



Sent via email and U.S. certified mail

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Re: 60-Day Notice of Endangered Species Act Violations Regarding the Lake Okeechobee Regulation Schedule

Dear Madam and Sirs:

This letter notifies the U.S. Army Corps of Engineers (Corps), U.S. Fish and Wildlife Service (FWS), and National Marine Fisheries Service (NMFS) of the intent of the Center for Biological Diversity, Calusa Waterkeeper, and Waterkeeper Alliance to sue for violations of the Endangered Species Act (ESA), 16 U.S.C. § 1531, *et seq.*, regarding the Lake Okeechobee Regulation Schedule (LORS). The Corps manages Lake Okeechobee and its discharges to the Caloosahatchee and St. Lucie estuaries via LORS. The Corps, FWS and NMFS violated and continue to be in violation of the ESA because of:

1. NMFS' issuance of and the Corps' reliance upon NMFS' unlawful 2015 concurrence letter regarding LORS;
2. FWS' issuance of and the Corps' reliance upon FWS' unlawful 2018 biological opinion regarding LORS;
3. The failure of the Corps, FWS, and NMFS to reinitiate consultation under Section 7 of the ESA on the 2018 and 2015 biological opinions respectively; and
4. The failure of the Corps, FWS, and NMFS to utilize their authorities regarding LORS in furtherance of the purposes of the ESA.

The Corps' unmitigated discharges of polluted water into the Caloosahatchee and St. Lucie rivers from Lake Okeechobee are killing countless marine species, crippling local economies, and violating U.S. laws enacted to protect the environment.

When the Corps updated its management of Lake Okeechobee in 2008 to lower the risk of damage to the Hebert Hoover Dike (HHD) it wrongly assumed that it would not negatively affect "any downstream ecosystems more than they already experience."¹ The Corps consulted with FWS and NMFS to analyze the effects of this new water management schedule, known as "LORS", on Florida's most imperiled species. In doing so, the federal agencies intended LORS to be in effect for only three years, or until around 2010 when the Corps would then incorporate HHD's structural improvements along with benefits from initial components of the Comprehensive Everglades Restoration Plan (CERP) into LORS.²

None of those triggers have come to pass: HHD repairs remain ongoing, few CERP projects have been completed, and now the Corps is claiming that it will continue to manage Lake Okeechobee under LORS until 2025.³

LORS is causing significant adverse impacts to the rivers and their estuaries by allowing the Corps to discharge freshwater into the system in a way that causes significant harm due to the algae and nutrients that are allowed to accumulate in the lake before being released to the estuaries. This in turn, has adversely affected ESA-listed species, like Florida manatees, smalltooth sawfish, Johnson's seagrass, sea turtles, and coral and degraded their habitat.

Past analyses of LORS did not consider the long term impacts of high volume discharges beyond three years, discounted the effects of harmful algal blooms (HABs), and entirely failed to consider how climate change might affect LORS and HABs.

This letter is provided pursuant to the sixty-day notice requirement of the citizen suit provision of the ESA.⁴ The Corps, FWS, and NMFS have sixty days to remedy the violations identified herein; if these violations are not cured within the sixty day notice period, the undersigned parties intend to file suit in federal court.

¹ U.S. Fish and Wildlife Service 2007 Biological Opinion on the Lake Okeechobee Regulation Schedule (FWS 2007) at 11, 64; The Corps' Record of Decision states that a key feature of LORS is that "it allows long-term, low-volume releases to the Caloosahatchee and St. Lucie estuaries" which are "intended to manage lake levels while reducing the potential for future prolonged high-volume releases." U.S. Army Corps of Engineers Record of Decision for the Lake Okeechobee Regulation Schedule (Corps 2008) at 2.

² FWS 2007 at 1. The Corps intended that LORS be in effect until the earlier of (1) implementation of a new lake schedule as a component of the system-wide operating plan for CERP Band 1 projects and Florida's Acceler8 projects; or (2) completion of HHD seepage berm construction or equivalent dike repairs for reaches 1, 2, and 3, upon information and belief, the Corps intended LORS to be interim and only last until 2010.

³ U.S. Fish and Wildlife Service 2018 Biological Opinion on the Lake Okeechobee Regulation Schedule (FWS 2018).

⁴ 16 U.S.C. §§ 1540(g).

I. ORGANIZATIONS GIVING NOTICE

The names, addresses, and phone numbers of the organizations giving notice of intent to sue under the ESA are:

Center for Biological Diversity
P.O. Box 2155
St. Petersburg, Florida 33731
(727) 490-9190

Calusa Waterkeeper
P.O. Box 1165
Fort Myers, FL 33902
(239) 633-7274

Waterkeeper Alliance
180 Maiden Lane, Suite 603
New York, NY 10038
(212) 747-0622 x. 132

II. THE ENDANGERED SPECIES ACT

The ESA, by way of its “language, history, and structure . . . indicates beyond doubt that Congress intended endangered species to be afforded the highest of priorities” for protection under the law.⁵ The purpose of the Endangered Species Act is in part “to provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved [and] to provide a program for conservation of such endangered and threatened species.”⁶ The secretaries of Interior and Commerce administer the ESA through FWS and NMFS respectively. FWS has jurisdiction over terrestrial species, non-marine aquatic species, and certain marine species while on land. NMFS has jurisdiction over marine species and most anadromous fish.

To fulfill the substantive purpose of the ESA, federal agencies are required to “insure that any action authorized, funded, or carried out by such agency . . . is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the adverse modification of [the critical] habitat of such species.”⁷ An action will cause “jeopardy” if it “reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.”⁸

The first step in the Section 7 process is for the agency authorizing the project to determine if the proposed action “may affect” an endangered or threatened species.⁹ If the agency determines the action will not affect a listed species, and FWS/NMFS concurs, no further action is required. If, on the other hand, the action agency has determined that the proposed action “may affect” a listed species or critical habitat, it may initiate “informal consultation” with FWS/NMFS.¹⁰ If

⁵ *Tennessee Valley Authority v. Hill*, 437 U.S. 153, 174 (1978).

⁶ 16 U.S.C. § 1531(b).

⁷ *Id.* § 1536(a)(2).

⁸ 50 C.F.R. § 402.02.

⁹ *Id.* § 402.02.

¹⁰ *Id.* § 402.13.

during this process it is revealed that the action is “likely to adversely affect” a listed species or critical habitat, formal consultation is required.¹¹

The formal consultation process requires a written statement, known as a “biological opinion,” setting forth the Secretary’s opinion detailing how the agency action affects the species or its critical habitat.¹² After FWS/NMFS analyzes the direct, indirect and cumulative effects of the proposed action it makes a finding as to whether the action “is likely to jeopardize the continued existence of the species.”¹³ If it is determined that the action will jeopardize a species or adversely modify the species’ critical habitat, the biological opinion must list any “reasonable and prudent alternatives” to the proposed action that would not result in jeopardy to the species.¹⁴ If FWS/NMFS concludes that the action or the RPAs will not cause jeopardy, but may result in the take of a listed species, FWS/NMFS must issue an incidental take statement (ITS) that specifies “the impact, i.e., the amount or extent, of . . . incidental taking” that may occur.¹⁵

To “take” an endangered or threatened species means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect” it, or “to attempt to engage in any such conduct.”¹⁶ “Harm” includes significant habitat modification or degradation that results in death or injury to listed species “by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”¹⁷ “Harass” is defined as intentional or negligent actions that create a likelihood of injury to listed species “to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering.”¹⁸ Congress intended the term “take” to be defined in the “broadest possible manner to include every conceivable way” a person could harm or kill fish or wildlife.¹⁹

An ITS must include “reasonable and prudent measures . . . necessary . . . to minimize such impact,”²⁰ and must specify the permissible level of taking, “thus . . . serv[ing] as a check on the agency’s original decision that the incidental take of listed species resulting from the proposed action will not [jeopardize the continued existence of the species].”²¹ In addition, when the listed species to be taken are marine mammals, the take must first be authorized pursuant to the Marine Mammal Protection Act (MMPA) and the ITS must include any additional measures necessary to comply with the MMPA take authorization.²²

Compliance with the biological opinion and its incidental take statement protects federal agencies, and others acting under the biological opinion, from enforcement action under Section

¹¹ *Id.* § 402.12(j).

¹² 16 U.S.C. § 1536(b)(3)(A); 50 C.F.R. § 402.02.

¹³ 16 U.S.C. § 1536(b).

¹⁴ *Id.* § 1536(b)(3)(A).

¹⁵ 50 C.F.R. § 402.14(h)(3).

¹⁶ 16 U.S.C. § 1532(19).

¹⁷ 50 C.F.R. § 17.3.

¹⁸ *Id.*

¹⁹ See S. Rep. No. 93-307, at 7 (1973), as reprinted in 1973 U.S.C.C.A.N. 2989, 2995.

²⁰ 16 U.S.C. § 1536(b)(4).

²¹ *Id.*; *Center for Biological Diversity v. Salazar*, 695 F.3d 893, 911 (9th Cir. 2012).

²² 50 C.F.R. § 402.14(h)(3).

9's prohibition against take;²³ however, take not in compliance with a biological opinion or absent a valid take statement or take permit is in violation of Section 9 of the ESA.

Even after the procedural requirements of a consultation are complete, the ultimate duty to ensure that an activity is not likely to cause jeopardy to a listed species lies with the action agency. An action agency's reliance on an inadequate, incomplete, or flawed biological opinion cannot satisfy its duty to avoid the likelihood of jeopardy to listed species.²⁴

Moreover, although the Section 7 formal consultation process is complete upon the of a biological opinion, reinitiation of formal consultation is required and shall be requested by the Federal agency or by FWS/NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and:

- (1) If the amount or extent of taking specified in the incidental take statement is exceeded;
- (2) If new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered;
- (3) If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or
- (4) If a new species is listed or critical habitat designated that may be affected by the identified action.²⁵

Furthermore, once the agencies reinitiate consultation, the action agency, here the Corps, shall not make any irretrievable commitment of resources with respect to the agency action which has the effect of foreclosing the formulation or implementation of any reasonable and prudent measures which would not violate subsection (a)(2) of this section."²⁶ Congress enacted Section 7(d) "to ensure that the status quo would be maintained during the consultation process, to prevent agencies from sinking resources into a project in order to ensure its completion regardless of its impacts to endangered species".²⁷ Congress amended the ESA to include this provision to prevent agencies from steamrolling activities in order to secure completion of projects.²⁸

Federal agencies have additional responsibilities under Section 7(a)(1) of the ESA, including a requirement that they "utilize their authorities in furtherance of the purposes of [the Act]" and to "carry[] out programs for the conservation of" listed species.²⁹ The ESA defines "conservation" to mean the use of "all methods and procedures" that are necessary to recover a listed species to

²³ 16 U.S.C. §§ 1536(o)(2); 1538(a); 50 C.F.R. § 17.31(a).

²⁴ See, e.g., *Florida Key Deer v. Paulison*, 522 F.3d 1133, 1145 (11th Cir. 2008) (action agency must independently ensure that its actions are not likely to cause jeopardy); *Pyramid Lake Tribe of Indians v. U.S. Dep't of Navy*, 898 F.2d 1410, 1415 (9th Cir. 1990) (same).

²⁵ 50 C.F.R. § 402.16.

²⁶ 16 U.S.C. § 1536(d).

²⁷ *Washington Toxics v. EPA*, 413 F.3d 1024, 1034-35 (9th Cir. 2005).

²⁸ *National Wilderness Institute v. Corps*, 2005 U.S. Dist. LEXIS 5159 (D.D.C. Mar. 23, 2005).

²⁹ 16 U.S.C. § 1536(a)(1).

the point where protections under the act are no longer necessary.³⁰ Thus, section 7(a)(1) requires each federal agency to ensure that its actions are consistent with the recovery of listed species.³¹

III. LAKE OKEECHOBEE & HARMFUL DISCHARGES TO THE NORTHERN ESTUARIES

The Greater Everglades Ecosystem stretches from Orange County to Monroe County, and comprises a network of freshwater ponds and sloughs, prairies, and forested uplands. Historically, water flowed from Shingle Creek just south of present day Orlando, through the Kissimmee River, into Lake Okeechobee and south where it reached Florida Bay.

More than a century ago, the Everglades was drained for development, agricultural production, and subsequently, for flood control. In 1948, Congress approved the Flood Control Act of 1948, which authorized the Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project). The purpose of the C&SF Project was to provide flood control; water supply for municipal, industrial, and agricultural uses; prevention of saltwater intrusion; water supply for Everglades National Park; recreation; and protection of fish and wildlife resources.³² To accomplish these objectives, the Corps constructed a network of levees, water storage areas, pumps and canal improvements in south Florida.³³ This network of canals, levees, and water control structures has fundamentally altered the nature of the ecosystem, and today, the Everglades is half the size it was a hundred years ago.³⁴

Moreover, much of what remains of the historic Everglades is heavily polluted by phosphorous, nitrogen, and mercury as a result of urban and agricultural development.³⁵ Most of this pollution is from “nonpoint sources” which are a type of pollution that “arises from many dispersed activities over large areas” and “not traceable to any single discrete source.”³⁶ These diffuse sources of pollution (like farms and roadways) are sources from which runoff drains into a watershed.³⁷

A. Lake Okeechobee

Lake Okeechobee and the rivers that drain it to the Gulf of Mexico and Atlantic Ocean – the Caloosahatchee and St. Lucie rivers, respectively – are human-altered systems that help sustain the greater Everglades region. Lake Okeechobee is often referred to as the “liquid heart” of the

³⁰ *Id.* at 1532(3).

³¹ See 50 C.F.R. § 402.15(a) (explaining that it is each agency’s continuing obligation to “determine whether and in what manner to proceed with the action in light of its section 7 obligations” to protect and recover listed species).

³² 68 Fed. Reg. 64200, *Programmatic Regulations for the Comprehensive Everglades Restoration Plan*, (Nov. 12, 2003).

³³ *Id.* .

³⁴ Florida Department of Environmental Protection, Brief History of the Everglades, at <http://www.dep.state.fl.us/evergladesforever/about/default.htm>.

³⁵ National Research Council, National Academy of Sciences, Preface to Progress Towards Restoring the Everglades: The Fourth Biennial Review (2012), available at <http://www.nap.edu/catalog/13422/progress-toward-restoring-the-everglades-the-fourth-biennial-review-2012>

³⁶ *Nw. Env'tl. Def. Ctr. v. Brown*, 640 F.3d 1063, 1070 (9th Cir. 2011).

³⁷ *American Farm Bureau Federation v. United States Env'tl. Protection Agency*, 792 F. 3d 281, 289 (3d Cir. 2015).

Everglades, encompassing 730 square miles. The lake is home to alligators, snail kites, bald eagles, crested caracara, Florida manatees, and grasshopper sparrows.

Over the past several decades, the lake has been heavily polluted by nutrients, particularly phosphorous, from nonpoint source runoff. After years of delay, and following a suit by environmental and conservation organizations to compel action,³⁸ the state of Florida adopted a Total Maximum Daily Load (TMDL) in 2001 for Lake Okeechobee limiting phosphorous to 140 metric tons a year and set a target date of 2015 to meet the phosphorous TMDL.³⁹ A TMDL is the amount of a pollutant that can enter a particular water without violating state water quality standards established pursuant to the Clean Water Act.⁴⁰ To implement and achieve the TMDL, the Lake Okeechobee Protection Act directed the Florida Department of Environmental Protection to create a “Lake Okeechobee Protection Plan” (LOPP). The LOPP set a target date of 2015 to meet the phosphorous TMDL.⁴¹

When 2015 came and went, the state was far from meeting the TMDL. The Florida Legislature amended the law in 2016 calling for the achievement of the TMDL 20 years after the adoption of a basin management action plan (BMAP),⁴² which was finalized in 2014. Consequently, this nonpoint source pollution is managed in the BMAP through non-regulatory controls (i.e. “best management practices”).⁴³ If achieving the TMDL within 20 years is “not practicable” additional five-year milestones can be established.⁴⁴

The lake has been besieged by nutrient pollution for decades and there are few signs that things are improving. A 2014 environmental report prepared by the South Florida Water Management District (SFWMD) revealed that the five-year phosphorous load was 451 metric tons, which is 311 metric tons or 322% of the water quality goal.⁴⁵ The majority of these nutrients entered the watershed from agricultural and urban sources. An estimated 4,256 metric tons of new phosphorous are added each year.⁴⁶ There have been no significant reductions in phosphorous loading in many of the Okeechobee sub-watersheds.⁴⁷ As the SFWMD summarized in its 2011 environmental report, “more aggressive nutrient control measures still need to be implemented in

³⁸ See *Florida Wildlife Federation v. Browner*, 4:98-CV-2560-WS (N.D. Fla. July 2, 1999).

³⁹ §373.4595, Fla. Stat. (2000); Florida Department of Environmental Protection. 2001. Total Maximum Daily Load for Total Phosphorous Lake Okeechobee, Florida..

⁴⁰ *American Farm Bureau Federation v. EPA*, 792 F.3d at 299.

⁴¹ § 373.4595, Fla. Stat (2000).

⁴² See *id* (2018).

⁴³ See Florida Department of Environmental Protection. 2014. Final Basin Management Action Plan for the Implementation of Total Maximum Daily Loads for Total Phosphorous by the Florida Department of Environmental Protection in Lake Okeechobee, available at <https://floridadep.gov/sites/default/files/LakeOkeechobeeBMAP.pdf>. Voluntary measures, such as BMPs, have been the hallmark of nonpoint source pollution management since 1972 even though there continues to be little empirical evidence on the relative effectiveness of such schemes. See Oliver A. Houck, *Cooperative Federalism, Nutrients, and the Clean Water Act: Three Cases Revisited*, 44 *Envtl. L. Rep.* 10426 (2014).

⁴⁴ See § 373.4595(3)(b), Fla. Stat (2018).

⁴⁵ SFWMD South Florida Environmental Report 2014. Pg. 8-3, 8-34, 8-35 at http://apps.sfwmd.gov/sfwmd/SFER/2014_SFER/v1/chapters/v1_ch8pdf.

⁴⁶ The HDR Team. 2010. Nutrient budget analysis for the Lake Okeechobee watershed: final comprehensive report. SFWMD, West Palm Beach.

⁴⁷ SFWMD South Florida Environmental Report 2011, Pg. 10-49 at

http://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_sfer/portlet_prevreport/2011_sfer/v1/chapters/v1_ch10.pdf

all the surrounding basins that discharge to the lake in order to reach the lake's TMDL goal of 140 mt of phosphorous per year.”⁴⁸

The University of Florida Water Institute recently examined the Lake Okeechobee TMDL and BMAP in their independent technical review, entitled *Options to Reduce High Volume Freshwater Flows to the St. Lucie and Caloosahatchee Estuaries and Move More Water from Lake Okeechobee to the Southern Everglades*.⁴⁹ Since 1974, annual total phosphorous loads to Lake Okeechobee have exceeded 500 metric tons nearly 50% of the time.⁵⁰ Averaged over the 41-year period of record, the annual phosphorous load is approximately 3.6 times the annualized TMDL.⁵¹ Thus, annual average phosphorous loads will have to be reduced by more than 350 metric tons per year to meet the current TMDL for the Lake.⁵² The study found that the current efforts to achieve the Lake Okeechobee TMDL “have proven inadequate” and that “none of the current BMAPs for the Lake Okeechobee, St. Lucie or Caloosahatchee watersheds will achieve their respective TMDLs within the next 5 years.”⁵³ The study explained that additional controls, such as flow equalization basins, storage treatment areas, and “aggressive BMPs” that include in-situ immobilization of legacy phosphorous by chemical amendments, will be needed to meet TMDL targets.”⁵⁴ New field-verified agricultural and urban Best Management Practices (BMPs) that protect water quality, advance in situ treatment technologies, and the strategic placement of additional FEB-STAs in priority basins will be essentials to achieve State and Federal water quality standards.⁵⁵ Beyond these approaches, the substantial amount of legacy phosphorus in the Northern Everglades watersheds “will necessitate new and more aggressive strategies to combat the mobility of phosphorous.”⁵⁶

B. The Caloosahatchee River

The 67-mile long Caloosahatchee River travels from Lake Okeechobee through Glades, Hendry, and finally Lee County, before meeting the Gulf of Mexico as a highly important resource for biodiversity. The river and estuary are home to the only known pupping grounds of the federally endangered smalltooth sawfish. The area is an important warm water refuge for the federally threatened Florida manatee. Five species of ESA-listed sea turtles frequent the estuary and nearby Gulf of Mexico: loggerhead, green, Kemp's ridley, hawksbill, and leatherback.

Five national wildlife refuges lie within the Caloosahatchee River and estuary, including J.N. “Ding” Darling National Wildlife Refuge, Pine Island National Wildlife Refuge, Matlacha Pass National Wildlife Refuge, Island Bay National Wildlife Refuge, and Caloosahatchee National Wildlife Refuge. These refuges comprise the Ding Darling Refuge Complex and total 8,000 acres of trust resources that are being adversely impacted by LORS. The Department of Interior

⁴⁸ *Id.* at 10-48.

⁴⁹ Graham, W.D., et al. 2015. *Options to Reduce High Volume Freshwater Flows to the St. Lucie and Caloosahatchee Estuaries and Move More Water from Lake Okeechobee to the Southern Everglades*. An Independent Technical Review by the University of Florida Water Institute.

⁵⁰ *Id.* at 63.

⁵¹ *Id.* at 63-64.

⁵² *Id.* at 64.

⁵³ *Id.* at 84.

⁵⁴ *Id.*

⁵⁵ *Id.* at 7.

⁵⁶ *Id.* at 131.

has acknowledged that Lake Okeechobee discharges impact water quality at the refuges, contributing to “red tides, eutrophication, impaired water bodies, mercury contamination, and pesticides and polychlorinated biphenyls” in the Caloosahatchee ecosystem,⁵⁷ and has described impacts from dry season lack of flows as allowing “saltwater from the Gulf of Mexico to migrate into brackish estuaries and up the Caloosahatchee River, thus raising the salinities of San Carlos Bay and the waters of the refuges.”⁵⁸

C. The St. Lucie Estuary

The St Lucie River and estuary is a 7-mile long system that makes its way from Lake Okeechobee through St. Lucie and Martin counties where it meets up with the greater Indian River Lagoon system, which is recognized as one of the most diverse estuarine environments in North America with more than 4,300 plants and animals. Sea turtles, smalltooth sawfish and manatees rely on these waters for warm water refuge, fresh water, and other essential habitat functions. Boulder star, elkhorn and staghorn coral are found off the coast near the estuary’s outlet. The lagoon also supports productive fisheries and tourism, and some of the only bioluminescent waters in the continental United States. The St. Lucie River is an Outstanding Florida Water and the North Fork of the St. Lucie is a state aquatic preserve and part of Florida’s “Save Our Rivers” program.⁵⁹

D. Managing Water Levels in Lake Okeechobee

Historically, water traveling through the system would take 6-8 months to travel from the northern part of the system to Lake Okeechobee, but due to the channelization of the system and upstream agriculture, water arrives at the lake in one month.⁶⁰ This coupled with the diking of the south side of the lake which cuts off natural flow to the Everglades, causes lake levels to rise rapidly, and for the Corps to release large volumes of water to the northern estuaries to lower the risk of damage to the Hebert Hoover Dike. Nearly 70% of the rainfall enters the system during just five months of the year, and each year is highly variable with annual rainfall varying as much as 82% between wet and dry years.⁶¹ El Nino years,⁶² competing water users, and aging plumbing further strain the system. The northern estuaries are connected to Lake Okeechobee and are a part of the Greater Everglades ecosystem.

⁵⁷ Department of the Interior, *J.N. “Ding” Darling National Wildlife Refuge*, 2010 (DOI 2010).

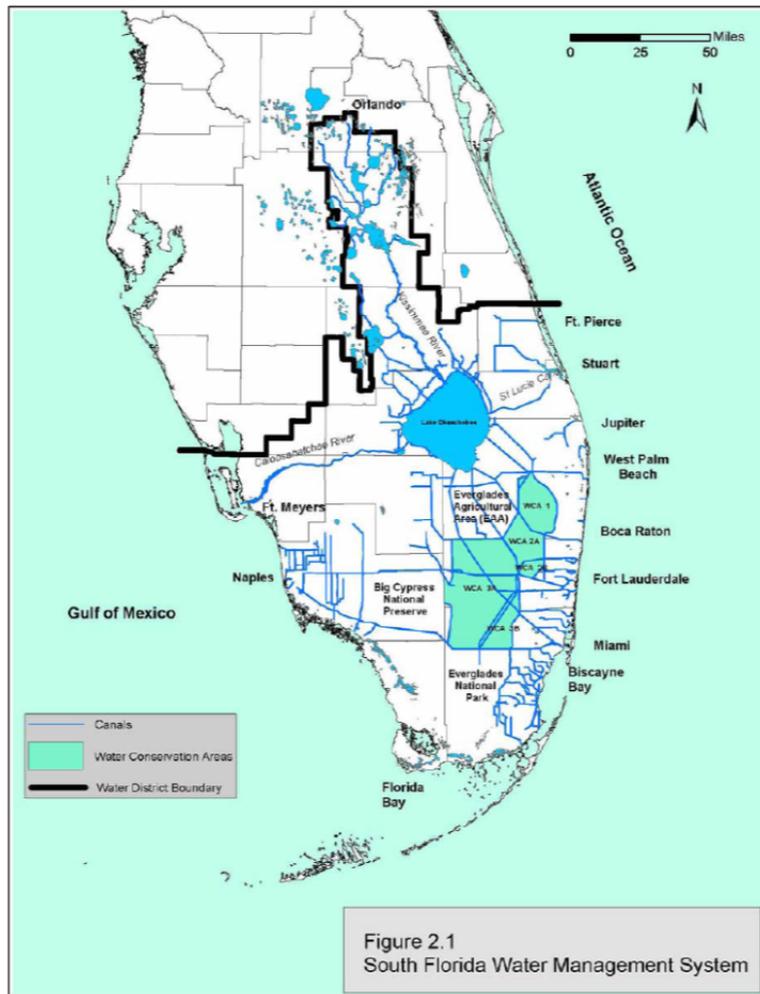
⁵⁸ *Id.* .

⁵⁹ *See* Rule 62-302.700, F.A.C.

⁶⁰ Florida Oceanographic Society. 2013. Water Flows & Current Issues. Presentation to Florida Governor Rick Scott.

⁶¹ Graham, W.D., et al. 2015. Options to Reduce High Volume Freshwater Flows to the St. Lucie and Caloosahatchee Estuaries and Move More Water from Lake Okeechobee to the Southern Everglades. An Independent Technical Review by the University of Florida Water Institute.

⁶² FWS 2007, citing 1981-82 drought, followed by the “Mother of All El Ninos” in 1982-1983, to moderately severe drought in 1990, and severe drought in 2001 and 2007, and hurricanes in 2004 and 2005.



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In 2000, Congress approved the Comprehensive Everglades Restoration Plan, a \$10.5 billion, 35-year-plus project to restore central and south Florida water resources, including Lake Okeechobee and the Everglades. As part of the Corps' management and restoration of the Everglades, and with CERP in mind, it is responsible for establishing a regulation schedule for managing the water levels in Lake Okeechobee.⁶⁴ The Corps has operated under several different regulatory regimes throughout the years, including the "Run 22" schedule in 1988, the "Run 25" schedule in 1992, and the Water Supply and Environment (WSE) schedule in 2000.⁶⁵

During the 2004 and 2005 hurricane seasons the lake sustained high water levels which caused the Corps to release high volumes of water to the estuaries to reduce risk of damage to the Herbert Hoover Dike. This in turn led to poor ecological conditions in the lake and the St. Lucie and Caloosahatchee estuaries.⁶⁶ In 2005, the Corps revisited the WSE schedule in part to address concerns regarding the frequency of high volume freshwater releases from Lake Okeechobee to

⁶³ South Florida Water Management District, Report of Expert Review Panel Technical Evaluation of Herbert Hoover Dike Lake Okeechobee, Florida, 2016 (SFWMD 2016).

⁶⁴ Corps 2008 at 1.

⁶⁵ FWS 2007 at 6.

⁶⁶ *Id.* at 47.

the rivers.⁶⁷ In 2007, the Corps established LORS to replace the WSE to address periods of high water events, to preserve the integrity of the dike, to protect ecological resources of the lake's littoral zone, and to reduce high discharges to the estuaries. The regulation schedule is a compilation of operating criteria, guidelines, rule curves and specifications for the storage and release of water from Lake Okeechobee to the St. Lucie Canal (C-44) and the Caloosahatchee Canal (C-43) and River, and is an ongoing agency action.⁶⁸ The Corps intended to use LORS only until the Herbert Hoover Dike repairs had been completed, or certain CERP projects had been completed, and in any event, only until 2010.⁶⁹

E. Herbert Hoover Dike Repairs

Dike repairs began in 1999 with Reaches 1-3 prioritized because the risk of loss of life.⁷⁰ Reach 1A was completed in 2005, but SFWMD expressed "considerable uncertainty regarding the effectiveness of the proposed repair measures."⁷¹ In 2006, it was estimated that Reach 1 would be completed in March 2010, Reach 2 by 2013, and Reach 3 by 2012.⁷² In 2007, the Corps launched an effort to rehabilitate the HHD, investing more than \$500 million from 2007-2016.⁷³ The Corps' 2016 Dam Safety Modification Study proposed a revised rehabilitation plan for HHD. While the Corps has completed repairs to Reach 1, repairs to Reach 2 and 3 are now scheduled to be completed by 2020.⁷⁴

The 2016 Herbert Hoover Dike Dam Safety Modification Study states that the goal of repairing the dike is to make the dike safe under the current LORS schedule; however, it also found that even when repaired, the dike will not provide a final solution for managing lake levels.⁷⁵ The Corps had "not determined what, if anything, will be done with the Lake Okeechobee regulation schedule once rehabilitation of the Herbert Hoover Dike is complete," and has stated that "[a] process to revise LORS 2008 is not scheduled to begin until 2022."⁷⁶ The July 2018 Draft Integrated Delivery Schedule advanced this timeline to revise LORS with a scheduled start date of 2019 and completion date of 2023, one year after the scheduled Herbert Hoover Dike

⁶⁷ U.S. Army Corps of Engineers, Final Environmental Impact Statement on the Lake Okeechobee Regulation Schedule (Corps 2008a) at ii; National Marine Fisheries Service, NMFS Concurrence Letter on Lake Okeechobee Regulation Schedule (2007) at 1, 2 (NMFS 2007).

⁶⁸ Corps 2008; *See Central and Southern Florida Project for Flood Control and Other Purposes, System Operating Manual*, Vol. I.

⁶⁹ FWS 2007 at 1. The Corps intended that LORS be in effect until the earlier of (1) implementation of a new lake schedule as a component of the system-wide operating plan for CERP Band 1 projects and Florida's Acceler8 projects; or (2) completion of HHD seepage berm construction or equivalent dike repairs for reaches 1, 2, and 3, upon information and belief, the Corps intended LORS to be interim and only last until 2010. Corps 2018a.

⁷⁰ SFWMD 2016.

⁷¹ *Id.*

⁷² *Id.*

⁷³ National Academies of Sciences, Engineering, and Medicine. 2016. *Progress Toward Restoring the Everglades: The Sixth Biennial Review – 2016*. Washington, DC: The National Academy Press (NAS 2016).

⁷⁴ Elskén, K. Storm damage sets back river restoration; repairs estimated at \$11 million, *Lake Okeechobee News* (May 9, 2018); U.S. Army Corps of Engineers, Fact Sheet: South Florida Ecosystem Restoration. 2017.

⁷⁵ U.S. Army Corps of Engineers, Herbert Hoover Dike Dam Safety Modification Study: Glades, Hendry, Martin, Okeechobee and Palm Beach Counties, Florida. 2016; South Florida Water Management District, Report of Expert Review Panel Technical Evaluation of Herbert Hoover Dike Lake Okeechobee, Florida, 2006.

⁷⁶ NAS 2016.

completion,⁷⁷ but this revision is not intended to address ongoing harm to the estuary from the current 2008 LORS. The Corps' July 2018 update to the Integrated Delivery Schedule (IDS) SFER Program Snapshot Through 2030 reports the "Lake Okeechobee Regulation Schedule Revision accelerated to FY19-22 (to sync with accelerated schedule of HHD) dependent upon FY19 funding."⁷⁸ The purpose of the review is to "provide an opportunity to evaluate the feasibility and the benefits and risks of allowing higher water levels in the lake once the Herbert Hoover Dike repairs are complete."⁷⁹

Additionally, new information and changes in lake management and planned projects have "reduced the storage capacity envisioned originally in CERP by over one million acre feet compared to the 1999 plan, which could have serious ecological consequences in both the northern estuaries and the Everglades ecosystem."⁸⁰ Therefore, there is considerable uncertainty regarding future Lake Okeechobee regulation, available water storage beyond Lake Okeechobee, and the impacts of a changing climate.⁸¹

IV. TOXIC ALGAE

The Corps flushes large volumes of water out to the estuaries to protect the integrity of the Herbert Hoover Dike. The shallow lake along with the nutrient runoff from north of the lake provide the ideal conditions for the algal blooms.⁸²

In 2016, January rainfall raised the lake level nearly two feet. It then took constant releases until mid-April for the lake to return to the pre-rainfall level going into rainy season. In 2017, Hurricane Irma caused the lake to rise over three and a half feet, putting the lake at the highest levels since the Corps started operating under LORS.⁸³ The heavy rain that came with Hurricane Irma and above-average rainfall in spring 2018 set the stage for another large-scale summer algal bloom in Lake Okeechobee in 2018, which prompted the Corps to initiate large-scale discharges out of the S-77 canal (Caloosahatchee) and S-380 canal (St. Lucie) on June 2, 2018. This water was rich in nutrients and algae and diluted the normally saline water, creating conditions for the growth and survival of intense cyanobacteria blooms in the estuaries. This happened in 2005 and 2016 as well.⁸⁴ The dominant algae discharged was the cyanobacteria *microcystis aeruginosa*.

⁷⁷ National Academies of Sciences, Engineering, and Medicine. 2018. Progress Toward Restoring the Everglades: The Seventh Biennial Review – 2018. Washington, DC: The National Academy Press (NAS 2018).

⁷⁸ U.S. Army Corps of Engineers, Integrated Delivery Schedule (IDS) SFER Program Snapshot Through 2030. 2018.

⁷⁹ NAS 2018.

⁸⁰ NAS 2016.

⁸¹ *Id.*

⁸² Havens, K. 2013. Deep Problems in Shallow Lakes: Why Controlling Phosphorus Inputs May Not Restore Water Quality. IFAS Extension. University of Florida; Havens, K, et al. 2016. Natural Climate Variability Can Influence Cyanobacteria Blooms in Florida Lakes and Reservoirs. IFAS Extension. University of Florida.

⁸³ Corps letter to Mast July 5, 2018, at 1.

⁸⁴ Philips, E. et al. 2012. Climatic Influences on Autochthonous and Allochthonous Phytoplankton Blooms in a Subtropical Estuary, St. Lucie Estuary, Florida, USA.

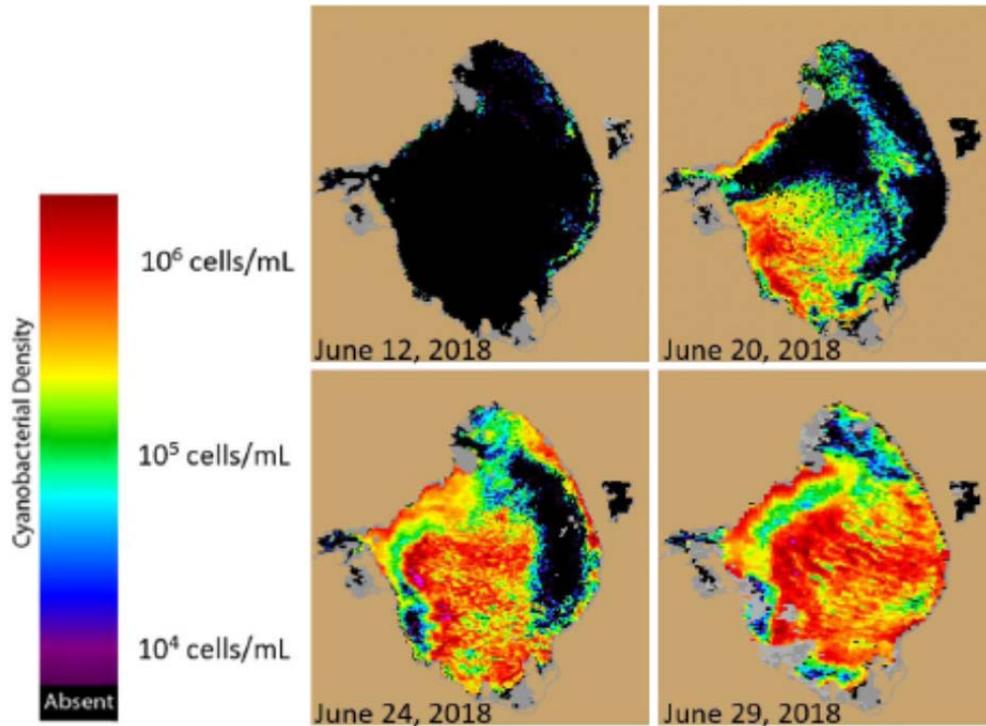


Image source: NOAA, derived from Copernicus Sentinel-3 data from EUMETSAT

It is well known that the release of large amounts of water from the lake contribute nutrients downstream and lead to the formation of toxic algae blooms in the northern estuaries.⁸⁵ The damaging discharges from Lake Okeechobee in 2016 and again in 2018 had a significant impact on the ecology of the northern estuaries, harming the economy, including significant economic losses in commercial fishing, recreation tourism, and the real estate sectors.⁸⁶

The human-caused nutrient pollution from Lake Okeechobee is contributing to the harmful algae blooms of both red tide and blue-green algae.⁸⁷ According to Dr. Karl Havens, “high levels of nitrogen and phosphorus are washing into the water from agricultural lands, leaky septic systems, and fertilizer runoff.”⁸⁸ The lake has been plagued by nutrient pollution for decades and there are little signs that things are improving.

From July through September 2016, bloom conditions persisted with a peak in July of roughly 200 square miles. In 2017, phosphorous loading to the lake approached 2.3 million pounds, the highest ever recorded. While the total incidents of bloom detections were less than in 2013, the 2017 samples had the highest recorded concentration of microcystin collected in the past five

⁸⁵ NAS 2018.

⁸⁶ South Florida Water Management District. 2018. Central Everglades Planning Project Post Authorization Change Report: Feasibility Study and Draft Environmental Impact Statement. (SFWMD 2018b).

⁸⁷ Havens, K. 2018. What is Causing Florida’s Algae Crisis? 5 Questions Answered. (Havens 2018a).

⁸⁸ *Id.*.

years.⁸⁹ By July 2018, 90% of the surface of Lake Okeechobee was covered with a blue green algae bloom.

A. Blue-Green Algae: Cyanobacteria

Cyanobacteria, particularly microcystis, have been found in Lake Okeechobee and the northern estuaries. *Microcystis aeruginosa* has been correlated with nitrogen and phosphorous, and toxic strains may have higher nitrogen and phosphorous requirements.⁹⁰ Exposure of *Microcystis aeruginosa* to saltwater may increase its toxicity.⁹¹

These cyanobacteria, or blue-green algae as they are commonly known, are hepatoxins and have been linked to poisoning and cancer.⁹² According to one leading expert, “[c]yanotoxins are among the most potent toxins known, far more potent than industrial chemicals.”⁹³ The non-protein amino acid, beta-N-methylamino-L-alanine (BMAA), is a cyanobacteria-derived toxin that has been linked to neurodegenerative diseases like ALS (Amyotrophic Lateral Sclerosis) and Parkinsonism Dementia Complex (ALS/PDC).⁹⁴ Most cyanobacteria produce BMAA.⁹⁵ People near blue-green algae blooms likely inhale the toxins deep into their lungs.⁹⁶ BMAA can biomagnify up some food chains and may pose an increasing human health risk.⁹⁷ BMAA biomagnification has been recorded in cyanobacteria to cycads to fruit bats, feral pigs, and flying squirrels.⁹⁸ The Chamorro of Guam, who consumed the bats, pigs and squirrels had a 100-fold increase in ALS/PDC.⁹⁹ The Chamorro who died of these neurodegenerative diseases as well as Canadian patients with Alzheimer’s disease had high concentrations of BMAA.¹⁰⁰ There is

⁸⁹ Zhang, J. et al. 2018. Chapter 8B: Lake Okeechobee Watershed Research and Water Quality Monitoring Results and Activities in 2018 South Florida Environmental Report – Volume I.

⁹⁰ Cessa, M. (ed). 2014. Beaches: Erosion, Management Practices and Environmental Implications. Environmental Health-Physical, Chemical and Biological Factors.

⁹¹ Rosen, B.H. et al. 2018. Understanding the effect of salinity tolerance on cyanobacteria associated with a harmful algal bloom in Lake Okeechobee, Florida: U.S. Geological Survey Scientific Investigations Report 2018-5092, 32 p. <https://doi.org/10.3133/sir20189082>.

⁹² A hepatoxin is a toxic chemical that damages the liver. Zanchett, G. and Oliveira-Filho, E.C. 2013. Cyanobacteria and Cyanotoxins: From Impacts on Aquatic Ecosystems and Human Health to Anticarcinogenic Effects. *Toxins* 2013, 5.

⁹³ Hudnell, K. 2009. Congressional Testimony.

⁹⁴ Banack, S.A. et al. 2010. The Cyanobacteria Derived Toxin Beta-N-Methylamino-L-Alanine and Amyotrophic Lateral Sclerosis. *Toxins* 2010, 2, 2837-2850; doi: 10.3390/toxins2122837; Bienfang, P.K. et al. 2011. Prominent Human Health Impacts from Several Marine Microbes: History, Ecology, and Public Health Implications. *International Journal of Microbiology*. Vol. 2011. Article ID 152815; doi:10.1155/2011/152815.

⁹⁵ Brand, L. et al. 2010. Cyanobacteria Blooms and the Occurrence of the neurotoxin beta-N-methylamino-L-alanine (BMAA) in South Florida Aquatic Food Webs. *Harmful Algae*. 2010 Sept. 1; 9(6): 620-635; doi:10.1016/j.hal.2010.05.002 (Brand 2010).

⁹⁶ Williams, A. 2018. Algae toxins are airborne and can reach deep into human lungs, FGCU research shows. Fort Myers News-Press. Nov. 27, 2018.

⁹⁷ Brand, L. 2009. Human exposure to cyanobacteria and BMAA. *Amyotrophic Lateral Sclerosis*, 2009, (Supplement 2): 85-95 (Brand 2009).

⁹⁸ Cox, P.A. and O.W. Sacks. 2002. Cycad neurotoxins, consumption of flying foxes, and ALS-PDC disease in Guam. *Neurology*. 2002 Mar. 26; 58(9): 956-9; Holtcamp, W. 2012. The Emerging Science of BMAA. *Environmental Health Perspectives*. Vol. 120, No. 3.

⁹⁹ Murch, S.J. et al. 2004. Occurrence of B-methylamino-L-alanine (BMAA) in ALS/PDC patients from Guam. *Acta Neurol Scand*. 2004; 110: 267-9.

¹⁰⁰ Pablo, J. et al. 2009. Cyanobacterial neurotoxin BMAA in ALS and Alzheimer’s disease. *Acta Neurol Scand*. Published online 26 Feb, 2009.

concern that people exposed to waterborne BMAA may have an increased risk of neurodegenerative disease.¹⁰¹

BMAA concentrations of animals exposed to cyanobacteria have been observed in Florida, including moderate amounts in mollusks and high concentrations in fish in the Caloosahatchee River.¹⁰² Bottlenose dolphins can eat similar diets to humans (fish and crustaceans), and those that have died in the Indian River Lagoon have similar concentrations of BMAA in their brains as humans that have died of neurodegenerative diseases.¹⁰³ Impacted wildlife in Florida have been found to have similar concentrations of BMAA as in impacted wildlife in Guam.¹⁰⁴ Even coral in Florida are being overgrown by cyanobacteria and cyanobacterial diseases.¹⁰⁵ In August 2018, the Florida Department of Environmental Protection collected water samples with toxic algae at the rate of 110 parts per billion, 10 times the level the World Health Organization has determined to be hazardous for humans in recreational waters.¹⁰⁶ Testing had detected even higher levels in July 2018 at 154.38 PPB and 33,000 PPB in 2016. Dozens of people have been hospitalized after being exposed to the toxic algae, which doctors describe as a “health hazard.”¹⁰⁷

A study sampling cyanobacteria in St. Lucie during the 2016 event detected concentrations of microcystins that greatly exceeded World Health Organization Guideline Values for drinking and recreational water, and also detected the neurotoxins anatoxin-a(S) and BMAA.¹⁰⁸ Additional research is underway at Florida Atlantic University after taking blood, urine, nose, and throat swab samples from people exposed to the 2018 bloom.¹⁰⁹

Cyanobacteria are frequently dominant in waters without detectable red tide, suggesting that they may play an important role in providing fuel to initiate red tide blooms.¹¹⁰ The cyanobacteria *synechococcus* is a potential prey source in nutrient poor environments for red tide.¹¹¹ *Synechococcus* has been detected in the Lake Okeechobee system.¹¹² Studies suggests that

¹⁰¹ Metclaf, J. and G. Codd. 2009. Cyanobacteria, neurotoxins and water resources: Are there implications for human neurodegenerative disease? *Amyotrophic Lateral Sclerosis*, 2009; (Supplement 2): 74-78.

¹⁰² Brand 2010.

¹⁰³ Brand 2009; Brand 2010.

¹⁰⁴ Brand 2009.

¹⁰⁵ Paul, V.J. et al. 2005. Benthic cyanobacterial bloom impacts the reefs of southern Florida (Broward County, USA), *Coral Reefs*. 2005; 24:693-7; Richardson, L.L. et al. 2003. Ecological physiology of the black band disease cyanobacterium *Phormidium corallyticum*. *FEMS Microbiol Ecol*. 2003; 43:287-98.

¹⁰⁶ Wright, P. 2018. Florida's Blue-Green Algae Bloom 10 Times Too Toxic to Touch, Testing Shows. Aug. 10, 2018. *Weather.com* (Wright 2018).

¹⁰⁷ *Id.*

¹⁰⁸ Metcalf, J.S. 2018. Public health responses to toxic cyanobacteria blooms: perspectives from the 2016 Florida event. *Water Policy*. Creative Commons.

¹⁰⁹ Williams, A. 2018(a). Researchers in town testing residents for exposure to algae toxins. *Fort Myers News-Press* Oct. 15, 2018.

¹¹⁰ Jones, K. et al. 2010. Comparative analysis of bacterioplankton from *Karenia brevis* bloom and nonbloom water on the west Florida shelf (Gulf of Mexico, USA) using 16SrRNA gene clone libraries. *FEMS Microbiol Ecol* 73 (2010) 468-485 (Jones 2010).

¹¹¹ *Id.*; Gilbert, P. 2011. Grazing by *Karenia brevis* on *Synechococcus* enhances its growth rate and may help to sustain blooms.

¹¹² Rosen, B. et al. 2016. Cyanobacteria of the 2016 Lake Okeechobee and Okeechobee Waterway Harmful Algal Bloom.

nutrients including phosphorous and nitrogen from discharges can energize or reawaken red tide.¹¹³

B. Red Tide: Brevetoxin

Red tide has been called “one of the most common chemical stressors impacting South Florida coastal and marine ecosystems,”¹¹⁴ and studies suggests that nutrients including phosphorous and nitrogen from discharges as well as biomass killed by cyanobacteria can energize or reawaken red tide.¹¹⁵ Red tide is caused by the dinoflagellate *Karenia brevis* which produces brevetoxins which kill fish,¹¹⁶ make filter-feeding fish extremely toxic to other animals, and cause respiratory and intestinal distress in humans.¹¹⁷ Red tide has also been linked to land mammal and bird

¹¹³ Olascoaga, M.J. 2010. Isolation on the West Florida Shelf with implications for red tides and pollutant dispersal in the Gulf of Mexico. *Nonlinear Process Geophys.* 2010 Jan. 1; 17(6): 685-696. Doi:10.5194/npg-17-685-2010; Olascoaga, M.J. et al. 2008. Tracing the Early Development of Harmful Algal Blooms on the West Florida Shelf with the Aid of Lagrangian Coherent Structure. *J. Geophys. Res.* 2008; 113(c12): c12014-doi: 10.1029/2007JC004533; Poulson-Ellestad, K. et al. 2014. Metabolics and proteomics reveal impacts of chemically mediated competition on marine plankton. *PNAS.* June 17, 2014. Vol. 11. No. 24. 9009-9014; Morey, J. et al. 2011. Transcriptomic response of the red tide dinoflagellate, *Karenia brevis*, to nitrogen and phosphorus depletion and addition. *Genomics* 2011, 12.346.

¹¹⁴ Pierce, R.H. 2008. Harmful algal toxins of the Florida red tide (*Karenia brevis*): natural chemical stressors in South Florida coastal ecosystems. *Ecotoxicology.* 2008 Oct. 17(7): 623-631. Doi:10.1007/s10646-008-0241-x.

¹¹⁵ Olascoaga, M.J. 2010. Isolation on the West Florida Shelf with implications for red tides and pollutant dispersal in the Gulf of Mexico. *Nonlinear Process Geophys.* 2010 Jan. 1; 17(6): 685-696. Doi:10.5194/npg-17-685-2010; Olascoaga, M.J. et al. 2008. Tracing the Early Development of Harmful Algal Blooms on the West Florida Shelf with the Aid of Lagrangian Coherent Structure. *J. Geophys. Res.* 2008; 113(c12): c12014-doi: 10.1029/2007JC004533; Poulson-Ellestad, K. et al. 2014. Metabolics and proteomics reveal impacts of chemically mediated competition on marine plankton. *PNAS.* June 17, 2014. Vol. 11. No. 24. 9009-9014; Morey, J. et al. 2011. Transcriptomic response of the red tide dinoflagellate, *Karenia brevis*, to nitrogen and phosphorus depletion and addition. *Genomics* 2011, 12.346; Garrett, M. 2011. Harmful algal bloom species and phosphate-processing effluent: Field and laboratory studies. *Marine Pollution Bulletin* 62 (2011) 596-601; Heil, C.A. et al. 2014. Blooms of *Karenia brevis* (Davis) G. Hansen & O. Moestrup on the West Florida Shelf: Nutrient sources and potential management strategies based on a multi-year regional study. *Harmful Algae* 38 (2014) 127-43; Killberg-Thoreson, L. et al. 2014. Nutrients released from decaying fish support microbial growth in the eastern Gulf of Mexico. *Harmful Algae* 38 (2014) 40-49; Mulholland, M.R. et al. 2014. Contribution of diazotrophy to nitrogen inputs supporting *Karenia brevis* blooms in the Gulf of Mexico. *Harmful Algae* 38 (2014) 20-29; Redalje, D.G. et al. 2008. The growth dynamics of *Karenia brevis* within discrete blooms on the West Florida Shelf. *Continental Shelf Research* 28 (2008) 24-44; Munoz, C. 2018. Scientists: Lake Okeechobee runoff may enhance red tide. *Daily Commercial.* Oct. 11, 2018.

¹¹⁶ Rolton, A. et al. 2014. Effects of the red tide dinoflagellate, *Karenia brevis*, on early development of the eastern oyster *Crassostrea virginica* and northern quahog *Mercenaria mercenaria*. *Aquatic Toxicology* 155 (2014) 199-206; Rolton, A. et al. 2015. Susceptibility of gametes and embryos of the eastern oyster, *Crassostrea virginica*, to *Karenia brevis* and its toxins. *Toxicon* 99 (2015) 6-15; Rolton, A. et al. 2016. Effects of field and laboratory exposure to the toxic dinoflagellate *Karenia brevis* on the reproduction of the eastern oyster, *Crassostrea virginica*, and subsequent development of offspring. *Harmful Algae* 57 (2016) 13-26; Walsh, J.J. et al. 2009. Isotopic evidence for dead fish maintenance of Florida red tides, with implications for coastal fisheries over both source regions of the west Florida shelf and within downstream waters of the South Atlantic Bight. *Progress in Oceanography* 80 (2009) 51-73.

¹¹⁷ Backer, L. et al. 2005. Occupational Exposure to Aerosolized Brevetoxins during Florida Red Tide Events: Effects on a Healthy Worker Population. *Environmental Health Perspectives.* Vol. 113. Iss. 5. May 2005; Bienfang, P.K. et al. 2011. Prominent Human Health Impacts from Several Marine Microbes: History, Ecology, and Public Health Implications. *International Journal of Microbiology* Vol. 2011. Art. ID 152815; CDC. 2008. Illness Associated with Red Tide – Nassau County, Florida, 2007; Fleming, L. 2005. Initial Evaluation of the Effects of Aerosolized Florida Red Tide Toxins (Brevetoxins) in Persons with Asthma. *Environmental Health Perspectives.* Vol. 113. Iss. 5. May 2005; Naar, J. 2002. Brevetoxin Depuration in Shellfish via Production of Non-toxic

mortality,¹¹⁸ and can bioaccumulate.¹¹⁹ Exposed fish and seagrasses can accumulate high concentrations of brevetoxins and act as toxin vectors to dolphins and manatees.¹²⁰ People generally do not become aware of its presence until it reaches above 100,000 cells/l, which is when it leads to fish kills,¹²¹ shellfish toxicity, and respiratory distress.¹²²

There has been an increase in red tide in southwest Florida since 1954, in abundance and frequency.¹²³ Other red tide impacts include paralytic shellfish poisoning,¹²⁴ neurotoxic shellfish poisoning, ciguatera fish poisoning, fish kills, loss of submerged vegetation, shellfish mortalities, and marine mammal mortalities.¹²⁵ Brevetoxins are large, lipid soluble molecules that bioaccumulate in fatty tissue and are not easily shed or excreted.¹²⁶ As a result, sublethal concentrations can have lethal consequences.¹²⁷ Because *k.brevis* is a particularly delicate dinoflagellate, turbulence can break apart the cells and aerosolize the brevetoxins which are then inhaled and can cause respiratory distress.¹²⁸

Eerera et al. (2011) determined that by rapidly changing salinity to simulate the shift from oceanic to coastal conditions, brevetoxin was triggered, showing that brevetoxin production can increase dramatically in response to osmotic stress regardless of the initial source of the red tide.¹²⁹ Sources contributing to red tide include nutrients in runoff, iron-rich atmospheric dust, dead marine life, and nutrient rich groundwater.¹³⁰

Metabolites: Consequences for Seafood Safety and the Environmental Fate of Biotoxins. Harmful Algae 2002 (2002). 2004; 10: 488-490; Steensma, D. 2007. Exacerbation of Asthma by Florida “Red Tide” During an Ocean Sailing Trip. Mayo Clin Proc. Sept. 2007; 82(9): 1128-1130.

¹¹⁸ Castle, K. et al. 2013. Coyote (*Canis latrans*) and domestic dog (*Canis familiaris*) mortality and morbidity due to a *Karenia brevis* red tide in the Gulf of Mexico. *Journal of Wildlife Diseases*, 49(4), 2013, pp. 955-64; Kreuder, C. 2012. Clinicopathologic features of suspected brevetoxicosis in double-crested cormorants (*phalacrocorax auritus*) along the Florida Gulf coast. *Journal of Zoo and Wildlife Medicine*, 33(1):8-15.

¹¹⁹ Echevarria, M. 2012. Effects of *Karenia brevis* on clearance rates and bioaccumulation on brevetoxins in benthic suspension feeding invertebrates. *Aquatic Toxicology* 106-107 (2012) 85-94.

¹²⁰ Flewelling, L. et al. 2005. Red tides and marine mammal mortalities.: Unexpected brevetoxin vectors may account for deaths long after or remote from an algal bloom. *Nature*. 2005. June 9; 435(7043).

¹²¹ Gravinese, P. et al. 2018. The effects of red tide (*Karenia brevis*) on reflex impairment and mortality of sublegal Florida stone crabs, *Menippe mercenaria*. *Marine Environmental Research* 137 (2018) 145-148.

¹²² Bienfang 2011; Pierce, R. 2011. Compositional changes in neurotoxins and their oxidative derivatives from the dinoflagellate, *Karenia brevis*, in seawater and marine aerosol. *Journal of Plankton Research*. Vol. 30. No. 2.

¹²³ Brand, L and A. Compton. 2007. Long-term increase in *Karenia brevis* abundance along the Southwest Florida Coast. *Harmful Algae*. 2007. 6(2): 232-252. doi:10.1016/j.hal.2006.08.005.

¹²⁴ Watkins, S. 2008. Neurotoxic Shellfish Poisoning. *Mar. Drugs* 2008, 6, 431-455; DOI: 10.3390/md20080021.

¹²⁵ Anderson, D. et al. 2008. Harmful algal blooms and eutrophication: Examining linkages from selected coastal regions of the United States. *Harmful Algae*. 2008. Dec. 1; 8(1): 39-53. Doi:10.1016/j.hal.2008.08.017.

¹²⁶ Bienfang 2011.

¹²⁷ *Id.*

¹²⁸ *Id.*; Fleming, L. 2007. Aerosolized Red-Tide Toxins (Brevetoxins) and Asthma. *Chest*. 2007. Jan; 131(1): 187-194. Doi:10.1378/chest.06-1830; Kirkpatrick, B. et al. 2010. Inland Transport of Aerosolized Florida Red Tide Toxins. *Harmful Algae*. 2010. Feb. 1; 9(2): 186-189. Doi:10.1016/j.hal.2009.09.003; Kirkpatrick, B. et al. 2011.

Aerosolized Red Tide Toxins (Brevetoxins) and Asthma: Continued health effects after 1 hour beach exposure. *Harmful Algae* 2011. Jan. 1: 10(2): 138-143. Doi:10.1016/j.hal.2010.08.005.

¹²⁹ Errera R. and L. Campbell. 2011. Osmotic stress triggers toxin production by the dinoflagellate *Karenia brevis*. *PNAS*. June 28,2011. Vol. 108. No. 26.

¹³⁰ Bienfang 2011; Walsh, J.J. et al. 2006. Red tides in the Gulf of Mexico: Where, when, and why? *J. Geophys Res*. 2006. Nov. 7; 111(C11003): 1-46. Doi:10.1029/2004JC002813.

At concentrations of >100,000 cells/l, the 12 brevetoxins produced by red tide can and have killed marine animals, including fish, sea turtles, manatee, sea birds, and dolphins.¹³¹ Brevetoxins from red tide have long been known to cause manatee mortality.¹³² One study found markedly less shrimp and fish activity during red tide.¹³³ Meanwhile, almost nothing is known about the longterm chronic exposure.¹³⁴

HABs have also impacted coastal economies. Red tide increases the use of emergency medical services, local fisheries close, and local shops are affected.¹³⁵ One study found that red tide can cause \$0.5-4 million in emergency room costs for treating respiratory illness associated with red tide.¹³⁶ Another calculated \$300,000 impacts in lifeguard absenteeism in Sarasota County alone.¹³⁷ Anderson (2000) calculated red tide is responsible for more than \$20 million tourism-related loses every year.¹³⁸

The current, ongoing red tide bloom started in October 2017 and by November 2018, red tide and fish kills had reached the Florida panhandle in Okaloosa, Walton, Bay and Franklin counties and wrapped around the southern tip of Florida and up the Atlantic coast.¹³⁹ By October 2018, red tide closed beaches in Pinellas, Manatee, Sarasota, Lee, Collier, Escambia, Okaloosa, Brevard and Indian River counties.¹⁴⁰ Concentrations of more than 1 million *K.brevis* cells per liter were observed in Pinellas, Hillsborough, Manatee, and Sarasota counties by November 2018.¹⁴¹ Governor Scott has declared a state of emergency, and by August 2018, thousands of tons marine life killed by the bloom had been removed, costing tax-payers millions of dollars.¹⁴²

¹³¹ Bienfang 2011; Twiner, M. et al. 2012. Comparative Analysis of Three Brevetoxin-Associated Bottlenose Dolphin (*Tursiops truncatus*) Mortality Events in the Florida Panhandle Region (USA). PLoS ONE 7(8):e42974. Doi:10.1371/journal.pone.0042974; Twiner, M. et al. 2011. Concurrent Exposure of Bottlenose Dolphins (*Tursiops truncatus*) to Multiple Algal Toxins in Sarasota Bay, Florida, USA. PLoS ONE 6(3): e17394. Doi:10.1371/journal.pone.0017394.

¹³² Kirkpatrick, B. et al. 2002. Florida Red Tides, Manatee Brevetoxicosis, and Lung Models Harmful Algae 2002 (2002). 2004; 10:491-493.

¹³³ Indeck, K.L. 2015. A severe red tide (Tampa Bay, 2005) cause an anomalous decrease in biological sound. R. Soc. Open sci. 2:150337.

¹³⁴ Erdner, D. et al. 2008. Centers for Oceans and Human Health: a unified approach to the challenge of harmful algal blooms. From Centers for Oceans and Human Health Investigators Meeting. Woods hole, MA. USA. 24-27. Apr. 2007.

¹³⁵ Backer, L. 2009. Impacts of Florida red tides on coastal communities. Harmful Algae 8 (2009) 618-622.

¹³⁶ Hoagland, P. et al. 2009. The Costs of Respiratory Illnesses Arising from Florida Gulf Coast *Karenia brevis* Blooms. Environmental Health Perspective. Vol. 117. Iss. 8; Fleming, L. et al. 2011. Review of Florida Red Tide and Human Health Effects. Harmful Algae. 2011. Jan. 1: 10(2): 224-233. Doi:10.1016/j.hal.2010.08.006; Anderson, D. 2008. Harmful algal blooms and eutrophication: Examining linkages from selected coastal regions of the United States. Harmful Algae. 2008. Dec. 1: 8(1): 39-53. Doi: 10.101016/j.hal.2008.08.017.

¹³⁷ Fleming 2011; Nierenberg, K. et al. 2010. Florida Red Tide Perception: Residents versus Tourists. Harmful Algae. 2010 Sept. 1; 9(6): 600-606. Doi:10.1016/j.hal.2010.04.010.

¹³⁸ Anderson, D. and P. Hoagland. 2000. Estimated Annual Economic Impacts from Harmful Algal Blooms (HABs) in the United States. WHOI-2000-11. Sea Grant. Woods Hole.

¹³⁹ Keiek, B. Red tide update for Northwest Florida. Mynbc15.com (Nov. 1, 2018); Jones, C. 2018. Could toxic red tide move farther north to St. Johns County? The St. Augustine Record. Oct. 8, 2018.

¹⁴⁰ Murphy. 2018. Red tide is spreading in Florida. Hurricane Michael didn't stop it. CNN. Oct. 18, 2018.

¹⁴¹ Ballogg, R. 2018. Red tide remains strong on Anna Maria Island. Bradenton Herald. Nov. 1, 2018.

¹⁴² Murphy, P. 2018. Red tide just spread to Florida's Atlantic coast, choking some the most popular beaches. CNN. Oct. 5, 2018.

C. Wildlife Impacts

Red tide and blue-green algae blooms have individually, collectively, and synergistically killed tens of thousands of tons of marine wildlife, including ESA-listed species like sea turtles, Florida manatees,¹⁴³ smalltooth sawfish, and coral, and species protected under the Marine Mammal Protection Act, 16 U.S.C. §1361 *et. seq.*, such as bottlenose dolphins. From July 2018 - December 6, 2018, 126 bottlenose dolphins have stranded due to exposure to red tide.¹⁴⁴ Red tide is responsible for the deaths of countless marine animals including those listed below:

Dead wildlife: Caloosahatchee, estuary, canals, back bays, Sanibel, Fort Myers beaches & Islands		
<u>Lee County has removed 2,200 tons of dead marine life. Sanibel = 425 tons</u>		
<i>Ongoing list not comprehensive</i> Endangered/Threatened Species		
American eels	Grunt sp.	Red snapper
American oystercatcher	Hardhead catfish	Remora
Anchovies	Horseshoe crabs	Reticulate moray
Angel fish	Jack fish sp.	Sand dollar
Anhinga	Kemps ridley sea turtle	Sanderling
Atlantic needlefish	Kingfish	Sand Trout
Atlantic spadefish	Lane snapper	Scaled sardine
Batfish	Laughing gull	Sheepshead
Black drum	Loggerhead sea turtle	Seahorses
Black tip shark	Lookdown fish	Shame- faced crab
Blenny	Mackerel	Snook
Blue crabs	Manatees	Snowy plover
Bottlenose dolphin	Mallard ducks	Starfish
Brown pelican	Mangrove snapper	Southern puffer
Bull shark	Mantis shrimp	Southern stargazer
Calico crab	Menhaden	Spanish mackerel
Catfish sp.	Minnnows	Spotted eels
Cobia	Moray Eel	Spotted seatrout
Common tern	Muscovy duck	Sting rays sp
Coquina	Mullet sp.	Stone crab
Cowfish	Ornate diamondback terrapin	Striped burr fish
Crevalle jack	Osprey	Threadfin herring
Double crested cormorant	Pale spotted eels	Tarpon
Flounder	Parchment worms	Toadfish
Gafftopsail catfish	Permit	Tri-colored Heron
Goby	Pig fish	Tripletail
Goliath grouper	Pinfish	Whale shark
Green sea turtle	Florida Pompano	Whiting
Grey triggerfish	Red drum/ Redfish	Yellow snake eel
Grouper sp.	Red knot	

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¹⁴³ The Florida manatee is also protected under the Marine Mammal Protection Act.

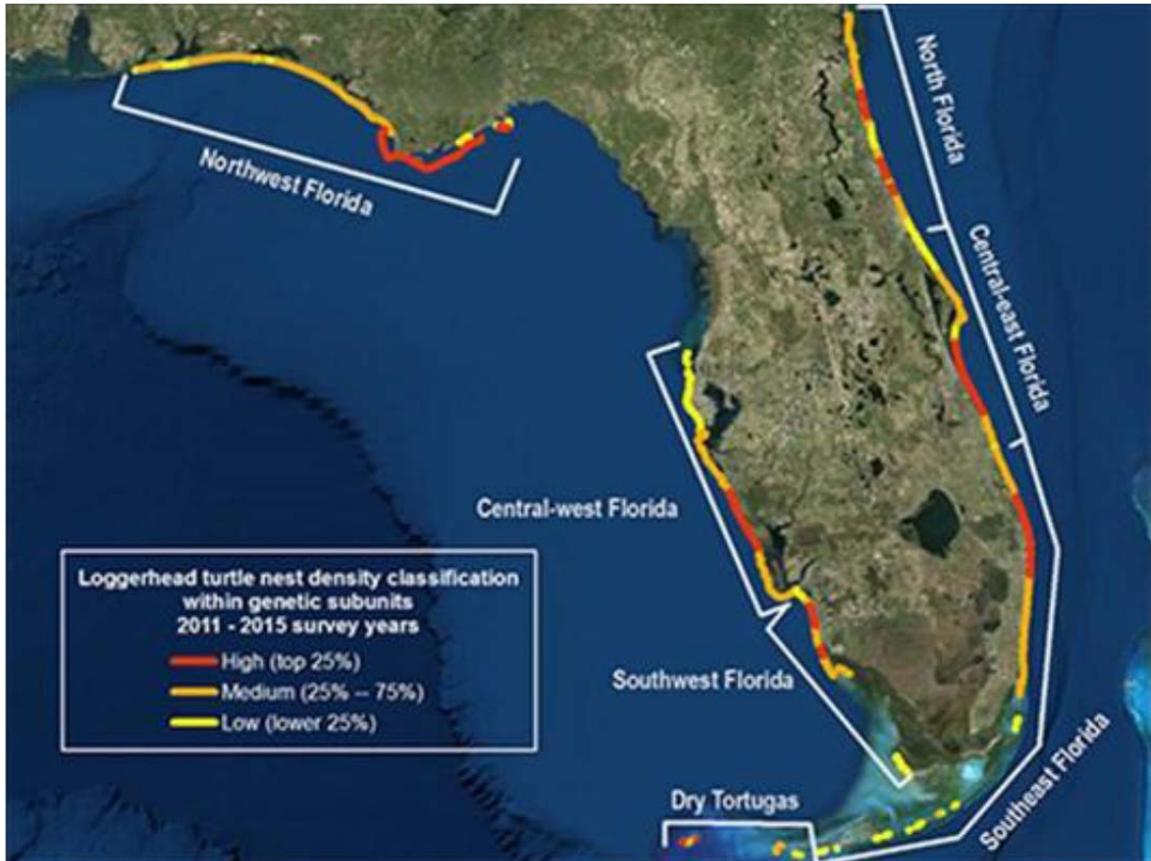
¹⁴⁴ NOAA 2018.

¹⁴⁵ 2018. Sanibel Captiva Conservation Foundation Memo to Corps. Dec. 4, 2018.

Sea turtles

FWS and NMFS have designated the leatherback, Kemp’s ridley, and hawksbill sea turtles as endangered under the ESA, and the Northwest Atlantic Ocean Distinct Population Segments of loggerhead and green sea turtles as threatened under the ESA.

The southeastern United States has the world’s largest number of loggerhead nests, with 90% of nesting in Florida.¹⁴⁶ The majority of this nesting occurs in Brevard, Indian River, St. Lucie, Martin and Palm Beach counties. Loggerhead sea turtles consistently aggregate in Indian River Lagoon.¹⁴⁷

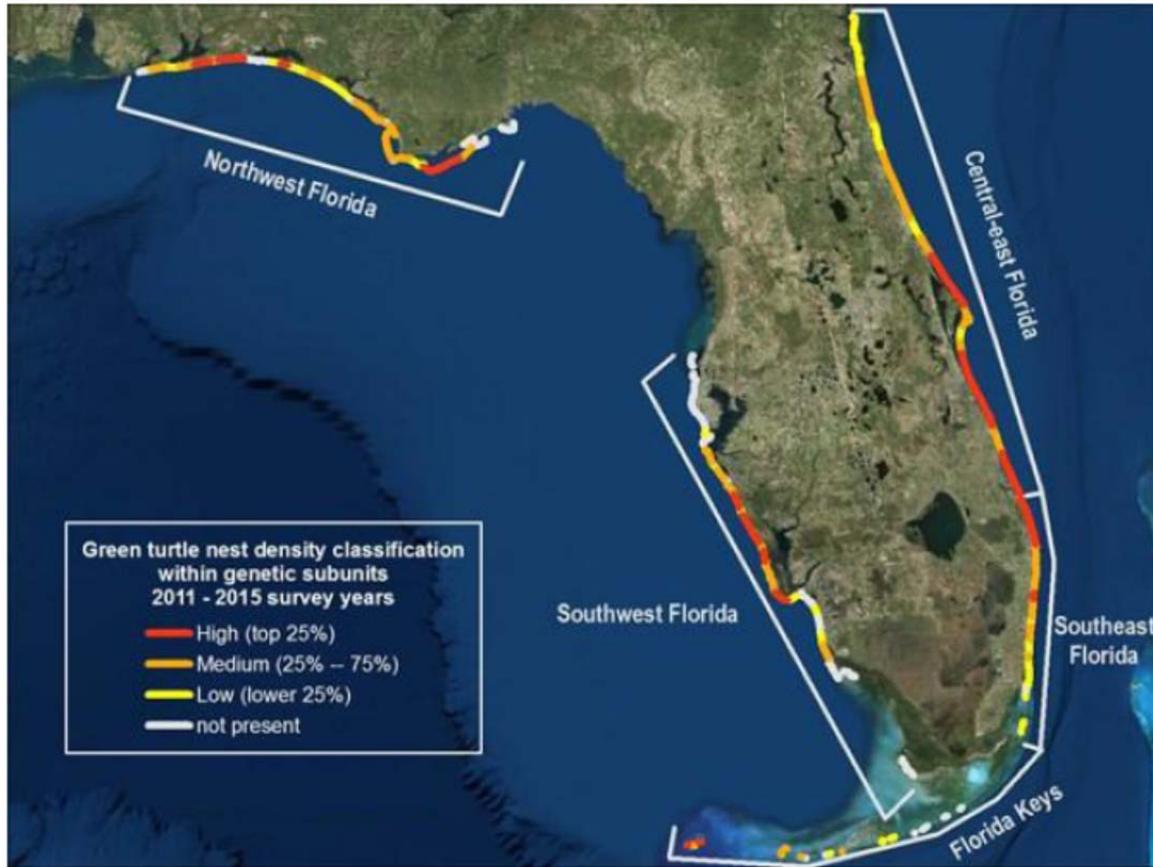


The second largest aggregation of green sea turtle nesting is in Florida.¹⁴⁸

¹⁴⁶ Casale, P. and A.D. Tucker. 2017. *Caretta caretta*, Loggerhead Turtle. The IUCN Red List of Threatened Species; Ceriani, S.A. and A.B. Melyan. 2017. *Caretta caretta* (North West Atlantic subpopulation) loggerhead turtle. The IUCN Red List of Threatened Species.

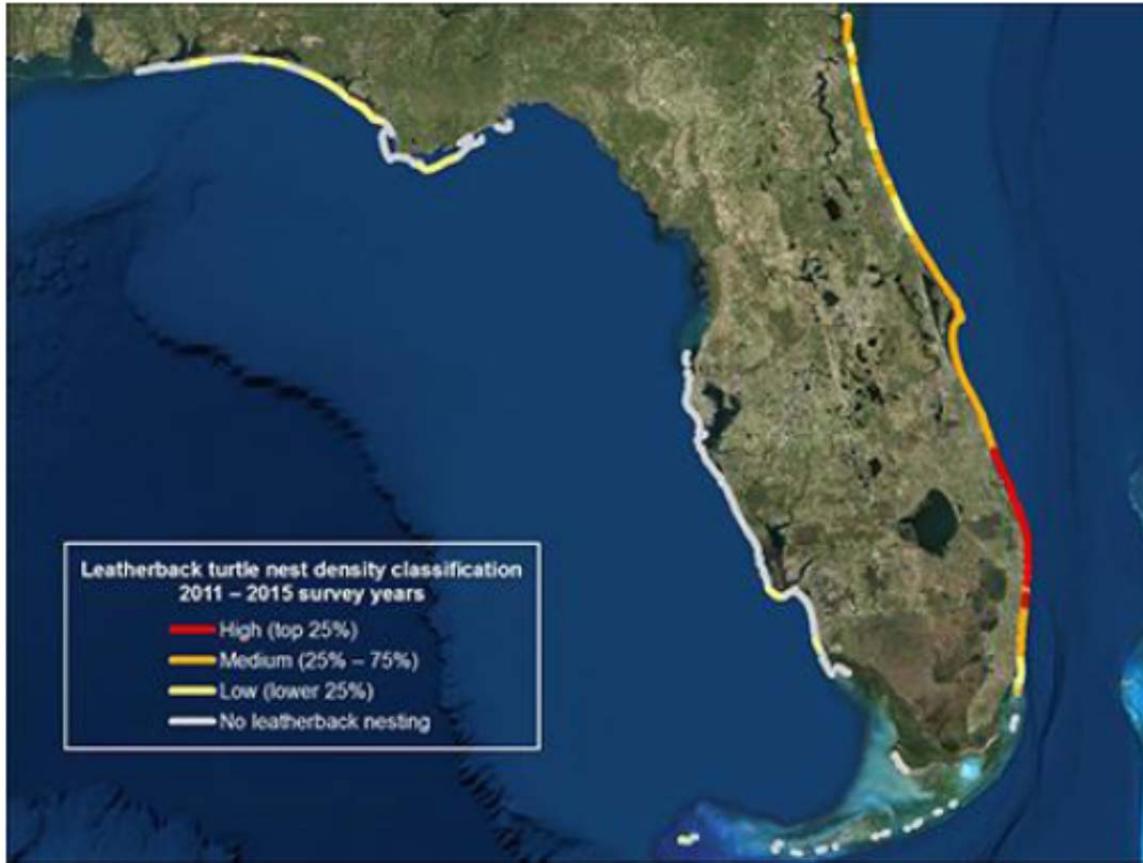
¹⁴⁷ FWC. 2018. Loggerhead Nesting in Florida. (FWC 2018b).

¹⁴⁸ FWC. 2018. Green Turtle Nesting in Florida. (FWC 2018c).



Florida is the only state in the continental U.S. where leatherback regularly nest.¹⁴⁹

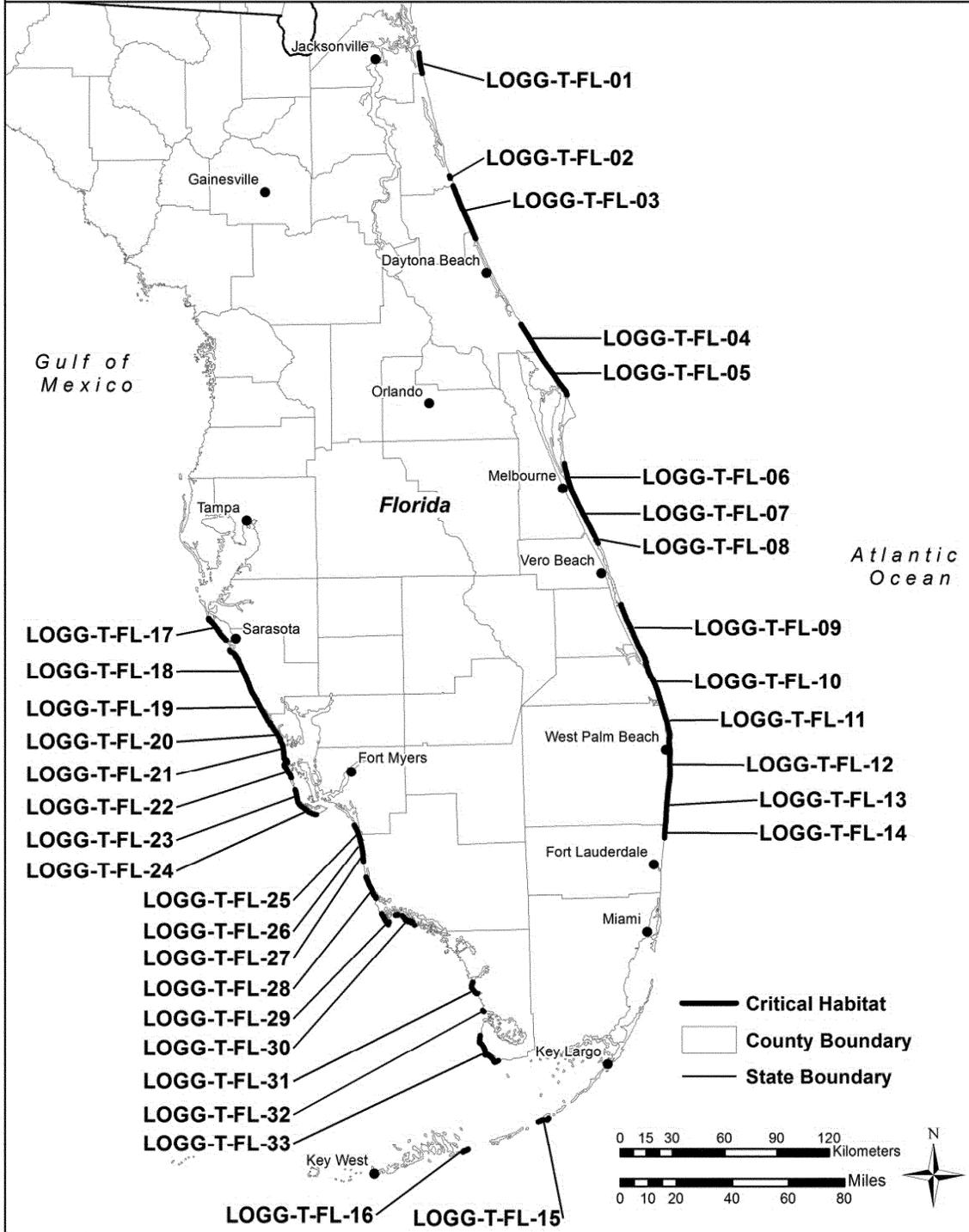
¹⁴⁹ FWC. 2018. Leatherback Nesting In Florida. (FWC 2018d).

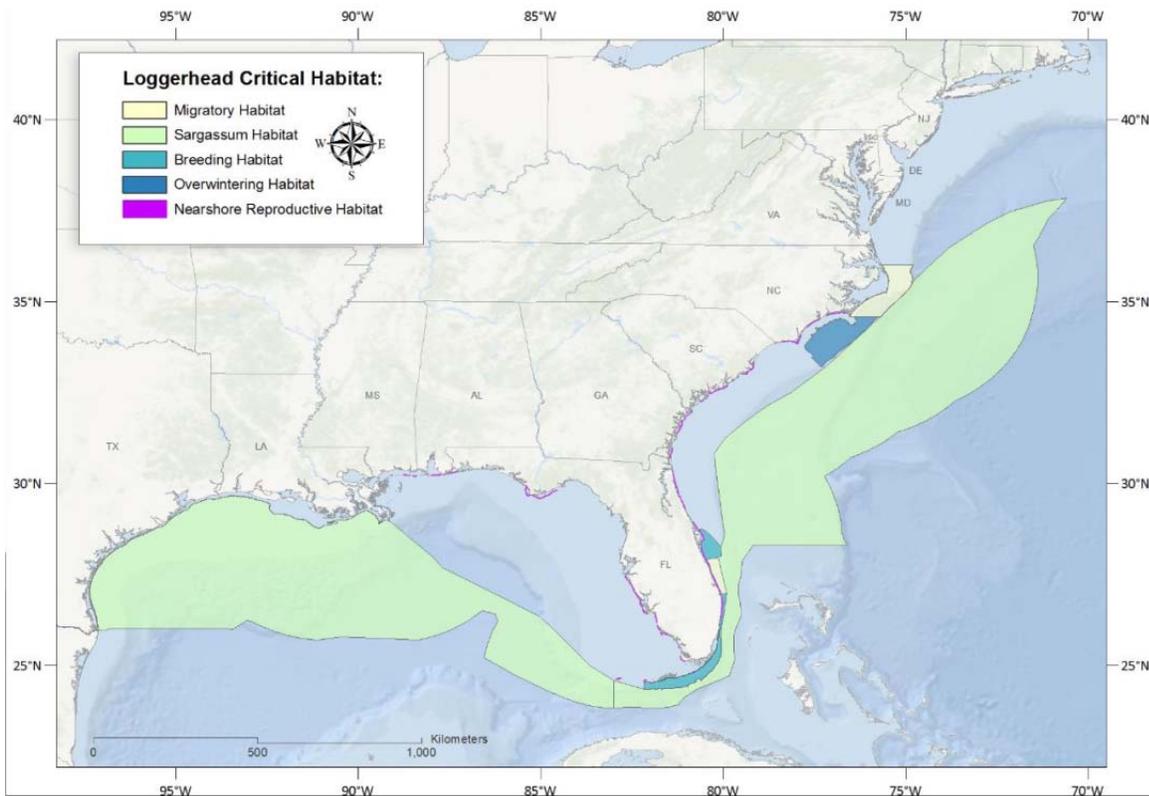


On July 10, 2104, FWS and NMFS designated critical habitat for the Northwest Atlantic Ocean Distinct Population Segment of the loggerhead sea turtle (*Caretta caretta*).¹⁵⁰ The critical habitat designations include areas impacted by the LORS discharges, blue-green algae, and red tide.

¹⁵⁰ 79 Fed. Reg. 39756, *Endangered and Threatened Wildlife and Plants; Designation of Critical Habitat for the Northwest Atlantic Ocean Distinct Population Segment of the Loggerhead Sea Turtle*, (July 10, 2014); 79 Fed. Reg. 39356, *Endangered and Threatened Species: Critical Habitat for the Northwest Atlantic Ocean Loggerhead Sea Turtle Distinct Population Segment (DPS) and Determination Regarding Critical Habitat for the North Pacific Ocean Loggerhead DPS*, (July 10, 2014).

**Index Map of the Peninsula Florida Recovery Unit Critical Habitat
for the Northwest Atlantic Ocean Loggerhead Sea Turtle DPS**





Red tide with concentrations of *karenia brevis* (at least 100,000 cells/l) is the concentration at which the Florida Fish and Wildlife Conservation Commission (FWC) believes sea turtle mortality due to brevetoxicosis typically begins to occur. It is believed that red tide exposure may pose significant implications for immune function in loggerhead sea turtles.¹⁵¹ From Nov. 2017-Dec. 10, 2018 FWC documented 1,260 stranded sea turtles with 577 (250 loggerheads, 263 Kemp’s ridleys, and 64 green sea turtles) to red tide, making it the largest number of stranded sea turtles attributed to red tide.¹⁵²

¹⁵¹ Walsh, C. 2009. Effects of brevetoxin exposure on the immune system of loggerhead sea turtles. *Aquatic Toxicology* 97 (2010) 293-303.

¹⁵² Foley, A. Email. Sea Turtle Stranding and Red Tide. Dec. 10, 2018.

2018 Pinellas County - Collier County									
Dates	Loggerhead	Green turtle	Kemp's ridley	Hawksbill	Leatherback	Unidentified	Number found alive	Weekly total	5-year average
5/29 - 6/4	7	3	1	0	0	0	6	11	9
6/5 - 6/11	15	3	1	0	0	1	3	20	10
6/12 - 6/18	7	3	4	0	0	0	3	14	7
6/19 - 6/25	13	3	11	0	0	0	2	27	9
6/26 - 7/2	13	5	14	0	0	0	8	32	10
7/3 - 7/9	9	10	5	0	0	1	3	25	12
7/10 - 7/16	10	5	10	0	0	0	3	25	7
7/17 - 7/23	18	20	22	0	0	3	5	63	7
7/24 - 7/30	23	5	42	0	0	0	8	70	8
7/31 - 8/6	10	11	33	0	0	0	2	54	9
8/7 - 8/13	18	12	25	3	0	2	1	60	9
8/14 - 8/20	20	11	27	0	0	0	4	58	7
8/21 - 8/27	19	39	47	0	0	1	8	106	6
8/28 - 9/3	0	2	2	0	0	0	0	4	4
9/4 - 9/10	15	3	3	0	0	2	3	23	6
9/11 - 9/17	33	8	23	0	0	0	2	64	3
9/18 - 9/24	14	17	36	0	0	3	5	70	6
9/25 - 10/1	5	7	18	0	0	1	2	31	7
10/2 - 10/8	1	4	4	0	0	1	1	10	2
10/9 - 10/15	2	6	5	0	0	0	2	13	5
10/16 - 10/22	3	4	3	0	0	1	0	11	4
10/23 - 10/29	6	7	2	0	0	0	4	15	3
10/30 - 11/5	0	4	2	0	0	0	1	6	7
11/6 - 11/12	1	5	1	0	0	0	1	7	5
11/13 - 11/19	2	5	1	0	0	0	2	8	5
11/20 - 11/26	5	5	5	0	0	0	2	15	5
11/27 - 12/3	5	6	6	0	0	0	0	17	3
12/4-12/10	2	2	2	0	0	1	1	7	7
Total	276	215	355	3	0	17	82	866	182

Dates	Collier	Lee	Charlotte	Sarasota	Manatee	Hillsborough	Pinellas	Total
5/29 - 6/4	0	4	1	1	1	0	4	11
6/5 - 6/11	4	9	0	2	0	0	5	20
6/12 - 6/18	0	3	3	1	2	0	5	14
6/19 - 6/25	8	7	2	5	2	0	3	27
6/26 - 7/2	1	13	5	6	1	2	4	32
7/3 - 7/9	2	3	3	9	0	0	8	25
7/10 - 7/16	8	2	2	5	2	1	5	25
7/17 - 7/23	4	23	9	26	0	1	0	63
7/24 - 7/30	16	40	4	6	0	0	4	70
7/31 - 8/6	1	33	1	16	2	0	1	54
8/7 - 8/13	6	16	5	29	2	0	2	60
8/14 - 8/20	2	24	5	23	2	1	1	58
8/21 - 8/27	2	35	5	56	3	0	5	106
8/28 - 9/3	0	2	0	2	0	0	0	4
9/4 - 9/10	2	7	0	7	2	0	5	23
9/11 - 9/17	4	38	3	8	0	1	10	64
9/18 - 9/24	1	34	8	10	5	0	12	70
9/25 - 10/1	0	14	0	3	5	0	9	31
10/2 - 10/8	2	0	0	1	0	1	6	10
10/9 - 10/15	0	3	1	3	1	0	5	13
10/16 - 10/22	0	3	1	3	2	0	2	11
10/23 - 10/29	5	2	0	0	0	0	8	15
10/30 - 11/5	0	0	1	2	0	0	3	6
11/6 - 11/12	0	1	0	0	0	0	6	7
11/13 - 11/19	0	1	0	2	2	0	3	8
11/20 - 11/26	3	5	0	2	1	1	3	15
11/27 - 12/3	7	3	0	3	0	0	4	17
12/4-12/10	3	1	0	0	1	0	2	7
Total	81	326	59	231	36	8	125	866

FWC reports that in Collier County, it documented 135 stranded sea turtles (72 loggerheads, 53 Kemp's ridleys, 7 green turtles, 1 hawksbill, and 2 sea turtles not identified to species) November 2017-December 2018. Most (N = 124) were found dead. The previous five-year average number of strandings for Collier County over that period was 36 (current number is 3.8 times greater than average). Red tide has been persistent in Collier County since March 2018 and FWC attributes 91 of the stranded sea turtles in Collier County (54 loggerheads, 36 Kemp's ridleys, and 1 green turtle) to the red tide.

In Lee County, FWC documented 404 stranded sea turtles (165 loggerheads, 165 Kemp's ridleys, 67 green turtles, and 7 sea turtles not identified to species) November 2017- December 2018. Most (N = 366) were found dead. The previous five-year average number of strandings for Lee County over that period was 101 (current number is 4.0 times greater than average). Red tide has been persistent in Lee County since November 2017 and FWC attributes 260 of the stranded sea turtles in Lee County (127 loggerheads, 114 Kemp's ridleys, and 19 green turtles) to the red tide.

In Charlotte County FWC documented 74 stranded sea turtles (24 loggerheads, 31 Kemp's ridleys, 18 green turtles, and 1 sea turtle not identified to species) November 2017- December 2018. Most (N = 68) were found dead. The previous five-year average number of strandings for Charlotte County over that period was 19 (current number is 3.9 times greater than average). Red tide was persistent in Charlotte County since December 2017 and FWC attributes 44 of the stranded sea turtles in Charlotte County (18 loggerheads, 21 Kemp's ridleys, and 5 green turtles) to the red tide.

In Sarasota County FWC has documented 263 stranded sea turtles (58 loggerheads, 89 Kemp's ridleys, 108 green turtles, 2 hawksbills, and 6 sea turtles not identified to species) November 2017- December 2018. Most (N = 248) were found dead. The previous five-year average number of strandings for Sarasota County over that period was 59 (current number is 4.5 times greater than average). Red tide was present in Sarasota County during November of 2017 and March 2018. It has been persistent in Sarasota County since June 2018 and FWC attributes 121 of the stranded sea turtles in Sarasota County (36 loggerheads, 59 Kemp's ridleys, and 26 green turtles) to the red tide.

In Manatee County, FWC has documented 66 stranded sea turtles (20 loggerheads, 14 Kemp's ridleys, 30 green turtles, and 2 sea turtles not identified to species) November 2017- December 2018. Most (N = 51) were found dead. The previous five-year average number of strandings for Manatee County over that period was 36 (current number is 1.9 times greater than average). Red tide has been persistent in Manatee County since August 2018 and FWC attributes 14 of the stranded sea turtles in Manatee County (5 loggerheads, 6 Kemp's ridleys, and 3 green turtles) to the red tide.

In Hillsborough County FWC has documented 18 stranded sea turtles (6 loggerheads, 4 Kemp's ridleys, 7 green turtles, and 1 sea turtle not identified to species) November 2017- December 2018. Most (N = 15) were found dead. The previous five-year average number of strandings for Hillsborough County over that period was 10 (current number is 1.7 times greater than average). Red tide has been present in Hillsborough County since August 21, 2018 and FWC

attributes 2 of the stranded sea turtles in Hillsborough County (1 Kemp's ridley and 1 green turtle) to the red tide.

In Pinellas County FWC has documented 300 stranded sea turtles (50 loggerheads, 58 Kemp's ridleys, 186 green turtles, 3 hawksbills, and 3 sea turtles not identified to species) November 2017- November 2018. Most (N = 225) were found dead. The previous five-year average number of strandings for Pinellas County over that period was 241 (current number is 1.2 times greater than average). Red tide has been present in Pinellas County since August 21, 2018 and FWC attributes 45 of the stranded sea turtles in Pinellas County (10 loggerheads, 26 Kemp's ridleys, and 9 green turtles) to the red tide.

Florida manatee

FWS has designated the Florida manatee a threatened species under the ESA. Red tide can cause direct mortality of manatees, but can also cause sublethal impacts.¹⁵³ FWC reports that red tide has contributed to the deaths of 207 Florida manatees January-December 12, 2018.¹⁵⁴ The brevetoxin binds to manatees' brains, leading to edema and hemorrhaging,¹⁵⁵ and ultimately leads to their death.¹⁵⁶

Smalltooth sawfish

Smalltooth sawfish are a tropical marine and estuarine fish that was once commonly found in waters throughout Florida and other states in the Southeast. In 2003, NMFS listed the United States population as an endangered distinct population segment under the ESA due to habitat destruction and bycatch in various commercial fisheries.¹⁵⁷ Currently, sawfish can only be found with any regularity in South Florida between the Caloosahatchee River and the Keys and it is believed that the population is at a level less than 5% of its size at the time of European settlement.¹⁵⁸

While it is unclear what the precise impacts to smalltooth sawfish and their habitat are from the discharges, freshwater flows do influence the movement and distribution of smalltooth sawfish.¹⁵⁹ The fish have an affinity for salinities between 18 and 24 psu, and these salinity levels are impacted by LORS discharges.

¹⁵³ Walsh, C. 2015. Sublethal red tide exposure in free-ranging manatees (*Trichechus manatus*) affects the immune system through reduced lymphocyte proliferation responses, inflammation, and oxidative stress. *Aquatic Toxicology* 161 (2015) 73-84.

¹⁵⁴ Hagan, A. 2018. Red tide has contributed to the deaths of nearly 190 Florida manatees, FWC says. *Abcactionnews.com*. Oct. 29, 2018; FWC. 2018 Preliminary Red Tide Manatee Mortalities, Jan. 01-Nov. 9. Manatees Carcasses Collected Within the Known Red Tide Bloom Boundary.

¹⁵⁵ Bossart, G. et al. 1998. Brevetoxicosis in Manatees (*Trichechus manatus latirostris*) from the 1996 Epizootic: Gross, Histologic, and Immunohistochemical Features. *Toxicologic Pathology*.

¹⁵⁶ Landsberg, J.E. et al. 2009. *Karenia brevis* red tides, brevetoxins in the food web, and impacts on natural resources: Decadal advancements. *Harmful Algae*. Vol. 8, Iss. 4; Trainer, V. and D. Baden. 1999. High affinity binding of red tide neurotoxins to marine mammal brain. *Aquatic Toxicology* Vol. 46, Iss. 2. July 1999.

¹⁵⁷ 68 Fed. Reg. 15674 (April 1, 2003).

¹⁵⁸ Smalltooth Sawfish Recovery Plan, National Marine Fisheries Service (Jan. 2009) at v.

¹⁵⁹ Simpfendorfer, C.A. 2011. Environmental Influences on the Spatial Ecology of Juvenile Smalltooth Sawfish (*Pristis pectinata*): Results from Acoustic Monitoring. *PloS One* 6(2).

When the Corps discharges water, “individuals may move to areas with their preferred salinity, but habitats within these areas may be less (or more) suitable than those previously occupied. Within the Caloosahatchee River, increases in salinity that led to [sawfish] occurring upriver of the study area may be most problematic as the river becomes quite narrow with few shallow habitats that species appears to use as a refuge from predation.”¹⁶⁰ Flow regimes that result in sawfish being distributed in sub-optimal habitats may reduce the survival “and thus hinder the recovery of this population.”¹⁶¹

The Simpfendorfer study further notes that water management practices that result in repeated large changes in flow over short periods of time will result in large amounts of movement between different habitats which will increase energy expenditure, and may expose individuals to greater risks of predation. . . . Water management practices therefore need to be considered in relation to the recovery of the [sawfish] population.”¹⁶²

One of the three main objectives of the 2009 Smalltooth Sawfish Recovery Plan is to protect and/or restore sawfish habitats.¹⁶³ One of the criteria that must be met for both the down-listing and de-listing of the species states:

Freshwater flow regimes (including timing, distribution, quality, and quantity) . . . are appropriate to ensure natural behavior (e.g., feeding, resting, and predator avoidance) by maintaining salinities within preferred physiological limits of juvenile smalltooth sawfish.¹⁶⁴

The Recovery Plan further calls for NMFS to “minimize the disruption of natural/historic freshwater flow regimes (including timing, quality, and quantity) and maintain or restore water quality to restore the long-term viability of the smalltooth sawfish”¹⁶⁵ and directs the smalltooth sawfish recovery team to “work with federal, state, and local agencies responsible for regulating and permitting freshwater flows and withdrawals and water quality to ensure that environmental conditions are maintained at levels suitable for sawfish survival and recovery.”¹⁶⁶

Coral

NMFS has designated boulder star coral (*Montastraea annularis*), elkhorn coral (*Acropora palmata*), and staghorn coral (*Acropora cervicornis*) threatened under the ESA. These coral were once the most abundant and important reef building corals of Florida and the greater Caribbean. They occur in United States waters off the coasts of Florida, Puerto Rico, the U.S. Virgin Islands and Navassa Island. Over just the last 30 years, these species have suffered an 80-98 percent

¹⁶⁰ Simpfendorfer, et al. at 10.

¹⁶¹ *Id.* at 11.

¹⁶² *Id.* at 11.

¹⁶³ See Smalltooth Sawfish Recovery Plan at III-3.

¹⁶⁴ Recovery Plan at III-4, III-5. The criterion for delisting reads almost verbatim: “Freshwater flow regimes (including timing, distribution, quality, and quantity) . . . are appropriate to ensure natural behavior (e.g., feeding, breeding, and pupping) by maintaining salinities within preferred physiological limits of juvenile smalltooth sawfish.”

¹⁶⁵ Smalltooth Sawfish Recovery Plan at III-4. See also, Recovery Plan at ix, IV-9, IV-22.

¹⁶⁶ *Id.* at IV-9.

decline throughout significant portions of their range, reducing coral cover and opening space on reefs at an unprecedented pace.

Dense thickets used to dominate Caribbean coral reefs in the 1970s. Now, colonies are small, isolated, and patchy. Because the populations are fragmented, the corals are unable to recruit new colonies because corals need to be in close proximity for reproduction.

Habitat degradation and modification is a primary threat to these corals. Corals have suffered severe bleaching and mortalities due to increases in water temperature. The increasing acidity of seawater as a result of the oceans' uptake of carbon dioxide is also known to reduce the growth rate of corals and to impair the ability of elkhorn corals to populate a reef. These corals are also threatened by pollution and sedimentation, which further contributes to algae overgrowth of corals. Other threats include abrasion and breakage from contact with boats, anchors, and storms. Disease and predation also contribute to the decline of the corals.

Black band disease of coral is a cyanobacteria-obligate disease that leads to extensive reef deterioration.¹⁶⁷ Coastal pollution, cyanobacteria and BBD have impacted coral like the federally threatened boulder coral (*Montastraea annularis*).¹⁶⁸ Studies of coral impacted by BBD off the coast of Florida tested positive for cyanotoxin microcystin.¹⁶⁹

D. Climate Change

Climate change is likely contributing to the growth of HAB,¹⁷⁰ and “will severely affect our ability to control blooms, and in some cases could make it near impossible.”¹⁷¹ Favorable conditions for blooms include warm waters, changes in salinity, increases in atmospheric carbon

¹⁶⁷ Gantar, M. et al. 2011. Antibacterial Activity of Marine and Black Band Disease Cyanobacteria against Coral-Associated Bacteria. *Marine Drugs*. 2011, 9(10), 2089-2105; doi:10.3390/md9102089; Bourne, D. et al. 2009. Microbial disease and the coral holobiont. <https://doi.org/10.1016/j.tim.2009.09.004>; Muller, E.M. et al. 2010. Black-band disease dynamics: Prevalence, incidence, and acclimatization to light. *Journal of Experimental Marine Biology and Ecology*. Vol. 397, Iss. 1, 31 Jan. 2011, p. 52-57; Viehman, S. et al. 2007. Culture and identification of *Desulfovibrio* spp. from corals infected by black band disease on Dominican and Florida Keys reefs. *Diseases of Aquatic Organisms*. Vol. 69: 119-127; Gantar, M. et al. 2007. Cyanotoxins from Black Band Disease of Corals and from Other Coral Reef Environments. *Microb Ecol*. 2009 Nov. 58(4): 856-64, doi:10.1007/s00248-009-9540-x; Bourne, D. et al. 2009. Microbial disease and the coral holobiont. *Trends in Microbiology* Vol. 17 No. 12; Klaus, J. et al. 2007. Coral microbial communities, zooxanthellae and mucus along gradients of seawater depth and coastal pollution. *Environmental Microbiology* 9(5), 1291-1305.

¹⁶⁸ Klaus, J. et al. 2009. Coral microbial communities, zooxanthellae and mucus along gradients of seawater depth and coastal pollution. *Environmental Microbiology* <https://doi.org/10.1111/j.1462-2920.2007.01249.x>.

¹⁶⁹ Myers, J. et al. 2007. Molecular Detection and Ecological Significance of the Cyanobacterial Genera *Geitlerinema* and *Leptolyngbya* in Black Band Disease of Corals. *Applied and Environmental Microbiology*. Vol. 73, No. 16, Aug. 2006, p. 5173-82.

¹⁷⁰ EPA. 2013. Impacts of Climate Change on the Occurrence of Harmful Algal Blooms (EPA 2013); Havens, K. 2015. Climate Change and the Occurrence of Harmful Microorganisms in Florida's Ocean and Coastal Waters. IFAS Extension; Havens, K. 2018. The Future of Harmful Algal Blooms in Florida Inland and Coastal Waters. IFAS Extension; Moss, B. et al. 2011. Allied attack: climate change and eutrophication. *Inland Waters*, 1:2, 101-105; Paerl, H. and J. Huisman. 2008. Blooms Like It How. *Science*. Vol. 320, 4 April 2008; Paerl, H. and J. Huisman. 2009. Climate change: a catalyst for global expansion of harmful cyanobacterial blooms. *Environmental Microbiology Reports* (2009) 1(1), 27-37.

¹⁷¹ Havens, K. et al. 2015. Climate Change at a Crossroad for Control of Harmful Algal Blooms. *Environmental Science & Technology* 2015, 49, 12605-12606.

dioxide concentrations, changes in rainfall patterns intensify coastal upwelling, sea level rise and high nutrient levels.¹⁷² Climate change is warming ocean waters which may create a competitive advantage for harmful algae, including microcystis, by out competing other algae that is not as successful at warmer temperatures.¹⁷³ Warming surface waters increases the frequency, strength, and duration of stratification which favors both cyanobacteria and dinoflagellates.¹⁷⁴ Warmer temperatures reduce water viscosity, which may give cyanobacteria a competitive advantage over other algae.¹⁷⁵

Climate change is also leading to an increase in extreme weather events. Extreme rainfall could increase nutrient loading from runoff.¹⁷⁶ Climate scientists believe that there is an Atlantic Multidecadal Oscillation, and that there are significant differences in Lake Okeechobee inflows between dry phases and wet phases. The dry phase, which lasted from about 1965 to 1994, has shifted to a wet phase, which means that nearly the entire period of record used by the Corps for evaluation of the LORS does not represent the wet phase we are now in. There is evidence that during the previous wet period from around 1930 to 1964 the inflows to the lake were about double as compared to the dry period of 1965 to 1994.¹⁷⁷ It is likely that climate-driven increases in inflows from human altered watersheds will increase the prevalence of HABs.¹⁷⁸

V. THE LAKE OKEECHOBEE REGULATION SCHEDULE

In 2006, the Corps began evaluating alternatives to WSE, ultimately selecting LORS. The changes between WSE and LORS include (1) the new low and high level to manage the lake are 11.5 ft and 17.25 ft, with up to maximum releases in Band A if the lake stage is greater than 17.25 ft; (2) regulatory Bands A, B, and C are lower; (3) the Band B discharges were reduced at S-80 from 3,500 to 2,800 cfs and B and C discharges at S-80 from 2,500 to 1,800 cfs; and (4) to allow for the beneficial base flows to the Caloosahatchee Estuary pending SFWMD approval on a case by case basis.¹⁷⁹ Alternative E, LORS, is the water control plan in operation today.

A. The Supplemental Environmental Impact Statement for LORS

In 2007, the Corps issued a notice of intent to prepare a Draft Supplemental Environmental Impact Statement (SEIS) pursuant to National Environmental Policy Act (NEPA) to evaluate new alternatives for the WSE.¹⁸⁰ The Corps selected LORS (known then as “Alternative E”) in part because federal agencies assumed that it would not negatively affect “any downstream

¹⁷² EPA 2013.

¹⁷³ *Id.*

¹⁷⁴ *Id.*

¹⁷⁵ *Id.*

¹⁷⁶ EPA 2013.

¹⁷⁷ Enfield, D. et al. 2001. The Atlantic multidecadal oscillation and its relation to rainfall and river flows in the continental U.S. *Geophysical Research Letters*, Vol. 28, No. 10, Pages 077-2080, May 15, 2001.

¹⁷⁸ Wells, M. et al. 2015. Harmful algal blooms and climate change: Learning from the past and present to forecast the future. *Harmful Algae*. 2015 Nov. 1; 49: 68-93. Doi:10.1016/j.hal.2015.07.009.

¹⁷⁹ FWS 2018.

¹⁸⁰ FWS 2007 at 9-11.

ecosystems more than they already experience,”¹⁸¹ and was intended to be active for three years, until around 2010 when the Corps would then incorporate structural improvements along with benefits from initial components of the Comprehensive Everglades Restoration Plan into LORS.¹⁸²

The Corps determined that flows between 450 cfs and 2800 cfs are necessary to sustain an ecologically appropriate range of salinity conditions in the estuary, and flows greater than 2800 cfs are high for the Caloosahatchee estuary.¹⁸³ High flows in this range can cause salinity to fall below the tolerance range of many organisms living in the estuary. Prolonged flows of 4500 cfs which may cause adverse effects to seagrasses and other organism, and high flows greater than 2800 cfs may prevent the early life stages of fish, shellfish and other commercially and recreationally important species from utilizing estuarine habitat.

The Corps determined that if inflows to the inner estuary exceeded 2000 cfs, salinity in the mid estuary will cause significant stress and a high probability of oyster mortality. Therefore, the Corps concluded that when possible, the lake release to tide would be limited to a pulse release from ale not to exceed 2800 cfs measures at s-79 and 2000 cfs measures at the St. Lucie estuary.

The SEIS only briefly mentions algae, noting that “a small percentage of algae produce toxins, and are termed HAB [harmful algae blooms],” but that even non-toxic algae can have harmful effects on marine ecosystems when masses of algae die and decompose, depleting oxygen in the water.¹⁸⁴ The SEIS states that cyanobacteria (also known as blue-green algae) and dinoflagellates (also known as red tide) “have traditionally received the dubious distinction of constituting nuisance bloom populations or HAB,”¹⁸⁵ and acknowledges that “[p]opulation increased [sic] and other anthropogenic factors have led to significant nutrient enrichment of Florida coastal waters over the past several decades,” yet the Corps then summarily concludes that “[i]t is unlikely that discharges from Lake Okeechobee are a prerequisite for HAB formation,”¹⁸⁶ and offers no further information or analysis on algae or its impacts to the human environment.

The current schedule, as it relates to the quantity and timing of the water delivered from the lake to the Caloosahatchee and St. Lucie rivers, continues to cause significant adverse impacts to the rivers and their estuaries by introducing and then depriving freshwater into the system in a manner that is inconsistent with the rivers’ natural salinity regime and that causes significant harm due to the algae and nutrients that are allowed to accumulate in the Lake. This in turn, has adversely affected the Florida manatee, smalltooth sawfish, Johnson’s seagrass, sea turtles, and coral and degraded their designated critical habitat.

¹⁸¹ *Id.* at 11, 64; The ROD states that a key feature of LORS is that “it allows long-term, low-volume releases to the Caloosahatchee and St. Lucie estuaries” which are “intended to manage lake levels while reducing the potential for future prolonged high-volume releases.” Corps 2008 at 2.

¹⁸² FWS 2007 at 1. The Corps intended that LORS be in effect until the earlier of (1) implementation of a new lake schedule as a component of the system-wide operating plan for CERP Band 1 projects and Florida’s Acceler8 projects; or (2) completion of HHD seepage berm construction or equivalent dike repairs for reaches 1, 2, and 3, upon information and belief, the Corps intended LORS to be interim and only last until 2010.

¹⁸³ Corps 2007.

¹⁸⁴ Corps 2008a at 111.

¹⁸⁵ *Id.*

¹⁸⁶ *Id.* at 112.

B. 2007 FWS Biological Opinion & NMFS Concurrence Letter

As part of the Corps' NEPA process, FWS and the Corps initiated formal consultation on LORS on July 3, 2006, and FWS issued a biological opinion on LORS October 15, 2007. The biological opinion identifies LORS as "operational changes to the water management infrastructure that discharges water from Lake Okeechobee to downstream systems (St. Lucie and Caloosahatchee estuaries, the Everglades Agricultural Area [EAA] and the Water Conservation Areas [WCAs])" which is "*intended to be active for three years, until around 2010*" when LORS "will incorporate possible structural improvements along with benefits from initial components of the Comprehensive Everglades Restoration Plan (CERP)."¹⁸⁷ The biological opinion noted that the Corps identified LORS as the preferred alternative in its NEPA analysis that would meet the goal of preserving the integrity of the Herbert Hoover Dike, reduce high releases to the estuaries, and meet other objectives including water supply, navigation, recreation, fish and wildlife enhancement in the littoral zone of Lake Okeechobee.¹⁸⁸

The Corps determined that LORS would not affect the eastern indigo snake, bald eagle, Cape Sable seaside sparrow, or West Indian manatee, and that it may affect the wood stork, Okeechobee gourd, and Everglades snail kite. FWS agreed that LORS would not affect the eastern indigo snake, bald eagle, or Cape Sable seaside sparrow; and that it may affect but was not likely to adversely affect the wood stork and Okeechobee gourd. FWS determined that LORS may affect, but is not likely to adversely affect the West Indian manatee. As a result, FWS limited the action area for formal consultation to the range of the snail kite, which does not include the Caloosahatchee estuary; therefore, the 2007 biological opinion does not analyze impacts to listed species in the estuary.¹⁸⁹

Meanwhile, on September 11, 2007, NMFS issued the Corps a concurrence letter concurring with the Corps' determination that LORS was not likely to adversely affect smalltooth sawfish and Johnson's seagrass. NMFS based its concurrence on the Corps' draft SEIS which the Corps intended to function as its biological assessment. It determined that LORS would have no effect on five listed sea turtle species because LORS "does not have any elements with potential to affect sea turtles."¹⁹⁰ The concurrence letter does not mention coral at all.

C. NMFS 2015 Concurrence Letter

Also as part of the Corps' NEPA process, in 2007, NMFS and the Corps concluded that the project may affect but was not likely to adversely affect the smalltooth sawfish.¹⁹¹ NMFS found that the project would "have at most an insignificant effect on smalltooth sawfish," finding that, due to fewer high volume freshwater releases, sawfish could move upstream to areas with more tolerable salinity regimes.¹⁹² On September 9, 2009, after the Corps completed its NEPA analysis

¹⁸⁷ FWS 2007 1, 11. In acknowledging uncertainties and impacts to species, FWS noted "[w]e must also keep in mind that the presently proposed schedule is expect to be in place for about 3 years." FWS 2007 at 64 (emphasis added).

¹⁸⁸ *Id.*

¹⁸⁹ *Id.* at 16.

¹⁹⁰ NMFS 2007 at 2.

¹⁹¹ Letter from Army Corps to NMFS, Aug. 10, 2006.

¹⁹² Letter from NMFS to Army Corps, Sept. 11, 2007.

and consultation with NMFS on LORS, NMFS designated critical habitat for the smalltooth sawfish, including portions of the Caloosahatchee River and estuary.¹⁹³

The Corps and NMFS reinitiated consultation on the smalltooth sawfish critical habitat and on May 14, 2015, NMFS issued a concurrence letter to the Corps concurring with its determination that LORS was not likely to adversely affect smalltooth sawfish or Johnson's seagrass, or destroy or adversely modify their habitat. The agencies reinitiated consultation due to the availability of new information regarding the smalltooth sawfish and the designation of smalltooth sawfish critical habitat. The concurrence letter describes the action area as Lake Okeechobee, the St. Lucie and Caloosahatchee estuaries, the Everglades Action Area, the northern Water Conservation Areas, and the Lake Worth Lagoon in Palm Beach County.¹⁹⁴

NMFS' 2000 Status Review for the sawfish identified habitat loss as the secondary cause of species' decline, and the recovery plan for the sawfish found that its recovery is dependent upon the availability and quality of nursery habitats. It also found that the protection of high-quality nursery habitats located in southwest Florida is essential to the species. NMFS determined that the key conservation goal in designating critical habitat was to "facilitate recruitment into the adult sawfish population by protecting juvenile nursery areas."¹⁹⁵ It found that the habitat features essential to the conservation of the species are red mangroves and shallow euryhaline habitats.

Protected areas include areas with red mangroves and shallow euryhaline habitats characterized by water depths between the Mean High Water (MHW) line and 3 feet measured at the Mean Lower Low Water,¹⁹⁶ including 221,459 acres of habitat in the Charlotte Harbor Estuary, which includes all of the Caloosahatchee River from the Caloosahatchee Estuary to the northern edge of Sanibel Island, up the river to the Franklin Lock and Dam. These features are essential to sawfish conservation because they "provide for predator avoidance and habitat for prey in the areas currently being used as juvenile nursery areas."¹⁹⁷ NMFS concluded that these features "may require special management considerations or protections due to human and natural impacts."¹⁹⁸ It also found that "[t]here may be a relationship between the use of the river and salinity,"¹⁹⁹ but declined to estimate a specific salinity regime.²⁰⁰

NMFS has noted "the physical and biological features are 'essential to the conservation' of the smalltooth sawfish; in other words, conservation of the species as defined in the ESA is not possible without the presence and protection of the features."²⁰¹ Notably, the Army Corps requested NMFS exclude federal channels (including Charlotte Harbor and the Intracoastal

¹⁹³ 74 Fed. Reg. 45353, *Endangered and Threatened Species; Critical Habitat for the Endangered Distinct Population Segment of Smalltooth Sawfish*, (Sept. 2, 2009).

¹⁹⁴ NMFS 2007 at 3.

¹⁹⁵ 74 Fed. Reg. 45353, 45353.

¹⁹⁶ *Id.* 45353, 45371.

¹⁹⁷ *Id.* 45353, 45353.

¹⁹⁸ *Id.* 45353, 45353.

¹⁹⁹ Letter from NMFS to Army Corps, Sept. 11, 2007, citing Simpfendorfer, C.A. 2006. Movement and habitat use of smalltooth sawfish. More Marine Laboratory Technical Report 1070, Final Report.

²⁰⁰ 74 Fed. Reg. 45353, 45356.

²⁰¹ *Id.* 45353, 45370.

Waterway Caloosahatchee River to Anclote River) from the critical habitat designation. It also requested an exemption from the rule for activities that are managed under the Comprehensive Everglades Restoration Program. In denying the requests, NMFS found that “the section 7 consultation process provides the best process for evaluating effects from future and ongoing CERP activities.”²⁰² NMFS also determine that it “would consult under section 7 of the ESA on the effects from alterations of freshwater flow regimes on the sawfish and its designate habitat.”²⁰³

NMFS found that the indirect effects of LORS to smalltooth sawfish include potential changes in the movement patterns as a result of changes in salinity as related to the amount of freshwater flow within the downstream waters of the Caloosahatchee.²⁰⁴ Sawfish critical habitat is within Charlotte Harbor and the Caloosahatchee and essential features necessary to ensure juvenile recruitment and conservation are red mangrove and shallow euryhaline habitats characterized by water depths between the mean high water line and 3 ft measured at mean lower low water as these conditions contribute to predator avoidance and foraging success. Sawfish may be temporarily affected by being unable to use the full range of foraging and resting habitats due to avoidance,²⁰⁵ but that the effects will be insignificant since sawfish are mobile and can avoid extreme conditions.²⁰⁶

The concurrence letter does not mention the impact of harmful algae blooms on smalltooth sawfish, Johnson’s seagrass, sea turtles, or boulder star, elkhorn and staghorn coral.

D. 2018 FWS Biological Opinion

In 2017 formal consultation on LORS was reinitiated because the 2007 biological opinion had used habitat a surrogate for take and FWS developed new techniques and new case law established that take of animals must be enumerated whenever possible.²⁰⁷ On June 4, 2018, FWS published its biological opinion which was based on the Corps’ 2017 biological assessments (received July 19, 2017 and September 28, 2017), meetings, analysis of modeling output, and additional information.²⁰⁸

FWS agreed with the Corps’ determination that LORS will not affect the Cape Sable seaside sparrow or its habitat, eastern indigo snake, Florida panther, or northern crested caracara. FWS agreed with the Corps’ determination that LORS is not likely to adversely affect the Florida bonneted bat, wood stork, Okeechobee gourd, or West Indian manatee or its critical habitat. FWS concluded that LORS is likely to adversely affect the Everglade snail kite and its critical habitat.²⁰⁹

²⁰² *Id.* 45353, 45361.

²⁰³ *Id.* 45353, 45356.

²⁰⁴ NMFS 2007 at 4.

²⁰⁵ *Id.* at 4.

²⁰⁶ *Id.* at 4.

²⁰⁷ FWS 2018 at 1.

²⁰⁸ *Id.*

²⁰⁹ FWS 2018 BO at 2.

The 2018 biological opinion recognizes that LORS is an ongoing action,²¹⁰ but for the first time claims that “[t]he current version of the *LORS is intended to remain in effect until about 2025.*”²¹¹ It noted that the LORS developed in 2007 was planned to be revised in 2010; however, due to delayed construction reinforcing the Herbert Hoover Dike around Lake Okeechobee that revision is now scheduled to occur in 2025.²¹²

FWS limited its analysis of the impacts of LORS to “all water bodies that a snail kite may use during its lifetime” and therefore did not analyze impacts to the Caloosahatchee.²¹³ The 2018 biological opinion makes little mention of algae. It notes that degradation of wetland habitat, particularly, due to water quality impacts associated with runoff of phosphorous are of concern, and that most of this increase has been attributed to nonpoint source runoff from agricultural lands north of the lake.²¹⁴ It found that “when herbivores consume hydrilla while this cyanobacteria and the neurotoxin are present, they can display loss of muscle control resulting in difficult flying, swimming, and eventual death”²¹⁵

The 2018 biological opinion found that the phosphorous goal for the lake is 40 ppb,²¹⁶ the concentration of total phosphorous in the lake nearly doubled from 49 parts per billion in 1973 to 98 ppb in 1984,²¹⁷ and 118 ppb by 2016 with a five-year previous average of 117 ppb;²¹⁸ and that higher concentrations of phosphorous also promote blooms of cyanobacteria.²¹⁹

FWS concurred with the Corps’ determination that LORS may affect, but is not likely to adversely affect the manatee. The Corps noted that manatees live year round in Lake Okeechobee where there have been 64 manatee deaths from 2000 to 2012.²²⁰ The 2018 biological opinion did not detail manatee deaths in the estuaries that may be linked to lake discharges. It found that submerged aquatic vegetation or seagrasses for foraging, shallow areas for resting and calving, channels for travel and migration, warm-water refuges, and fresh drinking water are essential habitat features,²²¹ and that while no designated manatee critical habitat occurs within the proposed project area (a departure from FWS’ 2007 biological opinion),²²² LORS has the potential to beneficially or adversely affect salinity conditions in the estuaries/rivers and therefore manatee forage.²²³

The SEIS found that LORS would provide “significant improvements to the estuaries in the number of months in the acceptable flow range and that it was equal to or better than the no

²¹⁰ *Id.* at 1.

²¹¹ FWS 2018 at 1 (emphasis added).

²¹² *Id.* at 1, 88.

²¹³ *Id.* at 4; 7 figure 3.

²¹⁴ *Id.* at 24.

²¹⁵ *Id.* at 27.

²¹⁶ *Id.* at 58.

²¹⁷ *Id.* .

²¹⁸ *Id.*..

²¹⁹ *Id.* at 59.

²²⁰ *Id.* at 8.

²²¹ *Id.* at 9.

²²² *Id.*..

²²³ *Id.*..

action alternative in reducing the number of high flow releases from Lake Okeechobee, and would therefore have no effect on the manatee or its habitat.²²⁴

VI. VIOLATIONS OF THE ESA REGARDING NMFS' 2015 CONCURRENCE LETTER

A. NMFS' 2015 Concurrence Letter is Arbitrary and Capricious and Violates the APA and ESA.

NMFS' 2015 concurrence letter is arbitrary and capricious and violates the ESA, 16 U.S.C. § 1536, and the Administrative Procedure Act (APA), 5 U.S.C. § 706, for a number of reasons, including, but not limited to:

1. NMFS failed to consider the entire scope of LORS, including all direct, indirect, and cumulative impacts. For example, NMFS failed to explicitly analyze the impacts of continuing LORS beyond 2010.
2. NMFS failed to articulate a rational connection between the facts found and the choice made for listed species, especially those that were expected to exhibit "avoidance behavior" as a result of LORS. NMFS has not explained why avoidance behaviors would not increase the likelihood of take, or how LORS is not likely to adversely affect any listed species, despite the resulting and acknowledged "avoidance behaviors" of listed species.
3. NMFS entirely failed to consider impacts of the discharges, blue-green algae, and red tide on sea turtles, smalltooth sawfish, Johnson's seagrass, boulder star, elkhorn and staghorn coral and their critical habitat.
4. NMFS failed to consider or address the potential impacts of LORS on the recovery of affected listed species.
5. NMFS completely failed to analyze the effects of climate change on LORS and listed species, including impacts like red tide.

B. The Corps and NMFS Must Reinitiate Consultation

Federal agencies must reinitiate formal consultation "if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion."²²⁵

By all accounts LORS was to commence in 2008 and conclude, or at the very least, be revisited by the Corps in 2010.²²⁶ The extension of LORS past the planned 2010 termination date constitutes a significant project modification that could have significant long-term implications to the survival and recovery of protected species. Accordingly, the Corps must reinitiate

²²⁴ Corps 2008a at 157.

²²⁵ 50 C.F.R. § 402.16(a).

²²⁶ "The Lake Okeechobee Regulation Schedule Study (LORSS) is at the point of selection of an alternative, and that new schedule is expected to be in effect in the years 2007 through 2010." See Letter from U.S. Fish & Wildlife Service to Army Corps, May 16, 2006; "The final SEIS also explains that the recommended plan will be an interim schedule..." Corps 2018, *supra* note 1, at 6; "The schedule is planned to be active for three years (2007-2010)." FWS 2007 at 11.

consultation with NMFS to analyze the potential long-term and permanent impacts the ongoing implementation of LORS is having on federally listed marine and estuarine species.

Federal agencies must reinitiate consultation if “new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered.”²²⁷

Since 2015, there have been two sustained summers (2016 and 2018) of blue-green algae and red tide which have harmed sea turtles, smalltooth sawfish, and elkhorn and staghorn coral. There is mounting science suggesting that Lake Okeechobee discharges are feeding the HABs which are in turn taking listed sea turtles and coral. NMFS and the Corps must reinitiate consultation based on this new information that reveals that LORS may be causing or contributing to HABs which are taking listed species like sea turtles, smalltooth sawfish, and coral.

Federal agencies must reinitiate consultation if “the amount or extent of taking specified in the incidental take statement is exceeded.”²²⁸ NMFS has not produced a biological opinion for LORS, therefore there is no incidental take statement and no authorized take associated with LORS. Therefore, every take of sea turtles, smalltooth sawfish, and coral and their habitat that occurs due to LORS is unauthorized and in excess of the NMFS’ authorized amount of zero take.

C. The Corps’ Reliance on NMFS’ 2015 Concurrence Letter is Arbitrary and Capricious and Violates the APA and ESA.

The Corps has an independent, substantive duty under Section 7 of the ESA to ensure that its actions are not likely to jeopardize listed species or adversely modify their critical habitat.²²⁹ NMFS’ 2015 concurrence letter on LORS violates the ESA and APA and is unlawful; therefore, the Corps’ reliance on NMFS’ concurrence letter to fulfill its Section 7 procedural and substantive violations is also arbitrary, capricious and violates the ESA.²³⁰ Furthermore, without a biological opinion from NMFS and accompanying “incidental take statement” including “reasonable and prudent measures” and “terms and conditions” to minimize impacts and incidental take, the Corps does not have incidental take authorization, and therefore, the Corps’ actions under LORS violate Section 9 of the ESA by causing unauthorized take.²³¹

VII. VIOLATIONS OF THE ESA REGARDING FWS’ 2018 BIOLOGICAL OPINION

Water inflows from Lake Okeechobee have a profound impact on the estuarine and coastal ecosystem. In times of drought, freshwater is deprived and the system becomes more estuarine,

²²⁷ 50 C.F.R. § 402.16(b).

²²⁸ *Id.* § 402.16(a).

²²⁹ 16 U.S.C. § 1536(a)(2).

²³⁰ *Id.*; *Center for Biological Diversity v. Salazar*, 804 F.Supp.2d 987, 1010 (D. Ariz. 2011) (holding an action agency’s reliance on a legally flawed biological opinion is arbitrary and capricious).

²³¹ 16 U.S.C. § 1536(b)(4); 16 U.S.C. § 1538.

in times of high water, the estuaries are blasted with nutrient rich water which may be fueling nearshore red tide.²³²

A. FWS' 2018 Biological Opinion is Arbitrary and Capricious and Violates the APA and ESA.

FWS' 2018 biological opinion is arbitrary and capricious and violates the ESA, 16 U.S.C. § 1536, and the APA, 5 U.S.C. § 706, for a number of reasons, including, but not limited to:

1. FWS failed to consider the entire scope of LORS, including all direct, indirect, and cumulative impacts. For example, because FWS failed to explicitly analyze the impacts of continuing LORS into 2025, it did not capture the entire scope and duration of the agency action.
2. FWS failed to articulate a rational connection between the facts found and the choice made of listed species, especially those that were expected to exhibit “avoidance behavior” as a result of LORS. FWS has not explained why avoidance behaviors exhibited by Florida manatees would not increase the likelihood of take, or how LORS is not likely to adversely affect any listed species, despite the resulting and acknowledged “avoidance behaviors” of listed species.
3. FWS failed to consider or address the potential impacts of LORS on the recovery of affected listed species.
4. FWS failed to consider the effects of climate change, specifically as they relate to precipitation, and contributions to HABS.
5. FWS improperly limited the “action area” for purposes of its ESA analysis to the lake and not the rivers and estuaries that receive the lake’s discharges and therefore failed to analyze impacts to the Florida manatee and its habitat.

B. The Corps and FWS Must Reinitiate Consultation.

Federal agencies must reinitiate consultation if “new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered.”²³³ Likewise, federal agencies must reinitiate consultation if “the amount or extent of taking specified in the incidental take statement is exceeded.”²³⁴

Since July 2018, there have been dozens of Florida manatee deaths directly attributable to red tide. Science suggests that LORS is contributing to the intensity and duration of the HABS, including red tide. FWS has not authorized take of Florida manatees associated with LORS. FWS and the Corps must reinitiate consultation based on this new information that reveals that LORS may be causing or contributing to HABS which are taking listed species like the Florida manatee. Furthermore, every take of Florida manatees and their habitat that occurs due to LORS is unauthorized and in excess of the FWS’ authorized amount of zero take.

²³² Dorado, S. et al. 2015. Towards an Understanding of the Interactions between Freshwater Inflows and Phytoplankton Communities in a Subtropical Estuary in the Gulf of Mexico. PLoS ONE 10(7):e0130931. Doi:10.1371/journal.pone.0130931.

²³³ 50 C.F.R. § 402.16(b).

²³⁴ *Id.* § 402.16(a).

C. The Corps' Reliance on FWS' 2018 Biological Opinion is Arbitrary and Capricious and Violates the APA and ESA.

The Corps has an independent, substantive duty under Section 7 of the ESA to ensure that its actions are not likely to jeopardize listed species or adversely modify their critical habitat.²³⁵ FWS' 2018 biological opinion on LORS violates the ESA and APA and is unlawful; therefore, the Corps' reliance on FWS' 2018 biological opinion to fulfill its Section 7 procedural and substantive violations is also arbitrary, capricious and violates the ESA.²³⁶ Furthermore, without a valid biological opinion from FWS, the Corps does not have incidental take authorization, and therefore, the Corps' actions under LORS violate Section 9 of the ESA by causing unauthorized take.²³⁷

VIII. VIOLATIONS OF THE ESA REGARDING THE AGENCIES' SECTION 7(a)(1) OBLIGATIONS

Given the size and scope of LORS, its persistent impacts to species through the years, and the number of species it impacts, the Corps, FWS, and NMFS have failed in their responsibilities under Section 7(a)(1) of the ESA to “utilize their authorities in furtherance of the purposes of [the Act]” and to “carry[] out programs for the conservation of” listed species.²³⁸ The agencies have failed to ensure that their actions are consistent with the recovery of listed species.²³⁹

Conclusion

State and federal plans to protect the estuaries have been continually delayed and are inadequate. This failure to provide minimal resource requirements for dry season flows and relief to the estuary during high flows violates the ESA.

For the above stated reasons, the Corps, FWS, and NMFS have violated and remain in violation of Sections 7 and 9 the ESA. If these violations are not cured within sixty days, Center for Biological Diversity, Calusa Waterkeeper, and Waterkeeper Alliance intend to file suit for declaratory and injunctive relief, as well as attorney and expert witness fees and costs. This notice letter was prepared based on good faith information and belief after reasonably diligent investigation. If you believe that any of the foregoing is factually erroneous or inaccurate, please notify us promptly.

²³⁵ 16 U.S.C. § 1536(a)(2).

²³⁶ *Id.*; *Center for Biological Diversity v. Salazar*, 804 F.Supp.2d 987, 1010 (D. Ariz. 2011) (holding an action agency's reliance on a legally flawed biological opinion is arbitrary and capricious).

²³⁷ 16 U.S.C. § 1536(b)(4); 16 U.S.C. § 1538.

²³⁸ *Id.* § 1536(a)(1).

²³⁹ *See* 50 C.F.R. § 402.15(a) (explaining that it is each agency's continuing obligation to “determine whether and in what manner to proceed with the action in light of its section 7 obligations” to protect and recover listed species).

Sincerely,

A handwritten signature in black ink, appearing to read 'J Lopez', with a long horizontal stroke extending to the right.

Jaclyn Lopez, Senior Attorney
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727-490-9190
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cc (w/o enclosure):

Colonel Andrew Kelly, Commander and District Engineer
Larry Williams, State Supervisor