Anadromous Fish Survey Cameron Run 2015

FINAL REPORT
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By

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to

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Introduction

The commercially valuable anadromous fishes in the herring family (Clupeidae) live as adults in the coastal ocean, but return to freshwater creeks and rivers to spawn. In the mid-Atlantic region, four species are present: American shad (*Alosa sapidissima*), blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), and hickory shad (*Alosa mediocris*). Two other herring family species are semi-anadromous and spawn in Potomac River tributaries. These are gizzard shad (*Dorosoma cepedianum*) and threadfin shad (*Dorosoma petenense*). Both are very similar morphologically and ecologically, but only *D. cepedianum* is found as far upriver on the Potomac River watershed as Hunting Creek/Cameron Run. Previous reports describe the history of herring populations in the Potomac River watershed (Jones et al. 2014).

The focus of the Cameron Run fish survey is river herring, the collective name of blueback herring and alewife. River herring populations have declined drastically over their range, spurring conservation efforts since 1970, which have been intensified since 2005 with implementation of moratoria. Identifying all areas used as spawning habitat by alewife and/or blueback herring is an important component of their conservation. Since 1988, George Mason University researchers have focused a monitoring program on the spawning of these species in other tributaries such as Pohick Creek, Accotink Creek, and, less regularly, Dogue Creek. With this study Cameron Run is added, which has not been monitored for presence of river herring or other anadromous species by either George Mason or other fisheries biologists before the start of this study in 2013 (Jim Cummins, pers. comm.). Our 2013 survey provided the first confirmation of Cameron Run as River Herring spawning habitat (Allan Weaver, VDGIF, pers. comm.). Use of Cameron Run by river herring upstream from where the effluent of Alexandria Renew Enterprises enters Cameron Run signifies that the effluent does not deter river herring from using Cameron Run as spawning habitat. In 2014 we moved the collection site approximately 500 m downstream (still above the Alexandria Renew Enterprises effluent), which increased our catches, and allows us to estimate the size of the spawning population. The new location proved successful and will remain the collection site for any subsequent surveys.

Methods

We conducted weekly sampling trips from March 20 to May 22 in 2015. During each trip a hoop net was set blocking the complete creek to collect adults swimming upstream, and ichthyoplankton nets were set to collected larvae floating downstream. The sampling location was chosen to be upstream from the ARE effluent, and downstream of the first dam in Cameron Run (Figure 1). Our slight change in sampling location from 2013 entailed moving the net downstream from the bridge (I-495 overpass).

Ichthyoplankton was collected by holding two conical plankton net with a mouth diameter of 0.25 m and a square mesh size of 0.333 mm in the stream current for 20 minutes. A mechanical flow meter designed for low velocity measurements was suspended in the net opening and provided estimates of water volume filtered by the net. The number of rotations of the flow meter attached to the net opening was multiplied with a factor of 0.0049 to gain volume filtered (m^3). Larval density (#/10m^3) per species was calculated using the following formula:

Larval density (#/10m^3) = 10N/(0.0049*(flow meter start reading-flow meter end reading))

Where N is the count of the larvae of one species in one sample.

We collected 2 ichthyoplankton samples per week, and these were spaced out evenly along the stream cross-section. Coincident with plankton samples, we calculated stream discharge rate from measurements of stream cross-section area and current velocity using the following equation:

Depth (m) x Width (m) x Velocity (m/s) = Discharge (m^3/s)

Velocity was measured using a handheld digital flow meter that measures flow in cm/s, which had to be converted to m/s to calculate discharge. Both depth and current velocity were measured at 12 to 20 locations along the cross-section. At each sampling trip other physical parameters of the creek were recorded as well (water temperature, dissolved oxygen, pH, and conductivity).

The ichthyoplankton samples were preserved in 70% ethanol and transported to the GMU laboratory for identification and enumeration of fish larvae. Identification of larvae was accomplished with multiple taxonomic resources: primarily Lippson & Moran (1974), Jones et al. (1978), and Walsh et al. (2005). River herring (both species) have semi-demersal eggs (tend to sink to the bottom) that are frequently adhesive. As this situation presents a significant bias, we made no attempts to quantify egg abundance in the samples. We estimate total larval production (P) during the period of sampling by multiplying the larval density (m^{-3}) with total discharge (m^3) during the spawning period, which we assume is represented with our sampling period.

The hoop net was deployed once each week in the morning and retrieved the following morning (see Figure 2). Fish in the hoop net were identified, enumerated, and measured.

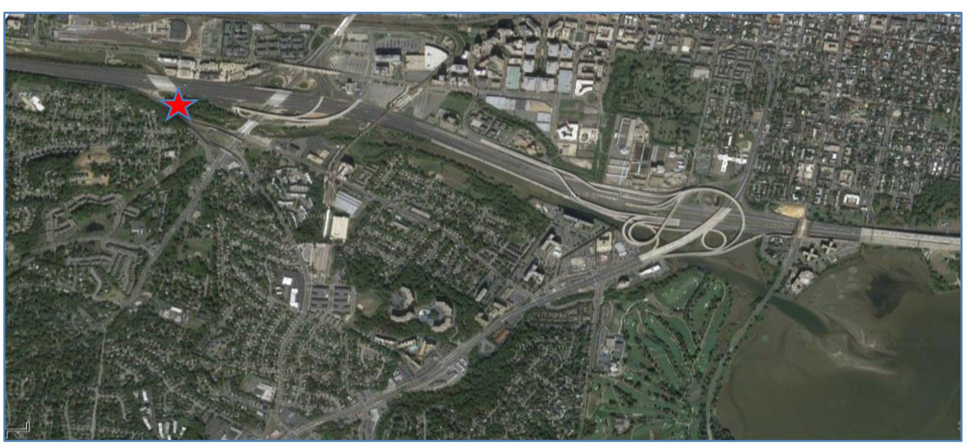

Figure 1. Sampling location Cameron Run.

Since the net was set 24 hours per week for 10 weeks, we approximated total abundance of spawning river herring during the time of collection by extrapolating the mean catch per hour per species during the time the creeks were blocked of over the total collection period as follows:

Average catch/24 hours * 1680 hours = total abundance of spawners

Our total collection period is a good approximation of the total time of the spawning run of alewife. To determine the number of females we used a ratio of 0.5.

In response to problems with animals tearing holes in our nets in previous sampling experiences, we used a fence device in front of the mouth of the net that significantly reduces this problem. The device effectively excluded otters and similar destructive wildlife, but has slots that allowed up-running fish to be captured.

Figure 2. Hoop net deployed in new location in Cameron Run. The hedging is angled downstream in order to funnel up-migrating herring into the opening of the net.

Results and Discussion

During the 10-week sampling period, we caught sixteen adult alewife, and one specimen of another species (Quillback; Table 1). The abundance of river herring collected in 2015 was higher than 2014 (6 alewife and 1 blueback herring), which signifies the consistent use of Cameron Run as spawning ground. The net is set in such a way that fishes need to swim upstream into Cameron Run to be caught in the net, which is a behavior associated with spawning. Extrapolating over the time sampled, this could mean that the alewife spawning population in 2015 was the size of 112 individuals (46 last year), which gives an average estimate of 79 individuals. We did not find adult blueback herring specimens in our collections, which were estimated to have a very small spawning population last year. The presence of blueback herring larvae (Table 2) suggest that blueback herring is using Camerun run as a spawning site again this year, but we are unable to estimate the size of the spawning population. Sampling over multiple years will provide us with increasingly better estimates of the spawning population of alewife and blueback herring in Cameron Run.

Table 1. Species collected in Cameron Run with hoop net during weekly sampling from 3/20/15-5/22/15. River herring are indicated bold font.

Date	Species	English name	count
04/10/2015	***Alosa pseudoharengus***	**Alewife**	**3**
04/17/2015	***Alosa pseudoharengus***	**Alewife**	**7**
04/17/2015	*Carpiodes cyprinus*	Quillback	1
04/24/2015	***Alosa pseudoharengus***	**Alewife**	**3**
05/01/2015	***Alosa pseudoharengus***	**Alewife**	**3**

In the ichthyoplankton samples we indeed found larvae of alewife and well as blueback herring (Table 2). This year we found a total of 11 positively identified alewife larvae and 3 blueback herring larvae in our samples. In addition, we found 506 larvae that could only be identified to clupeid sp., which is the family to which the river herring species belong. A large portion of these Clupeid species are likely to be gizzard shad (*Dorosoma cepedianum*), another member of the clupeid family of which we found 165 positively identified specimens, but river herring could also be included in that number. Larvae of other species were present in the samples as well, including, but not limited to, the semi-anadromous species white perch (*Morone americana*) and striped bass (*Morone saxatilis*; Table 2).

Table 2. Larvae collected in Cameron Run. Herring larvae (river herring and other clupeids) are in bold. Fish larvae too damaged for identification to species level were identified at the highest level possible.

Date	Species	Count	Volume sampled (m^3)	Larval density (#/10m^3)
03/20/2015	Eggs	6	75.372	0.796
03/27/2015	Eggs	10	46.570	2.147
04/03/2015	Eggs	2	102.302	0.195
04/10/2015	Eggs	1	9.913	1.009
04/17/2015	Eggs	21	3.435	79.068
04/17/2015	*Cyprinidae sp.*	10	6.870	1.717
04/24/2015	Unidentifiable	23	68.605	3.730
04/24/2015	*Perca flavescens*	1	50.872	0.197
04/24/2015	*Morone sp.*	296	68.605	45.440
04/24/2015	*Morone saxatilis*	11	68.605	2.367
04/24/2015	*Morone americana*	12	68.605	2.281
04/24/2015	*Cyprinidae sp.*	2	17.733	1.128
04/24/2015	*Lepomis sp.*	1	50.872	0.197
04/24/2015	Eggs	270	68.605	42.700
04/24/2015	***Dorosoma cepedianum***	**11**	**68.605**	**1.448**
04/24/2015	***Alosa pseudoharengus***	**1**	**17.733**	**0.564**
05/01/2015	***Clupeid sp.***	**3**	**0.662***	**-**
05/01/2015	Eggs	49	0.662*	-

Date	Species	Count	Volume sampled (m^3)	Larval density (#/10m^3)
05/01/2015	***Alosa pseudoharengus***	**5**	**0.470***	**-**
05/01/2015	***Alosa aestivalis***	**1**	**0.470***	**-**
05/08/2015	Unidentifiable	25	61.995	3.695
05/08/2015	*Notropis hudsonius*	1	27.915	0.358
05/08/2015	*Notemigonus crysoleucas*	2	27.915	0.716
05/08/2015	*Cyprinidae sp.*	7	89.910	0.748
05/08/2015	***Clupeid sp.***	**489**	**124.431**	**40.347**
05/08/2015	Eggs	43	61.995	7.268
05/08/2015	***Dorosoma cepedianum***	**149**	**89.910**	**16.721**
05/08/2015	***Alosa aestivalis***	**2**	**27.915**	**0.716**
05/15/2015	*Menidia beryllina*	1	30.380	0.329
05/15/2015	*Lepomis sp.*	1	17.547	0.570
05/15/2015	Eggs	10	47.927	2.127
05/15/2015	*Cyprinidae sp.*	3	65.474	0.490
05/22/2015	*Menidia beryllina*	1	30.733	0.325
05/22/2015	*Cyprinidae sp.*	2	59.319	0.337
05/22/2015	***Clupeid sp.***	**14**	**90.052**	**1.538**
05/22/2015	Eggs	12	60.393	1.994
05/22/2015	***Dorosoma cepedianum***	**5**	**60.393**	**0.837**
05/22/2015	*Catostomidae sp.*	1	29.660	0.337
05/22/2015	***Alosa pseudoharengus***	**5**	**60.393**	**0.837**

*The flow velocity in Cameron Run was too low at this date for the flow meter to function properly; therefore volume sampled is likely an underestimate, and larval density not calculated.

We measured creek discharge and other physical parameters at the same location and times where ichthyoplankton samples were taken, which was about 100 m downstream from the hoopnet (Table 3). Mean creek discharge was slightly higher compared to last year. Average discharge in 2015 was 0.79 $m^3 s^{-1}$, ranging from 0.29 $m^3 s^{-1}$ to 2.16 $m^3 s^{-1}$, and average discharge in 2014 was 0.58 $m^3 s^{-1}$, ranging from 0.27 $m^3 s^{-1}$ to 1.03 $m^3 s^{-1}$. However, on May 2, 2014 the water level was so high that none of the sampling could be performed, so that high discharge is not included in the 2014 average. Water temperature (Temp) was likely too low for river herring spawning the first sampling day on March 20, and specific conductivity (SpCond) high during that same time, likely due to road salts. Both were in the benign range starting March 27. Dissolved oxygen (DO), and pH were in the benign range for occurrence of river herring throughout the sampling period.

Table 3. Physical parameters measured at Cameron Run during each sampling week.

Date	Discharge ($m^3 s^{-1}$)	Temp (C°)	SpCond ($mS s^{-1}$)	DO ($mg l^{-1}$)	pH
03/20/2015	2.164	5.88	1.380	11.10	7.68
03/27/2015	2.165	10.13	0.977	10.31	7.97
04/03/2015	1.195	14.60	1.000	9.70	8.78
04/10/2015	0.339	13.43	0.999	11.93	9.19
04/17/2015	0.250	20.76	0.866	8.21	8.52
04/24/2015	0.610	16.99	0.780	9.39	8.10
050/1/2015	0.337	17.60	0.740	10.21	8.47
05/08/2015	0.382	27.48	0.848	8.13	7.68
05/15/2015	0.177	20.40	0.894	10.16	7.52
05/22/2015	0.289	23.43	0.885	10.09	N/A

During the sampling period of 10 weeks, the total discharge was estimated to be on the order of 4.8 million cubic meters. Given the observed mean densities of larvae, the total production of *Alosa* larvae was estimated at approximately 400 thousand for Cameron Run (Table 4). Note that the estimate is based on a small sample (0.0004 % of the total discharge).

Table 4. Estimation of river herring (alewife and blueback herring) larval production and spawner abundance from Cameron Run during spring 2015.

Parameter	Cameron Run
Mean discharge ($m^3 s^{-1}$)	0.79
Total discharge, 3/20 to 5/22 (m^3)	4,782,758
Total volume sampled (m^3)	1858
Mean *Alosa* larvae density ($10m^{-3}$)	0.71
Total river herring production (# larvae)	339,575
Total adult river herring (#)	112

Conclusion

After finding that Cameron Run is used as river herring spawning habitat with just one river herring and seven larvae in 2013, we were able to confirm this finding by collecting more river herring adults and larvae in 2014 and 2015. By moving our sampling site approximately 500 m downstream from 2013 we have found a better sampling location. Further downstream Cameron Run becomes too deep and wide for our sampling strategy.

The finding of river herring adults and larvae in an area above the outflow of the Alexandria Renew Enterprises wastewater reclamation facility signifies that the water of Cameron Run is clean enough to use as spawning habitat for these species of concern. These finding will not affect AlexRenew, but will affect the terms of construction permits in and around Cameron Run (i.e. some construction activities may be restricted by the Virginia Department of Game and Inland Fisheries (VDGIF) during the annual spawning period (mid-March to mid-May) of river herring (Allen Weaver, VDGIF, pers. comm.).

Although the current evidence suggests that the importance of Cameron Run may be marginal to alewife and blueback herring populations, it is important to recognize that marginal habitats may sustain fish populations during periods of declining abundance and low recruitment (Kraus and Secor 2005). Due to the recent moratorium on river herring, annual estimation of spawner abundance should be a continued priority for annual monitoring of this and other Potomac River tributaries. Anadromous fishes typically exhibit strong year-class fluctuations. Additional years of data collection (at least through 2 generation lengths ~ a decade) should provide a sufficient understanding of this variability.

Literature cited

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