Interim

Impingement and Entrainment Sampling for the Proposed Bell Bend Nuclear Power Plant at the SSES Circulating Water Supply System Intake Structure, Luzerne County, Pennsylvania

Submitted to:
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September 2008

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INTRODUCTION

This report presents the interim results of Impingement and Entrainment (I & E) sampling being conducted by Normandeau Associates, Inc. and Ecology III at the existing Susquehanna Steam Electric Station (SSES) circulating water supply system intake structure pumphouse (CWS) on the Susquehanna River (Figure 1). The I & E study plan was accepted by AREVA NP and UniStar Nuclear and was an addition to ongoing environmental studies to support the Bell Bend Nuclear Power Plant Environmental Report (ER) and Combined License Application (COLA).

Impingement occurs when fish and other aquatic organisms become trapped on intake screens at the entrance to an intake system. Entrainment occurs when aquatic organisms, suspended in the water column, pass through the intake screens and are transported through the cooling water system. Impinged organisms are typically larger than the mesh size of the screening equipment and conversely entrained organisms are typically smaller than the mesh size of the screening equipment. Factors that influence I & E include cooling system and intake structure location, design, construction, and capacity. CWA Section 316(b) requires that cooling water intakes be designs to represent Best Technology Available (BTA) for minimizing adverse environmental impacts for these factors. The US EPA promulgated regulations implementing Section 316(b) in 2001 for new (Phase I) facilities (USEPA 2001). The BBNPP intake and cooling water systems will conform to these regulations.

The one-year I & E study was initiated on April 22, 2008. I & E sampling was conducted to provide estimates of the species composition and number of organisms that may possibly be impinged and entrained at the future intake of the proposed BBNPP which is to be located approximately 300 feet downstream of the SSES CWS (Figure 1). Impingement and Entrainment samples were collected on a weekly basis. The following sections describe the I & E study and initial results.

Information describing the SSES's intake structure was available in EPA 316(b) Phase II Documentation for Susquehanna Steam Electric Station (PPL Susquehanna 2005). The intake structure is subdivided so that each half serves one of the SSES units.

METHODS

Impingement

The impingement monitoring program was based on guidance provided by Electric Power Research Institute (EPRI) in *Impingement Abundance Monitoring Technical Support Document* (EPRI 2004) and on Normandeau's experience performing several recent impingement sampling studies at other cooling water intake structures in Pennsylvania and elsewhere. Impingement sampling was performed over one 24-hour sampling event per week beginning on April 22, 2008 and will continue until April 2009. Note that sampling was suspended for five consecutive weeks from July 8 to August 5 as a result of maintenance to the SSES intake structure.

Weekly sampling events were scheduled for the same day each week to assure regular spacing of the events. If either planned or unanticipated events interfered with this schedule, an adjustment of a day or two was necessary. At least one river water make-up pump for SSES Unit 1 or 2 was in operation during impingement sampling.

Each 24-hour sampling event was subdivided into 12-hour, predominantly day/night periods to the extent feasible to allow for determination of day/night differences and to ensure that debris or large numbers of fish did not overflow the sampling baskets. Each sampling event was initiated by operation of the screens for at least 15 minutes to clean them of previously impinged organisms. After the cleaning run, a clean basket with mesh size of 0.125-inch was installed in the debris trough serving each SSES Unit. The basket was used to capture the debris and impinged organisms from the screen cleanings during the impingement sampling event

For each sample collection period, all fish were separated from the debris, identified to species, and enumerated. All fish were measured for total length to the nearest millimeter. If there were two size groups for a species (e.g., young of the year and older) then each size group was enumerated separately. Condition of impinged fish was categorized as alive, dead (freshly killed), dead (injured), or dead & decomposing (e.g. rotting, fungus covered). The determination was made based on visual inspection of the fish.

Other aquatic and/or semi-aquatic species observed in the impingement samples (including crayfish plus other crustaceans, invertebrates, amphibians, reptiles, waterfowl and/or aquatic / semi-aquatic mammals), were also documented.

Entrainment

The sampling frequency of the entrainment monitoring program was based on guidance provided by EPRI in Entrainment Abundance Monitoring Technical Support Document (EPRI 2005) and agency-approved entrainment studies conducted recently by Normandeau. Entrainment sampling was performed once per week from April 22, 2008 to August 12, 2008. Additional entrainment sampling may be completed from mid-March through mid-April 2009, if necessary to sample the earliest spawning fish as determined after evaluation of the spring 2008 data.

Two entrainment samples were collected after sunset during each weekly sampling event. The first sample for each weekly sampling event began at approximately, but no earlier than, one hour after sunset. The second sample was collected starting about 2 hours after the first sample was completed. The samples were collected at either SSES's Unit 1 or 2 submerged intake openings at the River, so that the water from which the samples were taken was irreversibly committed to entering the power plant cooling system. At least one river water make-up pump for either Unit 1 or 2 was in operation during the entrainment sample. The operational status of the pumps

determined where the entrainment sample was obtained. Samples were collected with a 4-inch pump that obtained sample water through a 4-inch diameter suction line positioned at mid-depth just in front of one of the intake openings through which river water entered into the pumphouse. Total target volume of each sample was approximately 28,000 gallons (100 m^3).

The intake pipe conveyed the sample water through a calibrated in-line flow meter and then to the pump. The throttle on the pump was adjusted to ensure a minimum pumping rate of approximately 240 gallons (0.9 m^3) per minute as measured on the in-line flow meter. Thus, a total of about 110 minutes or some 2 hours of pumping occurred to obtain a single sample. From the flow meter the sample was discharged through the 4-inch pipe into a plankton net (500-micron mesh) suspended in a large tank of water such that the velocity of water exiting the hose was reduced greatly before encountering the mesh of the net. The 500-micron mesh net was fine enough to capture the eggs, larvae and juveniles of all fishes likely to be encountered at SSES. The contents of the plankton net were rinsed down from the outside with ambient water and carefully transferred to sample containers. The samples were immediately preserved with 10 percent buffered formalin, labeled (both inside and out) and sent to Normandeau's laboratory for analysis.

In general, the entire sample was processed for ichthyoplankton (eggs and larvae), and juvenile fish. In the event that a sample contained high numbers of fish eggs, larvae or juveniles, a provision was included in the laboratory processing plan to allow the sample to be subsampled using a plankton splitter so that the fraction of the sample analyzed reached a quota of at least 200 organisms (all species and life stages combined). Samples were sorted under magnification to ensure that all organisms were removed.

Fish were removed from the samples, identified to the lowest taxon possible (generally species), and counted. Larvae and juveniles were categorized by life stage into prolarvae (yolk-sac larvae), postlarvae (post yolk-sac larvae), yearling, and unknown. The unknown life stage indicated that the larvae were damaged or the life stage could

not be determined. A maximum of 20 individuals for each species and life stage category was measured for total length to the nearest 0.1 mm (nearest 1.0 mm for juvenile fish).

RESULTS

Impingement

Impingement catch results were available from April 22 to August 12, except for July 8 to August 5 when the intake was being serviced, during which 19 impingement samples (12-hr per sample) were collected. During this interval a total of 81 fish and crayfish was collected (Table 1). This equates to an average of 6.2 fish and crayfish per day or approximately 186 fish and crayfish per month. Crayfish (*Orconectes* sp.) was the dominant organism, representing 62% of the total impingement. The most abundant fish was channel catfish, representing 16% of the total. Other species collected in low numbers included rock bass, tessellated darter, yellow bullhead, northern hog sucker, yellow perch, smallmouth bass, and brown trout. Length ranges of fish collected during impingement sampling are given in Table 2.

The impingement catch was low throughout the study period with minimal week-to-week variation (Figure 2). A maximum of 24 fish was collected during a single 24-hr sampling period.

Entrainment

Entrainment sampling results were available from April 22 to June 4, 2008 (14 samples), with the remainder of the samples still being processed in the laboratory. A total of 1,722 fish was collected in the 14 samples (Table 3). Quillback (47%), common carp (19%), darters (17%), and white sucker (10%) were the predominant fishes. Other species that were collected include chain pickerel, smallmouth bass, walleye, tessellated darter, banded darter, and yellow perch.

No fish eggs were collected in the entrainment samples. A majority of the entrained fish were larvae in the post yolk-sac life stage (Table 3). Substantial variation in total entrainment occurred based on the initial sample data with numbers of individuals varying from 2 fish on April 22 to 496 fish on May 7 (Figure 3).

No endangered, threatened, or species of special concern were collected in the impingement or entrainment samples processed to date.

REFERENCES

EPRI. 2004. Impingement Abundance Monitoring Technical Support Document. EPRI Report No. 1008470. Palo Alto, CA.

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PPL Susquehanna. 2005. Appendix A, EPA 316(b) Phase II Documentation. NPDES Renewal Application. Permit No. PA 0047325. PPL Susquehanna, LLC.

USEPA. 2001. NPDES Regulations Addressing Cooling Water Intake Structures for New Facilities, Final Rule, Federal Register 66:243, U. S. Environmental Protection Agency, December 2001.

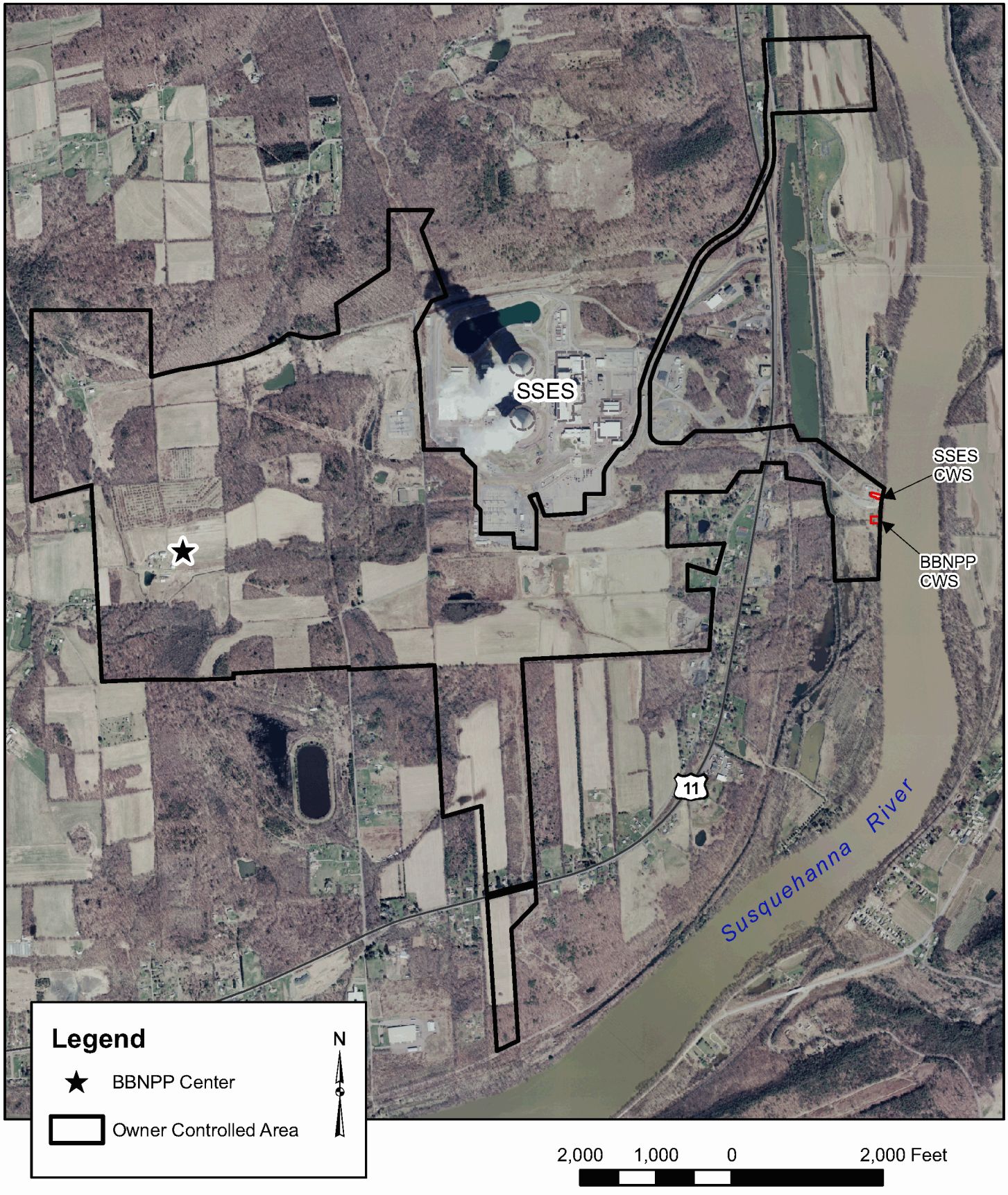

Figure 1.
Location of the SSES CWS
and the proposed location of the BBNPP CWS.

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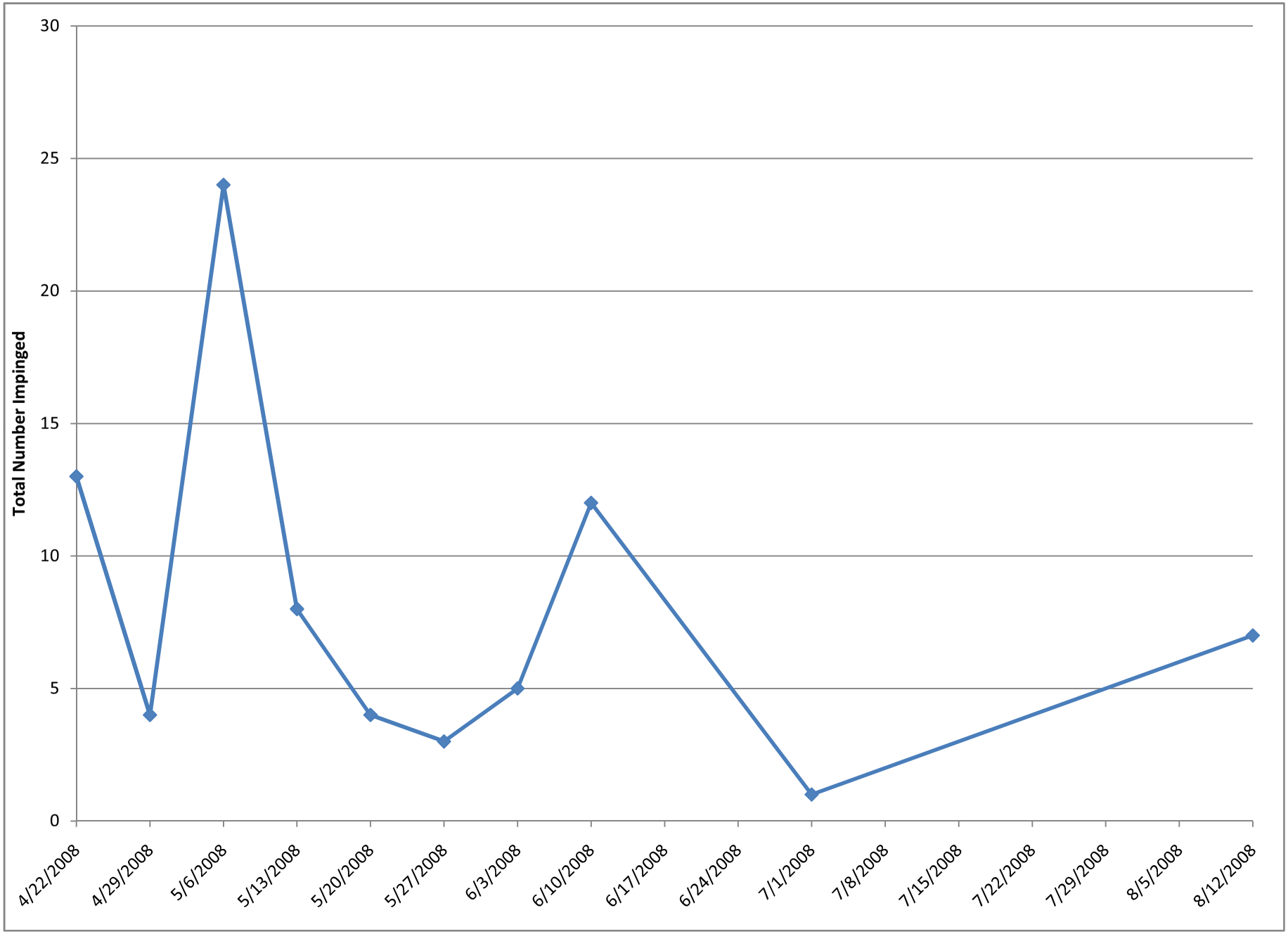

Figure 2. Total number of fish and crayfish collected in impingement samples at the SSES CWS, April 22 to August 12, 2008.

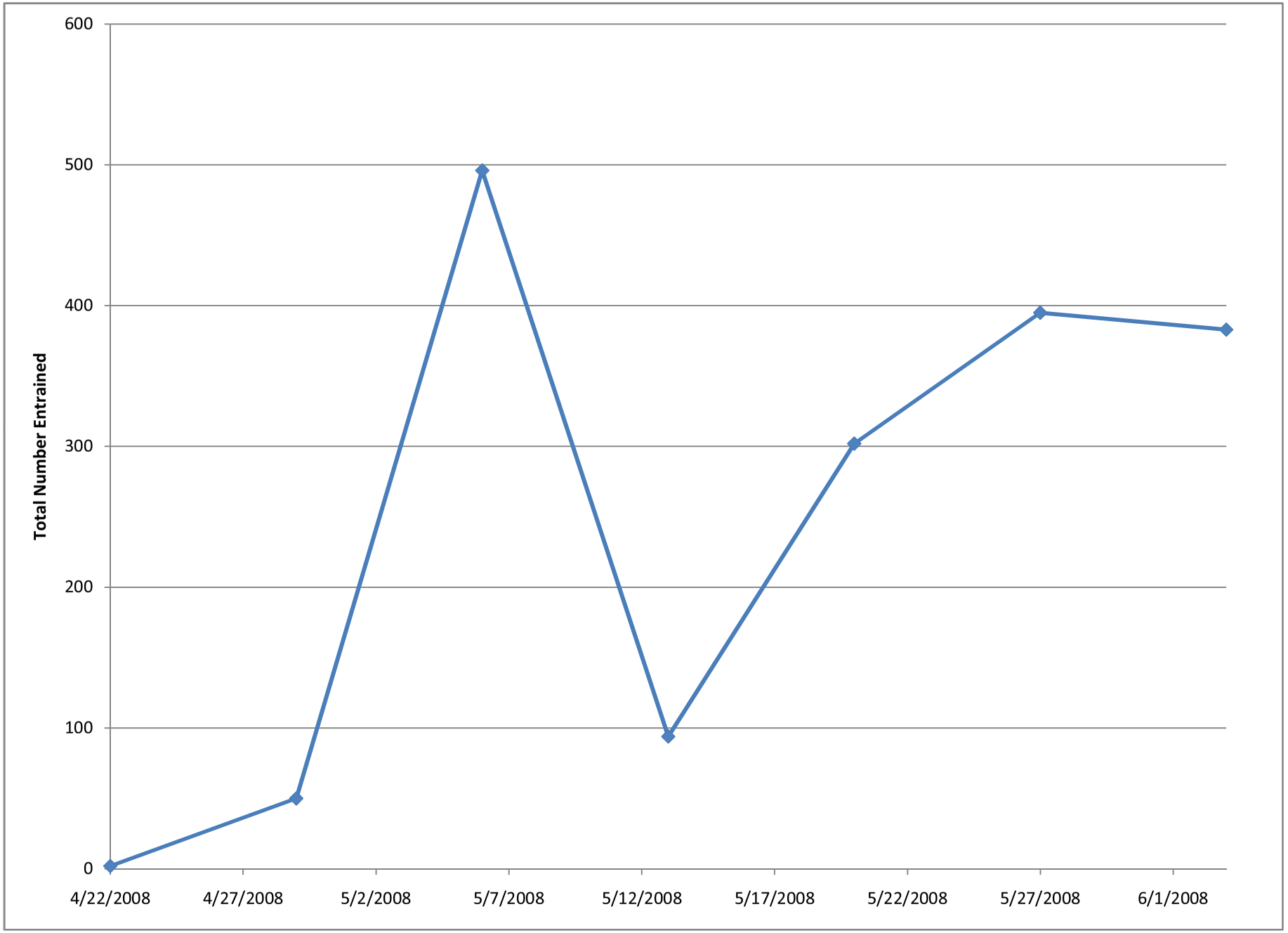

Figure 3. Total number of fish collected in entrainment samples at the SSES CWS, April 22 to June 4, 2008.

Table 1. Total number of fish and crayfish collected in impingement samples at the SSES CWS, April 22 to August 12, 2008.

Taxon	Total Number	Percent Composition
brown trout	1	1
channel catfish	13	16
Orconectes sp.	50	62
northern hog sucker	1	1
rock bass	5	6
smallmouth bass	2	2
tessellated darter	6	7
yellow bullhead	1	1
yellow perch	2	2
Total	81	100

Table 2. Length range of fish impinged at the SSES CWS, April 22 to August 12, 2008.

	Total Length (mm)	
Taxon	Minimum	Maximum
brown trout	292	
channel catfish	67	112
northern hog sucker	381	
rock bass	68	220
smallmouth bass	93	132
tessellated darter	44	73
yellow bullhead	218	
yellow perch	92	120

Table 3. Total number of each life stage of fish collected in entrainment samples from SSES CWS from April 22 to June 4, 2008. A total of 14 entrainment samples was collected.

	Life Stage					Percent
Taxon	Unknown	Yolk-sac larvae	Post yolk-sac larvae	Yearling	Total	Composition
banded darter	0	0	0	2	2	0.1
common carp	161	4	169	0	334	19.4
chain pickerel	0	1	1	0	2	0.1
Cyprinidae	0	20	7	0	27	1.6
Percidae	3	0	1	0	4	0.2
quillback	190	202	423	0	815	47.3
smallmouth bass	0	0	1	0	1	0.1
tessellated darter	0	0	0	1	1	0.1
unidentified fish	7	0	0	0	7	0.4
unidentified darter	31	228	27	0	286	16.6
walleye	0	6	31	0	37	2.1
white sucker	0	11	157	0	168	9.8
yellow perch	0	4	34	0	38	2.2
Total	392	476	851	3	1,722	