

Environmental Health of the Surface Waters in the Watershed of the Loxahatchee River

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September 2000

Introduction

The watershed of the Loxahatchee River and Jupiter Inlet offers a diversity of surface water environments. Vast tracts of land to the west form a mosaic of shallow wetlands that feed water into natural creeks and man-made canals. Much of the water falling on these wetlands flows to the northwest fork of the Loxahatchee, Florida's only designated 'Wild and Scenic' river. Downstream, in the estuary, the organically stained 'blackwaters' of the Loxahatchee River mix with the clear blue waters of the Atlantic Ocean. The waters near the inlet, south to the Lake Worth Creek and north into the southernmost portion of the Indian River Lagoon, are reflective of near marine conditions. Since the days of the earliest European settlements along the rivers shore, man has acted to alter the environmental health of the aquatic system. With over 50,000 people now calling the river 'home', the cumulative impact has been significant. The following sections discuss some of the most important environmental changes and present some of the technical knowledge that has been compiled over the past three decades.



WATER QUALITY

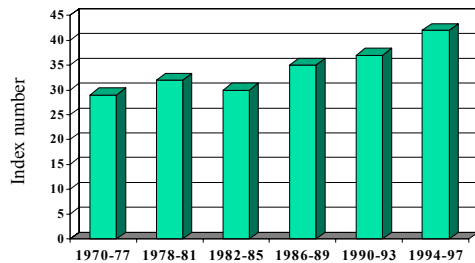
The surface waters of the Loxahatchee River have been monitored for quality since the early 1970's. Twenty-two long-term monitoring stations were established and have been sampled throughout the marine, estuarine and freshwater portions of the watershed.

In 1995, the Loxahatchee River District consolidated the 25 years of data then available and presented The Water Quality Baseline of the Loxahatchee River. This evaluation showed a declining trend in the overall quality in the Loxahatchee and set procedures and protocol for continued monitoring and the dissemination and use of the information.

One major scale employed in water quality evaluations is the Florida Water Quality Index (WQI). This index is helpful when comparing historic and current water quality conditions

and is composed of several sub indices, such as clarity, nutrients, dissolved oxygen, organic demand and bacteria. The graphic on the following page shows the general long-term decline in water quality (higher index numbers show poorer water quality) and the following paragraphs offer brief discussions of the individual results that go into the WQI.

Water Quality Index Loxahatchee River Estuary



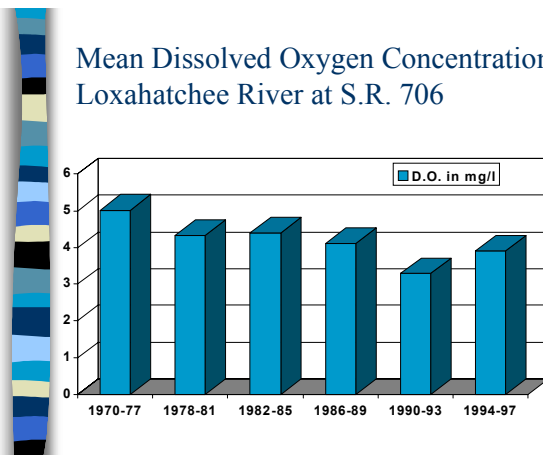
The clarity of surface waters includes measurements for turbidity, total suspended solids, color, and secchi disc depth. Greater clarity allows greater light penetration through the water column to the benthic habitat such as a seagrass bed. Upland development within the Loxahatchee watershed has resulted in significant stormwater runoff contributions and caused a gradual loss of clarity.

nitrogen has essentially doubled since the 1970's and is presently at levels above the statewide mean. Total phosphorus continues to show up in 'hot spots' often associated with agricultural land use. When these nutrients are combined with clarity and the chlorophyll found in algae, a second statewide index, the Trophic State Index (TSI) can be developed. The TSI for the Loxahatchee estuary over the past six years now falls in the 'fair' range during 59% of the monitoring events. Monitoring in 1970's and 1980's showed greater clarity, lower nutrients and resulted in most TSI readings registering in the 'good' range.

Nutrient concentrations in the surface waters have also changed over the years. Total

Sufficient levels of dissolved oxygen in the water column are essential for the existence and propagation of fish and other aquatic life. The levels in the estuary and in many freshwater portions of the watershed have declined over the past 30 years. The introduction of runoff from urban and agricultural areas directly contributes oxygen demanding substances and nutrients. The nutrients in turn can cause excessive plant growth which lowers dissolved oxygen during portions of the day. While most of the surface waters have sufficient oxygen concentrations, the gradual reduction over the years is of concern. Additionally, certain waters have shown significant oxygen depletions and posted numerous violations of state standards. One example is the headwaters of the northwest fork of the Loxahatchee River where a 1996 study by the Loxahatchee River District, Dissolved Oxygen Concentrations in Waters of the Loxahatchee River near Riverbend Park, demonstrated serious oxygen depletions.

Mean Dissolved Oxygen Concentrations Loxahatchee River at S.R. 706



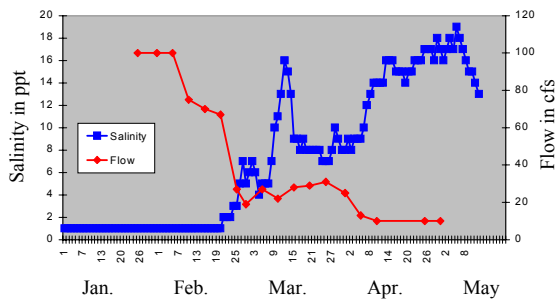
The Loxahatchee River has earned numerous designations for preservation. It is a national wild and scenic river; it has been classified by the state of Florida as an outstanding Florida water, Class II and two aquatic preserves. Yet, bacteria standards, set by the State of Florida, are violated for more than one-half of the samples taken. As early as the mid-1980's, bacterial contamination was reducing the public use of the waterway.

Many of the water quality problems identified by research can be attributed directly to improper management of stormwater and wastewater. A half-century of development within the watershed resulted in urban, rural, agricultural and even altered wetland discharges of stormwater to the river. These discharges have taxed and exceeded the natural assimilative capacity of the environment. In addition, thousands of septic tanks, serving older residential communities and large public areas, remain in operation. Studies have shown the negative impact of these systems when employed in areas of higher density and in close proximity to the surface waters.

SALINITY AND HYDROLOGIC CONDITIONS

The freshwater flows from the sloughs and wetlands of the western watershed vary seasonally in response to rainfall and man's operation of control structures. The salt water introduced through the Jupiter Inlet varies with normal tidal action and abnormal climactic conditions. The result is an extremely dynamic condition whereby salinity in the river experiences significant shifts. A certain degree of variation is natural and desired; however, a healthy condition has long since been exceeded. In 1973, the United States Geological Survey first cited the intrusion of salt water into the historically freshwater ecosystems of Jonathan Dickinson State Park as one of the major environmental problems facing the watershed. After thirty years of observation and attempts at resolution, the problem persists. Further analysis by the USGS in the early 1980's, Freshwater Runoff and Salinity Distribution in the Loxahatchee River Estuary, and more recent studies by the Loxahatchee River District, Freshwater Flow Requirements and Management Goals for the

Reductions in Upstream Flow Cause Increases in Salinity near Kitching Creek 1999



Northwest Fork of the Loxahatchee River and Salinity Changes in the Northwest Fork of the Loxahatchee River Resultant from the Re-Establishment of Meandering Flow Patterns, conclude that additional freshwater flows are needed during three or more months of a typical year. Minimum flow needs have been described, but these targets have yet to be achieved.

The second environmental problem related to salinity is within the estuary, where salinity levels are critical to the maintenance of a viable habitat for a balanced environmental community. Massive discharges of freshwater from the C-18 canal through the S-46 control structure occur several times each year. Ongoing research has shown that discharges of over 800 cfs that last for four or more days greatly alters the salinity of the estuary with negative and lasting impacts on the

native flora and fauna. Downward shifts in habitat (seagrasses) and food sources for the recreational fishery (macroinvertebrates and juvenile fishes) are directly related to the periodic excessive freshening of the normally brackish estuary.

The means to re-establish a more natural balance of freshwater flows is known and efforts are underway to purchase wetlands, develop them for wet weather storage and provide management controls to deliver the freshwater to the estuary under a more historic pattern.

SEDIMENTATION AND SILTATION

Without question, the embayment of the Loxahatchee River is filling in. Organic materials from upstream sources and sand introduced through the inlet converge to produce varying levels of sedimentation. The dynamics of this growing problem have been identified in a number of technical papers:

Sedimentologic History of the Loxahatchee River Estuary

Sediment Concentrations and Loads in the Loxahatchee River Estuary

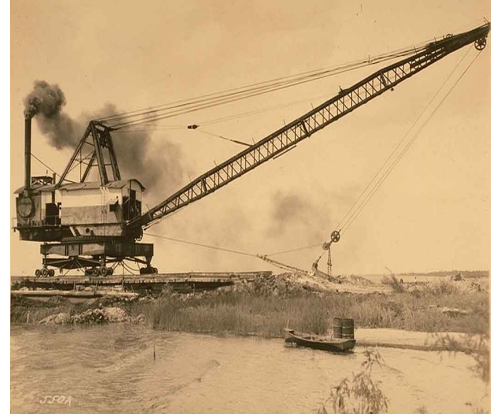
Environmental Factors Influencing Suspended Solids in the Loxahatchee River Estuary

Report on Environmental, Navigational and Drainage Investigations of Jupiter (Jones) Creek

Jones Creek Sediment Study

Deep organic or muck deposits, laden with wastes flushed from the land, are well established in the upper reaches of the north prong, Jones Creek and other areas. Accumulation of sand within the main portion of the estuary continues and is limiting recreational use.

The continued development within the urban and agricultural areas produces silt-laden runoff, usually associated with new construction activities. And, the past removal of shoreline stabilizers, mainly mangroves, continues to result in erosion.



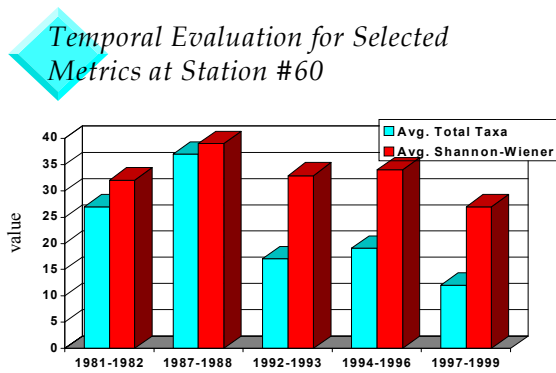
Restoration projects to re-establish shoreline and to remove the deposits of muck are a high priority. And the enforcement of stormwater regulations designed to attenuate construction problems is encouraged.

BIOLOGICAL QUALITY

Water quality data can be compared to a 'snapshot' of aquatic conditions during a brief time period in which the sample is taken. For a longer term 'video' of environmental conditions, analyses of the biological communities that are dependent upon good water

quality are undertaken. Evaluations of seagrass habitats, macroinvertebrates and fish have been conducted over the past twenty years.

Macroinvertebrates are animals without backbones that are visible to the unaided eye, like clams, shrimp, aquatic worms or insect larvae. When environmental conditions in which these organisms reside are altered, they do not possess the ability to move. Therefore, the health of these animal communities is reflective of longer-term water quality conditions. The Florida Department of Environmental Protection conducted several macroinvertebrate investigations in the 1980's, including The Benthic Macroinvertebrates of the Estuarine Portion of the Loxahatchee River and A Macroinvertebrate Study of the Loxahatchee River – 1983. A more recent report, published by the Loxahatchee River District in 1998, Profile of the Benthic Macroinvertebrates in the Loxahatchee River Estuary, summarized a seven-year research effort and made comparisons with the earlier DEP study. One significant



metric used in evaluating the macroinvertebrate community is diversity. A more diverse biological community represents a higher level of environmental health and indicates a long-term condition of favorable water quality. The associated graphic provides a general view of the negative trend observed in the macroinvertebrate communities of the Loxahatchee River.

Along with mangroves, the seagrass beds of a lagoon provide the most productive habitats to nourish a viable food web and fishery. The abundance, density and composition of the seagrasses in the estuarine environment can be measured and serves as a further indicator of overall environmental health. In the 1980's, Palm Beach County Environmental Resource Management conducted several surveys of the seagrass communities within the waters of the Loxahatchee River. These analyses were supplemented in the 1990's by work sponsored by the Jupiter Inlet District, Loxahatchee River Bathymetric and Seagrass Survey. Further studies have been conducted in recent years and have evaluated seagrass conditions within the southernmost reach of the Indian River Lagoon as well as sites within the Jupiter Inlet and Loxahatchee estuary. The findings of this survey are compiled in a report issued by the Loxahatchee River District in 1999, Distribution, Density and Composition of Seagrasses in the Southernmost Reach of the Indian River Lagoon. Comparison of the results of these scientific works results in an up and down shift in the viability of seagrasses with no discernable long-term trend. What is obvious from the data is that significant alterations within the estuary impact the seagrass; and, while not conclusive, it strongly appears that excessive stormwater discharge, and the resultant freshening of the estuary, is a long term, negative factor and causes reductions of seagrass habitat.



SUMMATION

In conclusion, the surface waters of the Loxahatchee watershed have been significantly impacted by the activities of an increasing human presence. Analytical works addressing water quality, salinity, hydrology, sedimentation and the biota each indicate declining trends. The extent of the decline however, is not believed to be irreversible. Efforts over the past 30 years to manage stormwater, wastewater and the dynamics of the saline-freshwater interface have nearly kept up with the impacts of development.

Looking to the future, numerous plans, drafted with the cooperation of the public and private entities providing stewardship to the river system, have laid out the blueprint for environmental restoration. Two of these plans, Loxahatchee River: National Wild and Scenic River Management Plan and Loxahatchee River Watershed Ecosystem Management Initiative consolidate many of the components proposed by the individual planning efforts, including land acquisitions, re-establishment of water retention areas, facilities and protocol to manage the flow of water, specific urban and agricultural stormwater attenuation, elimination of septic tanks and the restoration of segments of the environment significantly altered over the years.

With much of the research effort completed and land, where needed, acquired, the citizens of the watershed are prepared to move ahead with the specific restoration tasks identified in the planning documents.