CAPE FEAR RIVER ANADROMOUS FISH LARVAE AND EGG SURVEY

FINAL REPORT
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Prepared for:

U.S. Army Corps of Engineers
Wilmington District

Prepared BY:

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Cape Fear River
Anadromous Fish Larvae and Egg Survey

Final Report

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EXECUTIVE SUMMARY

Dial Cordy and Associates Inc. (DC&A) was contracted by the Wilmington District Corps of Engineers on 31 March 2006 to perform sampling of anadromous fish larvae and eggs within the Cape Fear River system. The project purpose was to ascertain through sampling whether any of the seven anadromous fish species are spawning above and/or below the three locks and dams located on the Cape Fear River, as evidenced by the collection of fish larvae and eggs. The targeted fish species consisted of American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), blueback herring (*A. aestivalis*), alewife (*A. pseudoharengus*), striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrhynchus*), and shortnose sturgeon (*A. brevirostrum*). The study included evaluation of in situ water quality, plankton net tows, and deployment and collection of spawning pads at seven stations located above and below Locks and Dams #1, #2 and #3 on the Cape Fear River, and two stations located on the Northeast Cape Fear River. Biweekly sampling of each station occurred from 10 April 2006 through 2 June 2006.

A total of 132 plankton tows were made over the study duration with 100 tows above and below Locks and Dams #1, #2, and #3, and 32 tows on the Northeast Cape Fear River. Of these plankton tows, 107 (81%) were stationary and 25 (19%) were made under power. The samples that contained eggs and/or larvae of the targeted species were all caught during stationary tows. The total number of eggs and larvae collected in plankton tows from targeted species included nine American shad eggs, 37 striped bass eggs, and seven striped bass larvae. For the 52 days that egg collection pads were on-site, collected eggs from targeted species consisted of only three hickory shad eggs from Station 1.

Evidence of spawning activity for American shad and striped bass was documented during the present study as occurring as far upriver as above Lock and Dam #3, with egg(s) collected in plankton tows in April at or above Station 8 (Fayetteville). None of the other targeted anadromous species were collected above the three locks and dams; however, hickory shad eggs were found on egg collection pads in the Northeast Cape Fear River in late April.

The brief spawning period and apparent low population level of both species observed early in the sampling effort may have been curtailed by the rise in river discharge in early May from approximately 2,000 cubic feet per second (cfs) to over 12,000 cfs at Lillington (Station 9), which is considerably higher than the average discharge of 3,900 cfs. Similar trends were observed at the other United States Geological Survey (USGS) gaging stations. American shad ran upstream to above Station 9 and spawned by 21 April 2006, as evidenced by eggs collected. No eggs were collected after April 21st, which may indicate that spawning did not occur or was very limited after this date. Eggs were collected when flow rates exceeded 0.396 meters per second (m/sec), and when water temperature was between 17.8 degrees centigrade (ºC) and 22.4 ºC. As evidenced by eggs and larvae collected, striped bass ran upstream above Lock and Dam #3 (Station 8) early in the season, spawned through early May, and thereafter spawning did not occur or was very limited above Lock and Dam #3. Flow rates were greater than 0.388 m/sec and water temperature ranged between 18.6 ºC and 22.5 ºC when eggs or larvae were collected.

While the study did document spawning for American shad, striped bass, and hickory shad in the study area, the actual number of eggs and larvae collected from the 16 plankton sampling events and 52 days of egg pad sampling were extremely low. Spawning activity during the present study was notably more active in May than in April, which may be attributable to the below average rainfall and corresponding low river discharge rate (flow) and gage elevation during April, and the higher than average water temperatures. Most of the catch occurred for American shad and striped bass during the first half of May when river discharges and gage elevations were higher, and water temperatures slightly lower than observed earlier or later during the study.

It appears that the migration upstream by a healthy population of both species may not have occurred this year, as more egg and larval catch would have likely occurred. Based on electroshocking by the North Carolina Wildlife Resources Commission (NCWRC) below Locks and Dams #1, #2, and #3 from mid-March through the end of May of this year, American shad total count was 281, with an overall catch per unit effort (CPUE) of 17.5 fish per hour (fish/h), which was very low as compared to the 44.1 fish/h observed in 2005 and 53.6 fish/h in 2004 (Personal communication, Keith Ashley, NCWRC). In 2006, 12 striped bass were caught. This was significantly less than the 111 fish collected in 2005, the 108 fish collected in 2004, and the 88 fish collected in 2003. The total CPUE for all striped bass was the lowest catch rate recorded to date (<1.0 fish/h). Overall, CPUE was five fish/h for 2003, 13 fish/h for 2004, and five fish/h in 2005. The 2006 catch rate for striped bass in the Cape Fear River was the lowest recorded to date and remains significantly below capture rates reported for the Neuse River (Farmer et al. 2002) and the Roanoke River (Kornegay and Thomas 2003). Low catches observed this year are considered a result of the warm dry spring, rather than evidence of any population declines (Personal communication, Keith Ashley, NCWRC). Other factors such as the sampling methods employed, the period of day when plankton sampling occurred, and the starting date of sampling could also have affected the catch.

It is likely that an initial run and spawn above Lock and Dam #3 by a smaller population of both species did occur in April, and then spawned further down river below Lock and Dam #2 through mid-May once the water temperature dropped and flows increased. The movement and spawning of striped bass were evidenced by the progressive upstream occurrence of eggs and/or larvae from 2 May 2006 through 23 May 2006. From mid-May through 2 June 2006, the water temperature increased and flow diminished, which may have negatively affected spawning activity, as no eggs or larvae were collected during this period.

In the event sampling is funded for next year, sampling design recommendations include, 1) performing diel plankton sampling for several events above Lock and Dam #3, 2) conducting plankton tows in the early evening during the beginning of the spring run, as documented by electroshocking through the end of the known spawning period, and 3) considering the use of egg collection pads only in areas where silt deposition is not high and desirable spawning habitat is present.

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1.0 INTRODUCTION

Dial Cordy and Associates Inc. (DC&A) was contracted by the Wilmington District Corps of Engineers on 31 March 2006 to perform sampling of anadromous fish larvae and eggs within the Cape Fear River system (Contract W912HN-05-D-0014, Task Order 0015). The project purpose was to ascertain through sampling whether any of the seven anadromous fish species are spawning above and/or below the three locks and dams located on the Cape Fear River, as evidenced by the collection of fish larvae and eggs. The targeted fish species consisted of American shad (*Alosa sapidissima*), hickory shad (*A. mediocris*), blueback herring (*A. aestivalis*), alewife (*A. pseudoharengus*), striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrhynchus*), and shortnose sturgeon (*A. brevirostrum*). This study represents the first effort at sampling anadromous eggs and fish larvae above the locks and dams on the river.

The information collected from this study and other components of the General Re-evaluation Report (GRR) will be used to evaluate the impact of potential alterations or removal of one or more of the locks and dams located on the river, or the addition of permanent fish passage structures on spawning and migration activities for the seven known anadromous species. The river supports a healthy population of American shad, with a low population of striped bass, hickory shad, blueback herring, alewife, Atlantic sturgeon, and shortnose sturgeon.

The figures and tables referenced within the body of this report are located in Appendix A and B, respectively.

2.0 TECHNICAL APPROACH

The study included evaluation of in situ water quality, flow rates, plankton net tows, and deployment and collection of egg collection pads at seven stations located above and below the three locks and dams on the Cape Fear River, and two stations located on the Northeast Cape Fear River (Figure 1).

2.1 Sampling Design

The locations and descriptions for each of the nine stations sampled are listed in Table 1 and illustrated on Figures 2 through 10. Of the nine stations, two were located on the Northeast Cape Fear River, one below Lock and Dam #1, two between Locks and Dams #1 and #2, two between Locks and Dams #2 and #3 and two were above Lock and Dam #3.

The actual locations for plankton tows and spawning pad placement at each river station were surveyed using a Trimble TDI 1 DGPS unit with sub-meter accuracy. Coordinates for all stations are listed in Table 1 and illustrated in Figures 2 through 10. Egg collection pads

that were either moved by the public or disturbed by high flows following significant river discharges from the locks were relocated or new ones deployed at the same location.

2.2 Sampling Methods

Sampling occurred at the nine stations from 10 April 2006 through 2 June 2006 with initial water quality and plankton sampling; and egg collection pad deployment on 10 April and 11 April 2006. Stations were sampled biweekly with 48 hours between each sampling event at a station, except for Station 7 on 28 April 2006 (ramp closed) and Stations 3 and 4 on 1 May 2006 (high water associated with elevated river stage). Sampling for fish eggs and larvae was conducted with plankton nets and polyester floor buffing pads. The buffing pads acted as egg collection pads for adhesive eggs.

2.2.1 Plankton tows

A 0.5 meter (m) diameter plankton net with a 6:1 tail-to-mouth ratio, 500-micron mesh, and solid cup at the cod end was used to capture fish larvae and semi-buoyant eggs. A General Oceanics Model 2030 Flowmeter with standard rotor [10 centimeters per second (cm/sec) minimum] was first used to estimate flow and volume of water filtered through the net; however, following use of two of these meters, a low speed rotor (6 cm/sec minimum) was employed by April. Plankton tows were taken at the deepest point in the river near each station. When adequate flow was present, the boat was anchored and stationary tows were performed; otherwise, the boat was used to tow the plankton net with just enough speed to keep the net open and oriented properly into the current. The plankton net was lowered to the bottom and slowly raised over a 15-minute time frame so as to equally sample the entire water column. The net was washed down with river water, the plankton sample was removed from the solid cup at the cod end and poured into a sample jar, and then the sample was preserved with 10% buffered formalin.

2.2.2 Egg Collection Pads

Polyester floor buffing pads were used as egg collection pads to capture adhesive eggs for hickory shad, blueback herring, and sturgeon during spawning. The 0.5 m pads were attached to a 10-pound barbell weight and tethered to an 8-inch white buoy with polypropylene line. Three pads were deployed near each other at each of the nine stations along the shoreline in about 0.1 m of water depth and approximately 1.0 m from the shoreline. The siting of pad deployment locations took considerable time at most of the upper river stations due to the narrow and steeply sloped shelf common to the shoreline below each dam. A description of the habitat characteristics along the shoreline and on the river bottom was made at each egg collection pad sampling location. A tactile assessment of the sediment type was made following sampling with a small ponar grab. A description of the habitat at each station where pads were deployed is provided below. As described above, the pads were pulled twice a week at each station and checked for eggs. Eggs were

removed from each of the pads, placed in individual sample jars, and preserved in 10% buffered formalin.

Habitat Description at Egg Collection Pad Locations

Station 1 (Figure 2) was located on a broad shelf along a straight section in the Northeast Cape Fear River upstream of the Interstate 40 bridge near Castle Hayne, NC. Substrate at the site consisted of sand. A broad 10- to 15-foot long band of spatterdock (*Nuphar sagittifolia*) covered the shallow shelf from its lower edge to the forested floodplain adjacent to it. Numerous snags were also present at the site. A natural wooded levee and floodplain were present along the shoreline.

Station 2 (Figure 3) was located on a broad shelf along a straight section in the Northeast Cape Fear River, just upstream of the Highway 210 bridge at. The shelf was covered with spatterdock and a few snags were present. The substrate at the site consisted of fine silty-sand. A broad bottomland hardwood floodplain was present along the shoreline.

Station 3 (Figure 4) was located on a moderately wide shelf in the inside corner of a bend of the Cape Fear River, just downstream of Lock and Dam #1. Snags were present at the site. Most river banks in the area were observed to be highly eroded; however, the river bank in the vicinity of this station was only moderately steep and had little herbaceous vegetation. This is likely due to the site's location on the inside corner of a bend. Substrate consisted of silty-sand. Woodlands were present along the banks.

Station 4 (Figure 5) was located on a narrow shelf along a straight section in the Cape Fear River, just above Elwell Ferry. No aquatic vegetation was observed at the site, but snags were present. The bottom substrate consisted of a heavy silt layer over silty-sand. The river bank was moderately steep with herbaceous vegetation. Woodlands were present along the banks.

Station 5 (Figure 6) was located on the inside corner of a soft bend in the Cape Fear River downstream of Lock and Dam #2. Shelf width along the edge of the river was very narrow. Substrate at the site consisted of fine silty-sand. No snags or aquatic vegetation were observed at the site. Banks in the vicinity of the site were steep with little herbaceous vegetation due to erosion caused by high flows characteristic of elevated river stages. Woodlands were present above the steep banks.

Station 6 (Figure 7) was located on the outside of a bend in the Cape Fear River, just downstream of Phillips Creek near Tar Heel, NC. Shelf width along the edge of the river was narrow and the substrate was composed of silty-clay. Numerous snags were present at the site and there was no aquatic vegetation. Riverbanks in the vicinity were steep and had little herbaceous vegetation. Woodlands were present above the steep banks.

Station 7 (Figure 8) was located along an open broad stretch downstream of Lock and Dam #3. Substrate at the site consisted of sand with the presence of some compacted clay boulders approximately ten inches in diameter. Snags and aquatic vegetation were absent. The riverbank in the vicinity of the site was highly eroded and steep, with little herbaceous vegetation. Woodlands were present above the steep banks.

Station 8 (Figure 9) was located on a narrow shelf just downstream of Rockfish Creek. Substrate at the site consisted of silty-sand. Snags and aquatic vegetation were absent. The riverbank in the vicinity of the site was steep and highly eroded, with little herbaceous vegetation. Woodlands were present above the steep banks.

Station 9 (Figure 10) was located along the opposite bank of the river and slightly downstream from the public boat landing near Lillington, NC. The river in the vicinity of the site was broad, shallow, and rocky. Substrate consisted of silty-sand with the presence of rocks and boulders of varying sizes. The riverbank in the vicinity of the site was steep and highly eroded, with little herbaceous vegetation. Woodlands were present above the steep banks.

2.2.3 In situ water quality and flow

For each sampling event at the plankton tow and egg pad locations, water temperature (+/- 0.1º C), conductivity [+/- 0.1 micro-Siemens per centimeter (µS/cm)], salinity [+/- 0.1 parts per thousand (ppt)], and dissolved oxygen [+/- 0.1 milligrams per liter (mg/l)] profiles were recorded with a YSI-85 water quality meter. River flow velocity [+/- 0.1 meters per second (m/s)] was recorded at the surface with a hand-held Global Digital Flow Probe (FP101), except for April 1st and 2nd when the meter failed and flows were calculated by recording the time and distance a deployed float traveled adjacent to the anchored boat. Data was recorded at surface (0.5 m), mid-depth, and bottom (0.5 m off the bottom) water depths for all plankton tow locations and at the surface only for the shallow egg pad locations. In addition, flow direction and water depth (fathometer) were noted in the field logbook.

2.3 Sample Processing and Taxonomic Identification

All samples returned from the field were sorted to remove all fish eggs and larvae. Larvae and eggs were placed in vials, enumerated, and identified to the lowest taxa possible. The samples were then sent to Dr. Joe Hightower at North Carolina State University for taxonomic verification of anadromous species. Once sample verification notes were returned, a data sheet was prepared which summarized the location, number, type of specimen, and species collected. All samples collected and identified will be forwarded to Dr. Hightower for archiving.

3.0 RESULTS

3.1 Water Quality and Flow

In situ water quality data, flow measurements, water sampling depths, and other general observations are listed in Table 2. General trends observed are summarized below for the major parameters measured. River gage and discharge levels, and rainfall for the study area are identified and discussed in both this section and Section 4.0 in relation to the parameters measured.

3.1.1 Water Quality

Temperature

Northeast Cape Fear River
Temperature showed little variation with depth at the two Northeast Cape Fear River stations (Stations 1 and 2). The maximum difference observed was 1.3 ºC between the surface and bottom depths at Station 2. Water temperature ranged from 17.7 ºC (1 May 2006) to 26.0 ºC (1 June 2006) at the surface for the study duration and 17.7 ºC (1 May 2006) to 26.3 ºC (1 June 2006) at the bottom. The low readings occurred following the late April rainfall and elevated river stage.

Cape Fear River
Water temperatures showed little spatial difference between Station 3, below Lock and Dam #1, and Station 9 at Lillington from 10 April 2006 through 25 April 2006. Temperatures at the surface ranged from 18.5 ºC at Station 3 and 17.1 ºC at Station 9 during the first sampling event (April 10th and 11th) to 21.3 ºC at Station 3 and 20.0 ºC at Station 9 during the fifth sampling event (April 24th and 25th). With the high rainfall event in the upper river basin between April 26th and 28th, and a peak discharge of 12,000 cfs near Station 9 (Figures 11 and 13; USGS Station 02102500), the surface water temperature recorded at Station 9 on April 28th had dropped to 16 ºC. The average discharge for this time period was 3,900 cfs. On April 27th and 28th, the surface water temperature ranged from 21.5 ºC at Station 3 to 16.0 ºC at Station 9. By the May 1st and 2nd sampling events, water temperature had dropped to 16.6 ºC at Station 3. Temperatures steadily rose at all stations for the balance of the survey, except following a rainfall event and high discharge around 8 May 2006. From the May 15th and 16th sampling event through the end of the study, there was little spatial variation between stations or with depth at each station, with the final surface water temperature ranging from 26.8 ºC (Station 3) to 27.8 ºC (Station 9). Overall temperatures showed little stratification at any of the stations sampled throughout the study.

Dissolved Oxygen

Northeast Cape Fear River
For the 16 sampling events, dissolved oxygen concentrations at the plankton tow sites seldom were less than 6.0 mg/l, except for Stations 1 and 2 in the Northeast Cape Fear. Levels on occasion at Stations 1 and 2 were less than 4.0 mg/l, especially late in the survey when water temperature exceeded 26 ºC. Dissolved oxygen saturation followed similar trends as described for dissolved oxygen concentration. Stratification with respect to dissolved oxygen was observed at Station 8 for nine of the sampling events and at Station 7 for two events. At Station 8, this is likely related to the location of the sampling station immediately below a large riffle complex, where faster highly oxygenated water stratified above the deeper water in the pool complex below.

Cape Fear River
During the first week of the survey, dissolved oxygen concentrations at the surface ranged from 7.58 mg/l to 9.45m at Station 3, to 8.43 mg/l to 12.06 mg/l at Station 9. Dissolved oxygen concentrations varied little for the balance of the study and showed a slight decline following each of the two significant increases in discharge and stage elevation. Dissolved

oxygen concentrations showed little stratification or variability with depth. Dissolved oxygen saturations followed similar trends as described for dissolved oxygen concentrations, with the highest saturations being observed near the surface of the water column.

Conductivity and Salinity

Northeast Cape Fear River
Northeast Cape Fear River Station 1, conductivity values ranged from a low of 121.5 µS/cm (surface) and 122.0 µS/cm (bottom) on 15 May 2006, to a high of 190.8 µS/cm (surface) and 191.50 µS/cm (bottom) on 27 April 2006. At Station 2, values ranged from a low of 103.5 µS/cm (surface) and 102.9 µS/cm (bottom) on 15 May 2006 to a high of 136.7 µS/cm (surface) and 133.2 µS/cm (bottom) on 17 April 2006. Salinity never exceeded 0.1 ppt, which is the margin of equipment error.

Cape Fear River
Conductivity values were quite variable both spatially and temporally during the study. Values tended to increase from Station 3, below Lock and Dam #1, to Station 9 at Lillington, with the conductivity at Station 9 nearly always higher than further downstream. Conductivity often declined following a large rainfall and high river discharge event (see Figures 11 through 17 for rainfall, river gage level, and discharge). The only significant change in conductivity from the surface to the bottom of the water column occurred at Station 8 (Fayetteville) for nine of the sampling events and at Station 7 for two sampling events. Specific conductivity showed the same trend as conductivity. Salinity never exceeded 0.1 ppt, which is the margin of equipment error.

3.1.2 Flow velocity

River flow at the surface of the water column is summarized for each station for the study duration (except for the first four sampling events) in Table 2. Data collected during this period was not available or consistent for the earlier sampling events due to equipment malfunction.

Northeast Cape Fear River
Flow at the two Northeast Cape Fear River stations ranged from 0.131 m/sec to 0.652 m/sec at Station 1 and 0.073 m/sec to 0.666 m/sec at Station 2, with the direction of flow varying based on the tidal stage during sampling. Higher flow rates were generally related to recent rainfall events in the drainage basin and increased river discharges following the rainfall events.

Cape Fear River
Flow rates for Stations 3, 5, and 7 (located immediately downstream of each respective lock and dam were on average less than 0.4 m/sec for over half of the sampling events when flow was measured. Peak flows associated with high discharge events during the first half of May were 1.055 m/sec, 0.733 m/sec, and 0.768 m/sec for Stations 3, 5, and 7, respectively. Low flows recorded in late May and early June were less than 0.20 m/sec at all three stations.

Flow rates for Stations 4, 6, and 8 (above Locks and Dams #1, #2, and #3 respectively) were on average less than 0.40 m/sec for over three-fourths of the sampling events when flow was

measured. Peak flows associated with high discharge events during the first half of May were 0.702 m/sec, 0.664 m/sec, and 0.680 m/sec for Stations 4, 6, and 8, respectively.

This excludes the manually recorded flows recorded for two events (see Section 2.2.3). Low flows recorded in late May and the first of June were less than 0.20 m/sec at all three stations. Flow rates at Station 9 in Lillington, immediately downstream of a riffle complex, were generally higher than the other three stations with flow less than 0.40 m/sec measured at one-quarter of the sampling events. Peak flows were 0.478 m/sec on 5 May 2006 and 0.475 m/sec on 16 May 2006, excluding manually measured data (see Section 2.2.3). Flow rates less than 0.372 m/sec were never recorded at this station.

3.2 Egg and Larval Sampling

A summary of plankton and egg pad catch data for targeted anadromous species is presented in Table 3. No anadromous fish eggs or larvae were collected during the first three sampling events (10 April 2006 through 20 April 2006). Due to the small number of larvae and eggs collected during the study, little data analysis can be done. Establishing catch per unit effort numbers for the plankton tows is also irrelevant for the same reason.

Plankton Sampling

A total of 132 plankton tows were made over the study duration with 100 above or below the three locks and dams, and 32 on the Northeast Cape Fear River (Tables 2 and 3). Of these plankton tows, 107 (81%) were stationary and 25 (19%) were made under power. Flow rates less than around 0.20 m/sec would not support the plankton net horizontally in the water column. The samples that contained targeted species eggs and/or larvae were all caught during stationary tows, thus during higher flows. The total number of larvae and eggs collected in plankton samples from targeted species included nine American shad eggs, 37 striped bass eggs, and seven striped bass larvae.

The first occurrence of American shad eggs within the plankton samples was on 21 April 2006 at Station 9 (one egg) in the Cape Fear River (Lillington) followed by egg collection at Stations 7 (four eggs), 6 (three eggs) and 5 (one egg) through 12 May 2006. A total of only nine American shad eggs were collected.

Striped bass eggs were first collected on 25 April 2006 from a plankton tow at Station 8, near Fayetteville, where 19 eggs were caught. During May, eggs were collected in the plankton tows at Stations 1 (one egg), 2 (one egg), 7 (nine eggs) and 8 (seven eggs); and larvae were collected at Stations 3 (one larva), 4 (two larvae), and 6 (four larvae). No eggs or larvae for the other five target species were collected in the plankton samples during the survey. The largest by-catch of non-target species was gizzard shad (*Dorosoma cepedianum*), which was present in the plankton samples at many of the stations throughout the study.

The volumes of water sampled during the plankton tows are listed in Table 4. A flow meter with a standard rotor was used from 10 April through 1 May 2006; thereafter, a low speed rotor was installed on the meter. Due to low flow conditions prior to the change in the rotor, and the inability of the standard rotor to accurately measure current flow, the data collected during this early use of the flow meter is not considered accurate, therefore volumes of water filtered during the plankton tows were not calculated for this period. Of the plankton tows

prior to the use of a low flow rotor, flow was estimated to be less than 0.2 m/sec during 11 of the 27 total plankton sampling events.

Volume filtered during the month of May ranged from 31.01 cubic meters (m^3) to 72.49 m^3, 10.63 m^3 to 69.21 m^3, 28.34 m^3 to 105.90 m^3, 14.29 m^3 to 50.45 m^3, 42.60 m^3 to 78.06 m^3, 32.11 m^3 to 98.48 m^3, 6.66 m^3 to 112.57 m^3, 31.91 m^3 to 98.07 m^3, and 45.12 m^3 to 70.93 m^3 at Stations 1 through 9, respectively. Peak volumes occurred on 8 May and 9 May 2006, with calculated volumes filtered being as high as 112.57 m^2 at Station 7.

Egg Collection Pad Samples

For the 52 days that egg collection pads were on-site, not discounting losses during the one storm event, the eggs of targeted species were only collected at one of the stations (Table 3). Three hickory shad eggs were collected at Station 1 from the egg pad on 24 April 2006, with no other occurrences for this species throughout the study duration. Centrarchid eggs were also collected on one egg pad at Station 1 and on two pads at Station 5.

4.0 DISCUSSION

The consensus of opinion is that anadromous fish resources in the Cape Fear River drainage are seriously threatened (Rulifson et al. 1982, Ross et al. 1988). Upstream spawning areas for anadromous species were historically heavily utilized until the three low-elevation dams and adjoining locks were constructed between 1915 and 1934 to provide navigational depth for commerce (Nichols and Louder 1970). Historic spawning grounds for both striped bass and shad were at Smiley Falls, near Erwin, NC (Davis and Cheek 1966). Since 1961, navigational locks on the river have been used to aid anadromous fish passage upstream to their historic spawning areas (Moser and Ross 1993).

Early literature synthesis and surveys in the river drainage included those by Sholar (1977) and Fischer (1979). Evidence of spawning of anadromous fishes in the Cape Fear River was documented by Winslow et al. (1983) for the period 1978-80. Ripe females and eggs of American shad were collected above Locks and Dams #1 and #2, but not above Lock and Dam #3. Moser and Ross (1993) studied the distribution and movement of anadromous species, with special emphasis on the shortnose sturgeon. The mark-recapture study by Moser and Ross (1993) supports the findings by Ashley and Rachels (1993) that *Morone* species are not very abundant in the system above Lock and Dam #1. Of the 92 striped bass and 54 Bodie bass (*Morone saxatilis x Morone chrysops*) tagged, only 6% were recaptured above Lock and Dam #1. Of the thirty-two striped bass recaptured, only 3 made it above Lock and Dam #1. Of these three, two were recaptured at Lock and Dam #2 and the third was recaptured at the base of Lock and Dam #3. Davis and Cheek (1966) evaluated whether locking provided greater use of historical spawning grounds by anadromous fish. During the study, 626 immature striped bass were locked through Lock and Dam #1, 28 through Lock and Dam #2, and none through the uppermost Lock and Dam (#3). More recent studies have included an evaluation of the effectiveness and efficiency of daily opening of the three locks on upstream movement of American shad and striped bass (Moser et al. 1998, 2000) and pre-construction monitoring of both species for potential fish passages (CZR 2002, 2003, and 2004).

Annual monitoring by the NCWRC has shown that both American shad and striped bass do occur upstream as far as Lock and Dam #3; however, spawning activity as evidenced by egg

or larval collections has not been documented for striped bass or shad above Lock and Dam #3. Evidence of adult catches of both species exists much further upstream than Lock and Dam #3, (Davis and Cheek 1966; Personal communication, K. Ashley, NCWRC).

Evidence of spawning activity for American shad and striped bass was documented during the present study as occurring as far up river as above Lock and Dam #3, with egg(s) collected in plankton samples in April at or above Station 8 (Fayetteville). This represents the first documented spawning by striped bass this far upriver since construction of the locks and dams. None of the other targeted anadromous species were collected above the locks and dams; however, hickory shad eggs were collected in the Northeast Cape Fear River in late April.

The brief spawning period and apparent low population level of both species observed early in the sampling effort may have been curtailed by the rise in river discharge in early May from around 2,000 cfs to over 12,000 cfs at Lillington (Station 9), which is considerably higher than the average discharge of 3,900 cfs (Figures 11 through 17). Similar trends were observed at the other USGS gaging stations. Based on eggs collected, American shad ran upstream as far as above Lock and Dam #3 and spawned by 21 April 2006. No evidence of spawning was found after this date above Lock and Dam #3. As shown in Table 5, eggs were collected when flow rates exceeded 0.396 m/sec, within a range of 0.396 m/sec to 1.000 m/sec, and when water temperature was between 17.8 ºC and 22.4 ºC. As evidenced by eggs and larvae collected, striped bass ran upstream above Lock and Dam #3 early in the season (Station 8), spawned through early May, and thereafter never spawned above Lock and Dam #2 (Table 5). Flow rates were greater than 0.388 m/sec when striped bass eggs or larvae were collected, within a range of 0.388m/sec to 1.00m/sec. Water temperature ranged between 18.6 ºC and 22.5 ºC when eggs or larvae were collected.

While the study did document spawning for American shad, striped bass, and hickory shad in the study area, the actual number of eggs and larvae collected from the 16 plankton sampling events and 52 days of egg pad sampling was extremely low. Understanding the reasons for the low catch involves a review of the water resource conditions present in the river this past season (flow, temperature, river discharge, and gage level) as related to the environmental cues triggering the timing of upstream runs by the targeted species, as well as assessing the adequacy of the sampling design based on the study results to aid in future investigations.

Past studies have shown that environmental factors such as river velocity and water temperature greatly determine the timing of upstream migration and spawning by anadromous species (Leggett and Whitney 1972, Marcy 1972, Williams and Bruger 1972, Beasley and Hightower 2000, and Bowman and Hightower 2001). Spawning activity during the present study was notably more active in May than in April, which may be attributable to the below average rainfall and corresponding low river discharge rate (flow) and gage elevation during April (Figures 11 through 17), and higher than average water temperatures. Most of the catch occurred for American shad and striped bass in the first half of May, when river discharges and gage elevations were higher and water temperatures slightly lower than observed earlier or later during the study. However, the lack of any egg or larval catch from 15 May 2006 through 2 June 2006 can not be explained by looking at any of the water quality or available discharge rates and gage elevations, other than that flow declined and water temperature increased through early June. It appears that the migration upstream by a healthy population of both species may not have occurred this year, as more egg and larval

catch would have likely occurred. Other factors such as the sampling methods used, time of the day sampling was performed, and starting the sampling late in the spawning run, may also have affected the catch.

Based on electroshocking by the North Carolina Wildlife Resources Commission (NCWRC), below Locks and Dams #1, #2, and #3 from mid-March through the end of May of this year, American shad total count was 281 with an overall CPUE of 17.5 fish/h which was very low as compared to the 44.1 fish/h observed in 2005 and 53.6 fish/h in 2004 (Personal communication, Keith Ashley, NCWRC). Striped bass catch this year, a total of 12 with no re-captures, was significantly less than the 111 fish collected in 2005, 108 fish collected in 2004, and 88 fish collected in 2003. The total CPUE for all striped bass was the lowest catch rate recorded to date (<1.0 fish/h). Overall, CPUE was five fish/h for 2003, 13 fish/h for 2004, and five fish/h in 2005. The 2006 catch rate for Cape Fear River striped bass was the lowest recorded to date and remains significantly below capture rates reported for the Neuse River (Farmer et al. 2002), and the Roanoke River (Kornegay and Thomas 2003). Low catches this year are considered a result of the warm dry spring, rather than evidence of any population declines. The NCWRC does not sample above Lock and Dam #3, so no data is available on upstream catch in recent years.

Discussions with Fritz Rohde of the NC Division of Marine Fisheries indicate that the actual peak in the anadromous fish run upstream may not have been while the sampling occurred during this study and indicated that shad runs in the Neuse River were late this past season and occurred in late May and the first half of June. It is likely; however, in the Cape Fear that an initial run and spawn above Lock and Dam #3 by a smaller population of both species did occur in April, and then spawned further down river below Lock and Dam #2 through mid-May once water temperature dropped and flows increased. As shown in Table 5, striped bass movement and spawning were evidenced by the progressive upstream occurrence of eggs and/or larvae from 2 May 2006 through 23 May 2006. From mid-May through 2 June 2006 the water temperature increased and flow diminished, which may have negatively effected spawning activity, as no eggs or larvae were collected during this period.

While it is likely that the reason for the poor catch this past season will remain a topic of some discussion, it is perhaps more prudent to consider revisions to the sampling design should the study be authorized next year. Due to the low catch of both eggs and larvae during this study, drawing conclusions regarding spawning activity and occurrence upstream of the locks and dams is difficult. Recommendations are as follows:

- Diel plankton sampling should be performed above Locks and Dams #2 and #3, and above Lillington to increase the catch of fish larvae and eggs. It would be desirable to conduct diel sampling for at least two events at three to four stations during the spawning run, as supported by electroshocking by NCDWR prior to the actual plankton sampling. As American shad and striped bass are known to spawn in the early evening and night, conducting diel plankton sampling would document spawning activity levels, based on egg catch for these species.
- Plankton sampling should be performed in the early evening to increase the catch rather than during the day, with both bottom tows for striped bass and tows throughout the water column for shad. Since both species are known to spawn during the early evening and night, additional sampling at night should prove productive. Striped bass eggs are negatively buoyant and tend to roll along the

bottom, while American shad eggs are neutrally buoyant and can be found throughout the water column.

- The sampling program should start earlier and run through the middle of June, to ensure the historic range of the timed runs are sampled, or as stated above, based on actual evidence of upstream movement by electroshocking. It is possible that the low catch this past season may have been in part due to the late start of sampling.
- Egg collection pads did not prove to be as useful of a sampling technique during this study as it has for others. The use of this technique between Stations 3 and 7 may not be considered viable due to the lack of shallow spawning substrate for pad placement, the observed high rate of silt deposition on the majority of pads above the locks and dams, and/or the delayed or lower than normal migration and spawning activity.

5.0 LITERATURE CITED

Ashley, K.W. and R.T. Rachels. 1993. Survey of the *Morone* Resources of the Cape Fear River, North Carolina. Final Rep., F-22, N.C. Wildl. Resour. Comm., Raleigh. 6pp.

Beasley, C.A. and J.E. Hightower. 2000. Effects of a low-head dam on the distribution and characteristics of spawning habitat used by striped bass and American shad. Transactions of the American Fisheries Society 129:1372-1386.

Bowman, S. and J.E. Hightower. 2001. American shad and striped bass spawning migration and habitat selection in the Neuse River, North Carolina. North Carolina Cooperative Fish and Wildlife Research Unit. Raleigh, NC.

Carmichael, J.T., S.L. Haeseker and J.E. Hightower. 1998. Spawning migration of telemetered striped bass in the Roanoke River, NC. Transactions of the American Fisheries Society 127:286-297.

CZR Incorporated. 2002. Pre-construction Monitoring of American Shad, Atlantic Sturgeon, and Striped Bass Passage at Lock and Dam #1 on the Cape Fear River, NC. Prepared for U.S. Army Corps of Engineers, Wilmington District.

CZR Incorporated. 2003. Pre-construction Monitoring of American Shad, Atlantic Sturgeon, and Striped Bass Passage at Lock and Dam #1 on the Cape Fear River, NC. Prepared for U.S. Army Corps of Engineers, Wilmington District.

CZR Incorporated. 2004. Pre-construction monitoring of American Shad and Striped Bass Passage at Lock and Dam #1 on the Cape Fear River, NC. Prepared for U.S. Army Corps of Engineers, Wilmington District.

Davis, J.R. and R.P. Cheek. 1966. Distribution, food habits, and growth of young clupeids, Cape Fear River system, North Carolina. Proc. Annu. Conf. Southeast. Assoc. Game and Fish Comm. 20:250-260.

Fischer, C. 1979. Anadromous fisheries research program, Cape Fear River System - Phase II. North Carolina Department of Natural Resources and Community Development, Division of Marine Fisheries, Progress Report for Project AFCS-15-1. 70 pp.

Kornegay, J.W. and C.D. Thomas, 2003. Review of striped bash fisheries and monitoring programs in North Carolina 2002. North Carolina Wildlife Resources Commission, Raleigh, North Carolina.

Leggett, W.C. and R.R. Whitney. 1972. Water temperature and the migrations of American shad. Fisheries Bulletin 70:659-670.

Marcy, B.C. 1972. Spawning of the American shad, *Alosa sapidissima*, in the lower Connecticut River. Chesapeake Science 13:116-119.

Moser, M.L., A.M. Darazdi, and J.R. Hall. 1998. Improving passage efficiency of adult American shad at low-elevation dams. Completion report to the North Carolina Sea Grant Fishery Resource Grant Program.

Moser, M.L., A.M. Darazdi, and J.R. Hall. 2000. Improving passage efficiency of adult American shad at low-elevation dams with navigation locks. Journal of Fisheries Management 20:376-385.

Moser, M.L. and S.W. Ross. 1993. Distribution and movements of shortnose sturgeon (*Acipenser brevirostrum*) and other anadromous fishes of the lower Cape Fear River, NC. Final Report to the U.S. Army Corps of Engineers, Wilmington District.

Nichols, P.R. and D.E. Louder. 1970. Upstream passage of anadromous fish through navigation locks and use of the stream for nursery and spawning habitat, Cape Fear River, North Carolina, 1962-1966. U.S. Fish and Wildlife Service, Circular 352. 12 pp.

Ross, S.W., F.C. Rohde, and D.G. Lindquist. 1988. Endangered, Threatened, and Rare Fauna of North Carolina. Part II. A Re-evaluation of the Marine and Estuarine Fishes. Occasional Papers of the North Carolina Biological Survey. Pp. 7-20.

Rulifson, R.A., M.T. Huish, and R.W. Thoesen. 1982. Status of anadromous fishes in southeastern U.S. estuaries. Pp. 413-426. In: V.S. Kennedy (ed), Estuarine Comparisons. Academic Press, New York, NY.

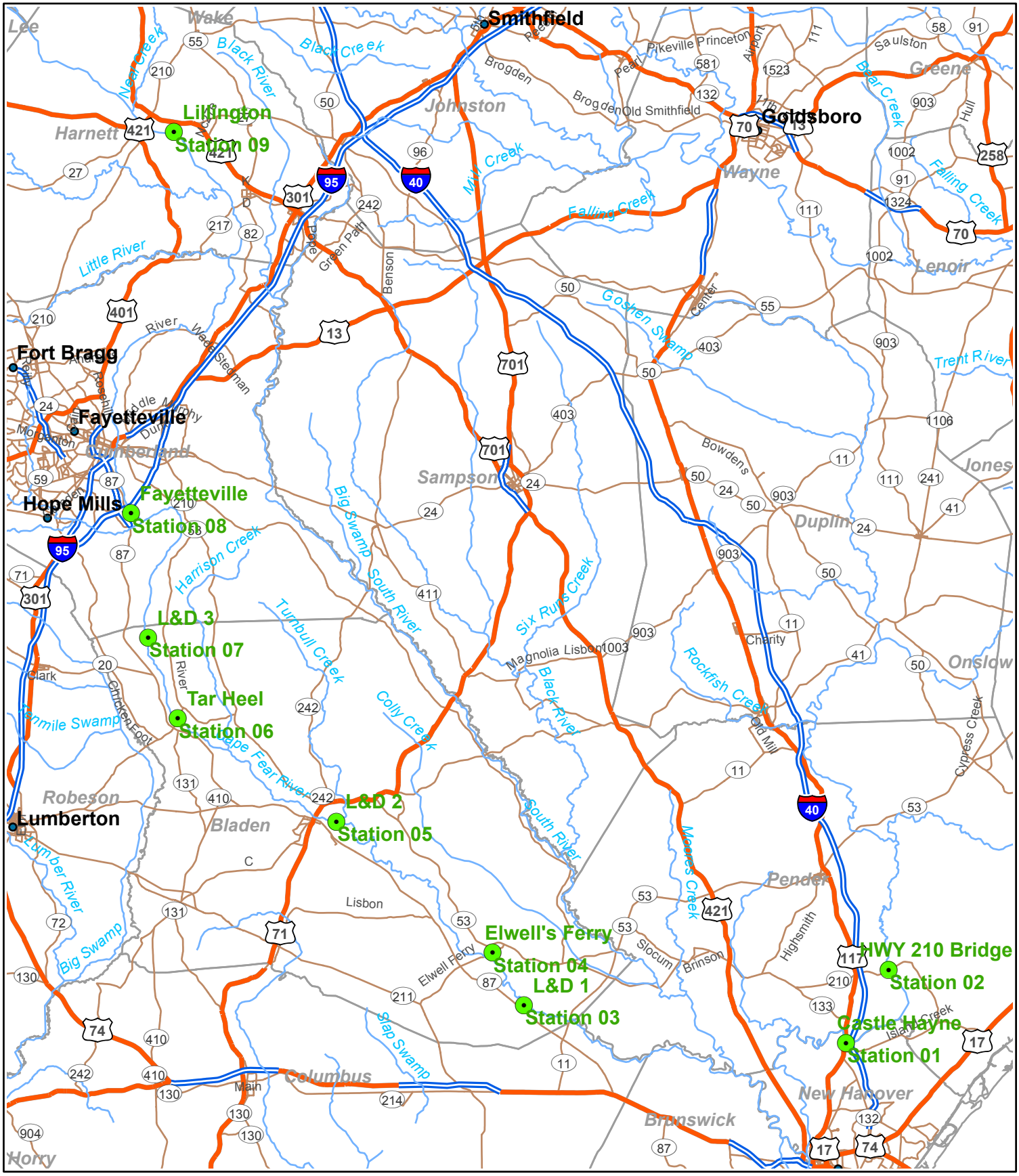
Sholar, T.M. 1977. Anadromous fisheries research program, Cape Fear River System, Phase I. North Carolina Department of Natural Resources and Economic Development, Division of Marine Fisheries, Completion Report for Project AFCS-12. 81 pp.

Williams, R.O. and G.E. Bruger. 1972. Investigations on American shad in the St. Johns River. State of Florida Department of Natural Resources. St. Petersburg, FL.

Winslow, S.E., N.S. Sanderlin, G.W. Judy, J.H. Hankins, B.F. Holland, Jr., C.A. Fischer, and R.A. Rulifson. 1983. North Carolina anadromous fisheries management program. North Carolina Department of Natural Resources and Community Development, Division of Marine Fisheries, Completion Report for Project AFCS-17. 402pp.

APPENDIX A

FIGURES



Location of Cape Fear River Study Area	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 10 miles	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 1

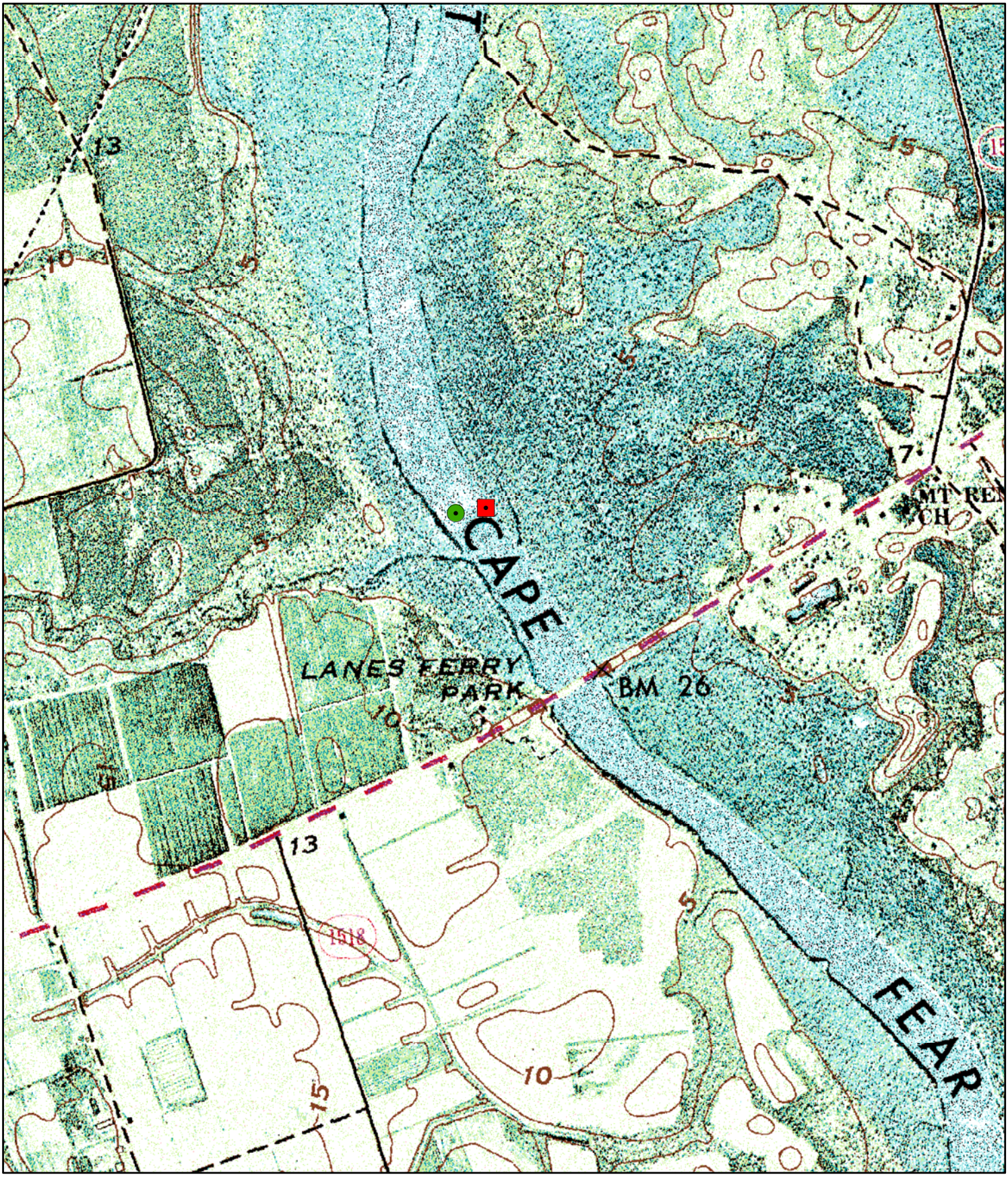
0 250 500 1,000 1,500 2,000 Feet

Legend

Sampling Station

- Egg Pad
- Plankton Tow

Station 01 - Castle Hayne Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 2



N

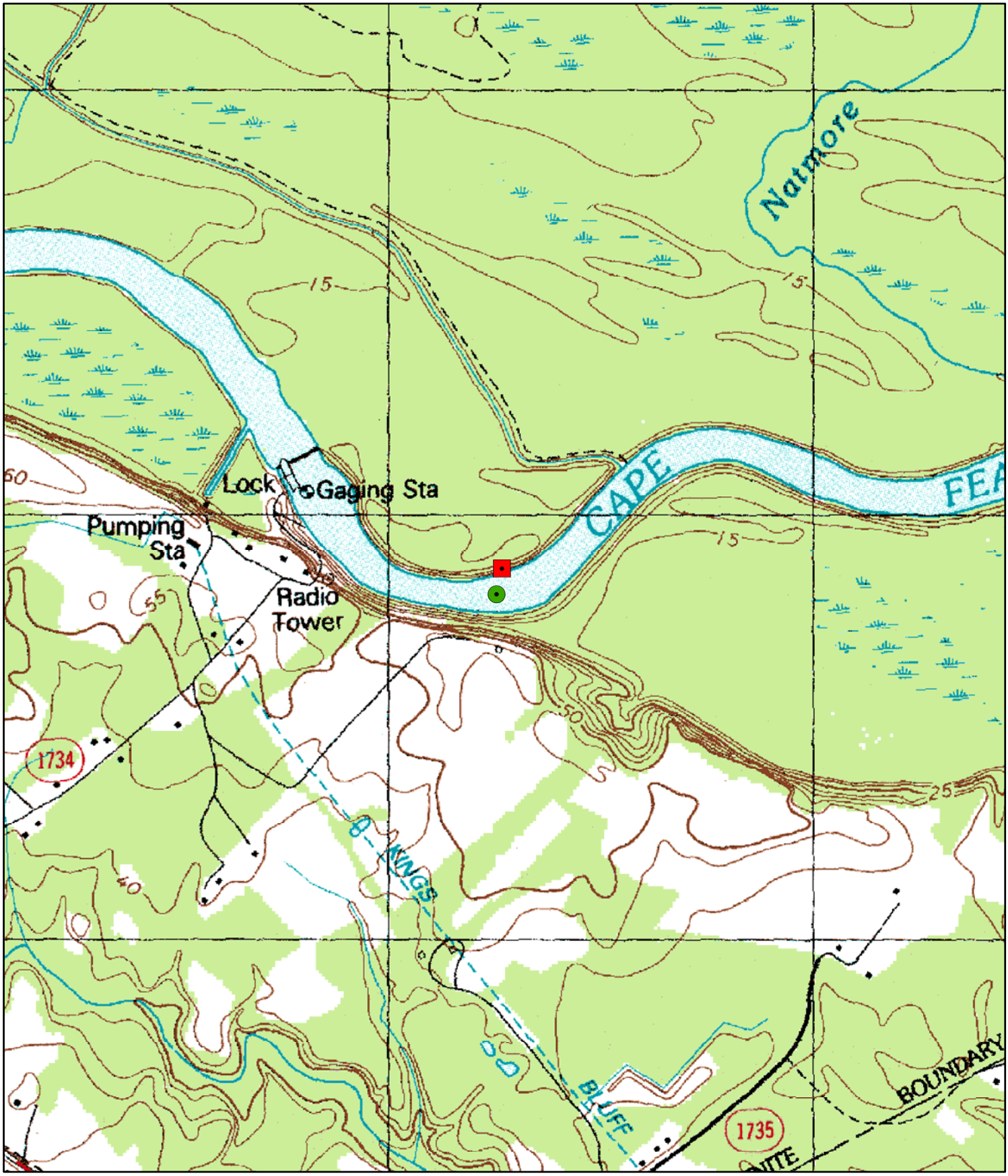
0 250 500 1,000 1,500 2,000 Feet

Legend

Sampling Station

- Egg Pad
- Plankton Tow

Station 02 - HWY 210 Bridge Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 3



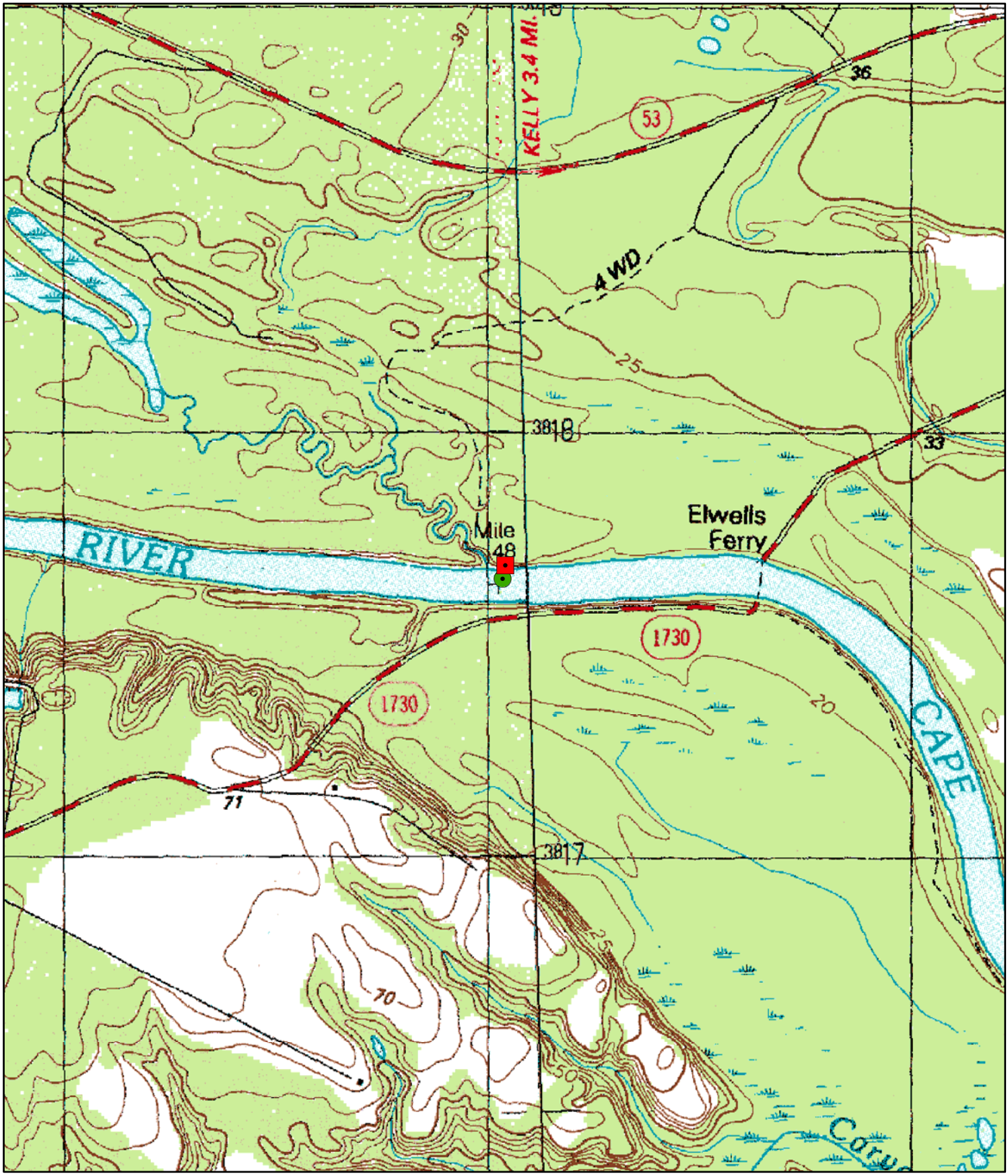
0 250 500 1,000 1,500 2,000 Feet

Legend

Sampling Station

- Egg Pad
- Plankton Tow

Station 03 - Lock and Dam #1 Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 4



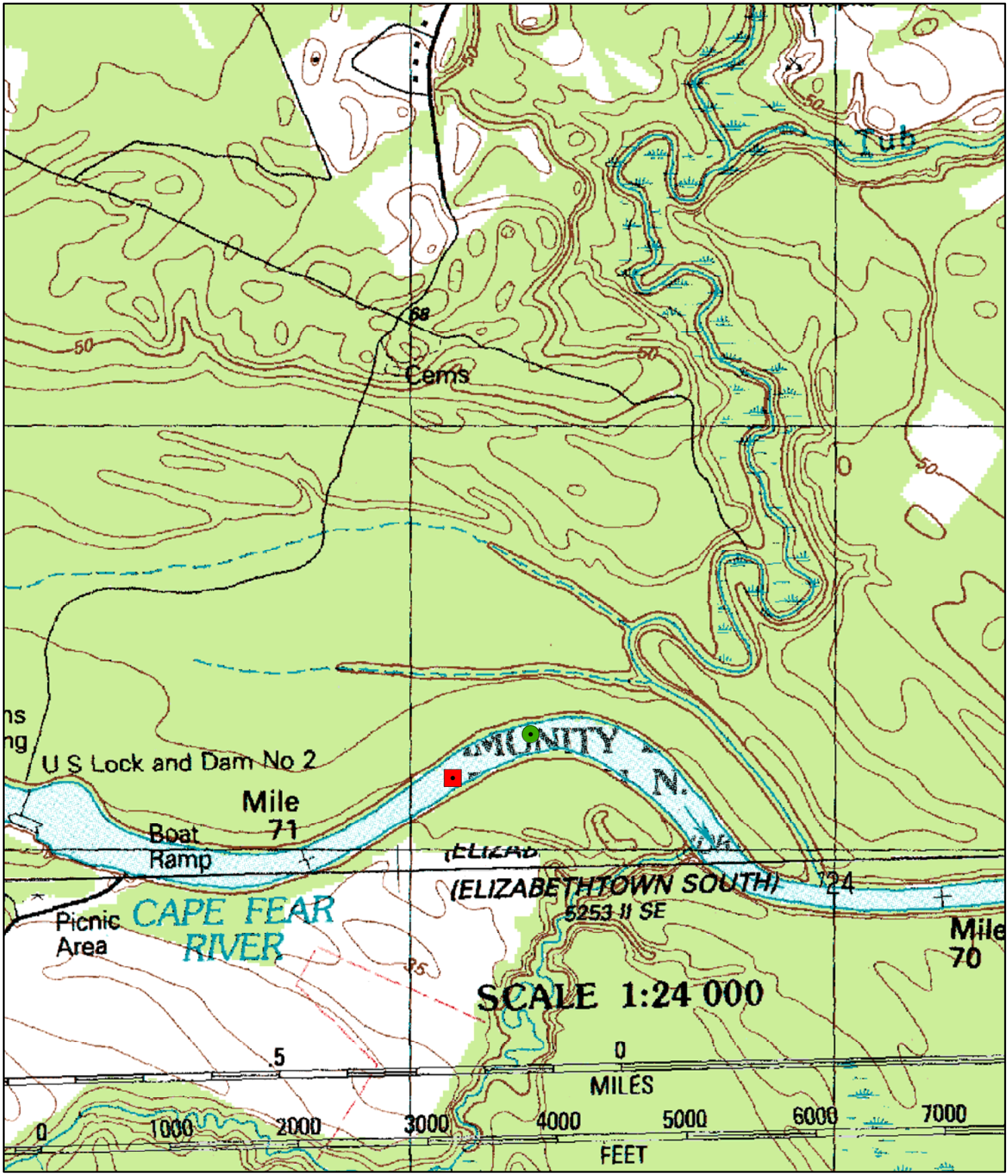
Legend

Sampling Station

- Egg Pad
- Plankton Tow

0 250 500 1,000 1,500 2,000 Feet

Station 04 - Elwell's Ferry Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 5



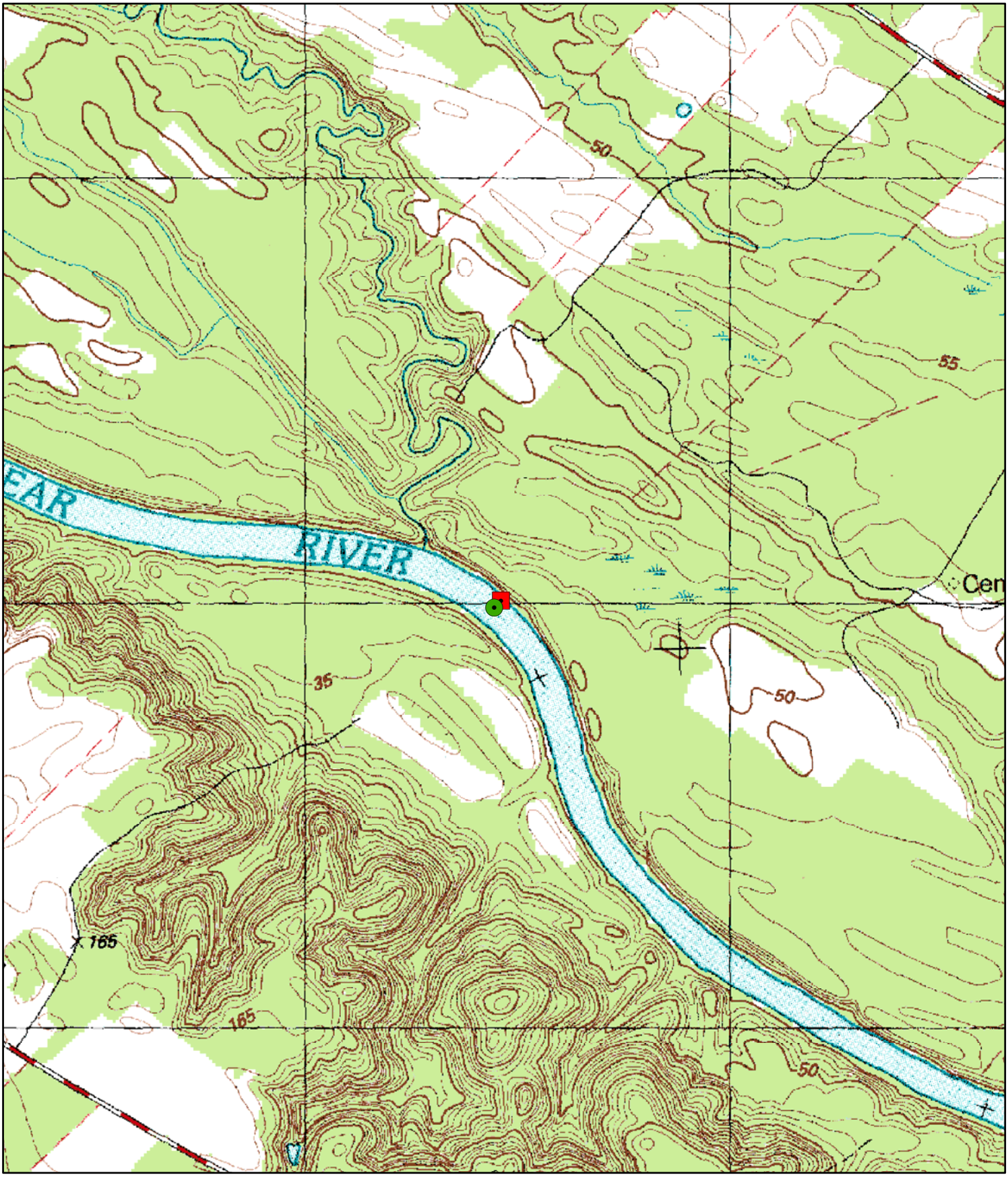
0 250 500 1,000 1,500 2,000 Feet

Legend

Sampling Station

- Egg Pad
- Plankton Tow

Station 05 - Lock and Dam #2 Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 6



N

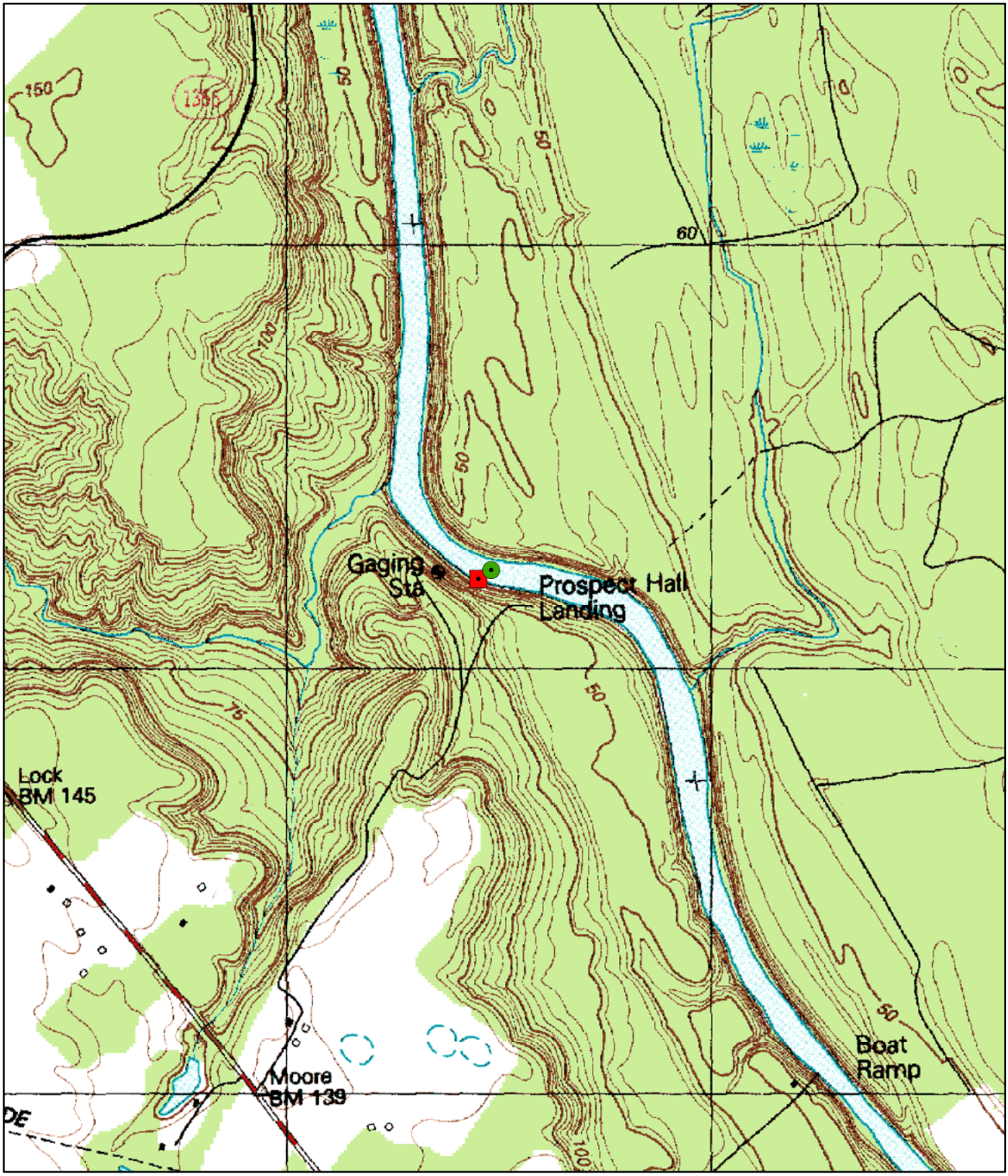
0 250 500 1,000 1,500 2,000 Feet

Legend

Sampling Station

- Egg Pad
- Plankton Tow

Station 06 - Tar Heel Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 7



N

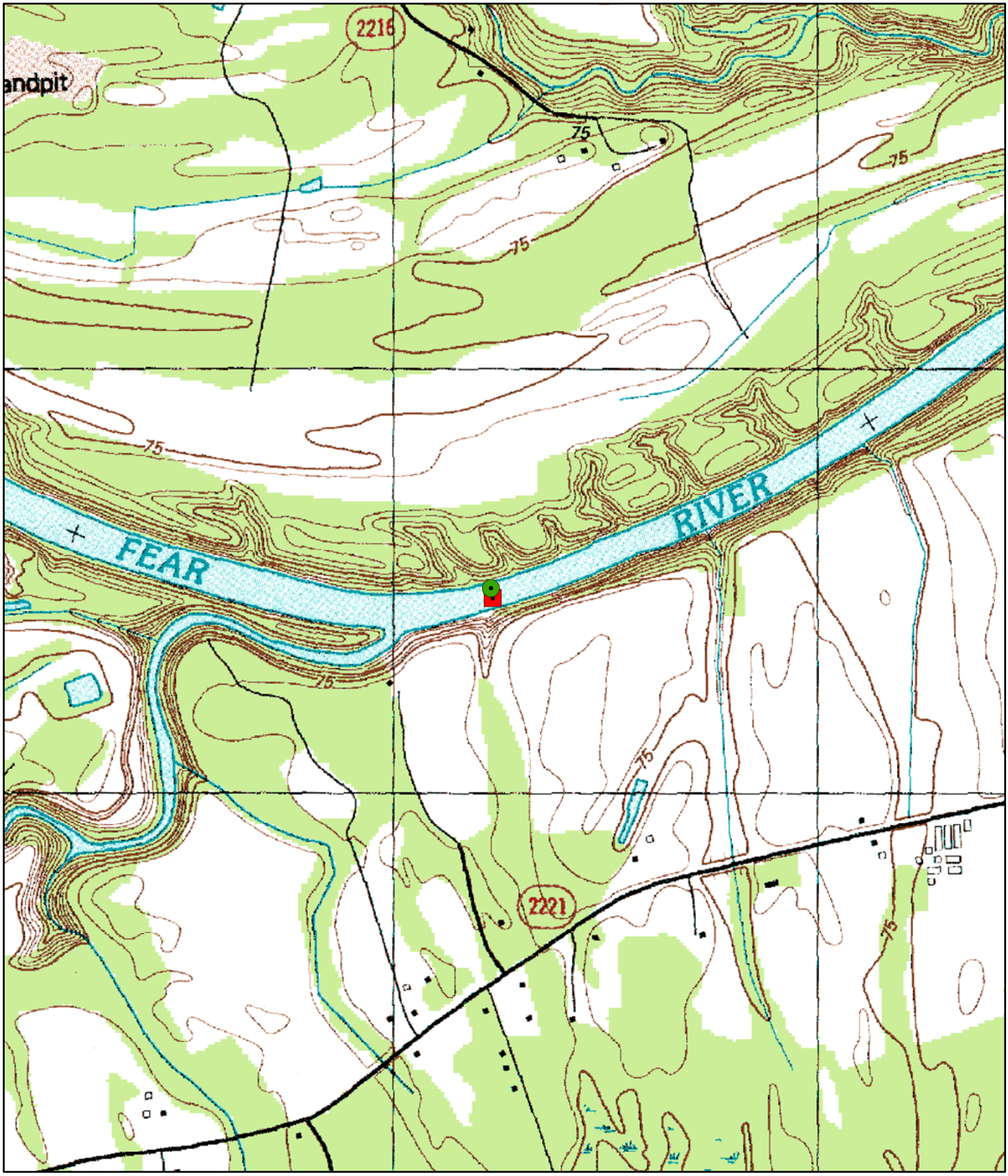
0 250 500 1,000 1,500 2,000 Feet

Legend

Sampling Station

- Egg Pad
- Plankton Tow

Station 07 - Lock and Dam #3 Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 8



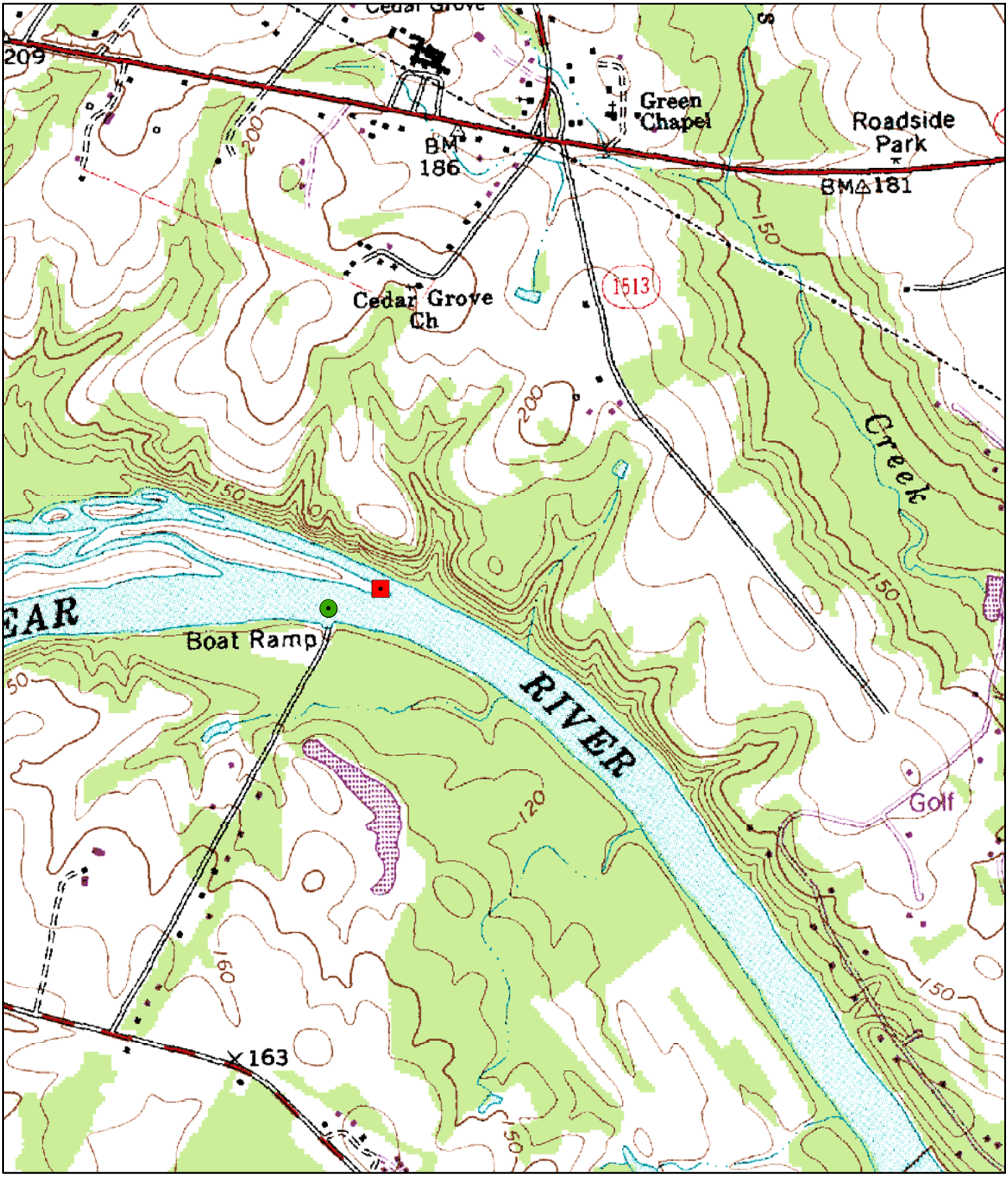
Legend

Sampling Station

- Egg Pad
- Plankton Tow

0 250 500 1,000 1,500 2,000 Feet

Station 08 - Fayetteville Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 9



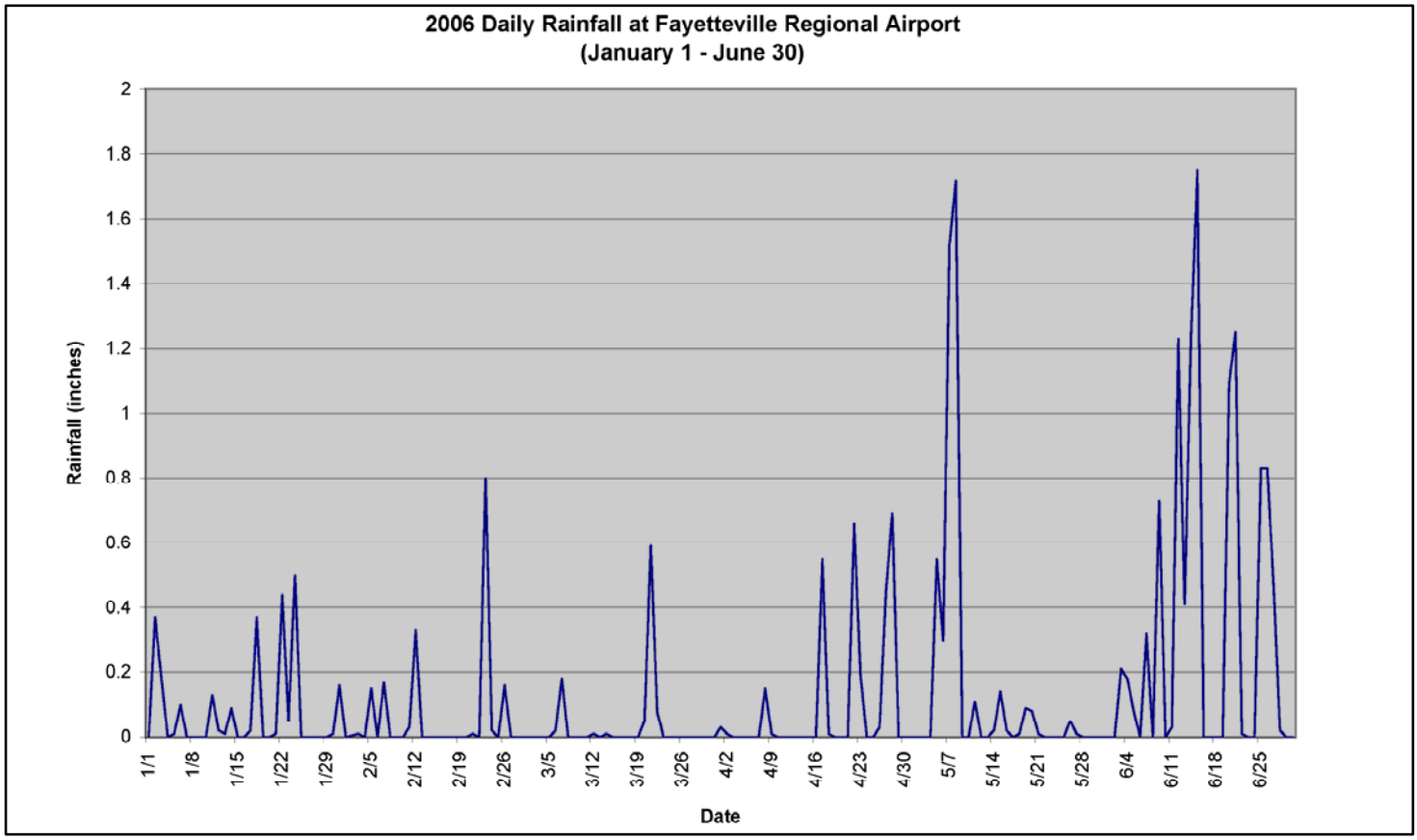
Legend

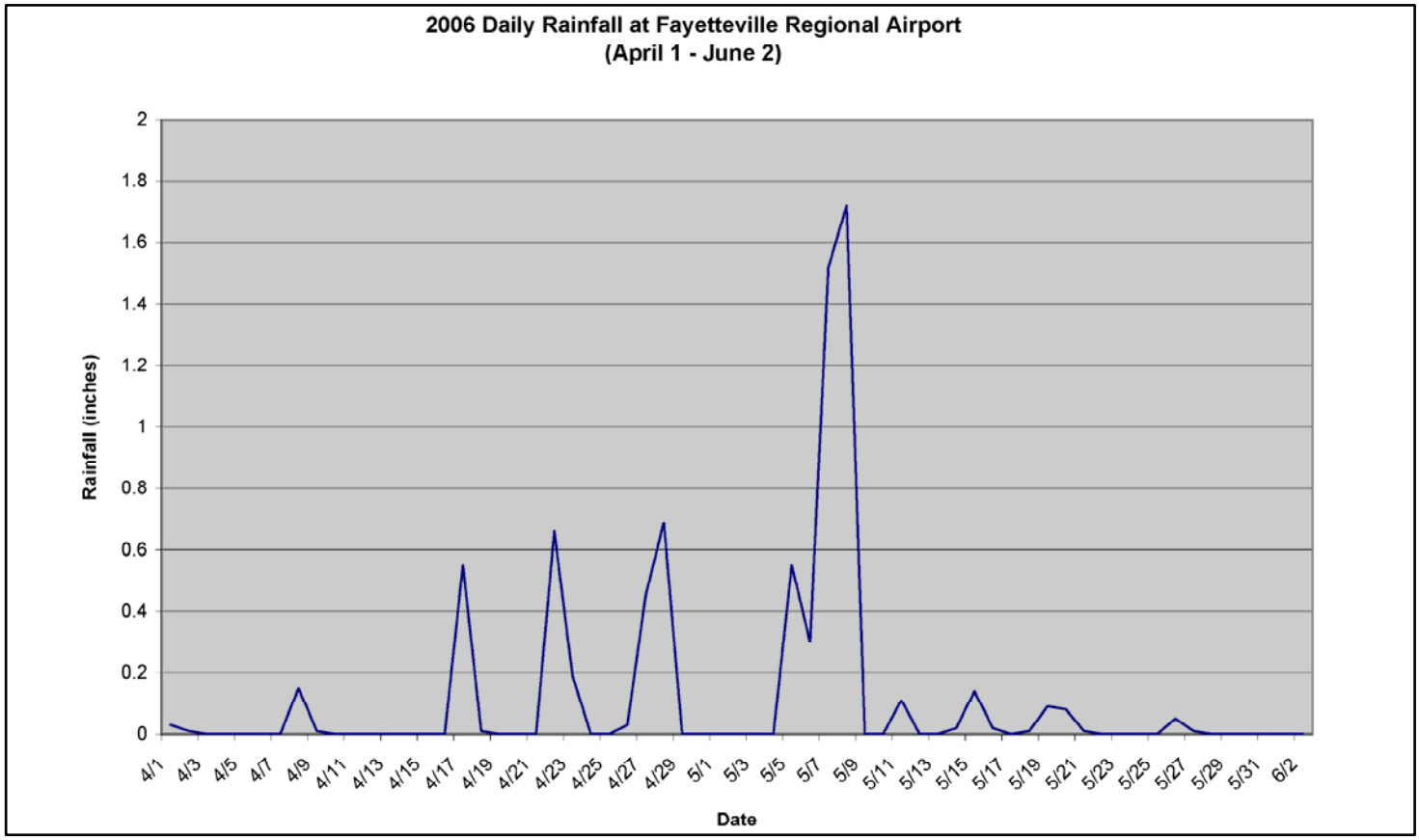
Sampling Station

- Egg Pad
- Plankton Tow

0 250 500 1,000 1,500 2,000 Feet

Station 09 - Lillington Sampling Station	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: 1 inch = 1,000 feet	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 10





Source: State Climate Office of North Carolina

Precipitation Data from Fayetteville Regional Airport	
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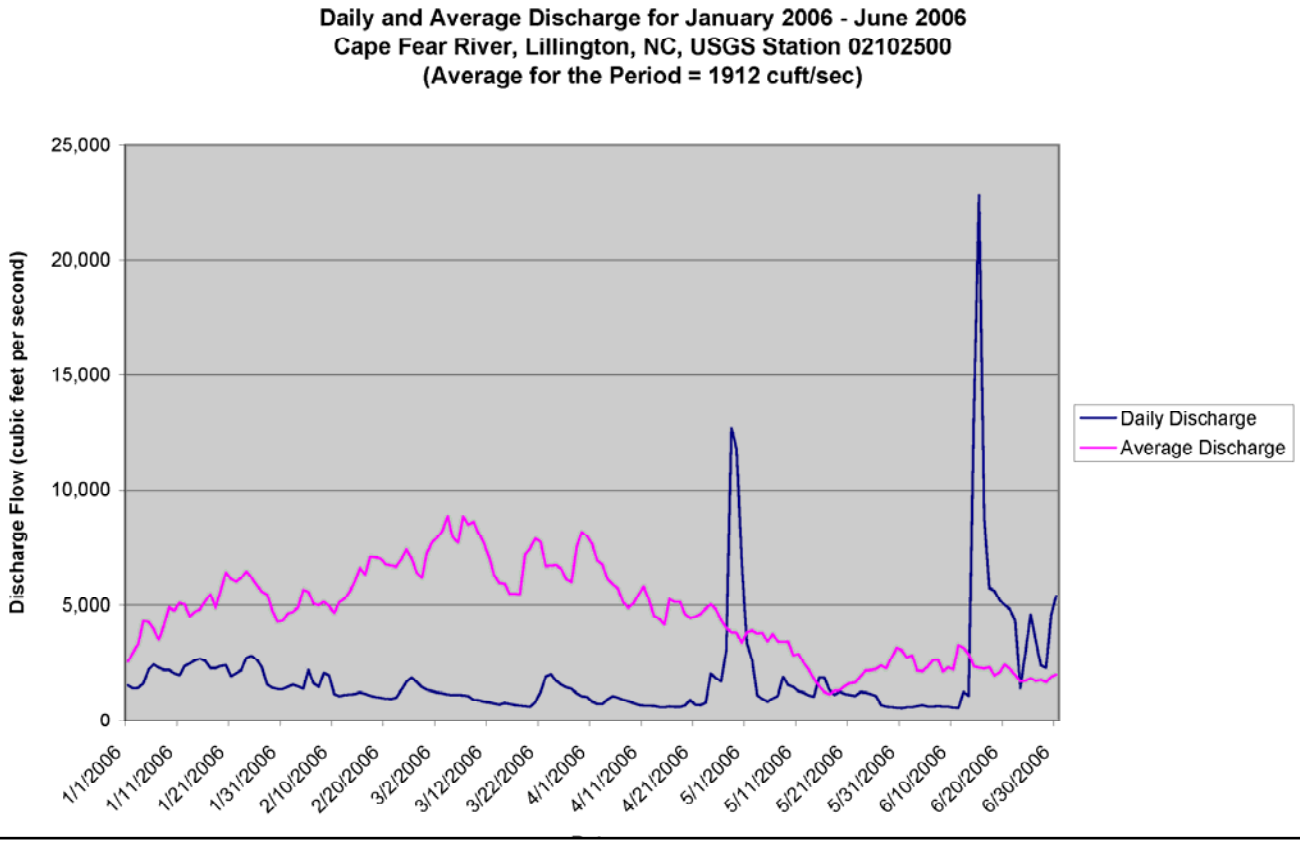
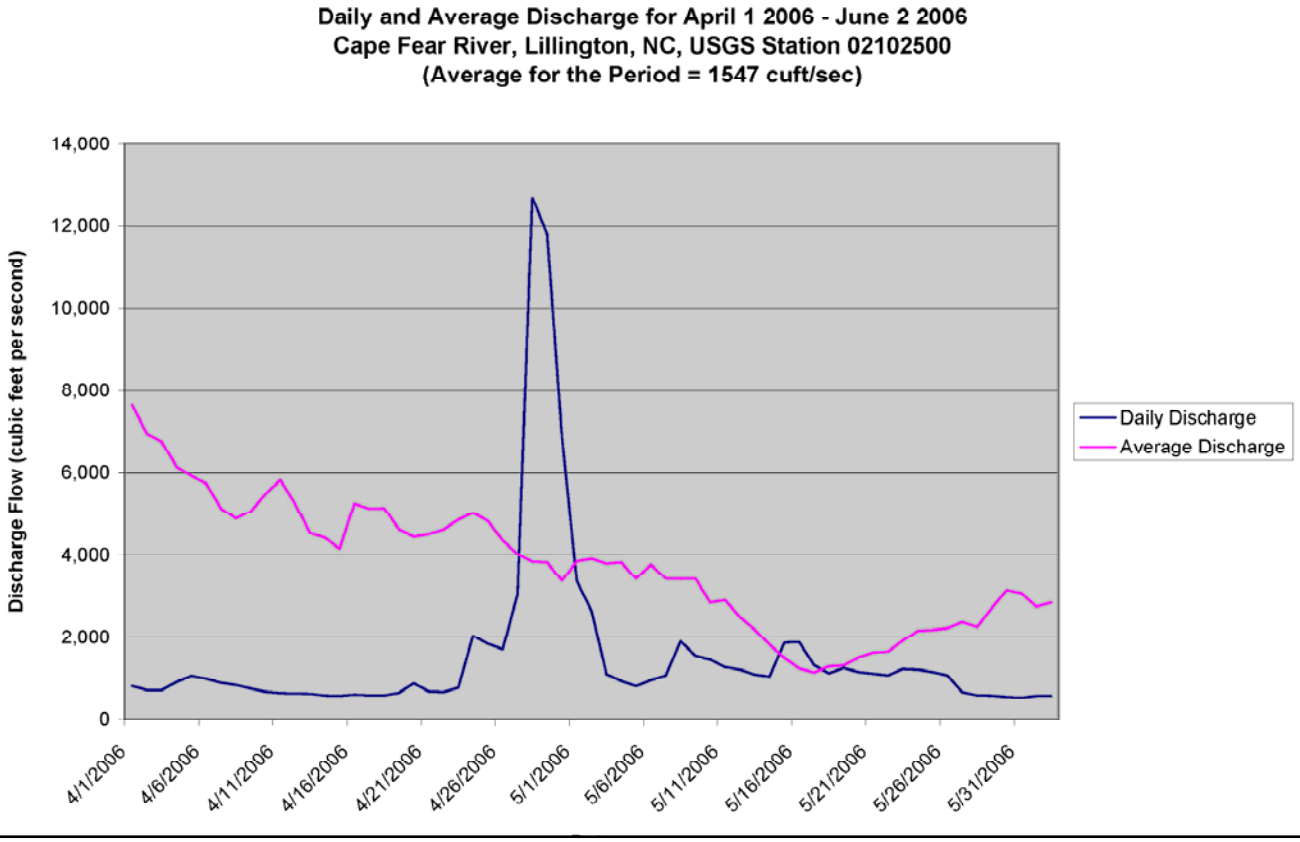
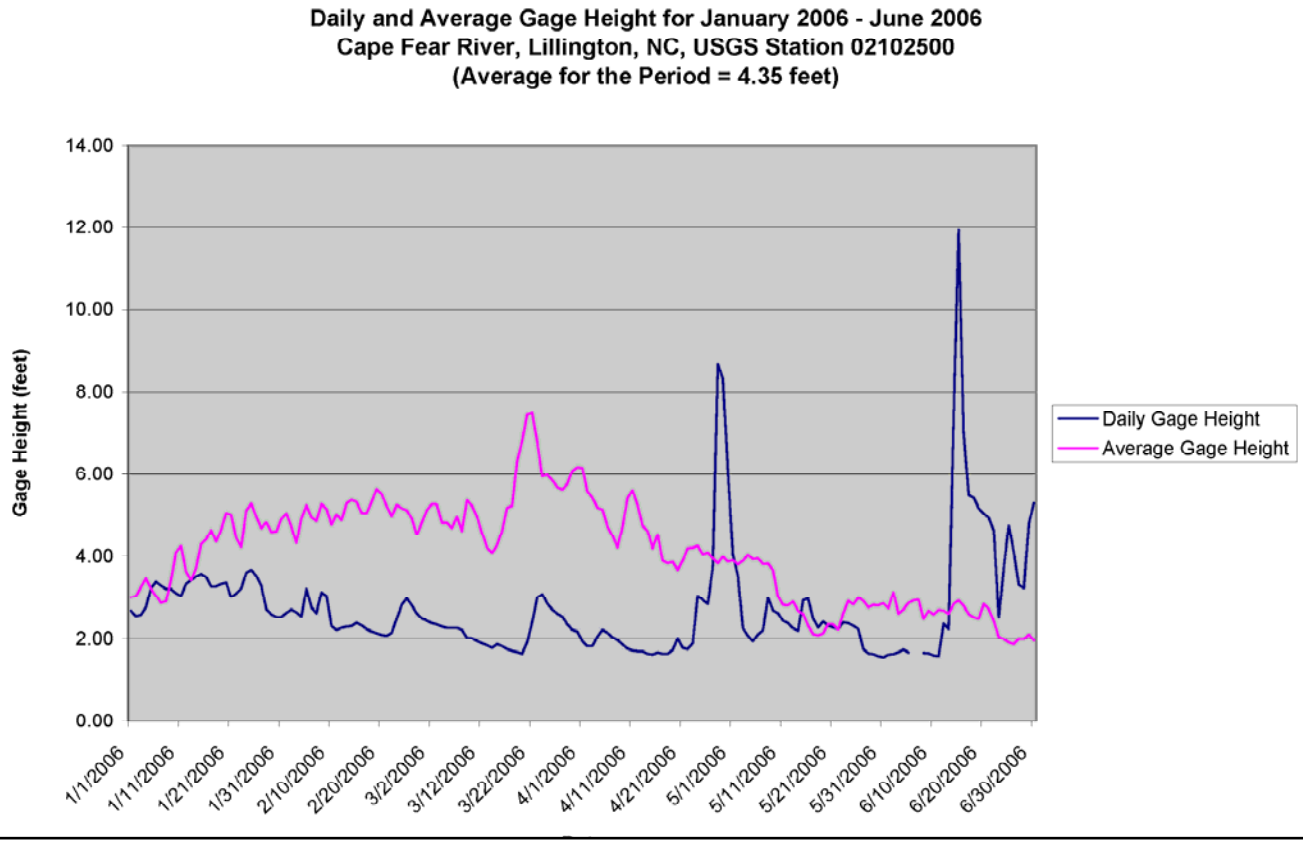
Scale: N/A	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 11

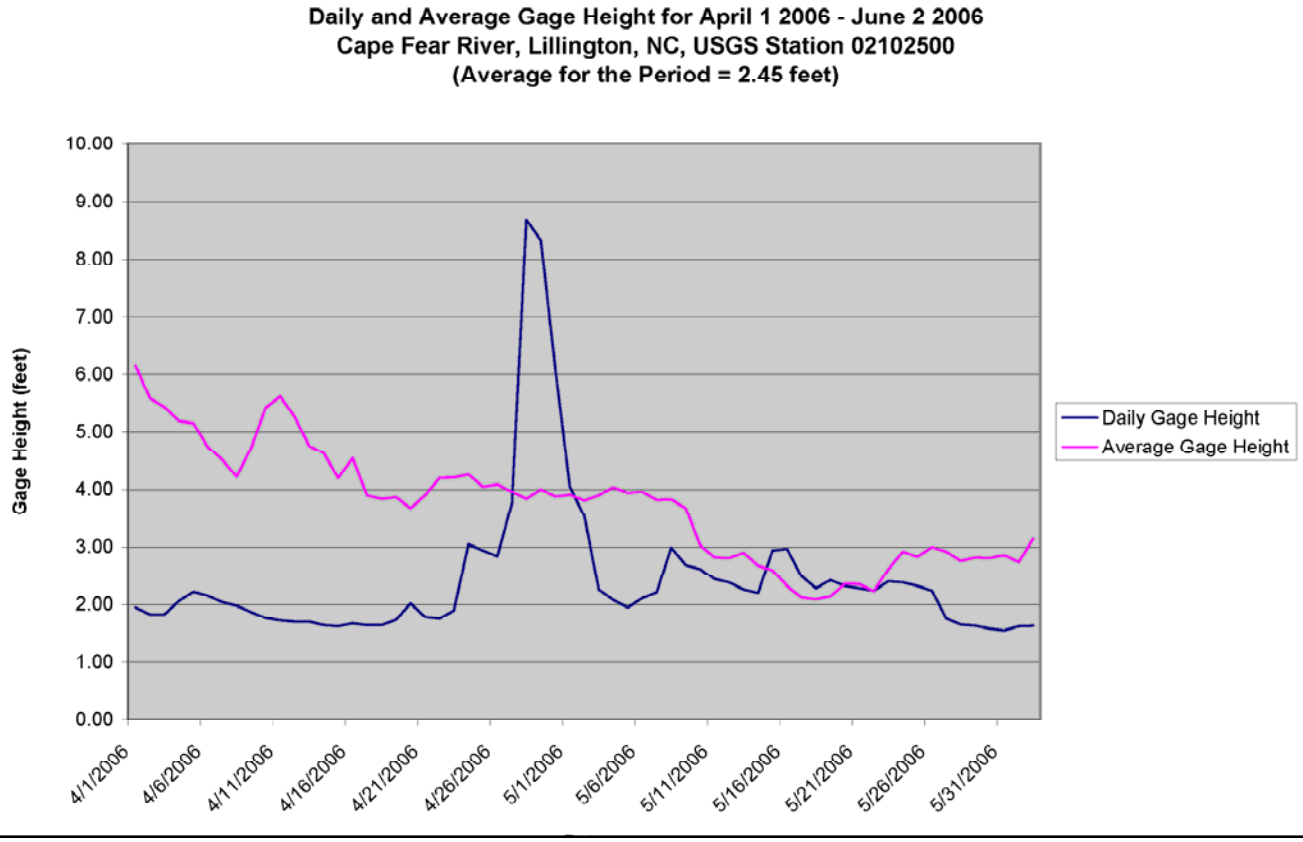




Source: USGS National Water Inormation System

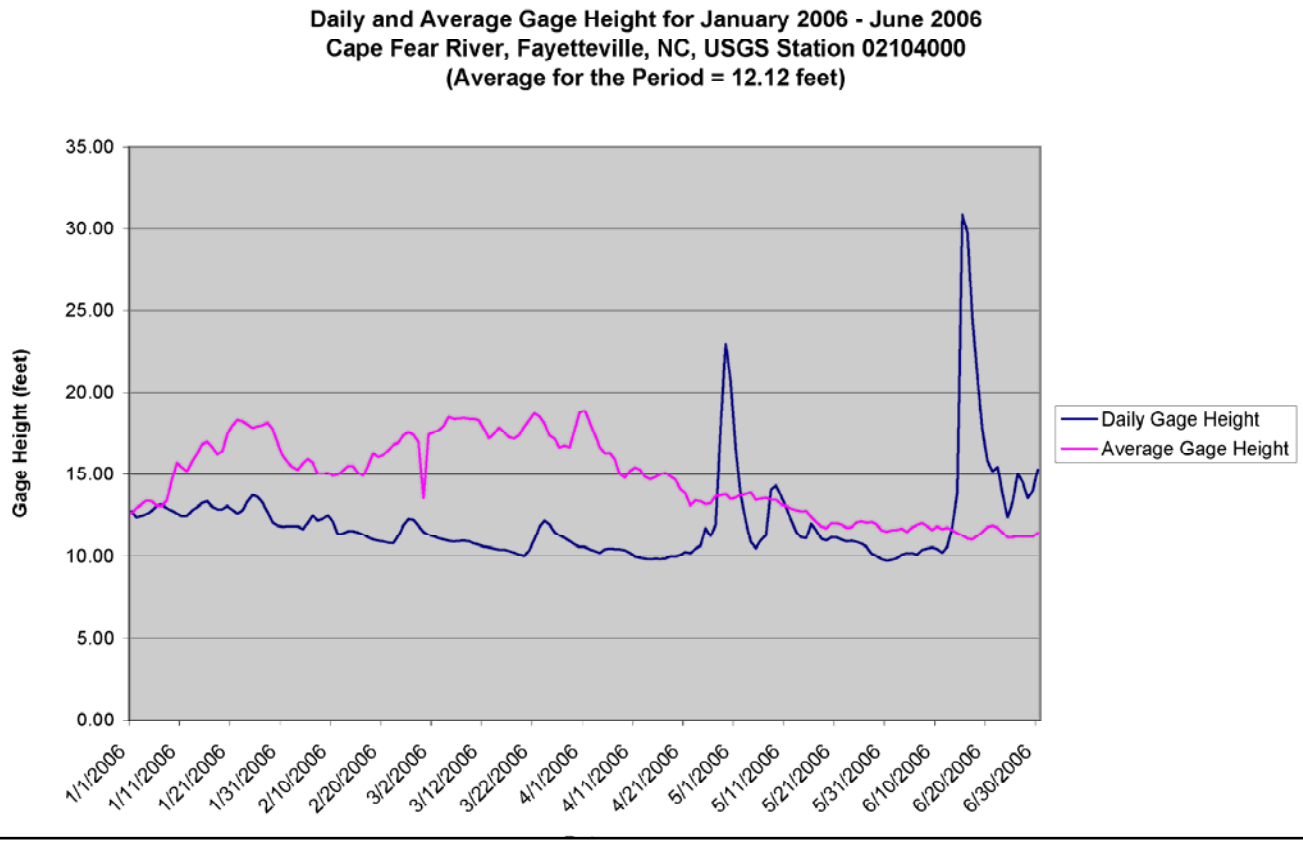
Daily and Average Discharge Rates - Station 02102500	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: N/A	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 12

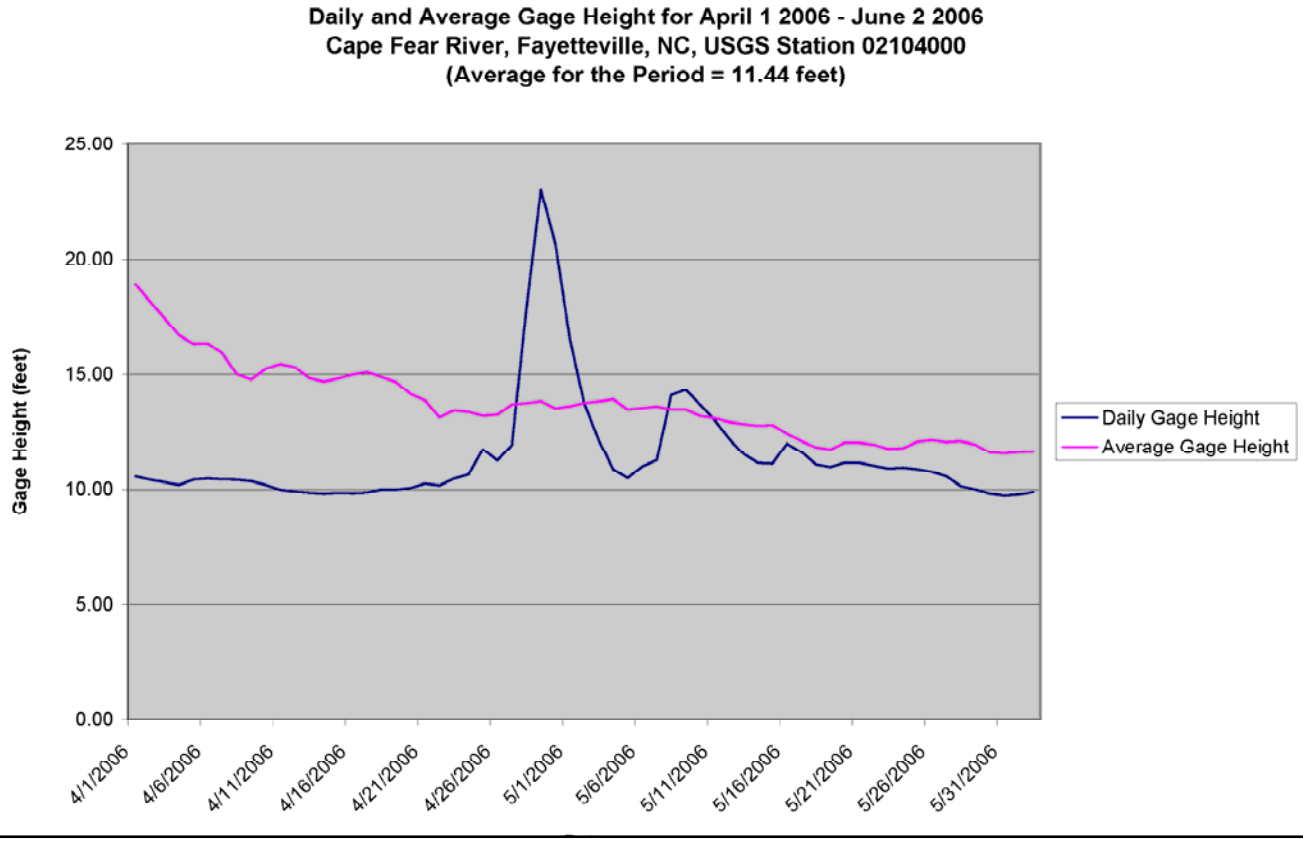




Source: USGS National Water Inormation System

Daily and Average Stage Elevation - Station 02102500	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: N/A	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 13





Source: USGS National Water Inormation System

Daily and Average Stage Elevation - Station 02104000	
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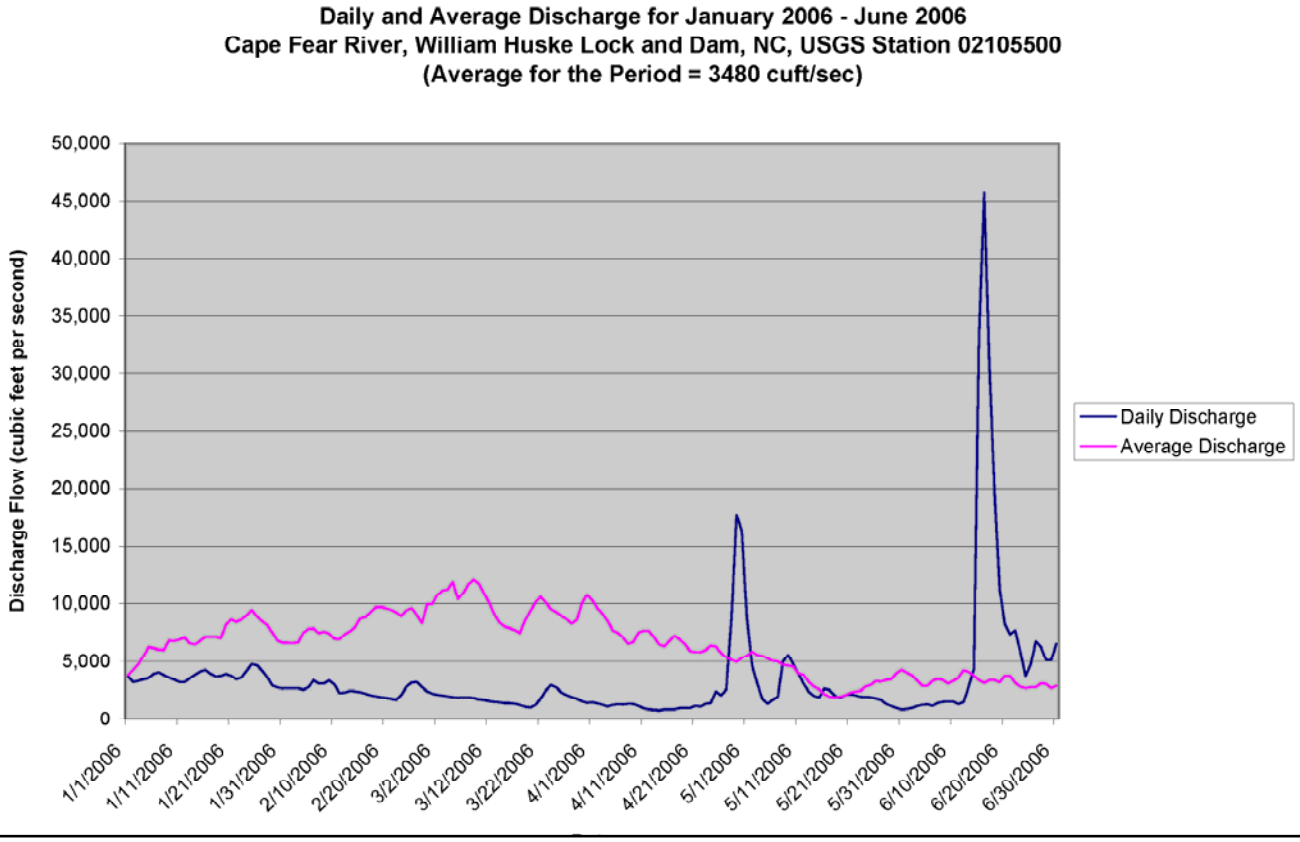
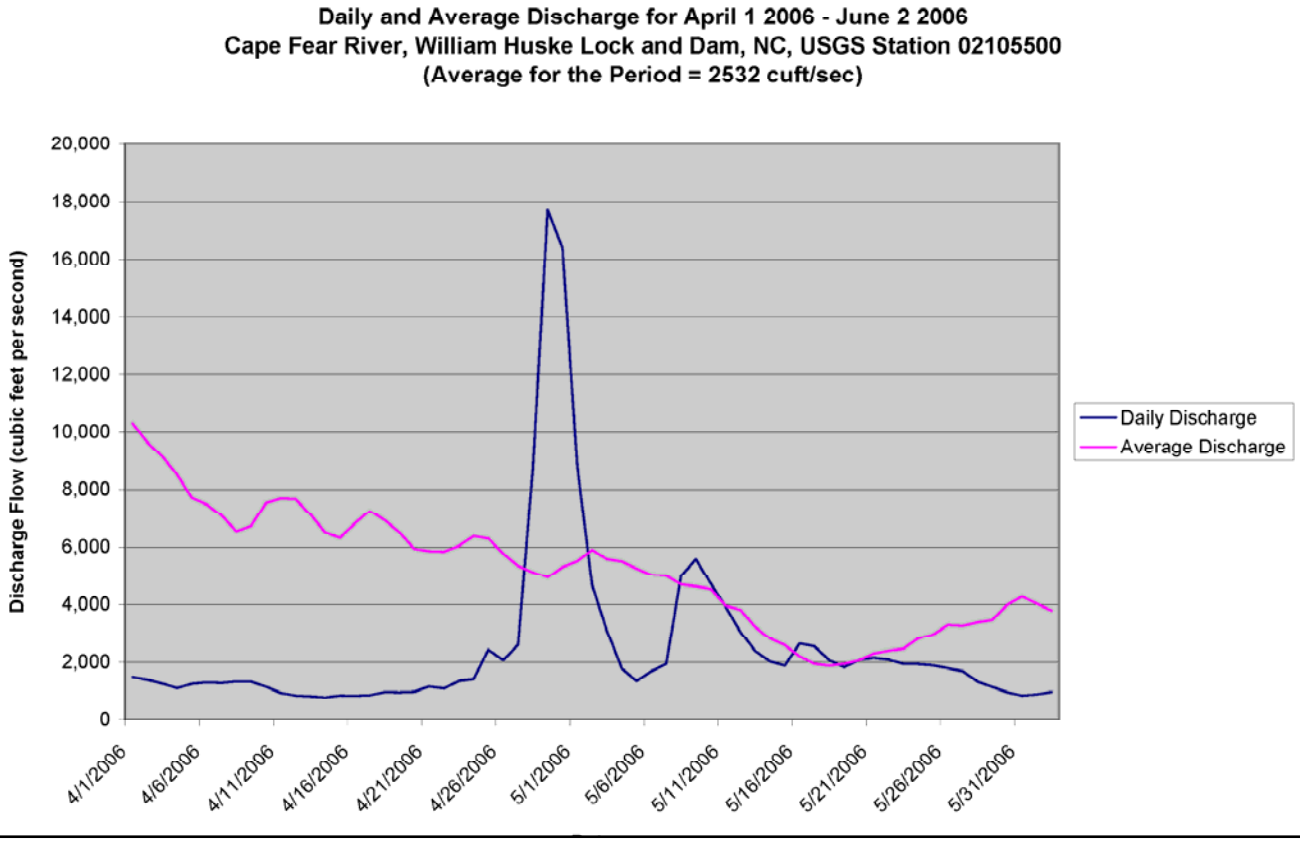
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 14





Source: USGS National Water Inormation System

Daily and Average Discharge Rates - Station 02105500	
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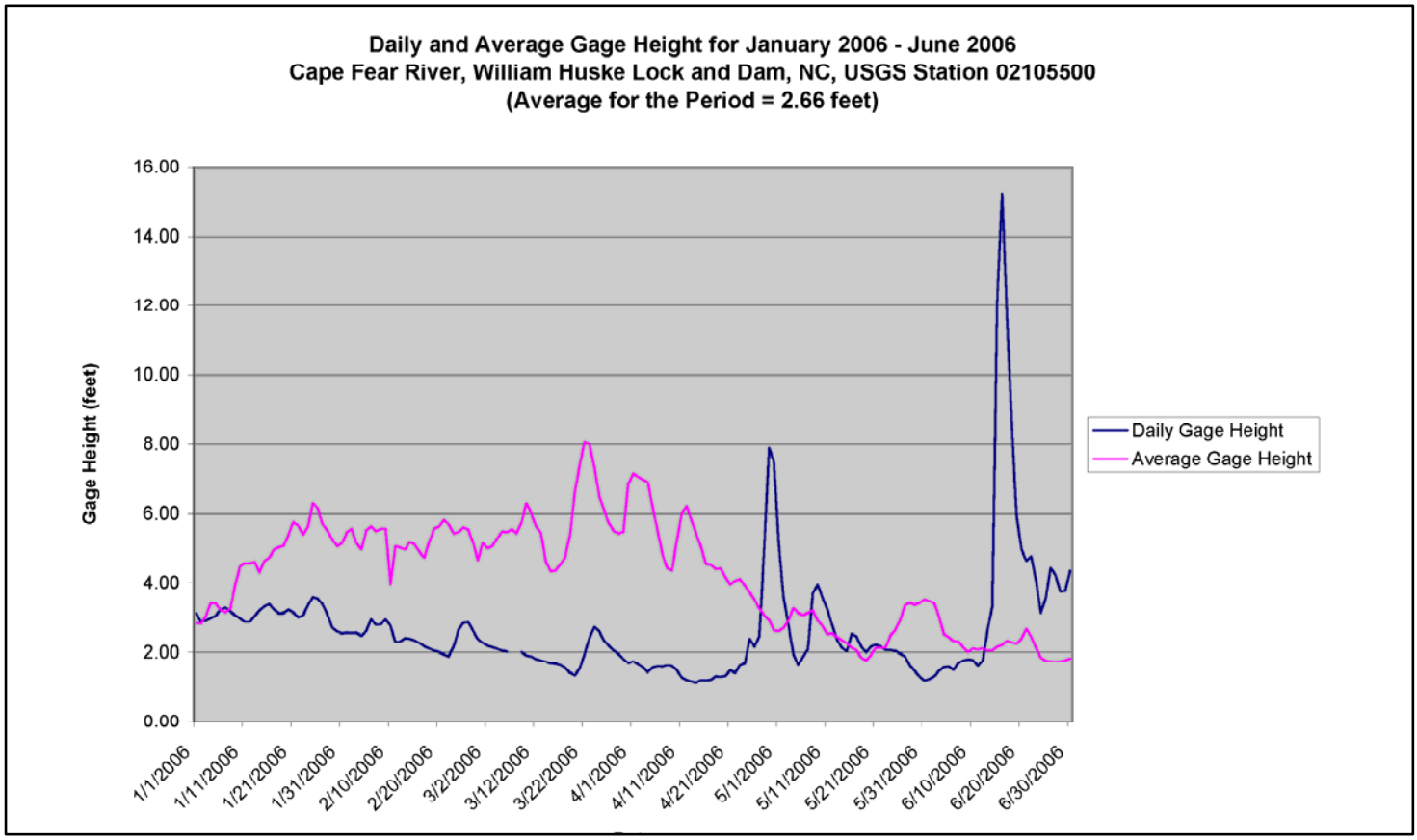
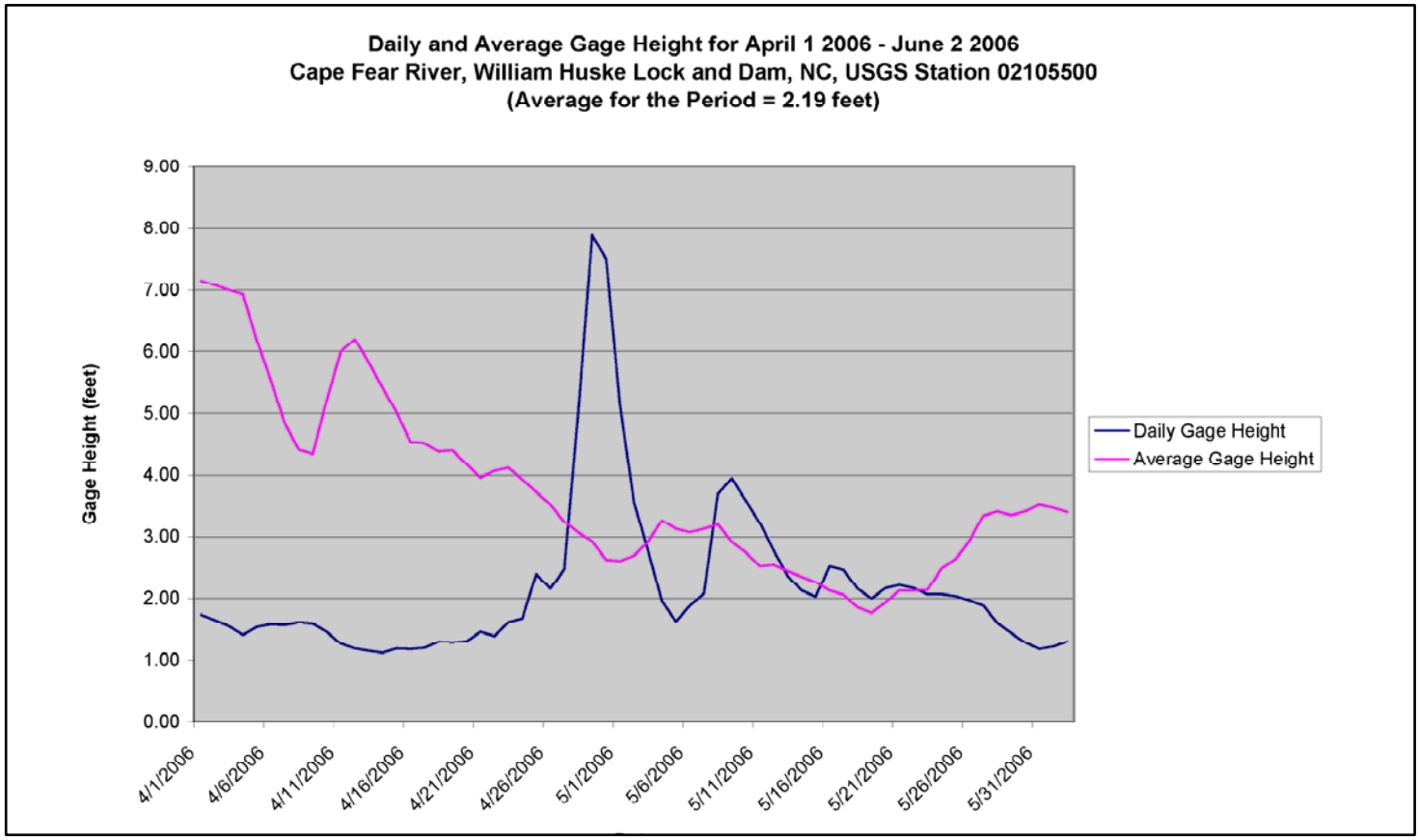
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 15





Source: USGS National Water Inormation System

Daily and Average Stage Elevation - Station 02105500	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
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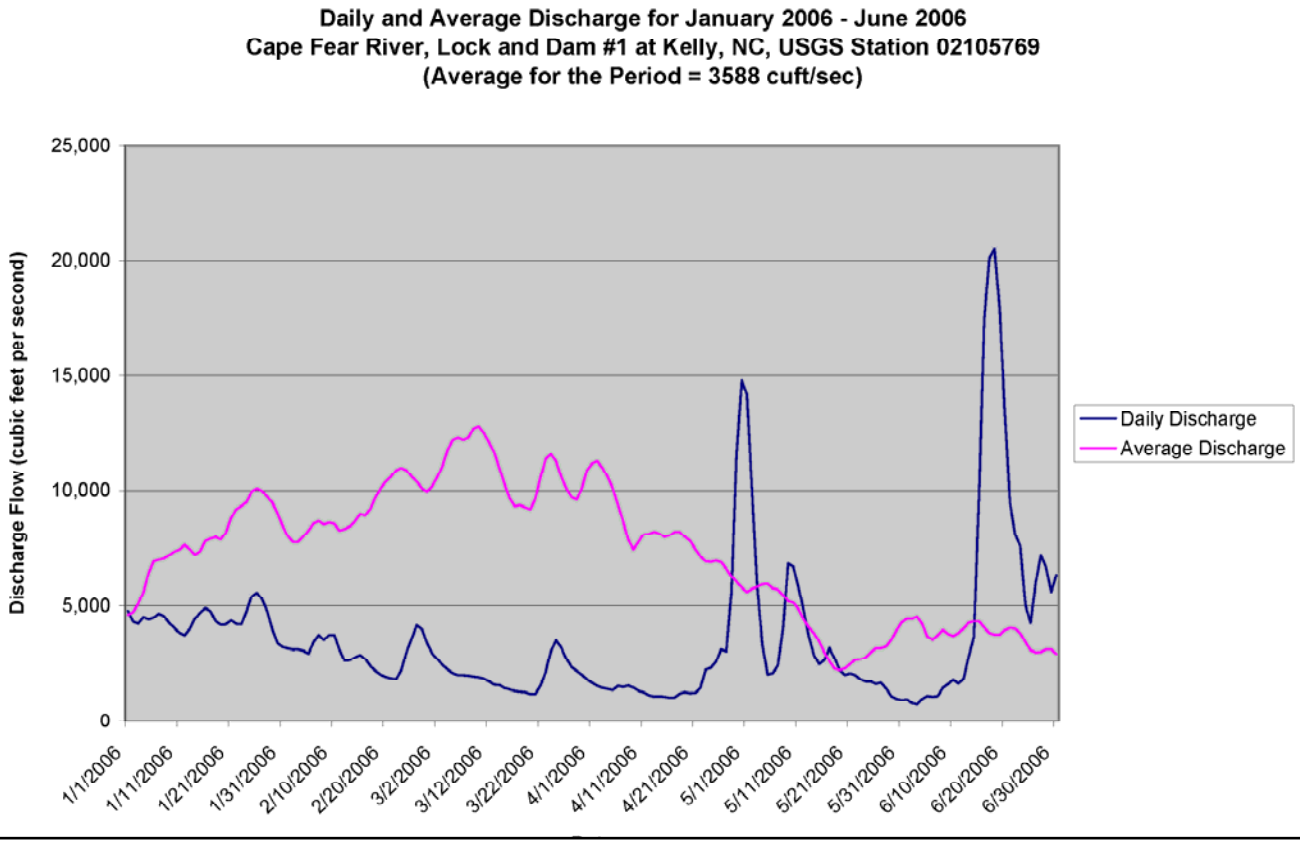
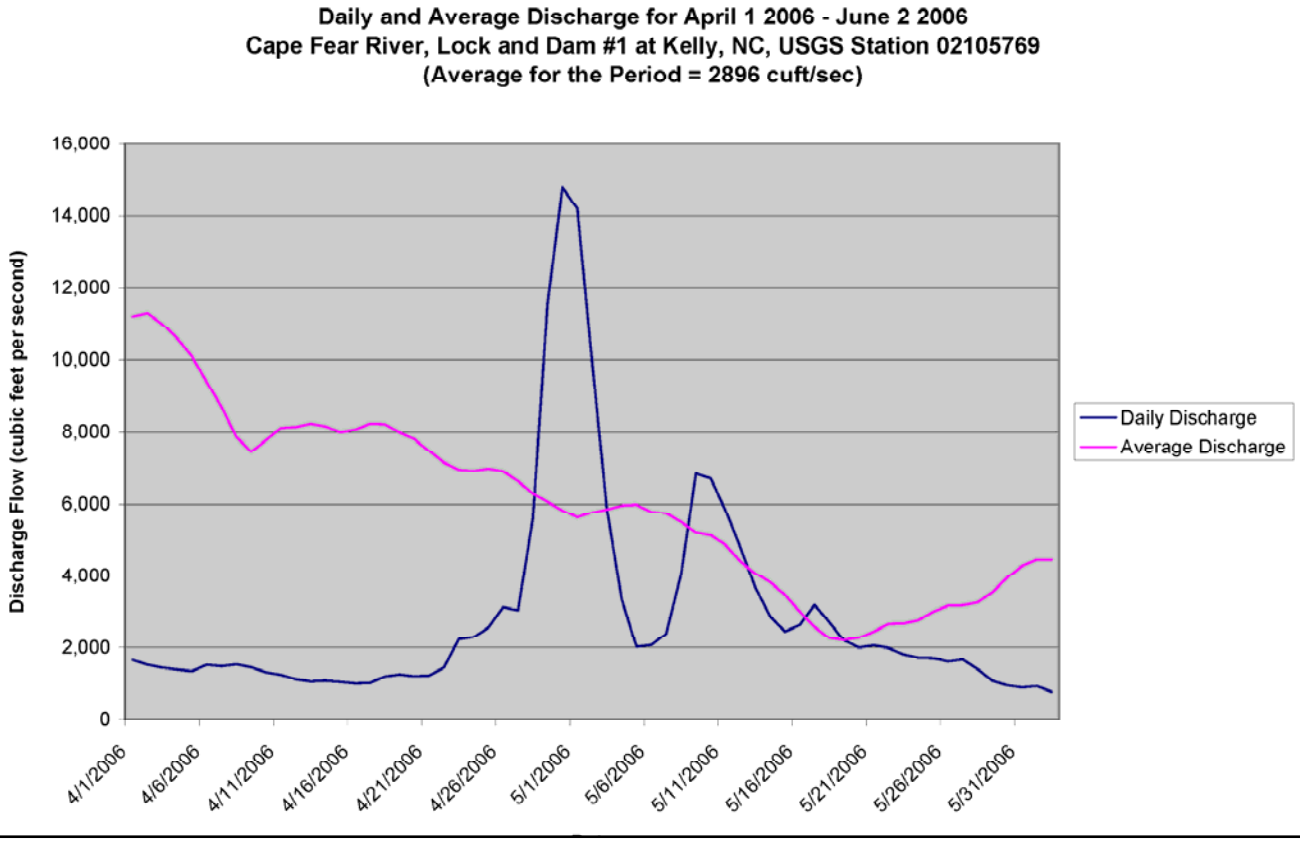
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 16





Source: USGS National Water Inormation System

Daily and Average Discharge Rates - Station 02105769	
Cape Fear Anadromous Fish Study Cape Fear River North Carolina	
Scale: N/A	Drawn By: MR
Date: August 2006	Approved By: SD
DIAL CORDY AND ASSOCIATES INC Environmental Consultants	J06-937
	Figure 17

APPENDIX B

TABLES

Table 1. Location of sampling stations on the Cape Fear River and the Northeast Cape Fear River.

Station Number	Description	Coordinates			
		Plankton		Egg Pads	
		Latitude	Longitude	Latitude	Longitude
1	4,625 ft. upstream of NC wildlife ramp at Castle Hayne, NC	34.365954767	77.880432536	34.366308150	77.881501575
2	1,902 ft. upstream of Hwy 210 bridge and private ramp on NE Cape Fear River	34.448303184	77.837858596	34.446805037	77.836494056
3	2,050 ft. downstream of Lock and Dam #1, near Kelly, NC	34.401506269	78.288224579	34.402050114	78.288068864
4	Near mouth of Donoho Creek, upstream of NC wildlife ramp at Elwell Ferry, near Kelly, NC	34.474064169	78.375177855	34.474391639	78.375252655
5	3,903 ft. below Lock and Dam #2	34.627979125	78.564142153	34.626944983	78.566137279
6	Near mouth of Phillips Creek, downstream of NC wildlife ramp at Tar Heel, NC	34.709180556	-78.713036111	34.709333333	-78.712861111
7	8,512 ft. below Lock and Dam #3, near Tar Heel, NC	34.812633913	78.818862502	34.812457703	78.819201691
8	Mouth of Rockfish Creek, downstream of NC wildlife ramp off NC87, Fayetteville, NC	34.968094114	78.817497413	34.967888554	78.817459654
9	At NC wildlife ramp off Wildlife Road in Lillington, NC	35.397925211	78.773808838	35.398326388	78.772449988

Note: Coordinates as decimal degrees in WGS84

Table 2. Flow and in situ water quality measurements at Stations 1 through 9 from 10 April through 2 June 2006.

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/10/2006	STA-1-S	Plankton	7.0	[a]	Upstream, tide rising	158.10	181.80	18.20	68.10	6.45	<0.1
4/10/2006	STA-1-MD	Plankton	7.0			154.70	177.80	18.20	67.40	6.47	<0.1
4/10/2006	STA-1-B	Plankton	7.0			154.70	178.00	18.20	69.50	6.55	<0.1
4/10/2006	STA-1	Egg Pad	0.8	[a]	Upstream, tide rising	148.40	171.20	18.00	59.90	6.05	<0.1
4/10/2006	STA-2-S	Plankton	3.0	[a]	Upstream, tide rising	112.80	129.10	18.40	65.10	6.04	<0.1
4/10/2006	STA-2-MD	Plankton	3.0			112.90	129.10	18.40	65.10	6.09	<0.1
4/10/2006	STA-2-B	Plankton	3.0			112.90	129.20	18.40	65.50	6.18	<0.1
4/10/2006	STA-2	Egg Pad	2.0	[a]	Upstream, tide rising	112.00	127.90	18.50	65.50	6.25	<0.1
4/10/2006	STA-3-S	Plankton	3.4	[a]	Downstream	133.00	152.10	18.50	100.10	9.45	<0.1
4/10/2006	STA-3-MD	Plankton	3.4			133.10	152.20	18.50	99.80	9.51	<0.1
4/10/2006	STA-3-B	Plankton	3.4			133.10	152.10	18.50	98.60	9.23	<0.1
4/10/2006	STA-3	Egg Pad	1.2	[a]	Downstream	132.40	151.00	18.60	98.40	9.42	<0.1
4/10/2006	STA-4-S	Plankton	4.8	[a]	Downstream	134.20	153.10	18.50	92.70	8.67	<0.1
4/10/2006	STA-4-MD	Plankton	4.8			133.40	153.00	18.30	90.30	8.45	<0.1
4/10/2006	STA-4-B	Plankton	4.8			133.20	152.80	18.30	85.40	7.74	<0.1
4/10/2006	STA-4	Egg Pad	1.8	[a]	Downstream	138.20	154.20	19.30	94.50	8.48	<0.1
4/11/2006	STA-7-S	Plankton	3.9	[a]	No flow	128.20	146.20	18.40	124.10	11.66	<0.1
4/11/2006	STA-7-MD	Plankton	3.9			132.10	151.70	18.30	122.10	11.32	<0.1
4/11/2006	STA-7-B	Plankton	3.9			132.60	152.20	18.30	125.50	11.76	<0.1
4/11/2006	STA-7	Egg Pad	0.6	[a]	No flow	132.30	151.60	18.30	103.00	9.62	<0.1
4/11/2006	STA-8-S	Plankton	5.2	[a]	Downstream	127.20	145.40	15.50	108.60	10.28	<0.1
4/11/2006	STA-8-MD	Plankton	5.2			124.70	145.20	17.60	109.10	10.37	<0.1
4/11/2006	STA-8-S	Plankton	5.2			124.50	145.30	17.50	105.80	10.15	<0.1
4/11/2006	STA-8	Egg Pad	2.1	[a]	Downstream	125.60	146.60	17.50	98.50	9.33	<0.1
4/11/2006	STA-9-S	Plankton	3.4	[a]	Downstream	140.80	165.10	17.10	127.90	12.16	<0.1
4/11/2006	STA-9-MD	Plankton	3.4			140.00	164.20	17.10	127.90	12.13	<0.1
4/11/2006	STA-9-B	Plankton	3.4			139.70	164.00	17.40	126.70	12.06	<0.1
4/11/2006	STA-9	Egg Pad	0.9	[a]	Downstream	139.70	162.90	17.50	121.50	11.42	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/13/2006	STA-1-S	Plankton	7.6	0.37	Downstream	157.80	174.00	20.20	66.70	6.02	<0.1
4/13/2006	STA-1-MD	Plankton	7.6			158.30	178.20	19.20	65.30	6.07	<0.1
4/13/2006	STA-1-B	Plankton	7.6			158.80	179.20	19.00	65.50	6.05	<0.1
4/13/2006	STA-1	Egg Pad	2.3	N/D	Downstream	160.30	173.00	21.50	71.20	6.83	<0.1
4/13/2006	STA-2-S	Plankton	2.9	N/D	Upstream, tide rising	126.50	138.20	20.20	56.10	5.06	<0.1
4/13/2006	STA-2-MD	Plankton	2.9			122.20	137.40	19.20	57.20	5.01	<0.1
4/13/2006	STA-2-B	Plankton	2.9			122.30	137.20	19.30	51.70	4.88	<0.1
4/13/2006	STA-2	Egg Pad	1.8	N/D	Upstream, tide rising	123.90	137.90	19.60	59.10	5.46	<0.1
4/13/2006	STA-3-S	Plankton	4.3	0.19	Downstream	131.90	149.50	18.80	91.40	8.48	<0.1
4/13/2006	STA-3-MD	Plankton	4.3			131.80	149.60	18.80	91.60	8.56	<0.1
4/13/2006	STA-3-B	Plankton	4.3			131.90	149.60	18.80	87.90	8.18	<0.1
4/13/2006	STA-3	Egg Pad	1.2	N/D	No flow	131.70	147.10	19.20	92.80	8.50	<0.1
4/13/2006	STA-4-S	Plankton	4.0	N/D	No flow	131.50	148.40	19.00	110.90	9.86	<0.1
4/13/2006	STA-4-MD	Plankton	4.0			130.50	148.30	18.70	101.90	9.94	<0.1
4/13/2006	STA-4-B	Plankton	4.0			130.20	147.90	18.70	104.10	9.74	<0.1
4/13/2006	STA-4	Egg Pad	1.5	N/D	No flow	130.50	147.10	19.00	106.00	9.85	<0.1
4/13/2006	STA-5-S	Plankton	5.5	N/D	No flow	162.50	140.40	17.90	97.90	8.88	<0.1
4/13/2006	STA-5-MD	Plankton	5.5			162.50	140.50	17.90	91.10	8.62	<0.1
4/13/2006	STA-5-B	Plankton	5.5			161.90	140.20	18.00	90.60	8.72	<0.1
4/13/2006	STA-5	Egg Pad	1.5	N/D	No flow	162.30	139.70	17.80	71.60	6.62	<0.1
4/14/2006	STA-6-S	Plankton	3.8	Malfunction	Downstream	148.10	131.30	19.10	85.90	8.05	<0.1
4/14/2006	STA-6-MD	Plankton	3.8			148.50	131.50	18.90	90.10	8.25	<0.1
4/14/2006	STA-6-B	Plankton	3.8			148.80	131.70	18.90	85.60	8.07	<0.1
4/14/2006	STA-6	Egg Pad	1.1	Malfunction	Downstream	151.30	133.90	19.20	78.30	7.03	<0.1
4/14/2006	STA-7-S	Plankton	4.5	Malfunction	Downstream	144.80	126.80	19.20	91.40	8.41	<0.1
4/14/2006	STA-7-MD	Plankton	4.5			148.30	130.90	19.00	89.50	8.31	<0.1
4/14/2006	STA-7-B	Plankton	4.5			147.20	128.90	19.00	86.40	8.08	<0.1
4/14/2006	STA-7	Egg Pad	1.1	Malfunction	Downstream	149.50	134.70	19.80	87.40	7.74	<0.1
4/14/2006	STA-8-S	Plankton	5.1	Malfunction	Downstream	115.90	110.70	19.60	82.80	7.58	<0.1
4/14/2006	STA-8-MD	Plankton	5.1			125.10	113.10	19.00	83.80	7.76	<0.1
4/14/2006	STA-8-B	Plankton	5.1			135.90	121.20	19.00	80.70	7.47	<0.1
4/14/2006	STA-8-A	Egg Pad [c]	0.9	Malfunction	No flow	142.10	127.80	19.70	79.20	7.16	<0.1
4/14/2006	STA-8-B	Egg Pad [c]	1.4	Malfunction	No flow	104.40	93.00	19.50	76.20	6.78	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/14/2006	STA-9-S	Plankton	3.3	0.318	Downstream	171.70	158.40	20.90	94.40	8.43	<0.1
4/14/2006	STA-9-MD	Plankton	3.3			171.70	158.40	20.90	94.80	8.51	<0.1
4/14/2006	STA-9-B	Plankton	3.3			171.80	158.40	20.90	96.20	8.53	<0.1
4/14/2006	STA-9	Egg Pad	1.0	N/D	Downstream	169.10	154.70	20.50	77.60	6.91	<0.1
4/17/2006	STA-1-S	Plankton	7.4	Malfunction	Upstream, tide rising	195.20	182.10	21.60	63.30	5.56	<0.1
4/17/2006	STA-1-MD	Plankton	7.4			194.90	181.50	21.20	64.70	5.62	<0.1
4/17/2006	STA-1-B	Plankton	7.4			196.40	182.20	21.20	61.70	5.52	<0.1
4/17/2006	STA-1	Egg Pad	1.1	Malfunction	Upstream, tide rising	203.40	192.70	22.00	59.90	5.12	<0.1
4/17/2006	STA-2-S	Plankton	3.3	Malfunction	Upstream, tide rising	136.70	129.10	22.60	56.40	4.82	<0.1
4/17/2006	STA-2-MD	Plankton	3.3			135.40	127.00	21.70	54.10	4.69	<0.1
4/17/2006	STA-2-B	Plankton	3.3			133.20	126.30	21.80	53.50	4.70	<0.1
4/17/2006	STA-2	Egg Pad	0.7	Malfunction	No flow	133.40	127.30	23.00	47.60	4.35	<0.1
4/17/2006	STA-3-S	Plankton	0.2	Malfunction	Downstream	157.10	145.10	21.10	92.30	8.11	<0.1
4/17/2006	STA-3-MD	Plankton	0.2			156.90	144.60	20.90	90.40	8.19	<0.1
4/17/2006	STA-3-B	Plankton	0.2			156.80	144.80	21.10	90.50	7.89	<0.1
4/17/2006	STA-3	Egg Pad	0.2	Malfunction	No flow	156.50	106.30	21.60	88.20	7.70	<0.1
4/17/2006	STA-4-S	Plankton	4.5	Malfunction	Downstream	155.40	143.90	21.10	106.90	9.48	<0.1
4/17/2006	STA-4-MD	Plankton	4.5			155.60	143.30	21.10	106.50	9.52	<0.1
4/17/2006	STA-4-B	Plankton	4.5			155.50	143.30	20.90	104.70	9.36	<0.1
4/17/2006	STA-4	Egg Pad	0.8	Malfunction	No flow	152.90	140.80	20.90	86.30	7.70	<0.1
4/17/2006	STA-5-S	Plankton	1.4	Malfunction	Downstream	151.70	137.70	20.20	87.20	7.87	<0.1
4/17/2006	STA-5-MD	Plankton	1.4			151.60	137.60	20.20	89.30	7.97	<0.1
4/17/2006	STA-5-B	Plankton	1.4			151.60	137.70	20.20	88.10	7.95	<0.1
4/17/2006	STA-5	Egg Pad	0.9	Malfunction	Downstream	152.10	138.20	20.20	79.00	7.27	<0.1
4/18/2006	STA-6-S	Plankton	3.6	Malfunction	Downstream	139.30	130.00	21.50	79.00	7.01	<0.1
4/18/2006	STA-6-MD	Plankton	3.6			139.50	129.60	21.20	81.50	7.25	<0.1
4/18/2006	STA-6-B	Plankton	3.6			139.90	129.90	21.20	77.00	6.84	<0.1
4/18/2006	STA-6	Egg Pad	0.8	Malfunction	Downstream	140.70	130.40	21.20	77.90	7.00	<0.1
4/18/2006	STA-7-S	Plankton	3.7	Malfunction	Downstream	131.80	122.70	21.80	91.20	8.01	<0.1
4/18/2006	STA-7-MD	Plankton	3.7			136.90	128.20	21.70	94.70	8.35	<0.1
4/18/2006	STA-7-B	Plankton	3.7			136.80	127.70	21.70	94.90	8.35	<0.1
4/18/2006	STA-7	Egg Pad	1.1	Malfunction	Downstream	131.30	123.20	21.80	96.60	8.36	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/18/2006	STA-8-S	Plankton	5.0	Malfunction	Downstream	136.50	129.40	22.40	73.20	6.33	<0.1
4/18/2006	STA-8-MD	Plankton	5.0			111.90	104.70	21.70	69.20	6.06	<0.1
4/18/2006	STA-8-B	Plankton	5.0			100.50	93.40	21.40	74.70	6.62	<0.1
4/18/2006	STA-8	Egg Pad	1.6	Malfunction	Downstream	133.40	128.30	22.70	66.00	5.70	<0.1
4/18/2006	STA-9-S	Plankton	1.6	Malfunction	Downstream	176.50	166.30	21.90	82.70	7.14	<0.1
4/18/2006	STA-9-MD	Plankton	1.6			176.70	166.20	21.90	84.50	7.39	<0.1
4/18/2006	STA-9-B	Plankton	1.6			176.70	166.20	21.90	84.70	7.41	<0.1
4/18/2006	STA-9	Egg Pad	0.6	0.670 [b]	Downstream	174.40	163.30	21.60	69.60	5.91	<0.1
4/20/2006	STA-1-S	Plankton	7.5	0.294	Upstream, tide rising	179.20	170.50	22.50	62.20	5.43	<0.1
4/20/2006	STA-1-MD	Plankton	7.5			180.20	167.50	21.30	62.40	5.52	<0.1
4/20/2006	STA-1-B	Plankton	7.5			179.70	167.00	21.30	62.80	5.57	<0.1
4/20/2006	STA-1	Egg Pad	1.5	N/D	Upstream, tide rising	178.70	172.90	22.70	59.60	5.01	<0.1
4/20/2006	STA-2-S	Plankton	2.9	0.281	Upstream, tide rising	123.00	114.70	21.50	51.60	4.55	<0.1
4/20/2006	STA-2-MD	Plankton	2.9			123.10	113.90	21.20	54.70	4.85	<0.1
4/20/2006	STA-2-B	Plankton	2.9			122.60	113.80	21.20	53.40	4.72	<0.1
4/20/2006	STA-2	Egg Pad	1.0	N/D	Upstream, tide rising	122.50	115.40	21.70	62.10	5.41	<0.1
4/20/2006	STA-3-S	Plankton	2.6	0.366	Downstream	148.40	137.40	21.10	99.20	8.83	<0.1
4/20/2006	STA-3-MD	Plankton	2.6			148.40	137.20	21.00	99.20	8.83	<0.1
4/20/2006	STA-3-B	Plankton	2.6			148.40	137.20	21.00	96.00	8.63	<0.1
4/20/2006	STA-3	Egg Pad	1.0	N/D	No flow	148.00	138.70	21.60	93.00	8.16	<0.1
4/20/2006	STA-4-S	Plankton	4.1	0.196	Downstream	143.70	133.80	21.20	108.50	9.54	<0.1
4/20/2006	STA-4-MD	Plankton	4.1			143.10	130.90	20.50	99.20	8.94	<0.1
4/20/2006	STA-4-B	Plankton	4.1			142.90	130.80	20.60	103.30	9.30	<0.1
4/20/2006	STA-4	Egg Pad	1.1	N/D	No flow	184.00	137.00	21.40	88.30	7.97	<0.1
4/20/2006	STA-5-S	Plankton	4.8	0.268	Downstream	144.80	131.70	20.30	84.60	7.67	<0.1
4/20/2006	STA-5-MD	Plankton	4.8			144.70	131.40	20.20	87.00	7.86	<0.1
4/20/2006	STA-5-B	Plankton	4.8			144.70	131.40	20.20	86.70	7.89	<0.1
4/20/2006	STA-5	Egg Pad	1.3	N/D	Downstream	144.20	130.40	20.00	91.30	8.30	<0.1
4/21/2006	STA-6-S	Plankton	3.5	0.288	Downstream	138.40	131.60	22.50	86.80	7.48	<0.1
4/21/2006	STA-6-MD	Plankton	3.5			139.50	130.80	22.20	86.70	7.56	<0.1
4/21/2006	STA-6-B	Plankton	3.5			138.60	130.10	21.90	84.90	7.44	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/21/2006	STA-6	Egg Pad	0.7	N/D	Downstream	146.10	139.20	22.60	76.30	6.53	<0.1
4/21/2006	STA-7-S	Plankton	3.7	0.308	Downstream	125.60	117.20	21.50	83.00	7.34	<0.1
4/21/2006	STA-7-MD	Plankton	3.7			126.70	118.20	21.50	81.80	7.22	<0.1
4/21/2006	STA-7-B	Plankton	3.7			126.30	117.80	21.40	81.40	7.20	<0.1
4/21/2006	STA-7	Egg Pad	1.0	N/D	Downstream	124.90	120.00	23.00	73.40	6.54	<0.1
4/21/2006	STA-8-S	Plankton	4.7	0.184	Downstream	146.90	137.50	21.60	81.40	7.17	<0.1
4/21/2006	STA-8-MD	Plankton	4.7			146.20	136.30	21.30	81.70	7.25	<0.1
4/21/2006	STA-8-B	Plankton	4.7			129.70	116.30	21.00	85.90	7.66	<0.1
4/21/2006	STA-8	Egg Pad	1.3	N/D	No flow	142.90	134.50	21.70	80.20	6.89	<0.1
4/21/2006	STA-9-S	Plankton	1.5	0.540	Downstream	184.50	169.00	20.60	103.20	9.29	<0.1
4/21/2006	STA-9-MD	Plankton	1.5			184.40	168.70	20.60	102.40	9.20	<0.1
4/21/2006	STA-9-B	Plankton	1.5			184.20	168.50	20.60	102.80	9.24	<0.1
4/21/2006	STA-9	Egg Pad	0.8	N/D	Downstream	179.10	163.00	20.30	87.40	7.87	<0.1
4/24/2006	STA-1-S	Plankton	7.9	0.458	Downstream	179.40	171.20	22.40	71.10	6.17	<0.1
4/24/2006	STA-1-MD	Plankton	7.9			184.60	173.90	22.20	69.70	6.06	<0.1
4/24/2006	STA-1-B	Plankton	7.9			188.40	179.10	22.20	63.80	5.56	<0.1
4/24/2006	STA-1	Egg Pad	1.2	N/D	No flow	187.50	182.10	23.20	66.90	5.63	<0.1
4/24/2006	STA-2-S	Plankton	3.0	0.420	Downstream	131.20	124.60	22.60	64.30	5.56	<0.1
4/24/2006	STA-2-MD	Plankton	3.0			130.70	124.40	22.40	64.50	5.63	<0.1
4/24/2006	STA-2-B	Plankton	3.0			130.50	124.10	22.40	64.40	5.64	<0.1
4/24/2006	STA-2	Egg Pad	1.9	0.097	Downstream	125.40	121.60	22.90	61.90	5.34	<0.1
4/24/2006	STA-3-S	Plankton	3.9	0.234	Downstream	134.50	126.30	21.80	105.80	9.27	<0.1
4/24/2006	STA-3-MD	Plankton	3.9			134.60	126.10	21.70	108.80	9.58	<0.1
4/24/2006	STA-3-B	Plankton	3.9			134.40	126.10	21.80	109.10	9.56	<0.1
4/24/2006	STA-3	Egg Pad	1.6	0.189	Downstream	132.10	124.90	22.00	102.50	9.10	<0.1
4/24/2006	STA-4-S	Plankton	4.5	0.233	Downstream	124.50	115.80	21.30	88.40	7.82	<0.1
4/24/2006	STA-4-MD	Plankton	4.5			124.50	115.50	21.20	88.50	7.86	<0.1
4/24/2006	STA-4-B	Plankton	4.5			124.50	115.50	21.20	87.10	7.73	<0.1
4/24/2006	STA-4	Egg Pad	1.1	N/D	Downstream	126.60	117.40	21.30	84.30	7.41	<0.1
4/24/2006	STA-5-S	Plankton	6.6	0.255	Downstream	119.00	111.00	21.50	91.90	8.14	<0.1
4/24/2006	STA-5-MD	Plankton	6.6			118.80	110.90	21.50	93.80	8.27	<0.1
4/24/2006	STA-5-B	Plankton	6.6			118.80	110.90	21.50	93.40	8.28	<0.1
4/24/2006	STA-5	Egg Pad	1.7	N/D	Downstream	114.60	106.90	21.60	82.70	7.36	<0.1
4/25/2006	STA-6-S	Plankton	5.6	0.388	Downstream	135.20	135.40	22.70	90.30	7.78	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/25/2006	STA-6-MD	Plankton	5.6			134.10	128.40	22.60	90.80	7.85	<0.1
4/25/2006	STA-6-B	Plankton	5.6			134.20	128.30	22.70	90.70	7.82	<0.1
4/25/2006	STA-6	Egg Pad	1.1	N/D	Downstream	132.70	127.50	22.80	87.30	7.24	<0.1
4/25/2006	STA-7-S	Plankton	5.6	0.514	Downstream	130.20	122.40	22.40	91.70	7.96	<0.1
4/25/2006	STA-7-MD	Plankton	5.6			128.60	122.40	22.40	91.00	7.89	<0.1
4/25/2006	STA-7-B	Plankton	5.6			129.50	123.10	22.50	90.60	7.86	<0.1
4/25/2006	STA-7	Egg Pad	1.7	N/D	Downstream	130.90	125.60	23.40	85.40	7.30	<0.1
4/25/2006	STA-8-S	Plankton	5.6	0.388	Downstream	147.20	140.20	22.50	87.80	7.57	<0.1
4/25/2006	STA-8-MD	Plankton	5.6			137.40	123.00	22.20	88.40	7.65	<0.1
4/25/2006	STA-8-B	Plankton	5.6			131.90	125.40	22.30	87.20	7.58	<0.1
4/25/2006	STA-8	Egg Pad	1.7	N/D	Downstream	136.60	130.40	22.50	84.20	7.19	<0.1
4/25/2006	STA-9-S	Plankton	3.7	0.547	Downstream	181.60	164.20	20.00	91.70	8.34	<0.1
4/25/2006	STA-9-MD	Plankton	3.7			182.00	164.30	19.90	92.10	8.39	<0.1
4/25/2006	STA-9-B	Plankton	3.7			181.90	164.40	19.90	92.20	8.39	<0.1
4/25/2006	STA-9	Egg Pad	0.7	0.225	Downstream	186.60	168.50	19.60	89.10	8.70	<0.1
4/27/2006	STA-1-S	Plankton	7.4	0.409	Downstream	190.80	179.30	21.90	64.80	5.66	<0.1
4/27/2006	STA-1-MD	Plankton	7.4			191.10	179.60	21.90	65.30	5.73	<0.1
4/27/2006	STA-1-B	Plankton	7.4			191.50	179.80	21.80	62.50	5.47	<0.1
4/27/2006	STA-1	Egg Pad	0.9	0.144	Downstream	192.10	177.80	21.20	57.10	5.07	<0.1
4/27/2006	STA-2-S	Plankton	3.6	0.073	Downstream	130.70	122.60	21.70	57.10	4.99	<0.1
4/27/2006	STA-2-MD	Plankton	3.6			130.90	122.70	21.70	57.50	5.03	<0.1
4/27/2006	STA-2-B	Plankton	3.6			131.10	122.80	21.70	57.10	5.01	<0.1
4/27/2006	STA-2	Egg Pad	0.8	N/D	No flow	130.00	121.00	21.20	66.60	5.45	<0.1
4/27/2006	STA-3-S	Plankton	3.6	0.328	Downstream	115.80	108.40	21.50	81.20	7.09	<0.1
4/27/2006	STA-3-MD	Plankton	3.6			115.90	108.40	21.50	80.20	7.09	<0.1
4/27/2006	STA-3-B	Plankton	3.6			115.50	108.10	21.60	77.80	6.84	<0.1
4/27/2006	STA-3	Egg Pad	0.9	0.250	Downstream	115.30	107.70	21.50	78.60	6.92	<0.1
4/27/2006	STA-4-S	Plankton	4.7	0.253	Downstream	126.90	119.00	21.70	73.90	6.51	<0.1
4/27/2006	STA-4-MD	Plankton	4.7			127.00	119.10	21.70	74.60	6.56	<0.1
4/27/2006	STA-4-B	Plankton	4.7			127.20	118.90	21.60	73.50	6.49	<0.1
4/27/2006	STA-4	Egg Pad	1.8	0.110	Downstream	126.90	117.80	21.40	71.10	6.27	<0.1
4/27/2006	STA-5-S	Plankton	4.7	0.257	Downstream	126.10	118.10	21.70	75.40	6.64	<0.1
4/27/2006	STA-5-MD	Plankton	4.7			126.30	118.20	21.60	75.50	6.65	<0.1
4/27/2006	STA-5-B	Plankton	4.7			126.40	118.10	21.60	74.30	6.57	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
4/27/2006	STA-5	Egg Pad	0.8	0.160	Downstream	125.40	116.80	21.50	71.10	6.26	<0.1
4/28/2006	STA-6-S	Plankton	5.7	1.25 [b]	Downstream	165.70	149.90	20.00	87.60	7.95	<0.1
4/28/2006	STA-6-MD	Plankton	5.7			165.70	149.90	20.00	88.00	8.03	<0.1
4/28/2006	STA-6-B	Plankton	5.7			165.30	150.10	20.00	88.50	8.03	<0.1
4/28/2006	STA-6	Egg Pad	1.6	0.50 [b]	Downstream	159.60	144.10	19.90	82.20	7.58	<0.1
4/28/2006	STA-7-S	Plankton	No Access								
4/28/2006	STA-7-MD	Plankton	No Access								
4/28/2006	STA-7-B	Plankton	No Access								
4/28/2006	STA-7	Egg Pad	No Access								
4/28/2006	STA-8-S	Plankton	7.1	1.50 [b]	Downstream	108.90	93.50	17.50	84.80	8.22	<0.1
4/28/2006	STA-8-MD	Plankton	7.1			108.90	93.40	17.50	85.10	8.13	<0.1
4/28/2006	STA-8-B	Plankton	7.1			108.90	93.40	17.60	85.90	8.18	<0.1
4/28/2006	STA-8	Egg Pad	4.5	1.00 [b]	Downstream	91.30	64.80	17.20	89.10	8.69	<0.1
4/28/2006	STA-9-S	Plankton	5.4	1.43	Downstream	108.10	89.50	16.00	102.10	10.03	<0.1
4/28/2006	STA-9-MD	Plankton	5.4			108.10	89.60	16.00	102.10	9.97	<0.1
4/28/2006	STA-9-B	Plankton	5.4			108.20	89.80	16.30	101.30	10.02	<0.1
4/28/2006	STA-9	Egg Pad	3.0	0.320	Downstream	110.80	92.30	16.10	93.40	9.12	<0.1
5/1/2006	STA-1-S	Plankton	7.9	Malfunction	Upstream, tide rising	144.30	127.80	19.20	46.00	4.21	<0.1
5/1/2006	STA-1-MD	Plankton	7.9			143.90	127.10	18.90	44.90	4.17	<0.1
5/1/2006	STA-1-B	Plankton	7.9			143.50	126.90	19.00	45.00	4.17	<0.1
5/1/2006	STA-1	Egg Pad	0.7	Malfunction	Upstream, tide rising	138.60	125.60	20.30	46.50	4.05	<0.1
5/1/2006	STA-2-S	Plankton	4.7	Malfunction	No flow	114.40	98.50	17.70	49.60	4.69	<0.1
5/1/2006	STA-2-MD	Plankton	4.7			114.60	98.50	17.70	49.10	4.63	<0.1
5/1/2006	STA-2-B	Plankton	4.7			114.40	98.40	17.70	49.50	4.71	<0.1
5/1/2006	STA-2	Egg Pad	0.7	Malfunction	No flow	116.00	100.30	17.90	47.70	4.84	<0.1
5/1/2006	STA-3-S	Plankton	Unable to sample due to high water								
5/1/2006	STA-3-MD	Plankton	Unable to sample due to high water								
5/1/2006	STA-3-B	Plankton	Unable to sample due to high water								
5/1/2006	STA-3	Egg Pad	Unable to sample due to high water								

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/1/2006	STA-4-S	Plankton	Unable to sample due to high water								
5/1/2006	STA-4-MD	Plankton	Unable to sample due to high water								
5/1/2006	STA-4-B	Plankton	Unable to sample due to high water								
5/1/2006	STA-4	Egg Pad	Unable to sample due to high water								
5/1/2006	STA-5-S	Plankton	9.1	1.00 [b]	Downstream	101.40	85.20	16.60	74.60	7.27	<0.1
5/1/2006	STA-5-MD	Plankton	9.1			101.50	85.20	16.60	76.10	7.27	<0.1
5/1/2006	STA-5-B	Plankton	9.1			101.50	85.20	16.60	76.50	7.46	<0.1
5/1/2006	STA-5	Egg Pad	5.3	1.00 [b]	Downstream	101.60	85.20	16.60	74.70	7.21	<0.1
5/2/2006	STA-6-S	Plankton	5.1	1.00 [b]	Downstream	119.10	103.50	18.20	74.40	7.03	<0.1
5/2/2006	STA-6-MD	Plankton	5.1			118.10	102.60	18.20	75.20	7.07	<0.1
5/2/2006	STA-6-B	Plankton	5.1			118.10	102.80	18.30	74.30	7.00	<0.1
5/2/2006	STA-6	Egg Pad	1.6	0.20 [b]	Downstream	115.40	100.70	18.40	68.30	6.64	<0.1
5/2/2006	STA-7-S	Plankton	4.9	1.00 [b]	Downstream	120.60	104.60	18.00	75.30	7.12	<0.1
5/2/2006	STA-7-MD	Plankton	4.9			121.10	104.10	18.00	75.70	7.17	<0.1
5/2/2006	STA-7-B	Plankton	4.9			121.10	105.30	18.20	75.90	7.19	<0.1
5/2/2006	STA-7	Egg Pad	1.5	0.10 [b]	Downstream	122.40	106.30	18.70	73.50	6.89	<0.1
5/2/2006	STA-8-S	Plankton	5.9	0.75 [b]	Downstream	123.80	106.30	17.70	75.70	7.20	<0.1
5/2/2006	STA-8-MD	Plankton	5.9			124.10	106.90	17.70	75.40	7.19	<0.1
5/2/2006	STA-8-B	Plankton	5.9			120.60	102.80	17.70	75.50	7.21	<0.1
5/2/2006	STA-8	Egg Pad	2.1	N/D	Downstream	110.40	95.10	17.80	73.50	7.02	<0.1
5/2/2006	STA-9-S	Plankton	4.2	0.75 [b]	Downstream	147.80	127.20	17.70	86.40	8.21	<0.1
5/2/2006	STA-9-MD	Plankton	4.2			147.70	127.10	17.70	87.70	8.34	<0.1
5/2/2006	STA-9-B	Plankton	4.2			147.70	127.00	17.70	85.90	8.23	<0.1
5/2/2006	STA-9	Egg Pad	1.6	0.1 [b]	Downstream	147.30	126.70	17.70	8<0.10	7.64	<0.1
5/4/2006	STA-1-S	Plankton	7.3	0.460	Upstream, tide rising	136.30	123.30	20.10	57.00	5.16	<0.1
5/4/2006	STA-1-MD	Plankton	7.3			136.40	121.90	19.40	55.90	5.15	<0.1
5/4/2006	STA-1-B	Plankton	7.3			136.10	121.70	19.50	55.90	5.13	<0.1
5/4/2006	STA-1	Egg Pad	1.5	N/D	Upstream, tide rising	132.60	122.60	21.00	52.40	4.84	<0.1
5/4/2006	STA-2-S	Plankton	3.0	0.439	Upstream, tide rising	105.70	94.40	19.30	57.20	5.27	<0.1
5/4/2006	STA-2-MD	Plankton	3.0			105.80	94.00	19.20	59.20	5.42	<0.1
5/4/2006	STA-2-B	Plankton	3.0			105.40	94.00	19.40	55.00	5.25	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/4/2006	STA-2	Egg Pad	0.7	N/D	Upstream, tide rising	106.70	95.70	20.70	46.70	4.27	<0.1
5/4/2006	STA-3-S	Plankton	4.5	0.747	Downstream	108.60	94.90	18.30	76.30	7.15	<0.1
5/4/2006	STA-3-MD	Plankton	4.5			108.60	94.70	18.30	76.40	7.16	<0.1
5/4/2006	STA-3-B	Plankton	4.5			108.40	94.70	18.40	76.20	7.14	<0.1
5/4/2006	STA-3	Egg Pad	1.1	0.491	Downstream	107.90	94.70	18.80	80.80	7.53	<0.1
5/4/2006	STA-4-S	Plankton	5.0	0.344	Downstream	112.70	98.60	18.50	78.00	7.24	<0.1
5/4/2006	STA-4-MD	Plankton	5.0			112.60	98.50	18.50	76.70	7.19	<0.1
5/4/2006	STA-4-B	Plankton	5.0			112.50	98.50	18.50	68.40	5.75	<0.1
5/4/2006	STA-4	Egg Pad	1.1	0.237	Downstream	105.10	85.00	18.00	67.80	5.73	<0.1
5/4/2006	STA-5-S	Plankton	6.4	0.438	Downstream	122.90	107.80	18.60	84.10	7.88	<0.1
5/4/2006	STA-5-MD	Plankton	6.4			128.00	107.60	18.50	85.70	8.03	<0.1
5/4/2006	STA-5-B	Plankton	6.4			122.50	107.60	18.50	83.70	7.87	<0.1
5/4/2006	STA-5	Egg Pad	1.3	0.134	Downstream	122.10	106.80	18.40	78.50	7.26	<0.1
5/5/2006	STA-6-S	Plankton	4.7	0.304	Downstream	135.10	123.30	20.20	85.10	7.62	<0.1
5/5/2006	STA-6-MD	Plankton	4.7			134.30	122.10	20.10	85.50	7.57	<0.1
5/5/2006	STA-6-B	Plankton	4.7			133.70	121.70	20.20	88.30	7.96	<0.1
5/5/2006	STA-6	Egg Pad	1.0	N/D	Downstream	129.40	119.00	20.70	79.90	7.27	<0.1
5/5/2006	STA-7-S	Plankton	4.5	0.344	Downstream	128.20	116.50	20.10	88.90	8.08	<0.1
5/5/2006	STA-7-MD	Plankton	4.5			127.90	114.80	20.10	88.70	8.05	<0.1
5/5/2006	STA-7-B	Plankton	4.5			131.20	117.50	20.20	90.40	8.11	<0.1
5/5/2006	STA-7	Egg Pad	1.1	N/D	Downstream	137.00	126.20	20.90	79.60	7.15	<0.1
5/5/2006	STA-8-S	Plankton	4.9	0.367	Downstream	127.20	120.60	20.20	74.20	6.71	<0.1
5/5/2006	STA-8-MD	Plankton	4.9			129.60	119.40	20.10	74.50	6.78	<0.1
5/5/2006	STA-8-B	Plankton	4.9			128.80	118.40	20.10	74.70	6.75	<0.1
5/5/2006	STA-8	Egg Pad	1.5	N/D	Downstream	100.60	91.40	20.00	85.60	7.81	<0.1
5/5/2006	STA-9-S	Plankton	3.1	0.478	Downstream	150.10	140.70	21.70	101.30	8.93	<0.1
5/5/2006	STA-9-MD	Plankton	3.1			150.00	140.70	21.70	98.80	8.74	<0.1
5/5/2006	STA-9-B	Plankton	3.1			149.90	140.60	21.80	103.10	9.00	<0.1
5/5/2006	STA-9	Egg Pad	0.7	N/D	Downstream	145.10	135.10	21.40	91.30	8.08	<0.1
5/8/2006	STA-1-S	Plankton	7.6	0.652	Downstream	122.00	111.50	20.20	52.80	4.73	<0.1
5/8/2006	STA-1-MD	Plankton	7.6			121.90	111.00	20.20	53.40	4.83	<0.1
5/8/2006	STA-1-B	Plankton	7.6			122.90	111.70	20.20	53.00	4.76	<0.1
5/8/2006	STA-1	Egg Pad	0.3	N/D	Downstream	130.80	119.80	20.60	40.30	3.54	<0.1
5/8/2006	STA-2-S	Plankton	2.7	0.666	Downstream	104.70	94.90	20.10	56.20	5.08	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/8/2006	STA-2-MD	Plankton	2.7			104.60	94.90	20.10	54.00	4.88	<0.1
5/8/2006	STA-2-B	Plankton	2.7			104.60	94.90	20.10	54.80	4.80	<0.1
5/8/2006	STA-2	Egg Pad	0.7	N/D	Downstream	104.90	94.90	20.00	44.00	3.88	<0.1
5/8/2006	STA-3-S	Plankton	4.4	0.840	Downstream	119.10	108.00	20.10	72.90	6.60	<0.1
5/8/2006	STA-3-MD	Plankton	4.4			119.00	107.90	20.10	73.50	6.67	<0.1
5/8/2006	STA-3-B	Plankton	4.4			119.10	108.00	20.10	73.30	6.60	<0.1
5/8/2006	STA-3	Egg Pad	0.8	0.554	Downstream	119.00	107.80	20.10	74.20	6.71	<0.1
5/8/2006	STA-4-S	Plankton	4.9	0.545	Downstream	120.80	109.40	20.10	67.10	6.10	<0.1
5/8/2006	STA-4-MD	Plankton	4.9			120.80	109.30	20.10	67.30	6.11	<0.1
5/8/2006	STA-4-B	Plankton	4.9			120.70	109.30	20.00	66.50	6.07	<0.1
5/8/2006	STA-4	Egg Pad	1.8	0.251	Downstream	120.10	108.60	19.80	59.20	5.49	<0.1
5/8/2006	STA-5-S	Plankton	6.3	0.733	Downstream	129.30	118.00	20.40	87.60	7.94	<0.1
5/8/2006	STA-5-MD	Plankton	6.3			129.40	118.00	20.40	86.40	7.82	<0.1
5/8/2006	STA-5-B	Plankton	6.3			129.40	118.10	20.40	87.40	7.86	<0.1
5/8/2006	STA-5	Egg Pad	1.4	0.295	Downstream	129.50	118.20	20.40	81.30	7.32	<0.1
5/9/2006	STA-6-S	Plankton	5.9	0.664	Downstream	88.90	77.50	18.30	76.00	7.13	<0.1
5/9/2006	STA-6-MD	Plankton	5.9			87.80	76.30	18.20	75.40	7.12	<0.1
5/9/2006	STA-6-B	Plankton	5.9			86.90	76.50	18.30	75.40	7.11	<0.1
5/9/2006	STA-6	Egg Pad	1.5	N/D	Downstream	85.80	74.90	18.20	74.10	6.98	<0.1
5/9/2006	STA-7-S	Plankton	6.0	0.768	Downstream	85.00	74.50	18.10	78.90	7.44	<0.1
5/9/2006	STA-7-MD	Plankton	6.0			85.50	74.00	18.10	79.00	7.46	<0.1
5/9/2006	STA-7-B	Plankton	6.0			85.40	74.90	18.10	79.10	7.48	<0.1
5/9/2006	STA-7	Egg Pad	2.2	0.588	Downstream	85.60	74.40	18.10	79.70	7.41	<0.1
5/9/2006	STA-8-S	Plankton	5.5	0.680	Downstream	83.50	70.00	17.30	78.30	7.45	<0.1
5/9/2006	STA-8-MD	Plankton	5.5			83.30	70.60	17.30	78.30	7.48	<0.1
5/9/2006	STA-8-B	Plankton	5.5			80.40	69.50	17.20	78.20	7.52	<0.1
5/9/2006	STA-8	Egg Pad	2.8	N/D	Downstream	55.80	47.40	16.70	76.20	7.42	<0.1
5/9/2006	STA-9-S	Plankton	4.0	0.372	Downstream	121.50	104.70	17.80	90.00	8.65	<0.1
5/9/2006	STA-9-MD	Plankton	4.0			121.90	105.00	17.80	87.40	8.33	<0.1
5/9/2006	STA-9-B	Plankton	4.0			122.00	105.20	17.80	86.70	8.20	<0.1
5/9/2006	STA-9	Egg Pad	0.9	N/D	Downstream	99.60	83.80	16.70	83.80	8.26	<0.0
5/11/2006	STA-1-S	Plankton	7.2	0.380	Downstream	128.90	117.90	20.60	53.60	4.75	<0.1
5/11/2006	STA-1-MD	Plankton	7.2			128.40	115.20	19.80	52.90	4.73	<0.1
5/11/2006	STA-1-B	Plankton	7.2			127.60	114.80	19.70	51.00	4.68	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/11/2006	STA-1	Egg Pad	1.2	0.121	Downstream	121.70	112.00	21.00	52.60	4.56	<0.1
5/11/2006	STA-2-S	Plankton	3.8	0.375	Downstream	123.10	111.60	20.10	57.00	5.17	<0.1
5/11/2006	STA-2-MD	Plankton	3.8			122.80	110.80	19.90	57.20	5.20	<0.1
5/11/2006	STA-2-B	Plankton	3.8			122.60	110.10	19.70	57.00	5.22	<0.1
5/11/2006	STA-2	Egg Pad	1.0	0.107	Downstream	123.30	114.20	21.40	56.30	4.99	<0.1
5/11/2006	STA-3-S	Plankton	4.6	1.055	Downstream	85.20	75.00	18.70	77.80	7.25	<0.1
5/11/2006	STA-3-MD	Plankton	4.6			85.30	74.90	18.70	77.60	7.20	<0.1
5/11/2006	STA-3-B	Plankton	4.6			85.30	75.00	18.70	77.90	7.27	<0.1
5/11/2006	STA-3	Egg Pad	1.2	0.648	Downstream	85.00	75.00	19.00	78.20	7.23	<0.1
5/11/2006	STA-4-S	Plankton	5.2	0.702	Downstream	85.60	75.10	18.60	72.00	6.72	<0.1
5/11/2006	STA-4-MD	Plankton	5.2			85.80	75.10	18.50	72.40	6.64	<0.1
5/11/2006	STA-4-B	Plankton	5.2			85.80	75.10	18.40	71.10	6.64	<0.1
5/11/2006	STA-4	Egg Pad	1.2	0.206	Downstream	86.00	75.40	18.60	69.80	6.54	<0.1
5/11/2006	STA-5-S	Plankton	7.9	0.697	Downstream	80.60	69.30	17.70	83.30	7.91	<0.1
5/11/2006	STA-5-MD	Plankton	7.9			80.50	69.30	17.70	85.10	8.80	<0.1
5/11/2006	STA-5-B	Plankton	7.9			80.50	69.30	17.70	84.60	8.07	<0.1
5/11/2006	STA-5	Egg Pad	3.0	0.313	Downstream	80.50	69.30	17.40	79.60	7.49	<0.1
5/12/2006	STA-6-S	Plankton	4.4	0.366 [b]	Downstream	78.90	68.80	18.40	81.80	7.64	<0.1
5/12/2006	STA-6-MD	Plankton	4.4			78.80	68.80	18.30	80.70	7.59	<0.1
5/12/2006	STA-6-B	Plankton	4.4			78.40	68.30	18.30	81.00	7.61	<0.1
5/12/2006	STA-6	Egg Pad	1.2	N/D	Downstream	71.60	63.00	18.70	72.00	6.73	<0.1
5/12/2006	STA-7-S	Plankton	4.8	0.396 [b]	Downstream	78.40	68.40	18.30	83.70	7.92	<0.1
5/12/2006	STA-7-MD	Plankton	4.8			81.20	70.70	18.30	84.60	7.96	<0.1
5/12/2006	STA-7-B	Plankton	4.8			81.60	71.60	18.30	84.40	7.90	<0.1
5/12/2006	STA-7	Egg Pad	0.9	N/D	Downstream	82.70	72.40	18.40	79.10	7.13	<0.1
5/12/2006	STA-8-S	Plankton	4.9	0.396 [b]	Downstream	87.00	75.50	18.80	79.40	7.45	<0.1
5/12/2006	STA-8-MD	Plankton	4.9			84.50	75.20	18.80	82.00	7.65	<0.1
5/12/2006	STA-8-B	Plankton	4.9			82.10	73.00	18.70	81.20	7.56	<0.1
5/12/2006	STA-8	Egg Pad	1.6	N/D	Downstream	77.90	68.30	18.70	81.80	7.70	<0.1
5/12/2006	STA-9-S	Plankton	3.6	0.405 [b]	Downstream	129.80	119.20	20.70	89.20	8.05	<0.1
5/12/2006	STA-9-MD	Plankton	3.6			129.90	119.20	20.70	89.90	7.93	<0.1
5/12/2006	STA-9-B	Plankton	3.6			129.90	119.20	20.70	87.50	7.84	<0.1
5/12/2006	STA-9	Egg Pad	0.8	N/D	Downstream	124.70	112.40	19.90	78.90	7.06	<0.1
5/15/2006	STA-1-S	Plankton	7.3	0.299	Upstream, tide rising	121.50	110.80	20.50	63.00	5.44	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/15/2006	STA-1-MD	Plankton	7.3			122.30	110.50	20.00	59.00	5.32	<0.1
5/15/2006	STA-1-B	Plankton	7.3			122.00	110.00	19.90	51.40	4.86	<0.1
5/15/2006	STA-1	Egg Pad	0.9	N/D	Upstream, tide rising	116.30	107.40	21.10	64.50	5.54	<0.1
5/15/2006	STA-2-S	Plankton	3.1	0.162	Upstream, tide rising	103.50	95.90	21.10	63.80	5.60	<0.1
5/15/2006	STA-2-MD	Plankton	3.1			103.30	93.20	19.90	59.00	5.30	<0.1
5/15/2006	STA-2-B	Plankton	3.1			102.90	92.70	19.80	57.90	5.40	<0.1
5/15/2006	STA-2	Egg Pad	0.9	N/D	Upstream, tide rising	102.60	95.30	21.40	62.90	5.81	<0.1
5/15/2006	STA-3-S	Plankton	3.4	0.512	Downstream	74.50	66.30	19.20	83.70	7.75	<0.1
5/15/2006	STA-3-MD	Plankton	3.4			74.60	66.30	19.20	84.70	7.82	<0.1
5/15/2006	STA-3-B	Plankton	3.4			74.60	66.30	19.20	84.80	7.85	<0.1
5/15/2006	STA-3	Egg Pad[4]	NA	0.052	Downstream	74.30	66.40	19.70	81.50	7.49	<0.1
5/15/2006	STA-4-S	Plankton	4.8	0.265	Downstream	77.50	69.10	19.40	84.50	7.40	<0.1
5/15/2006	STA-4-MD	Plankton	4.8			77.40	68.90	19.20	80.20	7.36	<0.1
5/15/2006	STA-4-B	Plankton	4.8			77.50	68.90	19.20	77.40	7.13	<0.1
5/15/2006	STA-4	Egg Pad	0.7	N/D	Downstream	77.40	68.70	19.20	72.10	6.64	<0.1
5/15/2006	STA-5-S	Plankton	6.0	0.347	Downstream	92.00	82.50	19.50	85.50	7.74	<0.1
5/15/2006	STA-5-MD	Plankton	6.0			92.10	82.40	19.50	85.60	7.85	<0.1
5/15/2006	STA-5-B	Plankton	6.0			92.10	82.50	19.50	85.80	7.74	<0.1
5/15/2006	STA-5	Egg Pad	1.1	.073	Downstream	89.40	79.90	19.40	79.40	7.22	<0.1
5/16/2006	STA-6-S	Plankton	4.5	0.460	Downstream	106.40	97.20	20.50	88.10	7.95	<0.1
5/16/2006	STA-6-MD	Plankton	4.5			106.30	97.10	20.40	89.30	8.04	<0.1
5/16/2006	STA-6-B	Plankton	4.5			104.30	96.00	20.40	89.60	8.07	<0.1
5/16/2006	STA-6	Egg Pad	0.9	N/D	Downstream	104.30	95.70	20.70	91.30	7.71	<0.1
5/16/2006	STA-7-S	Plankton	5.1	0.570	Downstream	102.90	96.00	20.60	91.50	8.18	<0.1
5/16/2006	STA-7-MD	Plankton	5.1			103.50	94.20	20.50	90.80	8.15	<0.1
5/16/2006	STA-7-B	Plankton	5.1			102.60	93.60	20.50	90.10	8.09	<0.1
5/16/2006	STA-7	Egg Pad	1.0	N/D	Downstream	105.90	97.10	20.80	76.30	6.97	<0.1
5/16/2006	STA-8-S	Plankton	5.5	0.396	Downstream	106.00	97.30	20.40	96.10	8.70	<0.1
5/16/2006	STA-8-MD	Plankton	5.5			103.50	97.50	20.20	97.50	8.82	<0.1
5/16/2006	STA-8-B	Plankton	5.5			100.00	88.00	20.10	94.60	8.62	<0.1
5/16/2006	STA-8	Egg Pad	1.1	N/D	Downstream	107.60	98.30	20.50	92.70	8.26	<0.1
5/16/2006	STA-9-S	Plankton	3.8	0.475	Downstream	148.10	133.60	19.80	95.10	8.69	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/16/2006	STA-9-MD	Plankton	3.8			148.10	133.60	19.80	95.50	8.67	<0.1
5/16/2006	STA-9-B	Plankton	3.8			148.30	133.60	19.80	94.80	8.69	<0.1
5/16/2006	STA-9	Egg Pad	0.9	0.094	Downstream	140.50	125.80	19.50	84.40	7.74	<0.1
5/18/2006	STA-1-S	Plankton	8.0	0.424	Upstream, tide rising	121.80	112.10	20.90	79.20	6.93	<0.1
5/18/2006	STA-1-MD	Plankton	8.0			123.40	113.00	20.60	75.30	6.74	<0.1
5/18/2006	STA-1-B	Plankton	8.0			123.60	113.00	20.50	74.40	6.71	<0.1
5/18/2006	STA-1	Egg Pad	0.7	N/D	Upstream, tide rising	118.20	110.90	21.80	75.30	6.65	<0.1
5/18/2006	STA-2-S	Plankton	3.5	0.366	Upstream, tide rising	108.10	101.90	22.00	71.60	6.08	<0.1
5/18/2006	STA-2-MD	Plankton	3.5			107.30	98.70	20.80	70.30	6.23	<0.1
5/18/2006	STA-2-B	Plankton	3.5			107.10	98.30	20.70	68.30	6.17	<0.1
5/18/2006	STA-2	Egg Pad	0.7	N/D	Upstream, tide rising	105.80	102.00	23.20	93.90	7.70	<0.1
5/18/2006	STA-3-S	Plankton	2.9	0.524	Downstream	93.30	85.60	20.70	100.00	8.83	<0.1
5/18/2006	STA-3-MD	Plankton	2.9			93.30	85.60	20.70	99.20	8.90	<0.1
5/18/2006	STA-3-B	Plankton	2.9			93.30	85.50	20.70	99.00	8.89	<0.1
5/18/2006	STA-3	Egg Pad	0.4	0.158	Downstream	92.50	86.00	21.50	102.50	8.36	<0.1
5/18/2006	STA-4-S	Plankton	5.0	0.366	Downstream	95.00	87.20	20.70	94.90	8.56	<0.1
5/18/2006	STA-4-MD	Plankton	5.0			94.90	86.90	20.60	93.10	8.30	<0.1
5/18/2006	STA-4-B	Plankton	5.0			94.80	86.90	20.60	93.80	8.42	<0.1
5/18/2006	STA-4	Egg Pad	1.0	0.094	Downstream	90.40	83.20	20.90	94.10	8.42	<0.1
5/18/2006	STA-5-S	Plankton	6.4	0.326	Downstream	104.70	95.40	20.60	95.30	8.56	<0.1
5/18/2006	STA-5-MD	Plankton	6.4			104.20	95.40	20.60	95.10	8.52	<0.1
5/18/2006	STA-5-B	Plankton	6.4			104.20	95.40	20.60	95.50	8.50	<0.1
5/18/2006	STA-5	Egg Pad	1.1	0.061	Downstream	98.30	89.70	20.40	87.30	7.74	<0.1
5/19/2006	STA-6-S	Plankton	4.9	0.241	Downstream	133.00	124.50	21.60	105.30	9.22	<0.1
5/19/2006	STA-6-MD	Plankton	4.9			131.30	122.40	21.40	103.80	9.17	<0.1
5/19/2006	STA-6-B	Plankton	4.9			130.20	121.40	21.40	104.40	9.23	<0.1
5/19/2006	STA-6	Egg Pad	0.4	0.046	Downstream	132.80	124.30	21.60	98.90	8.71	<0.1
5/19/2006	STA-7-S	Plankton	4.0	0.402	Downstream	121.30	112.90	21.00	108.10	9.64	<0.1
5/19/2006	STA-7-MD	Plankton	4.0			122.60	112.50	21.00	108.80	9.64	<0.1
5/19/2006	STA-7-B	Plankton	4.0			122.00	112.60	21.00	108.00	9.64	<0.1
5/19/2006	STA-7	Egg Pad	1.2	N/D	Downstream	121.60	112.50	21.20	104.10	9.18	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/19/2006	STA-8-S	Plankton	5.3	0.280	Downstream	119.00	109.10	20.60	101.20	9.06	<0.1
5/19/2006	STA-8-MD	Plankton	5.3			116.50	103.70	20.40	101.70	9.15	<0.1
5/19/2006	STA-8-B	Plankton	5.3			105.10	95.80	20.20	100.10	8.74	<0.1
5/19/2006	STA-8	Egg Pad	1.2	0.018	Downstream	118.00	108.50	20.60	96.10	8.55	<0.1
5/19/2006	STA-9-S	Plankton	3.2	0.396 [b]	Downstream	123.50	114.90	21.00	94.10	8.34	<0.1
5/19/2006	STA-9-MD	Plankton	3.2			124.20	115.30	21.10	94.10	8.36	<0.1
5/19/2006	STA-9-B	Plankton	3.2			124.10	114.80	21.10	94.30	8.38	<0.1
5/19/2006	STA-9	Egg Pad	0.5	N/D	Downstream	114.00	103.20	20.10	89.00	8.10	<0.1
5/22/2006	STA-1-S	Plankton	7.6	0.503	Downstream	128.30	122.30	22.40	70.00	6.03	<0.1
5/22/2006	STA-1-MD	Plankton	7.6			129.40	122.50	22.40	71.10	6.16	<0.1
5/22/2006	STA-1-B	Plankton	7.6			129.50	123.30	22.30	70.80	6.13	<0.1
5/22/2006	STA-1	Egg Pad	0.3	N/D	Downstream	129.10	124.60	23.10	61.60	5.27	<0.1
5/22/2006	STA-2-S	Plankton	2.7	0.561	Downstream	124.20	119.60	23.00	68.40	5.87	<0.1
5/22/2006	STA-2-MD	Plankton	2.7			124.00	119.10	22.90	67.70	5.81	<0.1
5/22/2006	STA-2-B	Plankton	2.7			118.90	117.50	23.00	70.10	6.05	<0.1
5/22/2006	STA-2	Egg Pad	0.6	N/D	Downstream	119.60	116.40	23.70	64.30	5.44	<0.1
5/22/2006	STA-3-S	Plankton	3.8	0.372	Downstream	106.20	101.80	22.70	87.70	7.56	<0.1
5/22/2006	STA-3-MD	Plankton	3.8			106.30	101.50	22.70	89.60	7.73	<0.1
5/22/2006	STA-3-B	Plankton	3.8			106.20	101.60	22.70	89.40	7.79	<0.1
5/22/2006	STA-3	Egg Pad	0.6	0.186	Downstream	105.20	100.90	22.90	92.60	7.93	<0.1
5/22/2006	STA-4-S	Plankton	4.8	0.222	Downstream	117.20	112.00	22.60	86.00	7.41	<0.1
5/22/2006	STA-4-MD	Plankton	4.8			117.20	111.40	22.50	87.60	7.60	<0.1
5/22/2006	STA-4-B	Plankton	4.8			117.00	111.30	22.50	86.20	7.73	<0.1
5/22/2006	STA-4	Egg Pad	0.9	N/D	Downstream	115.20	109.70	22.50	87.10	7.53	<0.1
5/22/2006	STA-5-S	Plankton	6.1	0.286	Downstream	131.80	125.00	22.30	90.80	7.88	<0.1
5/22/2006	STA-5-MD	Plankton	6.1			131.70	124.80	22.30	90.30	7.85	<0.1
5/22/2006	STA-5-B	Plankton	6.1			131.70	124.80	22.30	90.40	7.95	<0.1
5/22/2006	STA-5	Egg Pad	0.4	0.082	Downstream	130.40	123.40	22.10	88.10	7.69	<0.1
5/23/2006	STA-6-S	Plankton	5.7	0.287	Downstream	126.80	122.40	23.10	71.60	6.08	<0.1
5/23/2006	STA-6-MD	Plankton	5.7			126.60	120.90	22.90	73.90	6.36	<0.1
5/23/2006	STA-6-B	Plankton	5.7			125.40	120.30	22.90	73.20	6.24	<0.1
5/23/2006	STA-6	Egg Pad	0.6	N/D	Downstream	119.90	117.00	24.00	70.60	5.91	<0.1
5/23/2006	STA-7-S	Plankton	4.5	0.280	Downstream	118.90	114.30	23.10	76.20	6.51	<0.1
5/23/2006	STA-7-MD	Plankton	4.5			119.20	114.50	23.00	78.70	6.76	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/23/2006	STA-7-B	Plankton	4.5			119.00	114.40	23.00	76.20	6.53	<0.1
5/23/2006	STA-7	Egg Pad	0.3	N/D	Downstream	121.70	117.30	23.20	70.30	6.01	<0.1
5/23/2006	STA-8-S	Plankton	5.2	0.195	Downstream	115.80	111.20	22.60	70.20	6.01	<0.1
5/23/2006	STA-8-MD	Plankton	5.2			110.90	105.30	21.90	73.00	6.37	<0.1
5/23/2006	STA-8-B	Plankton	5.2			108.60	102.70	21.90	73.60	6.40	<0.1
5/23/2006	STA-8	Egg Pad	0.6	N/D	Downstream	120.60	114.40	22.40	70.60	6.04	<0.1
5/23/2006	STA-9-S	Plankton	3.6	0.369	Downstream	158.70	149.90	22.00	81.10	7.08	<0.1
5/23/2006	STA-9-MD	Plankton	3.6			158.80	149.80	22.00	82.50	7.20	<0.1
5/23/2006	STA-9-B	Plankton	3.6			158.90	149.80	21.90	79.30	6.98	<0.1
5/23/2006	STA-9	Egg Pad	0.4	N/D	Downstream	152.30	142.00	21.50	70.00	5.97	<0.1
5/25/2006	STA-1-S	Plankton	7.0	0.131	Downstream	144.80	142.20	24.00	78.90	6.72	<0.1
5/25/2006	STA-1-MD	Plankton	7.0			147.00	141.80	23.10	76.60	6.53	<0.1
5/25/2006	STA-1-B	Plankton	7.0			147.50	141.90	23.30	77.80	6.67	<0.1
5/25/2006	STA-1	Egg Pad	0.6	N/D	Downstream	141.20	140.40	24.60	75.80	6.05	<0.1
5/25/2006	STA-2-S	Plankton	2.8	0.265	Downstream	128.60	126.90	24.20	75.90	6.29	<0.1
5/25/2006	STA-2-MD	Plankton	2.8			128.10	123.80	23.30	70.60	6.28	<0.1
5/25/2006	STA-2-B	Plankton	2.8			125.50	121.20	23.30	69.40	5.86	<0.1
5/25/2006	STA-2	Egg Pad	0.8	N/A	Downstream	126.40	125.20	24.60	70.20	6.52	<0.1
5/25/2006	STA-3-S	Plankton	3.6	0.347	Downstream	124.40	120.20	23.20	113.00	9.61	<0.1
5/25/2006	STA-3-MD	Plankton	3.6			124.50	120.00	23.10	113.30	9.81	<0.1
5/25/2006	STA-3-B	Plankton	3.6			124.50	120.00	23.10	111.20	9.68	<0.1
5/25/2006	STA-3	Egg Pad	0.6	N/D	Downstream	123.30	120.10	23.40	115.70	9.89	<0.1
5/25/2006	STA-4-S	Plankton	4.8	0.192	Downstream	126.80	122.10	23.00	103.30	8.79	<0.1
5/25/2006	STA-4-MD	Plankton	4.8			126.70	121.70	22.90	104.10	8.90	<0.1
5/25/2006	STA-4-B	Plankton	4.8			127.10	121.80	23.00	94.20	7.72	<0.1
5/25/2006	STA-4	Egg Pad	0.6	N/D	Downstream	127.80	123.10	21.30	95.70	7.98	<0.1
5/25/2006	STA-5-S	Plankton	5.6	0.280	Downstream	126.10	121.00	22.90	82.40	7.08	<0.1
5/25/2006	STA-5-MD	Plankton	5.6			126.20	121.00	22.90	87.10	7.63	<0.1
5/25/2006	STA-5-B	Plankton	5.6			126.30	121.10	22.90	85.80	7.48	<0.1
5/25/2006	STA-5	Egg Pad	0.4	N/D	Downstream	126.30	121.40	22.90	75.70	6.45	<0.1
5/26/2006	STA-6-S	Plankton	3.8	0.219	Downstream	125.60	125.20	24.80	85.40	6.92	<0.1
5/26/2006	STA-6-MD	Plankton	3.8			125.30	123.40	24.20	85.40	7.17	<0.1
5/26/2006	STA-6-B	Plankton	3.8			124.30	122.60	24.30	85.00	7.07	<0.1
5/26/2006	STA-6	Egg Pad	0.3	N/D	Downstream	121.30	121.10	24.90	79.90	6.53	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/26/2006	STA-7-S	Plankton	4.7	0.332	Downstream	130.90	129.00	24.20	89.90	7.57	<0.1
5/26/2006	STA-7-MD	Plankton	4.7			129.90	127.20	24.20	94.30	7.84	<0.1
5/26/2006	STA-7-B	Plankton	4.7			128.60	126.30	24.30	86.10	7.48	<0.1
5/26/2006	STA-7	Egg Pad	0.4	N/D	Downstream	129.80	130.10	25.30	87.10	7.21	<0.1
5/26/2006	STA-8-S	Plankton	4.6	0.293	Downstream	142.60	139.20	23.90	83.60	7.13	<0.1
5/26/2006	STA-8-MD	Plankton	4.6			137.70	133.50	23.40	84.10	7.23	<0.1
5/26/2006	STA-8-B	Plankton	4.6			127.70	123.60	23.40	84.30	7.16	<0.1
5/26/2006	STA-8	Egg Pad	1.1	N/D	Downstream	145.80	142.40	23.80	74.60	6.76	<0.1
5/26/2006	STA-9-S	Plankton	2.9	0.390	Downstream	169.00	168.20	24.80	96.80	8.07	<0.1
5/26/2006	STA-9-MD	Plankton	2.9			169.00	168.20	24.80	98.90	8.14	<0.1
5/26/2006	STA-9-B	Plankton	2.9			168.90	168.10	24.80	97.60	8.15	<0.1
5/26/2006	STA-9	Egg Pad	0.4	N/D	None detected	162.60	160.10	24.20	83.10	6.63	<0.1
5/30/2006	STA-1-S	Plankton	7.2	0.360	Upstream, tide rising	158.80	161.50	26.00	44.10	3.56	<0.1
5/30/2006	STA-1-MD	Plankton	7.2			158.40	159.70	25.40	44.50	3.65	<0.1
5/30/2006	STA-1-B	Plankton	7.2			146.40	147.90	25.60	42.80	3.52	<0.1
5/30/2006	STA-1	Egg Pad	0.6	N/D	Upstream, tide rising	146.20	151.30	26.80	36.40	2.94	<0.1
5/30/2006	STA-2-S	Plankton	2.9	-	Upstream, tide rising	131.70	136.90	26.00	40.40	3.38	<0.1
5/30/2006	STA-2-MD	Plankton	2.9			131.10	132.70	25.70	40.00	3.25	<0.1
5/30/2006	STA-2-B	Plankton	2.9			130.90	132.40	25.70	39.10	3.20	<0.1
5/30/2006	STA-2	Egg Pad	0.8	N/D	Upstream, tide rising	129.70	136.00	27.50	32.70	2.63	<0.1
5/30/2006	STA-3-S	Plankton	2.7	0.155	Downstream	119.00	121.10	26.00	65.80	5.32	<0.1
5/30/2006	STA-3-MD	Plankton	2.7			118.70	120.40	25.70	67.80	5.53	<0.1
5/30/2006	STA-3-B	Plankton	2.7			118.60	120.40	25.80	69.40	5.69	<0.1
5/30/2006	STA-3	Egg Pad[d]	0.6	N/D	Downstream	118.30	121.70	26.50	61.70	4.90	<0.1
5/30/2006	STA-4-S	Plankton	4.9	0.180	Downstream	115.30	118.50	26.30	64.20	5.14	<0.1
5/30/2006	STA-4-MD	Plankton	4.9			115.10	116.50	25.60	59.90	4.92	<0.1
5/30/2006	STA-4-B	Plankton	4.9			115.00	116.40	25.70	61.60	5.06	<0.1
5/30/2006	STA-4	Egg Pad	0.3	N/D	Downstream	112.90	115.20	26.10	59.60	4.83	<0.1
5/30/2006	STA-5-S	Plankton	5.5	0.171	Downstream	137.20	138.10	25.30	81.40	6.65	<0.1
5/30/2006	STA-5-MD	Plankton	5.5			137.20	137.80	25.20	77.40	6.36	<0.1

Table 2. (continued)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
5/30/2006	STA-5-B	Plankton	5.5			137.00	137.50	25.20	76.30	6.42	<0.1
5/30/2006	STA-5	Egg Pad	0.2	N/D	Downstream	137.10	137.50	25.20	74.60	6.17	<0.1
5/31/2006	STA-6-S	Plankton	3.4	0.085	Downstream	152.40	164.20	29.20	113.00	8.85	<0.1
5/31/2006	STA-6-MD	Plankton	3.4			151.50	155.20	26.30	84.10	6.67	<0.1
5/31/2006	STA-6-B	Plankton	3.4			151.30	154.60	26.20	79.70	6.45	<0.1
5/31/2006	STA-6	Egg Pad	0.1	N/D	Downstream	151.00	161.50	28.40	105.30	7.98	<0.1
5/31/2006	STA-7-S	Plankton	4.0	0.210	Downstream	157.60	169.10	28.60	107.60	8.02	<0.1
5/31/2006	STA-7-MD	Plankton	4.0			148.70	152.00	26.10	88.10	7.09	<0.1
5/31/2006	STA-7-B	Plankton	4.0			149.60	152.80	26.10	70.00	5.27	<0.1
5/31/2006	STA-7	Egg Pad[d]	0.4	N/D	Downstream	150.30	157.70	28.30	90.30	7.54	<0.1
5/31/2006	STA-8-S	Plankton	5.0	0.168	Downstream	150.40	158.00	28.00	120.30	9.19	<0.1
5/31/2006	STA-8-MD	Plankton	5.0			139.00	142.70	26.20	85.90	7.17	<0.1
5/31/2006	STA-8-B	Plankton	5.0			149.90	110.30	25.30	77.10	4.29	<0.1
5/31/2006	STA-8	Egg Pad	0.2	N/D	Downstream	145.50	152.20	27.20	94.70	8.11	<0.1
5/31/2006	STA-9-S	Plankton	2.4	0.472	Downstream	174.10	184.10	28.00	98.90	7.76	<0.1
5/31/2006	STA-9-MD	Plankton	2.4			174.10	184.10	28.00	97.70	7.61	<0.1
5/31/2006	STA-9-B	Plankton	2.4			174.10	184.30	28.00	89.90	7.65	<0.1
5/31/2006	STA-9	Egg Pad[e]	0.1	N/D	Downstream	168.70	177.20	27.60	58.80	-	<0.1
6/1/2006	STA-1-S	Plankton	7.4	0.369	Upstream, tide rising	163.80	167.20	26.10	46.00	3.75	<0.1
6/1/2006	STA-1-MD	Plankton	7.4			163.90	166.90	26.00	46.40	3.77	<0.1
6/1/2006	STA-1-B	Plankton	7.4			163.80	166.70	26.00	45.30	3.71	<0.1
6/1/2006	STA-1	Egg Pad	0.2	N/D	Upstream, tide rising	161.30	167.20	26.90	34.80	2.67	<0.1
6/1/2006	STA-2-S	Plankton	2.8	0.332	Upstream, tide rising	131.40	136.30	26.70	43.50	3.50	<0.1
6/1/2006	STA-2-MD	Plankton	2.8			131.20	134.60	26.30	42.70	3.45	<0.1
6/1/2006	STA-2-B	Plankton	2.8			129.80	132.90	26.30	39.00	3.22	<0.1
6/1/2006	STA-2	Egg Pad	0.4	N/D	Upstream, tide rising	131.70	136.80	26.90	43.40	3.54	<0.1
6/1/2006	STA-3-S	Plankton	2.6	0.210	Downstream	114.40	117.20	26.50	81.80	6.52	<0.1
6/1/2006	STA-3-MD	Plankton	2.6			114.10	116.90	26.30	81.50	6.51	<0.1
6/1/2006	STA-3-B	Plankton	2.6			114.00	116.90	26.30	80.20	6.50	<0.1
6/1/2006	STA-3	Egg Pad	<0.1	N/D	Downstream	113.50	117.10	26.80	70.50	5.65	<0.1
6/1/2006	STA-4-S	Plankton	4.6	0.162	Downstream	119.00	123.60	27.10	81.20	6.46	<0.1

Table 2. (concluded)

Date	Station	Type	Depth(m)	Flow (m/sec)	Flow Direction	Conductivity (µS)	Specific Conductivity (µS)	Temperature (°C)	Dissolved Oxygen (%)	Dissolved Oxygen (mg/l)	Salinity (ppt)
6/1/2006	STA-4-MD	Plankton	4.6			118.80	121.00	26.00	72.30	5.82	<0.1
6/1/2006	STA-4-B	Plankton	4.6			118.70	120.80	25.90	70.20	5.80	<0.1
6/1/2006	STA-4	Egg Pad	0.4	N/D	Downstream	115.60	118.60	26.30	76.70	6.38	<0.1
6/1/2006	STA-5-S	Plankton	5.3	0.165	Downstream	145.10	148.20	26.10	80.10	6.67	<0.1
6/1/2006	STA-5-MD	Plankton	5.3			145.00	147.70	26.00	85.50	6.95	<0.1
6/1/2006	STA-5-B	Plankton	5.3			144.90	147.50	25.90	82.30	6.72	<0.1
6/1/2006	STA-5	Egg Pad	0.3	N/D	Downstream	143.20	145.80	26.00	81.60	6.53	<0.1
6/2/2006	STA-6-S	Plankton	3.8	0.122	Downstream	158.80	171.50	29.00	120.90	9.29	<0.1
6/2/2006	STA-6-MD	Plankton	3.8			158.20	163.90	26.90	96.70	7.73	<0.1
6/2/2006	STA-6-B	Plankton	3.8			156.10	161.30	26.80	85.60	6.86	<0.1
6/2/2006	STA-6	Egg Pad	0.3	N/D	Downstream	157.30	168.40	28.70	119.60	9.63	<0.1
6/2/2006	STA-7-S	Plankton	4.1	0.198	Downstream	158.40	169.00	28.30	114.90	8.99	<0.1
6/2/2006	STA-7-MD	Plankton	4.1			150.90	156.40	27.10	114.40	9.13	<0.1
6/2/2006	STA-7-B	Plankton	4.1			147.30	152.60	27.00	103.90	8.30	<0.1
6/2/2006	STA-7	Egg Pad	0.2	N/D	Downstream	161.10	170.70	28.30	101.10	7.81	<0.1
6/2/2006	STA-8-S	Plankton	4.5	0.165	Downstream	150.20	159.00	28.00	127.00	9.80	<0.1
6/2/2006	STA-8-MD	Plankton	4.5			141.90	147.50	27.00	107.10	8.52	<0.1
6/2/2006	STA-8-B	Plankton	4.5			110.80	113.40	26.20	98.60	7.98	<0.1
6/2/2006	STA-8	Egg Pad	0.3	N/D	Downstream	146.80	154.50	27.70	115.50	8.87	<0.1
6/2/2006	STA-9-S	Plankton	2.3	0.405	Downstream	177.30	187.00	27.80	103.90	8.14	<0.1
6/2/2006	STA-9-MD	Plankton	2.3			177.30	186.90	27.80	102.90	8.02	<0.1
6/2/2006	STA-9-B	Plankton	2.3			177.40	186.90	27.80	103.40	8.17	<0.1
6/2/2006	STA-9	Egg Pad	0.3	N/D	Downstream	174.20	183.10	27.60	75.60	6.38	<0.1

Notes: Station designation: S = surface, MD = mid-depth, B = bottom

N/D = Not detected or less than 0.10 m/sec

[a] Digital flow was not measured.

[b] Water velocity was measured manually due to equipment malfunction. (see Section 2.2.3)

[c] Pad 8, upstream of landing was moved downstream of Rockfish Ck on 4/14. WQ collected at each location on day of move. 8A = upstream, 8B = downstream

[d] Egg collection pads out of water.

[e] DO (mg/L) not collected.

Table 3. Anadromous fish larvae and eggs collected by plankton tows (PLK) and on egg pads (EGG), 21 April through 23 May 2006.[a]

Fish Species	Station	Date	Number Count
Alosa sapidissima	Sta-09-PLK	4/21/06	1 Egg
	Sta-07-PLK	4/25/06	1 Egg
	Sta-06-PLK	5/02/06	3 Eggs
	Sta-05-PLK	5/08/06	1 Egg
	Sta-07-PLK	5/09/06	2 Eggs
	Sta-07-PLK	5/12/06	1 Egg
Alosa mediocris	Sta-01-EGG	4/24/06	3 Eggs
Morone saxatilis	Sta-08-PLK	4/25/06	19 Eggs
	Sta-08-PLK	5/02/06	7 Eggs
	Sta-01-PLK	5/04/06	1 Egg
	Sta-02-PLK	5/08/06	1 Egg
	Sta-04-PLK	5/08/06	1 Larva
	Sta-06-PLK	5/09/06	4 Larvae
	Sta-03-PLK	5/11/06	1 Larva
	Sta-04-PLK	5/11/06	1 Larva
	Sta-07-PLK	5/23/06	9 Eggs

Notes:
[a] Time period between 10 April and 2 June 2006 that eggs and larvae of targeted species were collected.

Table 4. Filtered volume of water sampled during plankton tows from 4 May through 2 June 2006.

Station	Date	Stationary (S)/ Towed (T)	Start Count[1]	End Count[1]	Volume (m^3)
1	5/4/2006	S	845704	841598	46.38
2	5/4/2006	S	848230	845705	28.52
3	5/4/2006	S	855355	848226	80.53
4	5/4/2006	S	858536	855353	35.96
5	5/4/2006	S	862626	858530	46.27
6	5/5/2006	S	830144	827301	32.11
7	5/5/2006	S	834212	830141	45.99
8	5/5/2006	S	837592	834206	38.25
9	5/5/2006	S	841593	837599	45.12
1	5/8/2006	S	803243	798780	50.41
2	5/8/2006	S	808689	803247	61.47
3	5/8/2006	S	816323	808680	86.34
4	5/8/2006	S	821063	816321	53.57
5	5/8/2006	S	827313	821060	70.63
6	5/9/2006	S	774814	766096	98.48
7	5/9/2006	S	784783	774818	112.57
8	5/9/2006	S	793425	784743	98.07
9	5/9/2006	S	798783	793417	60.61
1	5/11/2006	S	743768	739418	49.14
2	5/11/2006	S	739198	734550	52.50
3	5/11/2006	S	753133	743759	105.90
4	5/11/2006	S	759200	753143	68.42
5	5/11/2006	S	766095	759185	78.06
6	5/12/2006	S	717415	711092	71.43
7	5/12/2006	S	724550	717420	80.54
8	5/12/2006	S	729743	724552	58.64
9	5/12/2006	S	734550	729740	54.33
1	5/15/2006	S	698027	694418	40.77
2	5/15/2006	S	694422	694024	44.96
3	5/15/2006	S	703722	698030	64.30
4	5/15/2006	S	706502	703730	31.31
5	5/15/2006	S	710302	706500	42.95
6	5/16/2006	S	675342	669260	68.70
7	5/16/2006	S	682246	675340	78.01
8	5/16/2006	S	687752	682248	62.17
9	5/16/2006	S	694033	687754	70.93
1	5/18/2006	S	654614	649837	53.96
2	5/18/2006	S	649834	648893	10.63
3	5/18/2006	S	661242	654617	74.84
4	5/18/2006	S	664865	661250	40.84
5	5/18/2006	S	669261	664867	49.64
6	5/19/2006	S	634550	630419	46.67

Table 4. (concluded)

Station	Date	Stationary (S)/ Towed (T)	Start Count[1]	End Count[1]	Volume (m^3)
7	5/19/2006	S	639905	634543	60.57
8	5/19/2006	S	643494	639898	40.62
9	5/19/2006	S	648898	643494	61.04
1	5/22/2006	S	618840	612423	72.49
2	5/22/2006	S	612418	606291	69.21
3	5/22/2006	S	623637	618841	54.18
4	5/22/2006	S	625719	623640	23.48
5	5/22/2006	S	630417	625721	53.05
6	5/23/2006	S	593883	589818	45.92
7	5/23/2006	S	598674	593879	54.17
8	5/23/2006	S	601497	598672	31.91
9	5/23/2006	S	606294	601497	54.19
1	5/25/2006	S	580870	578125	31.01
2	5/25/2006	S	578120	574445	41.51
3	5/25/2006	S	584801	580880	44.29
4	5/25/2006	S	586060	584795	14.29
5	5/25/2006	S	589814	586043	42.60
6	5/26/2006	S	561878	558721	35.66
7	5/26/2006	S	566320	561880	50.15
8	5/26/2006	S	569552	566312	36.60
9	5/26/2006	S	574450	569552	55.33
1	5/30/2006	S	544960	540467	50.75
2	5/30/2006	S	540462	*	*
3	5/30/2006	T	549544	544957	51.82
4	5/30/2006	T	553958	549544	49.86
5	5/30/2006	T	558720	553959	53.78
6	5/31/2006	T	530510	525622	55.22
7	5/31/2006	T	531108	530518	6.66
8	5/31/2006	T	535919	531107	54.35
9	5/31/2006	S	538189	*	*
1	6/1/2006	S	514120	509023	57.58
2	6/1/2006	S	509021	506411	29.48
3	6/1/2006	S	516612	514130	28.34
4	6/1/2006	T	521071	516605	50.45
5	6/1/2006	T	525624	521066	51.49
6	6/2/2006	T	495346	489821	62.41
7	6/2/2006	S	497810	495344	27.86
8	6/2/2006	T	501865	497808	45.83
9	6/2/2006	S	506411	501866	51.34

* Count not recorded.

[1] Mechanical flow data prior to 5/4/06 was determined to be inconsistent and unreliable. The standard size rotor on the flow meter was not recording properly due to the low flows present in April and early May. After 5/4/06, the standard flow meter was replaced with a General Oceanic environmental flow meter (Model 2030-R6) which uses a low speed rotor specifically designed to sample at lower water velocities (less than 0.6m/sec).

Table 5. Comparison of egg and larval collections with flows and water temperatures from 21 April through 15 May 2006.[a]

Species	Date	Station	No. Egg(s)/Larva(e)	Flow (m/sec)	Water Temp (°C) (Surface)
Alosa sapidissima	4/21/06	9	1/0	0.540	20.6
	4/25/06	7	1/0	0.514	22.4
	5/2/06	6	3/0	1.0 [c]	18.2
	5/8/06	5	1/0	0.733	17.8
	5/9/06	7	2/0	0.768	18.1
	5/12/06	7	1/0	0.396	18.3
Morone saxatilis	4/25/06	8	19/0	0.388	22.5
	5/2/06	8	7/0	0.751	18.7
	5/4/06	1	1/0	0.460	20.1
	5/8/06	2	1/0	0.660	20.1
	5/8/06	4	0/1	0.545	20.1
	5/9/06	6	0/4	0.664	18.3
	5/11/06	3	0/1	1.055	18.7
	5/11/06	4	0/1	0.702	18.6
	5/23/06	7	9/0	0.280	23.1
Alosa mediocris	4/24/06 [b]	1	3/0	N/D	23.2

Notes:
[a] Time period between 10 April and 2 June 2006 that eggs and larvae of targeted species were collected.
[b] Egg collection pad samples
[c] Based on manual estimate of flow