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SCHILLER STATION QUALITY ASSURANCE PLAN AND STANDARD OPERATING PROCEDURES FOR IMPINGEMENT MONITORING

Revision 0

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1.0 INTRODUCTION

Public Service Company of New Hampshire ("PSNH") owns and operates Schiller Station in Portsmouth, New Hampshire. The Station, which has four generating units ("Unit 3", "Unit 4", "Unit 5", and "Unit 6"), is located on the southwestern (New Hampshire) bank of the Piscataqua River, which forms the boundary between coastal New Hampshire and Maine. PSNH is currently in the process of completing the Northern Wood Power Project at Schiller Station. The existing 50 MWe coal-burning Unit 5 boiler will be replaced with a high efficiency fluidized bed wood-fired boiler scheduled to be fully operational during the summer of 2006.

The primary activity of Schiller Station is the generation of electric power. The Station generates at a rated capacity of 150 MWe and withdraws once-through cooling water from two separate cooling water intake structures ("CWIS's"), which are located in separate bulkheads at the shoreline of the Piscataqua River. The Unit 3 and Unit 4 CWIS's are located in the north bulkhead (Screen House #1), and the Unit 5 and Unit 6 CWIS's are located in the south bulkhead (Screen House #2). The two CWIS's at the Schiller Station have a combined total design intake flow in excess of 50 million gallons per day ("MGD") and use at least 25% of the water withdrawn exclusively for cooling purposes. The current expected operating mode for Schiller Station over the next ten years is as a base-loaded facility at a capacity utilization rate in excess of 15%.

The final regulations implementing §316(b) of the Clean Water Act ("CWA") at existing electricity-generating stations (the "Phase II Regulations"), among other things, establish performance standards for the reduction of impingement mortality by 80 to 95 percent and, under certain circumstances, for the reduction of entrainment by 60 to 90 percent (See 69 Fed. Reg. 41576 (July 9, 2004)). The applicability of these performance standards is determined by several factors, including the type of water body from which a plant withdraws cooling water and the plant's capacity utilization factor. Under the Phase II Regulations, applicable performance standards can be met by design and construction technologies, operational measures, restoration measures, or some combination of these compliance alternatives.

The Phase II Regulations require submission of a Proposal for Information Collection ("PIC") in certain circumstances. The following Quality Assurance Plan (QAP) and Standard Operating Procedures (SOP) comprise Appendix 2 of the PIC that PSNH is submitting to the United States Environmental Protection Agency ("USEPA"). They detail the methods for completing the 2006 impingement study at Schiller Station.

2.0 IMPINGEMENT FIELD STANDARD OPERATING PROCEDURES

PSNH proposes a one-year impingement sampling program for Schiller Station beginning in August 2006 because the most recent and comprehensive annual impingement data were obtained during the 1975-1976 study at the neighboring Newington Station as described in Section 6.1 of the PIC (Normandeau 2006), and because the present fish community in the Piscataqua River has most likely changed since then. The goal of the proposed program is to estimate the annual total potential

mortality of juvenile and adult fish and macro-crustaceans that become impinged on the traveling screens of the Schiller Station's two CWISs.

2.1 COOLING WATER INTAKE STRUCTURE DESCRIPTION

Schiller Station has two once-through CWIS's; Screen House #1 and Screen House #2 (Figure 2-1). Screen House #1 is located on the southwestern bank of the lower Piscataqua River in Portsmouth, New Hampshire at latitude 43°05'52" and longitude 70°46'59". Screen House # 2 is located approximately 150 ft south of Screen House #1 on the southwestern bank of the lower Piscataqua River in Portsmouth, New Hampshire at latitude 43°05'52" and longitude 70°46'58".

2.1.1 Schiller Station Unit 4 CWIS

Schiller Station Screen House #1 contains the CWIS for Unit 3 and Unit 4. Screen House #1 withdraws non-contact cooling water from a submerged intake structure and intake tunnels located approximately 30 ft offshore from Screen House #1 (Figure 2-1). Screen House #1 contains one traveling screen servicing the circulating water pump (Pump 4) supplying the Unit 4 condenser cooling system. The Unit 4 traveling screen (Screen 4) is located on the south side of Screen House #1 the CWIS (Figure 2-1). The north side of Screen House #1 is occupied by Unit #3, which currently inactive. The two intake pumps for Unit 4 are not found in Screen House #1; they are located in the power plant in a separate building approximately 300 ft to the west of Screen House #1. The cooling water pumps for Unit 4 withdraws Piscataqua River water from the submerged, offshore intake protected by a set of coarse bar racks (12 in x 12 in) and by a 1.5 in mesh fiberglass screen.

The Screen House #1 CWIS at Schiller Station has one operable traveling screen (Screen 4) servicing the Unit 4 circulating water pump (Figure 2-1). The Unit 4 traveling screen is a Rex Model (Chain Belt Company) screen with standard 3/8-inch (0.375-inch) square opening mesh panels of woven stainless steel wire screen cloth. The Unit 4 travelling screen is 5.5 feet wide and 28 feet high (measured from the center of the head shaft to the center of the tail shaft) and consists of 24 panels. Intake water passes through the submerged portion of the screen, where suspended fish and debris are deposited onto the screen cloth of the inclined trays and on the lower member of each tray which forms a shelf for lifting this solid material. The traveling screen is not rotated continuously, but is washed manually once every 6 hours or more frequently if a pressure differential develops between the front and back side of the screen. When the screen mechanism is operated, the screen trays ascend on the outboard (Piscataqua River) side and descend on the in-plant side at a speed of 10 feet per minute. Debris and fish are lifted from the water and removed from each tray just before it moves over the top sprockets and begins to descend by a spray manifold that is located in the head (top) section of the screen. The spray manifold for each screen has 5 overlapping spray nozzles operating at a relatively low 40 pounds per square inch (psig) spray pressure, and the spray wash covers the entire width of each tray. The fish and debris are washed by the spray manifold from the traveling screen into a 18-inch wide by 12-inch deep trough built into the concrete deck of the CWIS and located in front (Piscataqua River side) of the traveling screen. This trough runs south along Screen 4 and out the south side of Screen House #1, and all washed material is carried in the wash water for discharge into the Piscataqua River through the side of the CWIS at an elevation of about 11 ft. above MLW elevation.

2.1.2 Schiller Station Unit 5 and Unit 6 CWIS

The Schiller Station Unit 5 and Unit 6 CWIS is located in Screen House #2, which is a concrete bulkhead with a brick superstructure that is flush with the shoreline (Figure 2-1). Screen House #2 also has a canvas awning on the east (river) side to provide a degree of protection for the traveling screens from the weather. The single intake pump providing the Unit 5 circulating water flow is located on the north side of the Screen House #2, and the single intake pump providing the Unit 6 circulating water flow is located on the south side of the Screen House #2 (Figure 2-1).

The Unit 5 and Unit 6 intake pumps each have two vertical single entry/exit traveling screens (described below) providing a basic debris and fish handling and return system. A partition wall below the deck inside Screen House #2 divides the CWIS into two discrete forebays, one associated with each unit's intake pump. This partition wall separates the flow to each pump so that the fish and debris collected from the two traveling screens in the north forebay represent the collection from the water withdrawn through intake pump 5, and the fish and debris collected from the two traveling screens in the south forebay represent the collection from the water withdrawn through intake pump 6. Each of the Screen House #2 two forebay openings to the Piscataqua River consists of a pair of 8.5 ft. wide by 32 ft deep stop log slots, and each stop log slot is covered with a coarse bar rack that is 9 ft. wide and 32 ft high with a 3.5-inch clear space (4 inch on-center spacing).

The Screen House #2 CWIS at Schiller Station is portioned so that traveling screens 6a and 6b service the north inlet forebay to circulating water pump 6, and screens 5a and 5b service the south inlet to circulating water pump 5 (Figure 2-1). Each of the four traveling screens is a Rex Model (Chain Belt Company) screen with standard 3/8-inch (0.375-inch) square opening mesh panels of woven stainless steel wire screen cloth. Each of the four screens is 5.5 feet wide and 29 feet high (measured from the center of the head shaft to the center of the tail shaft) and consists of 24 panels. Intake water passes through the submerged portion of each screen, where suspended fish and debris are deposited onto the screen cloth of the inclined trays and on the lower member of each tray which forms a shelf for lifting this solid material. The traveling screens are not rotated continuously, but are washed manually once every 6 hours or more frequently if a pressure differential develops between the front and back side of the screens. When the screen mechanism is operated, the screen trays ascend on the outboard (Piscataqua River) side and descend on the in-plant side at a speed of 10 feet per minute. Debris and fish are lifted from the water and removed from each tray just before it moves over the top sprockets and begins to descend by a spray manifold that is located in the head (top) section of each screen. The spray manifold for each screen has 5 overlapping spray nozzles operating at a relatively low 40 pounds per square inch (psig) spray pressure, and the spray wash covers the entire width of each tray. The fish and debris are washed by the spray manifold from each traveling screen into a 24-inch wide by 18-inch deep trough built into the concrete deck of the CWIS and located in front (Piscataqua River side) of each traveling screen. This trough runs along the entire length of the Screen House #2, and all washed material is carried in the wash water to the north end of the CWIS for discharge into the Piscataqua River through the side of the CWIS at an elevation of about 11 ft. above MLW elevation.

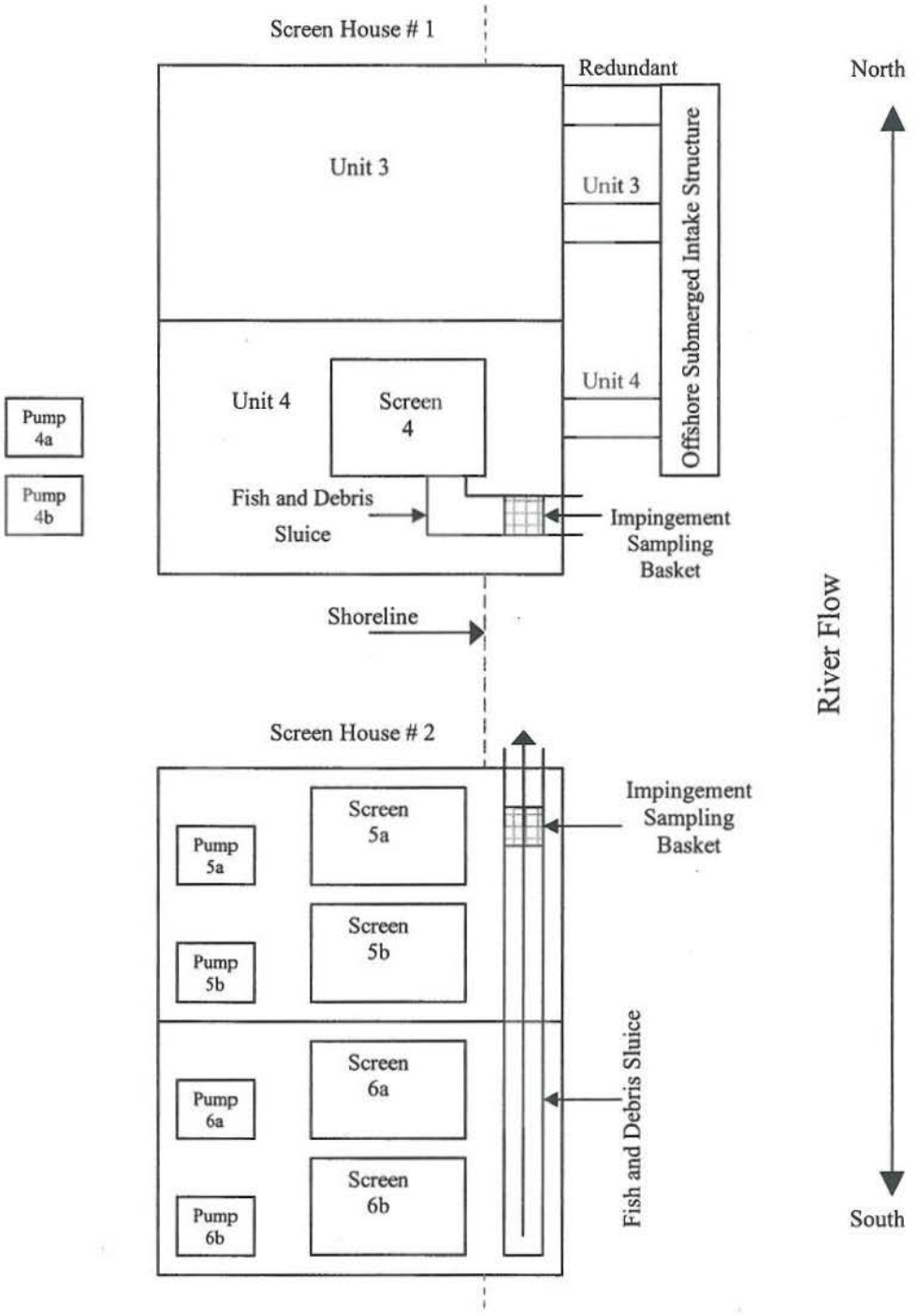


Figure 2-1. Schiller Station Screen House #1 (Unit 4) and Screen House #2 (Unit 5 and Unit 6) cooling water intake structures schematic showing the identification numbers for the circulating water pumps and traveling screens.

2.2 SAMPLING SCHEDULE AND LOCATION

The impingement sampling protocol for Schiller Station is based on a fixed-date design with uniform sampling intensity throughout the year, that is consistent with numerous impingement programs both completed or on-going at CWIS's located on estuaries throughout the United States (EPRI 2004). Separate impingement samples will be collected for each of Schiller Stations three generating units (Unit 4, Unit 5, and Unit 6). Impingement sampling will be conducted on the same day (24-hour period) each week at each of two Schiller Station screen houses throughout the year for 52 consecutive weeks. Impingement samples will only be collected when the CWIS for the generating unit is operating. On the selected impingement sampling day, four consecutive six-hour impingement samples will be collected to represent one 24-hour period from 1000 on day 1 through 0959 on the next day (day 2) for each generating unit. The four six-hour impingement collections will be taken at approximately the same beginning and ending times (± one hour) during each 24-hour period. Operation of the CWIS is defined as having at least one circulating water pump at each unit of Schiller Station CWIS running for one or more hours during the six-hour collection interval. This design will provide 208 six-hour impingement samples per unit if the CWIS operates throughout the day on all scheduled sampling dates throughout the year, which can be combined into 52 twenty-four-hour samples per unit.

2.3 EQUIPMENT

Impingement sampling for Schiller Station will be conducted by placing a basket made from the same wire mesh as the traveling screens (3/8 inch square mesh) into the common fish and debris return sluice to catch all of the fish and debris washed off of the operating traveling screens in each six-hour collection interval before this material flows back into the Piscataqua River. The sampling point for Screen House #1 (Unit 4) is located just prior to where the fish and debris return sluice exits the screen house sluice near the south side of the screen house. The sampling point for Screen House #2 (Unit 5 and Unit 6) is located just prior to where the fish and debris return sluice exits the screen house sluice near the north side of the screen house. A hand-held crowding net may be needed to aggregate each impingement sample into the collection basket.

The following additional equipment is required for impingement field sampling:

- copy of SOP and copy of Health & Safety Plan
- data sheets, clipboard, and pencils,
- buckets, plastic bags, and ties,
- labels and waterproof markers,
- net mending kit,
- scale and tape measure,
- YSI Model 85 temperature/salinity/dissolved oxygen meter,
- hard hats,
- gloves,
- hand tools to aid in sorting through debris,
- first aid kit,
- measuring board,
- quality control log,

- appropriate clothing, footwear, and personal protective equipment as specified in the Health & Safety Plan.

2.4 SAMPLING PROCEDURES

2.4.1 Initial Screen Wash

Prior to the collection of the first impingement sample of this year-long program, the traveling screens, debris deflector shields, and debris sluice at each screen house of Schiller Station will be thoroughly cleaned and washed to remove all debris and organisms. The pre-wash procedures described in Section 2.4.2.1 below will be followed for this initial screen wash, with the exception that all material removed during this initial cleaning will be discarded according to plant procedures, with the exception of American lobster (*Homarus americanus*) which will be processed as described below in Section 2.4.5.

2.4.2 Impingement Sample Collection

2.4.2.1 Pre-Wash

The single operating traveling screen at Screen House #1, and all operable traveling screens at Screen House #2 will be pre-washed to begin the sampling period just prior to the start of the first 6-hour impingement sampling period at 0800 on the selected sampling day. There is no need to pre-wash before each subsequent 6-hour sample. The purpose of the pre-wash is to clean the wash water sluice and traveling screen housings and debris deflectors of all previously retained debris, fish and macrocrustaceans so that this material from unknown earlier screen washes is not included with each subsequent sample of known duration. For the pre-wash, the traveling screens will be washed proceeding in a direction so that the wash always starts at the point located at the upstream end of the fish and debris sluice and proceeds towards the discharge end of the sluice. Pre-washing means that each traveling screen is rotated for at least one complete revolution to clean the accumulated debris and organisms from the screen, deflector, and debris return sluice. Following the pre-wash rotation, the access door at the side of each screen will be opened and a long-handled rake or hoe will be use to remove any remaining debris, vegetation, and fish that may have not been washed out of the sluice or off-of the screen wash deflector. Any deck plates covering the fish and debris return sluice will be lifted and all retained fish and debris will be removed before replacing the plates. Following cleaning, the collection basket will be installed and left installed in the debris and fish sluice during the collection of the four consecutive 6-hour samples representing the next 24 hours.

2.4.2.2 Collecting each 6-Hour Impingement Sample

After the initial pre-wash and sampling basket installation are completed, Normandeau personnel will return six hours later to collect the first of four consecutive 6-hour impingement samples ($\pm$ 1 hour) at each unit and screen house. The termination of each 6-hour impingement collection will consist of returning to the screen house approximately 6 hours ($\pm$ 1 hour) after the pre-wash date and time to accompany the plant operators as they rotate all operational traveling screens in a north to south sequence again for one complete revolution to wash all accumulated fish and debris into the fish and debris return sluice. Once again, the access door at the side of each screen will be opened and a long-

handled rake or hoe will be use to remove any remaining debris, vegetation, and fish that may have not been washed out of the sluice or off-of the screen wash deflector. Once again any deck plates covering the fish and debris return sluice will be lifted and all retained fish and debris will be removed and placed in the sampling basket before replacing the plates. The dislodged material will flow in the wash water into the collection basket for each screen house and will contain the fish and shellfish impinged during the preceding 6-hour sample. A crowding device or dip net will be used when cleaning the sluice to prevent any live fish and shellfish from swimming upstream in the sluice against the wash water flow. This device will consist of a panel of traveling screen material or net mesh attached to a handle that fights tightly from side to side and top to bottom in the sluice. The crowding device will be moved from the north end of the sluice down to the collection basket as each screen and section of sluice is cleaned during sample collection. Once the crowding device had reached the collection basket, the contents of the impingement basket will then be retrieved for processing. The crowding device will be removed only after the sampling basket has been removed, cleaned, and replaced to begin the next 6-hour sampling interval. The elapsed time between setting and retrieving the collection basket will be recorded to the nearest minute as the impingement sample duration for the 6-hour sample.

To separate the Unit 5 and Unit 6 impingement collections in Screen House #2, the screens will be washed in sequential order from the dividing point between the two units. First, the two traveling screens representing Unit 5 (Screens 5a and 5b, Figure 2-1) will be washed; Screen 5b will be washed first followed by Screen 5a. The fish and debris washed off of Screens 5a and 5b will be removed from the collection basket to represent the impingement collection for Unit 5, then the basket will be installed and the two traveling screens representing Unit 6 (Screens 6a and 6b, Figure 2-1) will be washed; Screen 6b will be washed first followed by Screen 6a.

The following information will be recorded for each six-hour impingement sample at each unit: fish species composition (identified to the lowest distinguishable taxon, generally species) and abundance (number, individual length and weight), predominant type and amount (gallons) of debris, and number of circulating water pumps and screens operating. Crabs and lobsters (macro-crustaceans) will also be identified to species, measured for carapace width or length (as appropriate), assigned gender, enumerated and weighed. All fish and macro-crustaceans will be processed immediately and returned alive to the Piscataqua River if possible. All length measurements will be to the nearest 1-mm total length (TL). All weight measurements will be wet weight to the nearest gram.

Any shortnose sturgeon (a Federally-listed endangered species of fish) collected through impingement sampling will be handled with great care and released alive if possible after length, weight, and condition are recorded. Any dead shortnose sturgeon collected through impingement sampling will be identified, measured and frozen. Appropriate agencies will be contacted (NMFS, USFWS) if threatened or endangered species are encountered during impingement sampling in accordance with the scientific collector's permit.

2.4.2.3 6-Hour Samples Collected During Periods of High Debris Loads

On sampling dates during periods of high debris loading, the traveling screens may be washed continuously. On these dates, the sampling baskets at Screen House #1 and Screen House #2 will be tended by Normandeau staff who will remain on-site for all four consecutive 6-hour samples

representing an impingement sampling day. It will not be possible to separate the Unit 5 and Unit 6 impingement samples at Screen House #2 during continuous wash periods (unless only one unit is operating), so each 6-hour sample will be reported as a combined Unit 5 and Unit 6 sample. During these sampling periods with continuous coverage, the collection basket in each screen house will be emptied as often as necessary to prevent overflowing, and the contents will be accumulated to represent each 6-hour period. If the debris load is in excess of 30 gallons per hour, a volumetric subsampling procedure will be used to randomly select and sort through no more than 30 gallons of debris in each 6-hour sample.

2.4.3 Use Code

Each impingement sample collected will be assigned a Use Code (1, 2, or 5) that defines its use in analytical tasks. Use Code 1 samples will be impingement collections from which valid data were collected and no sampling problems were encountered. This means that each 6-hour sample was collected in a manner that maintained the integrity of the collection for the entire period even if no fish or macro-crustaceans were caught, so that the sample represents the entire contents of fish, maco-crustaceans or debris collected in the circulating water flow through the traveling screens during the 6-hour collection period. A Use Code 1 impingement sample has no loss of any fish or debris in the sample, no unscheduled or unattended screen washes during the collection interval, and no interruption of circulating water flow during the collection interval. Use Code 1 impingement samples will be used for all analytical tasks. Use Code 2 samples will be collections in which a 6-hour collection was made and at least one fish or macro-crustacean was captured, but sampling problems were encountered that may affect the accuracy of the count, such as overflow of the sampling device. Use Code 2 samples will be excluded from calculations involving catch per unit of effort (volume or time) and length-frequency distributions, but would be useful for enumerating lobsters and for reporting the presence or absence and relative abundance of other fish and shellfish species. A Use Code 2 will also be assigned to each impingement sample from Screen House #2 collected during continuous wash periods when the sample represents the combined collections from Unit 5 and Unit 6. Use Code 5 samples will be Use Code 2 samples where no fish are caught due to failure of the sampling device or other catastrophic failure of the sampling procedures. Use Code 5 samples will be excluded from all analysis.

2.4.4 Environmental Parameters

2.4.4.1 Specifications

The following environmental parameters will be recorded at the beginning and end of each six-hour sampling interval at each screen house: mid-depth water temperature, dissolved oxygen concentration, conductivity, and river surface conditions (wave height, wind direction and velocity, water level, cloud cover, and precipitation). Dissolved oxygen and conductivity measurements will be converted into percent saturation (D.O.) and salinity at 25°C (conductivity) during data analysis.

2.4.4.2 Deployment

Water quality measurements will be taken at both the start and end of each 24-hour collection. Temperature, salinity (nearest 0.1 ppt), and dissolved oxygen (nearest 0.1 mg/L) will be measured

with a YSI model 85 dissolved oxygen meter. Air temperature (nearest 1.0°C) will be measured with an armored alcohol-filled thermometer. In general, Piscataqua River water temperatures should range between -2.0°C and +30.0°C during the course of this study, salinity should range between 4.0 ppt and 35.0 ppt, and dissolved oxygen concentrations should read between 5.0 mg/l and 14.0 mg/l. Any temperature, salinity or dissolved oxygen (DO) readings above 100% saturation and outside of this range should be noted on the field data sheet and the instrument should be inspected and recalibrated.

Table 2-1 presents the saturation concentrations of DO in water at various water temperatures and salinities. DO concentrations that are greater than the saturation levels at a given temperature and salinity are suspect. If DO readings are above saturation, all connections on the meter should be checked, the membrane checked for contamination and bubbles, and the reading retaken. If the reading is still above saturation note any pertinent environmental conditions that may cause supersaturation such as excessive water turbulence and record these observations in the COMMENTS section.

2.4.4.3 YSI Model 85 Temperature, Conductivity, and Dissolved Oxygen Meter

Batteries will be recharged or replaced every six months or when the **LO BATT** appears on the LCD display. The instrument batteries are six "AA" size cells located inside the instrument. The probe's electrolyte fluid and membrane will be replaced at two-week intervals or when a bubble appears in the electrolyte.

Perform calibration checks at the beginning of each day's use of the instrument, following the procedures recommended by the manufacturer (Appendix C).

Two-point calibration checks of the YSI dissolved oxygen meter will be performed at the beginning of a sampling day to maintain a field check of instrument performance and data quality. Calibration checks of the dissolved oxygen measurement system will be performed using water-saturated air for the 100% saturation point and a saturated solution of sodium sulfite with a trace of cobalt chloride for the 0% saturation point. These checks will be performed in the following manner and documented in an instrument calibration log:

- Inspect the probe to ensure that there are no air bubbles under the membrane and that it is not fouled.
- If air bubbles or fouling are observed, replace the membrane following procedures in the owner's manual.
- Ensure that the sponge inside the instrument's calibration chamber is wet and the probe is blotted dry.
- Insert the probe into the calibration chamber.
- Turn the instrument on by pressing the **ON/OFF** button on the front of the instrument.
- Press the **MODE** button until the dissolved oxygen is displayed in mg/L or %.

Table 2-1. 100% saturation values for dissolved oxygen (mg/l) in water exposed to water saturated air at 1.0 atmospheric pressure (modified from APHA 1985).

Water Temperature in °C	100% Dissolved Oxygen Concentration (mg/l) at Salinity (ppt)				
	0.0	9.0	18.0	27.0	36.0
0.0	14.6	13.7	12.9	12.1	11.4
2.0	13.8	13.0	12.2	11.5	10.8
4.0	13.1	12.3	11.6	10.9	10.3
6.0	12.4	11.7	11.0	10.4	9.8
8.0	11.8	11.2	10.5	9.9	9.4
10.0	11.3	10.7	10.1	9.5	9.0
12.0	10.8	10.2	9.6	9.1	8.6
14.0	10.3	9.7	9.2	8.7	8.2
16.0	9.9	9.3	8.8	8.4	7.9
18.0	9.5	9.0	8.5	8.0	7.6
20.0	9.1	8.6	8.2	7.7	7.3
22.0	8.7	8.3	7.9	7.5	7.1
24.0	8.4	8.0	7.6	7.2	6.8
26.0	8.1	7.7	7.3	7.0	6.6
28.0	7.8	7.4	7.1	6.7	6.4
30.0	7.6	7.2	6.8	6.5	6.2
32.0	7.3	7.0	6.6	6.3	6.0
34.0	7.1	6.7	6.4	6.1	5.8
36.0	6.8	6.5	6.2	5.9	5.6
38.0	6.6	6.3	6.0	5.7	5.5
40.0	6.4	6.1	5.8	5.6	5.3

- Wait for the dissolved oxygen and temperature readings to stabilize (usually 15 minutes is required).
- Use two fingers to press and release the **UP ARROW** and **DOWN ARROW** buttons at the same time once.
- The LCD will prompt you to enter the local altitude in hundreds of feet. Use the arrow keys to increase or decrease the altitude. When the proper altitude appears on the LCD, press the **ENTER** button once. EXAMPLE: Entering the number 12 indicates 1200 feet.
- The Model 85 should now display **CAL** in the lower left of the display, the calibration should be displayed in the lower right of the display and the actual % should be on the main display.
- Press the **ENTER** button and the display should read **SAVE** then should return to the Normal Operation Mode.

All calibrations should be completed at a temperature that is as close as possible to the sample temperature.

2.4.5 Impingement Sample Processing

All impingement samples will be processed on-site in fresh condition immediately after collection. Following sample processing, release all live fish and macro-crustaceans into the Piscataqua River but away from the CWIS to prevent re-impingement.

2.4.5.1 Measurements and Conditions

The following information will be recorded for each six-hour impingement sample: fish species composition (identified to the lowest distinguishable taxon, generally species) and abundance (number, individual length and weight), predominant type and amount (gallons) of debris, and number of circulating water pumps and screens operating. Crabs and lobsters (macro-crustaceans) will also be identified to species, measured for carapace width or length (as appropriate), assigned gender, enumerated and weighed. All fish and macro-crustaceans will be processed immediately and returned alive to the Piscataqua River if possible. All length measurements will be to the nearest 1-mm total length (TL). All weight measurements will be wet weight to the nearest gram. The condition (live, injured, or dead) for each individual identified and measured will be determined, and the data will be recorded in the appropriate spaces provided in the Impingement Count Data Sheet. Taxon codes for the fish and macro-crustaceans expected to be present in the Piscataqua River based on previous studies are listed in Appendix Table B-1. A more extensive list of fish taxon codes is presented in Appendix Table B-2. If the fish or macro-crustacean taxon code is not found in either list, assign a taxon code of 033 temporarily, until the identity can be determined or verified in Normandeau's Bedford laboratory as either a taxon code from the list or a new taxon code for that species is added to the list.

Care should be taken when identifying spider crabs, because two species may occur in the Piscataqua River and they are very similar. Both species are in some faunal lists from the Gulf of Maine, but Austin's decapod monograph says that *L. dubia* occurs from Cape Cod south, so theoretically only *L. emarginata* would be found in the Piscataqua River. However, until it is determined if both species are present in the Piscataqua River and reference specimens are collected and verified, the conservative assignment of TAXON code of *Libinia sp.* = 821 will be used. The report will state that no attempt was made in the field to verify the absence of *L. dubia*, but based on the reported range any spider crabs collected were most probably all *L. emarginata*.

2.4.5.2 Fish Requiring Special Handling

Any shortnose sturgeon captured alive will be processed immediately. Shortnose sturgeon will be examined for tags, and each specimen will be measured (total length) and weighed, handling it with care, and returned to the water alive if possible (whether tagged or not), away from the intake. Any dead shortnose sturgeon will be frozen and saved. The following criteria will be used to identify shortnose sturgeon and distinguish them from a similar species, the Atlantic sturgeon.

Three different external features will be used to distinguish shortnose and Atlantic sturgeon in the field:

1. the mouth width to eye distance ratio,
2. the presence or absence of bony plates (scutes) found between the base of the anal fin and the midlateral line, and

3. the presence of one or two rows of scutes found along the dorsal midline posterior to the dorsal fin, and along the ventral midline anterior to the anal fin.

To identify the correct sturgeon species, first the ratio of the mouth width to the distance between the eyes is calculated. A shortnose sturgeon has a relatively large mouth compared to an Atlantic sturgeon. Shortnose sturgeon are reported to exhibit a mouth width to eye distance ratio of greater than 62% (typically 63% to 81%, Musick in Collette and Klein-MacPhee, 2002). An Atlantic sturgeon has a smaller mouth and exhibits a mouth width to eye distance ratio of less than 62% (typically 43% to 66%, Musick in Collette and Klein-MacPhee, 2002). The mouth width in mm is measured with calipers inside of the lips. The distance between the eyes in mm is also measured with calipers. The ratio of the mouth width to the distance between the eyes is calculated by taking the measured mouth width and dividing it by the eye width and multiplying by 100 to express the number as a percentage. For example, if the measured mouth width is 47 mm and the measured eye width is 64 mm, then ratio is 47/64 = 0.734 * 100 = 73.4%, and this fish is likely to be a shortnose sturgeon.

Because there is some overlap between the range of mouth widths to eye width ratios reported for some Atlantic sturgeon (62% to 66% for both species, Musick in Collette and Klein-MacPhee, 2002), a second characteristic must also be used to distinguish the two sturgeon species. The presence or absence of bony plates (scutes) above the anal fin will also be used to distinguish shortnose and Atlantic sturgeon. If two to six scutes at least as large as the pupil of the eye are found above the anal fin in the space between the base of the anal fin and the midlateral row of scutes (see Figure II-3), then the sturgeon is an Atlantic sturgeon. If no scutes are found between the base of the anal fin and the midlateral row of scutes, the sturgeon is a shortnose sturgeon.

A third characteristic can also be used to verify the sturgeon species identification based on the mouth to eye ratio and the presence or absence of anal fin scutes. This is the presence of a single or double row of scutes in the post-dorsal or pre-anal portions of the body (Smith 1985). Looking at the dorsal (top) surface of the fish, an Atlantic sturgeon will have two rows of scutes between the posterior edge of the dorsal fin and the anterior edge of the caudal fin, one row on either side of the mid-dorsal line. Turning the fish over and looking at the ventral (belly) area between the anterior edge of the anal fin and the pelvic fins, an Atlantic sturgeon will also have two rows of scutes, one row on either side of the mid-ventral line. If the fish is a shortnose sturgeon, it will have a single row of scutes in both the post-dorsal and pre-anal areas, with this row aligned directly down the mid-line. In some shortnose sturgeon, particularly on smaller specimens, the post-dorsal row of scutes may be almost completely absent. A comparison of these distinguishing features is shown in the following table:

Species	Mouth/Eye Ratio	Anal Fin Lateral Scutes	Post-Dorsal Scutes	Pre-Anal Scutes
Atlantic Sturgeon TAXON = 29	<62%	2 to 6 bony plates present	Double row	Double row
Shortnose Sturgeon TAXON = 27	>62%	Absent	Single row or absent	Single row

2.4.5.3 Fish for Collection Efficiency Studies

After analysis, fish that will be needed for the next collection efficiency study will be bagged. From the species making up at least 10% of the month's total collection, at least 100 fish will be needed for each release at each unit. The fish will be marked and frozen. It is acceptable to save (freeze) and re-use collection efficiency fish after they are recovered and processed if they are in good condition.

2.4.5.4 Debris Processing

The amount of biological and other debris will be estimated to the nearest gallon for each 6-hour period. The volume and the dominant debris type will be recorded on the Impingement Field Data Sheet.

2.4.5.5 Reference Collection

A project-specific reference collection will be developed by retaining several representative individuals of each taxon identified and enumerated during the course of the program (except threatened or endangered species). Reference specimen will be placed in an appropriate sample container, one taxon per container, preserved in 10% buffered formalin, and labeled with the date and time of collection, species common and scientific name, fresh length and weight, and taxonomic key used to confirm the identification. The reference collection will be retained on-site for the duration of the study in an appropriate spill-proof box with sufficient absorbent material to contain the contents of any jar that is broken or spilled.

2.4.6 Collection Efficiency Studies

Impingement collection efficiency will be determined during one randomly selected 6-hour sampling period in each month for each unit to adjust each 6-hour sample for fish that are lost between the time they are impinged on the operating intake screens and their collection in the sampling device. A lot of 100 marked (finclipped or dyed) dead fish representative of the species and size range that are observed in impingement samples during the previous sampling events will be introduced immediately in front of the intake screen at Unit 4, a second lot of 100 marked fish will be released at a randomly selected traveling screen at Unit 5, and a third lot of 100 marked fish will be released at a randomly selected traveling screen at Unit 6. The Unit 5 and Unit 6 collection efficiency tests will be performed on the same date each month and will use different marks to distinguish the two lots of fish. Each lot of marked fish will be introduced in a stream of water through a 4-in. PVC pipe or other release device with the outlet held in front of the ascending face of an operating traveling screen near the river surface. The collection efficiency fish will be introduced at the midpoint ($\pm$ 1 hour) of the 6-hour sample (i.e. if the 6-hour sample began at 0800, the marked fish will be released some time between 1000 and 1200). The number of marked fish subsequently recovered in the collection device at the end of the sampling period, divided by the number released, represents the impingement collection efficiency for that period. Carry over of the collection efficiency fish into adjacent but subsequent 6-hour samples (or between units at Screen House #2) will also be observed and recorded. These impingement collection efficiency factors will be applied to other 6-hour impingement collections from each one-month period centered on the date of the collection efficiency test. For example, if collection efficiency tests were performed on Tuesday at 1300 to represent the 6-hour sample from 1000-1600 taken at Unit 4 during weeks 27 and 31, then the results from the week 27

test will be applied to any 6-hour collections taken within the period 15 days before or 15 days after the Tuesday date for week 27, and the results from the week 31 test will be applied to any 6-hour collections taken within the period 15 days before or 15 days after Monday date for week 31.

2.4.7 Impingement Survival

Impingement survival studies will be performed monthly at each unit 12 consecutive months to determine the total fish survival due to collection on the traveling screens, the screen wash procedure, and transit through the fish and debris return sluice. During these collection efficiency evaluations, the traveling screens will be operated in a continuously rotating mode with a continuous feed of screen wash water. The impingement survival studies will be staffed continuously during the collection and observation periods.

Impingement survival will be determined by collection of fish and macro-crustaceans off of continuously rotated and washed screens separately from each unit Schiller Station during two consecutive randomly selected 6-hour collection periods per month (12-hours) on a day not selected for impingement abundance sampling. Impinged fish will be collected by rotating the traveling screens continuously at each of the selected units for up to 12 hours with the basket sampler in place and the wash water flow continuously operating. The washwater flow from the screen wash spray headers is sufficient to maintain a water level of at least 10 cm deep in the return sluice into the sluice when the sampling basket is installed.

Impingement survival will be determined by collection of fish in the return sluice at the south end of the Schiller Station Screen House #1 and at the north end of Screen House #2 as the traveling screens are continuously rotated and washed. The same impingement collection baskets used for impingement sampling in the debris and fish return sluice will be used for collecting fish for impingement survival. To separate the Unit 5 and Unit 6 impingement survival samples in Screen House #2, the survival samples for Unit 5 will be collected on one day, and the survival samples for Unit 6 will be collected on the next day.

With the sampling device installed at the outlet of the return sluice at each screen house, the wash water in the sluice is typically about 10 cm deep during the screen wash, so impinged fish will be trapped in this pool of wash water with a second (moveable) screen mesh panel (crowding device) placed in the sluice flow upstream from the sampler. These trapped fish will then be gently crowded towards the sampler, removed from the sluice water with a plastic scoop, and placed into holding tanks for initial and latent survival observations. All holding tanks will be labeled with the Schiller Station unit they represent, and supplied with a continuous flow of ambient Piscataqua River water. All ambient fish and macro-crustaceans collected for survival determination will be identified to species, separated from the debris, gently removed and placed into holding tanks, and classified as alive, stunned, or dead. All alive or stunned fish will be held in separate predator and prey tanks to determine latent (24-hour) survival. Impingement survival collections at Screen House # 1 and Screen House #2 of Schiller Station will be made for 12 hours of continuous screen rotation and wash water supply on one day per month or until at least 100 ambient fish and macro-crustaceans (in aggregate) are collected and observed for survival. If fewer than 100 organisms are collected, marked bait fish (rainbow smelt, alewives or killifish, as available, with preference towards the less robust

species) will be obtained from local bait dealers and introduced in front of one of the two middle screens (screens 1B or 1C) to insure an adequate sample size for initial and latent survival observations. Prior to placement in holding tanks, the number of individuals in each of four survival classes will be determined and recorded on the Survival Study Count Sheet.

An additional 100 control fish will be marked and introduced directly into the collection tank at the mid-point of one collection interval and handled in the same manner as impinged fish to quantify handling mortality and separate it from impingement mortality.

Fish to be held for survival studies will be separated into predator and prey holding tanks for each unit. Various size tanks may be used depending on the number of fish to be tested per category. To prevent overcrowding, add fish to the holding tanks according to the following limits.

Fish – Size Range (mmtl)	# of Fish/Minimum Tank Volume
< 50	75/5 gallons
50-75	20/5 gallons
76-150	3/5 gallons
151-225	2/10 gallons
> 225	1/10 gallons

The condition of captured fish will be categorized according to the following four criteria: alive with no visible external injury; alive with obvious external injury (stunned); dead with no visible external injury; and dead with obvious external injury. Alive with no visible external injury is defined as fish that are actively swimming in an upright position with strong opercular movement. Alive with obvious external injury is defined as fish that are stunned with visible external physical damage, weak swimming ability, inability to remain upright, and weak opercular movement. Twenty-four hours (+/- 1 hour) after placement in holding tanks all fish will be removed, identified to species, measured for total length, and classified into one of the four survival categories. This data will be recorded on the Impingement Survival Length Measurement Data Sheet.

2.5 SAMPLE HANDLING

When processing of a sample is complete, the disposition of the sample (whether to discard it or subject it to QC procedures) will be determined by checking the updated logs regarding QC needs. After any fish requiring special handling, fish for collection efficiency testing, and any fish needed for the reference collection or needing verification have been removed from the sample, the sample (organisms and debris) will be discarded. Any fish that cannot be positively identified to species based on field examination (i.e. young of the year clupeids) will be saved for examination in the laboratory. Fish saved will be frozen. Preservation with formalin is not required for impingement samples except for voucher specimens.

2.6 DATA HANDLING

2.6.1 Data Sheets and Coding Instructions

2.6.1.1 Impingement Field Data Sheet

A unique sample number will be assigned to each impingement collection or survival study at Schiller Station. The sample identification number and type, plant operation data, collection times, water quality data, environmental parameter data, and debris data on the Impingement Field Data Sheet (Appendix A) will be recorded according to the instructions below. The space for comments at the bottom of the data sheet should be to explain any problems or unusual circumstances. A separate data sheet will be used for each 6-hour impingement sample.

In the unusual event that subsampling needs to be conducted due to high detrital loads (Section 2.3.3), a separate data sheet will be used for each subsample analyzed. Plant operating data and water quality data will be recorded on only the first subsample data sheet of the 6-hour period, but collection times and debris data will be recorded for every subsample along with the fish and macro-crustacean sample processing data.

VARIABLE	INSTRUCTIONS
Year	Record current calendar year
Task Code	Enter the task code (Sample type) 1 = 6-hour Impingement Sample 4 = Survival Study
Sample	Enter current sample #
Unit	Enter the code indicating the Unit from which the data was collected 4 = Unit 4 5 = Unit 5 6 = Unit 6 9 = Units 5 and 6 combined (continuous wash)
Use Code	Enter code for status of sample: 1 = data collected, no sampling problems 2 = fish were collected, sampling problems occurred 5 = no fish collected, sampling problems occurred
Comments	If comments are written at the bottom of the data sheet, enter 1; if not, leave it blank. Comments should be written for all samples that are not Use Code = 1.
Screen	Pre-coded 4, 51,52,61,62 to identify individual screens, numbered from south to north in each screen house
Mode	For each screen, enter the code for its screenwash mode at the start of a 6-hour sample: 0 = off

VARIABLE	INSTRUCTIONS
	1 = continuous wash 2 = intermittent wash
Prewash	For each screen, enter the code for its prewash status at the start of a 6-hour sample: 0 = not prewashed 1 = prewashed (a screen was prewashed if it was in continuous wash mode for at least 30 minutes)
Pump	Enter the number identifying the individual circulating water pumps 4 = Screen House #1 Pump 4 5 = Screen House #2 Pump 5 (north) 6 = Screen House #2 Pump 6 (south)
Pump On Status	For each circulating water pump, enter the code for its operational status at the start of a 6-hour sample: 0 = off 1 = on
Start Month	Record the month that 6-hour collection began
Start Day	Record the day that 6-hour collection began
End Month	Record the month that 6-hour collection ended
End Day	Record the month that 6-hour collection ended
Start Hour	Record the hour that the 6-hour sample (or a subsample) began, using 24-hr clock (0000-2359 hrs)
Start Min	Record the minute that the 6-hour sample (or a subsample) began, using 24-hr clock (0000-2359 hrs)
End Hour	Record the hour that the 6-hour sample (or a subsample) ended, using 24-hr clock (0000-2359 hrs)
End Min	Record the minute that the 6-hour sample (or a subsample) ended, using 24-hr clock (0000-2359 hrs)
Start Temp.	Record the temperature to the nearest 0.1°C, at the start of each 6-hour impingement sample
End Temp.	Record the temperature to the nearest 0.1°C, at the end of each 6-hour impingement sample
Start Salinity	Record the salinity to the nearest 0.1 ppt at the start of each 6-hour impingement sample
End Salinity	Record the salinity to the nearest 0.1 ppt at the end of each 6-hour impingement sample
Start D.O.	Record the dissolved oxygen concentration to the nearest 0.1 mg/l (ppm), at the start of each 6-hour impingement sample
End D.O.	Record the dissolved oxygen concentration to the nearest 0.1 mg/l

VARIABLE	INSTRUCTIONS
	(ppm), at the end of each 6-hour impingement sample
Start Air Temp	Record air temperature (°C) at start of each 6-hour impingement sample
End Air Temp	Record air temperature (°C) at end of each 6-hour impingement sample
Start Cloud Cover	Record the cloud cover at the start of each 6-hour impingement sample 0 = 1-9% 1 = 10-19% 2 = 20-29% 3 =30-39% 4 = 40-49% 5 = 50-59% 6 = 60-69% 7 = 70-79% 8 = 80-89% 9 = 90-100%
End Cloud Cover	Record the cloud cover at the end of each 6-hour impingement sample 0 = 1-9% 1 = 10-19% 2 = 20-29% 3 =30-39% 4 = 40-49% 5 = 50-59% 6 = 60-69% 7 = 70-79% 8 = 80-89% 9 = 90-100%
Start Precip.	Record the precipitation at the start of each 6-hour impingement sample 0 = None 1 = Light Rain 2 = Heavy Rain 3 = Snow
End Precip.	Record the precipitation at the end of each 6-hour impingement sample

VARIABLE	INSTRUCTIONS
	0 = None 1 = Light Rain 2 = Heavy Rain 3 = Snow
Start Wind Dir.	Record the wind direction at the start of each 6-hour impingement sample 0 = No Wind 1 = North 2 = South 3 = East 4 = West
End Wind Dir.	Record the wind direction at the end of each 6-hour impingement sample 0 = No Wind 1 = North 2 = South 3 = East 4 = West
Start Wind Speed	Record the wind speed (MPH) at the start of each 6-hour impingement sample 1 = Leaves rustle, wind on face 2 = leaves and twigs in constant motion, flag waving 3 = raises dust and loose paper, small branches moving 4 = small trees begin to sway 5 = whole trees in motion
End Wind Speed	Record the wind speed (MPH) at the end of each 6-hour impingement sample 1 = Leaves rustle, wind on face 2 = leaves and twigs in constant motion, flag waving 3 = raises dust and loose paper, small branches moving 4 = small trees begin to sway 5 = whole trees in motion
Debris Gal.	Record the estimated volume of debris in each 6-hour impingement sample (or subsample) to the nearest gallon (no decimal). If less than 1 gallon, record as 1 gallon. If none, record as zero.
% of Each Debris Type	Record the dominant type of debris in each 6-hour impingement sample

VARIABLE	INSTRUCTIONS
	1 = Aquatic Vegetation (seaweed) 2 = Terrestrial Vegetation 3 = Trash 4 = Other

2.6.1.2 Impingement Count Data Sheet

The counts and total weights will be recorded by species on the Impingement Count Data Sheet (Appendix A) according to the following instructions. A new data sheet will be used for each sample. The sample number at the top of the data sheet must correspond to the correct sample number on the Impingement Field Data Sheet (Section 2.6.1.1).

VARIABLE	INSTRUCTIONS
Year	Record current calendar year
Task Code	Enter the task code (Sample type) 1 = 6-hour Impingement Sample 4 = Survival Study
Sample	Enter the same sample number of the corresponding Impingement Field Data Sheet
Unit	Enter the code indicating the Unit from which the data was collected 4 = Unit 4 5 = Unit 5 6 = Unit 6 9 = Units 5 and 6 combined (continuous wash)
Taxon	Enter Piscataqua River taxon code (Appendix B). Enter a code of 033 for any fish taxon without an assigned code, or for any specimens that require subsequent identification or verification.
Weight	Record the total weight to the nearest gram (no decimal). Record the weight as one gram if it is <0.5 g.
Count	Record the total count unless the taxon was subsampled (leave blank for subsampled taxa)
Sub. weight	Leave blank unless the taxon was subsampled. If subsampling was used for counting the taxon, record the combined weight of the organisms in the subsample to the nearest gram (no decimal).
Sub. count	Leave blank unless the taxon was subsampled. If subsampling was used for counting the taxon, record the combined count of the organisms in the subsample.

2.6.1.3 Impingement Length Data Sheet

Measurement and condition data will be recorded for individual fish on the Impingement Length Data Sheet (Appendix A) according to the following instructions. A separate data sheet will be used for each taxon and Unit.

VARIABLE	INSTRUCTIONS
Year	Record current calendar year
Task Code	Enter the task code (Sample type) 1 = 6-hour Impingement Sample 4 = Survival Study
Sample	Enter the same sample number of the corresponding Impingement Field Data Sheet
Unit	Enter the code indicating the Unit from which the data was collected 4 = Unit 4 5 = Unit 5 6 = Unit 6 9 = Units 5 and 6 combined (continuous wash)
Taxon	Enter Piscataqua River taxon code (Appendix B)
ID	Precoded with sequential identification number (1-50 for each length class for the week).
AD	Enter the code for condition: 1 = alive 2 = dead 3 = injured or stunned
Length	Record total length of fish (nearest mm), carapace width of crabs (nearest mm), and carapace length of lobsters (nearest mm)
Weight	Record wet weight of fish (nearest g)

2.6.1.4 Impingement Survival Study Count Sheet

The treatment type, species and a count of survival status types will be recorded on the Survival Study Count Sheet (Appendix A) according to the following instructions. A new data sheet will be used for each Unit. The sample number at the top of the data sheet must correspond to the sample number on the Impingement Field Data Sheet (Section 2.6.1.1).

VARIABLE	INSTRUCTIONS
Year	Record current calendar year
Task Code	Pre-coded 4 for survival study
Sample	Enter current sample # (Using different sample numbers for the two

VARIABLE	INSTRUCTIONS
	units)
Unit	Enter the code indicating the Unit from which the data was collected 4 = Unit 4 5 = Unit 5 6 = Unit 6 9 = Units 5 and 6 combined (continuous wash)
Treatment	Enter the code indicating the study treatment the fish belong to 1 = Ambient (wild Piscataqua River) fish or macrocrustacean 2 = Control released fish
Time Status	Enter the code indicating when count took place 1 = initial count at start of 24 hours 2 = count of fish status' after 24 hour time period
Taxon	Enter Piscataqua River taxon code (Appendix B). Enter a code of 033 for any fish taxon without an assigned code, or for any specimens that require subsequent identification or verification.
Alive, no external injury	Record tally of fish in this category
Alive, external injury	Record tally of fish in this category
Dead, no external injury	Record tally of fish in this category
Dead, external injury	Record tally of fish in this category

2.6.1.5 Impingement Survival Status Data Sheet

The treatment type, species fish ID, length and survival status will be recorded on the Impingement Survival Status Data Sheet (Appendix A) according to the following instructions. A new data sheet will be used for each Unit. The sample number at the top of the data sheet must correspond to the sample number on the Impingement Field Data Sheet (Section 2.6.1.1).

VARIABLE	INSTRUCTIONS
Year	Record current calendar year
Task Code	Precoded 4 for survival study
Sample	Enter current sample # (Using different sample numbers for the two units)
Unit	Enter the code indicating the Unit from which the data was collected 4 = Unit 4 5 = Unit 5 6 = Unit 6 9 = Units 5 and 6 combined (continuous wash)

VARIABLE	INSTRUCTIONS
Year	Record current calendar year
Task Code	Precoded 4 for survival study
Treatment	Enter the code indicating the study treatment the fish belong to 1 = Ambient (wild Piscataqua River) fish 2 = Control released fish
Time Status	Pre-coded for data collected after 24-hr. hold period
Species	Enter Piscataqua River taxon code (Appendix B). Enter a code of 33 for any fish taxon without an assigned code, or for any specimens that require subsequent identification or verification.
Fish ID	Record a sequential fish identification number
Length	Record total length of the fish (nearest mm)
Weight	Record weight of the fish (nearest g)
A/D	Record Survival Status of the fish 1 = alive, no external injury 2 = alive, external injury 3 = dead, no external injury 4 = dead, external injury

2.6.2 Storage and Chain of Custody of Data Sheets

All data sheets will be reviewed to ensure that they are completely and correctly filled out. Normandeau staff will be alert to any unusual or unexpected data values. The original data sheets will be transported to the Bedford office.

2.7 QUALITY CONTROL

2.7.1 Tasks Subject to Quality Control

The efficiency of separating fish from debris, as well as all field identifications, counts, weights, and measurements will be subject to quality control (QC) inspection. The following items will be subjected to QC:

- Sorting of fish from debris
- Identification of all species
- Total count by fish species
- Total weight by fish species
- Subsample count by fish species
- Subsample weight by fish species
- Total length of individual fish
- Condition of individual fish

2.7.2 Inspection Plans

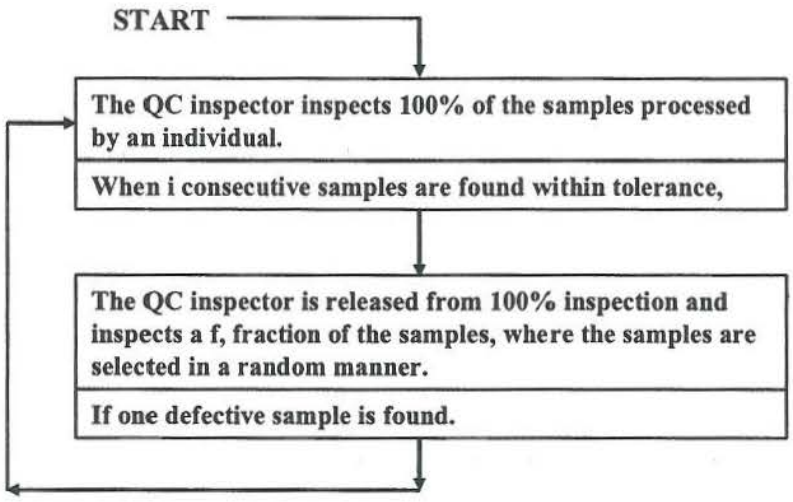
Items will be chosen for inspection using a "CSP-1" QC procedure derived from MIL-STD (military-standard) 1235 (Single and Multiple Level Continuous Sampling Procedures and Tables for Inspection by Attributes) to achieve a 10% Average Outgoing Quality Limit (i.e., ≥90% of samples are within specified quality control tolerance limits). Separate QC inspection plans will be applied for each individual processor within three categories of data: (1) sorting of fish from debris in a sample; (2) identification, counts, and weights by species; and (3) length and condition of individual fish. For sorting, a QC sample will consist of one complete 6-hour sample at one unit. For the count/weight data and the length/condition data, the term "sample" for the purposes of QC inspections will mean QC sample and is not the same as an entire 6-hour impingement sample. For identification/count data, one QC sample will consist of one line of data on the Impingement Count Data Sheet, including the taxon, total weight, and total count recorded on that line. All data appearing on a line selected as a QC sample for inspection must be within tolerance. If any of those values on the line fails, then that QC sample (data line) will fail. For species subsampled for counting, 100% of the subsample weights and subsample counts will be checked. For length/condition data, a QC sample will consist of the length and associated condition for one fish (both must agree with the QC inspection for that line of data to pass).

The QC sampling plan will be conducted in two modes as described below and illustrated in Figure 2.

- ***Mode 1.*** Reinspect one hundred percent of the QC samples until "i" consecutive samples pass. (The value of the parameter "i" depends on the anticipated size of the data set, differing among the three types of data, as shown in the table following the description of Mode 2).
- ***Mode 2.*** After "i" consecutive samples pass QC reinspection, randomly choose (using a random numbers table) the fraction "f" of QC samples for reinspection. (The value of the parameter "f" depends on the anticipated size of the data set, differing among the three types of data, as shown in the table below.) If any QC sample fails during a Mode 2 inspection, then return to Mode 1.

QC inspection plan parameters for Schiller Station impingement

QC Plan	i	f
Sorting	6	1/4
count/weight	7	1/5
length/condition	8	1/7



Procedure for using Quality Control Inspection Plan CSP-1.

Figure 2-2. The two modes of the QC sampling plan.

2.7.3 Acceptance/Rejection Criteria

A qualified person other than the original processor will conduct quality control reinspections. All QC reinspections will be performed "blindly," i.e., the individual doing the QC reinspection will have no knowledge of the original processor's results. The tolerance for each task will be

- 10% of the total fish count for sorting
- ±10% for count when the QC count ≥20
- ±2 for count when the QC count <20
- ±3% for weight when the QC weight >33 g
- ±1 g for weight when the QC weight ≤33 g
- ±3% for length when the QC length >33 mm
- ±1 g for length when the QC length ≤33 mm
- no difference for condition (must agree)

The percent error will be calculated as

$$\% \text{ error} = 100\% \times (\text{original value} - \text{QC value})/\text{QC value}$$

For the sorting task, the QC value for this calculation will be the total of the number of fish found by the original processor plus any additional fish found by the QC inspector. A resolution value may be determined for any QC sample found to exceed tolerance. Any person who has made an incorrect identification of his/her error should be advised and provided with help. If any discrepancies between the original value and the QC value exceed the acceptance criteria, the data sheet must reflect the corrected value.

2.7.4 Quality Control Records

All QC checks will be documented in QC logs and made available to any utility representative(s) at his/her request. A separate QC log will be maintained for each task type (sort, count, or length) for each individual processor (Appendix A). For each QC sample selected for reinspection, the following information will be recorded in the log:

a. identity of the QC sample:
   (1) sample number for sorting QC,
   (2) sample number and taxon for count/weight QC, or
   (3) sample number, taxon, and fish identification number for length/condition QC
b. date of QC
c. original count or measurement value
d. QC count or measurement value
e. percent error
f. resolution value (if any)
g. initials of all processors

2.8 Reference Collection

A representative sample of each fish taxon collected during the Schiller Station impingement program will be represented in the general reference collection at Normandeau's Bedford office or in the on-site field office (except shortnose sturgeon if any are caught). That reference collection will be supplemented as needed by removing specimens from Schiller Station impingement samples and preserving them in formalin. Each jar will be labeled with external and internal labels containing the scientific name, date of capture, Station, unit, capture location, and initials of the taxonomist making the identification.

2.9 Instrument Calibration and Maintenance

2.9.1 Schedule and Calibration Logs

Field instruments will be calibrated prior to each day of use, and service laboratory scales and balances will be calibrated once each year. Daily calibration checks will be performed with each use of a laboratory scale or balance; field scales will be calibrated every six months. Calibration logs will be maintained for all instruments and include the following information:

- instrument number and identification
- date of calibration
- initials of the person(s) calibrating the instrument
- standards used
- results, including instrument accuracy at receipt for calibration, adjustments made, instrument accuracy after calibration.

3.0 DATA PROCESSING

3.1 DATA ENTRY VERIFICATION

A submittal form will be provided with each batch of data sheets submitted to the Technical Data Processing (TDP) department in the Bedford office for data entry. Information on the submittal form should include names of sender and recipient, date sent, and dates of impingement collections included in the batch.

All data will be keyed twice, resolving discrepancies between the two versions as they are flagged by the data verification program.

3.2 SYSTEMATIC ERROR CHECKS

Keyed data will be subjected to a series of systematic error checking programs developed specifically for this project. These consist of univariate, bivariate, and multivariate checks specified by project personnel. Univariate range checks identify records for which one or more variables have values outside their valid or expected ranges. Bivariate and multivariate checks compare values of related variables. Additional checks scan the data for duplicate or missing observations. All records flagged by these programs will be resolved, and corrections to both the data files and the data sheets will be made as necessary. After error checking is complete, data files will be subjected to quality control inspection (refer to Section 3.4).

3.3 DATA FILE FORMAT

Error checked data files will be assembled into a computerized database.

3.4 QUALITY CONTROL OF DATA FILES

Data files that have completed the systematic error checking process will undergo a QC inspection to assure a 1% AOQL (Average Outgoing Quality Limit) according to a lot sampling plan (American Society for Quality Control. 1993. Sampling procedures and tables for inspection by attributes. ANSI/ASQC Z1.4-1993). This procedure insures that ≥99% of the observations in a data file agree with the original data sheets. The number of observations to be checked, and the number of those that must be within tolerance are shown below. If more than the acceptable number of failures are found, then the data set must be inspected 100%.

4.0 TRAINING

In order to assure the standardization of field, laboratory, and data processing procedures, Normandeau has developed a two-level system for training technicians: the first level being documented standard operating procedures; the second level being a training program for all new project personnel. At a minimum, this training program consists of the following steps:

Lot Sampling Plan for QC Inspection at Less Than 1% AOQL.

		Number of Failures	
Lot Size	Sample Size	Accept If ≤	Reject If ≥
1-32	ALL	0	1
33-500	32	0	1
501-3,200	125	1	2
3,201-10,000	200	2	3
10,001-35,000	315	3	4
35,001-150,000	500	5	6
150,001-500,000	800	7	8
500,001 and over	1,250	10	11

- A complete reading and explanation of the project SOP and QA manual. This is documented by a sign-off sheet which is filed in the program file.
- Observation by the Program Manager, Field Site Supervisor or Laboratory Manager of the first two or more times a new procedure is performed. This is documented with a signed checklist.
- Direct supervision by an experienced technician of personnel assigned to unfamiliar tasks for their first two or more attempts.
- 100% quality control checks for at least the first five samples analyzed.
- On tasks requiring identification of fish and ichthyoplankton, the Program Manager will have final approval as to who is qualified to make these identifications. In some cases special training will be required to participate in tasks, as set forth by the Program Manager.

5.0 QUALITY ASSURANCE PLAN

Normandeau's Program Manager is Mr. Richard Simmons. The program Technical Director is Dr. Mark Mattson, who will be the principle report reviewer and co-author. Normandeau's Quality Assurance Director is Mr. Robert Hasevlat, who is independent of the project and reports directly to the company's President, Ms. Pamela Hall. The Field Supervisor is Mr. Michael Jeanneau. Field crew members include Mr. Michael Jeanneau, Mr. Cory Francis, Mr. Donald Mason, Mr. Al Frizzell, Mr. Chris Baker, Ms. Shayle Reed, and Mr. Randy Whistler. Normandeau's laboratory fish taxonomist is Mr. Joseph Strube. Normandeau's technical information processing services will be provided by Ms. Susan Ward or Mr. Chris Gushin. Report authors and data analysts will include Mr. Paul Lindsay, Mr. Drew Trested, or Mr. Jason Wyda.

5.1 IMPORTANCE OF QUALITY ASSURANCE

The analytical study will provide qualitative and quantitative data for use in decision making. To be valuable, the data must accurately describe the characteristics and concentrations of constituents in

the sample analyzed. In many cases, because they lead to faulty interpretations, approximate or incorrect results are worse than no results at all. Decisions on process changes, plant modifications or the construction of new facilities may be based upon the results of field and laboratory analysis. The financial implications of such decisions make it imperative that extreme care be taken in analysis. The analyst should realize not only that he/she has considerable responsibility for providing reliable descriptions of the samples at issue, but also that his/her professional competence, the validity of the procedures used, and the resulting values reported may be challenged (perhaps in court). For the analyst to meet such challenges, he/she should support the data with an adequate documentation program that provides valid records of the control measures applied to all factors bearing on the final results of investigations. Although all analysts practice quality control (QC) in amounts depending upon their training, professional pride and the importance of their particular projects, under actual working conditions sufficiently detailed QC may be neglected. An established, routine, quality assurance program applied to each analytical test will provide the detailed QC necessary to insure the validity and reliability of the data.

5.2 QUALITY ASSURANCE

A Quality Assurance (QA) Program will be implemented that will provide a 10% Average Outgoing Quality Limit (AOQL) (i.e., 10% or less non-conforming product) for all field or laboratory measurement parameters and a 1% AOQL (i.e., 1% or less non-conforming product) for all data calculations and data tables. This Quality Assurance Program is designed to meet or exceed the USEPA's guidance criteria and be consistent with the intent of Federal regulations (10 CFR 50) which require that quality assurance be separated from operational and budgetary concerns. Normandeau has a full time Quality Assurance Director who supervises the implementation and documentation of the QA Program and reports directly to the President of the Company.

Normandeau's Quality Assurance Program will comprise two systems: a quality control (QC) system and a quality assurance (QA) system. The principal strengths of the QA Program are the functional independence of the systems and the common collection and interpretation point for quality related information, the Quality Assurance Director. The QC system is managed by the Program Manager and conducted by operational personnel. The QA system is managed by Normandeau's Quality Assurance Director and utilizes project-independent technical personnel during performance and system audits.

5.3 QUALITY CONTROL

The function of the QC system is to continually monitor the reliability and validity (accuracy, precision, and completeness) of data produced on a daily basis. The QC system is approved by the QA Director and incorporated into the project Standard Operating Procedures (SOP); any changes to the SOP must be coordinated through Normandeau's QA Department and approved by a client representative. The project SOP will describe and document the following tasks:

- technical requirements, methods, and procedures,
- Quality Control program,

- instrument maintenance and calibration,
- document control and documentation of the resulting from sample analysis, instrument maintenance and calibration and data processing,
- sample control procedures, and
- training of technicians.

Tasks subject to 10% AOQL quality control inspection will be specified in the project SOP. Quality assurance audits of field and laboratory activities will be performed at least once per year to verify that procedures are carried out as specified in the SOP and to verify the effectiveness of the quality control system. Computer entry of data from data sheets will be subjected to double entry verification. Computer files will be subjected to a rigorous set of univariate, bivariate, and multivariate systematic error checks. Analytical files will then be subjected to a 1% AOQL quality control inspection to verify that values have correctly been correctly transferred from data sheets to the analytical files. Representative data values in tables and graphs will be verified by recalculating them from the original data.

5.4 NONCONFORMANCE REPORTS AND CORRECTIVE ACTION

Documentation of problems or unusual events occurring during a program will be accomplished using Extraordinary Event/Nonconformity (EENC) forms. The EENC form (Appendix A) is designed to dispense information to the Program Manager and Quality Assurance department and to obtain necessary action on items that are critical to technical operations and management of programs. The report results from observations such as these:

- deviations from standard operating procedures
- losing a sample
- finding an endangered species in a sample
- noting samples that are grossly different from expected (content, preservation, labels)
- noting a phenomenon that may deserve continued monitoring in the interest of the client and therefore may require a change in the scope of work
- quality control samples that exceed acceptable limits
- unusually high impingement counts.

Items, samples, data, or information not in conformity with specifications or which do not meet preconditions for the next step in processing or use, will be set aside until the problem is resolved and documented via the EENC report procedure.

The EENC report is designed for use by any person who identifies a problem or discovers information that is germane to a program scope of work or the improvement or change of contract performance. The originator describes the problem and may make recommendations for its resolution. Two temporary copies are made, and the original is sent to the Program Manager. One of the copies is kept by the originator in a file for "open" EENC reports (corrective action in progress),

and the other is sent to the Quality Assurance Supervisor, who periodically checks on the progress of corrective action.

The Program Manager confers with appropriate parties and decides what corrective action will be required. Instructions to the Action Addressee (the person responsible for carrying out the corrective action) are written on the original EENC report. The Program Manger retains the original and sends a copy to the Action Addressee.

The Action Addressee resolves the problem as directed and then signs the EENC copy and returns it to the Program Manager to signify that the corrective action has been completed.

The Program Manager files the signed copy from each Action Addressee (there may be more than one), and when all corrective action is complete signs the original EENC report, keeps a temporary copy, and forwards the original to the QA Supervisor.

The QA Supervisor reviews the EENC report, and signifies acceptance of the resolution by signing and dating the report to "close" it. A copy of the closed EENC report is retained in QA files, the temporary copy received earlier from the originator is discarded, and the original is returned to the Program Manager.

The Program Manager discards the temporary copy and keeps the original on file. A copy of the closed EENC report is sent to the originator, and additional copies are sent to any other affected parties. The originator discards the temporary copy in the file of open EENC reports and files the copy of the closed EENC report.

5.5 QA AUDITS

It is the responsibility of the Quality Assurance organization to verify the achievement of quality through all phases of the project. Once the proposal, program design, and work development phases are complete, these responsibilities will be accomplished primarily by audits, tests, and surveys which will provide objective evidence that the quality control program and technical requirements, methods, and procedures as outlined in the study QA manual are being implemented. All field, laboratory, and data processing tasks will be subject to at least one audit. These audits will be conducted by an audit team of technically qualified personnel familiar with, but independent of and not responsible for, the work or activities under evaluation. The audit team will review the operations, specifications, QC systems, plans, and project objectives and examine the acquisition and transfer of data from field to report.

Observations of nonconformities and program deficiencies will be classified into three categories:

A. Deficiencies that affect the data adversely;
B. Deficiencies that might affect the data adversely; and
C. Deficiencies or procedural changes that cannot affect the data adversely.

Class A deficiencies will be resolved before that portion of the program can proceed. Class B deficiencies must have a determination as to whether they should be changed to Class A or C

deficiencies and whether or not corrective action is necessary. If corrective action is necessary, it will be performed within a reasonable time frame agreed to by the program management, the Quality Assurance Department, and PSNH. Operations with Class A or B deficiencies will be subject to reaudit to determine the effectiveness of corrective action. Class C deficiencies must have corrective action accomplished before the next scheduled audit or end of the project, whichever comes first.

Audit results will be presented orally to the appropriate project or facility management by the audit team after the audit has been completed. At this time, specific findings will be presented and recommended courses of corrective action developed. Subsequently, the audit results will be documented in a written audit report and reviewed by management having responsibility in the areas audited. These reports will include a summary of audit results, observations made with a listing of non-conformities, recommendations and corrective action taken.

The quality assurance director will maintain a file of all project and facility audits. This file will include copies of the audit checklists, audit reports, written replies, the record of completion of corrective action and follow-up action. Further copies of the audit reports, written responses and records of completion of corrective actions will be sent to Ms. Pamela S. Hall, Normandeau's President.

APPENDIX A

Forms

Extraordinary Event/Nonconformity Report

EE/NC Report Number: **Date:** **From:**

Respond by (date): **Project No.:** **Title:**

Date Closed:

Addresses:

QA: ☐ **Project Mgr.:** ☐ **Field Mgr.:** ☐ **Lab Mgr.:** ☐ **Technical Mgr.:** ☐ **Others:** ☐

Problem Definition (e.g., Sample ID, Activity, Data, Standard, etc. Not in Conformity):

Recommendations for or Corrective Action Taken:

Signed: _____

Action Addressee Response:

Corrective Action Completed: **Date:** _____ **Signed:** _____

Distribution: ***Original:*** QA, ***Copies of Original:*** Originator, Addressees
Responses: QA (responses are to be made on copies)

SCHILLER STATION GENERATING STATION, 2006

Impingement Field Data Sheet

Year	Task Code	Sample	Unit	Use Code	Comments
0					

PLANT OP.

		screen	mode	prewash		pump	on?
Screen House #1		4			South	4	
Screen House #2	North	51			North	5	
		52				5	
		61				6	
	South	62			South	6	

		month	day	hour	min
SCREENWASH DATE & TIME	start				
	end				

WATER QUALITY

	Start	End
temp.		
salinity		
D.O.		

ENVIRONMENT

	Air Temp (°C)	Cloud Cover	Precip.	Wind Dir.	Wind Speed (Mph)
Start	.				
End	.				

DEBRIS

gallons ____ dominant type ____

COMMENTS

CODES

Task Code	1=24hr. Imp Sample	Cloud Cover	0=1-9%	Wind Dir.	0=No Wind
	4= Survival Test		1=10-19%		1=North
Use Code	1=data collected, no problems encountered		2=20-29%		2=South
	2=fish collected, problems encountered		3=30-39%		3=East
	3=no fish collected, problems encountered		4=40-49%		4=West
Comments	1=yes		5=50-59%	Wind Speed	1=Leaves rustle, wind on face
	blank=no		6=60-69%		2=leaves and twigs in constant mtn, flag waves
Mode	0=off		7=70-79%		3=raises dust/loose paper, flag in motion
	1=continuous		8=80-89%		4=small trees begin to sway
	2=intermittant		9=90-100%		5=whole trees in motion
Prewash	0=not prewashed	Precip.	0=None	Dominant type	1=aquatic veg.
	1=prewashed		1=Light Rain		2=terrestrial veg.
On?	0=off		2=Heavy Rain		3=trash
	1=on		3=Snow		4=other

SCHILLER GENERATING STATION, 2006

Impingement Count Data Sheet

Year	Task Code	Sample	Unit
0			

taxon	weight	count	sub. weight	sub. count

SCHILLER STATION, 2006

Impingement Length Data Sheet

AD codes 1 = alive
2 = dead
3 = injured/stunned

Year	Task Code	Sample	Unit
0			

TAXON

Id	AD	length*	weight	Id	AD	length*	weight
1				26			
2				27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			
25				50			

TAXON

Id	AD	length*	weight	Id	AD	length*	weight
1				26			
2				27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			
25				50			

TAXON

Id	AD	length*	weight	Id	AD	length*	weight
1				26			
2				27			
3				28			
4				29			
5				30			
6				31			
7				32			
8				33			
9				34			
10				35			
11				36			
12				37			
13				38			
14				39			
15				40			
16				41			
17				42			
18				43			
19				44			
20				45			
21				46			
22				47			
23				48			
24				49			
25				50			

* Column used to record fish length, lobster carapace length, and crab carapace width

SCHILLER STATION, 2006

Survival Study Count Sheet

Year		Task Code	Sample				Unit	Treatment	Time Status
0		4							

Treatment: 1=ambient (wild Piscataqua River) fish or macro-crustacean; 2=control released fish

Time Status: 1 = initial count, 2 = latent (24hr.) count

taxon			Alive, no external injury				Alive, external injury				Dead, no external injury				Dead, external injury			

NEWINGTON STATION
Quality Control Log Book

Processor: _____ **Task Type: Sort / Count / Length**

Length/Condition QC***
Count/Weight QC**
Sort QC*

Sample Number	Taxon	Fish ID #	Date	Original Value	QC Value	% Error	Resolution Value	QC Initials

* For a sample sorting QC, fill in Sample # - leave Taxon and Fish ID blank

** For a count or weight QC, fill in Sample # and Taxon and leave Fish ID blank

*** For a length or condition QC, fill in Sample #, Taxon and Fish ID

APPENDIX B

Taxon Identification Codes

Appendix Table B-1. Taxon codes for fish and macro-crustaceans found in the Piscataqua River 1976-2003.

Family	Family Common Name	Scientific Name	Common Name	Taxon Code
Clupeidae	herrings	*Alosa pseudoharengus*	alewife	1
Clupeidae	herrings	*Alosa sapidissima*	American shad	3
Anguillidae	freshwater eels	*Anguilla rostrata*	American eel	10
Fundulidae	topminnows	*Fundulus heteroclitus*	mummichog	18
Clupeidae	herrings	*Brevoortia tyrannus*	Atlantic menhaden	19
Clupeidae	herrings	*Alosa aestivalis*	blueback herring	22
Atherinopsidae	New World silversides	*Menidia menidia*	Atlantic silverside	24
Osmeridae	smelts	*Osmerus mordax*	rainbow smelt	25
Gasterosteidae	sticklebacks	*Apeltes quadracus*	fourspine stickleback	31
Gadidae	cods	*Microgadus tomcod*	Atlantic tomcod	32
			to be identified	33
Syngnathidae	pipefishes	*Syngnathus fuscus*	northern pipefish	39
Labridae	wrasses	*Tautoga onitis*	tautog	62
Phycidae	phycid hakes	*Enchelyopus cimbrius*	fourbeard rockling	63
Pleuronectidae	righteye flounders	*Pseudopleuronectes americanus*	winter flounder	72
Merlucciidae	merluccid hakes	*Merluccius bilinearis*	silver hake	76
Gasterosteidae	sticklebacks	*Gasterosteus aculeatus*	threespine stickleback	78
Stromateidae	butterfishes	*Peprilus triacanthus*	butterfish	80
Phycidae	phycid hakes	*Urophycis chuss*	red hake	98
Cottidae	sculpins	*Myoxocephalus aenaeus*	grubby	101
Cottidae	sculpins	*Myoxocephalus octodecemspinosus*	longhorn sculpin	114
Clupeidae	herrings	*Clupea harengus*	Atlantic herring	117
Gadidae	cods	*Pollachius virens*	pollock	128
Pleuronectidae	righteye flounders	*Limanda ferruginea*	yellowtail flounder	131
Scophthalmidae	turbots	*Scophthalmus aquosus*	windowpane	132
Phycidae	phycid hakes	*Urophycis regia*	spotted hake	133
Ammodytidae	sand lances	*Ammodytes americanus*	American sand lance	137
Paralichthyidae	sand flounders	*Paralichthys oblongus*	fourspot flounder	139
Scombridae	mackerels	*Scomber scombrus*	Atlantic mackerel	140
Paralichthyidae	sand flounders	*Etropus microstomus*	smallmouth flounder	142
Pholidae	gunnels	*Pholis gunnellus*	rock gunnel	143
Labridae	wrasses	*Tautogolabrus adspersus*	cunner	164
Gadidae	cods	*Gadus morhua*	Atlantic cod	170
Hemitripteridae	sea ravens	*Hemitripterus americanus*	sea raven	171
Lophiidae	goosefishes	*Lophius americanus*	goosefish	203
Liparidae	snailfishes	*Liparis atlanticus*	Atlantic seasnail	218

(continued)

Appendix Table B-1. (Continued)

Family	Family Common Name	Scientific Name	Common Name	Taxon Code
Pleuronectidae	righteye flounders	*Glyptocephalus cynoglossus*	witch flounder	224
Stichaeidae	pricklebacks	*Ulvaria subbifurcata*	radiated shanny	227
Gadidae	cods	*Brosme brosme*	cusk	228
Pleuronectidae	righteye flounders	*Hippoglossoides platessoides*	American plaice	230
Gadidae	cods	*Melanogrammus aeglefinus*	haddock	237
Portunidae	crab	*Carcinus maenus*	green crab	762
Cancridae	crab	*Cancer irroratus*	Atlantic rock crab	764
Cancridae	crab	*Cancer borealis*	Jonah crab	765
Cancridae	crab	*Cancer sp.*	unidentified cancer crab	766
Nephropsidae	lobsters	*Homarus americanus*	American lobster	770
Majidae	spider crab	*Libinia sp.*	unidentified spider crab	821
Grapsidae	crab	*Hemigrapsus sanguineus*	Japanese shore crab	835

Appendix Table B-2. Taxon codes for fish species.

Taxon Code	Common Name
1	alewife
2	bay anchovy
3	American shad
4	bluefish
5	bluegill
6	brown bullhead
7	pumpkinseed
8	black crappie
9	common carp
10	American eel
11	goldfish
12	golden shiner
13	hogchoker
14	tessellated darter
15	banded killifish
16	emerald shiner
17	largemouth bass
18	mummichog
19	Atlantic menhaden
20	(use 59)
21	chain pickerel
22	blueback herring
23	white sucker
24	Atlantic silverside
25	rainbow smelt
26	smallmouth bass
27	shortnose sturgeon
28	spottail shiner
29	Atlantic sturgeon
30	striped bass
31	fourspine stickleback

(continued)

Appendix Table B-2 (Continued)

Taxon Code	Common Name
32	Atlantic tomcod
33	to be identified
34	white catfish
35	white perch
36	yellow perch
37	satinfin shiner
38	rock bass
39	northern pipefish
40	redbreast sunfish
41	Atlantic needlefish
42	crevalle jack
43	eastern silvery minnow
44	fallfish
45	weakfish
46	comely shiner
47	common shiner
48	mimic shiner
49	lookdown
50	unidentified clupeid
51	(use 50)
52	(use 60)
53	grass pickerel
54	lined seahorse
55	logperch
56	trout-perch
57	northern hog sucker
58	fathead minnow
59	unidentified cyprinid
60	unidentified *Morone*
61	redfin pickerel
62	tautog
63	fourbeard rockling

(continued)

Appendix Table B-2 (Continued)

Taxon Code	Common Name
136	northern stargazer
137	American sand lance
138	fat sleeper
139	fourspot flounder
140	Atlantic mackerel
141	black sea bass
142	smallmouth flounder
143	rock gunnel
144	inshore lizardfish
145	unidentified mudminnow
146	silver lamprey
147	rainbow trout
148	rosyface shiner
149	unidentified *Esox*
150	unidentified gobiid
151	unidentified *Fundulus*
152	unidentified cyprinodontid
153	unidentified *Myoxocephalus*
154	unidentified cottid
155	unidentified pleuronectiform
156	unidentified pleuronectid
157	unidentified atherinid
158	unidentified *Menidia*
159	unidentified bothid
160	speckled wormeel
161	unidentified syngnathid
162	mackerel scad
163	unidentified *Ammodytes*
164	cunner
165	unidentified sciaenid
166	unidentified gadid

(continued)

Appendix Table B-2 (Continued)

Taxon Code	Common Name
167	flying gurnard
168	shield darter
169	gray snapper
170	Atlantic cod
171	sea raven
172	bigeye scad
173	striped burrfish
174	sheepshead
175	unidentified percid
176	spotfin mojarra
177	spotfin butterflyfish
178	unidentified gasterosteid
179	planehead filefish
180	Atlantic cutlassfish
181	pigfish
182	short bigeye
183	guaguanche
184	freckled blenny
185	unidentified tetraodontid
186	orangespotted filefish
187	margined madtom
188	bluespotted cornetfish
189	black drum
190	northern sennet
191	scamp
192	cobia
193	least darter
194	unidentified percichthyid
195	scrawled cowfish
196	spotfin flyingfish
197	Gulf menhaden

(continued)

Appendix Table B-2 (Continued)

Taxon Code	Common Name
198	pugnose shiner
199	redfin shiner
200	sand shiner
201	swallowtail shiner
202	tiger muskellunge
203	goosefish
204	permit
205	freshwater drum
206	king mackerel
207	longnose gar
208	Spanish mackerel
209	highfin goby
210	unidentified sucker
211	unidentified labrid
212	blackcheek tonguefish
213	oyster toadfish
214	feather blenny
215	orange filefish
216	little skate
217	spiny dogfish
218	Atlantic seasnail
219	Gulf Stream flounder
220	spotted goatfish
221	brook silverside
222	harvestfish
223	pinfish
224	witch flounder
225	kokanee
226	ladyfish
227	radiated shanny
228	cusk
229	unidentified *Urophycis*

(continued)

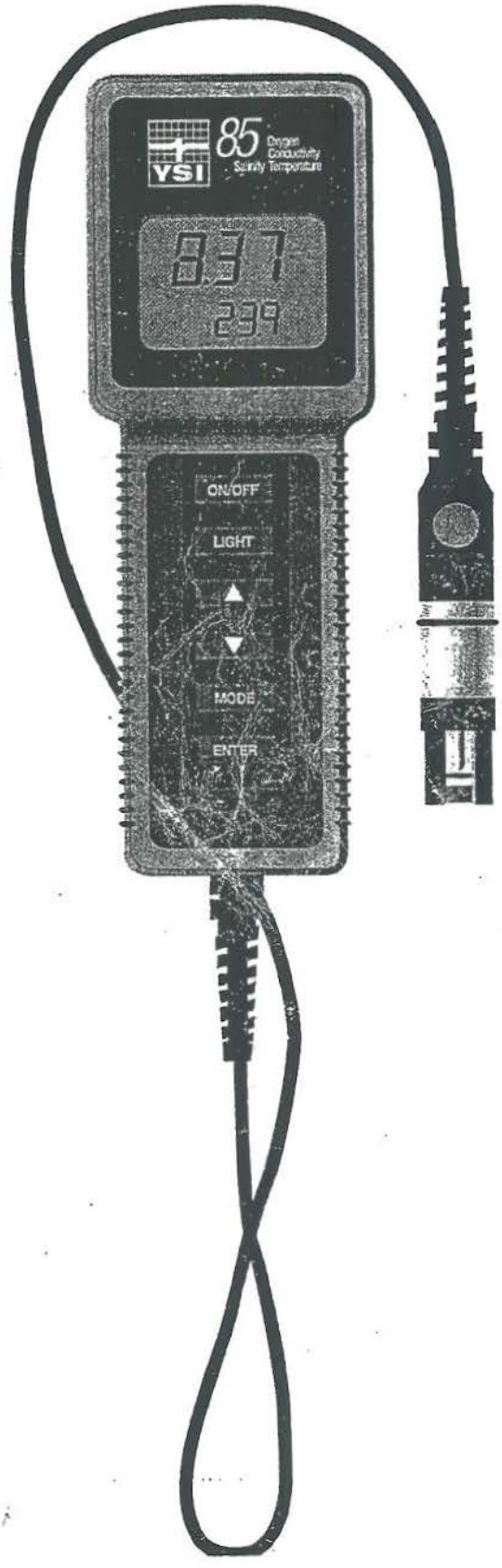
Appendix Table B-2 (Continued)

Taxon Code	Common Name
230	American plaice
231	slimy sculpin
232	sheepshead minnow
233	unidentified blenny
234	unidentified skate
235	clearnose skate
236	weakfish/scup
237	haddock
238	rudd

APPENDIX C

YSI Model 85 Temperature, Conductivity, and Dissolved Oxygen Meter

YSI *incorporated*



YSI Model 85

Handheld Oxygen, Conductivity, Salinity, and Temperature System

Operations Manual

CONTENTS