An Integrated Water Quality Monitoring Plan for Northwest Florida and Alabama Watersheds

Introduction

An integrated plan for measuring water quality in the Florida Panhandle and associated Alabama watersheds will enhance the information available to resource managers and the public. The aquatic environment, from freshwater streams to the ocean, is critical for human water use and to healthy aquatic ecosystems. A watershed approach is essential because land and water use in inland areas affects the quality of rivers that flow into coastal bays, estuaries, wetlands, and the ocean. Monitoring is key to determining whether goals for protection of these resources are being achieved.

Northwest Florida contains five interstate watersheds which originate in Alabama and empty into Florida's bays before entering the Gulf of Mexico Basin (Figure 1). The biological integrity of our freshwater, estuarine, and coastal environments have been and continue to be impacted by a suite of biological, chemical, and physical stressors. Specific stressors include habitat alteration, nutrient loading, suspended and bedded sediments, pathogens, toxic chemicals, and the introduction of invasive species. Aquatic life health effects also share a common concern with human health effects.

This report summarizes results of the workshop held at the University of West Florida on August 18, 2011. There were 37 participants including individuals from citizens groups, consulting companies, the University of West Florida, county, state and federal agencies. Participants of this workshop were grouped into four groups based on their familiarity and work done with the various watersheds. The groups consisted of the Perdido Bay; Pensacola Bay; Choctawhatchee Bay; and St. Andrew Bay systems. The goal of this workshop was to enhance and strengthen existing water quality monitoring programs in the region, as well as to work with Florida DEP's new Regional Water Quality Monitoring Councils and the ADEM Water Quality Monitoring Program.

In order to develop a more interactive workshop, the university created an online survey tailored to the area watersheds asking for information related to the following topics:

(i) Sampling location, frequency, and current status of sampling stations.
(ii) Parameters measured, sampling methodology, and methods used during the analysis of the samples
(iii) Data quality
(iv) Reporting methods
(v) Funding sources

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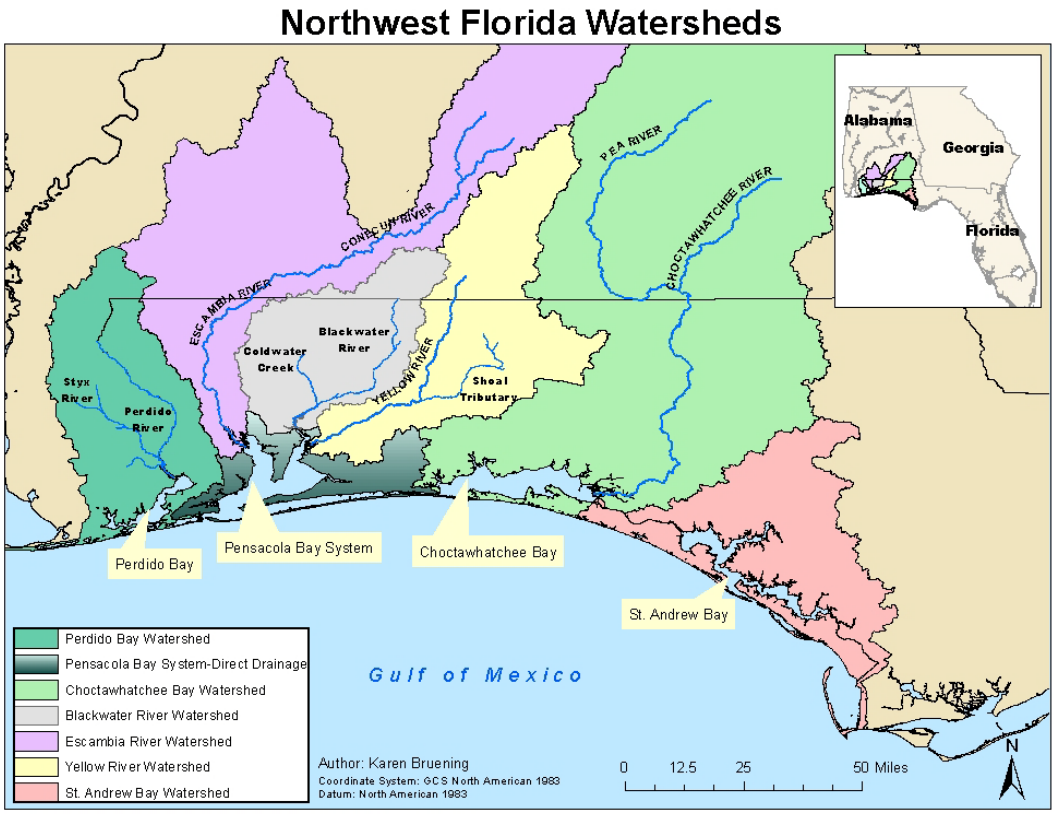

Figure 1. Four interstate watersheds originate in Alabama and empty into Florida bays, before entering the Gulf of Mexico Basin. Note that St. Andrews Bay Watershed is entirely located in the state of Florida.

Survey Results

- The survey respondents were represented by sector in the following manner: 31% state employees, 23% federal employees, 19% Non-governmental organizations, 11% academics, 10% citizen scientists, and 6% business.
- Among the area watersheds, 22% of the participants worked on the Escambia/ Conecuh River, 18% Choctawhatchee, 17% Yellow/Shoal, 16% Perdido, 15% Blackwater, and 13% St. Andrew.
- The purpose for sampling ranged from dedicated programs such as: TMDL, NPDES, 303d listings, to mussel presence/absence, water quality, and preliminary restoration site data.
- Respondents were asked if they had dedicated instruments/equipment to collect their data. Of the 33 individuals who answered the question, one organization did and 97% did not.
- One third of the respondents used a 12-digit Hydrologic Unit Code (HUC), while two thirds did not.

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- Twenty three of 35 respondents revisited their stations (weekly, monthly, bi-annually, or annually), 12 did not return to the site.
- Many of the respondents had long-term data for reference stations; others indicated they had difficulty identifying reference stations within their watersheds.
- Sampling frequency was connected to the 'purpose of sampling' question. About 20% of the respondents sampled monthly or seasonally, 10% sampled after rain events, 8% sampled annually, while only 3% sampled weekly.
- All of the respondents measured temperature. Other common parameters were pH (95%), Conductivity (92%), Salinity (90%), Nutrients (85%), Chlorophyll (85%), Total Suspended Solids (70%), Fecal Coliform (65%), Light (PAR or other – 55%), POC/DOC (particulate organic carbon/dissolved organic carbon – 40%), and flow rate (40%).
- 80% of the constituent form sampled was dissolved, whereas 70% of the constituents sampled were in the particulate phase.
- Of the groups sampling, 45% conducted Stream Condition Indices (SCI), 40% routinely conduct Benthic Assessments, and 30% routinely conduct Bioassays.
- 80% of the data collected was subjected to QA/QC.
- 31% of the data collected was stored on STORET, 24% was not available, 17% was stored on a hard drive and must be requested, 17% was publically accessible, and 11% was on a private server.
- Of the data collected:
    - 63% was available digitally; 37% was not.
    - 57% had metadata associated with the data; 43% did not.
    - 80% was available electronically; 20% was only available on paper.
- When asked if data was routinely published in reports, answers were very inconsistent. Many submitted their findings to scientific journals, management reports, or rely on their partners to publish their findings. FDEP uses data and then averages it for Basin Reports, Status Monitoring Network, and Ground Water Reports.
- When asked where the reports were housed and who had access to them, many organizations kept the reports and would only forward them if specifically requested to do so.
- Survey respondents were asked about federal sources of funding. 72% received funding from USEPA, 22% from USFWS, 16.7% from NOAA, 5.6% from ACOE, and 5.6% from USGS.
- Survey respondents were asked about state funding. 71% received funding from FDEP, 29% from WMD, 21% from Lake Watch, 14% from ADEM, and 7.1% from FFWCC.

- Participants were asked if their funding ever came from private sources; 55% answered yes, 45% said no.
- When asked if the funding was secure, 55% indicated that funding was based on a renewal process from year to year, 45% indicated that when the project was completed and there would be no additional funding for the effort.
- Participants were asked if their respective programs would be increasing or decreasing monitoring stations during the next 12 months. 45% of the responses indicated there would not be a change to their program, 28% indicated a change was funding dependant, 12% indicated they would be increasing monitoring stations, while another 12% indicated they would not be increasing stations. The responses indicated the monitoring programs were in flux, and the future was unknown.
- When asked if there were specific stations they would like to monitor but couldn't due to monetary constraints, the overwhelming response was 'Of Course'.

National Water Quality Monitoring Council

In 2006, the National Water Quality Monitoring Council developed a plan for monitoring water quality in coastal waters and their tributaries in the United States, called the National Monitoring Network and Their Tributaries (http://acwi.gov/monitoring/index.html). Several features of that plan would be particularly appropriate for the development of a Panhandle water quality monitoring plan.

The focus of the National Monitoring Network Plan is on coastal resources and the upland watersheds that affect them. The National Monitoring Network design includes an assessment of the status of tributary rivers, estuaries and coastal waters, which is currently being conducted by states through EPA's national assessment programs (Wadeable Streams Assessment, National Coastal Condition Assessment, etc.). However, the design also includes stations at strategic locations in rivers and estuaries in order to assess trends and fluxes of important constituents. This part of the design has only been implemented at a limited number of sites by the USGS, and none of those sites are located in the Panhandle. The design emphasizes the integration of data from multiple organizations into a coherent assessment of the condition of and trends in the quality of the Nation's coastal waters and their tributaries. To be successful, environmental monitoring data should be collected using known and appropriate methods; have documented quality assurance and quality control; and include metadata.

Common Characteristics of the Groups

Some individuals were familiar with the Watershed Monitoring Basin Reports produced by FDEP. Few people were aware of the FDEP status and trends monitoring guidance or the National Monitoring Network. The Watershed Management Plans need updating. Much of the historic data exists in gray literature reports which are not readily available. A summary (or digital archive) of this information would be helpful.

Several topics were common among the groups. There was a consensus in the need to control sediment, fertilizers, pesticides, and nutrient discharges into freshwater systems. In addition, although BMPs exist, the implementation is not always the norm; particularly the use of fertilizers in agriculture or golf courses. Another topic of concern was the presence of fecal contamination in fresh and estuarine waters, and the fact that state and federal programs testing for fecal indicators wax and wane due to politics rather than need.

The groups were aware of the existence of the STORET Database but were unclear how the data collected was being used, or if it was used. Most participants were unaware that the State of Florida received money to maintain and update the STORET Database from USEPA, this funding has ceased as of 2010, and the state is currently developing a new program which is called Watershed Information Network (WIN) which will allow spatial and temporal data to be included in a statewide program accessible by multiple agencies (WMD, FDEP, DOH, etc). A drawback of this new WIN system will be that as parameters are relaxed or tightened, on a regulatory basis - this type of historical information (values increasing/decreasing) was discussed with the transition team and may be flagged within the new system. The USEPA also uses a STORET Database for their regional states, which is a different program from what the state of Florida is currently using. In order for information to be archived in these systems, all data collected must adhere to standard QA/QC procedures, and include metadata. Citizen groups volunteering and assisting in water quality monitoring will need assistance with these requirements.

A portion of the workshop was dedicated to identifying key parameters needed to evaluate the conditions of the system. The groups reached a consensus that there should be a two-tier approach for our watersheds. The first tier parameters should be measured monthly and include: temperature, conductivity, salinity, dissolved oxygen, pH, nutrients, turbidity, suspended solids, and fecal coliform. The second tier data should be collected quarterly, biannually. This tier consists of specific conditions or parameters to support research, benthic assessments, or areas of interest for each watershed. The specific considerations for each watershed are in the following sections of this document.

Finally, there was a consensus about the need of more monitoring stations and the concern that with the recent budget cuts, the number of stations and sampling frequency had been reduced with no plan in place to provide continuity in environmental status and trends monitoring. All groups felt that there was little consistency with the monitoring

frequency and with an apparent dearth in public reporting, questioned whether anyone took time to review the data for the overall health of each of the watersheds.

Perdido Watershed

The group agreed with the basin monitoring report that the main land use in the basin is agricultural. However, the report needed to be revised and updated. The impact of increasing aquaculture located in the upper portion of the watershed with attendant increases in the level of nutrients was a significant concern. Sediment inputs were one of the main threats for the watershed. The presence of unpaved roads, uncontrolled active and abandoned gravel pits, cleared lands for residential developments, and areas of concentrated runoff appeared to be contributing large amounts of sediment into the rivers and streams of the watershed.

The Perdido group was also concerned about the effectiveness of the effluent treatment from the paper mill located in Cantonment and its effect on the receiving wetlands and river. Current permit approves the use of constructed wetland system. Concern was expressed for Tee and Wicker Lakes located immediately to the south of the receiving wetland. Concern was also expressed about the function of the receiving wetland at Bayou Marcus wastewater treatment plant, mainly that the flow has become channelized and was not filtered through the swamp as intended.

Pensacola Bay Watershed

The basin description from the watershed monitoring basin report needs extensive revision. It does not include a description of the legacy contaminants such as PCBs and dioxins. Industrial activities in the lower watershed from companies such as Gulf Power, Solutia, Air Products, Arizona Chemical, the new ECUA facility also need to be included in the description. There is no description of land uses in Alabama which may affect water quality in the Pensacola Bay area. These include 2000 wells associated with oil and gas exploration, hydropower and reservoirs, poultry and confined animal feedlots, sewage treatment plants, and plans for a large landfill adjacent to the Escambia River. Forestry management practices in both Alabama and Florida watersheds may also influence water quality.

Concerns include legacy pollutants (PCB, dioxin), mercury, sedimentation, nutrients, groundwater inputs of nitrogen and sulfur and atmospheric deposition of contaminants that are likely to be important and not currently captured. Some of the forestry practices such as site preparation in the late summer and early fall may lead to runoff of herbicides into surface waters.

The group felt that it would be beneficial to increase measurements of water quality in the major tributaries, particularly to get trend data. Cutbacks at the Department of Health mean that some critical recreational areas will no longer be monitored for fecal coliform, so continuing those stations is a critical need. Continuous monitoring of turbidity would be most effective in areas susceptible to sedimentation problems,

although some biotic assessments may also be useful. Biotic assessments are very useful and compliment physic-chemical assessments. The group also felt that continuous monitoring at major confluences and at the state line would be important.

The group felt that biotic assessments may be the most cost efficient way to assess the impacts of contaminants rather than measurements of these contaminants in the water. Work being done by the USFWS to create an Index of Biological Integrity (IBIs) throughout Alabama streams and rivers from the Pea to the Conecuh may serve as a useful model for the region. USFWS, Auburn University and other partners assess the biota to see which portions of the watershed have the highest diversity in order to develop areas for high priority ranking for additional or future conservation. Sites with reduced diversity or loss of sensitive species could then be targeted for contaminant analysis.

Choctawhatchee Bay Watershed

As with the other watersheds, the Choctawhatchee basin report will require extensive revision to accurately reflect current and future conditions. Growth in Okaloosa, Walton, Holmes, and Washington Counties is expected to increase based on the expansion of missions on Eglin and the supporting industries which are tied to these efforts. The addition of three new missions housed at Eglin AFB has had the most significant impact on Ft. Walton Beach, Ocean City, Shalimar, Valparaiso, and Niceville. In addition, mission support is also affecting Crestview and Mossy Head, but these communities are located in the Yellow/Shoal River Watershed. Development of the coast as resort communities continues to add pressures on infrastructure (roads and utilities) that impact water quality. One of the main concerns associated with the Choctawhatchee Bay is stormwater runoff.

Nutrient inputs are also a concern from septic systems and small wastewater treatment plant systems (< 1 MGD called “Package Plants”). Rocky Bayou, Blue Water bay, and Choctaw Beach are on septic systems. The communities of Freeport, Bruce, DeFuniak Springs, and Ponce de Leon Springs in upper portion of the Choctawhatchee watershed have package plants. These small-scale package plants cannot adequately buffer fluctuations in flow rates to maintain consistency in microbial treatment of the waste products resulting in effluent with high BOD and nutrients.

Sea grasses seem to be flourishing in the northern parts of the bay, whereas the sea grasses along the southern portion of the bay are in decline. The northern part of the bay drainage is buffered by Eglin AFB, whereas the southern shore of the bay has experienced increased eutrophication from urban runoff and sea grass beds continue to decline.

The Choctawhatchee Basin Alliance of Northwest Florida State College (CBA) has been active in monitoring the Bay system with State of FL assistance, but continued support is not secure. Sampling up into the watershed, including Alabama needs to be integrated.

St. Andrew Bay Watershed

St. Andrew Bay is located primarily in Bay County but is also influenced by activities in Walton, Washington, Jackson, Calhoun, and Gulf Counties. The natural tributaries from these surrounding counties are relatively clean, and several are spring-fed. No major rivers terminate in the watershed and therefore sediment burdens are quite low. As a result of these conditions, the estuary exhibits high water clarity and high salinity. This is the only bay system found along the northern Gulf of Mexico that is both an inland embayment and lacks large river system inputs.

The impacts of increasing development, industrial activities, and nutrient inputs all can impact water quality in St. Andrew Bay. The largest factor influencing St. Andrew Bay is the development associated with the St Joe Land Company, particularly the Northwest Florida Beaches International Airport. Most of these undeveloped lands border West Bay. The economic downturn has stopped many developments in the area, but a new 43,000 acre Sector Plan through FDEP's Ecosystem Management Agreement is underway and will streamline the permitting process when the economy turns around. The location of the previous airport has contributed to water quality impairments. The unpermitted filling of wetlands has led to increased turbidity for years.

Concerns about impairments include nitrogen and phosphorus inputs from waste water treatment plants (WWTP), both direct discharges and inputs from spray fields. Four WWTPs discharge directly into the Bay. The West Bay WWTP underwent construction upgrades between April and October 2011. Water quality monitoring from West Bay has identified poor flushing, increases in phosphorus and nitrogen and increased algal blooms. West Bay has also experienced high turbidity for several decades and a decline in seagrasses, while seagrass meadows in East Bay have increased over the last 15 years.

Other industry surrounding St. Andrew Bay includes the Gulf Lansing Power Plant (thermal effluent West Bay) and coal ash ponds along North Bay; Bay County Incinerator; Smurfit Stone paper mill effluent to St. Andrew Bay, Arizona Chemical. Drinking water for the region is from the impoundment of Deer Lake, which is near the site of the closed Magatte Landfill which has contributed to groundwater contamination. In nearby Mill Creek, a study conducted by USFWS identified dioxin, furans, metals, and chemicals suspected of causing endocrine disruption in sediments from the area. The Military Point vicinity has experienced degradation throughout the years likely due to the combined effluent from one of the WWTPs and the paper mill.

Recent declines in scallop population are a concern. Scalloping in this high salinity bay system has been famous for decades. The scallop industry is receiving assistance through highly publicized scallop gardens and scallop restoration efforts through the seasonal release of hatchery seed stock.

St. Andrew Bay Resource Management Association, a private, nonprofit citizens' group has coordinated volunteer water quality monitoring at 86 sites within the St.

Andrew Bay watershed, Bay County, FL for the past 22 years. State support for this effort is tenuous.

Recommendations

1. Increase the number of trend stations in each watershed and include flow measurements during sampling campaigns. Proposed stations can be located at:
    a. Perdido: Bayou Marcus, Eleven Mile Creek, and Perdido River. Recommend adding ADEM Stations.
    b. Pensacola: Quintette Road on Escambia River, Deaton Bridge on Blackwater River, Carpenters Park on Blackwater River, Rattlesnake Bluff on Yellow River. Regular sampling at USEPA stations in Escambia, East and Pensacola Bays.
    c. Choctawhatchee: Maintain existing CBA stations.
    d. St. Andrew: Maintain existing RMA stations, expand and maintain stream/lake surveys (stream condition indices, water/sediment quality parameters) and a survey of Deer Point Lake (potable water supply)
2. Maintain existing DOH fecal monitoring stations on a weekly basis, and trace the source of the problem.
3. Biological Monitoring
    a. Sea Grass Mapping: in all the bays (Appendix A & Appendix B),
    b. Stream Condition Indices, and
    c. Benthic Assessments.
4. Shoreline Assessments: in all the bays and land use changes over time.
5. Periodically assess legacy parameters: heavy metals, dioxins, hydrocarbons, pharmaceuticals, etc.
6. Standard suite of trends parameters should include:
    a. Water depth
    b. Secchi Disk depth
    c. Water Temperature (°C)
        i. Surface
        ii. Bottom
    d. Dissolved Oxygen (mg/L)
        i. Surface
        ii. Bottom
    e. Turbidity
        i. Surface
        ii. Bottom

f. Salinity (PSU)
    i. Surface
    ii. Bottom
g. pH (Standard Units)
    i. Surface
    ii. Bottom
h. Chlorophyll a (ug/L)
i. Total Nitrogen (ug/L)
j. Total Phosphorus (ug/L)
k. Nitrate (µgN/L)
l. Ammonium(µgN/L)

7. Ancillary data collected to compliment water quality parameters.
    1. Air Temperature (°C)
    2. Tides (incoming/outgoing)
    3. Rainfall in the area during the previous 24, 48, 96 hours
    4. Time of Sampling
    5. State of the Seas
    6. Area Weather Conditions
8. Training on calibration and maintenance of Data Sonde.
9. Separate efforts should be implemented to target problem areas and project-specific monitoring.
10. Outreach should include training in QA/QC accepted sampling and analysis methods, data handling, assistance with STORET/WIN data uploading, and support for annual watershed reports.

Acronyms

ACOE – Army Corps of Engineers

ADEM – Alabama Department of Environmental Management

AWT – Advanced Wastewater Treatment

BFA – Bream Fishermen's Association

CAFO – Confined Animal Feeding Operation

CEDB – Center for Environmental Diagnostics and Bioremediation

DOC – Dissolved Organic Carbon

DOH – Department of Health

FDEP – Florida Department of Environmental Protection

FFWCC – Florida Fish and Wildlife Conservation Commission

HUC – Hydrologic Unit Code

IBIs – Index of Biological Integrity

NOAA – National Oceanic Atmospheric Administration

NPDES – National Pollution Discharge Elimination System (Program)

NWQMC – National Water Quality Monitoring Council

PCBs - Polychlorinated Biphenyls

POC – Particulate Organic Carbon

QA/QC – Quality Assurance/Quality Control

RMA - Resource Management Association

SCI – Stream Condition Index

STORET – short for 'STOrage and RETrieval'

TMDL – Total Maximum Daily Load

TSS - Total Suspended Solids

USEPA – United States Environmental Protection Agency

USFWS – United States Fish and Wildlife Service

USGS – United States Geologic Survey

UWF – University of West Florida

WIN – Watershed Information Network

WMD – Water Management District

WWTP – Wastewater Treatment Plant

Workshop Attendees

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Appendix A

Florida Seagrass Integrated Mapping and Monitoring Program - 2004

Available in full format at:
http://www.fwc.state.fl.us/research/habitat/seagrasses/publications/simm-report-1/

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Appendix B

Seagrass Integrated Mapping and Monitoring Report No. 1 (2011)

Available in full format at:
http://myfwc.com/research/habitat/seagrasses/publications/simm-report-1/

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