

American Eel sampling at Conowingo Dam 2009

Steve Minkkinen, Ian Park, Maryland Fishery Resources Office, 12/29/2009

Background

Eels are a catadromous species that ascend freshwater environments as juveniles then reside in riverine habitats until reaching maturity at which time they migrate to the Sargasso Sea where they spawn once and die. Larval eels are transported by ocean currents to rivers along the eastern seaboard of the continent. Unlike anadromous shad and herring, they have no particular homing instinct. Historically, American eels were very abundant in East Coast streams, comprising more than 25 percent of the total fish biomass in many locations. Atlantic coast commercial landings have been declining since the 1970's.

The Atlantic States Marine Fishery Commission Fishery Management Plan for American Eel lists access to freshwater habitat as a priority for protecting the population. Although the Chesapeake Bay and tributaries support a large portion of the coastal eel population, eels have been essentially extirpated from the largest Chesapeake tributary, the Susquehanna River. The Susquehanna River basin comprises 43% of the Chesapeake Bay watershed. Construction of Conowingo Dam in 1928 effectively closed the river to upstream migration of elvers at river mile ten (figure 1).

Mainstem Susquehanna fish passage facilities (lifts and ladder) were designed and sized to pass adult shad and herring and are not effective (due to attraction flow velocities and operating schedules) in passing juvenile eels (elvers) upriver. Specialized passages designed to accommodate elvers are needed to allow them access to the watershed above dams.

Survey methods and Equipment Placement

To determine the best method to reintroduce eels into the Susquehanna River above the Conowingo dam, we have collected baseline information on eel abundance, migration timing, catch efficiency, and attraction parameters at the base of the Conowingo Dam since the spring of 2005. Information from the study will assist in determining the potential for reintroducing eels into the Susquehanna watershed above Conowingo Dam.

The 2009 American Eel sampling below Conowingo took place on the west side of the dam adjacent to the West fish lift. This sampling served as an attempt to further survey the population of juvenile eels at the base of Conowingo Dam. In 2008 we constructed an elver trap from industrial cable tray with landscape fabric attached to the bottom, which provided a substrate for the elvers to climb (figure 2). In 2009 we expanded our sampling to include two cable trays, one located in the same spot as in 2008 (control) and the new elver trap (experimental) going directly down to the river (figure 3). The top of the cable trays emptied into a fine mesh collection bag placed in collection tanks (figure 4). Aerated water was supplied to the collection and holding tanks using a 1/8 HP Sweetwater™ Blower.

In 2007, elvers were observed climbing up the rip rap where water was spilling over from pumps operated to supply water for the West fish lift operations. In 2008 we used this excess water as attraction flow for our elver trap. Elvers that found this attraction flow would crawl up the rip rap to the trap and then climb it into the collection bag. In 2009 we made an attempt to attract elvers directly from the Susquehanna River at the base of the riprap with the hope of increasing efficiency.

Elvers were sedated, measured, and individually counted. In the occurrence of large numbers, eels were counted volumetrically. The collection of substantial numbers of eels allowed for the experimental stocking of elvers into Conowingo Creek. All of the elvers stocked into Conowingo Creek were marked with a 6 hour immersion in buffered oxytetracycline (OTC) at a concentration of 550 ppm prior to release.

As in previous years eel pots with a 6 mm square mesh were set around the base of the West Fish Lift to catch larger eels. In 2009 the goal was to tag new eels and recapture yellow eels that were previously tagged with Passive Integrated Transponder (PIT) tags during 2007 and 2008. Yellow eels captured in eel pots were sedated with a concentrated solution of MS-222 (450g/L), measured, fin clipped, and had PIT tag inserted in the dorsal musculature and released.

Results

Eels were sampled between 29 May and 2 September 2009 (table 1). Elvers were collected from June 1st – September 2nd. A total of 17500 elvers were collected during 2009 (table 1). Juvenile eel lengths ranged from 92 to 162 mm TL (figure 5). A total of four releases in Conowingo Creek were conducted, with an estimated total of 15,300 elvers being stocked (table 2).

A total of 116 yellow eels were captured, with 49 recaptures and 67 new captures. Total lengths of yellow eels collected in eel pots ranged from 318 to 655 mm TL (figure 6). The 67 new captures was our greatest number of yellow eels caught during the project and the addition of the 67 new captures brings the total number of PIT tagged yellow eels in the study to 147 (table 3).

Discussion

Throughout the project we have compared elver captures to water temperature, stream flow, lunar phase, tidal amplitudes and date. It appears that elvers reach the dam from the first week of May through the end of June and peak captures are usually in June and July. However in 2009 large numbers of elvers were not captured until late June and throughout August (figure 7).

The past several years we have encountered problems ensuring a constant supply of water to the collection devices. In 2008 this resulted in what we believe to be a reduction in our total catch. This year several sampling design changes were made in an attempt to ensure that we would have an uninterrupted supply of water throughout the sample period. We also increased the size of our collection and holding tanks in an effort to decrease mortality while holding the elvers for shipment.

Our proposed goal for 2010 is to collect 60,000 elvers and release 20,000 each, in three separate creeks, Conowingo Creek in Maryland and Pine Creek and Buffalo Creek in Pennsylvania. Elvers will be marked with OTC before being released. The Maryland Biological Stream Survey plans on conducting surveys in Conowingo Creek to evaluate the stocking effort. The Maryland Fishery Resources Office will survey elvers released in the Pennsylvania tributary using electrofishing gear.

Figure 2. Eel trap constructed of industrial cable tray and landscape fabric.



Figure 3. Cable tray on the West Shore below Conowingo Dam, tray on the left is the experimental, and the tray on the right is the control location from 2008.



Figure 4. The cable tray emptying into a collection bag in a holding tank.



Figure 5. Length frequencies of elvers captured in cable tray at Conowingo Dam during 2009.

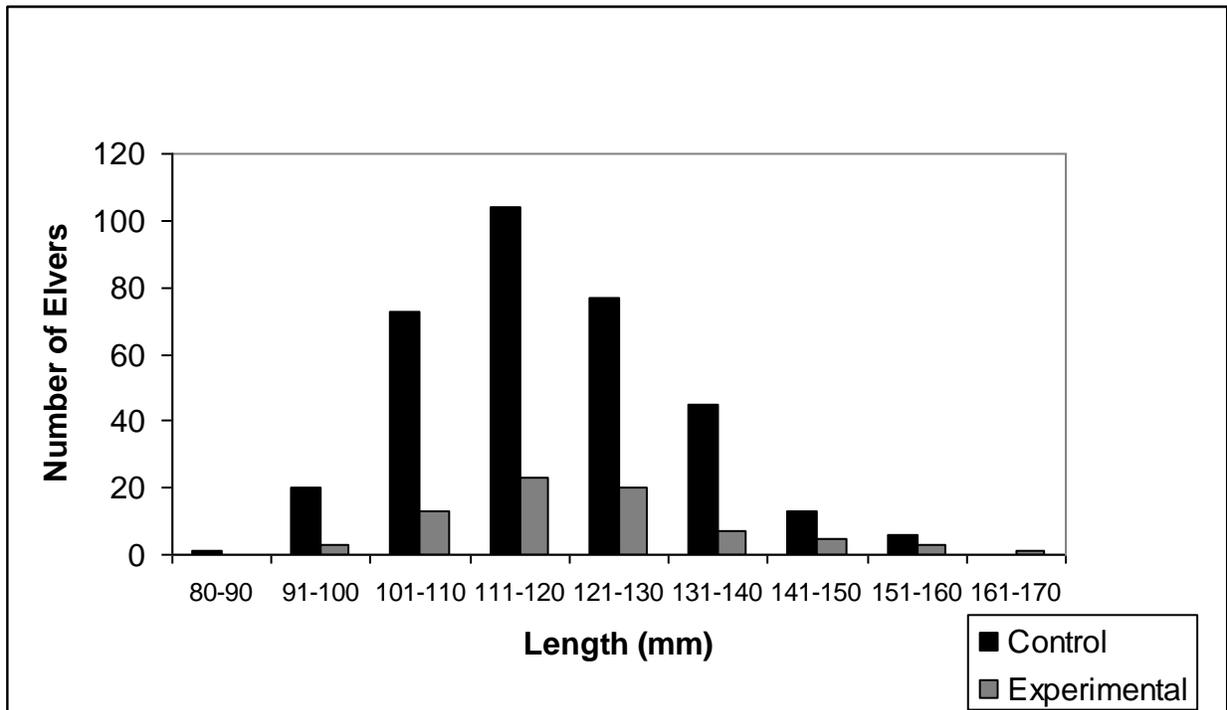


Figure 6. Length frequency of yellow eels captured in pots at Conowingo Dam, 2009.

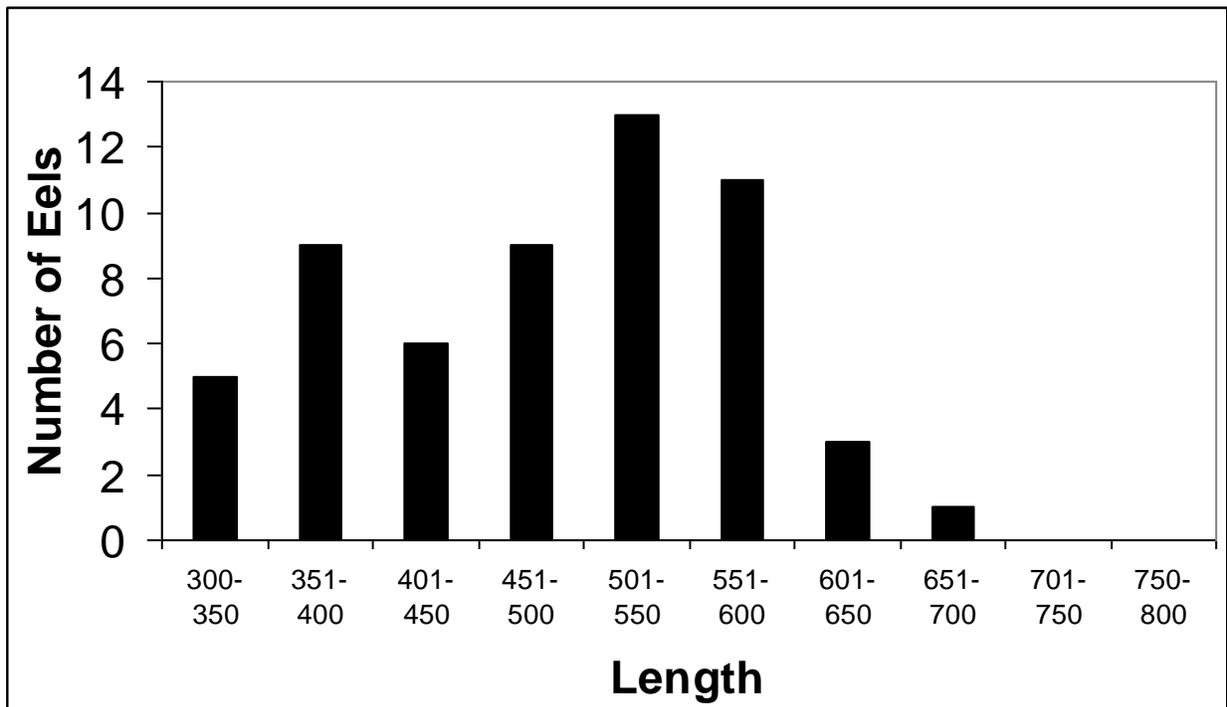


Figure 7 Elver capture in relation to Date for 2007, 2008, and 2009

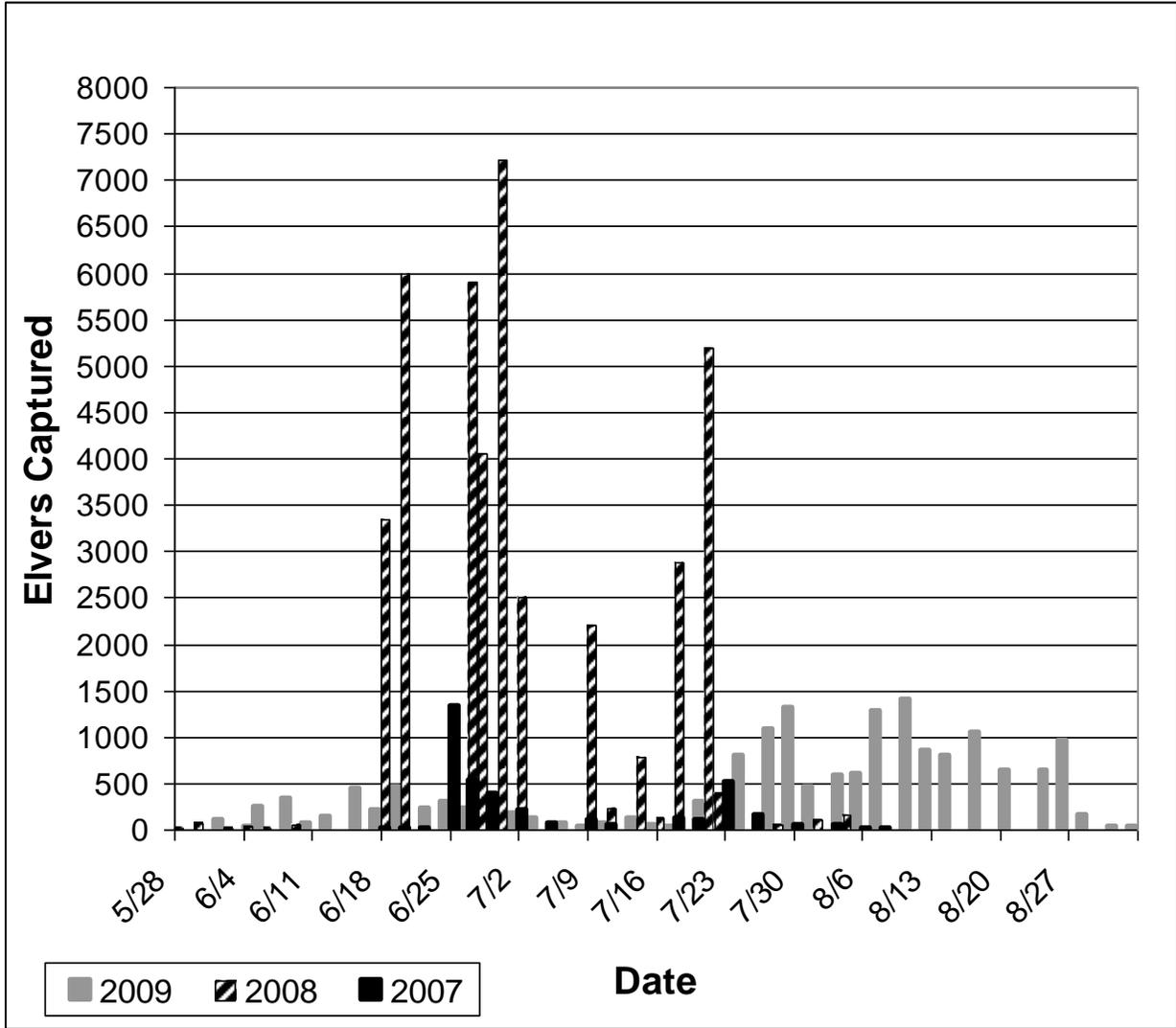


Table 1. Number of eels caught at the base of Conowingo Dam by eel traps on the West side of the dam during 2009.

Date	Control Total #	Experimental Total #	Total
6/1/2009	113	0	113
6/4/2009	30	0	30
6/5/2009	256	0	256
6/8/2009	297	44	341
6/10/2009	58	13	71
6/12/2009	134	5	139
6/15/2009	428	14	442
6/17/2009	106	103	209
6/19/2009	364	102	466
6/22/2009	117	117	234
6/24/2009	300	9	309
6/26/2009	187	49	236
6/29/2009	46	19	65
7/1/2009	151	35	186
7/3/2009	85	37	122
7/6/2009	38	26	64
7/8/2009	11	25	36
7/10/2009	13	64	77
7/13/2009	73	49	122
7/15/2009	25	20	45
7/17/2009	31	12	43
7/20/2009	24	283	307
7/22/2009	260	544	804
7/24/2009	595	202	797
7/27/2009	1078	0	1078
7/29/2009	1324	0	1324
7/31/2009	462	0	462
8/3/2009	581	0	581
8/5/2009	610	0	610
8/7/2009	1279	0	1279
8/10/2009	1400	0	1400
8/12/2009	847	0	847
8/14/2009	807	0	807
8/17/2009	1048	0	1048
8/20/2009	638	0	638
8/24/2009	647	0	647
8/26/2009	959	0	959
8/28/2009	165	0	165
8/31/2009	39	0	39
9/2/2009	39	0	39
Total	15665	1772	17437

Table 2. Date, Location, and number of elvers stocked in Conowingo Creek during 2009

Date	# Stocked	Creek	Latitude	Longitude
7/1/2009	2779	Conowingo Creek	39 43 852	76 10 701
7/29/2009	5108	Conowingo Creek	39 43 852	76 10 701
8/12/2009	5179	Conowingo Creek	39 43 502	76 11 019
9/2/2009	2250	Conowingo Creek	39 43 502	76 11 019

Table 3. Number of Passive Integrated Transponder Tags (PIT) applied to yellow eels by year.

2007 Tags Applied	2008 Tags Applied	2009 Tags Applied	Total
50	30	67	147

Table 4. Incremental growth of yellow eels caught and recaptured in pots at the base of Conowingo dam by year.

ID	Average Length (mm)			Growth Increment (mm)		
	2007	2008	2009	2007-2008	2008-2009	2007-2009
257C63E092	594	617	*	23	*	*
257C6534CA	733	770	*	37	*	*
257C6526C0	463	474	*	11	*	*
257C65EB48	404	510	521	106	11	117
257C655F24	426	445	*	19	*	*
257C65F2F2	338	390	505	52	115	167
257C63E581	551	589	*	38	*	*
257C65F8B0	475	511	*	36	*	*
257C65E87B	405	471	510	66	39	107
257C65FBAB	377	405	440	28	35	63
257C652B3A	466	490	*	24	*	*
257C63C580	391	520	*	129	*	*
257C660193	386	428	*	42	*	*
257C63CE9A	458	*	565	*	*	107
257C63CF54	484	*	624	*	*	140
257C652735	457	*	590	*	*	133
257C6534A4	386	*	478	*	*	92
257C66192F	447	*	580	*	*	133
257C63D36E	*	419	433	*	14	*
257C652BF4	*	364	383	*	19	*
257C65342C	*	393	516	*	123	*
257C65B1E0	*	479	543	*	64	*
257C660279	*	497	575	*	78	*

