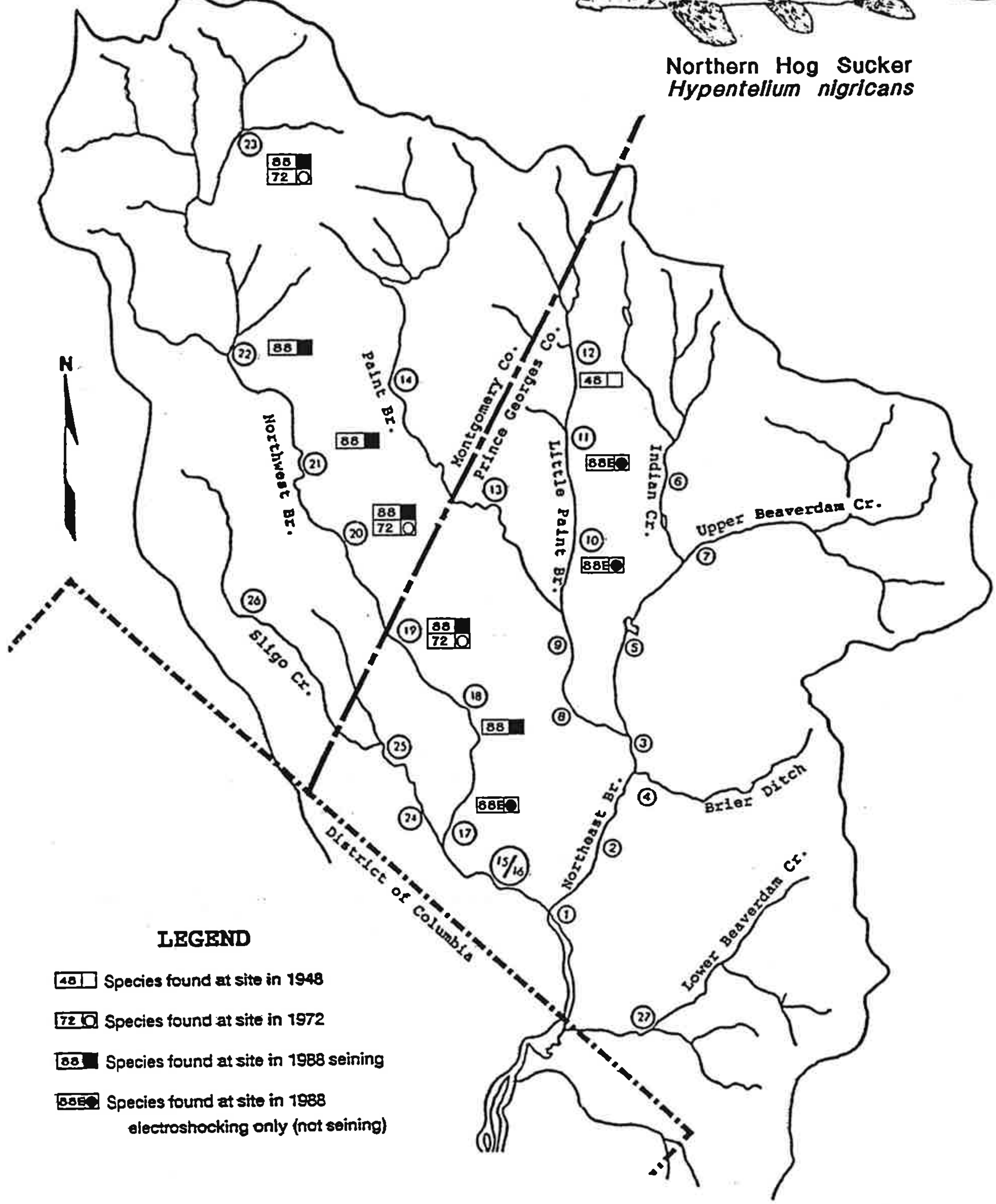
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



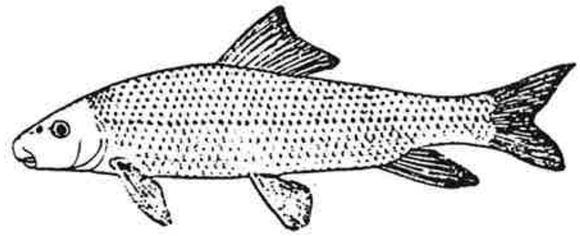
Northern Hog Sucker
Hypentelium nigricans



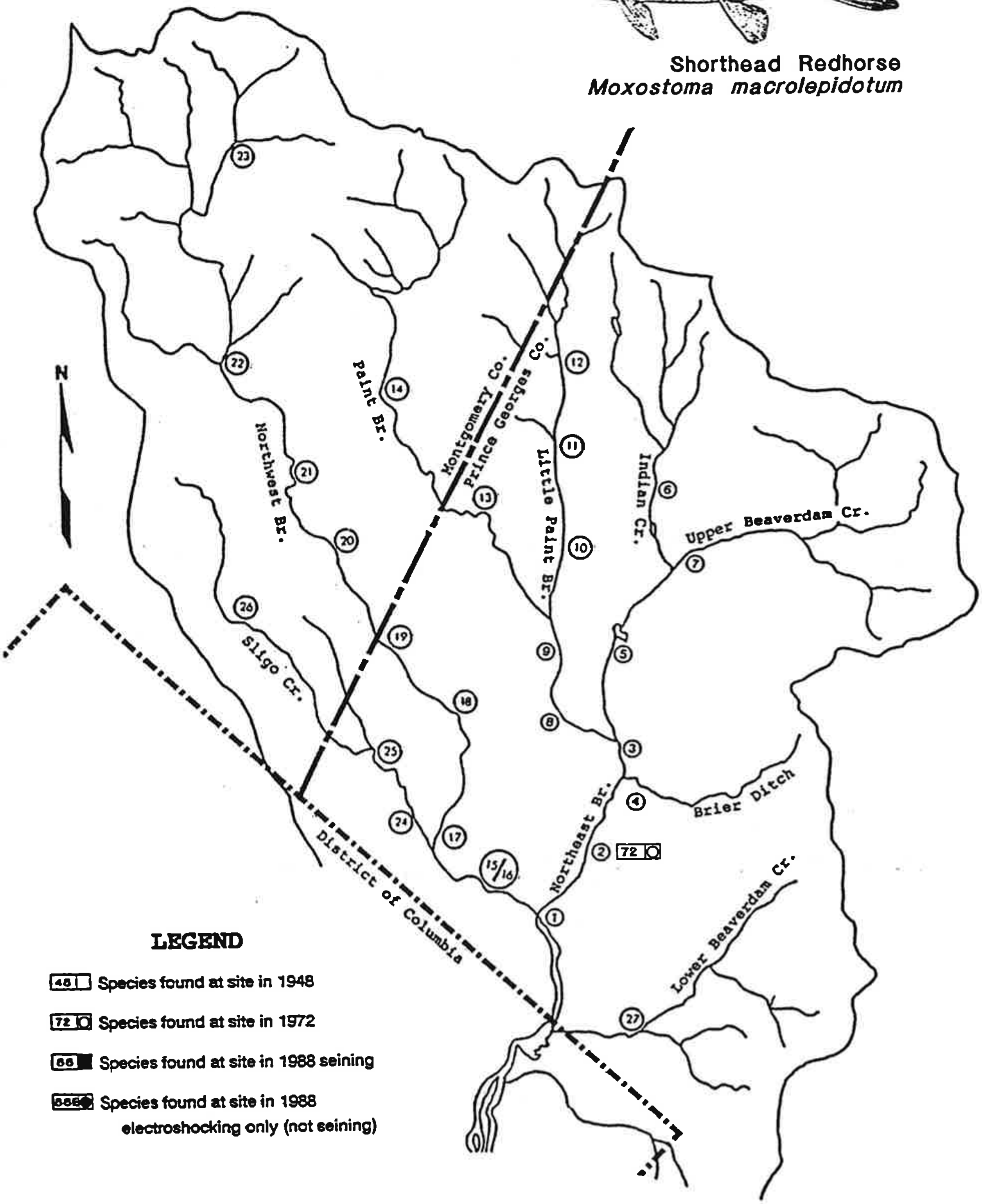
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



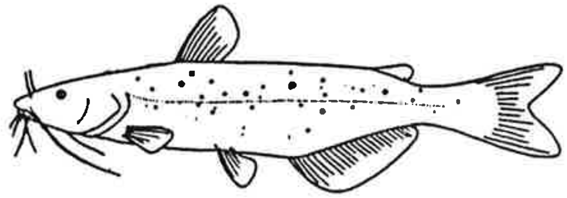
Shorthead Redhorse
Moxostoma macrolepidotum



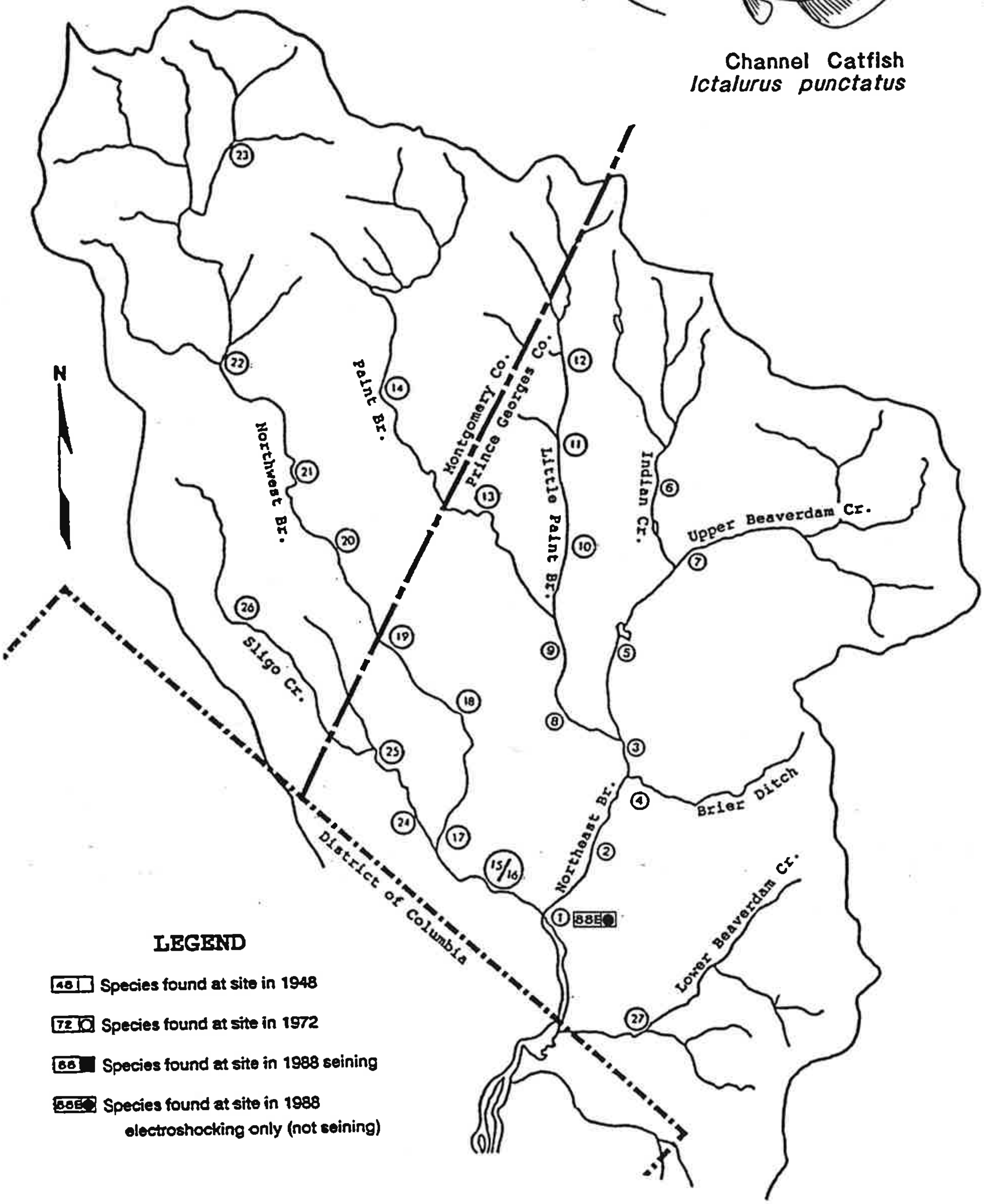
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



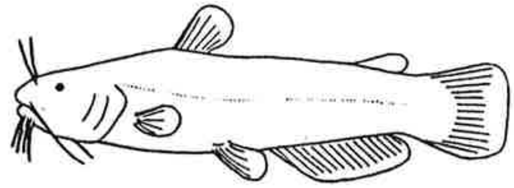
Channel Catfish
Ictalurus punctatus



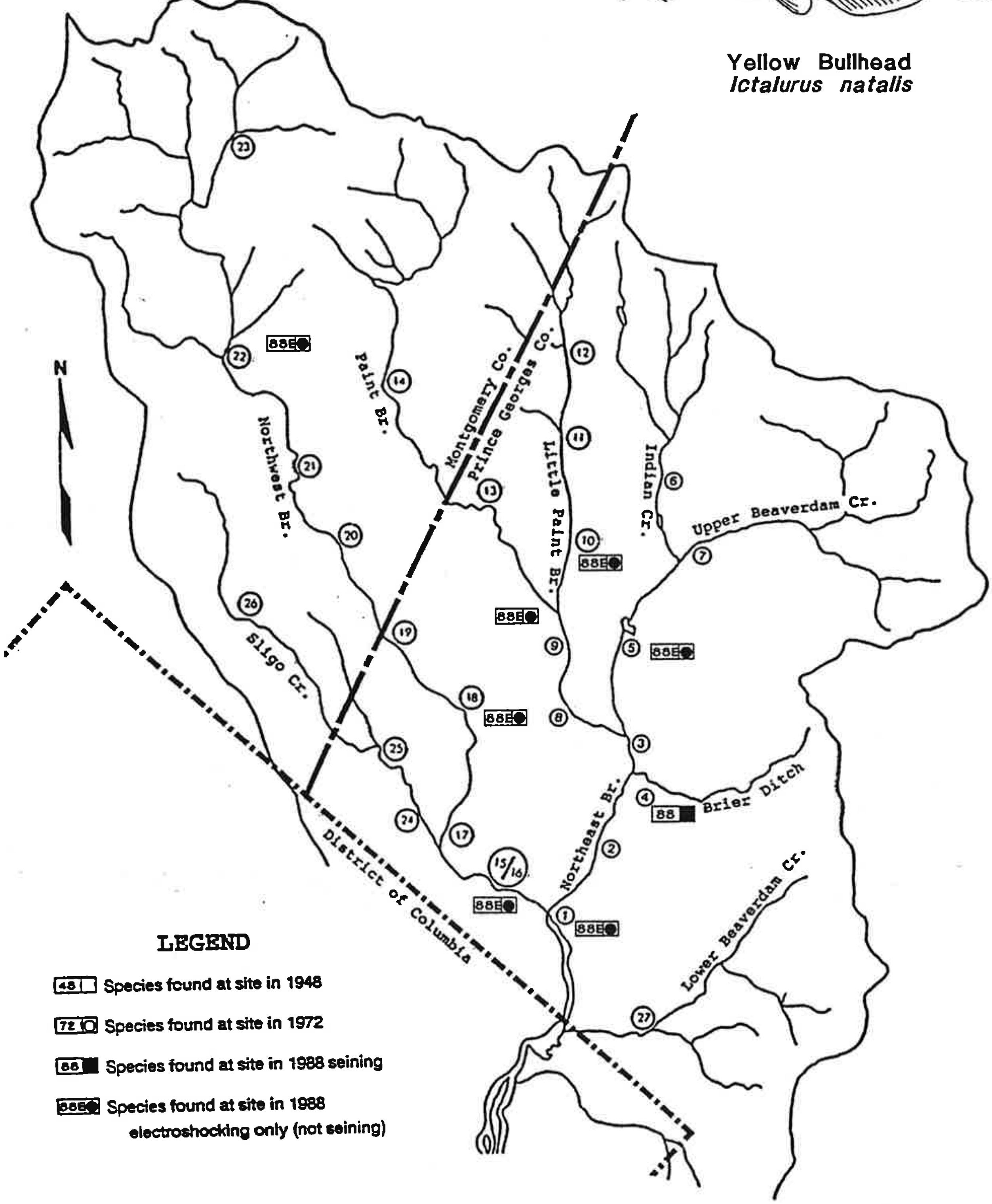
Anacostia Basin, Maryland

Fish Distribution

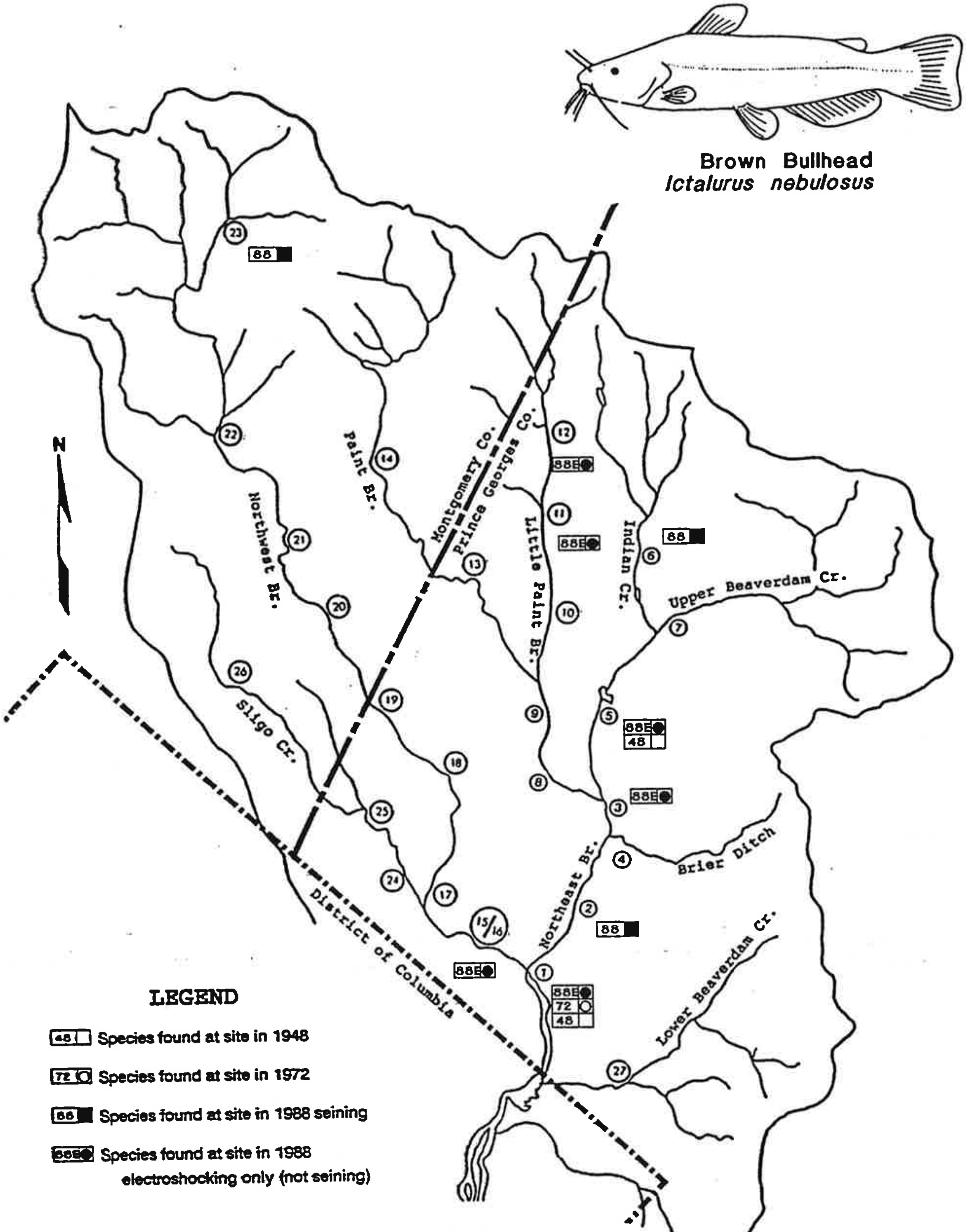
1948, 1972, and 1988



Yellow Bullhead
Ictalurus natalis



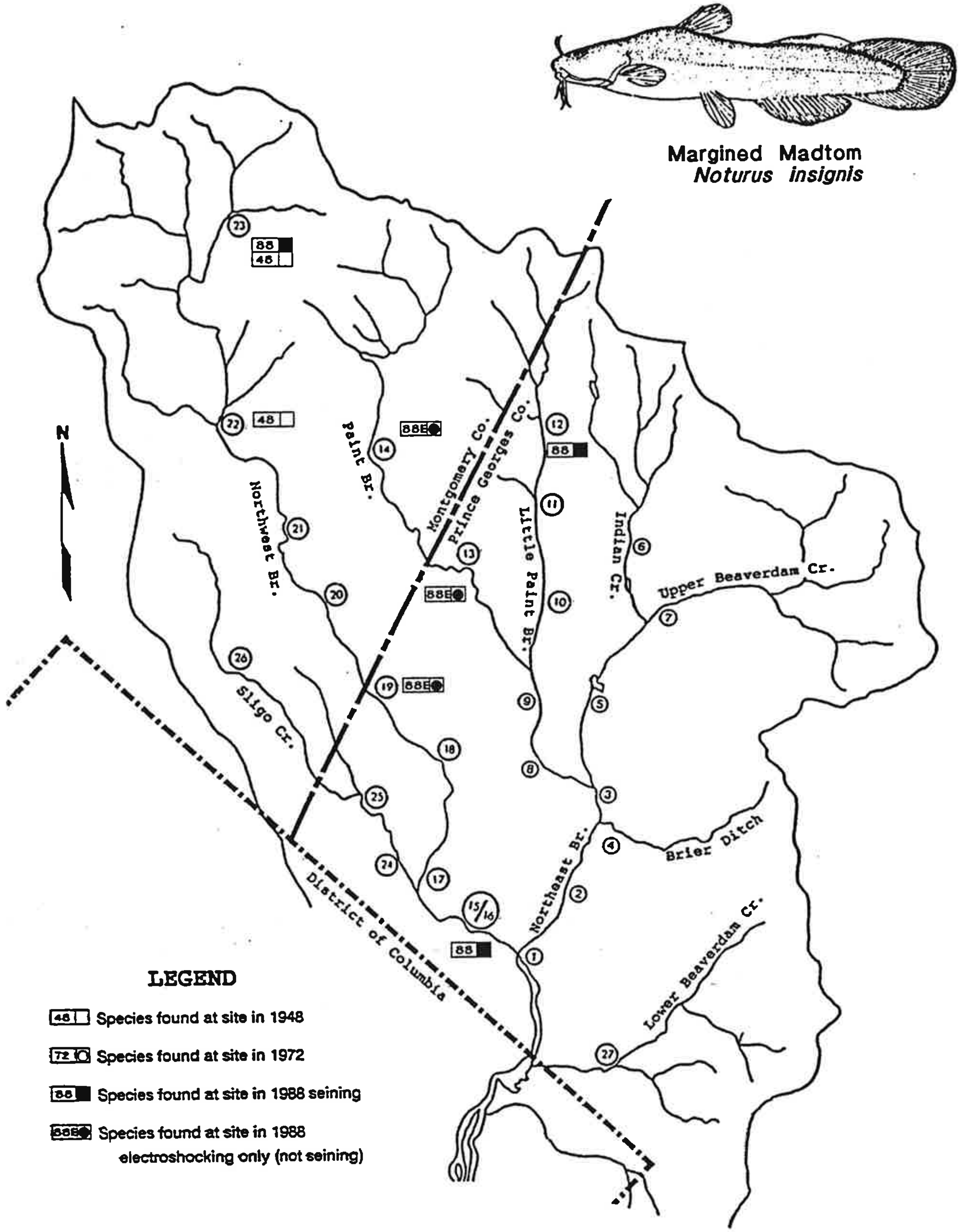
Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



Anacostia Basin, Maryland

Fish Distribution

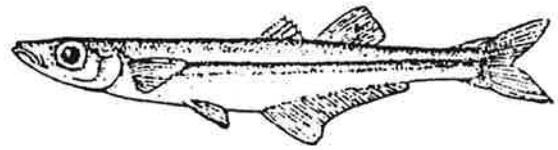
1948, 1972, and 1988



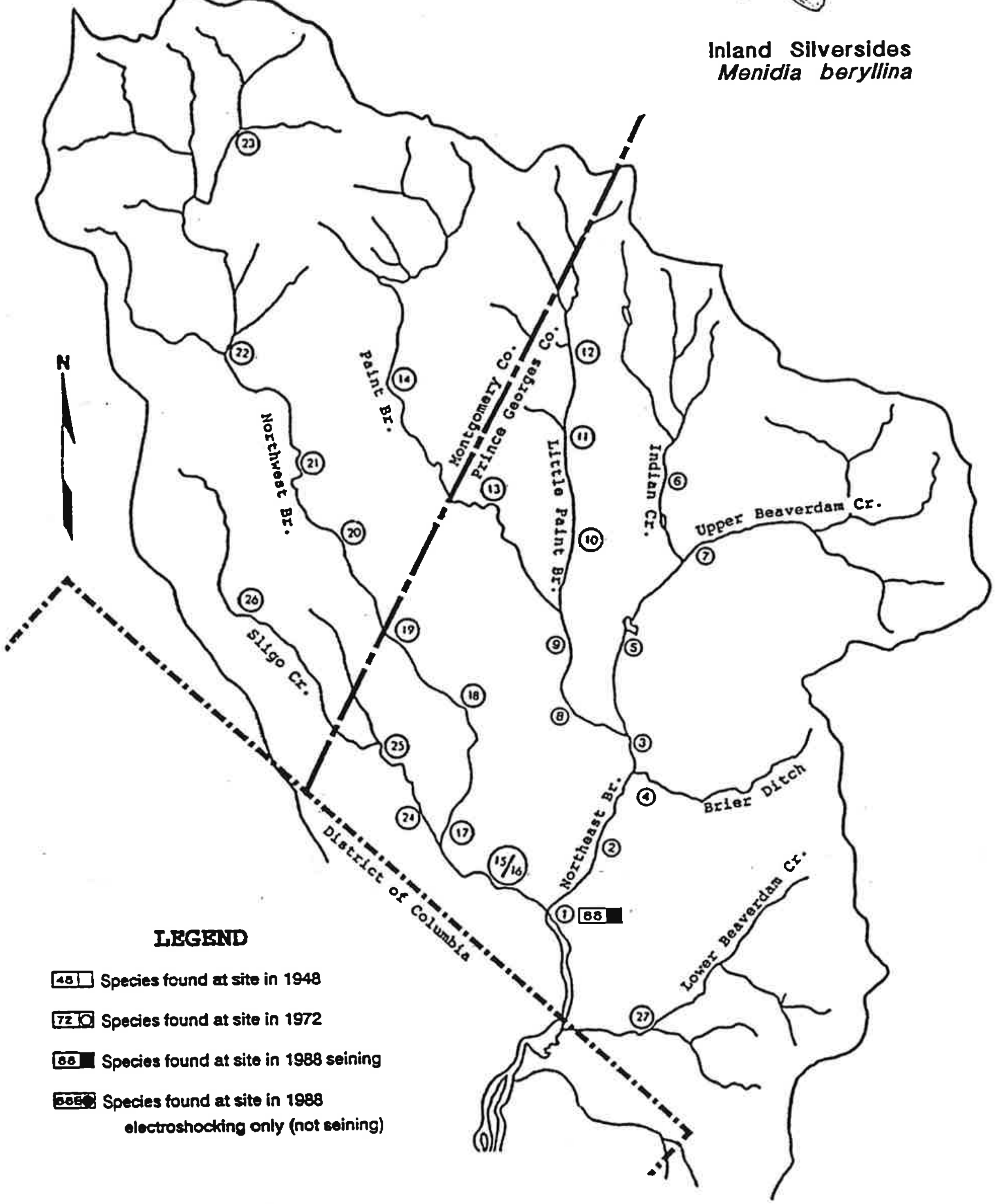
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



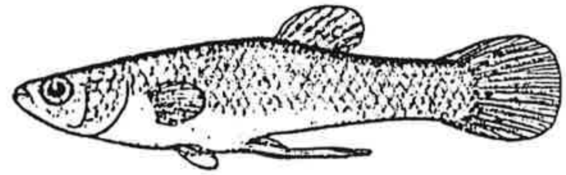
Inland Silversides
Menidia beryllina



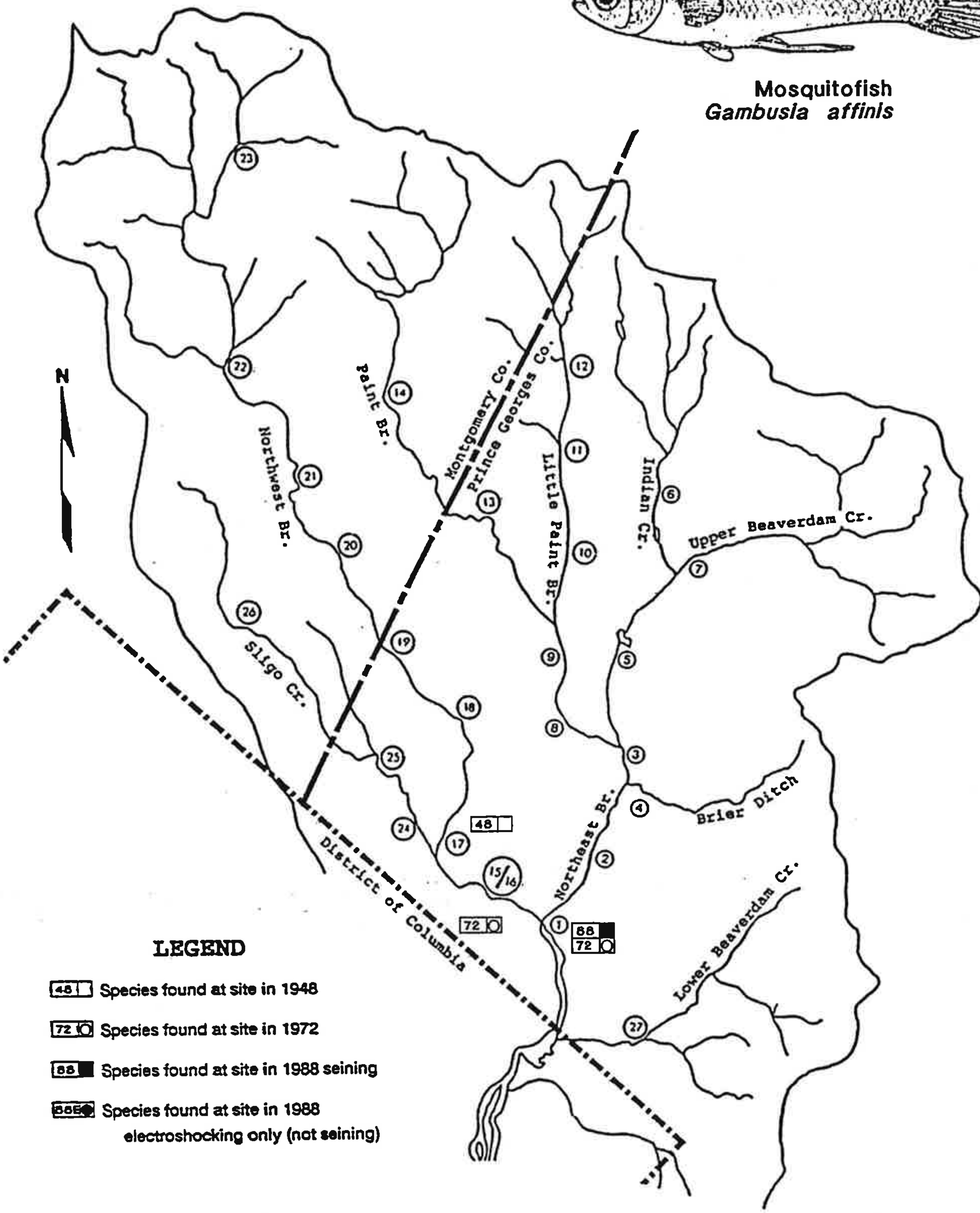
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



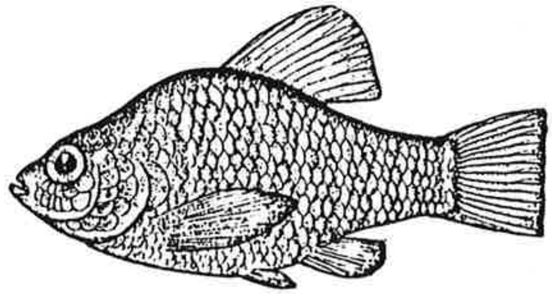
Mosquitofish
Gambusia affinis



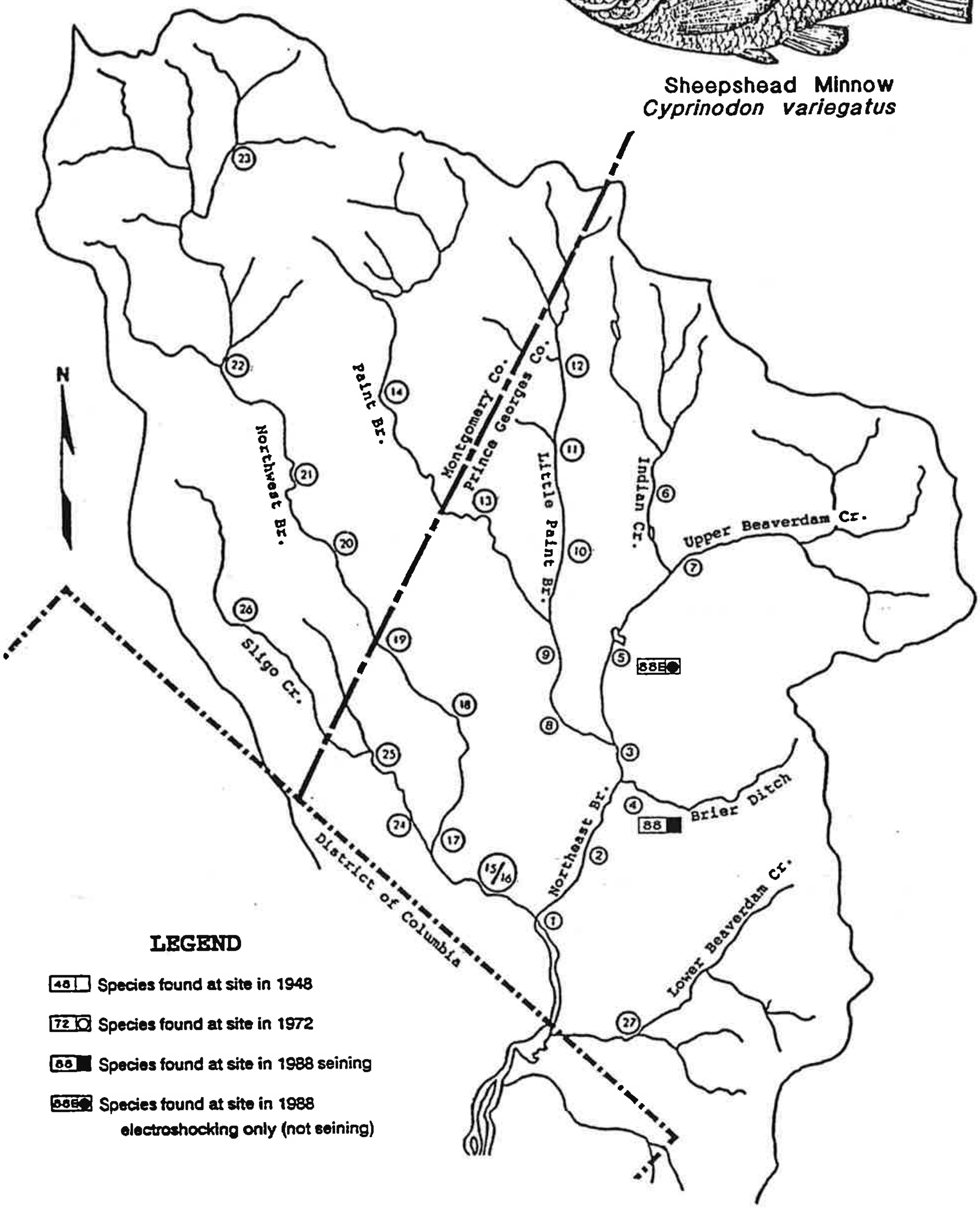
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



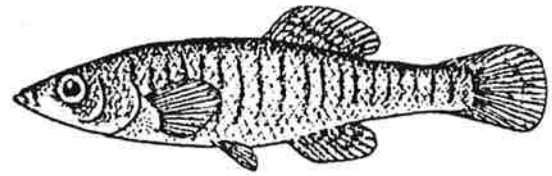
Sheepshead Minnow
Cyprinodon variegatus



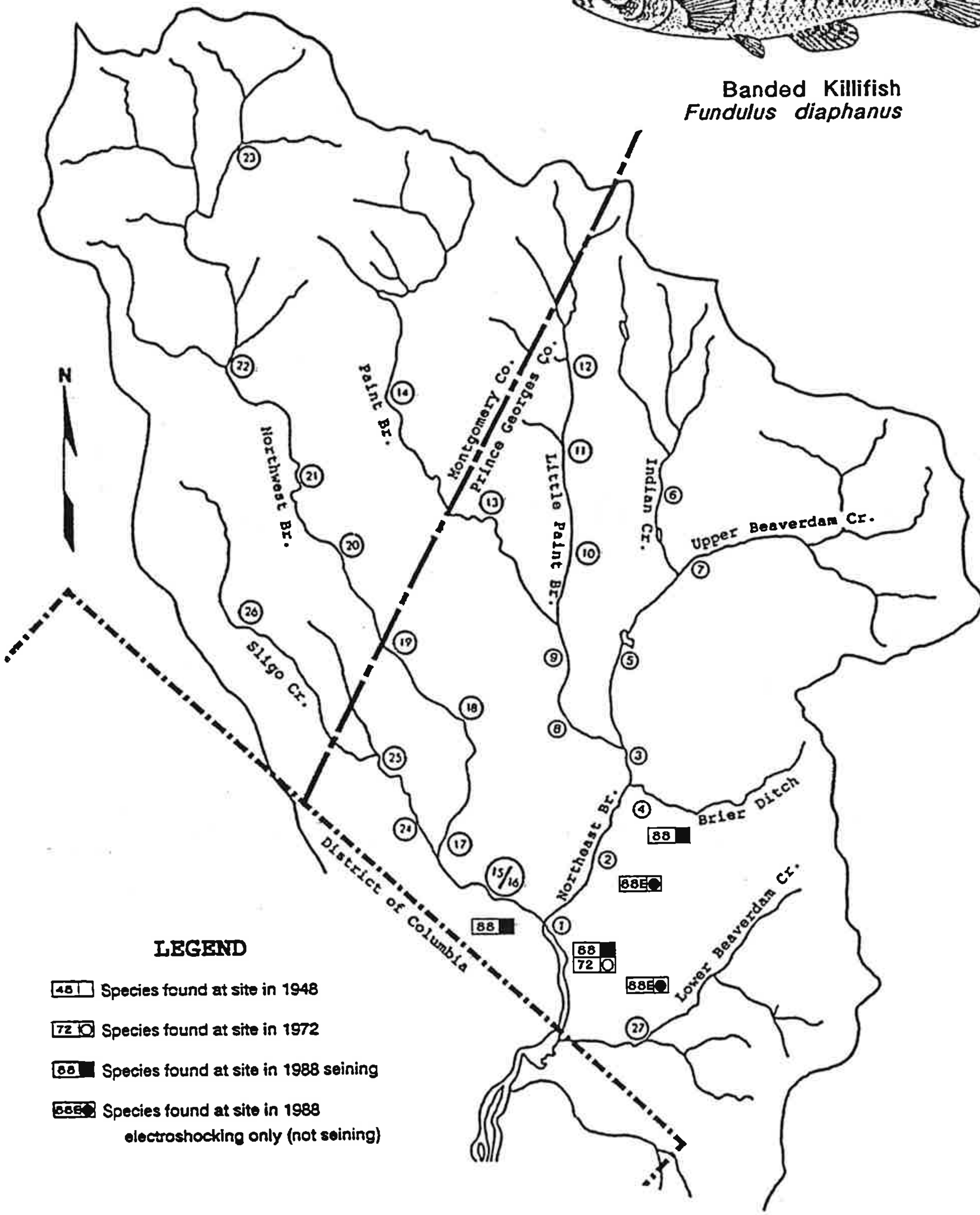
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



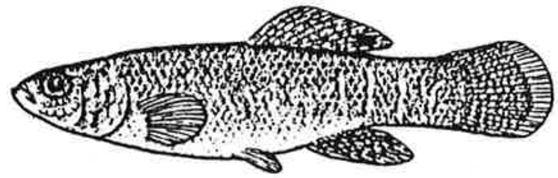
Banded Killifish
Fundulus diaphanus



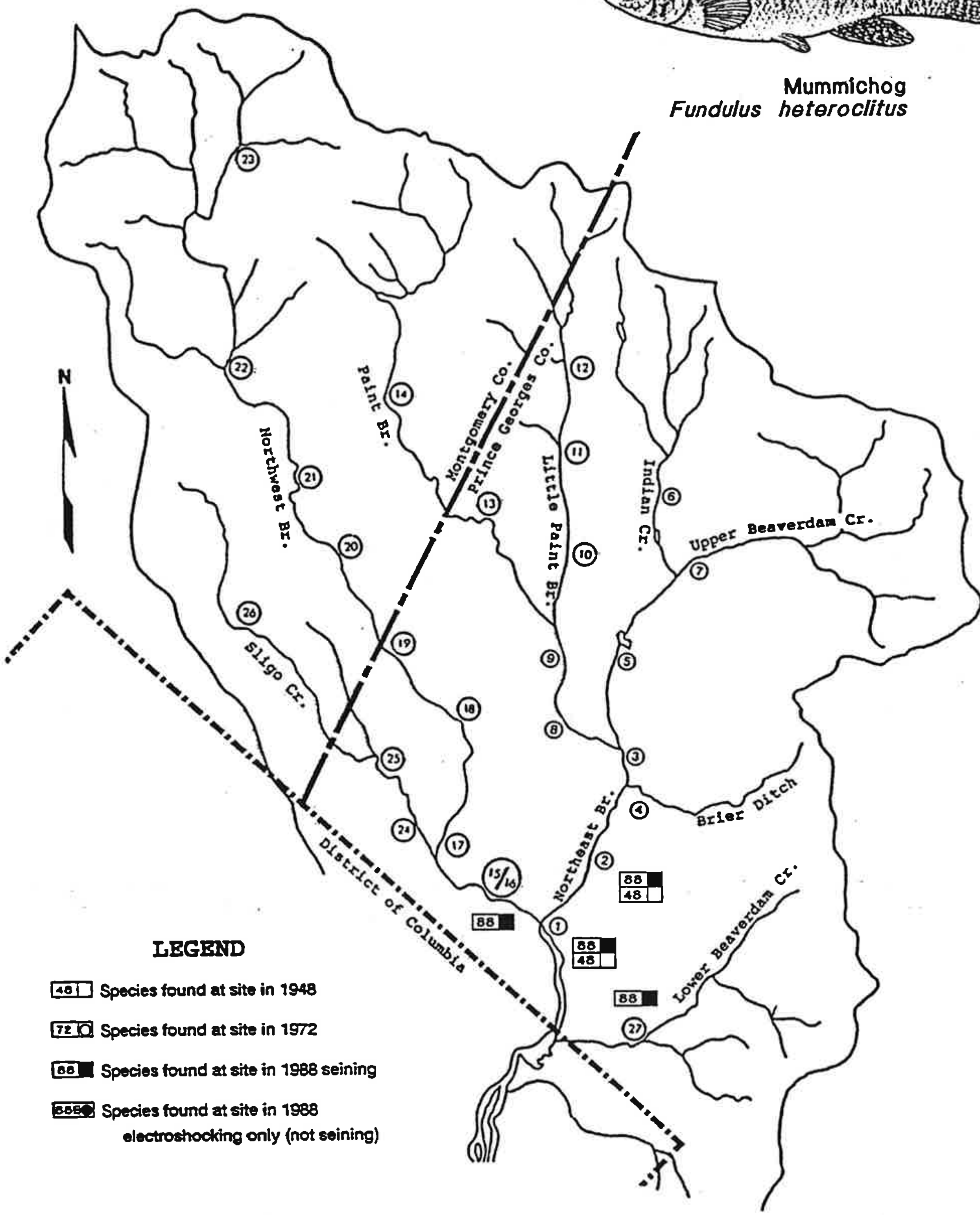
Anacostia Basin, Maryland

Fish Distribution

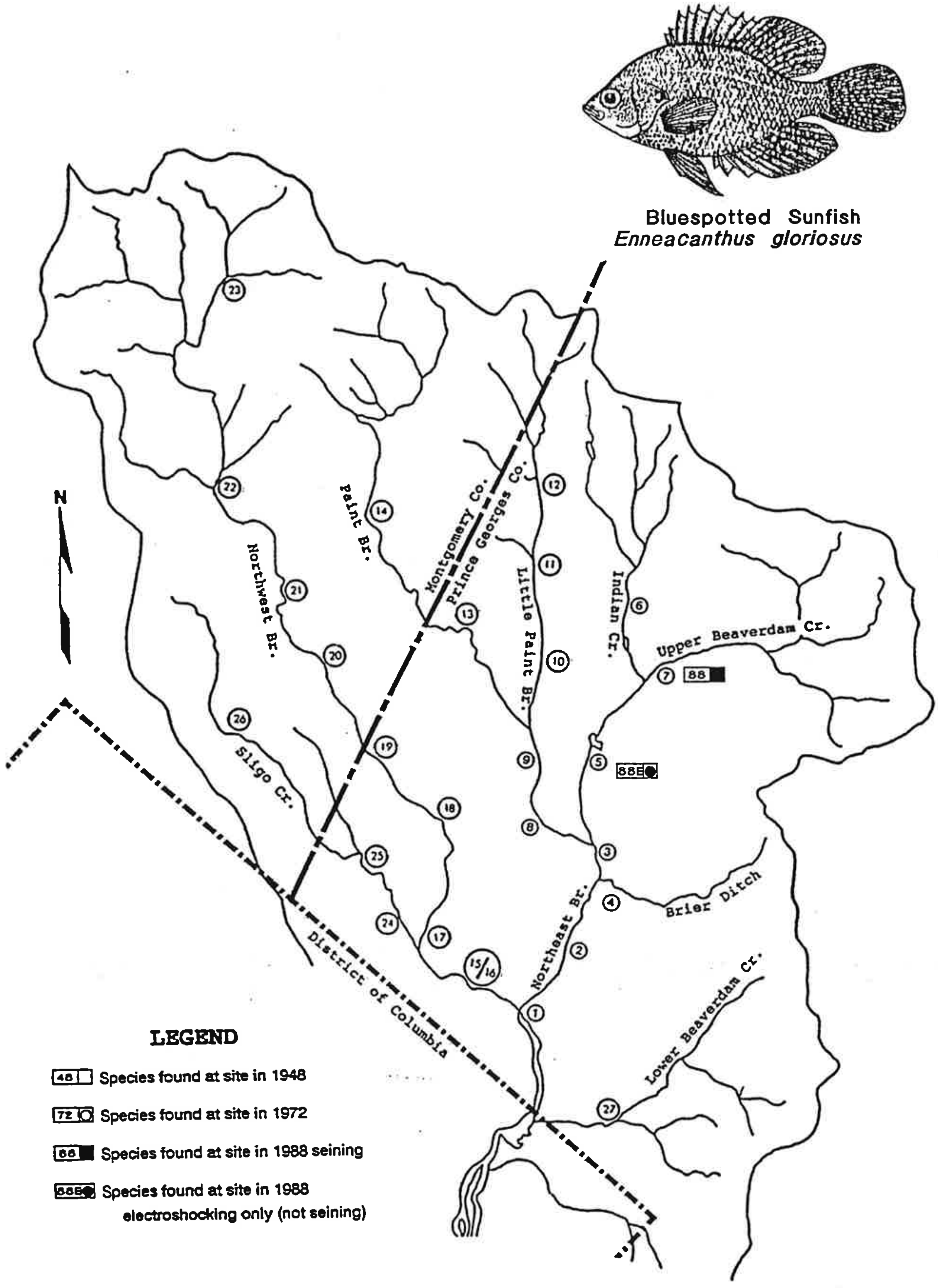
1948, 1972, and 1988



Mummichog
Fundulus heteroclitus



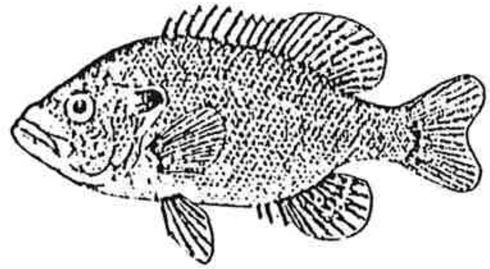
Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



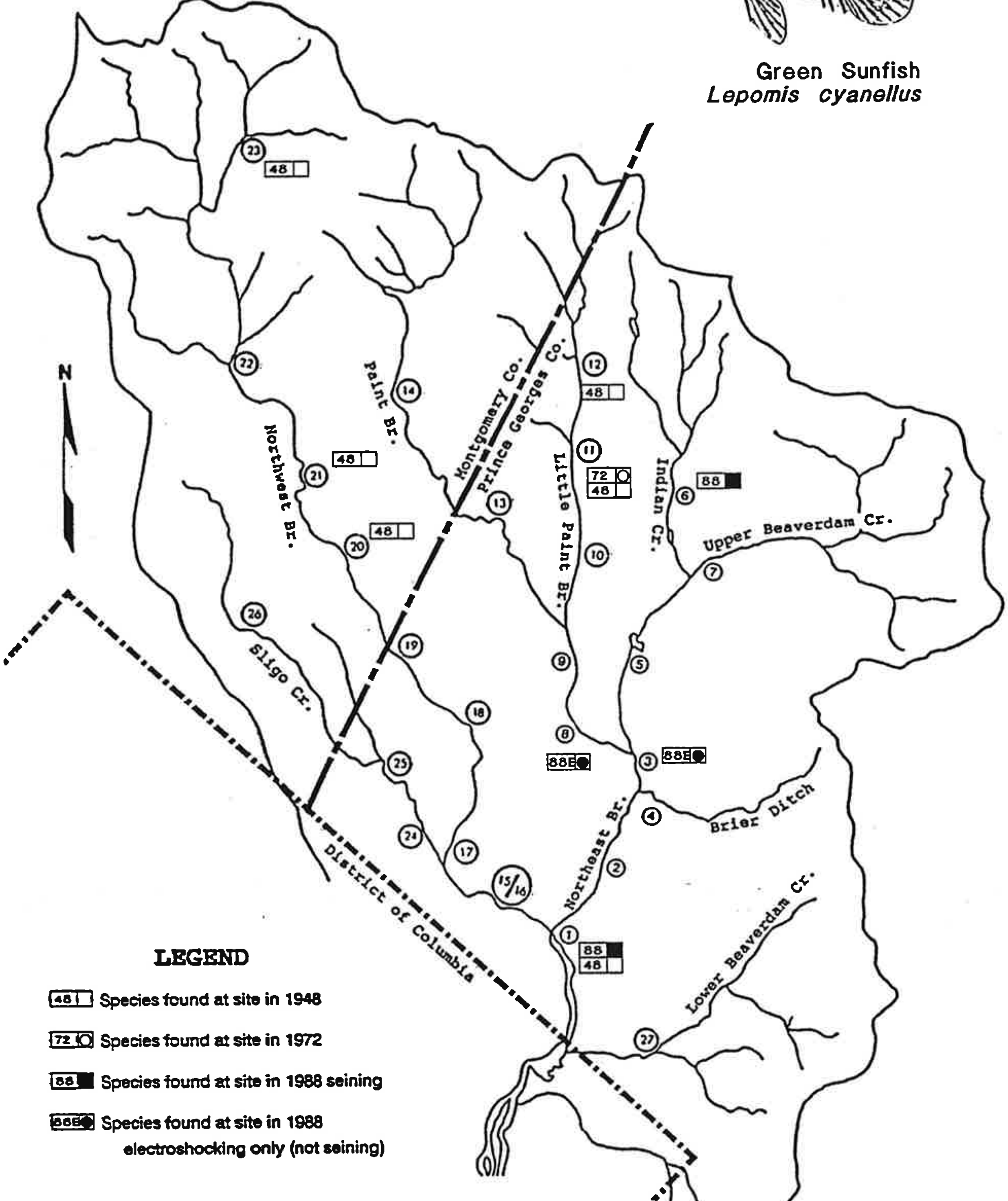
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



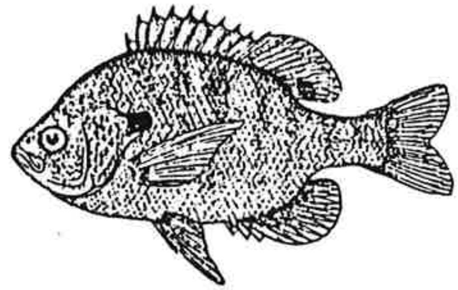
Green Sunfish
Lepomis cyanellus



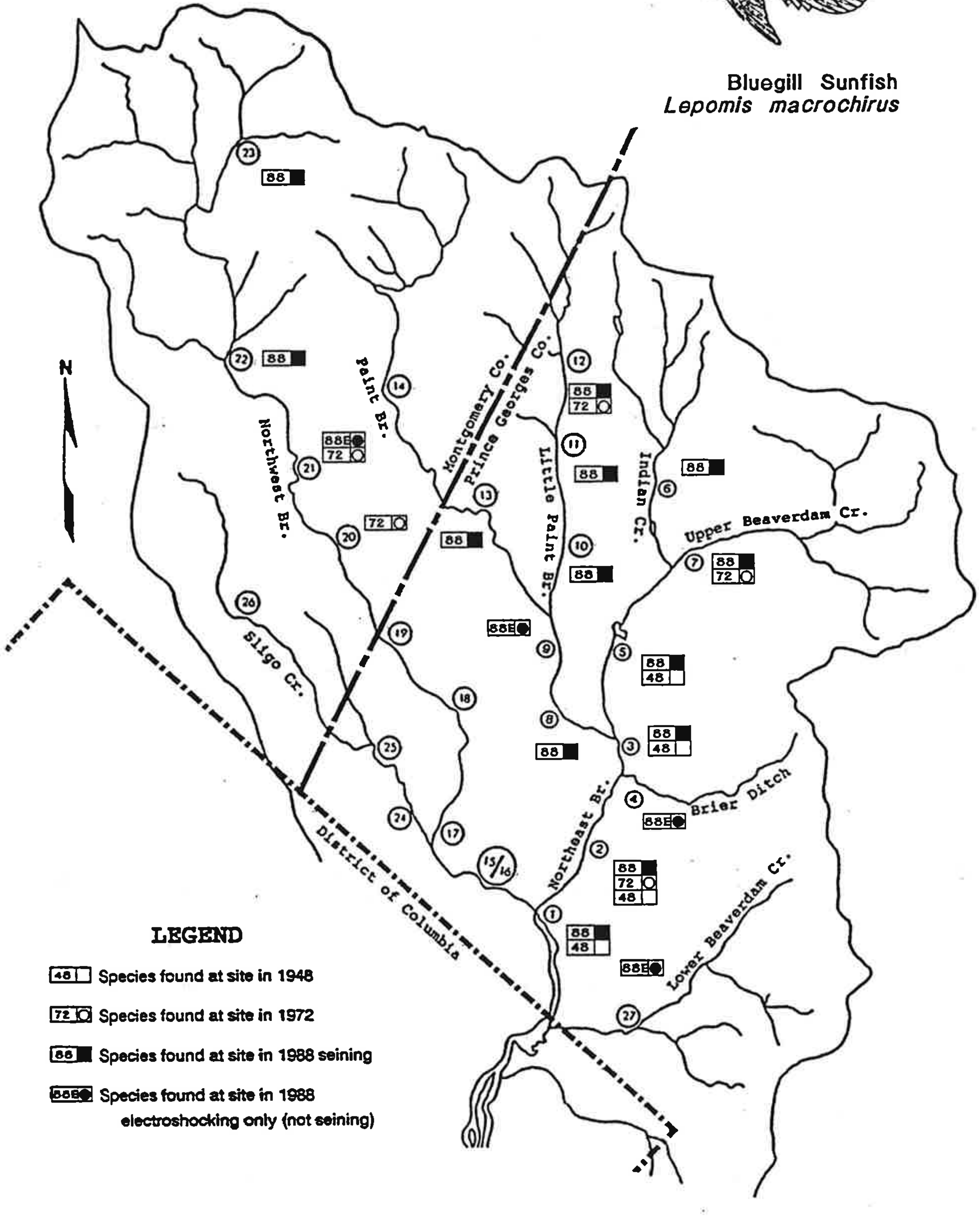
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



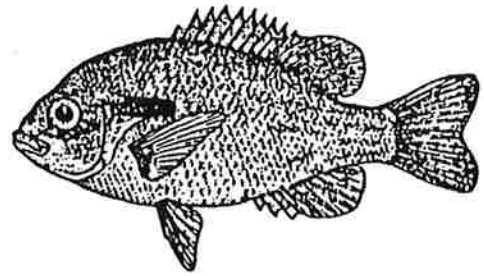
Bluegill Sunfish
Lepomis macrochirus



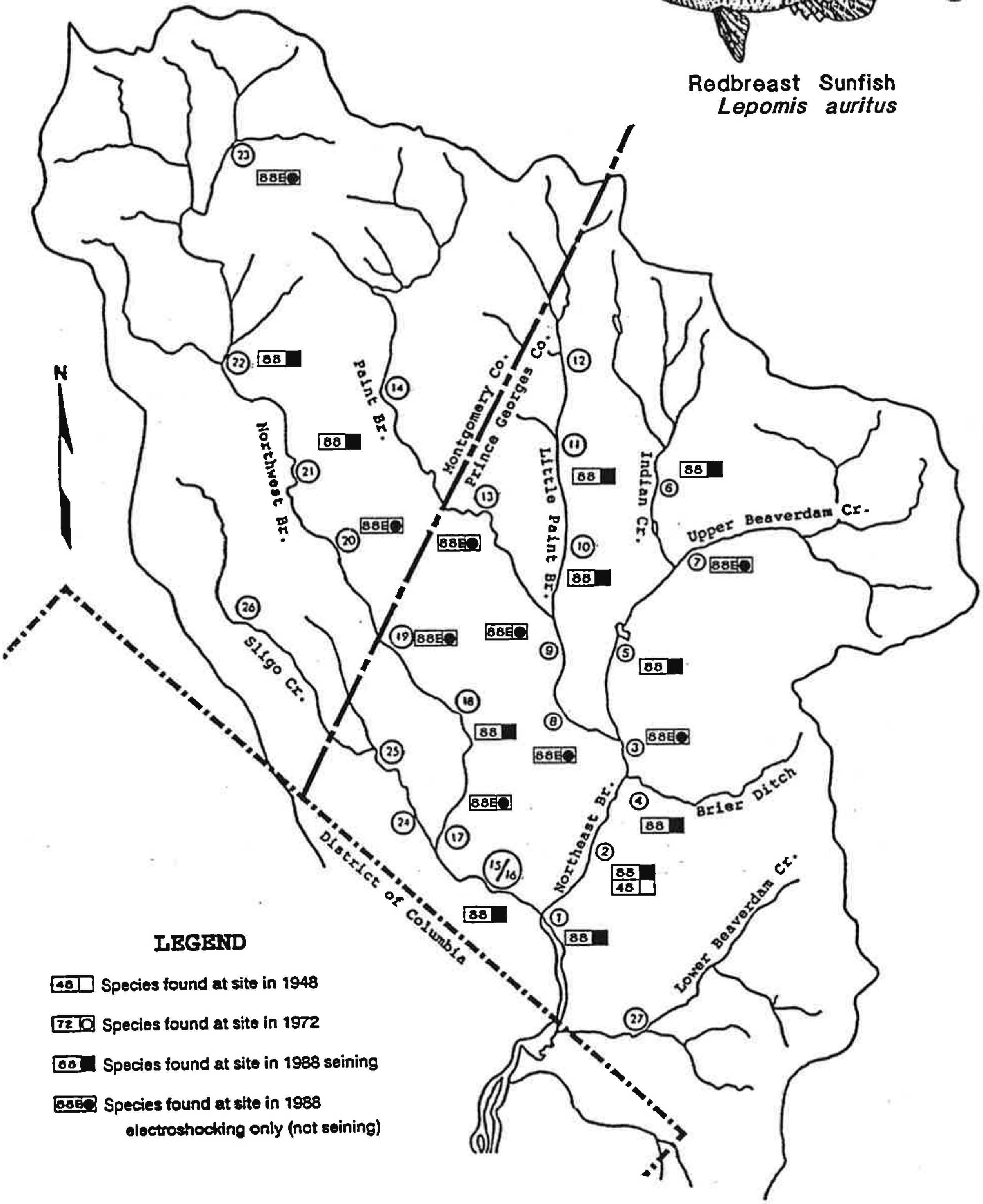
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



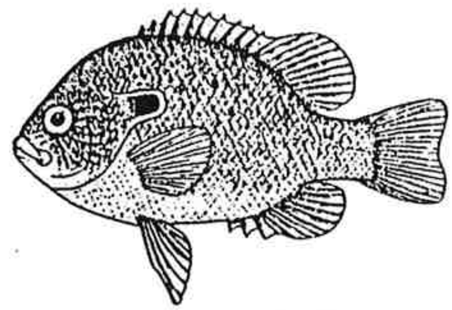
Redbreast Sunfish
Lepomis auritus



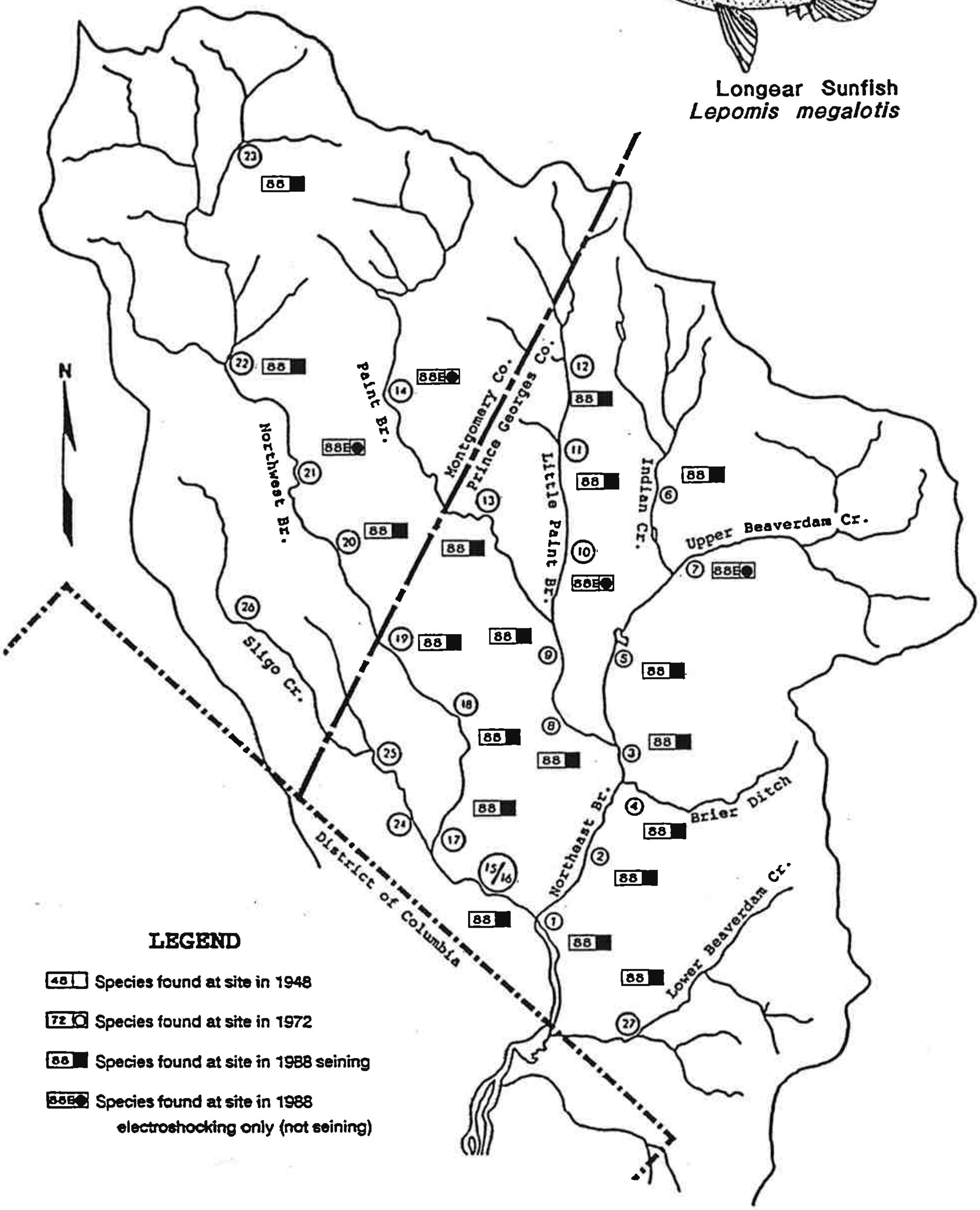
Anacostia Basin, Maryland

Fish Distribution

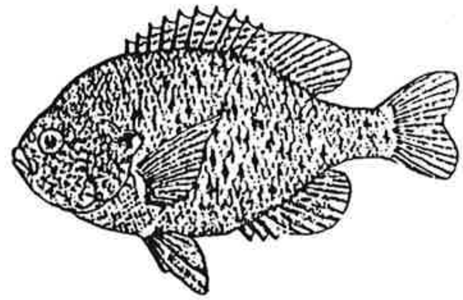
1948, 1972, and 1988



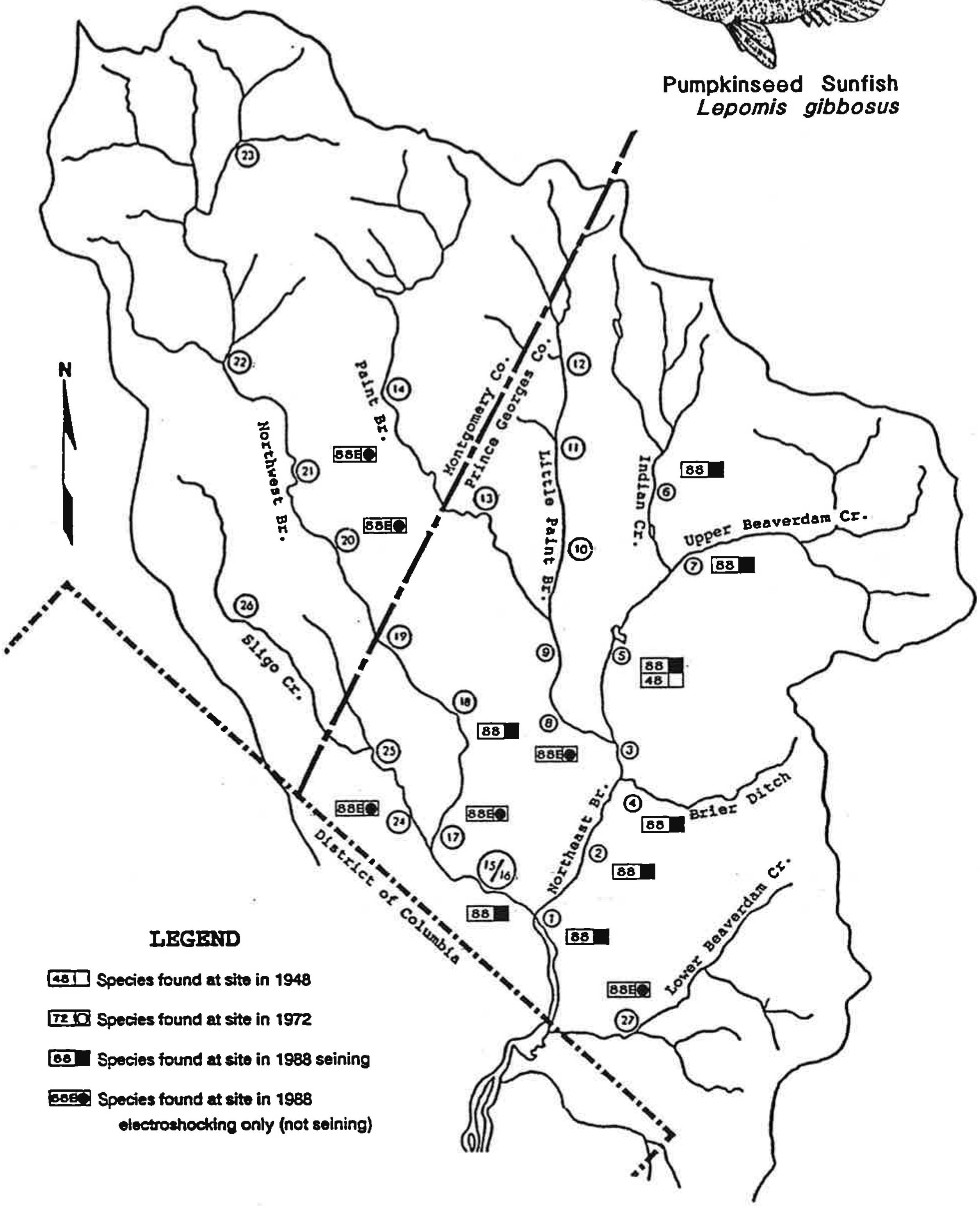
Longear Sunfish
Lepomis megalotis



Anacostia Basin, Maryland
Fish Distribution
1948, 1972, and 1988



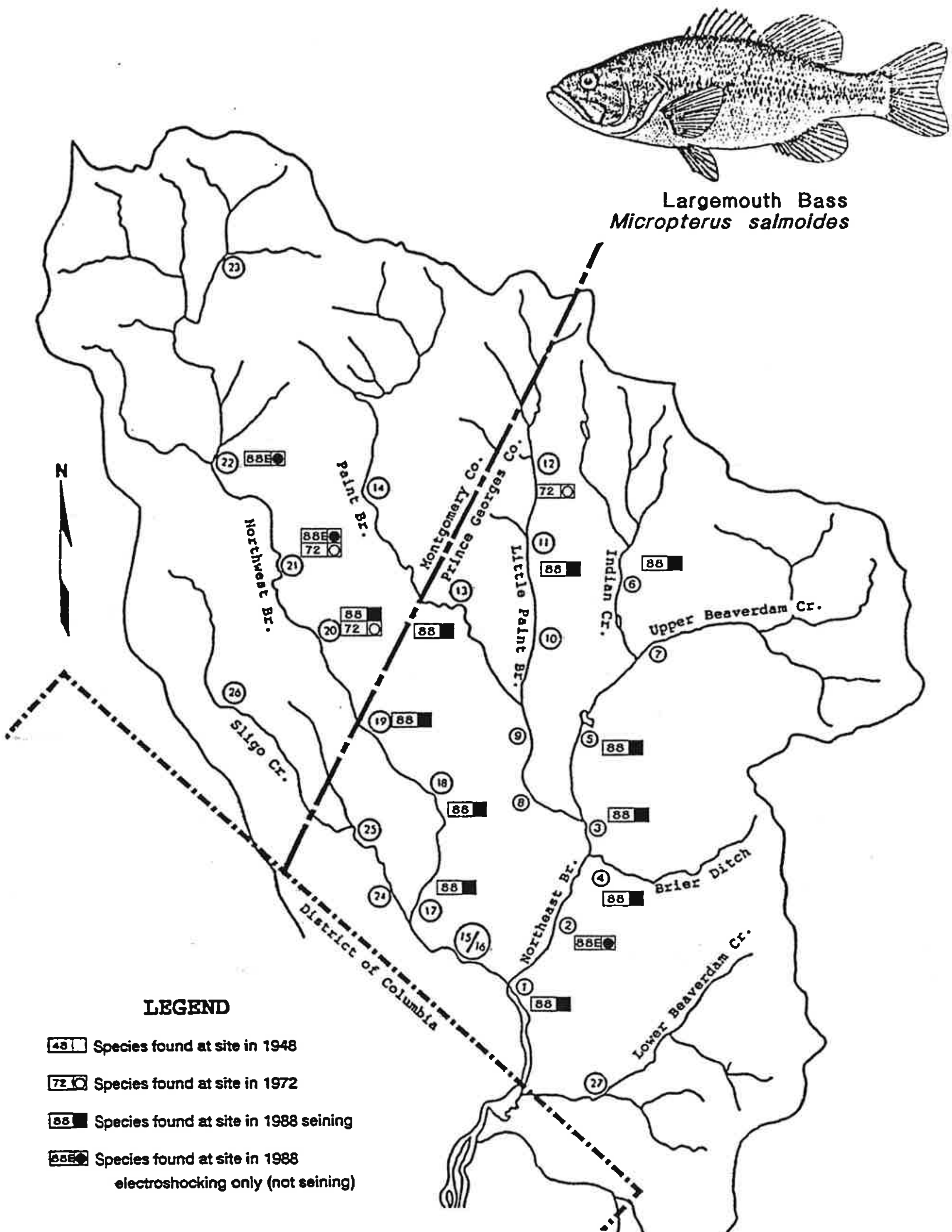
Pumpkinseed Sunfish
Lepomis gibbosus



Anacostia Basin, Maryland

Fish Distribution

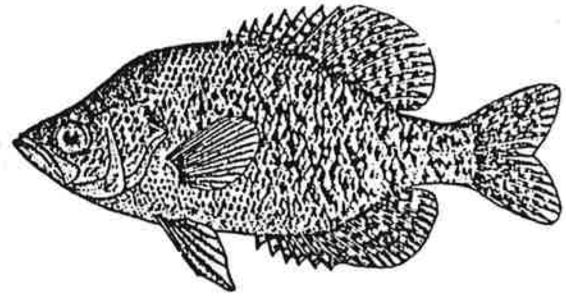
1948, 1972, and 1988



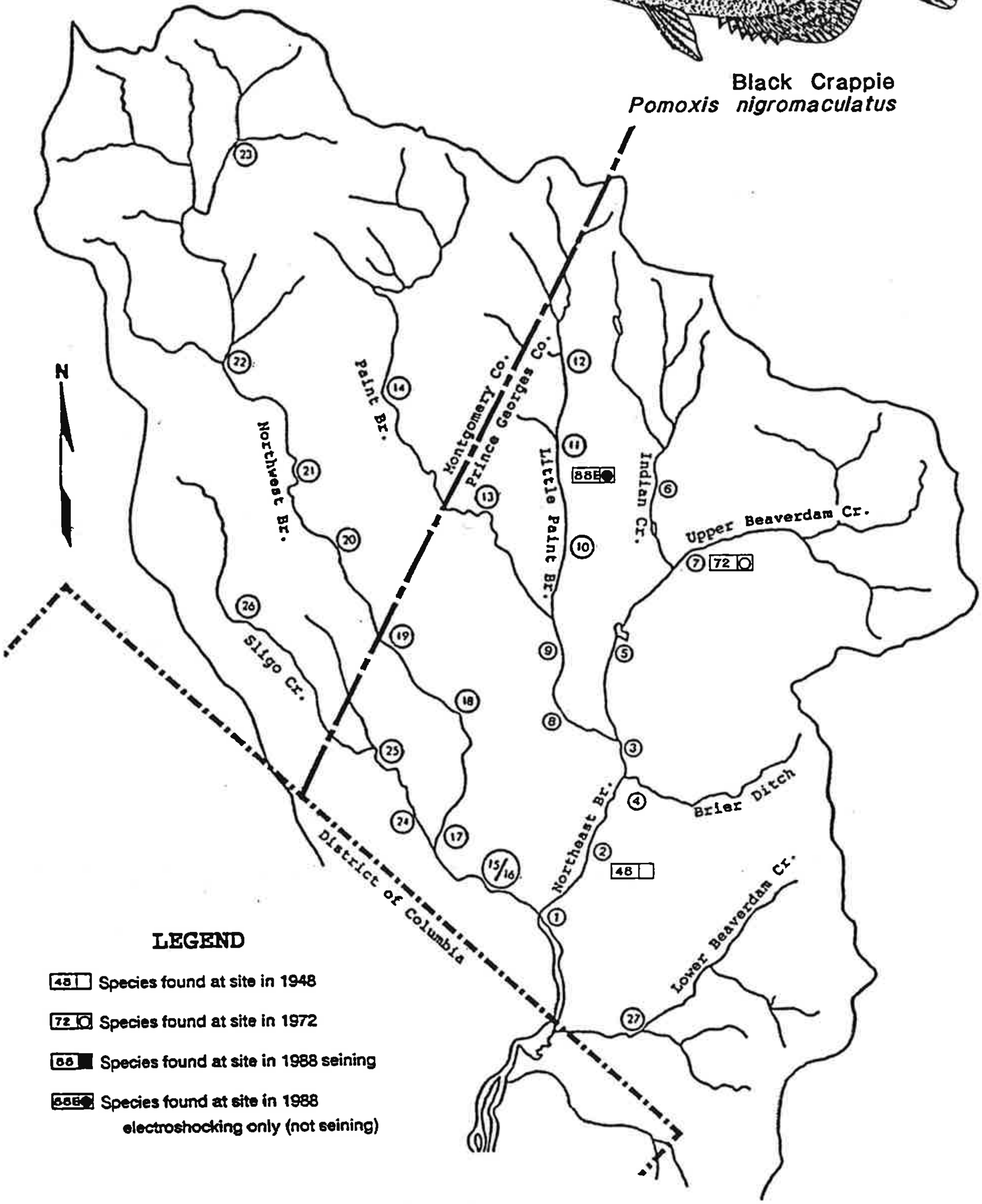
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



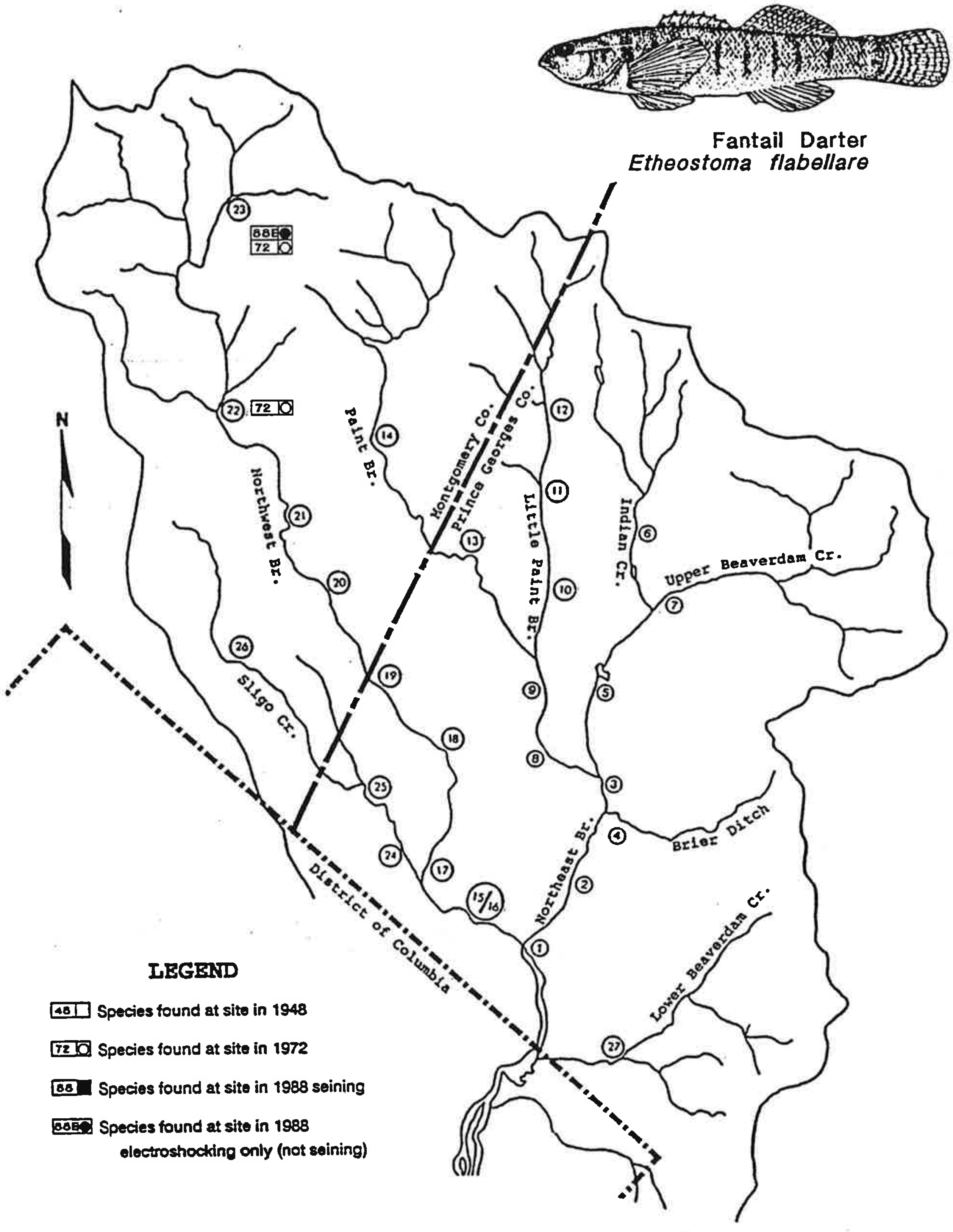
Black Crappie
Pomoxis nigromaculatus



Anacostia Basin, Maryland

Fish Distribution

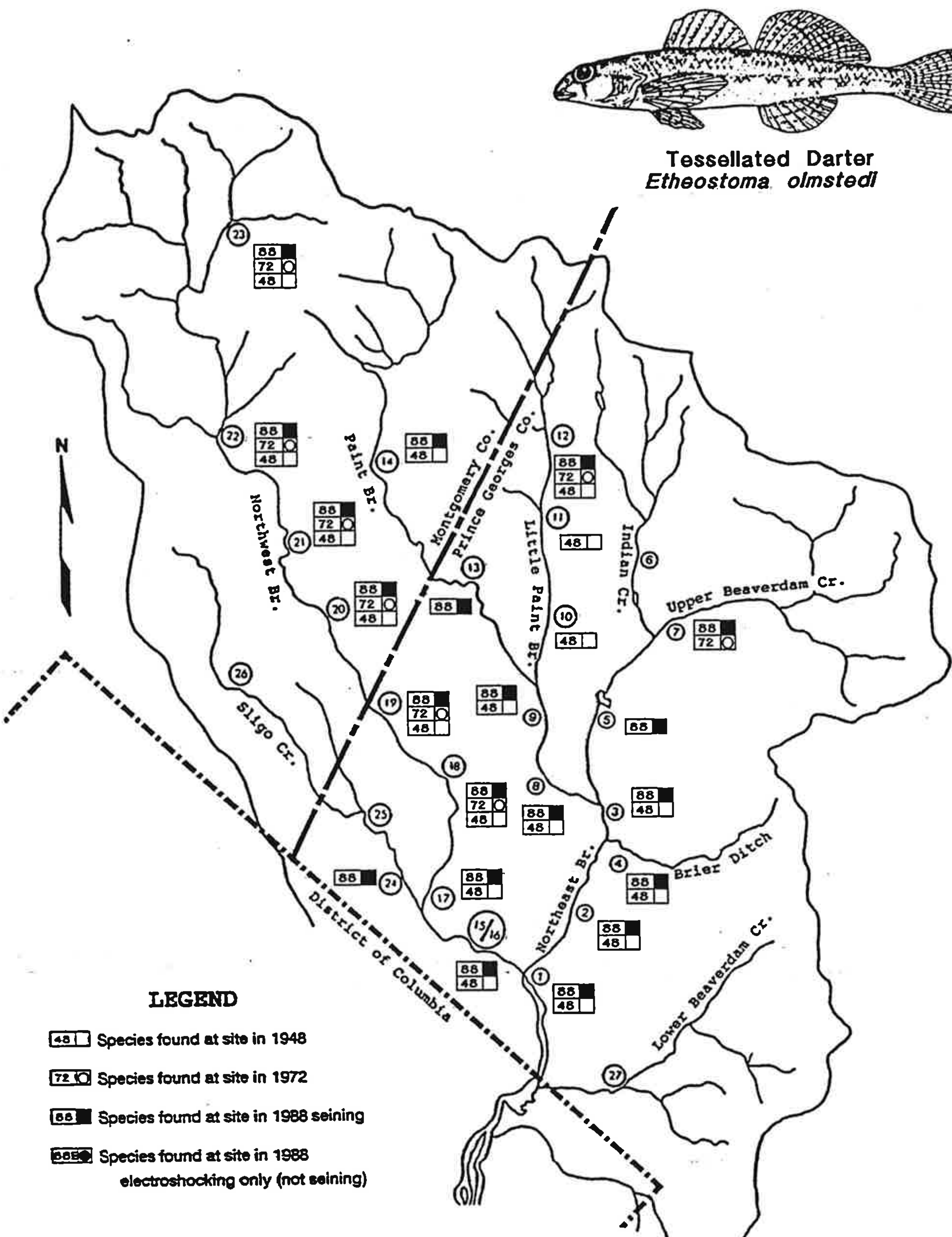
1948, 1972, and 1988



Anacostia Basin, Maryland

Fish Distribution

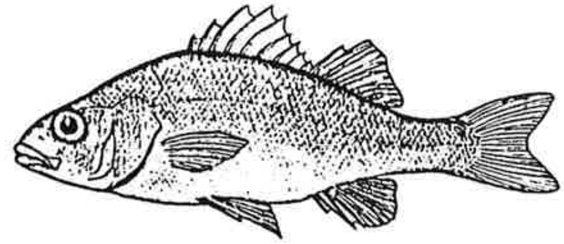
1948, 1972, and 1988



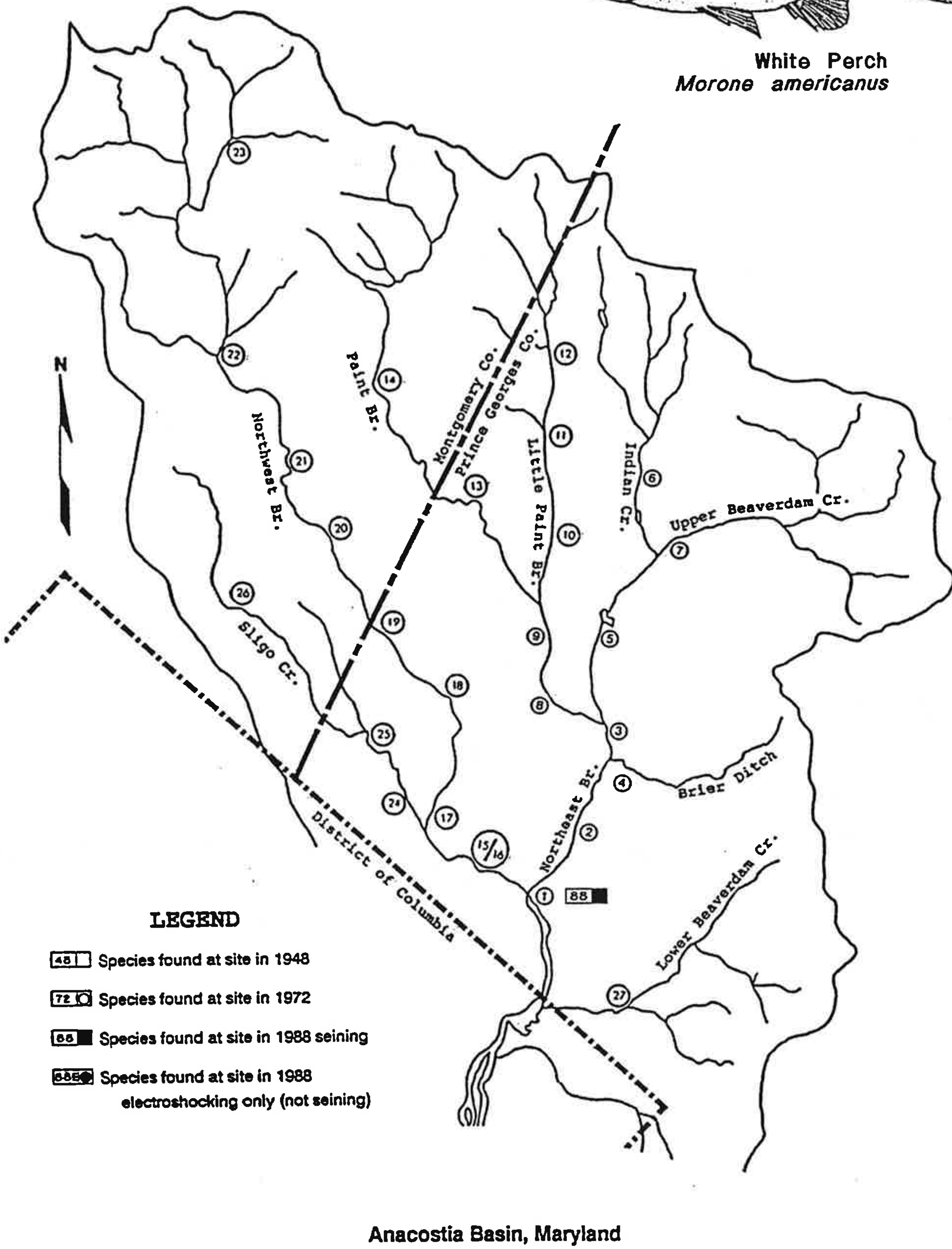
Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988



White Perch
Morone americanus



Anacostia Basin, Maryland

Fish Distribution

1948, 1972, and 1988