

Prepared for:
NJDEP Bureau of Marine Water Monitoring
Leeds Point, New Jersey 08220
and
Monmouth County Division of Engineering
Freehold, New Jersey 07728



2014 Wreck Pond Fish Inventory Study with Emphasis on Field Monitoring of Alewife and Blueback Herring

Final Report

Wreck Pond, Spring Lake and Sea Girt, Monmouth County, New Jersey

September 2014

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1.0 Introduction

1.1 PURPOSE AND NEED

The United States Fish and Wildlife Service (USFWS) was awarded a grant in October 2013 through the Department of Interior (DOI) to reestablish fish passage for anadromous fish to Wreck Pond while also restoring dune and beach habitat used by federally listed threatened wildlife. Currently, the only connection between the Atlantic Ocean and Wreck Pond is an 800 foot, 84-inch diameter pipe.

As part of the USFWS Wreck Pond Fish Passage and Dune Reconstruction Project (“Project”), a secondary corridor consisting of a six (6) foot by eight (8) foot bypass box culvert is proposed to be installed alongside the existing pipe and span approximately 500 to 600 feet from the Wreck Pond spillway into the Atlantic Ocean. The completed Project would provide improved aquatic connectivity for fish passage for migratory fish including alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and American eel (*Anguilla rostrata*) and would be designed to maximize access into and from Wreck Pond and its tributaries during spring migration and fall emigration. The Service would also advise on the potential reconstruction of the dune and berm system impacted by Sandy to minimize impact to nesting habitat for the federally listed threatened piping plover (*Charadrius melodus*) and the state listed least tern (*Sterna antillarum*). Project construction start date is tentatively scheduled for 2015.

Current use and presence/absence of anadromous and catadromous species within Wreck Pond, post Hurricane Sandy, is unknown. The most recent fish surveys were performed each spring from 2006 to 2008 as a condition of NJDEP Permit 1300-04-0010.1 (WFD 040001) and did not provide an adequate, current snapshot of diadromous use or indicate if spawning was taking place. No data has been collected since 2008 that could provide usable data on current habitat quality, diadromous use, spawning activity, fish abundance, and fish biodiversity. To better determine the success of the USFWS Project, improvement to fish passage through the installation of a bypass culvert, and if herring species are present and spawning; the Wreck Pond Technical Advisory Committee (TAC) recommended that a spring and fall fish inventory study be initiated prior to construction. Emphasis would be focused on verifying alewife and blueback herring presence and use at Wreck Pond.

The Monmouth County Division of Engineering, through funding provided by the New Jersey Department of Environmental Protection (NJDEP) Division of Water Monitoring and Standards, contracted the American Littoral Society (ALS) to conduct the baseline fish inventory study. Collected data will confirm if a viable herring run still exists within Wreck Pond and provide baseline pre-construction data to be compared with post-construction survey results. Overall, the study was designed to provide the following:

- 1) Baseline data for anadromous movement within Wreck Pond during spring migration and fall juvenile emigration;
- 2) An inventory of aquatic species collected using both passive and active sampling methods at various locations throughout Wreck Pond;
- 3) A comparison of movement and abundance from past surveys in 2006-2008 to be applied to current data and data to be collected post-construction;
- 4) Measurements, weights, and enumeration of collected species; and
- 5) Verification if anadromous spawning is occurring in Wreck Pond.

For the purpose of this report, only 2014 spring sampling will be discussed. A supplemental report summarizing the 2014 fall sampling will be provided under separate cover once sampling has been completed.

1.2 SITE LOCATION AND HISTORY

Wreck Pond is located between the boroughs of Sea Girt and Spring Lake, Monmouth County, New Jersey (Figure 1) and is connected directly to the Atlantic Ocean by an 84-inch diameter, 800-foot long intake/outfall structure (includes 300' extension completed in 2006). Watershed area is approximately 12.8 square miles (8,172 acres) and the Pond has an area of approximately 73 acres. The Pond is considered a shallow waterbody with depths ranging between one (1) to 1.5 feet deep under normal water level conditions (Najarian, 2011). There are three major tributaries in the watershed and include Hannabrand Brook, Wreck Pond Brook, and Black Creek, as well as several other ponds. Land use consists of a mix of wooded areas, agricultural areas, low to medium density residential areas, and mixed-use areas. Drainage into the system originates from its tributary streams and from storm water runoff through storm drains located in surrounding residential areas. As aforementioned, the eastern end of Wreck Pond contains an outfall structure that exchanges water with the Atlantic Ocean. The area where Wreck Pond interacts with near shore waters is classified by the New Jersey Department of Environmental Protection (NJDEP) as "Prohibited for Shellfish Harvest".

Wreck Pond has been identified and documented as a confirmed anadromous spawning ground for alewife (*Alosa pseudoharengus*) and blueback herring (*Alosa aestivalis*) (NJDEP, 2000; Byrne, 1986; Zich, 1978). In 2006, the existing 84-inch diameter, 500-foot long outfall structure that connected Wreck Pond to the Atlantic Ocean was extended seaward an additional 300 feet by the NJDEP Bureau of Coastal Engineering in an effort to improve water quality. Conditions were specifically incorporated into the NJDEP permit to monitor alewife and blueback herring movement post-construction and to determine if the 300 foot extension of the existing 500 foot outfall pipe would physically hinder, obstruct, and/or prevent herring from entering Wreck Pond to spawn. Results from the herring surveys performed each spring between 2006 and 2007 using a fyke net indicated an unhindered, viable run of alewife within Wreck Pond though abundance declined over the three (3) year period. Results were inconclusive in confirming if mass movements of blueback existed. To increase catch probability for blueback, the 2008 survey increased the level of collection effort by incorporating seine netting at numerous locations within the entire watershed. The results of the 2008 sampling program verified a small presence and migration of alewife in Wreck Pond at the beginning of the sampling event, and some juvenile emigration towards the end of the program (June 3, 2008). Declining numbers of alewife over the three year study could have been associated with a number of variables to include gear changes, catch effort, survey timing, the pipe extension, fish photo-sensitivity, and a number of environmental parameters. A blueback run was not observed during any of the sampling events.

Figure 1 Project Location Map - Wreck Pond



2.0 RIVER HERRING LIFE HISTORY

2.1 DESCRIPTION

Blueback herring (*Alosa aestivalis*) and alewife (*Alosa pseudoharengus*) are euryhaline, anadromous planktivores externally distinguishable by eye diameter and color (when freshly caught) and internally by the color of their peritoneum and number of gill rakers on the lower limb of the first gill arch. Adult bluebacks usually have a black peritoneum, smaller eye diameter, and approximately 44 to 50 gill rakers on the first limb of the first gill arch, whereas alewife have a more white to silvery coloration of the peritoneum, larger eye diameter, and 39 to 41 gill rakers on the first limb of the first gill arch. Alewife also have a slightly deeper body (Odell 1934; Loesch 1987; Robins, Ray, and Douglass, 1986). Though it may appear that species have discernible characteristics, determinations without internal confirmation between the two species are often difficult due to an overlap in habitat (Smith 1970).

2.2 LIFE HISTORY/SPAWNING CHARACTERISTICS

Juvenile, sub-adult, and adult alewife and blueback herring spend the majority of their life in the open ocean, but it has been documented that some alewife populations remain in freshwater. These populations in turn will migrate up sufficient rivers and streams for spawning (Scott & Crossman 1973). It has also been recorded that New Jersey inshore waters to 8km offshore, are an important over-wintering area for juvenile blueback (Bigelow and Schroeder, 2002). The following describes known spawning for blueback and alewife not landlocked in a freshwater system.

Initiation of spawning runs for alewife and blueback is temperature dependent (Bigelow and Schroeder, 2002; Bozeman and Van Den Avyle, 1989; Loesch, 1977). Alewife initiate spawning runs when water temperatures are between 5°-10°C, whereas blueback spawning begins in water temperatures between 10°-15°C (Loesch and Lund 1977). In the mid-Atlantic, alewife may begin spawning in late March early April and continue through May. Blueback initiate spawning runs about a month later, but the spawning peaks can differ by about 2-3 weeks (Hildebrand & Shroeder 1928; Loesch 1987). Ordinarily in New Jersey, there is a three to four week time difference between alewife and blueback spawning runs in sympatric areas (Don Byrne, NJDEP, pers. comm. November, 2005). Spawning times can also extend through August as long as temperatures remain below 27°C. Both species use similar hard ground habitats (gravel, packed sand, stones and sticks) along with relatively swift currents to spawn (Bigelow and Welsh 1925; Marcy 1976b; Loesch and Lund 1977). However when overlap occurs, herring will spawn in the main current flow of a river where the alewife will favor deeper pools and eddies along the shore bank (Loesch and Lund 1977). When eggs are deposited, they remain sticky and adhere to hard substrate up until about 24 hours when the eggs water hardens. Some eggs remain suspended and are dispersed due to a higher current flow. Eggs require an incubation time of 50 hours at 20-21°C (Kuntz & Radcliffe 1917; Jones et al. 1999).

3.0 SURVEY METHODOLOGY AND MATERIALS

Prior to initiating herring sampling, the American Littoral Society (ALS) identified an in-house supervisory fish biologist and forwarded primary surveyor qualifications and monitoring methodology to the Bureau of Marine Water Monitoring and Monmouth County Division of Engineering. In conjunction with the Bureau and County review, ALS submitted a scientific collections permit application in preparation for a May 1, 2014 sample start date. A New Jersey Scientific Collections Permit (Permit #0144) was issued on April 16, 2014 (Appendix A). Wreck Pond herring sampling was completed during three (3) lunar cycles from May 13th to June 13th, 2014. Sample event scheduling was based on the confirmed presence of clupeids in nearshore waters adjacent to Wreck Pond, presence of species based on 2006 - 2008 results, attainment of inshore water temperatures optimal for herring spawning, and the increased probability of herring movement relative to spring tide levels.

The following describes the sampling location, equipment, and protocol used to sample for presence/absence of clupeid species at Wreck Pond in 2014.

3.1 SAMPLING LOCATION

Sampling was performed in the same location as the 2006 and 2007 ENSR/AECOM surveys (Figure 1). The sampling site was located underneath the railroad bridge located directly west of the First Avenue Bridge and east of Route 71 in Spring Lake, New Jersey (Figure 1 and Appendix B). Adjacent shoreline perpendicular to the sampling site consisted of sand, riprap, large woody debris (LWD) and some vegetation. Shoreline underneath the railroad bridge consisted mostly of riprap and was bounded by the railroad bridge tiers (Appendix B). Water depth varied between two (2) to four (4) feet dependent on tide level and substrate consisted of large rocks and riprap associated with railroad and bridge construction. The channel located underneath the railroad bridge was approximately 25 to 30 feet in width and it was estimated that there was a tidal difference of approximately four (4) hours between Belmar Atlantic Ocean and the Wreck Pond Railroad Bridge.

3.2 EQUIPMENT

To remain consistent with the 2006 and 2007 surveys, ALS used the same sampling equipment employed in the ENSR/AECOM 2006 and 2007 Wreck Pond fish surveys. Gear employed included a fifteen (15) foot long fyke net with a four (4) foot by four (4) foot opening. The fyke net consisted of a series of five (5) hoops with two (2) funnel-shaped throats with one (1) inch stretch mesh. The net was attached to two 25-foot leaders/wings that were used to guide the fish into the mouth of the net and its throats. Prior to use, the fyke net was inspected for tears and untied throats and repaired accordingly.

Water quality at the sampling station was obtained each sampling event with a multi-probed YSI Environmental Monitoring System and a 650 MDS data-logger. Calibration was completed weekly by the NJDEP Bureau of Marine Water Monitoring laboratory at Leeds Points, New Jersey. Parameters measured included conductivity, specific conductivity, salinity, dissolved oxygen, water temperature, pH, and turbidity.

3.3 SAMPLING METHODS

As stated previously, initiation of spawning runs for alewife and blueback is temperature dependent (Bigelow and Schroeder, 2002; Bozeman and Van Den Avyle, 1989; Loesch, 1977). Alewife initiate spawning runs when water temperatures are between 5°-10°C, whereas blueback spawning begins in water temperatures between 10°-15°C (approximately 3-4 weeks after initiation of alewife migration in sympatric areas). ALS monitored water temperatures and preliminary movement of alewife daily along the New Jersey coast via local

Internet sites, interactions with the ALS Fish Tagging Department, reports from Atlantic coast anglers from multiple states, and through marine forecasts.

3.3.1 Preliminary Gear Investigations

On May 6th, 2014, ALS performed a preliminary gear set to ensure that the equipment was in proper working condition and to confirm that there were no major structural changes at the sample site. The fyke net was staked and set against the outgoing tide with the wings extending nearly the entire width of the channel beneath the bridge. A gap of roughly (two) 2 feet on either side of the wings was left open to ensure waterfowl and mammal access underneath the bridge. This shoreline gap was located above the mean low tide line and therefore only passable by aquatic organisms during high tide. The integrity of the net's exterior and wings, to include floats, lead-line, mesh, cod end security, and anchoring were inspected in-water. Gear was secure and net integrity was satisfactory. The fyke net was removed off-site after preliminary gear investigations were complete.

3.3.2 Physical Herring Sampling and Processing

Sampling protocol and processing for the 2014 survey replicated methodology used in 2006 and 2007. Sample event duration in 2014 was conducted one day before, the day of, and the day after the new or full moons. The first sampling event in 2014 (Sample Event 1) was initiated on the evening of May 12th, 2014 at 17:54 and concluded on May 16th, 2014. The remaining two events were performed May 27th - May 30th (Sample Event 2) and June 10th - June 13th (Sample Event 3). Signage, provided by the NJDEP Bureau of Marine Water Monitoring was posted on the northern and southern shorelines of the sample site to inform local residents and anglers about the sampling and to give contact information in the event that net tampering during the sampling event was witnessed (Appendix B).

The fyke net was positioned beneath the railroad bridge located immediately west of the First Avenue Bridge and east of Route 71 (Figure 1). During all three, three to four day sampling events, the net sampled continuously, 24 hours a day, except when catch was being processed. The net was deployed, retrieved for processing, and redeployed every 12 hours during each event. For each event, the fyke net was positioned and staked in the same manner as the preliminary gear investigation and the ENSR/AECOM 2006/2007 surveys.

The net retrieval process consisted of untying the cod-end of the net from its stationary stake, swinging the southern most wing northward in a counter-clockwise direction, and then pulling the net to the northern shore for fish processing. Once within a foot or two of the shoreline, the net was carefully lifted one hoop at a time to allow for sample accumulation within the cod end and to limit stress to captured species. Both the net's interior and wings were re-inspected for any remaining species that may have been missed during initial net retrieval. Species collected during re-inspection were processed with the original sample. During sorting, the cod end remained partially submerged to increase survivability of collected species. Herring were removed from the cod end first and transferred into partially submerged fish sorting baskets for processing (Appendix B). Sorting gloves were worn by processors to prevent further damage to the fish and remaining specimens were sorted by species, placed in either fish baskets or buckets according to size, and processed accordingly.

The processing of all fish and aquatic species collected included confirmation of taxonomic identification, enumeration, individual length determination and individual weight and/or batch weight. To show representative size of collected assemblages and assist in determining possible age class, fork length (FL) and total length (TL) were recorded for herring species and TL was recorded for all other species (dependent on caudal fin morphology). Since very few catches exceeded 25 individuals per species, length measurements to the nearest centimeter (cm) and individual weights to the nearest 0.1 gram (when applicable) were recorded for all processed species. In the event that species were batch weighed, sorting baskets or buckets were tared and weights were recorded in kilograms. In addition, species condition at time of release (i.e. live, fresh dead, or dead) was recorded. To minimize mortality, fish processing was expedient and did not require a significant

amount of time per individual. Once individual processing was complete, live specimens were released upstream of the sample site. When necessary, individuals were revived by gently passing water through their gills. All data was recorded on updated ALS data sheets (Appendix C).

4.0 RESULTS

A total of three fyke net sampling events lasting between three (3) and four (4) days in duration were conducted in Wreck Pond on May 13th-16th (Sampling Event 1), May 27th-30th (Sampling Event 2), and June 11th – 13th (Sampling Event 3). Net deployment/retrieval times were based on local tide tables for the open Atlantic Ocean in the nearshore waters of Belmar, New Jersey. Due to the landward distance of the sampling site from the outfall, the timing of the ebb and flood tides were found to lag considerably from the published local tide charts (approximately 3-4 hours). Net deployment/retrieval times were amended (when applicable) to compensate for this tidal difference. Tidal information for each event is given in Table 1. Upon completion of species processing, nets were redeployed and retrieved until that particular sampling event was concluded.

Table 1- 2014 Tide Table for Atlantic Ocean Belmar, NJ (Sampling Dates)

Sampling Event 1								
Day	High	Low	High	Low	High	Moon	Sunrise	Sunset
Tue 5/13	-	12:45 AM EDT/ 0.0 ft	6:47 AM EDT/ 4.6 ft	12:51 PM EDT/ 0.1 ft	7:10 PM EDT/ 5.5 ft		5:42 AM EDT	8:03 PM EDT
Wed 5/14	-	1:33 AM EDT/ -0.2 ft	7:31 AM EDT/ 4.7 ft	1:36 PM EDT/ 0.0 ft	7:51 PM EDT/ 5.7 ft	Full Moon	5:41 AM EDT	8:04 PM EDT
Thu 5/15	-	2:20 AM EDT/ -0.3 ft	8:16 AM EDT/ 4.7 ft	2:23 PM EDT/ -0.1 ft	8:34 PM EDT/ 5.7 ft		5:40 AM EDT	8:05 PM EDT
Fri 5/16	-	3:06 AM EDT/ -0.4 ft	9:03 AM EDT/ 4.7 ft	3:09 PM EDT/ -0.1 ft	9:22 PM EDT/ 5.7 ft		5:39 AM EDT	8:06 PM EDT
Sampling Event 2								
Tue 5/27		12:50 AM EDT/ -0.1 ft	6:53 AM EDT/ 4.7 ft	12:49 PM EDT/ -0.1 ft	7:13 PM EDT/ 5.6 ft		5:31 AM EDT	8:16 PM EDT
Wed 5/28		1:37 AM EDT/ -0.2 ft	7:40 AM EDT/ 4.7 ft	1:35 PM EDT/ 0.0 ft	7:56 PM EDT/ 5.5 ft	New Moon	5:31 AM EDT	8:16 PM EDT
Thu 5/29		2:23 AM EDT/ -0.2 ft	8:25 AM EDT/ 4.6 ft	2:18 PM EDT/ 0.1 ft	8:37 PM EDT/ 5.4 ft		5:30 AM EDT	8:17 PM EDT
Fri 5/30		3:05 AM EDT/ -0.1 ft	9:10 AM EDT/ 4.5 ft	3:00 PM EDT/ 0.3 ft	9:18 PM EDT/ 5.2 ft		5:30 AM EDT	8:18 PM EDT
Sampling Event 3								
Tue 6/10	5:22 AM EDT/4.3 ft	11:30 AM EDT/0.2 ft	5:53 PM EDT/5.3 ft	-	-		5:26 AM EDT	8:25 PM EDT
Wed 6/11	-	12:18 AM EDT/0.0 ft	6:16 AM EDT/4.5 ft	12:19 PM EDT/0.0 ft	6:41 PM EDT/ 5.6 ft		5:26 AM EDT	8:26 PM EDT
Thu 6/12	-	1:09:00 AM EDT/-0.2 ft	7:07 AM EDT/ 4.7 ft	1:11 PM EDT/ -0.1 ft	7:29 PM EDT/ 5.9 ft	Full Moon	5:26 AM EDT	8:26 PM EDT
Fri 6/13	-	1:59 AM EDT/ -0.5 ft	7:57 AM EDT/ 4.8 ft	2:02 PM EDT/ -0.2 ft	8:17 PM EDT/ 6.0 ft		5:26 AM EDT	8:26 PM EDT

In total, the fyke net was deployed 19 times for an approximate soak time of 227 hours. A total of 103 alewife were collected over the three (3) events. No blueback herring were collected during any of the three events. Table 2 gives number and type of fish caught by event. Clupeid species collected during sampling were all released alive and incurred a 0% mortality rate over the three sampling events as a result of delicate handling and reviving of each fish. Individual lengths and species conditions prior to release are given on the data sheets in Appendix C.

Table 2- Summary of Species Collected by Event

Sample ID Number	Alewife	Bleback	Banded Killifish	Golden Shiner	Striped Killifish	Atlantic Silverside	American eel	Largemouth Bass	Unknown Sunfish	Brown Bullhead	Pumpkinseed	Bluegill	Black Crappie	Blue Crab	White Sucker	Common Carp	White Perch	Yellow Perch	Gizzard Shad	Painted Turtle	Snapping Turtles	Total Per Event
WP051314AM	5				2	3							2		8	1	13		13		1	48
WP051314PM						1															1	2
WP051414AM	45						1		2		1	1					9		2		1	62
WP051414PM															3		4		2			9
WP051514AM	21								1						5	1	6		5			39
WP051514PM															1	2						3
WP051614AM	25						21					1	2	2	21	11	2	7				92
WP052714PM							2			2			1			1	1					7
WP052814AM			1				1		3	1			1	1	1	1					1	10
WP052814PM	1						1						1									3
WP052914AM	6						3				1		1	1	1	2	1					15
WP052914PM															9	3						12
WP053014AM							3	1							9	1	1	1				17
WP061114AM							2	3				1		4	4	5	1	1	1			18
WP061114PM								1		7						1						9
WP061214AM							3	1						1					5			10
WP061214PM				1				1	1										1		1	5
WP061314AM																						2
WP061314PM																						
Total	103	0	1	1	2	4	36	2	6	8	10	3	6	7	63	2	59	7	37	1	5	363

As shown in Table 2, ALS processed, enumerated, weighed (when applicable), measured, and identified all other collected species to the lowest practical taxonomical level (Appendix C). A total of 16 other fish species excluding alewife, were collected during the surveys and include the following: banded killifish (*Fundulus diaphanus*), striped killifish (*Fundulus majalis*), Atlantic silverside (*Menidia menidia*), American eel (*Anguilla rostrata*), white perch (*Morone americana*), black crappie (*Pomoxis nigromaculatus*), golden shiner (*Notemigonus crysoleucas*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), bluegill (*Lepomis macrochirus*), large-mouth bass (*Micropterus salmoides*), white sucker (*Catostomus commersonii*), yellow perch (*Perca flavescens*), gizzard shad (*Dorosoma cepedianum*), common carp (*Cyprinus carpio*), and unknown lepidomid sunfish. In addition to the above-listed species, seven (7) blue crab (*Callinectes sapidus*), one (1) painted turtle (*Chrysemys picta picta*), and five (5) snapping turtles (*Chelydra serpentina serpentina*) were collected. Total species count per net retrieval and species list by common name is given in Table 2.

During each event, individual water quality measurements were taken near the cod-end of the net with a YSI multi-probed water quality meter and a 650 MDS data logger. Water Quality Data for each individual sampling event is given in Table 3.

Table 3- Wreck Pond Water Quality Data for Each Sampling Event

Sample ID Number	Date/Time M/D/Y	Temp C	SpCond uS/cm	Salinity ppt	DO Conc mg/L	DO% %	pH	Turbidity Secchi (cm)
Preliminary set	5/12/2014 17:54	25.10	NA	3.65	6.77	87.50	7.00	NA
WP051314AM	5/13/2014 6:10	20.50	0.54	0.26	6.65	75.10	6.93	91.00
WP051314PM	5/13/2014 18:08	21.20	3.73	1.98	7.62	87.20	7.41	92.00
WP051414AM	5/14/2014 6:09	17.20	0.97	0.48	6.62	64.50	7.20	91.00
WP051414PM	5/14/2014 18:15	17.80	0.79	0.34	6.98	72.60	6.95	61.00
WP051514AM	5/15/2014 6:15	16.10	0.75	0.37	7.02	71.40	6.77	80.00
WP051514PM	5/15/2014 18:05	19.00	0.43	0.21	7.37	79.50	6.79	99.00
WP051614AM	5/16/2014 6:15	17.50	0.45	0.22	6.91	72.10	6.79	109.00
Preliminary set	5/27/2014 6:10	20.30	1.50	0.75	8.41	90.90	7.54	110.00
WP052714PM	5/27/2014 18:06	25.50	2.62	1.28	6.19	76.20	7.19	72.00
WP052814AM	5/28/2014 6:00	21.00	3.39	1.78	5.44	58.80	7.20	72.00
WP052814PM	5/28/2014 18:00	18.40	3.48	1.82	5.61	61.60	7.04	80.00
WP052914AM	5/29/2014 6:10	15.10	1.43	0.72	7.31	73.00	7.11	72.00
WP052914PM	5/29/2014 18:25	20.10	1.46	0.74	7.60	83.60	7.15	61.00
WP053014AM	5/30/2014 6:15	17.00	0.66	0.32	6.99	72.40	7.15	102.00
Preliminary set	6/10/2014 18:00	NA	NA	NA	NA	NA	NA	NA
WP061114AM	6/11/2014 06:18	20.90	3.93	0.19	5.75	65.20	7.52	60.50
WP061114PM	6/11/2014 18:10	20.00	3.06	1.44	7.45	84.70	7.31	61.00
WP061214AM	6/12/2014 6:15	18.50	2.53	1.33	6.37	69.20	7.26	60.50
WP061214PM	6/12/2014 18:22	21.90	3.62	1.60	7.72	90.20	7.14	62.00
WP061314AM	6/13/2014 7:04	20.10	3.70	1.90	6.84	77.21	7.18	75.00
WP061314PM	6/13/2014 18:12	24.50	0.93	0.42	7.97	93.80	7.07	75.00

5.0 CONCLUSION

As summarized in Section 1.0, the objective for the 2014 Wreck Pond fish survey was to confirm if a viable herring run still exists within Wreck Pond and provide baseline pre-construction data to be compared with post-construction survey results. Overall, the primary goals of the spring survey were to provide the following:

- 1) Baseline data for anadromous movement within Wreck Pond during spring migration;
- 2) An inventory of aquatic species collected using passive sampling methods at one location located underneath the existing railroad bridge where previous studies using same gear were performed;
- 3) A comparison of movement and abundance from past surveys in 2006-2008 to be applied to current data and data to be collected post-construction; and
- 4) Measurements, weights, and enumeration of collected species; and

Fall survey objectives have been provided in Section 1.0, but have been omitted from the aforementioned.

Results of the 2014 survey are somewhat comparable to results of 2006 and 2007. Each of the surveys used the same gear, relative level of catch effort, and were stationed in the same geographic area. Sampling duration of 227 hours and level of effort in 2014 was comparable with 204 sample hours in 2006 and 217 hours in 2007. As previously mentioned in the Results section, the 2014 sampling effort collected 103 alewife and no blueback; whereas 229 alewife and one (1) blueback were collected in 2006 and 49 alewife and two (2) blueback were collected in 2007. Results of each survey verify the inshore/offshore passage of adult clupeid species through the existing outfall. Even though results suggested a viable run for alewife, it is uncertain if the fluctuation in alewife numbers from each survey reflects if the run is reestablishing, declining, or stabilizing.

The repetitive low number of blueback collected relatively at the same time in 2006 and 2007 and the lack of blueback in 2014 tends to show that a viable blueback run does not exist in Wreck Pond. Based on 2006 results, the NJDEP recommended that the 2007 events be scheduled roughly 3 to 4 weeks after the initiation of alewife migration to better target blueback movement and determine if a viable run of blueback existed in Wreck Pond. The 2014 survey was scheduled to reflect those 2006 recommendations and spanned over the proposed blueback spawning window. A viable run of blueback herring was not observed in the 2006 through 2008 surveys or in 2014. Possible reasons for the absence of blueback in 2014 and the small number of blueback collected in 2006 and 2007 could be associated with the following:

1. A viable run of blueback does not exist in Wreck Pond and therefore, this waterbody can no longer be categorized as a confirmed spawning ground for blueback. Historically designated as confirmed spawning for blueback many years ago, stressors, over time, may have either diminished the population or caused the Wreck Pond spawning population to go elsewhere. Diminished populations may be attributed to overfishing, water quality degradation, lack of aquatic connectivity, and loss of spawning habitat. Unlike alewife, blueback prefer to spawn in swifter waters. Upstream habitat investigations may assist in determining if satisfactory spawning grounds are still present for blueback. Habitat assessments pre- and post-construction will be performed as part of the 2014 USFWS grant and should provide data pertaining to spawning habitat suitability.
2. Blueback herring are hindered by the extended outfall structure and cannot access natal spawning grounds. Clupeids are affected by light. In North Carolina, an extensive gill net survey indicated that river herring (blueback herring and alewife) no longer existed in streams where bridges have been replaced by pipes or box culverts (Moser and Terra 1999). Herring are also reluctant to enter pipes due to shadowing (Hendricks, 2006). Even though alewife may access Wreck Pond and are subject to

the same light limitations, blueback are known to be slightly more sensitive to light (Don Byrne, NJDEP, pers. comm. April, 2007) which may indicate a low presence. The proposed bypass culvert will be shorter in length than the existing pipe and should be designed to allow light to penetrate.

3. Other anthropogenic and chemical barriers are deterring blueback movement. It is a known fact that water quality in Wreck Pond needs improvement. In addition, development has been expanding. It is possible that natal qualities recognized historically no longer exist. Introduction of the bypass culvert may allow for improved water quality, tidal mixing, and a more attractant flow.

Overall, the 2014 survey did provide baseline data on anadromous movement within Wreck Pond during spring spawning migration. A total of 103 alewife were collected which could be indicative of a run. This number is approximately half of what was collected in 2006 and more than double the number collected in 2007. In comparison to results of the 2006 and 2007 spring sampling events using same survey methodology and gear, the 2014 spring survey further verified the continued presence and movement of alewife within Wreck Pond and most likely the unhindered inshore/offshore passage through the extended outfall. Even though results suggested a viable run for alewife, it is uncertain if the fluctuation in alewife numbers from each survey reflects if the run is reestablishing, declining, or stabilizing. However, results of the 2014 and 2006 through 2008 surveys did indicate that the majority of alewife were more predominant late April to mid-May in Wreck Pond; therefore, it is possible that the major alewife run in Wreck Pond starts in late April and ends in mid-May (temperature dependent).

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APPENDICES

Appendix A

New Jersey Scientific Collection Permit



State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

Date Issued: 04/16/14
MFA-SCP No.: 1444

CHRIS CHRISTIE
Governor

KIM GUADAGNO
Lt. Governor

Division of Fish and Wildlife
Mail Code 501-03
PO Box 420
Trenton, NJ 08625-0420
David Chanda, Director
njfishandwildlife.com
609-292-2965

BOB MARTIN
Commissioner

04/16/14 to 12/31/014

SCIENTIFIC COLLECTING PERMIT

TO WHOM IT MAY CONCERN:

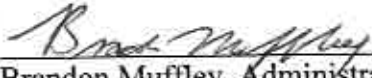
Under provisions of New Jersey Statutes Annotated Title 23:4-52, permission is hereby given to:

Captain Aleksandr C. Modjeski, American Littoral Society, 18 Hartshorne Drive, Highlands, NJ 07732 to conduct a Fish Inventory Study with emphasis on field monitoring of alewife and blueback herring in Wreck Pond, Monmouth County. Spring sampling, late April – June, will focus on adult migratory runs and collection will be done using a 15' deep, 4' high—modified fyke net (25' wings and 1" stretch mesh). There will also be a Fall sampling program, September - October to confirm presence of YOY herring and will use a 30' (1/4" nylon mesh bag seine with a 4'x4'x4' bag) and a 100' (1/4" nylon mesh bag seine with a 6'x6'x6' bag). Sampling will be done at various locations within the Wreck Pond Watershed. A small aluminum 12' skiff will be used to help deploy nets from the beach.

This permit is subject, but not limited to, the following conditions:

1. The person(s) named herein shall have this permit in their possession when collecting scientific specimens in marine, fresh, or estuarine waters of the State and must present it upon request to any official or citizen.
2. **The holder of this permit shall notify the Marine Law Enforcement Region Office of his/her scientific collecting activities in any of the State's marine, fresh, or estuarine waters at least 24 hours in advance of their activities. Notification can be made in writing to the Marine Enforcement Office, P.O. Box 418, Port Republic, NJ 08241, or by calling 609-748-2050.**
3. A **report** of the organisms collected (species, numbers, specific location where taken, dates of sampling) or a final report for the study for which the permit is requested shall be sent to the Administrator, Marine Fisheries, P.O. Box 400, Trenton, NJ 08625, within four (4) weeks of the expiration date or upon request for permit renewal, whichever is earlier.

4. This permit does not authorize the collection of any species listed by the United States Government as endangered. Special provisions may apply for endangered species. It is the permittee's responsibility to obtain, from the United States Government, any required permits to interact with any Federally listed endangered species.
5. This permit does not convey the right to trespass.
6. Violation by the permittee or subsidiary permit holders of any condition of the permit or any state law or regulation promulgated pursuant to N.J.S.A. 23 or 50 or N.J.A.C. 7:25 or 7:25A shall render this permit null and void and subject all parties to prosecution in addition to permit revocation upon conviction. Applications for future permits may also be denied.
7. The holder of this Scientific Collecting Permit is also required to have in his/her possession a "Special Permit for Research" from the Division of Watershed Management, Bureau of Marine Water Monitoring, P.O. Box 405, Leeds Point, NJ 08220, prior to the taking of shellfish (clams, oysters, mussels) for scientific purposes from the marine or estuarine waters of the State that are designated "Prohibited," "Special Restricted," or "Seasonal Special Restricted" (N.J.S.A. 58:24-3, and N.J.A.C. 7:12-2). A chart of these designated waters may be obtained from the Bureau of Marine Water Monitoring or by visiting www.nj.gov/dep/wms/bmw.


Brandon Muffley, Administrator
Marine Fisheries Administration

bd

c: Capt. Dominick Fresco, Chief, Bureau of Law Enforcement-Marine Enforcement Region
Office
Capt. Dennis Tully, NJ State Police-Marine Services Bureau
Deborah Watkins, Bureau of Marine Water Monitoring

Subsidiary Student or Employee Permit Holders:

Jesse Ebert
Julianne Schumacher
Jeff Derment
Stevie Thorensen
Megan Molok

Appendix B
Photograph Log



Photo 1: View facing southeast along shoreline of the first pond in the Wreck Pond watershed closest to the ocean. The outfall structure connected to the Atlantic Ocean is located to the left of the photo. Photo taken in 2008.



Photo 2: View facing east towards the New Jersey Transit railroad bridge and fyke net location. Photo taken in 2008.



Photo 3: Water Quality Monitoring was performed using handheld YSI multi-probed sonde supplied by the NJDEP. Photo taken in 2014 during Sampling Event 1.



Photo 4: Net set under railroad bridge showing centralized location and how wing was secured to the structure. Photo taken in 2014 during Sampling Event 1.



Photo 5: View looking south towards the signage provided by NJDEP. Poly-ball and wooden stake were used to identify net and anchor fyke. Processing was performed along the northern shoreline. Photo taken in 2014 during Sampling Event 1.



Photo 6: Typical fish sorting set-up that consisted of semi-submerged fish baskets that kept fish in water during processing. Photo taken in 2014 during Sampling Event 1.



Photo 7: Gloves were worn during sorting and fish handling. Fish were individually transferred to submerged fish baskets to promote survivability. Herring were processed first and released upstream..



Photo 8: Fish ready for immediate processing. There was 100% survivability for herring during each sampling event. Photo taken in 2014 during Sampling Event 1.



Photo 9: Processing of herring. Gloves were worn to reduce risk of injury and mortality to collected species. Photo taken in 2014 during Sampling Event 1.



Photo 10: A basket of gizzard shad and white perch ready for processing and release. Photo taken in 2014 during Sampling Event 1.



Photo 11: A basket of American eel showing average length and abundance. Photo taken in 2014 during Sampling Event 1.

Appendix C

Data Sheets

5/13 AM

200m set - 0300
1 snapper

Herring Project Data Sheet

Location: RR Bridge Field Crew: JD AM NM Date: 5/13/14 Water Quality Taken (circle) N
 Sample Number: WPOS1316-AM Weather: Clear 60°F
 Net Retrieval time: 7:12/16 Time Net collecting: 12:21
 Tides (time /ft) - Low: 12:04 High: 06:52 Precipitation in Last 24 hrs (circle) N
 Number of species: 7 Total Number of Individuals: 43 T&E Species Collected (circle)? Y N
 Data Recorder: NM Signature: _____

SPECIES	Total Wt/sub	Total Count/sub cl	Length (cm)			Weight (g)			Length (cm)			Weight (g)		
			Live (L)	Fresh Dead (FD)	FRTL	Live (L)	Fresh Dead (FD)	FRTL	Live (L)	Fresh Dead (FD)	FRTL	Live (L)	Fresh Dead (FD)	FRTL
1) <u>Albino</u>	150g	1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
2) <u>Silvers</u>		1	15.2	10	10	0.7	0.13	0.13	15.2	10	10	0.7	0.13	0.13
3) <u>S Killie</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
4) <u>G. snod</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
5) <u>G. shad</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
6) <u>W. perch</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
7) <u>B. cral</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
8) <u>W. perch</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
9) <u>G. shad</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
10) <u>A. cor p</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
11) <u>W. Suck</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10
12) <u>W. perch</u>		1	25.2	20.8	20.8	1.5	0.10	0.10	25.2	20.8	20.8	1.5	0.10	0.10

123107

5/13 PM

Snapper

Herring Project Data Sheet

Location: Rt Brooke Field Crew: JE JL Am Date: 5/13/14 Water Quality Taken (circle) Y N
 Sample Number: WP-051319-PM Weather: Clear w/ndy E-15-20 mph
 Net Deployment time: 0806 Net Retrieval time: 10:09 Precipitation in Last 24 hrs (circle) Y N
 Tides (time /ft) - Low 1250 PM High 1514 AM T&E Species Collected (circle)? Y N
 Number of species: 1 Total Number of Individuals: 2 Signature: [Signature]
 Data Recorder: Am

NET SET
1990

T 21.2C
 DO 87.2
 M/L 7.62
 SPC 3.73
 SAL 1.98
 PH 7.71

SPECIES	Total Wt/sub		Total Count/sub et		Length (cm)		Weight (g)		Live (L)		Fresh Dead (FD)	
	FLTL	FD	FLTL	FD	FLTL	FD	FLTL	FD	FLTL	FD	FLTL	FD
<u>Am Silversh</u>												

5/14 AM

FULL MOON

Net 5/14/14

Herring Project Data Sheet

Location: RR Bridge WP Field Crew AM TL KD SS Date: 5/14/14
 Sample Number: WP-051414-AM Weather 510F Windy, overcast Water Quality Taken (circle) (Y) N
 Net Deployment time: 1950 5/13 Net Retrieval time: 0614 Time Net collecting: 10:04
 Tides (time /ft) - Low 0136 AM High 0736 AM Precipitation in Last 24 hrs (circle) (Y) N
 Number of species: 7 Total Number of Individuals 61 T&E Species Collected (circle)? (Y) N
 Data Recorder: RB Signature: _____

SPECIES	Total wt/sub	Total Count/sub or	Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		Length (cm)		Weight (g)	
			FLTL	(FD)	(g)	(FD)	(g)	(FD)	(g)	(FD)	(g)	(FD)	(g)	(FD)	(g)	(FD)		
Alewife	0.63	55	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Alewife		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Alewife		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Alewife		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Alewife		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Alewife		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Alewife		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Whitefish		23	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Whitefish		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
BlackCrappie		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209
Bluegill		209	209	209	209	209	L	209	209	209	209	L	209	209	209	209	209	209

WD
 Temp - 17.2
 DO/0 - 64.5
 DO max - 6.62
 Src - 197
 Sal - 48
 pH - 7.2
 one alewife
 escape
 one snapping
 turtle
 Medium

Herring Project Data Sheet

Location: Red Bridge Weech Road Field Crew: Am. K. D. T. J. S. S. Date: 5/14/14
 Sample Number: WPO51404-AN Weather: see sheet
 Net Deployment time: 1:56 Net Retrieval time: 5:13 Time Net collecting: 10:00
 Tides (time /ft) - Low 1:25 High 4:45 Precipitation in Last 24 hrs (circle) (Y) (N)
 Number of species: 147 Total Number of Individuals: 187 T&E Species Collected (circle)? (Y) (N)
 Data Recorder: KD Signature: [Signature] (See page 1)

SPECIES	Total wt/sub		Total Count/sub of		Length (cm)		Weight (g)		Live (L)		Fresh Dead (FD)		Length (cm)		Weight (g)		Live (L)		Fresh Dead (FD)		
	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	
<u>Bluefish</u>																					
<u>GI 20101514</u>																					
<u>LM Bass</u>																					

5/14 PM

next net set: 1250

10/28 11:08
10/28 11:08

Herring Project Data Sheet

Location: RR Bridge Wreck Pond Field Crew AM, TL Date: 5/14/14 Water Quality Taken (circle) Y N
 Sample Number: W051414PM Weather 50% Misty & Foggy 11:00 hr
 Net Deployment time: 0712 Net Retrieval time: 1055 Time Net collecting: 343 Precipitation in Last 24 hrs (circle) Y N - Misting now
 Tides (time /ft) - Low 1341 High 1455 T&E Species Collected (circle)? Y N

Number of species: 3 Total Number of Individuals 9 Signature: [Signature]
 Data Recorder: [Signature]

SPECIES	Total Wt Sub	Total Count Sub cl.	Length (cm)			Weight (g)			Length (cm)			Weight (g)			Length (cm)			Weight (g)																				
			Live (L)	Fresh Dead (FD)	FLTL	Live (L)	Fresh Dead (FD)	FLTL	Live (L)	Fresh Dead (FD)	FLTL	Live (L)	Fresh Dead (FD)	FLTL	Live (L)	Fresh Dead (FD)	FLTL	Live (L)	Fresh Dead (FD)	FLTL																		
G12w1 Shad	5	39	41.5	1030	L	41.5	1260	L	36	39	630	L	30	31.5	450	L																						
Whit Sucker		39	51	790	L	36	37	610	L	30	32	490	L	30	31.5	450	L																					
Whit Perch		24	31	460	L	33	35	760	L	30	32	490	L	30	31.5	450	L																					

W0
 Time: 1815
 Temp: 17.8°C
 DO % 7.2
 DO mg/L 6.98
 SPC 0.79
 SecL 0.34
 pH 6.95
 Secchi 24
 X 2.5
 ch

WP 0515 AM
New net set - 0715

21- Alewife (1 sample)
6- Wiperich
6- Grz. Shad
1 carp
5 w/ sucker
1 B. Bull

Herring Project Data Sheet

Location: RL Bridge WP Field Crew: AM JD Date: 5/15/04
 Sample Number: WP051514 AM Weather: 60°F, Foggy with w-7 mph Water Quality Taken (circle) Y N
 Net Deployment time: 1:50/5/4 Net Retrieval time: 0630 Time Net collecting: 11:40
 Tides (time /ft) - Low: 0223 High: 0820 Precipitation in Last 24 hrs (circle) Y N Mist
 Number of species: 7 Total Number of Individuals: 39 T&E Species Collected (circle)? Y N
 Data Recorder: AM Signature: _____

SPECIES	Total wt sub	Total Count sub	Length (cm)			Weight (g)			Length (cm)			Weight (g)					
			(L)	(F)	(D)	(L)	(F)	(D)	(L)	(F)	(D)	(L)	(F)	(D)			
1 Alewife			252	190	21.5	143	FD	245	139	245	178	235	248	180	L	L	L
"			235	181	23.5	175	L	215	153	255	216	255	275	199	L	L	L
"			235	163	25.5	169	L	205	220	245	192	235	235	175	L	L	L
"			255	145	25.5	199	L	245	195	245	193	215	215	125	L	L	L
2 Whitefish			215	502	32.5	668	L	29	422	26.5	246	27	295	1096	L	L	L
3 S. Zon. Shad			315	402	44.5	1011	L	43	1070	43	1070	43	1070				
4 Blk. Crappie			27	34	2.6	249	L										
5 O. Shad			30	430	30	386	L										
6 C. Carp			43	1820			L										
7 W. Perch			23	231			L										
8 W. Sucker			33	556	40	971	L	34	591	34	549	34	549	500	L	L	L
9 Br. Bullhead			31	520			L										

1 Alewife
2 Whitefish
3 S. Zon. Shad
4 Blk. Crappie
5 O. Shad
6 C. Carp
7 W. Perch
8 W. Sucker
9 Br. Bullhead

Time: 0615
Temp: 16.1°C
DO % - 71.4
Dura - 7.02
SPC - 0.75
S.O. - 0.37
pH - 6.77
Sech. - 31.5
254 cm

onsale - 1752 next net set c - 1837

Herring Project Data Sheet

Location: CR Brigs Wreck Field Crew: AM JD, MM Date: 5/15/14
 Sample Number: WP-051514-PM Weather: 62°F, clear, water calm, no wind Water Quality Taken (circle) Y N
 Net Deployment time: 0715 Net Retrieval time: 1830 Time Net collecting: 10:14
 Tides (time / ft) - Low: 1427 High: 2038 Precipitation in Last 24 hrs (circle) Y N MIS, FG, drizzle
 Number of species: 2 Total Number of Individuals: 3 T&E Species Collected (circle)? Y N
 Data Recorder: TL Signature: _____

SPECIES	Total wt/sub	Total count/sub cl.	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)	
			(L)	(R)	(L)	(R)	(L)	(R)	(L)	(R)	(L)	(R)	(L)	(R)
			FLTL	FTL	FLTL	FTL	FLTL	FTL	FLTL	FTL	FLTL	FTL	FLTL	FTL
whit perch	358	3529	1080	L	35	36	730	L						
whit sucker	40	1425	880	L										

WQ - 1805
 Time: - 1810
 Temp: 19C
 DO % - 79.5
 DO mg/l - 7.37
 SPC - 1431
 Sal - 0.21
 PH - 6.79
 Secchi - 39.0
 22.5

Herring Project Data Sheet

Location: RR Body Weckford Field Crew: AM JD, TL, KD Date: 5/16/14
 Sample Number: WP-051614-AM Weather: 63°F 15mph wind overcast Water Quality Taken (circle) (Y) N
 Net Deployment time: 18:50 Net Retrieval time: 06:30 Time Net collecting: 12 hrs
 Tides (time / ft) - Low: 03:09 High: 09:07 Precipitation in Last 24 hrs (circle) (Y) N Drizzle periodic
 Number of species: 8 Total Number of Individuals: 99 T&E Species Collected (circle)? (Y) N
 Data Recorder: [Signature] Signature: _____

Bluegill
 WP-25
 MR-TT
 CRAB
 GRE-HL (cm) * 2 (ft)
 YR (2+5+0)

SPECIES	Total weight		Total count/sub st		Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)	
	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead	Live	Dead
Alcwife			352	140	1	1	227	150	227	190	227	200	227	190	227	200	227	190	227	200	227	190	227	200
Alcwife			2428	190	1	1	227	160	227	190	227	220	227	190	227	220	227	190	227	220	227	190	227	220
Alcwife			225	110	1	1	227	130	227	100	227	100	227	100	227	100	227	100	227	100	227	100	227	100
Alcwife			252	160	1	1	227	210	227	230	227	180	227	230	227	180	227	230	227	180	227	230	227	180
Alcwife			2800	260	1	1	227	160	227	160	227	130	227	160	227	130	227	160	227	130	227	160	227	130
W. Perch			336.5	710	1	1	227	430	227	650	227	40	227	650	227	40	227	650	227	40	227	650	227	40
O. shad			3275	540	1	1	227	540	227	540	227	540	227	540	227	540	227	540	227	540	227	540	227	540
O. shad			342	840	1	1	227	620	227	620	227	1300	227	620	227	1300	227	620	227	1300	227	620	227	1300
W. sucker			34	600	1	1	227	690	227	910	227	450	227	910	227	450	227	910	227	450	227	910	227	450
Bk. cunner			26	240	1	1	227	240	227	240	227	240	227	240	227	240	227	240	227	240	227	240	227	240
Bk. cunner			67	210	1	1	227	110	227	110	227	110	227	110	227	110	227	110	227	110	227	110	227	110
W. sucker			41	890	1	1	227	530	227	620	227	1000	227	620	227	1000	227	620	227	1000	227	620	227	1000
W. sucker			33	550	1	1	227	860	227	580	227	680	227	580	227	680	227	580	227	680	227	580	227	680
W. sucker			40	870	1	1	227	650	227	840	227	580	227	840	227	580	227	840	227	580	227	840	227	580
W. sucker			39	830	1	1	227	650	227	840	227	580	227	840	227	580	227	840	227	580	227	840	227	580

WY
 Time: 06:15
 Temp: 17.5C
 Diss: 17.9%
 DO mg/l: 6.91
 SPC: 454 mg/cm
 Sal: 0.37
 pH: 6.79
 Secchi: 43"
 X
 2.54

Bluegill = 605
 Yellow Perch (cm) = 605

Herring Project Data Sheet

Location: R. Brook WP Field Crew AM, JD, TC, KD Date: 5/16/14 Water Quality Taken (circle) Y N
 Sample Number: WP051614 AAA Weather _____ Net Retrieval time: _____ Time Net collecting: _____
 Net Deployment time: _____ Net Retrieval time: _____ Precipitation in Last 24 hrs (circle) Y N
 Tides (time /ft) - Low _____ High _____ T&E Species Collected (circle)? Y N
 Number of species: _____ Total Number of Individuals _____ Signature: _____
 Data Recorder: _____

SPECIES	Total wt/sub	Total Count/sub ct	Sub 1			Sub 2			Sub 3			Sub 4			Sub 5				
			Length (cm)	Weight (g)	Live (L) Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) Fresh Dead (FD)		
W. Perch	21	29	350	L	346	L	338	L	335	L	325	L	325	L					
W. Perch	30	27	530	L															
Y. Perch	26	27	260	L															
A. Eel	1	21	247	L															

Basket = 1720
 Total = 79805
 Ecl wt. g.
 (-1 lost eel)
 No sub ct but
 butch weight

7 A. Eel Lost Total Ecl = ~~1021~~ (Total Length) = 52cm - 58cm = 19 eels between these lengths
 *****CIRCLE LENGTH(S) OF SPECIES WITH ABNORMALITIES AND DESCRIBE IN SPACE TO RIGHT*****
 pg ___ of ___

Herring Project Data Sheet

Location: WIPACK RUN Field Crew: MKEJ + AJ Date: 5/27/14
 Sample Number: 2P052719AN Weather: 75° F Sunny calm WQ: N Water Quality Taken (circle) (Y) N
 Net Deployment time: 0620 Net Retrieval time: NA Time Net collecting: NA
 Tides (time /ft) - Low 1253 AM High 0658 Precipitation in Last 24 hrs (circle) (N) Y (N)
 Number of species: NA Total Number of Individuals NA T&E Species Collected (circle)? (Y) Y N
 Data Recorder: _____ Signature: _____

temp. 20.3
 DO: 9.07
 pH: 7.54
 sal: 1.50
 sal: 0.45

SPECIES	Total Wt/ind	Total Count/sub ct.	Length (cm)	Weight (g)	Live (L)	Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L)	Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L)	Fresh Dead (FD)
	FLTL													

Temp 20.3
 DO: 9.07
 pH: 7.54
 sal: 1.50
 sal: 0.45

Net set - 1845

Herring Project Data Sheet

Location: WRECK BOND KR Pidge Field Crew AM TL KD Date: 5/27/14
 Sample Number: IMP052714PM Weather: 85°F, NW Breeze Water Quality Taken (circle) Y N
 Net Deployment time: 0620 Net Retrieval time: 1830 Time Net collecting: 12hrs
 Tides (time /ft) - Low 1253 High 1917 Precipitation in Last 24 hrs (circle) Y N
 Number of species: 4 Total Number of Individuals: 107 T&E Species Collected (circle)? Y N
 Data Recorder: KD Signature: [Signature]

SPECIES	Total wt: sub	Total Count: sub et	Length (cm)			Weight (g)			Length (cm)			Weight (g)			Length (cm)			Weight (g)		
			FLTL	(L)	Fresh Dead (FD)	FLTL	(L)	Fresh Dead (FD)	FLTL	(L)	Fresh Dead (FD)	FLTL	(L)	Fresh Dead (FD)	FLTL	(L)	Fresh Dead (FD)	FLTL	(L)	Fresh Dead (FD)
White perch	1	1	283	280	L															
Yellow perch	1	1	368	368	L															
Pumpkinseed	2	14	575	76	L	147	49													
Eel	2	24	67	40	L															
Blue Crab																				

1806
 Seed 172 CH
 Temp 25.5°C
 DO 9.76.2
 DO m/L 6.19
 SPC 2.62
 Sal 1.28
 Ph 7.19

last
 small
 blue crab
 OLISIONS

Net SA: 0700

Herring Project Data Sheet

Location: Water Pond RL Field Crew: Am, JS, KD Date: 5/28/14
 Sample Number: WP0523H AM Weather: 0608 57° F Water Quality Taken (circle) Y N
 Net Deployment time: 1924 Net Retrieval time: 10:48
 Tides (time /ft) - Low: 0141 / 6.21 High: 0744 / 4.73 Precipitation in Last 24 hrs (circle) Y N
 Number of species: 7 Total Number of Individuals: 9 I&E Species Collected (circle)? Y N
 Data Recorder: KD Signature: _____

SPECIES	Total Wt/sub	Total Count/sub	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)	
			(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)
Banded Killi		1	10	FD										
White Sucker		1	48.5	704	L									
White Perch		1	33.5	634	L									
American Eel		1	84	891	L									
Pumpkinseed		1	10.3	16	L									
Brown Bullhead		3	28	313	L	25	220	L	85	190	L			
Bluegill		1	10		Male									

Snapping turtle
 Secchi - 72cm
 TAlC
 DO % 58.8
 DO 4.4
 Conductivity 3.39
 salinity 1.78
 pH 7.2

net st - 1245

Herring Project Data Sheet

Page 1 of 1

Location: Work Pond Rd. Boke Field Crew: AM TL, KD, Lisa Date: 5/28/14
 Sample Number: WFO57314PM Weather: Sun, overcast w/ light rain Water Quality Taken (circle) Y N
 Net Deployment time: 07:00 Net Retrieval time: 1:05 Time Net collecting: 0:55
 Tides (time /ft) - Low: 1:34/0.01 High: 7:59/5.57 Precipitation in Last 24 hrs (circle) Y N
 Number of species: 3 Total Number of Individuals: 3 T&E Species Collected (circle)? Y N
 Data Recorder: KD Signature: _____

SPECIES	Total wt./sub	Total Count/sub cl.	Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)	
			FLTL	FTL	FLTL	FTL	FLTL	FTL	FLTL	FTL	FLTL	FTL		
<u>alewife</u>	<u>325</u>	<u>1</u>	<u>126</u>	<u>1</u>										
<u>american</u>	<u>31</u>	<u>1</u>	<u>54</u>	<u>1</u>										
<u>blue crab</u>	<u>1</u>	<u>1</u>	<u>69</u>	<u>1</u>										

48cm
 18.4°C
 D.O. 251.6%
 P 0.5.61 mg/l
 3.487
 1.82 sal
 7.04 PH
 0 leasons
 crabmate

Net set 6:50 am

Herring Project Data Sheet

Location: WP MC Bridge Field Crew: AMTL KD Date: 5/25/14
 Sample Number: WP-022014 AM Weather: SAFE, overcast, mph NE Water Quality Taken (circle) Y N
 Net Deployment time: 12:15 Net Retrieval time: 06:15 Time Net collecting: 18 1/2 hr
 Tides (time /ft) - Low _____ High _____ Precipitation in Last 24 hrs (circle) Y N
 Number of species: 7 Total Number of Individuals: 1015 T&E Species Collected (circle)? Y N
 Data Recorder: KD Signature: _____

SPECIES	Total wt./sub	Total count/sub et	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)		
			(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	
alewife		6	232	236	184	L	232	149	L	232	198	L	232	178	L
alewife		2	232	163											
blugill		1	224	212											
WhitePerch		7	221	436											
White Sucke		1	245	604											
Yellow Perch		1	245	193											
Sydwaw		1	7												

Secchi = 73
 Time pump
 Temp 15.7 C
 DO 9.73
 Diss/L 7.31
 SPC 1.43
 Sal 6.72
 Ph 7.11

CEMB

M

LISA O BURNETT FULL 605

NET: 1835

Herring Project Data Sheet

Location: WP Le Budge Field Crew: L2, TL, KD, AM Date: 5/24/14 Water Quality Taken (circle) Y N
 Sample Number: WP052914 PM Weather: Clear, 59°F, E-W sup
 Net Deployment time: 12:45 Net Retrieval time: 10:05 Time Net collecting: 11:12 hr
 Tides (time /ft) - Low: 2:22 / 0:12 High: 2:40 / 5:44 Precipitation in Last 24 hrs (circle) Y N
 Number of species: 2 Total Number of Individuals: 12 T&E Species Collected (circle)? Y N
 Data Recorder: KD Signature: _____

SPECIES	Total Wt/sub	Total Count/sub (L)	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)		
			FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	
White perch	3	3	235	275	476	L	345	476	L	412	946	39	43	1030	L
White suckers	9	40	24	104	853	L	35	38	619	L	34	37	603	L	
White suckers	4	34	72	799	565	L	34	37	599	L	34	37	603	L	

Seci 61cm
 T- 20.1C
 PO₄ 83.6 µg/l
 DO 0.1 7.6 mg/l
 SPC 1.46
 Sal 0.74
 PH 7.15
 Time: 18:20

1 lost whitefish

Herring Project Data Sheet

Location: WP 12 Bay Field Crew: AM, TL, JD, KO Date: 5/30/14 Water Quality Taken (circle) Y N
 Sample Number: WP0304A Weather: _____
 Net Deployment time: 1235 Net Retrieval time: 0600 Time Net collecting: 1125 hr Precipitation in Last 24 hrs (circle) Y N
 Tides (time / ft) - Low: 0309 / 0.15 High: 0914 / 4.55 T&E Species Collected (circle)? Y N
 Number of species: 7 Total Number of Individuals: 17 Signature: _____
 Data Recorder: KO

SPECIES	Total wt/sub	Total Count/sub ct	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)					
			(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)				
Whitefish		3	370	710	L	391	759	L	374	833	L	335	461	L	374	466	L	17.0
			370	742	L	374	656	L	347	427	L							DO% 72.4%
																		PO 6.99 mg/l
																		SPC 0.66
																		sal 0.32
																		ph 7.15
																		Seci - 102 cm
																		0 along session
																		lost whitefish sample

NET SET - NO FISH DATA

Herring Project Data Sheet

Location: WR RR Bridge Field Crew TL, MM Date: 6/10/14
 Sample Number: WR-061014-NET SET Weather _____ Water Quality Taken (circle) Y N
 Net Deployment time: 1800 Net Retrieval time: NA Time Net collecting: NA
 Tides (time /ft) - Low 13:41 / High 17:53 / 5.3' Precipitation in Last 24 hrs (circle) Y N
 Number of species: _____ Total Number of Individuals NA T&E Species Collected (circle)? Y N
 Data Recorder: _____ Signature: UNC

SPECIES	Total Wt/sub	Total count/sub cl	Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		
			FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL	FL/TL
NET SET																					
AT																					
SS																					
FW																					
Time!																					
Temp!																					
Dryo!																					
Dumpe!																					
SPC!																					
Sal!																					
Sechs disk!																					

NET RESET - 1800 on 6/10/14

Herring Project Data Sheet

Location: WEEK AND RR BRIDGE Field Crew TL, KD, MM, JS Date: 6/11/14 Water Quality Taken (circle) Y N
 Sample Number: W061114-AM Weather _____
 Net Deployment time: 1800 Net Retrieval time: 0615 Time Net collecting: 12:15 Precipitation in Last 24 hrs (circle) Y N
 Tides (time / ft) - Low 12:18 / 0.0 High 06:16 / 4.5 T&E Species Collected (circle)? Y N
 Number of species: _____ Total Number of Individuals _____
 Data Recorder: FD Signature: _____

SPECIES	Total wt/sub	Total count/sub of	1			2			3			4			5		
			Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)
white sucker		1	53	614	L	45	551	L	24	235	L	36	581	L			
white perch		5	49	498	L	34	719	D	38	1144	P	33	509	D	23	210	D
oregon shad		1	51	470	L												
h sunnies		3			D												
black crappie		1	55	341	L												
yellow perch		1	15	121	L												
AM eel		2	50	302	L	25	30	L									

WD
 Time: 6:18
 Temp: 20.9
 DO%: 65.8
 DO mg/l: 50.7
 SPC: 5.79
 Sal: .19
 PH: 7.52
 Secchi - 24
 disk 60.5

2 Dead Sunnies (Eel has chuck missing)
 *****CIRCLE LENGTH(S) OF SPECIES WITH ABNORMALITIES AND DESCRIBE IN SPACE TO RIGHT*****
 pg 1 of 1

NET RESET - 1836

Herring Project Data Sheet

Location: WRECK POND RR BRIDGE Field Crew: TL, KD, JE, JD Date: 6/11/14 Water Quality Taken (circle) Y N
 Sample Number: WPO61114-PM Weather: OVERCAST
 Net Deployment time: 12:15/00 Net Retrieval time: 1:18:10 Time Net collecting: 11:55 Precipitation in Last 24 hrs (circle) Y N
 Tides (time /ft) - Low 12:19/0.0' High 12:41/5.6' T&E Species Collected (circle)? Y N
 Number of species: 3 Total Number of Individuals: 9
 Data Recorder: Rathellley Signature: _____

SPECIES	Total Weib	Total Count/sub	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)	
			(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)
white perch	1	28	27.5	L										
pumpkinseed	3	15.5	15.5	L	12.3	46	15.4	98	12.7	50	11.5	38	L	
sunfish	3	11.9	48	L	12.2	38								
white sunfish	1	11.9	40	L										

WQ
 Time: 18:10
 Temp: 20°C
 DO%: 84.7
 DO mg/l: 7.63
 SP: 7.45
 Sal: 1.4
 pH: 7.31
 Seach dust: 61 cm
 763.3 barpre

Herring Project Data Sheet

Sheeri Shifren NIDER

Location: Wreck Pond RR Budge Field Crew JL KD MM JJ D Date: 6/12/14
 Sample Number: WPO61214-AM Weather: overcast Water Quality Taken (circle) (Y) N
 Net Deployment time: 1836 Net Retrieval time: 6:20 Time Net collecting: 1:40
 Tides (time / ft) - Low 0109 / -0.2, High 0707 / 4.7 Precipitation in Last 24 hrs (circle) Y N
 Number of species: 5 Total Number of Individuals 12 & E Species Collected (circle)? Y N
 Data Recorder: Kathleen Devine Signature: Kathleen Devine

SPECIES	Total Wt/sub	Total Count/sub cl.	Length (cm)		Weight (g)		Length (cm)		Weight (g)		Length (cm)		Weight (g)	
			(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)	(L)	(FD)
shad	5	5	437		222	577	437		222	577	437		222	577
white sucker	1	1	537		577		537		577		537		577	
UNK	1	1	140		140		140		140		140		140	
Am eels	3	3	210	48	37		210	48	37		210	48	37	

WQ
 Time: 16.15
 Temp: 18.5C
 DO%: 69.2
 DO mg/l: 3.7
 SEC: 2.53
 SOD: 1.33
 Secchi: 24"
 disk: 60.5
 T62.6
 pH: 7.26
 lost 1
 plates: 2
 snappers
 1 of 1

has extremely large snappers

Full Moon

NET RESE

PM

Herring Project Data Sheet

Location: Wetland Park Rd Bridge Field Crew KD, JD, LD Date: 12 JUNE 2014 Water Quality Taken (circle) N
 Sample Number: WP-061214-PM Weather overcast cloudy
 Net Deployment time: 0655 Net Retrieval time: 1919 Time Net collecting: 11:15 Precipitation in Last 24 hrs (circle) Y
 Tides (time /ft) - Low 1311/-0.1' High 1429/5.9' T&E Species Collected (circle)? Y
 Number of species: 4 Total Number of Individuals 4
 Data Recorder: Jeff Diment Signature: _____

SPECIES	Total wt/sub	Total count/sub cl	Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)		Length (cm)		Weight (g)		Live (L) Fresh Dead (FD)	
			FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL	FLTL		
<u>Soldanella</u>		1	13.1	13.7	7									
<u>G. 12nd shed</u>		1	35.5	45.0	7									
<u>White</u>		1	9.3	8.8	6.5									
<u>Reddish spec</u>		1	25	181	265	272	L							
<u>Brown with red</u>		1	25	181	265	272	L							

WQ

Time: 18:22
 Temp: 21.9°C
 DO_{0%}: 90.2
 DO_{1%}: 7.72
 SPC: 3.62
 SAL: 1.60
 PH: 7.14
 Spec: 620
 disk.
 Pre 76.6

NET RESET -

Herring Project Data Sheet

Location: W. R. Bridge Field Crew KD, MM, JE, LS Date: 6/13/14 Water Quality Taken (circle) Y N
 Sample Number: WP-061314-AM Weather _____
 Net Deployment time: 18:40 Net Retrieval time: 11:40 Time Net collecting: _____
 Tides (time /ft) - Low 01:59 / High 07:57 / 4.8 Precipitation in Last 24 hrs (circle) Y N
 Number of species: 1 Total Number of Individuals _____ T&E Species Collected (circle)? Y N
 Data Recorder: LM Signature: _____

SPECIES	Total wt/sub	Total Count/sub ct.	1			2			3			4			5			6			7			8		
			Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)	Length (cm)	Weight (g)	Live (L) / Fresh Dead (FD)			
<u>Blue Crab</u>		<u>1</u>	<u>35</u>	<u>7.5</u>	<u>L</u>																					

Time 7:04
 Temp: 20.1C
 D.O% 7.65
 D.O. mg/L 77.21
 SPEC. WISH
 Sal 1.9
 Salinity 75.1
 DISK
 PH 7.18

