Executive Summary

FDEP's Bureau of Laboratories was requested to assess the status of selected waterbodies on the 303(d) list by conducting a Biological Reconnaissance of instream biota. Water bodies on this list are required by EPA to have a Total Maximum Daily Load (TMDL) study performed on them. The purpose of the TMDL is to determine the amount of pollution reduction needed to restore the system to a condition suitable for its designated use. Habitat and water quality was also assessed. A secondary objective of this study was to evaluate potential effects of stormwater runoff from selected poultry farms on adjacent receiving waters.

Erosion is a major concern in the Choctawhatchee River basin, with most sites sampled suffering either from elevated turbidity, habitat smothering and/or bank instability. Implementation of Best Management Practices (BMPs) to control erosion and sedimentation should be a priority for the Choctawhatchee River basin.

It should be noted that this study took place during a relatively dry period with little amounts of antecedent rainfall. Without stormwater events to transport pollutants into the waterbodies, results from this study probably represent a "best case scenario", and are not indicative of stormwater mediated inputs.

Biological communities were considered healthy only at the Choctawhatchee River @ Hwy 2 and Bruce Creek @ Hwy 81, as these were the only sites passing the Bio-Recon. Potential reasons these sites did not meet the minimum Biorecon thresholds, summarized by site in this report, include low dissolved oxygen, low water velocity, habitat problems, or degraded water quality.

Violations of Class III water quality standards for dissolved oxygen occurred at Parrot, Sikes, and Alligator Creeks.

Nutrient enrichment was observed at ten of the twelve sites in the watershed. Nitrite-nitrate concentrations at all three Choctawhatchee River stations were higher than those found in approximately 90% of other Florida streams. The highest nitrite-nitrate concentrations were in the upper and middle Choctawhatchee River, suggesting sources from Alabama. Nitrite-nitrate concentrations in Wrights Creek, Holmes Creek, Bruce Creek, Pittman Creek, and Cow Branch and exceeded those found 60% of other Florida streams. Total phosphorus in Alligator Creek exceeded the values found in 70 % of other Florida streams.

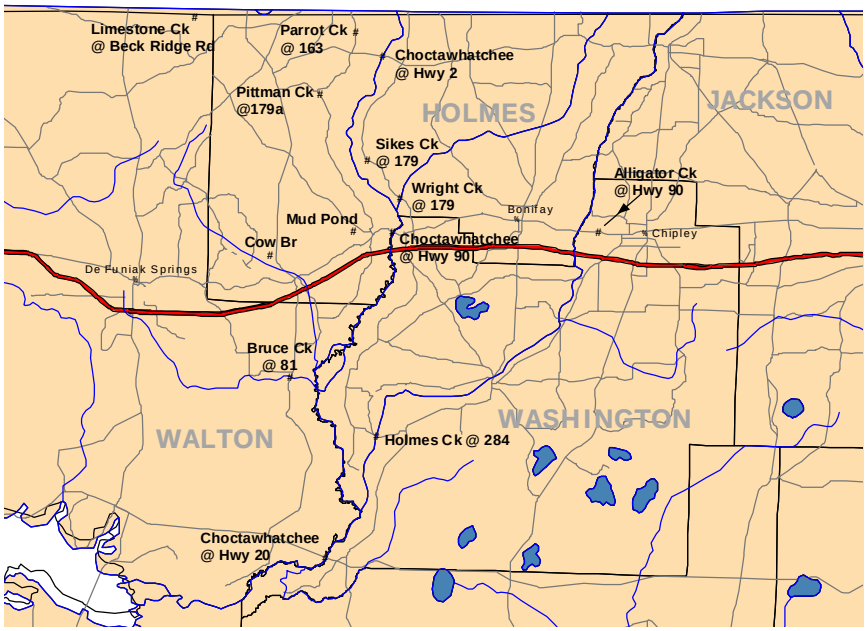
All three Choctawhatchee River sites had elevated turbidity, which contributes to habitat smothering under lower velocity conditions. Again, this suggests erosion from land use practices in Alabama is contributing to the elevated turbidities. Alligator Creek, with a value of 33 NTU, was in possible violation of turbidity standards

The four creeks located near poultry farms suffered either from dissolved oxygen violations (Parrot Creek), elevated values of BOD (Parrot Creek and Mud Pond tributary) nitrite-nitrate enrichment (Pittman Creek and Cow Branch), elevated TOC (Mud Pond tributary), or total coliform bacteria violations (Cow Branch). These data indicate that water quality concerns do exist in streams adjacent to poultry farms in the Choctawhatchee basin. Continued monitoring to evaluate the contribution of these poultry farms to water quality degradation is advised.

With one exception (Bruce Creek), it is recommended that all sites sampled remain on the 303(d) list. Based on these recent biological and water quality data, Bruce Creek should be given consideration for removal from the 303(d) list.

Introduction

Figure 1: Overview Map



The Choctawhatchee River drainage basin consists of approximately 5,349 square miles. The river flows from southern Alabama through northwest Florida and into Choctawhatchee Bay, a distance of approximately 90 miles. Mixed hardwood/pines forest and longleaf pine/xerophytic oaks forest are common natural uplands communities in the basin. Land in the watershed is used predominantly for silviculture, with extensive agricultural activities also occurring, especially in the northern portions of the basin.

Many of the waterbodies within the Choctawhatchee River Basin have been placed on the 303(d) list. Water bodies on this list are required by EPA to have a Total Maximum Daily Load (TMDL) study performed on them. The purpose of the TMDL is to determine the amount of pollution reduction needed to restore the system to a condition suitable for its designated use. In this case, the designated use is for recreation and the maintenance of a healthy, well-balanced aquatic community.

Sedimentation, animal waste, urban stormwater, and septic tanks are reported to be "particularly problematic" in the watershed (FDEP, 1998). FDEP's 305(b) report indicates many tributaries of the Choctawhatchee River have been heavily impacted by runoff from agricultural facilities and unpaved roads (Hand et. al., 1996).

FDEP's Bureau of Laboratories was requested to assess the status of selected waterbodies on the TMDL list by conducting a Biological Reconnaissance of instream biota. Habitat and water quality was also assessed. A secondary objective of this study was to evaluate potential effects of stormwater runoff from selected poultry farms on adjacent receiving waters.

Methods

The focus of this investigation was to determine if human activities were affecting the water quality or health of receiving water biota in selected streams in the Choctawhatchee River drainage basin. Twelve sites were sampled during this study (see site descriptions below).

Surface water samples were taken from all sites and analyzed for nitrite-nitrate, total Kjeldahl nitrogen, total phosphorus, total suspended solids, turbidity. Measurements were also taken at each site for fecal and total coliforms. A physical/chemical characterization (FDEP 1996b, Biology Section Standard Operating Procedure, BA-17) and habitat assessment (FDEP 1996b, BA-18) were performed at each study site. Of these twelve sites, eight (all except Par-

rot Creek, Pittman Creek, Mud Pond Tributary and Cow Branch) were sampled to determine biological health of the systems. Benthic macroinvertebrate communities were evaluated using DEP's technique for Biological Reconnaissance (Bio-Recon). Invertebrates were collected from multiple substrates (e.g., snags, leaf packs, vegetation) using 4 discrete dip net sweeps (FDEP 1996, BA-7). The samples were then field picked and brought back to the laboratory for identification under a dissecting microscope. Bio-Recon is a screening tool, designed to determine which systems are biologically healthy. Streams that fail the Bio-Recon are suspected to be impaired, and it is suggested that follow-up, definitive sampling (using Stream Condition Index methods) be performed for further evaluation.

Explanation of Measurements of Community Health

Selected measurements of macroinvertebrate community health were employed to assess a site. These are briefly discussed here.

Habitat Assessment: Eight attributes known to have potential effects on the stream biota were evaluated and scored, with 20 points possible for each factor. Based on the sum of these individual scores, overall habitat quality is assigned to one of four categories: Optimal (121-160 points); Suboptimal (81-120 points); Marginal (41-80 points); and Poor (0-40 points).

Taxa richness: This measurement is based on the total number of taxa found at a site. Stress tends to reduce the number of different types of organisms present in a system.

Numbers of pollution sensitive taxa: Some organisms become rare or absent as the intensity or duration of disturbance increases. For example, the Florida Index assigns points to stream-dwelling macroinvertebrates based on their sensitivity to pollution (see Ross 1990). A site with a high Florida Index score is considered healthy.

Ephemeroptera/Plecoptera/Trichoptera (EPT) Index: This index is the sum of the number of EPT taxa present. Higher EPT values are associated with healthier systems.

Sampling for this investigation was performed on July 28th and 29th, 1998 jointly by staff from FDEP's Bureau of Laboratories and Northwest District. The FDEP Bureau of Laboratories performed the biological and chemical analysis.

Descriptions of Study Sites

The northern-most river segment of the Choctawhatchee, which extends from the Alabama border down to the mouth of Wrights Creek, includes Parrot, Sikes, Pittman and Wrights Creeks. This area is located in subecoregion 65G (Dougherty/Marianna Plains) with local land use mostly agriculture and silviculture. The area has the highest potential runoff rates (20-40 inches) in Florida. Sedimentation is a major concern in the area.

Parrot Creek @ 163 is located near the Alabama-Florida border in Holmes County and has multiple poultry farms in its drainage basin (located upstream of the sampling point).

Choctawhatchee River @ Hwy 2 is located in northern Holmes County, west of Pittman, FL. Coliforms, nutrients, total suspended solids, turbidity and mercury (based on fish consumption advisory) were concerns of the 1998 State of Florida 303(d) list.

Sikes Creek @ 179 is located in the middle of Holmes County with headwaters near Pittman, FL and State Road 2. Coliforms, dissolved oxygen, total suspended solids, and turbidity put this segment on the 303(d) list.

Wrights Creek @ 179 extends from the northeastern most section of Holmes County, southwest through Caryville, Westville, Esto and Noma, FL. The sewage treatment plants for these 4 towns discharge into Wrights Creek.

Pittman Creek @ CR 179a is located north of Prosperity, FL in Holmes County. Three poultry farms are located upstream of the sampling site.

The Choctawhatchee River's middle segment includes Mud Pond tributary, Cow Branch and Bruce Creek. This area is located in subecoregion 65G (Dougherty/Marianna Plains) and 65f (Southern Pine Hills and Plains). Local land use is mostly agricultural, with silvicultural, commercial, industrial, strip mine, solid waste disposal, electrical transmission, transportation (road/highway and dirt road areas) uses also represented.

Choctawhatchee River @ Hwy 90 is on the border of Holmes and Washington Counties about 10 miles west of Bonifay, FL. Coliforms, total suspended solids, turbidity and mercury (from fish consumption advisory) were concerns of the 1998 303(d) list.

Mud Pond tributary is located southwest of Westville, FL in Holmes County. Four poultry farms are located in the immediate area.

Cow Branch is located 2 miles north of Ponce de Leon Springs State Recreation Area. Three poultry farms are upstream and adjacent to this sampling location.

Bruce Creek @ Hwy 81is located in eastern Walton County with headwaters in the south and southeastern areas of DeFuniak Springs, FL. Flow is south and then east to the Choctawhatchee River above Red Bay. Coliforms and turbidity violations placed Bruce Creek on the 1998 State of Florida 303(d) list.

The headwaters of Alligator Creek @ Hwy 90 are located in Jackson County south of Graceville and Campbellton, FL. Alligator Creek discharges into Holmes Creek in Washington County, a few miles southwest of Chipley. The watershed is located in the subecoregion 65G (Dougherty/Marianna Plains) with agriculture as the predominant landuse. The Chipley sewage treatment plant discharges to Alligator Creek near its mouth. The parameters that placed the creek on the 1998 303(d) list were coliforms, biological oxygen demand, dissolved oxygen, nutrients, and turbidity. Agricultural runoff is a major contributor to the above pollution concerns, as well as the City of Chipley WWTP.

The lower segment of the Choctawhatchee River is located in subecoregion 75A (Gulf Coast Flatwoods). Local land use outside of the predominantly forested wetland area is silviculture, agriculture, and some residential areas. Impacts to the entire river are integrated in this area. This section is the depositional zone for the pollutants discharged upstream. The lower segment includes Holmes Creek.

Holmes Creek @ Hwy 284, located near the Washington-Walton County border, receives sewage treatment discharges from Graceville, Noma, Chipley, Bonifay, and Vernon, FL. Runoff from hog and poultry farms has caused dissolved oxygen problems in the recent past.

Choctawhatchee River @ Hwy 20 is on the border of Washington and Walton Counties. Coliforms, total suspended solids and turbidity placed this segment on the 1998 State of Florida 303(d) list.

Camp Branch, another site of interest, is located east of Bonifay, FL and receives the city's STP effluent. Coliforms, nutrients and turbidity are parameters of concern on the 303(d) list. This site was not sampled during this study period. However, historical data is available.

Results and Discussion

Habitat Parameters

Habitat quality was in the "optimal" or "suboptimal" range for all assessed stations (Table 1, note that the Mud Pond Tributary data sheet was missing). Habitat scores ranged from a high of 137 points at Pittman Creek to a low of 99 at Sikes Creek. Four stations had habitat quality in the "optimal" range (Parrot Creek, Pittman Creek, Holmes Creeks and Cow Branch). The remaining stations (all three Choctawhatchee River stations, as well as Wrights, Alligator, and Bruce Creeks) ranked in the upper portions of the "suboptimal" range.

Sand or silt smothering was a major concern, with scores either in or below the "suboptimal" category for every site except Choctawhatchee at Hwy 20, which scored at the bottom of "optimal". Two factors that contributed to the sand/silt smothering were bank instability and erosion from disturbed soil in the adjacent watershed. Cow Branch, Bruce Creek, Holmes Creeks, and all three stations on the Choctawhatchee River had observable signs of small to moderate areas of bank erosion. Turbidity (see below) was elevated at several sites.

Water velocity at Parrot, Sikes and Alligator Creeks was very low (nearly stagnant) and Wright Creek and two Choctawhatchee River stations (at Highways 90 & 20) had flows of less than 0.1 m/sec. A combination of watershed sediment inputs (associated with storm events) and low stream velocity (during normal conditions) would be expected to promote deposition of sand and silt on habitats.

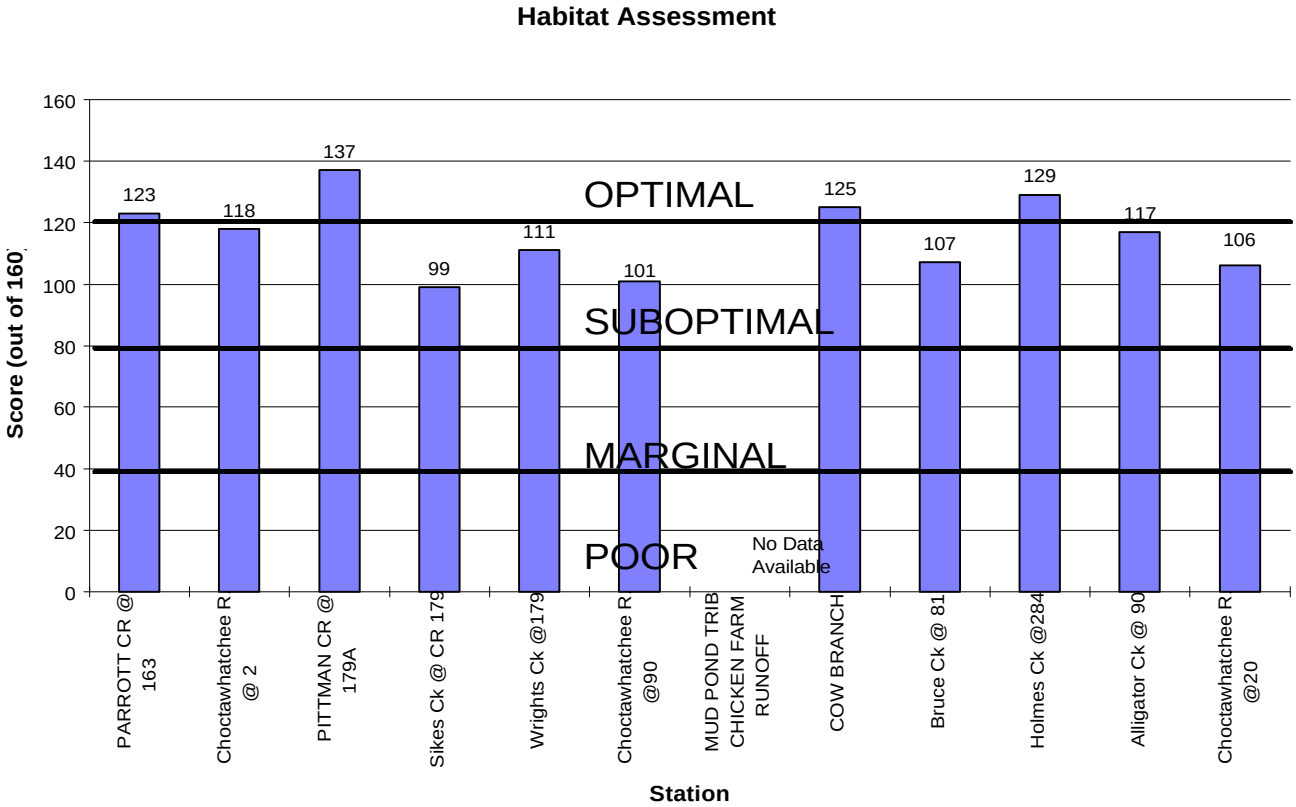


Figure 2: Habitat Scores

Water Quality

Dissolved oxygen concentrations at all but three stations complied with the Class III water quality standard of 5.0 mg/L (see Table 1). Dissolved oxygen at Parrot Creek (4.1 mg/L), Sikes Creek (3.0 mg/L), and Alligator Creek (1.9 mg/L) was less than the Class III standard, potentially due to lack of stream flow at time of sampling or presence of oxygen demanding substances (BOD). These three sites had BODs ranging from 1.7 mg/L (Sikes Creek) to 3.4 mg/L (Parrot Creek). The pH ranged from a low of 6.1 SU (Cow Branch) to a high of 7.4 SU (Choctawhatchee at hwy 90). Specific conductance ranged from 18 µmhos/cm at Cow Branch to 240 µmhos/cm at Alligator Creek.

Nitrite-nitrate concentrations at eight of the stations sampled were higher than the values found in 60% of other streams in Florida (Table 1, see *Typical Water Quality Values* in Appendix). Nitrite-nitrate represents a major form of bioreactive nitrogen in a system and high values are often associated with anthropogenic inputs such as fertilizer from agriculture. The highest nitrite-nitrate values were found at the three Choctawhatchee River stations (0.63 mg/L at Hwy 2, 0.75 mg/L at Hwy 90 and 0.53 mg/L at Hwy 20). Conversely, Sikes Creek, Alligator Creek and Mud Pond Tributary had nitrite-nitrate concentrations in the lower 30% of Florida streams.

Total Kjeldahl nitrogen levels throughout the basin were mostly low (below 0.49 mg/L) compared to other Florida streams. TKN at Alligator Creek and Mud Pond Tributary were slightly above average values for Florida streams (both were 1.1 mg/L). Phosphorus enrichment was seen at only Alligator Creek. The total phosphorus concentration at this station (0.27 mg/L) was higher than the values found in 70% of other Florida streams. All other stations had phosphorus values below 0.054 mg/L.

Station	Choctaw-hatchee R. @ Hwy 2	Sikes Ck @ CR179	Wrights Ck @179	Choctaw-hatchee R. @ Hwy 90	Bruce Ck @ 81	Holmes Ck @ Hwy284	Choctaw-hatchee R. @ Hwy 20	Alligator Ck @Hwy 90
Storet Number	32020001	32020114	32020017	32020011	32020020	32020005	32020007	32020025
Sampling Date	7/28/98	7/28/98	7/28/98	7/28/98	7/28/98	7/29/98	7/29/98	7/28/98
BIORECON DATA:								
# Taxa	28	18	26	22	38	17	17	31
Florida Index	23	0	5	10	31	5	7	6
EPT	11	0	4	6	14	6	6	1
Habitat	118	99	111	101	107	129	106	117
WATER QUALITY DATA:								
Cond (umho/cm^2)	72	139	173	82	70	211	115	240
DO (mg/l)	5.9	2.96	7.4	5.3	6.25	8.3	7.7	1.9
PH (SU)	6.7	6.72	7.31	7.4	6.37	7.31	7.27	6.77
Color (PCU)	70	70	15	60	60	10	50	80
Turbidity (NTU)	19	8	4.3	19	7	6.9	17	33
TSS (mg/l)	11	NA	8	11	NA	15	13	58
NO_2NO_3 (mg/l)	0.63	0.037	0.26	0.75	0.16	0.24	0.53	0.04
TKN (mg/l)	0.27	0.49	0.14	0.27	0.28	0.091	0.2	1.1
TP (mg/l)	0.054	0.021	0.027	0.044	0.026	0.027	0.038	0.27
TOC (mg/l)	3.8	6.5	1.8	2.6	5.6	2.3	2.3	9.2
BOD (mg/l)	1.4	1.7	0.5	2.1	1.4	0.8	0.5	1.9
Fecal Coliforms (#/100 ml)	32	60	56	20	100	110	50	250
Total coliforms (#/100 ml)	120	400	270	270	560	300	310	310

Figure 3: Data Table for TMDL Streams

Figure 4: Data Table for Streams Adjacent to Poultry Farms

Station	PARROTT CR @ 163	PITTMAN CR @ 179A	MUD POND TRIB CHICKEN FARM RUNOFF	COW BRANCH
Sampling Date	7/28/98	7/28/98	7/28/98	7/29/98
HABITAT	123	137	NA	125
WATER QUALITY DATA:				
Cond (umho/cm^2)	82	172	80	18
DO (mg/l)	4.1	5.7	6	8.56
PH (SU)	6.7	7.3	6.24	6.12
Color (PCU)	50	15	150	60
Turbidity (NTU)	4.9	4.5	6.2	8.7
TSS (mg/l)	4	4	7	12
NO_2NO_3 (mg/l)	0.078	0.16	0.006	0.27
TKN (mg/l)	0.49	0.11	1.1	0.39
TP (mg/l)	0.008	0.016	0.033	0.036
TOC (mg/l)	3.7	1.4	19	4.6
BOD (mg/l)	3.4	0.5	2.1	0.6
Fecal Coliforms (#/100 ml)	74	310	220	400
Total coliforms (#/100 ml)	510	1500	810	3000

Total organic carbon (TOC) was highest at Mud Pond (19 mg/L) and Alligator Creek (9.2 mg/L). All other stations had values below 6.5 mg/L. High TOC levels at Mud Pond may be related to the station's proximity to poultry farms. BOD was also moderately elevated at this site (2.1 mg/L). The elevated TOC at Alligator Creek may be related to algal growth observed there.

Turbidity was elevated at many sites in the Choctawhatchee basin. Turbidity at the three Choctawhatchee River stations (between 17 NTU to 19 NTU) was higher than the values found in 95% of other Florida streams. Although the Choctawhatchee is an alluvial system, these relatively high turbidity measurements are probably related to soil disturbance in the basin (probably agricultural in origin). The turbidity measurement at Alligator Creek (33 NTU) possibly represents a water quality violation, since the Class III water quality standard is 29 NTU above background, and the average turbidity for a Florida stream is 2.8 NTU. Total Suspended Solids (TSS) measurements at Alligator Creek (58 mg/L) were also relatively high.

Fecal coliform bacteria complied with the Class III standard of 800 colonies/100mL for all stations in the Choctawhatchee River basin. Total coliform measurements complied with the Class III standard of 2400 colonies/100 mL at all stations except Cow Branch. Total coliforms at Cow Branch (3,000 colonies/100 mL), exceeded the Class III water quality standard. It should be noted that sampling was done during a relatively dry period with little amounts of antecedent rainfall. Without stormwater events to transport bacteria into the waterbodies, coliform results from this study probably represent a "best case scenario", and are not indicative of stormwater mediated inputs.

Macroinvertebrate Parameters

Macroinvertebrate sampling, using the Bio-Recon 4-dip net sweep method, was performed at 8 of the 12 sampling locations. Taxa richness surpassed the expectations for unimpaired sites in the western panhandle (24 taxa) at only four sites, including Choctawhatchee River at Hwy 2 (28 taxa), Wrights Creek (26 taxa), Bruce Creek (38 taxa), and Alligator Creek (31 taxa). The Choctawhatchee River @ Hwy 90 had 22 total taxa, Sikes Creek @ CR 179 had only 18 taxa, while Holmes Creek and the Choctawhatchee River @ hwy 20 had 17 total taxa at each site.

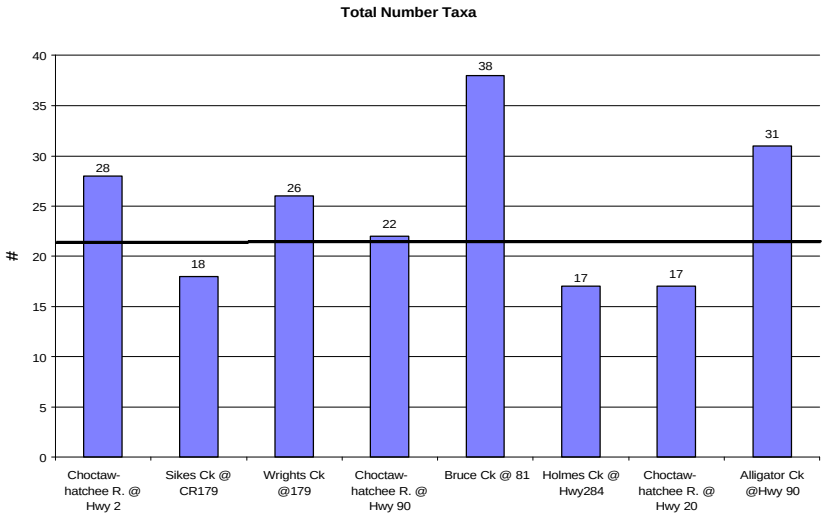
Florida Index scores exceeded the threshold value (22 Florida Index points) expected for western panhandle streams only at Choctawhatchee River @ Hwy 2 (with 23 Florida Index points) and Bruce Creek (31 points). The remaining 6 sites all scored less than 10 for this parameter, with Sikes Creek scoring a zero. The same pattern is evident with

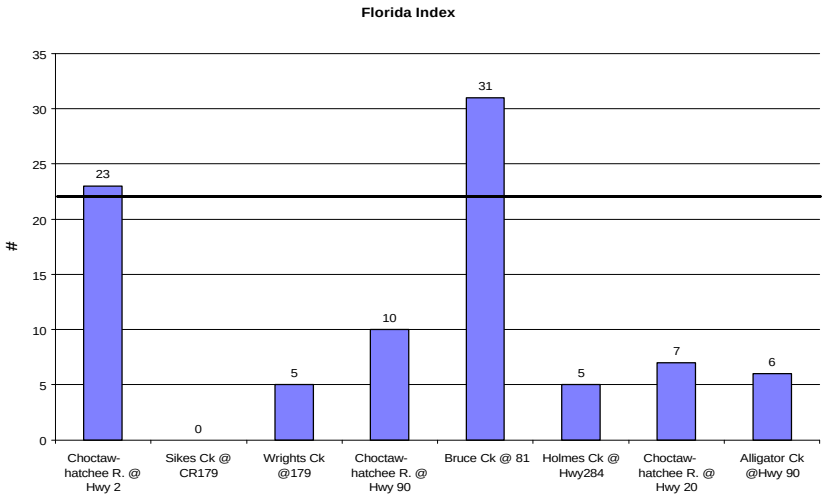
EPT Index scores. Only the Choctawhatchee River @ Hwy 2 (with 11 EPT taxa) and Bruce Creek (14 EPT taxa) exceeded the threshold value of 11 EPT taxa. The remaining 6 sites fell below 6 EPT taxa. Once again, Sikes Creek scored a zero for this parameter.

During this study, only the Choctawhatchee River @ Hwy 2 and Bruce Creek could be considered biologically healthy by virtue of passing all three Bio-Recon metrics. All remaining sites in the Choctawhatchee basin failed to meet even two of the three metrics, with several sites failing to meet even one metric.

Summary of Results by Site

The Choctawhatchee River @ Hwy 2 passed all three Bio-Recon metrics. Levels of coliform bacteria and most nutrients (except nitrite-nitrate) were acceptable at the time of sampling. However, values for nitrite-nitrate (0.63 mg/L) and turbidity (19 NTU) which (in part) were responsible for placing this reach on the 303(d) list, remained elevated. The habitat smothering observed at Choctawhatchee River stations located father downstream may be related to the elevated turbidity measured at this site. The elevated turbidity here may be due to land use practices in Ala-





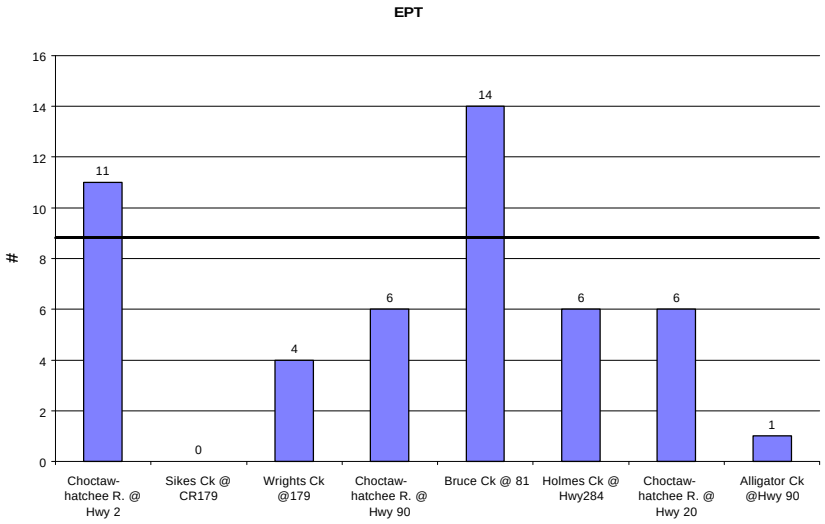


Figure 5: Selected Macroinvertebrate Parameters

bama. Mercury, another factor placing this site on the 303(d) list, was not sampled.

Sikes Creek @ 179 failed all three Bio-Recon metrics. Severe habitat smothering, low water velocity, and low dissolved oxygen (violating Class III water quality standards) contributed to the low Bio-Recon scores. It should be noted that the creek was almost dry at the time of sampling. Coliforms, turbidity and nutrients were not a problem.

Wrights Creek (at Hwy 179) failed to meet two of the three metrics for the Bio-Recon. At this location, Wrights Creek is very slow moving and quite deep. Biological sampling was restricted to habitats accessible near the stream banks. Results may have been different if the creek were sampled farther upstream, in areas of higher water velocity. Nitrite-nitrate (0.75 mg/L) enrichment was observed at this site. All other parameters were acceptable.

The Choctawhatchee River @ Hwy 90 failed all three of the Bio-Recon metrics. Deposition of silt and clay, related to slow stream velocity (0.08 m/s maximum), contributed to the poor Bio-Recon scores (habitat smothering). Nitrite-nitrate (0.75 mg/L) and turbidity (19 NTU) values, which (in part) were responsible for placing this reach on the 303(d) list, remained elevated. Mercury was not sampled.

Bruce Creek @ Hwy 81 passed all three Bio-recon metrics, indicating conditions there were favorable to biota. Turbidity (7 NTU) and nitrite-nitrate (0.16 mg/L) were slightly above background values. All other parameters were at acceptable levels. Based on these recent data, Bruce Creek should be given consideration for removal from the 303(d) list.

Turbidity (7 NTU) and nitrite-nitrate (0.24 mg/L) were slightly elevated at Holmes Creek (at Highway 284), but all other water quality parameters were satisfactory. However, this site did not pass any of the Bio-Recon metrics and had problems with habitat smothering and bank erosion.

The Choctawhatchee River @ Hwy 20 failed to meet any of the Bio-Recon metrics. Habitat problems included low water velocity and bank instability. Similar to the other Choctawhatchee River stations, turbidity (17 NTU) and nitrite-nitrate (0.53 mg/L) levels were elevated, suggesting that this site remain on the 303(d) list.

Alligator Creek @ Hwy 90 failed two of the three metrics. At the time of sampling, the site was almost dry, with very little water flow, and had an algal scum covering the surface of the water. Alligator Creek failed to meet water quality standards for dissolved oxygen (1.9 mg/L) and possibly turbidity (33 NTU). Suspended solids (58 mg/L), Kjeldahl nitrogen (1.1 mg/L) and total phosphorous (0.27 mg/L) were also elevated.

The four creeks located near poultry farms included Parrot Creek, Pittman Creek, Mud Pond tributary, and Cow Branch. Low dissolved oxygen was observed at Parrot Creek (4.1 mg/L), a violation of Class III water quality standards, probably related to the elevated BOD (4.9 mg/L) there. Slightly elevated concentration of nitrite-nitrate (0.16 mg/L) was measured in Pittman Creek. The total organic carbon (TOC) at Mud Pond Tributary (19 mg/L) was the highest in the basin, and moderately elevated BOD (2.1 mg/L) was also observed there. Elevated total coliform bacteria at Cow Branch (3,000 colonies/100 mL) exceeded the Class III water quality standard. Moderately elevated nitrate-nitrite (0.27 mg/L) was also measured in Cow Branch. These data indicate that water quality concerns do exist in streams adjacent to poultry farms in the Choctawhatchee basin. Continued monitoring to evaluate the contribution of these poultry farms to water quality degradation is advised.

Camp Branch, also within the drainage basin, was not sampled during this period, but data from

1995 are available (FDEP 1996, see Appendix). Based on the Stream Condition Index, macroinvertebrate communities in Camp Branch were severely impaired, both upstream and downstream of the Bonifay WWTP. It was noted that biological impairment was most probably related to poor water quality due to urban stormwater runoff, rather than proximity to the Bonifay WWTP. Violations of the Class III standard for dissolved oxygen and unionized ammonia were found at both sites. Concentrations of total phosphorus, ammonia, and TKN were higher than 90% of other Florida streams.

Conclusions

Erosion is a major concern in the Choctawhatchee River basin, with most sites sampled suffering either from elevated turbidity, habitat smothering and/or bank instability. Implementation of Best Management Practices (BMPs) to control erosion and sedimentation should be a priority for the Choctawhatchee River basin.

It should be noted that this study took place during a relatively dry period with little amounts of antecedent rainfall. Without stormwater events to transport pollutants into the waterbodies, results from this study probably represent a "best case scenario", and are not indicative of stormwater mediated inputs.

Biological communities were considered healthy only at the Choctawhatchee River @ Hwy 2 and Bruce Creek @ Hwy 81, as these were the only sites passing the Bio-Recon. Potential reasons these sites did not meet the minimum Biorecon thresholds, summarized by site in this report, include low dissolved oxygen, low water velocity, habitat problems, or degraded water quality.

Violations of Class III water quality standards for dissolved oxygen occurred at Parrot, Sikes, and Alligator Creeks.

Nutrient enrichment was observed at ten of the twelve sites in the watershed. Nitrite-nitrate concentrations at all three Choctawhatchee River stations were higher than those found in approximately 90% of other Florida streams. The highest nitrite-nitrate concentrations were in the upper and middle Choctawhatchee River, suggesting sources from Alabama. Nitrite-nitrate concentrations in Wrights Creek, Holmes Creek, Bruce Creek, Pittman Creek, and Cow Branch and exceeded those found 60% of other Florida streams. Total phosphorus in Alligator Creek exceeded the values found in 70 % of other Florida streams.

All three Choctawhatchee River sites had elevated turbidity, which contributes to habitat smothering under lower velocity conditions. Again, this suggests erosion from land use practices in Alabama is contributing to the elevated turbidities. Alligator Creek, with a value of 33 NTU, was in possible violation of turbidity standards

The four creeks located near poultry farms suffered either from dissolved oxygen violations (Parrot Creek), elevated values of BOD (Parrot Creek and Mud Pond tributary) nitrite-nitrate enrichment (Pittman Creek and Cow Branch), elevated TOC (Mud Pond tributary), or total coliform bacteria violations (Cow Branch). These data indicate that water quality concerns do exist in streams adjacent to poultry farms in the Choctawhatchee basin. Continued monitoring to evaluate the contribution of these poultry farms to water quality degradation is advised.

With one exception (Bruce Creek), it is recommended that all sites sampled remain on the 303(d) list. Based on these recent biological and water quality data, Bruce Creek should be given consideration for removal from the 303(d) list.