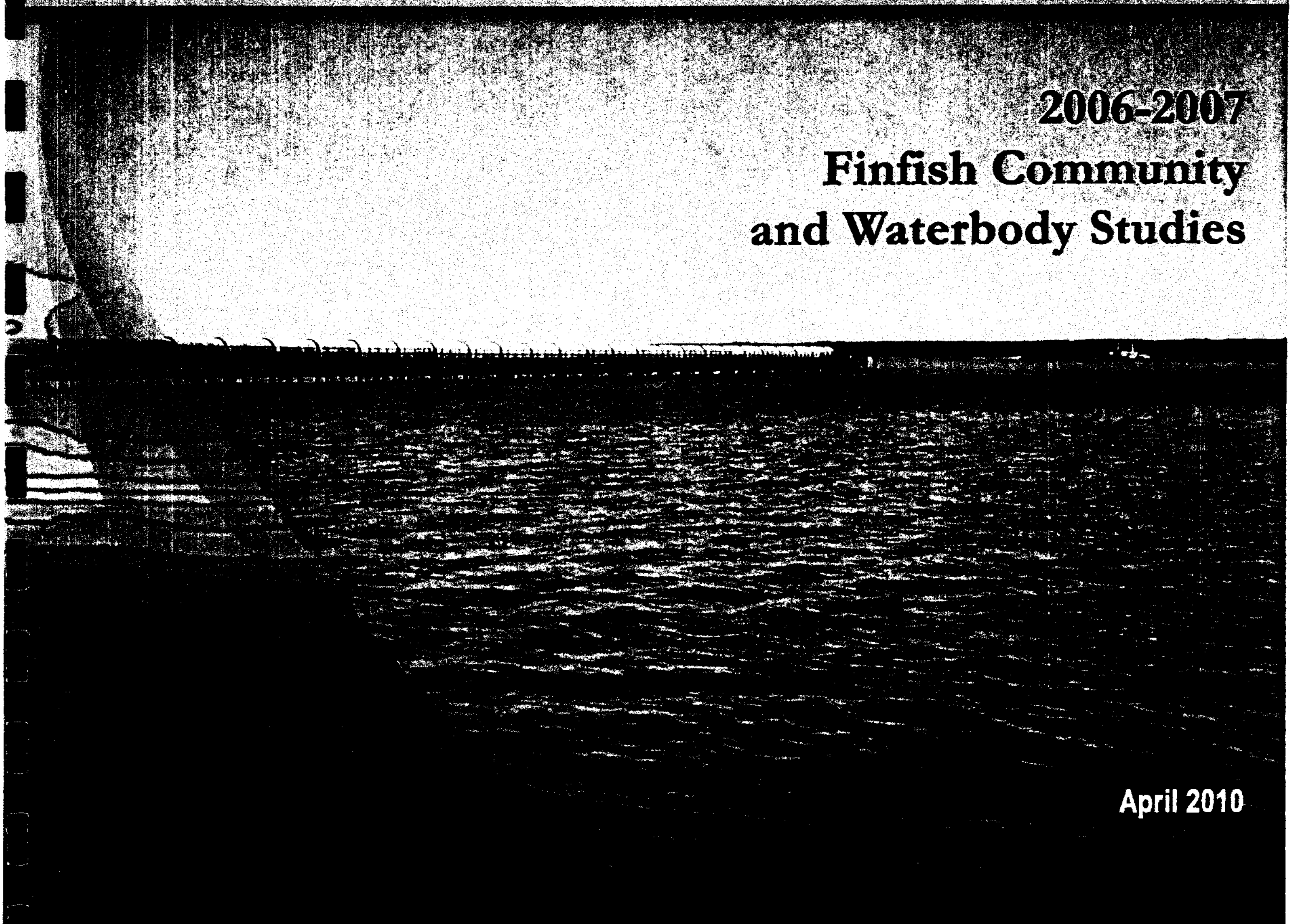
AES

GREENIDGE GENERATING STATION



2006-2007 Finfish Community and Waterbody Studies

April 2010

HDR

AES GREENIDGE GENERATING STATION

2006-2007 FINFISH COMMUNITY AND WATERBODY STUDIES

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1.0 INTRODUCTION

AES Greenidge Generating Station (hereafter AES Greenidge) is a coal-fired facility located on the western shore of Seneca Lake in Yates County, New York. During 2006 and 2007, when the most recent biological and waterbody studies were conducted, AES Greenidge consisted of two generating units (Units 3 and 4) that began operating in the 1950's and had a combined generating capacity of 161-megawatts (MW). At that time the station's once through condenser cooling water system had a maximum flow of 125.4 thousand gallons per minute (kgpm) and provided cooling water for both Units 3 and 4. A NYS Department of Environmental Conservation (DEC) Consent Decree required that Unit 3 shut down, repower, or be retrofitted with air emission controls after 31 December 2009. With consideration of the cost of the air emission controls, and additionally the potential for expensive modifications to the cooling water intakes to satisfy 6NYCRR §704.5 and Clean Water Act §316(b), AES chose to retire Unit 3 from service on December 31, 2009. The current generating capacity for the single unit in operation at AES Greenidge (Unit 4) is 107 MW with a once through cooling water maximum flow of 91.2 kgpm. As was done prior to the retirement of Unit 3, cooling water is drawn from Seneca Lake through offshore intake pipes and discharged into the Keuka Outlet through a discharge canal upstream of Seneca Lake.

AES Greenidge operates under State Pollutant Discharge Elimination System (SPDES) permit number NY 0001325, with a 1 February 2010 Effective Date (EDP). Section B (Biological Monitoring Requirements) of the permit calls for AES to submit a series of reports demonstrating how they will meet the requirements of 6NYCRR §704.5 and Clean Water Act §316(b). These reports are identified in Biological Requirements 1 through 6 in the permit. Biological Requirement 1, the *Impingement and Entrainment Characterization Study (IECS)*, is to be submitted to DEC by EDP plus three months, or 1 May 2010. This report, which is one of three appendices to the *IECS* (HDR 2010) to be submitted to meet Biological Requirement 1, details the methods and results of biological and physical sampling conducted in Seneca Lake during 2006 and early 2007. Biological sampling involved trawl, beach seine and hydroacoustic sampling. Waterbody sampling included water quality, bathymetric and hydrodynamic studies conducted in the vicinity of the station's cooling water intake. AES Greenidge entrainment and concurrent Seneca Lake ichthyoplankton sampling (HDR 2010, Appendix I) and AES Greenidge impingement sampling (HDR 2010, Appendix II) are covered in separate reports.

1.1 Background

1.1.1 Station Location and Description

AES Greenidge is located in Yates County, New York on the western shoreline of Seneca Lake (Figure 1a). AES Greenidge is a steam electric generating station which consisted of three coal-fired boilers and two turbine generators (Units 3 and 4) at the time that the 2006-2007 facility and waterbody studies were conducted. As mentioned in the introduction, with consideration of the cost of the air emission controls and the potential for expensive modifications to the cooling water intakes to satisfy 6NYCRR §704.5 and Clean Water Act §316(b), AES chose to retire Unit 3 from service on December 31, 2009. Notably, two generating units (Units 1 and 2) and associated boilers were also removed from service in 1985.

The maximum dependable capacity (gross) of Unit 3 was 54 MW. This unit was equipped with two circulating water pumps with a maximum intake capacity of 34.2 kgpm (Figure 1b). The generating capacity of Unit 4 is 107 MW. Cooling water is supplied to Unit 4 by three circulating pumps of which only two are typically operated outside of the summer months. The third pump is operated during summer months and acts as a backup during the remainder of the year. The maximum cooling water intake capacity of Unit 4 is 91.2 kgpm. As a result, at the time the 2006 and 2007 studies were conducted the maximum combined output capacity at AES Greenidge was 161 MW with a maximum circulating cooling water intake capacity of 125.4 kgpm. AES Greenidge uses once-through condenser cooling. Water is withdrawn from Seneca Lake and is discharged into the Keuka Outlet through a discharge canal (Figure 1b inset). The discharge canal, which is 900-feet long, empties into the Keuka Outlet 700-feet upstream from Seneca Lake.

Unit 3 was serviced by two intake pipes which lie on the lake bottom. A 6-foot-diameter pipe extends 550 feet offshore to a water depth of approximately 8 feet and an 8-foot-diameter pipe extends 710 feet offshore to a water depth of approximately 10 feet (Figure 1c). A steel cage, consisting of 1/2-inch bars on 12-inch centers, covers each intake pipe opening to screen out large debris. At the shoreline, the 6-foot and 8-foot pipes are joined into 5-foot and 6-foot diameter concrete pipes, respectively, which extend to the chlorination building. The pipes then combine into a single intake tunnel (seven feet in diameter) that leads to the traveling screens. Trash racks, composed of 1/4-inch bars on 3-inch centers are located 7 feet in front of the traveling screens. The traveling screens consist of wire panels with 3/8-inch square open mesh, and were operated automatically by a system of pressure differential controls. During the fall and spring, traveling-screen operation was generally continuous; whereas during the summer and winter, operation was usually at intervals of two or three hours. Fish and debris collected on the traveling screens were washed to a discharge tunnel and ultimately discharged to the thermal discharge canal. While these piping and screening infrastructural components are still in place at the facility, they are now only used to support the service water pumps (refer to the last paragraph in this section for a discussion of the service water system).

A third intake pipe, which supplies condenser cooling water to Unit 4, is elevated on wood pilings and extends from the pumphouse to a point 650-feet offshore (water depth of approximately 11 feet, Figure 3). The pipe opens facing downward and is surrounded by a 27-foot by 27-foot steel structure composed of 3/16-inch bars on 6-inch centers. The condenser cooling water is conveyed to Unit 4 through a 7-foot diameter concrete pipe which is reduced to four, 4-foot diameter pipes before entering the pump house and supplying each circulating water pump. The circulating water is recombined after leaving the pump house, first in a 5-foot diameter pipe and then a similarly sized concrete tunnel, and conveyed to the powerhouse and Unit 4. The Unit 4 intake relies on suction to convey water from the lake, through the elevated intake pipe, and on to the circulating water pumps. This configuration does not allow for traveling screens, or any other technology, that would interrupt the suction upstream of the circulating water pumps. Reversing valves on the condenser automatically wash out any debris and fish that might accumulate on the condenser tube face The Unit 4 cooling water is introduced to the discharge canal via a 7-foot by 10- foot concrete tunnel where it enters the Keuka Outlet. All debris and fish that are removed from the condenser tube face during backwash events exit the facility via the discharge.

Service water is supplied to AES Greenidge by four house service water pumps (rated at 550 gpm per pump), two hydrogen cooling pumps (rated at 120 gpm per pump), and a dual Hydro-jet Pump (rated at 1,300 gpm). All service water is withdrawn from the Unit 3 intake prior to the circulators such that service water withdrawals are in addition to circulating water pump withdrawals. The Unit 3 intake is also equipped with a fire pump that is for emergency use only. If operated, the fire pump would withdraw water from the discharge, after the circulating water pumps and thus not add to the total volume withdrawn by the facility. No service water pump withdraws water from the Unit 4 intake. All of the Unit 3 service water pumps were operational prior to the shutdown of Unit 3 and are currently in operation. Intermittent operation of the traveling screens is required as a part of the service water supply. There is no detailed record of service water use available for the facility.

1.1.2 Source Water Body

Seneca Lake is the second longest lake in the Finger Lakes, measuring 35.1 miles north to south. The Lake is 3.2 miles at its greatest width, with an average width of 1.9 miles. At its deepest point it is 651 feet deep, with an average depth of 290 feet. The surface area of the lake is 66.3 square miles. Seneca Lake is the second deepest lake in the country and contains the largest volume of all the Finger Lakes at over 4.2 trillion gallons of water. This glacial lake lies in a long, narrow valley between ridges which reach up to 900 feet above sea level. The ridges are the highest toward the southern end of the lake where the terrain is somewhat mountainous. The shoreline is well-developed and generally smooth, except for deltas formed by tributaries (NYSEG 1977).

The bottom of the lake drops off precipitously from the east and west shores and is relatively uniform and symmetric around the lake centerline. The northern and southern ends at Geneva and Watkins Glen, respectively, are relatively shallow with depths to about 18 feet. Depths of 500 feet or more are found in the central Lake area from 3.5 miles north of AES Greenidge to 3.5 miles north of Watkins Glen (NYSEG 1977). The drainage basin of the lake, which is a long narrow valley, is 50 miles long and 10 miles wide, and covers an area of 707 square miles. This includes the Keuka Lake drainage basin, which drains into Seneca Lake via the Keuka Outlet.

Traditionally, lake trout, smallmouth bass and yellow perch have been the mainstay of the Seneca Lake fishery. In the decades since the first survey of the lake in 1927, other species have also contributed prominently, including rainbow trout, brown trout, landlocked Atlantic salmon, northern pike and largemouth bass. Alewives, known to be abundant in Seneca Lake at the time of the first survey, and smelt, introduced in 1909, have provided a dependable forage base for salmonids. Seneca Lake's fishery has benefited greatly in recent years from steady annual stockings of hatchery-reared lake trout, brown trout and landlocked salmon.

1.2 Objectives

The objective of this report is to characterize the abundance and temporal and spatial distribution of the finfish community in Seneca Lake in the vicinity of AES Greenidge using a variety of sampling methods, including bottom and pelagic trawls, hydroacoustic monitoring, and beach seines. Additionally, physical conditions are characterized through water quality, bathymetric and hydrodynamic surveys conducted in the vicinity of the station.

2.0 METHODS

2.1 Finfish Community Studies

The finfish community in the vicinity of AES Greenidge was sampled using bottom and pelagic trawls, beach seines and hydroacoustic monitoring. Biological monitoring was conducted weekly from April through October 2006 near the AES Greenidge intake pipes.

2.1.1 Bottom/Pelagic Trawl Sampling

Bottom/pelagic trawl sampling was conducted once a week at AES Greenidge from April through October 2006. Trawling efforts focused on sampling the 30-foot depth contour. During the initial survey, two bottom trawl transect locations were established parallel to the shore and within one half mile of the existing Unit 3 intake pipes as stipulated in the scientific collecting permit; one to the north and one to the south. During this initial survey, however, it was found that the bathymetry in the vicinity of the two selected locations was not ideal for bottom trawl sampling. A steep drop-off exists near the 30-foot contour at the north location and a shallow area near the south location. Due to the drop-off, the north station was established due east of the Unit 3 intake in a flat bottom area in approximately 20 feet of water. At the south transect location, the available bottom trawl area was extremely limited due to a shallow spit of land, so the sample transect was established in deeper water (approximately 60 feet), and a fixed frame pelagic trawl was towed at mid-water along the slope to sample the 30-foot depth stratum (Figure 1). Also note that during times of high submerged aquatic vegetation (SAV) growth, the north transect bottom trawl was changed to a pelagic trawl, with the depth set to skim the top of the SAV. In total, 20 bottom trawls and 39 pelagic trawls were conducted at AES Greenidge in 2006 (Table 1).

2.1.1.1 16-foot Bottom Trawl Sampling Gear and Protocol

A 16-foot semi-balloon otter trawl with 1½-inch stretch mesh body and 1¼-inch stretch mesh cod-end fitted with an inner liner of ¼-inch stretch nylon mesh was used to sample the north transect location in April, May, June, the first three weeks of July, and in October. The head of the trawl was fixed to two 24-inch by 12-inch trawl doors fitted with a shoe runner and chain bridle. Each chain bridle was equipped with a swivel that attached to a 40-foot leg line. The two leg lines then came to a swivel and common tow line.

The bottom trawl was deployed using an 18-foot center console vessel with an outboard engine. During the sample, tow velocity and depth were monitored to ensure that the trawl was fishing properly. Bottom trawls were towed for five minutes using a stopwatch at a speed of 180 cm/sec over the bottom. Speed was measured using a General Oceanics (GO) Model 2031 electronic flowmeter coupled to a GO Model 2135 readout. GPS coordinates were recorded at the beginning and end of each tow. Upon retrieval, contents of the net were emptied and fish and decapods were placed in a bucket of ambient lake water for processing. If there was damage to the net, loss of sample, or if the trawl did not fish properly, then the tow was deemed invalid and the tow was repeated.

All fish and decapods collected were identified to the lowest practical taxonomic level. For each sample, up to 100 randomly selected live and fresh dead from each species collected were measured for total length to the nearest millimeter. The remaining live and fresh dead were enumerated and released, if alive. Representative specimens from certain species were preserved in 10% Formalin and returned to the laboratory to establish an AES project-wide reference collection, which was maintained for identification and verification purposes.

Water quality parameters were recorded at the end of each tow. Recorded parameters included at surface, mid-water and bottom water temperature (°C), mid-water dissolved oxygen (mg/L), and mid-water specific conductivity (µS/cm).

2.1.1.2 4-foot by 6-foot Fixed Frame Pelagic Trawl Sampling Gear and Protocol

A 4-foot by 6-foot fixed frame pelagic trawl with 5/16-inch bar mesh and ¼-inch cod end liner was used to sample the south transect in each month of sampling as well as the north transect during the last week of July and throughout August and September. Cable bridles made of 3/8-inch steel attached on both sides of the frame and were connected to 20-foot leg lines to a swivel and common tow line. Two 5-kg depressors were attached to the bottom of the frame for weight and two floats were used to maintain sample depth in the water column and avoid catching the bottom when first deployed. A GO Model 2030 mechanical flowmeter was fixed in the center of the frame to calculate sample volume.

The pelagic trawl was deployed using an 18-foot center console vessel with an outboard engine. Before sampling began, background current was measured and noted. During the sampling, tow velocity, depth, and tow cable angle were monitored to ensure that the trawl was fishing properly and at the correct depth. Pelagic trawls were towed for five minutes using a stopwatch at a speed of 135 cm/sec. Speed was measured using a General Oceanics (GO) Model 2031 electronic flowmeter coupled to a GO Model 2135 readout. GPS coordinates were recorded at the beginning and end of each tow. For pelagic trawls, the sample start time began when the trawl reached the desired depth. At the completion of the tow, the trawl was retrieved and the total revolutions on the mechanical flowmeter (used to calculate sample volume) were recorded. Upon retrieval, contents of the net were emptied and fish and decapods were placed in a bucket of ambient lake water for processing. If there was damage to the net, loss of sample, or if the trawl did not fish properly, then the tow was deemed invalid and the tow was repeated. All fish and decapods collected were identified to the lowest practical taxonomic level. For each sample, up to 100 randomly selected live and fresh dead from each species collected were measured for total length to the nearest millimeter. The remaining live and fresh dead were enumerated and released, if alive.

Similar to the bottom trawl sampling, water quality parameters were recorded at the end of each pelagic trawl tow. Recorded parameters included at surface, mid-water and bottom water temperature (°C), mid-water dissolved oxygen (mg/L), and mid-water specific conductivity (μS/cm).

2.1.1.3 Data Analysis

Gear-, taxon- and month-specific catch per unit effort (CPUE) was calculated from trawl collections. CPUE was calculated as the sum of the organisms collected in each month divided by the sum of the actual trawl durations times five. Additionally, gear-, taxon- and month-specific length frequencies (using 5-mm length bins) were developed from length data collected during each survey.

2.1.2 Beach Seine Sampling

Beach seine sampling was conducted once a week at AES Greenidge from April through October 2006. Because of dense vegetation and rocky areas on the shoreline, seining locations were somewhat limited and the scientific collecting permit stipulated that sampling be limited to within half a mile on either side of the Unit 3 intake. Consequently, two sampling locations were established on the shoreline due west of the Unit 3 intake pipes; one to the north and one to the south (Figure 1). Each location was sampled once a week for a total of 60 beach seine collections in 2006 (Table 1).

2.1.2.1 Sampling Gear and Protocol

The beach seine used for sampling was a 100-foot by 8-foot seine with ¼-inch H-Delta mesh netting. The ¼-inch border rope had No.13 lead weights placed on the bottom every 12 inches and SB-4 sponge floats placed on the top every 18 inches. Eight-foot jack poles were affixed to each end. An 18-foot center console vessel was used to assist in fishing the net. The boat was brought to shore and one member of the crew disembarked with one jack pole and placed it firmly at the shoreline. GPS coordinates were then recorded and the boat was slowly backed off shore to the maximum extent of the seine. The seine was then brought slowly back to shore in an arc with the bottom of the jack pole as close to the substrate as possible. The second crew member disembarked at the shoreline and the seine was hauled into shore. Captured fish and decapods were then placed in a bucket filled with ambient lake water for processing. All fish and decapods collected were identified to the lowest practical taxonomic level. For each sample, up to 100 randomly selected live and fresh dead from each species collected were measured for total length to the nearest millimeter. The remaining live and fresh dead were enumerated and released, if alive.

Water quality measurements were taken at mid-depth approximately 50-feet offshore in the area of the seine haul. Recorded parameters were temperature (°C), dissolved oxygen (mg/L), and specific conductivity (µS/cm).

2.1.2.2 Data Analysis

Similar to the analysis of trawl data, taxon- and month-specific CPUE was calculated for organisms collected with the beach seine. CPUEs for each species was calculated by dividing the number of organisms collected in each month by the number of beach seines hauls performed. Additionally, taxon- and month-specific length frequencies (using 5-mm length bins) were developed from length data collected during each survey.

2.1.3 Hydroacoustic Monitoring

Hydroacoustic monitoring was conducted in conjunction with both the bottom and pelagic trawling effort from August through October, 2006. Hydroacoustic monitoring involved the use of boat-mounted sonar to measure the distribution and abundance of fish in a target sample area. Hydroacoustic monitoring is generally complementary to other methods of fish sampling (e.g., trawls) in that, while it generally can't distinguish fish at the species level, it can provide information that is difficult to obtain with traditional sampling gears, including fish distribution and abundance throughout the water column.

2.1.3.1 Sampling Gear and Protocol

For this survey, hydroacoustic monitoring was conducted using a Hydroacoustic Technology, Inc. (HTI) Model 241 Portable Split-Beam Echo Sounder with a Model 540 Split-Beam Transducer (200 MHz, 15° conical beam width). The echo sounder was run by a laptop computer using HTI's Windows XP® based interface. The transducer was towed alongside the sampling vessel via a Model 624 Tow Fin.

Prior to beginning each trawl transect, the tow fin, with attached transducer was deployed over the side of the vessel and set at the proper sampling attitude. Data collection began when the trawl gear was deployed. Trawl start and end time and coordinates were noted on the data sheet for post-processing of hydroacoustic data. During the trawl, when possible, real-time monitoring of the hydroacoustic trace was conducted to note any possible targets located within the transect. After trawl gear was returned to the vessel, data collection for hydroacoustics was stopped and the tow fin was returned to the vessel.

2.1.3.2 Data Analysis

Hydroacoustic data collected during sampling was processed using HTI's Echoscape software. Echoscape is a Microsoft Windows based post processing, target tracking and database conversion program which reads the files created by the echosounder during data collection. The files created by the echosounder include RAW files (untracked individual echo data), ECH files (tracked individual echo data), FSH files (tracked fish data), BOT files (bottom and location data) and INT files (simultaneous echo integration data). All files were combined in a Microsoft Access database and displayed in Echoscape.

During preliminary data analysis, it was noted that due to the nature of the collected data, echo integration would be used to determine density estimates (number of fish per m^3) as there were very few individually tracked targets and instead numerous aggregations of small fish. Echo integration converts the raw voltages from fish echoes into numbers that are proportional to fish abundance (HydroacousticTechnology, Inc 2005). As a result, only the RAW, BOT and INT files were used in the post-processing of the data. Using the Echoscape software, the data was processed to remove extraneous data outside of the five minute trawl window and exclude integrations which included bottom echoes and false bottom echoes, and any non-target echoes. Bookmarks were added to show the limits of the data within the trawl period. A manually traced bottom line was added to exclude structure from the integration. After all non-target integration cells were removed, a small number of individual targets were selected and saved as "typical" targets. These targets were then used to scale the data for abundance estimates using the "A constant." The A constant is dependant on hydroacoustic system and fish parameters. The system parameters include transmit and receive settings, calibration data, frequency, and other factors and are typically fixed throughout the survey. The fish parameters are based on the selected "typical" target fish (HydroacousticTechnology, Inc, 2005).

Hydroacoustic data were used to evaluate the distribution of fish by one-meter depth intervals over the period of sampling. The number of fish per cubic meter of water was estimated for each tow using echo integration analysis (HydroacousticTechnology, Inc, 2005). Density values were then averaged by one-meter depth strata over each bottom depth encountered during sampling (4-31 meters). The result is estimated fish abundance (number per m^3) throughout the water column over the continuum of bottom depths sampled (up to 31 meters).

2.2 Waterbody Studies

In addition to the biological monitoring described above, a physical sampling component included water quality, bathymetric and hydrodynamic surveys conducted in the vicinity of the station.

2.2.1 Water Quality Survey

As described in Section 2.1, water quality sampling was conducted in conjunction with the April through October trawl and beach seine sampling. Water quality measurements were taken at the end of each trawl tow at surface, mid-water and bottom depths and at mid-depth approximately 50-ft from shore for the beach seines. For the month of November when there was no finfish sampling, water quality surveys were performed at each trawl and beach seine sampling station to provide data for the month. The following parameters were measured with the appropriate meters or backup wet chemistries: temperature (°C), dissolved oxygen (mg\L), and specific conductivity (µS/cm). Quality control for water quality samples was performed with a second meter or by taking wet chemistries at least once per 12-hour period.

2.2.2 Bathymetric Survey

2.2.2.1 Sampling Gear and Protocol

A bathymetric survey was conducted on June 26 and 27, 2007 using an Innerspace Technologies Model 455 single frequency precision depth sounder, a Trimble Pathfinder Pro XRS precision GPS navigation system, and Hypack Hydrographic Survey software installed on a field-rugged notebook computer. This survey system was deployed aboard an 18-foot, shallow-draft, outboard-powered boat. The GPS antenna was positioned vertically above the submerged depth sounder transducer to assure positioning accuracy.

Following standard bathymetric survey practice, the field crew performed a "bar check" calibration of the depth sounder at the beginning and end of each day of surveying. The "bar check" adjusts for density-dependent changes in the speed of sound in water. In freshwater, density changes are primarily due to temperature changes.

Prior to data collection, a survey "track line" grid was established using standard GIS technology. The track line spacing was set at a relatively close spacing of 50 ft to provide a relatively high degree of resolution. The track line plan also included "tie lines" oriented at approximately 90 degrees to the main track line pattern, to provide quality control on the results (Figure 2 and 3). The track line plan was transferred to the Hypack on-board software for navigation purposes.

The survey sounder was programmed to take a sounding approximately once every second, which, combined with the boat speed, meant that a sounding was taken every 3 to 5 feet along each track line. The Innerspace Technologies Model 455 sounder uses a 200 kilo-Hertz transducer, which typically provides the depth to the first return, representative of the bottom of the water body. Each data point consisted of the time, state-plane coordinates and depth sounding. The GPS and Hypack components were set up to record data coordinates in the New York State Plane Central Zone Coordinate System (NAD1983). The GPS was set to improve accuracy through use of real-time, differential technology, based on site-specific corrections broadcast from the OmniSTAR North American Satellite.

Once all the sounding data were collected, the Hypack Hydrographic Survey Software was used to process and filter data collected during each survey. Several site specific factors can introduce error into the raw sounding data. The tools in Hypack allow these errors to be minimized. The two major sources of error are submerged aquatic vegetation (SAV) and heave. The presence of dense patches of SAV can cause the echo sounder to return the top of the SAV instead of the actual lake bottom. Heave errors are introduced when waves (typically caused by wind) tip the survey vessel back and forth causing an undulating pattern in the soundings. In both of these cases, processing tools in Hypack along with a careful review of each transect and tie line will minimize or reduce these errors.

Meteorological data were collected for the dates on which the survey occurred from the Northeast Regional Climate Center (Penn Yan station). These data include air temperature, wind speed and direction and water surface elevation for the lake (from USGS station 04232400, Seneca Lake at Watkins Glen). Because windy conditions were experienced during the survey, the survey crew adjusted their operating procedures to minimize the effect of the wind.

2.2.2.2 Data Analysis

Once the raw data were processed using Hypack, a base map was established using shoreline data downloaded from the US Geological Survey (USGS) National Hydrography Data (NHD) set. The processed bathymetric survey data were superimposed on the base map, using the New York State Plane Central Zone Coordinate System (NAD 1983) associated with each sounding. This established the basic dataset for the remainder of the analyses.

A computerized data manipulation and contouring software package called Surfer was then used to process the data and develop the contour maps for the survey area. With the built-in Kriging methodology, Surfer was used to sub-sample the irregular track line data and create a regular grid of sounding data. Surfer then produced contours of the depths determined by the sounder. Finally, lake level data were used to calculate a bottom elevation for the survey area.

2.2.3 Hydrodynamic Survey

Current profile velocity data was acquired on June 26 and 27, 2007 using a Teledyne RD Instruments 1200 kHz Acoustic Doppler Current Profiler (ADCP). The ADCP is an acoustic instrument which uses the "Doppler Effect" to measure current velocity. The ADCP exploits the Doppler Effect by emitting a sequence of high frequency pulses of sound that scatter off of moving particles in the water. The ADCP has four acoustic transducers that emit and receive acoustical pulses from four different directions. Current direction is computed by using trigonometric relations to convert the return signal from the four transducers to 'earth' coordinates (north-south, east-west and up-down). Because the emitted sound extends from the survey vessel down to the bottom of the lake, water velocities are measured at multiple depths simultaneously, thereby providing an instantaneous profile of water velocity and direction as a function of depth. Prior to the survey the ADCP was calibrated according to the manufacturer's recommendations. For this survey, the ADCP was configured to collect data in 0.5 meter bins. Figure 4 shows the location of the ADCP transects.

3.0 RESULTS

The results from the various biological monitoring and waterbody studies conducted at AES Greenidge in 2006-2007 are presented below.

3.1 Finfish Community Studies

This section provides results from April through August 2006 finfish community sampling. When counting the number of distinct taxa collected, general taxonomic designations at the generic, familial, and higher taxonomic levels were dropped if there was one valid lower-level designation for that group. For example, if *Lepomis* species, *Lepomis gibbosus*, and *Lepomis macrochirus* were all identified in the collections, *Lepomis* species was not counted in the total number of distinct taxa.

3.1.1 Bottom/Pelagic Trawl Sampling

3.1.1.1 Species Composition

A total of 151 organisms, distributed among 9 distinct fish taxa and crayfish, were collected in the bottom trawl sampling effort during 2006 (Table 2 and Figure 5) as compared to just two organisms from two taxa collected in the pelagic trawls during the same period (Table 3 and Figure 6). *Lepomis* species, most likely comprised of pumpkinseed and bluegill, accounted for 56.3% of the total collected in the bottom trawls (Table 2) and 50% of the pelagic trawl collections (Table 3). Slimy sculpin (9.3% of the total), banded killifish (7.9%), bluntnose minnow (6.6%), and tessellated darter (6.0%) were the next most abundant taxa identified in the bottom trawl collections (Table 2). The remaining species, including crayfish (the only decapod taxa collected), each accounted for less than 5% of the total bottom trawl collection. One banded killifish accounted for the remaining 50% of the total pelagic trawl collection (Table 3).

3.1.1.2 Catch Per Unit Effort (CPUE)

The average monthly CPUE for each of the 9 fish taxa and crayfish collected in 2006 are presented in Table 4 (bottom trawls) and Table 5 (pelagic trawls). *Lepomis* species represented the three highest monthly bottom trawl CPUEs at 14.34 in October, 3.60 in May and 2.25 in April. Banded killifish and slimy sculpin had a CPUE of 2.00 in April and May, respectively, while monthly CPUE values for these and all other species were below 1.40 in all other months. The only monthly CPUEs greater than zero in the pelagic trawl were *Lepomis* species in April (0.25) and banded killifish in August (0.10).

Total monthly CPUE peaked in October at 17.0 fish per tow and was comprised primarily of Lepomis species. May was second highest at 10.4 fish per tow distributed across seven fish taxa and crayfish, the most taxa of any month sampled. April and June total CPUE values were intermediate at 6.3 and 2.9, respectively. No fish were collected in the three bottom trawl tows conducted in July. Figures 7 through 13 provide monthly CPUE values of numerically abundant taxa collected in bottom and pelagic trawls and beach seines (i.e., numerically dominant taxa were those that contributed 5% or more of the total catch in at least one gear). For bottom trawls, numerically dominant species included are *Lepomis* species (Figure 10), slimy sculpin (Figure 13), banded killifish (Figure 9), bluntnose minnow (Figure 8), and tessellated darted (Figure 15). Bluegill (Figure 12) and pumpkinseed (Figure 11), the two species expected to make up the *Lepomis* species category, are also included. For pelagic trawl, single banded killifish (Figure 9) and *Lepomis* species (Figure 10) represented the entire catch and therefore were the numerical dominants in this gear.

3.1.1.3 Length Frequency

The minimum, average and maximum total length of each taxa collected in the bottom trawl program are presented in Table 6. Total length measurements ranged from a 26 mm *Lepomis* species to a 170 mm yellow perch. The three largest species collected in bottom trawls as determined by average total length were alewife (151 mm, N=1), yellow perch (126 mm, N=3) and slimy sculpin (73 mm, N=14). Conversely, the three smallest species collected were crayfish (37 mm, N=3), *Lepomis* species (39 mm, N=85) and banded killifish (43 mm, N=12). Only two fish were collected in the pelagic trawls: a 24 mm *Lepomis* species and a 46 mm banded killifish (Appendix B).

Monthly length frequency distribution for the numerically abundant taxa, which includes *Lepomis* species, slimy sculpin, banded killifish, bluntnose minnow, and tessellated darter, collected in bottom trawls are contained in Figures 16 through 20, respectively. *Lepomis* species (Figure 16) were all less than 60-mm. Age-0 and small age-1 *Lepomis* species appear to be present during April through June. By October, age-0 fish, measuring between 20 and 60 mm, appear to have dominated the catches. Slimy sculpin collected in bottom trawls ranged from 50-90 mm in April through June collections and are therefore expected to be comprised of age-1 and older fish (Figure 17). Banded killifish collected in April ranged from 30 to 60 mm and appear to be age-1 fish (Figure 18). Age-0 banded killifish ranged from 30 to 50 mm dominated the collections in October. Bluntnose minnow ranged in length from 30 to 50 mm in April and May collections and are expected to be age-1 fish (Figure 19). Collections in October included 40 to 49 mm and 80 to 89 mm bluntnose minnow indicating that age-0 and age-1+ were present in the sampling location during this time of year. Tessellated darter ranged from 40 to 70 mm over the course of sampling. These fish are likely age-1+ fish during April through June with age-0 and age-1+ fish in October.

Catches in the pelagic trawl were too low (2 individuals) for the development of length-frequency distributions.

3.1.2 Beach Seine Sampling

3.1.2.1 Species Composition

A total of 15,873 organisms, distributed among 26 fish taxa and crayfish, were collected in the beach seine sampling effort during 2006 (Table 7). Numerically dominant species included bluntnose minnow (43.7% of the total), banded killifish (20.5%), spottail shiner (10.4 %), *Ameiurus* species (bullhead species; 6.8%), and pumpkinseed 5.5%. Each remaining taxa contributed less than 1% to the total except brown bullhead (2.9%), largemouth bass (2.3%), *Lepomis* species (1.3%), smallmouth bass (1.2%), alewife (1.1%), and bluegill (1.0%). The only decapod identified in the samples was crayfish, which accounted for 0.6% of the total collected.

3.1.2.2 Catch Per Unit (CPUE)

The monthly average catch per seine haul for each of the 26 fish taxa and crayfish collected in 2006 is presented in Table 8. Bluntnose minnow represented the two highest monthly average beach seine catches at 472.6 in August and 233.5 in September. There were three other monthly average catches above 100: spottail shiner in June (180.25), *Ameiurus* species in August (107.6) and banded killifish in September (102.13). Except for June through August and October banded killifish average catches, which ranged from 55.05 to 76.00, all other catch per seine haul values were below 50.

Total monthly catches peaked in August at 815.1 fish per haul, comprised primarily of bluntnose minnow. Taxa richness also peaked during this month at 20 taxa collected. September was second highest at 383.9 fish per haul distributed across 16 taxa, the second most taxa of any month sampled. September collections were comprised primarily of bluntnose minnow followed by banded killifish. June total catch was the only other monthly average catch above 300. April and May had both the lowest average total catch (1.1. and 8.7, respectively) and the lowest number of taxa collected (6 and 9, respectively)

Figures 7 through 13 provide monthly CPUE values of numerically abundant taxa collected in bottom and pelagic trawls and beach seines (i.e., numerically dominant taxa were those that contributed 5% or more of the total catch in at least one gear). For beach seines, numerically dominant species included: bluntnose minnow (Figure 8), banded killifish (Figure 9), spottail shiner (Figure 14), *Ameiurus* species (Figure 7), and pumpkinseed (Figure 11).

3.1.2.3 Length Frequency

The minimum, average and maximum total length of each taxon collected in the beach seines are presented in Table 9. Total length measurements ranged from an 11 mm Cyprinidae to a 490 mm smallmouth bass. The three largest species collected in beach seines as determined by average total length were chain pickerel (385 mm, N=1), gizzard shad (290 mm, N=3) and northern pike (287 mm, N=2). Conversely, the three smallest species collected were Cyprinidae (17 mm, N=4), Spotfin Shiner (37 mm, N=41) and white sucker (38 mm, N=16).

Monthly length frequency distributions for the numerically abundant taxa (i.e., bluntnose minnow, banded killifish, spottail shiner, *Ameiurus* species, and pumpkinseed) in beach seine collections are contained in Figures 22 through 26, respectively. Bluntnose minnow (Figure 22) typically measured 40 to 80 mm in most months. Individuals smaller than 40 mm (not less than 10 mm) were present in July and August while individuals greater than 80 mm (not exceeding 89 mm) were present in relatively low numbers in September only. It appears that age-1+ fish were present during all months of sampling while age-0 became susceptible to the gear in July and were collected as late as October. Banded killifish (Figure 23) displayed a pattern similar to bluntnose minnow. Individuals captured ranged in length from approximately 10 to 99 mm over the period of sampling. Age-1+ appeared to be present during all months of sampling while age-0 first appeared in July, were abundant in August, and remained in the sampling area through the end of sampling in October. Spottail shiner (Figure 24) generally ranged from 30 to 79 mm during April through October sampling. A single large individual (120 – 129 mm) was collected in July. Age-0 spottail shiner may be present as early as June and were relatively abundant in August. *Ameiurus* species (Figure 25) were collected and measured in August only. Individuals measured from 30 to 79 mm and were most likely age-0 fish. Pumpkinseed (Figure 26) showed a relatively wide range of lengths (40 – 229 mm) present in the sample area. June collections showed a number of age classes present (age-0 to possibly age-3), likely related to the spawning season. July through September collections showed abundance lengths from 60 to 110 mm likely representing primarily age-1+ and some age 0 fish.

3.1.3 Hydroacoustic Monitoring

Results from the hydroacoustic monitoring are presented in Figure 27. The figure shows the distribution of fish, expressed as number per cubic meter, throughout the water column for bottom depths ranging from 4 to 31 meters averaged over the August through October samples. Generally, fish density increased as bottom depth increased over the range of depths sampled. Fish also tended to be most abundant from approximately one to five meters above the bottom at most depths. The extent to which the observed distribution was affected by avoidance of the boat and trawl gear is unknown, although it would be expected to lessen with increased water depth.

3.2 Waterbody Studies

Results from the water quality, bathymetric and hydrodynamic surveys are provided below.

3.2.1 Water Quality Survey

Water temperature, dissolved oxygen and conductivity readings collected during the nearshore beach seine (Figures 28 through 30) and offshore trawl surveys (Figures 31 through 33) are provided below as average monthly values with associated minimum and maximum values. Data were collected over the April through November period, 2006.

3.2.1.1 Water Temperature

Nearshore water temperatures (Figure 28), which were measured at mid-water approximately 50-ft from shore, generally followed a bell-shaped curve from April through November. Temperatures were lowest in April and November, averaging approximately 10 to 12 °C, and highest in July and August, averaging approximately 26 to 27 °C. The range of water temperature values measured within each month was highest in spring and early summer (approximately 10 °C) and least in fall (< 5 °C). Offshore water temperatures (Figure 31) followed a similar distribution, but were lower than nearshore temperatures at all depths sampled (i.e., surface, mid-water and bottom). Offshore water temperatures average approximately 5 and 10 °C during April and November, respectively. Highest average water temperatures occurred offshore occurred during July and August at all depths. Average temperatures during these months ranged from a low of approximately 18 °C in bottom water in July to almost 25 °C at the surface in August. The range of values associated with bottom water temperatures, particularly in the summer, was the greatest of the three depths sampled. This was likely the result of the variable bottom depths at the bottom and pelagic trawl stations.

3.2.1.2 Dissolved Oxygen

Monthly average nearshore and offshore mid-water dissolved oxygen concentrations are provided in Figures 29 and 32, respectively. Average monthly dissolved oxygen concentrations at both locations ranged between 8 and 14 mg/L over the April through November sampling period. Both areas displayed a general trend of decreasing dissolved oxygen levels over April through August and an increasing trend from August through November. The range of values measured in each month was noticeably larger in the nearshore than offshore, as a result the nearshore had both higher and lower measured dissolved oxygen.

3.2.1.3 Conductivity

Monthly average nearshore and offshore mid-water specific conductivity values (µS/cm) are provided in Figures 30 and 33, respectively. Average monthly values were similar in both areas during April through August when measured values were generally between 650 and 700 µS/cm. September through November average specific conductivity values were relatively low within their respective time series and tended to have a larger range of values relative to other months. The nearshore values measured during these months were particularly low and variable. Average specific conductivity values in both areas increased abruptly from October to November.

3.2.2 Bathymetric Survey

Meteorological conditions during June 27 and 28, when bathymetric and hydrodynamic sampling was conducted, are contained in Figure 34. These data include air temperature, wind speed and direction and water surface elevation for the lake. Windy conditions were experienced during the survey such that the survey crew adjusted their operating procedures to minimize the effect of the wind. Figure 35 shows the contoured depths and Figure 36 shows the elevations. Figure 37 show the depth profile along the center of the survey area. The study area is characterized by a gentle slope (approximately 1%) from the shore line out to approximately 1600 feet before a sharp drop off. At 1600 feet from shore the bottom begins to drop off rapidly from approximately 20 feet to 180 feet.

3.2.3 Hydrodynamic Survey

Figures 38 though 41 show the depth averaged velocity magnitude (plot a) and the depth averaged current direction (plot b) along transects 1 through 4, respectively. Current velocities were typically less than 0.2 and ranged from 0.0 to 1.0 m/s while current directions varied from 0 to 360 degrees. No apparent flow pattern was discernible from the collected data. While these hydrodynamic conditions are representative of the period of sampling (June), currents would likely vary seasonally due to ice, wind, and lake turn over.

4.0 SUMMARY OF FINDINGS

4.1 Finfish Community Studies

A total of 150 finfish, distributed among nine distinct taxa, and three crayfish were collected in the bottom and pelagic trawl surveys conducted at AES Greenidge from April through October 2006. Trawl surveys focused on sampling the 30-foot depth contour in Seneca Lake in the vicinity of the station's cooling water intake pipes which lie in approximately 15 feet of water. Bottom trawl collections were comprised primarily of *Lepomis* species (56%), most likely bluegill and pumpkinseed, slimy sculpin (9%), banded killifish (8%), bluntnose minnow (7%), and tessellated darter (6%). The remaining taxa each accounted for less than 5% of the total bottom trawl collection. By contrast, only two organisms were collected in the pelagic trawls: one banded killifish and one *Lepomis* species.

During the same sampling period, a total of 15,781 finfish, distributed among 26 finfish taxa, and 92 crayfish were caught in the beach seine collections at AES Greenidge. Bluntnose minnow (44%), banded killifish (21%), and spottail shiner (10%) dominated the collections, accounting for nearly 75% of the finfish total. *Ameiurus* species (bullheads) and pumpkinseed contributed 7% and 6%, respectively with the remaining species each contributing less than 3% to the total.

As would be expected, some variation in the types of species collected and the number of individuals and their total lengths were observed when comparing the nearshore data collected using beach seines to the offshore data collected along the 30-foot contour using both bottom and pelagic trawls. The offshore samples were composed primarily of *Lepomis* species as compared to bluntnose minnow, banded killifish and spottail shiner which dominated the nearshore collections. Slimy sculpin was the only species collected offshore that was not collected in the nearshore beach seines. Conversely, 17 distinct taxa including four species of shiner, brown bullhead, both largemouth and smallmouth bass, and a Salmonidae were collected only in the nearshore samples

During trawl sampling events from August through October, hydroacoustic monitoring was conducted concurrently using a HTI Model 241 Portable Split-Beam Echo Sounder with a Model 540 Split-Beam Transducer. Data were processed using HTI's Echoscape software to evaluate the distribution of fish abundance by one-meter depth intervals. Hydroacoustic techniques offer the potential to non-invasively sample large areas over short temporal periods and have been successfully utilized to quantify fish populations in a variety of aquatic environments (Nealson and Brundage 2007). Hydroacoustic monitoring does have limitations, however, including decreased ability to sample boundary areas such as the near bottom where acoustic return from the bottom substrate may mask the return from fish lying on or very close to the lake floor. In addition, for the technique to be successful, fish must reflect sufficient acoustic energy to be resolved above ambient background noise levels (Nealson and Brundage 2007). The primary reflecting structure in most fish is the swim bladder, accounting for approximately 90% of the echo (Johannesson and Mitson 1983; Murphy & Willis 1996), thus precluding certain species of non-ray finned fish that do not possess swim bladders. Hydroacoustic data also generally cannot be used to differentiate among species, particularly in relatively species rich areas, such as Seneca Lake.

Results from the hydroacoustic survey provide information on the distribution of fish within the water column. In the areas sampled with this gear, it was determined that fish density was generally greater at deeper water depths and the fish were typically most abundant from one to five meters off the bottom. The extent to which avoidance of the sampling vessel and trawl gear affected the estimated fish abundance in shallow water depths is unknown but may be significant.

Finfish species representing at least 5% of the total catch in at least one of the three finfish sampling gears are discussed below based on the data collected during 2006 finfish community sampling.

4.1.1 *Ameiurus* spp.

There are four species of bullhead within the genus *Ameiurus* that have been documented in New York State waters: white catfish, black bullhead, yellow bullhead and brown bullhead (Smith 1985). Of these, only yellow and brown bullhead are likely to occur in Seneca Lake. Beach seine collections documented the presence of *Ameiurus* species and brown bullhead. No *Ameiurus* species were collected in bottom and pelagic trawl sampling.

Ameiurus species contributed 6.8% to the total beach seine collections while brown bullhead contributed just 2.9%. *Ameiurus* species were collected in August only, the month of highest brown bullhead catch. Like most catfishes, brown bullhead spawn in late May and June (Smith 1985). Growth in the first year of life is rapid with fish reaching 50 to over 100 mm by the end of the summer (Smith 1985). The *Ameiurus* species collected during August ranged from approximately 30 to 80 mm and therefore can all be assumed to be age-0 fish. Collectively, these data indicate that rearing of *Ameiurus* yearlings occurs in shoreline areas in the vicinity of AES Greenidge. Older juveniles and adults were not encountered in any of the April through October finfish sampling efforts, suggesting they are not particularly abundant in the area.

4.1.2 Bluntnose Minnow

Bluntnose minnow is a relatively ubiquitous minnow in New York State. The species is found in a variety of lotic and lentic habitats and is often very abundant in weedy areas (Smith 1985). Bluntnose minnow was the most abundant species in beach seine collections (comprising 43.7% of the total collected) and the fourth most abundance in bottom trawl collections (comprising 6.6% of the total collected). No bluntnose minnow were collected in the pelagic trawl sampling.

Bluntnose minnow spawn from the end of May to near the end of July and sometimes later in the summer in cold water habitats (Smith 1985). The species is relatively small, with few individuals exceeding 100 mm. Bluntnose minnow collected in beach seines were typically 40 to 80 mm in most months. Individuals smaller than 40 mm (not less than 10 mm) were present in July and August while individuals great than 80 mm (not exceeding 89 mm) were present in relatively low numbers in September only. It appears that age-1+ fish were present during all months of sampling while age-0 became susceptible to the gear in July and were collected as late as October. Bluntnose minnow collected in bottom trawl collections ranged in length from 30-50 mm in April and May and are therefore likely age-1+ fish. Collections in October included 40 to 49 mm and 80 to 89 mm bluntnose minnow suggesting age-0 and age-1+ fish were present in the sampling location during this time of year. Overall, bluntnose minnow appears to be an important species in the nearshore finfish community in the vicinity of AES Greenidge. The species is relatively abundant in both juvenile and adult life stages. Bluntnose minnow is an important food source for higher trophic level fishes including certain gamefish.

4.1.3 Banded Killifish

Banded killifish, a member of the topminnow family, are common and found throughout New York State. Banded killifish are commonly found in weedy shallows of lakes and ponds and slower moving parts of streams. This species is relatively small, rarely growing longer than 120 mm. Banded killifish spawn in spring with reports as late as September (Froese and Pauly 2007). By the end of their first summer, age-0 fish reach a length of between 20 and 58 mm (Smith 1985). Banded killifish were the second most abundant species in beach seine samples (20.5% of the total collected) and third most abundant in the bottom trawl samples (7.9% of the total collected).

Banded killifish were collected during each month of sampling of the beach seine (April through October). Catches were lowest in April and May and highest in August and September. Individuals captured ranged in length from approximately 10 to 99 mm over the period of sampling. Age-1+ appeared to be present during all months of sampling while age 0 first appeared in July, were abundant in August, and remained in the sample area through the end of sampling in October. Banded killifish were only collected during April and October with the bottom trawl (based on April through July and October samples) and only in August with the pelagic trawl (April through October sampling). Catches in the pelagic trawl were too small to be informative about length frequency. In bottom trawl samples, fish collected in April appear to be age-1+ fish ranging from 30-60 mm. Age-0 banded killifish were comprised the collection in October and ranged from 30-50 mm. There was no catch in the intervening months suggesting the fish were inshore during this period. Banded killifish are a particularly abundant species in the vicinity of AES Greenidge and use both nearshore and offshore habitats throughout their life history.

4.1.4 *Lepomis* spp., Pumpkinseed and Bluegill

The genus *Lepomis* is composed of 11 sunfish species, of which six are found in New York State (Smith 1985). Of the six species found in New York State, pumpkinseed and bluegill are the most common. Early life stage of these two species can be difficult to differentiate in the field. As a result, field sampling programs often report catches for *Lepomis* species, pumpkinseed and bluegill. During 2006 sampling, these three categories accounted for 1.3%, 5.5% and 1.0% of the total beach seine collections and 56.3%, 0.0% and 2.0% of bottom trawl collections, respectively. A single *Lepomis* species was collected in the pelagic trawl accounting for 50% of the total catch in that gear. No other *Lepomis* species were collected.

Lepomis species were moderately abundant in bottom trawls in April through June and most abundant in October, while bluegill were present only in May. Beach seine catches were different in that no *Lepomis* species, bluegill or pumpkinseed was collected in April and May. Catches of pumpkinseed, the most abundant of the three taxa in beach seine catches peaked in July and August. *Lepomis* species peaked in August while bluegill has similar high catch values in July and August.

Length frequencies were created for pumpkinseed collected in beach seines and *Lepomis* species in bottom trawls based on a greater than 5% of total catch criterion. Pumpkinseed collected in beach seines displayed a relatively wide range of lengths (40 – 229 mm) present in the sample area. June collections showed a number of age classes present (age 0 to possibly age 3), likely related to the spawning season as both pumpkinseed and bluegill spawn from early to late summer (i.e., as early as May to as late as August). July through September collections showed abundant lengths from 60 to 110 mm likely representing primarily age-1+ and some age 0 fish. In bottom trawls, *Lepomis* species were all less than 60-mm representing the age-0 and age-1 fish that cannot be differentiated as either pumpkinseed or bluegill. Age-0 and small age-1 *Lepomis* species appear to be present during April through June. By October it appears that age-0 fish predominated in the catches, measuring between 20 and 60 mm.

Based on numerical dominance in the trawl collections, *Lepomis* appear to be an important component of the fish community in the vicinity of AES Greenidge. Nearshore areas are used for spawning and rearing of young of these species while it appears that the majority of age-0 *Lepomis* move offshore (~30-foot depth contour) in the fall.

4.1.5 Slimy Sculpin

Slimy sculpin is one of four freshwater sculpin species found in New York State. Slimy sculpin occur in lakes and streams and are associated with bottom habitats. In lakes, slimy sculpin inhabit offshore areas at depth typically over 20 feet and in some waterbodies deeper than 300 feet. Slimy sculpin are small, typically measuring less than 120 mm as adults, and spawn in the spring (Smith 1985).

Consistent with their preference for deep water habitats in lakes, slimy scuplin were only collected in bottom trawl during 2006 sampling. Slimy sculpin accounted for 9.3% of the total collected with that gear and catches were limited to the months of April through June. Slimy sculpin collected in bottom trawls ranged from 50-90 mm in April through June collections and are therefore expected to be comprised of age-1 and older fish.

4.1.6 Spottail Shiner

Spottail shiner is one of the numerous *Notropis* species, or eastern shiners, found in New York State. Spottail shiner are found in a variety of habitats including large lakes and rivers and small streams. Spawning is thought to take place in June or July, typically at the mouth of streams. Adults are small, typically measuring less than 150 mm. Spottail shiner were the third most abundance species in beach seine samples (accounting for 10.4% of the total catch) and seventh in bottom trawl samples (accounting for 3.3% of the total catch).

Spottail shiner were very abundant in beach seines in June with few or no individuals collected in other months. In bottom trawls, individuals were only collected during May. Spottail shiner generally ranged from 30 to 79 mm during April through October sampling, with a single large individual (120 – 129 mm) collected in July. Age-0 spottail shiner may be present as early as June and were relatively abundant in August. Too few individuals were collected in bottom trawls to examine length frequency. Spottail shiner likely represent an important food resource for higher trophic level fishes.

4.1.7 Tessellated Darter

Tessellated darter is one of the numerous *Etheostoma* species, or smoothbelly darters, found in New York State. Tessellated darters are one of the more common of these species and are found throughout the state. This species occurs in both lentic and lotic habitats, but has a preference for quieter areas (Smith 1985). Tessellated darters are relatively small, occasionally reaching 110 mm in length (Frose and Pauly 2007).

Tessellated darter was the fifth most abundant species in bottom trawl collections (contributing 6.0% to the total catch) and 12th in the beach seine collections (contributing 0.7% to the total collected). Tessellated darter were collected in all months of sampling with the bottom trawl except July, with no month standing out as a distinct peak. In beach seine sampling, tessellated darter were collected in every month with peak abundance occurring in August. Tessellated darter ranged from 40 to 70 mm over the course of bottom trawl sampling. Given that tessellated darters are thought to spawn in May and June, these fish appear to be age-1 fish present in the sampling area during April through June with age-0 and age-1 fish present in October. Based on 2006 sampling, it appears that tessellated darter is a moderately abundant species in the vicinity of AES Greenidge.

4.2 Waterbody Studies

The lake bottom in the vicinity of AES Greenidge is characterized by a gentle slope (approximately 1%) from the shore line out to approximately 1600 feet. At 1600 feet from shore the bottom begins to drop off rapidly from approximately 20 feet to 180 feet. Current velocities measured during late June were typically below 0.2 m/s while current directions varied from 0 to 360 degrees. No apparent flow pattern was discernible from the collected data. While these currents are representative of the period of sampling (June), currents would likely vary seasonally due to ice, wind, and lake turn over.

As would be expected in a temperate lake, nearshore and offshore water temperatures generally followed a bell-shaped curve from April through November. Temperatures were lowest in April and November, averaging approximately 5 to 12 °C, and highest in July and August averaging approximately 18 to 27 °C. The range of water temperature values measured within each month was highest in spring and early summer (approximately 10 °C) and least in fall (< 5 °C). Monthly average offshore water temperatures were lower than nearshore temperatures at all depths sampled (i.e., surface, mid-water and bottom).

Dissolved oxygen concentrations in aquatic environments are typically highly variable and are affected by factors such as temperature, salinity, respiration, and photosynthesis of aquatic plants. Low dissolved oxygen content is often an indicator of organic pollution. Certain aquatic organisms, including many fishes, become stressed when dissolved oxygen levels drop below 5.0 mg/L while large fish kills can occur if levels remain below 1-2 mg/L for an extended period. Nearshore and offshore average monthly dissolved oxygen concentrations ranged from 8 to 14 mg/L over the April through November sampling period. Both areas showed a general trend of decreasing dissolved oxygen levels over April through August and an increase from August through November. The range (i.e., minimum and maximum) of values measured in each month was noticeably larger nearshore than offshore. The lowest dissolved oxygen level recorded during the survey was just below 6 mg/L in the nearshore and just below 8 mg/L in the offshore suggesting that dissolved oxygen levels were typically sufficient to support aquatic life.

Specific conductivity is a measure of the flow of electrical current in water made possible by ions in solution. It is an indirect measure of productivity and salinity, reflecting the osmotic concentrations of organic and inorganic solutes. Conductivity is sometimes used as an index of pollution. The specific conductance of water is measured in units of micro-Siemens per centimeter (µS/cm), and its value for drinking water is generally below 750 µS/cm. Average monthly conductivity values were generally between 650 and 700 µS/cm in nearshore and offshore areas during April through August. September through November average conductivity values were relatively low within their respective time series and tended to have a larger range of values relative to other months. The nearshore values measured during these months were particularly low and variable. Average specific conductivity values in both areas increased abruptly from October to November. Despite these fluctuations, measured values of conductivity were within an acceptable range throughout the period of sampling. The recorded values of specific conductivity are consistent with the use of Seneca Lake as a source of municipal water.

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Appendix I. AES Greenidge Generating Station 2006-2007 Entrainment and Ichthyoplankton Studies.

Appendix II. AES Greenidge Generating Station 2006-2007 Impingement Study.

Appendix III. AES Greenidge Generating Station 2006-2007 Finfish Community and Waterbody Studies.

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6.0 TABLES

Table 1 - Number of Sampling Events by Month and Gear Type Conducted in the Vicinity of AES Greenidge Generating Station, 2006

Gear Type	Number of Sampling Events							Total
	Apr	May	Jun	Jul	Aug	Sep	Oct	
100-ft Beach Seine	8	10	8	8	10	8	8	60
16-ft Bottom Trawl	4	5	4	3	0	0	4	20
4 x 6-ft Pelagic Trawl	4	5	4	4	10	8	4	39
Total	**16**	**20**	**16**	**15**	**20**	**16**	**16**	**119**

Table 2 - Number Collected and Percent Composition of Taxa in Bottom Trawl Samples Collected at AES Greenidge Generating Station, 2006

Common Name	Scientific Name	# Collected	Percent of Total
Sunfish Species	*Lepomis* spp.	85	56.3%
Slimy Sculpin	*Cottus cognatus*	14	9.3%
Banded Killifish	*Fundulus diaphanus*	12	7.9%
Bluntnose Minnow	*Pimephales notatus*	10	6.6%
Tessellated Darter	*Etheostoma olmstedi*	9	6.0%
Bluegill	*Lepomis macrochirus*	6	4.0%
Spottail Shiner	*Notropis hudsonius*	5	3.3%
Crayfish	Astacidae	3	2.0%
Pumpkinseed	*Lepomis gibbosus*	3	2.0%
Yellow Perch	*Perca flavescens*	3	2.0%
Alewife	*Alosa pseudoharengus*	1	0.7%
Total Collected		**151**	

Table 3 - Number Collected and Percent Composition of Taxa in Pelagic Trawl Samples Collected at AES Greenidge Generating Station, 2006

Common Name	Scientific Name	# Collected	Percent of Total
Banded Killifish	*Fundulus diaphanus*	1	50.0%
Sunfish Species	*Lepomis* spp.	1	50.0%
Total Collected		**2**	

Table 4 - Monthly CPUE of Taxa Collected in Bottom Trawl Samples at AES Greenidge Generating Station, 2006

Common Name	Scientific Name	CPUE*						
		April	May	June	July	August	September	October
Alewife	*Alosa pseudoharengus*			0.26		No Sampling		
Banded Killifish	*Fundulus diaphanus*	2.00						1.08
Bluegill	*Lepomis macrochirus*		1.20					
Bluntnose Minnow	*Pimephales notatus*	0.75	0.80					0.81
Crayfish	Astacidae		0.60					
Sunfish Species	*Lepomis* spp.	2.25	3.60	1.32				14.34
Pumpkinseed	*Lepomis gibbosus*	0.25	0.40					
Slimy Sculpin	*Cottus cognatus*	0.50	2.00	0.53				
Spottail Shiner	*Notropis hudsonius*		1.00					
Tessellated Darter	*Etheostoma olmstedi*	0.50	0.20	0.79				0.81
Yellow Perch	*Perca flavescens*		0.60					
Total		**6.3**	**10.4**	**2.9**	**0.0**	**NA**	**NA**	**17.0**
Number of Taxa		**5**	**8**	**3**	**0**	**NA**	**NA**	**4**

*blank cells have a value of zero

Table 5 - Monthly CPUE of Taxa Collected in Pelagic Trawl Samples at AES Greenidge Generating Station, 2006

Common Name	Scientific Name	CPUE*						
		April	May	June	July	August	September	October
Banded Killifish	*Fundulus diaphanus*					0.10		
Sunfish Species	*Lepomis spp*	0.25						
Total		**0.2**	**0.0**	**0.0**	**0.0**	**0.1**	**0.0**	**0.0**
Number of Taxa		**1**	**0**	**0**	**0**	**1**	**0**	**0**

*blank cell have a value of zero

Table 6 - Minimum, Average and Maximum Total Length of each Taxa Collected in the AES Greenidge Generating Station Bottom Trawl Program, 2006

Common Name	ScientificName	Length (mm)			Number Measured
		Min	Average	Max	
Alewife	*Alosa pseudoharengus*	151	151	151	1
Banded Killifish	*Fundulus diaphanus*	32	43	54	12
Bluegill	*Lepomis macrochirus*	41	45	52	6
Bluntnose Minnow	*Pimephales notatus*	31	44	80	10
Crayfish	Astacidae	30	37	42	3
Pumpkinseed	*Lepomis gibbosus*	44	51	55	3
Slimy Sculpin	*Cottus cognatus*	50	73	84	14
Spottail Shiner	*Notropis hudsonius*	42	52	60	5
Sunfish Species	*Lepomis* spp.	26	39	52	85
Tessellated Darter	*Etheostoma olmstedi*	43	57	68	9
Yellow Perch	*Perca flavescens*	96	126	170	3

Table 7 - Number Collected and Percent Composition of Taxa in Beach Seine Samples Collected at AES Greenidge Generating Station, 2006

Common Name	Scientific Name	# Collected	Percent of Total
Bluntnose Minnow	*Pimephales notatus*	6,936	43.7%
Banded Killifish	*Fundulus diaphanus*	3,258	20.5%
Spottail Shiner	*Notropis hudsonius*	1,648	10.4%
Bullhead Species	*Ameriurus* spp.	1,076	6.8%
Pumpkinseed	*Lepomis gibbosus*	869	5.5%
Brown Bullhead	*Ameiurus nebulosus*	457	2.9%
Largemouth Bass	*Micropterus salmoides*	369	2.3%
Sunfish Species	*Lepomis* spp.	204	1.3%
Smallmouth Bass	*Micropterus dolomieu*	184	1.2%
Alewife	*Alosa pseudoharengus*	180	1.1%
Bluegill	*Lepomis macrochirus*	163	1.0%
Tessellated Darter	*Etheostoma olmstedi*	106	0.7%
Crayfish	Astacidae	92	0.6%
Brook silverside	*Labidesthes sicculus*	82	0.5%
Rock Bass	*Ambloplites rupestris*	55	0.3%
Carp	*Cyprinus carpio carpio*	47	0.3%
Emerald Shiner	*Notropis atherinoides*	44	0.3%
Spotfin Shiner	*Cyprinella spiloptera*	41	0.3%
Shiner Species	*Notropis* spp.	19	0.1%
White Sucker	*Catostomus commersonii*	16	0.1%
Carps and Minnow	Cyprinidae spp.	5	0.03%
Common Shiner	*Luxilus cornutus*	3	0.02%
Gizzard Shad	*Dorosoma cepedianum*	3	0.02%
Stoneroller	*Campostoma* spp.	3	0.02%
Yellow Perch	*Perca flavescens*	3	0.02%
Eastern silvery minnow	*Hybognathus regius*	2	0.01%
Golden Shiner	*Notemigonus crysoleucas*	2	0.01%
Northern Pike	*Esox lucius*	2	0.01%
Redbreast Sunfish	*Lepomis auritus*	2	0.01%
Chain Pickerel	*Esox niger*	1	0.01%
Trouts and Salmons	Salmonidae	1	0.01%
Total Collected		**15,873**	

Table 8 - Monthly CPUE of Taxa Collected in Beach Seine Samples at AES Greenidge Generating Station, 2006

Common Name	Scientific Name	Catch per Seine Haul*						
		April	May	June	July	August	September	October
Alewife	*Alosa pseudoharengus*			22.50				
Banded Killifish	*Fundulus diaphanus*	0.38	4.20	67.25	55.50	80.60	102.13	76.00
Bluegill	*Lepomis macrochirus*			0.88	8.63	8.10	0.63	0.13
Bluntnose Minnow	*Pimephales notatus*	0.25		4.75	37.25	472.60	233.50	0.50
Brook silverside	*Labidesthes sicculus*		1.20	0.50	2.00	2.60	2.88	0.13
Brown Bullhead	*Ameiurus nebulosus*		0.50	14.38	2.00	31.90		0.25
Bullhead Species	*Ameiurus* spp.					107.60		
Carp	*Cyprinus carpio*				0.38	4.30	0.13	
Carps and Minnows	Cyprinidae spp.					0.40	0.13	
Chain Pickerel	*Esox niger*					0.10		
Common Shiner	*Luxilus cornutus*						0.38	
Crayfish	Astacidae	0.13	0.10			8.90	0.13	
Eastern silvery minnow	*Hybognathus regius*			0.25				
Emerald Shiner	*Notropis atherinoides*				0.50	1.90	0.38	2.25
Gizzard Shad	*Dorosoma cepedianum*	0.13				0.20		
Golden Shiner	*Notemigonus crysoleucas*	0.13						0.13
Largemouth Bass	*Micropterus salmoides*			0.13	1.50	23.50	14.63	0.50
Northern Pike	*Esox lucius*					0.10	0.13	
Pumpkinseed	*Lepomis gibbosus*			14.38	41.00	28.80	17.25	
Redbreast Sunfish	*Lepomis auritus*				0.13	0.10		
Rock Bass	*Ambloplites rupestris*			0.75	1.00	2.90	1.50	
Shiner Species	*Notropis* spp.		0.30			1.60		
Slimy Sculpin	*Cottus cognatus*							
Smallmouth Bass	*Micropterus dolomieu*		0.30	0.25	9.63	8.70	1.88	
Spotfin Shiner	*Cyprinella spiloptera*							5.13
Spottail Shiner	*Notropis hudsonius*		0.70	180.25	6.50	12.10	2.38	0.88
Stoneroller Species	*Campostoma* spp.					0.20	0.13	
Sunfish Species	*Lepomis* spp.				4.50	11.40	5.25	1.50
Tessellated Darter	*Etheostoma olmstedi*	0.13	1.00	1.13	1.63	6.40	0.50	0.63
Trouts and Salmons	Salmonidae spp.		0.10					
White Sucker	*Catostomus commersoni*		0.30	1.50		0.10		
Yellow Perch	*Perca flavescens*				0.38			
Total		**1.1**	**8.7**	**308.9**	**172.5**	**815.1**	**383.9**	**88.0**
Number of Taxa		**6**	**9**	**14**	**15**	**20**	**16**	**11**

*blank cells have a value of zero

Table 9 - Minimum, Average and Maximum Total Length of Each Taxa Collected in the AES Greenidge Generating Station Beach Seine Program, 2006

Common Name	ScientificName	Length (mm)			Number Measured
		Min	Average	Max	
Alewife	*Alosa pseudoharengus*	130	144	160	161
Banded Killifish	*Fundulus diaphanus*	17	62	94	2,000
Bluegill	*Lepomis macrochirus*	42	67	133	163
Bluntnose Minnow	*Pimephales notatus*	14	59	83	1,630
Brook silverside	*Labidesthes sicculus*	18	63	97	82
Brown Bullhead	*Ameiurus nebulosus*	34	170	390	324
Bullhead Species	*Ameiurus* spp.	35	51	73	100
Carp	*Cyprinus carpio*	37	74	284	47
Carps and Minnows	Cyprinidae spp.	11	17	20	4
Chain Pickerel	*Esox niger*	385	385	385	1
Common Shiner	*Luxilus cornutus*	60	83	119	3
Crayfish	Astacidae	19	45	100	91
Eastern silvery minnow	*Hybognathus regius*	63	69	74	2
Emerald Shiner	*Notropis atherinoides*	26	57	77	44
Gizzard Shad	*Dorosoma cepedianum*	203	290	426	3
Golden Shiner	*Notemigonus crysoleucas*	77	111	145	2
Largemouth Bass	*Micropterus salmoides*	28	83	397	369
Northern Pike	*Esox lucius*	252	287	322	2
Pumpkinseed	*Lepomis gibbosus*	42	85	220	867
Redbreast Sunfish	*Lepomis auritus*	167	169	171	2
Rock Bass	*Ambloplites rupestris*	30	58	233	55
Shiner Species	*Notropis* spp.	28	44	65	19
Smallmouth Bass	*Micropterus dolomieu*	25	71	490	184
Spotfin Shiner	*Cyprinella spiloptera*	24	37	62	41
Spottail Shiner	*Notropis hudsonius*	24	52	120	588
Stoneroller Species	*Campostoma* spp.	62	70	79	3
Sunfish Species	*Lepomis* spp.	30	43	72	204
Tessellated Darter	*Etheostoma olmstedi*	29	46	80	106
Trouts and Salmons	Salmonidae spp.	92	92	92	1
White Sucker	*Catostomus commersoni*	17	38	86	16
Yellow Perch	*Perca flavescens*	148	237	295	3

7.0 FIGURES

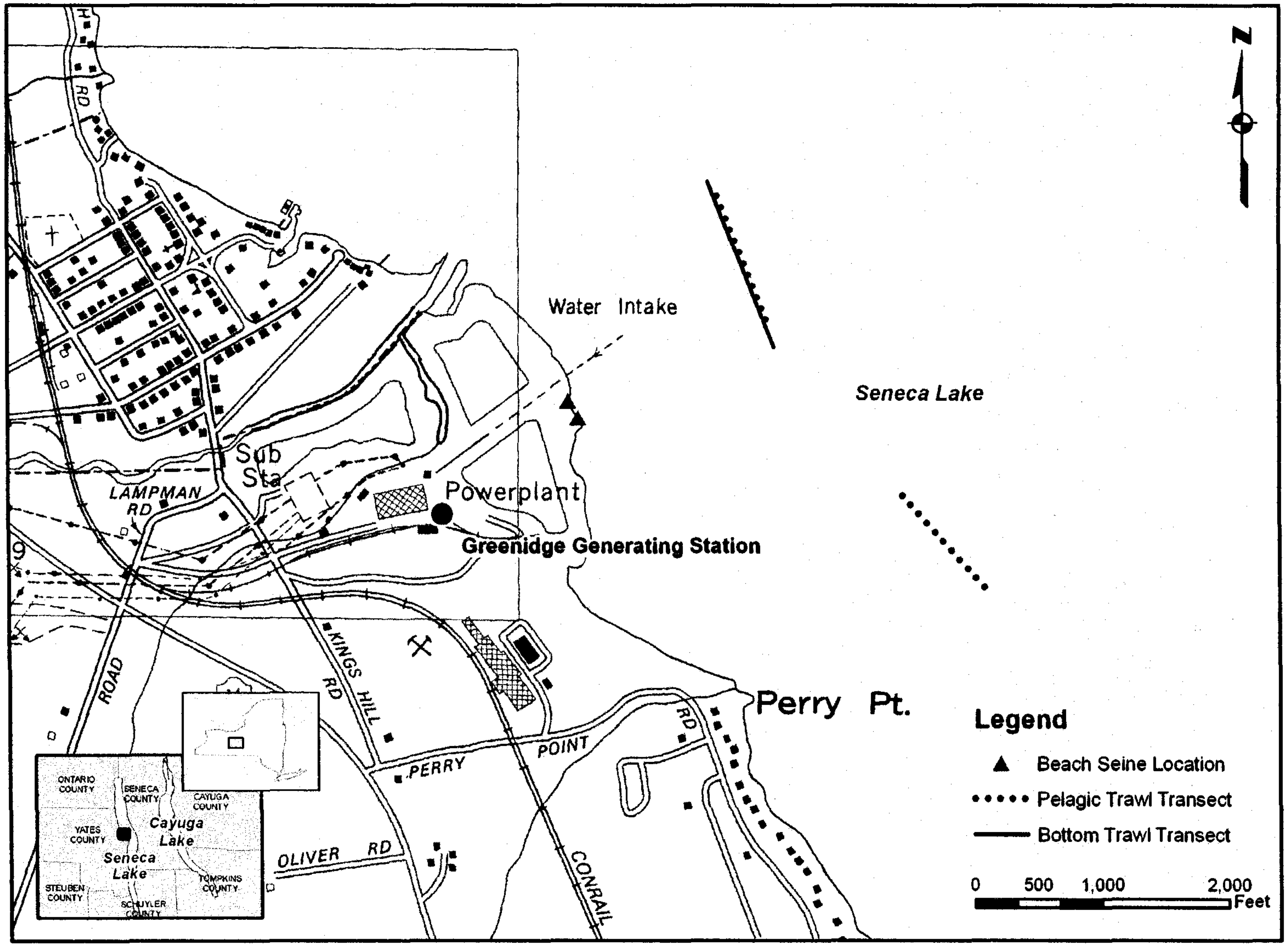


Figure 1a – AES Greenidge Generating Station Finfish Studies Sampling Locations, 2006

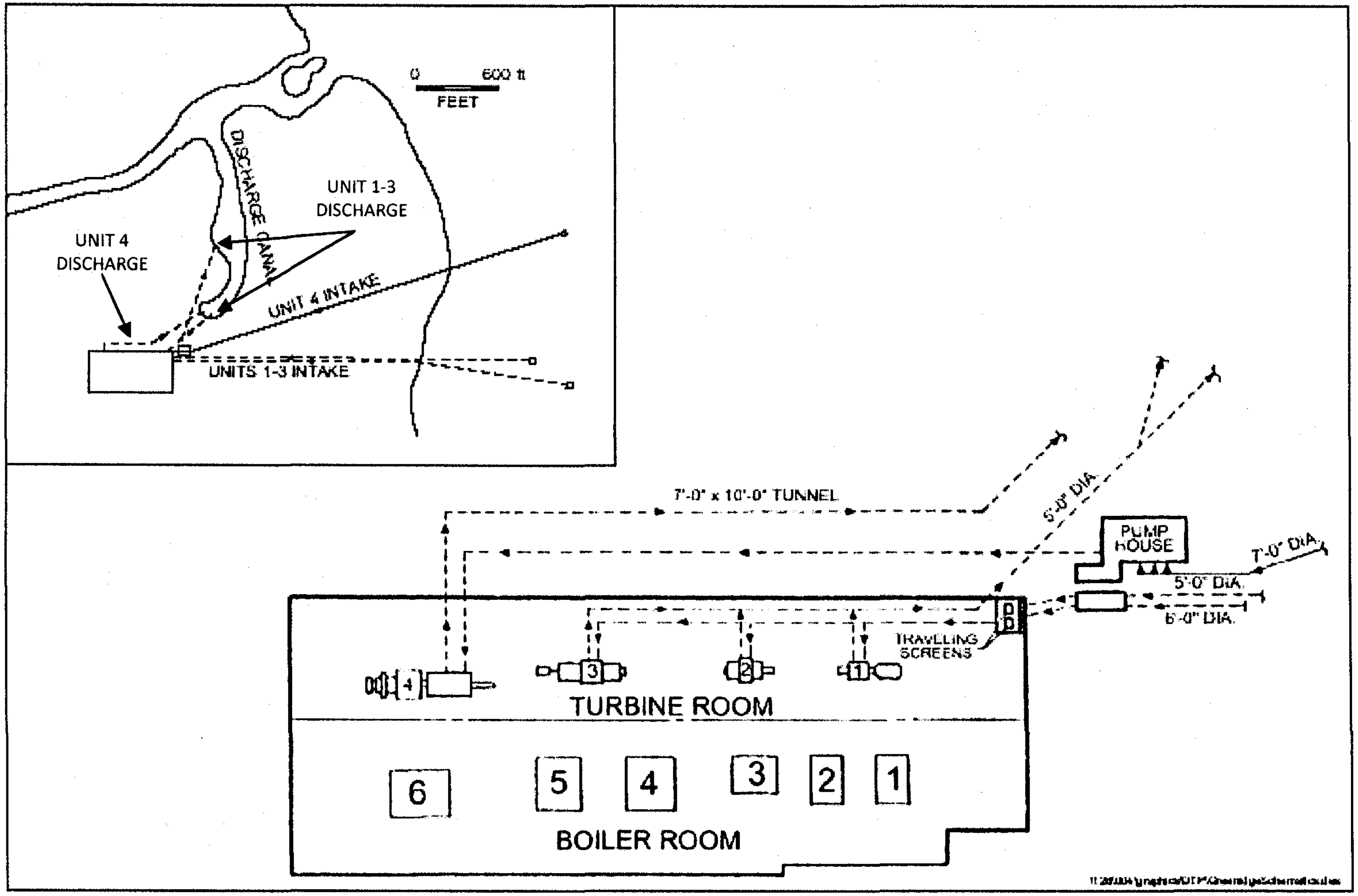


Figure 1b – Routing of Cooling Water Flow through AES Greenidge Generating Station

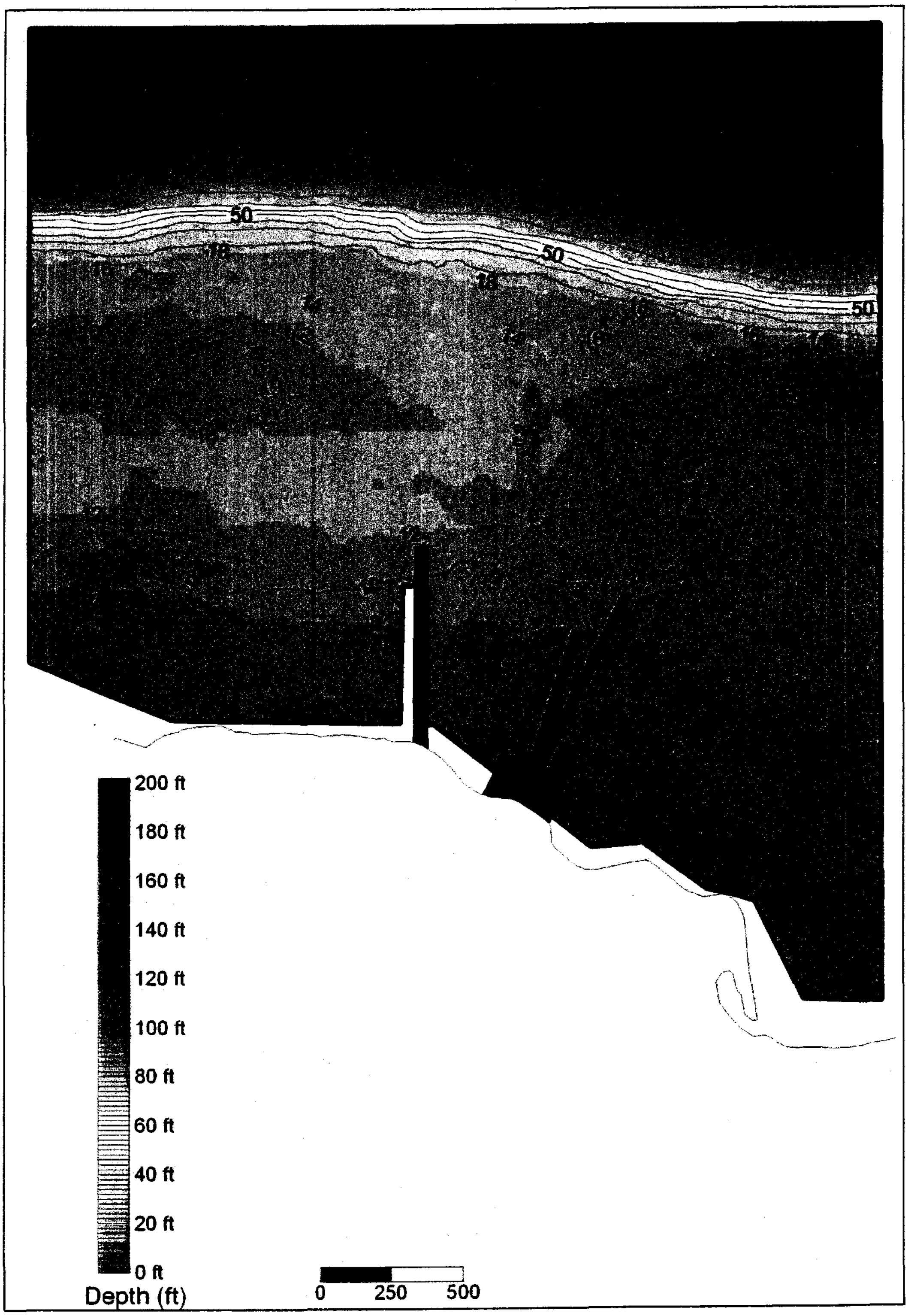


Figure 1c - Bathymetry of Seneca Lake in the Vicinity of AES Greenidge Generating Station Based on 2007 Sampling (Note: average lake surface elevation associated with the hydrographic survey [444.9 ft NGVD29] was very near the 1956-2007 average lake level [444.8 ft NGVD29])

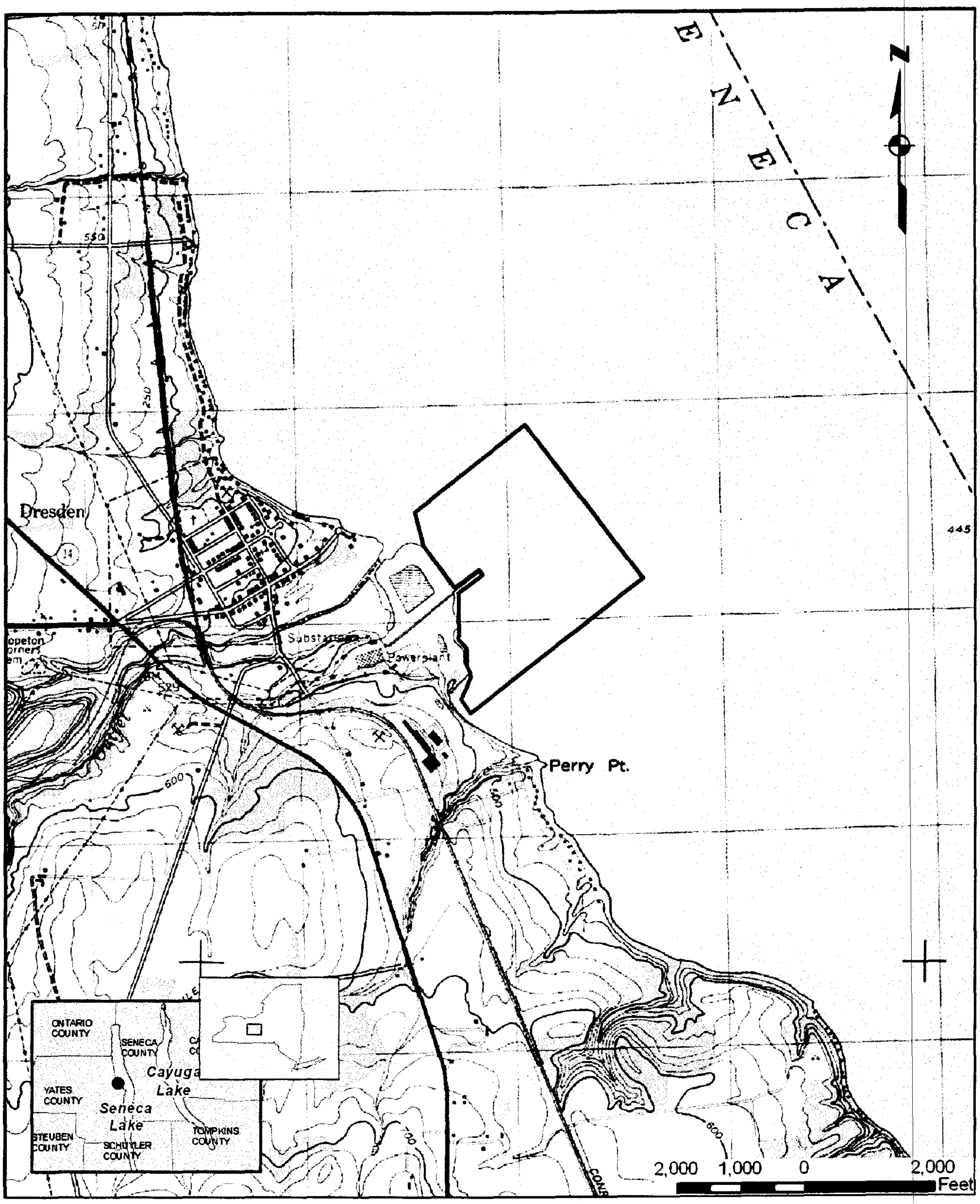


Figure 2 – AES Greenidge Generating Station Bathymetry Survey Area, 2007

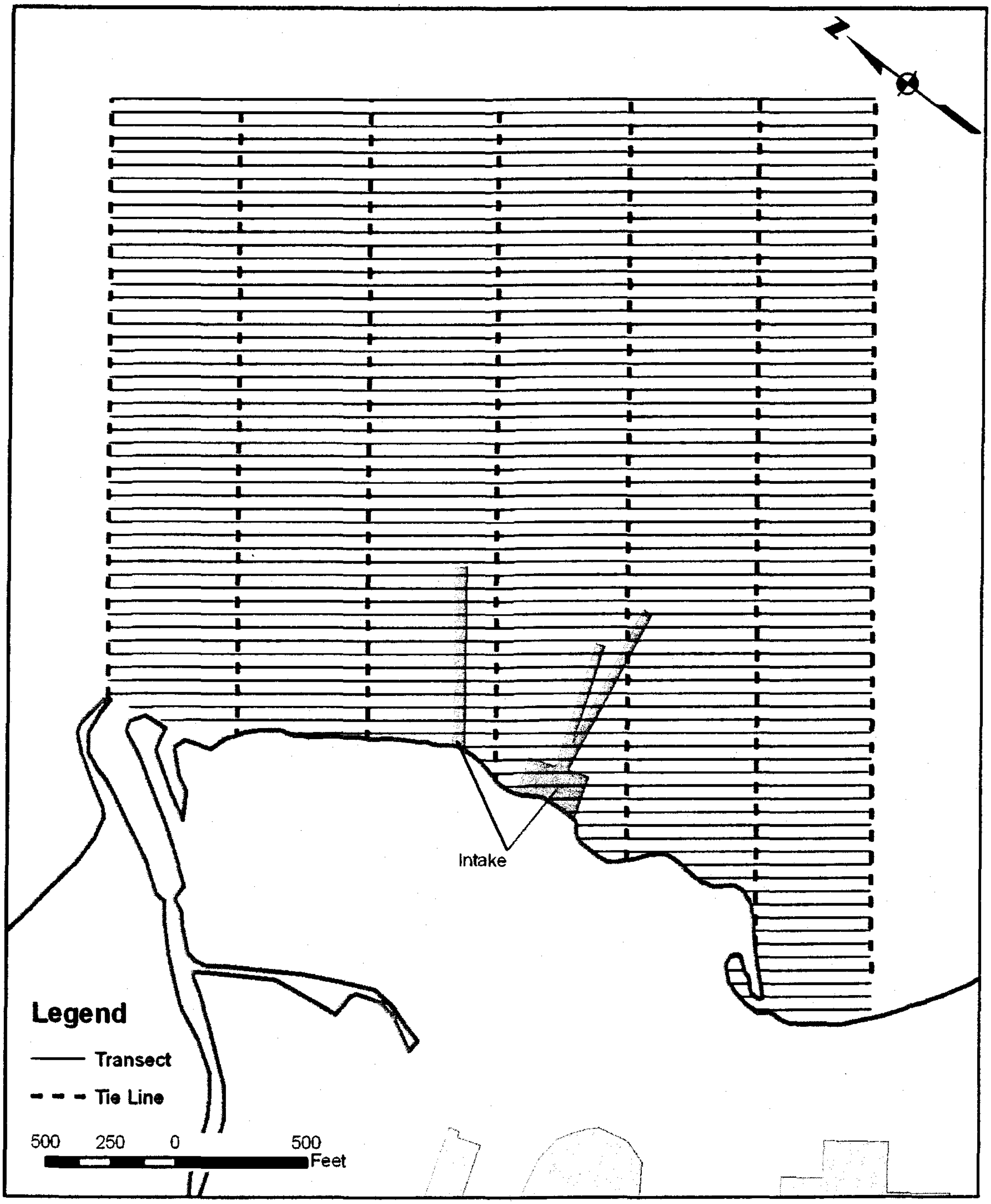


Figure 3 – AES Greenidge Generating Station Bathymetry Survey Track and Tie Line Plan, 2007

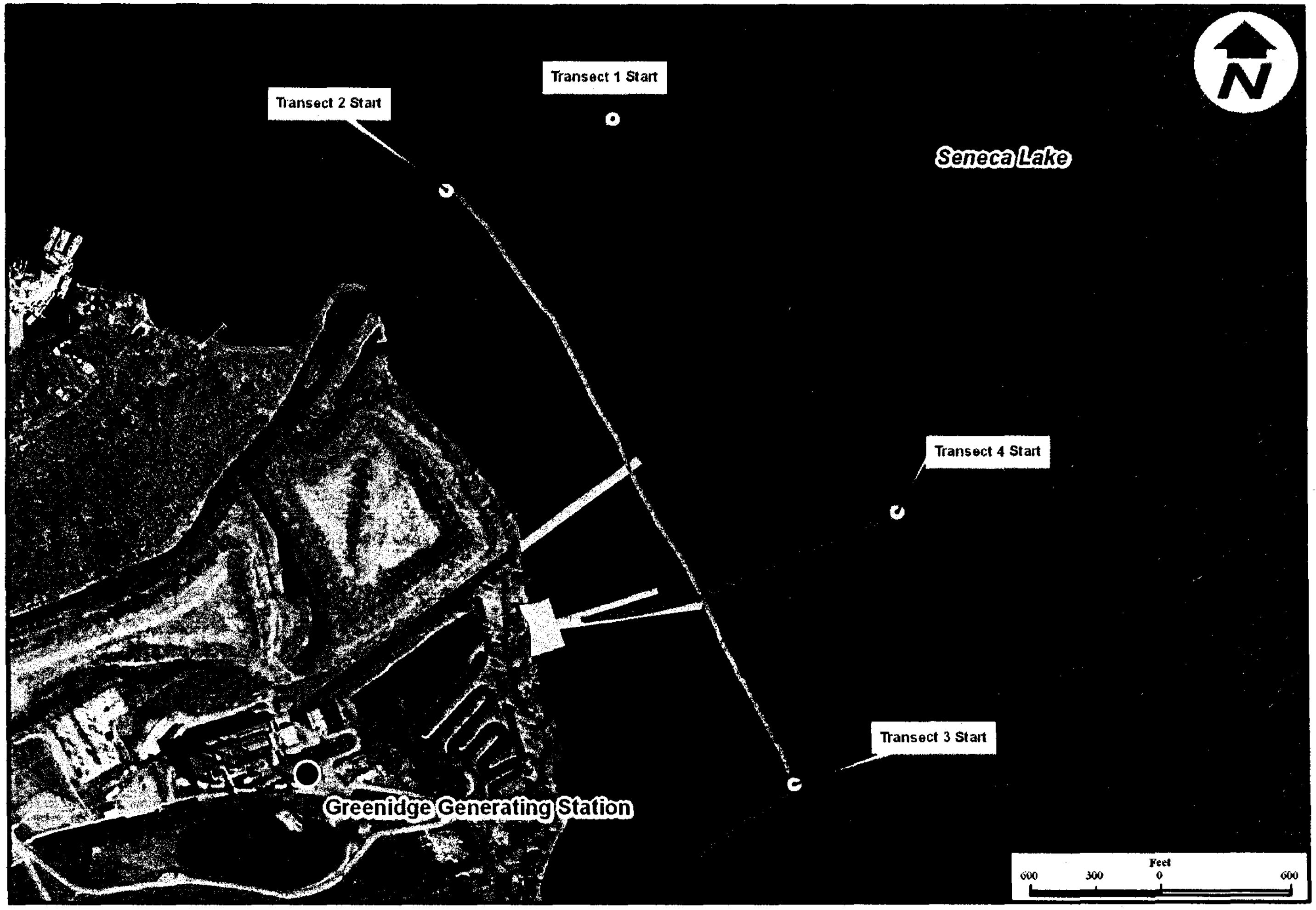


Figure 4 – AES Greenidge Generating Station Hydrodynamic Survey Transect Locations, 2007

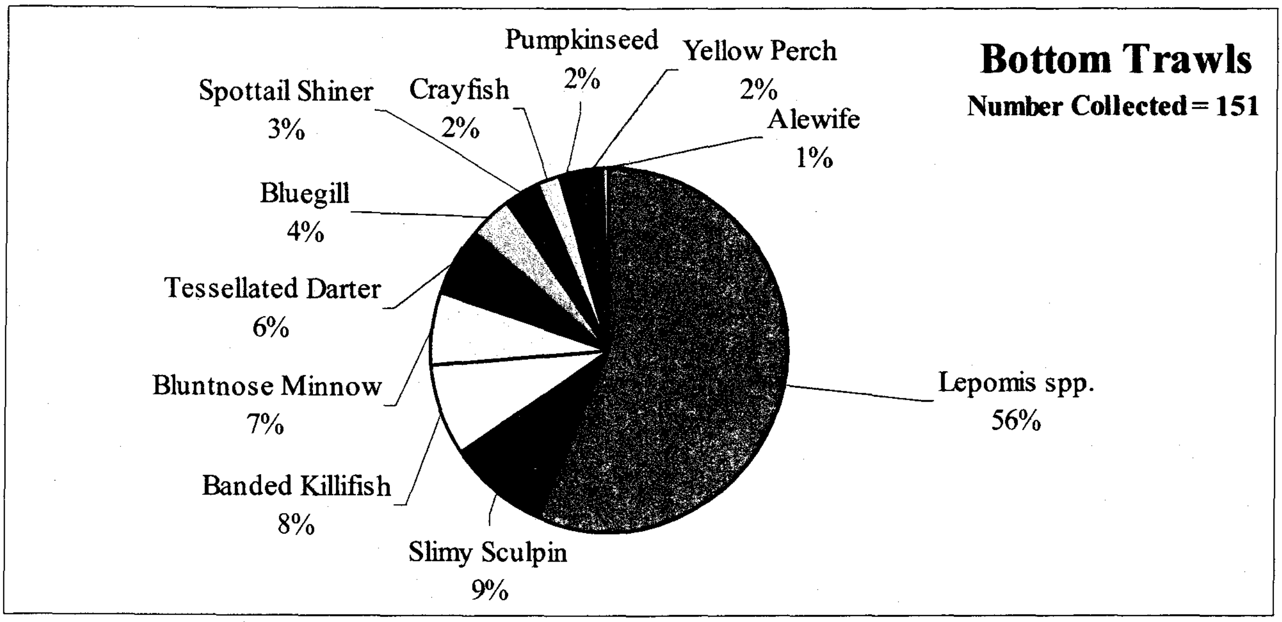


Figure 5 - Percent Composition of Taxa Collected in Bottom Trawl Samples Conducted in the Vicinity of AES Greenidge Generating Station, 2006

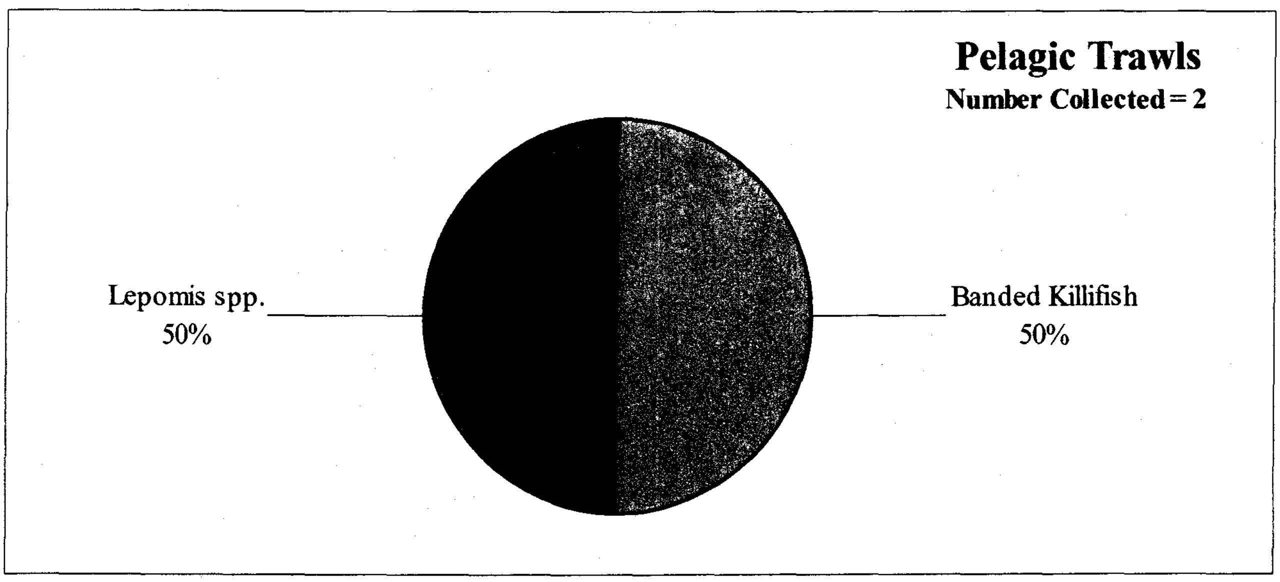


Figure 6 - Percent Composition of Taxa Collected in Pelagic Trawl Samples Conducted in the Vicinity of AES Greenidge Generating Station, 2006

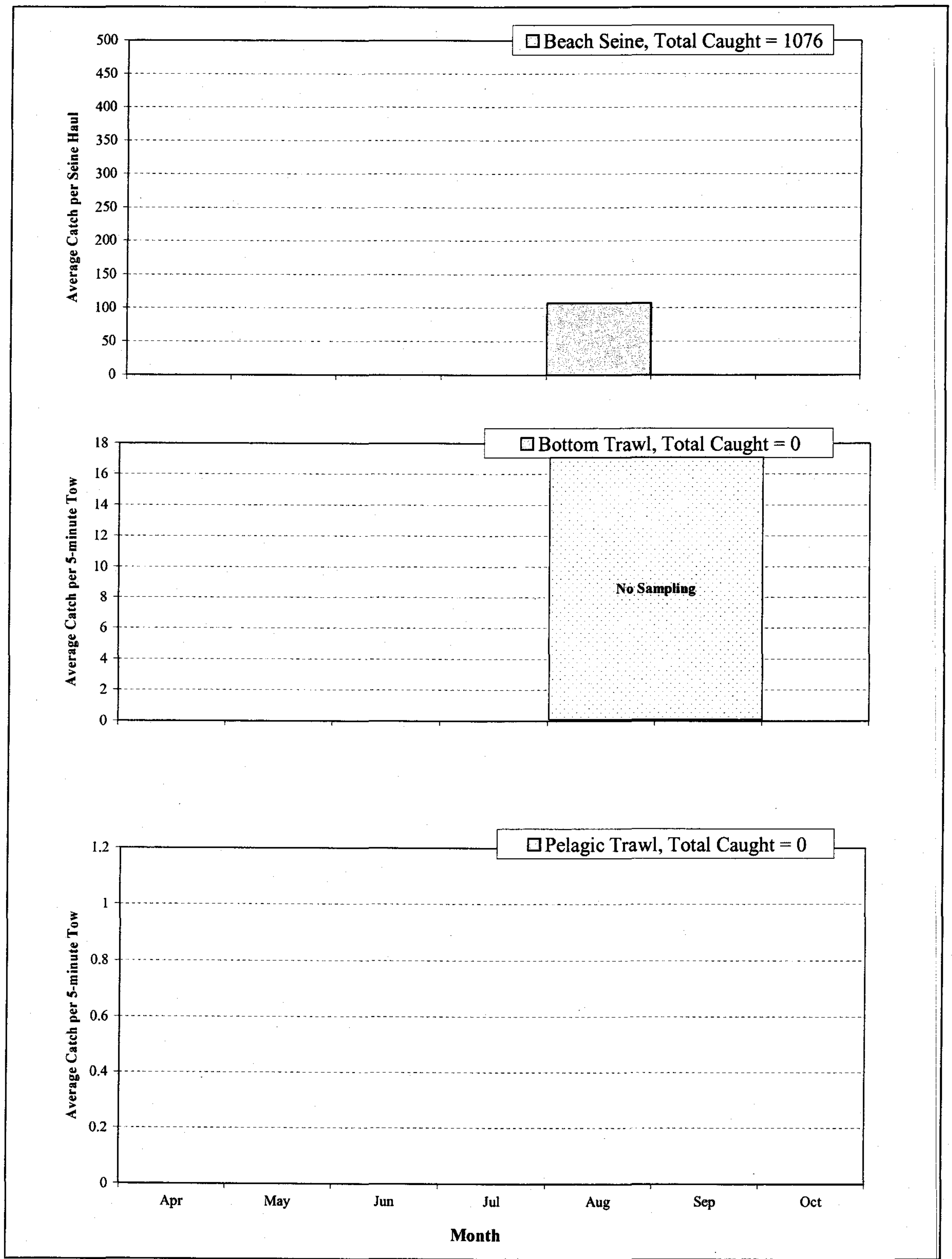


Figure 7 - Catch Per Unit Effort of *Ameiurus* spp. Collected in AES Greenidge Generating Station Finfish Sampling, 2006

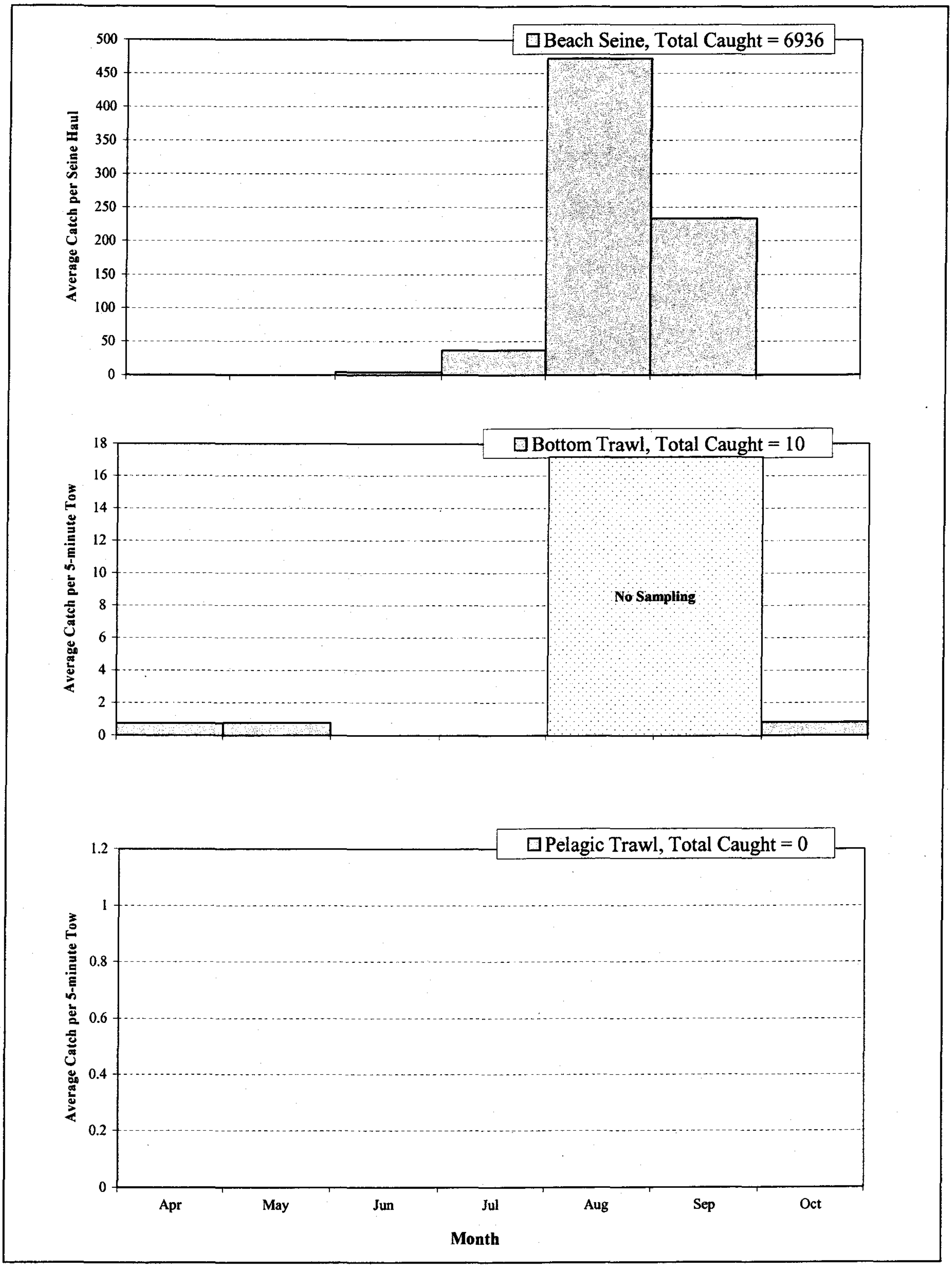


Figure 8 - Catch Per Unit Effort of Bluntnose Minnow Collected in AES Greenidge Generating Station Finfish Sampling, 2006

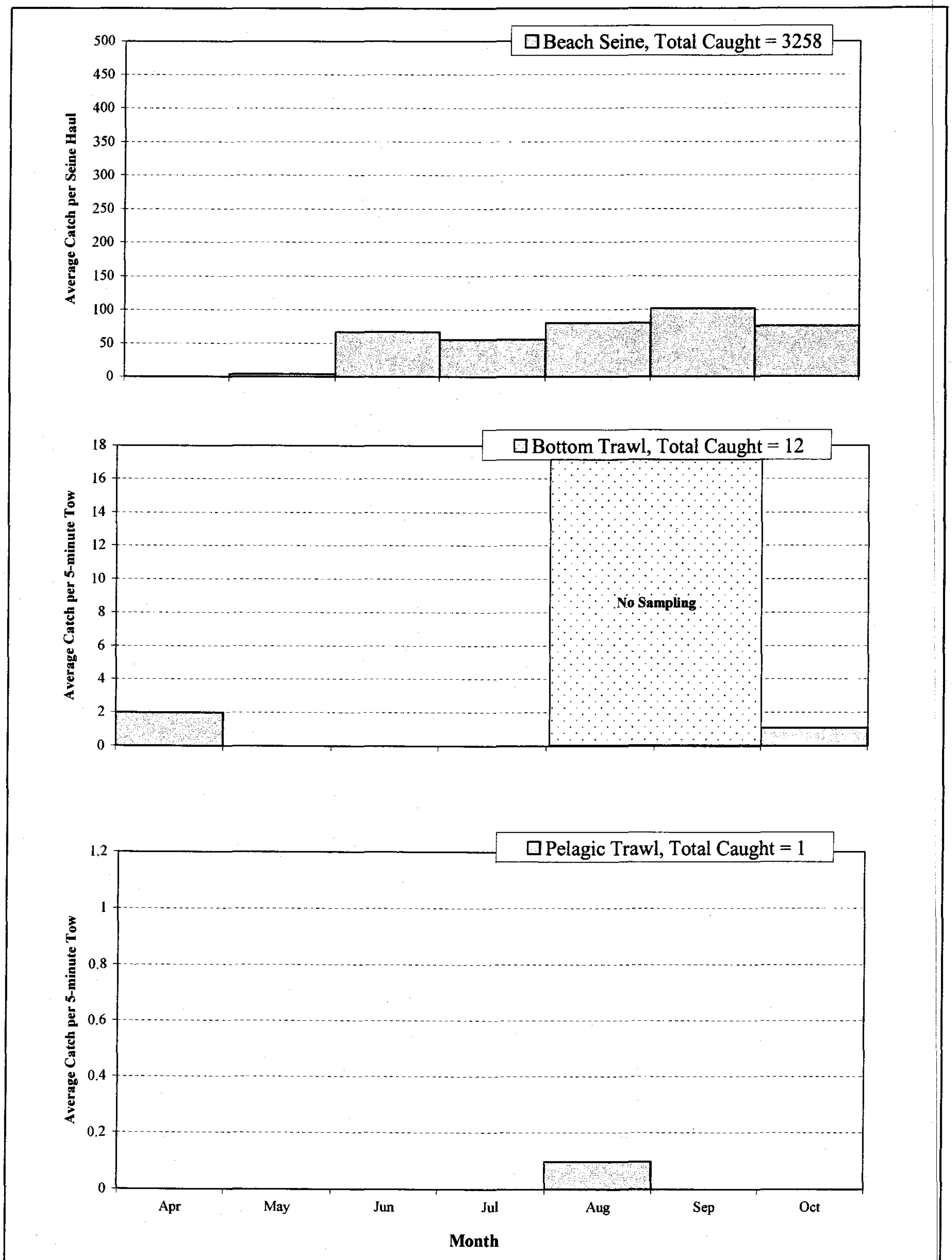


Figure 9 - Catch Per Unit Effort of Banded Killifish Collected in AES Greenidge Generating Station Finfish Sampling, 2006

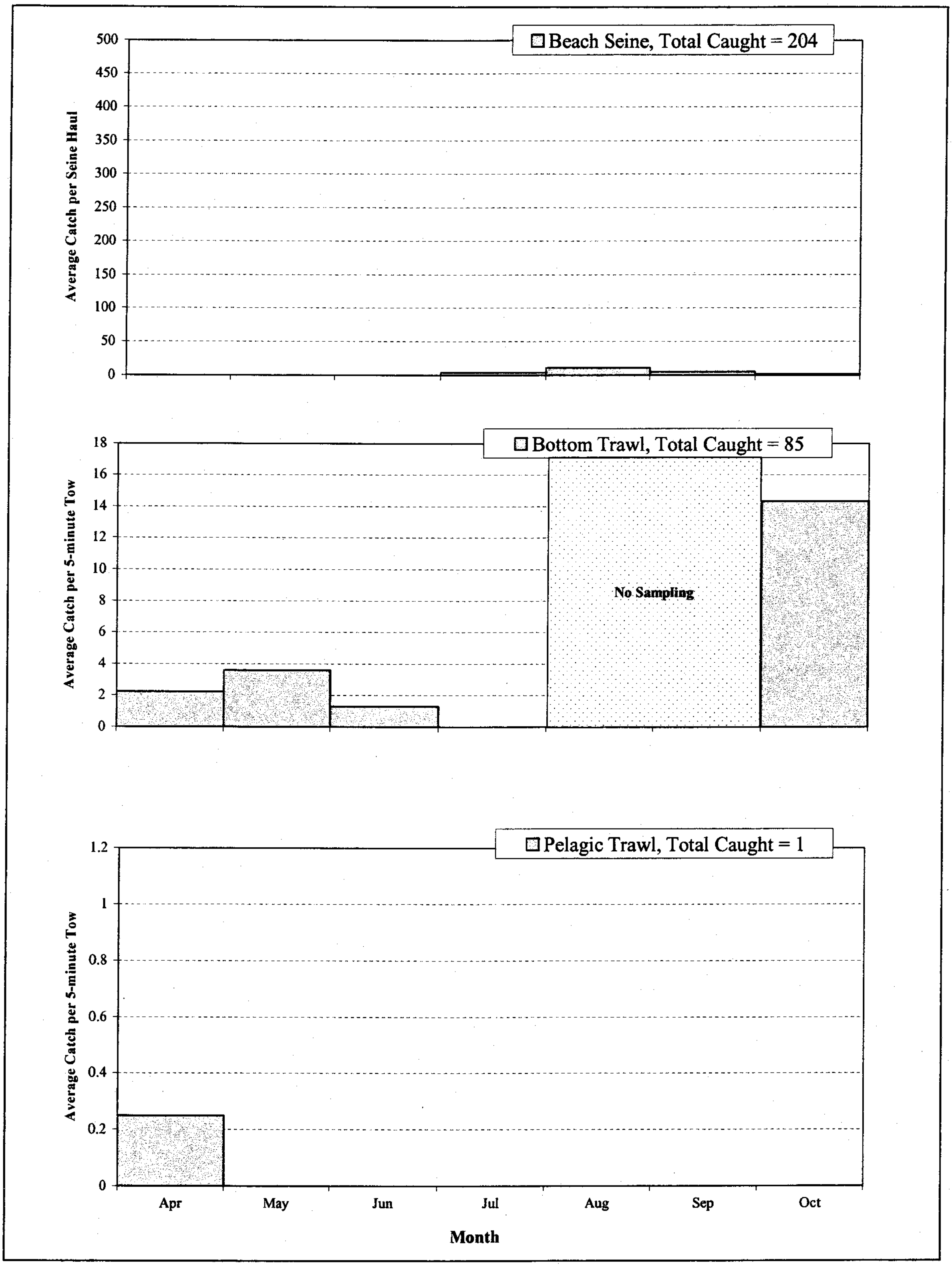


Figure 10 - Catch Per Unit Effort of *Lepomis* spp. Collected in AES Greenidge Generating Station Finfish Sampling, 2006

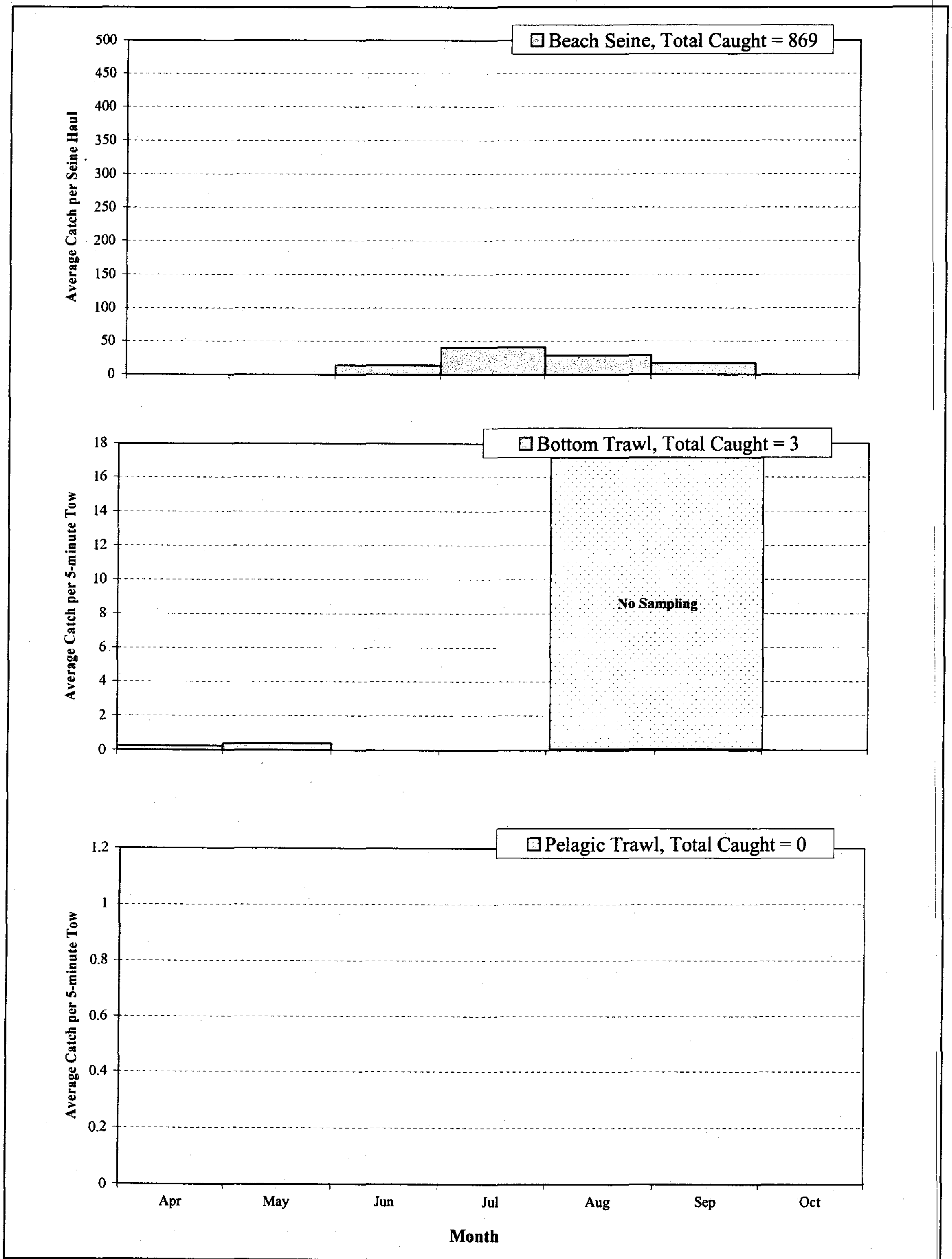


Figure 11 - Catch Per Unit Effort of Pumpkinseed Collected in AES Greenidge Generating Station Finfish Sampling, 2006

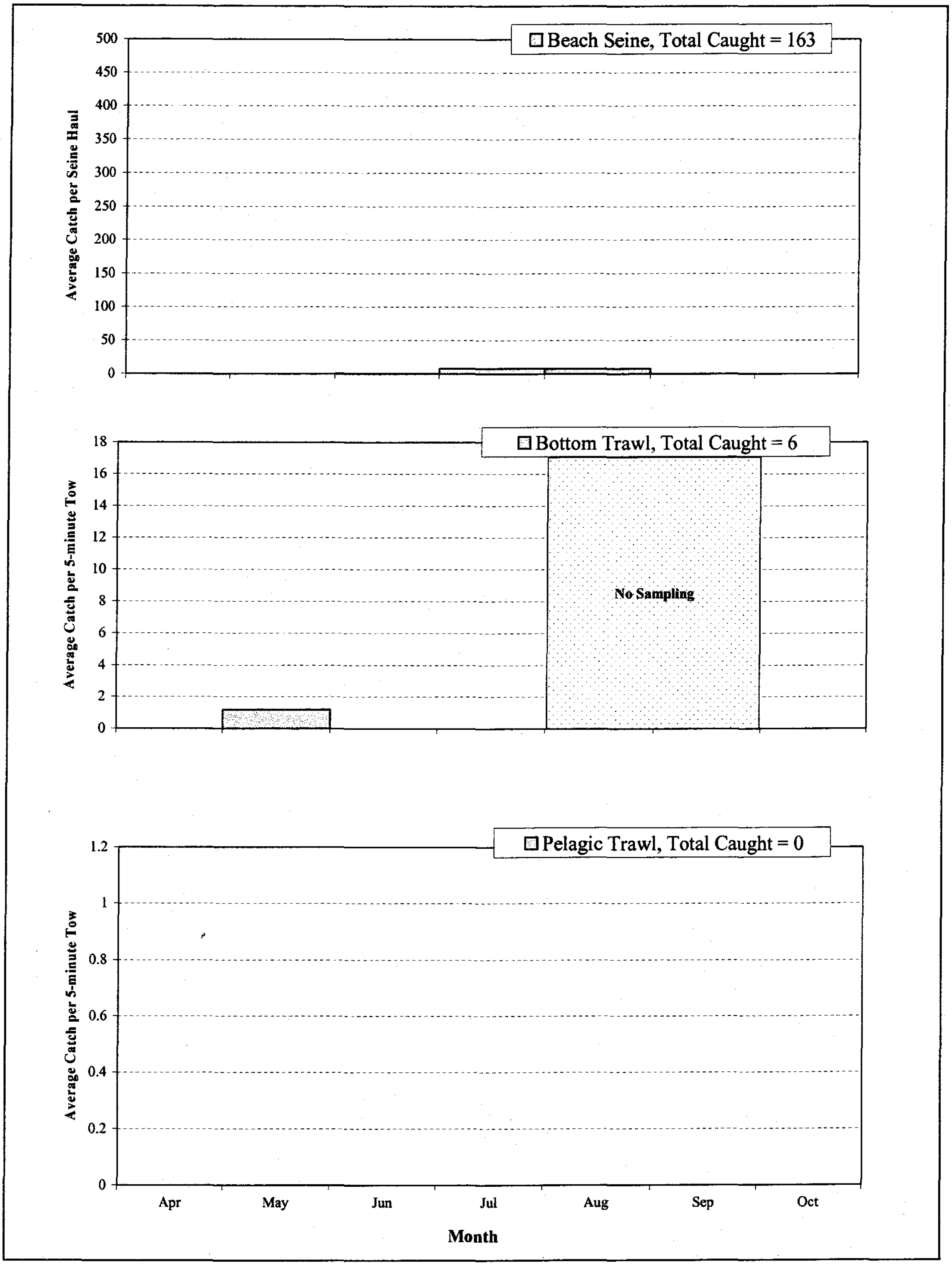


Figure 12 - Catch Per Unit Effort of Bluegill Collected in AES Greenidge Generating Station Finfish Sampling, 2006

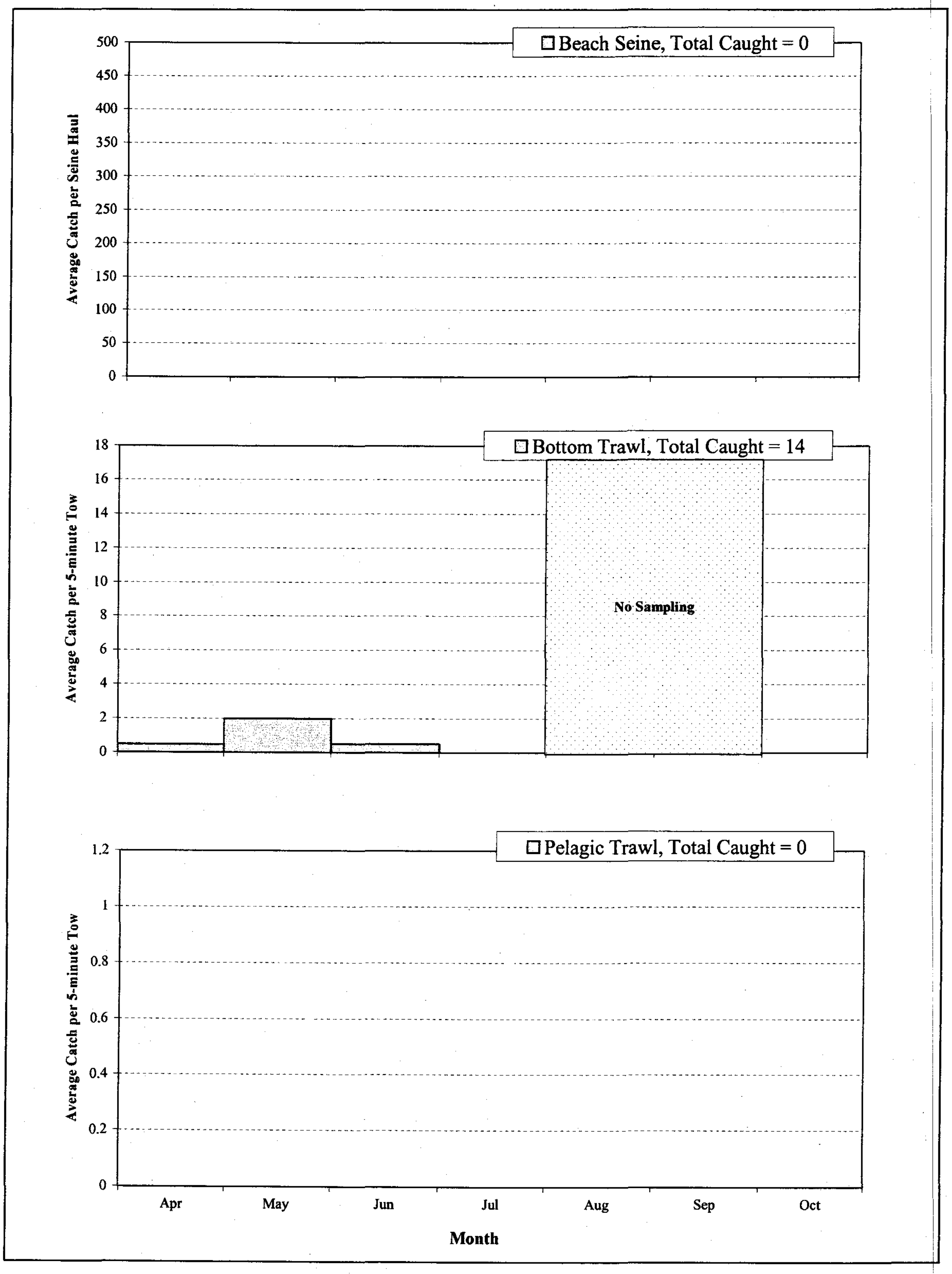


Figure 13 - Catch Per Unit Effort of Slimy Scuplin Collected in AES Greenidge Generating Station Finfish Sampling, 2006

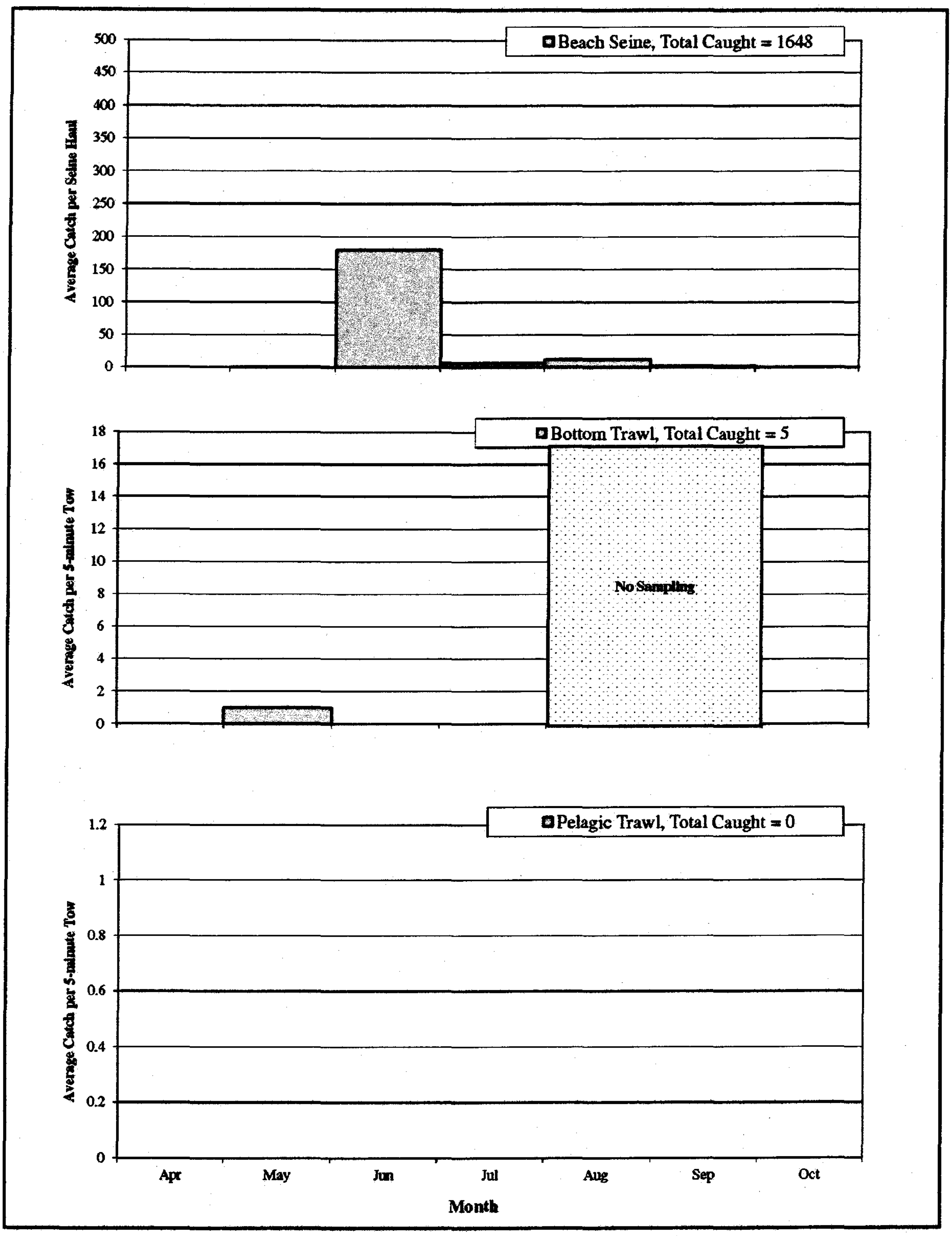


Figure 14 - Catch Per Unit Effort of Spottail Shiner Collected in AES Greenidge Generating Station Finfish Sampling, 2006

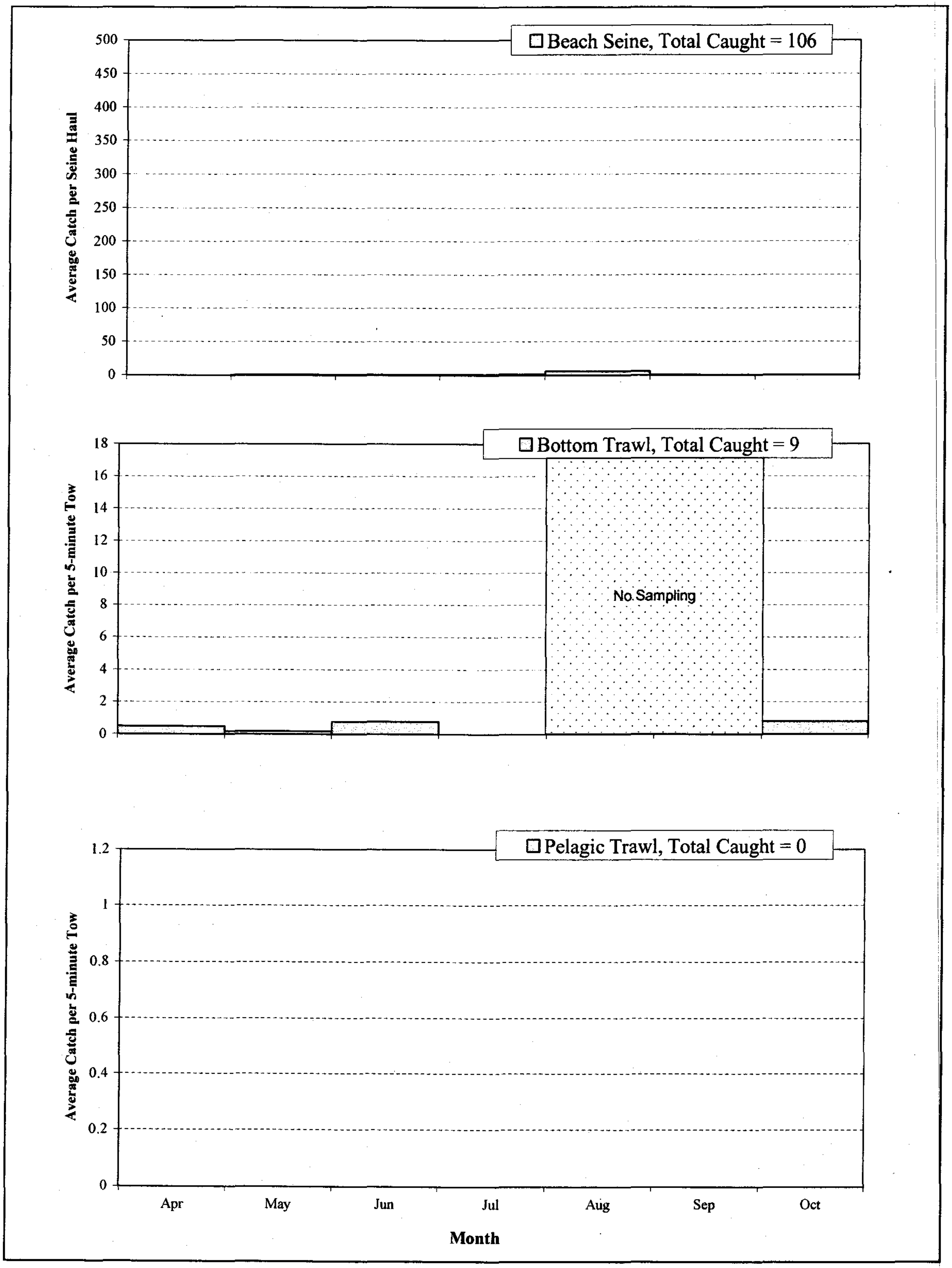


Figure 15 - Catch Per Unit Effort of Tessellated Darter Collected in AES Greenidge Generating Station Finfish Sampling, 2006

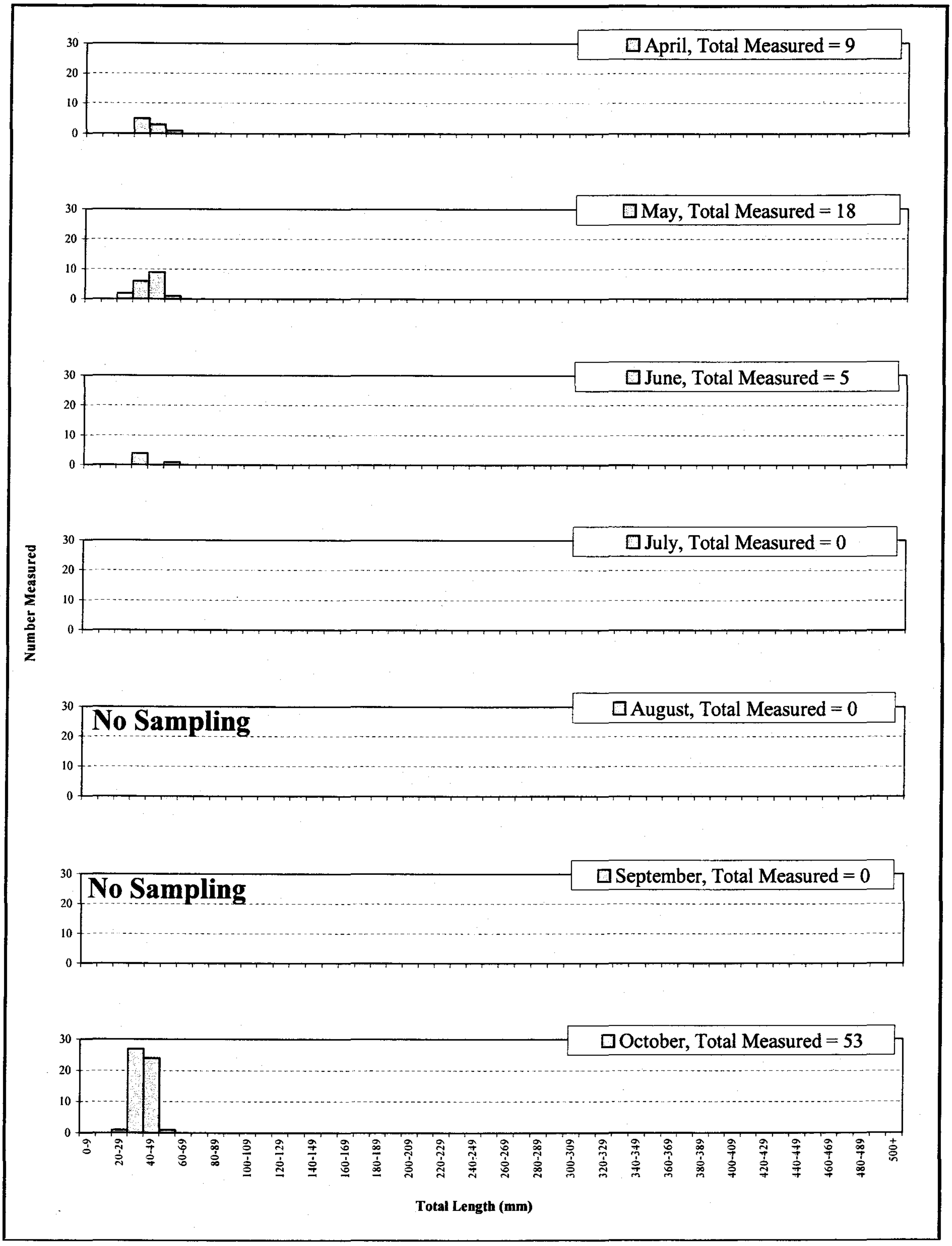


Figure 16 - Length-frequency Distribution for Lepomis spp. Collected in the AES Greenidge Generating Station Bottom Trawl Sampling Program, 2006

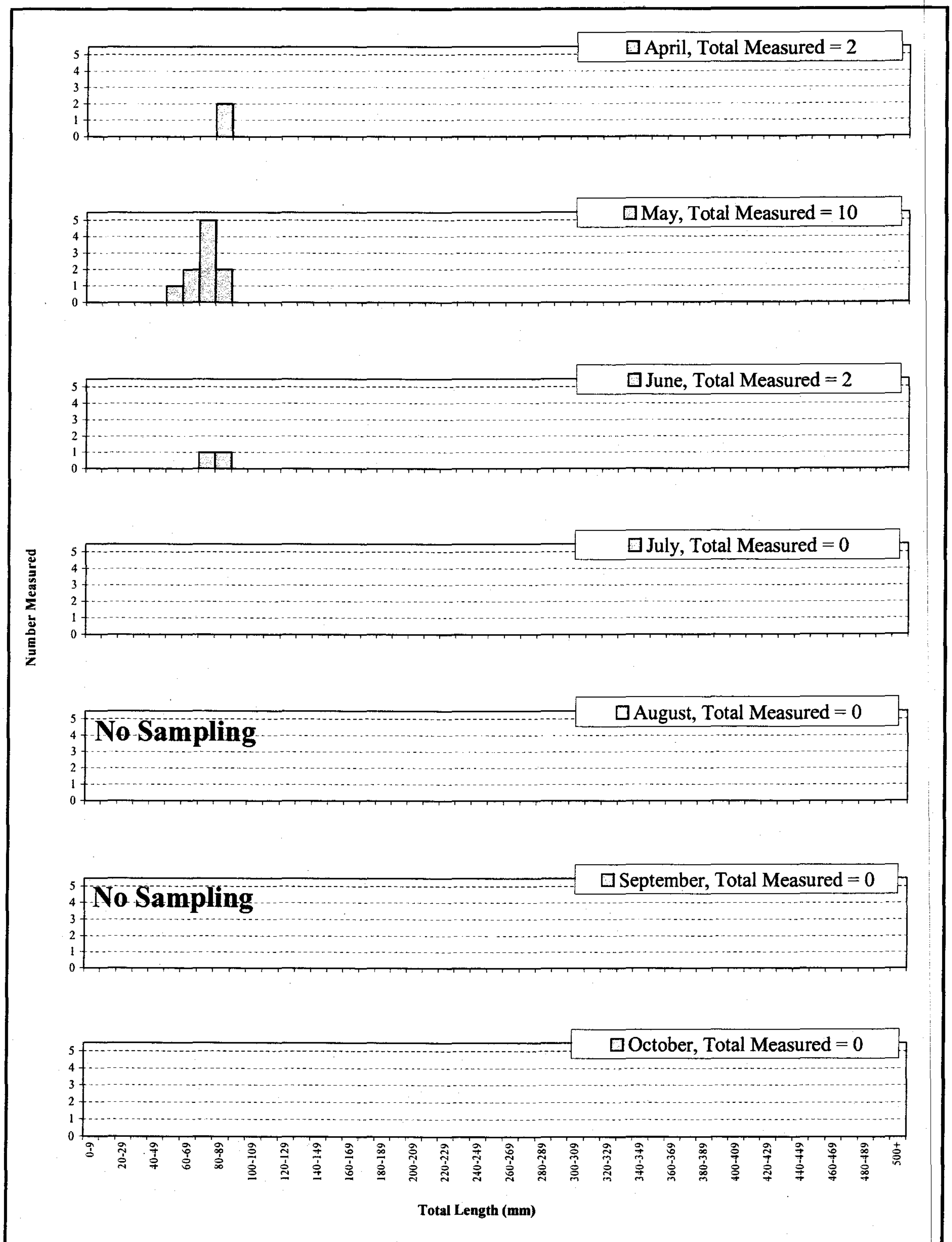


Figure 17 - Length-frequency Distribution for Slimy Scuplin Collected in the AES Greenidge Generating Station Bottom Trawl Sampling Program, 2006

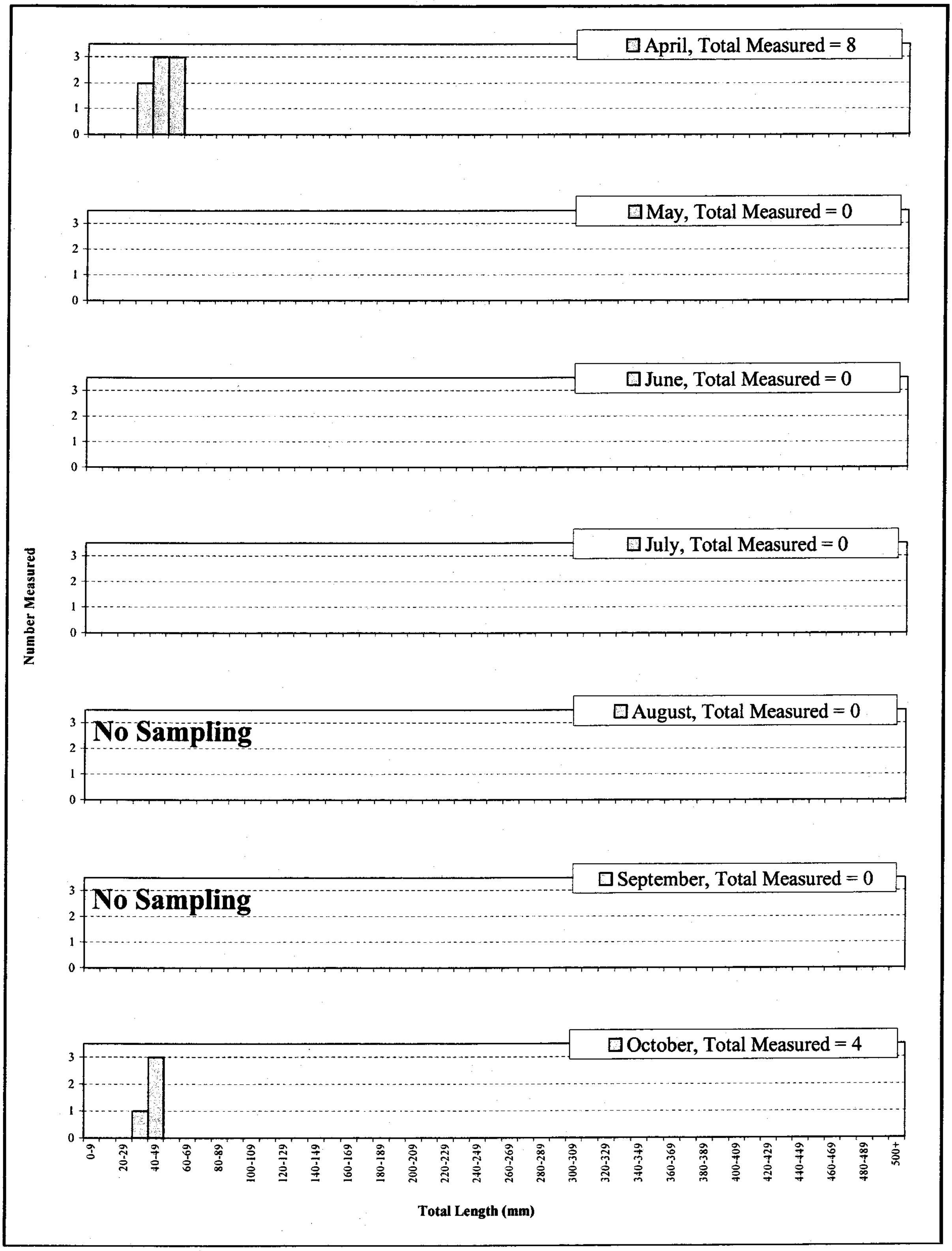


Figure 18 - Length-frequency Distribution for Banded Killifish Collected in the AES Greenidge Generating Station Bottom Trawl Sampling Program, 2006

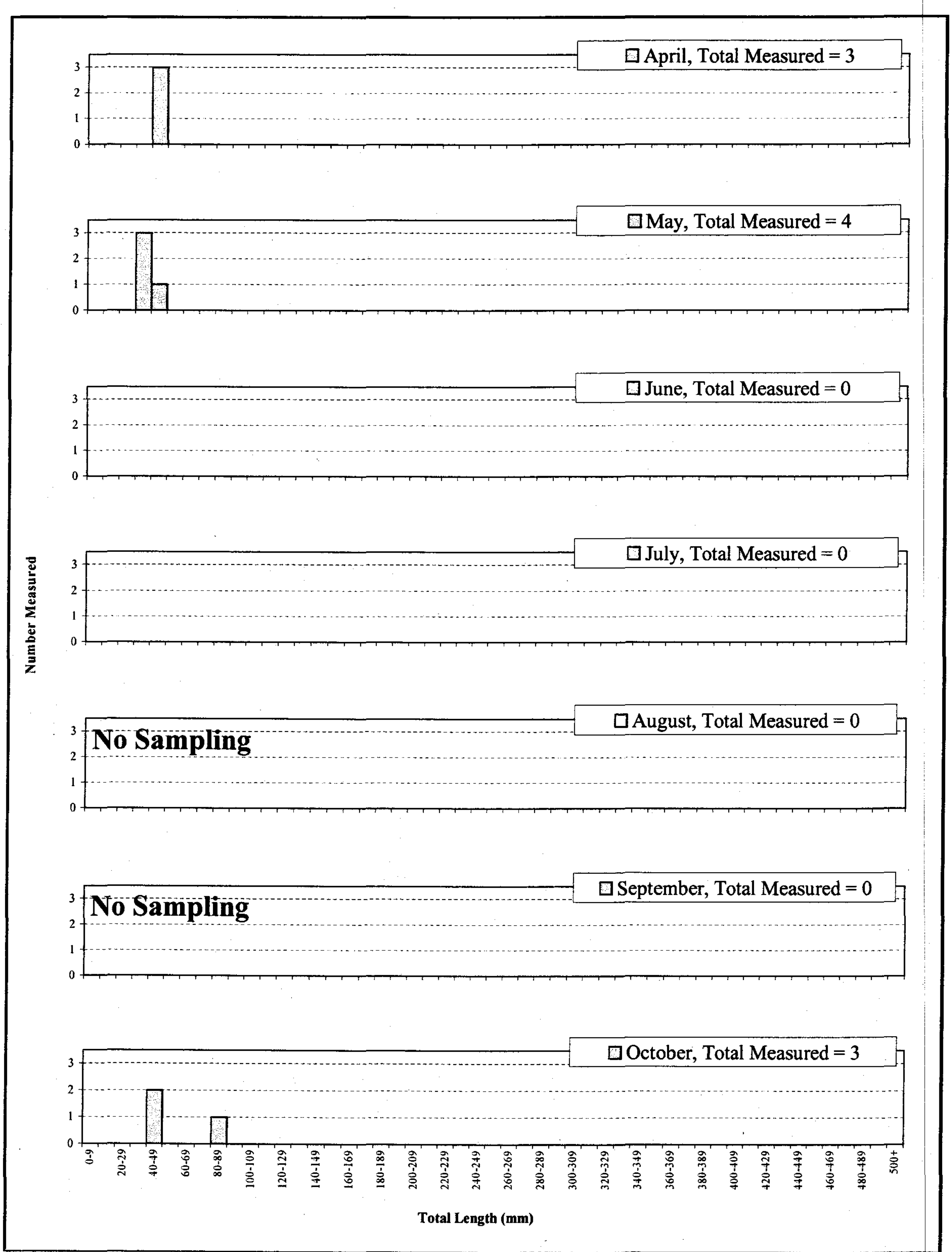


Figure 19 - Length-frequency Distribution for Bluntnose Minnow Collected in the AES Greenidge Generating Station Bottom Trawl Sampling Program, 2006

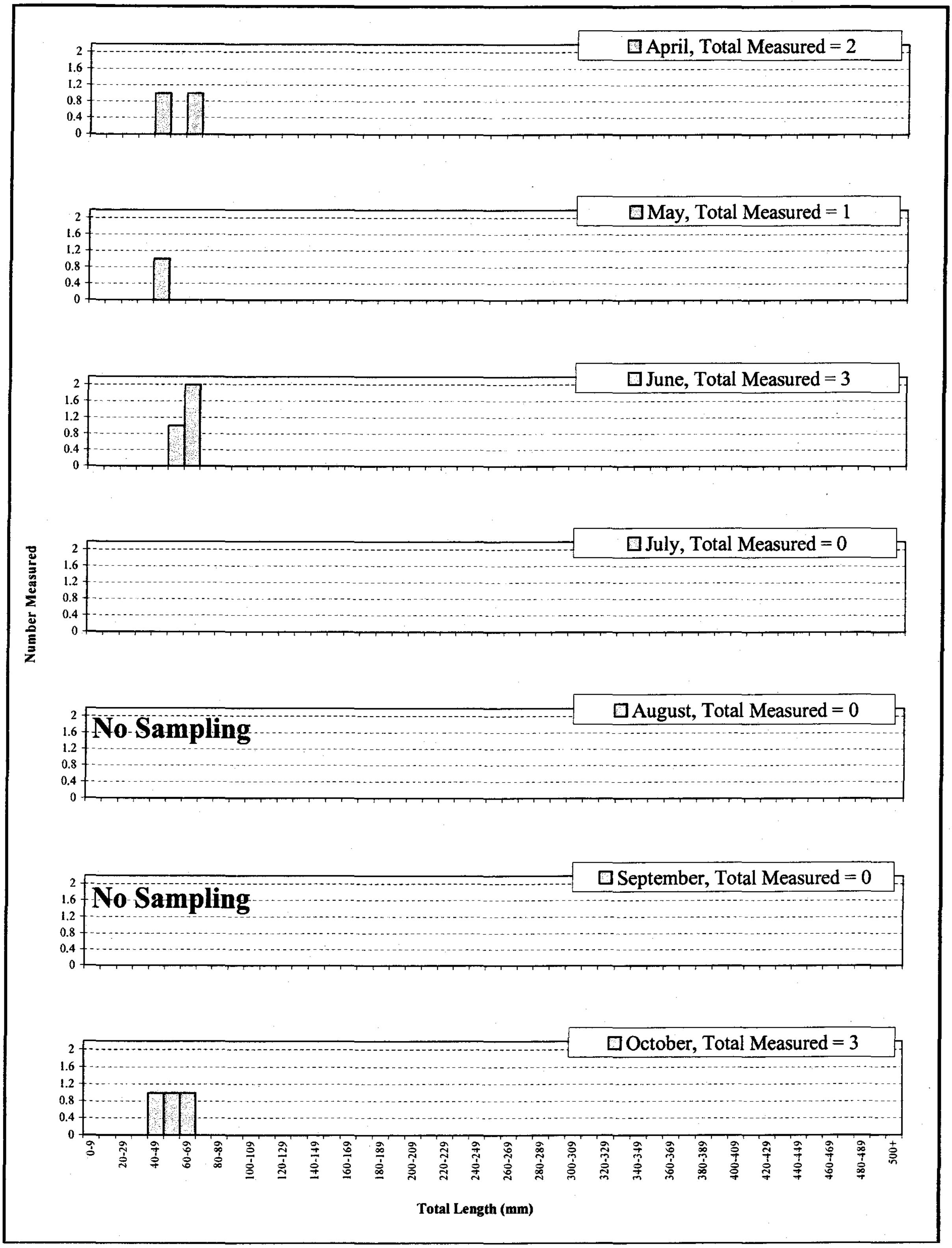


Figure 20 - Length-frequency Distribution for Tessellated Darter Collected in the AES Greenidge Generating Station Bottom Trawl Sampling Program, 2006

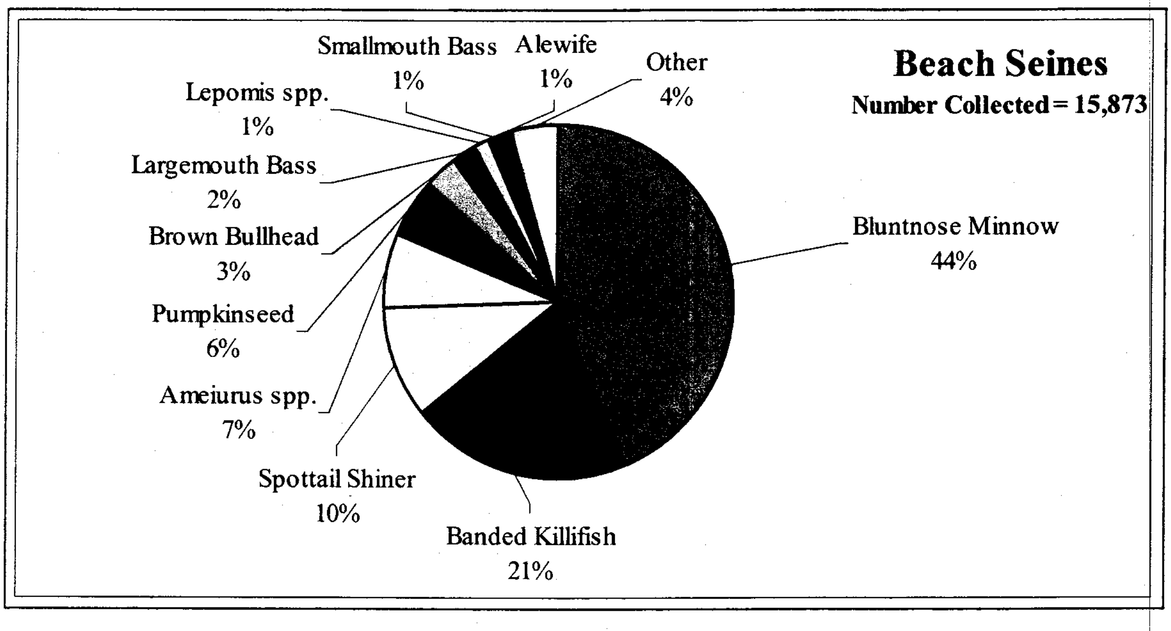


Figure 21 - Percent Composition of Taxa Collected in AES Greenidge Generating Station Beach Seine Samples, 2006

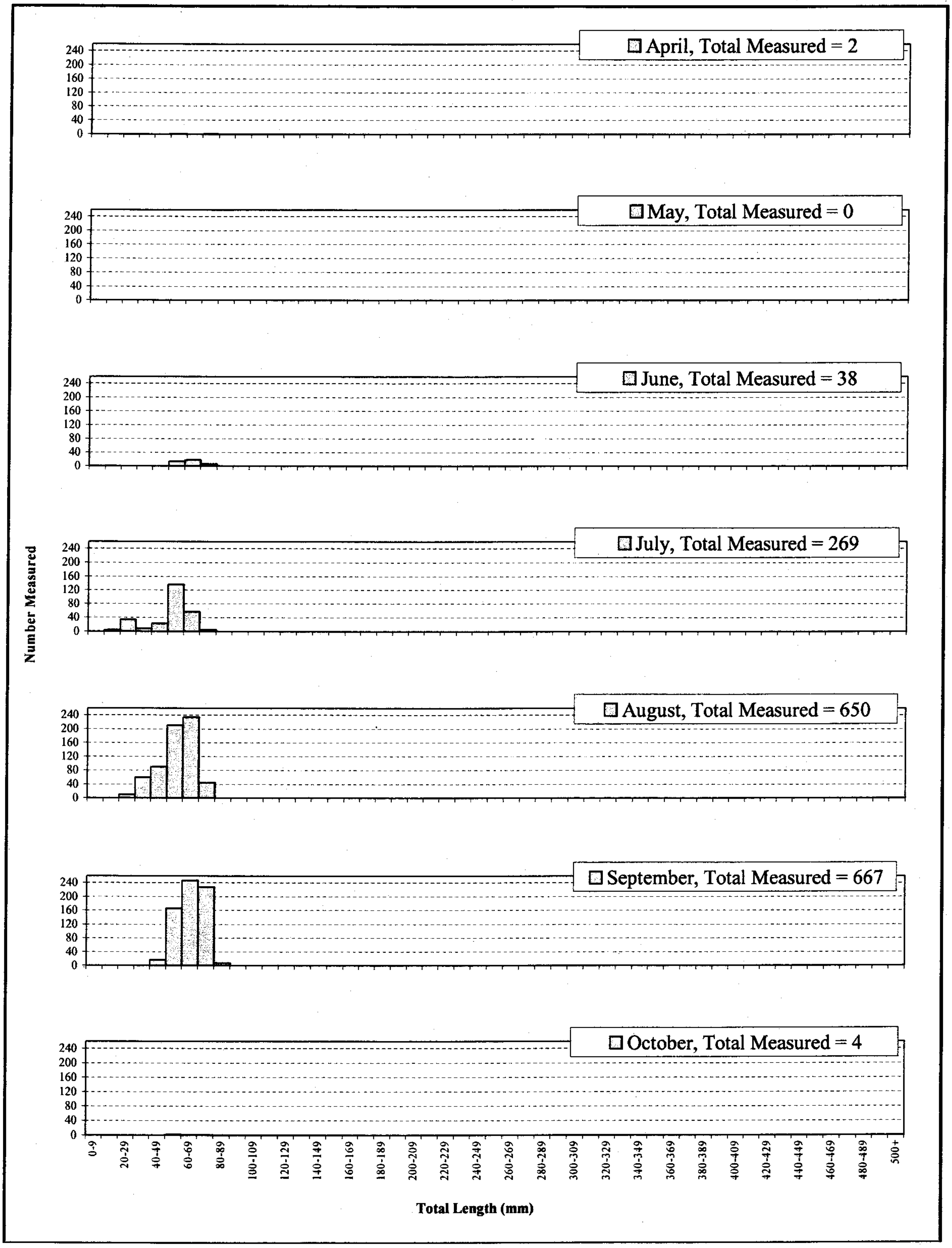


Figure 22 - Length-frequency Distribution for Bluntnose Minnow Collected in the AES Greenidge Generating Station Beach Seine Sampling Program, 2006

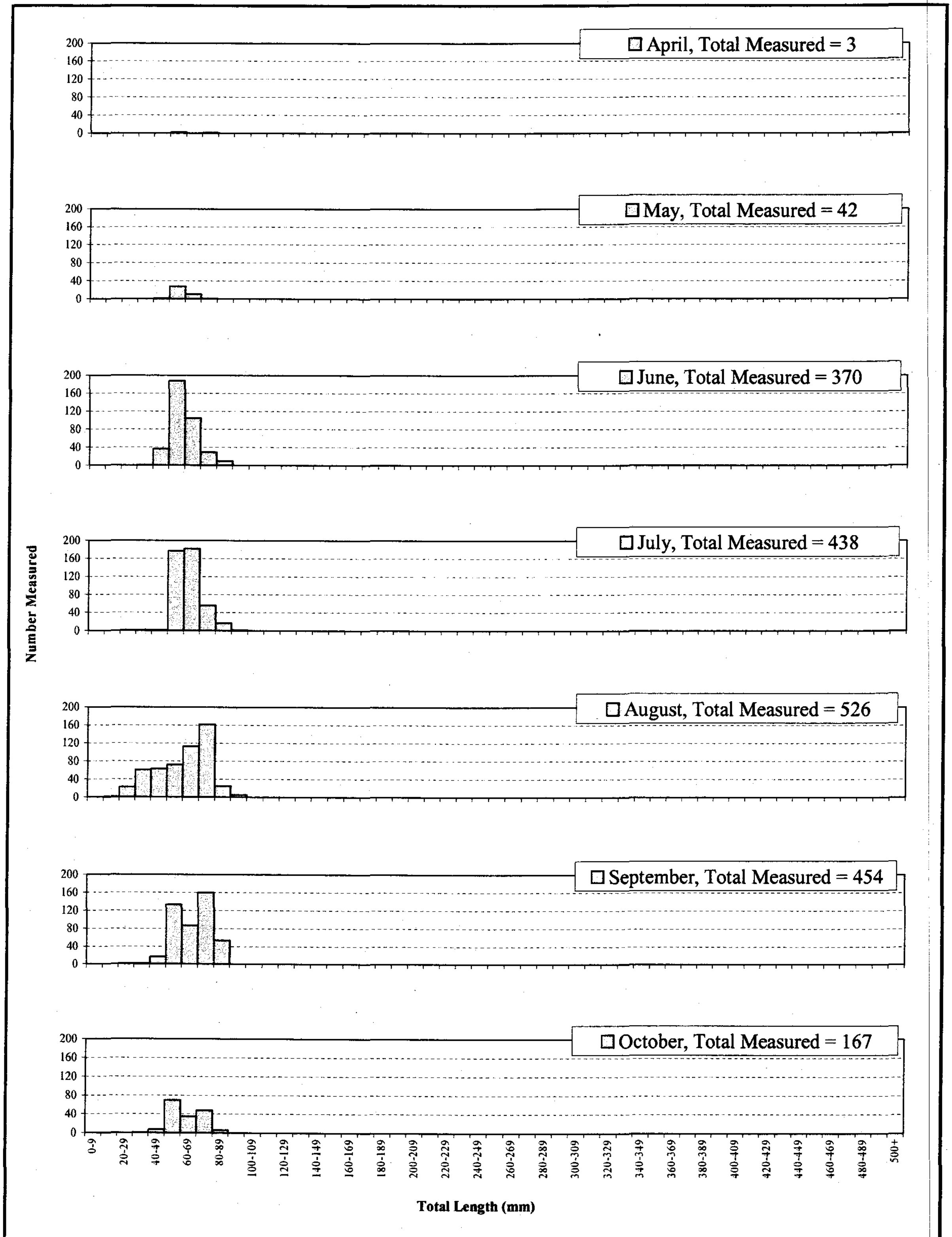


Figure 23 - Length-frequency Distribution for Banded Killifish Collected in the AES Greenidge Generating Station Beach Seine Sampling Program, 2006

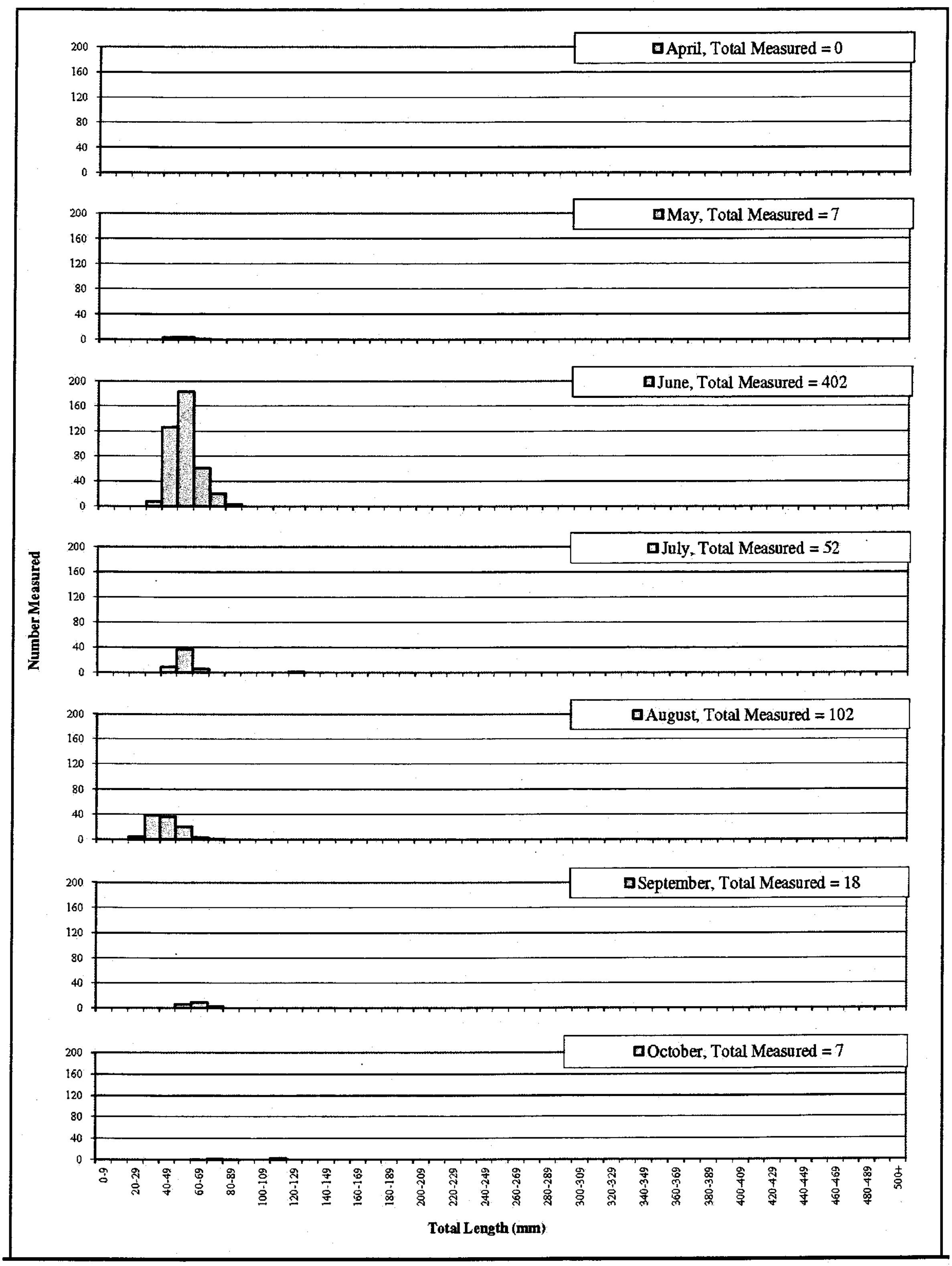


Figure 24 - Length-frequency Distribution for Spottail Shiner Collected in the AES Greenidge Generating Station Beach Seine Sampling Program, 2006

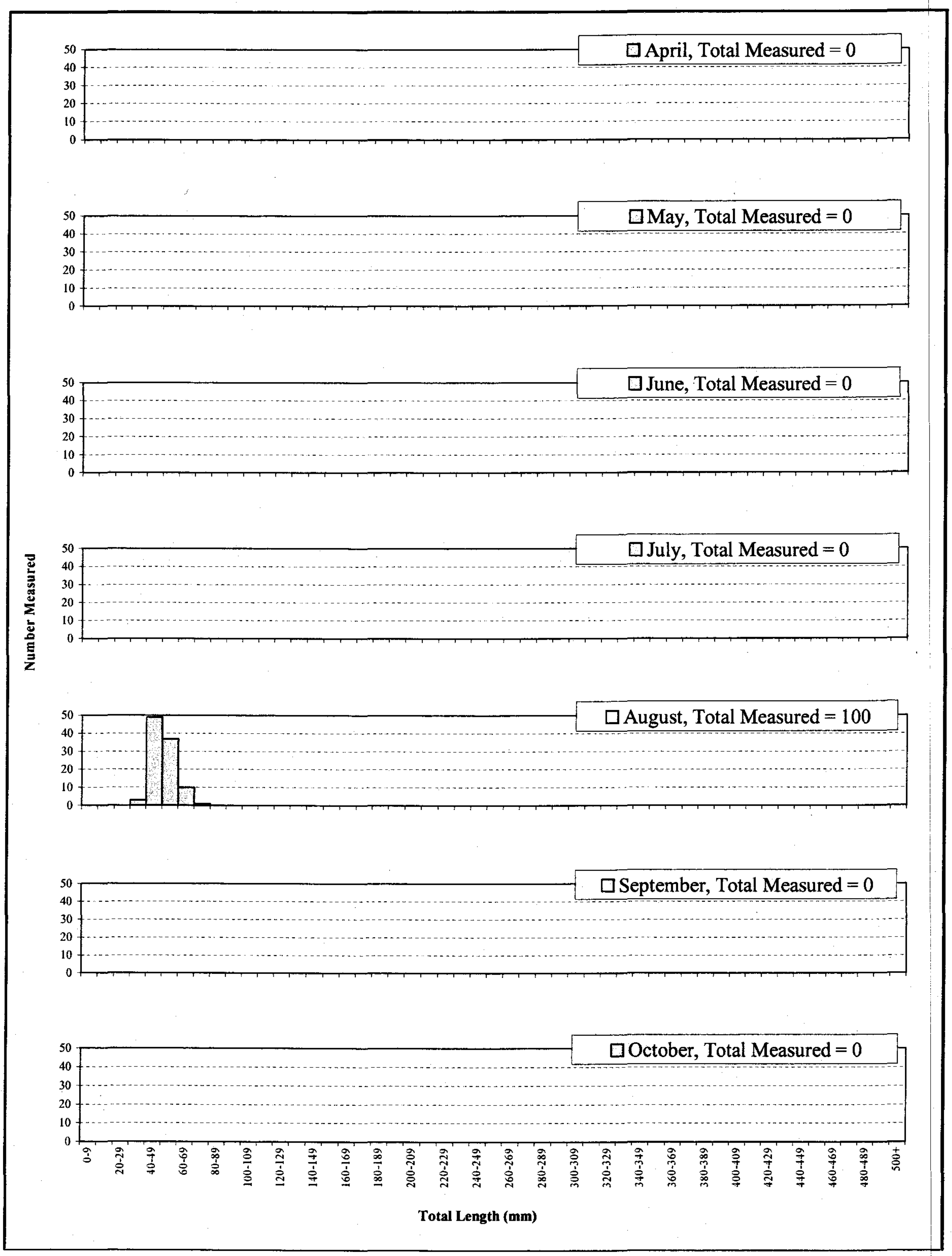


Figure 25 - Length-frequency Distribution for *Ameiurus* spp. Collected in the AES Greenidge Generating Station Beach Seine Sampling Program, 2006

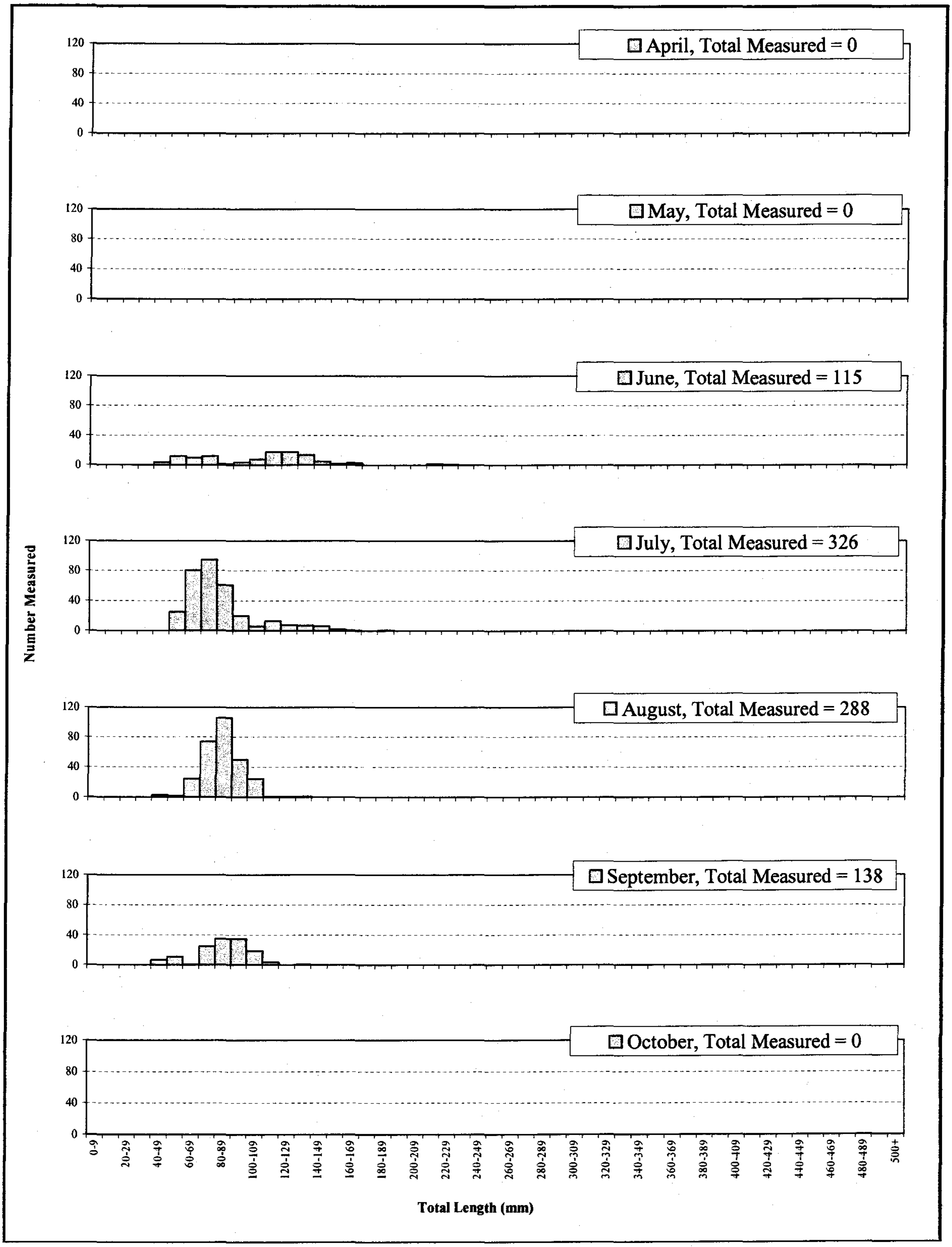


Figure 26 - Length-frequency Distribution for Pumpkinseed Collected in the AES Greenidge Generating Station Beach Seine Sampling Program, 2006

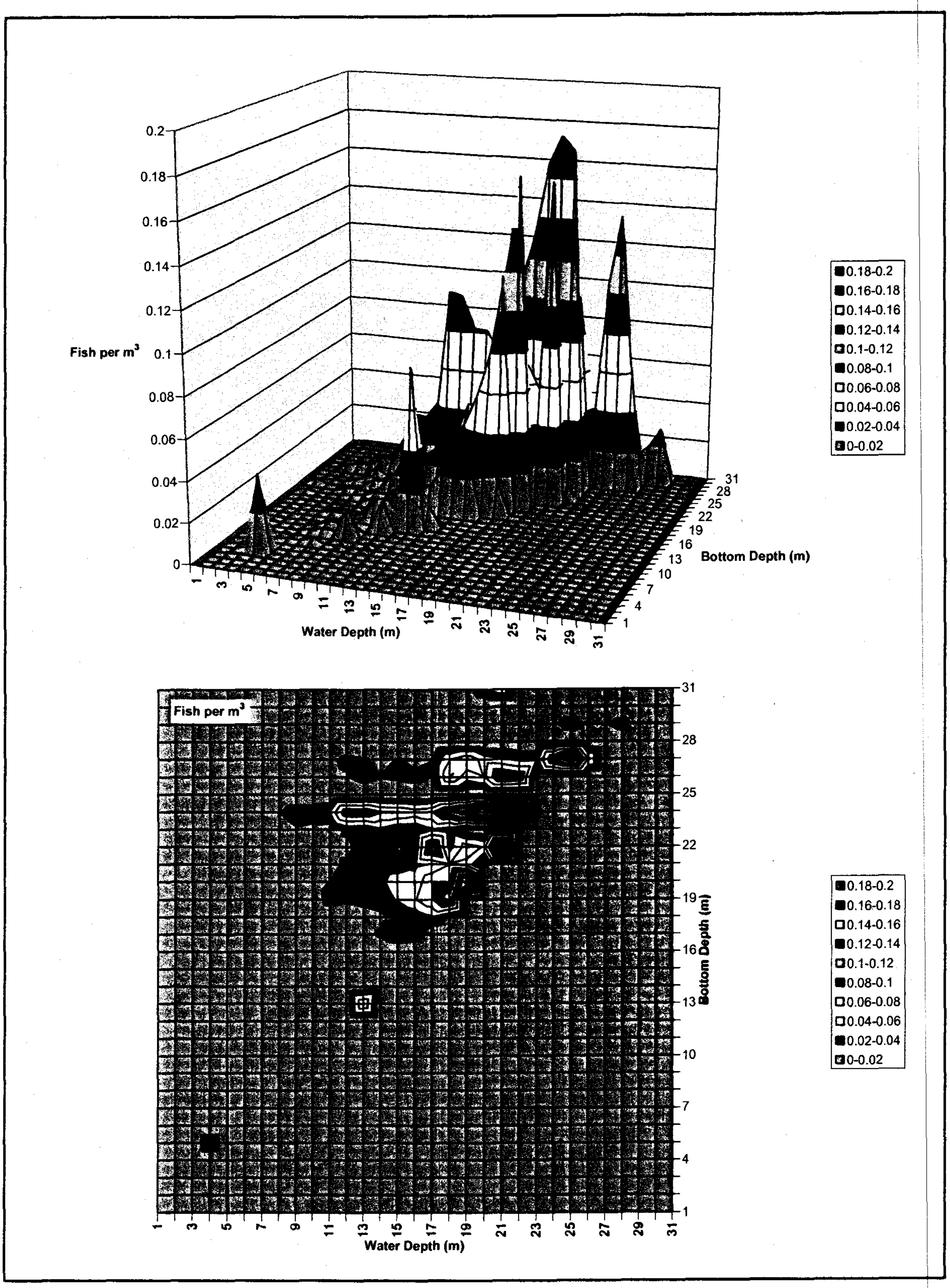


Figure 27 - Average Depth-stratified Fish Density (number/m^3) in Seneca Lake in the Vicinity of AES Greenidge Generating Station (based on August through October 2006 Hydroacoustic Survey)

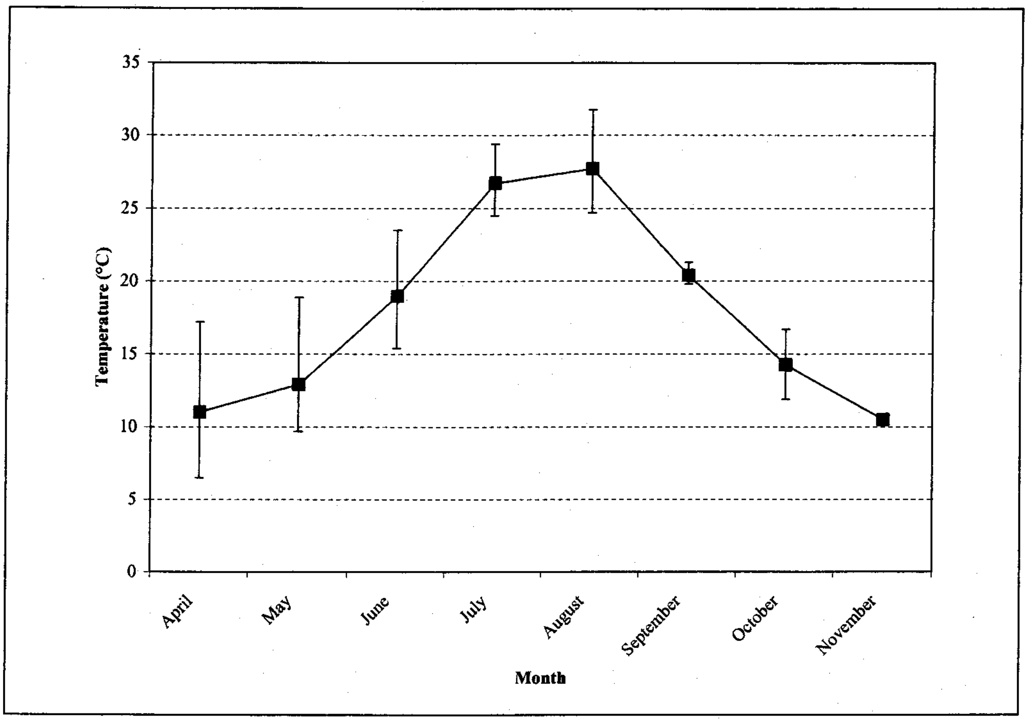


Figure 28 - Seneca Lake Monthly Average Nearshore Water Temperatures (°C) in the Vicinity of AES Greenidge Generating Station, 2006 (Data Collected During 100-ft Beach Seine Sampling)

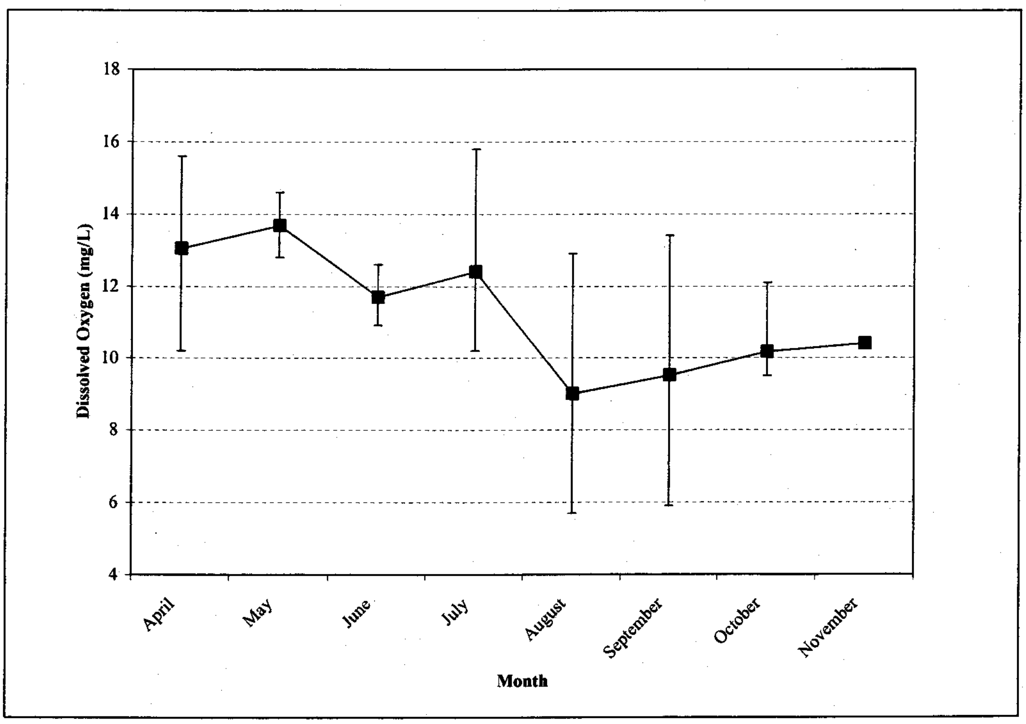


Figure 29 - Seneca Lake Monthly Average Nearshore Dissolved Oxygen Concentration (mg/L) in the Vicinity of AES Greenidge Generating Station, 2006 (Data Collected During 100-ft Beach Seine Sampling)

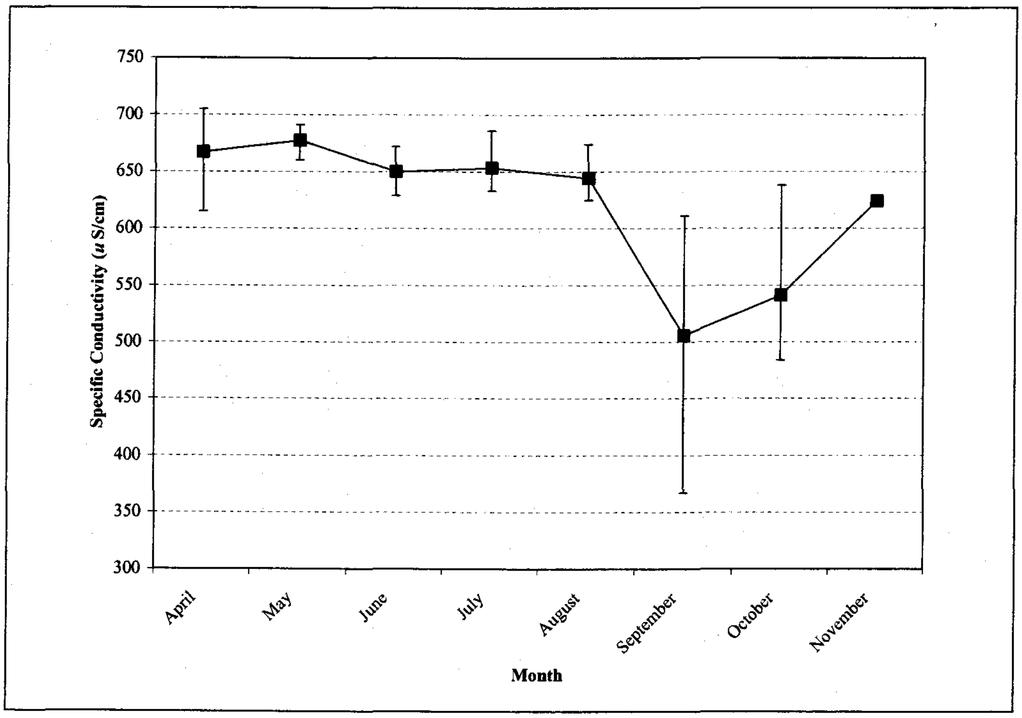


Figure 30 - Seneca Lake Monthly Average Nearshore Conductivity (µS/cm) in the Vicinity of AES Greenidge Generating Station, 2006 (Data Collected During 100-ft Beach Seine Sampling)

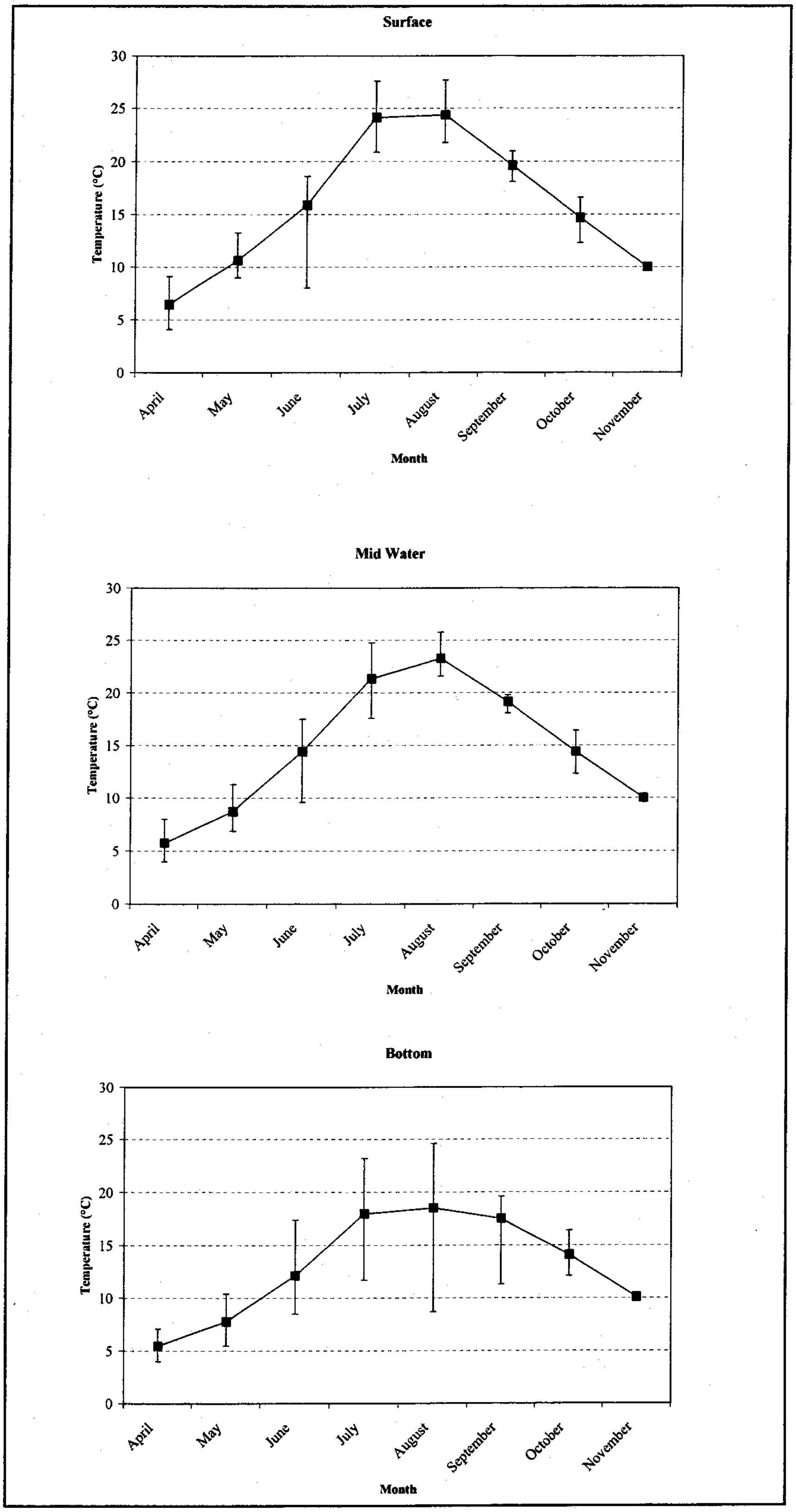


Figure 31 - Seneca Lake Monthly Average Offshore Surface, Mid and Bottom Water Temperatures (°C) in the Vicinity of AES Greenidge Generating Station, 2006 (Data Collected During Trawl Sampling)

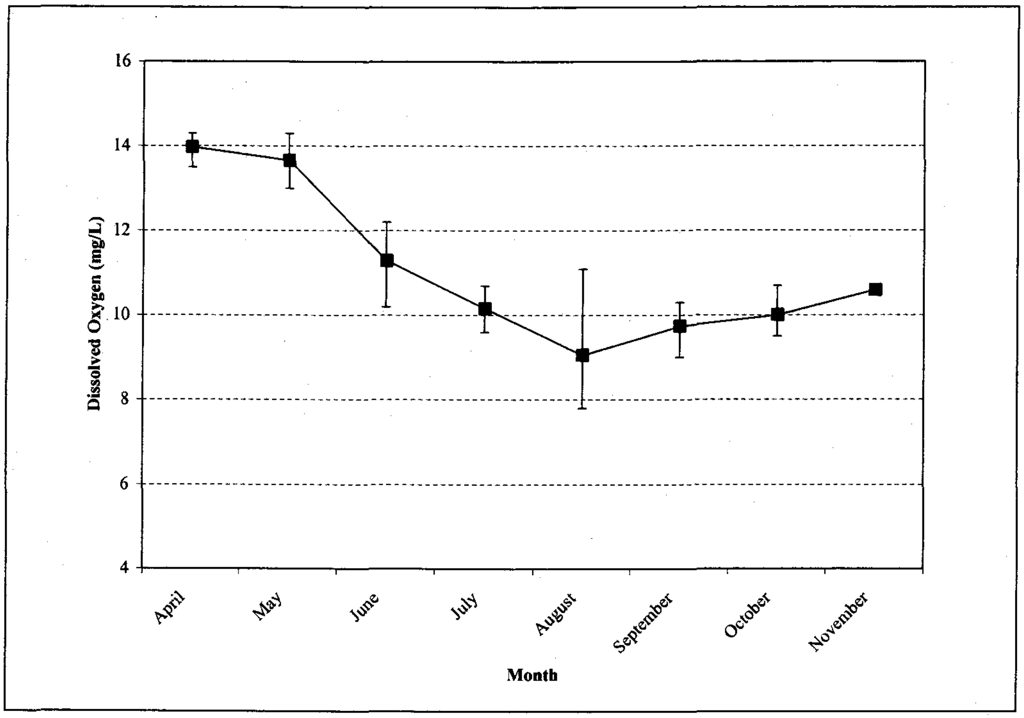


Figure 32 - Seneca Lake Monthly Average Offshore Dissolved Oxygen Concentration (mg/L) in the Vicinity of AES Greenidge Generating Station, 2006 (Data Collected During Trawl Sampling)

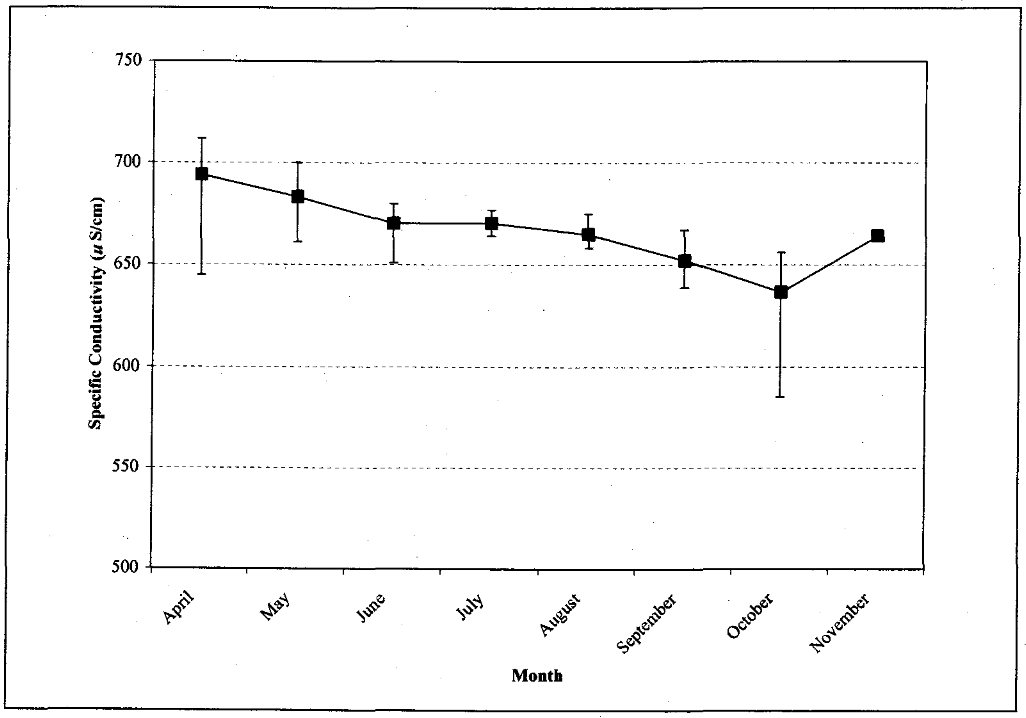


Figure 33 - Seneca Lake Monthly Average Offshore Conductivity (μS/cm) in the Vicinity of AES Greenidge Generating Station, 2006 (Data Collected During Trawl Sampling)

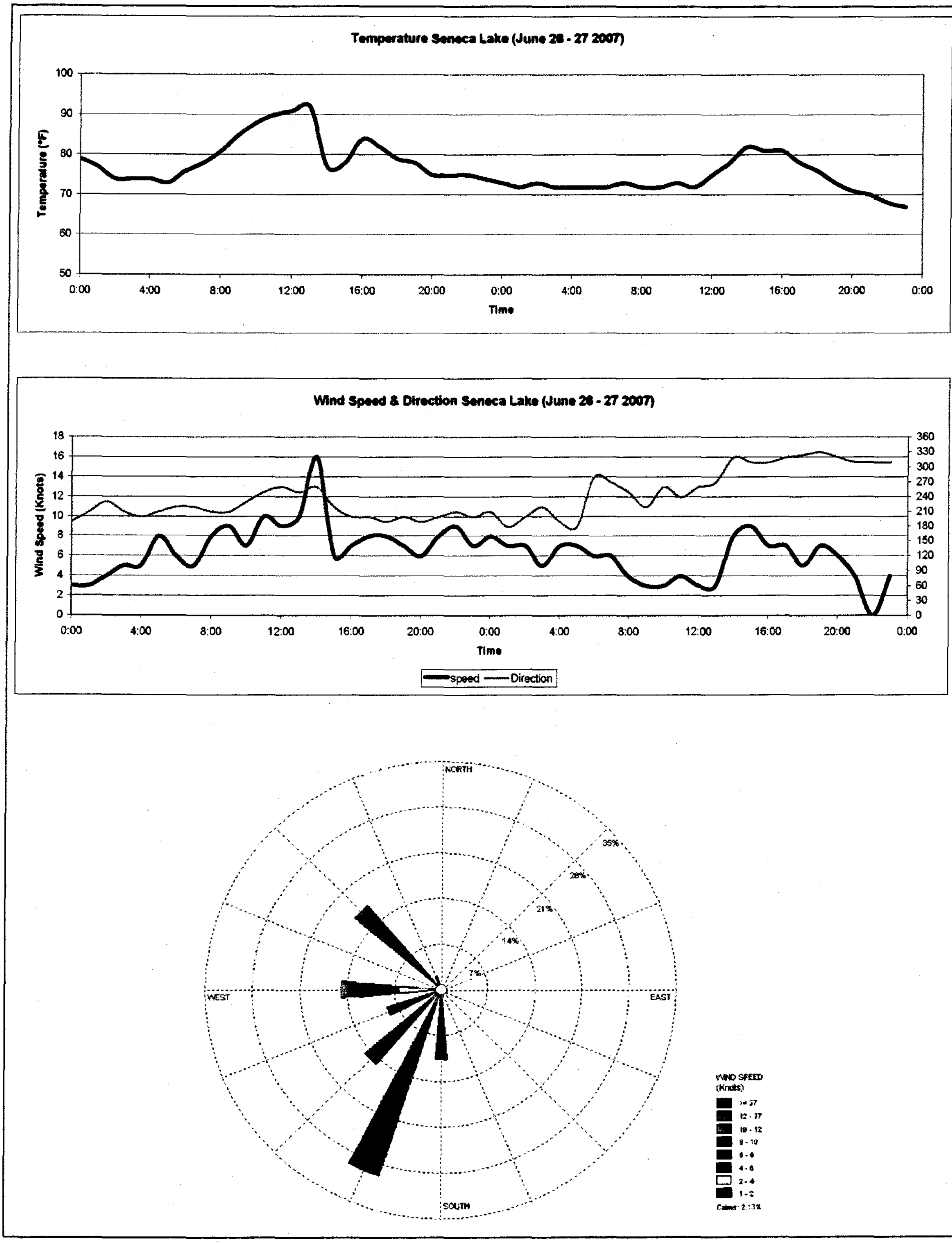


Figure 34 - Meteorological Conditions (Air Temperature, Wind Speed and Direction) in Seneca Lake During the Bathymetric and Hydrodynamic Surveys, 2007

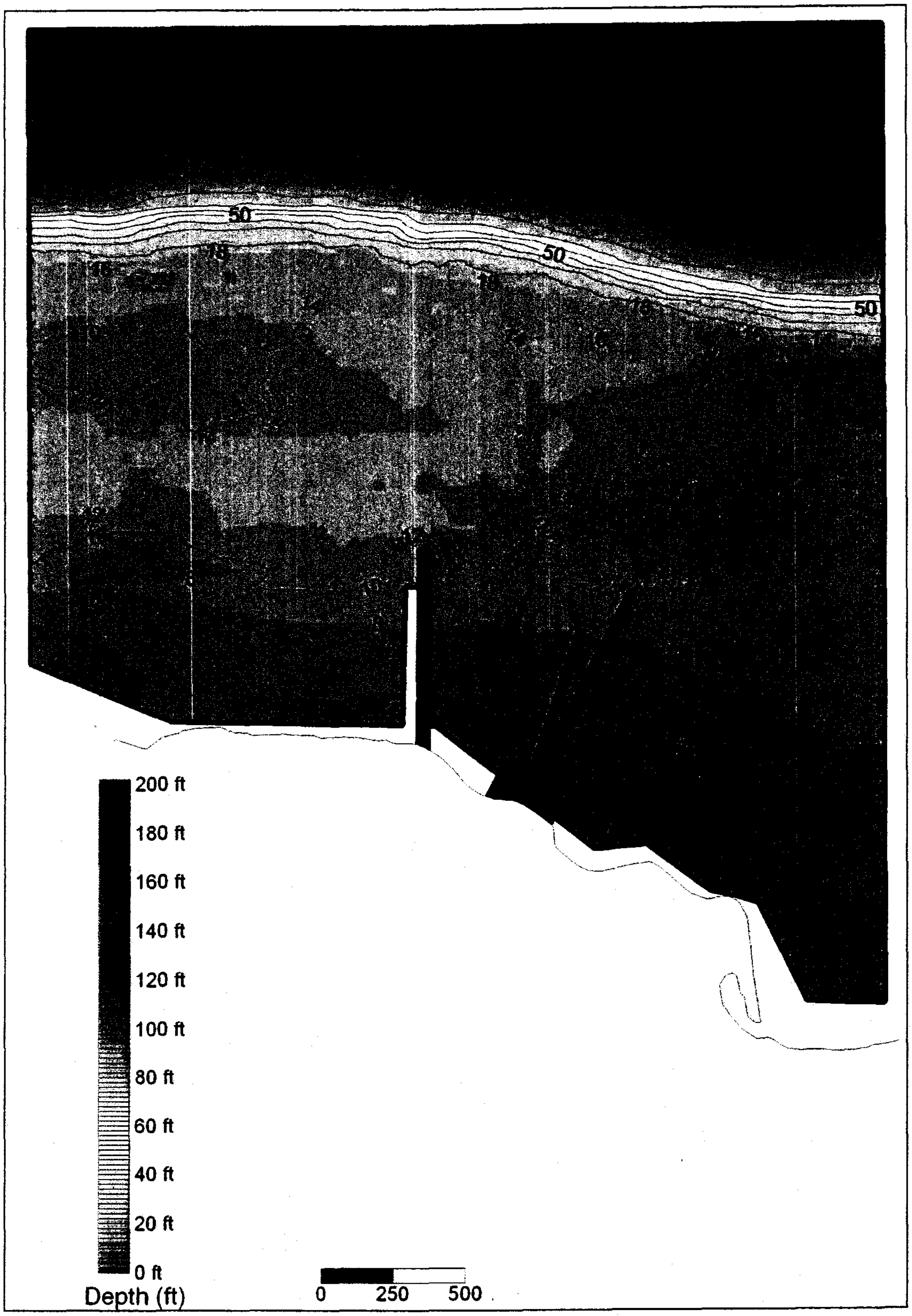


Figure 35 - Bathymetry of Seneca Lake in the Vicinity of AES Greenidge Generating Station Based on 2007 Sampling

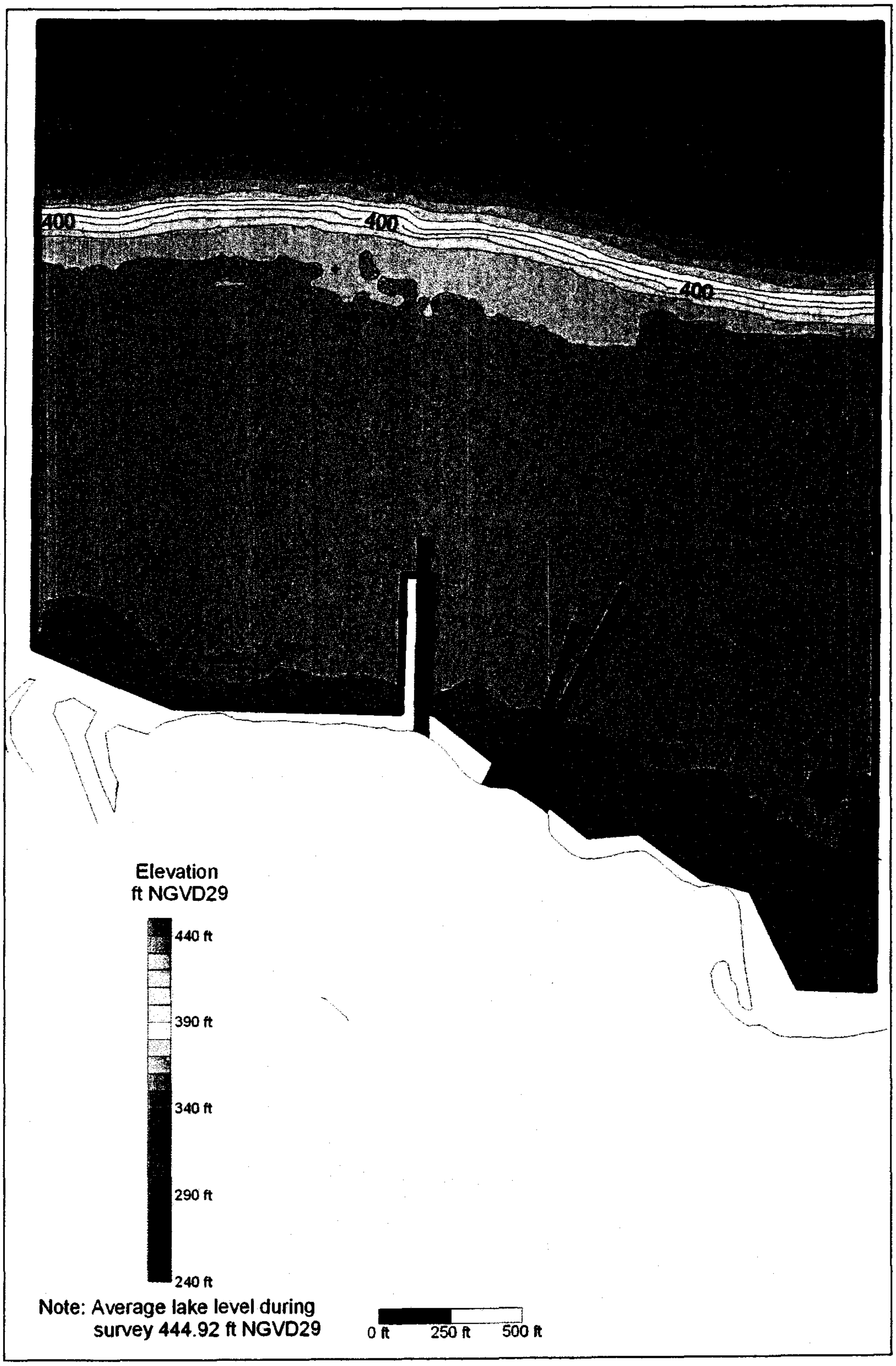


Figure 36 - Elevation Bathymetry of Seneca Lake in the Vicinity of AES Greenidge Generating Station Based on 2007 Sampling

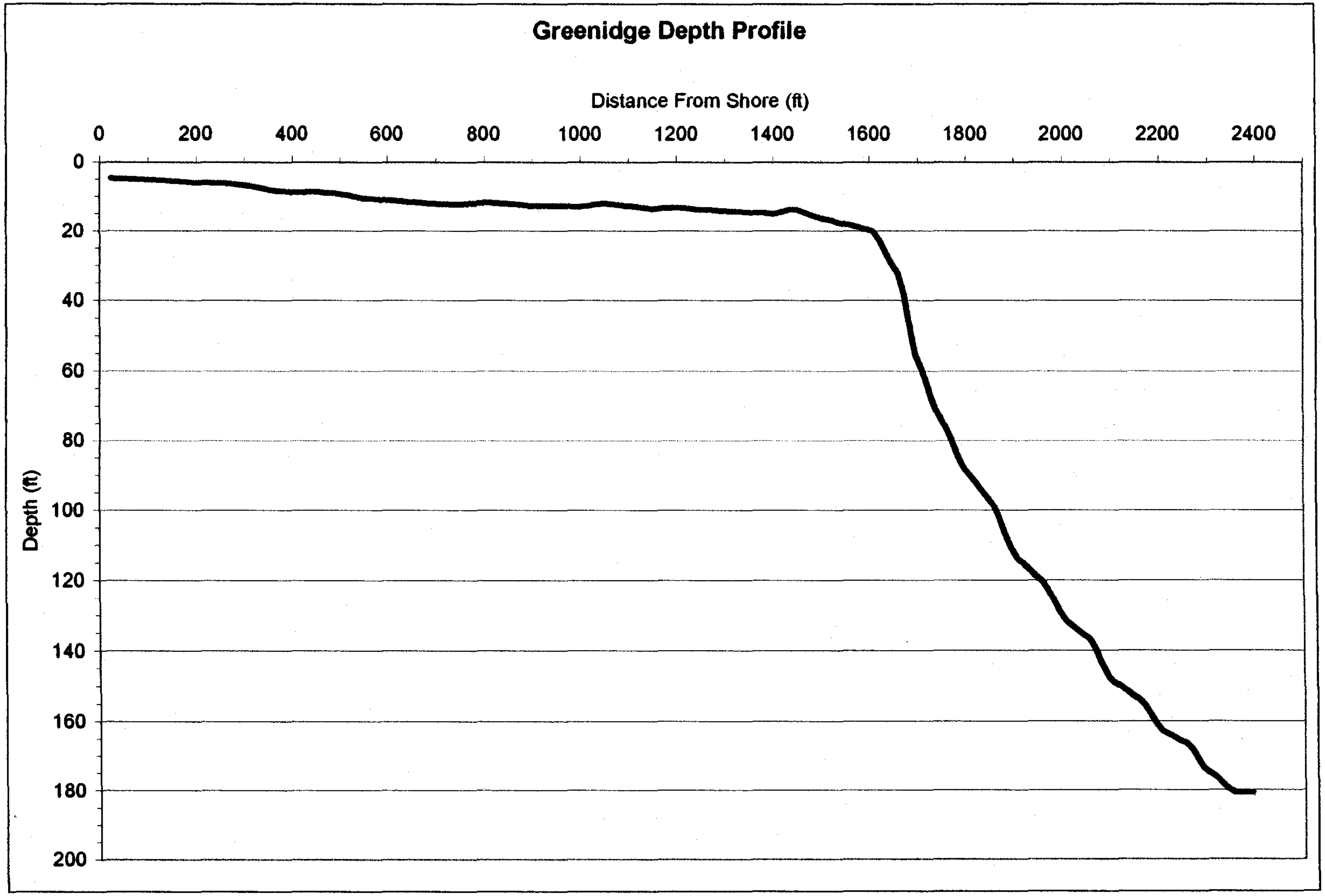
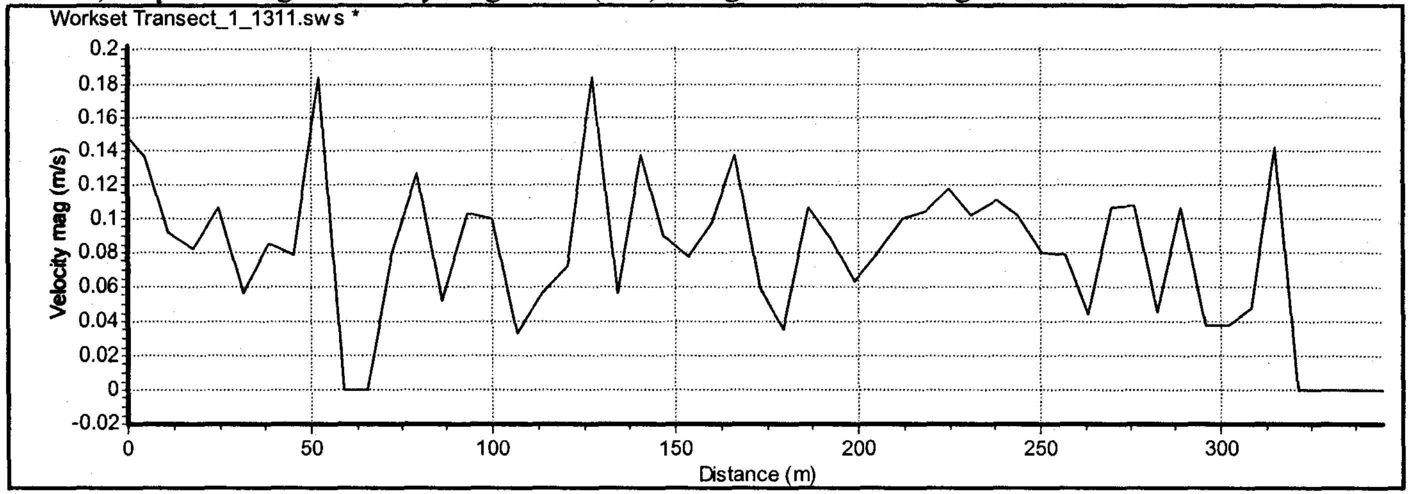


Figure 37 - Depth Profile for Seneca Lake in the Vicinity of AES Greenidge Generating Station Based on 2007 Sampling

a) Depth averaged velocity magnitude (m/s) along transect. Average of five ADCP ensembles.



b) Depth averaged current direction (deg) along transect. Average of five ADCP ensembles.

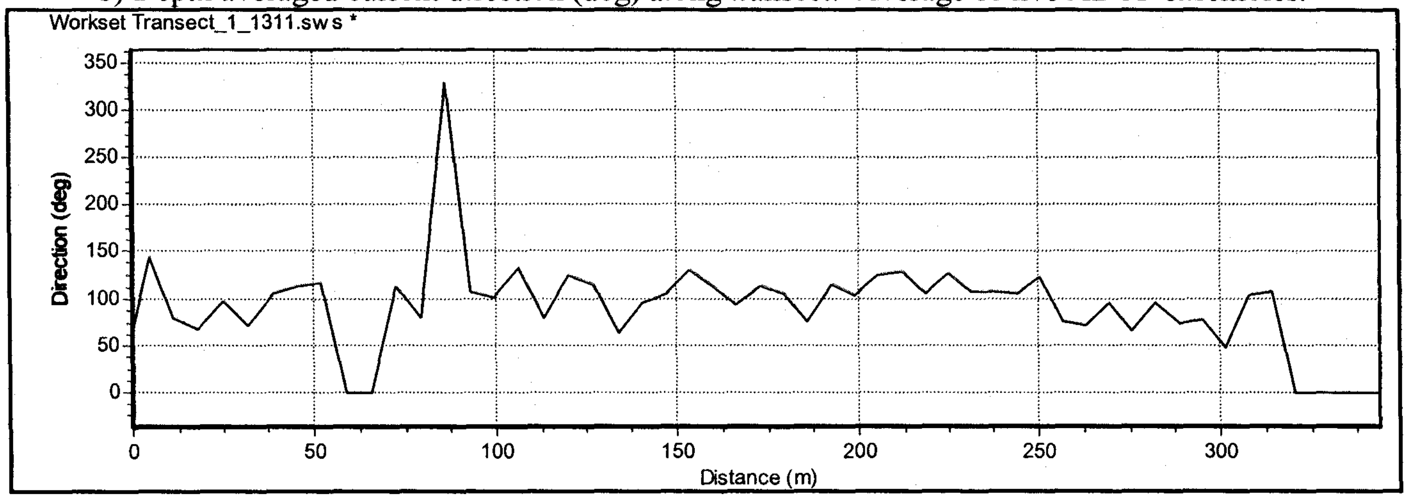
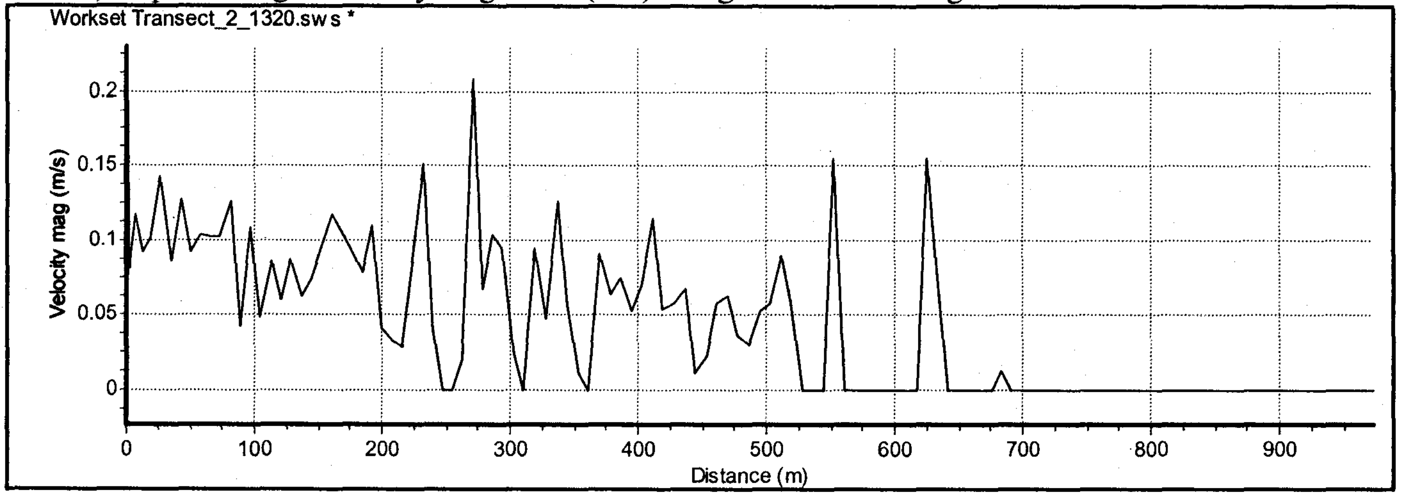


Figure 38 - Results from the Hydrodynamic Sampling at Transect 1 from ADCP Sampling in the Vicinity of AES Greenidge Generating Station, 2007

a) Depth averaged velocity magnitude (m/s) along transect. Average of five ADCP ensembles.



b) Depth averaged current direction (deg) along transect. Average of five ADCP ensembles.

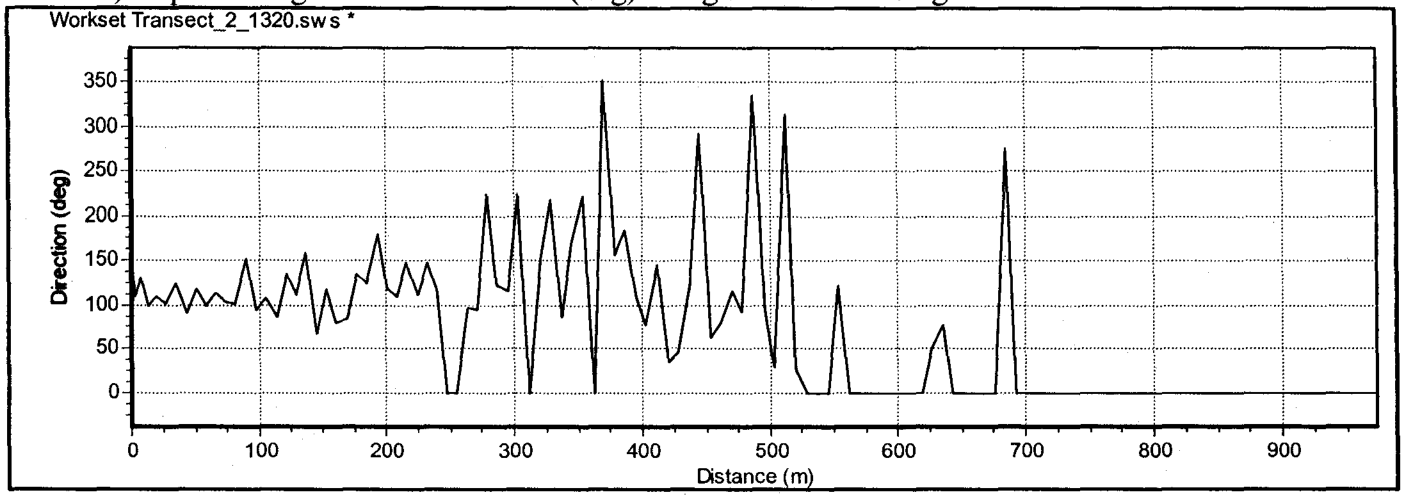
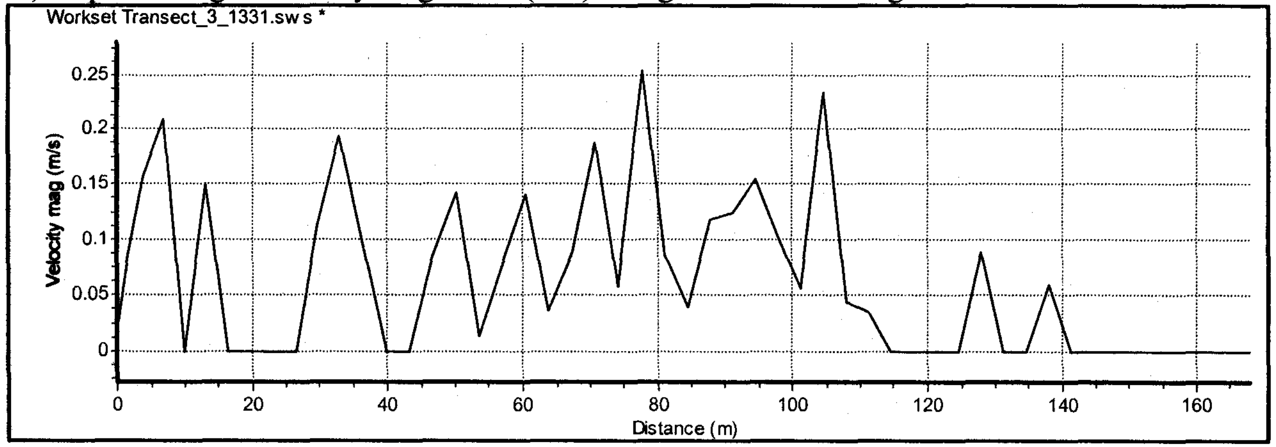


Figure 39 - Results from the Hydrodynamic Sampling at Transect 2 from ADCP Sampling in the Vicinity of AES Greenidge Generating Station, 2007

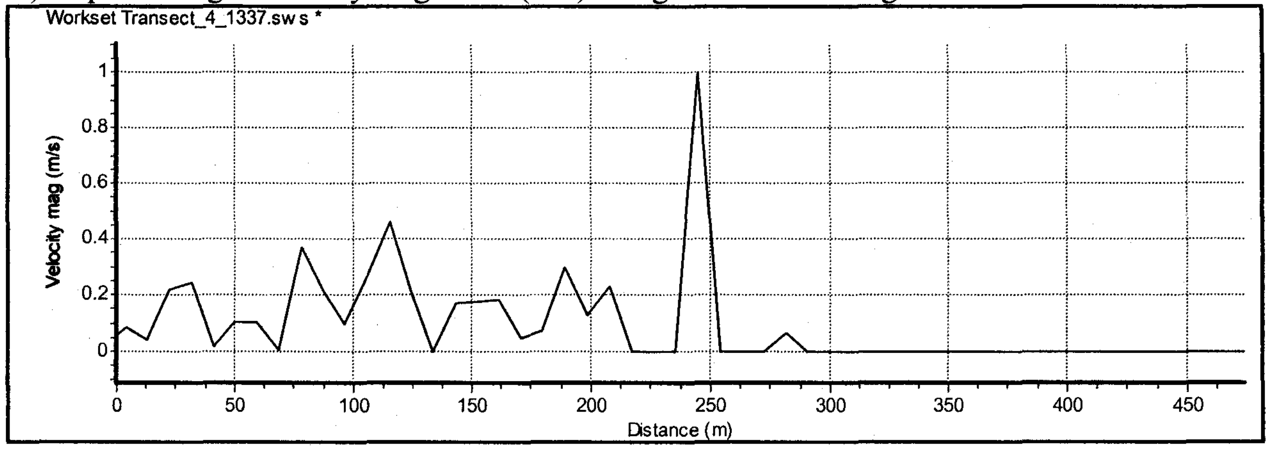
a) Depth averaged velocity magnitude (m/s) along transect. Average of five ADCP ensembles.



b) Depth averaged current direction (deg) along transect. Average of five ADCP ensembles.

Figure 40 - Results from the Hydrodynamic Sampling at Transect 3 from ADCP Sampling in the Vicinity of AES Greenidge Generating Station, 2007

a) Depth averaged velocity magnitude (m/s) along transect. Average of five ADCP ensembles.



b) Depth averaged current direction (deg) along transect. Average of five ADCP ensembles.

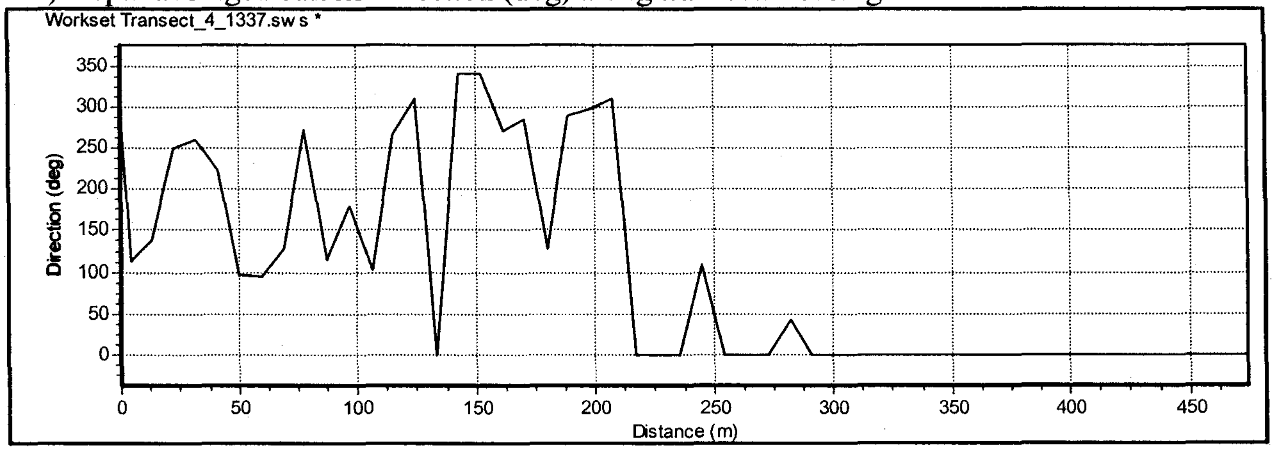


Figure 41 - Results from the Hydrodynamic Sampling at Transect 4 from ADCP Sampling in the Vicinity of AES Greenidge Generating Station, 2007

APPENDIX A

2006 Bottom Trawl Collection Data

Sample Date	Time	Common Name	Scientific Name	Total Collected	Avg. Length (mm)	Duration (minutes)
11-Apr-06	03:15 PM	Banded Killifish	*Fundulus diaphanus*	7	44.4	5.00
11-Apr-06	03:15 PM	Lepomis sp.	*Lepomis spp*	8	38.5	5.00
11-Apr-06	03:15 PM	Slimy Sculpin	*Cottus cognatus*	1	80.0	5.00
11-Apr-06	03:15 PM	Tessellated Darter	*Etheostoma olmstedi*	1	67.0	5.00
20-Apr-06	05:20 PM	Pumpkinseed	*Lepomis gibbosus*	1	44.0	5.00
20-Apr-06	05:20 PM	Tessellated Darter	*Etheostoma olmstedi*	1	49.0	5.00
25-Apr-06	02:00 PM	Banded Killifish	*Fundulus diaphanus*	1	42.0	5.00
25-Apr-06	02:00 PM	Bluntnose Minnow	*Pimephales notatus*	3	43.0	5.00
25-Apr-06	02:00 PM	Lepomis sp.	*Lepomis spp*	1	40.0	5.00
25-Apr-06	02:00 PM	Slimy Sculpin	*Cottus cognatus*	1	82.0	5.00
04-May-06	04:01 PM	Crayfish	*Astacidae*	1	30.0	5.00
04-May-06	04:01 PM	Lepomis sp.	*Lepomis spp*	3	39.3	5.00
04-May-06	04:01 PM	Pumpkinseed	*Lepomis gibbosus*	2	54.0	5.00
04-May-06	04:01 PM	Slimy Sculpin	*Cottus cognatus*	2	72.5	5.00
04-May-06	04:01 PM	Spottail Shiner	*Notropis hudsonius*	5	51.6	5.00
09-May-06	03:18 PM	Bluegill	*Lepomis macrochirus*	2	41.5	5.00
09-May-06	03:18 PM	Bluntnose Minnow	*Pimephales notatus*	4	36.5	5.00
09-May-06	03:18 PM	Crayfish	*Astacidae*	1	40.0	5.00
09-May-06	03:18 PM	Slimy Sculpin	*Cottus cognatus*	7	72.6	5.00
16-May-06	05:14 PM	Bluegill	*Lepomis macrochirus*	1	52.0	5.00
16-May-06	05:14 PM	Crayfish	*Astacidae*	1	42.0	5.00
16-May-06	05:14 PM	Lepomis sp.	*Lepomis spp*	10	38.8	5.00
16-May-06	05:14 PM	Slimy Sculpin	*Cottus cognatus*	1	61.0	5.00
16-May-06	05:14 PM	Tessellated Darter	*Etheostoma olmstedi*	1	47.0	5.00
16-May-06	05:14 PM	Yellow Perch	*Perca flavescens*	1	96.0	5.00
23-May-06	11:45 AM	Bluegill	*Lepomis macrochirus*	3	44.0	5.00
30-May-06	03:27 PM	Lepomis sp.	*Lepomis spp*	5	38.4	5.00
30-May-06	03:27 PM	Yellow Perch	*Perca flavescens*	2	141.5	5.00
06-Jun-06	02:35 PM	Lepomis sp.	*Lepomis spp*	2	45.0	4.00
06-Jun-06	02:35 PM	Slimy Sculpin	*Cottus cognatus*	1	80.0	4.00
06-Jun-06	02:35 PM	Tessellated Darter	*Etheostoma olmstedi*	3	62.0	4.00
13-Jun-06	02:22 PM	Alewife	*Alosa pseudoharengus*	1	151.0	5.00
13-Jun-06	02:22 PM	Lepomis sp.	*Lepomis spp*	1	38.0	5.00
20-Jun-06	06:32 PM	Lepomis sp.	*Lepomis spp*	2	31.5	5.00
20-Jun-06	06:32 PM	Slimy Sculpin	*Cottus cognatus*	1	71.0	5.00
04-Oct-06	09:04 AM	Banded Killifish	*Fundulus diaphanus*	1	47.0	5.00
04-Oct-06	09:04 AM	Lepomis sp.	*Lepomis spp*	11	37.6	5.00
09-Oct-06	01:57 PM	Lepomis sp.	*Lepomis spp*	1	44.0	5.00
09-Oct-06	01:57 PM	Tessellated Darter	*Etheostoma olmstedi*	1	53.0	5.00
18-Oct-06	09:08 AM	Banded Killifish	*Fundulus diaphanus*	2	43.0	4.00
18-Oct-06	09:08 AM	Lepomis sp.	*Lepomis spp*	14	41.5	4.00
23-Oct-06	02:22 PM	Banded Killifish	*Fundulus diaphanus*	1	33.0	4.48
23-Oct-06	02:22 PM	Bluntnose Minnow	*Pimephales notatus*	3	56.0	4.48
23-Oct-06	02:22 PM	Lepomis sp.	*Lepomis spp*	27	37.7	4.48
23-Oct-06	02:22 PM	Tessellated Darter	*Etheostoma olmstedi*	2	55.5	4.48

APPENDIX B

2006 Pelagic Trawl Collection Data

Sample Date	Time	Common Name	Scientific Name	Total Collected	Avg. Length (mm)	Duration (minutes)
11-Apr-06	02:16 PM	Lepomis sp.	*Lepomis spp*	1	24.0	5.00
22-Aug-06	12:26 PM	Banded Killifish	*Fundulus diaphanus*	1	46.0	5.00

APPENDIX C

2006 Beach Seine Collection Data

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
20-Apr-06	03:12 PM	South	Banded Killifish	*Fundulus diaphanus*	2	54.0
20-Apr-06	03:12 PM	South	Bluntnose Minnow	*Pimephales notatus*	2	61.0
20-Apr-06	03:12 PM	South	Golden Shiner	*Notemigonus crysoleucas*	1	77.0
25-Apr-06	12:27 PM	North	Tessellated Darter	*Etheostoma olmstedi*	1	69.0
25-Apr-06	01:04 PM	South	Banded Killifish	*Fundulus diaphanus*	1	72.0
25-Apr-06	01:04 PM	South	Crayfish	*Astacidae*	1	24.0
25-Apr-06	01:04 PM	South	Gizzard Shad	*Dorosoma cepedianum*	1	426.0
09-May-06	12:10 PM	North	Banded Killifish	*Fundulus diaphanus*	1	54.0
09-May-06	12:42 PM	South	Banded Killifish	*Fundulus diaphanus*	1	54.0
09-May-06	12:42 PM	South	Brown Bullhead	*Ameiurus nebulosus*	1	82.0
16-May-06	03:58 PM	South	Brown Bullhead	*Ameiurus nebulosus*	2	315.0
16-May-06	03:58 PM	South	Smallmouth Bass	*Micropterus dolomieu*	1	370.0
16-May-06	03:58 PM	South	Tessellated Darter	*Etheostoma olmstedi*	2	54.0
16-May-06	07:00 PM	North	Smallmouth Bass	*Micropterus dolomieu*	2	452.5
16-May-06	07:00 PM	North	Tessellated Darter	*Etheostoma olmstedi*	1	80.0
23-May-06	09:03 AM	North	Tessellated Darter	*Etheostoma olmstedi*	4	62.2
23-May-06	09:36 AM	South	Brown Bullhead	*Ameiurus nebulosus*	1	81.0
23-May-06	09:36 AM	South	Brook silverside	*Labidesthes sicculus*	2	81.0
23-May-06	09:36 AM	South	Salmonidae	*Salmonidae spp*	1	92.0
23-May-06	09:36 AM	South	Tessellated Darter	*Etheostoma olmstedi*	1	49.0
23-May-06	09:36 AM	South	White Sucker	*Catostomus commersoni*	2	17.5
30-May-06	12:53 PM	North	Banded Killifish	*Fundulus diaphanus*	39	58.3
30-May-06	12:53 PM	North	Brook silverside	*Labidesthes sicculus*	10	90.7
30-May-06	12:53 PM	North	Notropis sp.	*Notropis spp*	3	58.3
30-May-06	12:53 PM	North	Spottail Shiner	*Notropis hudsonius*	7	54.0
30-May-06	01:50 PM	South	Banded Killifish	*Fundulus diaphanus*	1	53.0
30-May-06	01:50 PM	South	Brown Bullhead	*Ameiurus nebulosus*	1	345.0
30-May-06	01:50 PM	South	Crayfish	*Astacidae*	1	70.0
30-May-06	01:50 PM	South	Tessellated Darter	*Etheostoma olmstedi*	2	53.0
30-May-06	01:50 PM	South	White Sucker	*Catostomus commersoni*	1	22.0
06-Jun-06	10:53 AM	North	Banded Killifish	*Fundulus diaphanus*	58	60.6
06-Jun-06	10:53 AM	North	Brook silverside	*Labidesthes sicculus*	2	86.0
06-Jun-06	10:53 AM	North	Brown Bullhead	*Ameiurus nebulosus*	1	353.0
06-Jun-06	10:53 AM	North	Spottail Shiner	*Notropis hudsonius*	14	54.7
06-Jun-06	10:53 AM	North	Tessellated Darter	*Etheostoma olmstedi*	3	57.7
06-Jun-06	05:45 PM	South	Alewife	*Alosa pseudoharengus*	119	145.3
06-Jun-06	05:45 PM	South	Banded Killifish	*Fundulus diaphanus*	22	66.1
06-Jun-06	05:45 PM	South	Bluegill	*Lepomis macrochirus*	6	56.5
06-Jun-06	05:45 PM	South	Brown Bullhead	*Ameiurus nebulosus*	8	347.8
06-Jun-06	05:45 PM	South	Pumpkinseed	*Lepomis gibbosus*	1	61.0
06-Jun-06	05:45 PM	South	Spottail Shiner	*Notropis hudsonius*	21	57.3
06-Jun-06	05:45 PM	South	Tessellated Darter	*Etheostoma olmstedi*	2	54.0
13-Jun-06	03:10 PM	South	Alewife	*Alosa pseudoharengus*	14	144.9
13-Jun-06	03:10 PM	South	Banded Killifish	*Fundulus diaphanus*	28	62.4
13-Jun-06	03:10 PM	South	Brown Bullhead	*Ameiurus nebulosus*	5	352.4
13-Jun-06	03:10 PM	South	Largemouth Bass	*Micropterus salmoides*	1	397.0
13-Jun-06	03:10 PM	South	Pumpkinseed	*Lepomis gibbosus*	2	127.5
13-Jun-06	03:10 PM	South	Spottail Shiner	*Notropis hudsonius*	25	49.7
13-Jun-06	03:10 PM	South	Tessellated Darter	*Etheostoma olmstedi*	1	47.0
13-Jun-06	04:41 PM	North	Banded Killifish	*Fundulus diaphanus*	6	57.0
13-Jun-06	04:41 PM	North	Brook silverside	*Labidesthes sicculus*	1	89.0
13-Jun-06	04:41 PM	North	Brown Bullhead	*Ameiurus nebulosus*	2	303.0
13-Jun-06	04:41 PM	North	Spottail Shiner	*Notropis hudsonius*	3	53.3

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
20-Jun-06	09:57 AM	South	Alewife	*Alosa pseudoharengus*	47	142.4
20-Jun-06	09:57 AM	South	Banded Killifish	*Fundulus diaphanus*	268	58.0
20-Jun-06	09:57 AM	South	Brook silverside	*Labidesthes sicculus*	1	93.0
20-Jun-06	09:57 AM	South	Brown Bullhead	*Ameiurus nebulosus*	22	322.7
20-Jun-06	09:57 AM	South	Pumpkinseed	*Lepomis gibbosus*	28	91.6
20-Jun-06	09:57 AM	South	Rock Bass	*Ambloplites rupestris*	4	108.2
20-Jun-06	09:57 AM	South	Spottail Shiner	*Notropis hudsonius*	808	52.4
20-Jun-06	09:57 AM	South	Tessellated Darter	*Etheostoma olmstedi*	1	61.0
20-Jun-06	02:12 PM	North	Banded Killifish	*Fundulus diaphanus*	58	58.0
20-Jun-06	02:12 PM	North	Bluntnose Minnow	*Pimephales notatus*	1	76.0
20-Jun-06	02:12 PM	North	Brown Bullhead	*Ameiurus nebulosus*	27	324.0
20-Jun-06	02:12 PM	North	Pumpkinseed	*Lepomis gibbosus*	16	123.1
20-Jun-06	02:12 PM	North	Smallmouth Bass	*Micropterus dolomieu*	2	222.0
20-Jun-06	02:12 PM	North	Spottail Shiner	*Notropis hudsonius*	36	53.1
27-Jun-06	08:36 AM	North	Banded Killifish	*Fundulus diaphanus*	73	52.9
27-Jun-06	08:36 AM	North	Bluntnose Minnow	*Pimephales notatus*	5	67.2
27-Jun-06	08:36 AM	North	Brown Bullhead	*Ameiurus nebulosus*	29	332.1
27-Jun-06	08:36 AM	North	Eastern silvery minnow	*Hybognathus regius*	2	68.5
27-Jun-06	08:36 AM	North	Pumpkinseed	*Lepomis gibbosus*	35	113.2
27-Jun-06	08:36 AM	North	Spottail Shiner	*Notropis hudsonius*	160	48.0
27-Jun-06	08:36 AM	North	Tessellated Darter	*Etheostoma olmstedi*	2	52.5
27-Jun-06	08:36 AM	North	White Sucker	*Catostomus commersoni*	12	39.2
27-Jun-06	09:55 AM	South	Banded Killifish	*Fundulus diaphanus*	25	53.5
27-Jun-06	09:55 AM	South	Bluegill	*Lepomis macrochirus*	1	50.0
27-Jun-06	09:55 AM	South	Bluntnose Minnow	*Pimephales notatus*	32	60.8
27-Jun-06	09:55 AM	South	Brown Bullhead	*Ameiurus nebulosus*	21	323.8
27-Jun-06	09:55 AM	South	Pumpkinseed	*Lepomis gibbosus*	33	96.2
27-Jun-06	09:55 AM	South	Rock Bass	*Ambloplites rupestris*	2	155.0
27-Jun-06	09:55 AM	South	Spottail Shiner	*Notropis hudsonius*	375	57.4
05-Jul-06	01:29 PM	North	Banded Killifish	*Fundulus diaphanus*	74	60.0
05-Jul-06	01:29 PM	North	Bluegill	*Lepomis macrochirus*	12	55.2
05-Jul-06	01:29 PM	North	Bluntnose Minnow	*Pimephales notatus*	21	55.5
05-Jul-06	01:29 PM	North	Brook silverside	*Labidesthes sicculus*	5	85.8
05-Jul-06	01:29 PM	North	Brown Bullhead	*Ameiurus nebulosus*	5	331.4
05-Jul-06	01:29 PM	North	Carp	*Cyprinus carpio*	1	284.0
05-Jul-06	01:29 PM	North	Lepomis sp.	*Lepomis spp*	7	47.1
05-Jul-06	01:29 PM	North	Pumpkinseed	*Lepomis gibbosus*	82	91.2
05-Jul-06	01:29 PM	North	Smallmouth Bass	*Micropterus dolomieu*	1	102.0
05-Jul-06	01:29 PM	North	Spottail Shiner	*Notropis hudsonius*	16	53.0
05-Jul-06	02:35 PM	South	Banded Killifish	*Fundulus diaphanus*	39	58.4
05-Jul-06	02:35 PM	South	Bluegill	*Lepomis macrochirus*	33	63.4
05-Jul-06	02:35 PM	South	Bluntnose Minnow	*Pimephales notatus*	78	56.9
05-Jul-06	02:35 PM	South	Brook silverside	*Labidesthes sicculus*	1	80.0
05-Jul-06	02:35 PM	South	Brown Bullhead	*Ameiurus nebulosus*	6	313.3
05-Jul-06	02:35 PM	South	Lepomis sp.	*Lepomis spp*	10	47.2
05-Jul-06	02:35 PM	South	Pumpkinseed	*Lepomis gibbosus*	41	76.6
05-Jul-06	02:35 PM	South	Rock Bass	*Ambloplites rupestris*	2	151.5
05-Jul-06	02:35 PM	South	Smallmouth Bass	*Micropterus dolomieu*	2	240.5
05-Jul-06	02:35 PM	South	Spottail Shiner	*Notropis hudsonius*	34	55.1
05-Jul-06	02:35 PM	South	Yellow Perch	*Perca flavescens*	1	269.0
12-Jul-06	02:14 PM	South	Banded Killifish	*Fundulus diaphanus*	34	59.6
12-Jul-06	02:14 PM	South	Bluegill	*Lepomis macrochirus*	8	59.8

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
12-Jul-06	02:14 PM	South	Bluntnose Minnow	*Pimephales notatus*	130	54.4
12-Jul-06	02:14 PM	South	Brook silverside	*Labidesthes sicculus*	2	86.5
12-Jul-06	02:14 PM	South	Brown Bullhead	*Ameiurus nebulosus*	1	359.0
12-Jul-06	02:14 PM	South	Largemouth Bass	*Micropterus salmoides*	1	38.0
12-Jul-06	02:14 PM	South	Lepomis sp.	*Lepomis spp*	9	43.0
12-Jul-06	02:14 PM	South	Pumpkinseed	*Lepomis gibbosus*	26	85.0
12-Jul-06	02:14 PM	South	Emerald Shiner	*Notropis atherinoides*	2	38.5
12-Jul-06	02:14 PM	South	Smallmouth Bass	*Micropterus dolomieu*	4	56.8
12-Jul-06	02:14 PM	South	Spottail Shiner	*Notropis hudsonius*	2	60.5
12-Jul-06	02:14 PM	South	Yellow Perch	*Perca flavescens*	2	221.5
12-Jul-06	04:47 PM	North	Banded Killifish	*Fundulus diaphanus*	86	66.3
12-Jul-06	04:47 PM	North	Bluegill	*Lepomis macrochirus*	6	63.5
12-Jul-06	04:47 PM	North	Bluntnose Minnow	*Pimephales notatus*	17	55.2
12-Jul-06	04:47 PM	North	Brook silverside	*Labidesthes sicculus*	5	88.6
12-Jul-06	04:47 PM	North	Brown Bullhead	*Ameiurus nebulosus*	1	330.0
12-Jul-06	04:47 PM	North	Largemouth Bass	*Micropterus salmoides*	1	41.0
12-Jul-06	04:47 PM	North	Lepomis sp.	*Lepomis spp*	8	44.9
12-Jul-06	04:47 PM	North	Pumpkinseed	*Lepomis gibbosus*	102	70.7
12-Jul-06	04:47 PM	North	Emerald Shiner	*Notropis atherinoides*	2	74.5
12-Jul-06	04:47 PM	North	Smallmouth Bass	*Micropterus dolomieu*	3	177.3
18-Jul-06	01:30 PM	North	Banded Killifish	*Fundulus diaphanus*	22	61.5
18-Jul-06	01:30 PM	North	Bluntnose Minnow	*Pimephales notatus*	2	21.0
18-Jul-06	01:30 PM	North	Pumpkinseed	*Lepomis gibbosus*	2	77.0
18-Jul-06	01:30 PM	North	Smallmouth Bass	*Micropterus dolomieu*	18	31.8
18-Jul-06	01:30 PM	North	Tessellated Darter	*Etheostoma olmstedi*	3	31.3
18-Jul-06	02:14 PM	South	Banded Killifish	*Fundulus diaphanus*	41	61.1
18-Jul-06	02:14 PM	South	Bluntnose Minnow	*Pimephales notatus*	5	45.6
18-Jul-06	02:14 PM	South	Brook silverside	*Labidesthes sicculus*	2	94.0
18-Jul-06	02:14 PM	South	Largemouth Bass	*Micropterus salmoides*	3	113.7
18-Jul-06	02:14 PM	South	Lepomis sp.	*Lepomis spp*	2	47.5
18-Jul-06	02:14 PM	South	Pumpkinseed	*Lepomis gibbosus*	29	91.8
18-Jul-06	02:14 PM	South	Rock Bass	*Ambloplites rupestris*	3	31.0
18-Jul-06	02:14 PM	South	Smallmouth Bass	*Micropterus dolomieu*	6	121.5
25-Jul-06	02:45 PM	South	Banded Killifish	*Fundulus diaphanus*	106	62.4
25-Jul-06	02:45 PM	South	Bluegill	*Lepomis macrochirus*	9	66.4
25-Jul-06	02:45 PM	South	Bluntnose Minnow	*Pimephales notatus*	8	46.4
25-Jul-06	02:45 PM	South	Brown Bullhead	*Ameiurus nebulosus*	2	35.0
25-Jul-06	02:45 PM	South	Pumpkinseed	*Lepomis gibbosus*	16	78.2
25-Jul-06	02:45 PM	South	Redbreast Sunfish	*Lepomis auritus*	1	171.0
25-Jul-06	02:45 PM	South	Rock Bass	*Ambloplites rupestris*	3	37.7
25-Jul-06	02:45 PM	South	Smallmouth Bass	*Micropterus dolomieu*	26	57.6
25-Jul-06	07:07 PM	North	Banded Killifish	*Fundulus diaphanus*	42	62.8
25-Jul-06	07:07 PM	North	Bluegill	*Lepomis macrochirus*	1	51.0
25-Jul-06	07:07 PM	North	Bluntnose Minnow	*Pimephales notatus*	37	27.2
25-Jul-06	07:07 PM	North	Brook silverside	*Labidesthes sicculus*	1	80.0
25-Jul-06	07:07 PM	North	Brown Bullhead	*Ameiurus nebulosus*	1	40.0
25-Jul-06	07:07 PM	North	Carp	*Cyprinus carpio*	2	39.0
25-Jul-06	07:07 PM	North	Largemouth Bass	*Micropterus salmoides*	7	52.0
25-Jul-06	07:07 PM	North	Pumpkinseed	*Lepomis gibbosus*	30	73.7
25-Jul-06	07:07 PM	North	Smallmouth Bass	*Micropterus dolomieu*	17	51.8
25-Jul-06	07:07 PM	North	Tessellated Darter	*Etheostoma olmstedi*	10	37.0
01-Aug-06	09:28 AM	South	Banded Killifish	*Fundulus diaphanus*	14	56.4
01-Aug-06	09:28 AM	South	Bluntnose Minnow	*Pimephales notatus*	22	45.3

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
01-Aug-06	09:28 AM	South	Brown Bullhead	*Ameiurus nebulosus*	8	37.4
01-Aug-06	09:28 AM	South	Carp	*Cyprinus carpio*	2	49.0
01-Aug-06	09:28 AM	South	Crayfish	*Astacidae*	1	90.0
01-Aug-06	09:28 AM	South	Cyprinid unidentified	*Cyprinid spp*	3	14.5
01-Aug-06	09:28 AM	South	Largemouth Bass	*Micropterus salmoides*	9	64.1
01-Aug-06	09:28 AM	South	Pumpkinseed	*Lepomis gibbosus*	15	72.3
01-Aug-06	09:28 AM	South	Smallmouth Bass	*Micropterus dolomieu*	2	47.5
01-Aug-06	09:28 AM	South	Tessellated Darter	*Etheostoma olmstedi*	5	39.2
01-Aug-06	10:19 AM	North	Banded Killifish	*Fundulus diaphanus*	7	56.0
01-Aug-06	10:19 AM	North	Bluegill	*Lepomis macrochirus*	1	64.0
01-Aug-06	10:19 AM	North	Bluntnose Minnow	*Pimephales notatus*	2	38.0
01-Aug-06	10:19 AM	North	Brook silverside	*Labidesthes sicculus*	4	36.8
01-Aug-06	10:19 AM	North	Crayfish	*Astacidae*	1	88.0
01-Aug-06	10:19 AM	North	Largemouth Bass	*Micropterus salmoides*	7	48.7
01-Aug-06	10:19 AM	North	Smallmouth Bass	*Micropterus dolomieu*	45	53.6
01-Aug-06	10:19 AM	North	Tessellated Darter	*Etheostoma olmstedi*	1	30.0
08-Aug-06	11:52 AM	South	Banded Killifish	*Fundulus diaphanus*	47	39.3
08-Aug-06	11:52 AM	South	Bluegill	*Lepomis macrochirus*	1	70.0
08-Aug-06	11:52 AM	South	Bluntnose Minnow	*Pimephales notatus*	16	48.1
08-Aug-06	11:52 AM	South	Brown Bullhead	*Ameiurus nebulosus*	6	46.3
08-Aug-06	11:52 AM	South	Carp	*Cyprinus carpio*	2	59.0
08-Aug-06	11:52 AM	South	Crayfish	*Astacidae*	2	34.5
08-Aug-06	11:52 AM	South	Largemouth Bass	*Micropterus salmoides*	24	61.9
08-Aug-06	11:52 AM	South	Lepomis sp.	*Lepomis spp*	4	36.8
08-Aug-06	11:52 AM	South	Pumpkinseed	*Lepomis gibbosus*	17	92.4
08-Aug-06	11:52 AM	South	Rock Bass	*Ambloplites rupestris*	6	36.3
08-Aug-06	11:52 AM	South	Emerald Shiner	*Notropis atherinoides*	10	57.9
08-Aug-06	11:52 AM	South	Smallmouth Bass	*Micropterus dolomieu*	27	60.4
08-Aug-06	11:52 AM	South	Spottail Shiner	*Notropis hudsonius*	119	42.0
08-Aug-06	11:52 AM	South	Tessellated Darter	*Etheostoma olmstedi*	9	43.1
08-Aug-06	02:29 PM	North	Ameiurus spp.	*Ameiurus spp*	1076	50.7
08-Aug-06	02:29 PM	North	Banded Killifish	*Fundulus diaphanus*	58	45.3
08-Aug-06	02:29 PM	North	Bluntnose Minnow	*Pimephales notatus*	57	34.8
08-Aug-06	02:29 PM	North	Brown Bullhead	*Ameiurus nebulosus*	5	54.2
08-Aug-06	02:29 PM	North	Carp	*Cyprinus carpio*	22	66.2
08-Aug-06	02:29 PM	North	Crayfish	*Astacidae*	76	42.2
08-Aug-06	02:29 PM	North	Largemouth Bass	*Micropterus salmoides*	53	64.4
08-Aug-06	02:29 PM	North	Lepomis sp.	*Lepomis spp*	4	38.5
08-Aug-06	02:29 PM	North	Spottail Shiner	*Notropis hudsonius*	1	56.0
08-Aug-06	02:29 PM	North	Pumpkinseed	*Lepomis gibbosus*	16	76.6
08-Aug-06	02:29 PM	North	Rock Bass	*Ambloplites rupestris*	1	35.0
08-Aug-06	02:29 PM	North	Tessellated Darter	*Etheostoma olmstedi*	41	42.0
15-Aug-06	08:13 AM	South	Banded Killifish	*Fundulus diaphanus*	37	65.2
15-Aug-06	08:13 AM	South	Bluegill	*Lepomis macrochirus*	53	80.1
15-Aug-06	08:13 AM	South	Bluntnose Minnow	*Pimephales notatus*	715	59.8
15-Aug-06	08:13 AM	South	Brook silverside	*Labidesthes sicculus*	2	52.0
15-Aug-06	08:13 AM	South	Brown Bullhead	*Ameiurus nebulosus*	5	58.4
15-Aug-06	08:13 AM	South	Largemouth Bass	*Micropterus salmoides*	26	93.7
15-Aug-06	08:13 AM	South	Lepomis sp.	*Lepomis spp*	2	54.5
15-Aug-06	08:13 AM	South	Spottail Shiner	*Notropis hudsonius*	1	74.0
15-Aug-06	08:13 AM	South	Notropis sp.	*Notropis spp*	16	41.2
15-Aug-06	08:13 AM	South	Pumpkinseed	*Lepomis gibbosus*	90	87.9
15-Aug-06	08:13 AM	South	Redbreast Sunfish	*Lepomis auritus*	1	167.0

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
15-Aug-06	08:13 AM	South	Smallmouth Bass	*Micropterus dolomieu*	7	78.1
15-Aug-06	08:13 AM	South	Tessellated Darter	*Etheostoma olmstedi*	2	38.5
15-Aug-06	12:14 PM	North	Banded Killifish	*Fundulus diaphanus*	255	71.4
15-Aug-06	12:14 PM	North	Bluegill	*Lepomis macrochirus*	5	75.2
15-Aug-06	12:14 PM	North	Bluntnose Minnow	*Pimephales notatus*	254	60.8
15-Aug-06	12:14 PM	North	Brown Bullhead	*Ameiurus nebulosus*	233	55.7
15-Aug-06	12:14 PM	North	Carp	*Cyprinus carpio*	9	71.1
15-Aug-06	12:14 PM	North	Crayfish	*Astacidae*	1	50.0
15-Aug-06	12:14 PM	North	Largemouth Bass	*Micropterus salmoides*	31	88.1
15-Aug-06	12:14 PM	North	Lepomis sp.	*Lepomis spp*	4	40.8
15-Aug-06	12:14 PM	North	Northern Pike	*Esox lucius*	1	322.0
15-Aug-06	12:14 PM	North	Pumpkinseed	*Lepomis gibbosus*	88	81.3
15-Aug-06	12:14 PM	North	Rock Bass	*Ambloplites rupestris*	4	47.2
15-Aug-06	12:14 PM	North	White Sucker	*Catostomus commersoni*	1	86.0
22-Aug-06	02:50 PM	South	Banded Killifish	*Fundulus diaphanus*	148	67.2
22-Aug-06	02:50 PM	South	Bluegill	*Lepomis macrochirus*	6	66.2
22-Aug-06	02:50 PM	South	Bluntnose Minnow	*Pimephales notatus*	891	56.8
22-Aug-06	02:50 PM	South	Brook silverside	*Labidesthes sicculus*	17	40.8
22-Aug-06	02:50 PM	South	Brown Bullhead	*Ameiurus nebulosus*	13	57.2
22-Aug-06	02:50 PM	South	Crayfish	*Astacidae*	4	56.8
22-Aug-06	02:50 PM	South	Largemouth Bass	*Micropterus salmoides*	25	83.8
22-Aug-06	02:50 PM	South	Lepomis sp.	*Lepomis spp*	40	40.2
22-Aug-06	02:50 PM	South	Pumpkinseed	*Lepomis gibbosus*	20	81.6
22-Aug-06	02:50 PM	South	Rock Bass	*Ambloplites rupestris*	3	43.0
22-Aug-06	02:50 PM	South	Tessellated Darter	*Etheostoma olmstedi*	3	44.3
23-Aug-06	07:02 AM	North	Banded Killifish	*Fundulus diaphanus*	24	65.0
23-Aug-06	07:02 AM	North	Bluegill	*Lepomis macrochirus*	1	65.0
23-Aug-06	07:02 AM	North	Bluntnose Minnow	*Pimephales notatus*	2092	60.6
23-Aug-06	07:02 AM	North	Brown Bullhead	*Ameiurus nebulosus*	28	68.3
23-Aug-06	07:02 AM	North	Carp	*Cyprinus carpio*	7	83.9
23-Aug-06	07:02 AM	North	Chain Pickerel	*Esox niger*	1	385.0
23-Aug-06	07:02 AM	North	Crayfish	*Astacidae*	2	42.5
23-Aug-06	07:02 AM	North	Largemouth Bass	*Micropterus salmoides*	35	90.9
23-Aug-06	07:02 AM	North	Lepomis sp.	*Lepomis spp*	30	42.5
23-Aug-06	07:02 AM	North	Pumpkinseed	*Lepomis gibbosus*	36	80.6
23-Aug-06	07:02 AM	North	Rock Bass	*Ambloplites rupestris*	6	43.7
23-Aug-06	07:02 AM	North	Stoneroller	*Campostoma spp*	2	65.5
29-Aug-06	08:38 AM	South	Banded Killifish	*Fundulus diaphanus*	176	52.9
29-Aug-06	08:38 AM	South	Bluntnose Minnow	*Pimephales notatus*	620	51.9
29-Aug-06	08:38 AM	South	Brook silverside	*Labidesthes sicculus*	2	33.5
29-Aug-06	08:38 AM	South	Brown Bullhead	*Ameiurus nebulosus*	13	124.8
29-Aug-06	08:38 AM	South	Cyprinid unidentified	*Cyprinid spp*	1	20.0
29-Aug-06	08:38 AM	South	Gizzard Shad	*Dorosoma cepedianum*	2	221.5
29-Aug-06	08:38 AM	South	Largemouth Bass	*Micropterus salmoides*	9	85.3
29-Aug-06	08:38 AM	South	Lepomis sp.	*Lepomis spp*	8	44.1
29-Aug-06	08:38 AM	South	Pumpkinseed	*Lepomis gibbosus*	3	92.0
29-Aug-06	08:38 AM	South	Rock Bass	*Ambloplites rupestris*	1	41.0
29-Aug-06	08:38 AM	South	Emerald Shiner	*Notropis atherinoides*	5	57.8
29-Aug-06	08:38 AM	South	Smallmouth Bass	*Micropterus dolomieu*	4	71.2
29-Aug-06	08:38 AM	South	Tessellated Darter	*Etheostoma olmstedi*	2	37.5
29-Aug-06	10:27 AM	North	Banded Killifish	*Fundulus diaphanus*	40	61.9
29-Aug-06	10:27 AM	North	Bluegill	*Lepomis macrochirus*	14	49.4
29-Aug-06	10:27 AM	North	Bluntnose Minnow	*Pimephales notatus*	57	60.3

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
29-Aug-06	10:27 AM	North	Brook silverside	*Labidesthes sicculus*	1	46.0
29-Aug-06	10:27 AM	North	Brown Bullhead	*Ameiurus nebulosus*	8	89.0
29-Aug-06	10:27 AM	North	Carp	*Cyprinus carpio*	1	111.0
29-Aug-06	10:27 AM	North	Crayfish	*Astacidae*	2	79.0
29-Aug-06	10:27 AM	North	Largemouth Bass	*Micropterus salmoides*	16	95.4
29-Aug-06	10:27 AM	North	Lepomis sp.	*Lepomis spp*	22	40.6
29-Aug-06	10:27 AM	North	Pumpkinseed	*Lepomis gibbosus*	3	80.3
29-Aug-06	10:27 AM	North	Rock Bass	*Ambloplites rupestris*	8	56.5
29-Aug-06	10:27 AM	North	Emerald Shiner	*Notropis atherinoides*	4	36.2
29-Aug-06	10:27 AM	North	Smallmouth Bass	*Micropterus dolomieu*	2	78.0
29-Aug-06	10:27 AM	North	Tessellated Darter	*Etheostoma olmstedi*	1	60.0
05-Sep-06	12:15 PM	South	Banded Killifish	*Fundulus diaphanus*	21	65.0
05-Sep-06	12:15 PM	South	Bluegill	*Lepomis macrochirus*	2	66.0
05-Sep-06	12:15 PM	South	Bluntnose Minnow	*Pimephales notatus*	21	64.1
05-Sep-06	12:15 PM	South	Brook silverside	*Labidesthes sicculus*	8	46.6
05-Sep-06	12:15 PM	South	Largemouth Bass	*Micropterus salmoides*	9	85.0
05-Sep-06	12:15 PM	South	Lepomis sp.	*Lepomis spp*	7	41.6
05-Sep-06	12:15 PM	South	Pumpkinseed	*Lepomis gibbosus*	20	87.8
05-Sep-06	12:15 PM	South	Rock Bass	*Ambloplites rupestris*	3	45.0
05-Sep-06	12:15 PM	South	Emerald Shiner	*Notropis atherinoides*	1	55.0
05-Sep-06	12:15 PM	South	Smallmouth Bass	*Micropterus dolomieu*	1	87.0
05-Sep-06	01:12 PM	North	Banded Killifish	*Fundulus diaphanus*	6	61.8
05-Sep-06	01:12 PM	North	Bluntnose Minnow	*Pimephales notatus*	46	64.5
05-Sep-06	01:12 PM	North	Crayfish	*Astacidae*	1	68.0
05-Sep-06	01:12 PM	North	Largemouth Bass	*Micropterus salmoides*	10	91.0
05-Sep-06	01:12 PM	North	Lepomis sp.	*Lepomis spp*	2	46.0
05-Sep-06	01:12 PM	North	Spottail Shiner	*Notropis hudsonius*	4	57.0
05-Sep-06	01:12 PM	North	Pumpkinseed	*Lepomis gibbosus*	5	74.4
05-Sep-06	01:12 PM	North	Spottail Shiner	*Notropis hudsonius*	1	54.0
12-Sep-06	02:53 PM	North	Banded Killifish	*Fundulus diaphanus*	17	57.5
12-Sep-06	02:53 PM	North	Bluntnose Minnow	*Pimephales notatus*	220	56.7
12-Sep-06	02:53 PM	North	Brook silverside	*Labidesthes sicculus*	13	55.5
12-Sep-06	02:53 PM	North	Carp	*Cyprinus carpio*	1	112.0
12-Sep-06	02:53 PM	North	Common Shiner	*Luxilus cornutus*	2	65.5
12-Sep-06	02:53 PM	North	Largemouth Bass	*Micropterus salmoides*	9	88.9
12-Sep-06	02:53 PM	North	Lepomis sp.	*Lepomis spp*	3	43.0
12-Sep-06	02:53 PM	North	Spottail Shiner	*Notropis hudsonius*	2	68.5
12-Sep-06	02:53 PM	North	Rock Bass	*Ambloplites rupestris*	2	48.0
12-Sep-06	02:53 PM	North	Smallmouth Bass	*Micropterus dolomieu*	1	73.0
12-Sep-06	05:11 PM	South	Banded Killifish	*Fundulus diaphanus*	35	65.2
12-Sep-06	05:11 PM	South	Bluegill	*Lepomis macrochirus*	2	69.5
12-Sep-06	05:11 PM	South	Bluntnose Minnow	*Pimephales notatus*	203	63.3
12-Sep-06	05:11 PM	South	Brook silverside	*Labidesthes sicculus*	2	75.0
12-Sep-06	05:11 PM	South	Largemouth Bass	*Micropterus salmoides*	17	89.6
12-Sep-06	05:11 PM	South	Lepomis sp.	*Lepomis spp*	1	50.0
12-Sep-06	05:11 PM	South	Spottail Shiner	*Notropis hudsonius*	1	66.0
12-Sep-06	05:11 PM	South	Pumpkinseed	*Lepomis gibbosus*	32	83.2
12-Sep-06	05:11 PM	South	Rock Bass	*Ambloplites rupestris*	3	43.3
12-Sep-06	05:11 PM	South	Smallmouth Bass	*Micropterus dolomieu*	4	91.2
12-Sep-06	05:11 PM	South	Tessellated Darter	*Etheostoma olmstedi*	1	60.0
19-Sep-06	11:13 AM	South	Banded Killifish	*Fundulus diaphanus*	459	72.6
19-Sep-06	11:13 AM	South	Bluegill	*Lepomis macrochirus*	1	84.0
19-Sep-06	11:13 AM	South	Bluntnose Minnow	*Pimephales notatus*	749	68.8

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
19-Sep-06	11:13 AM	South	Largemouth Bass	*Micropterus salmoides*	45	86.1
19-Sep-06	11:13 AM	South	Lepomis sp.	*Lepomis spp*	20	44.0
19-Sep-06	11:13 AM	South	Spottail Shiner	*Notropis hudsonius*	11	64.7
19-Sep-06	11:13 AM	South	Pumpkinseed	*Lepomis gibbosus*	80	85.4
19-Sep-06	11:13 AM	South	Rock Bass	*Ambloplites rupestris*	1	55.0
19-Sep-06	11:13 AM	South	Smallmouth Bass	*Micropterus dolomieu*	5	76.2
19-Sep-06	12:52 PM	North	Banded Killifish	*Fundulus diaphanus*	81	69.0
19-Sep-06	12:52 PM	North	Bluntnose Minnow	*Pimephales notatus*	113	68.3
19-Sep-06	12:52 PM	North	Largemouth Bass	*Micropterus salmoides*	4	86.5
19-Sep-06	12:52 PM	North	Lepomis sp.	*Lepomis spp*	9	47.3
19-Sep-06	12:52 PM	North	Rock Bass	*Ambloplites rupestris*	1	48.0
19-Sep-06	12:52 PM	North	Smallmouth Bass	*Micropterus dolomieu*	1	90.0
19-Sep-06	12:52 PM	North	Tessellated Darter	*Etheostoma olmstedi*	1	53.0
25-Sep-06	02:36 PM	South	Banded Killifish	*Fundulus diaphanus*	94	64.7
25-Sep-06	02:36 PM	South	Bluntnose Minnow	*Pimephales notatus*	200	66.3
25-Sep-06	02:36 PM	South	Largemouth Bass	*Micropterus salmoides*	14	102.3
25-Sep-06	02:36 PM	South	Northern Pike	*Esox lucius*	1	252.0
25-Sep-06	02:36 PM	South	Pumpkinseed	*Lepomis gibbosus*	1	77.0
25-Sep-06	02:36 PM	South	Smallmouth Bass	*Micropterus dolomieu*	2	99.5
25-Sep-06	02:36 PM	South	Tessellated Darter	*Etheostoma olmstedi*	2	58.0
25-Sep-06	03:15 PM	North	Banded Killifish	*Fundulus diaphanus*	104	62.3
25-Sep-06	03:15 PM	North	Bluntnose Minnow	*Pimephales notatus*	316	66.5
25-Sep-06	03:15 PM	North	Common Shiner	*Luxilus cornutus*	1	119.0
25-Sep-06	03:15 PM	North	Cyprinid unidentified	*Cyprinid spp*	1	19.0
25-Sep-06	03:15 PM	North	Largemouth Bass	*Micropterus salmoides*	9	88.8
25-Sep-06	03:15 PM	North	Rock Bass	*Ambloplites rupestris*	2	72.5
25-Sep-06	03:15 PM	North	Emerald Shiner	*Notropis atherinoides*	2	59.0
25-Sep-06	03:15 PM	North	Smallmouth Bass	*Micropterus dolomieu*	1	74.0
25-Sep-06	03:15 PM	North	Stoneroller	*Campostoma spp*	1	79.0
04-Oct-06	09:55 AM	South	Banded Killifish	*Fundulus diaphanus*	9	53.4
04-Oct-06	09:55 AM	South	Bluntnose Minnow	*Pimephales notatus*	1	50.0
04-Oct-06	09:55 AM	South	Brook silverside	*Labidesthes sicculus*	1	51.0
04-Oct-06	09:55 AM	South	Spotfin Shiner	*Cyprinella spiloptera*	38	36.5
04-Oct-06	09:55 AM	South	Tessellated Darter	*Etheostoma olmstedi*	2	65.0
04-Oct-06	10:44 AM	North	Banded Killifish	*Fundulus diaphanus*	55	56.5
04-Oct-06	10:44 AM	North	Largemouth Bass	*Micropterus salmoides*	1	71.0
04-Oct-06	10:44 AM	North	Lepomis sp.	*Lepomis spp*	2	42.5
04-Oct-06	10:44 AM	North	Spotfin Shiner	*Cyprinella spiloptera*	1	62.0
04-Oct-06	10:44 AM	North	Tessellated Darter	*Etheostoma olmstedi*	2	64.0
09-Oct-06	11:31 AM	South	Lepomis sp.	*Lepomis spp*	2	36.0
09-Oct-06	11:54 AM	North	Banded Killifish	*Fundulus diaphanus*	541	66.9
09-Oct-06	11:54 AM	North	Bluntnose Minnow	*Pimephales notatus*	1	59.0
18-Oct-06	09:54 AM	South	Largemouth Bass	*Micropterus salmoides*	1	80.0
18-Oct-06	09:54 AM	South	Emerald Shiner	*Notropis atherinoides*	18	61.3
18-Oct-06	09:54 AM	South	Tessellated Darter	*Etheostoma olmstedi*	1	50.0
18-Oct-06	10:18 AM	North	Largemouth Bass	*Micropterus salmoides*	2	97.0
23-Oct-06	03:21 PM	South	Bluntnose Minnow	*Pimephales notatus*	1	75.0
23-Oct-06	03:21 PM	South	Brown Bullhead	*Ameiurus nebulosus*	2	65.5
23-Oct-06	03:21 PM	South	Golden Shiner	*Notemigonus crysoleucas*	1	145.0
23-Oct-06	03:21 PM	South	Spotfin Shiner	*Cyprinella spiloptera*	2	38.0
23-Oct-06	03:21 PM	South	Spottail Shiner	*Notropis hudsonius*	1	66.0
23-Oct-06	04:00 PM	North	Banded Killifish	*Fundulus diaphanus*	3	62.7
23-Oct-06	04:00 PM	North	Bluegill	*Lepomis macrochirus*	1	53.0

Sample Date	Time	Location	Common Name	Scientific Name	Total Collected	Avg Length (mm)
23-Oct-06	04:00 PM	North	Bluntnose Minnow	*Pimephales notatus*	1	61.0
23-Oct-06	04:00 PM	North	Lepomis sp.	*Lepomis spp*	8	44.5
23-Oct-06	04:00 PM	North	Spottail Shiner	*Notropis hudsonius*	6	96.3

APPENDIX D

2006 Bottom Trawl Water Quality Data

Sample Date	Time	Station Depth (ft)	Surface Temp (°C)	Surface DO (mg/L)	Surface Conductivity (µS/cm)	Mid-water Temp (°C)	Mid-water DO (mg/L)	Mid-water Conductivity (µS/cm)	Bottom Temp (°C)	Bottom DO (mg/L)	Bottom Conductivity (µS/cm)
05-Apr-06	03:49 PM	18	4.1	14.1	702	4.0	14.3	702	4.0	14.0	702
11-Apr-06	03:15 PM	18	8.0	14.1	698	5.1	14.3	712	4.8	14.4	696
20-Apr-06	05:20 PM	60	8.2	13.9	695	8.0	14.0	696	7.1	14.4	690
25-Apr-06	02:00 PM	23	6.1	13.4	700	6.2	13.5	699	6.2	13.5	699
04-May-06	04:01 PM	18	11.4	13.0	686	8.0	13.5	691	7.7	13.3	693
09-May-06	03:18 PM	21	10.1	13.8	677	7.7	14.2	661	5.5	13.5	667
16-May-06	05:14 PM	16	10.8	13.8	673	8.8	14.1	677	8.4	14.0	679
23-May-06	11:45 AM	17	9.8	13.7	700	9.7	13.7	700	9.6	13.6	691
30-May-06	03:27 PM	17	13.3	13.3	670	11.3	13.0	677	10.4	13.3	677
06-Jun-06	02:35 PM	18	18.6	10.7	680	14.0	11.8	676	12.5	12.0	675
13-Jun-06	02:22 PM	18	16.5	10.9	673	13.7	10.6	674	10.5	11.0	682
20-Jun-06	06:32 PM	18	17.5	10.4	672	17.4	10.2	673	17.4	10.1	674
27-Jun-06	11:38 AM	20	18.6	11.8	652	17.5	12.2	651	16.1	12.1	652
05-Jul-06	05:17 PM	17	24.0	10.1	618	22.9	9.8	670	22.6	9.9	672
12-Jul-06	12:12 PM	18	22.1	9.6	667	20.9	10.0	669	20.4	9.8	670
19-Jul-06	02:15 PM	25	25.8	10.0	673	24.8	10.3	671	23.2	8.9	671
04-Oct-06	09:04 AM	18	16.4	10.0	615	16.4	10.0	585	16.4	10.0	656
09-Oct-06	01:57 PM	19	16.6	10.9	419	16.2	10.7	631	15.2	10.5	642
14-Oct-06	11:14 AM	18	10.0	10.6	663	10.0	10.6	663	10.1	10.6	663
18-Oct-06	09:08 AM	20	13.4	10.2	658	13.3	10.1	655	13.3	10.1	655
23-Oct-06	02:22 PM	18	12.3	9.5	630	12.3	9.5	620	12.1	9.6	630
14-Nov-06	11:14 AM	18	10.0	10.6	663	10.0	10.6	663	10.1	10.6	663

APPENDIX E

2006 Pelagic Trawl Water Quality Data

Sample Date	Time	Transect	Station Depth (ft)	Surface Temp (oC)	Surface DO (mg/L)	Surface Conductivity (uS/cm)	Middle Temp (oC)	Middle DO (mg/L)	Middle Conductivity (uS/cm)	Bottom Temp (oC)	Bottom DO (mg/L)	Bottom Conductivity (uS/cm)
11-Apr-06	02:16 PM	N	70	5.0	14.0	704	4.2	14.0	700	4.6	13.9	690
11-Apr-06	02:45 PM	S	80	5.0	14.0	704	4.3	14.0	700	4.6	13.9	690
20-Apr-06	04:45 PM	S	110	9.1	13.7	606	8.0	14.2	645	6.3	14.1	690
25-Apr-06	03:01 PM	S	90	6.2	13.5	699	6.2	13.5	699	6.2	13.5	699
04-May-06	01:53 PM	S	65	10.2	12.8	681	6.9	13.2	686	5.7	12.8	687
09-May-06	06:42 PM	S	65	9.5	13.5	680	7.0	14.3	682	5.6	13.6	686
16-May-06	02:03 PM	S	60	9.0	13.8	678	8.2	13.9	680	7.1	13.4	681
23-May-06	11:13 AM	S	50	10.1	13.4	686	9.7	13.7	700	9.5	13.7	700
30-May-06	02:52 PM	S	60	12.2	12.0	667	10.0	13.0	680	8.4	12.7	688
06-Jun-06	12:28 PM	S	61	15.6	10.9	681	9.6	12.2	680	8.8	12.8	663
13-Jun-06	01:51 PM	S	65	14.0	10.3	666	11.5	11.1	676	8.5	11.2	689
20-Jun-06	04:51 PM	S	65	8.0	10.8	670	16.7	10.7	675	14.1	11.1	676
27-Jun-06	11:04 AM	S	80	18.3	12.0	655	15.0	11.6	656	9.2	12.2	666
12-Jul-06	11:04 AM	S	50	20.9	9.8	673	18.8	9.6	677	12.7	10.9	683
18-Jul-06	03:30 PM	S	90	25.8	10.5	678	21.8	10.5	668	11.7	11.4	685
25-Jul-06	11:28 AM	S	62	22.8	10.6	668	17.6	10.2	673	12.8	11.1	676
25-Jul-06	04:43 PM	N	18	27.6	9.3	660	22.7	10.7	664	22.4	10.6	661
01-Aug-06	11:14 AM	N	30	26.6	10.3	662	25.8	11.1	665	24.3	10.3	664
01-Aug-06	11:40 AM	S	90	26.0	10.5	668	23.5	9.1	674	14.4	11.1	688
08-Aug-06	09:03 PM	N	33	24.7	9.1	664	24.7	9.2	665	24.6	9.3	665
08-Aug-06	09:29 PM	S	70	24.5	9.3	672	23.8	9.5	675	8.7	11.3	685
15-Aug-06	11:13 AM	S	70	23.2	10.0	658	22.1	9.2	665	16.4	9.9	667
15-Aug-06	11:42 AM	N	20	24.2	9.6	654	22.9	9.7	660	22.5	9.3	661
22-Aug-06	11:49 AM	S	60	23.4	8.4	661	23.0	8.5	659	15.0	8.5	624
22-Aug-06	12:26 PM	N	15	27.7	9.2	640	23.7	7.8	658	23.9	7.6	655
29-Aug-06	02:36 PM	N	16	21.9	8.2	661	21.9	8.2	662	21.8	8.1	663
29-Aug-06	02:55 PM	S	60	21.8	8.4	661	21.6	8.3	665	13.6	9.0	691
05-Sep-06	02:29 PM	S	60	19.5	9.6	653	18.9	9.0	667	11.3	9.7	684
05-Sep-06	02:53 PM	N	18	21.0	8.9	419	19.4	9.5	661	19.3	8.5	662
12-Sep-06	11:10 AM	S	60	19.6	10.3	650	19.6	10.2	650	16.5	9.5	670
12-Sep-06	11:59 AM	N	18	19.8	10.4	621	19.8	10.2	639	19.6	10.1	647
19-Sep-06	02:51 PM	N	20	20.2	9.7	570	19.3	10.3	650	19.0	9.9	650
19-Sep-06	03:25 PM	S	75	19.9	10.3	642	19.7	10.2	653	18.1	9.4	654
25-Sep-06	01:22 PM	S	60	18.1	9.5	654	18.1	9.4	653	18.1	9.5	653
25-Sep-06	01:50 PM	N	18	18.9	9.2	640	18.3	9.1	644	18.3	9.2	646

Sample Date	Time	Transect	Station Depth (ft)	Surface Temp (oC)	Surface DO (mg/L)	Surface Conductivity (uS/cm)	Middle Temp (oC)	Middle DO (mg/L)	Middle Conductivity (uS/cm)	Bottom Temp (oC)	Bottom DO (mg/L)	Bottom Conductivity (uS/cm)
04-Oct-06	08:37 AM	S	60	16.4	10.0	616	16.2	10.0	644	15.8	9.7	659
09-Oct-06	01:31 PM	S	65	16.2	10.6	626	14.7	10.0	656	14.1	9.8	659
14-Oct-06	11:27 AM	S	58	10.0	10.7	664	10.0	10.5	664	10.0	10.6	664
18-Oct-06	08:42 AM	S	60	13.6	10.3	656	13.6	10.2	656	13.5	10.0	655
23-Oct-06	01:52 PM	S	60	12.6	9.5	648	12.6	9.5	647	12.5	9.5	645
14-Nov-06	11:27 AM	S	58	10.0	10.7	664	10.0	10.5	664	10.0	10.6	664

APPENDIX F

2006 Beach Seine Water Quality Data

Sample Date	Time	Station Depth (ft)	Mid-water Temp (°C)	Mid-water DO (mg/L)	Mid-water Conductivity (µS/cm)	Location
05-Apr-06	05:00 PM	4	6.5	15.6	705	N
05-Apr-06	05:25 PM	6	6.5	15.6	705	S
11-Apr-06	12:22 PM	4	8.8	14.7	700	N
11-Apr-06	12:57 PM	5	8.8	14.7	700	S
20-Apr-06	02:40 PM	4	17.2	10.2	647	N
20-Apr-06	03:12 PM	5	17.2	10.2	647	S
25-Apr-06	12:27 PM	4	11.6	11.7	615	N
25-Apr-06	01:04 PM	4.5	11.6	11.7	615	S
04-May-06	07:50 PM	4	10.6	13.9	679	S
04-May-06	08:29 PM	4	11.0	12.8	676	N
09-May-06	12:10 PM	4	13.8	14.2	660	N
09-May-06	12:42 PM	5	13.8	14.2	660	S
16-May-06	03:58 PM	4	13.2	13.4	682	S
16-May-06	07:00 PM	3	10.8	14.6	675	N
23-May-06	09:03 AM	4	9.7	12.8	691	N
23-May-06	09:36 AM	4.5	10.6	13.2	688	S
30-May-06	12:53 PM	3	18.9	13.4	682	N
30-May-06	01:50 PM	4	16.9	14.3	681	S
06-Jun-06	10:53 AM	4	15.4	12.0	672	N
06-Jun-06	05:45 PM	4	18.1	13.3	662	S
13-Jun-06	03:10 PM	4	16.8	11.7	629	S
13-Jun-06	04:41 PM	4	16.4	12.6	636	N
20-Jun-06	09:57 AM	5	17.8	11.6	667	S
20-Jun-06	02:12 PM	4	20.3	12.2	664	N
27-Jun-06	08:36 AM	4	23.5	10.9	635	N
27-Jun-06	09:55 AM	4.5	23.5	10.9	635	S
05-Jul-06	01:29 PM	4	26.5	10.9	660	N
05-Jul-06	02:35 PM	4	26.6	10.8	662	S
12-Jul-06	02:14 PM	5	25.2	10.2	686	S
12-Jul-06	04:47 PM	4	24.5	10.9	633	N
18-Jul-06	01:30 PM	4	29.4	12.5	649	N
18-Jul-06	02:14 PM	4	28.4	13.9	645	S
25-Jul-06	02:45 PM	5	27.2	15.8	644	S
25-Jul-06	07:07 PM	4	26.0	14.3	646	N
01-Aug-06	09:28 AM	4.5	28.4	12.8	641	N
01-Aug-06	10:19 AM	5	28.4	12.9	632	S
08-Aug-06	11:52 AM	4	31.8	8.1	637	S
08-Aug-06	02:29 PM	4	31.7	8.4	637	N
15-Aug-06	08:13 AM	4	24.7	7.9	653	S
15-Aug-06	12:14 PM	4	26.6	10.5	660	N
22-Aug-06	02:50 PM	4	27.3	11.4	652	S
23-Aug-06	07:02 AM	4	25.2	5.7	674	N
29-Aug-06	08:38 AM	4	26.2	6.0	632	S
29-Aug-06	10:27 AM	4	26.7	6.3	625	N
05-Sep-06	12:15 PM	5	20.2	5.9	367	S
05-Sep-06	01:12 PM	5	20.3	5.9	370	N
12-Sep-06	02:53 PM	5	20.7	12.1	440	N
12-Sep-06	05:11 PM	5	20.4	13.4	460	S
19-Sep-06	11:13 AM	5	20.7	8.8	611	S
19-Sep-06	12:52 PM	4	21.3	10.3	610	N
25-Sep-06	02:36 PM	5	19.8	9.8	590	S

Sample Date	Time	Station Depth (ft)	Mid-water Temp (°C)	Mid-water DO (mg/L)	Mid-water Conductivity (µS/cm)	Location
25-Sep-06	03:15 PM	4	19.9	9.9	598	S
04-Oct-06	09:55 AM	4	15.8	9.7	535	S
04-Oct-06	10:44 AM	4	15.9	9.6	512	N
09-Oct-06	11:31 AM	4	16.1	11.2	484	S
09-Oct-06	11:54 AM	4	16.7	12.1	488	N
18-Oct-06	09:54 AM	4	12.9	9.9	637	S
18-Oct-06	10:18 AM	4	12.9	9.9	638	N
23-Oct-06	03:21 PM	4	12.0	9.5	517	S
23-Oct-06	04:00 PM	4	11.9	9.5	522	N
14-Nov-06	11:05 AM	4	10.4	10.3	628	S
14-Nov-06	11:08 AM	4	10.5	10.5	620	N