BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NEW R	**SR 1314**	**PB4**	**06/09/10**	**Good-Fair**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ONSLOW	2	03020302	34.848889	-77.519722	19-(1)	Carolina Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; NSW	81.0	6	12	0.6

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	80	20	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	NA	NA

Water Quality Parameters

Temperature (℃)	22.8
Dissolved Oxygen (mg/L)	6.1
Specific Conductance (µS/cm)	440
pH (s.u.)	7.3

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	12
Bottom Substrate (15)	7
Pool Variety (10)	6
Riffle Habitat (16)	0
Bank Erosion (7)	7
Bank Vegetation (7)	7
Light Penetration (10)	9
Left Riparian Score (5)	3
Right Riparian Score (5)	4
Total Habitat Score (100)	70

Site Photograph

Substrate Mostly sand (75%) and silt (20%) with some CPOM (5%)

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/09/10	10981	81	17	5.79	4.40	Good-Fair
06/30/04	9422	76	13	6.17	5.38	Good-Fair
07/13/99	7915	53	11	6.21	5.42	Good-Fair
07/14/95	6872	74	12	6.40	5.71	Good-Fair
06/26/90	5327	70	15	6.31	5.11	Good-Fair

Taxonomic Analysis

17 EPT taxa were collected in the New River in 2010, the most since the river rated Good in 1988 during which 24 EPT taxa were collected. The 2010 increase in EPT over previous basinwide cycles was primarily driven by the increase in caddisflies. Caddisfly richness in 2010 (9 taxa) increased by 50% over 2004 levels (6 taxa) and included both *Pycnopsyche* spp and *Lype diversa* neither of which had been collected since 1988. Also, *Perlesta* spp. was the first stonefly taxa collected in this waterbody since 1990 and was abundant. The mayfly community has remained relatively stable over successive sampling cycles with the first appearance of the burrowing mayfly *Hexagenia* spp. in over 20 years. Pollution tolerant midges and oligochaetes declined both in richness and abundance in 2010.

Data Analysis

New River at SR 1314 is approximately 4.5 miles downstream of Richland's WWTP (0.25 MGD, receiving water body- Squires Run) which may explain the high specific conductance measured during this low flow year. However, it has been noted in previous reports that New River may be influenced by freshwater tides up to Richland. Thus, it is possible that saltwater intrusion is a contributing factor to the high specific conductance levels measured. Despite elevated specific conductance, the biotic index decreased significantly as a result of 2010 sampling and the EPT richness increased to pre-1990 levels. In fact, New River would have rated good had the EPT abundance been only slightly higher. The New River is a low productivity system due to the lack of suitable macroinvertebrate habitat as evidenced by the shifting sand and silt stream bottom. Water quality in the New River appears to be improving although additional basinwide sampling is needed to determine if the trend continues.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
L NORTHEAST CR	SR 1423	PB5	02/11/08	Moderate

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ONSLOW	2	03020302	34.768889	-77.305833	19-16-2	Carolina Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; NSW	8.3	15	4	0.2

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
Morton Elementary School WWTP	NC0043711	0.0075

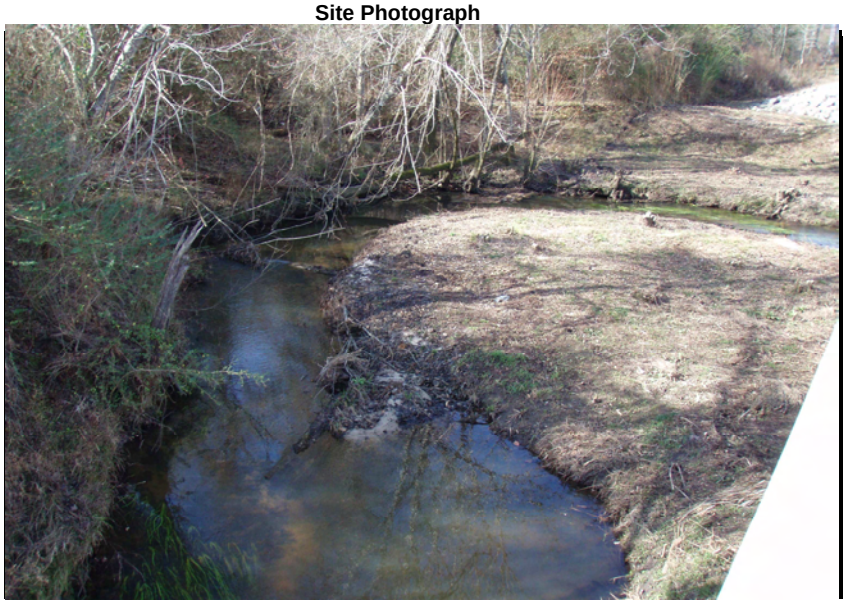
Water Quality Parameters

Temperature (℃)	10.4
Dissolved Oxygen (mg/L)	10.8
Specific Conductance (µS/cm)	224
pH (s.u.)	6.7
Water Clarity	tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	10
Bottom Substrate (15)	6
Pool Variety (10)	8
Left Bank Stability (7)	8
Right Bank Stability (7)	8
Light Penetration (10)	9
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	74

Site Photograph



Substrate Almost all sand with a small amount of silt

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/11/08	10390	63	9	7.00	5.77	Moderate
03/01/04	9333	50	11	6.16	5.12	Moderate
02/09/99	7802	62	15	6.69	5.48	Natural

Taxonomic Analysis

The moderately tolerant stonefly, *Perlesta spp* , which had been collected previously in both 1999 and 2004, was not collected in 2008. This combined with the increase in tolerant chironomid taxa, increasing biotic and EPT biotic indices may indicate declining water quality.

Data Analysis

This site is located east of Jacksonville just downstream of a minor discharger, Morton Elementary School WWTP (0.0075 MGD). Land use in this area is primarily forested. In 1999, the site rated Natural. In 2004, a decrease in EPT taxa richness resulted in a Moderate rating. A further decline in EPT taxa richness occurred in 2008 but the bioclassification remained unchanged. The decrease in total taxa richness from 1999 to 2004 was primarily due to a decrease in chironomids thereby lowering the Biotic Index. However, in 2008, the Biotic Index was 7.0, higher than the 6.69 recorded in 1999 and was largely the result of increased chironomid taxa richness. The specific conductance data tends to support the declining benthic macroinvertebrate community metrics as it was much lower in 2004 (79 µS/cm) and 1999 (137 µS/cm) than the 224 µS/measured in 2008. It is possible that the very elevated reading in 2009 was a result of concentrated effluent due to the drought.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
HARRIS CR	**SR 1109**	**PB6**	**02/11/08**	**Moderate**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ONSLOW	2	03020302	34.730556	-77.544444	19-17-3	Carolina Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C; NSW	9.5	10	3	0.3

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	9.3
Dissolved Oxygen (mg/L)	7.2
Specific Conductance (µS/cm)	311
pH (s.u.)	6.5

Water Clarity	tannin stained

Habitat Assessment Scores (max)

Channel Modification (5)	15
Instream Habitat (20)	15
Bottom Substrate (15)	5
Pool Variety (10)	8
Left Bank Stability (7)	7
Right Bank Stability (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	72

Site Photograph

Substrate	Mostly detritus and silt with a small amount of sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/11/08	10391	69	12	6.83	5.82	Moderate
03/01/04	9332	50	11	6.25	5.43	Moderate
02/09/99	7800	63	13	7.13	5.70	Moderate

Taxonomic Analysis

No major changes in the benthic community were observed. Numerous taxa were abundant and included the mayflies *Pseudocloeon frondale* , *Caenis spp* , *Eurylophella doris* , *Maccaffertium modestum* , *Stenacron interpunctatum* , *Leptophlebia spp* , the caddisflies *Cheumatopsyche spp* , *Pycnopsyche spp* , the odonates *Enallagma spp* , *Ischnura spp* , and the beetles *Neoporus spp* , *Dubiraphia spp* , *Macronychus glabratus* , and the chironomids *Corynoneura* , and *Dicrotendipes neomodestus.* In addition, the low dissolved oxygen indicating gastropod *Physa spp* was also abundant.

Data Analysis

Harris Creek, located west of Jacksonville in Onslow County, was sampled approximately one kilometer above its confluence with Southwest Creek. This site has consistently rated Moderate since 1999. Based on the benthic data, no major changes in water quality have been observed since the initial 1999 assessment.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
WHITE OAK R	**US 17**	**PB1**	**06/09/10**	**Good**

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
ONSLOW	1	03020301	34.891111	-77.234722	20-(1)	Carolina Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	68.0	14	6	0.3

	Forested/Wetland	Urban	Agriculture	Road	Other (describe)
Visible Landuse (%)	20	0	0	0	80 (campground/park)

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
none	NA	NA

Water Quality Parameters

Temperature (℃)	24.6
Dissolved Oxygen (mg/L)	5.6
Specific Conductance (µS/cm)	318
pH (s.u.)	7.1

Water Clarity	clear

Habitat Assessment Scores (max)

Channel Modification (5)	10
Instream Habitat (20)	16
Bottom Substrate (15)	15
Pool Variety (10)	6
Riffle Habitat (16)	0
Bank Erosion (7)	6
Bank Vegetation (7)	7
Light Penetration (10)	5
Left Riparian Score (5)	1
Right Riparian Score (5)	1
Total Habitat Score (100)	67

Site Photograph

Substrate predominately sand (50%) with some gravel (30%) and silt (15%)

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
06/09/10	10982	70	20	5.99	4.93	Good
06/30/04	9423	72	21	6.19	5.06	Good-Fair
07/14/99	7918	74	15	6.71	5.49	Good-Fair

Taxonomic Analysis

EPT richness at this reach of the White Oak River has remained stable over the last 10 years although 2010 saw a loss in mayfly richness (-3) but an increase in caddisfly richness (+2). The loss in mayflies was seen mostly in the lack of baetids collected (*Acentrella* spp, *Centroptilum* spp). Caddisflies recorded at this site for the first time included *Hydropsyche decalda (* a taxa limited to the Sand Hills and southern Coastal Plain) *Trianodes ignitus* and *Chimarra* spp. Stoneflies maintained both their 2004 richness composition and included an uncommonly collected perlid, *Acroneuria evoluta*. Pollution tolerant midges and oligochaetes declined both in richness and abundance in 2010. For the first time, abundant amounts of both emergent macrophytes and non-emergent macroalgaes were recorded from this section of the White Oak River and included the diatom *Melosira varians* (the white floating and filamentous areas in the photo above), *Nitella* spp, and the mosses *Fontinalis novae-angliae* and *Leptodictyum riparium*.

Data Analysis

This reach of the White oak River is atypical of the entire waterbody as it flows over fossilized seabed that was exposed during the construction of US 17. As a consequence, this is one of the only places on the river where hard substrate riffles can be found. Sampling during 2010 has resulted in this reach of the White Oak River receiving the first Good rating since sampling began over 10 years ago. The lower biotic index coupled with the EPT richness and relatively high abundance values (EPT N = 105) indicate that water quality has not been severely hampered by surrounding land uses which includes upstream logging activities, animal operations, and urbanized areas. The one area of concern, however, is a fertilizer factory just upstream of the sampled reach. The overwhelming biomass of algae and macrophytes present in this portion of the White Oak (see photo) is indicative of a high nutrient load and contributes to low dissolved oxygen concentrations. The eutrophication of this reach is most likely due to the factory as the high algae and macrophyte biomass were not present in the area just upstream of the ditch originating near the factory.

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
NW PR NEWPORT R	SR 1124	PB7	03/02/08	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CARTERET	3	03020301	34.798056	-76.913611	21-2	Carolina Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
C	9.7	15	5	1.0

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	15.0
Dissolved Oxygen (mg/L)	5.0
Specific Conductance (µS/cm)	86
pH (s.u.)	3.4

Water Clarity	clear/tannic

Habitat Assessment Scores (max)

Channel Modification (15)	13
Instream Habitat (20)	13
Bottom Substrate (15)	13
Pool Variety (10)	4
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	83

Site Photograph

Substrate mostly silt with some detritus

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/20/08	10383	37	7	5.97	3.78	Not Rated
03/02/04	9336	25	6	5.89	4.70	Not Rated
02/10/99	7804	40	6	6.53	3.33	Natural

Taxonomic Analysis

The EPT fauna was dominated by the caddislfies H*ydropsyche decalda* and *Pycnopsyche spp* both of which were abundant and collected in the two previous sampling efforts. Common EPT in 2008 were the caddiflies *Triaenodes ochraceus* , *Heteroplectron americanum* and *Molanna blenda* .

Data Analysis

The Northwest Prong Newport River received a Not Rated bioclassification in 2008 due to a pH less than 4.0. Current Standard Operating Procedures of the Bioassessment Unit (BAU) prohibit assigning bioclassifications in instances where pH values are below 4.0 (NCDWQ 2006). Had the pH measured 4.0 or higher, this site would have rated Natural in both years. The low pH conditions are naturally occurring here. The 1999 sample had a pH of 4.1 allowing it to receive a bioclassification. It appears that differences in flow between wet and dry years can affect the pH (2004 and 2008 were years of lower flows with limited rainwater available to raise the pH). The three samples collected here since 1999 that suggest a stable macroinvertebrate community and a minimally disturbed swamp habitat

BENTHIC MACROINVERTEBRATE SAMPLE

Waterbody	Location	Station ID	Date	Bioclassification
PETTIFORD CR	FR 128	PB7	02/20/08	Not Rated

County	Subbasin	8 digit HUC	Latitude	Longitude	AU Number	Level IV Ecoregion
CARTERET	3	03020301	34.798056	-76.913611	21-2	Carolina Flatwoods

Stream Classification	Drainage Area (mi2)	Elevation (ft)	Stream Width (m)	Stream Depth (m)
SA;HQW	9.7	271	5	1.0

	Forested/Wetland	Urban	Agriculture	Other (describe)
Visible Landuse (%)	100	0	0	

Upstream NPDES Dischargers (>1MGD or <1MGD and within 1 mile)	NPDES Number	Volume (MGD)
None	---	---

Water Quality Parameters

Temperature (℃)	15.0
Dissolved Oxygen (mg/L)	5.0
Specific Conductance (µS/cm)	86
pH (s.u.)	3.4

Water Clarity: clear/tannic

Habitat Assessment Scores (max)

Channel Modification (15)	15
Instream Habitat (20)	20
Bottom Substrate (15)	7
Pool Variety (10)	4
Left Bank Stability (10)	10
Right Bank Stability (10)	10
Light Penetration (10)	10
Left Riparian Score (5)	5
Right Riparian Score (5)	5
Total Habitat Score (100)	92

Site Photograph

Substrate: mostly detritus with some sand

Sample Date	Sample ID	ST	EPT	BI	EPT BI	Bioclassification
02/20/08	10382	43	10	5.92	4.67	Not Rated
03/02/04	9336	25	6	5.89	4.70	Not Rated
02/10/99	7804	40	6	6.53	3.33	Natural
03/05/98	7525	30	8	6.42	5.44	Natural

Taxonomic Analysis

The EPT fauna collected in 2008 was very similar to previous samples. This community was dominated by the caddisfly *Heteroplectron americanum* and the mayflies *Leptophlebia spp* , *Maccaffertium modestum* and *Eurylophella doris* . Non EPT abundant taxa collected in 2008 included the blackfly *Simulium spp* as well as the chironomid *Unniella multivirga* , a species known to inhabit low pH swamp streams.

Data Analysis

Pettiford Creek received a Not Rated bioclassification in 2008 due to a pH less than 4.0. Current Standard Operating Procedures employed by the Bioassessment Unit (BAU) prohibit assigning bioclassifications to waterbodies which have a pH below 4.0 (NCDWQ 2006). Had the pH measured 4.0 or higher, this site would have rated Natural in both years. The low pH conditions are naturally occurring here and at times can be above 4.0 depending on flow (2007 and 2008 were years of lower flows with limited rainwater available to raise pH levels). There have been four samples collected here since 1998 that suggest a stable macroinvertebrate community with a minimally disturbed swamp habitat.