Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina
Year 7: June 1, 2006 – May 31, 2007

Prepared for the U.S. Army Corps of Engineers, Wilmington District

Contract No DACW 54-02-0009

Project Manager

Courtney T. Hackney
Department of Biology and Marine Biology
University of North Carolina Wilmington
601 S. College Road
Wilmington, NC 28403

Principal Investigators

Courtney T. Hackney, Ph.D., Department of Biology and Marine Biology
Martin Posey, Ph.D., Department of Biology and Marine Biology
Lynn A. Leonard, Ph.D., Department of Geography and Geology
Troy Alphin, M.S., Department of Biology and Marine Biology
G. Brooks Avery, Jr., Ph.D., Department of Chemistry and Biochemistry
David M. DuMond, M.S. Adjunct Faculty, Department of Biology and Marine Biology

Research Associates

Jason L. Hall, B.A., Field Crew Chief and Senior Technician
Robert Lomax, B.S., Field Technician
Alex Croft, M.S., Research Specialist
Russ Barbour, M.S., Benthic Crew Chief

Student Field and Laboratory Assistants

David Moose, Devon Olivola, Steven Artabane, Sara Colosimo, Jennifer Kelly, Jeremy LaRosa, Ann Markwith, Antario McDonald, Mebane Sherard, Michael Tuttweiler, Nicole Lancaster, Jesse Baldwin, and Ben Kearns

JANUARY 2008

Acronyms Used in this Report

ANOSIM	Analysis of Similarity
ANOVA	Analysis of Variance
DCP	Data Collection Platform
M	Methanogenic
MPSR	Methanogenic with evidence of past sulfate reduction
MSL	Mean Sea Level
PPT	Parts Per Thousand
SR	Sulfate Reducing
SRNS	Sulfate reducing with non-seawater source of sulfate
UNCW	University of North Carolina Wilmington
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey

Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 7: June 1, 2006 – May 31, 2007

ABSTRACT

Despite a few mechanical problems that resulted in data loss at some stations, data loss this year was lower than most previous years because the base station, upon which all comparative data is based, lost only 4% of tides from all causes. The station that had the greatest loss of tidal range data was P14 (Prince George Creek), which lost 10.1% of tides due to mechanical errors. Similar to P9 (Black River), this site is prone to water level equipment failures during major flooding events that significantly raise water levels in the river. The remote nature of these two sites coupled with the conversion of phone towers to a digital only format has made problems more difficult to detect. Even with the typical data loss described, there were still more than 1400 tide ranges measured between 1 June 2006 and 31 May 2007 that were available for analyses.

A good correlation between measured tidal range from the base station at Ft Caswell (P1), and the predicted tidal range for this station continued to exist. Tidal range upstream diminished with distance upstream and water levels at the most upstream sites and the inner Town Creek station continued to be more affected by discharge rates in their respective drainages than stations lower in the river. Comparisons of the regression slopes, when tidal range at each site was regressed against P1 tidal range, yielded significant differences between this reporting period and the previous reporting period for almost one-half of the stations (P6, P7, P8, P9, and P11). When the slopes from this reporting period were compared to slopes calculated for Year 1 (2000-2001), only sites P2, P4, P6, and P11 yielded a significant difference in slope between years. There were also some significant differences in yearly mean tidal ranges between this reporting period and 2005-2006. These occurred primarily in the upstream stations. Mean tidal range at seven out of eleven of the river monitoring stations were significantly different from the mean tidal range reported in Year 1 of monitoring. This year (2006-2007) flow conditions were more similar to those reported during 2003-2004 and in excess of both Year 1 the 30 year average. The similarity in discharge rates between this project year and 2003-2004 reporting period, may explain the greater similarity in mean tidal ranges between these two reporting periods than between this reporting period and the previous 2 reporting periods. At present, our observations indicate that upstream discharge plays a significant role in determining mean tidal range.

In general, salinities at P8 (Eagle Island) were low (0.1-0.5 parts per thousand (ppt)) and reflected the range of salinities expected for normal to above average flow. However, in late summer to early fall 2006, river discharge was relatively low compared to the remainder of the year, and a maximum salinity (5.4 ppt) more indicative of drought conditions was recorded. September was the only month when site P8 exhibited salinity greater than 0.5 ppt. At P13, measured salinities were consistent with those expected

during average to above average flow conditions. The maximum salinity of 8.4 ppt occurred in May 2007 at this site.

For the first time this year, cruises upstream from P7 to Lock and Dam 1 were made to determine the degree that ocean-derived saline water extended upstream. During the nine cruises, flow over Lock & Dam 1 ranged from 963 cfs to 3,640 cfs. Collection in September 2006 found no saline water in the water column at any site. Data collected in May 2006, during the lowest flow period, also did not detect saline water at any site. No saline water was measured during any of the nine cruises upstream of P7.

There were some marked differences in flooding frequency within swamps and marshes at a number of upstream stations. Significant differences in tidal ranges, as noted earlier, occurred in 2006-2007 compared to both the previous reporting year and the initial year (2000-2001). Most occurred for upstream stations and likely result from inter-annual difference in upstream discharge. Thus, flooding at these stations is limited when mean water levels are lower and the mean tidal range is lower. Salinity largely reflected conditions in the river, i.e. generally lower.

The biogeochemistry of sediments in the current year was characterized by the fact that each month at P8 was independent of the previous month's condition indicating the lack of carryover from one month to the next. This suggests that sediments at P8 were well flushed. Consumption of sulfate in sediments was more rapid this year when present, resulting in conditions unable to support active sulfate reduction. This resulted in a combination of sulfate reducing, methane producing with evidence of past sulfate reduction, and even some methane reducing conditions where conditions were generally more sulfate reducing in past years. Patterns observed at P8, where analyses occur monthly, generally reflect lower, but highly variable, salinities resulting from higher flow rates from upstream drainage interacting with the strong tidal signal that occurs at this station. There were no discernible seasonal trends or patterns at Eagle Island during the current year similar to previous years where one season was more or less saline for an extended period. Pulses in salinity were observed during June, September, October, and May at individual subsites within P8. More freshwater led to more stations upstream of P8 becoming methanogenic and where there was sulfate reduction, it was highly variable.

Richness and diversity for 2006 infauna was intermediate and not significantly different from 2005. Analysis of Similarity and Multidimensional Scaling Analysis indicated that 1999-2001 samples did not have significantly dissimilar faunal assemblages from 2006. However, subsequent years after 1999-2001 did have distinct infaunal assemblages relative to the initial data as well as from each other. Note that benthic samples were collected in June and may reflect the hydrologic conditions described in the previous report more than those discussed here. There is often a notable lag in the response of the benthic community to changes in salinity.

Conversely, epibenthos (fish, crabs, shrimp, etc.) are mobile, collected in spring and fall and tend to reflect more recent hydrologic conditions than the benthos. Breder traps (a passive sampling device) deployed at multiple tidal positions within the marsh

and Drop traps (an active density based sampling method) deployed along the shallow subtidal marsh edge habitat, record both presence and movement of this important component of the estuary. Previous findings indicated changes in species patterns consistent with developing drought conditions in 2001 and 2002, though this period was also coincident with initial construction activity. The current 2006-2007 (spring 2007) sampling period also represents the initial stages of potential drought conditions (rainfall records <12 inches below annual average), but few indications of a response in the epibenthic fish community were noted. Normal seasonal differences include shifts in species compositions, richness, and diversity. Seasonal shifts in species composition and shifts in abundance were expected based on life history strategies of common taxa. Overall, fall 2006 and spring 2007 represented seasons with intermediate abundances, diversity, and species richness.

Monitoring of sensitive herbaceous vegetation at seven stations in the Cape Fear River estuary was completed for the seventh year in August 2006. Sensitive vegetation responds relatively quickly to hydrologic conditions covered in this year's report (June and July). Changes this year have been largely those anticipated based upon salinity. The dominant sensitive herbaceous species at P3 (Town Creek), *Zizaniopsis miliacea*, has expanded toward Town Creek where it is currently mixing with *Spartina cynosuroides*, a species more regularly associated with margins of more saline creeks. The stand of *Zizaniopsis miliacea* has largely ceased expansion in one direction, but appears to be expanding north toward the northern boundary of the belt transect. This year the polygon has increased in size by about 2,000 ft^2. *Zizania aquatica* appeared last year for the first time in the center of the older portion of the sensitive herbaceous vegetation polygon. This species, more of an indicator of oligohaline conditions, is continuing to survive. No new species were noted within the polygon this year.

At P7, no new sensitive herbaceous species were observed in the plot this year, but *Lycopus virginicus* once again became visible. Overall cover within the plot has diminished considerably due to loss of substrate from erosion. Relocation of this sampling station must be considered since the tidal swamp forest habitat along the Cape Fear River just south of Indian Creek is being cleared. Dollisons Landing (P8) contains two new species, *Hydrocotyle verticillata*, and *Lycopus virginicus.* Both species are characteristic of wooded freshwater wetlands, but the former is usually in non-tidal habitats and the latter is often associated with low hummocks or rotten stumps. *Saururus cernuus* contributed less cover this year. Black River (P9) has experienced no salinity events and has remained much the same as last year with the exception of the loss of *Ludwigia palustris*.

In the Northeast Cape Fear River stations, boundaries of Rat Island's (P12) sensitive herbaceous vegetation plot have remained fixed since last year and dominance is still largely shared between *Schoenoplectus americanus*, the sensitive herbaceous species, and *Spartina cynosuroides*, the non-sensitive herbaceous species. Cover by live stems of *Schoenoplectus americanus* is down from 90 percent last year to 50 percent this year. This year many of the stems of this species have fallen or show signs of stress, perhaps from salinity events that occurred late last year. There are no new sensitive

herbaceous plant species this year, but *Peltandra virginica* was again present, likely from rhizomes. At Fishing Creek (P13), the sensitive herbaceous polygon has shown a loss of cover by the long dominant *Pontederia cordata* and for the first time, *Peltandra virginica*, more tolerant of low salinity habitats, became the overall dominant plant in the plot. This shift, along with a slow increase in diversity at the site may indicate a slight shift toward more brackish conditions. No significant salinity event was detected at the Prince George Creek (P14) monitoring station and the sensitive herbaceous polygon remains much as it was last year.

Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 7: June 1, 2006 – May 31, 2007

TABLE OF CONTENTS

Page

COVER SHEET i

ABSTRACT ii

TABLE OF CONTENTS vi

LIST OF TABLES viii

LIST OF FIGURES xii

LIST OF APPENDICES xiv

1.0 STATION OPERATION 1
- 1.1 Summary 1
- 1.2 Methodology 1
- 1.3 Ft Caswell (P1) 2
- 1.4 Town Creek Mouth (P2) 4
- 1.5 Inner Town Creek (P3) 4
- 1.6 Corps Yard (P4) 4
- 1.7 Eagle Island (P6) 4
- 1.8 Indian Creek (P7) 4
- 1.9 Dollisons Landing (P8) 5
- 1.10 Black River (P9) 5
- 1.11 Smith Creek (P11) 5
- 1.12 Rat Island (P12) 5
- 1.13 Fishing Creek (P13) 5
- 1.14 Prince George Creek (P 14) 5

2.0 MONUMENT AND STATION SURVEY VERIFICATION 6
- 2.1 Summary 6

3.0 PART A - RIVER WATER LEVEL/SALINITY MONITORING 6
- 3.1A Summary 6
- 3.2A Database 8
- 3.3A Data Analyses Methods 8
- 3.4A Tidal Effects 15
- 3.41A Ft. Caswell (P1) and Outer Town Creek (P2) 15
- 3.42A Inner Town Creek (P3) 18

3.43A Corps Yard (P4) 19
3.44A Cape Fear River: Eagle Island (P6), Indian Creek (P7), Dollisons Landing (P8) and Black River (P9) 20
3.45A Northeast Cape Fear River: Smith Creek (P11), Rat Island (P12), Fishing Creek (P13), and Prince George Creek (P14) 24
3.5A Influence of Upstream Flow 27
3.6A Tidal Harmonics 29

3.0 PART B – SALINITY PROFILES IN THE CAPE FEAR RIVER TO LOCK AND DAM 1 34
3.1B Summary 34
3.2B Background 34
3.3B Methods 36
3.4B Results 36

4.0 MARSH/SWAMP FLOOD AND SALINITY LEVELS 37
4.1 Summary 37
4.2 Data Base 37
4.3 Marsh/Swamp Flooding 43
4.4 Water Salinity in Marshes and Swamps 44

5.0 MARSH/SWAMP BIOGEOCHEMISTRY 45
5.1 Summary 45
5.2 Geochemical Theory and Classification 45
5.3 Geochemical Methodology 46
5.4 Eagle Island (P6) Annual Cycles of Sulfate, Chloride & Methane 47
5.5 Marsh/Swamp Transect Stations, Geochemistry, Annual Variability 55
5.51 Town Creek (P3) 55
5.52 Indian Creek (P7) 89
5.53 Dollisons Landing (P8) 97
5.54 Black River (P9) 98
5.55 Smith Creek (P11) 98
5.56 Rat Island (P12) 98
5.57 Fishing Creek (P13) 99
5.58 Prince George Creek (P14) 100
5.6 Long Term Trends and Change 110

6.0 BENTHIC INFAUNAL COMMUNITIES 113
6.1 Summary 113
6.2 Background 113
6.3 Methodology 115
6.4 Faunal Patterns 116

7.0 EPIBENTHIC STUDIES: DECAPODS AND EPIBENTHIC FISH 144
7.1 Summary 144
7.2 Background 144

7.3 Methodology 147
7.4 Community Evaluation 148

8.0 SENSITIVE HERBACEOUS VEGETATION SAMPLING.....192
8.1 Summary 192
8.2 Introduction and Background 193
8.3 Methodology 194
8.4 Hydrologic Events and Sensitive Vegetation 195
8.41 Inner Town Creek 195
8.42 Indian Creek.....199
8.43 Dollisons Landing.....203
8.44 Black River 206
8.45 Rat Island 208
8.46 Fishing Creek.....211
8.47 Prince George Creek.....214
8.5 Discussion.....217

9.0 LITERATURE CITED 219

LIST OF TABLES

Table Page
1.1-1 Percentages of tides unavailable for analysis and reasons for loss.....2
3.3A-1 Monthly maximum, minimum, and range of salinity values for each station.....10
3.3A-2 Summary of statistical analyses of mean annual water level comparisons for each of the 11 data collection platforms (DCP).....13
3.3A-3 Summary of statistical tests for yearly data collected at the 11 DCP stations 13
3.3A-4 Summary of tidal data generated from the 11 DCP stations along the Cape Fear River and tributaries 14
3.3A-5 Yearly comparisons of mean monthly maximum and minimum water levels collected at the 11 DCP stations.....15
3.5A-1 Mean tidal ranges for upriver stations in both the Cape Fear River and Northeast Cape Fear River.....29
3.6A-1 Summary of tidal harmonics for reporting period 2006-2007.....30
3.6A.2 Summary of yearly tidal harmonics for station P4 from 1994 to 2006 32
4.2-1 Flooding frequency, duration and depth, and actual water level of marsh/swamp substations during fall 2006.....37
4.2-2 Flooding frequency, duration and depth, and actual water level of marsh/ swamp substations during spring 2007 39
4.2-3 Summary of salinity data from nine substations collected along the Cape Fear River and its tributaries in fall 2006 41
4.2-4 Summary of salinity data from nine substations collected along the Cape Fear River and its tributaries in spring 2007 42

5.4-1 Eagle Island (P6) Geochemical Classifications by month 54
5.51-1 Salinity of Sites 56
5.51-2 Classification of Sites in Summer 64
5.51-3 Classification of Sites in Winter 72
5.51-4 Methane Concentrations of Sites 80
5.52-1 Sulfate Concentrations of Sites 89
5.58-1 Chloride Concentrations of Sites 101
6.4-1a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected on the Town Creek mouth site (P2) during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 117
6.4-1b Mean (no. per 0.01 m^2) and (standard error) for all taxa collected on the Town Creek mouth site (P2) during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 118
6.4-2a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3A upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 119
6.4-2b Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3A upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 120
6.4-3a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3B upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 121
6.4-3b Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3B upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 122
6.4-4a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at the lowest main-stem Cape Fear site P6 during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 123
6.4-4b Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at the lowest main-stem Cape Fear site P6 during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 124
6.4-5a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P7 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 125
6.4-5b Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P7 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 127
6.4-6a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P8 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 128
6.4-6b Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P8 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 129
6.4-7a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P11 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 130

6.4-7b Mean (no. per 0.01 m^2) and (standard deviation) for all taxa collected at P11 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 131
6.4-8a Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P12 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 132
6.4-8b Mean (no. per 0.01 m^2) and (standard deviation) for all taxa collected at P12 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 133
6.4-9a Mean (no. per 0.01 m^2) and (standard deviation) for all taxa collected at P13 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 134
6.4-9b Mean (no. per 0.01 m^2) and (standard deviation) for all taxa collected at P13 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006 135
6.4-10 Among year comparison of species richness for the infaunal community 137
6.4-11 Among year comparison of species diversity for the infaunal community 139
6.4-12 Among-year comparison of diversity and species richness for each site 141
7.4-1a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P2 (Mouth of Town Creek) 152
7.4-1b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P2 (Mouth of Town Creek) 153
7.4-2a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P3A (Town Creek) 154
7.4-2b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P3A (Town Creek) 155
7.4-3a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P3B (Town Creek) 156
7.4-3b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P3B (Town Creek) 157
7.4-4a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P6 (Eagle Island) 158
7.4-4b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P6 (Eagle Island) 159
7.4-5a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P7 (Indian Creek) 160
7.4-5b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P7 (Indian Creek) 161
7.4-6a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P8 (Dollisons Landing) 162
7.4-6b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P8 (Dollisons Landing) 163
7.4-7a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P11 (Smith Creek) 164

7.4-7b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P11 (Smith Creek) 165
7.4-8a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P12 (Rat Island) 166
7.4-8b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P12 (Rat Island).....167
7.4-9a Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P13 (Fishing Creek) 168
7.4-9b Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P13 (Fishing Creek).....169
7.4.10a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P2 (Mouth of Town Creek).....170
7.4.10b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P2 (Mouth of Town Creek) 171
7.4.11a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P3 (Town Creek).....172
7.4.11b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P3 (Town Creek) 173
7.4-12a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P6 (Eagle Island).....174
7.4-12b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P6 (Eagle Island) 175
7.4.13a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P7 (Indian Creek).....176
7.4.13b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P7 (Indian Creek) 177
7.8-14a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P8 (Dollisons Landing).....178
7.8-14b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P8 (Dollisons Landing).....179
7.4-15a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P11 (Smith Creek) 180
7.4-15b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P11 (Smith Creek) 181
7.4-16a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P12 (Rat Island) 182
7.4-16b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P12 (Rat Island).....183
7.4-17a Mean abundance (SE) for epibenthic fauna collected in fall drop trap sampling at station P13 (Fishing Creek).....184
7.4-17b Mean abundance (SE) for epibenthic fauna collected in spring drop trap sampling at station P13 (Fishing Creek).....185
7.4-18 Comparison of species richness by year for fall Breder trap samples 186
7.4-19 Comparison of species richness by year for spring Breder trap samples 186
7.4-20 Comparison of species diversity by year for fall Breder trap samples 187
7.4-21 Comparison of species diversity by year for spring Breder trap samples.....187

7.4-22 Comparison of total abundance by year for fall Breder trap samples.....188
7.4-23 Comparison of total abundance by year for spring Breder trap samples.....188
7.4-24 Comparison of species richness by year for fall drop trap samples.....189
7.4-25 Comparison of species richness by year for spring drop trap samples.....189
7.4-26 Comparison of species diversity by year for fall drop trap samples.....190
7.4-27 Comparison of species diversity by year for spring drop trap samples.....190
7.4-28 Comparison of total abundance by year for fall drop trap samples.....191
7.4-29 Comparison of total abundance by year for spring drop trap samples 191
8.2-1 Locations, streams and numbers of sensitive herbaceous vegetation monitoring stations in the Wilmington Harbor monitoring project, Cape Fear River Estuary, North Carolina.....193
8.41-1 Comparisons of areas (ft^2) of sensitive herbaceous vegetation polygons for years 2000-2006 at sensitive herbaceous vegetation monitoring stations, Wilmington Harbor monitoring project, Town Creek, North Carolina.....196
8.41-2 Comparisons of percent cover contributions by sensitive herbaceous species in major (and outlier) polygons at the Inner Town Creek Station (P3) for years 2000-2006, Wilmington Harbor monitoring project, Town Creek, North Carolina 197
8.42-1 Comparisons of percent cover contributions by sensitive herbaceous species in the sampling polygon at the Indian Creek Station (P7) for years 2000-2006, Wilmington Harbor monitoring project, Cape Fear River, North Carolina.....200
8.43-1 Comparisons of percent cover contributions by sensitive herbaceous species in the sampling polygon at the Dollisons Landing Station (P8) for years 2000-2006, Wilmington Harbor monitoring project, Cape Fear River, North Carolina 204
8.44-1 Comparisons of percent cover contributions by sensitive herbaceous species in old polygons from years 2000-2004 and new sensitive herbaceous polygon for 2005 and 2006 at the Black River (P9), Wilmington Harbor monitoring project, Cape Fear River, North Carolina.....206
8.45-1 Comparisons of percent cover contributions by sensitive herbaceous species in the polygon for years 2000-2006 at the Rat Island (P12), Wilmington Harbor monitoring project, Northeast Cape Fear River, North Carolina 209
8.46-1 Comparisons of percent cover contributions by sensitive herbaceous species in polygons from years 2000-2006 at the Fishing Creek Station (P13), Wilmington Harbor monitoring project, Northeast Cape Fear River, North Carolina.....211
8.47-1 Comparisons of percent cover contributions by sensitive herbaceous species in polygons from years 2000-2006 at the Prince George Creek Station (P14), Wilmington Harbor monitoring project, Northeast Cape Fear River, North Carolina 215

LIST OF FIGURES

Figure		Page
1.2-1	Location of permanent stations on the Cape Fear River estuary and tributaries	3
3.3A-1	Mean tidal range for each station for all monitoring years	9
3.41A-1	Plot of predicted tidal range at P1 relative to measured tidal range at P1 for June 2006 to May 2007	17
3.41A-2	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Outer Town Creek (P2)	17
3.42A-1	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Inner Town Creek (P3)	18
3.43A-1	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and the Corps Yard station (P4)	20
3.44A-1	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Eagle Island (P6)	22
3.44A-2	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Indian Creek (P7)	22
3.44A-3	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Dollisons Landing (P8)	23
3.44A-4	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Black River (P9)	23
3.45A-1	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Smith Creek (P11)	25
3.45A-2	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Smith Creek (P12)	25
3.45A-3	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Fishing Creek (P13)	26
3.45A-4	Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Prince George Creek (P14)	26
3.5A-1	Mean discharge for each monitoring period	28
3.5A-2	Plot showing discharge in the Cape Fear River at Lock 1 for the current monitoring period	28
3.1B-1	Sites 1 through 4 were the stations closest to the ocean and did not detect saline water at any depth during the period of lowest stream flow measured over Lock and Dam 1	34
3.2B-1	Location of salinity depth sampling stations	35
4.3-1	Water level flux at Fishing Creek (P13) at subsite 1 from 6-20 December 2006 illustrating the low frequency of surface flooding during this two week (27 tides) interval	44
5.4-1	Methane concentrations of Eagle Island porewaters vs. month	49
5.4-2	Sulfate concentrations of Eagle Island porewaters vs. month	50
5.4-3	Chloride to sulfate ratios of Eagle Island porewaters vs. month	51
5.4-4	Salinities of Eagle Island porewaters vs. month	52
6.4-1	Multidimensional Scaling plot for infaunal community assemblages by sites and years	140

6.4-2 Mean diversity for all sites sampled in 2006 142
6.4-3 Mean species richness for all sites sampled in 2006.....143
7.4-1 Analysis of similarity (PRIMER 6.0) based on spring drop trap samples from 2000 to 2007.....150
7.4-2 Analysis of similarity (PRIMER 6.0) for fall drop trap samples from 1999 to 2006 150
8.41-1 Comparison of sensitive herbaceous vegetation polygons from years 2000, 2004, 2005, and 2006 at station P3 (Inner Town Creek), Wilmington Harbor Monitoring Project, Town Creek, North Carolina 198
8.42-1 Sensitive herbaceous vegetation polygon from year 2003 at station P7 (Indian Creek), Wilmington Harbor Monitoring Project, Cape Fear River, North Carolina.....202
8.43-1 Sensitive herbaceous vegetation polygon from year 2003 at station P8 (Dollisons Landing), Wilmington Harbor Monitoring Project, Cape Fear River, North Carolina 205
8.44-1 Comparison of sensitive herbaceous vegetation polygons from years 2000, 2004, and 2005 at station P9 (Black River), Wilmington Harbor Monitoring Project, Cape Fear River, North Carolina.....207
8.45-1 Sensitive herbaceous vegetation polygon from year 2000 at station P12 (Rat Island), Wilmington Harbor Monitoring Project, Northeast Cape Fear River, North Carolina 210
8.46-1 Comparison of sensitive herbaceous vegetation polygons from years 2000, 2005, and 2006 at station P13 (Fishing Creek), Wilmington Harbor Monitoring Project, Northeast Cape Fear River, North Carolina.....212
8.46-2 River flow along the Northeast Cape Fear River at the NC 53 Bridge near Burgaw, NC 214
8.47-1 Comparison of sensitive herbaceous vegetation polygons from years 2000, 2005, and 2006 at station P14 (Prince George Crook), Wilmington Harbor Monitoring Project, Northeast Cape Fear River, North Carolina 216

LIST OF APPENDICES

APPENDIX

A LIST OF TIDAL RANGE DATA FOR ALL 14 STATIONS USED TO GENERATE FIGURES AND TABLES IN SECTION 3.0 (1 June 2006 – 31 May 2007)

B CRUISE DATABASE BY DATE AND SITE SHOWING ALL PARAMETERS COLLECTED BY DEPTH.

C SALINITY PROFILES FOR ALL SITES FOR ALL COLLECTION DATES

D LIST OF SPECIES, COMMON NAMES, AND AUTHORITIES FOR PLANTS SEEN IN OR NEAR POLYGONS AT SAMPLING STATIONS IN THE CAPE FEAR ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

E METADATA COVERING GIS/GPS FILES USED IN TEXT FIGURES IN SENSITIVE HERBACEOUS VEGETATION POLYGONS: 2006 ASSESSMENTS AT SEVEN STATIONS ESTABLISHED FOR THE WILMINGTON HARBOR MONITORING PROJECT IN THE CAPE FEAR RIVER ESTUARY, NORTH CAROLINA

F AREAS AND LOCATIONS OF NEW YEAR 2006 SENSITIVE HERBACEOUS SPECIES POLYGONS AT SAMPLING STATIONS IN THE CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

1.0 STATION OPERATION

1.1 Summary

Measurement of water levels in the main channel of the Cape Fear River, the Northeast Cape Fear River, and Town Creek continue to provide data necessary to determine the impact associated with the widening and deepening the Cape Fear River. Differences between the high and low points of each tide, referred to as ranges in this report, can be followed upstream from the base station at Ft Caswell (P1) to any individual station. Differences between stations with respect to tidal range, time to high or low tide, length of low and high tides were also determined. Comparisons of these variables before and after channel modifications will provide the statistical testing mechanism to examine whether the project has impacted adjacent wetlands. In addition, the absolute elevation of floodwater when related to measurements of water levels at marsh/swamp substations allows the determination of both flood duration and flood depth for any tide. This report includes data collected from June 2006 through May 2007. During this period, problems of communication with instruments or minor instrument malfunction were solved as they occurred. Mechanical errors were slightly higher at some sites this year than during previous reporting periods, and this may reflect the age of some of the equipment. As was the case in previous monitoring years, each tide has been examined for each station and a determination made as to whether the data collected are reliable. Table 1.1-1 provides a general summary of all data loss for present and future comparisons.

1.2 Methodology

Water level at each station was sampled by a UNIDATA shaft-encoded water level recorder housed in an aluminum stilling well at 1-second intervals. A UNIDATA Starlogger logged the average, maximum, and minimum values every 3 minutes. Conductivity and temperature were also sampled by a UNIDATA conductivity instrument and recorded by the Starlogger every 3 minutes. Data were downloaded to a PC housed in the laboratory every 2 weeks via modem. In instances when the modem did not function properly, technicians on site downloaded data loggers using a laptop. Preliminary data quality review consisted of visually reviewing data for major problems (e.g. float hang-ups in the stilling well, data transmission errors, large jumps/shifts in water level, loss of data) within 2-3 days of download. This process was done so that any major problems identified could be rectified immediately. Data were then compiled into files each of which contained one month of data for each station. Data files were then sorted at 6 minutes intervals and the resulting data set stored for subsequent data analysis. As in previous reporting periods, the terms used to describe general mechanisms through which data are lost or compromised are defined below:

<u>Loss at Station P1</u>: Because the response of each variable upstream (Figure 1.2-1) is related to the base station at Ft Caswell (P1), the loss of a variable from P1 during a particular tide means that there is no means of comparison with other stations. Reasons for data loss at P1 as well as other stations are: 1) <u>QA/QC Procedure</u>, which refers to tides that were removed from the data set when measurements coincided with QA/QC and equipment maintenance procedures. In these instances, recorded water levels were

inaccurate due to cleaning the water level float, removing/replacing the water level recorder, replacing the beaded cable, or performing a field reset when in-situ observations of water level were inconsistent with water levels reported by the data logger. 2) Under ranging events refers to tides that were removed from the data set when the actual water level fell below the elevation of the stilling well cap. In these instances, the instruments were unable to detect the minimum water level. 3) Absence of Data refers to tides that were lost when data were not recorded by the data logger or were not transmitted properly via the modem or PC download process. 4) Freezing of surface water in the stilling well prohibited the float from following the rise and fall of the tides and these tides were removed. 5) Mechanical Errors refer to tides removed from the data set during the data review process because of likely mechanical malfunction. Mechanical malfunctions were suspected when the plotted data exhibited misshapen curves, large jumps, and flat lines (i.e. hang-ups).

Table 1.1-1. Percentages of tides removed from analysis and reasons for loss. Detailed descriptions of "loss" categories are listed in Section 1.2 above.

Station	% Loss At Station P1	% QA/QC	% Under-ranging Events	% Absence of Data	% Freezing	% Mechanical Errors	Total % Lost Tides
P1	N/A	0	0	0	0	4.0	4.0
P2	4.0	0.2	0.4	0	0	0.3	4.9
P3	4.0	0	0	0.9	0	3.1	8.0
P4	4.0	0	0	0	0	0.1	4.1
P6	4.0	0	0.2	4.7	0	0.1	8.8
P7	4.0	0.1	1.4	1.6	0.1	1.0	8.2
P8	4.0	0.8	0	2.3	0	3.9	11.0
P9	4.0	0.5	0	1.8	0	4.7	11.0
P11	4.0	0.4	0	0	0	0.9	5.3
P12	4.0	0.3	0	1.3	0	0.6	6.2
P13	4.0	0.1	0	0	0	0.4	4.5
P14	4.0	0.8	0	0.4	0	10.1	15.3

1.3 Ft Caswell (P1)

Ft Caswell is the most important station because this station experiences amplitude changes that are essentially oceanic tides. All upstream water levels are related to this station. This station functioned well during the reporting period. The total percentage of lost tides at this station from June 2006 to May 2007 (4.0%) was lower than during the previous three reporting periods (6.9%, 10.2%, and 8.0%). Data collected at this station still show occasional irregularities in the shape of the water level curves but these variations do not affect the reported minimum and maximum water level values (i.e. reported tidal range). The station was mostly affected by passing weather systems that caused erroneous data collection during high wind and wave action. Monthly QA/QC checks and cleaning of probes, at this very saline station, and the well interior seem to prevent most minor problems before they occur. Corrosion of the beaded cable also affects data quality; therefore, cable integrity is assessed each month and the cable replaced when necessary.

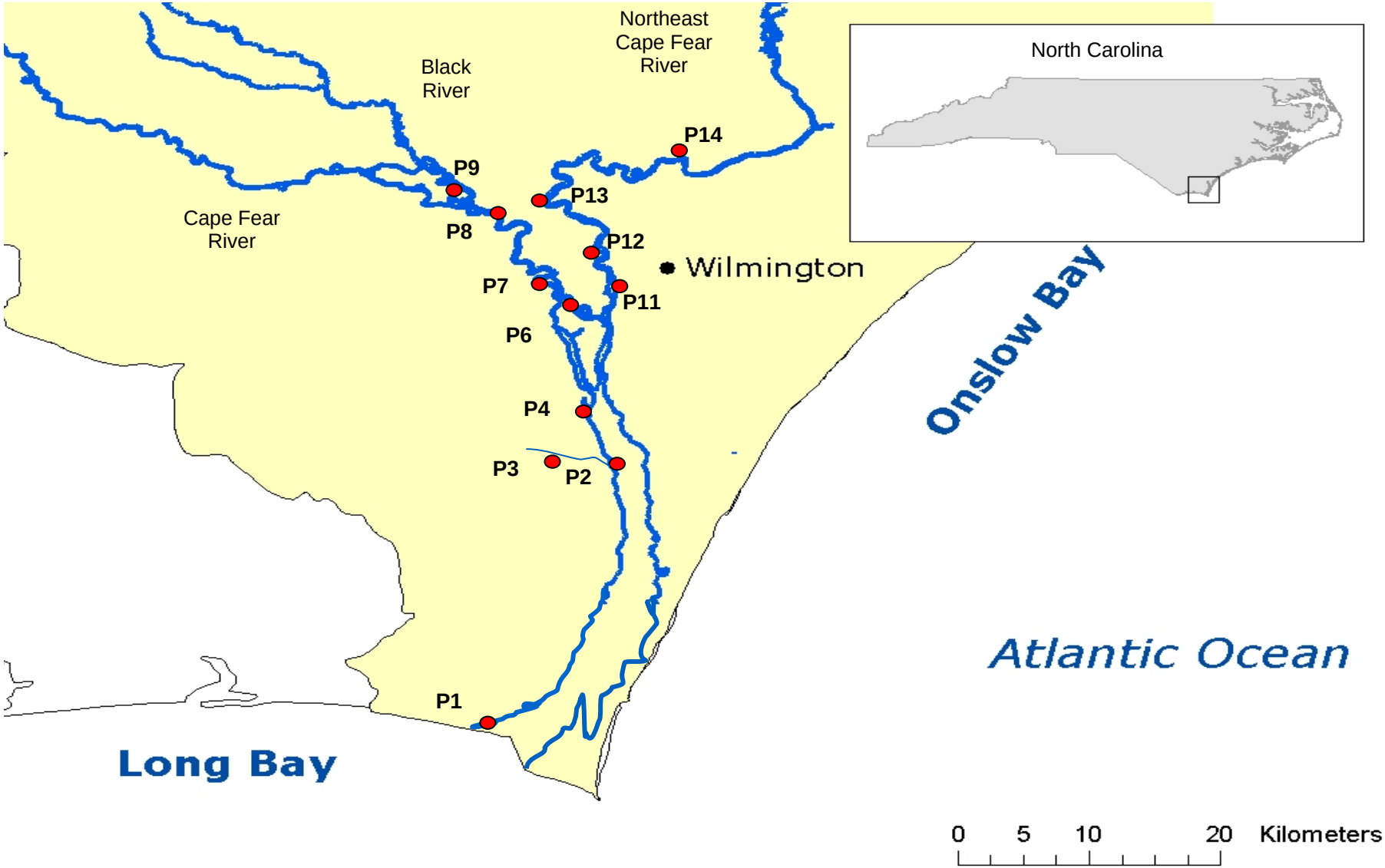


Figure 1.2-1. Location of permanent stations on the Cape Fear River estuary and tributaries.

1.4 Town Creek Mouth (P2)

Water level curves at this station can be noisy due to periods of what appear to be high frequency variations in water level. These episodes do not occur with any regular periodicity and are believed to be associated with nearby ship traffic. Nonetheless, these data are of sufficient quality to regularly identify maximum and minimum water levels and these data correspond well with data from P1. The total percentage of lost tides at this station (4.9%) was less than during 2005-2006 reporting period (11.7%). P2 experienced just a few mechanical errors this reporting period. Minor data loss also occurred during QA/QC resets. Under-ranging, which was non-existent during the last reporting period, was a minor problem during this reporting period. Water relatively high in salinity at this site continues to affect the beaded cables, necessitating their replacement on occasion.

1.5 Inner Town Creek (P3)

This station generally experiences few problems and continues to generate smooth tidal curves. Data loss during this reporting period was slightly less than last year (12.0%). Mechanical problems continued to be the primary cause of data loss at P3 comprising 3.1% of total tides. In July, a power issue caused the batteries and water level equipment to fail. This event resulted in a loss of just less than 1% of total tides.

1.6 Corps Yard (P4)

NOAA operates the tidal gauge at this site and data are available at their website after curve-smoothing procedures are applied. The UNCW conductivity/salinity gauges located at this site have operated with only a few problems over the reporting period.

1.7 Eagle Island (P6)

During this reporting period, data loss at this station was considerably less (8.8%) than during the 2005 to 2006 project year (33.3%). The primary cause of failure during this reporting period was tides lost to absence of data. Data were lost when the water level instrument was removed, serviced, and replaced during August 2006. QA/QC water level resets and minor mechanical issues also resulted in some tide loss, although this loss was minor (less than 1%).

1.8 Indian Creek (P7)

Under-ranging continued to be problematic during the 2006-2007 sampling period (1.4% of total tides). However, this was less than the percentage of under ranging events reported during the 2005-2006 sampling period (4.5% of total tides). This site continued to experience infrequent mechanical errors resulting in a loss of 1% of total tides.

1.9 Dollisons Landing (P8)

As was the case in previous reporting periods, this station experienced a high percentage of total tides lost (11%) due to various mechanical errors and absence of data; although this percentage was dramatically less then the 2005-2006 reporting period (31.2%). As in previous years, the mechanical errors were usually associated with the water level cable getting snagged in the stilling well. On a positive note, the problem with the cell tower at P8 has been fixed this reporting year, and the station is now able to be remotely downloaded.

1.10 Black River (P9)

Site P9 experienced a loss of 11% of total tides for the 2006-2007 reporting period. Data loss at the station was primarily associated with mechanical errors (4.7%) resulting from periodic river flooding that interrupted operation of the water level recorder. Data absences also occurred following some flooding events. During this reporting period, this station required many water level resets due to a gradual drift in the water level recorder.

1.11 Smith Creek (P11)

Similar to the previous reporting period, P11 has operated with very few problems during the 2006-2007 period. The percentage of total tides lost was only 5.3%. Approximately 1% of the total tides were lost due to QA/QC and minor mechanical problems combined.

1.12 Rat Island (P12)

The percentage of total tides lost from this site was comparable to the 2005-2006 reporting period. Similar to the previous reporting period, tide loss resulted from water level jumps and subsequent QA/QC visits required to correct the problem. Further, some mechanical problems resulted in loss of water level data. The total tide loss for this site was approximately 2% of total tides.

1.13 Fishing Creek (P13)

The percentage of lost tides at this site was comparable to the previous reporting period. As was the case during the 2005-2006 reporting period, this site operated exceedingly well with a 0.5% loss of tides due to mechanical or other problems.

1.14 Prince George Creek (P14)

As with the other stations on the Northeast Cape Fear River, the performance of P14 was similar to the previous reporting period. The percentage of total tides lost due to mechanical errors was (10.1%). Similar to P9, this site is prone to water level equipment failures during major flooding events.

2.0 MONUMENT AND STATION SURVEY VERIFICATION

2.1 Summary

Elevation monuments remain stable. There have been extensive alteration of the vegetation at P7, which damaged subsite elevation monuments, but the primary monument does not appear to have been altered. This tidal swamp is undergoing development of some sort. If and when the development stops, subsites distant from the river edge must be resurveyed by professional surveyors to reestablish accurate NAVD88 elevations.

3.0 PART A - RIVER WATER LEVEL/SALINITY MONITORING

3.1A Summary

More than 1,400 tide ranges measured between 1 June 2006 and 31 May 2007 (Appendix A) were used to conduct analyses of changes in tidal amplitude as well as changes of ebb and flood duration. A good correlation between measured tidal range from the base station at Ft Caswell and the predicted tidal range for this station continues to exist. When observed tidal ranges were regressed against predicted tidal ranges at P1, there was no difference in the slope of the regression between this reporting period and the previous reporting period. The mean tidal range at P1 was not significantly different from the mean reported in the previous monitoring period, but was significantly lower than the range reported in Year 1. Tidal ranges within the estuary were fairly constant, including the lowermost of the upstream stations, and were higher than tidal ranges measured at most upstream stations. Water levels in the most upstream sites and the inner Town Creek station continued to be affected by discharge rates in their respective drainages, however, some sites also may have been affected by local processes including ship traffic, siltation, and potentially by land clearing activities. Some significant differences in yearly mean tidal ranges between this reporting period and 2005-2006 were observed and these occurred primarily in the upstream stations. Mean tidal range at seven out of eleven of the river monitoring stations were significantly different from the mean tidal range reported in Year 1 of monitoring. This finding contrasts with the previous reporting period where only two stations (P1 and P7) showed significant differences in tidal range between this reporting period and the first year of monitoring. The observation that mean tidal range observed at P1 (Ft. Caswell) is again significantly less than in Year 1 continues to complicate interpretation of the results as this station was initially expected to be unimpacted by river widening activities. Similar to the pattern reported last year, mean monthly maximum water levels for this reporting period were not significantly different from the values reported for the previous monitoring period with the exception of sites P2 and P9. There also was no significant difference in mean monthly minimum water level between this reporting period and last year with the exception of sites P2 and P6. Comparisons of the regression slopes when tidal range at each site was regressed against P1 tidal range yielded significant differences between this reporting period and the previous reporting period for almost one-half of the stations (P6, P7, P8, P9, and P11). When the slopes from this reporting period were compared to

slopes calculated for Year 1 (2000-2001), only sites P2, P4, P6, and P11 yielded a significant difference in slope between years.

Both the high tide and low tide lag values were comparable to those reported last year. In the mainstem, where changes were noted, the mean high tide lag from P1 decreased minimally relative to the lag times reported in 2005-2006, while mean low tide lag increased slightly at most stations. This trend contrasts with the previous reporting period where slight increases were observed. In the Northeast Cape Fear River, changes in tidal lag also were minor and consisted of slight increases in mean high tide lag and slight decrease in low tide lag at most stations. During this reporting period, mean flood duration changed by less than 1% at all stations. Mean ebb duration also varied little from those values reported in the last monitoring period (<1%). For the minor flood and ebb durations that were observed, the flood duration slightly decreased, while the ebb duration slightly increased at most stations. This pattern contrasts with the previous two reporting periods where flooding duration increased and ebb tide durations decreased at most monitoring stations.

Periods of lower, drought-induced water levels and extreme flooding in the system over the last five years have contributed to differing tidal conditions in the Cape Fear and Northeast Cape Fear Rivers between monitoring years. These effects are confounded by the shortened data set for Year 1, which included data collected from October to June, only, and covered a period when monthly river discharge was below the long-term average (~5,531 ft^3/s) reported by the USGS at Lock and Dam 1 on the Cape Fear mainstem. This reporting period, the mean discharge is comparable to the mean discharge that existed during Year 4 (2003-2004). The similarity in discharge rates between this project year and 2003-2004, may explain the greater similarity in mean tidal ranges between these two reporting periods than between this reporting period and the previous two reporting periods. At present, our observations indicate that upstream discharge plays a significant role in determining mean tidal range; however, they remain somewhat inconsistent with the expected effects of dredging. Additional types of data analyses will be necessary to elucidate the relative effects of channel modification and upstream discharge on tidal attributes.

Harmonic analysis of tidal constituents has continued during this reporting period. For all of the stations, the M2 component is the dominant constituent as expected. A longer water level time series exists at station P4, allowing for examination of tidal harmonics for several years prior to the initiation of dredging. Over the 12 year period between 1994 and 2006, however, neither the amplitude nor the phase of the M2 constituent has changed appreciably. For the most part, the amplitude of the M2 constituent at P4 has varied between 2.03 and 2.09. As expected, the M2 amplitude at sites just upstream and downstream of P4 (e.g. P2, P6, and P11) are more similar to P4 than to other sites in the river. As with mean water level, changes in harmonic amplitude appear to be linked to variations in discharge. This relationship will be examined in greater detail following completion of dredging activities.

In 2000-2001, salinity did not exceed 1 ppt at stations upstream of Eagle Island on the Cape Fear River because of the continuous release of freshwater upstream. In 2001-2002 and 2002-2003 drought conditions existing in the region reduced upstream releases in the Cape Fear River. During these years, salinities as high as 5.8 ppt were measured at P8 while salinities exceeding 14 ppt were measured at P13, 8 miles north of Point Peter in the Northeast Cape Fear River. Project years 2003-2004 and 2004-2005 were periods of more typical flow conditions in the river, and maximum salinities for P8 and P13 were much lower (0.2 ppt and 8.6 ppt, respectively). During this reporting period, flow conditions were more similar to those reported during 2003-2004 and in excess of the 30 year average. In general, salinities at P8 were low (0.1-0.5 ppt) and reflected the range of salinities expected for normal to above average flow. However, in late summer early fall 2006, river discharge was relatively low compared to the remainder of the year, and a maximum salinity (5.4 ppt) more indicative of drought conditions was recorded. September was the only month when site P8 exhibited a salinity greater than 0.5 ppt. At P13, measured salinities were consistent with those expected during average to above average flow conditions. The maximum salinity of 8.4 ppt occurred in May 2007 at this site. Discharge data are not available for the Northeast Cape Fear to enable a direct comparison of salinity to discharge, although discharge measured in the Cape Fear mainstem indicates increased flow in April and early May.

3.2A Database

Water level, conductivity, and temperature data collected at DCP stations from June 2006 through May 2007 are incorporated in this report. This year's database includes approximately 1,400 tides of sufficient quality to be used in the analyses of each of the 11 DCP stations. Specific problems associated with each station have been described in Section 1.0 of this report. Table 1.1-1 summarizes the percentage of tides unavailable for analysis due to the various reasons cited above.

3.3A Data Analyses Methods

Maximum, minimum, and mean water level and conductivity/ temperature were recorded every 3 minutes. The final data set used for analyses consists of 3-minute averages of water level and conductivity collected every 6 minutes. The 6-minute means were plotted after each two-week interval and the resulting curves visually inspected by a senior analyst for quality control purposes. Suspect data, such as outliers or data points that deviate from a smooth curve, were discarded. Unreliable data, such as those collected during periods of mechanical malfunction, equipment maintenance, under-ranging events, and freezing events, were also removed. The remaining data were then filtered to extract the maximum and minimum water levels associated with each tidal event. For this report, a tidal event consists of one high water/low water pair.

The high and low water values contained in the final data set were used to determine the mean tidal range and to compute tidal lags between sites. The mean tidal range was computed from the difference in water level between each high and low tide event for each station (Figure 3.3A-1). Unlike the previous reporting period, the mean

tidal ranges measured during this reporting period were significantly different ($p<0.05$) than the means reported during the first year of monitoring (2000-2001), or pre-dredging, at about one-half of the stations (Table 3.3A-1). In the previous reporting period, mean tidal ranges measured at P1 and P7 were the only means that significantly differed from the means reported during the first year of monitoring. At five out of the twelve stations, the mean tidal range measured during this reporting period also was significantly different ($p<0.05$) than the means reported during the previous reporting period. Those stations included the three most upstream stations in the mainstem Cape Fear and the two most upstream stations in the Northeast Cape Fear River.

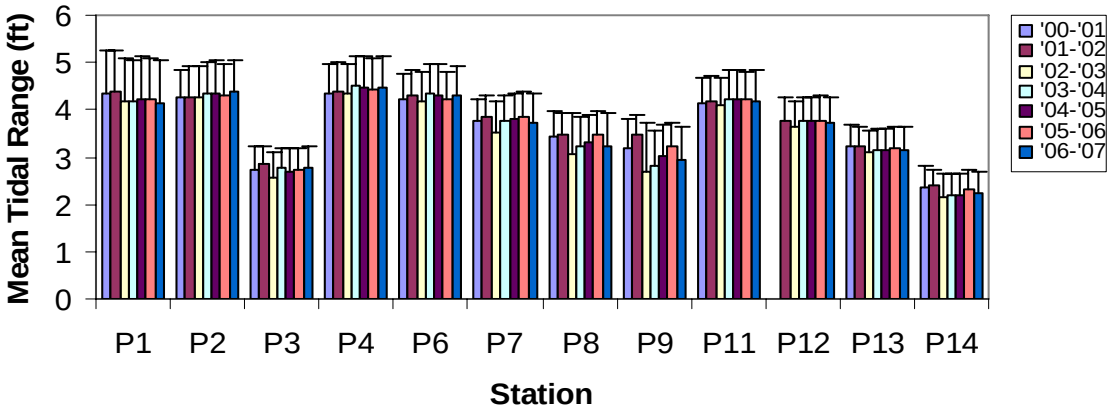


Figure 3.3A-1**.** Mean tidal range for each station for all monitoring years. All water levels are relative to NAVD88 with the exception of P4 (USACE yard), which is relative to MSL. Error bars show one standard deviation. Significant differences between yearly means ($p<0.05$) for one or more monitoring periods are shown in Table 3.3A-2. Table 3.3A-3 shows a summary of statistical tests for yearly data collected at the 11 DCP stations.

Table 3.3A-1. Monthly maximum, minimum, and range of salinity values for each station. Monthly maximum, minimum, and range of water level for each station are also given. All water levels are relative to NAVD88 with the exception of P4 (USACE yard), which is relative to MSL. "XXX" indicates periods of extended data loss due to mechanical failure of water level instrument.

		Salinity (ppt)			Water Level (ft)		
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P1	Jun-06	30.4	10.1	20.3	2.21	-4.21	6.42
	Jul-06	33.5	16.5	17.0	1.95	-4.16	6.11
	Aug-06	33.9	18.0	15.9	2.90	-3.92	6.82
	Sep-06	29.9	12.9	17.0	3.11	-3.16	6.27
	Oct-06	38.6	12.3	26.3	3.01	-3.43	6.44
	Nov-06	37.2	9.7	27.5	2.73	-3.83	6.56
	Dec-06	33.3	5.8	27.5	2.50	-3.85	6.35
	Jan-07	24.8	6.1	18.7	2.50	-3.94	6.44
	Feb-07	36.1	4.6	31.5	2.53	-4.62	7.15
	Mar-07	41.0	6.3	34.7	1.88	-4.91	6.79
	Apr-07	37.5	7.7	29.8	3.04	-3.70	6.74
	May-07	33.4	16.0	17.4	2.67	-4.25	6.92
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P2	Jun-06	14.4	0.8	13.6	5.79	0.05	5.74
	Jul-06	22.0	0.9	21.1	5.57	-0.32	5.89
	Aug-06	22.3	1.4	20.9	6.00	-0.22	6.22
	Sep-06	8.7	0.1	8.6	6.71	0.38	6.33
	Oct-06	17.2	0.4	16.8	6.73	0.10	6.63
	Nov-06	11.6	0.3	11.3	4.07	-2.12	6.19
	Dec-06	4.1	0.1	4.0	4.70	-2.61	7.31
	Jan-07	3.9	0.7	3.2	4.21	-2.62	6.83
	Feb-07	8.0	0.0	8.0	3.87	-2.64	6.51
	Mar-07	10.4	0.0	10.4	3.04	-2.73	5.77
	Apr-07	15.6	0.4	15.2	4.27	-2.74	7.01
	May-07	13.7	7.3	6.4	3.75	-2.67	6.42
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P3	Jun-06	12.8	0.1	12.7	1.78	-1.96	3.74
	Jul-06	9.1	0.1	9.0	1.65	-2.31	3.96
	Aug-06	13.4	0.1	13.3	2.18	-1.94	4.12
	Sep-06	2.8	0.0	2.8	3.32	-1.45	4.77
	Oct-06	15.8	0.1	15.7	2.61	-1.71	4.32
	Nov-06	10.1	0.0	10.1	2.80	-1.50	4.30
	Dec-06	8.0	0.0	8.0	2.83	-1.90	4.73
	Jan-07	2.7	0.0	2.7	2.61	-2.02	4.63
	Feb-07	3.1	0.0	3.1	2.33	-2.37	4.70
	Mar-07	6.4	0.1	6.3	2.28	-2.22	4.50
	Apr-07	13.5	0.1	13.4	2.37	-2.09	4.46
	May-07	18.7	0.2	18.5	2.10	-2.00	4.10
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P4	Jun-06	13.8	0.1	13.7	2.87	-2.94	5.81
	Jul-06	14.2	0.5	13.7	2.68	-3.33	6.01
	Aug-06	15.2	0.0	15.2	3.01	-3.15	6.16
	Sep-06	5.8	0.0	5.8	3.79	-2.52	6.31
	Oct-06	15.8	1.4	14.4	3.71	-2.86	6.57
	Nov-06	11.3	0.0	11.3	3.42	-3.06	6.48
	Dec-06	8.9	0.0	8.9	3.28	-3.83	7.11
	Jan-07	5.8	0.0	5.8	3.50	-3.52	7.02
	Feb-07	8.1	0.0	8.1	3.09	-4.22	7.31
	Mar-07	8.0	0.0	8.0	3.20	-3.90	7.10
	Apr-07	13.5	0.1	13.4	3.67	-4.05	7.72
	May-07	21.2	0.8	20.4	3.09	-3.46	6.55

Table 3.3A-1. (continued)

		Salinity (ppt)			Water Level (ft)		
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P6	Jun-06	17.4	0.1	17.3	3.25	-2.32	5.57
	Jul-06	11.6	0.0	11.6	2.92	-2.89	5.81
	Aug-06	13.9	0.1	13.8	2.76	-2.45	5.21
	Sep-06	9.9	0.0	9.9	3.98	-2.20	6.18
	Oct-06	14.3	0.1	14.2	3.79	-2.56	6.35
	Nov-06	10.1	0.1	10.0	3.73	-2.66	6.39
	Dec-06	7.7	0.0	7.7	4.14	-3.34	7.48
	Jan-07	4.7	0.0	4.7	3.80	-3.56	7.36
	Feb-07	6.1	0.0	6.1	2.81	-4.24	7.05
	Mar-07	7.8	0.0	7.8	2.98	-3.84	6.82
	Apr-07	11.7	0.0	11.7	3.33	-4.02	7.35
	May-07	12.8	6.5	6.3	2.76	-3.51	6.27
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P7	Jun-06	0.2	0.1	0.1	3.02	-2.07	5.09
	Jul-06	0.1	0.0	0.1	2.82	-2.25	5.07
	Aug-06	0.1	0.0	0.1	3.06	-2.25	5.31
	Sep-06	6.0	0.0	6.0	3.87	-1.91	5.78
	Oct-06	0.2	0.0	0.2	3.53	-2.27	5.80
	Nov-06	0.7	0.0	0.7	4.01	-2.15	6.16
	Dec-06	0.1	0.1	0.0	4.06	-2.27	6.33
	Jan-07	0.1	0.0	0.1	3.34	-2.28	5.62
	Feb-07	0.1	0.0	0.1	3.24	-2.29	5.53
	Mar-07	0.1	0.0	0.1	3.39	-2.26	5.65
	Apr-07	0.2	0.1	0.1	3.78	-2.28	6.06
	May-07	0.1	0.0	0.1	3.05	-2.36	5.41
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P8	Jun-06	0.1	0.0	0.1	2.79	-2.06	4.85
	Jul-06	0.1	0.1	0.0	2.58	-2.60	5.18
	Aug-06	0.1	0.0	0.1	3.02	-1.95	4.97
	Sep-06	5.4	0.0	5.4	3.81	-1.66	5.47
	Oct-06	0.2	0.0	0.2	3.26	-1.66	4.92
	Nov-06	0.2	0.1	0.1	3.06	-3.38	6.44
	Dec-06	0.1	0.0	0.1	3.92	-2.04	5.96
	Jan-07	0.1	0.0	0.1	3.38	-2.00	5.38
	Feb-07	0.1	0.0	0.1	2.76	-2.65	5.41
	Mar-07	0.1	0.0	0.1	3.27	-1.76	5.03
	Apr-07	0.1	0.0	0.1	3.83	-1.47	5.30
	May-07	0.5	0.1	0.4	3.14	-2.62	5.76
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P9	Jun-06	0.1	0.0	0.1	3.42	-1.57	4.99
	Jul-06	0.1	0.0	0.1	3.19	-1.78	4.97
	Aug-06	0.1	0.0	0.1	3.87	-1.20	5.07
	Sep-06	0.1	0.0	0.1	3.81	-1.48	5.29
	Oct-06	0.1	0.1	0.0	3.21	-1.57	4.78
	Nov-06	0.1	0.0	0.1	4.04	-1.12	5.16
	Dec-06	0.1	0.0	0.1	4.23	-1.49	5.72
	Jan-07	0.0	0.0	0.0	3.76	-1.21	4.97
	Feb-07	0.0	0.0	0.0	3.46	-1.75	5.21
	Mar-07	0.1	0.0	0.1	3.64	-1.42	5.06
	Apr-07	0.1	0.0	0.1	4.35	-1.51	5.86
	May-07	0.3	0.1	0.2	3.51	-2.11	5.62
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P11	Jun-06	13.8	0.1	13.7	2.67	-2.80	5.47
	Jul-06	10.6	0.1	10.5	2.53	-3.36	5.89
	Aug-06	11.7	0.1	11.6	2.98	-2.62	5.60
	Sep-06	8.5	0.0	8.5	3.92	-2.26	6.18
	Oct-06	13.7	0.1	13.6	3.67	-2.52	6.19
	Nov-06	7.9	0.0	7.9	4.11	-2.63	6.74
	Dec-07	13.9	5.2	8.7	3.91	-3.63	7.54
	Jan-07	5.5	0.0	5.5	3.50	-3.22	6.72
	Feb-07	8.0	0.0	8.0	3.13	-3.37	6.50
	Mar-07	9.6	0.0	9.6	3.86	-3.25	7.11

Table 3.3A-1. (concluded)

		Salinity (ppt)			Water Level (ft)		
	Apr-07	10.5	0.1	10.4	4.21	-2.67	6.88
	May-07	13.0	6.9	6.1	3.02	-3.12	6.14
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P12	Jun-06	14.2	0.1	14.1	2.33	-2.57	4.90
	Jul-06	8.7	0.0	8.7	2.13	-3.01	5.14
	Aug-06	12.5	0.1	12.4	2.59	-2.68	5.27
	Sep-06	9.4	0.0	9.4	3.57	-2.23	5.80
	Oct-06	12.4	0.1	12.3	2.90	-2.64	5.54
	Nov-06	7.9	0.0	7.9	2.71	-2.60	5.31
	Dec-06	6.6	0.0	6.6	3.42	-2.72	6.14
	Jan-07	3.9	0.0	3.9	3.08	-3.11	6.19
	Feb-07	6.3	0.0	6.3	2.67	-3.66	6.33
	Mar-07	5.6	0.0	5.6	2.79	-3.34	6.13
	Apr-07	10.3	0.0	10.3	3.13	-3.05	6.18
	May-07	17.6	0.1	17.5	3.24	-2.94	6.18
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P13	Jun-06	4.5	0.1	4.4	2.47	-1.79	4.26
	Jul-06	3.1	0.1	3.0	2.02	-2.55	4.57
	Aug-06	2.0	0.1	1.9	2.42	-2.12	4.54
	Sep-06	0.1	0.0	0.1	3.57	-1.80	5.37
	Oct-06	6.4	0.1	6.3	2.82	-2.27	5.09
	Nov-06	1.2	0.0	1.2	3.12	-2.04	5.16
	Dec-06	0.4	0.0	0.4	3.21	-2.64	5.85
	Jan-07	0.1	0.0	0.1	2.99	-2.62	5.61
	Feb-07	0.1	0.0	0.1	2.51	-2.97	5.48
	Mar-07	1.2	0.0	1.2	2.65	-2.74	5.39
	Apr-07	7.0	0.0	7.0	2.89	-2.47	5.36
	May-07	8.4	0.0	8.4	2.43	-2.27	4.70
Site	Month	Maximum	Minimum	Range	Maximum	Minimum	Range
P14	Jun-06	0.1	0.0	0.1	1.99	-1.42	3.41
	Jul-06	0.9	0.0	0.9	1.83	-1.95	3.78
	Aug-06	0.1	0.0	0.1	2.07	-1.55	3.62
	Sep-06	0.1	0.0	0.1	3.43	-1.19	4.62
	Oct-06	0.1	0.0	0.1	2.31	-1.73	4.04
	Nov-06	0.1	0.0	0.1	3.38	-1.15	4.53
	Dec-06	0.1	0.0	0.1	3.09	-1.70	4.79
	Jan-07	0.0	0.0	0.0	2.85	-1.80	4.65
	Feb-07	0.1	0.0	0.1	2.21	-2.14	4.35
	Mar-07	0.1	0.0	0.1	2.28	-2.12	4.40
	Apr-07	0.1	0.0	0.1	2.44	-1.93	4.37
	May-07	0.1	0.0	0.1	1.94	-1.84	3.78

Table 3.3A-2**.** Summary of statistical analyses of mean annual water level comparisons for each of the 11 DCP stations. Yearly mean tidal ranges were compared using Tukey-Kramer highest significant difference ($p<0.05$). Years with different letter superscripts were significantly different. Asterisks denote where significant differences occurred between this reporting period and Year 1. Ampersands denote where significant differences exist between this reporting period and the preceding reporting period. Note that the Year 1 reporting period only included the period of October to May and all subsequent periods have included a complete calendar year. No data (NA) were available for Year 1 for station P12.

Station	**Significant**	**Effect (Year)**						
P1	*	1^{a}	2^{a}	3^{b}	4^{b}	5^{b}	6^{b}	7^{b}
P2	*	1^{a}	2^{ab}	3^{a}	4^{b}	5^{b}	6^{ab}	7^{b}
P3		1^{ad}	2^{b}	3^{c}	4^{a}	5^{d}	6^{ad}	7^{ad}
P4	*	1^{ac}	2^{ac}	3^{a}	4^{b}	5^{b}	6^{bc}	7^{b}
P6		1^{ac}	2^{bc}	3^{a}	4^{bc}	5^{bc}	6^{ac}	7^{c}
P7	@	1^{ad}	2^{b}	3^{cd}	4^{ad}	5^{ab}	6^{b}	7^{d}
P8	*@	1^{a}	2^{a}	3^{b}	4^{c}	5^{d}	6^{a}	7^{bc}
P9	*@	1^{a}	2^{b}	3^{c}	4^{d}	5^{e}	6^{a}	7^{f}
P11		1^{ab}	2^{ac}	3^{b}	4^{c}	5^{c}	6^{ac}	7^{abc}
P12		NA	2^{a}	3^{b}	4^{a}	5^{a}	6^{a}	7^{a}
P13	*@	1^{a}	2^{a}	3^{b}	4^{cd}	5^{cd}	6^{ac}	7^{bd}
P14	*@	1^{a}	2^{a}	3^{b}	4^{bc}	5^{c}	6^{a}	7^{bc}

Table 3.3A-3. Summary of statistical tests for yearly data collected at the 11 DCP stations. Yearly means of tidal ranges were compared. Also shown are yearly differences in the slopes of the best-fit lines generated by regressing each tidal range for each station on the corresponding tidal range for P1. These were compared using analysis of covariance. NS indicates no significant difference at $p<0.05$. Asterisks denote significant differences between years and p values are given. N/A indicates insufficient data to complete analyses.

Station	**Y1/Y2 Regression Slope**	**Y1/Y3 Regression Slope**	**Y1/Y4 Regression Slope**	**Y1/Y5 Regression Slope**	**Y1/Y6 Regression Slope**	**Y1/Y7 Regression Slope**	**Y6/Y7 Regression Slope**
	---	---	---	---	---		---
P2	*(<0.0001)	NS	NS	* (<0.0001)	* (0.0101)	* (<0.0001)	NS
P3	* (<0.0001)	NS	* (0.0227)	NS	NS	NS	NS
P4	NS	NS	* (<0.0001)	* (<0.0001)	* (<0.0001)	* (<0.0001)	NS
P6	NS	NS	* (<0.0001)	* (<0.0001)	NS	* (0.0002)	* (<0.0001)
P7	*(0.0247)	NS	* (0.0064)	* (<0.0001)	* (<0.0001)	NS	* (<0.0004)
P8	NS	NS	NS	* (0.0005)	* (<0.0001)	NS	* (<0.0009)
P9	NS	NS	* (0.0001)	* (0.0020)	* (<0.0052)	NS	* (<0.0001)
P11	NS	NS	* (<0.0001)	* (<0.0001)	* (<0.0001)	* (<0.0005)	* (<0.0001)
P12	N/A	N/A	N/A	N/A	N/A	N/A	NS
P13	NS	NS	NS	* (<0.0001)	NS	NS	NS
P14	* (0.0088)	NS	* (<0.0001)	NS	* (0.0020)	NS	NS

Tidal lags were determined by measuring the difference in time for high (or low) tide at two different stations as described in the Year 1 report. All tidal lags were calculated relative to station P1 and are being used to evaluate the impact of dredging on the propagation of the tidal wave upriver. Mean tidal range, flood duration, ebb duration, and tidal lags for each station are given in Table 3.3A-4. During this reporting period, both the high tide and low tide lag values were comparable to those reported for 2005-2006. The greatest difference between years occurred at station P14 where the mean high tide lag decreased by 0.2 hours. During this reporting period, the mean flood duration and the mean ebb duration varied little (<1%) from the previous reporting period (Table 3.3A-4). For changes that were observed, flood durations decreased at almost all stations whereas ebb duration tended to increase at upstream stations and decrease or remain unchanged lower in the estuary. Yearly comparisons of mean monthly maximum and minimum water levels collected at the 11 DCP stations are summarized in Table 3.3A-5.

Table 3.3A-4. Summary of tidal data generated from the 11 DCP stations along the Cape Fear River and tributaries. Values in italicized parentheses are the percent change between the current monitoring interval and the previous reporting period. Positive values indicate an increase and negative values a decrease. ND indicates that a change was not measurable. N/A indicates that data were insufficient to measure a reliable change. Mean lag times for the previous reporting period are also given in parentheses for both high and low tide.

Station Number	Mean Tidal Range (ft)	Mean Flood Duration (hr) (% change)	Mean Ebb Duration (hr) (%change)	Mean High Tide Lag From P1 (hr) ('05-'06 lag time)	Mean Low Tide Lag From P1 (hr) ('05-'06 lag time)
P1	4.15 ± 22.04%	6.30 (+0.02)	6.12 (0.00)	N/A	N/A
P2	4.37 ± 15.82%	5.63 (0.00)	6.73 (-0.02)	1.35 (1.38)	1.88 (1.98)
P3	2.77 ± 17.13%	6.33 (-0.02)	6.08 (-0.42)	2.98 (2.95)	2.93 (2.88)
P4	4.46 ± 15.17%	5.66 (-0.02)	6.73 (0.01)	1.55 (1.62)	2.18 (2.18)
P6	4.29 ± 15.00%	5.80 (-0.18)	6.58 (-0.02)	2.07 (2.15)	2.53 (2.57)
P7	3.72 ± 16.53%	5.75 (-0.08)	6.38 (+0.08)	2.62 (2.60)	3.08 (3.02)
P8	3.21 ± 22.42%	5.78 (-0.12)	6.63 (+0.13)	2.97 (3.07)	3.48 (3.45)
P9	2.93 ± 24.35%	5.78 (-0.05)	6.63 (+0.08)	3.32 (3.37)	3.86 (3.82)
P11	4.17 ± 15.91%	5.78 (-0.12)	6.61 (+0.11)	2.12 (2.15)	2.62 (2.57)
P12	3.72 ± 14.46%	5.80 (-0.07)	6.60 (-0.10)	2.45 (2.52)	2.93 (2.90)
P13	3.13 ± 15.85%	5.81 (-0.07)	6.58 (+0.08)	2.98 (3.17)	3.45 (3.42)
P14	2.24 ± 20.06%	5.88 (-0.03)	6.58 (+0.05)	4.01 (4.12)	4.52 (4.48)

Table 3.3A-5. Yearly comparisons of mean monthly maximum and minimum water levels collected at the 11 DCP stations. Significant differences were identified using a Wilcoxon Rank Sum test. NS indicates no significant difference at $p<0.05$. Asterisks denote significant differences between years and p values are given. N/A indicates insufficient data to complete analyses. Additional yearly comparisons are available in previous reports.

Station	Yr1/Yr7 Mean Monthly Maximum WL	Yr6/Yr7 Mean Monthly Maximum WL	Yr1/Yr7 Mean Monthly Minimum WL	Yr6/Yr7 Mean Monthly Minimum WL
P1	NS	NS	NS	NS
P2	*(0.0016)	*(0.0015)	*(0.0012)	*(0.0140)
P3	*(0.0337)	NS	*(0.0012)	NS
P4	NS	NS	NS	NS
P6	*(0.0227)	NS	NS	*(0.0363)
P7	*(0.0097)	NS	*(0.0009)	NS
P8	NS	NS	NS	NS
P9	*(0.0055)	*(0.0047)	*(0.0004)	NS
P11	*(0.0253)	NS	NS	NS
P12	N/A	NS	N/A	NS
P13	*(0.0038)	NS	*(0.0448)	NS
P14	*(0.0136)	NS	NS	NS

Statistical differences between tidal range values for upstream stations, before versus after channel deepening for specified tidal changes at the river mouth (P1) comprise one key approach to determining if the project has resulted in detectable changes in tidal range upstream. One assumption of this approach is that the tidal range at the base station at Ft Caswell (P1) is in equilibrium with open ocean tides and not subject to changes associated with dredging activities. To verify this condition, the observed tidal range at P1 for each reporting period is regressed against the predicted (astronomical) range. Analysis of Covariance (ANCOVA) is then used to determine if significant differences exist between each yearly regression (i.e. slope). The tidal ranges observed at each upstream station are then regressed on the corresponding tidal range for P1. Comparisons of the resultant regression slopes are then conducted between subsequent reporting periods using ANCOVA ($p<0.05$).

3.4A Tidal Effects

3.41A Ft Caswell (P1) and Outer Town Creek (P2)

The tidal ranges observed at the Ft Caswell base station show good agreement with the predicted tides for the area (Figure 3.41A-1). When observed tidal ranges are regressed against the predicted tidal ranges, the R^2 value is similar to those documented in previous reports. The slope of the predicted tidal range versus observed tidal range regression for this monitoring period was not significantly different from the slope

reported in 2005-2006. The mean tidal range at P1 was not significantly different from the mean reported in the previous monitoring period, but was significantly lower than the range reported in Year 1 (Table 3.3A-2, Figure 3.3A-1). Mean tidal range at P1 has not significantly differed between subsequent years since the significant decrease noted in Year 2 of this study. There continues to be no significant difference in either the mean monthly maximum or minimum water levels relative to last year's reporting period or relative to Year 1 (Table3.3A-5). The mean tidal range at the Outer Town Creek (P2) site was not significantly different from the means reported in the previous three monitoring periods or the mean reported Year 2 of the study. This year, the mean tidal range at P2 was significantly higher than the mean reported in Year 1. At station P2, both the mean monthly maximum water level and mean monthly minimum water level were significantly higher from the first year of reporting and the previous reporting period. The mean monthly maximum water level also was significantly higher than the value reported in the previous monitoring period. As seen in Figure 3.41A-2, the tidal range at P2 is strongly and positively correlated with observed tidal ranges at P1. The slope of the P1 versus P2 regression for this monitoring period was not significantly different from the slope reported during 2005-2006 reporting period (Table 3.3A-3). The slope measured during this reporting period at P2 was significantly different from the slope measured in the first monitoring period ($p<0.0001$) at the $p<0.05$ significance level. This result is consistent with both the 2004-2005 and 2005-2006 reporting periods. Although tidal fluctuations at this station are impacted by regional climatology (e.g. drought and flooding), P2 was not appreciably affected by climatological events this year as evidenced by the low range in water level variability ($R^2 = 0.94$).

The water level curve at P1 has remained generally symmetrical and continues to show less evidence of the time asymmetries (Table 3.3A-3) measured at other stations. These asymmetries, as evidenced by the unequal flood and ebb durations shown in Table 3.3A-3, begin at site P2 and continue up river to all monitoring sites. The duration of flooding tide at P2 did not change during this reporting period relative to the duration reported in 2005-2006. The ebb tide duration at P2 is comparable to the duration reported in the previous reporting period. The mean high tide lag has not changed appreciably since the last reporting period. The mean low tide lag decreased slightly (0.10 hour) relative to the previous reporting period. When coupled with the data presented in previous monitoring reports, the tidal lags show no consistent pattern and do not indicate a definitive change in the rate of the tidal wave propagation up-estuary.

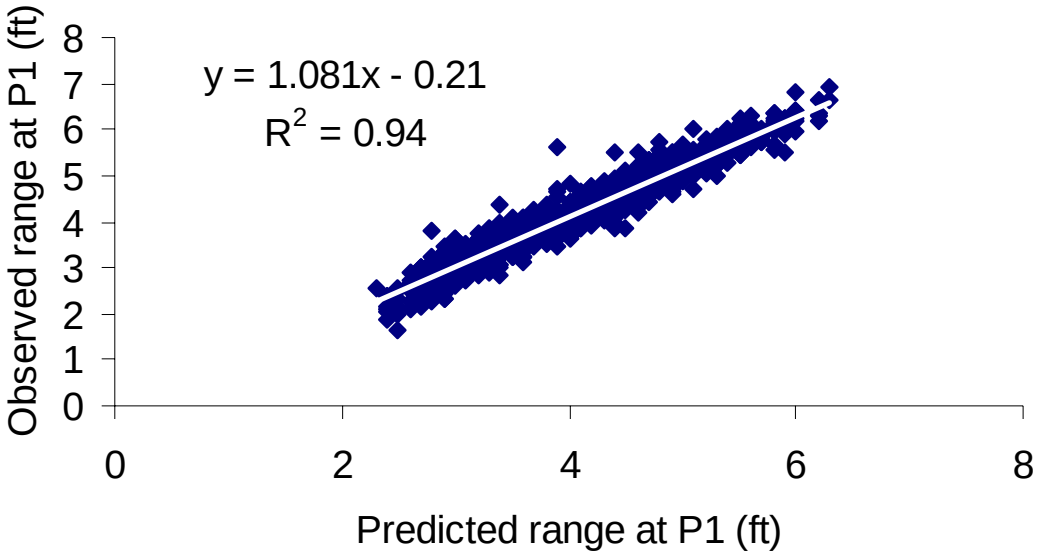


Figure 3.41A-1. Plot of predicted tidal range at P1 relative to measured tidal range at P1 for June 2006 to May 2007.

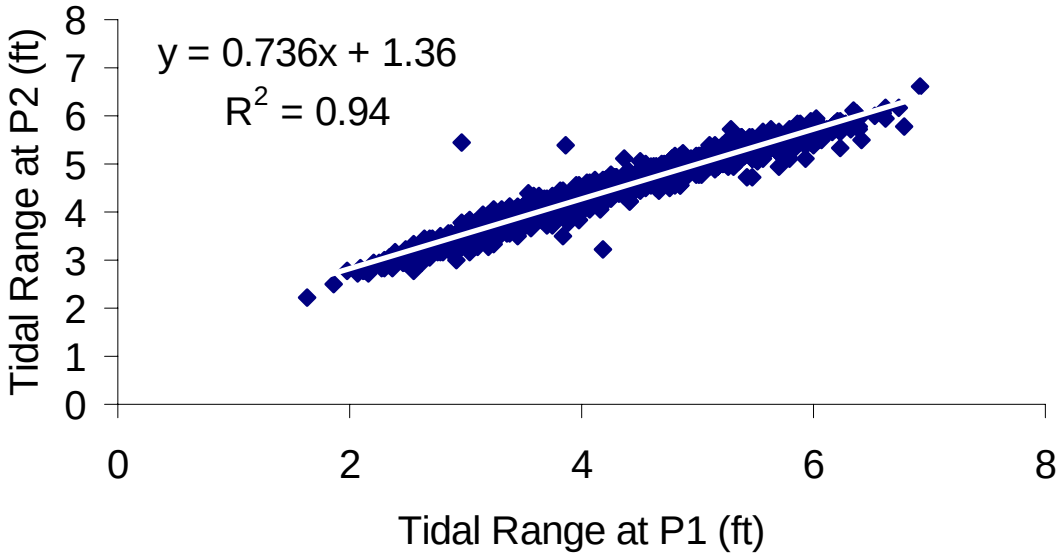


Figure 3.41A-2. Plot showing relationship between tidal ranges observed at Ft Caswell (P1) and Outer Town Creek (P2).

3.42A Inner Town Creek (P3)

The mean tidal range observed at this site during this reporting period was approximately 1.6 feet less than the tidal range observed at the creek mouth (Table 3.3A-4, Figure 3.42A-1) and lower than the mean tidal ranges of all other sites except P14. This result is consistent with the results of the previous 2 reporting periods. The mean tidal range from June 2006 to May 2007 was not significantly different from the mean tidal range reported for the previous reporting period or from the mean reported for Year 1. The mean tidal range at P3 during this reporting period is significantly different from the means reported in Year 2 and 3, only. This result is consistent with the findings of the previous reporting period. As reported previously, Years 2 and 3 were strongly influenced by climatological events including regional drought and increased localized precipitation events in the watershed, respectively. Water level curves generated for this station and computed tidal ranges continue to exhibit a wide range of variability and depend on flow conditions in the creek. Both the mean flood and mean ebb duration decreased slightly during this reporting period relative to the previous reporting period (Table 3.3A-4**).** This contrasts with the previous reporting period when both mean flood and mean ebb duration increased relative to the prior year. There was no significant difference in either mean monthly maximum or mean monthly minimum water level when this reporting period was compared to the previous reporting period. Both the mean monthly maximum and minimum water levels, however, are significantly different from those reported during the first year of monitoring. These results are consistent with the 2005-2006 reporting period.

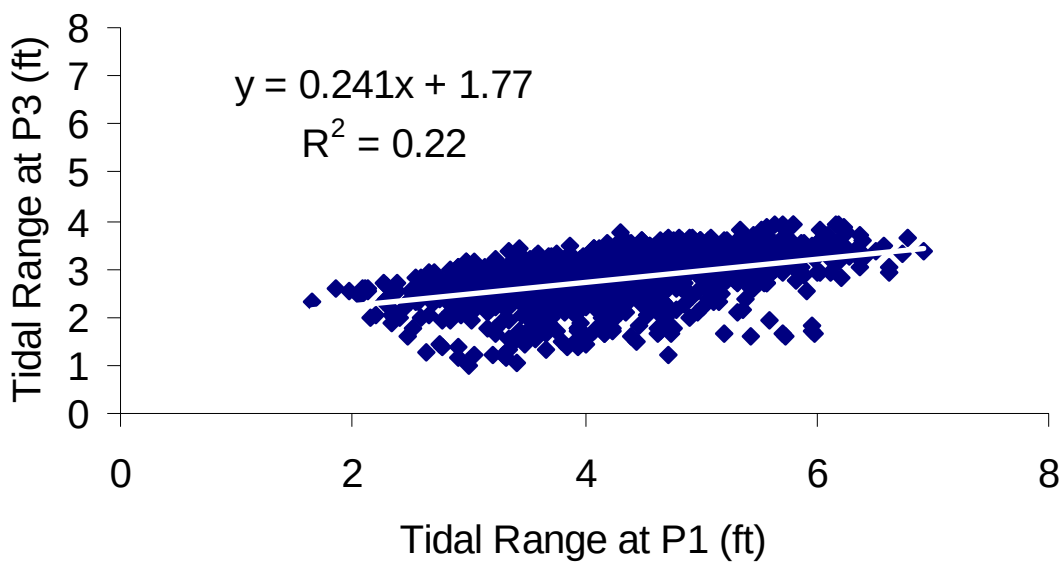


Figure 3.42A-1. Plot showing relationship between tidal ranges observed at Ft Caswell (P1) and Inner Town Creek (P3).

The correlation between tides at P3 and P1 this year was less than the values reported in 2005-2006 (R^2<0.46). The slope of the P1 versus P3 regression for this monitoring period was not significantly different from the slope reported in 2005-2006 or significantly different from the slope reported for Year 1 (Table 3.3A-2). This result is consistent with the previous reporting period.

3.43A Corps Yard (P4)

As has been noted for previous reporting periods, the mean tidal range observed at P4 is significantly higher than the mean tidal range at the P1 base station (Figure 3.43A-1). The mean tidal range during the 2006-2007 reporting period was significantly greater than the mean reported for Years 1, 2, and 3, but not significantly different from the means reported for Years 4, 5, and 6. As described in the 2005 -2006 report, Year 3 was exceptional due to the large degree of flooding and high discharge that persisted during most of that reporting period. The slope (0.708) of the P1/P4 regression was significantly greater than the slope reported for the first monitoring period (Table 3.3A-3), but not significantly different from the slope reported last year (0.718). This result is consistent with results reported for 2004-2005 and 2005-2006. Water level curves generated for P4 continue to show a slight time asymmetry that does not occur at P1. The mean ebb and flood durations, 6.73 and 5.66 hours, respectively, are comparable to those reported in 2004-2005 and 2005-2006. These durations have changed by less than 1% since the previous reporting periods. The mean low tide lag has not changed since the last reporting period; however, the mean high tide lag has decreased slightly (Table 3.3A-4). This finding contrasts with the previous reporting period where the mean high tide lag had not changed since the last reporting period, but the mean low tide lag decreased slightly. While the mean high is still less than the lag reported for 2002-2003 when the river was characterized by higher than average discharge, the mean low tide lag for this reporting period was the same as that reported for 2002-2003 **(**Figure 3.5A-1**).** Mean maximum and minimum water levels at this station are not significantly different from those reported in 2005-2006 or 2000-2001 (Table 3.3A-5). These results are consistent with those reported for the previous 2 reporting periods. Water levels at the Corps yard continue to be impacted by changes in river discharge, but to a much lesser degree than stations further upstream and to lesser degree than in 2002-2003 and 2003-2004.

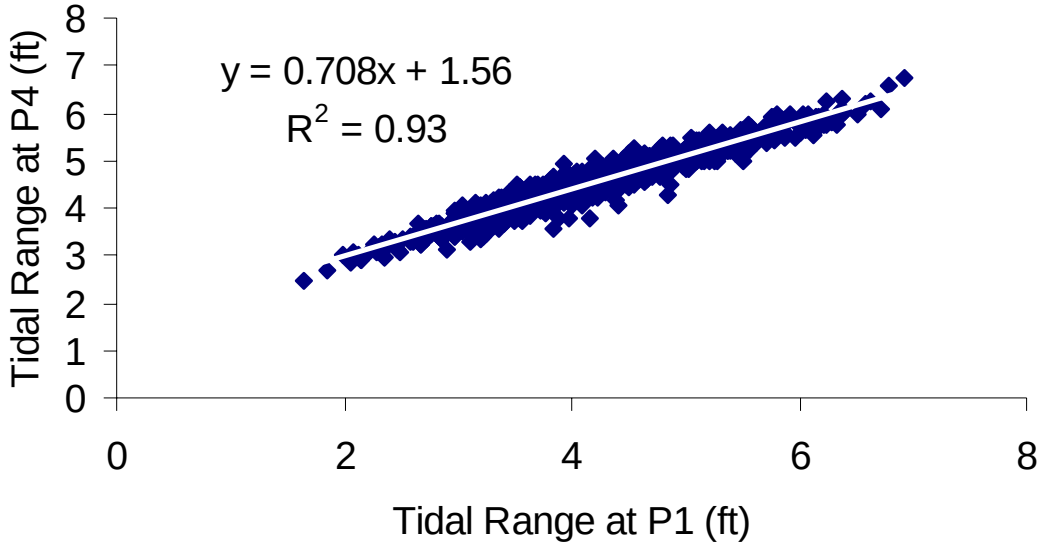


Figure 3.43A-1. Plot showing relationship between tidal ranges observed at Ft Caswell (P1) and the Corps Yard station (P4).

3.44A Cape Fear River: Eagle Island (P6), Indian Creek (P7), Dollisons Landing (P8), and Black River (P9)

With the exception of P6, mean tidal ranges computed for mainstem river sites were lower than the mean determined for P1. For the third consecutive year, the mean tidal range at P6 was less than the mean tidal range reported for P2 (Table 3.3A-4**)**. During the 2003-2004 reporting period, the mean tidal range at P6 was identical to the mean reported at P2. Consistent with previous years, tidal range decreased with distance upriver (Table 3.3A-4) with P9 exhibiting the lowest tidal range of these sites. Tidal range variability, however, increased with distance upriver (Table 3.3A-4) with P9 exhibiting the greatest variability. The mean tidal ranges measured at the mainstem river sites were generally lower than last year, with the exception of site P6 which increased by 0.07 feet. With the exception of site P6, changes in mean tidal range at the mainstem stations also were greater (0.12 to 0.28 feet) than changes observed for stations in the Northeast Cape Fear River (Section 3.45). The mean tidal ranges were significantly lower than those measured during the previous reporting period at sites P7, P8, and P9. This contrasts with the previous reporting period when most mainstem stations had mean tidal ranges that were significantly higher than the 2004-2005 reporting period. Further, sites P8 and P9 had mean tidal ranges that were significantly different from the ranges reported for the first project year (Figure 3.3A-1, Table 3.3A-2). During the previous reporting period, P1 and P7 were the only sites that exhibited a mean tidal range that was significantly different from Year 1. This year's results are more similar to those reported for the 2003-2004 and 2004-2005 reporting periods and may reflect a greater similarity in mean discharge between this reporting period and the mean discharge recorded in Years 4 and 5 (Figure 3.5A-1). With the exception of site P9, the mean monthly maximum

water levels did not differ significantly from the values reported in 2005-2006 (Table 3.3A-2). At P9, the mean monthly maximum water level was significantly higher than the mean reported for the previous reporting period. When compared to the Year 1 value, mean monthly maximum values were significantly higher at all stations except P8 where there was no difference. The mean monthly minimum values were significantly different from 2005-2006 only at station P6 (lower). In the previous reporting period, the mean monthly minimum values were significantly different from the previous year also only at P6. The mean monthly minimum values were significantly different from Year 1 values at P7 and P9.

Figures 3.44A-1, 3.44A-2, 3.44A-3, and 3.44A-4 illustrate the relationship between tidal range at these Cape Fear River sites and tidal range at Ft. Caswell. In general, tidal range at each upriver site is positively correlated with tidal range at the mouth. During this reporting period, the R^2 values were much lower that the 2005-2006 values for all mainstem stations with the exception of site P6. The increased variability noted during this reporting period may reflect a combination of more frequent periods of increased precipitation, higher river discharge (Figure 3.5A-1), and local landscape modifications that occurred near some of the sites. For example, extensive land clearing occurred near site P7 this year which may have affected local runoff or the introduction of detrital material and sediment to the area surrounding the DCP. It is also possible that some of these sites may be exhibiting a degradation of data quality due to the age of the equipment. Sites P7 and P8 experienced the largest number of lost tides of all stations due to a combination of mechanical errors that persisted over extended periods of time. Comparisons of the regression slopes between this reporting period and Year 6 were significantly different at all of the mainstem sites (Table 3.3A-3). This result contrasts with last year's report where none of the stations showed a significant difference in slope relative to the previous year except for station P6. When regression slopes for this reporting period were compared to Year 1, only site P6 exhibited a significant difference.

The mainstem upriver sites continue to exhibit pronounced time asymmetries as shown in previous reports. The duration of flooding tide at these stations has increased very slightly (by less than 0.2%), since the last reporting period (Table 3.3A-4). This increase is much lower than in the previous two reporting periods where flooding duration had increased by less than 1.5 to 2% at all stations. The duration of ebb tide also changed very little during this reporting period (also less than 0.2%). With the exception of P6, the duration of ebb tide increased, albeit minimally, at all stations. At station P6, the duration of ebb tide decreased by 0.02%. The mean high tide lag from P1 was comparable to the lag times reported in 2005-2006. P8 exhibited the greatest change; a decrease in mean high tide lag of six minutes. P8 also showed the greatest change (again a decreased in lag time of 6 minutes relative to 2004-2005) during the previous reporting period. Changes in mean low tide lag relative to the previous reporting period also were comparable to 2005-2006, with a slight decrease at site P6 and slight increases at the remaining sites (Table 3.3A-4).

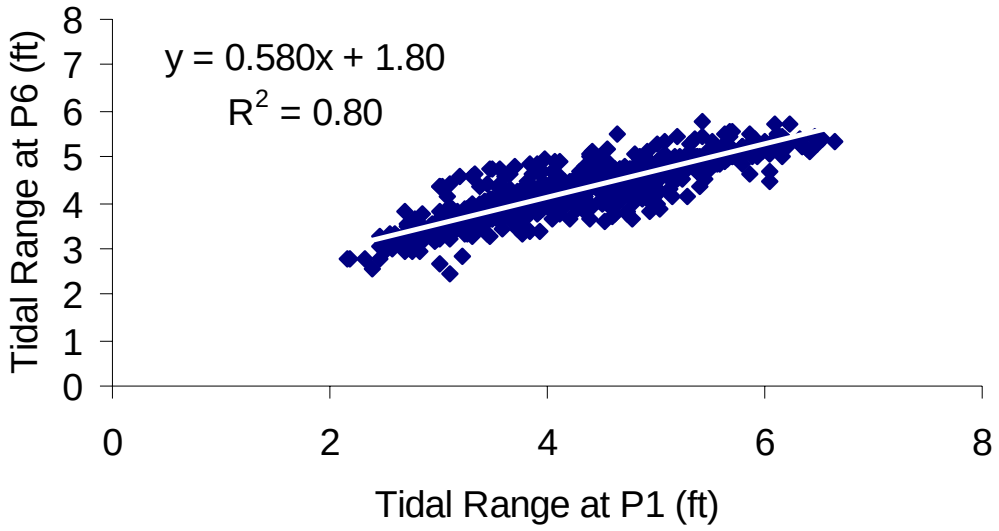


Figure 3.44A-1. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Eagle Island (P6).

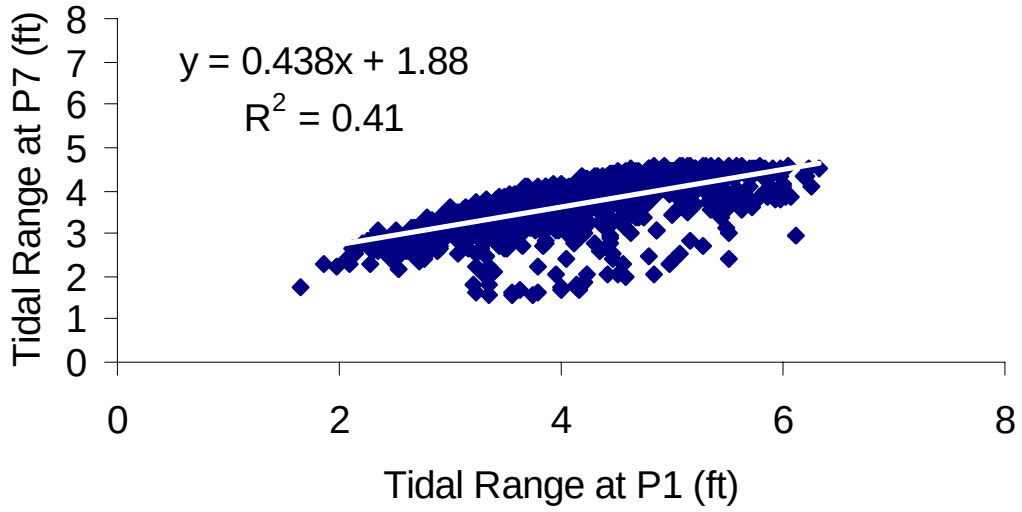


Figure 3.44A-2**.** Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Indian Creek (P7).

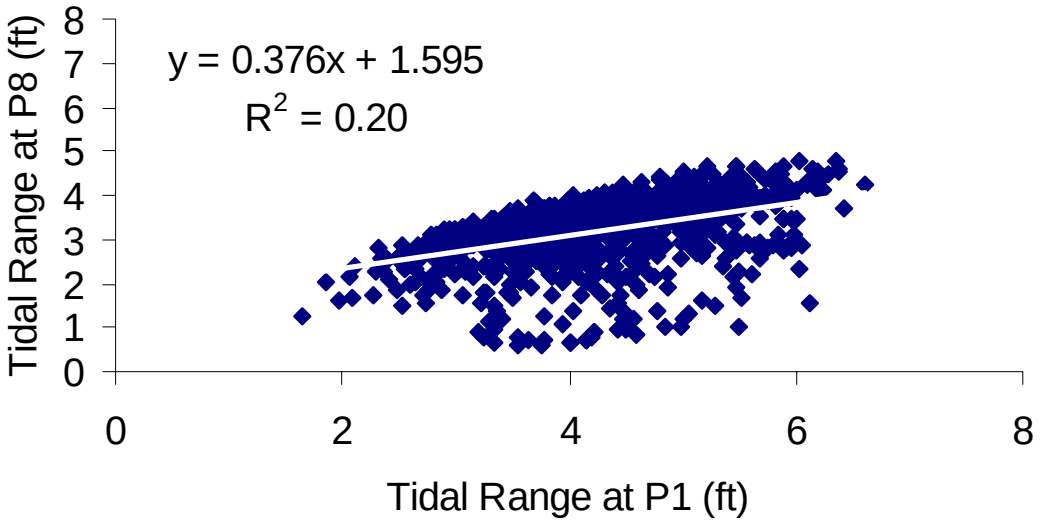


Figure 3.44A-3. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Dollisons Landing (P8).

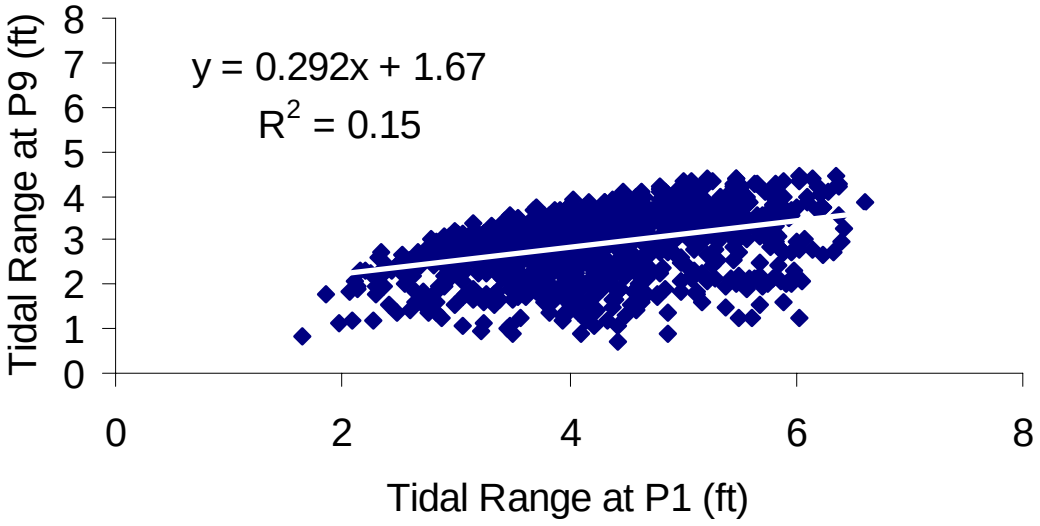


Figure 3.44A-4. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Black River (P9).

3.45A Northeast Cape Fear: Smith Creek (P11), Rat Island (P12), Fishing Creek (P13), and Prince George Creek (P14)

The mean tidal ranges computed for northeast Cape Fear sites over the current reporting period were not significantly different from those reported in 2005-2006 at sites P11 and P12 (Figure 3.3A-1, Table 3.3A-2); a finding consistent with last year's report for these stations. There also was no difference in mean tidal range between this reporting period and Year 1 at station P11. A similar comparison is unavailable for site P12 due to an incomplete data set at that station during the first year of monitoring. Mean tidal ranges at sites P13 and P14, however, were significantly lower than those reported in both 2005-2006 and Year 1 (Table 3.3A-2). This observation contrasts with the 2005-2006 reporting period where mean tidal ranges at these sites were not significantly different from Year 1, but is consistent with the findings reported in 2004-2005. These results most likely reflect discharge variability in the river. Although discharge data are no longer available for the Northeast Cape Fear, discharge on the Cape Fear mainstem increased during this reporting period; reaching a mean in excess of the 30 year average for the first time since 2004-2005 (Figure 3.5A-1). The greater similarity in discharge between this reporting period and the 2004-2005 reporting period may account for the similarity in mean tidal ranges between this reporting period and the 2004-2005 reporting periods. Mean tidal ranges for all of the Northeast Cape Fear River stations decrease upstream and continue to be lower than the mean determined for P1 with the exception of station P11 which was slightly higher (0.02 ft.) than station P1 (Table 3.3A-3). This result is consistent with results from the previous reporting periods. Neither the mean monthly minimum water level nor the mean monthly maximum water level significantly differed from values reported in 2005-2006 (Table 3.3A-5). This result is consistent with previous reporting periods. All of the sites in the Northeast Cape Fear River continue to exhibit time asymmetries. The mean monthly maximum water level, however, were significantly higher than the Year 1 value at all sites except P12 where no Year 1 data are available. Mean minimum water levels exhibited a significant difference from Year 1 only at station P13 (higher). Mean flood durations are shorter than ebb durations and show little variability among sites (Table 3.3A-4). During this monitoring period, mean flood duration changed little relative to the previous reporting period. Where changes were noted, a decrease in duration occurred. The greatest change occurred at P11 where the flood duration decreased by less than 1% (Table 3.3A-4). The mean ebb durations also changed little (~0.1% or less). All sites showed a slight increase except for P12.

Tidal ranges at upstream stations in the Northeast Cape Fear are positively correlated with the tidal range at P1 (Figures 3.45A-1, 3.45A-2, 3.45A-3, and 3.45A-4). The mean tidal range at P14 on the Northeast Cape Fear River continues to be less than the mean range measured at P9, 12 miles from convergence on the Cape Fear River. Consistent with previous years, tidal ranges at stations P11 and P12 are more strongly correlated to tidal ranges observed at P1 than the tidal ranges at P13 and P14. Water levels at these upriver stations continue to be impacted strongly by other types of events; especially increased rainfall and upriver discharge as suggested by the lower R^2 values for the most upstream stations (Figures 3.45A-3 and 3.45A-4). Interestingly, tidal ranges

at Northeast Cape Fear River stations and P1 during this reporting period are stronger than those at most of the mainstem (i.e. P6, P7, P8, and P9) stations. Comparisons of the regression slopes between this reporting period and last year yielded no significant difference for any of the sites except P11. At site P11, slope decreased from 0.63 to 0.61. A significant difference in regression slope between this reporting period and 2000-2001 also occurred at site P11 (increase). As noted earlier and in previous reports, no Year 1 data were available for P12 with which to make a similar comparison.

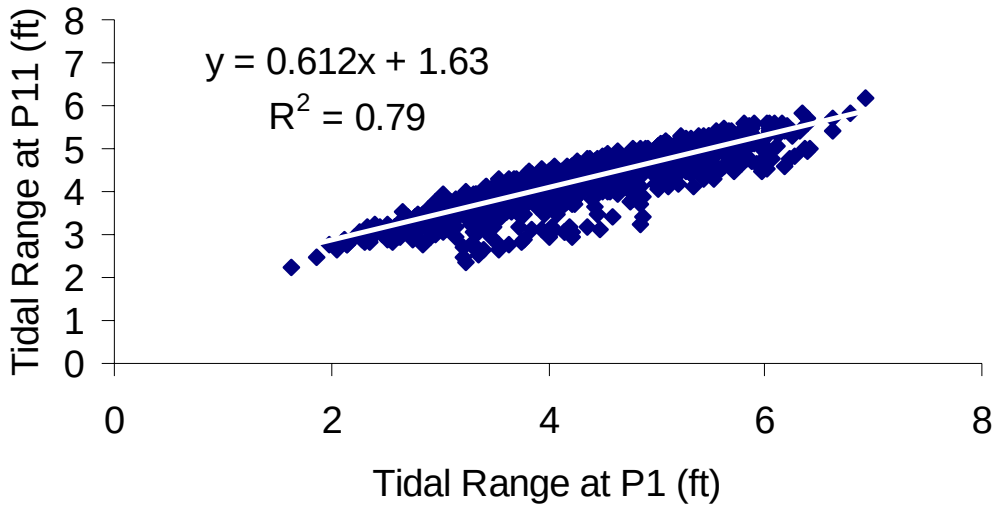


Figure 3.45A-1. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Smith Creek (P11).

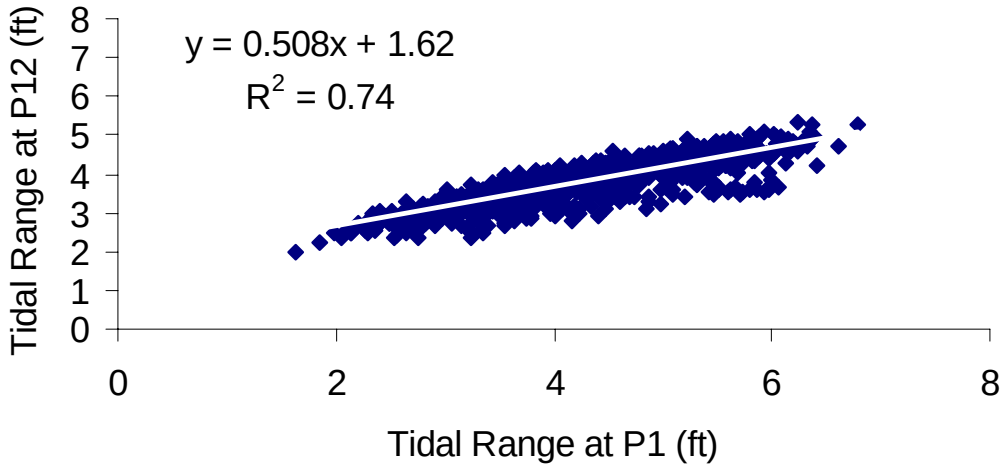


Figure 3.45A-2. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Smith Creek (P12).

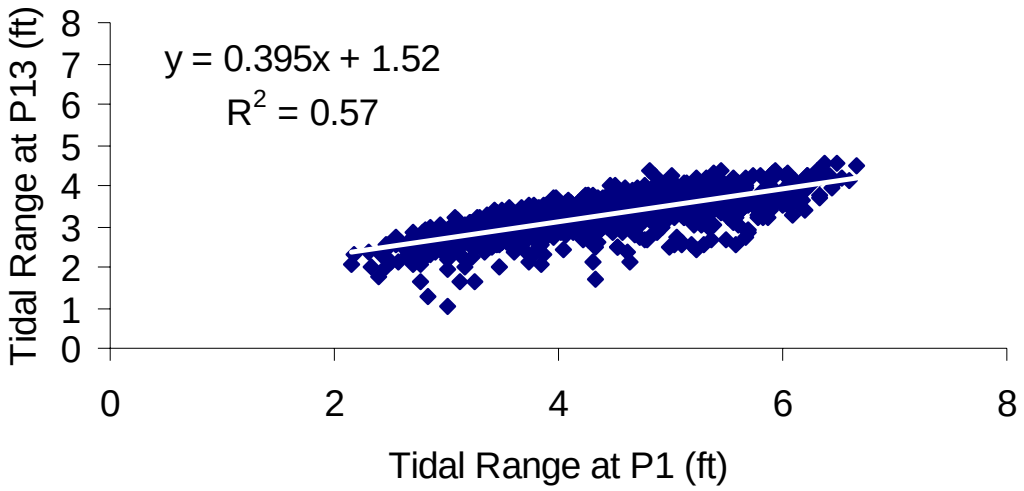


Figure 3.45A-3. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Fishing Creek (P13).

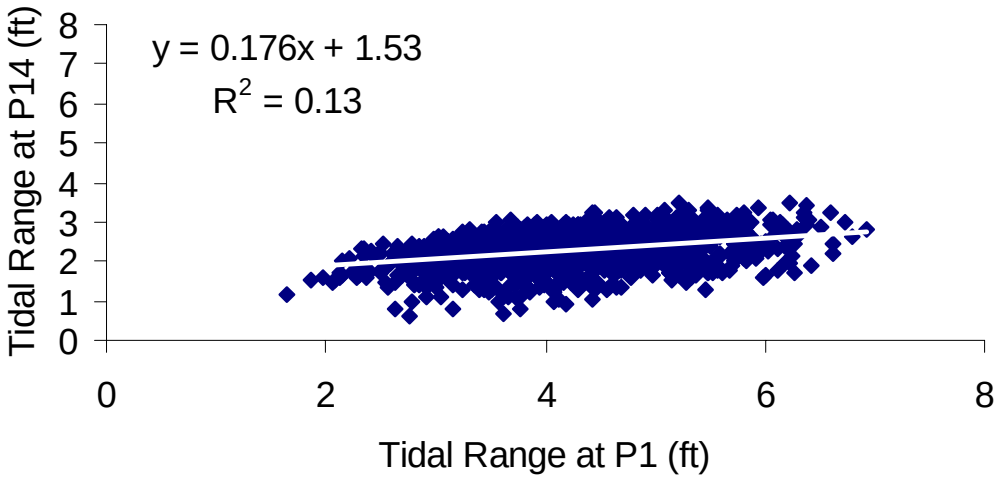


Figure 3.45A-4. Plot showing relationship between tidal ranges observed at Ft. Caswell (P1) and Prince George Creek (P14).

3.5A Influence of Upstream Flow

The mean annual discharge for the 2003-2004 reporting period (Figure 3.5A-1) was very close to that reported for this year and the mean tidal ranges. Periods of lower, drought-induced water levels and extreme flooding in the system over the last 5 years have contributed to differing tidal conditions in the Cape Fear and Northeast Cape Fear Rivers between monitoring years. These effects are confounded by the shortened data set for Year 1, which included data collected from October to June, only, and covered a period when monthly river discharge was below the long-term average (~5,531 ft^3/s) reported by the USGS at Lock and Dam 1 on the Cape Fear mainstem (Figure 3.5A-1). Interpretations related to discharge are also complicated by the fact that the discharge time series for the Northeast Cape Fear River is no longer available. As noted in the 2005-2006 report, information provided by Ramona Traynor at the USGS in Reston, VA indicates that "streamflow data collection at this station was only funded for a short term project. With the completion of the data-collection phase of the project, the station has returned to "gauge-only data collection". We suggest that the Corps pursue a dialog with the USGS to ensure that discharge data are available in the future. Nonetheless, data from previous years indicate that even though discharge rates in the Northeast Cape Fear River are lower than in the mainstem, periods of increased discharge frequently occur. As discussed in previous reports, the higher tidal ranges observed for P1 for the first two monitoring periods may reflect lower than average flows in the river which have a tendency to produce higher tidal ranges. In contrast, the above average discharges recorded during monitoring Years 3 and 4, may explain the lower mean tidal ranges observed at P1 and other stations during those years. The Year 5 discharge data included fewer high flow events and more closely approximated mean conditions for the river (Figures 3.5A-1 and 3.5A-2) than the previous 3 years. During this reporting period, the mean discharge in the Cape Fear mainstem exceeded the 30 year average for the first time since 2004-2005. The mean discharge for this reporting period is similar to the mean discharge reported for 2003-2004. This similarity in discharge may account for the greater similarity in mean tidal ranges between this reporting period and 2003-2004 than between this reporting period and the intervening years for the upriver stations (Table 3.5A-1).

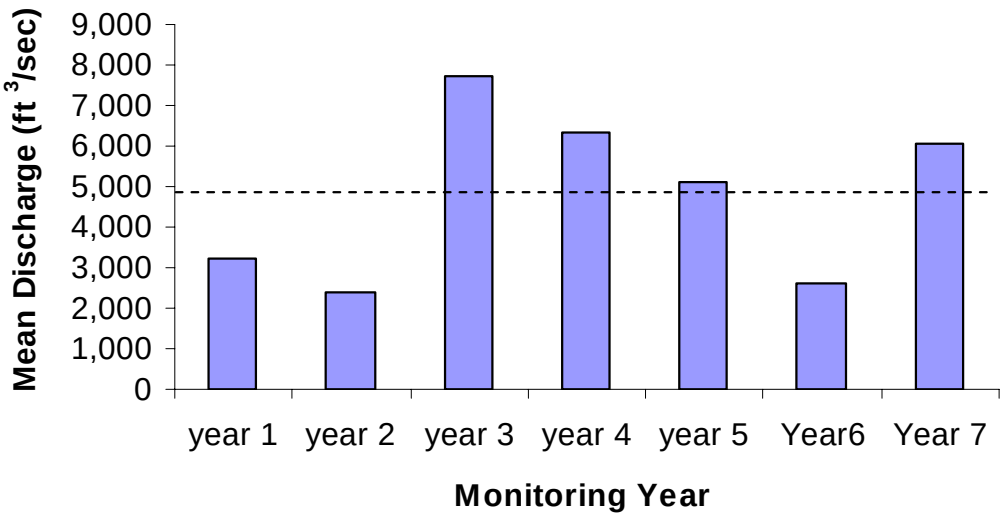


Figure 3.5A-1. Mean discharge for each monitoring period. Monitoring Year 1 is October 2000 to May 2001; monitoring Year 2 in June 2001 to May 2002; monitoring Year 3 is June 2002 to May 2003; monitoring Year 4 is June 2003 to May 2004; monitoring Year 5 is June 2004 to May 2005; monitoring Year 6 is June 2005 to May 2006; and monitoring Year 7 is June 2006 to May 2007. The line denotes the long-term mean discharge for the Cape Fear River as measured at Lock 1 by a USGS gauging station.

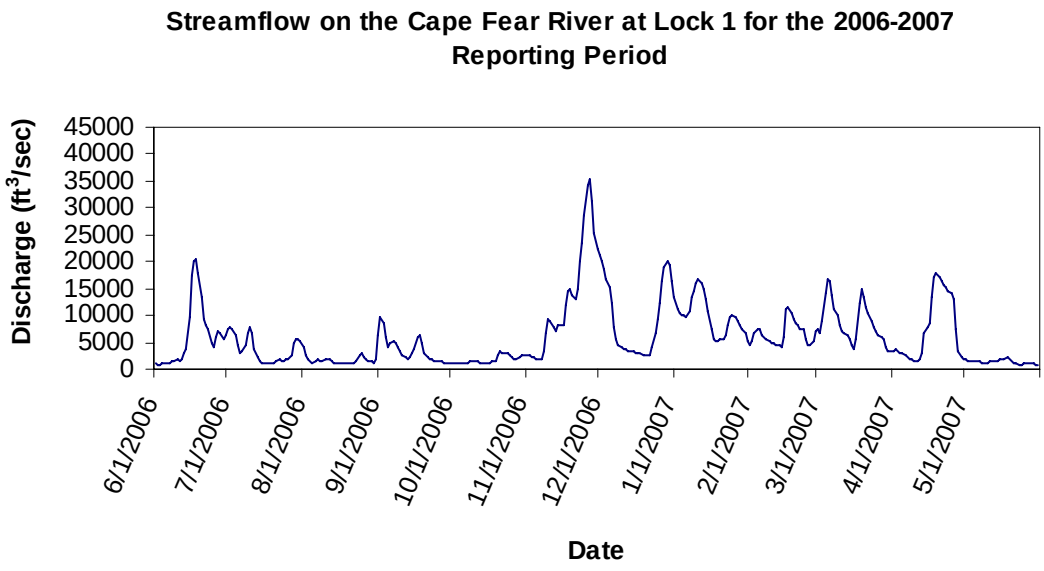


Figure 3.5A-2. Plot showing discharge in the Cape Fear River at Lock 1 for the current monitoring period. Data available at http://nwis.waterdata.usgs.gov/nc/nwis site number 02105769.

Table 3.5A-1**.** Mean tidal ranges for upriver stations in both the Cape Fear River and Northeast Cape Fear River. The data are derived from tables included in monitoring reports submitted between 2003 and present.

Station Number	Mean Tidal Range (ft) 2003-2004	Mean Tidal Range (ft) 2004-2005	Mean Tidal Range (ft) 2005-2006	Mean Tidal Range (ft) 2006-2007
P6	4.33 ± 14.14%	4.29 ± 15.44%	4.22 ± 13.92%	4.29 ± 15.00%
P7	3.74 ± 15.0%	3.79 ± 14.33%	3.84 ± 14.05%	3.72 ± 16.53%
P8	3.22 ± 19.9%	3.32 ± 16.83%	3.46 ± 15.22%	3.21 ± 22.42%
P9	2.81 ± 26.8%	3.03 ± 21.23%	3.21 ± 15.89%	2.93 ± 24.35%
P11	4.19 ± 14.44%	4.22 ± 14.63%	4.21 ± 14.32%	4.17 ± 15.91%
P12	3.77 ± 13.4%	3.75 ± 14.16%	3.75 ± 14.53%	3.72 ± 14.46%
P13	3.16 ± 13.9%	3.16 ± 13.98%	3.18 ± 14.92%	3.13 ± 15.85%
P14	2.19 ± 20.4%	2.21 ± 19.18%	2.31 ± 18.18%	2.24 ± 20.06%

3.6A Tidal Harmonics

Because tides are resonance phenomena, any changes in cross sectional area will affect propagation frequency such that some harmonic components may be altered to a greater or lesser degree. In the CFR, it is anticipated that the tidal amplitudes and phases of the six primary harmonics, as monitored and defined by the National Ocean Service of the National Oceanic and Atmospheric Administration, will change after dredging. By focusing on the primary harmonics for the Lower Cape Fear, we are attempting to resolve differences in water levels resulting from tides versus upstream inputs.

A classical tidal harmonics analysis was performed on each of the individual stations of the Cape Fear River Project (Table 3.6A-1) using the MATLAB version of T-Tide (Pawlowicz et al. 2002). The relative phase and amplitude of the major frequencies in the measured 6-minute water level data have been determined with error estimates and a 95% confidence level. Constituents were considered significant if the signal-to-noise ratio was greater than 1. As expected the M2 component is the dominant constituent at every station. This result is consistent with the previous reporting period. These phase/amplitude data provide a compression of the data in the complete time series and will eventually be used to identify differences in tidal dynamics between the stations along the river that have been impacted by channel modification activities. Table 3.6A-2 shows tidal harmonics for station P4 over the years spanning 1994 to 2006. Station P4 was selected because water level time series data were available for several years prior to the initiation of dredging activities and because harmonic constituents have been well-established. T-tide was used to determine the phase and amplitude of the dominant tidal constituents by year. While the relative dominance of the lesser constituents varied among years, the M2 component was the dominant constituent every year. Neither the amplitude nor the phase of the M2 constituent has changed appreciably over the years examined. For the most part, the amplitude has varied between 2.03 and 2.09. Higher amplitudes were noted in 1997 (pre-dredging) and in 2003 and 2004 (during dredging

modifications). Lower amplitudes occurred in 1994, 1995, and 1998 (prior to dredging activities) and again in 2001 and 2002 after dredging had been initiated. There does not appear to be a consistent pattern in amplitude change over the 11 year period examined. The amplitude of the M2 constituent for the current reporting period is very close to the amplitude reported last year. Changes in harmonic amplitude initially appear to be more closely linked to variations in discharge than dredging activities. As expected, the M2 amplitude at sites P2, P6, and P11 (sites just upstream and downstream of P4) are more similar to the P4 M2 amplitude than other monitoring sites.

Table 3.6A-1. Summary of tidal harmonics for reporting period 2006-2007. Errors shown represent the standard error association with each respective data set.

Site	Tide	Amplitude	Amplitude Error	Phase	Phase Error
P01	M2	1.9582	0.032	220.44	0.98
	N2	0.4363	0.033	209.39	4.54
	K1	0.4211	0.035	249.93	4.38
	S2	0.275	0.036	131.24	6.93
	O1	0.2649	0.032	127	7.83
P02	M2	2.0717	0.043	263.19	1.32
	N2	0.4078	0.044	251.43	6.37
	K1	0.332	0.047	298.13	7.26
	S2	0.2645	0.033	133.59	6.81
	O1	0.2596	0.036	152.69	6.84
P03	M2	1.3047	0.05	291.23	1.79
	K1	0.2552	0.047	295.33	9.41
	N2	0.1929	0.045	340.76	12.84
	O1	0.1842	0.023	179.07	7.34
	S2	0.1636	0.023	164.13	7.91
P06	M2	2.0632	0.048	278.69	1.35
	N2	0.3983	0.047	269.05	6.03
	K1	0.3135	0.054	316.6	7.82
	S2	0.2544	0.037	163.6	8.31
	O1	0.2533	0.034	144.24	6.73
P07	M2	1.777	0.044	290.94	1.36
	N2	0.3326	0.043	285.7	8.08
	K1	0.2457	0.043	329.2	10.91
	O1	0.2407	0.027	173.83	6.77
	S2	0.2393	0.026	154.53	7.09
P08	M2	1.5875	0.049	332.23	1.77
	K1	0.3343	0.024	181.44	4.79
	O1	0.2606	0.045	351.09	9.55
	N2	0.2368	0.031	214.11	7.54
	S2	0.1515	0.048	355.29	16.85
P09	M2	1.2873	0.067	333.23	2.75
	K1	0.2299	0.065	352.28	15.59
	O1	0.2131	0.026	214.12	7.63
	N2	0.2084	0.025	169.85	6.71

Table 3.6A-1. (concluded)

Site	Tide	Amplitude	Amplitude Error	Phase	Phase Error
	S2	0.1347	0.058	343.22	27.94
P11	M2	2.013	0.047	303.88	1.25
	N2	0.3824	0.047	307.35	7.31
	K1	0.3008	0.043	316.75	8.78
	O1	0.248	0.033	144.58	8.87
	S2	0.2478	0.035	188.95	8.15
P12	M2	1.7744	0.035	314.44	1.35
	N2	0.3445	0.037	323.06	6.47
	K1	0.2805	0.04	330.96	7.37
	S2	0.2243	0.031	197.37	7.05
	O1	0.1937	0.031	155.22	8.95
P13	M2	1.4802	0.042	326.72	1.79
	N2	0.2628	0.042	333.94	8.45
	K1	0.1991	0.027	210.49	6.63
	S2	0.1978	0.028	165.23	7.49
	O1	0.1953	0.039	342.06	11.68
P14	M2	0.9689	0.054	331.27	2.78
	N2	0.1685	0.022	223.98	7.36
	K1	0.1586	0.021	179.65	6.84
	O1	0.1501	0.051	354.64	18.51
	S2	0.0819	0.056	352.76	42.94

Table 3.6A-2. Summary of yearly tidal harmonics for station P4 from 1994 to 2006. Errors shown represent the standard error association with each respective data set.

Year	Tide	Amplitude	Amplitude Error	Phase	Phase Error
1994	M2	2.0292	0.019	278.61	0.53
	N2	0.4042	0.016	273.67	2.49
	K1	0.2552	0.016	148.7	3.59
	S2	0.2475	0.018	310.98	4.5
	O1	0.1759	0.019	172.29	5.39
	P1	0.092	0.016	158.88	11.02
1995	M2	2.0374	0.016	278.72	0.52
	N2	0.3876	0.018	273.44	2.6
	S2	0.2349	0.017	311.04	4.78
	K1	0.2236	0.016	149.54	4.57
	O1	0.1776	0.017	174.01	5.37
	P1	0.0829	0.017	157.01	11.85
1996	M2	2.0925	0.023	279.22	0.58
	N2	0.3901	0.02	271.06	3.41
	S2	0.2511	0.021	312.45	5.64
	K1	0.2328	0.022	155.42	5.51
	O1	0.1635	0.02	169.37	6.59
	P1	0.0936	0.021	163.6	12.77

Table 3.6A-2. (continued)

Year	Tide	Amplitude	Amplitude Error	Phase	Phase Error
1997	M2	2.0934	0.017	279.78	0.42
	N2	0.3757	0.018	272.17	2.46
	S2	0.2399	0.017	312.47	3.72
	K1	0.2268	0.019	156.46	4.81
	O1	0.1611	0.017	163.3	6.95
	P1	0.0898	0.019	160.1	11.54
1998	M2	2.0315	0.024	281.11	0.63
	N2	0.3747	0.02	267.61	2.8
	K1	0.2347	0.017	160.05	5.52
	S2	0.2306	0.022	311.18	5.14
	O1	0.1831	0.016	161.94	5.91
	P1	0.0976	0.017	147.25	10.41
1999	M2	2.0322	0.032	281.45	0.89
	N2	0.3835	0.033	269.1	4.19
	S2	0.2437	0.031	311.72	6.5
	K1	0.233	0.018	163.4	3.84
	O1	0.1775	0.018	155.05	5.63
	P1	0.101	0.018	163.96	10.7
2000	M2	2.061	0.012	281.36	0.3
	N2	0.3999	0.011	270.58	1.63
	S2	0.246	0.013	308.76	2.42
	K1	0.2412	0.014	165.5	2.74
	O1	0.172	0.012	151.74	4.37
	P1	0.1016	0.012	164.04	6.32
2001	M2	2.0368	0.015	280.83	0.45
	N2	0.4185	0.018	269.97	2.45
	K1	0.2626	0.016	162.8	3.58
	S2	0.2594	0.017	308.46	3.42
	O1	0.1945	0.016	155.4	4.36
	P1	0.0896	0.015	161.15	10.74
2002	M2	2.0304	0.013	279.96	0.5
	N2	0.4274	0.016	272.48	2.26
	K1	0.2818	0.015	162.31	2.95
	S2	0.2722	0.015	307.5	3.2
	O1	0.213	0.013	151.06	4.41
	P1	0.1047	0.016	167.79	8.28
2003	M2	2.1106	0.019	277.22	0.48
	N2	0.4341	0.021	272	2.86
	K1	0.2883	0.019	158.71	3.81
	S2	0.2703	0.018	303.72	4.1
	O1	0.2267	0.016	157.51	4.85
	P1	0.0776	0.017	147.96	13.59

Table 3.6A-2. (concluded)

Year	Tide	Amplitude	Amplitude Error	Phase	Phase Error
2004	M2	2.1067	0.016	276.66	0.42
	N2	0.4145	0.019	271.6	1.97
	K1	0.2957	0.015	155.28	2.92
	S2	0.2844	0.016	307.37	3.18
	O1	0.236	0.015	157.85	3.7
	P1	0.0909	0.014	159.76	10.99
2005	M2	2.0998	0.018	275.82	0.58
	N2	0.3863	0.021	269.08	2.91
	K1	0.304	0.016	156.03	3.01
	S2	0.2826	0.02	304.19	3.44
	O1	0.2494	0.016	159.28	3.5
	P1	0.0933	0.018	152.62	9.17
2006	M2	2.0967	0.015	40.16	0.44
	N2	0.3789	0.015	315.05	2.64
	K1	0.3048	0.019	149.04	3.19
	S2	0.2764	0.015	307.25	2.9
	O1	0.241	0.019	288.87	4.29

3.0 PART B - SALINITY PROFILES IN THE CAPE FEAR RIVER TO LOCK AND DAM 1

3.1B Summary

Vertical salinity profiles were measured at twelve stations during cruises conducted between August 2006 and May 2007 in the Cape Fear River from P7 to Lock & Dam 1. The cruises consisted of 2 persons on a vessel stopping and collecting data using a GPS for location, YSI85 for salinity detection and Van Durn bottle for water collection. During these nine months of field collection, flow rates over Lock and Dam 1 ranged from 963 cfs to 3,640 cfs (Figure 3.5A-2). During the period of highest flow rate in December 2006 no saline water was observed at any station. Data collected in May 2006, during the lowest flow period, also did not detect saline water at any station from the surface to maximum depth (Figure 3.1B-1). No saline water was measured during any of the nine cruises.

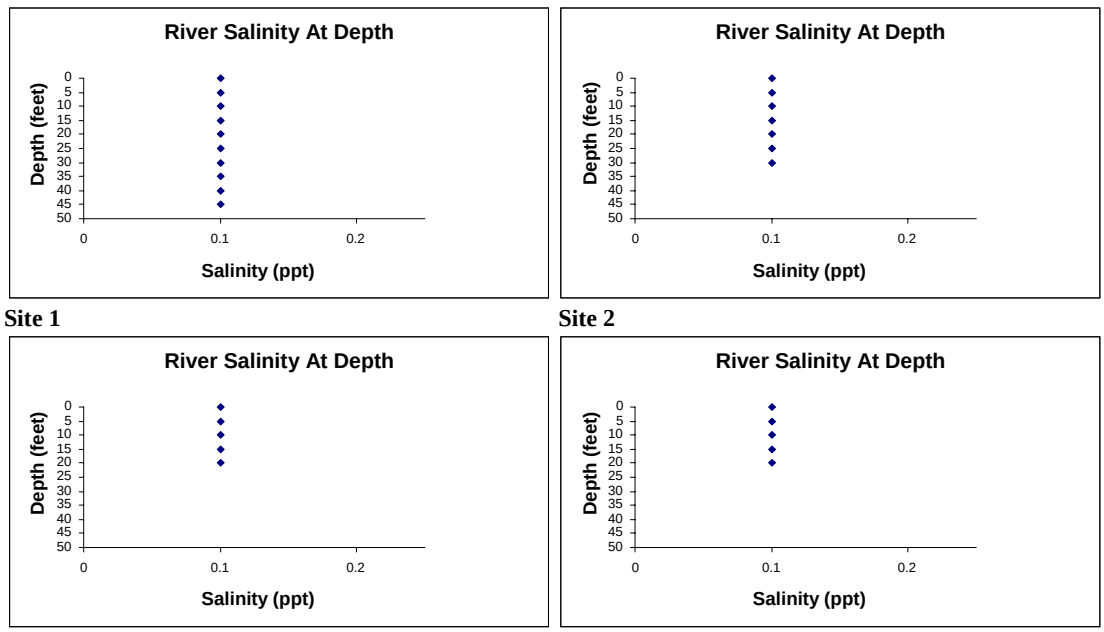
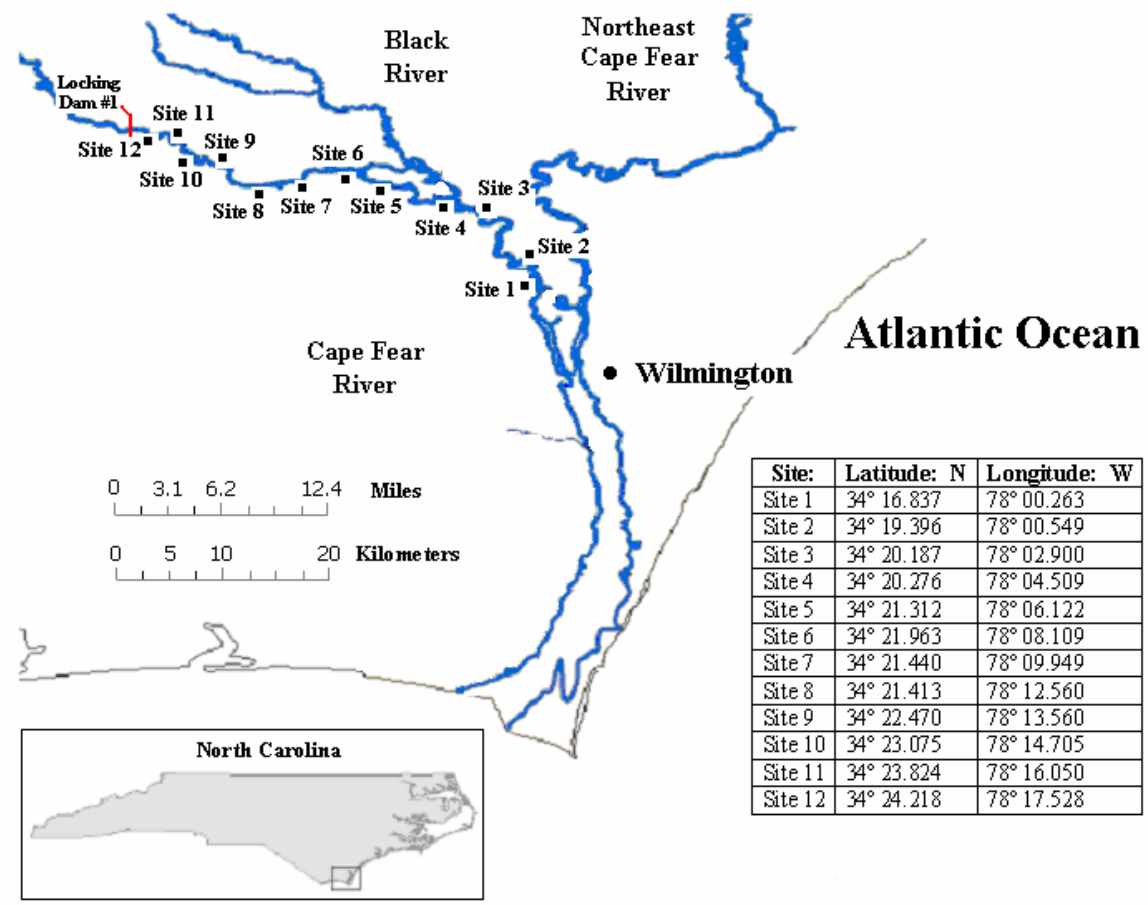


Figure 3.1B-1. Sites 1 through 4 were the stations closest to the ocean and did not exhibit saline water at any depth during the period of lowest stream flow measured over Lock and Dam 1. Data collected in May 2006.

3.2B Background

Monitoring to detect a potential increased tidal range due to deepening of the Wilmington Harbor has occurred since June of 2000. Surface water salinity has been collected continuously at 12 monitoring stations (Figure 1.2-1) since that time. These measurements, however, did not include measurements of salinity throughout the entire

water column. Factors influencing this part of the river are the release of water from Jordan Lake and the resulting flow of water over Lock and Dam 1, variations of tide, and rainfall, which feeds local streams. In order to monitor the salinity gradient, 12 sites (Figure 3.2B-1) were established. The upstream limit of saltwater has become more important since the USACE began a consideration of removal or modifications of locks and dams in the Cape Fear River as part of an overall interest in improving the migration of anadramous fish, especially short-nose sturgeon, an endangered species. Several communities obtain their freshwater from intakes above Lock & Dam 1 on the Cape Fear River. If saline water penetrated upstream to Lock and Dam 1, the water supply of these communities could be threatened. The Wilmington District of USACE requested profiles upstream from the furthest known upstream salinity incursion to determine the extent of saline water upstream.



Site:	Latitude: N	Longitude: W
Site 1	34° 16.837	78° 00.263
Site 2	34° 19.396	78° 00.549
Site 3	34° 20.187	78° 02.900
Site 4	34° 20.276	78° 04.509
Site 5	34° 21.312	78° 06.122
Site 6	34° 21.963	78° 08.109
Site 7	34° 21.440	78° 09.949
Site 8	34° 21.413	78° 12.560
Site 9	34° 22.470	78° 13.560
Site 10	34° 23.075	78° 14.705
Site 11	34° 23.824	78° 16.050
Site 12	34° 24.218	78° 17.528

Figure 3.2B-1. Location of salinity depth sampling stations.

3.3B Methods

Twelve collection sites were established randomly and equally spaced along the river. The first station coincided with P7, approximately 14 miles North of Wilmington, North Carolina on the main stem Cape Fear River. Eleven additional sites were established from P7 to Lock and Dam 1 and a GPS fix determined for each. Waypoints (Figure 3.2B-1), established at each sampling location, were used for consistency during the study. When an increase in salinity was observed at the Indian Creek (P7) monitoring station, a cruise was conducted. This resulted in a total of 9 cruises from August 2006 until May 2007. Each cruise began on-or-close to a high tide and followed the high tide upstream. Thus, profiles were collected at high tide at each station when saline water was expected to be at its maximum penetration upstream. Each vertical profile recorded salinity, conductivity, temperature, and dissolved oxygen. These data should provide a view of the salinity wedge and its maximum upstream propagation when all 12 stations are examined together.

Water parameters were measured at each site starting at the surface, and at 5-foot depth intervals until 45 feet or the bottom was reached. Data were collected with a YSI 85 equipped with a 50-foot cable and multi-parameter probe that measured dissolved oxygen, temperature, conductivity, and salinity. The multi-parameter instrument was calibrated prior to the beginning of each sampling day. Water samples were taken with a Van Dorn water bottle at the first and last site at the surface, and lowest 5- foot increment possible. Samples were also collected if a change of conductivity was observed that might indicate ocean-derived salt water. Water samples were added to a 20 ml serum vial with a ratio of 1 ml of sample to 10 ml of milli Q water. Immediately after collection, the samples were capped and placed on ice. Samples were analyzed on a Dionex DX-1500 chromatograph for both chloride and sodium. Prior to analyzing samples the DX-1500 was calibrated using a Dionex seven anion standard. Milli Q water was run through the chromatograph for a control. The ratio of chloride to sodium is a constant and expected in all samples where an increase in conductivity above background was caused by ocean-derived saltwater. Other sources of increased conductivity in water do not show this ratio.

3.4B Results

There were no cruises where ocean-derived saltwater was found at any station. Figure 3.4B-1 illustrates the pattern found at all sites during all nine cruises, i.e. there was no salt water nor was any type of differentiation observed with respect to vertical profile and conductivity. The profile remained linear in shape and consistent during all collections. Data shown in Figure 3.1B-1 were from the period of the year when flow of freshwater over Lock & Dam 1 was lowest. Saline water would be expected to reach its maximum upstream intrusion during this time. Additional data can be found in Appendices B and C.

4.0 MARSH/SWAMP FLOOD AND SALINITY LEVELS

4.1 Summary

There were some marked differences in flooding frequency at a number of upstream stations. Significant differences (see Section 3) in tidal ranges occurred in 2006-2007 compared to both the previous reporting year and the initial year (2000-2001). Most occurred for upstream stations likely result from inter-annual difference in upstream discharge.

4.2 Data Base

Few problems were encountered this reporting year with the exception of P6 (Eagle Island) and P7 (Indian Creek) in spring 2007 (Tables 4.2-1 and 4.2-2). Station P6 has experienced additional erosion due to an increase in boat traffic from a boat manufacturing operation in Leland, North Carolina. Boats are tested at high speeds adjacent to P6. Instruments at subsite 1 at P6 were destroyed by wakes and instruments at subsite 2 damaged. At P7, there was extensive development in the adjacent uplands and clearing of the entire wetlands for development. Timber operations, heavy equipment, and the general disturbance at the site prevented the deployment of water level monitors and other electronics at these substations. A few subsites at other stations do not have salinity data (Tables 4.2-3 and 4.2-4) due to equipment failure, but these data losses were minor.

Table 4.2-1. Flooding frequency, duration, depth, and actual water level of marsh/swamp substations during fall 2006. Actual water level is calculated using the maximum depth and marsh/swamp surface elevation relative to NAVD88 datum.

Station Number	Substation Number	Season	Start Date	End Date	# Flood Events	Mean Flood Duration (hr)	Maximum Depth (ft)	Marsh/Swamp Elevation (ft)	Actual water level (ft)
P3	1	Fall 06	9/20/2006	10/4/2006	26/27	5.6	2.2	0.66	1.5
	2	Fall 06	9/20/2006	10/4/2006	26/27	5.4	2.0	0.83	1.2
	3	Fall 06	9/20/2006	10/4/2006	26/27	6.0	2.1	0.52	1.6
	4	Fall 06	9/20/2006	10/4/2006	26/27	6.0	2.0	1.49	0.5
	5	Fall 06	9/20/2006	10/4/2006	22/27	5.3	1.9	0.99	0.9
	6	Fall 06	9/20/2006	10/4/2006	22/27	4.4	4.3	3.31	1.0
P6	1	Fall 06	10/4/2006	10/18/2006	27/27	6.6	3.5	0.76	2.7
	2	Fall 06	10/4/2006	10/18/2006	27/27	5.4	3.5	1.56	1.9
	3	Fall 06	10/4/2006	10/18/2006	27/27	6.7	3.4	0.85	2.6
	4	Fall 06	10/11/2006	10/18/2006	14/27	4.5	3.2	1.13	2.1
	5	Fall 06	10/4/2006	10/14/2006	17/27	4.9	3.6	1.92	1.7
	6	Fall 06	10/4/2006	10/18/2006	21/27	5.0	3.3	1.74	1.6
P7	1	Fall 06	9/15/2006	9/29/2006	27/27	5.3	3.4	1.76	1.6
	2	Fall 06	9/15/2006	9/29/2006	16/27	4.7	3.3	2.23	1.1

Table 4.2-1. (concluded)

Station Number	Substation Number	Season	Start Date	End Date	# Flood Events	Mean Flood Duration (hr)	Maximum Depth (ft)	Marsh/Swamp Elevation (ft)	Actual water level (ft)
	3	Fall 06	9/15/2006	9/29/2006	12/27	5.2	3.3	2.26	1.0
	4	Fall 06	9/15/2006	9/29/2006	12/27	4.6	3.5	2.43	1.1
	5	Fall 06	9/15/2006	9/29/2006	13/27	4.5	3.3	2.31	1.0
	6	Fall 06	9/15/2006	9/29/2006	8/27	6.1	3.3	2.37	0.9
P8	1	Fall 06	10/13/2006	10/27/2006	14/27	4.8	2.9	2.14	0.8
	2	Fall 06	10/13/2006	10/27/2006	22/27	4.6	2.9	1.54	1.4
	3	Fall 06	10/13/2006	10/27/2006	27/27	4.8	3.0	1.46	1.5
	4	Fall 06	10/13/2006	10/27/2006	14/27	3.9	2.8	1.98	0.8
	5	Fall 06	10/13/2006	10/27/2006	4/27	3.9	2.8	2.24	0.6
	6	Fall 06	10/13/2006	10/27/2006	3/27	4.4	2.7	2.38	0.3
P9	1	Fall 06	9/29/2006	10/13/2006	27/27	8.8	3.2	0.58	2.6
	2	Fall 06	9/29/2006	10/13/2006	27/27	5.4	3.1	2.21	0.9
	3	Fall 06	9/29/2006	10/13/2006	21/27	4.2	3.0	1.22	1.8
	4	Fall 06	9/29/2006	10/13/2006	17/27	5.6	3.0	2.06	0.9
	5	Fall 06	9/29/2006	10/13/2006	0/27	0.0	0.0	2.20	-2.2
	6	Fall 06	9/29/2006	10/13/2006	15/27	5.3	3.0	1.92	1.1
P11	1	Fall 06	10/18/2006	11/1/2006	20/27	4.8	2.9	1.44	1.5
	2	Fall 06	10/18/2006	11/1/2006	19/27	5.0	3.0	1.82	1.2
	3	Fall 06	10/18/2006	11/1/2006	18/27	4.6	3.0	1.76	1.2
	4	Fall 06	10/18/2006	11/1/2006	17/27	5.6	2.8	1.85	1.0
	5	Fall 06	10/18/2006	11/1/2006	16/27	6.2	2.9	1.91	1.0
	6	Fall 06	10/18/2006	11/1/2006	14/27	5.3	3.1	2.04	1.1
P12	1	Fall 06	11/3/2006	11/17/2006	27/27	6.1	3.1	0.90	2.2
	2	Fall 06	11/3/2006	11/17/2006	26/27	4.7	2.9	1.62	1.3
	3	Fall 06	11/3/2006	11/17/2006	17/27	4.3	2.8	2.00	0.8
	4	Fall 06	11/3/2006	11/17/2006	13/27	4.6	2.8	1.90	0.9
	5	Fall 06	11/3/2006	11/17/2006	10/27	3.9	2.5	2.08	0.4
	6	Fall 06	11/3/2006	11/17/2006	7/27	4.6	2.9	2.44	0.5
P13	1	Fall 06	12/6/2006	12/20/2006	9/27	4.4	2.4	1.43	1.0
	2	Fall 06	12/6/2006	12/20/2006	23/27	5.3	2.6	1.08	1.5
	3	Fall 06	12/6/2006	12/20/2006	26/27	4.6	2.3	0.75	1.6
	4	Fall 06	12/6/2006	12/20/2006	25/27	3.8	2.6	1.00	1.6
	5	Fall 06	12/6/2006	12/20/2006	23/27	4.0	2.6	1.21	1.4
	6	Fall 06	12/6/2006	12/20/2006	5/27	5.0	2.5	1.64	0.9
P14	1	Fall 06	11/1/2006	11/15/2006	27/27	8.4	2.7	0.70	2.0
	2	Fall 06	11/1/2006	11/15/2006	27/27	6.6	2.4	0.87	1.5
	3	Fall 06	11/1/2006	11/15/2006	27/27	6.6	2.3	1.08	1.2
	4	Fall 06	11/1/2006	11/15/2006	26/27	5.7	2.3	1.22	1.1
	5	Fall 06	11/1/2006	11/15/2006	26/27	5.3	2.4	1.28	1.1
	6	Fall 06	11/1/2006	11/15/2006	24/27	6.4	2.3	1.49	0.8

Table 4.2-2. Flooding frequency, duration, depth, and actual water level of marsh/swamp substations during spring 2007. Actual water level is calculated using the maximum depth and marsh/swamp surface elevation relative to NAVD88 datum.

Station Number	Substation Number	Season	Start Date	End Date	# Flood Events	Mean Flood Duration (hr)	Maximum Depth (ft)	Marsh/Swamp Elevation (ft)	Actual water level (ft)
P3	1	Spr 07	4/2/2007	4/16/2007	24/27	4.8	2.0	0.66	1.3
	2	Spr 07	4/2/2007	4/16/2007	21/27	4.4	1.9	0.83	1.1
	3	Spr 07	4/2/2007	4/16/2007	24/27	5.5	1.8	0.52	1.3
	4	Spr 07	4/2/2007	4/16/2007	25/27	5.0	1.9	1.49	0.4
	5	Spr 07	4/2/2007	4/16/2007	17/27	5.1	1.8	0.99	0.8
	6	Spr 07	4/2/2007	4/16/2007	11/27	6.1	4.1	3.31	0.8
P6	1	Spr 07	ND	ND	ND	ND	ND	ND	ND
	2	Spr 07	5/1/2007	5/15/2007	24/27	5.9	3.1	1.56	1.5
	3	Spr 07	5/1/2007	5/15/2007	27/27	6.5	3.3	0.85	2.5
	4	Spr 07	5/1/2007	5/15/2007	26/27	5.8	3.2	1.13	2.1
	5	Spr 07	5/1/2007	5/15/2007	21/27	5.3	3.4	1.92	1.5
	6	Spr 07	5/1/2007	5/15/2007	18/27	5.7	3.0	1.74	1.3
P7	1	Spr 07	ND	ND	ND	ND	ND	ND	ND
	2	Spr 07	ND	ND	ND	ND	ND	ND	ND
	3	Spr 07	ND	ND	ND	ND	ND	ND	ND
	4	Spr 07	ND	ND	ND	ND	ND	ND	ND
	5	Spr 07	ND	ND	ND	ND	ND	ND	ND
	6	Spr 07	ND	ND	ND	ND	ND	ND	ND
P8	1	Spr 07	3/22/2007	4/4/2007	8/27	5.1	2.7	2.14	0.6
	2	Spr 07	3/22/2007	4/4/2007	21/27	4.2	2.7	1.54	1.2
	3	Spr 07	3/22/2007	4/4/2007	24/27	4.9	2.8	1.46	1.3
	4	Spr 07	3/22/2007	4/4/2007	10/27	5.7	2.6	1.98	0.6
	5	Spr 07	3/22/2007	4/4/2007	3/27	7.5	2.6	2.24	0.4
	6	Spr 07	3/22/2007	4/4/2007	13/27	6.1	2.6	2.38	0.2
P9	1	Spr 07	2/26/2007	3/12/2007	26/27	8.8	2.9	0.58	2.3
	2	Spr 07	2/26/2007	3/12/2007	25/27	6.3	3.4	2.21	1.2
	3	Spr 07	2/26/2007	3/12/2007	6/27	4.3	2.6	1.22	1.4
	4	Spr 07	2/26/2007	3/12/2007	12/27	4.2	3.2	2.06	1.1
	5	Spr 07	2/26/2007	3/12/2007	2/27	7.8	2.8	2.20	0.6
	6	Spr 07	2/26/2007	3/12/2007	8/27	5.1	2.9	1.92	1.0
P11	1	Spr 07	4/13/2007	4/27/2007	26/27	4.5	3.7	1.44	2.3
	2	Spr 07	4/13/2007	4/27/2007	23/27	5.0	3.6	1.82	1.8
	3	Spr 07	4/13/2007	4/27/2007	24/27	5.3	3.2	1.76	1.4
	4	Spr 07	4/13/2007	4/27/2007	22/27	5.1	3.3	1.85	1.5
	5	Spr 07	4/13/2007	4/27/2007	22/27	5.4	3.1	1.91	1.2
	6	Spr 07	4/13/2007	4/27/2007	19/27	5.3	3.2	2.04	1.2

ND=No data available

Table 4.2-2. (concluded)

Station Number	Substation Number	Season	Start Date	End Date	# Flood Events	Mean Flood Duration (hr)	Maximum Depth (ft)	Marsh/Swamp Elevation (ft)	Actual water level (ft)
P12	1	Spr 07	4/18/2007	5/2/2007	27/27	5.4	3.3	0.90	2.4
	2	Spr 07	4/18/2007	5/2/2007	22/27	5.2	3.3	1.62	1.7
	3	Spr 07	4/18/2007	5/2/2007	18/27	4.5	3.2	2.00	1.2
	4	Spr 07	4/18/2007	5/2/2007	10/27	5.5	3.2	1.90	1.3
	5	Spr 07	4/18/2007	5/2/2007	6/27	5.6	2.9	2.08	0.8
	6	Spr 07	4/18/2007	5/2/2007	6/27	6.0	3.2	2.44	0.8
P13	1	Spr 07	3/14/2007	3/28/2007	14/27	6.6	2.0	1.43	0.6
	2	Spr 07	3/14/2007	3/28/2007	21/27	5.4	2.0	1.08	0.9
	3	Spr 07	3/14/2007	3/28/2007	26/27	5.4	2.0	0.75	1.3
	4	Spr 07	3/14/2007	3/28/2007	25/27	6.0	2.1	1.00	1.1
	5	Spr 07	3/14/2007	3/28/2007	22/27	4.9	1.9	1.21	0.7
	6	Spr 07	3/14/2007	3/28/2007	10/27	3.7	1.9	1.64	0.3
P14	1	Spr 07	2/28/2007	3/14/2007	27/27	7.6	2.1	0.70	1.4
	2	Spr 07	2/28/2007	3/14/2007	27/27	5.7	2.3	0.87	1.4
	3	Spr 07	2/28/2007	3/14/2007	24/27	5.9	2.3	1.08	1.2
	4	Spr 07	2/28/2007	3/14/2007	23/27	5.7	2.3	1.22	1.1
	5	Spr 07	2/28/2007	3/14/2007	22/27	5.6	2.3	1.28	1.0
	6	Spr 07	2/28/2007	3/14/2007	13/27	5.5	2.3	1.49	0.8

Table 4.2-3. Summary of salinity data from nine substations collected along the Cape Fear River and its tributaries in fall 2006.

Station Number	Station Name	Substation Number	Fall 2006 Salinity Range (ppt)	Proportion of flood events containing > 1 ppt salinity
P3	Town Creek	1	<1 – 7	7/27
		2	<1 – 5	6/27
		3	<1 – 5	5/27
		4	<1 – 4	4/27
		5	<1 – 2	2/27
		6	<1	0/27
P6	Eagle Island	1	ND	ND
		2	<1 – 13	25/27
		3	<1 – 13	25/27
		4	<1 – 10	25/27
		5	<1 – 7	20/27
		6	<1 – 5	12/27
P7	Indian Creek	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27
P8	Dollisons Landing	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27
P9	Black River	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27
P11	Smith Creek	1	<1 – 12	14/27
		2	<1 – 8	14/27
		3	<1 – 11	14/27
		4	<1 – 10	12/27
		5	<1 – 18	16/27
		6	ND	ND
P12	Rat Island	1	<1 – 6	9/27
		2	<1 – 2	3/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27
P13	Fishing Creek	1	<1	0/27
		2	<1	0/27

Station Number	Station Name	Substation Number	Fall 2006 Salinity Range (ppt)	Proportion of flood events containing > 1 ppt salinity
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27
P14	Prince George	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	ND	ND

ND=No data available

Table 4.2-4. Summary of salinity data from nine substations collected along the Cape Fear River and its tributaries in spring 2007.

Station Number	Station Name	Substation Number	Spring 2007 Salinity Range (ppt)	Proportion of flood events containing > 1 ppt salinity
P3	Town Creek	1	<1 – 12	21/27
		2	<1 – 5	21/27
		3	<1 – 2	11/27
		4	<1 – 9	16/27
		5	<1 – 6	4/27
		6	<1 – 8	4/27
P6	Eagle Island	1	ND	ND
		2	<1 – 16	21/27
		3	<1 – 16	21/27
		4	<1 – 14	19/27
		5	<1 – 10	18/27
		6	<1 – 7	15/27
P7	Indian Creek	1	ND	ND
		2	ND	ND
		3	ND	ND
		4	ND	ND
		5	ND	ND
		6	ND	ND
P8	Dollisons Landing	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27
P9	Black River	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27

Table 4.2-4. (concluded)

Station Number	Station Name	Substation Number	Spring 2007 Salinity Range (ppt)	Proportion of flood events containing > 1 ppt salinity
		6	<1	0/27
P11	Smith Creek	1	ND	ND
		2	<1 – 9	5/27
		3	<1 – 9	15/27
		4	<1 – 9	15/27
		5	<1 – 8	2/27
		6	<1 – 8	5/27
P12	Rat Island	1	<1 – 1	1/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	ND	ND
		6	<1	0/27
P13	Fishing Creek	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	ND	ND
P14	Prince George	1	<1	0/27
		2	<1	0/27
		3	<1	0/27
		4	<1	0/27
		5	<1	0/27
		6	<1	0/27

ND=No data available

4.3 Marsh/Swamp Flooding

The general pattern of flooding within each station was similar to previous years, i.e. some subsites flooded more frequently than adjacent subsites (Tables 4.2-1 and 4.2-2). However, some stations during fall 2006 were noteworthy in that they were flooded less frequently than most previous years. Substation P13, flooded only 9 of 27 tides and two subsites (#4 & #5) at P6, flooded only 14 and 17 of 27 tides, respectively (Table 4.2-1). A closer examination of subsite P1 at P13 clearly shows that tides were affecting pore water, but the absolute elevation of high tide was below the surface level of this subsite (Figure 4.3-1). Note that when tides did flood the marsh/swamp surface the average depth and duration of flooding was not very different than previous years (Hackney et al. 2002a & b; 2003; 2005; 2006; 2007). These data are collected for two-week periods, but all stations are not collected during the same two-week time frame. Typically, each two-week period includes either a new moon or full moon tide, which are usually higher than average. There is no attempt to schedule these two-week collection periods with high or low river flow so it is not unusual for any one station to have a lower frequency of flooding from chance alone.

There were significant differences in mean tidal range between the 2005-2006 and the current reporting year (2006-2007) at seven of the eleven stations as noted in Section 3.0 of this report. The most likely explanation is related to differences in upstream freshwater discharge.

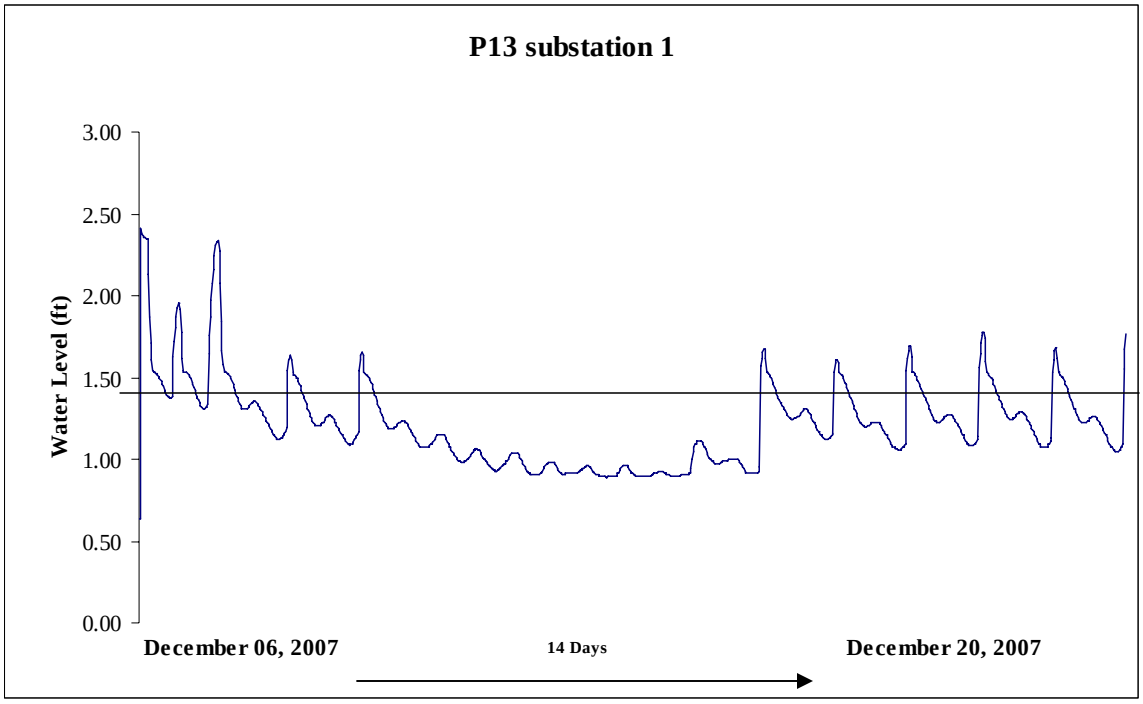


Figure 4.3-1. Water level flux at Fishing Creek (P13) at subsite 1 from 06-20 December 2006 illustrating the low frequency of surface flooding during this two week (27 tides) interval. Note the tidal signature below the surface of the swamp persists even when the subsite was not flooded.

4.4 Water Salinity in Marshes and Swamps

Salinity of surface water flooding swamps and marshes reflected the overall state of river flows relative to previous reporting periods. This reporting year was similar to 2003-2004 in that tidal ranges at DCP stations and the flow of water through lock & dam 1 were similar. As expected, this was reflected in the salinity measured on the marsh/swamp surface. No salinity was measured at P7, P8, P9, P13, or P14 during fall 2006 (Table 4.2-3). At P12, salinity was measured only at subsites 1 and 2 (Table 4.2-3). The maximum salinity measured was at P11 with 18 ppt (Table 4.2-3). Spring 2007 was similar, although no data were available for P7 (Table 4.2.4). Note, however, that only subsite 1 was influenced by saline water just one time and that was P12 only 1 ppt (Table 4.2-4). The highest salinity was measured at P6 of 16 ppt (Table 4.2-4). Station P3, P6, and P11 were regularly inundated by saline water during both spring 2007 and fall 2006.

5.0 MARSH/SWAMP BIOGEOCHEMISTRY

5.1 Summary

Geochemical data were collected at nine stations along the Cape Fear River Estuary beginning in winter of 2000. Data from the winters of 2000-2006 and the summers of 2000-2005 was presented in the previous annual reports for this project (CZR Incorporated 2001; Hackney et al. 2002a, 2002b, 2003, 2005, 2006, 2007). Data presented in the current report includes winter 2007 and summer 2006. The microbial modes of organic matter remineralization of the study sites range from sulfate reducing to methanogenic. Analysis of porewater chloride, sulfate, and methane was performed at six substations per station and at 6 sub-depths per substation. Samples were collected during the winter and summer at eight sites and monthly at P6 (Eagle Island). These data were used to classify the geochemical setting of each substation at each station as methanogenic (M), sulfate reducing (SR), methanogenic with evidence of past sulfate reduction (MPSR), and sulfate reducing with a non-seawater source of sulfate (SRNS). Classifications were compared to the previous data for these sites.

Station P6's (Eagle Island) geochemistry was analyzed monthly and displayed a steady decrease in salinity from June of 2002 until June of 2003. Salinity slightly rebounded during the winters of 2004 and 2005, however, it was still lower than previous years. Winter 2005 had almost identical conditions as 2004 with the exception of a salinity peak in November (Hackney et al. 2006). This monthly pattern of salinity variation has been observed in previous years where peaks in salinity were observed during November and May (Hackney et al. 2002a, 2002b, 2003). Last year, a similar pattern was observed with both fall (September and November) and spring (April) peaks in salinity at the substations closet to the riverbanks. Although salinity pulses were of similar magnitude to the previous year, it appeared that the consumption of sulfate was more rapid during the current year resulting in conditions unable to support active sulfate reduction. The current year is characterized by high variability in salinity and a lack of carryover from one month to the next. This suggests that the site is either well flushed or the actual floodwater varied more in salinity during the current year compared to previous ones.

5.2 Geochemical Theory and Classification

Porewater sampling of the metabolic products of sulfate reducing and methanogenic bacteria help establish the frequency and duration of organic soil inundation by tidal water carrying ocean-derived salt versus inundation by fresh water. Changes in flooding frequency have a more significant impact if salts from seawater enter the pore space of wetland sediments. In the presence of sufficient seawater sulfate, organic matter is remineralized via sulfate reducing bacteria in anaerobic environments generating hydrogen sulfide. In freshwater environments, organic matter is usually remineralized via methanogens that generate methane as a byproduct. In the presence of high levels of sulfate from seawater, methanogens are replaced by sulfate reducing bacteria and methanogenesis is inhibited. Hydrogen sulfide is toxic and limits both plants

and animal species that do not have a behavioral or physiological mechanism to tolerate this bacterial metabolite. Thus, a shift in remineralization pathway can lead to different communities of plants and animals.

Chloride concentrations are a direct measure of salinity as it occurs in a constant proportion in seawater and has no substantial sinks or sources in wetland sediments. Therefore, the term salinity used in the biogeochemistry section of this report will refer to salinity based on measured chloride concentrations.

Chloride and sulfate concentrations are in a constant ratio in seawater (approximately 20:1). Unlike sulfate, which can decrease due to sulfate reduction, there are no common removal mechanisms (biotic or abiotic) for chloride from seawater. Therefore, chloride concentrations can be used as an indicator of the amount of sulfate originally supplied to a site by seawater. Changes in the ratio of chloride to sulfate are an indicator of sulfate reduction. In the presence of sulfate reduction, methanogenic bacteria are out competed and methane production is inhibited. Therefore, low concentrations of methane are another indicator of sulfate reduction. When sulfate concentrations decrease sufficiently, sulfate-reducing bacteria are no longer able to function and methane production dominates. Thus, a sulfate reducing threshold concentration can be identified in sulfate concentration versus depth profiles, where sulfate concentrations no longer decrease with increasing depth and methane concentrations increase. Data from all nine marsh/swamp stations of the present study place the level where the shift occurs at approximately 300 µM sulfate. This corresponds to sulfate being supplied by salinities of approximately 0.4 parts per thousand.

Using this sulfate reducing threshold (300 µM sulfate) stations and substations were classified as sulfate reducing or methanogenic. Methanogenic substations that had a chloride to sulfate ratio significantly greater than seawater (>30:1) were classified as methanogenic sites with evidence of past sulfate reduction. Sulfate reducing sites with ratios less than seawater (5:1) were classified as sulfate reducing with a non-seawater source of sulfate which may also indicate oxidation of hydrogen sulfide in the porewaters. The four main classifications are: 1) sulfate reducing (SR), 2) methanogenic (M), 3) methanogenic with evidence of past sulfate reduction (MPSR) and 4) sulfate reducing with a non-seawater source of sulfate (SRNS). Changes in these classifications will be used to determine changes in biogeochemical setting associated with river dredging, drought, or other factors.

5.3 Geochemical Methodology

Biogeochemical monitoring was established in close proximity to shallow water well/conductivity/temperature substations. Six substations are distributed along the length of each of nine monitoring belt transects with number one near the river or channel and number 6 adjacent to uplands. Substations are roughly perpendicular to the segment of the stream along which they have been established. Sampling devices, peepers, are constructed of thick acrylic with wells (1-cm deep grooves) located at six different depths that sample 1, 6, 11, 16, 21, and 26 cm below the soil surface. Semipermeable

membranes allow methane, sulfate, and chlorine to equilibrate with distilled water in wells. Peepers are inserted into the substrate and left for 1 week, which is ample time for equilibration. Peepers have been shown to be reliable collection devices for these types of dissolved substances (Hesslein 1976). The concentrations of all parameters are determined after removing samples from peeper cells with a syringe equipped with a needle. Sulfate and chloride concentrations are stable under oxic conditions and can be stored in serum vials until analysis. Sulfate and chloride concentrations are determined with an ion chromatograph (Hoehler et al. 1994). Salinity is calculated from the chloride concentrations of the equilibrated peeper chamber water based on the constant ratio of chloride to total dissolved salts in seawater. Samples for porewater methane analysis are prepared by extraction of porewater methane into an inert helium headspace within a gas-tight syringe. The headspace gas is then injected into a gas chromatograph equipped with a flame ionization detector (Kelley et al. 1995) for quantitative determination of methane concentration.

Porewater is collected and analyzed at all 54 substations in all nine transect stations during mid-summer and mid-winter, the coldest and warmest parts of the year. This provides data during periods of maximum and minimum bacterial metabolism. In addition, porewater is collected from the Eagle Island station (P6) every month using the same procedures. This station represents a transition between saline and fresh-dominated stations. In addition, the six substations represent the same transition along a different scale, well-flooded to less flooded.

5.4 Eagle Island (P6) Annual Cycles of Sulfate, Chloride, and Methane

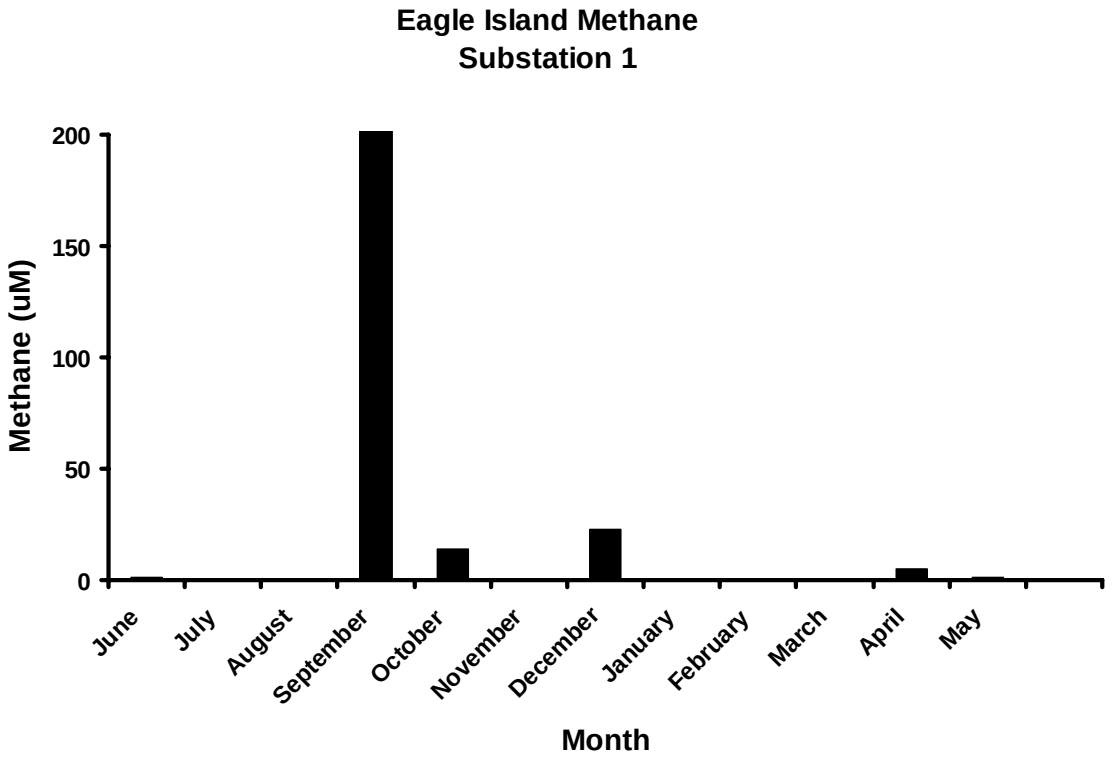
Prior to the spring of 2003, Eagle Island had been classified primarily as SR and MPSR classification because both methanogenesis and sulfate reduction occur at this station (CZR Incorporated 2001; Hackney et al. 2002a, 2002b, 2003). The occurrence of methanogenic geochemical classifications increased during the spring of 2003 and continued through the summer of 2004. Following the pulse of salinity during November 2004, many sites returned to SR classification at the near-shore stations and eventually at all locations by spring 2005 (Hackney et al. 2006). During winter 2005 and spring 2006, both fall (September and November) and spring (April) peaks in salinity were observed at the substations closest to the riverbanks (Hackney et al. 2007). Although the salinity pulses were of similar magnitude to the previous year, it appeared that the consumption of sulfate was more rapid resulting in conditions unable to support active sulfate reduction. This resulted in a combination of SR, MPSR and even some M conditions. Salinity input to Eagle Island during the current year was highly variable and showed no discernable trends or patterns. The classifications were similar to the previous year with a combination of SR, MPSR, and M classifications. The only difference between the current year and previous year's classifications was a higher occurrence of MPSR classifications. Eagle Island's general classifications are based on the following observations: 1) Methane is present at depth in all substations, but is often at very low concentrations at the surface during times of high sulfate input (Figure 5.4-1), 2) Sulfate concentrations range from below the sulfate reducing threshold of 300 µM indicating methane production, to as high as 4000 µM indicating sufficient sulfate to drive sulfate

reduction (Figure 5.4-2). The ratios of sulfate to chloride range from those found in seawater to ratios indicating a depletion of sulfate due to sulfate reduction (Figure 5.4-3). Some lower ratios also occur, possibly indicating oxidation of hydrogen sulfide from previous sulfate reduction.

Salinity input to Eagle Island varies during the 2006-2007 samping year (Figure 5.4-4). Generally the salinity is higher during summer months when the flow rate of the river is lower, however, an input of salt and a corresponding shift in classification was observed during November of 2000, 2001 and 2004 and May of 2001 and 2002 (Hackney et al. 2002a, 2002b, 2006). These events overshadowed seasonal trends and dominated geochemical conditions during these years. During the winter of 2003 and summer of 2002, the pattern of salinity variations was different (Hackney et al. 2003). Instead of salinity peaks during November and May, the salinity steadily decreased from the summer of 2002 until the spring of 2003. A November pulse of salinity during fall (2004) resulted in a shift towards SR classifications leading into the spring of 2005 (Hackney et al. 2006). Salinity variations during the previous reporting period (summer 2005, winter 2006) were surprisingly different in that the fall and spring pulses of salinity did not appear to affect the biogeochemical setting for an extended period of time due to more rapid consumption of sulfate (Hackney et al. 2007). The rapid consumption of sulfate during that year was evidenced by the high ratios of chloride to sulfate observed in the late summer and fall indicating sulfate reduction without replenishment of sulfate from sea salts (Figure 5.4-3). Salinity variations during the current reporting period were highly variable without any obvious trends or patterns (Figure 5.4-4). Peaks in salinity were observed during June, September (S6), October (S1), and May. These peaks were not followed by a slow steady decrease but often displayed dramatic decreases the next month. These results indicate that during the current year either the floodwater salinity varied more rapidly or the flushing and exchange of porewaters was more rapid.

Salinities at the near-shore station S1 were approximately 10-15 ppt during the summer of 2002 (Hackney et al. 2003). By November 2002, they had dropped below 0.5 ppt and remained there until the fall of 2003 (Hackney et al. 2005) when there was a slight increase with salinity values approaching 1 ppt. With the exception of low salinity values in February and April, the salinities though the winter of 2004 remained at approximately 1 ppt. At the beginning of the previous report year (June 2004), salinities at S1 were approximately 2 ppt and steadily decreased to approximately 0.1 ppt through October S1 (Hackney et al. 2006). A sharp increase in salinity reaching values greater than 8 ppt was observed in November. Salinities rapidly decreased and varied between approximately 0.1-2.0 ppt throughout the rest of the study period. During last years reporting period, salinities were approximately 2 ppt with the exceptions of the salinity peaks which ranged from about 4 to 9 ppt (Hackney et al. 2007). Low salinities were observed in June, the winter (December and January) and May. These salinities were less than 0.5 ppt. During the current reporting period S1 salinities ranged from <0.1 ppt to about 5 ppt and were highly variable.

At the most inland station S6, the salinities dropped from about 8 ppt during the summer of 2002 to below 0.5 ppt by March of 2003 (Hackney et al. 2003). They have



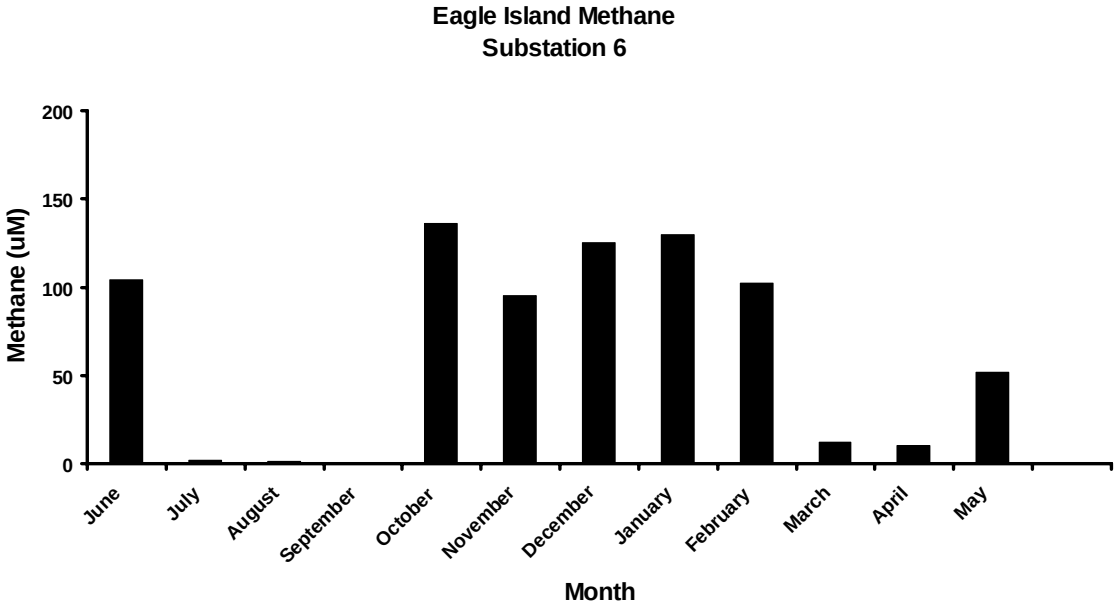
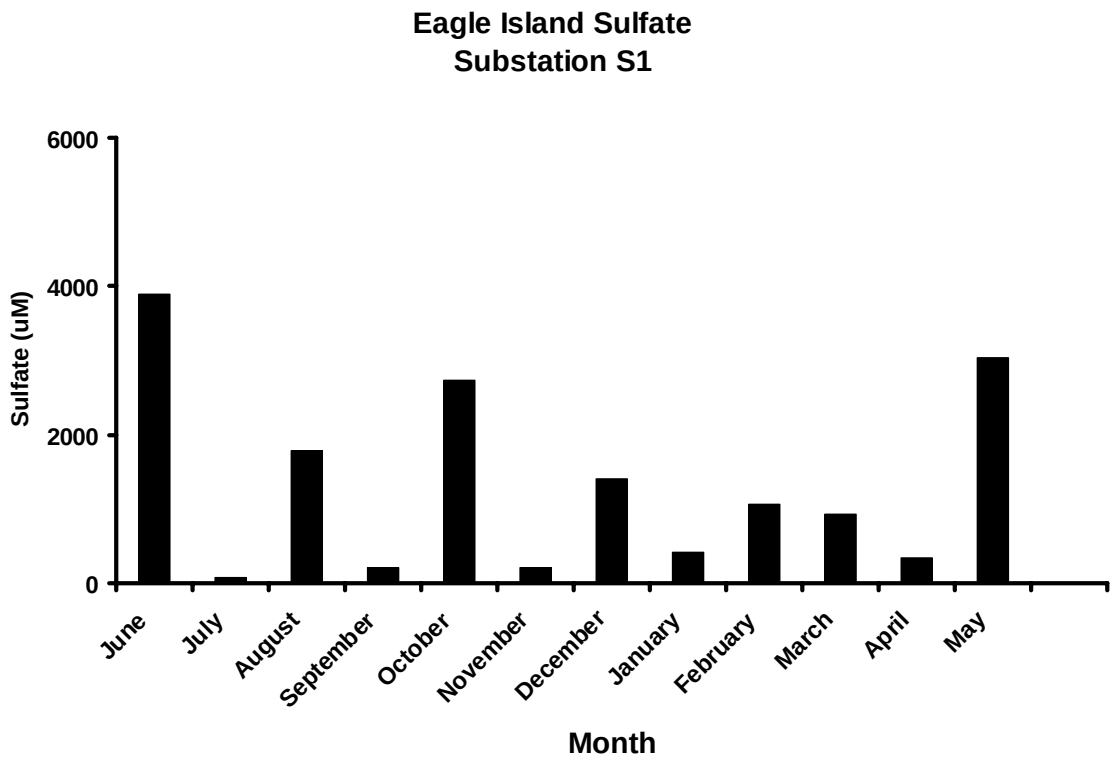


Figure 5.4-1. Methane concentrations of Eagle Island porewaters vs. month. Top shows nearshore site (S1) and bottom shows most upland site (S6).



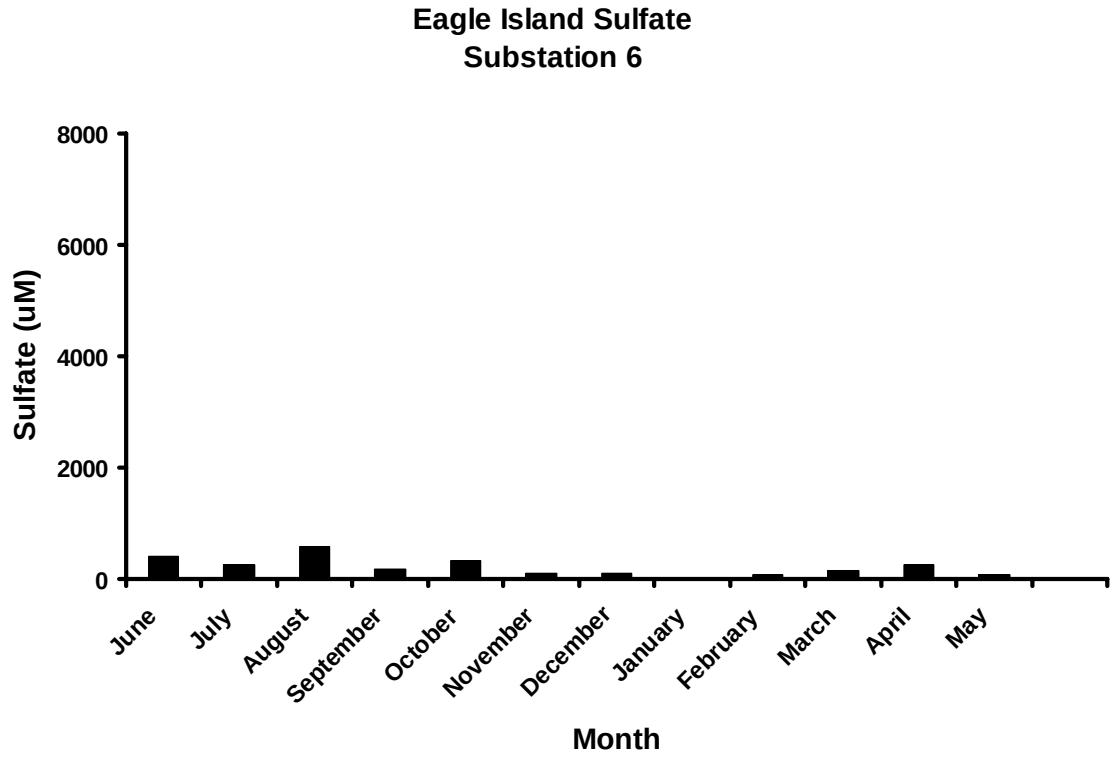


Figure 5.4-2. Sulfate concentrations of Eagle Island porewaters vs. month. Top shows nearshore site (S1) and bottom shows most upland site (S6).

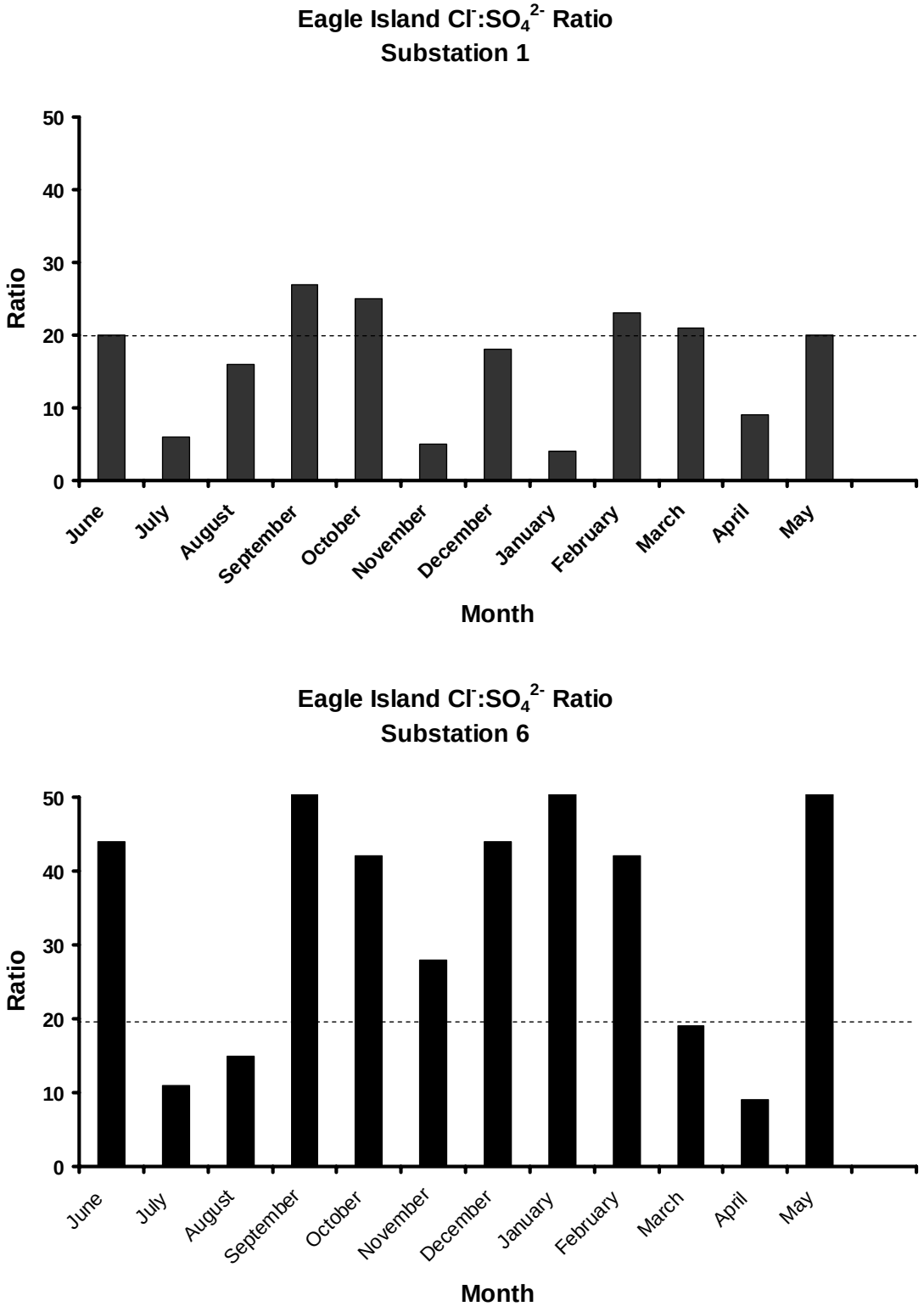
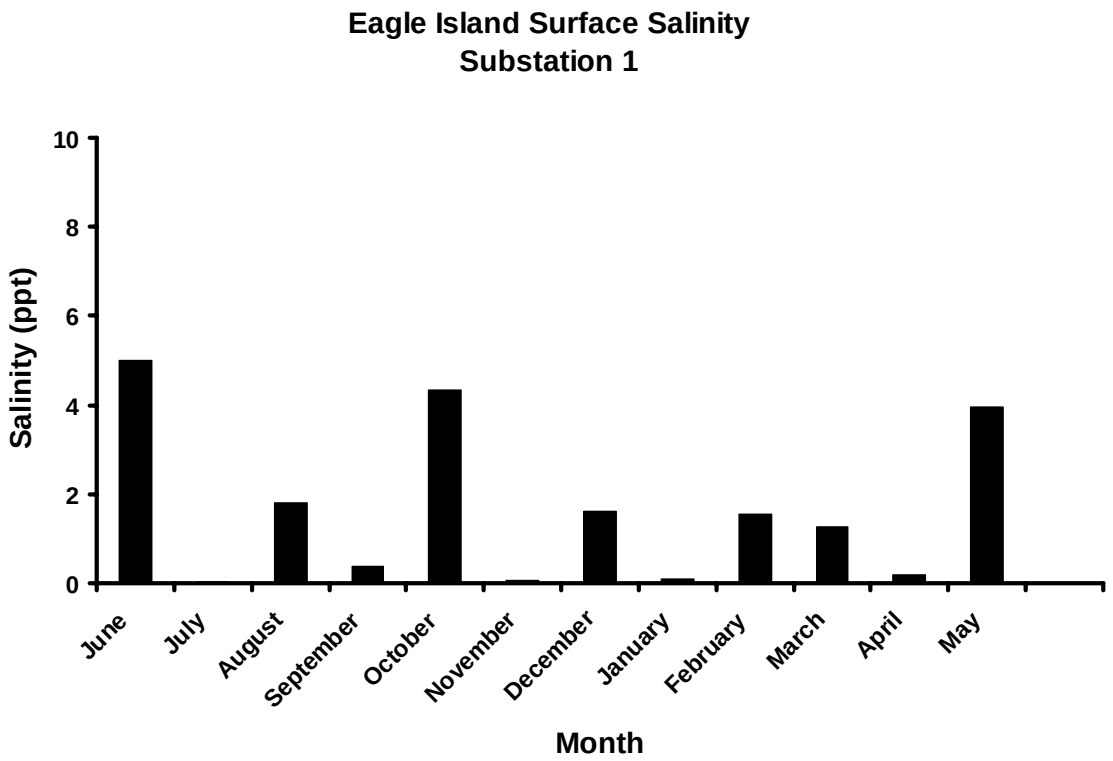


Figure 5.4-3. Chloride to sulfate ratios of Eagle Island porewaters vs. month. Dashed line shows ratio for seawater. Top shows nearshore site (S1) and bottom shows most upland site (S6).



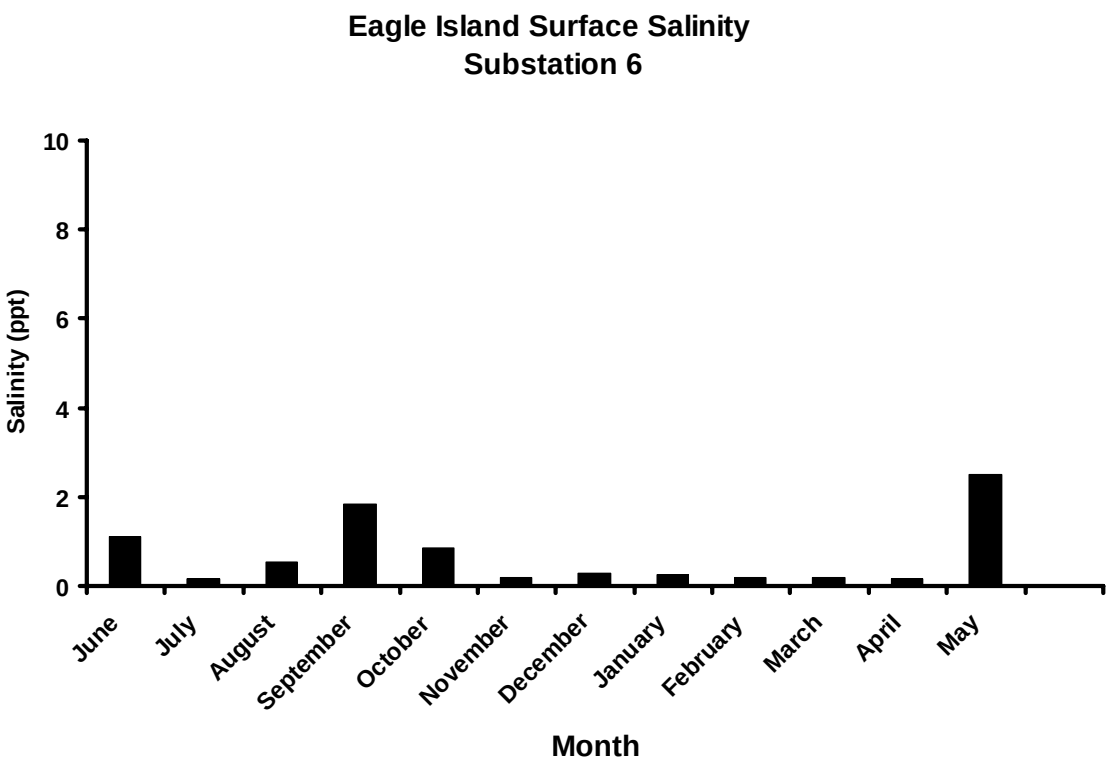


Figure 5.4-4. Salinities of Eagle Island porewaters vs. month. Top shows nearshore site (S1) and bottom shows most upland site (S6).

remained at approximately 0.1 ppt through the winter and spring of 2004 and the previous report year (Hackney et al. 2006). Salinities during the previous reporting year appear to display the fall and winter peaks in salinity which were approximately 1 ppt. During the rest of the year salinities remained in the 0.5 ppt range (Hackney et al. 2007). Salinities at S6 for the current year reached values ranging from approximately 0.2 to 2.5 ppt (Figure 5.4-4)

Sulfate concentrations at Eagle Island generally paralleled salinity trends (Figure 5.4-2), and were similar in magnitude to the previous year (Hackney et al. 2007). Sulfate concentrations at S1 during fall 2004 approached the 8,000-10,000 uM values (Hackney et al. 2006) seen during the summer of 2002 prior to the drop in salinity (Hackney et al. 2003). The current years peaks in sulfate (Figure 5.4-2) are similar to the previous year (Hackney et al. 2007) approaching approximately 4,000 uM at S1. Sulfate values at S6 remained low throughout 2004-2005 staying close to sulfate reducing threshold values (Hackney et al. 2006). During the next year concentrations exceeded threshold concentrations most of the time at this upland site and were as high as 1,700 uM during the spring peak (Hackney et al. 2007). During the current reporting year, sulfate concentrations at S6 ranged from approximately 30-400µM remaining below the threshold concentration for sulfate reduction most of the year with the exception of June, August and October (Figure 5.4-2).

Prior to the decrease in salinity that began during the fall of 2002, the majority of Eagle Island classifications were SR and MPSR (CZR Incorporated 2001; Hackney et al. 2002a, 2002b, 2003). During the following year (Hackney et al. 2005), the majority of sites were methanogenic due to continued fresh conditions with only a few sub-stations having SR classifications primarily resulting from the slight rebound in salt input which began during the winter of 2004. Geochemical classifications of Eagle Island during the 2004-2005 reporting period (Hackney et al. 2006) showed the expected trend for a system experiencing an input of salinity during November. Starting with near-shore stations, classifications shifted to SR. By May 2005, all locations had been converted to SR classifications (Hackney et al. 2006). Last year, Eagle Island classifications were mainly SR and MPSR with a few M classifications (Hackney et al. 2007) and were similar to the classifications at the onset of the monitoring project. MPSR classifications increased last year and continued to increase during the current year likely reflecting high rates of sulfate consumption (Table 5.4-1). This may have been due to higher temperatures or more bioavailable organic matter in this wetland.

The chloride to sulfate ratios ($Cl^-:SO_4^{2-}$) reflect the consumption of sulfate observed during the current year (Figure 5.4-3). At S1 the ratios were either close to the ratio of seawater indicating recent resupply of sulfate or considerably less that the sea salt ratio indicating possible oxidation of hydrogen sulfide from previous sulfate reduction. Very low ratios were observed during July and November immediately following peaks in salinity and sulfate during the previous months which is consistent with oxidation of hydrogen sulfide after rapid sulfate reduction during the previous month. Chloride to sulfate ratios for S6 varied considerably but were generally greater than the ratio seawater indicating sulfate reduction had occurred.

Table 5.4-1. Eagle Island (P6) Geochemical Classifications by month. Site classifications are as follows: Methanogenic I, Sulfate Reducing II, Methanogenic with evidence of past sulfate reduction I*, Sulfate reducing non-seawater source of sulfate II*.

Sites	June 06	July	August	September	October	November	December	January	February	March	April	May 07
S1-1	II	I	II	I	II	I	II	II*	II	II	II	II
S1-2	II	II	II	II	II	I	II	II*	II	II	II	II
S1-3	II	I*	II	I	II	I	II	II	I	II	II	II
S1-4	II	I*	II	I	II	I*	II	I*	I*	II	I*	II
S1-5	II	I*	I*	II	II	I*	II	I*	I*	I	I*	II
S1-6	I*	I*	I*	I	II	I*	I*	I*	I*	I*	I*	I*
S2-1	II	II	II	I*	II	I*	I*	I*	II	II	II	II
S2-2	II	II	II	I*	II	I*	I*	I*	I*	I*	I*	II
S2-3	II	I*	I*	II	I*	I*	I*	I*	I*	I*	I*	II
S2-4	II	I*	I*	I	I*	I*	I*	I*	I*	I*	I*	II
S2-5	I*	I*	I*	I	I*	I*	I*	I*	I*	I*	I*	II
S2-6	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	II
S3-1	II	II	II	I*	II	I	II	II	I*	II	II	II
S3-2	II	II	II	I*	II	I*	II	II	I*	II	I	II
S3-3	II	II	II	I*	II	I	II	II	I*	I*	I	II
S3-4	II	I*	II	I	II	I*	II	I*	I*	I*	I*	I*
S3-5	II	I*	II	I*	II	I*	II	I*	I*	I*	I*	I*
S3-6	II	I	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*
S4-1	II	I	II	I*	II	I	I	II	I*	I*	II	II
S4-2	II	I*	II	I*	II	I	I*	I	I*	I*	II	I*
S4-3	II	I*	II	I*	II	I	II	I	I*	I*	I*	II
S4-4	II	I*	I*	I*	II	I	I*	I*	I*	I*	I*	II
S4-5	I*	I*	I*	I*	II	I	I*	I*	I*	I*	I*	II
S4-6	I*	II	I*	I*	II	I*	I*	I*	I*	I*	I*	II
S5-1	II	II	I*	I*	I	I	I*	I	I	I	I	II
S5-2	I*	I	I*	I*	I*	I*	I*	I*	I	I*	I*	II
S5-3	I*	I*	I*	I	I*	I*	I*	I*	I*	I*	I*	I*
S5-4	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*
S5-5	I*	I*	I*	II	I*	I*	I*	I*	I*	I*	I*	I*
S5-6	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I	I*
S6-1	II	I	II	I*	II	I	I*	I*	I*	I	I	I*
S6-2	I*	I	II	I*	I*	I*	I*	I*	I*	I*	I	I*
S6-3	I*	I	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*
S6-4	I*	I*	I*	I*	I*	I*	I	I*	I	I*	I*	I*
S6-5	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*
S6-6	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*	I*

Methane concentrations at Eagle Island were generally lower at the creek bank locations compared to substations closer to uplands (Figure 5.4-1). Higher salinities at creek bank locations result in inhibition of methanogenesis at these sites, while fresher conditions near uplands are conducive to methanogenesis. Peaks in methane concentrations were observed during the fall and winter at S6 coinciding with increased chloride to sulfate ratios and concentrations of sulfate that were below threshold values. This is consistent with previous sulfate consumption lowering the amount of sulfate present below threshold concentrations allowing for methanogenesis.

5.5 Marsh/Swamp Transect Stations Geochemistry, Annual Variability

The following section compares the geochemistry of substations from the previous years 2000-2001 (Hackney et al. 2002a), 2001-2002 (Hackney et al. 2002b), 2002-2003 (Hackney et al. 2003), 2003-2004 (Hackney et al. 2005), 2004-2005 (Hackney et al. 2006), and 2005-2006 (Hackney et al. 2007) to the current year. The current report includes the winter of 2007 and the summer of 2006.

5.51 Town Creek (P3)

Town Creek is the most downstream station monitored for geochemistry. The average winter porewater salinities increased steadily throughout the first four years of this study [winter 2000 = 0.8 $\pm$ 0.4 ppt; winter 2001 = 1.4 $\pm$ 0.8 ppt (Hackney et al. 2002a); winter 2002 = 3.8 ppt $\pm$ 1.9 (Hackney et al. 2002b); winter 2003 = 7.2 $\pm$ 4.9 ppt (Hackney et al. 2003)]. Porewater salinities during the winter of 2003 were as high as 17 ppt, roughly twice the highest winter salinities ever observed (Hackney et al. 2003). Since the winter of 2004 there has been a dramatic shift towards lower salinity conditions (Hackney et al. 2005; Hackney et al. 2006; Hackney et al. 2007). Salinities have ranged from approximately 0.5 ppt to 3.0 ppt, whereas during the winter of 2003 the majority of the salinities were greater than 3 ppt (Hackney et al. 2003). Salinities during the current winter (2007) were in the same range (0.5 -3 ppt). In the first 4 winters, the majority of geochemical classifications were SR (Hackney et al. 2002a, 2002b, 2003). During the winter of 2004, geochemical classifications reflected the lower salinities with the majority of substations having MPSR conditions indicating a lack of re-supply of sulfate to the porewaters after depletion. Salinities were slightly higher during the winter of 2005 compared to 2004, but were still relatively low (1-3 ppt, Hackney et al. 2006). The slightly higher salinities resulted in some 2004 winter MPSR classifications being converted to SR. Last year, all but one classification was MPSR (Hackney et al. 2007) indicating more rapid consumption of sulfate compared to previous years. The current year is exactly the same as the previous year with all MPSR classifications except one (Table 5.51-3).

The average summer salinities showed no obvious changes over the first 3 years of summer data [(summer 2000 = 4.3 $\pm$ 1.7 (Hackney et al. 2002a); summer 2001 = 3.4 $\pm$ 0.8 (Hackney et al. 2002b); summer 2002 = 4.8 $\pm$ 2.2 (Hackney et al. 2003)]. Average porewater salinities were always higher during the summer compared to the winters

reflecting the general trend towards higher freshwater river flow in winter. Salinities during the summer of 2003 ranged from approximately 0.4 ppt to 3.0 ppt (Hackney et al. 2005) in contrast to the previous summer 2002, where the majority of salinities were greater than 3.0 ppt (Hackney et al. 2003). Summer 2003 classifications reflected the fresher conditions with the majority of sites having MPSR conditions for the first time (Hackney et al. 2005). During the summer of 2004, salinities were slightly higher ranging from 2-5 ppt (Hackney et al. 2006) resulting in some MPSR classifications being converted to SR. Last year this trend continued with several more MPSR classifications being converted to SR indicating slightly higher salinities (Hackney et al. 2007). The current year salinities were similar in magnitude to the previous year with values ranging from approximately 2-7 ppt (Table 5.51-1). Classifications were also similar with the exception of a few SR classifications converted to MPSR (Table 5.51-2) likely reflecting higher rates of sulfate reduction since salinities were essentially the same.

Methane concentrations were lower during the summer of 2005 (Hackney et al. 2007) and 2004 (Hackney et al. 2006) compared to the summer (2003) reflecting a continued increase in salinity since the summer of 2003 and increased inhibition of methanogenesis. During the current winter (2007) methane concentrations (Table 5.51-4) were similar to the previous winter of 2006 (Hackney et al. 2007) and slightly elevated compared to the previous winter of 2005 (Hackney et al. 2006) reflecting the slightly fresher conditions during the past two winters.

Table 5.51-1. Salinity of Sites. Salinity in parts per thousand calculated from chloride concentrations in porewaters. A [---] indicates no data. A [nd] means not determined.

Station	**Substation**	**Depth (cm)**	**Salinity**	
			Summer 2006	**Winter 2007**
Town Creek	1	1	3.87	1.01
P3	1	6	3.54	1.44
	1	11	3.01	1.86
	1	16	2.84	2.20
	1	21	2.92	2.40
	1	26	2.92	2.55
	2	1	6.02	1.27
	2	6	4.95	1.51
	2	11	4.66	1.72
	2	16	4.97	1.73
	2	21	4.33	2.00
	2	26	4.00	2.61
	3	1	3.88	1.28
	3	6	4.00	2.01
	3	11	3.36	2.44
	3	16	3.19	2.94
	3	21	3.15	3.05
	3	26	2.69	2.85

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Town Creek (continued)	4	1	4.51	1.83
	4	6	4.19	2.10
	4	11	7.19	2.18
	4	16	3.56	2.29
	4	21	2.52	2.21
	4	26	2.08	2.16
	5	1	3.35	0.34
	5	6	3.46	0.33
	5	11	3.20	0.41
	5	16	3.01	0.46
	5	21	2.61	0.69
	5	26	2.10	0.86
	6	1	1.38	1.44
	6	6	1.49	1.56
	6	11	1.47	1.63
	6	16	0.95	1.73
	6	21	1.35	1.69
	6	26	1.64	1.64
Eagle Island P6	1	1	0.03	0.09
	1	6	1.08	0.06
	1	11	1.09	0.26
	1	16	1.01	0.93
	1	21	1.05	1.70
	1	26	1.23	2.75
	2	1	1.67	2.26
	2	6	1.38	2.15
	2	11	1.36	1.69
	2	16	1.55	3.30
	2	21	1.71	3.69
	2	26	1.67	3.55
	3	1	1.22	1.09
	3	6	1.17	1.08
	3	11	1.12	1.23
	3	16	1.07	1.32
	3	21	1.08	1.61
	3	26	0.01	1.69
	4	1	0.01	0.26
	4	6	0.44	0.28
	4	11	0.46	0.31
	4	16	0.53	0.60
	4	21	0.71	0.86
	4	26	1.02	1.22
	5	1	0.65	0.26
	5	6	0.31	0.36

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Eagle Island (continued)	5	11	0.33	0.67
	5	16	0.42	1.05
	5	21	0.44	0.86
	5	26	0.46	0.83
	6	1	0.17	0.24
	6	6	0.18	0.70
	6	11	0.22	0.58
	6	16	0.24	0.72
	6	21	0.26	0.82
	6	26	0.26	0.55
Indian Creek P7	1	1	0.03	0.04
	1	6	0.05	0.03
	1	11	0.07	0.04
	1	16	0.10	0.04
	1	21	0.12	0.06
	1	26	0.13	0.09
	2	1	0.02	0.03
	2	6	0.03	0.04
	2	11	0.04	0.05
	2	16	0.04	0.06
	2	21	0.04	0.09
	2	26	0.04	0.13
	3	1	0.01	0.03
	3	6	0.02	0.03
	3	11	0.03	0.00
	3	16	0.03	0.04
	3	21	0.03	0.06
	3	26	0.03	0.09
	4	1	0.03	0.04
	4	6	0.04	0.04
	4	11	0.05	0.04
	4	16	0.04	0.00
	4	21	0.06	0.05
	4	26	0.07	nd
	5	1	0.03	0.02
	5	6	0.03	0.02
	5	11	0.02	0.02
	5	16	0.03	0.02
	5	21	0.03	0.02
	5	26	0.03	0.02
	6	1	0.05	0.02
	6	6	0.04	0.02
	6	11	0.03	0.02
	6	16	0.03	0.02

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Indian Creek (continued)	6	21	0.02	0.02
	6	26	0.02	0.00
Dollisons Landing P8	1	1	0.05	0.02
	1	6	0.04	0.03
	1	11	0.04	0.02
	1	16	0.04	0.02
	1	21	0.04	0.02
	1	26	0.04	0.02
	2	1	0.05	0.03
	2	6	0.04	0.03
	2	11	0.04	0.02
	2	16	0.05	0.05
	2	21	0.04	0.03
	2	26	0.04	0.02
	3	1	0.04	0.03
	3	6	0.05	0.03
	3	11	0.05	0.03
	3	16	0.05	0.04
	3	21	0.05	0.03
	3	26	0.05	0.02
	4	1	0.04	0.03
	4	6	0.04	0.03
	4	11	0.08	0.03
	4	16	0.04	0.03
	4	21	0.04	0.03
	4	26	0.04	0.03
	5	1	0.12	0.12
	5	6	0.12	0.12
	5	11	0.10	0.12
	5	16	0.10	0.12
	5	21	0.10	0.11
	5	26	0.12	0.10
	6	1	0.16	0.13
	6	6	0.17	0.12
	6	11	0.18	0.13
	6	16	0.17	0.13
	6	21	0.16	0.13
	6	26	0.18	0.12
Black River P9	1	1	0.03	0.04
	1	6	0.03	0.04
	1	11	0.04	0.04
	1	16	0.04	0.03
	1	21	0.04	0.03
	1	26	0.04	0.05

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Black River (continued)	2	1	0.03	0.02
	2	6	0.03	0.02
	2	11	0.03	0.02
	2	16	0.03	0.02
	2	21	0.03	0.02
	2	26	0.10	0.03
	3	1	0.03	0.02
	3	6	0.04	0.02
	3	11	0.04	0.03
	3	16	0.03	0.03
	3	21	0.04	0.01
	3	26	0.03	0.03
	4	1	0.03	0.02
	4	6	0.03	0.02
	4	11	0.03	0.02
	4	16	0.03	0.02
	4	21	0.03	0.02
	4	26	0.03	0.02
	5	1	0.03	0.02
	5	6	0.03	0.03
	5	11	0.02	0.01
	5	16	0.04	0.02
	5	21	0.06	0.02
	5	26	0.05	0.02
	6	1	0.02	0.02
	6	6	0.03	0.02
	6	11	0.03	0.02
	6	16	0.03	0.02
	6	21	0.03	0.02
	6	26	0.03	0.02
Smith Creek P11	1	1	5.81	1.03
	1	6	6.19	1.08
	1	11	5.97	1.60
	1	16	5.12	2.35
	1	21	4.52	2.97
	1	26	4.72	3.31
	2	1	6.97	1.83
	2	6	6.35	2.64
	2	11	6.03	2.97
	2	16	5.79	2.98
	2	21	5.66	3.53
	2	26	5.19	3.59
	3	1	5.81	1.28
	3	6	6.54	1.87

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Smith Creek (continued)	3	11	6.28	2.28
	3	16	5.97	2.55
	3	21	5.06	3.22
	3	26	4.47	3.47
	4	1	4.79	1.36
	4	6	4.95	1.97
	4	11	3.73	2.53
	4	16	3.44	2.88
	4	21	2.67	2.96
	4	26	3.38	2.92
	5	1	0.01	1.58
	5	6	2.23	2.32
	5	11	3.36	2.36
	5	16	4.01	2.33
	5	21	3.81	2.28
	5	26	3.77	2.13
	6	1	2.81	0.42
	6	6	4.24	0.56
	6	11	2.93	0.66
	6	16	2.58	0.78
	6	21	2.62	0.90
	6	26	2.39	1.10
Rat Island P12	1	1	1.29	0.07
	1	6	0.74	0.10
	1	11	0.33	0.16
	1	16	0.42	0.23
	1	21	0.52	0.34
	1	26	0.13	0.52
	2	1	1.37	0.15
	2	6	1.08	0.19
	2	11	0.46	0.29
	2	16	0.47	0.41
	2	21	0.50	0.48
	2	26	0.11	0.55
	3	1	1.45	0.44
	3	6	1.29	0.45
	3	11	0.69	0.47
	3	16	0.62	0.50
	3	21	0.57	0.47
	3	26	0.09	0.48
	4	1	1.29	0.26
	4	6	1.30	0.27
	4	11	0.82	0.30
	4	16	0.66	0.32

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Rat Island (continued)	4	21	0.52	0.35
	4	26	0.09	0.40
	5	1	1.32	0.12
	5	6	1.32	0.11
	5	11	0.98	0.11
	5	16	0.68	0.12
	5	21	0.40	0.12
	5	26	0.09	0.14
	6	1	1.07	0.05
	6	6	1.34	0.04
	6	11	0.89	0.04
	6	16	0.49	0.04
	6	21	0.36	0.04
	6	26	0.11	0.04
Fishing Creek P13	1	1	0.05	0.02
	1	6	0.05	0.02
	1	11	0.05	0.02
	1	16	0.05	0.02
	1	21	0.05	0.03
	1	26	0.06	0.03
	2	1	0.04	0.04
	2	6	0.04	0.05
	2	11	0.05	0.00
	2	16	0.04	0.04
	2	21	0.05	0.04
	2	26	0.06	0.04
	3	1	0.00	0.00
	3	6	0.02	0.09
	3	11	0.02	0.10
	3	16	0.03	0.07
	3	21	0.02	0.07
	3	26	0.02	0.07
	4	1	0.04	0.03
	4	6	0.05	0.06
	4	11	0.05	0.03
	4	16	0.05	0.03
	4	21	0.06	0.03
	4	26	0.05	0.03
	5	1	0.04	0.03
	5	6	0.04	0.04
	5	11	0.04	0.02
	5	16	0.04	0.02
	5	21	0.02	0.02
	5	26	0.04	0.02

Table 5.51-1. (continued)

Station	Substation	Depth (cm)	Salinity	
			Summer 2006	Winter 2007
Fishing Creek (continued)	6	1	0.01	0.02
	6	6	0.15	0.02
	6	11	0.14	0.02
	6	16	0.14	0.02
	6	21	0.15	0.02
	6	26	0.15	0.02
Prince George P14	1	1	0.04	0.03
	1	6	0.03	0.04
	1	11	0.03	0.03
	1	16	0.03	0.03
	1	21	0.03	0.02
	1	26	0.03	0.02
	2	1	0.03	0.03
	2	6	0.03	0.04
	2	11	0.03	0.03
	2	16	0.03	0.03
	2	21	0.04	0.02
	2	26	0.04	0.02
	3	1	0.03	0.02
	3	6	0.03	0.03
	3	11	0.03	0.03
	3	16	0.03	0.03
	3	21	0.03	0.02
	3	26	0.03	0.02
	4	1	0.04	0.02
	4	6	0.04	0.04
	4	11	0.04	0.02
	4	16	0.04	0.03
	4	21	0.04	0.02
	4	26	0.04	0.02
	5	1	0.04	0.02
	5	6	0.04	0.03
	5	11	0.04	0.03
	5	16	0.03	0.03
	5	21	0.03	0.02
	5	26	0.03	0.02
	6	1	0.03	0.03
	6	6	0.03	0.03
	6	11	0.03	0.03
	6	16	0.03	0.03
	6	21	0.03	0.02
	6	26	0.03	0.02

Table 5.51-2. Classification of Sites Summer. Site classifications are as follows: Methanogenic I, Sulfate Reducing II, Methanogenic with evidence of past sulfate reduction I*, Sulfate reducing non-seawater source of sulfate II*. A [---] indicates no data. A [nd] means not determined.

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Town Creek	1	1	II	II	II	I*	II	II*	II
P3	1	6	II	II	II	I*	I*	II*	II
	1	11	II	II	II	I*	I*	II*	II
	1	16	II	II	II	I*	I*	II	II
	1	21	II	II	II	I*	I*	II	I*
	1	26	I*	II	II	I*	I*	II	II
	2	1	II	II	II	II	II	II	II
	2	6	II	II	II	II	I	II*	II
	2	11	II	II	I*	II	I	II	I*
	2	16	II	II	I*	II	I	II	I*
	2	21	II	II	I*	I*	I*	II	I*
	2	26	II	II	I*	II	I	II	I*
	3	1	II	II	II	I*	II	II*	II
	3	6	II	II	II	I*	II	II*	II
	3	11	II	II	II	I*	II	II	I*
	3	16	II	II	II	I*	I*	II	I*
	3	21	II	II	II	I*	I*	II	I*
	3	26	II	II	II	I*	I*	II	II
	4	1	II	II	II	I	II	I*	II
	4	6	II	II	II	I*	II	II*	II
	4	11	II	II	II	I*	II	II	II
	4	16	II	II	II	I*	II	II	II
	4	21	II	II	II	I*	II	II	I*
	4	26	II	II	II	I*	II	II	I*
	5	1	II	II	I*	I*	I*	I	II
	5	6	II	II	II	I*	I*	I*	II
	5	11	II	II	II	I	I*	I*	I*
	5	16	II	II	II	I*	I*	I*	I*
	5	21	II	II	II	I*	I*	I*	I*
	5	26	II	II	II	I*	I*	I*	I*
	6	1	II	II	II	I	II	II*	II
	6	6	II	II	II	I*	I*	II	II
	6	11	II	II	II	I*	I*	II	II
	6	16	II	II	II	I*	I*	II	I*
	6	21	II	II	II	I*	I*	II	II
	6	26	I*	II	II	I*	I*	II	II
Eagle Island	1	1	II	II	II	I	II	II	I
P6	1	6	II	II	II	Ns	II	II	II
	1	11	II	II	II	Ns	I*	II	I*
	1	16	II	II	II	I*	I*	II	I*

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Eagle Island	1	21	II	II	II	I*	I*	I*	I*
(continued)	1	26	II	II	I*	I*	I*	II	I*
	2	1	II	II	II	I	I*	II	II
	2	6	II	II	II	I	I*	II	II
	2	11	II	II	II	I	I*	II	I*
	2	16	II	I*	II	I	I*	II	I*
	2	21	II	I*	II	I*	I*	II	I*
	2	26	II	I*	I*	I*	I*	I*	I*
	3	1	I*	II	II	I*	II	II	II
	3	6	I*	I*	II	I*	I*	II	II
	3	11	I*	I*	II	I*	I*	II	II
	3	16	I*	I*	II	I*	I*	II	I*
	3	21	I*	I*	II	I*	I*	II	I*
	3	26	I*	I*	II	I*	I*	II	I
	4	1	II	II	I*	I*	I*	II	I
	4	6	II	I*	I*	I*	I*	I*	I*
	4	11	II	I*	I*	I*	I*	I*	I*
	4	16	II	I*	I*	I*	I*	I*	I*
	4	21	II	I*	I*	I*	I*	I*	I*
	4	26	I*	I*	I*	I*	I*	I*	II
	5	1	II	I*	II	I*	I	II	II
	5	6	I*	I*	II	I*	I*	II	I
	5	11	II	I*	I*	I*	I*	II	I*
	5	16	I*	I*	I*	I*	I*	I*	I*
	5	21	I*	I*	I*	I*	I*	I*	I*
	5	26	I*	I*	I*	I*	I*	I*	I*
	6	1	II	I*	II	I	I	II	I
	6	6	I*	I*	II	I	I	I*	I
	6	11	---	I*	II	I	I*	I*	I
	6	16	II	I*	II	I*	I	I*	I*
	6	21	I*	I*	II	I*	I	I*	I*
	6	26	I*	I*	I*	I*	II	I	I*
Indian Creek	1	1	II	II	II	I	II	II	I
P7	1	6	II	II	II	I*	I	II	I
	1	11	II	II	II	I*	I	I	I
	1	16	II	II	II	I*	I*	I*	I
	1	21	II	II	II	I*	I*	I*	I*
	1	26	I	I*	II	I*	I*	I*	I*
	2	1	I	II	II	I	I	I	I
	2	6	I	I	II	I*	I	I	I
	2	11	I	I	II	I	I*	I	I
	2	16	I	I*	II	I*	I*	I*	I
	2	21	I	I*	II	I*	I*	I	I
	2	26	I	I	II	I*	I*	I	I

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Indian Creek	3	1	II	II	I*	I	I	I	I
(continued)	3	6	II	I	I*	I	I	I	I
	3	11	I	I*	I*	I	I	II*	I
	3	16	I	I	I*	I	I*	I	I
	3	21	II	I	I*	I	I*	I	I
	3	26	I	II	I*	I*	I*	I	I
	4	1	I	I	II	I	I	I	I
	4	6	II	I	II	I	I*	I	I
	4	11	II	I	II	I	I	I	I
	4	16	I	I	II	I	I*	I	I*
	4	21	I	I	II	I	I*	I	I*
	4	26	I	I	II	I	I*	I	I*
	5	1	II	I	I*	I	I	I	I
	5	6	I	I	I*	I	I	I	I
	5	11	II	I	I*	I	I	I	I
	5	16	II	---	I*	I	I	I	I
	5	21	I	I*	I*	I	I	I	I
	5	26	I	I	I*	I	I	I	I
	6	1	II	---	I	I	I	I	I
	6	6	I	---	I	I	I	I	I
	6	11	I	I	I	I	I	I	I
	6	16	I	I	I	I	I	I	I
	6	21	I	---	I	I	I	I	I
	6	26	II	I	I	I	I	I	I
Dollisons	1	1	I	---	II	I	I	I	I
Landing P8	1	6	II*	II	II	I	I	I	I
	1	11	II*	II	I	I	I	I	I
	1	16	II*	II	I	I	I	I	I
	1	21	II	I	II	I	I*	I	I
	1	26	II	I	I	I	I*	I	I
	2	1	II*	II	I	I	I	I	I
	2	6	II	I	I*	I	I	I	I
	2	11	I	II	I*	I*	I	I	I
	2	16	I	I*	I*	I*	I	I	I
	2	21	I	II	I*	I*	I	I	I
	2	26	I	I	I*	I*	I	I	I
	3	1	II	I	I	I	I	I	I
	3	6	I	---	I*	I	I	I	I
	3	11	I	I	I*	I*	I	I	I
	3	16	I	I	I*	I	I*	I*	I
	3	21	I	I	I*	I*	I	I*	I
	3	26	I	II	I*	I	I	I*	I
	4	1	I	I	II*	I	I	I	I
	4	6	I	I	I	I	I	I	I

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Dollisons	4	11	I	II	I*	I	I*	I	I
Landing	4	16	I	I	---	I	I	I	I
(continued)	4	21	I	II	I*	I	I	I	I
	4	26	I	II	I*	I*	I	I	I
	5	1	I	I	I	I	I	I	I
	5	6	I	I	I	I	I*	I	I
	5	11	I	I	I*	I	I*	I	I
	5	16	I	I*	I*	I	I*	I*	I
	5	21	I	II	I*	I	I*	I*	I
	5	26	I	II	I*	I	I*	I*	I*
	6	1	I	I	I	I	I*	I*	I
	6	6	I	I*	I	I	I*	I*	I
	6	11	I	I*	I*	I	I*	I*	I*
	6	16	I	I*	I*	I	I*	I*	I
	6	21	I	I	I*	I	I*	I*	I*
	6	26	I	I	I*	I	I*	I*	I*
Black River	1	1	I	---	I*	I	I	I	I
P9	1	6	---	---	I*	I	I	I	I
	1	11	I	---	I	I	I*	I	I
	1	16	I	---	II*	I	I*	I	I
	1	21	II	---	I*	I	I	I	I
	1	26	I	II	I*	I	I*	I	I
	2	1	I	I*	I*	I	I	I	I
	2	6	I	I*	I*	I	I	I	I
	2	11	I	I	I*	I	I	I	I
	2	16	I	I	II*	I	I	I*	I
	2	21	I	I	I	I	I	I*	I
	2	26	I	I*	I*	I	I	I	I*
	3	1	I	II	I*	I	I	I	I
	3	6	I	II*	I*	I	I	I	I
	3	11	I	I	I	---	I	I	I
	3	16	I	I	II*	I	I	I*	I
	3	21	I	I	I	I	I*	I*	I
	3	26	I	I	I	I	I*	I	I*
	4	1	I	II	I*	I	II	I	I
	4	6	II	II*	I	I	I	I	I
	4	11	I	II	II*	I	I	I	I
	4	16	I	I	II*	I	I*	I	I
	4	21	I	I	II*	I	I	I	I
	4	26	I	I	II*	---	I	I	I
	5	1	II*	II*	I	I	I	I	II*
	5	6	II	II	I	I	I	I	II*
	5	11	I	II	II*	I	I	I	I
	5	16	I	I	II*	I*	I	I	I

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Black River	5	21	II	I	II*	I	I*	I	I
(continued)	5	26	II	I	I	I	I*	I	I
	6	1	II*	---	I	I	---	I	II*
	6	6	II*	II	II*	I	I	I	I
	6	11	II*	I	II*	I	I	I*	I
	6	16	I	I*	II*	I	I	I*	I
	6	21	I	I	I	I	I	I*	I
	6	26	I	I	I	I	I	I*	I
Smith Creek	1	1	II	II	II	II	II	II	II
P11	1	6	II	I*	II	II	II	II	II
	1	11	---	II	II	II	II	II	II
	1	16	II	II	II	II	II	II	II
	1	21	---	II	II	II	I	II	I*
	1	26	---	II	II	II	I	II	I*
	2	1	II	II	II	II*	II	II	I*
	2	6	---	I*	II	II	II	II	I*
	2	11	II	II	II	II	II	II	I*
	2	16	II	II	II	II	II	II	I*
	2	21	II	II	II	II	II	II	I*
	2	26	II	II	II	II	II	II	I*
	3	1	II	II	II	II	II	II	II
	3	6	II	II	II	I*	II	II	II
	3	11	II	II	II	I*	II	II	II
	3	16	II	II	II	II	I	II	I*
	3	21	II	II	II	I*	I*	II	I*
	3	26	II	II	II	II	I	II	II
	4	1	II	II	II	II	II	II	II
	4	6	II	II	II	II	II	II	II
	4	11	II	II	II	II	II	II	II
	4	16	II	II	II	II	I	II	I*
	4	21	II	II	II	II	---	II	I*
	4	26	II	II	II	II	I	II	I*
	5	1	II	I*	II	---	I	II	I
	5	6	II	II	II	II	I	II	II
	5	11	II	II	II	II	I	II	II
	5	16	II	II	II	II	I	II	II
	5	21	II	II	II	II	I	II	I*
	5	26	II	II	II	II	I	II	I*
	6	1	II	II	II	I	II	II	II
	6	6	II	I*	II	I	II	II	II
	6	11	II	I*	II	I*	II	II	I*
	6	16	II	I*	II	II	I	II	I*
	6	21	II	---	II	II	II	II	I*
	6	26	II	II	II	II	II	II	I*

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Rat Island	1	1	II	II	II	I	I*	II	I*
P12	1	6	II	II	II	I	II	II	I*
	1	11	II	II	II	I	I*	I*	II
	1	16	II	II	II	I	I*	II	II
	1	21	II	II	II	I*	I*	II	I*
	1	26	I	II	II	I*	I*	I*	II
	2	1	II	I*	II	I	II	I	I*
	2	6	II	I*	II	II	II	I*	II
	2	11	II	I*	II	II	I	I*	II
	2	16	II	II	II	II	I	I*	I*
	2	21	II	II	I*	I*	I*	I*	II
	2	26	I*	---	II	I*	I*	I*	I
	3	1	II	II	II	I	I	II	I*
	3	6	II	I	II	I	II	II	II
	3	11	II	I	II	I	II	II	II
	3	16	II	I	II	I	II	I	I*
	3	21	II	I*	II	I	II	I	I*
	3	26	II	I*	II	I	II	I	I
	4	1	II	I*	II	I	II	I	I*
	4	6	I*	II	II	I	II	I	I*
	4	11	I*	I*	II	I	I*	I*	II
	4	16	II	I*	II	I*	II	I	I*
	4	21	II	I*	I*	I*	II	I	I*
	4	26	I*	I*	I*	I*	II	I	I
	5	1	II	I	II	I*	I*	I*	I*
	5	6	II	I	II	I*	I*	I*	I*
	5	11	I	I*	II	I*	I*	I*	II
	5	16	II	I*	II	I*	I*	I*	I*
	5	21	II	I*	II	I*	I*	I*	I*
	5	26	I*	I*	II	I*	I*	I*	I
	6	1	I	---	II	II	I	II*	I*
	6	6	I	I	II	II	II	I	I*
	6	11	I	I	II	I*	I	I	I*
	6	16	I	I*	II	I*	I	I	I*
	6	21	I	I	II	I*	I	I	I*
	6	26	I	I	II	I*	I*	I	I
Fishing Creek	1	1	II	---	II	I	I	I	I
P13	1	6	II	---	II	I	I	I	I
	1	11	II	I*	II	I	I*	I*	I
	1	16	II	II	II	I	I*	I*	I
	1	21	II	I*	II	I	I*	I*	I
	1	26	I*	II	II	I	I*	I*	I*
	2	1	II	I	II	I	I*	I	I
	2	6	II	I	II	I	I*	I	I

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Fishing Creek	2	11	II	I	II	I	I*	I	I
(continued)	2	16	II	II	II	I	I*	I	I
	2	21	II	II	II	I	I*	I	I
	2	26	I*	II	II	I	I*	I	I
	3	1	II	II	II	I	I*	I	I
	3	6	I	I*	II	I	I*	I	I
	3	11	II	I*	II	I	I*	I	I
	3	16	II	I*	II	I	I*	I*	I
	3	21	II	II	II	I*	I*	I*	I
	3	26	I	I*	II	I*	I*	I*	I*
	4	1	I	I	II	I	I	I	I
	4	6	I	II	II	I	I	I	I
	4	11	I	I	II	I	I*	I	I
	4	16	I	I	II	I	I*	I	I
	4	21	I	I	II	I	I*	I	I
	4	26	I	I	---	I	I*	I	I
	5	1	II	I	II	II	I	I	I
	5	6	II	I	II	I	I	I	I
	5	11	II	I	II	I	I	I	I
	5	16	II	I	II	I	I	I	I
	5	21	II	II	II	I*	I*	I	I
	5	26	II	I	II	I	I	I	I
	6	1	I	II	II	I	I	I	I
	6	6	II*	I	I	II*	I	I	II
	6	11	I	I	I	I	I	I	I
	6	16	II	II	I	I	I	I	I
	6	21	I	I*	I	I	I	I	I
	6	26	I	I	I	I	I	I	I
Prince George	1	1	I	I	II	I	I	I	I
P14	1	6	I	I	II	I	I	I	I
	1	11	I	I*	II	I	I	II*	I
	1	16	I	I	II	I	I	I	I
	1	21	I	I	I*	I	I	II*	I
	1	26	I	I*	I*	I	I	I	I
	2	1	I	I	II	I*	I	I	I
	2	6	I	I	II	I*	I	I	I*
	2	11	I	I	II	I*	I	I	I
	2	16	I	I	I*	I*	I	I	I*
	2	21	I	I*	I*	I*	I	I	I
	2	26	I	I*	I*	I*	I	I	I
	3	1	I	I	II	I	I	I	I
	3	6	I	II*	II	I	I	I	I
	3	11	I	I	II	I	I	I	I
	3	16	I	I*	II	I	I	I	I

Table 5.51-2. continued

Station	Substation	Depth (cm)	Summer 2000	Summer 2001	Summer 2002	Summer 2003	Summer 2004	Summer 2005	Summer 2006
Prince George	3	21	I	I	I*	I	I	I	I
(continued)	3	26	I	I	I*	I	I	I	I
	4	1	I	I	II	I	I	I	I
	4	6	I	I	II	I*	I	I	I
	4	11	I*	I	II	I*	I	I	I
	4	16	I	I	II	I*	I	I	I
	4	21	I	I	I*	I*	I*	I	I
	4	26	I	I	I*	I*	I*	I	I
	5	1	I	II	II	I	I	I	I
	5	6	II	II	II	I	I	II*	I
	5	11	I	I	II	I	I	I	I
	5	16	I	I	II	I	I	I	I
	5	21	I	I	II	I	I	I	I
	5	26	I	I*	I*	I	I	I	I
	6	1	I	I	I	I	I	I	I
	6	6	I	I	II	I	I	I	I
	6	11	I	I	I*	I	I	I	I
	6	16	I	I	I*	I	I	I	I
	6	21	I	I	I*	I	I	I	I
	6	26	I	II	I*	I	I	I	I

Table 5.51-3. Classification of Sites Winter. Site classifications are as follows: Methanogenic I, Sulfate Reducing II, Methanogenic with evidence of past sulfate reduction I*, Sulfate reducing non-seawater source of sulfate II*. A [---] indicates no data. A [nd] means not determined.

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Town Creek	1	1	---	II	II	II	I	II	I*	I*
P3	1	6	---	II	II	II	I*	II	I*	I*
	1	11	---	II	II	II	I*	II	I*	I*
	1	16	---	I*	II	II	I*	II	I*	I*
	1	21	---	I*	II	I*	I*	II	I*	I*
	1	26	I*	I*	II	I*	I*	II	I*	I*
	2	1	II	II	II	II	I*	II	I*	I*
	2	6	II	II	II	I*	I*	II	I*	I*
	2	11	I*	II	II	I*	I*	I*	I*	I*
	2	16	I	II	II	I*	I*	II	I*	I*
	2	21	I*	II	II	I*	I*	I*	I*	I*
	2	26	I*	II	II	II	I*	I*	I*	I*
	3	1	II	I	II	II	II	II	I*	I*
	3	6	I	II	II	II	I	II	I*	I*
	3	11	I	II	II	II	I*	II	I*	I*
	3	16	I*	I*	II	II	I*	II	I*	I*
	3	21	I*	II	II	II	I*	II	I*	I*
	3	26	I*	II	II	II	I*	II	I*	I*
	4	1	I	II	II	II	II	II	I*	I*
	4	6	I*	I*	II	II	I*	II	I*	I*
	4	11	II	I*	II	II	I*	I*	I*	I*
	4	16	II	I*	II	II	I*	II	I*	I*
	4	21	II	II	II	II	I*	II	I*	I*
	4	26	II	II	II	II	II	II	I*	I*
	5	1	---	II	II	II	I	II	II	I
	5	6	I	II	II	II	I	II	I*	I*
	5	11	I	II	II	II	I*	II	I*	I*
	5	16	II	II	II	II	I*	II	I*	I*
	5	21	---	II	II	II	I*	II	I*	I*
	5	26	II	II	II	II	II	II	I*	I*
	6	1	II	II	II	II	II	II	I*	I*
	6	6	II	II	II	II	I*	II	I*	I*
	6	11	II	II	II	II	I*	II	I*	I*
	6	16	II	II	II	II	I*	II	I*	I*
	6	21	II	II	II	II	I*	I*	I*	I*
	6	26	II	II	II	II	I*	II	I*	I*
Eagle Island	1	1	---	II	II	II	II	II	II*	II*
P6	1	6	---	II	II	II	II	II	II*	II*
	1	11	---	II	II	II	II	II	II*	II
	1	16	I	II	II	I	II	II	II*	I*

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Eagle Island	1	21	I	II	II	I	II	II	II	I*
(continued)	1	26	I*	II	II	I*	II	II	II	I*
	2	1	I	II	II	II	II	II	II	I*
	2	6	I	II	II	II	II	II	II	I*
	2	11	---	II	II	II	II	II	II	I*
	2	16	---	II	II	II	I*	I*	I*	I*
	2	21	I	II	II	II	I*	I*	II	I*
	2	26	I	II	II	II	I*	I*	I*	I*
	3	1	I	II	II	II	II	II	II	II
	3	6	---	II	II	II	II	II	II	II
	3	11	I*	II	II	II	II	II	II	II
	3	16	I*	I*	II	II	II	II	II	I*
	3	21	I*	II	II	I*	I*	II	II	I*
	3	26	II	II	II	I*	I*	I*	II	I*
	4	1	I	II	II	II	II	II	II	II
	4	6	I*	II	II	I*	I*	I*	II	I
	4	11	I*	II	II	I*	I*	I*	II	I
	4	16	II	I*	II	I*	I*	II	I	I*
	4	21	I*	II*	II	I*	I*	I*	I*	I*
	4	26	I*	II	II	I*	I*	I*	I*	I*
	5	1	I	II	II	II	II	II	II	I
	5	6	I*	II	I*	I*	II	II	II	I*
	5	11	I	II	I*	I*	II	I	II	I*
	5	16	I*	II	I*	I*	II	I	I*	I*
	5	21	I*	II	II	I*	I	I*	II	I*
	5	26	I*	II	I*	I*	II	I	II	I*
	6	1	I	I*	I*	II	II	II	II	I*
	6	6	I*	I*	I*	I*	II	I	II	I*
	6	11	I	I*	I*	I*	I	I	II	I*
	6	16	I	I*	I*	I*	I	I	II	I*
	6	21	I	I*	I*	I*	I	I	II	I*
	6	26	I	I*	I*	I*	I	I	II	I*
Indian Creek	1	1	I	I	I	I	I	I	II*	I
P7	1	6	I	I	I	II*	II*	I	II*	I
	1	11	I	I	I	II	II*	---	II	I
	1	16	---	I	I	II	II*	0	I	I
	1	21	I	I	I	II	I	I	I	I*
	1	26	I	I	I	II	I	I*	I*	I*
	2	1	I	I	I*	I*	I	I	I	I
	2	6	I	I	I*	I*	I	I	I	I
	2	11	I	I	I*	I*	I	I	I	I
	2	16	I	I	I*	I*	I*	I	I	I*
	2	21	I*	I	I*	I*	I*	I	I*	I*

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Indian Creek	2	26	I*	I	I*	I*	I*	I	I*	I
(continued)	3	1	I	I	I	I*	I	I	I	I
	3	6	I*	I	I	I*	I	I	I	I
	3	11	I*	I	I*	I*	I*	I	I	I*
	3	16	I	I	I*	I*	I*	I	I	I
	3	21	I*	I	I*	I*	I	I*	I	I*
	3	26	I	I	I*	I*	I	I	I	I*
	4	1	I	I	I	I	I	I	I	I
	4	6	I	I	I	I*	I	I	I	I
	4	11	I	I	I	I*	I*	I	I	I
	4	16	I*	I	I	I*	I*	I	I	I
	4	21	I*	I	I	I*	I*	I	I	I
	4	26	I	I	I	I*	I*	I	I	---
	5	1	I	I	I	---	I	I	I	I
	5	6	I	I	I	I	I	I	I	I
	5	11	I	I	I	I	I	I	I	II*
	5	16	I*	I	I	I	I	I	I	I
	5	21	I	I	I	I	I	I	I	I
	5	26	I*	I	I	I	I	I	I	I
	6	1	I	I	I	I	I	I	I	I
	6	6	I	I	I	I	I	I	I	I
	6	11	I	I	I	I	I	I	I	I
	6	16	I	I	I	I	I	I	I	I
	6	21	I	I	I	I	I	I	I	I
	6	26	II*	I	I	I	I	I	I	I
Dollisons	1	1	---	II*	I	I	I	I	I	I
Landing P8	1	6	I	II*	II*	I	II	I	I	I
	1	11	II	II*	II*	I	II	I	I	I
	1	16	I	II*	II*	I	I	I	I	I
	1	21	I*	II	II*	I	I	I	I	I
	1	26	II*	II*	I	I	I	I	I	I
	2	1	---	I	I	I	I	I	I	I
	2	6	---	I	I	I	I	I	I	I
	2	11	II	I	I	I	I	I	I	I
	2	16	II	I	I	I	II*	I	I	I
	2	21	I	I	I	I*	II*	I	I	I*
	2	26	I	I	I	I	I	I	I	I*
	3	1	II	I	I	I	I	I	I	I*
	3	6	I	I	I	I	I	I	I	I*
	3	11	II*	II*	I	I	I	I	I	I*
	3	16	I	II*	I	I	I	I	I	I*
	3	21	II	I	I	I	II*	I	I	I*
	3	26	I	I	I	I	I	I	I	I*

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Dollisons	4	1	II	I	I	I	I	I	I	I*
Landing	4	6	I	I	I	I	I	I	I	I*
(continued)	4	11	I*	I	I	I	I	I	I	I*
	4	16	---	I	I	I	I	I	I	I*
	4	21	---	I	I	I	I	I	I	I*
	4	26	I	I	I	I*	I	I	I	I*
	5	1	I	I	I	I	I	I	I	I*
	5	6	II	I	I	I	I	I*	I	I*
	5	11	---	I	I	I	I	I*	I*	I*
	5	16	II	I	I	I	I	I*	I*	I*
	5	21	I	II*	I	I	I	I*	I*	I*
	5	26	II	I	I	I	II*	I	I*	I*
	6	1	I*	I	I	I	I	I	I*	I
	6	6	I	I	I	I	I	I*	I*	I
	6	11	II*	I	I*	I	I	I*	I*	I
	6	16	II	I	I	I*	I	I	II	I
	6	21	---	I	I	I	I	I	I*	I
	6	26	I	I	I	I	I	I*	I*	I
Black River	1	1	---	I	I	I*	II	I	I	I
P9	1	6	I	I	I	I	II	I	I	I
	1	11	I	I	I	I	I	I	I*	I
	1	16	I	I	I	I	I	I	I*	I
	1	21	I	II	I	I	I	I	I*	I
	1	26	I*	II	I	I	I	I	I	I
	2	1	I	II*	I	I	I	I	I	I
	2	6	I	II*	I	I	I	I	I	I
	2	11	I	I	I	I	I	I	I	I
	2	16	I*	I	I	I	I	I	I	I*
	2	21	I	II	I	I	I	I	I	I*
	2	26	I	I	I	I*	I	I	I	I
	3	1	I	II*	I	I	I	I	I	I
	3	6	I	II*	I	I	I	I	I	I
	3	11	I	II*	I	I	I	I	I	I
	3	16	I	I	I	I	I	I	I	I
	3	21	I	II	I	I	I	I	I*	I*
	3	26	I	II*	I	I	I	I	I*	I*
	4	1	I	II*	I	I	I	I	I	I*
	4	6	I*	I	I	I	I	I	I	I*
	4	11	I*	II*	I	I	I	I	I	I*
	4	16	I*	II*	I	I	I	I	I*	I*
	4	21	I*	II*	I	I	I	I	I*	I*
	4	26	I*	II*	I	I	I	I	I	I*
	5	1	I*	II*	I	I	I	I	I	I*

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Black River	5	6	I	II*	I	I	I	I	I	I*
(continued)	5	11	I	II*	I	I*	I	I	I	I
	5	16	I*	II*	I	I*	I	I	I	I*
	5	21	I*	II*	I*	I	I	I	I	I*
	5	26	I*	II*	I	I*	I	I	I	I*
	6	1	I	I	I	I	I	I	I	I
	6	6	I	I	I	I	I	I	I	I*
	6	11	I*	I	I	I	I	I	I	I*
	6	16	I*	I	I	I	I	I	I*	I
	6	21	I	II*	I	I	I	I	II*	I*
	6	26	I	II*	I	I	I	I	I*	I*
Smith Creek	1	1	I	II	II	II	II	II	II	II
P11	1	6	I*	I*	II	II	II	II	II	II
	1	11	---	II	II	II	II	II	II	I*
	1	16	I*	II	II	II	II	II	II	I*
	1	21	I*	II	II	II	II	II	I*	I*
	1	26	---	II	II	II	II	II	I*	I*
	2	1	II	II	---	II	II	II	II	I*
	2	6	I*	II	II	II	II	II	II	I*
	2	11	I*	II	II	II	II	II	II	I*
	2	16	I*	II	II	II	II	II	II	I*
	2	21	I*	II	II	II	II	II	II	I*
	2	26	---	II	II	II	II	II	II	I*
	3	1	---	II	II	II	II	II	II	I*
	3	6	I*	II	II	II	II	II	II	I*
	3	11	I*	II	II	II	II	II	I*	I*
	3	16	I*	II	II	II	II	II	I*	I*
	3	21	I*	II	II	II	II	II	I*	I*
	3	26	I*	II	II	II	II	II	I*	I*
	4	1	I	II	II	II	II	II	II	I*
	4	6	II	I	II	II	II	I*	II	I*
	4	11	II	II	II	II	II	I*	I*	I*
	4	16	II	II	II	II	II	I*	I*	I*
	4	21	II	II	II	II	II	I*	I*	I*
	4	26	II	II	II	II	II	II	I*	I*
	5	1	II	II	II	II	II	II	II	I*
	5	6	II	II	II	II	II	II	I*	I*
	5	11	I*	II	II	II	II	II	I*	I*
	5	16	I*	II	II	II	I*	I*	I*	I*
	5	21	I*	II	II	II	I*	I*	I*	I*
	5	26	---	II	II	II	I*	I*	II	I*
	6	1	---	II	II	II	II	II	II	I*
	6	6	---	II	II	II	II	II	I*	I*

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Smith Creek	6	11	---	II	II	II	II	II	I*	I*
(continued)	6	16	---	II	II	II	I*	II	I	I*
	6	21	---	II	II	II	II	II	I*	I*
	6	26	---	II	II	II	II	II	I*	I*
Rat Island	1	1	---	II	II	II	II	II	II	II*
P12	1	6	---	II	II	II	II	II	II	II*
	1	11	I*	II	II	II	II	II	I*	I
	1	16	I*	II	II	II	II	II	I*	I
	1	21	I*	II	II	II	I*	II	I	I*
	1	26	I*	II	II	II	II	II	II*	I*
	2	1	I*	II	II	II	II	II	II*	II*
	2	6	I*	I	II	II	II	II	II	II
	2	11	I*	II	II	II	II	II	II	I
	2	16	I*	II	II	II	II	II	II	I*
	2	21	I*	II	II	II	II	II	I*	I*
	2	26	I*	II	II	II	II	II	I*	I*
	3	1	II	II	II	II	II	II	II	II
	3	6	I	II	II	II	II	II	I*	I*
	3	11	I*	II	II	II	II	II	I*	I*
	3	16	I	II	II	II	II	I	I*	I*
	3	21	I	II	II	II	I	II	I	I*
	3	26	I	II	II	II	I*	I	I*	I*
	4	1	I*	II	II	II	II	II	I	I*
	4	6	I*	I*	II	II	II	I	I*	I*
	4	11	I*	I*	II	II	II	I	I*	I*
	4	16	I*	I*	II	I*	I	I*	I*	I*
	4	21	I*	I*	II	I*	I	I*	I*	I*
	4	26	I*	I*	II	II	I	I*	I*	I*
	5	1	I	II	II	II	I*	I*	I	I
	5	6	I	I*	I	II	I*	I*	I	I
	5	11	I	I*	II	II	II	II	I	I
	5	16	I	I*	II	II	I*	II	I	I
	5	21	I	I*	I*	II	I*	II	I	I*
	5	26	I	I*	I*	II	I*	II	I	I
	6	1	I	I	---	II	II*	II*	II*	II*
	6	6	I	I	---	II	II*	II*	II*	II*
	6	11	I	I	II	II	II*	II*	II*	I
	6	16	I	II	II	II	II	II	II*	II*
	6	21	I	I	II	II	I	II	II*	I
	6	26	I	I	II	II	I	I*	II*	I
Fishing	1	1	II	II	I	I	I	I	I	I
Creek P13	1	6	II	II	I	I	I	I	II*	I
	1	11	I	II	II	II*	I	I*	II*	I

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Fishing	1	16	I	II	II	II*	II*	I	II*	I
Creek	1	21	I	II	II	II*	I	I	II*	I
(continued)	1	26	I	II	II	II*	I	I	II*	I
	2	1	---	II	I	II*	I	I*	I	I
	2	6	I	II	II	I	I	I*	I	I
	2	11	I	II	II	I	I	I	I	I
	2	16	I	I	II	I	I	I*	I	I
	2	21	I*	I	II	I	I	I*	I	I
	2	26	I*	I	II	I*	I*	I*	I	I
	3	1	I	I	II	I*	I*	II	I	I
	3	6	I	I	II	II	I*	I	I*	I*
	3	11	I*	I	II	I*	I*	I*	I*	I*
	3	16	I	I	II	I*	I*	I*	I*	I*
	3	21	I*	I	II	I*	I*	I*	I*	I*
	3	26	I	II	II	I*	I*	I*	I*	I*
	4	1	II*	II	II	I	I	I	I	I
	4	6	I	II	II	II	I	I	I	I
	4	11	I	II	II	II	I	I	I	I
	4	16	I	II	II	II	I	I	I	I
	4	21	I	I	II	II	I	I	I	I
	4	26	I	I	II	II	I	I	I	I
	5	1	I	I	---	I	I	I	I	I
	5	6	I	I	II	I	I	I	I	I
	5	11	I	I	II	I	I	I	I	I
	5	16	I	I	II	I	I	I	I	I
	5	21	I	I	I*	I*	I	I	I	I
	5	26	I	I	---	I*	I	I	I	I
	6	1	II	I	I	I	I	I	I	I
	6	6	I*	I	I*	I	I	I	I	I
	6	11	II	I	I	I	I	I	I	I
	6	16	---	I	I	I	I	I	I	I
	6	21	II	I	I	I	I	I	I	I
	6	26	I	I	I	I	I	I	I	I
Prince	1	1	I	II*	II*	---	I	I	I	I
George P14	1	6	I	I	II*	II*	I	I	I	I
	1	11	I	I	II	II*	I	I	I*	I*
	1	16	I	I	II	II*	I	I	I	I
	1	21	I	I	II	II*	I	I	I	I
	1	26	I	I	II*	II*	I	I	I	I
	2	1	I	I	II*	I	I	I	I	I*
	2	6	I	I	II*	I	I*	I	I	I*
	2	11	I	I	II*	I	I*	I	I	I*
	2	16	I	II	II*	I	I*	I	I	I*

Table 5.51-3. (continued)

Station	Substation	Depth (cm)	Winter 2000	Winter 2001	Winter 2002	Winter 2003	Winter 2004	Winter 2005	Winter 2006	Winter 2007
Prince	2	21	I	I*	II*	I	I*	I*	I	I
George	2	26	I*	I	II	I	I*	I	I*	I
(continued)	3	1	II	I	II*	---	I	I	I*	I*
	3	6	II	I	II*	II*	I	I	I*	I*
	3	11	I	I	II	I	I	I	I	I
	3	16	I	I	II*	I	I	I	I	I*
	3	21	I	I	II	I	I*	I	I	I
	3	26	I	I	II	I	I*	I*	I	I
	4	1	I	I	II*	I	I	I	I	I*
	4	6	I	II*	II*	I	I	I*	I	I
	4	11	I	I	II	I*	I*	I*	I	I
	4	16	I	I	II*	I*	I*	I*	I	I*
	4	21	I	I	II	I*	I*	I	I	I
	4	26	I	I	II	I*	I*	I*	I	I
	5	1	I	I	II	II*	I	I	I	I
	5	6	I	I	II*	I	I*	I	I	I
	5	11	I	I	II	I	I	I	I	I
	5	16	I	II	II	I	I*	I	I	I
	5	21	I	I	II	I	I	I*	I	I
	5	26	I	I	II	I	I	I	I	I
	6	1	II*	II	II*	II*	I	I	I	I
	6	6	I	I	II	II*	I	I	I	I
	6	11	I	I	II	II*	I	I	I	I
	6	16	I	I	II	II*	I	I*	I	I
	6	21	I	I	I	II*	I	I	I	I
	6	26	I	I	I	I	I	I*	I	I

Table 5.51-4. Methane Concentrations of Sites. Porewater methane concentrations are µM. A [nd] means not determined.

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Town Creek	1	1	12	94
P3	1	6	38	94
	1	11	88	156
	1	16	75	117
	1	21	93	120
	1	26	118	114
	2	1	102	248
	2	6	135	378
	2	11	167	500
	2	16	37	428
	2	21	162	352
	2	26	108	421
	3	1	101	151
	3	6	126	263
	3	11	110	271
	3	16	123	294
	3	21	116	358
	3	26	221	264
	4	1	1	308
	4	6	26	373
	4	11	58	389
	4	16	91	392
	4	21	107	351
	4	26	37	326
	5	1	117	45
	5	6	284	155
	5	11	240	327
	5	16	208	370
	5	21	265	287
	5	26	274	214
	6	1	72	276
	6	6	101	247
	6	11	149	222
	6	16	217	305
	6	21	178	217
	6	26	60	201

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Eagle Island	1	1	nd	nd
P6	1	6	nd	nd
	1	11	253	49
	1	16	409	385
	1	21	377	395
	1	26	504	443
	2	1	7	176
	2	6	41	221
	2	11	129	195
	2	16	190	178
	2	21	326	179
	2	26	301	273
	3	1	nd	1
	3	6	8	nd
	3	11	50	2
	3	16	143	21
	3	21	319	55
	3	26	nd	115
	4	1	29	30
	4	6	117	47
	4	11	169	109
	4	16	212	135
	4	21	262	125
	4	26	233	101
	5	1	3	404
	5	6	218	433
	5	11	367	0
	5	16	365	536
	5	21	406	0
	5	26	426	470
	6	1	2	130
	6	6	nd	265
	6	11	146	459
	6	16	285	415
	6	21	263	519
	6	26	335	0

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Indian Creek	1	1	nd	nd
P7	1	6	5	nd
	1	11	83	nd
	1	16	181	12
	1	21	212	42
	1	26	298	37
	2	1	145	99
	2	6	Nd	288
	2	11	141	269
	2	16	161	201
	2	21	202	129
	2	26	229	129
	3	1	69	220
	3	6	160	306
	3	11	312	nd
	3	16	247	269
	3	21	282	314
	3	26	255	289
	4	1	164	65
	4	6	240	63
	4	11	271	87
	4	16	169	93
	4	21	187	81
	4	26	317	101
	5	1	31	5
	5	6	88	28
	5	11	163	34
	5	16	197	49
	5	21	233	30
	5	26	268	39
	6	1	84	28
	6	6	123	55
	6	11	151	72
	6	16	149	68
	6	21	165	70
	6	26	183	10

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Dollisons	1	1	100	57
Landing P8	1	6	299	96
	1	11	270	97
	1	16	303	94
	1	21	286	96
	1	26	277	120
	2	1	nd	56
	2	6	65	67
	2	11	105	63
	2	16	122	60
	2	21	85	75
	2	26	85	118
	3	1	114	88
	3	6	162	41
	3	11	156	58
	3	16	157	52
	3	21	224	64
	3	26	208	56
	4	1	173	113
	4	6	338	58
	4	11	341	113
	4	16	323	126
	4	21	319	119
	4	26	319	125
	5	1	40	99
	5	6	102	91
	5	11	204	116
	5	16	203	184
	5	21	187	181
	5	26	217	133
	6	1	53	5
	6	6	98	17
	6	11	150	35
	6	16	197	46
	6	21	220	62
	6	26	209	33

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Black River	1	1	166	283
P9	1	6	331	338
	1	11	317	162
	1	16	293	149
	1	21	303	159
	1	26	296	115
	2	1	1	2
	2	6	48	2
	2	11	127	9
	2	16	149	22
	2	21	150	28
	2	26	175	47
	3	1	12	181
	3	6	124	240
	3	11	237	214
	3	16	209	181
	3	21	157	213
	3	26	175	177
	4	1	86	2
	4	6	223	93
	4	11	292	365
	4	16	365	451
	4	21	363	271
	4	26	388	478
	5	1	4	107
	5	6	65	148
	5	11	100	141
	5	16	187	124
	5	21	200	152
	5	26	263	141
	6	1	3	254
	6	6	203	420
	6	11	271	513
	6	16	362	562
	6	21	344	537
	6	26	393	0

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Smith Creek	1	1	8	60
P11	1	6	69	31
	1	11	109	172
	1	16	130	305
	1	21	239	333
	1	26	234	333
	2	1	144	498
	2	6	160	441
	2	11	226	510
	2	16	274	470
	2	21	195	377
	2	26	209	270
	3	1	126	326
	3	6	183	408
	3	11	208	412
	3	16	224	337
	3	21	266	392
	3	26	240	422
	4	1	6	307
	4	6	152	524
	4	11	198	0
	4	16	346	464
	4	21	287	426
	4	26	223	402
	5	1	nd	259
	5	6	102	409
	5	11	218	534
	5	16	269	426
	5	21	224	538
	5	26	228	533
	6	1	5	152
	6	6	84	216
	6	11	221	306
	6	16	193	253
	6	21	339	273
	6	26	139	204

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Rat Island	1	1	150	nd
P12	1	6	258	9
	1	11	180	52
	1	16	127	75
	1	21	232	97
	1	26	154	93
	2	1	311	4
	2	6	333	94
	2	11	338	147
	2	16	303	182
	2	21	238	222
	2	26	312	272
	3	1	52	64
	3	6	123	388
	3	11	156	376
	3	16	202	412
	3	21	245	391
	3	26	nd	300
	4	1	62	230
	4	6	225	252
	4	11	250	319
	4	16	209	276
	4	21	229	427
	4	26	178	440
	5	1	187	9
	5	6	218	34
	5	11	112	72
	5	16	311	114
	5	21	301	169
	5	26	297	132
	6	1	242	4
	6	6	288	5
	6	11	279	8
	6	16	274	5
	6	21	234	6
	6	26	239	5

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Fishing Creek	1	1	nd	nd
P13	1	6	6	nd
	1	11	42	nd
	1	16	68	nd
	1	21	90	nd
	1	26	126	5
	2	1	78	50
	2	6	29	68
	2	11	77	36
	2	16	72	143
	2	21	76	163
	2	26	60	227
	3	1	nd	nd
	3	6	10	57
	3	11	9	110
	3	16	12	173
	3	21	3	184
	3	26	nd	183
	4	1	18	18
	4	6	77	15
	4	11	118	14
	4	16	102	23
	4	21	121	32
	4	26	141	62
	5	1	37	3
	5	6	59	57
	5	11	50	90
	5	16	97	161
	5	21	119	141
	5	26	nd	136
	6	1	nd	nd
	6	6	nd	nd
	6	11	nd	nd
	6	16	nd	nd
	6	21	nd	nd
	6	26	nd	nd

Table 5.51-4. (continued)

Station	Substation	Depth (cm)	Methane	
			Summer 2006	Winter 2007
Prince George	1	1	nd	nd
P14	1	6	70	4
	1	11	26	15
	1	16	212	20
	1	21	191	35
	1	26	193	29
	2	1	207	15
	2	6	228	95
	2	11	185	200
	2	16	131	120
	2	21	177	174
	2	26	147	189
	3	1	96	2
	3	6	61	5
	3	11	191	19
	3	16	141	39
	3	21	144	108
	3	26	139	91
	4	1	201	26
	4	6	233	45
	4	11	211	189
	4	16	192	220
	4	21	206	219
	4	26	171	223
	5	1	Nd	4
	5	6	53	26
	5	11	63	49
	5	16	119	95
	5	21	121	150
	5	26	113	222
	6	1	6	20
	6	6	258	152
	6	11	316	227
	6	16	327	229
	6	21	341	285
	6	26	97	183

5.52 Indian Creek (P7)

Porewaters of Indian Creek were essentially fresh during the winters of 2000, 2001, and 2002, with highest salinities never exceeding 0.2 ppt (Hackney et al. 2002a, 2002b). Winter porewater salinities increased substantially at this station during the winter of 2003 with salinities as high as 1.3 ppt at the near shore substation S1 and averaged 0.4 $\pm$ 0.3 ppt at substations 1, 2, 3, and 4 combined (Hackney et al. 2003). The substations closer to uplands, 5 and 6, were still fresh and likely not influenced as much by tidal flood waters. During the winter of 2004, salinities returned to low values with only 2 substations reaching values above 0.2 ppt (Hackney et al. 2005). Classifications were generally MP and MPSR, similar to the winters of 2000, 2002, and 2003, but not as fresh as the winter of 2001 where all classifications were M (Table 5.51-3). Only substation S1 had sulfate concentrations sufficient to sustain sulfate reduction (Table 5.52-1). The winters of 2005, 2006 and the current winter (2007) were very fresh and similar to the winter of 2001. Salinities were generally less than 0.1 ppt (Table 5.51-1) and all classifications were M except for a few MPSR classifications (Table 5.51-3).

An increase in salinity was observed during the summer of 2002 (Hackney et al. 2003). During the previous 2 summers, the majority of the substations had values below 0.5 ppt (Hackney et al. 2002a, 2002b). During the summer of 2002 most values at the non-upland substations had salinities in the 2.0 ppt range clearly showing an increase in salinity. The following summer of 2003 had all but 3 substations sub-depths with salinities below 0.2 ppt indicating very low salinity conditions for this site. For the first time, this site had all methanogenic summer classifications with the majority being M and only a few MPSR (Hackney et al. 2005). Salinities during the summer of 2004 were slightly higher ranging from 0.05-0.13 ppt. Classifications reflected the slightly higher salinities with some M classifications converted to MPSR (Hackney et al. 2006). Salinities last summer (2005) were slightly fresher and similar to the summer of 2003 with most salinities below 0.05 ppt (Hackney et al. 2007). Several MPSR classifications were converted back to M (Table 5.51-2). The current summer (2007) is similar to the previous one with a majority of M classifications and a few MPSR classifications.

Table 5.52-1. Sulfate Concentrations of Sites. Porewater sulfate concentrations are µM. A [---] indicates no data. A [nd] means not determined.

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Town Creek	1	1	1496	99
P3	1	6	694	41
	1	11	474	39
	1	16	399	40
	1	21	124	59
	1	26	478	107
	2	1	838	51

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Town Creek	2	6	432	94
(continued)	2	11	160	38
	2	16	242	6
	2	21	142	14
	2	26	211	67
	3	1	1194	180
	3	6	457	71
	3	11	249	18
	3	16	278	111
	3	21	287	68
	3	26	439	126
	4	1	2808	82
	4	6	1941	43
	4	11	1101	68
	4	16	384	24
	4	21	232	62
	4	26	210	57
	5	1	871	227
	5	6	456	80
	5	11	149	75
	5	16	59	49
	5	21	167	50
	5	26	129	187
	6	1	405	76
	6	6	343	19
	6	11	321	38
	6	16	193	63
	6	21	314	25
	6	26	349	67
Eagle Island	1	1	69	413
P6	1	6	322	536
	1	11	196	512
	1	16	116	104
	1	21	72	111
	1	26	90	116
	2	1	1172	130
	2	6	805	64
	2	11	283	36
	2	16	93	66
	2	21	82	150
	2	26	80	40
	3	1	552	380
	3	6	520	374
	3	11	397	566

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Eagle Island (continued)	3	16	259	276
	3	21	170	144
	3	26	55	35
	4	1	25	364
	4	6	227	160
	4	11	201	196
	4	16	200	25
	4	21	161	7
	4	26	519	37
	5	1	317	140
	5	6	223	45
	5	11	97	39
	5	16	153	22
	5	21	78	22
	5	26	57	37
	6	1	243	32
	6	6	145	61
	6	11	141	17
	6	16	91	31
	6	21	125	30
	6	26	107	15
Indian Creek P7	1	1	144	196
	1	6	193	221
	1	11	136	172
	1	16	64	57
	1	21	31	17
	1	26	27	24
	2	1	45	28
	2	6	125	41
	2	11	45	44
	2	16	50	32
	2	21	41	22
	2	26	37	73
	3	1	44	37
	3	6	71	34
	3	11	50	0
	3	16	56	39
	3	21	49	7
	3	26	32	15
	4	1	40	50
	4	6	50	58
	4	11	40	37
	4	16	14	9
	4	21	21	30

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Indian Creek (continued)	4	26	24	nd
	5	1	56	43
	5	6	65	27
	5	11	31	23
	5	16	32	20
	5	21	43	19
	5	26	42	24
	6	1	115	27
	6	6	99	37
	6	11	65	29
	6	16	57	24
	6	21	41	32
	6	26	54	2
Dollisons Landing P8	1	1	187	28
	1	6	69	30
	1	11	54	20
	1	16	67	13
	1	21	44	15
	1	26	31	21
	2	1	165	19
	2	6	125	22
	2	11	71	21
	2	16	90	36
	2	21	44	12
	2	26	75	4
	3	1	99	13
	3	6	96	12
	3	11	102	4
	3	16	107	19
	3	21	105	7
	3	26	98	11
	4	1	169	5
	4	6	135	38
	4	11	194	22
	4	16	112	14
	4	21	97	8
	4	26	61	7
	5	1	138	16
	5	6	101	18
	5	11	89	16
	5	16	71	24
	5	21	79	17
	5	26	49	14
	6	1	116	52

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Dollisons Landing	6	6	111	36
(continued)	6	11	60	20
	6	16	118	18
	6	21	65	27
	6	26	62	14
Black River	1	1	56	28
P9	1	6	51	24
	1	11	36	35
	1	16	32	32
	1	21	33	53
	1	26	32	60
	2	1	187	111
	2	6	171	86
	2	11	99	61
	2	16	51	27
	2	21	61	53
	2	26	43	29
	3	1	223	18
	3	6	54	16
	3	11	31	16
	3	16	32	13
	3	21	43	4
	3	26	12	15
	4	1	274	73
	4	6	248	71
	4	11	63	23
	4	16	55	17
	4	21	31	8
	4	26	20	9
	5	1	320	5
	5	6	323	6
	5	11	151	7
	5	16	46	4
	5	21	48	4
	5	26	63	8
	6	1	305	20
	6	6	73	7
	6	11	60	10
	6	16	37	11
	6	21	44	6
	6	26	47	3
Smith Creek	1	1	2827	419
P11	1	6	2405	361
	1	11	1118	210

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Smith Creek (continued)	1	16	388	67
	1	21	93	49
	1	26	66	7
	2	1	121	46
	2	6	81	55
	2	11	74	32
	2	16	116	33
	2	21	74	27
	2	26	65	3
	3	1	938	65
	3	6	1101	180
	3	11	927	58
	3	16	269	37
	3	21	86	79
	3	26	356	81
	4	1	3518	167
	4	6	2100	47
	4	11	449	37
	4	16	155	19
	4	21	76	53
	4	26	201	92
	5	1	78	90
	5	6	1013	41
	5	11	888	16
	5	16	654	21
	5	21	220	24
	5	26	210	39
	6	1	2395	114
	6	6	1301	109
	6	11	244	28
	6	16	177	70
	6	21	157	68
	6	26	144	73
Rat Island P12	1	1	279	353
	1	6	261	382
	1	11	426	260
	1	16	363	142
	1	21	129	72
	1	26	338	70
	2	1	238	472
	2	6	340	346
	2	11	496	232
	2	16	120	129
	2	21	361	27

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Rat Island (continued)	2	26	162	39
	3	1	98	488
	3	6	360	108
	3	11	856	52
	3	16	130	46
	3	21	146	82
	3	26	110	108
	4	1	192	59
	4	6	277	42
	4	11	905	27
	4	16	103	47
	4	21	177	63
	4	26	191	111
	5	1	130	134
	5	6	237	149
	5	11	888	107
	5	16	158	111
	5	21	66	54
	5	26	161	85
	6	1	172	499
	6	6	156	311
	6	11	300	190
	6	16	166	321
	6	21	133	289
	6	26	230	178
Fishing Creek P13	1	1	131	50
	1	6	121	76
	1	11	71	122
	1	16	38	110
	1	21	40	131
	1	26	30	116
	2	1	31	105
	2	6	36	126
	2	11	37	3
	2	16	24	70
	2	21	33	65
	2	26	54	26
	3	1	10	5
	3	6	126	32
	3	11	96	18
	3	16	118	19
	3	21	91	14
	3	26	1	12
	4	1	67	46

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Fishing Creek (continued)	4	6	48	88
	4	11	32	124
	4	16	35	93
	4	21	62	88
	4	26	49	77
	5	1	82	125
	5	6	73	133
	5	11	73	53
	5	16	54	37
	5	21	37	39
	5	26	164	82
	6	1	27	120
	6	6	337	124
	6	11	267	164
	6	16	245	113
	6	21	185	109
	6	26	152	121
Prince George P14	1	1	219	24
	1	6	75	26
	1	11	73	8
	1	16	48	18
	1	21	18	16
	1	26	52	46
	2	1	30	5
	2	6	15	11
	2	11	26	8
	2	16	13	12
	2	21	21	23
	2	26	43	25
	3	1	36	8
	3	6	22	6
	3	11	20	16
	3	16	29	10
	3	21	20	19
	3	26	18	19
	4	1	26	7
	4	6	20	20
	4	11	31	47
	4	16	24	9
	4	21	48	28
	4	26	28	17
	5	1	87	53
	5	6	33	34
	5	11	35	83

Table 5.52-1. (continued)

Station	Substation	Depth (cm)	Sulfate	
			Summer 2006	Winter 2007
Prince George	5	16	22	16
(continued)	5	21	25	26
	5	26	30	14
	6	1	125	99
	6	6	74	26
	6	11	37	130
	6	16	26	38
	6	21	22	74
	6	26	29	13

5.53 Dollisons Landing (P8)

Winter porewaters at Dollisons Landing have been essentially fresh with only a few substation sub-depths with sulfate concentrations able to support sulfate reduction, mainly during the winter of 2000 (Hackney et al. 2002a). Since the winter of 2000 the site has remained relatively fresh. During the winters of 2000 and 2001, the site had porewater salinities in the 0.1 to 0.3 ppt range (Hackney et al. 2002a). During the winters of 2002, 2003, and 2004, salinities were below 0.1 ppt (Hackney et al. 2002b, Hackney et al. 2003, Hackney et al. 2005), continuing the low salinity conditions. Salinities during the winters of 2005, 2006, and the current winter were approximately 0.02-0.13 ppt (Hackney et al. 2006; Hackney et al. 2007; Table 5.51-1) with the majority of classifications being M and MPSR (Table 5.51-3). Conditions have remained essentially the same for the past 3 winters.

Salinities during the summer of 2003 were all at or below 0.05 ppt resulting in the lowest salinities observed at this site since the project's inception. For the first time all substations had methanogenic conditions (Hackney et al. 2005). The majority of substations had M classifications and only a few had MPSR classifications. During the summer of 2004, conditions were slightly saltier in the uplands resulting in several M classifications converted to MPSR (Hackney et al. 2006). Conditions were slightly fresher nearer to the river with a few SR classifications converted to M. Classifications during the summer of 2005 were essentially the same as the previous one with only a few minor exceptions (Table 5.51-2). The current summer's classifications are similar to the previous two summers with the exception of several MPSR classifications converted to M classifications in the upland sites.

5.54 Black River (P9)

Winter porewaters of the Black River station continued to display fresh conditions from the winter of 2002 to present. Most classifications have been M except at the most upland stations during the past winter and the current winter which had some MPSR classifications (Table 5.51-3). Salinities have remained low with the majority of values ranging from 0.02-0.05 ppt (Table 5.51-1.)

On the basis of classifications and salinities, the summer of 2003 was the freshest summer since monitoring began for this site with all M classifications and only one MPSR (Table 5.51-2). During the past three summers conditions have been relatively the same with the majority of classifications being M and a few MPSR classifications. Summer salinities for the past three summers have ranged from approximately 0.01-0.04 ppt (Hackney et al. 2006; Hackney et al. 2007; Table 5.51-1). One notable difference is that the presence of previous sulfate reduction at the upland-most site during 2005 was not present during the current summer (Table 5.51-2).

5.55 Smith Creek (P11)

Porewater salinities during the winter at Smith Creek showed a steady increase from 2000 (Hackney et al. 2002a) to 2002 (Hackney et al. 2002b). However, salinities during the winter of 2003 [av. = 4.4 $\pm$ 1.1 ppt; (Hackney et al. 2003)] and 2004 [av. = 3.3 $\pm$ 1.1 ppt; (Hackney et al. 2005)] were lower than the winter of 2002 [(av. = 7.2 $\pm$ 2.1 ppt; (Hackney et al. 2002b)]. Smith Creek classifications have displayed a steady shift from SR classifications to MPSR classifications since the winter of 2003 (Table 5.51-3). The shift started at the upland stations during the winter of 2003, and have progressed to the nearshore stations. During the current winter all stations are MPSR classifications except for the surface subsites at S1. Salinities have continued in the 1-4 ppt range so the shift is likely due to increased rates of sulfate reduction at this site.

The summer of 2004 salinities ranged from 5-8 ppt (Hackney et al. 2006) with the exception of S5 which displayed very fresh conditions (0.01-0.02 ppt). These salinities are higher than those observed during the summer of 2003 (0.1-4 ppt; Hackney et al. 2005), but are not as high as previous years, which have reached, as high as 14 ppt. Last summer (2005), all classifications were SR indicating saltier conditions particularly in the upland station (Table 5.51-2). Salinities for the current summer are average for this site (approximately 2-7 ppt) (Table 5.51-1). However, several sites have been converted from SR to MPSR classifications similarly to the winter 2007 (Table 5.51-2) strongly suggesting more rapid rates of sulfate reduction occurring at this site during the past year.

5.56 Rat Island (P12)

Vegetation along this transect is strongly transitional, from saline tolerant species near the river to salt intolerant species toward the upland boundary. Porewater salinity reflects the gradient with higher salinity at substations near the river and fresher conditions toward the uplands. Winter salinities steadily increased from 2000-2002

(Hackney et al. 2002a, 2002b), with the winter of 2003 showing a dramatic salinity increase in sites adjacent to uplands for the first time (Hackney et al. 2003). Average substation S6 salinities had never exceeded 0.2 ppt, but were 2.7 $\pm$ 0.2 ppt during the winter of 2003, representing more than a ten fold increase. The salinities during the winter of 2004 returned to lower values similar to those observed during winters of 2001-2002 with the majority of salinities near the upland edge below 0.3 ppt (Hackney et al. 2005). Winter classifications reflected lower salinities with several upland sites returning to methanogenic conditions (Table 5.51-3). The winter of 2005 was similar to the previous one (2004), but conditions were slightly saltier in the uplands with some M classifications converted to MPSR and some MPSR classifications converted to SR (Table 5.51-3). Fresher condition prevailed last year and during the current year with several SR classifications converting to MPSR or M classifications. The past two winters are comparable to the freshest winter so far for this monitoring project, which occurred during the first year, 2000.

The summer of 2002 was the saltiest summer recorded for this site since the inception of this monitoring project. Average salinities at this site (1.9 $\pm$ 0.2 ppt; Hackney et al. 2003) increased almost tenfold from previous average salinities (0.2 + 0.1 ppt, Hackney et al. 2002a, 2002b). Salinities during the summer of 2003 were lower than that of the summer of 2002 with the majority of salinities below 0.4 ppt (Hackney et al. 2005). Summer salinities during the past three years have been fairly consistent with values in the 0.1 to 1.0 ppt range. With the exception of subsite 3 during the summer of 2004, the past four summer's classifications have been dominated by as a combination of MPSR and M with a few SR classifications (Table 5.51-2).

5.57 Fishing Creek (P13)

The winter porewater salinities at Fishing Creek displayed a peak during the winter of 2002 (Hackney et al. 2002b) and returned to values similar to the winters of 2000 and 2001 (Hackney et al. 2002a) during the winter of 2003 (Hackney et al. 2003). Salinities of approximately 1 ppt were observed during the winter of 2002 (Hackney et al. 2002b). During the winter of 2003 salinities were all less than 0.5 ppt (Hackney et al. 2003). Winter 2004 salinities displayed a freshening trend with all salinities below 0.1 ppt except for substation 3 (Hackney et al. 2005). On the basis of classifications, winter conditions at Fishing Creek have remained approximately the same throughout the current winter (Table 5.51-3). In general all sites have been M classifications with the exception of S3 which has shown evidence of past sulfate reduction and S1 which occasionally shows a non-sea salt source of sulfate.

Porewater salinities measured during the summer of 2002 were the highest ever obtained for Fishing Creek since the beginning of the project in 2000 with values of approximately 5-7 ppt at the near-bank substation, 3 ppt at the mid substations, and essentially fresh conditions at stations near the upland (Hackney et al. 2003). Porewater salinities during the summer of 2003 were the lowest observed during the project for Fishing Creek with values less than 0.1 ppt at the near-bank substation, less than 0.5 ppt at the mid substations (Hackney et al. 2005). Summer 2003 classifications reflected the

fresher conditions with all but 2 sub-depths with methanogenic conditions. In previous summers at least 1/3 of the sub-depths were sulfate reducing (Table 5.51-2). Salinities during the summer of 2004 were still relatively fresh but slightly saltier than the previous fresh summer of 2003. Several M classifications were converted to MPSR (Table 5.51-2) indicating that the spring was saltier than the previous spring of 2003. However, there were no SR classifications such as those observed during the saltier summers of 2000-2002. Last summer (2006) and the current summer displayed fresher conditions similar to the winter of 2003. The majority of classifications were M with a few MPSR classifications.

5.58 Prince George Creek (P14)

Winter salinities peaked during the winter (2002) and decreased during the winters of 2003-2005. Salinities during the winter (2003) ranged from 0.05 to 0.26 ppt (Hackney et al. 2003), while salinities for the winter of 2004 and 2005 were all below 0.1 ppt (Hackney et al. 2005; 2006). For the first time all substation sub-depths were methanogenic (Hackney et al. 2005). Conditions during the winter of 2006 were slightly saltier at the creek bank locations and slightly fresher at the mid and upland locations (Table 5.51-3). Conditions during the current winter are very similar to the previous winter with the exception of a few more MPSR classifications at S2 and S4. No sites had sulfate concentrations able to support sulfate reduction due to lower chloride (Table 5.58-1) and salinities levels (Table 5.51-1).

Summer salinities peaked during 2002 and returned to lower salinity during the summer of (2003). Summer 2002 salinity values were approximately 1 ppt (Hackney et al. 2003), roughly twice previous values (Hackney et al. 2002a, 2002b). The majority of summer (2003) values were below 0.04 ppt (Hackney et al. 2005). Salinities during the summer 2004 were slightly lower than the previous summer of 2003. Prior to the summer of 2002, summer geochemical classifications were essentially all (M). Due to the increase in salinity at this site during the summer 2002, the majority of substations were converted to (SR) (Table 5.51-2). None of the classifications from the summers (2003, 2004) were sulfate reducing and were similar to the previous summers of 2000 and 2001. Conditions during the last summer (2006) were similar with the exception of a few sites displaying a non-sea salt source of sulfate (Table 5.51-3). Classifications during the current summer are all essentially M with two MPSR classifications.

Table 5.58-1. Chloride Concentrations of Sites. Chloride concentrations of porewaters in µM.

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Town Creek	1	1	60426	15794
P3	1	6	55300	22485
	1	11	47090	29047
	1	16	44381	34419
	1	21	45684	37487
	1	26	45587	39914
	2	1	94091	19908
	2	6	77401	23586
	2	11	72843	26807
	2	16	77653	27031
	2	21	67672	31179
	2	26	62526	40714
	3	1	60678	19953
	3	6	62547	31398
	3	11	52542	38194
	3	16	49859	46011
	3	21	49201	47606
	3	26	42061	44607
	4	1	70447	28558
	4	6	65440	32884
	4	11	112337	33993
	4	16	55669	35777
	4	21	39389	34588
	4	26	32472	33811
	5	1	52322	5266
	5	6	54081	5224
	5	11	50030	6380
	5	16	47050	7255
	5	21	40738	10843
	5	26	32838	13364
	6	1	21537	22552
	6	6	23274	24398
	6	11	22954	25537
	6	16	14908	26975
	6	21	21113	26441
	6	26	25588	25576

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Eagle Island	1	1	416	1476
P6	1	6	16864	1004
	1	11	17072	4056
	1	16	15821	14460
	1	21	16403	26525
	1	26	19167	42937
	2	1	26044	35350
	2	6	21630	33538
	2	11	21288	26353
	2	16	24185	51529
	2	21	26756	57719
	2	26	26132	55419
	3	1	19013	16982
	3	6	18303	16914
	3	11	17429	19271
	3	16	16666	20564
	3	21	16861	25134
	3	26	227	26462
	4	1	221	4081
	4	6	6840	4416
	4	11	7251	4835
	4	16	8321	9395
	4	21	11125	13511
	4	26	15865	19014
	5	1	10105	4138
	5	6	4774	5568
	5	11	5219	10490
	5	16	6601	16399
	5	21	6804	13424
	5	26	7164	13002
	6	1	2669	3795
	6	6	2886	10985
	6	11	3436	9029
	6	16	3688	11321
	6	21	4010	12740
	6	26	4037	8586

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Indian Creek	1	1	441	570
P7	1	6	795	522
	1	11	1100	606
	1	16	1494	701
	1	21	1853	911
	1	26	2008	1477
	2	1	341	543
	2	6	461	653
	2	11	556	780
	2	16	559	963
	2	21	621	1393
	2	26	583	2006
	3	1	190	531
	3	6	329	496
	3	11	398	22
	3	16	484	632
	3	21	474	869
	3	26	517	1338
	4	1	543	657
	4	6	628	677
	4	11	707	644
	4	16	666	20
	4	21	860	729
	4	26	1047	nd
	5	1	395	363
	5	6	404	345
	5	11	336	328
	5	16	419	353
	5	21	490	330
	5	26	516	380
	6	1	834	305
	6	6	695	308
	6	11	438	287
	6	16	488	305
	6	21	369	259
	6	26	238	25

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Dollisons	1	1	747	344
Landing P8	1	6	624	453
	1	11	580	359
	1	16	694	362
	1	21	597	362
	1	26	610	390
	2	1	709	429
	2	6	614	434
	2	11	635	376
	2	16	723	729
	2	21	605	407
	2	26	636	369
	3	1	647	443
	3	6	733	478
	3	11	789	442
	3	16	840	576
	3	21	849	530
	3	26	753	371
	4	1	597	443
	4	6	616	471
	4	11	1218	492
	4	16	556	435
	4	21	573	414
	4	26	627	411
	5	1	1814	1824
	5	6	1799	1850
	5	11	1596	1866
	5	16	1521	1950
	5	21	1577	1720
	5	26	1871	1602
	6	1	2554	2000
	6	6	2629	1951
	6	11	2788	1993
	6	16	2620	2056
	6	21	2517	2069
	6	26	2738	1930

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Black River	1	1	519	553
P9	1	6	509	618
	1	11	564	585
	1	16	590	531
	1	21	659	539
	1	26	679	838
	2	1	532	305
	2	6	504	296
	2	11	462	283
	2	16	440	236
	2	21	507	390
	2	26	1589	416
	3	1	537	351
	3	6	602	374
	3	11	631	410
	3	16	530	422
	3	21	548	199
	3	26	439	416
	4	1	504	299
	4	6	433	290
	4	11	435	311
	4	16	440	308
	4	21	391	326
	4	26	522	335
	5	1	399	328
	5	6	428	393
	5	11	387	199
	5	16	642	346
	5	21	1015	386
	5	26	733	388
	6	1	368	264
	6	6	391	271
	6	11	446	302
	6	16	440	293
	6	21	466	282
	6	26	435	299

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Smith Creek	1	1	90787	16127
P11	1	6	96661	16903
	1	11	93279	24927
	1	16	79965	36706
	1	21	70557	46404
	1	26	73683	51690
	2	1	108863	28542
	2	6	99233	41212
	2	11	94141	46483
	2	16	90476	46637
	2	21	88444	55218
	2	26	81075	56053
	3	1	90723	20036
	3	6	102254	29215
	3	11	98072	35602
	3	16	93278	39888
	3	21	79064	50279
	3	26	69839	54232
	4	1	74871	21213
	4	6	77299	30800
	4	11	58220	39551
	4	16	53748	45000
	4	21	41730	46327
	4	26	52821	45588
	5	1	188	24737
	5	6	34846	36323
	5	11	52448	36839
	5	16	62667	36374
	5	21	59528	35650
	5	26	58853	33258
	6	1	43848	6552
	6	6	66189	8689
	6	11	45708	10298
	6	16	40323	12205
	6	21	40910	14129
	6	26	37294	17230

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Rat Island	1	1	20153	1092
P12	1	6	11636	1521
	1	11	5225	2525
	1	16	6619	3646
	1	21	8180	5359
	1	26	2075	8155
	2	1	21349	2326
	2	6	16912	3025
	2	11	7238	4607
	2	16	7341	6441
	2	21	7858	7551
	2	26	1676	8609
	3	1	22636	6925
	3	6	20229	6977
	3	11	10748	7284
	3	16	9670	7862
	3	21	8902	7302
	3	26	1369	7497
	4	1	20097	4106
	4	6	20281	4294
	4	11	12845	4727
	4	16	10267	5060
	4	21	8162	5397
	4	26	1340	6186
	5	1	20581	1862
	5	6	20649	1644
	5	11	15307	1698
	5	16	10595	1862
	5	21	6212	1938
	5	26	1347	2219
	6	1	16684	842
	6	6	20921	644
	6	11	13961	654
	6	16	7689	673
	6	21	5606	686
	6	26	1650	616

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Fishing Creek	1	1	810	254
P13	1	6	729	287
	1	11	757	362
	1	16	832	334
	1	21	796	453
	1	26	897	458
	2	1	555	579
	2	6	662	782
	2	11	779	24
	2	16	667	589
	2	21	711	557
	2	26	889	572
	3	1	34	41
	3	6	275	1341
	3	11	240	1589
	3	16	486	1129
	3	21	244	1113
	3	26	297	1101
	4	1	548	417
	4	6	807	948
	4	11	778	488
	4	16	709	487
	4	21	936	447
	4	26	830	460
	5	1	604	418
	5	6	566	577
	5	11	547	366
	5	16	563	390
	5	21	366	335
	5	26	587	376
	6	1	95	357
	6	6	2345	358
	6	11	2154	380
	6	16	2204	279
	6	21	2367	267
	6	26	2304	286

Table 5.58-1. (continued)

Station	Substation	Depth (cm)	Chloride	
			Summer 2006	Winter 2007
Prince George	1	1	652	476
P14	1	6	510	574
	1	11	541	403
	1	16	517	453
	1	21	477	290
	1	26	520	307
	2	1	543	435
	2	6	481	563
	2	11	536	405
	2	16	532	449
	2	21	586	321
	2	26	684	288
	3	1	544	378
	3	6	514	485
	3	11	493	407
	3	16	516	461
	3	21	491	323
	3	26	432	250
	4	1	557	256
	4	6	556	577
	4	11	582	383
	4	16	604	437
	4	21	607	316
	4	26	624	290
	5	1	582	357
	5	6	659	458
	5	11	669	426
	5	16	527	436
	5	21	540	274
	5	26	482	380
	6	1	536	438
	6	6	439	527
	6	11	498	393
	6	16	410	404
	6	21	408	349
	6	26	433	273

5.6 Long Term Trends and Change

The patterns of variations for the current year and previous years follow.

Year 1 (winter 2000, 2001, summer 2000):

During the first year of the study general geochemical classifications were established for the sites in order to compare with future conditions. In the first report, which included the winters of 2000, 2001, and the summer of 2000 (Hackney et al. 2002), three of these stations were primarily sulfate reducing year-round (P3 - Town Creek, P12 - Rat Island, and P11- Smith Creek) two were primarily methanogenic year round (P8 - Dollisons Landing, and P14 - Prince George) and four exhibited mixed conditions with sulfate reduction typically dominating the geochemistry during the summer and methanogenesis dominating during the winter (P7- Indian Creek , P9 - Black River, P12 - Rat Island, P13 - Fishing Creek) (Hackney et al. 2002).

Year 2 (winter 2002, summer 2001):

In the second report, which included the summer of 2001 and the winter of 2002 (Hackney et al. 2002a, 2002b), two Northeast Cape Fear River sites, Prince George (P14) and Fishing Creek (P13), displayed a dramatic change in winter classification from methanogenic in the winters of 2000 and 2001 to sulfate reducing in the Winter of 2002 resulting from an increase in salinity. The other two sites on the Northeast Cape Fear River, Rat Island (P12) and Smith Creek (P11), also showed signs of increased salinity although their general classification did not change. Rat Island (P12) had several methanogenic classifications converted to sulfate reducing. Smith Creek (P11), which was already a sulfate reducing system, recorded higher salinities in porewaters.

The summer geochemical classifications on the Cape Fear River showed the opposite trend with evidence of a slight freshening of the porewaters. Changes in classifications of the Cape Fear River sites were not as dramatic as those observed on the Northeast Cape Fear River. The general trend for Cape Fear River sites was a slight freshening of the porewaters in winter 2002 and saltier conditions in summer 2001 compared to the data contained in the previous report. Town Creek (P3), which is located below the confluence of the Northeast Cape Fear River and the Cape Fear River, displayed a similar trend as that of the Cape Fear River sites with slightly saltier conditions during the summer and slightly fresher conditions during the winter.

Year 3 (winter 2003, summer 2002):

The increases in porewater salinities observed during previous summers continued through the summer of 2002 in the Northeast Cape Fear River (Fishing Creek, Prince George, Rat Island, and Smith Creek). Due to the continued increase in summer salinities, all four sites were classified as sulfate reducing geochemical classifications for the first time. With the exception of Smith Creek, which already had a sulfate reducing geochemical classification, this was the first time the upper Northeast Cape Fear sites

have had a summertime sulfate reducing geochemical classifications. A similar increase in summertime porewater salinity was noted in the Cape Fear River sites immediately above the City of Wilmington (Indian Creek, Eagle Island) while the sites further upstream on the Cape Fear River (Black River, Dollisons Landing) had peak salinities occurring during the previous summer (2001). The salinities of Town Creek, the only site below the City of Wilmington monitored for geochemical classification, showed no obvious change in summer porewater salinity.

With the exception of Town Creek, which is below the City of Wilmington, and the Cape Fear River sites immediately above the City of Wilmington (Indian Creek and Eagle Island) all sites had lower winter porewater salinities than previous winters. For the upper Cape Fear River stations (Black River and Dollisons Landing), winter conditions showed a steady decrease in salinity since 2000. Fresher conditions did not cause a shift in geochemical classification for these sites since they were already methanogenic. In the Northeast Cape Fear River (Fishing Creek, Prince George, Rat Island, and Smith Creek), winter (2003) porewater salinities returned to lower values after peaking during the previous winter (2002). The decrease in salinities for the more seaward stations (Rat Island and Smith Creek) was not enough to convert these systems from sulfate reducing geochemical classification. For upstream stations (Fishing Creek and Prince George), several substations that previously converted to sulfate reducing returned to a methanogenic geochemical classification in 2003. Porewater salinities of Town Creek, Indian Creek, and Eagle Island increased during the winter (2003). The changes in geochemical classifications were relatively small for these sites with only slight changes towards higher salinity classifications.

Year 4: (winter 2004, summer 2003)

Low salinity conditions characterize Year 4, summer 2003 and winter 2004. In general, all sites experienced conditions that would be considered low salinity on the basis of previous winters and summers. Several sites had conditions that were the lowest in salinity since the study began in 2000. For the most seaward station, Town Creek, both the winter and summer were the freshest on record. The Cape Fear River sites (Indian Creek, Dollisons Landing, and Black River) had a relatively low salinity winter and a summer that was the freshest observed during this study. While all Northeast Cape Fear River sites had relatively fresher conditions during the current year, there was more variability in the extent to which they experienced low salinities. Fishing Creek had the freshest winter and summer on record, Prince George had the freshest winter on record, and Rat Island had the freshest summer on record. Smith Creek had fresh conditions during both the summer and winter, but not the freshest on record.

Year 5: (winter 2005, summer 2004)

Low salinity conditions characterize Year 5 of the study, summer 2004 and winter 2005. In general, all sites experienced conditions that would be considered low salinity on the basis of previous winters and summers. However, conditions were not as fresh as the previous year. Five stations experienced slightly saltier conditions during the current

summer (2004) compared to last summer (Town Creek, Indian Creek, Black River, Smith Creek, and Fishing Creek), while Prince George experienced slightly fresher conditions. The remainder of sites either had no change or a mix of fresher and saltier conditions within the site. Two stations experienced slightly saltier conditions during the current winter (2005) compared to last winter (Town Creek and Rat Island), while Indian Creek experienced slightly fresher conditions. Five sites were essentially the same as the previous winter (Eagle Island, Black River, Smith Creek, Fishing Creek, and Prince George) and Dollisons Landing had both saltier and fresher conditions within the site.

Year 6: (winter 2006, summer 2005)

In general, fresher conditions continued though Year 6 of this monitoring study, although slight differences were noted between the current year and the previous one. During the current winter, these slight changes in salinity and mode of organic matter remineralization varied systematically with river location. NECF river sites (Prince George, Fishing Creek, Rat Island, and Smith Creek) displayed a slight freshening, while all but one (Indian Creek) main stream CFR sites showed slightly saltier conditions (Eagle Island, Black River, and Dollisons Landing). Town Creek, which is the most sea ward location monitored for geochemistry was noticeable fresher.

During the summer there were no consistent patterns with some sites showing slightly saltier conditions (Rat Island creek bank, Smith Creek, Eagle Island, and Town Creek) and some showing slightly fresher conditions (Fishing Creek, Rat Island upland, and Indian Creek). Generally conditions remained fairly fresh during this summer.

Year 7: (winter 2007, summer 2006)

Fresher conditions continued throughout both the winter and summer of year seven of the monitoring project. Classifications at most sites were essentially the same as year six with the exception of very slightly fresher conditions.

6.0 BENTHIC INFAUNA COMMUNITIES

6.1 Summary

This chapter summarizes infaunal community patterns at nine sites distributed among the Cape Fear River, Northeast Cape Fear River and Town Creek from 1999-2006. This period covered three major potential system-level impacts: a developing drought in 2001-2002, a period of recovery and relatively higher freshwater input late in 2003 and in 2004, as well as the initiation of channel widening construction in 2001-2002. 2000 and 2002 continued to represent the years of lowest diversity for most sites, with highest diversity occurring at most sites during 2003 or 2004. Species richness was highest in 2004 for 5 of the 9 sites showing significant differences (and not significantly different from the year with highest species richness for the remaining sites). However, there were no consistent patterns for either diversity or richness among the remaining years. Richness and diversity for 2006 was intermediate and not significantly different from 2005. Analysis of Similarity and Multidimensional Scaling Analysis indicated that 1999-2001 samples did not have significantly dissimilar faunal assemblages. However, subsequent years did have distinct infaunal assemblages relative to the 1999-2001 grouping as well as from each other. The overall separation of 2002-2005 from 1999-2001 was greater than differences among the 2002-2005 grouping as indicated by Analysis of Similarity. 2006 samples generally grouped with the 2003-2005 samples with respect to faunal community similarity. The 2006 samples were characterized by high abundances of amphipods at P2 and P3, high abundances of bivalves at P2, high abundances of the deep burrowing functional guild at P3, high abundances of sedentary/tube builders at P12, low abundances of polychaetes at P3, low abundances of oligochaetes at P11, low abundances of sedentary/tube builders at P3, P8, and P11 and low abundances of deep burrowers at P11. Other faunal abundance patterns were intermediate to previous years and these patterns did not, indicate a distinct pattern for 2006 relative to 2003-2005.

6.2 Background

As part of the U.S. Army Corps of Engineers project to deepen the Cape Fear River shipping channel from the mouth of the river to Wilmington Harbor, benthic infaunal communities have been monitored at stations predicted to have the greatest potential impacts. The focus of this sampling effort is on the fringing wetlands that border the river and represent critical habitat and nursery areas for a number of commercially and ecologically important taxa. Changes in the composition and abundance of organisms living within or directly on the sediments of the fringing marsh (infauna) may result from changes in salinity, flow, and tidal currents. Benthic infaunal community patterns integrate environmental changes at a specific site over time. Most infaunal groups have limited post-larval mobility or dispersal, with abundances at a site reflecting a combination of recruitment patterns and site-specific processes. Infauna may be relatively long-lived, with lifespans of months to years for some taxa, and they occupy intermediate trophic positions, consuming detrital or planktonic food sources and being prey for larger fish and decapods. As a result, the infaunal community present in an area represents cumulative impacts of varying environmental factors over a several month

period. Changes in the composition of the infaunal community in response to changing environmental conditions may occur more rapidly than for more motile organisms that can migrate to optimal locations. However, changes in this group may also have fundamental importance for local ecosystem functioning because of their key position in nearshore estuarine food webs.

While many benthic species are resilient to short-term disturbances, long-term change associated with fluctuations in water quality, changes in tidal inundation or amplitude, changes in current flow or local hydrology, or changes in salinity regime and other physical factors may alter species composition and abundance. These physical changes may impact the infaunal community through direct mortality, reduced dispersal, food web alteration, and impacts related to increased stress (e.g. reduced feeding, competition). The monitoring effort reported here is designed to detect changes in the infaunal communities at selected sites that may be coincident with the timing of deepening of the Cape Fear River shipping channel. We hope to be able to distinguish potential long-term changes related to these anthropogenic impacts from year-to-year variability related to climatic fluctuations. Current working hypotheses are: 1) Changes in salinity and/or tidal amplitude and/or inundation period will lead to changes in intertidal and shallow subtidal benthic community composition, 2) If alterations of the Cape Fear River shipping channel significantly change estuarine flow characteristics, a change in community composition and function reflecting altered recruitment patterns may follow.

Polychaetes, oligochaetes, amphipods, and insect larvae are the dominant taxonomic groups of the Cape Fear estuary. Polychaetes and amphipods tend to dominate mesohaline sites in the river, while oligochaetes and insects dominate the oligohaline sites, although this pattern may shift among years and site-specific responses may vary with taxonomic composition. The relative importance of specific species that dominate a site changes along the estuarine gradient from polyhaline to oligohaline and tidal freshwater conditions. As noted in previous evaluations of the Cape Fear River estuary, both bivalves and gastropods have conspicuously low abundances in estuarine portions of the river both in the intertidal and subtidal habitats (Mallin et al. 1999 and 2001). Infaunal groups demonstrate a variety of reproductive, dispersal, and functional strategies that can directly relate to timing and magnitude of their response to shifting environmental conditions. Polychaetes (segmented worms bearing specialized appendages) are common throughout the estuary and are generally the numerically dominant taxa in euhaline to mesohaline environments. Polychaetes have a variety of living modes including free-living, burrowing, and sedentary forms. Burrowing and tube-dwelling species dominate in most of the intertidal and shallow subtidal areas and are common prey for fish, shrimp, and crabs. Oligochaetes are another group of segmented worms that generally lack specialized appendages, have a burrowing habit, and exhibit direct development. Direct development in this group can result in locally dense patches and the ability to respond quickly to local environmental changes. Their deeper burrowing habit often makes them less available as a prey resource for fish and decapods than tube-dwelling polychaetes or amphipods. Amphipods are a diverse group of brooding crustaceans. This group can exhibit explosive population growth under

optimal conditions, and serves as a critical food resource in fringing wetlands during at least certain time periods. Although many are free-living or pelagic, a large proportion of estuarine amphipods are tube builders that can be highly mobile over small spatial scales and may quickly colonize disturbed habitats. Insect larvae are among the most numerous and diverse groups that inhabit the oligohaline and tidal freshwater regions of the estuary, but are generally absent from lower mesohaline and more saline areas. Insect larvae exploit virtually every habitat type in the upper estuary and are distinct from other groups in having aerial dispersal. However, many insects are very sensitive to salt intrusions and are indicators of changing salinity conditions. Like other infaunal groups, this group includes of a number of living strategies including surface tube-dwelling and free-living species that would be susceptible to predation especially by juvenile fish that recruit into the system heavily in the spring and to a lesser extent in the fall of each year.

6.3 Methodology

Infaunal core samples were collected at nine stations along the Cape Fear River estuarine gradient. Three benthic stations are located in Town Creek (P2 at the mouth of Town Creek, P3A and P3B inner Town Creek), three stations in the main stem Cape Fear above the City of Wilmington (P6-Eagle Island, P7-Indian Creek, and P8-Dollisonss Landing), and three stations in the Northeast Cape Fear River (P11-Smith Creek, P12-Rat Island, and P13-Fishing Creek). These stations are the same as those being monitored for epifauna patterns (Section 7.0) and represent a subset of those stations being monitored for changes in physical factors that may be causal for possible biotic changes (including tidal elevation, inundation, and biogeochemical composition among other variables).

Infaunal core samples (10 cm diameter X 15 cm deep) were collected at two upper intertidal subsites and two lower intertidal subsites at each station. These subsites are fixed stations that were originally marked (and positions recorded using GPS) in 1999. Three replicate core samples were collected within a one-meter area around these points. Core samples are collected at all stations in June of each year. All samples are fixed in a 10% formalin solution (~4% formaldehyde), with Rose Bengal dye added, later sieved through a 500 micron screen to remove excess sediment, and preserved in 50% isopropanol. All organisms are separated from the remaining sediment by sorting under a dissecting microscope and identified to lowest reasonable taxon, in most cases this is genus or species.

The major deepening efforts for the Cape Fear River channel began in winter 2001 and were ongoing at various areas within the Cape Fear system into 2006. Since the current report summarizes data from infaunal samples taken through June 2006, the data represents background conditions (pre-dredging; 1999-2001), possible initial impacts related to the actual sediment removal activities (2002-2006) and any developing hydrologic impacts of channel alterations. Full effects of the deepening project cannot be assessed until 2-3 years of post-dredging data are available to compare to pre-dredging conditions and patterns occurring while dredging was ongoing. However, interim community patterns at each site over the 7 years of sampling were assessed by examining patterns of species diversity, species richness, taxonomic and guild dominance, and

community similarity. Per site diversity was calculated using the Shannon-Weiner Diversity Index and was compared along with per sample taxonomic richness among years by site. For comparison of taxonomic richness, taxa were combined where there was uncertainty among years. Abundances of major taxonomic groups (polychaetes, oligochaetes, amphipods, and insects) and major functional guilds (sedentary/tube dwellers, surface/mobile taxa, deep burrowing taxa, and surface burrowing taxa) were compared among years separately for each site using analysis of variance. Abundances were log-transformed before analyses to meet assumptions of homogeneity of variances. Community similarity was compared among site/year combinations using the ANOSIM and multidimensional scaling data analysis procedures of the PRIMER statistical package (Clarke and Gorley 2001). These procedures examine community similarity based on a Bray-Curtis Similarity matrix. All species were included in this analysis and abundances were square root transformed to reduce dominating effects on analyses by common taxa.

6.4 Faunal Patterns

While four locations (two high intertidal and two low intertidal substations) were sampled at each station, mean total abundances for all infaunal species present at a specific station are given by tidal position. In order to more easily compare the relative abundance and shifts in composition between tidal positions and among years, abundance data is presented in three year blocks by tidal position and only for taxa that were present at that site/substation combination. Tables 6.4-1a and 6.4-1b represent the mouth of Town Creek (P2) located in the mesohaline region of the Cape Fear River, while Tables 6.4-2a and 6.4-2b and Tables 6.4-3a and 6.4-3b represent the two inner Town Creek sites, P3A and P3B respectively. Shifts in species composition and relative abundance are evident in the main stem Cape Fear sites; Eagle Island (P6) (Tables 6.4-4a and 6.4-4b), Indian Creek (P7) (Tables 6.4-5a and 6.4-5b), and Dollisons Landing (P8) (Tables 6.4-6a and 6.4-6b). Most of these individual species shifts follow major taxonomic changes (see below), though there was considerable species replacement among years within a guild or higher taxonomic grouping. Mean abundances for the three Northeast Cape Fear River stations, Smith Creek (P11) (Tables 6.4-7a and 6.4-7b), Rat Island (P12) (Tables 6.5-8a and 6.4-8b), and Fishing Creek (P13) (Tables 6.4-9a and 6.4-9b) also show a high degree of variability among years, generally following the shifts in major guild or taxonomic groups.

Table 6.4-1a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected on the Town Creek mouth site (P2) during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.71)	0(0)	0.25(0.25)
amphipod sp.	0.17(0.17)	0.50(0.23)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Bezzia/Palpomia	0.50(0.50)	0(0)	0(0)	2.00(2.00)	2.50(0.86)	3.50(2.06)	0(0)	0.50(0.29)
juv. Bivalve	1.00(0.37)	0.50(0.29)	0(0)	0(0)	0.25(0.25)	1.00(0.58)	0.25(0.25)	2.00(0.71)
Boccardia sp. A	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.75(1.75)	0(0)
Boccardiella sp.	0(0)	26.50(18.62)	0(0)	0.25(0.25)	0.75(0.48)	18.75(6.97)	6.25(4.73)	0.25(0.25)
Capitellidae sp.	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0.17(0.17)	0.50(0.50)	0(0)	0(0)	0.50(0.50)	2.00(1.35)	2.25(0.63)	0.75(0.48)
Caulleriella killariensis	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Chironomidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Coleoptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Corophium acherusicum	0(0)	0(0)	12.50(8.72)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium acutum	0(0)	0(0)	7.75(7.75)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium lacustre	0(0)	4.25(0.85)	0(0)	0(0)	0.50(0.29)	28.25(9.28)	75.25(40.79)	25.00(9.23)
Corophium sp.	0.17(0.17)	0(0)	11.75(7.81)	0(0)	0(0)	2.00(2.00)	0(0)	0.50(0.50)
Crangonyx pseudogracilis	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Curculionidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.50(1.19)	0(0)	1.00(0.58)
Cyathura polita	0(0)	0.75(0.75)	0(0)	0(0)	0(0)	4.50(3.84)	0.25(0.25)	0(0)
Dicrotendipes (*lobus*)	0(0)	0(0)	0(0)	0(0)	0(0)	22.00(17.64)	0(0)	0(0)
Dicrotendipes nervosa	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Dicrotendipes sp.	2.00(0.93)	1.00(1.00)	0.25(0.25)	0(0)	7.50(6.85)	1.50(1.50)	0.25(0.25)	0.50(0.50)
Dipolydora ligni	0(0)	0(0)	0(0)	0(0)	0(0)	2.00(1.08)	0(0)	0(0)
Dolichopodidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
(*Dumosus* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)
Eteone heteropoda	0(0)	1.00(0.41)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Eteone sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fabriciola sp.	0(0)	0(0)	0(0)	37.00(37.00)	0(0)	0(0)	0(0)	0(0)
Fabriciola trilobata	0(0)	0(0)	0(0)	5.75(5.42)	0(0)	0.25(0.25)	0.50(0.50)	0(0)
Flabelligeridae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Gammarus sp.	0(0)	0.75(0.48)	0(0)	0.25(0.25)	0(0)	0.25(0.25)	0(0)	0(0)
Gammarus tigrinus	0(0)	2.25(2.25)	0(0)	0(0)	0(0)	0(0)	0(0)	4.75(3.82)
juv. Gastropod	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Hargeria rapax	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	5.00(4.67)	24.50(12.58)	55.00(26.69)
Hobsonia florida	3.67(2.01)	3.00(2.68)	0.50(0.50)	0(0)	0.50(0.50)	11.25(4.27)	0(0)	0.25(0.25)
insect pupae	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0.17(0.17)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0.17(0.17)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	1.25(0.75)	0.25(0.25)
Marenzelleria viridis	1.67(1.67)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)	0(0)
Megalops spp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.50(0.65)	0.25(0.25)	0(0)
Melita nitida	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)
Neanthes succinea	0(0)	0.25(0.25)	1.50(0.96)	0(0)	0(0)	0(0)	1.75(0.63)	0.50(0.50)
Nereidae sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Nereis falsa	0(0)	1.25(1.25)	0(0)	0(0)	0(0)	0(0)	1.00(1.00)	0(0)
Nereis riisei	0.67(0.49)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Notophilia sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Oligochaete	36.50(11.55)	8.75(6.79)	2.25(1.31)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0.25(0.25)	0.25(0.25)	0(0)
Owenia sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)
Parandalia sp.	1.00(0.63)	0(0)	0.50(0.29)	2.75(1.11)	0(0)	4.75(2.93)	1.25(0.95)	0.75(0.48)
Polydora caulleryi	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Polydora ligni/cornuta	12.17(10.83)	0.25(0.25)	0.25(0.25)	0.75(0.48)	0(0)	0(0)	2.00(1.68)	1.50(1.50)
Polydora socialis	5.50(4.11)	0(0)	3.25(3.25)	0.25(0.25)	0(0)	0(0)	3.25(2.93)	0(0)
Polypedilum sp.	1.50(0.72)	0(0)	0(0)	0(0)	13.50(11.51)	0.50(0.29)	0(0)	0(0)
Streblospio benedicti	0.83(0.31)	0.75(0.25)	0.25(0.25)	8.25(4.77)	0(0)	0(0)	1.75(1.44)	0(0)
Tanais sp.	0.33(0.33)	0(0)	16.75(9.46)	0(0)	0(0)	0(0)	0(0)	0(0)
Tanytarus sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)	0(0)
Tipulidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	2.25(1.93)	2.75(1.55)	52.50(27.52)	31.00(17.61)	6.50(4.63)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	6.25(5.92)	0.25(0.25)
Uca minax	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0.25(0.25)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)

Table 6.4-1b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected on the Town Creek mouth site (P2) during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)
amphipod sp.	0.17(0.17)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Balanus improvisus	0(0)	0(0)	4.80(4.80)	0(0)	0(0)	0(0)	0(0)	0(0)
Balanus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.71)	0(0)	0(0)
juv. Bivalve	0(0)	0.25(0.25)	0(0)	0.29(0.18)	0(0)	0.50(0.29)	0.20(0.20)	0.25(0.25)
Boccardiella sp.	0(0)	16.50(5.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Capitella capitata	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Cerapus tubularis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Chironomus sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Collembola sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60(0.24)	0(0)
Corophium lacustre	0(0)	2.50(1.19)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0.50(0.50)
Corophium sp.	0(0)	0.25(0.25)	0.20(0.20)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Cyclaspis varians	0(0)	0(0)	0(0)	0.14(0.14)	0(0)	0(0)	0(0)	0(0)
Dicrotendipes sp.	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Edotea (*montosa*)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Edotea sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)
Edotea triloba	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Eteone heteropoda	0(0)	0(0)	0(0)	0.71(0.42)	0(0)	0(0)	0(0)	0(0)
Gammarus sp.	0(0)	0.25(0.25)	0.20(0.20)	0.14(0.14)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	0.33(0.33)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Hargeria rapax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)
Haustoridae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Hobsonia florida	0.83(0.83)	4.00(2.74)	0(0)	0(0)	0.25(0.25)	0.25(0.25)	0(0)	0(0)
insect pupae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40(0.40)	0(0)
Laeonereis culveri	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mediomastus ambiseta	1.17(0.83)	0(0)	0(0)	2.86(2.54)	0(0)	0(0)	3.40(1.47)	1.75(1.75)
Mediomastus sp.	1.67(0.99)	0(0)	0(0)	4.29(2.30)	0.25(0.25)	0.25(0.25)	4.20(1.68)	1.25(0.95)
Melita nitida	0(0)	0.50(0.50)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Mucrogammarus mucronata	0(0)	0(0)	0(0)	0.14(0.14)	0(0)	0(0)	0(0)	0(0)
Neanthes succinea	0(0)	1.25(0.95)	0.20(0.20)	0.14(0.14)	0(0)	1.25(0.95)	0(0)	0(0)
Nemertea sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40(0.24)	0(0)
Nereis acuminata	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	4.83(2.21)	2.50(1.19)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes (pugio)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Parandalia sp.	2.50(0.85)	1.00(0.71)	0.80(0.37)	2.43(1.49)	0(0)	0.75(0.25)	0.20(0.20)	0(0)
Paraprionospio pinnata	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora ligni/cornuta	0.83(0.83)	1.50(1.50)	0(0)	0.43(0.43)	0(0)	0(0)	0(0)	0(0)
Procladius sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.25)	0(0)	0(0)	0(0)
Sphenia antillensis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Spisula solidessima	0(0)	0(0)	0(0)	0.29(0.18)	0(0)	0(0)	0(0)	0(0)
Streblospio benedicti	3.00(1.69)	0(0)	1.60(1.03)	54.29(11.27)	0(0)	0(0)	0.40(0.40)	0(0)
Syllidae sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Tanais sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Tanypus sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0.20(0.20)	0(0)	0.25(0.25)	0.25(0.25)	0.20(0.20)	1.00(0.71)
Tubificoides heterochaetus	0(0)	0(0)	0.20(0.20)	0.86(0.70)	0(0)	3.25(1.31)	12.80(3.43)	3.50(1.89)

Table 6.4-2a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3A upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0.17(0.17)	0(0)	0(0)	0.17(0.17)	0(0)	0.25(0.25)	0.25(0.25)	0(0)
Apedilum sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Bezzia/Palpomyia	0(0)	0(0)	0.40(0.24)	0.17(0.17)	0.75(0.47)	0.25(0.25)	2.00(0.91)	0.25(0.25)
juv. Bivalve	0.17(0.17)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0.50(0.29)	0(0)
Cassidinidea lunifrons	0(0)	0(0)	1.00(0.32)	0(0)	1.25(0.63)	4.00(0.91)	1.00(0)	0.25(0.25)
Collembola sp.	0.33(0.21)	0(0)	0(0)	8.67(7.09)	0(0)	1.25(0.48)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	1.00(0.41)	0(0)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cryptochironomous sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Cyathura (madelinae)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	1.50(1.19)	2.75(1.11)	0(0)
Dicrotendipes (lobus)	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Dicrotendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Dolichopodidae sp.	0(0)	3.75(1.38)	0.60(0.40)	0(0)	0.25(0.25)	0(0)	0.25(0.25)	0.50(0.50)
Elasmopus sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Enchytraeidae sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Eukiefferiella sp.	0(0)	0(0)	1.80(1.56)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Hemipodus roseus	0(0)	0.50(0.50)	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)
Hobsonia florida	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)
insect pupae	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. b	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. g	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0.67(0.67)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
(*Limnophyes* sp.)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)
Lumbriculidae sp.	0(0)	1.00(1.00)	0.20(0.20)	0(0)	0.75(0.75)	0.75(0.75)	0(0)	0(0)
(Lumbriculidae sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Megalops spp.	0(0)	0(0)	0(0)	0.17(0.17)	0.25(0.25)	0.25(0.25)	0(0)	0(0)
Nais sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
juv. Nereid	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	36.67(24.02)	42.00(12.81)	9.60(3.98)	0(0)	0(0)	0(0)	0(0)	0(0)
Olivella sp.	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	0(0)	0(0)	0.80(0.58)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0(0)	0(0)	0.40(0.40)	0.17(0.17)	0(0)	0.50(0.29)	0(0)	1.75(0.25)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	4.00(1.58)	0(0)	0(0)
Polypedilum sp.	0(0)	0.25(0.25)	0(0)	0(0)	3.50(2.36)	0.25(0.25)	0(0)	0(0)
Procladius sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Spionidae sp.	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Tabanus sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0.25(0.25)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	2.40(2.40)	6.67(3.26)	6.00(0.25)	26.25(5.76)	21.00(5.02)	29.75(9.80)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)	0(0)
Uca pugilator	0.50(0.34)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0.25(0.25)	0(0)	0.33(0.21)	0.25(0.25)	0(0)	1.00(0.41)	0(0)

Table 6.4-2b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3A upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	4.75(1.25)	0.25(0.25)	0(0)
Ampharetidae sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Amphipod sp.	0.67(0.33)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Anurida maritime	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5.00(5.00)	0.25(0.25)
Bezzia/Palpomyia	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
juv. Bivalve	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Boccardiella sp.	0(0)	0(0)	0(0)	0.33(0.21)	0(0)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0.17(0.17)	0.25(0.25)	0.20(0.20)	0(0)	0.50(0.29)	0.25(0.25)	0.25(0.25)	0.25(0.25)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Coleoptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Collembola sp.	0(0)	0(0)	0(0)	0.33(0.21)	0(0)	21.00(7.15)	0(0)	0(0)
Corophium lacustre	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.50(0.50)	1.75(1.44)	0(0)
Cryptochironomous sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cyathura (madelinae)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Dolichopodidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	4.25(1.11)	2.00(1.08)	2.25(1.11)
Eukiefferiella sp.	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus plumosa	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	2.67(2.12)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
(*Georthocladius* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Hemiptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Hobsonia florida	3.17(1.33)	0(0)	0.60(0.40)	0(0)	0.50(0.29)	0(0)	0(0)	0(0)
Hydrophilidae larvae	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect larva b	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect pupae	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	5.25(2.87)	0(0)
(*Limnophyes* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Lumbriculidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	13.50(13.5)	0(0)	0(0)
Marenzelleria viridis	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mediomastus ambiseta	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mediomastus califoriensis	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Megalops spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Melita nitida	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Monopylephorus irroratus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	60.25(60.25)	0(0)
Monopylephorus sp.	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Munna sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Neanthes succinea	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Oligochaete	5.00(3.85)	83.00(35.67)	12.40(3.91)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Orchestia sp.	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.25)
Polydora ligni/cornuta	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polypedilum sp.	1.00(0.37)	0(0)	0(0)	0(0)	1.50(1.19)	0(0)	0(0)	0(0)
Procladius sp.	2.50(0.34)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Streblospio benedicti	0.17(0.17)	0(0)	0.20(0.20)	1.67(1.12)	0(0)	0(0)	0(0)	0(0)
Tanytarsus sp.	0.50(0.34)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	4.50(1.34)	2.00(1.08)	44.50(15.44)	43.25(21.26)	113.00(94.18)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0.67(0.33)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 6.4-3a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3B upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Ablabesmyia sp.	0(0)	0(0)	0(0)	0(0)	2.00(2.00)	0(0)	0(0)	0(0)
Apedilum sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Axarus sp.	0(0)	0(0)	0(0)	0(0)	2.50(2.50)	0(0)	0(0)	0(0)
Bezzia/Palpomyia	0(0)	0(0)	0(0)	0.80(0.58)	0.25(0.25)	1.50(0.65)	0.50(0.29)	1.00(0.71)
juv. Bivalve	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Boccardiella sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0(0)	0(0)	0.60(0.24)	0(0)	0.50(0.50)	0.75(0.25)	1.50(0.64)	0.25(0.25)
Chrysops sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Collembola sp.	0.40(0.24)	0(0)	0(0)	0.20(0.20)	0.25(0.25)	1.00(0.58)	0(0)	0(0)
Corophium lacustre	0(0)	0(0)	0(0)	0(0)	1.25(0.95)	0(0)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0.40(0.20)	0(0)	1.25(0.95)	0.25(0.25)	0(0)	0(0)
Cryptochironomous sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cyathura (madelinae)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.50)	0.50(0.50)	0.25(0.25)
Dero sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Dicrotendipes sp.	0(0)	0(0)	0(0)	0(0)	2.50(2.50)	0(0)	0(0)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0.20(0.20)	0.25(0.25)	0(0)	0(0)	0.50(0.50)
Dolichopodidae sp.	0(0)	0.50(0.50)	0.40(0.24)	0(0)	0(0)	0.50(0.50)	0(0)	1.00(0.71)
Dolichopus sp.	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Enchytraeidae sp.	0(0)	0(0)	0(0)	3.00(3.00)	0(0)	0(0)	0(0)	0(0)
Ephydridae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	2.00(1.41)	0(0)	0(0)
Erioptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Eukiefferiella sp.	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0.25(0.25)
*Hobsonia flori*da	0(0)	0(0)	0.80(0.80)	0.20(0.20)	0(0)	0.25(0.25)	0(0)	0(0)
Hydrothassa sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
insect larva c	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.41)
Lumbriculidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)
Marenzelleria viridis	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Megalops spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)	0(0)
Munna sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Nereid	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Nereidae sp.	0(0)	0.75(0.75)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	16.40(6.24)	27.30(6.80)	3.00(1.84)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	0.20(0.20)	0.25(0.25)	4.20(3.95)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0(0)	0.75(0.48)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(0.48)	0(0)	0(0)
Paratendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)	0.50(0.50)
Platyhelminthes sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Polypedilum sp.	0(0)	0.25(0.25)	0(0)	0(0)	2.50(2.18)	0.25(0.25)	0.25(0.25)	0(0)
Procladius sp.	0(0)	0(0)	0(0)	0(0)	1.00(1.00)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0.25(0.25)	0.20(0.20)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)
Tabanus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(1.25)	0(0)	0(0)
Tanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	1.50(1.19)	0.80(0.58)	8.00(4.74)	16.50(1.71)	9.50(2.99)	37.50(12.30)
Uca mixax	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Uca sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 6.4-3b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P3B upper Town Creek sites during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	4.75(2.43)	0(0)	0(0)
Amphipod sp.	0.33(0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Apedilum sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Cassidinidea lunifrons	0.17(0.17)	0(0)	0(0)	0.20(0.20)	0(0)	2.00(2.00)	0(0)	0(0)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0.25(0.25)
Collembola sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	13.50(6.54)	0(0)	0(0)
Coelotanypus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Corophium acutum	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium lacustre	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	9.0(5.70)	0(0)	0.25(0.25)
Cryptochironomous sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0.25(0.25)
Cyathura polita	0(0)	0.50(0.29)	0.25(0.25)	0.80(0.80)	0(0)	1.50(0.87)	0.50(0.29)	0.25(0.25)
Dicrotendipes sp.	0.17(0.17)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Dolichopodidae sp.	0(0)	0.25(0.25)	0.25(0.25)	0(0)	0(0)	1.25(1.25)	0.25(0.25)	0(0)
Enchytraeidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(1.00)	0(0)	0(0)
Gammarus lawrencianus	0.83(0.83)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	1.83(1.83)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus sp.	0.17(0.17)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Goeldichironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Heteromastus filiformis	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hobsonia florida	2.50(0.89)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
insect pupae	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	4.25(3.33)	0.75(0.48)	1.50(0.87)
Limnodrilus hoffmeisteri	0(0)	0(0)	0(0)	0(0)	1.75(1.75)	0(0)	0(0)	0(0)
(*Limnophyes* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Lumbriculidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Marenzelleria viridis	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Marinogammarus sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Melita dentata	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Monopylephorus irroratus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Munna sp.	0.50(0.34)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Namalycastis sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Nimbocera sp.	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	4.83(2.36)	39.30(13.90)	10.50(3.23)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora ligni/cornuta	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora socialis	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)
Polydora sp.	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polypedilum sp.	0.67(0.49)	0(0)	0(0)	0(0)	1.50(0.96)	0(0)	0.75(0.48)	1.25(1.25)
Procladius sp.	0.50(0.34)	0(0)	0(0)	0(0)	4.50(2.60)	0(0)	0(0)	0(0)
Rhithropanapeus harisii	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Strictochironomus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	3.60(1.03)	0(0)	0(0)	0(0)	0(0)
Tharyx sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	1.00(1.00)	6.60(2.01)	1.75(0.63)	50.25(29.71)	17.50(7.64)	117.00(26.57)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0.80(0.58)	0.50(0.50)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)	0(0)

Table 6.4-4a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at the lowest main-stem Cape Fear site P6 during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0.75(0.48)	1.50(1.50)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	17.25(7.05)
Bezzia/Palpomyia	0.60(0.24)	0.25 (0.25)	0(0)	0.50(0.29)	6.75(4.01)	4.00(0.91)	3.50(1.55)	1.50(0.64)
juv. Bivalve	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Cassidinidea lunifrons	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Chrysops sp.	0(0)	0(0)	0(0)	0.25(0.25)	1.00(1.00)	0(0)	0(0)	0(0)
Collembola sp.	1.60(0.75)	0(0)	0(0)	1.00(0.41)	1.75(0.63)	0.75(0.25)	0.50(0.50)	1.00(0.71)
Curculionidae sp.	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0.25(0.25)	0(0)
Cyathura (*madelinae*)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cyathura polita	0.80(0.58)	0(0)	0(0)	0(0)	0(0)	1.00(0.58)	0(0)	0(0)
Dero sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)	0.25(0.25)	0.50(0.29)
Dolichopodidae sp.	0(0)	0.25 (0.25)	1.00(0.41)	0.25(0.25)	1.00(0.58)	1.00(0.41)	0.25(0.25)	0.25(0.25)
Dolichopus sp.	0.80(0.80)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Enchytraeidae sp.	0(0)	0.50 (0.50)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Endochironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Ephydridae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Eukiefferiella (*claripennis*)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0.20(0.20)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Hemipodus roseus	0.80(0.80)	0(0)	1.75(0.85)	0(0)	0(0)	0(0)	0(0)	0(0)
insect larva c	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. h	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. I	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	3.20(2.03)	2.50(1.66)	0(0)	1.00(0.58)	0(0)	0(0)	1.75(1.03)	1.75(1.03)
Lumbriculidae sp.	0(0)	0(0)	0(0)	2.25(2.25)	0(0)	0(0)	0.25(0.25)	0(0)
Marenzelleria viridis	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mesovelia sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Microvelia sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Monopylephorus irroratus	0(0)	0(0)	0(0)	0(0)	4.00(3.67)	0(0)	6.25(5.01)	0(0)
Namalycastis abiuma	0(0)	1.00(0.41)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Nereidae sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Oligochaete	9.60(4.84)	9.50(2.90)	6.00(4.06)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	1.20(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	1.00(0.55)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
(*Ormosia* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Orthocladiinae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(1.00)	0(0)	0(0)
Paratendipes sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Polypedilum sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Procladius sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Sabellaria vulgaris beauforteasis	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Sciomyzidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Sthenelais sp. A	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Syrphidae	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	1.50(0.29)	19.75(6.34)	14.25(3.86)	13.25(5.51)	19.00(5.21)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	1.00(1.00)	0(0)	0(0)
Uca minax	0(0)	0(0)	0.25(0.25)	0.25(0.25)	0(0)	0(0)	0.50(0.50)	0(0)
Uca pugilator	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)
Uca pugnax	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0.20(0.20)	0(0)	0(0)	1.00(0.41)	0(0)	0(0)	0(0)	0(0)

Table 6.4-4b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at the lowest main-stem Cape Fear site P6 during June 1999, 2000, 2001, 2002, 2003 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)
Americhelidium americanum	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
amphipod sp.	0.80(0.58)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)
Anurida maritime	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	89.00(49.14)	0(0)
Bezzia/Palpomyia	0.60(0.40)	0(0)	0.20(0.20)	0(0)	0.25(0.25)	0.50(0.29)	0.25(0.25)	0(0)
juv. Bivalve	0.60(0.40)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Boccardiella sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4.75(1.84)
Capitellidae sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	1.00(0.77)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ceratopogonidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)
Coelotanypus sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)	0(0)
Collembola sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	2.00(2.00)	3.75(2.39)	0.25(0.25)
Cyathura polita	5.00(5.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dicrotendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.41)
Dipolydora sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Dolichopus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dolichopodidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	1.00(0.58)	0(0)
Eukiefferiella (*claripennis*)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus daiberi	0.20(0.20)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
juv. Gastropod	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hargeria rapax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Hobsonia florida	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
insect pupae	1.80(1.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)
Lumbriculidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.50(0.87)	0(0)
Marenzelleria viridis	0(0)	2.00(0.91)	3.80(1.16)	0(0)	0(0)	4.75(2.63)	0(0)	3.75(2.84)
Melita sp.	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Munna sp.	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Nemertea sp.	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)
Oligochaete	49.60(18.89)	3.50(1.94)	1.00(0.55)	0(0)	0(0)	0(0)	0(0)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Parandalia sp.	0(0)	0(0)	0(0)	0.40(0.24)	0.25(0.25)	0(0)	0(0)	0(0)
Pectinaria gouldii	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Polydora socialis	2.60(2.60)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.71)
Polydora sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Polypedilum sp.	0.40(0.40)	0(0)	0(0)	0(0)	0.50(0.29)	1.50(1.50)	0(0)	0.75(0.25)
Procladius sp.	0.60(0.60)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Pyrrhalta sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)
Spirosperma sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Tabanus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	0(0)	1.75(0.25)	10.0(5.29)	9.50(4.42)	6.25(1.49)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	3.80(2.33)	0(0)	0.50(0.29)	0(0)	0.25(0.25)
Uca sp.	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 6.4-5a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P7 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	1.00(0.71)	0(0)	0.75(0.75)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Asellus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	17.50(8.66)	2.00(2.00)
Bezzia/Palpomyia	0.20(0.20)	0(0)	0.17(0.17)	0(0)	2.25(1.03)	0(0)	1.25(0.95)	1.25(0.48)
juv. Bivalve	0(0)	0.20(0.20)	0.17(0.17)	0(0)	2.00(0.82)	0.25(0.25)	0.25(0.25)	0.25(0.25)
Cassidinidea lunifrons	0(0)	0(0)	1.00(0.52)	0(0)	0.25(0.25)	0.75(0.75)	0(0)	0(0)
Celina sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Chironomus sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Chrysops sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Collembola sp.	0.40(0.24)	1.20(0.80)	0(0)	0.17(0.17)	0(0)	0.50(0.29)	1.00(0.71)	0.50(0.50)
Corophium acherusicum	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium sp.	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0.67(0.67)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Crangonyx pseudogracilis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)
Cryptochironomus sp.	0.20(0.20)	0(0)	0(0)	0(0)	1.00(0.58)	0(0)	0(0)	0(0)
Cyathura (*madelinae*)	0.40(0.40)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0.20(0.20)	3.67(1.02)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)
Dolichopodidae sp.	0(0)	1.60(0.24)	0.50(0.50)	0(0)	0(0)	1.00(0.71)	0.25(0.25)	2.25(0.75)
Dolichopus sp.	1.60(0.51)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Enchytraeidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Erioptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	3.75(1.75)	0(0)	0.25(0.25)
Gammarus diaberi	0(0)	0(0)	4.00(4.00)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus sp.	0(0)	0(0)	0.67(0.67)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
(*Georthocladius* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Hargeria rapax	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Hobsonia florida	0(0)	0.20(0.20)	0.17(0.17)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
insect larvae	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect pupae	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0(0)	0.67(0.49)	0(0)	0(0)	0(0)	0(0)	0(0)
Isochaetides sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.00(1.68)
isopod sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(0.95)	2.00(1.68)
Limnodrilus hoffmeisteri	0(0)	0(0)	0(0)	0(0)	11.50(3.75)	0(0)	0(0)	0(0)
(*Limnophyes* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)
Lirceus sp.	1.40(1.20)	0(0)	0.67(0.67)	0(0)	0(0)	0(0)	0(0)	0(0)
Lumbriculidae sp.	7.40(3.33)	1.00(1.00)	0.33(0.21)	0.17(0.17)	0(0)	17.25(6.70)	4.50(2.06)	3.25(2.14)
(Lumbriculidae sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.75(1.03)
Megalops spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Micropsectra sp.	0.80(0.37)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Microtendipes (*rydalensis* grp.)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Nemertea sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
(*Netamelita* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(1.25)
Noteridae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Oligochaete	52.20(15.47)	64.20(23.70)	20.17(10.29)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Omisus sp.	0(0)	0(0)	1.83(1.83)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia (platensis)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0.60(0.60)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)	1.00(1.00)
Orchestia sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Orthocladiinae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Paratendipes sp.	0(0)	0(0)	1.83(1.64)	0(0)	0(0)	0(0)	13.50(10.44)	1.25(0.75)
Peloscolex sp.	0(0)	0(0)	0(0)	0(0)	0(0)	5.50(3.57)	7.75(4.70)	0(0)
(*Peloscolex* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	23.25(18.59)	0(0)
Polypedilum sp.	0(0)	0(0)	0.17(0.17)	0(0)	6.75(2.84)	0.25(0.25)	0(0)	0(0)
Pristinella sp.	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Spionidae sp.	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Spirosperma carolinensis	0(0)	0(0)	0.83(0.83)	0(0)	0(0)	0(0)	0(0)	10.75(4.30)
Spirosperma sp.	0(0)	0(0)	0(0)	0(0)	1.00(0.58)	0(0)	0(0)	0(0)
Staphylinidae sp.	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)
Stictochironomus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Tabanus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Tanytarsus sp.	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	3.17(2.01)	24.5(5.36)	104.00(30.6)	13.75(3.57)	33.75(18.08)	22.50(5.20)
Tubificoides heterochaetus	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0.33(0.33)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)

Table 6.4-5b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P7 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)	0.50(0.50)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Arcteonais lomondi	0(0)	0(0)	0(0)	0(0)	0.40(0.24)	0(0)	0(0)	0(0)
Asellus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Aulodrilus pluriseta	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Batea cathariensis	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Bezzia/Palpomyia	0.20(0.20)	0(0)	0(0)	0.17(0.17)	3.80(2.58)	1.75(0.48)	0(0)	0.25(0.25)
juv. Bivalve	0.60(0.40)	0.25(0.25)	0(0)	0.17(0.17)	0.40(0.40)	0.25(0.25)	0.50(0.50)	0.50(0.29)
Cassidinidea lunifrons	0.60(0.24)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0.50(0.50)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Chironomus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Chrysops sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Cladotanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)
Coelotanypus sp.	0(0)	0(0)	0(0)	0.17(0.17)	2.00(1.05)	0(0)	0(0)	0(0)
Collembola sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0.25(0.25)	0(0)
Cryptochironomous sp.	0.60(0.60)	0(0)	0(0)	0(0)	2.00(0.89)	0.75(0.25)	0(0)	0(0)
Cryptotendipes sp.	0(0)	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)
Cyathura (*madelinae*)	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0.50(0.29)	0.67(0.49)	0(0)	0(0)	0.25(0.25)	1.50(0.87)	1.25(0.95)
Dicrotendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Dispio uncinata	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dolichopodidae sp.	0(0)	0.25(0.25)	0.67(0.67)	0(0)	0(0)	0.50(0.29)	0.75(0.48)	0(0)
Dolichopus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus daiberi	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	0.60(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dero sp.	0(0)	0(0)	0(0)	0(0)	0.80(0.80)	0(0)	0(0)	0(0)
juv. Gastropod	1.00(0.45)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
insect larvae	0(0)	0(0)	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)
insect pupae	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0(0)	0.33(0.21)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. a	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Isochaetides sp.	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)
isopod sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	1.25(0.95)	0.50(0.29)
Limnodrilus hoffmeisteri	0(0)	0(0)	0.50(0.50)	0(0)	2.80(1.16)	0(0)	0(0)	0(0)
Lumbriculidae sp.	0(0)	4.00(4.00)	0.83(0.54)	0(0)	0(0)	0(0)	4.00(1.22)	3.00(1.00)
(Lumbriculidae sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Megalops spp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Nereidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Oligochaete	17.80(4.55)	64.00(19.63)	46.83(25.24)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Paratendipes sp.	0.20(0.20)	1.50(1.19)	0(0)	0(0)	0(0)	1.00(1.00)	2.00(1.08)	0.50(0.50)
Peloscolex sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	1.50(0.96)	0(0)
Polypedilum sp.	1.00(1.00)	1.25(0.48)	0.33(0.33)	0(0)	2.00(0.84)	0.75(0.75)	1.00(0.71)	0(0)
Procladius sp.	0.20(0.20)	0(0)	0(0)	0(0)	1.60(0.40)	0(0)	0(0)	0(0)
Saetheria sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Spionidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Spirosperma carolinensis	0(0)	0(0)	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)
Tanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.40(0.24)	0(0)	0(0)	0.25(0.25)
Tubificidae spp.	0(0)	0(0)	8.50(5.38)	11.00(3.34)	48.20(6.85)	24.50(3.23)	38.00(12.86)	60.50(16.78)

Table 6.4-6a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P8 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.00(1.15)
Aulodrilus paucichaeta	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)
Bezzia/Palpomyia	0.33(0.33)	0.75 (0.25)	0.33(0.21)	0(0)	0(0)	1.00(0.00)	0(0)	0(0)
juv. Bivalve	11.17(4.32)	23.50(8.51)	5.17(1.82)	0.60(0.40)	2.00(1.15)	18.50(1.16)	0.20(0.20)	1.00(0.58)
Branchiura sowerbyi	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0(0)	0(0)	0(0)	0.40(0.24)	0(0)	0(0)	0(0)	0(0)
Coelotanypus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Coleoptera sp.	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Collembola sp.	1.50(0.43)	6.50(2.53)	0.33(0.21)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)
Cryptochironomus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Curculionidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)
Cyathura polita	0(0)	0(0)	0(0)	0.60(0.40)	0(0)	0(0)	0(0)	0(0)
Dero sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)
Dolichopodidae sp.	0(0)	6.50(2.33)	0.67(0.49)	0.40(0.40)	0.50(0.50)	0.75(0.75)	0.40(0.40)	2.50(1.19)
Dolichopus sp.	2.17(.75)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Enchytraeidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0.25(0.25)	0.75(0.75)	0(0)	0(0)
Erpobdella sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Erioptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.50(1.19)	0(0)	0(0)
Fabriciola trilobata	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)
Gammarus tigrinus	1.33(1.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0.50(0.34)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(0.63)
Hydaticus larvae	0.33(0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hydrobia sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Hydrophilidae larvae	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect larvae	0(0)	0(0)	1.33(0.88)	0(0)	0(0)	0(0)	0(0)	0(0)
insect pupae	0(0)	0(0)	0.83(0.31)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0.17(0.17)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0.20(0.20)	1.25(0.75)
Isochaetides sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2.25(2.25)
Limnodrilus hoffmeisteri	0(0)	0(0)	0(0)	0(0)	1.00(0.71)	0(0)	0(0)	0(0)
Lumbriculidae sp.	5.00(2.89)	2.00(2.00)	0(0)	1.40(0.75)	0.25(0.25)	4.00(2.83)	4.00(1.70)	3..25(2.63)
(Lumbriculidae sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(0.75)
Micropsectra sp.	3.17(3.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Neanthes succinea	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Nemertea sp.	0(0)	0(0)	0.33(0.21)	0(0)	0.25(0.25)	0(0)	0(0)	0.25(0.25)
Oligochaete	73.5(14.07)	180.25(37.14)	44.17(11.32)	0(0)	0(0)	0(0)	0(0)	0(0)
Omisus sp.	0(0)	0(0)	0(0)	0.60(0.60)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	0(0)	0(0)	5.50(1.57)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	3.50(1.48)	2.50(1.50)	0(0)	1.00(1.00)	0(0)	0.59(0.50)	2.60(1.03)	1.25(0.48)
Oribatei sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Paratendipes sp.	0(0)	5.75(2.69)	0(0)	0(0)	1.50(1.19)	0.75(0.48)	0(0)	0(0)
Paratendipes subaequalis	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Peloscolex sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	6.00(5.02)	0(0)
(*Peloscolex* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.50(1.50)	0(0)
Pericoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	3.00(1.22)	0(0)	4.50(2.22)
Polypedilum sp.	0.17(0.17)	2.75(2.43)	0.17(0.17)	0.20(0.20)	3.00(1.41)	0(0)	0(0)	0(0)
Rheotanytarsus sp.	0.33(0.33)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Spirosperma carolinensis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	7.75(2.93)
Spirosperma sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Stratiomya sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Tabanus sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Tanais sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Tanytarsus sp.	1.00(1.00)	7.50(2.99)	0.17(0.17)	0(0)	0(0)	1.75(1.03)	0(0)	0(0)
Telmatoscopus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4.20(3.29)	0(0)
Tipula sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0.50(0.50)	0(0)	0(0)
Tipulidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)	1.00(1.00)
Tubificidae spp.	0(0)	0(0)	0(0)	19.40(9.14)	128.00(39.51)	63.25(16.14)	75.20(18.92)	47.75(8.38)
Tubificoides heterochaetus	0.17(0.17)	0(0)	0(0)	1.00(1.00)	0.25(0.25)	0(0)	0.40(0.40)	0(0)
Uca pugilator	0.17(0.17)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Uca pugnax	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 6.4-6b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P8 on the main-stem Cape Fear during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40(0.24)	0.50(0.50)
Apedilum sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)
Armadillidium quadrifrons	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Bezzia/Palpomyia	0.33(0.33)	0(0)	0.33(0.21)	0.75(0.48)	1.00(0.58)	0.25(0.25)	0.20(0.20)	0(0)
juv. Bivalve	1.67(0.56)	5.75(4.46)	1.83(0.31)	0.25(0.25)	1.00(0.71)	0.25(0.25)	1.20(0.37)	1.25(0.75)
Branchiura sowerbyi	0(0)	0(0)	0(0)	0(0)	1.00(0.71)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0.83(0.83)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Chironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Coelotanypus sp.	0(0)	0(0)	0(0)	0.25(0.25)	0.75(0.48)	0(0)	0(0)	0(0)
Collembola sp.	0.17(0.17)	0.25(0.25)	1.00(1.00)	0(0)	0(0)	3.75(3.09)	0(0)	0(0)
Corophium lacustre	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0.25(0.25)
Corophium acherusicum	0(0)	0(0)	3.33(0.99)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5.00(2.88)	0(0)
Cryptochironomous sp.	0.33(0.33)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cyathura (*madelinae*)	0.67(0.67)	0.75(0.75)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0(0)	1.50(0.56)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Dolichopodidae sp.	0(0)	0.75(0.25)	0.67(0.33)	0(0)	0.25(0.25)	2.50(0.64)	0.80(0.20)	1.50(0.64)
Dolichopus sp.	1.00(0.82)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	1.50(1.15)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0.17(0.17)	0.50(0.50)	1.00(0.68)	0.50(0.50)	0(0)	0.25(0.25)	0(0)	0(0)
Goeldichironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
insect pupae	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. b	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
isopod sp.	0(0)	0(0)	0.83(0.65)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Leptochelia sp.	0(0)	0(0)	1.00(0.71)	0(0)	0(0)	0(0)	0(0)	0(0)
Limnodrilus hoffmeisteri	0(0)	0(0)	0(0)	0(0)	6.25(5.92)	0(0)	0(0)	0(0)
Lumbriculidae sp.	3.00(1.61)	1.50(1.19)	0(0)	0(0)	0(0)	5.00(2.61)	3.80(1.46)	7.25(6.60)
(Lumbriculidae sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(0.75)
Megalops spp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Micropsectra sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Namalycastis sp.	0(0)	0(0)	0.80(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	122.83(31.34)	103.00(16.91)	63.00(67.60)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Orchestia sp.	0(0)	0(0)	57.00(21.70)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0(0)	0.75(0.48)	0(0)	0(0)	0(0)	0(0)	0.40(0.24)	0(0)
Orthocladiinae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)
Palaemontes pugio	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Paratendipes sp.	0.17(0.17)	1.00(0.58)	0(0)	0(0)	0(0)	0.50(0.50)	0.60(0.60)	0.25(0.25)
Peloscolex sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)
Polypedilum haterale	2.33(2.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polypedilum sp.	1.33(0.56)	3.00(1.58)	2.50(2.40)	0(0)	0(0)	0(0)	0(0)	0(0)
Pristinella sp.	0.67(0.67)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Procladius sp.	0(0)	0(0)	0.30(0.50)	0(0)	1.00(0.71)	0(0)	0(0)	0(0)
Rheotanytarsus sp.	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Spirosperma sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Tanytarsus sp.	0.33(0.33)	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Tipulidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)
Tribelos sp.	0.33(0.33)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	6.50(2.06)	57.25(32.77)	129.50(47.23)	70.60(17.64)	37.25(3.70)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0.25(0.25)
(*Xestochironomus* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)

Table 6.4-7a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P11 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
amphipod sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Apedilum sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.40(0.87)	0(0)	0(0)
Bezzia/Palpomia	0(0)	0(0)	0.50(0.50)	0.50(0.29)	0(0)	4.80(2.37)	0.75(0.48)	0.25(0.25)
juv. Bivalve	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)
Boccardiella sp.	0(0)	1.25(1.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	1.00(0.71)	0.25(0.25)	1.25(0.48)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Chironomus sp.	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	3.20(2.06)	0(0)	0(0)
Collembola sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.60(0.24)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Cladotanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Cricotopus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)
Cryptochironomus sp.	0(0)	0(0)	0(0)	0(0)	1.75(1.44)	0.60(0.60)	0(0)	0(0)
Curculionidae sp.	0.75(0.75)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	4.50(3.57)	1.00(0.71)
Cyathura madelinae	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0.25(0.25)	0(0)	0.25(0.25)	0(0)	0.80(0.58)	0(0)	0.25(0.25)
Dicrotendipes lobus	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dicrotendipes nervosa	0.50(0.50)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)
Dicrotendipes sp.	0(0)	1.00(0.71)	0.50(0.29)	0.25(0.25)	0(0)	0(0)	0.25(0.25)	0.25(0.25)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Dolichopodidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.40(0.24)	0(0)	0(0)
Edotea triloba	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus diaberi	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus mucronatus	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus sp.	0(0)	0(0)	0(0)	1.50(1.50)	0(0)	0(0)	0(0)	0(0)
Goeldichironomus holoprasinus	0(0)	0(0)	0(0)	0(0)	0(0)	1.60(1.60)	0(0)	0(0)
Hobsonia florida	7.50(4.33)	0(0)	3.25(1.11)	0(0)	0(0)	0(0)	2.75(2.75)	1.00(0.58)
insect larvae (Elimidae)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect larvae	1.25(1.25)	0(0)	0(0)	0(0)	0(0)	0.60(0.60)	0(0)	0(0)
insect pupae	1.00(1.00)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0.60(0.60)	0(0)	0(0)
Megalopae (Uca)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Megalops spp.	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Neanthes succinea	0(0)	0(0)	1.75(1.75)	0(0)	0(0)	0.60(0.60)	0(0)	0(0)
Nemertea sp.	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Nereidae sp.	0(0)	0(0)	1.00(0.71)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	10.50(3.69)	14.25(7.70)	1.75(0.85)	0(0)	0(0)	0(0)	0(0)	0(0)
Oniscus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)
Orchestia uhleri	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)
Paratendipes sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Polydora ligni/cornuta	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora socialis	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Polypedilium sp.	0.50(.50)	0.25(0.25)	0.50(0.50)	0(0)	3.75(1.49)	2.00(1.26)	0(0)	0(0)
Stictochironomus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	0.75(0.49)	0(0)	0(0)	0.25(0.25)	0(0)
Tanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)
Tipulidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.60(0.40)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	9.75(8.76)	4.75(2.59)	13.40(5.55)	47.25(19.55)	10.25(5.51)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	1.00(0.71)	0.75(0.48)	2.00(2.00)	0(0)	0.50(0.29)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)

Table 6.4-7b. Mean (no. per 0.01 m^2) and (standard deviation) for all taxa collected at P11 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
amphipod sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Armadillidium vulgare	0(0)	0(0)	0(0)	0(0)	0.33(0.33)	0(0)	0(0)	0(0)
Axarus sp.	0(0)	0(0)	0(0)	0(0)	3.67(1.52)	0(0)	0(0)	0(0)
juv. Bivalve	0(0)	0(0)	0(0)	0.20(0.20)	1.17(0.40)	0.25(0.25)	0(0)	0(0)
Boccardiella sp.	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)	0(0)	0(0)
Cladotanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Collembola sp.	0(0)	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	1.25(0.63)	0.25(0.25)
Corophium acherusicum	0(0)	0(0)	0.33(0.33)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium lacustre	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)
Corophium sp.	0(0)	0(0)	0.33(0.33)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Cryptochironomous (*fulvens*)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cryptochironomous sp.	0(0)	0(0)	0(0)	0(0)	2.00(0.58)	0(0)	0(0)	0(0)
Cyathura (madelinae)	0(0)	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0(0)	0(0)	0(0)	0.17(0.17)	0.25(0.25)	0(0)	0(0)
Eteone heteropoda	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Gammarus tigrinus	0.60(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hobsonia florida	0.60(0.24)	0(0)	0.33(0.21)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	5.00(4.43)	0.20(0.20)	0(0)	0(0)	0.75(0.25)	3.00(1.29)
Marenzelleria viridis	1.00(0.77)	3.75(1.93)	22.83(5.72)	0(0)	12.17(3.51)	51.50(6.85)	0.50(0.50)	0(0)
Megalops spp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Nemertea sp.	0.20(0.20)	0(0)	0.50(0.22)	0.20(0.20)	0(0)	0(0)	0.25(0.25)	0(0)
Nereidae sp.	0(0)	0(0)	7.00(2.50)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	3.60(1.86)	0.25(0.25)	7.50(4.63)	0(0)	0(0)	0(0)	0(0)	0(0)
Parandalia sp.	0(0)	0(0)	0(0)	0.20(0.20)	0.17(0.17)	0(0)	0(0)	0(0)
Paratanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Paratendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Pentatomidae sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Polypedilum sp.	0.40(0.40)	0.50(0.50)	1.67(0.61)	0(0)	3.00(0.93)	1.75(1.11)	0.50(0.50)	0.25(0.25)
Procladius sp.	0(0)	0(0)	0(0)	0(0)	1.33(1.33)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	2.00(1.38)	0(0)	0(0)	0(0)	0(0)
Tanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.17(0.17)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	0.40(0.40)	1.17(1.17)	0(0)	0.75(0.48)	0(0)
Tubificoides heterochaetus	6.20(6.20)	0(0)	1.50(1.31)	30.40(18.98)	6.50(2.86)	3.50(1.71)	20.75(4.33)	0(0)

Table 6.4-8a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P12 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for high intertidal areas.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Bezzia/Palpomyia	1.80(0.37)	0(0)	0.25(0.25)	1.40(0.93)	0.60(0.24)	0.50(0.29)	4.25(2.02)	1.00(0.41)
Cassidinidea lunifrons	0.20(0.20)	0.25(0.25)	0.25(0.25)	0.40(0.40)	0(0)	0.25(0.25)	0(0)	0(0)
Coleoptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Collembola sp.	0.20(0.20)	1.00(0.41)	0(0)	0(0)	0(0)	0.75(0.48)	0.25(0.25)	0.50(0.29)
Corophium (*lacustre*)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Cricotopus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cyathura polita	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.25)	0(0)	0(0)
Dicrotendipes sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Dispio uncinata	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dolichopodidae sp.	0(0)	0.25(0.25)	0.75(0.75)	0.20(0.20)	0.40(0.24)	1.00(0.41)	0.25(0.25)	1.00(0.41)
Dolichopus sp.	0.60(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Donacia sp.	0.20(0.20)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Donaciinae sp.	0(0)	0(0)	0.25(0.25)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Endochironomus sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Ephydra sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)
Ephydridae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Gammarus sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
juv. Gastropod	0.20(0.20)	0.50(0.50)	0(0)	0(0)	0(0)	0.25(0.25	0(0)	0(0)
Hemiptera sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Heterothissocladius sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Homoptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)
Hydrobia sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect larvae g	0.40(0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect larvae h	1.20(1.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0(0)	0.75(0.48)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. f	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	1.40(0.51)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
(*Limnophyes* sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Lumbriculidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mesovelia mulsanti	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0.50(0.50)	0(0)	0(0)
Monopylephorus irroratus	1.00(1.00)	0(0)	0(0)	0(0)	0.40(0.40)	0.25(0.25)	0(0)	0(0)
Namalycastis sp.	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Neanthes succinea	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Nereidae sp.	0(0)	0.25(0.25)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Ocypode quadrata	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	47.8(15.93)	30.00(9.61)	13.25(7.11)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0.20(0.20)	0.50(0.29)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0.25(0.25)
Orthocladiinae sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0.25(0.25)
Parametriocnemus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	3.75(1.49)	0(0)	0(0)
Paratandipes sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Polypedilium sp.	0(0)	0(0)	0.50(0.50)	0(0)	1.8(1.11)	0.50(0.29)	0(0)	0(0)
Pristinella sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Spiophanes bombyx	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	3.20(1.16)	17.6(4.15)	55.25(10.0)	25.50(15.94)	9.75(4.09)
Uca minax	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)	0(0)
Uca pugilator	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)
Uca sp.	0(0)	0.25(0.25)	0.25(0.25)	0.40(0.40)	0(0)	0(0)	0.75(0.75)	0(0)

Table 6.4-8b. Mean (no. per 0.01 m^2) and (standard deviation) for all taxa collected at P12 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-sites for low intertidal areas.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Ablabesmyia sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.71)	0(0)	0(0)	0(0)
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(0.41)	1.00(0.71)
amphipod sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Apedilum sp.	0(0)	0(0)	0(0)	0(0)	0(0)	2.75(2.75)	0(0)	0(0)
Axarus sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)	0(0)
Bezzia/Palpomyia	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)
Boccardiella sp.	0(0)	0(0)	12.50(12.50)	7.60(4.43)	0.75(0.48)	0(0)	0(0)	5.00(2.34)
Cassidinidea lunifrons	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)	0(0)	1.00(0.71)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Chironomus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	1.00(1.00)	0(0)	0(0)
Collembola sp.	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0.75(0.49)	0.75(0.75)	0(0)
Corophium acherusicum	0(0)	0(0)	1.00(1.00)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium lacustre	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	7.00(6.35)
Corophium sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Crangonyx sp.	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0(0)	0(0)
Cricotopus sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Cryptochironomus sp.	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)	0(0)	0(0)
Dicrotendipes Lucifer	0(0)	0(0)	0(0)	0(0)	0.25(0.25	0(0)	0(0)	0(0)
Dicrotendipes sp.	0(0)	0(0)	0(0)	0(0)	1.75(1.75)	0(0)	0(0)	0(0)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)
Dolichopodidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.50(0.50)	0(0)
Edotea sp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0.25(0.25)
Edotea (*triloba*)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Enchytraeidae sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Gammarus tigrinus	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gammarus sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
juv. Gastropod	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Goeldichironomus holoprasinus	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Goeldichironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	3.25(2.36)	0(0)	0(0)
Geukensia demissa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Hobsonia florida	0(0)	0(0)	0(0)	0.40(0.40)	0.25(0.25)	0(0)	0(0)	0.50(0.50)
Idoteidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)
insect larvae	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0(0)	0.50(0.50)	1.25(1.25)
Lumbriculidae sp.	0(0)	1.75(1.44)	0(0)	0(0)	0(0)	0(0)	0.75(0.75)	0(0)
Marenzelleria viridis	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0(0)	0(0)
Mediomastus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Megalops spp.	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0.50(0.29)	0(0)
Naididae sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Namalycastis sp.	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)
Nemertea sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Nereis lamellose	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Oligochaete	1.60(0.51)	7.25(4.40)	2.75(1.49)	0(0)	0(0)	0(0)	0(0)	0(0)
Paracladopelma sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paratendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Paratendipes (subaequalis)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)
Polydora ligni/cornuta	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polydora socialis	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Polydora sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Polypedilum sp.	0.20(0.20)	0(0)	0(0)	0(0)	3.75(1.11)	0(0)	0(0)	0(0)
Procladius sp.	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)
Rhithropanopeus harrisii	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Spiophanes bombyx	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	0.80(0.58)	0(0)	0(0)	0.25(0.25)	0(0)
Tanypodinae sp.	0(0)	0(0)	0(0)	0(0)	1.25(1.25)	0(0)	0(0)	0(0)
Tanytarsus sp.	0(0)	0(0)	0(0)	0(0)	0.50(0.29)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	1.80(1.36)	0.50(0.29)	0.25(0.25)	18.00(15.02)	8.25(4.61)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0.40(0.40)	0(0)	0.75(0.75)	0(0)	0(0)

Table 6.4-9a. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P13 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-site for high intertidal areas at each station.

High Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Acarina spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0.25(0.25)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.50(0.50)
Aricidea suecica	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Bezzia/Palpomyia	0(0)	0(0)	0.20(0.20)	0.75(0.75)	1.00(0.71)	3.75(1.18)	3.75(1.11)	0.25(0.25)
juv. Bivalve	0(0)	0.75(0.48)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cassidinidea lunifrons	0(0)	0(0)	0(0)	0(0)	0(0)	0.75(0.48)	0.75(0.25)	0(0)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Chironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Collembola sp.	0.20(0.20)	0(0)	0.80(0.80)	0(0)	0.50(0.50)	1.50(0.96)	0.50(0.50)	0(0)
Corophium lacustre	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Corophium sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Corophium volutator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Cryptochironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Cyathura polita	0.20(0.20)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	1.00(0.71)	0(0)
Dicrotendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Dolichopodidae sp.	0(0)	0.50(0.50)	0.20(0.20)	0.25(0.25)	0(0)	0.50(0.29)	0.25(0.25)	0.25(0.25)
Dolichopus sp.	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Erioptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Goeldichironomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)
Haliplidae sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Helophorus linearis	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Helophorus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)
Hydrobia sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hydrophilidae larvae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
insect pupae	0.20(0.20)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp.	0(0)	0(0)	0.40(0.40)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0.40(0.24)	2.00(1.08)	0(0)	0.25(0.25)	0(0)	0.75(0.75)	0.50(0.50)	0(0)
Limnophila sp.	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Lumbriculidae sp.	1.40(1.40)	0.50(0.29)	18.40(18.40)	1.00(0.58)	0(0)	0.25(0.25)	0.75(0.75)	1.50(1.19)
(Lumbriculidae sp.)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	5.25(3.35)
Mediomastus sp.	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Megalopae (Uca)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Megalops spp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)	0(0)
Namalycastis sp.	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Nereidae sp.	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Oligochaete	29.40(6.9)	11.00(3.72)	37.20(14.04)	0(0)	0(0)	0(0)	0(0)	0(0)
Oribatei sp.	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Orchestia sp.	0(0)	0(0)	0.40(0.24)	0(0)	0(0)	0(0)	0(0)	0(0)
Orchestia uhleri	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)
Parachaetocladius sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Paratendipes sp.	0(0)	0.50(0.50)	0.60(0.40)	0(0)	1.00(0.71)	3.75(0.85)	26.00(14.72)	0.25(0.25)
Polichopodidae sp.	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)	0(0)	0(0)
Polypedilium sp.	0.60(0.40)	0(0)	0.40(0.24)	0(0)	5.00(1.22)	0.25(0.25)	0(0)	0(0)
Spirosperma carolinensis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Tabanus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	2.75(2.43)	6.25(1.97)	60.00(11.37)	95.75(22.76)	49.25(12.97)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Uca sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 6.4-9b. Mean (no. per 0.01 m^2) and (standard error) for all taxa collected at P13 on the NE Cape Fear River during June 1999, 2000, 2001, 2002, 2003, 2004, 2005, and 2006. The means presented here represent the combination of two sub-site for low intertidal areas at each station.

Low Intertidal	**June 99**	**June 00**	**June 01**	**June 02**	**June 03**	**June 04**	**June 05**	**June 06**
Amphididae sp.	0(0)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Anurida maritima	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Bezzia/Palpomyia	0(0)	0(0)	0.25(0.25)	0.75(0.48)	0(0)	1.50(0.50)	2.00(1.08)	0.50(0.29)
Cassidinidea lunifrons	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Chiridotea caeca	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Chironomidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Collembola sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Corophium sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0(0)
Cryptochironomous (*fulvens*)	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cryptochironomous sp.	0(0)	0(0)	0(0)	0(0)	0.80(0.37)	1.00(1.00)	0.50(0.29)	0.75(0.75)
Cyathura polita	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)	0.25(0.25)
Diptera sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0.25(0.25)
Dolichopodidae sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hobsonia florida	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
insect pupae	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. d	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
insect sp. e	0.50(0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Laeonereis culveri	0(0)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)
Larval fish	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Limnodrilus hoffmeisteri	0(0)	0(0)	0(0)	0(0)	0.60(0.24)	0(0)	0(0)	0(0)
Lumbriculidae sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25(0.25)
Megalopae (Uca)	0(0)	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)
Namalycastis sp.	0(0)	0.25(0.25)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Oligochaete	34.25(11.13)	29.30(15.37)	8.25(4.97)	0(0)	0(0)	0(0)	0(0)	0(0)
Paratendipes sp.	0(0)	0(0)	0(0)	0(0)	0(0)	1.00(1.00)	0.25(0.25)	0(0)
Polypedilum sp.	0.25(0.25)	1.00(0.71)	1.25(0.95)	0(0)	0.80(0.20)	1.00(1.00)	0.25(0.25)	0(0)
Procladius sp.	0.75(0.48)	0(0)	0(0)	0(0)	0.20(0.20)	0(0)	0(0)	0(0)
Streblospio benedicti	0(0)	0(0)	0(0)	0(0)	0.50(0.50)	0(0)	0(0)	0(0)
Tubificidae spp.	0(0)	0(0)	0(0)	4.00(3.08)	5.00(2.65)	17.50(0.50)	20.00(2.48)	14.00(4.38)
Tubificoides heterochaetus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.25(1.25)	0(0)

ANOVA comparisons of among-year abundances for major taxonomic groups and functional guilds show generally greater abundances of insect larvae in most sites (8 of 9) in 2003-2006 compared to at least certain earlier years (Table 6.4-10) – a period coincident with the lessening of an earlier drought as well as ongoing channel widening. Insect larvae as a group are generally less common with increasing salinity in the estuary. Oligochaetes showed significant patterns less often, and patterns were more variable when they occurred, with higher abundances in 2006, 2005, 2004, 2003, 2000, or 1999 depending on the site. This group also tends to be more abundant in lower salinities, though high numbers are characteristic of certain mesohaline to euhaline marsh, inner marsh locations, and greatest abundances at normally high salinity sites generally occurred during non-drought years. Polychaetes showed a mixed pattern, with no detectable among year differences at 5 sites, greater abundance in drought years at P2 and P11, and greater abundances in 1999 at P3, and in 2005 at P7 (an oligohaline/tidal freshwater site). Functional guild changes paralleled these patterns, with among year variations in surface /mobile fauna reflecting their dominance by insect larvae and certain amphipods in sites where significant among year variations in this functional group occurred, deep burrowers reflecting the patterns for oligochaetes at most sites, and sedentary/tube builders reflecting mixed effects of polychaetes (especially *Streblospio* and *Marenzellaria*) and certain tube-dwelling amphipods (Table 6.4-11). In general, 2006 patterns were more similar to 2003-2005 than previous years. The most distinctive faunal pattern during 2006 was relatively higher amphipod abundances at 3 sites.

More pronounced than variations in abundance of higher taxonomic groups was their relative composition as indicated by Analysis of Community Similarity (ANOSIM) and Multidimensional Scaling Analysis (MDS). These analyses indicated that 1999-2001 samples did not have significantly dissimilar faunal assemblages (Figure 6.4-1). However, the period from 2003-2006 was distinct from the 1999-2001 grouping (ANOSIM, $R=0.48$, $p<0.001$). There were minor variations within this grouping, but differences were small relative to the differences with 1999-2001. MDS and ANOSIM analyses also indicated that 2002 differed from most other years, though it did not differ from 2003 and 2006. This roughly corresponds to pre-dredging periods differing from those after channel deepening began; and variable patterns among years during this deepening activity. Strong effects of a drought in 2002 also mean this pattern corresponds with pre-drought/developing drought conditions (1999-2001) and post-drought conditions (2003-2006).

Table 6.4-10. Among-year comparison of abundance by taxonomic group for each site. Years are listed from greatest abundance to least. F (and p) values are from Analysis of Variance. Where ANOVA indicated a significant year effect, year differences were tested using a SNK post-hoc test. Years with the same superscript do not vary significantly ($p<0.05$). Years with two letter superscripts were not different from either year.

Site	Group	F(p)	SNK(where ANOVA significant)
P2	Amphipoda	3.19(0.0056)	06^{a} 05^{a} 04^{a} 00^{a} 01^{a} 02^{a} 99^{a} 03^{a}
	Bivalvia	2.85(0.011)	06^{a} 04^{ab} 99^{ab} 02^{ab} 00^{ab} 05^{b} 03^{b} 01^{b}
	Decapada	1.91(0.08)	NS
	Gastropoda	1.22(0.30)	NS
	Insecta	4.05(0.0009)	03^{a} 04^{ab} 99^{bc} 06^{bc} 05^{bc} 00^{bc} 02^{c} 01^{c}
	Isopoda	3.00(0.08)	4^{a} 05^{ab} 00^{ab} 06^{ab} 03^{b} 99^{b} 01^{b} 02^{b}
	Oligochaete	6.08(0.0001)	05^{a} 04^{a} 99^{ab} 06^{abc} 00^{bc} 01^{c} 02^{c} 03^{c}
	Polychaete	9.37(0.0001)	02^{a} 00^{ab} 99^{bc} 05^{bc} 04^{bc} 01^{cd} 06^{d} 03^{d}
P3A	Amphipoda	2.73(0.01)	06^{a} 05^{a} 99^{a} 04^{a} 01^{a} 00^{a} 02^{a} 03^{a}
	Bivalvia	1.51(0.17)	NS
	Decapada	1.97(0.08)	NS
	Gastropoda	1.38(0.22)	NS
	Insecta	4.57(0.0003)	04^{a} 05^{b} 03^{b} 99^{b} 06^{b} 00^{b} 02^{b} 01^{b}
	Isopoda	6.57(0.0001)	4^{a} 05^{a} 03^{a} 01^{ab} 06^{b} 99^{b} 00^{b} 02^{b}
	Oligochaete	7.88(0.0001)	00^{a} 04^{a} 05^{a} 06^{a} 00^{ab} 99^{b} 02^{b} 03^{b}
	Polychaete	2.81(0.0001)	99^{a} 05^{a} 02^{ab} 01^{ab} 04^{ab} 00^{ab} 03^{ab} 06^{b}
P3B	Amphipoda	1.74(0.11)	NS
	Bivalvia	1.69(0.12)	NS
	Decapada	3.86(0.0015)	04^{a} 05^{b} 02^{b} 99^{b} 00^{b} 01^{b} 06^{b} 03^{b}
	Gastropda	0.92(0.49)	NS
	Insecta	9.00(0.0001)	04^{a} 03^{a} 06^{b} 99^{b} 05^{b} 02^{b} 00^{b} 01^{b}
	Isopoda	2.44(0.02)	04^{a} 05^{ab} 01^{ab} 06^{ab} 02^{ab} 99^{ab} 03^{ab} 00^{b}
	Oligochaete	9.09(0.0001)	06^{a} 00^{ab} 04^{ab} 05^{bc} 99^{c} 03^{c} 01^{c} 02^{c}
	Polychaete	1.40(0.22)	NS
P6	Amphipoda	6.78(0.0001)	99^{a} 01^{b} 04^{b} 02^{b} 00^{b} 05^{b} 06^{b} 03^{b}
	Bivalvia	2.41(0.03)	99^{a} 04^{a} 02^{a} 01^{a} 00^{a} 05^{a} 06^{a} 03^{a}
	Decapada	2.02(0.06)	NS
	Gastropoda	2.28(0.04)	99^{a} 03^{a} 00^{a} 02^{a} 04^{a} 01^{a} 06^{a} 05^{a}
	Insecta	9.51(0.0001)	05^{a} 06^{b} 04^{bc} 99^{bcd} 03^{bcd} 02^{cd} 01de 00^{e}
	Isopoda	3.24(0.006)	99^{a} 04^{ab} 02^{b} 01^{b} 00^{b} 05^{b} 06^{b} 03^{b}
	Oligochaete	3.16(0.007)	99^{a} 05^{ab} 06^{ab} 04^{ab} 03^{ab} 00^{ab} 02^{ab} 01^{b}
	Polychaete	1.84(0.09)	NS

Table 6.4-10. (continued)

Site	Group	F(p)	SNK(where ANOVA significant)
P7	Amphipoda	3.67(0.002)	01^{a} 06^{ab} 99^{ab} 05^{ab} 04^{b} 03^{b} 00^{b} 02^{b}
	Bivalvia	1.67(0.13)	NS
	Decapoda	1.29(0.26)	NS
	Gastropoda	3.78(0.002)	99^{a} 04^{b} 05^{b} 02^{b} 00^{b} 01^{b} 06^{b} 03^{b}
	Insecta	8.72(0.0001)	03^{a} 05^{a} 04^{ab} 06^{ab} 99^{ab} 00^{b} 01^{b} 02^{c}
	Isopoda	3.44(0.003)	01^{a} 99^{ab} 05^{ab} 04^{ab} 06^{ab} 00^{b} 03^{b} 02^{b}
	Oligochaete	4.52(0.0003)	03^{a} 00^{a} 06^{a} 05^{a} 99^{ab} 01^{ab} 04^{ab} 02^{b}
	Polychaete	3.29(0.004)	05^{a} 06^{ab} 00^{ab} 02^{b} 01^{b} 03^{b} 04^{b} 99^{b}
P8	Amphipoda	7.81(0.0001)	01^{a} 05^{ab} 99^{abc} 00^{bcd} 06^{cd} 02^{cd} 04^{cd} 03^{d}
	Bivalvia	4.33(0.0005)	00^{a} 04^{ab} 99^{ab} 01^{ab} 03^{b} 06^{b} 05^{b} 02^{b}
	Decapada	0.87(0.53)	NS
	Gastropoda	1.08(0.39)	NS
	Insecta	5.31(0.0001)	00^{a} 04^{a} 99^{ab} 06^{abc} 03^{bc} 01^{bc} 05^{bc} 02^{c}
	Isopoda	2.04(0.06)	NS
	Oligochaete	13.51(0.0001)	00^{a} 99^{ab} 04^{ab} 05^{ab} 03^{ab} 06^{b} 01^{b} 02^{c}
	Polychaete	1.25(0.28)	NS
P11	Amphipoda	0.92(0.498)	NS
	Bivalvia	4.16(0.0008)	03^{a} 04^{b} 02^{b} 99^{b} 00^{b} 01^{b} 06^{b} 05^{b}
	Decapada	0.50(0.83)	NS
	Insecta	5.74(0.0001)	03^{a} 04^{a} 05^{ab} 99^{b} 01^{b} 06^{b} 00^{b} 02^{b}
	Isopoda	0.63(0.732)	NS
	Oligochaete	2.85(0.0118)	05^{a} 02^{ab} 99^{ab} 04^{ab} 03^{ab} 01^{ab} 00^{b} 06^{b}
	Polychaete	3.29(0.0047)	01^{a} 04^{ab} 03^{ab} 99^{ab} 06^{b} 02^{b} 05^{b} 00^{b}
P12	Amphipoda	1.28(0.27)	NS
	Bivalvia	1.18(0.33)	NS
	Decapada	1.08(0.38)	NS
	Gastropda	0.86(0.54)	NS
	Insecta	5.01(0.0001)	04^{a} 03^{a} 05^{ab} 99^{ab} 06^{ab} 01^{b} 00^{b} 02^{b}
	Isopoda	1.61(0.14)	NS
	Oligochaete	2.06(0.06)	NS
	Polychaete	1.44(0.20)	NS
P13	Amphipoda	3.90(0.0014)	05^{a} 01^{ab} 06^{b} 00^{b} 04^{b} 03^{b} 0^{b} 99^{b}
	Bivalvia	1.62(0.14)	NS
	Decapada	0.66(0.70)	NS
	Gastropoda	0.77(0.61)	NS
	Insecta	5.92(0.0001)	05^{a} 04^{a} 03^{ab} 06^{b} 99^{b} 01^{b} 00^{b} 02^{b}
	Isopoda	2.47(0.02)	05^{a} 04^{ab} 99^{ab} 03^{ab} 06^{ab} 02^{ab} 00^{b} 01^{b}
	Oligochaete	7.10(0.0001)	05^{a} 04^{a} 99^{a} 06^{a} 00^{ab} 01^{ab} 03^{bc} 02^{c}
	Polychaete	0.85(0.54)	NS

Table 6.4-11. Among-year comparison of abundance by functional group for each site. Years are listed from greatest abundance to least. F (and p) values are from Analysis of Variance. Where ANOVA indicated a significant year effect, year differences were tested using a SNK post-hoc test. Years with the same superscript do not vary significantly ($p<0.05$).

Site	Group	F(p)	SNK(where ANOVA significant)
P2	Deep burrowing	7.26(0.0001)	05^{a} 99^{a} 04^{ab} 03^{abc} 06^{bcd} 00^{cd} 01^{cd} 03^{d}
	Surface/mobile	1.21(0.30)	NS
	Sedentary/tube builder	2.88(0.0)	02^{a} 00^{a} 04^{ab} 06^{ab} 05^{ab} 99^{ab} 01^{ab} 03^{b}
P3A	Deep burrowing	8.09(0.0001)	00^{a} 04^{ab} 05^{ab} 06^{ab} 01^{bc} 99^{c} 02^{c} 03^{c}
	Surface/mobile	5.03(0.0001)	04^{a} 05^{b} 03^{b} 99^{b} 06^{b} 01^{b} 00^{b} 02^{b}
	Sedentary/tube builder	3.26(0.005)	99^{a} 05^{a} 02^{ab} 04^{ab} 03^{ab} 01^{ab} 00^{b} 06^{b}
P3B	Deep burrowing	9.90(0.0001)	06^{a} 00^{ab} 04^{ab} 05^{bc} 99^{c} 03^{c} 01^{c} 02^{c}
	Surface/mobile	4.80(0.0002)	04^{a} 03^{ab} 06^{bc} 05^{bc} 99^{bc} 02^{bc} 01^{c} 00^{c}
	Sedentary/tube builder	3.54(0.003)	04^{a} 02^{ab} 99^{ab} 01^{ab} 03^{ab} 06^{b} 05^{b} 00^{b}
P6	Deep burrowing	3.04(0.008)	99^{a} 05^{ab} 06^{ab} 04^{ab} 03^{ab} 00^{ab} 02^{ab} 01^{b}
	Surface/mobile	6.09(0.0001)	05^{a} 99^{b} 06^{b} 04^{b} 03^{b} 02^{b} 01^{b} 00^{b}
	Sedentary/tube builder	1.65(0.14)	NS
P7	Deep burrowing	4.52(0.0003)	03^{a} 00^{a} 06^{a} 05^{a} 99^{ab} 01^{ab} 04^{ab} 02^{b}
	Surface/mobile	9.93(0.0001)	05^{a} 03^{a} 04^{ab} 06^{ab} 99^{ab} 01^{ab} 00^{b} 02^{c}
	Sedentary/tube builder	0.94(0.48)	NS
P8	Deep burrowing	13.45(0.0001)	0^{a} 99^{ab} 04^{ab} 05^{ab} 03^{ab} 06^{b} 01^{b} 02^{c}
	Surface/mobile	5.47(0.0001)	00^{a} 99^{ab} 04^{ab} 01^{bc} 06^{abc} 05^{bc} 03^{bc} 02^{c}
	Sedentary/tube builder	3.65(0.002)	00^{a} 01^{ab} 04^{abc} 99^{abc} 05^{abc} 03^{bc} 06^{bc} 02^{c}
P11	Deep burrowing	2.88(0.01)	05^{a} 02^{ab} 99^{ab} 04^{ab} 03^{ab} 01^{ab} 00^{b} 06^{b}
	Surface/mobile	2.93(0.01)	03^{a} 04^{ab} 05^{ab} 01^{ab} 99^{ab} 06^{ab} 02^{b} 00^{b}
	Sedentary/tube builder	3.52(0.003)	01^{a} 04^{ab} 03^{ab} 99^{ab} 00^{ab} 05^{ab} 02^{ab} 06^{b}
P12	Deep burrowing	2.10(0.06)	NS
	Surface/mobile	3.22(0.005)	04^{a} 03^{ab} 05^{ab} 06^{ab} 99^{ab} 00^{ab} 01^{ab} 02^{b}
	Sedentary/tube builder	2.23(0.05)	06^{a} 02^{a} 01^{a} 04^{a} 99^{a} 03^{a} 05^{a} 00^{a}
P13	Deep burrowing	7.10(0.0001)	05^{a} 04^{a} 99^{a} 06^{a} 00^{ab} 01^{ab} 03^{abc} 02^{c}
	Surface/mobile	4.53(0.0004)	04^{a} 05^{a} 03^{b} 06^{b} 99^{b} 01^{b} 00^{b} 02^{b}
	Sedentary/tube builder	1.05(0.40)	NS

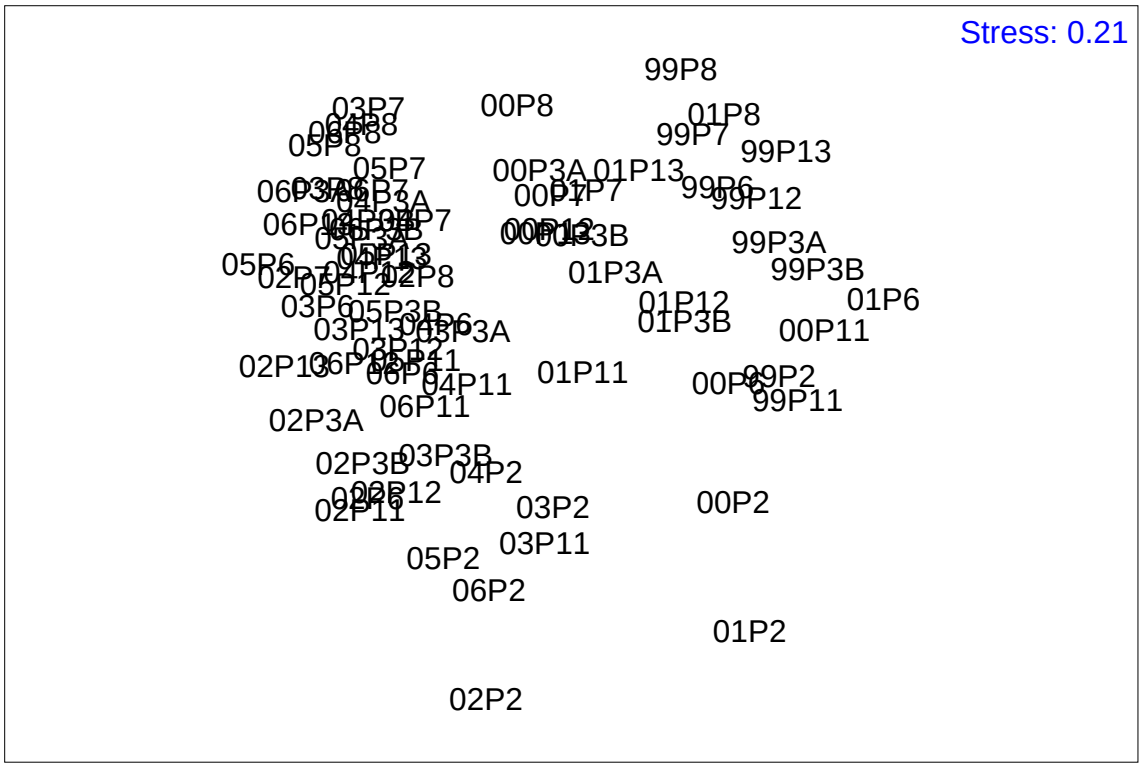


Figure 6.4-1. Multi-dimensional scaling plot for infaunal community assemblages by site and year. These data show that the 1999-2001 years group differently than the 2002-2006 years. While this grouping does coincide with increasing drought conditions, the patterns do not show an accompanying return to conditions demonstrated in the pre-drought years. This rebound may occur on a longer time period, if at all.

Species richness and diversity exhibited significant variation among years and sites. 2000 and 2002 continued to represent the years of lowest diversity for most sites (6 sites exhibited lowest diversity in 2000, 2 sites had lowest diversity in 2002) (Table 6.4-12; Analysis of Variance followed by SNK comparison of means). Highest diversity occurred at most sites during 2003 (2 sites) or 2004 (3 sites), with 2005 having higher diversity for P7 and 2006 for P12. Patterns for other years were not as consistent. With the exception of P12, 2006 diversity patterns were generally intermediate relative to other years. Species richness was highest in 2004 for 5 of the 9 sites showing significant differences (and not significantly different from the year with highest species richness for the remaining sites) (Table 6.4-12). Lowest richness generally occurred in 2000 or 2002 (7 of 9 sites exhibiting significant differences). 2006 richness was intermediate relative to other years for most sites.

Table 6.4-12. Among-year comparison of diversity and species richness for each site. Years are listed from greatest abundance to least. F (and p) values are from Analysis of Variance. Where ANOVA indicated a significant year effect, year differences were tested using a SNK post-hoc test. Years with the same superscript do not vary significantly ($p<0.05$). Years with two letter superscripts were not different from either year.

Site	Metric	F(p)	SNK (where ANOVA significant)
P2	Diversity	4.47(0.0004)	04^{a} 00^{ab} 06^{abc} 99^{abc} 05^{abc} 03^{bc} 01^{bc} 02^{c}
	Species Richness	2.88(0.01)	04^{a} 05^{ab} 00^{ab} 06^{ab} 99^{ab} 02^{ab} 01^{b} 03^{b}
P3A	Diversity	4.88(0.0002)	04^{a} 03^{ab} 99^{ab} 05^{ab} 02^{abc} 01^{abc} 06^{bc} 00^{c}
	Species Richness	3.94(0.001)	04^{a} 05^{a} 99^{ab} 03^{ab} 06^{ab} 02^{b} 01^{b} 00^{b}
P3B	Diversity	4.60(0.0003)	04^{a} 03^{a} 99^{ab} 02^{ab} 05^{ab} 01^{ab} 06^{b} 00^{b}
	Species Richness	3.26(0.0052)	04^{a} 03^{ab} 99^{b} 06^{b} 05^{b} 01^{b} 02^{b} 00^{b}
P6	Diversity	1.74(0.1167)	NS
	Species Richness	4.23(0.0008)	99^{a} 05^{a} 04^{ab} 06^{ab} 03^{abc} 02^{abc} 01^{bc} 00^{c}
P7	Diversity	7.80(0.0001)	05^{a} 04^{a} 06^{a} 03^{ab} 99^{ab} 01^{ab} 00^{bc} 02^{c}
	Species Richness	15.24(0.0001)	05^{a} 03^{a} 04^{a} 06^{a} 99^{a} 01^{ab} 00^{b} 02^{c}
P8	Diversity	1.50(0.1807)	NS
	Species Richness	4.38(0.0004)	00^{a} 04^{a} 99^{a} 01^{a} 06^{a} 05^{a} 03^{a} 02^{b}
P11	Diversity	3.40(0.0036)	03^{a} 01^{ab} 04^{ab} 99^{ab} 05^{ab} 02^{ab} 06^{b} 00^{b}
	Species Richness	3.55(0.0027)	03^{a} 04^{ab} 01^{abc} 99^{abc} 05^{abc} 02^{abc} 06^{bc} 00^{c}
P12	Diversity	2.69(0.0165)	06^{a} 03^{ab} 04^{ab} 05^{ab} 99^{ab} 02^{ab} 01^{ab} 00^{b}
	Species Richness	2.20(0.05)	04^{a} 03^{a} 06^{a} 99^{a} 05^{a} 02^{a} 00^{a} 01^{a}
P13	Diversity	1.84(0.095)	03^{a} 01^{ab} 04^{ab} 99^{ab} 05^{ab} 02^{ab} 06^{b} 00^{b}
	Species Richness	3.51(0.003)	04^{a} 05^{a} 06^{ab} 03^{ab} 99^{ab} 01^{ab} 00^{b} 02^{b}

Among site comparisons for 2006, samples indicated low diversity for both low and high intertidal sites at the P3 and P13 sites (Figure 6.4-2) during this sampling period. For low intertidal sites, diversity was also low at P7, P8, and P11. Species richness did not show as strong a pattern, though richness was high at P2, consistent with the higher salinity of this site, and was low at P11 for low intertidal samples (Figure 6.4-3). Site P2 was dominated primarily by amphipods and polychaetes in 2006 while P3 sites were dominated more by oligochaetes. The lower estuarine sites in both the mainstem Cape Fear and the Northeast Cape Fear tributaries (P6 and P11) were dominated by various polychaete species (*Marenzellaria*, *Boccardiella*, *Laeonereis*, *Hobsonia*) and oligochaetes. Other sites (P12, P13, P7, and P8) were dominated by oligochaetes, insect larvae, and amphipods.

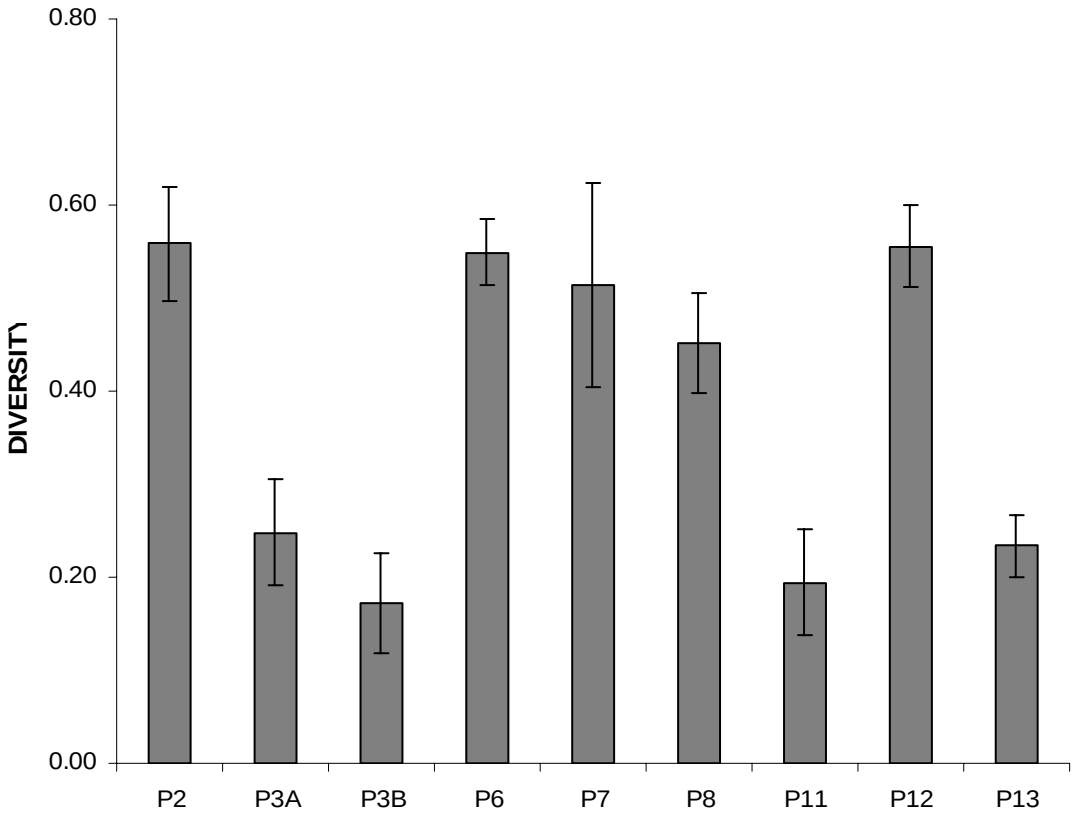


Figure 6.4-2. Mean diversity for all sites sampled in 2006. This data represents both high and low intertidal subsites. Diversity was calculated using Shannon-Weiner diversity calculation.

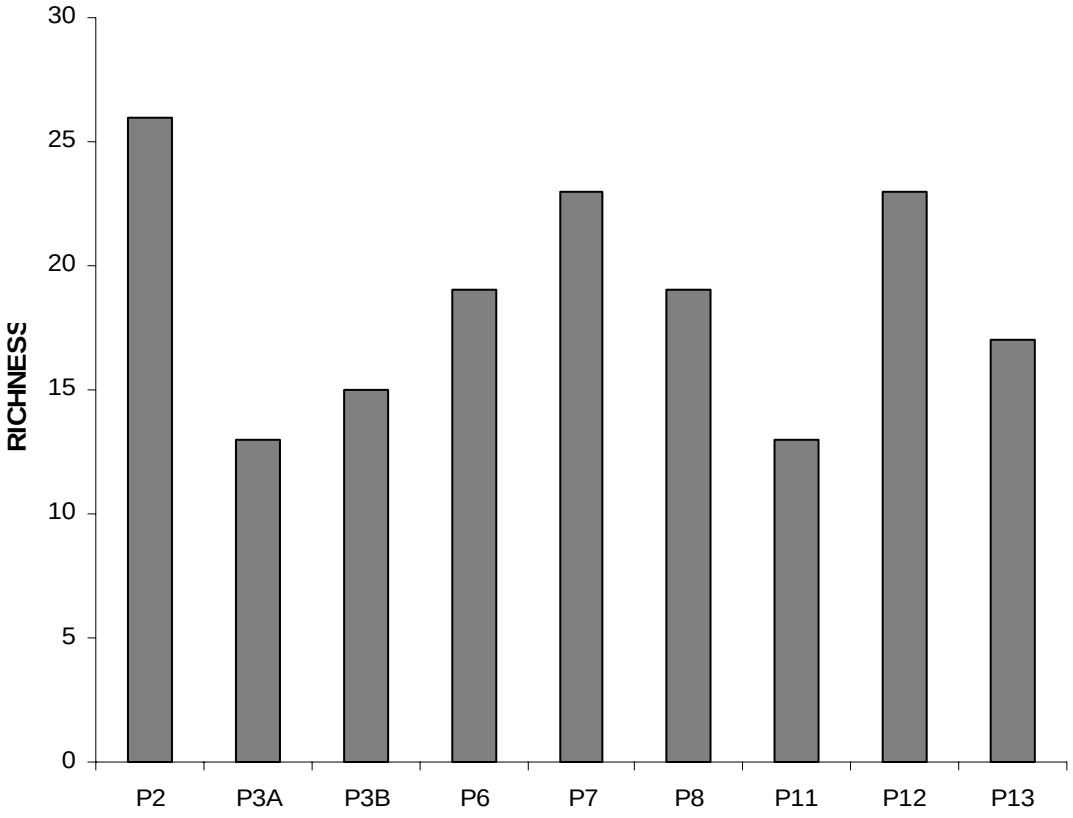


Figure 6.4-3. Mean species richness for all sites sampled in 2006. This data represents both high and low intertidal subsites.

7.0 EPIBENTHIC STUDIES: DECAPODS AND EPIBENTHIC FISH

7.1 Summary

Fauna that live (during at least a portion of their lives) on or just over the substrate or derive a significant portion of their energy from the benthic environment are characterized as epibenthic. By and large, this group of organisms is represented by larval and/or juvenile stages of many finfish, and adult stages of some finfish taxa, and crustaceans. This study focuses on evaluating the abundance, diversity, and species richness of the epibenthic organisms that utilize both marsh interior and edge habitats along the mesohaline to oligohaline portion of the Cape Fear River estuary. For many taxa, distinct life history strategies depend on these marsh and tidal swamp habitats as refuge and forage for vulnerable early developmental stages. These groups represent a vital link between benthic secondary production and higher trophic levels. Here we evaluate utilization during critical recruitment periods in the spring and fall to detect potential impacts from deepening activities in the lower ~30 kilometers of the estuary. Since 1999, the UNCW Benthic Ecology Lab has conducted a series of seasonal studies focusing on shifts in community level factors such as composition, dominance, diversity, species richness, and abundance of the highly motile epibenthos. The distribution and abundance of this group of organisms is affected by the distribution and species composition of the benthic infauna (critical prey for most of the taxa collected as part of this study) discussed in Chapter 6. Many of the epibenthic organisms that have been the target of this study are the juveniles of commercially important species, e.g. *Leiostomus xanthurus* (spot) and *Paralichthys* spp. (flounder), or are critical prey items for fishery species.

This study was initiated in 1999 prior to the deepening of the Cape Fear River. Actual dredging activities started late in 2001, with a major portion of the activities taking place in the 2002-2003 time period, but continuing into 2006. Two methods were employed to sample epibenthos, Breder traps (a passive sampling device) deployed at multiple tidal positions within the marsh and Drop traps (an active density based sampling method) deployed along the shallow subtidal marsh edge habitat. Previous findings indicated changes in species patterns consistent with developing drought conditions in 2001 and 2002, though this period was also coincident with initial construction activity. The 2006-2007 (fall ’06 and spring ’07) sampling period also represents the initial stages of potential drought conditions (rainfall records <12 inches below annual average), but few indications of a response in the epibenthic fish community. Seasonal differences include shifts in species compositions, richness, and diversity. Seasonal shifts in species composition and shifts in abundance were expected based on life history strategies of common taxa. Overall, fall 2006 and spring 2007 represented seasons with intermediate abundances, diversity, and species richness.

7.2 Background

The presence of refuges and sufficient forage habitat are critical to maintaining community diversity and ecosystem function. Shifts in salinity or inundation period have been shown to effect community dynamics and could have an upward cascade effect on

prey composition and density. These increased inundation periods or changes in salinity could lead to shifts in vegetation type, dominance, or coverage directly altering habitat quality. Tidal fringing marsh and swamps provide essential habitat for juvenile fishes and crustaceans across the estuarine gradient. The maintenance of these habitats supports the commercial and recreational shrimp fishery (both *Farfantepanaeus aztecus* and *Litopanaeus setiferus)* in the lower Cape Fear River and provides essential refuge for juvenile blue crabs, *Callinectes sapidus*, several species of scianids, and a large number of prey fishes. These are critical fisheries for the Cape Fear region. Changes in the epibenthic organisms (either composition or abundance) could cause significant impacts on these critical groups, either through the direct impacts in the juvenile stages or through the shift in available forage species. Epibenthos are sensitive to changes associated with shifts in salinity and/or tidal inundation. The ingress of juvenile stages of many of the fishery species is closely dependent on the recruitment of prey species. In general, benthic fauna such as annelids tend towards highest abundances in early spring, following a winter relatively free of predator influence and abundant benthic production. Juvenile fish and crustaceans that depend on this benthic resource start invading the estuary by mid February with full recruitment of multi-species assemblages by early March. There is also a slightly smaller recruitment of benthos in the fall of each year and this too is closely followed by benthic feeding fishes and crustaceans. These annual cycles of recruitment were the basis for our focus on spring and fall sampling events.

As part of the long-term project to monitor potential changes in the communities that depend on these habitats, we are examining the epibenthic community (primarily fish and decapods) found along the marsh and swamp boundary. Aside from resident fish and decapods, epibenthos include juveniles of transient fish, crabs and shrimp, as well as larger snails, amphipods, and isopods. These organisms tend to be highly motile, are often able to utilize a variety of habitats, and may respond rapidly to environmental cues. Many species have larval stages that leave the upper estuary, making recruitment, and subsequent impacts on population levels, potentially responsive to changes in river hydrology. Examples of epibenthos in the Cape Fear system include important fisheries species such as the blue crab (*Callinectes sapidus*), spot (*Leiostomus xanthurus*), flounder (*Paralichthys dentatus*), and commercial shrimp (*Farfantepanaeus* sp. and *Litopanaeus* sp). Many epibenthos occupy critical intermediate trophic roles, being predators on benthos or plankton and prey for larger fish [e.g. grass shrimp (*Palaemonetes* spp.), killifish (*Fundulus* spp.), and bay anchovy (*Anchoa* sp.)]. Evaluation of epibenthos provides direct information on possible year class strength of target fishery and indicator species as well as indications of resource and ecosystem responses. Epibenthos may respond quickly to changing conditions because of their ability to move away from unfavorable conditions as well as their dependence on annual recruitment events.

Epibenthic taxa may represent indicators of ecosystem level changes for three reasons: 1) their motile lifestyles allow them to quickly respond to physical changes in the environment, 2) many of the species are juveniles that represent a critical "bottleneck" in year class strength that is sensitive to hydrodynamic factors affecting larval ingress, and 3) the intermediate trophic role of many epibenthos may lead to greater responsiveness to both changes in primary consumer abundances (e.g. benthos)

and higher predator abundances. Changes in tidal amplitude or salinity regimes may be first detected as a change in the distribution of certain epifaunal organisms, including shifts in dominance at a site or along the upstream/downstream gradient. Epifauna are sensitive to changes in many physical conditions and may show behavioral avoidance depending on the factor (i.e. rapid shift in dissolved oxygen, temperature, or salinity). Conversely, they may show consistency on the longer temporal scale (i.e. timing of ingress/egress into the estuary and dominance patterns). For many epifauna, especially the juveniles of transient fish, a critical factor may be resource limitation. The presence of a consistent and abundant food resource (including benthic fauna) and refuge (structural habitat within the marsh system) are important for determining population levels and survivorship.

The objective of this section of the monitoring project is to evaluate long-term trends in abundance, species composition, and habitat utilization of epibenthos, and to detect shifts (if any) in these patterns concordant with river deepening activities and any associated physical changes. The primary objective of the first 2 years of sampling (fall 1999-spring 2001) was to establish a baseline for species composition and abundance patterns. The third and fourth year of monitoring represents a construction phase of the project, and a potential impact to hydrology may start to become apparent at this time; likewise, a potential impact to the faunal communities may also begin to be detected. Any potential long-term impacts of the river deepening project would be detected by comparison of patterns in multiple years after channel deepening has been completed to pre-construction and construction patterns. As with the benthic infaunal sampling, some of the potential impacts to these communities are similar to those predicted for rapid sea level rise and so may indicate long-term community changes expected in other systems over the next several decades.

In previous reports, there have been three working hypotheses focusing only on main effects of channel deepening; however, a fourth hypothesis dealing with indirect effects of site development is also appropriate to mention;

1) Shifts in salinity, tidal inundation, or tidal amplitude may cause shifts in the epibenthic community composition and/or abundance.
2) Changes in the benthic community resulting from the deepening and widening of the river channel may cause a trophic cascading effect that will change the dominance patterns and distribution of some epibenthic species.
3) Hydrologic alterations may affect annual recruitment patterns into the estuary, especially for transient species.
4) Alteration of salinity regime, tidal inundation and/or tidal amplitude may lead to shifts in dominant marsh vegetation and alter epibenthic assemblages.

The fourth hypothesis deals with several sites that seem to be in a state of "development" in terms of dominant vegetation, noted in Section 8.

7.3 Methodology

Marshes and boundary wetlands in the Cape Fear River estuary provide a variety of habitats, especially in the tidally influenced areas that have both intertidal and shallow subtidal edge habitats. We use two sampling methods, Breder traps and Drop traps, to target fauna with different utilization patterns. Breder trap sampling targets bottom oriented organisms that utilize the intertidal marsh or swamp habitat during the period of inundation. Breder traps are a passive form of sampling that average use patterns over a several hour period. This method has the advantage of being reliably deployed among a variety of structures. Drop trap sampling targets those organisms that utilize the shallow subtidal or "edge" habitat. It is an instantaneous method that provides reliable estimates for both bottom oriented and pelagic species, with the advantage of allowing high replication, but it is difficult to deploy within heavy structure.

Breder traps are constructed of clear acrylic (31 cm length X 16 cm height X 15 cm width). When submerged, these traps are transparent and catch epibenthic fish and crustaceans passively, as they move into the tidal wetlands. At each station, traps are placed at three tidal heights; lower intertidal (near mean low water), mid intertidal (submerged ~1m depth at mean high water), and upper intertidal (submerged ~ 0.5m at mean high water). Two sets of five traps are set at each tidal height with the opening oriented toward the channel or downstream. The orientation of the traps is based on preliminary data that indicates this positioning is optimal for obtaining highest catches. Each trap is secured to the substrate to ensure it maintains proper orientation. All traps are set on the rising tide and traps are allowed to "fish" for two hours. This time period is based on previous work and represents a compromise between obtaining higher catches and reducing possible loss due to escape, predation, or cannibalism among organisms within the traps. All organisms caught are identified to lowest possible taxon and representative specimens are preserved for verification. All organisms caught are measured for total length. Breder trap sampling is conducted at 9 sites: P11 (Smith Creek), P12 (Rat Island) and P13 (Fishing Creek) in the mainstem Cape Fear River, P6 (Eagle Island), P7 (Indian Creek), and P8 (Dollisons Landing) in the Northeast Cape Fear, and P2 (at the mouth of Town Creek) and 2 sites at P3 in Town Creek.

Drop traps sample those epibenthos utilizing the lower marsh edge or shallow subtidal regions adjacent to the marsh. The drop trap is an aluminum square that is 1m on a side and 1m high with mesh netting and floats attached to the top edge to prevent organisms from escaping. The trap is deployed from a boat using a large boom that suspends the trap 6-8 feet above the water surface. When the trap is released, its weight drives it into the substrate and seals the bottom to prevent organisms from escaping beneath the trap (each drop is checked for an adequate bottom seal upon deployment to ensure that organisms cannot escape). Eighteen replicate drops are made in the shallow subtidal areas at each station. Replicate samples are taken at least 10m apart and at least 20 minutes is allowed between each sample. Once the trap is secured the contents are removed using a steel frame sweep net with a 2mm mesh. The trap is considered empty when five consecutive sweeps of the entire trap yield no organisms. All organisms caught are identified, enumerated, and measured (total length). Representatives of each

species caught are preserved for verification. Drop sampling is conducted at the same sites as Breder trap sampling, except that the two P3 subsites are sampled as one site because of edge area limitations.

Drop trap and Breder trap sampling was conducted during the same time window for all stations. At least 24 hours separated the use of each method at a site. While Breder traps were deployed on a single day per site, drop trap samples were collected over a 3+ day period for each site. The collection of drop trap data over a multi-day sampling period gives a more accurate evaluation of the use of the subtidal areas adjacent to each site.

For this report, we present mean abundance of epibenthos for each station by year and season (reflecting seasonal variation in faunal abundances) (Tables 7.4-1 and 7.4-17). To evaluate potential trends and community level responses, analyses for this report focus on differences in diversity, species richness, and total fauna by season across years. Breder trap and drop trap data was analyzed separately. Because of interactions between seasons and among sites the data was analyzed using a 1-way Analysis of Variance among years for each season. The Shannon-Weiner diversity index was used to describe diversity patterns at each site. The Shannon-Weiner diversity index accounts for both species abundance and evenness among species. Comparisons of diversity among sites were conducted using Analysis of Variance. Where significant year effects were found, an SNK test was used to distinguish among years. Overall community comparisons, including all species present, were analyzed using an Analysis of Similarity with Primer 6.0 a multivariate statistical package. Fall and spring data were analyzed separately, results are presented in a multidimensional scaling plot.

7.4 Community Evaluation

Multivariate Analysis

Multivariate analysis techniques were applied to both Breder trap and Drop trap data sets. Due to the large number of subsites per site/season combination, analysis of data collected using Breder traps showed no discernible patterns. However, data from the epibenthic catches along the marsh edge (drop trap), show weak annual groupings for spring (Figure 7.4-1). These data show that 2002 and 2003 continue to group together weakly, likewise 2001 and 2000 appear as closely related groups, and 2004-2007 cluster together. Analyses for fall (Figure 7.4-2) show that 2002 and 2000 form groups, but that most other site/year combinations cluster somewhere between them. These close groupings most likely reflect the overlap in dominant species and an overall similarity of rare species.

Dominance Patterns

Cumulative species curves indicate that the accumulation of new species reached its peak in 2002-2004. Since 2005, only a handful of species have been added to either the Breder trap or drop trap species listing. The current cumulative species listing by Breder trap and drop trap are 58 and 86 respectively. The mean abundance and standard errors for

each taxa by site/season/year is presented for marsh samples (Breder traps) in Tables 7.4-1 through 7.4-9, while marsh edge data (drop trap) is presented in Tables 7.4-10 through 7.4-17. Several species were consistently present among the numerically dominant (comprising >10% of the total number of individuals collected) taxa among years and across habitats. *Leiostomus xanthurus* (spot) was the most common taxa collected in both habitats during spring 2007, comprising 50% or more of the total catch for 7 of 9 sites. Other dominant taxa include two species of goby, *Ctenogobius shufeldi* (freshwater goby) and *Ctenogobius boleosoma*, *Palaemonetes pugio* (grass shrimp), and *Trinectes maculates* (hogchoker). Several species of flounder (*Paralichthyes* spp.) were also prominent in both fall and spring catches, but dominant in marsh edge samples rather than marsh interior samples. While the fiddler crabs, *Uca minax*, and *Uca pugilator*, were common across most sites and seasons, 2000-spring 2006; in fall 2006 and spring 2007, only *Uca minax* was dominant. This relatively minor shift in dominance may be reflective of potential shifts in flow or salinity following increasing drought conditions in the Cape Fear region throughout this time period. *Anchoa mitchilli* (anchovies) and *Menidia beryllina* (silverside) had previously been reported from marsh edge samples (during fall) and comprised greater than 5% of the total catch in the fall 2006 samples, but were rarely collected in marsh interior samples. Likewise larval clupeids were collected along the marsh edge during spring sampling. These species are surface oriented and feed in open water. However, as reported in the 2006 summary, they are consistently captured along the marsh edge. While we report these species as part of our overall epibenthic evaluation, neither of these species (or the larval clupeids captured along the marsh edge in the spring) are considered epibenthic. Their consistent presence along the marsh edge suggests a potential benefit from utilizing this habitat. It seems likely that these organisms may receive some benefit through a reduction in predation along the shallow margins of the estuary.

Community Measures

Analysis of species richness data from both marsh interior (Breder trap) and marsh edge (drop trap) samples detected significant differences in utilization among years, across both sampling seasons at most sites. Fall 2006 represented an intermediate year in terms of species richness for 6 out of 9 comparisons, and an all time low for one of the inner Town Creek sites and the Eagle Island site (Table 7.4-18). Spring 2007 was intermediate for all comparisons, except the Inner Town Creek site where species numbers were still at an all time low (Table 7.4-19). Marsh edge showed similar patterns to interior samples, with intermediate values for fall 2006 and spring 2007 (Table 7.4-24 and 7.4-25).

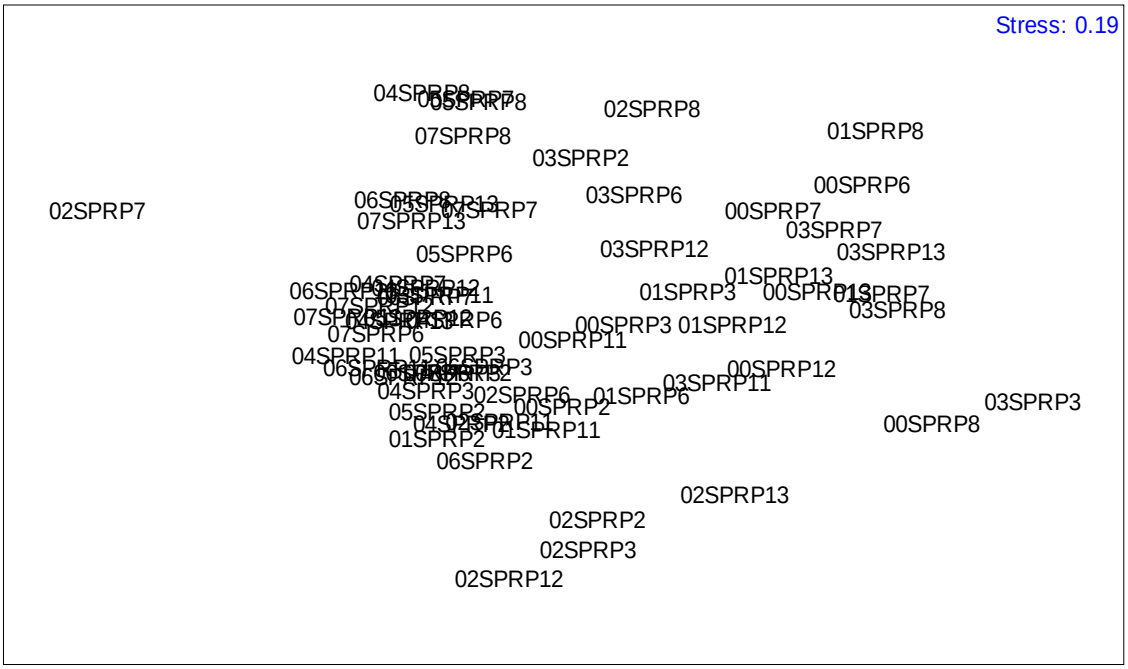


Figure 7.4-1. Analysis of similarity (PRIMER 6.0) based on Spring Drop Trap samples from 2000 to 2007. Plot shows weak year groupings for 2000 and 2002. All other years seem to group relatively closely.

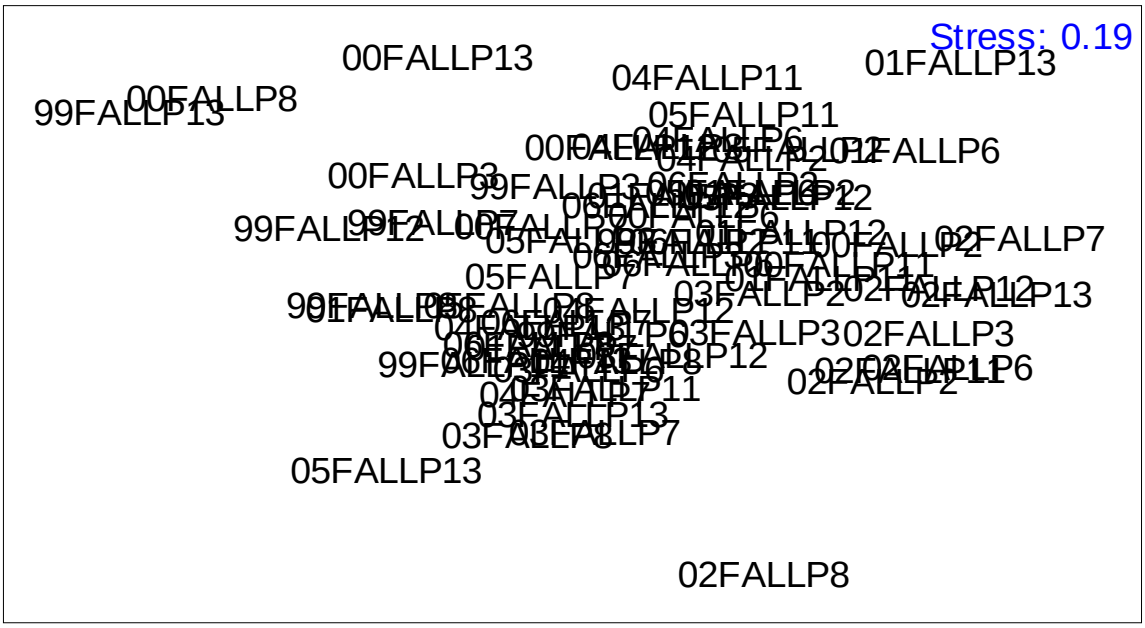


Figure 7.4-2. Analysis of similarity (PRIMER 6.0) for Fall Drop Trap samples from 1999 to 2006. This plot shows some clustering of sites, with 2000 and 2002 clustering as groups and most other site-year combinations falling between these two clusters.

Diversity measures for the two sampling types showed almost identical patterns, with fall 2006 being intermediate for both marsh interior (interestingly 4 sites showed no difference among years) and marsh edge habitats (Tables 7.4-20 and 7.4-26), and intermediate to low in the significant comparisons in spring 2007 (Tables 7.4-21 and 7.4-27). Not surprising, this pattern followed the general trends observed with species richness. Even comparisons of total abundance among years revealed that 2006-2007 sampling year was by and large average (Tables 7.4-22, 7.4-23, 7.4-28, and 7.4-29). The only exception to trend for three indicators (richness, diversity, and total abundance) is the inner Town Creek site. All parameters for interior marsh utilization were low. However, there are no observations that make this site seem remarkable and the other inner Town Creek site follows the trend observed for other sites along the river.

Table 7.4-1a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P2 (Mouth of Town Creek).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Anchoa mitchelli	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0.20 (0.20)	0(0)	0.30 (0.15)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Clupeidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.21)	0.30 (0.15)	0.30 (0.21)	0(0)	0.10 (0.10)	0(0)
Ctenogobius shufeldti	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	010 (0.10)	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0.70 (0.33)	0.90 (0.28)	0.60 (0.27)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	3.50 (0.82)	4.50 (1.18)	3.70 (1.68)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hirudinea	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomas xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Litopenaeus setiferus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.15)	0(0)	0.20 (0.13)	0.70 (0.26)	0.50 (0.22)	0.50 (0.17)	0.70 (0.26)	0.40 (0.16)	0.50 (0.17)
Micropogonias undulatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0.30 (0.15)	0.10 (0.10)	0(0)	0(0)	0(0)	0.10 (0.10)	0.30 (0.21)	0.40 (0.22)	0.60 (0.31)	0.80 (0.42)	0.30 (0.15)	0(0)	0(0)	0(0)	0.40 (0.31)	0.60 (0.27)	0.50 (0.22)	0(0)	0(0)	0.70 (0.39)	0(0)	0(0)	0.10 (0.10)
Palaemonetes vulgaris	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostigma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Rhithropanopeus harrisii	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)
Symphurus plagiusa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Syngnathidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I insect	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I larval fish	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.50 (1.19)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.80)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-1b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P2 (Mouth of Town Creek).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Anchoa mitchelli	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.70 (0.33)	0.20 (0.13)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)
Clupeidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.30)	0.20 (0.13)	0(0)	0.10 (0.10)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50 (0.22)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0.10 (0.10)	0.20 (0.13)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.27)	0.30 (0.30)	0.10 (0.10)	0.40 (0.22)	0.40 (0.22)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0.10 (0.10)	0.10 (0.10)	0(0)	0.20 (0.13)	0.20 (0.13)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.30 (0.15)	0.20 (0.13)	1.00 (0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.21)	0(0)	0(0)	0.20 (0.13)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.30 (0.15)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia Affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Hirudinea	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0.40 (0.16)	0.30 (0.21)	0(0)	0.40 (0.22)	0.22 (0.15)	0(0)
Leiostomas xanthurus	9.90 (2.66)	5.00 (1.62)	5.30 (2.33)	0(0)	0(0)	0.50 (0.22)	1.00 (0.54)	0.50 (0.27)	0.30 (0.21)	0(0)	0(0)	0(0)	2.60 (1.64)	2.20 (0.44)	1.40 (0.40)	2.10 (0.48)	3.30 (0.67)	2.90 (0.74)	20.60 (7.56)	20.70 (5.78)	17.20 (5.67)	11.50 (1.53)	21.44 (2.30)	29.10 (6.92)
Litopenaeus setiferus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulates	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.40 (0.40)
Palaemonetes pugio	1.50 (0.43)	1.40 (0.52)	2.30 (1.04)	2.00 (0.82)	1.10 (0.53)	1.30 (0.68)	1.00 (0.45)	1.00 (0.47)	0.10 (0.10)	0.80 (0.44)	0.80 (0.51)	1.70 (0.96)	1.60 (0.67)	1.80 (0.36)	1.30 (0.50)	1.90 (0.41)	3.80 (0.57)	1.50 (0.43)	1.00 (0.30)	1.00 (0.49)	1.00 (0.52)	3.70 (0.91)	3.44 (1.00)	0.40 (0.22)
Palaemonetes vulgaris	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostigma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.15)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Rhithropanopeus harrisii	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Symphurus plagiusa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Syngnathidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I insect	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I larval fish	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.20 (0.13)	0.80 (0.59)	0.10 (0.10)	0.30 (0.30)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-2a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P3A (Town Creek).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0.80 (0.47)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.21)	0.10 (0.10)	0.40 (0.22)	0.30 (0.15)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.33 (0.33)	0.20 (0.13)	0.70 (0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0.20 (.20)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.20 (0.13)	0.40 (0.16)	0.22 (0.15)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.70 (0.40)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0.50 (0.31)	1.10 (0.41)	0.50 (0.31)	0.11 (0.11)	0.20 (0.20)	0.20 (0.20)	0.60 (0.50)	1.60 (0.85)	1.20 (0.57)	0(0)	0(0)	0.10 (0.10)	0(0)	0.70 (0.60)	1.40 (0.60)	0(0)	0(0)	0.40 (0.22)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Heterandria formosa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0.10 (0.10)	0.10 (0.10)	0.20 (0.20)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Palaemonetes pugio	0(0)	0(0)	0(0)	0.70 (0.52)	0.40 (0.31)	0.50 (0.31)	0.30 (0.15)	0.40 (0.22)	0(0)	0.33 (0.24)	0.80 (0.61)	0.90 (0.69)	0.20 (0.133)	0.40 (0.16)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Rhithropanopeus harrisi	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.33 (0.17)	0.50 (0.31)	0.50 (0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0.20 (0.20)	0.40 (0.22)	0.80 (0.25)	0(0)	0.20 (0.20)	0.30 (0.21)	0.20 (0.20)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-2b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P3A (Town Creek).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.90 (0.35)	0.80 (0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0.10 (0.10)	1.00 (0.54)	1.00 (0.89)	1.50 (0.82)	0.10 (0.10)	0.30 (0.15)	0.80 (0.51)	0.20 (0.20)	0.50 (0.27)	0.89 (0.35)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.25 (0.16)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0.10 (0.10)	0.50 (0.27)	0.50 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0.30 (0.21)	0.60 (0.43)	0.90 (0.69)	0.10 (0.10)	0.60 (0.34)	0(0)	1.70 (0.86)	0.80 (0.29)	0(0)	0.70 (0.52)	2.40 (1.48)	1.80 (0.92)	0(0)	0(0)	25.38 (11.57)	0(0)	0.60 (0.43)	0.10 (0.10)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Heterandria formosa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.12 (0.12)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.30 (0.60)	1.50 (0.52)	2.70 (1.75)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50 (0.34)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.70 (0.60)	0.70 (0.60	0(0)	0.50 (0.40)	0.30 (0.21)	0(0)	6.22 (3.38)	0.70 (0.21)	0(0)	0.20 (0.13)	0.10 (0.10)	0(0)
Lepomis macrochirus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.30 (0.15)	0(0)	0(0)	0.20 (0.13)	0.90 (0.55)	0(0)	0.55 (0.24)	0.30 (0.21)	0(0)	0.20 (0.13)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)
Rhithropanopeus harrisi	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.31)	0.80 (0.29)	1.11 (0.31)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	1.00 (0.30)	1.10 (0.48)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	1.50 (0.62)	2.10 (0.57)	2.00 (0.67)	0.10 (0.10)	1.40 (0.56)	1.80 (0.53)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-3a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P3B (Town Creek).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Cambaridae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.50 (0.22)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.50 (0.50)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0.30 (0.30)	0.10 (0.10)	0.20 (0.20)
Dormitator maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Esox niger	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0.70 (0.47)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.22)	0.40 (0.27)	0.80 (0.51)	0.10 (0.10)	0.15 (0.08)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus confluentus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.40)	0(0)	0(0)	0(0)
Fundulus majalis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	1.00 (0.56)	0.20 (0.13)	1.00 (0.49)	0(0)	0.30 (0.15)	0(0)	0.50 (0.40)	0(0)	0.10 (0.10)	0(0)	0.20 (0.16)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.27)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	1.60 (0.40)	1.50 (0.76)	1.20 (0.59)	0.20 (0.13)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.80 (0.49)	0.90 (0.41)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys albigutta	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Sesarma cinereum	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.20 (0.49)	1.80 (0.61)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	1.10 (0.90)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0.50 (0.22)	0.20 (0.13)	0.40 (0.16)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-3b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P3B (Town Creek).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Cambaridae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.60 (0.27)	0(0)	0.30 (0.21)	0.30 (0.21)	0(0)	0.30 (0.15)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)
Dormitator maculatus	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Esox niger	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus confluentus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0.30 (0.30)	0.60 (0.31)	0(0)	0(0)	0.14 (0.14)
Fundulus majalis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0.10 (0.10)	0.20 (0.13)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0.40 (0.31)	1.10 (0.67)	0.60 (0.40)	2.30 (0.83)	2.30 (1.04)	0.60 (0.34)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0.14 (0.14)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0 (0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0.30 (0.21)	0(0)	0.20 (0.13)	0.90 (0.35)	0.20 (0.20)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0.50 (0.31)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	030 (0.15)	1.80 (0.92)	0.10 (0.10)	0.30 (0.21)	0.40 (0.22)	0.30 (0.21)	1.20 (0.71)	1.60 (0.76)	0.20 (0.13)	1.50 (0.70)	3.30 (1.30)	0.14 (0.14)
Lepomis macrochirus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0.20 (0.20)	0.10 (0.10)	0.10 (0.10)	1.20 (0.53)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0.10 (0.10)	0.30 (0.15)	0.80 (0.39)	0.20 (0.13)	0.80 (0.25)	1.00 (0.42)	2.30 (1.32)	0.50 (0.27)	0.30 (0.21)	0.14 (0.14)
Paralichthys albigutta	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.30 (0.21)	0.10 (0.10)	0(0)	0.20 (0.13)	0.10 (0.10)	0(0)	0.20 (0.13)	0(0)	0(0)
Sesarma cinereum	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.47)	1.40 (0.60)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0.43 (0.20)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.22)	0.30 (0.15)	2.60 (0.73)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0.70 (0.26)	1.20 (0.49)	0.60 (0.34)	0.20 (0.13)	0.60 (0.40)	0.90 (0.50)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-4a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P6 (Eagle Island).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	1.50 (0.50)	0.90 (0.55)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)
Diving beetle	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dormitator maculates	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.40 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.90 (0.23)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.50)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)
Fundulus majalis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leptocephalus larvae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Lutjanus griseus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulates	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	1.00 (0.60)	0.80 (0.44)	0.20 (0.13)	1.90 (1.49)	1.40 (0.45)	2.89 (1.74)	0.50 (0.22)	0.50 (0.31)	4.22 (4.10)	0(0)	0(0)	0(0)	0.40 (0.22)	0.50 (0.22)	0.20 (0.13)	1.80 (0.70)	1.50 (0.62)	0.80 (0.59)	0(0)	0(0)	0.30 (0.21)
Paralichthys albigutta	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Rhithropanopeus harrisii	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Sygnathidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.50 (0.22)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I fish	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-4b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P6 (Eagle Island).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Callinectes sapidus	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)
Ctenogobius shufeldti	0(0)	0.10 (0.10)	0.10 (0.10)	0.20 (0.13)	0.30 (0.21)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0.30 (0.15)	0.50 (0.22)	0.10 (0.10)	0.50 (0.27)	0.90 (0.69)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)
Diving beetle	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dormitator maculates	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.90 (0.59)	1.00 (0.89)	0.50 (0.27)	0.10 (0.10)	0.20 (0.13)	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0.20 (0.13)	0.70 (0.33)	0.20 (0.13)	0.10 (0.10)	0.10 (0.10)	0(0)
Fundulus majalis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.70 (0.21)	0.40 (0.27)	0.50 (0.27)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.20 (0.20)	0(0)	0(0)	0(0)	8.70 (2.87)	14.30 (4.37)	32.90 (12.60)	5.30 (2.82)	11.40 (3.53)	9.3 0 (3.00)	15.50 (3.14)	30.90 (10.09)	33.50 (9.06)	1.80 (0.96)	0.60 (0.22)	2.20 (1.16)
Leptocephalus larvae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lutjanus griseus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.31)	0.70 (0.40)	2.30 (1.08)	0(0)	0(0)	0(0)	0.80 (0.51)	0.70 (0.42)	0.10 (0.10)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0.30 (0.30)	0.10 (0.10)	0.20 (0.20)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	1.40 (0.58)	1.00 (0.30)	4.30 (1.57)	0(0)	0(0)	0(0)
Paralichthys albigutta	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0.30 (0.30)	0.40 (0.22)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	2.30 (0.67)	1.80 (0.63)	0.80 (0.59)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0.20 (0.20)	0(0)	0.20 (0.13)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0.70 (0.21)	0.50 (0.22)	0(0)
Rhithropanopeus harrisii	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Sygnathidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)
Uca pugilator	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0(0)	0(0)	0(0)	0.30 (0.21)	0(0)	0.60 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I fish	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-5a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P7 (Indian Creek).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Anguilla rostrata	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Clupidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0.50 (0.22)	0.10 (0.10)	0.40 (0.22)	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)
Dormitator maculatus	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus argenteus	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.40 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Evorthodus lyricus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropterus salmoides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	1.56 (0.56)	0.56 (0.34)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0.20 (0.20)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostigma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Rhithropanopeus harrisi	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0.40 (0.31)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)
Uca pugnax	0.60 (0.34)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-5b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P7 (Indian Creek).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Anguilla rostrata	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Clupidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0.40 (0.16)	1.10 (0.28)	4.33 (3.85)	0.40 (0.22)	0.60 (0.22)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.70 (0.42)	0.70 (0.30)	0(0)	1.00 (0.49)	0.70 (0.40)	0(0)	0.90 (0.35)	0.90 (0.41)	0.10 (0.10)	0.20 (0.20)	0.33 (0.24)	0(0)
Dormitator maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus araenteus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Evorthodus lyricus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0.50 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0.11 (0.11)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0.10 (0.10)	3.00 (1.30)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	4.20 (2.09)	0(0)	0(0)	0(0)	0(0)	0.22 (0.15)	0.11 (0.11)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropterus salmoides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	6.60 (2.35)	8.20 (3.57)	2.80 (0.66)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.60 (0.78)	0.90 (0.31)	1.10 (0.35)	0.40 (0.22)	1.10 (0.46)	0.50 (0.22)	0.40 (0.16)	0.60 (0.40)	0.30 (0.15)	0(0)	0(0)	0(0)
Lepomis macrochirus	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0.40 (0.22)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0.40 (0.16)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostiama	0(0)	0.30 (0.15)	0.67 (0.44)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.20 (0.33)	0.70 (0.37)	0.50 (0.17)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.34)	0.11 (0.11)	0(0)
Rhithropanopeus herbstii	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.33 (0.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.55 (0.44)	2.22 (1.22)
Uca pugnax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-6a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P8 (Dollisons Landing).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Amphipoda	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Anguilla rostrata	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cambarus robustus	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.10 (0.60)	0.50 (0.27)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dormitator maculatus	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus confluentus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus diaphanus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.50 (0.27)	1.60 (0.64)	2.20 (1.17)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.20 (0.13)	0.20 (0.13)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.22)	0.10 (0.10)	0.50 (0.34)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	1.0 0 (1.0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Menidia beryllina	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropterus salmoides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.78 (0.66)	0.30 (0.21)	1.10 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0.20 (0.13)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Trinectes maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.20 (0.20)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.30)	0.10 (0.10)	0.10 (0.10)	0(0)	0.10 (0.10)

Table 7.4-6b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P8 (Dollisons Landing).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Amphipoda	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Anguilla rostrata	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Cambarus robustus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0(0)	0.60 (0.31)	0.30 (0.15)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dormitator maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus confluentus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus diaphanus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.21)	0.30 (0.15)	0.10 (0.10)	0(0)	0(0)	0(0)	0.40 (0.22)	2.50 (1.27)	1.20 (0.85)	0(0)	0.20 (0.13)	0.20 (0.13)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.60 (0.40)	0.50 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia affinis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Menidia beryllina	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropterus salmoides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	1.00 (0.80)	0(0)	0(0)	0(0)	0.10 (0.10)	0.11 (0.11)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.20 (0.61)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Trinectes maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-7a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P11 (Smith Creek).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.30)	0.40 (0.22)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	2.10 (0.85)	0.70 (0.40)	0.30 (0.21)	0.10 (0.10)	0(0)	0.10 (0.10)	0.20 (0.20)	0(0)	0(0)	0.20 (0.20)	0(0)	0.40 (0.16)
Dormitator maculatus	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.27)	0.50 (0.22)	0.20 (0.13)	1.20 (0.70)	1.80 (0.61)	1.20 (0.36)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0.10 (0.10)
Fundulus majalis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Litopenaeus setiferus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.10 (0.10)	0.40 (0.16)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lutjanus griseus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Menidia beryllina	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulatu	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.80)	0(0)	0.40 (0.31)	0.40 (0.22)	0.40 (0.16)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostigma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Symphorus plagiusa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Trinectes maculatus	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I larval fish	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.40 (0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0.10 (0.10)	0.20 (0.13)	8.50 (4.17)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-7b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P11 (Smith Creek).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Callinectes sapidus	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.30 (0.15)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.11 (0.11)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0(0)	0.60 (0.31)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Dormitator maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Fundulus majalis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.50 (0.67)	1.10 (0.46)	0.60 (0.31)	0(0)	0(0)	0(0)	0.33 (0.24)	0.70 (0.26)	0.10 (0.10)
Leiostomus xanthurus	1.30 (0.76)	0.30 (0.21)	1.0 0 (0.39)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	6.80 (2.08)	9.70 (3.85)	25.90 (11.83)	15.30 (5.11)	26.60 (8.71)	19.20 (4.62)	21.80 (2.93)	45.20 (6.12)	22.70 (5.51)	13.55 (2.96)	44.30 (9.24)	62.50 (17.35)
Lepomis macrochirus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Litopenaeus setiferus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lutjanus griseus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Menidia beryllina	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.61)	0.50 (0.22)	1.10 (0.60)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.20 (0.20)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.59)	1.00 (0.42)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.40 (0.16)	0.40 (0.31)	1.20 (0.63)	0.33 (0.17)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0.20 (0.13)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostigma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.89 (0.56)	0.10 (0.10)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.40 (0.22)	0(0)	0.10 (0.10)	0.11 (0.11)	0.10 (0.10)	0(0)
Symphorus plagiusa	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Trinectes maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
U/I larval fish	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca pugnax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-8a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P12 (Rat Island).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0.60 (0.43)	0.60 (0.40)	0.60 (0.31)	0.30 (0.15)	0.70 (0.26)	0(0)	0(0)	0(0)	0(0)	1.10 (0.28)	0.55 (0.29)	0.10 (0.10)
Dormitator maculatus	0.60 (0.34)	0(0)	0.40 (0.22)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.10 (0.10)	0.30 (0.21)	0.30 (0.15)	0.89 (0.26)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomas xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0.20 (0.13)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)
Litopenaeus setiferus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.27)	0.60 (0.16)	0.60 (0.22)	0(0)	0.11 (0.11)	0(0)
Macrobranchium acanth	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatu	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0.10 (0.10)	0 (0)	0 (0)	0.40 (0.31)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.44 (0.24)	0 (0)	0 (0)	0 (0)	0 (0)	0.10 (0.10)	0 (0)	0.70 (0.26)	0.40 (0.22)	0.10 (0.10)	0(0)	0(0)	0(0)
Palaemonetes vulgaris	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralychthys albigutta	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus herbstii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Syngnathidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.11 (0.11)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.10 (0.10)
Uca pugnax	0(0)	0.20 (0.13)	0.10 (0.10)	0.10 (0.10)	0(0)	1.70 (0.53)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-8b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P12 (Rat Island).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper	Low	Mid	Upper
Callinectes sapidus	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0.60 (0.31)	0.60 (0.31)	0.10 (0.10)	0(0)	0.20 (0.20)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.22)	0.60 (0.22)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0.60 (0.16)	0.70 (0.15)	0.20 (0.20)
Dormitator maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0.10 (0.10)	0(0)	0.20 (0.20)	0.80 (0.49)	0(0)	0(0)	0.30 (0.21)	0(0)	0(0)	0(0)	0.90 (0.41)	0.55 (0.25)	0.90 (0.50)	0(0)	0(0)	0(0)	0.50 (0.22)	0.60 (0.30)	0.90 (0.41)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	6.20 (1.54)	3.30 (1.15)	2.90 (0.62)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)
Leiostomas xanthurus	0.20 (0.20)	0.20 (0.13)	0.10 (0.10)	0.50 (0.31)	0.60 (0.27)	0.80 (0.49)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	13.20 (3.03)	15.40 (5.68)	11.40 (8.63)	31.90 (7.54)	26.60 (7.74)	0(0)	0.30 (0.15)	0.10 (0.10)	2.50 (1.86)
Lepomis macrochirus	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Macrobranchium acanth	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)
Micropogonias undulatu	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Mugil cephalus	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0.20 (0.20)	0.30 (0.21)	0.50 (0.22)	0(0)	1.00 (0.39)	0.50 (0.27)	0.67 (0.55)	1.60 (0.93)	3.50 (3.06)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0.30 (0.21)	1.10 (0.58)	0(0)	0(0)	0(0)	0(0)
Palaemonetes vulgaris	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)
Paralychthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0.22 (0.15)	1.40 (1.09)	0.40 (0.22)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys lethostigma	0(0)	0.30 (0.21)	0.30 (0.15)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Rhithropanopeus herbstii	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Syngnathidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	2.30 (1.24)	0(0)	0(0)	0(0)
Uca pugnax	0.10 (0.10)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.81 (0.55)	1.50 (0.43)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-9a. Mean abundance (SE) for epibenthic fauna collected during fall (1999-2006) Breder trap samples at station P13 (Fishing Creek).

	Fall 1999			Fall 2000			Fall 2001			Fall 2002			Fall 2003			Fall 2004			Fall 2005			Fall 2006		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Anguilla rostrata	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Centrarchidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Clupeidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0.60 (0.34)	0.20 (0.13)	0.20 (0.13)	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0.33 (0.24)	0(0)
Dormitator maculatus	0.10 (0.10)	0.20 (0.20)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.51)	0.30 (0.30)	0.30 (0.21)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.20)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lepomis macrochirus	0.60 (0.60)	0.30 (0.30)	0(0)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)
Lutjanus griseus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulatu	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.30)	0(0)	0.40 (0.40)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0(0)	0(0)	0.30 (0.15)	0(0)	0(0)	0(0)
Uca pugnax	0(0)	0.40 (0.31)	0.40 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-9b. Mean abundance (SE) for epibenthic fauna collected during spring (2000-2007) Breder trap samples at station P13 (Fishing Creek).

	Spring 2000			Spring 2001			Spring 2002			Spring 2003			Spring 2004			Spring 2005			Spring 2006			Spring 2007		
	Low	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**	**Low**	**Mid**	**Upper**
Anguilla rostrata	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Centrarchidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)
Clupeidae	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)
Ctenogobius boleosoma	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Ctenogobius shufeldti	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.21)	0.70 (0.33)	0(0)	0.10 (0.10)	0.10 (0.10)	0.50 (0.50)	0(0)	0.20 (0.13)	0.20 (0.13)	0(0)	0.10 (0.10)	0(0)
Dormitator maculatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Eucinostomus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Farfantepenaeus aztecus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Fundulus heteroclitus	0(0)	0(0)	0(0)	0.10 (0.10)	0.80 (0.42)	0.40 (0.22)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.30 (0.47)	1.00 (0.49)	1.50 (0.70)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.50 (0.34)	0.30 (0.21)	0.20 (0.13)
Fundulus sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Gambusia holbrooki	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.20 (0.13)	0.20 (0.13)
Gobiosoma sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lagodon rhomboides	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.60 (0.34)	0.20 (0.13)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)
Leiostomus xanthurus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	1.30 (1.10)	0.60 (0.34)	0.20 (0.13)	0(0)	0(0)	0(0)	2.00 (1.31)	2.20 (1.04)	5.50 (2.87)	0.10 (0.10)	0.40 (0.31)	0.10 (0.10)	0(0)	1.70 (0.47)	0.90 (0.46)	0(0)	0(0)	0(0)
Lepomis macrochirus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Lutjanus griseus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Micropogonias undulatu	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Palaemonetes pugio	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys dentatus	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.21)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Paralichthys sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.30 (0.30)	0.20 (0.20)	0.40 (0.22)	0(0)	0(0)	0.10 (0.10)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca minax	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.20 (0.13)	0.40 (0.16)	0.90 (0.31)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0.80 (0.39)	0(0)	0(0)	0.10 (0.10)
Uca pugnax	0(0)	0(0)	0.10 (0.10)	0.20 (0.13)	0.60 (0.43)	0.80 (0.33)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Uca sp.	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)

Table 7.4-10a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P2 (Mouth of Town Creek).

	1999	2000	2001	2002	2003	2004	2005	2006
Alpheus heterochelis	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Anchoa mitchelli	0.44 (0.44)	0 (0)	1.39 (1.33)	0.28 (0.23)	0 (0)	5.22 (5.11)	0.89 (0.46)	1.28 (0.69)
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anthinnae	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Bivalve	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Brevoortia tyrannus	0 (0)	0 (0)	0.17 (0.17)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0.33 (0.14)	0.67 (0.23)	0.78 (0.42)	0.11 (0.11)	0 (0)	0.67 (0.40)	1.89 (0.47)	0.78 (0.17)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0.17 (0.09)
Ctenogobius shufeldti	0.44 (0.20)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0.05 (0.05)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0.11 (0.11)
Farfantepenaeus aztecus	0 (0)	0.17 (0.09)	0.17 (0.12)	3.50 (1.35)	0.44 (0.23)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Gerreidae	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.13)	0 (0)	0 (0)	0 (0)
Gobiesox punctulatus	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboids	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Larimus fasciatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Litopenaeus setiferus	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	1.00 (0.48)	2.11 (0.74)	0.55 (0.29)
Lutjanus griseus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Menidia beryllina	0 (0)	0 (0)	0.39 (0.24)	0 (0)	0 (0)	0.22 (0.22)	0.17 (0.17)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.33 (0.24)	0 (0)	0 (0)	0 (0)
Menticirrhus saxatilis	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulates	0 (0)	0 (0)	0.44 (0.27)	0 (0)	0 (0)	0.06 (0.06)	0.83 (0.28)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes intermedius	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.27 (0.27)	0 (0)	0 (0)
Palaemonetes pugio	1.39 (0.88)	0.78 (0.61)	2.11 (0.81)	0.06 (0.06)	3.06 (0.73)	2.56 (1.25)	2.39 (1.05)	0.28 (0.23)
Palaemonetes vulgaris	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.72 (0.45)	0 (0)
Panopeus herbstii	0.06 (0.06)	0.50 (0.31)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0 (0)	0.06 (0.06)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Penaeid	0 (0)	0.17 (0.12)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rangia cuneata	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0.06 (0.06)	0 (0)	0.06 (0.06)	0.06 (0.06)	0 (0)	0.22 (0.10)	0 (0)	0.05 (0.05)
Sciaenidae sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Sesarma reticulatum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Smphurus plagiusa	0 (0)	0 (0)	0 (0)	1.00 (0.44)	0.11 (0.11)	0 (0)	1.33 (0.48)	0 (0)
Syngnathid sp.	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Trachinotus falcatus	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Trinectes maculates	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.05 (0.05)	0 (0)
Uca pugnax	0.06 (0.06)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *A*	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-10b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P2 (Mouth of Town Creek).

	2000	2001	2002	2003	2004	2005	2006	2007
Alpheus heterochelis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anchoa mitchelli	0 (0)	0 (0)	2.00 (1.94)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0.05 (0.05)
Anguilla rostrata	0 (0)	0.06 (0.06)	0.28 (0.14)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Anthinnae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Bivalve	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Brevoortia tyrannus	0 (0)	0 (0)	21.67 (20.80)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0.06 (0.06)	0.06 (0.06)	0.50 (0.15)	0.17 (0.09)	0.17 (0.09)	1.17 (0.40)	1.05 (0.23)	0.39 (0.14)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.22)	0 (0)	0.17 (0.12)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.09)	0.22 (0.13)
Ctenogobius shufeldti	0.17 (0.09)	0.06 (0.06)	0.11 (0.08)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	3.06 (2.37)	0 (0)	1.22 (0.75)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Gerreidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiesox punctulatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0.44 (0.23)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.13)	0 (0)	0.05 (0.05)
Larimus fasciatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	7.0 (2.41)	62.89 (40.60)	0.22 (0.17)	0 (0)	4.61 (1.39)	7.94 (2.11)	2.55 (0.79)	10.22 (4.82)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lutjanus griseus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	5.61 (3.20)	1.28 (0.75)	1.39 (1.13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	4.56 (4.38)	0.89 (0.35)	0 (0)	0 (0)	0 (0)
Menticirrhus saxatilis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	9.06 (1.89)	16.56 (4.12)	0 (0)	0.06 (0.06)	0.11 (0.11)	0.55 (0.28)
Mugil cephalus	0 (0)	1.39 (0.78)	0.89 (0.35)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes intermedius	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Palaemonetes pugio	5.56 (1.35)	20.22 (10.05)	37.94 (16.39)	1.33 (0.55)	1.33 (0.53)	16.22 (6.10)	3.78 (1.75)	2.78 (1.50)
Palaemonetes vulgaris	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Panopeus herbstii	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.11 (0.08)	0 (0)	0.11 (0.08)	0.17 (0.12)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	1.61 (0.57)	0.06 (0.06)	0.11 (0.08)	0 (0)	0.11 (0.08)
Penaeid	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rangia cuneata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0.22 (0.10)	0 (0)	0 (0)	0.11 (0.11)	0.05 (0.05)	0.17 (0.12)
Sciaenidae sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Sesarma reticulatum	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Syngnathid sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trachinotus falcatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculates	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca pugnax	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
/I larval fish sp. *A*	0 (0)	0 (0)	0 (0)	0.17 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-11a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P3 (Town Creek).

	1999	2000	2001	2002	2003	2004	2005	2006
Anchoa mitchelli	1.36 (0.63)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	14.33 (11.63)	0 (0)	0 (0)
Anguilla rostrata	0.06 (0.04)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Brevoortia tyrannus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0.11 (0.10)	0 (0)	0.11 (0.08)	0 (0)	0.39 (0.18)	0.22 (0.10)	0.11 (0.08)	0.39 (0.22)
Cambarus robustus	(0.03) (0.03)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Ctenogobius shufeldti	0.53 (0.34)	0.33 (0.16)	0.17 (0.09)	0 (0)	1.22 (0.45)	2.89 (0.59)	0.22 (0.17)	0.55 (0.20)
Eucinostomus argenteus	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2.11 (1.02)	0.05 (0.05)	0.17 (0.09)
Evorthodus lyricus	0 (0)	0 (0)	0 (0)	0 (0)	2.44 (0.89)	0 (0)	0 (0)	0.05 (0.05)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	2.33 (0.67)	3.56 (2.05)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0.12 (.08)	0 (0)	0 (0)	0.17 (0.12)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Fundulus majalis	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0.81 (0.72)	1.83 (0.62)	3.39 (1.72)	0.11 (0.08)	1.00 (0.58)	1.50 (0.78)	1.05 (0.57)	0.78 (0.49)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.56 (0.22)	0.28 (0.16)	0.28 (0.13)
Gobiosoma bosc	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0.28 (0.14)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lepomis macrochirus	0.09 (0.07)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lutjanus griseus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)
Menidia beryllina	0.06 (0.04)	0 (0)	0.06 (0.06)	0 (0)	2.89 (2.38)	0.22 (0.17)	0.17 (0.17)	0.33 (0.28)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)	0.78 (0.34)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Notropis petersoni	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	0 (0)	1.39 (0.83)	0.56 (0.30)	0.17 (0.12)	2.11 (1.03)	0 (0)	4.28 (3.38)
Panopeus herbstii	0.06 (0.06)	0.17 (0.12)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Paralichthys dentatus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 .06 (0.06)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.12)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.06 (0.06)	0.56 (0.50)	0.17 (0.09)	0 (0)
Sesarma cinereum	0 (0)	0.28 (0.11)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Sesarma reticulatum	0 (0)	0 (0)	0 (0)	0.17 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Sygnathidae	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	2.14 (1.05)	0.06 (0.06)	0 (0)	0 (0)	0.06 (0.06)	0.06 (0.06)	0 (0)	0.55 (0.25)
Uca minax	0 (0)	0 (0)	0 (0)	0.17 (0.09)	0 (0)	0.67 (0.61)	0 (0)	0 (0)
Uca pugnax	0.92 (0.47)	5.06 (0.96)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	

Table 7.4-11b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P3 (Town Creek).

	2000	2001	2002	2003	2004	2005	2006	2007
Anchoa mitchelli	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anguilla rostrata	0.09 (0.07)	0.28 (0.16)	0 (0)	0 (0)	0.06 (0.06)	0.06 (0.06)	0 (0)	0 (0)
Brevoortia tyrannus	0 (0)	0 (0)	4.00 (2.50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0.20 (0.11)	0.28 (0.16)	0.56 (0.27)	0 (0)	0.56 (0.22)	0.22 (0.13)	0.28 (0.13)	0.17 (0.12)
Cambarus robustus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.39 (0.33)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.39 (0.23)	0 (0)	0 (0)
Ctenogobius shufeldti	0.28 (0.12)	0.73 (0.39)	0.22 (0.17)	0 (0)	5.78 (1.79)	0.17 (0.12)	0.28 (0.13)	0.17 (0.09)
Eucinostomus argenteus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Evorthodus lyricus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0 (0)	1.39 (1.16)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0.11 (0.11)	0 (0)	0 (0)	0 (0)
Fundulus majalis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	2.00 (1.28)	0.06 (0.06)	0.22 (0.13)	0 (0)	1.11 (0.54)	0 (0)	7.94 (4.82)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiosoma bosc	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0.34 (0.19)	0 (0)	0.22 (0.10)	0 (0)	0.11 (0.11)	1.39 (0.89)	0 (0)	0.44 (0.20)
Leiostomus xanthurus	0 (0)	0.28 (0.17)	0 (0)	0 (0)	36.39 (13.62)	31.22 (12.62)	13.8 (6.83)	20.28 (5.91)
Lepomis macrochirus	1.59 (1.70)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lutjanus griseus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0.06 (0.06)	0 (0)	4.33 (2.22)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	50.44 (21.43)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Mugil cephalus	0 (0)	0 (0)	2.89 (1.19)	0 (0)	0.06 (0.06)	0 (0)	0.50 (0.40)	0 (0)
Notropis petersoni	0 (0)	0.22 (0.22)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	0.17 (0.09)	7.17 (3.23)	0 (0)	10.39 (5.52)	3.94 (3.08)	10.9 (8.27)	5.28 (1.73)
Panopeus herbstii	0.06 (0.04)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.45 (0.16)	1.17 (0.59)	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.44 (0.35)	0.22 (0.13)	0.94 (0.34)	0.11 (0.11)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.05 (0.05)	0 (0)
Sesarma cinereum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Sesarma reticulatum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Sygnathidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0.31 (0.17)	0.39 (0.22)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca minax	0 (0)	0 (0)	0 (0)	0.50 (0.22)	0 (0)	2.28 (2.22)	0 (0)	0 (0)
Uca pugnax	0.03 (0.03)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0.78 (0.46)	0 (0)	0.39 (0.39)	0 (0)	0 (0)	0 (0)

Table 7.4-12a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P6 (Eagle Island).

	1999	2000	2001	2001	2003	2004	2005	2006
Anchoa mitchelli	0 (0)	1.00 (0.37)	0 (0)	0 (0)	0 (0)	9.72 (6.05)	3.39 (2.99)	0.22 (0.22)
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0.22 (0.10)	0.06 (0.06)	0 (0)	0.06 (0.06)	0.39 (0.16)	0.33 (0.16)	0.39 (0.12)	0.17 (0.09)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Corbicula fluminea	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.10)	0.11 (0.11)
Ctenogobius shufeldti	0.06 (0.06)	0.22 (0.15)	0 (0)	0 (0)	1.61 (0.51)	0.33 (0.11)	0.17 (0.12)	0.11 (0.08)
Eucinostomus harengulus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0.11 (0.11)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0.83 (0.35)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gerres cinereus	0 (0)	0.28 (0.16)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0.22 (0.13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lepomis sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.09)	0.28 (0.16)	0.05 (0.05)
Macrobrachium sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)
Menidia beryllina	0.11 (0.08)	0 (0)	0.17 (0.09)	0.72 (0.42)	0 (0)	0.28 (0.18)	0.05 (0.05)	0.50 (0.40)
Menidia menidia	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	5.44 (3.28)	1.00 (1.00)	0 (0)	0 (0)	14.72 (8.95)	3.39 (2.06)	0.05 (0.05)
Panopeus herbstii	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.17)	0.05 (0.05)	0 (0)
Sesarma cinereum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Sesarma reticulatum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0.44 (0.20)	0.11 (0.08)	0 (0)	0 (0)	0.50 (0.25)	0 (0)	0 (0)	0.05 (0.05)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	2.44 (1.72)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-12b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P6 (Eagle Island).

	2000	2001	2002	2003	2004	2005	2006	2007
Anchoa mitchelli	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.61 (0.42)	0 (0)
Anguilla rostrata	0 (0)	0.11 (0.08)	0.05 (0.05)	0.50 (0.25)	0.11 (0.08)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0.06 (0.06)	0.53 (0.18)	0.22 (0.10)	0.61 (0.18)	0.56 (0.25)	0.28 (0.11)	0.05 (0.05)
Clupeidae	0 (0)	0 (0)	0.21 (0.21)	0 (0)	0 (0)	37.78 (14.75)	0.94 (0.77)	1.67 (0.72)
Corbicula fluminea	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.05 (0.05)	0 (0)
Ctenogobius shufeldti	0.11 (0.11)	0.11 (0.08)	0 (0)	0 (0)	1.78 (0.33)	0.67 (0.21)	0.11 (0.08)	0.33 (0.11)
Eucinostomus harengulus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0.32 (0.27)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Gerres cinereus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.11 (0.08)	0.39 (0.24)	0 (0)	0.11 (0.11)
Leiostomus xanthurus	0 (0)	1.72 (0.72)	1.00 (0.52)	0 (0)	25.61 (9.85)	2.50 (1.02)	19.94 (3.90)	74.94 (23.79)
Lepomis sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Macrobrachium sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0 (0)	20.83 (10.04)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0.28 (0.28)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0.32 (0.32)	0 (0)	3.44 (2.55)	0 (0)	1.22 (0.62)	0 (0)
Mugil cephalus	0 (0)	0.22 (0.17)	0.16 (0.16)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	1.78 (0.60)	8.21 (2.52)	0.22 (0.13)	0.22 (0.13)	2.11 (0.82)	15.6 (8.11)	0.44 (0.25)
Panopeus herbstii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.17 (0.12)	1.17 (0.56)	0.11 (0.11)	0.44 (0.23)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0.26 (0.13)	10.83 (3.68)	11.00 (3.82)	1.06 (0.36)	0.22 (0.10)	0.17 (0.09)
Rhithropanopeus harrisii	0 (0)	0 (0)	0.05 (0.05)	0 (0)	0.06 (0.06)	0.17 (0.17)	0.05 (0.05)	0 (0)
Sesarma cinereum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Sesarma reticulatum	0 (0)	0 (0)	0.05 (0.05)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-13a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P7 (Indian Creek).

	1999	2000	2001	2002	2003	2004	2005	2006
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.33 (0.14)	0 (0)	0 (0)	0.05 (0.05)
Callinectes sapidus	0.06 (0.06)	0 (0)	0.17 (0.09)	0 (0)	0.11 (0.07)	0.06 (0.06)	0.17 (0.09)	0.11 (0.11)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.17)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.12)	0 (0)
Ctenogobius shufeldti	0.06 (0.06)	0.28 (0.18)	0.22 (0.10)	0 (0)	2.11 (0.38)	1.17 (0.35)	0.17 (0.09)	0.17 (0.12)
Dorosoma cepedianum	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Dorosoma pretense	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Esox lucius	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus argenteus	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)
Evorthodus lyricus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Fundulus heteroclitus	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0.06 (0.06)	0.17 (0.17)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Gerres cinereus	0 (0)	0.22 (0.10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)
Litopanaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Menidia beryllina	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	0.28 (0.23)	0 (0)	0.33 (0.28)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)
Paralichthys dentatus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.28 (0.19)	0 (0)	0 (0)
Rangia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)
Trinectes maculatus	0 (0)	0.06 (0.06)	0.44 (0.15)	0 (0)	2.06 (0.60)	0.06 (0.06)	0.05 (0.05)	0.33 (0.18)
Uca pugnax	0.06 (0.06)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0.05 (0.05)
U/I juvenile fish	0 (0)	0.39 (0.33)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-13b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P7 (Indian Creek).

	2000	2001	2002	2003	2004	2005	2006	2007
Anguilla rostrata	0.71 (0.34)	0.11 (0.11)	0 (0)	0.39 (0.28)	1.06 (0.41)	0 (0)	0 (0)	0.17 (0.09)
Callinectes sapidus	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.05 (0.05)	0.05 (0.05)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.22)	0.83 (0.78)	1.22 (0.77)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius shufeldti	0.29 (0.14)	0 (0)	0 (0)	0 (0)	1.72 (0.53)	0.22 (0.13)	0.11 (0.11)	0.22 (0.13)
Dorosoma cepedianum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Dorosoma pretense	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Esox lucius	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus argenteus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Evorthodus lyricus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gerres cinereus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0.35 (0.35)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.05 (0.05)
Leiostomus xanthurus	0 (0)	0 (0)	0 (0)	0 (0)	38.78 (21.08)	0 (0)	11.6 (6.07)	1.00 (0.36)
Litopanaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0 (0)	0.28 (0.18)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.28 (0.23)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.05 (0.05)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0.28 (0.28)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.47 (0.29)	1.56 (0.56)	0 (0)	1.50 (0.48)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0.11 (0.08)	0 (0)	9.50 (2.14)	1.72 (0.40)	0.55 (0.22)	2.83 (0.83)
Rangia sp.	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Trinectes maculatus	0 (0)	0 (0)	0 (0)	0.61 (0.22)	0 (0)	0 (0)	0 (0)	0 (0)
Uca pugnax	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I juvenile fish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.8-14a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P8 (Dollisons Landing).

	1999	2000	2001	2002	2003	2004	2005	2006
Alosa pseudoharengus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.17)	0 (0)	0 (0)
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.11 (0.11)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0.11 (0.08)	0.11 (0.08)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius shufeldti	0.11 (0.08)	0 (0)	0.06 (0.06)	0 (0)	2.56 (0.67)	1.00 (0.27)	0.33 (0.16)	0.17 (0.09)
Cyprinidae	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)
Dorosoma petenense	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Esox niger	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus harengulus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.10)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2.89 (2.14)	0.05 (0.05)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0.22 (0.22)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.22)	0 (0)
Gambusia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0.17 (0.12)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lepomis gibbensis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lepomis macrochirus	0.06 (0.06)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)		0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Notropis chalybaeus	2.94 (1.98)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Notropis petersoni	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.06 (0.06)	0.11 (0.08)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Penaeid	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithorpanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0.06 (0.06)	0 (0)	0 (0)
Sesarma cinereum	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0.17 (0.12)	0 (0)	0.11 (0.11)	0.06 (0.06)	4.00 (1.40)	0.28 (0.14)	0.33 (0.14)	0.94 (0.35)
Uca pugnax	0 (0)	0.17 (0.12)	0.17 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *A*	0 (0)	0 (0)	0 (0)	1.17 (0.74)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *B*	0 (0)	0 (0)	0 (0)	0.17 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.8-14b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P8 (Dollisons Landing).

	2000	2001	2002	2003	2004	2005	2006	2007
Alosa pseudoharengus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anguilla rostrata	0 (0)	0.33 (0.18)	0.39 (0.14)	0.06 (0.06)	0.11 (0.08)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0 (0)	0.22 (0.10)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	69.78 (45.05)	7.94 (5.06)	1.61 (0.98)	0.67 (0.40)
Ctenogobius shufeldti	0 (0)	0 (0)	0 (0)	0 (0)	2.17 (0.62)	0.33 (0.11)	0.05 (0.05)	0.11 (0.08)
Cyprinidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Dorosoma petenense	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Esox niger	0 (0)	0 (0)	0 (0)	0.12 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus harengulus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0.17 (0.17)
Gambusia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.33 (0.23)	0 (0)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1.83 (0.49)	0 (0)
Lepomis gibbensis	0 (0)	0 (0)	0 (0)	1.76 (1.76)	0 (0)	0 (0)	0 (0)	0 (0)
Lepomis macrochirus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0.61 (0.39)	0 (0)	0 (0)	0.12 (0.12)	0 (0)	0.11 (0.08)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Notropis chalybaeus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Notropis petersoni	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.11 (0.11)	0.06 (0.06)	0 (0)	1.35 (0.34)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	1.72 (0.40)	0.50 (0.25)	1.50 (0.78)	2.22 (0.60)
Penaeid	0 (0)	0 (0)	0.22 (0.13)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithorpanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Sesarma cinereum	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0 (0)	0 (0)	0.06 (0.06)	0.18 (0.13)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Uca pugnax	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *A*	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *B*	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-15a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P11 (Smith Creek).

	1999	2000	2001	2002	2003	2004	2005	2006
Anchoa mitchelli	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	1.94 (1.83)	0.11 (0.11)	0 (0)
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0.06 (0.06)	0.50 (0.25)	0.17 (0.09)	0.22 (0.10)	0 (0)	0.17 (0.12)	0.17 (0.09)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0.05 (0.05)
Ctenogobius shufeldti	0.22 (0.13)	0 (0)	0.06 (0.06)	0 (0)	0.28 (0.16)	0.06 (0.06)	0 (0)	0.05 (0.05)
Eucinostomus argenteus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0.17 (0.12)	0.05 (0.05)
Farfantepenaeus aztecus	0 (0)	0.83 (0.49)	6.28 (4.30)	3.56 (1.16)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0.11 (0.11)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ictalurus furcatus	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.78 (0.39)	0.50 (0.18)	0.28 (0.13)
Lutjanus griseus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0 (0)	1.89 (0.64)	0.83 (0.61)	0 (0)	0 (0)	0.22 (0.13)	0 (0)	0.11 (0.08)
Menidia menidia	0 (0)	0 (0)	0 (0)	0 (0)	1.50 (1.44)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0.28 (0.28)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	1.56 (0.41)	0.17 (0.17)	0.17 (0.17)	0 (0)	0 (0)	0.05 (0.05)	0.22 (0.22)
Paralichthys dentatus	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0.05 (0.05)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Penaeus setiferus	0 (0)	1.89 (0.85)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rangia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0.06 (0.06)	0.06 (0.06)	0.17 (0.12)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Sesarma cinereum	0 (0)	0.72 (0.38)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0.22 (0.13)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0.22 (0.17)	0.06 (0.06)	0 (0)	0 (0)	0.33 (0.14)	0 (0)	0 (0)	0 (0)
Uca minax	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *A*	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-15b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P11 (Smith Creek).

	2000	2001	2002	2003	2004	2005	2006	2007
Anchoa mitchelli	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0.39 (0.33)	0 (0)	0 (0)	0 (0)
Anguilla rostrata	0.33 (0.16)	0 (0)	0.06 (0.06)	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0.11 (0.08)	0 (0)	1.17 (0.56)	0.28 (0.11)	0.72 (0.33)	0.26 (0.10)	0.28 (0.13)	0.11 (0.08)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1.42 (0.69)	0.11 (0.08)	3.28 (1.87)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.16 (0.09)	0 (0)	0 (0)
Ctenogobius shufeldti	0.17 (0.12)	0 (0)	0 (0)	0 (0)	0.72 (0.23)	0.05 (0.05)	0 (0)	0 (0)
Eucinostomus argenteus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0.28 (0.18)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0.33 (0.20)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ictalurus furcatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0.72 (0.50)	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0.26 (0.13)	0 (0)	0 (0)
Leiostomus xanthurus	14.83 (9.79)	9.56 (2.30)	1.94 (0.60)	0.39 (0.23)	64.11 (14.63)	16.89 (4.91)	50.5 (15.9)	63.05 (21.15)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lutjanus griseus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0.22 (0.17)	1.0 (0.76)	0.06 (0.06)	0 (0)	0 (0)	0.05 (0.05)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	2.67 (1.11)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	1.89 (0.87)	0 (0)	1.22 (0.51)	0 (0)
Mugil cephalus	0 (0)	0.94 (0.79)	0.17 (0.12)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Palaemonetes pugio	0.06 (0.06)	0.17 (0.09)	5.20 (2.38)	0.22 (0.13)	0.06 (0.06)	0.05 (0.05)	0.39 (0.24)	0.05 (0.05)
Paralichthys dentatus	1.17 (0.44)	0.06 (0.06)	0 (0)	16.11 (3.31)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0.28 (0.14)	0 (0)	14.78 (3.73)	1.53 (0.40)	0.22 (0.10)	0.61 (0.30)
Penaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rangia sp.	0.17 (0.12)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Sesarma cinereum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Trinectes maculatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.15)	0 (0)
Uca minax	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish sp. *A*	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-16a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P12 (Rat Island).

	1999	2000	2001	2002	2003	2004	2005	2006
Alosa aestivalis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anchoa mitchilli	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.50 (0.36)	0.50 (0.05)
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Brevoortia tyrannus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0.11 (0.08)	0.56 (0.27)	0.06 (0.06)	0.11 (0.08)	0.22 (0.17)	0.28 (0.13)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0.22 (0.13)
Ctenogobius shufeldti	0.11 (0.08)	0.06 (0.06)	0.06 (0.06)	0 (0)	0.72 (0.40)	0.39 (0.16)	0.11 (0.08)	0.61 (0.24)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Farfantepenaeus aztecus	0 (0)	0 (0)	0.06 (0.06)	0.22 (0.10)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.67 (0.61)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0.28 (0.23)	0 (0)	0 (0)	0 (0)	0.55 (0.28)	0 (0)
Lepomis macrochirus	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2.39 (0.78)	0.72 (0.27)
Lutjanus griseus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0 (0)	0 (0)	0.33 (0.23)	0 (0)	0 (0)	0.28 (0.19)	0.89 (0.49)	0.11 (0.08)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	1.22 (0.66)	1.56 (0.89)	0.33 (0.16)	0.11 (0.11)	0 (0)	0.55 (0.03)	0.72 (0.39)
Palaemonetes vulgaris	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Sesarma cinereum	0 (0)	0.17 (0.09)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)	0 (0)
Trinectes maculatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.05 (0.05)
Uca minax	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)
Uca pugnax	0.06 (0.06)	1.11 (0.54)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0.22 (0.22)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-16b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P12 (Rat Island).

	2000	2001	2002	2003	2004	2005	2006	2007
Alosa aestivalis	0 (0)	0 (0)	0 (0)	0 (0)	2.56 (2.44)	0 (0)	0 (0)	0 (0)
Anchoa mitchilli	0 (0)	0 (0)	0 (0)	0 (0)	1.67 (1.05)	0 (0)	0.05 (0.05)	0 (0)
Anguilla rostrata	0 (0)	0.33 (0.28)	0 (0)	0 (0)	0.17 (0.12)	0 (0)	0 (0)	0.05 (0.05)
Brevoortia tyrannus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0 (0)	0.78 (0.26)	0 (0)	0.17 (0.09)	0.11 (0.08)	0.28 (0.11)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	4.39 (2.94)	1.05 (0.89)	4.55 (2.70)
Ctenogobius boleosoma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.28 (0.14)	0.28 (0.18)	0 (0)
Ctenogobius shufeldti	0.06 (0.06)	0.56 (0.23)	0 (0)	0 (0)	1.83 (0.69)	0.17 (0.12)	0.50 (0.24)	0.44 (0.25)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Fundulus heteroclitus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.22 (0.10)	0.05 (0.05)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.17)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0.22 (0.10)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	1.22 (0.55)	0 (0)	0.11 (0.08)
Leiostomus xanthurus	0.11 (0.08)	0 (0)	17.56 (15.35)	0 (0)	16.94 (8.08)	33.11 (9.33)	71.6 (13.9)	88.11 (22.81)
Lepomis macrochirus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Litopenaeus setiferus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lutjanus griseus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Micropogonias undulatus	0 (0)	0 (0)	0 (0)	0 (0)	8.22 (4.56)	0 (0)	4.61 (1.86)	0.72 (0.61)
Menidia beryllina	0.17 (0.12)	0.39 (0.39)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.11)	0.22 (0.17)	0 (0)
Palaemonetes pugio	0.06 (0.06)	1.61 (0.93)	1.50 (0.41)	5.94 (2.60)	0 (0)	0.94 (0.61)	13.1 (3.71)	0.05 (0.05)
Palaemonetes vulgaris	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys albigutta	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.17 (0.12)	0.33 (0.16)	0 (0)	11.44 (3.57)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys lethostigma	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	1.17 (0.68)	2.22 (1.19)	1.06 (0.30)	0.33 (0.18)	0.44 (0.22)
Rhithropanopeus harrisii	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)
Sesarma cinereum	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Symphurus plagiusa	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0 (0)	0 (0)	0.11 (0.08)	0.06 (0.06)	0 (0)	0 (0)	0.17 (0.17)	0 (0)
Uca minax	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca pugnax	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Uca sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-17a. Mean abundance (SE) for epibenthic fauna collected in Fall drop trap sampling at station P13 (Fishing Creek).

	1999	2000	2001	2002	2003	2004	2005	2006
Alosa aestivalis	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Anchoa mitchelli	0 (0)	0 (0)	0 (0)	0.28 (0.28)	0 (0)	0 (0)	0 (0)	0 (0)
Anguilla rostrata	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0.05 (0.05)
Cambarus robustus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Ctenogobius shufeldti	0 (0)	0 (0)	0 (0)	0 (0)	1.39 (0.74)	0.33 (0.18)	0 (0)	0.67 (0.28)
Dorosoma petenense	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Esox americanus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0.33 (0.16)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0.33 (0.18)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.17)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Leiostomus xanthurus	0 (0)	0 (0)	0.39 (0.27)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lepomis macrochirus	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	0 (0)	0 (0)	0.72 (0.46)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	4.28 (2.51)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Palaemonetes pugio	0 (0)	0 (0)	0 (0)	0.44 (0.29)	0 (0)	0 (0)	0 (0)	0 (0)
Panopeus herbstii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Panopeus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Procambarus robostus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0.22 (0.10)	0 (0)	0 (0)	0.11 (0.11)	0.06 (0.06)	0 (0)	0.11 (0.11)
Trinectes maculatus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.12)	0.17 (0.12)	0.78 (0.25)
Uca pugnax	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0.89 (0.89)	0.11 (0.11)	0 (0)	0 (0)	0 (0)

Table 7.4-17b. Mean abundance (SE) for epibenthic fauna collected in Spring drop trap sampling at station P13 (Fishing Creek).

	2000	2001	2002	2003	2004	2005	2006	2007
Alosa aestivalis	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Anchoa mitchelli	0 (0)	0 (0)	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)
Anguilla rostrata	0.17 (0.17)	0.28 (0.14)	0 (0)	0.06 (0.06)	0.11 (0.08)	0.05 (0.05)	0 (0)	0 (0)
Callinectes sapidus	0 (0)	0.17 (0.12)	0.06 (0.06)	0 (0)	0.11 (0.08)	0.05 (0.05)	0 (0)	0 (0)
Cambarus robustus	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Clupeidae	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	7.05 (5.99)	2.39 (1.60)	2.50 (2.27)
Ctenogobius shufeldti	0.22 (0.15)	0.17 (0.09)	0.11 (0.08)	0 (0)	1.17 (0.40)	0.16 (0.09)	0 (0)	0.05 (0.05)
Dorosoma petenense	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Esox americanus	0 (0)	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Eucinostomus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Farfantepenaeus aztecus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gambusia holbrooki	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobionellus oceanicus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Gobiosoma sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Lagodon rhomboides	0 (0)	0 (0)	0 (0)	0 (0)	0.17 (0.09)	7.32 (6.07)	0 (0)	0.05 (0.05)
Leiostomus xanthurus	0 (0)	0 (0)	0.11 (0.11)	0 (0)	27.22 (5.68)	1.26 (0.57)	8.44 (3.65)	3.50 (1.23)
Lepomis macrochirus	0.11 (0.11)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia beryllina	1.39 (0.97)	0.22 (0.22)	6.89 (6.54)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia menidia	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Menidia sp.	0 (0)	0 (0)	0 (0)	0 (0)	7.28 (3.11)	0 (0)	0 (0)	0 (0)
Mugil cephalus	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.39 (0.39)	0.17 (0.17)
Palaemonetes pugio	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)	0 (0)
Panopeus herbstii	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Panopeus sp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys dentatus	0.33 (0.16)	0.56 (0.23)	0 (0)	1.29 (0.50)	0 (0)	0 (0)	0 (0)	0 (0)
Paralichthys sp.	0 (0)	0 (0)	0 (0)	0 (0)	0.56 (0.20)	1.47 (0.54)	0.17 (0.12)	2.05 (0.48)
Procambarus robostus	0 (0)	0 (0)	0.06 (0.06)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Rhithropanopeus harrisii	0 (0)	0 (0)	0 (0)	0.24 (0.14)	0 (0)	0 (0)	0 (0)	0 (0)
Trinectes maculatus	0.33 (0.20)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0.11 (0.08)
Uca pugnax	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
U/I larval fish	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

Table 7.4-18. Comparison of species richness by year for fall Breder trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE
Smith Creek (P11)	8.41(0.0001)	02^{a} 01^{b} 99^{bc} 03^{bc} 04^{bc} 06^{bc} 05^{bc} 00^{c}
Rat Island (P12)	6.07(0.0001)	05^{a} 00^{b} 02^{b} 06^{b} 99^{b} 04^{b} 03^{b} 01^{b}
Fishing Creek (P13)	3.80(0.0006)	04^{a} 05^{ab} 99^{abc} 02^{abc} 06^{bc} 03^{bc} 00^{bc} 01^{c}
Town Creek Mouth (P2)	14.55(0.0001)	02^{a} 05^{b} 04^{c} 00^{cd} 06^{cd} 01^{cd} 99^{cd} 03^{d}
Inner Town Creek (P3A)	5.54(0.0001)	03^{a} 01^{ab} 02^{ab} 00^{abc} 99^{bc} 05^{bc} 04^{bc} 06^{c}
Inner Town Creek (P3B)	13.49(0.0001)	02^{a} 00^{a} 99^{b} 06^{b} 03^{b} 01^{b} 04^{b} 05^{b}
Eagle Island (P6)	7.04(0.0001)	05^{a} 03^{ab} 02^{ab} 01^{ab} 04^{abc} 00^{bc} 99^{c} 06^{c}
Indian Creek (P7)	1.92 NS	
Dollisons Landing (P8)	3.81(0.006)	03^{a} 04^{ab} 02^{ab} 05^{ab} 06^{abc} 99^{abc} $00b^{c}$ 01^{c}

Table 7.4-19. Comparison of species richness by year for spring Breder trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE
Smith Creek (P11)	18.39 (0.0001)	06^{a} 05^{a} 07^{a} 04^{b} 02^{ab} 03^{c} 00^{c} 01^{c}
Rat Island (P12)	15.67(0.0001)	05^{a} 06^{b} 01^{c} 07^{c} 04^{c} 00^{c} 02^{c} 03^{c}
Fishing Creek (P13)	8.64(0.0001)	04^{a} 06^{b} 07^{b} 05^{b} 01^{b} 03^{b} 00^{c}
Town Creek Mouth (P2)	20.98(0.0001)	05^{a} 04^{b} 07^{b} 06^{b} 00^{b} 01^{c} 02^{c} 03^{c}
Inner Town Creek (P3A)	3.45(0.002)	04^{a} 00^{ab} 02^{ab} 03^{ab} 06^{ab} 05^{ab} 01^{ab} 07^{b}
Inner Town Creek (P3B)	4.26(0.0002)	05^{a} 06^{a} 02^{a} 07^{a} 01^{a} 04^{a} 00^{ab} 03^{b}
Eagle Island (P6)	14.95(0.0001)	06^{a} 04^{b} 05^{b} 07^{c} 03^{c} 02^{c} 01^{c} 00^{c}
Indian Creek (P7)	11.60(0.0001)	01^{a} 04^{a} 05^{ab} 06^{bc} 00^{bc} 07^{bc} 03^{cd} 02^{d}
Dollisons Landing (P8)	4.73(0.0001)	04^{a} 01^{ab} 06^{abc} 05^{abcd} 00^{bcd} 07^{cd} 03^{cd} 02^{d}

Table 7.4-20. Comparison of species diversity by year for fall Breder trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE
Smith Creek (P11)	6.14(0.0001)	02^{a} 01^{b} 99^{b} 03^{b} 06^{b} 00^{b} 04^{b} 05^{b}
Rat Island (P12)	2.43(0.02)	05^{a} 02^{ab} 99^{ab} 04^{ab} 00^{b} 01^{b} 06^{b} 03^{b}
Fishing Creek (P13)	1.13 NS	
Town Creek Mouth (P2)	5.90(0.0001)	02^{a} 05^{b} 04^{b} 99^{b} 01^{b} 06^{b} 00^{b} 03^{b}
Inner Town Creek (P3A)	3.25(0.003)	03^{a} 02^{ab} 01^{ab} 00^{ab} 99^{ab} 05^{ab} 06^{b} 04^{b}
Inner Town Creek (P3B)	6.45(0.0001)	02^{a} 00^{ab} 06^{b} 03^{b} 99^{b} 01^{b} 04^{b} 05^{b}
Eagle Island (P6)	1.64 NS	
Indian Creek (P7)	0.81 NS	
Dollisons Landing (P8)	1.57 NS	

Table 7.4-21. Comparison of species diversity by year for spring Breder trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE
Smith Creek (P11)	4.82(0.0001)	05^{a} 02^{ab} 06^{ab} 07^{b} 01^{b} 03^{b} 00^{b} 04^{b}
Rat Island (P12)	10.82(0.0001)	05^{a} 06^{b} 01^{b} 02^{b} 07^{b} 00^{b} 04^{b} 03^{b}
Fishing Creek (P13)	3.55(0.003)	04^{a} 07^{ab} 05^{ab} 06^{ab} 01^{b} 00^{b} $03^{b}02^{b}$
Town Creek Mouth (P2)	18.59(0.0001)	05^{a} 04^{b} 00^{c} 07^{c} 06^{cd} 01^{d} 02^{d} 03^{d}
Inner Town Creek (P3A)	2.35(0.03)	04^{a} 00^{ab} 03^{ab} 02^{ab} 05^{ab} 01^{b} 06^{b} 07^{b}
Inner Town Creek (P3B)	4.07(0.0003)	05^{a} 06^{ab} 02^{ab} 07^{ab} 01^{b} 04^{b} 00^{b} 03^{b}
Eagle Island (P6)	5.25(0.0001)	06^{a} 05^{ab} 07^{abc} 04^{abc} 02^{bc} 03^{bc} 00^{bc} 01^{c}
Indian Creek (P7)	7.11(0.0001)	04^{a} 01^{a} 05^{ab} 00^{bc} 07^{bc} 06^{c} 02^{c} 03^{c}
Dollisons Landing (P8)	0.52 NS	

Table 7.4-22. Comparison of total abundance by year for fall Breder trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE
Smith Creek (P11)	3.37(0.002)	99^{a} 02^{ab} 03^{b} 01^{b} 04^{b} 05^{b} 06^{b} 00^{b}
Rat Island (P12)	3.53(0.002)	05^{a} 00^{ab} 06^{abc} 02^{abc} 03^{abc} 99^{abc} 04^{bc} 01^{c}
Fishing Creek (P13)	3.13(0.004)	05^{a} 99^{a} 04^{a} 02^{a} 06^{a} 03^{a} 00^{a} 01^{a}
Town Creek Mouth (P2)	30.47(0.0001)	02^{a} 05^{b} 04^{b} 00^{b} 06^{b} 01^{b} 99^{b} 03^{b}
Inner Town Creek (P3A)	4.43(0.0001)	03^{a} 02^{ab} 01^{abc} 00^{abc} 05^{abc} 99^{bc} 04^{c} 06^{c}
Inner Town Creek (P3B)	11.17(0.0001)	02^{a} 00^{a} 06^{b} 03^{b} 99^{b} 04^{b} 01^{b} 05^{b}
Eagle Island (P6)	2.21(0.04)	01^{a} 02^{a} 05^{a} 03^{a} 00^{a} 04^{a} 06^{a} 99^{a}
Indian Creek (P7)	2.96(0.006)	02^{a} 04^{ab} 03^{ab} 99^{ab} 05^{ab} 06^{b} 01^{b} 00^{b}
Dollisons Landing (P8)	4.55(0.0001)	04^{b} 03^{ab} 02^{ab} 05^{b} 06^{b} 99^{b} 00^{b} 01^{b}

Table 7.4-23. Comparison of total abundance by year for spring Breder trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE
Smith Creek (P11)	19.07(0.0001)	07^{a} 06^{b} 05^{bc} 04^{cd} 02^{d} 00^{d} 03^{d} 01^{d}
Rat Island (P12)	16.40(0.0001)	06^{a} 05^{a} 03^{b} 04^{b} 07^{b} 01^{b} 00^{b} 02^{b}
Fishing Creek (P13)	7.59(0.0001)	04^{a} 06^{b} 01^{b} 07^{b} 05^{b} 03^{b} 00^{b}
Town Creek Mouth (P2)	24.71(0.0001)	07^{a} 06^{a} 00^{b} 05^{bc} 04^{bc} 01^{c} 03^{c} 02^{c}
Inner Town Creek (P3A)	3.12(0.003)	06^{a} 04^{b} 05^{b} 00^{b} 01^{b} 02^{b} 03^{b} 07^{b}
Inner Town Creek (P3B)	3.10(0.004)	06^{a} 02^{ab} 07^{ab} 04^{ab} 05^{ab} 01^{ab} 00^{b} 03^{b}
Eagle Island (P6)	17.14(0.001)	06^{a} 04^{b} 05^{c} 07^{c} 03^{c} 02^{c} 01^{c} 00^{c}
Indian Creek (P7)	6.69(0.0001)	01^{a} 05^{b} 04^{bc} 00^{bc} 07^{bc} 06^{bc} 03^{c} 02^{c}
Dollisons Landing (P8)	1.29 NS	

Table 7.4-24. Comparison of species richness by year for fall drop trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE (high to low)
Smith Creek (P11)	4.19(.0003)	00^{a} 01^{b} 02^{b} 03^{b} 05^{b} 06^{b} 04^{b} 99^{b}
Rat Island (P12)	4.98(.0001)	05^{a} 06^{ab} 01^{bc} 00^{bc} 02^{bc} 03^{bc} 04^{bc} 99^{c}
Fishing Creek (P13)	3.45(.002)	06^{a} 02^{ab} 03^{ab} 04^{ab} 00^{ab} 01^{b} 05^{b} 99^{b}
Town Creek mouth (P2)	4.82(.0001)	05^{a} 03^{ab} 04^{bc} 02^{bc} 01^{bc} 06^{bc} 00^{bc} 99^{c}
Town Creek Inner (P3)	9.96(.0001)	04^{a} 03^{a} 06^{b} 99^{b} 02^{b} 00^{b} 05^{b} 01^{b}
Eagle Island (P6)	4.77(.0001)	04^{a} 05^{ab} 00^{ab} 03^{abc} 02^{abc} 06^{bc} 99^{bc} 01^{c}
Indian Creek (P7)	4.49(.0002)	03^{a} 04^{b} 01^{b} 00^{b} 05^{b} 06^{b} 02^{b} 99^{b}
Dollisons Landing (P8)	7.83(.0001)	03^{a} 04^{a} 06^{b} 05^{b} 02^{b} 99^{b} 00^{b} 01^{b}

Table 7.4-25. Comparison of species richness by year for spring drop trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE (high to low)
Smith Creek (P11)	5.37(.0001)	04^{a} 03^{ab} 05^{abc} 02^{abc} 06^{bc} 00^{c} 07^{c} 01^{c}
Rat Island (P12)	9.74(.0001)	06^{a} 05^{ab} 07^{bc} 04^{bc} 02^{bc} 03^{cd} 01^{cd} 00^{d}
Fishing Creek (P13)	11.35(.0001)	04^{a} 05^{b} 07^{b} 06^{bc} 01^{bc} 00^{c} 03^{c} 02^{c}
Town Creek mouth (P2)	3.11(.005)	02^{a} 05^{b} 03^{b} 07^{b} 00^{b} 01^{b} 04^{b} 06^{b}
Town Creek Inner (P3)	9.10(.0001)	04^{a} 02^{ab} 06^{ab} 05^{bc} 00^{bc} 07^{bc} 01^{c} 03^{d}
Eagle Island (P6)	12.55(.0001)	04^{a} 05^{ab} 06^{ab} 07^{bc} 01^{bc} 02^{bc} 03^{c} 00^{d}
Indian Creek (P7)	13.36(.0001)	04^{a} 07^{b} 06^{b} 03^{b} 05^{bc} 00^{bc} 01^{bc} 02^{c}
Dollisons Landing (P8)	7.83(.0001)	04^{a} 06^{b} 07^{b} 03^{bc} 05^{bc} 02^{bc} 01^{c} 00^{c}

Table 7.4-26. Comparison of species diversity by year for fall drop trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE (high to low)
Smith Creek (P11)	5.49(.0001)	00^{a} 01^{b} 05^{b} 06^{b} 02^{b} 03^{b} 04^{b} 99^{b}
Rat Island (P12)	6.38(.0001)	05^{a} 06^{ab} 01^{bc} 00^{bc} 02^{c} 03^{c} 04^{c} 99^{c}
Fishing Creek (P13)	1.74(NS)	
Town Creek mouth (P2)	4.11(.0004)	05^{a} 03^{ab} 02^{bc} 01^{bc} 04^{bc} 06^{bc} 00^{bc} 99^{c}
Town Creek Inner (P3)	5.55(.0001)	04^{a} 03^{ab} 99^{bc} 02^{bc} 06^{bc} 00^{bc} 05^{c} 01^{c}
Eagle Island (P6)	2.15(.04)	04^{a} 00^{ab} 05^{ab} 03^{ab} 06^{ab} 02^{ab} 99^{ab} 01^{b}
Indian Creek (P7)	3.43(.002)	03^{a} 00^{b} 04^{b} 06^{b} 01^{b} 05^{b} 99^{b} 02^{b}
Dollisons Landing (P8)	4.80(.0001)	03^{a} 04^{ab} 06^{bc} 02^{c} 05^{c} 00^{c} 01^{c} 99^{c}

Table 7.4-27. Comparison of species diversity by year for spring drop trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE (high to low)
Smith Creek (P11)	5.75(.0001)	02^{a} 03^{ab} 04^{abc} 05^{abc} 00^{abcd} 06^{bcd} 01^{cd} 07^{d}
Rat Island (P12)	3.75(.001)	06^{a} 02^{ab} 05^{abc} 04^{abc} 03^{abc} 07^{abc} 01^{bc} 00^{c}
Fishing Creek (P13)	6.57(.0001)	04^{a} 05^{a} 07^{ab} 01^{bc} 00^{bc} 06^{bc} 03^{c} 02^{c}
Town Creek mouth (P2)	0.74(NS)	
Town Creek Inner (P3)	3.61(.002)	06^{a} 04^{a} 02^{a} 00^{a} 01^{ab} 05^{ab} 07^{ab} 03^{b}
Eagle Island (P6)	6.23(.0001)	04^{a} 06^{a} 05^{ab} 01^{ab} 02^{ab} 03^{abc} 07^{bc} 00^{c}
Indian Creek (P7)	6.41(.0001)	04^{a} 07^{b} 03^{bc} 00^{bc} 06^{bc} 05^{bc} 01^{bc} 02^{c}
Dollisons Landing (P8)	3.68(.001)	04^{a} 06^{ab} 07^{ab} 02^{ab} 05^{ab} 03^{b} 01^{b} 00^{b}

Table 7.4-28. Comparison of total abundance by year for fall drop trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE (high to low)
Smith Creek (P11)	4.73(.0001)	00^{a} 01^{b} 02^{b} 03^{b} 04^{b} 05^{b} 06^{b} 99^{b}
Rat Island (P12)	4.21(.0003)	05^{a} 06^{a} 01^{ab} 00^{ab} 04^{ab} 03^{ab} 02^{ab} 99^{b}
Fishing Creek (P13)	3.49(.002)	02^{a} 06^{ab} 03^{ab} 01^{b} 04^{b} 00^{b} 05^{b} 99^{b}
Town Creek mouth (P2)	4.17(.0003)	05^{a} 03^{ab} 04^{b} 02^{b} 01^{b} 06^{b} 00^{b} 99^{b}
Town Creek Inner (P3)	6.74(.0001)	04^{a} 03^{a} 99^{ab} 00^{bc} 06^{bc} 02^{bc} 05^{bc} 01^{c}
Eagle Island (P6)	6.27(.0001)	04^{a} 00^{ab} 05^{ab} 02^{bc} 03^{bc} 06^{c} 99^{c} 01^{c}
Indian Creek (P7)	7.56(.0001)	03^{a} 04^{b} 00^{b} 01^{b} 05^{b} 06^{b} 02^{b} 99^{b}
Dollisons Landing (P8)	6.67(.0001)	03^{a} 04^{b} 05^{b} 99^{bc} 02^{bc} 06^{bc} 01^{bc} 00^{c}

Table 7.4-29. Comparison of total abundance by year for spring drop trap samples.

SITE	F(p)	SNK OF F SIGNIFICANCE (high to low)
Smith Creek (P11)	4.99(.0001)	04^{a} 03^{ab} 06^{abc} 07^{abc} 05^{abcd} 01^{bcd} 02^{cd} 00^{d}
Rat Island (P12)	21.41(.0001)	06^{a} 07^{ab} 05^{bc} 03^{cd} 04de 02de 01^{ef} 00^{f}
Fishing Creek (P13)	15.14(.0001)	04^{a} 06^{b} 05^{b} 07^{b} 01^{c} 00^{c} 03^{c} 02^{c}
Town Creek mouth (P2)	4.76(.0001)	02^{a} 01^{ab} 03^{abc} 05^{abc} 00^{bc} 07^{bc} 04^{bc} 06^{c}
Town Creek Inner (P3)	18.25(.0001)	04^{a} 07^{ab} 05^{ab} 02^{ab} 05^{b} 00^{c} 01^{cd} 03^{d}
Eagle Island (P6)	13.75(.0001)	07^{a} 04^{a} 06^{a} 05^{ab} 01^{b} 02^{b} 03^{b} 00^{c}
Indian Creek (P7)	21.70(.0001)	04^{a} 06^{b} 07^{bc} 03^{bcd} 05^{bcd} 01^{cd} 00^{cd} 02^{d}
Dollisons Landing (P8)	9.74(.0001)	04^{a} 06^{b} 07^{bc} 05^{bc} 03^{bc} 02^{bc} 00^{bc} 01^{bc}

8.0 SENSITIVE HERBACEOUS VEGETATION SAMPLING

8.1 Summary

Monitoring of sensitive herbaceous vegetation at seven stations in the Cape Fear River estuary was completed for the seventh year in 2006. Conditions this year at each of the seven sites varied relative to the effects of salinity changes experienced through the year. Changes this year have been largely those anticipated.

At the Inner Town Creek (P3) the dominant sensitive herbaceous species, *Zizaniopsis miliacea*, has expanded toward Town Creek where it is currently mixing with *Spartina cynosuroides*, a species more regularly associated with margins of more saline creeks. The *Zizaniopsis miliacea* has largely ceased expansion to the east, but appears to be moving north toward the northern boundary of the belt transect. This year the polygon has increased in size by about 2,000 ft^2. *Zizania aquatica*, appeared last year for the first time in the center of the older portion of the sensitive herbaceous vegetation polygon. This species, more of an indicator of oligohaline conditions, is continuing to survive. No new species were noted within the polygon this year. Strong salinity events during the late summer and early fall of 2005 may or may not have had a direct effect on the course of vegetation within the polygon during the growing season of 2006.

The sensitive herbaceous vegetation polygon at Indian Creek (P7) has continued to erode at times of falling tide following the initiation of regular human traffic in the area. Current vegetation existing in this permanent plot continues to diminish in total cover. *Saururus cernuus* has declined after a maximum cover during the 2004 sampling year. *Polygonum virginicum* has disappeared from within the plot, but was seen this year just outside. *Phanopyrum gymnocarpum*, *Chasmanthium latifolium* (typically a flood plain forest species) and *Hymenocallis crassifolia* have increased. *Hymenocallis* may seem more abundant because of the increasing lack of cover throughout the plot and erosion of its underground structures. The clearing includes the entire sampling station. A low level salinity event occurring along the Cape Fear River during late summer low freshwater flow likely had little immediate effect on vegetation. The plot for monitoring sensitive herbaceous vegetation at Dollisons Landing (P8) contains two new species, *Hydrocotyle verticillata* and *Lycopus virginicus.* Both species are characteristic of wooded freshwater wetlands, but the former is usually in non-tidal habitats and the latter is often associated with low hummocks or rotten stumps. *Saururus cernuus* contributes somewhat less cover this year than in most recently past years. Reasons for this decrease in cover and the other minor variations in sensitive herbaceous species occurrences are unknown. The very slight salinity event during September of 2005 in the river at Dollisons Landing may or may not have had a significant effect in the plot. The sensitive herbaceous vegetation plot at Black River (P9) has experienced no apparent salinity events and has remained much the same as last year with the exception of the loss of *Ludwigia palustris*. Since the plot was relocated last year *Boehmeria cylindrica* has also appeared. *Saururus cernuus* remains the dominant species in the plot. The boundaries of Rat Island (P12) sensitive herbaceous vegetation plot have remained fixed since last year and dominance is still largely shared between *Schoenoplectus americanus*, the sensitive herbaceous species, and *Spartina cynosuroides*, the non-sensitive herbaceous species.

Cover by live stems of *Schoenoplectus americanus* is down from 90 percent last year to 50 percent this year. This year many of the stems of this species have fallen or show signs of stress, perhaps from salinity events that occurred late last year. There are no new sensitive herbaceous plant species this year, but *Peltandra virginica* is again visible. Salinity events late last year were strongly evident and have functioned in maintaining the sulfate reducing status of this plot. The habitat is continuing to be controlled by the mesohaline environment in the Northeast Cape Fear River. Further up stream along the Northeast Cape Fear River the Fishing Creek (P13) sensitive herbaceous polygon has shown a loss of cover by the long dominant *Pontederia cordata*. This year, for the first time, *Peltandra virginica*, thought to be tolerant of slightly more saline habitats, became the overall dominant plant in the plot. This shift along with a slow increase in diversity at the site may indicate a slight shift toward more brackish conditions. No significant salinity event was detected at the Prince George Creek (P14) monitoring station and the sensitive herbaceous polygon remains much as it was last year, with the exception of aberrations in GPS data. GPS data collected from tidal swamps continue to show results of multipath or deflection of satellite signals and should not be considered adequate for detecting minor polygon changes in size and shape.

8.2 Introduction and Background

It has been assumed as a basis for monitoring vegetation that the effects of flooding and salinity influence the health, viability and species content of plants in the Cape Fear Estuary. In this regard seven stations have been examined annually since 2000 for the purpose of assessing plant species content and percent cover (Table 8.2-1). The current report applies to the seventh year of sensitive herbaceous vegetation data collection during 2006.

Each of the monitoring stations is subject to the astronomical tides experienced within the lower Cape Fear River estuarine system. Six of the seven stations, during the seven years of the sampling, have experienced exposure to ocean-derived salt carried by tidal flooding. Ocean-derived salts have not been documented at Black River, the uppermost Cape Fear River station. Generalized vegetation zones along 50-meter wide transects extending from the tidal shore line to the upland at each station were defined and described as a part of an earlier report (CZR Incorporated 2001). Methods and results from past years' of sensitive herbaceous species sampling and observations at the seven stations are covered in earlier reports (CZR Incorporated 2001 2002; Hackney 2002a, 2002b, 2003, 2004, 2005, and 2006).

Table 8.2-1. Locations, streams and numbers for sensitive herbaceous vegetation monitoring stations in the Wilmington Harbor monitoring project, Cape Fear River Estuary, North Carolina

Station Name	Stream Name	Station Number
Inner Town Creek	Town Creek	P3
Indian Creek	Cape Fear River	P7
Dollisons Landing	Cape Fear River	P8
Black River	Cape Fear River (near Black River)	P9
Rat Island	Northeast Cape Fear River	P12
Fishing Creek	Northeast Cape Fear River	P13
Prince George Creek	Northeast Cape Fear River	P14

8.3 Methodology

Data collection methods remain largely the same as those used during previous years of sensitive herbaceous vegetation sampling (CZR Incorporated 2002, Hackney 2002a, 2002b, 2003, 2004, 2005, and 2006). This year's data for plant species presence and percent cover were gathered from four variable plots and three fixed plots. Percent cover data from previous years were not consulted immediately prior to assessment of conditions for the current year. Assessments are made in the field independent of pre-existing data.

Variable polygons were sampled at Inner Town Creek (P3), Rat Island (P12), Fishing Creek (P13), and Prince George Creek (P14) and are used below to demonstrate yearly changes in size, shape, and plant species cover. These variable-size plots have boundaries created by on-site delineations of recognizable assemblages of sensitive herbaceous species. Polygons at three stations with fixed, four-sided plots were chosen because they best represented larger, more widespread sensitive herbaceous vegetation assemblages. Last year the variable plot at Black River (P9) was converted to a permanent, four-sided plot for the same reason. The original plots being monitored at this site were abandoned because flooding interfered with the species being monitored (Hackney 2005). Permanent plots also occur at Indian Creek (P7) and Dollisons Landing (P8) (CZR Incorporated 2001). Although the plot at Rat Island (P 12) is a variable plot, its shape and size have remained unchanged since it became dominated by salt-tolerant plant species.

Sampling stations were visited during the first week of August 2006, while wetland herbaceous vegetation was at its optimum seasonal development. Polyvinyl chloride (PVC) stakes were added, moved, or removed at three sites in order to remark polygons for the current iteration of sampling. Each stake was renumbered and flagged as necessary. At each station plant species seen in each polygon were listed and their

contributed cover percentages were estimated and recorded. Position data of the PVC stakes were recorded using GPS (Global Positioning System) January 23 and 24, 2007 at the three stations. Details of the GPS data gathering process are covered in earlier reports (Hackney 2002a and 2002b).

It appears that multipath problems (those associated with reflection of the GPS signals before reaching the antenna) are still being experience at forested sites. More will be said of these problems in the later sections.

Field personnel responsible for gathering sensitive herbaceous vegetation data and GPS data have not changed since the inception of the project. The same personnel are responsible for analysis and reporting.

8.4 Hydrologic Events and Sensitive Vegetation

The effects of past hydrological events on habitats, growth, and distribution of sensitive herbaceous plant species are being monitored and assessed in tidal marsh and swamp forest communities (Hackney 2005). The changes in growth, contraction, or expansion of several perennial species apparently relative to salinity events within various plots have been remarkable.

Polygon sizes are presented below for each monitoring year (Table 8.41-1). Data covering sensitive herbaceous vegetation are presented below for each of the sampling stations (Tables 8.41-2 through 8.47-1). Polygon configurations are presented for the baseline year (2000), last year (2005), and the current year (2006) (Figures 8.41-1 through 8.47-1). Discussions may allude to interim data. Data from interim years of sensitive herbaceous vegetation sampling are presented in previous reports (CZR Incorporated 2001 and 2002; Hackney 2002a, 2002b, 2003, 2004, 2005, and 2006) and will be referenced as needed in the text.

Additional variables considered important during collection and presentation of the data are discussed for each station. Some of these variables include: 1) changes in sensitive herbaceous species, 2) shifts in dominance of sensitive herbaceous species, 3) changes in cover contributions of sensitive herbaceous species within delineated polygons, 4) variations in shapes and sizes of polygons, 5) habitat-related hydrological factors and, 6) plant characteristics of special importance in vegetation change within the plots.

8.41 Inner Town Creek

Cover by the dominant sensitive herbaceous species, *Zizaniopsis miliacea*, at the Inner Town Creek site has expanded greatly beyond the area measurements obtained in previous years (Table 8.41-2, Figure 8.41-1). Pre-existing boundaries that occurred near the originally marked clone have coalesced and outlier stems have all merged into one large polygon over 5,500 ft^2 in size. This expansion was anticipated last year and now includes the southern part of the levee that once separated the main area of sensitive

herbaceous vegetation from that growing along the bank of Town Creek (Figure 8.41-1). Only a small patch of the polygon, resembling a doughnut hole, has apparently not been invaded by *Zizaniopsis miliacea*. Rhizomes that possibly now are under this area may produce subaerial stems by next year.

Continued northerly expansion of the polygon and union with existing stands dominated by *Zizaniopsis miliacea* is anticipated. However, *Zizaniopsis miliacea* is already co-dominant with *Spartina cynosuroides* that is abundant along the banks of Town Creek. Substrate in the area of the polygon adjacent to substation one (red dot closest to the creek, Figure 8.41-1) has been heavily disturbed by foot traffic along a trail providing access between substations. These regularly perturbed substrate soils do not currently favor growth of *Zizaniopsis miliacea* though its rhizomes may pass through the disturbed area. A second trail used twice yearly to access the southeastern tip of the polygon may prevent eastern expansion.

Substrate to the east of this latter trail experiences surface retention of tidal waters that may undergo some evaporation and affect increased salinity or concentration of sulfates in the soils. Immediately east of the polygon access trail to the southeastern tip of the polygon, *Schoenoplectus robustus* is a dominant species and is scattered with *Schoenoplectus tabernaemontani*. Both of these species are scattered within the polygon. However, these latter species are not considered sensitive herbaceous species.

Other species occurring within the polygon are also of importance. Along the eastern half of the polygon *Zizaniopsis miliacea* occurs less densely. Here as well *Typha angustifolia*, not considered a sensitive herbaceous species, is co-dominant. As indicated last year, a small stand of *Zizania aquatica*, traditional wild rice, has taken root in the southern center of the polygon just east of the levee (Hackney 2006). It is interesting that the area in which the wild rice occurs is the most thoroughly watered portion of the polygon along the small tidal stream that allows regular flooding of the polygon. The substrate here is more of a thick suspension than a consolidated substrate. *Sagittaria lancifolia*, near this area, now constitutes less cover, but much of the apparent decrease is an artifact of the increase in size of the polygon. The same is true for *Peltandra virginica*. Cover by *Carex hyalinolepis* has remained about the same.

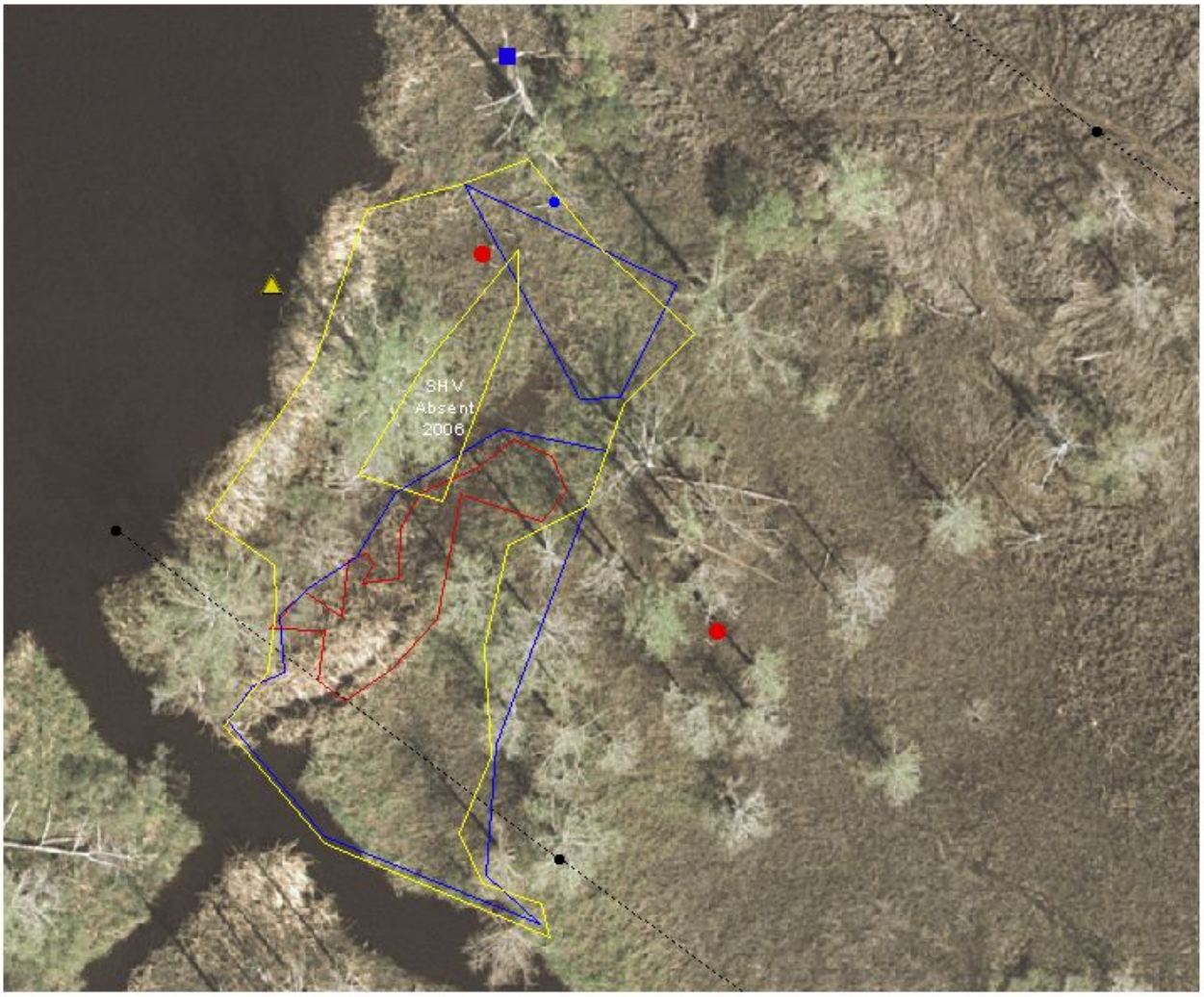
Table 8.41-1. Comparisons of areas (ft^2) of sensitive herbaceous vegetation polygons for years 2000-2006 at sensitive herbaceous vegetation monitoring stations, Wilmington Harbor monitoring project, North Carolina.

Station	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Inner Town Creek (P3)	710.0	1,552.5	1,311.0	1,326.0	1,518.1	3,619.2	5,595.4
Indian Creek (P7)	129.8	129.8	281.9 [a]	281.9	281.9	281.9	281.9
Dollisons Landing (P8)	404.5	404.5	286.1 [a]	286.1	286.1	286.1	286.1
Black River (P9)	431.0	1,120.0	913.0	567.8	69.5	251.8[b]	251.8
Rat Island (P12)	532.9	532.9	532.9	532.9	532.9	532.9	532.9
Fishing Creek (P13)	1,522.2	1,646.1	971.9	682.1	2,506.3	2,272.8	2,305.3
Prince George Creek (P14)	3,931.2	36,631.3	5,190.2	5,265.4	5,227.2	5,245.9	4,654.3

[a] Changes in area are an artifact of shift to winter GPS data collection (Hackney 2003).
[b] Polygon moved to new location.

Table 8.41-2. Comparisons of percent cover contributions by sensitive herbaceous species in major (and outlier) polygons at the Inner Town Creek Station (P3) for years 2000-2006, Wilmington Harbor monitoring project, Town Creek, North Carolina.

Species	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Zizaniopsis miliacea	70	60	20	50	60 (20)	55 (5)	50
Sagittaria lancifolia	5	20	5	10	10	10 (30)	2
Peltandra virginica	3	<1	<1	10	<1 (--)	<5 (<1)	1
Carex hyalinolepis	1	10	10	40	1	<5	2
Schoenoplectus americanus	--	--	10	10	10	>1 (<1)	1
Zizania aquatica	--	--	--	--	--	-- (<1)	1



LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON 2006
- SENSITIVE HERBACEOUS VEGETATION OUTLIER 2005
- SENSITIVE HERBACEOUS VEGETATION POLYGONS 2005
- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2000
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNDARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

30 0 30 60 Feet

4 0 4 8 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

COMPARISON OF SENSITIVE HERBACEOUS VEGETATION POLYGONS FROM YEARS 2000, 2004, 2005 AND 2006 AT STATION P3 (INNER TOWN CREEK), WILMINGTON HARBOR MONITORING PROJECT, TOWN CREEK, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE:TC06.APR	APPROVED BY: CTH	#CFRM-7
DRAWN BY: DMD	DATE: 05 FEBRUARY 2007	FIGURE 8.41-1

Occurrences of other species within and outside the polygon are also changing. *Spartina cynosuroides*, which has been present within the polygon for the last two years, now dominates an area along the southwestern edge of the polygon at the corner of the creek and the old irrigation ditch (Figure 8.41-1). This species also occurs interspersed with *Zizaneopsis miliacea* along the bank of Town Creek.

Along the southern half of the levee, several species have not yet disappeared from the remnants of the old swamp forest. *Taxodium ascendens* stems were killed by the last major salinity event in 2001and 2002. *Rosa palustris* is almost dead, but a few stems are still alive. *Baccharis halimifolia* had invaded several years ago before the inception of this project and is now diminishing. *Morella cerifera* is still present. *Ampelopsis arborea, Parthenocisus quinquifolius* and *Toxicodendron radicans* are surviving.

During the past year monthly salinity values in Town Creek averaged greater that 16 ppt from June to November of 2005 and just over 7 from December of 2005 to July of 2006. The monthly average during September was just over 19 ppt. The mean for November was almost 31 ppt. The yearly average of maximum salinity values in Town Creek (Hackney 2006 and additional data provided by Dr. Lynn Leonard for June and July 2006) roughly place the salinity for the period prior to vegetation sampling in the medium mesohaline range (5-18 ppt, Cowardin, et al. 1979). Monthly mean salinity highs of 19.2 ppt in September and 30.7 ppt in November may or may not have had any significant effect on existing vegetation since these values were realized at the close of the growing season. Neither surface salinity (conductivity) data collected from substations near Town Creek nor biogeochemical data (chloride) indicate clearly that these riverine salinity events influenced adjacent wetlands (Hackney 2006).

8.42 Indian Creek

The combination of a low levee along the Cape Fear River and presence of flood plain forest species lends this site certain characteristics of a brown water flood plain. Dominant swamp forest species dictate the character of a southeastern coastal swamp. Essentially both characteristics combine in a diminishing order as one progresses up stream. Further up stream, characteristics of an alluvial flood plain paralleling a brown water river rising in the piedmont become more abundant as the characteristics of a tidal swamp forest diminish. Species that occupy both flood plain and tidal swamp forests are common in the sensitive herbaceous polygon at this site. However, as time has passed and the pedestrian traffic has continued through the site, both groups have deteriorated (Table 8.42-1, Figure 8.42-1). The polygon was located in an area that was prone to erosion.

Saururus cernuus has declined after a maximum cover during the 2004 sampling year. *Polygonum virginicum* has disappeared from within the plot, but was seen this year just outside. *Phanopyrum gymnocarpum*, *Chasmanthium latifolium* (typically a flood plain forest species), and *Hymenocallis crassifolia* have increased. *Hymenocallis* may seem more abundant because of the increasing lack of cover throughout the plot and

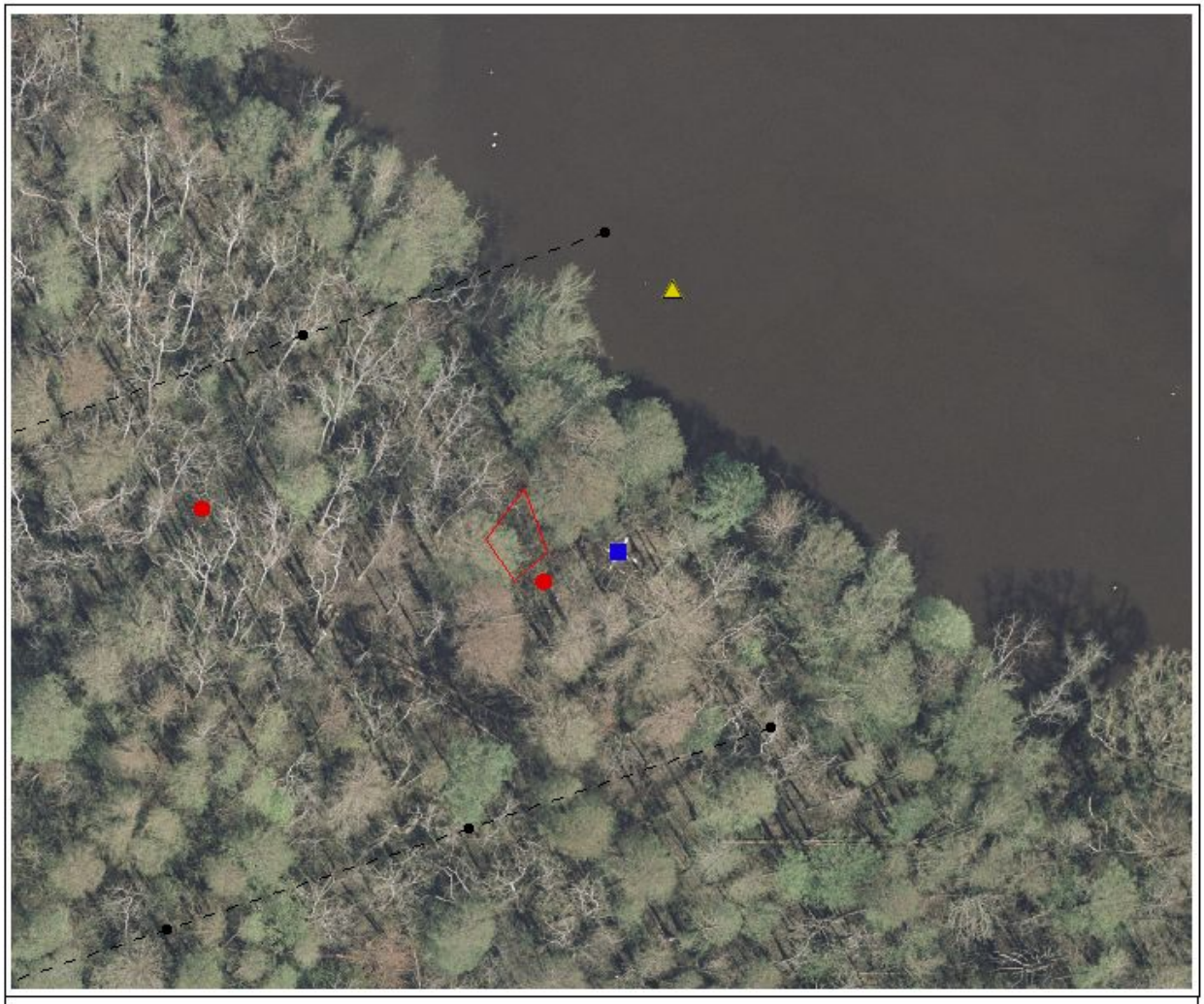
erosion of its underground structures. No new sensitive herbaceous species were seen in the plot this year, but *Lycopus virginicus* once again became visible. Overall cover within the plot has diminished considerably due to loss of substrate from erosion. *Polygonum arifolium*, a relatively abundant annual, was found for the first time in the plot. *Impatiens capensis*, also an annual, was also present along with *Clematis crispa*. *Clematis* was seen for the first time growing from a rotting stump that projected above the regularly flooded surface of the substrate. *Carex amphibole* is abundant on stumps and hummocks. A young stem of *Smilax rotundifolia* and the usual tangle of *Campsis radicans* comprised the dominant woody species seen in the plot.

Table 8.42-1. Comparisons of percent cover contributions by sensitive herbaceous species in the sampling polygon at the Indian Creek Station (P7) for years 2000-2006, Wilmington Harbor monitoring project, Cape Fear River, North Carolina.

Species	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Saururus cernuus	2	1	--	2	20	1	5
Cicuta maculata	5	2	<1	2	1	1	2
Polygonum punctatum	<1	<1	--	--	<1	<1	<1
Commelina virginica	<1	2	1	<1	--	<1	<1
Carex crinita var. *brevicrinus*	<1	<1	10	--	--	<1	1
Carex hyalinolepis	<1	2	--	1	<1	<1	<1
Symphyotrichum elliottii	<1	--	--	--	--	<1	<1
Triadenum walteri	<1	<1	--	--	--	--	--
Lycopus virginicus	<1	--	--	--	--	--	<1
Galium sp.	<1	--	--	--	--	--	--
Phanopyrum gymnocarpum	--	<1	2	1	1	1	2
Peltandra virginica	--	--	<1	--	--	--	--
Boehmeria cylindrica	--	<1	--	--	--	<1	<1
Polygonum virginianum	--	--	--	1	--	<1	--
Chasmanthium latifolium	--	--	--	1	--	<1	2
Hymenocallis floridana	--	--	--	--	<1	<1	2
Cinna arundinacea	--	--	--	--	<1	<1	--

A low-level salinity event was recorded in the Cape Fear River DCP during September of 2005 when the mean maximum salinity reached 6.0 ppt (Hackney 2006). There are no indications from Indian Creek substation data that salt entered the system from the river. Peeper data indicate sulfate reduction from non-sea water sources in the

winter sample (Hackney 2006). However, a September spike in salinity was documented at the shoreward substation for Eagles Island and may also have been detected had sampling equipment been used on a monthly basis at the Indian Creek Station (Hackney 2006). It is unlikely that this late growing season minor event had any effect on vegetation growth during the 2006 growing season. The most severe limitations on growth of sensitive herbaceous vegetation (and other vegetation) most likely resulted from continued erosion of substrate within the sample plot.



LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNDARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

100 0 100 Feet

20 0 20 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

SENSITIVE HERBACEOUS VEGETATION POLYGON FROM YEAR 2003
AT STATION P7 (INDIAN CREEK),
WILMINGTON HARBOR MONITORING PROJECT,
CAPE FEAR RIVER, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE: IC06.APR	APPROVED BY: CTH	#CFRM-7
DRAWN BY: DMD	DATE: 12 February 2007	FIGURE 8.42-1

As of early January in, 2007 the Indian Creek tidal swamp forest was being selectively cut from the southwestern bluff to the river's edge. The clearing operation being undertaken by an unknown party included swamp forest bordering an old ditch near the mouth of Indian Creek and extended east and northeast beyond the monitoring station for almost a half mile down stream. This clearing process currently involves most vegetation with the exception of larger cypress (*Taxodium ascendens*), which are being avoided. Many of the straighter trees (*Fraxinus* spp., *Acer rubrum*, *Nyssa biflora*, and some smaller cypress) with sufficiently large trunks are being trimmed and laid in the swamp to form a corduroy road that may connect with the mainland bluff to the east. This road extended from the western bluff to near the natural levee, passing parallel to the levee and along the river east past the station belt transect. The remaining wood felled was being cut and carried with human labor to the adjacent bluff. For purposes of the current project the current Indian Creek site has little further usefulness. It would become difficult to distinguish progressive river changes from the effects of clearing. Continued monitoring to follow the wake of the human modifications at the site might be instructive. However, construction of an additional monitoring site may in order since this is a rather critical part of the river potentially subject to change given significant modifications in salinity or flooding resulting from deepening of the Cape Fear River for Wilmington Harbor. Selection of a second monitoring site for the area will have to consider the final limits and potential effects of these new developments.

8.43 Dollisons Landing

The sensitive herbaceous vegetation sample plot associated with the Dollisons Landing station (P8) is a fixed plot (Table 8.43-1). This sample plot showed little variation that could be considered directly an effect of salinity or flooding (Figure 8.43-1). Two new species have appeared in the plot *Hydrocotyle verticillata* and *Lycopus virginicus*. Both species are characteristic of wooded freshwater wetlands, but the former is usually in non-tidal habitats and the latter is often associated with low hummocks or rotten stumps. *Saururus cernuus* contributes somewhat less cover this year than in most recently past years. Reasons for this decrease in cover and the other minor variations in sensitive herbaceous species occurrences are unknown. *Eryngium aquaticum* has again appeared in the plot, but remains at a low level of contributed cover. The species has likely been present as rhizome material and is representative of a group of species that occurs in freshwater systems but seems preconditioned to thrive in brackish conditions should they occur.

A low-level spike in salinity (5.4 ppt, expressed as a mean of the maximum readings for the month) was documented at the Dollisons Landing DCP during September of 2005 (Hackney 2006). It is uncertain if this spike was experienced in any way at near-shore substations. The effect, if any, of this spike on the 2006 growing season is unknown.

Table 8.43-1. Comparisons of percent cover contributions by sensitive herbaceous species in the sampling polygon at the Dollisons Landing Station (P8) for years 2000-2006, Wilmington Harbor monitoring project, Cape Fear River, North Carolina.

Species	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Saururus cernuus	30	20	35	35	40	50	30
Boehmeria cylinidrica	<1	--	<1	<1	1	<1	<1
Rumex verticillatus	<1	--	2	2	<1	<1	--
Cicuta maculata	2	--	2	2	<1	<1	<1
Carex sp.	1	--	--	--	--	--	--
Polygonum punctatum	1	1	3	3	--	<1	1
Peltandra virginica	2	1	3	3	<1	1	1
Carex crinita	<1	2	--	--	--	--	--
Dulichium arundinaceum	<1	--	--	--	--	--	--
Triadenum walteri	<1	--	--	--	--	--	--
Eryngium aquaticum	--	3	1	1	--	--	<1
Pontederia cordata	--	<1	--	--	--	<1	<1
Hymenocallis floridana	--	--	<1	<1	<1	--	--
Alternanthera philoxeroides	--	--	<1	<1	--	--	--
Proserpinaca palustris	--	--	--	--	<1	--	--
Ipomoea sp.	--	--	--	--	<1	--	--
Hydrocotyle verticillata	--	--	--	--	--	--	1
Lycopus virginicus	--	--	--	--	--	--	<1

LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNDARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

100 0 100 Feet

20 0 20 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

SENSITIVE HERBACEOUS VEGETATION POLYGON FROM YEAR 2003
AT STATION P8 (DOLLISONS LANDING),
WILMINGTON HARBOR MONITORING PROJECT,
CAPE FEAR RIVER, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE: dl06.APR	APPROVED BY: CTH	#CFRM-7
DRAWN BY: DMD	DATE: 10 February 2007	FIGURE 8.43-1

8.44 Black River

Information included in the following table represents data obtained from both old and new sensitive herbaceous vegetation plots at Black River (P9). The data from 2005 and 2006 are most current and do not represent the previous variable plot which has now been abandoned (Table 8.44-1, Figure 8.44-1). The species compositions of the old and new plots are similar. The old plot will no longer be monitored.

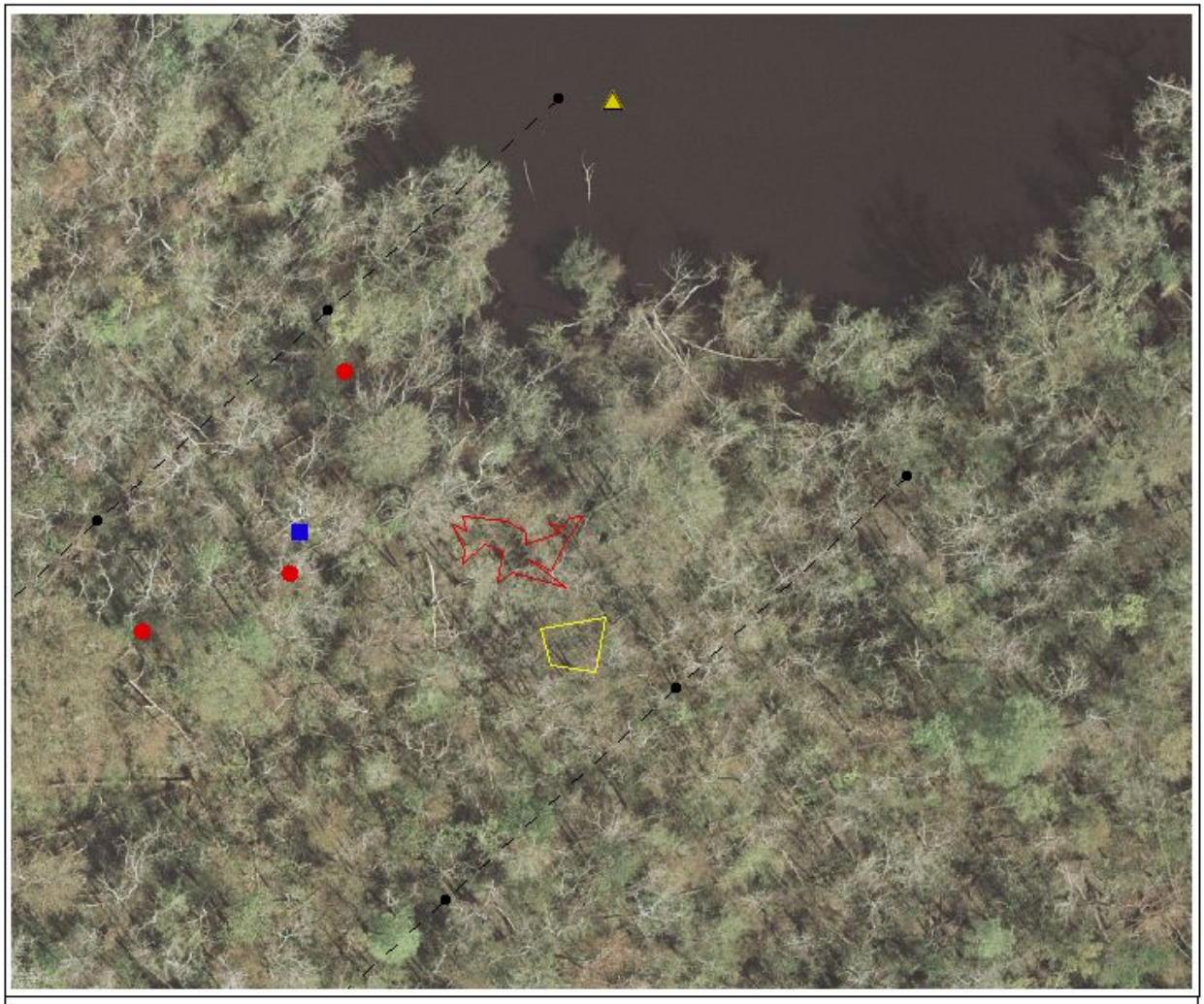
The loss of *Ludwigia palustris* from the new plot is not surprising considering the mobility of this species within the old plot. *Boehmeria cylindrica* has appeared in the new plot as has *Cicuta maculata*. *Physostegia leptophylla* was not present this year. *Saururus cernuus* remains the dominant species.

Changes resulting from salinity events have not been noted from this plot, and no significant changes in cover have occurred since last year.

Table 8.44-1. Comparisons of percent cover contributions by sensitive herbaceous species in old polygons from years 2000-2004 and new sensitive herbaceous polygon for 2005 and 2006 at the Black River (P9), Wilmington Harbor monitoring project, Cape Fear River, North Carolina (plots relocated in 2005 and 2006, designated with a superscript [a]by the year designation)..

Species	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005 [a]**	**2006 [a]**
Ludwigia palustris	50	20	20	1	5	5	--
Polygonum punctatum	--	15	1	--	1	<1	<1
Symphyotrichum elliottii	--	2	<1	1	<1	<1	<1
Scutellaria lateriflora	--	--	<1	--	--	--	--
Boehmeria cylindrical	--	--	<1	--	<1	--	<1
Saururus cernuus	--	--	--	--	--	10	10
Physostegia leptophylla	--	--	--	--	--	<1	--
Peltandra virginica	--	--	--	--	--	<1	1
Cicuta maculate	--	--	--	--	--	--	<1

[a]Plot relocated in 2005



LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2005
- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2000
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNDARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

100 0 100 Feet

20 0 20 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

COMPARISON OF SENSITIVE HERBACEOUS VEGETATION POLYGONS FROM YEARS 2000, 2004 AND 2005 AT STATION P9 (BLACK RIVER), WILMINGTON HARBOR MONITORING PROJECT, NORTHEAST CAPE FEAR RIVER, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE: PR06.APR	APPROVED BY: CTH	#CFRM-7
DRAWN BY: DMD	DATE: 10 February 2007	FIGURE 8.44-1

8.45 Rat Island

The sensitive herbaceous polygon at the Rat Island (P12) sampling station remains the same size and shape as in previous years (Figure 8.45-1). The overall cover by live sensitive herbaceous species has decreased (Table 8.45.1). Stems of *Schoenoplectus americanus* cover half of the polygon, but many appear dead this year. Stems are brown and laying horizontally on the substrate. Those that are erect show signs of stress and have brown spots scattered over their surfaces. Stem death could have resulted from continued salt intrusion, competition for light, or both.

The maximum monthly salinity levels have averaged 11.4 ppt between August of 2005 and July of 2006, the month just prior to sampling (Hackney 2006 and additional data provided by Dr. Lynn Leonard for June and July 2006). This value places the salinity for the period prior to sampling roughly in the medium mesohaline range, 5-18 ppt, the same as last year, but last year's average was slightly lower (10.31 ppt). Maximum salinity values at the substation nearest the river during spring of 2006 most nearly approximated the oligohaline range, 0.5-5.0 ppt (Cowardin et al. 1979). As could be expected, the surface substrate at the substation nearest the sensitive herbaceous vegetation plot showed sulfate oxidation during summer and sulfate oxidation later in the winter (Hackney 2006).

Additional species contributing significantly to the over all cover within the polygon, *Carex hyalinolepis* and *Sagittaria lancifolia*, apparently have expanded their cover slightly over 2005. However, this apparent increase may be an artifact of increased visibility. *Peltandra virginica* again became visible from the rootstocks that have maintained a presence in the plot. Corms of *Hymenocallis floridana* are still visible. It is not known if the latter species is still flowering in the plot during the spring.

Spartina cynosuroides, though not a sensitive herbaceous species, continues to maintain 50% of the cover within the plot as noted last year. The major dominance prevails along the outer, eastern edges of the plot along the Northeast Cape Fear River. It appears to be moving west as well, outside of the plot. *Pluchea odorata* and *Schoenoplectus tabernaemontani* were noted in the plot, but only as one or two scattered individuals. A few scattered stems of *Rumex verticillata*, *Alternanthera philoxeroides*, and *Zizania aquatica* were noted west of and outside the plot, but did not appear healthy. The *Zizania* stem had been grazed by insects and was depauperate. *Polygonum arifolium*, an annual, and *Typha angustifolia* were both noted outside the plot, rare and in poor condition.

The rhizomes of *Schoenoplectus americanus* and *Spartina cynosuroides* compete for space within the substrate. As conditions favor the latter, the former will appear to give way above the soil. Ultimately, the rhizomes of *Schoenoplectus* will fail to bud and subaerial stems will disappear, assuming a steady increase in salinity. It is possible that with the decrease in cover by live stems of *Schoenoplectus americanus* this year there will be a visible increase in cover by *Spartina cynosuroides* in 2007.

Table 8.45-1. Comparisons of percent cover contributions by sensitive herbaceous species in the polygon for years 2000-2006 at the Rat Island (P12), Wilmington Harbor monitoring project, Northeast Cape Fear River, North Carolina.

Species[a]	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Schoenoplectus americanus	100	20	30	50	25	90	50
Carex hyalinolepis	20	8	10	<1	2	<1	2
Sagittaria lancifolia	10	30	--	5	10	<1	5
Alternanthera philoxeroides	<1	--	<1	--	--	--	--
Boltonia asteroides	<1	<1	--	--	--	--	--
Symphyotrichum subulatum	<1	<1	<1	<1	--	--	--
Peltandra virginica	--	1	--	--	--	--	<1
Rumex verticillatus	--	1	--	--	--	--	--
Hymenocallis floridana	--	<1	--	1	<1	<1	<1
Polygonum punctatum	--	--	--	--	<1	--	--

[a] *Symphyotrichum tenuifolium* was reconsidered as salt tolerant and removed from the table.

LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2000
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

100 0 100 Feet

20 0 20 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

SENSITIVE HERBACEOUS VEGETATION POLYGON
FROM YEAR 2000 AT STATION P12 (RAT ISLAND),
WILMINGTON HARBOR MONITORING PROJECT,
NORTHEAST CAPE FEAR RIVER, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE: ri06.APR	APPROVED BY: CTH	#CFRM-7
DRAWN BY: DMD	DATE: 13 FEBRUARY 2007	FIGURE 8.45-1

8.46 Fishing Creek

This year the simple diversity of the Fishing Creek sensitive herbaceous species polygon has increased to 22 species, the highest of all the stations. This amounts to two more species than accounted for last year (Table 8.46-1). The sensitive herbaceous species polygon demonstrates a shape and size similar to those of past years (Figure 8.46-1 and Table 8.41-1). Apparent changes in size and shape are largely GPS data artifacts.

Table 8.46-1. Comparisons of percent cover contributions by sensitive herbaceous species in polygons from years 2000-2006 at the Fishing Creek Station (P13), Wilmington Harbor monitoring project, Northeast Cape Fear River, North Carolina.

Species	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Pontederia cordata	20	40	50	30	30	35	20
Symphyotrichum elliottii	<1	--	--	--	--	1	--
Polygonum punctatum	2	1	--	<1	10	2	3
Sium suave	<1	2	5	1	1	--	2
Zizaniopsis miliacea	2	<1	<1	5	5	<1	--
Saururus cernuus	2	2	--	1	5	1	1
Cicuta maculata	<1	2	--	--	1	1	<1
Sagittaria lancifolia	2	20	5	20	5	1	3
Orontium aquaticum	<1	--	--	--	--	--	--
Peltandra virginica	<1	1	5	30	12	5	25
Rhynchospora corniculata	<1	<1	--	--	<1	--	<1
Carex sp.	<1	--	--	--	--	--	--
Alternanthera philoxeroides	--	5	<1	<1	--	1	<1
Zizania aquatica	--	2	<1	50	<1	<1	<1
Boltonia asteroides	--	1	--	--	<1	<1	<1
Rumex verticillatus	--	<1	2	1	--	<1	<1
Cinna arundinacea	--	<1	--	<1	<1	--	<1
Eryngium aquaticum	--	<1	5	2	2	5	2
Schoenoplectus americanus	--	--	<1	--	--	--	--
Carex hyalinolepis	--	--	--	1	--	--	--
Apios americana	--	--	--	<1	<1	<1	<1
Hymenocallis floridana	--	--	--	2	--	--	--
Ludwigia palustris	--	--	--	<1	<1	--	<1
Hypericum mutilum	--	--	--	--	<1	--	--
Boehmeria cylindrica	--	--	--	--	<1	<1	<1
Lycopus virginicus	--	--	--	--	--	<1	<1
Lycopus virginicus	--	--	--	--	--	<1	<1
Cyperus sp.	--	--	--	--	--	<1	--
Elymus virginicus	--	--	--	--	--	<1	--
Lobelia cardinalis	--	--	--	--	--	--	<1
Carex crus-corvi	--	--	--	--	--	--	<1
Bidens laevis	--	--	--	--	--	--	<1
Mikania scandens	--	--	--	--	--	--	<1

LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2006
- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2005
- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2000
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNDARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

100 0 100 Feet

20 0 20 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

COMPARISON OF SENSITIVE HERBACEOUS VEGETATION POLYGONS FOR YEARS 2000, 2005 AND 2006 AT STATION P13 (FISHING CREEK), WILMINGTON HARBOR MONITORING PROJECT, NORTHEAST CAPE FEAR RIVER, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE: fc06APR	APPROVED BY: CTH	#CFRM-7
DRAWN BY: DMD	DATE: 12 FEBRUARY 2007	FIGURE 8.46-1

Pontederia cordata, long the dominant sensitive herbaceous species at the site, now exhibits less cover than *Peltandra virginica*. From 2000 *Peltandra virginica* increased irregularly in cover until this year when it became dominant in the plot. During 2003 the two contributed the same cover within the polygon. During 2004, following the rebound from the previous salinity event, *Pontederia cordata* became less abundant than *Zizania aquatica*. *Zizania* has not since shown such subaerial prevalence.

The average of the mean monthly maximum salinity readings between September 2005 and July 2006 from the Northeast Cape Fear River at Fishing Creek station is about 4.4 ppt (Hackney 2006 and supplemental water data obtained from Lynn Leonard). This average is somewhat higher than the same average for last year, which was 2.7 ppt. The difference is due largely to a spike in salinity that extended up the Northeast Cape Fear River during September and October of 2006. Maximum values for these months were 16.7 ppt and 13.7 ppt, respectively. An equally important salinity value for the period was the average monthly minimum value for the month of October, 2005. This value was 8.5 ppt. Such a value indicates that mean salinity levels at Fishing Creek did not decrease for an appreciable time during the month of October. In the winter of 2006, substation peeper sampling detected non-seawater sulfate reduction just below the surface (Hackney 2006).

Salinity regimes for the months September and October of 2005 may have had a significant influence on the growth of sensitive herbaceous plant species during the 2006 growing season. These regimes could have been responsible for the decrease in *Pontederia cordata* subaerial cover in the sensitive herbaceous species polygon this year as well as the increase in cover by *Peltandra virginica*. The shift in dominance is significant. These salinity highs occurred during periods of low freshwater flow along the Northeast Cape Fear River as well as along the main stem of the estuary when daily minimum discharge was below zero cubic feet per second (Figure 8.46-2). Such periods of low flow and the subsequent adjustments in vegetative cover will be the important events to monitor for clues to future changes in tidal swamp forest habitat in the lower Cape Fear River Estuary. An increase in diversity and a slight shift in dominance may indicate a subsequent shift toward a more saline environment.

Other notable species present at this station include *Impatiens capensis*, an annual that occupied nearly 50 percent of the polygon last year. This year the plants constitute about 10 percent of the cover within the polygon. Since this species likely requires nearly freshwater conditions for germination and growth, it is possible that either seed cast, germination or early growth were truncated by some factor or set of factors late during the 2005 growing season or the first part of the 2006 growing season. Multi-annual counts of various stages of annual species could be instructive in determining the effects of salinity and or flooding events could be instructive. Periodicity of alternate freshwater and saline water flooding may have a profound influence in vegetation that exists opportunistically from year to year.

Seedlings of *Taxodium ascendens* were seen within the sensitive herbaceous polygon this year. This occurrence seems to indicate that salinity conditions had not been

sufficiently severe as to retard germination and early growth of that species during the early part of the 2006 growing season. However, *Lilaeopsis chinensis*, a broadly mesohaline species, still occupies exposed organic mud flats at the site. Otherwise, the site is best characterized as an oligohaline habitat.

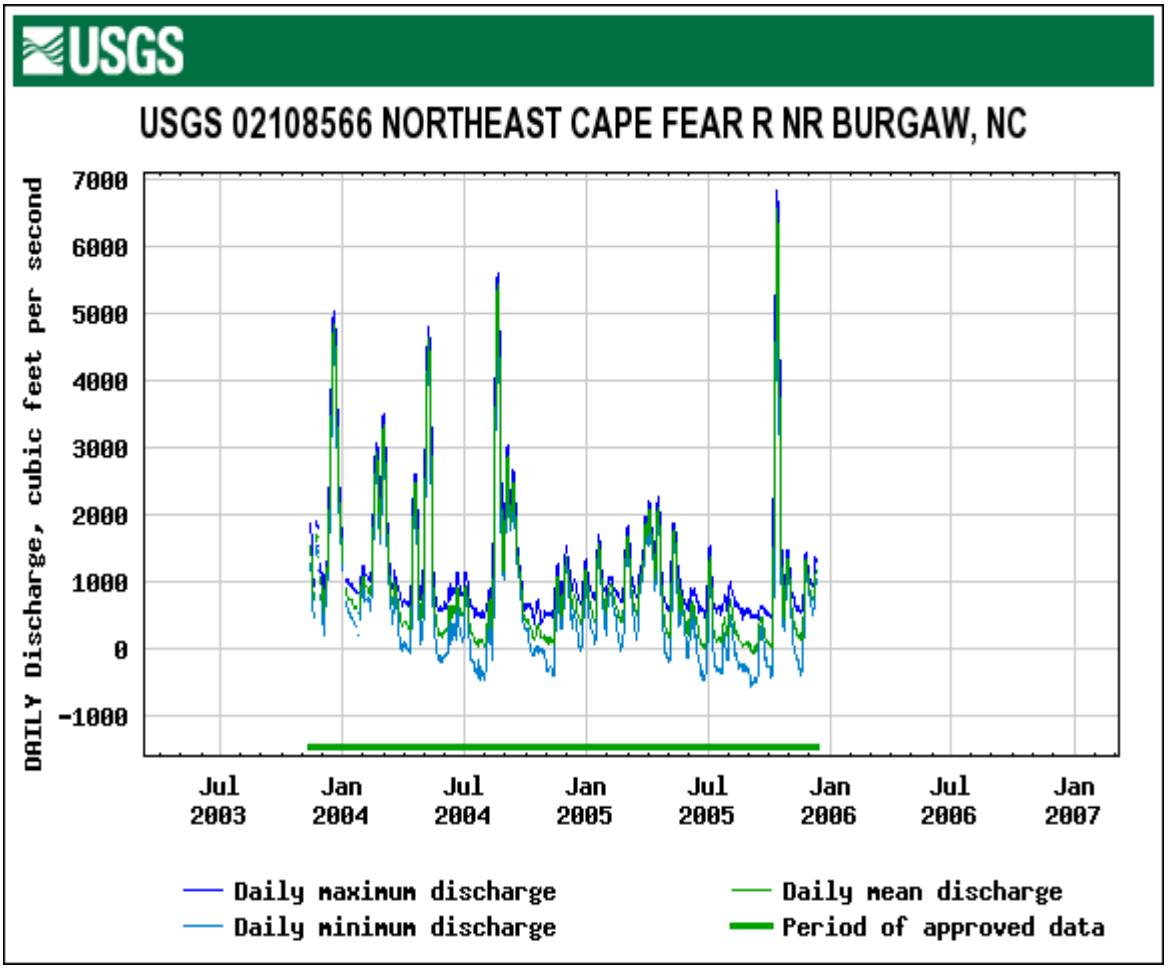


Figure 8.46-2. River flow along the Northeast Cape Fear River at the NC 53 bridge near Burgaw, NC
(http://waterdata.usgs.gov/nc/nwis/uv/?site_no=02108566&PARAmeter_cd=00065,00060)

8.47 Prince George Creek

Shape, size, and species content of the sensitive herbaceous vegetation polygon at Prince George Creek have remained similar since 2005 (Table 8.47-1, Figure 8.47-1). Most apparent changes in shape and size of the polygon are artifacts of GPS data aberrations.

Saururus cernuus has increased in its contribution of total cover since last year following a year with few or no salinity events. The salinity event seen in September of 2005 at lower reaches of the Northeast Cape Fear River was manifested at the Prince

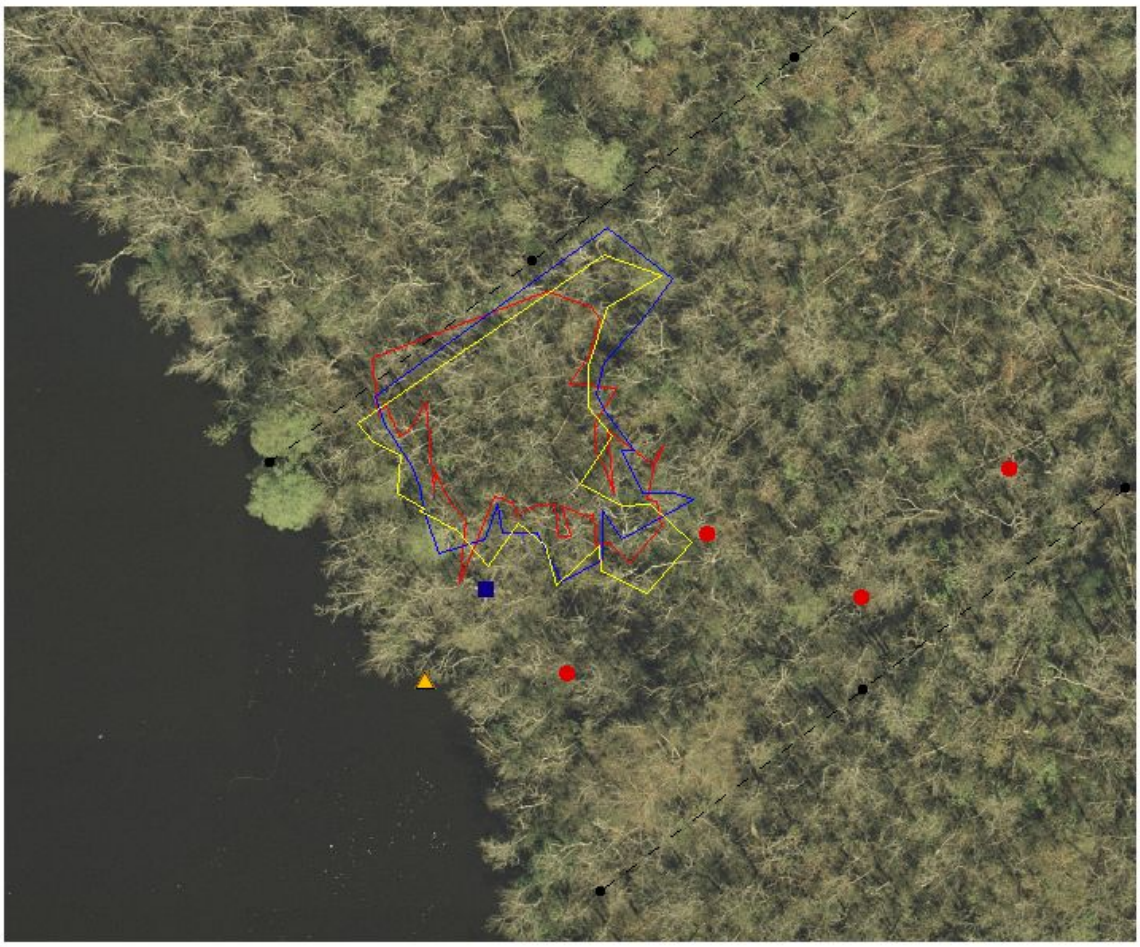
George Creek station as a slight spike at a mean of 0.8 ppt for the month (Hackney 2006). This is considered scarcely significant. *Peltandra virginica* is denser at this station than it has ever been. Reasons for this increase in cover are unknown.

Table 8.47-1. Comparisons of percent cover contributions by sensitive herbaceous species in polygons from years 2000-2006 at the Prince George Creek Station (P14), Wilmington Harbor monitoring project, Northeast Cape Fear River, North Carolina.

Species	**Year**						
	2000	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**
Saururus cernuus	35	60	20	40	40	20	50
Polygonum punctatum[a]	20	15	--	<1	20	30	10
Peltandra virginica	10	8	1	5	10	5	30
Pontederia cordata	--	5	--	--	<1	--	<1
Cicuta maculata	--	<1	<1	<1	--	--	<1
Zizania aquatica	--	<1	--	--	--	--	--
Cinna arundinacea	--	<1	--	--	<1	<1	<1
Boehmeria cylindrica	--	<1	<1	--	--	1	--
Carex lupulina	--	<1	<1	--	--	--	--
Alternanthera philoxeroides	--	--	<1	--	--	--	--
Decodon verticillatus	--	--	<1	<1	<1	<1	<1
Hymenocallis floridana	--	--	<1	<1	1	1	1
Zizaniopsis miliacea	--	--	--	<1	<1	<1	<1
Triadenum walteri	--	--	--	<1	--	--	--
Hydrocotyle sp.	--	--	--	--	<1	--	<1
Lobelia cardinalis	--	--	--	--	--	<1	--
Ludwigia palustris	--	--	--	--	--	--	<1

[a] Previously identified as *Polygonum hydropiper* and *Polygonum hydropiperoides*.

Simple diversity stands at 11 species and is the highest yet seen at this station. Reasons for this increase in diversity may relate to frequent human traffic in the area as well as general site disturbance. Apparent increases in diversity could also relate, at least in part, to an increase in visibility at the site due to familiarity. The newest addition to sensitive herbaceous species at the site is *Ludwigia palustris*. The mobility of this species is related to flooding conditions and the release of propagules.



LEGEND

- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2006
- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2005
- SENSITIVE HERBACEOUS VEGETATION POLYGON, 2000
- DATA COLLECTION PLATFORM PILING
- CONCRETE BENCHMARK
- BELT TRANSECT BOUNDARY
- BELT TRANSECT MARKER
- SUBSTATION SURVEY POINT

100 0 100 Feet

20 0 20 Meters

DAVID M. DUMOND
ECOLOGICAL SERVICES AND CONSULTING
225 CHEYENNE TRAIL
WILMINGTON, NC 28409
PHONE (910)799-0363

COMPARISON OF SENSITIVE HERBACEOUS VEGETATION POLYGONS FOR YEARS 2000, 2005 AND 2006 AT STATION P14 (PRINCE GEORGE CREEK), WILMINGTON HARBOR MONITORING PROJECT, NORTHEAST CAPE FEAR RIVER, NORTH CAROLINA

WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE: pgc05.APR	APPROVED BY: CTH	#CFRM-2
DRAWN BY: DMD	DATE: 30 MARCH 2006	FIGURE 8.47-1

8.5 Discussion

The sensitive herbaceous vegetation data for this sampling year are not outstandingly different from those of the previous year. However, it will be worth while to briefly discuss some factors which may have roles in shaping the data. These factors deal with collection of GPS data, the nature of the minor salinity events, increases in diversity and the periodic visibility of species.

Methods for collection of GPS data have been discussed in previous reports. Points at the ends of straight-line segments of a polygon are marked during summer by placement of polyvinyl chloride (pvc) stakes. These segments mark the sides of a polygon and the boundaries of a community of sensitive herbaceous species (that may as well include other species). Data for GPS gathered during the following winter at each point. The signals reaching the antenna seem to be subject to bounce and deflection by wetland vegetation resulting in the collection of aberrant data. The deflection is thought to be caused by woody vegetation because aberrant points do not generally appear in data gathered in habitats not dominated by trees.

To date GPS data have been gathered using signals from the nearest US Coast Guard DGPS beacon which differentially corrects satellite data and broadcasts correction signals. NAVCEN or Navigation Center operates the Coast Guard Maritime Differential GPS (DGPS) Service and the developing Nationwide DGPS Service, consisting of over 60 remote broadcast sites. The Service broadcasts correction signals on marine radio-beacon frequencies to improve the accuracy of and integrity to GPS-derived positions (http://www.navcen.uscg.gov/misc/ directions.htm).

The habitats with the most trees seem to demonstrate the most aberrant data. The results of this bounce are points in the data set that show unexpected deviations from the real situation. All points in a data set may show some degree of aberration, rendering the entire data set questionable for the purposes intended. A mapped polygon that exhibits acute angular projections to points along its sides is symptomatic of poorly received data. The aberrations usually result in point locations that deviate two to three meters from their expected positions.

In short, use of map-grade DGPS data in swamp forest situations can not be considered a satisfactory tool to define changing boundaries of sensitive herbaceous vegetation plots. It is not known if post processing of direct satellite data will correct the problem. This method of GPS data collection will be employed next year. However, post processing DGPS data has had little or no effect on correction of the aberrations.

A salinity event (as defined in Hackney et al. 2003) may have briefly influenced salt concentrations in both the Cape Fear and the Northeast Cape Fear Rivers. Past salinity events detected during the course of the current project have occurred during periods of low river flow. The short-term salinity event that occurred during September and October of 2005 has been documented in river flow records at both Lock and Dam Number One (Hackney 2006) and at the US Geological Survey station on the Northeast

Cape Fear River (see Figure 8.5-1 in Hackney et al. 2006). The lowest periods of daily minimum discharge occurred in September and October 2005. This salinity event was followed by a pulse of freshwater through the Northeast Cape Fear River, most likely due to precipitation in the watershed. This salinity event constitutes only a minor adjustment in the general quantity of the river flow. However, the quality of the flow, or its periodicity, relative to the course of the growing season may have had some effect at Fishing Creek. The slight increase in diversity and the slight shift in dominance could represent the first change of a slightly higher salinity regime.

Time-related changes in species presence at the Fishing Creek and Prince George Creek polygons as well as the periodic appearance and disappearance of species may be due to one or more of three phenomena. Movements of annuals (and assumedly mobile perennials) are subject to activities of various vectors including wildlife and humans, wind and water flow. Water in particular is capable of moving plant diaspores in and out of the system depending on tides and floods. The salinity of these flood waters influences later growth and survival of seeds and vegetative diaspores. A brackish water inundation in fall or winter can have different effects than one in mid summer. All these characteristics seem to work in unison to elevate diversity, one of the possible indices of potential change in mildly brackish systems.

Tidal distribution of plant diaspores is likely very important in tidal habitats and add, possibly measurably, to the chaotic nature of tidal systems and the absence of predictable successional development. Human activities promote disturbance of substrates while humans as diaspore vectors increase both establishment and movement of species.

Rhizome-based plant species, particularly herbaceous species, perennate for periods with no obvious subaerial structures. The functions of such habits remain unclear, but are assumed to allow the plants to survive through unfavorable conditions. Appearance and disappearance of above-ground structures of such plants is the perceived result of the salt content of flood waters.

9.0 LITERATURE CITED

Clarke, K.R. and R.N. Gorley. 2001. PRIMER v5: User Manual / Tutorial. PRIMER-E: Plymouth, United Kingdom.

CZR Incorporated. 2001. Monitor Potential Effects of Increased Tidal Range on the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina. Part B. Initial Baseline Monitoring. Prepared for U. S. Army Corps of Engineers, Wilmington District, Wilmington, NC.

Hackney, C. T., M. Posey, L.L. Leonard, T Alphin, G.B. Avery Jr., and others. 2002a. Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 1: August 1, 2000 – July 31, 2001. Unpublished report prepared for the U. S. Army Corps of Engineers, Wilmington District. University of North Carolina at Wilmington Department of Biological Sciences, Wilmington, NC.

Hackney, C. T., M. Posey, L.L. Leonard, T Alphin, G.B. Avery Jr., and others. 2002b. Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 2: June 1, 2001 – May 31, 2002. Unpublished report prepared for the U. S. Army Corps of Engineers, Wilmington District. University of North Carolina at Wilmington Department of Biological Sciences, Wilmington, NC.

Hackney, C. T., M. Posey, L.L. Leonard, T Alphin, G.B. Avery Jr., and others. 2003. Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 3: June 1, 2002 – May 31, 2003. Unpublished report prepared for the U. S. Army Corps of Engineers, Wilmington District. University of North Carolina at Wilmington Department of Biological Sciences, Wilmington, NC.

Hackney, C. T., M. Posey, L.L. Leonard, T Alphin, G.B. Avery Jr., D.M. DuMond, and others. 2005. Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 4: June 1, 2003 – May 31, 2004. Unpublished report prepared for the U. S. Army Corps of Engineers, Wilmington District. University of North Carolina at Wilmington Department of Biological Sciences, Wilmington, NC.

Hackney, C. T., Posey, L.L. Leonard, T Alphin, G.B. Avery Jr., D.M. DuMond, and others. 2006. Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 5: June 1, 2004 – May 31, 2005. Unpublished report prepared for the U. S. Army Corps of Engineers, Wilmington District. University of North Carolina at Wilmington Department of Biological Sciences, Wilmington, NC.

Hackney, C. T., Posey, L.L. Leonard, T Alphin, G.B. Avery Jr., D.M. DuMond, and others. 2007. Monitoring Effects of a Potential Increased Tidal Range in the Cape Fear River Ecosystem Due to Deepening Wilmington Harbor, North Carolina Year 6: June 1, 2004 – May 31, 2005. Unpublished report prepared for the U. S. Army Corps of Engineers, Wilmington District. University of North Carolina at Wilmington Department of Biological Sciences, Wilmington, NC.

Hesslein, R.H. 1976. An in situ sampler for close interval pore water studies. Limnology and Oceanography 21:912-914.

Hoehler, T.M., M.J. Alperin, D.B. Albert and C.S. Martens. 1994. Field and laboratory studies of methane oxidation in an anoxic marine sediment: Evidence for a methanogen-sulfate reducer consortium. Global Biogeochemical Cycles 8:451-463.

Kartesz, J.T., and C.A. Meacham. 1999. Synthesis of the North American Flora, Version 1.0. North Carolina Botanical Garden, Chapel Hill, NC.

Kelley, C.A., C.S. Marten, and W. Ussler III. 1995. Methane dynamics across a tidally flooded riverbank margin. Limnology and Oceanography 40:1112-1129.

Mallin, M., M. Posey, G. Shank, M. McIver, S. Ensign, and T. Alphin. 1999. Hurricane effects on water-quality and benthos in the Cape Fear watershed: Natural and anthropogenic impacts. Ecological Applications 9(1): 350-362.

Mallin, M., M.H. Posey, T.E. Lankford, M.R. McIver, S.H. Ensign, T.D. Alphin, M.S. Williams, M.L. Moser, and J.F. Merritt. 2001. Environmental assessment of the lower Cape Fear River system 2000-2001. CMS Report No. 01-02.

Mitsch, W. J and J. M. Gosselink. 1993. Wetlands. Van Nostrand Reinhold. New York.

Pawlowicz, R., B. Beardsley, and S. Lentz. 2002. Classical tidal harmonic analysis including error estimates in MATLAB using T_TIDE. Computers and Geosciences 28: 929-937.

APPENDIX A

LIST OF TIDAL RANGE DATA FOR ALL 14 STATIONS USED TO GENERATE FIGURES AND TABLES IN SECTION 3.0 (1 June 2006 – 31 May 2007)

Appendix A. List of tidal range data for all 14 stations used to generate figures and tables in Section 3.0.

Station	P01	P02	P03	P04	P06	P07	P08	P09	P11	P12	P13	P14
1	3.97	4.32	3.07	4.41	3.92	3.97	xxx	3.55	4.25	3.84	3.38	2.64
2	3.34	3.84	2.79	4.02	3.57	3.61	xxx	3.22	3.88	3.51	3.08	2.38
3	3.04	3.53	2.59	3.60	4.00	3.33	xxx	2.97	3.54	3.22	2.86	2.26
4	3.68	4.06	2.91	4.07	4.05	3.77	xxx	3.40	3.98	3.62	3.22	2.58
5	3.67	4.06	2.87	4.18	3.68	3.75	xxx	3.31	4.01	3.62	3.17	2.46
6	3.04	3.57	2.62	3.77	3.38	3.40	xxx	3.01	3.62	3.30	2.92	2.27
7	2.89	3.25	2.43	3.42	3.64	3.15	2.93	2.82	3.38	3.04	2.68	2.07
8	3.29	3.59	2.64	3.68	4.02	3.41	3.17	3.05	3.63	3.28	2.89	2.24
9	3.81	3.98	2.86	4.08	3.60	3.78	3.52	3.39	3.99	3.60	3.19	2.47
10	3.37	3.55	2.59	3.65	3.54	3.35	3.10	2.98	3.59	3.21	2.83	2.20
11	2.99	3.52	2.58	3.52	3.64	3.33	3.10	2.99	3.52	3.20	2.86	2.33
12	3.29	3.63	2.64	3.65	3.62	3.42	3.18	3.06	3.61	3.29	2.92	2.33
13	3.2	3.55	2.68	3.72	3.81	3.39	3.19	3.08	3.61	3.30	2.96	2.41
14	3.15	3.76	2.79	3.91	3.42	3.60	3.41	3.35	3.79	3.48	3.14	2.57
15	2.94	3.37	2.43	3.45	3.22	3.20	2.96	2.83	3.41	3.08	2.71	2.10
16	3.03	3.18	2.44	3.22	3.72	3.00	2.77	2.65	3.21	2.89	2.57	2.00
17	3.49	3.67	2.79	3.70	4.20	3.54	3.36	3.26	3.69	3.41	3.11	2.57
18	3.88	4.18	2.94	4.20	3.76	4.04	3.78	3.65	4.17	3.88	3.44	2.80
19	3.32	3.75	2.55	3.81	3.39	3.55	3.24	3.09	3.76	3.43	2.97	2.28
20	3.03	3.33	2.39	3.43	3.70	3.16	2.91	2.79	3.38	3.06	2.70	2.10
21	3.32	3.64	2.66	3.77	4.09	3.47	3.25	3.15	3.67	3.37	3.02	2.40
22	3.74	4.13	2.96	4.19	3.73	3.85	3.63	3.50	4.07	3.73	3.34	2.69
23	3.46	3.82	2.50	3.83	3.29	3.47	3.23	3.06	3.70	3.32	2.90	2.18
24	2.84	3.25	2.22	3.33	3.72	3.03	2.79	2.65	3.26	2.91	2.55	1.91
25	3.24	3.62	2.63	3.73	4.50	3.50	3.30	3.15	3.68	3.34	3.01	2.42
26	4.17	4.60	3.00	4.58	4.05	4.24	3.96	3.80	4.47	4.03	3.58	2.78
27	3.86	4.18	2.57	4.13	3.38	3.72	3.39	3.19	4.02	3.55	3.06	2.22
28	2.9	3.33	2.26	3.41	3.77	3.11	2.84	xxx	3.35	2.98	2.61	1.94
29	3.45	3.75	2.65	3.82	4.48	3.52	3.51	xxx	3.74	3.40	3.01	2.34
30	4.51	4.62	3.05	4.58	4.36	4.18	3.89	3.72	4.46	4.01	3.52	2.70
31	xxx	4.48	2.72	4.40	3.38	3.92	3.54	3.28	4.31	3.77	3.19	2.20
32	xxx	3.29	2.17	3.37	3.80	2.97	2.61	2.42	3.30	2.89	2.43	1.69
33	xxx	3.69	2.74	3.88	4.92	3.53	3.27	3.18	3.73	3.41	3.07	2.52
34	4.84	4.98	3.28	5.08	4.58	4.58	4.27	4.10	4.86	4.38	3.88	3.02
35	4.65	4.67	2.86	4.73	3.66	4.10	3.70	3.43	4.52	3.97	3.35	2.34
36	3.35	3.61	2.41	3.73	4.10	3.26	2.90	2.70	3.60	3.18	2.70	1.92
37	3.77	4.07	2.93	4.24	5.18	3.83	3.54	3.39	4.06	3.70	3.30	2.59
38	5.2	5.30	3.43	5.39	4.73	4.81	4.47	4.27	5.06	4.63	4.06	3.09
39	4.91	4.85	2.91	4.84	3.53	4.19	3.76	3.47	4.66	4.08	3.40	2.29
40	3.44	3.52	2.34	3.56	3.99	3.10	2.74	2.53	3.47	3.06	2.57	1.75
41	3.87	4.03	2.90	4.10	5.16	3.71	3.44	3.11	3.95	3.61	3.21	2.55
42	5.52	5.40	3.48	5.38	4.97	4.77	4.42	4.21	5.12	4.60	4.02	3.09
43	5.51	5.19	3.08	5.18	3.96	4.39	3.90	3.58	4.90	4.26	3.53	2.37
44	3.92	3.93	2.56	4.03	4.18	3.48	3.07	2.84	3.88	3.40	2.83	1.92
45	4.18	4.16	2.98	4.25	5.21	3.81	3.47	3.15	4.12	3.72	3.24	2.20
46	5.53	5.34	3.48	5.42	5.17	4.77	4.38	4.01	5.16	4.63	4.01	2.76

Appendix A. (continued)

47	5.43	5.34	3.31	5.43	4.13	4.58	4.10	3.77	5.10	4.45	3.69	2.47
48	4.15	4.15	2.76	4.27	4.25	3.61	3.20	2.95	4.05	3.54	2.93	1.93
49	4.09	4.25	3.01	4.35	5.43	3.84	3.50	3.29	4.16	3.76	3.27	2.49
50	5.66	5.61	3.61	5.59	4.52	4.95	4.55	4.27	5.32	4.75	4.07	3.03
51	5	4.80	2.84	4.72	4.51	3.96	3.49	3.14	4.48	3.90	3.14	2.02
52	4.23	4.59	2.88	4.70	5.26	3.99	3.55	3.21	4.50	3.96	3.24	2.16
53	5.6	5.32	3.15	5.50	4.82	4.52	3.89	3.41	5.18	4.46	3.58	2.13
54	5.69	4.95	2.93	5.03	4.98	4.11	3.53	3.09	4.70	4.04	3.24	1.92
55	5.12	5.07	3.15	5.14	4.46	4.38	3.80	3.37	4.84	4.28	3.58	2.46
56	4.29	4.44	2.85	4.56	4.19	3.94	3.43	3.03	4.31	3.79	3.15	2.12
57	3.87	4.14	2.91	4.29	5.16	3.67	3.13	2.69	4.08	3.68	3.20	2.38
58	5.17	5.24	3.38	5.30	4.82	4.57	3.99	3.49	5.02	4.48	3.85	2.80
59	5.05	4.98	2.98	5.02	4.29	3.92	3.14	2.40	4.72	4.10	3.35	2.13
60	4.11	4.28	2.73	4.43	4.44	3.41	2.63	1.90	4.17	3.65	3.01	1.94
61	4.17	4.40	2.94	4.55	4.84	3.60	2.76	2.02	4.33	3.85	3.27	2.30
62	4.82	4.92	3.12	4.98	4.98	3.99	3.16	2.39	4.74	4.18	3.51	2.43
63	5.08	5.16	3.17	5.17	4.72	3.99	3.03	2.14	4.92	4.28	3.55	2.36
64	4.6	4.81	3.03	4.90	4.31	3.75	2.78	1.91	4.65	4.05	3.38	2.25
65	3.97	4.37	2.81	4.43	4.52	3.42	2.52	1.70	4.22	3.71	3.12	2.12
66	4.3	4.64	2.93	4.65	4.96	3.61	2.71	1.87	4.44	3.90	3.27	2.23
67	5.12	5.07	3.18	5.22	4.83	3.87	2.81	1.86	4.89	4.29	3.57	2.41
68	4.78	4.88	3.08	5.10	4.44	3.77	2.73	1.80	4.75	4.17	3.46	2.31
69	4.08	4.47	2.91	4.63	4.36	3.48	2.50	1.62	4.37	3.87	3.25	2.23
70	4.1	4.42	2.89	4.54	4.83	3.40	2.43	1.58	4.28	3.79	3.18	2.20
71	4.68	4.92	3.21	5.09	5.06	3.75	2.67	1.75	4.76	4.21	3.56	2.50
72	4.85	5.16	3.29	5.31	4.59	3.96	2.86	1.90	4.97	4.39	3.71	2.57
73	4.38	4.67	2.93	4.78	4.13	3.58	2.56	1.65	4.51	3.94	3.26	2.16
74	3.83	4.21	2.77	4.34	4.69	3.18	2.21	1.39	4.09	3.58	2.98	2.00
75	4.46	4.79	3.22	4.95	5.19	3.73	2.73	1.92	4.65	4.15	3.56	2.59
76	5.1	5.34	3.40	5.46	4.83	4.15	3.09	2.20	5.11	4.53	3.85	2.74
77	4.61	4.96	3.11	5.05	4.12	3.91	2.98	2.17	4.74	4.16	3.48	2.36
78	3.79	4.21	2.80	4.34	4.61	3.25	2.36	1.61	4.07	3.59	3.01	2.05
79	4.35	4.67	3.23	4.80	5.26	3.86	3.10	2.49	4.53	4.06	3.53	2.66
80	5.32	5.45	3.53	5.46	4.88	4.47	3.66	3.01	5.16	4.59	3.96	2.94
81	4.74	5.02	3.16	5.06	4.25	4.15	3.42	2.82	4.76	4.18	3.51	2.42
82	3.86	xxx	2.86	4.42	4.61	3.54	2.83	2.25	4.15	3.66	3.08	2.13
83	4.18	xxx	3.15	4.76	5.38	4.02	3.44	2.99	4.51	4.05	3.51	2.65
84	5.27	xxx	3.56	5.56	4.92	4.72	4.09	3.63	5.25	4.69	4.03	2.98
85	4.71	5.00	3.11	5.10	4.17	4.23	3.55	3.03	4.79	4.20	3.49	2.36
86	3.71	4.18	2.77	4.34	4.61	3.56	2.94	2.45	4.09	3.60	3.01	2.06
87	4.19	4.61	3.15	4.78	5.53	4.07	3.54	3.05	4.52	4.04	3.48	2.59
88	5.56	5.67	3.58	5.73	5.04	4.86	4.24	3.78	5.40	4.79	4.08	2.97
89	5.07	5.18	3.07	5.24	4.08	4.32	3.70	3.20	4.90	4.26	3.50	2.29
90	3.68	4.07	2.65	4.23	4.61	3.48	2.93	2.48	4.00	3.49	2.90	1.93
91	4.18	4.57	3.15	4.74	5.41	4.15	3.75	3.42	4.52	4.05	3.49	2.60
92	5.38	5.51	3.52	5.60	4.98	4.80	4.32	3.97	5.29	4.71	4.01	2.91
93	5.01	5.09	3.09	5.16	4.19	4.35	3.85	3.46	4.85	4.23	3.51	2.35
94	3.85	4.15	2.71	4.29	4.37	3.66	3.23	2.91	4.09	3.57	2.97	2.04

Appendix A. (continued)

95	4.08	4.31	2.95	4.43	5.05	3.93	3.56	3.28	4.26	3.82	3.30	2.40
96	5.07	5.12	3.29	5.17	4.84	4.55	4.13	3.81	4.92	4.40	3.79	2.71
97	4.86	4.97	2.98	5.00	4.22	4.23	3.72	3.34	4.72	4.12	3.42	2.25
98	3.76	4.18	2.68	4.31	4.22	3.72	3.28	2.94	4.10	3.60	3.01	2.00
99	3.98	4.25	2.80	4.33	5.01	3.77	3.34	2.99	4.11	3.66	3.12	2.23
100	5.12	5.18	3.20	5.15	4.72	4.47	3.97	3.59	4.86	4.31	3.65	2.58
101	4.85	4.86	2.74	4.87	3.94	4.00	3.40	2.90	4.57	3.96	3.22	1.99
102	3.68	3.92	2.44	4.05	4.29	3.30	2.78	2.30	3.85	3.34	2.72	1.72
103	3.98	4.25	2.77	4.39	4.89	3.79	3.29	2.87	4.19	3.73	3.14	2.18
104	4.83	4.96	3.05	5.04	4.83	4.34	3.79	3.35	4.75	4.22	3.55	2.46
105	4.64	4.89	2.88	4.99	3.98	4.20	3.58	3.08	4.68	4.08	3.34	2.14
106	3.52	3.95	2.48	4.11	3.96	3.43	2.86	2.40	3.88	3.38	2.77	1.76
107	3.48	3.94	2.66	4.07	4.70	3.53	3.11	2.76	3.87	3.43	2.93	2.08
108	4.54	4.78	3.02	4.84	4.56	4.20	3.73	3.36	4.57	4.05	3.45	2.45
109	4.29	4.60	2.75	4.70	4.07	3.97	3.45	3.01	4.40	3.82	3.14	1.98
110	3.55	4.02	2.50	4.19	3.83	3.54	3.06	2.64	3.95	3.44	2.84	1.84
111	3.33	3.85	2.50	3.92	4.18	3.41	3.05	2.54	3.72	3.27	2.72	1.80
112	3.87	4.29	2.69	4.29	4.29	3.72	3.33	2.97	4.06	3.58	2.98	1.97
113	3.97	4.37	2.68	4.39	3.90	3.76	3.29	2.88	4.17	3.62	2.99	1.90
114	3.42	3.90	2.45	3.97	3.62	3.41	2.98	2.58	3.79	3.28	2.71	1.70
115	3.26	3.57	2.38	3.70	3.91	3.24	2.84	2.49	3.52	3.10	2.60	1.73
116	3.68	3.88	2.52	3.99	4.20	3.50	3.08	2.73	3.79	3.34	2.79	1.87
117	3.74	4.20	2.75	4.30	3.87	3.69	3.23	2.80	4.08	3.61	3.02	2.02
118	3.22	3.85	2.57	3.97	3.55	3.39	2.94	2.52	3.77	3.32	2.78	1.85
119	2.95	3.50	2.38	3.61	3.73	3.16	2.74	2.39	3.46	3.05	2.58	1.79
120	3.21	3.69	2.45	3.79	3.97	3.33	2.91	2.55	3.63	3.20	2.70	1.87
121	3.43	3.96	2.69	4.09	3.89	3.52	3.05	2.65	3.87	3.41	2.88	1.98
122	3.25	3.88	2.63	4.01	3.42	3.45	2.98	2.68	3.80	3.36	2.84	1.95
123	2.99	3.50	2.31	3.48	3.34	3.04	2.62	2.25	3.35	2.95	2.43	1.59
124	2.95	3.43	2.29	3.38	3.88	2.95	2.53	2.17	3.27	2.89	2.39	1.58
125	3.3	3.86	2.72	3.97	4.09	3.48	3.05	2.67	3.79	3.38	2.91	2.06
126	3.5	4.12	2.77	4.18	3.51	3.68	3.25	2.86	3.99	3.53	3.02	2.11
127	2.98	3.52	2.34	3.53	3.12	3.12	2.72	2.37	3.40	2.96	2.46	1.61
128	2.54	3.06	2.18	3.17	3.79	2.75	2.35	2.01	3.03	2.66	2.21	1.46
129	3.05	3.74	2.71	3.88	4.28	3.44	3.07	2.76	3.70	3.32	2.87	2.13
130	3.63	4.24	2.90	4.36	3.57	3.89	3.50	3.19	4.16	3.71	3.18	2.31
131	3.05	3.53	2.35	3.61	2.90	3.21	2.86	2.57	3.45	3.02	2.49	1.61
132	2.3	2.86	2.05	2.93	3.61	2.56	2.24	1.96	2.81	2.48	2.05	xxx
133	2.93	3.55	2.64	3.66	4.29	3.35	3.12	2.92	3.52	3.20	2.81	xxx
134	3.77	4.25	2.95	4.37	3.87	3.98	3.70	3.50	4.18	3.75	3.27	xxx
135	xxx	3.84	2.57	3.92	3.10	3.53	3.21	2.99	3.74	3.27	2.74	xxx
136	xxx	3.04	2.17	3.12	xxx	2.78	2.47	2.26	3.00	2.62	2.17	xxx
137	3.33	3.93	2.90	4.06	xxx	3.76	3.49	xxx	3.95	3.56	3.12	xxx
138	4.08	4.22	3.03	4.32	3.52	3.96	3.68	xxx	4.16	3.72	3.24	xxx
139	3.25	3.49	2.59	3.60	3.11	3.26	3.09	3.01	3.42	3.07	2.70	xxx
140	2.6	3.01	2.27	3.10	3.89	2.84	2.67	2.57	3.00	2.68	2.34	xxx
141	3.34	3.77	2.84	3.92	4.83	3.63	3.39	3.25	3.80	3.46	xxx	xxx
142	4.63	4.86	3.42	4.91	4.19	4.51	4.27	4.11	4.74	4.29	3.78	xxx

Appendix A. (continued)

143	4.13	4.28	2.84	4.29	3.55	3.78	3.47	3.24	4.10	3.58	3.00	xxx
144	3.02	3.49	2.48	3.61	4.13	3.18	2.88	2.67	3.47	3.03	2.51	xxx
145	3.54	4.06	2.99	4.17	5.06	3.82	3.56	3.38	4.03	3.64	3.19	xxx
146	4.81	5.12	3.46	5.19	4.66	4.72	4.41	4.19	4.94	4.43	3.86	xxx
147	4.57	4.82	3.09	4.82	3.77	4.20	3.74	3.41	4.57	3.99	3.33	xxx
148	3.23	3.74	2.62	3.83	4.31	3.39	3.02	2.74	3.66	3.22	2.68	xxx
149	3.79	4.23	3.11	4.39	5.24	3.97	3.64	3.39	4.19	3.81	3.33	xxx
150	5.17	5.32	3.59	5.40	4.99	4.85	4.45	4.15	5.12	4.58	3.97	xxx
151	5	5.12	3.31	5.16	4.05	4.44	3.90	3.48	4.88	4.27	3.58	xxx
152	3.6	3.97	2.80	4.14	4.52	3.56	3.10	2.74	3.93	3.46	2.89	xxx
153	4.14	4.45	3.28	4.64	5.62	4.08	3.74	3.43	4.42	4.01	3.52	xxx
154	5.63	5.70	3.82	5.77	5.28	5.04	4.62	4.27	5.45	4.88	4.24	xxx
155	5.52	5.40	3.43	5.43	4.27	4.62	4.02	3.57	5.13	4.47	3.72	xxx
156	4.07	4.22	2.92	4.36	4.79	3.71	3.18	2.79	4.16	3.63	3.02	xxx
157	4.5	4.62	3.39	4.88	5.72	4.15	3.94	3.64	4.66	4.19	3.66	xxx
158	5.89	5.74	3.86	5.91	5.40	4.98	4.67	4.34	5.58	4.98	4.30	xxx
159	5.57	5.51	3.53	5.57	4.53	4.83	4.27	3.91	5.26	4.62	3.86	xxx
160	4.31	4.55	3.12	4.63	4.80	4.01	3.50	3.19	4.40	3.88	3.26	xxx
161	4.63	4.79	3.42	4.90	5.76	xxx	4.03	3.83	4.66	4.20	3.65	xxx
162	6.02	5.88	3.89	5.94	5.42	xxx	4.75	4.47	5.61	5.02	4.32	xxx
163	5.79	5.56	3.49	5.61	4.60	4.81	4.28	3.96	5.28	4.61	3.85	xxx
164	4.57	4.63	3.11	4.75	4.82	4.08	3.56	3.34	4.44	3.94	3.31	xxx
165	4.88	4.87	3.39	4.93	5.45	xxx	4.05	3.84	4.74	4.21	3.65	xxx
166	5.83	5.59	3.70	5.60	5.41	xxx	4.53	4.28	5.31	4.74	4.08	xxx
167	5.72	5.51	3.53	5.60	4.80	4.79	4.36	4.09	5.28	4.63	3.89	xxx
168	4.74	4.78	3.22	4.94	4.73	4.23	3.81	3.61	4.63	4.12	3.45	xxx
169	4.56	4.73	3.31	4.83	5.27	xxx	4.00	3.80	4.62	4.14	3.58	xxx
170	5.45	5.37	3.58	5.43	5.23	xxx	4.42	4.19	5.15	4.59	3.97	xxx
171	5.57	5.34	3.45	5.43	4.74	4.70	4.30	3.96	5.11	4.51	3.80	xxx
172	4.91	4.84	3.22	4.90	4.71	4.24	3.71	3.58	4.64	4.09	3.45	xxx
173	4.57	4.87	3.18	4.82	4.88	4.24	3.90	3.69	4.58	4.09	3.54	xxx
174	5	5.07	3.30	4.99	5.15	4.45	4.10	3.88	4.75	4.27	3.70	xxx
175	5.33	5.22	3.46	5.33	5.06	xxx	4.26	4.00	5.03	4.47	3.81	xxx
176	5.19	5.11	3.43	5.27	4.47	xxx	4.16	3.90	4.94	4.38	3.72	xxx
177	4.26	4.57	3.12	4.61	4.49	4.09	3.79	3.60	4.39	3.93	3.40	xxx
178	4.21	4.58	3.13	4.65	4.84	4.13	3.82	3.63	4.43	3.97	3.44	xxx
179	4.62	4.86	3.35	5.06	5.07	4.41	4.10	3.89	4.76	4.27	3.71	xxx
180	4.98	5.13	3.45	5.27	4.41	4.63	4.30	4.09	4.98	4.45	3.86	xxx
181	4.22	4.48	2.96	4.57	4.08	4.04	3.69	3.50	4.36	3.85	3.30	xxx
182	3.7	4.09	2.80	4.21	4.69	3.72	3.40	3.23	4.02	3.58	3.08	xxx
183	4.49	4.71	3.26	4.89	5.06	4.29	3.97	3.79	4.60	4.14	3.61	xxx
184	4.95	5.10	3.43	5.27	4.53	4.65	4.29	4.09	4.96	4.44	3.86	xxx
185	4.3	4.58	3.06	4.63	3.88	4.16	3.79	3.59	4.47	3.96	3.41	xxx
186	3.45	3.87	2.73	3.96	4.41	3.54	3.22	3.04	3.84	3.40	2.94	xxx
187	3.96	4.38	3.16	4.54	5.03	4.03	3.78	3.62	4.34	3.91	3.47	xxx
188	4.79	5.09	3.47	5.18	4.56	4.63	4.34	4.17	4.96	4.45	3.92	xxx
189	4.4	4.62	3.08	4.65	3.78	4.17	3.82	3.61	4.51	4.00	3.46	xxx
190	3.44	3.71	2.64	3.82	4.23	3.41	3.09	2.91	3.73	3.31	2.87	xxx

Appendix A. (continued)

191	3.85	4.15	3.08	4.35	5.11	3.88	3.67	3.51	4.18	3.81	3.41	xxx
192	5.01	5.19	3.56	5.31	4.53	4.74	4.51	4.33	5.05	4.58	4.06	3.18
193	4.5	4.63	3.03	4.66	3.75	4.10	3.70	3.48	4.48	3.95	3.37	2.43
194	3.37	3.69	2.63	3.79	4.19	3.36	3.00	2.83	3.70	3.28	2.82	2.06
195	3.9	4.15	3.05	4.27	5.15	3.91	3.60	3.45	4.13	3.74	3.33	2.60
196	5.1	5.22	3.52	5.31	4.34	4.80	4.42	4.22	5.09	4.56	4.01	3.07
197	4.41	4.49	2.89	4.49	3.48	3.95	3.56	3.34	4.33	3.80	3.23	2.29
198	3.25	3.52	2.51	3.59	4.07	3.16	2.86	2.71	3.46	3.08	2.65	1.93
199	3.94	4.12	3.01	4.20	4.95	3.77	3.51	3.33	4.03	3.63	3.20	2.49
200	5.09	5.10	3.45	5.12	4.59	4.59	4.24	4.03	4.90	4.38	3.83	2.91
201	4.65	4.82	3.02	4.72	3.09	4.12	3.71	3.47	4.53	3.97	3.34	2.36
202	2.91	3.19	2.15	3.11	4.13	2.68	2.35	2.17	3.04	2.65	2.22	1.56
203	3.97	4.10	3.05	4.16	5.14	xxx	3.57	3.43	4.06	3.71	3.36	2.70
204	5.27	5.26	3.65	5.29	5.02	xxx	4.49	4.30	5.08	4.59	4.08	3.20
205	5.09	5.08	3.48	5.13	4.06	4.48	4.22	4.00	4.96	4.41	3.82	2.86
206	3.88	3.96	2.83	4.08	4.25	3.51	xxx	3.10	3.98	3.54	3.06	2.26
207	3.85	4.10	3.04	4.31	5.18	xxx	xxx	3.49	4.16	3.79	3.40	2.70
208	5.08	5.18	3.65	5.32	4.70	xxx	xxx	4.34	5.11	4.64	4.14	3.27
209	4.73	4.75	3.25	4.85	4.23	4.28	xxx	3.67	4.64	4.11	3.52	2.55
210	3.86	4.19	xxx	4.27	4.32	3.80	xxx	xxx	4.17	3.67	3.13	2.28
211	xxx	4.27	xxx	4.41	4.87	3.95	xxx	xxx	4.26	3.82	3.35	2.58
212	xxx	4.92	xxx	5.04	4.63	4.53	xxx	xxx	4.82	4.37	3.87	3.02
213	4.53	4.73	xxx	4.77	4.05	4.23	xxx	xxx	4.57	4.06	3.49	2.53
214	3.74	4.06	xxx	4.14	4.01	3.64	xxx	xxx	3.98	3.53	3.04	2.22
215	3.71	4.06	xxx	4.12	4.60	3.67	xxx	xxx	3.95	3.54	3.09	2.35
216	4.5	4.72	xxx	4.74	4.53	4.25	xxx	xxx	4.55	4.06	3.53	2.67
217	4.45	4.60	xxx	4.65	4.16	4.11	xxx	xxx	4.46	3.93	3.34	2.41
218	3.81	4.12	xxx	4.24	4.05	3.77	xxx	xxx	4.07	3.61	3.08	2.21
219	3.73	4.02	xxx	4.10	4.32	3.70	3.39	xxx	3.97	3.55	3.09	2.26
220	4.22	4.39	xxx	4.40	4.35	3.98	3.68	xxx	4.24	3.79	3.30	2.43
221	4.35	4.50	xxx	4.45	3.97	3.97	3.59	xxx	4.27	3.79	3.26	2.40
222	3.59	3.95	xxx	4.02	4.00	3.63	3.29	xxx	3.81	3.44	2.96	2.17
223	3.69	3.92	2.88	3.99	4.14	3.66	3.34	xxx	4.06	3.51	3.05	2.31
224	3.95	4.12	2.97	4.15	4.60	3.80	3.49	xxx	4.04	3.62	3.13	2.34
225	4.26	4.54	3.30	4.68	4.30	4.19	3.85	xxx	4.48	4.05	3.56	2.72
226	3.77	4.24	3.02	4.34	3.95	3.88	3.56	xxx	4.09	3.75	3.29	2.47
227	3.41	3.86	2.82	3.95	4.06	3.60	3.31	xxx	4.04	3.48	3.07	2.37
228	3.68	3.93	2.95	4.10	4.29	3.71	3.41	xxx	3.98	3.60	3.16	2.47
229	3.8	4.19	3.14	4.35	4.32	3.94	3.63	xxx	4.19	3.81	3.36	2.62
230	3.8	4.22	3.15	4.38	3.78	3.98	3.66	xxx	4.22	3.83	3.38	2.63
231	3.42	3.67	2.72	3.82	3.72	3.46	3.17	xxx	3.70	3.30	2.85	2.12
232	3.39	3.61	2.71	3.72	4.16	3.40	3.11	xxx	3.63	3.26	2.84	2.16
233	3.65	4.04	3.01	4.16	4.40	3.82	3.53	xxx	4.05	3.67	3.23	2.49
234	3.94	4.38	3.16	4.44	3.50	4.06	3.77	xxx	4.31	3.90	3.42	2.62
235	3.04	3.49	2.51	3.63	xxx	3.22	2.99	xxx	3.45	3.08	2.65	1.96
236	2.87	3.27	2.44	3.45	xxx	3.07	2.84	xxx	3.29	2.95	2.55	xxx
237	3.34	3.79	2.79	3.93	xxx	3.60	3.34	3.16	3.80	3.42	2.96	2.26
238	3.52	4.05	2.93	4.04	xxx	3.76	3.48	3.32	4.00	3.60	3.12	2.39

Appendix A. (continued)

239	2.98	3.69	2.52	3.47	xxx	3.25	3.01	2.86	3.50	3.09	2.64	1.95
240	2.49	3.21	2.27	3.16	xxx	2.84	2.59	2.43	3.09	2.73	2.32	1.69
241	2.94	3.55	2.71	3.71	xxx	3.42	3.23	3.11	3.56	3.27	2.91	2.36
242	3.48	4.05	2.97	4.06	xxx	xxx	3.64	3.53	3.79	3.67	3.25	2.57
243	3	3.52	2.55	3.52	xxx	xxx	3.08	2.96	3.54	3.17	2.74	2.06
244	2.39	2.94	2.22	3.07	xxx	xxx	2.55	2.42	3.00	2.68	2.31	1.73
245	3	3.53	2.73	3.75	xxx	xxx	3.25	3.15	3.60	3.30	2.96	2.41
246	3.71	4.19	3.10	4.30	xxx	xxx	3.81	3.72	3.87	3.84	3.42	2.74
247	3.25	3.76	2.68	3.72	xxx	xxx	3.23	3.12	3.72	3.33	2.89	2.17
248	2.38	2.97	2.24	3.08	xxx	xxx	2.53	2.44	3.00	2.67	2.33	1.77
249	2.9	3.47	2.71	3.68	xxx	xxx	3.21	3.09	3.56	3.26	2.94	2.41
250	4.03	4.47	3.27	4.48	xxx	xxx	4.02	3.94	4.45	4.05	3.61	2.88
251	3.58	4.31	2.84	4.02	xxx	xxx	3.40	3.27	4.02	3.54	3.06	2.31
252	2.55	3.36	2.27	3.21	xxx	xxx	2.54	2.44	3.16	2.75	2.37	1.81
253	2.99	3.54	2.71	3.66	xxx	xxx	3.22	3.15	3.61	3.30	2.98	2.46
254	4.47	4.76	3.37	4.83	xxx	xxx	4.23	4.10	4.67	4.25	3.79	3.03
255	4.11	4.43	2.94	4.50	xxx	xxx	3.61	3.40	4.29	3.78	3.25	2.36
256	3.2	3.66	2.61	3.81	xxx	xxx	3.04	2.89	3.64	3.24	2.81	2.07
257	3.53	4.06	2.92	4.18	xxx	xxx	3.44	3.25	4.02	3.60	3.16	2.44
258	4.87	5.20	3.39	5.17	xxx	xxx	4.25	4.02	4.95	4.40	3.82	2.89
259	4.67	4.87	3.05	4.85	xxx	xxx	3.77	3.51	4.62	4.05	3.40	2.30
260	3.51	3.90	2.67	4.02	xxx	xxx	3.12	2.93	3.85	3.40	2.88	1.98
261	4.02	4.37	3.09	4.41	xxx	xxx	xxx	xxx	4.28	3.86	3.36	2.56
262	5.44	5.56	3.57	5.48	xxx	xxx	4.50	4.25	5.27	4.71	4.04	2.98
263	5.31	5.25	3.19	5.22	xxx	xxx	3.95	3.62	4.96	4.32	3.55	2.31
264	3.85	4.02	2.70	4.12	xxx	xxx	3.12	2.89	3.95	3.45	2.87	1.90
265	4.65	4.68	3.32	3.97	xxx	4.22	3.99	3.77	4.62	4.14	3.62	2.74
266	6.14	5.70	3.67	4.84	xxx	4.92	4.60	4.37	5.33	4.82	4.09	3.00
267	6.1	5.67	3.54	5.64	xxx	4.84	4.32	4.00	5.34	4.68	3.91	2.70
268	4.95	4.84	3.20	4.93	xxx	4.28	3.83	3.57	4.70	4.15	3.49	2.43
269	5.03	4.99	3.40	5.07	xxx	4.37	4.00	3.69	4.84	4.29	3.65	2.60
270	6.35	6.13	3.90	6.14	xxx	5.22	4.78	4.45	5.80	5.11	4.34	3.10
271	5.7	5.49	3.26	5.51	xxx	4.54	3.96	3.58	5.15	4.44	3.59	2.17
272	5.03	4.92	3.09	4.98	xxx	4.20	3.69	3.38	4.72	4.12	3.37	2.09
273	5.29	5.05	3.19	5.11	xxx	4.35	3.87	3.49	4.83	4.20	3.41	2.12
274	6.11	5.70	3.46	5.69	xxx	4.77	4.22	3.83	5.36	4.64	3.75	2.34
275	6.24	5.74	3.27	5.72	xxx	4.73	4.12	3.71	xxx	4.60	3.67	2.14
276	5.48	5.12	3.03	5.17	xxx	4.31	3.75	3.40	xxx	4.19	3.35	1.96
277	5.28	5.24	3.23	5.31	xxx	4.55	4.08	3.78	5.00	4.38	3.59	2.30
278	5.88	5.69	3.41	5.71	xxx	4.82	4.32	3.97	5.33	4.65	3.81	2.43
279	5.72	5.34	3.05	5.38	xxx	4.44	3.91	3.55	5.00	4.30	3.46	2.04
280	5.81	5.40	3.11	5.41	xxx	4.49	3.95	3.60	5.07	4.36	3.52	2.09
281	5.22	5.04	2.85	5.03	xxx	4.17	3.68	3.35	4.71	4.04	3.23	1.89
282	5.3	5.16	2.91	5.14	xxx	4.28	3.77	3.41	4.83	4.15	3.32	1.95
283	5.57	5.32	2.91	5.27	xxx	4.36	3.81	3.43	4.95	4.23	3.35	1.90
284	5.47	5.14	2.84	5.12	xxx	4.24	3.71	3.35	4.80	4.12	3.27	1.85
285	5.18	4.97	2.80	4.96	xxx	4.15	3.64	3.31	4.65	4.01	3.20	1.87
286	4.42	4.50	2.63	4.54	xxx	3.83	3.36	3.07	4.28	3.71	2.95	1.73

Appendix A. (continued)

287	5.16	5.09	3.09	5.17	xxx	4.41	3.97	3.69	4.83	4.24	3.48	2.23
288	5.17	5.11	3.06	5.20	xxx	4.42	3.96	3.69	4.85	4.22	3.45	2.17
289	4.69	4.74	2.92	4.79	xxx	4.14	3.72	3.48	4.53	3.95	3.25	2.12
290	4.14	4.30	2.72	4.37	xxx	3.77	3.39	3.16	4.12	3.60	2.96	1.93
291	4.49	4.64	3.03	4.78	xxx	4.15	3.78	3.57	4.47	3.97	3.35	2.37
292	4.91	5.01	3.18	5.17	xxx	4.49	4.08	3.85	4.81	4.27	3.59	2.48
293	4.3	4.50	2.87	4.57	xxx	4.02	3.62	3.39	4.39	3.83	3.19	2.13
294	3.47	3.73	2.53	3.82	xxx	3.34	3.01	2.82	3.67	3.22	2.68	1.81
295	3.97	4.24	3.01	4.44	xxx	3.96	3.69	3.55	4.20	3.81	3.32	2.55
296	4.81	4.85	3.24	4.94	xxx	xxx	4.08	3.91	4.67	4.20	3.63	2.70
297	4.02	4.20	2.79	4.28	xxx	xxx	3.48	3.31	4.11	3.63	3.11	2.25
298	3.07	3.38	2.41	3.56	xxx	xxx	2.84	2.68	3.43	3.03	2.59	1.86
299	3.77	3.99	2.94	4.18	xxx	xxx	3.55	3.42	4.01	3.67	3.26	2.58
300	4.65	4.74	3.27	4.84	4.05	xxx	4.13	3.98	4.65	4.22	3.72	2.91
301	3.98	4.17	2.82	4.23	3.39	3.80	3.51	3.36	4.09	3.65	3.15	2.35
302	2.97	3.38	2.44	3.54	3.83	3.15	2.90	2.76	3.42	3.07	2.65	1.98
303	3.42	3.80	2.79	3.97	4.64	3.60	3.35	3.20	3.84	3.49	3.08	2.41
304	4.38	4.66	3.21	4.73	4.21	4.32	4.05	3.90	4.57	4.14	3.64	2.82
305	3.97	4.25	2.83	4.31	3.54	3.85	3.54	3.35	4.17	3.72	3.19	2.29
306	3.09	3.49	2.47	3.61	3.90	3.20	2.92	2.76	3.50	3.12	2.69	1.95
307	3.43	3.86	2.82	3.97	4.64	3.61	3.35	3.22	3.85	3.49	3.07	2.41
308	4.32	4.67	3.21	4.76	4.29	4.32	4.03	3.88	4.59	4.14	3.63	2.80
309	4.08	4.32	2.83	4.37	3.58	3.89	3.53	3.32	4.24	3.72	3.18	2.26
310	3.09	3.54	2.47	3.61	3.94	3.22	2.88	2.71	3.53	3.11	2.66	1.91
311	3.63	3.95	2.84	3.94	4.65	3.65	3.39	3.25	3.87	3.50	3.08	2.39
312	4.55	4.71	3.21	4.72	4.39	4.31	4.02	3.86	4.56	4.12	3.61	2.76
313	4.33	4.43	2.92	4.48	3.55	3.97	3.64	3.44	4.33	3.82	3.26	2.31
314	3.28	3.49	2.46	3.57	4.06	3.18	2.89	2.72	3.50	3.09	2.64	1.86
315	3.81	4.03	2.94	4.17	4.63	3.78	3.56	3.41	4.02	3.65	3.24	2.40
316	4.63	4.67	3.28	4.79	4.25	4.34	4.06	3.93	4.64	4.17	3.70	2.77
317	4.17	4.25	2.94	4.35	3.78	3.91	3.57	3.39	4.20	3.73	3.20	2.35
318	3.47	3.71	2.64	3.81	3.74	3.44	3.12	2.97	3.71	3.29	2.80	2.05
319	3.7	3.77	xxx	3.83	4.59	3.46	3.19	3.07	3.67	3.28	2.85	2.11
320	4.8	4.71	xxx	4.73	4.54	4.28	3.97	3.81	4.53	4.04	3.53	2.63
321	4.59	4.64	2.88	4.70	3.92	4.11	3.72	3.47	4.48	3.90	3.23	2.07
322	3.81	3.96	2.60	4.05	4.02	3.53	3.21	3.01	3.85	3.39	2.82	1.86
323	3.81	4.12	2.77	4.17	4.72	3.70	3.39	3.18	3.93	3.54	2.93	1.99
324	4.78	4.93	3.08	4.90	4.41	4.34	3.97	3.74	4.64	4.13	3.41	2.29
325	4.36	4.53	2.72	4.56	4.04	3.90	3.50	3.23	4.32	3.75	3.06	1.95
326	3.83	4.08	2.58	4.15	4.18	3.59	3.26	3.05	3.94	3.44	2.83	1.83
327	4.08	4.28	2.68	4.31	4.47	3.74	3.38	3.14	4.07	3.58	2.99	1.97
328	4.39	4.59	2.82	4.63	4.37	4.00	3.62	3.38	4.35	3.83	3.18	2.09
329	4.28	4.54	2.71	4.49	4.09	3.87	3.50	3.24	4.26	3.73	3.06	1.95
330	3.91	4.24	2.57	4.17	4.21	3.61	3.27	3.04	3.98	3.48	2.87	1.84
331	3.96	4.26	2.71	4.33	4.33	3.78	3.45	3.15	4.09	3.61	3.03	2.04
332	4.2	4.42	2.75	4.48	4.26	3.89	3.52	3.31	4.23	3.73	3.10	2.07
333	4.16	4.33	2.72	4.38	4.13	3.84	3.51	3.31	4.17	3.69	3.07	2.05
334	4	4.16	2.65	4.23	4.13	3.71	3.40	3.21	4.02	3.57	2.98	1.99

Appendix A. (continued)

335	3.95	4.16	2.69	4.27	4.15	3.72	3.41	3.21	4.03	3.58	2.98	2.01
336	3.93	4.21	2.69	4.31	4.07	3.73	3.40	3.22	4.07	3.60	2.99	2.02
337	3.85	4.11	2.61	4.19	4.14	3.66	3.36	3.19	4.00	3.50	2.93	1.97
338	3.93	4.19	2.66	4.28	3.88	3.75	3.45	3.27	4.07	3.57	3.01	2.03
339	3.67	3.95	2.51	4.04	3.82	3.50	3.20	3.02	3.82	3.35	2.77	1.80
340	3.54	3.85	2.48	3.95	3.91	3.43	3.14	2.96	3.76	3.31	2.73	1.79
341	3.6	3.94	2.56	4.01	4.06	3.54	3.27	3.11	3.83	3.39	2.82	1.88
342	3.78	4.13	2.64	4.12	3.69	3.70	3.41	3.24	3.99	3.52	2.94	1.95
343	3.49	3.76	2.33	3.72	3.31	3.34	3.03	2.85	3.64	3.16	2.59	1.60
344	2.95	3.31	2.17	3.36	3.87	2.98	2.71	2.55	3.25	2.84	2.33	1.46
345	3.53	3.84	2.61	3.94	4.08	3.55	3.31	3.16	3.78	3.37	2.85	2.00
346	3.77	4.08	2.67	4.09	3.56	3.75	3.47	3.31	4.00	3.54	2.98	2.05
347	3.38	3.60	2.30	3.48	3.16	3.22	2.94	2.79	3.52	3.07	2.53	1.62
348	2.81	3.15	2.10	3.14	3.73	2.84	2.58	2.45	3.10	2.72	2.23	1.42
349	3.17	3.71	2.63	3.80	4.23	3.51	3.29	3.20	3.64	3.31	2.89	2.22
350	3.88	4.26	2.82	4.22	3.67	3.97	3.67	3.56	4.15	3.72	3.21	2.35
351	3.42	3.66	2.32	3.41	2.87	3.32	3.00	2.83	3.62	3.15	2.60	1.70
352	2.56	2.80	1.95	2.67	3.26	2.55	2.31	2.18	2.80	2.44	2.00	1.32
353	2.78	3.18	2.32	3.31	4.45	3.01	2.83	2.72	3.19	2.91	2.55	1.99
354	xxx	4.47	xxx	4.50	2.77	xxx	xxx	xxx	4.37	3.99	xxx	xxx
355	xxx	3.07	xxx	4.44	3.26	xxx	xxx	xxx	xxx	xxx	xxx	xxx
356	xxx	3.19	xxx	4.81	4.37	xxx	xxx	xxx	xxx	xxx	xxx	xxx
357	3.81	4.44	xxx	4.61	3.70	xxx	xxx	xxx	xxx	xxx	xxx	xxx
358	3.66	3.86	xxx	3.98	3.61	2.73	1.93	xxx	3.54	2.94	2.15	xxx
359	3.27	3.68	xxx	3.83	3.00	2.65	1.81	xxx	3.51	2.94	2.17	xxx
360	2.53	3.10	xxx	3.22	3.39	2.17	1.47	xxx	2.89	2.35	1.63	xxx
361	2.72	3.45	xxx	3.61	4.39	2.52	1.75	xxx	3.31	2.80	2.10	xxx
362	3.98	4.48	xxx	4.59	3.86	3.35	2.40	xxx	4.23	3.62	2.81	xxx
363	3.48	3.97	xxx	4.04	3.21	2.91	1.97	xxx	3.71	3.12	2.34	xxx
364	2.73	3.36	xxx	3.41	3.42	2.35	1.53	xxx	3.12	2.61	1.89	xxx
365	2.88	3.54	xxx	3.61	4.46	2.58	1.84	1.23	3.33	2.85	2.18	xxx
366	4.22	4.61	xxx	4.66	4.13	3.49	2.57	1.71	4.29	3.65	2.86	xxx
367	4.02	4.31	xxx	4.37	3.42	3.21	2.34	1.56	3.93	3.22	2.36	xxx
368	3.06	3.55	xxx	3.64	3.80	2.53	1.72	1.06	3.30	2.73	1.97	xxx
369	3.26	3.89	xxx	4.09	4.73	3.06	2.36	1.80	3.65	3.06	2.24	xxx
370	4.62	4.96	xxx	5.11	4.43	3.85	3.02	2.32	4.56	3.81	2.92	xxx
371	4.61	4.69	xxx	4.66	3.95	3.51	2.69	2.00	4.19	3.31	2.32	xxx
372	xxx	4.10	xxx	4.15	4.50	3.12	2.35	1.67	3.75	3.02	2.11	xxx
373	xxx	4.68	xxx	4.76	5.29	3.72	2.97	2.32	4.25	3.40	2.36	xxx
374	xxx	5.64	xxx	5.61	4.95	4.34	3.46	2.77	5.06	4.08	2.92	xxx
375	5.5	5.39	1.59	5.36	4.09	3.85	2.91	2.17	4.68	3.61	2.36	xxx
376	4.4	4.35	1.19	4.40	4.62	3.17	2.37	1.68	3.83	2.91	1.82	xxx
377	4.73	4.82	1.73	4.86	5.33	3.77	2.99	2.29	4.38	3.42	2.28	xxx
378	5.97	5.72	1.93	5.66	4.80	4.34	3.46	2.73	5.09	4.03	2.79	xxx
379	5.59	5.25	1.65	5.18	4.67	3.74	2.86	2.11	4.55	3.51	2.30	xxx
380	5.21	5.04	1.59	4.98	4.83	3.66	2.83	2.09	4.41	3.42	2.27	xxx
381	5.43	5.22	1.68	5.16	5.19	3.77	2.89	2.12	4.56	3.52	2.34	xxx
382	5.99	5.65	1.83	5.61	4.95	4.07	3.12	2.34	4.93	3.83	2.49	xxx

Appendix A. (continued)

383	5.97	5.45	1.68	5.40	4.76	3.76	2.81	2.02	4.69	3.61	2.23	xxx
384	5.71	5.21	1.62	5.16	4.85	3.63	2.74	1.97	4.50	3.46	2.17	xxx
385	5.74	5.33	xxx	5.26	4.98	3.73	2.82	2.04	4.60	3.53	2.28	xxx
386	5.87	5.49	xxx	5.42	5.00	3.82	2.88	2.09	4.72	3.62	2.29	xxx
387	6.06	5.51	xxx	5.19	4.90	3.86	2.85	2.06	4.74	3.64	2.30	xxx
388	5.92	5.38	xxx	5.08	4.91	3.78	2.79	2.01	4.63	3.55	2.27	xxx
389	5.79	5.38	xxx	5.11	4.76	3.82	2.86	2.11	4.65	3.61	2.36	xxx
390	5.47	5.21	xxx	5.08	4.92	3.70	2.75	2.01	4.51	3.47	2.28	xxx
391	5.67	5.35	xxx	5.10	5.05	3.84	2.93	2.17	4.68	3.65	2.49	xxx
392	5.99	5.54	xxx	5.08	4.84	3.93	2.99	2.21	4.79	3.72	2.51	xxx
393	5.63	5.32	xxx	5.24	4.39	3.80	2.87	2.14	4.60	3.61	2.46	xxx
394	4.99	4.78	xxx	4.72	4.70	3.43	2.57	1.86	4.15	3.23	2.14	xxx
395	5.08	5.01	xxx	3.98	5.00	3.78	2.98	2.30	4.48	3.58	2.51	xxx
396	5.84	5.44	xxx	4.38	4.56	4.00	3.13	2.43	4.78	3.78	2.65	xxx
397	5.08	4.95	xxx	4.87	4.07	3.62	2.82	2.17	4.36	3.48	2.46	xxx
398	4.24	4.32	1.71	4.32	4.38	3.21	2.48	1.85	3.86	3.07	2.10	xxx
399	4.66	4.62	2.07	4.58	4.82	3.60	2.92	2.32	4.20	3.42	2.50	xxx
400	5.31	5.18	2.24	5.11	4.35	3.94	3.18	2.56	4.64	3.75	2.74	xxx
401	4.69	4.67	1.96	4.68	3.70	3.47	2.72	2.14	4.18	3.39	2.47	xxx
402	3.62	3.87	1.65	3.94	3.93	2.92	2.26	1.71	3.53	2.86	2.02	0.70
403	3.67	4.02	1.99	4.11	4.65	3.25	2.71	2.23	3.76	3.17	2.38	1.08
404	4.7	4.92	2.33	4.95	3.96	3.85	3.19	2.66	4.49	3.74	2.81	1.32
405	4.12	4.23	1.79	4.27	3.34	3.18	2.53	2.02	3.82	3.14	2.31	1.05
406	3.16	3.44	1.52	3.53	3.61	2.67	2.12	1.66	3.19	2.65	1.93	0.81
407	3.57	3.74	1.69	3.80	4.10	2.97	2.44	2.00	3.43	2.87	2.15	0.99
408	4.08	4.28	1.97	4.36	3.92	3.38	2.81	2.35	3.93	3.26	2.47	1.20
409	3.72	4.10	1.45	4.18	3.06	3.13	2.53	2.01	3.76	3.09	2.32	1.07
410	2.76	3.15	1.21	3.23	3.54	2.40	1.86	1.36	2.89	2.37	1.70	0.62
411	3.05	3.54	1.39	3.67	4.00	3.01	2.53	2.09	3.38	2.90	2.27	1.11
412	3.85	4.13	1.72	4.21	3.68	3.40	2.89	2.43	3.84	3.26	2.54	1.22
413	3.61	3.84	1.29	3.86	3.07	3.08	2.55	2.10	3.55	3.00	2.32	1.15
414	2.64	3.12	1.01	3.19	3.61	2.54	2.05	1.62	2.93	2.47	1.87	0.81
415	3	3.65	1.32	3.76	3.95	3.09	2.66	2.27	3.48	3.00	2.41	1.32
416	3.66	4.06	1.52	4.13	3.57	3.38	2.95	2.56	3.82	3.26	2.59	1.34
417	3.39	3.65	1.36	3.70	3.31	3.06	2.59	2.17	3.45	2.98	2.37	1.26
418	2.91	3.33	1.16	3.40	3.41	2.85	2.38	1.96	3.18	2.75	2.17	1.11
419	2.92	3.41	1.38	3.50	4.16	2.95	2.50	2.09	3.29	2.88	2.32	1.33
420	3.95	4.26	1.69	4.30	3.78	3.60	3.09	2.65	4.03	3.48	2.79	1.58
421	3.77	3.96	1.36	3.98	3.14	3.09	2.47	1.94	3.64	3.08	2.37	1.12
422	2.78	3.20	1.04	3.26	3.80	2.55	1.98	1.47	3.00	2.58	2.00	0.95
423	3.42	3.83	1.66	3.88	4.23	3.23	2.67	2.18	3.65	3.18	2.56	1.45
424	3.98	4.32	1.77	4.36	4.04	3.60	3.01	2.50	4.09	3.52	2.80	1.52
425	3.94	4.17	1.68	4.20	3.72	3.38	2.75	2.23	3.92	3.33	2.59	1.33
426	3.49	3.84	1.47	3.85	4.11	3.09	2.48	1.98	3.61	3.07	2.39	1.21
427	3.81	4.20	1.91	4.23	4.43	3.56	3.02	2.58	3.98	3.45	2.79	1.57
428	4.23	4.62	2.02	4.63	4.39	3.82	3.23	2.76	4.31	3.71	2.97	1.64
429	xxx	4.57	2.15	4.57	3.58	3.78	3.24	2.80	4.27	3.69	2.96	1.66
430	xxx	3.66	1.72	3.71	3.88	3.04	2.57	2.18	3.46	3.00	2.40	1.29

Appendix A. (continued)

431	3.44	3.88	2.06	3.99	4.44	3.47	3.10	2.80	3.77	3.33	2.81	1.81
432	4.2	4.53	2.29	4.61	4.57	3.95	3.52	3.18	4.32	3.77	3.12	1.95
433	4.32	4.69	2.42	4.74	4.19	3.99	3.53	3.17	4.44	3.87	3.16	1.91
434	3.92	4.25	2.18	4.31	4.09	3.64	3.21	2.89	4.05	3.54	2.90	1.72
435	3.88	4.16	2.29	4.21	4.28	3.63	3.27	3.01	3.97	3.51	2.92	1.89
436	4.05	4.37	2.34	4.44	4.28	3.81	3.42	3.12	4.18	3.67	3.03	1.93
437	4.08	4.36	2.42	4.42	4.19	3.80	3.41	3.10	4.17	3.66	3.02	1.93
438	3.96	4.26	2.36	4.30	4.19	3.71	3.33	3.04	4.07	3.58	2.96	1.89
439	4.03	4.27	2.41	4.31	4.16	3.70	3.31	3.04	4.07	3.57	2.95	1.92
440	3.92	4.23	2.37	4.31	4.21	3.67	3.28	2.99	4.04	3.54	2.90	1.88
441	4.04	4.28	2.52	4.36	4.23	3.77	3.41	3.15	4.08	3.60	3.00	2.00
442	3.95	4.27	2.51	4.38	4.39	3.80	3.43	3.18	4.12	3.63	3.03	2.01
443	4.3	4.47	2.67	4.55	4.04	3.94	3.53	3.27	4.27	3.75	3.13	2.06
444	3.9	4.11	2.47	4.18	4.35	3.60	3.21	2.98	3.91	3.43	2.86	1.87
445	3.98	4.35	2.80	4.45	4.56	3.95	3.61	3.41	4.23	3.79	3.26	2.34
446	4.2	4.57	2.85	4.68	4.31	4.15	3.79	3.56	4.43	3.95	3.39	2.41
447	4.18	4.38	2.75	4.50	3.96	3.89	3.51	3.26	4.18	3.69	3.11	2.14
448	3.73	4.00	2.57	4.13	4.26	3.55	3.19	2.97	3.84	3.40	2.85	1.96
449	3.75	4.19	2.87	4.34	4.24	3.89	3.60	3.43	4.16	3.74	3.28	2.44
450	4.07	4.23	2.85	4.33	4.29	3.87	3.58	xxx	4.13	3.69	3.22	2.40
451	4.01	4.31	2.92	4.39	3.97	3.91	3.64	xxx	4.16	3.77	3.25	2.46
452	3.51	3.94	2.70	4.06	3.98	3.59	3.33	3.14	3.85	3.48	3.00	2.22
453	3.41	3.89	2.85	4.02	4.47	3.67	3.45	3.32	3.90	3.55	3.16	2.53
454	4.13	4.45	3.11	4.56	4.06	4.14	3.89	3.73	4.38	3.99	3.53	2.80
455	3.89	4.10	2.74	4.23	3.53	3.69	3.36	3.16	3.94	3.51	2.99	2.17
456	3.12	3.52	2.47	3.64	3.71	3.20	2.91	2.75	3.42	3.06	2.61	1.93
457	3.24	3.65	2.67	3.74	4.32	3.44	3.24	3.14	3.62	3.31	2.94	2.38
458	4.11	4.34	3.01	4.41	3.83	4.03	3.78	3.64	4.23	3.85	3.40	2.67
459	3.68	3.88	2.56	3.96	3.31	3.50	3.20	3.02	3.74	3.33	2.83	2.05
460	2.97	3.27	2.29	3.38	3.52	3.00	2.74	2.58	3.23	2.88	2.45	1.80
461	3.01	3.45	2.52	3.58	4.18	3.28	3.07	2.96	3.44	3.13	2.78	2.21
462	3.85	4.21	2.89	4.30	3.71	3.93	3.67	3.52	4.11	3.73	3.30	2.55
463	3.42	3.77	2.40	3.86	3.13	3.38	3.06	2.86	3.67	3.23	2.71	1.87
464	2.66	3.09	2.13	3.22	4.03	2.83	2.57	2.42	3.07	2.72	2.28	1.62
465	3.63	3.91	2.76	4.04	4.34	3.67	3.42	3.28	3.88	3.53	3.09	2.43
466	4.11	4.30	2.91	4.39	3.64	3.97	3.67	3.51	4.21	3.80	3.31	2.54
467	3.28	3.65	2.47	3.72	3.05	3.36	3.09	2.94	3.60	3.20	2.76	2.09
468	xxx	2.96	2.08	3.08	3.17	2.76	2.50	2.36	2.99	xxx	2.26	1.68
469	xxx	3.07	2.30	3.25	4.02	2.97	2.80	2.74	3.11	2.88	2.60	2.18
470	3.69	4.04	2.78	4.17	3.59	3.82	3.61	3.51	3.97	3.66	3.29	2.66
471	3.28	3.63	2.37	3.70	3.03	3.32	3.06	2.91	3.56	3.20	2.76	2.04
472	2.49	2.97	2.09	3.12	3.51	2.77	2.56	2.44	3.00	2.70	2.33	1.77
473	2.97	3.45	2.47	3.63	4.20	3.28	3.07	2.95	3.46	3.15	2.80	2.22
474	3.93	4.28	2.84	4.34	4.08	3.93	3.61	3.51	4.14	3.75	3.31	2.56
475	3.83	4.15	2.64	4.19	3.47	3.71	3.41	3.21	4.03	3.58	3.06	2.20
476	3.01	3.42	2.33	3.55	3.80	3.14	2.88	2.72	3.42	3.05	2.61	1.90
477	3.25	3.73	2.64	3.90	4.42	3.53	3.29	3.17	3.74	3.40	3.02	2.38
478	4.19	4.47	2.97	4.55	4.34	4.12	3.84	3.68	4.36	3.92	3.47	2.68

Appendix A. (continued)

479	4.26	4.42	2.79	4.45	3.87	3.92	3.56	3.33	4.27	3.76	3.20	2.26
480	3.52	3.85	2.55	3.95	4.26	3.47	3.15	2.94	3.80	3.36	2.86	2.03
481	3.96	4.27	2.93	4.36	4.93	3.95	3.66	3.49	4.17	3.77	3.33	2.58
482	4.94	5.04	3.24	5.07	4.70	4.55	4.18	3.96	4.83	4.33	3.77	2.85
483	4.83	4.81	2.93	4.85	4.34	4.20	3.75	3.46	4.61	4.04	3.38	2.30
484	4.32	4.39	2.79	4.47	4.58	3.90	3.50	3.24	4.26	3.75	3.17	2.20
485	4.62	4.67	3.01	4.73	5.16	4.19	3.82	3.58	4.51	4.00	3.43	2.50
486	5.39	5.33	3.27	5.35	5.01	4.66	4.21	3.93	5.08	4.47	3.79	2.71
487	5.41	5.19	3.02	5.23	4.79	4.40	3.87	3.54	4.91	4.25	3.50	2.29
488	5.17	4.94	2.92	4.98	4.90	4.22	3.72	3.41	4.67	4.07	3.37	2.22
489	5.33	5.08	3.06	4.61	5.23	4.39	3.93	3.65	4.79	4.20	3.52	2.45
490	5.86	5.48	3.20	4.98	5.13	4.63	4.13	3.82	5.11	4.46	3.71	2.55
491	5.83	5.35	3.01	5.37	5.12	4.46	3.89	3.52	4.99	4.32	3.52	2.26
492	5.72	5.32	3.04	5.35	5.04	4.47	3.92	3.56	4.99	4.33	3.56	2.31
493	5.74	5.23	2.93	5.29	4.54	4.38	3.86	3.50	4.91	4.26	3.47	2.13
494	5.42	4.74	2.73	4.74	5.06	3.97	3.49	3.16	4.43	3.86	3.14	1.95
495	5.58	5.25	3.16	5.21	5.67	4.55	4.12	3.84	4.95	4.37	3.71	2.63
496	6.2	5.90	3.41	5.90	5.21	5.03	4.53	4.19	5.55	4.84	4.07	2.80
497	5.97	5.46	3.00	5.46	5.06	4.50	3.95	3.56	5.09	4.38	3.56	2.25
498	5.68	5.26	2.90	5.25	5.02	4.38	3.85	3.47	4.92	4.26	3.47	2.22
499	5.71	5.23	2.91	5.20	5.54	4.38	3.86	3.51	4.89	4.26	3.47	2.23
500	6.62	5.92	3.24	5.82	5.16	4.81	4.22	3.83	5.42	4.70	3.84	2.47
501	6.42	5.52	2.68	5.50	4.55	xxx	3.72	3.27	4.99	4.24	3.32	1.87
502	5.47	4.71	2.40	4.76	4.65	3.87	3.35	2.98	4.39	3.78	2.99	1.73
503	xxx	4.82	2.50	4.81	5.43	4.05	3.62	3.30	4.53	3.94	3.21	1.99
504	xxx	5.78	2.94	5.73	5.01	4.68	4.13	3.72	5.31	xxx	3.69	2.26
505	6.01	5.39	2.41	5.33	4.06	4.14	3.47	2.99	4.87	xxx	3.16	1.66
506	4.42	4.22	1.98	4.23	4.60	3.41	2.91	2.55	3.94	xxx	2.66	1.45
507	4.9	4.74	2.53	4.77	5.20	4.06	3.60	3.27	4.51	xxx	3.21	1.96
508	5.91	5.47	2.80	5.46	4.66	4.54	3.97	3.57	5.09	xxx	3.52	2.08
509	5.3	4.93	2.34	4.87	3.92	3.98	3.38	2.98	4.52	xxx	3.05	1.70
510	4.01	4.01	2.02	4.05	4.19	3.38	2.91	2.58	3.81	xxx	2.62	1.48
511	4.19	4.26	2.32	4.33	4.80	3.72	3.35	3.07	4.10	xxx	2.96	1.87
512	5.11	4.99	2.60	5.00	4.51	4.22	3.74	3.40	4.70	xxx	3.30	2.04
513	4.87	4.77	2.35	4.68	3.58	3.91	3.37	3.02	4.41	xxx	3.01	1.76
514	3.44	3.66	1.90	3.67	3.87	3.12	2.70	2.45	3.49	xxx	2.42	1.41
515	3.68	3.95	2.31	4.02	4.26	3.54	3.24	3.09	3.78	xxx	2.90	2.07
516	4.29	4.46	2.48	4.47	4.07	3.89	3.53	3.33	4.18	xxx	3.11	2.16
517	4.01	4.18	2.33	4.23	3.23	3.67	3.27	3.03	4.01	xxx	2.89	1.91
518	2.92	3.19	1.90	3.31	3.71	2.86	2.56	2.39	3.14	xxx	2.28	1.52
519	3.28	3.61	2.42	3.79	4.50	3.41	3.19	3.08	3.60	xxx	2.89	2.24
520	4.4	4.58	2.77	4.65	3.83	4.16	3.84	3.87	4.41	xxx	3.44	2.54
521	3.62	3.92	2.32	3.94	3.12	3.47	3.17	2.98	3.79	xxx	2.83	1.99
522	2.7	3.08	1.94	3.19	3.44	2.80	2.55	2.41	3.07	xxx	2.31	1.65
523	3.02	3.36	2.27	3.53	4.00	3.18	2.95	2.83	3.29	xxx	2.69	2.07
524	3.78	4.03	2.54	4.12	3.92	3.71	3.45	3.29	3.96	3.57	3.11	2.34
525	3.76	4.03	2.43	3.95	3.31	3.55	3.24	3.06	3.89	3.43	2.91	2.05
526	2.89	3.31	2.09	3.32	3.45	2.97	2.69	2.55	3.26	2.89	2.45	1.74

Appendix A. (continued)

527	2.92	3.41	2.33	3.57	3.79	3.18	2.95	2.85	3.41	3.10	2.71	2.12
528	3.39	3.81	2.49	3.91	3.95	3.52	3.27	3.15	3.76	3.41	2.96	2.29
529	3.61	4.09	2.61	4.00	3.47	3.64	3.38	3.25	3.91	3.52	3.05	2.32
530	3.03	3.57	2.31	3.51	3.55	3.16	2.89	2.77	3.44	3.07	2.65	1.99
531	3.07	3.51	2.52	3.64	3.76	3.32	3.08	2.99	3.51	3.22	2.88	2.33
532	3.36	3.73	2.62	3.86	3.94	3.52	3.29	3.19	3.69	3.40	3.04	2.44
533	3.54	3.87	2.72	4.01	3.79	3.64	3.38	3.25	3.88	3.54	3.12	2.46
534	3.3	3.71	2.64	3.84	3.46	3.51	3.26	3.13	3.75	3.42	3.01	2.39
535	3.18	3.46	2.44	3.51	3.88	3.22	2.98	2.86	3.44	3.13	2.73	2.13
536	3.57	3.89	2.69	4.06	3.92	3.64	3.39	3.26	3.85	3.52	3.09	2.42
537	3.65	3.90	2.60	4.17	3.64	3.62	3.34	3.17	3.86	3.50	3.01	2.21
538	3.42	3.59	2.46	4.07	3.80	3.34	3.07	2.92	3.58	3.24	2.79	2.06
539	3.46	3.77	2.67	4.02	3.95	3.55	3.29	3.18	3.74	3.40	3.02	2.43
540	3.65	3.97	2.72	4.15	3.97	3.69	3.42	3.28	3.89	3.52	3.10	2.45
541	3.64	3.96	2.66	4.27	4.16	3.66	3.34	3.15	3.91	3.52	3.05	2.31
542	3.94	4.17	2.77	4.31	3.93	3.84	3.52	3.34	4.10	3.69	3.20	2.43
543	3.78	3.97	2.53	4.23	4.12	3.57	3.24	3.04	3.88	3.47	2.94	2.15
544	3.97	4.16	2.65	4.19	3.79	3.75	3.41	3.21	4.06	3.63	3.09	2.27
545	3.65	3.85	2.39	4.31	4.11	3.43	3.08	2.87	3.73	3.30	2.79	1.92
546	3.99	4.19	2.57	4.56	4.28	3.71	3.36	3.15	4.06	3.59	3.03	2.10
547	4.41	4.37	2.58	4.23	3.72	3.80	xxx	3.08	4.21	3.69	3.06	1.98
548	3.69	3.73	2.31	3.83	4.20	3.30	2.93	2.72	3.62	3.20	2.67	1.74
549	3.94	4.20	2.72	4.33	4.51	3.79	3.46	3.25	4.11	3.69	3.18	2.34
550	4.61	4.65	2.87	4.65	4.24	4.09	3.72	3.49	4.42	3.93	3.36	2.42
551	4.32	4.39	2.65	4.39	4.10	3.80	3.42	3.18	4.17	3.69	3.10	2.15
552	4	4.16	2.57	4.25	3.91	3.65	3.29	3.05	4.04	3.58	3.00	2.07
553	3.74	3.97	2.52	4.05	4.42	3.54	3.24	3.04	3.87	3.45	2.95	2.12
554	4.48	4.55	2.80	4.61	4.40	4.02	3.66	3.42	4.39	3.89	3.32	2.38
555	4.6	4.55	2.59	4.54	3.70	3.84	3.37	3.04	4.34	3.76	3.07	1.94
556	3.5	3.71	2.23	3.76	4.32	3.19	2.80	2.53	3.62	3.16	2.60	1.67
557	4.17	4.33	2.83	4.40	4.13	3.93	3.58	3.37	4.23	3.80	3.29	2.44
558	4.26	4.27	2.75	4.22	3.99	3.74	3.42	3.22	4.05	3.63	3.12	2.28
559	3.98	4.10	2.74	4.07	3.51	3.64	3.46	3.23	3.92	3.55	3.10	2.39
560	3.13	3.46	2.37	3.58	4.18	3.16	2.86	2.70	3.46	3.09	2.66	2.01
561	3.75	4.10	3.03	4.22	4.66	3.89	3.63	3.50	4.12	3.81	3.45	2.84
562	4.59	4.75	3.31	4.74	4.23	4.37	4.11	3.96	4.62	4.24	3.81	3.09
563	4.24	4.33	2.96	4.30	3.66	3.88	4.00	3.38	4.21	3.77	3.28	2.55
564	3.26	3.58	2.57	3.72	3.72	3.32	2.99	2.85	3.62	3.26	2.85	2.21
565	3.24	3.68	2.75	3.78	4.54	3.47	3.22	3.13	3.69	3.41	3.08	2.53
566	4.47	4.66	3.25	4.64	4.23	4.29	4.02	3.89	4.51	4.15	3.72	3.02
567	4.22	4.33	2.90	4.38	3.40	3.88	3.55	3.36	4.21	3.77	3.27	2.46
568	2.91	3.33	2.41	3.49	3.65	3.05	2.76	2.60	3.36	3.03	2.65	2.02
569	3.08	3.52	2.67	3.70	4.49	3.38	3.16	3.05	3.59	3.32	3.00	2.48
570	4.29	4.51	3.18	4.61	4.04	4.22	3.96	3.82	4.45	4.08	3.65	2.94
571	4.06	4.12	2.75	4.19	3.35	3.71	3.40	3.22	4.02	3.61	3.13	2.35
572	3.07	3.28	2.34	3.41	3.56	3.02	2.73	2.58	3.31	2.99	2.61	1.99
573	3.05	3.43	2.54	3.58	4.61	3.27	3.04	2.93	3.51	3.21	2.88	2.33
574	4.4	4.64	3.15	4.70	3.55	4.29	4.02	3.85	4.56	4.14	3.68	2.92

Appendix A. (continued)

575	3.74	3.74	2.08	3.70	3.51	3.10	2.71	2.47	3.49	2.99	2.46	1.56
576	xxx	3.53	2.15	3.59	3.89	3.12	2.78	2.58	3.44	3.03	2.58	1.77
577	xxx	3.88	2.36	3.96	3.59	3.53	xxx	2.93	3.81	3.38	2.83	1.76
578	xxx	3.67	2.23	3.66	4.23	3.19	xxx	2.62	3.52	3.09	2.55	1.57
579	4.08	4.29	2.68	4.30	3.01	3.87	3.54	3.35	4.14	3.68	3.14	2.29
580	2.62	2.97	1.94	3.06	3.35	2.68	2.37	2.19	2.94	2.58	2.13	1.44
581	2.85	3.22	2.46	3.35	4.38	3.12	2.92	2.82	3.27	3.08	2.78	2.30
582	4.01	4.34	3.01	4.46	4.13	4.14	3.90	3.79	4.32	4.00	3.58	2.90
583	3.81	4.16	2.80	4.26	3.37	3.87	3.58	3.43	4.08	3.72	3.25	2.50
584	2.92	3.30	2.34	3.46	3.81	3.10	2.81	2.66	3.32	3.02	2.61	2.00
585	3.23	3.67	2.71	3.92	4.41	3.50	3.24	3.08	3.75	3.44	3.04	2.43
586	3.98	4.44	3.05	xxx	4.33	4.11	3.86	3.72	4.34	3.99	3.55	2.85
587	3.93	4.39	2.94	4.93	4.11	3.98	3.66	3.48	4.25	3.85	3.34	2.55
588	3.7	4.06	2.80	4.21	3.86	3.74	3.41	3.23	4.01	3.63	3.14	2.40
589	3.44	3.80	2.70	3.97	4.43	3.55	3.25	3.10	3.76	3.44	3.02	2.35
590	4.1	4.42	3.01	4.55	4.53	4.12	3.81	3.64	4.34	3.96	3.49	2.70
591	4.41	4.58	2.87	4.67	4.37	4.10	3.69	3.43	4.41	3.93	3.33	2.34
592	4.25	4.42	2.81	4.51	4.35	3.93	3.55	3.32	0.00	3.80	3.22	2.29
593	4.11	4.50	2.90	4.40	4.71	3.93	3.62	3.45	3.80	3.80	3.28	2.41
594	4.56	4.89	3.07	4.77	4.76	4.27	3.92	3.70	3.80	4.09	3.52	2.57
595	4.81	4.86	3.03	4.90	4.76	4.26	3.80	3.51	4.09	4.08	3.41	2.32
596	4.86	4.86	3.05	4.90	4.77	4.27	3.81	3.52	4.08	4.09	3.43	2.35
597	4.74	4.81	3.01	4.90	4.66	4.28	3.85	3.56	4.09	4.10	3.45	2.35
598	4.76	4.80	2.96	4.81	5.09	4.16	3.74	3.46	4.10	4.01	3.36	2.27
599	5.31	5.20	3.24	5.23	4.98	4.55	4.11	3.82	4.01	4.40	3.73	2.61
600	5.52	5.08	3.19	5.12	4.69	4.42	xxx	3.69	4.40	4.28	3.63	2.53
601	5.02	4.93	3.06	4.84	4.96	4.20	xxx	3.57	4.28	4.07	3.49	2.51
602	5.03	5.17	3.14	5.11	5.23	4.46	4.04	3.76	4.07	4.30	3.66	2.59
603	5.58	5.36	3.31	5.38	5.54	4.64	4.15	3.83	4.30	4.51	3.78	2.62
604	6.22	5.74	3.48	5.73	5.28	4.90	4.37	4.02	4.51	4.76	4.00	2.76
605	5.96	5.65	3.22	5.49	4.82	4.63	4.07	3.70	4.76	4.50	3.72	2.46
606	5.1	5.08	2.99	4.98	5.14	4.24	3.74	3.42	4.50	4.13	3.42	2.29
607	5.46	5.22	3.28	5.28	5.63	4.59	4.13	3.82	4.13	4.45	3.77	2.67
608	6.28	5.85	3.51	5.82	5.34	5.01	4.47	4.11	4.45	4.83	4.07	2.83
609	6.01	5.62	3.26	5.59	4.88	4.68	4.13	3.76	4.83	4.54	3.76	2.50
610	5.19	5.01	3.03	5.08	5.07	4.27	3.78	3.45	4.54	4.17	3.46	2.31
611	5.31	5.15	3.24	5.23	5.72	4.52	4.07	3.77	4.17	4.39	3.73	2.66
612	6.38	5.97	3.57	5.95	5.40	5.08	4.55	4.19	4.39	4.92	4.16	2.92
613	6.18	5.70	3.20	5.69	4.55	4.70	4.09	3.70	4.92	4.56	3.74	2.40
614	4.87	4.65	2.82	4.76	4.66	3.97	3.46	3.15	4.56	3.89	3.20	2.08
615	4.7	4.68	3.05	4.81	5.78	4.20	3.80	3.57	3.89	4.09	3.51	2.58
616	6.37	6.05	3.62	6.04	4.29	5.16	4.61	4.28	4.09	4.98	4.23	3.06
617	xxx	4.86	2.37	4.61	3.64	3.64	3.06	2.67	4.98	3.52	2.71	1.50
618	xxx	3.90	2.12	3.82	4.63	3.14	2.72	2.42	3.52	3.10	2.45	1.46
619	4.63	4.68	2.60	4.78	5.06	4.06	3.55	3.20	3.10	3.95	3.18	1.91
620	5.44	5.26	2.86	5.29	4.90	4.43	3.86	3.47	3.95	4.29	3.44	2.07
621	5.33	5.14	2.62	5.16	3.81	4.24	3.62	3.17	4.29	4.09	3.23	1.82
622	3.73	3.87	2.10	3.97	4.21	3.30	2.83	2.46	4.09	3.19	2.53	1.41

Appendix A. (continued)

623	3.89	4.20	2.51	4.30	4.97	3.77	3.37	3.08	3.19	3.67	3.11	2.12
624	5.1	5.08	2.86	5.11	4.34	4.46	3.99	3.66	3.67	4.25	3.54	2.34
625	4.44	4.47	2.38	4.50	3.70	3.76	3.21	2.78	4.25	3.66	2.95	1.79
626	3.42	3.71	2.06	3.77	3.87	3.19	2.71	2.30	3.66	3.12	2.53	1.55
627	3.53	3.89	2.34	3.95	4.66	3.41	2.95	2.56	3.12	3.36	2.85	1.95
628	4.55	4.77	2.71	4.79	4.18	4.14	3.63	3.22	3.36	4.00	3.36	2.25
629	4.09	4.29	2.26	4.29	3.53	3.56	2.97	2.47	4.00	3.49	2.80	1.68
630	3.16	3.53	1.93	3.59	3.76	2.95	2.40	1.92	3.49	2.96	2.38	1.42
631	3.34	3.74	2.21	3.85	4.29	3.25	2.78	2.36	2.96	3.23	2.71	1.81
632	4.01	4.32	2.45	4.42	3.74	3.76	3.27	2.84	3.23	3.68	3.06	2.02
633	3.51	3.80	2.10	3.86	3.25	3.24	2.76	2.34	3.68	3.17	2.57	1.56
634	2.85	3.30	1.88	3.35	3.87	2.78	2.32	1.91	3.17	2.77	2.27	1.39
635	xxx	3.79	2.25	3.88	3.47	3.38	xxx	2.48	2.77	3.32	2.78	1.79
636	xxx	3.38	2.04	3.49	4.09	3.00	xxx	2.13	3.32	2.95	2.42	1.52
637	3.63	4.07	2.75	4.13	3.60	3.72	3.33	3.01	2.95	3.66	3.21	2.49
638	3.02	3.53	2.36	3.63	3.39	3.26	2.86	2.60	3.66	3.17	2.74	2.07
639	2.76	3.24	2.37	3.45	3.86	3.09	2.81	2.58	3.17	3.01	2.64	2.05
640	3.35	3.75	2.62	3.92	3.58	3.54	3.25	2.99	3.01	3.45	3.04	2.38
641	3.09	3.50	2.47	3.62	3.82	3.29	2.98	2.73	3.45	3.18	2.77	2.15
642	3.29	3.76	2.58	3.88	3.42	3.52	3.20	2.95	3.18	3.39	2.95	2.26
643	2.91	3.37	2.20	3.50	3.57	3.07	2.72	2.41	3.39	2.96	2.49	1.76
644	3.06	3.55	2.30	3.63	3.78	3.22	2.85	2.53	2.96	3.12	2.65	1.90
645	3.3	3.80	2.48	3.87	3.74	3.41	2.99	2.64	3.12	3.31	2.82	2.01
646	3.3	3.72	2.47	3.86	3.47	3.37	2.97	2.62	3.31	3.26	2.77	1.98
647	2.97	5.43	2.24	3.61	3.54	3.08	2.71	2.37	3.26	3.00	2.52	1.76
648	3.04	3.29	2.28	3.64	3.60	3.15	2.76	2.42	3.00	3.07	2.61	1.83
649	3.32	3.57	2.25	3.64	4.30	3.18	2.75	2.38	3.07	3.08	2.55	1.71
650	3.96	4.31	2.63	4.37	3.10	xxx	3.32	2.93	3.08	3.69	3.07	2.09
651	xxx	3.13	1.57	3.05	2.51	xxx	xxx	xxx	3.69	xxx	xxx	xxx
652	xxx	2.55	1.29	2.39	4.54	xxx	xxx	xxx	xxx	xxx	xxx	xxx
653	xxx	4.59	2.72	4.65	4.37	xxx	3.27	2.72	xxx	3.89	3.25	2.17
654	4.23	4.37	2.62	4.53	4.26	3.78	3.17	2.65	3.89	3.71	3.05	1.96
655	3.93	4.26	2.69	4.33	3.87	3.66	3.03	2.50	3.71	3.70	3.14	2.17
656	3.41	3.83	2.46	3.95	4.10	3.28	2.68	2.16	3.70	3.34	2.81	1.90
657	3.54	4.08	2.79	4.21	4.50	3.51	2.89	2.34	3.34	3.65	3.17	2.38
658	4.2	4.54	2.98	4.60	4.32	3.90	3.26	2.69	3.65	3.96	3.45	2.58
659	4.05	4.30	2.78	4.46	4.10	3.57	2.89	2.25	3.96	3.72	3.16	2.22
660	3.61	4.03	2.65	4.26	4.00	3.35	2.68	2.06	3.72	3.55	3.00	2.10
661	3.48	3.98	2.71	4.14	4.76	3.34	2.66	2.05	3.55	3.53	3.03	2.22
662	4.55	4.84	3.07	4.89	4.40	4.06	3.36	2.71	3.53	4.15	3.56	2.57
663	4.24	4.51	2.65	4.59	3.89	3.56	2.81	2.09	4.15	3.72	3.05	1.94
664	3.38	3.90	2.42	4.08	4.24	3.08	2.34	1.66	3.72	3.32	2.72	1.75
665	3.77	4.21	2.73	4.40	4.65	3.46	2.71	2.04	3.32	3.68	3.11	2.16
666	4.58	4.71	2.94	4.80	4.70	3.84	3.08	2.37	3.68	4.01	3.39	2.35
667	4.49	4.76	2.90	4.89	3.61	3.82	3.02	2.26	4.01	4.01	3.34	2.20
668	3.33	3.60	2.40	3.83	4.33	2.83	2.12	1.52	4.01	3.11	2.58	1.68
669	3.78	4.19	2.81	4.52	4.77	3.53	2.82	2.24	3.11	3.87	3.38	2.54
670	5.03	4.79	3.10	4.97	3.41	3.89	3.10	2.41	3.87	4.20	3.65	2.76

Appendix A. (continued)

671	3.84	3.52	1.90	3.55	3.62	2.73	2.15	1.60	xxx	xxx	2.39	1.61
672	3.56	3.67	2.09	3.72	3.82	2.96	2.38	1.85	xxx	xxx	2.64	1.85
673	3.83	3.90	2.12	3.98	4.89	3.03	2.35	1.69	xxx	3.19	2.55	1.32
674	4.98	5.06	2.69	5.10	4.20	4.03	3.32	2.61	xxx	4.19	3.47	2.19
675	4.86	4.58	1.77	4.52	3.16	3.08	2.19	1.35	xxx	3.26	2.33	xxx
676	3.23	3.35	1.44	3.42	3.65	2.22	1.54	0.95	3.26	2.50	1.81	xxx
677	3.48	3.79	1.74	3.90	4.74	2.65	1.80	1.04	2.50	2.97	2.19	xxx
678	4.77	4.93	2.28	4.96	4.46	3.64	2.63	1.69	2.97	3.82	2.93	xxx
679	4.87	4.78	1.56	4.78	3.42	3.05	1.92	0.90	3.82	3.43	2.46	xxx
680	3.36	3.68	1.14	3.76	3.59	2.23	1.39	xxx	3.43	2.65	1.79	xxx
681	3.33	3.87	1.66	3.92	4.63	2.49	1.47	xxx	2.65	3.00	2.23	xxx
682	4.75	4.96	2.11	4.95	4.04	3.36	2.16	xxx	3.00	3.74	2.86	xxx
683	4.35	4.42	1.51	4.40	3.30	2.61	1.44	xxx	3.74	3.19	2.33	xxx
684	3.4	3.64	1.23	3.65	3.31	2.09	1.18	xxx	3.19	2.67	1.89	xxx
685	3.3	3.68	1.48	3.66	4.29	2.05	1.12	xxx	2.67	2.79	2.07	xxx
686	4.45	4.64	1.83	4.66	4.01	2.87	1.75	xxx	2.79	3.50	2.67	xxx
687	4.47	4.46	1.55	4.48	3.14	2.38	1.18	xxx	3.50	3.11	2.21	xxx
688	3.35	3.57	1.21	3.58	3.21	1.82	0.93	xxx	3.11	2.51	1.74	xxx
689	3.21	3.68	1.59	3.65	3.93	1.80	0.87	xxx	2.51	2.69	1.93	xxx
690	4.04	4.37	1.79	4.36	3.77	2.38	1.37	xxx	2.69	3.20	2.38	xxx
691	4.23	4.31	1.67	4.27	2.96	2.03	0.88	xxx	3.20	2.95	2.08	xxx
692	3.24	3.50	1.33	3.44	3.15	1.60	0.79	xxx	2.95	2.34	1.55	xxx
693	3.35	3.72	1.74	3.68	3.73	1.55	0.63	xxx	2.34	2.63	1.84	xxx
694	3.95	4.28	1.88	4.23	3.67	2.05	1.07	xxx	2.63	3.09	2.27	xxx
695	4.15	4.34	2.04	4.25	3.22	1.83	0.73	xxx	3.09	3.03	2.16	xxx
696	3.55	3.87	1.79	3.79	3.23	1.65	0.76	xxx	3.03	2.66	1.82	xxx
697	3.55	3.91	1.97	3.83	3.27	1.56	0.59	xxx	2.66	2.75	1.95	xxx
698	3.63	3.94	1.96	3.86	3.54	1.67	0.73	xxx	2.75	2.77	1.96	xxx
699	4.14	4.32	2.28	4.21	3.49	1.75	0.69	xxx	2.77	3.05	2.19	xxx
700	4.01	4.25	2.18	4.16	3.36	1.73	0.68	xxx	3.05	2.99	2.13	xxx
701	3.78	4.06	2.20	4.03	3.30	1.65	0.70	xxx	2.99	2.91	2.11	xxx
702	3.75	4.01	2.15	3.96	3.62	1.59	0.62	xxx	2.91	2.85	2.05	xxx
703	4.19	4.38	2.46	4.26	3.96	1.83	0.80	xxx	2.85	3.15	2.32	xxx
704	4.59	4.74	2.57	4.60	3.60	1.98	0.82	xxx	3.15	3.40	2.52	xxx
705	4.22	4.31	2.32	4.20	3.42	1.85	0.87	xxx	3.40	3.07	2.24	xxx
706	4	4.13	2.25	4.05	3.56	1.67	0.67	xxx	3.07	2.94	2.13	xxx
707	4.5	4.56	2.52	4.43	0.24	2.03	0.93	xxx	2.94	3.28	2.43	xxx
708	4.98	5.01	2.70	4.90	4.25	2.26	0.99	xxx	xxx	3.60	2.70	xxx
709	4.84	4.55	2.42	4.26	3.73	2.06	1.04	xxx	4.35	3.10	2.32	xxx
710	4.16	4.06	2.19	3.80	3.26	1.67	0.71	xxx	3.71	2.77	2.04	xxx
711	5.02	4.93	2.77	4.86	4.23	2.41	1.20	xxx	3.70	3.65	2.76	xxx
712	5.5	5.13	2.84	4.98	4.33	2.38	1.04	xxx	4.36	3.68	2.75	xxx
713	5.06	5.06	2.84	4.97	4.40	2.51	1.33	xxx	4.44	3.77	2.90	xxx
714	4.42	4.54	2.58	4.45	3.88	2.04	0.93	xxx	4.46	3.32	2.49	1.03
715	4.78	4.82	2.93	4.75	4.21	2.47	1.36	xxx	3.97	3.70	2.93	1.58
716	6.12	5.67	3.26	5.55	5.01	2.96	1.57	xxx	4.32	4.31	3.37	1.80
717	5.28	5.07	2.65	4.96	4.49	2.70	1.50	xxx	5.06	3.80	2.94	1.49
718	4.56	4.58	2.47	4.50	4.01	2.31	1.19	xxx	4.49	3.44	2.66	1.31

Appendix A. (continued)

719	5.17	5.07	2.89	4.98	4.48	2.84	1.61	xxx	4.05	3.88	3.08	1.70
720	5.52	5.42	3.03	5.33	4.81	3.03	1.66	xxx	4.51	4.13	3.25	1.72
721	5.48	5.39	2.98	5.34	4.86	3.15	1.90	xxx	4.84	4.15	3.28	1.80
722	4.47	4.61	2.65	4.59	4.12	2.52	1.38	xxx	4.87	3.55	2.79	1.45
723	4.62	4.80	2.94	4.72	4.33	3.03	1.84	xxx	4.16	3.84	3.18	1.96
724	6.03	5.93	3.40	5.78	5.39	3.84	2.35	1.24	4.36	4.62	3.76	2.23
725	5.62	5.47	2.89	5.39	4.98	3.54	2.20	1.22	5.34	4.15	3.24	1.71
726	4.44	4.52	2.50	4.51	4.10	2.77	1.58	0.74	4.89	3.50	2.75	1.44
727	4.51	4.82	2.88	4.79	4.47	3.31	2.16	1.32	4.08	3.91	3.25	2.06
728	5.88	5.86	3.30	5.75	5.40	4.10	2.72	1.58	4.45	4.59	3.75	2.29
729	5.67	5.52	2.85	5.46	5.07	3.77	2.56	1.55	5.31	4.20	3.29	1.78
730	4.11	4.34	2.38	4.35	3.97	2.78	1.73	0.91	4.95	3.39	2.67	1.41
731	4.2	4.65	2.83	4.65	4.36	3.42	2.47	1.74	3.95	3.85	3.24	2.12
732	5.38	5.54	3.18	5.48	5.16	4.08	2.94	1.95	4.33	4.43	3.64	2.31
733	5.16	5.29	2.91	5.28	5.00	4.01	3.11	2.26	5.06	4.18	3.37	2.01
734	3.24	3.68	2.22	3.69	3.44	2.55	1.78	1.12	4.83	2.93	2.33	1.29
735	4.54	4.73	3.39	5.24	5.05	4.14	3.50	2.94	3.39	4.57	4.02	3.02
736	5.75	5.40	3.60	5.90	5.66	4.66	3.90	3.16	4.89	xxx	4.34	3.20
737	4.5	4.68	3.02	4.77	4.61	4.05	3.47	2.97	xxx	xxx	3.40	2.47
738	3.37	3.99	2.69	4.20	4.06	3.53	2.98	2.53	xxx	3.54	3.01	2.17
739	3.61	4.14	2.96	4.32	4.25	3.84	3.40	3.04	3.96	3.77	3.29	2.55
740	4.42	4.78	3.24	4.90	4.79	4.34	3.87	3.48	4.15	4.23	3.69	2.82
741	4.19	4.56	3.05	4.70	4.55	4.08	3.62	3.26	4.68	3.95	3.40	2.54
742	3.15	3.66	2.58	3.85	3.73	3.30	2.86	2.52	4.42	3.27	2.82	2.14
743	3.61	4.13	3.01	4.32	4.24	3.83	3.51	3.22	3.65	3.80	3.37	2.71
744	4.02	4.46	3.16	4.64	4.56	4.12	3.79	3.52	4.16	4.03	3.54	2.77
745	3.65	4.17	3.05	4.35	4.27	3.93	3.58	3.35	4.45	3.80	3.36	2.75
746	3.22	3.80	2.78	3.99	3.91	3.58	3.25	3.01	4.17	3.49	3.08	2.52
747	3.11	3.73	2.76	3.92	3.84	3.56	3.27	3.06	3.84	3.44	3.05	2.49
748	3.49	4.09	2.99	4.25	4.16	3.87	xxx	3.34	3.77	3.74	3.32	2.69
749	3.42	4.00	2.92	4.16	4.07	3.77	3.45	3.27	4.08	3.64	3.25	2.64
750	3.11	3.69	2.74	3.88	3.79	3.48	3.18	2.99	3.98	3.39	3.02	2.46
751	2.77	3.36	2.53	3.62	3.51	3.23	2.99	2.82	3.71	3.14	2.79	2.29
752	2.93	3.43	2.59	3.66	3.58	3.31	3.06	2.90	3.43	3.22	2.87	2.35
753	3.06	3.62	2.76	3.81	3.74	3.49	3.27	3.13	3.50	3.40	3.09	2.60
754	3.48	3.91	2.88	4.06	3.97	3.69	3.45	3.30	3.66	3.60	3.24	2.68
755	3.22	3.62	2.61	3.79	3.67	3.38	3.11	2.95	3.88	3.29	2.90	2.32
756	2.67	3.30	2.46	3.47	3.40	3.13	2.89	2.72	3.58	3.05	2.71	2.20
757	2.79	3.43	2.62	3.62	3.56	3.34	3.13	3.01	3.30	3.24	2.94	2.47
758	3.43	3.94	2.93	4.13	4.00	3.77	3.54	3.41	3.47	3.67	3.32	2.74
759	3.08	3.52	2.48	3.70	3.58	3.28	3.02	2.84	3.94	3.19	2.78	2.15
760	2.59	3.10	2.28	3.30	3.24	2.95	2.70	2.53	3.52	2.86	2.50	1.98
761	2.84	3.37	2.54	3.56	3.51	3.29	3.09	2.96	3.15	3.18	2.87	2.38
762	3.7	4.11	2.93	4.26	4.13	3.88	3.65	3.50	3.41	3.76	3.37	2.73
763	3.25	3.71	2.48	3.83	3.65	3.35	3.07	2.87	4.05	3.25	2.81	2.10
764	2.58	3.23	2.26	3.37	3.24	2.97	2.66	2.53	3.61	2.88	2.52	1.93
765	3.38	3.91	2.77	4.08	3.99	3.66	3.38	3.19	3.18	3.54	3.12	2.44
766	3.97	4.30	2.96	4.43	4.32	3.96	3.67	3.47	3.86	3.83	3.35	2.60

Appendix A. (continued)

767	3.57	3.98	2.72	4.08	3.97	3.64	3.36	3.17	4.21	3.51	3.06	2.36
768	2.77	3.31	2.37	3.48	3.40	3.10	2.84	2.66	3.89	3.00	2.61	2.01
769	3.31	3.86	2.81	3.99	3.93	3.67	3.40	3.24	3.33	3.54	3.15	2.56
770	4.31	4.69	3.20	4.75	4.62	4.34	4.03	3.84	3.84	4.16	3.69	2.93
771	3.97	4.35	2.91	4.43	4.26	3.95	3.61	3.39	4.54	3.78	3.29	2.48
772	3.05	3.59	2.55	3.77	3.65	3.35	3.03	2.84	4.19	3.23	2.81	2.14
773	3.41	3.89	2.85	4.11	4.01	3.73	3.44	3.28	3.57	3.60	3.19	2.57
774	4.5	4.79	3.29	4.91	4.76	4.46	4.14	3.93	3.91	4.26	3.76	2.99
775	4.61	4.75	3.08	4.86	4.66	4.25	3.85	3.57	4.66	4.06	3.48	2.56
776	3.48	3.81	2.60	4.01	3.87	3.48	3.10	2.86	4.56	3.35	2.87	2.08
777	3.78	4.20	3.07	4.40	4.33	3.94	3.71	3.53	3.77	3.88	3.47	2.79
778	4.81	5.02	3.46	5.14	5.02	4.59	4.33	4.11	4.22	4.48	3.97	3.16
779	4.6	4.83	3.20	4.94	4.75	4.33	3.95	3.68	4.91	4.16	3.59	2.71
780	3.71	4.08	2.82	4.25	4.10	3.71	3.35	3.10	4.65	3.59	3.08	2.32
781	3.82	4.21	3.07	4.42	4.35	3.97	3.74	3.55	4.00	3.91	3.48	2.81
782	5.47	5.46	3.66	5.55	5.39	4.93	4.64	4.40	4.25	4.80	4.27	3.37
783	4.93	4.95	3.09	5.00	4.76	4.29	3.85	3.54	5.28	4.11	3.49	2.47
784	3.77	4.04	2.74	4.22	4.03	3.63	3.25	2.99	4.69	3.51	2.98	2.15
785	4.07	4.27	3.00	4.47	4.34	3.99	3.69	3.49	3.97	3.85	3.38	2.66
786	5.06	5.15	3.38	5.25	5.08	4.67	4.31	4.06	4.24	4.48	3.91	3.02
787	5.28	5.21	3.24	5.31	5.06	4.53	4.07	3.72	4.97	4.36	3.68	2.58
788	4.09	4.32	2.82	4.43	4.28	3.79	3.36	3.07	4.95	3.68	3.10	2.17
789	4.02	4.38	3.08	4.48	4.41	4.07	3.75	3.57	4.20	3.94	3.48	2.76
790	5.48	5.53	3.60	5.63	5.43	5.02	4.63	4.37	4.32	4.82	4.23	3.27
791	5	4.85	2.77	4.83	4.60	4.06	3.55	3.18	5.31	3.90	3.18	2.03
792	4.06	4.27	2.65	4.38	4.29	3.83	3.45	3.18	4.51	3.67	3.08	2.21
793	4.82	4.73	2.85	4.88	4.71	4.00	3.37	2.85	4.18	3.89	3.09	1.77
794	5.53	5.22	3.04	5.28	5.07	4.36	3.70	3.12	4.54	4.24	3.41	2.01
795	xxx	4.98	2.77	5.01	4.78	4.02	3.29	2.64	4.90	3.93	3.06	1.59
796	xxx	4.08	2.47	4.20	4.02	3.32	2.64	2.06	4.61	3.33	2.62	1.37
797	4.04	4.29	2.69	4.47	4.31	3.69	3.03	2.48	3.87	3.65	2.98	1.78
798	5.14	5.12	3.02	5.22	5.01	4.34	3.66	3.05	4.18	4.21	3.40	2.01
799	4.98	4.94	2.63	5.06	4.78	3.98	3.19	2.46	4.86	3.97	3.09	1.66
800	4.36	4.36	2.45	4.52	4.27	3.51	2.74	2.05	4.64	3.56	2.79	1.50
801	3.82	4.00	xxx	4.17	3.99	3.31	2.66	2.04	4.14	3.40	2.73	1.57
802	xxx	5.88	xxx	6.02	5.70	4.82	4.04	xxx	3.89	4.80	3.86	2.35
803	xxx	5.30	xxx	5.32	4.82	3.58	2.61	1.75	5.56	3.74	2.68	0.94
804	xxx	3.95	xxx	4.02	3.69	2.67	1.86	1.12	4.64	2.93	2.18	0.92
805	xxx	4.16	xxx	4.21	3.98	3.10	2.27	1.49	3.54	3.23	2.47	1.13
806	4.08	4.06	1.63	4.08	3.83	2.95	2.13	1.36	3.83	3.07	2.29	0.99
807	4.64	4.76	1.67	4.77	4.47	3.44	2.45	1.58	3.69	3.65	2.76	1.33
808	4.18	4.25	1.45	4.21	3.90	2.95	2.07	1.32	4.34	3.17	2.32	0.91
809	4.01	4.37	1.65	4.40	4.09	3.13	2.27	1.49	3.79	3.48	2.76	1.45
810	4.17	4.53	1.72	4.59	4.28	3.30	2.38	1.56	4.02	3.59	2.84	1.44
811	4.24	4.52	1.79	4.52	4.26	3.28	2.28	1.44	4.18	3.61	2.88	1.58
812	4.62	4.82	1.90	4.80	4.55	3.53	2.50	1.60	4.18	3.83	3.03	1.66
813	3.97	4.37	1.74	4.43	4.14	3.10	2.17	1.28	4.44	3.49	2.74	1.44
814	3.56	4.04	1.53	4.14	3.85	2.87	2.01	1.22	4.04	3.25	2.56	1.33

Appendix A. (continued)

815	3.94	4.43	2.04	4.46	4.18	3.19	2.15	1.30	3.77	3.60	2.91	1.66
816	4.54	4.90	2.16	4.91	4.63	3.58	2.48	1.53	4.12	3.95	3.17	1.80
817	4.34	4.69	2.06	4.74	4.41	3.23	2.18	1.20	4.54	3.70	2.90	1.51
818	3.45	3.99	1.70	4.06	3.75	2.70	1.79	1.02	4.33	3.16	2.49	1.26
819	3.95	4.46	2.30	4.50	4.21	3.05	2.02	1.17	3.70	3.65	3.00	1.74
820	5.16	5.37	2.59	5.38	5.09	3.80	2.61	1.58	4.17	4.33	3.51	2.03
821	4.44	4.71	2.20	4.75	4.42	3.16	2.04	1.06	4.98	3.66	2.84	1.43
822	3.51	4.01	1.91	4.49	3.75	2.63	1.69	0.91	4.31	3.17	2.49	1.26
823	4.21	4.56	2.38	5.02	4.25	3.02	1.93	1.04	3.70	3.65	2.93	1.61
824	5.39	5.54	2.76	5.56	5.20	3.82	2.56	1.48	4.22	4.36	3.47	1.95
825	4.59	4.81	2.30	4.82	4.47	3.13	1.98	xxx	5.09	3.67	2.77	1.34
826	3.85	4.29	2.07	4.34	4.00	2.75	1.72	xxx	4.37	3.35	2.56	1.27
827	4.3	4.39	2.17	4.33	3.99	2.79	1.76	xxx	3.95	3.34	2.57	1.29
828	5.36	5.30	2.59	5.18	4.83	3.55	2.38	xxx	3.95	3.97	3.08	1.62
829	5.45	5.36	2.40	5.15	4.74	3.34	2.13	xxx	4.73	3.79	2.84	1.26
830	3.78	4.02	1.81	3.89	3.47	2.24	1.27	xxx	4.61	2.84	2.09	0.82
831	4.7	5.02	2.70	5.04	4.65	3.34	2.22	xxx	3.46	3.98	3.18	1.79
832	5.49	5.47	2.81	5.40	5.00	3.55	2.27	1.24	4.63	4.20	3.29	1.72
833	4.6	4.88	2.59	4.85	4.52	3.35	2.30	1.43	4.94	3.85	3.06	1.71
834	4.15	4.55	2.42	4.56	4.22	3.07	2.03	1.17	4.44	3.61	2.86	1.55
835	4.59	4.89	2.71	4.91	4.59	3.45	2.44	1.61	4.16	3.93	3.19	1.88
836	5.57	5.61	3.01	5.55	5.25	4.04	2.90	1.87	4.53	4.43	3.56	2.07
837	5.13	5.31	2.70	5.18	4.88	3.76	2.71	1.77	5.14	4.03	3.16	1.68
838	4.22	4.57	2.37	4.55	4.22	3.13	2.17	1.35	4.74	3.52	2.78	1.46
839	4.56	5.02	2.74	4.91	4.61	3.57	2.63	1.83	4.12	3.93	3.23	1.93
840	5.29	5.74	3.03	5.50	5.20	4.12	3.08	2.13	4.52	4.39	3.56	2.08
841	5.57	5.60	2.86	5.45	5.13	3.98	2.95	2.01	5.09	4.24	3.33	1.79
842	4.38	4.60	2.46	4.60	4.28	3.19	2.27	1.48	4.99	3.58	2.82	1.48
843	4.27	4.73	2.86	4.82	4.54	3.59	2.75	2.02	4.19	3.96	3.33	2.10
844	5.11	5.41	3.09	5.42	5.15	4.14	3.20	2.31	4.47	4.39	3.64	2.23
845	4.98	5.17	2.79	5.11	4.85	3.88	2.93	2.08	5.02	4.03	3.23	1.84
846	3.97	4.43	2.49	4.46	4.20	3.29	2.39	1.68	4.69	3.55	2.86	1.61
847	xxx	4.00	2.54	4.08	3.90	3.26	2.57	1.98	4.10	3.46	2.98	1.94
848	xxx	4.29	2.66	4.31	4.13	3.45	2.71	2.04	3.81	3.61	3.05	1.97
849	4.8	4.95	2.91	5.01	4.75	3.89	3.00	2.26	4.05	4.04	3.29	2.04
850	3.77	4.10	2.54	4.23	3.94	3.16	2.36	1.73	4.63	3.39	2.76	1.66
851	3.51	4.19	2.85	4.32	4.11	3.44	2.73	2.16	3.88	3.70	3.20	2.28
852	4.42	4.86	3.12	4.92	4.74	3.99	3.20	2.52	4.08	4.16	3.57	2.52
853	4.17	4.45	2.73	4.48	4.30	3.55	2.78	2.10	4.64	3.66	3.05	1.98
854	3.78	4.24	2.68	4.29	4.10	3.38	2.65	2.02	4.18	3.55	2.99	1.97
855	3.49	3.81	2.34	3.71	3.55	2.90	2.25	1.66	4.02	3.04	2.54	1.62
856	3.59	3.99	2.43	3.84	3.70	3.03	2.37	1.76	3.45	3.17	2.64	1.70
857	3.97	4.57	2.78	4.58	4.39	3.56	2.72	1.99	3.59	3.81	3.19	2.10
858	3.34	3.84	2.43	3.93	3.70	2.96	2.20	1.58	4.31	3.20	2.65	1.68
859	2.84	3.56	2.42	3.66	3.48	2.85	2.18	1.62	3.65	3.12	2.70	1.93
860	3.55	4.40	2.76	4.43	4.27	3.54	2.77	2.06	3.47	3.76	3.24	2.31
861	4.36	5.09	3.08	5.06	4.84	3.93	2.97	2.16	4.21	4.23	3.59	2.46
862	3.54	4.19	2.68	4.27	4.02	3.21	2.36	1.70	4.76	3.55	2.98	1.98

863	3.33	3.98	2.69	4.11	3.90	3.12	2.38	1.75	4.00	3.51	3.04	2.22
864	3.61	4.13	2.73	4.22	4.03	3.22	2.46	1.78	3.90	3.57	3.09	2.27
865	2.78	3.50	2.49	3.62	3.45	2.81	2.15	1.56	3.99	3.10	2.73	2.11
866	3.07	3.72	2.58	3.85	3.68	3.02	2.33	1.71	3.43	3.32	2.93	2.26
867	2.77	3.37	2.31	3.59	3.40	2.71	2.06	1.43	3.66	3.00	2.58	1.85
868	2.28	2.81	2.00	3.05	2.87	2.26	1.71	1.19	3.36	2.57	2.21	1.58
869	2.6	3.28	2.39	3.33	3.16	2.57	1.97	1.44	2.86	2.98	2.71	2.19
870	3.37	4.09	2.76	4.13	3.96	3.26	2.52	1.84	3.19	3.61	3.23	2.54
871	2.82	3.43	2.32	3.67	3.42	2.76	2.04	1.38	3.94	2.97	2.53	1.82
872	1.64	2.23	1.60	2.44	2.23	1.75	1.26	0.84	3.36	1.97	1.69	1.18
873	2.47	2.95	2.31	3.11	2.96	2.42	1.86	1.39	2.22	2.82	2.61	2.17
874	3.48	4.06	2.96	4.25	4.06	3.34	2.57	1.88	3.01	3.75	3.39	2.76
875	2.98	3.65	2.54	3.89	3.64	2.95	2.22	1.57	4.06	3.22	2.79	2.06
876	1.98	2.78	2.01	3.00	2.80	2.23	1.63	1.13	3.59	2.51	2.17	1.58
877	2.4	3.17	2.44	3.35	3.22	2.61	2.06	1.56	2.79	3.02	2.74	2.25
878	3.53	4.14	3.02	4.33	4.15	3.40	2.70	2.01	3.24	3.81	3.42	2.78
879	3.24	3.81	2.62	4.02	3.79	3.10	2.38	1.71	4.13	3.33	2.86	2.12
880	2.09	2.84	2.04	3.06	2.87	2.30	1.70	1.19	3.72	2.56	2.19	1.55
881	2.65	3.47	2.64	3.66	3.53	2.93	2.34	1.84	2.85	3.30	2.97	2.39
882	4.05	4.62	3.28	4.78	4.62	3.89	3.14	2.44	3.55	4.21	3.74	2.99
883	3.59	4.13	2.75	4.21	4.04	3.40	2.70	2.07	4.59	3.54	3.03	2.23
884	2.69	3.44	2.41	3.54	3.39	2.80	2.15	1.60	3.97	3.00	2.59	1.91
885	3.27	3.91	2.78	4.05	3.92	3.35	2.73	2.23	3.35	3.49	3.03	2.30
886	4.29	4.75	3.25	4.84	4.69	4.06	3.37	2.78	3.87	4.17	3.62	2.75
887	4.2	4.56	2.95	4.67	4.53	3.90	3.26	2.71	4.62	3.88	3.26	2.26
888	3.08	3.46	2.35	3.60	3.45	2.84	2.24	1.76	4.41	2.94	2.43	1.61
889	3.83	4.39	3.18	4.66	4.55	xxx	3.57	3.20	3.38	4.12	3.68	2.92
890	5.31	5.29	3.61	5.45	5.34	xxx	4.30	3.87	4.48	4.74	4.20	3.28
891	4.31	4.48	2.99	4.54	4.45	3.97	3.54	3.17	5.20	3.85	3.32	2.53
892	3.7	4.10	2.80	4.24	4.15	3.68	3.27	2.91	4.30	3.62	3.12	2.37
893	3.88	4.15	2.92	4.35	4.23	3.81	3.45	3.11	4.03	3.71	3.23	2.47
894	5.43	5.47	3.51	5.47	5.29	4.76	4.30	3.90	4.12	4.63	4.01	3.03
895	5.06	5.01	2.84	4.98	5.17	4.09	3.52	3.01	5.17	3.99	3.24	2.07
896	4.09	4.34	2.61	4.44	4.28	3.66	3.14	2.68	4.62	3.62	2.95	1.89
897	4.69	4.86	3.01	4.92	4.86	4.22	3.68	3.25	4.19	4.13	3.48	2.41
898	5.21	5.36	3.23	5.38	5.21	4.61	4.03	3.57	4.69	4.47	3.76	2.60
899	5.35	5.34	3.05	5.35	5.14	4.46	3.78	3.26	5.07	4.33	3.54	2.26
900	4.32	4.54	2.74	4.66	4.49	3.89	3.29	2.80	4.99	3.80	3.12	1.99
901	4.78	5.09	3.27	5.27	5.12	4.54	4.03	3.57	4.36	4.48	3.85	2.80
902	5.86	5.82	3.53	5.89	5.68	5.02	4.45	3.95	4.99	4.92	4.16	2.97
903	5.39	5.39	3.10	5.35	5.14	4.47	3.87	3.33	5.55	4.38	3.61	2.40
904	4.7	4.87	2.91	4.94	4.76	4.17	3.60	3.10	5.01	4.07	3.38	2.26
905	4.98	5.03	3.15	5.20	5.01	4.43	3.90	3.44	4.63	4.33	3.66	2.62
906	5.79	5.66	3.41	5.74	5.51	4.85	4.27	3.77	4.88	4.74	4.01	2.84
907	5.83	5.54	3.14	5.63	5.37	4.59	3.92	3.34	5.36	4.52	3.70	2.38
908	5.33	5.26	3.11	5.44	5.20	4.46	3.85	3.29	5.21	4.42	3.65	2.43
909	4.88	4.84	2.74	5.01	4.78	4.10	3.52	2.98	5.05	4.02	3.29	2.09
910	4.73	4.69	2.72	4.82	4.63	3.97	3.38	2.84	4.63	3.90	3.19	2.03

Appendix A. (continued)

911	5.32	5.09	2.82	5.21	5.00	4.26	3.62	3.03	4.50	4.22	3.43	2.14
912	5.18	4.97	2.79	5.10	4.89	4.17	3.55	2.97	4.86	4.12	3.35	2.10
913	4.87	4.85	2.73	4.95	4.78	4.12	3.48	2.94	4.74	4.09	3.39	2.23
914	5.4	5.17	2.85	5.23	5.04	4.36	3.70	3.15	4.65	4.29	3.54	2.30
915	5.09	4.98	2.57	5.06	4.84	4.10	3.40	2.77	4.89	4.09	3.33	2.09
916	4.87	4.97	2.64	5.07	4.88	4.14	3.45	2.82	4.70	4.14	3.40	2.17
917	4.62	4.71	2.36	4.81	4.63	3.89	3.14	2.48	4.74	3.90	3.16	1.93
918	4.46	4.57	2.34	4.71	4.51	3.78	3.03	2.37	4.49	3.81	3.09	1.90
919	4.67	4.82	2.44	4.97	4.74	3.93	3.17	2.47	4.38	4.02	3.29	2.07
920	4.93	5.04	2.54	5.16	4.94	4.11	3.34	2.65	4.62	4.17	3.42	2.14
921	4.46	4.54	2.24	4.64	4.46	3.66	2.93	2.26	4.79	3.73	3.01	1.81
922	3.9	4.05	2.01	4.20	4.02	3.26	2.54	1.87	4.32	3.38	2.72	1.63
923	4.18	4.52	2.48	4.69	4.51	3.78	3.10	2.46	3.91	3.91	3.30	2.23
924	4.19	4.51	2.44	4.66	4.48	3.75	3.07	2.43	4.40	3.85	3.23	2.17
925	4.17	4.48	2.52	4.67	4.47	3.76	3.09	2.47	4.36	3.83	3.22	2.18
926	3.75	4.29	2.40	4.50	4.31	3.60	2.94	2.34	4.35	3.70	3.10	2.10
927	3.74	4.25	2.54	4.40	4.26	3.63	2.99	2.44	4.20	3.68	3.09	2.18
928	4.5	4.78	2.74	4.89	4.73	4.08	3.43	2.86	4.16	4.07	3.41	2.38
929	4.18	4.42	2.47	4.46	4.28	3.61	xxx	2.42	4.61	3.60	2.95	1.91
930	2.78	3.47	2.04	3.61	3.46	2.84	xxx	1.73	4.13	2.94	2.42	1.55
931	3.64	4.32	2.82	4.51	4.37	3.81	3.23	2.74	3.36	3.88	3.38	2.49
932	4.64	4.93	3.02	4.95	4.83	4.23	3.63	3.11	4.29	4.18	3.60	2.64
933	3.86	4.24	2.60	4.32	4.20	3.65	3.10	2.61	4.72	3.56	3.00	2.10
934	3.28	3.94	2.49	4.13	3.98	3.47	2.92	2.43	4.09	3.43	2.90	2.02
935	xxx	5.12	3.34	5.36	5.22	4.52	3.96	3.42	3.88	4.61	4.02	2.96
936	xxx	4.99	3.18	5.22	5.05	4.36	3.82	3.29	5.08	4.38	3.75	2.69
937	4.11	4.43	2.96	4.57	4.48	3.97	3.47	3.01	4.90	3.90	3.34	2.51
938	3.63	4.15	2.82	4.31	4.25	3.74	3.24	2.80	4.37	3.75	3.26	2.49
939	3.73	4.23	2.92	4.42	4.30	3.83	3.33	2.91	4.15	3.77	3.26	2.47
940	4.86	5.16	3.38	5.30	5.15	4.62	4.07	3.60	4.19	4.50	3.90	2.92
941	4.24	4.40	2.75	4.48	4.32	3.79	3.27	2.79	5.02	3.69	3.09	2.10
942	3.56	3.97	2.58	4.10	3.95	3.45	2.95	2.49	4.20	3.41	2.87	1.97
943	4.69	4.90	3.10	5.09	4.91	4.30	3.70	3.21	3.85	4.22	3.55	2.48
944	4.66	4.57	2.93	4.73	4.56	3.96	3.37	2.90	4.76	3.89	3.24	2.25
945	3.87	4.21	2.93	4.41	4.29	3.91	3.54	3.20	4.42	3.81	3.35	2.62
946	4.24	4.65	3.07	4.86	4.69	4.26	3.87	3.52	4.20	4.14	3.60	2.72
947	4.21	4.57	2.95	4.73	4.57	4.06	3.62	3.25	4.60	3.93	3.32	2.37
948	5.14	5.26	3.32	5.29	5.13	4.55	4.06	3.65	4.45	4.45	3.79	2.76
949	4.97	4.96	2.74	4.99	4.77	4.08	3.53	3.06	5.00	3.97	3.22	2.02
950	4.66	4.78	2.72	4.86	4.67	4.02	3.48	3.03	4.60	3.92	3.19	2.02
951	4.27	4.37	2.39	4.44	4.26	3.66	3.13	2.69	4.52	3.55	2.84	1.75
952	5.07	5.00	2.75	5.04	4.82	4.15	3.56	3.07	4.12	4.03	3.26	2.07
953	5.22	4.98	2.48	5.00	4.73	3.98	3.27	2.67	4.66	3.91	3.06	1.66
954	3.98	4.11	2.14	4.23	4.04	3.40	2.71	2.22	4.57	3.37	2.65	1.43
955	4.79	4.93	2.61	5.04	4.86	4.19	3.51	2.93	3.90	4.14	3.38	2.12
956	4.83	4.87	2.59	4.94	4.74	4.08	3.42	2.85	4.73	4.00	3.24	2.00
957	4.73	4.76	2.49	4.84	4.67	4.02	3.38	2.84	4.60	3.96	3.24	2.05
958	4.04	4.28	2.26	4.41	4.28	3.66	3.04	2.51	4.53	3.61	2.93	1.82

Appendix A. (continued)

959	4.63	4.90	2.78	5.06	4.92	4.29	3.66	3.11	4.14	4.29	3.63	2.55
960	5.01	5.11	2.83	5.25	5.08	4.45	3.82	3.26	4.80	4.36	3.66	2.54
961	4.48	4.57	2.61	4.70	4.54	3.96	xxx	2.83	4.93	3.89	3.27	2.25
962	3.69	4.05	2.38	4.16	4.08	3.51	2.93	2.43	4.40	3.53	2.97	2.05
963	4.39	4.77	3.01	4.14	4.90	4.16	3.65	3.14	3.97	4.32	3.72	2.74
964	4.4	4.62	2.89	4.05	4.72	4.00	3.51	3.00	4.78	4.14	3.54	2.60
965	3.98	4.39	2.94	4.58	4.42	3.91	3.37	2.93	4.61	3.90	3.36	2.56
966	3.79	4.30	2.81	4.47	4.34	3.83	3.30	2.85	4.34	3.79	3.26	2.46
967	3.95	4.54	3.14	4.78	4.68	xxx	3.67	3.23	4.23	4.12	3.61	2.81
968	4.18	4.57	3.06	4.85	4.73	xxx	3.72	3.30	4.55	4.16	3.63	2.78
969	3.81	4.15	2.93	4.34	4.23	3.81	3.38	3.02	4.61	3.71	3.23	2.46
970	3.85	4.46	3.11	4.61	4.52	4.07	3.61	3.22	4.12	4.02	3.56	2.78
971	4	4.30	2.94	4.44	4.35	3.88	xxx	3.01	4.42	3.78	3.25	2.35
972	3.08	3.48	2.37	3.67	3.56	3.12	xxx	2.33	4.22	3.09	2.60	1.82
973	3.03	3.81	2.82	4.07	3.98	3.48	xxx	2.92	3.48	3.62	3.25	2.60
974	4.02	4.43	3.22	4.65	4.55	4.04	3.77	3.43	3.93	4.08	3.65	2.91
975	3.24	3.76	2.68	3.92	3.85	3.48	3.11	2.79	4.45	3.36	2.92	2.23
976	3.16	3.65	2.63	3.84	3.77	3.40	xxx	2.70	3.75	3.32	2.89	2.22
977	3.09	3.51	2.58	3.69	3.61	3.29	2.96	2.66	3.69	3.19	2.80	2.19
978	3.37	3.89	2.84	4.04	3.97	3.63	3.27	2.97	3.53	3.53	3.14	2.46
979	2.92	3.47	2.46	3.67	3.58	3.24	2.91	2.61	3.88	3.13	2.72	2.05
980	2.36	2.84	2.00	2.96	2.91	2.57	2.27	1.98	3.48	2.52	2.13	1.56
981	2.35	2.87	2.14	2.95	2.93	2.67	2.44	2.21	2.85	2.62	2.33	1.88
982	3.19	3.62	2.66	3.75	3.68	3.41	3.16	2.91	2.88	3.32	2.98	2.39
983	3.04	3.48	2.44	3.63	3.51	3.20	2.90	2.62	3.58	3.09	2.67	1.98
984	2.06	2.73	1.89	2.83	2.72	2.41	2.12	1.84	3.39	2.37	2.05	1.47
985	2.34	3.05	2.26	3.08	3.04	2.81	2.56	2.34	2.64	2.76	2.50	2.13
986	3.03	3.61	2.66	3.70	3.67	3.44	3.17	2.96	2.99	3.31	2.98	2.48
987	3.11	3.65	2.61	3.83	3.74	3.40	3.08	2.80	3.57	3.28	2.86	2.21
988	2.12	2.79	2.02	3.01	2.97	2.65	2.37	2.10	3.61	2.57	2.23	1.69
989	2.33	2.99	2.37	3.12	3.15	2.97	2.78	2.61	2.86	2.90	2.69	2.35
990	3.31	3.87	2.93	3.98	3.93	3.71	3.48	3.31	3.07	3.62	3.29	2.78
991	3.08	3.67	2.60	3.85	3.73	3.39	3.09	2.85	3.84	3.32	2.88	2.23
992	1.86	2.49	1.78	2.66	2.59	2.29	2.01	1.78	3.62	2.26	1.97	1.55
993	2.52	3.13	2.44	3.34	3.28	3.06	2.84	2.67	2.50	3.02	2.79	2.43
994	3.68	4.25	3.22	4.47	4.35	4.10	3.86	3.69	3.22	4.01	3.64	3.05
995	3.42	3.86	2.81	4.03	3.89	3.58	3.28	3.08	4.27	3.50	3.09	2.49
996	2.72	3.28	2.41	3.44	3.39	3.11	2.83	2.63	3.80	3.03	2.66	2.14
997	xxx	3.05	2.30	3.16	3.12	2.93	2.72	2.57	3.29	2.85	2.55	2.08
998	xxx	4.07	3.01	4.16	4.01	3.79	3.55	3.36	3.03	3.70	3.35	2.74
999	xxx	4.32	2.90	4.38	4.29	3.92	3.53	3.21	3.95	3.78	3.28	2.47
1000	xxx	3.18	2.19	3.29	3.26	2.93	2.37	2.31	4.18	2.83	2.40	1.78
1001	3.54	4.13	3.09	4.45	4.38	xxx	3.73	3.50	3.16	3.99	3.58	2.98
1002	5.22	5.37	3.75	5.58	5.43	xxx	4.66	4.39	4.27	4.89	4.35	3.51
1003	4.31	4.49	3.01	4.61	4.42	3.96	3.55	3.20	5.30	3.89	3.36	2.51
1004	4	4.49	3.03	4.58	4.47	4.03	3.63	3.29	4.33	3.92	3.42	2.60
1005	4.71	4.88	3.16	4.96	4.82	4.19	3.62	3.11	4.36	4.18	3.56	2.58
1006	5.42	5.27	3.43	5.40	5.23	4.60	4.01	3.47	4.70	4.56	3.90	2.86

Appendix A. (continued)

1007	5.28	5.17	3.20	5.28	5.05	4.26	3.50	2.81	5.09	4.34	3.63	2.46
1008	4.49	4.69	2.98	4.88	4.68	3.92	3.18	2.49	4.93	4.01	3.35	2.26
1009	4.87	4.99	3.28	5.13	4.97	4.21	3.43	2.73	4.56	4.35	3.71	2.70
1010	5.69	5.64	3.55	5.70	5.54	4.73	3.93	3.24	4.86	4.81	4.08	2.95
1011	5.88	5.47	3.26	5.46	5.23	4.34	3.45	2.70	5.41	4.45	3.63	2.36
1012	5.27	5.22	3.12	5.19	4.98	4.10	3.21	2.44	5.10	4.24	3.47	2.27
1013	5.81	5.68	3.50	5.84	5.61	4.67	3.74	2.97	4.87	4.81	4.03	2.77
1014	5.88	5.46	3.42	5.61	5.32	4.39	3.47	2.71	5.49	4.57	3.81	2.64
1015	5.84	5.46	3.55	5.77	5.50	4.63	3.81	3.06	5.21	4.78	4.04	2.89
1016	5.46	5.13	3.36	5.45	5.18	4.34	3.06	2.83	5.35	4.46	3.73	2.60
1017	5.93	5.13	3.85	5.98	5.76	xxx	4.15	3.50	5.02	5.10	4.37	3.37
1018	6.23	5.32	3.90	6.23	6.00	xxx	4.39	3.72	5.18	5.31	4.57	3.48
1019	5.63	5.31	3.52	5.53	5.28	4.55	3.81	3.25	5.41	4.58	3.90	2.83
1020	5.87	5.63	3.69	5.88	5.62	4.85	4.09	3.52	5.15	4.87	4.15	3.02
1021	5.58	5.53	3.54	5.71	5.45	4.69	3.93	3.30	5.48	4.71	4.01	2.85
1022	5.09	5.17	3.42	5.42	5.15	4.42	3.68	3.06	5.33	4.48	3.84	2.77
1023	5.32	5.19	3.41	5.38	5.12	4.43	3.72	3.14	5.08	4.42	3.74	2.67
1024	5.79	5.64	3.57	5.73	5.48	4.75	4.01	3.42	5.00	4.73	3.99	2.83
1025	5.22	5.30	3.35	5.43	5.19	4.49	3.79	3.22	5.35	4.48	3.76	2.65
1026	4.91	4.96	3.22	5.11	4.90	4.23	3.55	2.99	5.06	4.24	3.56	2.51
1027	5.41	5.27	3.41	5.46	5.22	4.52	3.84	3.28	4.78	4.52	3.83	2.73
1028	5.72	5.55	3.56	5.69	5.45	4.72	4.02	3.45	5.09	4.72	4.01	2.88
1029	4.77	4.93	3.13	5.08	4.88	4.21	3.59	3.05	5.31	4.20	3.53	2.45
1030	4.43	4.68	3.04	4.88	4.66	4.01	3.41	2.87	4.75	4.02	3.38	2.34
1031	4.6	4.79	3.13	4.99	4.78	4.19	3.92	3.10	4.55	4.18	3.54	2.53
1032	4.9	4.84	3.15	5.01	4.81	4.21	3.62	3.12	4.66	4.19	3.54	2.54
1033	4.65	4.77	3.11	4.88	4.76	4.17	3.63	3.16	4.68	4.11	3.51	2.59
1034	3.78	4.06	2.73	4.19	4.07	3.50	2.99	2.54	4.64	3.52	2.98	2.17
1035	4	4.27	3.02	4.42	4.28	3.82	3.37	3.00	3.99	3.79	3.29	2.57
1036	5.02	5.19	3.45	5.34	5.15	4.64	4.13	3.73	4.20	4.54	3.95	3.05
1037	4.2	4.50	2.86	4.68	4.46	3.93	3.47	3.06	5.04	3.83	3.24	2.31
1038	3.31	3.86	2.60	4.02	3.90	3.41	2.99	2.61	4.34	3.38	2.87	2.06
1039	3.52	4.03	2.81	4.15	4.10	3.73	3.37	3.09	3.81	3.60	3.13	2.41
1040	4.48	4.70	3.11	4.81	4.68	4.25	3.83	3.52	4.00	4.10	3.55	2.68
1041	3.84	4.12	2.58	4.23	4.06	3.62	3.20	2.88	4.58	3.49	2.90	2.01
1042	3.06	3.65	2.45	3.82	3.71	3.32	2.94	2.65	3.97	3.24	2.73	2.00
1043	xxx	3.78	2.57	3.85	3.82	3.48	3.15	2.88	3.63	3.34	2.85	2.05
1044	xxx	4.02	2.66	4.02	3.97	3.61	3.26	2.98	3.72	3.46	2.94	2.08
1045	4.01	4.23	2.75	4.32	4.21	3.82	3.42	3.11	3.87	3.65	3.10	2.21
1046	3.12	3.60	2.42	3.77	3.69	3.33	2.96	2.67	4.10	3.18	2.68	1.88
1047	3.34	3.90	2.81	4.09	4.04	3.73	3.44	3.21	3.59	3.61	3.18	2.53
1048	4.38	4.58	3.11	4.69	4.59	4.22	3.90	3.65	3.96	4.06	3.54	2.74
1049	3.75	4.12	2.68	4.19	4.08	3.64	3.30	3.02	4.49	3.53	3.00	2.17
1050	3.14	3.73	2.50	3.84	3.74	3.36	3.05	2.79	3.98	3.26	2.79	2.06
1051	3.69	4.18	2.85	4.34	4.22	3.81	3.42	3.12	3.65	3.69	3.19	2.39
1052	4.41	4.67	3.07	4.78	4.66	4.22	3.81	3.47	4.11	4.05	3.48	2.57
1053	4.25	4.56	2.94	4.63	4.49	3.98	3.53	3.12	4.52	3.91	3.32	2.44
1054	3.72	4.18	2.78	4.32	4.20	3.73	3.30	2.92	4.37	3.66	3.11	2.29

Appendix A. (continued)

1055	3.7	4.20	2.81	4.35	4.22	3.75	3.32	2.94	4.08	3.67	3.14	2.30
1056	4.49	4.78	3.09	4.85	4.71	4.20	3.73	3.32	4.10	4.08	3.50	2.56
1057	4.22	4.37	2.71	4.39	4.21	3.70	3.19	2.75	4.58	3.59	2.97	2.01
1058	3.8	4.22	2.67	4.31	4.13	3.64	3.14	2.71	4.10	3.56	2.98	2.05
1059	3.97	3.86	2.32	3.76	3.57	3.08	2.58	2.12	4.03	2.97	2.40	1.50
1060	4.52	4.62	2.77	4.57	4.39	3.76	3.20	2.70	3.47	3.67	3.01	2.01
1061	5.5	5.43	2.98	5.63	5.32	4.38	3.48	2.74	4.80	4.36	3.37	1.77
1062	4.42	4.22	2.42	4.41	4.16	3.34	2.52	1.85	5.18	3.43	2.65	1.37
1063	4.28	4.73	3.03	4.81	4.66	4.05	3.42	2.89	4.03	4.02	3.33	2.14
1064	xxx	5.00	3.09	5.02	4.86	4.25	3.63	3.07	4.54	4.14	3.41	2.15
1065	xxx	4.70	2.99	4.77	4.58	3.96	4.26	2.74	4.72	3.89	3.19	1.98
1066	xxx	4.57	2.92	4.71	4.51	3.90	3.26	2.69	4.44	3.82	3.13	1.94
1067	4.8	5.00	3.26	5.16	4.96	4.20	3.41	2.72	4.36	4.27	3.56	2.34
1068	4.23	4.45	2.94	4.60	4.40	3.65	2.88	2.23	4.84	3.75	3.07	1.96
1069	4.22	4.64	3.26	4.83	4.65	3.89	3.16	2.46	4.30	4.11	3.55	2.60
1070	4.67	4.94	3.34	5.10	4.91	4.16	3.38	2.69	4.56	4.28	3.66	2.62
1071	4.31	4.73	3.22	4.82	4.64	3.86	3.04	2.30	4.77	4.05	3.45	2.50
1072	4.36	4.77	3.26	4.86	4.67	3.87	xxx	2.32	4.53	4.09	3.49	2.56
1073	4.22	4.39	2.99	4.53	4.31	3.50	xxx	1.98	4.58	3.72	3.13	2.21
1074	4.21	4.57	3.10	4.72	4.51	3.70	2.89	2.17	4.21	3.91	3.31	2.34
1075	4.5	5.03	3.35	5.16	4.92	3.99	3.04	2.22	4.41	4.29	3.63	2.57
1076	4.21	4.52	3.08	4.64	4.41	3.51	2.63	1.87	4.85	3.83	3.23	2.27
1077	3.7	4.09	2.92	4.24	4.10	3.25	2.52	1.85	4.35	3.59	3.10	2.33
1078	4.59	4.93	3.32	5.04	4.90	4.02	3.20	2.42	4.00	4.27	3.68	2.73
1079	4.06	4.35	2.78	4.47	4.28	3.51	2.67	1.90	4.76	3.65	3.01	1.98
1080	3.62	4.16	2.74	4.36	4.17	3.39	2.56	1.83	4.18	3.59	2.97	1.98
1081	3.8	4.36	2.86	4.52	4.31	3.53	2.69	1.97	4.10	3.70	3.07	2.04
1082	3.82	4.30	2.86	4.42	4.20	3.41	2.58	1.86	4.23	3.62	3.02	2.02
1083	4.02	4.52	3.00	4.72	4.54	3.69	2.93	2.22	4.12	3.92	3.31	2.29
1084	3.25	3.60	2.48	3.86	3.68	2.90	2.20	1.58	4.44	3.17	2.63	1.75
1085	2.85	3.34	2.51	3.59	3.46	2.92	2.42	1.97	3.62	3.10	2.74	2.14
1086	3.79	4.24	2.96	4.41	4.26	3.68	3.12	2.57	3.42	3.75	3.29	2.54
1087	3.25	4.05	2.65	3.95	3.93	3.40	2.86	2.36	4.17	3.42	2.91	2.13
1088	2.71	3.41	2.36	3.36	3.36	2.82	2.29	1.83	3.86	2.98	2.54	1.86
1089	3.19	3.58	2.63	3.78	3.68	3.15	2.69	2.27	3.34	3.26	2.83	2.21
1090	3.54	4.04	2.83	4.15	4.07	3.55	3.08	2.62	3.60	3.58	3.11	2.40
1091	3.31	3.84	2.65	3.96	3.82	3.37	2.94	2.51	3.97	3.33	2.88	2.15
1092	2.3	2.99	2.16	3.18	3.06	2.60	2.19	1.79	3.73	2.66	2.27	1.65
1093	2.44	3.11	2.37	3.29	3.23	2.91	2.59	2.30	3.01	2.91	2.60	2.11
1094	3.32	3.83	2.82	3.99	3.90	3.58	3.23	2.92	3.19	3.53	3.15	2.55
1095	3.13	3.62	2.58	3.80	3.71	3.34	2.99	2.67	3.80	3.27	2.81	2.16
1096	2.13	2.79	2.04	2.96	2.89	2.52	2.18	1.89	3.58	2.50	2.11	1.60
1097	2.21	2.96	2.24	3.05	3.00	2.77	2.51	2.32	2.80	2.71	2.44	2.08
1098	3.31	3.92	2.80	3.97	3.91	3.67	3.39	3.17	2.95	3.55	3.18	2.61
1099	3.08	3.77	2.53	3.81	3.72	3.38	3.07	2.78	3.83	3.30	2.86	2.18
1100	2.14	2.78	1.97	2.89	2.82	2.51	2.24	1.98	3.63	2.48	2.14	1.64
1101	2.15	2.72	2.14	2.89	2.85	2.66	2.48	2.32	2.74	2.59	2.36	2.04
1102	3.05	3.65	2.68	3.76	3.69	3.47	3.26	3.08	2.77	3.35	3.03	2.54

Appendix A. (continued)

1103	3.43	3.92	2.73	4.13	3.95	3.59	3.26	2.96	3.59	3.49	3.02	2.30
1104	2.26	2.95	2.13	3.23	3.12	2.80	2.50	2.24	3.86	2.72	2.33	1.78
1105	2.34	3.04	2.38	3.22	3.25	3.07	2.87	2.72	3.03	2.97	2.70	2.34
1106	3.53	4.03	2.96	4.17	4.11	3.88	3.64	3.45	3.15	3.76	3.38	2.78
1107	3.73	4.17	2.94	4.33	4.19	3.86	3.53	3.27	4.03	3.74	3.28	2.55
1108	2.65	3.31	2.42	3.52	3.44	3.14	2.30	2.61	4.12	3.04	2.68	2.11
1109	2.99	3.65	2.78	3.85	3.81	3.58	xxx	3.18	3.36	3.44	3.12	2.55
1110	4.18	4.59	3.32	4.73	4.60	4.32	xxx	3.85	3.70	4.19	3.76	3.02
1111	4.05	4.34	3.02	4.44	4.31	3.96	xxx	3.40	xxx	3.83	3.34	2.54
1112	3.52	3.96	2.85	4.09	4.00	3.66	3.34	3.13	xxx	3.54	3.11	2.40
1113	3.87	4.36	3.11	4.52	4.43	4.08	3.78	3.57	3.93	3.92	3.46	2.71
1114	5.07	5.26	3.59	5.33	5.22	4.83	4.47	4.21	4.31	4.63	4.07	3.15
1115	xxx	4.66	2.93	4.56	4.42	4.02	3.59	3.29	5.11	3.84	3.24	2.25
1116	xxx	4.30	2.81	4.18	4.05	3.65	3.26	2.97	4.34	3.51	2.95	2.12
1117	5.52	5.43	3.50	5.61	5.48	4.56	4.43	4.07	3.97	4.75	4.05	2.99
1118	6.04	5.77	3.59	5.95	5.77	4.83	4.67	4.30	5.31	4.97	4.22	3.03
1119	5.2	5.17	3.16	5.24	5.06	4.51	4.12	3.58	5.59	4.37	3.71	2.59
1120	4.9	4.95	3.10	5.09	4.93	4.44	3.84	3.57	4.94	4.25	3.62	2.54
1121	5.29	5.20	3.27	5.29	5.11	4.50	3.87	3.36	4.79	4.42	3.74	2.70
1122	5.65	5.46	3.37	5.49	5.33	4.72	4.09	3.56	4.99	4.57	3.86	2.79
1123	5.74	5.46	3.30	5.54	5.33	4.51	3.72	3.04	5.18	4.56	3.84	2.67
1124	5.71	5.51	3.32	5.63	5.45	4.63	3.86	3.18	5.20	4.65	3.92	2.72
1125	5.84	5.60	3.37	5.64	5.46	4.54	3.64	2.85	5.29	4.69	3.93	2.75
1126	5.77	5.57	3.37	5.63	5.46	4.54	3.64	2.87	5.34	4.69	3.94	2.75
1127	6.32	5.71	3.43	5.77	5.53	4.53	3.54	2.72	5.34	4.72	3.93	2.68
1128	6.24	5.69	3.40	5.76	5.52	4.52	3.53	2.69	5.40	4.71	3.92	2.68
1129	6.15	5.79	3.55	5.93	5.68	4.67	3.66	2.79	5.39	4.91	4.14	2.93
1130	5.67	5.41	3.36	5.61	5.34	4.34	3.32	2.46	5.57	4.60	3.86	2.71
1131	6.04	5.52	3.58	5.82	5.53	4.56	3.57	2.76	5.43	4.80	4.08	2.96
1132	6.4	5.71	3.69	6.05	5.75	4.78	3.79	2.99	5.39	4.97	4.23	3.06
1133	6.08	5.71	3.68	5.99	5.73	4.74	3.81	3.02	5.59	4.96	4.22	3.06
1134	5.46	5.12	3.40	5.43	5.19	4.22	3.31	2.53	5.59	4.49	3.81	2.74
1135	5.56	5.12	3.68	5.74	5.50	4.45	3.75	3.04	5.07	4.83	4.19	3.17
1136	6.38	5.76	3.94	6.32	6.05	4.97	4.26	3.53	5.19	5.30	4.57	3.43
1137	5.81	5.70	3.62	5.83	5.59	4.71	3.88	3.17	5.73	4.83	4.12	2.99
1138	4.9	5.11	3.38	5.33	5.10	4.27	3.46	2.78	5.47	4.44	3.81	2.78
1139	5.04	5.17	3.54	5.46	5.23	4.49	3.77	3.16	5.00	4.60	3.99	2.99
1140	5.8	5.73	3.80	5.95	5.71	4.91	4.15	3.52	5.11	5.01	4.34	3.25
1141	5.33	5.36	3.43	5.52	5.31	4.53	3.80	3.20	5.58	4.57	3.87	2.79
1142	4.08	4.49	3.04	4.74	4.54	3.81	3.12	2.55	5.18	3.94	3.34	2.45
1143	4.46	4.80	3.38	5.05	4.88	4.21	3.68	3.20	4.45	4.30	3.76	2.88
1144	5.32	5.39	3.65	5.58	5.40	4.69	4.13	3.63	4.76	4.73	4.13	3.13
1145	4.81	5.14	3.42	5.30	5.17	4.49	3.88	3.39	5.26	4.43	3.82	2.86
1146	3.44	4.11	2.84	4.32	4.22	3.59	3.02	2.57	4.97	3.61	3.11	2.32
1147	3.81	4.41	3.24	4.63	4.54	3.81	3.63	3.26	4.10	4.05	3.62	2.89
1148	4.65	4.97	3.55	5.17	5.06	4.32	4.11	3.73	4.44	4.49	3.99	3.14
1149	4.37	4.78	3.37	4.92	4.85	4.29	3.91	3.55	4.93	4.27	3.79	2.97
1150	3.34	3.73	2.61	3.83	3.80	3.28	2.71	2.62	4.73	3.34	3.01	2.30

Appendix A. (continued)

1151	3.03	3.55	2.72	3.74	3.71	3.31	3.19	2.98	3.73	3.39	3.11	2.60
1152	4.42	4.73	3.51	4.89	4.82	4.35	4.18	3.93	3.67	4.36	3.94	3.24
1153	4.19	4.46	3.17	4.59	4.50	4.09	3.73	3.43	4.73	3.96	3.48	2.71
1154	2.99	3.62	2.63	3.83	3.79	3.42	3.11	2.85	4.39	3.35	2.94	2.30
1155	3.01	3.61	2.75	3.82	3.78	3.53	3.29	3.12	3.71	3.41	3.08	2.56
1156	3.93	4.38	3.27	4.55	4.45	4.17	3.89	3.68	3.71	4.04	3.64	3.01
1157	4.02	4.43	3.17	4.62	4.49	4.12	3.76	3.48	4.39	3.99	3.52	2.76
1158	2.97	3.66	2.69	3.92	3.84	3.50	3.17	2.92	4.40	3.41	3.02	2.38
1159	3.24	3.89	2.94	4.12	4.11	3.70	3.56	3.36	3.76	3.71	3.35	2.74
1160	3.91	4.32	3.24	4.52	4.47	4.04	3.88	3.66	4.01	4.03	3.63	2.93
1161	3.72	4.18	3.13	4.40	4.29	3.99	3.70	3.49	4.37	3.87	3.48	2.82
1162	3.44	4.04	3.02	4.25	4.17	3.87	3.58	3.38	4.21	3.76	3.38	2.75
1163	3.58	4.07	3.03	4.32	4.26	3.90	3.69	3.49	4.09	3.83	3.42	2.74
1164	4.16	4.38	3.26	4.60	4.49	4.10	3.87	3.65	4.18	4.05	3.62	2.91
1165	3.7	4.27	3.12	4.49	4.38	4.09	3.85	3.66	4.41	3.87	3.54	2.85
1166	3.9	4.33	3.15	4.53	4.41	4.10	3.83	3.64	4.30	3.98	3.56	2.87
1167	3.64	3.97	2.85	4.15	4.04	3.70	3.42	3.24	4.34	3.58	3.14	2.45
1168	3.84	4.23	3.02	4.40	4.29	3.94	3.66	3.46	3.97	3.83	3.37	2.65
1169	4.26	4.56	3.18	4.73	4.55	4.18	3.87	3.64	4.23	4.04	3.52	2.72
1170	4.11	4.67	3.17	4.72	4.53	4.16	3.85	3.64	4.47	4.03	3.52	2.73
1171	4.07	4.59	3.07	4.59	4.46	4.09	3.74	3.52	4.45	3.93	3.41	2.60
1172	4.26	4.56	3.13	4.67	4.55	4.19	3.83	3.60	4.38	4.01	3.48	2.64
1173	4.21	4.39	3.03	4.51	4.35	4.01	3.67	3.25	4.47	3.85	3.35	2.56
1174	4.23	4.43	3.06	4.57	4.41	4.06	3.72	3.51	4.28	3.90	3.40	2.62
1175	4.39	4.61	3.13	4.76	4.63	4.22	3.84	3.60	4.40	4.05	3.49	2.64
1176	3.98	4.24	2.96	4.40	4.31	3.91	3.54	3.32	4.54	3.76	3.24	2.46
1177	4.29	4.43	3.17	4.52	4.42	4.08	3.76	3.55	4.22	3.91	3.42	2.66
1178	4.68	4.80	3.32	4.88	4.75	4.40	4.04	3.83	4.32	4.18	3.65	2.80
1179	4.37	4.61	3.15	4.74	4.61	4.22	3.85	3.61	4.70	4.04	3.50	2.63
1180	4.05	4.30	3.02	4.44	4.33	3.96	3.61	3.39	4.52	3.81	3.30	2.51
1181	4.14	4.25	2.98	4.36	4.26	3.90	3.58	3.37	4.28	3.75	3.25	2.49
1182	4.69	4.71	3.20	4.81	4.67	4.28	3.93	3.70	4.18	4.11	3.56	2.71
1183	4.63	4.79	3.21	4.94	4.79	4.35	3.96	3.69	4.59	4.18	3.59	2.67
1184	3.93	4.25	2.95	4.37	4.30	3.89	3.52	3.27	4.70	3.75	3.22	2.41
1185	3.91	4.26	3.03	4.40	4.33	3.99	3.65	3.42	4.21	3.82	3.33	2.61
1186	4.8	4.97	3.36	5.07	4.91	4.53	4.16	3.93	4.26	4.33	3.77	2.92
1187	4.45	4.58	2.97	4.63	4.47	4.06	3.65	3.39	4.86	3.88	3.29	2.37
1188	3.87	4.22	2.85	4.36	4.24	3.84	3.44	3.19	4.42	3.70	3.14	2.30
1189	4.04	4.15	2.83	4.29	4.17	3.83	xxx	3.30	4.22	3.66	3.15	2.36
1190	4.7	4.57	3.02	4.66	4.48	4.12	xxx	3.53	4.08	3.93	3.37	2.50
1191	4.77	4.90	3.18	5.01	4.86	4.40	xxx	3.72	4.40	4.23	3.60	2.62
1192	4.07	4.21	2.85	4.32	4.23	3.79	xxx	3.18	4.77	3.66	3.11	2.26
1193	3.49	3.75	2.64	3.84	3.79	3.49	xxx	3.08	4.13	3.35	2.93	2.30
1194	4.26	4.42	2.96	4.53	4.39	4.08	xxx	3.61	3.70	3.89	3.40	2.65
1195	4.28	4.59	2.98	4.71	4.52	4.13	xxx	3.55	4.30	3.95	3.38	2.49
1196	3.58	3.96	2.70	4.12	3.99	3.63	xxx	3.11	4.47	3.50	3.01	2.21
1197	3.13	3.41	2.38	3.51	3.39	3.13	xxx	2.73	3.94	3.02	2.60	1.94
1198	4.04	4.32	2.86	4.40	4.20	3.91	xxx	3.40	3.36	3.75	3.24	2.44

Appendix A. (continued)

1199	xxx	5.06	3.09	5.19	4.97	4.46	xxx	3.63	4.17	4.28	3.55	2.33
1200	xxx	3.53	2.27	3.65	3.56	3.06	xxx	2.33	4.88	3.02	2.45	1.50
1201	3.16	3.51	2.64	3.55	3.54	3.32	xxx	3.05	3.49	3.24	2.93	2.44
1202	3.81	4.15	2.97	4.28	4.13	3.92	xxx	3.64	3.48	3.78	3.39	2.77
1203	3.64	4.06	2.92	4.26	4.06	3.79	xxx	3.41	4.07	3.67	3.24	2.56
1204	2.71	3.37	2.49	3.54	3.45	3.19	xxx	2.85	4.04	3.09	2.74	2.17
1205	2.67	3.14	2.38	3.25	3.22	3.02	xxx	2.75	3.43	2.93	2.63	2.14
1206	3.56	3.81	2.79	3.86	3.81	3.62	xxx	3.31	3.20	3.50	3.13	2.54
1207	3.77	4.15	2.96	4.23	4.11	3.86	xxx	3.52	3.78	3.73	3.29	2.62
1208	2.84	3.33	2.38	3.40	3.37	3.12	xxx	2.77	4.07	3.02	2.63	2.06
1209	2.68	3.15	2.40	3.25	3.29	3.12	xxx	2.84	3.33	3.01	2.72	2.27
1210	3.55	3.89	2.91	4.07	3.97	3.80	xxx	3.52	3.25	3.66	3.32	2.75
1211	3.47	3.92	2.82	4.13	3.93	3.68	xxx	3.33	3.94	3.57	3.17	2.52
1212	2.6	3.10	2.29	3.30	3.22	2.97	xxx	2.66	3.92	2.88	2.56	2.04
1213	2.49	2.97	2.27	3.07	3.06	2.91	2.74	2.72	3.18	2.81	2.58	2.21
1214	3.7	4.10	2.96	4.12	4.01	3.84	3.65	3.58	3.02	3.71	3.36	2.81
1215	3.43	3.71	2.51	3.70	3.59	3.32	3.10	2.96	4.00	3.26	2.82	2.18
1216	2.96	3.38	2.41	3.40	3.34	3.07	2.71	2.77	3.60	3.02	2.66	2.11
1217	2.86	3.25	2.36	3.35	3.26	3.05	2.86	2.77	3.32	2.95	2.64	2.16
1218	3.53	3.86	2.64	3.95	3.82	3.61	3.40	3.27	3.24	3.46	3.06	2.48
1219	4.27	4.58	3.08	4.70	4.53	4.19	xxx	3.63	3.82	4.00	3.48	2.56
1220	3.22	3.67	2.57	3.81	3.70	3.36	xxx	2.85	4.49	3.26	2.83	2.05
1221	3.63	4.10	3.05	4.22	4.16	3.85	3.64	3.51	3.67	3.79	3.41	2.80
1222	3.86	4.14	3.03	4.26	4.18	3.88	3.67	3.54	4.13	3.79	3.38	2.72
1223	4.19	4.51	3.30	4.66	4.57	xxx	4.03	3.76	4.14	4.13	3.69	2.93
1224	4.26	4.77	3.39	4.84	4.75	xxx	4.10	3.95	4.51	4.26	3.79	2.95
1225	4.21	4.64	3.34	4.72	4.61	xxx	3.89	3.69	4.69	4.17	3.72	2.91
1226	4.92	5.05	3.57	5.21	5.05	xxx	4.39	4.18	4.58	4.53	4.02	3.15
1227	4.84	4.91	3.38	5.06	4.85	4.39	3.95	3.63	4.98	4.33	3.74	2.86
1228	5.08	5.26	3.57	5.42	5.24	4.77	3.68	3.98	4.80	4.66	4.05	3.12
1229	4.65	4.48	2.89	4.53	4.33	3.84	3.33	2.95	5.15	3.73	3.13	2.20
1230	5.36	5.37	3.37	5.47	5.26	4.70	4.10	3.66	4.26	4.58	3.91	2.89
1231	xxx	4.53	2.40	4.45	4.17	3.41	xxx	2.11	5.19	3.40	2.56	1.18
1232	xxx	4.28	2.32	4.15	3.89	3.13	xxx	1.91	3.96	3.22	2.47	1.28
1233	xxx	6.32	3.59	6.45	6.11	5.01	xxx	3.09	3.94	5.02	3.90	2.06
1234	xxx	5.06	3.03	5.26	5.00	3.98	xxx	2.20	5.95	4.09	3.12	1.54
1235	5.79	5.09	3.64	5.92	5.74	4.52	xxx	3.26	4.86	4.88	4.03	2.52
1236	6.79	5.79	3.81	6.55	6.26	5.05	xxx	3.76	5.27	5.27	4.31	2.61
1237	6.03	5.75	3.51	5.91	5.63	4.71	xxx	3.03	5.81	4.74	3.84	2.35
1238	5.59	5.38	3.36	5.53	5.27	4.38	xxx	2.72	5.45	4.44	3.58	2.19
1239	5.41	5.31	3.37	5.49	5.22	4.29	xxx	2.62	5.12	4.48	3.68	2.38
1240	6.92	6.59	3.90	6.74	6.36	5.31	xxx	3.53	5.10	5.38	4.41	2.80
1241	6.18	5.84	3.22	5.94	5.52	4.35	xxx	2.38	6.18	4.58	3.59	1.97
1242	5.36	5.16	3.02	5.30	5.00	3.93	xxx	1.99	5.40	4.22	3.35	1.88
1243	5.49	5.19	3.02	5.32	5.01	3.97	xxx	1.95	4.91	4.22	3.37	1.91
1244	6.62	6.17	3.43	6.24	5.81	4.66	xxx	2.60	4.91	4.84	3.86	2.21
1245	6.26	5.81	2.96	5.89	5.44	4.12	xxx	1.99	5.68	4.45	3.40	1.69
1246	5.14	4.89	2.61	5.01	4.71	3.51	xxx	1.48	5.32	3.90	3.01	1.52

Appendix A. (continued)

1247	5.12	4.99	2.80	5.10	4.80	3.68	2.61	1.63	4.60	4.03	3.17	1.72
1248	6.22	5.90	3.20	6.00	5.56	4.34	3.21	2.23	4.69	4.63	3.61	1.98
1249	5.98	5.88	2.85	5.76	5.28	3.92	2.80	1.78	5.44	4.34	3.28	1.60
1250	4.44	4.56	2.34	4.47	4.14	2.92	1.96	1.08	5.19	3.46	2.63	1.28
1251	4.67	4.60	2.74	4.74	4.44	3.38	2.36	1.50	4.09	3.79	3.04	1.76
1252	5.83	5.71	3.19	5.85	5.42	4.26	3.09	2.09	4.37	4.52	3.59	2.04
1253	5.33	5.32	2.77	5.46	5.01	3.75	2.66	1.66	5.29	4.11	3.14	1.57
1254	3.86	4.15	2.29	4.33	3.98	2.84	1.89	1.06	4.89	3.34	2.57	1.26
1255	4.15	4.48	2.73	4.62	4.33	3.35	2.35	1.54	xxx	3.71	3.04	1.82
1256	5.06	5.19	3.01	5.30	4.97	3.92	2.81	1.81	xxx	4.17	3.35	1.96
1257	4.8	5.05	2.85	5.21	4.84	3.74	2.69	1.70	4.83	4.04	3.19	1.78
1258	3.36	4.01	2.39	4.17	3.86	2.86	1.94	1.16	4.73	3.27	2.59	1.38
1259	3.67	4.27	2.80	4.40	4.16	3.28	2.37	1.63	3.82	3.64	3.07	2.00
1260	4.53	4.86	3.01	5.01	4.70	3.73	2.71	1.80	4.11	4.03	3.34	2.14
1261	4.28	4.71	2.89	4.86	4.55	3.60	2.65	1.77	4.60	3.87	3.17	2.01
1262	3.16	3.94	2.52	4.10	3.87	2.99	2.13	1.38	4.45	3.31	2.70	1.65
1263	3.19	3.92	2.71	4.08	3.89	3.14	2.35	1.69	3.80	3.41	2.91	2.04
1264	3.96	4.41	2.92	4.57	4.30	3.48	2.60	1.83	3.82	3.72	3.16	2.22
1265	4.04	4.45	2.92	4.61	4.30	3.48	2.63	1.88	4.21	3.72	3.15	2.19
1266	3.17	3.90	2.64	4.06	3.81	3.05	2.26	1.57	4.22	3.32	2.79	1.90
1267	2.97	3.80	2.65	3.91	3.77	3.08	2.36	1.74	3.69	3.31	2.82	2.05
1268	3.57	4.18	2.84	4.20	4.05	3.32	2.54	1.86	3.70	3.54	3.02	2.21
1269	3.67	4.25	2.85	4.30	4.11	3.37	2.59	1.90	3.98	3.57	3.04	2.19
1270	3.32	4.04	2.74	4.17	4.00	3.26	2.49	1.82	4.04	3.46	2.94	2.08
1271	3.01	3.77	2.62	3.91	3.79	3.15	2.45	1.85	3.92	3.31	2.85	2.10
1272	3.44	3.98	2.73	4.09	3.95	3.29	2.58	1.94	3.71	3.43	2.94	2.14
1273	3.58	4.14	2.81	4.22	4.06	3.36	2.66	2.00	3.86	3.53	3.03	2.22
1274	3.38	4.09	2.78	4.21	4.04	3.35	2.65	2.00	3.98	3.53	3.02	2.20
1275	3.26	3.94	2.66	4.07	3.94	3.30	2.65	2.07	3.95	3.41	2.89	2.08
1276	3.43	4.03	2.71	4.13	4.00	3.36	2.70	2.11	3.85	3.46	2.94	2.12
1277	3.59	4.05	2.72	4.08	3.95	3.43	3.30	2.41	3.91	3.41	2.91	2.10
1278	3.83	4.38	2.85	4.36	4.22	3.66	2.90	2.63	3.84	3.65	3.12	2.25
1279	3.75	4.32	2.69	4.40	4.31	3.81	3.32	2.90	4.10	3.64	3.01	2.00
1280	3.25	3.63	2.42	3.72	3.64	3.17	2.69	2.29	4.18	3.10	2.55	1.69
1281	3.55	4.05	2.85	4.24	4.17	3.85	xxx	3.29	3.54	3.66	3.19	2.44
1282	4.13	4.55	3.03	4.73	4.59	4.18	xxx	3.57	4.05	4.00	3.44	2.55
1283	3.99	4.45	2.91	4.56	4.44	4.01	xxx	3.37	4.48	3.83	3.23	2.33
1284	3.5	3.95	2.70	4.09	4.01	3.62	xxx	3.01	4.33	3.48	2.95	2.14
1285	3.59	4.10	2.89	4.31	4.19	3.87	xxx	3.39	3.91	3.68	3.22	2.45
1286	4.21	4.68	3.12	4.89	4.69	4.30	xxx	3.75	4.08	4.09	3.55	2.66
1287	4.19	4.66	3.02	4.82	4.61	4.18	xxx	3.55	4.57	3.98	3.38	2.47
1288	3.5	4.00	2.74	4.15	4.02	3.66	3.27	3.07	4.49	3.52	2.99	2.18
1289	3.81	4.13	2.94	4.30	4.15	3.85	3.55	3.40	3.95	3.71	3.25	2.52
1290	4.54	4.79	3.21	4.99	4.74	4.38	4.06	3.86	4.08	4.18	3.65	2.80
1291	4.49	4.82	3.14	4.97	4.76	4.32	3.92	3.66	4.53	4.12	3.50	2.54
1292	3.46	3.93	2.73	4.07	3.97	3.59	3.22	3.00	4.64	3.46	2.93	2.13
1293	3.65	4.04	2.96	4.19	4.07	3.77	3.48	3.33	3.88	3.62	3.19	2.54
1294	4.52	4.80	3.30	5.00	4.76	4.42	4.09	3.90	4.00	4.20	3.69	2.89

Appendix A. (continued)

1295	4.5	4.79	3.18	4.98	4.76	4.34	3.95	3.69	4.65	4.14	3.54	2.61
1296	3.53	3.98	2.78	4.16	4.06	3.68	3.30	3.09	4.67	3.53	3.01	2.22
1297	3.59	4.00	2.93	4.15	4.07	3.79	3.49	3.34	4.07	3.62	3.20	2.54
1298	4.7	4.85	3.35	4.96	4.79	4.45	4.14	3.94	3.99	4.25	3.73	2.92
1299	4.55	4.77	3.18	4.90	4.74	4.32	3.94	3.70	4.71	4.12	3.53	2.62
1300	3.49	3.87	2.75	3.99	3.93	3.57	3.22	3.04	4.65	3.41	2.93	2.19
1301	3.58	4.01	2.94	4.18	4.11	3.80	3.53	3.24	3.84	3.67	3.24	2.58
1302	4.7	4.76	3.32	4.87	4.73	4.39	4.10	3.92	4.04	4.22	3.71	2.92
1303	4.35	4.49	3.05	4.61	4.44	4.09	3.78	3.58	4.67	3.92	3.39	2.56
1304	3.52	3.90	2.76	4.05	3.93	3.59	3.29	3.10	4.39	3.48	3.01	2.27
1305	3.33	3.81	2.80	3.99	3.90	3.62	3.38	3.25	3.87	3.49	3.11	2.49
1306	4.57	4.83	3.28	4.92	4.77	4.44	4.14	3.96	3.83	4.24	3.75	2.96
1307	4.28	4.65	2.85	4.52	4.37	3.95	3.57	3.33	4.70	3.79	3.20	2.30
1308	3.16	3.74	2.48	3.72	3.65	3.30	2.97	2.79	4.32	3.19	2.71	1.98
1309	3.38	3.75	2.69	3.88	3.81	3.51	3.21	3.03	3.60	3.39	2.97	2.29
1310	4.36	4.62	3.08	4.65	4.52	4.20	3.88	3.66	3.76	4.02	3.51	2.67
1311	4.4	4.72	3.03	4.83	4.67	4.30	3.92	3.68	4.47	4.13	3.53	2.57
1312	2.91	3.01	2.07	3.13	3.01	2.67	2.33	2.14	4.63	2.59	2.16	1.53
1313	3.03	3.31	2.52	3.51	3.42	3.22	3.04	2.97	2.96	1.59	2.84	2.45
1314	4.44	4.55	3.26	4.71	4.58	4.38	4.19	4.09	3.25	4.21	3.82	3.22
1315	3.86	3.89	2.67	4.03	3.94	3.68	3.42	3.27	4.53	3.54	3.11	2.35
1316	3.2	3.30	2.35	3.35	3.25	2.96	2.68	2.54	3.91	2.87	2.52	1.87
1317	3.22	3.50	2.59	3.63	3.52	3.37	3.12	3.02	3.22	1.90	2.89	2.38
1318	4.55	4.52	3.09	4.65	4.56	4.37	4.13	3.98	3.41	4.14	3.72	2.99
1319	3.88	3.77	2.40	3.78	3.68	3.47	3.20	3.02	4.58	3.29	2.88	2.04
1320	3.19	3.41	2.28	3.48	3.41	3.19	2.95	2.81	3.65	3.07	2.72	1.99
1321	3.11	3.28	2.14	3.29	3.22	2.96	2.74	2.60	3.37	2.89	2.52	1.83
1322	3.94	4.06	2.56	4.10	3.99	3.70	3.44	3.24	3.18	3.58	3.10	2.25
1323	4.24	4.28	2.50	4.32	4.16	3.70	3.38	3.07	3.95	3.57	2.94	1.87
1324	3.13	3.53	2.18	3.65	3.56	3.16	2.90	2.65	4.10	3.07	2.54	1.64
1325	3.32	3.68	2.42	3.74	3.67	3.39	3.14	2.96	3.48	3.23	2.75	1.96
1326	3.82	4.10	2.59	4.12	4.02	3.73	2.11	3.23	3.59	3.54	2.99	2.10
1327	4.34	4.47	2.78	4.52	4.38	4.03	xxx	4.42	3.97	xxx	3.20	2.17
1328	3.5	3.73	2.45	3.86	3.77	3.45	xxx	2.92	4.33	xxx	2.76	1.86
1329	3.32	3.68	2.58	3.78	3.73	3.53	3.28	3.14	3.70	3.32	2.90	2.22
1330	3.88	4.16	2.73	4.24	4.13	3.87	3.59	3.40	3.65	3.64	3.13	2.33
1331	4.48	4.60	2.97	4.60	4.45	4.14	3.83	3.60	4.06	3.93	3.39	2.46
1332	4.05	4.32	2.85	4.35	4.24	3.98	3.67	3.53	4.41	3.76	3.26	2.37
1333	3.74	4.07	2.77	4.17	4.08	3.84	3.54	3.37	4.20	3.62	3.14	2.34
1334	4.24	4.39	2.90	4.46	4.33	4.04	3.71	3.51	4.02	3.82	3.29	2.43
1335	4.53	4.72	2.98	4.69	4.51	4.15	3.78	3.53	4.26	3.94	3.36	2.37
1336	4.58	4.84	3.06	4.81	4.65	4.27	3.91	3.69	4.44	4.06	3.47	2.47
1337	4.5	4.61	2.93	4.71	4.56	4.15	3.78	3.51	4.58	3.96	3.34	2.30
1338	4.48	4.51	2.87	4.59	4.44	4.05	3.66	3.40	4.48	3.85	3.24	2.23
1339	4.77	4.77	3.08	4.97	4.79	4.41	4.03	3.77	4.36	4.18	3.55	2.52
1340	5.36	5.05	3.20	5.18	4.97	4.56	4.16	3.88	4.73	4.33	3.66	2.58
1341	4.65	4.57	2.84	4.62	4.46	4.06	3.68	3.41	4.90	3.87	3.23	2.22
1342	4.6	4.71	2.90	4.78	4.62	4.18	3.80	3.52	4.38	4.01	3.36	2.32

Appendix A. (continued)

1343	5.26	5.09	3.04	5.16	4.94	4.40	3.94	3.60	4.54	4.23	3.47	2.28
1344	5.72	5.47	3.21	5.55	5.29	4.69	4.19	3.84	4.84	4.53	3.71	2.44
1345	5.78	5.43	3.11	5.44	5.21	4.58	4.04	3.65	5.19	4.42	3.57	2.23
1346	4.5	4.42	2.70	4.50	4.36	3.88	3.42	3.11	5.11	3.72	3.02	1.90
1347	5.55	5.16	3.35	5.22	5.01	4.60	4.16	3.88	4.27	4.36	3.71	2.63
1348	6.52	5.98	3.64	6.00	5.71	5.17	4.66	4.33	4.91	4.93	4.15	2.87
1349	6.05	5.58	3.32	5.62	5.38	4.75	4.20	3.82	5.60	4.59	3.75	2.41
1350	4.8	4.58	2.91	4.70	4.56	4.05	xxx	3.26	5.27	3.88	3.17	2.05
1351	5.26	4.97	3.32	4.99	4.83	4.42	xxx	3.73	4.45	4.19	3.56	2.59
1352	6.73	6.14	3.76	6.08	5.78	5.22	4.70	4.37	4.70	5.00	4.20	2.97
1353	6.26	5.83	3.42	5.86	5.57	4.87	4.30	3.89	5.66	4.74	3.86	2.46
1354	4.67	4.45	2.88	4.58	4.41	3.86	3.38	3.08	5.47	3.75	3.07	1.98
1355	5.23	5.01	3.47	5.27	5.09	4.37	4.22	3.99	4.31	4.45	3.86	2.88
1356	6.59	6.08	3.89	6.21	5.97	5.15	4.95	4.63	4.96	5.19	4.44	3.23
1357	6.17	5.69	3.48	5.78	5.54	4.89	4.34	3.94	5.84	4.74	3.92	2.63
1358	4.77	4.48	2.98	4.68	4.51	3.97	3.48	3.16	5.44	3.86	3.20	2.14
1359	4.69	4.59	3.27	4.80	4.64	4.21	3.92	3.70	4.42	4.12	3.60	2.76
1360	6.36	6.03	3.81	6.04	5.79	5.23	4.85	4.54	4.54	5.10	4.39	3.26
1361	5.72	5.42	3.23	5.38	5.13	4.53	4.02	3.66	5.69	4.42	3.65	2.42
1362	4.34	4.37	2.86	4.48	4.31	3.82	3.40	3.12	5.07	3.75	3.14	2.13
1363	4.41	4.41	2.98	4.55	4.36	3.96	3.60	3.38	4.25	3.83	3.27	2.37
1364	5.65	5.50	3.46	5.58	5.31	4.79	4.36	4.04	4.28	4.65	3.93	2.80
1365	5.34	5.20	3.04	5.20	4.97	4.34	3.85	3.47	5.24	4.25	3.46	2.19
1366	3.6	3.83	2.49	3.92	3.81	3.32	2.93	2.67	4.91	3.27	2.69	1.73
1367	3.99	4.12	2.90	4.22	4.12	3.81	3.51	3.35	3.74	3.65	3.18	2.40
1368	5.1	4.94	3.21	5.00	4.81	4.44	4.05	3.82	4.04	4.24	3.63	2.65
1369	4.77	4.83	3.09	4.91	4.73	4.29	3.87	3.62	4.75	4.13	3.47	2.44
1370	3.49	3.88	2.67	4.01	3.91	3.53	3.54	2.97	4.68	3.41	2.88	2.04
1371	3.7	3.99	2.89	4.14	4.07	3.76	3.45	3.29	3.85	3.61	3.14	2.40
1372	4.53	4.60	3.15	4.69	4.57	4.23	3.89	3.69	3.99	4.05	3.49	2.63
1373	4.2	4.44	3.00	4.54	4.38	4.02	3.71	3.51	4.50	3.88	3.33	2.46
1374	3.51	3.87	2.70	3.94	3.85	3.52	3.23	3.15	4.33	3.40	2.94	2.17
1375	3.39	3.83	2.75	3.87	3.85	3.57	3.31	3.18	3.78	3.44	3.03	2.36
1376	4.01	4.28	3.01	4.36	4.26	3.96	3.69	3.53	3.78	3.81	3.34	2.59
1377	4.05	4.33	2.99	4.46	4.30	3.98	3.71	3.53	4.21	3.83	3.33	2.56
1378	3.46	3.70	2.65	3.86	3.79	3.47	3.21	3.05	4.27	3.35	2.91	2.22
1379	3.25	3.56	2.62	3.64	3.65	3.40	3.16	3.04	3.73	3.27	2.91	2.30
1380	3.57	3.89	2.79	3.94	3.90	3.64	3.40	3.26	3.58	3.51	3.11	2.46
1381	3.9	4.19	3.03	4.37	4.23	3.97	3.72	3.57	3.84	3.84	3.38	2.70
1382	3.62	4.03	2.93	4.23	4.11	3.82	3.60	3.46	4.18	3.72	3.28	2.60
1383	3.14	3.58	2.56	3.58	3.57	3.34	3.08	2.96	4.04	3.24	2.85	2.20
1384	3.24	3.69	2.66	3.70	3.67	3.44	3.20	3.08	3.52	3.35	2.95	2.31
1385	3.61	3.96	2.89	4.12	xxx	3.76	3.51	3.37	3.65	3.62	3.21	2.53
1386	3.65	4.01	2.90	4.17	xxx	3.84	3.58	3.44	3.95	3.68	3.28	2.58
1387	3.33	3.68	2.63	3.77	3.74	3.52	3.26	3.11	4.01	3.35	2.96	2.27
1388	2.96	3.36	2.43	3.44	3.40	3.18	2.91	2.76	3.70	3.03	2.67	2.04
1389	3.49	3.93	2.90	4.02	3.95	3.76	3.49	3.35	3.37	3.57	3.22	2.63
1390	3.79	4.21	3.06	4.35	4.26	4.07	3.81	3.68	3.90	3.86	3.46	2.79

Appendix A. (continued)

1391	3.56	3.94	2.81	3.99	3.97	3.70	3.44	3.28	4.20	3.55	3.12	2.38
1392	2.98	3.38	2.49	3.42	3.43	3.16	2.92	2.78	3.93	3.05	2.69	2.09
1393	3.39	3.73	2.82	3.82	3.78	3.59	3.39	3.26	3.40	3.45	3.12	2.59
1394	4.21	4.48	3.21	4.57	4.49	4.27	4.02	3.86	3.74	4.07	3.63	2.93
1395	3.83	4.11	2.90	4.23	4.17	3.89	3.59	3.40	4.44	3.71	3.26	2.50
1396	3.07	3.47	2.55	3.54	3.53	3.27	3.00	2.85	4.12	3.14	2.80	2.17
1397	3.31	3.71	2.77	3.78	3.72	3.52	3.29	3.17	3.47	3.38	3.05	2.51
1398	4.29	4.54	3.22	4.63	4.51	4.26	4.00	3.85	3.66	4.08	3.63	2.94
1399	4.04	4.29	2.95	4.36	4.30	3.96	3.65	3.46	4.47	3.79	3.30	2.49
1400	3.14	3.45	2.54	3.55	3.54	3.25	2.99	2.82	4.25	3.12	2.75	2.10
1401	3.37	3.66	2.76	3.84	3.75	3.54	3.33	3.18	3.48	3.39	3.06	2.49
1402	4.46	4.66	3.26	4.78	4.64	4.37	4.12	3.96	3.69	4.17	3.71	2.97
1403	4.17	4.42	2.94	4.44	4.36	4.00	3.68	3.48	4.57	3.82	3.28	2.46
1404	3.24	3.61	2.56	3.67	3.66	3.36	3.05	2.88	4.29	3.20	2.77	2.09
1405	3.24	3.65	2.71	3.84	3.76	3.54	3.28	3.08	3.59	3.37	3.00	2.40
1406	4.54	4.75	3.23	4.87	4.71	4.40	4.11	3.91	3.71	4.21	3.70	2.90
1407	4.36	4.48	2.89	4.54	4.43	4.01	3.67	3.42	4.65	3.84	3.24	2.31
1408	3.13	3.45	2.43	3.56	3.52	3.20	2.90	2.71	4.34	3.05	2.60	1.89
1409	3.55	3.92	2.86	4.04	3.96	3.74	3.48	3.26	3.44	3.55	3.15	2.51
1410	4.68	4.90	3.27	3.98	4.78	4.47	4.16	3.95	3.89	4.26	3.73	2.88

APPENDIX B

CRUISE DATABASE BY DATE AND SITE SHOWING ALL PARAMETERS COLLECTED BY DEPTH

Appendix B. Cruise database by date and site showing all parameters collected by depth.

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 8/22/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	326	uS	28.7	ºC	0.1	ppt	2.33	mg/L
5 ft	326	uS	28.7	ºC	0.1	ppt	2.33	mg/L
10 ft	326.8	uS	28.6	ºC	0.1	ppt	2.35	mg/L
15 ft	330	uS	28.6	ºC	0.1	ppt	2.25	mg/L
20 ft	333	uS	28.6	ºC	0.1	ppt	2.31	mg/L
25 ft	326	uS	28.6	ºC	0.1	ppt	2.34	mg/L
30 ft	326	uS	28.6	ºC	0.1	ppt	2.36	mg/L
35 ft	328	uS	28.6	ºC	0.1	ppt	2.34	mg/L
40 ft	330	uS	28.6	ºC	0.1	ppt	2.35	mg/L
45 ft	321	uS	28.6	ºC	0.1	ppt	2.38	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 8/22/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	277	uS	28.8	ºC	0.1	ppt	2.38	mg/L
5 ft	278	uS	28.8	ºC	0.1	ppt	2.26	mg/L
10 ft	279	uS	28.7	ºC	0.1	ppt	2.45	mg/L
15 ft	278	uS	28.8	ºC	0.1	ppt	2.37	mg/L
20 ft	278	uS	28.8	ºC	0.1	ppt	2.26	mg/L
25 ft	278	uS	28.8	ºC	0.1	ppt	2.34	mg/L
30 ft	278	uS	28.8	ºC	0.1	ppt	2.33	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 8/22/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	254	uS	28.8	ºC	0.1	ppt	2.96	mg/L
5 ft	255	uS	28.7	ºC	0.1	ppt	2.76	mg/L
10 ft	254	uS	28.7	ºC	0.1	ppt	2.7	mg/L
15 ft	255	uS	28.7	ºC	0.1	ppt	2.74	mg/L
20 ft	255	uS	28.7	ºC	0.1	ppt	2.67	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 8/22/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	262	uS	28.9	ºC	0.1	ppt	2.86	mg/L
5 ft	261	uS	28.9	ºC	0.1	ppt	2.8	mg/L
10 ft	245	uS	28.9	ºC	0.1	ppt	2.88	mg/L
15 ft	263	uS	28.9	ºC	0.1	ppt	2.9	mg/L
20 ft	262	uS	28.8	ºC	0.1	ppt	2.72	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 8/22/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	368.7	uS	29.4	ºC	0.2	ppt	3.03	mg/L
5 ft	369.1	uS	29.4	ºC	0.2	ppt	3.05	mg/L
10 ft	369.9	uS	29.4	ºC	0.2	ppt	3.27	mg/L
15 ft	369.3	uS	29.3	ºC	0.2	ppt	3.24	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 8/22/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	352	uS	29.5	ºC	0.2	ppt	3.84	mg/L
5 ft	351.5	uS	29.4	ºC	0.2	ppt	3.01	mg/L
10 ft	351.7	uS	29.4	ºC	0.2	ppt	2.92	mg/L
15 ft	352.3	uS	29.4	ºC	0.2	ppt	3.17	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 8/22/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	399.2	uS	29.6	ºC	0.2	ppt	3.75	mg/L
5 ft	392.6	uS	29.3	ºC	0.2	ppt	3.37	mg/L
10 ft	386	uS	29.2	ºC	0.2	ppt	3.4	mg/L
15 ft	376.4	uS	29.2	ºC	0.2	ppt	3.42	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 8/22/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	156	uS	29.6	ºC	0.1	ppt	4.25	mg/L
5 ft	160	uS	29	ºC	0.1	ppt	3.88	mg/L
10 ft	156	uS	28.8	ºC	0.1	ppt	3.92	mg/L
15 ft	154	uS	28.8	ºC	0.1	ppt	3.81	mg/L
20 ft	159	uS	28.8	ºC	0.1	ppt	3.77	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 8/22/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	131.8	uS	30	ºC	0.1	ppt	4.81	mg/L
5 ft	127.9	uS	28.8	ºC	0.1	ppt	4.11	mg/L
10 ft	127.8	uS	28.7	ºC	0.1	ppt	3.91	mg/L
15 ft	127.8	uS	28.6	ºC	0.1	ppt	3.9	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 8/22/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	131.8	uS	31.2	ºC	0.1	ppt	5.28	mg/L
5 ft	126	uS	28.9	ºC	0.1	ppt	3.84	mg/L
10 ft	125	uS	28.8	ºC	0.1	ppt	3.74	mg/L
15 ft	125	uS	28.7	ºC	0.1	ppt	3.9	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 8/22/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	128	uS	29.8	ºC	0.1	ppt	5.76	mg/L
5 ft	125	uS	28.7	ºC	0.1	ppt	4.07	mg/L
10 ft	125.3	uS	28.5	ºC	0.1	ppt	3.66	mg/L
15 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 8/22/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	126.8	uS	29	ºC	0.1	ppt	4.5	mg/L
5 ft	126.9	uS	28.9	ºC	0.1	ppt	4.19	mg/L
10 ft	126.8	uS	28.9	ºC	0.1	ppt	4.37	mg/L
15 ft	126.8	uS	28.9	ºC	0.1	ppt	4.42	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 9/16/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	103.3	uS	23	ºC	0.1	ppt	3.22	mg/L
5 ft	102.1	uS	23.2	ºC	0.1	ppt	2.91	mg/L
10 ft	101.7	uS	23.2	ºC	0.1	ppt	2.91	mg/L
15 ft	101.5	uS	23.2	ºC	0.1	ppt	2.83	mg/L
20 ft	94.6	uS	23.2	ºC	0.1	ppt	2.78	mg/L
25 ft	100.6	uS	23.2	ºC	0.1	ppt	3.02	mg/L
30 ft	95.9	uS	23.2	ºC	0.1	ppt	2.72	mg/L
35 ft	103.3	uS	23.2	ºC	0.1	ppt	2.98	mg/L
40 ft	102.2	uS	23.3	ºC	0.1	ppt	3.08	mg/L
45 ft	102	uS	23.3	ºC	0.1	ppt	3.04	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 9/16/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	93.5	uS	22.4	ºC	0.1	ppt	3.1	mg/L
5 ft	93.5	uS	23	ºC	0.1	ppt	3.05	mg/L
10 ft	93.5	uS	23.1	ºC	0.1	ppt	3.07	mg/L
15 ft	93.6	uS	23.1	ºC	0.1	ppt	3.04	mg/L
20 ft	93.9	uS	23.1	ºC	0.1	ppt	3.02	mg/L
25 ft	93.7	uS	23.1	ºC	0.1	ppt	2.95	mg/L
30 ft	93.6	uS	23	ºC	0.1	ppt	3.14	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **015** **Date:** 9/16/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	106.1	uS	23.8	ºC	0.1	ppt	4.12	mg/L
5 ft	109.5	uS	23.9	ºC	0.1	ppt	4	mg/L
10 ft	113.4	uS	23.9	ºC	0.1	ppt	4	mg/L
15 ft	115.4	uS	23.9	ºC	0.1	ppt	3.96	mg/L
20 ft	119.5	uS	23.9	ºC	0.1	ppt	3.93	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 9/16/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	95.2	uS	23.8	ºC	0.1	ppt	4.37	mg/L
5 ft	95.4	uS	23.8	ºC	0.1	ppt	4.31	mg/L
10 ft	97.4	uS	23.9	ºC	0.1	ppt	4.21	mg/L
15 ft	97.3	uS	24	ºC	0.1	ppt	4.18	mg/L
20 ft	97.8	uS	24	ºC	0.1	ppt	4.08	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 9/16/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	170	uS	24.1	ºC	0.1	ppt	4.04	mg/L
5 ft	170.7	uS	24.2	ºC	0.1	ppt	4.14	mg/L
10 ft	171	uS	24.2	ºC	0.1	ppt	4.17	mg/L
15 ft	170.7	uS	24.2	ºC	0.1	ppt	4.31	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 9/16/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	94.5	uS	23.9	ºC	0	ppt	4.4	mg/L
5 ft	94.5	uS	24	ºC	0	ppt	4.27	mg/L
10 ft	94.6	uS	24	ºC	0	ppt	4.28	mg/L
15 ft	94.5	uS	24	ºC	0	ppt	4.26	mg/L
20 ft	94.7	uS	24	ºC	0	ppt	4.28	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 9/16/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	88.6	uS	23.8	ºC	0	ppt	4.61	mg/L
5 ft	89.4	uS	23.9	ºC	0	ppt	4.51	mg/L
10 ft	89.2	uS	23.9	ºC	0	ppt	4.43	mg/L
15 ft	89.2	uS	23.9	ºC	0	ppt	4.4	mg/L
20 ft	89.1	uS	23.9	ºC	0	ppt	4.21	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 9/16/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	80.1	uS	24.2	ºC	0	ppt	4.73	mg/L
5 ft	80	uS	24.1	ºC	0	ppt	4.73	mg/L
10 ft	79.9	uS	24.1	ºC	0	ppt	4.7	mg/L
15 ft	79.9	uS	24.1	ºC	0	ppt	4.77	mg/L
20 ft	79.9	uS	24.1	ºC	0	ppt	4.62	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 9/16/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	81.4	uS	24.1	ºC	0	ppt	4.52	mg/L
5 ft	81.3	uS	24.1	ºC	0	ppt	4.65	mg/L
10 ft	81.4	uS	24.1	ºC	0	ppt	4.55	mg/L
15 ft	81.4	uS	24.1	ºC	0	ppt	4.68	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 9/16/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	82.7	uS	24.1	ºC	0	ppt	4.67	mg/L
5 ft	82.7	uS	24.1	ºC	0	ppt	4.71	mg/L
10 ft	82.8	uS	24.1	ºC	0	ppt	4.71	mg/L
15 ft	82.8	uS	24.1	ºC	0	ppt	4.71	mg/L
20 ft	82.9	uS	24.1	ºC	0	ppt	4.84	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 9/16/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	84.8	uS	24.2	ºC	0	ppt	5.06	mg/L
5 ft	84.2	uS	24.2	ºC	0	ppt	5.04	mg/L
10 ft	84.8	uS	24.2	ºC	0	ppt	5.04	mg/L
15 ft	84.8	uS	24.2	ºC	0	ppt	5.03	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 9/16/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	85.5	uS	24.2	ºC	0	ppt	5.51	mg/L
5 ft	85.5	uS	24.2	ºC	0	ppt	5.24	mg/L
10 ft	85.5	uS	24.2	ºC	0	ppt	5.01	mg/L
15 ft	85.6	uS	24.2	ºC	0	ppt	4.93	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 9/23/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	130.5	uS	23.4	ºC	0.1	ppt	3.26	mg/L
5 ft	130.2	uS	23.4	ºC	0.1	ppt	3.44	mg/L
10 ft	130.8	uS	23.3	ºC	0.1	ppt	3.31	mg/L
15 ft	130.5	uS	23.4	ºC	0.1	ppt	3.33	mg/L
20 ft	130.6	uS	23.4	ºC	0.1	ppt	3.39	mg/L
25 ft	130.2	uS	23.4	ºC	0.1	ppt	3.18	mg/L
30 ft	130.1	uS	23.4	ºC	0.1	ppt	3.39	mg/L
35 ft	130.1	uS	23.4	ºC	0.1	ppt	3.44	mg/L
40 ft	130.3	uS	23.4	ºC	0.1	ppt	3.25	mg/L
45 ft	130.6	uS	23.4	ºC	0.1	ppt	3.23	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 9/23/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	137.1	uS	23.3	ºC	0.1	ppt	3.59	mg/L
5 ft	137.1	uS	23.2	ºC	0.1	ppt	3.35	mg/L
10 ft	137	uS	23.2	ºC	0.1	ppt	3.51	mg/L
15 ft	137.2	uS	23.2	ºC	0.1	ppt	3.42	mg/L
20 ft	137.4	uS	23.2	ºC	0.1	ppt	3.37	mg/L
25 ft	137	uS	23.2	ºC	0.1	ppt	3.49	mg/L
30 ft	137.1	uS	23.2	ºC	0.1	ppt	3.43	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 9/23/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	138.3	uS	23.3	ºC	0.1	ppt	3.64	mg/L
5 ft	124.4	uS	23.1	ºC	0.1	ppt	3.46	mg/L
10 ft	129.2	uS	23	ºC	0.1	ppt	3.24	mg/L
15 ft	129.2	uS	22.9	ºC	0.1	ppt	3.52	mg/L
20 ft	129.3	uS	22.9	ºC	0.1	ppt	3.53	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 9/23/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	150.1	uS	23.4	ºC	0.1	ppt	3.69	mg/L
5 ft	149.2	uS	23.2	ºC	0.1	ppt	3.65	mg/L
10 ft	149.2	uS	23.2	ºC	0.1	ppt	3.75	mg/L
15 ft	148.5	uS	23.1	ºC	0.1	ppt	3.82	mg/L
20 ft	147.9	uS	23.1	ºC	0.1	ppt	3.85	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 9/23/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	259.2	uS	24.6	ºC	0.1	ppt	4.5	mg/L
5 ft	258.9	uS	24.5	ºC	0.1	ppt	4.42	mg/L
10 ft	258.6	uS	24.4	ºC	0.1	ppt	4.31	mg/L
15 ft	258.7	uS	24.4	ºC	0.1	ppt	4.4	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 9/23/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	197.7	uS	24.6	ºC	0.1	ppt	4.55	mg/L
5 ft	198.1	uS	24.4	ºC	0.1	ppt	4.64	mg/L
10 ft	202	uS	24.3	ºC	0.1	ppt	4.37	mg/L
15 ft	203.9	uS	24.3	ºC	0.1	ppt	4.35	mg/L
20 ft	201.9	uS	24.2	ºC	0.1	ppt	4.73	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 9/23/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	252.8	uS	24.9	ºC	0.1	ppt	4.74	mg/L
5 ft	255.1	uS	24.6	ºC	0.1	ppt	4.78	mg/L
10 ft	257.5	uS	24.5	ºC	0.1	ppt	4.74	mg/L
15 ft	255.7	uS	24.4	ºC	0.1	ppt	4.8	mg/L
20 ft	247.8	uS	24.4	ºC	0.1	ppt	4.81	mg/L
25 ft	251	uS	24.4	ºC	0.1	ppt	4.56	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 9/23/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	165.4	uS	25.1	ºC	0.1	ppt	5.16	mg/L
5 ft	170	uS	24.7	ºC	0.1	ppt	4.91	mg/L
10 ft	173	uS	24.6	ºC	0.1	ppt	4.94	mg/L
15 ft	180.5	uS	24.5	ºC	0.1	ppt	4.78	mg/L
20 ft	177.9	uS	24.4	ºC	0.1	ppt	4.85	mg/L
25 ft	171.8	uS	24.3	ºC	0.1	ppt	4.89	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 9/23/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	161	uS	25.1	ºC	0.1	ppt	5.01	mg/L
5 ft	160	uS	24.7	ºC	0.1	ppt	4.81	mg/L
10 ft	159.6	uS	24.6	ºC	0.1	ppt	4.91	mg/L
15 ft	159.6	uS	24.5	ºC	0.1	ppt	4.55	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 9/23/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	162.7	uS	25	ºC	0.1	ppt	5.08	mg/L
5 ft	165.6	uS	24.9	ºC	0.1	ppt	5	mg/L
10 ft	164.1	uS	24.5	ºC	0.1	ppt	4.72	mg/L
15 ft	164.2	uS	24.5	ºC	0.1	ppt	4.94	mg/L
20 ft	164.2	uS	24.5	ºC	0.1	ppt	4.99	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 9/23/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	176.4	uS	25.7	ºC	0.1	ppt	5.03	mg/L
5 ft	173	uS	24.8	ºC	0.1	ppt	5.12	mg/L
10 ft	173.1	uS	24.7	ºC	0.1	ppt	5.22	mg/L
15 ft	173.1	uS	24.6	ºC	0.1	ppt	5.17	mg/L
20 ft	173.1	uS	24.6	ºC	0.1	ppt	5.24	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 9/23/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	179.6	uS	24.8	ºC	0.1	ppt	5.14	mg/L
5 ft	179.4	uS	24.7	ºC	0.1	ppt	5.02	mg/L
10 ft	179.5	uS	24.7	ºC	0.1	ppt	5.09	mg/L
15 ft	179.5	uS	24.7	ºC	0.1	ppt	5.16	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 9/23/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	130.5	uS	23.4	ºC	0.1	ppt	3.26	mg/L
5 ft	130.2	uS	23.4	ºC	0.1	ppt	3.44	mg/L
10 ft	130.8	uS	23.3	ºC	0.1	ppt	3.31	mg/L
15 ft	130.5	uS	23.4	ºC	0.1	ppt	3.33	mg/L
20 ft	130.6	uS	23.4	ºC	0.1	ppt	3.39	mg/L
25 ft	130.2	uS	23.4	ºC	0.1	ppt	3.18	mg/L
30 ft	130.1	uS	23.4	ºC	0.1	ppt	3.39	mg/L
35 ft	130.1	uS	23.4	ºC	0.1	ppt	3.44	mg/L
40 ft	130.3	uS	23.4	ºC	0.1	ppt	3.25	mg/L
45 ft	130.6	uS	23.4	ºC	0.1	ppt	3.23	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 9/23/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	137.1	uS	23.3	ºC	0.1	ppt	3.59	mg/L
5 ft	137.1	uS	23.2	ºC	0.1	ppt	3.35	mg/L
10 ft	137	uS	23.2	ºC	0.1	ppt	3.51	mg/L
15 ft	137.2	uS	23.2	ºC	0.1	ppt	3.42	mg/L
20 ft	137.4	uS	23.2	ºC	0.1	ppt	3.37	mg/L
25 ft	137	uS	23.2	ºC	0.1	ppt	3.49	mg/L
30 ft	137.1	uS	23.2	ºC	0.1	ppt	3.43	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 9/23/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	138.3	uS	23.3	ºC	0.1	ppt	3.64	mg/L
5 ft	124.4	uS	23.1	ºC	0.1	ppt	3.46	mg/L
10 ft	129.2	uS	23	ºC	0.1	ppt	3.24	mg/L
15 ft	129.2	uS	22.9	ºC	0.1	ppt	3.52	mg/L
20 ft	129.3	uS	22.9	ºC	0.1	ppt	3.53	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 9/23/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	150.1	uS	23.4	ºC	0.1	ppt	3.69	mg/L
5 ft	149.2	uS	23.2	ºC	0.1	ppt	3.65	mg/L
10 ft	149.2	uS	23.2	ºC	0.1	ppt	3.75	mg/L
15 ft	148.5	uS	23.1	ºC	0.1	ppt	3.82	mg/L
20 ft	147.9	uS	23.1	ºC	0.1	ppt	3.85	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 9/23/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	259.2	uS	24.6	ºC	0.1	ppt	4.5	mg/L
5 ft	258.9	uS	24.5	ºC	0.1	ppt	4.42	mg/L
10 ft	258.6	uS	24.4	ºC	0.1	ppt	4.31	mg/L
15 ft	258.7	uS	24.4	ºC	0.1	ppt	4.4	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 9/23/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	197.7	uS	24.6	ºC	0.1	ppt	4.55	mg/L
5 ft	198.1	uS	24.4	ºC	0.1	ppt	4.64	mg/L
10 ft	202	uS	24.3	ºC	0.1	ppt	4.37	mg/L
15 ft	203.9	uS	24.3	ºC	0.1	ppt	4.35	mg/L
20 ft	201.9	uS	24.2	ºC	0.1	ppt	4.73	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 9/23/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	252.8	uS	24.9	ºC	0.1	ppt	4.74	mg/L
5 ft	255.1	uS	24.6	ºC	0.1	ppt	4.78	mg/L
10 ft	257.5	uS	24.5	ºC	0.1	ppt	4.74	mg/L
15 ft	255.7	uS	24.4	ºC	0.1	ppt	4.8	mg/L
20 ft	247.8	uS	24.4	ºC	0.1	ppt	4.81	mg/L
25 ft	251	uS	24.4	ºC	0.1	ppt	4.56	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 9/23/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	165.4	uS	25.1	ºC	0.1	ppt	5.16	mg/L
5 ft	170	uS	24.7	ºC	0.1	ppt	4.91	mg/L
10 ft	173	uS	24.6	ºC	0.1	ppt	4.94	mg/L
15 ft	180.5	uS	24.5	ºC	0.1	ppt	4.78	mg/L
20 ft	177.9	uS	24.4	ºC	0.1	ppt	4.85	mg/L
25 ft	171.8	uS	24.3	ºC	0.1	ppt	4.89	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 9/23/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	161	uS	25.1	ºC	0.1	ppt	5.01	mg/L
5 ft	160	uS	24.7	ºC	0.1	ppt	4.81	mg/L
10 ft	159.6	uS	24.6	ºC	0.1	ppt	4.91	mg/L
15 ft	159.6	uS	24.5	ºC	0.1	ppt	4.55	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 9/23/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	162.7	uS	25	ºC	0.1	ppt	5.08	mg/L
5 ft	165.6	uS	24.9	ºC	0.1	ppt	5	mg/L
10 ft	164.1	uS	24.5	ºC	0.1	ppt	4.72	mg/L
15 ft	164.2	uS	24.5	ºC	0.1	ppt	4.94	mg/L
20 ft	164.2	uS	24.5	ºC	0.1	ppt	4.99	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 9/23/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	176.4	uS	25.7	ºC	0.1	ppt	5.03	mg/L
5 ft	173	uS	24.8	ºC	0.1	ppt	5.12	mg/L
10 ft	173.1	uS	24.7	ºC	0.1	ppt	5.22	mg/L
15 ft	173.1	uS	24.6	ºC	0.1	ppt	5.17	mg/L
20 ft	173.1	uS	24.6	ºC	0.1	ppt	5.24	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 9/23/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	179.6	uS	24.8	ºC	0.1	ppt	5.14	mg/L
5 ft	179.4	uS	24.7	ºC	0.1	ppt	5.02	mg/L
10 ft	179.5	uS	24.7	ºC	0.1	ppt	5.09	mg/L
15 ft	179.5	uS	24.7	ºC	0.1	ppt	5.16	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 10/7/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	234.2	uS	21.8	ºC	0.1	ppt	3.9	mg/L
5 ft	242	uS	22.2	ºC	0.1	ppt	3.9	mg/L
10 ft	235.3	uS	22.3	ºC	0.1	ppt	3.91	mg/L
15 ft	239.7	uS	22.3	ºC	0.1	ppt	3.93	mg/L
20 ft	238.7	uS	22.3	ºC	0.1	ppt	3.85	mg/L
25 ft	241.6	uS	22.3	ºC	0.1	ppt	3.89	mg/L
30 ft	241.5	uS	22.3	ºC	0.1	ppt	3.76	mg/L
35 ft	233.1	uS	22.3	ºC	0.1	ppt	3.72	mg/L
40 ft	232.9	uS	22.3	ºC	0.1	ppt	3.83	mg/L
45 ft	245.2	uS	22.2	ºC	0.1	ppt	3.88	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **014** **Date:** 10/7/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	195.3	uS	21.9	ºC	0.1	ppt	4.04	mg/L
5 ft	195.2	uS	22	ºC	0.1	ppt	4.01	mg/L
10 ft	195.2	uS	22.1	ºC	0.1	ppt	3.93	mg/L
15 ft	195.3	uS	22.2	ºC	0.1	ppt	3.95	mg/L
20 ft	195.3	uS	22.2	ºC	0.1	ppt	3.98	mg/L
25 ft	195.3	uS	22.2	ºC	0.1	ppt	3.95	mg/L
30 ft	195.3	uS	22.3	ºC	0.1	ppt	3.82	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 10/7/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	200	uS	21.9	ºC	0.1	ppt	4.16	mg/L
5 ft	188.2	uS	22	ºC	0.1	ppt	4.15	mg/L
10 ft	188.1	uS	22	ºC	0.1	ppt	4.16	mg/L
15 ft	188.1	uS	22.1	ºC	0.1	ppt	4.15	mg/L
20 ft	188.2	uS	22.1	ºC	0.1	ppt	4.14	mg/L
25 ft	188.2	uS	22.1	ºC	0.1	ppt	4.11	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 10/7/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	193.1	uS	21.8	ºC	0.1	ppt	4.3	mg/L
5 ft	194.1	uS	21.9	ºC	0.1	ppt	4.28	mg/L
10 ft	197.5	uS	22	ºC	0.1	ppt	4.27	mg/L
15 ft	193.2	uS	22	ºC	0.1	ppt	4.22	mg/L
20 ft	192.6	uS	22	ºC	0.1	ppt	4.13	mg/L
25 ft	192.8	uS	22	ºC	0.1	ppt	4.15	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 10/7/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	268.5	uS	22.5	ºC	0.1	ppt	4.71	mg/L
5 ft	268.4	uS	22.7	ºC	0.1	ppt	4.64	mg/L
10 ft	268.3	uS	22.7	ºC	0.1	ppt	4.68	mg/L
15 ft	268.4	uS	22.7	ºC	0.1	ppt	4.51	mg/L
20 ft	268.4	uS	22.8	ºC	0.1	ppt	4.5	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 10/7/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	292	uS	22.7	ºC	0.1	ppt	4.53	mg/L
5 ft	292	uS	22.7	ºC	0.1	ppt	4.7	mg/L
10 ft	292.2	uS	22.7	ºC	0.1	ppt	4.76	mg/L
15 ft	292	uS	22.8	ºC	0.1	ppt	4.83	mg/L
20 ft	292	uS	22.8	ºC	0.1	ppt	4.75	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 10/7/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	266.8	uS	22.5	ºC	0.1	ppt	4.87	mg/L
5 ft	268.4	uS	22.6	ºC	0.1	ppt	5	mg/L
10 ft	267.7	uS	22.6	ºC	0.1	ppt	4.88	mg/L
15 ft	269.5	uS	22.6	ºC	0.1	ppt	4.97	mg/L
20 ft	270.2	uS	22.6	ºC	0.1	ppt	4.98	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 10/7/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	96.4	uS	22.2	ºC	0.1	ppt	5.01	mg/L
5 ft	166.6	uS	22.3	ºC	0.1	ppt	5.2	mg/L
10 ft	167.9	uS	22.3	ºC	0.1	ppt	5.21	mg/L
15 ft	168.1	uS	22.3	ºC	0.1	ppt	4.55	mg/L
20 ft	168.5	uS	22.4	ºC	0.1	ppt	4.64	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 10/7/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	68.7	uS	22	ºC	0.1	ppt	5.31	mg/L
5 ft	135.6	uS	22.2	ºC	0.1	ppt	5.05	mg/L
10 ft	135.6	uS	22.2	ºC	0.1	ppt	5.18	mg/L
15 ft	135.6	uS	22.2	ºC	0.1	ppt	5.4	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 10/7/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	136.2	uS	22.2	ºC	0.1	ppt	5.11	mg/L
5 ft	136.3	uS	22.3	ºC	0.1	ppt	5.58	mg/L
10 ft	136.4	uS	22.4	ºC	0.1	ppt	4.97	mg/L
15 ft	136.3	uS	22.4	ºC	0.1	ppt	4.89	mg/L
20 ft	136.4	uS	22.4	ºC	0.1	ppt	5.34	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 10/7/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	136.9	uS	22.1	ºC	0.1	ppt	5.4	mg/L
5 ft	137	uS	22.1	ºC	0.1	ppt	5.43	mg/L
10 ft	137.1	uS	22.2	ºC	0.1	ppt	5.64	mg/L
15 ft	137.1	uS	22.2	ºC	0.1	ppt	5.55	mg/L
20 ft	137.1	uS	22.2	ºC	0.1	ppt	5.51	mg/L
25 ft	137.3	uS	22.2	ºC	0.1	ppt	5.61	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 10/7/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	**Conductivity**		**Temp**		**Salinity**		**D.O.**	
Surface	136.7	uS	22.2	ºC	0.1	ppt	5.63	mg/L
5 ft	136.7	uS	22.3	ºC	0.1	ppt	5.88	mg/L
10 ft	136.8	uS	22.3	ºC	0.1	ppt	5.9	mg/L
15 ft	136.8	uS	22.3	ºC	0.1	ppt	5.6	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 10/21/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	224.9	uS	19.7	ºC	0.1	ppt	4.67	mg/L
5 ft	225.1	uS	19.9	ºC	0.1	ppt	4.62	mg/L
10 ft	225.3	uS	19.9	ºC	0.1	ppt	4.6	mg/L
15 ft	225.4	uS	20	ºC	0.1	ppt	4.55	mg/L
20 ft	225.4	uS	20	ºC	0.1	ppt	4.52	mg/L
25 ft	225.4	uS	20	ºC	0.1	ppt	4.66	mg/L
30 ft	224.9	uS	20	ºC	0.1	ppt	4.57	mg/L
35 ft	225.2	uS	20	ºC	0.1	ppt	4.61	mg/L
40 ft	224.5	uS	20	ºC	0.1	ppt	4.6	mg/L
45 ft	224.1	uS	20	ºC	0.1	ppt	4.17	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 10/21/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	229	uS	20.2	ºC	0.1	ppt	4.47	mg/L
5 ft	228.9	uS	20.2	ºC	0.1	ppt	4.72	mg/L
10 ft	228.4	uS	20.2	ºC	0.1	ppt	4.78	mg/L
15 ft	228.7	uS	20.2	ºC	0.1	ppt	4.75	mg/L
20 ft	228.1	uS	20.2	ºC	0.1	ppt	4.71	mg/L
25 ft	227.6	uS	20.2	ºC	0.1	ppt	4.77	mg/L
30 ft	228.2	uS	20.2	ºC	0.1	ppt	4.62	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 10/21/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	204.4	uS	20.1	ºC	0.1	ppt	4.78	mg/L
5 ft	204.3	uS	20.1	ºC	0.1	ppt	4.99	mg/L
10 ft	203.9	uS	20.1	ºC	0.1	ppt	4.87	mg/L
15 ft	203.7	uS	20.1	ºC	0.1	ppt	4.94	mg/L
20 ft	203.8	uS	20.1	ºC	0.1	ppt	5.03	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 10/21/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	206.8	uS	20.1	ºC	0.1	ppt	5.11	mg/L
5 ft	205.4	uS	20.1	ºC	0.1	ppt	5.26	mg/L
10 ft	205.4	uS	20.1	ºC	0.1	ppt	5.2	mg/L
15 ft	204.8	uS	20.1	ºC	0.1	ppt	5.25	mg/L
20 ft	204.9	uS	20.1	ºC	0.1	ppt	5.3	mg/L
25 ft	205.4	uS	20.1	ºC	0.1	ppt	5.1	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 10/21/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	170.5	uS	20	ºC	0.1	ppt	5.75	mg/L
5 ft	170.5	uS	20	ºC	ND	ppt	5.85	mg/L
10 ft	170.2	uS	20	ºC	0.1	ppt	5.87	mg/L
15 ft	169.4	uS	20	ºC	0.1	ppt	5.94	mg/L
20 ft	169	uS	20	ºC	0.1	ppt	5.84	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 10/21/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	217.9	uS	20.3	ºC	0.1	ppt	5.66	mg/L
5 ft	217	uS	20	ºC	0.1	ppt	5.83	mg/L
10 ft	217.5	uS	19.9	ºC	0.1	ppt	5.83	mg/L
15 ft	217.4	uS	19.9	ºC	0.1	ppt	5.88	mg/L
20 ft	217.4	uS	19.9	ºC	0.1	ppt	5.21	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 10/21/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	153.1	uS	20.2	ºC	0.1	ppt	5.93	mg/L
5 ft	149.8	uS	19.7	ºC	0.1	ppt	5.91	mg/L
10 ft	150	uS	19.7	ºC	0.1	ppt	5.61	mg/L
15 ft	150.1	uS	19.7	ºC	0.1	ppt	6	mg/L
20 ft	150.5	uS	19.7	ºC	0.1	ppt	6.06	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 10/21/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	134.9	uS	19.6	ºC	0.1	ppt	5.99	mg/L
5 ft	134.8	uS	19.5	ºC	0.1	ppt	6.25	mg/L
10 ft	134.7	uS	19.5	ºC	0.1	ppt	6.32	mg/L
15 ft	134.7	uS	19.5	ºC	0.1	ppt	6.33	mg/L
20 ft	134.8	uS	19.5	ºC	0.1	ppt	6.27	mg/L
25 ft	134.8	uS	19.5	ºC	0.1	ppt	6.43	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 10/21/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	136.1	uS	19.6	ºC	0.1	ppt	6.28	mg/L
5 ft	136.1	uS	19.6	ºC	0.1	ppt	6.18	mg/L
10 ft	136.1	uS	19.6	ºC	0.1	ppt	6.21	mg/L
15 ft	136.1	uS	19.1	ºC	0.1	ppt	6.35	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 10/21/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	136.9	uS	19.7	ºC	0.1	ppt	6.13	mg/L
5 ft	136.8	uS	19.6	ºC	0.1	ppt	6.37	mg/L
10 ft	136.8	uS	19.6	ºC	0.1	ppt	6.39	mg/L
15 ft	136.8	uS	19.6	ºC	0.1	ppt	6.47	mg/L
20 ft	136.8	uS	19.6	ºC	0.1	ppt	6.42	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 10/21/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	136	uS	19.7	ºC	0.1	ppt	6.57	mg/L
5 ft	136.3	uS	19.6	ºC	0.1	ppt	6.32	mg/L
10 ft	136.3	uS	19.6	ºC	0.1	ppt	6.58	mg/L
15 ft	136.3	uS	19.6	ºC	0.1	ppt	6.42	mg/L
20 ft	136.3	uS	19.6	ºC	0.1	ppt	6.52	mg/L
25 ft	136.3	uS	19.6	ºC	0.1	ppt	5.84	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 10/21/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	136.9	uS	19.6	ºC	0.1	ppt	6.5	mg/L
5 ft	136.9	uS	19.6	ºC	0.1	ppt	6.53	mg/L
10 ft	136.8	uS	19.6	ºC	0.1	ppt	6.57	mg/L
15 ft	136.8	uS	19.6	ºC	0.1	ppt	6.5	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 12/16/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	96.9	uS	8.9	ºC	0.1	ppt	8.07	mg/L
5 ft	96.9	uS	8.9	ºC	0.1	ppt	8.26	mg/L
10 ft	97	uS	8.9	ºC	0.1	ppt	7.93	mg/L
15 ft	97	uS	8.9	ºC	0.1	ppt	8.11	mg/L
20 ft	97.1	uS	8.9	ºC	0.1	ppt	8.26	mg/L
25 ft	96.6	uS	8.9	ºC	0.1	ppt	8.3	mg/L
30 ft	96.6	uS	8.9	ºC	0.1	ppt	8.33	mg/L
35 ft	96.5	uS	8.9	ºC	0.1	ppt	8.13	mg/L
40 ft	96.4	uS	8.9	ºC	0.1	ppt	7.97	mg/L
45 ft	96.4	uS	8.9	ºC	0.1	ppt	8.33	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 12/16/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	31.6	uS	9	ºC	0	ppt	8.57	mg/L
5 ft	96.8	uS	9.1	ºC	0.1	ppt	8.22	mg/L
10 ft	97.1	uS	9.1	ºC	0.1	ppt	8.16	mg/L
15 ft	97	uS	9	ºC	0.1	ppt	8.17	mg/L
20 ft	97.1	uS	9	ºC	0.1	ppt	8.16	mg/L
25 ft	97	uS	9.1	ºC	0.1	ppt	8.34	mg/L
30 ft	96.9	uS	9.1	ºC	0.1	ppt	8.26	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 12/16/2006

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	84.7	uS	9	ºC	0.1	ppt	8.08	mg/L
5 ft	87.8	uS	9.1	ºC	0.1	ppt	7.93	mg/L
10 ft	87.7	uS	9.1	ºC	0.1	ppt	8.19	mg/L
15 ft	92.7	uS	9.1	ºC	0.1	ppt	7.75	mg/L
20 ft	94.5	uS	9.1	ºC	0.1	ppt	7.79	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 12/16/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	102.7	uS	9	ºC	0.1	ppt	8.66	mg/L
5 ft	102.9	uS	9	ºC	0.1	ppt	8.61	mg/L
10 ft	102.8	uS	9	ºC	0.1	ppt	8.62	mg/L
15 ft	103.1	uS	9	ºC	0.1	ppt	8.63	mg/L
20 ft	102.8	uS	9	ºC	0.1	ppt	8.71	mg/L
25 ft	103.1	uS	9	ºC	0.1	ppt	8.73	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 12/16/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	120.5	uS	8.9	ºC	0.1	ppt	8.82	mg/L
5 ft	120.3	uS	8.9	ºC	0.1	ppt	8.77	mg/L
10 ft	120.3	uS	9	ºC	0.1	ppt	8.92	mg/L
15 ft	118.9	uS	8.9	ºC	0.1	ppt	8.77	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 12/16/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	101.1	uS	8.8	ºC	0.1	ppt	9.08	mg/L
5 ft	101.1	uS	8.8	ºC	0.1	ppt	9.07	mg/L
10 ft	101	uS	8.8	ºC	0.1	ppt	9.12	mg/L
15 ft	101	uS	8.8	ºC	0.1	ppt	9.14	mg/L
20 ft	101	uS	8.8	ºC	0.1	ppt	9.11	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 12/16/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	95	uS	8.6	ºC	0.1	ppt	8.85	mg/L
5 ft	95	uS	8.6	ºC	0.1	ppt	8.93	mg/L
10 ft	94.8	uS	8.6	ºC	0.1	ppt	8.89	mg/L
15 ft	94.7	uS	8.6	ºC	0.1	ppt	9.06	mg/L
20 ft	94.3	uS	8.6	ºC	0.1	ppt	9.19	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 12/16/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	67.2	uS	8.4	ºC	0	ppt	9.09	mg/L
5 ft	67.2	uS	8.4	ºC	0	ppt	9.08	mg/L
10 ft	67.2	uS	8.4	ºC	0	ppt	9.36	mg/L
15 ft	67.3	uS	8.4	ºC	0	ppt	9.2	mg/L
20 ft	67.3	uS	8.4	ºC	0	ppt	9.18	mg/L
25 ft	67.2	uS	8.4	ºC	0	ppt	9.09	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 12/16/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	67.6	uS	8.4	ºC	0	ppt	9.05	mg/L
5 ft	67.5	uS	8.3	ºC	0	ppt	9.17	mg/L
10 ft	67.6	uS	8.3	ºC	0	ppt	9.27	mg/L
15 ft	67.5	uS	8.3	ºC	0	ppt	8.99	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 12/16/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	68	uS	8.4	ºC	0	ppt	8.97	mg/L
5 ft	67.9	uS	8.4	ºC	0	ppt	9.43	mg/L
10 ft	68	uS	8.4	ºC	0	ppt	9.29	mg/L
15 ft	68	uS	8.4	ºC	0	ppt	9.14	mg/L
20 ft	68	uS	8.4	ºC	0	ppt	9.14	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 12/16/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	68	uS	8.4	ºC	0	ppt	9.37	mg/L
5 ft	68	uS	8.4	ºC	0	ppt	9.44	mg/L
10 ft	68.1	uS	8.3	ºC	0	ppt	9.4	mg/L
15 ft	68	uS	8.3	ºC	0	ppt	9.28	mg/L
20 ft	68	uS	8.3	ºC	0	ppt	9.34	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 12/16/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	68	uS	8.3	ºC	0	ppt	9.48	mg/L
5 ft	68	uS	8.3	ºC	0	ppt	9.42	mg/L
10 ft	68	uS	8.3	ºC	0	ppt	9.4	mg/L
15 ft	68	uS	8.3	ºC	0	ppt	9.47	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 12/19/2006

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	95	uS	10.3	ºC	0.1	ppt	7.47	mg/L
5 ft	95	uS	10.2	ºC	0.1	ppt	7.42	mg/L
10 ft	95	uS	10.1	ºC	0.1	ppt	7.4	mg/L
15 ft	95.3	uS	10.1	ºC	0.1	ppt	7.47	mg/L
20 ft	95.3	uS	10	ºC	0.1	ppt	7.46	mg/L
25 ft	95.5	uS	9.9	ºC	0.1	ppt	7.51	mg/L
30 ft	95.5	uS	9.9	ºC	0.1	ppt	7.56	mg/L
35 ft	95.5	uS	9.9	ºC	0.1	ppt	7.64	mg/L
40 ft	95.6	uS	9.9	ºC	0.1	ppt	7.65	mg/L
45 ft	95.7	uS	9.8	ºC	0.1	ppt	7.77	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 12/19/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	93.8	uS	9.9	ºC	0.1	ppt	7.69	mg/L
5 ft	92.2	uS	9.9	ºC	0.1	ppt	7.72	mg/L
10 ft	92.2	uS	9.9	ºC	0.1	ppt	7.77	mg/L
15 ft	92.6	uS	9.9	ºC	0.1	ppt	7.8	mg/L
20 ft	92.8	uS	9.9	ºC	0.1	ppt	7.92	mg/L
25 ft	92.2	uS	9.8	ºC	0.1	ppt	7.79	mg/L
30 ft	92.7	uS	9.8	ºC	0.1	ppt	7.88	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 12/19/2006

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	93.8	uS	9.9	ºC	0.1	ppt	7.69	mg/L
5 ft	92.2	uS	9.9	ºC	0.1	ppt	7.72	mg/L
10 ft	92.2	uS	9.9	ºC	0.1	ppt	7.77	mg/L
15 ft	92.6	uS	9.9	ºC	0.1	ppt	7.8	mg/L
20 ft	92.8	uS	9.9	ºC	0.1	ppt	7.92	mg/L
25 ft	92.2	uS	9.8	ºC	0.1	ppt	7.79	mg/L
30 ft	92.7	uS	9.8	ºC	0.1	ppt	7.88	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 12/19/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	103.8	uS	10	ºC	0.1	ppt	7.7	mg/L
5 ft	103.8	uS	9.9	ºC	0.1	ppt	7.91	mg/L
10 ft	103.3	uS	9.9	ºC	0.1	ppt	7.95	mg/L
15 ft	103.2	uS	9.8	ºC	0.1	ppt	8.09	mg/L
20 ft	103.4	uS	9.8	ºC	0.1	ppt	8.05	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 12/19/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	89.4	uS	9.5	ºC	0.1	ppt	8.71	mg/L
5 ft	89.1	uS	9.4	ºC	0.1	ppt	8.53	mg/L
10 ft	89.3	uS	9.4	ºC	0.1	ppt	8.47	mg/L
15 ft	89.3	uS	9.4	ºC	0.1	ppt	8.39	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 12/19/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	143.9	uS	9.7	ºC	0.1	ppt	8.51	mg/L
5 ft	144.3	uS	9.6	ºC	0.1	ppt	8.66	mg/L
10 ft	144.3	uS	9.6	ºC	0.1	ppt	8.35	mg/L
15 ft	144.3	uS	9.6	ºC	0.1	ppt	8.29	mg/L
20 ft	144.5	uS	9.6	ºC	0.1	ppt	8.33	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 12/19/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	84	uS	9.5	ºC	0.1	ppt	8.68	mg/L
5 ft	83.4	uS	9.5	ºC	0.1	ppt	8.41	mg/L
10 ft	84	uS	9.4	ºC	0.1	ppt	8.45	mg/L
15 ft	84	uS	9.4	ºC	0.1	ppt	8.48	mg/L
20 ft	84.3	uS	9.4	ºC	0.1	ppt	8.57	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 12/19/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	72	uS	9.5	ºC	0	ppt	8.9	mg/L
5 ft	71.6	uS	9.3	ºC	0	ppt	8.66	mg/L
10 ft	71.6	uS	9.3	ºC	0	ppt	8.66	mg/L
15 ft	71.6	uS	9.3	ºC	0	ppt	8.81	mg/L
20 ft	71.6	uS	9.3	ºC	0	ppt	8.87	mg/L
25 ft	71.8	uS	9.3	ºC	0	ppt	8.94	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 12/19/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	72.3	uS	9.5	ºC	0	ppt	8.79	mg/L
5 ft	72.2	uS	9.5	ºC	0	ppt	8.65	mg/L
10 ft	72.3	uS	9.4	ºC	0	ppt	8.64	mg/L
15 ft	72.3	uS	9.4	ºC	0	ppt	8.43	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 12/19/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	72.8	uS	9.5	ºC	0	ppt	8.68	mg/L
5 ft	72.6	uS	9.4	ºC	0	ppt	8.65	mg/L
10 ft	72.6	uS	9.4	ºC	0	ppt	8.6	mg/L
15 ft	72.6	uS	9.4	ºC	0	ppt	8.85	mg/L
20 ft	72.6	uS	9.4	ºC	0	ppt	8.88	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 12/19/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	72.7	uS	9.5	ºC	0	ppt	8.88	mg/L
5 ft	72.6	uS	9.5	ºC	0	ppt	8.95	mg/L
10 ft	72.6	uS	9.5	ºC	0	ppt	8.99	mg/L
15 ft	72.6	uS	9.4	ºC	0	ppt	9.01	mg/L
20 ft	72.6	uS	9.4	ºC	0	ppt	8.99	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 12/19/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	72.5	uS	9.6	ºC	0	ppt	8.95	mg/L
5 ft	72.5	uS	9.5	ºC	0	ppt	8.93	mg/L
10 ft	72.5	uS	9.5	ºC	0	ppt	9	mg/L
15 ft	72.5	uS	9.5	ºC	0	ppt	8.94	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **1** **Way point:** **013** **Date:** 1/6/2007

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	75.8	uS	12.9	ºC	0	ppt	6.32	mg/L
5 ft	75.4	uS	12.7	ºC	0	ppt	6.27	mg/L
10 ft	75.4	uS	12.6	ºC	0	ppt	6.25	mg/L
15 ft	98.8	uS	12.6	ºC	0	ppt	6.41	mg/L
20 ft	75.2	uS	12.6	ºC	0	ppt	6.46	mg/L
25 ft	75.3	uS	12.6	ºC	0	ppt	6.52	mg/L
30 ft	75.3	uS	12.5	ºC	0	ppt	6.54	mg/L
35 ft	75.3	uS	12.5	ºC	0	ppt	6.53	mg/L
40 ft	75.3	uS	12.5	ºC	0	ppt	6.53	mg/L
45 ft	75.3	uS	12.5	ºC	0	ppt	6.34	mg/L

Physical Measurements At Depth

Site: **2** **Way point:** **014** **Date:** 1/6/2007

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	73.8	uS	12.8	ºC	0	ppt	6.27	mg/L
5 ft	73.8	uS	12.7	ºC	0	ppt	6.37	mg/L
10 ft	73.8	uS	12.7	ºC	0	ppt	6.35	mg/L
15 ft	73.7	uS	12.7	ºC	0	ppt	6.36	mg/L
20 ft	73.7	uS	12.7	ºC	0	ppt	6.45	mg/L
25 ft	7.38	uS	12.6	ºC	0	ppt	6.43	mg/L
30 ft	7.38	uS	12.6	ºC	0	ppt	6.42	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **3** **Way point:** **015** **Date:** 1/6/2007

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	93.5	uS	12	ºC	0.1	ppt	7.09	mg/L
5 ft	94.7	uS	11.9	ºC	0.1	ppt	7.15	mg/L
10 ft	94.7	uS	11.8	ºC	0.1	ppt	7.16	mg/L
15 ft	94.9	uS	11.7	ºC	0.1	ppt	7.29	mg/L
20 ft	94.4	uS	11.7	ºC	0.1	ppt	7.35	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **4** **Way point:** **016** **Date:** 1/6/2006

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	95.4	uS	11.9	ºC	0.1	ppt	7.23	mg/L
5 ft	95.8	uS	11.8	ºC	0.1	ppt	7.33	mg/L
10 ft	95.8	uS	11.7	ºC	0.1	ppt	7.38	mg/L
15 ft	95.8	uS	11.7	ºC	0.1	ppt	7.42	mg/L
20 ft	95.8	uS	11.7	ºC	0.1	ppt	7.42	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **5** **Way point:** **017** **Date:** 1/6/2006

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	94	uS	11.7	ºC	0.1	ppt	7.33	mg/L
5 ft	94	uS	11.7	ºC	0.1	ppt	7.34	mg/L
10 ft	94	uS	11.7	ºC	0.1	ppt	7.41	mg/L
15 ft	93.4	uS	11.6	ºC	0.1	ppt	7.43	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **6** **Way point:** **018** **Date:** 1/6/2006

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	93.2	uS	12.5	ºC	0.1	ppt	6.47	mg/L
5 ft	93.8	uS	12	ºC	0.1	ppt	7.21	mg/L
10 ft	93.8	uS	11.9	ºC	0.1	ppt	7.32	mg/L
15 ft	93.7	uS	11.9	ºC	0.1	ppt	7.38	mg/L
20 ft	93.8	uS	11.7	ºC	0.1	ppt	7.41	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **7** **Way point:** **019** **Date:** 1/6/2006

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	98.8	uS	11.9	ºC	0.1	ppt	7.15	mg/L
5 ft	98.8	uS	11.9	ºC	0.1	ppt	7.22	mg/L
10 ft	97.7	uS	11.8	ºC	0.1	ppt	7.27	mg/L
15 ft	97.1	uS	11.8	ºC	0.1	ppt	7.28	mg/L
20 ft	97.1	uS	11.7	ºC	0.1	ppt	7.3	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **8** **Way point:** **020** **Date:** 1/6/2006

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	77.4	uS	11.9	ºC	0.1	ppt	7.24	mg/L
5 ft	77.3	uS	11.8	ºC	0.1	ppt	7.4	mg/L
10 ft	77.3	uS	11.7	ºC	0.1	ppt	7.41	mg/L
15 ft	77.4	uS	11.6	ºC	0.1	ppt	7.46	mg/L
20 ft	77.3	uS	11.5	ºC	0.1	ppt	7.58	mg/L
25 ft	77.3	uS	11.5	ºC	0.1	ppt	7.59	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **9** **Way point:** **021** **Date:** 1/6/2006

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	77.6	uS	11.8	ºC	0.1	ppt	7.28	mg/L
5 ft	77.6	uS	11.7	ºC	0.1	ppt	7.39	mg/L
10 ft	77.6	uS	11.6	ºC	0.1	ppt	7.48	mg/L
15 ft	77.6	uS	11.6	ºC	0.1	ppt	7.5	mg/L
20 ft	77.6	uS	11.5	ºC	0.1	ppt	7.51	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **10** **Way point:** **022** **Date:** 1/6/2006

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	77.6	uS	11.7	ºC	0.1	ppt	7.42	mg/L
5 ft	77.6	uS	11.6	ºC	0.1	ppt	7.49	mg/L
10 ft	77.6	uS	11.6	ºC	0.1	ppt	7.53	mg/L
15 ft	77.6	uS	11.6	ºC	0.1	ppt	7.58	mg/L
20 ft	77.6	uS	11.5	ºC	0.1	ppt	7.61	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **11** **Way point:** **023** **Date:** 1/6/2006

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	78.3	uS	11.6	ºC	0.1	ppt	7.49	mg/L
5 ft	78.5	uS	11.5	ºC	0.1	ppt	7.61	mg/L
10 ft	78.1	uS	11.4	ºC	0.1	ppt	7.65	mg/L
15 ft	77.8	uS	11.4	ºC	0.1	ppt	7.63	mg/L
20 ft	77.8	uS	11.4	ºC	0.1	ppt	7.64	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements At Depth

Site: **12** **Way point:** **024** **Date:** 1/6/2006

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	78.3	uS	11.4	ºC	0.1	ppt	7.69	mg/L
5 ft	78.4	uS	11.3	ºC	0.1	ppt	7.67	mg/L
10 ft	78.3	uS	11.2	ºC	0.1	ppt	7.73	mg/L
15 ft	78.3	uS	11.2	ºC	0.1	ppt	7.66	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **1** **Way point:** **013** **Date:** 5/22/2007

Latitude: 34º 16.837 N **Longitude: 78º 00.263 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	196.3	uS	23.6	ºC	0.1	ppt	4.91	mg/L
5 ft	199.4	uS	23.4	ºC	0.1	ppt	4.84	mg/L
10 ft	198.9	uS	23.2	ºC	0.1	ppt	4.74	mg/L
15 ft	199.9	uS	23.3	ºC	0.1	ppt	4.84	mg/L
20 ft	197.6	uS	23.3	ºC	0.1	ppt	4.67	mg/L
25 ft	195.6	uS	23.2	ºC	0.1	ppt	4.65	mg/L
30 ft	203.3	uS	23.3	ºC	0.1	ppt	4.8	mg/L
35 ft	202.4	uS	23.2	ºC	0.1	ppt	4.85	mg/L
40 ft	203.2	uS	23.2	ºC	0.1	ppt	4.83	mg/L
45 ft	210.3	uS	23.3	ºC	0.1	ppt	4.74	mg/L

Physical Measurements Collected At Depth

Site: **2** **Way point:** **014** **Date:** 5/22/2007

Latitude: 34º 19.396 N **Longitude: 78º 00.549 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	176.8	uS	23.7	ºC	0.1	ppt	4.85	mg/L
5 ft	175.9	uS	23.6	ºC	0.1	ppt	4.84	mg/L
10 ft	176.1	uS	23.6	ºC	0.1	ppt	4.82	mg/L
15 ft	176.4	uS	23.5	ºC	0.1	ppt	4.77	mg/L
20 ft	176.3	uS	23.5	ºC	0.1	ppt	4.83	mg/L
25 ft	176.2	uS	23.5	ºC	0.1	ppt	4.84	mg/L
30 ft	176.1	uS	23.5	ºC	0.1	ppt	4.78	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **3** **Way point:** **015** **Date:** 5/22/2007

Latitude: 34º 20.187 N **Longitude: 78º 02.900 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	170	uS	23.5	ºC	0.1	ppt	4.83	mg/L
5 ft	169.8	uS	23.5	ºC	0.1	ppt	4.79	mg/L
10 ft	169.8	uS	23.4	ºC	0.1	ppt	4.79	mg/L
15 ft	169.8	uS	23.4	ºC	0.1	ppt	4.74	mg/L
20 ft	175.2	uS	23.4	ºC	0.1	ppt	4.73	mg/L
25 ft	169.8	uS	23.4	ºC	0.1	ppt	4.76	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **4** **Way point:** **016** **Date:** 5/22/2007

Latitude: 34º 20.276 N **Longitude: 78º 04.509 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	183.2	uS	23.9	ºC	0.1	ppt	4.91	mg/L
5 ft	183.6	uS	23.8	ºC	0.1	ppt	4.9	mg/L
10 ft	185.9	uS	23.7	ºC	0.1	ppt	4.91	mg/L
15 ft	185.1	uS	23.7	ºC	0.1	ppt	4.84	mg/L
20 ft	185.2	uS	23.7	ºC	0.1	ppt	4.83	mg/L
25 ft	182.5	uS	23.7	ºC	0.1	ppt	4.81	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **5** **Way point:** **017** **Date:** 5/22/2007

Latitude: 34º 21.312 N **Longitude: 78º 06.122 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	222.2	uS	24.2	ºC	0.1	ppt	5.48	mg/L
5 ft	222	uS	24.1	ºC	0.1	ppt	5.29	mg/L
10 ft	222.6	uS	24	ºC	0.1	ppt	5.27	mg/L
15 ft	222.5	uS	24	ºC	0.1	ppt	5.22	mg/L
20 ft	222.4	uS	24	ºC	0.1	ppt	5.21	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **6** **Way point:** **018** **Date:** 5/22/2007

Latitude: 34º 21.963 N **Longitude: 78º 08.109 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	238.6	uS	24.3	ºC	0.1	ppt	5.43	mg/L
5 ft	237.1	uS	24.2	ºC	0.1	ppt	5.33	mg/L
10 ft	236.5	uS	24.2	ºC	0.1	ppt	5.32	mg/L
15 ft	236.2	uS	24.1	ºC	0.1	ppt	5.52	mg/L
20 ft	235.7	uS	24.1	ºC	0.1	ppt	5.3	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **7** **Way point:** **019** **Date:** 5/22/2007

Latitude: 34º 21.440 N **Longitude: 78º 09.949 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	269.1	uS	24.4	ºC	0.1	ppt	5.35	mg/L
5 ft	270	uS	24.1	ºC	0.1	ppt	5.42	mg/L
10 ft	271	uS	24	ºC	0.1	ppt	5.43	mg/L
15 ft	270.8	uS	24	ºC	0.1	ppt	5.52	mg/L
20 ft	270.9	uS	24	ºC	0.1	ppt	5.41	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **8** **Way point:** **020** **Date:** 5/22/2007

Latitude: 34º 21.413 N **Longitude: 78º 12.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	130.2	uS	24.4	ºC	0.1	ppt	6.05	mg/L
5 ft	143.3	uS	24.1	ºC	0.1	ppt	5.36	mg/L
10 ft	138.4	uS	24	ºC	0.1	ppt	5.08	mg/L
15 ft	139	uS	23.9	ºC	0.1	ppt	5.77	mg/L
20 ft	139.4	uS	23.9	ºC	0.1	ppt	5.65	mg/L
25 ft	140.6	uS	23.9	ºC	0.1	ppt	5.54	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **9** **Way point:** **021** **Date:** 5/22/2007

Latitude: 34º 22.470 N **Longitude: 78º 13.560 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	115.7	uS	24.8	ºC	0.1	ppt	6.61	mg/L
5 ft	115	uS	24.5	ºC	0.1	ppt	5.76	mg/L
10 ft	114.3	uS	24.1	ºC	0.1	ppt	5.41	mg/L
15 ft	113.7	uS	23.9	ºC	0.1	ppt	5	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **10** **Way point:** **022** **Date:** 5/22/2007

Latitude: 34º 23.075 N **Longitude: 78º 14.705 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	117.1	uS	25.2	ºC	0.1	ppt	6.99	mg/L
5 ft	116.6	uS	24.3	ºC	0.1	ppt	6.41	mg/L
10 ft	114.3	uS	23.9	ºC	0.1	ppt	6.32	mg/L
15 ft	114.2	uS	23.8	ºC	0.1	ppt	6.07	mg/L
20 ft	114.1	uS	23.4	ºC	0.1	ppt	5.65	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **11** **Way point:** **023** **Date:** 5/22/2007

Latitude: 34º 23.824 N **Longitude: 78º 16.050 W**

Depth	Conductivity		Temp		Salinity		D.O.	
Surface	119.1	uS	25.6	ºC	0.1	ppt	7.35	mg/L
5 ft	114.9	uS	24.2	ºC	0.1	ppt	6.85	mg/L
10 ft	114.4	uS	23.6	ºC	0.1	ppt	5.63	mg/L
15 ft	114.1	uS	23.5	ºC	0.1	ppt	6.05	mg/L
20 ft	114	uS	23.5	ºC	0.1	ppt	4.89	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

Physical Measurements Collected At Depth

Site: **12** **Way point:** **024** **Date:** 5/22/2007

Latitude: 34º 24.218 N **Longitude: 78º 17.528 W**

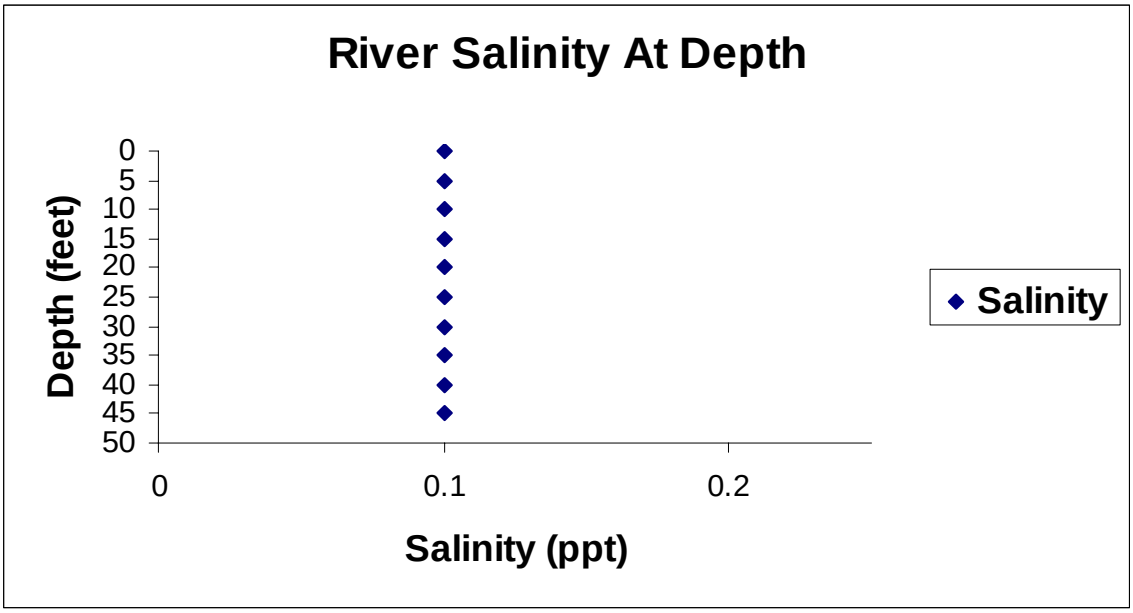
Depth	Conductivity		Temp		Salinity		D.O.	
Surface	114.2	uS	24.2	ºC	0.1	ppt	6.4	mg/L
5 ft	113.9	uS	23.9	ºC	0.1	ppt	6.57	mg/L
10 ft	113.9	uS	23.8	ºC	0.1	ppt	6.23	mg/L
15 ft	114	uS	23.8	ºC	0.1	ppt	6.15	mg/L
20 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
25 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
30 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
35 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
40 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L
45 ft	ND	uS	ND	ºC	ND	ppt	ND	mg/L

APPENDIX C

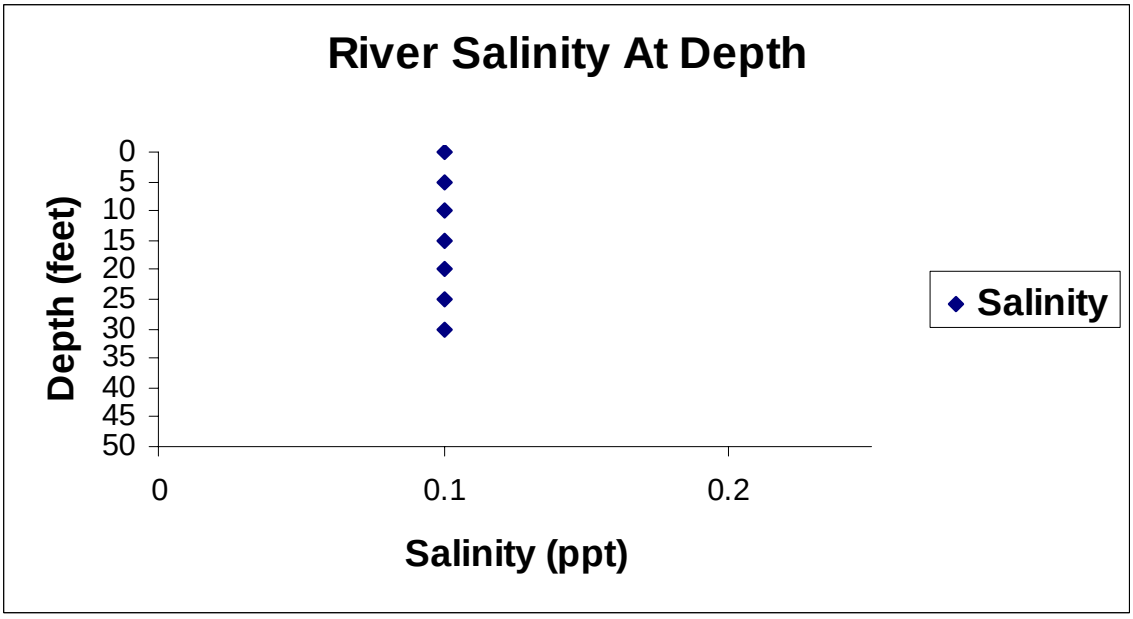
SALINITY PROFILES FOR ALL SITES FOR ALL COLLECTION DATES

Sampling date: 8/22/2006

Site 1

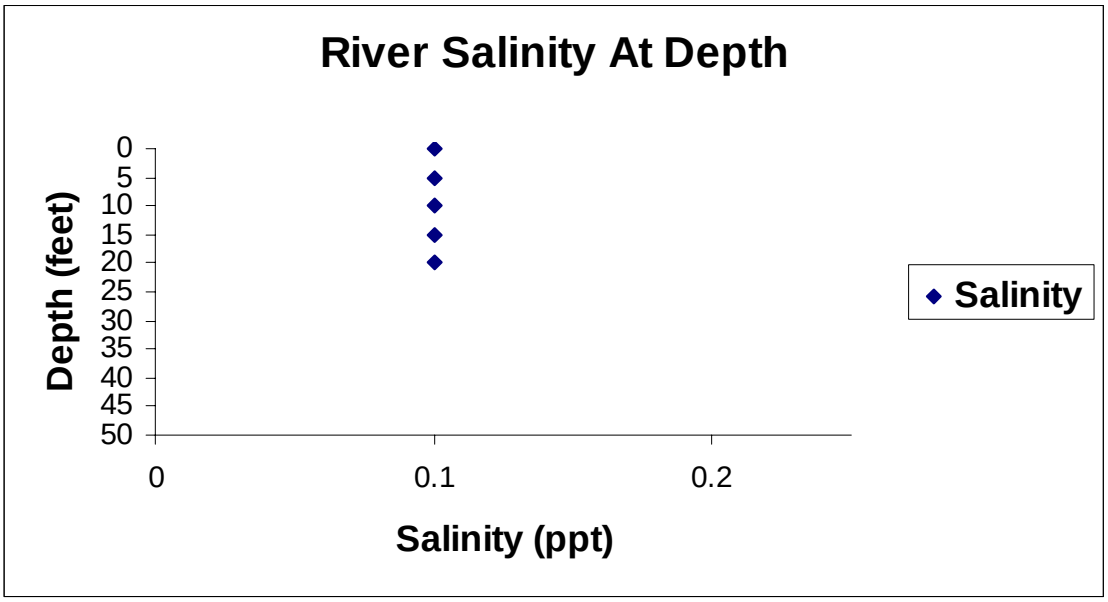


Site 2

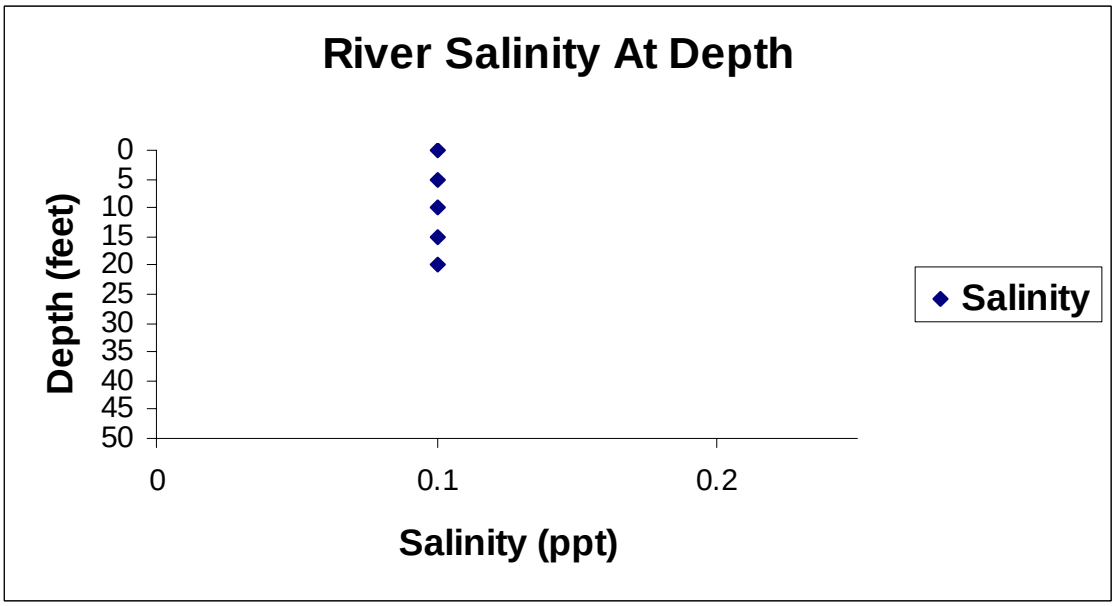


Sampling date: 8/22/2006

Site 3

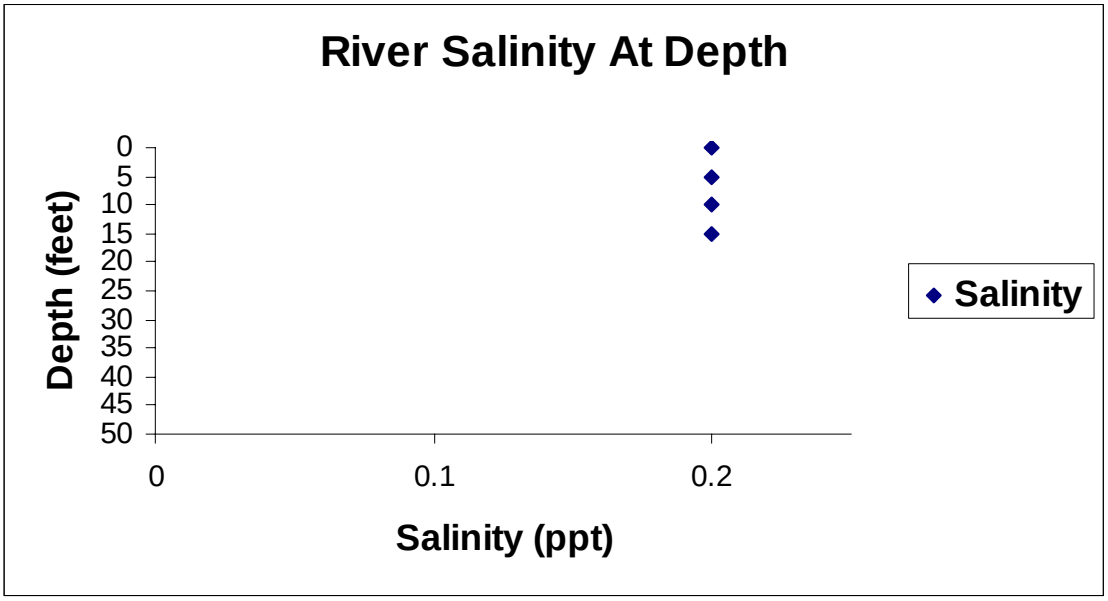


Site 4

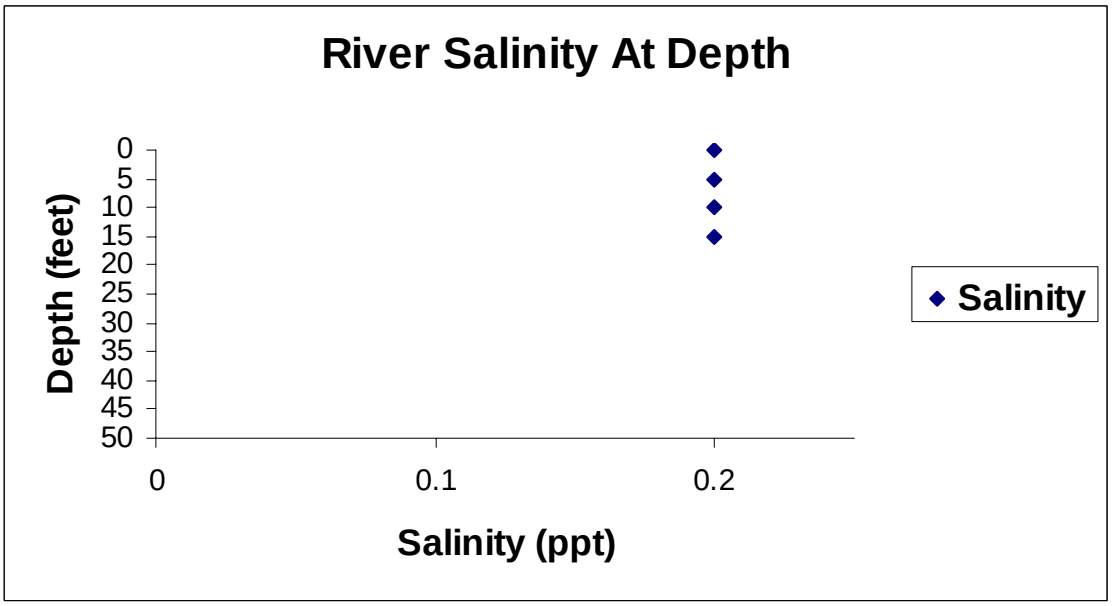


Sampling date: 8/22/2006

Site 5

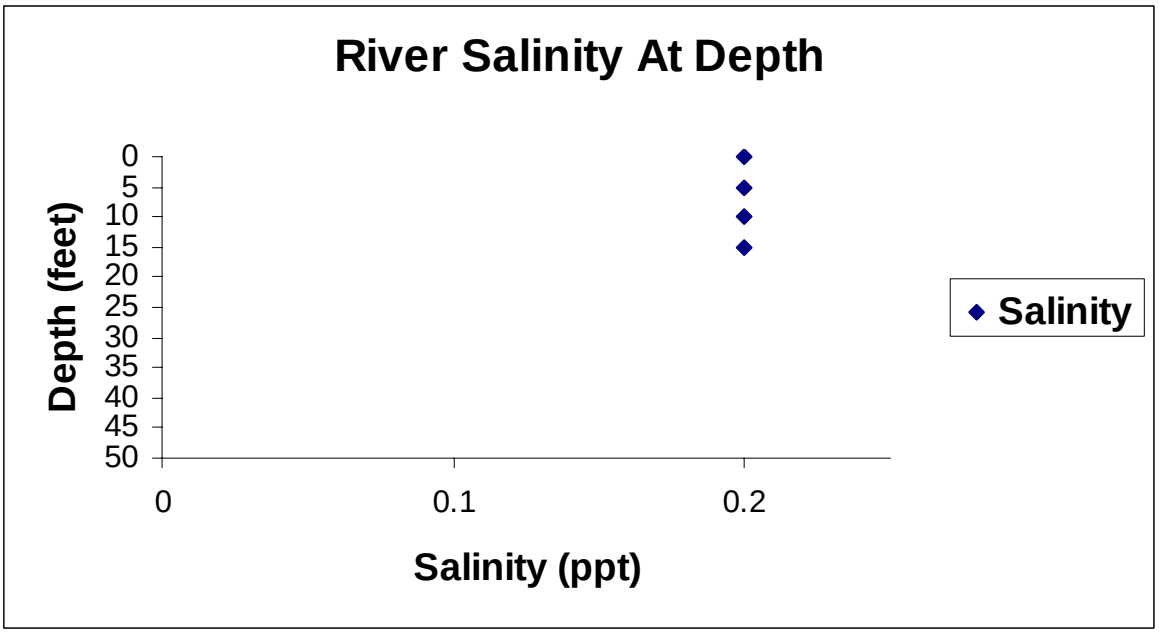


Site 6

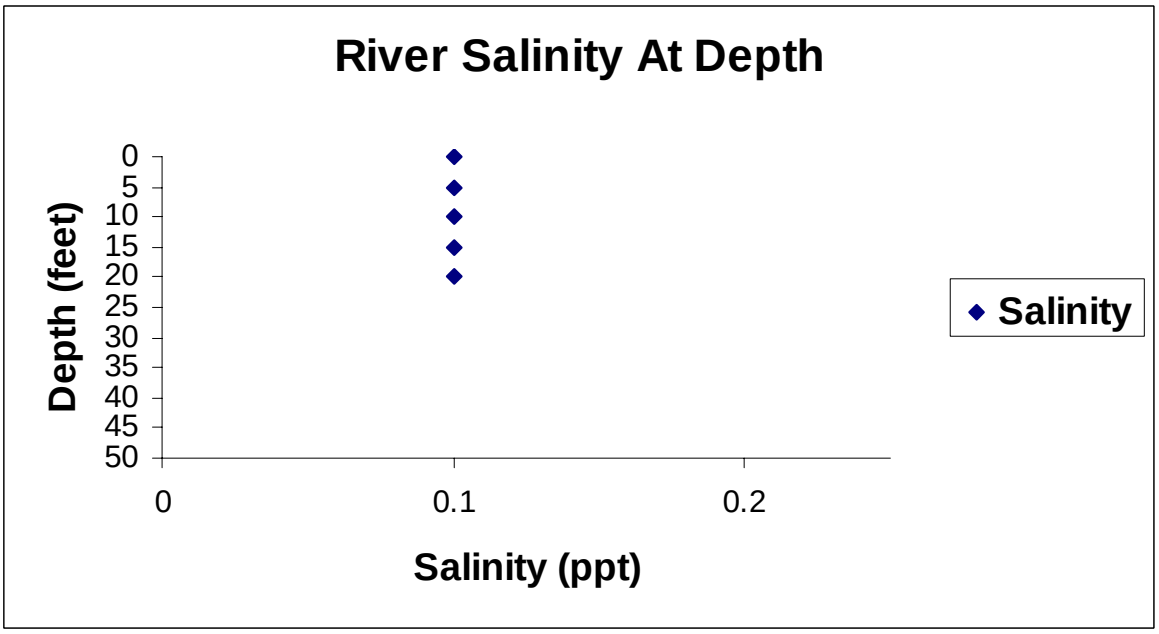


Sampling date: 8/22/2006

Site 7

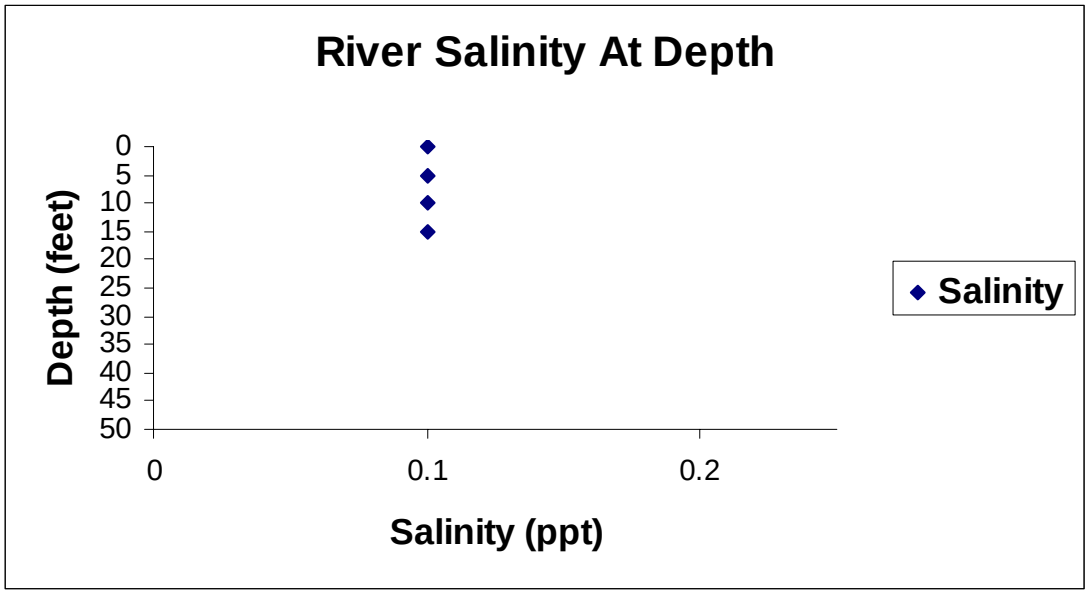


Site 8

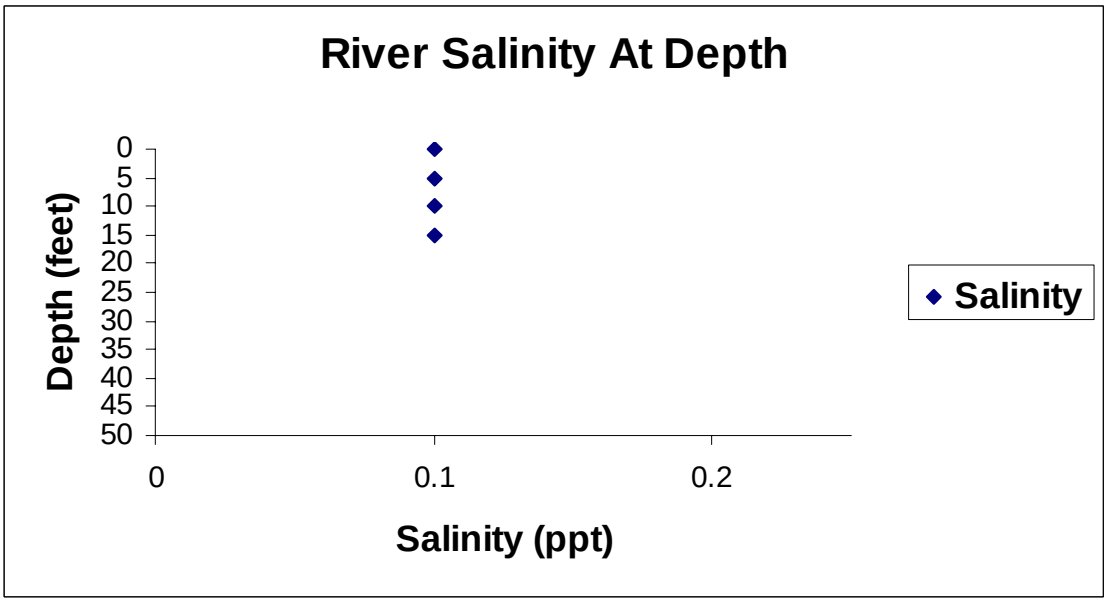


Sampling date: 8/22/2006

Site 9

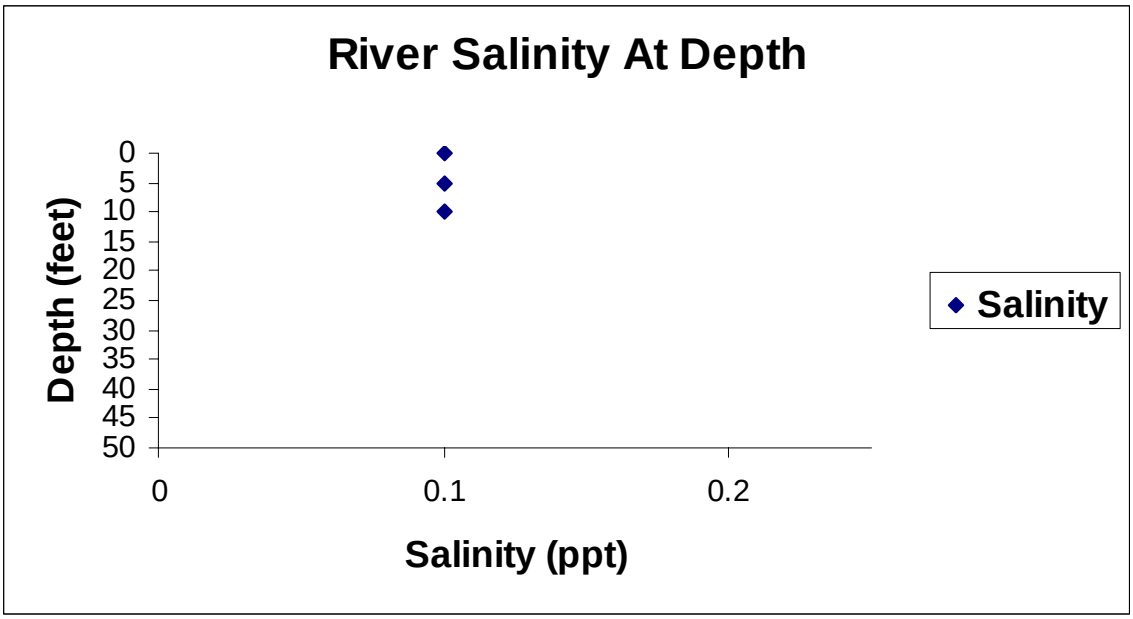


Site 10

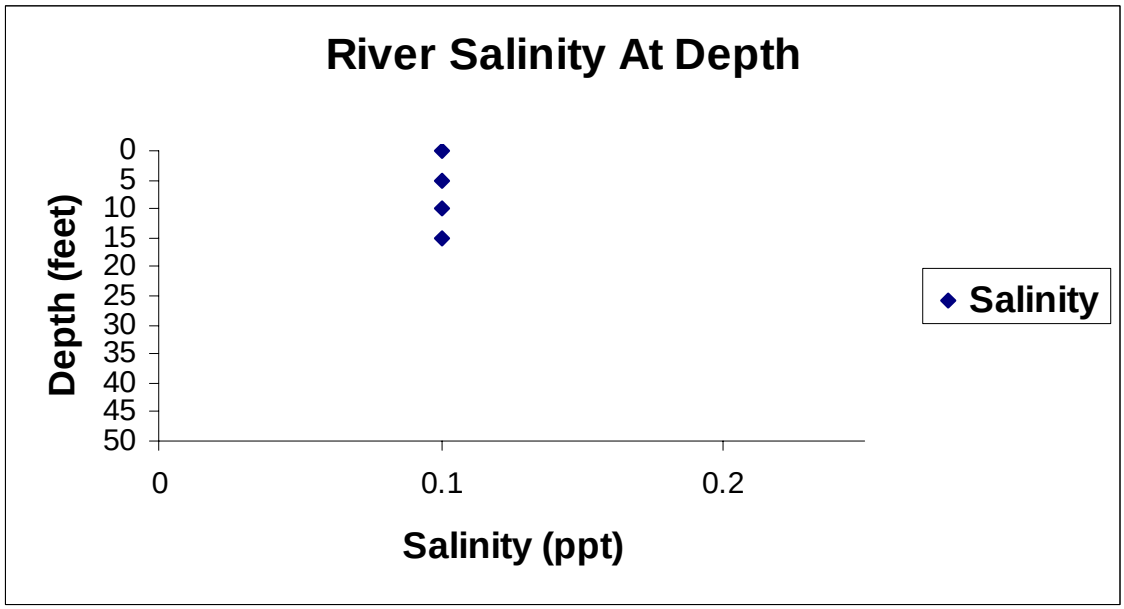


Sampling date: 8/22/2006

Site 11

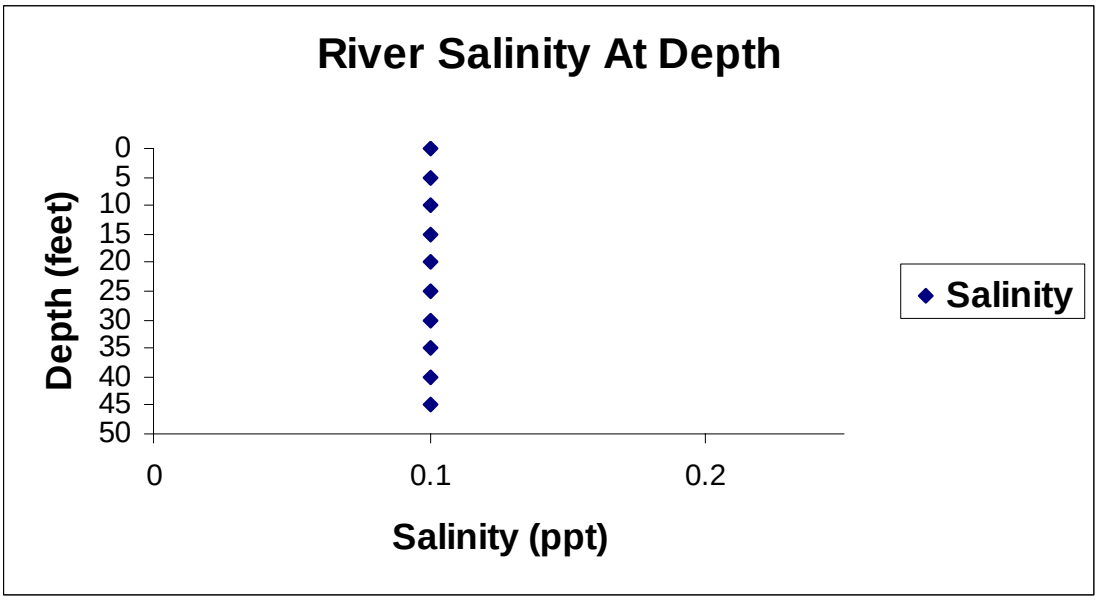


Site 12

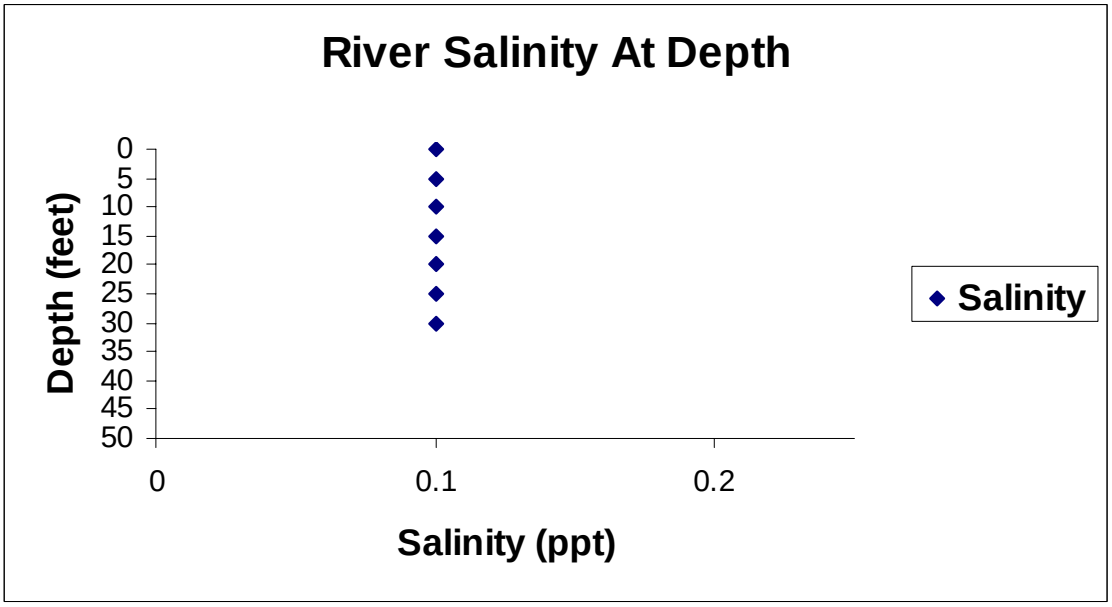


Sampling date: 9/16/2006

Site 1

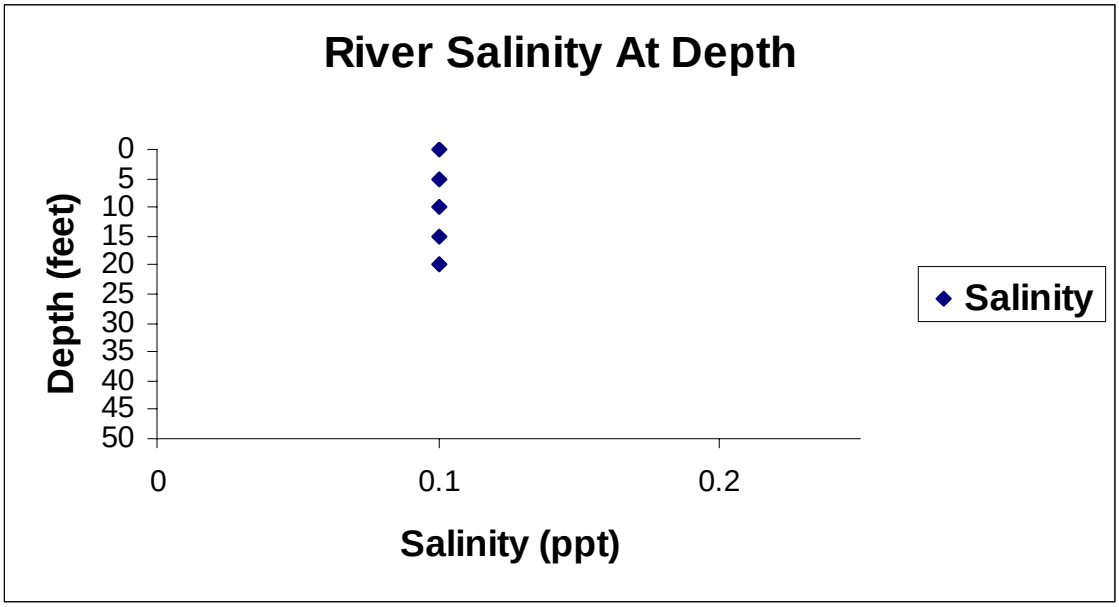


Site 2

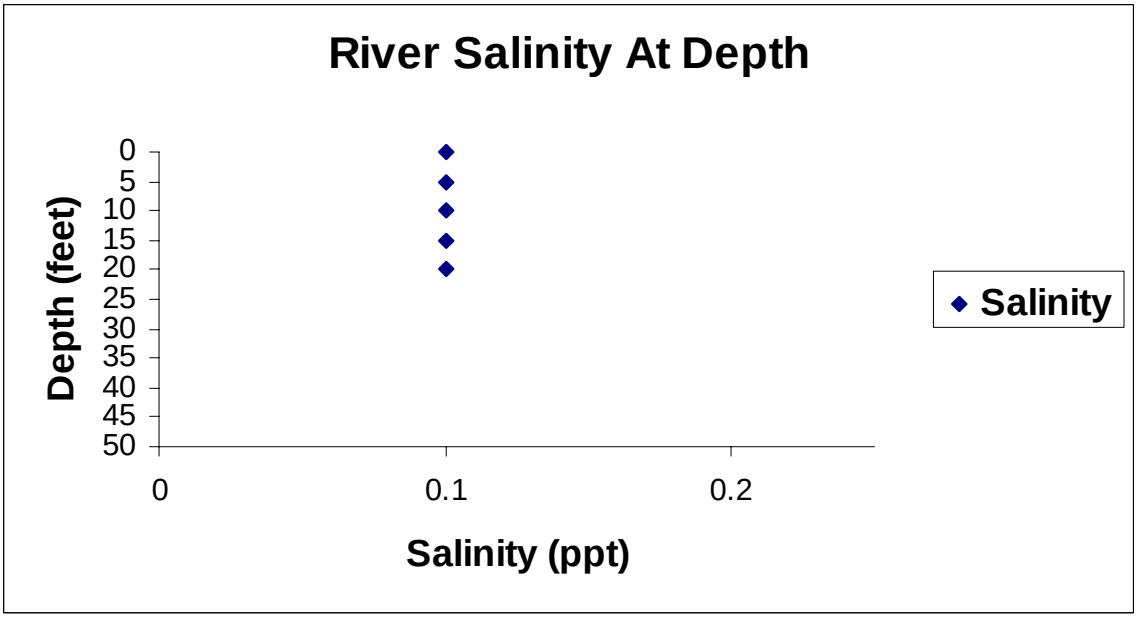


Sampling date: 9/16/2006

Site 3

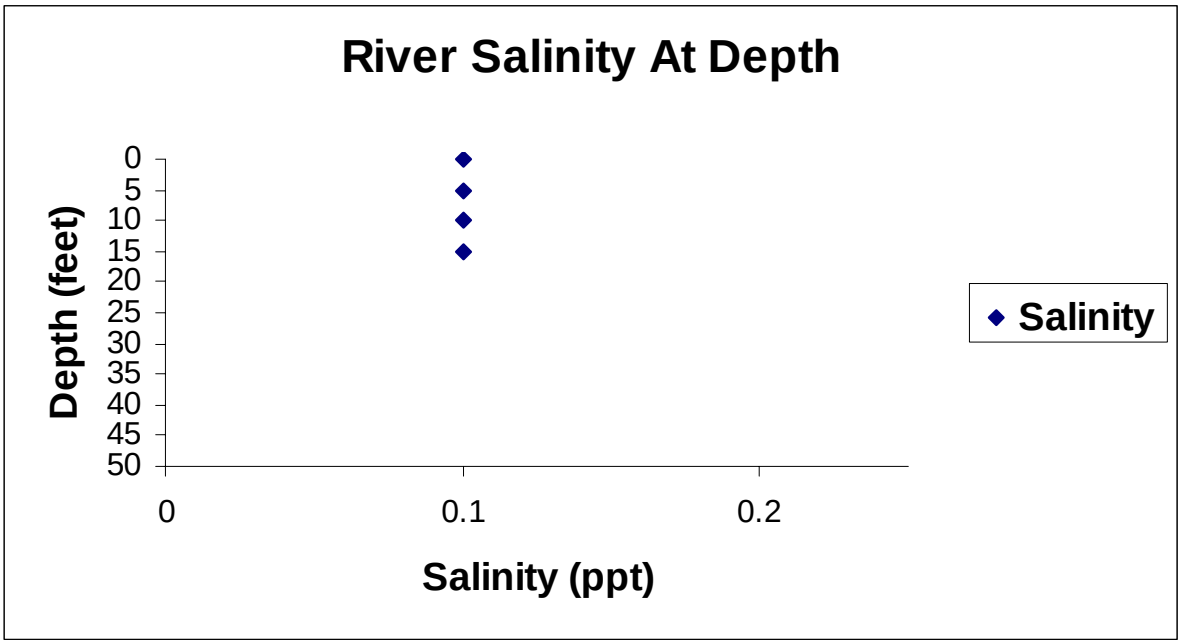


Site 4

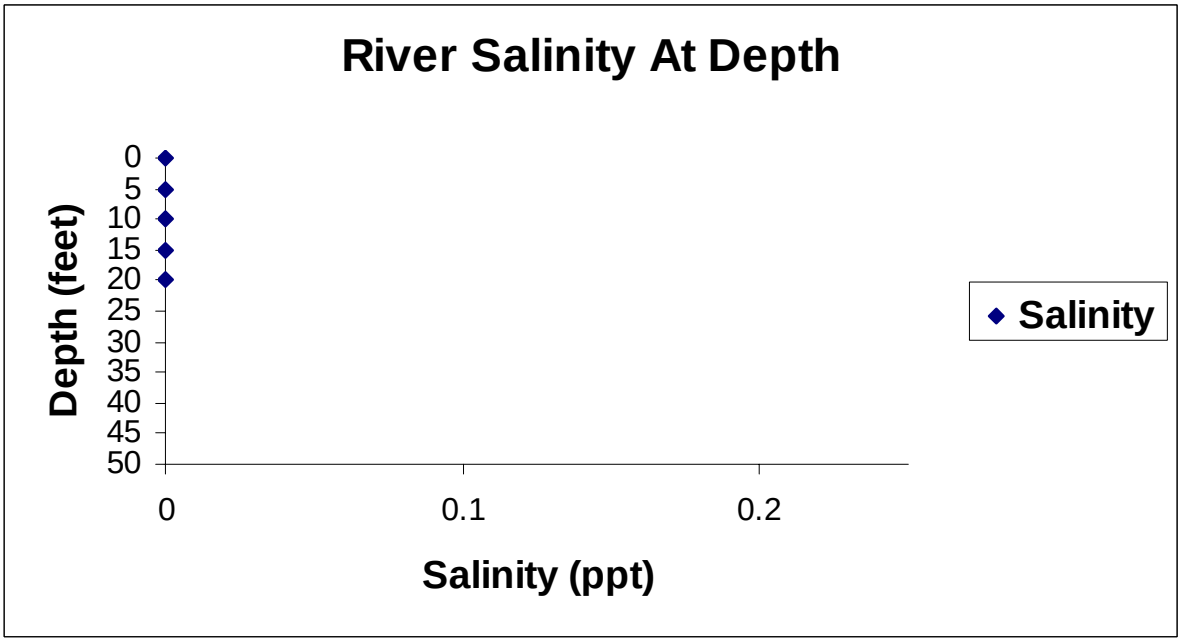


Sampling date: 9/16/2006

Site 5

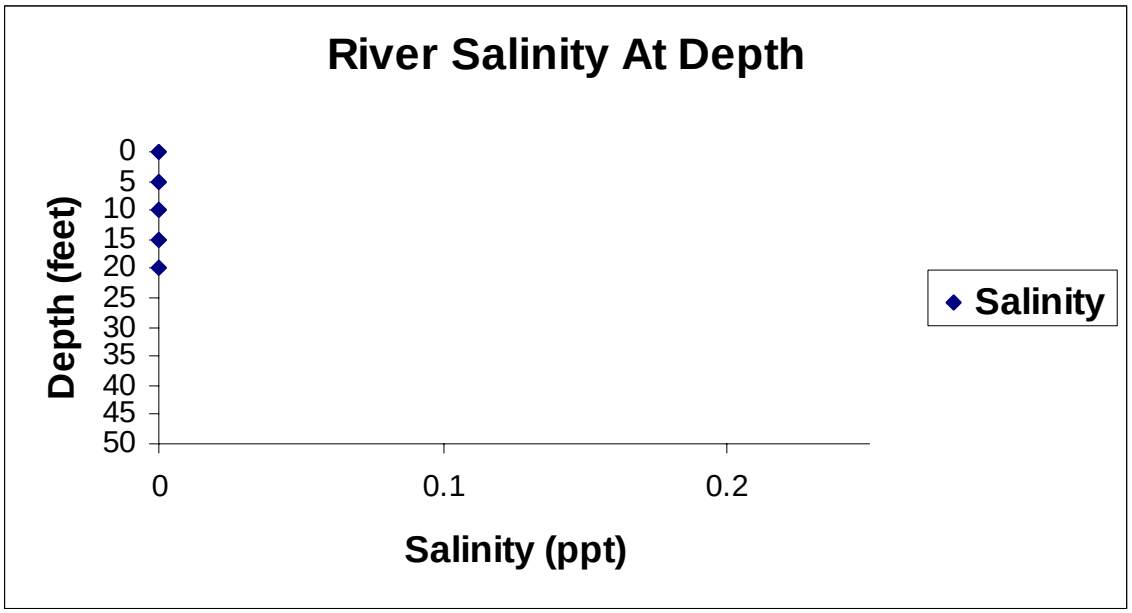


Site 6

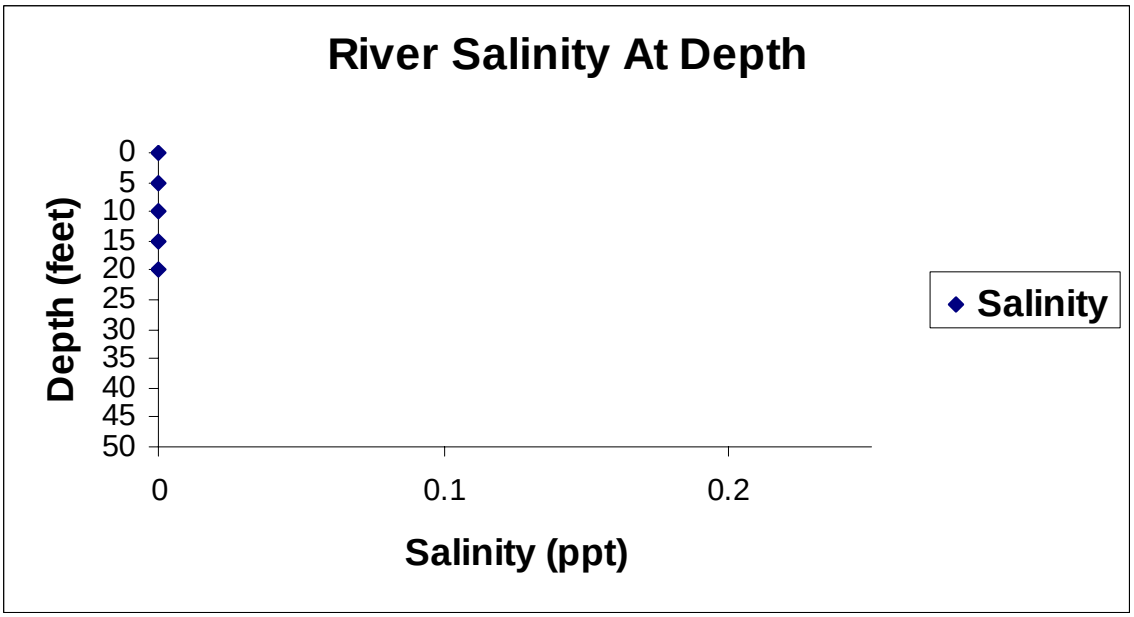


Sampling date: 9/16/2006

Site 7

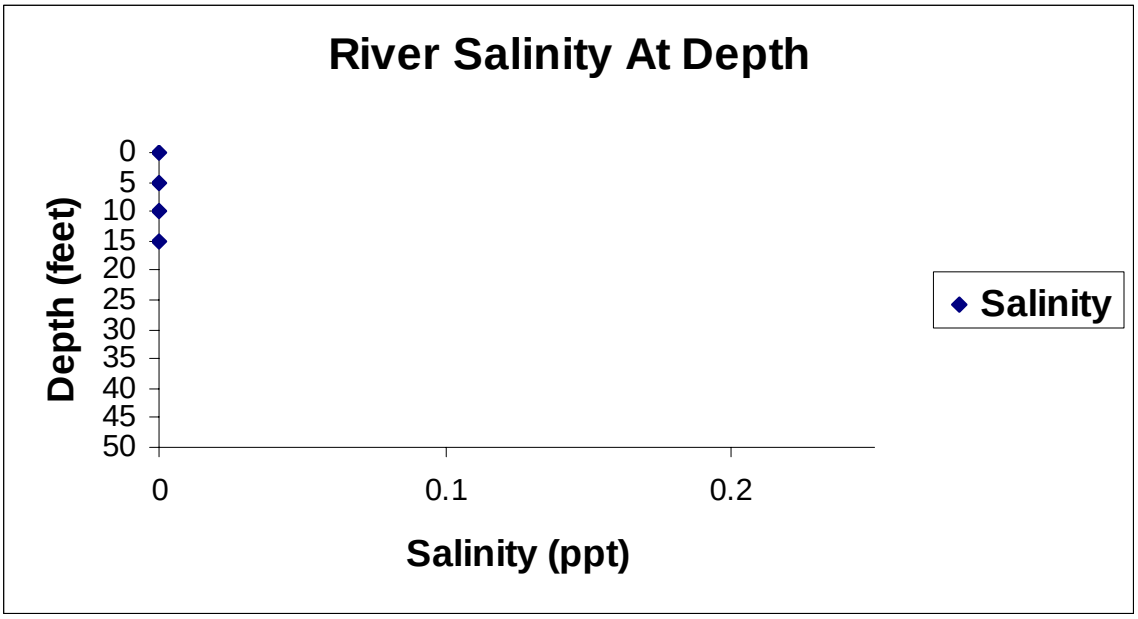


Site 8

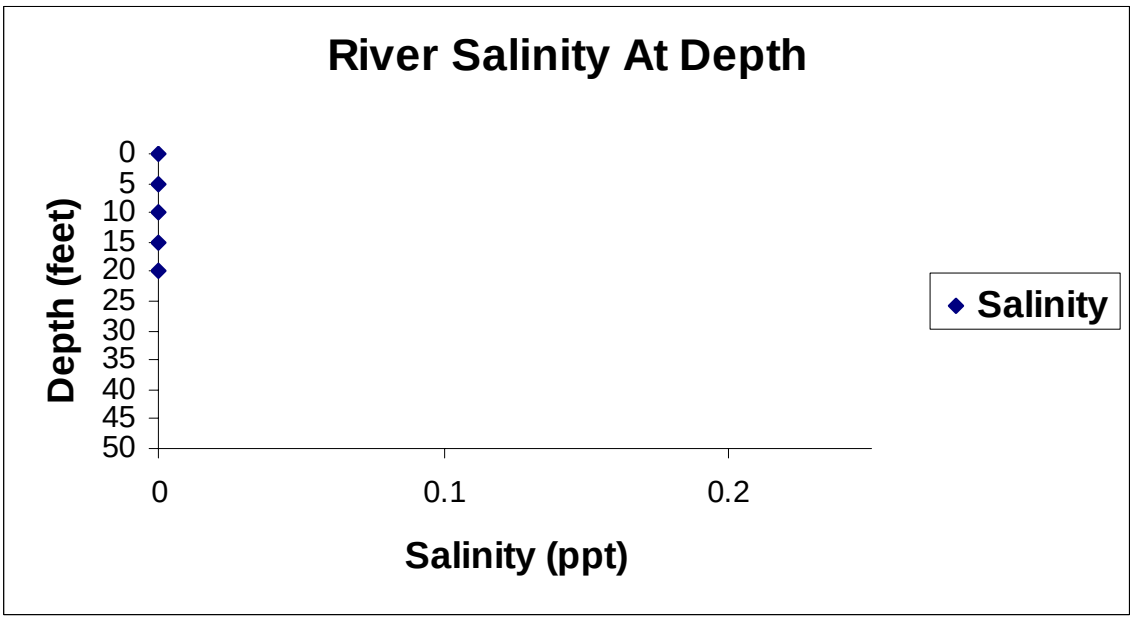


Sampling date: 9/16/2006

Site 9

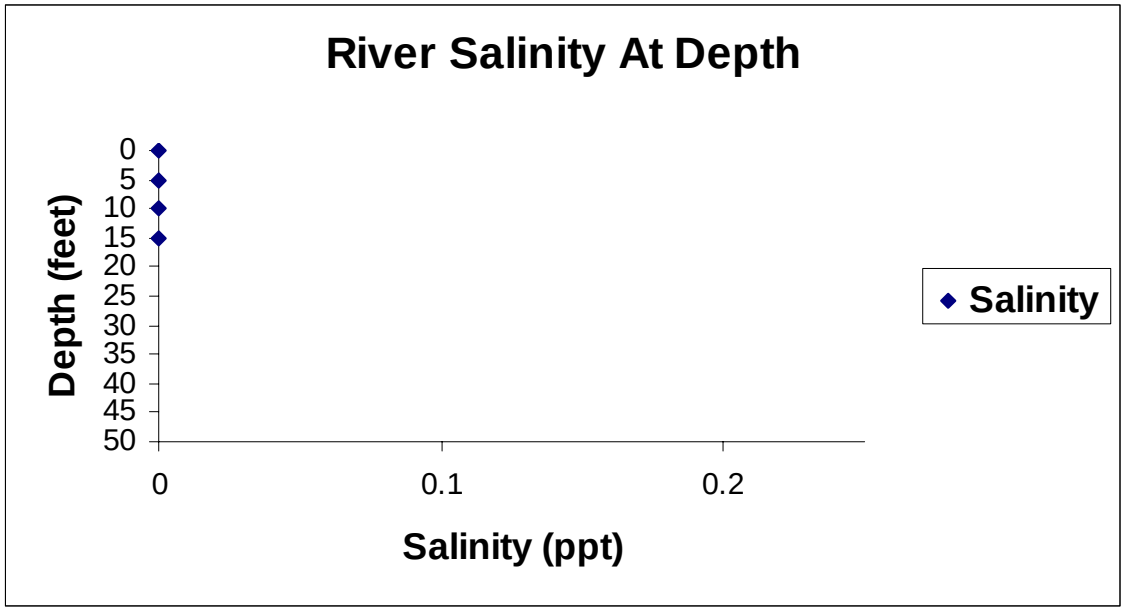


Site 10

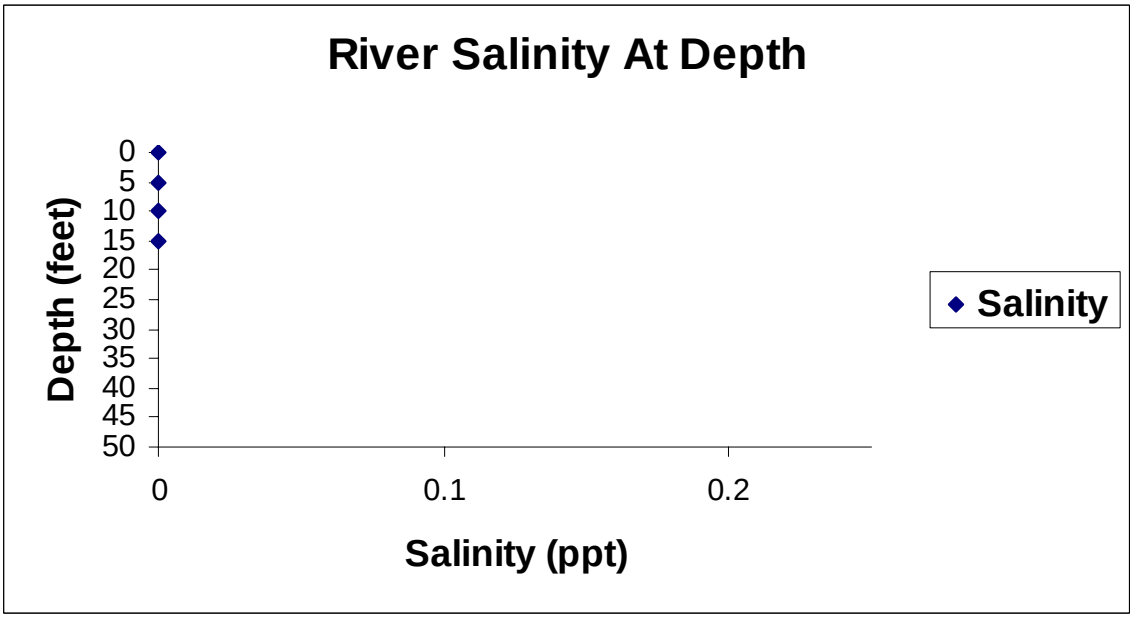


Sampling date: 9/16/2006

Site 11

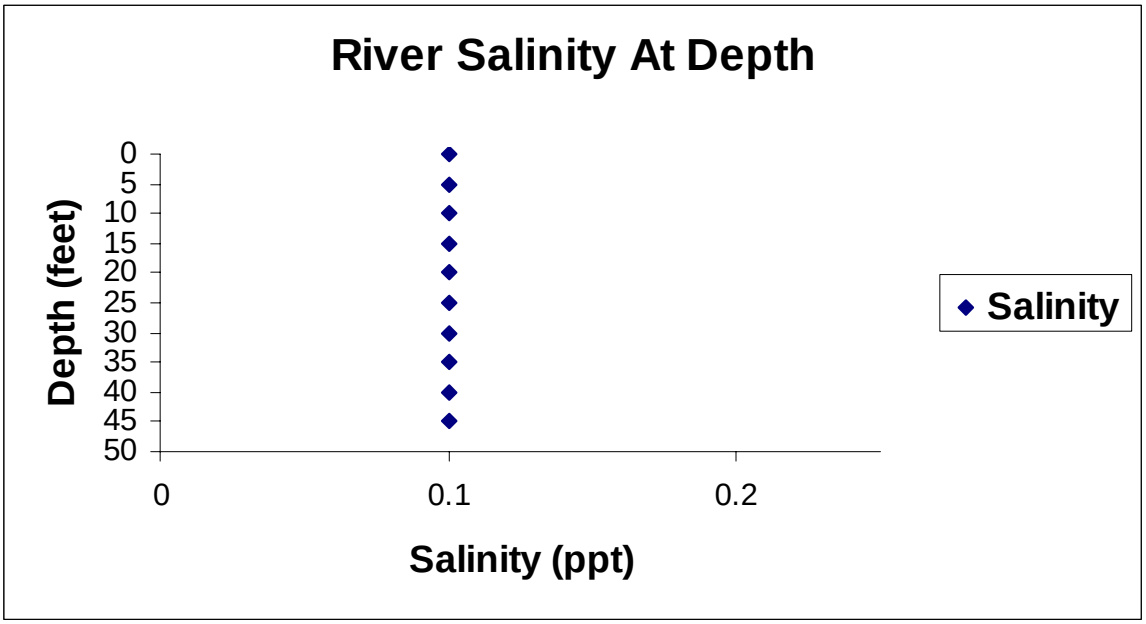


Site 12

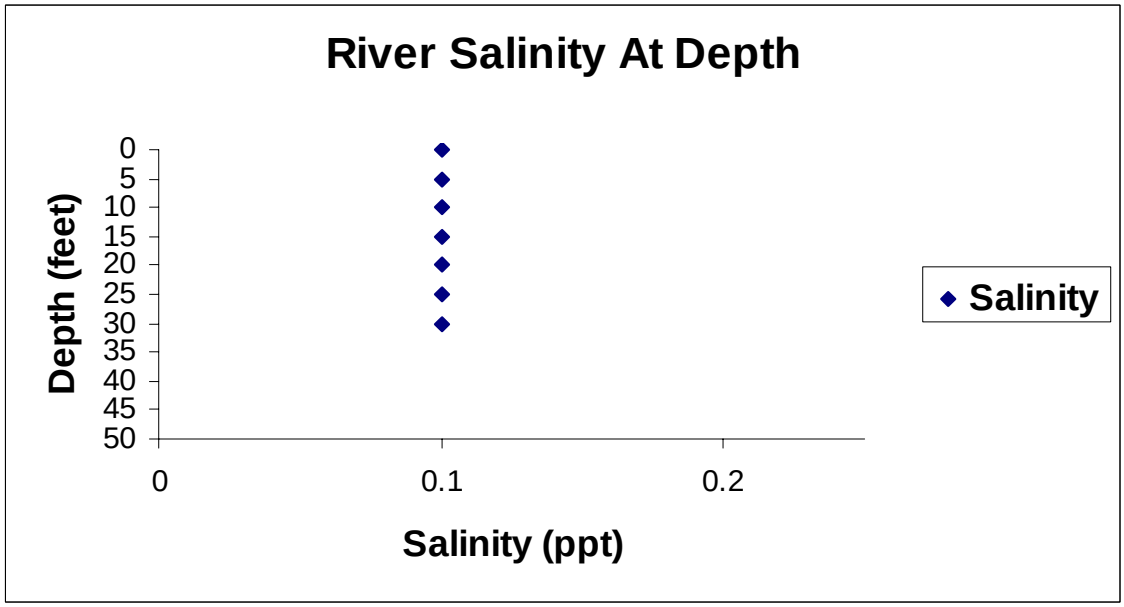


Sampling date: 9/23/2006

Site 1

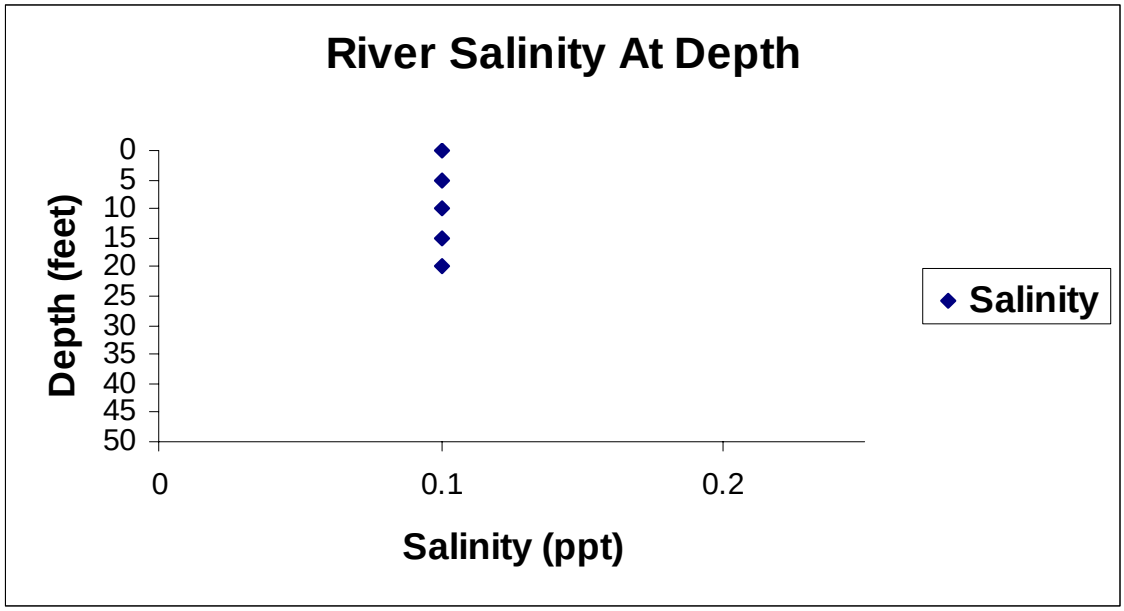


Site 2

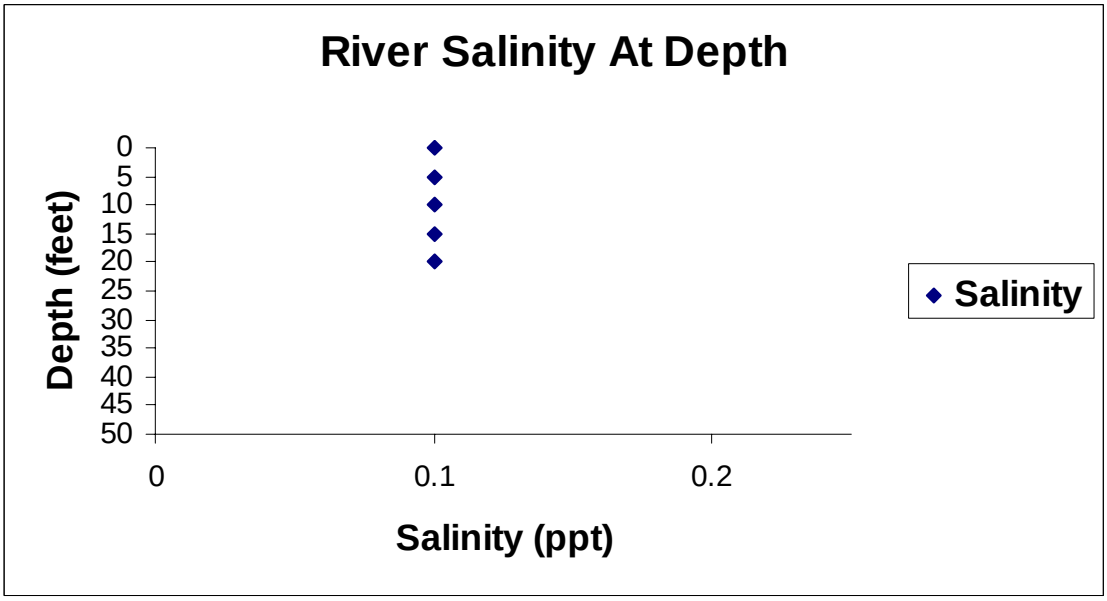


Sampling date: 9/23/2006

Site 3

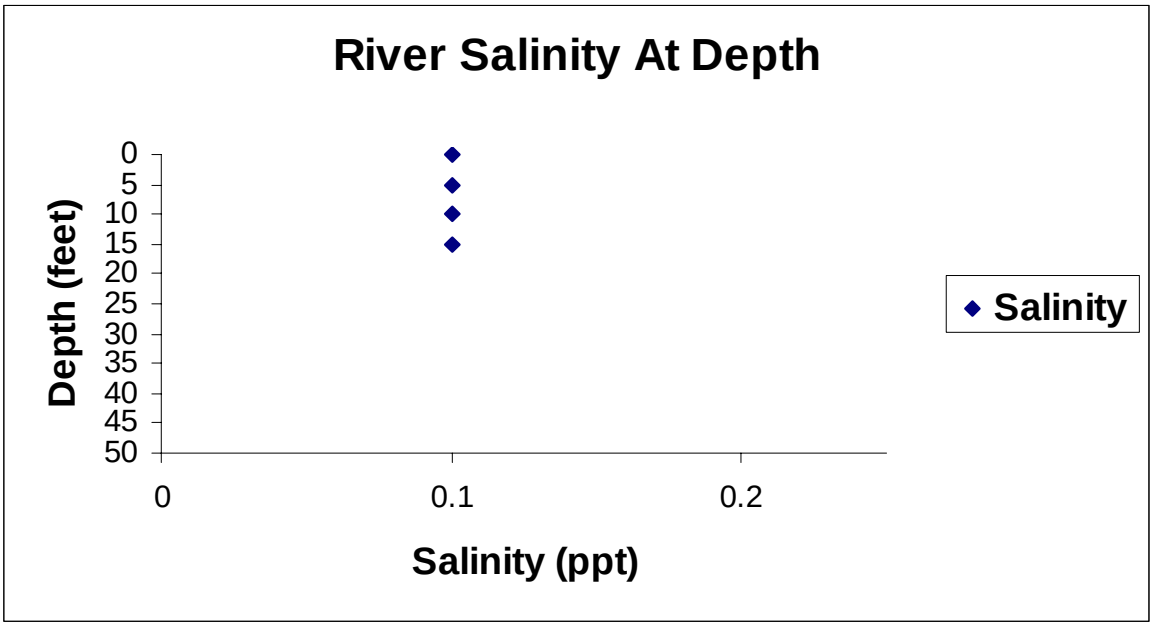


Site 4

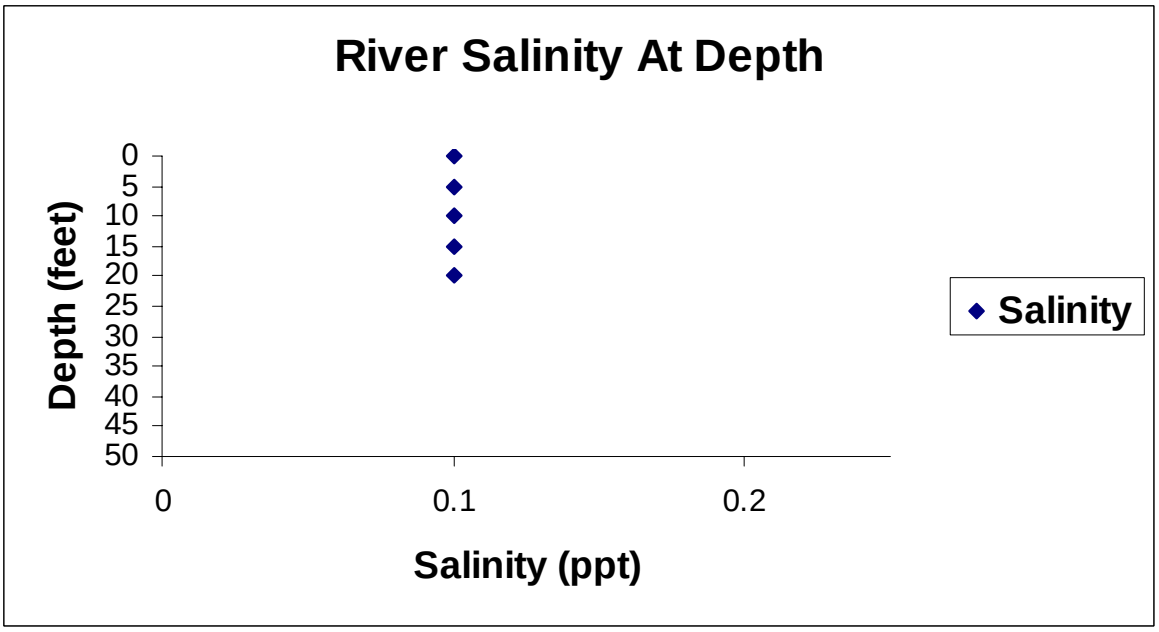


Sampling date: 9/23/2006

Site 5

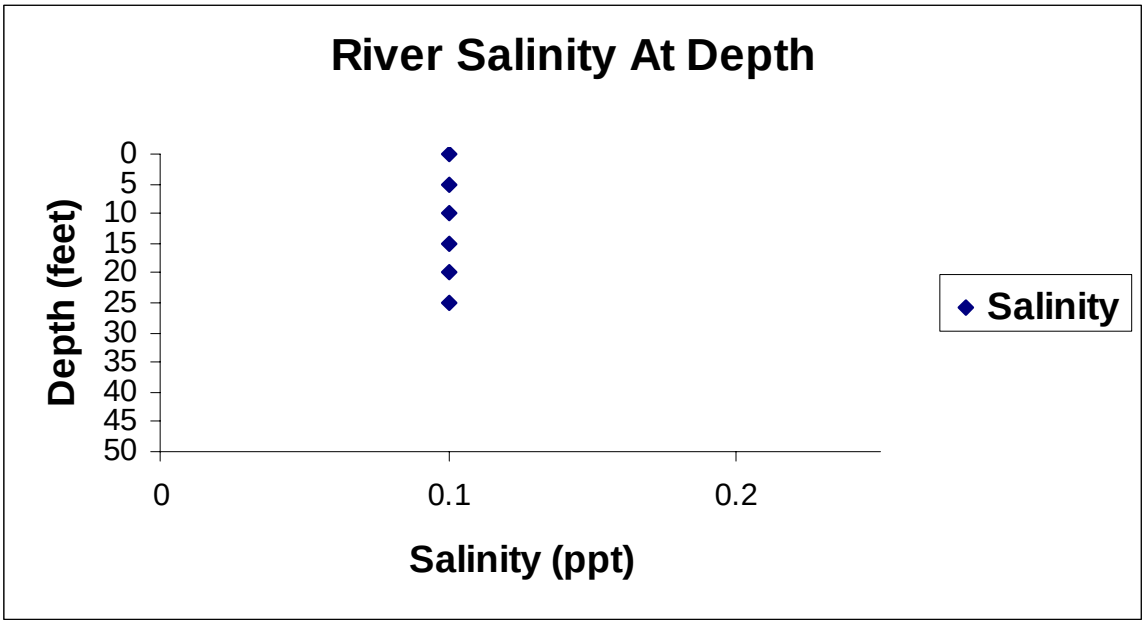


Site 6

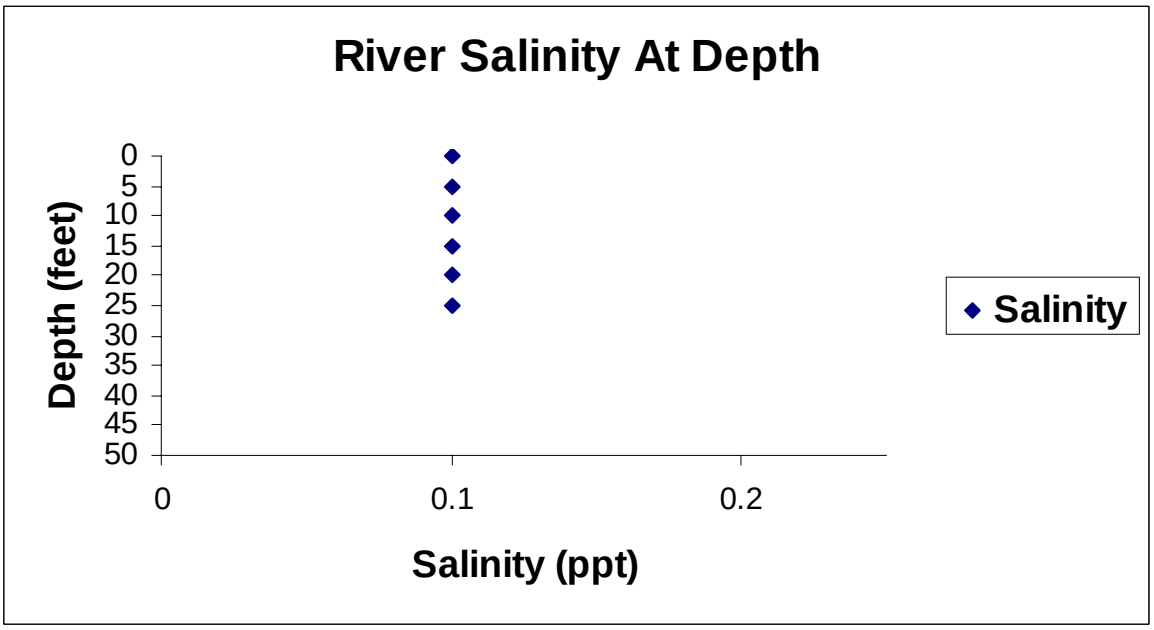


Sampling date: 9/23/2006

Site 7

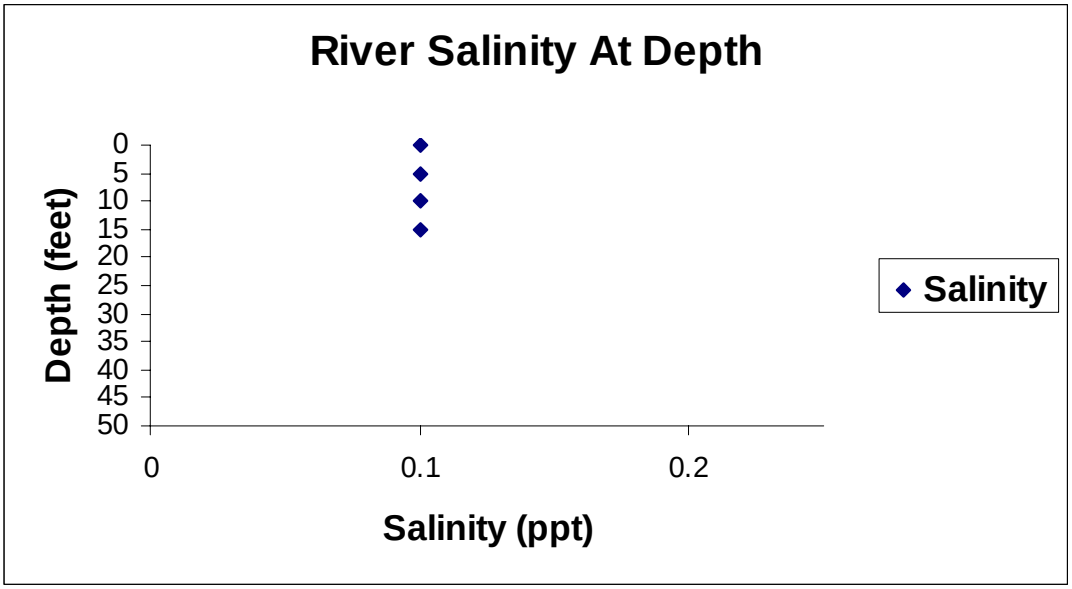


Site 8

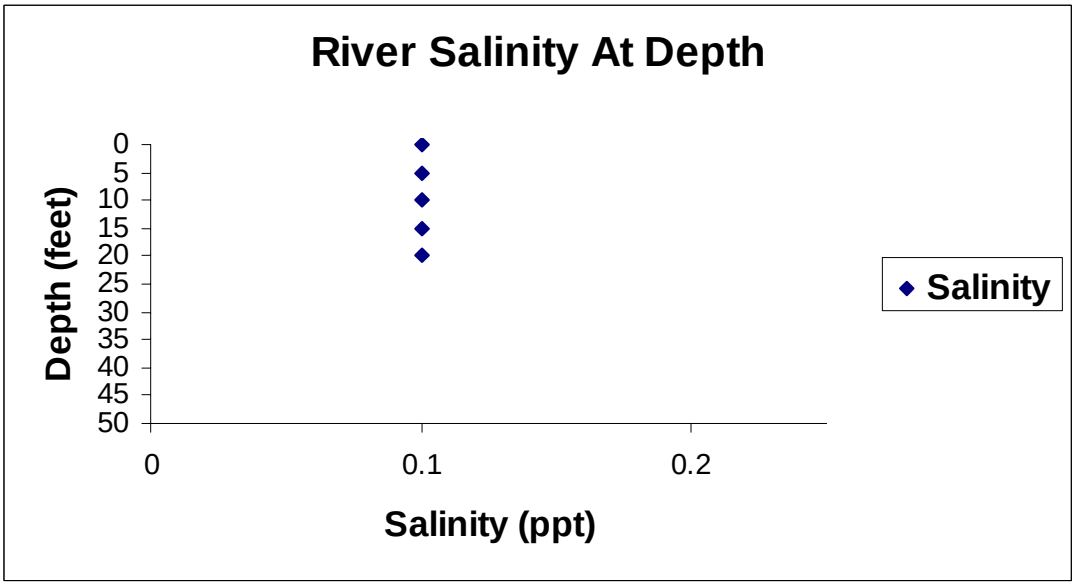


Sampling date: 9/23/2006

Site 9

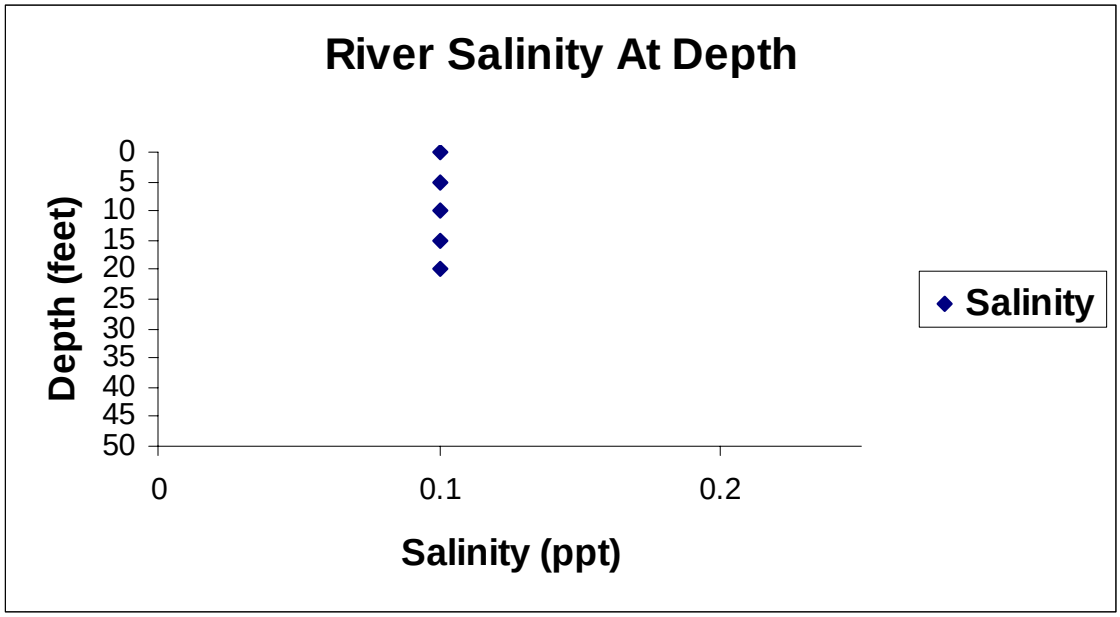


Site 10

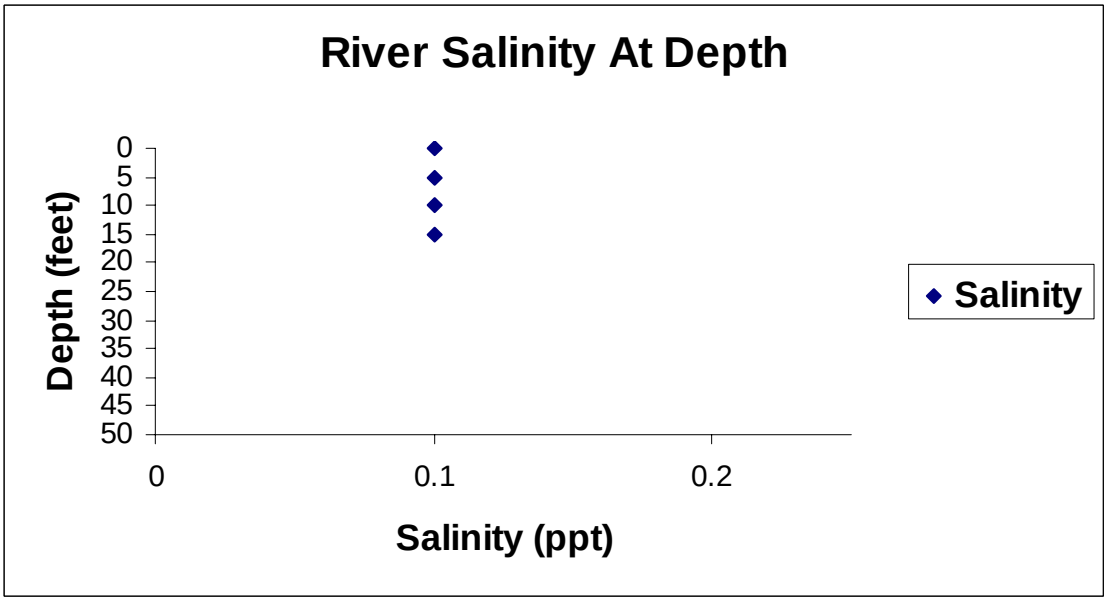


Sampling date: 9/23/2006

Site 11

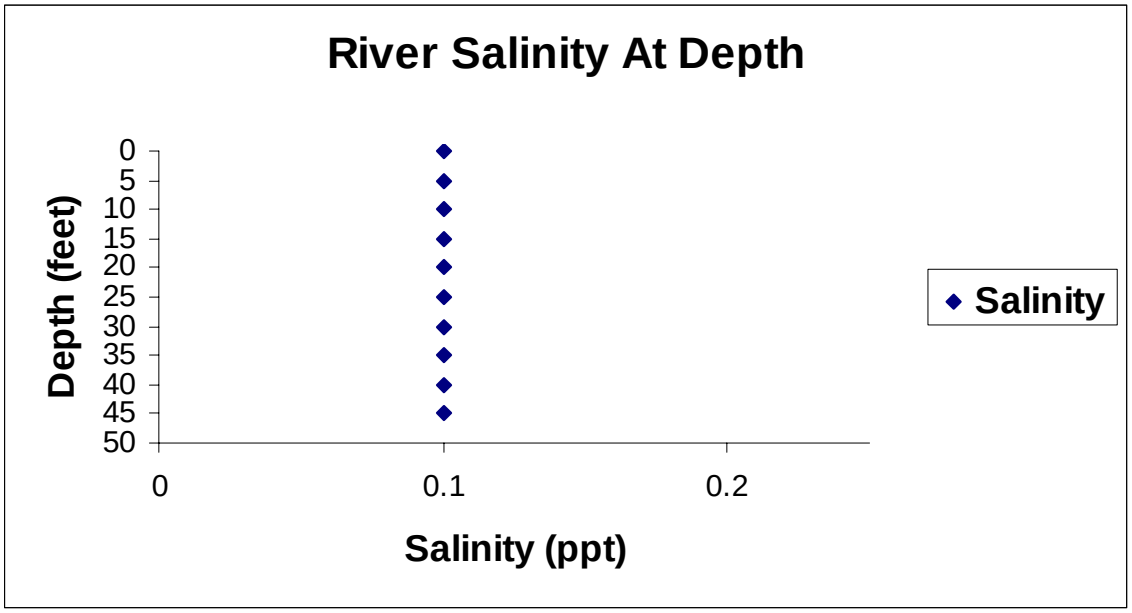


Site 12

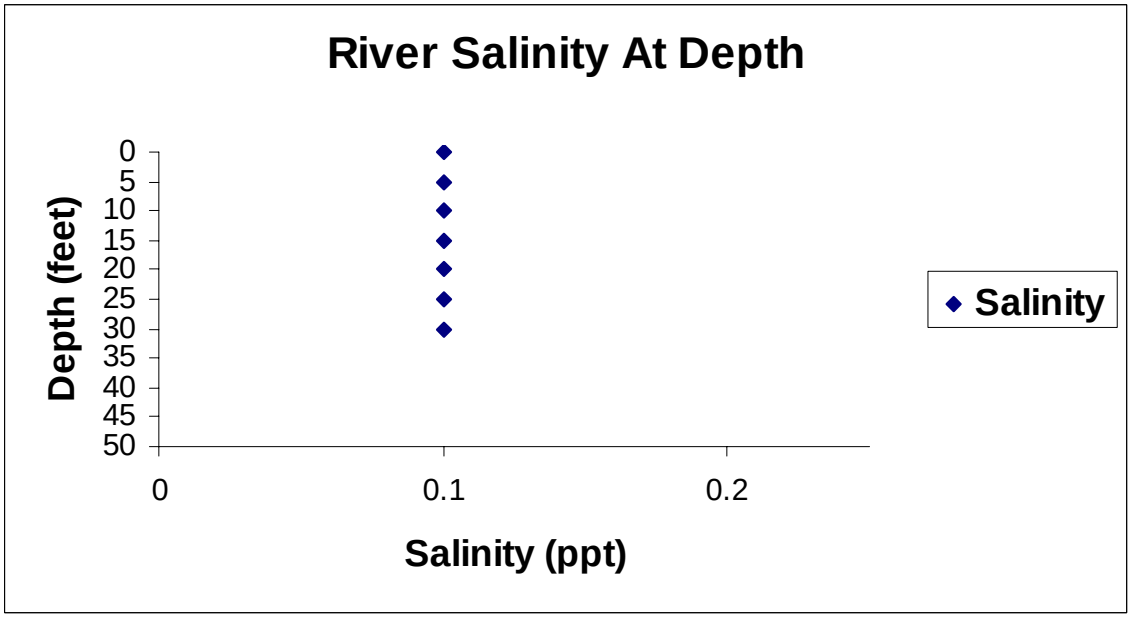


Sampling date: 10/07/2006

Site 1

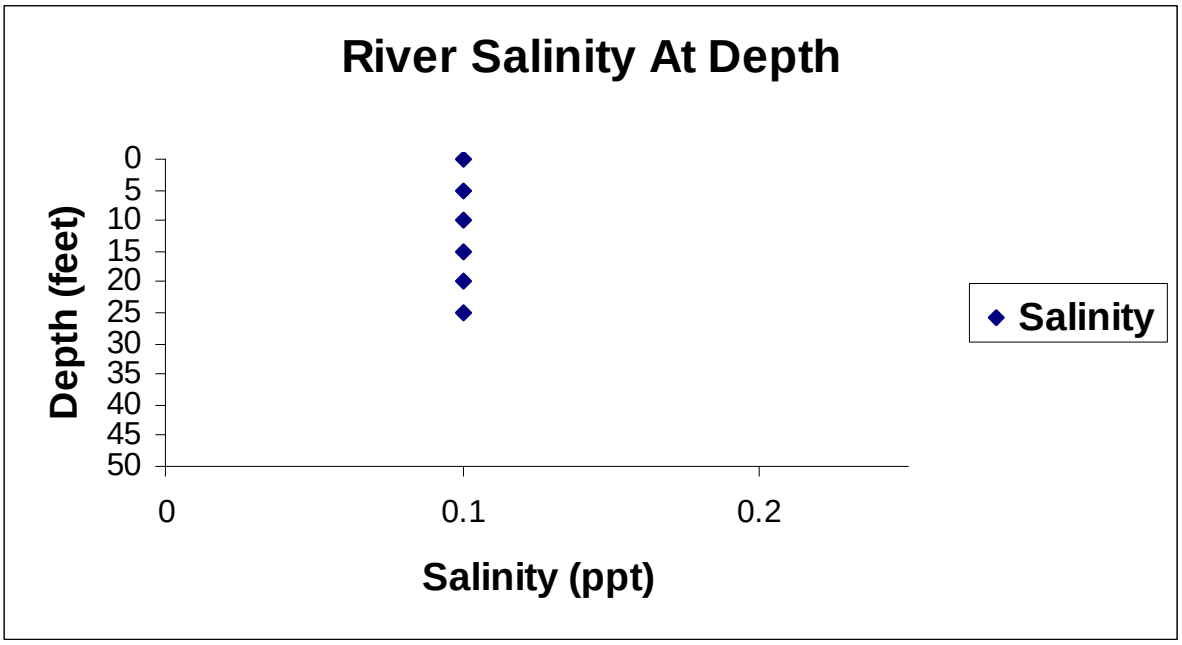


Site 2

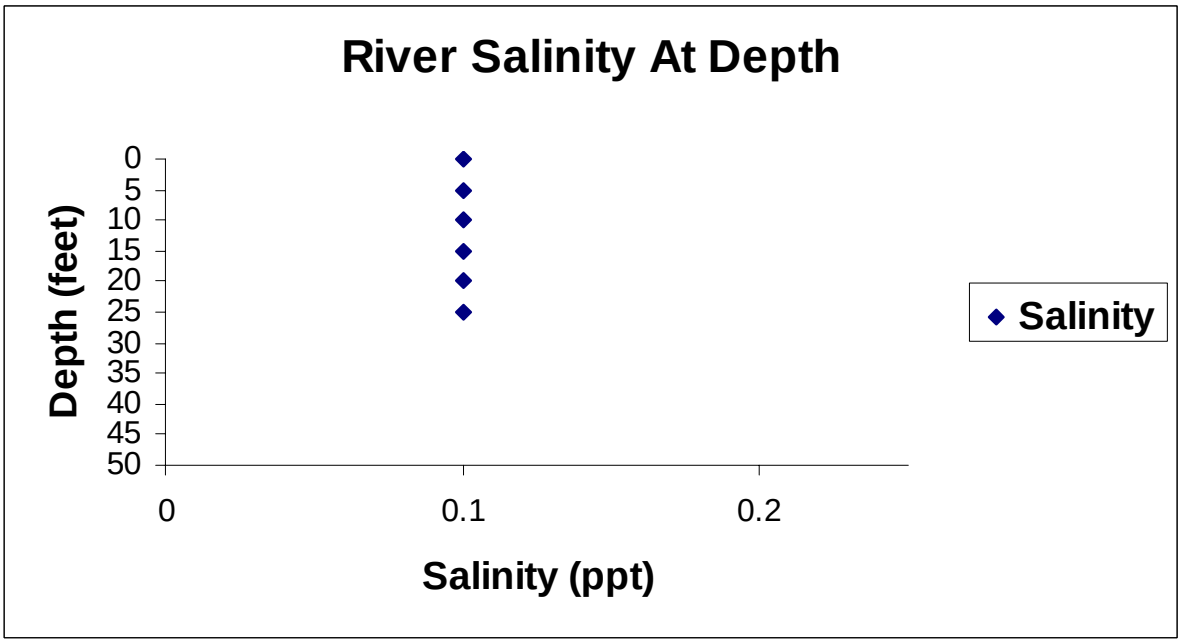


Sampling date: 10/07/2006

Site 3

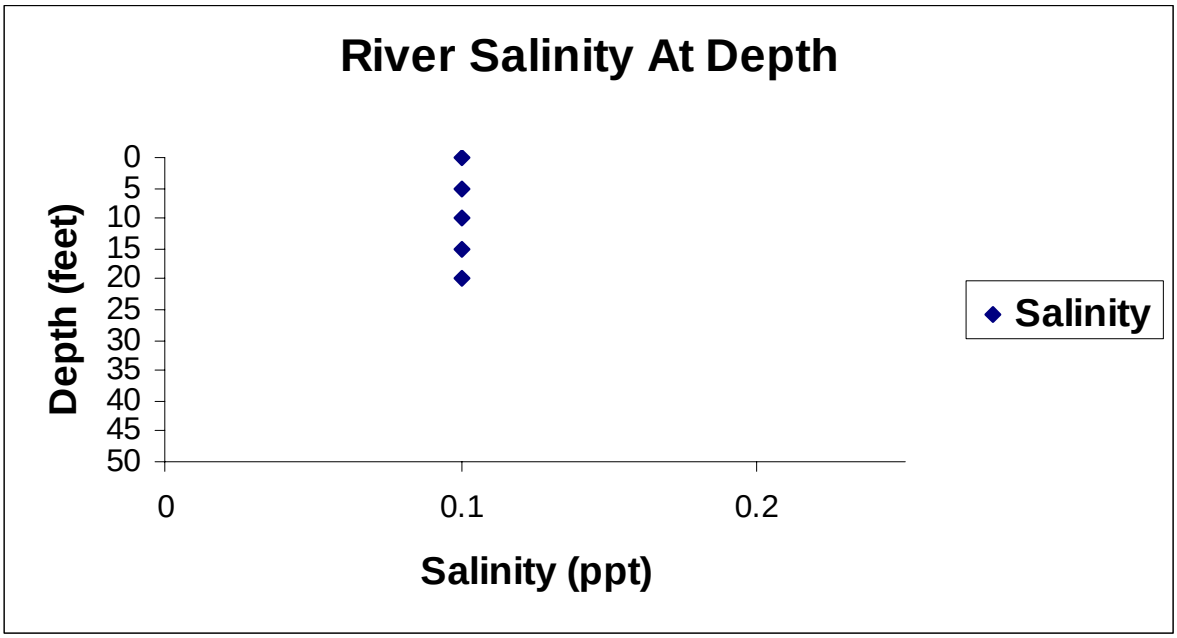


Site 4

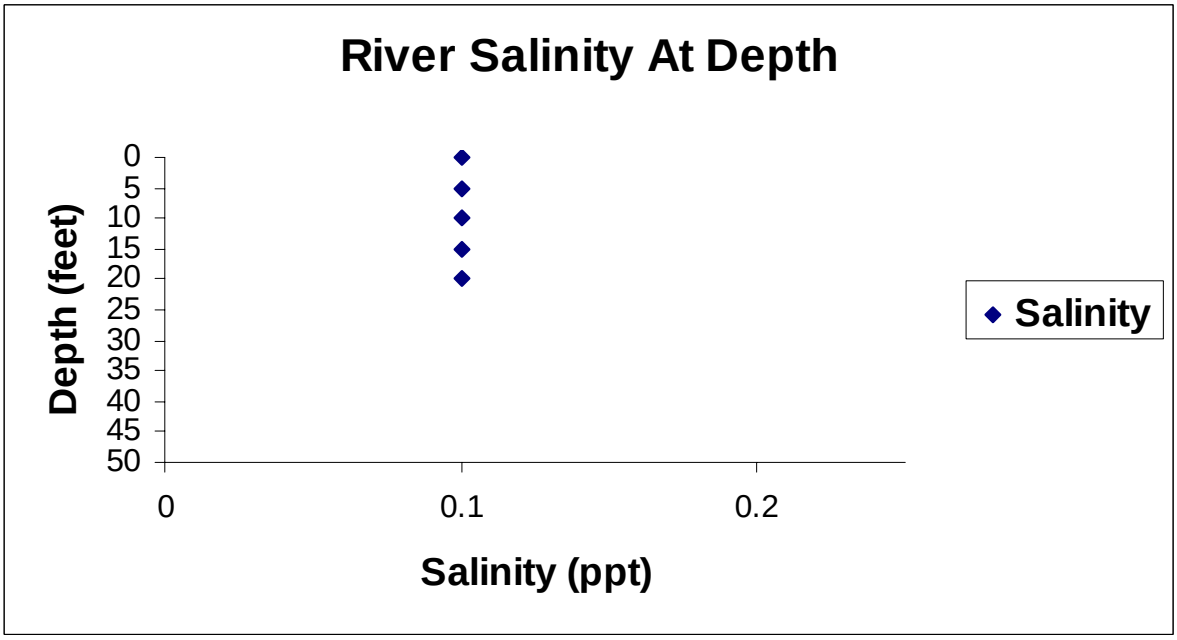


Sampling date: 10/07/2006

Site 5

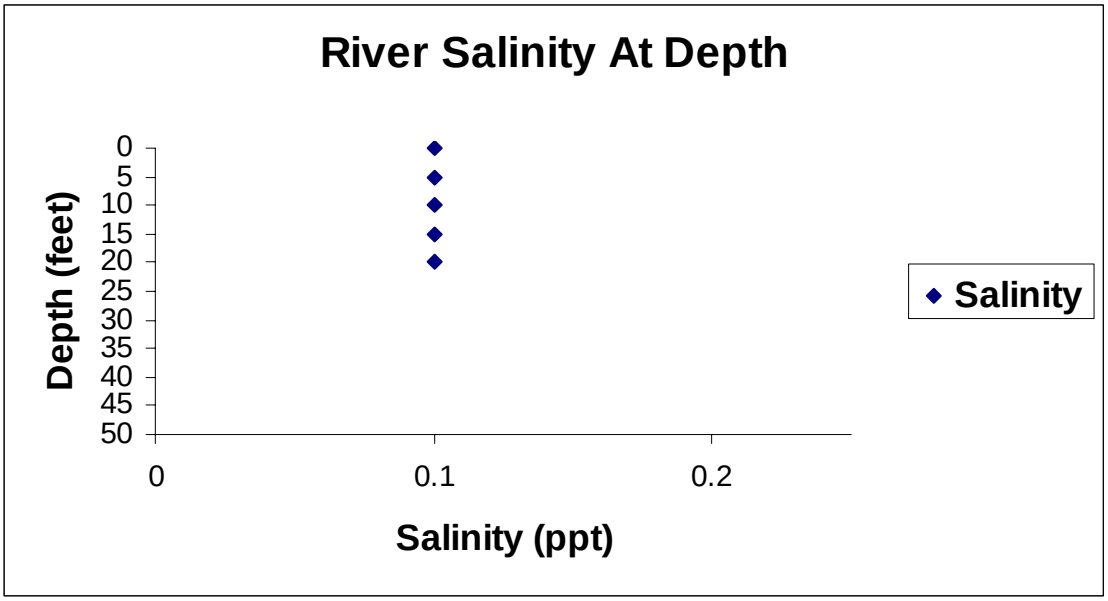


Site 6

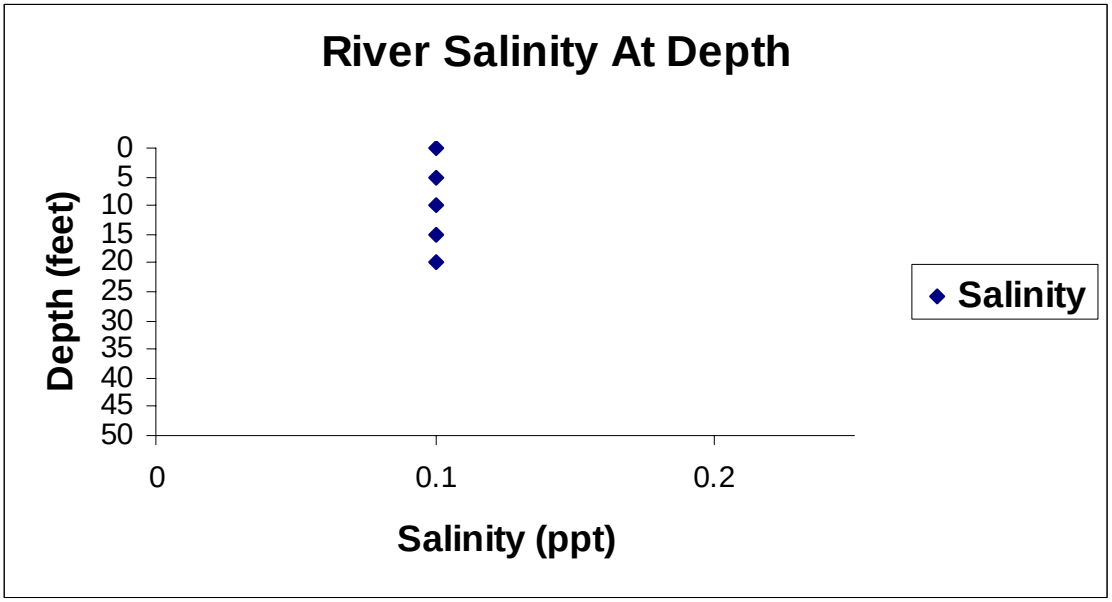


Sampling date: 10/07/2006

Site 7

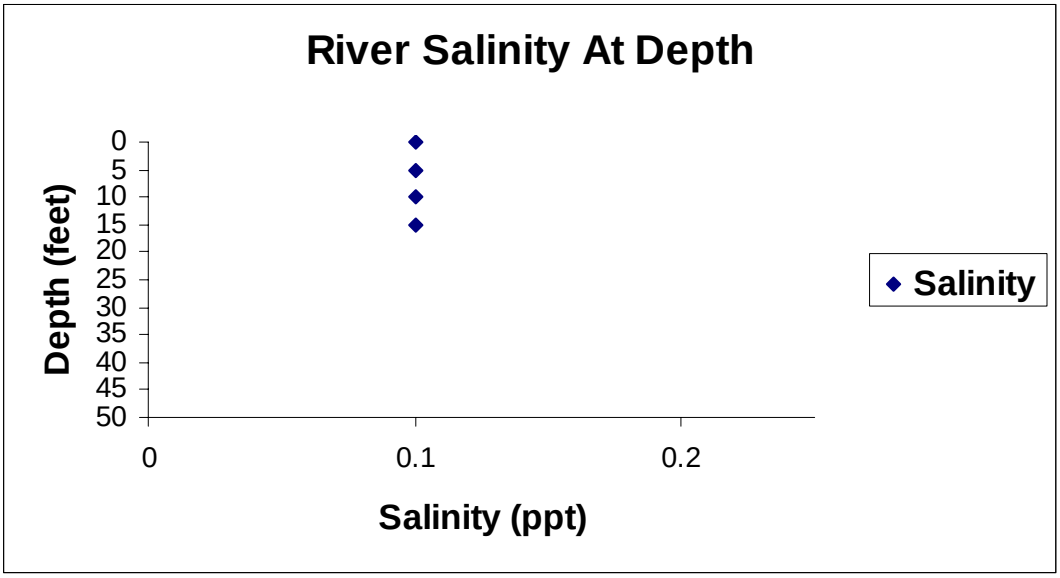


Site 8

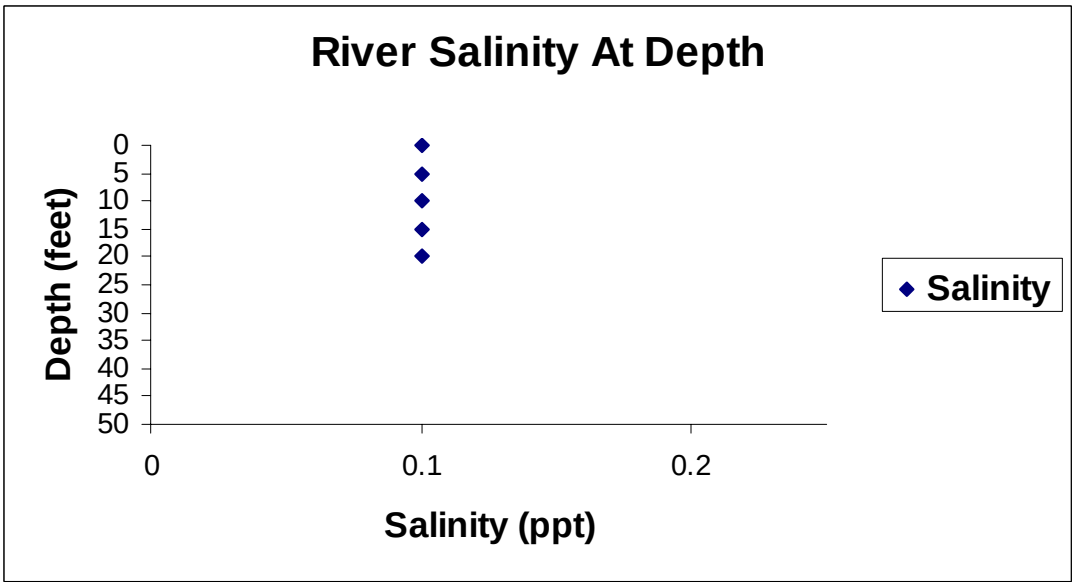


Sampling date: 10/07/2006

Site 9

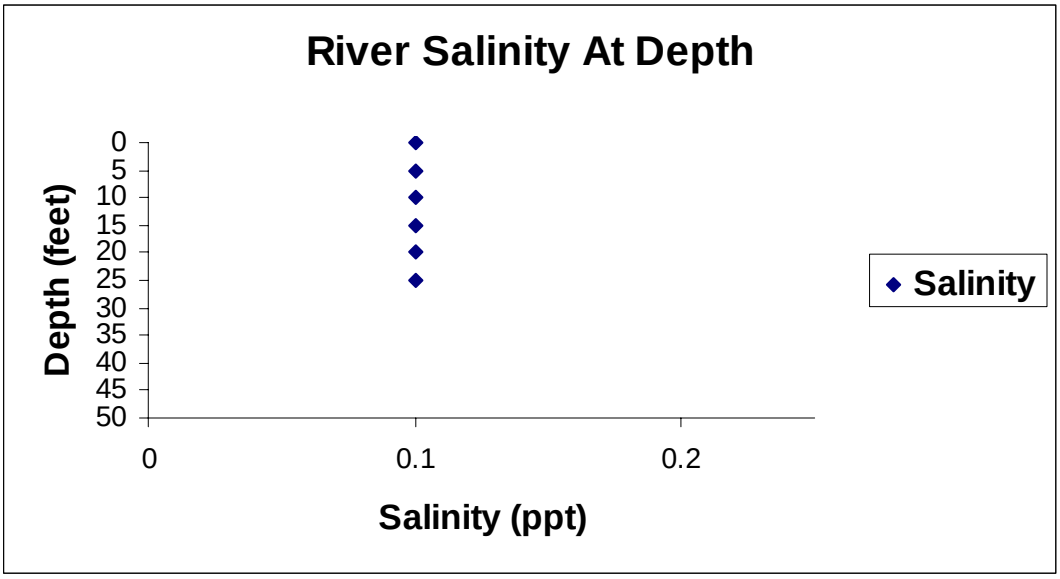


Site 10

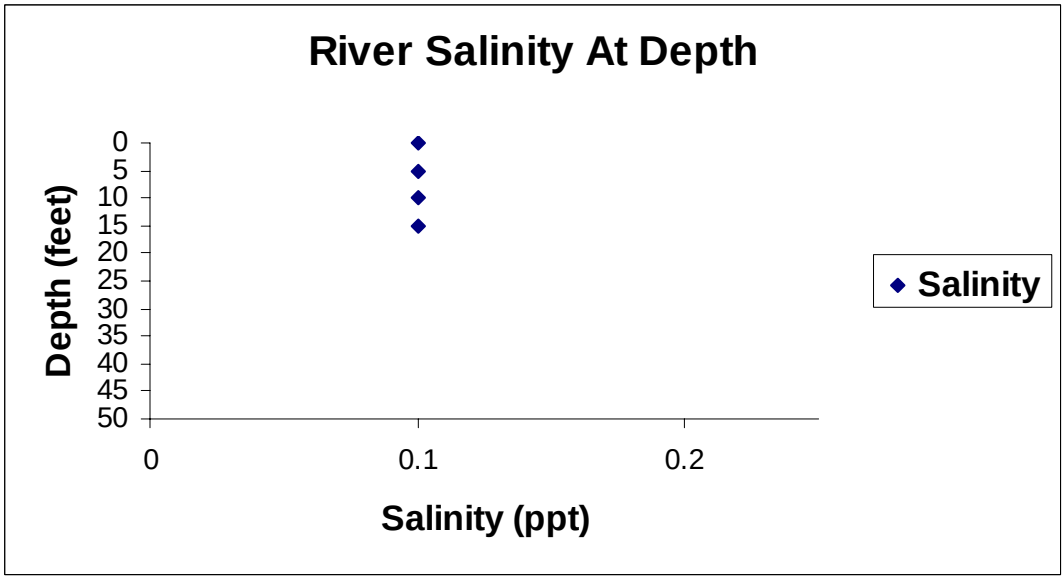


Sampling date: 10/07/2006

Site 11

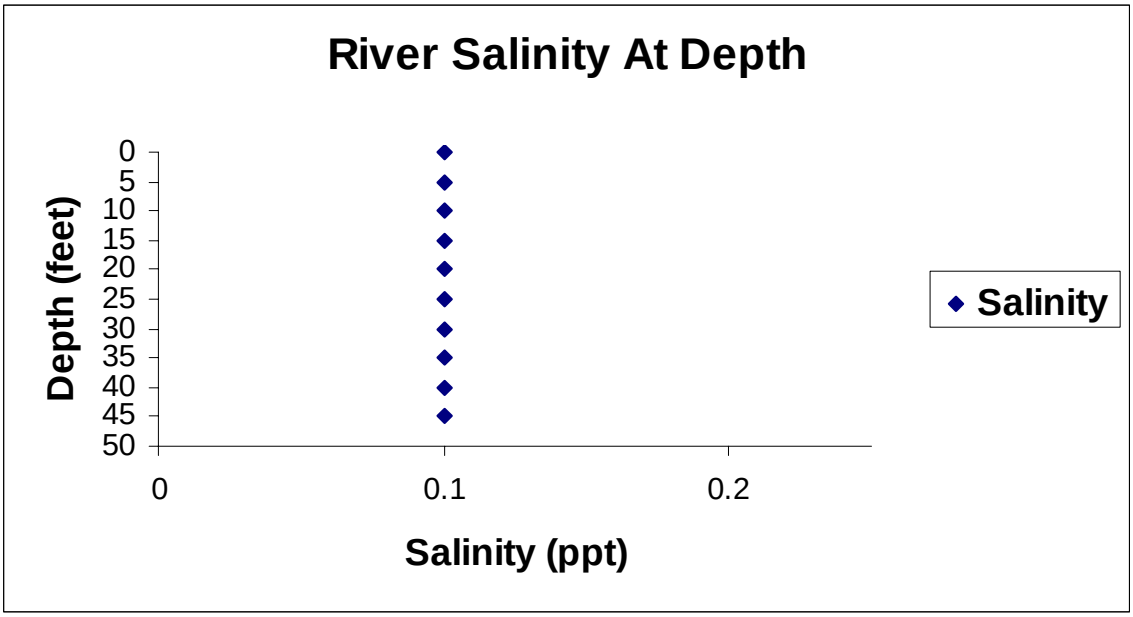


Site 12

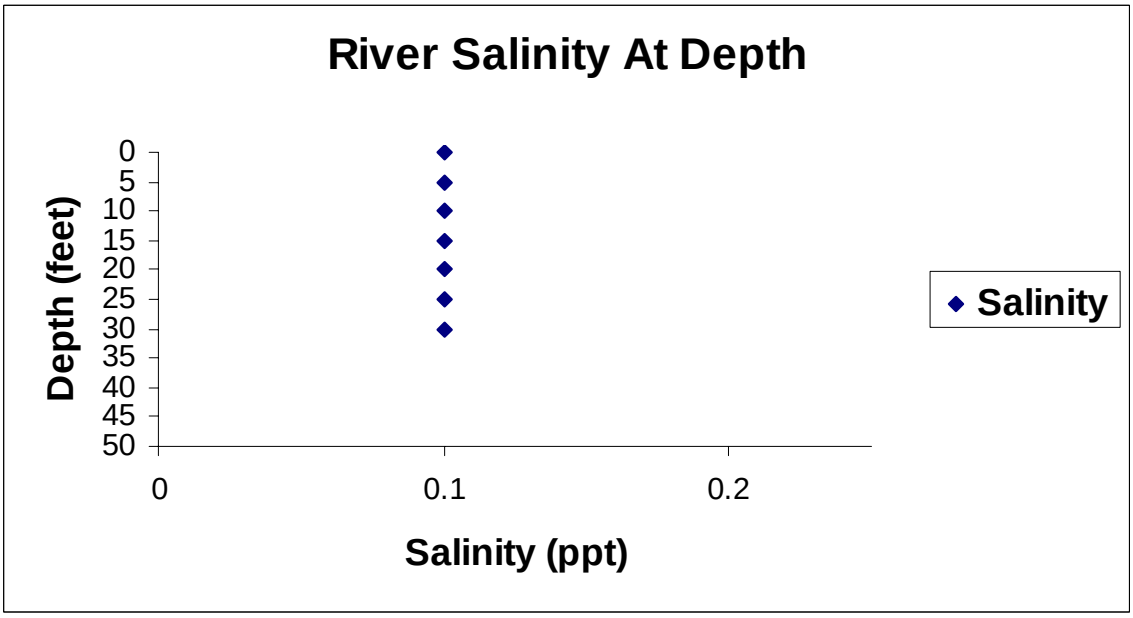


Sampling date: 10/21/2006

Site 1

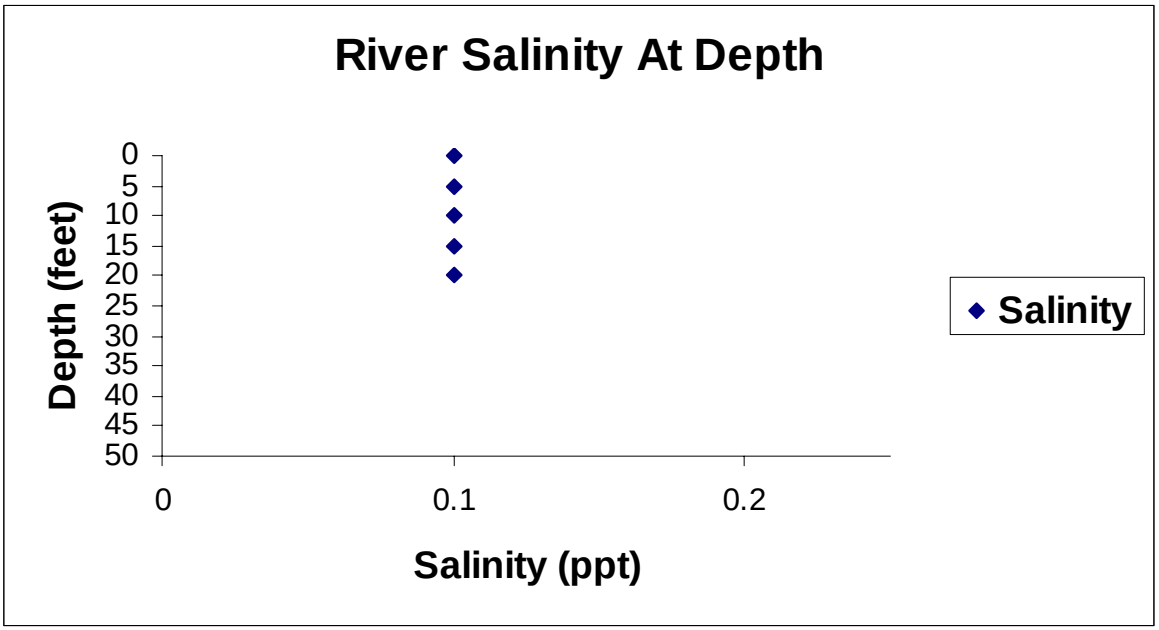


Site 2

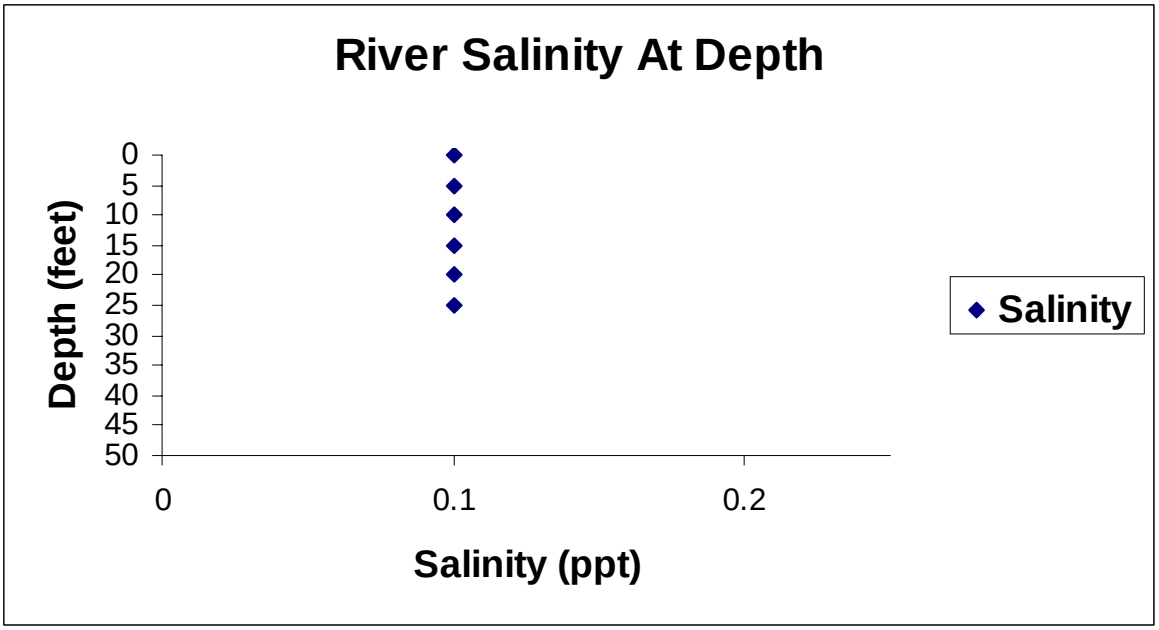


Sampling date: 10/21/2006

Site 3

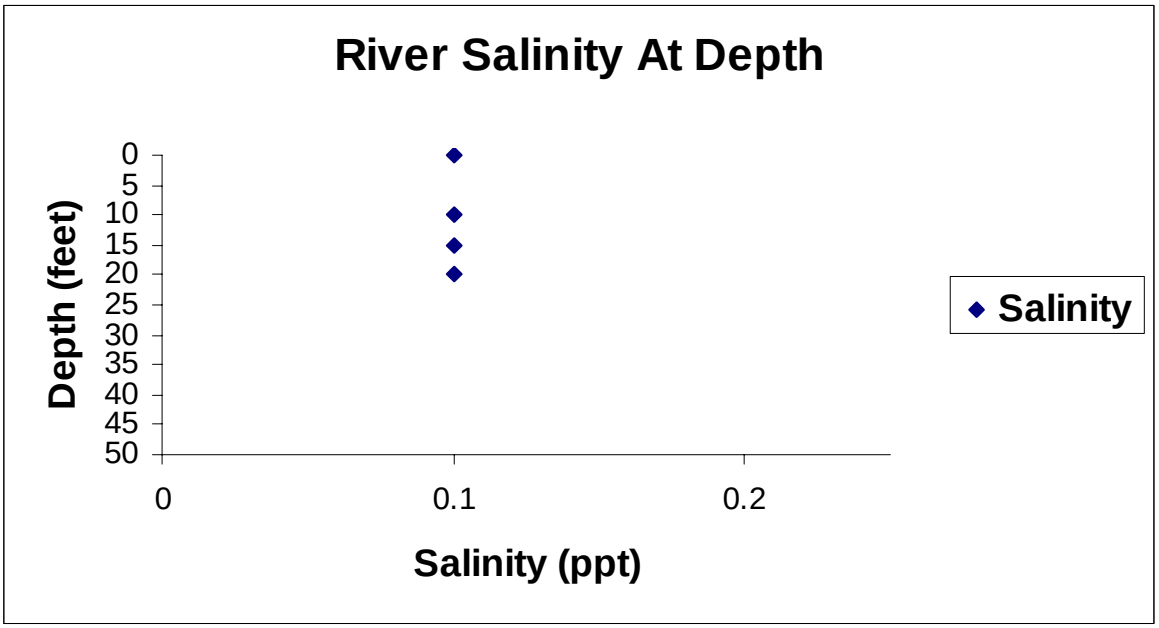


Site 4

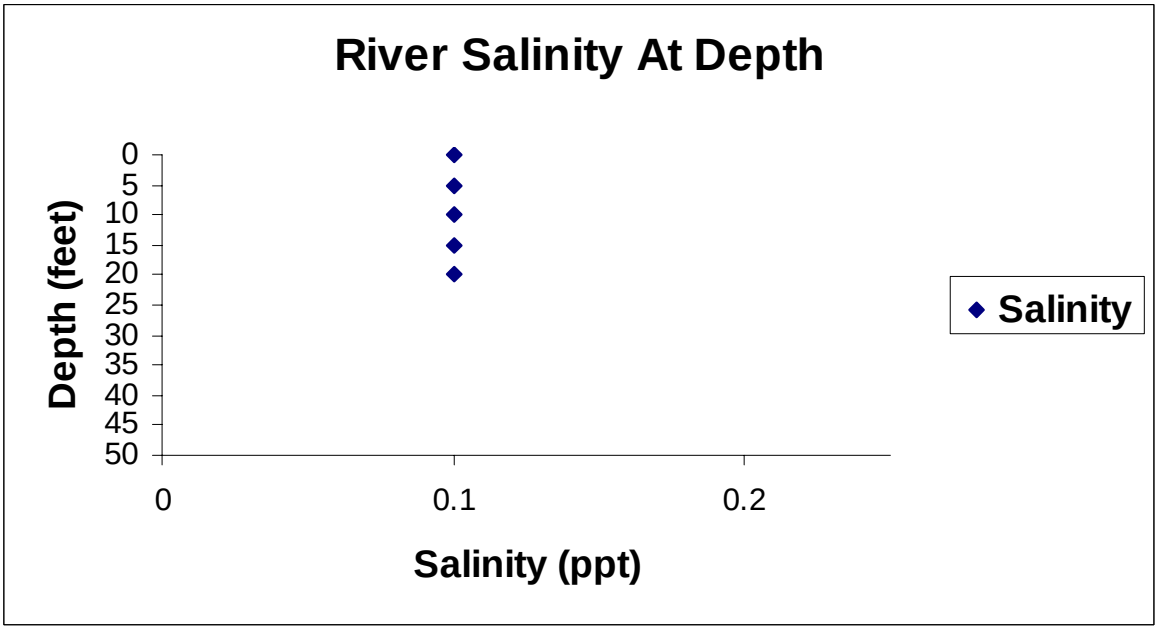


Sampling date: 10/21/2006

Site 5

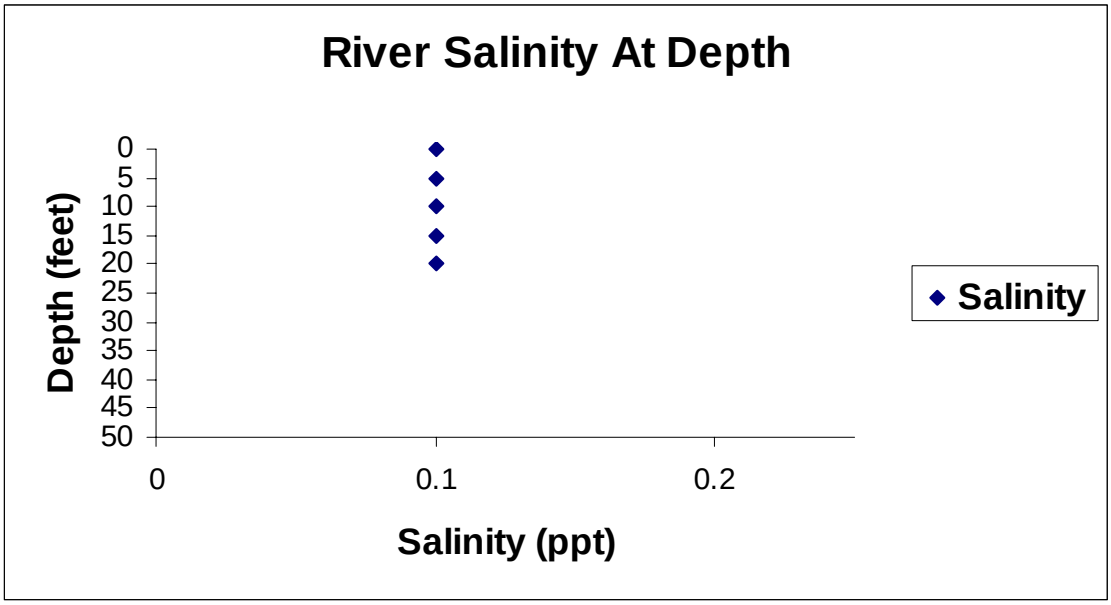


Site 6

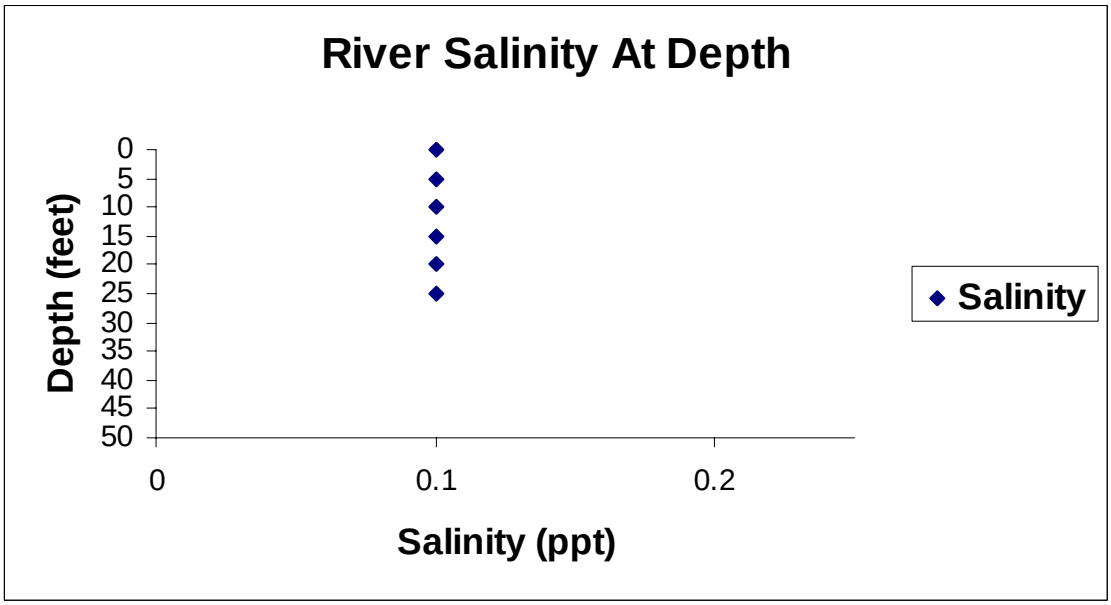


Sampling date: 10/21/2006

Site 7

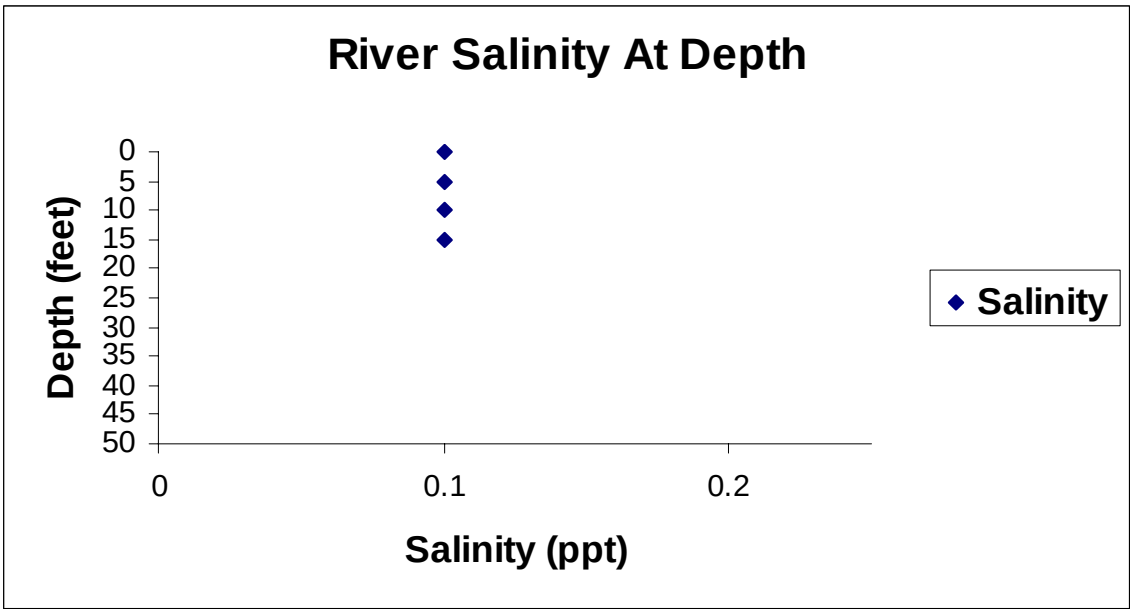


Site 8

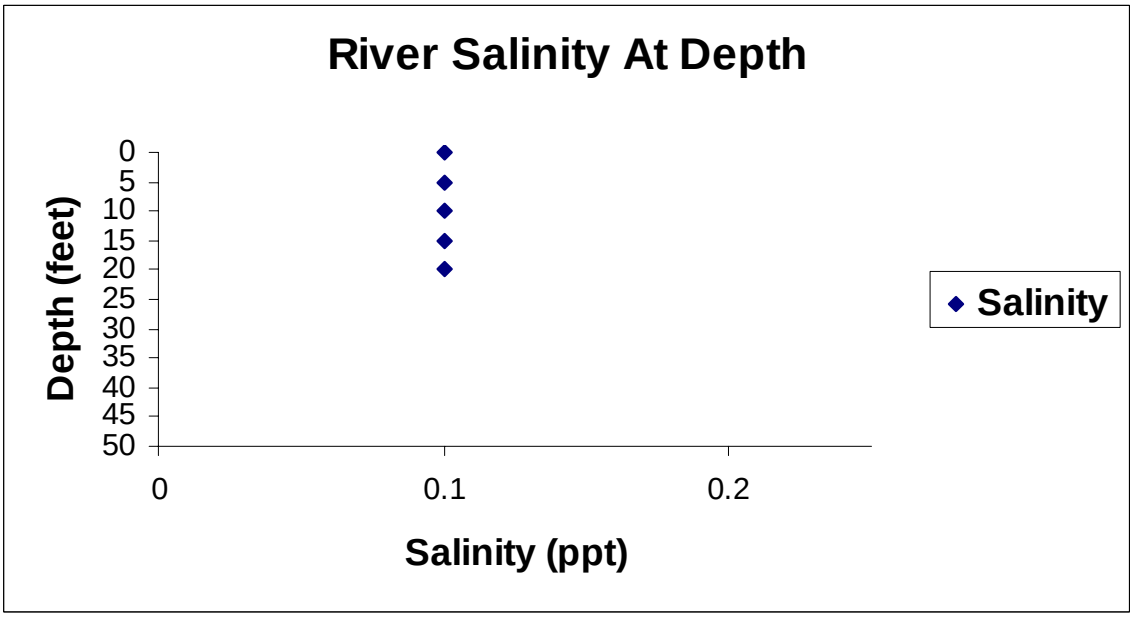


Sampling date: 10/21/2006

Site 9

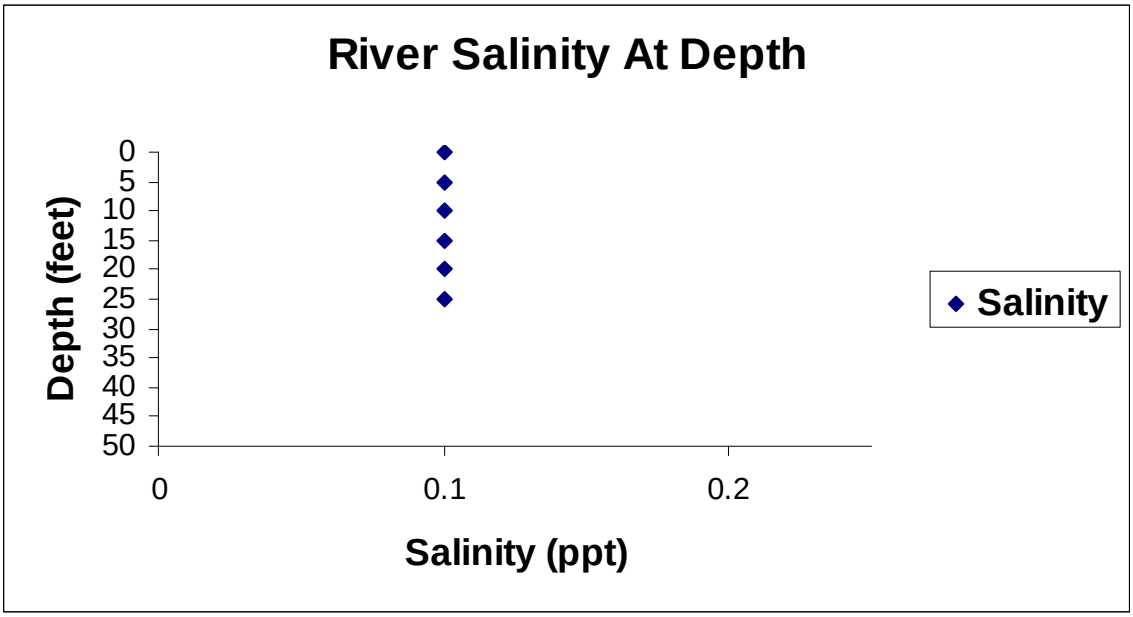


Site 10

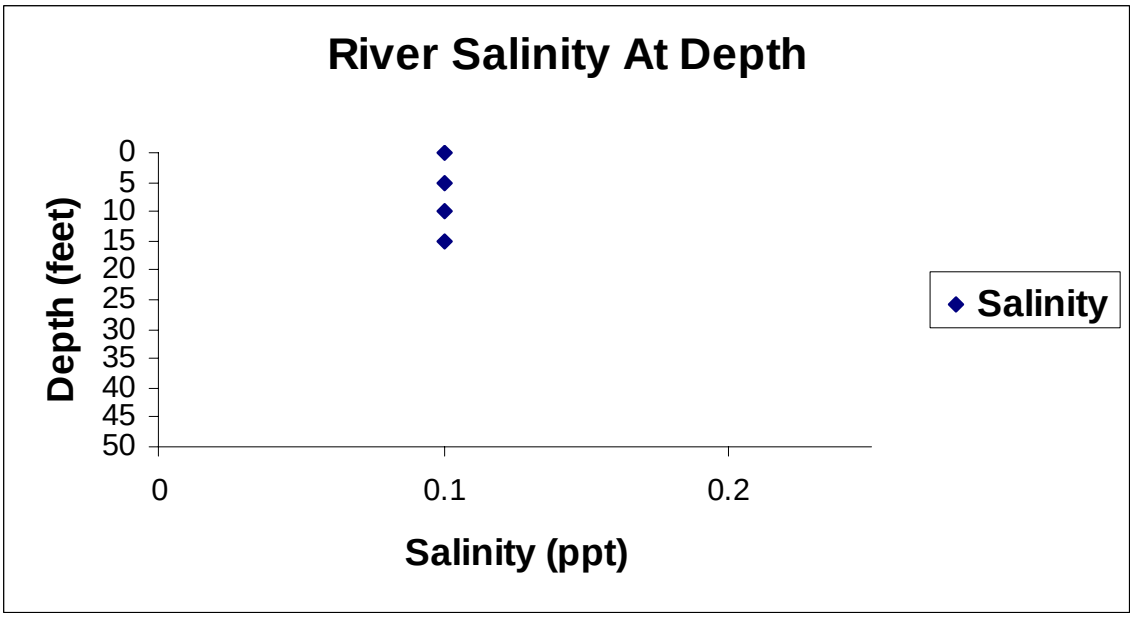


Sampling date: 10/21/2006

Site 11

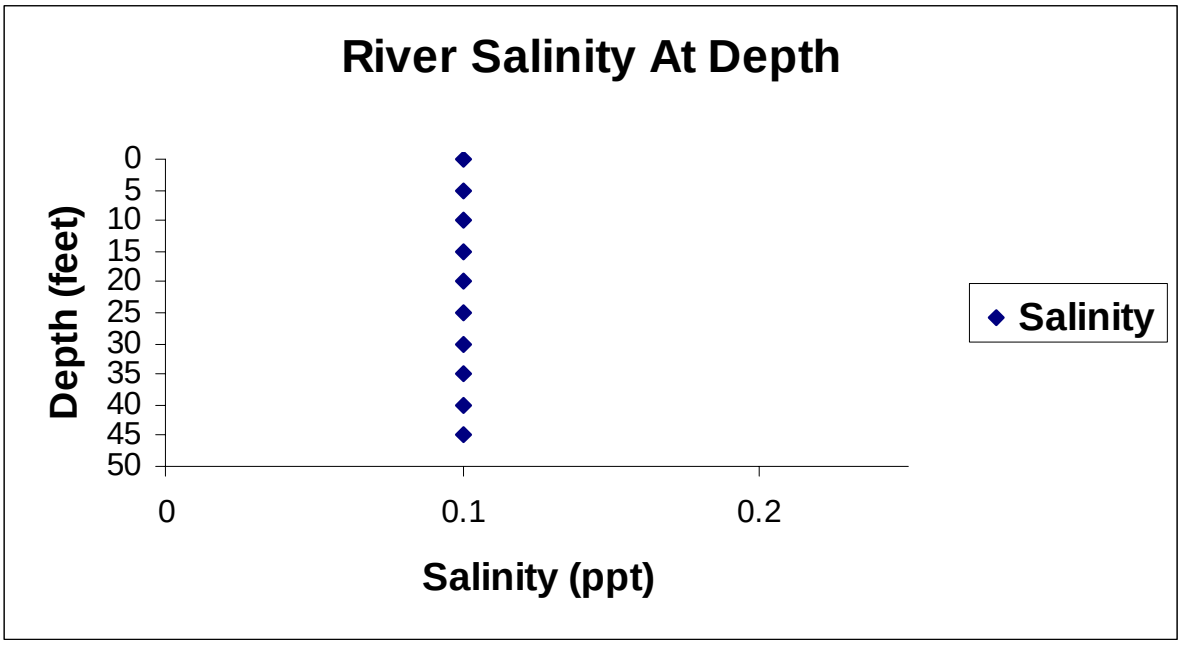


Site 12

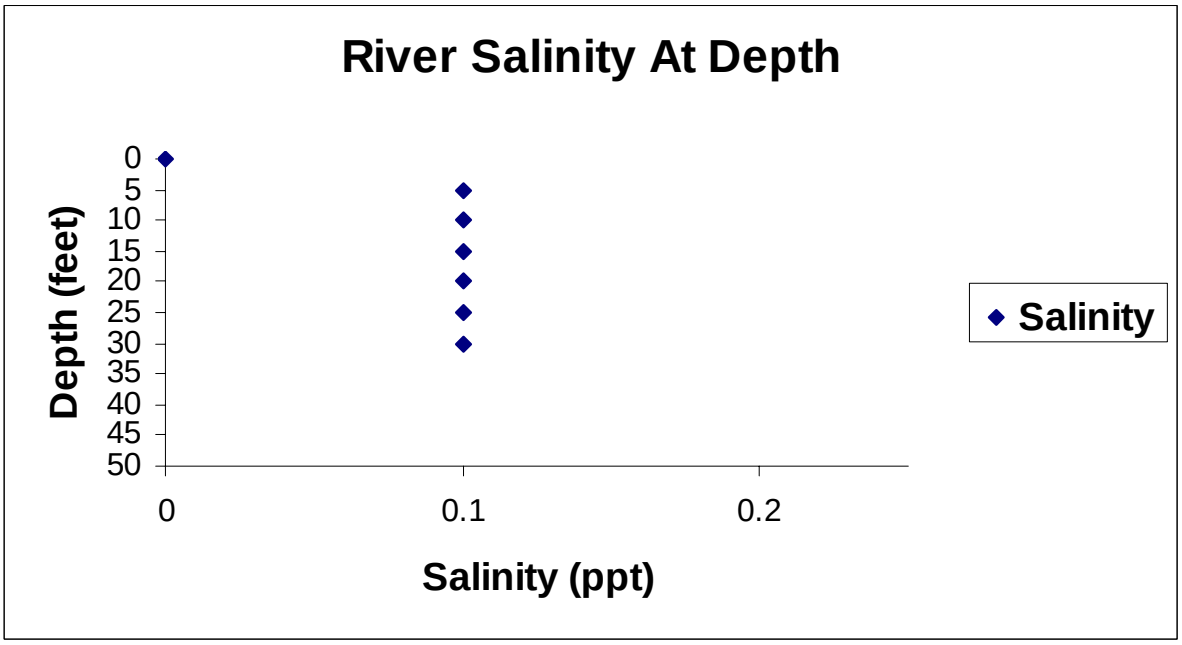


Sampling date: 12/16/2006

Site 1

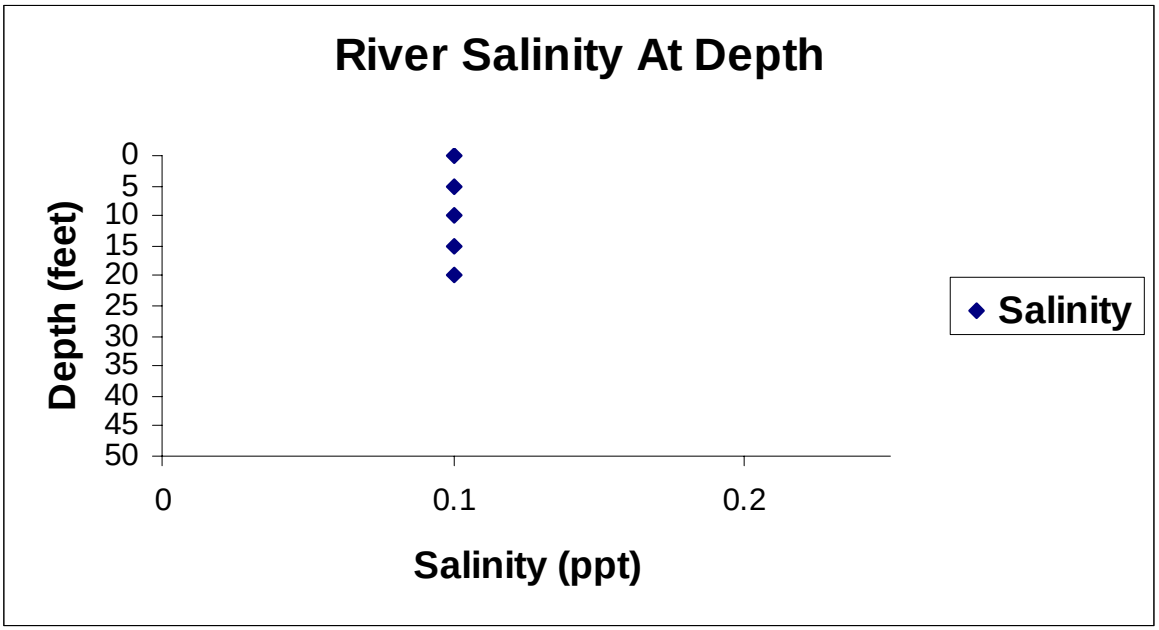


Site 2

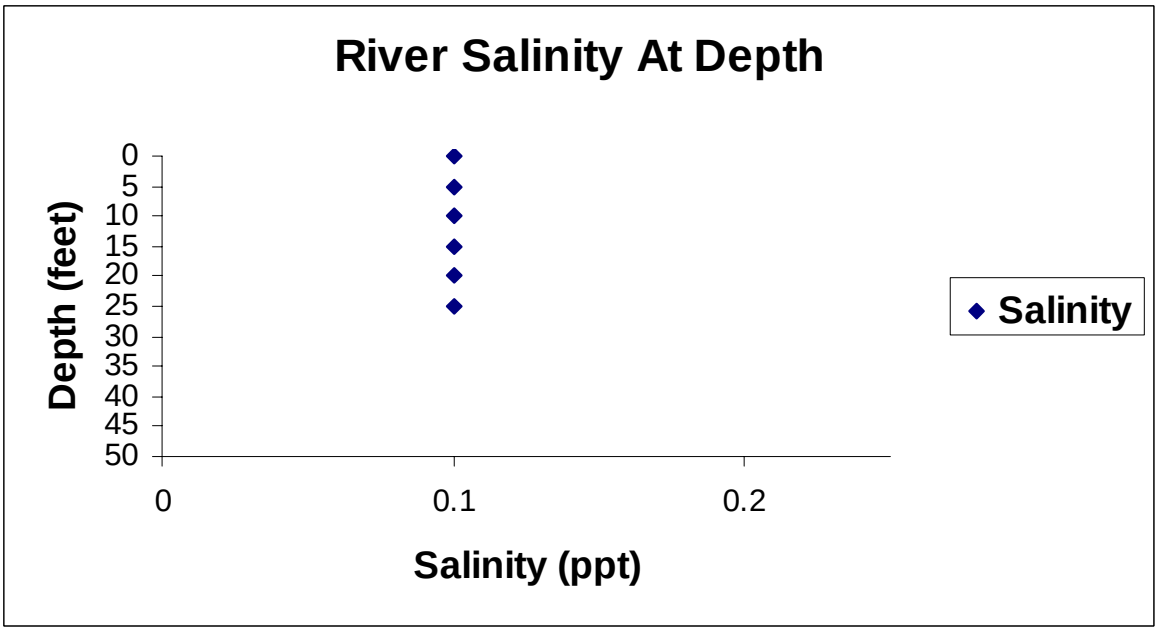


Sampling date: 12/16/2006

Site 3

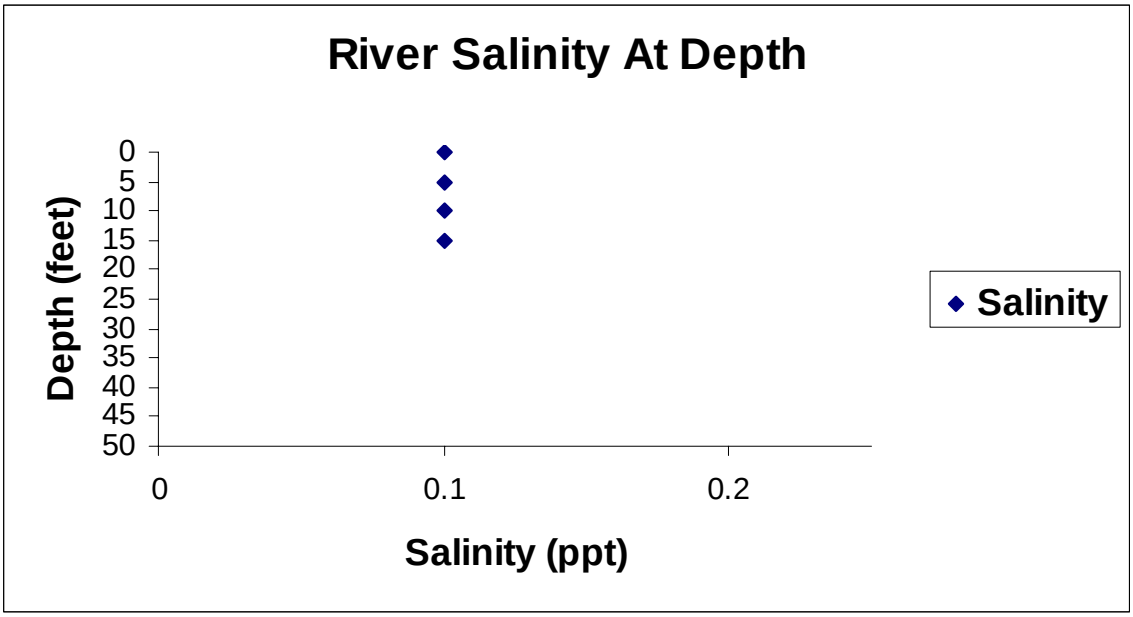


Site 4

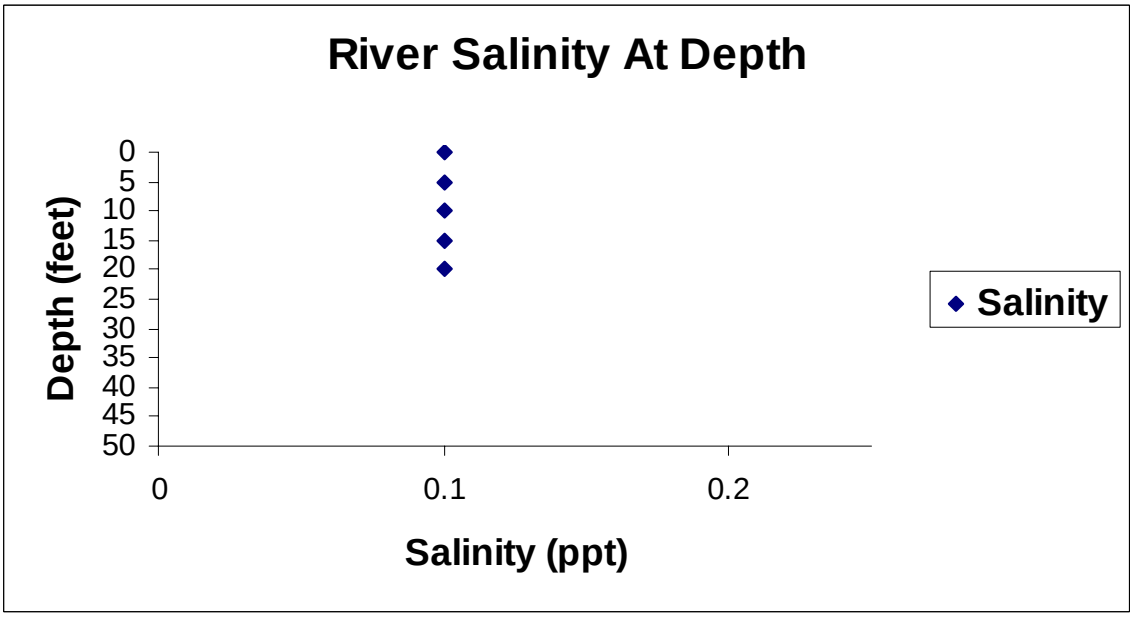


Sampling date: 12/16/2006

Site 5

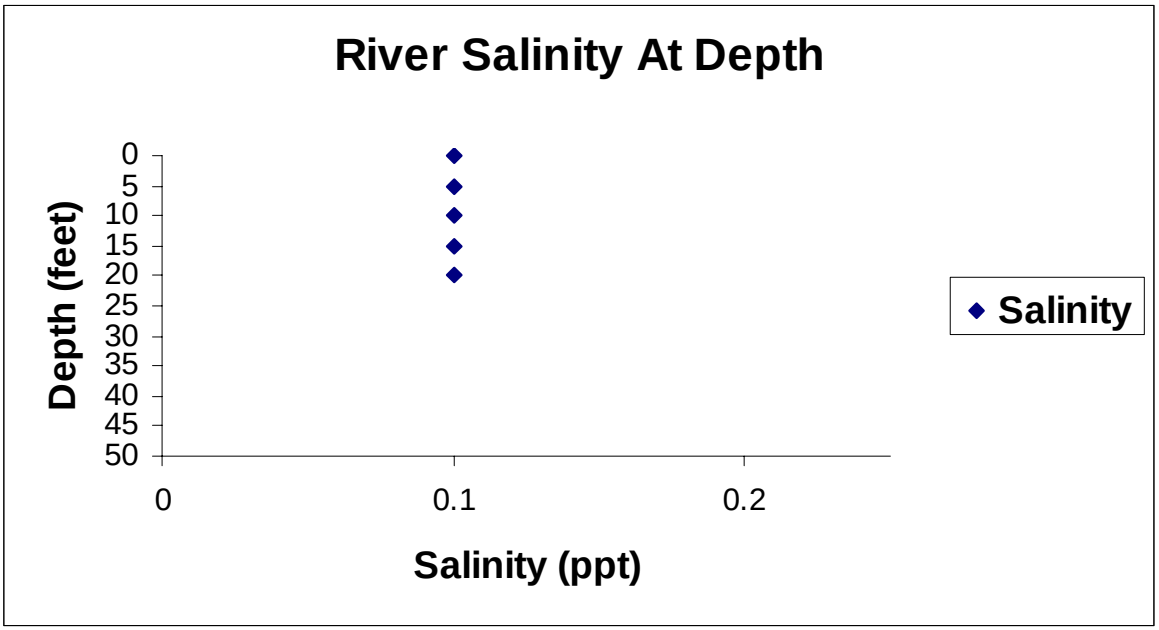


Site 6

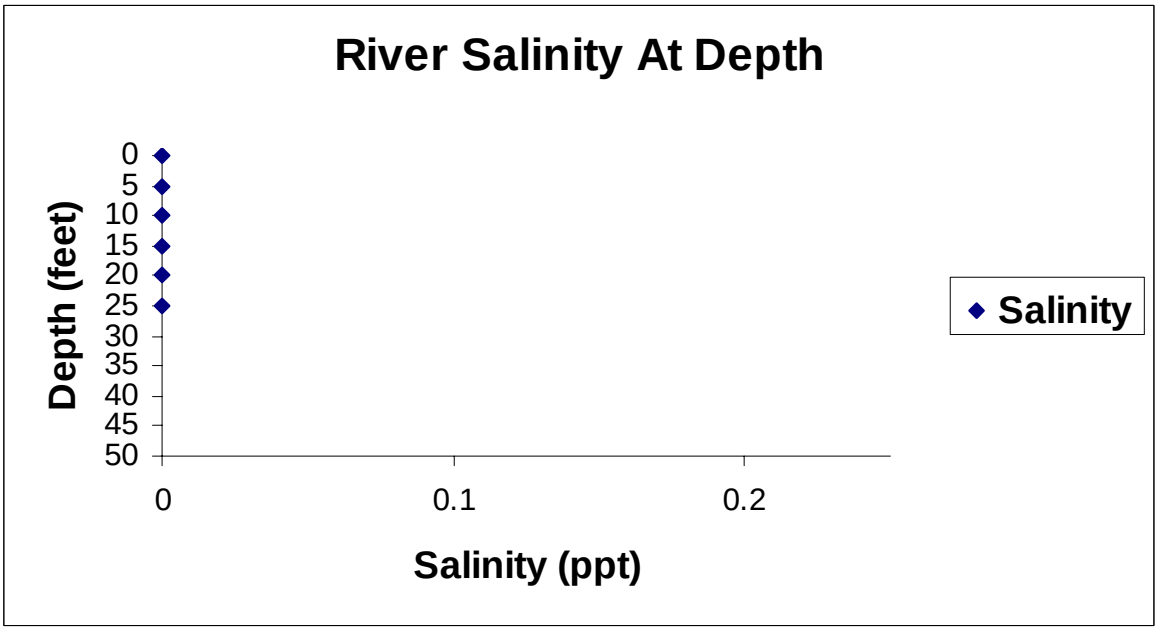


Sampling date: 12/16/2006

Site 7

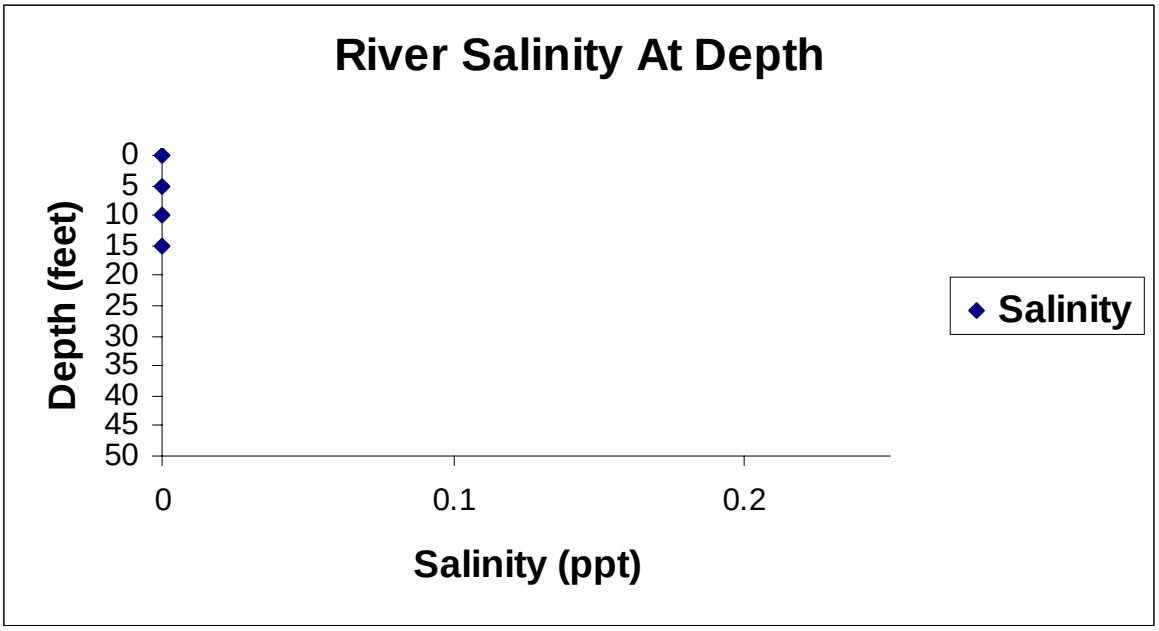


Site 8

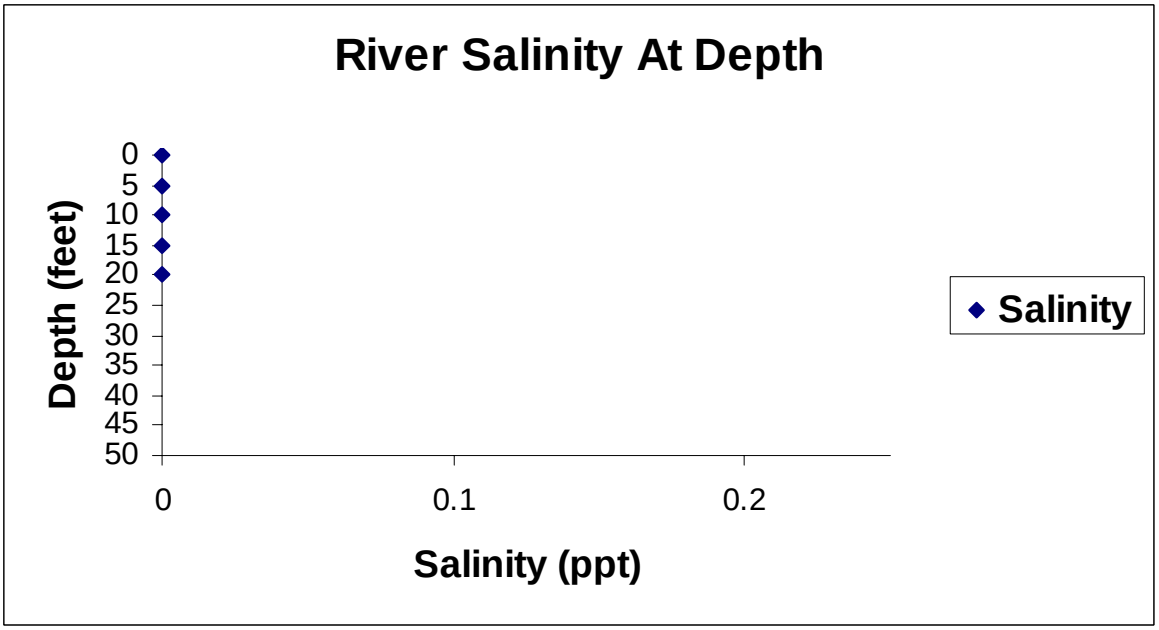


Sampling date: 12/16/2006

Site 9

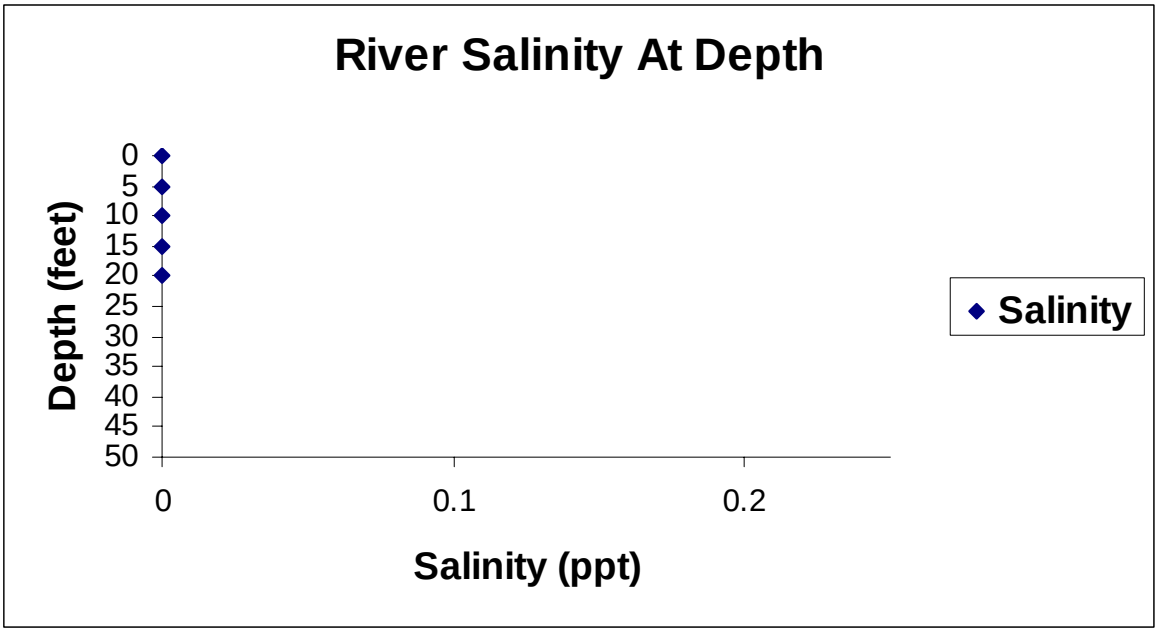


Site 10

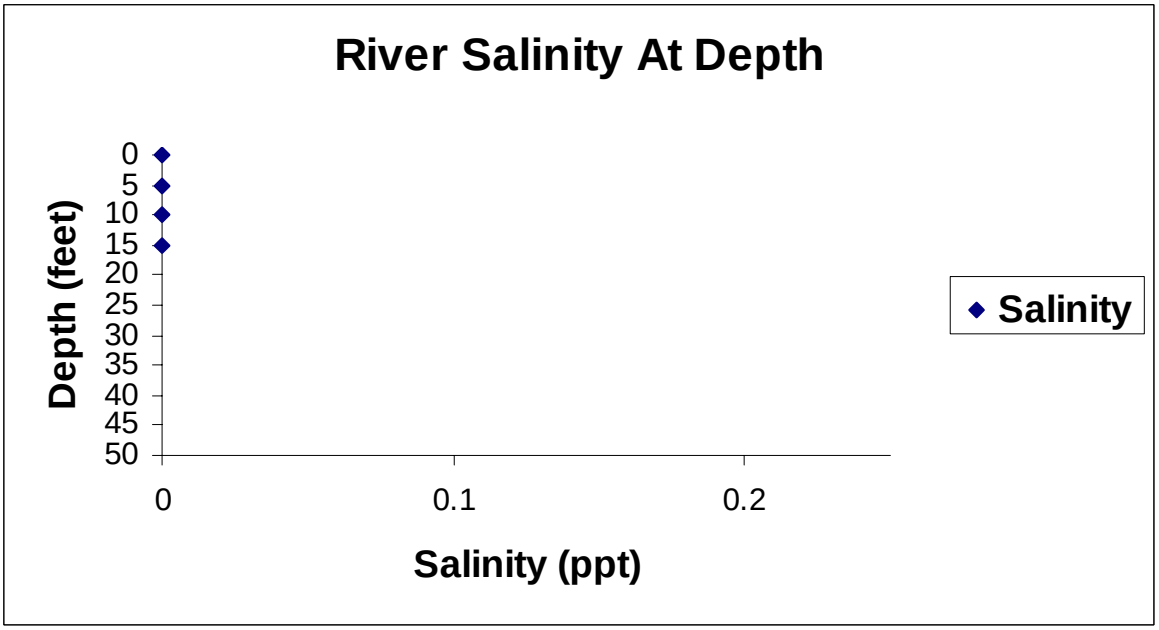


Sampling date: 12/16/2006

Site 11

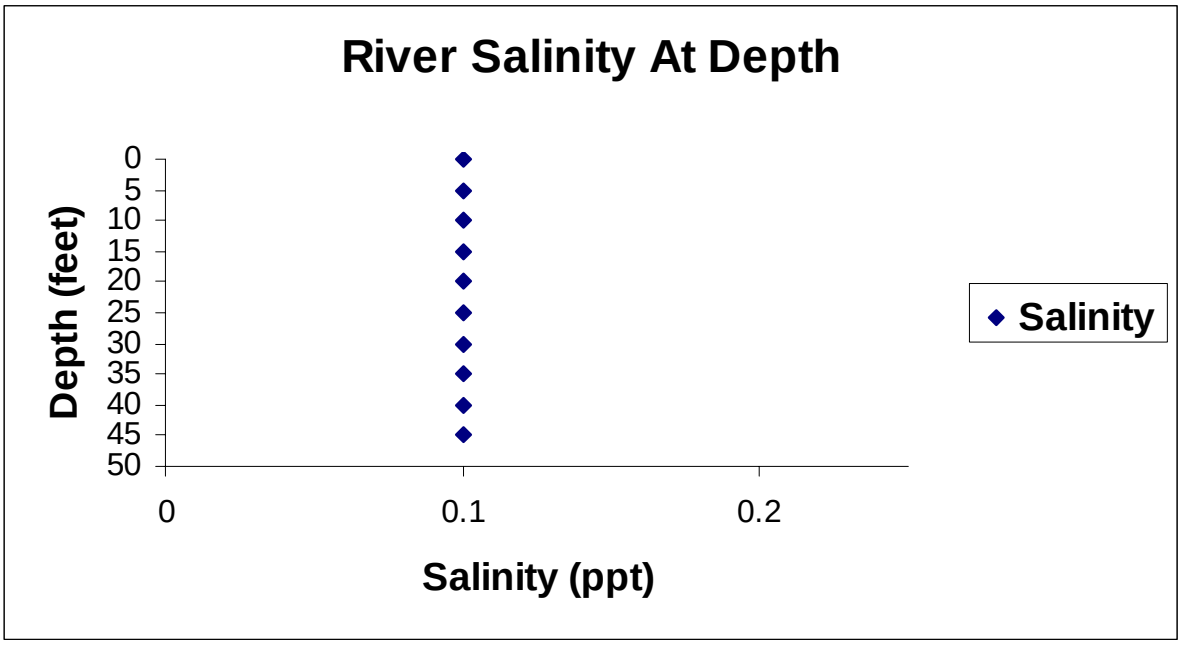


Site 12

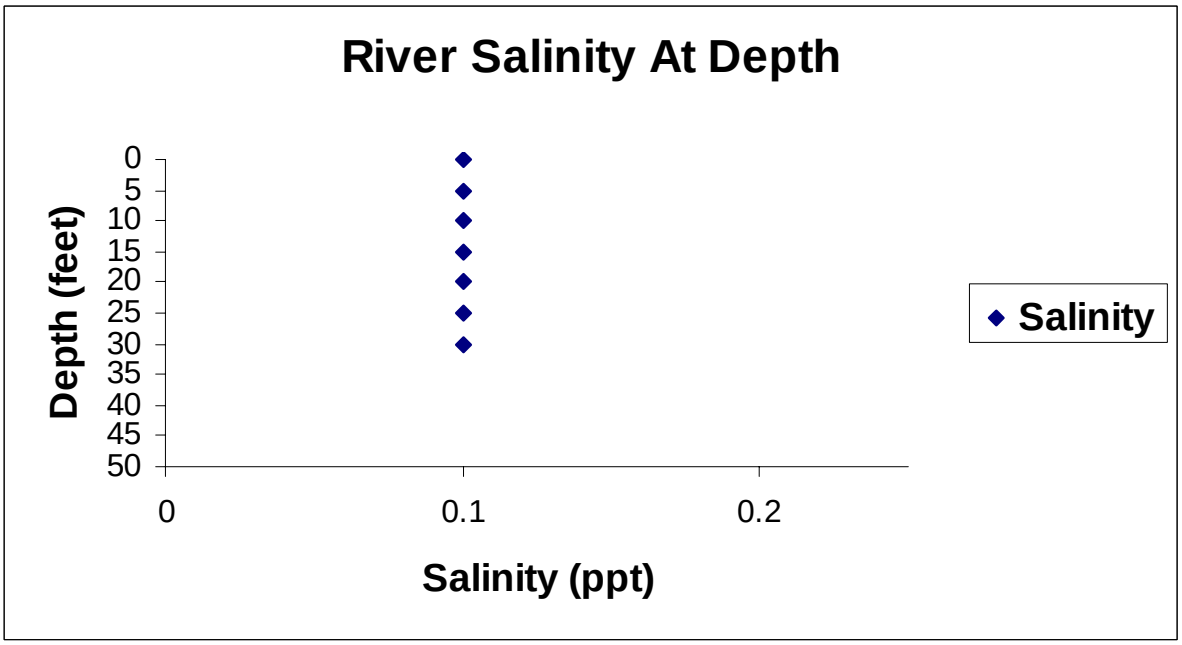


Sampling date: 12/19/2006

Site 1

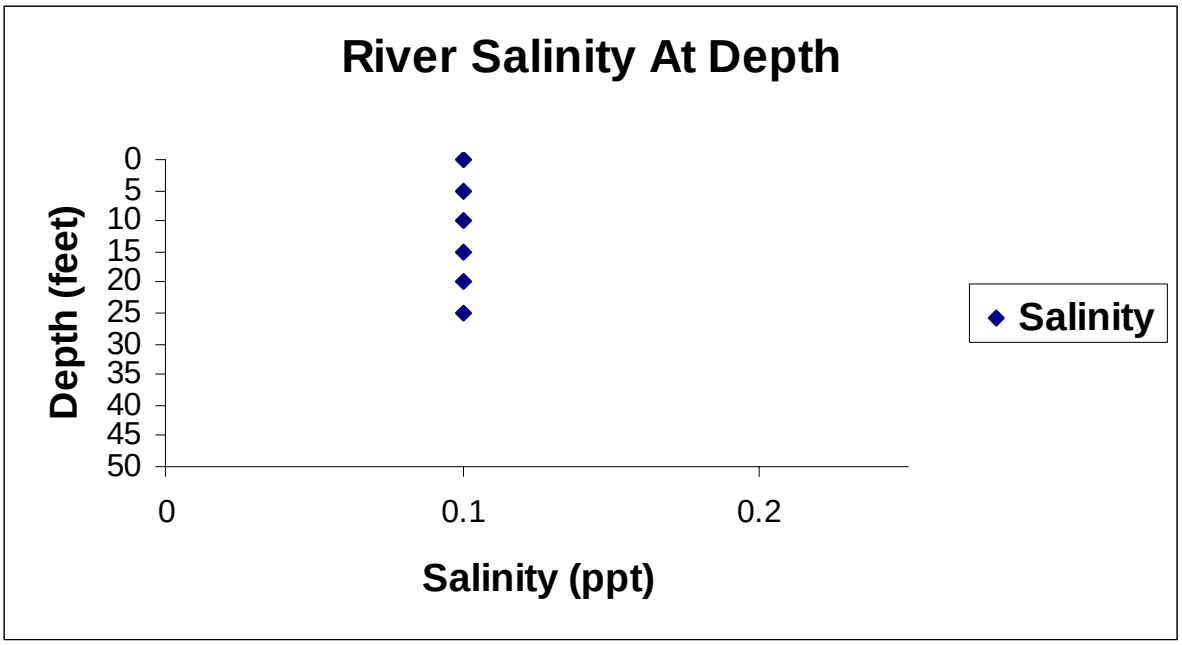


Site 2

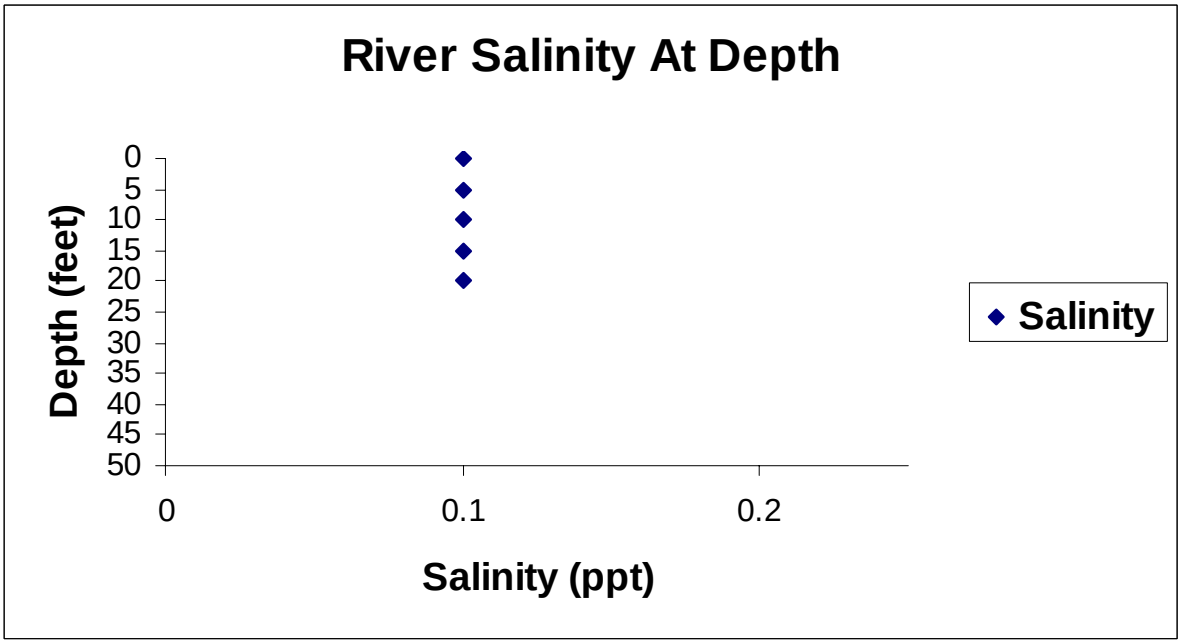


Sampling date: 12/19/2006

Site 3

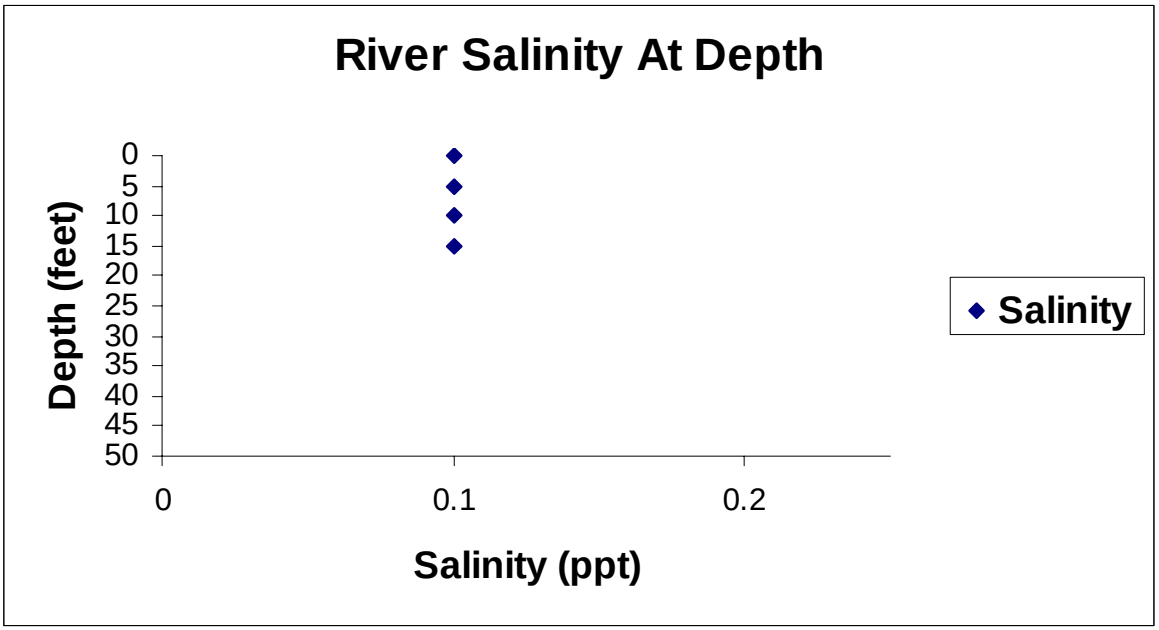


Site 4

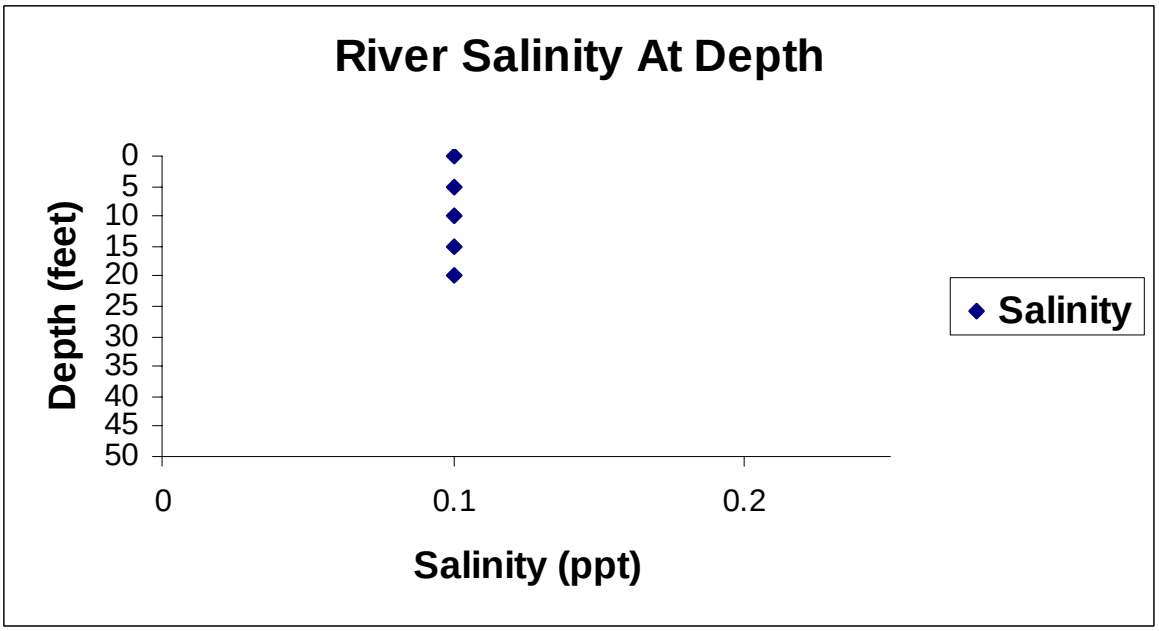


Sampling date: 12/19/2006

Site 5

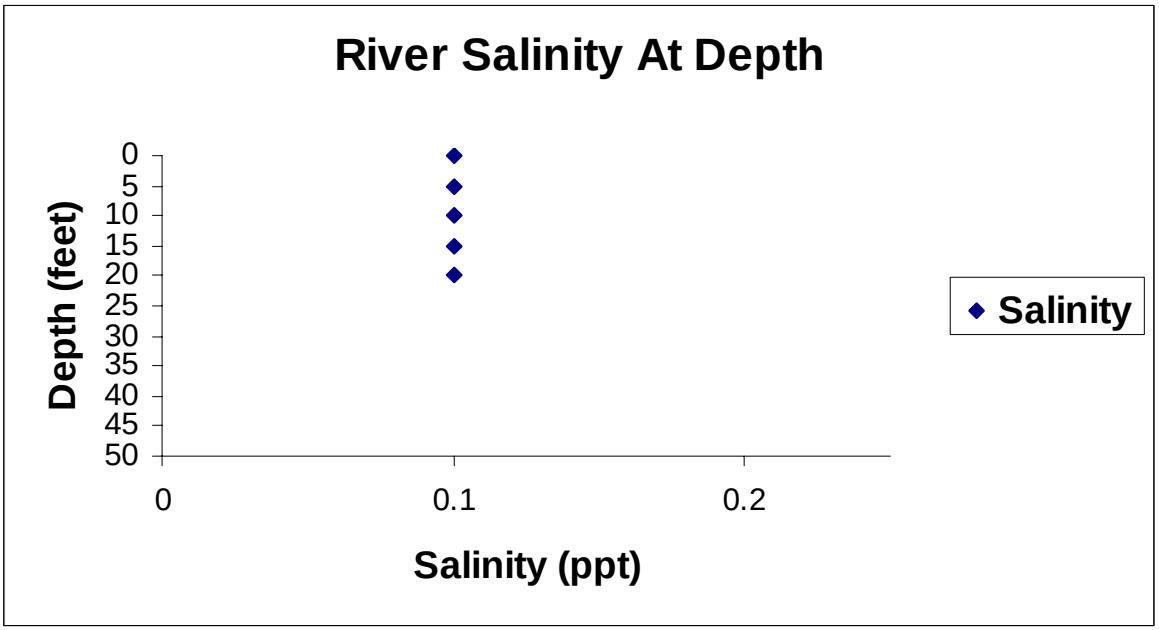


Site 6

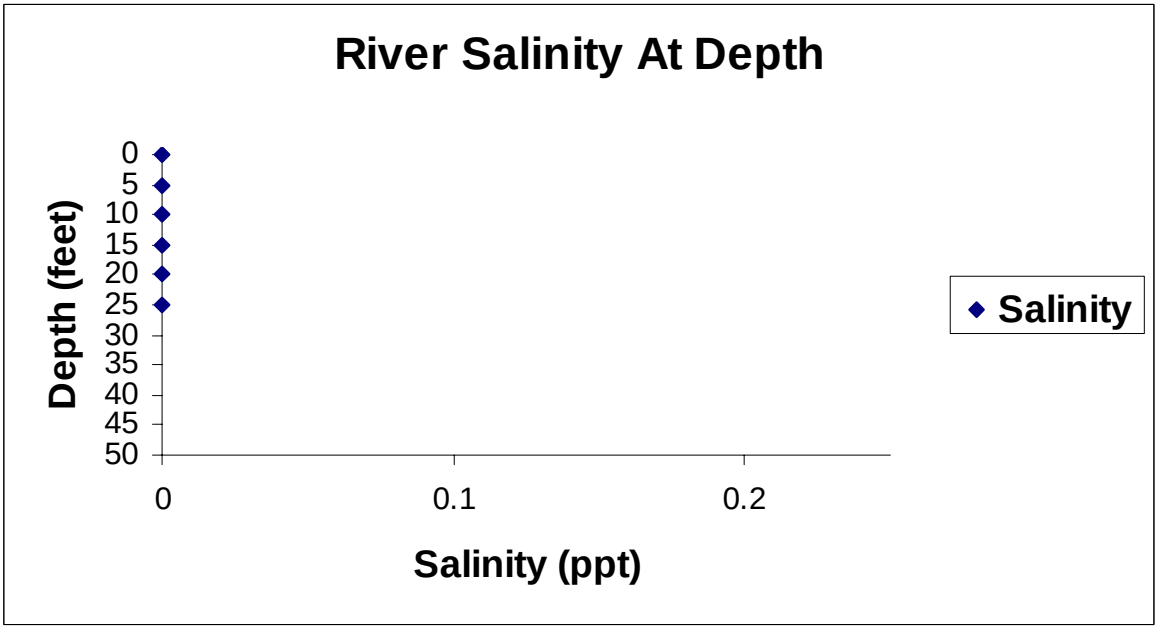


Sampling date: 12/19/2006

Site 7

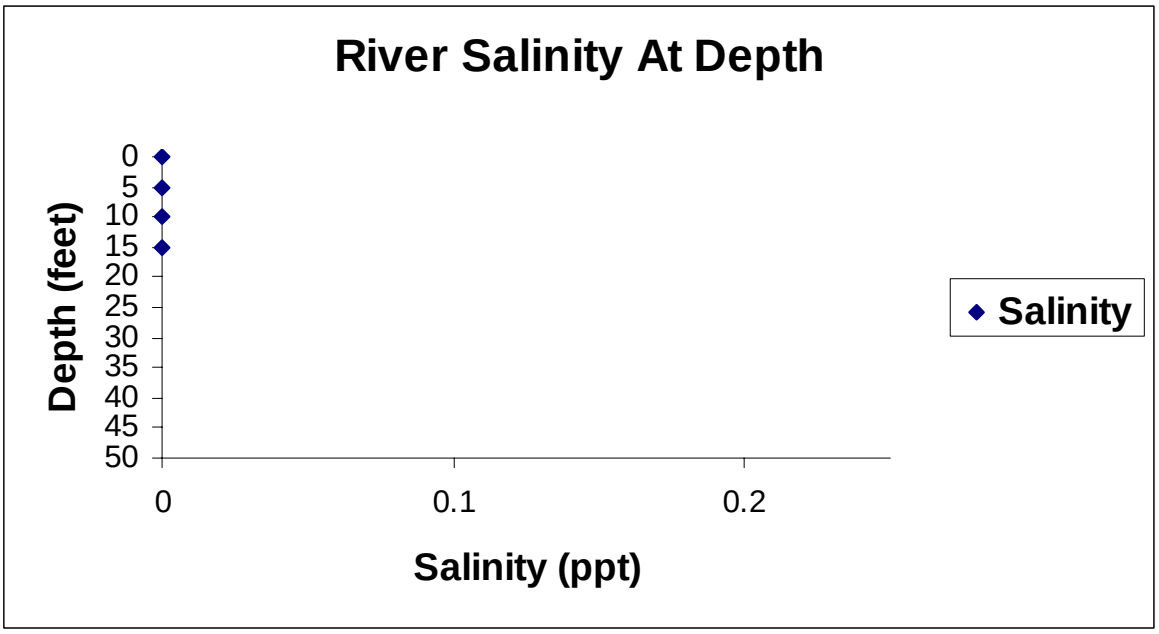


Site 8

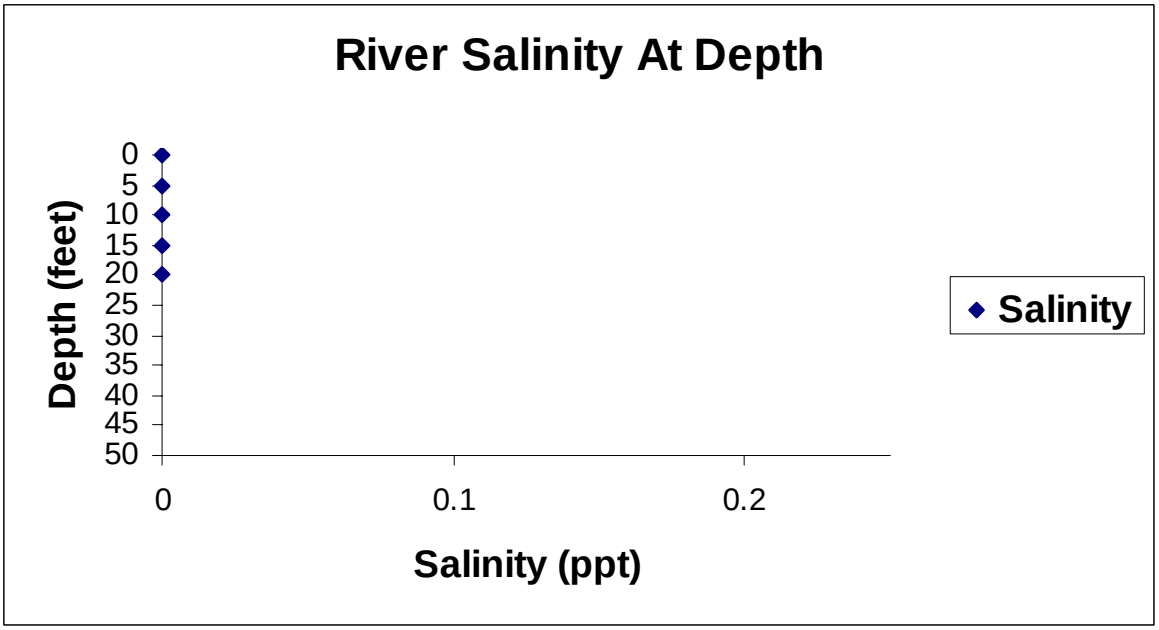


Sampling date: 12/19/2006

Site 9

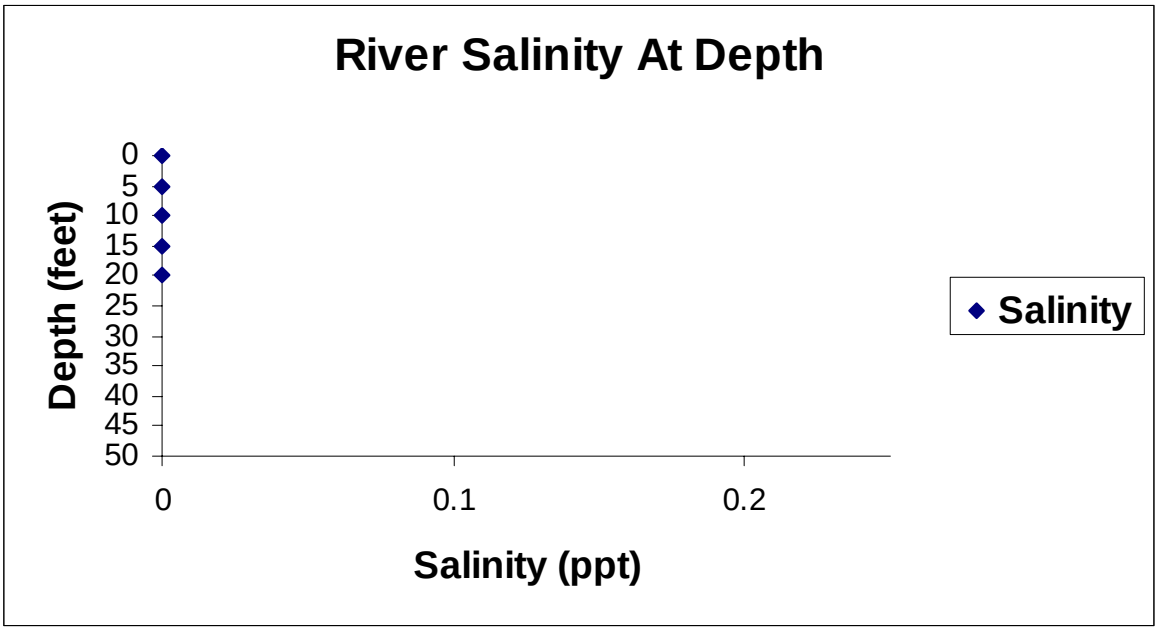


Site 10

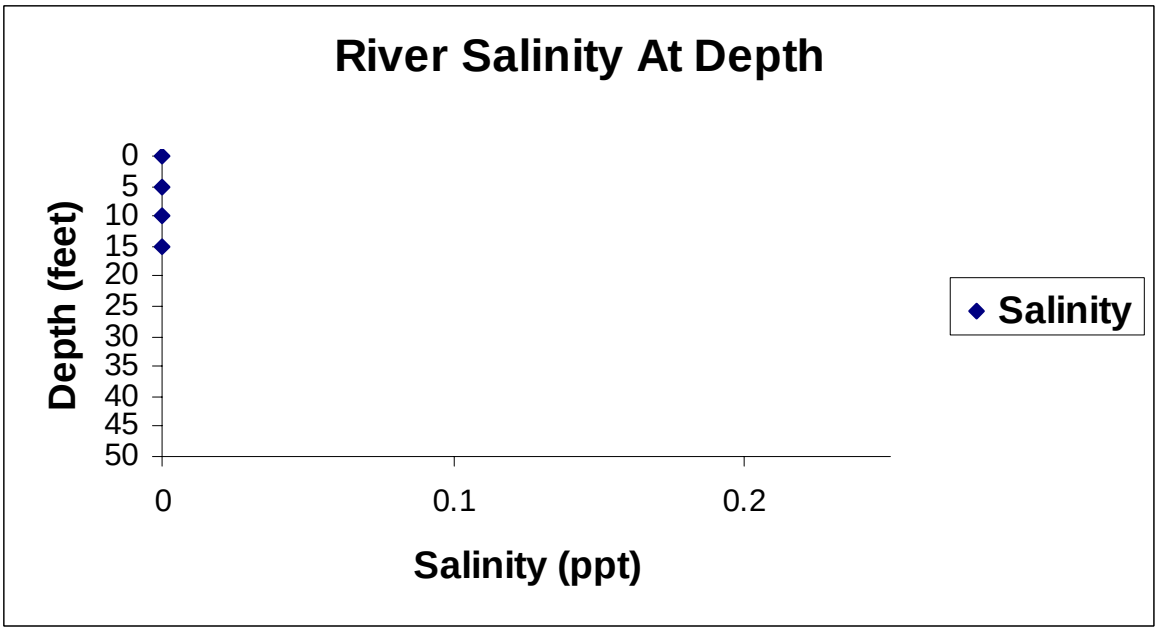


Sampling date: 12/19/2006

Site 11

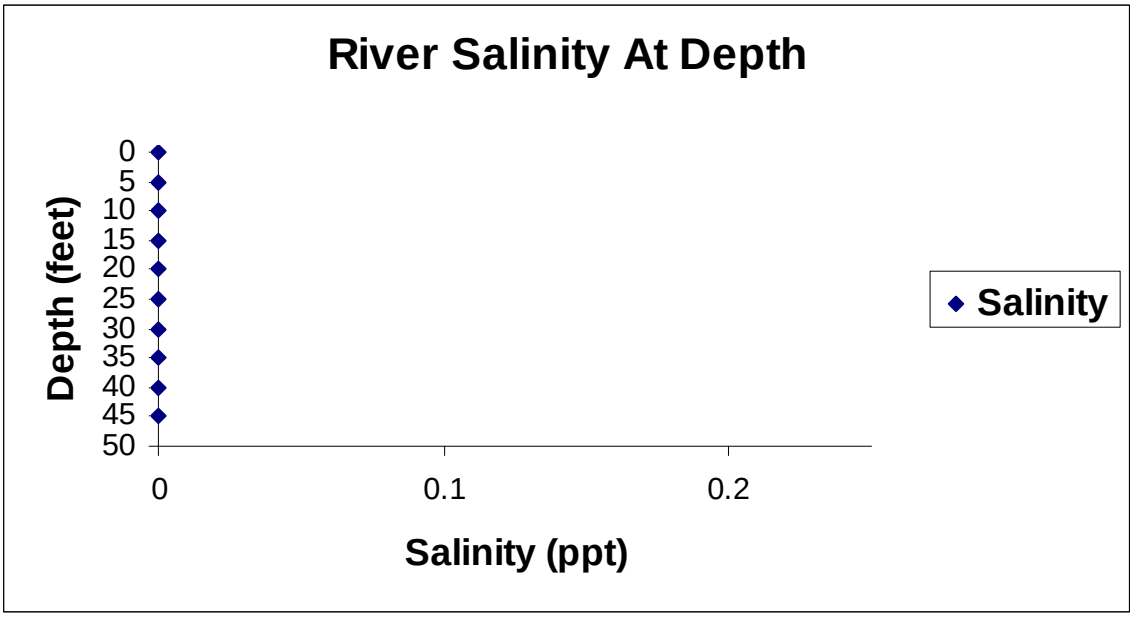


Site 12

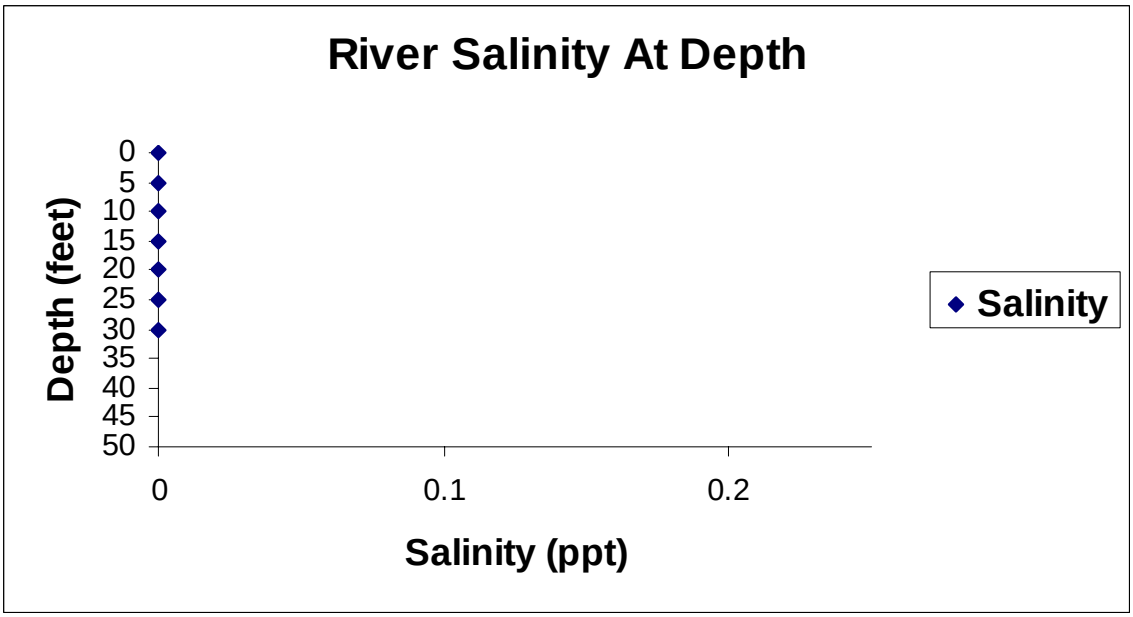


Sampling date: 1/06/2007

Site 1

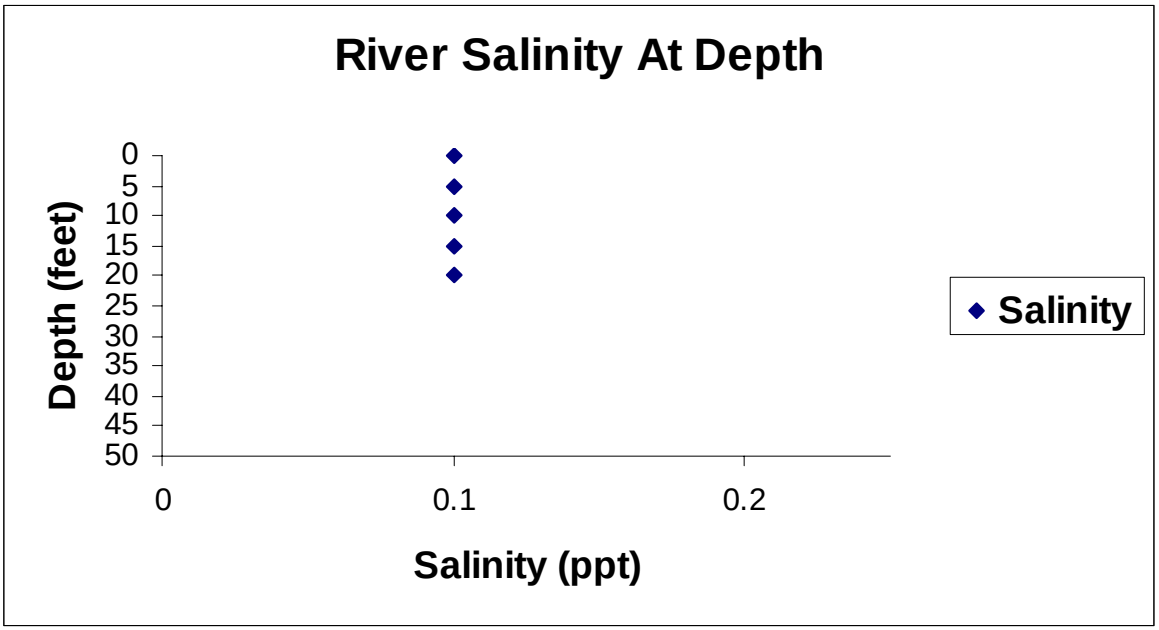


Site 2

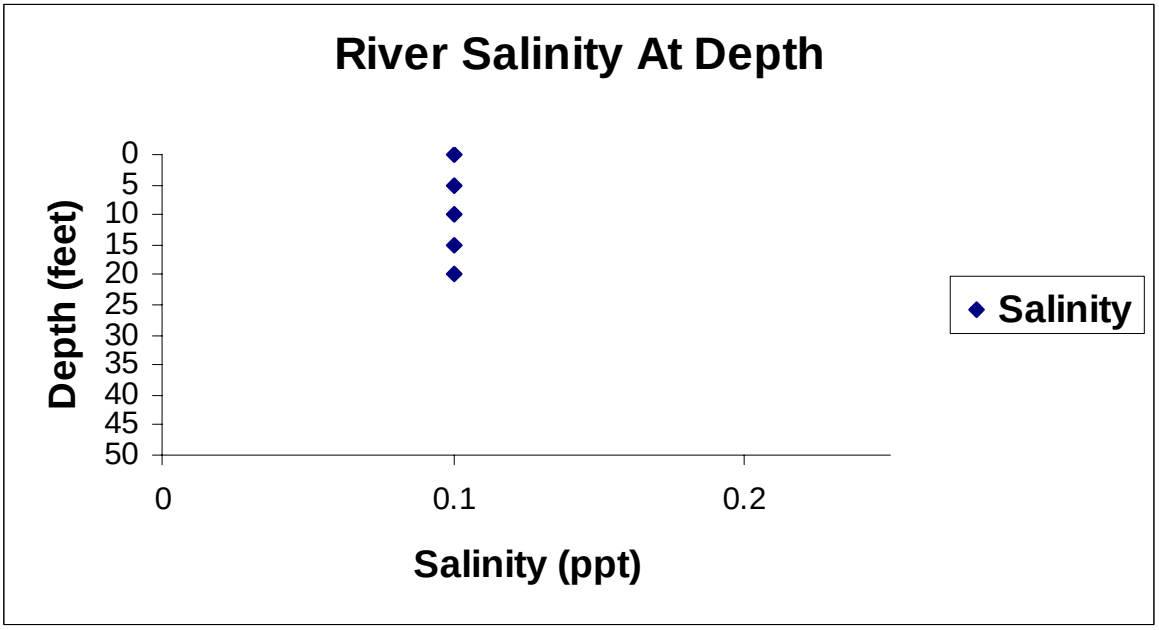


Sampling date: 1/06/2007

Site 3

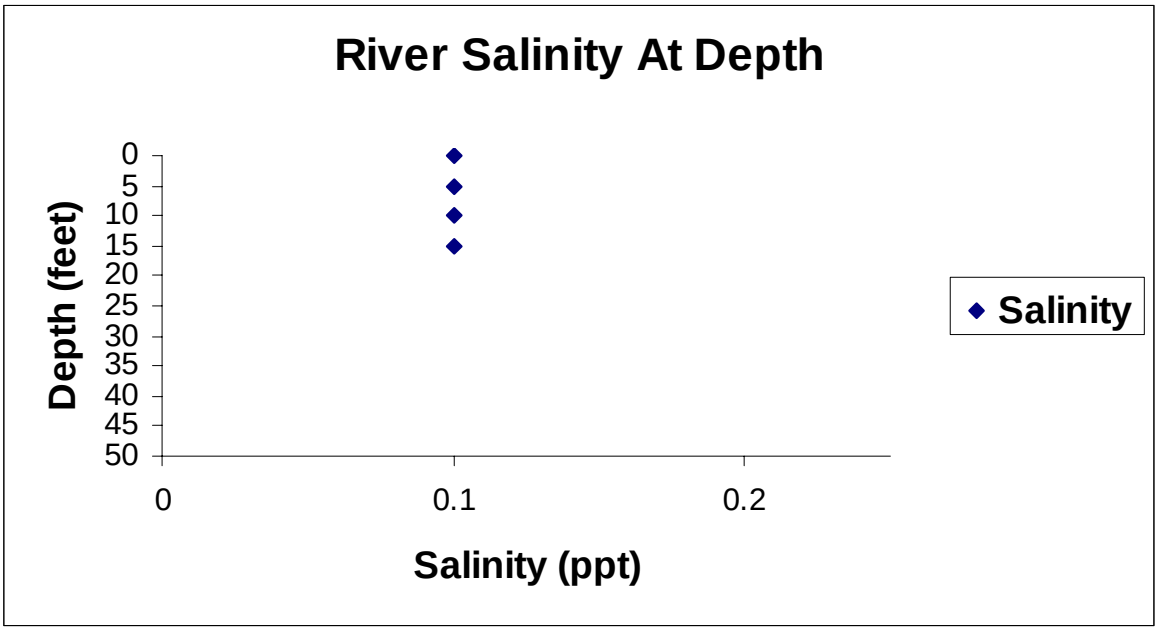


Site 4

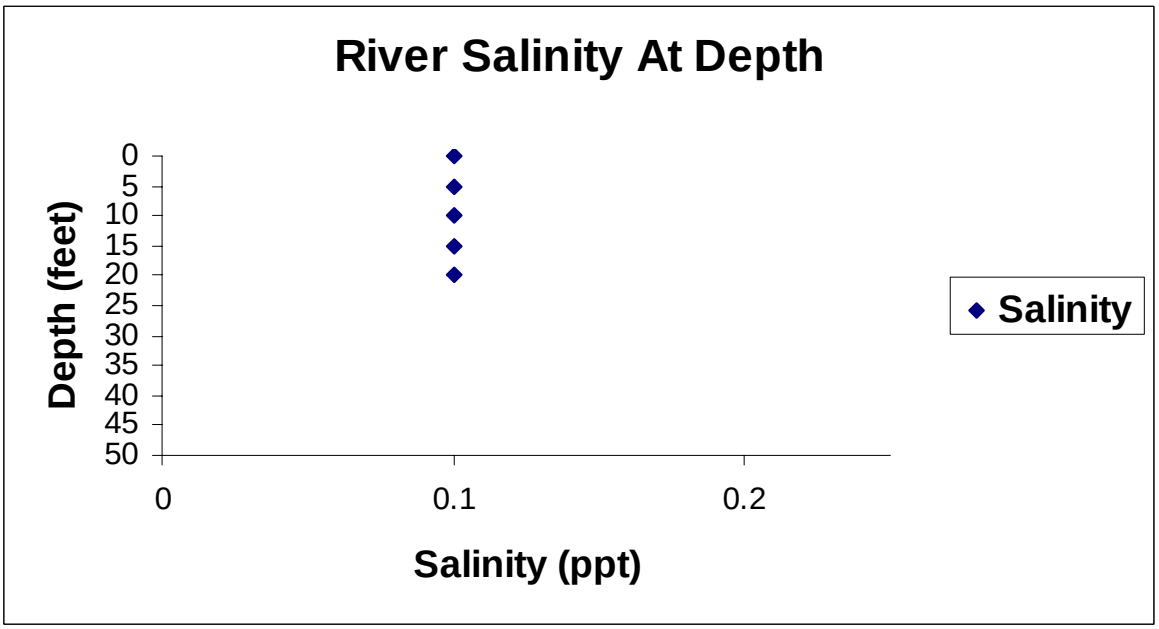


Sampling date: 1/06/2007

Site 5

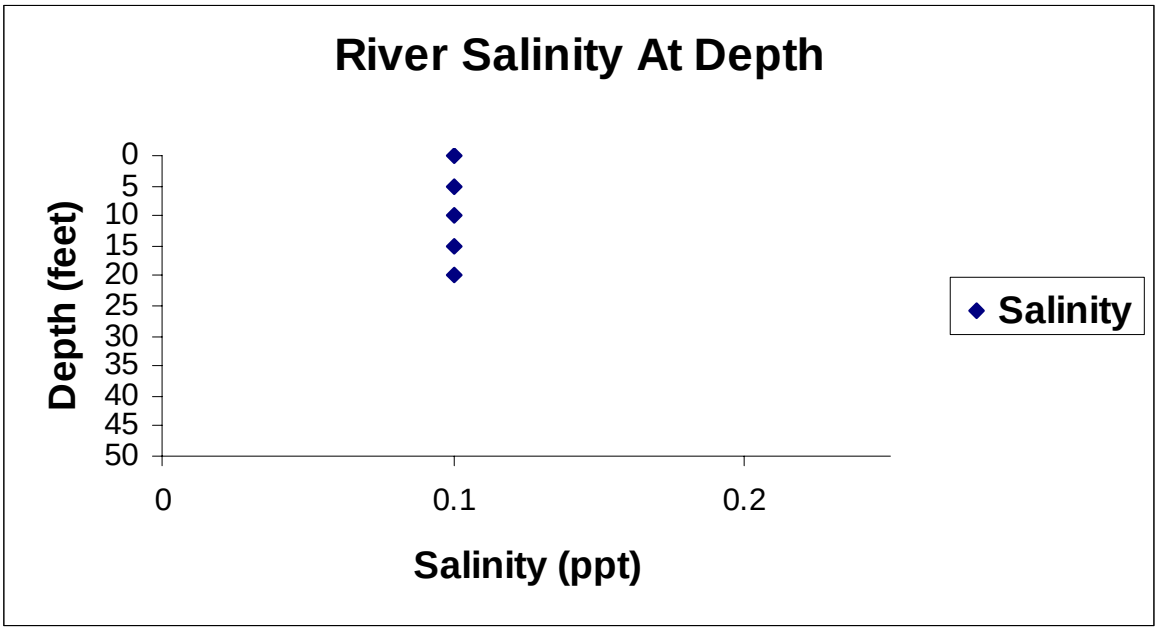


Site 6

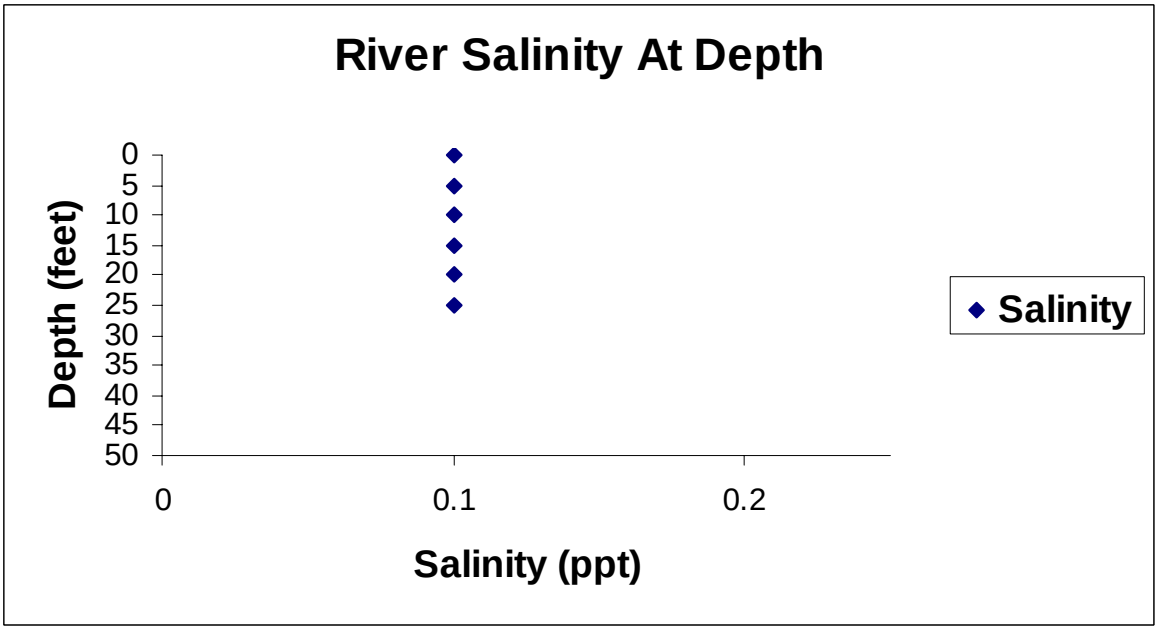


Sampling date: 1/06/2007

Site 7

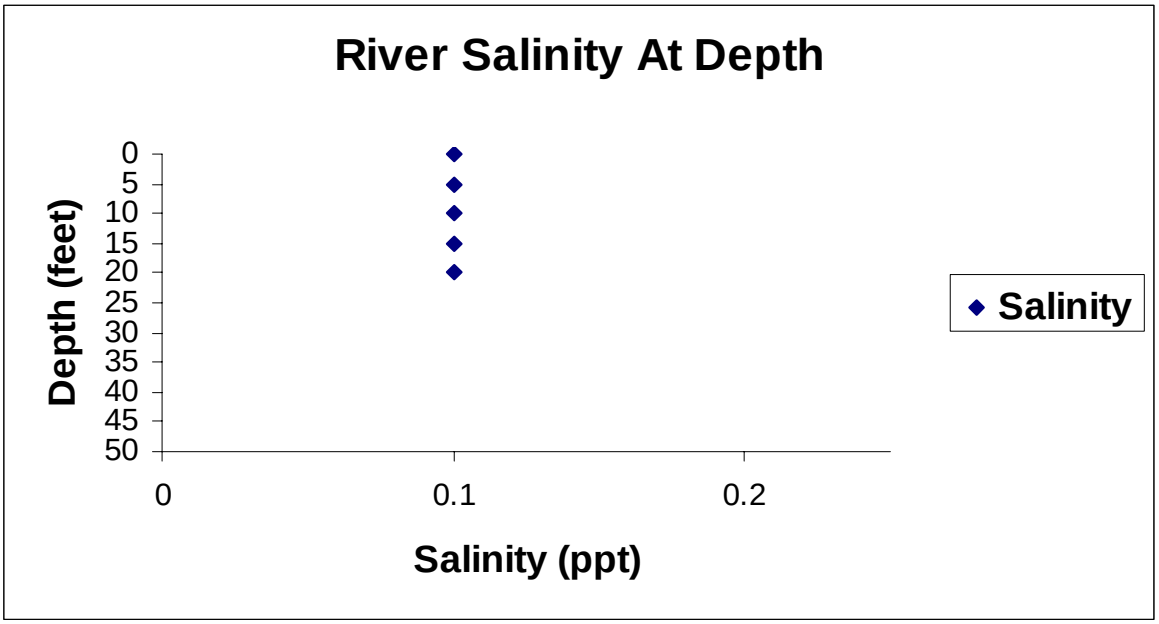


Site 8

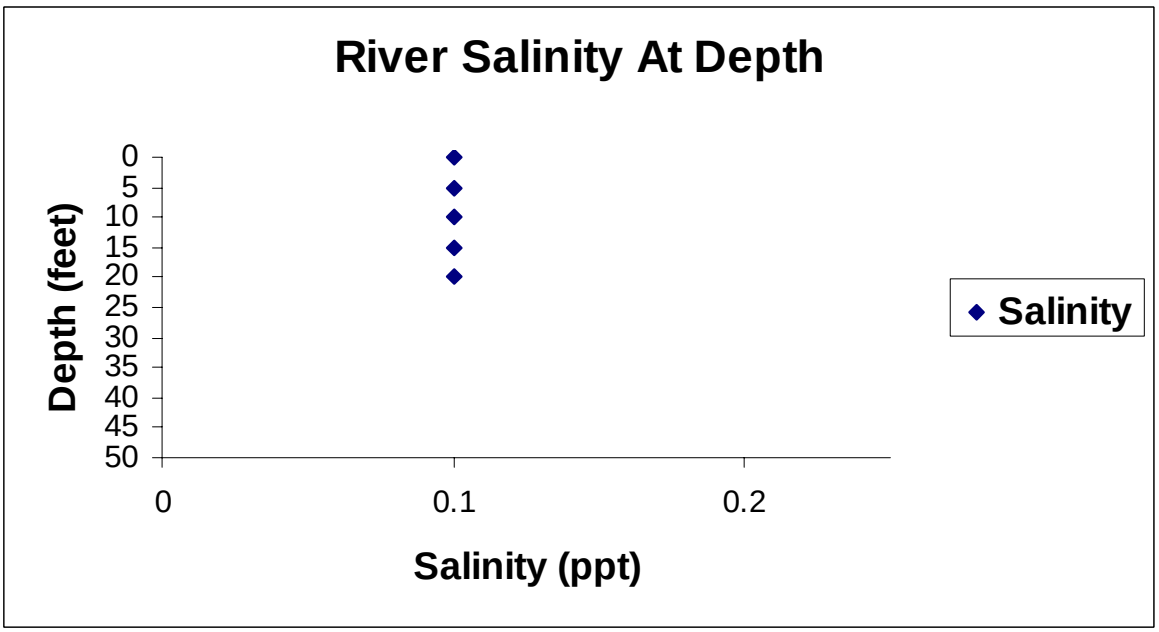


Sampling date: 1/06/2007

Site 9

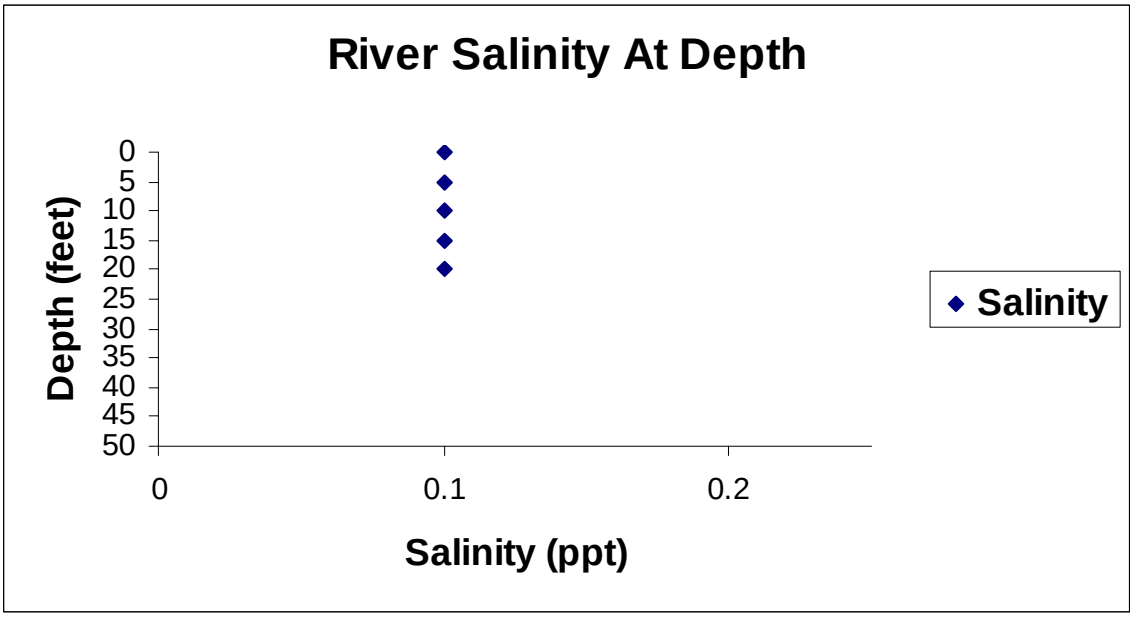


Site 10

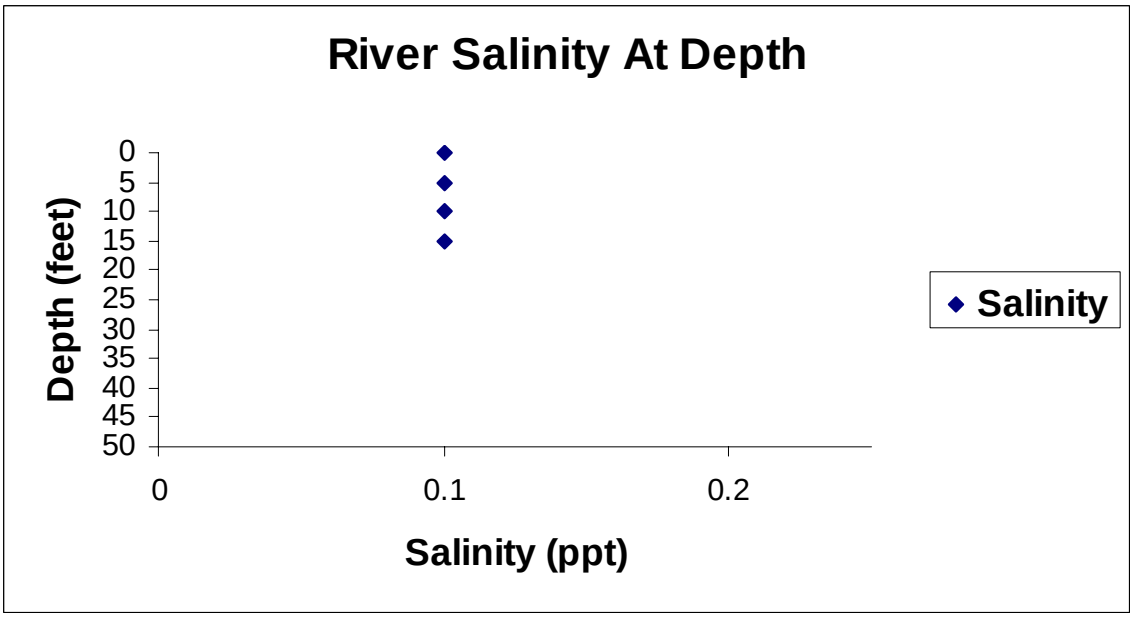


Sampling date: 1/06/2007

Site 11

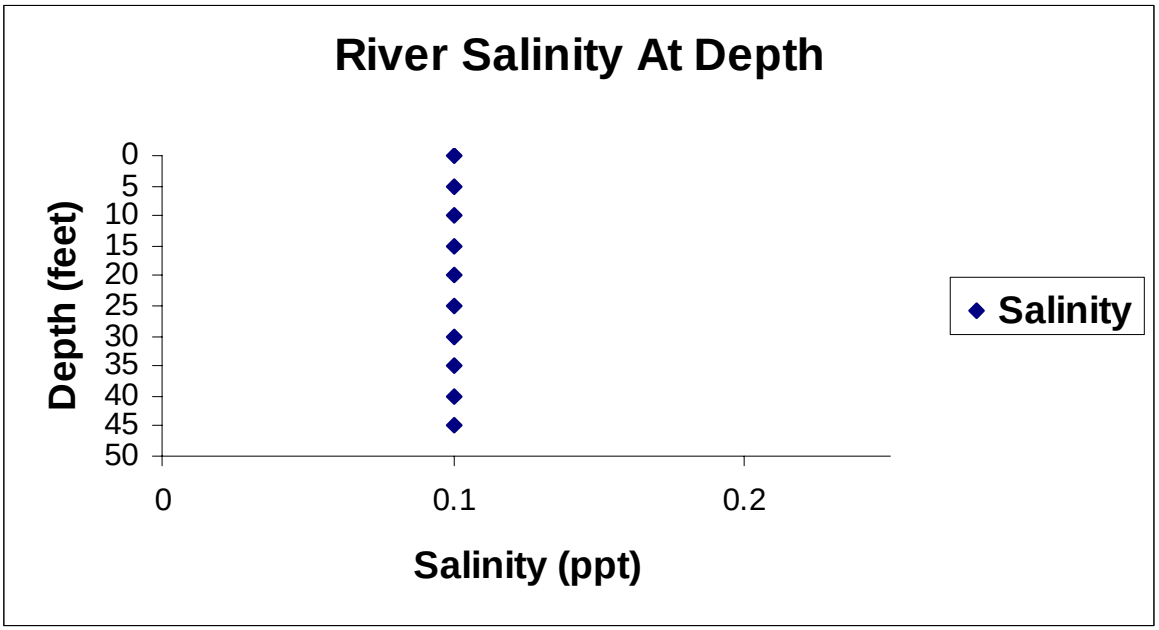


Site 12

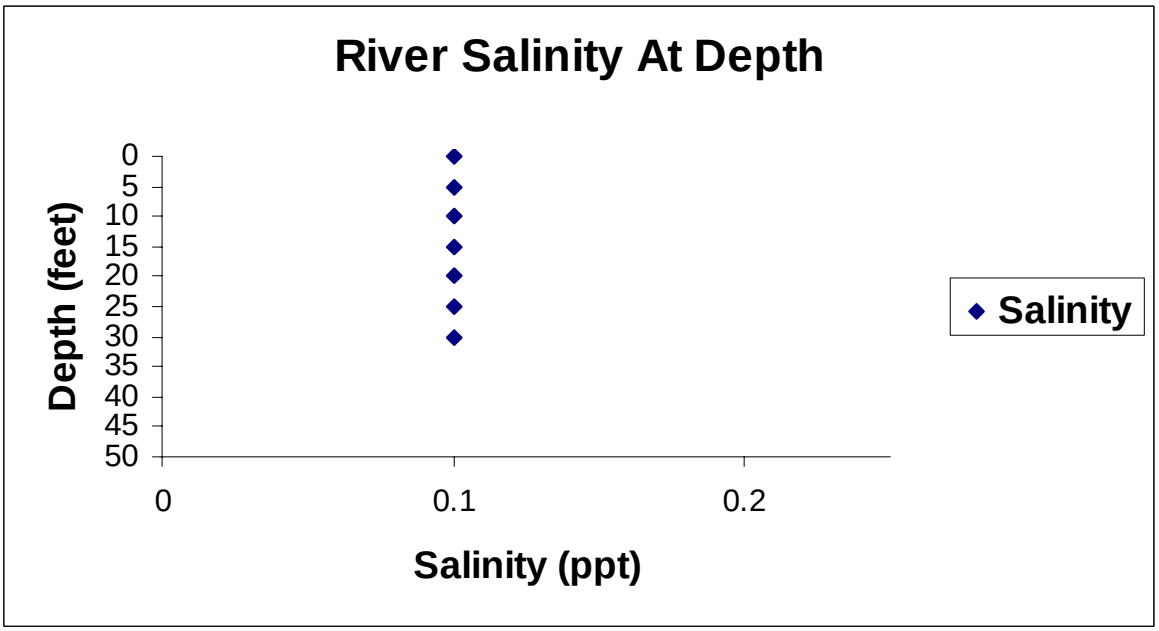


Sampling date: 5/22/2007

Site 1

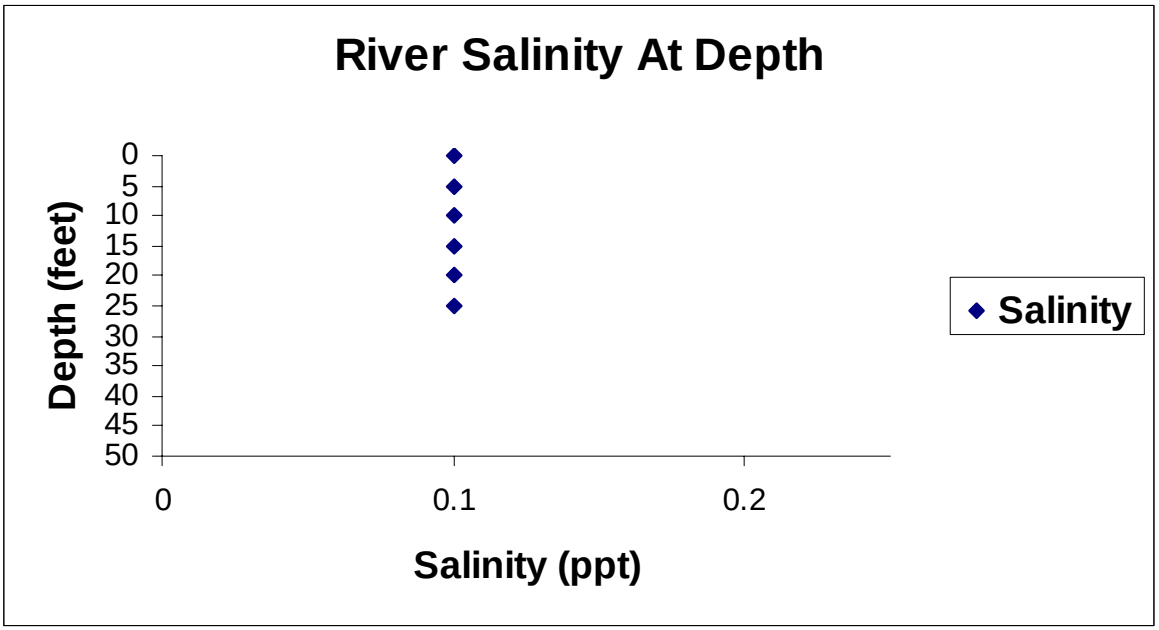


Site 2

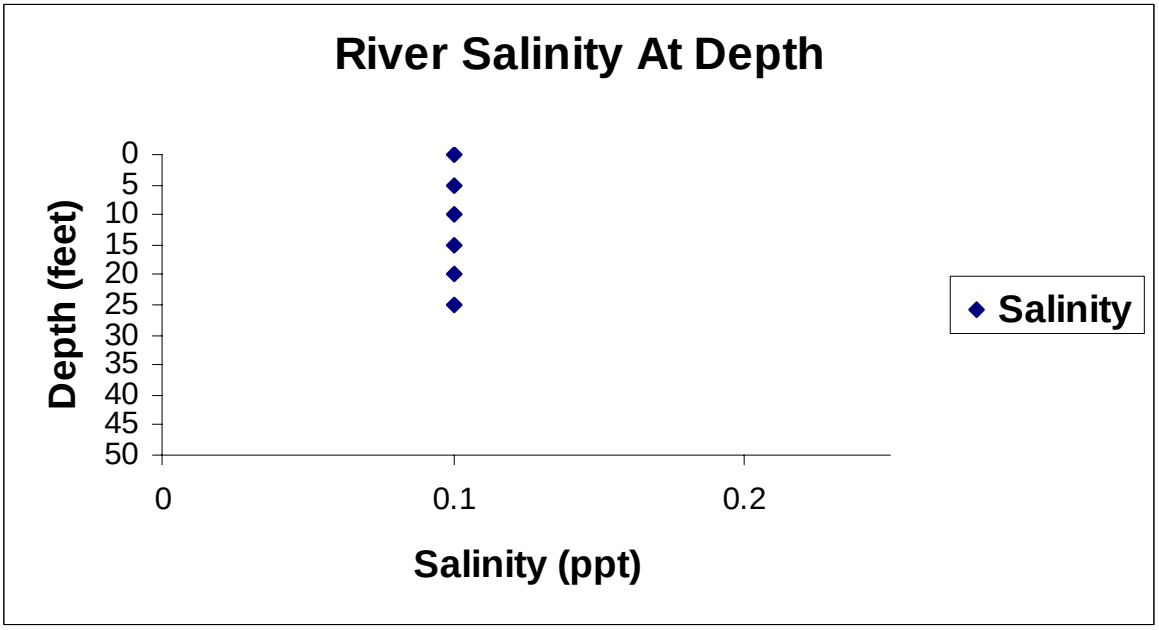


Sampling date: 5/22/2007

Site 3

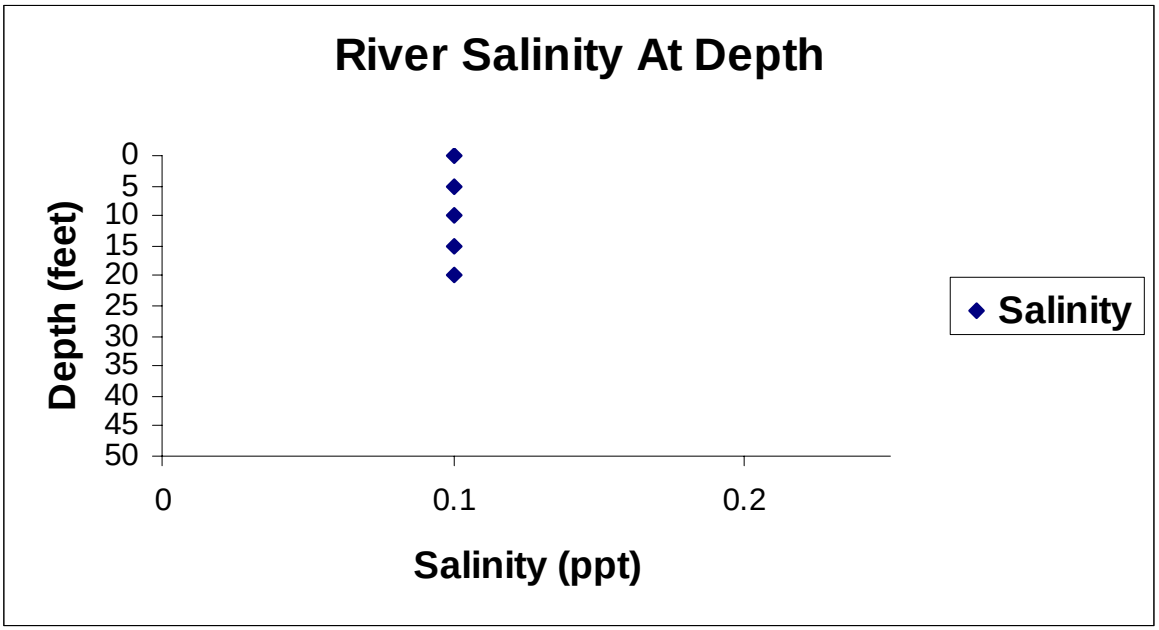


Site 4

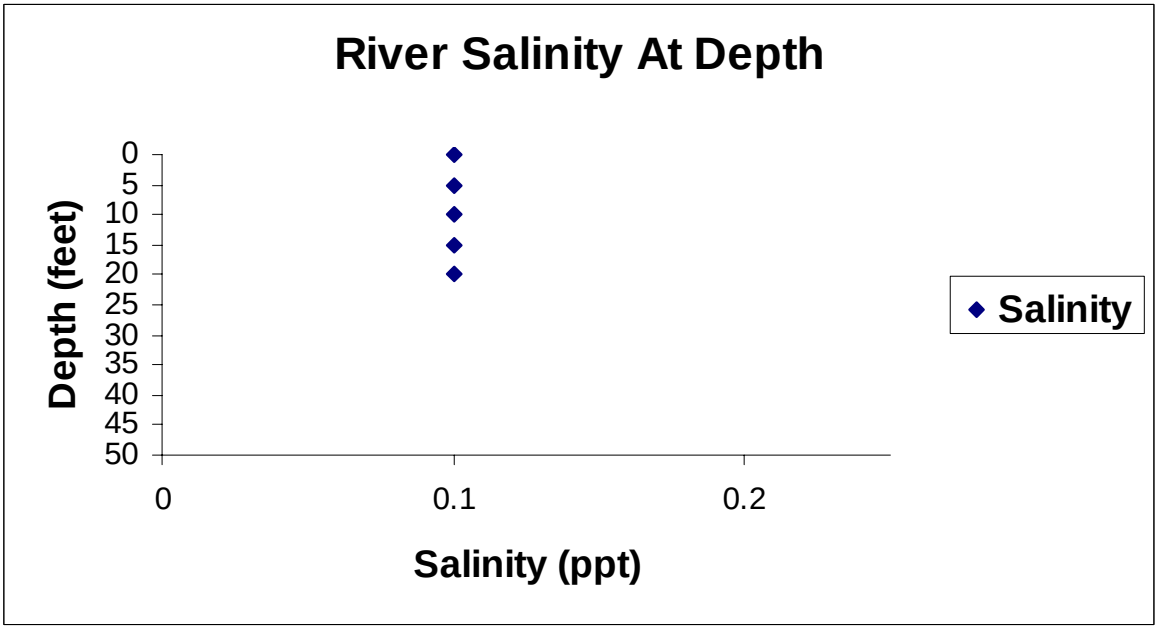


Sampling date: 5/22/2007

Site 5

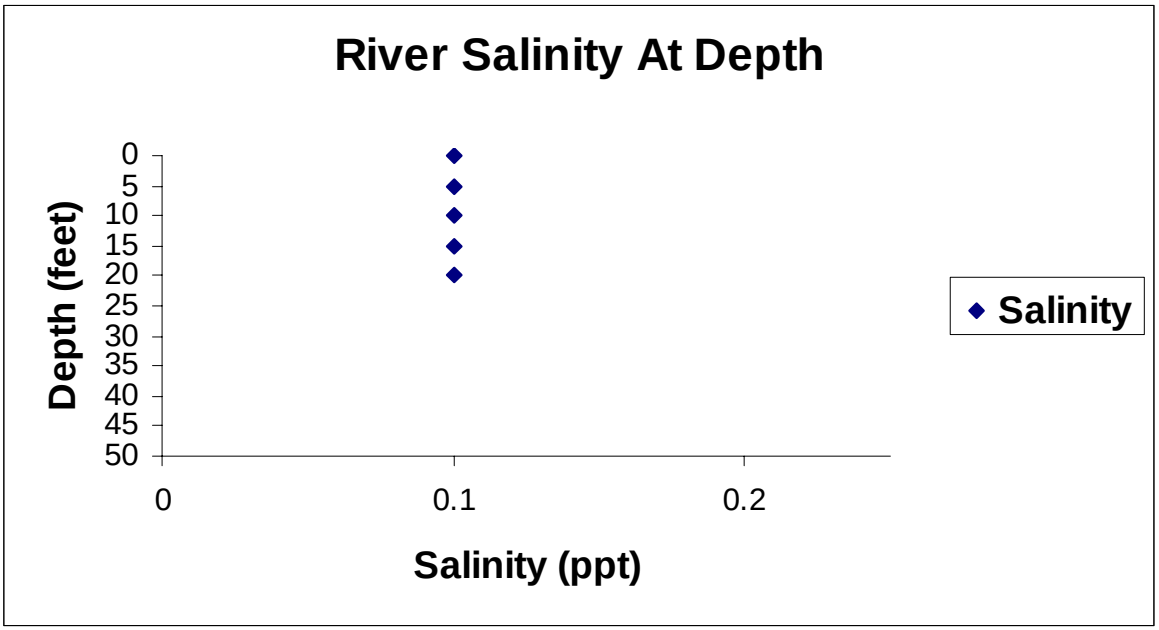


Site 6

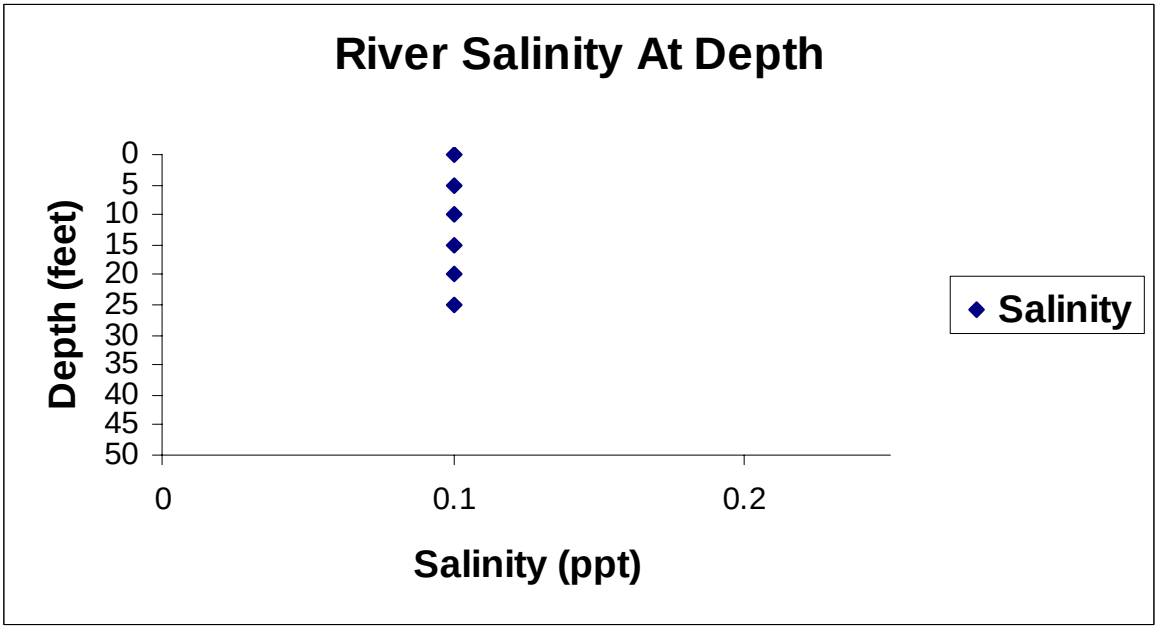


Sampling date: 5/22/2007

Site 7

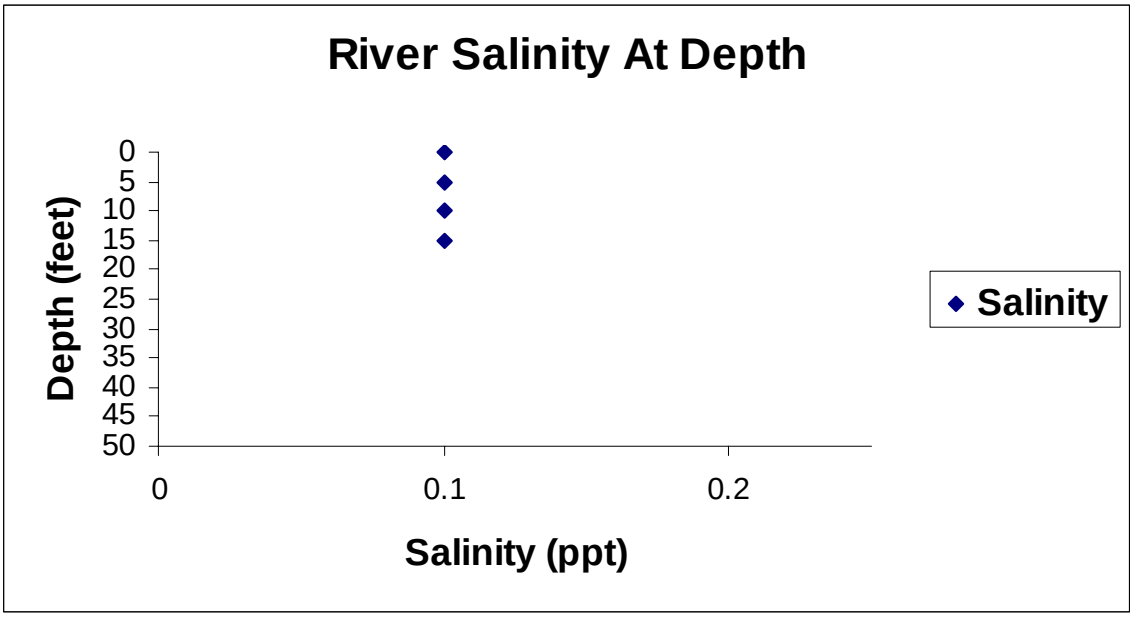


Site 8

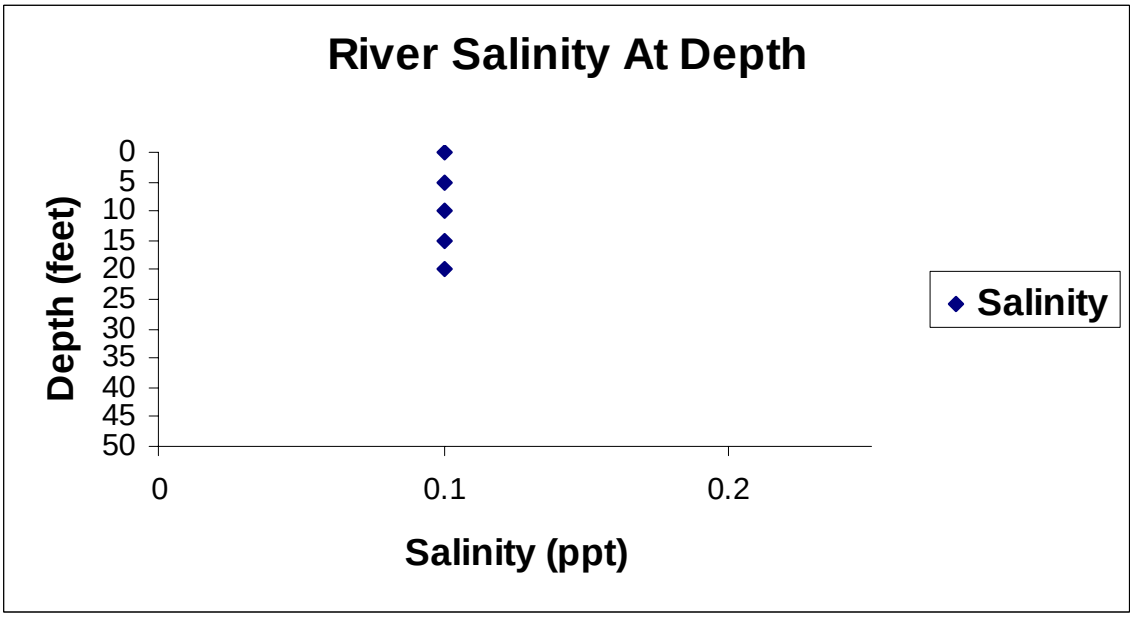


Sampling date: 5/22/2007

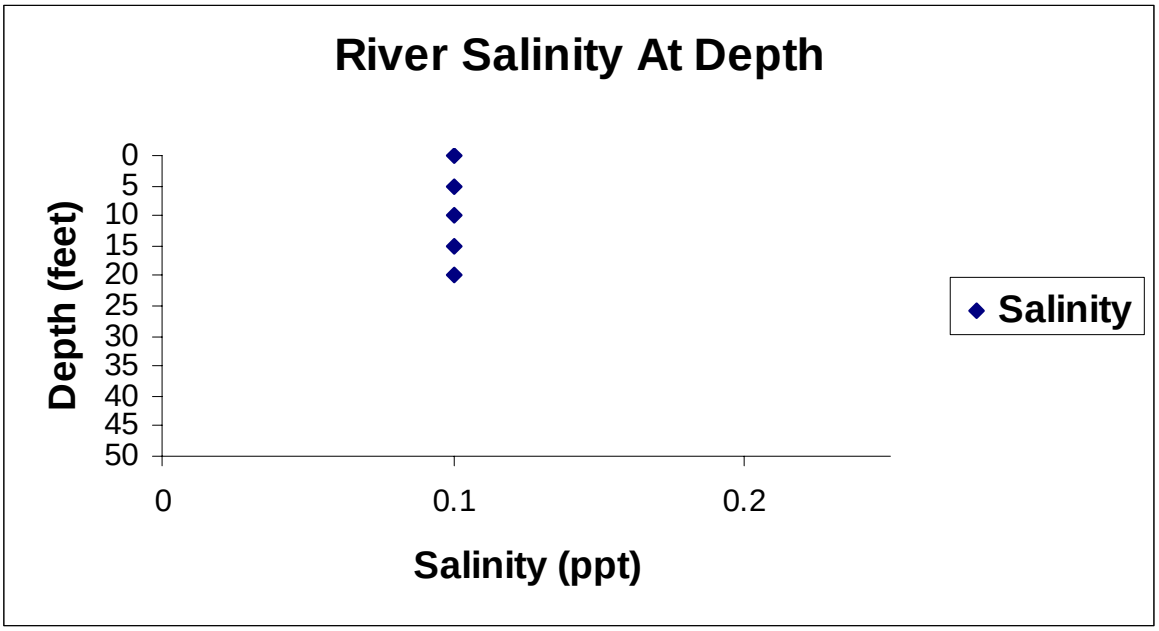
Site 9



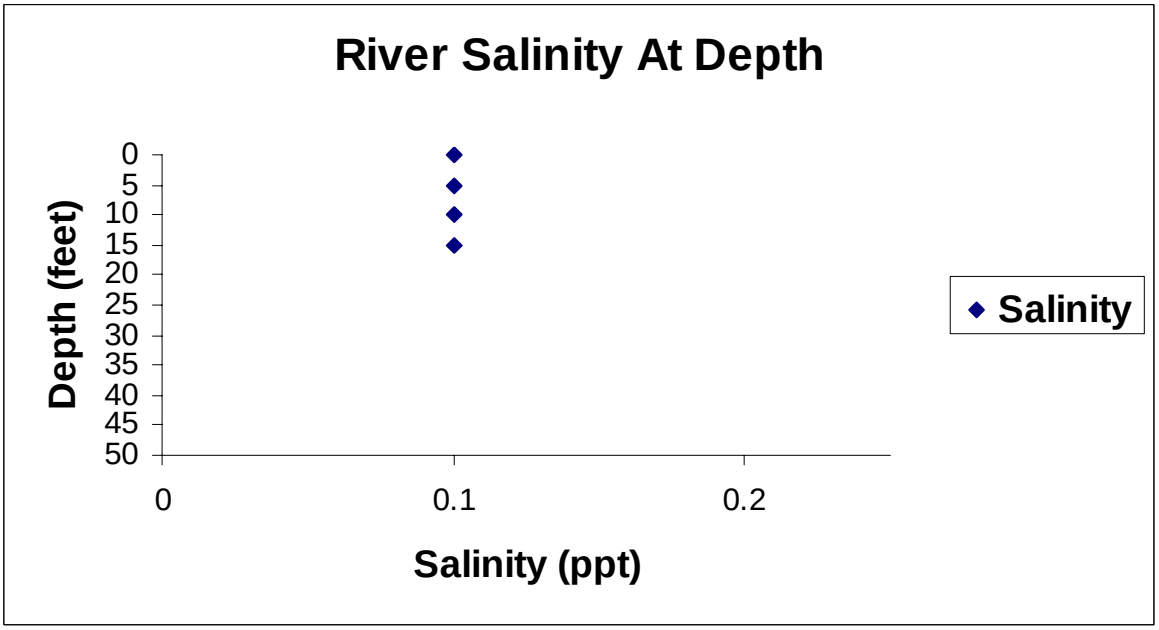
Site 10



Site 11



Site 12



APPENDIX D

LIST OF SPECIES, COMMON NAMES AND AUTHORITIES FOR PLANTS SEEN IN OR NEAR POLYGONS AT SAMPLING STATIONS IN THE CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

Appendix D. List of Plant Species

A list of plant species used in text and tables with accompanying authorities and common names follows. Both common and scientific names for vascular plants follow Kartesz and Meachum 2005. Species considered sensitive herbaceous species are marked with an asterisk (*). The list is cumulative for the project.

Acer rubrum L. Red Maple
**Alternanthera philoxeroides* (Mart.) Griseb. Alligator-Weed
Amaranthus cannabinus (L.)Sauer Tidal-Marsh Amaranth
Apios americana Medik. Groundnut
**Aster* sp. Probably *Symphyotrichum elliottii*.
Bidens laevis (L.)B.S.P. Smooth Beggarticks
Bidens mitis (Michx.)Sherff. Small-furit Beggarticks
**Bidens laevis* (L.)Britton Smooth Beggarticks
Bidens sp. Beggarticks
**Boehmeria cylindrica* (L.) Sw. Small-Spike False Nettle
**Boltonia asteroides* (L.) L'Hér. White Doll's-Daisy
Campsis radicans (L.) Seem. Ex Bureau Trumpet-Creeper
**Carex* L. Sedge
Carex amphibole Steud. Eastern narrow-leaf Sedge
**Carex crinita* Lam. Fringed Sedge
**Carex crinita* var. *brevicrinis* Fern. Fringed Sedge
**Carex crus-corvi* Shuttlw. Ex Kunze Raven-Foot Sedge
**Carex hyalinolepis* Steud. Shoreline Sedge
Carex leptalea Wahlenb. Bristly-stalk Sedge
**Carex lupulina* Muhl. Ex Willd. Hop Sedge
**Chasmanthium latifolium* (Michx.) Yates Indian Wood-Oats
**Cicuta maculata* L. Spotted Water-Hemlock
**Cinna arundinacea* L. Sweet Wood-Reed
**Commelina virginica* L. Virginia Dayflower
**Cyperus* L. Umbrella Sedge
**Decodon verticillatus* (L.) Ell. Swamp-Loosestrife
**Dulichium arundinaceum* (L.) Britt. Three-Way Sedge
**Elymus virginicus* L. Virginia Wild Rye
**Eryngium aquaticum* L. Rattlesnake-Master
Fraxinus caroliniana P. Mill. Carolina Ash
Fraxinus pennsylvanica Marsh. Green Ash
Fraxinus profunda (Bush) Bush Pumpkin Ash
**Galium* L. Bedstraw
Hydrocotyle L. Marsh-Pennywort
**Hydrocotyle verticillata* Thunb. Whorled Marsh-Pennywort
**Hymenocallis floridana* (Raf.) Morton Florida Spider-Lily
Hypericum mutilum L. Dwarf St. John's-Wort
Impatiens capensis Meerb. Spotted Touch-Me-Not
Ipomoea L. Morning-Glory
Lilaeopsis chinensis (L.) Kuntze Eastern Grasswort
**Lobelia cardinalis* L. Cardinal-Flower
**Ludwigia grandiflora* (M. Micheli) Greuter & Burdet Large-Flower Primrose-Willow
**Ludwigia palustris* (L.) Ell. Marsh Primrose-Willow
**Lycopus virginicus* L. Virginia Water-Horehound
**Mikania scandens* (L.) Willd. Climbing Hempvine
Murdannia keisak (Hassk.) Hand.-Maz. Wart-Removing-Herb
Nyssa aquatica L. Water Tupelo
Nyssa biflora Walt. Swamp Tupelo
Oenothera fruticosa ssp. *glauca* (Michx.) Straley Narrow-leaf Evening Primrose

**Orontium aquaticum* L. Goldenclub
Osmunda regalis L. Gray Royal Fern
Packera glabella (Poir.) C. Jeffrey Cress-Leaf Groundsel
**Peltandra virginica* (L.) Schott Green Arrow-Arum
**Phanopyrum gymnocarpon* (Ell.) Nash Savannah-Panic Grass
Physostegia leptophylla Small Slender-Leaf False Dragonhead
Pilea pumila (L.) Gray Canadian Clearweed
Platanthera flava (L.) Lindley
Pluchea odorata (L.) Cass. Sweetscent
Polygonum arifolium L. Halberd-Leaf Tearthumb
**Polygonum hydropiper* L. Mild Water-Pepper
**Polygonum hydropiperoides* Michx. Swamp Smartweed
**Polygonum punctatum* Ell. Dotted Smartweed
**Polygonum virginianum* L. Jumpseed
**Pontederia cordata* L. Pickerelweed
Porella pinnata L Leafy Liverwort
Proserpinaca palustris L. Marsh Mermaidweed
**Rhynchospora corniculata* (Lam.) Gray Short-Bristle Horned Beak Sedge
**Rhynchospora inundata* (Oakes) Fern. Narrow-Fruit Horned Beak Sedge
Rosa palustris Marsh. Swamp Rose
**Rumex verticillatus* L. Swamp Dock
**Sagittaria lancifolia* L. Bull-Tongue Arrowhead
**Saururus cernuus* L. Lizard's-Tail
**Scutellaria lateriflora* L. Mad Dog Skullcap
**Schoenoplectus americanus* (Pers.) Volk. Ex Schinz & R. Keller Chairmaker's Club-Rush
Schoenoplectus robustus (Pursh) M.T. Strong Seaside Club-Rush
Schoenoplectus tabernaemontani (K.C. Gmel.) Palla Soft-Stem Club-Rush
**Sium suave* Walt. Hemlock Water-Parsnip
Smilax rotundifolia L. Horsebrier
Solidago sempervirens var. *mexicana* (L.) Fern. Seaside Goldenrod
Spartina cynosuroides (L.) Roth Big Cord Grass
**Symphyotrichum elliottii* (Torr. & Gray) Nesom Marsh American-Aster
Symphyotrichum subulatum (Michx.) Nesom Seaside American-Aster
Symphyotrichum tenuifolium (L.) Nesom Perennial Saltmarsh American-Aster
Taxodium ascendens Brongn. Pond-Cypress
Toxicodendron radicans (L.) Kuntze Eastern Poison-Ivy
**Triadenum walteri* (J.G. Gmel.) Gleason Greater Marsh-St. John's-Wort
**Typha latifolia* L. Broad-Leaf Cat-Tail
Typha angustifolia L. Narrow-Leaf Cat-Tail
Typha ×glauca Godr. (pro sp.)
**Zizania aquatica* L. Indian Wild Rice
**Zizaniopsis miliacea* (Michx.) Doell & Aschers. Marsh-Millet

Literature Cited

Kartesz, J.T., and C.A. Meacham. 2005. Synthesis of the North American Flora, Prepublication Version 2.0. Missouri Botanical Garden Press, St. Louis.

APPENDIX E

METADATA COVERING GIS/GPS FILES USED IN TEXT FIGURES IN SENSITIVE HERBACEOUS VEGETATION POLYGONS: 2006 ASSESSMENTS AT SEVEN STATIONS ESTABLISHED FOR THE WILMINGTON HARBOR MONITORING PROJECT IN THE CAPE FEAR RIVER ESTUARY, NORTH CAROLINA

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P3, INNER TOWN CREEK

FIGURE 8.41-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	13ben.shp 13ben.dbf 13ben.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	13pil.shp 13pil.dbf 13pil.shx
DESCRIPTION OF LAYER:	Point depicting data collect platform piling
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P3, INNER TOWN CREEK

FIGURE 8.41-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	13poly.shp 13poly.dbf 13poly.shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2000 (13poly.ssf GPS file from CZR Incorporated)
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	13sub.shp 13sub.dbf 13sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P3, INNER TOWN CREEK

FIGURE 8.41-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site9.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns)
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P3, TOWN CREEK

FIGURE 8.41-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	13tra.shp 13tra.dbf 13tra.shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	itcpol05 .shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2005
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9 and Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	10 Jan 2005
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P3, TOWN CREEK

FIGURE 8.41-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	itcpt05 .shp, .dbf, .shx
DESCRIPTION OF LAYER:	Point depicting sensitive herbaceous plants, 2005
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9 and Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	10 Jan 2006
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

FILE NAMES:	P3Poly06 .shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2006
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9 and Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	23 Jan 2007
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P7, INDIAN CREEK

FIGURE 8.42-1

CAPE FEAR RIVER ESTUARY,
WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	15ben.shp 15ben.dbf 15ben.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	15pil.shp 15pil.dbf 15pil.shx
DESCRIPTION OF LAYER:	Point depicting data collect platform piling
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P7, INDIAN CREEK

FIGURE 8.42-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	15sub.shp 15sub.dbf 15sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P7, INDIAN CREEK

FIGURE 8.42-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site8.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns)
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P7, INDIAN CREEK

FIGURE 8.42-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	15tra.shp 15tra.dbf 15tra.shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P8, DOLLISONS LANDING

FIGURE 8.43-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	16ben.shp 16ben.dbf 16ben.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	16pil.shp 16pil.dbf 16pil.shx
DESCRIPTION OF LAYER:	Point depicting data collect platform piling
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P8, DOLLISONS LANDING

FIGURE 8.43-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	Area-gen.shp, .dbf .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2002
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	6 January 2003
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

FILE NAMES:	16sub.shp 16sub.dbf 16sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P8, DOLLISONS LANDING

FIGURE 8.43-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site3.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns):
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P8, DOLLISONS LANDING

FIGURE 8.43-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	16tra.shp 16tra.dbf 16tra.shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P9, BLACK RIVER

FIGURE 8.44-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	17ben.shp 17ben.dbf 17ben.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	17pil.shp 17pil.dbf 17pil.shx
DESCRIPTION OF LAYER:	Point depicting data collect platform piling
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P9, BLACK RIVER

FIGURE 8.44-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	17poly.shp 17poly.dbf 17poly.shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2000 (17poly.ssf GPS file from CZR Incorporated)
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	17sub.shp 17sub.dbf 17sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P9, BLACK RIVER

FIGURE 8.44-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site4.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns)
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P9, BLACK RIVER

FIGURE 8.44-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	17tra.shp, .dbf, .shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	briv.shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2005
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.9, ArcView 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	21 January, 2006
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P12, RAT ISLAND

FIGURE 8.45-1

CAPE FEAR RIVER ESTUARY,
WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	Cam2.shp Came2.dbf Cam2.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	Ratpil2.shp, .dbf, .shx
DESCRIPTION OF LAYER:	Point depicting new location of piling, 2002
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.8 and Arcview 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	5 August 2002
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P12, RAT ISLAND

FIGURE 8.45-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	19poly.shp 19poly.dbf 19poly.shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2000 (19poly.ssf GPS file from CZR Incorporated)
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	19sub.shp 19sub.dbf 19sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P12, RAT ISLAND

FIGURE 8.45-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site5.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns)
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P12, RAT ISLAND

FIGURE 8.45-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	19tra.shp 19tra.dbf 19tra.shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P13, FISHING CREEK

FIGURE 8.46-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	20ben.shp 20ben.dbf 20ben.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	20pil.shp 20pil.dbf 20pil.shx
DESCRIPTION OF LAYER:	Point depicting data collect platform piling
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P13, FISHING CREEK

FIGURE 8.46-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	20poly.shp 20poly.dbf 20poly.shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2000 (20poly.ssf GPS file from CZR Incorporated)
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	20sub.shp 20sub.dbf 20sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P13, FISHING CREEK

FIGURE 8.46-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site2b.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns)
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P13, FISHING CREEK

FIGURE 8.46-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	20tra.shp 20tra.dbf 20tra.shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	fcreek05, .shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2005
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9, Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	12 January, 2006
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409:
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P13, FISHING CREEK

FIGURE 8.46-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	Fishcr06, .shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2006
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9, Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	23 January, 2007
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409:
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P14, PRINCE GEORGE CREEK

FIGURE 8.47-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	21ben.shp 21ben.dbf 21ben.shx
DESCRIPTION OF LAYER:	Point depicting concrete benchmark
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	21pil.shp 21pil.dbf 21pil.shx
DESCRIPTION OF LAYER:	Point depicting data collect platform piling
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Point
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P14, PRINCE GEORGE CREEK

FIGURE 8.47-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	21poly.shp 21poly.dbf 21poly.shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2000 (21poly.ssf GPS file from CZR Incorporated)
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	21sub.shp 21sub.dbf 21sub.shx
DESCRIPTION OF LAYER:	Points depicting substation survey points
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P14, PRINCE GEORGE CREEK

FIGURE 8.47-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	site1.tif
DESCRIPTION OF LAYER:	True color aerial photography was flown on March 25, 2000 at an altitude of 1500 feet.
SOURCE:	Wild RC20 Aerial Mapping Camera Scale: 1” = 250’ Resolution: 1100 DPI (23.1 microns)
DATA TYPE:	The image source consisted of color contact prints and diapositives were created and the negative film then digitally scanned on a Vexcell 4000 to create raw digital images to be rectified and produce digital orthophotos. This produced an original raw pixel size of .2272’ based on the scale of the negative film.
SOFTWARE:	Tif/Tfw file format
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	25 March 2000
SOURCE:	3Di, LLC Wilmington NC, Office
SOURCE CONTACT:	Scott C. Williams, PLS
SOURCE ADDRESS:	2704-A Exchange Drive Wilmington, NC 28405
SOURCE PHONE:	910/392-1496
SOURCE FAX:	910/392-7326

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P14, PRINCE GEORGE CREEK

FIGURE 8.47-1

CAPE FEAR RIVER ESTUARY,
WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	21tra.shp 21tra.dbf 21tra.shx
DESCRIPTION OF LAYER:	Points depicting belt transect markers
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Points
SOFTWARE:	Pathfinder Office 2.1 and Arcview version 3.2
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	20 December 2000
SOURCE:	CZR Incorporated
SOURCE CONTACT:	Samuel Cooper
SOURCE ADDRESS:	4709 College Acres, Suite 2 Wilmington, NC 28403
SOURCE PHONE:	910/392-9253
SOURCE FAX:	910/392-9139

FILE NAMES:	pgc05.shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2005
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9, Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	12 January, 2006
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

METADATA

POSITIONS OF MONITORING STATION COMPONENTS AND SENSITIVE HERBACEOUS PLANT SPECIES POLYGONS WITHIN THE BELT TRANSECT AT MONITORING STATION P14, PRINCE GEORGE CREEK

FIGURE 8.47-1

CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

FILE NAMES:	Prgeo06.shp, .dbf, .shx
DESCRIPTION OF LAYER:	Polygon depicting sensitive herbaceous plants, 2006
SOURCE:	Trimble PRO XRS GPS Unit
DATA TYPE:	Polygon from points
SOFTWARE:	Pathfinder Office 2.9, Arcview 3.3
DATUM:	North American Datum (NAD) 1983
COORDINATE SYSTEM:	U.S. State Plane 1983
REGION:	North Carolina 3200
UNITS OF MEASURE:	Feet
DATA COLLECTION:	24 January, 2007
SOURCE:	David M. DuMond
SOURCE CONTACT:	David M. DuMond
SOURCE ADDRESS:	225 Cheyenne Trail Wilmington, NC 28409
SOURCE PHONE:	910/799-0363

APPENDIX F

AREAS AND LOCATIONS OF NEW YEAR 2006 SENSITIVE HERBACEOUS SPECIES POLYGONS AT SAMPLING STATIONS IN THE CAPE FEAR RIVER ESTUARY, WILMINGTON HARBOR MONITORING PROJECT, NORTH CAROLINA

Appendix F. Areas and locations of year 2006 sensitive herbaceous species polygons at sampling stations in the Cape Fear River Estuary, Wilmington Harbor Monitoring Project, North Carolina.

Station Name/Number	Polygon Area (ft^2)	Point Number	Northing* (ft)	Easting* (ft)
Town Creek/ P3	6,084.53 (Larger-outer)	1	140321.525	2304213.490
		2	140317.146	2304196.454
		3	140288.938	2304186.740
		4	140261.076	2304167.636
		5	140252.607	2304179.883
		6	140244.929	2304180.148
		7	140233.154	2304178.647
		8	140223.507	2304170.777
		9	140202.159	2304188.911
		10	140184.878	2304229.544
		11	140191.199	2304228.044
		12	140194.678	2304217.586
		13	140203.754	2304213.263
		14	140217.817	2304219.008
		15	140237.667	2304217.875
		16	140256.128	2304222.170
		17	140263.265	2304236.491
		18	140281.737	2304242.985
		19	140294.556	2304255.712
		20	140310.799	2304238.115
		21	140326.113	2304225.572
	489.15 (Smaller-inner exclusion)	1	140309.910	2304223.889
		2	140288.351	2304206.672
		3	140269.109	2304195.101
		4	140264.040	2304210.054
	SHV 5,595.38	5	140300.055	2304223.981
Fishing Creek P13	2,305.25	1	215488.258	2303579.337
		2	215477.957	2303573.547
		3	215460.894	2303577.797
		4	215462.618	2303580.661
		5	215459.321	2303588.410
		6	215454.031	2303589.906
		7	215440.722	2303601.881
		8	215441.058	2303588.009
		9	215444.086	2303570.767
		10	215449.537	2303569.833
		11	215462.874	2303562.776
		12	215471.319	2303561.060
		13	215484.991	2303554.457
		14	215490.240	2303559.210
		15	215512.084	2303552.944
		16	215515.847	2303544.156
		17	215534.395	2303532.742
		18	215541.905	2303521.272
		19	215557.480	2303535.837
		20	215539.168	2303556.427
		21	214528.129	2303555.210
		22	215515.587	2303563.859
		23	215499.374	2303578.647

Appendix F. (continued)

Station Name/Number	Polygon Area (ft^2)	Point Number	Northing* (ft)	Easting* (ft)
		24	215496.352	2303584.049
		25	215492.110	2303579.827
		26	215492.295	2303576.125
Prince George	4,654.27	1	227249.382	2320207.407
Creek./P14		3	227239.422	2320220.613
		4	227228.147	2320219.541
		5	227223.333	2320227.802
		6	227222.761	2320226.481
		7	227216.395	2320237.856
		8	227205.979	2320246.828
		9	227219.109	2320255.928
		10	227212.191	2320264.090
		11	227200.192	2320267.484
		12	227212.408	2320280.374
		13	227204.615	2320281.100
		14	227197.910	2320294.990
		15	227212.928	2320308.345
		16	227224.513	2320295.858
		17	227224.402	2320287.504
		18	227230.925	2320275.025
		19	227245.152	2320284.439
		20	227254.087	2320277.377
		21	227266.556	2320276.958
		22	227283.959	2320282.841
		24	227293.668	2320299.085
		25	227300.016	2320282.207

*North Carolina State Coordinate System, Region 3200, North American Datum, 1983.