The Cost of Inaction on the Florida Everglades & Lake Okeechobee Water Crisis

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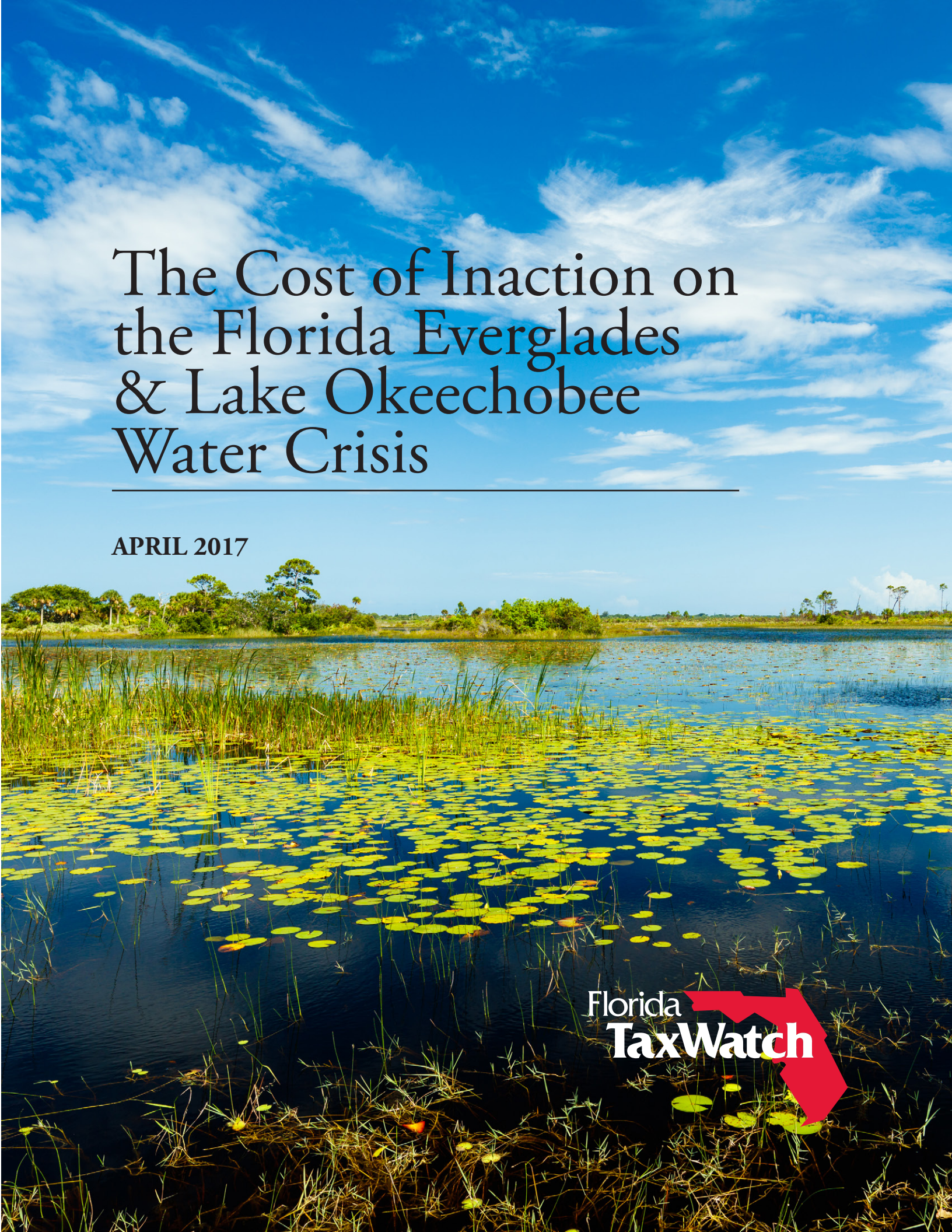

Florida TaxWatch

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David Mann
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Dear Fellow Taxpayer:

When a state is fortunate enough to have an internationally revered ecosystem at its heart, it is incumbent upon that state to manage that ecosystem at a level befitting such a global treasure. Over decades in Florida, the Everglades have withstood expanding development, increased agricultural pressure, and significant changes in natural systems. The intense development of Central and South Florida has changed the timing of water runoff, has increased the levels of nutrients and pollution in its waters, and has caused a major crisis affecting both the natural systems and those who depend on them.

While some point to inaction on the part of the state and local governments, the actions of private industry, and/or the heavy hand of the federal government, the fact is, we find ourselves at a boiling point. Florida TaxWatch, as the eyes and ears of the taxpayers, believes that it is imperative that the Florida Legislature take decisive, corrective action to address the Everglades water issue. To do nothing given the scientific and economic information available would simply be a dereliction of duty as the elected representatives of the people.

This report outlines the cost of further inaction on the natural, human, and economic facets of the state of Florida to show that the Everglades literally impacts each and every one of the state's residents. It is rare in public policy that any solution would be a significant improvement over the status quo, but this is, in fact, one such situation.

It is my sincere hope that the effects outlined in this report serve as a call to action to those whom we have entrusted with leading our great state.

Sincerely,

Dominic M. Calabro

Dominic M. Calabro
President & CEO

"There are no other Everglades in the world. They are, they have always been, one of the unique regions of the earth; remote, never wholly known. Nothing anywhere else is like them."

— Marjory Stoneman Douglas

EXECUTIVE SUMMARY

Currently more than eight million South Florida residents, almost one-third of the state's population, directly rely on the Everglades system for freshwater supply. Florida's $55 billion agriculture sector also relies heavily on this system to supply water for crop irrigation.[1] Urbanization of much of the region mandates the need for flood control during Florida's wet season and necessary measures to assure an adequate water supply during the dry season. As of now, when stormwater runoff causes water in the Lake Okeechobee to rise to high levels, the U.S. Army Corps of Engineers discharges large volumes of water west into the Caloosahatchee River and east into the St. Lucie River. For years, many Florida beaches and waterways have been declared as impaired and have faced contamination issues that have impacted the state's economy, environment, and health of Florida's residents.

Contaminated water has already had a drastic impact on Florida's natural habitat. Research has shown that seagrass populations have precipitously declined in recent years in the St. Lucie and Caloosahatchee River estuaries and lagoons, as well as in the Biscayne and Florida bays. Between 2009 and 2011, about 45 percent of the North Indian River Lagoon total seagrass acreage was lost.[2] Furthermore, studies of the St. Lucie River indicate an 83 percent decrease in the total population density of benthic organisms over the last 30 years, and local extinction of some benthic organisms is possible. Florida Bay suffered a devastating loss of seagrass in 2015, affecting more than 50,000 acres of the bay.[3] These losses in coastal habitat have had direct impacts on our recreational fishing industry, as professional guides regularly report declining catch, increased fuel use to find bait or fish, and lost business.

Just as ecosystem health is impacted by changes in the Everglades water flow, human health is also affected, particularly by the algal blooms. In the first half of 2016 alone, there were 44 freshwater blooms in the Everglades water system, with 21 of these blooms containing toxic blue-green algae. Humans are exposed to toxins that originate from the algae via ingestion of fish and shellfish that are contaminated, accidental ingestion during recreation, and inhalation of aerosolized toxins. Dermal (skin) exposure can also occur during swimming and wading. Exposure to such toxins can lead to rashes, liver and digestive issues, upper and lower respiratory symptoms, eye irritation, bronchoconstriction, and dry cough.[4]

1 Water Supply Planning. South Florida Water Management District. (n.d.). https://www.sfwmd.gov/our-work/water-supply

2 Summary report for the northern Indian River Lagoon, Morris, L. J., R.C. Chamberlain, and C.A. Jacoby. 2015.. pp. in L. Yarbro and P. R. Carlson, eds. Seagrass Integrated Mapping and Monitoring Report No. 2. Fish and Wildlife Research Institute Technical Report TR-17B, St. Petersburg, Florida.

3 2015 Florida Bay Seagrass Die-Off. National Parks Service, 2016.

4 The human health effects of Florida Red Tide (FRT) blooms: an expanded analysis, Hoagland, P., Jin, D., Beet, A., Kirkpatrick, B., Reich, A., Ullmann, S., ... & Kirkpatrick, G. (2014). *Environment international*, *68*, 144-153.

With water pollution having such a significant impact on our state's waterways, coastlines, beaches, and the health of Florida's residents, there is certainly going to be a significant impact on the state's economy. Studies have found that polluted bodies of water can have a significant impact on property values throughout the state. For example, houses that are in close proximity to clean water sources can experience an increase in home value of up to 25 percent, compared to their counterparts. Polluted beaches and lakes can also have a significant impact on tourism throughout the state. In July of 2016, Governor Rick Scott declared a state of emergency due to contaminated bodies of water along Florida's coastline. The declaration made headlines across the United States and left many of Florida's tourism hubs desolate. It is estimated that tourism destinations in Florida could lose out on millions in potential revenue if Florida's beaches and waterways are not cleaned up.

The time is now. No one argues that solutions to the issue may be costly and quite frankly complicated, but the fact of the matter is, each day Florida waits to solve the problem, the solution becomes more expensive. While the price tag to address the issues raised in this report may be a shock to the system, the cost of inaction could be far more devastating to the state of Florida and its hardworking taxpayers.

BACKGROUND

Currently, more than eight million South Florida residents, almost one-third of the state's population, directly rely on the Everglades system for freshwater supply. Florida's $55 billion agriculture sector also relies heavily on this system to supply water for crop irrigation.[5] Urbanization of the region mandates the need for flood control during Florida's wet season and necessary measures to assure an adequate water supply during the dry season. Competing demands and tradeoffs have impacted South Florida's environment, placing our rivers, estuaries, lagoons, and near-shore ocean habitats in crisis.

Stormwater runoff in Central Florida flows south into Lake Okeechobee. Historically, these waters then flowed into the Everglades and eventually into the Florida and Biscayne bays and the Gulf of Mexico. As the water flowed south, it was naturally filtered and purified by marsh plants and organic soils of the Everglades.

As more people moved to South Florida, portions of the Everglades were drained and developed for agricultural and urban use. Draining wetlands reduced the region's ability to store water during the dry season, creating water supply problems. To provide protection from flooding, as well as water supply, the U.S. Army Corps of Engineers installed a massive network of canals, levees, and water conservation areas that blocked sheetflow to urban areas and provided water for dry season use.[6] In order to address flooding concerns following the great hurricane of 1928, the Herbert Hoover Dike was constructed in 1930 to protect residents and their property from flooding. In 2000, Congress approved the Comprehensive Everglades Restoration Plan (CERP), a $10.5 billion, 35-plus year project, designed to restore natural sheetflow, rehydrate marshes, and provide freshwater flows to protect our estuaries.

5 Everglades, it's the water you drink., Everglades Foundation (n.d) http://www.evergladesfoundation.org/wp-content/uploads/2016/09/Water_Supply_FactSheet.pdf. Accessed March 21, 2017.

6 "Comprehensive Everglades Restoration Plan," National Park Service (n.d.), retrieved from www.nps.gov/ever/learn/nature/upload/CERPFSLoResSecure.pdf, March 2, 2017.

When stormwater runoff causes water levels in Lake Okeechobee to rise to high levels, the U.S. Army Corps of Engineers discharges large volumes of water west into the Caloosahatchee River and east into the St. Lucie River. The Corps claims that these discharges are the only way to move large volumes of water fast enough to prevent a failure of the 100-mile Herbert Hoover Dike that encircles the lake.

The influx of nutrient-laden and contaminated freshwater into brackish estuaries creates problems for fish, oysters, seagrasses, and the people and businesses that depend on healthy rivers, clean water, and working land for their livelihoods. But the problems are not limited to the rivers and estuaries. The Southern Everglades and Florida Bay are no longer receiving the quantities of freshwater historically provided and, as a result, the Florida Bay is plagued by hypersalinity and algal blooms.

PURPOSE

Florida TaxWatch undertakes this independent research not to recommend one specific solution over another, but to assess the consequences of inaction by Florida's policymakers in addressing the problems created by discharging excess water from Lake Okeechobee.

ENVIRONMENTAL IMPACTS

The quantity, timing, distribution, and quality of freshwater are of paramount importance to South Florida's river systems and estuaries,[7] not to mention the safety of human and animal life. These factors are interdependent, and all have played a key role in the disruption of South Florida's ecosystems.

Water

An evaluation of the impact of water quantity issues centers around the timing and disruption of surface water flows. Historically, wet season rains in the Lake Okeechobee Northern Watershed would take six to eight months to make their way into Lake Okeechobee, eventually finding their way into the Southern Everglades as well as Florida and Biscayne Bays.[8] Currently, due to waterway channelization for agriculture and urban development, this drainage takes place within a month. This results in the rapid increase of Lake Okeechobee's water level. To prevent flooding and the breaching of the Herbert Hoover Dike, large quantities of water are released into the Caloosahatchee and St. Lucie Rivers. Large freshwater releases reduce the level of salinity which, in turn, disrupts an estuary system's delicate balance of flora and fauna, including sensitive oyster and seagrass habitats.

Today, about 40 percent of the water that naturally would have flowed into the Everglades Park and Florida and Biscayne bays is diverted.[9] These changes in the surface water distribution, timing, and quantity result in alternating periods of drying and flooding in the remaining Everglades, low and high salinity in the Caloosahatchee and St. Lucie Rivers' estuaries, and hypersalinity of the Florida and Biscayne bays.

7 Hydrological Changes and Estuarine Dynamics, Montagna PA, Palmer TA, Pollack JB. (2013). New York (NY): Springer New York. 83 p.

8 Progress Toward Restoring the Everglades: The Fourth Biennial Review, National Research Council. (2013) National Academies Press.

9 Progress Toward Restoring the Everglades: The Fourth Biennial Review National Research Council. (2013, 2012). National Academies Press.

Surface Water Quality

In addition to changes resulting from altering surface water quantity, timing, and distribution, years of agricultural runoff and urbanization have led to unnaturally high levels of nitrogen and phosphorus in Lake Okeechobee waters and sediments.

Nutrient-laden contaminated water flowing from Lake Okeechobee could result in explosive growth of certain aquatic plants and algae.[10] During these algal blooms, the density of algae in the water prevents sunlight from reaching submerged aquatic vegetation, resulting in plant death and the accompanying loss of habitats for aquatic organisms—both in Lake Okeechobee and the Caloosahatchee and St. Lucie Rivers. Additionally, algal blooms in these waters lead to periods of low dissolved-oxygen concentration in the water, which causes fish kills and additional damages to the ecosystem.[11] A further impact to aquatic life, and potentially to human health, can arise when algal blooms become toxin-forming, as was the case in the St. Lucie Estuary in the summer of 2016.

Herbicide contamination is another common pollutant in South Florida water systems. Like nutrients, herbicides find their way into Lake Okeechobee due to agricultural runoff. Herbicide contamination can impact submerged aquatic vegetation and beneficial algae. Risk assessment models found that the Caloosahatchee River, St. Lucie Canal, and portions of the Indian River Lagoon are at risk from herbicide contamination.[12]

Groundwater Salinity

Large portions of the Everglades were drained to provide dry land for urban and agricultural use. This draining, and the subsequent water management for flood control, have resulted in the decline in groundwater levels in the aquifers, which are the main supply of water for South Florida residents, businesses, and visitors.[13] Pumping too much water from the aquifer for human and agricultural use has also contributed to lower aquifer water levels. As levels drop, salt water from the coast and canal system moves into the aquifer, resulting in salt contamination, particularly during periods of droughts.[14] Saltwater intrusion is of major concern, as it threatens South Florida's drinking water supply. A few cities in the region have been forced to shut down wells due to high salinity content.[15,16]

10 It Takes Two to Tango: When and Where Dual Nutrient (N & P) Reductions Are Needed to Protect Lakes and Downstream Ecosystems. Paerl, H. W., Scott, J. T., McCarthy, M. J., Newell, S. E., Gardner, W. S., Havens, K. E., Wurtsbaugh, W. A. (2016). Environmental Science & Technology, 50(20), 10805-10813

11 Ibid.

12 Aquatic risk assessment of herbicides in freshwater ecosystems of South Florida, Schuler, L. J., & Rand, G. M. (2008). Archives of environmental contamination and toxicology, 54(4), 571-583.

13 D.V. Origins and Delineation of Saltwater Intrusion in the Biscayne Aquifer and Changes in the Distribution of Saltwater in Miami-Dade County, Florida, Prinos, S.T.; Wacker, M.A.; Cunningham, K.J.; Fitterman, D.V., U.S. Geological Survey.

14 Origins and Delineation of Saltwater Intrusion in the Biscayne Aquifer and Changes in the Distribution of Saltwater in Miami-Dade County, Florida, Prinos, S.T.; Wacker, M.A.; Cunningham, K.J.; Fitterman, D.V., U.S. Geological Survey.

15 Water, Water Everywhere: Sea Level Rise in Miami, McNoldy, Brian (2014) Rosenstiel School of Marine & Atmospheric Science.

16 Beyond the high tides, South Florida water is changing, Staletovich, Jenny (2015). Miami Herald.

In addition to saltwater intrusion, the aquifers are shallow and with high transmissivity, allowing for water exchange between ground and surface water. As a result, the contamination of surface water can flow directly into drinking water resources, negatively impacting the water supply of communities and necessitating additional treatment to ensure a safe drinking water supply.[17]

Aquatic Life

A naturally low-phosphorus system, the Everglades has a fragile ecological balance that can be disturbed by even small amounts of additional nutrients or other components.[18] Plants and animals native to the Everglades flourished under very low phosphorus conditions. Increased levels of phosphorus in the Everglades has resulted in the "loss of the natural communities of algae…; loss of water-dissolved oxygen that fish need; and changes in the native plant communities that result in a loss of the open water areas where wading birds feed."[19]

Flora

Submerged aquatic vegetation (SAV) communities are essential to an ecosystem's health. Seagrass and other aquatic plants provide habitat, food, and nursery grounds for various aquatic organisms (crabs, shrimp, etc.) and fish, including recreationally important varieties such as snapper, common snook, gag grouper, crevalle jack, spotted sea trout and redfish.[20] It is estimated that 2.5 acres of healthy seagrass can support as many as 100 million worms, claims, snails and other invertebrates, and up to 100,000 fish.[21] Disruption of SAV has serious repercussions for an entire system.

Research has shown that seagrass populations have precipitously declined in recent years in the St. Lucie and Caloosahatchee estuaries and lagoons, as well as in Florida and Biscayne Bays. Between 2009 and 2011, about 45 percent of the North Indian River Lagoon's total seagrass acreage was lost.[22] Likewise, Caloosahatchee Estuary seagrass has seen a decline in many areas.[23] SAV decline is attributable to alterations in salinity, water quality issues that result in algal blooms, and sedimentation.

Alterations in salinity levels lead to die-offs or stunting of seagrass, as some species cannot tolerate salinity outside of a certain range. An increase in nutrients and organic matter flowing into the system leads to cloudy water and overgrowth of algae, blocking light from the aquatic plant beds and limiting growth. [24]

17 Impact and Mitigation of Nutrient Pollution and Overland Water Flow Change on the Florida Everglades, USA, Möller, Gregory; Schade-Poole, Kristin (2016) Environmental Science Program, University of Idaho

18 "Harmful Nutrients in the Everglades Now Reduced by 90%." (Accessed 3/16/2017). South Florida Water Management District. Available at: https://www.sfwmd.gov/sites/default/files/documents/infographic_everglades_wq.pdf.

19 Why is it important to Restoree the Everglades? Environmental Protection Agency (2017)

20 St. Lucie Estuary and Indian river lagoon conceptual ecological model, Sime, P. (2005). Wetlands, 25(4), 898-907.

21 Seagrasses of the Indian River Lagoon, St. Johns Water Management District (2014). http://www.sjrwmd.com/indianriverlagoon/seagrasses.html

22 Summary report for the northern Indian River Lagoon, Morris, L. J., R.C. Chamberlain, and C.A. Jacoby. 2015., in L. Yarbro and P. R. Carlson, eds. Seagrass Integrated Mapping and Monitoring Report No. 2. Fish and Wildlife Research Institute Technical Report TR-17B, St. Petersburg, Florida.

23 Results of the Florida Department of Environmental Protection, Charlotte Harbor aquatic preserves seagrass monitoring program from 1999–2009, Brown, M., Leary, R., Langenberg, N., McMurray, M., & Stafford, H. (2012). *Florida Scientist.*

24 Effects of climate change on fishery species in Florida, Shenker, J. M. I. Hronszky, & G. L. Nelson (Eds.), AIP Conference Proceedings (Vol. 1157, No. 1, pp. 39-47). AIP. (2009)

From 2005 to 2008, Southern Biscayne Bay experienced an algal bloom that reduced visibility and resulted in a 51 percent decrease in seagrasses.[25] The 2015 seagrass die-off in Florida Bay affected an area of the bay more than 50,000 acres in size and fueled an algal bloom that plagued the western bay throughout the summer and fall of 2016.

The sediments flowing into the systems have replaced the natural bottom, and the seagrass cannot grow normally in these sediments.[26] All of these factors are directly the result of either controlled releases from Lake Okeechobee, or the decreased water flow into the Biscayne and Florida bays. The decline in SAV compromises the ecological and economic integrity of lakes, rivers and estuaries.

Fauna

When discussing ecological impacts to aquatic fauna, it is essential to first address impacts at the bottom, and work up. The benthic community, or benthos, consists of organisms that live in and on the bottom of a waterbody. These organisms include a diverse group of worms, clams, snails, shrimp, crabs, lobsters, and sponges, and other tiny organisms that inhabit this zone. Benthic species are a major link in the food chain and an important source of water column nutrients that are essential to a healthy estuary.[27] For these reasons, the health of benthos is critical.

Scientific research has shown that salinity variations due to freshwater inflow have changed the species distribution and total population of the benthic community in the Caloosahatchee and St. Lucie estuaries and Indian River Lagoon.[28,29] In the Indian River Lagoon and St. Lucie estuary, salinity shifts and pollution have resulted in a 44 to 79 percent decline in benthic species diversity.[30,31]

Studies of the St. Lucie Estuary indicate an 83 percent decrease in the total population density of benthic organisms over the last 30 years, and local extinction of some benthic organisms is likely.[32] A similar decrease in benthos has been noted in areas of Biscayne Bay.[33] The benthos is a source food for many fish and shellfish, and decreases in benthic community health can have a large economic impact as commercially and recreationally fish species decline. Bay scallops, once plentiful in the area, are one casualty of these changes.[34]

25 *Imperiled Water Quality of Biscayne Bay: The Economics of What is at Stake* Florida Sea Grant College Program Adams, Chuck, Blair, Stephen (2014), Florida Sea Grant and Miami Dade Division of Environmental Resources Management

26 St. Lucie Estuary and Indian River Lagoon conceptual ecological model, Sime, P. (2005) Wetlands, 25:898-207.

27 Estuary science: Benthic community, EPA, Narragansett Bay Commission, Univ. of Rhode Island Office of Marine Programs (n.d.) http://omp.gso.uri.edu/ompweb/doee/science/biology/benth3.htm. Accessed March 20, 2017.

28 Determining the effects of freshwater inflow on benthic macrofauna in the Caloosahatchee Estuary, Florida, Palmer, T. A., Montagna, P. A., Chamberlain, R. H., Doering, P. H., Wan, Y., Haunert, K. M., & Crean, D. J. (2015). Integrated environmental assessment and management.

29 St. Lucie Estuary and Indian river lagoon conceptual ecological model, Sime, P. (2005). Wetlands, 25(4), 898-907

30 Ibid.

31 Hayek, L. A. C., & Buzas, M. A. (2006). The martyrdom of St. Lucie: decimation of a meiofauna. Bulletin of Marine Science, 79(2), 341-352.

32 Ibid.

33 Seagrasses of the Indian River Lagoon, St. Johns Water Management District https://eos.ucs.uri.edu/EOS_Linked_Documents/flsgp/Imperiled-Water-Quality-in-Biscayne-Bay.pdf

34 Barnes, T. (2005), Caloosahatchee Estuary conceptual ecological

Additionally, "oysters are considered a 'keystone species' due to their critical roles in maintaining water quality and biodiversity and cycling water and nutrients within an ecosystem."[35] Oyster bars provide habitat and food for a wide variety of species. A healthy oyster population contributes to an increase in water quality by stabilizing sediments on the bottom and filtering out particles and nutrients in the water. Oysters are a highly prized source of food for humans, and oyster harvests can have a huge economic impact in some communities.[36]

In the St. Lucie Estuary and Indian River Lagoon, historically, oyster beds occupied up to 567 hectares (roughly 1,400 acres).[37] Similarly, early descriptions of the Caloosahatchee estuaries indicate that some areas were barely navigable due to the extensive shoals and oyster bars.[38] Excess nutrients, muck sediments, algal blooms, and freshwater outflows from Lake Okeechobee, however, have decimated the oyster population of some areas of these estuaries.[39] Oysters were once present in greater numbers within Biscayne Bay, but now are almost completely absent due to hypersalinity.[40,41]

Recreational, commercial, and forage fish species rely on estuaries during one or more of their life stages for highly productive environments that provide refuge, food, spawning, and nursery habitats.[42] In the U.S., approximately 46 percent of commercial fish and shellfish by weight (and 68 percent by value) are species that depend on estuaries for at least part of their lifecycle.[43] An analysis of recreational fishing found that approximately 80 percent of recreational fish landings were dependent on estuaries.[44]

Salinity changes and algal blooms caused by excess nutrients have resulted in the loss of SAV and benthos, which in turn have impacted the abundance, speciation, and predatory/prey balance of fish in an estuary.[45,46] In addition, algal blooms can result in fish mortality by asphyxiation due to oxygen depletion, lower immunity due to the stress of oxygen deprivation, and direct exposure to toxins produced by the harmful algal blooms (HABs).

Recreationally important varieties of fish are experiencing vast declines, particularly the spotted sea trout, redfish, snook, and the gag grouper in the Caloosahatchee and St. Lucie estuaries, and Indian River

35 Oyster Reefs: Habitat of the Month (2011), http://www.habitat.noaa.gov/abouthabitat/oysterreefs.html

36 Ibid.

37 Sime, P. 2005. St. Lucie Estuary and Indian River Lagoon conceptual ecological model. Wetlands, 25:898-207.

38 Chapter 10: St. Lucie and Caloosahatchee River Watershed Protection Plan Annual and Three-Year Updates, Buzzelli, C., Cater, K., Bertolotti, L., & Doering, P. (2015). *2015 South Florida Environmental Report*, *1*.

39 Ibid.

40 Impacts of freshwater management activities on eastern oyster (Crassostrea virginica) density and recruitment: recovery and long-term stability in seven Florida estuaries, Parker, M. L., Arnold, W. S., Geiger, S. P., Gorman, P., & Leone, E. H. (2013). Journal of Shellfish Research, 32(3), 695-708.

41 Marine Exploited Invertebrates Monitoring, National Park Service, South Florida/Carribbean Inventory & Management Network (2016).

42 Estuarine Fish and Shellfish Species in U.S. Commercial and Recreational Fisheries: Economic Value as an Incentive to Protect and Restore Estuarine Habitat, Bigford, T.E., K.A. Lellis-Dibble, K.E. McGlynn, National Oceanic and Atmospheric Administration (2008).

43 Ibid.

44 Lellis-Dibble, K. A., McGlynn, K. E., & Bigford, T. E. (2008). Estuarine fish and shellfish species in US commercial and recreational fisheries: economic value as an incentive to protect and restore estuarine habitat. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Habitat Conservation, Habitat Protection Division.

45 St. Lucie Estuary and Indian River Lagoon conceptual ecological model, Sime, P. (2005) Wetlands, 25:898-207.

46 Caloosahatchee Estuary conceptual ecological model, Barnes, T. (2005) Wetlands, 25(4), 884-897.

Lagoon.[47,48] The Florida Bay has seen a decline across the entire food chain, including populations at the top of the chain.[49]

Manatees, dolphins, turtles, and birds are also greatly affected by HABs and declining SAV communities. Manatees rely on SAV for food, habitat, mating, and calving, with seagrass comprising the greatest portion of their diets.[50] The destruction of SAV habitats is resulting in a reduction of the manatee population in impacted estuaries.

HABs, particularly the toxin associated with Florida Red Tide (brevetoxin), are responsible for an increase in mortality among sea creatures:

- In 1996, a red tide bloom along the west coast of Florida killed 149 manatees, with 81 deaths occurring in the Caloosahatchee estuary;[51]
- During a prolonged 2005-2006 bloom along the west coast, 300 turtles were stranded, with red tide toxins causing or contributing to 95 percent of stranding;[52] and
- During a severe 2007-2008 east coast red tide bloom, 69 percent of manatees and 92 percent of dolphins that died had high levels of Red Tide toxins in their systems.[53]

Mass die-offs of coastal and shore birds alike occur during red tide blooms as fish consume prey items contaminated with brevetoxins.[54] Despite efforts to reduce the occurrences of these blooms over the past 20 years, red tide remains an ongoing threat. [55]

The alteration of the Everglades for water supply and flood control has resulted in a reduction of foraging habitat for wading birds. While wading bird nesting naturally fluctuates, drainage and variation in water levels in estuaries have made it difficult for populations to recover from poor nesting efforts.[56] Consequently, there has been a 90 percent decline in wading bird populations and more than 67 federally listed threatened and endangered species have been affected.[57]

47 Caloosahatchee Estuary conceptual ecological model, Barnes, T. (2005) Wetlands, 25(4), 884-897.

48 St. Lucie Estuary and Indian River Lagoon conceptual ecological model, Sime, P. (2005) Wetlands, 25:898-207.

49 A review of the effects of altered hydrology and salinity on vertebrate fauna and their habitats in northeastern Florida Bay, Lorenz, J. J. (2014) Wetlands, 34(1), 189-200.

50 Caloosahatchee Estuary conceptual ecological model. Wetlands, Barnes, T. (2005) 25(4), 884-897.

51 Harmful algal toxins of the Florida red tide (Karenia brevis): natural chemical stressors in South Florida coastal ecosystems, Pierce, R. H., & Henry, M. S. (2008) Ecotoxicology, 17(7), 623-631.

52 Effects of Florida's red tide on marine animals, Florida Fish and Wildlife Conservation Commission (n.d.). http://myfwc.com/research/redtide/general/marine-animals/. Accessed March 23, 2017.

53 Brevetoxin-associated mass mortality event of bottlenose dolphins and manatees along the east coast of Florida, USA, Fire, S. E., Flewelling, L. J., Stolen, M., Durden, W. N., de Wit, M., Spellman, A. C., & Wang, Z. (2015).. Marine Ecology Progress Series, 526, 241-251.

54 Ibid.

55 "Harmful Nutrients in the Everglades Now Reduced by 90%." (Accessed 3/16/2017). South Florida Water Management District. Available at: https://www.sfwmd.gov/sites/default/files/documents/infographic_everglades_wq.pdf.

56 Annual Wading Bird Report Shows Steep Nesting Decline. Audubon Society (March 7, 2017). Accessed April 12, 2017. http://fl.audubon.org/press-release/annual-wading-bird-report-shows-steep-nesting-decline

57 "South Florida Ecosystem Restoration (SFER) Program Overview." (January 2017). U.S. Army Corps of Engineers Jacksonville District.

Without clean water, the delicate ecosystems of Florida could be at risk. Currently, pollution discharges are altering lakes, rivers, and coastlines across the state, putting various species at risk. Furthermore, there are millions of individuals who rely on clean water for their businesses and recreational activities. If actions are not taken to clean up pollution, millions of individuals, and a countless number of animal species throughout Florida could suffer.

HUMAN HEALTH IMPACTS

Just as animal and ecosystem health is impacted by changes in the Everglades' water flow, human health is also affected, particularly by the algal blooms.

In the first half of 2016, there were 44 freshwater blooms in the Everglades water system, with 21 of these blooms containing toxic blue-green algae. Blooms occurred in Lake Okeechobee, along the St. Lucie River, and along the Caloosahatchee River.[58] Marine HABs are also increasing, particularly blooms of red tide caused by the *Karenia brevis* algal species.[59] It is hypothesized that greater nutrient availability due to the increase in human population and related activities in South Florida is a major factor.[60] Humans are exposed to these toxins via ingestion of fish and shellfish that are contaminated, accidental ingestion during recreation, and inhalation of aerosolized toxins. Dermal (skin) exposure can also occur during swimming and wading.

Ingestion of Contaminated Products

Finfish and shellfish, including commonly consumed clams, oysters, conch, and mussels accumulate toxins during their normal feeding. Fish, both large and small, can accumulate toxins directly from eating toxic algae or via predation and food chain amplification. The finfish and shellfish themselves are not sickened, but may contain dangerous levels of toxins, even months after exposure.[61] Furthermore, the toxins are odorless and tasteless, and are not removed by cooking, making exposure difficult to avoid.

Common fish and shellfish poisoning syndromes associated with HABs in Florida include Neurotoxic Shellfish Poisoning (NSP), Pufferfish Poisoning (PFP) and Ciguatera Fish Poisoning (CFP). Symptoms include a wide range of neurological and digestive issues, and emergency room visits and hospitalizations are not uncommon as a result of ingestion of contaminated seafood.[62, 63]

Physicians are required by law to report NSP, PFP, and CFP to the Department of Health, allowing for quick investigations of possible outbreaks. In addition, the Florida Fish and Wildlife Conservation Commission (FWC) routinely monitors shellfish harvesting areas to detect HABs, and closes impacted areas to harvesting.

58 Where will the green slime go? Florida tracks its spreading algae, Dewey, Eliza (2016). Miami Herald.

59 Due to an increase in monitoring over the last decade, it is difficult pinpoint the exact increase of red tide HABs over historic levels.

60 Long-term increase in *Karenia brevis* abundance along the Southwest Florida Coast, Brand, L. E., & Compton, A. (2007) *Harmful Algae*, *6*(2), 232–252.

61 Neurotoxic shellfish poisoning, Watkins, S. M., Reich, A., Fleming, L. E., & Hammond, R. (2008) *Marine drugs*, 6(3), 431-455.

62 Neurotoxic Shellfish Poisoning (NSP) FDOH (2014) http://www.floridahealth.gov/environmental-health/aquatic-toxins/_documents/nsp-medical-facts-2014-56kb.pdf. Accessed March 15, 2017.

63 Ibid,

The FWC has permanently banned collection of pufferfish from the Indian River Lagoon as sampling indicates that pufferfish in the area have consistently high levels of toxins and are unsafe for consumption.[64]

Monitoring programs have resulted a reduction of HAB-related illnesses. For example, there were only 21 cases of NSP reported to the Florida Department of Health in the last 10 years. [65] Evidence suggests that HAB syndrome cases may be underreported by as much as 90 percent; thus, it is likely that many more Floridians and visitors may be impacted by the consumption of contaminated HAB-related contaminated food.[66] One study found emergency room visits for digestive illnesses increased by 40 percent during a HAB event associated with Florida red tide.[67]

Cyanobacteria-contaminated drinking water also poses a risk to human health and there are numerous cases of illness related to ingestion of contaminated drinking water. In one outbreak, 62 percent of the population of a town in Pennsylvania developed symptoms of gastroenteritis after drinking filtered, chlorinated water contaminated with toxins from cyanobacteria.[68] In another incident in Australia, 140 children and 10 adults were hospitalized for liver and digestive issues after drinking water contaminated with toxic cyanobacteria. It is hypothesized that chronic exposure may be related to a high rate of liver cancer among Chinese villagers who drink water frequently contaminated with cyanobacteria.[69]

Accidental ingestion of freshwater containing high levels of hazardous cyanobacteria during recreational activities can result in a variety of symptoms. Depending on the type of cyanobacteria present, symptoms may include digestive issues, respiratory impacts, liver damage, and neurological symptoms.[70] There are, however, no epidemiological studies that characterize the level of exposure needed to result in symptoms.[71]

Even though cyanobacterial blooms have become a serious problem for water resources in the United States, no federal regulatory guidelines for cyanobacteria or their toxins in drinking or recreational waters exist to date.[72] With the possibility of an increase in HAB prevalence in Florida, the risk for contaminated drinking water became a real and dangerous threat to the residents of the state.

64 Saxitoxin monitoring in three species of Florida pufferfish, Abbott, J. P., Flewelling, L. J., & Landsberg, J. H. (2009) *Harmful Algae*, *8*(2), 343-348.

65 Florida charts: Neurotoxic shellfish poisoning, FDOH (2017). http://www.flhealthcharts.com/charts/OtherIndicators/NonVitalIndNoGrpCountsDataViewer.aspx?cid=8614. Accessed March 15, 2017.

66 Physician diagnosis and reporting of ciguatera fish poisoning in an endemic area, McKee, D. B., Fleming, L. E., Tamer, R., Weisman, R., & Blythe, D. (2001) *Harmful Algal Blooms 2000.*, 451-453.

67 Gastrointestinal emergency room admissions and Florida red tide blooms, Kirkpatrick, B., Bean, J. A., Fleming, L. E., Kirkpatrick, G., Grief, L., Nierenberg, K., Naar, J. (2010). *Harmful Algae*, *9*(1), 82-86.

68 An overview of problems caused by toxic blue–green algae (cyanobacteria) in drinking and recreational water, Falconer, I. R. (1999) Environmental Toxicology, 14(1), 5-12.

69 Toxicology of freshwater cyanobacteria, Liyanage, H. M., Arachchi, D. M., Abeysekara, T., & Guneratne, L. (2016) Journal of Environmental Science and Health, Part C, 34(3), 137-168.

70 Health and Ecological Effects, How are humans exposed cyanobacteria and cyanotoxins?, Environmental Protection Agency (n.d.)

71 Resource Guide for Public Health Response to Harmful Algal Blooms in Florida, Abbot, Meghan, Blackmore, Karina, Ketchen, Sharon, et al. (2009)

72 Cyanobacteria blooms and non-alcoholic liver disease: evidence from a county level ecological study in the United States, Zhang F, Lee J, Liang S, Shum CK. Environmental Health. 2015;14(1):41.

Inhalation and Dermal Contact with HAB Toxins

Normal wave and wind action causes individual HAB organisms to break apart, releasing toxins contained within the individual organisms. These toxins aerosolize and are carried inland by breezes.[73] Studies indicate that aerosolized toxins from red tide-producing *K. brevis* pose the greatest risk.[74]

Exposure to *K. brevis* toxins (brevetoxins) cause upper and lower respiratory symptoms, including eye irritation, bronchoconstriction, and dry cough.[75] Typically, people recover shortly after leaving the impacted area; however, people with a history of chronic obstructive pulmonary disease (COPD), asthma, and bronchitis are at greatest risk and symptoms may linger. Several studies have evaluated the impact of exposure to aerosolized toxins and found an increase in emergency room visits related to respiratory illnesses.

Freshwater cyanobacteria can also pose an inhalation risk. Air samples collected from a bloom-impacted lake during recreational activities found detectable levels of toxins and inhalation of these toxins produce illness in mice.[76] Dermal contact with toxins associated with red tide HABs and freshwater cyanobacterial HABs can result in rare cases of contact dermatitis.[77] Cyanobacteria can also cause acute dermatitis during recreational exposure.

Future Impacts

Many HAB species are not well characterized and mutation of HAB organisms is likely.[78] This unknown represents a large potential source of risk to human health. HAB organisms identified in Florida waters have produced health impacts in other parts of the world, but not in Florida. Laboratory studies show that the amount and type of toxins produced vary by HAB strains, but it is unknown how environmental conditions impact toxin production in the wild.[79]

The sudden appearance of high levels of toxins in pufferfish in the Indian River Lagoon represents a cogent example of how quickly a situation may change. Prior to 2002, pufferfish from the Indian River Lagoon were not toxic; however, by 2004, 28 cases of human poisoning due to saxitoxin (STX) accumulation in pufferfish had occurred.[80] The specific HAB responsible for contamination of the pufferfish (*Pyrodinium bahamense*) has been known to exist in Florida for years without causing any impacts. What caused the changes in the puffer population is still unknown, but should serve as a harbinger of possible changes that could affect other fish populations rendering them toxic for consumption by other fish or human populations.

73 What is a red tide?, NOAA (2017) http://oceanservice.noaa.gov/facts/redtide.html accessed March 21, 2017

74 Resource guide for public health response to harmful algal blooms in Florida, Abbott, G. M., J. H. Landsberg, A. R. Reich, K. A. Steidinger, S. Ketchen, and C. Blackmore. 2009. Fish and Wildlife Research Institute Technical Report TR-14. viii + 132 p.

75 The human health effects of Florida Red Tide (FRT) blooms: an expanded analysis, Hoagland, P., Jin, D., Beet, A., Kirkpatrick, B., Reich, A., Ullmann, S., ... & Kirkpatrick, G. (2014). *Environment international*, *68*, 144-153.

76 Cyanobacteria blooms and non-alcoholic liver disease: evidence from a county level ecological study in the United States, Zhang F, Lee J, Liang S, Shum CK. Environmental Health. 2015;14(1):41+.

77 Resource guide for public health response to harmful algal blooms in Florida, Abbott, G. M., Landsberg, J. H., Reich, A. R., Steidinger, K. A., Ketchen, S., & Blackmore, C. (2009). Fish and Wildlife Research Institute Technical Report TR-14.

78 Ibid.

79 Ibid.

80 Saxitoxin Pufferfish Poisoning in the United States, with the First Report of Pyrodinium bahamense as the Putative Toxin Source, Landsberg, J. H., Hall, S., Johannessen, J. N., White, K. D., Conrad, S. M., Abbott, J. P., … Steidinger, K. A. (2006). Environmental Health Perspectives, 114(10), 1502–1507. http://doi.org/10.1289/ehp.8998

Furthermore, STX poisoning is usually associated with contaminated shellfish ingestion, but clams in the area appear to not accumulate the toxin. Indian River Lagoon pufferfish poisonings provide a lesson—public health officials and natural resource managers must be aware of the possible risks HABs pose and remain vigilant.

Contacts with HAB toxins are usually a short-term event and most symptoms of human exposure to HAB are reversible when the exposure ceases. Over the course of a lifetime, however, individuals may contact HABs multiple times. There are no studies that evaluate chronic or intermittent health impact of HAB exposure.

The health impacts of polluted water sources and coastlines could have a devastating impact on residents and visitors in Florida. Research shows that exposure to water pollution can cause upper and lower respiratory symptoms, including eye irritation, bronchoconstriction, and dry cough.[81] There have also been incidents around the world that have left many hospitalized, and in some cases in critical condition. If Florida's waterways are not cleaned, Florida's residents and visitors could be in danger.

ECONOMIC IMPACTS

When examining the impacts of Everglades restoration, it is important not only to think of the Everglades as a landmark or ecosystem, but also as a critical part of daily life for millions of Floridians and a countless number of visitors. More than eight million people depend on the network of estuaries, basins, and rivers entwined with the Everglades to provide them with resources essential to their economies.[82]

Tourism and Recreational Activities

For years, residents, and lawmakers at the local, state, and federal levels have debated the issue of pollution and its effects on Lake Okeechobee. The pollution has left the region in a dire situation. While the impacts on the water quality and health in the region may be evident, the pollution of Lake Okeechobee also has a great impact on the area's economy. Nutrient pollution affects bodies of water not only in South Florida, but across the United States. It is estimated that across the nation, the tourism industry loses nearly $1 billion a year in revenues due to polluted waterways.[83] These losses are primarily due to the effects algal blooms and other nutrient pollutions have on fishing and recreational boating activities.[84] These are among the activities for which Florida is best known, and for which the Everglades is a top destination. While some come to ride on airboats or go hiking, many more come to see alligators, manatees, and birds, or to hunt and fish. [85] Without continued restoration of the Everglades, these activities may no longer be possible, which would be very detrimental to state and local economies.

81 Resource guide for public health response to harmful algal blooms in Florida, Abbott, G. M., Landsberg, J. H., Reich, A. R., Steidinger, K. A., Ketchen, S., & Blackmore, C. (2009). Fish and Wildlife Research Institute Technical Report TR-14.

82 "Everglades Restoration." *It's Your Government*, Issue 1.1003. (Sept. 2016). Florida TaxWatch.

83 United States Environmental Protection Agency.

84 Ibid.

85 The Indian River Lagoon Species Inventory: The Indian River Lagoon Estuary. Smithsonian Marine Station at Fort Pierce.

The Indian River Lagoon in South Florida is one of the nation's most plentiful commercial fishing sources. Each year the lagoon accounts for nearly 15 percent of all fish and shellfish harvested in the U.S., and the sector generates roughly $140 million in economic impact for the region.[86] The impact of fishing on the economy in the Florida Bay region is even greater.

A recent study found that commercial and recreational fishing in the Florida Bay region generates an economic impact of $458 million per year.[87] As mentioned in the environmental impacts section, increased prevalence of algal blooms could result in more frequent fish kills. Further loss to commercial fishing would greatly impact Florida, as it has other states in the past.

A study conducted in the Machias Bay region of Maine, for example, found that over a nine-year period from 2001-2009, temporary closures due to polluted waterways caused the area to miss out on $3.6 million in revenues, a significant sum that made up 27.4 percent on total "bay-related" revenues to the region.[88] Extrapolating this example out, the dollar figure of lost revenues would be much more significant in either the Indian River Lagoon or Florida Bay areas. If the Indian River Lagoon region were to miss out on just 27.4 percent of the economic impact due to commercial fishing, the local economy would miss out on more than $38 million annually, and for the Florida Bay Region, that number would climb to more than $125 million. The Everglades region is no different. It is clear that continued effects of algal blooms and nutrient pollution in the Everglades and connected water bodies are felt in all areas of tourism.

Local examples

Lake Okeechobee is the seventh-largest freshwater lake in the U.S., and portions of the lake can be found in five different counties: Okeechobee, Glades, Martin, Palm Beach, and Hendry. Each year, tourists from around the world come to visit the lake to enjoy the 730 miles of fresh water, and all five counties benefit from the lake's draw.

Hendry County

Hendry County, the home of Clewiston, hosts many fishing tournaments each year. With nearly $1 million in cash prizes up for grabs, the Walmart FLW tour fishing competition is the biggest of them all. Each year Clewiston sees an influx of competitors and spectators for the tournament, and the impact on the local economy is roughly $1.5 million. This is significant when one considers Clewiston is a town of only 7,000 residents.[89]

Fishing tournaments are not the only draws to the area though. The lake brings tens of thousands of visitors to the county who are looking to enjoy recreational boating activities, more casual fishing experiences, or even just some peace and quiet around the lake. Each year, tourists spend more than $30 million in the county and

86 The Indian River Lagoon Species Inventory: The Indian River Lagoon Estuary. Smithsonian Marine Station at Fort Pierce.

87 The Economic Significance of Florida Bay. Steinbeck, Andrew. (Jan. 2017) The Everglades Foundation.

88 Measuring the impact of pollution closures on commercial shellfish harvest: The Case of soft-shell clams in Machias Bay, Maine, Athearn, Kevin, Bell, Kathleen, Chen, Xuan, et al. (2016) Ocean and Coastal Management, Vol. 130 pp.196-204.

89 Fishing For Tourists on Lake Okeechobee, Ruane, Laura (2016) http://www.news-press.com/story/money/2016/02/03/fishing-tourists-lake-okeechobee-florida/79418414/

support more than 400 jobs.[90] In addition, state and local tax revenues of roughly $2.5 million are collected each year from visitors to Hendry County,[91] almost all of whom come to experience the lake. Pollution to the lake and the surrounding waterways could threaten the survival of fishing tournaments and the accompanying tourism that benefits Hendry County each year.

Okeechobee County

Okeechobee County, which encompasses the city of Okeechobee, is another small community that is home to just over 39,000 residents and 13,000 workers, many of whom rely on the lake and its natural resources in one form or another. With Lake Okeechobee, and all of the surrounding areas to camp and explore Florida's natural habitat, the city has become an attraction for those looking to experience the outdoors and "be one with nature."

A 2013 study published by Florida TaxWatch found that more than 1,100 residents in Okeechobee County were employed in the tourism sector, and that their total wages were more than $17 million collectively.[92] In more recent years, Okeechobee has expanded its tourism draw by bringing in one of the nation's top music festivals, the Okeechobee Music and Arts Festival (OMF). In its first year (2016), the OMF generated more than $16.4 million in economic impact.[93] The inaugural OMF was so successful that 2017's OMF was one of the most sought-after music festivals in the world, attracting nearly 40,000 visitors to the area.[94] The festival, which takes place at the Sunshine Grove, sits in close proximity to Taylor Creek and is just blocks away from the lake. In fact, many of the visitors to the festival stay at camp grounds that typically service visitors to the lake. The continued contamination of Lake Okeechobee could make festival organizers question the area as a venue in the years to come.

Glades County

Glades County, a rural area that borders 30 miles of shoreline on Lake Okeechobee, is not the state's most popular tourism destination; however, that does not mean its residents do not benefit (albeit in a relatively small way) from their proximity to the lake. The small county, which is home to only 3,700 working residents, had roughly 79 individuals working in the field of leisure and hospitality.[95] This is to be expected, as the area is home to just a limited number of small hotels.

Instead, visitors to the area typically stay in campgrounds or residential vehicle resorts and, therefore, measuring the impact of tourists by just the sector of hospitality and leisure does not paint a complete picture. To help explain the true economic impact of tourism on the region, it is also prudent to look at the number of jobs in other fields that are typically impacted by tourism. For example, the county has approximately 325

90 Fishing For Tourists on Lake Okeechobee, Ruane, Laura (2016) http://www.news-press.com/story/money/2016/02/03/fishing-tourists-lake-okeechobee-florida/79418414/

91 Ibid.

92 Unpacking the Benefits of Florida Tourism: Quantifying the Jobs Created by Increased Florida Tourism, Florida TaxWatch, August 2014.

93 OMF Gearing up for 2017 Festival, Elksen, Katrina (2017) http://okeechobeenews.net/entertainment/omf-gearing-2017-festival/?utm_source=feedblitz&utm_medium=FeedBlitzRss&utm_campaign=okeechobeenews

94 Ibid.

95 Unpacking the Benefits of Florida Tourism: Quantifying the Jobs Created by Increased Florida Tourism (2014) http://floridataxwatch.org/resources/pdf/unpackingtourismfinal.pdf

residents working in the food service industry. The county also benefits from its proximity to the lake with nearly 200 individuals employed in the farming, fishing, and forestry industries.[96] While these numbers may seem small compared to neighboring counties, the impact is still significant for the rural area.

Martin and Palm Beach Counties

The last two counties that border Lake Okeechobee, Martin County and Palm Beach County, have been combined in this section for a simple reason: both counties have major tourism draws in addition to Lake Okeechobee. For this reason, it is difficult to distinguish the economic impact of tourism in each county related to the lake.

Pollution from the lake has made its way to coastal areas, and Martin and Palm Beach counties have seen toxic sludge infect their beaches, which has led to warnings being issued in each county.[97] The issue came to national prominence on July 1, 2016, when Governor Rick Scott declared a state of emergency for the counties as a result of the discharge of cyanobacteria from Lake Okeechobee into area waterways to prevent flooding.[98]

In May of that year, toxic cyanobacteria (blue-green algae) bloomed in Lake Okeechobee. Controlled releases of the water carried the algae to the St. Lucie River, Indian River Lagoon, and the Martin County shoreline where the organisms bloomed uncontrollably. This forced the closure of Martin County beaches. The same turn of events occurred on the west coast as algae-laden water was released into the Caloosahatchee River. The bloom spread to Fort Myers, forcing beach closures in that region as well. Instead of tourists and residents flocking to the beach to celebrate the Fourth of July, reservations were cancelled and alternate plans made, resulting in a large economic loss.[99] Florida TaxWatch internal estimates found that Lee County lost out on up to $185 million.[100]

Coverage from national media outlets, such as CNN, showed pictures of algae-covered waterways, which endangered the region's tourism sector. At the time, reports from Palm Beach and Martin counties stated that beaches, hotels, and restaurants in the region experienced a significant reduction in the number of visitors. Considering the counties rely heavily on the tourism sector, with nearly 83,500 residents employed in the industry combined,[101] the negative and distorted media reports damaged the area. One local surf shop owner estimated that the pollution cost his business roughly $10,000 a week[102] and, unfortunately, his story was not unique. Studies have found that tourism-based economies in the surrounding areas are adversely impacted

96 Data USA: Glades County, Florida https://datausa.io/profile/geo/glades-county-fl/

97 Lake Okeechobee Algal blooms Threatens to Worsen Water Woes, Reid, Andy (2016) http://www.sun-sentinel.com/local/palm-beach/fl-lake-okeechobee-algae-bloom-20160517-story.html, Sun Sentinel

98 Ibid.

99 Toxic algal bloom hits Florida, drives away tourists, Pittman, Craigh (2016) http://www.tampabay.com/news/environment/water/toxic-algae-bloom-crisis-hits-florida-drives-away-tourists/2283838 Tampa Bay Times

100 Estimate based on lee county losing out on the equivalent of 2 weeks of visitors (roughly 185,000 "visitors") spending approximately $1,000 per visit.

101 Unpacking the Benefits of Florida Tourism: Quantifying the Jobs Created by Increased Florida Tourism (2014) http://floridataxwatch.org/resources/pdf/unpackingtourismfinal.pdf

102 Toxic Algal bloom Blankets Florida Beaches, Prompts State Emergency, Cuevas, Maya (2016) http://www.cnn.com/2016/07/01/us/florida-algae-pollution/ CNN

by pollution of the river, and the subsequent discharges that affect the coastal areas in the region.[103] Unless a sustainable solution to the issue is found, it is not just the shorelines of Lake Okeechobee that are at risk, it may also be Florida's pristine beaches.

General Economic Effects

While the tourism industry has been and will continue to be affected by the pollution of Lake Okeechobee, there are other economic factors to consider as well.

Property Values

Proximity to water, a view of water, and the quality of water are among the top attributes sought by homebuyers—but only if that water is clean.[104] The pollution of freshwater sources can have a negative effect on property values for homes near the affected bodies of water. One study examining property values in Lee and Martin counties between 2010 and 2014 found that, when water quality dropped following discharges from Lake Okeechobee, property values dropped by a total of $1 billion between the two counties. This represents an average of a $135.3 million drop per year in Lee County, and a $107 million drop per year in Martin County.[105]

Addressing water quality issues in Lake Okeechobee, the Everglades, and the Kissimmee River will greatly improve property values in the surrounding areas that rely on these bodies of water. Houses that are in close proximity to clean water sources have seen an increase in home value of up to 25 percent.[106] A more regionally specific study out of Clemson University found that, if water quality were improved in the rivers surrounding Lake Okeechobee, homeowners in the proximity of those bodies of water would see their property values increase by 18 percent ($12 billion in total value added).[107] In the Florida Bay region, access to the bay adds a significant value to residential properties in the region. A recent study found that the bay adds nearly $1.2 billion in value to homes in the area.[108]

These findings are clear—if the deterioration of the Everglades continues, property values will continue to decline in the surrounding areas, weakening those communities and resulting in significant losses to real estate owners and local government tax revenues.

Clean Water Costs

Another major concern is the cost of clean water, and the costs that can come about when a state does not deal with water pollution. One example is Minnesota. For years, lakes and rivers in Minnesota were subject to

103 A Draining Problem: How the Release of the Lake Okeechobee Floodwaters is Dirtying Florida's Coastline, Reid, Andy, Uraizee, Ifran, Zhu, Yiran (2016) http://interactive.sun-sentinel.com/lake-okeechobee-flooding/ Sun Sentinel

104 Nutrient Pollution: The Effects: Economy (2017)https://www.epa.gov/nutrientpollution/effects-economy

105 "The Impact of Water Quality on Florida's Home Values." (March 2015). FloridaRealtors.

106 Nutrient Pollution: The Effects: Economy (2017)https://www.epa.gov/nutrientpollution/effects-economy

107 Maloney, Michael; De Los Santos, Babur; Thomas, Charles et al, "Benefit and Benefit/Cost Calculations for Two Everglades Restoration Projects," Clemson University (2017)

108 The Economic Significance of Florida Bay. Steinbeck, Andrew. (Jan. 2017) The Everglades Foundation.

nitrogen pollution due to runoff from agricultural lands. The crisis has come to a head, as recent studies have found that pollutants have impaired 40 percent of rivers, streams, and lakes in the state.[109] The pollution has truly had an economic impact on the state, as the cost of clean water has risen significantly. Due to the need for nitrate-removal systems (which can cost communities as much as $3,300 per household),[110] the cost of clean water in the state has risen by as much as 8,000 percent.[111]

Due to the way drainage is managed in the state, the ground water stored in the aquifers in the coastal counties of South Florida is becoming increasingly brackish (a mixture of salt and freshwater).[112] This water necessitates higher energy costs, as it must be desalinated in order to be used.[113] Combining salinity and nitrogen pollution issues, it becomes clear that a rise in water prices is imminent and could cost Florida taxpayers hundreds of millions of dollars,[114] and make utility costs unaffordable for many.

The findings are clear: if Florida does not take action to clean the state's polluted waterways, the state's economy could suffer. Residents could see their property values decrease as water pollution negatively impacts local housing markets. Those residents who rely on commercial and recreational fishing are also at risk as pollution causes fish kills each year, and potentially worst of all, contaminated water has found its way to our coastlines, which has an impact on our beaches. Florida relies on tourism more than any other in the U.S., and one of its major selling points is its pristine beaches. Many of the state's coastlines have already experienced toxic sludge and bouts of red tide that have left tourist hotspots empty. If Florida does not clean up its waterways, the state's tourism sector could suffer substantially.

Impact on Taxes

In addition to all the other impacts discussed in this report, failure to act on the water quality problems in Lake Okeechobee and the Everglades could have significant impacts on Florida state and local government tax revenues.

Taxes from Tourist Spending

Tourists contribute a significant share of Florida's tax revenues. The biggest impact is on the sales tax, by far the largest state government tax source. Local option sales surtaxes also are an important revenue source for Florida's counties, cities, and school districts. Florida's state sales tax of 6 percent brings in $25.9 billion annually.[115]

109 MN adds more than 300 lakes, streams to polluted water list, Gunderson, Dan (2016) https://www.mprnews.org/story/2016/07/13/minnesota-adds-pollution-sources-impaired-waters-list. Minnesota Public Radio

110 Tainted drinking water is costing Minnesota taxpayers millions, Kennedy, Tony (2015) http://www.startribune.com/tainted-drinking-water-costs-minn-taxpayers-millions/301324001/ Star Tribune

111 Nutrient Pollution: The Effects: Economy https://www.epa.gov/nutrientpollution/effects-economy

112 "Everglades Restoration: A 4-to-1 Return on Investment." (April 2014). Everglades Foundation.

113 Ibid.

114 Based on research that shows Florida water costs $0.50 to $1.06 per 1,000 gallons in many communities across the state.

115 Results of the General Revenue Estimating Conference, March 17, 2017.

Local government surtaxes, ranging from 0.5 percent to 2.0 percent, produce another $2.3 billion annually.[116] Sixty-one (61) of Florida's 67 counties levy at least one local option sales surtax.[117]

It is conservatively estimated that tourists pay 12.5 percent of all sales taxes in Florida.[118] This only includes out-of-state visitors because it is assumed that all spending by Floridians when on an in-state vacation simply replaces other spending they would make in Florida, but this may not always be the case. If Florida tourism destinations, such as Everglades National Park, keep Floridians from leaving the state for vacation, their spending in Florida—and the sales tax they pay on that spending—is a plus for Florida. Even assuming the limited 12.5 percent contribution, out-of-state tourists provide $3.24 billion in sales taxes to the state and close to $300 million in additional local taxes.[119]

The Everglades, the impacted waterways, and the counties in the area play a big role in creating these revenues through Florida tourism. As mentioned before, recreational activities like fishing, boating, wildlife viewing, and camping are just some of the activities that draw visitors, not to mention the beaches and attractions in the surrounding area. The Everglades National Park and the Big Cypress National Preserve host a combined two million visitors a year.[120] A small change in these tourist visits can have a significant impact on sales tax revenues, as every one percent change in the number of visitors equates to $35 million in sales tax collections.

Florida relies very heavily on taxing transactions—80 percent of state taxes come from transaction taxes, compared to the national average of 47 percent.[121] This includes more than sales taxes. Other excise taxes that tourists help pay include:

- Motor Fuel (Gas) Taxes – The combined state and local gas tax rate in Florida varies by county and can be as high as 36.9 cents per gallon.[122] It raises $2.8 billion at the state level and almost another $1 billion through local option taxes;[123]
- Alcoholic Beverage Taxes – In addition to sales taxes, taxes are also levied on beer, wine, and liquor sales. These taxes raise $307 million for the state;
- Tobacco Taxes – Sales of cigarettes and other tobacco products bring in $1.2 billion in taxes. This money, among other things, helps pay for Florida's Medicaid and state general revenue programs, and some is shared with local governments;
- Rental Car Surcharge – This $2 a day tax on rental cars produces $195 million and is an important source of Florida's transportation funding;

116 Florida Legislature, 2017 Florida Tax Handbook.

117 Florida Department of Revenue, Form DR-15DSS, Discretionary Sales Surtax Information for Calendar Year 2017.

118 Florida Office of Economic and demographic Research, Return on Investment for Visit Florida, January 1, 2015.

119 A portion of state sales is also shared with local governments. In 2016-17 it is estimated that $2.8 billion in state sales taxes will be shared with local governments. Results of the General Revenue Estimating Conference, March 17, 2017.

120 National Park Service, NPS Stats. Available at: https://irma.nps.gov/Stats/

121 Florida TaxWatch, 2017 How Florida Compares: Taxes, March 2017.

122 Florida Department of Revenue, Revised 2017 Florida Fuel Tax, Collection Allowance, Refund, and Pollutants Tax Rates.

123 All estimates of revenue for these taxes is from the Florida Legislature, 2017 Tax Handbook. Some calculation by Florida TaxWatch.

- Local "Bed" Taxes – Local governments are authorized to levy a number of different taxes on transient rentals (hotels, RV parks, timeshares, vacation rentals and other short-term rentals). These levies bring in just over $1 billion a year. These funds are generally used for tourism promotion and other tourism related spending. A reduction in these revenues can have snowball effect—less money means less tourism promotion, which can mean a further reduction in tourists; and

- Lottery – Although not an excise tax, the Lottery is another major revenue source to which tourists contribute. The Lottery sells approximately $6 billion in tickets annually. After prizes and administrative costs are deducted, the Lottery contributes more than $1.6 billion to Florida's education system.

Assuming tourists contribute the same percentage of these taxes as they do the sales tax,[124] they would contribute another $1 billion to Florida governments. Each 1 percent change in the number of tourists equates to $10 million in tax revenue.

Property Taxes

As discussed earlier in this report, water quality can have a significant impact on property values, which in turn have an impact on property taxes—the major tax source for local governments and school districts.

One study that compared two restoration projects—the construction of a reservoir south of Lake Okeechobee versus a reservoir north of the lake—estimated that construction of the South Reservoir would increase property values in Lee and Martin counties by $19.2 billion.[125] Due to Florida's constitutional caps on property assessments,[126] it would be difficult to estimate how that large of a value increase would translate into increased property tax collections.

Using the previously mentioned example regarding property values in Lee and Martin counties, however, shows how detrimental a decrease in values could be. Assuming average millage rates for the counties and the combined $1 billion dollar drop in property value between 2010 and 2014,[127] total property tax loss is estimated at $16.8 million.

Taxes from Overall Economic Growth

Water quality problems can also negatively impact the overall economy and fixing the problem can improve the economy. One study estimates that restoration of the Everglades will impact the number of jobs in a variety of industries and the economic activity they generate.[128] The study estimates 442,664 jobs will be created in recreational and commercial fishing, construction and real estate services, and tourism-related industries.

124 For illustration only. There is not a good estimate of the amount paid by tourists and it would vary by source. Tourists likely contribute less than 12.5 percent in motor fuel taxes, but more in rental car and bed taxes.

125 Michael T. Maloney, Benefit & Benefit/Cost Calculations for Two Everglades Restoration Projects, February 2017.

126 Article VII, Section 4(d) (Save Our Homes) limits annual increases in homestead assessments to 3 percent and Article VII, Section 4(g) limits non-homestead assessments to 10 percent annually. The 10 percent cap is scheduled to be repealed in 2019, but voters will have a chance to abrogate that during the November 2018 election.

127 Florida Realtors, "The Impact of Water Quality on Florida's Home Values." (March 2015)

128 Mather Economics, Measuring the Economic Benefits of America's Everglades Restoration.

This is the net of an estimated loss of 3,724 agricultural jobs due to decreased acreage. These job gains stem from the ecosystem improvements. In addition, the Corps of Engineers has estimated the work of completing the actual restoration projects will create 22,000 jobs.[129]

As the impact of this economic activity ripples through the economy and more dollars are spent, collections of taxes discussed above will increase, and other taxes are likely to rise as well. These include documentary stamp and intangibles taxes from real estate transactions, and corporate income taxes from higher profits.

With any significant change in spending, whether it is due to a decrease in tourism, property values, or a loss in expendable income (due to job loss), the state is likely to experience a loss of economic vitality and reduced tax revenue. As shown above, there are various tax resources that are susceptible to a decrease in revenue if the state does not shore up water pollution. Any significant loss in tax revenues could affect state programs and infrastructure projects that benefit millions of Floridians each day.

CONCLUSION

Overall, polluted waterways and dying ecosystems can have a major impact on Floridians, visitors, animals, and the economy of the state. Poor water quality and reduced recreational opportunities can threaten tourism, harming many businesses that rely on the beauty of Florida to sell their products and negatively impact property values and communities.

The quality of water in the Everglades system is important to all of Florida's taxpayers in so many ways. Solutions to the issue may be costly, but the fact of the matter remains, the longer Florida waits to solve the problem, the solution becomes more expensive. While the price tag to address the issues raised in this report may be a shock to the system, the cost of inaction could be even more costly and damaging to the state of Florida and its resilient, hardworking taxpayers.

> *"There are risks and costs to action. But they are far less than the long range risks of comfortable inaction."*
>
> — President John F. Kennedy

129 Mather Economics, Measuring the Economic Benefits of America's Everglades Restoration.

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