No. 142, Original

In the

Supreme Court of the United States

STATE OF FLORIDA,

Plaintiff,

v.

STATE OF GEORGIA,

Defendant.

Before the Special Master

Hon. Ralph I. Lancaster

UPDATED PRE-FILED DIRECT TESTIMONY OF FLORIDA WITNESS THEODORE SCOTT HOEHN

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October 26, 2016

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INTRODUCTION

1. I, Theodore Scott Hoehn, offer the following as my Direct Testimony concerning my personal observations of the Apalachicola River over the last 32 years in connection with my work as a biologist for the State of Florida since 1984.

2. I have spent virtually my entire professional career studying and attempting to protect the Apalachicola River. In that time, I have personally observed the River, tributaries, sloughs, the floodplain, and many of the plant and animal species that call the Apalachicola Basin home. I have spent a career working to preserve the Apalachicola because it is truly one of the most unique, pristine and intact ecosystems in the United States.

3. This testimony will attempt to describe in words the beauty and majesty of the River, its floodplain, and its many associated microhabitats, as well as some of the wildlife that depends on these areas.

4. Over the years, I have concluded based on my personal observations and reading much of the literature that has been written about the River that adequate river flows and floodplain connectivity are essential to maintain the health of the many unique habitats within the Apalachicola and the species that depend on those habitats.

5. After testifying about my education and relevant work experience, I provide sworn testimony on the following topics: geography and topography of the Apalachicola River and its floodplain, biological productivity of the region, and changes to the system I have personally observed during the last thirty years.

BACKGROUND

6. I hold a Master's Degree in Biology with a marine emphasis and a Bachelor's Degree in Biology, both from Florida State University.

7. I am currently employed by the Florida Fish and Wildlife Conservation Commission (FWC) as a senior level biologist. I serve as the point of contact for the agency for issues relating to the Apalachicola River.

8. In 1984, I was hired by the Florida Department of Environmental Regulation (which is now the Florida Department of Environmental Protection (DEP)). Since then, I have served in various roles related to the Apalachicola River, from acting as DEP's primary technical representative for riverine species and environmental issues during the Comprehensive Study to overseeing the Surface Water Improvement Management Program in Northwest Florida, and developing a program to use Geographic Information Services (GIS) information to track and better protect aquatic species and their habitats in the region.

9. Currently, I am responsible for assisting in the development of plans to maintain, restore, and preserve vital habitats in the State's wildlife management areas, including in the Apalachicola Basin. I also work on aquatic habitat restoration and enhancement projects, several of which were implemented in the Apalachicola and Chipola River systems.

I. OVERVIEW OF THE APALACHICOLA RIVER & FLOODPLAIN

10. In describing the Apalachicola, I use certain key terms. The "floodplain" is the area of land near the river that stretches from the banks of the main river channel to nearby areas that are seasonally inundated.

11. A "slough" is simply a natural channel cut through the river levee which allows water to flow through it.

12. The "channel margin" is the outer, shallower part of a river channel leading to the steeper river bank. Channel margins in many areas can be exposed by even small reductions in River flow when flow is already naturally low.

13. A "microhabitat" is a localized, small-scale habitat in which aquatic or terrestrial organisms live. They vary widely, from tree roots, to woody debris in the river or deep pools within sloughs, and many others.

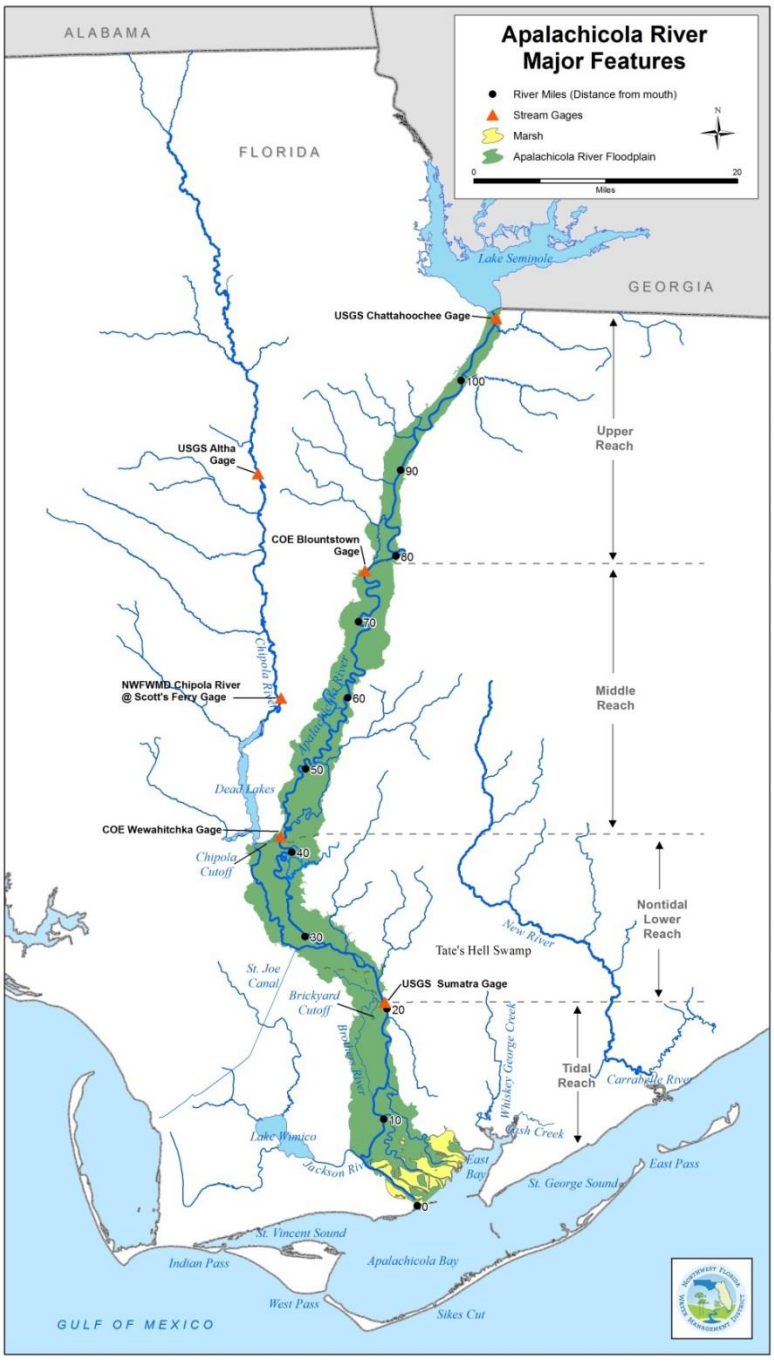
14. The Apalachicola River is Florida's largest river in terms of flow. The mean annual discharge at the Chattahoochee gage at the northern end of the Apalachicola River of 21,500 cubic feet per second (cfs) (1923-2013) with maximum high flows averaging 93,000 cfs. (USGS Historic Gage Data (JX-128)). The River lies in the southern portion of an almost 20,000 square mile interstate river basin running from the Appalachian Mountains in northern Georgia all the way to the Gulf of Mexico.

The Apalachicola River, Iola Landing above Wewahitchka near the Florida River, showing a "hook and bay," photographed on March 29, 2007, by Michael Hill (FWC). I am familiar with the River, and this is an accurate representation of how the River looks in March.

15. The Florida portion of the Basin is about 13 percent of the Basin. (Lee Edmiston 2008, *A River Meets the Bay: A Characterization of the Apalachicola River and Bay System*, JX-29, at 6). The Apalachicola is roughly 106 miles in length, beginning at the confluence of the Chattahoochee and Flint Rivers just north of the Jim Woodruff Lock and Dam. After leaving the Jim Woodruff Dam, the Apalachicola flows unimpeded by any other dams to Apalachicola Bay and the Gulf of Mexico.

16. The Apalachicola River has the largest floodplain in Florida, and it is one of the most intact forested floodplains in the United States, in large part because the State of Florida, the United States, and other entities have purchased thousands of acres of lands for public conservation. With so much land in conservation, it preserves the opportunity for the River to function naturally and sustain an enormously important ecosystem.

17. For purposes of reference, the River is typically divided into four different "reaches" from north to south: the Upper Reach, Middle Reach, Lower Reach, and Tidal Reach. Each of these "reaches" generally align with four river gages, which are constantly measuring water levels. These gages, two maintained by the U.S. Geological Survey (the "USGS") and two by the U.S. Army Corps of Engineers (the "Corps"), are named after four small communities that lie along the River from north to south: Chattahoochee (USGS), Blountstown (USGS), Wewahitchka (Corps), and Sumatra (Corps).



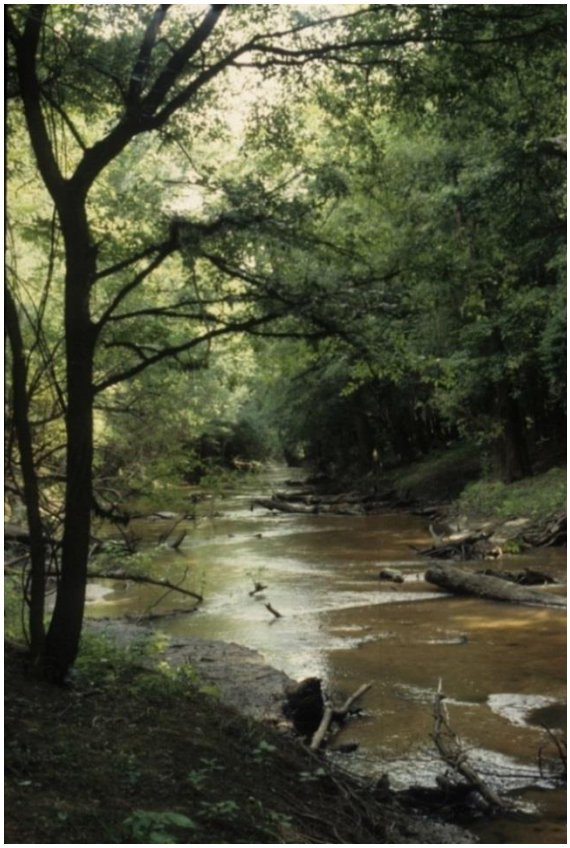
Map of the Apalachicola River and Floodplain, Northwest Florida Water Management District, 2016. Based on my personal familiarity with the River, this map fairly and accurately represents the Apalachicola River and floodplain region.

18. The green shaded area in the map above is the river floodplain. The Apalachicola is not confined solely to the banks of the main channel, as one might imagine, but rather includes the floodplain, which varies from approximately one to five miles across in width depending on the topography, tributaries, backwaters, and the amount of water flowing through the system. Generally, the floodplain is narrow in the upper reaches and begins to broaden as it makes its way toward the Gulf.

19. The Upper Reach, from Chattahoochee to Blountstown, has a narrower floodplain that is one to two miles wide due to the higher banks, bluffs, and natural levees on both sides of the River. Because the River is more "contained" in this area, the water levels can fluctuate greatly, in the tens of feet during the flood stage. All the while in this reach, small tributaries join and merge with the river creating cold water refuges for fish and other species.

20. The Middle Reach, from Blountstown to Wewahitchka, begins to broaden, surrounded by gulf coastal lowlands on both sides of the River as it continues south, and the natural river levees are smaller.

Upper portion of the Apalachicola River, illustrating High Bluffs- Alum Bluff. Available at http://myfwc.com/fishing/freshwater/sites-forecast/nw/apalachicola-river/ I took this photo and am familiar with and have frequently visited Alum Bluff. This picture fairly and accurately represents this area.



Flat Creek, a tributary in the upper reach of river, in 1993. I am familiar with and have frequently visited Flat Creek. This picture fairly and accurately represents this area.

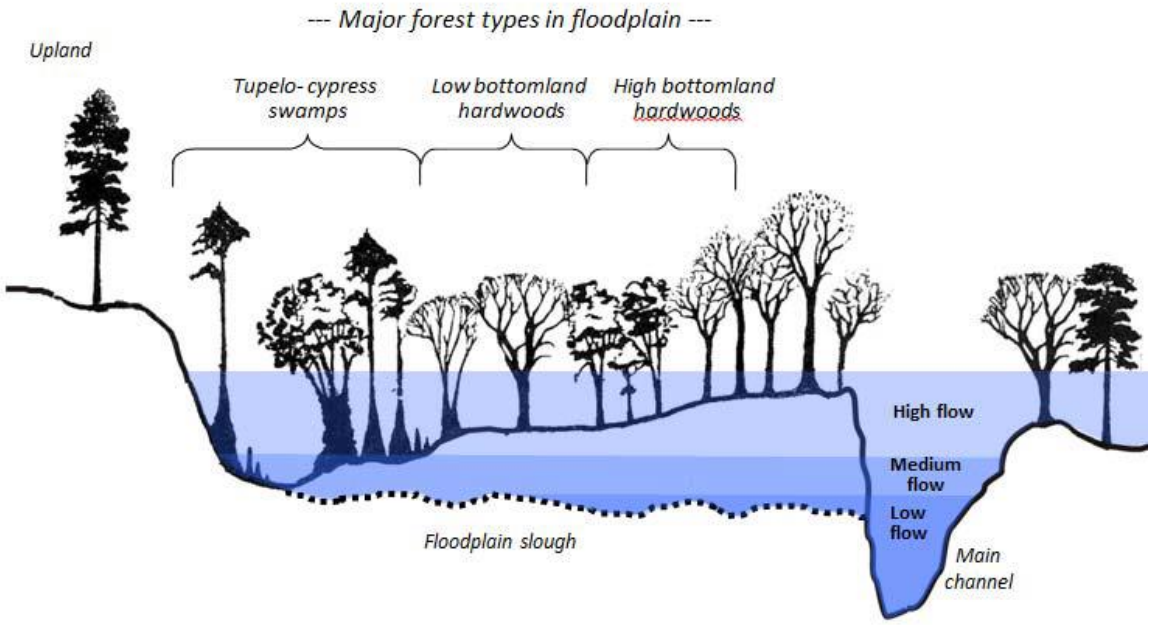
21. As you head south of the Wewahitchka gage, around river mile 41, to Sumatra, you come into the Lower Reach where the floodplain broadens significantly. The River can overflows its banks and surges through the sloughs that are punctuated gaps through the otherwise lower natural river levees. In the Lower Reach, the largest tributary to the Apalachicola, the Chipola River joins near River Mile 28 adding additional flow.

22. Finally, the floodplain in the Tidal Reach is broader still. The upper tidal reach is home to vast Ogeechee Tupelo swamps, which is the source of tupelo honey, prized by many and has supported a commercial industry in the area for over a century. In the lower Tidal Reach, the River broadens out into distributaries that flow into highly productive coastal marshes, until it ultimately melds with the Apalachicola Bay. Marshes, fed by the River, include fresh, brackish and salt marshes. As you reach the lower tidal areas near the mouth of the River, the River's delta fans out and provides shelter for numerous species, including young Gulf Sturgeon who grow and develop in the sheltered lower river creeks and streams before they reach maturity.

Tupelo trees lining the banks of the River near the junction of the upper tidal reach and the lower non-tidal reaches of the River. Available at http://publicfiles.dep.state.fl.us/cama/plans/aquatic/ANERR_Management_Plan_2013.pdf *I am familiar with this area of the River, and this picture fairly and accurately represents a scene on the River.*

Salt marsh in the Apalachicola region. Available at http://publicfiles.dep.state.fl.us/cama/plans/aquatic/ANERR_Management_Plan_2013.pdf *I am familiar with the salt marshes in the Apalachicola region, and this picture fairly and accurately represents a common marsh landscape in the estuary of the River.*

23. Several key habitats predominate along the River: uplands, tupelo-cypress swamps, low bottomland hardwoods, high bottomland hardwoods, sloughs and oxbow lakes. The floodplain contains about 127,000 acres of wetlands, which are almost entirely swampy forests that transition to tidal marshes near the River's mouth. (FWC, *The Impact of Reduced Flows on the Apalachicola River and Bay Ecosystems* (JX-149), at 1). The combination of these habitats and the waters that inundate them is a defining characteristic of the system.



See Figure 3 from Expert Report of J. David Allan (FX-790). Conceptual diagram of floodplain cross section showing major forest types in non-tidal reach of Apalachicola River. Modified from Figure 3 in Light et al. 2006; forest types follow Darst and Light 2008. This is a true and correct copy of Figure 3 from the Expert Report of J. David Allan. This figure illustrates my personal knowledge about the forest types of the River and how the River flows inundate the floodplain.

24. Since much of the middle and lower River flows through flat and low-lying coastal plain, the broad floodplain – filed with riverine lakes and interconnected backwaters – has historically been inundated with water. This connectivity makes the Apalachicola floodplain

a transition zone between upland habitat and aquatic habitat and incredibly productive for many of the plant and animal species that depend on that water for all or part of their lifecycle. Sometimes, the floodplain inundation occurs simply because the River overtops its natural levees or banks during the flood stage, generally winter through early spring. But the River can escape its banks and enter the floodplain through sloughs, even when the river is not at flood stage (such as in the summer).

Example of inundated floodplain forest in Tidal Reach of the River taken on April 25, 2014. Available at http://fdep.maps.arcgis.com/apps/MapTour/index.html?appid=fe16e3385ec04b768d383c61bb78adcb&webmap=7b235908110345bd9c3bb597faf31652#. *I am familiar with the floodplain forest in the tidal reach, and this picture fairly and accurately represents the forest in April in this reach of the River.*

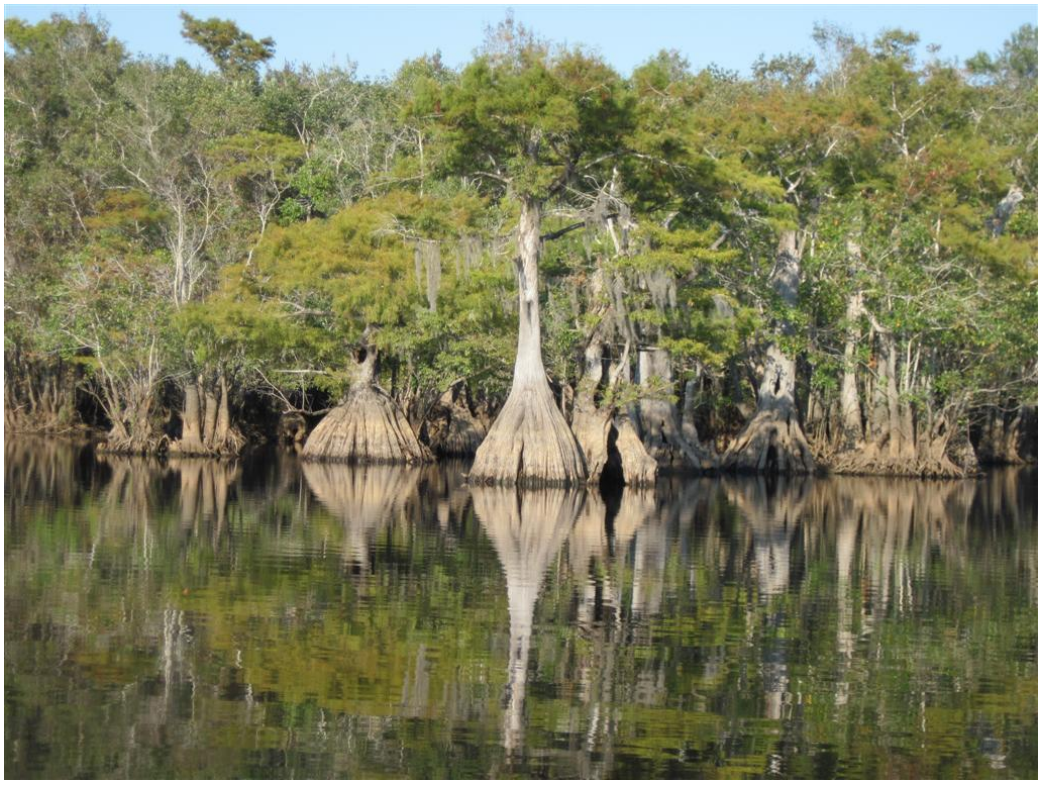
25. Sloughs along the Apalachicola are fed by the River, meander through the floodplain forest swamp, and often return back to the River directly in a loop pattern or through a tributary. There are more than 200 small to medium-sized sloughs in the Apalachicola River basin, each of which requires a different flow-rate in order to maintain connection to the main

stem. Collectively, the sloughs, streams and lakes in the basin are over 400 miles long, which is more than four times as long as the Apalachicola River itself. (FWC 2011, JX-149, at 7).

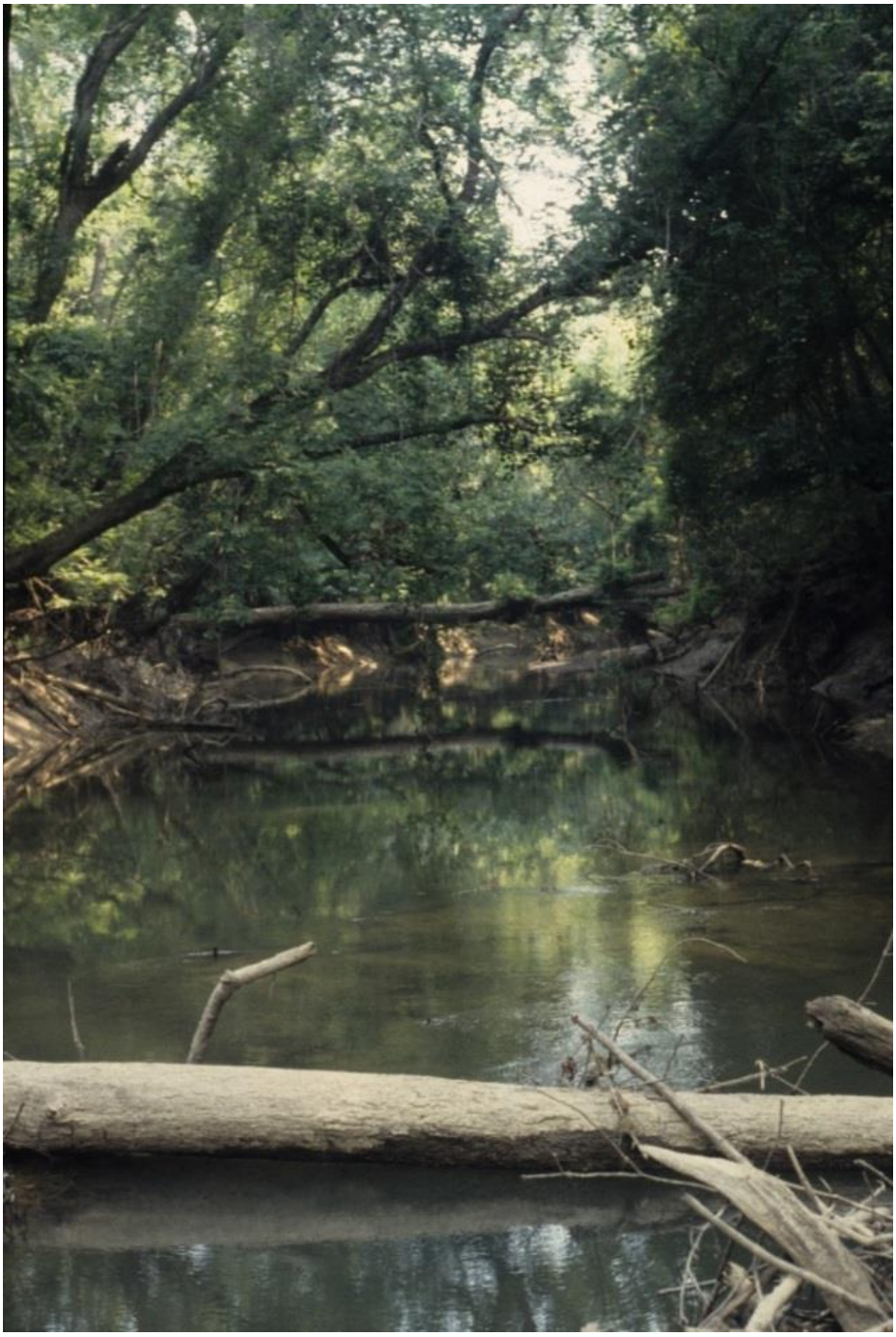
Small slough connecting main river to Brushy Creek lower reach of river, 2001. I am familiar with Brushy Creek, including its appearance in 2001, and this photograph fairly and accurately represented what Brushy Creek looked like at that time.

26. Many of the iconic sloughs of the Apalachicola occur in the Middle and Lower Reaches of the River and upper tidal portion of the River. Bee Tree Slough and Mary Slough connect key large slough or lake habitat like Iamonia Lake, which parallels the main river channel. Others such as Swift Slough, Hog Slough, and Moccasin Slough – in the River Styx area – weave a dynamic web of hydrologic connectivity through the floodplain forest, and provide incredible habitat for a host of species. These sloughs depend upon certain levels of water in the main river channel to maintain these dynamic properties.

Cypress trees bordering floodplain slough (Iamonia Lake) in middle riverine reach of river, 1993. I am familiar with Iamonia Lake, including in 1993, and this picture fairly and accurately represents what the area looked like around that time.

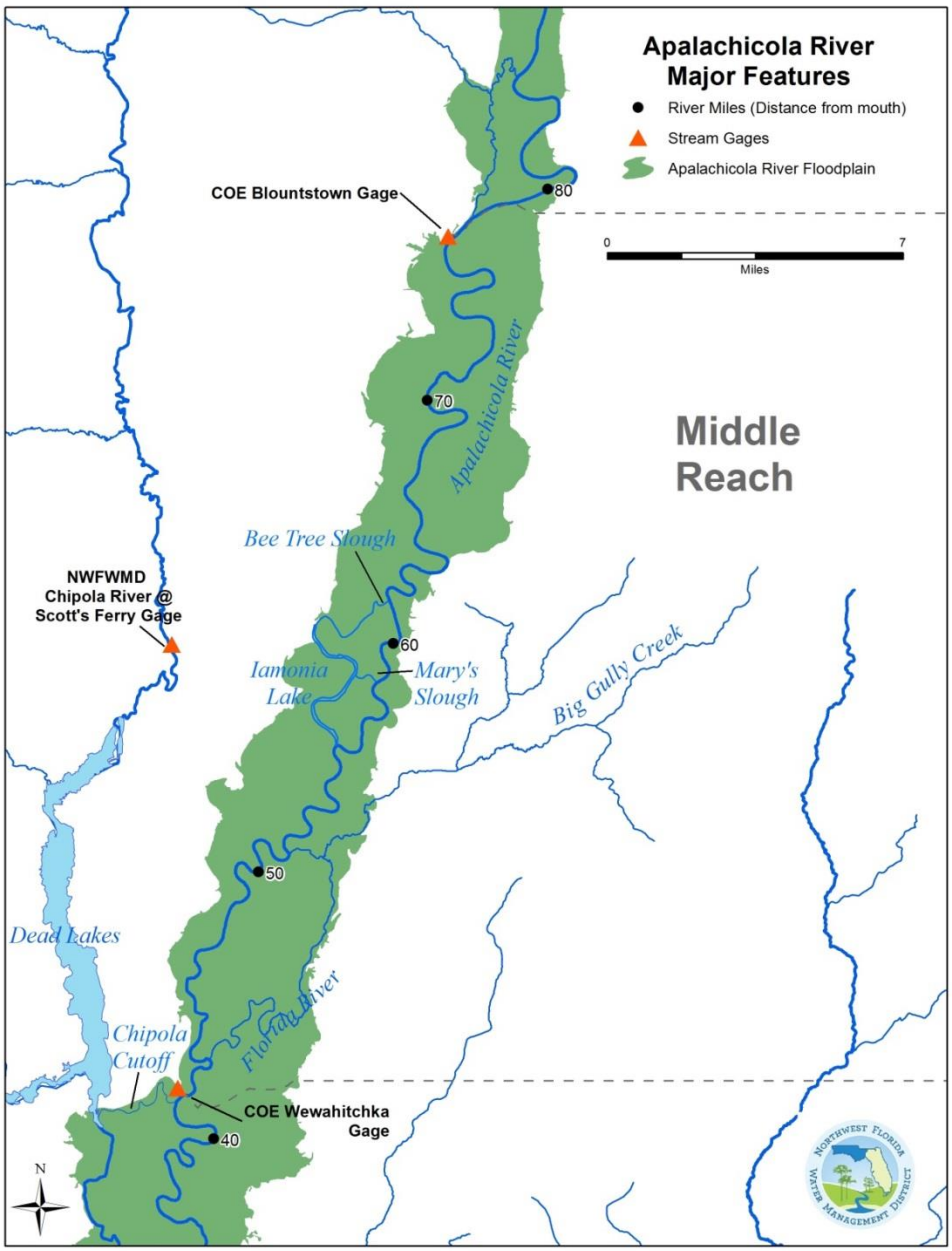


Cypress trees bordering floodplain slough (Owl Creek) in non-tidal lower riverine reach of river, 2010. I am familiar with Owl Creek, and took this photograph in 2010, and this picture fairly and accurately represents what this area looked like at that time.

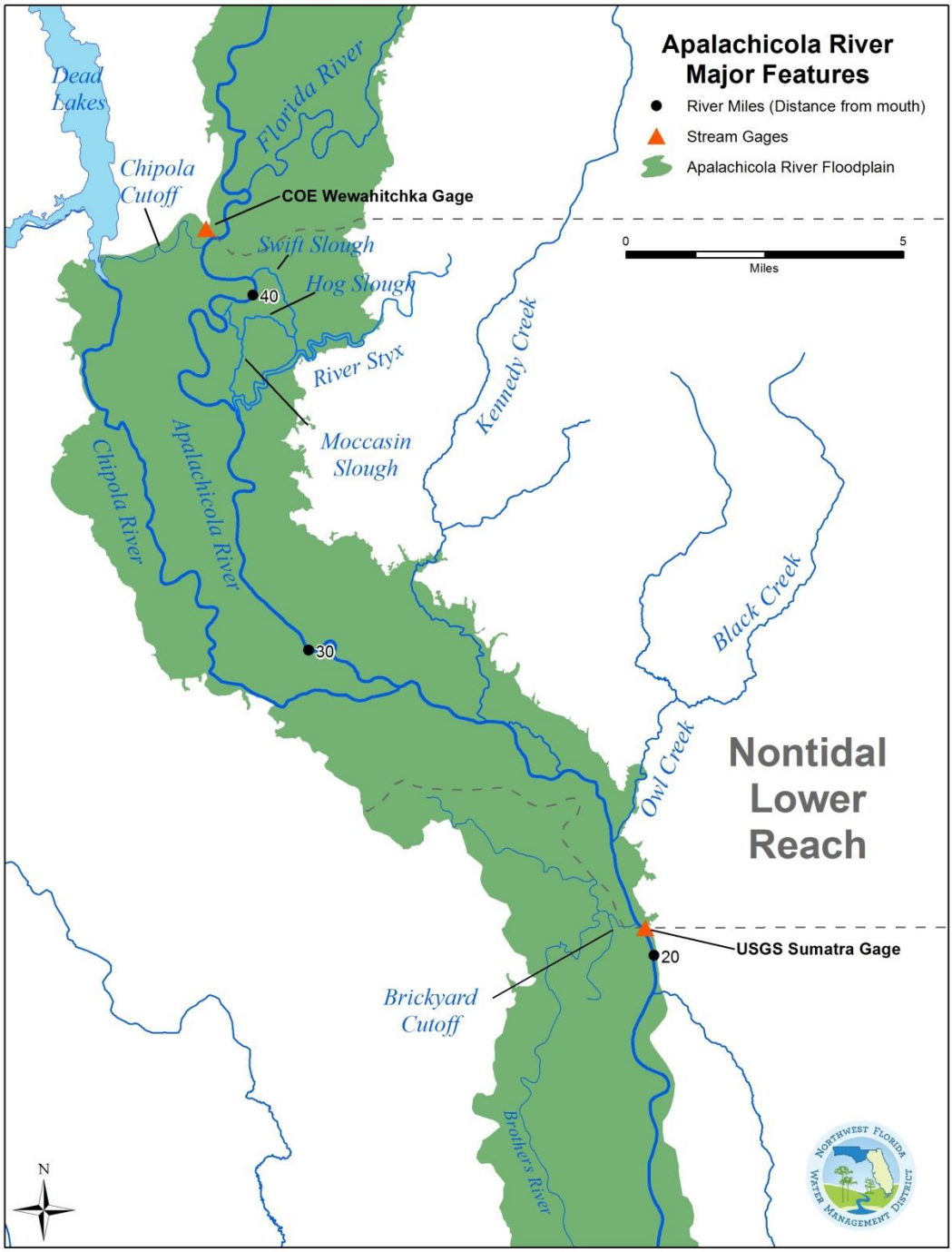


Moccasin Slough in lower riverine reach of river, 1993. I am familiar with Moccasin Slough, including in 1993, and this picture fairly and accurately represents what this slough looked like at that time.

27. Some of the most significant sloughs of the middle and lower reaches of the River are illustrated on the maps below.



Middle Reach of the Apalachicola River and Floodplain, Northwest Florida Water Management District, 2016. Based on my personal familiarity with the Apalachicola River, this is a fair and accurate representation of the middle reach of the Apalachicola River and floodplain.



Lower Reach of the Apalachicola River and Floodplain, Northwest Florida Water Management District, 2016. Based on my personal familiarity with the Apalachicola River, this is a fair and accurate representation of the non-tidal lower reach of the Apalachicola River and floodplain.

II. BIOLOGICAL PRODUCTIVITY OF THE RIVER

29. The hydrologic interconnectivity of the River and floodplain allow the Apalachicola River to host an extraordinary diversity of plants and wildlife. When sufficiently inundated, this tremendous habitat diversity creates an ideal scenario for the many different species that have found a home in the Apalachicola Basin. For instance, the Apalachicola Basin's density of amphibians and reptiles is the highest in North America outside of Mexico. (Edmiston 2008 (JX-29), at 61).

Apalachicola dusky salamander - Pierson Hill (FWC).

Marbled salamander - Pierson Hill (FWC).

Bird-voiced treefrog - Kevin Enge (FWC).

Red-bellied water snake - Pierson Hill (FWC). I have personally seen red-bellied water snakes, and this picture fairly and accurately represents this species.

Barbour's map turtles - Jonathan Mays (FWC). I have personally seen Barbour's map turtles, and this picture fairly and accurately represents this species.

Aligator Snapping Turtle – Jonathan Mays (FWC). I have personally seen alligator snapping turtles, and this picture fairly and accurately represents this species.

30. An immense number of different species inhabit the River and floodplain: 342 plant species (FDEP 2013, Addendum to 2011 FWC Report (JX-87), at 3), including more than 70 tree species (Darst & Light 2008, Drier Forest Composition Associated with Hydrologic Change in the Apalachicola River Floodplain, Florida (GX-364), at 4); 142 freshwater and estuarine fish species (FWC 2011(JC-149), at 7); 282 bird species, including kites, woodpeckers and warblers (Edmiston 2008 (JX-29), at 100-101); 44 amphibian species (Edmiston 2008 (JX-29), at 61); 64 reptile species (Edmiston 2008 (JX-29), at 61); and 52 mammal species, including otters and beavers (Edmiston 2008 (JX-29), at 62).

31. The River, along with its side channels and sloughs, supports a large variety of freshwater mussel species. This collection includes three federally listed mussels (the endangered fat threeridge, threatened purple bankclimber, and threatened Chipola slabshell). The vast majority of freshwater mussels are concentrated in the Southeastern United States,

where freshwater mussel species diversity is the richest. In particular, the Apalachicola River and its sloughs have the highest mussel diversity of any body of freshwater draining into the Atlantic Ocean or into the Gulf of Mexico east of Mobile Bay. There are 26 known freshwater mussel species in the Apalachicola and its main tributary, the Chipola.

32. The River also is home to the threatened Gulf sturgeon, which is also federally listed under the Endangered Species Act. This "ancient" fish evolved from larger ancestors that lived over 225 million years ago, and can live to be over 40 years old and grow to over six feet long. The Gulf sturgeon has bony plates on its head and body and "whiskers" on its long snout, but no internal skeleton. The Gulf sturgeon spawns in freshwater—and almost always in the same river that the fish itself was spawned in—but spends its adult life in saltier water.

University of Florida scientists studying Gulf sturgeon in the Apalachicola River. I have personally seen Gulf sturgeon, and this picture fairly and accurately represents this species.

33. There is a complex network of microhabitats within the River and floodplain. Each microhabitat depends on the right quantity and timing of water to sustain them, as do the species that depend on the microhabitats. Some of those habitats are channel margins, flats along the bank, deep pools, submerged wood, locations of different current speeds, and areas of more or less sun, among many others. Many of the microhabitats exist either along the margins of the main channel, in one of the many sloughs connected to the River, or in the floodplain.

34. Each microhabitat is differentiated from the next by its unique characteristics. At least half of the 142 fish species in the Apalachicola River and Bay, for instance, rely upon the floodplain for habitat for all or a portion of their lives. (FWC 2011 (JX-149), at 7). While some fish prefer relatively deep, swift running channels, others prefer shallower areas with more vegetative structure. Some mussels can tolerate higher water temperatures or lower levels of dissolved oxygen than others. Some trees in the floodplain require some level of inundation or at least saturation during their seedling stage, while others would not survive such conditions. Because of the innumerable microhabitats in the Apalachicola Basin, all of these species are accommodated. The density and diversity of species in the basin is the result.

Example of largemouth bass collected in the River on September 27, 2016. I have personally seen largemouth bass in the River, and I took this picture, which fairly and accurately represents this species.

Cypress roots on river bank in lower reach near River Mile 30 (2001). This is an example of a microhabitat that provides excellent mussel substrate & hideouts and food supply for fish when it is sufficiently inundated. I am familiar with cypress roots like this around this location, and this picture fairly and accurately represents a typical scene in this location.

Example of Yellow sandshell mussel that may live in this microhabitat. I have personally observed mussels such as this yellow sandshell mussel living in microhabitats like tree roots, and this picture fairly and accurately represents the yellow sandshell mussel.

Example of mussel species that may live in the shoreline microhabitat. I have personally observed mussel species in the Apalachicola River, and this picture fairly and accurately represents such mussels.

35. The multiplicity of microhabitats in the Basin and highly varied population of species depend on an intricate food web that is highly sensitive to disturbances in the water flow regime. The food web begins with nutrients, one of the sources of which is litterfall in the floodplain, which over time decays into organic "detritus." As the seasonal flooding inundates the floodplain, fish and filter feeders (such as mussels) derive nourishment from the nutrients contained in this detritus and from organisms like algae that take the nutrients directly. Receding floodwaters carry nutrients into sloughs and the main channel itself where they continue to provide essential nourishment to plants and animals.

36. Furthermore, sloughs throughout the floodplain produce large amounts of algae and provide an additional catchment for litterfall and other organic matter (such as submerged wood). Species that rely on these algae and organic matter sources of nutrients become food for animals further up the food chain, including sport fish, turtles and birds. The disruption of any part of this extremely complex set of interrelationships can cause negative impacts on other strands of the food web.

III. OBSERVED CHANGES TO THE APALACHICOLA RIVER SYSTEM

37. My professional responsibilities require me to frequently visit the Apalachicola River, sometimes multiple times in a single month. Over the last 30 years I have personally observed the increasing frequency and severity of breakdowns in crucially important habitats as a result of decreasing water flows at key points in time, when the habitats are sensitive to even minor alterations in flow. I continue to study the River and believe the productive habitats can recover with adequate river flows occurring at key times.

38. The following are some of my specific observations of how the River and floodplain, and the species that depend on them, have been affected by low water flows. I have included several photographs that were taken on my recent trips to the River in August of this

year, when River flows were low. On August 2nd, 2016, when we were on the River taking photographs, the River flows were approximately 6,500 cfs [1]at Chattahoochee and on August 31st, 2016, flows were approximately 5,500 cfs.

A. *Changes in the Floodplain*

39. Over three decades working on and along the River, I have personally witnessed major changes to the character of the floodplain. Areas that were swamps when I first began, like Sutton's Lake at River Mile 78, are now covered in grasses. This would not have occurred in the past because frequent inundations prevented grasses from taking root. Now, grasses have spread across formerly barren swamplands and prevent swamp tree seedlings from germinating.

40. I have also observed, through the work of my agency, reductions in fish year classes, and reduced health of the surviving fish. Successive year-over-year reductions can do serious harm to fish populations. I understand that connectivity of the River to the floodplain is typically the cause for these changes, particularly lack of connectivity during critical spring spawning months.

41. The reduction in the frequency of floodplain inundations has directly resulted in lower numbers of swamp trees. Swamp tree species common in the Apalachicola include water tupelo, bald cypress and Ogeechee tupelo. Swamp species require saturated or shallowly inundated soils during the growing season to encourage seedlings to rapidly grow. Without sufficient water, seedlings will not grow to a sufficient height to prevent their being overtopped by floodwaters later in the year.

42. The reduced number of swamp trees taking root and seedling survival will have a major impact on tree density in the future. Fewer trees will mean less tree cover, and less tree

[1] It is my understanding that the Corps was conducting releases that day, resulting in a spike in flow in the evening. However, for the majority of the day, flows were much lower.

cover means both more sunlight (which can lead to an overproduction of algae), and less litterfall, an essential input to the Apalachicola food web. Over the long-term, the floodplain drying can also lead to upland tree species moving in and out-competing the swamp tree species.

43. Marginal increases in flows would be sufficient in many areas to keep soils sufficiently saturated to prevent the spread of grasses and to encourage the rapid growth of tree seedlings.

B. *Changes in Sloughs*

44. As I have testified, without a continuous connection to fresh River flows, the sloughs, the lifeblood of the floodplain, turn into puddles and ponds, sometimes drying up altogether in the dryer late summer months when flows are the lowest. When the River drops below the level of the slough's mouth, water stops flowing into the slough, and it becomes "disconnected" from the River. When this happens, the water in the slough becomes stagnant and dissolved oxygen in the water drops to levels that are lethal for many fish and mussels within a matter of days. Prolonged disconnection dries sloughs entirely, killing all aquatic animals trapped in the slough when the River declined. Below are some of the examples of sloughs photographed in August 2016 during a low water period.

Hog Slough in the Lower Reach, near River Mile 40. This is a true and correct copy of a photo of me taken on August 2, 2016, and accurately represents conditions at Hog Slough on that day when river flow was approximately 6,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-812o).

Small Slough in the Lower Reach, near River Mile 40. This is a true and correct copy of a photo of me taken on August 2, 2016, and accurately represents conditions at an unnamed small slough on that day when river flow was approximately 6,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-817h).

45. Under good conditions, many sloughs provide important habitat for mussels because they are more likely to provide stable substrates, exhibit lower levels of shear stress than the main river channel and also typically contain sandy-mud sediments and larger amounts of submerged wood, another preferred microhabitat.

46. However, as is demonstrated through the photos taken of me in August of this year (2016), sloughs present another set of risks for mussels that result directly from inadequate flow levels. Stagnant sloughs typically warm more quickly than sloughs with flowing water. Elevated temperatures are highly stressful and potentially lethal for mussels.

47. Therefore, while sloughs provide significant habitat for mussels, they can quickly become "death traps" when flows drop below the slough mouth and it is disconnected from the River. Mussels trapped in disconnected sloughs suffer from low dissolved oxygen levels, elevated temperatures, desiccation and exposure to predators.

48. Sadly, I have personally witnessed disconnected sloughs with increasing frequency in recent years. I have seen large numbers of dead mussels in relatively large sloughs such as the River Styx; I have also seen it happen in sloughs that require relatively higher flows near 10,000 cfs, such as Mary Slough; and I have even seen it happen in sloughs that remain connected to the river at low flows, such as Swift Slough (connected at approximately 5,700 cfs).

Dead mussels stranded in Swift Slough, July 3, 2006. This is a true and correct copy of a photo taken by me, and accurately represents conditions at Swift Slough on July 3, 2006.

49. Slough disconnections are problematic for many other species in addition to mussels. Sloughs provide important habitat for fish during the spring spawning season and during the juvenile growth season in the hot summer months. Fish are threatened by low dissolved oxygen levels, elevated temperatures, and stranding just as mussels are. Furthermore, the inability to access these areas in the first place greatly reduces the amount of available habitat. This is particularly damaging to "young of the year" fish (fish that are less than one year old), which require large amounts of submerged woody structure both as a source of food and to provide protection from predators. Even a small increase in the amount of water flowing through the system can have a disproportionately large impact on the health of the slough ecosystems. A

variation up or down of a thousand cubic feet per second is sufficient to connect or disconnect a large number of sloughs along the River's length.

Swift Slough in the Lower Reach, near River Mile 40.2. This is a true and correct copy of a photo of me taken on August 2, 2016, and accurately represents conditions at Swift Slough on that day when river flow was approximately 6,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-818h).

An unnamed slough in the Lower Reach, near River Mile 49.8. This is a true and correct copy of a photo taken on August 31, 2016, during a river trip I attended. I was present when the photo was taken, and it accurately represents conditions on that day when the slough was completely disconnected and river flow was approximately 5,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-824q).

Dog Slough in the Lower Reach, near River Mile 50. This is a true and correct copy of a photo of me taken on August 31, 2016, and it accurately represents conditions on that day when the slough was completely disconnected and river flow was approximately 5,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-820o).

50. Slough connectivity is most important during the hottest days of the summer. Even if an increase in flows is only sufficient to intermittently connect a slough to the main stem of the River, this can still mean the difference between life and death for many species, as that intermittent connectivity very quickly elevates levels of dissolved oxygen, lowers temperatures, and provides an opportunity for trapped animals to escape into the main stem.

C. *Changes in Channel Margins*

51. Channel margins along the main stem of the River are a preferred microhabitat for freshwater mussels. Mussels require stable substrate to propagate and find such substrates more often in the channel margins than in the main channel. Furthermore, the current along the channel margins is not as strong as in the main channel resulting in lower levels of shear stress. This is important because even though mussels can survive in parts of the deep channel of the River, they often cannot weather intense flood events that scour the bottom and alter habitat.

Channel margin habitat at Hog Slough in the Lower Reach, near River Mile 40. This is a true and correct copy of a photo taken on August 2, 2016, during a river trip I attended. I was present when this photo was taken, and it accurately represents conditions at Hog Slough on that day when river flow was approximately 6,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-812m).

Channel margin habitat federal listed mussel tagging site in the Lower Reach, near River Mile 46.9. This is a true and correct copy of a photo taken on August 31, 2016, during a river trip I attended. I was present when this photo was taken, and it accurately represents conditions at River Mile 46.8 on that day when river flow was approximately 5,500 cfs as measured at the Chattahoochee gage on the Apalachicola River. (FX-823l).

52. Mussels tend to concentrate in distinct, linear bands along the channel margin. The FWC, working with the U.S. Fish and Wildlife Service, has confirmed the presence of threatened, endangered, and other mussels at the site in the photograph above. In a prior mussel study, in which I participated, there were many federally-listed mussels tagged at this site. As you can see, when I visited the site in August the water was low and the areas on top of the sand bar are dry.

53. When the River level drops below where mussel bands have established themselves, entire populations of mussels can be killed. I have seen this occur more and more frequently in recent years, as river levels have dropped lower for longer periods of time. I have observed long lines of thousands of dead mussels stranded above the waterline, including the

federally threatened and endangered mussels. Considering that mussels populate these long, linear sections of the river edge, even incremental increases in the amount of flow resulting in marginal increases in the water level can be sufficient to save countless numbers of mussels.

D. *Other Habitats*

54. I am also aware that there have been studies performed by researchers suggesting that there are an abundance of mussels, both federally-listed and other varieties, that exist in deep water habitats in the River. When I learned of these studies, I explored the possibility that mussels in deep water habitats represent stable populations that should be added to the FWC's overall understanding of the mussel assemblage in the River.

55. To that end, FWC along with the U.S. Fish and Wildlife Service conducted underwater surveys with divers in August 2016. The surveys indicated that some deep water habitats still harbor good densities of the fat threeridge mussel while other habitats appear to have greatly reduced densities. It is possible that the extreme high flows during winter 2015-2016, which were close to historic record floods, have changed the characteristics of some deep water habitats. These high flows may have been directly or indirectly responsible for reduction of mussel densities. The habitat changes are apparent enough that locations of former stable habitat and densities of mussels are being re-evaluated to determine if habitats have been shifted or possibly eliminated. We are currently conducting additional mussel surveys and will provide that data to the U.S. Fish and Wildlife Service.

56. In my view, shallow water mussel communities are the most stable habitat and serve as the source population for deep water habitats. If deep water habitats prove more unstable than previously thought, as I suspect, I believe that even more emphasis should be assigned to shallow water mussel communities in channel margins and sloughs.

E. *Other Impacts to the Apalachicola River*

57. The purpose of my testimony has been to highlight the unique ecological importance of the Apalachicola River and its floodplain, and the impacts that I have seen over the years due to low river flows. However, I want to mention briefly that the Apalachicola River and floodplain – and the species that inhabit it – have experienced some impacts caused by a history of navigational improvements to the River made by the Corps. Over the course of my career, I have become familiar with the navigation and maintenance plan that the Corps implemented, and I was one of the state agency employees in Florida responsible for reviewing proposed actions by the Corps.

58. Since I began my service to the State in in 1984, and indeed prior to that, Florida has consistently opposed environmentally detrimental activities that adversely impacted the habitats along the River. Florida recognized long ago that the Apalachicola was a federally-authorized navigational project that was intended to facilitate commerce to the upstream interests and give them access to shipping in the Gulf of Mexico. Even Georgia acknowledged as recently as the ACF Compact negotiations that navigation along the Apalachicola-Chattahoochee-Flint River system generated the most economic value in Georgia. (Primary Statements of ACF River Basin Commission Meeting, March 18, 2002 (FX-199), at 11). Among the navigational activities that had the greatest impact on the River were the construction of Jim Woodruff Dam at the head of the Apalachicola in the 1950s, the dredging of a 100-foot-wide by 9-foot-deep channel in the River, the practice of cutting off river meander bends to straighten the River, and the pumping of dredge spoil into the floodplain, sometimes blocking sloughs.

59. While these navigational improvements affected certain reaches of the River, they did not affect all of it. Florida was also regularly submitting comments and conditions to

the Corps, in many instances forcing the Corps to use methods with the least impacts. Florida also required the Corps to implement restoration activities to mitigate impacts that did occur.

60. Because Florida used federal and state law processes effectively it was able to stop dredging on the River, with the last major dredge occurring in 1999, and a final, minor dredge occuring in 2001. In 2005, the Florida Department of Environmental Protection permanently denied the Corps a state permit to dredge, which has effectively stopped any recurrence of dredging on the River. (FDEP Consolidated Notice of Denial 2005 (FX-404)).

61. In the 17 years since dredging ceased, the River has been in recovery. I personally have participated in several restoration projects to aid that recovery. Now evidence is showing the natural riverine process is starting to take over, leading River banks to stabilize, the width of the River to narrow, and causing the return of dredged sand that was previously deposited on point bars and other within banks locations in the River. Florida's actions in stopping the federal navigation project have not erased all the impacts caused by those actions, but it has put the River in the best position possible to recover impacted areas naturally. I liken the River's situation to a hospital patient with a broken arm and suffering from a systemic disease. By stopping the dredging, Florida is treating the fractures; however, unless the disease of artificially induced low flows is addressed, the River will never return to full health.

SUMMARY AND CONCLUSION

62. In my testimony, I referenced several documents related to the river and photographs of certain locations on the river. I have reviewed all of the referenced documents as part of my duties with the FWC and with respect to the photographs, I either took the photo, was present for the taking of the photo, or am familiar with the subject depicted in the photo. Below I further describe the documents and photographs I discuss and my familiarity with them. I also

describe a number of other documents and videos that have been produced by the state of Florida in relation to this lawsuit and describe my familiarity with them.

63. Over the last 30 years, I have had more experience on the Apalachicola River than anyone currently in Florida government. While Florida has expended tremendous resources and effort to preserve, protect, and restore the River, I have observed the gradual degradation of key river and floodplain features due to lack of adequate fresh water flows, particularly in summers during dry years. I have personally seen harmful low water flows causing a lack of connectivity to the floodplain, more frequently and for a longer duration, as time has gone on.

64. After more than thirty years supporting the numerous negotiation efforts and litigation between Florida and Georgia, I have come to believe that this lawsuit is our last chance to protect these precious resources. Through proper management and conservation, I believe they can and must be protected.

ATTACHMENT 1 – DOCUMENTS REFERENCED IN THIS TESTIMONY

- JX-128: USGS Historic Gage Data. This data is compiled, maintained and made publicly available by the United States Geological Survey. The figures provided are derived from the USGS data. I am familiar with and have reviewed and relied upon data from this gage as part of my duties with the FWC.
- JX-29: Lee Edmiston, 2008, A River Meets the Bay: A Characterization of the Apalachicola River and Bay System. This is a true and accurate copy of a book written by Lee Edmiston about the Apalachicola River and Bay ecosystems. I am familiar with and reviewed and relied on this book as part of my duties with the FWC.
- JX-87: FDEP, Addendum to the February 2011 Fish and Wildlife Coordination Act Report Entitled: "The Impact of Reduced Flows on the Apalachicola River and Bay Ecosystem." (2013). This is a true and accurate copy of the FDEP's Addendum to the 2011 Report. I am familiar with and reviewed and relied on this document as part of my duties with the FWC. This document is part of the official records of Florida. It was made as part of FWC's regular practice and was maintained in the course of its regularly conducted business.
- JX-149: FWC, The Impact of Reduced Flows on the Apalachicola River and Bay Ecosystems. This is a true and accurate copy of the FWC's comments to the USFWS and USACE regarding the ACF Master Water Control Manual Update submitted on February 22, 2011. I assisted in the creation of this document as part of my duties with the FWC. This document is part of the official records of

Florida. It was made as part of FWC's regular practice and was maintained in the course of its regularly conducted business.

- FX-199: Primary Statements of the ACF River Basin Commission Meeting, March 18, 2002. This is a true and accurate copy of the transcript of statements made by the state's representatives during the ACF Compact meeting on March 18, 2002. I am familiar with and reviewed and relied on this transcript as part of my duty to assist the state of Florida during the Compact negotiations, This document is part of the official records of Florida. It was made as part of the State's regular practice and was maintained in the course of its regularly conducted business.
- FX-404: FDEP, Consolidated Notice of Denial of Wetland Resource Permit And Authorization to Use Sovereign Submerged Lands, Apalachicola River Maintenance Dredging, Applicant Curtis M. Flakes, U.S. Army Corps of Engineers, Mobile, Alabama. (2005). This is a true and accurate copy of the FDEP's Notice of Denial issued in response to the Corp's application for a permit to dredge the river. I am familiar with and reviewed and relied on this document as part of my duties with the FWC. This document is part of the official records of Florida. It was made as part of FWC's regular practice and was maintained in the course of its regularly conducted business.
- FX-812m: Photograph of Hog Slough taken on August 2, 2016. This is a true and accurate copy of a photograph of the slough taken on August 2, 2016, during a river trip which I attended as part of my duties with the FWC. I was present

when the photograph was taken, and it accurately represents conditions at the slough on that day.

- FX-812o: Photograph of Hog Slough taken on August 2, 2016. This is a true and accurate copy of a photograph of the slough taken on August 2, 2016, during a river trip which I attended as part of my duties with the FWC. I was present when the photograph was taken, and it accurately represents conditions at the slough on that day.
- FX-817h: Photograph of Small Slough taken on August 2, 2016. This is a true and accurate copy of a photograph of the slough taken on August 2, 2016, during a river trip which I attended as part of my duties with the FWC. I was present when the photograph was taken, and itaccurately represents conditions at the slough on that day.
- FX-818h: Photograph of Swift Slough taken on August 2, 2016. This is a true and accurate copy of a photograph of the slough taken on August 2, 2016, during a river trip which I attended as part of my duties with the FWC. I was present when the photograph was taken, and it accurately represents conditions at the slough on that day.
- FX-820o: Photograph of Dog Slough taken on August 31, 2016. This is a true and accurate copy of a photograph of the slough taken on August 31, 2016, during a river trip which I attended as part of my duties with the FWC. I was present when the photograph was taken, and it accurately represents conditions at the slough on that day.

- FX-823l: Photograph of federal mussel tagging site after Unnamed Slough taken on August 31, 2016. This is a true and accurate copy of a photograph of the mussel tagging site taken on August 31, 2016, during a river trip which I attended as part of my duties with the FWC. I was present when the photograph was taken, and itaccurately represents conditions at the slough on that day.
- FX-824q: Photograph of Unnamed Slough after Dog Slough taken on August 31, 2016. This is a true and accurate copy of a photograph of the slough taken on August 31, 2016, during a river trip which I attended as part of my duties with the FWC. I was present when the photograph was taken, and it accurately represents conditions at the slough on that day.
- FX-870: Darst, M.R., and H.M. Light. Drier Forest Composition Associated with Hydrologic Change in the Apalachicola River Floodplain, Florida. This is a true and accurate copy of a report generated by Darst and Light. I am familiar with and have reviewed and relied on the report as part of my duties with the FWC.
- Photograph of Dead Mussels at Swift Slough taken on July 3, 2006. This is a true and accurate copy of a photograph of mussels in Swift Slough taken on July 3, 2006. I took this photograph as part of my duties with the FWC. The photograph accurately represents conditions at the slough on that day.

ATTACHMENT 2 – DOCUMENTS PRODUCED BY THE STATE OF FLORIDA WITH WHICH I AM FAMILIAR

- FX-405: Hoehn, T. and S. Leitman. History of Navigation Improvements on the Apalachicola River. I created FX-405 in collaboration with Steve Leitman as part of my duties for the FWC. The information presented in FX 405 is derived from the following: United States Army Corps of Engineers Annual Maintenance Reports; Annual Reports to Congress by the United States Army Corps of Engineers; and the United States Army Corps of Engineers Navigation Maintenance Plan. The information provided by FX 405 fairly and accurately represents the information contained within the documents referenced above.
- FX-577a: I recognize the scene depicted in this image. The image depicts the Apalachicola River at River Mile 14.7. This picture was taken on March 29, 2007, at 11:38 a.m. by Michael Hill, an FWC employee, as part of the Battle Bend restoration project. I was an FWC employee at the time and was involved in the Battle Bend restoration project. Based on my extensive personal knowledge of the river and involvement with the Battle Bend restoration project, the image fairly and accurately represents the condition of the river at Bloddy Bluff Landing at 11:38 a.m. on March 29, 2007.
- FX-577b: I recognize the scene that is depicted in this image. The image depicts the Apalachicola River at River Mile 21.3. This picture was taken on March 29, 2007, at 11:43 a.m. by Michael Hill, an FWC employee, as part of the Battle Bend restoration project. I was an FWC employee at the time and was involved in the Battle Bend restoration project. Based on my extensive personal knowledge of the river and involvement with the Battle Bend restoration project, the image

fairly and accurately represents the condition of the river at Brickyard Island at 11:43 a.m. on March 29, 2007.

- FX-577c: I recognize the scene that is depicted in this image. The image depicts the Apalachicola River at River Mile 71.3. This picture was taken on March 29, 2007, at 12:19 p.m. by Michael Hill, an FWC employee, as part of the Battle Bend restoration project. I was an FWC employee at the time and was involved in the Battle Bend restoration project. Based on my extensive personal knowledge of the river and involvement with the Battle Bend restoration project, the image fairly and accurately represents the condition of the river at Poloway Cutoff at 12:19 p.m. on March 29, 2007.
- FX-577e: I recognize the scene that is depicted in the image. The image depicts the Apalachicola River at River Mile 49.7 and Brown's Lake on September 22, 2014. This picture was taken at approximately 11:44 a.m. I took this image. The image fairly and accurately represents the scene at Apalachicola River at River Mile 49.7 and Brown's Lake on September 22, 2014 at 11:44 a.m.
- FX-577f: I recognize the scene that is depicted in this image. The image depicts the Apalachicola River at River Mile 36.2 on May 10, 2012. This picture was taken at approximately 2:42 p.m. I took this image. The image fairly and accurately represents the scene at Corley Slough Reach on May 10, 2012 at 2:42 p.m.
- FX-577g: I recognize the scene that is depicted in this image. The image depicts Mary Slough on May 2, 2007. This picture was taken at approximately 3:25 p.m.

I took this image. The image fairly and accurately represents the scene at Mary Slough on May 2, 2007 at 3:25 p.m.

- FX-577h: I recognize the scene that is depicted in this image. The image depicts the Apalachicola River at River Mile 105.7 on May 20, 2005. This picture was taken in the morning. I was present when this image was taken. The image fairly and accurately represents the scene at Race Shoals on May 20, 2005 in the morning.
- FX-577i: I recognize the scene that is depicted in the image. The image depicts the Apalachicola River near Point Poloway on March 22, 2002. This picture was taken at approximately 3:30 p.m. I was present when these images were taken. The image fairly and accurately represents the scene at Point Poloway on March 22, 2002 at 3:30 p.m.
- FX-577j: I recognize the scene that is depicted in the image. The image depicts the Apalachicola River at River Mile 84.1 on May 9, 2012. This picture was taken at approximately 12:27 p.m. I took this image. The image fairly and accurately represents the scene at Alum Bluff on 12:27 p.m. on May 9, 2012.
- FX-577k: I recognize the scene that is depicted in the image. The image depicts the Apalachicola River at River Mile 42.8 on May 10, 2012. This picture was taken at approximately 12:22 p.m. I took this image. The image fairly and accurately represents the scene at River Mile 42.8 on May 10, 2012 at 12:22 p.m.
- FX-577l: I recognize the scene that is depicted in the image. The image depicts Swift Slough on May 10, 2012. This picture was taken at approximately 1:47

p.m. I took this image. The image fairly and accurately represents the scene at Swift Slough on May 10, 2012 at 1:47 p.m.

- FX-577m: I recognize the scene that is depicted in the image. The image depicts the Dead Lakes on the Chipola River above the Chipola Cut-off near River Mile 41.6 on May 10, 2012. This picture was taken at approximately 4:28 p.m. I took this image. The image fairly and accurately represents the scene at Dead Lakes on the Chipola River above the Chipola Cut-off near River Mile 41.6 on May 10, 2012 at 4:28 p.m.
- FX-577n: I recognize the scene that is depicted in the image. The image depicts Swift Slough on July 25, 2007. This picture was taken at approximately 2:41 p.m. I took this image. The image fairly and accurately represents the scene at Swift Slough on July 25, 2007 at 2:41 p.m.
- FX-577o: I recognize the scene that is depicted in the image. The image depicts dead mussels on a side channel at River Mile 44.3 on July 3, 2006. This picture was taken at approximately 11:50 a.m. I took this image. The image fairly and accurately represents the scene at River Mile 44.3 on July 3, 2006 at 11:50 a.m.
- FX-812a-l: I recognize the scene that is depicted in these videos. The videos depict Hog Slough on August 2, 2016. The videos were taken at approximately 10:30 a.m. I was present at Hog Slough on August 2, 2016 at approximately 10:30 a.m. when these videos were taken. The videos fairly and accurately represent the scene at Hog Slough at 10:30 a.m. on August 2, 2016.
- FX-812m-o: I recognize the scene that is depicted in these images. The images depict Hog Slough on August 2, 2016. The pictures were taken at approximately

10:45 a.m. I was present at Hog Slough on August 2, 2016 at approximately 10:45 a.m. when these images were taken. The images fairly and accurately represent the scene at Hog Slough at 10:45 a.m. on August 2, 2016.

- FX-813a-b: I recognize the scene that is depicted in these videos. The videos depict the Apalachicola River after Hog Slough and before Old Moccasin Head Slough on August 2, 2016. The videos were taken at approximately 11:00 a.m. I was present at Apalachicola River after Hog Slough and before Old Moccasin Head Slough on August 2, 2016 at 11:00 a.m. when these videos were taken. The videos fairly and accurately represent the scene on the Apalachicola River between Hog Slough and Old Moccasin Head Slough at 11:00 a.m. on August 2, 2016.
- FX-814: I recognize the scene that is depicted in the video. The video depicts the Apalachicola River at Wewahitchka before Swift Slough on August 2, 2016. This video was taken at approximately 10:10 a.m. I was present at August 2, 2016 at 10:10 a.m. when this video was taken. The video fairly and accurately represents the scene at Wewahitchka before Swift Slough at 10:10 a.m. on August 2, 2016.
- FX-815: I recognize the scene that is depicted in the video. The video depicts Moccasin Slough at the mouth of the River Styx on August 2, 2016. This video was taken at approximately 1:00 p.m. I was present at Moccasin Slough at the mouth of the River Styx on August 2, 2016 at approximately 1:00 p.m. when this video was taken. The video fairly and accurately represents the scene at Moccasin Slough at the mouth of the River Styx at 1:00 p.m. on August 2, 2016.

- FX-816a-e: I recognize the scene that is depicted in these videos. The videos depict New Moccasin Head Slough on August 2, 2016. The videos were taken at approximately 12:20 p.m. I was present at New Moccasin Head Slough on August 2, 2016 at 12:20 p.m. when these videos were taken. The videos fairly and accurately represent New Moccasin Head Slough at 12:20 p.m. on August 2, 2016.
- FX-817a-d: I recognize the scene that is depicted in these videos. The videos depict Small Slough between Swift Slough and Hog Slough on August 2, 2016. These videos were taken at approximately 10:30 a.m. I was present when these videos were taken. The videos fairly and accurately represent the scene at Small Slough between Swift Slough and Hog Slough at 10:30 a.m. on August 2, 2016.
- FX-817e-h: I recognize the scene that is depicted in these images. The images depict Small Slough between Swift Slough and Hog Slough on August 2, 2016. The images were taken at approximately 10:32 a.m. I was present when these images were taken. The images fairly and accurately represent the scene at Small Slough between Swift Slough and Hog Slough at 10:32 a.m. on August 2, 2016.
- FX-818a-f: I recognize the scene that is depicted in these videos. The videos depict Swift Slough on August 2, 2016. The videos were taken at approximately 10:15 a.m. I was present when these videos were taken. The videos fairly and accurately represent the scene at Swift Slough at 10:15 a.m. on August 2, 2016.
- FX-818g-i: I recognize the scene that is depicted in these images. The images depict Swift Slough on August 2, 2016. The images were taken at approximately

10:15 a.m. I was present when these images were taken. The images fairly and accurately represent the scene at Swift Slough at 10:15 a.m. on August 2, 2016.

- FX-819a-c: I recognize the scene that is depicted in these videos. The videos depict Douglas Slough feeder sloughs on August 2, 2016. The videos were taken at approximately 1:30 p.m. I was present when these videos were taken. The videos fairly and accurately represent the scene at Douglas Slough feeder sloughs at 1:30 p.m. on August 2, 2016.
- FX-820a-j: I recognize the scene that is depicted in these videos. The videos depict Dog Slough on August 31, 2016. The videos were taken at approximately 11:00 a.m. I was present when these videos were taken. The videos fairly and accurately represent the scene at Dog Slough at 11:00 a.m. on August 31, 2016.
- FX-820k-o: I recognize the scene that is depicted in these images. The images depict Dog Slough on August 31, 2016. The images were taken at approximately 11:00 a.m. I was present when these images were taken. The images fairly and accurately represent the scene at Dog Slough at 11:00 a.m. on August 31, 2016.
- FX-821a: I recognize the scene that is depicted in the video. The video depicts the Florida River on August 31, 2016. This video was taken at approximately 1:40 p.m. I was present when this video was taken. The video fairly and accurately represents the scene at the Florida River at 1:40 p.m. on August 31, 2016.
- FX-821b: I recognize the scene that is depicted in the video. The video depicts the Florida River on August 31, 2016. This video was taken at approximately 1:45 p.m. I was present when this video was taken. The video fairly and

accurately represents the scene at the Florida River at 1:45 p.m. on August 31, 2016.

- FX-821c-g: I recognize the scene that is depicted in these images. The images depict the Florida River on August 31, 2016. The images were taken at approximately 1:45 p.m. I was present when these images were taken. The images fairly and accurately represent the scene at the Florida River at 1:45 p.m. on August 31, 2016.
- FX-822: I recognize the scene that is depicted in the video. The video depicts a hook and bay in the Apalachicola River at River Mile 46 on August 31, 2016. This video was taken at approximately 1:00 p.m. I was present when this video was taken. The video fairly and accurately represents the scene at River Mile 46 at 1:00 p.m. on August 31, 2016.
- FX-823a-f: I recognize the scene that is depicted in these videos. The videos depict the Apalachicola River approaching the mussel tagging site after Unnamed Slough and at the tagging site at River Mile 46.9 on August 31, 2016. The videos were taken at approximately 12:00 p.m. I was present when the videos were taken. The videos fairly and accurately represent the scene at the Apalachicola River approaching the mussel tagging site after Unnamed Slough and at the tagging site at River Mile 46.9 at 12:00 p.m. on August 31, 2016.
- FX-823g-s: I recognize the scene that is depicted in these images. The images depict the Apalachicola River approaching the mussel tagging site after Unnamed Slough and at the tagging site at River Mile 46.9 on August 31, 2016. The images were taken at approximately 12:00 p.m. I was present when these images were

taken. The images fairly and accurately represent the scene at the Apalachicola River approaching the mussel tagging site after Unnamed Slough and at the tagging site at River Mile 46.9 at 12:00 p.m. on August 31, 2016.

- FX-824a-j: I recognize the scene that is depicted in these videos. The videos depict the Unnamed Slough after Dog Slough on August 31, 2016. The videos were taken at approximately 11:30 a.m. I was present when these videos were taken. The videos fairly and accurately represent the scene at Unnamed Slough after Dog Slough at 11:30 a.m. on August 31, 2016.
- FX-824m-v: I recognize the scene that is depicted in these images. The images depict the Unnamed Slough after Dog Slough on August 31, 2016. These images were taken at approximately 11:30 a.m. I was present when these images were taken. The images fairly and accurately represent the scene at Unnamed Slough after Dog Slough at 11:30 a.m. on August 31, 2016.
- FX-825: I recognize the scene that is depicted in this image. The image depicts the Apalachicola River at River Mile 46 on August 31, 2016. This image was taken at approximately 1:00 p.m. I was present when this image was taken. The image fairly and accurately represents the scene at River Mile 46 at 1:00 p.m. on August 31, 2016.
- Allan Expert Report, Photo 6A: I recognize the scene depicted in Photo 6A of the Allan Report. This image depicts the Apalachicola River at River Mile 57.8. The image was taken on August 21, 2015. Based on my extensive personal knowledge of the river and the activities of FWC staff that day, the image fairly and accurately represents the scene at River Mile 57.8 on that day.

- Allan Expert Report, Photo 6B: I recognize the scene depicted in Photo 6B of the Allan Report. This image depicts mussels collected at the site depicted in Photo 6A along the Apalachicola River at River Mile 57.8. The image was taken on August 21, 2015. Based on my extensive personal knowledge of the river and the activities of FWC staff that day, the image fairly and accurately represents the scene at River Mile 57.8 on that day.
- Allan Expert Report, Photo 6E: I recognize the scene depicted in Photo 6E of the Allan Report. This image depicts Swift Slough at 2:51 p.m. I took the image on July 12, 2006. The image fairly and accurately represents the scene at Swift Slough at 2:51 p.m. on July 12, 2006.
- Allan Expert Report, Photo 6F: I recognize the scene depicted in Photo 6F of the Allan Report. This image depicts Swift Slough at 12:10 p.m. I took the image on July 19, 2006. The image fairly and accurately represents the scene at Swift Slough at 12:10 p.m. on July 19, 2006.
- Allan Expert Report, Figure 7: I recognize the photos depicted in Figure 7 of the Allan Report. This figure depicts freshwater mussels that are federally listed or petitioned for listing that have been found in habitats vulnerable to low flows. I directed FWC staff to take the photos for my use in performing my duties at the FWC. The image fairly and accurately represents the mussels.
- Allan Expert Report, Figure 17: I recognize the photos depicted in Figure 17 of the Allan Report. This figure depicts Iamonia Lake, Florida River and Moccasin Slough. The photos were taken by Helen Light. Based on my extensive personal

knowledge of these areas, the images fairly and accurately represent the locations depicted in the images.