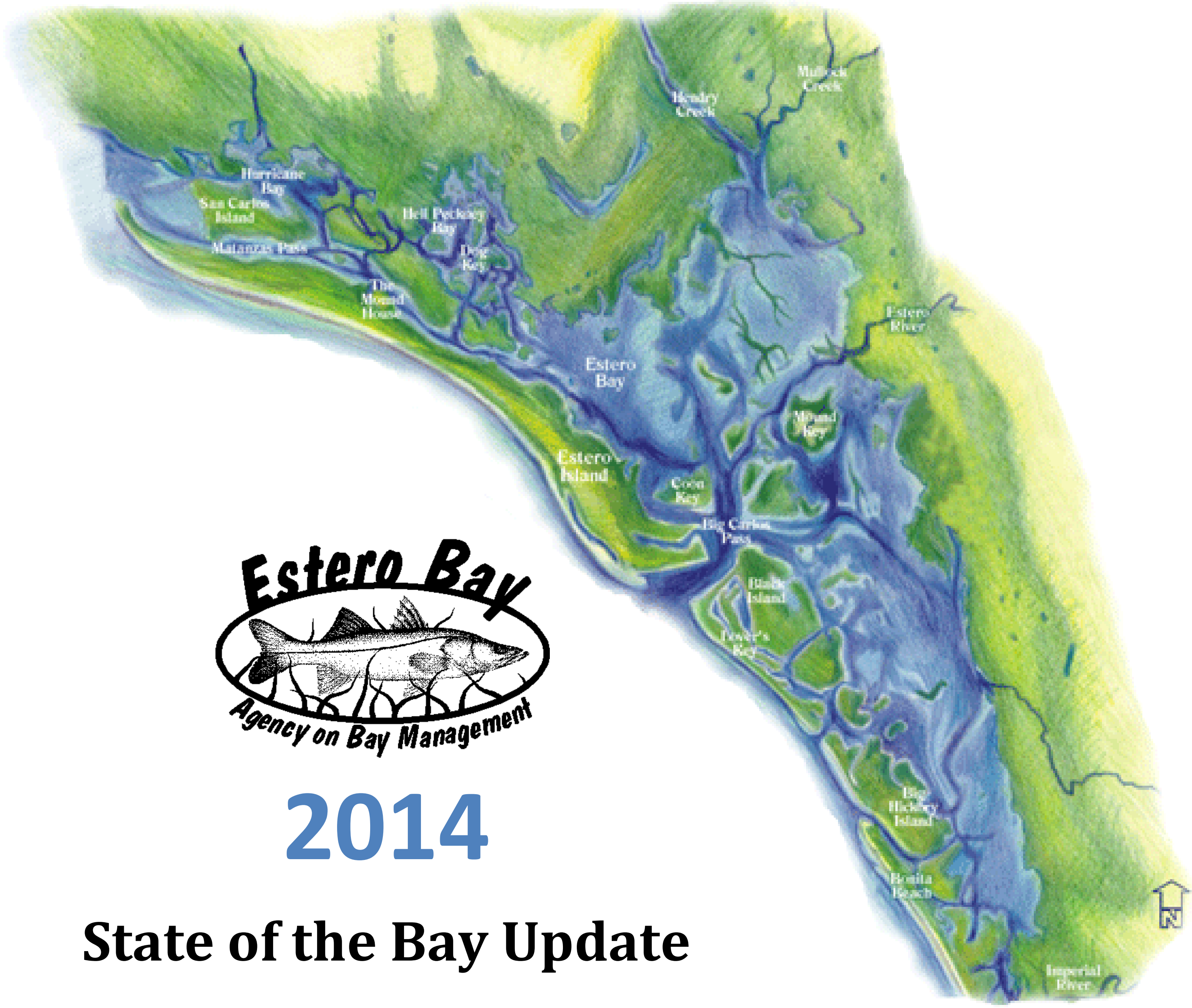

Estero Bay
Agency on Bay Management

2014

State of the Bay Update

Funded by the City of Bonita Springs.

Prepared by the Southwest Florida Regional Planning Council and the Charlotte Harbor National Estuary Program.

City of Bonita Springs Florida
Small Town Charm. Big Bright Future.

Southwest Florida Regional Planning Council
Big Issues * Real Solutions

Charlotte Harbor National Estuary Program

Contents


Estero Bay

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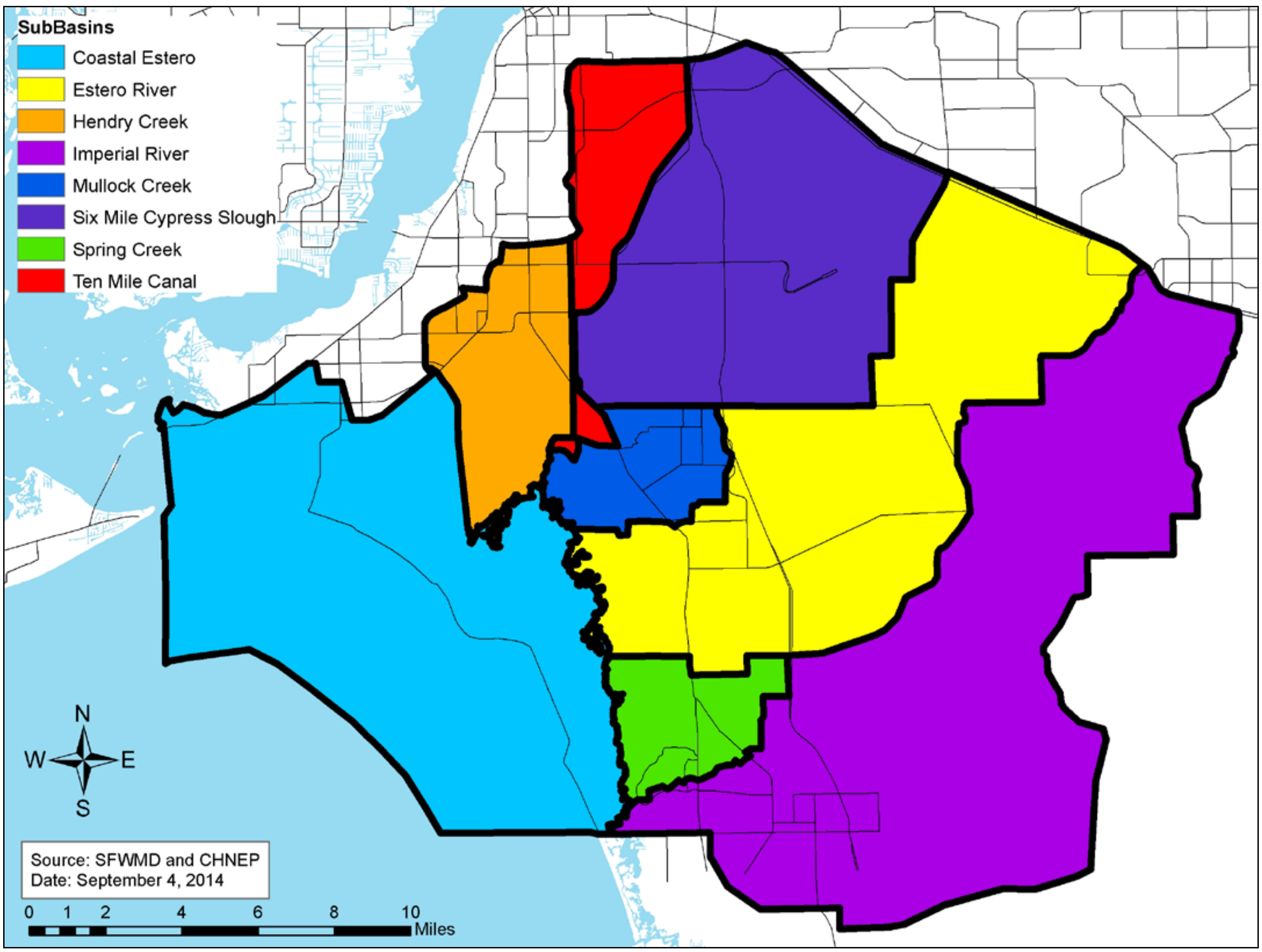
Introduction

The Estero Bay Agency on Bay Management (ABM) was established in 1996 in accordance with the settlement agreement for the completion of permitting for Florida Gulf Coast University (FGCU), after the completion of the Arnold Committee study process. The ABM membership consists of, but is not limited to, representatives from the following: local chambers of commerce, citizen and civic associations, Lee County government, the South Florida Water Management District (SFWMD), the Florida Department of Environmental Protection (FDEP), the Florida Fish and Wildlife Conservation Commission (FWC), FGCU, the Southwest Florida Regional Planning Council (SWFRPC), commercial and recreational fishing interests, environmental and conservation organizations, the Responsible Growth Management Coalition (RGMC), the Town of Fort Myers Beach, the City of Sanibel, scientists, affected property owners and the land development community. The ABM is a non-regulatory, advisory body whose directive is to make recommendations to the SWFRPC for the management of Estero Bay and its watershed (Estero Bay Agency on Bay Management 2004). The waters of Estero Bay provide a tremendous resource for local residents and tourists who enjoy fishing and appreciate the local vegetation and wildlife. It is also important to note that Estero Bay is Florida's first aquatic preserve (Estero Bay Agency on Bay Management 2002).



Principles of the Estero Bay Agency on Bay Management

I. General

I. A. The ABM will be cognizant of the "big picture" and to the concept of "ecosystem management" and sustainable development.
I. B. Water conservation practices and wastewater reuse will be encouraged throughout the watershed to protect potable water supplies."
I.C. All re-zoning requests within the Estero Bay watershed will be critically evaluated to ensure protection of water quality, rare and unique habitats, listed wildlife, and ecosystem functions.
I.D. Variances from environmental regulations and deviations from development standards will be the exception, not the rule.
I.E. Environmental protection and long-term quality of life will not suffer based on short-term economic impacts or political pressures.
I.F. Zoning resolutions that are required as a part of the approval for re-zoning must be tracked for future compliance and enforcement.
I.G. Compliance and enforcement of existing environmental regulations will be a top priority for regulatory agencies.
I.H. Additional staff will be hired to assist in the compliance and enforcement of zoning resolutions related to environmental issues.
I.I. Agency staffing will keep pace with increased demand on services, especially environmental protection issues. Trained and experienced wildlife biologists and environmental scientists will be hired to ensure adequate development review.
I.J. Activities in the watershed by any regulatory agency shall provide the opportunity for public participation.

II. Uplands, Headwaters and Isolated Wetlands

II. A. Land Management and Acquisition
II. A. (1) Lands identified as critical for listed species shall be targeted for public purchase and managed to maintain their environmental value.
II. A. (2) The Lee County Conservation Land Acquisition and Stewardship Advisory Committee will consider priorities for land purchases adopted by the "Arnold Committee" and the ABM.
II. A. (3) The Lee County Conservation Land Acquisition and Stewardship Advisory Committee will use proactive approaches to investigate the willingness of landowners to be voluntary sellers, as specified in the requirements of the ordinance that established the land acquisition program.
II. A. (4) Regulations within the existing "Notice of Clearing" process by Lee County will be developed that require wildlife surveys, habitat assessments, and a development plan for the agricultural operations so that critical habitats for state and federal listed species can be preserved.
II. A. (5) Conservation easements will be used as an option to protect critical habitats.
II. A. (6) Programs such as the "Keep It Clean" and "Florida Yards and Neighborhoods" programs should be promoted, to minimize inputs of storm water pollutants into the bay.
II. A. (7) Before off-site mitigation for wetland and listed-species upland impacts is considered, opportunities for avoidance, minimization, and on-site mitigation must be exhausted.
II. A. (8) Off-site mitigation projects should be within watershed and within habitat type wherever possible.

II. B. Vegetation
II. B. (1) Natural, native vegetation within natural systems will be retained to the greatest extent possible.

II. B. (2) Physical removal of invasive vegetation will be utilized for control rather than widespread chemical treatment.
II. B. (3) Limited application of herbicides that rapidly degrade may be used, according to the product label, on a case by case basis for the control of nuisance and invasive non-native vegetation and to maintain native plant communities.
II. B. (4) Promote, whenever possible, the active and aggressive removal of invasive non-native plants from all common areas, conservation easements, preserves and natural areas within the Estero Bay watershed.
II. B. (5) Isolated and seasonal wetlands are recognized for their importance for flood protection, unique fish and wildlife habitat, water quality, and water quantity. These wetlands should be preserved to the greatest extent possible.

II. C. Physiographic
II. C. (1) Consideration will be given to the ancient relief of the watershed by: preserving vegetation that provide the characteristic habitat and canopy; retaining the relic natural features; and reconnecting historic natural flow ways that have been diverted or severed.

II. D. New Construction
II. D. (1) Construction within flood plains shall be avoided wherever possible.
II. D. (2) For construction that must occur within flood plains, utilize techniques that do not adversely impact the capacity of the floodplain (e.g. use of pilings to raise living floor elevations versus use of fill).
II. D. (3) Utilize non-polluting construction materials (e.g. concrete pilings versus treated wood) within flood plains.

II. E. Hazardous Materials
II. E. (1) Specifically placed larvacides and biological controls are the preferred methods for mosquito control. Adulticides should only be used in compliance with Section 388.011(1) Florida Statutes.

II. F. Agriculture
II. F. (1) Tax incentives should be created so that landowners may continue land use practices that maintain ecologically important habitat.
II. F. (2) Adequate staff at Property Appraisers Offices within the watershed will be provided to review the high number of applications and strictly enforce the rules for Bona fide agricultural tax exemptions.
II. F. (3) The minimum time period for re-zoning of agricultural land should be increased from three years to ten years to reduce the speculative clearing of agricultural land for "higher use" which results in the loss of natural habitat and the loss of tax revenue.
II. F. (4) Legislation should be implemented that provides inheritance tax, real estate tax and estate tax relief for agriculture landowners and their heirs, who will maintain their land in agriculture.
II. F. (5) Legislation should be implemented that provides inheritance tax, real estate tax and estate tax relief for landowners and their heirs, who provide permanent conservation easements on their property.

II. G. Urban
II. G. (1) Old surface water management (SWM) systems built before current regulations will be retrofitted, using best available management practices, to meet current SWM standards.
II. G. (2) Permitting must address cumulative impacts to the water storage capacity of the watershed.
II. G. (3) Grants or incentives should be provided for retrofitting old surface water management systems that are not effectively managing water volume or flow, or removing nutrients and other pollutants.
II. G. (4) Proposals that reduce impacts to Estero Bay and its watershed, that might include: rural village concepts, urban infill, redevelopment sites, greenways; should be encouraged.

II. H. Roadways

II. H. (1) All future roadways to be located in the floodplain within the Estero Bay watershed will be designed and constructed to not impede flows from a 25-year, 3 day, storm event.

II. H. (2) Transportation planning shall be undertaken with goals of increasing public transportation and enhancing new and existing roads with walkable, bikeable passageways that are connected and landscaped.

III. Water Courses

III. A. Physiographic

III. A. (1) Non-structural approaches versus structural approaches will be used for water resource management solutions.

III. A. (2) No further canalization or dredging of remaining natural watercourses will occur.

III. A. (3) A better balance of ecological needs versus water flow will be used for water resource management decisions.

III. A. (4) Establish and restore the historic basin flood plains to the maximum extent possible.

III. A. (5) The ancient relief of the upper tributary reaches will be maintained by: preserving vegetation that provide the characteristic riparian habitat and canopy, retaining the relic natural features of the tributary bank contours, and reconnecting historic natural flow ways that have been diverted or severed.

III. B. Vegetation

III. B. (1) Natural, native vegetation versus non-native invasive vegetation within flow ways and natural systems will be retained to the greatest extent possible.

III. B. (2) Physical removal of invasive vegetation versus widespread chemical treatment will be utilized for control.

III. B. (3) Limited application of herbicides that rapidly degrade may be used on a case-by-case basis, under the supervision of certified personnel, for control of nuisance and invasive nonnative vegetation and to maintain native plant communities.

III. B. (4) Promote, whenever possible, the active and aggressive removal of invasive non-native plants from all common areas, conservation easements, preserves and natural areas within the Estero Bay watershed.

III. C. New Construction

III. C (1) New setback criteria will be developed and implemented along watercourses to provide construction setbacks to the maximum extent possible. These setback criteria will be based on the best available scientific data.

III. C. (2) Construction within tributary flood plains shall be avoided wherever possible.

III. C. (3) For construction that must occur within flood plains, utilize techniques that do not adversely impact the capacity of the floodplain (e.g. pilings to raise living floor elevations versus fill).

III. C. (4) Utilize non-polluting construction materials (e.g. concrete pilings versus treated wood) within flood plains.

III. D. Hazardous Materials

III. D. (1) Specifically placed larvacides and biological controls are the preferred methods for mosquito control. Adulticides should only be used in compliance with Section 388.011(1) Florida Statutes.

III. E. Boating
III. E. (1) No special accommodations will be made for boats (e.g. no cutting of over story vegetation, no removal of oxbows, no dredging or filling except for permitted maintenance of navigation channels).

IV. Bay Waters

IV. A. Water Quality
IV. A. (1) Regulatory agencies will adopt requirements for "Best Management Practices." IV. A. (2) Operation of overloaded and outdated package wastewater treatment plants will be discontinued.
IV. A. (3) All urbanization will be served by centralized sewage systems.
IV. A. (4) There should be uniform application of water quality protection measures by regulatory agencies. A holistic management scheme should be implemented that takes into consideration ecological impacts of regulated activities.
IV. A. (5) Compliance and enforcement of existing regulations are needed to protect water quality and biological integrity.
IV. A. (6) There shall be no discharge of hazardous materials into Estero Bay.
IV. A. (7) Surface water management systems in new developments will be required to utilize state-of-the-art best management practices and increased BMP’s.
IV. A. (8) Grants and other incentives for retrofitting old or ineffective storm water systems should be encouraged.
IV. A. (9) The State of Florida will actively investigate and prosecute water quality violators.
IV. A. (10) Retrofitting existing shorelines hardened with vertical seawalls to sloping lime rock revetments or native, salt tolerant vegetation, should be encouraged wherever possible.
IV. A. (11) Compliance and enforcement of existing environmental regulations will be a top priority for regulatory agencies.

IV. B. Habitat Alteration
IV. B. (1) No further alteration of Estero Bay bottom shall occur, except as proven necessary for the health, safety and welfare of the natural resources of Estero Bay and of the people in the watershed.

IV. C. New Construction
IV. C. (1) New construction projects should utilize best management practices to minimize negative impacts to the bay to the greatest extent possible; and in addition, the project as a whole, including mitigation, should be necessary to protect the public health, safety, or welfare, or the property of others, and should improve the current condition and relative value of functions being performed by the areas affected by the project.
IV.C.(2) Utilize non-polluting construction materials (e.g. concrete pilings versus treated wood).

IV. D. Wildlife
IV. D. (1) A manatee protection plan will be adopted to reduce the number of boat-related manatee mortalities and that respects the rights of other users of the bay; to achieve a sustainable manatee population (the goal of the Marine Mammal Protection Act); to protect manatee habitat; to promote boating safety; and to increase public awareness of the need to protect manatees and their environment.
IV. D. (2) Efforts by wildlife protection agencies will be accelerated to reduce other non-boat related manatee mortalities.
IV. D. (3) Maintain and improve the overall ecology of the bay and its watershed.
IV. D. (4) Wildlife resources such as rookeries, sea grass beds and fisheries are under increasing threat from human activity. Greater efforts are required by regulatory and other agencies and groups to insure the sustained productivity of these resources.

IV. D. (5) Additional manatee research funding should be provided.

IV. E. Recreation

IV. E. (1) Regulatory agencies and boaters will make special effort to maintain the bay as a major natural resource for fishing and appreciation of vegetation and wildlife.

IV. E. (2) Safe operation of vessels is mandatory.

IV. E. (3) Respect for wildlife, its habitat, and other bay users are particularly important in a crowded bay.

IV. E. (4) Use of non-motorized boats, such as kayaks and canoes, is encouraged and supported. (Estero Bay Agency on Bay Management 2002)


Bunche Beach

Human History of Estero Bay

Calusa Period

As new archeological data are analyzed, the date of the first human habitation of Florida is pushed earlier and earlier. It is currently estimated that the first human habitation of Lower Charlotte Harbor and the Estero Bay region occurred approximately 10,000 years ago. These first inhabitants were nomadic people who used stone tools and hunted large mammals in the interior plains. Coastal villages developed as climate changed, sea levels rose and fishing skills increased. Farming, pottery skills, and trade with people outside of Florida developed between 3,000 and 500 years ago. Archeological records indicate that copper, iron ore and maize seeds were prized imports, while pearls, shells, and fish bones were the primary exports. During this period, mound building began and ceramic pottery was used to store goods. There is debate over whether the Estero Bay area was more dominated by the Mississippian culture or by contacts with Central and South American civilizations, with which contact existed through marine trade.

The Calusa Period spanned from 4,000 BC to 1710 AD. The Estero Bay and the Lower Charlotte Harbor area was the center of the Kingdom of the Calusa. It is thought that this tribe came from Caribbean islands. The Calusas fished the Gulf of Mexico, established settlements near fresh water tributaries, and paddled cypress canoes to colonies in other areas. Archeologists believe nearby Mound Key in Estero Bay may have been the tribe's regional center. The 125-acre island is approximately 33 feet high and covered with massive middens - refuse heaps composed of discarded shells. As had other Indian civilizations living on the Gulf of Mexico, the Calusa built large structural mounds from mollusk shells on which important buildings were constructed. Structures on the mounds ranged from the residence of the Chief to temple-like buildings. The Calusa built small canals that served as access to Lake Okeechobee and the Kissimmee River from the Caloosahatchee.

The Calusa tribal area covered most of southwest Florida and parts of southeast Florida. Population estimates vary, but the natural ecology may have maintained a native Calusa population of up to 40,000 at the time of Columbus. A population of this size was not again achieved for the same area until after World War I.

Spanish Exploration Period

The first documented Europeans to visit southwest Florida were members of the Juan Ponce de León expedition. In 1493 Juan Ponce de León sailed with Columbus on his second voyage to the Americas. He landed at St. Augustine in late March of 1513, after looking for gold and the Fountain of Youth in the Bahamas and Bimini. He named the place La Florida. It was during the final phase of his first voyage that Ponce de León led the first documented Spanish landing party ashore near Lovers Key on June 4, 1513 and first encountered the Calusa Indians. As Ponce de León and his men explored inland for wood and fresh water, they saw the Calusa tribal village at Mound Key. They encountered the Calusa and discovered that they were an unfriendly tribe. The explorers fled back to their ships and decided to leave the area, sailing back to Puerto Rico.
In 1521, Ponce de León returned to the Southwest coast of Florida to colonize. He landed on the gulf beaches near Lovers Key in Estero Bay with over 200 settlers, 50 horses, numerous beasts of burden, tools, and seeds. The plan was to set up a farming colony. As they went inland for fresh water, the Calusa ambushed

them. Ponce de León was shot in the thigh by an arrow and was seriously wounded. The settlers decided to abandon the settlement and sail back to Cuba. As a result of his wound, Ponce de León died at the age of 61 in Cuba.

Throughout the 1500s, other Spanish explorers and enterprising pirates sailed southwest Florida's coastal waters. Treasure-laden galleons from Mexico and Central America sailed past Estero Bay. Map-makers named the bay "Estero," the Spanish word for estuary.

A tenuous alliance was later formed between the Calusa and the Spanish in 1567. Mound Key was also the site of the first Jesuit mission in North America. However, the Spanish did not want to help the Calusa against their enemy the Tocobaga and the Calusa were disinterested in Christianity, so the alliance dissolved. Other Spaniards followed, and the Calusa were eventually conquered—but by disease, not warfare. Although the Calusa eventually died out in Florida due principally to the introduction of common European illnesses such as smallpox and influenza for which they had no natural immunities, they succeeded in keeping their would-be Spanish conquerors at bay for over a 250-year period. The last known documented Calusa in southwest Florida died in the late 1700s. Slavery, indenture, or conversion led to the transfer of the majority of the last remnants of the tribe by the 1800's remaining population to Cuba and other Caribbean lands where descendants can be found today.

Cuban Period

The Cuban Period spanned from 1710 to 1836. Southern Florida became lightly repopulated through migration of the southern Creek Indians from Alabama and Georgia, who likely intermarried or absorbed very small numbers of remnant native peoples, and became known as Seminoles. The name Seminole is from the Creek word 'semino le', interpreted to translate as 'runaway.' Another, better description of the meaning can be "emigrants who left the main body and settled elsewhere." The term was first applied to the tribe about 1778.

Southwest Florida, while it remained under Spanish control, was not a center for major settlement. Fishing camps were established by people of direct Spanish and Cuban descent who harvested the bounty of the estuary and brought salted and smoked fish to the urban centers of Cuba and the Spanish Caribbean. Beyond fishing camps, the interior was visited only for hunting trips. Here the Cubans made contact with the Seminoles. The Cuban populations did not desire to settle in the interior of southwest Florida so conflict with the Seminoles was minimal.

The settlement history of southwest Florida by Americans was driven by military decisions associated with the series of Seminole Wars generated by the southward movement of American settlers from Georgia and elsewhere in the southeastern United States immigrating into Florida even when it was still a Spanish possession. There were three Seminole Wars in Florida; the first Seminole War started in 1817 and shortly thereafter Spain ceded Florida to the United States. The series of wars, ending finally in 1858, led to the Seminoles moving further southward and residing in southwestern Florida, including family groups in the Estero basin.

American Period

The American Period spans from 1817, when Florida became a territory of the United States, to the present. The Treaty of Camp Moultrie was signed in 1823, legally establishing large parts of Lower Charlotte Harbor south of the Peace River as the promised Seminole territory. By 1840, the Lower Charlotte Harbor area had several forts: Fort Dulany, Fort Denaud, Fort Adams, and Fort Thompson. The last Seminole War ended in 1842 with an agreement that the Seminoles could remain in Florida but were forced further south into the Big Cypress Swamp and the Everglades.

By the mid 1800s, settler families headed south, settling on the high ground created by the Calusas and scrub lands along rivers. Estero's first American homesteader arrived in 1882. He was followed by others who farmed citrus along the river, ranched cattle and commercial fished and then used the waterway to ship harvests north via the Gulf. Frank Johnson, one of Lee County's early pioneers, settled on Mound Key and began excavating the historic site, gathering Calusa artifacts and gold and items left behind by the Spanish and Cubans.

The early settlements in the Estero Bay watershed of town size all occurred after the Civil War and were isolated pods created by land-hungry pioneers, or by visionaries in pursuit of dreams. Through the late 19th and early 20th centuries, the Estero Bay towns and area depended principally upon agriculture (citrus and cattle), commercial fishing, recreational fishing and tourism. Estero River Groves was renowned for its wonderful citrus.

Bonita Springs' history begins in 1888 when Alabama cotton farmer B.B. Coomer moved there and purchased 6,000 acres to start a plantation of pineapples, coconut and bananas. Coomer subsequently saw his entire crop wiped out by a freeze in 1893.

Estero was established and incorporated by the followers of Dr. Cyrus Teed, who proposed a theory that we live on the inside of the Earth's outer skin, and that celestial bodies are all contained inside the hollow Earth. This theory, which he called Koreshan Unity, drew followers to purchase and occupy a 320-acre tract in 1894. They were business-oriented and lived communally, prospering enough to found its own political party ("The Progressive Liberty Party") and be considered among San Carlos Island's first developers. In 1904, the Koreshans, a celibate Utopian society, built a post office at their settlement and Estero officially became a town. But three years later, other local citizens protested the incorporation, the neophyte city was dissolved and once again part of unincorporated Lee County.

As coastal settlements were few and far between south of San Carlos Bay, there was no incentive for the federal government to conduct bathymetric surveys and compile charts. Eventually, when the US Army Corps of Engineers (USACOE) surveyed Estero Bay in 1908, they could not locate an inland water route from Matanzas Pass to Naples, even though the Coast Survey chart seemed to indicate an interior waterway as far south as Clam Pass. At the time, there were three very small gasoline freight launches running between Ft. Myers and the Estero River, one twice weekly and two three-times weekly. Also, a mail steamer provided service from Ft. Myers to Carlos. As many as 36 fishing shacks were counted on the bay during the fishing season, when one carload of fish could be taken every two days to Punta Gorda for shipment by railroad. The USACOE recommended dredging a 5-foot-deep by 60-foot-wide channel from the mouth of Matanzas Pass to Surveyor's Creek (Imperial River) in 1908. This proposed project was not implemented.

By the 1920 Census, Bonita Springs and Estero were named and settled farming and fishing villages, as was Bayview (a.k.a. Crescent Beach or Estero Island, now as the Town of Fort Myers Beach). The creation of the Tamiami Trail in the late 1920s opened up most of the Estero Bay coastal watershed, becoming motor court and trailer park destinations, and the construction of a toll bridge to Estero Island (54 cents in 1921) inspired further development of the island. The coastal component of the basin endured the same boom and bust phenomenon Florida had during the 1920s, with its own promoters engaged in the same land sales schemes depicted by the Marx Brothers in the movie *Coconuts.*

Development has changed the historic boundaries and extent of the Estero Bay watershed. The boundaries were increased when 10-Mile Canal was dredged in the 1920's thereby connecting areas that formerly flowed north to the Caloosahatchee. The dredging began as a source of fill to create a dike to prevent parts of Fort Myers from flooding with seasonal sheetflow from undeveloped lands to the east of the city boundary. The boundaries were also reduced by drainage projects associated with the development of Lehigh Acres.

World War II brought the area out of the Depression, and Fort Myers Beach was used as a rest and recreation site for trainees at the military bases, Page Field and Buckingham Field, only briefly discomfited by the 1944 hurricane.

Estero remained a quiet, sleepy citrus and fishing community for the next 50 to 60 years, harboring small retirement communities and mobile home parks. Estero River Heights, the area's first major development, was built along the river during the late 1960s; today, the neighborhood is filled with mature landscaping and trees, and renovated homes.

A set of technological innovations associated with working in the tropics developed by the U.S. military during World War II including air-conditioning, chemical mosquito control, quick land clearing and wetland filling, and the interstate highway system opened up southwest Florida to easier habitation by visitors and immigrants from the midwest and northeast. Following World War II, many of the servicemen who had trained on bases in southwest Florida and had experienced the region's environment either immediately returned to the area with their families after the war or, after working in other areas of the country, began retiring to this area. This trend created a one-way population influx beginning in the 1960s and 1970s. This population increase caused areas in the western corridor of the Estero Bay watershed, including San Carlos Park, Estero, San Carlos Estates, Estero Bay Shores, Spring Creek Village, Bonita Springs, and Bonita Beach to expand. Agricultural subsequently moved eastward to less expensive lands converted from former native range.

This post World War II boom came to the Estero Watershed later than other parts of the west coast of Florida, but ultimately with similar results. Large amounts of land were committed to residential urban/suburban purposes without commitments to urban services and infrastructure, viable higher income employment for the working age population, a functional transportation network. The new developments either grew around or bypassed the older villages, creating new named communities from raw land, and increasing the density and intensity of development within the watershed. Fort Myers Beach and Bonita Beach went condo and high rise. San Carlos Island and San Carlos Park became intensely developed.

The first attempt to incorporate Fort Myers Beach occurred in the mid 1940's and failed by a margin of six or seven votes. A second try in the late 40's lost by a larger number, and an attempt in November, 1953 was a total failure.

In 1955, private developer Walter Mack, with contributions from the Bonita (town) Chamber of Commerce, dredged a channel, 4-feet-deep by 50-feet-wide, from Big Hickory Pass south to the Cocohatchee, thereby providing boat access between Estero Bay and Wiggins Pass.

The Matanzas Harbor became a reliably accessible fishing port after maintenance dredging of Matanzas Pass. Reflecting this use, 1956 records listed 280 shrimp boats using the facilities at Fort Myers Beach. That year shrimp boats delivered 3,800 tons of shrimp. By 1960, waterborne commerce consisted principally of diesel fuel, fish, shrimp and ice, with tanker barges delivering the fuel. The commercial facilities - included two shrimp and several fish packinghouses, fuel and ice distribution points, and two marine railways. Much of the land development - construction of an ice plant and diesel fuel terminal - were for the support of the shrimp and fishing activity. The local fleet required a supply of fuel and ice in order to operate. From 1963 to 1966, the shrimp harvest increased from 1,294 to 1,713 short tons. The need for vessel facilities was strong during this period, enabling the justification for a channel extension that created a 5-foot-deep by 60-foot-wide channel from the mouth of Matanzas Pass to the Imperial River and improved the Matanzas Pass Channel from the Gulf to a turning basin off San Carlos Island. Prospects for continued commercial growth were good.

In 1958 Barry C. Williams and Investors purchased 5,500 acres along the northern and eastern coast of Estero Bay for $1.6 million. Robert Troutman, an Atlanta attorney representing investors, drew up a plan to expand a seawall deep into Estero Bay along 18 miles of this coastline. The seawall, called a bulkhead, would straighten out the jagged coastline by using 17 million cubic yards of fill. Along the way it would swallow up submerged lands and islands, creating 1,100 upland acres that previously were under water. For fill, Troutman proposed dredging a 12-foot channel through the seagrass beds around his bulkhead. The same technique had been employed along the east coast and in areas to the north, such as Tampa, St. Petersburg and Sarasota.

Determined to keep Estero Bay from the loss of habitat and degraded water quality when developers removed the mangroves and seagrass beds that served as a nursery for fish, shrimp, mammals and birds, local residents and fishermen formed the Lee County Conservation Association. At one point during the mid-1960s, it’s estimated that about 50 percent of the registered voters in Lee County belonged to the association.

The members of the association wrote letters, engaged politicians and used their voting bloc to change leadership in Lee County. They argued that submerged lands belonged to the state and tried to create the Estero Bay State Park. Florida law clearly states that any land above the high tide mark can be owned privately but property below it belongs to the state. Their efforts led to the creation of the Estero Bay Aquatic Preserve which was the first aquatic preserve designated under Florida Statutes, in 1966, and today the Department of Environmental Protection, Office of Coastal and Aquatic Managed Areas (CAMA) manages the aquatic preserves. The state eventually would use the preserve as a model to create 41 others along Florida's coastal waters.

The 10-Mile Canal was extended in the 1970s, dredging through uplands and wetlands and blasting through rock to connect it to Mullock Creek, cutting off the connection of the Six-Mile Cypress Slough to the headwaters of Hendry Creek.

From 1973 to 1976, a group of Lee County students from each of the high schools studying the role of forested wetlands in Florida's ecology became alarmed at how fast these environmental treasures were disappearing to private interests. The students, known as "the Monday Group," envisioned a place where visitors could stroll among majestic cypress trees and catch the whisper of Florida's primordial past. In such pristine surroundings, they hoped that people could begin to learn how wetlands provide priceless but often hidden benefits, such as water purification and storage, natural flood control and wildlife habitat. Knowing that Six Mile Cypress Slough was under imminent threat from logging and the channeling, the Monday Group launched a daring campaign to save the area for future generations. Lee County voters responded overwhelmingly by referendum to increase their own taxes to purchase and convert the Slough into a preserve.

Beginning in 1974, Regional Planning Councils were charged with coordination of the review of any large-scale development project which, because of its character, magnitude, or location, could have a substantial effect upon the health, safety, or welfare of the citizens of more than one county. Such a project, known as a Development of Regional Impact (DRI) is typically complex and requires input from many reviewing agencies. Demand for the southwest Florida lifestyle, the livability of the environment, the increased use of air conditioning and the control of mosquitoes, which in a large part has been due to the ongoing development, kept the land use conversions growing.

In the mid 1980s, the growth-impacted counties containing the Estero Bay basin amended their comprehensive plans in an attempt to control the location and intensity of urban land use changes. The comprehensive plans attempted to contain the urban growth to the western portion of the basin (located near US 41 and the railroads) while protecting the major wetlands systems existing in the eastern part of the basin and the state buffer preserves surrounding the Bay. The result was that, south of State Road 82 and east of 1-75, the greater part of the wetland system that was present in 1900 is now mostly identified as Density Reduction/ Groundwater Recharge (DR/GR). For a time it looked as though this area would be protected through a combination of regulations by the United States Army Corps of Engineers (USACOE), State of Florida, the South Florida Water Management District (SFWMD), and county regulations. State wetland regulations and Federal wetland permitting practices have allowed the reduction of wetland protection (Beever 2007).

Spanish Wells was Bonita Springs' first gated community, founded in 1979, and within 20 years, many upscale gated communities followed, including Bonita Bay, Pelican Landing, Worthington and Hunter's Ridge**.**

In 1980, the Coast Guard established a search and rescue station on San Carlos Island at Matanzas Pass, which is reportedly the fourth busiest station in the United States. The station handles over 600 search and rescue missions a year including Cuban refugees' interdiction and drug enforcement duty. The Coast Guard station covers a coastline of about 60 miles from Sarasota Beach to Cape Romano.

Southwest Florida Regional Airport (RSW) opened on May 14, 1983.The original terminal was located off of Daniels Parkway. On May 14, 1993, ten years after opening, the airport was renamed Southwest Florida International Airport. Southwest Florida International Airport's new terminal, accessed from Ben Hill Griffin Parkway, opened in 2005 to accommodate record numbers of travelers. It is one of the newest terminals in the nation and was the largest public works project in Lee County history. A recent economic impact study showed the airport's annual contribution to the region's economy is$3.6 billion. Southwest Florida International Airport served over 8 million passengers in 2007 and is one of the top 50 busiest airports in the nation.

The 7,000-acre Mitigation Park, located four miles southeast of Southwest Florida International Airport, was established to compensate for the impact of long-term development and expansion of the airport. The lands are among the most pristine and environmentally sensitive in the region. Site surveys resulted in identifying eight plant and eleven wildlife species listed as protected by State and Federal agencies. The site includes the Imperial Marsh, the largest freshwater marsh in Lee County, and extends from the headwaters of the Imperial and Estero river watersheds through the Flint Pen Strand, ultimately connecting to the Estero Bay. The Port Authority has been recognized and has won several industry environmental awards for this project. The total budget for the project was $30 million, which included land acquisition and restoration costs. The Lee County Port Authority maintains this property for approximately $500,000 per year. No ad valorem (property) taxes are used for airport operation or construction. Although it is called a park, this mitigation land is not a public area.

The siting of Florida Gulf Coast University, Florida's newest higher education facility, in the DR/GR, led to serious opposition, because of the possible threat to Lee County's domestic water supply, wildlife habitats, wetlands, and the cost of the infrastructure for such an inaccessible site. The formation of the Estero Bay Agency for Bay Management in 1995 was a direct result of the settlement agreement to address that opposition. Within the first two years after the FGCU founding much residential and commercial development was approved for the area, including three Developments of Regional Impact (DRIs). The Southwest Florida International Airport reconfigured and expanded, and Lee County's largest. The Lee County Metropolitan Planning Organization (MPO) has also considered the possibility of new roads bisecting the area in several directions.

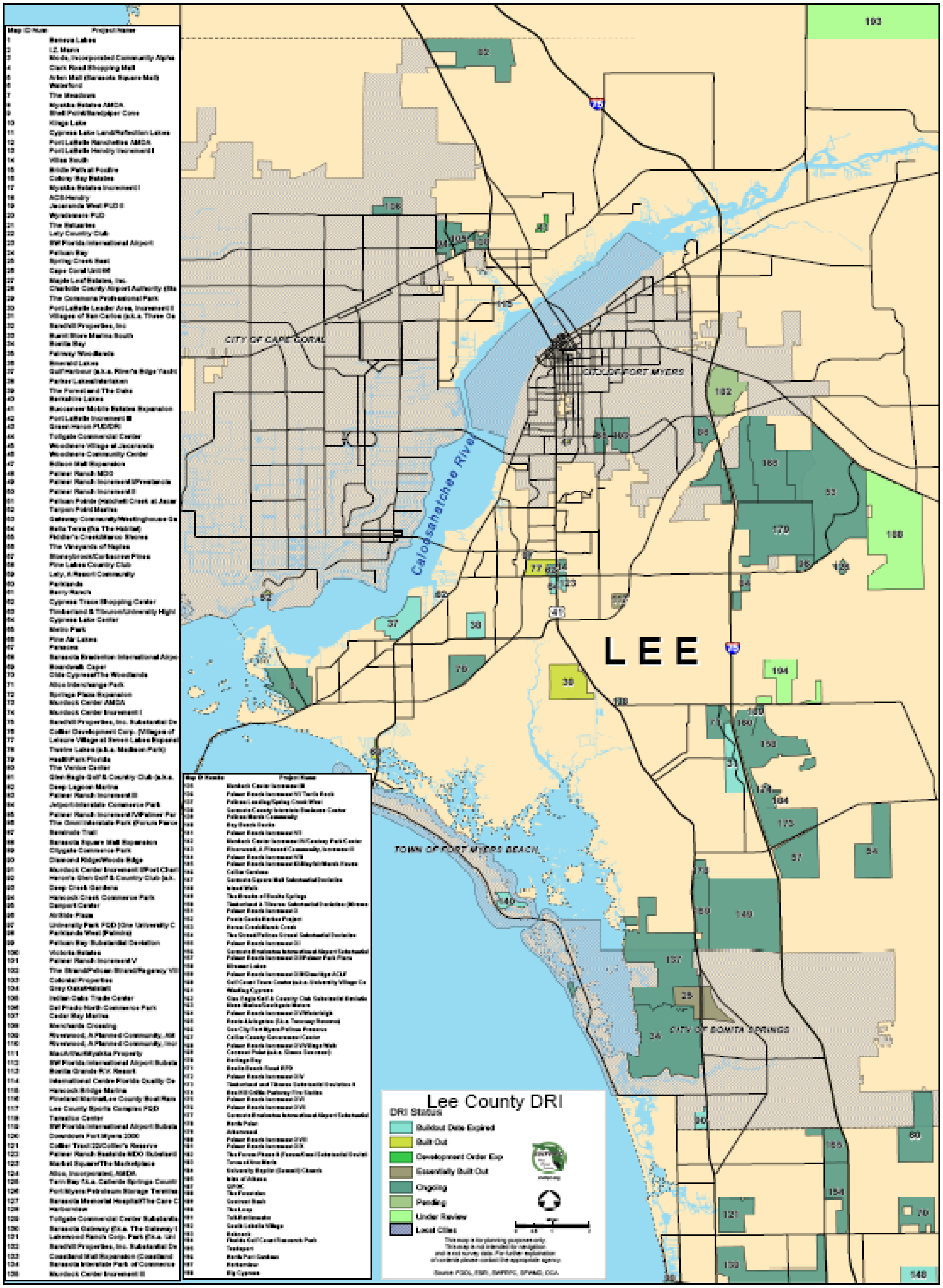
In 1997, Southwest Florida's only four-year university, Florida Gulf Coast University, opened in the middle of the watershed east of Estero and I -75. Then, as predicted, Germain Arena and Miromar Outlets opened in Estero in 1998, and growth exploded both east of Interstate 75 extending to the Collier County Line along Bonita Beach Road, and into the areas flanking US 41, Ben Hill Griffin Parkway and Three Oaks Parkway. The most dramatic of these changes in the land uses is the reduction in wetlands, the increases and then the decreases in agricultural areas, and the continued increasing of urbanization in a six- to eight-mile wide corridor between the Bay on the west and 1-75 to the east.

In 1997 the voters of Lee County demonstrated their concern for preservation by voting for Conservation 2020, a plan for citizens to tax themselves in order to set up a fund for purchase of sensitive lands from willing sellers.

The Town of Fort Myers Beach incorporated in 1995. The City of Bonita Springs incorporated into a municipality in 1999.

According to the 2000 census, the Estero Bay basin population totaled nearly 145,000 people. By 2010, the Estero Bay basin population had grown by a third to over 195,000.

Most recently the Village of Estero voted to incorporate in 2014 and became the newest municipality in the Estero Bay Watershed on January 1, 2015.


CITY OF CAPE CORAL
CITY OF FORT MYERS
Caloosahatchee River
LEE
TOWN OF FORT MYERS BEACH
CITY OF BONITA SPRINGS
Lee County DRI
DRI Status
Buildout Date Expired
Built Out
Development Order Exp
Essentially Built Out
Ongoing
Pending
Under Review
Local Cities

Water Quality

2013 Water Quality Status

	Chlorophyll -a	DO	Fecal Coliform	Total Nitrogen	Total Phosphorus	Turbidity	Total Met
Estuarine							
Estero Bay							**6**
Hendry Creek		V	V				**4**
Mullock Creek		V					**6**
Estero River		V					**4**
Spring Creek		V					**4**
Imperial River	V	V	V				**4**
Fresh							
6-Mile Cypress		V	V				**4**
10-Mile Canal		V					**5**
Hendry Creek		V					**5**
Mullock Creek		V	V				**4**
Spring Creek		V					**4**
Imperial River		V	V				**3**
Total Met	**12**	**2**	**9**	**10**	**12**	**12**	

(red)	Appears to have not met standards in 2013, based on Lee County Environmental Lab data*
(orange)	Appears to have not met standards in both 2008 and 2013*
(green)	Appears to have not met standards in 2008 but met them in 2013*
V	Verified as Impaired in 2010 by Florida Department of Environmental Protection

* Lee County Environmental Lab, 2013

**Copper was met in all years in 2008. Methods changed in 2009, showing much higher copper amounts concurrent with the change of methodology. Verified impairments for copper include Imperial River Marine and Spring Creek Marine.

In the past, the state of Florida has not provided quantitative standards for nutrients such as nitrogen and phosphorus. These nutrients are often cited as the cause of low dissolved oxygen levels, a factor in the health of fish and wildlife resources in the Estero Bay watershed. In response from a January 14, 2009 US Environmental Protection Agency (USEPA) determination letter, the State of Florida adopted numeric standards for nitrogen and phosphorus in streams (freshwater) and southwest Florida's estuarine segments. Currently the Charlotte Harbor National Estuary Program, Sarasota Bay Estuary Program and Tampa Bay Estuary Program are evaluating tidal creeks for development of numeric nutrient criteria. For the interim, stream standards were applied in general to tidal creeks and streams.

Water Quality Standards

Water quality standards have evolved since the 2009 State of the Bay report. Estuarine numeric nutrient and new chlorophyll *a* standards were recommended by CHNEP, the adopted by FDEP and approved by EPA. Freshwater numeric nutrient standards were adopted by FDEP and approved by EPA, for implementation in 2012..

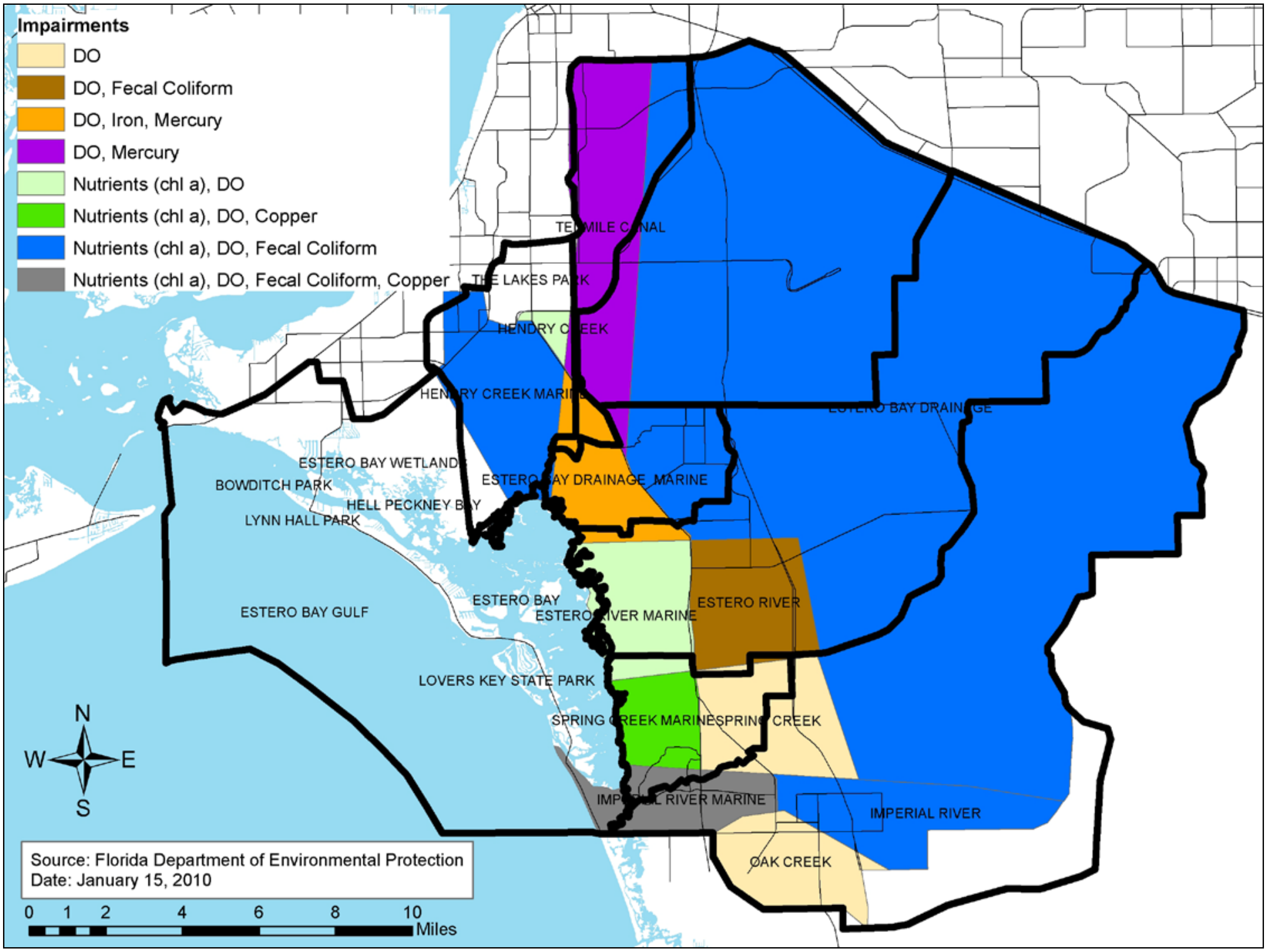
Finally, methods to measure copper have changed so that continuing comparisons have no utility.

Parameter	**State Standards**		
	Estero Bay, including tidal Imperial	**Tidal Creeks**	**Freshwater Creeks**
Chlorophyll-a	5.9 ug/L	11 ug/L (superseded)	20 ug/L (superseded)
Dissolved oxygen	4.0 mg/L (superseded)	4.0 mg/L (superseded)	5.0 mg/L (superseded)
Fecal Coliform (average)	200 count/100 mL	200 count/100 mL	200 count/100 mL
Fecal Coliform (one time)	800 count/100 mL	800 count/100 mL	800 count/100 mL
Total nitrogen	0.63 mg/L	1.54 mg/L	1.54 mg/L
Total phosphorus	0.07 mg/L	0.12 mg/L	0.12 mg/L
Turbidity	29 NTUs over background	29 NTUs over background	29 NTUs over background

Note: mg/mL3 = ug/L (micrograms/Liter)
62-302 = Surface Water Quality Standards (August 2013)

Note: A portion of the Numeric Nutrient Standards rule became effective on 7-3-12, 20 days after filing the rule certification package for Florida's numeric nutrient standards. EPA approved the Florida rule November 30, 2012, resulting in approval of the Florida numeric nutrient standards in their entirety. The August 2013 date relate to additional estuary-specific standards beyond the Estero Bay basin.

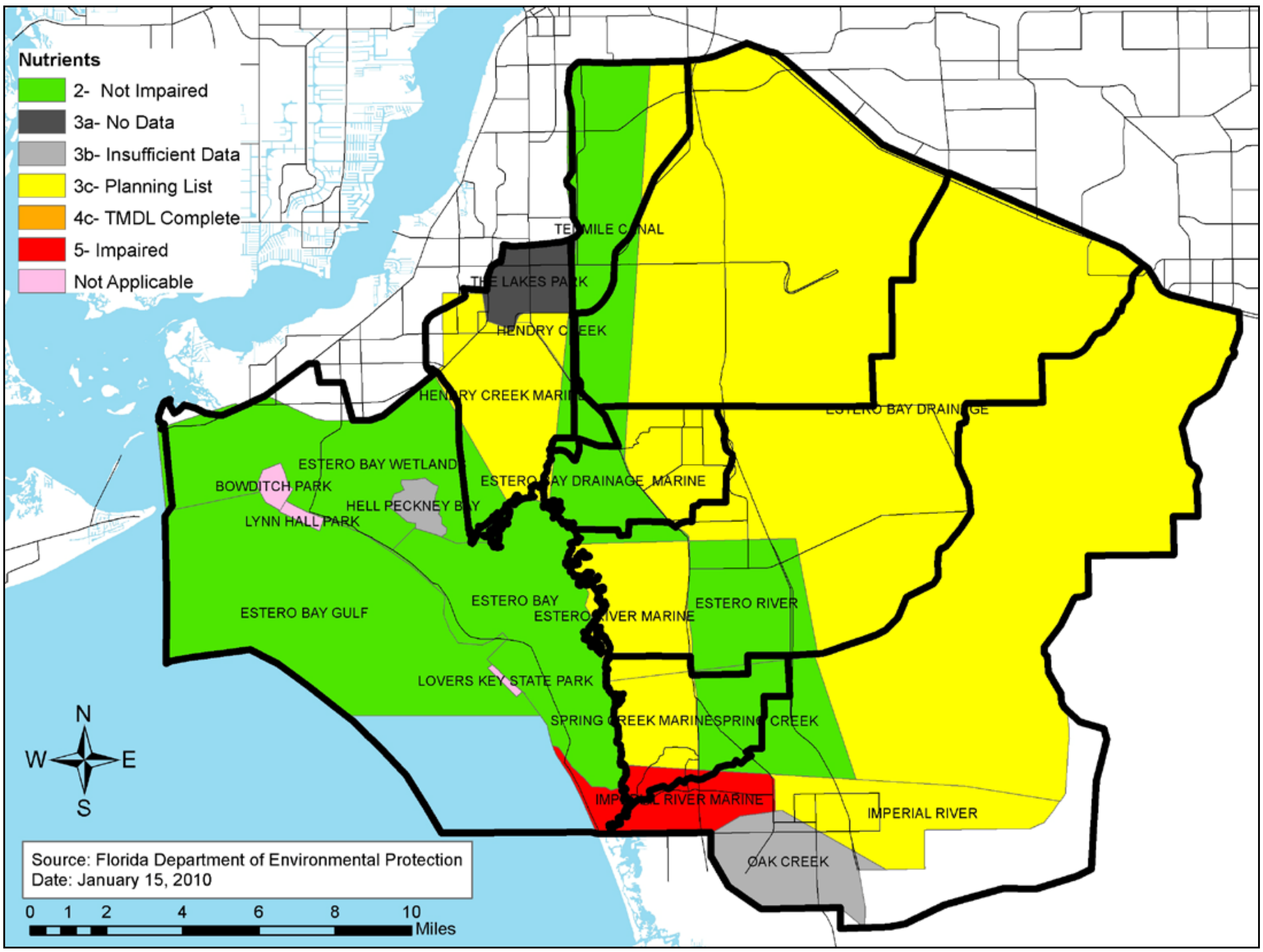
Impaired Waters



The Florida Department of Environmental Protection establishes a list of water quality impairments. The map above illustrates the locations of these impairments in the Estero Bay watershed and surroundings. The verified list does not conform entirely to the 2013 water quality assessment above. As is evident from the following data, water quality varies each year. The 2013 assessment provides a snapshot in time, whereas the FDEP information shown above illustrates areas of chronic water quality problems.

Parameter: Chlorophyll-a

Chlorophyll-a is a measure of phytoplankton activity in the water column based on the primary photosynthetic pigment of green and other algae. It is a resultant parameter that synthesizes many environmental factors including nutrients, temperature, salinity, trace elements, toxics, tides and relative dilution, including water flows. It is proposed as a presumptive measure of estuarine health for the purpose of determining impaired waters. According the Florida Impaired Waters Rule (62-303), an annual average measurement greater than 11 mg/l in estuarine conditions is considered impaired. An annual average exceeding 20 mg/M^3 in freshwater streams is considered impaired. CHNEP recommended 5.9 mg/M^3 for Estero Bay and the state adopted the standard for implementation in January 2012. The maps shown below is the water quality assessment by FDEP for nutrients as measured at the time by chlorophyll *a*.



The Lee County Environmental Laboratory provided the data for all chlorophyll-a analysis.

Between 2009 and 2013, average annual chlorophyll-a dropped in all estuarine segments. The average reduction was 39%. The peak monthly chlorophyll-a dropped in all estuarine segments but one, for an average of 38% reduction.

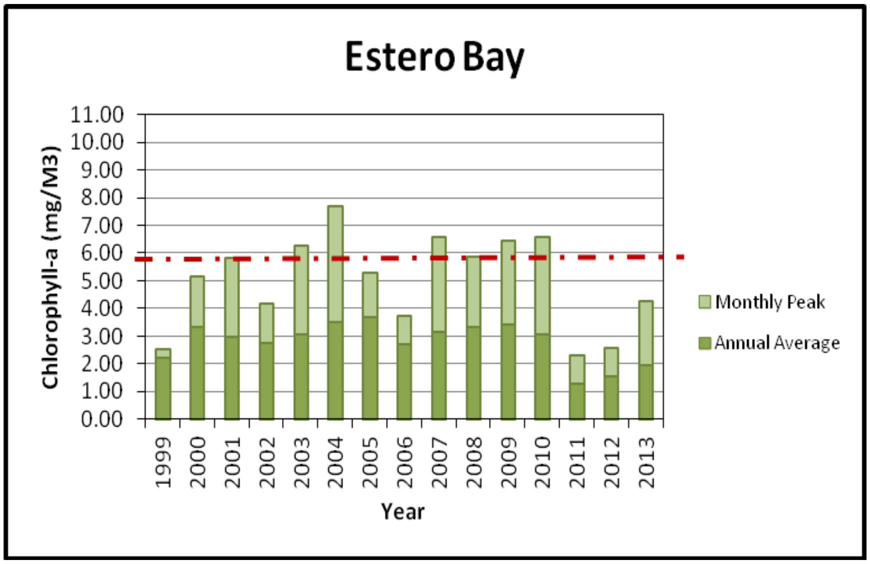
The most common peak month was June (23%), however, all month except March were represented.

2009-2013 change

average -43%

peak -34%

Year	Mean	Peak	Month of Peak
2009	3.45	6.46	September
2010	3.06	6.58	August
2011	1.30	2.31	August
2012	1.58	2.58	July
2013	1.95	4.29	August

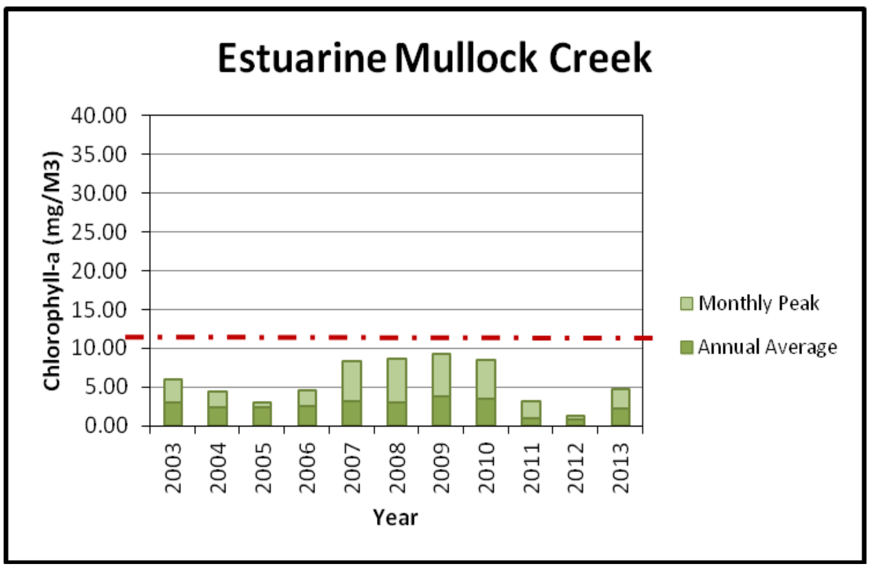


2009-2013 change

average -41%

peak -49%

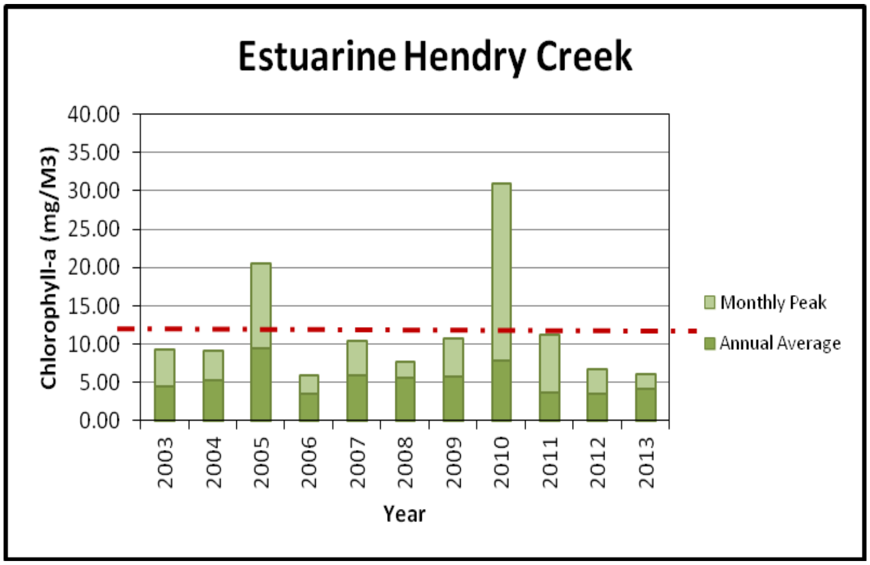
Year	Mean	Peak	Month of Peak
2009	3.78	9.30	June
2010	3.58	8.55	May
2011	0.99	3.20	June
2012	0.95	1.30	June
2013	2.23	4.75	December



2009-2013 change

average	-27%
peak	-44%

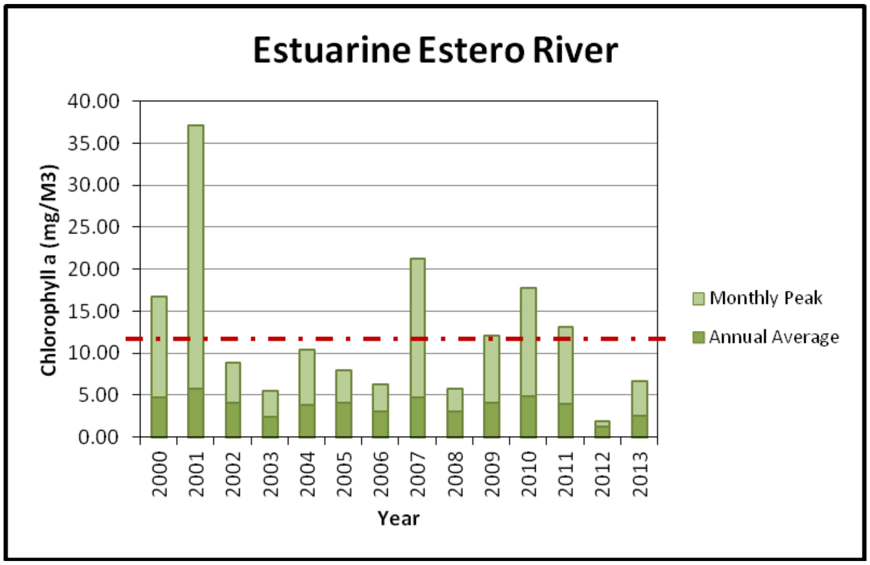
Year	Mean	Peak	Month of Peak
2009	5.72	10.83	June
2010	7.96	30.98	April
2011	3.78	11.20	July
2012	3.62	6.70	October
2013	4.19	6.10	October



2009-2013 change

average	-37%
peak	-44%

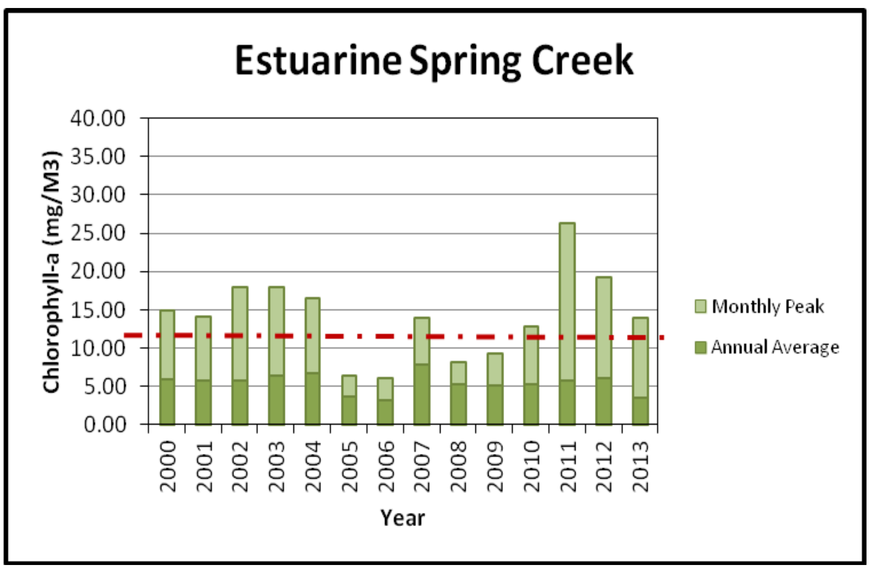
Year	Mean	Peak	Month of Peak
2009	4.17	12.08	February
2010	4.91	17.83	June
2011	4.07	13.23	August
2012	1.24	1.96	April
2013	2.63	6.77	November



2009-2013 change

average	-31%
peak	49%

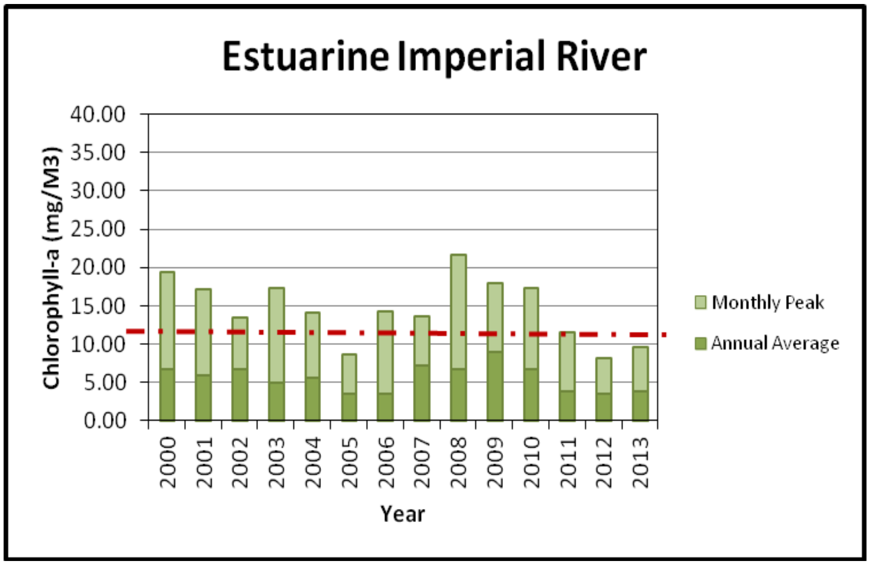
Year	Mean	Peak	Month of Peak
2009	5.23	9.38	December
2010	5.28	12.85	July
2011	5.82	26.28	April
2012	6.07	19.35	January
2013	3.61	14.00	May



2009-2013 change

average	-56%
peak	-47%

Year	Mean	Peak	Month of Peak
2009	9.07	18.07	February
2010	6.80	17.43	June
2011	3.92	11.65	June
2012	3.58	8.20	May
2013	3.95	9.63	December



Chlorophyll-a in Fresh Systems

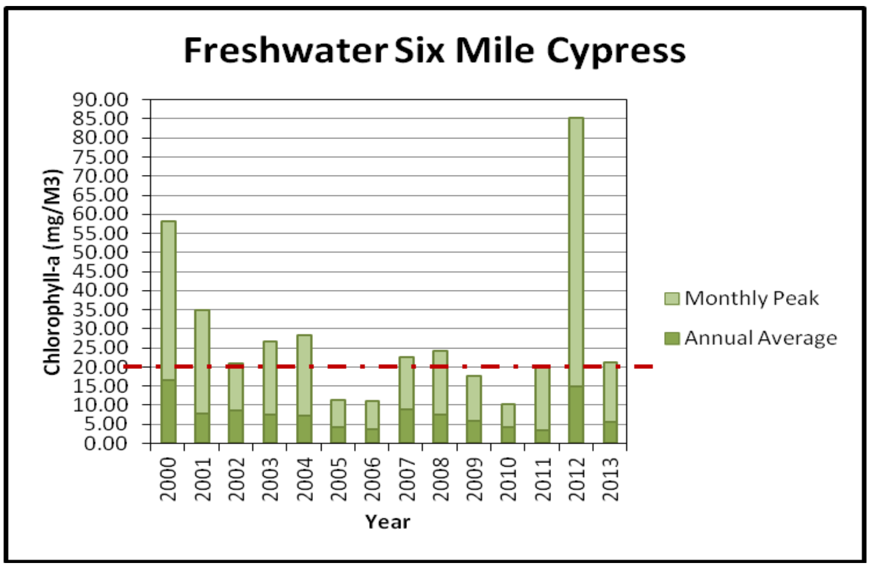
Between 2009 and 2013, average annual chlorophyll-a dropped in all freshwater segments. The average reduction was 46%. The peak monthly chlorophyll-a dropped in all estuarine segments but one, for an average of 34% reduction.

The most common peak month was May (30%), followed by June (17%). These probably represent first flush events. All months except July and October were represented.

2009-2013 change

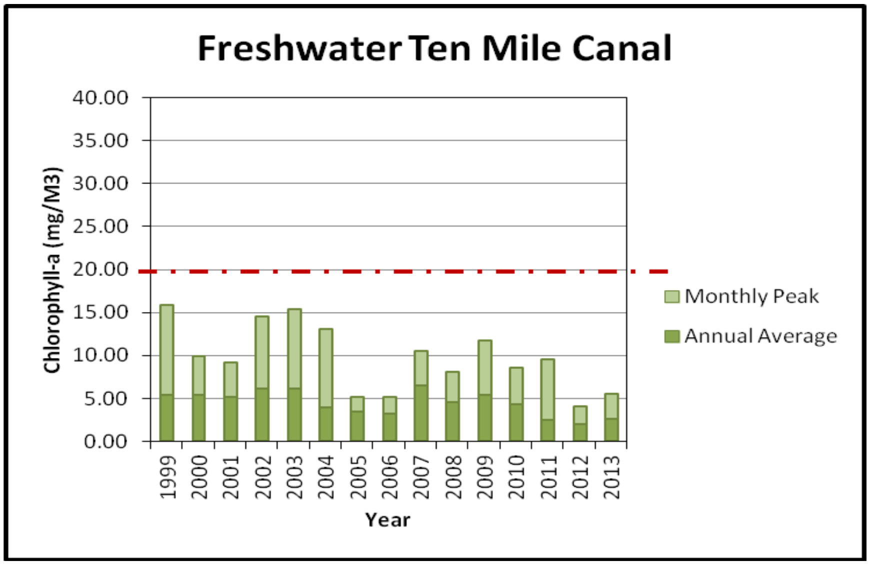
average	**-9%**
peak	**21%**

Year	Mean	Peak	Month of Peak
2009	6.11	17.65	March
2010	4.43	10.23	June
2011	3.60	20.58	February
2012	14.99	85.38	May
2013	5.58	21.30	May



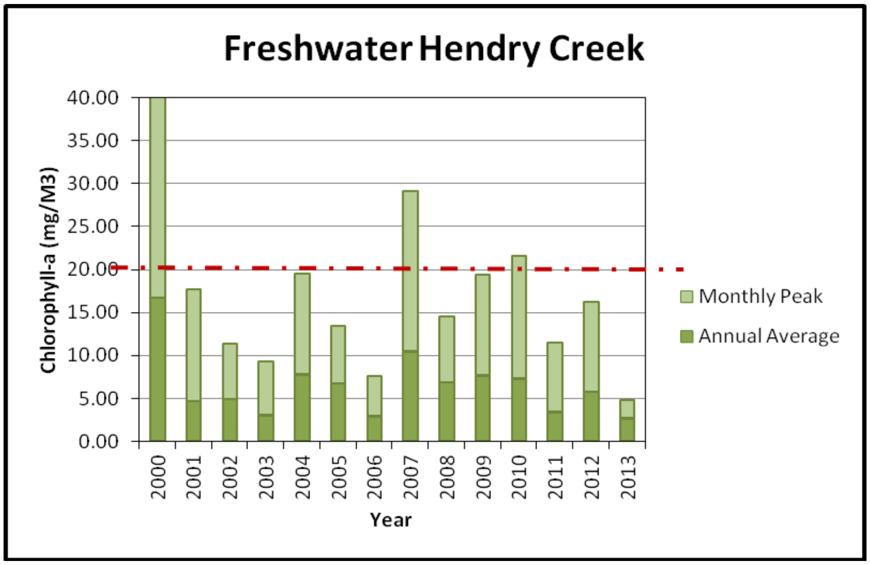
2009-2013 change
average -50%
peak -53%

Year	Mean	Peak	Month of Peak
2009	5.42	11.78	September
2010	4.33	8.62	December
2011	2.56	9.63	April
2012	2.08	4.10	May
2013	2.68	5.57	September



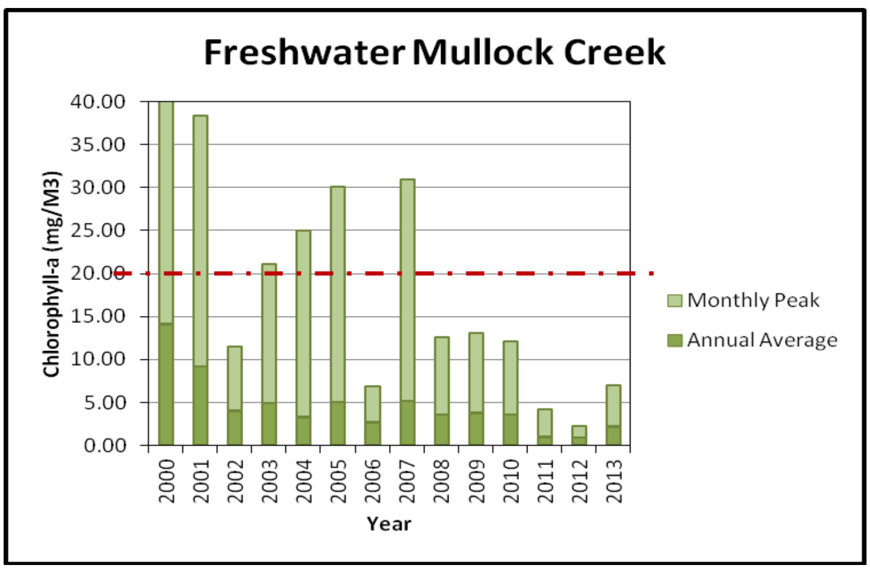
2009-2013 change
average -65%
peak -75%

Year	Mean	Peak	Month of Peak
2009	**7.70**	**19.40**	**November**
2010	**7.28**	**21.50**	**December**
2011	**3.43**	**11.50**	**January**
2012	**5.78**	**16.20**	**April**
2013	**2.70**	**4.80**	**June**



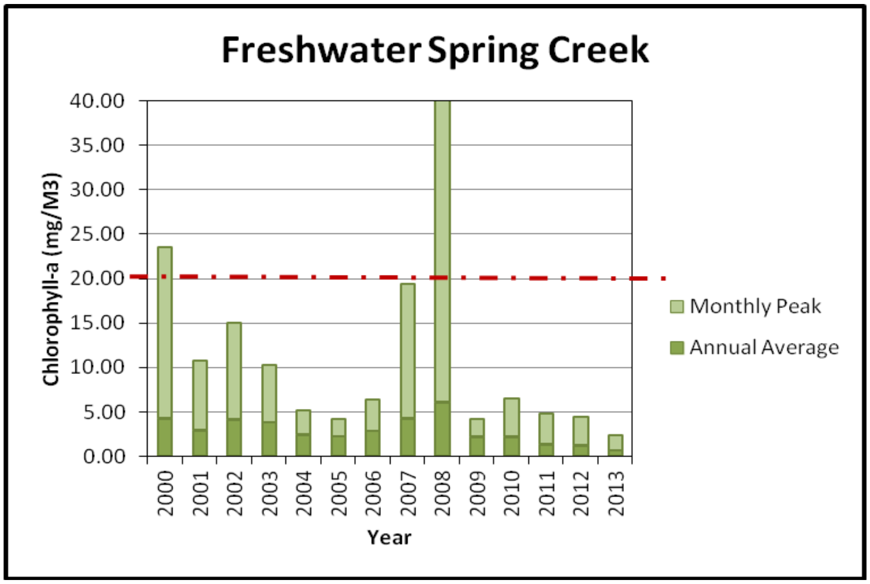
2009-2013 change
average -41%
peak -49%

Year	Mean	Peak	Month of Peak
2009	3.78	9.30	June
2010	3.58	8.55	May
2011	0.99	3.20	June
2012	0.95	1.30	June
2013	2.23	4.75	December



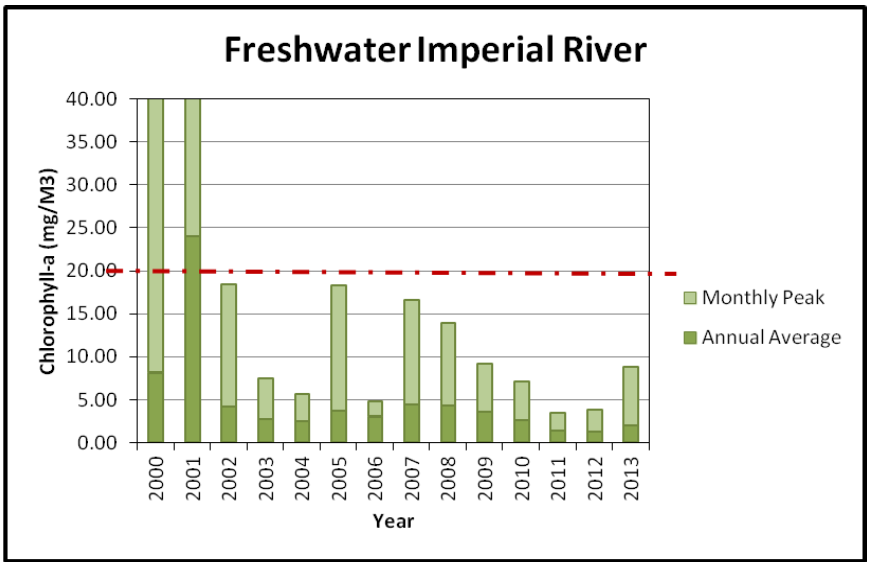
2009-2013 change
average -69%
peak -45%

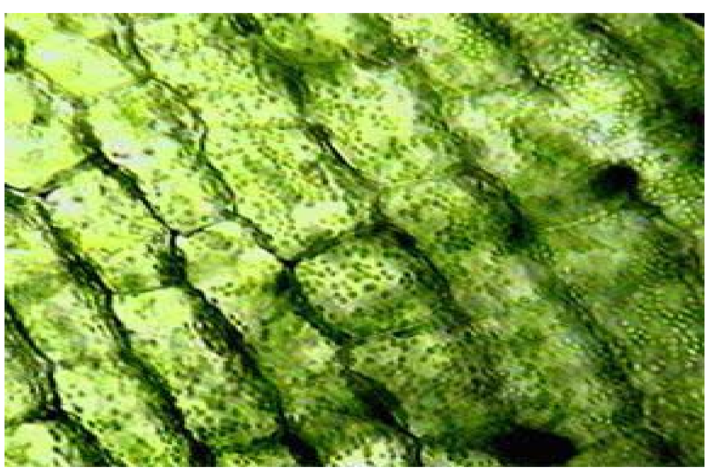
Year	Mean	Peak	Month of Peak
2009	2.18	4.20	May
2010	2.18	6.50	December
2011	1.37	4.80	May
2012	1.21	4.40	May
2013	0.69	2.30	August



2009-2013 change
average -43%
peak -4%

Year	Mean	Peak	Month of Peak
2009	3.63	9.15	March
2010	2.68	7.10	August
2011	1.41	3.50	May
2012	1.28	3.90	April
2013	2.07	8.80	May





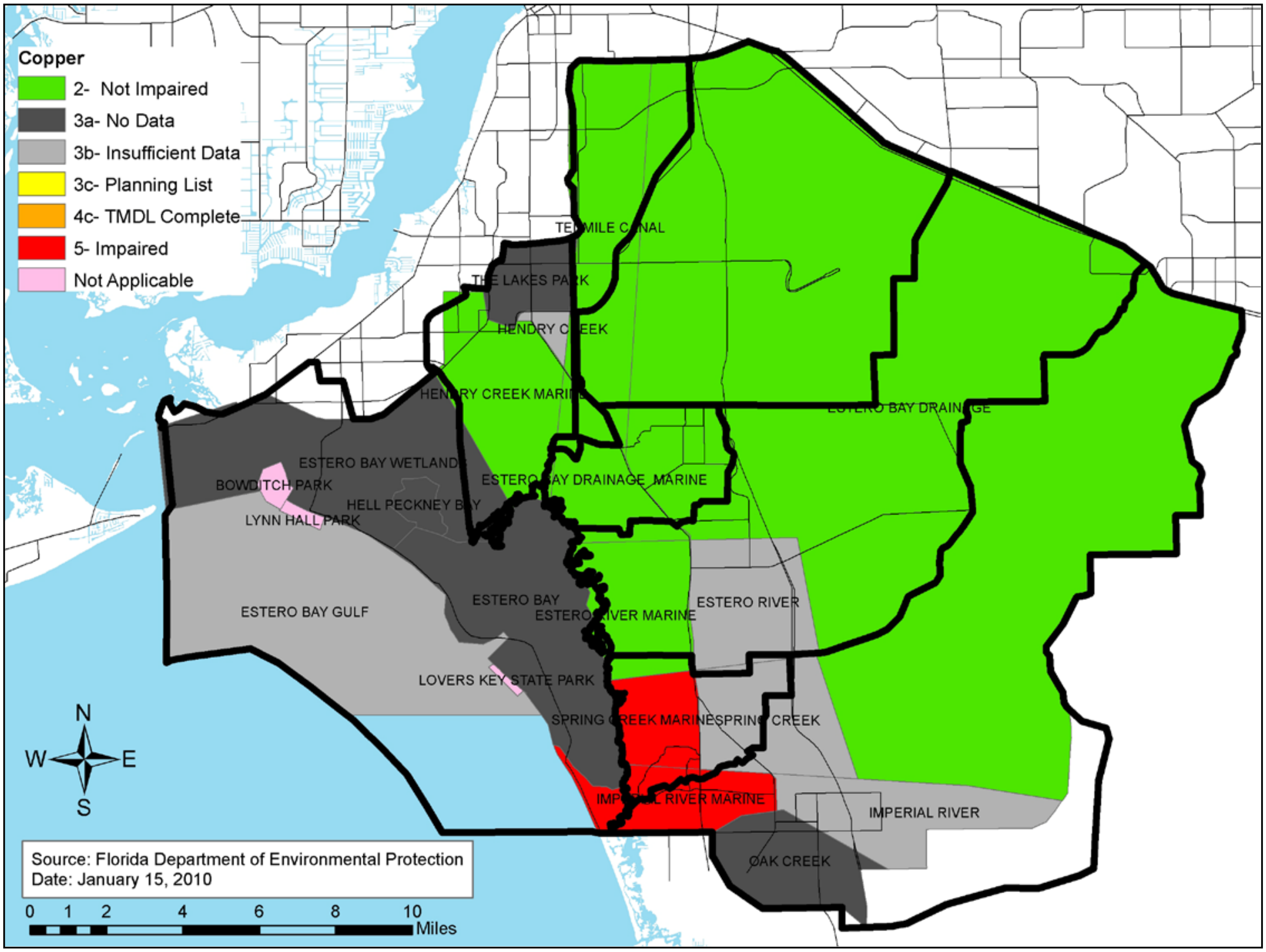
Parameter: Copper

Copper (Cu) is a measure of all dissolved copper in the water column, including hexavalent, bivalent, and trivalent ions. It is a resultant parameter that synthesizes many environmental inputs of copper including: dissolved copper from roadways; antifouling paints for marine applications; treated wood, such as pilings; aquatic algaecides and lake treatments; architectural sources; marine cathodes; human debris; and natural sources.

In December 2008, the City of Naples, just outside the Estero Bay watershed, enacted a ban on copper-containing herbicides commonly used in city lakes for control of aquatic plants. The ordinance states that, "…amending the existing Code to prohibit the use of copper sulfate or any other copper-containing herbicide in City lakes is likely to provide enhanced environmental protection to Naples Bay, decrease the amount of copper entering the City's lakes and natural waterways, including Naples Bay, thus improving water quality…" (City of Naples 2008). At the time of this writing, the Florida Department of Agriculture and Consumer Services has restricted the City of Naples from enforcing this ban.

According to USEPA National Recommended Water Quality Criteria, the "Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect" (US Environmental Protection Agency 2009). For copper in marine or estuarine systems, the CCC is 3.1 µg/L and in freshwater systems, the CCC is 9.0 µg/L. This appears to be a tightening of the federal standards. The general state standard for copper is 3.7 µg/L in Class III marine and Class II fresh waters.

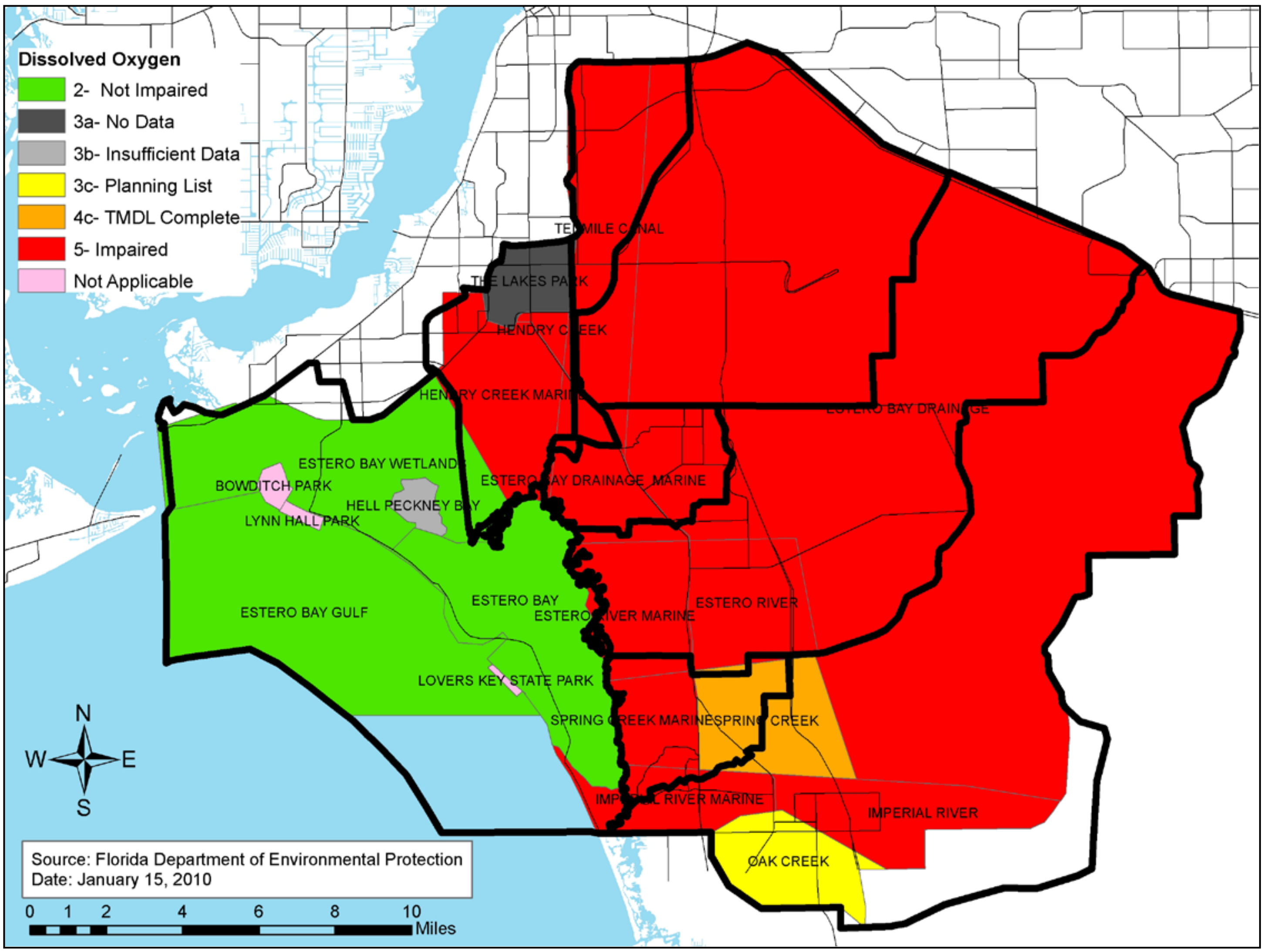
The Lee County Environmental Laboratory had a methodological change in 2009, with results driven substantially by the methods change. The map of impairments will be the only copper information presented in this State of the Bay report. Marine Imperial River and marine Spring Creek are the two verified impairments for copper within the Estero Bay basin.


Copper
2- Not Impaired
3a- No Data
3b- Insufficient Data
3c- Planning List
4c- TMDL Complete
5- Impaired
Not Applicable
TEN MILE CANAL
THE LAKES PARK
HENDRY CREEK
HENDRY CREEK MARINE
ESTERO BAY DRAINAGE
ESTERO BAY WETLANDS
BOWDITCH PARK
HELL PECKNEY BAY
LYNN HALL PARK
ESTERO BAY DRAINAGE MARINE
ESTERO BAY GULF
ESTERO BAY
ESTERO RIVER MARINE
ESTERO RIVER
LOVERS KEY STATE PARK
SPRING CREEK MARINE
SPRING CREEK
IMPERIAL RIVER MARINE
IMPERIAL RIVER
OAK CREEK
N
W
E
S
Source: Florida Department of Environmental Protection
Date: January 15, 2010
0 1 2 4 6 8 10
Miles

Parameter: Dissolved Oxygen

Dissolved oxygen (DO) is a measure of all dissolved oxygen in the water column. DO is vital to aerobic organisms in the aquatic ecosystem, and most higher taxa require higher DO levels for healthy life cycles and successful reproduction. Many factors affect DO including wind mixing, turbulence, flow volumes and rates, biochemical oxygen demand, algal blooms, photosynthesis and respiration, salinity and thermal stratification, anthropogenic eutrophication, and toxic spills.

Florida's water quality standards state that dissolved oxygen in Class III freshwaters, "…shall not be less than 5.0 [mg/L]," and in Class III marine waters, "Shall not average less than 5.0 in a 24-hour period and shall never be less than 4.0." (Florida State Legislature 2008) Some natural estuaries will experience periods of low DO during the night due to community respiration exceeding the level of dissolved oxygen in the water column. This is rapidly recovered by community photosynthesis during the day. Prolonged periods of DO below 4.0 mg/L indicate problems. These may be transient, such as an algal bloom. However, prolonged systemic DO



depression from anthropogenic inputs and other excess nutrient loading (such as atmospheric doposition) is not recoverable without source reduction efforts. Conditions below 2.0 mg/L are considered anoxic and can be fatal to most fishes and invertebrates.

The above map illustrates the water quality assessment for Estero Bay basin waterbodies.

The Lee County Environmental Laboratory provided the data for all dissolved oxygen data.

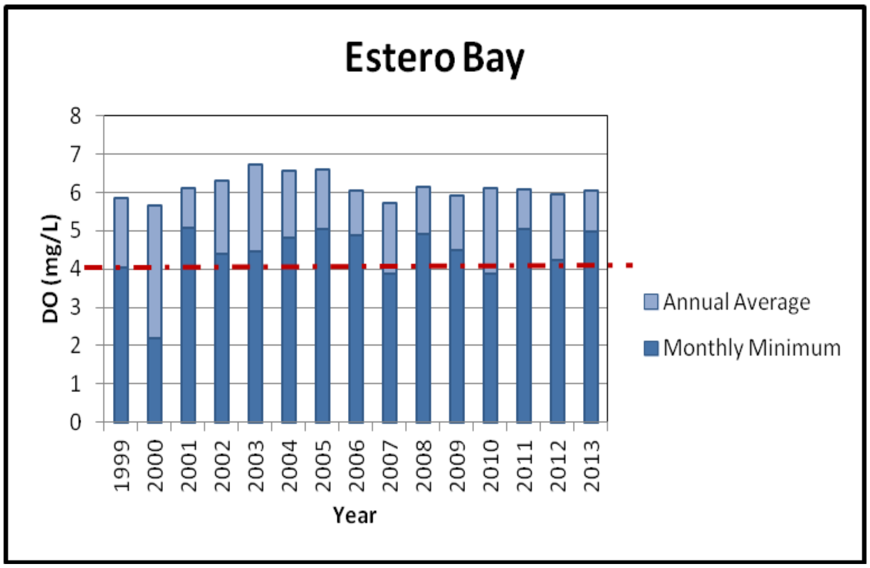
Dissolved Oxygen in Estuarine Systems

Between 2009 and 2013, average Dissolved Oxygen decreased in all estuarine segments but two: Estero Bay and Hendry Creek. The average decrease was negligible at 3%. The monthly minimum Dissolved Oxygen increased in all estuarine segments but two: Estero River and Spring Creek. The average increase could not be determined because of a 2009 anoxic event in Hendry Creek. The most common minimum month was August (30%), however, all months except January, February, and March were represented.

2009-2013 change

average	2%
minimum	10%

Year	Mean	Min	Month of Min
2009	5.9	4.5	October
2010	6.1	3.9	August
2011	6.1	5.1	August
2012	5.9	4.2	August
2013	6.1	5.0	September

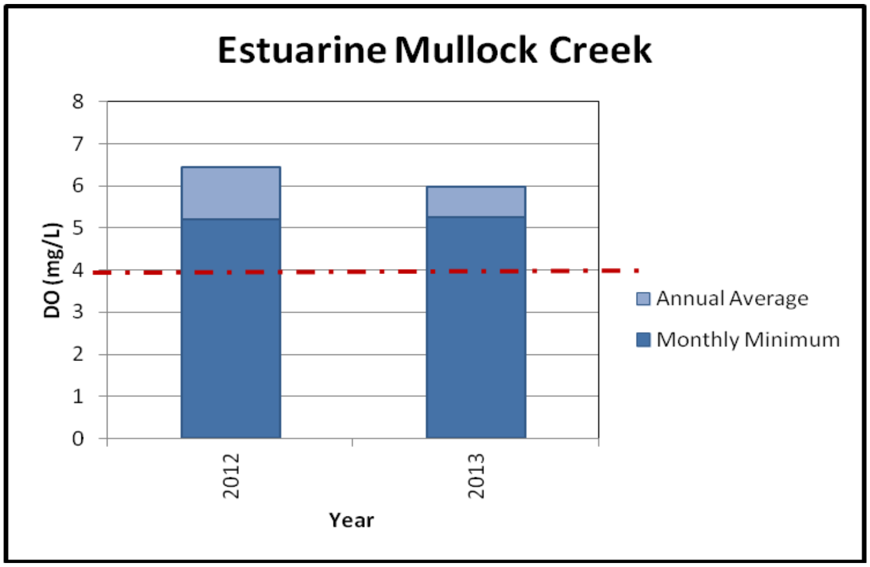


2012-2013 change

average -7%

minimum 1%

Year	Mean	Min	Month of Min
2012	6.4	5.2	December
2013	6.0	5.3	December

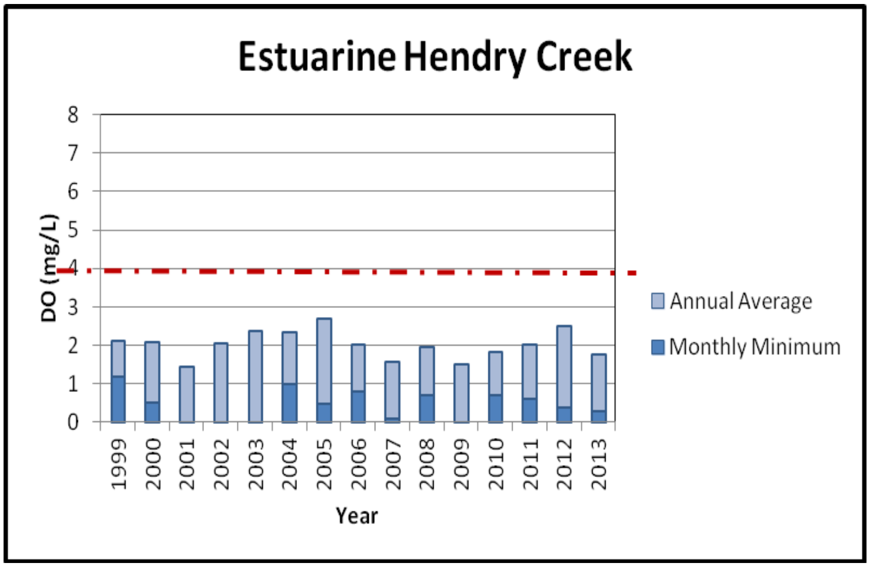


2009-2013 change

average 18%

minimum >100%

Year	Mean	Min	Month of Min
2009	1.5	0.0	June
2010	1.8	0.7	May
2011	2.0	0.6	April
2012	2.5	0.4	June
2013	1.8	0.3	April

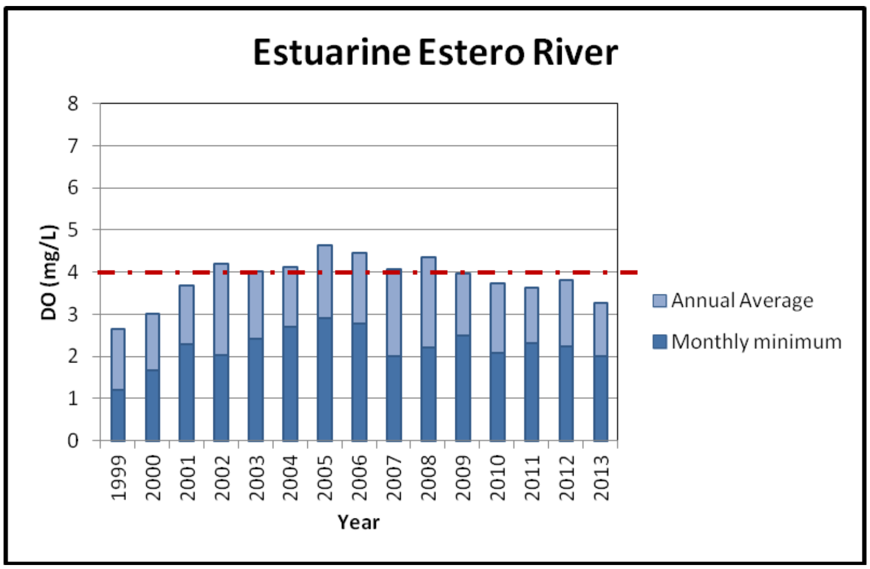


2009-2013 change

average -18%

minimum -19%

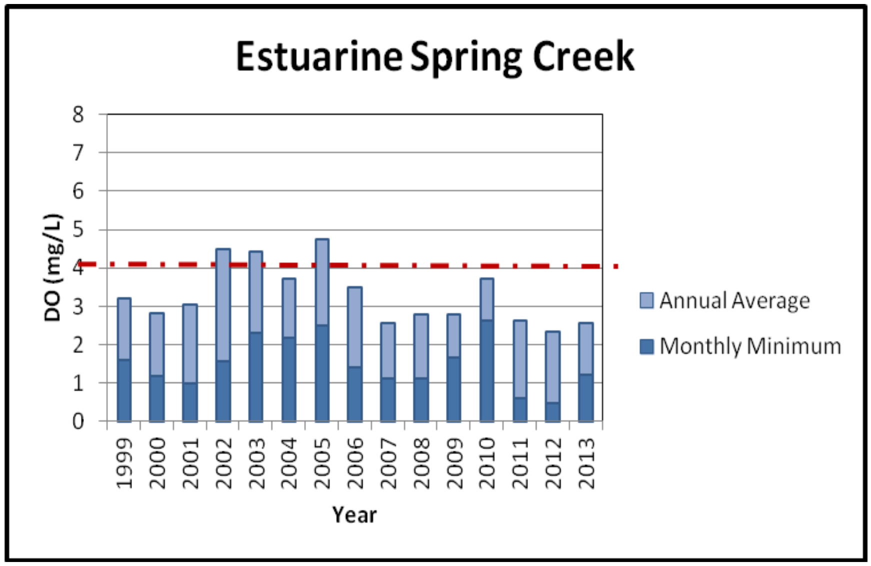
Year	Mean	Min	Month of Min
2009	4.0	2.5	September
2010	3.7	2.1	June
2011	3.6	2.3	August
2012	3.8	2.2	August
2013	3.3	2.0	July



2009-2013 change

average	-9%
minimum	-27%

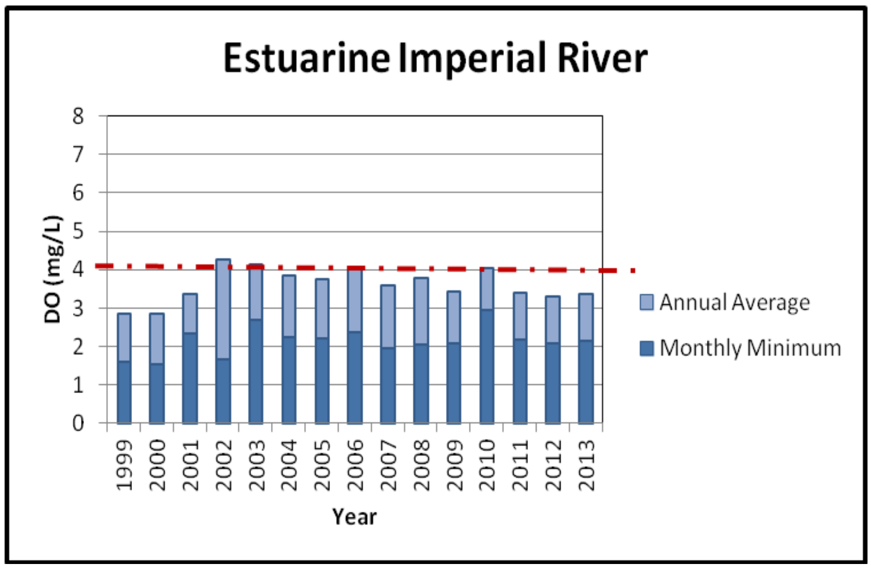
Year	Mean	Min	Month of Min
2009	2.8	1.7	November
2010	3.7	2.6	June
2011	2.6	0.6	June
2012	2.3	0.5	June
2013	2.6	1.2	April



2009-2013 change

average	-2%
peak	2%

Year	Mean	Peak	Month of Peak
2009	3.4	2.1	August
2010	4.1	3.0	August
2011	3.4	2.2	September
2012	3.3	2.1	August
2013	3.4	2.2	July



Dissolved Oxygen in Fresh Systems

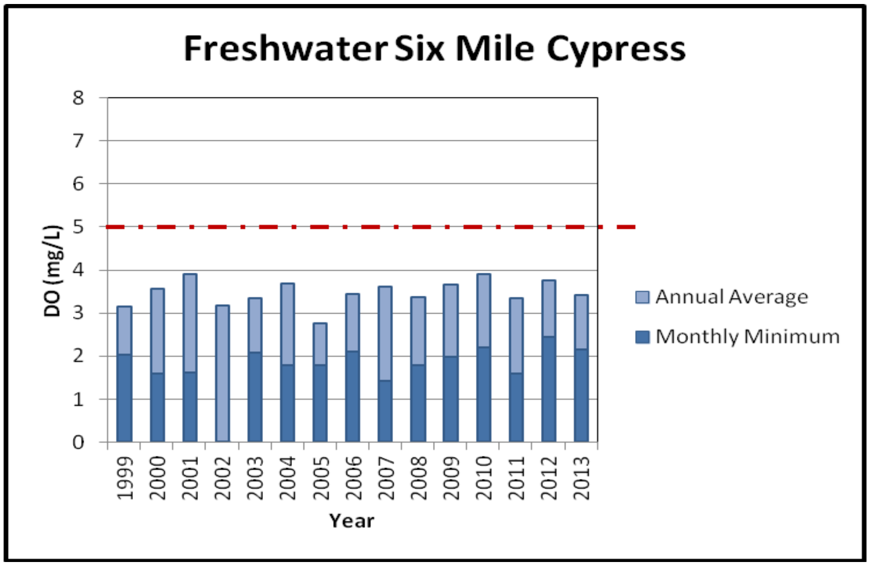
Between 2009 and 2013, average annual Dissolved Oxygen decreased in all freshwater segments but two: Mullock Creek and Spring Creek. The average decrease was 10%. The monthly minimum Dissolved Oxygen decreased in all freshwater segments but one: Six Mile Cypress. The average decrease was 20%.

The most common minimum months were July (23%) and September (23%), however, all months except January, March, October and November were represented.

2009-2013 change

average	-7%
minimum	9%

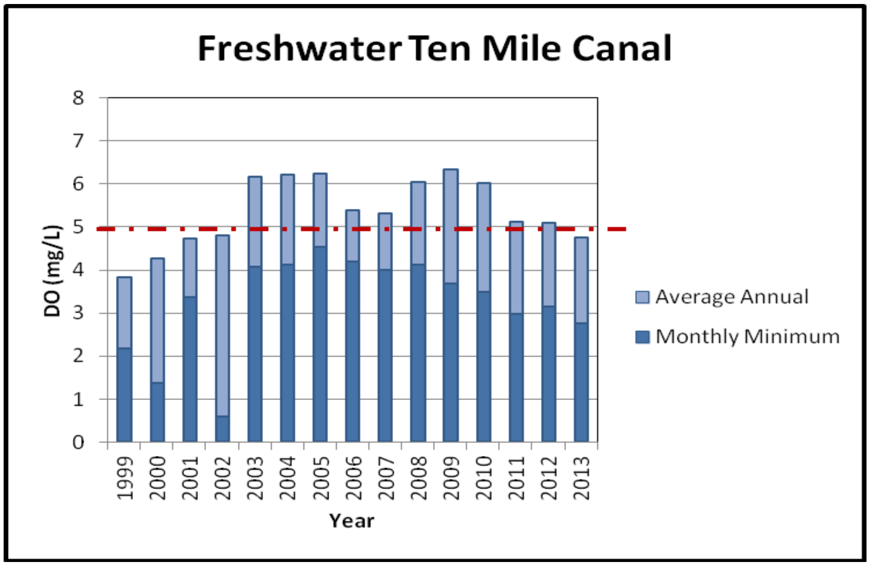
Year	Mean	Min	Month of Min
2009	3.7	2.0	September
2010	3.9	2.2	September
2011	3.4	1.6	July
2012	3.8	2.5	September
2013	3.4	2.2	July



2009-2013 change

average	-25%
minimum	-25%

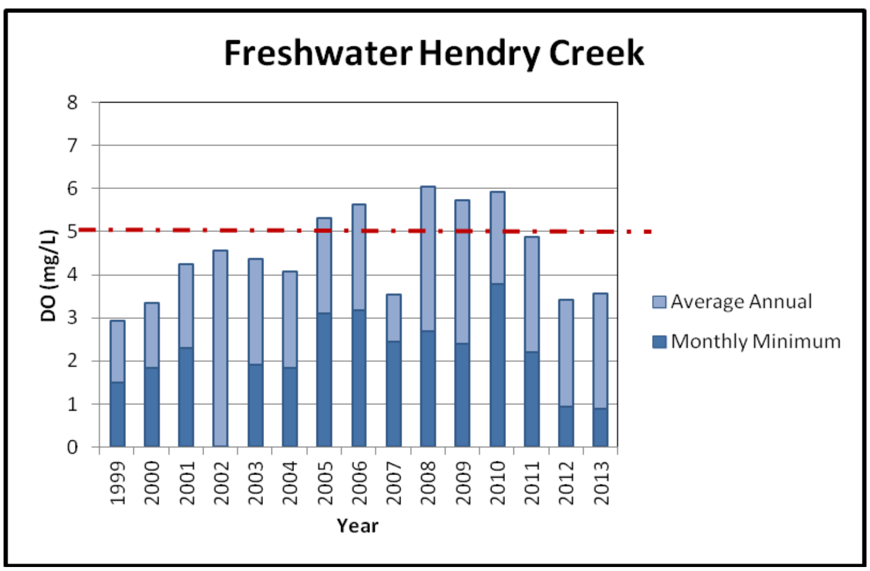
Year	Mean	Min	Month of Min
2009	6.4	3.7	June
2010	6.0	3.5	May
2011	5.1	3.0	July
2012	5.1	3.2	September
2013	4.8	2.8	August



2009-2013 change

average	-38%
minimum	-63%

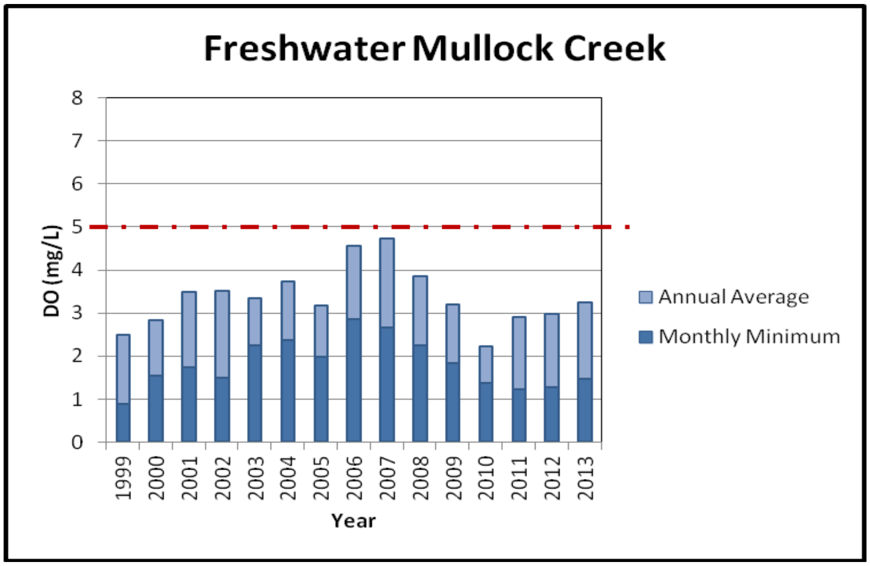
Year	Mean	Min	Month of Min
2009	5.7	2.4	May
2010	5.9	3.8	May
2011	4.9	2.2	June
2012	3.4	1.0	May
2013	3.6	0.9	April



2009-2013 change

average	**1%**
minimum	**-20%**

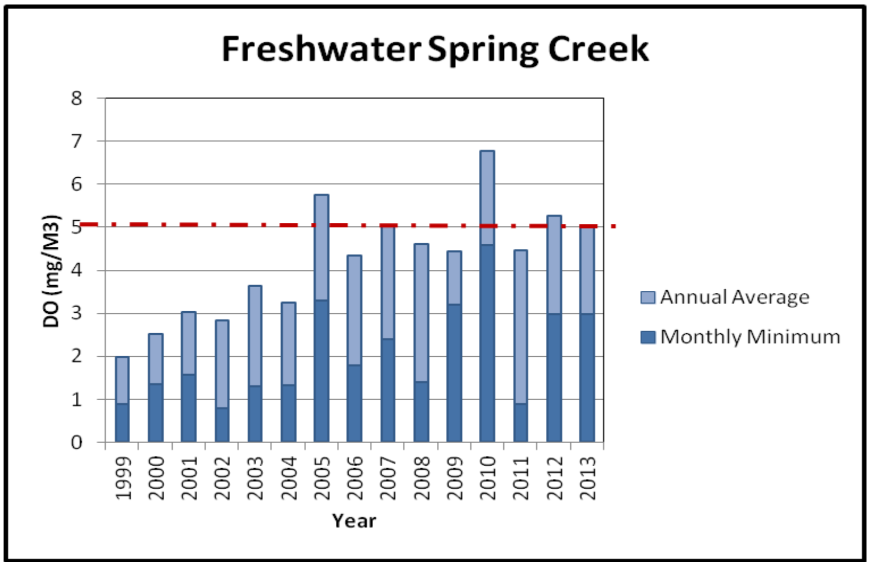
Year	Mean	Min	Month of Min
2009	3.2	1.9	December
2010	2.2	1.4	September
2011	2.9	1.2	July
2012	3.0	1.3	June
2013	3.2	1.5	September



2009-2013 change

average	**14%**
minimum	**-6%**

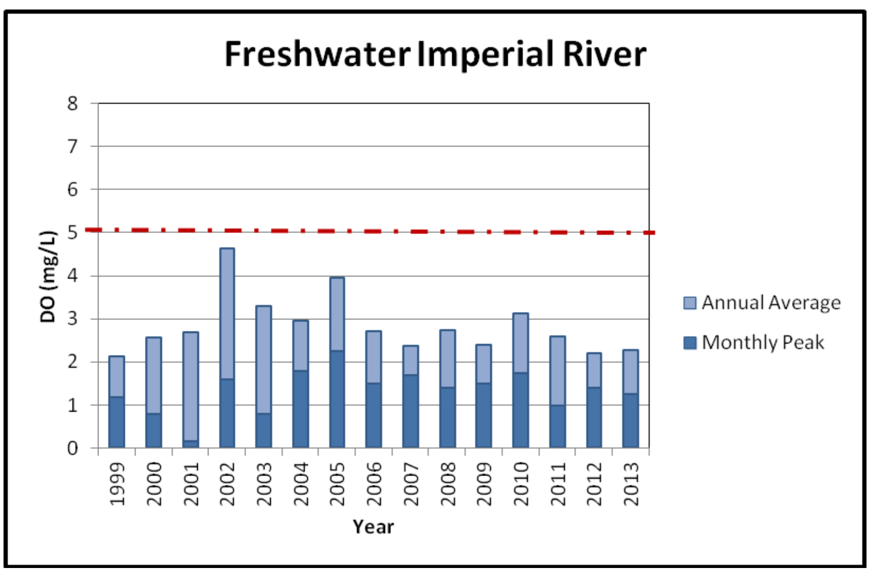
Year	Mean	Min	Month of Min
2009	4.5	3.2	June
2010	6.8	4.6	September
2011	4.5	0.9	July
2012	5.3	3.0	July
2013	5.1	3.0	December



2009-2013 change

average	**-6%**
peak	**-17%**

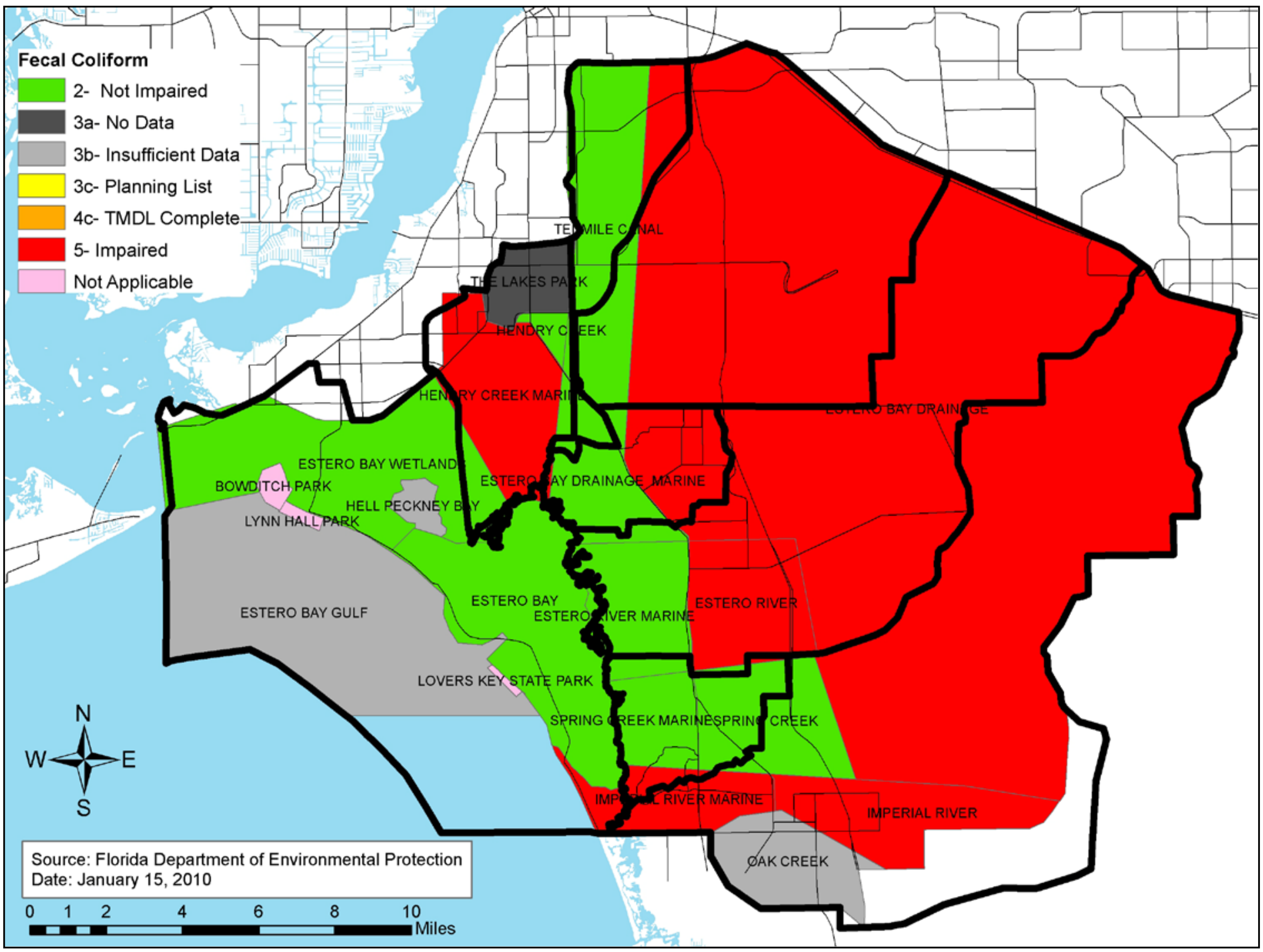
Year	Mean	Peak	Month of Peak
2009	2.4	1.5	December
2010	3.1	1.8	February
2011	2.6	1.0	May
2012	2.2	1.4	July
2013	2.3	1.3	May



Parameter: Fecal Coliform

Fecal coliform is a measure of bacteriological contamination of the water column based on the activity of *Escheria coli*, commensal bacteria of higher vertebrates. It is a surrogate measure for other more harmful bacteriological and viral contaminants associated with waste material from human and vertebrate fecal discharges. This parameter includes inputs from many environmental inputs of fecal waste including human sewage (from vessel holding tanks, septic tanks, land sludge spreading, and package and other sewage treatment plants), waste from livestock (including cattle and chickens), and waste from wild and feral animals. Fecal coliform can also be naturally high in association with active bird rookeries; therefore, a healthy estuary with normal animal activity will have a natural background level.

According to State of Florida standards, a measurement of more than 800 bacterial colonies per 100 mL on any single day of sampling or a monthly average of 200 colonies per 100 mL indicates impairment in Class III waters. Based on EPA recommendations, Florida's fecal Coliform standards are likely to be amended in the next year or two.



The Lee County Environmental Laboratory provided the data for all fecal coliform analysis.

Fecal Coliform in Estuarine Systems

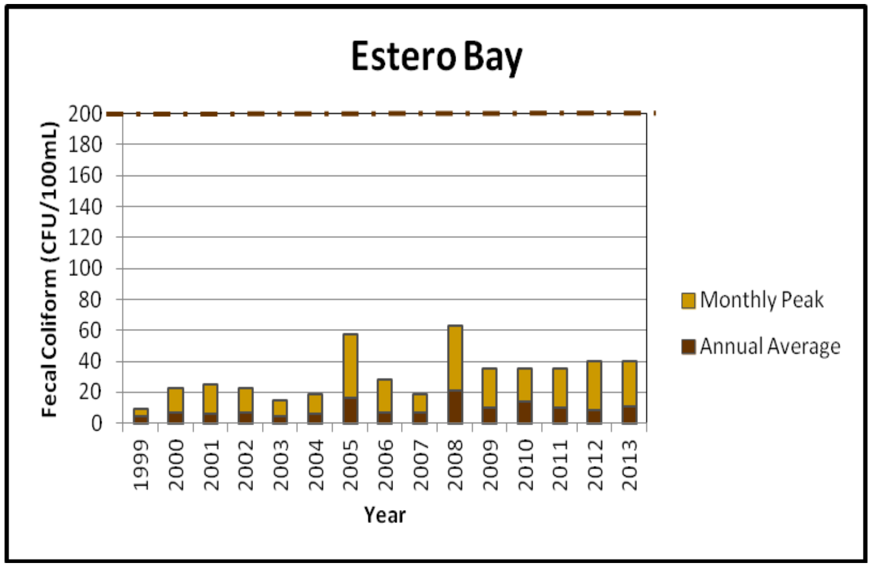
Between 2009 and 2013, average fecal Coliform increased in all estuarine segments but two: Mullock Creek and Estero River. The average increase was negligible at 2%. The peak monthly fecal Coliform also increased in all estuarine segments but two: Estero River and Spring Creek. The average reduction was negligible at 3%.

The most common peak month was June (20%), however, all months except January were represented.

2009-2013 change

average	6%
peak	12%

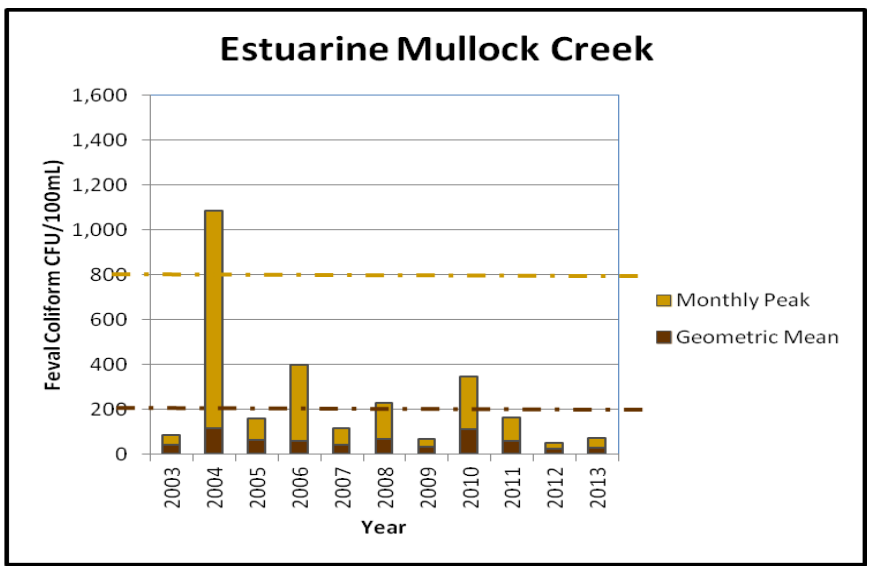
Year	Mean	Peak	Month of Peak
2009	10	36	June
2010	14	36	April
2011	10	36	October
2012	9	40	December
2013	11	40	July



2009-2013 change

average	-21%
peak	8%

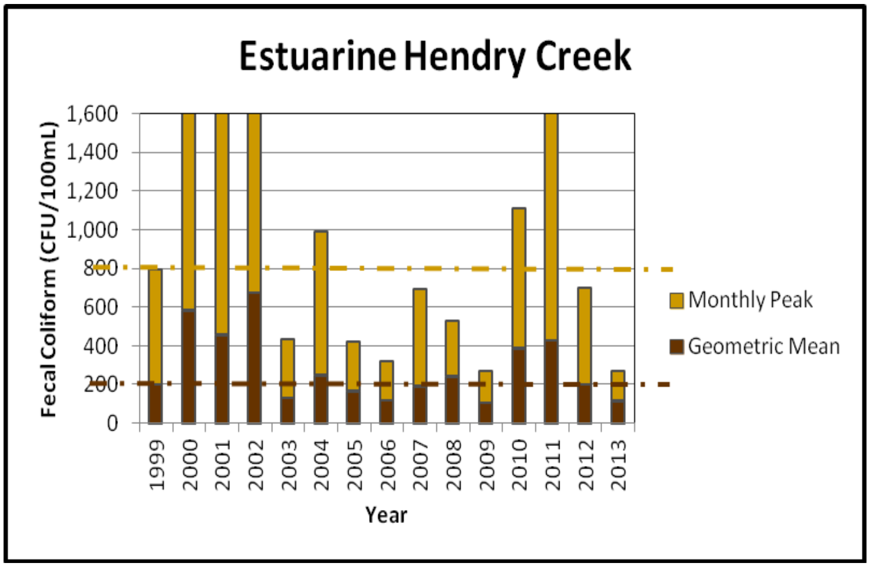
Year	Mean	Peak	Month of Peak
2009	36	70	October
2010	112	347	August
2011	58	166	August
2012	25	49	December
2013	28	75	August



2009-2013 change

average	10%
peak	1%

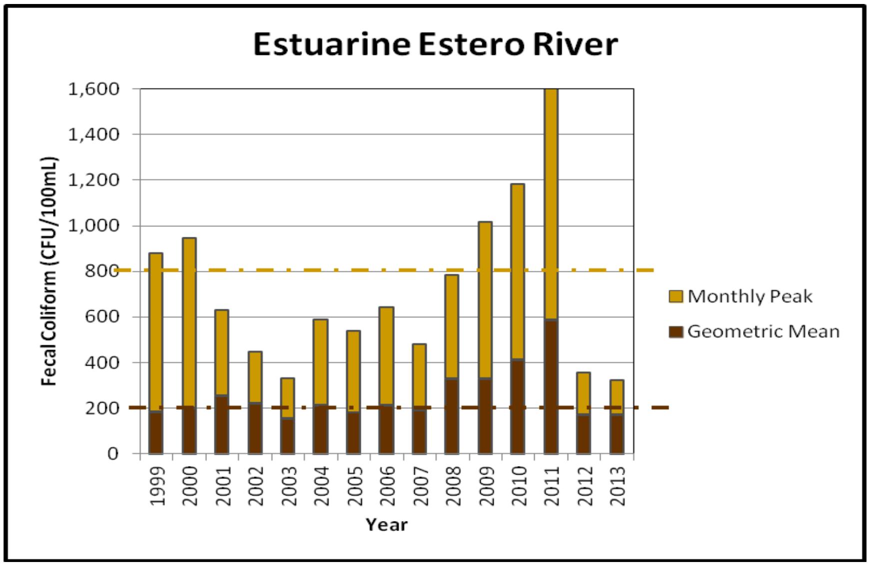
Year	Mean	Peak	Month of Peak
2009	104	267	March
2010	388	1,110	February
2011	428	1,846	October
2012	201	700	June
2013	114	269	May



2009-2013 change

average	-48%
peak	-68%

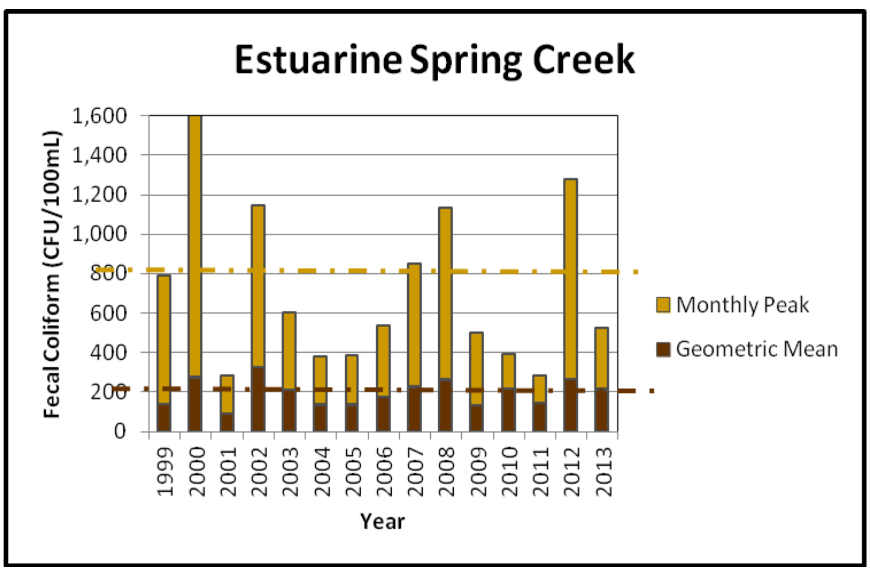
Year	Mean	Peak	Month of Peak
2009	328	1,014	November
2010	414	1,183	June
2011	588	1,921	February
2012	172	353	June
2013	172	320	February



2009-2013 change

average	53%
peak	-13%

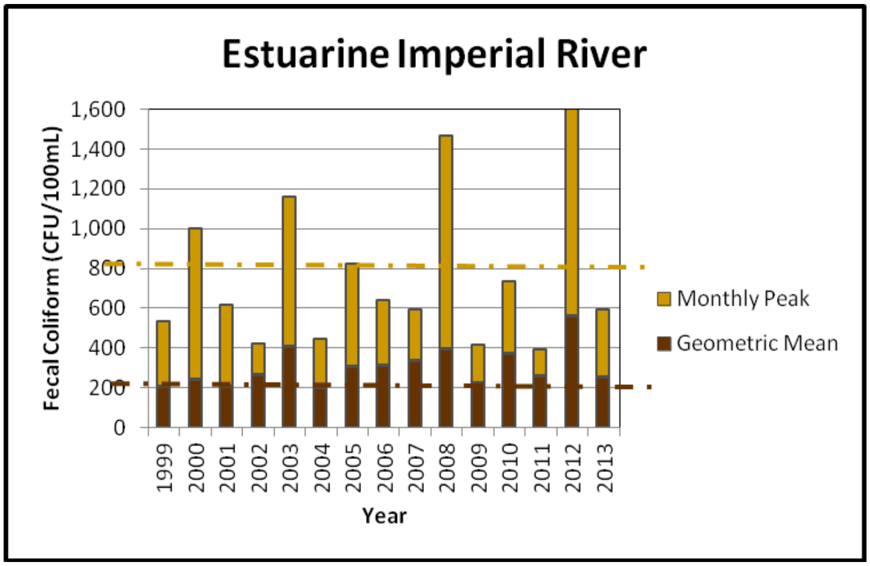
Year	Mean	Peak	Month of Peak
2009	137	497	October
2010	206	391	September
2011	159	281	August
2012	293	1,280	June
2013	210	432	September



2009-2013 change

average	12%
peak	42%

Year	Mean	Peak	Month of Peak
2009	227	416	November
2010	373	734	November
2011	259	390	February
2012	560	4,538	June
2013	255	593	September



Fecal Coliform in Fresh Systems

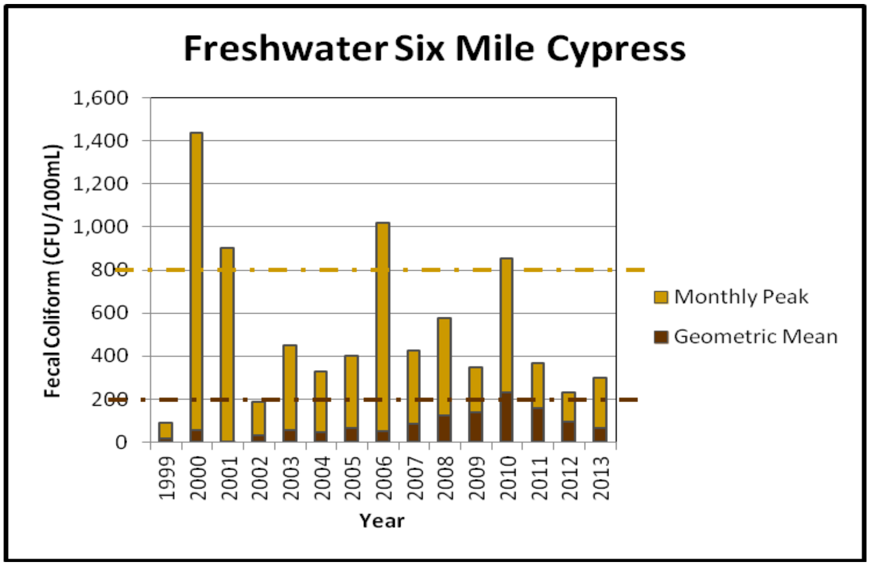
Between 2009 and 2013, average annual fecal Coliform decreased in all freshwater segments but two: Mullock Creek and Spring Creek. The average increase was 23%. The peak monthly fecal Coliform increased in half of the freshwater segments, including Mullock Creek, Spring Creek and Imperial River. The average increase was 30%.

The most common peak month was August (20%), followed by July (17%). All months except June were represented.

2009-2013 change

average	-47%
peak	-15%

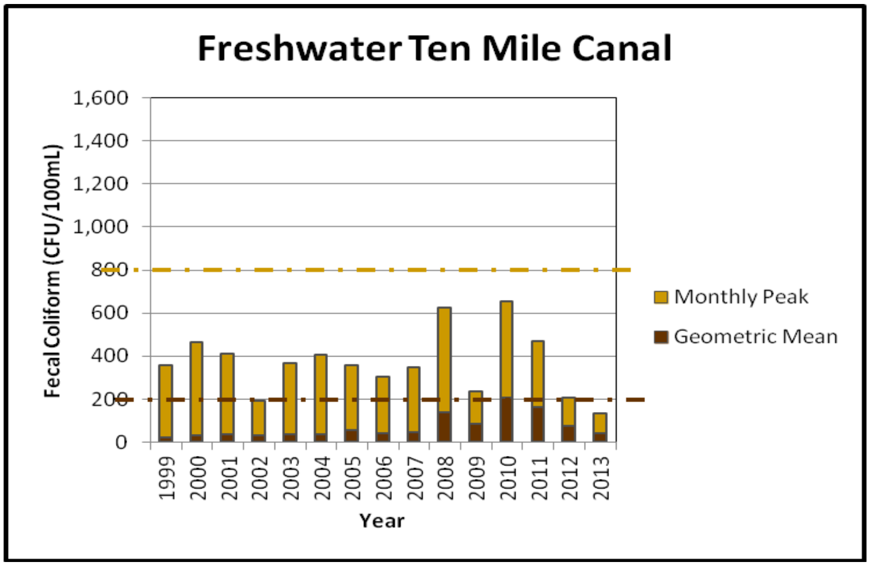
Year	Mean	Peak	Month of Peak
2009	141	352	December
2010	222	855	August
2011	155	368	December
2012	93	233	May
2013	75	300	August



2009-2013 change

average	-51%
peak	-44%

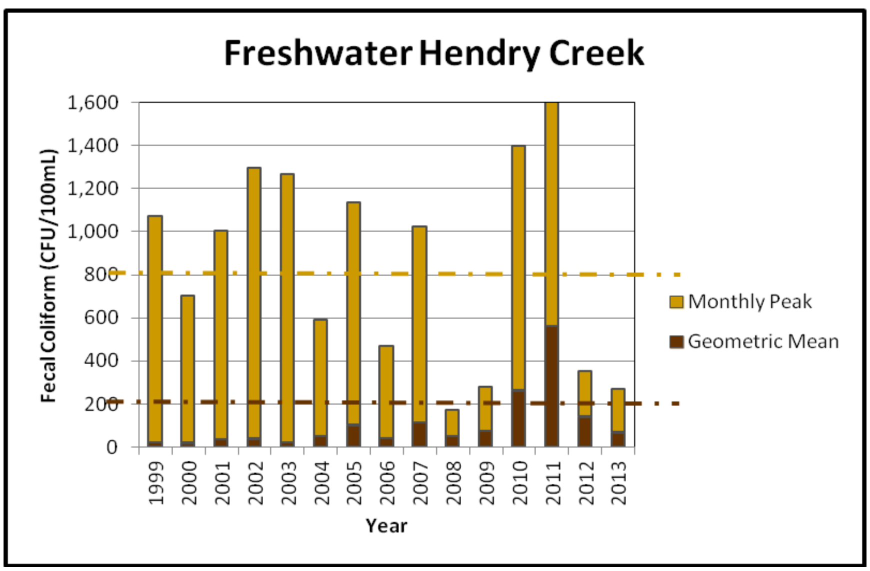
Year	Mean	Peak	Month of Peak
2009	91	237	September
2010	208	654	June
2011	162	470	August
2012	75	207	April
2013	44	133	August



2009-2013 change

average	-7%
peak	-4%

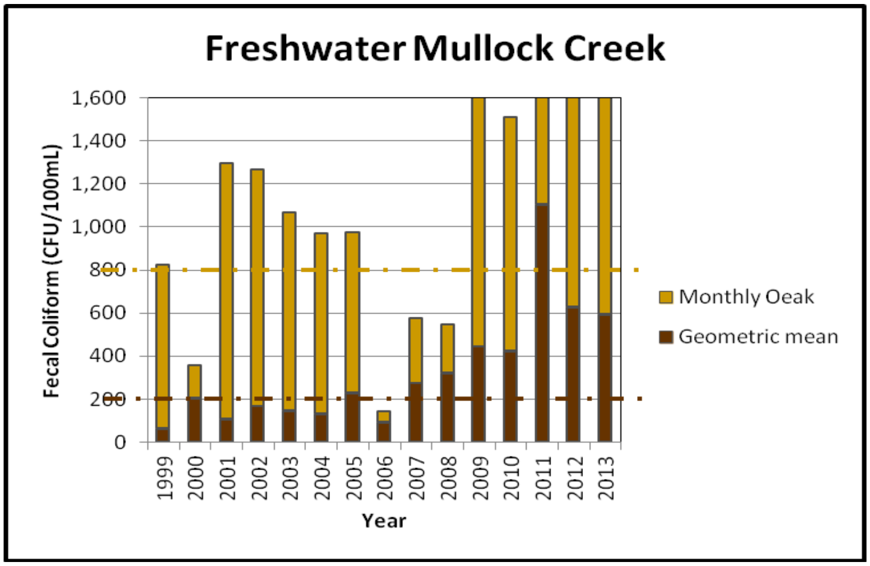
Year	Mean	Peak	Month of Peak
2009	75	280	February
2010	264	1,400	November
2011	563	3,500	October
2012	141	350	November
2013	70	270	July



2009-2013 change

average	**34%**
peak	**24%**

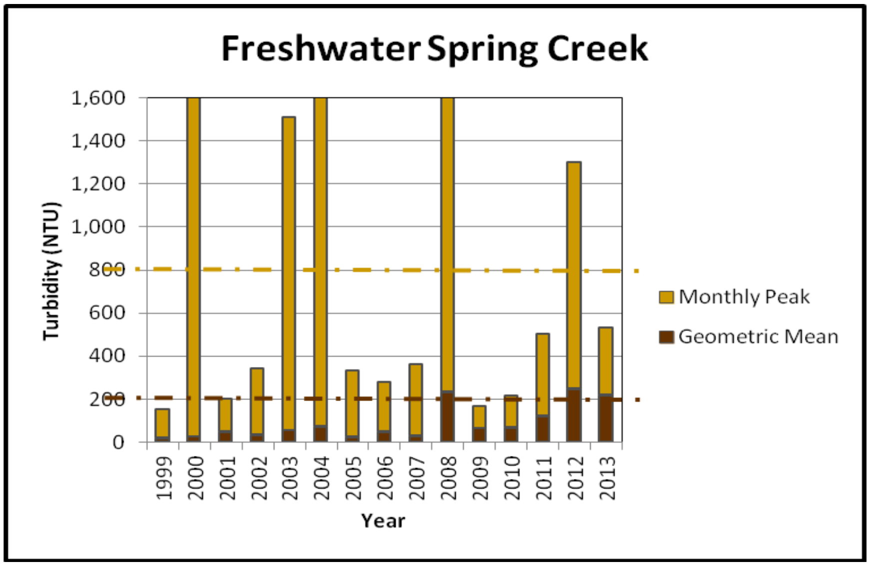
Year	Mean	Peak	Month of Peak
2009	445	1,705	September
2010	422	1,507	August
2011	1,105	3,260	July
2012	628	1,990	July
2013	595	2,122	December



2009-2013 change

average	**234%**
peak	**215%**

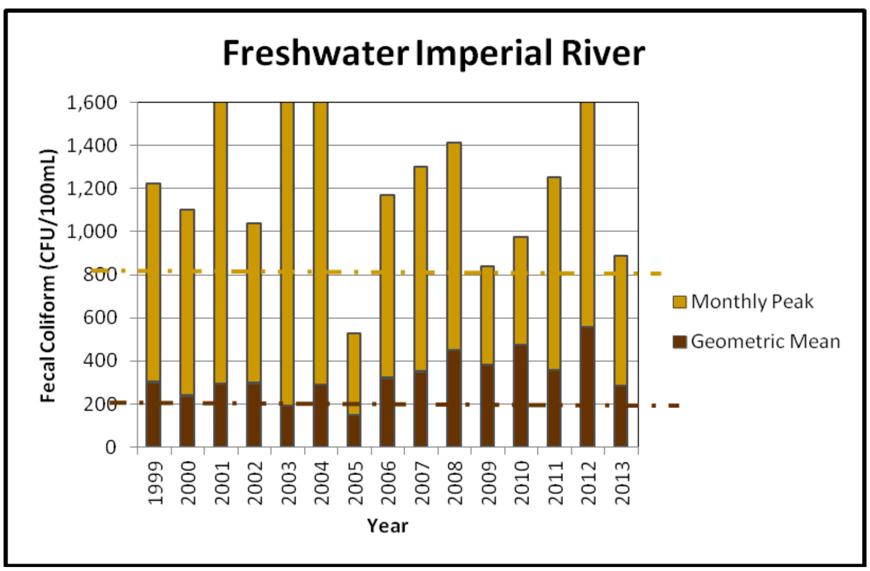
Year	Mean	Peak	Month of Peak
2009	66	168	August
2010	68	214	June
2011	123	500	July
2012	249	1,300	February
2013	219	530	April



2009-2013 change

average	**-26%**
peak	**6%**

Year	Mean	Peak	Month of Peak
2009	382	840	November
2010	476	974	September
2011	360	1,252	February
2012	559	1,866	July
2013	284	888	January



Parameter: Total Nitrogen

Total nitrogen (TN) is a measure of all dissolved nitrogen in the water column, including nitrates, nitrites and ammonia. It is a resultant parameter that synthesizes many environmental inputs of nitrogen, including the dissolved organics from algae, sea grass, mangrove, and phytoplankton productivity. Also included are anthropogenic inputs, such as from agriculture and fertilizer over-application, which may run off into water bodies.

The USEPA Nutrient Criteria for this area, Aggregate Ecoregion XII, the Southeastern Coastal Plain, is 0.9 mg/L for rivers and streams (USEPA 2000). While the state of Florida has in the past had only narrative criteria for nutrients in water bodies, in response to a lawsuit by the Sierra Club, the Conservancy of Southwest Florida, the Florida Wildlife Federation, and others, USEPA recently issued a determination letter requiring the state to determine and adopt numeric nutrient standards for nitrogen and phosphorus in water bodies. USEPA has stated that the state must propose nutrient limits by January 14, 2010 and the resultant rule must be finalized by October of 2010.

The southwest Florida region has been proactive in addressing nutrient pollution at the local level. The Lower West Coast Watersheds Committee of the Southwest Florida Regional Planning Council developed a resolution regarding fertilizer regulation, which was adopted by Lee County as an ordinance in May of 2008. The ordinance regulates the nitrogen and phosphorus content of landscaping fertilizers, establishes a fertilizer black-out period during the rainy season, and establishes a 10-foot no-fertilizer buffer around waterbodies. Most municipalities in Lee County have followed suit, adopting the Lee County standards in whole, or some variation. The Lee County Environmental Laboratory provided the data for all total nitrogen analysis.

Because nitrogen standards were not adopted before the last water quality assessment conducted for Estero Bay basin, no such map is available to date.

The Lee County Environmental Laboratory provided the data for all fecal coliform analysis.

Total Nitrogen in Estuarine Systems

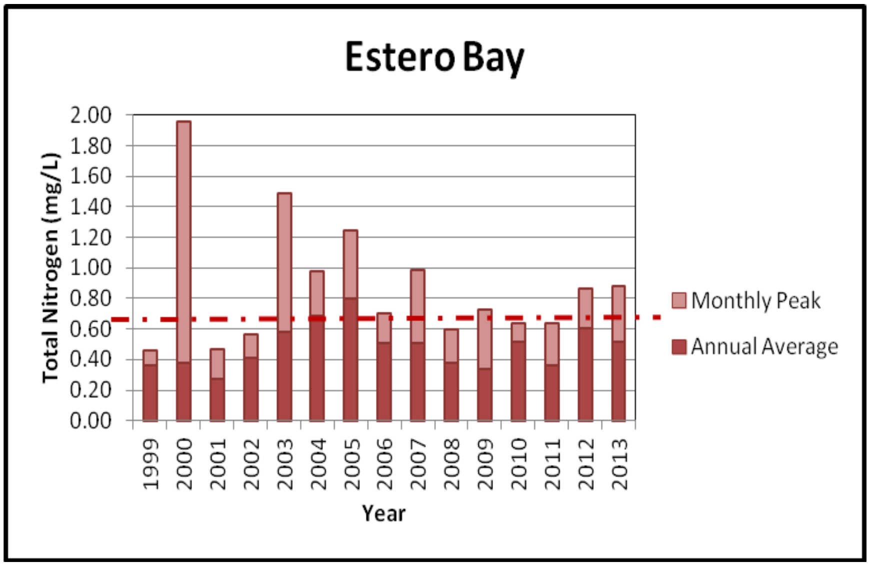
Between 2009 and 2013, average annual total nitrogen increased in all estuarine segments, however the geometric mean nitrogen standards were not exceeded. The average increase was 40%. The peak monthly nitrogen increased in all estuarine segments, for an average of 23%.

The most common peak month was September (33%), however, all months except March and April were represented.

2009-2013 change

average	52%
peak	21%

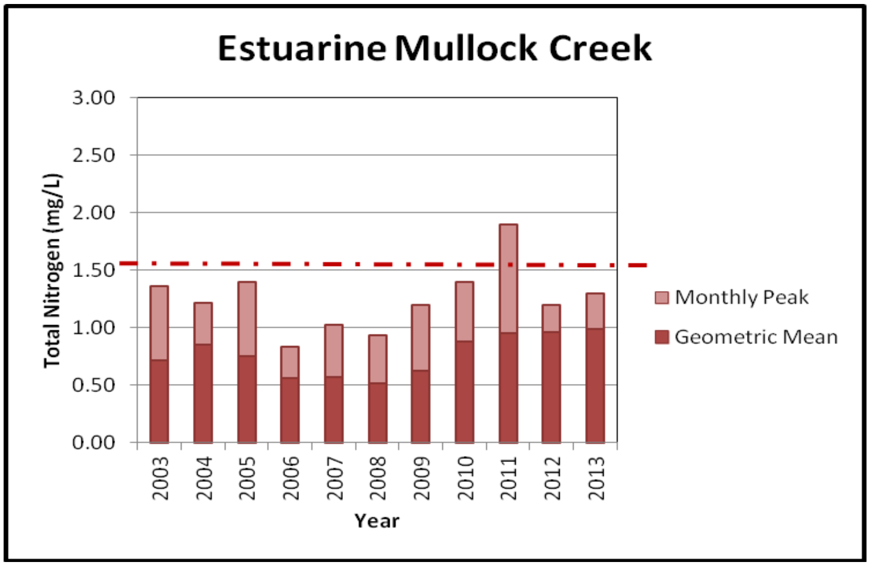
Year	Mean	Peak	Month of Peak
2009	0.34	0.73	December
2010	0.52	0.64	August
2011	0.36	0.64	August
2012	0.61	0.87	September
2013	0.52	0.88	September



2009-2013 change

average	58%
peak	8%

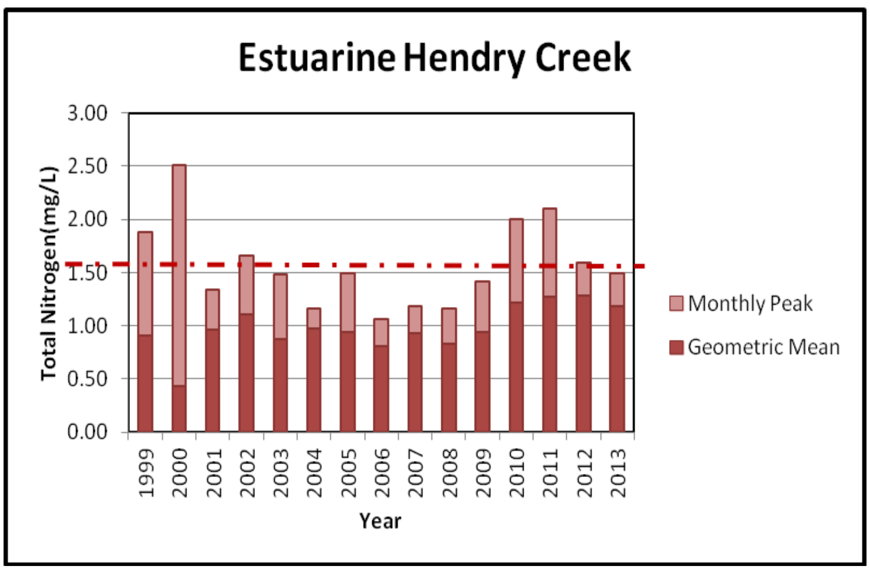
Year	Mean	Peak	Month of Peak
2009	0.63	1.20	December
2010	0.88	1.40	August
2011	0.95	1.90	October
2012	0.97	1.20	October
2013	0.99	1.30	December



2009-2013 change

average	26%
peak	6%

Year	Mean	Peak	Month of Peak
2009	0.94	1.42	December
2010	1.22	2.00	August
2011	1.28	2.10	July
2012	1.29	1.60	July
2013	1.19	1.50	May

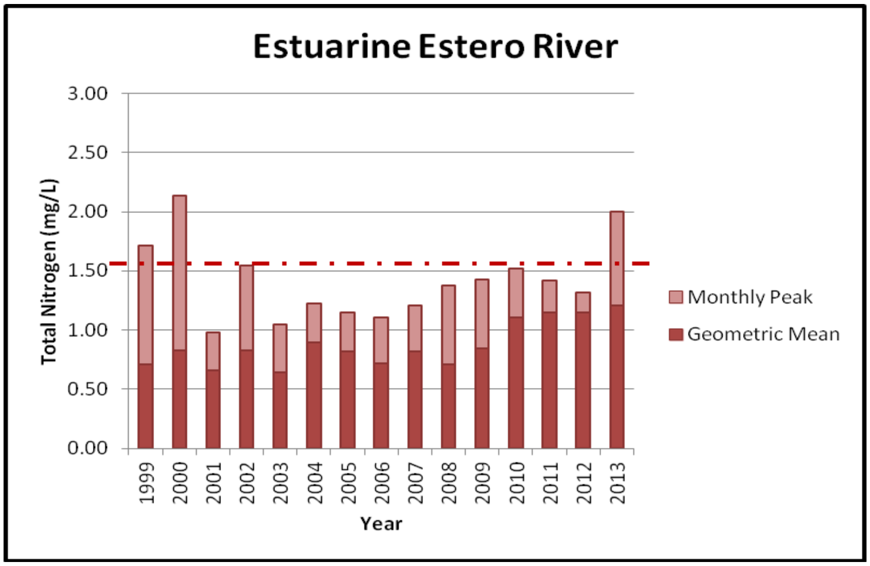


2009-2013 change

average 42%

peak 40%

Year	Mean	Peak	Month of Peak
2009	0.85	1.43	October
2010	1.11	1.52	September
2011	1.15	1.43	July
2012	1.16	1.32	February
2013	1.21	2.00	September

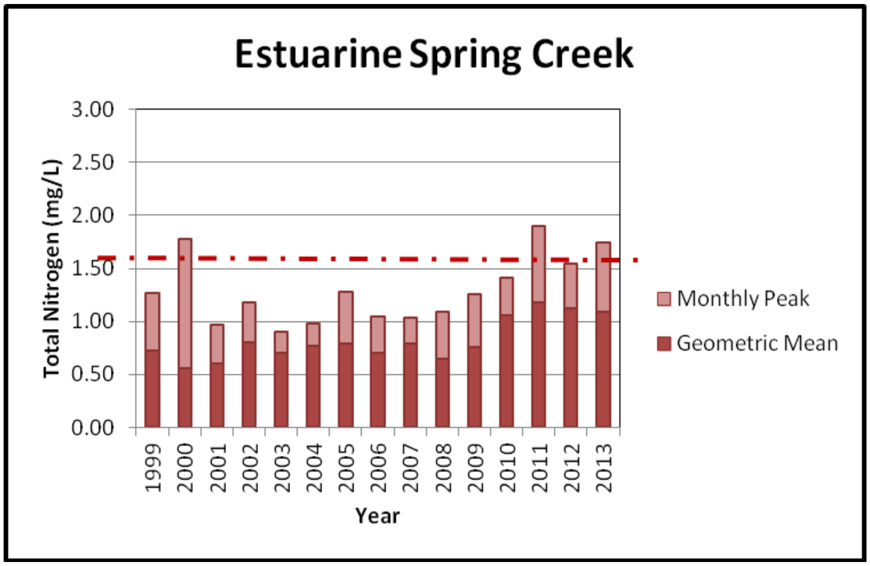


2009-2013 change

average 42%

peak 39%

Year	Mean	Peak	Month of Peak
2009	0.77	1.26	January
2010	1.06	1.42	January
2011	1.19	1.90	November
2012	1.13	1.55	July
2013	1.09	1.75	September

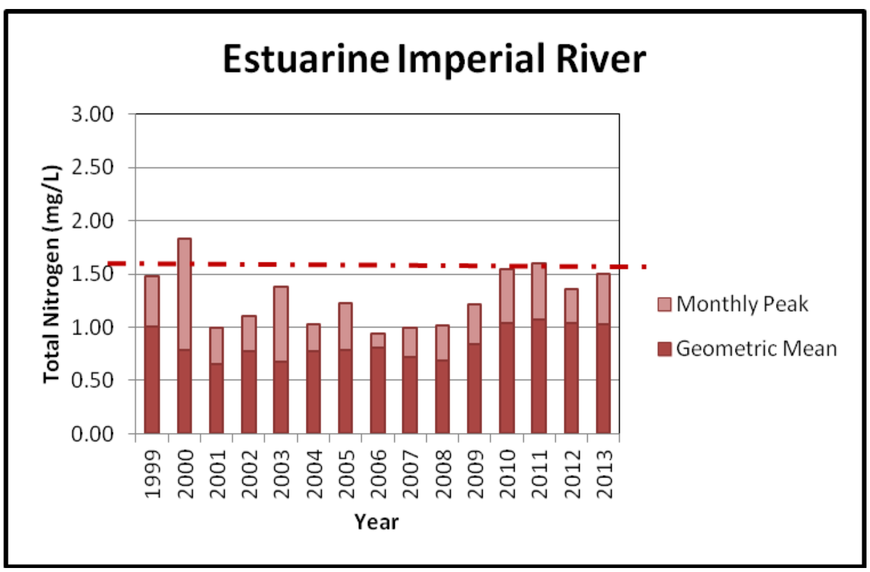


2009-2013 change

average 22%

peak 24%

Year	Mean	Peak	Month of Peak
2009	**0.85**	**1.21**	June
2010	**1.05**	**1.55**	September
2011	**1.08**	**1.60**	October
2012	1.04	1.37	October
2013	1.03	1.50	September



Total Nitrogen in Fresh Systems

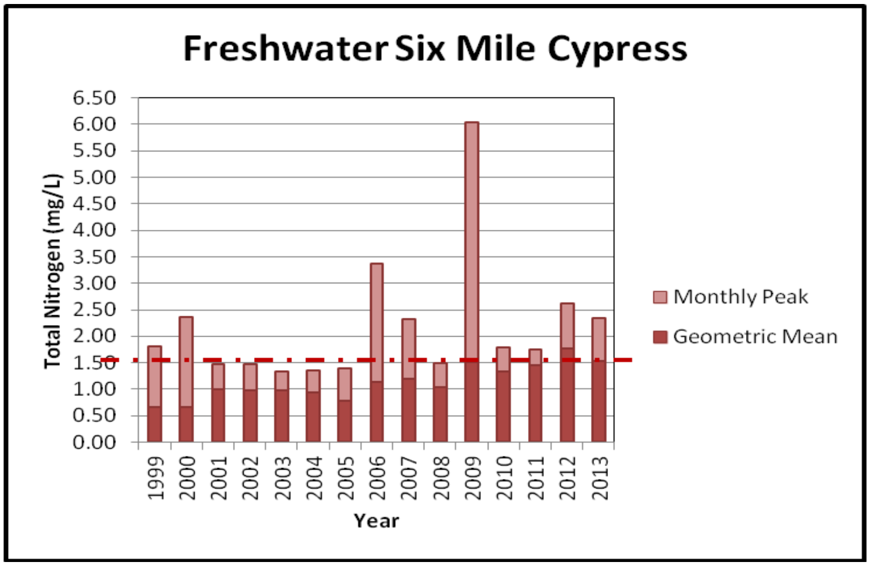
Between 2009 and 2013, average annual total nitrogen increased in all freshwater segments. The average increase was 30%. The peak monthly total nitrogen increased in all estuarine segments but two, for an average of 7% increase. Six-Mile Cypress reduced by 61%. Its increase was the least at 2%. Mullock Creek's peak reduced by 10%. Only Six-Mile Cypress and Imperial River exceeded the geometric mean standard in one year. A decline is occurring between 2012 and 2013 but it will take more years to see if this is a trend.

The most common peak month was September (20%) and June (20%). All months except January, March and May were represented.

2009-2013 change

average	**2%**
peak	**-61%**

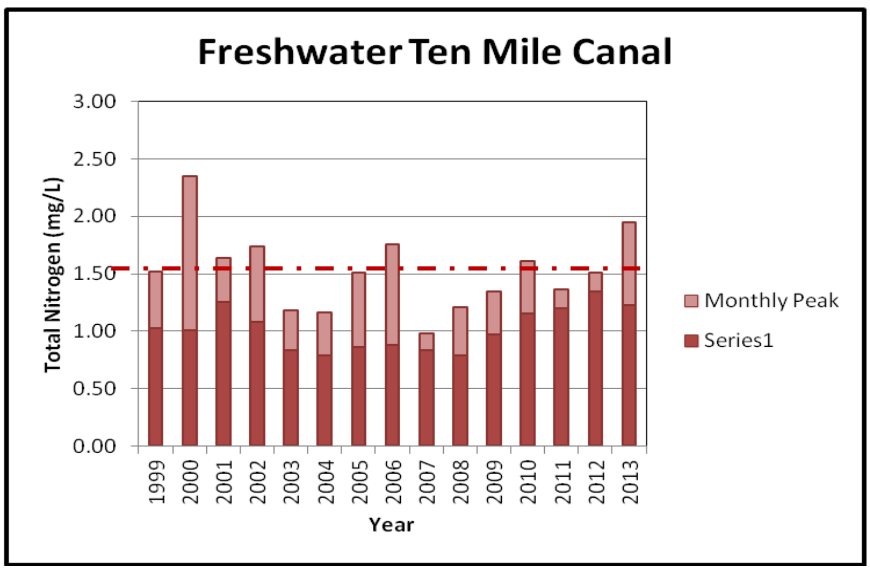
Year	Mean	Peak	Month of Peak
2009	1.52	6.04	April
2010	1.34	1.80	June
2011	1.46	1.75	April
2012	1.78	2.63	April
2013	1.55	2.35	April



2009-2013 change

average	**26%**
peak	**44%**

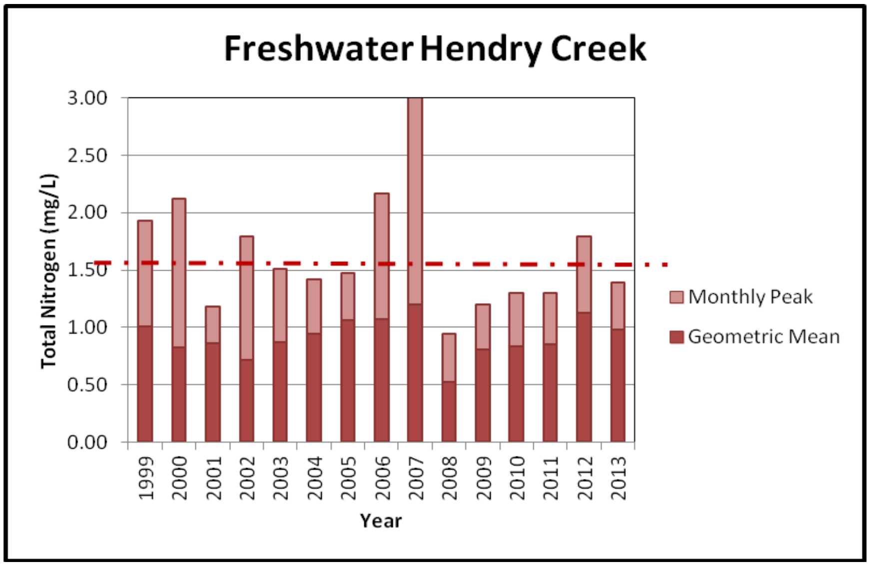
Year	Mean	Peak	Month of Peak
2009	0.97	1.35	October
2010	1.16	1.62	June
2011	1.20	1.37	November
2012	1.35	1.52	November
2013	1.23	1.95	September



2009-2013 change

average	21%
peak	17%

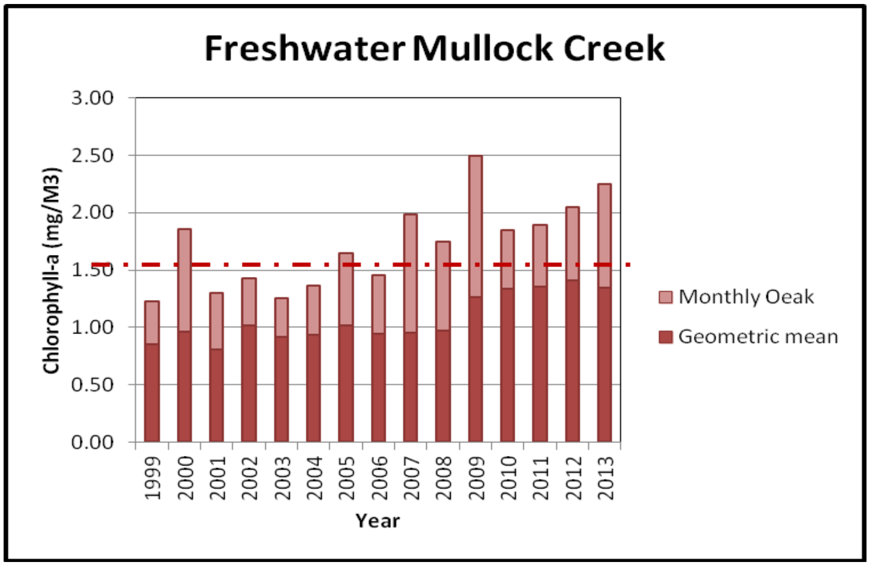
Year	Mean	Peak	Month of Peak
2009	0.81	1.20	November
2010	0.84	1.30	August
2011	0.86	1.30	February
2012	1.13	1.80	June
2013	0.98	1.40	December



2009-2013 change

average	**7%**
peak	**-10%**

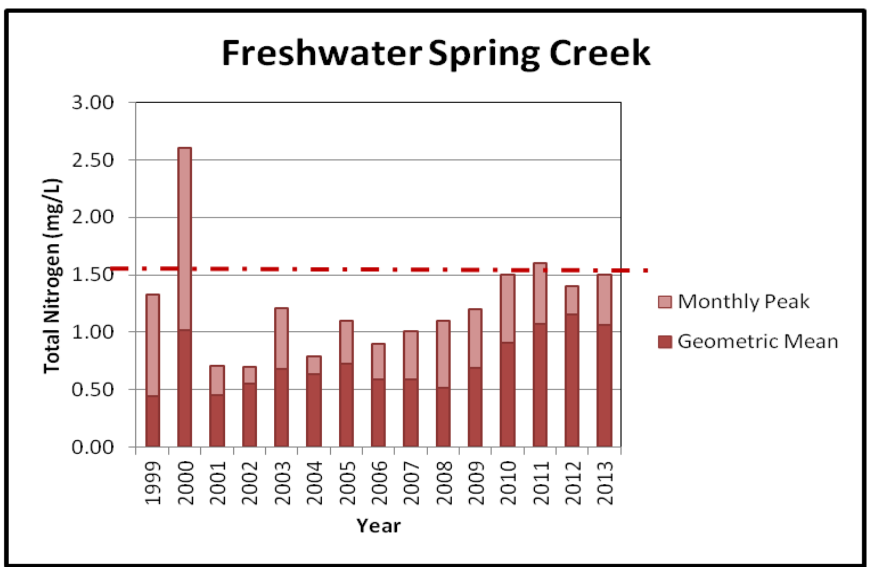
Year	Mean	Peak	Month of Peak
2009	1.27	2.50	October
2010	1.34	1.85	September
2011	1.36	1.90	December
2012	1.41	2.05	September
2013	1.35	2.25	September



2009-2013 change

average	**54%**
peak	**25%**

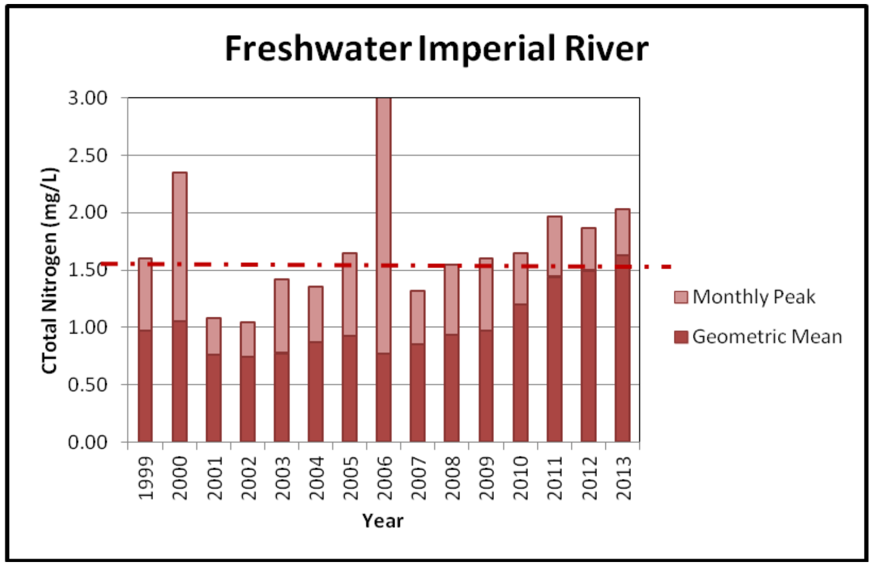
Year	Mean	Peak	Month of Peak
2009	0.69	1.20	June
2010	0.91	1.50	September
2011	1.08	1.60	June
2012	1.16	1.40	June
2013	1.06	1.50	September



2009-2013 change

average	**68%**
peak	**27%**

Year	Mean	Peak	Month of Peak
2009	**0.97**	**1.60**	July
2010	**1.20**	**1.65**	December
2011	**1.44**	**1.97**	October
2012	**1.50**	**1.87**	October
2013	**1.63**	**2.03**	October



Parameter: Total Phosphorus

Total phosphorus (TP) is a measure of all dissolved phosphorus in the water column, including phosphates. It is a resultant parameter that synthesizes many environmental inputs of phosphates. The USEPA Nutrient Criteria for this area, Aggregate Ecoregion XII, the Southeastern Coastal Plain, is 40.0 µg/L for rivers and streams (USEPA 2000), which is equivilent to 0.04 mg/L. As discussed above, the state of Florida is in the process of developing numeric criteria for this nutrient.

TP, in and of itself, does not identify the source phosphorus in the water column. The main contributor is stormwater runoff containing excess fertilizer from residential and agricultural sources. The fertilizer regulations noted above are intended to help reduce these inputs.

Because phosphorus standards were not adopted before the last water quality assessment conducted for Estero Bay basin, no such map is available to date.

The Lee County Environmental Laboratory provided the data for all total phosphorus analysis.

Total Phosphorus in Estuarine Systems

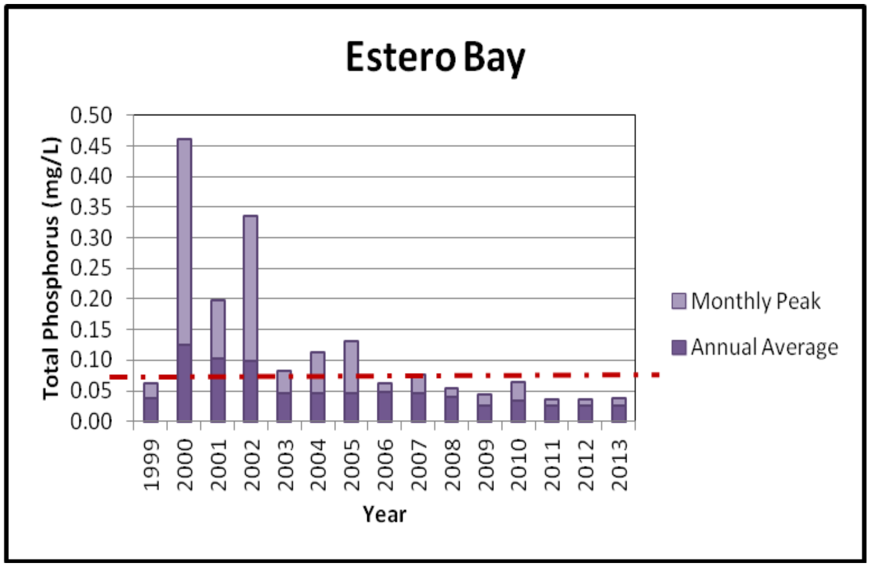
Between 2009 and 2013, average annual total phosphorus dropped in all estuarine segments. The average reduction was 14%. The peak monthly total phosphorus dropped in all estuarine segments, for an average of 22% reduction.

The most common peak month was June (33%), followed by September (17%). February, March, April and October were not represented.

2009-2013 change

average	-2%
peak	-13%

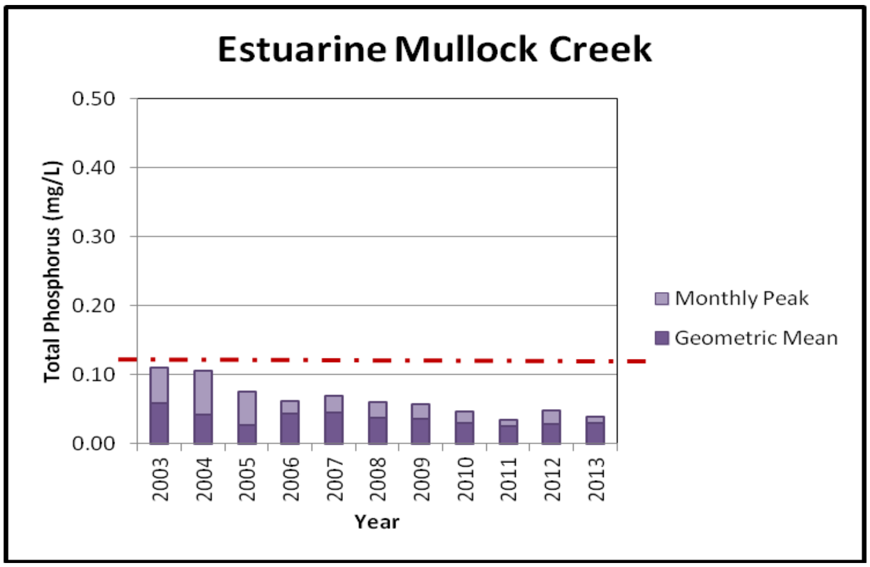
Year	Mean	Peak	Month of Peak
2009	0.03	0.04	November
2010	0.04	0.07	December
2011	0.03	0.04	September
2012	0.03	0.04	November
2013	0.03	0.04	September



2009-2013 change

average	-14%
peak	-31%

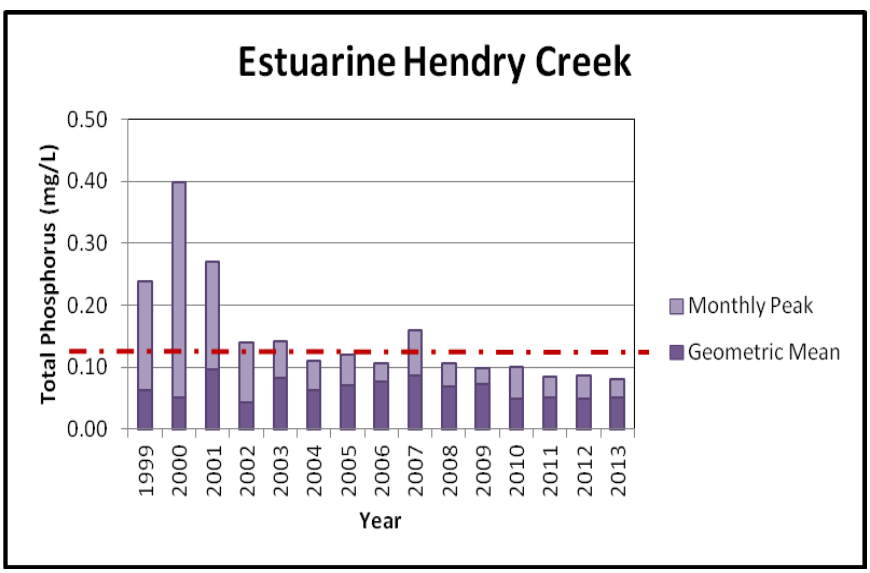
Year	Mean	Peak	Month of Peak
2009	0.04	0.06	August
2010	0.03	0.05	June
2011	0.03	0.03	December
2012	0.03	0.05	June
2013	0.03	0.04	June



2009-2013 change

average	-30%
peak	-19%

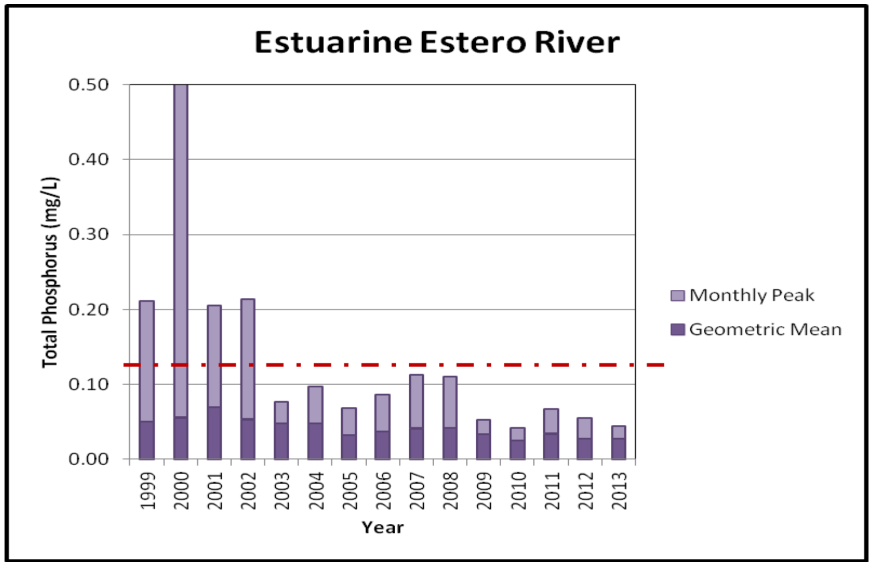
Year	Mean	Peak	Month of Peak
2009	0.07	0.10	May
2010	0.05	0.10	June
2011	0.05	0.08	July
2012	0.05	0.09	September
2013	0.05	0.08	May



2009-2013 change

average	-17%
peak	-17%

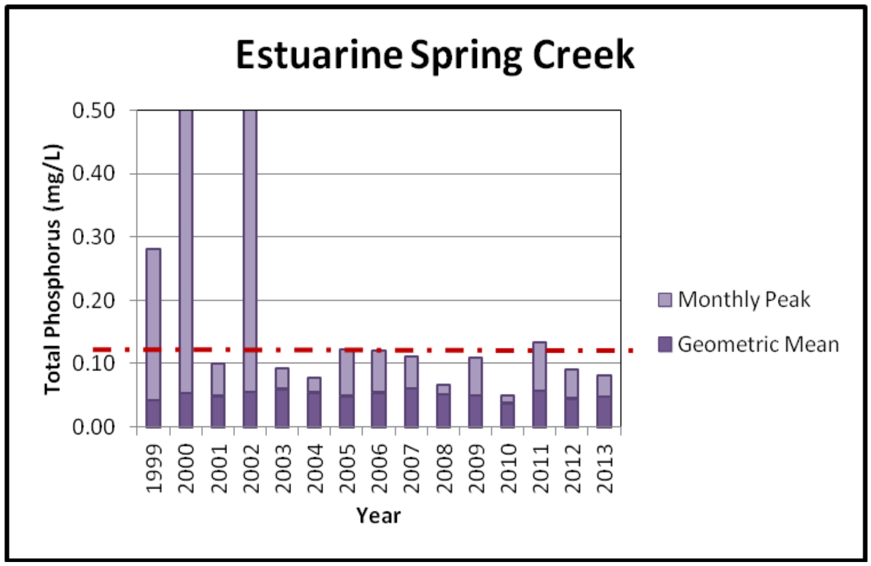
Year	Mean	Peak	Month of Peak
2009	0.03	0.05	September
2010	0.03	0.04	June
2011	0.03	0.07	June
2012	0.03	0.06	June
2013	0.03	0.04	June



2009-2013 change

average	-4%
peak	-26%

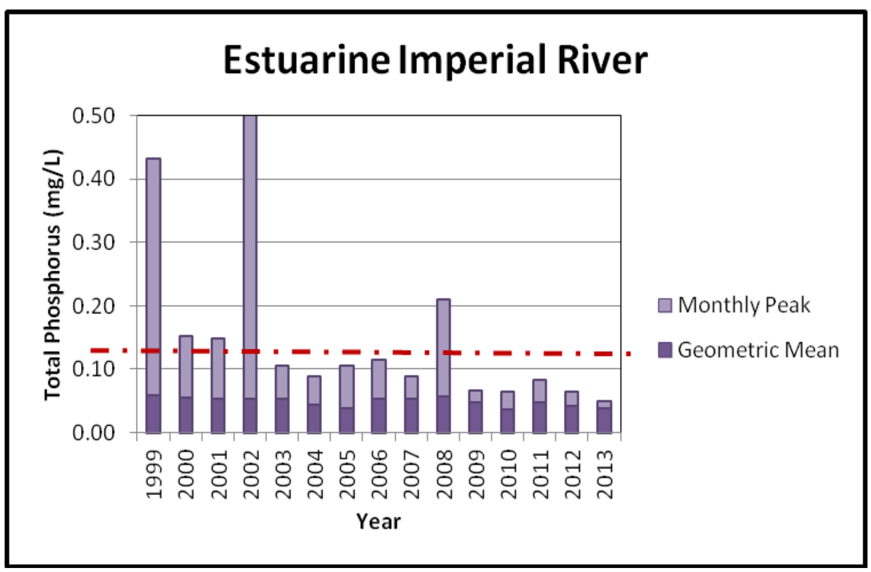
Year	Mean	Peak	Month of Peak
2009	0.05	0.11	January
2010	0.04	0.05	August
2011	0.06	0.13	January
2012	0.05	0.09	May
2013	0.05	0.08	September



2009-2013 change

average	-18%
peak	-25%

Year	Mean	Peak	Month of Peak
2009	0.05	0.07	January
2010	0.04	0.07	January
2011	0.05	0.08	June
2012	0.04	0.06	June
2013	0.04	0.05	May



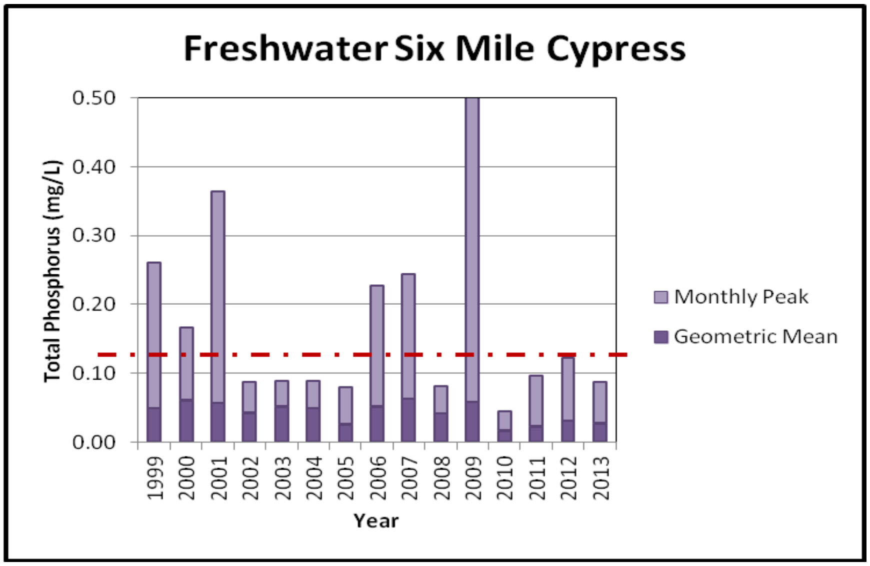
Total Phosphorus in Fresh Systems

Between 2009 and 2013, average annual total phosphorus dropped in all freshwater segments except Hendry Creek. In all tributaries the geometric mean standard was achieved after adoption of the fertilizer ordinances. The average reduction was 13%. The peak monthly total phosphorus dropped in all freshwater segments except Ten-Mile Canal and Imperial River, for an average of 12.5% reduction.

The most common peak month was May (23%), followed by June (20%). February and August were not represented.

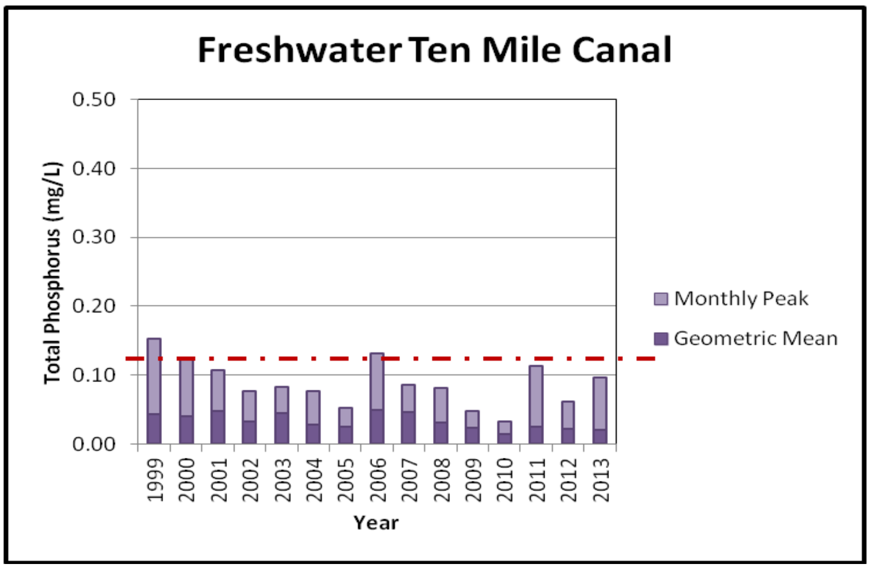
2009-2013 change
average -53%
peak -84%

Year	Mean	Peak	Month of Peak
2009	0.06	0.56	April
2010	0.02	0.04	November
2011	0.02	0.10	September
2012	0.03	0.12	May
2013	0.03	0.09	May



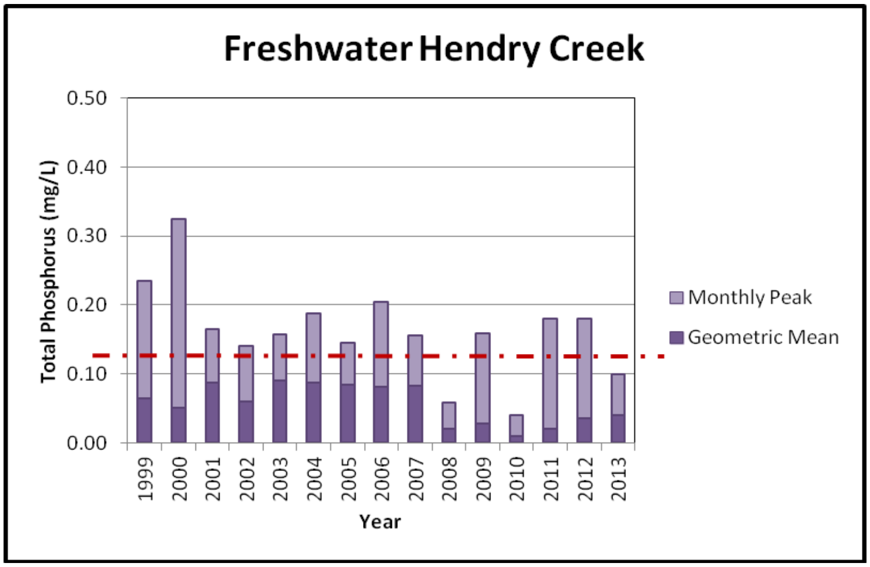
2009-2013 change
average -13%
peak 103%

Year	Mean	Peak	Month of Peak
2009	0.02	0.05	September
2010	0.02	0.03	May
2011	0.03	0.11	June
2012	0.02	0.06	September
2013	0.02	0.10	October



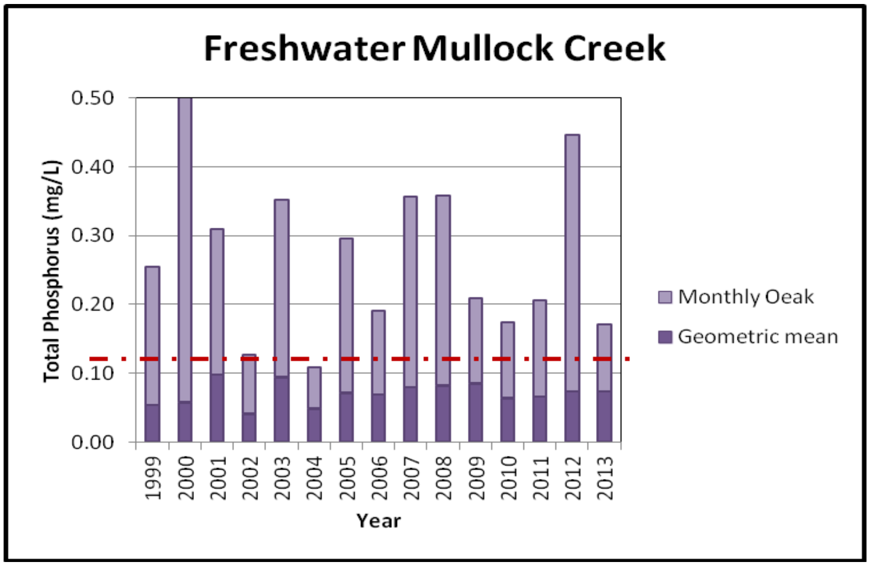
2009-2013 change
average 41%
peak -38%

Year	Mean	Peak	Month of Peak
2009	0.03	0.16	May
2010	0.01	0.04	November
2011	0.02	0.18	June
2012	0.04	0.18	June
2013	0.04	0.10	May



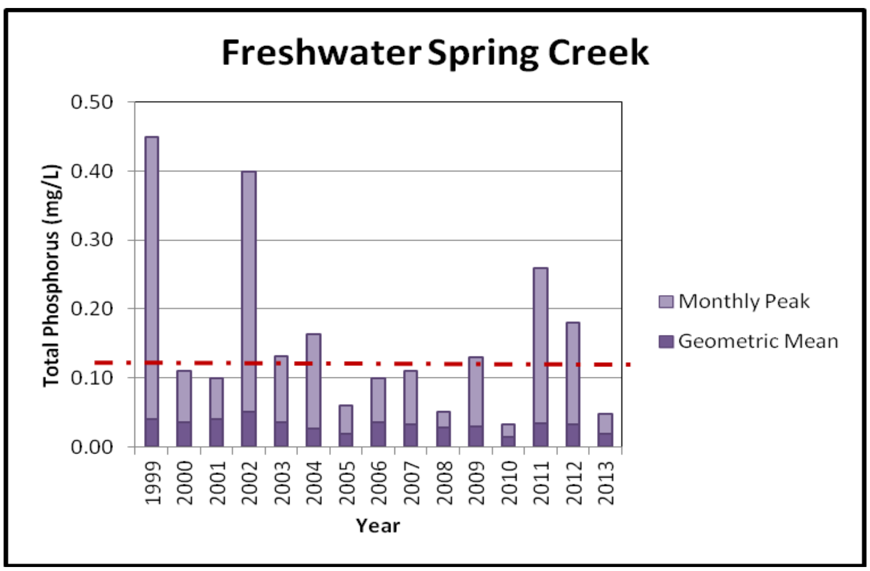
2009-2013 change
average -13%
peak -18%

Year	Mean	Peak	Month of Peak
2009	0.09	0.21	December
2010	0.06	0.17	October
2011	0.07	0.21	July
2012	0.07	0.45	May
2013	0.07	0.17	April



2009-2013 change
average -35%
peak -63%

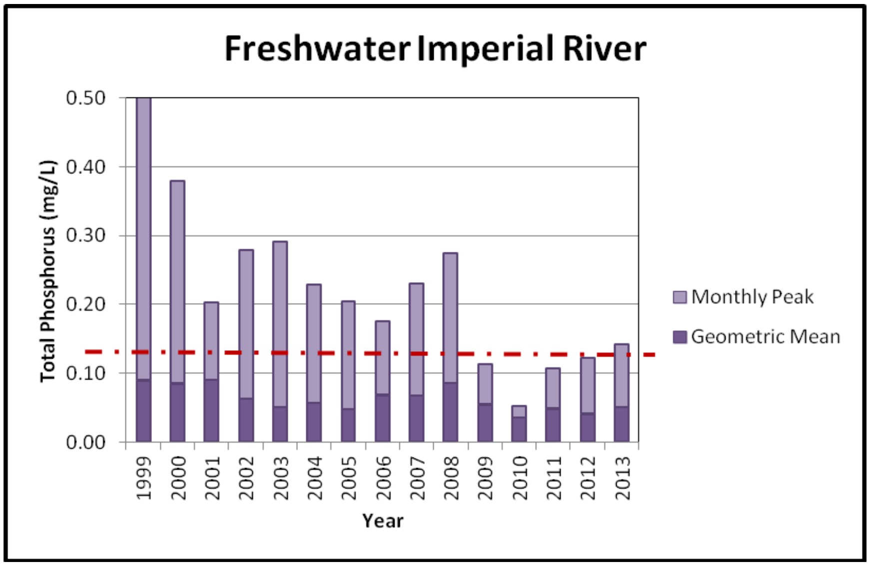
Year	Mean	Peak	Month of Peak
2009	0.03	0.13	May
2010	0.02	0.03	June
2011	0.03	0.26	March
2012	0.03	0.18	June
2013	0.02	0.05	September



2009-2013 change

average	-6%
peak	25%

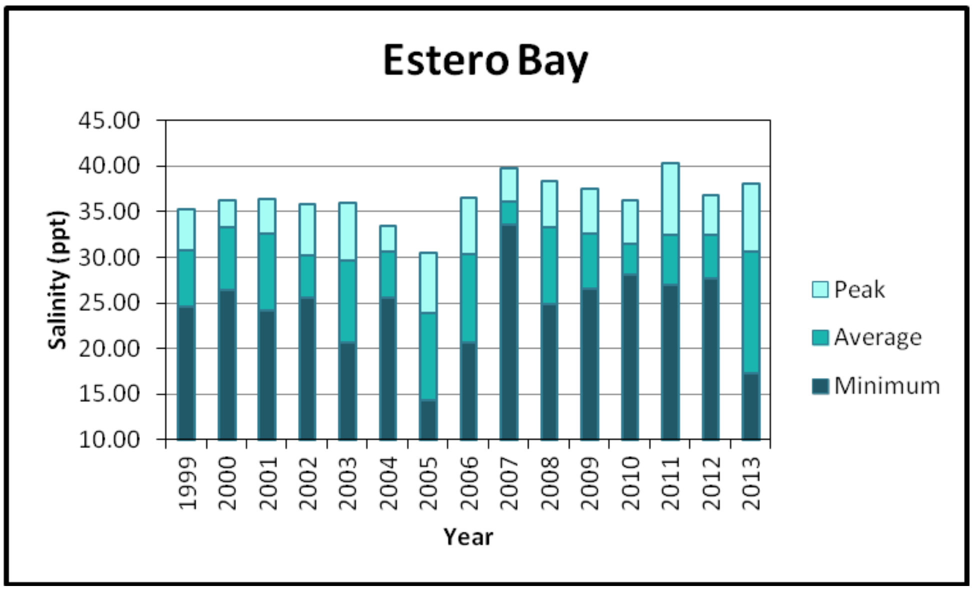
Year	Mean	Peak	Month of Peak
2009	0.05	0.11	July
2010	0.04	0.05	April
2011	0.04	0.11	January
2012	0.05	0.12	September
2013	0.05	0.14	June



Parameter: Salinity

Long term salinity changes in estuaries can reflect many changing factors. In Gulf of Mexico estuaries, landscape changes which alter the volume and periodicity of freshwater delivery to the estuaries can result in measureable changes. Examples include hypersalinity in lagoons and major freshwater dumping to bays at the receiving end of major canals. There is a rising trend of salinity for Estero Bay over the last decade. Of note is the contrast between annual minimums and annual peaks. In the period of record, 2005 had the lowest minimum and the lowest peak, while 2007 had the highest minimum and the highest peak. In the 2009 - 2013 period, the average salinity dropped by 5%, the peak increase by 1% and the minimum was at its lowest since 2005, dropping 35% from 2009 values.

The Lee County Environmental Laboratory provided the data for all salinity analysis.



2009-2013 change

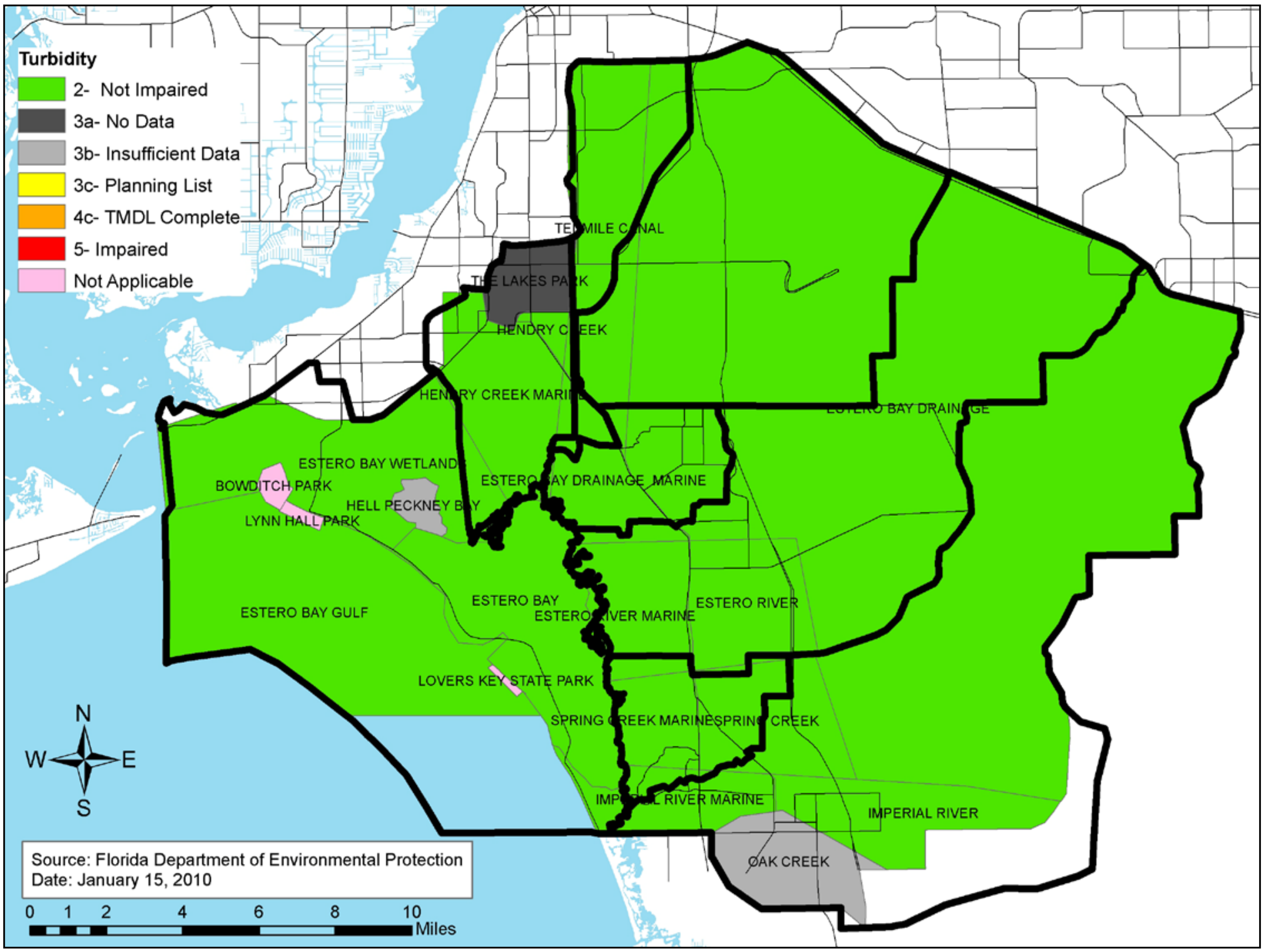
average	-6%
peak	1%
minimum	-35%

Year	Average	Peak	Month of Peak	Minimum	Month of Minimum
2009	**32.6**	**37.6**	April	**26.5**	September
2010	**31.5**	**36.3**	June	**28.1**	March
2011	**32.5**	**40.3**	June	**27.0**	November
2012	**32.5**	**36.8**	June	**27.8**	September
2013	**30.7**	**38.1**	June	**17.3**	September

Parameter: Turbidity

Turbidity is a measure of water clarity. It is a resultant parameter that synthesizes many environmental inputs of particles and dissolved materials, including the organics from detritus, plankton productivity, natural suspended particles and pollutants. The USEPA Nutrient Criteria for this area is 1.9 NTU, whereas the state standard is expressed as 29 or fewer NTUs above normal background levels.

The map below shows that all waterbodies where there are data are verified as not impaired for turbidity.



Turbidity in Estuarine Systems

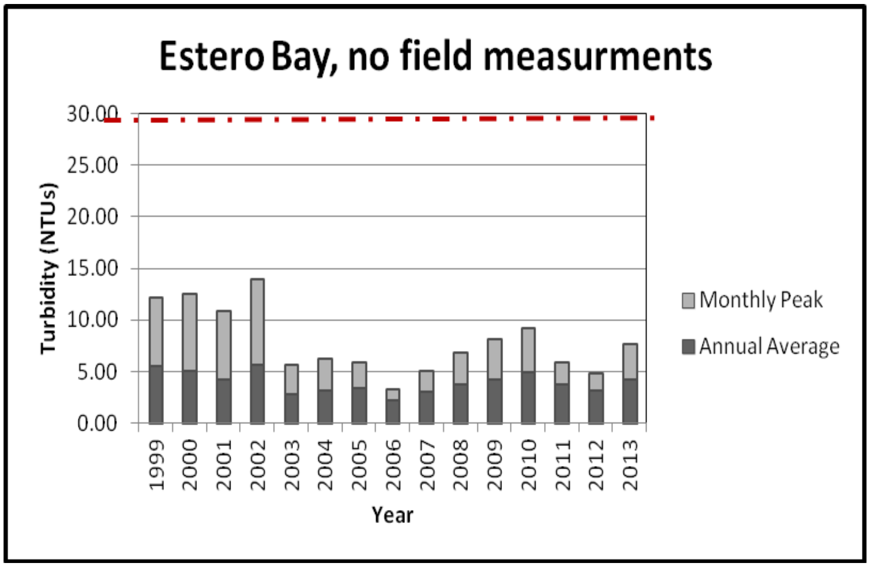
Between 2009 and 2013, average turbidity increased in the 3 most northern segments and decreased in the 3 most southern segments. The average reduction was 10%. The peak monthly turbidity dropped in all estuarine segments but two, for an average of 8% reduction.

The most common peak months were February (17%) and June (17%), however, all month except December were represented.

2009-2013 change

average	0%
peak	-6%

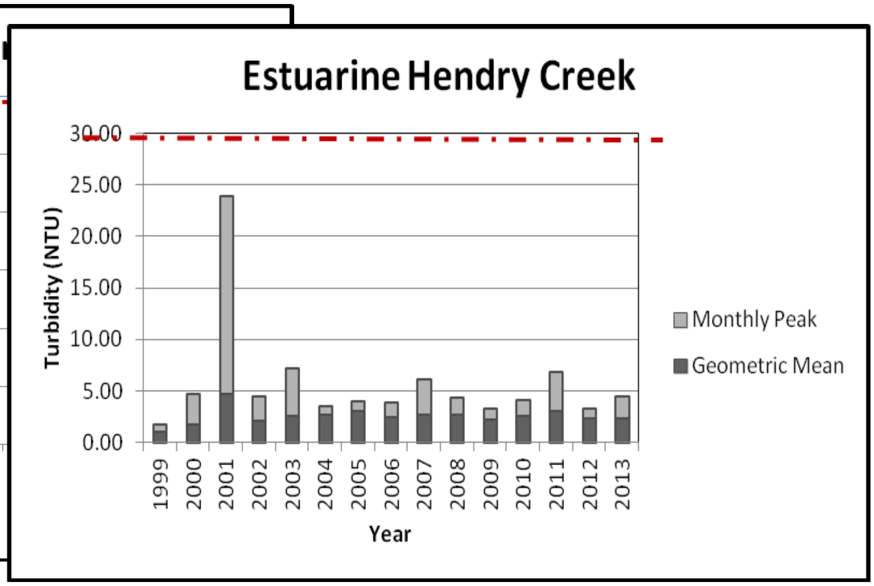
Year	Mean	Peak	Month of Peak
2009	4.22	8.23	January
2010	4.94	9.25	April
2011	3.79	5.93	January
2012	3.22	4.82	October
2013	4.23	7.74	January



2009-2013 change

average	10%
peak	-10%

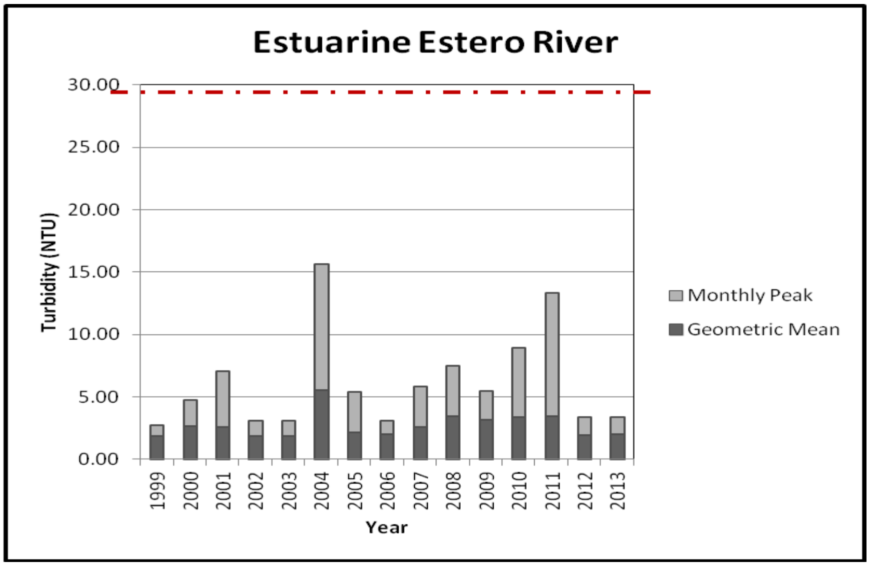
Year	Mean	Peak	Month of Peak
2009	2.82	4.91	September
2010	2.87	5.86	April
2011	2.39	4.40	June
2012	2.13	2.78	June
2013	3.10	4.39	February



2009-2013 change

average	-35%
peak	-37%

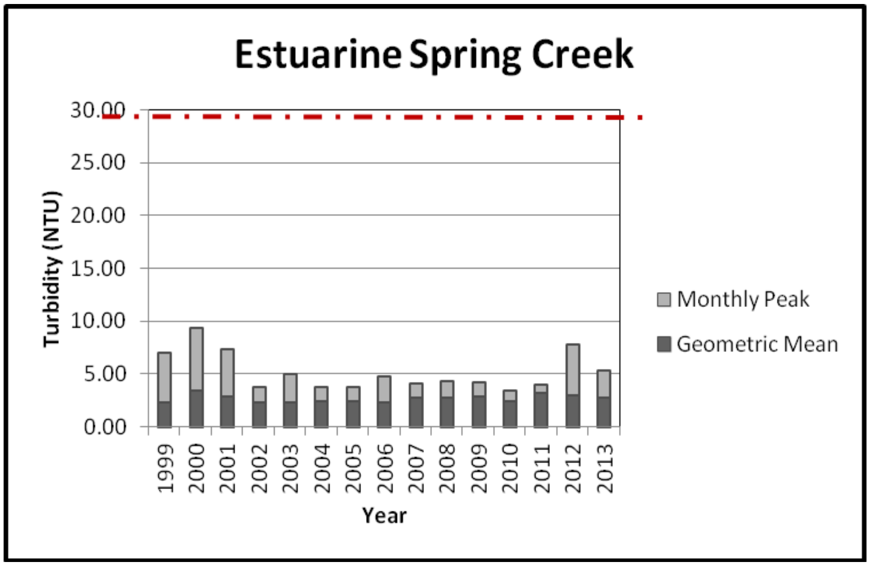
Year	Mean	Peak	Month of Peak
2009	3.19	5.49	May
2010	3.44	8.95	June
2011	3.47	13.38	August
2012	1.98	3.40	February
2013	2.06	3.43	February



2009-2013 change

average	-4%
peak	25%

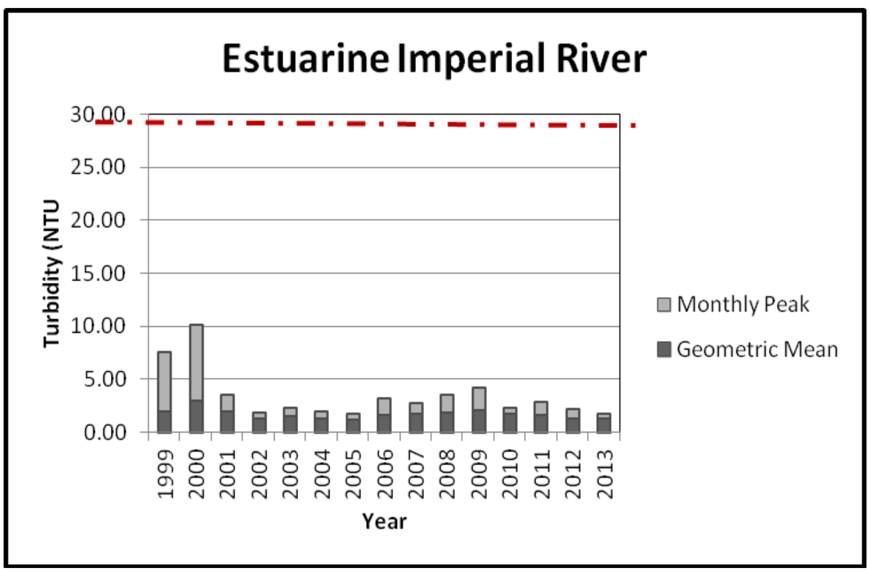
Year	Mean	Peak	Month of Peak
2009	2.87	4.28	January
2010	2.47	3.42	November
2011	3.19	4.06	May
2012	3.02	7.87	July
2013	2.75	5.34	May



2009-2013 change

average	-37%
peak	-57%

Year	Mean	Peak	Month of Peak
2009	2.06	4.21	May
2010	1.82	2.36	February
2011	1.66	2.86	June
2012	1.29	2.24	June
2013	1.31	1.83	February



Turbidity in Fresh Systems

Between 2009 and 2013, average turbidity dropped in all freshwater segments. The average reduction was 29%. The peak monthly turbidity dropped in all estuarine segments but two, for an average of 30% reduction.

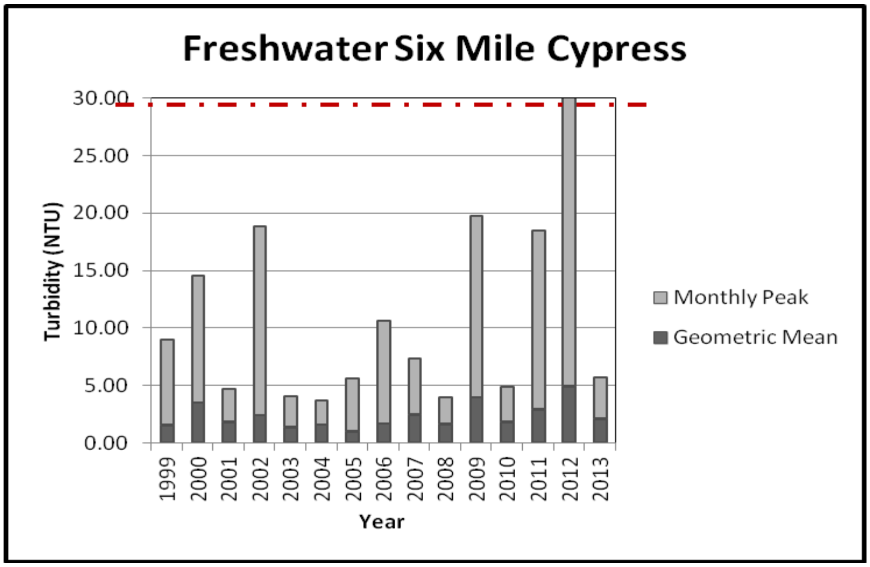
The most common peak month was June (23%), followed by July (17%) and January (17%). All months except August, September and December were represented.

2009-2013 change

average -47%

peak -71%

Year	Mean	Peak	Month of Peak
2009	3.97	19.70	April
2010	1.85	4.87	January
2011	2.93	18.44	June
2012	4.93	33.60	May
2013	2.10	5.72	April

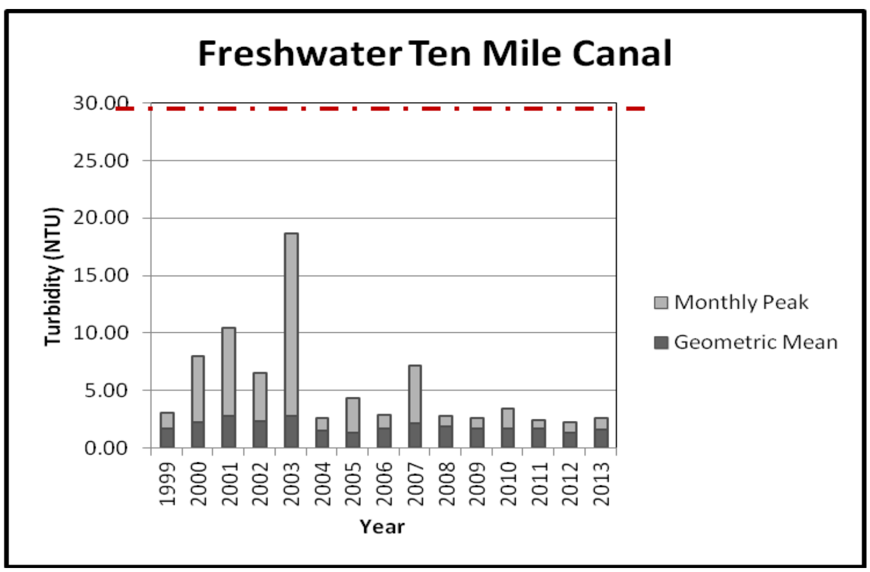


2009-2013 change

average -3%

peak 1%

Year	Mean	Peak	Month of Peak
2009	1.72	2.60	July
2010	1.76	3.41	June
2011	1.68	2.49	April
2012	1.38	2.31	May
2013	1.67	2.62	October

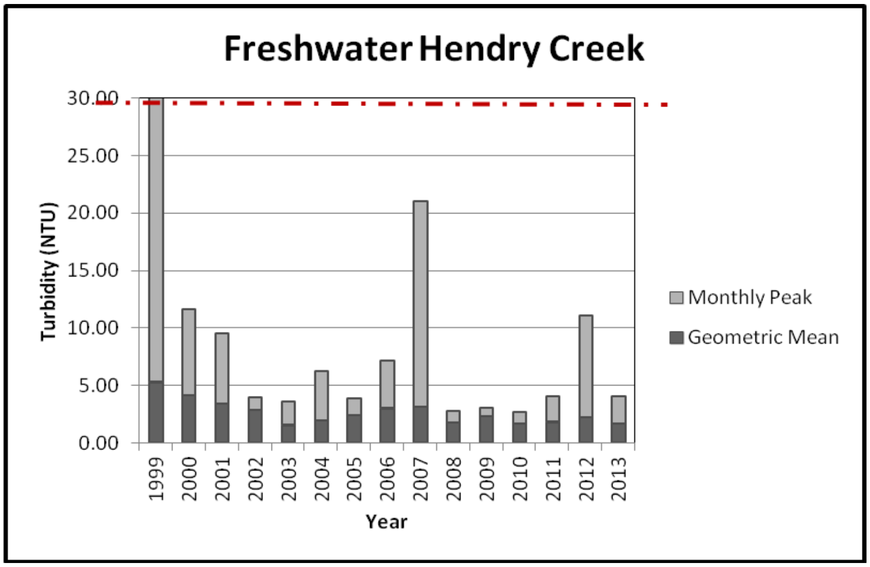


2009-2013 change

average -27%

peak 32%

Year	Mean	Peak	Month of Peak
2009	2.32	3.09	November
2010	1.70	2.69	January
2011	1.83	4.07	June
2012	2.29	11.10	June
2013	1.70	4.09	November

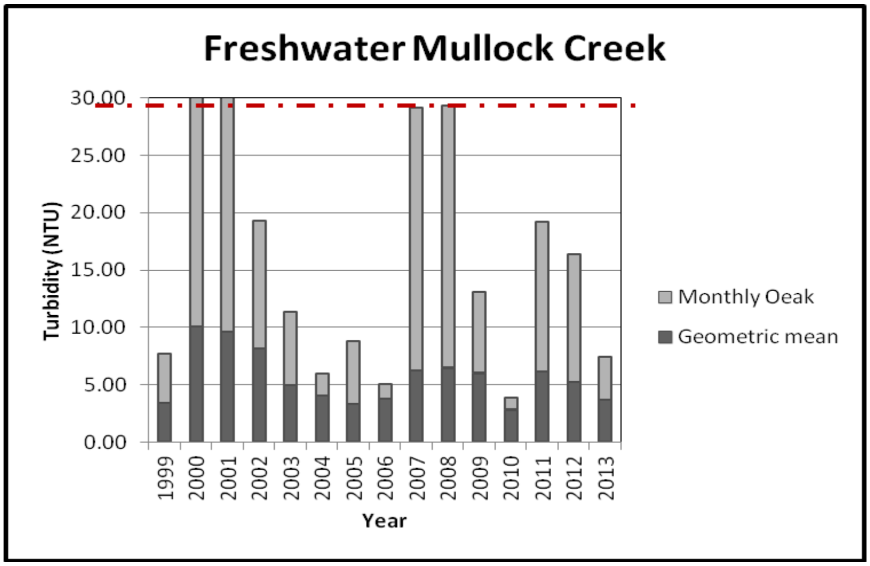


2009-2013 change

average -38%

peak -43%

Year	Mean	Peak	Month of Peak
2009	**6.05**	**13.12**	**October**
2010	**2.86**	**3.93**	**July**
2011	**6.17**	**19.26**	**July**
2012	**5.23**	**16.40**	**June**
2013	**3.75**	**7.49**	**April**

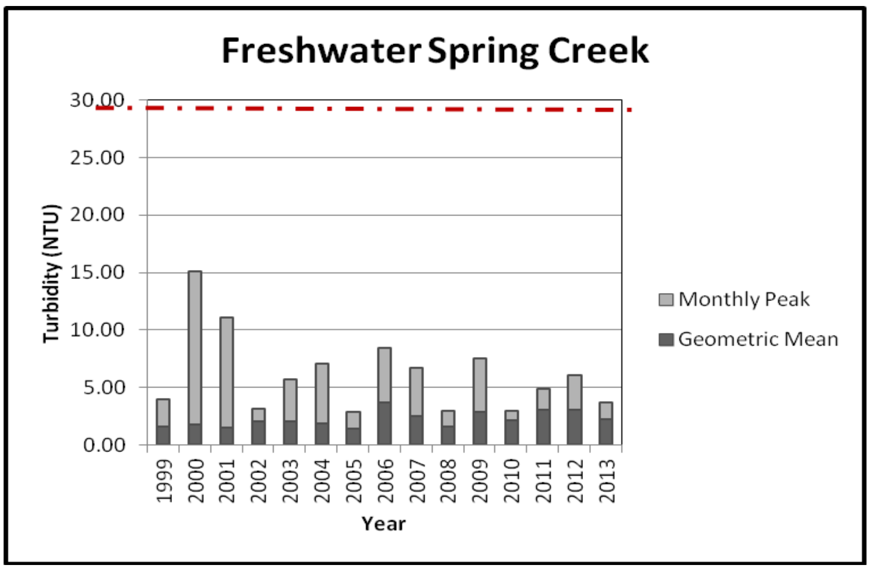


2009-2013 change

average -22%

peak -51%

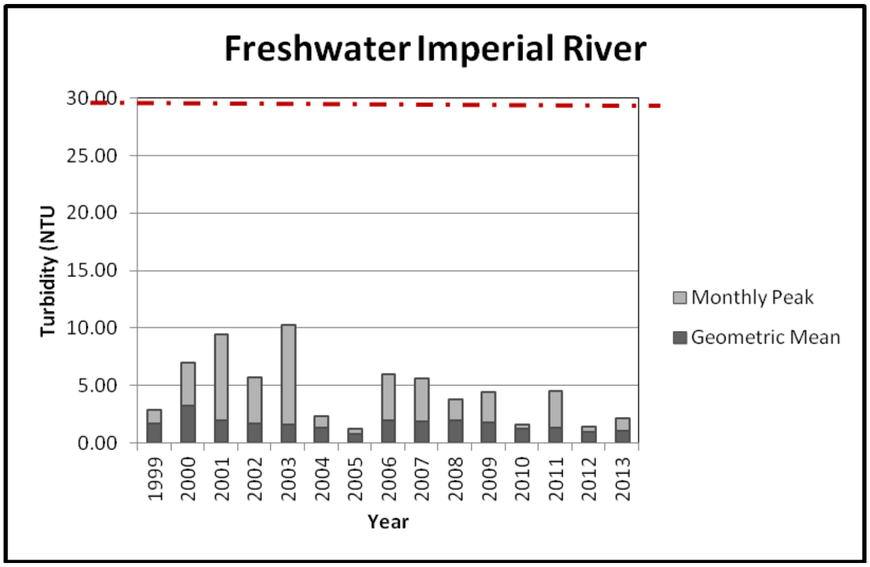
Year	Mean	Peak	Month of Peak
2009	**2.87**	**7.57**	**June**
2010	**2.17**	**3.01**	**October**
2011	**3.09**	**4.88**	**February**
2012	**3.12**	**6.09**	**July**
2013	**2.23**	**3.73**	**March**



2009-2013 change

average	**-39%**
peak	**-50%**

Year	Mean	Peak	Month of Peak
2009	1.77	4.45	July
2010	1.24	1.61	January
2011	1.35	4.55	January
2012	0.99	1.44	June
2013	1.08	2.21	January



Charlotte Harbor NEP Status and Trends Assessment

The Charlotte Harbor National Estuary Program (CHNEP) completed a water quality status and trends assessment on July 5, 2013, for period of record data through 2011. Estero Bay was among the basins assessed. The report had the following findings and recommendations:

- Land use in the Estero Bay basin was reported to be primarily mixed wetlands (11%), upland forests (12%), pasture land (8%) and residential (4%), the same as in the 2007 report.
- A statistically significant trend of < 5% per year was considered "shallow". A statistically significant trend of ≥ 5% per year was considered "steep".
- Coastal Estero Bay basin fixed station data had consistently decreasing trends for several parameters including; total phosphorus (16 of 24 stations), total organic carbon (10 of 18 stations), color (12 of 20 stations, and chlorophyll (5 of 14 stations). Total nitrogen concentrations exhibited decreasing trends at 3 of 24 stations. Despite significant improvements for these parameters there were some degrading trends as evidenced by increasing biological oxygen demand and total suspended solids concentrations (8 of 14 stations each). Otherwise, trends were mostly stable throughout the basin.
- Within Estero River basin there were generally 5 stations had sufficient data for trend testing within the basin with a period of record between 1992 and 2011. Total nitrogen concentrations, and the associated constituents that make up total nitrogen were found to be significantly increasing at the majority of these stations. Total phosphorus concentrations were stable at 3 stations, increasing at 1 station and decreasing at one station though dissolved orthophosphate concentrations increased at 3 of 5 stations. Dissolved silica and chloride concentrations increased at 2 of 4 stations. Dissolved oxygen concentrations were mostly stable with one decreasing trend. Copper and lead concentrations were stable at all stations sampled.
- For Hendry Creek and Six Mile Cypress there were generally 30 stations within the basin had sufficient data for trend testing and though the period of record among these stations was variable, many stations had data dating back to 1990. Total nitrogen trends increased at 13 of 31 stations and no stations had decreasing trends in total nitrogen. The increases in total nitrogen seem principally due to increased concentrations of total Kjeldahl nitrogen rather than the associated inorganic forms of nitrogen. Biological oxygen demand also increased at 12 of the 31 stations and dissolved silica increased at 6 stations. Despite these increasing trends in nitrogen and biological oxygen demand, chlorophyll a concentrations improved at 14 of the 31 stations. Total phosphorus also exhibited improving trends at 13 of those 31 stations though there were 4 stations with increasing trends for total phosphorus. Decreased trends in color were also observed at 11 stations within the basin. The remaining parameters had mixed results such as dissolved oxygen which decreased at 6 stations but increased at 5 stations within the basin.

- For Imperial River, there were generally 7 stations had sufficient data for trend testing within the basin with a period of record either between 1992 and 2011 or beginning in the early 2000's through 2011. Three of 7 stations in the Imperial River exhibited increasing trends in total nitrogen and dissolved silica. Five of 7 stations exhibited increased trends in total Kjeldahl nitrogen. Biological oxygen demand increased at 2 of 7 stations while other parameters exhibited stable trends over the period of record of had only a single increasing or decreasing trend.

- Spring Creek generally had 7 stations with sufficient data for trend testing within the basin with a period of record either between 1992 and 2011 or beginning in the early 2000's through 2011. Five of the 7 stations in Spring Creek exhibited increasing trends in total nitrogen and total Kjeldahl nitrogen. Three of seven station exhibited increasing trends in dissolved silica. Five of 7 stations exhibited increased trends in Biological oxygen demand. However, despite these degrading trends, chlorophyll concentrations decreasing at 4 of 7 stations and total phosphorus also decreased at 3 of 7 stations. Dissolved oxygen decreased at 3 stations, pH decreased at two stations and conductivity increased at 2 stations. Copper increased at 3 of the 7 stations while lead decreased at a single station in the basin. Other parameters including color and temperature were stable over the period of record.

- The annual 1-day and 30-day flow maxima in Estero Bay appeared to be increasing, coincident with decreases in the number of low flow pulses. From these results, it may be concluded that changes to stream flow have been occurring at statistically significant rates for many streams over the period of record. Many of the strongest IHA stream flow changes were observed to occur in the Estero Bay watershed, and these locations were also locations where changes in water quality were detected. However, these results are not a direct causative expression of relationships between stream flow and water quality as these trends can represent differing periods of record. Other potential sources of surface water quality declines include changes in pollutant loading from non-point sources in the watershed, point sources, and or atmospheric deposition. (Janicki Environmental, Inc. 2013)

Number of Stations

Parameter	Estero Bay Random	Coastal Estero	Hendry Creek	Estero River	Spring Creek	Imperial River	Total
BOD	1	8	31	5	7	7	59
Chl-a corr	1	14	14	4	7	7	47
Color	1	20	31	4	7	7	70
Copper			31	5	7	7	50
DO	1	24	27	5	5	6	68
F Coli		9	8	5	4	4	30
NH3	1	14	31	5	7	7	65
NO23	2	24	31	5	7	7	76
NO3	1	14	31	5	7	7	65
pH	1	24	27	5	5	6	68
PO4	1	14	32	5	7	7	66
Salinity	1	24					25
Conductivity			27	5	5	6	43
Temp	1	24	27	5	5	6	68
TkN	1	20	31	5	7	7	71
TN	1	24	31	5	7	7	75
TOC	1	18	7				26
TP	1	24	31	5	7	7	75
TSS	1	14	31	5	7	7	65

Percent of Station Decreasing Trends

Parameter	Estero Bay Random	Coastal Estero	Hendry Creek	Estero River	Spring Creek	Imperial River
BOD	0%	0%	3%	0%	0%	0%
Chl-a corr	0%	36%	100%	0%	57%	14%
Color	100%	60%	35%	20%	0%	0%
Copper			3%	0%	0%	0%
DO	100%	4%	22%	20%	60%	17%
F Coli		22%	0%	20%	0%	0%
NH3	100%	14%	3%	0%	0%	0%
NO23	100%	0%	13%	0%	0%	14%
NO3	0%	0%	10%	0%	14%	14%
pH	0%	8%	0%	0%	40%	0%
PO4	100%	0%	44%	20%	43%	14%
Salinity	0%	0%				
Conductivity			0%	0%	0%	0%
Temp	100%	0%	11%	0%	0%	0%
TkN	100%	5%	0%	0%	0%	0%
TN	100%	13%	0%	0%	0%	0%
TOC	0%	56%	43%			
TP	100%	67%	42%	20%	43%	14%
TSS	0%	0%	13%	80%	0%	0%

Percent of Station Increasing Trends

Parameter	Estero Bay Random	Coastal Estero	Hendry Creek	Estero River	Spring Creek	Imperial River
BOD	100%	25%	39%	20%	71%	29%
Chl-a corr	0%	0%	0%	0%	0%	14%
Color	0%	0%	3%	0%	0%	14%
Copper			10%	0%	43%	14%
DO	0%	13%	19%	0%	20%	0%
F Coli		11%	63%	0%	50%	50%
NH3	0%	0%	39%	60%	43%	29%
NO23	0%	0%	6%	40%	14%	0%
NO3	0%	0%	16%	60%	14%	14%
pH	0%	0%	15%	0%	0%	0%
PO4	0%	0%	13%	20%	14%	0%
Salinity	0%	0%				
Conductivity			26%	40%	40%	17%
Temp	0%	0%	4%	0%	0%	0%
TkN	0%	5%	48%	100%	71%	71%
TN	0%	4%	42%	80%	71%	43%
TOC	0%	0%	0%			
TP	0%	0%	13%	20%	14%	0%
TSS	100%	57%	13%	0%	29%	14%

Net Station Improvement and Degradation

Parameter	Estero Bay Random	Coastal Estero	Hendry Creek	Estero River	Spring Creek	Imperial River	2011 Basin Net	2007 Basin Net
BOD	-1	-2	-11	-1	-5	-2	**-22**	**-3**
Chl-a corr	0	5	14	0	4	0	**23**	**2**
Color	1	12	10	1	0	-1	**23**	**2**
Copper			-2	0	-3	-1	**-6**	
DO	-1	2	-1	-1	-2	-1	**-4**	**25**
F Coli		1	-5	1	-2	-2	**-7**	**1**
NH3	1	2	-11	-3	-3	-2	**-16**	**-6**
NO23	2	0	2	-2	-1	1	**2**	**-7**
NO3	0	0	-2	-3	0	0	**-5**	**-5**
pH	0	2	-4	0	2	0	**0**	**4**
PO4	1	0	10	0	2	1	**14**	**-4**
Salinity	0	0					**0**	**9**
Conductivity			-7	-2	-2	-1	**-12**	
Temp	1	0	2	0	0	0	**3**	**-1**
TkN	1	0	-15	-5	-5	-5	**-29**	**-5**
TN	1	2	-13	-4	-5	-3	**-22**	**-3**
TOC	0	10	3			0	**13**	
TP	1	16	9	0	2	1	**29**	**1**
TSS	-1	-8	0	4	-2	-1	**-8**	**5**
	6	**42**	**-21**	**-15**	**-20**	**-16**	**-24**	**15**

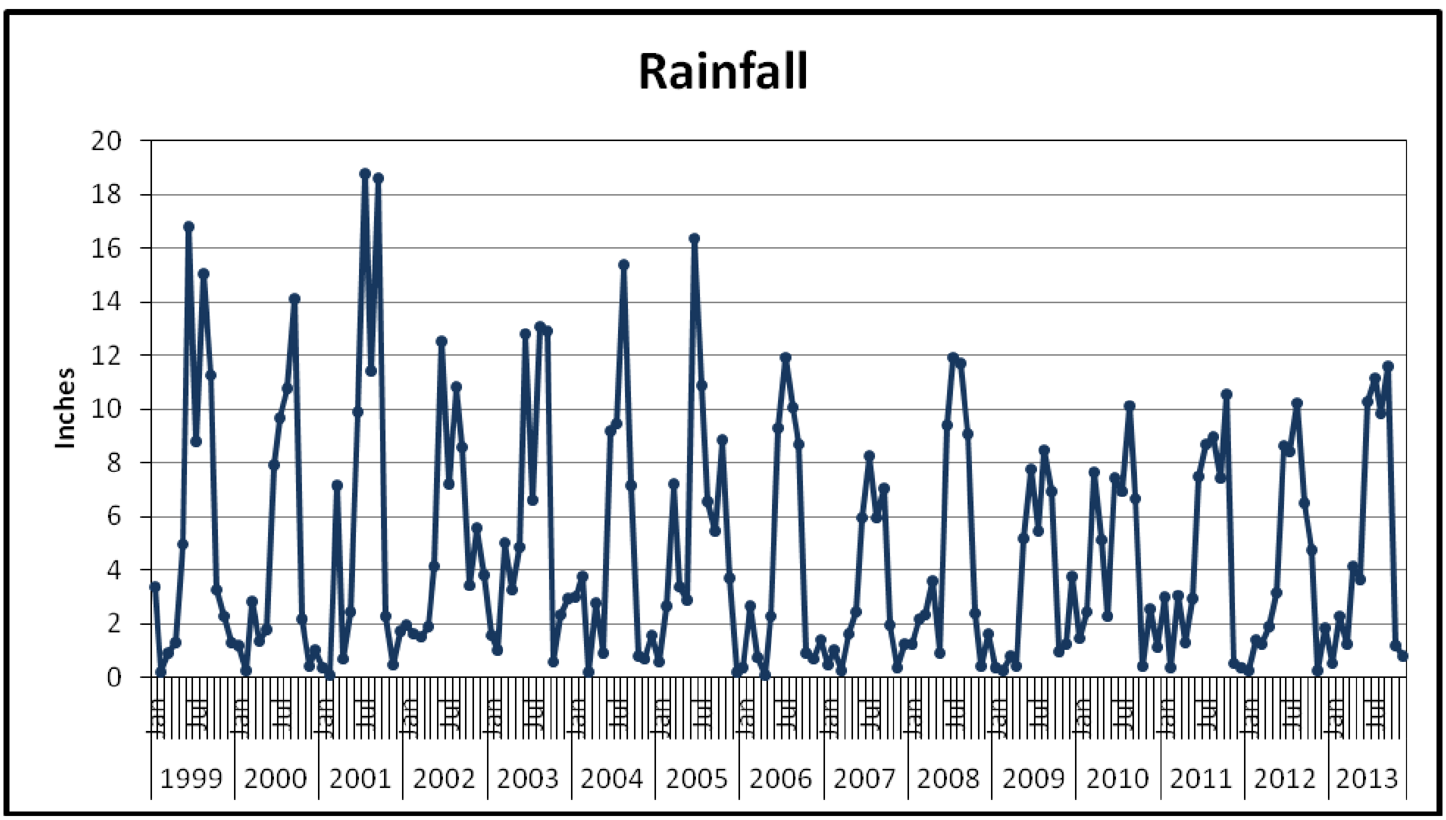
good trend
neutral trend
bad trend

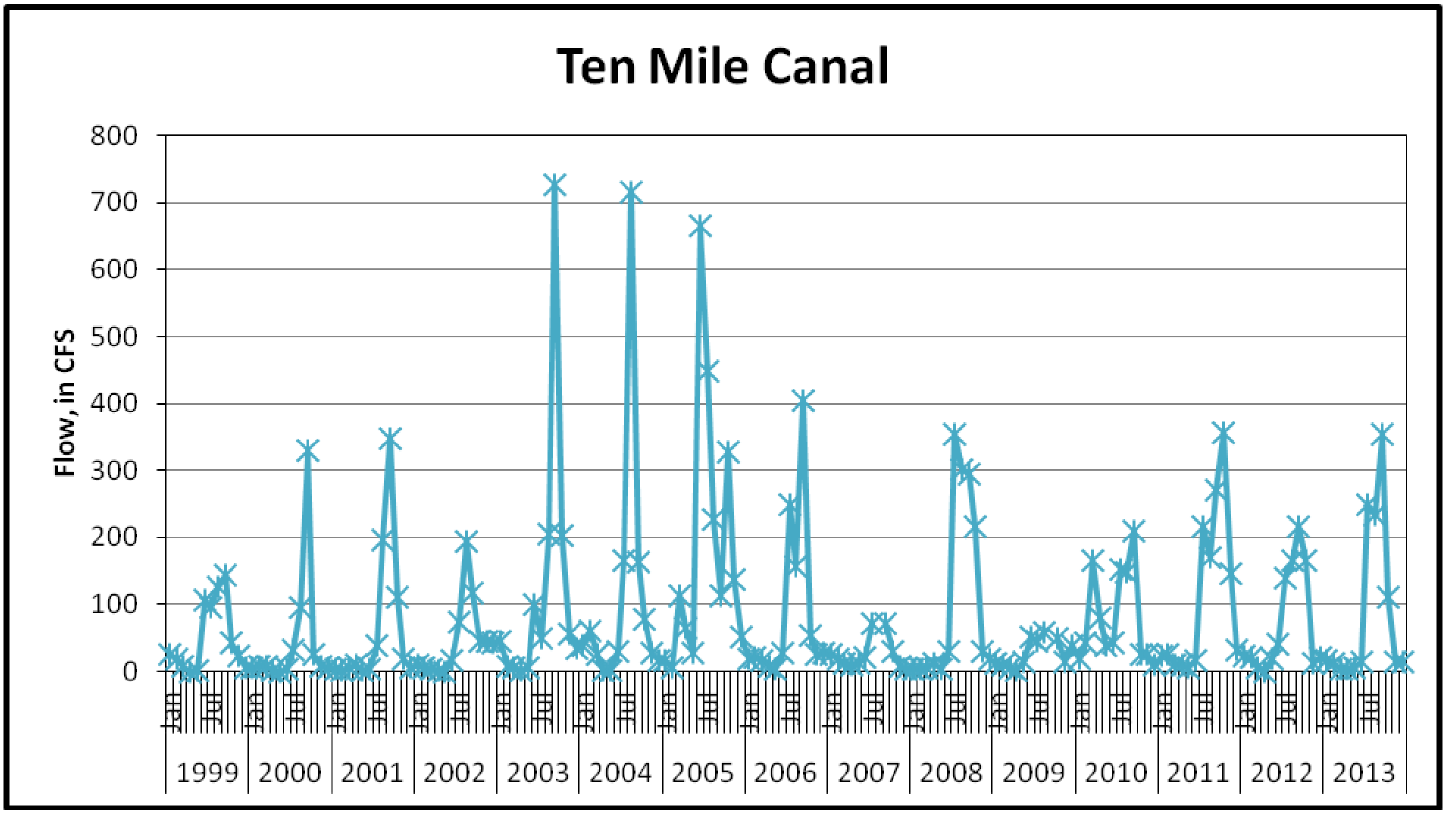
Hydrology

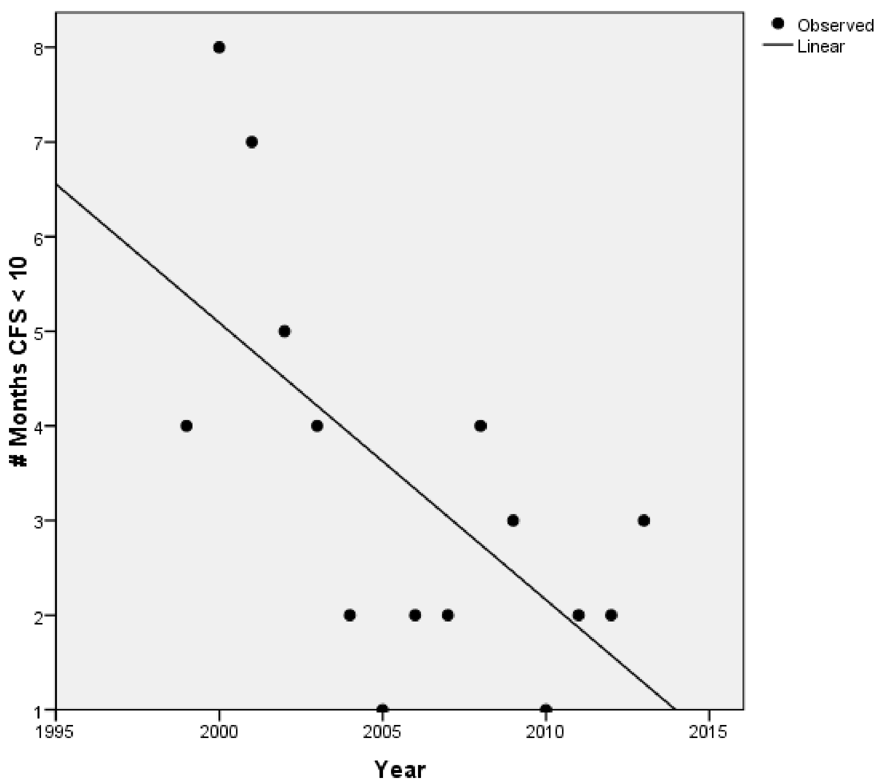
Factor: Tributary Flows

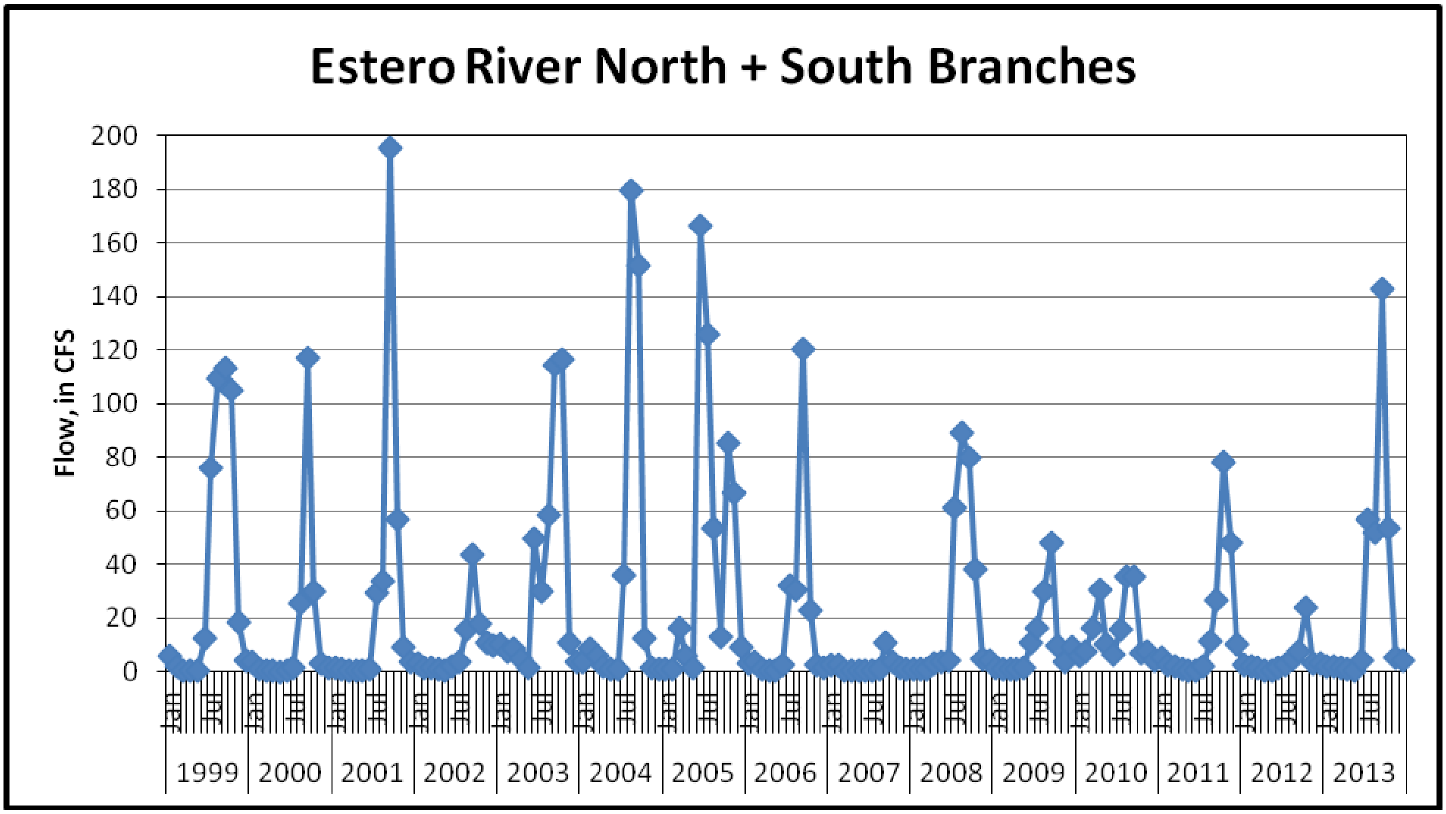
Tributary flows to Estero Bay have been altered by enhancements intended to drain land surfaces during the wet season and to retain water behind weirs and salinity barriers during the dry season. This continues to result in a spiked hydroperiod with little discharge of water during the dry season and sharp peaks during rain events, particularly when water control structures are opened. The lack of surface water retention on the landscape and the elimination of gradual sheetflow delivery to the estuary has shortened freshwater wetland hydroperiods. Surface water table elevations are rapidly lowered and drought conditions are accentuated, encouraging the invasion of exotic vegetation into wetlands and increasing the severity of fire season. Fisheries and wildlife that are dependent on depressional wetlands and riparian habitats lose valuable breeding periods and nursery habitats as the hydrologic system acts as a flush plumbing mechanism. In some areas, wading bird breeding is reduced and fails as wetlands drain too quickly and vital food concentration is lost. Amphibians, such as gopher frogs and tree frogs, are unable to complete reproductive life cycles. Under these conditions, exotic fish, amphibian and plant species fill in and flourish.

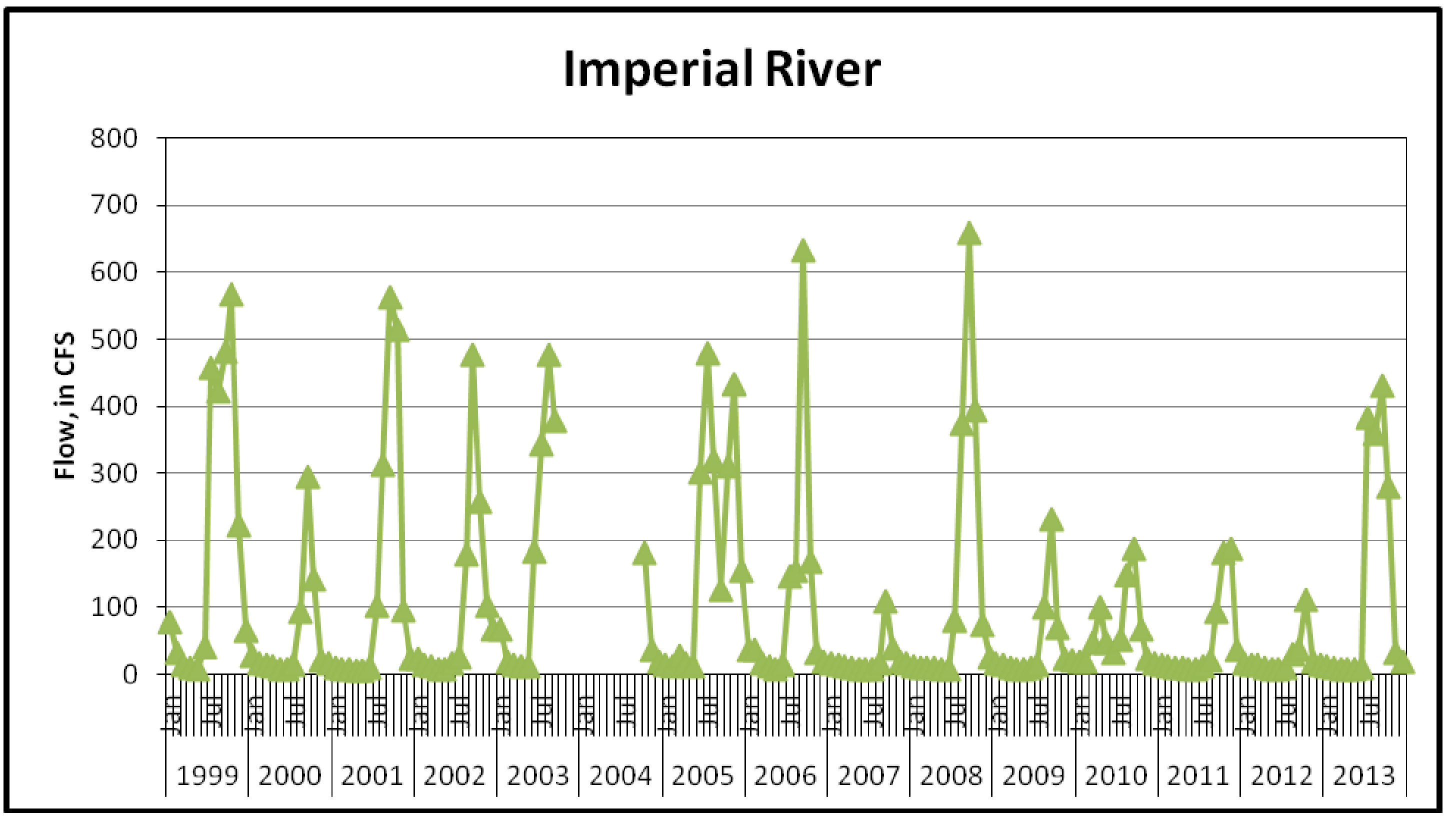
Data for analysis in this section is from the US Geological Survey (US Geological Survey 2014)

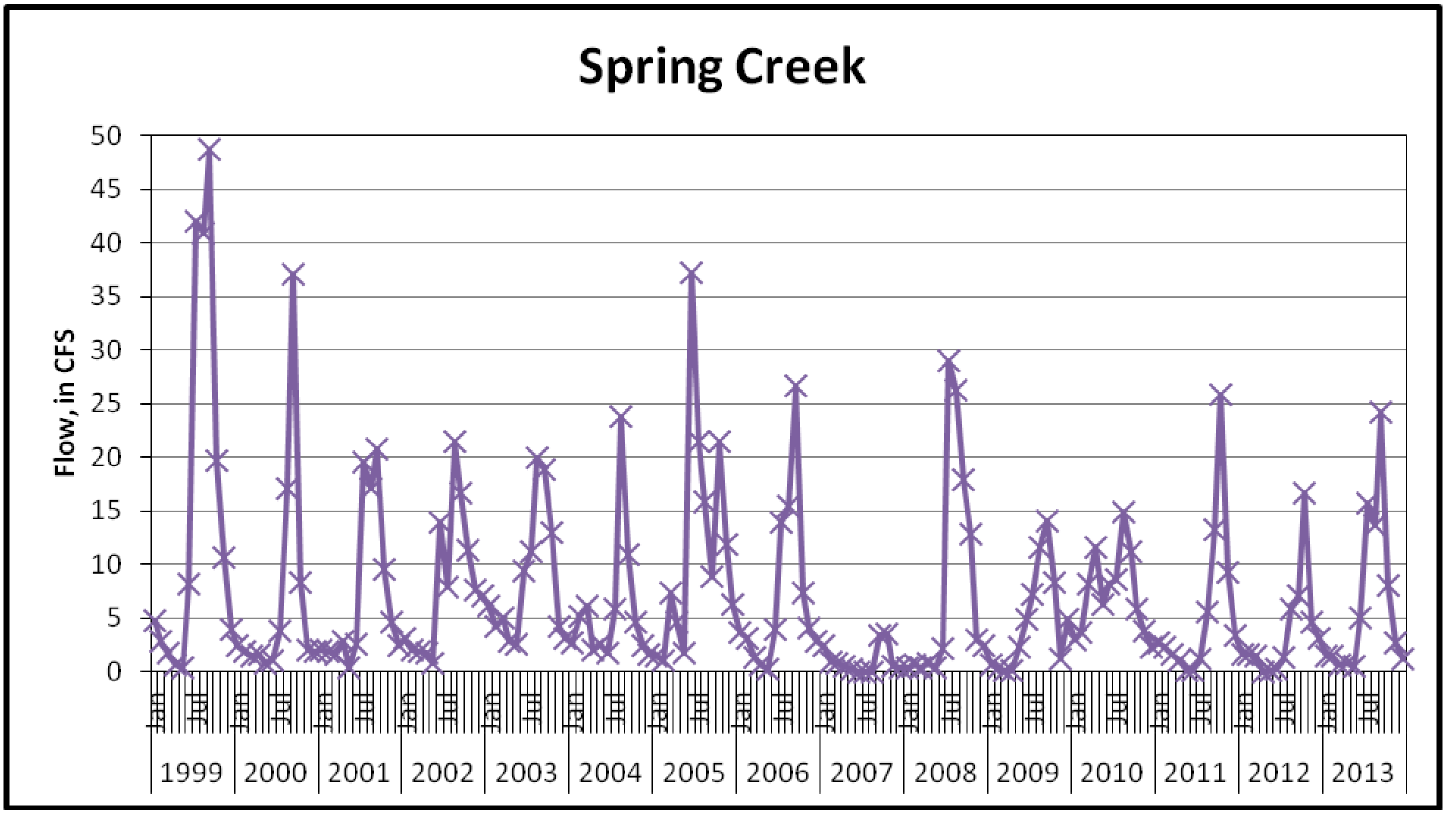



Ten Mile Canal
Flow, in CFS
800
700
600
500
400
300
200
100
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013


Observed
Linear
Months CFS < 10
Year
1995
2000
2005
2010
2015


Estero River North + South Branches
Flow, in CFS
200
180
160
140
120
100
80
60
40
20
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013


Imperial River
Flow, in CFS
800
700
600
500
400
300
200
100
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013


Spring Creek
Flow, in CFS
50
45
40
35
30
25
20
15
10
5
0
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013

Correlations

		Year	Month	Hendry	NB Estero	SB Estero	Imperial River	Spring Creek	10-mile	Estero N&S	Rain_in
Year	Correlation Coefficient	1.000	.000	.142	.072	-.065	-.112*	-.119*	.075	-.007	-.042
	Sig. (2-tailed)	.	1.000	.280	.168	.206	.037	.021	.148	.887	.419
	N	180	180	35	180	180	168	180	178	180	180
Month	Correlation Coefficient	.000	1.000	.076	.307**	.236**	.284**	.238**	.257**	.269**	.134*
	Sig. (2-tailed)	1.000	.	.538	.000	.000	.000	.000	.000	.000	.010
	N	180	180	35	180	180	168	180	178	180	180
Hendry	Correlation Coefficient	.142	.076	1.000	.611**	.589**	.358**	.616**	.611**	.586**	.646**
	Sig. (2-tailed)	.280	.538	.	.000	.000	.004	.000	.000	.000	.000
	N	35	35	35	35	35	32	35	34	35	35
NB Estero	Correlation Coefficient	.072	.307**	.611**	1.000	.716**	.660**	.669**	.661**	.833**	.318**
	Sig. (2-tailed)	.168	.000	.000	.	.000	.000	.000	.000	.000	.000
	N	180	180	35	180	180	168	180	178	180	180
SB Estero	Correlation Coefficient	-.065	.236**	.589**	.716**	1.000	.706**	.769**	.626**	.884**	.338**
	Sig. (2-tailed)	.206	.000	.000	.000	.	.000	.000	.000	.000	.000
	N	180	180	35	180	180	168	180	178	180	180
Imperial River	Correlation Coefficient	-.112*	.284**	.358**	.660**	.706**	1.000	.688**	.579**	.720**	.202**
	Sig. (2-tailed)	.037	.000	.004	.000	.000	.	.000	.000	.000	.000
	N	168	168	32	168	168	168	168	166	168	168
Spring Creek	Correlation Coefficient	-.119*	.238**	.616**	.669**	.769**	.688**	1.000	.617**	.755**	.362**
	Sig. (2-tailed)	.021	.000	.000	.000	.000	.000	.	.000	.000	.000
	N	180	180	35	180	180	168	180	178	180	180
10-mile	Correlation Coefficient	.075	.257**	.611**	.661**	.626**	.579**	.617**	1.000	.655**	.399**
	Sig. (2-tailed)	.148	.000	.000	.000	.000	.000	.000	.	.000	.000
	N	178	178	34	178	178	166	178	178	178	178
Estero N&S	Correlation Coefficient	-.007	.269**	.586**	.833**	.884**	.720**	.755**	.655**	1.000	.327**
	Sig. (2-tailed)	.887	.000	.000	.000	.000	.000	.000	.000	.	.000
	N	180	180	35	180	180	168	180	178	180	180
Rain_in	Correlation Coefficient	-.042	.134*	.646**	.318**	.338**	.202**	.362**	.399**	.327**	1.000
	Sig. (2-tailed)	.419	.010	.000	.000	.000	.000	.000	.000	.000	.
	N	180	180	35	180	180	168	180	178	180	180

*. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

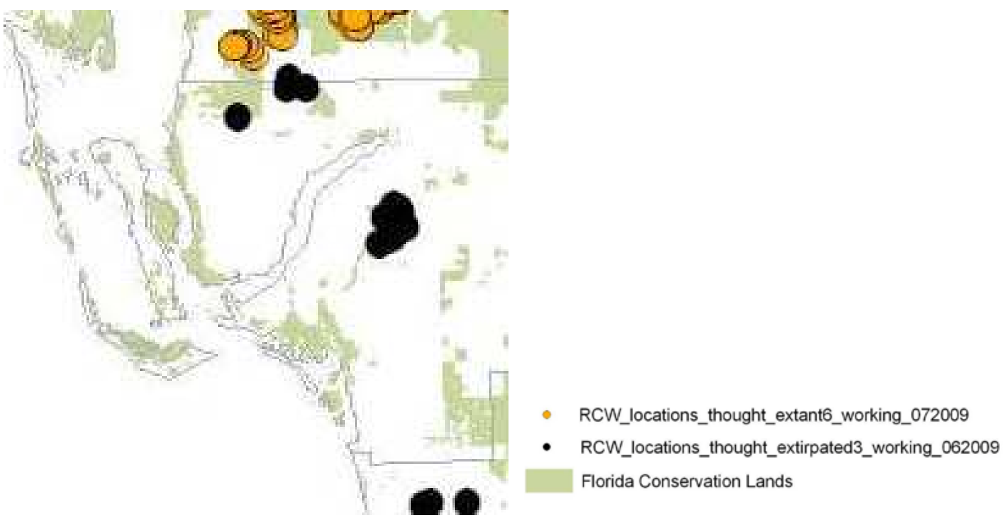
Wildlife

Factor: Red-Cockaded Woodpecker Presence

Measure: Number of Red-Cockaded Woodpecker Family Groups
Time Frame: 1991-2013
Data Source: FWC
Level of Change: -100% in EBABM area
Meeting Recovery? No

Significant loss of red cockaded woodpecker families and individuals have occurred in south and central Florida within the past twenty-three years from catastrophic natural events (Hurricane Andrew), loss of foraging and nesting habitat to exotic invaders such as melaleuca and Brazilian pepper, direct violation takes, hydrologic change and land conversion from pine flatwoods to residential and agricultural landscapes lacking pines. This includes the apparent local extirpation of the red-cockaded woodpecker from in Lee County, 37% loss in Collier County west of the Big Cypress National Preserve, apparent local extinction from Sarasota, Manatee, Hillsborough, northern Hendry, and perhaps Hardee Counties in the last fifteen years. The average loss of clusters in the Southwest Florida Regional Planning Council Area on private lands in the past fifteen years is 44%.

2013	X																				
% Change	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90
Negative								Neutral								Positive					



Factor: Bald Eagle Nesting

Measure: Number of Successful Bald Eagle Nests
Time Frame: 1995-2013
Data Source: FWC
Level of Change: - 22% in EBABM area
Meeting Recovery? Yes according to FWC

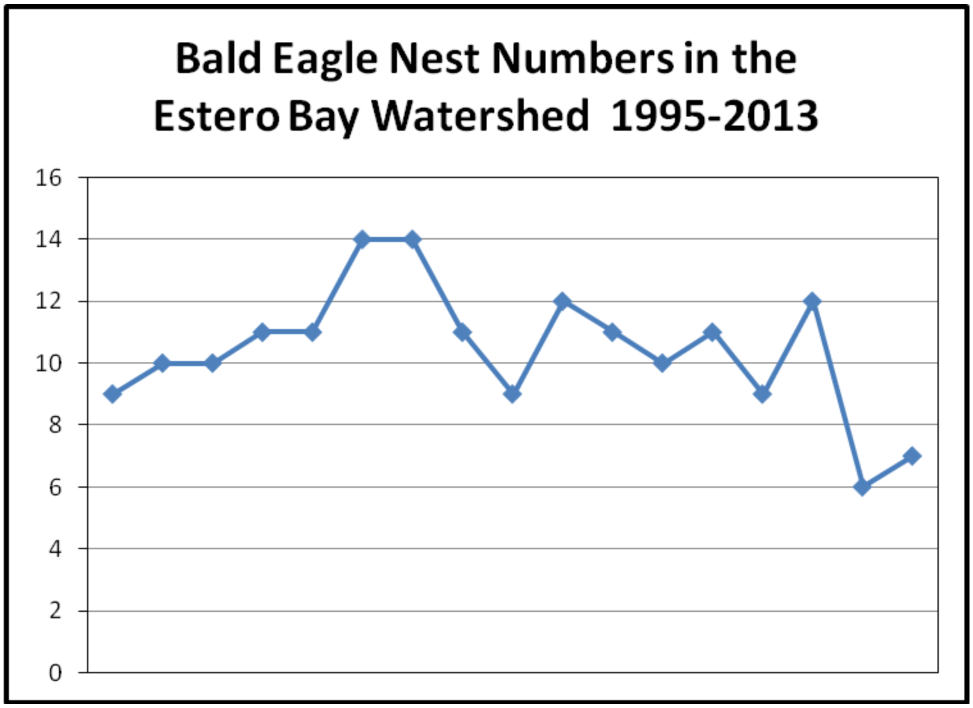
Changes in the nesting success of bald eagles have occurred in the Estero Bay Basin in response to land use changes and shifts in food resources. In 1995 there were nine bald eagle nests in the basin. By 1999 there were 11. In 2009, there were 12. The number of known nests has ranged from a low of six in 2012 to a peak of 14 in 2000 and 2001. In general, nests in interior locations depending on freshwater wetlands were less productive in fledging young than coastal nests. There is a 42% decline in active nesting territories occurring in the period since the last State of the Bay report in 2009.Since 2009, four new nest territories were established in the Estero Bay Basin but 8 have been lost. In the 1995 to 2013 time frame there is a 22% loss of nesting territories.

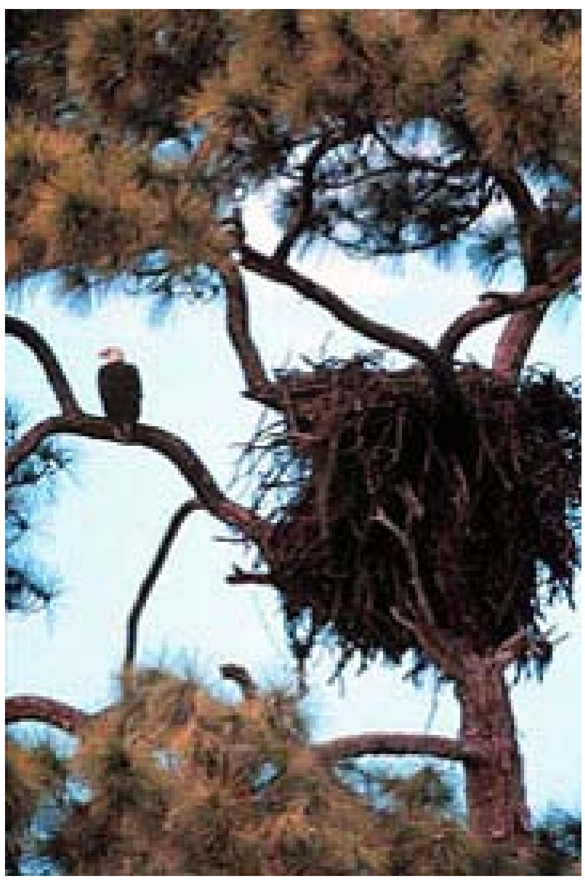
In 2008, the statewide bald eagle nesting territory survey protocol changed. The protocol change reduces annual statewide survey effort and increases the amount of information gained from the nests that are visited during the survey season. Because of the sampling change data for 2010 and 2011 were not collected. Nest productivity is now determined for a sub-sample of the nests that are surveyed annually. Nest activity and productivity information are critical to determining if the goals and objectives of the Bald Eagle Management Plan are being met.

The information contained within the FWC database is current through the 2012-2013 nesting season; nests were surveyed by FWC from November 2012 to April 2013. Accuracy of the nest locations is estimated to be within 0.1 miles of the true location. Not all eagle nests in Florida have been documented by FWC. Non-documented nests receive the same level of protections as FWC documented nests.

Year	Number of Nests	Success Rate
1995	9	5 (55%)
1996	10	6 (60%)
1997	10	4 (40%)
1998	11	7 (64 %)
1999	11	6 (55 %)
2000	14	?
2001	14	10(71%)
2002	11	2(18%)
2003	9	2(22%)
2004	12	6(50%)
2005	11	?
2006	10	7(70%)
2007	11	4(37%)
2008	9	6(67%)
2009	12	5(42%)
2012	6	?

2013	7	


Bald Eagle Nest Numbers in the Estero Bay Watershed 1995-2013
16
14
12
10
8
6
4
2
0



Factor: Florida Scrub Jay Nesting

Measure: Number of Successful Florida Scrub Jay Nests
Time Frame: 1995-2009
Data Source: FWC
Level of Change: -100% in EBABM area
Meeting Recovery? No

The Florida scrub jay became locally extinct in the Estero Bay Basin in the mid-1990's. At least one and perhaps two families of Florida scrub jays were found on the Chapel Ridge scrub system. Presence was confirmed during surveys by Estero Bay Aquatic Preserve biologists in 1989. The nest territories were within the proposed acquisition area (at that time) for the Estero Bay Buffer Preserve CARL project. During site reviews for the development project now known as West Bay Club these jay families were no longer present. The last confirmed siting was in 1994. Unless a translocation is performed to some public land with improved scrub management there is no reasonable expectation that the Florida scrub jay will return to the Estero Bay Watershed. Since it is locally extinct future Estero Bay State of the Bay reviews will not include this species in the evaluation

Year	Number of Nests	Success Rate
1989	2	2 (100%)
1993	1	unknown
1995	0	0
1999	0	0
2001	0	0
2009	0	0
2013	0	0


Photo by: Joe Vidulich

Factor: Gopher Tortoise Habitat

Measure: Acres of gopher tortoise habitat impacted
Time Frame: 1999-2009
Data Source: FWC?
Level of Change: -4% in EBABM area by 1999 to 2003
Meeting Recovery? No

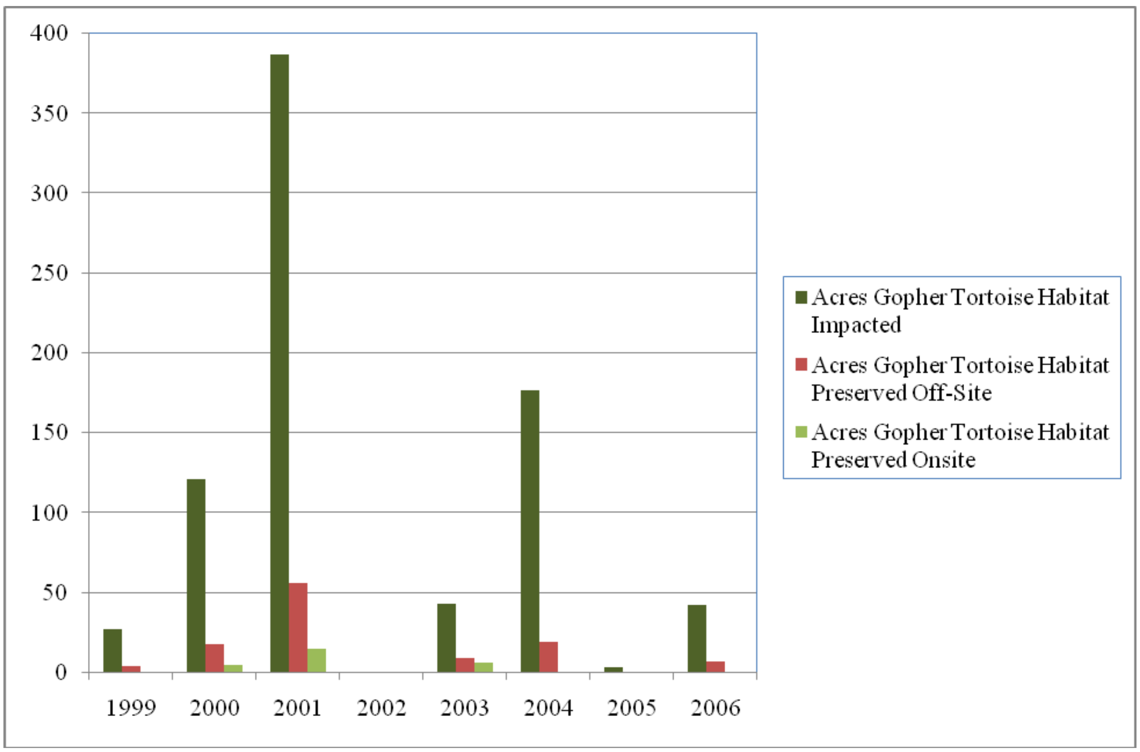
The gopher tortoise utilizes dry, well-drained soils with areas of open herbaceous understory (Auffenberg 1978), including Unimproved Pastures (212), Woodland Pastures (213), Herbaceous (310), Shrub and Brushland (320), Palmetto Prairies (321), Coastal Scrub (322), Other Shrubs and Brush (329), Mixed Rangeland (330), Coniferous Forests (410), Pine Flatwoods (411),Longleaf - Xeric Oak (412), Sand Pine Scrub (413), Pine- Mesic Oak (414), Longleaf - Upland Oak (415), Other Pine (419), Upland Hardwood Forests (420), Xeric Oak (421), Brazilian Pepper (422), Oak - Pine - Hickory (423), Melaleuca (424), Temperate Hardwood Hammock(425), Tropical Hardwood Hammock (426), Live Oak Hammock (427), Cabbage Palm (428),Wax Myrtle - Willow (429), Beech - Magnolia (431), Sand Live Oak (432), Western Everglades Hardwoods (433), Hardwood - Conifer Mixed (434), Dead Trees (435), Australian Pines (437),Mixed Hardwoods (438), Other Hardwoods (439), Tree Plantations (440), Coniferous Tree Plantations (441), Hardwood (442), Forest Regeneration Area (443), Experimental Tree Plots(444), Seed Plantation (445), Beaches Other Than Swimming Beaches (710), Sand Other Than Beaches (720), Disturbed Lands (740), Rural Land in Transition Without Positive Indicators of Intended Activity (741), Borrow Areas (742), Spoil Areas (743), Fill Areas (744), and Burned Areas (745). In the year 2003, based upon FWC land cover mapping there was 40,198 acres of potential gopher tortoise habitat in the Estero Bay Watershed. Numbers in parentheses refer to FLUCCS codes.

In most of south Florida, perennially dry habitats exist as islands surrounded by a reticulation of hydric habitats. The gopher tortoise forages in both the upland and the adjacent hydric habitats when water levels recede and throughout the dry-season. The gopher tortoises that utilize natural hydric habitats construct dry-season burrows in hydric habitats, and wet-season burrows in dry, upland ridge islands. In drained Hydric Pine Flatwoods (624), gopher tortoises construct dry season burrows in the upper portions of the flatwoods.

During development review in the Estero Bay Basin, Lee County requires listed species surveys. These surveys reveal the presence of gopher tortoises and generate a measure of gopher tortoise habitat. In the course of conservation land acquisition and large scale land development, some areas are set aside as gopher tortoise habitat.


Gopher tortoise

Date	Acres Gopher Tortoise Habitat Impacted	Acres Gopher Tortoise Habitat Preserved Off-Site	Acres Gopher Tortoise Habitat Preserved Onsite	Net Gopher Tortoise Habitat Lost	Total Project Impact
1999	27	4	0	23	76
2000	121	18	5	98	436
2001	387	56	15	316	1,108
2002	0	0	0	0	0
2003	43	9	6	28	88
2004	177	19	0	158	531
2005	3	0	0	3	3
2006	42	7	0	35	1,173
8-year total	**800**	**113**	**26**	**661**	**3,415**



The table and graph display the gopher tortoise incidental take permit activity for the Estero Bay Basin from 1999 through 2006. This does not include habitat losses accrued where off-site relocation or less-than-five on-site relocation permitting occurred. The effective mitigation ratio for the five year period was 1 acre of habitat preserved for every 5 acres impacted. Not all offsite mitigation occurs in the Estero Bay basin. A substantial part of this mitigation occurred at the Hickey Creek Gopher Tortoise Mitigation Park in the Caloosahatchee River basin.

Beginning in the year 2007 incidental take permits stopped and gopher tortoises in th path of development are now addressed principally with relocation permits. The following is the listing of gopher tortoise relocations for the Estero Bay watershed.

Year	Number of gopher tortoises relocated in the Estero Bay Watershed	GT acres impacted per year
2009	19	88.73
2010	2	9.63
2011	23	18.05
2012	15	102.32
2013	15	81.88
2014	42	74.32

Source FWC 2014

Factor: Wading Bird and Brown Pelican Rookeries

Time Frame: 1986-1999/2008-2009-2013
Data Source: FWC and FDEP
Level of Change: + 47% in rookery number and 133% in total nest number
Meeting Recovery? Not Yet

Wading birds are an important indicator species for the health of the estuaries since they feed at such a high trophic level. Their indicator species status and dramatic decline since the 1930s makes their protection a necessity. Surveying and documenting trends in wading bird populations will help document the preservation of biodiversity in Estero Bay Aquatic Preserve.

Changes in the nesting success of wading birds and brown pelicans have occurred in the Estero Bay Basin in response to land use changes, altered hydrology, and shifts in food resources. In a preliminary survey of Estero Bay's coastal and estuarine resources, conducted in 1971, Tabb et al. indicated, "The abundance of brown pelicans is of particular note. Approximately 120 were recorded on a single island location in Estero Bay between Julie's Island and Coon Key." In 1977, brown pelican surveys were initiated in Estero Bay and continued through 1982. The surveys were expanded in 1983 to include all wading and diving birds and continued through 1989. In 1986 there were nine wading bird or brown pelican rookeries in the basin. Surveys conducted in May of 1997 and 1998 only documented brown pelican nesting activity. By 1999 there were six. Rookeries were lost from interior locations depending on freshwater wetlands. In 1998, 2001, and 2007 surveys of all wading and diving bird nests were conducted during April. Monthly nest counts were initiated in 2008 and have continued thereafter to capture true nesting peaks, as well as the full extent of the nesting season. There has been a significant increase in estuarine rookeries record in the FDEP monitoring of 2008/2009. A total of 16 potential rookery sites exist and in 2009 14 of these were active. By 2013 there were 17 rookeries active.

Surveys between 2009 and 2013 were conducted once, mid-month throughout the nesting season. Each year, surveys were initiated when birds were observed carrying nesting materials and concluded when all chicks had fledged. Perimeter surveys were conducted by boat using a direct count method. Islands were surveyed at a distance of 30 to 45 meters by two observers; nests were documented by species and nesting stage. The primary observer, an aquatic preserve staff member, was consistent throughout the study period, and trained volunteers conducted secondary observer counts. The average of the two observers' counts was reported. Species monitored include: double-crested cormorant (DCCO), brown pelican (BRPE), great blue heron (GBHE), great egret (GREG), snowy egret (SNEG), little blue heron (LBHE), tricolor heron (TRHE), reddish egret (REEG), anhinga (ANHI), black-crowned night heron (BCNH), yellow-crowned night heron (YCNH), green heron (GRHE), and cattle egret (CAEG).

The presence/absence of fishing line was documented monthly on nesting islands. Line was removed by staff and volunteers whenever it could be done without disturbing nesting activities. The length of the line removed and number of hooks were documented. Birds found entangled in fishing line were recorded by their species and taken to a wildlife rehabilitation facility if they were still living when documented.

Historic survey (1977 - 1982) methodology was outlined by Clark and Leary (2013), which analyzed Estero Bay Aquatic Preserve data from 1977-2011.

A qualitative trend analysis was performed using a simple linear regression to compute a rate of change over time (i.e. slope) in an effort to estimate nesting trends between 2009 and 2013. Due to the low sample size, no formal statistical test was performed with the linear regression. Comparison of brown pelican peak nest counts between historic (1977-1982) and modern (2009-2013) time periods were conducted using the Wilcoxon rank sum test, since data were not normally distributed. All statistical analyses were performed using Excel 2013 (Version 15.0, Microsoft, Santa Rosa, CA, USA), R (R version 3.1.1, The R Foundation for Statistical Computing) and JMP (Version 10.0.0, SAS, Cary, NC, USA).

Peak nest counts over the five year period showed an increasing trend in nesting activity for brown pelican, snowy egret, little blue heron, tricolored heron, reddish egret, yellow-crowned night heron, and green heron. Double-crested cormorant, great blue heron, great egret, and black-crowned night heron showed a decreasing trend in nesting effort. For this time period, overall nesting effort in Estero Bay showed a slight decline (Figure 1).

Between 1977 and 2008, nesting was documented on 21 islands within Estero Bay with the number of islands surveyed increasing annually as new colonies were formed and documented; inactive islands continue to be monitored. Between 2009 and 2013, the number of active islands ranged annually from 14 (2009) to 17 (2012 and 2013), and the total nest counts ranged between 352 (2011) and 439 (2009) (Table 1) with an average nest count on 406 for this time period.

A comparison of April historic (1998 and 2001) to modern (2009-2013) nests counts show an increase in double-crested cormorant, great blue heron, yellow-crowned night heron, and green heron nesting efforts, while all other species showed a decrease in nesting effort (Table 2).

Brown pelican nesting was documented on four islands in 2009 and three islands from 2010 to 2013. Over the five year time period, recorded nesting efforts were greatest in 2013 (n=110) and lowest in 2010 (n=77). Overall, nesting data showed an increasing trend in nesting activity with an average annual increase of 1.5 nests.

Comparison of historic and modern brown pelican nest counts conducted during the month of May showed a significant downward shift in nesting ($p<0.01$). Mean May nest count for historic surveys were 171 ($\pm$28.58 SD) versus 70.6 ($\pm$16.58 SD) for modern surveys (Figure 2), showing a decrease of 58.7 percent from the historic to the modern survey period.

Fishing line fatalities on nesting islands in Estero Bay averaged 21 birds annually during this five year period with a total of 106 fatalities documented (Figure 3). Three entangled BRPE were rescued and released during this time.

Peak nest counts are calculated by using the highest nest count for each species at each of the colonies and adding them to obtain the total peak nest count for the season. Peak nest counts may exclude nests that are not occupied during the peak of the nesting season and therefore may underestimate nesting when nesting seasons are spread out. Monthly nest surveys used to calculate peak nest counts may provide a more accurate representation of the nesting population than annual surveys, since peak nesting time for individual species may vary from year to year. Shifts in nesting time may represent shifts in food availability (Keith, 1978; North American Bird Conservation Initiative, U.S. Committee, 2010) or shifts in age composition of the population since younger birds tend to nest later in the season (Perrins, 1970).

The qualitative assessment of species nesting trends in Estero Bay showed increased nesting for seven out of 11 species, however the short length of time (~5 years) precluded rigorous quantitative assessment. Most species of colonial waterbirds are long-lived and decades of data are needed for analysis (Steinkamp et al., 2003). Continued monitoring over the next five years using consistent survey methods will allow for a more comprehensive evaluation of nesting trends in colonial waterbirds over time in Estero Bay. Additionally, due to the complex annual cycles and wide geographic ranges of some species of colonial waterbirds (Kushlan, 1993), regional coordination is imperative for the protection of these species. Combing data from Estero Bay with data collected by Charlotte Harbor Aquatic Preserves and J.N. “Ding” Darling National Wildlife Refuge, who currently use the same survey techniques, will provide a larger geographical scale to evaluate trends in the future.

Brown pelican nest counts during the month of May have remained stable the past three years; 2011 (n=82), 2012 (n=82), 2013 (n=84). However, they are still not at historic levels. Results from this analysis of brown pelican data in Estero Bay is similar to Clark and Leary’s (2013) OLS regression which showed a mean decrease of 56.9 percent for brown pelican nests during the month of May from 1977-2011.

Brown pelican nesting efforts have centered on three islands in Estero Bay: Matanzas Island, Coconut Point West, and Big Carlos W of M-52. Critical Wildlife Area designation or an alternative method of enforcement of marked buffer zones around brown pelican nesting colonies in Estero Bay is necessary to protecting the species from human disturbance and fishing line entanglement. Over 50 percent of the fishing line fatalities recorded on nesting islands in Estero Bay are of brown pelican.

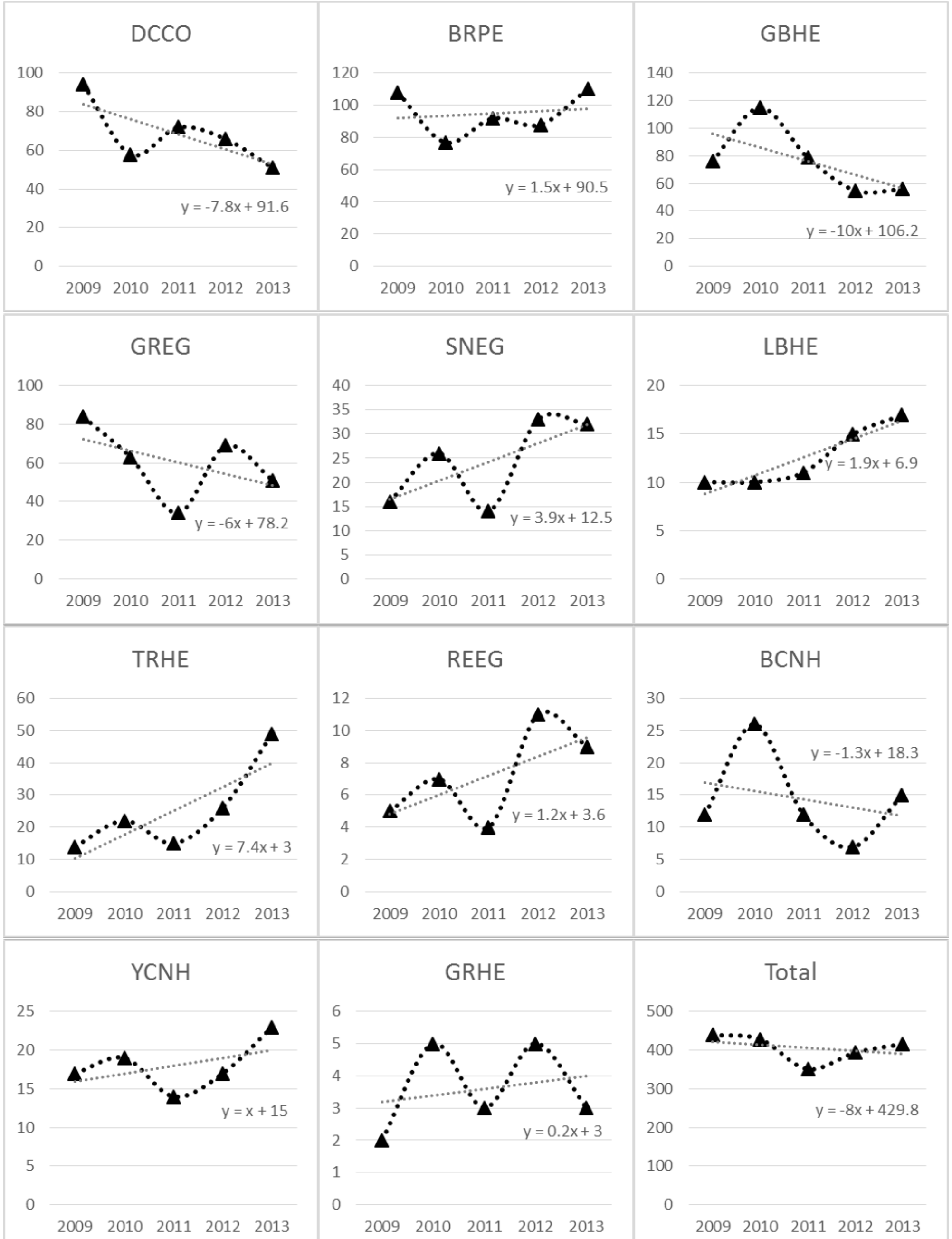


Figure 1: Linear regression of peak nest counts conducted in Estero Bay between 2009 and 2013, by species. Total nest counts include ANHI and CAEG which were not graphed separately due to small sample size.

Table 1: Peak nest counts, by species, for surveys conducted in Estero Bay from 2009 to 2013.

Year	Months	DCCO	ANHI	BRPE	GBHE	GREG	SNEG	LBHE	TRHE	REEG	CAEG	BCNH	YCNH	GRHE	Total
2009	Feb - Aug	94	1	108	76	84	16	10	14	5	0	12	17	2	439
2010	Feb - Aug	58	0	77	115	63	26	10	22	7	0	26	19	5	428
2011	Jan - Aug	72	0	92	79	34	14	11	15	4	2	12	14	3	352
2012	Jan - Dec	66	0	88	55	69	33	15	26	11	2	7	17	5	394
2013	Jan - Dec	51	0	110	56	51	32	17	49	9	0	15	23	3	416

Table 2: Mean nest count, standard error, and percent mean difference, by species, for April historic surveys (1998 and 2001) and modern surveys (2009–2013). For the historic period, standard error that is null indicates that nest counts for that species only occurred in one of the two years, and SE that is equivalent to its respective mean results from a species that had a positive nest count in one year and a count of zero in the other.

	Historic Surveys		Modern Surveys		
	Mean	Std. Error	Mean	Std. Error	Percent Difference
DCCO	27	4	36	5	33
ANHI	5	1	0	0	-100
BRPE	158	32	77	11	-51
GBHE	24	12	45	7	91
GREG	35	20	1	0	-97
SNEG	46	39	9	3	-80
LBHE	6	–	4	1	-33
TRHE	95	–	3	1	-97
REEG	9	–	2	1	-78
CAEG	50	50	0	0	-100
BCNH	7	7	4	0	-38
YCNH	3	3	8	0	220
GRHE	0	0	1	3	–

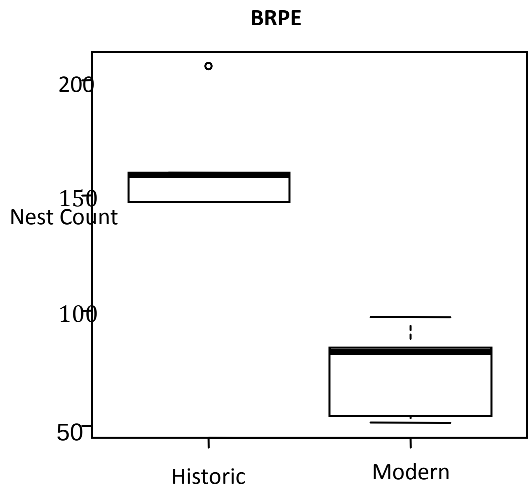


Figure 2: The distribution of May nest counts for brown pelicans shifted downward from historic to modern surveys (p<0.01). Mean nest count for brown pelicans during the month of May for historic surveys was 171 (+28.58 SD) versus 70.6 (+16.58 SD) for modern surveys.

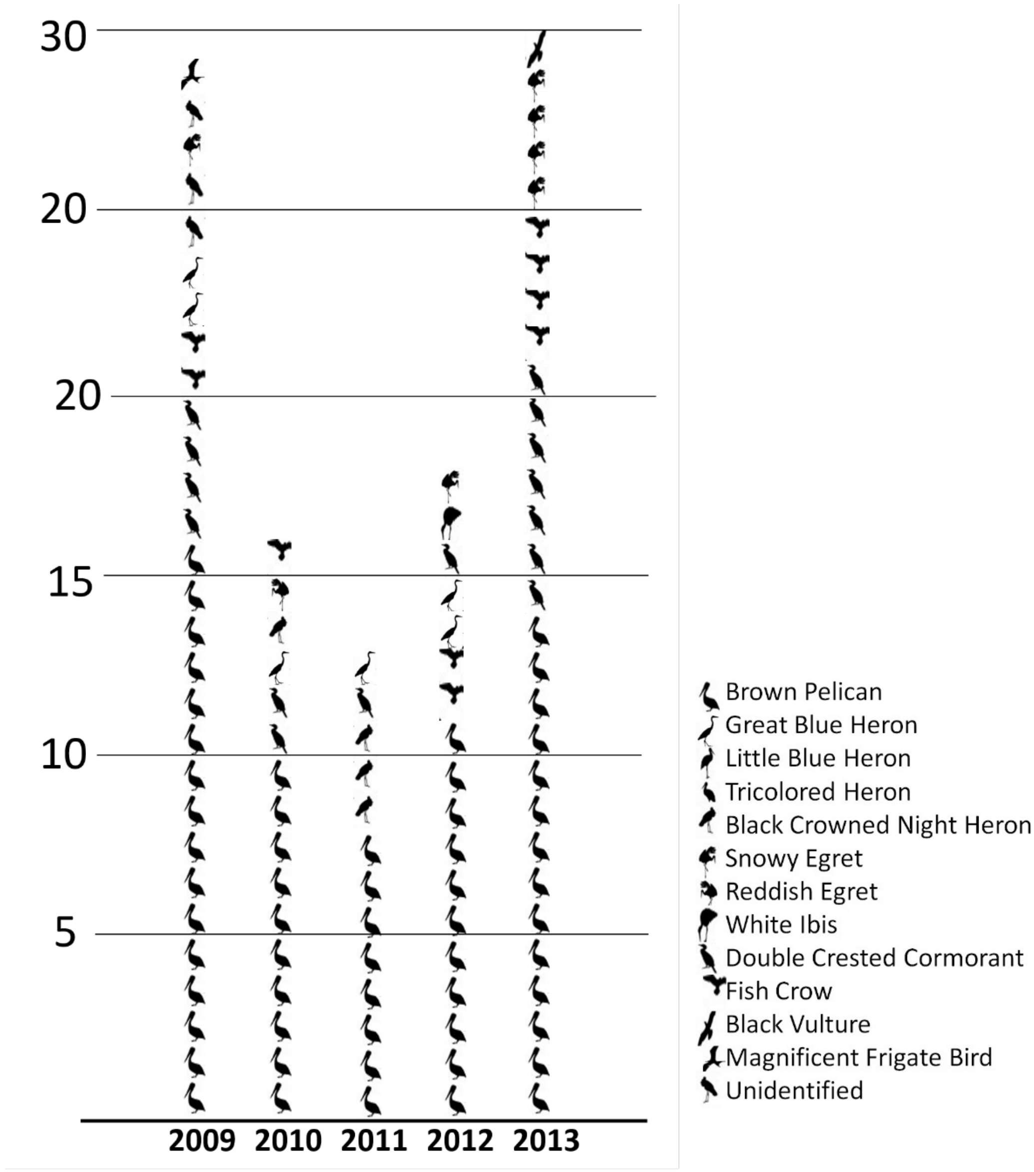


Figure 3: Bird mortality due to fishing line entanglement by species on nesting islands in Estero Bay Aquatic Preserve from 2008 to 2013.

Factor: Amphibians

The worldwide decline in amphibians is a phenomenon that is poorly understood and may have significant implications for entire ecosystems. Amphibians have been identified as important indicators of ecosystem health due to their physiology and diversity of ecological requirements. The planetary decline in many species of amphibians has resulted in an increased level of research into their life histories. Scientists and conservation organizations all over the world have initiated monitoring projects to document the status of amphibian populations and to gain insight into why some species are declining. In Southwest Florida very little information exists on amphibian diversity, distribution, abundance and ecology. This is unfortunate since this region is experiencing rapid land development that has led to significant loss of wetland communities on which amphibians depend. All but two species of amphibians in Southwest Florida are considered indicators of hydrologic change because they are dependent on water or wetland habitats for successful reproduction.


Eastern narrowmouth toad (*Gastrophryne carolinensis*)

The Southwest Florida Amphibian Monitoring Network represents a diverse group of citizen volunteers organized for the purpose of monitoring amphibians (mostly frogs) in southwest Florida. Early in 2000 several individuals began discussing the possibility of setting up an amphibian monitoring program in Southwest Florida based on the guidelines developed by the North American Amphibian Monitoring Program (NAAMP). Subsequently it was decided to make an effort to launch a program and on April 15, 2000 a "kick off" workshop was held at the Calusa Nature Center and Planetarium. The project was co-sponsored by the Calusa Nature Center and Planetarium, Corkscrew Regional Ecosystem Watershed, Florida Gulf Coast University and the Audubon Society of Southwest Florida and the Charlotte Harbor National Estuary Program.


Florida cricket frog (*Acris gryllus dorsalis*)

The basic approach is to establish a route with 12 predetermined "stops" along a roadway. Volunteers monitor the "stops" at designated dates by listening for the frogs that are calling at each "stop". The information is sent to the network coordinator who summarizes the information from all routes and shares it with the NAAMP.

During 2000, eight routes were monitored on four dates during June, July, August and September. A total of 17 frog species were recorded during this period in Lee and Charlotte County.

An analysis of population trends from 2000 to 2004 was performed on the first five years of data and was presented at the CHNEP Charlotte Harbor Watershed Summit in 2005 and published in the *Florida Scientist* 69:117–126. (Both the presentation and article are available at www.CHNEP.org.) From this analysis it was determined that the calling intensity of the Cuban treefrog had increased and that there had been a shift to native frog species that require more permanent water. Permanent water habitats are less important to most anurans (frogs and toads), which have evolved to utilize ephemeral (seasonal) wetlands.

A key indicator species, the barking treefrog, appears to be declining. In 2007, seven of the nine occurrences of the barking treefrog were at just a single route near Corkscrew Swamp Sanctuary. Multiple factors including habitat loss combined with drought and declining water quality are likely responsible for this observation. The Corkscrew route is the only route representing an area with abundant wetlands that has maintained relatively stable frog diversity and abundance from 2000 to current (Southwest Florida Amphibian Monitoring Network 2008).

The Southwest Florida Amphibian Monitoring Network has started the 2010 to 2014 summary which will likely be integrated into the dataset since 2001 representing a 15 year summary. There is a great deal of data to entered so it may be several months before there is a useful summary including the last 5 years. Therefore at this time an update for the State of the Bay is not available.

Frog species observed by Frog Watch in Charlotte, Lee and Collier counties

<u>Relatively common species:</u>
Oak toad, *Bufo quercicus*
Eastern narrowmouth toad, *Gastrophryne carolinensis*
Green treefrog, *Hyla cinerea*
Florida cricket frog, *Acris gryllus dorsalis*

<u>Rare species:</u>
Florida chorus frog, *Pseudacris nigrita verrucosa*
Florida gopher frog, *Rana areolata aesopus*

<u>"Indicator" species:</u>
Barking treefrog, *Hyla gratiosa*
Pinewoods treefrog, *Hyla femoralis*

<u>Nonnative species:</u>
Greenhouse frog, *Eleutherodactylus planirostris*
Cuban treefrog, *Osteopilus septentrionalis*
Giant toad, *Bufo marinus*
Bullfrog, *Rana catesbeiana*

During 2000, 297 monitoring events (total stops among all routes times the number of dates monitored) occurred as part of the seasonal project during the months of June through September. A total of 19 individuals participated in the monitoring network resulting in the detection of 17 species of frogs (Table 1).

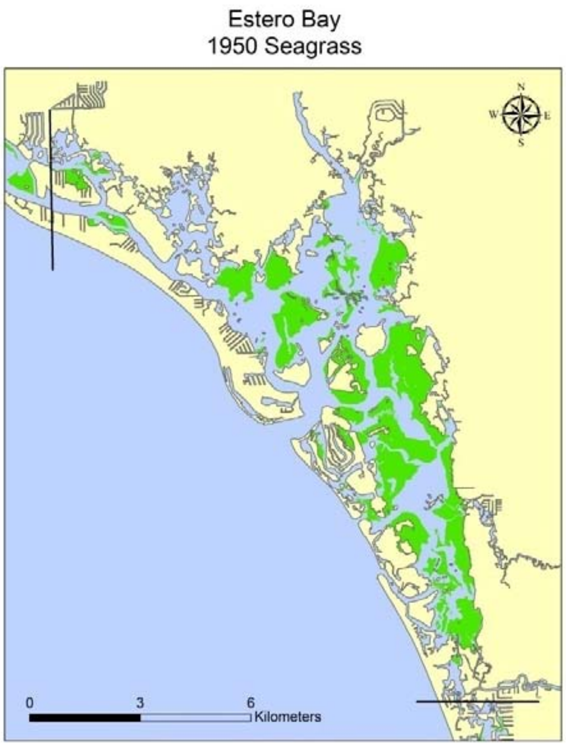
Table 1. Frog species detected and rank based on frequency of occurrence during the 2000 season. Based on 525 "detection events" (a).

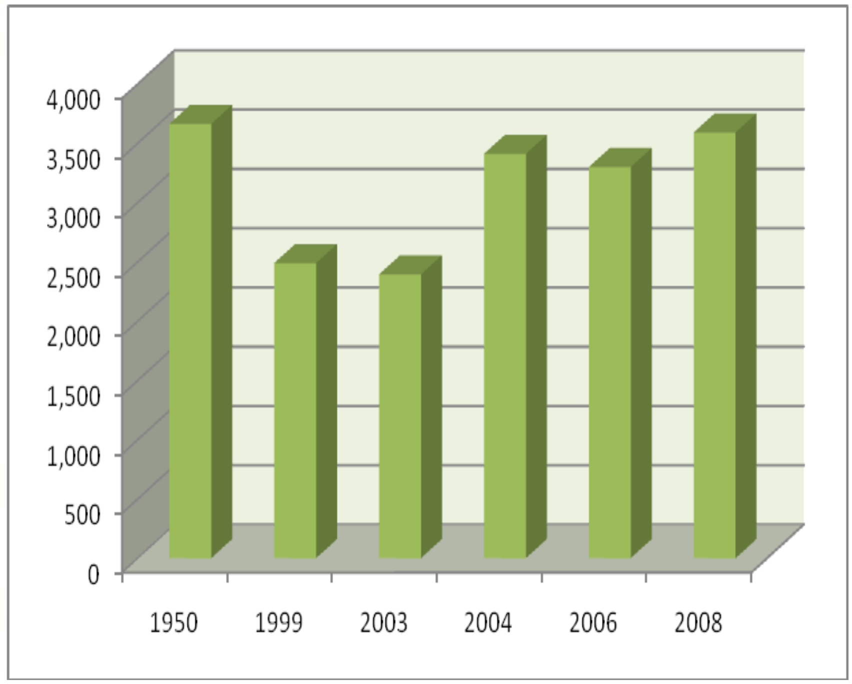
Rank	Frog Species	% Occurrence
1	Oak toad, *Bufo quericus*	17.1
2	Southern toad, *Bufo terrestris*	10.3
3	Florida cricket frog, *Pseduacris nigrita verrucosa*	9.0
4	Green treefrog, *Hyla cinerea*	8.8
5	Squirrel treefrog, *Hyla squirella*	7.6
6	Greenhouse frog, *Eleutherodactylus planirostris*	6.3
7	Narrow-mouthed toad, *Gastrophryne carolinensis*	5.7
8	Pinewoods treefrog, *Hyla femoralis*	4.8
9	Pig frog, *Rana grylio*	3.8
10	Barking treefrog, *Hyla gratiosa*	3.4
11	Cuban treefrog, *Hyla septentrionalis*	3.2
12	Florida chorus frog, *Pseduacris nigrita verrucosa*	2.9
13	Southern leopard frog, *Rana sphenocephala*	2.5
14	Little grass frog, *Limnaoedus ocularis*	0.6
15	Eastern spadefoot toad, *Scaphiopus holbrooki*	0.4
16	Bull frog, *Rana catesbeiana*	0.2
17	Giant toad, *Bufo marinus*	0.2
18	none detected	13.1

a=Any time a species was detected or not detected at any given stop or date.

Factor: Seagrass Extents

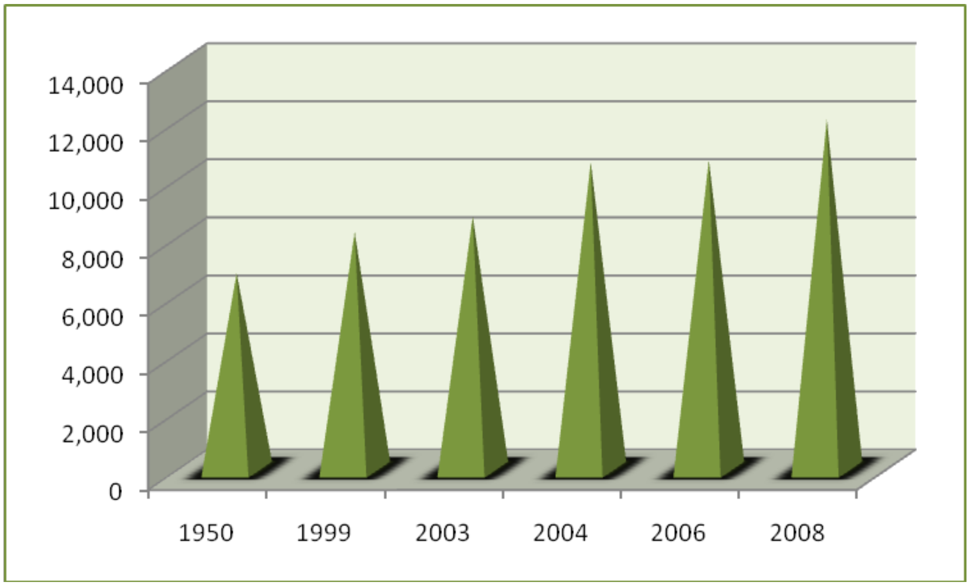
It is estimated that, in 1950, Estero Bay contained 3,769 acres of seagrasses. While seagrass acreage declined between 1950 and 1999, significant gains have been made since then. All figures and data for analysis in this section are from Janicki, Dema and Wessel (2006).





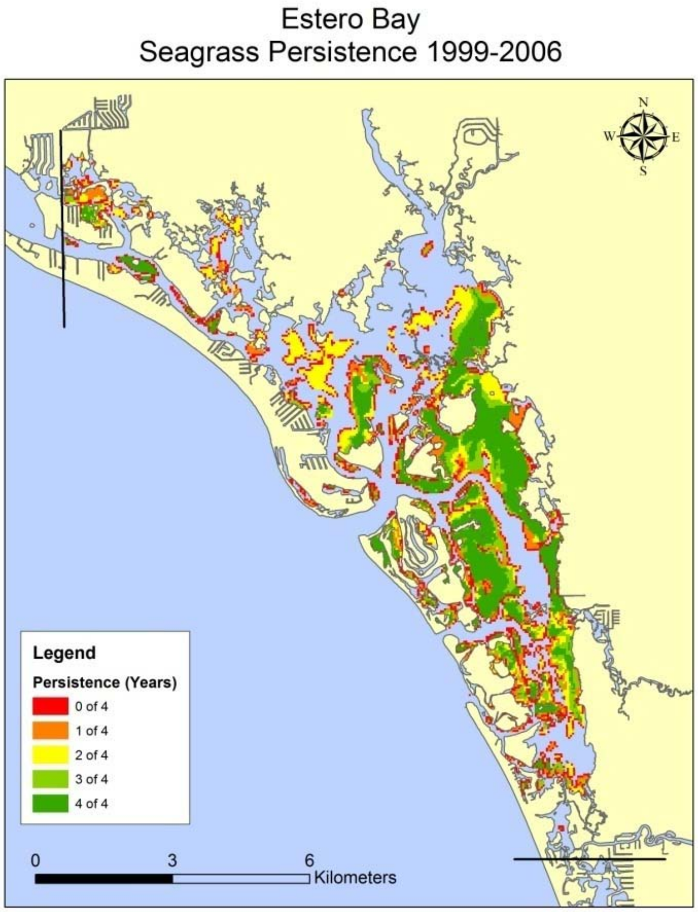
Change in Seagrass Acreages in the Estero Bay Segment of the CHNEP

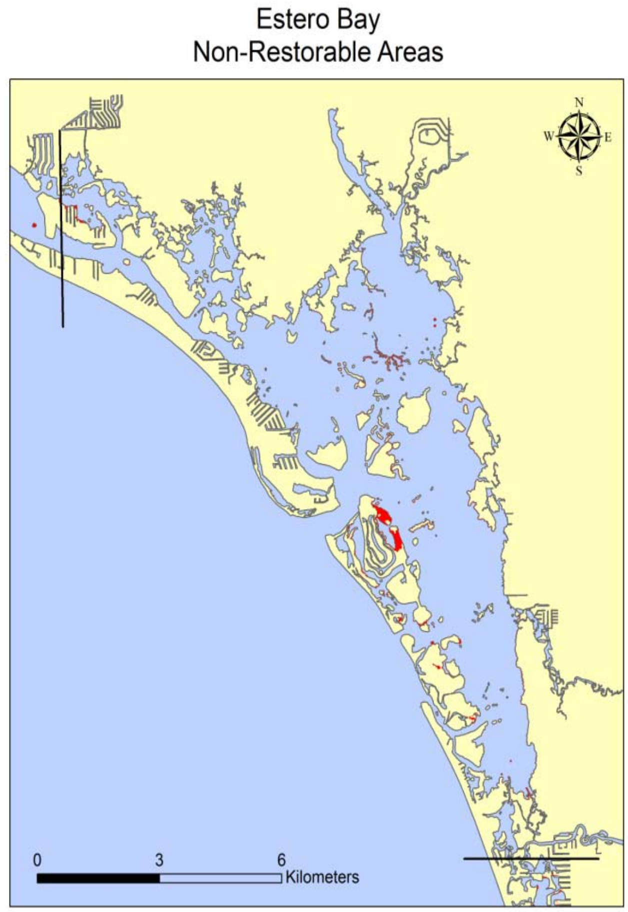
Seagrass Acreages in the Estero Bay Segments of the CHNEP						
Harbor Segment	**1950s**	**1999**	**2003**	**2004**	**2006**	**2008**
San Carlos Bay	3,118	3,709	4,338	5,192	5,376	6,469
Estero Bay	3,662	2,488	2,393	3,409	3,298	3,590
TOTAL	6,780	8,196	8,734	10,605	10,680	12,067



Change in Seagrass Acreages in the Estero Bay and San Carlos Bay Segments of the CHNEP

Persistence of seagrass has also been tracked. Persistence appears to be linked to water depth, with the most persistent areas being shallower and near-shore.





It is estimated that Estero Bay contains 107 acres of seagrasses that have been lost and are not restorable.

Baseline, non-restorable and adjusted baseline seagrass extents and potential seagrass targets (acres).

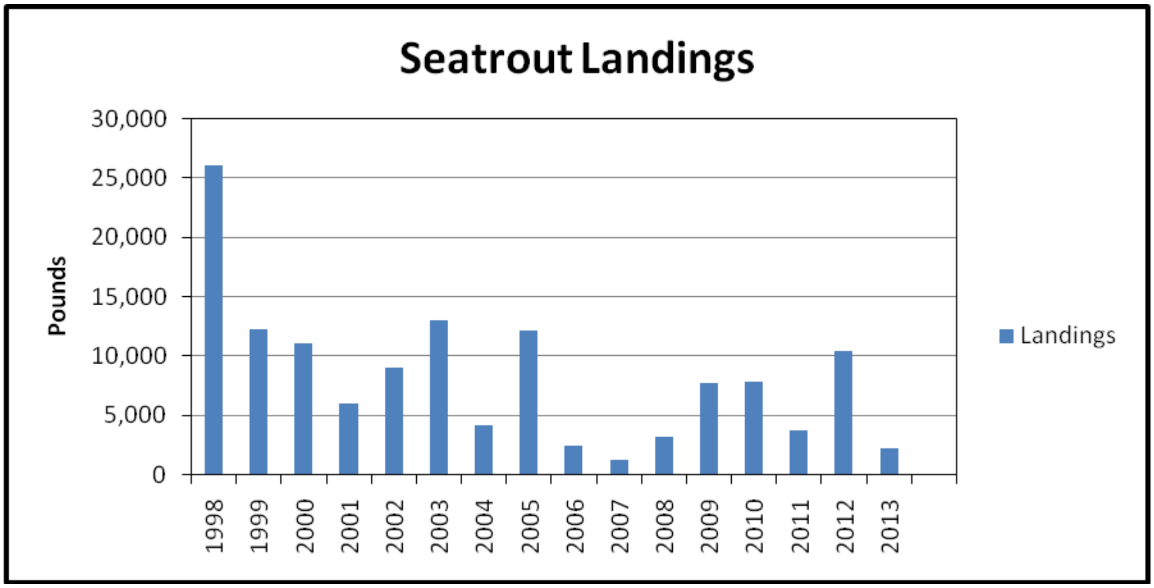
	San Carlos Bay	Estero Bay	Total CHNEP
Baseline	3,243	3,769	61,513
Non-restorable Areas	125	107	1,737
Adjusted Baseline	3,118	3,662	59,776
Maximum Annual Extent	5,376	3,409	67,415
Mean Annual Extent: all years	4,372	3,071	62,103
Mean Annual Extent: last 3 years	4,969	3,033	63,749
Most Recent Annual Extent	5,376	3,298	65,873

Factor: Landings

Data on fisheries landings for all of Lee County were collected for Spotted Sea Trout, Mullet, and Blue Crab. Pounds (landings), number of trips and landings per trip are shown below for all three species. Landings for all three species have had a downward trend for the period between 1998 and 2013. In addition, the number of successful fishing trips for the three species has similarly declined.

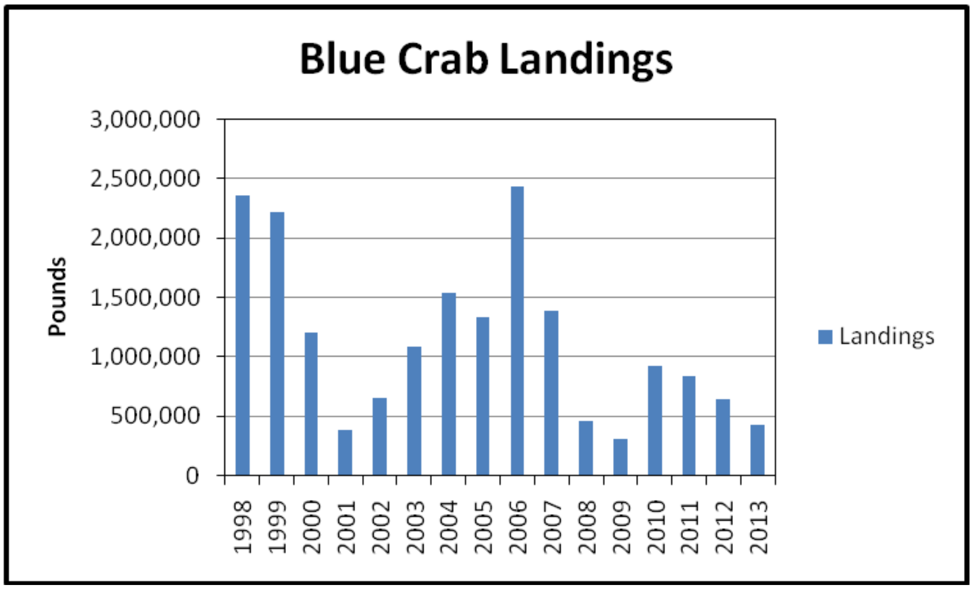
Spotted Sea Trout
1998-2013

Year	Landings	Trips	Landings/Trip
1998	26,085	949	27
1999	12,224	566	22
2000	11,054	636	17
2001	5,975	369	16
2002	8,963	358	25
2003	12,985	392	33
2004	4,120	198	21
2005	12,113	359	34
2006	2,479	149	17
2007	1,248	95	13
2008	3,166	142	22
2009	7,706	377	20
2010	7,817	282	28
2011	3,683	157	23
2012	10,435	353	30
2013	2,268	114	20
1998-2013 change	-91.31%	-87.99%	-27.62%


Seatrout Landings
30,000
25,000
20,000
15,000
10,000
5,000
0
Pounds
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
Landings

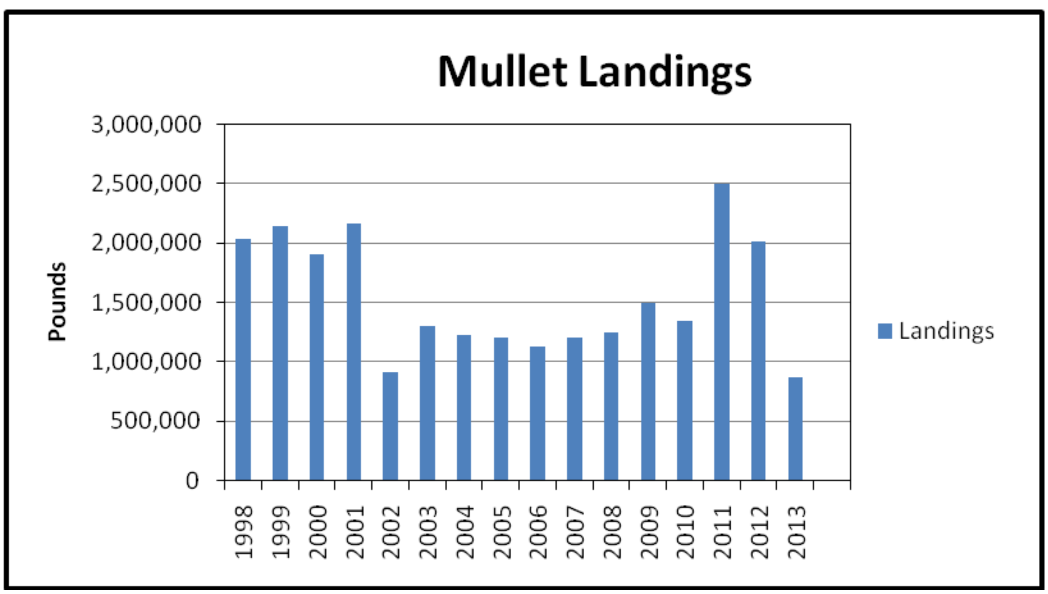
Blue Crab
1998-2013

Year	Landings	Trips	Landings/Trip
1998	2,361,740	8,889	266
1999	2,217,971	8,549	259
2000	1,205,304	6,194	195
2001	384,724	3,075	125
2002	661,615	3,914	169
2003	1,092,288	4,967	220
2004	1,547,053	4,606	336
2005	1,338,285	4,708	284
2006	2,441,143	6,343	385
2007	1,390,276	5,087	273
2008	463,839	2,879	161
2009	317974	2238	**142**
2010	932757	3910	**239**
2011	842171	3763	**224**
2012	649485	3039	**214**
2013	428421	1857	**231**
1998-2013 change	-81.86%	-79.11%	-13.17%



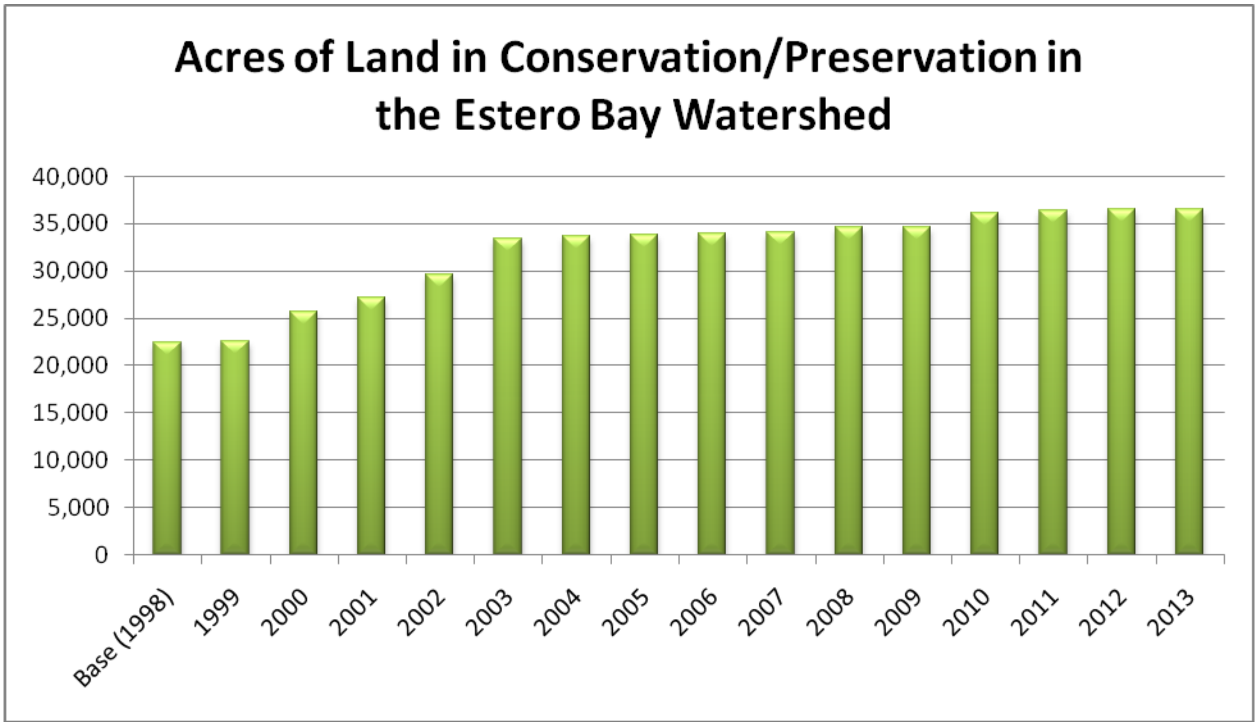
Mullet
1998-2013

Year	Landings	Trips	Landings/Trip
1998	2,035,783	6,755	301
1999	2,141,311	5,904	363
2000	1,900,655	5,586	340
2001	2,168,389	5,045	430
2002	912,046	3,118	293
2003	1,296,915	3,828	339
2004	1,229,949	4,123	298
2005	1,202,347	3,888	309
2006	1,127,618	3,669	307
2007	1,202,984	3,643	330
2008	1,247,834	3,392	368
2009	1,493,269	4,500	332
2010	1,344,186	4,113	327
2011	2,504,178	4,836	518
2012	2,014,653	4,805	419
2013	871,807	2,565	340
1998-2008 change	-57%	-62%	13%



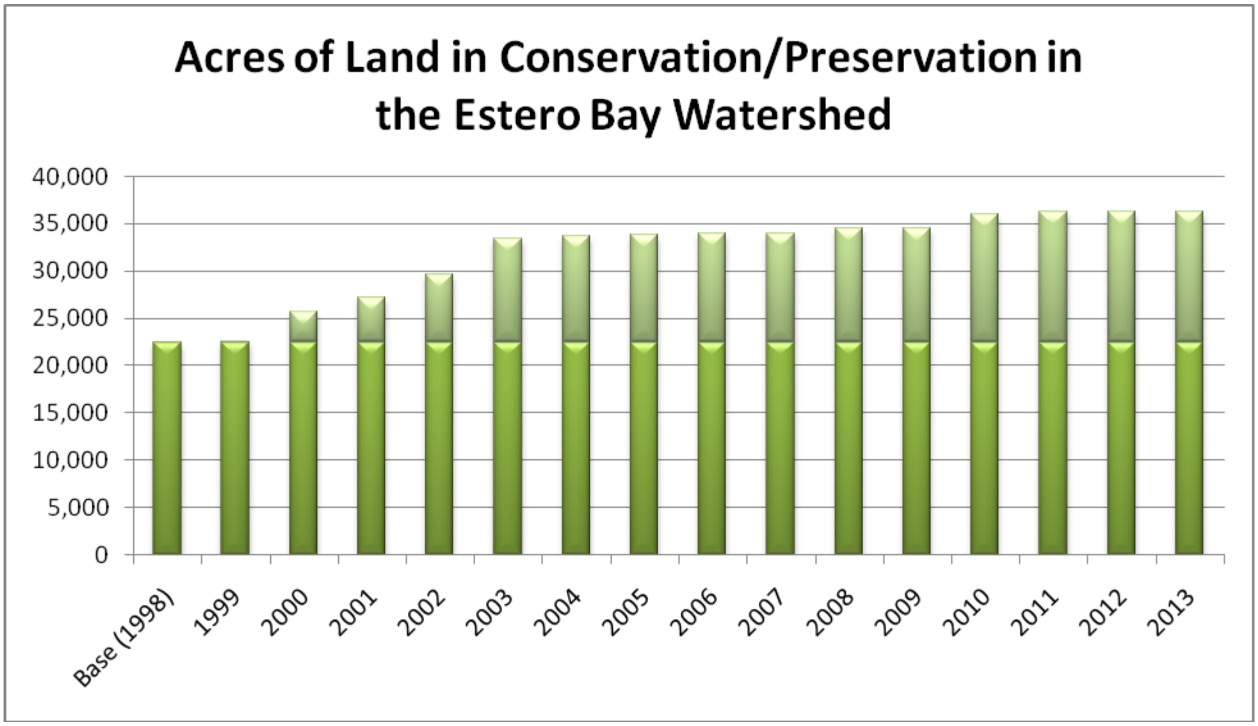
Factor: Conservation Lands Extents

It is estimated that, in 1998, the Estero Bay watershed contained 22,502 acres of conservation lands. Significant gains (66% increase) have been made since then. A plateau and decline in land acquisition progress began in 2011 an is continuing with the only significant activity coming from local government. All figures and data for analysis in this section are from CHNEP (2014).

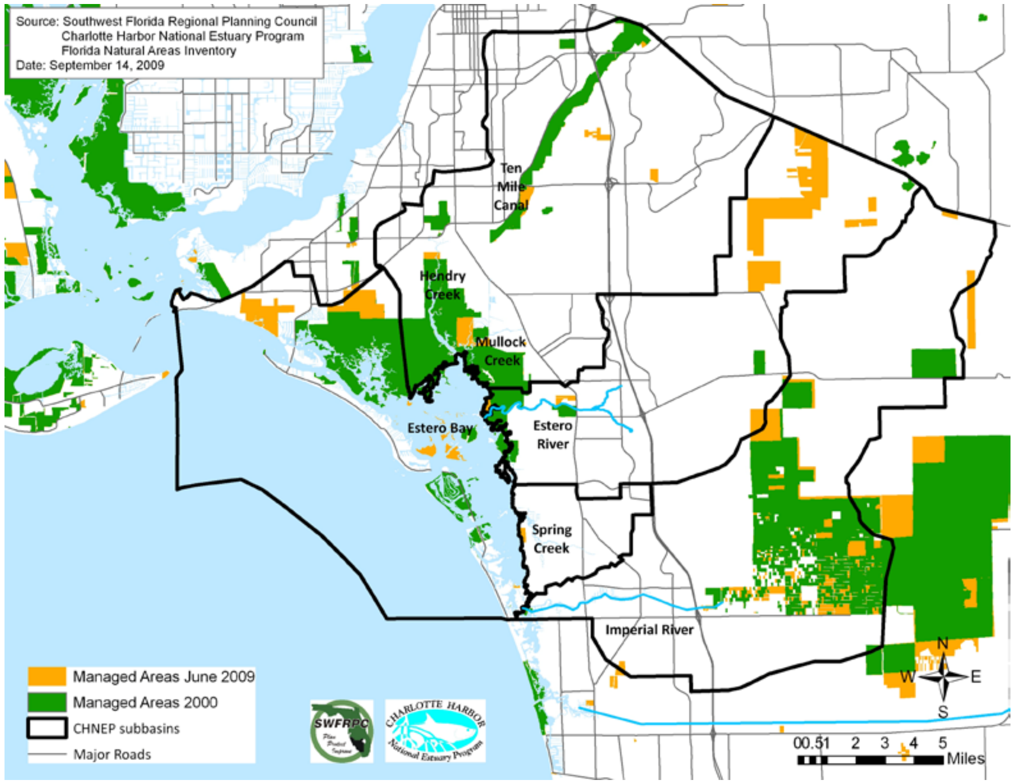


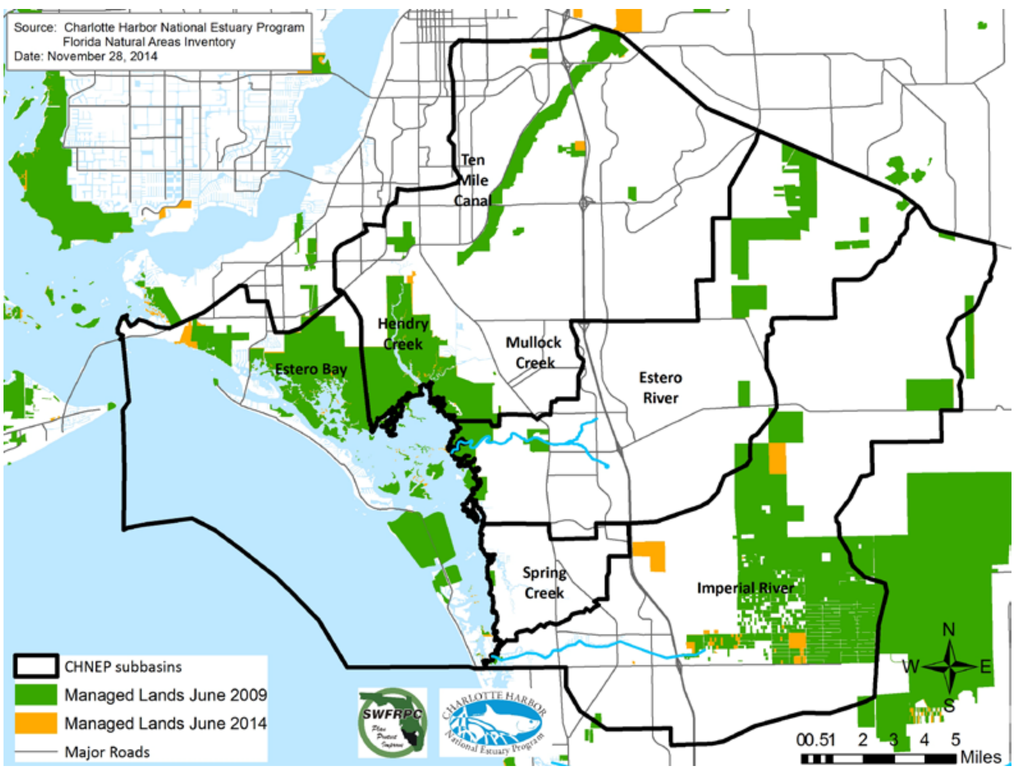
Year	Base (1998)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Acres	22,502	122	3,032	1,491	2,429	3,887	167	238	109	1,042	511

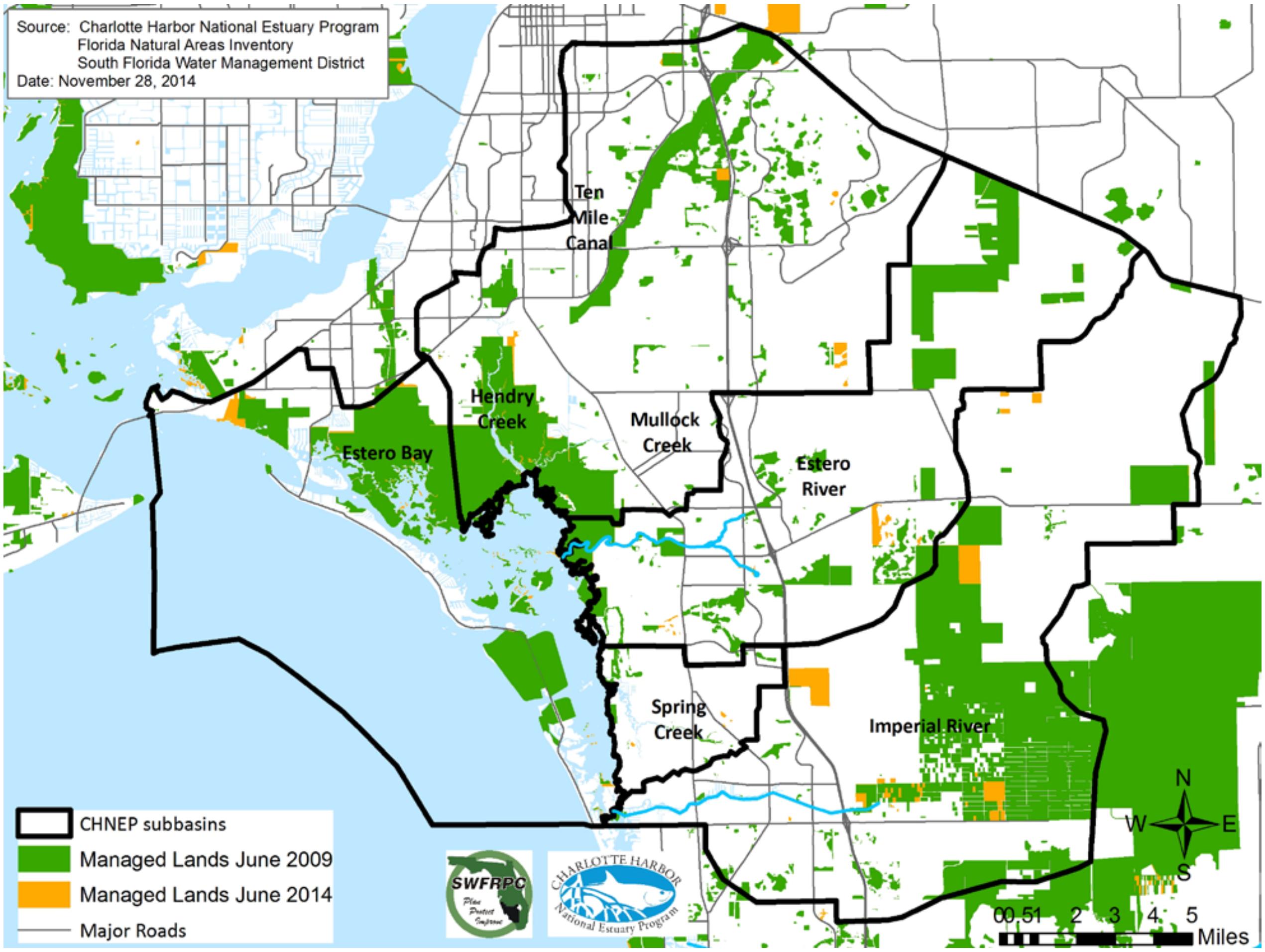
Year	2009	2010	2011	2012	2013
Acres	19	1,523	210	63	0



Original Target CCMP Acres	Total CCMP Additions in Acres	Total Acres	Percent Increase over Base
5,626 (25%)	14,851	37,353	66%


Source: Southwest Florida Regional Planning Council
Charlotte Harbor National Estuary Program
Florida Natural Areas Inventory
Date: September 14, 2009
Ten Mile Canal
Hendry Creek
Mullock Creek
Estero Bay
Estero River
Spring Creek
Imperial River
Managed Areas June 2009
Managed Areas 2000
CHNEP subbasins
Major Roads
00.51 2 3 4 5
Miles
N
W
E
S


Source: Charlotte Harbor National Estuary Program
Florida Natural Areas Inventory
Date: November 28, 2014
Ten Mile Canal
Hendry Creek
Mullock Creek
Estero Bay
Estero River
Spring Creek
Imperial River
CHNEP subbasins
Managed Lands June 2009
Managed Lands June 2014
Major Roads
00.51 2 3 4 5
Miles
N
W
E
S

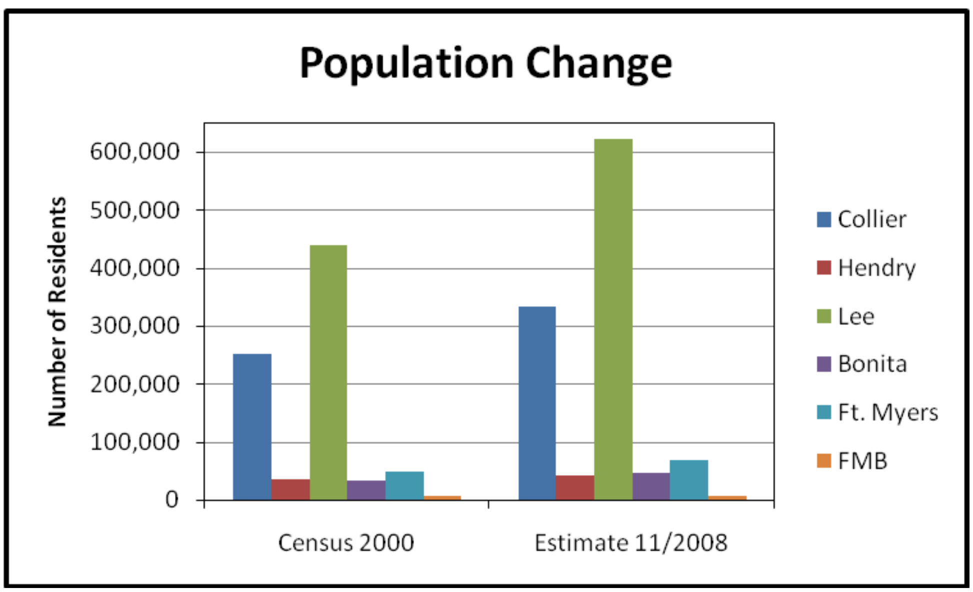


2014 Conservation Lands of the Estero Bay Watershed with Conservation Easements

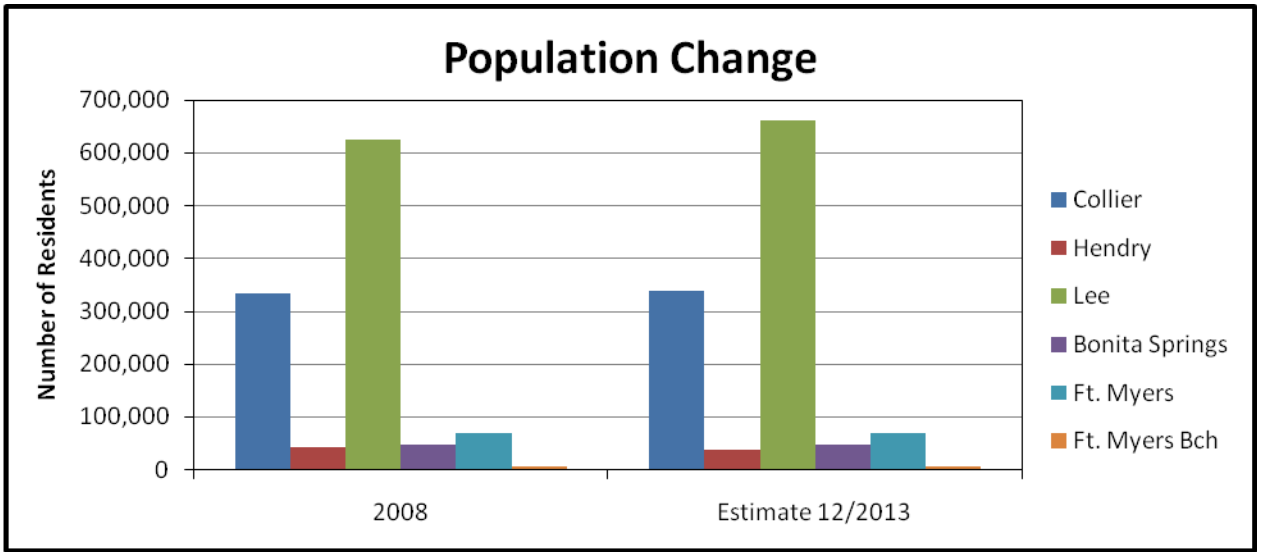
Social

Factor: Population

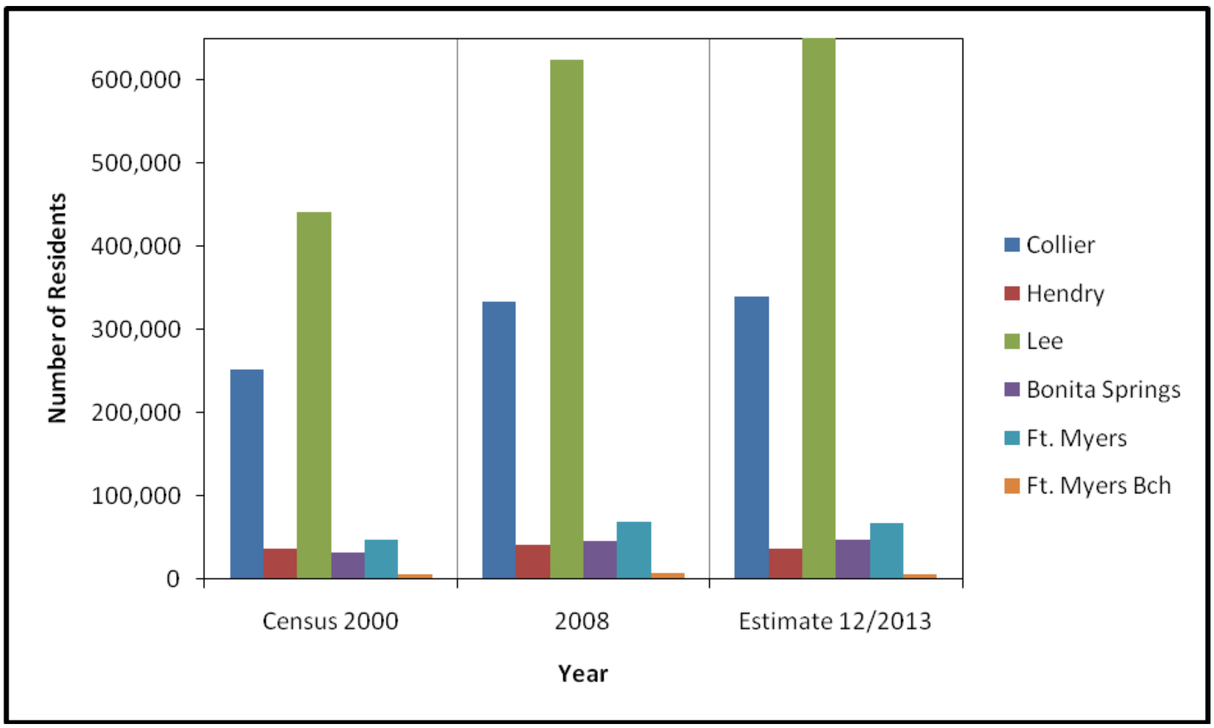
At the time of the 2000 Census, the Estero Bay Basin had nearly 145,000 people living within its boundaries. By 2010, the Estero Bay basin population had grown by a third to over 195,000. Most of the population has been concentrated around Estero Bay itself. The presence of the Estero Bay state preserve has served as a buffer, keeping development back from the edges of the bay. Since the last State of the Bay report, there have been significant changes in population and development trends, most recently with a slight decline in population in Hendry County, Fort Myers, and Fort Myers Beach occurring as a result of the economic downturn of 2008-2009. In contrast Collier County, Lee County, and Bonita Springs continued to grow in population at a lower rate. The figures below reflect population in the counties and cities that contribute to the Estero Bay Watershed. Most of the population within the watershed resides within Lee County. Since the year 2000 the growth rates for each jurisdiction are: Collier 35.11%, Hendry 3.38%, Lee County 49.95%, Bonita Springs 45.28%, Fort Myers 41.45%, and Fort Myers Beach 1.75%.



(Southwest Florida Regional Planning Council 2009)



(Southwest Florida Regional Planning Council 2014)

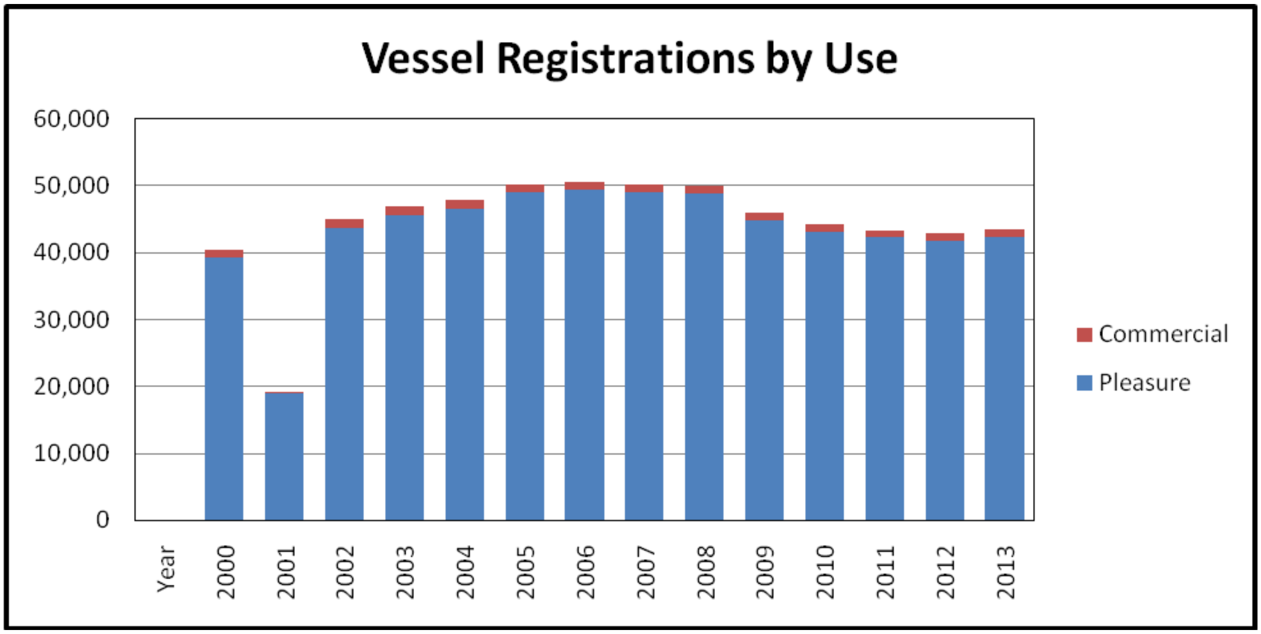


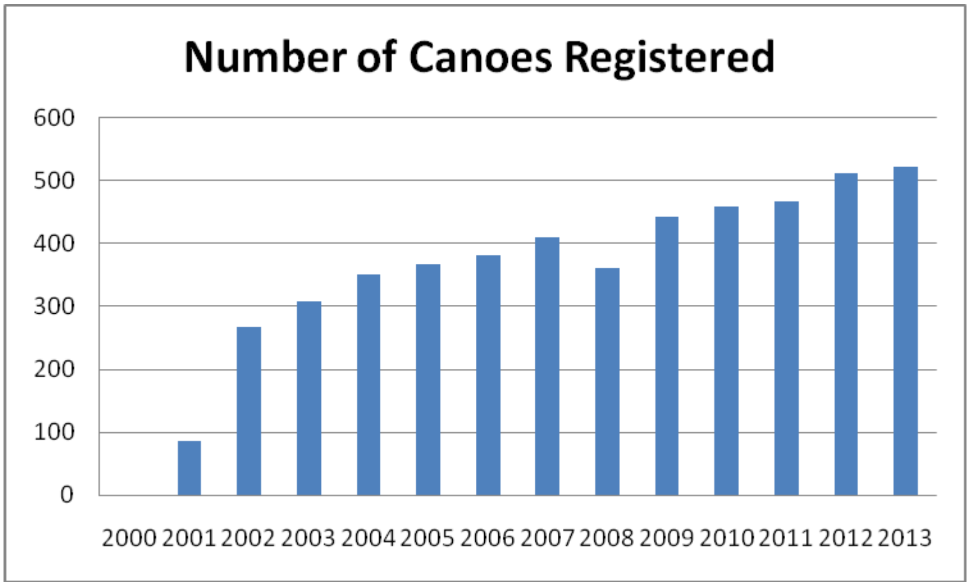
(Southwest Florida Regional Planning Council 2014)

Factor: Boating

Vessel registrations in Lee County are dominated by recreational vessels that are less than 26 feet in length. Vessels from all over the region and from various parts of the US and Caribbean utilize and moor in the waters of Estero Bay, and many of these are not registered in Lee County, but in their home ports, so quantifying that level of utilization is very difficult. The figures below only reflect vessels that are registered in Lee County.

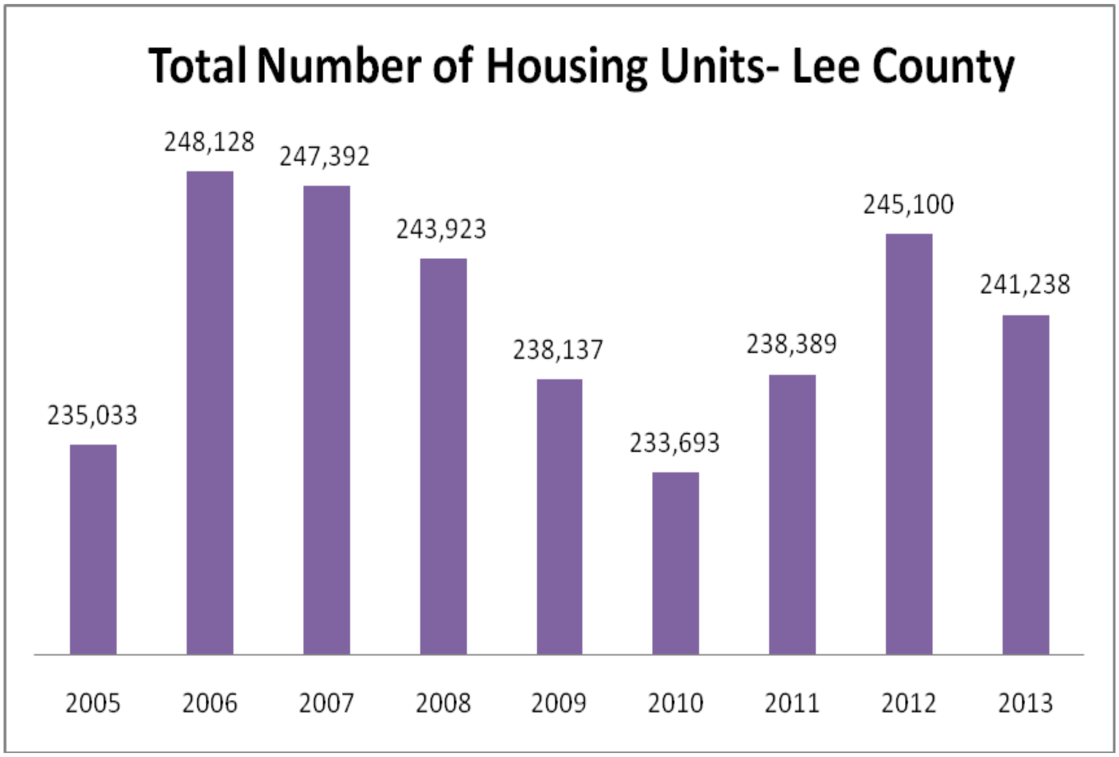
Trends in recreational vessel registrations generally reflect the state of the economy and available disposable income. While there was some growth during the beginning and middle of the period of study, the recent economic downturn appears to have contributed to the flattening of that trend over the last few years.

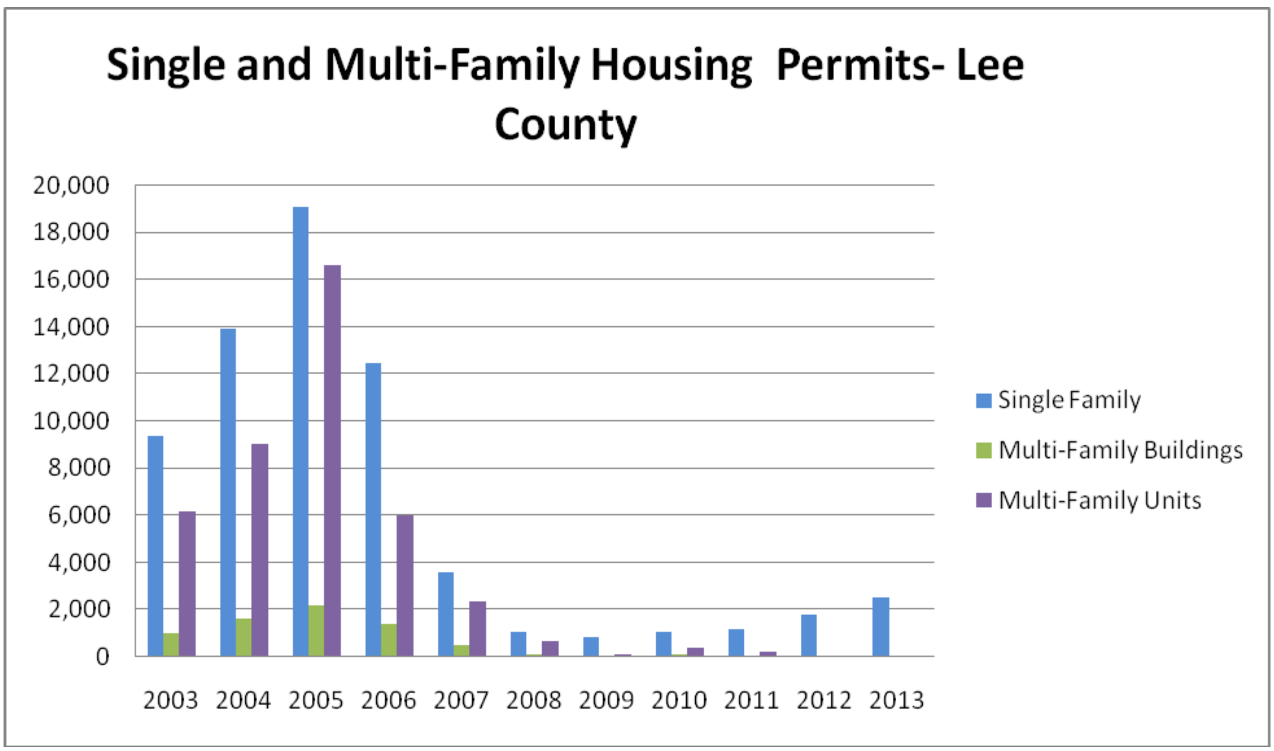



Number of Canoes Registered
600
500
400
300
200
100
0
2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013

Year	Number of Canoes Registered
2000	0
2001	86
2002	268
2003	309
2004	351
2005	367
2006	382
2007	410
2008	362
2009	443
2010	460
2011	468
2012	513
2013	522

Factor: Building Permits





Discussion and Conclusions

By most measurements, growing human population continues to have an effect on Estero Bay and the natural environment of its watershed. There are many ongoing local initiatives to address indicators such as nutrients in surface waters and seagrass extent. Listed species continue to decrease in numbers and water quality, particularly with regard to nutrients, continues to degrade. Economic conditions that have flattened or reduced growth in construction and recreational boating are evident but now reversed. One bright opportunity , the increased availability at reduced prices for conservation land acquisitions, was missed and lost by policies that reduced land acquisition programs and raided their funds at a time critical. At the state level many protections for the environment and planning processes were weakened or removed in favor of unrestrained development without plan.

There are some significant areas in improvement in water quality associated principally with the adoption and implementation of strict local government fertilizer ordinances and construction of filter marshes in the headwaters of tributaries leading to nutrient reduction principally in phosphorous and chlorophyll-a; and increases in colonial bird nesting.

It is estimated that, in 1950, Estero Bay contained 3,769 acres of seagrasses. While seagrass acreage declined between 1950 and 1999, significant gains have been made since then. Persistence of seagrass has also been tracked. Persistence appears to be linked to water depth, with the most persistent areas being shallower and near-shore. It is estimated that Estero Bay contains 107 acres of seagrasses that have been lost and are not restorable. As of 2006, there were 3,590 acres of seagrasses of all species in Estero Bay and 6,469 acres in San Cartlos Bay, which includes Matanzas Pass and the areas south of Bunche Beach.

Landings of economically important indicator species including spotted sea trout, mullet and blue crab have declined from 1998 to 2013. The number of trips taken to harvest these species has declined while landings per trip have declined for sea trout (-27.62%) and blue crab (-13.17%), but increased for mullet (13%).

Wildlife dependent upon interior habitats of the basin including xeric (dry) communities and pine forests has declined significantly. Florida scrub jays were extirpated from the basin sometime in the middle 1990's. Red-cockaded woodpeckers have disappeared in 2001. Significant amounts of gopher tortoise habitat has been eliminated from the basin while being mitigated in the Caloosahatchee River basin. Bald eagle nesting territories have decreased and success rates also remain roughly the same.

In contrast water dependent bird species display increased in nesting. The number of rookeries has increased 47%, and success rates at 133% over the first State of the Bay.

Based on the work of the Southwest Florida Amphibian Monitoring Network, the calling intensity of the Cuban treefrog has increased, while a key indicator species, the barking treefrog, appears to be declining.

Existing water quality can be interpreted in many different ways and the trends vary by location and parameter. Our analysis of 2013 water quality data indicates a positive reduction in some nutrient parameters is evident since the adoption and 2009 implementation of the Lee County, Fort Myers Beach, and Bonita Springs fertilizer ordinances, all of which are stricter than the base State of Florida standard. There has been an improvement in chlorophyll-a standards in Estero Bay and all the tributaries except Six -Mile Cypress and tidal Spring Creek.

For dissolved oxygen, standards were not met in estuarine reaches of Hendry, Estero, and Spring Creeks and the Imperial River, and in the fresh reaches of Six-Mile Cypress. Ten-Mile Canal, Hendry Creek, Mullock Creek, Spring Creek, and the Imperial River. FDEP Water Quality Impairments for DO have been assigned to the fresh and estuarine reaches of all the tributaries of Estero Bay including Hendry Creek, the Imperial River, the Estero River, Six-Mile Cypress, Mullock Creek and Ten Mile Canal; but not in the Bay itself.

Fecal coliform standards were exceeded in freshwater and estuarine Imperial River and Spring Creek, estuarine reaches of Hendry Creek and Estero River, and freshwater Hendry Creek, Mullock Creek, Spring Creek, and Imperial River. FDEP Water Quality Impairments for fecal Coliform have been assigned the totality of the Imperial River, the estuarine reaches of Hendry Creek, freshwater Estero River, and the fresh reaches of Mullock Creek.

In the last (2008) State of the Bay Report USEPA standards for total nitrogen are exceeded in estuarine Hendry Creek, and the fresh reaches of Mullock Creek, Ten Mile Canal and the Imperial River. Between 2009 and 2013, average annual total nitrogen increased in all estuarine segments, however the newly adopted geometric mean nitrogen standards were not exceeded. The average increase was 40%. The peak monthly nitrogen increased in all estuarine segments, for an average of 23%. Average annual total nitrogen increased in all freshwater segments. The average increase was 30%. The peak monthly total nitrogen increased in all estuarine segments but two, for an average of 7% increase. Six-Mile Cypress reduced by 61%. Its increase was the least at 2%. Mullock Creek's peak reduced by 10%. Only Six-Mile Cypress and Imperial River exceeded the geometric mean standard in one year. A decline is occurring between 2012 and 2013 but it will take more years to see if this is a trend.

In contrast to the last State of the Bay Report when USEPA standards for total phosphorus were exceeded in Estero Bay and all reaches of all tributaries with the exception of fresh Spring Creek. between 2009 and 2013, average annual total phosphorus dropped in all estuarine segments. The average reduction was 14%. The peak monthly total phosphorus dropped in all estuarine segments, for an average of 22% reduction. Average annual total phosphorus dropped in all freshwater segments except Hendry Creek. In all tributaries the geometric mean standard was achieved after adoption of the fertilizer ordinances. The average reduction was 13%. The peak monthly total phosphorus dropped in all freshwater segments except Ten-Mile Canal and Imperial River, for an average of 12.5% reduction.

There is a rising trend of salinity for Estero Bay over the last decade. Of note is the contrast between annual minimums and annual peaks. In the period of record, 2005 had the lowest minimum and the lowest peak, while 2007 had the highest minimum and the highest peak. In the 2009 - 2013 period, the average salinity dropped by 5%, the peak increase by 1% and the minimum was at its lowest since 2005, dropping 35% from 2009 values.

State standards for turbidity were not exceeded in the Bay or any tributaries. All waterbodies where there are data are verified as not impaired for turbidity.

The Charlotte Harbor National Estuary Program (CHNEP) completed a water quality status and trends assessment on July 5, 2013, for period of record data through 2011. Estero Bay was among the basins assessed. The report had the following findings

- Land use in the Estero Bay basin was reported to be primarily mixed wetlands (11%), upland forests (12%), pasture land (8%) and residential (4%), the same as in the 2007 report.
- A statistically significant trend of < 5% per year was considered "shallow". A statistically significant trend of ≥ 5% per year was considered "steep". Coastal Estero Bay basin fixed station data had consistently decreasing trends for several parameters including; total phosphorus (16 of 24 stations), total organic carbon (10 of 18 stations), color (12 of 20 stations, and chlorophyll (5 of 14 stations). Total nitrogen concentrations exhibited decreasing trends at 3 of 24 stations. Despite significant improvements for these parameters there were some degrading trends as evidenced by increasing biological oxygen demand and total suspended solids concentrations (8 of 14 stations each). Otherwise, trends were mostly stable throughout the basin.

- Within Estero River basin there were generally 5 stations had sufficient data for trend testing within the basin with a period of record between 1992 and 2011. Total nitrogen concentrations, and the associated constituents that make up total nitrogen were found to be significantly increasing at the majority of these stations. Total phosphorus concentrations were stable at 3 stations, increasing at 1 station and decreasing at one station though dissolved orthophosphate concentrations increased at 3 of 5 stations. Dissolved silica and chloride concentrations increased at 2 of 4 stations. Dissolved oxygen concentrations were mostly stable with one decreasing trend. Copper and lead concentrations were stable at all stations sampled.

- For Hendry Creek and Six Mile Cypress there were generally 30 stations within the basin had sufficient data for trend testing and though the period of record among these stations was variable, many stations had data dating back to 1990. Total nitrogen trends increased at 13 of 31 stations and no stations had decreasing trends in total nitrogen. The increases in total nitrogen seem principally due to increased concentrations of total Kjeldahl nitrogen rather than the associated inorganic forms of nitrogen. Biological oxygen demand also increased at 12 of the 31 stations and dissolved silica increased at 6 stations. Despite these increasing trends in nitrogen and biological oxygen demand, chlorophyll a concentrations improved at 14 of the 31 stations. Total phosphorus also exhibited improving trends at 13 of those 31 stations though there were 4 stations with increasing trends for total phosphorus. Decreased trends in color were also observed at 11 stations within the basin. The remaining parameters had mixed results such as dissolved oxygen which decreased at 6 stations but increased at 5 stations within the basin.

- For Imperial River, there were generally 7 stations had sufficient data for trend testing within the basin with a period of record either between 1992 and 2011 or beginning in the early 2000's through 2011. Three of 7 stations in the Imperial River exhibited increasing trends in total nitrogen and dissolved silica. Five of 7 stations exhibited increased trends in total Kjeldahl nitrogen. Biological oxygen demand increased at 2 of 7 stations while other parameters exhibited stable trends over the period of record of had only a single increasing or decreasing trend.

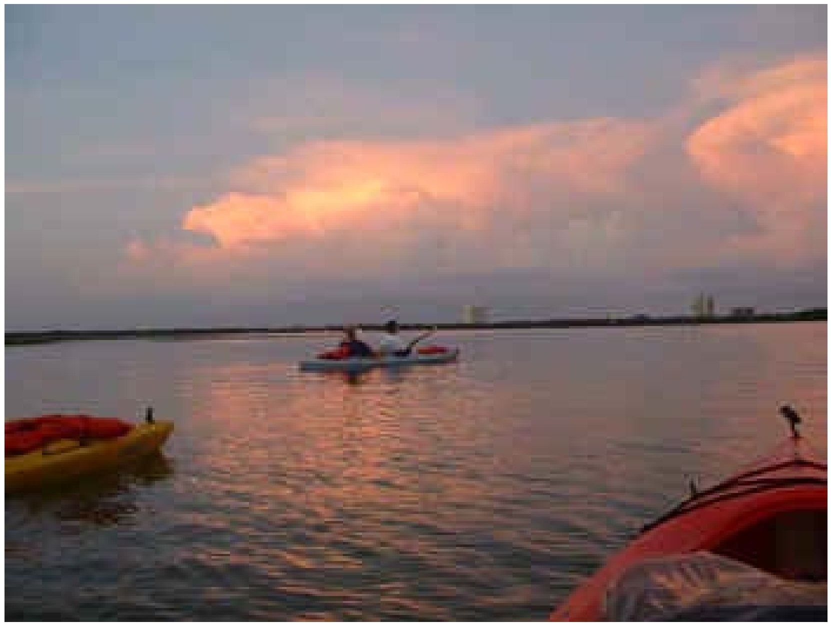
- Spring Creek generally had 7 stations with sufficient data for trend testing within the basin with a period of record either between 1992 and 2011 or beginning in the early 2000's through 2011. Five of the 7 stations in Spring Creek exhibited increasing trends in total nitrogen and total Kjeldahl nitrogen. Three of seven station exhibited increasing trends in dissolved silica. Five of 7 stations exhibited increased trends in Biological oxygen demand. However, despite these degrading trends, chlorophyll concentrations decreasing at 4 of 7 stations and total phosphorus also decreased at 3 of 7 stations. Dissolved oxygen decreased at 3 stations, pH decreased at two stations and conductivity increased at 2 stations. Copper increased at 3 of the 7 stations while lead decreased at a single station in the basin. Other parameters including color and temperature were stable over the period of record.

- The annual 1-day and 30-day flow maxima in Estero Bay appeared to be increasing, coincident with decreases in the number of low flow pulses. From these results, it may be concluded that changes to stream flow have been occurring at statistically significant rates for many streams over the period of record. Many of the strongest IHA stream flow changes were observed to occur in the Estero Bay watershed, and these locations were also locations where changes in water quality were detected. However, these results are not a direct causative expression of relationships between stream flow and water quality as these trends can represent differing periods of record. Other potential sources of surface water quality declines include changes in pollutant loading from non-point sources in the watershed, point sources, and or atmospheric deposition. (Janicki Environmental, Inc. 2013)

Continuing urban development has led to flashier hydrology. The Estero Bay basin has shown water quality degradation even though most of the area has been designated an Outstanding Florida Water during most of the trends period.

Solving problems with habitat loss, alterations in hydrology, and declines in fisheries and wildlife will require more than nutrient management. Although the recent economic downturn has slowed the rate of growth in the watershed, it is important to note that, during the period of this study, 108,340 residential (single and multi units) building permits were issued, indicating a very high rate of growth and development across Lee County. The Lee County Mitigation Plan is the type of integrated restoration and acquisition plan that can address issues of biodiversity, hydrology, and water quality. The solution to pollution in the Estero Bay basin will occur on a landscape scale, requiring Smart Growth, and including areas without growth (such as the Density Reduction Groundwater Recharge (DRGR) area), that allow the Estero Bay ecosystem to provide the many invaluable natural functions and services that provide clean water, natural hydrology and fish and wildlife resources.

The Estero Bay Agency on Bay Management will continue participate in these important public private partnerships for nutrient management, biodiversity, hydrologic and water quality restoration. If these projects are successfully implemented, we anticipate an improved State of the Bay when the next report is issued in 2019.



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