

Spring 2000 Anacostia Tributary System Herring Reconnaissance and Larval Stocking



**Prepared For
Potomac Crossing Consultants**

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Summary

In order to compensate for impacts to tidal and non-tidal wetlands and submerged aquatic vegetation (SAV) in the replacement of the Woodrow Wilson Bridge, a mitigation package is underway which proposes a number of projects to replace the environmental function of affected resources. One of these mitigation projects involves restoration of migratory river herring to historical spawning areas in the Anacostia watershed. Removal of migratory fish blockages and start of a larval stocking program were priorities set in 1999 by the Anacostia Fish Passage Working Group (AFPWG), working in conjunction with the Potomac Crossing Consultants (PCC). In 2000, the Interstate Commission on the Potomac River Basin (ICPRB), the Metropolitan Washington Council of Governments (MWCOG), and PCC subsequently performed a migratory fish reconnaissance survey and stocking program. Alewife herring (*Alosa pseudoharengus*) and Blueback herring (*Alosa aestivalis*) broodstock were collected, the eggs fertilized, then transported to the Maryland Department of Natural Resources (MDDNR) Joseph H. Manning Fish Hatchery at Cedarville State Forest in Charles County, Maryland for incubation and hatching. An estimated 2.6 million hatched larvae were subsequently stocked back to the Anacostia River tributaries and Rock Creek, another tributary to the Potomac River.

Project Background and Purpose

During construction of the Woodrow Wilson Bridge replacement, unavoidable impacts to wetlands and submerged aquatic vegetation will occur. As part of the Aquatic Resource Conceptual Mitigation Plan (ARCMP) of the Environmental Impact Statement for the Woodrow Wilson Bridge Improvement Study, several out-of-kind options to replace the functions and values of the impacted areas will be conducted. One of the out-of-kind replacement options identified in the ARCMP is the removal of migratory fish blockages in the Anacostia River watershed. This option seeks to open historical spawning areas of migratory fish and as a result, mitigate for impacts on fish habitat from bridge construction.

Organized in 1990 by ICPRB and more recently reconvened by the MWCOG, the Anacostia Fish Passage Working Group (AFPWG) has served as the coordinating body for local, state, and federal agencies. As one of the group's priority tasks, fish barriers throughout the Anacostia River watershed were to be identified and subjected to removal/modification to allow resident and anadromous fish migration. Since 1998, the PCC has worked with AFPWG, and in 1999 an anadromous fish survey was conducted by ICPRB and MWCOG for PCC to determine the extent of fish migration and evaluate past restoration efforts (1999 Assessment of Migratory Fishes on the Northeast and Northwest Branches of the Anacostia River, PCC, ICPRB, MWCOG, Sept. 1999). The findings of that study indicated continued efforts were needed to restore fish passage in the Anacostia River tributaries. Important examples of these efforts included the need to repair the fishway on the Northwest Branch at Route 1, and the stocking of river herring into upstream historic spawning ranges in the Anacostia River in order to imprint these migratory species and rebuild the population. In 1999, the AFPWG designated River Herring Larval Stocking Project as a priority. In coordination with AFPWG, PCC agreed to conduct a Spring 2000 larval herring stocking program in conjunction with ICPRB, MWCOG, and MDDNR as an out-of-kind option to mitigation for impacts from the Woodrow Wilson Bridge construction. This report describes the project results.

The objective of the project was to continue restoration of the fisheries in the Anacostia and Rock Creek watersheds through the stocking of larval Alewife (*Alosa pseudoharengus*) and Blueback Herrings (*Alosa aestivalis*). The spring 2000 Larval Herring Stocking Project involved two tasks. Under the first task, an electrofishing reconnaissance survey was performed to:

- verify the presence of herring and other migratory fishes in both the Northwest and Northeast Branches of the Anacostia River,
- gauge the relative strength of the run, and

- determine which location(s) provide the greatest probability for the collection of broodstock.

Under the second task, herring broodstock collection and restocking was performed to:

- remove eggs from approximately 100 ripe female river herring, fertilize them with milt from an equivalent number of collected male herring, fertilize the eggs in the field,
- transport fertilized eggs to the MDDNR's Manning Fish Hatchery in Cedarville, Maryland for incubation and hatching and
- stock of herring fry into the Northeast and Northwest Branches, Anacostia River and Rock Creek, Potomac River.

Methodology

Task 1. Electrofishing Reconnaissance Survey

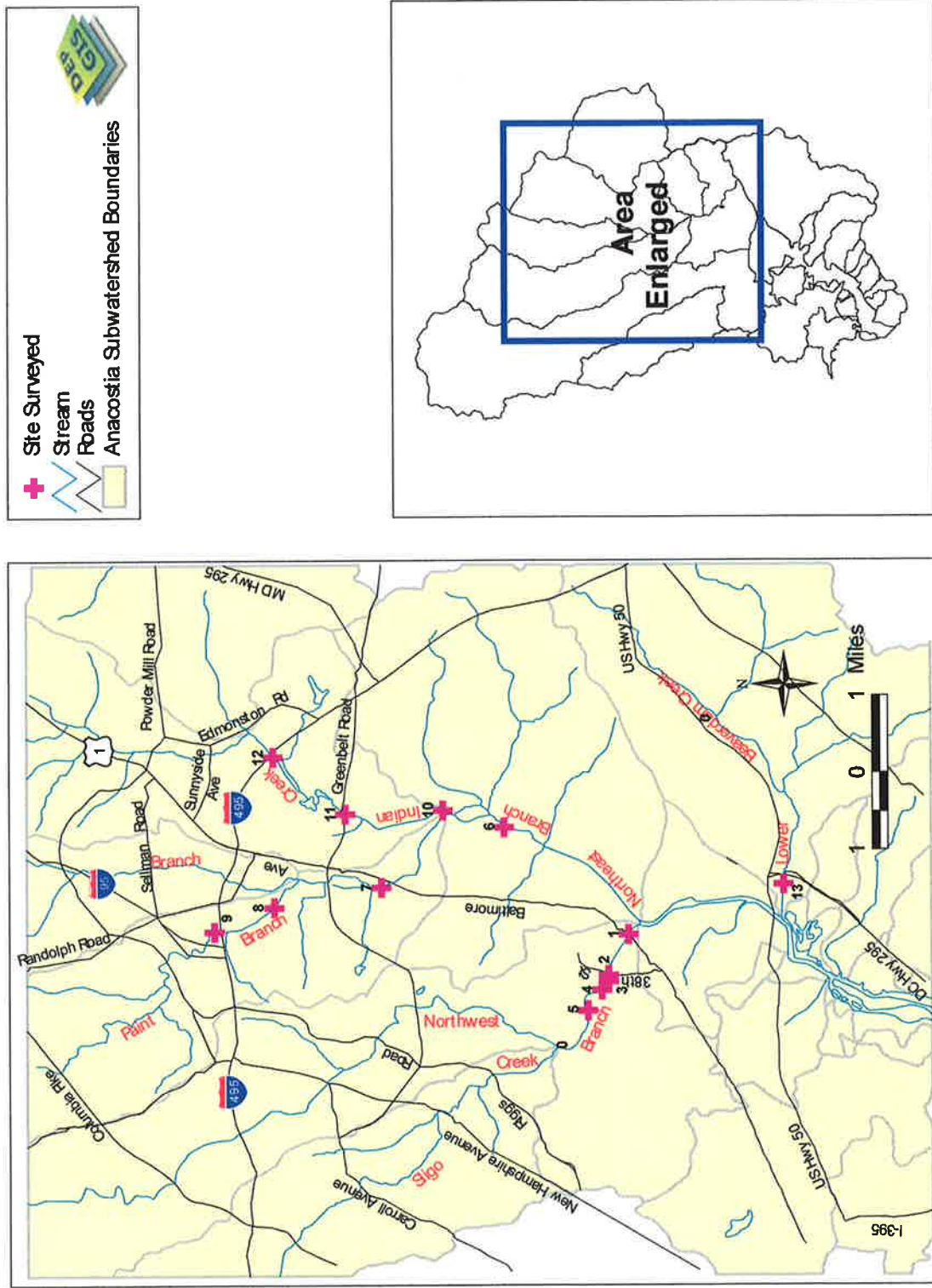
An electrofishing reconnaissance survey, as seen in Photo 1, of adult migratory fishes was conducted during the spring 2000 migratory fish runs which include Alewife Herring (*Alosa pseudoharengus*), Blueback Herring (*Alosa aestivalis*), Hickory Shad (*Alosa mediocris*), White Perch (*Morone americanus*), Striped Bass (*Morone saxatilis*), Yellow Perch (*Perca flavescens*), American Eel (*Anquilla rostrata*), and Sea Lamprey (*Petromyzon marinus*). Thirteen stations (shown in Figure 1) were sampled to determine the presence and strength of the herring run. The stations were located immediately downstream from known or suspected blockages, where migrating herring typically concentrate. Four of these stations were selected for sampling based on their known and/or expected ability to concentrate migrating herring, and were prioritized in the Northwest Branch due to planned concentration of fish passage projects in that watershed. Additional sampling sites were selected to determine their ability to concentrate migrating fish. Sampling was conducted during daylight hours using a Smith-Root backpack electroshocker employing pulsed direct current. Generally, one person operated the electroshocker while two persons netted stunned fishes. The nets used to capture the stunned fish were of two varieties: A Smith-Root Model #EDN-83-TD with 0.25 inch mesh net and a six foot pole, and a wide mouth 2.0 inch mesh net and 4 foot aluminum pole. One of each type of net was used during the sampling event.

The major objectives of each collection trip were to determine the extent and magnitude of upstream migration occurring on that particular day, and the spawning condition of the river herring. At each station, a one pass or "sweep-type" electrofishing was performed for an approximately 400 to 600 foot length of stream. Output power was field adjusted to account for variations in stream conductivity. Sampling was conducted during daylight hours using a Smith-Root backpack electrofisher as described above, and electrofishing times were staggered (i.e. starting at mid-morning to mid-afternoon, at times ending as late as dusk) to increase the likelihood of encountering migrating fish. Depending on stream conditions, the Northwest Branch at US Route 1 was surveyed more than once per day. Collected migratory fishes were counted, measured for length and weight, and sexed for evidence of row or milt. Notes were taken on their general condition, dorsal fins were clipped to identify where they were captured, and then they were released. Attempts were made to capture all fish sighted during electrofishing. If schools were so large that capture of all individuals was not possible or desirable, they were sub-sampled and records were kept on the estimated size of the school observed. Daily water temperature, water clarity, and general flow and weather conditions were recorded. Information was obtained and recorded from these surveys and used to evaluate the best locations for the collection of broodstock.



Photo 1. Electrofishing the Paint Branch at PB1 Blockage.

Figure 1. Spring 2000 Anadromous Fish Monitoring Stations



During each day of the reconnaissance survey period efforts were made to determine whether the herring run was weak, i.e. not likely to yield the daily targeted minimum of 0.15 liters of eggs necessary for hatchery incubation, or strong, i.e. likely to meet or exceed the daily threshold. In addition, an overall project target of at least 100 ripe females were estimated necessary to produce one to two million stocked larvae. If the overall herring run was not found to be strong enough in the Anacostia River system to support these targets, then the protocol for collection of broodstock was to be modified to include supplemental herring collection in the Potomac River.

Task 2. Herring Broodstock Collection and Stocking

The protocol for collecting Alewife and Blueback broodstock involved a targeted collection of approximately 100 ripe females over an estimated 4-6-week period. The stations designated for broodstock collection were determined from the results of previous surveys and the reconnaissance survey. Collections occurred during daylight hours using electrofishing direct current backpack shockers. Since changing tide and water levels on the Northwest branch at Route 1 make electrofishing capture difficult, a 50 x 4 foot and ¼ inch mesh haul seine was employed to capture broodstock in a sweeping arc across the width of the stream. The use of a haul seine can reduce the stress placed upon the fish compared with the stress on the fish as a result of electrofishing.

During the course of the project it was determined that the seasonal egg collection target (approximately 100 ripe female herring) would not be fully obtained by this method. Therefore, the cooperation of Fletcher's Boathouse in the District of Columbia was enlisted and broodstock were collected at a site on the mainstem Potomac River. In these instances, two 75 foot and one 150 foot long mono-filament gill nets with 2.75-inch stretch mesh were employed for use in capturing fish on the Potomac River. The nets were pulled through the water column until a sufficient number of fish were captured.

Ripe females were collected and stripped of eggs into shaded bowls containing ambient temperature stream water. Eggs from Alewife herring were kept separate from Blueback herring and each set of eggs was fertilized by milt from males of the appropriate species. A minimum of 0.15 L of fertilized eggs per sampling event was required for incubation. Fertilized eggs were allowed to sit in darkened buckets for approximately 45 minutes, after which all eggs were transferred to a single darkened container, packaged with supplemental oxygen at ambient stream temperature, and delivered promptly to the Maryland Department of Natural Resource's (MDDNR's) Joseph H. Manning Fish Hatchery, at Cedarville State Park, located approximately 40 miles away in Charles County, Maryland. Through a cooperative agreement with MDDNR, the fertilized eggs were incubated to yolk sac-stage larvae.

In preparation for incubation, the eggs were separated by adding 20 grams of NaCl and 0.375 grams of tannic acid into 5 liters of water. A few drops of de-foamer were added and the mixture agitated and aerated for 6-7 minutes. To clear the eggs, they were extracted from the above mixture and added to 20 grams of NaCl, 15 grams of Urea, and 5 liters of water. De-foamer was added, and the mixture agitated/aerated for 6-7 minutes more. The eggs were then transferred to incubation containers, which are constantly refreshed with cool fresh stream water (Photo 3). Over an approximately 5 to 10 day period, the eggs were incubated and hatched to larvae stage, after which



Photo 2. Stripping of Herring Eggs

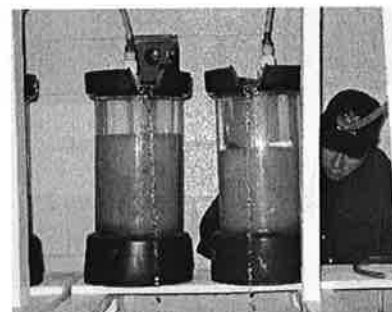


Photo 3. Egg incubation at MDDNR hatchery.

approximate counts of viable eggs and pre-stock larvae survival rates were determined. The larvae were then transported in covered, black, 5 gallon containers from the hatchery back to the Anacostia and Rock Creek watersheds. The Anacostia watershed stocking locations are shown in Figure 2.

Larval stocking occurred at 5 sites in major tributaries to the Anacostia River:

Indian Creek at Sunnyside Avenue,
Little Paint Branch at Sellman Road,
Paint Branch at Powder Mill Road (MD 212),
Northwest Branch at Riggs Road (MD 212),
Sligo Creek at New Hampshire Avenue (MD 650),
and at one Rock Creek Site:
Rock Creek at Garrett Park Road.

All five Anacostia sites are located well upstream of existing fish blockages and represent what are believed to be the upper historical range of river herring in the Anacostia tributary system. When placing the larval herring into the stream, the container holding the larvae was first placed into the stream to help the contents acclimate to the ambient temperature of the stream, with additional amounts of stream water slowly poured into the container. After 5-10 minutes of acclimating to the stream temperature, the herring fry were released into a slow moving portion of riffle habitat. Over a 4-6 week period (approximately April 14 to May 31), a target of one to two million Alewife and Blueback herring larvae were to be released in batches at the six locations.

Results

Task 1. Reconnaissance Survey

Reconnaissance sampling was initiated on April 4, 2000 and occurred intermittently through May 16, 2000. Results from reconnaissance sampling (Table 1) showed no presence of migratory herring reaching stations on the Northwest Branch Anacostia River above 38th street.

Reconnaissance sampling showed no presence of migratory herring on Indian Creek of the Northeast Branch Anacostia River. Reconnaissance sampling did show migration of herring on Paint Branch of the Northeast Branch, but only up to the concrete dam just upstream from Route 1.

Task 2. Broodstock Collection and Stocking

Broodstock collection containing ripe females occurred from April 11, 2000 through May 12, 2000. A summary of the estimated number of viable eggs and stocked larvae is shown in Table 2. On a few occasions, storm events on previous days resulted in higher flows preventing sampling at some locations. In general, water clarity was good in both the Northwest and Northeast Branches.

By the end of April the collections of herring broodstock on the Northwest and Northeast Branches were producing less than the desired amounts of viable eggs. Therefore, the collection of broodstock was supplemented by fish collected at Fletcher's Boathouse on the mainstem Potomac River. Fletcher's Boathouse has had a long- running collection permit for river herring to be used as bait. Through a cooperative agreement with Fletcher's Boathouse, collections at this site occurred in the early mornings using gillnets and proved successful, producing 40% of the total viable egg harvest and 72% of the final viable larvae stocked.

The Anacostia and Rock Creek watershed-stocking schedule is shown in Table 3. Approximately 2.4 million Alewife and Blueback herring larvae were stocked to five locations located in the Anacostia Watershed.

Table 1. Year 2000 Anacostia Watershed River Herring Reconnaissance Survey

Stream	Northwest Branch										North-east Branch	Paint Branch				Indian Creek	Lower Beaverdam Creek		
Site	US Route 1								38 th St.		NW1	NW2	NW3	NEB1	PB @ Rt 1		PB1	PB2	IC2 @ Green-belt
Species Observed	Alewife Herring	Blueback Herring	Hickory Shad	White Perch	Yellow Perch	Striped Bass	American eel	Alewife Herring	Blueback Herring	American eel	American eel	No Anadromous Herring observed		Alewife Herring	American eel	Sea lamprey	American eel	Sea lamprey	American eel
Date																			
4/4/00	32	0	0	0	0	0	0	0	0	0	0	0	0						
4/7/00	1	0	0	0	0	0	0	0	0	1	0	0	0	0					
4/11/00	87	0	0	30+	0	0	0	0	0	0				1					0
4/14/00	110	0	0	ob	0	0	0	0	0	0	0	0	0		0				
4/20/00	63	0	0	ob	0	0	0	0	0	0	0	0	0						
4/27/00	80	0	0	ob	0	0	0	0	0	0	0	0	0	7	20	1	1	0	0
5/1/00	214	10	1	71	1	0	0												
5/3/00	63	169	0	ob	0	0	0								65	0	0		
5/9/00	80	208	0	0	0	1	0												
5/12/00	17	86	0	0	0	2	1	0	3	1	1	0	0		0	0	0		0
5/16/00	0	0	0	0	1	1	1	0	0	0				0	0	1	0	1	
Total	747	473	1		2	4	2	0	3	1	1	0	0	8	85	2	1	1	0

Note: Number of migratory fish captured for reconnaissance survey does not include migratory herring captured by use of haul seine or gill nets for broodstock collection.

- Gizzard Shad observed throughout the study.
- Shaded areas indicate that electrofishing survey was not conducted.
- ob indicates white perch were observed in large numbers but not counted.

Table 2. Year 2000 Estimated Number of Viable Eggs and Stocked River Herring Larvae

Sample Date	Collection Site ¹	Collection Technique ²	Number of Ripe Female Herring Stripped of Eggs	Volume of Fertilized ³ River Herring Eggs Collected				Range of Number of Viable Eggs Collected ⁴			Volume of Pre-Stock Larva		Median No. of Pre-Stock Larva/ml ⁵	Total No. of Pre-Stock Larva	Pre-Stock Survival Rate ⁶	Total Number of Viable Larva Stocked
				(L)				Low Range	Median Range	High Range	L Gal					
				Blueback	Alewife	Total	Viable Eggs									
04/11/2000	Northwest Branch @ US Route 1 – Below Fishway	Electrofishing	3	0.00	0.20	0.20	0.20	80,000.0	173,000.0	266,000.0	18.9	5.0	6	113,562.0	0.60	68,137.2
04/20/2000	Northwest Branch @ US Route 1 – Below Fishway	Electrofishing	1	0.00	0.15	0.15	0.15	60,000.0	129,750.0	199,500.0	18.9	5.0	22	416,394.0	0.90	374,754.6
04/26/2000	Potomac River @ Fletcher's Boathouse	Gill Netted	15	0.00	1.65	1.65	1.65	660,000.0	1,427,250.0	2,194,500.0	94.6	25.0	22	2,081,970.0	0.90	1,873,773.0
04/28/2000	Potomac River @ Fletcher's Boathouse	Gill Netted	20	0.00	3.00	3.00	0.00	0.0	0.0	0.0	0.0	0.0				
05/01/2000	Northwest Branch @ US Route 1 – Below Fishway	Electrofishing	14	0.00	0.60	0.60	0.60	240,000.0	519,000.0	798,000.0	9.5	2.5	10	94,635.0	0.80	75,708.0
05/03/2000	Paint Branch @ US Route 1	Electrofishing	26	0.75	0.48	1.23	0.48	490,000.0	410,875.0	1,629,250.0	18.9	5.0	10	189,270.0	0.50	94,635.0
	Northwest Branch @ US Route 1 – Above and Below Fishway	Electrofishing and Seined														
05/09/2000	Northwest Branch @ US Route 1 – Above and Below Fishway	Seined	18	0.40	0.51	0.91	0.00	364,000.0	0.0	1,210,300.0	0.0	0.0	0	0.0	0.00	0
	Northwest Branch @ US Route 1 – Above and Below Fishway	Electrofishing and Seined	11	0.75	0.30	1.05	1.05	420,000.0	908,250.0	1,396,500.0	38.0	10.0	3	113,562.0	0.92	104,477.0
05/12/2000	Northwest Branch @ US Route 1 – Above and Below Fishway	Seined	108	1.90	6.89	8.79	4.13	1,650,000.0	3,568,125.0	5,486,250.0	198	7	3,009,393.0		2,591,484.0	8
Totals																

Note: The shaded/bolded number for volume of fertilized eggs collected indicates that egg mortality was up to 100 percent. Consequently, those egg batches were not reared to the larval stage.

¹ River herring were not collected from the Northeast Branch at River Road (behind the Maryland-National Capital Park and Planning Commission parking lot) due to relatively low abundance. In-stream construction was observed during the first two weeks of May just above the confluence of Brier Ditch.

² River herring collection technique employed the following sampling equipment: Model 15-D Smith-Root Backpack Electrofisher, 50 and 25 foot-long seine haul nets, and three 75 foot-long gill nets with 2.75 inch mesh openings.

³ Generally, three male herrings were used to remove milt for every one female stripped of eggs.

⁴ Per correspondence with MDDNR, mature blueback female herrings generally broadcast 800 to 1330 total number of eggs per milliliter. Alewife herrings generally broadcast in the range of 400 to 1030 total number of eggs per milliliter. Since both blueback and alewife herring eggs were combined into a hatching jar, the range of 400 to 1330 total number of eggs per milliliter was used to consistently estimate the total number of viable eggs collected. Additionally, 865 eggs per milliliter was used as the median range value.

⁵ Median number of pre-stock larvae per milliliter were calculated from multiple 30-ml sub-samples collected from the 5-gallon stocking buckets.

⁶ Survival rates were estimated from the larvae holding tanks, or when possible, they were determined from the sub-sample median larvae per milliliter counts.

Approximately 0.2 million herring larvae were stocked at one site in the Rock Creek Watershed. The estimated total of 2.6 million stocked larva exceeded the original projected target stocking numbers of 1-2 million.

Table 3. Year 2000 Anacostia and Rock Creek Watershed Stocking Schedule and total number of viable larvae stocked

Year 2000	Anacostia Watershed Tributaries and Stocking Sites						Rock Creek Watershed	
	Sligo Creek	Northwest Branch	Paint Branch	Little Paint Branch	Indian Creek	Totals	Mainstem	Totals
	New Hampshire Avenue	Riggs Road	Powder Mill Road	Selman Road	Sunnyside Avenue		Garrett Park Road	
04/20/2000		68,137.2				68,137.2		68,137.2
05/01/2000	749,509.2	749,509.2	0.0	374,754.6	374,754.6	2,248,527.6		2,248,527.6
05/09/2000			75,708.0			75,708.0	94,635.0	170,343.0
05/18/2000							104,477.0	104,477.0
Totals	749,509.2	817,646.4	75,708.0	374,754.6	374,754.6	2,392,372.8	199,112.0	2,591,484.8

Shaded area indicates no stocking.

Discussion

As in past years, Alewife herring dominated the herring collections. A significant number of White Perch were also captured on the Northwest Branch, which is consistent with previous years. The capture of one Hickory Shad and four Striped Bass in the Northwest Branch at Route 1 is noteworthy, since these species primarily spawn in the Potomac River mainstem. Hickory Shad were first captured in 1999 in the Northwest Branch. Only one Yellow Perch was captured and represented a smaller number than those collected in previous studies.

Electroshocking reconnaissance of the Northwest Branch showed a strong run up to the fishway at Route 1. In many instances, herring were observed swimming in the channel of the fishway or on the concrete pad just above the fishway and not migrating further upstream. Very few herring were captured at the next upstream fishway at 38th street, and none were captured at the next blockages upstream of 38th street. As was determined from the previous 1999 study, the baffle on the most downstream cell of the Route 1 fishway is still in need of repair, and therefore this fishway is not effectively allowing the herring to run through at all flow velocities.

A comparison of the catch per unit effort (CPUE) at US Route 1 with previous years is shown in Figure 3,

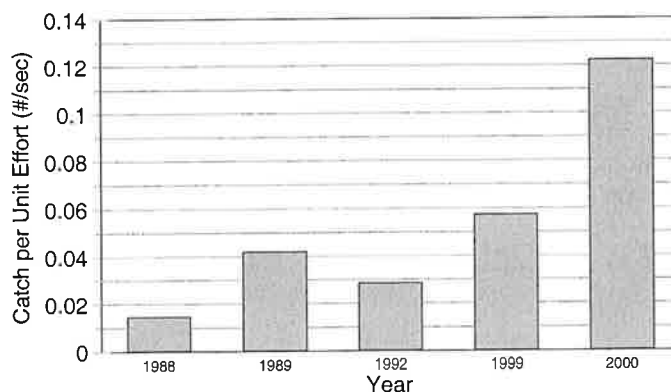


Figure 3. Electrofishing Catch per Unit Effort of River Herring on Northwest Branch at US Route 1.

and indicates an increase in the strength of the herring run. However, the project was not specifically designed to determine CPUE. The larger CPUE in 2000 for this station is complicated by the extended effort that was made to capture as many fish as possible for the collection of broodstock, as well as the use of two netters instead of one to capture stunned fish. A larger and more efficient collection net employed for broodstock capture may also have contributed to this apparent increase. There are inherent conflicts in a study requiring both reconnaissance and capture of a migratory species in the short time span of several weeks, and therefore direct comparisons of 2000 data with previous years data can not be made.

Results of the electroshocking reconnaissance showed that the best locations for collection of herring broodstock in the Anacostia watershed were the Northwest Branch below Route 1 and in the Northeast Branch at the Paint Branch blockage above Route 1. Information gathered from previous studies (Cummins, 1988, 1989) show the current blockage on Paint Branch at Route 1 did not exist. Thus, this structure, a utility line crossing with a concrete cap, is a recent blockage to river herring that may have developed as a result of urban sediment movement.

Initially, electroshocking collections at these locations resulted in a low number of individuals, and few ripe females were captured. It was determined that, when feasible, some collections of broodstock would occur in conjunction with herring collections made by Fletcher's Boathouse on the mainstem Potomac River. This change in collection protocol proved advantageous and provided the largest number of eggs collected at any one sampling event. However, the collection of broodfish by gillnet was performed after the loaded net was brought to shore which resulted in the premature mortality of captured fish. Even though more ripe females were captured using the gillnet, the premature mortality may have reduced the number of females producing viable eggs. Despite this problem, the success in harvesting such a large number females and eggs seems to indicate a need to continue collection efforts at this station in the future.

Overall, collection efforts at all stations using all collection methods resulted in the capture of more than 1700 alewife and blueback herring individuals (total includes 402 alewife herring caught from the Potomac River), with 108 ripe females bearing eggs. As Table 2 shows, pre-stocking survival rate ranged from 50 to 92 percent. Egg mortality may be due to several factors, such as variations in sunlight, water temperature, oxygen saturation and time allowed for fertilization or transport. Larval mortality may include such factors as limited food supply in hatchery holding tanks, the exchange of larvae from holding tank to the stocking containers and transport time.

Table 3 shows the herring-stocking schedule to the Anacostia and Rock Creek watersheds. Between April 20th 2000 and May 18th 2000, nearly 2.6 million herring larvae were released, thereby surpassing the stocking targets for this project. This stocking should promote the return of spawning adult herring (in approximately four to five years) to these currently blocked reaches by chemically imprinting these fishes to their historic spawning streams. By that time, it is envisioned that existing downstream fish blockage(s) will have been removed and/or modified; thereby permitting full upstream migration and utilization of spawning habitat. As per the AFPWG's restoration priorities, larval stocking was proportional to stream size, habitat quality and expected herring utilization, and the Northwest Branch, including Sligo Creek, received a greater proportion (65%) of stocked fry than other Anacostia streams.

Recommendations

The findings of this study support the priorities and objectives of the Anacostia Fish Passage Workgroup with the following additions:

1. Repair the fishway at US Route 1 on the Northwest Branch. As determined in 1999, the baffle on the lowest cell of this fishway is in need of repair. While the fishway probably needs to be dewatered before a final determination can be made, it appears that this baffle needs to be brought to a similar relative elevation to the height of the baffles in the other cells.
2. Continue the broodstock collection and stocking of river herring larvae into the upper reaches of the Anacostia Watershed to continue to restore these fish to historic spawning ranges and rebuild the their populations.
3. Future broodstock collections in the Anacostia Watershed should employ the use of haul seines.
4. Continue collection of broodstock from the Potomac River through the collaborative arrangement with Fletchers Boat House. These nets should be tended and herring removed as soon as they are captured.
5. The Paint Branch blockage located upstream of Route 1 should be modified to permit fish passage and added to the reconnaissance survey and monitored for river herring.

Appendix A: Sampling Sites

The following are descriptions of the sampling sites. These sites are based on historic migratory fish sampling study areas in the Anacostia River watershed. The Northwest Branch, identified by the Anacostia Fish Passage Workgroup as the area of highest priority for fish passage, received the study's highest priority. Sampling station locations are shown in Figure 1, Page x

Northwest Branch:

1. (Us Route 1 fishway): The structure supporting the MD Route 1 Bridge crossing the Northwest Branch has, at times, had an adverse affect on fish migration. This area was modified in the fall of 1995, and the glide leading under the bridges was replaced with a notched weir and Denil fish passage. The area below the weir was designated as the furthest downstream point. This point was used to assess the strength of the migratory run and to establish the abundance and species that might employ the fish passage. In 1999 and 2000, it was determined that the baffle on the lowest cell of this fishway is in need of repair.
2. (38th Street V-notched sheet pile weir): The blockage is immediately upstream of 38th Street and is a sheet pile weir notched to allow fish passage. A small boulder field lies downstream of the weir to concentrate baseflow and provide an approach channel to the V-notch.
3. (NW1): Northwest Branch at the Pumping Station is approximately 400 feet upstream from 38th Street. It is a severely deteriorating gabion weir with two large pools below it.
4. (NW2): Approximately 2850 feet above the pumping station site. This site is a gabion weir 10 meters downstream from a tot lot. This weir might pass fish near a cascade on the right side (looking upstream) during high flows. During lower flows, it becomes a 6- to 18-inch cascade.
5. (NW3): Approximately 500 feet below Queens Chapel Road, are two large concrete and gabion capped pipes that cross close to one another, with a deep, narrow pool between the two pipes and a large deep pool below the second pipe.

Northeast Branch:

6. (NEB1 @ MNCPPC): The furthest downstream point in the Northeast Branch to be sampled for this study is under River Road, near the Maryland National Capital Park and Planning Commission Offices (identified as Northeast Branch at MNCPPC), where a large metal weir spills over boulders and chunks of concrete into a deep pool. In the past this weir was a complete blockage to migration but in 1991 was modified to permit fish passage. Large numbers of herring can usually be spotted just below this weir during the peak of the run.
7. (Paint Branch 1 @ US Route 1): This blockage is located approximately 500 feet upstream of the Route 1 crossing. A large pool below a concrete rubble dam seems to have concentrated migrating herring in 2000.
8. (Paint Branch 2 @ Indian Creek): Two sweep sampling stations are located closely together upstream at the junction of Paint Branch and Indian Creek (see below, Indian Creek1). Monitoring was performed in a sweep section above the confluence with Indian Creek.
9. (Paint Branch 3 @ I-495): Paint Branch at I-495, to determine whether fish had migrated that far upstream. Both Alaska steep-pass and concrete step-pool fish passages have been installed at this site by the Maryland State Highway Administration to assist fish in bypassing blockages. The first, just on the south end of the inner loop, is a two-tier concrete step-pool that allows the fish to make three small attainments rather than one large one. Downstream of the outer loop of I-495, a small Denil fish passage has been built to help fish make the attainment over the foundation of the bridge. A previous blockage just below the Washington Beltway on Paint Branch has ceased to function as a blockage. The concrete casing for the pipe has continued to erode to a point where the flow is smooth, laminar, and slow when going over the structure. This area will be visually examined to ensure that this situation did not change.
10. (Indian Creek1 @ Paint Branch): Two sweep sampling stations are located closely together upstream at the junction of Paint Branch and Indian Creek (see above, Paint Branch1). Monitoring was performed in a sweep section above the confluence with Paint Branch. Turbidity in Indian Creek is typically much higher than Paint Branch.

11. (Indian Creek2 @ Greenbelt Road): Downstream from the box culvert crossing.

12. (Indian Creek3 @ I-495): at and immediately upstream from I-495 (Washington Beltway) bridge, along a glide where fish tend to congregate. This is the furthest upstream that herring have been found in the recent past (1992). At that time a large beaver dam created a blockage that made monitoring more conclusive. The beaver dam was removed in 1993 and sweep electrofishing was performed here on occasion.

13. (Lower Beaverdam Creek1 @ Kenilworth Avenue): Immediately below the concrete channel

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14. (Fletcher's Boathouse) Gill net sampling site located in the mainstem Potomac River approximately 5000 feet downstream of Chain Bridge, and approximately 400 ft downstream of Fletchers Boathouse landing.