UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
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St. Petersburg, Florida 33701-5505
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F/SER31: JAC

Chief, Fort Myers Permits Section
Jacksonville District Corps of Engineers
Department of the Army
1520 Royal Palm Square Boulevard, Suite 310
Fort Myers, Florida 33919

DEC 01 2017

Dear Sir or Madam:

Enclosed is the National Marine Fisheries Service's (NMFS) Biological Opinion (Opinion) on the U.S. Army Corps of Engineers, Jacksonville District's (USACE) proposed actions to issue permits to the applicants in the following table.

	Project Name	NMFS Number	USACE Number	County
1	Advaniara Trust, LLC Seawall 1 (2939 SW 28th Lane)	SER-2016-18237	SAJ-2016-223 (NW-SJF)	Lee
2	Advaniara Trust, LLC Seawall 2 (2712 SW 29th Court)	SER-2016-18238	SAJ-2016-221(NW-SJF)	Lee
3	Manfred Waldinger Seawall (2929 SW 27th Street)	SER-2016-18258	SAJ-2016-02340 (NW-EMC)	Lee

In order to expedite review of these projects, we are responding to your consultation request in a batched format. We have batched these projects based on the location, type of project, construction methods, and species. This Opinion analyzes the projects effects on green sea turtles (North and South Atlantic distinct population segments [DPSs]), Kemp's ridley sea turtles, loggerhead sea turtles (Northwest Atlantic Ocean DPS), smalltooth sawfish (U.S. DPS), and smalltooth sawfish critical habitat, in accordance with Section 7 of the Endangered Species Act (ESA). This analysis is based on project-specific information provided by USACE, consultants, and NMFS's review of published literature. We conclude that these actions are likely to affect, but are not likely to adversely affect, sea turtles and smalltooth sawfish and are likely to adversely affect, but are not likely to destroy or adversely modify critical habitat for smalltooth sawfish.

Please direct questions regarding this Opinion to Jacquelyn DeAngelo, Consultation Biologist, by phone at (727) 551-5097, or by email at Joseph.Cavanaugh@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosures:
Biological Opinion
File: 1514-22 F.4

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: U.S. Army Corps of Engineers (USACE), Jacksonville District

Activity: Proposed USACE issuance of 3 regulatory permits for shoreline stabilization in Cape Coral, Lee County, Florida

Applicant	NMFS Number	USACE Number
Advaniara Trust, LLC 1	SER-2016-18237	SAJ-2016-223 (NW-SJF)
Advaniara Trust, LLC 2	SER-2016-18238	SAJ-2016-221 (NW-SJF)
Manfred Waldinger	SER-2016-18258	SAJ-2016-02340 (NW-EMC)

Consulting Agency: National Oceanic and Atmospheric Administration (NOAA), National Marine Fisheries Service (NMFS), Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida

Approved by:

Roy E. Crabtree, Ph.D., Regional Administrator
NMFS, Southeast Regional Office
St. Petersburg, Florida

Date Issued: Dec 1, 2017

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Acronyms and Abbreviations

CFR	Code of Federal Regulations
CHEU	Charlotte Harbor Estuary Unit
CO_2	Carbon Dioxide
DPS	Distinct Population Segment
EFH	Essential Fish Habitat
ESA	Endangered Species Act
IPCC	Intergovernmental Panel on Climate Change
LAA	Likely to Adversely Affect
MHWL	Mean High Water Line
MIT	Massachusetts Institute of Technology
MLW	Mean Low Water
MLLW	Mean Lower Low Water
NE	No Effect
NLAA	Not Likely to Adversely Affect
NMFS	National Marine Fisheries Service
NOAA	National Ocean and Atmospheric Association
RPMs	Reasonable and Prudent Measures
RMS	Red mangrove shoreline
SEH	Shallow, eurhaline habitat

USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
YOY	Young-of-the-year

Units of Measurement

Temperature

°F	degrees Fahrenheit
°C	degrees Celsius

Length and Area

ac	acre(s)
cm	centimeter(s)
ft	foot/feet
ft^2	square feet
in	inches
km	kilometer(s)
lin ft	linear feet
m	meter(s)
mi	miles
mi^2	square miles

1. INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 et seq.), requires that each federal agency ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. Section 7(a)(2) requires federal agencies to consult with the appropriate Secretary on any such action. NMFS and the U.S. Fish and Wildlife Service (USFWS) share responsibilities for administering the ESA.

Consultation is required when a federal action agency determines that a proposed action "may affect" listed species or designated critical habitat. Consultation is concluded after NMFS determines that the action is not likely to adversely affect listed species or critical habitat or issues a Biological Opinion ("Opinion") that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. The Opinion states the amount or extent of incidental take of the listed species that may occur, develops measures (i.e., reasonable and prudent measures - RPMs) to reduce the effect of take, and recommends conservation measures to further the recovery of the species. Notably, no incidental destruction or adverse modification of designated critical habitat can be authorized, and thus there are no RPMs—only reasonable and prudent alternatives that must avoid destruction or adverse modification.

This document represents NMFS's Opinion based on our review of impacts associated with the proposed action to issue a permit within Lee County, Florida. This Opinion analyzes the effects of the projects on threatened and endangered species and designated critical habitat, in accordance with Section 7 of the ESA. We based our Opinion on project information provided by USACE and other sources of information, including the published literature cited herein.

2. CONSULTATION HISTORY

Table 1. Consultation History for 3 Seawall Projects

Project Name	NMFS Number	Requested Consultation	Requested Information	Final Response
Advaniara Trust, LLC Seawall 1	SER-2016-18237	9/27/2016	10/24/2016	4/19/2017
Advaniara Trust, LLC Seawall 2	SER-2016-18238	9/27/2016	10/24/2016	4/19/2017
Manfred Waldinger Seawall	SER-2016-18258	10/05/2016	12/01/2016	4/18/2017

2.1. Advaniara Trust, LLC Seawall

NMFS received a request for informal consultation under Section 7 of the ESA from the USACE in a letter dated September 27, 2016. A field investigation conducted by NMFS and USACE on November 1, 2016, noted the presence of red mangroves in the proposed construction footprint. NMFS made a number of requests for additional information from October 24, 2016, through April 17, 2017. We received a final response on April 19, 2017, and initiated formal consultation that day.

2.2. Advaniara Trust, LLC Seawall 2

NMFS received a request for informal consultation under Section 7 of the ESA from the USACE in a letter dated September 27, 2016. A field investigation conducted by NMFS and USACE on November 1, 2016, noted the presence of red mangroves in the proposed construction footprint. NMFS made a number of requests for additional information from October 24, 2016, through April 17, 2017. We received a final response on April 19, 2017, and initiated formal consultation that day.

2.3. Manfred Waldinger Seawall

NMFS received a request for informal consultation through the National Letter of Concurrence Pilot Program under Section 7 of the ESA from the USACE in a letter dated October 5, 2016. A field investigation conducted by NMFS and USACE on November 1, 2016, noted the presence of red mangroves in the proposed construction footprint. NMFS made a number of requests for additional information from December 1, 2016, through April 17, 2017. We received a final response on April 18, 2017, and initiated formal consultation that day.

3. DESCRIPTION OF THE PROPOSED ACTIONS AND ACTION AREAS

3.1. Proposed Actions

3.1.1 Advaniara, LLC Seawall 1

The applicant proposes to remove the shoreline vegetation including approximately 25 lin ft of red mangroves, construct a new 245-lin-ft concrete panel seawall, and backfill to level the land behind it. Prior to the start of construction, turbidity curtains will be installed around the work area and will remain in place until completion. Any shoreline vegetation in the footprint of the proposed seawall will be removed completely using land based mechanical equipment. Prefabricated, concrete slabs (8-foot [ft]-long x 6-ft-tall x 5-inches[in]-thick) will be jetted into place at the Mean High Water Line (MHWL) using mechanical equipment from shore. Backfill will be distributed landward of the seawall only to level the land, and will join with natural shorelines south and north of the property. In-water construction is expected to take 2 days to complete and will take place during daylight hours only. The applicant will comply with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions.*[1]

3.1.2 Advaniara , LLC Seawall 2

The applicant proposes to remove the shoreline vegetation including approximately 10 lin ft of red mangroves, construct a new 230-lin-ft concrete panel seawall, and backfill to level the land behind it. Prior to the start of construction, turbidity curtains will be installed around the work area. Any shoreline vegetation in the footprint of the proposed seawall will be removed completely using land based mechanical equipment. Prefabricated, concrete slabs (8-ft-long x 6-ft-tall x 5-in-thick) will be jetted into place 12-in waterward of the MHWL using mechanical equipment from shore. Backfill will be distributed landward of the seawall only to level the

1 NMFS. 2006. Sea Turtle and Smalltooth Sawfish Construction Conditions revised March 23, 2006. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division, Saint Petersburg, Florida. http://sero.nmfs.noaa.gov/protected_resources/section_7/guidance_docs/documents/sea_turtle_and_smalltooth_sawfish_construction_conditions_3-23-06.pdf, accessed June 2, 2017.

land, and will join with natural shorelines south and north of the property. In-water construction is expected to take 2 days to complete and will take place during daylight hours only. The applicant will comply with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*[1].

3.1.3 Manfred Waldinger Seawall

The applicant proposes to remove the shoreline vegetation including approximately 5 lin ft of red mangroves, construct a new 295-linear-foot concrete panel seawall, and backfill to level the land behind it. Prior to the start of construction, turbidity curtains will be installed around the work area). Any shoreline vegetation in the footprint of the proposed seawall will be removed completely using land based mechanical equipment. Prefabricated, concrete slabs (8- ft-long x 6-ft-tall x 5-in-thick) will be jetted into place at the MHWL using mechanical equipment from shore. Backfill will be distributed landward of the seawall only to level the land, and will join with natural shorelines south and north of the property. In-water construction is expected to take 2 days to complete and will take place during daylight hours only. The applicant will comply with NMFS's *Sea Turtle and Smalltooth Sawfish Construction Conditions*[1]).

3.2. Action Area

The action area is defined by regulation as "all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action" (50 Code of Federal Regulations [CFR] 402.02). The proposed action areas include three sites on the South Spreader Wateray Canal (Figure 1, Table 2), a man-made residential canal that leads to the North Spreader Waterway Canal, and, eventually, to the Caloosahatchee River. For each proposed action, the action area consists of the submerged lands and waters in the immediate area of the construction activity and those that will be enclosed by turbidity curtains. Combined, the 3 action areas include a total of 770 lin ft of unconsolidated shoreline, including approximately 40 lin ft of red mangroves that occupy a total area of 276 ft^2 (Table 3). Assuming a typical deployment of turbidity curtains approximately 10 ft from the excavation area, approximately 7,700 ft^2 of water will be enclosed. Water depths range from 0-2.7 ft at mean low water, and the bottom of the canal is sandy. The area surrounding the three sites consists of developed and undeveloped single-family lots on the eastern shore of the canal, and Charlotte Harbor Preserve State Park, which is comprised of 43,000 acres (ac) much of which is mangrove forest, on the western shore of the canal. The action areas are within the boundary of the Charlotte Harbor Estuary Unit of smalltooth sawfish critical habitat.

Figure 1. Image showing the approximate locations of the 3 proposed action areas and their proximity to the Charlotte Harbor Preserve State Park, which includes the mangroves shown at the top of the image; the approximate action areas are depicted in light blue, and assume deployment of turbity curtains approximately 10-ft waterward of the shoreline (©2017 Google)

Table 2. Proposed Sites for Seawall Construction

Project Name	Street Address	Approximate Coordinates North American Datum 1983 (NAD83)
Advaniara, LLC Seawall 1	2939 Southwest 28th Lane Cape Coral, Lee County, Florida	26.600522°N, 82.036792°W
Advaniara, LLC Seawall 2	2712 Southwest 29th Court Cape Coral, Lee County, Florida	26.601019°N, 82.036750°W
Manfred Waldinger Seawall	2929 Southwest 27th Street Cape Coral, Lee County, Florida	26.602497°N, 82.036728°W

Table 3. Shoreline and Water Measurements in each Proposed Action Area (Lengths are reported in linear feet. Areas are reported in square feet.)

Project Name	Total Shoreline Length	Red Mangrove Shoreline Length to be Removed	Red Mangrove Area	Water Area Enclosed by Turbidity Curtains
Advaniara, LLC Seawall 1	245	5	128	2,450
Advaniara, LLC Seawall 2	230	10	123	2,300
Manfred Waldinger Seawall	295	25	25	2,950
Total	770	40	276	7,700

4. STATUS OF LISTED SPECIES AND CRITICAL HABITAT

Tables 4 and 5 provide the effect determinations for the ESA-listed species and critical habitat in the action area.

Table 4. Effect Determinations for Species the Action Agency or NMFS Believe May Be Affected by the Proposed Actions

Species	ESA Listing Status	Action Agency Effect Determination	NMFS Effect Determination
Sea Turtles			
Green (North and South Atlantic distinct population segments [DPSs])	T	NLAA	NLAA
Kemp's ridley	E	NLAA	NLAA
Loggerhead (Northwest Atlantic Ocean DPS)	T	NLAA	NLAA
Fish			
Smalltooth sawfish (U.S. DPS)	E	NLAA	NLAA
E = endangered; T = threatened; NLAA = may affect, not likely to adversely affect			

Table 5. Determinations of Effects for Designated Critical Habitat the Action Agency or NMFS Believe May Be Affected by the Proposed Action

Species	Unit	USACE Effect Determination	NMFS Effect Determination
Smalltooth sawfish	Charlotte Harbor Estuary Unit (CHEU) for protection and restoration of nursery habitat	LAA, NE[†]	LAA, will not destroy or adversely modify
LAA = likely to adversely affect; NE = No Effect [†]The USACE determined that the Manfred Waldinger Seawall would have no effect on smalltooth sawfish critical habitat and the 2 Advaniara Seawalls would be likely to adversely affect smalltooth sawfish critical habitat.			

4.1. Species Not Likely to be Adversely Affected

Green sea turtles (North and South Atlantic distinct population segments [DPSs]), hawksbill sea turtles, Kemp's ridley sea turtles, and loggerhead sea turtles (Northwest Atlantic Ocean DPS) (collectively hereafter, "sea turtles") and smalltooth sawfish (U.S. DPS) may be found in or near the action area and may be affected by the proposed action. We have identified the following potential adverse effects to these species and concluded that they are not likely to be adversely affected by the proposed action for the reasons described below.

Physical Effects

Sea turtles and smalltooth sawfish may be physically injured or killed if they are struck by construction equipment or material. NMFS believes these potential effects are extremely unlikely to occur, and are therefore discountable for the following reasons. First, these species are highly mobile and are able to evade slow-moving equipment. They are also expected to leave areas disturbed by the noise and activity of the proposed action. This movement is also an effect of the action, which will be discussed below. In addition, the applicant's implementation of NMFS's Sea Turtle and Smalltooth Sawfish Construction Conditions will further reduce the risk by requiring all construction workers to watch for sea turtles and smalltooth sawfish, and immediately cease operation of any mechanical construction equipment if a sea turtle or

smalltooth sawfish is seen with in a 50-foot radius of the equipment. Activities will not resume until the protected species has departed the project areas of its own volition.

Temporary Habitat Loss
Sea turtles and smalltooth sawfish may be temporarily unable to use the action areas as foraging and refuge habitat due to their avoidance of construction activities and related noise, and due to physical exclusion from the area blocked by turbidity curtains. NMFS believes that these effects will be insignificant due to the small project footprints (less than 1 ac), the short duration of the projects (2-10 days), and the availaibility of similar habitat nearby, described in Section3.2, which the mobile animals can easily access.

Permanent Habitat Loss
Smalltooth sawfish may be affected by the permanent loss of red mangroves, which are used for foraging, refuge, and reproduction, along 40 lin ft of shoreline. However, NMFS believes the effects to smalltooth sawfish will be insignificant because the area of lost will be very small and there is ample mangrove habitat nearby, as described in Section 3.2.

4.2. Status of Critical Habitat Likely to be Adversely Affected

Smalltooth Sawfish Critical Habitat
The U.S. Distinct Population Segment (DPS) of smalltooth sawfish was listed as endangered on April 1, 2003; however, at that time, NMFS was unable to determine critical habitat. After funding additional studies necessary for the identification of specific habitats and environmental features important for the conservation of the species, establishing a smalltooth sawfish recovery team, and reviewing the best scientific data available, NMFS issued a Final Rule (74 Federal Register [FR] 45353; see also 50 CFR § 226.218) to designate critical habitat for the U.S. DPS of smalltooth sawfish on September 2, 2009. Through the additional studies, researchers identified 2 primary nursery areas in southwest Florida and centered the critical habitat designations around these nurseries. The critical habitat consists of 2 units located along the southwestern coast of Florida: the Charlotte Harbor Estuary Unit (CHEU), which is comprised of approximately 221,459 acres (ac) (346 square miles [mi²]) of coastal habitat, and the Ten Thousand Islands/Everglades Unit (TTIEU), which is comprised of approximately 619,013 ac (967 mi^2) of coastal habitat.

Critical Habitat Unit Affected by this Action
This consultation focuses on an activity occurring in the CHEU, which encompasses portions of Charlotte and Lee Counties (Figure 2). The CHEU is comprised of Charlotte Harbor, Gasparilla Sound, Matlacha Pass, Pine Island Sound, San Carlos Bay, and Estero Bay. The unit is fed by the Myakka and Peace Rivers to the north and the Caloosahatchee River to the east. A series of passes between barrier islands connect the CHEU with the Gulf of Mexico. The CHEU is a relatively shallow estuary with large areas of submerged aquatic vegetation, oyster bars, saltwater marsh, freshwater wetlands, and mangroves. Freshwater flows from the Caloosahatchee River are controlled by the Franklin Lock and Dam, which periodically releases water, which thereby affects downstream salinity regimes. The CHEU boundaries are defined in detail in the Final Rule (74 FR 45353; see also 50 CFR § 226.218).

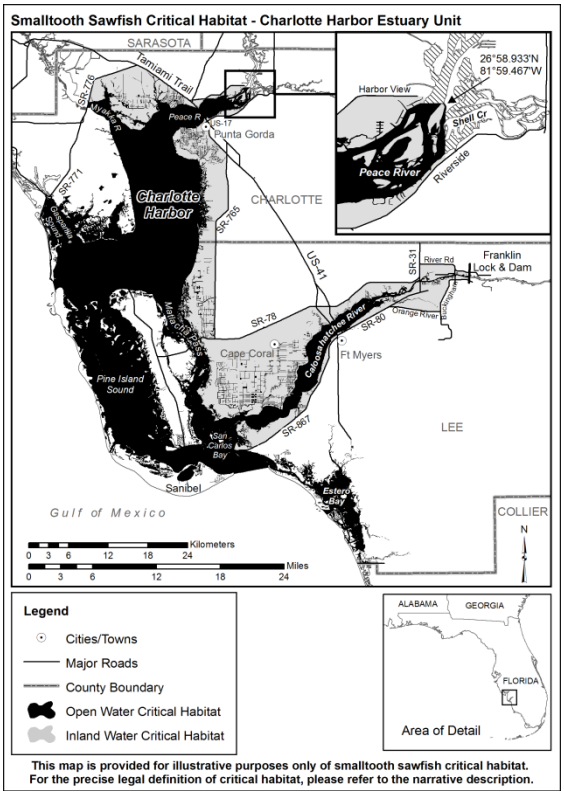


Figure 2. Map of smalltooth sawfish critical habitat –CHEU

Essential Features of Critical Habitat

The recovery plan developed for the smalltooth sawfish, which represents NMFS's best judgment about the objectives and actions necessary for the species' recovery, identified a need to increase the number of juvenile smalltooth sawfish developing into adulthood by protecting or restoring nursery habitat (NMFS 2009). NMFS determined that without sufficient habitat, the population was unlikely to increase to a level associated with low extinction risk and de-listing. Therefore, within the 2 critical habitat units NMFS identified 2 habitat features essential for the conservation of this species: (1) red mangroves, and (2) shallow, euryhaline habitats (shallow, euryhaline habitats) characterized by water depths between mean high water (MHW) and 3 ft (0.9 m) measured at mean lower low water (MLLW) (Final Rule, 74 FR 45353). These essential features of critical habitat provide juveniles refuge from predation and forage opportunities within their nursery habitat. One or both of these essential features must be present in an action area for it to function as critical habitat for smalltooth sawfish.

Habitat Use

Juvenile smalltooth sawfish, identified as those up to 3 years of age or approximately 8 ft (2.4 meters [m]) in length (Simpfendorfer et al. 2008), inhabit the shallow waters of estuaries and can be found in sheltered bays, dredged canals, along banks and sandbars, and in rivers (NMFS 2000). Juvenile smalltooth sawfish occur in euryhaline waters (i.e., waters with a wide range of salinities) and are often closely associated with muddy or sandy substrates, and shorelines containing red mangroves (Simpfendorfer 2001; 2003). The structural complexity of red mangrove prop roots creates a unique habitat used by a variety of fish, invertebrates, and birds.

Juvenile smalltooth sawfish, particularly young-of-the-year (YOY) (measuring less than 39.4 inches (in) [100 centimeters (cm)] in length), use these areas as both refuge from predators and forage grounds, taking advantage of the large number of fish and invertebrates found there.

Tracking data from the Caloosahatchee River in Florida indicate very shallow depths and specific salinity ranges are important abiotic factors influencing juvenile smalltooth sawfish movement patterns, habitat use, and distribution (Simpfendorfer et al. 2011). An acoustic tagging study in a developed region of Charlotte Harbor, Florida, identified the importance of mangroves in close proximity to shallow-water habitat for juvenile smalltooth sawfish, stating that juveniles generally occur in shallow water within 328 ft (100 m) of mangrove shorelines (Simpfendorfer et al. 2010). Juvenile smalltooth sawfish spend the majority of their time in waters shallower than 13 ft (4 m) deep (Simpfendorfer et al. 2010) and are seldom found deeper than 32 ft (10 m) (Poulakis and Seitz 2004). Simpfendorfer et al. (2010) also indicated the following developmental differences in habitat use: the smallest YOY juveniles generally used water shallower than 1.6 ft (0.5 m), had small home ranges, and exhibited high levels of site fidelity. Although small juveniles exhibit high levels of site fidelity for specific nursery habitats for periods of time lasting up to 3 months (Wiley and Simpfendorfer 2007), they undergo small movements coinciding with changing tidal stages. These movements often involve moving from shallow sandbars at low tide and among red mangrove prop roots at higher tides (Simpfendorfer et al. 2010), behavior likely to reduce the risk of predation (Simpfendorfer 2006). As juveniles increase in size, they begin to expand their home ranges (Simpfendorfer et al. 2010; Simpfendorfer et al. 2011), eventually moving to more offshore habitats where they likely feed on larger prey and eventually reach sexual maturity.

Researchers have identified several areas within the Charlotte Harbor Estuary that are disproportionately more important to juvenile smalltooth sawfish, based on intra- or inter-annual capture rates during random sampling events within the estuary (Poulakis 2012; Poulakis et al. 2011). The areas, which were termed "hotspots," correspond with areas where public encounters are most frequently reported. Use of these hotspots can be variable within and among years based on the amount and timing of freshwater inflow. Smalltooth sawfish use hotspots further upriver during drought (i.e., high salinity) conditions and hotspot areas closer to the mouth of the Caloosahatchee River during times of high freshwater inflow (Poulakis et al. 2011). At this time, researchers are unsure what specific biotic (e.g., presence or absence of predators and prey) or abiotic factors (e.g., flow rate, water temperature, etc.) influence this habitat selection. Still, they believe a variety of conditions in addition to salinity, such as temperature, dissolved oxygen, water depth, shoreline vegetation, and food availability, may influence smalltooth sawfish habitat selection (Poulakis et al. 2011).

Status and Threats to Critical Habitat

Modification and loss of smalltooth sawfish critical habitat is an ongoing threat contributing to the current status of the species. Activities such as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff contribute to these losses (SAFMC 1998). Large areas of coastal habitat were modified or lost between the mid-1970s and mid-1980s within the United States (Dahl and Johnson 1991; USFWS 1999). Since then, rates of loss have decreased even though habitat loss continues. Between 1998 and 2004, approximately 2,450 ac (3.8 mi^2) of intertidal wetlands consisting of

mangroves or other estuarine shrubs were lost along the Atlantic and Gulf coasts of the United States (Stedman and Dahl 2008). In another study, Orlando et al. (1994) analyzed 18 major southeastern estuaries and recorded over 703 mi (1,131 kilometers [km]) of navigation channels and 9,844 mi (15,842 km) of shoreline with modifications. Additionally, changes to the natural freshwater flows into estuarine and marine waters through construction of canals and other water-control devices have altered the temperature, salinity, and nutrient regimes, reduced both wetlands and submerged aquatic vegetation coverage, and degraded vast areas of coastal habitat utilized by smalltooth sawfish (Gilmore 1995; Quigley and Flannery 2002; Reddering 1988; Whitfield and Bruton 1989). Juvenile sawfish and their critical habitat are particularly vulnerable to these kinds of habitat losses or alterations due to the juveniles' affinity for (and developmental need of) shallow, estuarine systems. Although many forms of habitat modification are currently regulated, some permitted direct and/or indirect damage to habitat from increased urbanization still occurs and is expected to continue in the future.

In Florida, coastal development often involves the removal of mangroves, the armoring of shorelines through seawall construction, and the dredging of canals. This is especially apparent in master plan communities such as Cape Coral and Punta Gorda which are located within the Charlotte Harbor Estuary. These communities were created through dredge-and-fill projects to increase the amount of waterfront property available for development, but in doing so, developers removed the majority of red mangrove habitat from the area. The canals created by these communities require periodic dredging for boat access, further affecting the shallow, euryhaline essential feature of critical habitat. Development continues along the shorelines of Charlotte Harbor in the form of docks, boat ramps, shoreline armoring, utility projects, and navigation channel dredging.

To protect critical habitat, federal agencies must ensure that their activities are not likely to result in the destruction or adverse modification of the physical and biological features that are essential to the conservation of sawfish, or the species' ability to access and use these features (ESA Section 7(a)(2); see also 50 CFR 424.12(b) [discussing essential features]). Therefore, proposed actions that may impact critical habitat require an analysis of potential impacts to each essential feature. As mentioned previously, there are 2 essential features of smalltooth sawfish critical habitat: (1) red mangroves; and (2) shallow, euryhaline habitats characterized by water depths between the MHWL and 3 ft (0.9 m) measured at MLLW. The USACE oversee the permitting process for residential and commercial marine development in the CHEU. The Florida Department of Environmental Protection (FDEP) and their designated authorities also regulate mangrove removal in Florida. All red mangrove removal permit requests within smalltooth sawfish critical habitat necessitate ESA Section 7 consultation. NMFS Protected Resources Division tracks the loss of these essential features of smalltooth sawfish critical habitat.

Threats to Critical Habitat

Dock and Boat Ramp Construction

The USACE recommends that applicants construct docks in accordance with the NMFS-USACE *Dock Construction Guidelines in Florida for Docks or Other Minor Structures Constructed in or over Submerged Aquatic Vegetation (SAV), Marsh, or Mangrove Habitat* ("Dock Construction Guidelines") when possible. The current dock construction guidelines allow for some amount of

mangrove removal; however, it is typically restricted to either (1) trimming to facilitate a dock, or (2) complete removal up to the width of the dock extending toward open water, which the guidelines define as a width of 4 ft. Installation or replacement of boat ramps is often part of larger projects such as marinas, bridge approaches, and causeways where natural and previously created deepwater habitat access channels already exist. Boat ramps can result in the permanent loss of both the red mangrove and the shallow, euryhaline habitat features of critical habitat for smalltooth sawfish.

Marina Construction

Marinas have the potential to adversely affect aquatic habitats. Marinas are typically designed to be deeper than 3 ft MLLW to accommodate vessel traffic; therefore, most existing marinas lacking essential features are unlikely to function as critical habitat for smalltooth sawfish. The expansion of existing marinas and creation of new marinas can result in the permanent loss of large areas of this nursery habitat.

Bulkhead and Seawall Construction

Bulkheads and other shoreline stabilization structures are used to protect adjacent shorelines from wave and current action and to enhance water access. These projects may adversely impact critical habitat for smalltooth sawfish by removal of the essential features through direct filling and dredging to construct vertical or riprap seawalls. Generally, vegetation plantings, sloping riprap, or gabions are environmentally-preferred shoreline stabilization methods instead of vertical seawalls because they provide better quality fish and wildlife habitat. Nevertheless, placement of riprap material removes more of the shallow euryhaline essential feature than a vertical seawall. Also, many seawalls built along unconsolidated shorelines require the removal of red mangroves to accommodate the seawalls.

Cable, Pipeline, and Transmission Line Construction

While not as common as other activities, excavation of submerged lands is sometimes required for installing cables, pipelines, and transmission lines. Construction may also require temporary or permanent filling of submerged habitats. Open-cut trenching and installation of aerial transmission line footers are activities that have the ability to temporarily or permanently impact critical habitat for smalltooth sawfish.

Transportation Infrastructure Construction

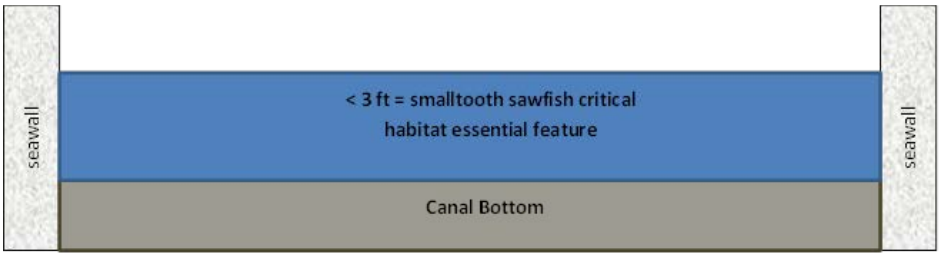
Potential adverse effects from federal transportation projects in smalltooth sawfish critical habitat (CHEU) include operations of the Federal Highway Administration, USACE, and the Federal Emergency Management Agency. Construction of road improvement projects typically follow the existing alignments and expand to compensate for the increase in public use. Transportation projects may impact critical habitat for smalltooth sawfish through installation of bridge footers, fenders, piles, and abutment armoring, or through removal of existing bridge materials by blasting or mechanical efforts.

Dredging

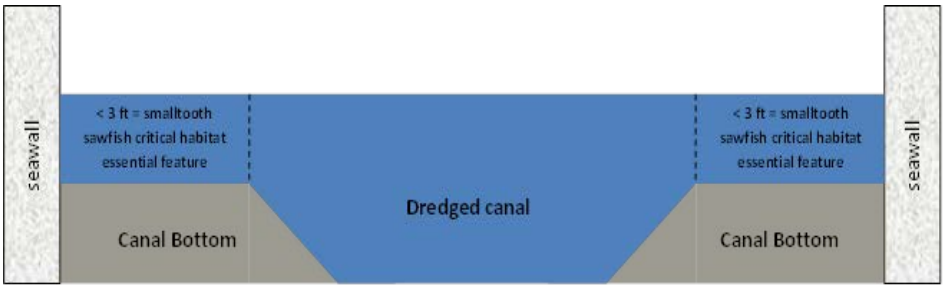
Riverine, nearshore, and offshore areas are dredged for navigation, construction of infrastructure, and marine mining. An analysis of 18 major southeastern estuaries conducted in 1993-1994 demonstrated that over 7,000 kilometers of navigation channels have already been dredged

(Orlando et al. 1994). Habitat effects of dredging include the loss of submerged habitats by disposal of excavated materials, turbidity and siltation effects, contaminant release, alteration of hydrodynamic regimes, and fragmentation of physical habitats (GMFMC 1998; GMFMC 2005; SAFMC 1998). In the CHEU, dredging to maintain canals and channels constructed prior to the critical habitat designation, limits the amount of available shallow, euryhaline essential feature to the edges of waterways and these dredging activities can disturb juveniles that are using these areas. At the time of critical habitat designation, many previously dredged channels and canals existed within the boundaries of the critical habitat units; however, we are unsure which of those contained the shallow-water essential feature at that time. It is likely that many of these channels and canals were originally dredged deeper than -3 ft MLLW, but they have since shoaled in and now contain the essential feature of shallow, euryhaline habitat. Therefore, maintenance dredging impacts are counted as a loss to this essential feature, even though the areas may or may not have contained the essential feature at time of designation (see Figure 3, Diagrams A and B).

A.



B.



C.

Figure 3. Diagram A depicts a cross section of a historically dredged channel/canal within the boundaries of the critical habitat units that has not been maintained. Diagram B depicts the typical cross section of a maintenance-dredged channel/canal. Diagram C depicts a cross section of a maintained dredged channel/canal after sea level rise of > 1 ft.

Construction, Operations and Maintenance of Impoundments and Other Water Level Controls

Federal agencies such as the USACE have historically been involved in large water control projects in Florida. Agencies sometimes propose impounding rivers and tributaries for such purposes as flood control, salt water intrusion prevention, or creation of industrial, municipal, and agricultural water supplies. Projects to repair or replace water control structures may affect smalltooth sawfish critical habitat by limiting sufficient freshwater discharge which could alter the salinity of estuaries. The ability of an estuary to function as a nursery depends upon the quantity, timing, and input location of freshwater inflows (Garmestani and Percival 2005; Norton et al. 2012; USEPA 1994). Estuarine ecosystems are vulnerable to the following man-made disturbances: (1) decreases in seasonal inflow caused by the removal of freshwater upstream for agricultural, industrial, and domestic purposes; (2) contamination by industrial and sewage discharges; (3) agricultural runoff carrying pesticides, herbicides, and other toxic pollutants; and (4) eutrophication (e.g., influx of nutrients such as nitrates and phosphates most often from fertilizer runoff and sewage) caused by excessive nutrient inputs from a variety of nonpoint and point sources. Additionally, rivers and their tributaries are susceptible to natural disturbances, such as floods and droughts, whose effects can be exacerbated by these man-made disturbances.

As stated above, smalltooth sawfish show an affinity for a particular salinity range, moving downriver during wetter months and upriver during drier months to remain within that range (Simpfendorfer et al. 2011). Therefore, water management decisions that affect salinity regimes may impact the functionality of critical habitat. This may result in smalltooth sawfish following specific salinity gradients into less advantageous habitats (e.g., areas with less shallow-water or red mangrove habitat). Furthermore, large changes in water flow over short durations would likely escalate movement patterns for smalltooth sawfish, thereby increasing predation risk and energy output. Researchers are currently looking into the effects of large-scale freshwater discharges on smalltooth sawfish and their designated critical habitat. The most vulnerable portion of the juvenile sawfish population to water-management outfall projects appears to be smalltooth sawfish in their first year of life. Newborn smalltooth sawfish remain in smaller areas irrespective of salinity, which potentially exposes them to greater osmotic stress (a sudden change in the solute concentration around a cell, causing a rapid change in the movement of water across its cell membrane), and impacts the nursery functions of sawfish critical habitat (Poulakis et al. 2013; Simpfendorfer et al. 2011).

Climate Change Threats

The Intergovernmental Panel on Climate Change (IPCC) has stated that global climate change is unequivocal and its impacts to coastal resources may be significant (IPCC 2007). There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities (i.e., global warming mostly driven by the burning of fossil fuels). The latest report by the IPCC (2013) is more explicit, stating that, "science now shows with 95% certainty that human activity is the dominant cause of observed warming since the mid-twentieth century." Some of the anticipated outcomes are sea level rise, increased frequency of severe weather events, and changes in air and water temperatures. NOAA's climate change web portal provides information on the climate-related variability and changes that are exacerbated by human activities (http://www.climate.gov/#understandingClimate). The EPA's climate change webpage also provides basic background information on these and other measured or anticipated effects (http://www.epa.gov/climatechange/index.html).

Though the impacts on smalltooth sawfish cannot, for the most part, be predicted with any degree of certainty, we can project some effects to sawfish critical habitat. We know that both essential features (red mangroves and shallow, euryhaline waters less than 3 ft deep at MLLW) will be impacted by climate change. Sea level rise is expected to exceed 3.3 ft (1 m) globally by 2100, according to the most recent publications, exceeding the estimates of the Fourth Assessment of the IPCC (Meehl et al. 2007; Pfeffer et al. 2008; Rahmstorf et al. 2009). Mean sea level rise projections have increased since the Fourth Assessment because of the improved physical understanding of the components of sea level, the improved agreement of process-based models with observations, and the inclusion of ice-sheet dynamical changes (IPCC 2013). A 1-m sea level rise in the state of Florida is within the range of recent estimates by 2080 (Pfeffer et al. 2008; Rahmstorf et al. 2009).

Sea level increases would affect the shallow-water essential feature of smalltooth sawfish critical habitat within the CHEU. A 2010 climate change study by the Massachusetts Institute of Technology (MIT) forecasted sea level rise in a study area with significant overlap with the CHEU (Vargas-Moreno and Flaxman 2010). The study investigated possible trajectories of future transformation in Florida's Greater Everglades landscape relative to 4 main drivers: climate change, shifts in planning approaches and regulations, population change, and variations in financial resources. MIT used (IPCC 2007) sea level modeling data to forecast a range of sea level rise trajectories from low, to moderate, to high predictions (Figure 4). The effects of sea level rise on available shallow-water habitat for smalltooth sawfish would be exacerbated in areas where there is shoreline armoring (e.g., seawalls). This is especially true in canals where the centerlines are maintenance-dredged deeper than 3 ft (0.9 m) for boat accessibility. In these areas, the areas that currently contain the essential feature depth (less than 3 ft at MLLW) will be reduced along the edges of the canals as sea level rises (see previous Figure 4, Diagram C).

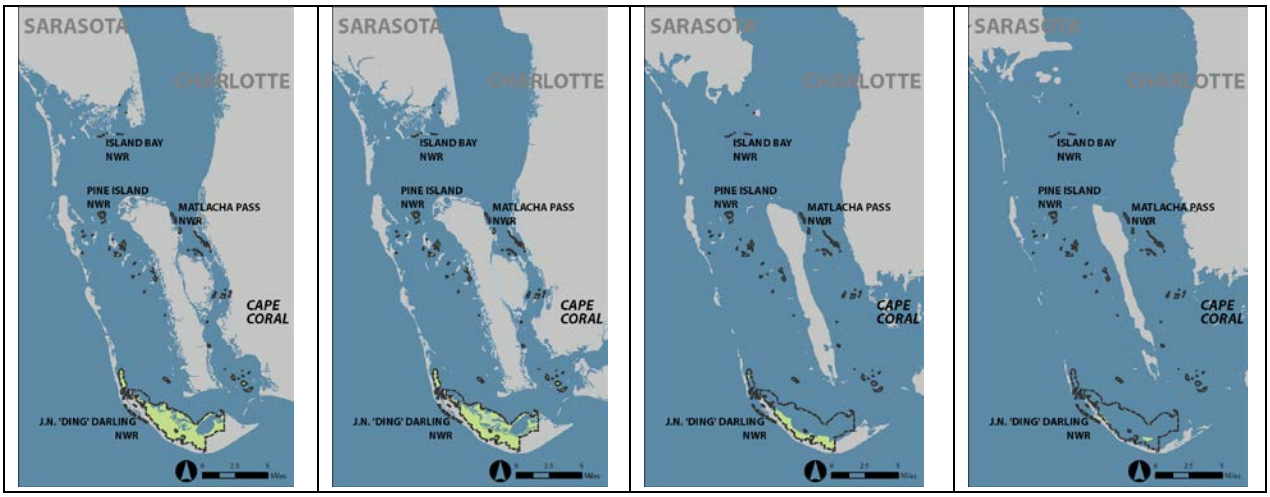


Figure 4. From left to right: current shoreline, + 3.5 in (+ 9 cm); + 18.5 in (+ 47 cm); and + 38.97 in (+ 99 cm) sea level rise by 2060.[2]

[2] Adapted from (Vargas-Moreno and Flaxman), M. Addressing the Challenges of Climate Change in the Greater Everglades Landscape. Project Sheet. November, 2010. Department of Urban Planning, MIT.

Along the Gulf Coast of Florida, and south Florida in particular, rises in sea level will impact mangrove resources. As sea levels rise, mangroves will be forced landward in order to remain at a preferred water inundation level and sediment surface elevation, which is necessary for successful growth. This retreat landward will not keep pace with conservative projected rates of elevation in sea level (Gilman et al. 2008). This forced landward progression poses the greatest threat to mangroves in areas where there is limited or no room for landward or lateral migration (Semeniuk 1994). Such is the case in areas of the CHEU where landward mangrove growth is restricted by shoreline armoring and coastal development. This man-made barrier will prohibit mangroves from moving landward and will result in the loss of the mangrove essential feature. Other threats to mangroves result from climate change: fluctuations in precipitation amounts and distribution, seawater temperature, carbon dioxide (CO_2) levels, and damage to mangroves from increasingly severe storms and hurricanes (McLeod and Salm 2006). A 25% increase in precipitation globally is predicted by 2050 (McLeod and Salm 2006), but the specific geographic distribution will vary, leading to increases and decreases in precipitation at the regional level. Changes in precipitation patterns caused by climate change may adversely affect the growth of mangroves and their distribution (Field 1995; Snedaker 1995). Decreases in precipitation will increase salinity and inhibit mangrove productivity, growth, seedling survival, and spatial coverage (Burchett et al. 1984). Decreases in precipitation may also change mangrove species composition, favoring more salt-tolerant types (Ellison 2010). Increases in precipitation may benefit some species of mangroves, increasing spatial coverage and allowing them to out-compete other salt marsh vegetation (Harty 2004). Even so, potential mangrove expansion requires suitable habitat for mangroves to increase their range, which depends to a great extent on patterns and intensity of coastal development (i.e., bulkhead and seawall construction). Seawater temperature changes will have potential adverse effects on mangroves as well. Many species of mangroves show an optimal shoot density in sediment temperatures between 59°-77°F (15°-25°C) (Hutchings and Saenger 1987). Yet, at temperatures between 77°-95°F (25°-35°C), many species begin to show a decline in leaf structure and root and leaf formation rates (Saenger and Moverley 1985). Temperatures above 95°F lead to adverse effects on root structure and survivability of seedlings (UNESCO 1992) and temperatures above 100.4°F (38°C) lead to a cessation of photosynthesis and mangrove mortality (Andrews et al. 1984). Although impossible to forecast precisely, sea surface ocean temperatures are predicted to increase 1.8°-3.6°F (1°-2°C) by 2060 (Chapter 11 (IPCC 2013)), which will in turn impact underlying sediment temperatures along the coast. If mangroves shift pole-ward in response to temperature increases, they will at some point be limited by temperatures at the lower end of their optimal range and available recruitment area. This is especially true when considering already armored shorelines in residential communities such as those within and surrounding the CHEU of critical habitat for smalltooth sawfish.

As atmospheric CO_2 levels increase, mostly resulting from man-made causes (e.g., burning of fossil fuels), the world's oceans will absorb much of this CO_2, causing potential increases in photosynthesis and mangrove growth rates. This increase in growth rate, however, would be limited by lower salinities expected from CO_2 absorption in the oceans (Ball et al. 1997), and by the availability of undeveloped coastline for mangroves to expand their range. A secondary effect of increased CO_2 concentrations in the oceans is the deleterious effect on coral reefs' ability to absorb calcium carbonate (Hoegh-Guldberg et al. 2007), and subsequent reef erosion.

Eroded reefs may not be able to buffer mangrove habitats from waves, especially during storm/hurricane events, causing additional physical effects.

Finally, the anticipated increase in the severity of storms and hurricanes may also impact mangroves. Tropical storms are expected to increase in intensity and/or frequency, which will directly impact existing mangroves that are already adversely impacted by increased seawater temperatures, CO_2, and changes in precipitation (Cahoon et al. 2003; Trenberth 2005). The combination of all of these factors may lead to reduced mangrove height (Ning et al. 2003). Further, intense storms could result in more severe storm surges and lead to potential changes in mangrove community composition, mortality, and recruitment (Gilman et al. 2006). Increased storms surges and flooding events could also affect mangroves' ability to photosynthesize (Gilman et al. 2006) and the oxygen concentrations in the mangrove lenticels (Ellison 2010).

5. ENVIRONMENTAL BASELINE

This section describes the effects of past and ongoing human and natural factors contributing to the current status of the affected smalltooth sawfish critical habitat in the action area. The environmental baseline describes the critical habitat's health based on information available at the time of this consultation.

By regulation (50 CFR 402.02), environmental baselines for Biological Opinions include the past and present impacts of all state, federal, or private actions and other human activities in, or having effects in, the action area. We identify the anticipated impacts of all proposed federal projects in the specific action area of the consultation at issue that have already undergone formal or early Section 7 consultation (as defined in 50 CFR 402.11), as well as the impact of state or private actions, or the impacts of natural phenomena, which are concurrent with the consultation in process (50 CFR 402.02).

Focusing on the impacts of the activities in the action area specifically allows us to assess the prior experience and state (or condition) of the critical habitat. We can focus on areas of designated critical habitat that occur in an action area that may be exposed to effects from the action under consultation. This is important because in some areas, critical habitat features will commonly exhibit, or be more susceptible to, adverse responses to stressors than they would be in other areas. These localized stress responses or stressed baseline conditions may increase the severity of the adverse effects expected from the proposed action.

5.1. Status of Designated Critical Habitat In or Near the Action Area

As described in Section 3.2, the proposed action areas are within the boundary of the CHEU, and contain approximately 40 lin ft of red mangrove shoreline (RMS) and red mangroves covering a total area of 276 ft^2. Water depths in the action areas range from 0-2.7 ft at mean low water, so shallow, euryhaline waters are also present, in an area of approximately 7,700 ft^2 (see Table 3). The action areas are also adjacent to Charlotte Harbor Preserve State Park, which is comprised of 43,000 acres and protects 80 miles of shoreline habitat along the Charlotte Harbor estuaries in Charlotte and Lee Counties, most of which is composed of mangroves.

5.2. Factors Affecting Critical Habitat within the Action Area

Federal Actions

Since the designation of smalltooth sawfish critical habitat on September 2, 2009, we have consulted on several shoreline stabilization projects (seawall installation necessitating red mangrove and shallow-water habitat removal) in the South Spreader waterway canal near the proposed actions areas considered in this Opinion. However, no actions are known to have occurred within the action area, as per a review of the completed consultations in NMFS Public Consultation Tracking System.[3]

USACE Authorized Marine Construction Permitting

The USACE issues permits under the Clean Water Act and Rivers and Harbors Act for coastal in-water marine construction, including actions to consolidate shoreline abutting residential properties for new home construction. Consolidation of shoreline usually involves shoreline armoring, such as seawall and riprap revetment, which often necessitates the removal of mangroves and disturbance of submerged aquatic vegetation (e.g., seagrasses that are covered by riprap). In the action area, state and county ordinances often require shoreline armoring before building on vacant lots is allowed. Although individual shoreline armoring projects may be small in scale, cumulatively, these required armoring projects could have a potentially large effect on smalltooth sawfish critical habitat. This is particularly true given the limited options available under the ordinances for shoreline armoring. For example, alternatives to vertical seawalls such as living shorelines are not currently an option for the required pre-construction shoreline armoring.

State or Private Actions

A number of nonfederal activities that may adversely affect designated critical habitat for smalltooth sawfish in the action area include impacts from residential shoreline stabilization activities that do not require federal permits or otherwise have a federal nexus (i.e., seawall, riprap). The direct and indirect impacts from some of these activities are difficult to quantify. Where possible, conservation actions in ESA Section 10 permits, ESA Section 6 cooperative agreements, and state permitting programs are being implemented or investigated to monitor or study impacts from these sources.

Other Potential Sources of Impacts to the Environmental Baseline

Stochastic (i.e., random) events, such as hurricanes, occur in Southwest Florida and may affect the action area. The occurrence of these events is, by nature, unpredictable, as is their effect on

[3] NMFS. 2017. Public Consultation Tracking System. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources. https://pcts.nmfs.noaa.gov/pcts-web/searchTrackable.pcts, accessed December 1, 2017.

critical habitat; but, they have the potential to directly impede recovery if animals die as a result of the event, or indirectly if important habitats are damaged. For example, storm surge can result in severe erosion of shorelines or in deposition of sediments, altering water depths, and hurricane force winds can damage mangroves, Between 1916 and 2015, 35 hurricanes have approached Southwest Florida closely enough to affect Naples Beach (Gamio 2016). Most recently, in 2005, Hurricane Charley likely damaged habitat, including mangroves, in and around the action area. However, the mangroves in the area appear to have recovered.

Conservation and Recovery Actions Shaping the Environmental Baseline
Federal Essential Fish Habitat (EFH) consultation requirements pursuant to the Magnuson-Stevens Fishery Conservation and Management Act minimize and mitigate for losses of wetlands and preserve valuable foraging and developmental habitat that is used by juvenile smalltooth sawfish, including areas that have been designated as smalltooth sawfish critical habitat. NMFS has designated mangrove and estuarine habitats as EFH as recommended by the Gulf of Mexico Fishery Management Council. Both essential features (shallow, euryhaline habitats less than 3 ft MLLW and red mangroves) are critical components of areas designated as EFH and receive a basic level of protection under the Magnuson-Stevens Act to the extent that the Act requires minimization of impacts to EFH resources.

6. EFFECTS OF THE ACTION ON CRITICAL HABITAT

As described in Section 3.2, both essential features of critical habitat designated for smalltooth sawfish, shallow euryhaline habitats and red mangroves, are present in the proposed action areas and may be affected by the proposed actions.

6.1. Effects on Shallow, Euryhaline Habitats

Of the three proposed actions, only the Advaniara Trust, LLC 2 seawall will be installed waterward of the MHWL. Water depth in the area of the proposed seawall is less than 2.7 ft at mean low water (MLW), and the difference between MLW and MLLW is 0.15 ft in this region.[4] Therefore, SEH exist along the entire length of the proposed seawall (maximum depth = 2.7 ft + 0.15 ft = 2.85 ft at MLLW), and the proposed installation will result in a permanent loss of approximately 230 ft^2 (230-lin-ft seawall × 1 ft waterward of the MHWL) SEH. Using remote sensing data acquired from the Fish and Wildlife Research Institute (FWRI), we were able to compile information relating to the total area of this essential feature within smalltooth sawfish critical habitat. The total amount of shallow, euryhaline habitat in CHEU at the time smalltooth sawfish were listed under the ESA in 2003 was approximately 132 mi^2 (84,480 ac) (NMFS unpublished data). While the available shallow, euryhaline essential feature will be diminished, the project is not severing or preventing juvenile smalltooth sawfish access to alternate habitat with this essential feature in the surrounding area. Still, some ecological function provided to juvenile smalltooth sawfish currently using the area, and conservation benefits to future juvenile sawfish in terms of the shallow, euryhaline essential feature will be lost. The project is located deep within a residential canal system far away from any known hotspot reproductive areas such as those areas identified within the Caloosahatchee River (Poulakis 2012; Poulakis et al. 2011). Juvenile smalltooth sawfish use shallow, euryhaline habitat to forage and take refuge from

[4] Datums for NOAA Tide Station 8725520, Fort Myers, Florida, 1983-2001 Epoch, https://tidesandcurrents.noaa.gov/datums.html?id=8725520, accessed July 6, 2017

potential predators. Thus, we believe the permanent loss of 230ft^2 (0.005280 ac) of shallow, euryhaline habitat at the project site is an adverse effect to critical habitat.

6.2. Effects on Red Mangroves

The red mangrove essential feature of designated critical habitat is present and is likely to be adversely affected by the seawall installations. The three projects will result in a combined permanent loss of 40 lin ft of red mangroves as potential forage and shelter area for juvenile smalltooth sawfish. Using remote sensing data acquired from the FWRI, we were able to compile information relating to the total area of this essential feature within smalltooth sawfish critical habitat. Based on that information, we estimated that the total amount of RMS in CHEU at the time that smalltooth sawfish were listed under the ESA in 2003 was approximately 5,512,320 lin ft (1,044 mi). While the available red mangrove essential feature in the CHEU will be diminished, the project is not severing or preventing access to alternate refuge or forage areas at the site or in the surrounding area, for juvenile smalltooth sawfish. Still, some ecological function provided to juvenile smalltooth sawfish currently using the area, and conservation benefits to future juvenile sawfish in terms of the red mangrove essential feature will be lost. Thus, we believe the proposed permanent removal of 40 lin ft red mangrove shoreline at the project site is an adverse effect to critical habitat.

7. CUMULATIVE EFFECTS

Cumulative effects include the effects of future state, tribal, or local private actions that are reasonably certain to occur in the action area considered in this Opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA (50 CFR 402.02).

Many threats to smalltooth sawfish critical habitat are expected to be exacerbated by the effects of global climate change (see Threats to Critical Habitat section). Potential increases in sea level may impact the availability of nursery habitat, particularly red mangrove lined, low-lying coastal habitats (IPCC 2014; Wanless et al. 2005). Red mangroves could be negatively affected by increased temperatures, salinities, and acidification of coastal waters (Snedaker 1995), Wanless et al. 2005 (Scavia et al. 2002), as well as increased runoff and erosion due to the expected increase in extreme storm events (IPCC 2014; Wanless et al. 2005). These alterations of the marine environment due to global climate change could ultimately affect the distribution, physiology, and growth rates of red mangroves, potentially eliminating them from particular areas. The magnitude of these effects on smalltooth sawfish critical habitat are difficult to predict, yet the cyclical loss of habitat from extreme storm events combined with sea level rise may result in a decrease in areal coverage of red mangrove essential feature of smalltooth sawfish critical habitat (Norton et al. 2012; Scavia et al. 2002). However, this proposed action is of such a small scale, scope, and limited time frame that is not very likely to contribute to, or be affected cumulatively by climate change.

Smalltooth sawfish habitat has been degraded or modified throughout the southeastern United States, including areas designated as critical habitat, from agriculture, urban development, commercial activities, channel dredging, boating activities, and the diversion of freshwater runoff. No future actions with effects beyond those already described are reasonably certain to occur in the action area. The man-made canals within the CHEU will likely continue to

experience the same types of actions described in Section 4.2 (Status of the Critical Habitat within the Action Area). These threats include shoreline armoring (e.g., seawall installation and associated red mangrove removal), canal dredging, and dock construction.

8. INTEGRATION AND SYNTHESIS

8.1. Critical Habitat Destruction/Adverse Modification Analysis

NMFS's regulations define *Destruction or adverse modification* to mean "a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features" (50 CFR § 402.02). Other alterations that may destroy or adversely modify critical habitat may include impacts to the area itself, such as those that would impede access to or use of the essential features. We intend the phrase "significantly delay" in development of essential features to encompass a delay that interrupts the likely natural trajectory of the development of physical and biological features in the designated critical habitat to support the species' recovery. NMFS will generally conclude that a Federal action is likely to "destroy or adversely modify" designated critical habitat if the action results in an alteration of the quantity or quality of the essential physical or biological features of designated critical habitat, or that precludes or significantly delays the capacity of that habitat to develop those features over time, and if the effect of the alteration is to appreciably diminish the value of critical habitat for the conservation of the species.

This analysis takes into account the geographic and temporal scope of the proposed action, recognizing that "functionality" of critical habitat necessarily means that it must now and must continue in the future to support the conservation of the species and progress toward recovery. The analysis must take into account any changes in amount, distribution, or characteristics of the critical habitat that will be required over time to support the successful recovery of the species. Destruction or adverse modification does not depend strictly on the size or proportion of the area adversely affected, but rather on the role the action area and the affected critical habitat serves with regard to the function of the overall critical habitat designation, and how that role is affected by the action.

The smalltooth sawfish recovery plan identifies 3 recovery objectives to help facilitate recruitment of juveniles into the recovering adult population (NMFS 2009). Recovery Objective #1 is to minimize human interactions and associated injury and mortality; this objective is not relevant to critical habitat. Recovery Objective #2 is to protect and/or restore smalltooth sawfish habitats. Recovery Objective #3 is to ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had previously been extirpated. Our analysis evaluates whether the anticipated impacts to critical habitat associated with the proposed action would interfere with Recovery Objectives #2 and #3, and ultimately, the conservation objective behind the designated critical habitat—that is, facilitation of juvenile recruitment into a recovering adult population.

8.2. Recovery Objective 2: Protect and Restore Smalltooth Sawfish Habitat

In establishing Recovery Objective #2, we recognized that recovery and conservation of smalltooth sawfish depends on the availability and quality of nursery habitats. Historically, juvenile sawfish were documented in mangrove and non-mangrove habitat in the southeastern U.S. Due to the protections provided by the Ten Thousand Islands National Wildlife Refuge, Everglades National Park, and the Florida Keys National Marine Sanctuary, much of the historic juvenile smalltooth sawfish habitat in southwest Florida has remained high-quality juvenile habitat. Recovery Regions G, H, and I in southwest Florida extend from the Manatee River on the west coast of Florida, south through Everglades National Park and the Florida Keys to Caesar Creek on the southeast coast of Florida. The CHEU is in Recovery Region G. While much of the CHEU is protected by the Charlotte Harbor Preserve State Park (CHPSP) system, it is also highly anthropomorphically influenced.

The recovery plan states that for the 3 recovery regions with remaining high-quality habitats (i.e., Recovery Regions G, H, and I), juvenile habitats "must be maintained over the long term at or above 95% of the acreage available at the time of listing" (NMFS, 2009). To ensure that a proposed action will not impede Recovery Objective #2, we determine whether the critical habitat unit will be able to maintain 95% of the areas containing each essential feature after taking into account project impacts in the context of the status of the critical habitat, the environmental baseline, and cumulative effects. While the CHEU is only a part of the larger Recovery Region G, and the 95% protection threshold applies across not just Recovery Region G, but also Recovery Regions H and I, the threshold is still useful for evaluating the impacts at the individual recovery region level and for sub-units of the recovery regions. The CHEU contains the only known nursery areas within Recovery Region G, thus we believe it is appropriate to evaluate impacts at the level of the unit. In addition, functioning critical habitat contains either one or both of the essential features, and the essential features were selected based on their role in facilitating recruitment of juvenile animals into the adult population, which the recovery plan likewise seeks to conserve and protect. Consequently, we also believe it is appropriate to consider whether 95% of each of the essential features of critical habitat in the CHEU is maintained. Therefore, below we estimate the percent impact the proposed action will have on the shallow, euryhaline habitat and red mangrove essential features of critical habitat within the CHEU.

Shallow, Euryhaline Essential Feature Impacts

NMFS estimated that 84,480 ac of shallow, euryhaline habitat (abbreviated SH throughout this section) was available within the CHEU at the effective date of species listing (i.e., May 1, 2003) (Table 3, Line 1). As discussed above, we must determine whether a proposed action's impact will interfere with long-term maintenance of this essential feature at or above 95% of the acreage available at the time of listing; however, loss of critical habitat was not formally monitored until the effective date of critical habitat designation (i.e., October 2, 2009). Therefore, we must estimate habitat loss that occurred during the period between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009).

To do this, we use an 84-month dataset of our completed Section 7 consultations (October 3, 2009 – September 30, 2016), including yearly losses due to programmatic consultations, to

generate a rate of loss that can then be used to back-calculate the loss of SH between the effective date of species listing and the effective date of critical habitat designation. We rely on this dataset because using approximately 7 years of information helps avoid over- or under-estimating the rate of habitat loss due to any potential inter-annual variability associated with economic growth and contraction that may have occurred in that time. NMFS consultations completed during this time indicate that 17.60 ac of SH in the CHEU was lost due to federal agency actions.

Based on these losses, we estimate a monthly loss rate of SH in the CHEU using the following equation:

$$Monthly\ loss\ rate\ of\ SH\ (CHEU) = SH\ lost\ through\ federal\ agency\ actions \div 84\ months$$
$$Monthly\ loss\ rate\ of\ SH\ (CHEU) = 17.60\ ac\ \div 84\ months$$
$$Monthly\ loss\ rate\ of\ SH\ (CHEU) = 0.21\ ac\ per\ month$$

Assuming the same monthly loss rate, we back-calculate the loss of SH in the 77 months between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009) in the CHEU using the following equation:

$$SH\ lost\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 0.21\ ac\ per\ month \times 77\ months$$
$$SH\ lost\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 16.17\ ac \text{ (Table 3, Line 2)}$$

Next, we determine the loss of SH since the effective date of critical habitat designation. From the effective date of critical habitat designation through September 30, 2017, 20.59 ac of SH in the CHEU has been lost due to federal agency actions (Table 3, Line 3).[5] While this amount of loss only takes into account projects with a federal nexus requiring ESA Section 7 consultation, there are very few projects without a federal nexus that could affect shallow, euryhaline habitat in the CHEU as most in-water construction projects require federal authorization.

Using this information, we calculate the SH currently available in CHEU using the following equation:

$$SH\ currently\ available\ (CHEU) = SH\ at\ time\ of\ species\ listing - (SH\ lost\ prior\ to\ critical\ habitat\ designation + SH\ lost\ since\ critical\ habitat\ designation)$$
$$SH\ currently\ available\ (CHEU) = 84,480\ ac\ - (16.17\ ac + 20.59\ ac)$$
$$SH\ currently\ available\ (CHEU) = 84{,}443.24\ ac \text{ (Table 3, Line 4)}$$

We calculate the amount of SH that must be maintained in the CHEU per Recovery Objective #2 using the following equation:

[5] Due to the high frequency of relatively small projects affecting smalltooth sawfish critical habitat, NMFS updates shallow, euryhaline habitat losses quarterly based on the U.S. federal fiscal year (December 31, March 31, June 30, September 30).

$$SH\ that\ must\ be\ maintained\ (CHEU) = SH\ at\ time\ of\ species\ listing\ \times 95\%$$
$$SH\ that\ must\ be\ maintained\ (CHEU) = 84{,}480\ ac\ \times 0.95$$
$$SH\ that\ must\ be\ maintained\ (CHEU) = 80{,}256\ ac\ (\text{Table 3, Line 5})$$

The proposed action would result in the permanent loss of 0.005280 ac only of SH (Table 3, Line 6). Using the above results, we estimate the total amount of SH lost in the CHEU since species listing, including losses from the proposed action using the following equation:

$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = [(SH\ lost\ due\ to\ this\ project + SH\ lost\ prior\ to\ critical\ habitat\ designation + SH\ lost\ since\ critical\ habitat\ designation) \div Total\ SH\ at\ time\ of\ species\ listing] \times 100$$
$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = [(0.005280\ ac + 16.17\ ac\ + 20.59\ ac) \div 84{,}480\ ac] \times 100$$
$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = (36.765280\ ac \div 84{,}480\ ac) \times 100$$
$$\%\ SH\ lost\ since\ species\ listing\ (CHEU) = 0.043520\%\ (Table\ 3, Line\ 7)$$

Thus, we estimate the percent of SH remaining within the CHEU as:

$$\%\ SH\ remaining\ (CHEU) = 100\% - \%\ SH\ lost\ since\ species\ listing\ (CHEU)$$
$$\%\ SH\ remaining\ (CHEU) = 100\% - 0.043520\%$$
$$\%\ SH\ remaining\ (CHEU) = 99.965480\%\ (Table\ 3, Line\ 8)$$

Table 6. Summary of Impacts to the Shallow, Euryhaline Habitat Essential Feature

Shallow, Euryhaline Habitat in the CHEU		**Acres**
1.	Available at the time of species listing	84,480
2.	Losses prior to critical habitat designation	16.17
3.	Losses since critical habitat designation	20.59
4.	Available as of September 30, 2017	84,443.24
5.	Area that must be maintained per Recovery Plan	80,256 (95% of 84,480)
6.	Affected by the proposed action	0.005280
7.	Affected since species listing (including the proposed action)	36.765280 (0.043520% of 84,480)
8.	Remaining	84,443.234720 (99.956480% of 84,480)

Red Mangrove Essential Feature Impacts

Remote sensing data from FWRI indicated that approximately 5,512,320 lin feet of red mangrove shoreline (abbreviated RM throughout this section) was available in the CHEU at the effective date of species listing (i.e., May 1, 2003) (Table 4, Line 1). As described above, we must determine whether project impacts will interfere with long-term maintenance of this

essential feature at or above 95% of the linear feet of habitat available at the time of listing; however, loss of critical habitat was not formally monitored until the effective date of critical habitat designation (i.e., October 2, 2009). Therefore, we must estimate habitat loss that occurred during the period between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009).

To do this, we use an 84-month dataset of our completed Section 7 consultations (October 3, 2009 – September 30, 2016), including yearly losses due to programmatic consultations, to generate a rate of loss that can then be used to back-calculate the loss of RM between the effective date of species listing and the effective date of critical habitat designation. We rely on this dataset because using approximately 7 years of information helps avoid over- or under-estimating the rate of habitat loss due to any potential inter-annual variability associated with economic growth and contraction that may have occurred in that time. NMFS consultations completed during this time indicate that 9,142.50 lin ft of RM in CHEU was lost due to federal agency actions.

Based on these losses, we estimate a monthly loss rate of RM using the following equation:

$$Monthly\ loss\ rate\ of\ RM\ (CHEU) = RM\ lost\ through\ federal\ agency\ actions \div 84\ months$$
$$Monthly\ loss\ rate\ of\ RM\ (CHEU) = 9{,}142.50\ lin\ ft \div 84\ months$$
$$Monthly\ loss\ rate\ of\ RM\ (CHEU) = 108.84\ lin\ ft\ per\ month$$

Assuming the same monthly loss rates, we back-calculate the loss of RM in the 77 months between the effective date of species listing and the effective date of critical habitat designation (i.e., May 1, 2003 – October 2, 2009) in the CHEU using the following equation:

$$RM\ loss\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 108.84\ lin\ ft\ per\ month \times 77\ months$$
$$RM\ loss\ prior\ to\ critical\ habitat\ designation\ (CHEU) = 8{,}380.68\ lin\ ft\ (Table\ 4, Line\ 2)$$

Next, we determine the loss of RM since the effective date of critical habitat designation. From the effective date of critical habitat designation through September 30, 2017, 11,818.75 lin ft of RM in the CHEU has been lost due to federal agency actions (Table 4, Line 3).[6] While this amount of loss only takes into account projects with a federal nexus requiring ESA section 7 consultation, there are very few projects without a federal nexus that could affect red mangrove shoreline in the CHEU as most in-water construction projects require federal authorization.

Using this information, we calculate the RM currently available in the CHEU using the following equation:

[6] Due to the high frequency of relatively small projects smalltooth sawfish critical habitat, NMFS updates red mangrove shoreline losses quarterly based on the U.S. federal fiscal year (December 31, March 31, June 30, September 30).

$$RM\ currently\ available\ (CHEU)$$
$$= RM\ at\ time\ of\ species\ listing$$
$$- (RM\ loss\ prior\ to\ critical\ habitat\ designation$$
$$+ RM\ loss\ since\ critical\ habitat\ designation)$$
$$RM\ currently\ available\ (CHEU) = 5{,}512{,}320\ lin\ ft - (8{,}380.68\ lin\ ft + 11{,}818.75\ lin\ ft)$$
$$RM\ currently\ available\ (CHEU) = 5{,}492{,}120.57\ lin\ ft\ (Table\ 4, Line\ 4)$$

We calculate the amount of RM that must be maintained in the CHEU using the following equation:

$$RM\ that\ must\ be\ maintained\ (CHEU) = RM\ at\ time\ of\ species\ listing \times 95\%$$
$$RM\ that\ must\ be\ maintained\ (CHEU) = 5{,}512{,}320\ lin\ ft \times 0.95$$
$$RM\ that\ must\ be\ maintained\ (CHEU) = 5{,}236{,}704\ lin\ ft\ (Table\ 4, Line\ 5)$$

The proposed action would result in the loss of only 40 lin ft of RM (Table 4, Line 6). Using the above results, we estimate the total amount of RM lost in the CHEU since species listing, including losses from the proposed action using the following equation:

$$\%\ RM\ lost\ in\ CHEU\ since\ species\ listing$$
$$= [(RM\ loss\ due\ to\ this\ project$$
$$+\ RM\ lost\ prior\ to\ critical\ habitat\ designation$$
$$+ RM\ lost\ since\ critical\ habitat\ designation)$$
$$\div Total\ RM\ in\ CHEU\ at\ time\ of\ species\ listing] \times 100$$
$$\%\ RM\ lost\ in\ CHEU\ since\ species\ listing$$
$$= [(40\ lin\ ft + 8{,}380.68\ lin\ ft + 11{,}818.75\ lin\ ft) \div 5{,}512{,}320\ lin\ ft] \times 100$$
$$\%\ RM\ lost\ in\ CHEU\ since\ species\ listing = (20{,}239.43\ lin\ ft\ \div 5{,}512{,}320\ lin\ ft) \times 100$$
$$\%\ RM\ lost\ in\ CHEU\ since\ species\ listing = 0.367167\%\ (\text{Table 4, Line 7})$$

Thus, we estimate the percent of RM remaining within the CHEU as:

$$\%\ RM\ remaining\ (CHEU) = 100\% - \%\ RM\ lost\ since\ species\ listing\ (CHEU)$$
$$\%\ RM\ remaining\ (CHEU) = 100\% - 0.367167\%$$
$$\%\ RM\ remaining\ (CHEU) = 99.632833\%\ (Table\ 4, Line\ 8)$$

Table 7. Summary of Impacts to the Red Mangrove Essential Feature

Red Mangrove Shoreline in the CHEU		**Linear Feet**
1.	Available at the time of species listing	5,512,320
2.	Losses prior to critical habitat designation	8,380.68
3.	Losses since critical habitat designation	11,818.75
4.	Available as of September 30, 2017	5,492,120.57
5.	Linear feet that must be maintained per Recovery Plan	5,236,704 (95% of 5,512,320)
6.	Affected by the proposed action	40

Red Mangrove Shoreline in the CHEU		Linear Feet
7.	Affected since species listing (including the proposed action)	20,239.43 (0.367167% of 5,512,320)
8.	Remaining	5,492,080.57 (99.632833% of 5,512,320)

Summary of Effects on the Essential Features

Very small percentages of the essential features of smalltooth sawfish designated critical habitat have been affected by federal agency actions since the effective date of species listing. Including losses from this project, 99.956480% of the SH essential feature (Table 3, Line 8) and 99.632833% of the RM essential feature (Table 4, Line 8) available at the time of species listing remain in the CHEU. Thus, the loss of essential features associated with the proposed action, in combination with losses since we listed the species, does not provide any impediment to effectively protecting 95% of juvenile habitat in the CHEU available at the effective date of species listing, and therefore will not be an impediment to Recovery Objective #2.

8.3. Recovery Objective 3: Ensure that Smalltooth Sawfish Abundance Increases Substantially

In establishing Recovery Objective #3, we recognized that it was important that sufficient numbers of juvenile sawfish inhabit several nursery areas across a diverse geographic area to ensure survivorship and growth and to protect against the negative effects of stochastic events within parts of their range. To meet this objective, Recovery Region G (i.e., CHEU) must support sufficiently large numbers of juvenile sawfish to ensure that the species is viable in the long-term and can maintain genetic diversity. Recovery Objective #3 requires that the relative abundance of small juvenile sawfish (< 200 cm) either increases at an average annual rate of at least 5% over a 27-year period, or juvenile abundance is at greater than 80% of the carrying capacity of the recovery region.

Assessing the effect of the proposed action on small juvenile abundance is made difficult by the state of available data. Since the designation of critical habitat and the release of the recovery plan in 2009, ongoing studies have been in place to monitor the U.S. DPS of smalltooth sawfish. FWC FWRI is conducting a study in the CHEU that is supported primarily with funding provided by NMFS through the ESA Section 6 Species Recovery Grants Program, while Florida State University, also funded by NMFS through ESA Section 6, and the NOAA NMFS Southeast Fisheries Science Center Panama City Laboratory and have focused studies in the Ten Thousand Islands/Everglades Unit (TTIEU). The intent of these studies is to determine the abundance, distribution, habitat use, and movement of juvenile sawfish. Given the limited duration of the study in the CHEU (September 2009-current), there is not yet enough data to discern the trend in juvenile abundance within that Unit. Early indications are that juvenile sawfish are at least stable and likely increasing in the CHEU, due in large part to ESA-listing of the species and designation of critical habitat. While it may be too early to state definitively that juveniles within CHEU are surviving to adulthood, researchers consistently capture newborn smalltooth sawfish, particularly within "hot spots," indicating adult smalltooth sawfish are pupping within Recovery Region G. Available data from the adjacent Recovery Region H (i.e., TTIEU) indicate that adult smalltooth sawfish are also reproducing within this recovery region and that the

juvenile population trend is at least stable and possibly increasing—though variability is high (Carlson and Osborne 2012; Carlson et al. 2007). With no other data to consider, the abundance trend in the TTIEU represents the best data available for assessing the population trends in the CHEU. Therefore, we do not believe the loss of habitat associated with the proposed action, in combination with the losses to date, will impede the 5% annual growth objective for the juvenile population within Recovery Region G.

9. CONCLUSION

After reviewing the current status of smalltooth sawfish critical habitat, the environmental baseline, and the cumulative effects, it is our opinion that the 0.005280 ac (230ft^2) of shallow, euryhaline essential feature and the loss of 40 lin ft (276ft^2) of red mangrove essential feature from the shoreline armoring will not interfere with achieving the relevant habitat-based recovery objectives for smalltooth sawfish. Therefore, we conclude the proposed action will not impede the critical habitat's ability to support the smalltooth sawfish's conservation, despite permanent adverse effects. Given the nature of the proposed action and the information provided above, we conclude that the action, as proposed, is likely to adversely affect, but is not likely to destroy or adversely modify, smalltooth sawfish critical habitat.

10. INCIDENTAL TAKE STATEMENT

NMFS does not anticipate that the proposed actions will incidentally take any species and no take is authorized. Nonetheless, any takes of smalltooth sawfish or sea turtles shall be immediately reported to takereport.nmfsser@noaa.gov. Refer to the present Biological Opinions by title, issuance date, NMFS PCTS identifier number SER-2016-18237 for Advaniara Seawall Project 1, SER-2016-18238 for Advaniara Seawall Project 2 and SER-2016-18258 for Manfred Waldinger Seawall Project. At that time, consultations must be reinitiated.

11. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations identified in Biological Opinions can assist action agencies in implementing their responsibilities under Section 7(a)(1). Conservation recommendations are discretionary activities designed to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The following conservation recommendations are discretionary measures that NMFS believes are consistent with this obligation and therefore should be carried out by the federal action agency:

1. Continue public outreach and education on smalltooth sawfish and smalltooth sawfish critical habitat, in an effort to minimize interactions, injury, and mortality.

2. Provide funding to conduct directed research on smalltooth sawfish that will help further our understanding about the species (e.g., implement a relative abundance monitoring program which will help define how spatial and temporal variability in the physical and biological environment influence smalltooth sawfish) in an effort to predict long-term

changes in smalltooth sawfish distribution, abundance, extent, and timing of movements.

3. Fund surveys of detailed bathymetry and mangrove coverage within smalltooth sawfish critical habitat. Lee County and the USACE recently funded such surveys within the Cape Coral municipality. Data is needed from other municipalities within the CHEU to establish a more accurate baseline assessment of both critical habitat features (red mangroves and shallow-water areas).

4. Fund and support restoration efforts that rehabilitate and create shallow, euryhaline and mangrove fringe habitats within the range of smalltooth sawfish.

To stay abreast of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, we request notification of the implementation of any conservation recommendations.

12. REINITIATION OF CONSULTATION

This concludes NMFS's formal consultation on the proposed actions. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal action agency involvement or control over the action has been retained, or is authorized by law, and if (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this Opinion, (3) the agency actions are subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

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