CHEVWQMN

Status and Trends: 1998—2005

Raymond E. Leary, 11/13/2008

Florida Department of Environmental Protection, Charlotte Harbor Aquatic Preserves

Points of Interest

- Turbidity and total nitrogen are decreasing
- Color is increasing
- San Carlos Bay had the best water quality overall
- Upper Charlotte Harbor had the worst water quality overall
- CHV011 had the best water quality overall
- CHV013 had the worst water quality overall

Inside:

Background

This report describes water quality conditions throughout the Charlotte Harbor estuaries region of southwest Florida. The region includes six Florida Aquatic Preserves across eight interconnected estuary regions. Data used in the analyses were collected by the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network (CHEVWQMN) from 1998 through 2005.

The Charlotte Harbor estuaries region extends from Venice south to Bonita Springs, and encompasses over 700 km^2 (~175,000 acres) of diverse, productive submerged habitats. North to south, the six designated Florida Aquatic Preserves are: Lemon Bay, Gasparilla Sound/ Charlotte Harbor, Cape Haze, Pine Island Sound, Matlacha Pass and Estero Bay. The Aquatic Preserve Program is administered through the Florida Department of Environmental Protection (FDEP), Office of Coastal and Aquatic Managed Areas (CAMA). The local Aquatic Preserve offices are the Charlotte Harbor Aquatic Preserves (CHAPs) and the Estero Bay Aquatic Preserve (EBAP).

The CHEVWQMN conducts water quality monitoring throughout the region each month at 48 sites for 19 field and laboratory parameters. The CHEVWQMN was established in 1996 as a partnership of the FDEP, CHAPs, the Charlotte Harbor Environmental Center (CHEC), and local citizens. Since 1998, The Charlotte Harbor National Estuary Program (CHNEP) and EBAP have been active partners in supporting the CHEVWQMN.

The goal of the CHEVWQMN is to provide consistent, scientifically sound water quality data throughout the region each month. These data are used to guide resource management efforts by identifying the most critical water quality parameters, locations and trends within the region. The most critical parameters are those that directly affect estuarine health, including: dissolved oxygen, water clarity, salinity, nutrients, chlorophyll *a*, and fecal coliform bacteria.

Monthly samples were taken at 48 fixed sites that are widely distributed and represent general conditions in the region. Most of the locations are shallow, near shore areas, with few sites in deeper, open water.

Brief Summary of Results

Across the region, CHEVWMQN results generally indicated average conditions compared to Florida's estuaries although results varied. Dissolved oxygen (DO) concentrations were typically below average compared to typical Florida estuaries values, and frequently fell below Florida Surface Water Criteria of 4.0 and 5.0 mg/L. Decreasing trends in salinity, turbidity, total Kjeldahl nitrogen and increases in color concentrations were observed for many estuaries.

Water quality in Upper Lemon Bay and Upper Charlotte Harbor was below average compared to other estuary regions within the Charlotte Harbor area. Lower water clarity and DO, and higher color, nutrients and bacteria values were observed in these regions. San Carlos Bay had the best water quality, followed by Pine Island Sound.

The Charlotte Harbor National Estuary Program is a partnership of citizens, elected officials, resource managers and commercial and recreational resource users working to improve the water quality and ecological integrity of the greater Charlotte Harbor watershed. A cooperative decision-making process is used within the Program to address diverse resource management concerns in the 4,400 square mile study area. Many of these partners also financially support the Program, which, in turn, affords the Program opportunities to fund projects such as this. The entities that have financially supported the Program include the following:

U.S. Environmental Protection Agency
Southwest Florida Water Management District
South Florida Water Management District
Florida Department of Environmental Protection
Florida Coastal Zone Management Program
Peace River/Manasota Regional Water Supply Authority
Polk, Sarasota, Manatee, Lee, Charlotte, DeSoto, and Hardee Counties
Cities of Sanibel, Cape Coral, Fort Myers, Punta Gorda, North Port, Venice,
Fort Myers Beach, and Winter Haven
and the Southwest Florida Regional Planning Council.

The Southwest Florida Water Management District, on behalf of the Peace River and Manasota Basin Boards, provided funding for this project.

Program Coordinator/Volunteer Coordinator

Melynda Brown/Charlotte Harbor Aquatic Preserves

Supporting Partners

Charlotte Harbor & Estero Bay Aquatic Preserves - Program Support
Charlotte Harbor National Estuary Program - Grant & Technical Support
Florida Department of Environmental Protection Laboratories

Regional Coordinators

Bobbi Rodgers/Charlotte Harbor Environmental Center - Lemon Bay
Melynda Brown/Charlotte Harbor Aquatic Preserves - Charlotte Harbor
Judy Ott/Charlotte Harbor National Estuary Program - Pine Island Sound & Matlacha Pass
Stephanie Erickson/Estero Bay Aquatic Preserves - Estero Bay

Special Thanks

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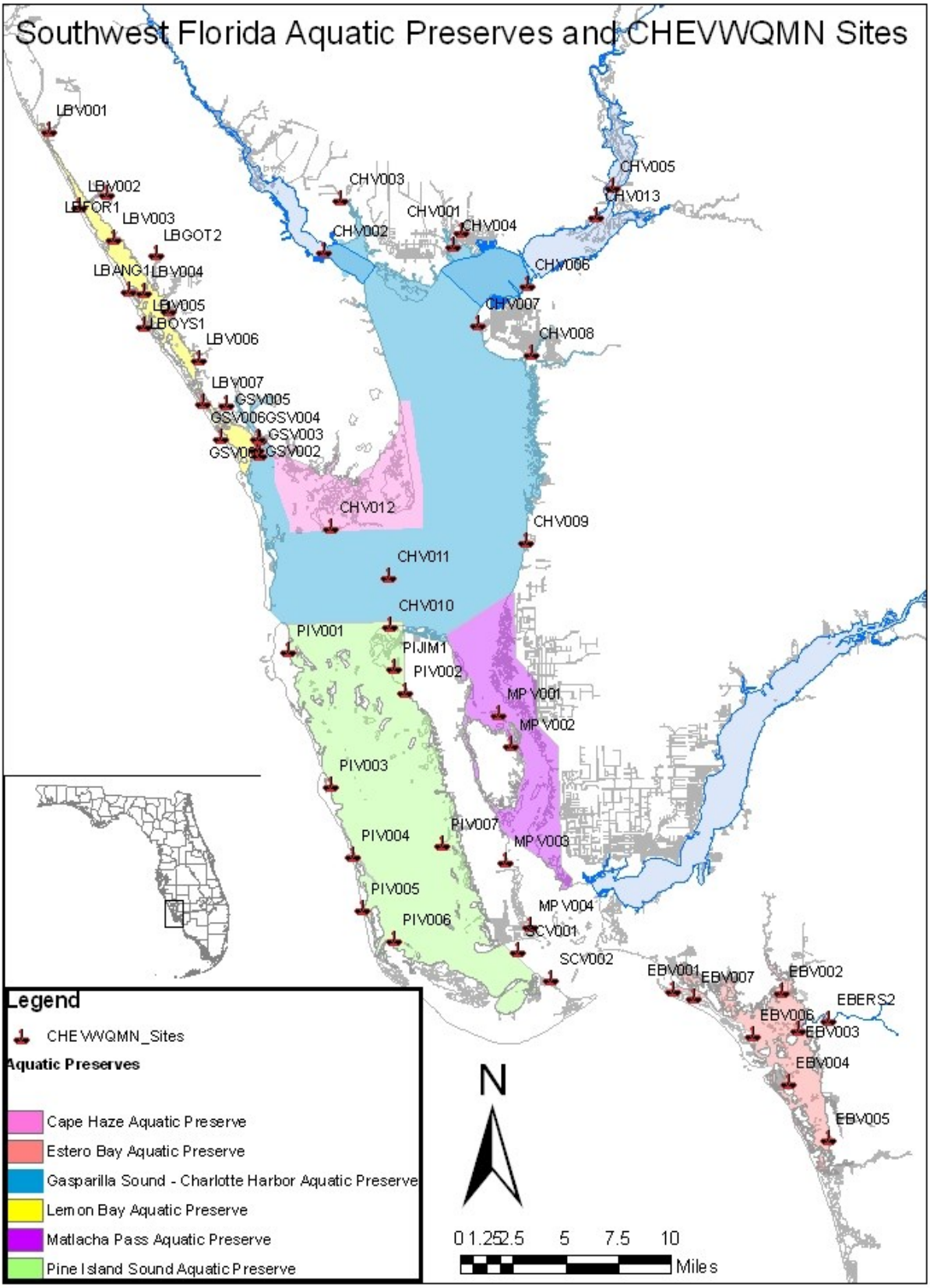
Southwest Florida Aquatic Preserves and CHEVWQMN Sites
LBV001
LBV002
LBFOR1
LBV003
LBGOT2
LBANG1
LBV004
LBV005
LBQYS1
LBV006
LBV007
GSV005
GSV006
GSV004
GSV003
GSV002
CHV003
CHV001
CHV002
CHV004
CHV005
CHV013
CHV006
CHV007
CHV008
CHV012
CHV009
CHV011
CHV010
PIV001
PIJIM1
PIV002
MPV001
MPV002
PIV003
PIV004
PIV007
MPV003
PIV005
MPV004
PIV006
SCV001
SCV002
EBV001
EBV007
EBV002
EBERS2
EBV006
EBV003
EBV004
EBV005
Legend
CHEVWQMN_Sites
Aquatic Preserves
Cape Haze Aquatic Preserve
Estero Bay Aquatic Preserve
Gasparilla Sound - Charlotte Harbor Aquatic Preserve
Lemon Bay Aquatic Preserve
Matlacha Pass Aquatic Preserve
Pine Island Sound Aquatic Preserve
N
0 1.25 2.5 5 7.5 10
Miles

Methods

Field Parameters:

- Water Depth
- Secchi Depth
- Water Temperature
- pH
- Dissolved Oxygen
- Salinity

Laboratory Parameters:

- Chlorophyll *a*
- Turbidity
- Color
- Total Phosphorus
- Total Kjeldahl Nitrogen
- Nitrate/Nitrite
- Fecal Coliform Bacteria

Field and Laboratory Methods

At each site, during the monthly sampling time, surface water samples are collected and field measurements are made for ten physical and chemical parameters: wind speed and direction, wave height, tide stage, water depth, Secchi depth, water temperature, pH, dissolved oxygen and salinity. Water samples are collected for seven additional laboratory parameters: chlorophyll *a*, turbidity, color, total phosphorus, total Kjeldahl nitrogen, nitrate/nitrite, and fecal coliform bacteria. These are key water quality parameters needed to determine overall estuary health as it relates to seagrass, fish and wildlife needs. For quality assurance purposes, duplicate and blank laboratory parameters are collected each month at 10% of the sampling sites.

The water monitors collect the water to be sampled using a clean bucket lowered to the surface of the water and filled slowly to avoid adding oxygen. Laboratory parameters were analyzed at various labs during the course of the CHEVWQMN. Water monitors collect samples in pre-cleaned preserved sample bottles provided by the laboratory. Collected samples are stored in coolers on ice and then transported to the laboratory .

Volunteers at Punta Gorda

Typical Florida Estuaries

To interpret CHEVWQMN results relative to Florida estuaries, results for each estuary and site were compared to baseline water quality conditions for over 20 estuaries around the state. The publication *Typical Water Quality Values for Florida's Lakes, Streams, and Estuaries* (Hand 2004) was chosen as the source of baseline comparison. The publication was chosen because of the large number of samples (over 20,000), consistent sampling period (1990 - 2003), and complete set of parameters. Because of its uniform, continuous and reliable dataset, the publication appears to be the most representative source of estuary conditions across the state. However, it should be emphasized that the data contained within the publication represent very different climactic regions.

To characterize water quality in the Charlotte Harbor estuaries, median values for each parameter were compared to percentile distributions compiled from *Typical Water Quality Values for Florida's Lakes, Streams, and Estuaries* (Hand 2004). To aid in interpreting water quality values for estimating estuary health, the percentile distributions were grouped to represent above average, average and below average conditions. For this report, the following percentile categories were used to interpret CHEVWQMN results: below average =10 through 30, average = 31 through 69, and above average = 70 and greater.

Helpful Terms

Chlorophyll *a*: a green pigment found in most plants which is necessary for photosynthesis; may be utilized as an indicator of algae population levels.

Clarity: how far sunlight can penetrate into water; affected by plankton, sediment particles, water color, etc; measured with Secchi disk or other devices.

Color: dissolved organic compounds that typically make water yellow or brown, for example tannins.

Detritus: a mixture of decaying plant & animal remains; includes decomposing seagrass & mangrove leaves found near shore in estuarine waters.

Dissolved oxygen (DO): concentration of oxygen in the water; necessary for animal respiration; levels consistently below 3 – 5 parts per million oxygen may stress fish & other marine organisms.

Fecal Coliform Bacteria: rod-shaped bacteria that can grow in elevated temperatures and are usually associated with the fecal material of warm blooded animals; includes *E. coli*.

Hydrometer: instrument used to measure water salinity based on the density & specific gravity of the water.

Inorganic: not relating to or arising from living organisms; usually does not contain carbon.

Nitrogen: an element necessary for plant growth; low levels of nitrogen or phosphorus may limit plant growth in surface waters; high levels may cause excess plant & phytoplankton growth; common inorganic forms needed for plants: ammonia (NH_3), nitrate (NO_3) and nitrite (NO_2).

Nutrients: nitrogen and phosphorus combined.

Organic: related to or arising from living organisms; contains carbon.

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pH: the measure of how acidic or basic (alkaline) a solution is; ranges from 1 (acids) to 14 (bases) with distilled water being 7 (neutral); in aquatic systems, important for solubility of materials & tolerable ranges of biological species; estuaries are often slightly basic.

Plankton: the community of micro-organisms, consisting of plants (phytoplankton) & animals (zooplankton) inhabiting open water regions of oceans, estuaries, lakes & rivers.

Phosphorus: an element necessary for plant growth; found naturally in low concentrations but added to surface & ground waters through human activity; not often the element limiting plant growth in estuaries, but often the limiting element for plants in lakes; common inorganic form needed for plants: orthophosphate (PO_4).

Salinity: the saltiness of water, usually expressed as parts (salt) per thousand (water); freshwater is generally less than 5 parts per thousand, estuaries generally range from 10 – 30 parts per thousand & ocean water is generally 35 parts per thousand.

Secchi Disk: a simple black & white disk lowered into the water to measure water transparency or clarity.

Total Kjeldahl Nitrogen (TKN): organic nitrogen plus ammonia.

Total Nitrogen (TN): the dissolved organic plus inorganic nitrogen in the water.

Total Phosphorus (TP): the dissolved organic plus inorganic phosphorus in the water.

Turbidity: how cloudy water is; influenced by plankton, sediment, water color; may limit plant growth if sunlight cannot penetrate.

Sites

- LBFOR1
- LBGOT2
- LBV001
- LBV002
- LBV003

Status and Trends in Upper Lemon Bay

- Nutrients and fecal bacteria high in Upper Lemon Bay
- Trends show water quality improving in Upper Lemon Bay
- DO on the rise
- Turbidity decreasing

Sites of Special Interest

- LBV001 exhibited the most degraded water quality in Upper Lemon Bay
- LBGOT2 above average for color, fecal coliform bacteria and total phosphorus values
- LBV002 and LBV003 have the best water quality in the region

Upper Lemon Bay

Introduction

Upper Lemon Bay is located in the northern part of Lemon Bay, the smallest of the five Aquatic Preserves in the Charlotte Harbor estuarine complex. The estuary region spans from South Venice to north of the Sarasota and Charlotte County border. Upper Lemon Bay is a narrow, long and shallow waterbody sheltered from the gulf by numerous barrier islands. The estuary region is fed by several freshwater tributaries with the majority of freshwater flow originating from Forked and Gottfried Creeks.

The watershed adjacent to Upper Lemon Bay ranges from highly developed to rural and agricultural land uses. The adjacent coast bordering Upper Lemon Bay is heavily populated with two major cities, Englewood and South Venice representing a combined population size of nearly 30,000 (estimates from 2000, United States Census Bureau). An increasing population and urban development in the area may have serious impacts on the water quality of Upper Lemon Bay. For example, by 2010 the amount of nitrogen input into the Lemon Bay estuary is predicted to increase by 45% to 58% from sources including older septic tanks, sewage stormwater and other urban runoff (Tomaskso et. al.).

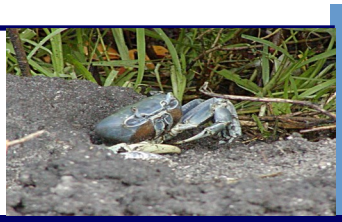
Seagrasses and mangroves

Results

In the Upper Lemon Bay region, CHEVWQMN results indicated generally below average water quality conditions and ranked below average compared to other estuaries in the Charlotte Harbor region as well as other estuaries across the state. Upper Lemon Bay ranked in the 70th, or greater, percentile of Florida estuaries for all nutrients and fecal coliform bacteria, in addition to ranking in the bottom 10th percentile for dissolved oxygen (DO). Results showed frequent exceedances of Florida Surface Water Standards for DO, chlorophyll *a*, fecal coliform bacteria and turbidity. Trends in Upper Lemon Bay indicate a decrease in TKN, turbidity, salinity and pH, and an increase in DO. The primary factors contributing to light attenuation are turbidity and color.

Site LBV001 exhibited the most degraded water quality in the region, possibly affecting the collective results. The site had one of the greatest percentages of DO values that were less than 4.0 and 5.0 mg/L, as well as the only site to have fecal coliform bacteria exceedances greater than both 400 and 800 cfu/100mL. The site is located near a smaller tributary and is the northernmost site in Upper Lemon Bay. Site LBV003 was the only site in the region to have turbidity exceedances. Site LBGOT2, located upstream in Gottfried Creek, also exhibited above average color, fecal coliform bacteria and total phosphorus values.

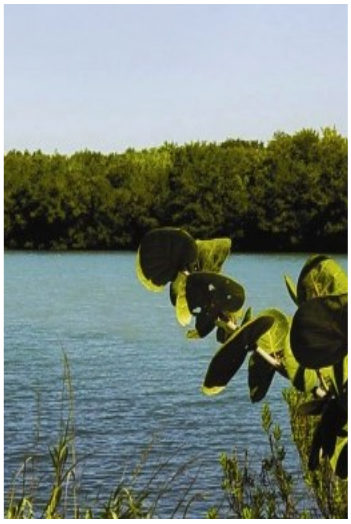
Lower Lemon Bay



Introduction

Lower Lemon Bay is located in the southern portion of Lemon Bay. The estuary region extends from the Charlotte and Sarasota County line to Gasparilla Pass. It is a long and narrow lagoonal system, which is sheltered from the Gulf of Mexico by barrier islands. The average depth of Lower Lemon Bay is 1.8 meters, and is one of the smallest estuarine regions within the Charlotte Harbor study area. The region receives freshwater from many small creeks including, Oyster, Ainger and Buck Creeks. The largest submerged habitat type in Lower Lemon Bay is seagrass beds.

The ratio of watershed land area to open water area in Lower Lemon Bay is approximately 6:1. Based on 1990 data from the Charlotte Harbor National Estuary Program (CHNEP), the largest land use within the watershed is urban (26%), followed by rangeland (24%) and upland forest (20%), with very little agriculture (2%). Of the urban area, the majority is residential; and is located adjacent to the estuary and its tributaries. The most significant projected change in future land use in the region is a very large increase (>240%) in residential acres.



Seagrapes overlooking Lemon Bay

Results

Water quality in Lower Lemon Bay ranged from above average to below average depending on the parameter of interest. The pH and salinity within the region were relatively high with median values of 8.3 and 33.5, respectively, ranking in the top 90th and 100th percentiles, respectively, of Florida estuaries. Secchi depth was above average in Lower Lemon Bay ranking in the 70th percentile of Florida estuaries. DO concentrations were typically low in Lower Lemon Bay, ranking in the 20th percentile of all Florida estuaries and frequently below Florida Surface Water Standards of 4.0 and 5.0 mg/L. Significant trends include decreasing TKN and turbidity and increasing color. As in Upper Lemon Bay, turbidity and color are the primary light attenuating parameters.

Site LBV006 had the lowest water quality status in general of all sites in Lower Lemon Bay. LBV006, located in Buck Creek, had frequent exceedances of regulatory criteria including dissolved oxygen, chlorophyll *a*, and fecal coliform bacteria. Fecal coliform bacteria levels for sites LBV006 and LBANG1 were above the typical Florida estuarine water quality average, ranking in the 100th percentile of Florida estuaries. Site LBV007 generally exhibited the highest water quality, with frequent status rankings below the 50th percentile of Florida estuaries and with the smallest percent of regulatory exceedances.

Sites

- GSV002
- LBANG1
- LBOYS1
- LBV004
- LBV005
- LBV006
- LBV007

Trends in Lower Lemon Bay

- Lower Lemon Bay ranks in the 70th percentile of Florida estuaries for Secchi depth
- Total Kjeldahl Nitrogen and turbidity are decreasing in Lower Lemon Bay
- Color is increasing in Lower Lemon Bay

Sites of Special Interest

- LBV007 had the best water quality in Lower Lemon Bay
- LBV006 had the lowest ranking in Lower Lemon Bay, with DO, chlorophyll *a*, and fecal coliform bacteria exceeding State standards
- GSV002 had the greatest water clarity in Lower Lemon Bay
- LBV005 had the highest median DO levels

Sites

- CHV001
- CHV002
- CHV003
- CHV004
- CHV005
- CHV006
- CHV007
- CHV008
- CHV013

Trends in Upper Charlotte Harbor

- Dissolved oxygen increasing in Upper Charlotte Harbor
- Total phosphorus and color on the rise
- Salinity decreasing in the region, possibly from higher than average rainfall

Sites of Special Interest

- CHV001 had the highest water clarity in the region
- CHV002 had the greatest DO levels
- CHV008 had the lowest chlorophyll *a* levels
- CHV002 had the lowest fecal coliform bacteria levels

Upper Charlotte Harbor

Introduction

Upper Charlotte Harbor is located in the northern part of Charlotte Harbor, and extends from the mouths of the Peace and Myakka Rivers south to approximately the Lee and Charlotte County border. Upper Charlotte Harbor is one of the deepest sub-estuaries in the region, with depths of more than 6 m (approximately 20 ft). The estuary region is located adjacent to the communities of Port Charlotte and Punta Gorda. The watershed for Upper Charlotte Harbor is huge, with a land to water ratio of 22:1. Most of the watershed (55%) is comprised of pasture, rangeland, and upland forest; and mining and urban development comprising only 13% combined.

A large percent of the estuary shoreline is preserved and managed as the Charlotte Harbor Preserve State Park. Urban areas within the watershed are centered adjacent to the estuary at Punta Gorda and Port Charlotte, along the Peace River at Arcadia and Bartow, and near Lake Hancock. The most critical changes predicted by the CHNEP for future land uses are a more than 125% increase in mining and nearly a 300% increase in residential areas.

Snapper swimming among pilings

Results

Water quality in Upper Charlotte Harbor was generally below average compared to other estuaries in the region and across the state of Florida. Upper Charlotte Harbor was tied with Upper Lemon Bay for the lowest median Secchi value and had the highest median total phosphorus and color of all estuary regions. The total phosphorus in Upper Charlotte Harbor had significantly increased over the study period and the median value for all years was higher than average compared to Florida's estuaries, ranking in the 70th percentile or above. Fecal coliform bacteria levels were also high in the area and frequently exceeded Florida Surface Waters Criteria at 200, 400 and 800 cfu/100mL. Salinity in Upper Charlotte Harbor significantly decreased over the study duration and was the lowest recorded median value among all estuary regions. Decreasing salinity levels may correspond to increasing trends in color concentrations. Additional significant trends included an increase of dissolved oxygen at a rate of approximately 0.1 mg/L per year.

Site-specific water quality varied throughout the Upper Charlotte Harbor estuary region. Sites CHV005 and CHV013 ranked among the sites having the lowest salinity and highest nutrients and chlorophyll *a*. Both sites had higher than average results for total phosphorus compared to typical Florida estuarine water quality. Fecal coliform was high at both sites, particularly in the rainy season, with frequent exceedances of state standards. Sites CHV005 and CHV013 are the most upstream sites in the Tidal Peace River.

Lower Charlotte Harbor

Introduction

Lower Charlotte Harbor is located in the north along the Charlotte and Lee County line, and extends south to the northern edges of Cayo Costa and Pine Island. It is bordered to the west primarily by Gasparilla Island; and on the east by the East Wall of Charlotte Harbor. It is the deepest estuary region within the CHEVWQMN; over 15 m (about 50 ft) deep at Boca Grande Pass. Lower Charlotte Harbor primarily receives freshwater from southward flows out of Lemon Bay and Upper Charlotte Harbor; and saltwater from the Gulf of Mexico. Seagrasses are an important habitat within Lower Charlotte Harbor.

The majority of Lower Charlotte Harbor's watershed is shared with Upper Charlotte Harbor, and has the same relative percentages. Resource management goals within the watershed and estuary are multi-faceted, due to the complex nature of the Harbor (both Upper and Lower). These goals focus on reducing nutrient loads to the estuary, sustaining shellfish and finfish, reducing impacts from mining and agriculture, and understanding the role and natural variability of color within this black-water system.

Shoal grass in Charlotte Harbor

Results

Lower Charlotte Harbor had fair to good water quality for all water quality parameters. Turbidity values in Lower Charlotte Harbor decreased significantly during the study period, and were tied with Matlacha Pass for the lowest median value observed across all estuary regions in the CHEVWQMN. The median Secchi depth value was above average in comparison to typical values for Florida estuaries. Salinity significantly decreased within the region, possibly corresponding to a significant decrease in pH and an increase in color concentrations, due to increases in rainfall amounts. Additional significant trends include an increase in dissolved oxygen and a decrease in total Kjeldahl nitrogen.

Site CHV011 exhibited above average water quality compared to other sites in the CHEVWQMN and across Florida estuaries. This open water site is located in the center of Lower Charlotte Harbor and had the deepest average depth of all the sites (3.8 m). Site CHV011 had the highest median Secchi value (2.3 m) for all sites in the CHEVWQMN and was the only site that ranked in the top 100th percentile of all Florida estuaries. This site had the lowest median total nitrogen and turbidity across all sites in the CHEWVQMN, and fecal coliform bacteria was tied for the lowest. Site CHV011 also had the lowest percentage of regulatory exceedances for dissolved oxygen, with only 3 occasions sampled less than 5.0 mg/L and none of them below 4.0 mg/L.

Sites

- CHV009
- CHV010
- CHV011

Trends in Lower Charlotte Harbor

- Dissolved oxygen increasing in Lower Charlotte Harbor
- Turbidity is going down
- Total nitrogen levels are decreasing
- Color is on the rise

Sites of Special Interest

- CHV011 had the greatest water clarity of all the sites in the CHEVWQMN
- CHV011 had the lowest total nitrogen
- CHV009 and CHV010 were average compared to typical FL estuaries

Sites

- CHV012
- GSV001
- GSV003
- GSV004

Trends in Gasparilla Sound/Cape Haze

- Dissolved oxygen is decreasing in Gasparilla Sound/ Cape Haze
- Salinity and pH are decreasing and color is increasing, possibly due to increases in rainfall
- Turbidity is decreasing

Sites of Special Interest

- GSV003 had the lowest color median values for the entire CHEVWQMN
- GSV004 had the lowest total nitrogen in the region
- GSV001 had the lowest chlorophyll *a* median value for the entire CHEVWQMN

Gasparilla Sound/Cape Haze

Introduction

Gasparilla Sound/Cape Haze is east of Boca Grande and is bordered to the north by Lemon Bay and to the south and east by Charlotte Harbor. Gasparilla Sound/Cape Haze is adjacent to Placida and Boca Grande. The region is a maze of small islands and shallow passages. It is fed by Catfish and Whidden Creeks, and mixes with waters from the Gulf of Mexico. The estuary region contains a myriad of mangrove forests and seagrass meadows, which provide important habitat for shellfish, crustaceans and finfish. The region also contains many islands that serve as important bird rookeries (www.dep.state.fl.us/coastal/sites/capehaze/).

Seagrass beds are a critical submerged habitat within Gasparilla Sound/Cape Haze, occurring along the shallow shoreline areas and comprising more than 40 km^2 (10,000 acres). The average deep edge of seagrass growth is 1.9 m (> 6 ft) in Cape Haze. The diverse submerged habitats support a vast food web. Activities in the region are important both commercially and recreationally. Commercial harvests of clams and fish contribute to the local economy.

Stilt house on Cape Haze

Results

Water quality in Gasparilla Sound/Cape Haze had many parameters falling within the 40th to 60th percentiles of Florida's estuaries and moderate rankings within the CHEVWMQN. Secchi depth was relatively high, with a median value of 1.5 m, which fell within the 70th percentile of Florida's estuaries. Chlorophyll *a* concentrations were very low in the region, with few regulatory exceedances. The dissolved oxygen levels were generally low, with frequent regulatory exceedances of 4.0 and 5.0 mg/L. Cape Haze was the only estuary region in which dissolved oxygen appeared to be significantly decreasing. Other significant observed trends included a significant increase in color concentrations, as well as decreases in salinity, pH and turbidity values.

Water quality was relatively consistent across the four sites located in Cape Haze, ranging from below to above average depending on the parameter of interest. Sites GSV001 and GSV004 had the most dissolved oxygen samples below state regulatory criteria of 4.0 and 5.0 mg/L in the region. Median values for GSV001 and GSV004 were also below the 4.0 mg/L standard, at 4.0 and 3.6 mg/L, respectively. Additionally, GSV001 had the lowest chlorophyll *a* median value (2.16 µg/L) across all sites in the CHEVWQMN. Site GSV003 had the lowest color value of all sites in the CHEVWQMN, ranking in the 30th percentile of Florida's estuaries.

Pine Island Sound

Introduction

Pine Island Sound extends from Boca Grande Pass south to Sanibel, between Pine Island and four barrier islands. There is one primary tributary (Caloosahatchee River) and four Gulf passes (Boca Grande, Captiva, Red Fish and Blind). Pine Island Sound is approximately 18 mi long and 5 mi wide, with an area of approximately 54,176 acres. It is the second largest and second deepest of the estuaries in the region. The aquatic preserves are located in Lee County and the City of Sanibel is the only incorporated adjacent to the Sound.

The Pine Island Sound and Matlacha Pass watershed includes the coastal areas of northern Lee and southern Charlotte Counties, Pine Island and the lower Caloosahatchee River drainage area. The watershed is approximately 355 km^2 (87,850 acres) in size. The ratio of watershed land area to open water estuary area is slightly over 1:1. A large percent of the shoreline is managed for preservation by the Charlotte Harbor Preserves State Park, "Ding" Darling National Wildlife Refuge and the nonprofit Calusa Land Trust. A large increase (almost 350%) in urban use is predicted by the CHNEP for Sanibel and Pine Island.

Sandpipers on Pine Island

Results

Results from the CHEVWQMN indicated that water quality in Pine Island Sound ranged from below average to above average compared to the typical water quality of Florida's estuaries and ranked very well compared to other estuary regions in the Charlotte Harbor area. The median Secchi depth value of 1.3 m was average compared to Florida's estuaries (Hand 2004). Pine Island Sound had the lowest median nutrient levels across the nine estuary regions. Total Kjeldahl nitrogen decreased significantly during the study. Additional significant trends included an increase in pH and decreases in salinity, fecal coliform bacteria and turbidity values.

Water quality was relatively uniform across most sites in Pine Island Sound. Site PIJIM1 exhibited the lowest water quality in Pine Island Sound. The site is located near Big Jim Creek on the northwestern side of Pine Island. It had the shallowest average depth of all sites; high fecal coliform bacteria, and the lowest Secchi depth and dissolved oxygen median values of all sites in the CHEVWQMN, ranking in or below the lower 20th percentile of Florida's estuaries. Sites PIV004 and PIV006 had the best relative water quality in comparison to sites within the Pine Island Sound region and across all sites in the region. These are both open water sites on the eastern side of Captiva and Sanibel Islands. Both sites had the highest dissolved oxygen levels across all sites in the CHEVWQMN. Water clarity at PIV004 was tied with MPV003 for the second highest median Secchi depth (1.8 m) of all sites in the CHEVWQMN.

Sites

- PIJIM1
- PIV001
- PIV002
- PIV004
- PIV006
- PIV007

Trends in Pine Island Sound

- Fecal coliform bacteria, total nitrogen and turbidity are decreasing in Pine Island Sound
- pH is increasing
- Salinity is decreasing in the region

Sites of Special Interest

- PIV004 had the second highest water clarity median for the CHEVWQMN
- PIV004 and PIV006 had the highest dissolved oxygen levels in the CHEVWQMN
- PIV007 had the lowest total phosphorus levels in the CHEVWQMN

Sites

- MPV001
- MPV002
- MPV003

Trends in Matlacha Pass

- Dissolved oxygen is on the rise
- pH is increasing while salinity is decreasing
- Color levels are increasing within Matlacha Pass
- Temperature is decreasing

Sites of Special Interest

- MPV003 had the 2nd lowest chlorophyll *a* median value in the CHEVWQMN
- MPV003 had the 2nd highest Secchi depth (1.8 m) in the CHEVWQMN
- MPV001 and MPV003 had the 2nd lowest fecal coliform levels in the CHEVWQMN

Matlacha Pass

Introduction

Matlacha Pass Aquatic Preserve is located between Pine Island and Cape Coral, extending north-south along the length of the island. The primary tributary is the Caloosahatchee River, as well as overland flow from preserve lands to the east. Matlacha Pass is approximately 13 miles (21 km) long and 3 miles (5 km) wide, with an area of approximately 12,511 acres (50 km^2). It is the most sinuous of the estuaries in the region. The Aquatic Preserve is located in Lee County and the primary adjacent urban area is Cape Coral (CHNEP 1999).

Matlacha Pass shares its watershed with Pine Island Sound. The watershed is approximately 87,850 acres (355 km^2) in size. The ratio of watershed land area to open water estuary area is slightly over 1:1. Urban uses make up a relatively small percent (14%) of the overall watershed, but it is concentrated in the City of Cape Coral to the east of Matlacha Pass. Based on the Charlotte Harbor National Estuary Program's 1990 data, the largest land use in the watershed is rangeland (33%) and upland forest (16%).

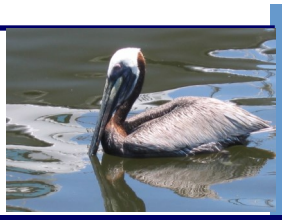
White pelicans

Results

Water quality in Matlacha Pass ranked moderately compared to other estuary regions within the Charlotte Harbor estuarine complex. Secchi depth was high in the region with a median value of 1.6 m, ranking highest among CHEVWQMN regions and in the 80th percentile of Florida estuaries. Salinity varied seasonally in the region, was generally lower than other estuary regions and was average compared to salinity values for Florida's estuaries. Matlacha Pass had the second lowest chlorophyll *a* median value across all estuary regions and had no annual means exceeding 11 µg/L per Florida's Impaired Waters Rule. Matlacha Pass was the only estuary region in the study area which had no site demonstrating exceedances of Florida's Surface Water Standards for fecal coliform bacteria at 200, 400 and 800 cfu/100mL. Color concentrations were average and increased significantly over the study period. Other significant trends include an increase in dissolved oxygen and pH, and decreases in salinity and temperature.

Water quality results were fairly uniform across the three sites located in Matlacha Pass. All sites were located in open water with a minimum average sample depth of 2 m. Site MPV003 had the second lowest median chlorophyll *a* value across all sites. Site MPV003 tied with PIV004 for the second highest Secchi depth across all sites in the CHEVWQMN.

San Carlos Bay



Introduction

San Carlos Bay, while not designated as an aquatic preserve itself, connects three adjacent aquatic preserves: Matlacha Pass, Pine Island Sound and Estero Bay Aquatic Preserves. It is located at the mouth of the Caloosahatchee River, its primary tributary. It is located in Lee County and adjacent urban areas include Cape Coral, Fort Myers and Fort Myers Beach. Within the estuary, seagrasses are an important submerged habitat compromising approximately 5,000 acres, growing to approximately 2.0 m deep, though the conditions vary annually, seasonally and with changes in hydrologic flows from the Caloosahatchee River (CHNEP2006).

The San Carlos Bay watershed includes the lower drainage area of the Caloosahatchee River and is approximately 231,638 acres in size. Land use within the watershed consists of 33% urban and 21% pasture. Urban areas within the watershed are projected to increase by 80% and wetland areas are predicted to decrease by 74%. There are 76 domestic wastewater discharges, 7 industrial wastewater discharges, 5 public water uses and an undetermined number of industrial uses permitted in the watershed (CHNEP 1999).

Bird rookery

Results

San Carlos Bay had above average water quality and ranked as having the highest water quality of all estuary regions in the CHEVWQMN study area. San Carlos and Estero Bays were the only estuaries exhibiting a significant increase in Secchi depth over the eight-year study period, with the median value for all years ranking in the top 70th percentile of Florida's estuaries. Total nitrogen was average compared to Florida's estuaries, with total and total Kjeldahl nitrogen median values ranking second across all estuaries within the Charlotte Harbor region. The median chlorophyll *a* value was lower than the average value for Florida's estuaries and was the lowest concentration of all estuary regions in the CHEVWQMN. No site within San Carlos Bay demonstrated chlorophyll *a* annual means exceeding the state criteria of 11 µg/L. San Carlos Bay tied for the lowest median fecal coliform bacteria concentrations across all estuary regions in the Charlotte Harbor study area. The dissolved oxygen (DO) and color values significantly increased over the study duration, while salinity, temperature and turbidity levels significantly decreased.

Site-specific water quality results were generally uniform. Sites SCV001 and SCV002 had the highest median DO values within the region, with only four samples at each site under 5.0 mg/L per Florida's Surface Water Standards. San Carlos had the second deepest average depth of 3.7 m, with site depths ranging from 2.5 to 4.5 m. All sites in San Carlos Bay are located offshore, and generally outside or bordering Aquatic Preserves boundaries.

Sites

- EBV001
- MPV004
- SCV001
- SCV002

Trends in San Carlos Bay

- Dissolved oxygen is increasing in San Carlos Bay
- Salinity, temperature and turbidity are decreasing
- Color levels are moving up

Sites of Special Interest

- SCV002 had the third highest median DO levels in the CHEVWQMN
- MPV004 had the lowest chlorophyll *a* median level
- SCV002 had the lowest color values
- SCV001 never dropped below 4 mg/L for DO

Sites

- EBERS2
- EBV003
- EBV004
- EBV005
- EBV006
- EBV007

Trends in Estero Bay

- Temperature, pH and salinity are decreasing in Estero Bay
- Water clarity is increasing as measured by Secchi depth
- Color levels are on the rise

Sites of Special Interest

- EBERS2 had the highest median Secchi depth
- EBV007 had the 3rd lowest total nitrogen in the CHEVWQMN
- EBERS2 had the 2nd lowest total phosphorus in the CHEVWQMN
- EBV006 had the highest turbidity in the CHEVWQMN

Estero Bay

Introduction

Estero Bay is the second smallest and shallowest of the estuaries in the region. The aquatic preserve is located in Lee County and is adjacent to the urban areas of Fort Myers, Fort Myers Beach and Bonita Springs. Seagrass is a critical submerged habitat in Estero Bay, comprising over 3,400 acres, growing to an average depth of 1.0 m. Seagrass acreage in Estero Bay appears to have declined over the past decade (CHNEP 2006).

The Estero Bay watershed extends to the headwaters of the creeks and the lower drainage area of the Caloosahatchee River and is approximately 186,200 acres in size. The largest land use in the watershed is forested and non-forested wetlands (37%), followed by forest and rangeland (24%) and pasture (18%). The most significant projected change in future land use is a large increase (253%) in urban area and a large decrease in wetlands and preserve lands. There is also a projected increase in the acquisition of public lands for preservation. The shoreline of the estuary is predominately urban use, including 113 domestic wastewater discharges, 14 industrial wastewater discharges, and 6 public water uses (CHNEP 1999).

Aerial view of Estero Bay

Results

Water quality in Estero Bay ranked moderately compared to other estuary regions in the CHEVWQMN study region, with median values ranging from below to above typical Florida estuarine water quality values (Hand 2004). Estero Bay had the highest turbidity levels in the region, with a median value of 4.2 NTU, ranking in the 60th percentile of Florida's estuaries. The DO value was below average compared to typical Florida estuaries and was frequently observed below the Florida Surface Waters Standards of 4.0 and 5.0 mg/L. The pH, temperature and salinity levels significantly decreased over the study period, with significant increases in Secchi depth and color concentrations over the eight-year period.

Sites EBV006, EBV004 and EBV005 had the highest median turbidity values of all sites in the CHEVWQMN. Turbidity at these sites ranked in the top 70th and 80th percentiles of Florida's estuaries, resulting in an overall below average status rating. Site EBERS2, located at the mouth of the Estero River, had DO results that were below Florida's estuarine average and had the lowest median DO value (4.0 mg/L) in the estuary. Salinity and turbidity levels were also lowest at EBERS2.

Contact Information

Do you want to learn more about your local estuaries?

Questions, comments, or for information on how to become a volunteer:

The Project Coordinator for the Charlotte Harbor Estuaries Volunteer Water Quality Monitoring Network is Melynda (Mindy) Brown. Mindy can be reached at the FDEP Charlotte Harbor Aquatic Preserves' office in Punta Gorda, or by e-mail at melynda.a.brown@dep.state.fl.us.

Those interested in the program in the Estero Bay area may contact Stephanie Erickson at the FDEP Estero Bay Aquatic Preserve's office in Fort Myers Beach, or by e-mail at stephanie.erickson@dep.state.fl.us.

Or, you may call the local volunteer coordinator nearest you:
Lemon Bay: Bobbi Rodgers—(941) 475-0769
Pine Island Sound & Matlacha Pass: Judy Ott—(239) 338-2556

The Quality Assurance Officer and Data Manager for the CHEVWQMN is Ray Leary. Ray may be contacted for any questions concerning quality assurance, quality control or about matters concerning data analyses. He is located at the FDEP Charlotte Harbor Aquatic Preserves' office in Punta Gorda, and can be reached at raymond.leary@dep.state.fl.us.

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A copy of the complete technical report can be found at: http://www.chnep.org/info/CHEVWQMN2007.pdf

Southwest Florida Aquatic Preserves and the year they were established:

- Lemon Bay—July 1986
- Cape Haze—1978
- Gasparilla Sound—Charlotte Harbor—1979
- Matlacha Pass—1972
- Pine Island Sound—1970
- Estero Bay, Florida's first Aquatic Preserve—1966

CAMA Mission Statement:

- To Protect and Maintain the Natural Conditions of Florida's Aquatic Preserves for Future Generations