**ANNEX 5:** Endangered Species Act Consultation

Section 7(a)(2) of the Endangered Species Act (ESA) Consultation Timeline.

- On August 15, 2025, USACE utilized the Application for Information and Planning Consultation (IPaC), developed by the U.S. Fish and Wildlife Service (USFWS), which resulted in a determination of "may affect, not likely to adversely affect" for listed species or critical habitats.

- On August 28, 2025, USACE sent a follow-up consultation letter for all species listed in the August 15, 2025 IPaC and determined that the proposed action for the subject project may affect but will not likely adversely affect any threatened or endangered species or their associated critical habitat under the jurisdiction of the Service .

- The USFWS concurred with USACE's determination of "may affect but is not likely to adversely affect" and returned a copy of USACE's letter and enclosures with their office stamp of concurrence dated September 4, 2025 (on the August 15, 2025 IPaC document) thus concluding consultation under Section 7(a)(2) of the ESA.

- A copy of the April 2025 USACE Biological Assessment titled, "Bonnet Carré Spillway Operations" is incorporated for reference purposes as it is both geographically relevant and a reasonably foreseeable federal action that is occurring where the project proposes to obtain borrow material for levee construction.

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Louisiana Ecological Services Field Office
200 Dulles Drive
Lafayette, LA 70506
Phone: (337) 291-3100 Fax: (337) 291-3139

In Reply Refer To: 08/15/2025 12:00:30 UTC
Project code: 2025-0135083
Project Name: IHNC Lock Replacement Study - Project Area

Subject: Technical Assistance letter for the project named 'IHNC Lock Replacement Study - Project Area' for specified threatened and endangered species that may occur in your proposed project location pursuant to the Louisiana Endangered Species Act project review and guidance for other federal trust resources determination key (Louisiana DKey).

Dear Mark Lahare:

The U.S. Fish and Wildlife Service (Service) received on August 15, 2025 your effects determination(s) for the 'IHNC Lock Replacement Study - Project Area' (the Action) using the Louisiana DKey within the Information for Planning and Consultation (IPaC) system. The Service developed this system in accordance with the Endangered Species Act of 1973 (ESA) (87 Stat.884, as amended; 16 U.S.C. 1531 et seq.).

Based on your answers, and the assistance in the Service's Louisiana DKey, you made the following effect determination(s) for the proposed Action:

| Species | Listing Status | Determination |
|---|---|---|
| Pallid Sturgeon (*Scaphirhynchus albus*) | Endangered | May affect |
| West Indian Manatee (*Trichechus manatus*) | Threatened | NLAA |

**Consultation with the Service is not complete.** Further consultation or coordination with the Louisiana Ecological Services Office is necessary for those species with a determination of "may affect" listed above. Please contact our office at 337-291-3100 or lafayette@fws.gov to discuss methods to avoid or minimize potential adverse effects to those species.

This IPaC-generated letter only applies to the species in the above table and **does not** apply to the following ESA-protected species that also may occur in the Action Area:

- Alligator Snapping Turtle *Macrochelys temminckii* Proposed Threatened
- Monarch Butterfly *Danaus plexippus* Proposed Threatened
- Tricolored Bat *Perimyotis subflavus* Proposed Endangered

**Please Note:** If the Federal Action may impact bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) may be required. Please contact Ulgonda Kirkpatrick (phone: 321/972-9089, e-mail: ulgonda_kirkpatrick@fws.gov) with any questions regarding potential impacts to bald or golden eagles.

The Fish and Wildlife Service (Service) has reviewed the information provided and offers the following comments in accordance with the provisions of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended, 16 U.S.C. 1531 et seq.). Based on the description of the proposed action and the responses you provided while using the Information, Planning, and Conservation (IPaC) system for project review, we concur with the Federal Action Agency's Section 7 ESA determination that the implementation of the proposed action is "not likely to adversely affect" the federally listed species analyzed in this consultation.

The Federal Action Agency may need to reassess the potential impacts of the project on federally protected species if any of the following occur: (1)The scope or location of the proposed project is changed; (2) New information reveals that the action may affect listed species or designated critical habitat; (3)The action is modified in a manner that causes effects to listed species or designated critical habitat; or (4) A new species is listed, or critical habitat is designated.

Deputy Field Supervisor

09/04/2025

Brigette D. Firmin
DATE

FOR Field Supervisor
Louisiana Ecological Services Office

**Action Description**
You provided to IPaC the following name and description for the subject Action.

**1. Name**

IHNC Lock Replacement Study - Project Area

**2. Description**

The following description was provided for the project 'IHNC Lock Replacement Study - Project Area':

> Construction of the new lock north of Claiborne Avenue would require a complex sequence of tasks. It is anticipated that the entire construction process could take up to 14 years to complete, if adequate funding is provided (project construction would begin in year 2033 and end in year 2047, with Engineering and Design beginning in Fiscal Year 2029. (see Figure 2).
>
> Project Construction Major Features Years 1-14:
> Years 1-2.
> • Install Outer Wall of Cofferdam at New Lock Site
> • Dredge Bypass Channel
>
> Years 3-9.
> • Install Remainder of Cofferdam
> • Unwater New Lock Site
> • Construct New Lock
>
> Years 9-14.
> • Remove Cofferdam and Backfill
> • Construct Flood walls and Levee(s)
> • Construct New St. Claude Avenue Bridge
> • Demolish Existing Lock and St. Claude Avenue Bridge
>
> Dredged Material Management and Disposal Plan
>
> Soils and sediments that require excavation for project construction have been thoroughly evaluated under regulations and procedures developed under requirements of the Clean Water Act and may be divided into two categories: Approximately 614,000 cubic yards of dredged material that would be excavated from Dredged Material Management Units (DMMUs) 3, 4, 6, 9, and 10 is “suitable for open water discharge” (see Figure 3 for DMMU Map). This material is non-toxic to sensitive benthic organisms, does not contain contaminants at concentrations that would adversely bioaccumulate or bio-magnify in aquatic food webs, and would not violate or exceed regulatory water quality criteria or drinking

water standards upon discharge into the proposed Mississippi River open-water disposal site. The dredged material would mix with the river's normal suspended and bedload sediments and be carried downstream. Approximately 105,000 cubic yards of dredged material that would be excavated from DMMUs 5 and 7 is "unsuitable for open water discharge" because it is toxic to sensitive benthic organisms. This material would be excavated with an environmental bucket dredge to minimize on-site loss of material and turbidity and would be hauled to and permanently disposed in a permitted solid waste landfill.

• Dredging depths and widths required for this plan do not warrant vertical or lateral subdivision of DMMUs into "native layer" and "fill" categories as for previously evaluated deep draft lock alternatives. However, results from chemical and biological testing of the material within these DMMUs were utilized in assessing current dredged material disposal alternatives in that contaminant maximums and worst-case toxicity determinations for overlapping units were considered to represent a dredging unit. As an example, testing results from the non-native or fill layer of DMMU 7 which contained higher levels of contaminants than the native layer was used to represent the entire unit, and were not averaged or weighted with native and fill layers.
• DMMUs previously evaluated for deeper lock alternatives that have sufficient depth and would not be dredged as part of this plan are DMMUs 1, 2, 8, and 11 (IHNC Channel).
• Approximately 106,100 cubic yards of sediment would need to be dredged to construct the bypass channel. The majority of this dredged material – approximately 70,000 cubic yards from DMMU 6 – is suitable for open water placement and would be discharged into the Mississippi River. The remaining dredged material, about 36,000 cubic yards from DMMU 7, is not suitable for discharge into the Mississippi River and would be bucket dredged and disposed of in a solid waste landfill.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@29.96969495,-90.02503322694535,14z

# QUALIFICATION INTERVIEW

1. Does the proposed action involve **wind or solar energy**?

   *No*

2. Is the action authorized, funded, or being carried out by a Federal agency?

   *Yes*

3. Is the action authorized, funded, or being carried out by the:

   *a. U.S Army Corps of Engineers*

4. Please identify your agency or organization type:

   *a. Federal agency*

5. Have you determined that the project will have "no effect" on federally listed species? (If unsure select "No")

   *No*

6. Are you with the U.S. Army Corps of Engineers Regulatory Division?

   *No*

7. Are you with the U.S. Army Corps of Engineers Planning Division?

   *Yes*

8. Is the action part of a Civil Works project?

   *Yes*

9. Does the action result in the discharge of fill into wetlands that meets the *de minis* standard?

   *Yes*

10. [Hidden Semantic] Does the project intersect the west indian manatee AOI?

    **Automatically answered**
    *Yes*

11. (Semantic) Is the project located within the manatee consultation zone, excluding the Mississippi River?

    **Automatically answered**
    *Yes*

12. Is the project footprint entirely on land?

    *No*

13. Is the water depth within the project greater than 2 feet (at mean high tide)?

    *Yes*

14. Will the project occur during the months of June through November?

    *Yes*

15. Will the following Standard Manatee Conditions for in-Water Activities be included as permit conditions?

    *Yes*

16. [Hidden Semantic] Does the project intersect the pink mucket mussel AOI ?

    **Automatically answered**
    *No*

17. [Hidden Semantic] Does the project intersect the pallid sturgeon AOI?

    **Automatically answered**
    *Yes*

18. Will the project result in riverine pathway obstruction (such as construction of dams, hydropower plants, etc.)?

    *Yes*

19. (Semantic) Does the project intersect the Louisiana black bear Range?

    **Automatically answered**
    *No*

# IPAC USER CONTACT INFORMATION

Agency: Army Corps of Engineers
Name: Mark Lahare
Address: 7400 Leake Avenue
City: New Orleans
State: LA
Zip: 70118
Email mark.h.lahare@usace.army.mil
Phone: 5048621344

**DEPARTMENT OF THE ARMY**
**U.S. ARMY CORPS OF ENGINEERS, NEW ORLEANS DISTRICT**
**7400 LEAKE AVE**
**NEW ORLEANS LA 70118-3651**

August 28, 2025

Regional Planning and
Environment Division South
Environmental Compliance Branch

Ms. Brigette Firmin
Field Supervisor
U.S. Fish and Wildlife Service
200 Dulles Drive
Lafayette, Louisiana 70506

Dear Ms. Firmin:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is reinitiating consultation with your office for threatened or endangered species per Section 7 of the Endangered Species Act (ESA) for replacing the navigation lock on the Inner Harbor Navigation Canal, also known as the IHNC and Industrial Canal, in New Orleans, Louisiana. Prior ESA consultation for a plan to replace the IHNC Lock was completed during preparation of a 2017 draft general reevaluation report (GRR) with an integrated supplemental environmental impact statement (SEIS). Pursuant to Section 7 of the ESA, the CEMVN consulted with the U.S. Fish and Wildlife Service (USFWS) by letter dated January 23, 2017, and determined that the proposed project would not likely adversely affect any threatened or endangered species under the purview of the USFWS (West Indian manatee, pallid sturgeon) and would have no effect on Atlantic sturgeon and Sprague's pipit. The USFWS concurred with CEMVN's not likely to adversely affect determination and returned a copy of CEMVN's letter with their official stamp of concurrence dated March 6, 2017. On May 30, 2025, the CEMVN released a supplemental draft GRR with an integrated SEIS titled Mississippi River, Baton Rouge to the Gulf of Mexico Mississippi River-Gulf Outlet (MRGO), Louisiana, New Industrial Canal Lock and Connecting Channels. As you may be aware, this project has a long history and is now in a reevaluation phase. This updated ESA assessment and determination summarizes current efforts to evaluate the feasibility of constructing a new navigation lock and provides an assessment of potential effects on several threatened or endangered species under USFWS purview.

*Study Area*

The IHNC and existing lock connects the Mississippi River and Lake Pontchartrain and provides a connection with the GIWW and the remaining authorized portion of the Mississippi River-Gulf Outlet. The existing lock is 640 feet long by 75 feet wide by -31.5 feet North American Vertical Datum 1988 (NAVD88) and is located on the left descending bank at Mississippi River Mile 92.6 above Head of Passes (Figure 1).

*Study Authority*

Public Law 455 (PL 84-455), Chapter 112, 84th Congress, 2nd Session, approved March 29, 1956 (1956 Act), authorized construction of the Mississippi River-Gulf Outlet (MR-GO), a navigation channel, which was completed in the mid-1960s. The 1956 Act also modified the existing Mississippi River, Baton Rouge to the Gulf of Mexico project to provide for replacement of the existing IHNC Lock, or an additional lock with suitable connections when replacement was found by the Chief of Engineers to be economically justified by obsolescence of the existing industrial canal lock or by increased traffic. Replacement of the existing lock or an additional lock with suitable connections was approved to be constructed in the vicinity of Meraux, Louisiana, with type, dimensions, and cost estimates to be approved by the Chief of Engineers. The Water Resources Development Act (WRDA) of 1986, Section 844 (PL 99-62) modified the 1956 Act authorization language to state that the replacement and expansion of the existing IHNC Lock and connecting channels or the construction of an additional lock and connecting channels shall be in the area of the existing lock site or at the Violet, Louisiana site. WRDA 1996, Section 326 (PL 104-303), amended Section 844 of WRDA 1986 to include the implementation of a comprehensive community impact mitigation plan, as described in the preliminary draft evaluation report by the New Orleans District Engineer dated August 1995, and, to the maximum extent practicable, provides for mitigation or compensation, or both, for the direct and indirect social and cultural impacts that the project will have on the affected areas.

*Study Purpose and Need*

The existing deep-draft IHNC navigation lock[1] is obsolete and is not efficient. Since the beginning of lock operations in 1923, the types of vessels utilizing the navigation lock has changed and the dimensions of waterborne vessels typically utilizing the lock has increased. As far back as the 1950s, the number of deep-draft vessels was declining. In the 1940s, when the GIWW was directly connected to the IHNC, the number of shallow-draft vessels (typically inland waterborne commerce) began increasing. As shallow-draft vessel numbers were increasing, the size of shallow-draft vessels was also increasing as industry standards changed. The inefficiency of the lock is related to the inability to "pack" multiple large shallow-draft vessels in the lock chamber in order to move as many vessels as possible during each lockage. The size of the largest shallow-draft (or inland navigation) vessels has essentially reached an industry maximum size of nearly 55-feet wide by 300-feet. While the overall tonnage of commodities passing through the existing lock is expected to slowly increase into the future, the percentage of large shallow-draft vessels locking through the IHNC is also expected to increase. Currently, the percentage of shallow-draft traffic that is greater than 900 feet in length passing through the IHNC is already over 50 percent of all traffic locking through the IHNC; and that proportion is not expected to decline. Furthermore, the age of the lock has led to increased costs associated with the operation and

[1] The existing lock is 640ft.L x 75ft.W x -31.5ft. NAVD88.

maintenance of the lock, including more and more frequent maintenance events. The purpose of a new lock is to provide a more efficient locking process by increasing lock capacity, to increase the reliability of the lock, as well as to reduce operation and maintenance costs and related delays.

*2017 Draft GRR and SEIS History*

In January 2017, USACE previously released an integrated Draft GRR and SEIS, evaluating four IHNC navigation lock replacement plans, to be constructed within the IHNC at a site between the Claiborne Avenue and Florida Avenue Bridges, as well as a No-Action plan in the final array of alternatives:

- Plan 1 – No-Action
- Plan 2 - *900 feet long x 75 feet wide x -22 feet deep (NAVD88)*
- Plan 3 - *900 feet long x 110 feet wide x -22 feet deep (NAVD88)*
- Plan 4 - *1,200 feet long x 75 feet wide x -22 feet deep (NAVD88)*
- Plan 5 - *1,200 feet long x 110 feet wide x -22 feet deep (NAVD88)*.

In the 2017 Draft GRR/SEIS, Plan 3, the 900-foot-long by 110-foot-wide lock configuration, was found to result in the greatest net excess benefits over the other potential plans and was identified as the National Economic Development plan and the Recommended Plan.

After the draft 2017 report, USACE revised the proposed plan to include: construction of a 900ft.L x 110ft.W x -22ft. shallow draft cast-in-place concrete lock and associated support structures and facilities; construction of a permanent double leaf bascule bridge north of the existing St. Claude Avenue bridge, which would require acquisition of a small number of residential properties, demolition of the existing St. Claude Ave. bridge; a by-pass channel around the new lock construction site; disposal of dredged material suitable for aquatic disposal into the Mississippi River and disposal of material that is not suitable for aquatic disposal in an approved solid waste landfill site; and extension of the Mississippi River flood risk reduction levees and floodwalls along the banks of the IHNC to the site of the new lock and demolition of existing floodwalls. The revision eliminated the need for a temporary by-pass bridge north of the existing St. Claude Bridge as well as the placement of a light rail on the new permanent bridge and its approaches.

Before finalizing a report, USACE determined it would take additional steps to ensure that impacts of the project would be addressed, including updating and reformulating the Community Impact Mitigation Plan, completing a traffic analysis and developing a Traffic Mitigation Program, and developing a plan to avoid pre-existing contamination at the former Coast Guard facility. While undertaking those efforts, USACE also further refined the lock project design. Due to the extent of the changes since the draft 2017 report, USACE has prepared a 2025 supplemental draft GRR/SEIS to address changes since the 2017 draft GRR/SEIS. The following project description details changes to the project since the 2017 report.

*2025 Supplemental Draft GRR and SEIS Recommended Plan and Description*

Construction of the new lock north of Claiborne Avenue would require a complex sequence of tasks. It is anticipated that the entire construction process could take up to 14 years to complete, if adequate funding is provided (project construction would begin in year 2033 and end in year 2047, with Engineering and Design beginning in Fiscal Year 2029. (see Figure 1).

*Project Construction Major Features Years 1-14*

Years 1-2.

- Install Outer Wall of Cofferdam at New Lock Site
- Dredge Bypass Channel

Years 3-9.

- Install Remainder of Cofferdam
- Unwater New Lock Site
- Construct New Lock

Years 9-14.

- Remove Cofferdam and Backfill
- Construct Flood walls and Levee(s)
- Construct New St. Claude Avenue Bridge
- Demolish Existing Lock and St. Claude Avenue Bridge

*Project Construction Years 1-2*

- A cofferdam around the new lock construction site is required so that the site can be unwatered. Foundational support is required for the cofferdam; therefore, jet grouting of the canal bottom sediments utilizing barge-mounted equipment would be performed to strengthen the sediments. The soil improvements would occur prior to placement of sheeting for the cofferdam. The required sheet pile tip elevation for the cofferdam is elevation -90 feet (NAVD 88). The sheet pilings would be placed using a barge-mounted vibratory hammer to form cell walls, and the interior of the cofferdam cells would be filled with sand to an elevation of +3.5 feet (NAVD 88) (Figure 3).
- The north-south section (eastern wall) of the cofferdam would be constructed within the IHNC as the first actual construction feature of the project. Construction of this part of the cofferdam in the navigation channel would separate two distinct dredging areas, namely the new lock construction site on the west side and the north bypass channel on the east side. The lock construction site and the bypass channel require excavation to significantly different depths. Although the sill elevation of the lock is -22 feet (NAVD88), the dredging depth required for the new lock site is elevation -33 feet (NAVD 88).

The additional 11 feet are needed to allow for placement of base and stabilization slabs. For the north bypass channel, the required elevation is -17 feet (NAVD 88). This depth includes 2 feet for advanced dredging and 1 foot over dredging to eliminate periodic maintenance dredging during construction.

- A temporary bypass channel would be excavated between the north-south cofferdam section and the new Mississippi River levee located along the east bank of the IHNC. Some of the existing east bank of the IHNC may need to be removed. The bypass channel would accommodate vessel traffic around the new lock construction site. To protect the east bank of the IHNC and cofferdam, and the vessels transiting the bypass channel, tugboats would be permanently stationed to assist vessels transiting the area. In addition, protection cells would be placed along the west side of the bypass channel to protect the cofferdam. All vessel traffic would be rerouted through the bypass channel while the new lock is being constructed.
- Once the bypass channel is operational, the new lock site would be dredged by a combination of hydraulic and bucket dredges. Approximately 69,000 CY of dredged material from Dredged Material Management Unit (DMMU) 5 is unsuitable for discharge into the aquatic environment and would be bucket dredge and disposed of in a solid waste landfill. An additional 278,000 cubic yards of dredged material would be removed from the new lock site (DMMUs 3 and 4) by hydraulic dredging. That material is suitable for disposal in the freshwater aquatic environment and would be discharged into the Mississippi River.

*Project Construction Years 3-9*

- After completing the dredging work at the new lock site, the east-west sections (northern and southern walls) of the cofferdam would be constructed to close the cofferdam for unwatering. Unwatering of the cofferdam would be accomplished with a combination of pumps, sumps, and wells, including pressure relief wells. All water collected within the cofferdam would be pumped into the IHNC.
- Foundation pilings would be driven within the unwatered cofferdam to support the concrete pours of the lock module. Foundation pilings would consist of 24-inch x 24-inch precast, pre-stressed concrete pilings spaced on approximately 10-foot centers with tighter spacing under lock module walls. A total of 1,386 vertical pilings would be driven to a depth of 136 feet below grade. Either a vibratory or impact hammer, or a combination of both, would be used for pile driving. Concrete pours for the lock modules would begin at the location for the gates and work inward to the chambers. Alternate sections of the module would be poured, and some concrete pours may need to occur at night with the use of lighting due to concrete technical restrictions. An on-site concrete batch plant would be necessary, and nearby staging areas for construction materials and parking area for construction workers would be required (Figure 4).

- Floodwall and levee segments outside of the immediate cofferdam location and underneath the St. Claude Avenue Bridge will be constructed throughout the duration with the main efforts falling in years 2-7.

*Project Construction Years 9-14*

- Following completion of the lock modules, the cofferdams would be removed and the area re-watered. Areas around the lock modules would be backfilled with excess sand from the cofferdams and earthen fill material. Starting on the southwest side of the project, the new floodwall will tie-in into the existing wall on the west of the existing IHNC Lock. The new floodwall will tie to the new lock on the west side. Starting on the southeast side of the project, the new levee will tie into the existing MRL levee on the east side of the existing IHNC Lock and travel to the new lock tie-in wall on the east side. The new floodwall segments under the St. Claude and North Claiborne Ave bridges will tie to the new levees on the east side. The new levee will consist of 1V:3H slopes, 10-ft crown, reinforcement geotextile, deep material mixing, riprap, and will be constructed to a final elevation of 24.5. Total cubic yards (CY) of Embankment, Compacted fill is 515,000 CY. The west side of the lock would be backfilled first, prior to opening the lock, so that the control house, maintenance and administration building, machinery building with emergency generators, paint shed, parking lot, and permanent access roadway can be constructed in that area and to avoid working on the west side of the lock while traffic is passing through the lock. The new lock would be expected to take approximately 8 years to build, years 2034 to 2041. The additional structures and facilities associated with the new lock are required in order to maintain operation and functionality of the lock. In addition, site access roads will be constructed for ingress and egress to these structures. The maintenance and administration building, parking lot, and access roadway is shown in Appendix B, Engineering, Annex 11, Plate Sheet C-103. During future detailed design, USACE will design and layout in further detail the various buildings to be constructed as part of the new lock and determine the logistics and suitable locations for the proposed structures.
- The proposed borrow sites for the levee are located within the Bonnet Carré Spillway and are approximately 45 acres and 18.5 acres, respectively. It is expected that the site would be cleared and grubbed prior to excavation, and then excavated to a pit depth of approximately –15.0 feet NAVD88, with side slopes of 1-foot vertical on 3-feet horizontal on all sides. Excavation activities would be conducted during dry or low water periods as much as practicable. Bulldozers would be utilized to clear the proposed borrow areas of any surface vegetation and earthen material deemed not suitable for the levee enlargement project. The vegetation and unsuitable earthen material removed would all be temporarily stockpiled on-site. Groundwater seeping into the pit would be pumped out into adjacent areas. Excavators would remove the earthen material deemed suitable for the levee project, which would be processed within the borrow sites to reduce the moisture content within the soil. Moisture content

processing will be performed by mechanical methods such as utilizing bulldozers to stockpile materials and disks to further reduce the moisture content of the soil. Once the moisture content has been reduced to acceptable levels, haul trucks would be utilized to transport material to the IHNC Lock site. It is anticipated that primary transportation routes would be utilized such as U.S. Hwy 61, I-310, I-10, I-610, LA Hwy 39 (North Claiborne Avenue), LA Hwy 46 (St. Claude Avenue), and Florida Avenue (Figure 7).

- The new lock would then be opened to navigation traffic in a pass-through mode and the bypass channel backfilled with earthen fill material. Completion of tie-ins to existing levee and floodwalls on both sides of the IHNC would be achieved after construction of the new lock, while the new lock remains in the pass-through mode (all gates open). Throughout this time, the existing lock would continue normal operation (Figure 8).
- The reconfiguration of the new lock would maintain flood risk reduction for the communities and remove the risk at the existing lock. The reconfiguration of the fronting of the new lock facing the Mississippi River will be brought to the appropriate design elevation and will maintain the level of risk reduction pursuant to the Mississippi River & Tributaries authority level of risk reduction. The Lake Pontchartrain and Vicinity levee system will tie into the new lock and maintain the storm risk reduction capability of the LPV project. IHNC construction will not interfere with the ability of the non-Federal sponsors of the LPV and MRL to operate and maintain appropriate levels of risk reduction.
- Once the new lock becomes operational and all new levees and floodwalls are constructed, the old lock would be put into pass-through mode. The new St. Claude Bridge would be constructed by building the bridge piers and protective dolphins, installing lift bridges and constructing the tie-in into the existing road. The floodwalls underneath the new bridge would be constructed as well.
- The new St. Claude Avenue bridge will be a 70 ft wide with two (2), 12 ft wide eastbound lanes and two (2), 12 ft wide westbound lanes. Four (4) foot shoulders are provided on the outside and minimum one-foot shoulders are provided on the inside. A 6-ft wide pedestrian/bicycle lane is provided on the outside edge of the eastbound lanes, separated by traffic with a concrete barrier. A 7-inch reinforced concrete slab/deck was preliminary sized for the bridge approaches. Eighteen-inch steel pipe piles were assumed to support the approach piers. Pile capacity curves used for the floodwalls were utilized for the pile tip selection. Initial design and quantities are based on a similar bascule bridge design constructed in another location. The foundation design will be site adapted for this project (pile design, bridge pier design, etc.). Bascule spans were selected to span the existing/future channel alignment and the demolition bypass channel alignment during demolition of the existing lock.
- Construction of the new St Claude Avenue Bridge will be phased such that thru traffic along the existing St. Claude Avenue Bridge will be maintained, with the exception of any typical bridge closures to pass navigation, for the entire construction duration. In the event that restriction of thru traffic is required for construction of tie-ins; closures will be minimized to nights and weekends during

low traffic volume periods. Additional details regarding traffic control will be developed with the Port of New Orleans, Louisiana Department of Transportation and Development (LA-DOTD) and the City of New Orleans during future detailed design.

- The proposed bridge deck elevation is (+) 39 ft, whereas the existing bridge deck elevation is approximately (+) 20 ft. However, the approach ramps have to tie back to the existing tie-ins along St. Claude Avenue at both Poland Avenue and Reynes Street. The approach ramps are steeper in grade than the existing ramps, but with the addition of longer vertical curves, still suitable for traffic. Three existing homes along the west side will require demolition in order to construct the new St. Claude bridge.
- Construction would begin on the replacement bridge approximately 10 years into the project construction and it would take approximately 36 months to complete. Demolition could take approximately 6 months for 2 lanes, or a total of 1 year to demolish all four lanes.
- The old St. Claude Bridge would then be demolished, and the floodwalls under the footprint of the now demolished bridge would be constructed. It is expected that it will take approximately 18 months to demolish the old lock and associated support structures and facilities, and the structural material hauled away to be salvaged or scrapped. About 181,000 CY of dredged material would then be removed from the lock demolition site (DMMU 9) with hydraulic and or mechanical dredges. This material is suitable for open water discharge into the Mississippi River, and most or all of it would likely be disposed there unless needed elsewhere for backfill. Upon completion, the new lock and connecting channels would be fully functional (Figures 9 and 10).

*Occurrence of Threatened and Endangered Species*

Several Federally-listed threatened or endangered species, and candidate species are either known to or may occur in the vicinity of the project area. These species are pallid sturgeon (*Scaphirhynchus albus*, endangered), Atlantic sturgeon (*Acipenser oxyrhynchus desotoi*, threatened), West Indian manatee (*Trichechus manatus*, endangered), alligator snapping turtle (*Macrochelys temminckii*, proposed threatened), monarch butterfly (*Danaus plexippus*, proposed threatened), and tricolored bat (*Perimyotis sublfavus*, proposed endangered).

*Pallid sturgeon*

The pallid sturgeon only occurs in large rivers within the Mississippi and Missouri River Basins from Montana to Louisiana. This includes the Mississippi River and Atchafalaya River in south Louisiana. The pallid sturgeon tends to select main channel habitats in the Mississippi River. Additional habitat descriptions state that the pallid sturgeon generally inhabits large, turbid, free-flowing riverine type environments with swift moving waters and rocky or sandy substrates (USFWS 1990). The species is long-lived, and spawning is believed to occur between June and August. Larval fish drift

downstream from the hatching site and settle in the lower portion of the water column 11 to 17 days after hatching (USFWS 2007). Anthropogenic alterations to the Mississippi River such as bend way cutoffs, tributary impoundments and channel erosion have led to changes in deposition and erosion patterns potentially affecting pallid sturgeon populations (USFWS 2007). Habitat decline for this species has been attributed to channelization of rivers and construction of reservoirs that ultimately reduce the amount of turbidity in the water, which is vital for the pallid sturgeon for not only feeding areas but also spawning habitat.

The IHNC is outside of the main current of the Mississippi River and there is no strong current flowing through the canal. Pallid sturgeons are normally found in moving water, so their presence in the IHNC is unlikely. Due to consistent vessel traffic stirring up sediments, it is unlikely that the IHNC channel bottom contains adequate food items for pallid sturgeon to forage. The floor and walls of the lock are/would be composed of concrete and pallid sturgeon are not likely to occur or forage in areas where the natural water bottom has been altered. The intake culverts of the lock are covered with grates and are expected to prevent pallid sturgeon from being pulled into the culverts while a vessel is locking through the structure. For the two proposed borrow areas, the excavation activities would have no impact on this species. It is anticipated that the proposed IHNC Lock construction project may affect but is not likely to adversely affect the pallid sturgeon.

*Atlantic sturgeon*

The Atlantic sturgeon is an anadromous fish that occurs in many rivers, streams, and estuarine waters along the northern Gulf coast between the Mississippi River and the Suwannee River, Florida (USFWS 2003). In Louisiana, the Atlantic sturgeon has been reported at Rigolets Pass, rivers and lakes of the Pontchartrain Basin, and adjacent estuarine areas, including the MR-GO inland reach. Spawning occurs in coastal rivers between late winter and early spring (i.e., March to May). Atlantic sturgeons are more likely to be in the inland reach of the Mississippi River Gulf Outlet during the winter months, (i.e., November 1 through March 31). Atlantic sturgeon less than 2 years old appear to remain in riverine habitats and estuarine areas throughout the year, rather than migrate to marine waters. Habitat alterations and poor water quality, especially in rivers used for spawning, hurricanes, toxic spills and over-fishing, have negatively affected this species.

Critical habitat for Atlantic sturgeon was designated in 2003. In Louisiana, Atlantic sturgeon have been reported at Rigolets Pass, in rivers and lakes of the Pontchartrain Basin, and adjacent estuarine areas, including the MR-GO inland reach (USFWS 2003). The Atlantic sturgeon critical habitat unit 8 includes the portion of Lake Pontchartrain east of the Causeway, all of Little Lake (Mud Lake), the Rigolets, Lake St. Catherine, Lake Borgne, and Mississippi Sound. No Atlantic sturgeon critical habitat exists within the areas that would be affected by the project. It is anticipated the proposed project would have no effect on Atlantic sturgeon or its designated critical habitat due to the

industrialized nature of the IHNC, the hydrodynamics within the IHNC (lack of water flow in the southern end of the canal), likely scarcity of prey items, lack of sandy water bottom for feeding, and the distance of the construction project from designated critical habitat Unit 8. The CEMVN has determined that the proposed project will have no effect on any threatened or endangered species including Atlantic sturgeon or its designated critical habitat Unit 8.

*West Indian manatee*

West Indian manatees can be found in shallow, slow-moving rivers, estuaries, salt-water bays, canals, and coastal areas (LDWF 2007). West Indian manatees are typically found in waters with dense submerged aquatic beds or floating vegetation where the species graze on a variety of aquatic plants. This species has been known to occasionally enter Lake Pontchartrain and associated coastal waters from June through September. Manatees have been reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution.

West Indian manatees occasionally enter Lake Pontchartrain and associated coastal waters from June through September and could pass through the project area or forage on nearby grass beds in Lake Pontchartrain. However, the likelihood of a manatee occurring in the project area is extremely low since the project area is outside of their normal range and no aquatic plants suitable as a food source are located in the construction area. There are no known warm or hot water industrial discharge locations in the vicinity of the IHNC that would serve to attract manatees during cold weather. However, as per standard requirements for CEMVN dredging contracts in coastal Louisiana, the following manatee protective measures would still be included in all dredging contracts awarded for construction of this project:

- All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.
- All construction personnel will be responsible for observing water-related activities for the presence of manatee(s).
- Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (i.e., work area) and at least one sign would be placed where it is visible to the vessel operator.
- Siltation barriers, if used, would be made of material in which manatees could not become entangled, and would be properly secured and monitored.

- If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed.
- Any manatee sighting would be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

USACE anticipates that the proposed action may affect but is not likely to adversely affect the West Indian manatee.

*Alligator snapping turtle*

The alligator snapping turtle may be found in large rivers, canals, lakes, oxbows, and swamps adjacent to large rivers. It is most common in freshwater lakes and bayous but also found in coastal marshes and sometimes in brackish waters near river mouths. Typical habitat is mud-bottomed waterbodies having some aquatic vegetation. Floodplain water bodies near the MRL, including associated borrow areas, are conducive habitat for alligator snapping turtle.

Alligator snapping turtles may be found within waterbodies (tributaries) adjacent to the Mississippi River and Bonnet Carré Spillway. For the relatively few snapping turtles that reside in the spillway; furthermore, the occurrence of this species within the project area is relatively rare in comparison with the rest of southeast LA. Likewise, southeast LA is not heavily populated as compared to other regions within the alligator snapping turtle's range. It is unlikely any species would be present within the two proposed borrow areas, as there are no representative habitat qualities that are conducive to this species. Therefore, it is our determination that excavation operations associated with the two proposed borrow areas would have no effect on the alligator snapping turtle.

*Monarch butterfly*

The monarch butterfly lives in a variety of habitats throughout North America but need milkweed for breeding. Recent research has shown dramatic declines in monarchs (~80 percent in 20 years) and their habitats leading conservation groups to petition the USFWS to list the species under the ESA. Monarch butterflies could be found in available habitat where flowering plants are present adjacent to the MR.

Monarch butterflies could use open fields and forested areas in the immediate vicinity of the study area and within or adjacent to the two proposed borrow areas in the Bonnet Carré Spillway. However, conservation opportunities for monarch butterfly along the MRL (to include the proposed east bank earthen levee) are limited due to

USACE guidelines for vegetation management at levees (ETL 11110-2-583 2014). The only acceptable vegetative ground cover within the vegetation-free zone along the levee is perennial grasses with the primary function to reliably protect against erosion. These vegetation-free zones shall, when dry, be mowed to a height of 3–6 in. at any time the grass reaches a height of 12 in. The maximum height of grasses shall be 12 in. There may be some opportunities to encourage nectar producing plants into areas where tree survivability is poor and other locations maintained as open areas (e.g., around parking areas, etc.) at sites proposed by the community impact mitigation planning efforts. For the two proposed borrow areas, it is expected that direct impacts to terrestrial habitat would occur with the excavation of borrow pits. Any species present that may be located within the recently disturbed areas would likely be displaced to suitable surrounding habitat during excavation of the pits. However, it is anticipated that best practical techniques such as the placement of trees and vegetative debris along the banklines would be employed to sustain and somewhat enhance the remaining wildlife and fisheries values. USACE anticipates that the proposed action would have no effect on the monarch butterfly.

*Tricolored bat*

The tricolored bat was proposed for federal listing under the ESA in 2022 (87 FR 56381). The tricolored bat is a small insectivorous bat that is distinguished by its unique tricolored fur and often appears yellowish to nearly orange. The once common species is wide ranging across the eastern and central United States and portions of southern Canada, Mexico and Central America. During the winter, tricolored bats are often found in caves and abandoned mines, although in the southern United States, where caves are sparse, tricolored bats are often found roosting in road-associated culverts where they exhibit shorter torpor bouts and forage during warm nights. During the spring, summer, and fall, tricolored bats are found in forested habitats where they roost in trees, primarily among leaves of live or recently dead deciduous hardwood trees, but may also be found in Spanish moss, pine trees, and occasionally human structures. Tricolored bats face extinction due primarily to the range wide impacts of white-nose syndrome, a deadly disease affecting cave-dwelling bats across the continent. White-nose syndrome has caused estimated declines of more than 90 percent in affected tricolored bat colonies across the majority of the species range. During summer, tri-colored bats may roost underneath bark, in cavities, or in crevices of both live and dead trees.

While the tricolored bat could pass through portions of the study area during spring, summer, and fall migration, habitat qualities conducive to this species are typically found in forested habitats where they roost in trees, primarily among leaves of live or recently dead deciduous hardwood trees. The proposed project area does not contain any of these habitat features, and it is unlikely that this species would occupy any lands associated with the proposed project area. Therefore, the excavation of the two proposed borrow areas would have no effect on this species or its habitat.

In accordance with Section 7 of the Endangered Species Act of 1973, as amended, the CEMVN has determined that the proposed action for the subject project may affect but is not likely to adversely affect any threatened or endangered species under the jurisdiction of the U.S. Fish and Wildlife Service or their associated critical habitat. The CEMVN requests you review the information provided and advise us of your determination. Responses should be mailed to Mark Lahare at: U.S. Army Corps of Engineers, CEMVN-PDC-CEC, 7400 Leake Avenue, New Orleans, Louisiana, 70118. Responses may also be provided by e-mail to mark.h.lahare@usace.army.mil, or by phone at (504) 862-1344.

Sincerely,

Mark R. Smith
Chief, Environmental Compliance Branch

Enclosures

*References*

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**DEPARTMENT OF THE ARMY**
**CORPS OF ENGINEERS, NEW ORLEANS DISTRICT**
**7400 LEAKE AVE**
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April 9, 2025

Ms. Brigette Firmin
Field Office Supervisor
U.S. Fish and Wildlife Service
200 Dulles Drive
Lafayette, Louisiana 70506

Dear: Ms. Firmin

The U.S. Army Corps of Engineers, New Orleans District (CEMVN), prepared the enclosed Biological Assessment (BA) in accordance with Section 7 (Interagency Cooperation) of the Endangered Species Act (ESA) of 1973, as amended, for operations of the Bonnet Carré Spillway (BCS). The BCS is operated to reduce the potential for loss of life and property from floodwaters on the lower Mississippi River. Section 7(a)(2) of the ESA requires that "[e]ach Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species…." 16 USC 1536(a)(2).

CEMVN submits the enclosed BA to the U.S. Fish and Wildlife Service (USFWS) to request the initiation of formal consultation pursuant to 50 CFR 402.14 and requests your concurrence with the conclusions found within. For past operation events, CEMVN prepared a separate BA for each operation year in accordance with the emergency consultation provisions at 50 CFR 402.05. The enclosed BA is intended to provide a prospective assessment of the potential impacts to threatened and endangered species and their critical habitat resulting from future operations of BCS. A copy of this BA is also being forwarded to the National Marine Fisheries Service for their review of potential effects to their managed species.

Please address comments and questions to Mr. Howard Ladner, U.S. Army Corps of Engineers, Room 140, 7400 Leake Avenue, New Orleans, Louisiana 70118, or via email to Howard.w.Ladner@usace.army.mil. Mr. Ladner may be contacted at phone number (504) 862-2021 if questions arise.

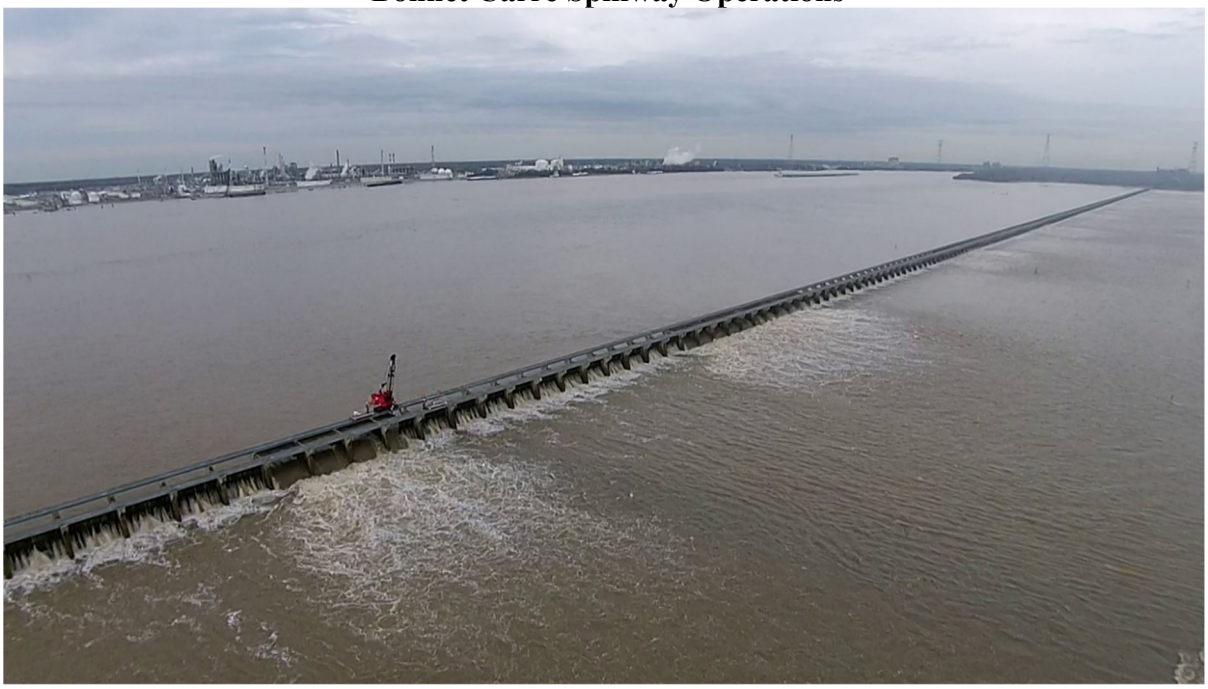
Sincerely,

Mark R. Smith
Chief, Environmental Compliance Branch

Enclosure

**US ARMY CORPS OF ENGINEERS**
NEW ORLEANS DISTRICT

# Biological Assessment
# Bonnet Carré Spillway Operations



## April 2025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## EXECUTIVE SUMMARY

This Biological Assessment (BA) was prepared in accordance with Section 7(a)(2) of the Endangered Species Act (ESA) of 1973 and submitted to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) by the U.S. Army Corps of Engineers, New Orleans District (CEMVN) to initiate formal consultation regarding impacts to threatened and endangered species resulting from future operations of the Bonnet Carré Spillway (BCS).

The BCS is located approximately 30 miles upstream of New Orleans, Louisiana and is a feature of the Mississippi River and Tributaries Project (MR&T) which was implemented in response to the Great Flood of 1927. The BCS is a massive concrete weir structure designed to divert up to 250,000 cubic feet per second of water from the Mississippi River into a floodway that empties into Lake Pontchartrain to lessen downriver river stages thereby reducing the risk of flood damage and loss of life in the New Orleans metropolitan area and other downstream communities. First opened during the 1937 flood, the Spillway has been opened 15 times through 2020. Periodic openings are capable of entraining freshwater sturgeon and other species from the Mississippi River into a shallow, brackish lagoon. In addition, intermittent freshwater discharge into Lake Pontchartrain may temporarily alter habitat conditions including salinity in Lake Pontchartrain, Lake Borgne, most of the Biloxi Marsh, the Western Chandeleur and Mississippi Sounds, and the nearshore portions of the Mississippi Bight, depending on the scale of the opening.

**Table 1. ESA species effects determinations.**

| | | | Determination | |
|---|---|---|---|---|
| **Listed Species** | **Management Agency** | **Status** | **Species** | **Critical Habitat** |
| Pallid Sturgeon (*Scaphirhynchus albus*) | USFWS | E | LAA | NA |
| Shovelnose Sturgeon *(Scaphirhynchus platorynchus)* | USFWS | T; SOA | LAA | NA |
| Gulf Sturgeon *(Acipenser oxyrinchus desotoi)* | Both | T | LAA | NE |
| Green Sea Turtle *(Chelonia mydas)* | NMFS | T | NLAA | NA |
| Loggerhead Sea Turtle *(Caretta caretta)* | NMFS | T | NLAA | NA |
| Kemp's Ridley Sea Turtle *(Lepidochelys kempii)* | NMFS | E | NLAA | NA |
| West Indian Manatee *(Trichechus manatus)* | USFWS | T | NLAA | NA |
| Giant Manta Ray (*Manta birostris*) | NMFS | T | NLAA | NA |
| Piping Plover *(Charadrius melodus)* | USFWS | T | NLAA | NE |
| Red Knot (*Calidris canutus rufa)* | USFWS | T | NLAA | NE |
| Eastern Black Rail (*Laterallus jamaicensis jamaicensis*) | USFWS | T | NLAA | NA |
| Alligator Snapping Turtle (*Macrochelys temminckii)* | USFWS | PT | NLAA | NA |
| Hawksbill Sea Turtle *(Eretmochelys imbricata)* | NMFS | E | NE | NA |
| Leatherback Sea Turtle *(Dermochelys coriacea)* | NMFS | E | NE | NA |

Source: United States Fish and Wildlife Service and National Marine Fisheries Service (USFWS, July 2020, NMFS, July 2020).
Abbreviations: T = Threatened; E = Endangered; PT = Proposed Threatened; SOA = similarity of appearance; NA= not applicable; NE = no effect; NLAA = may affect, not likely to adversely affect; LAA = may affect, likely to adversely affect.

There are 14 animal species under the jurisdiction of the USFWS and/or the NMFS presently classified as threatened or endangered that may be found within the action area (Table 1). Of these 14 species, it was determined that the project would have "no effect" on hawksbill and leatherback sea turtles, "may affect, but not likely to adversely affect" green, loggerhead, and Kemp's ridley sea turtles, the West Indian manatee, giant manta ray, Piping Plover, Red Knot, Eastern Black Rail and Alligator Snapping Turtle, and "may affect, likely to adversely affect" Pallid, Shovelnose and Gulf sturgeons.

This BA analyzes a range of potential future operation impacts of the BCS by including physical, water quality, and habitat data from past events that represent high, medium, and low volume operations. Direct effects on population abundance or trends were considered when demographic data were available for the species. Indirect effects were evaluated based on species distribution within the geographic area and impacts to the forage base and preferred nesting/spawning habitat.

Due to the potential for indirect effects, it was concluded that the project "may affect, but not likely to adversely affect" nine species, including green, loggerhead, and Kemp's ridley sea turtles (Table 1). It was determined that operations of the BCS would have "no effect" on the hawksbill and leatherback sea turtles due to their rarity in the vicinity of the impacted area and extremely low or zero stranding frequencies within the action area. There is no evidence that BCS operations directly caused strandings of any sea turtle species. Although, green and loggerhead sea turtles had elevated stranding counts during operation years, these stranding trend differences were correlational and lacked measurable evidence of BCS impacts. BCS operations can indirectly impact food and habitat resources for green and loggerhead sea turtles, however, causes of disturbances to these resources are likely varied and include ecosystem-level influences. Therefore, indirect effects on green and loggerhead sea turtles which may lead to elevated strandings were not distinguishable between potential BCS impacts and external environmental impacts. Although Kemp's ridley sea turtle strandings have occurred in the action area, counts do not differ between periods of BCS operation versus non-operation, suggesting that external stranding causes are probable.

Direct effects of BCS operations on the giant manta ray and West Indian manatee were not evident due to their salinity tolerance, adaptation to a variety of available food resources, and ability to move away from unsuitable areas if needed. Indirect effects to these species may include impacts on foraging habitat or food resource availability from intermittent or episodic operation of the BCS. Although the natural availability of suitable habitat in the BCS action area is likely low, indirect BCS operations effects to three listed bird species (Piping Plover, Red Knot, and Eastern Black Rail) are possible through the temporary reduction in nesting or foraging habitat or through impacts to benthic invertebrate prey communities. However, any impacts are likely negligible because typical frequency of occurrence of these birds in the action area is low and direct effects of BCS openings on foraging resources would be spatially

restricted and short-lived. Further, if these species do visit the area, relocation to other suitable habitats during BCS operations is highly probable.

The potential for the direct entrainment of Pallid, Shovelnose, and Gulf sturgeon from the MSR during BCS operations resulted in a determination of "may affect, likely to adversely affect" requiring an incidental take statement. However, the rapid rescue of entrained sturgeon has been demonstrated to minimize impacts on population integrity and this effort is expected to continue for future openings. Gulf Sturgeon are a highly mobile anadromous fish that spend a large portion of their life in riverine systems. Operations of BCS may cause short-term changes in salinity levels and other water quality parameters, but these changes are not known to create long-term changes in benthic infaunal community composition that would have long lasting effects on Gulf Sturgeon critical habitat. Entrained Gulf Sturgeon or those individuals captured in the BCS project area will be moved to more suitable habitat near Lake Pontchartrain (LP). Conservation recommendations previously provided by the USFWS to minimize or avoid adverse effects of BCS operations and to help implement recovery plans are considered by USACE in this assessment.

## ACRONYMS AND ABBREVIATOINS

| | |
|---|---|
| AL | Alabama |
| BCS | Bonnet Carré Spillway |
| °C | Degrees Celsius |
| cfs | Cubic feet per second |
| cm | Centimeters |
| DIP | Dissolved inorganic phosphorus |
| DO | Dissolved oxygen |
| E | East |
| EFH | Essential fish habitat |
| EPA | Environmental Protection Agency |
| °F | Degrees Fahrenheit |
| FL | Florida |
| ft | Feet |
| GMFMC | Gulf of Mexico Fishery Management Council |
| GOA | Gulf of America |
| HUC | Hydrologic Unit Code |
| in | Inch |
| km | Kilometer |
| L | Liter |
| LA | Louisiana |
| LDWF | Louisiana Department of Wildlife and Fisheries |
| LMR | Lower Mississippi River |
| LP | Lake Pontchartrain |
| LPB | Lake Pontchartrain Basin |
| LPE | Lake Pontchartrain Estuary |
| m | Meter |
| MDEQ | Mississippi Department of Environmental Quality |
| mg | Milligram |
| mi | Mile |
| MMR | Middle Mississippi River |
| MRGO | Mississippi River Gulf Outlet |
| MS Bight | Mississippi Bight |
| MS Sound | Mississippi Sound |
| MSR | Mississippi River |
| MSFCMA | Magnuson-Stevens Fishery Conservation and Management Act |
| N | North |
| NGOA | Northern Gulf of America |
| NGVD | National Geodetic Vertical Datum |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| OFS | Operational Forecast System |
| ppt | Parts per thousand |
| PL | Public law |

| | |
|---|---|
| RM | River mile |
| s | Second |
| S | South |
| SAV | Submerged aquatic vegetation |
| STSSN | Seat Turtle Stranding and Salvage Network |
| TL | Total length |
| TSS | Total suspended sediments |
| USACE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | U.S. Geological Survey |
| W | West |
| WGOA | Western Gulf of America |
| YOY | Young of year |

# 1.0 INTRODUCTION

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended, requires that "[e]ach Federal agency shall, in consultation with and with the assistance of the Secretary, insure that any action authorized, funded, or carried out by such agency…is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species…." 16 USC § 1536(a)(2).

The Bonnet Carré Spillway (BCS), located approximately 30 miles (mi) upstream of New Orleans, Louisiana (LA), was completed in 1936 by the U.S. Army Corps of Engineers (USACE) as a feature of the Mississippi River and Tributaries Project (MR&T) following the Great Flood of 1927. The BCS is designed to divert a portion of the water from the Mississippi River (MSR) into a floodway that empties into Lake Pontchartrain (LP) to reduce downriver river stages thereby reducing the risk of flood damage and loss of life in the New Orleans metropolitan area and other downstream communities (USACE 1998).

Operation of the BCS is guided by the MR&T, Water Control Manual, Bonnet Carré Spillway (last revised September 1999), which states that the BCS "will normally be operated when the flow in the MSR below Morganza reaches 1,250,000 cubic feet per second (cfs) on a rising hydrograph or to preserve a desired level of freeboard on deficient levees through the New Orleans area. The Spillway will be controlled so that the flow below BCS in the MSR does not exceed 1,250,000 cfs."

This Biological Assessment (BA) provides the information required pursuant to the ESA and implementing regulations 50 CFR § 402.14 (Formal Consultation). This BA is submitted to the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) by the U.S. Army Corps of Engineers, New Orleans District (CEMVN) to initiate formal consultation regarding impacts to threatened and endangered species resulting from future operations of the BCS. The BA summarizes the effects of previous BCS openings on listed species and provides an analysis of the potential impacts to threatened and endangered species resulting from future operations. This BA is promulgated in accordance with Section 7 (Interagency Cooperation) of the ESA.

## *1.1 BONNET CARRÉ SPILLWAY*

### 1.1.1 LOCATION AND PURPOSE

The BCS is located in St. Charles Parish, LA, approximately 30 mi upstream from New Orleans (Figure 1) and is an integral component of the MR&T project. Construction of the BCS structure began in 1929 and was completed in 1931. The guide levees (Figure 2) were completed in 1932 with associated highway and railroad crossings completed in 1936. The primary purpose of the project is to reduce the risk of flooding to New Orleans and other downstream communities from the MSR by discharging excess floodwaters into LP which has a hydrologic connection to the Mississippi (MS) Sound. The Spillway is designed to convey 250,000 cfs of MSR floodwaters from the weir structure to LP (Figure 3).

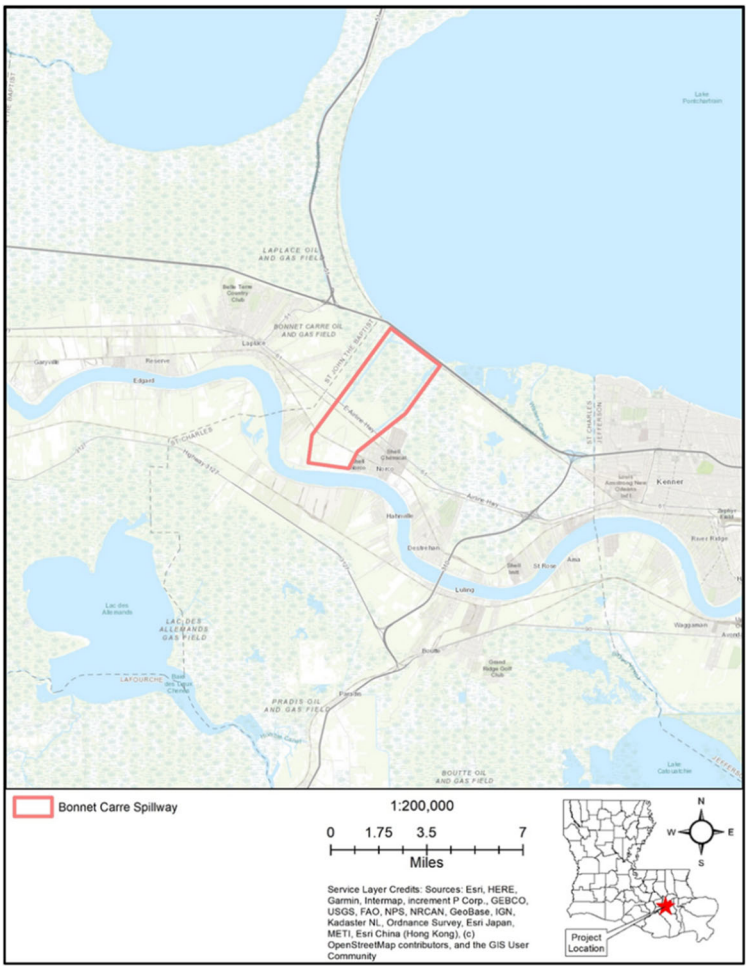


**Figure 1. Location of Bonnet Carré Spillway project area.**

### 1.1.2 PROJECT DESIGN

The BCS consists of a massive concrete weir structure adjacent to the MSR, upper and lower guide levees, a 7,623-acre floodway that stretches from the MSR to LP, Spillway office and warehouse buildings, various highway and railroad crossings, and miscellaneous pipeline and utility crossings.

#### 1.1.2.1 Control Structure

The control structure is a concrete, gravity overfall dam controlled by manually operated timber needles. The control structure is founded on untreated timber pilings and has a steel sheet piling cutoff wall 45 to 55 ft in depth on the riverside of the weir. Immediately lakeward of the control structure, and integral to it, is a shallow, reinforced concrete stilling basin approximately 50 ft wide with three rows of low concrete baffle piers. Beyond the lakeward row of baffle piers there is a heavy articulated concrete mat 175 to 225 ft wide, underlain by an inverted filter of gravel, spalls, and riprap. The control structure is 7,698 ft in length. It consists of 350 bays, each 20 ft in width, separated by reinforced concrete piers 2 ft thick which carry two sets of steel beams as operating rail bridges. There are 176 bays with a weir crest of 17.0 ft NGVD and the remaining 174 bays have a weir crest of 15.0 ft NGVD. Each bay is closed with 20 timber needles whose actual dimensions are 8 x 11.5 in to permit operation without binding. The loose fit of the needles also allows seepage of river water into the floodway during high MSR stages. The

lengths of the timber needles are 10 and 12 ft, depending on the elevation of the crest of the control structure's weir. When in place, the needles are seated on the control structure crest and lean against a reaction beam. When the bays are opened, the needles are stored by hooking one end of each below the upstream service bridge and resting the other end on the reaction beam. Two diesel-powered, traveling gantry cranes are provided for removing and installing the needles.

#### 1.1.2.2 Floodway

The floodway conveys the floodwaters from the weir structure to LP. This flooding is confined by upper and lower guide levees. The elevation of the levees is approximately 19 ft NGVD. The floodway is approximately 5.7 mi long, 7,700 ft wide at the river end and 12,400 ft wide at the lake end. Ground elevations in the floodway range from approximately 12 ft NGVD near the river to 0 ft NGVD at the LP shoreline. The area of the floodway is approximately 7,623 acres.

#### 1.1.2.3 Project Buildings

The Spillway office building is located directly adjacent to the downstream terminus of the Spillway structure. It is situated on the protected side slope of the MSR Levee and its confluence with the lower guide levee and is elevated to allow full view of the structure and bordering floodway. The building includes an office for the Spillway manager, a reception area, a large conference room, a rest room, and a small kitchen area.

Adjacent to the office building and located on the protected side of the levee is the maintenance facility and fenced storage yard. Spillway maintenance equipment is stored in this area.

### 1.1.3 AUTHORIZATION

The BCS was authorized by the Flood Control Act of 15 May 1928, as amended. It is an integral part of the comprehensive MR&T Project which was implemented in response to the Great Flood of 1927. The authorizing legislation requires that the Spillway be operated to prevent river flows from exceeding 1,250,000 cfs at New Orleans.

### 1.1.4 OPERATION

First opened during the 1937 flood, the Spillway has also been used in the floods of 1945, 1950, 1973, 1975, 1979, 1983, 1997, 2008, 2011, 2016, 2018, twice in 2019, and 2020. Dates and maximum flows for each opening are provided in Table 2 below (USACE New Orleans District 2023a, 2023b).

**Table 2. Bonnet Carré Spillway openings**

| Year | Days Open | Bays Opened | Maximum Flow (cfs) | Total Volume Passed ($km^3$) | Total Volume Passed ($mi^3$) | Scale of Event* |
|---|---|---|---|---|---|---|
| 1937 | 48 | 285 | 211,000 | 15.2 | 3.6 | High |
| 1945 | 57 | 350 | 318,000 | 30.1 | 7.2 | High |
| 1950 | 38 | 350 | 228,000 | 13.4 | 3.2 | Med |
| 1973 | 75 | 350 | 207,000 | 23.5 | 5.6 | High |
| 1975 | 13 | 225 | 110,000 | 2.11 | 0.5 | Low |
| 1979 | 45 | 350 | 228,000 | 13.9 | 3.3 | Med |
| 1983 | 35 | 350 | 268,000 | 15.2 | 3.6 | High |
| 1997 | 31 | 298 | 243,000 | 11.7 | 2.8 | Med |
| 2008 | 31 | 160 | 160,000 | 7.5 | 1.8 | Low |
| 2011 | 42 | 330 | 316,000 | 21.9 | 5.3 | High |
| 2016 | 22 | 210 | 203,000 | 6.9 | 1.7 | Low |
| 2018 | 22 | 183 | 196,000 | 5.8 | 1.4 | Low |
| 2019a | 43 | 206 | 213,000 | 38.1 | 9.1 | High |
| 2019b | 78 | 168 | 161,000 | | | |
| 2020 | 28 | 90 | 90,000 | 3.98 | 1.0 | Low |

* Low-volume event is defined as an opening with less than 7.5 $km^3$ (1.8 $mi^3$) of water released from BCS from the beginning of the opening to the end; a high-volume event is any event in which over 15 $km^3$ (3.6 $mi^3$) is released.

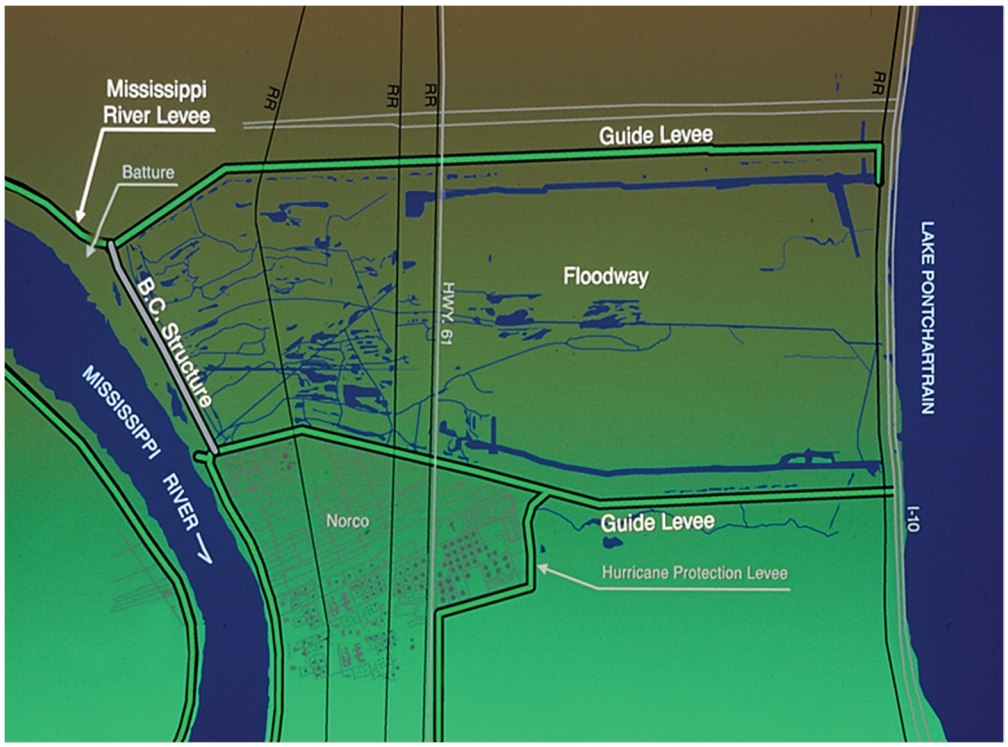


**Figure 2. Bonnet Carré Spillway project map.**

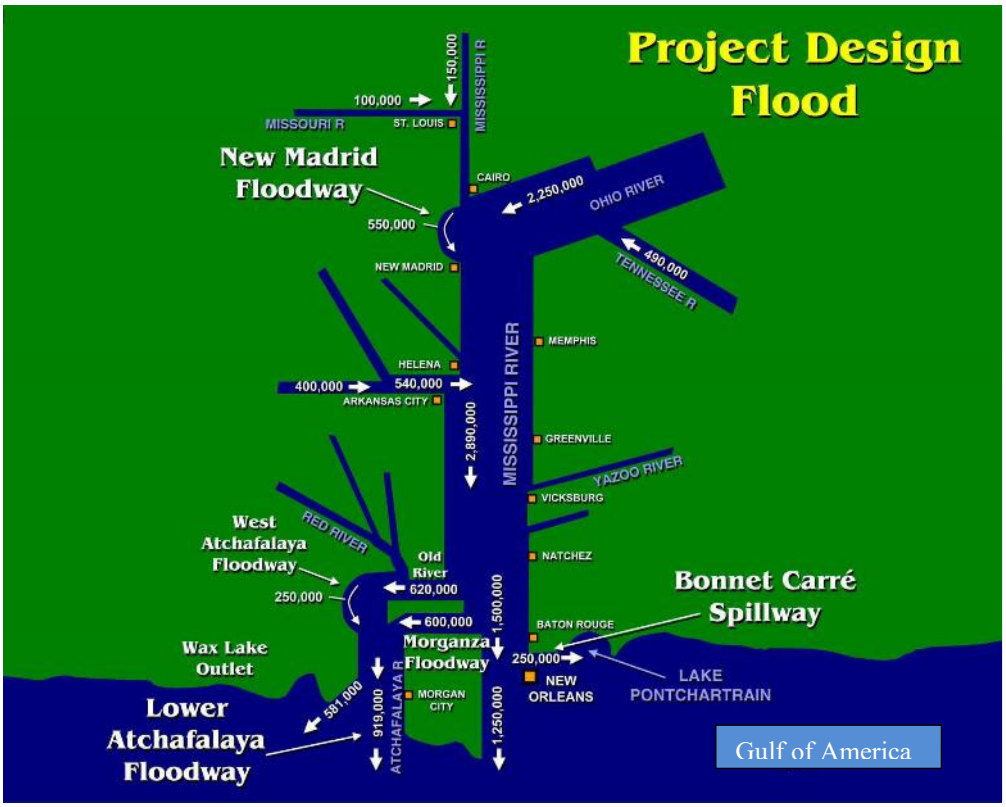


**Figure 3. Project design flood for the Bonnet Carré Spillway.**

### 1.1.5 PREVIOUS CONSULTATION

Prior to the 2008 Spillway operation, Pallid Sturgeon were thought to be rare to infrequently found in the lower reaches of the MSR where the BCS is located. Additionally, Pallid Sturgeon were believed to be confined to the main channel and channel border, and not normally found in the flooded riverbanks during high water periods. However, additional information became available indicating Pallid Sturgeon were more abundant in the lower reaches of the MSR than previously believed and prompting CEMVN to initiate ESA consultation for Spillway operations going forward.

**2008 Operation**

On April 4, 2008, the Louisiana Department of Wildlife and Fisheries (LDWF) captured a sturgeon of the genus *Scaphirhynchus* exhibiting morphological characteristics of a Pallid Sturgeon in approximately 14 ft of water in the Spillway forebay. Subsequently, on April 10, 2008, the CEMVN reached out to the USFWS, discussing the possibility of opening the BCS and initiating emergency consultation. On April 11, 2008, the USFWS sent a letter to CEMVN acknowledging the initiation of emergency consultation under Section 7 of the ESA and providing conservation recommendations for reducing or avoiding adverse effects to Pallid Sturgeon.

The BCS was opened on April 11, 2008. On April 14, 2008, CEMVN acknowledged receipt of the conservation recommendation letter from USFWS via email. Throughout the opening and after the structure's closure, CEMVN provided USFWS with periodic updates. Once the structure stopped leaking through the pins and boat access became available in the floodway, CEMVN tasked the Engineer Research and Development Center (ERDC) Fish Ecology Team with conducting pallid sturgeon rescue and recovery efforts. Over the course of four weeks of collecting, the ERDC team captured 14 Pallid Sturgeon and 41 Shovelnose Sturgeon within the outfall of the BCS and released all sturgeon back into the MSR.

On January 5, 2009, CEMVN sent USFWS a BA (dated December 31, 2008) requesting initiation of formal consultation on the effects of the 2008 BCS opening on Pallid Sturgeon. The USFWS requested additional information regarding the CEMVN's incidental take rationale, and all additional information was provided by March 13, 2009. The USFWS provided a Biological Opinion (BO) to CEMVN on August 14, 2009, completing formal consultation for the 2008 operation of BCS.

Following the 2008 flood event, the CEMVN initiated a study aimed at filling in data gaps that existed regarding sturgeon distribution and abundance in the lower MSR. The CEMVN and the Mississippi Valley Division funded ERDC to monitor potential entrainment of Pallid Sturgeon in existing diversions and provide information to evaluate the risk of future entrainment.

**2011 and 2016 Operations**

Since a known entrainment risk existed for the BCS, CEMVN contacted USFWS when flood fight monitoring indicated the need to operate the BCS in 2011. On April 27, 2011, CEMVN contacted USFWS via telephone to discuss the implications of a 2011 BCS opening on the Pallid

Sturgeon and recently listed Shovelnose Sturgeon. During this conversation, CEMVN expressed its continued commitment to conducting recovery efforts for sturgeon entrained through the BCS. The CEMVN tasked ERDC with preparing a scope of work (SOW) for their retrieval efforts, and to determine specific actions that will reduce or eliminate incidental take during future operations of the Spillway. On May 5, 2011, CEMVN determined that operation of the BCS was necessary and sent a letter requesting the initiation of emergency consultation under Section 7 of the ESA for potential impacts to Pallid Sturgeon and Shovelnose Sturgeon. Enclosed within this letter was a copy of the SOW for ERDC efforts. The USFWS responded via letter on May 6, 2011, providing CEMVN with four conservation recommendations.

On May 27, 2011, the USFWS provided their comments on the ERDC SOW provided on May 6, 2011. The ERDC SOW was revised to incorporate the USFWS's revisions. When the Spillway became accessible by the ERDC Fish Ecology Team, rescue and recovery operations were initiated.

In 2016, CEMVN again determined that operation of the Spillway was necessary and sent a letter to USFWS on January 5, 2016, requesting the initiation of emergency consultation for potential impacts to Pallid and Shovelnose Sturgeon. The USFWS responded on January 6, 2016, and provided six conservation recommendations, building upon those that were provided in 2011, focusing on ways to minimize the potential take of sturgeon species during the operation of BCS. However, no sturgeon were collected in 2016, presumably due to low water temperatures in the MSR which restricted sturgeon movement near the structure while it was opened.

On December 12, 2017, CEMVN sent a letter and finalized BA to USFWS to initiate formal consultation on the 2011 and 2016 BCS emergency operations. On June 18, 2018, the USFWS provided CEMVN with a BO covering the 2011 and 2016 openings.

**2018 Operation**

On March 2, 2018, CEMVN determined that operation of the BCS was necessary and sent a letter requesting the initiation of emergency consultation under Section 7 of the ESA. The USFWS responded the same day and provided CEMVN with six conservation recommendations. Following the BCS operation, only four Pallid Sturgeon and four Shovelnose Sturgeon were collected likely due to the low water temperatures.

On March 6, 2018, CEMVN emailed an informal consultation letter to NMFS, who responded the same day, stating that CEMVN should "proceed with the emergency work described in [its] email," and notify NMFS if any threatened or endangered species or designated critical habitat is adversely affected by the action. CEMVN reached a "no effect" determination for all species within NMFS jurisdiction for the 2018 opening.

On March 2, 2020, CEMVN sent a letter and finalized BA, dated February 27, 2020, to USFWS to initiate formal consultation for the 2018 BCS operation. On April 6, 2020, USFWS provided confirmation to CEMVN that all information had been received and that the BO would be issued by July 15, 2020. On June 24, 2020 USFWS requested a time extension to July 30, 2020 which

was granted by CEMVN. The signed USFWS 2018 BO was received by CEMVN on August 26, 2020.

**2019 Operations**

On February 25, 2019, CEMVN determined that operation of the BCS was necessary and sent a letter to USFWS and NMFS requesting the initiation of emergency consultation under Section 7 of the ESA. The USFWS responded on February 26, 2019, and provided CEMVN with six conservation recommendations. The NMFS also responded on February 26, 2019, and informed CEMVN to proceed with the emergency operation described in the notice.

On May 7, 2019, CEMVN determined that the BCS would need to be operated for a second time and notified both USFWS and NMFS of the second opening. On May 8, 2019, the USFWS sent CEMVN another letter providing conservation recommendations. The NMFS also responded on May 7, 2019 stating that CEMVN should proceed with the emergency operation described in the notice.

Following the second 2019 operation of the BCS, sturgeon rescue efforts resulted in 19 Pallid Sturgeon and 289 Shovelnose Sturgeon collected.

On September 17, 2020, CEMVN sent a letter and finalized BA to USFWS to initiate formal consultation for the 2019 BCS operation. On October 20, 2020, the USFWS provided confirmation to CEMVN that all information had been received and that the BO would be issued by January 30, 2021. On 15 December 2020 USACE granted USFWS request for an extension of the timeline to complete the 2019 BO. USFWS provided USACE with a BO on February 18, 2021.

NMFS similarly received CEMVN's request (SERO-2021-00679) for after-the-fact consultation regarding the 2019 BCS emergency operations on September 17, 2020. NMFS concurred with the USACE determinations on April 1, 2021.

**2020 Operation**

On April 1, 2020, CEMVN contacted USFWS via phone to discuss the implications of a near-term opening of the BCS and sent a letter to USFWS and NMFS requesting the initiation of emergency consultation under Section 7 of the ESA. The USFWS responded on the same day, providing CEMVN with six conservation recommendations. NMFS also responded on the same day, stating that CEMVN should proceed with the emergency operation described in the notice.

On December 22, 2020, the CEMVN sent USFWS a report for the 2020 BCS operation, detailing the sturgeon rescue and recovery efforts.

On January 14, 2021, the CEMVN sent a letter and finalized BA to USFWS to initiate formal consultation for the 2020 BCS operation. On January 15, 2021, USACE sent a follow-up email with a revised BA to correct an error regarding the Eastern Black Rail.

On March 3, 2021, the USFWS provided confirmation to CEMVN that all information had been received and that the BO would be issued by May 30, 2021. The USFWS BO was signed on May 28, 2021.

NMFS similarly received CEMVN's request for after-the-fact consultation regarding the 2020 BCS emergency operation on January 14, 2021 (SERO-2021-00679). NMFS concurred with the USACE determinations on April 1, 2021.

### *1.2 SCOPE OF ANALYSIS*

The geographic scope of the BCS action area includes the BCS, Lake Pontchartrain Estuary (LPE), and receiving waterbodies along the Mississippi Bight (MS Bight) to ensure that all potential biological effects from periodic openings of the structure are considered (See Section 1.3). A total of 14 species listed as threatened or endangered occur within the geographic scope of the action area and were considered in this BA (See Section 3). The array of fishes, turtles, birds, and mammals can be found within the broad spectrum of the coastal, freshwater, estuarine, and saltwater habitats along the LA-MS coast that could potentially be affected by BCS operations. Direct effects on population abundance or trends were considered when demographic data were available for the species. Indirect effects were evaluated based on species distribution within the geographic area and impacts to the forage base and preferred nesting/spawning habitat.

For the effects analysis, this BA analyzes a range of potential future operations of the BCS by including physical, water quality, and habitat data from past events when available, representing high, medium, and low-volume operations. Historically, operations have varied from small scale openings, such as the 1975 and the 2020 events that involved low release volumes, to large scale openings like the operations in 1945, 1983, 2011, and 2019 during which the volume of water released was much higher (see Table 2, which categorizes each previous operation by scale based on the total volume of water passed through the BCS during each event), and as such have a greater potential to affect listed species. The exact impacts will also vary by local habitat conditions and time of year. The estuarine watersheds undergo natural, episodic fluctuations in salinity due to annual flood events from local rivers. The opening of the BCS does at times, however, alter local ambient water conditions (salinity, temperature, turbidity, etc.). We can conclude that small scale operations of the BCS typically have few long-term ramifications and result in only minor effects to local ecosystems, similar to those episodic events from local river systems. Large scale events (such as 2019) have a greater potential to adversely affect federally managed listed species. USACE defined a low-volume event as an event which released less than 7.5 $km^3$ (1.8 $mi^3$) of water from the beginning of the opening to the end, and a high-volume event as any event which released over 15 $km^3$ (3.6 $mi^3$) (Table 2).

### *1.3 ACTION AREA*

For purposes of consultation under ESA §7, the action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR § 402.02). The areas to be affected directly or indirectly will vary based on the duration and flow associated with a particular Spillway opening. There are other sources of freshwater in this area, particularly during major flood events, making it difficult to estimate the

exact limits of any potential effects from BCS operations. To ensure this BA captures all areas within which effects to listed species are reasonably certain to occur, the action area includes the BCS project area (i.e., area adjacent to the Spillway structure and the floodway between the guide levees extending from the structure downstream to LP), Lakes Pontchartrain and Borgne, the majority of the Biloxi Marsh, the Western Chandeleur Sound, the Western Mississippi Sound (MS Sound; primarily West of the Gulfport Ship Channel), and a small nearshore portion of the MS Bight (Figure 4). This determination was based on a combination of data sources (e.g., Hydrocoast maps, Lake Pontchartrain Basin Foundation) which are discussed primarily in Section 2 below, showing salinity gradients during and shortly after operation of the BCS, in conjunction with USACE water quality monitoring data.

The absolute geographic extent and temporal duration of low salinity contours can vary depending upon the scale of the BCS opening event. Therefore, the defined action area aims to include the locations within which BCS impacts are *reasonably certain to occur* during any given operation event (see 50 CFR § 402.02).

This determination is further supported by recent modelling work conducted by Parra et al. (2020), who collected physical, chemical, and remote sensing data for one month during and after the BCS opening of 2016 (January 10 to February 1). Low surface-water salinity signatures within the MS Bight during early 2016 appeared to have three major sources including (1) BCS discharge through Lakes Pontchartrain and Borgne, (2) MSR waters entering the southern part of the Bight through the MSR Delta, and (3) Mobile Bay waters (see Fig 8, Parra et al. 2020). The freshwater signature of the BCS was most discernable within the defined action area and rapidly dissipated at greater distances from the LPE. While trajectories of simulated drifters released from LP during the 2016 BCS opening showed that some surface water particles may reach areas outside of the action area (see Fig. 9c-f, Parra et al. 2020), these drifters are not representative of overall salinity contour patterns and are unlikely to be associated with affects to listed species. Beyond the defined action area, it is increasingly difficult to differentiate low salinity signatures from BCS discharge from additional freshwater sources, such as the MSR outflow (southwest/southeast passes) and Mobile Bay waters. Therefore, this BA considers the action area (defined above) to be the area within which all direct and indirect impacts of intermittent freshets on listed species are reasonably certain to be related to BCS operations.

**Figure 4. Map of the Bonnet Carré Spillway action area and the additional bounding freshwater sources of the Mississippi River Delta and Mobile Bay.**

## 2.0 AFFECTED ENVIRONMENT

### *2.1 BONNET CARRÉ SPILLWAY PROJECT AREA WATERSHEDS*

#### 2.1.1 LAKE PONTCHARTRAIN BASIN (HUC 080902)

The Lake Pontchartrain Basin (LPB) (Figure 5; Incorporates HUC 08090202 and HUC 08090203) is a 12,173 km$^2$ (4,700 mi$^2$) watershed, and it encompasses 16 parishes in southeast Louisiana. It is one of the largest estuarine ecosystems on the Gulf Coast and one of the largest in the United States. The LPB has the most diverse complex of environments in LA, ranging from rolling woodlands in northern portions of the Basin to coastal wetlands in the southern part of the Basin. At the center of the Basin is the 1,632 km$^2$ (630 mi$^2$) LP and the largest population center in LA, the Greater New Orleans area, with 1.5 million individuals. Climate is integral to the natural systems of the LPB. Short- and long-term climate variability has an enormous impact on the seasonal and long-term health of any ecosystem. Annual average temperatures range from 19 to 21°C (66 to 69°F), with July averaging 28°C (82°F) and January averaging 12°C (53°F). Snow rarely falls in the southern sections, with only small snowfalls usually recorded in the northern areas. The statewide annual rainfall is about 142 cm (56 in) a year, with the northern regions averaging 117 cm (46 in) and some of the southern coastal parishes averaging as high as 167 cm (66 in) of rainfall a year (Penland et al. 2002).

**Figure 5. Lake Pontchartrain Basin (HUC 080902)**

### 2.1.2 MISSISSIPPI COASTAL BASIN (HUC 03170009)

The Mississippi Coastal Watershed (Figure 6; HUC 03170009) covers approximately 4,059 $mi^2$, stretching from LA to Alabama (AL). The hydrology of the area is heavily influenced by the MSR, which provides a vast amount of freshwater to the Gulf of America (GOA). All climate features are similar to the LPB referenced above. The potential effects of BCS operation to this HUC are generally limited to the area west of the Gulfport Ship Channel. Spillway waters are first diverted from the MSR through the Bonnet Carré structure into LP and from there into Lake Borgne and western MS Sound. The Pearl and Pascagoula Rivers empty directly into the Sound while the Jourdan and Wolf Rivers first drain into the Bay of St. Louis and then into the Sound. Similarly, the Biloxi and Tchoutacabouffa Rivers empty into the Back Bay of Biloxi before discharging into the Sound. The combined drainage of all these systems totals approximately 51,000 $km^2$ (19,691 $mi^2$). The Pearl River and Pascagoula River drainage areas far exceed those of Biloxi and St. Louis Bays. Pascagoula River has a drainage area of 24,346 $km^2$ (9400 $mi^2$) with an average discharge of 430 $m^3/s$ (15,185 $ft^3/s$). Pearl River drains 22,533 $km^2$ (8700 $mi^2$) and has an average discharge of 365 $m^3/s$ (12,890 $ft^3/s$). The combined drainage area for rivers emptying into Biloxi and St. Louis Bays is 3,626 $km^2$ (1400 $mi^2$) with an average discharge of 79

$m^3/s$ (2790 $ft^3/s$). Silty clay is the dominant sediment in MS Sound. Coastal bays receive large volumes of sandy, silty-sandy sediments from the surrounding mainland. In addition, these embayments and the Sound proper receive clay-silt sediments from the rivers. Fine sediments are also carried into the Sound via tidal currents from LP and Mobile Bay. The central portion of the Sound is composed of silt and clay muds. In some areas these sediments grade into fine and very fine sands. Medium and coarse sands characterize the barrier islands and are also found along the mainland beach west of the Pascagoula River. Medium to coarse sands extend from Round Island in MS Sound to Horn Island.

The shallowness of the Sound (average depth at mean low water is 2 m or 6.6 ft), and its sediments and wave action are responsible for the turbidity of the water. In most months, nearshore waters are brown in color due to suspended fine sediment in the water column. In periods of peak river flow, these muddy waters may reach and extend beyond the barrier islands (GMFMC 1998).

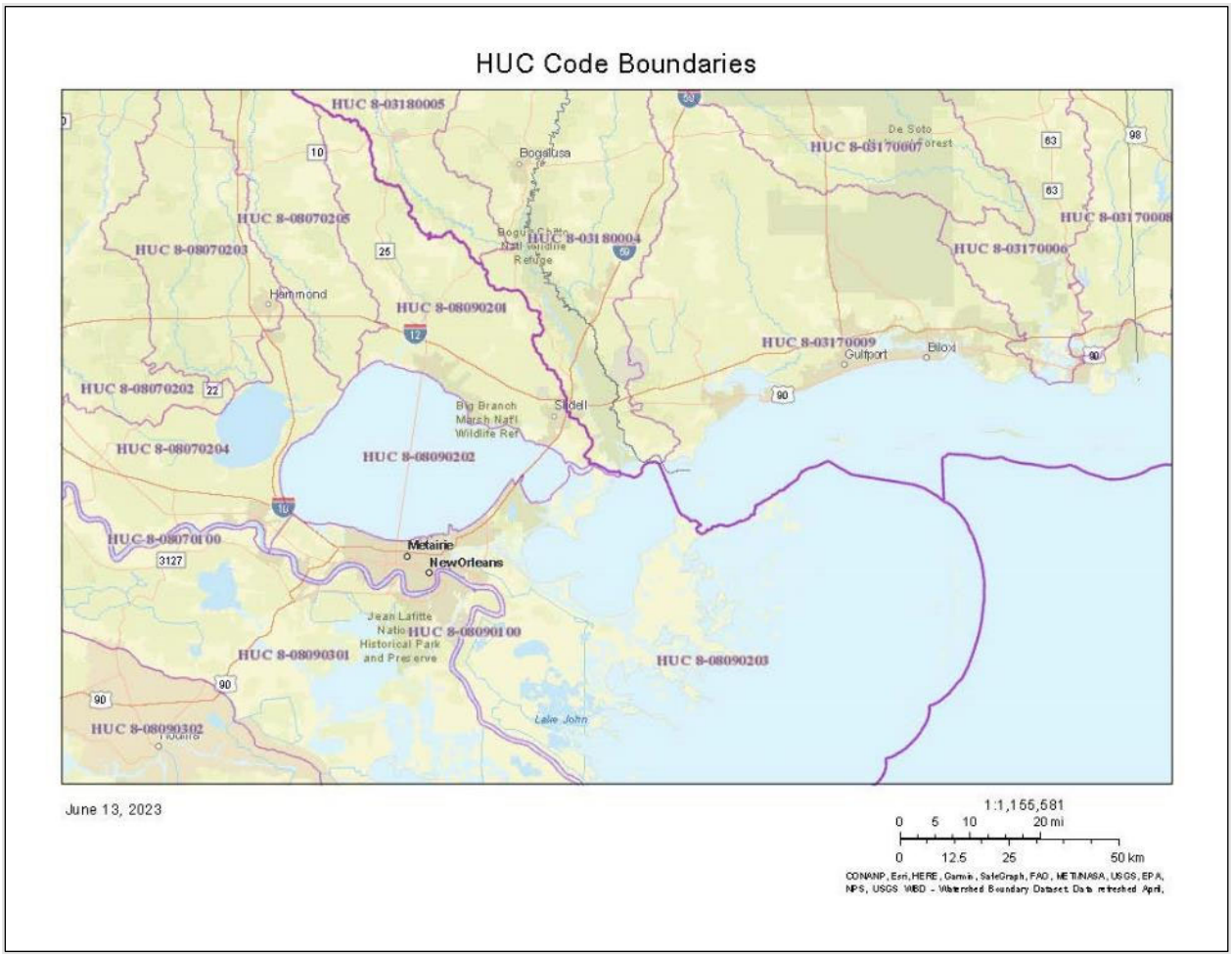


**Figure 6. Map of Mississippi Coastal Watershed (HUC 03170009).**

## 3.0 STATUS OF THE SPECIES AND CRITICAL HABITAT

There are 14 animal species, under the jurisdiction of USFWS and/or NMFS, presently classified as threatened or endangered that may be found within the action area (Table 3). The USFWS and NMFS share jurisdictional responsibility for sea turtles and the Gulf Sturgeon. Of these 14 species, it was determined that the project would have "no effect" on two species as described below. The project may have either a direct or indirect effect on the remaining species.

### *3.1 SPECIES LIST*

**Table 3. Threatened (T) and endangered (E) species potentially in the BCS action area.**

| Common Name | Scientific name | Federal Status | Effect Determination | Managed By: USFWS or NMFS Within Action Area |
|---|---|---|---|---|
| Pallid Sturgeon | *Scaphirhynchus albus* | E | May affect, likely to adversely affect | USFWS |
| Shovelnose Sturgeon | *Scaphirhynchus platorynchus* | T; SOA | May affect, likely to adversely affect | USFWS |
| Gulf Sturgeon | *Acipenser oxyrinchus desotoi* | T; Critical Habitat | Species – May affect, likely to adversely affect; Critical habitat – No effect | Both |
| Green Sea Turtle | *Chelonia mydas* | T | May affect, not likely to adversely affect | NMFS |
| Loggerhead Sea Turtle | *Caretta caretta* | T | May affect, not likely to adversely affect | NMFS |
| Kemp's Ridley Sea Turtle | *Lepidochelys kempii* | E | May affect, not likely to adversely affect | NMFS |
| West Indian Manatee | *Trichechus manatus* | T | May affect, not likely to adversely affect | USFWS |
| Giant Manta Ray | *Manta birostris* | T | May affect, not likely to adversely affect | NMFS |
| Piping Plover | *Charadrius melodus* | T; Critical Habitat | Species – May affect, not likely to adversely affect; Critical habitat – No effect | USFWS |
| Red Knot | *Calidris canutus rufa* | T; Critical Habitat | Species – May affect, not likely to adversely affect; Critical habitat – No effect | USFWS |

| | | | | |
|---|---|---|---|---|
| Eastern Black Rail | *Laterallus jamaicensis ssp.* | T | May affect, not likely to adversely affect | USFWS |
| Alligator Snapping Turtle | *Macrochelys temminckii* | PT | May affect, not likely to adversely affect | USFWS |
| Hawksbill Sea Turtle | *Eretmochelys imbricata* | E | No effect | NMFS |
| Leatherback Sea Turtle | *Dermochelys coriacea* | E | No effect | NMFS |

## *3.2 DESCRIPTION OF SPECIES*

### 3.2.1 Pallid Sturgeon and Shovelnose Sturgeon (*Scaphirhynchus albus* and *Scaphirhynchus platorynchus)*

The Pallid Sturgeon (*Scaphirhynchus albus*) is a large elongate fish with a flattened, shovel-shaped snout (rostrum). The eyes are small, the spiracle is absent, and belly squamation is generally lacking. Individuals possess five longitudinal rows of sharply keeled bony plates (scutes) extending along the dorsal midline, lateral midline, and ventral edge of lateral body surface. The elongate body tapers posteriorly into a long, slender, and completely armored caudal peduncle. A long caudal filament often extends from the upper lobe of the caudal fin; a feature more prevalent in younger individuals. There are two sets of fringed barbels placed along ventral surface of the rostrum with the outer pair positioned more anteriorly and decidedly longer than the inner pair. Body coloration is uniformly, grayish-white to light tan, and is generally lighter in color than the Shovelnose Sturgeon (*Scaphirhynchus platorynchus*) (Ross 2001, Robison and Buchanan 2020). Compared to Pallid Sturgeon, the snout of the Shovelnose Sturgeon is shorter and less pointed, the bases of the inner barbels are approximately equally distant between the mouth opening and the snout tip, the belly is covered with scales, dorsal and fin ray counts are different, and individuals are smaller in size, generally less than 5-6 lbs. Adult Pallid Sturgeon range in maximum size from 10-12 lbs in southern latitudes, attaining larger sizes in the upper Missouri River with a historic maximum size of 88 lbs (40 kg) being noted in the literature (Vecsei and Peterson, 2004). Shovelnose Sturgeon attains a smaller maximum size than the Pallid Sturgeon, ranging from 5 to 7 lbs.

*Taxonomic Status*

Pallid and Shovelnose Sturgeon belong to the family Acipenseridae (Actinopterygii: Acipenseriformes) and members of this order are often referred to as “living fossils” because of their prehistoric appearance and representation in the fossil record from the Cretaceous period of geological history (Hilton and Grande 2006). Both species are obligate, benthic rheophils occurring in the MSR Basin, including the Mississippi and Missouri Rivers, and their major tributaries (i.e., Platte and Yellowstone rivers), and the MSR’s major distributary, the Atchafalaya River (USFWS 1990). The Pallid sturgeon was listed as endangered by the USFWS in 1990 (USFWS 1990). A recovery plan was released in 1993 with the most current revision approved in 2014 (USFWS 1993, 2014). Further protection was provided with the listing of the

sympatric Shovelnose Sturgeon as threatened under the Similarity-of-Appearance Provisions of the ESA in 2010 (USFWS 2010). This provision only provides a protective status to Shovelnose Sturgeon in river systems where both species co-occur.

Shovelnose Sturgeon are more widespread and abundant than Pallid Sturgeon possibly due to different life history characteristics that allow Shovelnose Sturgeon to inhabit smaller systems, thereby occupying and persisting through a much broader range (Phelps et al. 2016). Of the 24 states that comprise the historical range of the Shovelnose Sturgeon, five list the species as extirpated, and eight list the species as either imperiled or vulnerable. The World Conservation Union listed the species as "vulnerable." However, Shovelnose Sturgeon along with Blue Catfish are the most abundant large-bodied benthic species in the LMR (Killgore et al. 2007a). Mortality and mean length at age in the LMR is less than has been reported for upper MSR populations (Morrow et al. 1998a). The higher abundance of Shovelnose Sturgeon in comparison to Pallid Sturgeon is partly due to its earlier maturity, lower trophic status, and adaptability to a broader range of environmental conditions. Female Shovelnose Sturgeon mature earlier than any other North American chondrostean, usually 5 to 6 years, compared to 15-20 years for female Pallid Sturgeon. The smaller Shovelnose Sturgeon primarily subsists on invertebrates, whereas the larger Pallid Sturgeon becomes piscivorous relatively early in life. Pallid Sturgeon also are highly adapted to large, turbid, riverine environments, and avoid most tributaries where Shovelnose Sturgeon occur.

Morphological and genetic variation exists across the species range with Pallid Sturgeon from the upper Missouri River having lower levels of mitochondrial DNA and microsatellite variation. Genetic variation increases in the southern portion of the range where Pallid Sturgeon become more genetically similar to the more variable Shovelnose Sturgeon with high hybridization rates (Campton et al. 2000, Schrey et al. 2011). Murphy et al. (2007) observed morphological variation across the range of both Pallid and Shovelnose Sturgeon noting distinct differences in morphology were more prevalent in the upper Missouri River. Morphological features varied more in the lower Missouri and Mississippi Rivers with individuals spanning a continuum of morphotypes raising concerns on field identification methodologies (Wills et al. 2002, Jordan et al. 2019). In addition, northern populations of Pallid Sturgeon attain a larger size, mature at a later age, and exhibit greater longevity (Keenlyne and Jenkins 1993, Killgore et al. 2007b). Estimated age of first spawning may be similar between the populations although at a smaller size for southern populations; however, these populations possess greater gonadal mass equating to higher fecundity per unit of body weight (George et al. 2012).

*Range and Population Status*

To promote directed recovery efforts, Pallid Sturgeon populations were assigned to four management units (Figure 7) (USFWS 2014). These areas were selected as areas of high importance for recovery task implementation based on population variation (i.e., morphological, genetic) and habitat differences (i.e., physiographic regions, impounded, unimpounded reaches) throughout the extensive range of the sturgeon (USFWS 1993). The Great Plains Management Unit (GPMU) extends from Great Falls of the Missouri River, Montana, to Fort Randall Dam, South Dakota, and includes the major tributaries thereof (Yellowstone, Marias, and Milk rivers). The Central Lowlands Management Unit (CLMU) includes the Missouri River from Fort Randall Dam, South Dakota, to the confluence of the Grand River, Missouri, and includes the

major tributaries thereof (lower Platte, lower Kansas Rivers). The Interior Highlands Management Unit (IHMU) includes the Missouri River from the confluence of the Grand River, Missouri, to the confluence of the MSR, Missouri, and the MSR from Keokuk, Iowa, to the confluence of the Ohio River, Illinois. The Coastal Plain Management Unit (CPMU) includes the MSR from the confluence of the Ohio River, Illinois, to the GOA, LA, and includes the Atchafalaya River distributary system, Louisiana. Pallid Sturgeon historically did not occur in the Red-Atchafalaya system in Louisiana but were first documented in this system in 1991 (Reed and Ewing 1993). Introduction into this system was via entrainment from the MSR through the Old River Control Complex which was further supported through a telemetry-based study directed at evaluating entrainment rates of river sturgeon at the complex (Slack et al. 2017)

GPMU: Within the GPMU, the population consists of older adult individuals with no evidence of natural recruitment occurring over the past decades. A stocking plan was initiated in 1997 and continues today. Broodstock are captured from the region with offspring hatchery-reared at Gavins Point National Fish Hatchery until age one before being released. More recently, a fish passage project was developed to increase access to 265 river kilometers (165 mi) of additional river habitat in the Yellowstone River (USFWS 2007, Gerrity et al. 2008, Jordan et al. 2016).

CLMU: There are no naturally occurring wild Pallid Sturgeon remaining in the most upstream portion of the CLMU, including the Missouri River downstream of Fort Randall Dam to Lewis and Clark Lake, the entire population is made up of hatchery-reared fish and translocated wild individuals (USFWS 2007). Stocking in this region began in 1997 and continues today. A recent study conducted in a 50-mi reach of the lower Missouri River downstream from the confluence of the Platte River estimated a population size much higher than those in the GPMU (Steffensen et al. 2012). It is currently unclear whether natural recruitment occurs in this study area (USFWS 2007).

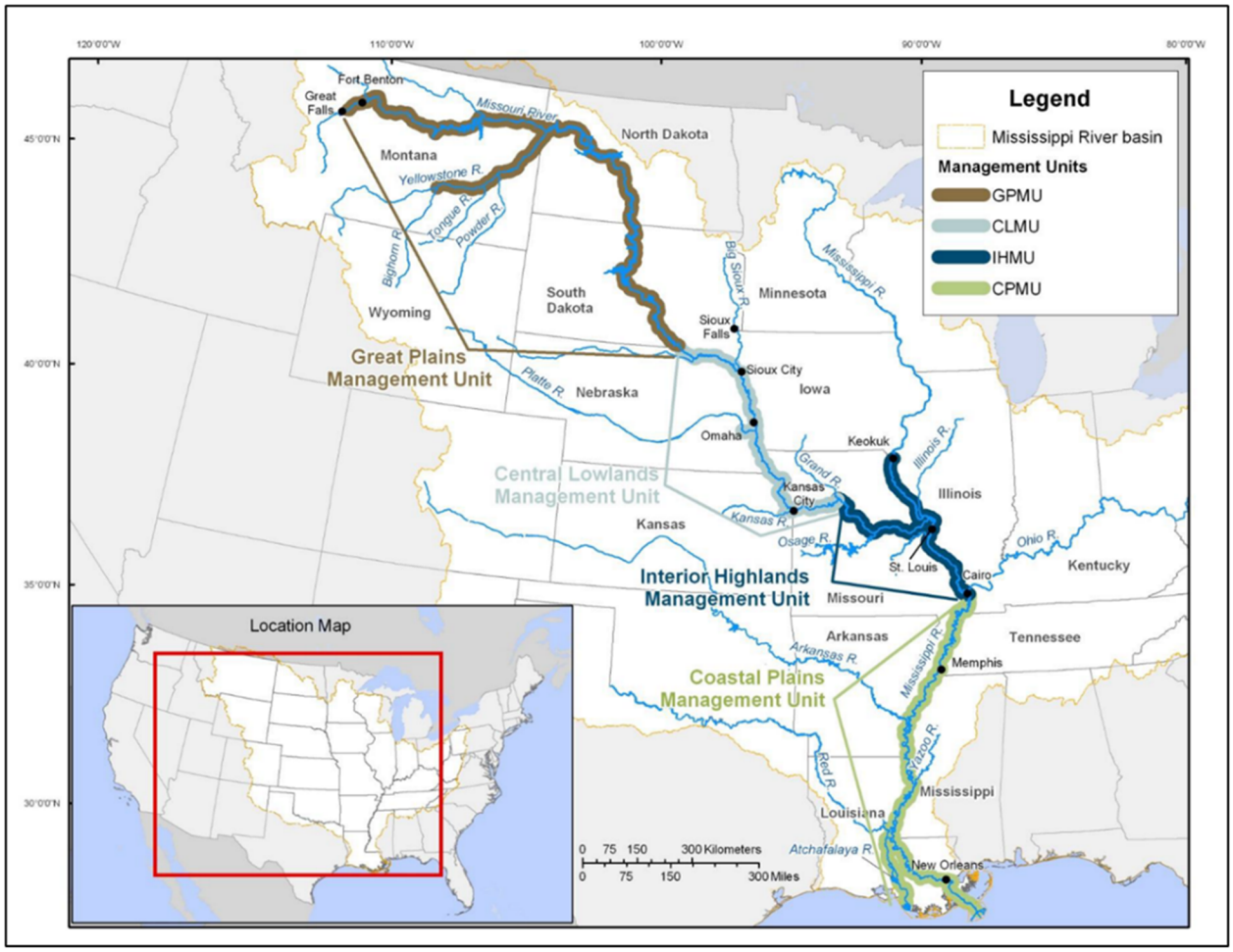


**Figure 7. Delineation of Pallid Sturgeon management units (USFWS 2014).**

IHMU: There is evidence of limited recruitment of Pallid Sturgeon in the Lower Missouri River, from Gavins Point Dam to the confluence of the MSR (Steffensen et al. 2010, Steffensen et al. 2019, USFWS 2007). Between 1994 and 2008, nearly 80,000 hatchery-reared Pallid Sturgeon had been released into the lower Missouri River, and as of 2008, only 1% had been recaptured (Steffensen et al. 2010). Wild Pallid Sturgeon are more frequently captured in the Middle Mississippi River (MMR), which extends from the confluence of the Missouri River to the confluence of the Ohio River, than in either the GPMU or CLMU. In a collaborative sampling effort between 2002 and 2005, researchers from the USACE, Missouri Department of Conservation, and Southern Illinois University, captured 148 Pallid Sturgeon, with only 12 fish of hatchery origin (USFWS 2007). In the MMR, the Pallid to Shovelnose Sturgeon ratio ranges from 1:36 to 1:77 (Killgore et al. 2007a). Age 0 Pallid Sturgeon have been collected in the MMR, although it is unknown where spawning occurs (Hrabik et al. 2007).

CPMU: Pallid Sturgeon have been collected throughout the CPMU represented by multiple age cohorts (Killgore et al. 2007a, 2007b). However, uncertainty exists on the contribution of local spawning and recruitment to populations within the CPMU compared to upstream/tributary spawning followed by downstream migrations of larvae and juveniles (Jordan et al. 2016). Between 1996-2006, 162 Pallid Sturgeon were collected in the Lower Mississippi River (LMR),

and >500 individuals have been captured to date (Killgore et al. 2007a, USFWS 2025 database: http://pallidsturgeon.org/). Over 4,000 Shovelnose Sturgeon have been captured, tagged, and released in the LMR by ERDC since 1996. Based on Killgore et al. (2007a), the ratio between Pallid and Shovelnose sturgeon varied from a high of 1:6 at the lower reach below Baton Rouge, LA, and gradually decreased upstream to a low of 1:77 at the Chain of Rocks (COR) above St. Louis (1839.5 river km, 1143 river mi). Catch-per-unit-effort (CPUE) of Pallid Sturgeon was also higher in the lower reach and at the COR. Shovelnose sturgeon abundance increased going upstream, but was disproportionally higher at the COR. There is a relatively large population (1:6 ratio of Pallid to Shovelnose) of Pallid Sturgeon in the Atchafalaya River distributary compared to other parts of the Pallid Sturgeon range, although it is still unclear whether natural recruitment occurs in this area (Killgore et al. 2007a, USFWS 2007). Since 1991, more than 600 Pallid Sturgeon have been captured and marked in the Atchafalaya (USFWS database: http://pallidsturgeon.org/). Age 0 Pallid Sturgeon have been captured in the LMR, although it is unclear exactly where and when spawning occurs (U.S. Army Engineer Research and Development Center (ERDC), unpublished data; Hartfield et al. 2013). Two Age-0 *Scaphirhynchus* were collected at RM 35 representing the most downstream occurrence of either Pallid or Shovelnose Sturgeon.

*Habitat*

Pallid Sturgeon are typically associated with main channel habitats with relatively deep, flowing water in the Mississippi, Missouri, and Yellowstone Rivers. It commonly occurs over sandy substrates but often collected over gravel (USFWS 1993, Bramblett and White 2001, Hurley et al. 2004, Garvey et al. 2009, Koch et al. 2012). Several studies have documented Pallid Sturgeon near islands and dikes, and these habitats likely provide a break in water velocity and an increased area of depositional substrates appropriate for foraging. Increased use of side channel and main channel islands has been noted in spring, and it is hypothesized that these habitats may be used as refugia during periods of increased flow (Garvey et al. 2009, Koch et al. 2012). Telemetry monitoring of Pallid Sturgeon in the LMR indicates use of most channel habitats, including dikes, revetment, islands and secondary channels (Kroboth et al. 2013). A more recent study of 116 telemetry-tagged Pallid Sturgeon in the LMR indicated that natural bank, island tip, and secondary channel were positively selected and main channel, although frequently used, was avoided (Kroboth et al. 2020). The degree of selection varied among river stages, water temperatures, and reaches.

The Pallid Sturgeon occurs within a variety of flow regimes (Garvey et al. 2009). In their upper range, adult Pallid Sturgeon are collected in depths that vary between 2.0 to 48.0 ft, with bottom water velocities ranging 2.0 to 3.0 ft/s (USFWS 1993, Bramblett and White 2001, Gerrity 2005). Pallid Sturgeon in the LMR have been collected at depths greater than 65 ft, but with a preference for locations with moderate depth (median 11.7 m, 38.4 ft; lower and upper quartiles 8.1 m, 26.6ft and 16.3 m, 53.5 ft) and moderate current velocity (median 0.9 m/s, 3 ft/s; lower and upper quartiles 0.7 m/s, 2.3 ft/s and 1.2 m/s, 3.9 ft/s) (ERDC unpublished data, Kroboth et al. 2013; Kroboth et al 2020). Turbidity is thought to be an important factor in habitat selection by Pallid Sturgeon, as they have a tendency to occupy more turbid habitats than Shovelnose Sturgeon (Blevins 2011). In the LMR, Pallid Sturgeon have been collected in turbidities of up to 340 Nephelometric Turbidity Units (NTU), with a mean value of 90 NTU (ERDC unpublished

data). Critical habitat for the Pallid Sturgeon is currently not designated though a petition is pending (https://ecos.fws.gov/ecp/species/7162).

*Spawning and Rearing*

The Pallid Sturgeon, like other sturgeon species, is a migratory fish species moving upstream annually to spawn (Koch et al. 2012). Females may not spawn each year with a spawning periodicity of 2-3 years in northern latitudes (Kallemeyn 1983). Movements are generally triggered by increased water temperature, day length, and flow during spring months (Garvey et al. 2009, Blevins 2011, DeLonay et al. 2009). Subsequently, the seasonal movement of both Pallid Sturgeon and Shovelnose Sturgeon varies with greatest movement distances occurring in the spring and summer and lowest during the winter (Bramblett 1996). In addition, Bramblett (1996) noted a maximum home range of Pallid Sturgeon as large as 205 mi (330 km), with Pallid Sturgeon moving up to 13 mi/day (21 km/day) and Shovelnose Sturgeon moving up to 9 mi/day (15 km/day). Hoover et al. (2007) hypothesized that long-range movements during the spring may not just be associated with spawning but could also be associated with feeding. Movement patterns also likely differ between spawning and non-spawning years (Bramblett and White 2001). Garvey et al. (2009) suggested that Pallid Sturgeon remain sedentary or remain in one area for much of the year, and then move either upstream or downstream during spring. In addition, Pallid Sturgeon may undertake long-distance, multi-year upstream migrations or movements, based on recaptures of Shovelnose Sturgeon in the Missouri River that were originally tagged in the LMR. Upstream distances approaching 1,245 mi have been recorded (ERDC unpublished data) with similar distances recorded for downstream movements (Kroboth et al. 2013).

Spawning occurs during the spring with a second spawn or an extended spawning period potentially occurring during the fall in southern portions of the range (i.e., MSR) (USFWS 2007). Sexual maturity in female *Scaphirhynchus* spp. does not occur until ages 6 to 17, with spawning taking place every two to three years. Males reach sexual maturity earlier at ages four to nine (Keenlyne and Jenkins 1993, Colombo et al. 2007, Stahl 2008, Divers et al. 2009). The Pallid and Shovelnose Sturgeon at lower latitudes (e.g., LMR) may begin spawning at an earlier age than those in upper portions of the range (e.g., Upper and Middle Mississippi and Missouri Rivers), and as such both species from the LMR are reported to have shorter lifespans and reach smaller sizes (George et al. 2012). Also, LMR Pallid Sturgeon may be more highly fecund than those in northern portions of their range (George et al. 2012). Spawning is associated with coarse substrate (boulder, cobble, gravel) or bedrock, in deeper water, with relatively fast, converging flows, but natural spawning has never been directly observed in this species (USFWS 1993, DeLonay et al. 2007, DeLonay et al. 2009). Larval hatchlings are approximately 0.25 in total length (TL) and predominantly pelagic. They feed on yolk reserves while drifting downstream with the river current for 11 to 17 days, until yolk reserves are depleted (Snyder 2002, Braaten et al. 2008, DeLonay et al. 2009). Drift distance of larval sturgeon is thought to be between 86 to 329 mi (Kynard et al. 2007, Braaten et al. 2008).

*Feeding*

Pallid Sturgeon begin exogenous feeding around 11 to 12 days posthatch in upper portions of their range, but exogenous feeding was observed in fish as small as 0.70 in TL in the LMR

(Harrison et al. 2014), which could be as young as six to eight days posthatch (Braaten et al. 2007). The diets of young-of-year (YOY) and juvenile Pallid Sturgeon and Shovelnose Sturgeon in upper portions of their ranges are primarily composed of aquatic insects and other benthic macroinvertebrates, much like those of adult Shovelnose Sturgeon (Braaten et al. 2007, Wanner et al. 2007, Grohs et al. 2009). In contrast, YOY and juvenile Pallid Sturgeon in the LMR feed primarily on Chironomidae over sand in channel habitats (Harrison et al. 2014). Sturgeon are benthic feeders well-adapted morphologically (ventral positioning of the mouth, laterally compressed body) for the benthic lifestyle (USFWS 1993, Findeis 1997). Adult Pallid Sturgeon are primarily piscivorous (but still consume invertebrates) and are thought to switch from feeding primarily on invertebrates to fish at around age five or six years (Kallemeyn 1983, Carlson et al. 1985, Hoover et al. 2007, Grohs et al. 2009). In a study of Pallid Sturgeon in the MMR and LMR, fish were a common dietary component primarily represented by Cyprinidae, Sciaenidae, and Clupeidae (Hoover et al. 2007). Other important dietary items for Pallid Sturgeon in the MSR included larval hydropsychid caddisflies, mayflies, and true flies (Hydropsychidae (Insecta: Trichoptera), Ephemeridae (Insecta: Ephemeroptera), and Chironomidae (Insecta: Diptera)) (Hoover et al. 2007). Diet was found to vary depending on season and location which is likely related to prey availability with overall dietary richness found to be greatest in winter months (Hoover et al. 2007); for example, Trichoptera and Ephemeroptera were consumed in greater quantities in winter months in the LMR, while the opposite trend was observed in the MMR (Hoover et al. 2007).

*Swimming Performance*

Adams et al. (1999) evaluated swimming performance in juvenile Pallid Sturgeon and noted maximum sustained swimming speed was 0.328 and 0.82 ft/s (9.99 and 25 cm/s) for their two groups of fish. The fish were found to transition to burst swimming speeds at 1.31 and 1.9 ft/s (39.9 and 58 cm/s). White and Mefford (2002) examined swimming behavior and performance of Shovelnose Sturgeon ranging from 25.2 to 31.5 in (64.0 to 80.0 cm) in length to aid in the design of a fish passage on the Yellowstone River. The ability of Shovelnose Sturgeon to navigate the length of the test flume was best (60 to 90 percent) over a smooth bottom followed by coarse sand, gravel and then cobble, but the small sample size and large variability precluded this from being a definitive conclusion. The greatest success at negotiating the flume was determined to occur between the range of 2 and 4 ft/s (61 to 122 cm/s). Failure to exhibit rheotaxis was also observed at velocities below 1.6 ft/s (49 cm/s). Conversely, Adams et al. (1997) found all adult Shovelnose Sturgeon to be positively rheotatic. Pallid Sturgeon are believed to avoid areas that have no water velocity (Constant et al. 1997). Hoover, et al. (2005) examined swimming performance of juvenile Pallid Sturgeon (maximum size 6.3 in; 16 cm) at different velocities to evaluate entrainment risks during dredging operations. Minimum escape speeds for Pallid Sturgeon ranged from 1.6 to 1.7 ft/s (49 to 52 cm/s) while burst speeds ranged 1.7 to 2.95 ft/s (52 to 89.9 cm/s). Because they frequently failed to exhibit rheotaxis or orientation to the direction of flow (greater than 25 percent were non-swimmers), their ability to avoid entrainment based on swimming performance was determined to be relatively low. Hoover et al. (2011) examined swimming performance of adult Shovelnose Sturgeon in rectilinear and boundary layer flow. Mean critical swim speed in rectilinear flow was documented as 3.35 ft/s (102 cm/s) and boundary layer flow was documented as 5.25 ft/s (160 cm/s). Swim speeds were reduced in rectilinear flow because Shovelnose Sturgeon were unable to seek velocity refugia by

skimming above the ground. It is important to note that swimming performance studies are often performed on hatchery-reared fish or fish kept in tanks with low water velocity.

### 3.2.2 Gulf Sturgeon (*Acipenser oxyrinchus desotoi*)

The Gulf Sturgeon, *Acipenser oxyrinchus desotoi*, is one of the largest species of fish occurring in U.S. Gulf Coast rivers (Sulak et al. 2016). The fish has a cartilaginous skeleton with 5 rows of bony scutes which extend along the dorsal midline, lateral midline, and ventral edge of the lateral body surface. The snout is characteristically shovel-shaped with large fleshy barbels and a ventral mouth (Page and Burr 1991). Body coloration ranges from olive green, bluish gray or brownish along the dorsal surface with a pale white or cream-colored belly. Gulf Sturgeon are characterized as benthic cruisers and are generally oriented near the bottom where feeding targets small soft-bodied organisms (Kuhajda 2014). The species is anadromous with adults generally moving into rivers in the spring for spawning and moving back to coastal waters in the fall to feed (Ross 2001). Young sturgeon may spend up to six years in freshwater before moving out to sea, although the time spent in freshwater may be shorter in the Gulf Sturgeon, perhaps less than one year (Huff 1975). Sturgeon have a long adolescent period, with the youngest age of ripe fish being 12 years for females and 9 for males.

Sulak et al. (2016) noted that body size and duration for specific life history stages varies. Free embryo hatch from the egg at approximately 6.8–8.8 mm TL before transitioning to the exogenously feeding larval stage which lasts 5-8 days with fish attaining a TL of 14.7-17.5 mm. Larvae are initially free-swimming before transforming to a completely benthic lifestyle. YOY include age-0 stages from larva through first migration to the estuary in January-February (at age 9 months, 330–450 mm TL). YOY are initially described as black-stage YOY (age 2–4 months, 85– 150 mm TL) in reference to their dull black body coloration. This is a non-dispersal stage that occupies riverbed deposits of black decaying leaf litter. In contrast, bicolored-stage YOY (age 4–9 months, 150– 450 mm TL) acquire the typical adult body coloration and actively disperses widely within the natal river. Juvenile are <900 mm TL (age-0-6 years) and are sexually immature with individuals conducting annual seasonal movement back and forth between riverine freshwater and estuarine brackish waters. Subadults are characterized by early stages of gonadal development and range in age between 6 and 9-12, depending on sex (>900 mm TL, <1350 mm TL). Individuals in this stage conduct annual seasonal movement between the river and the open GOA. Adults (>1350 mm TL) possess mature gonads, migrate to upriver locations for spawning and conduct annual seasonal movements between the river and the open GOA.

Historically, maximum size was likely larger with multiple observations reporting individuals routinely exceeding 244 cm TL (8 ft) and upwards of 273 kg (602 lbs) in weight (Cook 1959, Reynolds 1993, Sulak et al. 2016). Huff (1975) reported a maximum age of 42 years using sections from pectoral rays but noted that reading sectioned rays for fish older than 17 years was problematic. Based on mean values for fork length, age 17 individuals generally exceed 160 cm FL. Sulak and Randall (2002) estimated that only 0.5% of adult Gulf Sturgeon in the Suwannee River lived beyond age 20.

*Taxonomic Status*

Initially termed as the Gulf of Mexico Sturgeon (Vladykov 1955), the Gulf Sturgeon belongs to the family Acipenseridae (Actinopterygii: Acipenseriformes) whose members represent one of the most endangered faunal groups in the world (Birstein 1993, Auer 2004). Recognized as a subspecies of the Atlantic Sturgeon by Vladykov (1955), Gulf Sturgeon are noted to have a longer head, longer pectoral fins, strongly developed scutes of distinctive shape and an unusually long spleen which extends much farther posteriorly beyond the middle loop of the small intestine compared to the nominal form. Wooley (1985) reevaluated these characters using a larger sample size and determined a high degree of overlap in most characters, but spleen length remained a highly diagnostic feature. King et al. (2001) conducted a nuclear DNA analysis between the two subspecies and demonstrated substantial genetic distance between the two forms.

The Gulf Sturgeon was listed as threatened by the USFWS in 1991 (USFWS 1991). A recovery plan was released in 1995 (USFWS 1995) with a five-year review completed in 2009 (USFWS and NMFS 2009) and a follow up five-year review initiated in 2019 (USFWS 2019a).

*Range and Population Status*

The Gulf Sturgeon occurs in the NGOA where it historically ranged from Tampa Bay, Florida (FL), west to at least the mouth of the MSR (Vladykov and Greeley 1963) but is now confined to seven core rivers extending from the Pearl River (W) to Suwannee River (E) (Sulak et al. 2016). Historically Gulf Sturgeon occurred in the Mobile Bay drainage (Sulak et al. 2016, Reynolds 1993) but the lack of contemporaneous data supporting an extant spawning population resulted in it not being included in the designation of critical habitat in 2003. However, Greenheck et al. (2023) recently evaluated a multi-year acoustic dataset for the Mobile Bay estuary and determined extensive seasonal use of the system by adult and subadult Gulf Sturgeon from both EGOA and WGOA systems.

The species exhibits high degree of stream fidelity (i.e., return to natal river to spawn) (Rudd et al. 2014) with a higher level of "wandering", especially during the summer holding phase, occurring between adjacent river systems (Sulak and Clugston 1999, Craft et al. 2001, Fox et al. 2002). Stabile et al. (1996) indicated substantial geographic population structure and identified regional and river-specific populations. Dugo et al. (2004) further evaluated the genetic structure of the species across it range and identified a western GOA group (Pearl and Pascagoula River systems) and an eastern GOA group (Escambia, Yellow, Choctawhatchee, Apalachicola and Suwannee River systems) with the divide occurring at Mobile Bay. Finer scale resolution within a natal drainage was noted by Dugo et al. (2004) for the Pascagoula River which supported the occurrence of multiple, unique spawning locations within that system.

North American sturgeon population levels plummeted during the late 1800s and into the early 1900s due to overfishing (Saffron 2002) with population recovery slowed as a result of influences associated with inland navigation practices and habitat degradation (Billard and Lecointre 2000). Furthermore, as a long-lived species with a late age of sexual maturity, in addition to their long-distance migratory behavior, the recovery potential for sturgeon likely occurs at a multi-generational scale (Ahrens and Pine 2014, Rudd et al. 2014).

Currently, Gulf Sturgeon population status across its range varies between systems with highest abundances generally occurring in EGOA systems with the Suwannee River having the highest followed, in decreasing order, by Choctawhatchee, Yellow, Escambia, Apalachicola, Pearl and Pascagoula rivers (Sulak et al. 2016). Western GOA population levels have generally been much lower, comparatively, which may be attributed in part to episodic stochastic mortality events such as hurricanes (Havrylkoff 2010, Dula et al. 2022). However, current population levels are considered to be substantially less than those reported from commercial harvest records during the early 1900s (Flowers 2008, Ahrens and Pine 2014).

The Gulf Sturgeon recovery plan (USFWS 1995) identified several short-term and long-term objectives to promote recovery of the species. Short-term objectives included 1) preventing further reduction of existing wild populations, 2) establishing a baseline population index using fishery independent CPUE levels and 3) documenting a change from the baseline CPUE level over a three-to-five-year period. Long-term objectives focused on 1) establishing population levels that allowed delisting management units by 2023 and 2) following delisting, establish management unit populations that could sustain a directed fishery. With the release of the Five-Year Review (USFWS and NMFS 2009), the Services acknowledged great progress in terms of understanding metrics important to Gulf Sturgeon recovery (e.g., population status, genetic structure, migration windows, habitat, reproduction); however, most of the criteria identified in the Recovery Plan for establishing recovery success were not met. In particular, it was noted that baseline CPUE indices were not initially established and as such a defined recovery metric was lacking although most Gulf Sturgeon populations were considered to be stable or slowly increasing (USFWS and NMFS 2009).

*Habitat*

As dictated by their anadromous lifestyle, Gulf Sturgeon inhabit a variety of habitats ranging from upriver reaches where spawning occurs to offshore marine areas where subadults and adults feed (Foster and Clugston 1997, Heise et al. 2004). Following hatching, free embryo larvae seek shelter within the interstitial spaces of the gravel characteristic of the spawning area (Kynard and Parker 2004). Exogenously feeding larvae initiate drift foraging as they commence their downstream dispersal from the spawning area (Kynard and Parker 2004). Black-stage YOY are generally associated with blackened decaying vegetative litter occurring in riverbed swales, crevices and depressions within mid to lower reaches of the river and are primarily sedentary feeding on epibenthic invertebrates (Kirk et al. 2010, Sulak et al. 2016). The bicolored-stage YOY exhibits mobile foraging on open sand substrates in the river (Sulak and Clugston 1999). Juveniles, subadults and adults conduct annual seasonal movement back and forth between riverine freshwater and estuarine brackish and open marine waters (Sulak and Randall 2002).

Within WGOA drainages, Heise et al. (2005) noted Gulf Sturgeon congregating in deep locations, either in or downstream from river bends during the summer holding period and generally exhibited little movement during this residency period. Grammer et al. (2015) further highlighted the environmental drivers that initiated the movement of sturgeon from upriver holding areas to the downstream fall staging areas occupied prior to emigration from the freshwater system. Fall staging areas generally occur upstream of the fresh/saltwater interface where fish remain for extended periods (days to weeks) to facilitate a period of osmoregulatory adjustment.

For the Pascagoula River estuary, Peterson et al. (2013) observed differential habitat use by Gulf Sturgeon depending on life history stage with adults generally moving quickly through the system during fall and spring compared to longer but more spatially and temporally variable occupancy patterns noted for juveniles and sub-adults during both seasons. Juveniles spent considerably more time in the estuary than subadults or adults (Peterson et al. 2016). Physical habitat where sturgeon typically occurred differed by season for lower river sites due primarily to differences in river stage. River sites were characterized with a mean depth of 5.04 m (16.5 ft) during the fall and 4.07 m (13.4 ft) in the spring. Similarly, salinity averaged 22.89 ppt (fall) and 11.26 ppt (spring). Substrate consisted primarily of sand (65.59%, fall; 61.21%, spring) followed by silt (29.37%, fall; 25.79%, spring) and clay (5.04%, fall; 10.59%, spring). Estuarine stations were shallower, comparatively (1.36 m, fall; 1.71 m, spring) but salinity and substrate compositions were similar to those observed for riverine stations. Peterson et al. (2018) evaluated use of nearshore estuarine habitat, particularly shallow non-island beach environments within the western MS Sound. Gulf Sturgeon of all stages appear to use this habitat which was counter to previous concepts regarding use by adult Gulf Sturgeon. Adults and larger subadults likely use the habitat as a travel corridor between drainages, offshore barrier islands or as feeding zones while juvenile Gulf Sturgeon exhibit restricted movement away from estuaries of natal river until they reach a larger size.

Open water marine habitat including the MS Sound and its associated barrier islands are areas utilized by older subadult and adult Gulf Sturgeon to feed (Rogillio et al. 2007, Ross et al. 2009). Presumed foraging areas near the barrier island based on telemetry detections are characterized with a mean depth of 4.1 m (13.5 ft ) (range 1.4-11.0 m, 4.6-36 ft) and consist primarily of sand substrate (88.1%, range 3.2-100%) with varying proportions of silt (mean 7.5%) and clay (mean 3.8%) (Wilber et al. 2020) Sturgeon from both WGOA and EGOA populations have been noted to occur within these habitats during the winter foraging period (Vick et al. 2018).

Critical habitat was designated in 2003 (USFWS and NMFS 2003) and encompasses approximately 2,783 river km (1,730 river mi) and 6,042 $km^2$ (2,333 $mi^2$) of estuarine and marine habitat extending from LP to the Suwannee River, FL (Figure 8).

*Spawning and Rearing*

Spawning occurs in upriver reaches in the spring following the upriver migration of reproductively mature adults. In the Pascagoula drainage, individuals have been documented to arrive at the spawning area on the Bouie River starting from early to mid-April (Heise et al. 2004). Spawning habitat generally consists of hard substrates such as bedrock or clay overlaid with gravel and/or cobble and turbulent flows (Sulak and Clugston 1998, Heise et al. 2004, Scollan and Parauka 2008). The initiation of spawning has been linked to multiple cues including temperature, river discharge and lunar phase (Wooley and Crateau 1985, Sulak and Clugston 1998, Fox et al. 2000, Heise et al. 2004). Following the spawning period, adults migrate downstream to the summer holding area. There has been increasing evidence that some populations exhibit a separate fall spawning period (Randall and Sulak 2012, A.G. Fox University of Georgia personal communication).

Free embryos seek refuge within the interstitial spaces of gravel at the spawning area (Kynard and Parker 2004). Transformation to the free-swimming stage occurs about 5-8 days post hatch (Bardi et al. 1998, Kynard and Parker 2004) followed by a slow downstream dispersal period featured by a transition to a mobile foraging state (Sulak and Clugston 1999). Spring spawned YOY reach to the lower estuarine reach of the river at age 10-11 months (late January - early February) (Sulak and Clugston 1998, 1999).

*Feeding*

Most dietary information for Gulf Sturgeon is based on examination of a limited number of archived specimens, samples acquired via gastric lavage on live specimens or from sampled benthic habitats associated with high detection occurrences of the species or life history stage. Feeding by YOY occurs primarily within the freshwater portion of the natal river where individuals consume primarily aquatic insect larvae and gammarid amphipods (Mason and Clugston 1993). Juveniles feed almost extensively within estuarine habitats although freshwater prey items have been noted which included aquatic insect larvae (chironmids and mayflies), oligochaetes and gastropods and amphipods (Mason and Clugston 1993). Subadults and adults feed only within brackish estuaries or open water marine environments and exhibit a trophic ratchet pattern with alternating winter weight gain while in saline waters versus a spring-to-autumn weight loss while in riverine freshwaters (Sulak and Randall 2002).

Estuarine and open water marine prey resources represent a diverse group of primarily soft bodied organism. Mason and Clugston (1993) listed 24 major taxa as prey items and Peterson et al. (2013) expanded on that list by providing a summary of documented Gulf Sturgeon prey items by drainage. Important prey items include brachipods (*Glottidia pyramidata*), ghost shrimp (*Lepidophthalmus louisianensis*), lancelets (*Branchiostoma caribaeum*) and gammarid amphipods. In addition, Haustoriidae, Corophiidae and Amplescidae amphipods, cumaceans, isopods (Cyathura), mysids, grass shrimp (Palaemonetes), insect larvae (Chironomidae, Ceratopogonidae), polychaetes (Arenicolidae, Nereidae, Orbiniidae, Sabellidae, Capitellidae), oligochaetes (Tubificidae), brittlestars, starfishes, keyhole urchins (Mellita), sea cucumbers, globular bivalves (Cardidae, Tellinidae), gastropods, small fishes, decapod crustaceans, bryozoans, diatoms, fibrous plant material have been noted (Boschung and Mallory 1956, Huff 1975, Carr 1983, Mason and Clugston 1993, Carr et al. 1996, Fox et al. 2000, Heard et al. 2002, Murie and Parkyn 2002, Ross et al. 2009, Peterson et al. 2013).

However, Wilber et al. (2019) evaluated multiple long-term benthic datasets to assess the relative quality of Gulf Sturgeon foraging habitat within the open water marine environment throughout the northern GOA. High prey densities frequently occurred where high Gulf Sturgeon activity levels previously were identified in telemetry studies although potential prey assemblages differed geographically. Gulf Sturgeon prey assemblages were correlated with physical habitat parameters, but these relationships differed between eastern and western regions reflecting a shift in substrate composition along a EGOA to WGOA gradient resulting in a variable benthic infauna assemblage. For example, prey assemblages were dominated by amphipods on the northwest coast of FL, followed by overall lower potential prey densities in the north-central GOA, and relatively high gastropod and bivalve densities in Louisiana waters.

*Migration and Movement*

In MS, sub-adult and adult Gulf Sturgeon overwinter in the MS Sound, congregating near the passes between barrier islands (Rogillio et al. 2007, Ross et al. 2009) from October through April with the highest number of sturgeon appearing December - February (Figure 9). The spring migration is segregated into spawners and non-spawners. Spawners enter the river in early spring and travel to the spawning grounds where they remain for discrete spawning events before they move downriver to the in-river holding area (Fox et al. 2000, Heise et al. 2004). In contrast, non-spawning late juvenile and sub-adult Gulf sturgeon migrate to in-river holding areas in late May – June (Foster and Clugston 1997, Heise et al. 2005). The shift from the holding areas to downstream staging areas occurs during early to late fall prior to emigration from freshwater to estuarine and marine open water areas where feeding occurs (Grammer et al. 2015). Spring spawned YOY reach the lower estuarine reach of the river late January - early February and remain within the estuary feeding until they initiate the annual upriver migration characteristic of older subadults and adults by age 6 (Sulak and Clugston 1998, 1999) (Table 4).

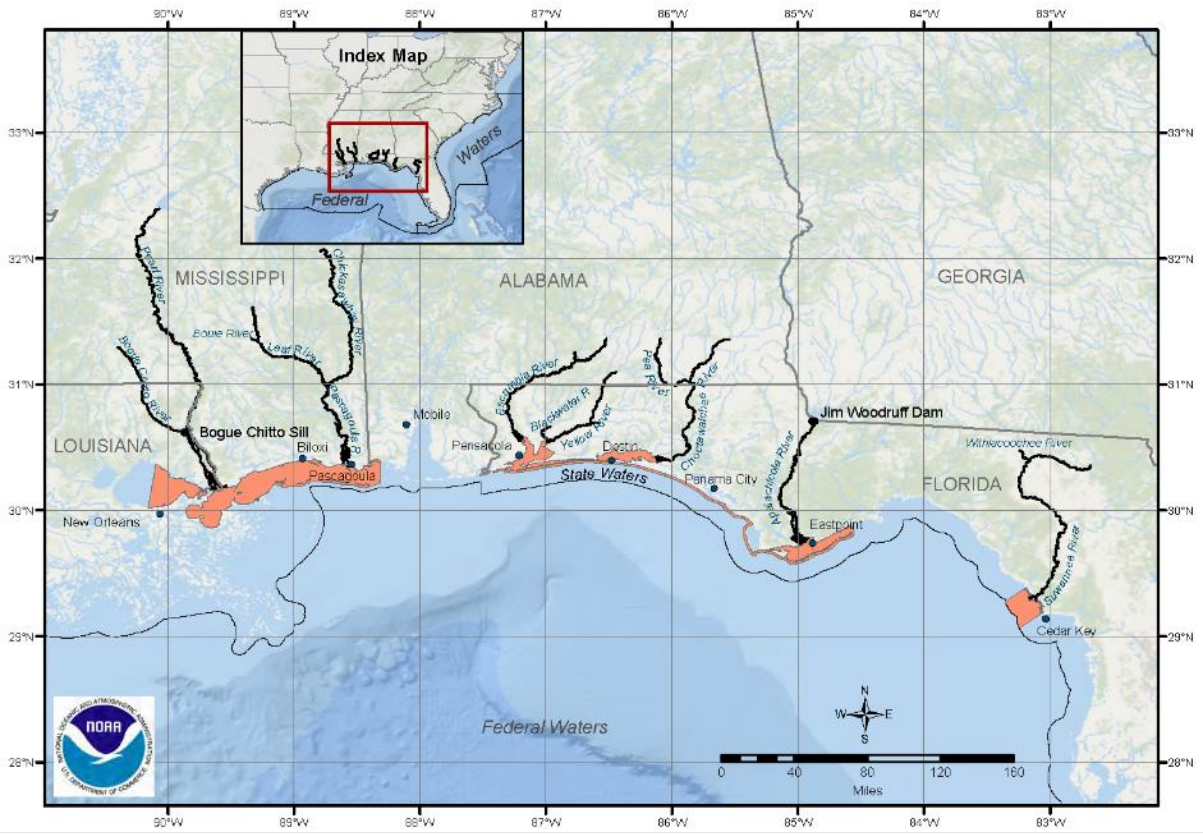


**Figure 8. Map of Gulf Sturgeon critical habitat.**

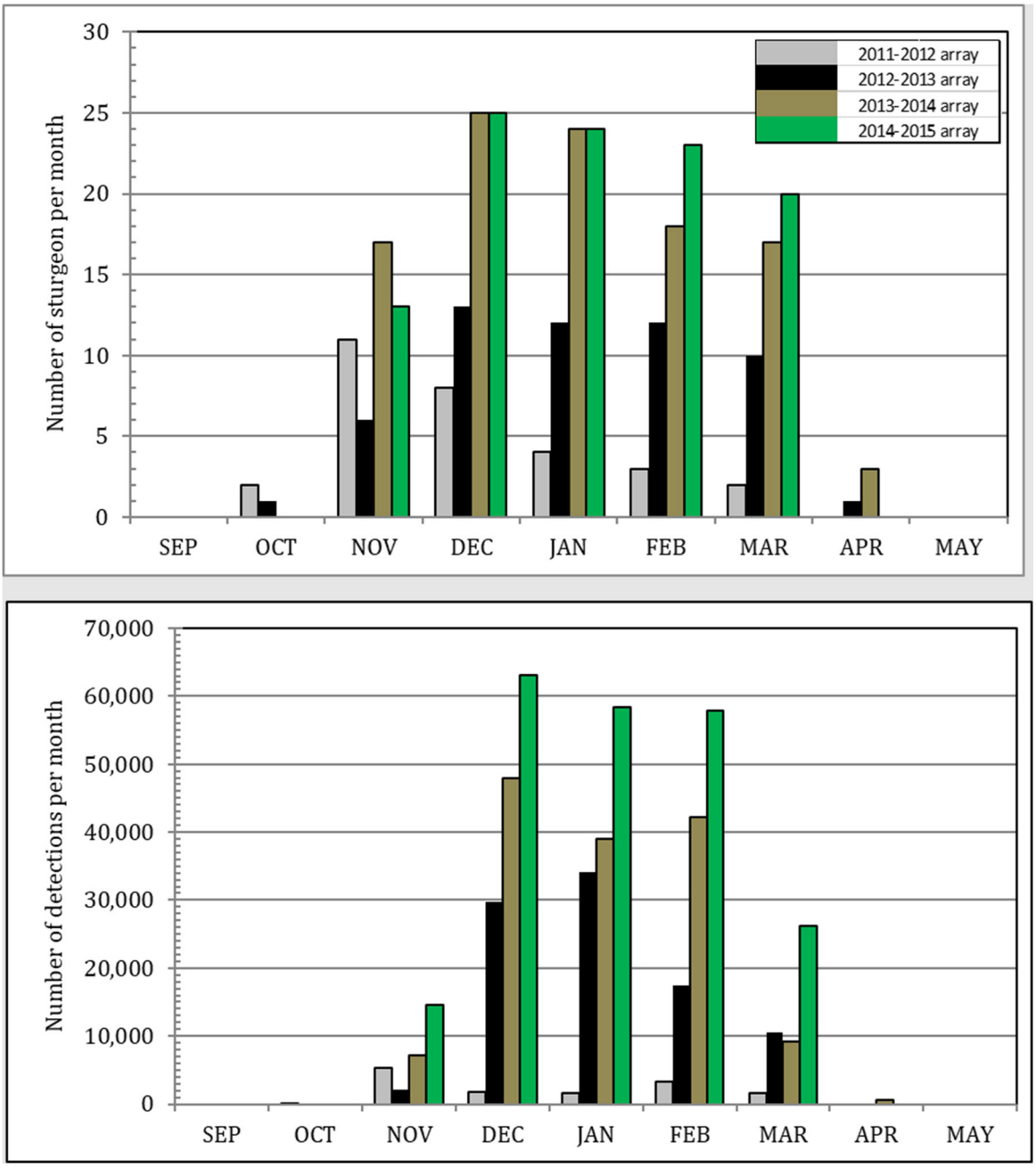


**Figure 9. Number of Gulf Sturgeon (top panel) and associated telemetry detections (bottom panel) observed for an acoustic telemetry array deployed annually (2011-2015) from September through June at Ship Island. USACE Mobile District Mississippi Coastal Improvements Program (Slack, Peterson and Andres, unpublished data).**

**Table 4. Generalized timing of YOY, juvenile, subadult, and adult Gulf Sturgeon *(Acipenser oxyrinchus desotoi)* migratory movement within the Pascagoula drainage, MS.**

| Activity | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Age 0 | | | | | | | | | | | | |
| | Spawn → Downstream riverine dispersal → | | | | | | | | | | | |
| Age 0 | | | | | | | | | | | | |
| | Arrive at estuary | | | | | | | | | | | |
| Age 1-6 | | | | | | | | | | | | |
| | Movement and feeding confined to lower river and associated estuary and bays. | | | | | | | | | | | |
| | | | | | | | | | | | | |
| 1 | | | | | | | | | | | | |
| 2 | | | | | | | | | | | | |
| 3 | | | | | | | | | | | | |
| 4 | | | | | | | | | | | | |
| 5 | | | | | | | | | | | | |

1. Movement from saltwater to freshwater (adult).
2. Spawning (upper reaches of river) (adult).
3. Summer holding and staging area (lower reach of river) (juvenile, subadult, adult).
4. Movement from freshwater to saltwater (juvenile, subadult, adult).
5. Feeding in estuarine (juvenile) and open water marine environments (subadult, adult).

### 3.2.3 Green Sea Turtle (*Chelonia mydas*)

Green sea turtles (*Chelonia mydas*) are characterized by light or dark brown carapaces sometimes shaded with olive, often with radiating mottled coloration, wavy dark markings, or large dark brown blotches (Figure 10). Adults have an average length of 36 to 48 in and weigh from 250 to 450 lbs. Green sea turtles are considered nutrient-limited, resulting in low growth rate, delayed sexual maturity, and low annual reproductive effort. Juveniles are mainly carnivorous, feeding on jellyfish and other invertebrates, while adults are primarily herbivorous and feed on seagrasses, such as *Thalassia testudinum* in shallow waters (Hirth 1997).

**Figure 10. Green sea turtle (*Chelonia mydas*). (Photo Credit: P. Lindgern, Wikimedia Commons).**

Most green sea turtle populations have been severely depleted and are now endangered because of direct exploitation or take as bycatch in other fisheries. Additional threats include feeding habitat degradation, loss of nest beaches to shoreline development, and disease (Seminoff 2004).

*Habitat use in the NGOA*

Green sea turtles have a circumglobal distribution and are concentrated primarily in tropical and secondarily in subtropical waters (Seminoff 2004). In the NGOA, green sea turtle nesting sites are located on select beaches along the FL panhandle (Rose 2014). Recent genetic work has also

shown that the NGOA contains important nursey and foraging habitats for juvenile and adult green sea turtles originating from nesting sites in Mexico (Shamblin et al. 2023). Outside of FL, the offshore waters of LA, MS, and AL appear to be suitable areas for migratory adults and surface-pelagic aggregations (Putman et al. 2020, Shamblin et al. 2023). Although green sea turtles are occasionally observed in the nearshore areas of these states (Howell et al. 2021), these areas are not considered "hotspots" for aggregations of the species (Cuevas et al. 2022). However, there is one known reoccurring foraging aggregation of green sea turtles near Port Fourchon, LA, directly south of the MSR Delta (Shamblin et al. 2023).

### 3.2.4 Loggerhead Sea Turtle (*Caretta caretta*)

The loggerhead sea turtle (*Caretta caretta*) adults generally reach carapace lengths of 33-48 in and weights between 175-440 lbs. As they grow, their carapace transitions from dark coloration to a reddish-brown with a yellowish plastron (Figure 11). Their scutes form three keels on their back and two on their underside. Loggerheads are known for having a relatively large head for their body size, due to large jaw muscles that enable them to crush and eat shelled prey items. They are a long-lived species and may live to over 80 years. Female loggerheads become mature around 28-33 years (Spotila 2004).

**Figure 11. Loggerhead sea turtle (*Caretta caretta*). (Photo Credit: USFWS, Wikimedia Commons).**

Bycatch of loggerheads in commercial fisheries continues to be the biggest threat to the Northwest Atlantic population (Bolten et al. 2011, Finkbeiner et al. 2011, NMFS/USFWS, 2023). Another major threat is loss of nesting beaches due to coastal development or light pollution that deters loggerheads from nesting (Bolten et al. 2011, Rizkalla and Savage 2011, Reece et al. 2013, NMFS/NOAA 2023).

*Habitat use in the NGOA*

Genetic analysis and satellite tracking from nesting areas throughout the tropics and subtropics support that there are nine distinct loggerhead population segments spread throughout the world (Conant et al. 2009, Shamblin et al. 2014, Hawkes et al. 2011, Winton et al. 2018, Evans et al. 2019). Only one population segment, the Northwest Atlantic, nests within the GOA, US Atlantic Coast, and the northern region of South America (NMFS/USFWS 2023). Loggerheads are philopatric, with mating occurring in the NGOA in late March to early June (Lasala et al. 2018). Nesting occurs from April to September, peaking in June and July (Conant et al. 2009). Females prefer highly sloped open beaches which reduces travel distance to reach the nesting area above the high-tide line (Miller et al. 2003, Lamont and Houser 2014). About 90% of the Northwest Atlantic loggerhead population segment nests within Florida borders annually. Less than 1% of

the population nests in AL, MS, and Texas (NMFS/USFWS 2023). There are no nesting sites reported within Louisiana. Older juveniles and adults forage within the coastal and offshore areas of the NGOA throughout the year. The coastal NGOA west of FL to Texas is within the migratory range of loggerheads but is not designated as a hotspot for foraging or migration (Cuevas et al. 2022). The main hotspots for female adult loggerheads are the southwest portion of Florida and the southern GOA.

Once entering the water, the hatchlings will swim until reaching offshore currents (DuBois et al. 2021). Young juveniles are omnivores, drifting within sargassum patches within the GOA and the Sargasso Sea oceanic zone (Witherington et al. 2012). Older juveniles, like loggerhead adults, transition to foraging in the neritic zone but may move back to the oceanic zone based on prey availability (Ramirez et al. 2015, 2017). Adult loggerheads typically have an adaptable carnivorous diet while foraging in neritic coastal zone of tropical and temperate waters (Dodd 1988, Conant et al. 2009). Common hard-shelled prey include swimming crabs, lobster, horseshoe crabs, bivalves, whelk, and conch. They are also known to feed on soft-bodied organisms.

### 3.2.5 Kemp's Ridley Sea Turtle (*Lepidochelys kempi*)

The Kemp's ridley sea turtle (*Lepidochelys kempii*) is the smallest sea turtle within US waters. Adults have shell lengths ranging from 24-30 in and weigh 80-110 lbs. The adults usually have an olive-green, almost circular-shaped carapace and a yellowish-brown or white plastron. The juveniles are black on both sides. The Kemp's ridley has a triangular head with a moderately hooked beak. Additional identifying characteristics include five costal scutes with the first touching the nuchal scute (Spotila 2004) (Figure 12). Subadults become sexually mature around 10-18 y of age with variation based on water temperatures (Schmid and Woodhead 2000, Snover et al. 2008, Shaver and Wibbels 2007, Caillouet et al. 2011). Their lifespan of this species is unknown but is estimated to be >30 years.

**Figure 12. Kemp's ridley sea turtle (*Lepidochelys kempii*). (Photo Credit: NER Sea Turtle Stranding Network, Wikimedia Commons).**

Kemp's ridley is listed as endangered and protected by the US Endangered Species Act. The estimated 40,000 females nesting yearly at just Rancho Nuevo in the 1940s plummeted to <300 females in the 1980s (Spotila 2004, NMFS/USFWS 2015). The main cause of the population collapse was collection of the eggs by humans during the nesting period. Kemp's ridleys are also subject to drowning in commercial fisheries, most notably shrimp trawling. Following improved management strategies, Kemp's ridley nesting populations steadily increased between 1990 and

2010. Unfortunately, from 2011 to 2015 there has been a decreasing trend in nesting populations (Caillouet 2014, Shaver and Caillouet 2015).

*Habitat use in the NGOA*
Kemp's ridley occur mainly in bays and coastal waters of the Atlantic Ocean and GOA, but on rare occasions have been documented off France, Morocco, and within the Mediterranean Sea (Spotila 2004, Watson et al. 2004, Witt et al. 2007). Currently, tens of thousands (~95% of the entire species) nest on or within a few hundred miles around the island of Rancho Nuevo, Mexico. Due to nest relocation programs, a few hundred females nest along Padre Island, Texas annually. A few nests (1-10) are documented in AL, FL, Georgia, North Carolina, and South Carolina annually (NMFS/USFWS 2015). Kemp's ridley nesting has not been documented in LA or MS. Adult females generally inhabit coastal waters <50 m deep throughout the GOA while most males are non-migratory and stay close to nesting beaches year-round (Spotlia 2004, Hughes and Landry 2013, Shaver et al. 2005, 2013, 2016).

Mating occurs near nesting beaches prior to nesting period from April to August (Morreale et al. 2007, Rostal 2007). After hatching, juveniles flow with the current for 2 years, feeding on sargassum or small sargassum-associated fauna. Most juveniles stay within the GOA while an estimated 1/3 drift along the eastern coast of the US (Spotila 2004, Putman et al. 2010, 2013). At 2-3 years of age, subadults migrate towards the coastline to feed on larger prey such as portunid crabs, mollusks, jellyfish, other invertebrates, and small fish, which are the typical prey items of adults as well (Ogren 1989, Witzell and Schmid 2005, Schmid et al. 2013, Ramirez et al. 2020).

Kemp's ridley are mostly confined to the GOA with juveniles and subadults also inhabiting the eastern US coast and bays. Nesting is relatively rare outside of the western GOA but juveniles, subadults, and adults are common throughout the NGOA. Coastal waters of northern Texas to western FL seem to be common foraging areas for subadults and female Kemp's ridley (Shaver et al. 2013, Howell et al. 2021). Based on satellite telemetry data from breeding-age Kemp's ridley females tagged at nesting grounds throughout the western GOA, there is a foraging-aggregation hotspot from the Texas-Louisiana border to just west of the MSR mouth and an additional foraging-aggregation area offshore of MS (Gredzen and Shaver 2020, Cuevas et al. 2022).

### 3.2.6 Hawksbill Sea Turtle (*Eretmochelys imbricata*)
The hawksbill sea turtle (*Eretmochelys imbricata*) is a relatively small sea turtle, generally reaching only 2-3.5 ft carapace length and 100 to 150 lbs in adulthood. Hawksbills are distinguishable from other sea turtle species by their strong beak-like mouth and their "tortoise shell" coloration (Figure 13). This species is distributed circumglobally in tropical waters and are less commonly found in subtropical waters. Although this species is highly migratory, within the continental US, nesting areas are restricted to the east coast of the southern FL and the FL Keys (NOAA Fisheries 2022).

Hawksbill are endangered throughout their range. Major threats to this species include direct harvest, bycatch, loss of nesting and foraging habitats, egg depredation by non-native predators, marine pollution, changes in environmental conditions, and vessel strikes (NOAA Fisheries 2022).

*Habitat use in the NGOA*

Preferred habitats for hawksbill include coral reefs, brackish mangrove estuaries, and rocky bottom habitats (Hart et al. 2012, Martinez-Estevez et al. 2021). This species is omnivorous and primarily feeds on marine algae, invertebrates, and small fishes (NOAA Fisheries 2022). In North and Central America, hotspots for hawksbill migratory and foraging aggregations are concentrated in the southern GOA, surrounding the Yucatan Peninsula and south of Cuba. The only hotspots identified in the continental US are surrounding the southern FL Keys (Cuevas et al. 2022). Acoustic and satellite tracking studies have shown that hawksbill turtles exhibit small home ranges (i.e., generally 1-10 $km^2$) surrounding mixed habitat foraging areas and generally do not migrate from the southern to the northern GOA (Cuevas et al. 2022, Hart et al. 2012, Martinez-Estevez et al. 2021).

**Figure 13. Hawksbill sea turtle (*Eretmochelys imbricata*). (Photo Credit: Anonymous, Wikimedia Commons).**

### 3.2.7 Leatherback Sea Turtle (*Dermochelys coriacea*)

The leatherback sea turtle (*Dermochelys coriacea*) is the largest extant sea turtle, weighing up to 1980 lbs. with adult carapace lengths of 50-70 in. They are unique among sea turtles in that in lieu of keratinized scutes, they have a leathery hide with seven horizontal ridges which aid in hydrodynamics. Their carapace is mostly black with white blotches, but their plastron is mostly white with black blotches (Figure 14). Leatherbacks lack the typical crushing jaws of other turtles, so their diet mainly consists of gelatinous prey (NMFS/USFWS 2020). Leatherbacks mature around 11-20 years of age when they will start mating and nesting (Avens et al. 2020).

**Figure 14. Leatherback sea turtle (*Dermochelys coriacea*). (Photo Credit: Claudia Lombard, USFWS, Wikimedia**

The leatherback is listed as endangered throughout its entire range. Historically harvest of adults and eggs during nesting events were the main drivers that caused the decline in leatherback populations. While harvest still occurs, fisheries bycatch is currently the main threat to population recovery along with coastal development interfering with nesting success (NMFS/USFWS 2020).

*Habitat use in the NGOA*
Leatherbacks are mainly pelagic, inhabiting the open ocean and seldom entering coastal waters except for nesting purposes (NMFS/USFWS 2020). They forage in all marine areas except Arctic and Antarctic. All leatherback life stages eat gelatinous organisms, including pelagic jellyfish, tunicates, and ctenophores (Salmon 2004, Eckert et al. 2012, Jones and Seminoff 2013). Adults may forage over thousands of miles between nesting periods which are typically in 3-year intervals (Spotila 2004). Like other sea turtles, leatherbacks are philopatric, meaning adults tend to mate and nest at the same general location they were hatched (Stewart and Dutton 2011, NMFS/USFWS 2020).

Leatherbacks nest during summer on tropical and subtropical beaches around the world in both the northern and southern hemispheres (Hays and Scott 2013). No leatherback nesting has been documented in the NGOA (NMFS/USFWS 2020). However, satellite tracking data show that some adults nest in Panama (the southwest Atlantic population) and FL (the northwest Atlantic population). Once reaching the water, hatchlings swim for days away from shore (Wyneken and Salmon 1992, Eckert et al. 2012). Although little is known about leatherback juvenile and immature life stages, the general hypothesis is that they inhabit warmer waters until they reach 40 in curved carapace length and then may spread to colder waters to exploit additional foraging habitat (Eckert 2002, Eckert et al. 2012, Pritchard 2015). For this reason, both the southwest and northwest Atlantic population segments inhabit the NGOA to forage (Fossette et al. 2014, Aleksa et al. 2018). One of the main foraging areas was on the coastal shelf of the FL panhandle; however, no tagged turtle went within 70 mi of the outflow of LP (Heal et al. 2023).

### 3.2.8 West Indian Manatee (*Trichechus manatus*)

The West Indian manatee (*Trichechus manatus*) is a slow-moving sirenian mammal adapted to grazing on submerged aquatic vegetation (SAV) in shallow coastal areas. Manatees are easily recognizable among marine mammals by their round, gray bodies with square snouts, flexible flippers, and flat paddle-like tails (Figure 15). Adults usually are 9-13 ft in TL and 440-1100 lbs. West Indian manatees live in marine, brackish, and freshwater systems in coastal and riverine areas throughout their range. They are primarily found in subtropical and tropical areas of northern South America, West Indies/Caribbean region, GOA (now mainly western and southwestern portions) and southeastern North America (Nowak 2003). In the US, manatee populations are threatened by high mortality often associated with human activity (especially collisions with boats in FL), low reproductive rates, and habitat loss.

**Figure 15. West Indian Manatee (*Trichechus manatus*).**
**(Photo Credit: USGS, Wikimedia Commons).**

Though not part of their current primary range, the West Indian manatee is an infrequent visitor to the MS Sound, Lakes Borgne, Pontchartrain, and the surrounding delta (Fertl et al. 2005). Present range limits are similar to those known historically, but the distribution is patchy due to

areas of localized extirpation. Sightings of manatees in the NGOA have increased in frequency since the 1970s, which may in part be due to rising sea surface temperatures allowing for range expansion, as well as improved reporting and record keeping (Slone et al. 2022, Hieb et al. 2017). Although data on the habitat use of manatees in the NGOA are limited, preferred habitats throughout their range are shallow nearshore areas featuring freshwater for drinking, warm water refuge, or SAV such as seagrass and macroalgae (Slone et al. 2022).

Although manatees can be found year-round in the NGOA west of FL, peaks numbers are observed in the summer months (Hieb et al. 2017). Opportunistic sightings of manatees are less common outside of FL and generally continue to decline moving westward on the NGOA coasts from AL to MS to LA. As such, these sighted manatees are primarily thought to be transient in the NGOA, arriving in the spring, and leaving during the fall (Carmichael et al. 2023; Figure 16). Winter in the NGOA poses a cold stress threat to manatees as water temperatures fall below manatee thermal tolerance levels, unless they find a warmer water source such as near a power plant (Slone et al. 2022).

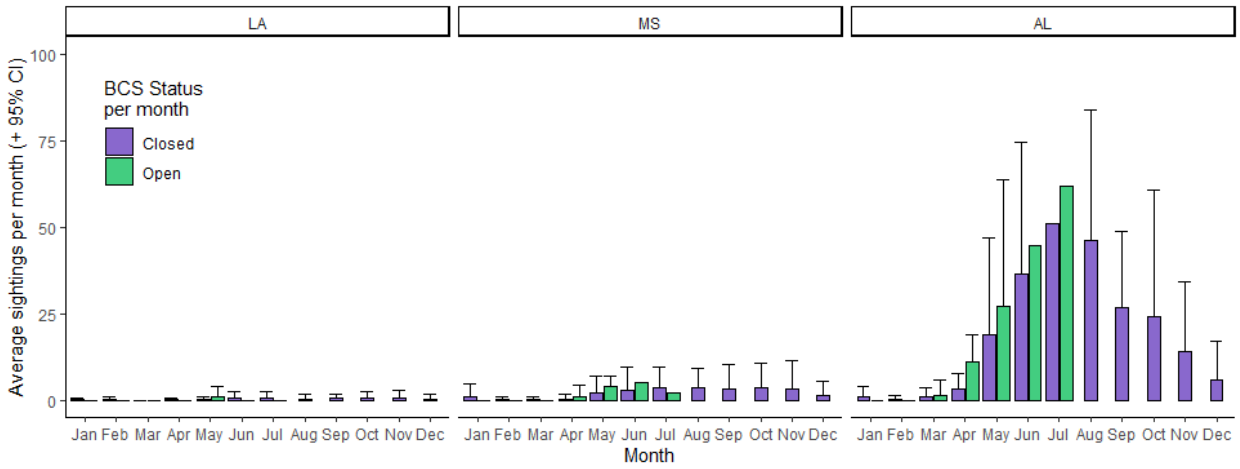


**Figure 16. Opportunistic manatee sighting records in LA, MS, and AL (2007-2022). Average monthly sighting counts recorded during months which the BCS was open or closed.**

**Figure notes: Error bars represent the upper bound of the 95% confidence interval. Bars missing error bars indicate strandings were only recorded in one year during that month and BCS status. Data provided by Dauphin Island Sea Lab's Manatee Sighting Network Database (Carmichael et al., 2023).**

Manatees may visit the NGOA to access areas with less extensively grazed submergent, emergent, and floating vegetation. Marine SAV in MS and LA is primarily found surrounding the barrier islands which bound the Chandeleur and MS Sounds (Fodrie et al. 2010). Further, freshwater SAV can be found in Lake Pontchartrain along the northeastern and southeastern shorelines, although it is declining in abundance and distribution (Poirrier et al. 2009). Manatee sightings in LA, MS, and AL are primarily opportunistic and therefore may be biased toward areas with greater human populations. Yet, manatees have been observed in the coastal, lotic, and lentic waters of these states (Carmichael et al. 2023, Fertl et al. 2005; Figure 16), possibly taking advantage of grazing opportunities with less competition from conspecifics. Manatees have also been occasionally observed grazing on emergent salt marsh grasses, such as *Spartina alterniflora* (Baugh et al. 1989), which is an abundant species throughout the NGOA.

### 3.2.9 Giant Manta Ray (*Manta birostris*)

The giant manta ray (*Manta birostris*) is the world's largest ray with a wingspan of up to 29 ft (Figure 17). Giant manta rays are slow growing, highly migratory, filter feeding animals with small, sparsely distributed populations across the world (Couturier et al. 2012). The main threat to the giant manta ray is commercial fishing, with the species both targeted and caught as bycatch in numerous fisheries throughout its range (NOAA Fisheries 2020).

**Figure 17. Giant Manta Ray (*Manta birostris*) (Photo Credit: Rilando June Lamadjido, Wikimedia**

Recent survey data consolidation and synthesis efforts have revealed that within the GOA the highest concentration of giant manta ray sightings is in the offshore waters of LA, primarily surrounding a known nursey area in the Flower Garden Banks National Marine Sanctuary (FGBNMS), located south of the MSR delta near the Louisiana–Texas border (Farmer et al. 2022). Manta rays in this area are likely capitalizing on high concentrations of large zooplankton in the MSR plume, especially in mid-salinity regions (Shropshire et al. 2020). Therefore, core habitats for giant manta ray do not appear to include areas within the nearshore waters of LA or MS (Garzon et al. 2021). However, transient occurrences of this highly mobile species appear common outside of core habitats, in the MS Bight, on the seaward sides of the Chandeleur and MS barrier islands, from April to June and September to November (Farmer et al. 2022).

### 3.2.9 Piping Plover (*Charadrius melodus*)

The Piping Plover (*Charadrius melodus*) is a small shorebird with populations along the Atlantic Coast, Great Lakes, and the Great Plains. This plover is characterized by a white pale belly and throat, and sand-colored upper parts, with a distinct black band on the head and an incomplete black collar on both males and females (Figure 18). During the breeding season, the bird supports a short, thick orange bill with a black tip, and short orange legs. Breeding male coloration is more pronounced than the drabber breeding female. During the nonbreeding seasons, collar and head bands turn gray, bills are black, and legs are a paler yellow or orange.

**Figure 18. Piping Plover (*Charadrius melodus*). (Photo Credit: Rhododendrites, Wikimedia Commons).**

The Piping Plover is a migratory species that winters along the south Atlantic coast and along the Gulf Coast south into Mexico and portions of Central America and the Yucatan Peninsula. Some

individuals winter in Cuba and the Caribbean Islands (Elliott-Smith and Haig 2020). Approximately 90% of known wintering populations occur along the Gulf of America in the United States (Nicholls and Baldassarre 1990). A ten-year banding survey (1995-2005) observed one banded Piping Plover (out of 154) in the vicinity surrounding the BCS action area during the overwintering season (November to February) (Stucker et al. 2010), though based on migratory patterns, individuals may arrive as early as July and depart as late as May (i.e., fall and spring migration) (Elliott-Smith and Haig 2020). During migration, this bird utilizes lake shores and beaches in natural settings and in man-made reservoirs. The birds will also use rivers, marshes, and aquaculture ponds. The predominate substrate used by migratory Piping Plovers is mudflats; proper water management can be used to ensure availability of this habitat (Elliott-Smith and Haig 2020). During the overwintering period, these birds use beaches, mudflats and sand flats (Johnson and Baldassarre 1988, Nicholls and Baldassarre 1990). Birds may use these habitats found in barrier islands, island overwash areas, and man-made dredged material islands. Wintering birds are often associated with bays, lagoons and inlets. Ocean-front beaches are not used often by wintering Piping Plovers (Drake et al. 2001).

During migration and the overwintering seasons, Piping Plovers generally forage on freshwater, marine and benthic invertebrates. Birds may forage more during low or falling tides. Migratory birds forage during the day and night (Elliott-Smith and Haig 2020), while overwintering birds may spend more than 70% of the day foraging (Johnson and Baldassarre 1988). Piping Plovers forage alone or in small groups. Principle prey items include marine worms (polychaetes), amphipods, and insects (larvae and adults). These birds tend to forage on invertebrates in proportion to available prey at a given location; however, they infrequently forage on bivalves regardless of abundance (Elliott-Smith and Haig 2020).

There are three known breeding populations of two subspecies of Piping Plovers in North America. Two populations of Piping Plover are found in the Northern Great Plains and the western Great Lakes (*C. m. circumcinctus*). The remaining population (*C. m. melodus*) is found along the Atlantic Coast. Both the Northern Great Plains and Atlantic Coast populations are listed as threated under ESA, while the Great Lakes population is listed as endangered. Overwintering populations mix and overlap rendering determination of source breeding population difficult during the nonbreeding season. Critical overwintering habitat for the Piping Plover was designated in 2001 along the Atlantic and Gulf Coasts, with the goal of being able to protect and conserve all populations during the overwintering season: 519,677 ha (Federal Land: 51,480 ha; State land: 386,746 ha; Private land: 81,451 ha) of land along 551 mi of shoreline has been designated as critical habitat in Louisiana (USFWS 2001). While small portions of coastal Louisiana have been included as wintering critical habitat for the Piping Plover, no critical habitat has been designated within the BCS action area.

### 3.2.10 Red Knot (*Calidris canutus*)

**z**The Red Knot (*Calidris canutus*) is one of the largest sandpipers in North America in the *Calidris* genus. A long-distance migrant, this species is known for breeding in high-arctic regions and overwintering along the Pacific and Atlantic coasts as far south as Central and South America. Highly dependent on migratory stopover habitat to survive the migratory journey, populations of this species plummeted in the 1980's and 1990's along the Atlantic coast, largely

due to the decimation of the horseshoe crab (*Limulus* sp.), whose eggs form a significant prey item during the spring migration season (Baker et al. 2020). Populations of the *rufa* subspecies was formally listed as threatened under the ESA in 2014, making this species the only non-breeding, transitory bird listed. Based on a fifteen-year (2003-2018) banding survey, a total of 42 banded Red Knots (out of 4,005) were observed in coastal LA, with a site fidelity of 59% (i.e., percent individuals returning year after year) primarily during migratory periods (i.e., April to May, July to August) and rarely during overwintering (January) (Tuma and Powell, 2021).

**Figure 19. Red Knot (*Calidris canutus*) (Photo Credit: Dick Daniels, Wikimedia Commons).**

In general appearance, the Red Knot is characterized by bright rufous to orange breast and throat, with mottled black, gray and rufous upper body primary feathers (Figure 19). This sandpiper is bulky in appearance compared to other sandpipers and possesses a black bill and black-to-greenish legs. This bird can form large flocks during the migratory season, where nearly 90% of the range-wide *rufus* population can be observed in Delaware Bay on a single day (Baker et al. 2020). During the non-breeding seasons, this bird is gray above and white below, often with gray specks and rufous hints on the breast. A white-eye strip is present on non-breeding birds, and in flight, there is a faint white wing strip.

The Red Knot is largely limited to coastal and estuarine habitats during the non-breeding seasons, where it forages on intertidal mudflats, sand flats, open beaches, and sheltered bays and lagoons. Many of the habitats used during the non-breeding seasons are associated with inlets (Baker et al. 2020). Red Knots are molluscivores and focus largely on hard-shelled mollusks but will also eat other prey when available including shrimp, crab, and horseshoe crab eggs. Mollusks are swallowed whole, where the shells are ground down in the gizzard. Foraging habitats are limited by tidal conditions, where they rarely forage in depths more than 2-3 cm (0.8-1.2 in). Mollusks that form important prey are often distributed in shallow depths of 2-3 cm (0.8-1.2 in) in the sand. Since the Red Knot is known to fly thousands of miles during migration, they are known to focus on several key staging areas where they accumulate fat stores to survive the journey. For example, from Delaware Bay, these birds will fly non-stop to the arctic breeding grounds.

Loss and degradation of stopover migratory habitat is considered a primary cause of population declines for the Red Knot (USFWS 2020). Harvesting of horseshoe crabs has significantly reduced use of the Delaware Bay as a stopover staging area for the Red Knot. Habitat loss from urbanization, coastal engineering, and sea-level rise likely contributes to lower overwintering populations along the Atlantic and Gulf Coasts (Baker et al. 2020, USFWS 2020). Recently, the USFWS (2023) published critical habitat designations for the Red Knot. Although portions of

coastal Louisiana and the Louisiana-Mississippi barrier island chain have been designated as nonbreeding critical habitat, designations do not include the BCS action area (USFWS 2023).

### 3.2.11 Eastern Black Rail (*Laterallus jamaicensis*)

**Figure 20. Black Rail (*Laterallus jamaicensis*). (Photo Credit: Hector Bottai, Wikimedia Commons).**

The Eastern Black Rail (*Laterallus jamaicensis*) (Figure 20) is a tiny, sparrow-sized rail that inhabits estuarine tidal and freshwater marshes. Although broad in distribution, this species has declined significantly over the past three decades or longer. This species is notoriously difficult to observe visually; the easiest way to detect presence is through vocalizations (USFWS 2019b). This bird readily vocalizes to play-back recordings, and the use of such recordings are frequently used for monitoring. This rail has breeding populations along the Atlantic and Gulf coasts, portions of the mid-west, and small populations in California, Mexico and Central America (Eddleman et al. 2020). It is a year-round resident along the Atlantic and Gulf Coasts in FL, and west to Texas and Mexico; however, populations are uncommon, small, and scattered. Two subspecies are recognized in North America, the Eastern Black Rail (*L. j. jamaicensis*), and the California Black Rail (*L. j. coturniculus*) (USFWS 2019b, Eddleman et al. 2020).

The Eastern Black Rail has dark blue or gray head and belly coloration, while upper portions and feathers are largely black with white speckles. This rail has dark legs and bill and may have a black crown. There is also a distinctive brown to chestnut colored patch on the upper back and nape, just behind the head and between the speckled wings and back. Adults possess a red eye, while young have amber or hazel eyes until about 3 months in age. There is some sexual dimorphism in plumage but not between males and females: males generally have a darker throat, while females have a white to pale gray throat (USFWS 2019b, Eddleman et al. 2020).

Atlantic coast populations of the Black Rail are short distance migrants to FL and the Gulf Coast during the winter months. However, very little is known about the migratory patterns of this rail. This rail nests in high elevation portions on salt water and freshwater marshes, wet meadows, and other areas of wet or flooded grass vegetation. Overwinter habitat is poorly known, but likely similar to breeding habitat (USFWS 2019b, Eddleman et al. 2020). Diet of this rail is poorly known, but likely includes aquatic and terrestrial invertebrates (insects, amphipods and gastropods) (USFWS 2019b), and seeds; likely forages more on seeds during the winter due to lower invertebrate abundance at this time of the year (Eddleman et al. 2020). Bill shape suggests opportunistic diurnal foraging strategy where the bird forages throughout the day.

The Eastern Black Rail was listed as threatened under ESA in 2020 (USFWS 2019b). At this time, critical breeding and overwintering habitat has not been designated.

### 3.2.13 Alligator Snapping Turtle (*Macrochelys temminckii)*

The largest freshwater turtle in North America, the alligator snapping turtle (*Macrochelys temminckii)*, can grow to lengths of 22 (female) to 29 in (male) and weights of up to 62 lbs. for females and 249 lbs. for males (Ewert et al. 2006, Pritchard 2006). Unlike most turtles that have pink mouth linings, the inner mouth lining of the alligator snapping turtle is gray/brown with black splotches (Ewert et al. 2006). This species has a long tail, a large, triangle-shaped head, a curved beak and a rough brown shell with three vertical spines (Florida Natural Areas Inventory 2001). Alligator snapping turtles are omnivorous opportunistic scavengers that consume fish, mollusks, turtles, insects, rodents, snakes, acorns, nuts, berries, and vegetation (Pritchard 1992, Elsey 2006). The USFWS proposed listing the species as threatened under the ESA in 2021 and has conducted a Species Status Assessment (SSA) to evaluate population status across it range. It is currently still in the proposed listing phase. After the closure of commercial harvesting, the primary remaining threats to the alligator snapping turtle are fishing bycatch in active and abandoned fishing gear, roadkill incidents, and intentional kill incidents (Shook et al. 2023).

The alligator snapping turtle's range is limited to rivers and streams that flow into the GOA as far north as Iowa in the MSR drainage, west into eastern Texas, and east into southern Georgia and the FL panhandle. Preferred wetland habitats include bald cypress forests, buttonbush, floating vegetation mats, and other vegetative debris structures (Harrel et al. 1996). Alligator snapping turtle has been one of several focal species targeted for population increases as a result of restoration through the reintroduction of MSR water in the Upper Sub-Basin of the Maurepas Region (Comprehensive Habitat Management Plan for the Lake Pontchartrain Basin, 2006, Lake Pontchartrain Basin Restoration Program, EPA).

## *3.3 CRITICAL HABITAT*

### 3.3.1 Gulf Sturgeon

Gulf Sturgeon critical habitat (Unit 8) has been designated in LP, Lake St. Catherine, The Rigolets, Little Lake, Lake Borgne, and the MS Sound. Based in part on a 2009 Benthic Report (Ray 2009), CEMVN has made a no adverse modification determination for Gulf sturgeon critical habitat within the action area considered for this assessment.

In conjunction with the 2008 opening of BCS, Ray (2009) conducted a study to evaluate potential impacts on benthic infauna as it relates to Gulf Sturgeon foraging habitat within LP. The BCS structure was opened April 11 to May 8, 2008 (160 total bays open) and was characterized as a low-volume event (Table 2). For the study, five N-S transects were established extending from the western boundary of LP to the Rigolets. Stations along the transect were initially sampled following the opening of the BCS on April 24 to 29 and subsequently again in August and October to provide a temporal assessment of benthic community changes. Standard water quality parameters (temperature, salinity and dissolved oxygen) were measured at the surface and bottom at each station in addition to water clarity (Secchi depth). Sediment grain size, sediment organic content and infaunal macroinvertebrates were assessed from Ponar Grab samples obtained at each sample station along each transect.

Salinity levels within the study area changed the most in response to the increase in freshwater within LP following the opening of BCS, and generally tracked the progression and spatial extent of the freshwater plume emanating from the BCS. Temporal and spatial changes in the associated benthic community were noted during the study period with most spatially mediated changes observed for salinity sensitive species. Observed temporal patterns in community composition were attributed to seasonal life history patterns or responses to natural seasonal patterns (e.g., low dissolved oxygen, high predator abundance). The period of lowest salinities was limited to just after the BCS was open to mid-May, and initially included only those stations nearest the BCS project area. Areas within LP east of BCS never experienced severely reduced salinity levels for an extended period although many areas experienced a temporary loss of high salinity species and a reduction in species abundance and diversity. These biotic responses were similar to those reported by other studies evaluating similar conditions following previous BCS openings (Hawes and Perry 1978, Sikora and Sikora 1982, Jeandron 1999). Low-volume events such as the 2008 BCS opening represent a short term and spatially restricted impact.

Impacts associated with salinity shifts within LP and the NGOA within the MS Sound may affect Gulf Sturgeon critical habitat and the quality of associated foraging habitat with the degree of impact linked to timing and duration of corresponding openings of BCS and how that corresponds with occurrence of Gulf Sturgeon life history stages within specific habitats (Table 4). In addition, increased levels of freshwater discharge within areas of the WGOA during critical benthic invertebrate recruitment periods could impact nearshore estuarine and offshore open water marine foraging areas during prolonged openings of the BCS. As summarized by Ray (2009), short duration openings of the BCS (i.e., low-volume events) represent a short term and spatially restricted impact. The temporal and spatial extent of benthic community change likely expands as BCS opening duration increases (i.e., gradient from low-volume to high-volume events) resulting in localized impacts to Gulf Sturgeon critical habitat. However, episodic BCS operations would not result in a long-term change in the benthic community that would adversely modify Gulf Sturgeon critical habitat across the species range.

### 3.3.2 Piping Plover and Red Knot

Critical habitat for the Piping Plover and the Red Knot includes critical habitat unit (LA-7) in the Breton Islands and Chandeleur Island chain, which are outside of the action area for the BCS. Since these critical habitat areas are beyond the action area, no adverse impacts to critical habitat for these species are expected due to operation of the BCS.

## 4.0 ENVIRONMENTAL BASELINE

### *4.1 USGS SAMPLING STATIONS*

The U.S. Geological Survey (USGS) operates several continuous water-quality gages in LP and the MS Sound and collects discrete water quality samples at several other stations during BCS operation in partnership with USACE. Data from the stations shown below are the focus of this BA (Figure 21).

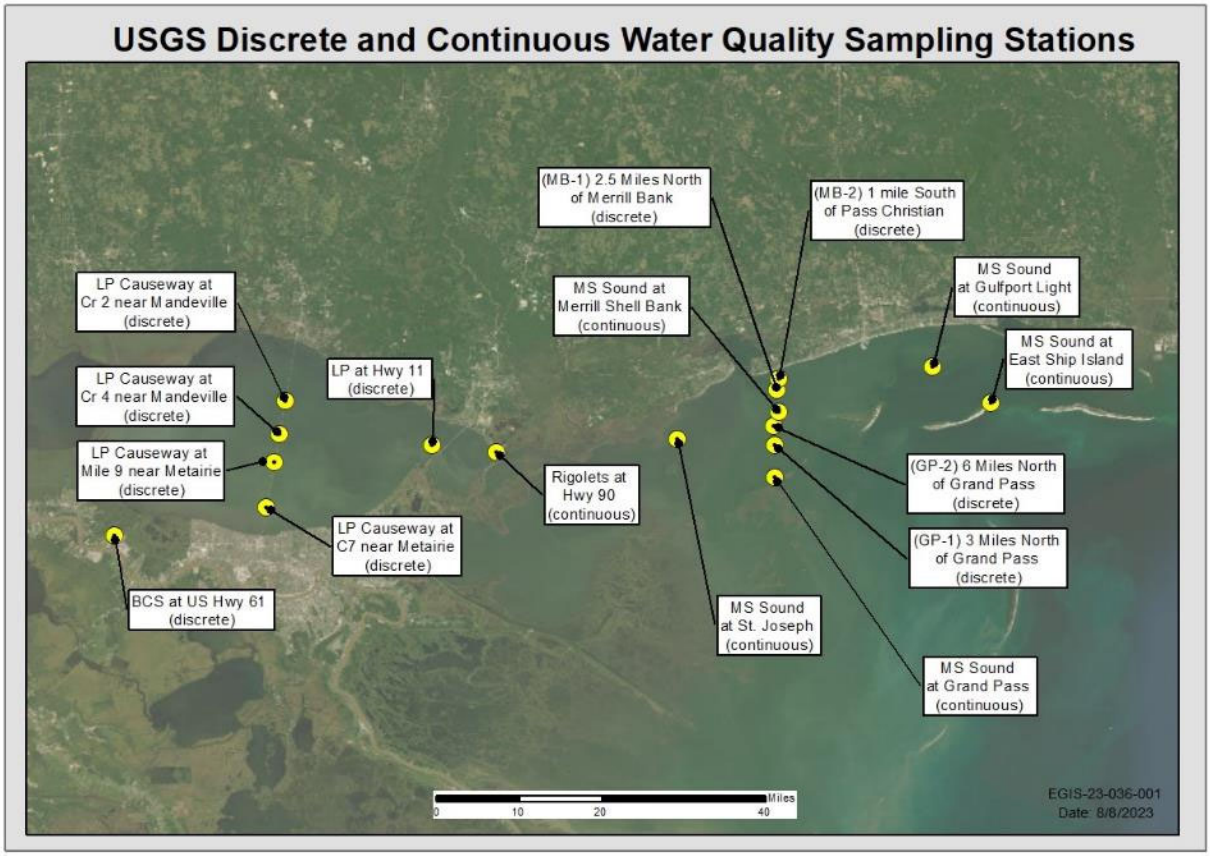


**Figure 21. USGS sampling stations within the area of potential effects.**

This BA cites several studies that investigated LP and MS Sound water quality as it relates to the operation of the BCS. Sample locations not shown in Figure 21 can instead be found in the referenced reports.

USGS discharge measurements were used to estimate the contribution of the local northern tributaries to the action area. The total tributary discharge is computed by summing the timeseries for each respective gage (Figure 22), to provide an estimate of tributary contribution to the action area.

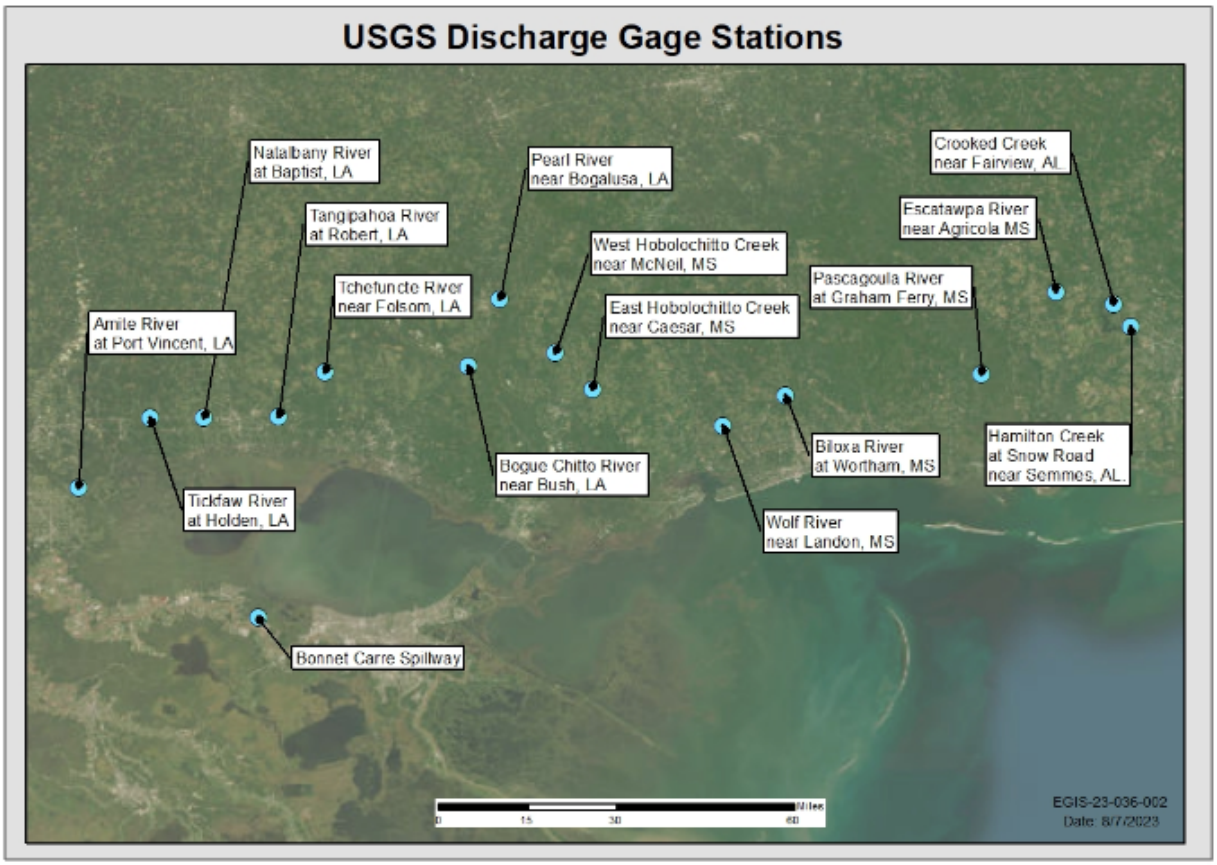


**Figure 22. USGS stream gaging stations used to estimate local tributary discharge.**

## *4.2 SALINITY*

### 4.2.1 BASELINE

All salinity measurements reported are surface salinities unless specified otherwise. LP salinities range between 2 and 14 ppt with a salinity gradient that is saltiest near the New Orleans Land Bridge, and freshest in the western LP near Pass Manchac (Georgiou et al. 2009; Figure 23).

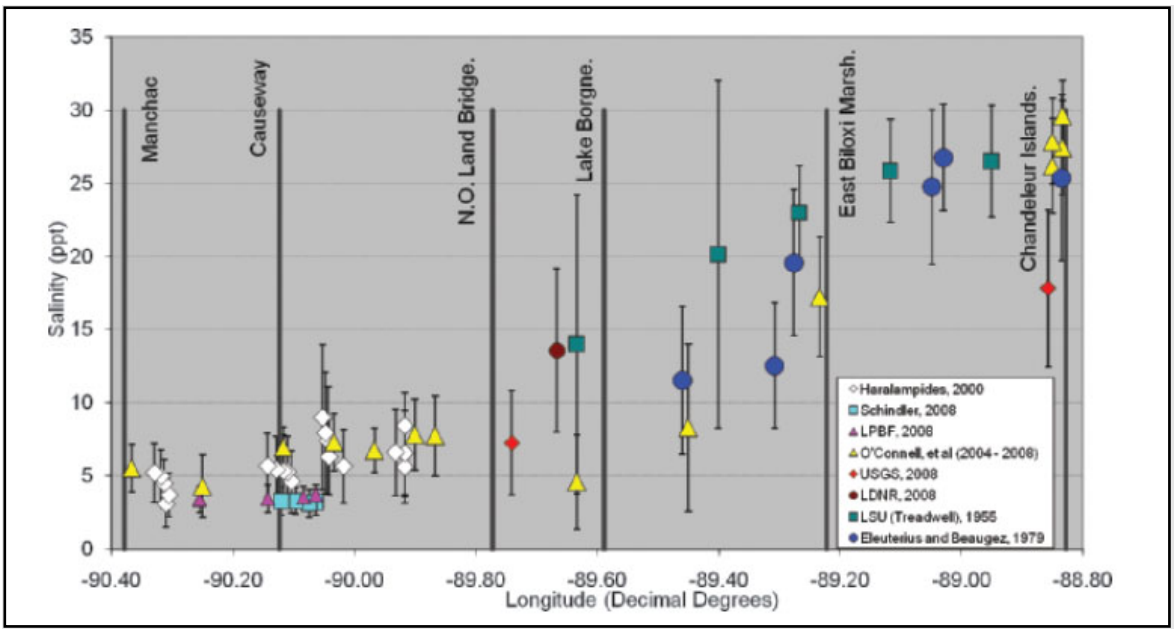


**Figure 23. From Georgiou et al. 2009, salinity ranges throughout LPE.**

Salinities in LP are affected by local river discharge (Georgiou et al. 2009). When river discharge is high in the spring, lake salinities can drop below 1 ppt (NOAA 2023). During the fall and winter, salinities are typically higher. Following the closure of the Mississippi River Gulf Outlet (MRGO) in 2009, average salinities in LP have been lower, since MRGO was a significant entry point for high salinity water from the GOA.

There are long-term (2007-present) salinity gages operated by the Louisiana Coastwide Reference Monitoring System, though these gages are in the marshes on the edges of LP. The Rigolets gage (Figure 24) is the only USGS-operated long-term salinity gage within LP. This gage records salinities on the eastern edge of the lake where tidal flows enter and exit.

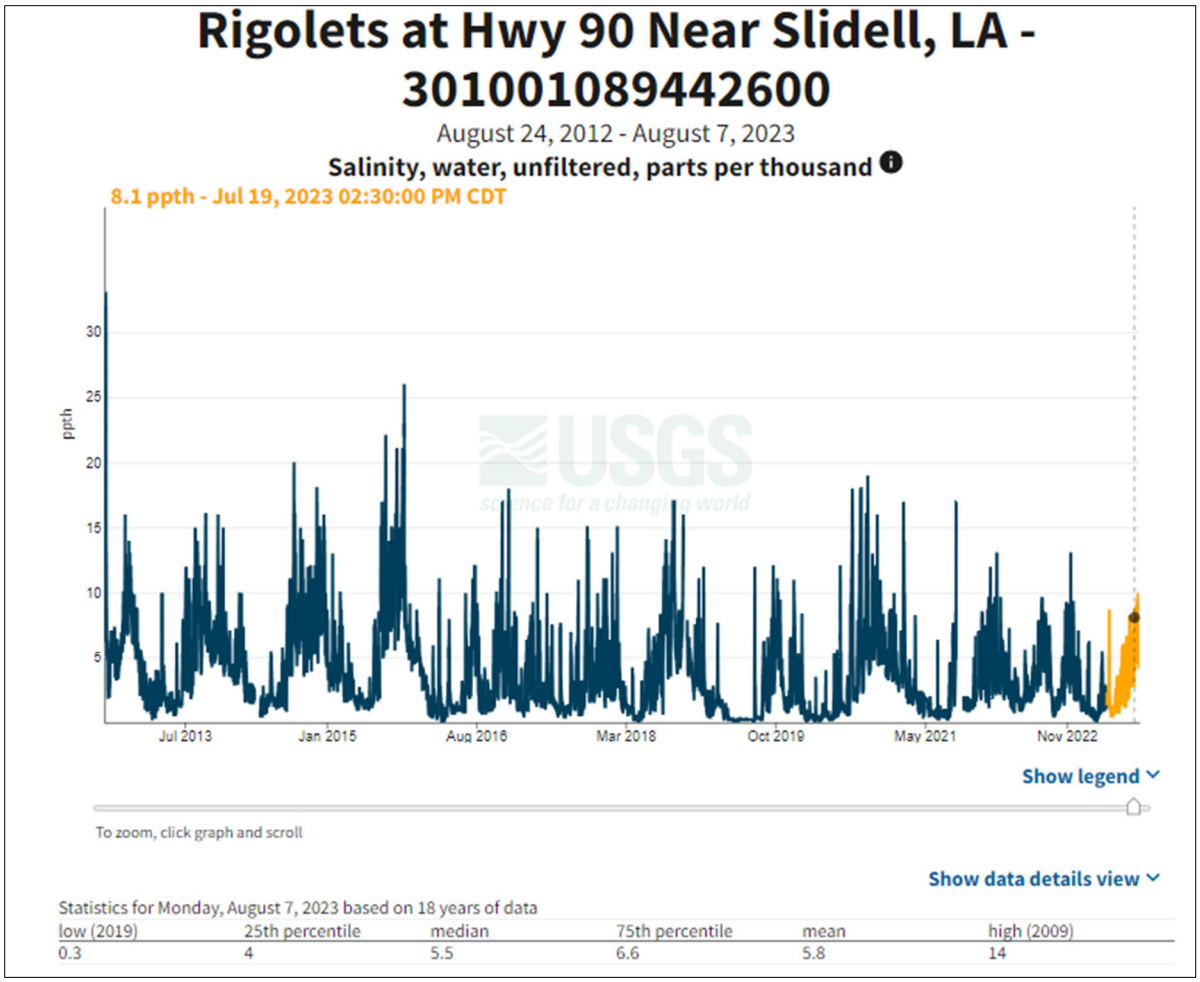


**Figure 24. USGS Rigolets at Highway 90 gage salinity.**

The April 28, 2023 predicted salinities for LP from NOAA's Operational Forecast System (OFS), estimated salinity to be between 3.6 and 5.4 ppt throughout the southern portion of the lake, and estimated 1.8 to 3.6 ppt near the north shore where many local rivers enter the lake (Figure 25). The model estimated salinities east of the lake to be between 0 and 1.8 ppt, likely due to discharges from the Pearl River. The same forecast model for August 6, 2023 (Figure 26) shows salinities in the range of 5.4 to 7.2 ppt close to the Inner Harbor Navigational Canal, likely due to saltwater intrusion from the GOA.

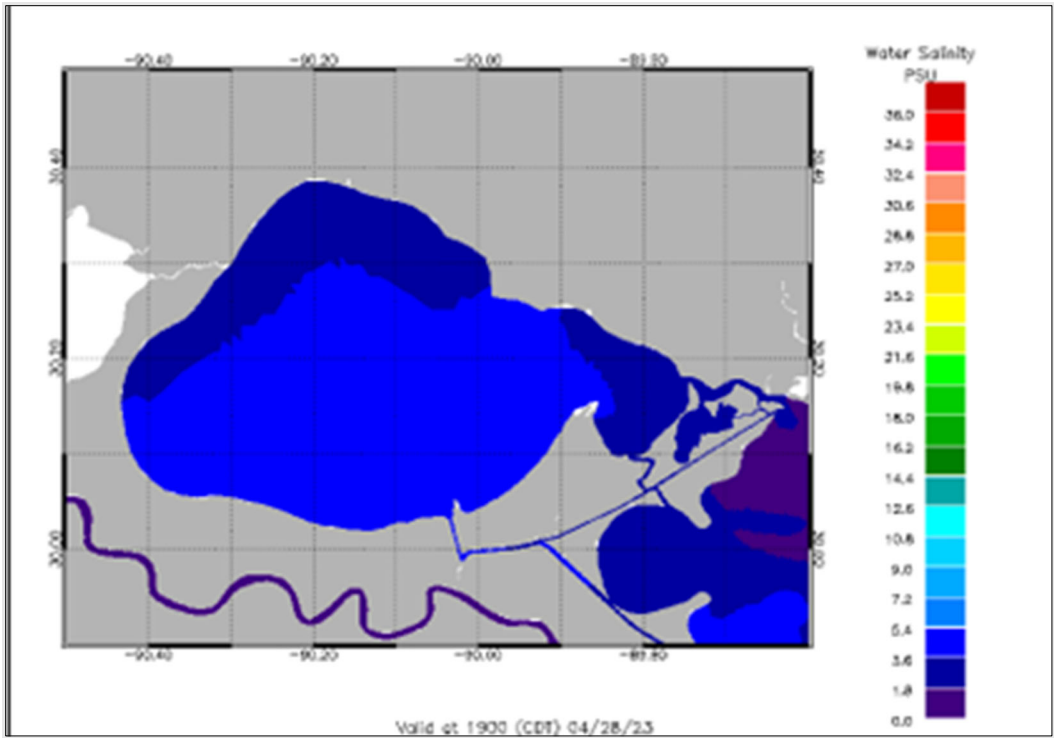


**Figure 25. Predicted salinities for Lake Pontchartrain. Obtained from NOAA OFS.**

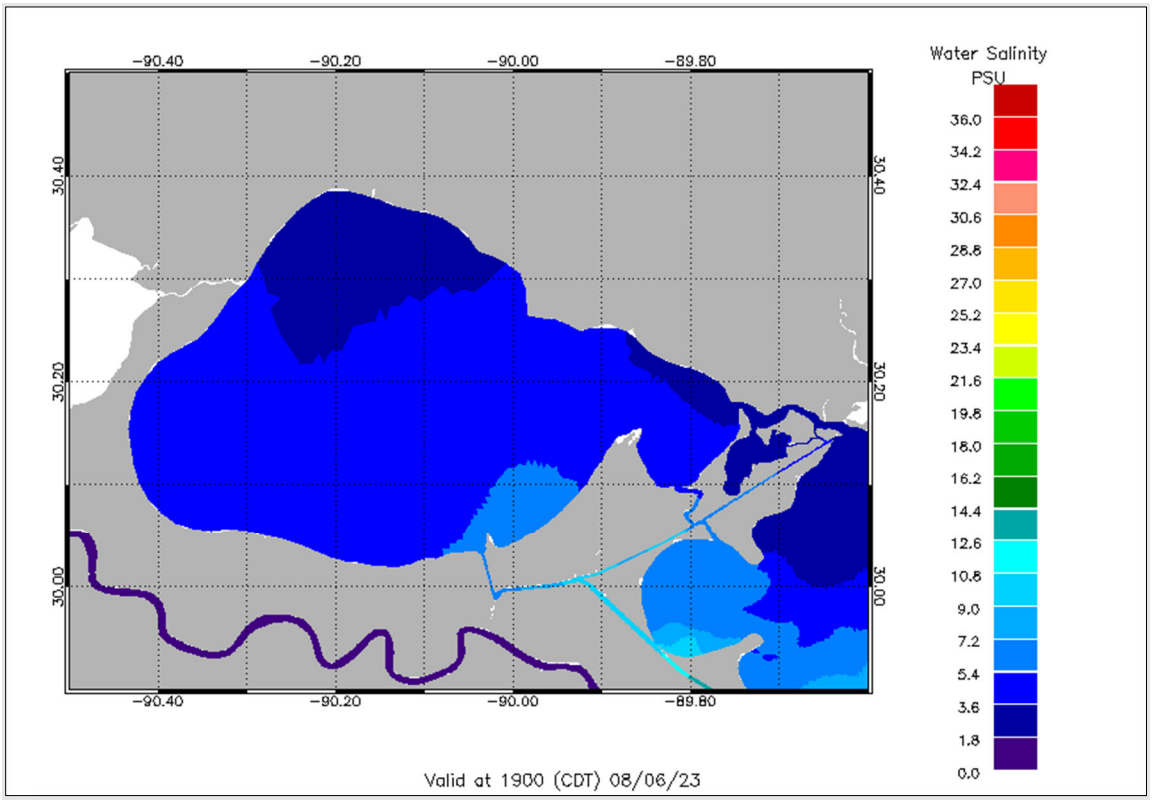


**Figure 26. Predicted salinities for Lake Pontchartrain. Obtained from NOAA OFS.**

Georgiou et al. (2009) also measured salinity ranges further east into the Biloxi Marsh and Chandeleur Sound (Figure 23). These baseline salinity ranges are similar to salinity ranges found in the MS Sound. Gledhill et al. (2020) characterized the MS Sound as "a well-mixed estuary fringed with brackish salt marshes with various natural freshwater inputs and salinities ranging from 5 to 20 ppt in nearshore areas heavily influenced by local rivers, and 20 to 25 ppt in offshore areas with greater exposure to GOA waters." Continuous gages in the MS Sound estimated the long-term median salinity values (Table 5). For some portions of the gage record where specific conductivity is available but not salinity, salinity was calculated according to Miller et al. (1988). The USGS also provided seasonal statistics for these five stations (Figure 27-Figure 31). These plots show average salinity values for a calendar day based on data averaged across multiple years.

**Table 5. Median salinity records at USGS continuous sample stations in the MS Sound**

| USGS Station | Median Salinity | Gage Record |
|---|---|---|
| St Joseph Island Light | 16 ppt (converted from median specific conductance) | 24 years |
| Merrill Shell Bank Light | 21 ppt (converted from median specific conductance) | 6 years |
| Grand Pass | 17 ppt | 21 years |
| Gulfport Light | 24 ppt | 10 years |
| East Ship Island | 27 ppt (converted from median specific conductance) | 5 years |

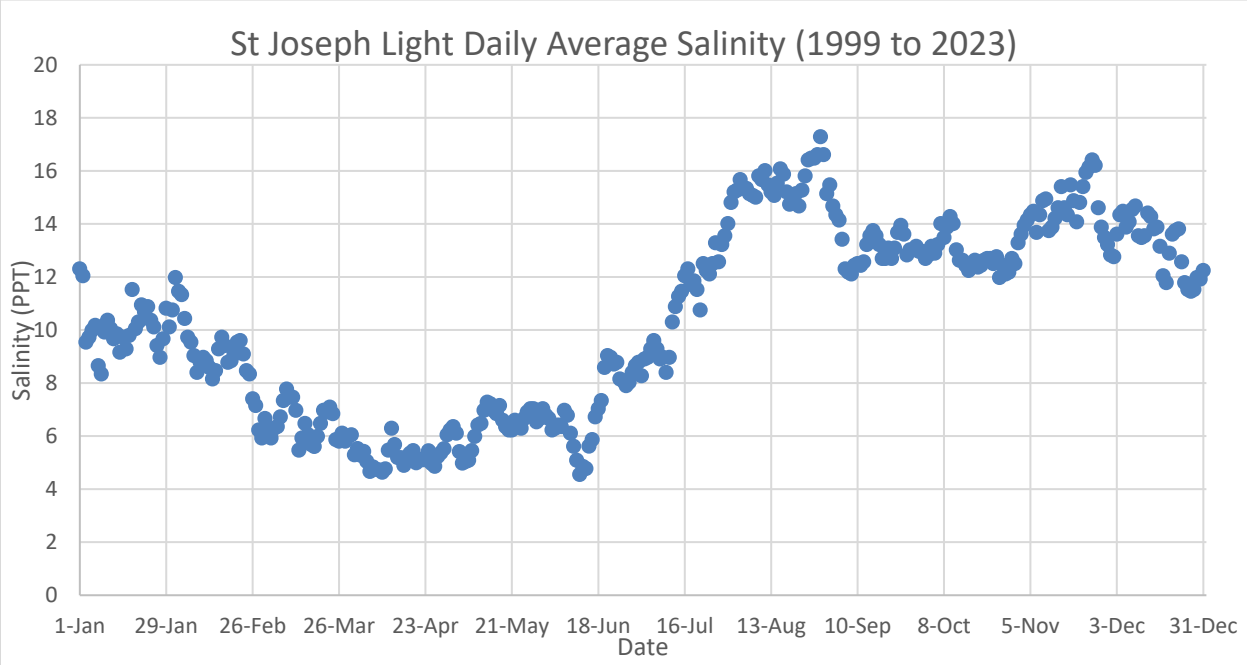


**Figure 27. MS Sound at USGS St Joseph Island Light daily mean salinity (1999-2023).**

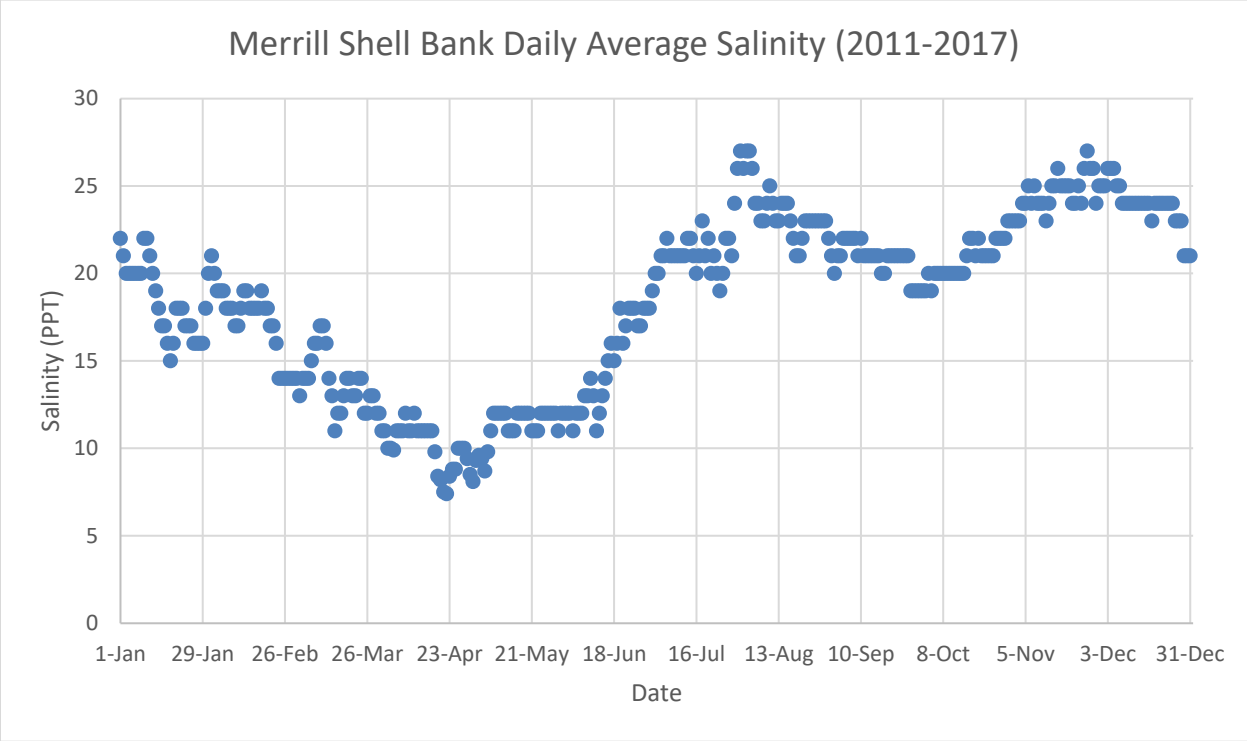


**Figure 28. MS Sound at USGS Merrill Shell Bank Light daily mean salinity (2011-2017).**

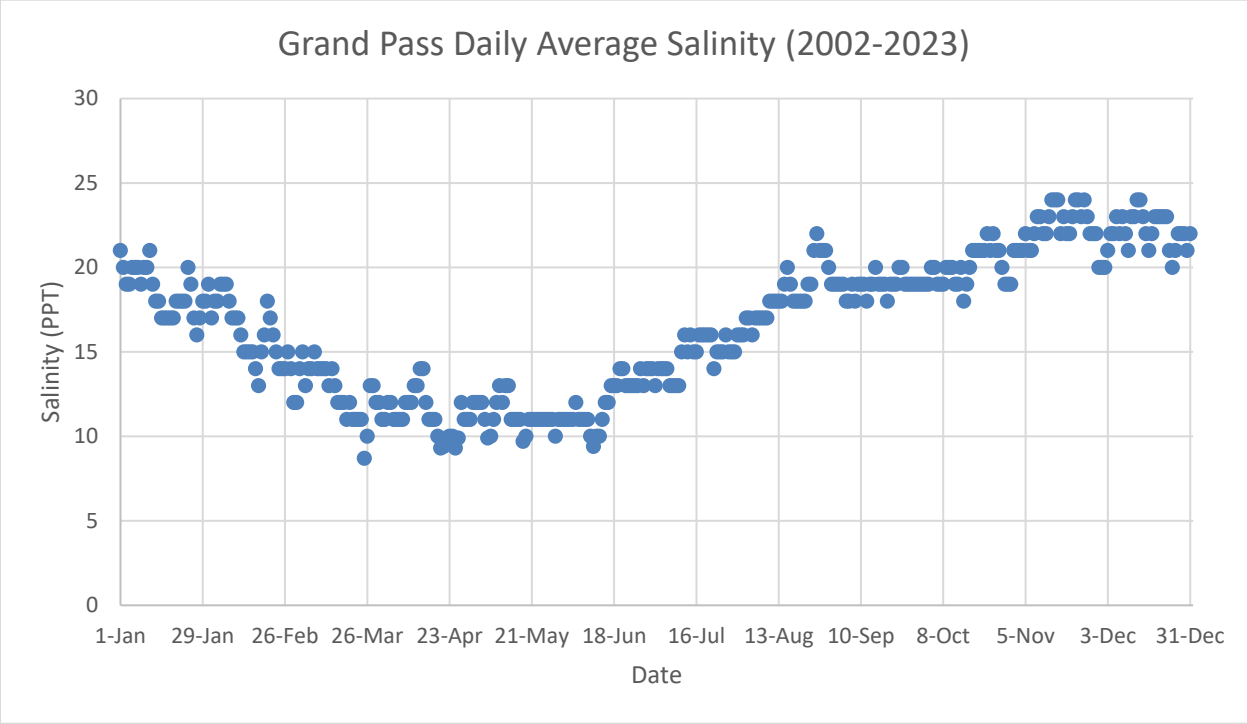


**Figure 29. MS Sound near Grand Pass daily mean salinity (2002-2023).**

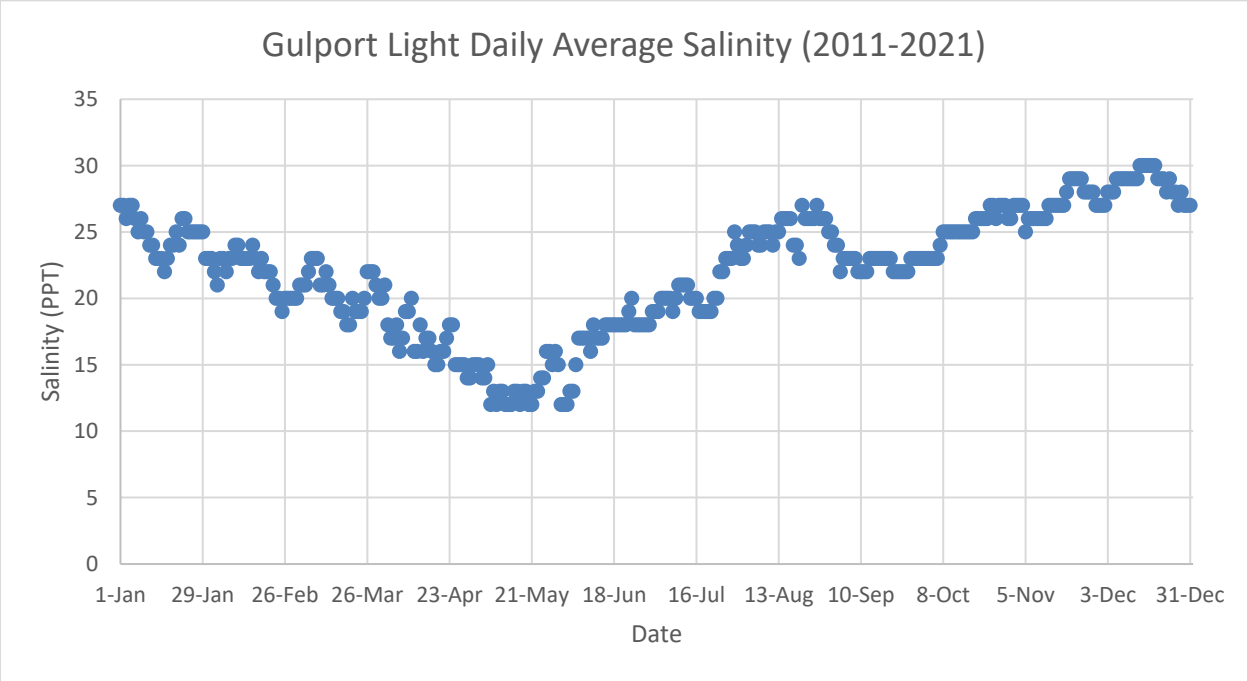


**Figure 30. MS Sound at USGS Gulfport Light daily mean salinity (2011-2021).**

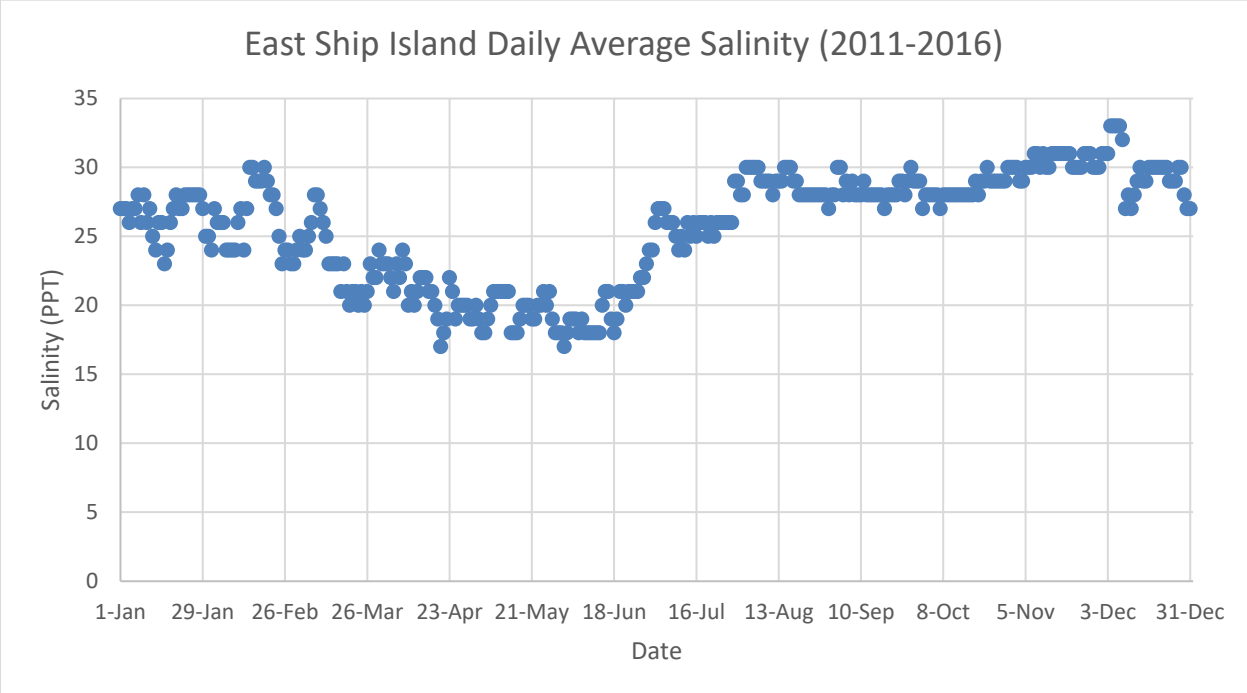


**Figure 31. MS Sound at USGS East Ship Island Light daily mean salinity (2011-2016).**

This BA uses the 2017 salinity data as an example of salinity patterns with no BCS operation, and near-average northern tributary flow volumes (Figure 32). The determination of near-average northern tributary flow is based on summing the daily average streamflow from the USGS stream discharge gages (Figure 22) for each year from 2010 to 2020. Based on this estimation method, the total flow from tributaries in 2017 was approximately 10% higher than average for the period of record.

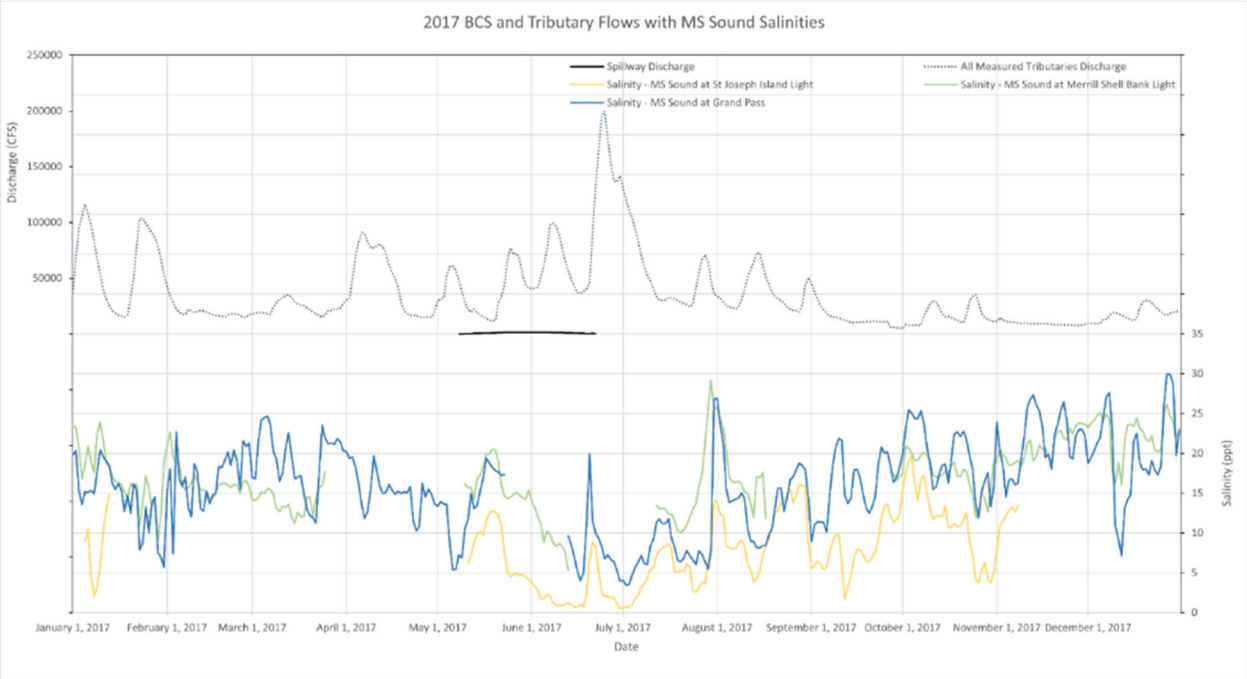


**Figure 32. 2017 northern tributary inflows and salinity in the MS Sound.**

The Pontchartrain Conservancy Hydrocoast maps are another tool for salinity distribution in the LPE and MS Sound. The Hydrocoast maps aggregate data from several different sources, and collect their own supplemental data, to create surface salinity contour maps throughout the LPE. These maps are representative of 2-week average surface salinity conditions in the region (Lopez et al. 2015), coinciding with a spike in northern tributary flows (Figure 33).

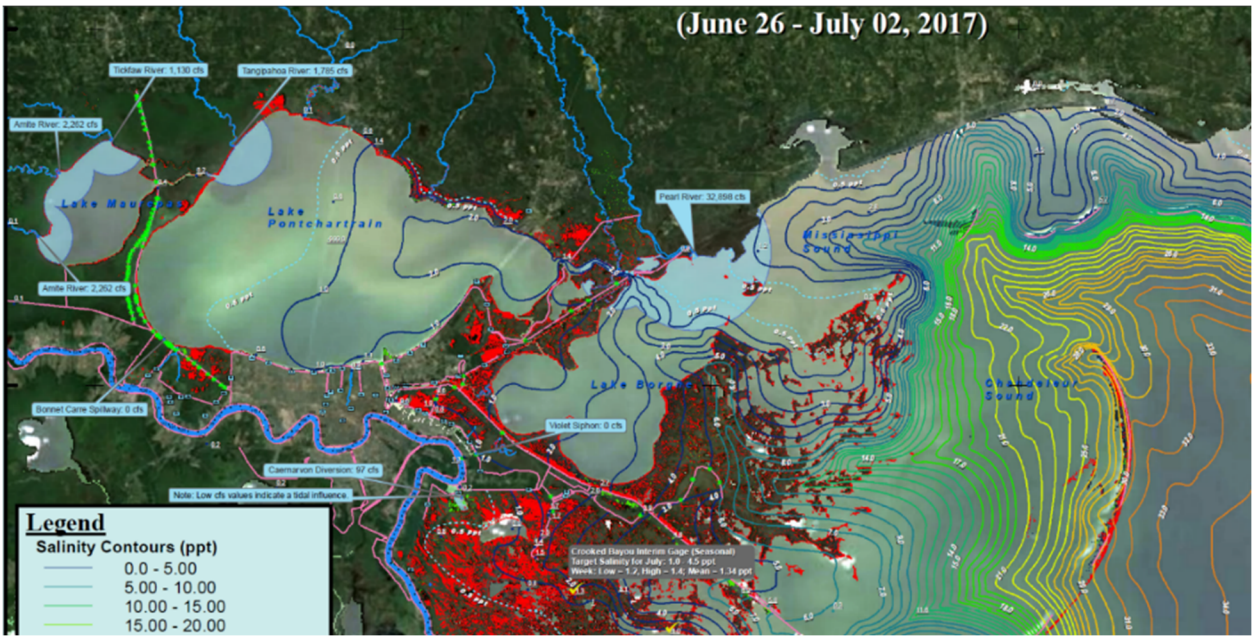


**Figure 33. June 26 to July 2, 2017 Hydrocoast map for salinity.**

### 4.2.2 BONNET CARRÉ SPILLWAY IMPACTS ON SALINITY

Impacts on salinity from BCS operations will vary depending on the scale of the opening. Large-scale events with long durations and/or high flows will typically have a greater impact on salinity, whereas small and medium scale events will typically result in fewer impacts. As examples of how different operations have historically influenced fisheries habitat, the impacts of the 2011, 2016, and 2019 BCS openings will be the focus of this analysis and will be used to make general conclusions about salinity impacts due to the BCS. The 2011 opening represents a large-scale opening with low tributary inflows. The 2016 event represents a small-scale event with average tributary inflows. The 2019 opening represents a large scale opening with high tributary inflows.

#### 4.2.2.1 LAKE PONTCHARTRAIN

As the direct outfall area of the BCS, LP experiences significant freshening due to BCS operations. Discrete samples collected by the USGS in 2011, 2016, and 2019 depict the BCS impact in LP (Heal et al. 2023).

2019

Discrete salinity samples were collected at 3 stations along the Causeway as well as at Highway 11 on the eastern edge of the Lake on 9 dates between February 27 and October 22, 2019. Salinity measurements on February 27 and 28 were between 1.3 and 2 ppt across the four stations. February 27 was the date of the first BCS opening in 2019, and thus the full influence of BCS release water would not have reached those stations on that date. On March 12 and 13, samples taken at the southern Causeway station near Metairie showed significant freshening (salinity = 0.13 ppt) while the two Causeway stations further north still had salinities >1.5 ppt. Meanwhile, the Hwy 11 station measured 0.45 ppt, suggesting that the BCS flow followed the southern rim of the Lake. For six sampling dates between March 26 and August 2, salinities at all

four stations measured less than 0.5 ppt. By October 18, salinities had recovered to above the February 27 levels at three of the four stations, with the Causeway station near Metairie remaining below 1 ppt (Figure 34).

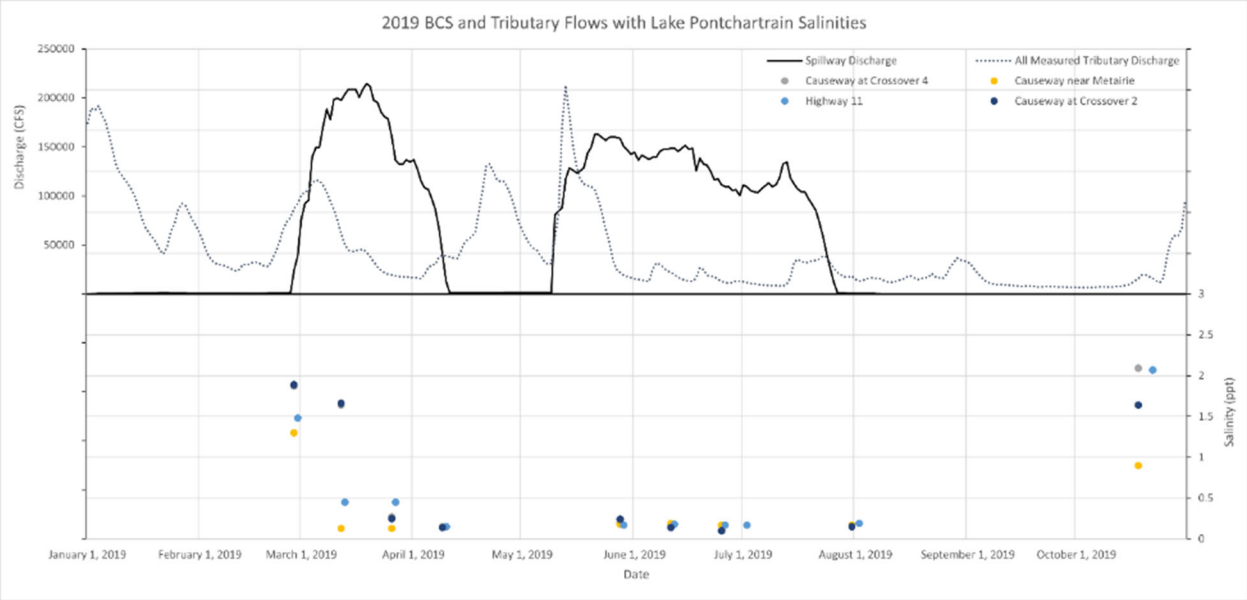


**Figure 34. 2019 BCS discharge and LP surface salinities.**

2016 & 2011

Sampling during the 2016 and 2011 openings followed a similar pattern as 2019. The salinity measurements also suggest that BCS released water flowed along the southern edge of the Lake, with salinities along the southern edge and at Highway 11 on the eastern side dropping sooner than salinities in the center and northern sections of the Lake.

Salinities dropped from between 2 and 4 ppt in early January to below 2 ppt for most of the year, remaining below 2 ppt into August 2016 (Figure 35).

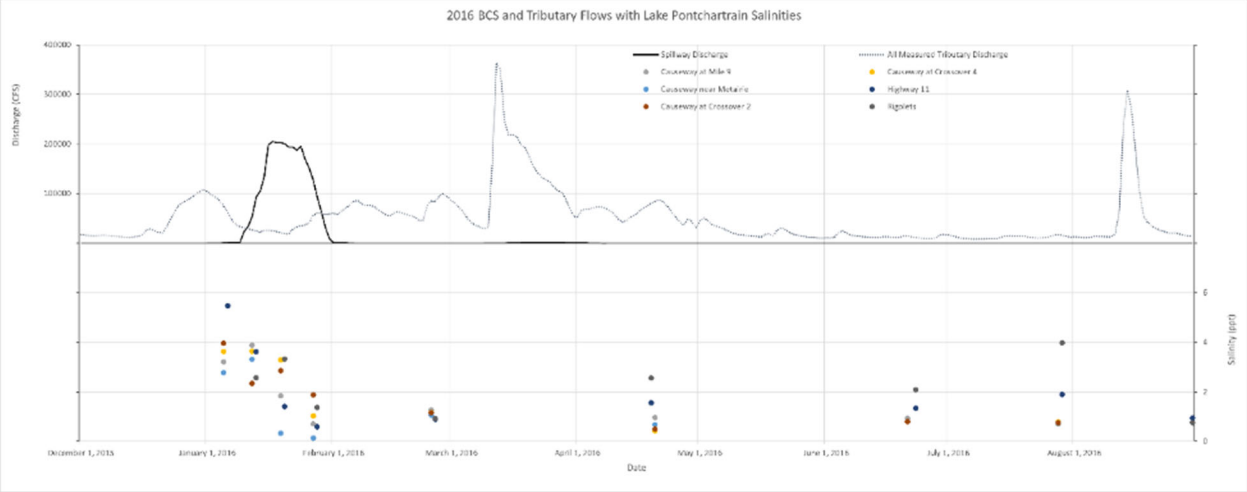


**Figure 35. 2016 BCS discharge and LP surface salinities.**

In 2011, salinities dropped from above 4 ppt at most stations before May 19 to below 2 ppt and remained between zero and 2 ppt until after August 19 (Figure 36).

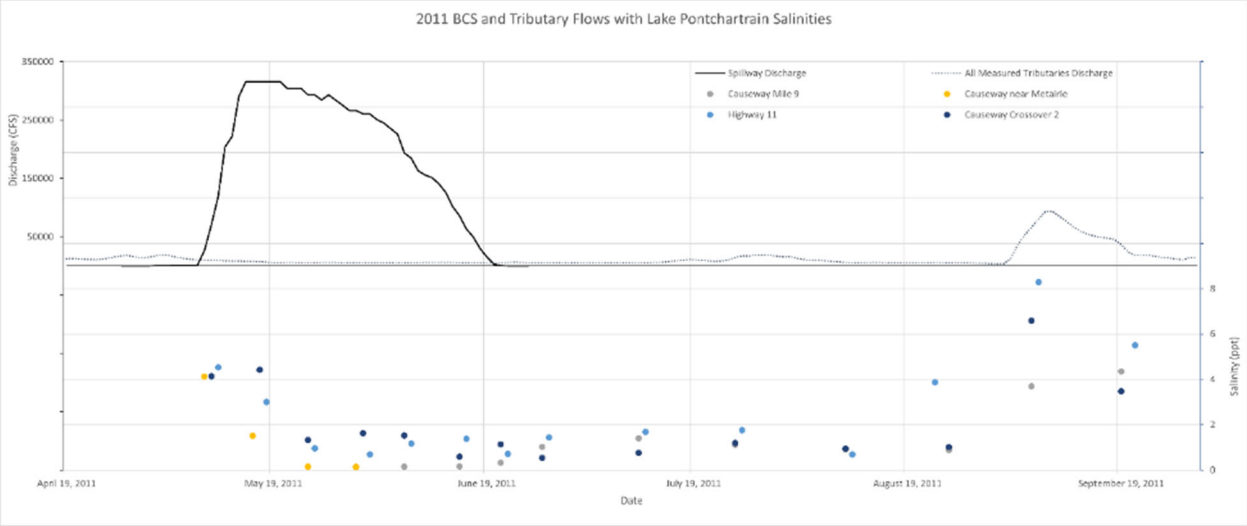


**Figure 36. 2011 BCS discharge and LP surface salinities.**

### 4.2.2.2 MISSISSIPPI SOUND

Gledhill et al. (2020) monitored salinity in the MS Sound during and after the 2019 BCS double opening. Surface salinity was sampled at six stations in the Sound on four dates: April 23 (T-0, 12 days after the first spillway closing), May 6 (T-1, 25 days after first closing), May 24 (T-2, 14 days after the second opening) and September 27 (T-3, 60 days after the second closing). These stations were at different locations than the USGS stations (Figure 37). Samples taken on T-0 showed depressed salinities less than 1 ppt at the four stations further west, but showed that Henderson Point Reef and Kittiwake Reef (two easternmost stations) had higher salinities of 3.14 and 4.21 ppt. The baseline salinities in this area can be estimated using USGS salinity measurements near Grand Pass and Merrill Shell Bank Lighthouse. The baseline salinity

estimates at the Merrill (observations from 2011 – 2017) and Grand Pass (observations from 2002 – 2023) gages for the months of April – May in this area range from 8.5 to 13 ppt. Therefore, the Henderson and Kittiwake Reef stations appear to be affected by a freshwater pulse on the April 23 sampling date. The May 6 salinity samples show that five of the six stations have lower salinities than April 23, suggesting that freshwater influence grew between those two dates, despite the BCS being closed. Salinities at Henderson and Kittiwake were reduced by 50% between April 23 and May 6. Samples taken on May 24 exhibited salinities <1 ppt at the Henderson and Kittiwake, with the other four stations remaining fresh, suggesting that the influence of the two BCS openings had reached all six of the stations on May 24. Salinities on September 27 were near the baseline average of 15-21 ppt at all stations, except for Back Bay St. Louis, which was not measured. Salinity data collected by the USGS in 2019 can help illustrate the timing of the salinity rebound in the MS Sound (Heal et al. 2023). USGS gages within the MS Sound at Grand Pass, Merrill Shell Bank, St. Joseph, and Gulfport Light collected salinity data throughout the summer of 2019. The Gulfport Light gage, north of Ship Island measured 12 ppt on April 1, was consistently below 5 ppt between May 12 and June 4, and recovered to 15 ppt by June 11.

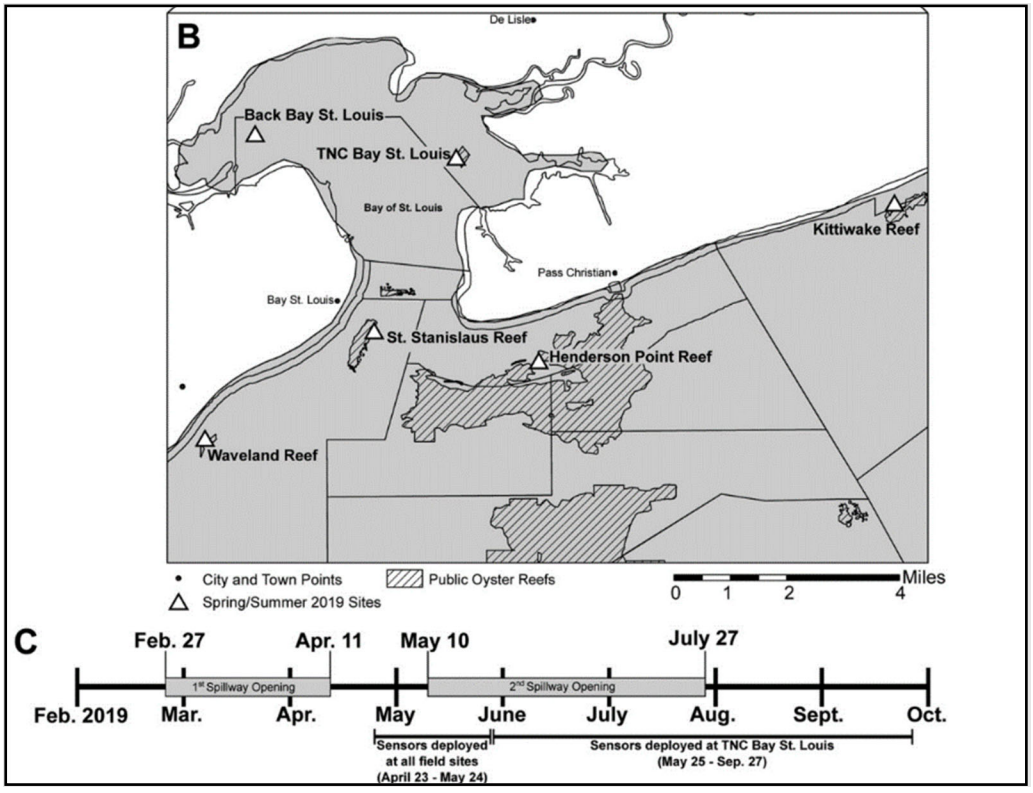


**Figure 37. Gledhill et al. (2020) sampling stations.**

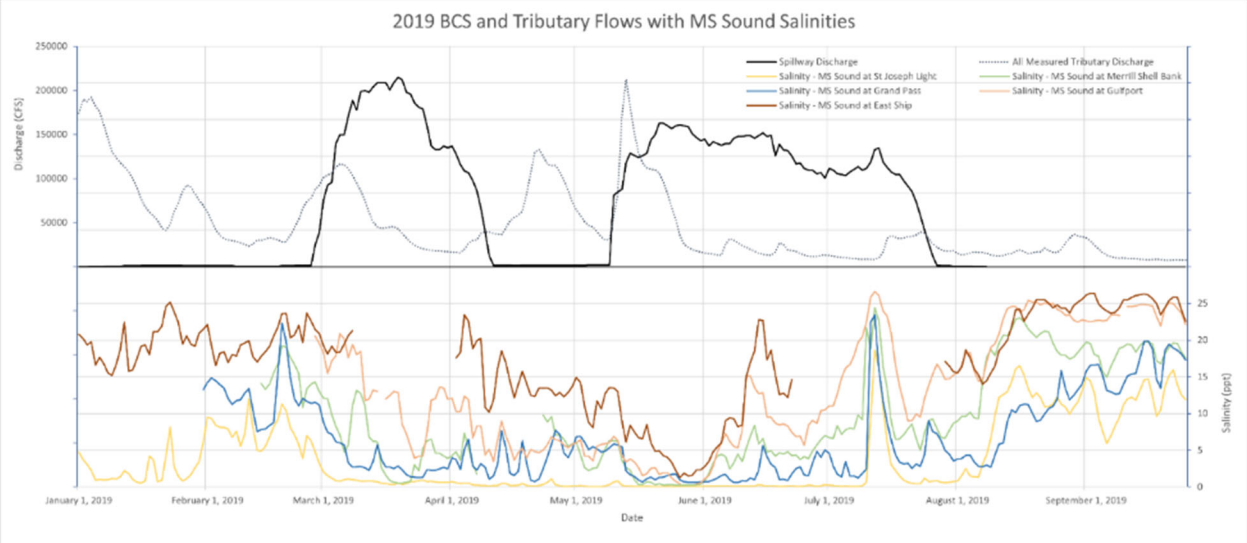


**Figure 38. BCS and northern tributary flow and salinity in the MS Sound.**

A comparison of data collected from USGS continuous salinity gages at the Grand Pass, Merrill Shell Bank, St. Joseph, Gulfport Light, and East Ship to BCS and northern tributary discharge shows that the discharge from the BCS and northern tributaries caused freshening conditions at all sampling stations in the MS Sound (Figure 38). The largest influence occurred in late May, and with the salinity rebounding by mid-August. The contributions from northern tributary flow was higher than average in 2019, based on USGS daily average flow rate data (Figure 38).

Bottom salinities were recorded less frequently than surface salinities (Figure 39). Five measurements taken at the Grand Pass and Merrill gages from March – October revealed freshening and recovery during that period.

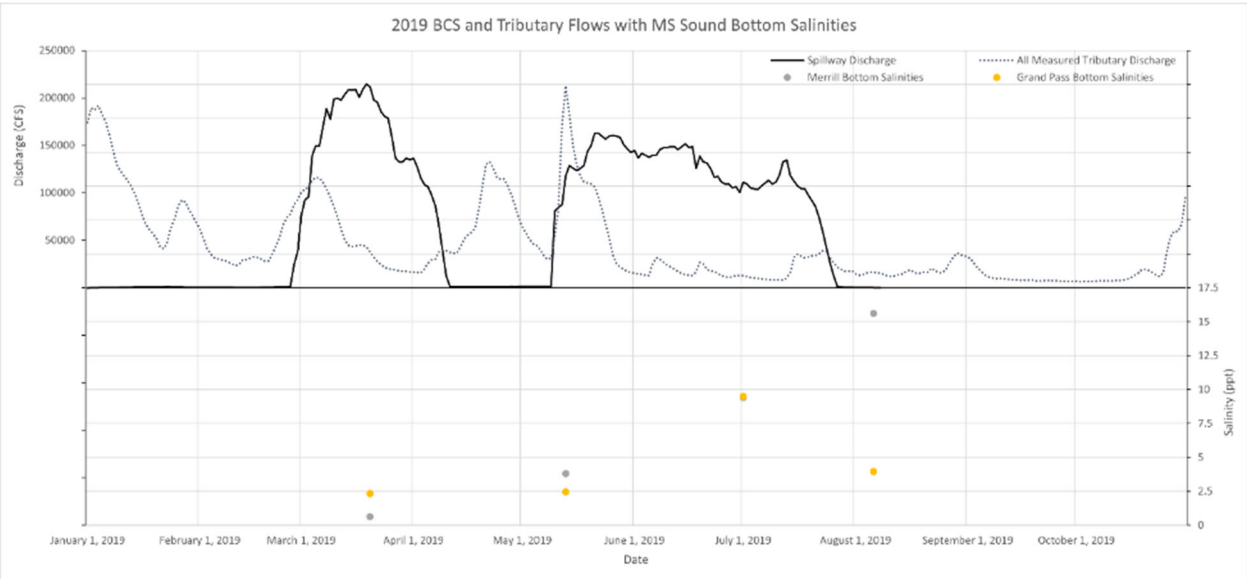


**Figure 39. Bottom salinities in the MS Sound during 2019 operation.**

Numerical models have been built to try to assess the salinity influence of the BCS. Armstrong et al. (2021) built a msbCOAWST model with 24 vertical layers to assess the salinity influence of the BCS. Their report highlights the influence of the BCS on bottom salinities in the western MS Sound, stating that their model results show 72 and 78 additional days of bottom water salinity < 2 ppt in some areas during the first and second 2019 openings respectively. Based on comparing a model run with the BCS and a model run without the BCS, certain areas experience additional days of salinities < 2 ppt due to the BCS (Figure 40).

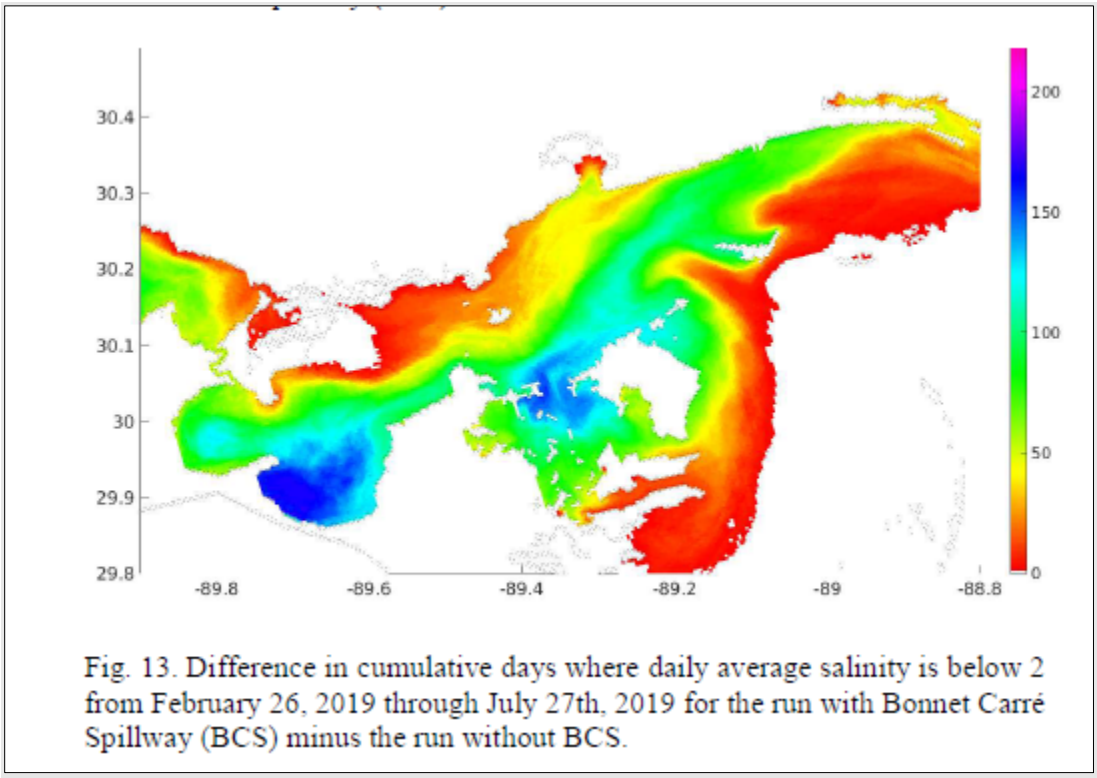


Fig. 13. Difference in cumulative days where daily average salinity is below 2 from February 26, 2019 through July 27th, 2019 for the run with Bonnet Carré Spillway (BCS) minus the run without BCS.

**Figure 40. From Armstrong et al. (2021).**

Wiggert et al. (2022) uses a similar model as Armstrong et al. (2021) to evaluate the Mid-Breton Diversion project. Wiggert et al. (2022) present figures that estimate where MS bottom salinity is below 5 ppt (Figure 41). The Mid-Breton diversion is not included in this model run.

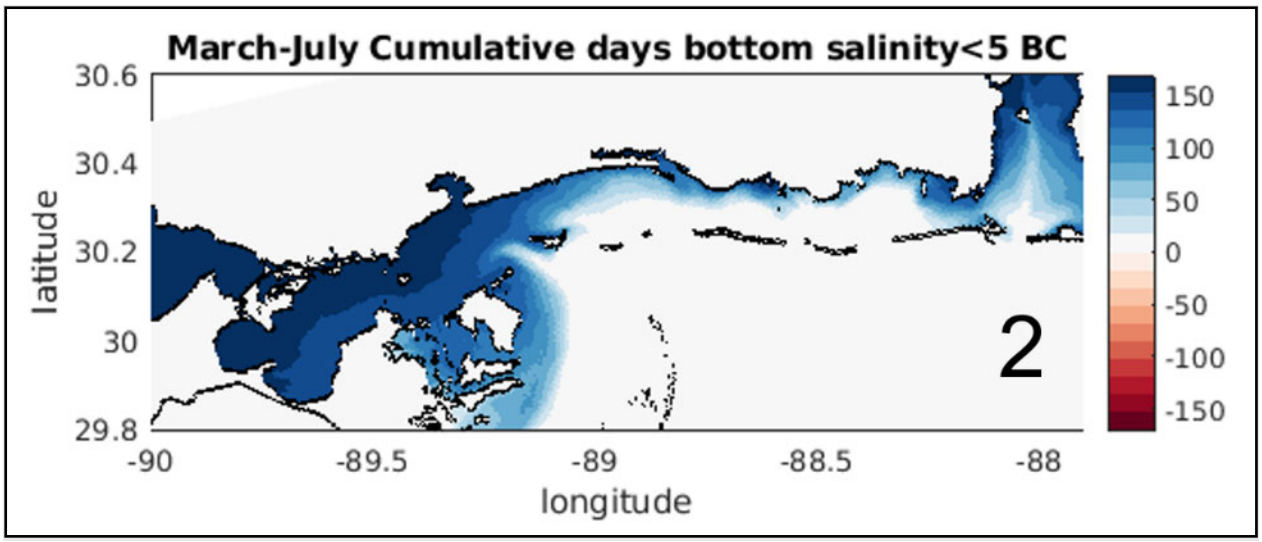


**Figure 41. Cumulative days in 2019 when bottom water salinities were below 5 ppt based on msbCOAWST model outputs (Wiggert et al. 2022).**

In conclusion, the 2019 BCS double opening contributed to salinities in LP remaining below 0.5 ppt throughout the summer of 2019, showing recovery by October at the latest. The maximum extent of the bottom salinity 5 ppt isohaline likely occurred in late May and early June, and likely ran north-south between the Biloxi Marshes and Chandeleur Sound, and between Cat Island and Ship Island, based on the msbCOAWST modeling. The surface salinity 5 ppt isohaline extended further into Chandeleur Sound and around Ship Island. The Pontchartrain Conservancy collected salinity data in 2019 which informs their Hydrocoast maps and show salinities below 5 ppt to the south of Ship Island. The period of greatest freshening in the MS Sound was caused by simultaneous high flows from both the BCS and northern tributaries (Figure 42).

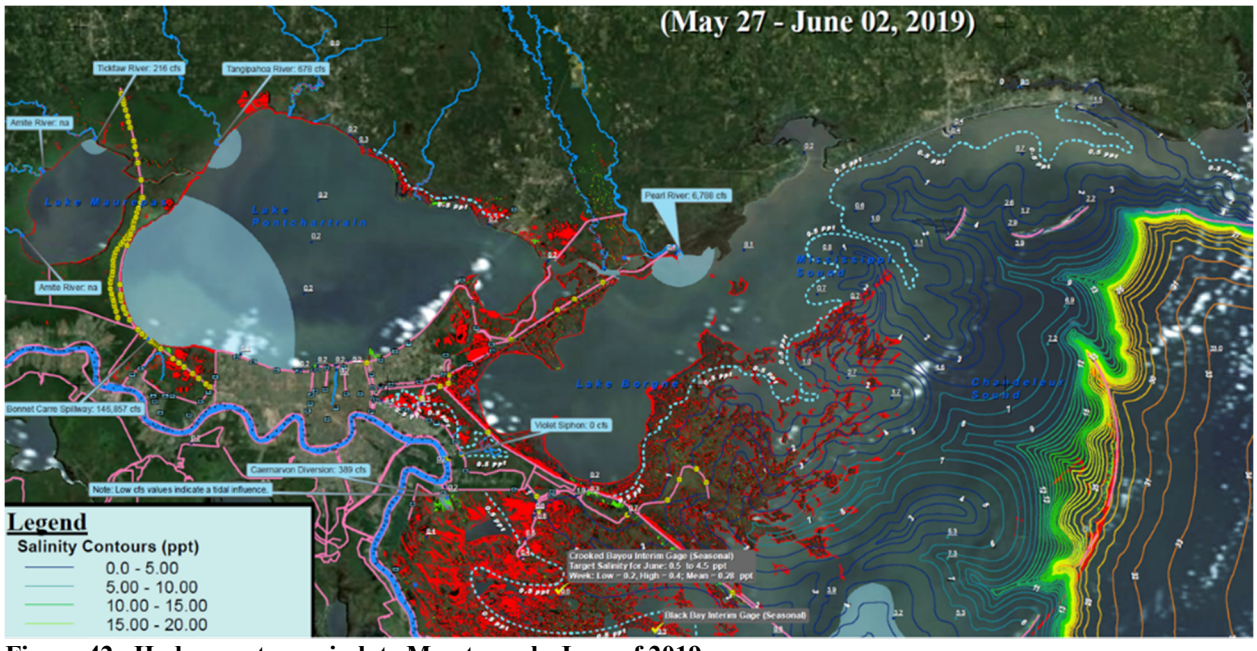


**Figure 42. Hydrocoast map in late May to early June of 2019.**

The 2016 BCS opening had a relatively less freshening effect in the MS Sound, based on the salinity gage records at the St Joseph Light, Merrill Shell Bank Light, Grand Pass, Gulfport Light, and East Ship USGS stations (Figure 43). The scale and duration of freshening is similar to the freshening following a northern tributary flow spike occurring in mid-March. Unlike the 2019 event, the BCS and tributary discharge do not coincide and the freshening is much less persistent in 2016.

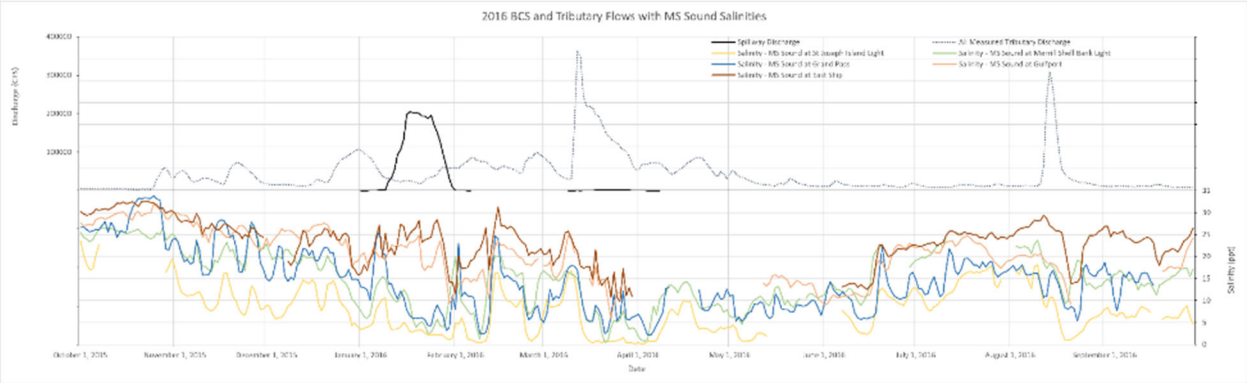


**Figure 43. 2016 BCS and tributary flows and MS Sound salinities.**

The 2016 Hydrocoast Map for late January shows the 0.5 ppt isohaline extending to the Rigolets, and this area of freshwater overlaps with a visible sediment plume in the satellite imagery. The Hydrocoast contours combined with the MS Sound salinities suggest that the freshening from the 2016 BCS opening were mostly contained to LP.

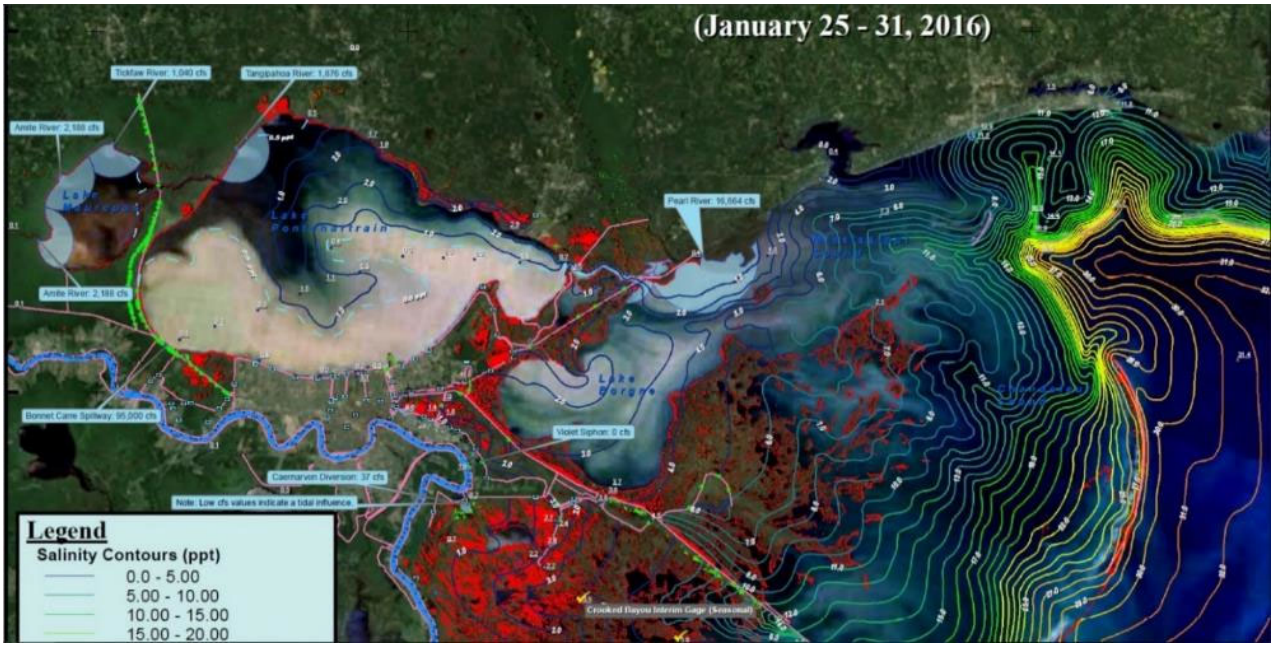


**Figure 44. Hydrocoast salinity map January 25 to January 31, 2016.**

In conclusion, a small-scale event, such as the 2016 opening, is expected to have much less persistent freshening than a larger scale opening (Figure 44).

The 2011 BCS opening had very little accompanying local tributary inflows. Freshening at St Joseph Light station started 4-7 days after spillway flow began, with Grand Pass and Merrill Shell Bank Light freshening starting about a week after the opening began. Salinities began to recover during the week of June 16, 2011, about 4 days before the spillway closure. The freshening effects were short-lived during the 2011 event (Figure 45).

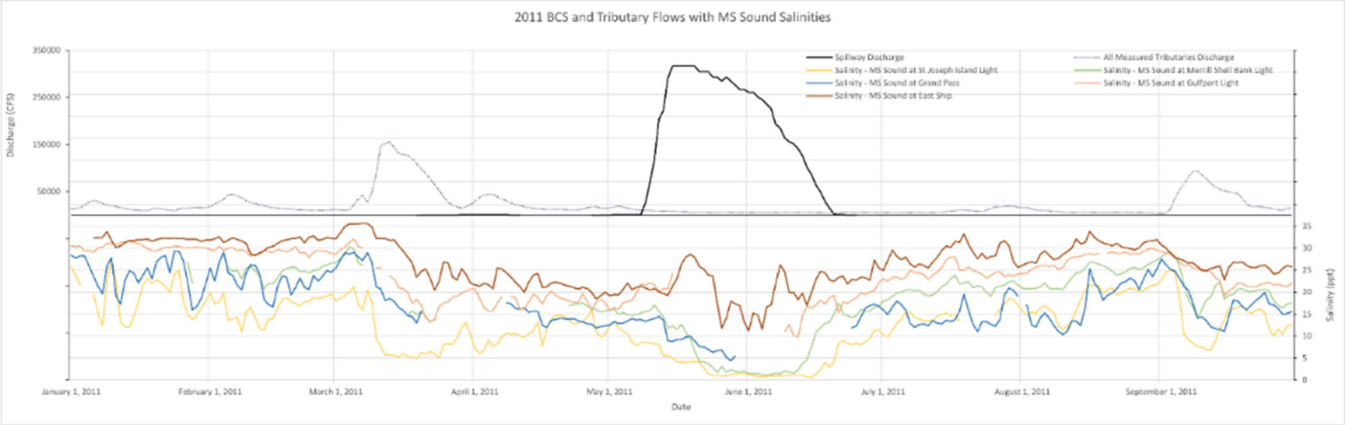


**Figure 45. 2011 BCS and tributary flows and MS Sound salinities.**

The area impacted by the 2011 BCS opening appears similar to the 2019 opening, based on the freshening observed at all MS Sound stations in the figure above. The freshening is far less severe at the East Ship station, though spillway flows appear to lower salinities by approximately 10 ppt for about a week. There are no Hydrocoast Maps for 2011. Comparing this opening to the 2019 second opening suggests that local tributaries had a large effect on the MS Sound salinities in 2019, since the volumes of the spillway openings are similar.

## *4.3 TURBIDITY AND SUSPENDED SEDIMENT*

Total suspended sediment (TSS) is a direct measurement of the mass of particulate matter that is trapped by a standard filter when the sample is filtered and is expressed as a concentration. Turbidity is a measure of light reflectance, which is correlated to the amount of particulates in the water. Turbidity and TSS can be damaging for aquatic ecosystems due to light inhibition. Suspended sediments are often carriers of contaminants and nutrients like phosphate. Satellite imagery illustrates the large sediment plume that flows with the BCS waters, as well as the plumes at the mouths of the MSR and Pearl River (Figure 46, Jeansonne 2019).

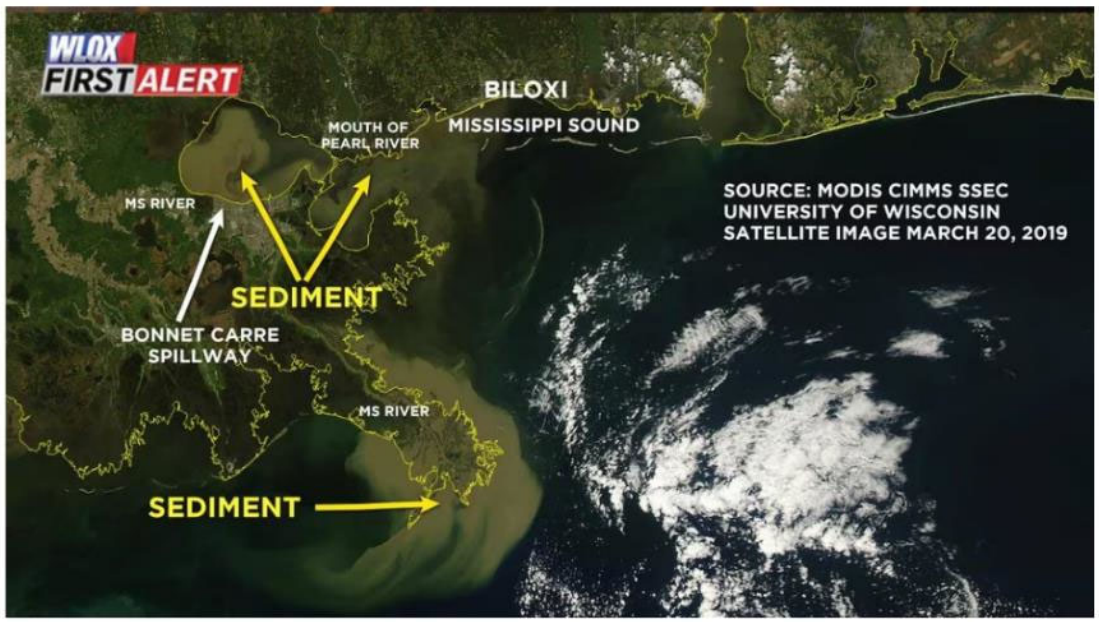


**Figure 46. BCS sediment plume on March 20, 2019, along with plumes at the mouth of the MSR and Pearl River, from MS WLOX (Jeansonne 2019).**

TSS and turbidity increase in LP during BCS operation due to the high energy of the spillway flows, which can entrain more sediment. Sediment settles out of the water column as the spillway flows lose energy. The same dynamic exists for most rivers entering coastal areas, as can be seen for the MSR and the Pearl River (Figure 46). USGS sampling during the 2019 BCS operation measured Secchi depths as a proxy for TSS and turbidity, which is another optical measurement that records the depth of visibility using a weighted optical target hanging off a measuring line. A low Secchi depth reading correlates to high turbidity and TSS. Secchi depth is correlated to the euphotic zone, defined as the depths where 1% of the light level reaches and where photosynthetic organisms can survive. This correlation is complicated (Luhtala and Tolvanen 2013) but can be approximated by multiplying the Secchi depth by 2.8 to estimate the euphotic zone (Kudela). (The results for select stations are plotted in Figure 47-Figure 50.)

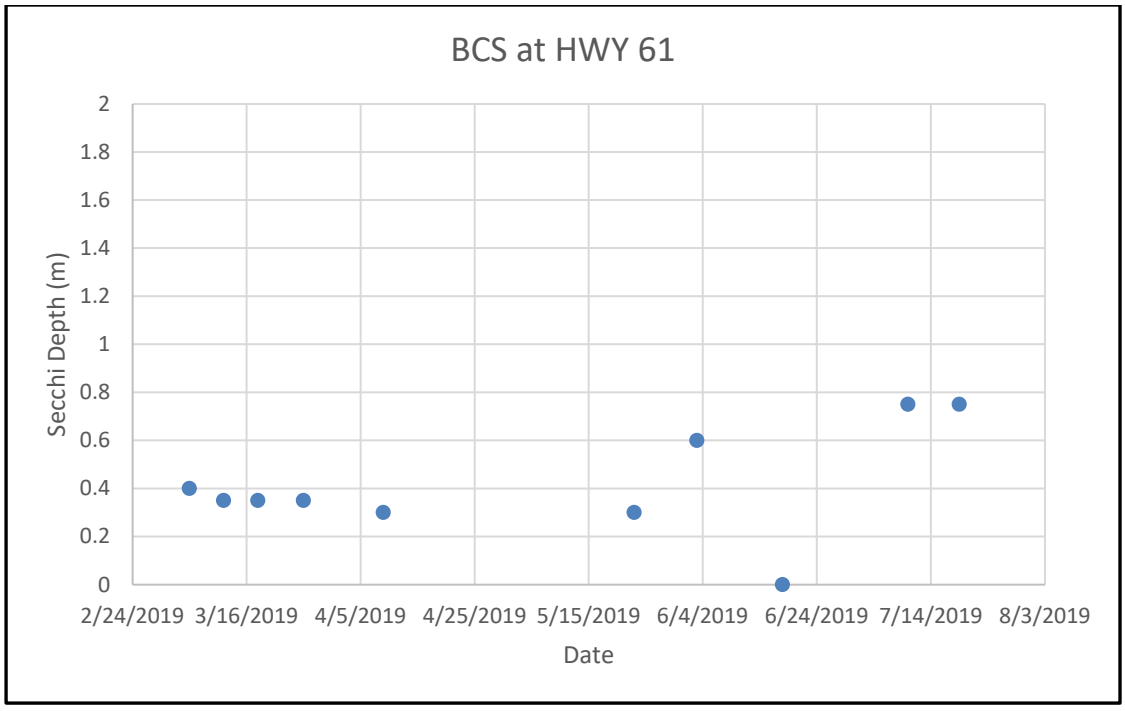


**Figure 47. Secchi depths recorded at USGS Station BCS at HWY 61.**

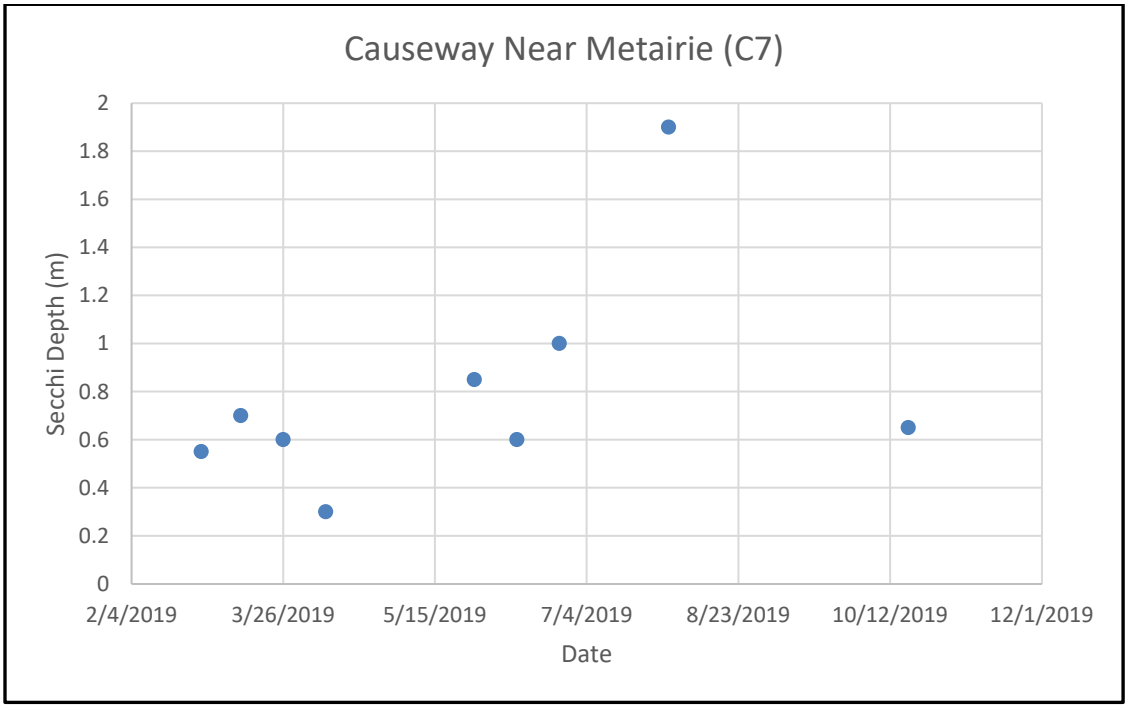


**Figure 48. Secchi depths recorded at USGS station Causeway Near Metairie (C7).**

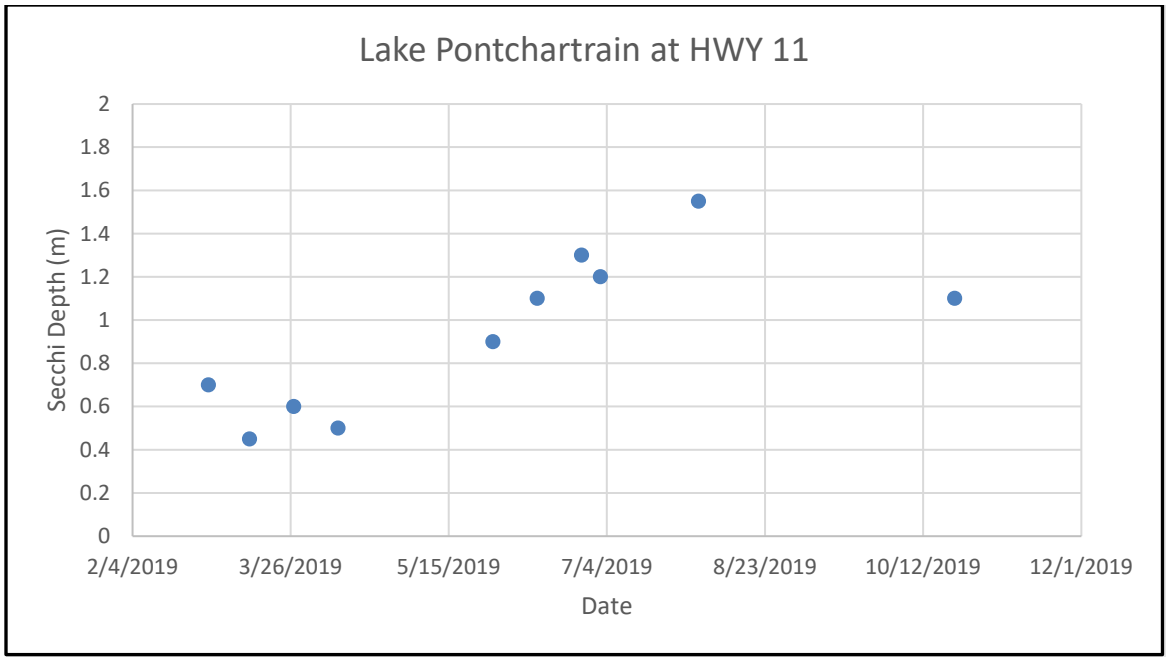


**Figure 49. Secchi depths recorded at USGS station LP at HWY 11.**

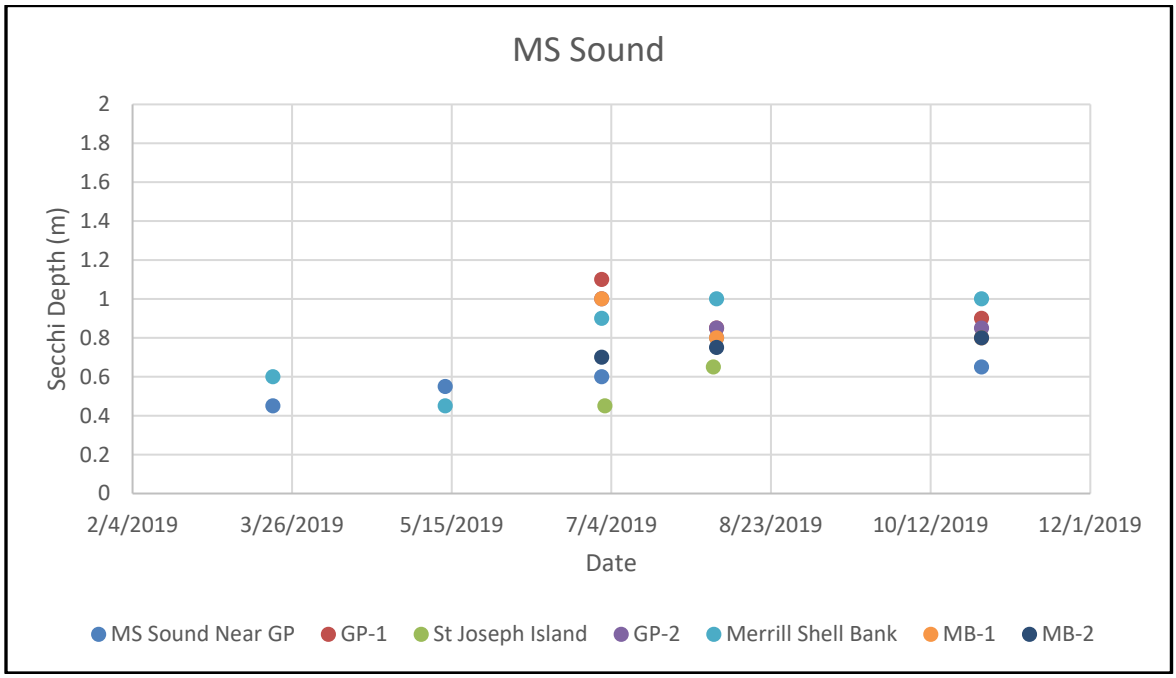


**Figure 50. Secchi depths recorded at USGS stations within MS Sound.**

Secchi depths were lowest during the first 2019 Spillway opening (February 27 to April 11). The second opening does not appear to have the same level of TSS/turbidity impact, since Secchi depths at most stations are rising during this period (May 10 to July 27). The rapid rebound in water clarity may be due to biologic activity, like in Lake Tahoe, California, where zooplankton is credited with increasing water clarity (Weber 2013).

Turbidity measurements from long-term continuous USGS gages at Gulfport Light (Figure 51) and East Ship Island (Figure 52) offer another way to approximate turbidity impacts. The turbidity record from 2017 through 2019 shows the range of turbidity values for a non-BCS year (2017) and a large BCS year (2019). The data shows high turbidity during the spring of 2017 at both gages. Fewer data points are available during the spring of 2019, but the max values are lower than observed in 2017, suggesting that the BCS is not the primary driver of turbidity in that region of the MS Sound. The East Ship Island gage has a stretch of continuous turbidity readings from April 3 to June 19, 2019, when the impacts of BCS salinity are estimated to be highest in the MS Sound. This data shows an average turbidity of 8.41 FNU (FNU is roughly equivalent to NTU) (The Wastewater Blog 2021), ranging between 6.5 and 11.00 FNU. USGS considers 10 NTU or lower to be low turbidity (Water Science School 2018), indicating that high turbidities from the BCS were not an issue in that location from April 3 to June 19, 2019.

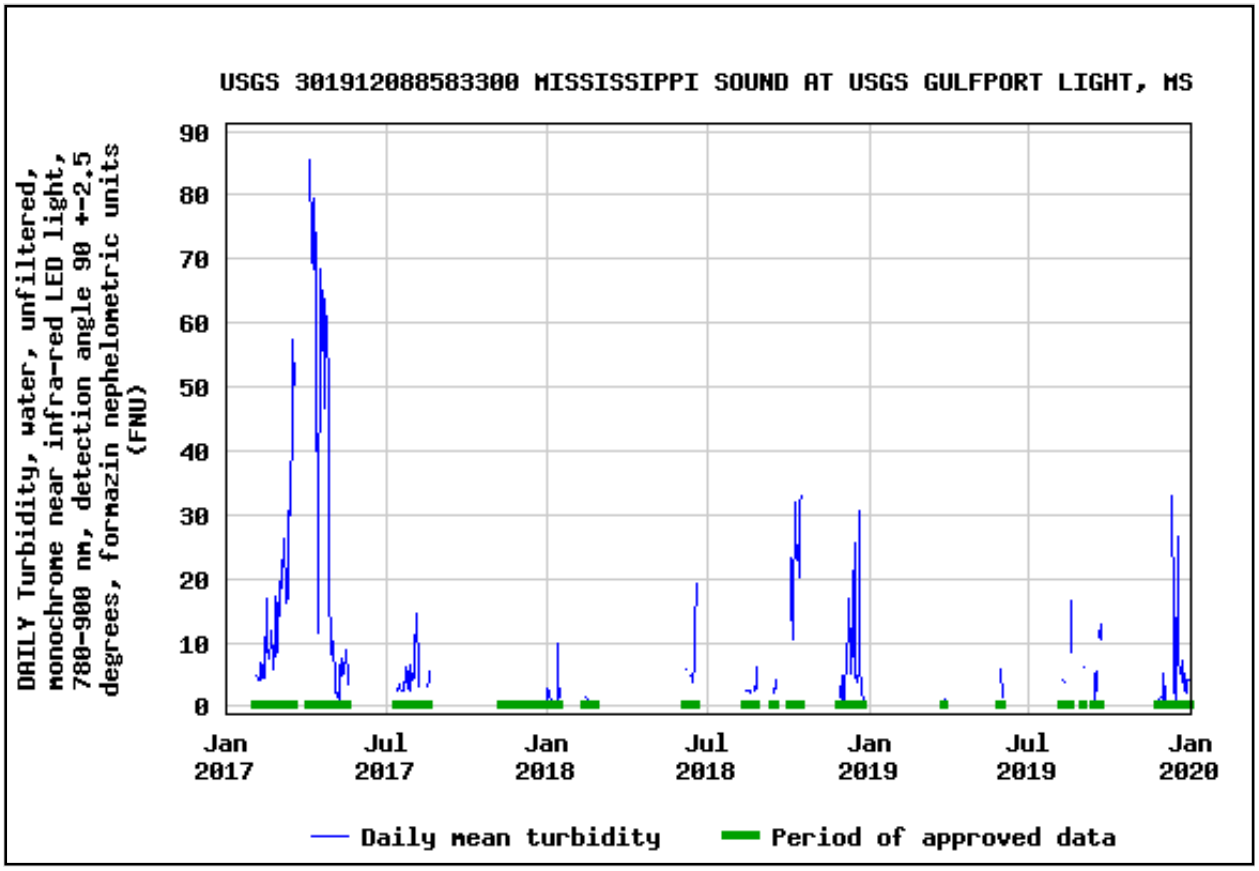


**Figure 51. Turbidity measurements recorded at USGS station Gulfport Light.**

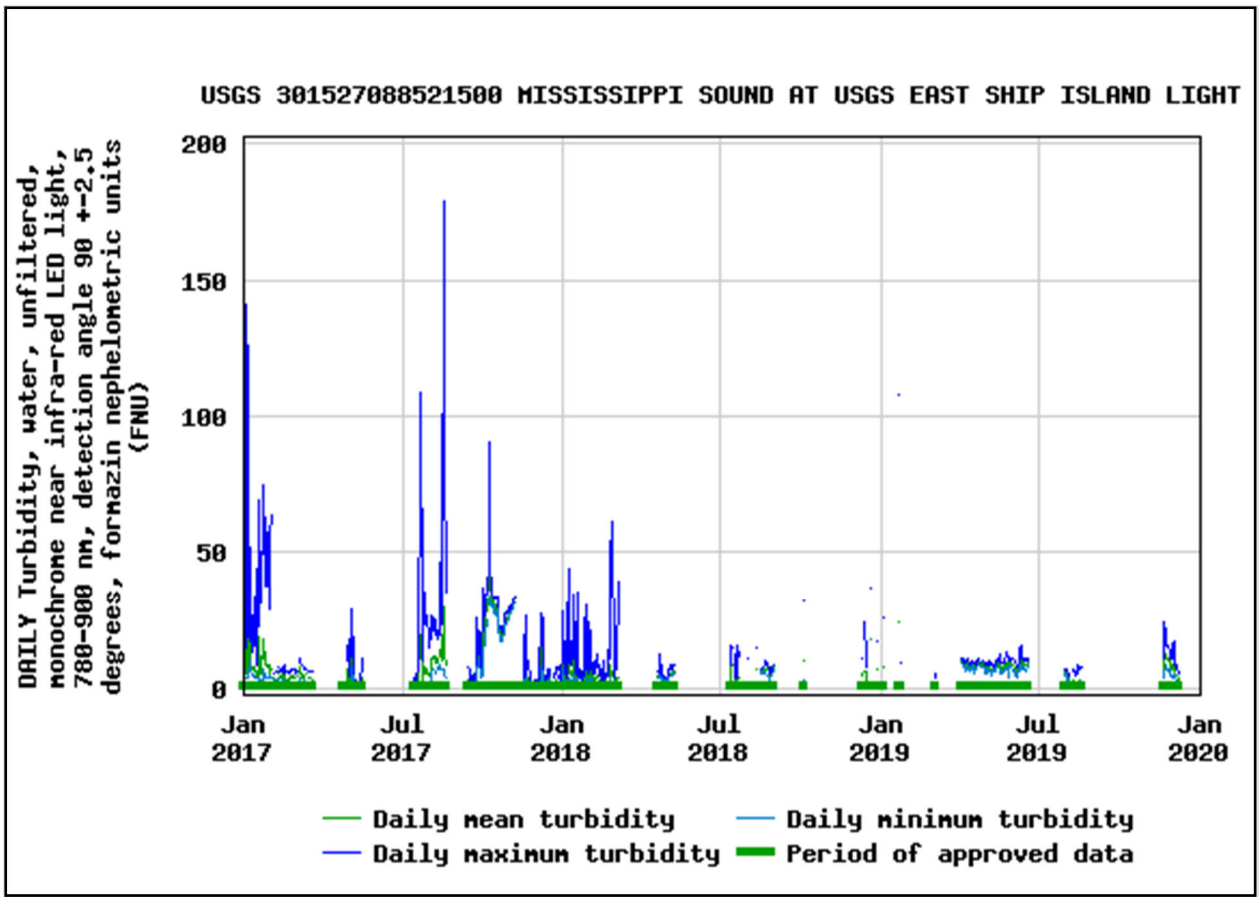


**Figure 52. Turbidity measurements recorded at USGS station East Ship Island.**

Several studies have measured the extent and duration of high TSS and turbidity due to the BCS in other years when the spillway opened.

Roy et al. (2013) measured Secchi depths along a 10-station transect extending straight out from the BCS outfall into LP for the 2011 BCS opening. Measurements show that the Spillway initially reduces Secchi depths from 0.9 m (3 ft) on May 8 to 0.3 m (1 ft) in late May during the Spillway opening. Secchi depths increased to >1 m (3.3 ft) at all stations in late June and up to 3.4 m (11.2 ft) at the station approximately 11 km (6.8 mi) from the Spillway.

Chao et al. (2014) quantified sediment flux from the BCS into LP during the 1997 opening, estimating the total amount of inflowing sediment to be 9.1 million tons, based on a TSS of 241 mg/L at the Spillway gates. Using satellite imagery as a comparison, Chao et al. (2014) showed that TSS moved first along the southern edge but gradually expanded north and impacted the entire lake approximately one month after the spillway opening. They also state that the recovery period to seasonally average TSS levels was about 2 to 3 months.

Brammer et al. (2007) recorded Secchi depth measurements along 5 stations east-west across LP, and 2 along the New Orleans lakefront, in their review of BCS impacts to macroinvertebrates after the 1997 opening. The Secchi depths before the opening was between 1-5 m (3.3-16.4 ft) but dropped below 0.3 m (1 ft) after the opening, and remained low (below 0.6 m, 2 ft) through

June 6 except at the easternmost site. By July 28, the visibility had returned to above 1 m (3.3 ft) Secchi depths at all stations except station 4, the 2 easternmost stations, where Secchi depths remained around 0.6 m (2 ft).

Based on the turbidity measurements from the USGS gages in MS Sound (Figure 51 and Figure 52), there does not appear to be a correlation between BCS flows and turbidity increases in that area of the MS Sound. In contrast, the literature shows that LP experiences high TSS concentrations and low water clarity usually during the earlier stages of BCS operation. Data from 2019 showed water clarity improving throughout the summer, even as the BCS continued to operate.

### *4.4 SEDIMENT DEPOSITION*

As suspended sediments settle out of the BCS waters, the sediment deposition can become an issue for SAV, oysters, and other benthic organisms. Damage can occur when sediment obstructs substrate habitat, or when organisms are smothered in sediments or exposed to pollution carried by the sediments (Wilber et al. 2010). Kroes et al. (2023) estimated the mass balance of the sediment that passed through the BCS during 2019 and concluded that most sediment deposition occurs within the floodway. They estimate the total sediment load passing highway 61 (about 1/3rd of the way down the floodway) to be 4.25 teragrams or 4,250,000 metric tonnes.

The quantity of sediment passing through the BCS was also estimated in Meselhe et al. (2016). The authors created a 3D numerical model using Delft 3D and calibrated and validated the model using sediment flux estimates from the 1997, 2008, and 2011 openings of BCS. The study estimated diverted fine sediment loads for the three openings to be 175,000, 1,100,000, and 200,000 metric tonnes respectively. It estimates diverted sand loads to be 15,000, 30,000, and 10,000 metric tonnes respectively.

A USGS webpage article discussed BCS sedimentation due to the 1997 Spillway opening and describes a “large lobe of silty sand an average of 19 cm [(7.5 in)] thick near the spillway mouth.” The article calculated the total quantity of wet sediment to total 9.1 million tons and calculates that this amount of sediment spread evenly across the Lake would have a depth of 0.42 cm (0.17 in). This page also described heavy metal sampling conducted on the sediment from this opening, and found that the levels of copper, lead, and zinc were similar to “data from nationwide sediment samplings in coastal waterways” (Manheim and Hayes 2002).

Several studies have been done on sedimentation and turbidity impacts in LP. Poirrier et al. (2017) documented the reduction in SAV coverage in LP between 1953 and 1990, attributing much of that reduction to increases in turbidity. They identified urbanization and shell dredging as the primary cause of these increases. The BCS was mentioned in this study, but as a carrier of nutrient pollution. The sedimentation impacts of the BCS were not discussed.

Brammer et al. (2007) conducted a study on the impacts of the 1997 BCS opening on LP’s infaunal macroinvertebrates. This study did not find sedimentation to be a problem for these species, concluding that sedimentation due to the BCS may provide beneficial nutrients. However, this study did not consider all benthic organisms. Overall, the study did not highlight that sedimentation was much of a factor in BCS impacts during 1997. Overall, there are still

some data gaps present on overall effect of sedimentation to all managed species. It is likely that if sedimentation occurs within SAV or oyster beds it would adversely affect those resources.

In summary, the BCS deposits large sediment loads in the immediate outfall area of the Spillway in LP, and likely impacts the organisms in this outfall area. Sedimentation due to BCS operation is likely not an issue for organisms outside of LP, as sedimentation rates decline precipitously along a gradient extending from the spillway outfall out into LP.

### *4.5 NUTRIENTS AND DISSOLVED OXYGEN*

Nutrient loading from the BCS is a high priority problem due to the ecosystem impacts that rapid nutrient changes can create. Several studies collected data on the scale, timing, and migration of different nutrients, primarily nitrogen (N), phosphorus (P), and silica-based (Si) compounds. Nutrients fuel biological processes, such as algae growth, which in turn impact dissolved oxygen levels. Pulses of nutrients fuel algal blooms that cannot survive at ambient nutrient levels, leading to mass die-offs that consume dissolved oxygen (DO). Some species of algae, such as cyanobacteria species, release toxic substances. Several BCS openings have been followed by algal blooms and subsequent low oxygen events, including the 1997, 2008 and 2019 openings. The nutrient and DO dynamics following the 1997 and 2008 spillway openings have been studied in detail. The 2019 nutrient and DO dynamics have not been analyzed in published documents to the same extent, but news reports and presentations document the toxic algal blooms and DO depletion that occurred that year.

USGS nutrient sampling within the BCS at Hwy 61 during the 2019 BCS operation measured a range of N and P species (USGS NWIS 2023). The total loads of total N (TN) and total P (TP) during the 2019 BCS opening were estimated by multiplying the measured concentrations by the BCS daily average flow rates (USACE 2023a). TN and TP concentrations were linearly interpolated to estimate concentrations for the entire duration of BCS operation. TN was explicitly measured, while TP was estimated as the sum of elemental P and orthophosphate. The concentration measurements ranged from 1.4 to 1.9 mg/L and 0.293 to 0.487 mg/L for TN and TP respectively. The TN and TP total loads flowing into the BCS were 63,366 and 13,911 tonnes respectively in 2019. Kroes et al. (2023) estimated that nutrients removed due to sedimentation in the spillway to be 4,900 and 3,420 tonnes of TN and TP respectively, leaving approximately 58,466 and 10,491 tonnes of TN and TP entering Lake Pontchartrain.

Harmful algal blooms (HABs) were reported during the summer of 2019 in LP (Phillips 2019), as well as in the MS Sound. According to a USGS data release describing algae and toxin sampling in 2019 (Rowley et al. 2021):

> "The timing and magnitude of the 2019 [BCS] diversions provided nutrient flux and freshwater inflows that resulted in algal accumulations that included harmful algal bloom species with possible algal toxins in coastal zones in MS. Especially hard hit was the MS shoreline/beach area, where bloom status for several species of algae was recorded along with elevated algal toxin levels. The Mississippi Department of Environmental Quality issued water contact advisories for 21 different beach locations from June until October 2019 (MDEQ, 2019, 1p)."

There was a press release from NOAA and news reports citing cyanobacteria as the source of toxins (NOAA NMFS 2019, The Weather Channel 2019). Algae toxin sampling reported by the USGS (Rowley et al. 2021) showed 15 samples with microcystin levels above the level of detection, with the highest concentrations measured in local tributaries – 4.65 and 2.81 µg/L in the Pearl and Pascagoula Rivers respectively. These samples do not have associated dates but were collected between July 1 and November 30, 2019. The high toxin levels found in northern tributaries as well as the high tributary flows occurring during that time suggest that northern tributaries could be the source of the 2019 HAB in the MS Sound. Another toxin sampling effort conducted by the USGS and reported on their NWIS database measured 0.13 µg/L concentrations of total microcystin at two stations in the MS Sound (Grand Pass and Merrill Shell Bank Light) on July 1, with no other samples measuring any toxins above the detection limit (USGS NWIS 2023). However, peer reviewed analyses of the algal toxins and species measured during this time have not been conducted.

DO measurements conducted by USGS showed steady declines in DO values in LP throughout the 2019 sampling period (Figure 53-Figure 56), likely due to warming temperatures since warmer water has less capacity for DO than colder water. Minimum DO measurements in LP during the 2019 sample was approximately 6 mg/L for both surface and bottom samples, suggesting a well-mixed system that is not experiencing hypoxia. Hypoxic conditions are defined as DO concentrations below 2 mg/L (Dzwonkowski et al. 2018). DO values below 2 mg/L were observed in the MS Sound in the month of July. These samples were from the bottom of the water column, whereas surface water sampled on the same date had DO levels above 6 mg/L, suggesting a stratified water column. These observations are consistent with findings made by the Gulf States Fisheries Commission studying the effects of the 2019 opening in the MS Bight, which presented data on hypoxic conditions further south and east from the USGS sampling stations, beyond the chain of barrier islands. However, as the Commission points out, hypoxic conditions in the MS Sound occur with and without BCS openings due to seasonal stratification (Dzwonkowski et al. 2018).

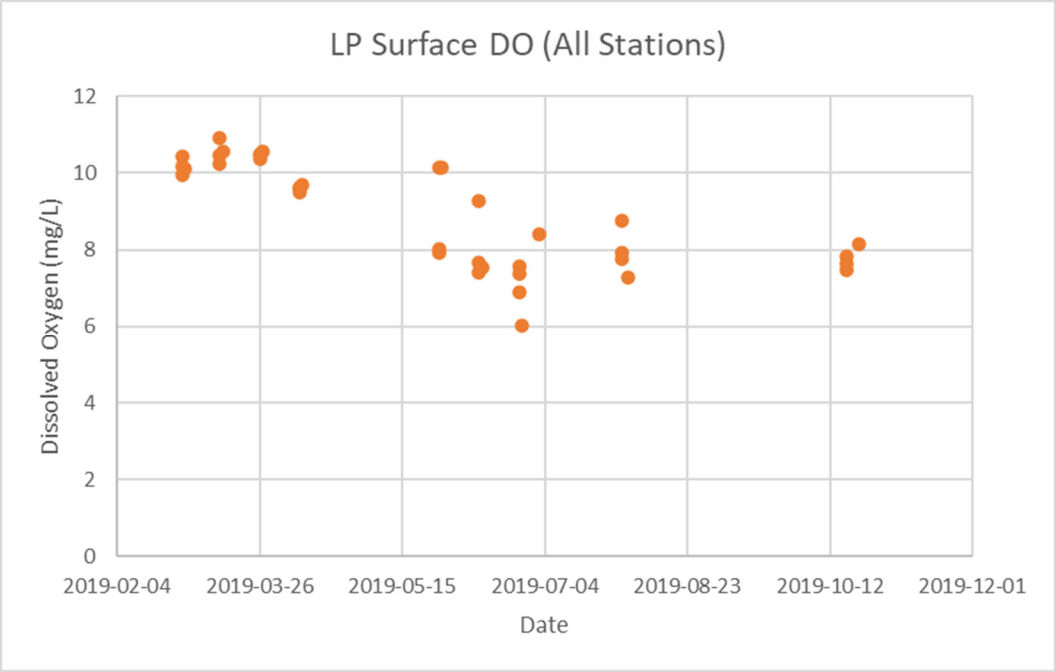


**Figure 53. Surface dissolved oxygen recorded at all USGS stations within LP in 2019.**

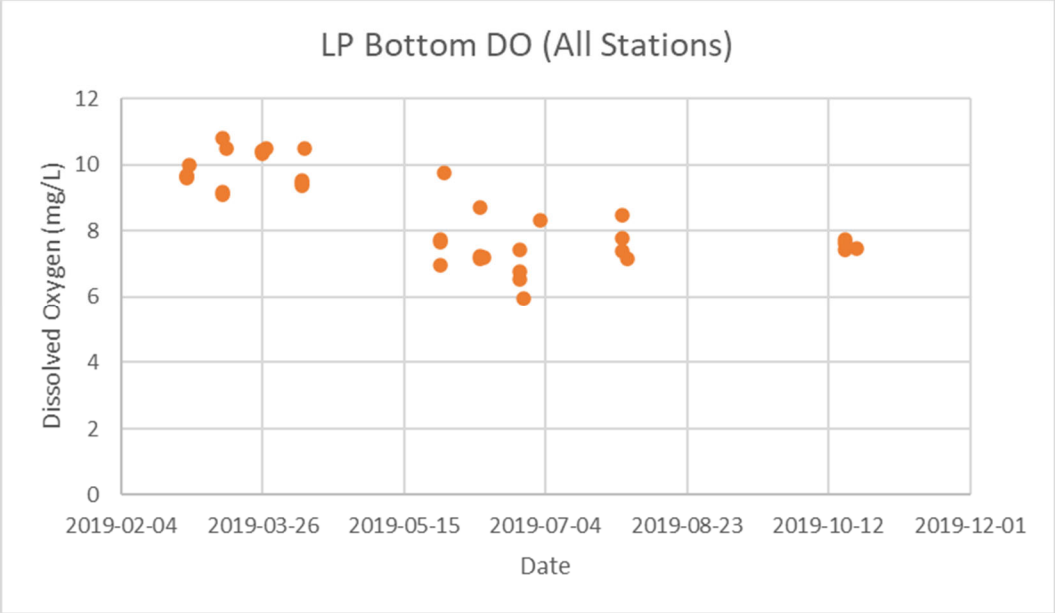


**Figure 54. Water bottom dissolved oxygen recorded at all USGS stations LP in 2019.**

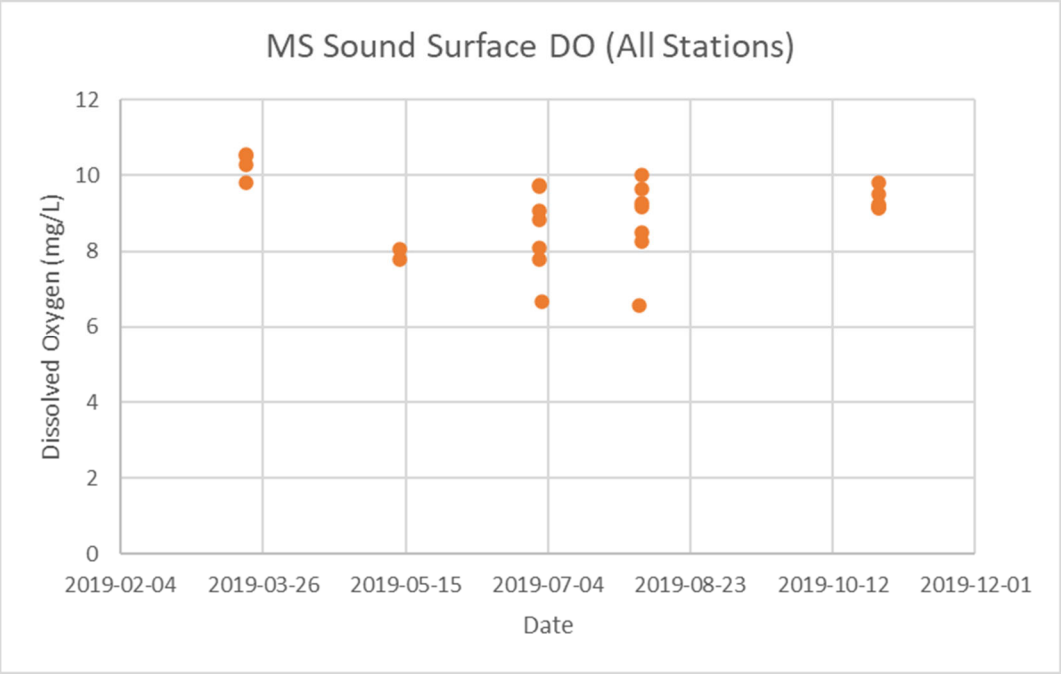


**Figure 55. Surface dissolved oxygen recorded at all USGS stations within MS Sound in 2019.**

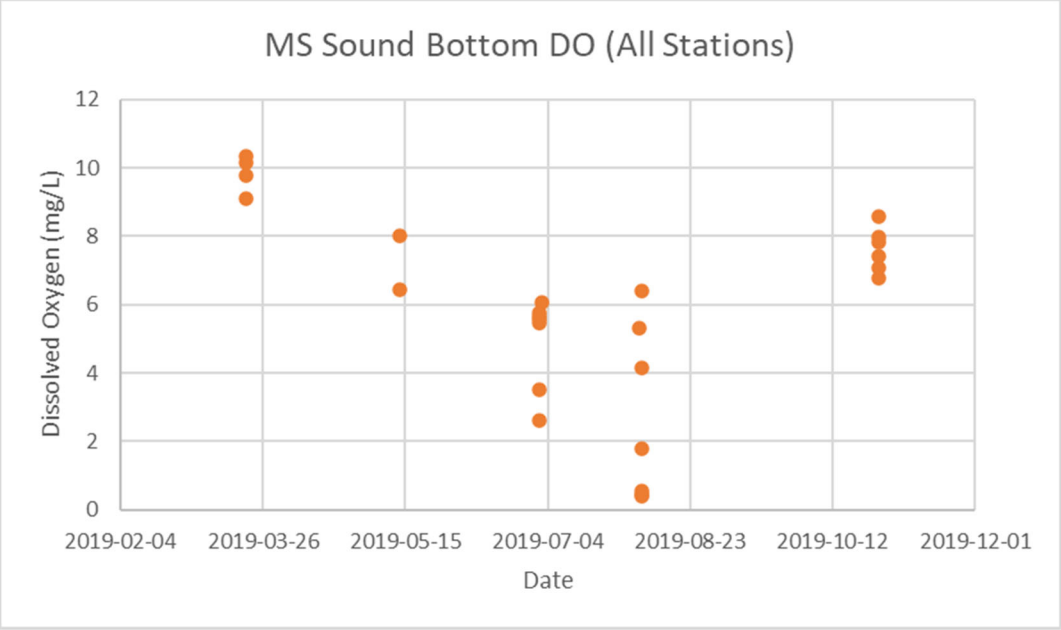


**Figure 56. Water bottom dissolved oxygen recorded at all USGS stations within MS Sound in 2019.**

Mize and Demcheck (2009) conducted a detailed study on nutrient and phytoplankton dynamics in LP following the 2008 BCS opening. The TN and TP loading from this opening are estimated at approximately 13,150 and 2,515 metric tonnes respectively. They measured dissolved nitrate concentrations during the 2008 BCS opening at station C7, near Metairie on the causeway bridge. Nitrate concentrations increased from approximately 0.6 to 1.5 mg/L in late April and early May, identified in their paper as period 2, the period of maximum influence of the BCS. The nitrate concentration dropped back to near baseline levels by late May, whereas salinity did

not return to baseline conditions until late July. The difference in salinity and nutrient recovery periods is likely due to microbial processes that can remove certain types of nitrogen from the system. Spatially averaged dissolved phosphorus concentrations were not significantly different between the four periods identified in this paper, measuring between 0.07 and 0.1 mg/L. However, orthophosphate, the most bioavailable form of phosphate, did drop to a minimum during the second time window. Mize and Demcheck (2009) attribute this to the tendency of LP phytoplankton communities to react to different limiting nutrients. LP phytoplankton are typically nitrogen limited (Turner 1999). Since N species spike in phase 2, phosphorus likely replaces it as the limiting nutrient, thus P is drawn down by organism growth. Dissolved silica concentrations were also at their lowest during period 2, measuring 1.31 mg/L, compared to pre-spillway concentrations of 4.13 mg/L. Dissolved silica measurements from MSR water in this study were 6.16 mg/L, suggesting that the drop in dissolved silica is not due to dilution, but some other process, likely bioaccumulation.

Mize and Demcheck (2009) identified the algae taxa present in LP after the 2008 Spillway opening. They show that diatoms species dominated MSR water species composition, while LP water was diverse prior to opening, with dinoflagellates, Chlorophyta, and diatoms all well represented. However, in period 2 (April 29 – May 29) during the opening, cyanobacteria concentrations began to grow, and by periods 3 and 4, in months after the BCS closure, cyanobacteria were by far the dominant genera of algae. Cyanobacteria are associated with HABs, which produce harmful toxins.

Roy et al. (2013) explored nutrient dynamics after the 2011 BCS opening, identifying a similar spike and rapid decrease in nitrates as Mize and Demcheck (2009). Roy et al. (2013) described a distinct nitrate collapse, which is defined as the time between Spillway closure and the date when nitrate levels drop below 0.1 mg/L "within the region of the estuary affected by the diversion." All measurements were taken along a 10-station transect extending straight out from the BCS outfall into LP. They compared the timing of the collapse period for the 2011 opening with that of the 1997 and 2008 openings. The 1997 opening represents a medium scale opening with above average tributary flow compared to the last 10 years and the 2008 opening represents a small opening with below average tributary flow. The nitrate collapse period in 2008 and 2011 were both 21 days, while it was 87 days in 1997. Roy et al. (2013) also state that chlorophyll-a measurements were much higher in 1997 than in 2008 or 2011. Regarding dissolved inorganic phosphorus (DIP), they measured initial decreases in concentration along the sample transect from June 4 to June 30, with values dropping to near zero, before rebounding above the MSR inflow concentration of 0.054 mg/L. The DIP fluctuations are likely due to the same nutrient ratio dynamics described by Mize and Demcheck (2009) – Roy et al. (2013) cite their study to explain the DIP drop. The rapid DIP rebound in 2011 is explained by internal loading from sediments since northern tributaries were in drought condition according to the study. Roy et al. (2013) observed a similar dissolved silica drop in 2011 as was observed in 2008, suggesting a similar dynamic of N overloading leading to consumption of other nutrients due to organism growth. The TN and TP loads from the 2011 BCS opening are estimated to be 36,500 and 3,300 metric tonnes respectively (Welch et al. 2011).

Lane et al. (2001) provided a more detailed description of the possible causes of the nitrate decline post-spillway closure, focused on the 1994 BCS opening. Lane et al. (2001) states that both denitrifying bacteria – which converts nitrates to nitrites and nitrites to nitrogen gas – as well as bioaccumulation in growing organisms, lead to the rapid decline of nitrate concentrations delivered by the BCS.

Dortch et al. (1998) reported on the 1997 bloom, observing 96% relative abundance of cyanobacteria (genera *Anabaena* and *Microcystis*) at the blooms peak in mid-June. The 2011 opening released about 57% of the volume compared to the 2019 opening, and USGS data presented by Heal et al. (2023) show depressed salinities after the opening at MS Sound monitoring stations, so for this comparison, it is assumed that 2011 had a similar area of potential effects as 2019. Roy et al. (2016) found no evidence of cyanobacterial blooms in LP after the 2011 opening, and there were no MS beach closures that year either. Roy et al. (2013) compared the 2011, 2008, and 1997 openings, asking why the 2011 did not produce a cyanobacterial bloom. The report notes that the 2011 opening dwarfed the northern tributary contributions, whereas 1997 and 2008 had relatively even contributions from tributary and BCS flows. 2011 had lower wind speeds post-opening compared to 1997 and 2008, which would theoretically support algal growth. Ultimately, Roy et al. (2013) attributed the lack of cyanobacterial HAB formation to higher hydraulic flushing rates from the higher BCS flow rates. The 2011 opening occurred about a year after the Deepwater Horizon Oil Spill, which undoubtedly affected the ecological dynamics during this time-period.

In summary, nutrient and dissolved oxygen dynamics during and after BCS operation are highly variable. LP and the MS Sound consistently experience spikes in nitrogen species, primarily nitrates, and orthophosphates from BCS flows, followed by rapid drawdowns of these nutrients attributed to biologic activity. In some years (1997, 2008, and 2019), this biologic activity is considered harmful. Other years, such as 2011, this biologic activity is not considered harmful. DO depletion due to biologic activity is an issue in the MS Sound, where stratification exacerbates DO drawdown. DO depletion does not appear to be as problematic in LP, likely due to more mixing and oxygen replenishment from the atmosphere. While estimating the temporal and spatial patterns of algae blooms and DO is challenging due to their dynamic nature, the 2019 HAB led to 3 months of beach closures in MS– from early July to early October. This 2019 HAB depicts the potential scale of influence from a large-scale opening, though northern tributary flow could have played a role. The importance of local tributary influence is reinforced by the lack of bloom after the large-scale 2011 BCS opening, which coincided with low tributary flow. Smaller scale BCS openings such as the 1997 and 2008 openings influenced the nutrient cycles which led to HABs in LP but did not lead to HABs in the MS Sound, suggesting that the scale of the opening determines the spatial extent of these effects.

## 5.0 ANALYSIS OF EFFECTS

Under Section 7(a)(2) of the Endangered Species Act (ESA) Federal agencies are required to ensure, in consultation with the Services, any actions authorized, funded, or carried out are not likely to jeopardize species or destroy or adversely modify critical habitat. In addition, the ESA provides guidance on the determination of whether proposed actions “may affect” a Section 7 resource and how to gauge adverse effects of the action. During the development of the

Biological Assessment (BA), the Federal action agency analyzes the potential direct and indirect adverse effects of the action and provides a determination on the resource in question. The following are designated levels of determinations:

1. No effect (NE) – the proposed action will not affect listed species and/or critical habitat.

2. May affect, not likely to adversely affect (NLAA) – the effects of the proposed action on listed species or critical habitat are expected to be completely beneficial, discountable, or insignificant.

3. May affect, likely to adversely affect (LAA) – the proposed action may have an adverse effect on listed species or critical habitat and the effect is not discountable, insignificant, or completely beneficial.

### *5.1 LISTED SPECIES WITH "NO EFFECT" (NE) DETERMINATIONS*

*No effect on two sea turtle species*

The USACE is unaware of any documented effects to hawksbill or leatherback sea turtles from previous BCS openings. In general, sea turtles can tolerate short-term decreases in salinity and are highly mobile. However, CEMVN has considered data from the Sea Turtle Stranding and Salvage Network (STSSN) (Figure 57), which has been tracking sea turtle standings in AL, MS and LA since the 2010 Deepwater Horizon oil spill, to assess potential effects for this analysis for the counties and parishes bordering the BCS action area. "Traditional strandings" include live sea turtles that are sick or injured, and dead sea turtles which may show signs of disease, major injury, or have an unknown cause of death due to a lack of abnormalities or due to decomposition. Traditional strandings do not include incidental captures, post-hatchlings, cold stunning, or disoriented nesting females (Howell et al. 2021). Based on these data within and surrounding the approximate BCS action area, CEMVN concludes that BCS operations will have "*no effect"* on the hawksbill and leatherback sea turtles.

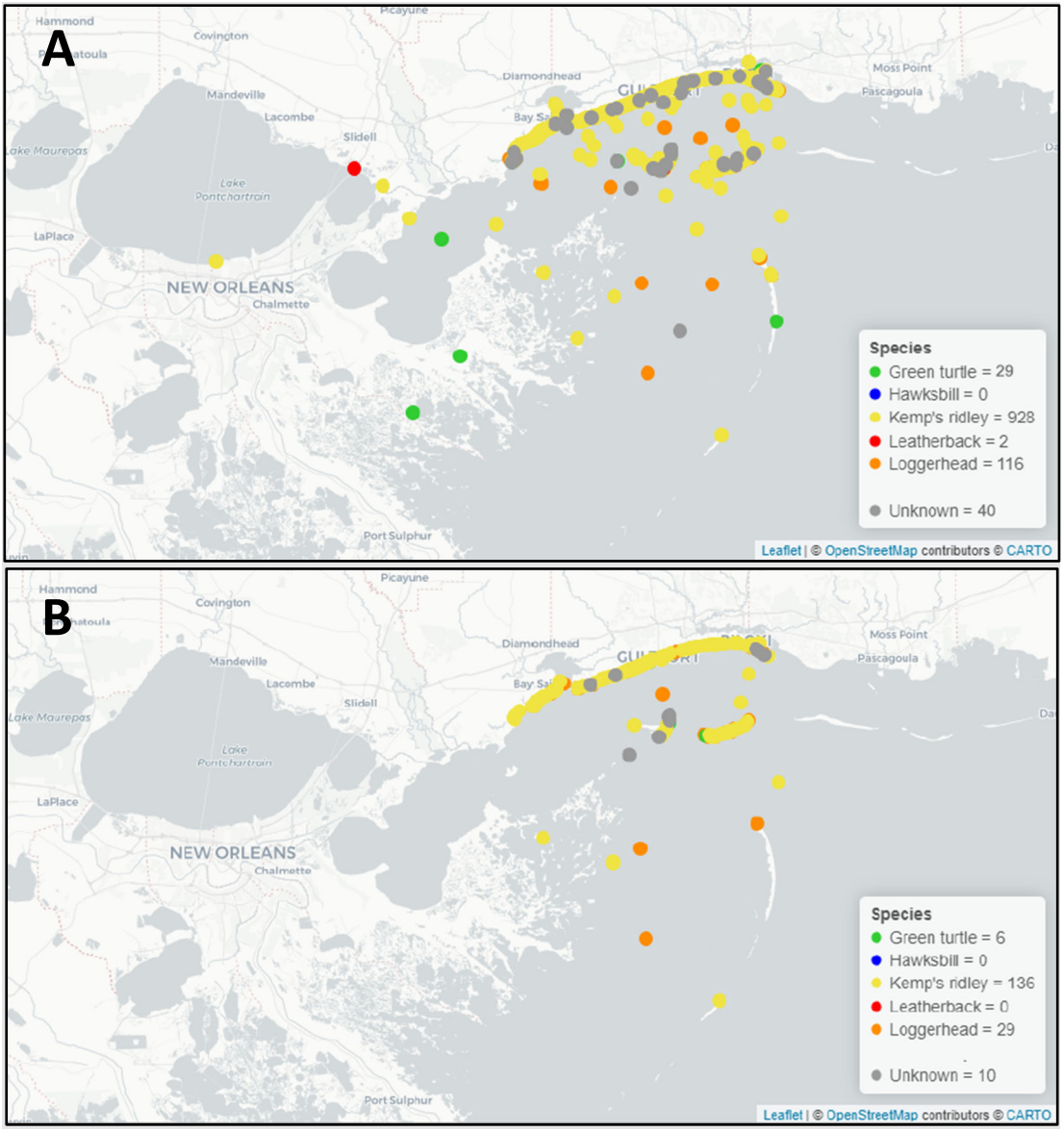


**Figure 57. "Traditional" sea turtle strandings by species recorded by the STSSN from (A) 2013-2022 and (B) during 2019, within the approximate BCS action area.**

**Figure notes: Coastal counties/parishes of LA and MS included (in counterclockwise order) are St. Tammany, Orleans, St. Bernard, Hancock, and Harrison. Data available at: https://www.fisheries.noaa.gov/national/marine-life-distress/sea-turtle-stranding-and-salvage-network**

### 5.1.1 Hawksbill Sea Turtle

Although the NGOA is within the hawksbill sea turtle's temperature tolerance range, it does not include the hawksbills' preferred habitats of coral reefs and mangrove estuaries. Indeed, hawkbills are rarely observed in the nearshore waters of AL, MS, or LA (Howell et al. 2021). From 2013 to 2022, no hawksbill sea turtle strandings were recorded by the STSSN within the BCS action area (Figure 57A). Further, a NOAA NMFS assessment of potential BCS operation impacts on sea turtle strandings in LA, MS, and AL (Howell et al. 2021) found that there was likely no effect from BCS operations on hawksbill strandings. This report also anecdotally noted that hawksbill sea turtles have been held in captivity at low salinities for prolonged periods

without apparent negative effects. Further, low salinity events likely would not directly affect hawksbill, as brackish mangrove estuaries are among their most preferred foraging habitats (Martinez-Estevez et al. 2023). Taken together, due to the rarity of hawksbill presence in the NGOA in general and within the action area in particular, as well as observed tolerances to low salinities, BCS operations will likely have "*no effect"* on hawksbill sea turtles.

### 5.1.2 Leatherback Sea Turtle

From 2013 to 2022, only two leatherback sea turtle strandings have been recorded by the STSSN within the BCS action area (Figure 57A). One individual was found in 2013, a year in which the BCS was not operated. The other individual was found in LP during May of 2016, four months after the 2016 BCS opening. Although this individual was found within the BCS action area after an opening event, a single stranding record is insufficient evidence for BCS impacts in a population context. Further, evidence suggests that leatherbacks do not regularly visit the action area. They are a mainly pelagic species and do not nest in the NGOA (NMFS/USFWS 2020). Although leatherbacks occasionally use the NGOA for foraging, hotspots are generally found on the coastal shelf of the Florida panhandle (Heal et al. 2023), far outside of the action area. The NOAA NMFS assessment of potential BCS operation impacts on sea turtle strandings in LA, MS, and AL found that there was likely no effect from BCS operations on leatherback strandings (Howell et al. 2021). Considering available information, this BA also finds that BCS operations likely have "*no effect"* on leatherback sea turtles.

## *5.2 LISTED SPECIES WITH "MAY AFFECT, LIKELY TO ADVERSELY AFFECT" (LAA) DETERMINATIONS*

The species directly affected from one or more previous openings of the BCS beginning in 2008 are the Pallid Sturgeon (*Scaphirhynchus albus*), Shovelnose Sturgeon (*Scaphirhynchus platorynchus*), and Gulf Sturgeon (*Acipenser oxyrinchus desotoi*). Therefore, a determination of *"may affect, likely to adversely affect*" was made for those three species of sturgeon. The following sections provide greater detail about the effects of the BCS operation on these species.

### 5.2.1 Pallid Sturgeon and Shovelnose Sturgeon

Historically, the Pallid Sturgeon occurred over a larger, contiguous riverscape. Today the distribution has been fragmented by large dams and reservoirs with dams on larger tributaries being constructed for power generation, flood control, navigation, and irrigation (Jordan et al. 2016). A decline in numbers has been attributed to several anthropogenic impacts, including habitat modification and commercial harvest of the fish (USFWS 1990). More recent studies have added water contamination, entrainment, and hybridization to the list of impacts (Divers et al. 2009, USFWS 2009, Blevins 2011, Schrey et al. 2011). Recently, invasive species, particularly Invasive Carp, have been added as an emerging concern as they may alter food web dynamics within large river systems (Freedman et al. 2012, Jordan et al. 2016, Kramer et al. 2019). Jordan et al. (2016) notes that approximately 51% of the historical range of the Pallid Sturgeon has been affected to some degree by channelization, 28% has been impounded, and 21% is affected by upstream impoundments that alter flow regimes, depress turbidity and water temperatures, as well as by continuing bank stabilization activities that limit channel meandering (Kallemeyne 1983, Keenlyne 1997, USFWS 1993, 2007, 2014). While anthropogenic habitat alterations were the primary factor for listing (USFWS 1990), the extent of these impacts vary by management unit. The Pallid Sturgeon currently remains endangered. The USFWS (1993) criteria to downlist Pallid Sturgeon from endangered to threatened include a population structure

with at least 10% sexually mature females, and sufficient numbers in the wild to maintain population stability. An updated recovery plan was released in 2014 (USFWS 2014) and the criteria for downlisting was expanded:

> A self-sustaining genetically diverse population of 5,000 adult Pallid Sturgeon is realized and maintained within each management unit for two generations (20 to 30 years). In this context, a self-sustaining population is described as a spawning population that results in sufficient recruitment of naturally produced Pallid Sturgeon into the adult population at levels necessary to maintain a genetically diverse wild adult population in the absence of artificial population augmentation. Metrics suggested to define a minimally sufficient population would include incremental relative stock density of stock-to-quality-sized naturally produced fish (Shuman et al. 2006) being 50 to 85 over each 5-year sampling period, catch-per-unit-effort data indicative of a stable or increasing population, and survival rates of naturally produced juvenile Pallid Sturgeon (age 2+) equal to or exceeding those of the adults. Additionally, in this context a genetically diverse population is defined as one in which the effective population size (Ne) is sufficient to maintain adaptive genetic variability into the foreseeable future (Ne = 500), conserve localized adaptions, and preserve rare alleles.

In addition, the revision (USFWS 2014) noted significant genetic structure throughout the range, redefined management units, and identified the potential of delisting by management area. The primary strategy for recovery of Pallid Sturgeon is to:

> 1) conserve the range of genetic and morphological diversity of the species across its historical range; 2) fully quantify population demographics and status within each management unit; 3) improve population size and viability within each management unit; 4) reduce threats having the greatest impact on the species within each management unit; and, 5) use artificial propagation to prevent local extirpation within management units where recruitment failure is occurring. Pallid sturgeon recovery will require an improved understanding of the status of the species throughout its range; developing information on life history, ecology, mortality, and habitat requirements; improving our understanding of some poorly understood threat factors potentially impacting the species; and using that information to implement management actions in areas where recovery can be achieved.

Water diversions within the LMR are used for flood risk reduction, water supply and habitat restoration. As such, there is a growing concern that entrainment of Pallid Sturgeon at existing and proposed diversions may impact local abundances which may alter population trends and affect recovery potential for the species. To provide context for entrainment risks at LMR diversions, ERDC researchers (ERDC-EL 2013) evaluated the spatial distribution and relative abundance of sturgeon in the lower 320 mi of the MSR where all of the LMR diversions either currently exist or are proposed. Four hundred and sixty-nine (469) total sampling gears were deployed at 85 sample stations along the 320-river mi reach with 74.1% of the sampling efforts conducted within the reach associated with existing or planned river diversions. A total of 51 Pallid Sturgeon, 319 Shovelnose Sturgeon, and 84 YOY sturgeon were collected between 2001 and 2011 below river mile (RM) 320. The most downstream collection of a confirmed Pallid Sturgeon is at RM 95.5. Two juvenile Shovelnose Sturgeon were collected opposite the Caernarvon Diversion at RM 81, and more recently, two young-of-year *Scaphiryhnchus* were

collected at RM 33, which is the most downstream collection of *Scaphiryhnchus*. These data indicate a low risk of entraining Pallid Sturgeon below New Orleans because of their rarity or absence in the lower 100 mi of the LMR, although entrainment risk was noted to be higher for larger diversions (>10,000 cfs) located above New Orleans (ERDC-EL 2013).

Six openings and corresponding rescue operations in the BCS occurred between 2008 and 2020 after each BCS closure. A total of 90 days with a crew number ranging from 3 to 12 were expended to collect 69 Pallid Sturgeon, seven of which were dead, and 439 Shovelnose Sturgeon, 105 of which were dead, after the six openings that spanned 269 total days (Table 6). Dead sturgeon primarily occurred in the Stilling Basin after the structure ceased leaking through the pins resulting in hypoxic conditions (Figure 59). More sturgeon were entrained at higher water temperatures, with a greater number of bays opened for longer durations. Recovery of sturgeon is initially high but over time declines as sturgeon are depleted from the floodway, stranded in isolated waterbodies in the floodway, and/or displaced further downstream into LP during longer openings. Sturgeon that cannot find their way back to the floodway are unlikely to be rescued.

Killgore et al. (2007b) identified an annual total mortality rate in the LMR of 7% for age 3+ Pallid Sturgeon. Existing and planned small-scale diversions (< 2000 cfs) within the LMR have been estimated to impose a substantially reduced annual mortality rate of 0.02-0.11% (Friedenberg 2022), although the median time to a population decline < 5000 age 3+ individuals was 37.5 years under simulated baseline conditions. The median time was reduced (34.3 years) under the conditions simulated with the continuous operation of a small-scale diversion suggesting that entrainment at the diversion could reduce the local population size by 0.6% (0.4-2.1%) over a 50-year project period (Friedenberg 2022).

Using an age-based population viability model for Pallid Sturgeon populations in the LMR, ecological risks associated with entrainment were modeled for episodic (e.g., BCS operation) and chronic water diversions (e.g., continuous operation) with demographic and environmental stochasticity incorporated into the model framework (ERDC-EL 2013). Entrainment during episodic diversions had the potential to reduce median local population size by 0-20% over a 60-year project period while entrainment at chronic water diversions reduced median local population size by 2-50%. Given abundance of Pallid Sturgeon (age 3+) in the LMR is near 5,000 or more, entrainment concerns are not a major risk to the recovery and maintenance of the population. Only a worst-case scenario of low abundance and high entrainment presented an appreciable risk to the population for this modeling approach.

LMR populations of Pallid Sturgeon appear to be stable (USFWS 2014, Jordan et al. 2016). This species has been reported to migrate long distances, presumably in association with spawning events and as such it is uncertain how localized processes may impact a wide-ranging species. Although the number of rescued Pallid and Shovelnose Sturgeon from the BCS has varied across openings due to differences in seasonality and duration of the openings, the number of rescued sturgeon represent a relatively small proportion of the total population size in the LMR with even the lowest estimates (Killgore et al. 2022). However, it is our determination that operation of the BCS *"may affect, likely to adversely affect"* the Pallid and Shovelnose Sturgeon due to entrainment risk.

**Table 6. Characteristics of the BCS after closure from 2008 – 2019 and number of sturgeon collected. Water quality measurements occurred after closure during sampling and included canals, ditches, and lakes.**
**Sampling was not allowed after the first 2019 opening indicated by N/A. Data compiled from Slack and Killgore (2020) and Killgore et al. (2022)**

| Variable | 2008 | 2011 | 2016 | 2018 | 2019 – 1st Opening | 2019 – 2nd Opening[1] | 2020 |
|---|---|---|---|---|---|---|---|
| Calendar Days Open (number of days) | April 11-May 8 (28) | May 9-June 20 (43) | January 10-February 1 (23) | March 8-30 (23) | February 27-April 11 (44) | May 10-July 27 (79) | April 3-May 1 (29) |
| Bay Days | 3334 | 11409 | 3132 | 2561 | 6528 | 10890 | 1655 |
| Percent Open | 45.7 | 94.3 | 60 | 52.3 | 58.9 | 48.0 | 25.7 |
| Maximum Discharge, cubic meters/second (cms) | 4535 | 8946 | 5748 | 5550 | 6032 | 4559 | 2549 |
| Total Volume Passed, billion cubic meters | 7.47 | 21.87 | 6.93 | 5.77 | 15.1 | 23 | 3.98 |
| Mean (min-max) Water Temperature, °C (MS River[2]) | 16.8 (14.7 – 19.5) | 22.7 (17.9 – 28.3) | 6.8 (5.2 – 9.2) | 12.8 (12.2 – 14.4) | 9.6 (6.5 – 14.5) | 25.2 (19.6 – 28.9) | 16.6 (14.9-17.7) |
| Mean (min-max) Water Temperature, °C (Spillway) | 22.7 (16.4 – 31.1) | 30.2 (26.7 – 32.9) | 10.8 (6.6-19.2) | 24.0 (15.2-29.8) | N/A | 30.5 (28.8-32.0) | 24.3 (21.5-29.6) |
| Mean (min-max) Dissolved Oxygen, mg/l | 6.7 (3.2-9.0) | 7.6 (3.5-12.1) | 11.9 (7.2-13.9) | 8.5 (0.4-17.3) | N/A | 7.4 (4.1-13.6) | 7.5 (3.2-9.5) |
| Mean (min-max) Turbidity, NTU | 47.4 (27.9-69.9) | 51.0 (34.5-71.8) | 39.1 (16.1-55.9) | 20.0 (10.5-38.1) | N/A | 17.7 (12.2-28.6) | 17.5 (4.4-30.0) |
| Number of Pallid Sturgeon Collected | 14 | 20 | 0 | 4 | N/A | 19 | 12 |
| Number of dead Pallid Sturgeon | 0 | 1 | 0 | 2 | N/A | 1 | 3 |
| Mean (min-max) Pallid Fork Length, mm | 710 (528-884) | 786 (676-924) | - | 691 (614-863) | N/A | 783 (586-1035) | 756 (380-930) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Number of Shovelnose Sturgeon Collected | 41 | 78 | 0 | 4 | N/A | 239 | 77 |
| Number of dead Shovelnose Sturgeon | 2 | 3 | 0 | 0 | N/A | 78 | 2 |
| Mean (min-max) Shovelnose Fork Length, mm | 668 (539-841) | 608 (384-830) | - | 667 (643-690) | N/A | 617 (400-928) | 629 (380-911) |
| Pallid:Shovelnose Ratio | 1:2.9 | 1:3.9 | 0 | 1:1.0 | N/A | 1:12.6 | 1:6.4 |

[1] – Water quality and number of sturgeon collected occurred after the second opening.
[2] – Water temperature in the Mississippi River at Baton Rouge, LA
[3] – CPUE includes combined hours sampled using electroshocking, nets, and gillnet-seine

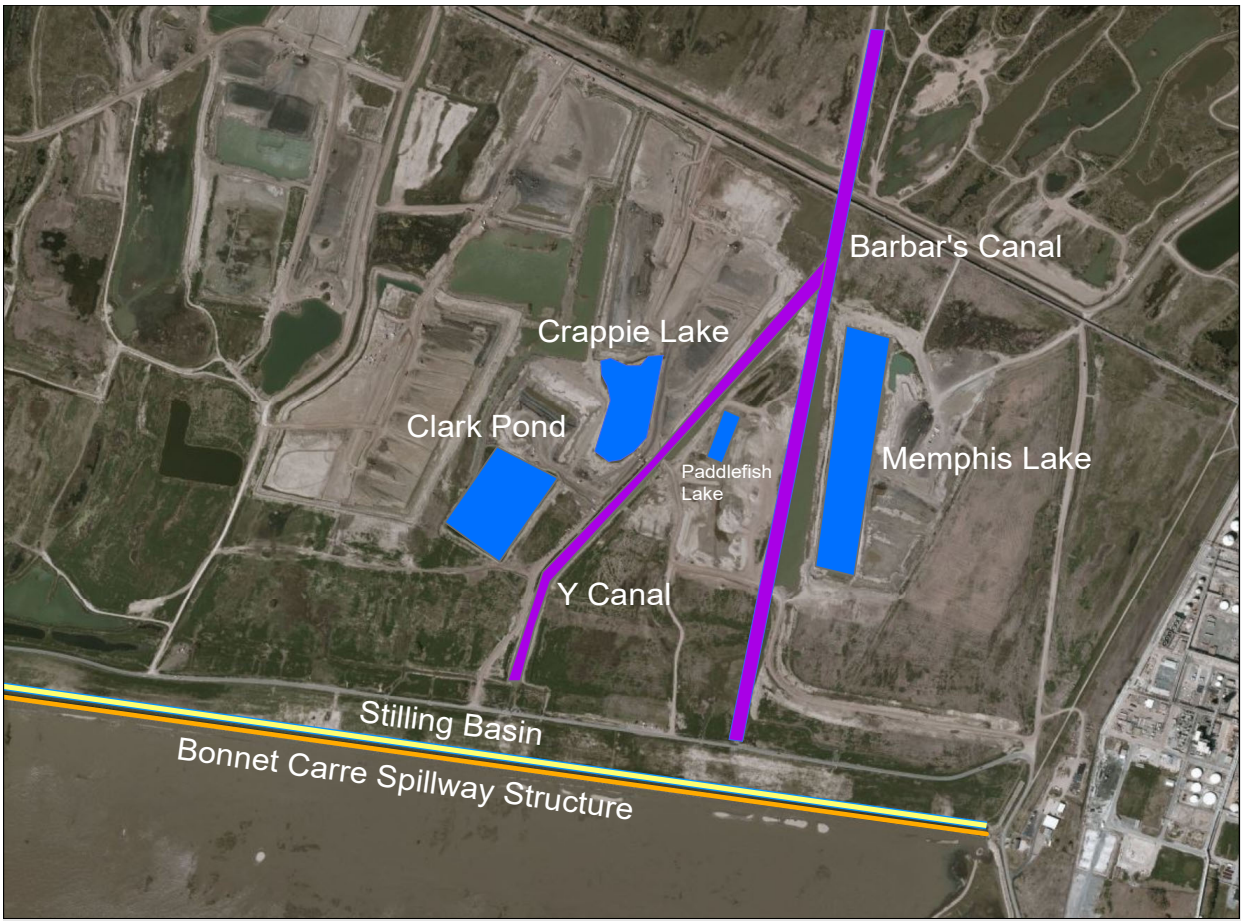


**Figure 58. Three primary areas where sturgeon have been collected in the floodway following openings of BCS (2008-2020): Stilling Basin, Canals (Barbar's and Y), and Lakes.**

### 5.2.2 Gulf Sturgeon

Occurrences of Gulf Sturgeon within the vicinity of the BCS project area are rare although their occurrence within the larger action area, particularly LP and the WGOA is not uncommon (Reynolds 1993). A telemetry tagged adult originally tagged in the Pearl River was recorded in 2012 while an acoustic telemetry array was deployed within the BCS project area to evaluate movement of telemetry tagged Shovelnose Sturgeon following the 2011 opening of the BCS (Slack et al. 2012). The fish entered the Lower Guide Canal where it empties into LP and remained in the canal for 7 days before exiting back to LP (Peterson et al. 2018, see Figure 3). A second individual (juvenile) was captured in the Stilling Basin on 8 August 2019 after the structure was closed following the 2019 openings. The fish was noted in good condition and was released by biologists from the Louisiana Department of Wildlife and Fisheries in the Lower Guide Canal downstream of US Hwy 61 (E Airline Hwy) after tissue and pectoral spine samples were obtained (Killgore and Slack 2019).

Baseline levels for Gulf Sturgeon populations in the WGOA are quite variable as monitoring efforts were limited prior to the listing of the species in 1991 (Reynolds 1993). After the species was listed, wildlife resource agencies from both LA and MS began to support directed research efforts to characterize the species abundance within each state along with identifying critical life

history components (e.g., spawning habitat, summer holding areas, movement chronologies). Catches during the late 1980s and early 1990s were generally low (Miranda and Jackson 1987, Rogillio 1992, Murphy and Skains 1994, Skains and Murphy 1995, Morrow et al. 1998b) but provided an informative move forward for planning future monitoring directives. Efforts within the late 1990s and early 2000s illustrated a general increase in Gulf Sturgeon abundances within both the Pearl and Pascagoula drainages (Heise et al. 2004, 2005, Rogillio et al. 2007, Ross et al. 2009).

During the early 2000s a Gulf Sturgeon Database was initially compiled which contained historic and contemporaneous capture data and Gulf Sturgeon tagging information. The database, jointly managed by NMFS and USFWS, serves to house tagging and biological data for Gulf Sturgeon across their range (A. Kaeser, USFWS and J Heublein, NMFS pers. comm.). This database has undergone several iterations over the past years, but the data housed within this database provides the most comprehensive assessment of Gulf Sturgeon status within this region and offers an opportunity to evaluate catch trends across a defined period or from within a specified drainage. Compiling catch data for WGOA drainages from 2000 through 2022 provides a relative breakdown of captured Gulf Sturgeon by size class across years (Figure 60). Data illustrate a distinct drop in abundance in 2005 which was associated with high in-river mortalities following Hurricanes Cindy, Katrina and Rita (Peterson et al. 2008). Gulf Sturgeon recovery within this region was markedly low (Havrylkoff 2010) and there may have been some ancillary impacts resulting from the Deepwater Horizon Event which occurred in 2010, but no major changes in Gulf Sturgeon populations were noted (Rudd 2013, Deepwater Horizon Natural Resource Damage Assessment Trustees 2021). After 2015, the relative number of juvenile and subadults reported in the annual catch illustrates increased recruitment rates for the WGOA Gulf Sturgeon populations. Fishing days per year for WGOA drainages was highly variable (Figure 61) and reflect, in part, the availability of funding for targeted sampling as well as the different degrees of efforts required for ongoing projects within these systems. CPUE standardized by fishing days per year was also variable across years but illustrates a trend of increasing catch rates after 2010 (Figure 62). There appears to be no appreciable change in Gulf Sturgeon catch rates coinciding with openings of the BCS in 2008, 2011, 2016, 2018, 2019 and 2020 although 2008 and 2020 had few sampling days recorded and fewer captured sturgeon compared to years sampled before and after.

Entrainment and subsequent mortality events due to individuals being landlocked in the numerous backwater lakes prevalent within the BCS project area as floodwaters recede following the closure of BCS are rare considering only one Gulf Sturgeon has been captured within the project area since intensive sturgeon recovery operations began in 2008. The operation of the BCS may minimally impact Gulf Sturgeon juvenile, subadult and adult life history stages since the timing of previous openings occurred primarily while the majority of individuals were in freshwater or in the associated estuaries (Table 6). However, the potential for stranding within the BCS project area following the recession of floodwaters, particularly the stilling basin and the numerous water bodies within the floodway, has a low probability of likelihood. However, given the known possibility of incidental take due to entrainment, it is our determination that operation of the BCS *"may affect, likely to adversely affect"* the Gulf Sturgeon.

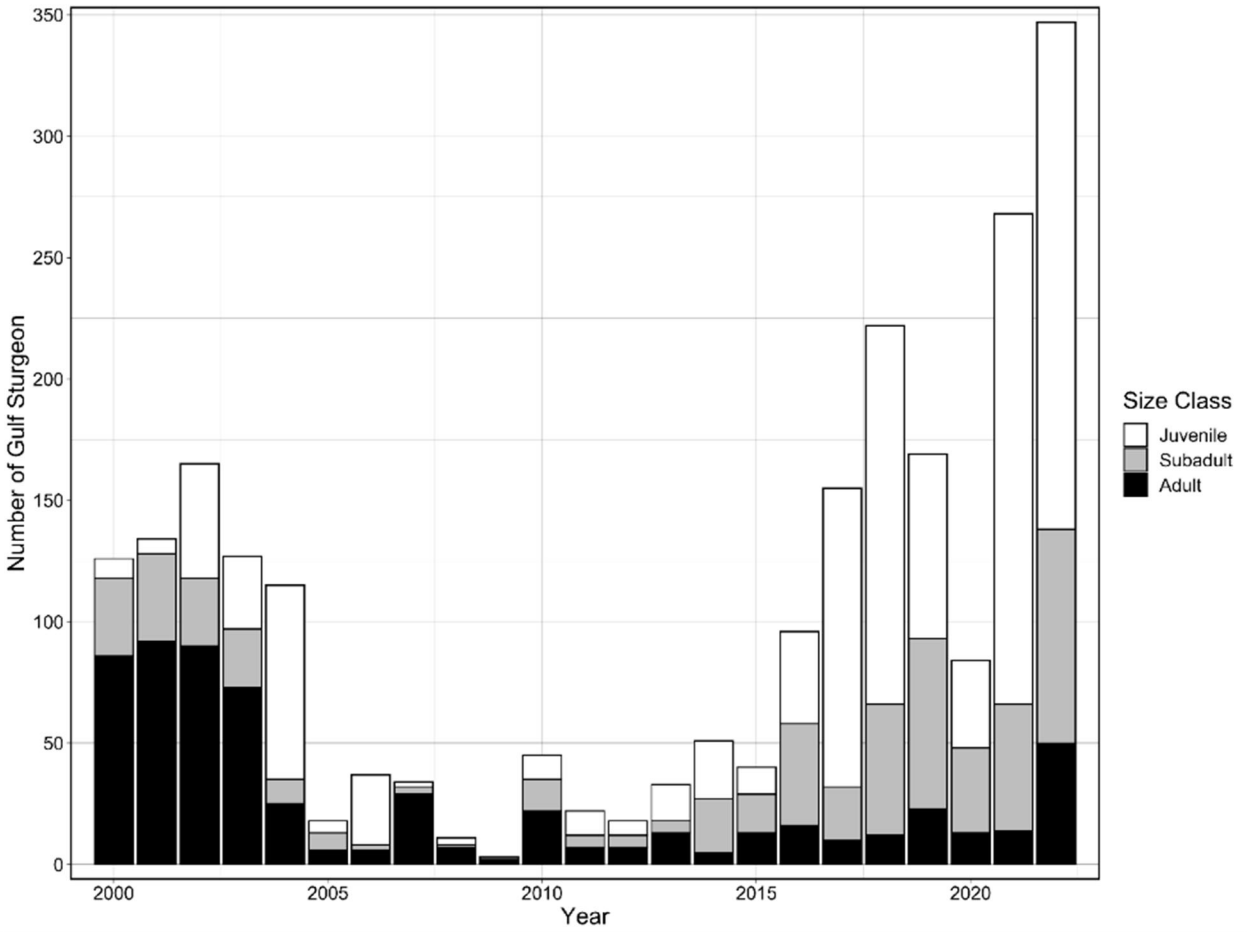


**Figure 59. Number of Gulf Sturgeon captured in the Pearl and Pascagoula Rivers delineated by life history stage between 2000 and 2022.**

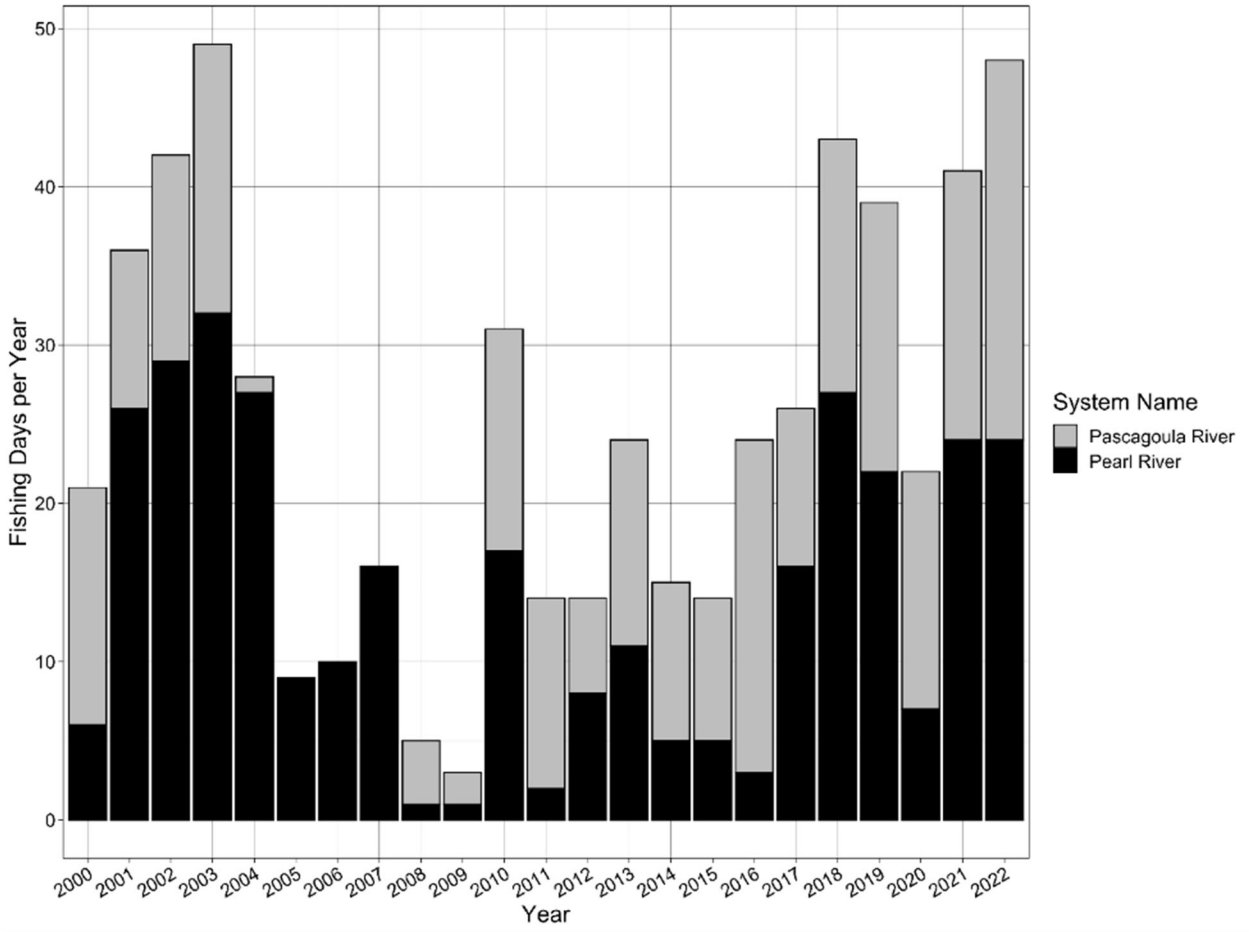


**Figure 60. Total number of Gulf Sturgeon fishing days in the Pearl and Pascagoula Rivers between 2000 and 2022.**

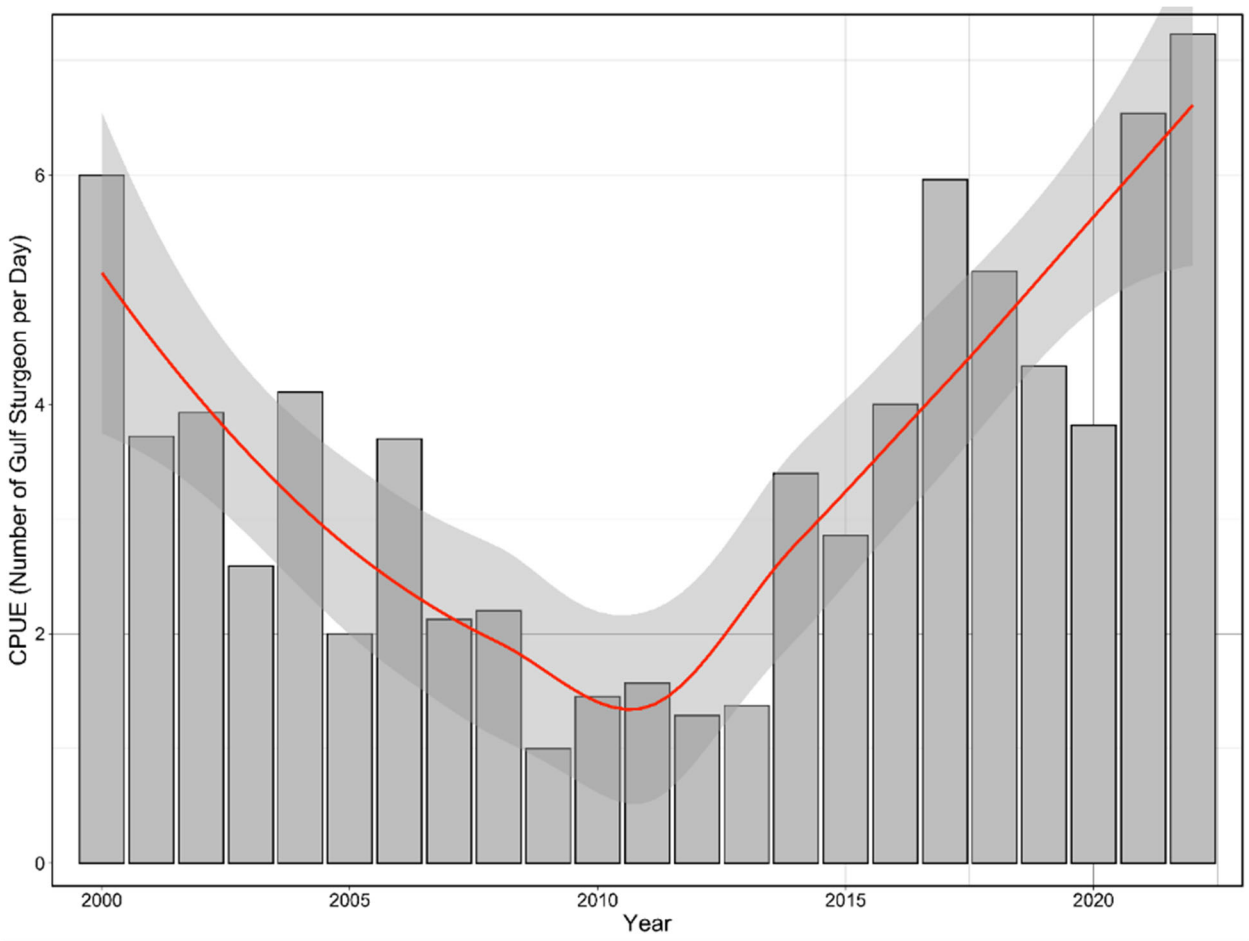


**Figure 61. Catch per unit effort (Gulf Sturgeon per fish day) combined for Pearl and Pascagoula River between 2000 and 2022.**
**The redline represents the best fit for the data using a geometric smoothing function for the predictive model and includes 95% confidence intervals.**

**Table 7. Characteristics of the BCS after closure from 2008 – 2020 and the associated habitat of respective Gulf Sturgeon life history stages.**

| Variable | 2008 | 2011 | 2016 | 2018 | 2019 | 2020 |
|---|---|---|---|---|---|---|
| **Days Open** | 31 | 42 | 22 | 22 | 122 | 29 |
| **Calendar Days** | April 11 – May 8 | May 9 – June 20 | January 10-February 1 | March 8 - 30 | February 27-April 11 – 43 days<br>May 10-July 22 – 79 days | April 3-May 1 |
| **Age 1-6** | Estuary or initiating upriver freshwater phase | Estuary or initiating upriver freshwater phase | Estuary | Estuary | Estuary or initiating upriver freshwater phase | Estuary or initiating upriver freshwater phase |
| **Juvenile** | Transition from estuary to upriver holding area | Upriver holding area | Nearshore estuary or open water marine areas | Transition from estuary to upriver holding area | Transition from estuary to upriver holding area; upriver holding area | Transition from estuary to upriver holding area |
| **Subadult** | Transition from estuary to upriver holding area | Upriver holding area | Nearshore estuary or open water marine areas | Transition from estuary to upriver holding area | Transition from estuary to upriver holding area; upriver holding area | Transition from estuary to upriver holding area |
| **Adult** | Upriver spawning area | Upriver holding area | Nearshore estuary or open water marine areas | Initiating upriver run to spawning area | Initiating upriver run to spawning area; upriver spawning area | Upriver spawning area |

## *5.3 LISTED SPECIES WITH "MAY AFFECT, NOT LIKELY TO ADVERSELY AFFECT" (NLAA) DETERMINATIONS*

### 5.3.1 Green Sea Turtle

From 2013 to 2022, a total of 29 stranded green sea turtles have been recorded within the action area (Figure 57A), two of which were initially found alive (NOAA Fisheries 2023). Based on historical data for this region, it is likely that more than half of the green sea turtle stranding deaths are due to disease or major injuries from boat strikes or fishing gear. In general, the cause of roughly 25-40% of sea turtle stranding deaths (across species) cannot be determined, often due to extensive decomposition prior to necropsy (Howell et al. 2021).

When average monthly strandings were separated by periods when the BCS was closed or open (Figure 62A), it was clear that typical green sea turtle stranding frequencies generally did not exceed one per month when the BCS was closed. However, when the BCS was open, green sea turtles stranded more often than the typical frequency during May and June. These higher than usual May and June stranding numbers were observed during 2019, while the BCS was open. Further, total strandings during calendar years when the BCS was operated appear to be higher than years when the BCS was not operated (Figure 62B, C). During 2019, the year of the most prolonged BCS operation, six green sea turtles were stranded within the BCS action area (Figure 57B). The first stranding occurred prior to the first 2019 BCS opening, while the remaining five were recorded on days during which the BCS was open (NOAA Fisheries 2023). While there appears to be a difference in stranding trends between periods of BCS openings versus closures, these findings are correlational and lack measurable evidence for direct or indirect BCS effects on green sea turtle strandings. Notably, these records include all traditional stranding types (e.g., injury, disease, unknown cause) (Howell et al. 2021). Therefore, it is possible some or all of these strandings are unrelated to potential BCS effects. Further, it remains unclear whether an increase in median annual stranding counts by roughly three individuals between BCS closed versus open years would have an impact on green sea turtles at the population level.

Despite the increase in strandings in BCS versus non-BCS operation years, green sea turtle strandings in general are unlikely to be directly related to a decline in salinity, as green turtles have been observed nesting throughout estuaries with a large salinity range (1.2 ppt to 35.5 ppt). Therefore, this species is likely highly tolerant to salinity changes (Chambault et al. 2016). Previous work which assessed potential BCS operation impacts on sea turtle strandings in LA, MS, and AL found that typical seasonal peaks of green turtle strandings (March to June) tended to overlap with spring and summer BCS openings (Howell et al. 2021). This makes parsing historical stranding patterns from BCS impacts difficult. The NOAA NMFS report (Howell et al. 2021) did not find a correlation between BCS operations with green sea turtle standings. Further, they anecdotally noted that large juvenile and adult green sea turtles have been held in captivity at low salinities for prolonged periods without apparent negative effects.

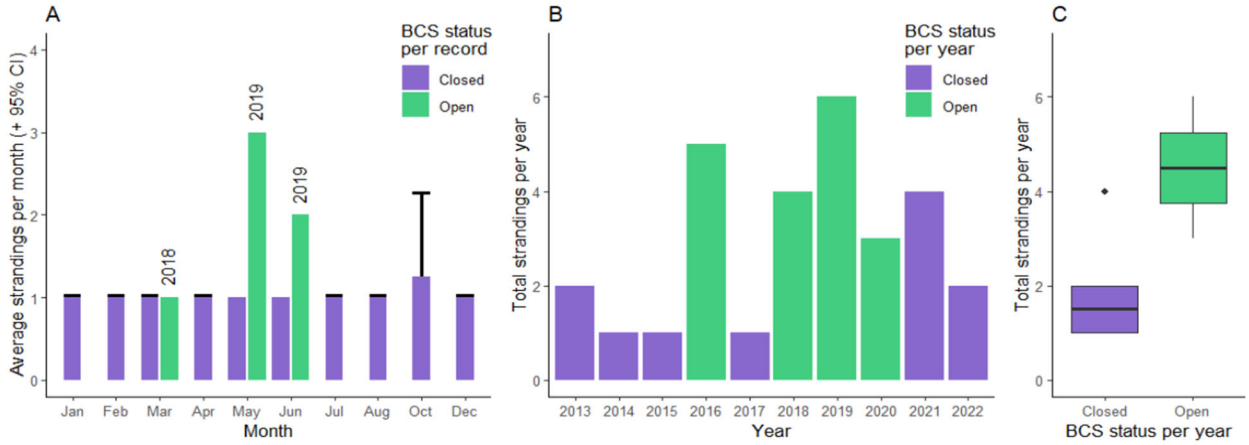


**Figure 62. Green sea turtle strandings recorded in BCS action area when the BCS was open or closed (2013-2022).**
**(A) Average monthly stranding counts on days when the BCS was open or closed. Years above BCS open bars indicate the years during which these stranding were recorded. Error bars represent the upper bound of the 95% confidence interval. Bars missing error bars indicate strandings were only recorded in one year during that month and BCS status (e.g., March 2018, when the BCS was open). (B) Bar chart and (C) box and whisker plot for total stranding counts in years during which the BCS was or was not operated.**

Potential indirect effects from BCS operations on green sea turtles may result from impacts on coastal food sources, although there is no known measurable evidence showing that this has been the cause of increased strandings, and most stranded green turtles were found with food in their mouths, throats, or stomachs. Common seagrasses in the NGOA, including *T. testudinum* and *H. wrightii*, are considered a major component of adult green sea turtles' diet (Hirth 1997, Howell and Shaver 2021). Both seagrasses have been observed to experience declines in growth and survival during extreme freshening events (Lirman and Cropper 2003). BCS opening events have also been well modeled for effects on water quality variables within Lakes Pontchartrain and Borgne including salinity, suspended sediments, and nutrient load (Chao et al. 2012, 2016, 2021, Iles et al. 2021). It is likely that increases in suspended sediments and turbidity during Spillway openings have the potential to negatively influence SAV within the action area through declines in available light and increased sedimentation rates over SAV beds (Poirrier et al. 2009). Further, rapid or prolonged salinity declines and turbidity increases observed during 2019 in the western MS Sound (Gledhill et al. 2020) also imposed temporary negative influences on estuarine and marine SAV survival and growth rates, as well as reproductive output and success (Biber 2022, La Peyre and Rowe 2003, Lirman and Cropper 2003).

Notably, *H. wrightii* monoculture populations around Cat Island, the Western most of the MS barrier islands, appear to be habituated to freshwater input from the Pearl River and the LPB. In fact, recent work has shown that *H. wrightii* collected from Cat Island during September 2019, survived in a laboratory setting for 12 months at salinities as low as 5 ppt (Biber 2022). Further, although this experiment showed that shoot densities and biomass were lower in tanks held at 5 versus 15 ppt, these differences were not statistically significant. Both experimental low salinity treatments exhibited 10-times lower shoot densities and biomass than those typically observed in

the MS Sound. These findings led the investigator to conclude that although *H. wrightii* is negatively influenced by low salinity, Cat Island populations have an increased tolerance to low salinity (in terms of survival), relative to published *H. wrightii* salinity tolerance limits (Biber 2022). In part, this tolerance to hyposalinity may be due to a history of periodic and prolonged low salinity events caused by natural freshets and historic BCS operations.

BCS operations potentially affect growing seasons for seagrasses important to the green sea turtle diet in the northern Chandeleur and western MS Sounds. As a result, green sea turtles in the NGOA during BCS operation years may have had more difficulty finding suitable foraging habitats or adequate nutrition in these areas. However, the BCS action area is not considered primary foraging habitat for green turtles (Cuevas et al. 2022). Further, it has been noted that most stranded green turtles in LA, MS, and AL (that show no signs of trauma or disease) are usually found with food in their mouths, throats, or stomachs. Across all traditional stranding types (included those with disease and trauma-related causes of death) from 2010 to 2019, typically 65% of green sea turtles show no or only mild signs of diminished fat content (Howell et al. 2021).

Although Howell et al. (2021) found no causational link between green sea turtle strandings and potential BCS operational impacts, the correlational increase in strandings during years of BCS operation remains unexplained. It is possible that some negative indirect BCS impacts to habitat and food resources may be occurring in the action area. However, based on current measurable evidence, any potential BCS impacts are indistinguishable from other external environmental impacts. Therefore, this potential anomaly in green sea turtle strandings does not contradict the findings of Howell et al. (2021). However, it may merit closer monitoring of green sea turtle strandings during future late spring and early summer BCS operational periods to rule out potential BCS impacts. Taken together, there are likely relatively few green turtles present in the action area during BCS operations, there is no evidence of direct BCS impacts on green turtles, and strandings with unknown cause do not appear be caused by starvation suggesting that indirect BCS impacts on green sea turtle strandings are unlikely (Howell et al. 2021). Consequently, it is our determination that operation of the BCS *"may affect, but not likely to adversely affect*" green sea turtles.

### 5.3.2 Loggerhead Sea Turtle

From 2013 to 2022, a total of 116 stranded loggerhead sea turtles have been recorded within the BCS action area (Figure 57A), five of which were initially found alive (NOAA Fisheries 2023). Based on trends for loggerhead strandings in this area, it is likely roughly 35% of stranding deaths are due to disease or major injuries from boat strikes or fishing gear. Typically, a further 40% of loggerhead sea turtle strandings cause of death cannot be determined, often due to decomposition prior to necropsy (Howell et al. 2021).

From 2013 to 2022, 16% of all recorded loggerhead strandings in the action area were recorded on days of operation. However, BCS operation days make up only 5% of the time period between 2013 and 2022. It is possible that loggerhead strandings are relatively more common during BCS operation periods, because BCS openings tend to coincide with seasonal peaks in sea turtle strandings even during non-operation years (Howell et al. 2021). In general, the

majority of average monthly loggerhead sea turtle strandings recorded during periods in which the BCS is open, tend to fall within the typical ranges seen in periods when the BCS is closed (Figure 63A). One exception appears to be the eleven strandings that occurred during May 2019 while the BCS was open (Figure 63). A further eight strandings occurred earlier in May 2019, after the first 2019 BCS opening, but before the second. From 2013 to 2022, the STSSN typically recorded more loggerhead strandings during years of BCS operation versus years when the BCS remained closed. However, there are also non-BCS operation years which had higher stranding counts than BCS operation years (Figure 63B). The slight relative increase in strandings during BCS operation years overall is driven by primarily 2019, followed by 2020 (Figure 63B). During all of 2019, the year of the most prolonged BCS operation, 29 loggerhead sea turtle strandings were recorded within the action area (Figure 57B, Figure 63A), 16 of which were recorded on days in which the BCS was open and 12 were recorded between the first and second BCS openings of 2019 (NOAA Fisheries 2023).

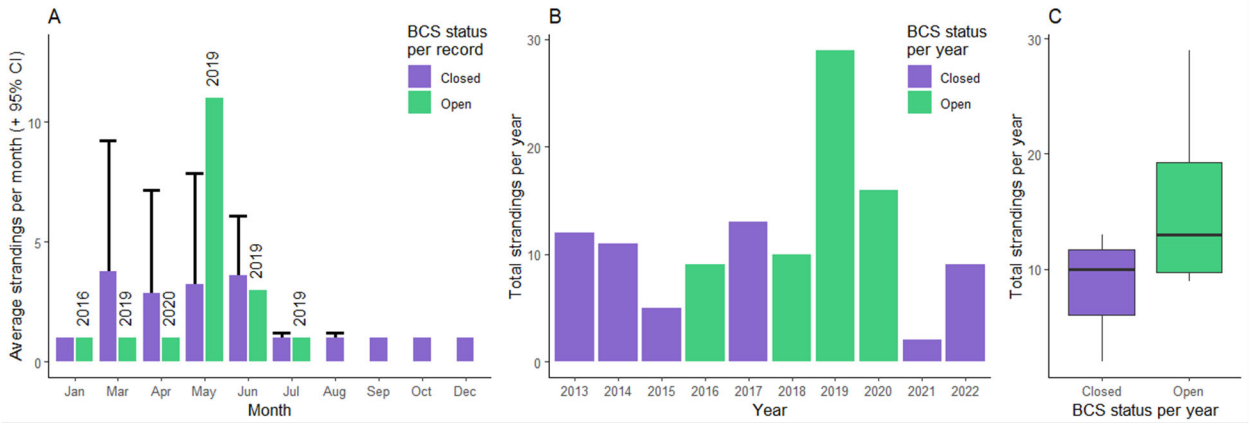


**Figure 63. Loggerhead sea turtle strandings recorded in BCS action area when the BCS was open or closed (2013-2022).**
**(A) Average monthly stranding counts on days when the BCS was open or closed. Years above BCS open bars indicate the years during which these stranding were recorded. Error bars represent the upper bound of the 95% confidence interval. Bars missing error bars indicate strandings were only recorded in one year during that month and BCS status (e.g., January 2018, when the BCS was open). (B) Bar chart and (C) box and whisker plot for total stranding counts in years during which the BCS was or was not operated.**

Despite the increase in May stranding counts in 2019, direct negative effects of BCS operations on loggerheads are unlikely as they have been shown to withstand prolonged freshwater exposure (Howell et al. 2021). Further, habitat modeling work conducted in the Chesapeake Bay shows that loggerheads can use areas of salinity as low as 15 ppt, but generally avoid areas shallower than 10 m (33 ft) (DiMatteo et al. 2022), suggesting that loggerheads would typically avoid the nearshore areas of the NGOA most often influenced by freshwater input. However, increased freshwater inputs from BCS openings may modify prey species assemblages within the NGOA which could potentially have an indirect impact on loggerheads.

Marine macroinvertebrates (e.g., crabs, shrimp) and fishes are among the primary food resources for loggerhead sea turtles. It is likely that numerous species consumed by loggerheads are impacted by reduced salinity, bottom water hypoxia, and harmful algal blooms (HABs) associated with BCS freshwater discharge (Savoie et al. 2022, Soto Ramos et al. 2023).

Among the diversity of small crustacean species known to be prey items for carnivorous sea turtles, only a select few have population levels that are closely monitored for commercial fisheries. As such, commercial shellfishery landings are often used as a proxy for marine fish and macroinvertebrate population health. Therefore, this BA uses trends in commercial fishery landings within the action area as a proxy to assess potential BCS impacts to prey of loggerhead sea turtles. The effect of BCS operations on marine fisheries has been considered early in its operation history (Russell 1977). In 2011 and 2019, the Governors of MS, LA, and AL (in 2019 only) requested federal aid from the Secretary of the Department of Commerce under the MSFCMA, seeking a "federal fisheries disaster declaration" (NOAA NMFS 2023). These requests were in part made to request support for reductions in commercial crab and shrimp landings. In 2019, the Mississippi Department of Marine Resources estimated a 35% loss in crab landings, while the opening of shrimp season was delayed and ultimately landings declined by 33% as compared to the previous five-year average (Byrd 2019, Posadas 2019).

BCS impacts to small fish prey of carnivorous turtles can be approximated by known impacts to various fish species fisheries. BCS operations as early as 1973 appear to have negatively correlated to MS Bight commercial landings of bottomfish such as Atlantic croaker (*Micropogon undulatus;* Russell 1977). While few studies have examined direct BCS operation effects on marine fish species, it appears that the influence of freshwater inputs on population dynamics may be species-specific. In examining environmental influences on red snapper (*Lutjanus campechanus*) reproduction from 2016 to 2019, Brown-Peterson et al. (2022) determined that interannual variation was not well explained by including BCS discharge in models. Alternatively, Hoover et al. (2022) found that BCS discharge during 2016 negatively impacted Gulf Menhaden (*Brevoortia patronus*) larvae body condition, growth, and survival.

While direct BCS impacts on marine fishes and macroinvertebrates may vary, it should be noted that marine food webs are highly connected; therefore, negative BCS impacts to one species may influence several higher trophic levels, including carnivorous sea turtles. However, because loggerhead sea turtles have diverse diets, they are likely resilient to temporary changes in prey assemblages resulting from BCS effects. Strandings documented in the NGOA from 2010-2019 reported that cumulatively only 9 of 51 (18%) loggerheads had severe atrophy when found, whereas 31 (61%) had no atrophy at all (Howell et al. 2021). These findings support that loggerheads have a robust diet, can adapt to a variety of available prey items, and can move away from unsuitable forage areas if needed. In general, loggerheads are uncommon in LA, MS, and AL because nesting numbers in these states are extremely low, representing <1% of the female population. However, Bolten et al. (2019) documents a general increase in loggerhead nesting in the NGOA from 2010 to 2018. Unfortunately, data from 2019 nesting were not incorporated into the report nesting index; however, nesting was documented in AL and MS in 2019 (NMFS/USFWS 2023).

The 2021 NOAA NMFS Sea turtle stranding report (Howell et al. 2021) could not find any correlation between loggerhead strandings and potential BCS operational impacts. The potential anomaly in May 2019 strandings may suggest that intense spring and early summer BCS

operational periods could negatively influence loggerhead strandings, yet measurable causational evidence is lacking. Considering the available information, it is our determination that operation of the BCS *"may affect, but not likely to adversely affect"* loggerhead sea turtles in the NGOA.

### 5.3.3 Kemp's Ridley Sea Turtle

Of the five sea turtle species found in the GOA, Kemp's ridley turtles are the most populous and therefore are found stranded most often. From 2013 to 2022, 928 Kemp's ridley sea turtle strandings have been recorded by the STSSN within the action area (Figure 57A; NOAA Fisheries 2023). Based on trends for Kemp's ridley strandings in this area, it is likely that roughly 20% of stranding deaths are due to disease or major injuries from boat strikes or fishing gear. Typically, a further 25% of Kemp's ridley sea turtle stranding causes of death cannot be determined, often due to decomposition prior to necropsy (Howell et al. 2021).

From 2013 to 2022, 8% of all recorded Kemp's ridley strandings in the action area were recorded on days of operation. Average monthly Kemp's ridley sea turtle strandings recorded during periods in which the BCS was open tend to fall within the typical ranges seen in periods when the BCS was closed (

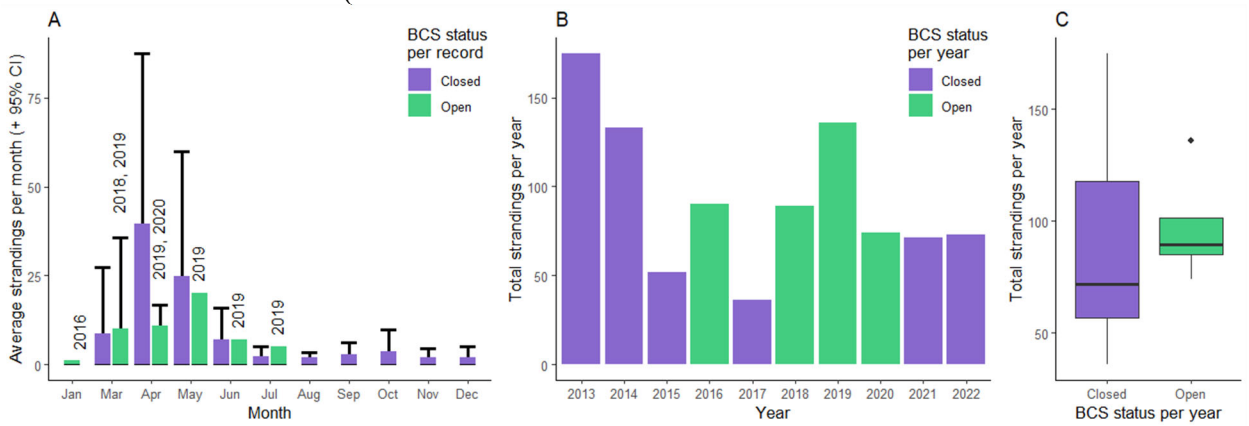


Figure 64A). Further, total stranding counts for calendar years during which the BCS was open and closed appear to be similar (

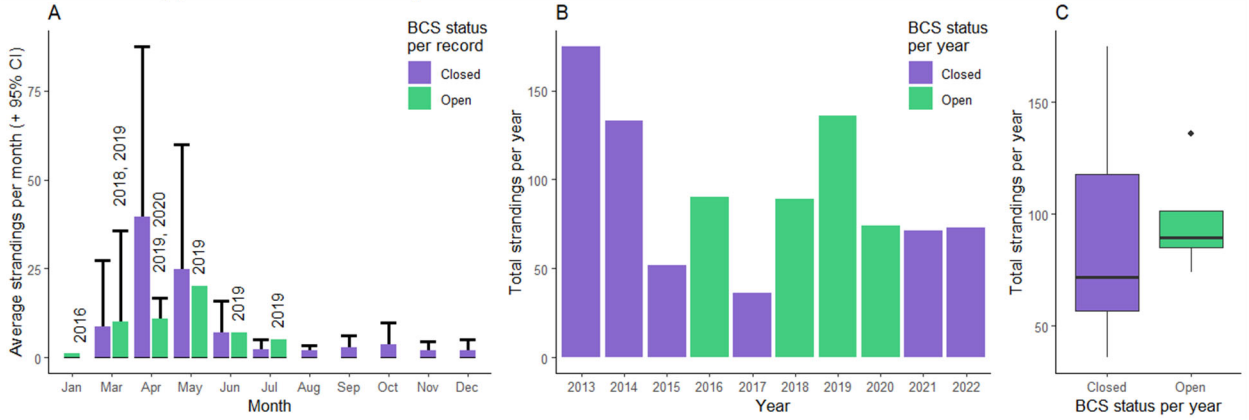


Figure 64B, C). Stranding trends during 2019 were more closely examined to assess potential impacts from the most extensive BCS opening to date. Notably, 2019 was the second highest year on record for Kemp's ridley strandings (n = 136) in the region, behind 2013 (n = 175) and followed closely by 2014 (n = 133) during both of which the BCS remained closed (Figure 57B,

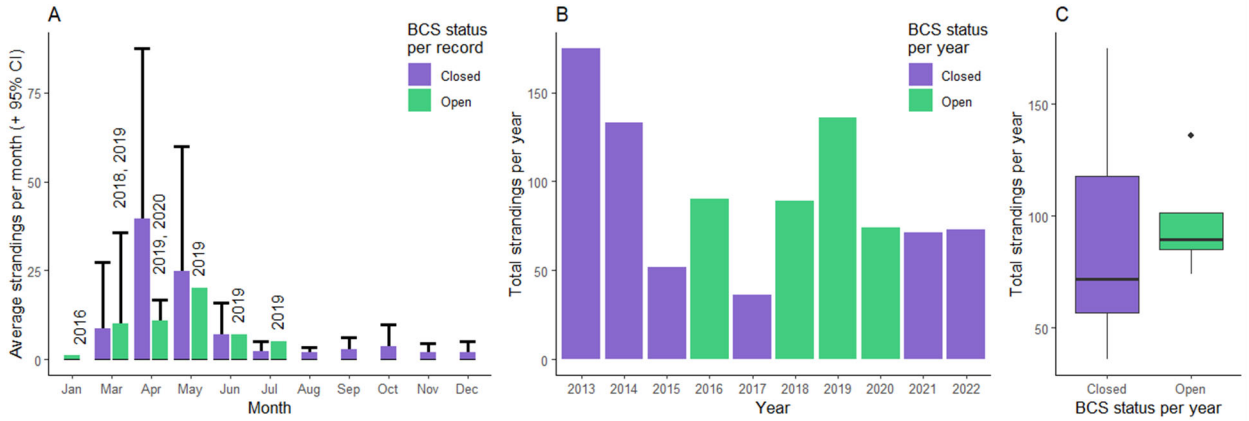


Figure 64). Although this stranding count appears alarming, it is important to note the context of the 10-year STSSN dataset, during which Kemp's ridley stranded more often than all other species combined (Figure 57A). Average January (2016), March (2018 and 2019), and July (2019) strandings during the BCS openings surpassed the typical monthly stranding counts when the BCS was not in operation; however, each of these differences were slight (

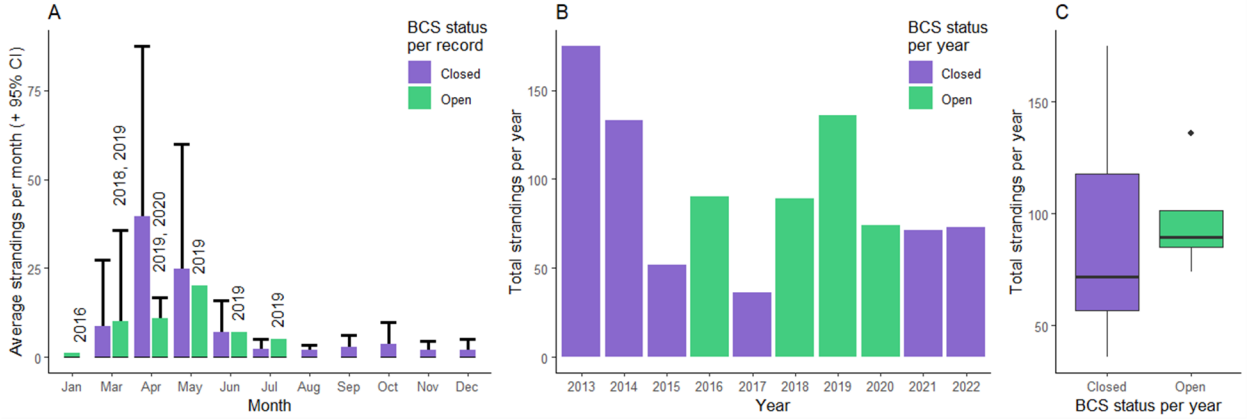


Figure 64). Of the 2019 strandings, 42 were recorded on days in which the BCS was open, 93 were recorded between the first and second BCS openings, 3 were recorded within 30 days after the second BCS operation ended, and a further 8 strandings occurred during fall and winter months before or well after the BCS openings (NOAA Fisheries 2023).

Kemp's ridley show a preference of foraging in the NGOA compared to the southern GOA (Gredzen and Shaver 2020). Metz et al. (2004) showed that this species frequents areas that had a reduced monthly mean salinity of 4.5 ppt. Ortiz et al. (2000) demonstrated that Kemp's ridley transferred directly from saltwater to freshwater survived 4 days before being returned to saltwater. Additionally, habitat modelling work conducted in the Chesapeake Bay suggests that Kemp's ridley regularly visit shallow areas and typically inhabit mid-salinities as low as 10 ppt, especially during summer and fall months (DiMatteo et al. 2022). Further, the extensive study of NGOA sea turtle strandings in relation to environmental factors, including BCS operational impacts, found no correlation between Kemp's ridley strandings and freshwater input for BCS openings (Howell et al. 2021).

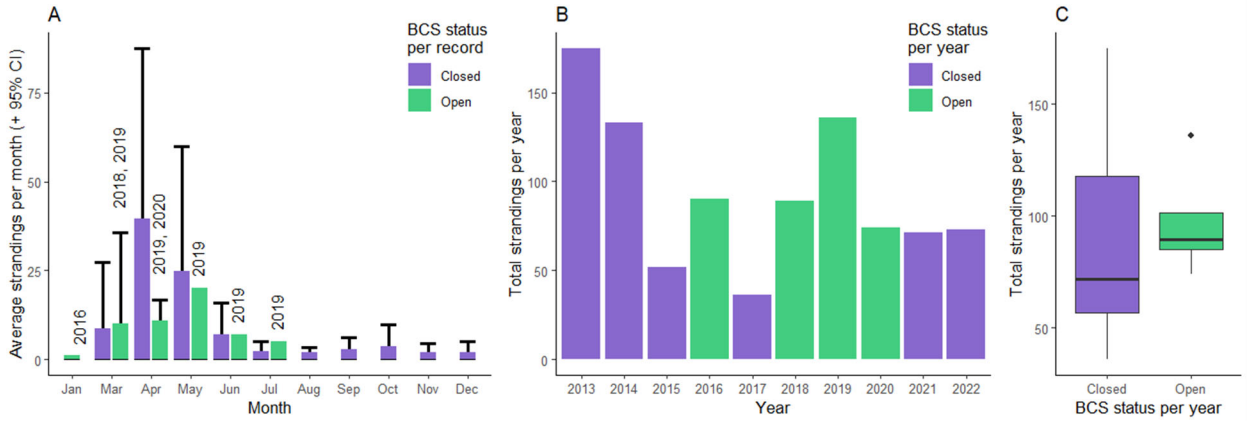


**Figure 64. Kemp's ridley sea turtle strandings recorded in BCS action area when the BCS was open or closed (2013-2022).**
**(A) Average monthly stranding counts on days when the BCS was open or closed. Years above BCS open bars indicate the years during which these stranding were recorded. Error bars represent the upper bound of the 95% confidence interval. Bars missing error bars indicate strandings were only recorded in one year during that month and BCS status (e.g., January 2018, when the BCS was open). (B) Bar chart and (C) box and whisker plot for total stranding counts in years during which the BCS was or was not operated.**

Indirect negative impacts to Kemp's ridley are possible through impacts to food supplies. Marine macroinvertebrates (e.g., crabs, shrimp) and fishes comprise the diverse food resources for Kemp's ridley sea turtles. It is likely that numerous species consumed by these carnivorous sea turtles are impacted by reduced salinity, bottom water hypoxia, and harmful algal blooms (HABs) associated with BCS freshwater discharge (Savoie et al. 2022, Soto Ramos et al. 2023). As with the assessment of BCS impacts to the prey assemblages of the loggerhead sea turtle (see Section 5.3.2) trends in commercial fishery landings within the action area suggest that BCS operations on marine fisheries (of fishes and invertebrates) have experienced marked reductions in landings attributed to various BCS opening events (Brown-Peterson et al. 2022, Byrd 2019, Hoover et al. 2022, Posadas 2019, Russell 1977). While BCS impacts on marine fish and macroinvertebrate species vary, marine food web connectivity can influence higher trophic levels, including carnivorous sea turtles. Fortunately, since the Kemp's ridley diet is adaptable, it is unlikely BCS openings would cause nutritional stress, as this species naturally consumes different prey items as they are available across time and space. In accordance, strandings examined by Howell et al. (2021) show that no stranded Kemp's ridley in the NGOA from 2010 to 2019 had signs of severe atrophy, further over 76% showed no signs of any atrophy. The fat condition of strandings in 2019 was among the best recorded during the 2010-2019 period.

Finally, many BCS openings occur from February to May when nearly all adult females are migrating or nesting at beaches in the western GOA where the males typically reside throughout the year. Therefore, most adults are not within the NGOA during typical BCS openings. Likewise, juveniles are also generally beyond the influence of the BCS openings, drifting far offshore. Finally, although subadults may be in the area of influence of BCS openings, during this life stage, Kemp's ridley regularly inhabit brackish water bays along the coast (Seney and Landry 2011). As such, low salinity in the NGOA will likely not have any deleterious effects on this species. Considering that Howell et al. (2021) could not find any correlation between BCS openings and Kemp's ridley strandings, as well as all the additional aspects described above, it is

our determination that operation of the BCS *"may affect, but not likely to adversely affect"* Kemp's ridley sea turtles.

### 5.3.4 West Indian Manatee

The potential effects of prolonged BCS openings on the West Indian manatee are primarily indirect, through negative influences on certain vegetative food resources. Manatees are known to forage on freshwater, estuarine, and marine SAV and emergent vegetation as available. Therefore, manatee diets are adaptable to disparate assemblages of vegetation (Alves-Stanley et al. 2010, Baugh et al. 1989, Reich and Worthy 2006). However, each vegetation type provides different nutrient ratios and digestible energy amounts to manatees; therefore, a balanced diet of multiple seagrass, marsh species and plant portions (i.e., leaves versus rhizomes) may be important for manatee health (Siegal-Willott et al. 2010). BCS openings generally occur during spring months, potentially resulting in a poor growing season for marine SAV in the BCS action area (La Peyre and Rowe 2003, Lirman and Cropper 2003, Biber 2022) due to declines in salinity, and increases in suspended sediments, and nutrient load (Chao et al. 2012, 2016, 2021, Iles et al. 2021, Poirrier et al. 2009).

Surveys in the early 2000s indicated that SAV bed species compositions drastically differ by location within the BCS action area. SAV beds were dominated by *Ruppia maritima* along the MS mainland shorelines, *Halodule wrightii* around the MS barrier islands, and *Thalassia testudinum* on the west side of the Chandeleur island chain (Pham et al. 2014) *Syringodium filiforme* was also occasionally observed around the MS and Chandeleur barrier islands (Fodrie et al. 2010). Each of these species has its own salinity tolerance limits (Table 5). *S. filiforme* is highly susceptible to salinity changes, *T. testudinum* has intermediate susceptibility, while *H. wrightii* and *R. maritima* are more tolerant to salinity changes, but still experience declines in growth during extreme freshening events (La Peyre and Rowe 2003, Lirman and Cropper 2003). Species also vary in tolerance to low light availability (%) (Table 8) due to turbidity. BCS openings tend to occur in spring, at the beginning of the SAV growing season.

The extent of BCS effects on SAV occur over a spectrum related to species-specific tolerances (Table 8), yet episodic or prolonged declines in salinity and increases in turbidity likely result in poorer growing seasons (in terms of shoot density) for even euryhaline SAV species in the BCS action area. These changes have the potential to alter food resource quality for West Indian manatees. However, due to habituation, SAV populations in the action area may be more well-adapted to survive these short-term conditions than published tolerance limits suggest (Biber 2022), allowing for rebounds in growing season productivity during non-BCS operation years.

While BCS driven changes to seagrass meadow densities and compositions may be temporary, manatees in the NGOA during summer months when the BCS is operated may have difficulty finding suitable marine foraging habitats with adequate nutrition. Therefore, manatees may have either relied more heavily on emergent marsh vegetation, algae, or freshwater SAV during these periods or left the BCS action area to find more productive SAV beds elsewhere (Allen et al. 2022).

**Table 8. Reported salinity tolerance (ppt) and minimum light availability tolerance (%) for survival of selected seagrass species in the US NGOA.**
**Where lower limits are not specified, "up to" terminology is used. Variation in tolerances likely has to do with the acclimation of a species in a certain area. (Table adapted from Eisemann et al. 2021.)**

| Species | Salinity tolerance (ppt) | Salinity tolerance sources | Minimum light tolerance (%) | Minimum light tolerance sources |
|---|---|---|---|---|
| *Halodule wrightii* | 0-60<br>Up to 70<br>5–45<br>Up to 72<br>5–80 | Pulich and Calnan 1999<br>Koch et al. 2007<br>Lirman and Cropper 2003<br>McMillian and Mosley 1967<br>McMahan 1968 | 18<br>15–20<br>24–37<br>20<br>18<br>20<br>18<br>17 | Dunton 1994<br>Burd and Dunton 2001<br>Kenworthy and Fonseca 1996<br>Steward et al. 2005<br>Dunton 1994<br>Czerny and Dunton 1995<br>Dunton 1994<br>Dennison et al. 1993 |
| *Ruppia maritima* | 0–60<br><35–70<br>0–100<br>0–35 | Phillips 1960<br>Koch et al. 2007<br>Kantrud 1991<br>Strazisar et al. 2013 | 8.2 | Dennison et al. 1993 |
| *Syringodium filiforme* | 4–45<br>Up to 45 | Lirman and Cropper 2003<br>McMillan and Mosley 1967 | 19<br>17–18<br>24–37 | Dennison et al. 1993<br>Dennison et al. 1993<br>Kenworthy and Fonseca 1996 |
| *Thalassia testudinum* | 5–45<br>20–40<br>Up to 45<br>36–70 | Lirman and Cropper 2003<br>Zieman 1982<br>McMillian and Mosley 1967<br>Koch et al. 2007 | 24<br>24<br>13<br>20<br>>14<br>15 | Dennison et al. 1993<br>Dennison et al. 1993<br>Fourqurean and Zieman 1991<br>Czerny and Dunton 1995<br>Lee and Dunton 1997<br>Dennison et al. 1993 |

Direct negative effects of the BCS opening on manatees are unlikely as manatees are accustomed to freshwater and turbid conditions. In addition, average monthly opportunistic sightings of manatees in LA and MS during BCS openings appear similar to months during which the BCS remained closed (Carmichael et al. 2023; Figure 65A). Further, although total annual sightings appear to be increasing since 2007, several years of BCS operation (e.g., 2016, 2018, 2020) appear to have sighting counts higher than the overall trend (Figure 65B). Sightings during 2019, the year of the most prolonged BCS operation to date, appear to follow the typical intra-annual trend for LA and MS (Carmichael et al. 2023; Figure 16, Figure 65).

Although BCS diversion events have had associated HABs (Chao et al. 2016, Lane et al. 2001, Bargu et al. 2011), there is no recorded evidence of toxic algae effects on manatees present in the NGOA during or after BCS openings. Within the stranding response area of the Dauphin Island Sea Lab (DISL) Manatee Sighting Network (which does not include LA waters), during 2019 (i.e., an intense BCS operation year with an associated HAB) only three manatee carcasses were recovered and necropsied in AL and MS. All causes of death were determined to be cold stress. One was recovered in January, while the other two were recovered in December (Carmichael et al. 2023). Further, bottlenose dolphins involved in the November 2019 NGOA unusual mortality event (due to direct freshwater effects), tested negative for microcystic toxins (i.e., 7 out of 7 individuals tested had negative results) (NOAA Fisheries 2019).

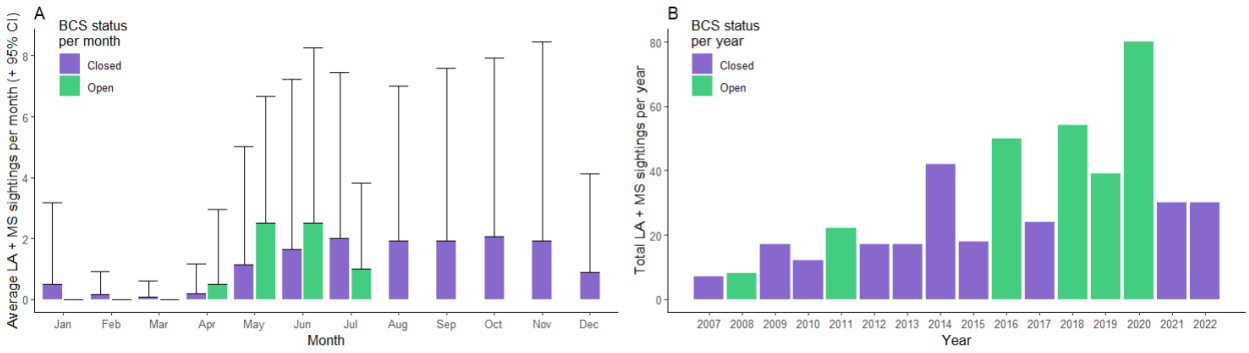


**Figure 65. Opportunistic manatee sighting records in LA and MS (2007-2022).**
**(A) Average monthly sighting counts recorded during months when the BCS was open or closed (B) Total annual sightings during years in which the BCS was opened or remained closed.**
**Data provided by Dauphin Island Sea Lab's Manatee Sighting Network Database (Carmichael et al. 2023).**

Overall, West Indian manatee occurrence and habitat usage in the NGOA outside of FL is less extensively documented, although it is well established that manatee are observed less frequently within the area influenced by the operation of the BCS as compared to FL coastal waters. Further, the West Indian manatee is not directly affected by reductions in salinity and no mortalities were documented in the action area during or immediately after the most prolonged BCS operation yet. While BCS operations may indirectly affect manatee through negative effects to forage habitat, evidence of manatees grazing in areas where SAV is most negatively affected by BCS freshwater input is lacking. Consequently, it is our determination that operation of the BCS *"may affect, but not likely to adversely affect"* the West Indian manatee.

### 5.3.5 Giant Manta Ray

The potential effects of prolonged BCS openings on the giant manta ray would likely be minor and indirect through two possible pathways, which are (1) potentially increasing concentrations of zooplankton prey surrounding the LPE outflow, and (2) potentially causing rays to flee from low salinity and DO conditions.

BCS opening events tend to bookend or overlap with the spring seasonal peak of giant manta ray occurrence in the NGOA. Because BCS events sharply increase discharge through the LPE they may also increase concentrations of large zooplankton, the manta ray's primary food source, with the action area. High zooplankton concentrations are naturally observed at major MSR outflows where fresh and saltwater mix (Liu and Dagg 2003, Liu et al. 2005). BCS river diversion events are intended to reduce river discharge rates around New Orleans, LA, and divert/increase discharge through the LPE. This may in turn cause a relative increase in concentrations of large zooplankton, the manta ray's primary food source, at the outflow of the LPE. MSR discharge downstream from the Spillway during opening events appears to be similar, but still in excess of typical annual trends (Figure 66). Peak discharge rates recorded by a USGS river gage located at Belle Chasse, LA are >1.125 million cfs during the most recent five BCS openings. During periods when the BCS was not open (from 2015 to 2022), peak discharge rates did not generally surpass this level (Figure 66). BCS openings potentially substantially alter

zooplankton concentrations in the LPE, northern Chandeleur Sound, and western MS Sound (Parra et al. 2020). While the spillway remains open, high flow rates create high turbidity and stratification, both of which subdue plankton growth. After the BCS is closed, increased phytoplankton and zooplankton growth in the calmer, higher nutrient-content waters can be observed as salinities increase and stabilize (Bargu et al. 2011). These conditions may lead to a relative increase in zooplankton biomass in the BCS action area, increasing food resource availability for planktivores, such as the giant manta ray.

BCS openings would not likely reduce zooplankton concentrations in primary manta ray habitats (surrounding the FGBNMS) to below normal levels, because flow rates at major MSR outflows remain high (Figure 66). Although, the action area is not considered core giant manta ray habitat, rays are observed in this area occasionally and are known to swim tens of kilometers within a single day to access food (Burgess 2017). Despite the ability to access shifting distributions of food concentrations with relative ease, it is unclear whether giant manta rays utilize increased zooplankton concentrations within the action area.

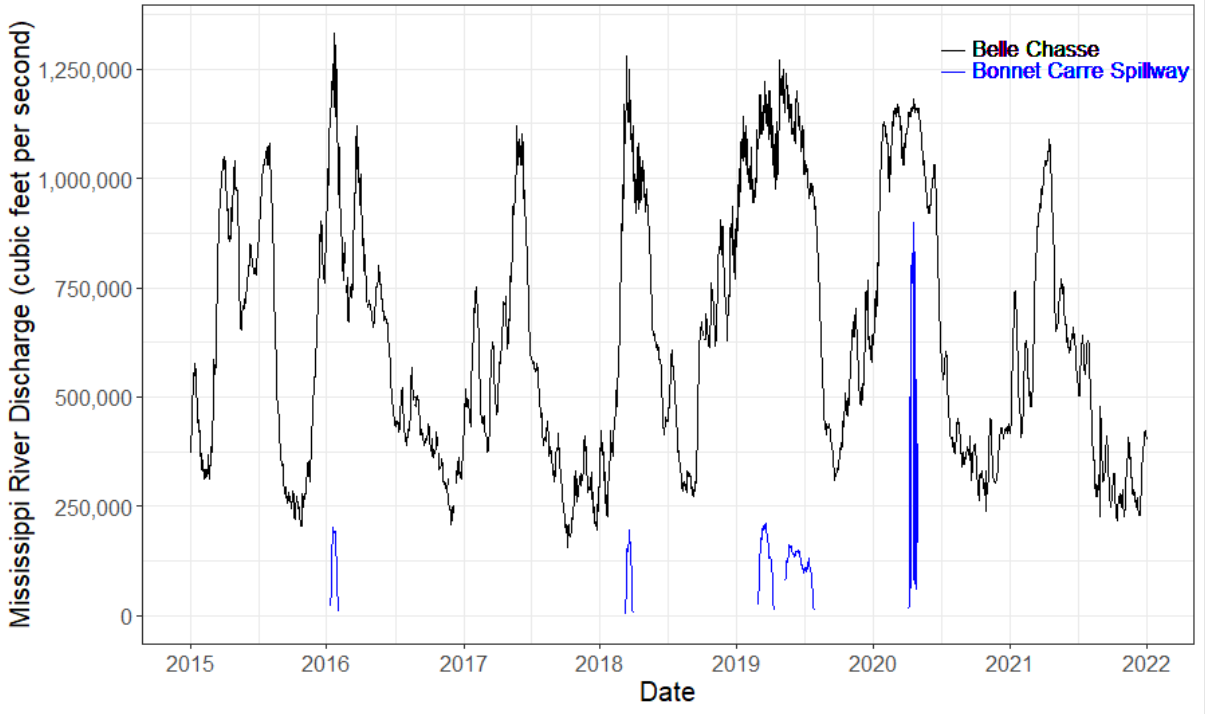


**Figure 66. MSR discharge (cfs) at two locations.**

**Figure notes: Daily discharge data were available for the five most recent Bonnet Carre Spillway opening events (blue; U.S. Army Corps of Engineers, New Orleans District 2023). The next downstream Mississippi River location for which daily discharge data were available was from Belle Chasse, LA (black; USGS National Water Information System 2023). These data were subset to include a full calendar year on either end of the available Spillway data.**

Although salinity at the interface of the MS Sound with the LPB can be reduced to ~0 ppt during and immediately after BCS openings (Gledhill et al. 2020, USGS NWIS 2023), giant manta rays

are not regularly observed in these nearshore areas (Farmer et al. 2022). They have however been observed regularly in turbid estuarine waters with mid-salinities in South America (Medeiros et al. 2015). Further, giant manta rays prefer to feed in areas where fresh and saltwater mix as these areas contain high zooplankton concentrations (Burgess 2017). Giant manta rays are highly mobile and would likely flee from extreme low salinity areas. Areas they most commonly use in the MS Bight are outside of the BCS action area (i.e., east of the Chandeleur Islands and south of the MS barrier islands; Farmer et al. 2022) and are likely within their salinity tolerance range during BCS opening events. Further, although water column stratification and nutrient loads from BCS openings have caused pockets of bottom water hypoxia (Savoie et al. 2022), giant manta rays generally feed near the surface, are able to flee hypoxic areas. Giant manta rays are known to swim between shallow inshore and deep offshore environments within a single day (Burgess 2017), suggesting that manta rays could easily avoid areas of poor water quality.

Core habitats for giant manta rays are not within the areas most influenced by the operation of the BCS. However, operation may indirectly affect manta rays through shifting distributions of food resources and by causing them to flee areas of low salinity and DO concentration, although there is no known measurable evidence of this occurring. Consequently, it is our determination that operation of the BCS *"may affect, but not likely to adversely affect"* the giant manta ray.

### 5.3.6 Piping Plover

A readily available data source for monitoring bird occurrence patterns is eBird. eBird (https://ebird.org/home) is a social media application, managed by the Cornell Lab of Ornithology, used by recreational and professional birders to document auditory and visual bird detections throughout North America and the World. Based on millions of uploaded detections, eBird can provide and update current range maps, distributions, and population trends over time. eBird distribution and population trends information shows few to no Piping Plovers have been documented wintering around LP or in the BCS action area between 2007 and 2020 (Fink et al. 2022). Moreover, only one Piping Plover, out of 154 banded individuals, was relocated in the vicinity of the BCS (Stucker et al. 2010). However, Piping Plover may occasionally be found within the action area during the spring or fall migration seasons and if present, would typically occupy non-vegetated intertidal habitat of coastal shores and barrier islands.

In the context of intertidal habitats within the action area, the operation of the BCS and the movement of fresh water into Lake Pontchartrain will likely raise water levels in the lake between 0.31 m to 0.61 m (1 to 2 ft.) and inundate some mud and sand flats (UGSG NWIS 2023). Such flood events likely reduce the availability of foraging habitat for migratory and non-breeding Piping Plovers. However, like most migratory shorebirds, Piping Plovers are adapted to the temporary reduction of foraging habitat due to tidal cycles and flood events. These birds will simply move to other areas in search of suitable foraging sites. Unlike tidal cycles, the operations of the BCS may last over a month, but since this has only happened 15 times since 1937, the effects are short term. During the non-breeding season, Piping Plovers feed on a diversity of macroinvertebrates, with Polychaetes and other annelida comprising the bulk of their diet (Elliott-Smith and Haig 2020). The inflow of fresh water into Lake Pontchartrain during BCS operations (Parra et al. 2020), usually during the early spring, can temporarily alter salinity and

affect the macroinvertebrate community (Ray 2009). Fresh water inflow reduces salinity and moves nutrients into the system, potentially causing exponential growth of harmful algae leading to periods of hypoxia (Parra et al. 2020), especially during late summer periods that are often accompanied by higher temperatures and drought conditions (Ray 2009). However, based on numerous macroinvertebrate surveys before, during and after flood events and the opening of the BCS, Polychaetes abundance is largely unaffected and overall effect on the macroinvertebrate community is short-lived (Ray 2009), indicating that the impact on prey items for this plover is minimal.

The general absence of this plover within the BCS action area reduces concerns regarding possible impacts to this species. BCS operations likely cause little or no additional impact on intertidal foraging habitat availability than natural flood events. And given that salinity changes generally have little to no long-term effect on macroinvertebrates, we determine that BCS operations "*may effect, not likely to adversely affect*" the Piping Plover.

### 5.3.7 Red Knot

Based on eBird data from 2007 to 2020, no Red Knots have been documented migrating or overwintering within the BCS action area. Coastal LA in general supports Red Knot populations during the non-breeding season, yet Red Knot presence is low throughout the state during spring and fall migration periods (Fink et al. 2022). Only 42 of 4,005 banded birds (0.01%) were resighted along the Louisiana coast during a 15-year study (Tuma and Powell 2021).

If present in the action area, Red Knot would occupy non-vegetated intertidal habitat typical of coastal shores and barrier islands. Inundation of mudflats and sandy foraging areas caused by the operation of the BCS would be short-lived, and the response would mimic the adaptive response to changing foraging habitat availability that all shorebirds encounter during tidal cycles and flood events. As with the Piping Plover (see Section 5.3.6), at this time no measurable indirect impacts to Red Knot via benthic invertebrate prey communities have been recorded. Potential impacts to Red Knot bivalve-prey communities may occur via changes in salinity, sedimentation, and decreased water quality during large scale floods events and associated BCS operations (Pruett et al. 2022), but effects are short-lived (Ray 2009). Moreover, while the Red Knot frequently forages on bivalves when available, the bird will adapt to available macroinvertebrates, foraging on a diversity of prey items, including polychaetes and annelids (Baker et al. 2020), which are largely unaffected by the operations of the BCS (Ray 2009). Therefore, we determine that BCS operations "*may affect, not likely to adversely affect*" the Red Knot.

### 5.3.8 Eastern Black Rail

Information on the distribution and general abundance of the Eastern Black Rail within the BCS action area was determined through eBird. No observations of the Eastern Black Rail within the BCS action area have been recorded from 2007 to 2020 during the breeding or non-breeding seasons. However, sightings of this species have been documented from the central coast of LA to the west toward Corpus Christi, Texas (Fink et al. 2022).

While this rail has been documented in LA Parishes of Cameron and Vermillion, no rail observations have been documented near the BCS project area nor the LPB. If they do occur within the action area, they would typically occupy high marsh habitat, as they do year-round within their central-western Gulf Coast range. The amount of suitable nesting habitat for this rail in and around the BCS is unknown, but likely to be minimal. The Eastern Black Rail is dependent on high marsh habitat which is likely inundated during natural high tide cycles and flood events. BCS operations likely have little additional impact beyond natural flooding conditions to these high marshes. The availability and quality of nesting habitat for the Eastern Black Rail within the BCS action area is uncertain yet based on the low frequency of Black Rail detections, it is believed that little or no nesting habitat exists in the area. Therefore, we determine that BCS operations "*may affect, not likely to adversely affect*" the Eastern Black Rail.

### 5.3.9 Alligator Snapping Turtle

Among eight trapping surveys conducted throughout the alligator snapping turtle's native range, capture rates and size classes were among the lowest in southeast LA (Boundy and Kennedy 2006). Because of historical trends in commercial and recreational harvest, it is difficult to parse the effects of harvest versus environmental conditions on the distribution of alligator snapping turtles (Boundy and Kennedy 2006, Shook et al. 2023). Within the BCS project area, trapping rates were lower than average for the southeast LA region, further suggesting that this area is not heavily populated by alligator snapping turtles (Boundy and Kennedy 2006).

For the relatively few snapping turtles that reside in the BCS project and action areas, direct BCS operation impacts on this species are unlikely because they are a freshwater species, well adapted to turbid water conditions (Harrel et al. 1996). Further, indirect impacts of BCS operations on the alligator snapping turtle's food resources are unlikely given that their diets are extremely broad and opportunistic (Elsey 2006). One possible impact BCS operations may have on this species is through potential negative impacts on nesting success. According to an acoustic telemetry study in northern LA, over the course of a year alligator snapping turtles tend to remain within small home ranges of <1 river km (<0.62 river mi) (Harrel et al. 1996). Presumably, females also nest within these home ranges. Nesting typically occurs in terrestrial habitats near rivers, lakes, or bayous from late April to early May. Hatchings then emerge from late August through September (Holcomb and Carr 2011). For nest that experience mortality, up to 25% can be attributed to flooding of nest cavities from heavy rains (Holcomb and Carr 2023). If nesting is occurring within the direct vicinity of the BCS project area, operations occurring during the nesting season have the potential to increase flooding-related nest mortality in this small portion of the alligator snapping turtle population. While this is a possible negative impact of BCS operations on the alligator snapping turtle, there has been no measurable evidence that nests in the BCS project area (if they exist) have ever been directly impacted. Furthermore, the occurrence of this species within the project area is relatively rare in comparison with the rest of southeast LA. Likewise, southeast LA is not heavily populated as compared to other regions within the alligator snapping turtle's range. Therefore, it is our determination that operation of the BCS *"may affect, but not likely to adversely affect"* the alligator snapping turtle.

## 6.0 CUMULATIVE IMPACTS

Cumulative effects are defined as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area." Several current and future cumulative impacts to listed species within the action area are possible due to influences including, but not limited to, additional freshwater inputs, human population growth, and urban/agricultural runoff.

Beyond the periodic influence of BCS diversion events, numerous observational and forecast-modelling studies suggest that extreme rainfall events, riverine discharge, and flood risk are likely increasing on a global scale (Kundzewicz et al. 2014, Trenberth 2011). Within the MSR watershed, it appears that the heavy spring precipitation in the Midwest US is correlated to atmospheric changes over the past several decades (Zhang and Villarini 2021) and may be a 10- to 20-fold more important driver of flood risk in southern LA than sea level rise (Getirana et al. 2023). As such, much evidence suggests that multiple sources that contribute freshwater discharge to the action area, including the MS, Pearl and Pascagoula River basins, are likely on a trajectory of increasing frequency, duration, and discharge intensity into the future (Getirana et al. 2023, Roland et al. 2023). Therefore, the cumulative impacts of freshwater inputs, including and beyond BCS impacts, may become increasingly important drivers of ecosystem-level dynamics within the action area.

Within the last decade, populations in the coastal MS counties and LA parishes immediately surrounding the action area have leveled off and, in some places, slightly declined (US Census Bureau 2023). Despite these localized and recent population trends, multidecadal population increases and land urbanization in the greater LPB have increased the proportion of impervious surfaces and subsequently urban runoff into the action area (Carstens and Amer 2019). In a comparison of 1985 to 2015, Carstens and Amer (2019) found that the majority of the LPB experienced increased phosphorous loading but decreased nitrogen loading. Fecal coliform concentrations increased throughout urban areas and dissolved oxygen concentrations decreased in more offshore areas near MSR outflows. This work illustrates that urban expansion and agricultural activities beyond the immediate coastal area (i.e., throughout the watershed), can influence water quality conditions for the listed species in the action area.

On a larger spatial scale, the MSR and its tributaries are influenced far beyond local populations and are a primary source of agriculture runoff input to the GOA, due to upstream land use in the Midwest. These extreme eutrophication conditions have cascading effects on the action area and beyond, including inducing algal blooms, hypoxia, and SAV habitat loss. LP is among the top six US estuaries considered to be most influenced by humans and is predicted to experience worsening eutrophication conditions over the next 20 years (Kennicutt 2017). Because the MSR watershed spans nearly two-thirds of continental US, many influences far beyond the BCS project area and federal action can have critical impacts on the habitat and food resources of listed species within the action area.

## 7.0 CONSERVATION RECOMMENDATIONS

Conservation recommendations include discretionary agency activities 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. Following the 2008 BCS opening, the CEMVN and the USACE Mississippi Valley Division (MVD) initiated studies to comply with conservation recommendations noted in the 2009 BO. Similarly, following the 2011 BCS opening, USFWS provided CEMVN with four conservation recommendations and later expanded the list after the 2018 opening to six conservation recommendations (February 26, 2019) in response to an emergency Section 7 coordination request by CEMVN. On April 1, 2020, USFWS further supported the previously described conservation recommendations to CEMVN in their consultation concerning the 2020 BCS opening. The recommendations provided guidance that our agency could undertake to minimize the potential take of species during the future BCS operation. All recommendation measures emphasized the recovery of entrained sturgeon, particularly Pallid and Shovelnose, and to date no measures have been formally recommended for any of the remaining listed species occurring within the project area.

The conservation recommendations provided by USFWS and CEMVN's responses follow:

Conservation Recommendation 1:
Recover pallid sturgeon entrained through the BCS and return them to the river.

*Response:* Recovery efforts at BCS have logged a total of 90 field days with crew numbers ranging from 3 to 12. Total recovery efforts, spanning six openings between 2008-2020 and including 269 total days in which the BCS structure was open, yielded 69 Pallid Sturgeon, seven of which were dead, and 439 Shovelnose Sturgeon, 105 of which were dead. Most of the mortality occurred within the Stilling Basin after leakage through the low bays ceased, resulting in low dissolved oxygen. Future rescue operations in the Stilling Basin will be prioritized once access is available. The current sturgeon recovery operation at BCS has been successful in capturing and returning entrained sturgeon back to the MSR including observations on multiple recaptures following their release. Three sturgeon (1 Pallid, 2 Shovelnose) were recaptured during the 2020 BCS opening following their original capture within the floodway during the 2019 recovery efforts. All individuals exhibited increases in fork length between capture dates and were noted to be in good condition (Slack and Killgore 2020). Similarly, Hoover et al. (2013) reported a recaptured Paddlefish that had been originally entrained at the BCS during the 2011 opening. The individual was recaptured by a commercial fisherman 627 km (390 mi) upriver, eight weeks following its release in the MSR, and was reported to be in healthy condition. These studies indicate that a large, entrained fish, trapped for several days in a hyperthermic and hypoxic habitat, can be viable when returned to the river (Hoover et al. 2013). Additionally, one Gulf Sturgeon was relocated to the Guide Canals draining into LP in 2019. CEMVN plans to continue recovery efforts during future events. Predictive equations in Killgore et al. (2022) for hours of fishing using electroshocking, entanglement nets, and gillnet-seine can be used to estimate partial catch rates after closure, and adding the overall percent catch of other collecting gear during the 5 years of sampling (i.e., 2008-2019 BSC openings) can provide an estimate of total numbers expected to be rescued.

Conservation Recommendation 2:
Tag and track (either actively and/or passively) Shovelnose Sturgeon (as a surrogate species for the Pallid Sturgeon) with sonic transmitters to determine movement within and out of the spillway and, if possible, relate those movements to environmental conditions.

*Response:* USACE will consider initiating a telemetry study prior to the next opening provided sufficient funding is available and there is enough time to purchase transmitters and deploy receivers within the floodway before floodwaters recede. This study would be similar in scope to the efforts conducted following the 2011 opening and would track movement rates and patterns within the floodway as well as dispersal potential into LP. Acoustic tags would be implanted in Shovelnose Sturgeon as surrogates for Pallid Sturgeon.

Conservation Recommendation 3: Determine salinity tolerance of Shovelnose Sturgeon as a means of possibly determining dispersal of Pallid Sturgeon during BCS operation.

*Response:* CEMVN considers a laboratory assessment of salinity tolerance an important research consideration, however, during BCS operations limited available funding has been prioritized to support sturgeon recovery efforts. Sturgeon biologists and published literature confirms that the genus *Scaphirhynchu*s is strictly a freshwater species and there have been no confirmed reports of either Pallid or Shovelnose Sturgeon occurring in a saline environment. Their tolerance to salinity is minimal and any sturgeon making their way to LP during or after an opening would be unlikely to survive. When the MSR falls below the concrete weir of the structure, which is approximately 14.8 ft (4.5 m) on the structure tile gage, or 11.8 ft (3.60 m) at Carrolton gage, flow into the BCS stops, however the water within the BCS floodway continues to drain towards LP.

Conservation Recommendation 4: To the maximum extent practicable, conduct a slow closure of the BCS.

*Response:* The Corps strives to close the structure slowly for a variety of reasons, including this request and the stability of downstream levees. The structure is designed such that when the MSR stage falls below the concrete sill, all discharge ceases whether the bays are still open or not. Discharge begins at 14.8 ft on the MSR at BCS or approximately 11.8 ft at Carrollton, therefore discharge through the structure will stop when the river stage falls below that level.

Conservation Recommendation 5: Reexamine pallid sturgeon demographics and update the 2013 population viability analysis.

*Response:* A draft population viability analysis was provided to USFWS for review (April 22, 2020).

Conservation Recommendation 6: Provide a report documenting completion of sturgeon conservation recommendations.

*Response:* Following future operations of the BCS, CEMVN will work to provide USFWS with a summary of sturgeon recovery efforts.

## 8.0 CONCLUSION

It is the CEMVN's determination that operation of the BCS "*may affect, likely to adversely affect"* individual Pallid and Shovelnose Sturgeon. Some incidental take has been reported following BCS operations since the 2008 opening, however, these events have not jeopardized overall populations of Pallid and Shovelnose Sturgeon within the LMR. It has been demonstrated that the rapid rescue of entrained adult river sturgeon can be successfully accomplished to minimize impacts to these species. For future BCS openings, the CEMVN will continue to contract the ERDC Fish Ecology Team to rescue and return Pallid and Shovelnose Sturgeon back into the MSR.

It is the CEMVN's determination that operation of the BCS *"may affect, likely to adversely affect*" the Gulf Sturgeon due to the potential for entrainment. However, only a single individual has been recovered within the BCS project area following BCS operations since sturgeon recovery efforts were initiated in 2008, thus entrainment of Gulf Sturgeon in association with BCS operations will not detrimentally impact the WGOA population. Gulf Sturgeon critical habitat (Unit 8) has been designated in parts of the LPB and MS Sound. Based in part on a 2009 Benthic Report (Ray 2009), CEMVN has determined that Gulf sturgeon critical habitat within the action area will not be adversely modified by future BCS operations.

In general, Gulf Sturgeon are a highly mobile anadromous fish that spend a large portion of their life in riverine systems. Foraging habitat within the WGOA includes nearshore estuarine habitats and offshore areas near the barrier islands. The influx of freshwater into LP and the WGOA in response to flood control operations of BCS will cause short-term changes in salinity levels and other water quality parameters, but these changes will not create long-term changes in benthic infaunal community composition.

Although there are elevated stranding counts of both the green sea turtle and the loggerhead sea turtle within the action area during years that experienced high flood events and BCS operations, NOAA NMFS (Howell et al. 2021) was not able to attribute the cause of the increase in stranding rates of any sea turtle species to freshwater input impacts from the BCS. Although the BCS has the potential to contribute to indirect effects on sea turtle food sources and habitats, measurable causational evidence is lacking. Consequently, CEMVN finds BCS operations "*may affect, but not likely to adversely affect*" these two sea turtle species.

While Kemp's ridley sea turtles are observed to have higher stranding counts in the action area than all other sea turtle species combined, stranding counts do not differ between periods of BCS operation versus non-operation. Further, Kemp's ridley are known to have an adaptive diet of diverse invertebrate prey, therefore indirect BCS impacts to this species' food resource availability is likely negligible. As such, CEMVN finds that BCS operations "*may affect, but not likely to adversely affect*" the Kemp's ridley sea turtle.

CEMVN finds BCS operations have *"no effect*" on the hawksbill sea turtle or the leatherback sea turtle due to the rarity of their occurrence in the action area.

The West Indian manatee is not directly affected by reductions in salinity. Further, manatee rarely occur within the BCS action area. No mortalities of manatee were documented during periods of BCS operations. However, the BCS operation may indirectly affect manatee by negatively affecting their SAV foraging habitat. CEMVN therefore finds that BCS operations "*may affect, but not likely to adversely affect*" the West Indian manatee.

The giant manta ray is not likely directly affected by reductions in salinity. Further, the action area is not considered to be core habitat for the giant manta ray. However, BCS operations may indirectly affect the ray through spatial shifts in food resource availability and causing avoidance of localized bottom water hypoxia within this rarely visited area. Consequently, CEMVN finds that BCS operations "*may affect, but not likely to adversely affect*" the giant manta ray.

CEMVN determined that operation of the BCS "*may affect, but not likely to adversely affect*" Piping Plover, Red Knot, and Eastern Black Rail. Although these shorebirds are highly mobile and have low frequency of occurrence within the action area, intertidal habitats and food resources may potentially be affected by the additional short-term input of freshwater into the local ecosystems. These short-term impacts do not rise to a measurable level and are expected to be negligible. Critical habitat unit (LA-7) for the Piping Plover and the Red Knot includes the Breton Islands and Chandeleur Island chain, which are outside of the BCS action area. Therefore, no adverse modification to critical habitat for these species is expected due to operation of the BCS.

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, NEW ORLEANS DISTRICT
7400 LEAKE AVENUE
NEW ORLEANS, LOUISIANA 70118

REPLY TO
ATTENTION OF:

Regional Planning and
Environment Division, South
Environmental Compliance Branch

January 23, 2017

Mr. Joe Ranson
Field Supervisor
U.S. Fish and Wildlife Service
646 Cajundome Blvd, Suite 400
Lafayette, LA 70506

Attn: Mr. David Walther

This project has been reviewed for effects to Federal trust resources under our jurisdiction and currently protected by the Endangered Species Act of 1973 (Act). The project, as proposed,
( ) Will have no effect on those resources
(✓) Is not likely to adversely affect those resources.
This finding fulfills the requirements under Section 7(a)(2) of the Act.

Monica Silvas for
Acting Supervisor
Louisiana Field Office
U.S. Fish and Wildlife Service

3/6/17
Date

manatee
pallid sturgeon

Dear Mr. Ranson:

The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is reinitiating consultation with your office for threatened or endangered species per Section 7 of the Endangered Species Act (ESA) for replacing the navigation lock on the Inner Harbor Navigation Canal, also known as the IHNC and Industrial Canal, in New Orleans, Louisiana. The CEMVN is preparing a general reevaluation report with an integrated environmental impact statement titled Mississippi River, Baton Rouge to the Gulf of Mexico Mississippi River-Gulf Outlet (MRGO), Louisiana, New Industrial Canal Lock and Connecting Channels. Prior ESA consultation for a plan to replace the IHNC Lock. was completed during preparation of a Supplemental Environmental Impact Statement (SEIS), titled, "Inner Harbor Navigation Canal Lock Replacement Project, Orleans Parish, Louisiana." That consulation resulted in the USFWS concurring with CEMVN's determination, by correspondence dated September 19, 2008, that the proposed action may affect, but is not likely to adversely affect, any threatened or endangered species. As you may be aware, this project has a long history and is now in a reevaluation phase. This updated ESA assessment and determination summarizes current efforts to evaluate the feasibility of constructing a new navigation lock, and provides an assessment of potential effects on several threatened or endangered species under USFWS purview.

*Study History*

The original 1997 Evaluation Report and EIS for this project was finalized in March 1998. A Record of Decision was signed in December 1998, selecting the location for a replacement lock within the IHNC, north of the Claiborne Avenue Bridge. Other project features were replacement of the St. Claude Avenue Bridge, modification of the Claiborne Avenue Bridge, extension of the Mississippi River flood protection levees and floodwalls, a community impact mitigation plan, and a fish and wildlife mitigation plan. Via FAX dated October 9, 1996, your office agreed with our determination that the

proposed action would not likely adversely affect listed or proposed threatened or endangered species. The National Marine Fisheries Service also agreed similarly to our not likely to adversely affect determination via letter dated October 17, 1996.

In 2007, the Corps began preparing a SEIS for the IHNC Lock Replacement Project to address changes in existing conditions after Hurricane Katrina, further analyze anticipated impacts associated with construction of a lock, and determine if any significant changes to the previously-recommended plan were necessary. CEMVN began informal consultation as per Section 7(a)(2) of the Endangered Species Act with your office through a letter dated February 20, 2008. CEMVN determined that the proposed project would not likely adversely affect any threatened or endangered species in the project area. Your office requested continuation of consultation to acknowledge the possible occurrence of pallid sturgeon within the IHNC and possible interaction with the lock structure and associated culverts. CEMVN reinitiated consultation with your office by a letter dated August 15, 2008. Your office concurred with CEMVN's determination that the proposed action may affect, but is not likely to adversely affect, any threatened or endangered species in the project area on September 19, 2008. The final SEIS was completed in March 2009. In May 2009, a Record of Decision was signed, recommending the float-in-place plan for lock construction for a new lock within the IHNC, the hydraulic dredging method for excavation of sediment from the canal, a detailed plan for dredged material disposal, and bridge replacement and modifications. These features were similar to the plan recommended in the 1997 Evaluation Report and EIS.

*Study Purpose and Need*

This current reevaluation study addresses the feasibility of improving navigation efficiencies for traffic on the GIWW and the Mississippi River via the IHNC in New Orleans, Louisiana. A General Reevaluation Report (GRR) of the lock replacement is required to analyze shallow draft lock alternatives.

*Study Area*

The study area is located in Orleans Parish in southeastern Louisiana. The area is generally bounded by the Mississippi River Gulf Outlet (MRGO) and Gulf Intracoastal Waterway (GIWW) on the north, the Mississippi River on the south, Louisiana Highway 47/Paris Road on the east, and the hurricane protection floodwalls on the west bank of the IHNC on the west.

*Tentatively Selected Plan and Plans Description*

The current study addresses four lock replacement plans in the final array of alternatives, as well as a no-action plan. Under the no-action plan, the proposed construction of a replacement lock or an additional lock would not occur and the Federal

government would continue to operate and maintain the existing lock. Plan 3 is the tentatively selected plan (TSP). The main feature of this plan is a new lock with dimensions of 900 feet long by 110 feet wide by 22 feet deep to be located within the IHNC, north of Claiborne Avenue (Figure 1). Plans 2, 4 and 5 would have similar environmental effects as compared to the tentatively selected plan. All plans include replacement of the St. Claude Avenue Bridge and demolition and removal of the existing IHNC Lock. The site of the new lock, major construction activities, and project features for Plans 2, 4 and 5 would all be comparable to the TSP with the only variation being the dimensions of the locks (Plan 2 - 900 feet long x 75 feet wide x 22 feet deep; Plan 4 - 1,200 feet long x 75 feet wide x 22 feet deep; and Plan 5 - 1,200 feet long x 110 feet wide x 22 feet deep).

Figure 1. Vicinity Map of IHNC Project.

The most significant difference between previous lock replacement plans and the plans currently being studied is the method by which dredged material is disposed. Previous lock replacement plans, which were deep-draft locks with a sill depth of 36 feet, included the disposal of dredged material in confined disposal facilities and in the Mississippi River. The currently studied plans eliminate the use of confined disposal facilities and include bucket-dredging of material that is unsuitable for open water and disposal in commercial landfills and disposal of material suitable for open water disposal into the main channel of the Mississippi River.

Construction of the new lock would require a complex sequence of tasks (see Figure 2). It is anticipated that the entire construction process could take up to 13 years to complete, if adequate funding is provided. The following bullets describe the major tasks in sequence:

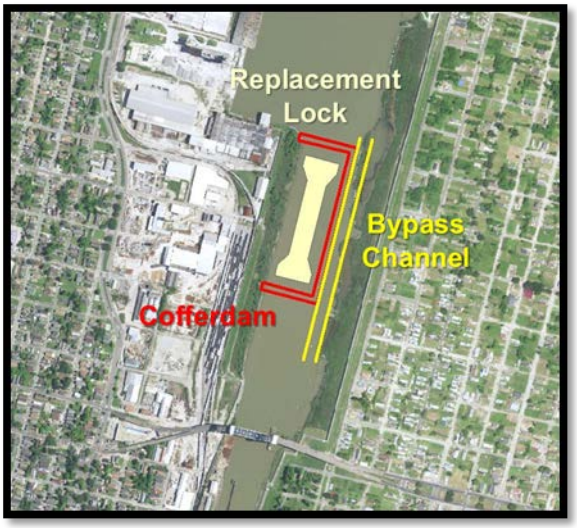


Figure 2. Location of Replacement Lock, Bypass Channel, and Cofferdam

- A cofferdam around the new lock construction site is required so that the site can be unwatered. Foundational support is required for the cofferdam, therefore jet grouting of the canal bottom sediments utilizing barge-mounted equipment would be performed to strengthen the sediments. The soil improvements would occur prior to placement of sheeting for the cofferdam. The required sheet pile tip elevation for the cofferdam is elevation -90 feet North American Vertical Datum 1988 (NAVD88). The sheet pilings would be placed using a barge-mounted vibratory hammer to form cell walls, and the interior of the cofferdam cells would be filled with sand to an elevation of +3.5 feet (NAVD 88).
- The north-south section (eastern wall) of the cofferdam would be constructed within the IHNC as the first actual construction feature of the project. Construction of this part of the cofferdam in the navigation channel would separate two distinct dredging areas, namely the new lock construction site on the west side and the north bypass channel on the east side. The lock construction site and the north bypass channel require excavation to significantly different depths. The dredging depth required for the new lock site is elevation -33 feet (NAVD 88). For the north bypass channel, the required elevation is -17 feet (NAVD 88).
- A temporary bypass channel would be excavated between the north-south cofferdam section and the floodwall located along the east bank of the IHNC. Some of the existing east bank of the IHNC may need to be removed. The north bypass channel would accommodate vessel traffic around the new lock

construction site. To protect the east bank of the IHNC and cofferdam, and the vessels transiting the bypass channel, tugboats would be permanently stationed to assist vessels transiting the area. In addition, protection cells would be placed along the west side of the bypass channel to protect the cofferdam. All vessel traffic would be rerouted through the north bypass channel while the new lock is being constructed.

- Approximately 106,000 cubic yards of sediment would need to be dredged to construct the north bypass channel. The majority of this dredged material – approximately 70,000 cubic yards from Dredged Material Management Unit (DMMU) 6 – is suitable for open water placement and would be discharged into the Mississippi River. See Figure 4 for locations of DMMUs. The remaining dredged material, about 36,000 cubic yards from DMMU 7, is not suitable for discharge into the Mississippi River and would be bucket dredged and disposed of in a solid waste landfill (Refer to *Dredged Material Disposal Plans* section for detailed soils and sediment excavation and discharge discussion).
- Once the north bypass channel is operational, the new lock site would be dredged by a combination of hydraulic and bucket dredges. Approximately 69,000 cubic yards of dredged material from DMMU 5 is unsuitable for discharge into the aquatic environment and would be bucket dredged and disposed of in a solid waste landfill. An additional 278,000 cubic yards of dredged material would be removed from the new lock site (DMMUs 3 and 4) by hydraulic dredging. That material is suitable for disposal in the freshwater aquatic environment and would be discharged into the Mississippi River.
- After completing the dredging work at the new lock site, the east-west sections (northern and southern walls) of the cofferdam would be constructed to close the cofferdam for unwatering. Unwatering of the cofferdam would be accomplished with a combination of pumps, sumps, and wells, including pressure relief wells. All water collected within the cofferdam would be pumped into the IHNC.
- Foundation pilings would be driven within the unwatered cofferdam to support the concrete pours of the lock module. Foundation pilings would consist of 24-inch x 24-inch precast, pre-stressed concrete pilings spaced on approximately 10-foot centers with tighter spacing under lock module walls. A total of 1,386 vertical pilings would be driven to a depth of 136 feet below grade. Either a vibratory or impact hammer, or a combination of both, would be used for pile driving. Concrete pours for the lock modules would begin at the gates and work inward to the chambers. Alternate sections of the module would be poured, and some concrete pours may need to occur at night with the use of lighting due to concrete technical restrictions. Machinery, valves, electrical, and mechanical connections would all be installed after completion of concrete placement. An on-site concrete batch plant would be necessary, and nearby staging areas for construction materials and parking areas for construction workers would be required.
- Following completion of the lock modules, the cofferdams would be removed and the area re-watered. Areas around the lock modules would be backfilled with

excess sand from the cofferdams and earthen fill material from off-site sources. The west side of the lock would be backfilled first, prior to opening the lock, so that administration buildings can be constructed in that area and to avoid working on the west side of the lock while traffic is passing through the lock. The lock would then be opened to navigation traffic in a pass-through mode and the bypass channel backfilled with earthen fill material from an offsite source. Completion of tie-ins to existing floodwalls on both sides of the IHNC would be achieved after construction of the new lock, while the new lock remains in the pass-through mode (all gates open). During this time, the existing lock would continue normal operation.

- A temporary bridge (see Figure 3) would be constructed adjacent to the St. Claude Avenue Bridge to provide a comparable level of traffic flow while the St. Claude Avenue Bridge is replaced with a low-level double bascule bridge.
- Replacement storm and flood risk reduction measures (see Figure 3) would be constructed to at least in-kind and up to current design standards.
- Once the new lock becomes operational and all new levees and floodwalls are constructed, the old lock would be put into pass-through mode. During this time a south bypass channel around the east side of the old lock would be constructed to allow for continued vessel traffic while the old lock is demolished (see Figure 3). Hydraulic and/or mechanical dredges would remove approximately 85,000 cubic yards of sediment from DMMU 10 to construct the south bypass channel. This material is suitable for open water placement and would be discharged into the Mississippi River.
- Once the south bypass channel is operational, the old lock would be demolished and the structural material hauled away to be salvaged or scrapped. About 181,000 cubic yards of dredged material would then be removed from the lock demolition site (DMMU 9) with hydraulic and or mechanical dredges. This material is suitable for open water discharge into the Mississippi River. Upon completion, the new lock and connecting channels would be fully functional.

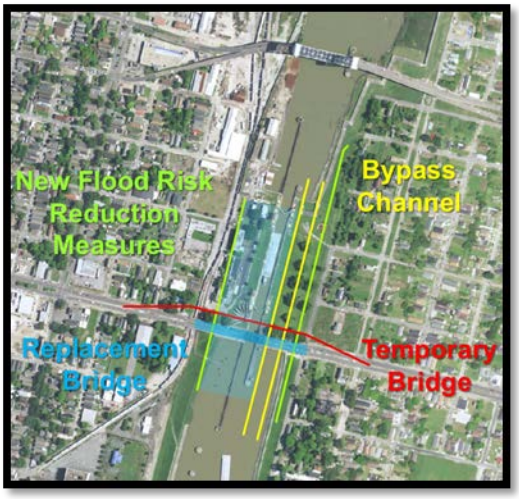


Figure 3. Project Features near the St. Claude Avenue Bridge

*Dredged Material Disposal Plans*

Soils and sediments that require excavation for project construction have been thoroughly evaluated under regulations and procedures developed under requirements of the Clean Water Act and may be divided into two categories.

- Approximately 614,000 cubic yards of dredged material that would be excavated from Dredged Material Management Units (DMMUs) 3, 4, 6, 9, and 10 is “suitable for open water discharge” (see Figure 4). This material is non-toxic to sensitive benthic organisms, does not contain contaminants at concentrations that would adversely bioaccumulate or bio-magnify in aquatic food webs, and would not violate or exceed regulatory water quality criteria or drinking water standards upon discharge into the proposed Mississippi River open-water disposal site. The dredged material would mix with the river’s normal suspended and bedload sediments and be carried downstream. Approximately 105,000 cubic yards of dredged material that would be excavated from DMMUs 5 and 7 is “unsuitable for open water discharge” because it is toxic to sensitive benthic organisms. This material would be excavated with an environmental bucket dredge to minimize on-site loss of material and turbidity, and would be hauled to and permanently disposed in a permitted solid waste landfill.

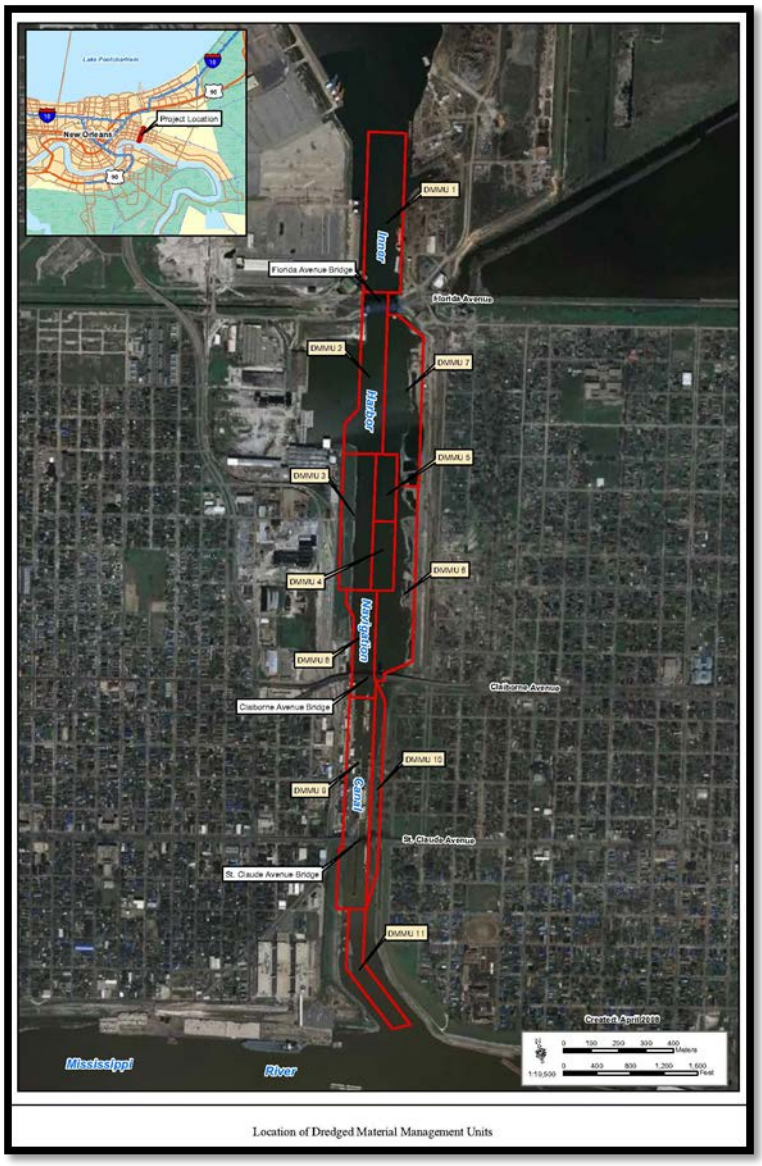


Figure 4. Location of IHNC Dredged Material Management Units.

- Dredging depths and widths required for the this plan do not warrant vertical or lateral subdivision of DMMUs into “native layer” and “fill” categories as for previously-evaluated deep draft lock alternatives. However, results from chemical and biological testing of the material within these DMMUs were utilized

in assessing current dredged material disposal alternatives in that contaminant maximums and worst-case toxicity determinations for overlapping units were considered to represent a dredging unit. As an example, testing results from the non-native or fill layer of DMMU 7 which contained higher levels of contaminants than the native layer were used to represent the entire unit, and were not averaged or weighted with native and fill layers.

- DMMUs previously evaluated for deeper lock alternatives that have sufficient depth and would not be dredged as part of this plan are DMMUs 1, 2, 8, and 11 (IHNC Channel).

The lock replacement alternatives evaluated in prior reports (1997 and 2009) would have required large areas for the disposal of dredged material generated from lock construction. In those reports, large quantities, up to 1,400,000 cubic yards, were to be excavated with hydraulic dredges and pumped as a slurry to confined disposal areas located along the south bank of the GIWW/MRGO east of the IHNC. Some dredged material would have also been placed into the deep channel of the Mississippi River.

A reevaluation of dredged material disposal alternatives was conducted for this report. It was determined that the required dredging quantities for all DMMUs were significantly reduced from the volumes described for all of the alternatives assessed previously. Two dredging and disposal alternatives were evaluated for the discharge of dredged material that has been determined to be unsuitable for aquatic disposal: 1) hydraulic dredging and disposal in an 81-acre confined disposal facility located along the south bank of the GIWW; and 2) environmental bucket dredging and placement into hopper barges and transported to a permitted solid waste landfill. Cost estimates associated with the use of an environmental bucket dredge and subsequent disposal of dredged material into a permitted solid waste landfill were determined to be less costly than hydraulic dredging and permanent confinement of dredged material in a confined disposal facility. Moreover, the use of an environmental bucket dredge and disposal into a permitted solid waste landfill would eliminate impacts to productive fish and wildlife habitats, including wetlands, as well as avoid and minimize potential adverse impacts to waters of the U.S. The dredged material determined to be suitable for aquatic disposal would be hydraulically dredged and disposed into the Mississippi River. Earthen fill material would also be needed for backfill at and around the new lock construction site, however this deposition of fill is not expected to cause impacts that warrant special construction conditions. Construction specifications would include measures to avoid and minimize impacts to threatened and endangered species, namely West Indian manatee and pallid sturgeon, if they are observed in or near the construction site, even though no such encounters are expected.

*Occurrence of Threatened or Endangered Species within the Study Area*

Three threatened, endangered, or candidate species under USFWS purview are either known to or may possibly/seasonally occur in Orleans Parish: West Indian

manatee (*Trichechus manatus*) (endangered); pallid sturgeon (*Scaphirhynchus albus)* (endangered); and Sprague's pipit (*Anthus spragueii*) (candidate). While the Sprague's pipit winter range sightings have been documented in the coastal prairies of Texas and Louisiana, it is not anticipated that this species would occupy any lands associated with the study area. The lock construction and demolition sites at the IHNC do not contain any representative habitat qualities that are conducive to this species. Therefore, the proposed project would have no effect on this species or its wintering habitat.

Gulf sturgeon (*Acipenser oxyrinchus desotoi*) are known to occur in nearby Lakes Pontchartrain and Borgne. In these lakes, the species is under the purview of the National Marine Fisheries Service (NMFS). CEMVN will consult with the NMFS under Section 7 of the ESA on the potential for the proposed action to affect Gulf sturgeon.

*West Indian manatee*

West Indian manatees can be found in shallow, slow-moving rivers, estuaries, salt-water bays, canals, and coastal areas (LDWF, 2012). West Indian manatees are typically found in waters with dense submerged aquatic beds or floating vegetation where the species grazes on a variety of aquatic plants. This species has been known to occasionally enter Lake Pontchartrain and associated coastal waters from June through September. Manatees have been reported in the Amite, Blind, Tchefuncte, and Tickfaw Rivers, and in canals within the adjacent coastal marshes of Louisiana. They have also been occasionally observed elsewhere along the Louisiana Gulf coast. The manatee has declined in numbers due to collisions with boats and barges, entrapment in flood control structures, poaching, habitat loss, and pollution. While manatees have previously been sighted in the Mississippi River, their occurrence is extremely rare since the main river has no adequate food source (i.e., aquatic vegetation). Historical data and data collected and analyzed for the previous IHNC maintenance dredging event reveal that certain contaminants such as PAHs, pesticides, and metals exist at elevated levels relative to sediment quality benchmarks in the top portions of the channel bottom. It is expected that impacts associated with either hydraulic cutterhead dredging or with an environmental bucket dredge within the IHNC would have no effect on the manatee due to the industrialized nature of the project, turbid water conditions, and lack of adequate food sources in and around the existing lock and navigation channel. It is expected that no manatees would be present in the Mississippi River near the discharge zones of dredged material. Therefore, there would be no effect to this species as a result of temporary increases in turbidity near the discharge sites. The discharged dredged material would disperse relatively quickly due to the swift moving currents of the river. However, as per standard requirements for CEMVN dredging contracts in coastal Louisiana, the following manatee protective measures would still be included in all dredging contracts awarded for construction of this project:

- All contract personnel associated with the project would be informed of the potential presence of manatees and the need to avoid collisions with

manatees, which are protected under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973.

- All construction personnel will be responsible for observing water-related activities for the presence of manatee(s).
- Temporary signs would be posted prior to and during all construction/dredging activities to remind personnel to be observant for manatees during active construction/dredging operations or within vessel movement zones (*i.e.*, work area) and at least one sign would be placed where it is visible to the vessel operator.
- Siltation barriers, if used, would be made of material in which manatees could not become entangled, and would be properly secured and monitored.
- If a manatee is sighted within 100 yards of the active work zone, special operating conditions would be implemented, including: no operation of moving equipment within 50 feet of a manatee; all vessels would operate at no wake/idle speeds within 100 yards of the work area; and siltation barriers, if used, would be re-secured and monitored. Once the manatee has left the 100-yard buffer zone around the work area on its own accord, special operating conditions would no longer be necessary, but careful observations would be resumed.
- Any manatee sighting would be immediately reported to the Service's Lafayette, Louisiana Field Office (337/291-3100) and the Louisiana Department of Wildlife and Fisheries, Natural Heritage Program (225/765-2821).

In conclusion, it is expected that the proposed project have no effect on West Indian manatee.

*Pallid sturgeon*

In 2012, the U.S. Fish and Wildlife Service (USFWS), in collaboration with both the Corps Mississippi Valley Division (MVD) office and local Corps Districts (to include Memphis, Vicksburg and New Orleans), completed the final *Lower Mississippi Strategic Habitat Conservation Plan* that outlined the process by which components of the Mississippi River Channel Improvement Program would serve as conservation tools to maintain and improve habitat values of endangered species inhabiting the lower river channel. As part of that ongoing collaborative effort, in August 2013, the MVD office submitted the *Conservation Plan for the Interior Least Tern, Pallid Sturgeon, and Fat Pocketbook Mussel, in the Lower Mississippi River*, formally requesting USFWS' consideration of that plan as a biological assessment of the Channel Improvement Program and its potential for adverse effects on three endangered species; interior least tern (*Sterna antillarum*), pallid sturgeon (*Scaphirhynchus albus)*, and fat pocketbook mussel (*Potamilus capax*), in the Lower Mississippi River (Killgore et. al 2014). In September 2013, the USFWS agreed to consider the systemic impacts of the continued implementation of the Channel Improvement Program on the three listed species as

projected 20 years into the future. On December 12, 2013, the USFWS issued their Biological Opinion detailing the various direct, indirect and cumulative effects of the action on the three listed species, as well as the various reasonable and prudent measures, terms and conditions and conservation recommendations to be implemented as part of the Corps' comprehensive conservation plan for the Channel Improvement Program.

While the proposed action is not associated with the annual maintenance work performed under the Channel Improvement Program, the New Orleans District acknowledges the location of the proposed discharge zone for dredged material in the Mississippi River may affect pallid sturgeon.

The pallid sturgeon only occurs in large rivers within the Mississippi and Missouri River Basins from Montana to Louisiana. This includes the Mississippi River and Atchafalaya River in south Louisiana. The pallid sturgeon tends to select main channel habitats in the Mississippi River. Aquatic habitats in the Mississippi River have been modified though the construction of flood control levees and channel modification through time, and some changes resulting from those modifications have likely been detrimental to pallid sturgeon. Although the river flows unobstructed for about 2,000 river miles from Gavins Point Dam in the middle Missouri River to the Gulf of Mexico, tributary impoundments, bendway cutoffs and dike and levee construction have each changed localized patterns of channel erosion and deposition in the Mississippi River. Collectively, they have resulted in a degradation trend throughout the system. Effects of these changes on pallid sturgeon are unknown, because there are no historical data for comparison. The Pallid Sturgeon Lower Basin Recovery Workgroup has identified information gaps essential to the consultation and recovery processes in the Lower Mississippi River Basin. These include: relative abundance of pallid sturgeon; demographics; feeding habits; habitat use; hybridization ratios; presence of fish diseases in the wild; population anomalies; and reliable separation and identification of pallid sturgeon, shovelnose sturgeon, and hybrids. While recent publications have contributed to filling some of these data gaps (e.g., Killgore et al., 2007a) incomplete knowledge of those areas remains.

Current information provided through previous collecting and sampling efforts (Killgore et al. 2007b), seems to indicate that the pallid sturgeon is widely distributed throughout the Lower Mississippi River, habitat is abundant and of high quality, and the species is reproducing and recruiting (USFWS, 2013). As noted in the November 2013 Entrainment Studies of Pallid Sturgeon Associated with Water Diversions in the Lower Mississippi River Study, field sampling of sturgeon in the lowermost reach of the Mississippi River between river miles 0 and 320 has been ongoing since 2001. Results of that study indicated that a total of 51 pallid sturgeon, 319 shovelnose sturgeon, and 84 young-of-year sturgeon were collected between 2001 and 2010 below river mile 320 (ERDC-EL, 2013). While Sturgeon were generally distributed from river mile 319 downstream to river mile 81, it was noted that only one pallid sturgeon was caught

between river miles 99 and 80. The specific area where this single pallid sturgeon was caught was around river mile 95.5 just downstream of the Crescent City Connection Bridge in New Orleans (ERDC-EL, 2013). The IHNC project is located near river mile 92, and based upon available capture data it is assumed that pallid sturgeon would seldom venture below New Orleans. It is anticipated that dredging activities, in-situ lock construction and modifications to the St. Claude and Claiborne Avenue Bridges would result in disturbance of substrates in the IHNC and would temporarily increase turbidity in the Mississippi River and shallow estuarine waters adjacent to the project area. Any pallid sturgeon potentially present in the main channel of the Mississippi River near the discharge zones of dredged material may be temporarily affected by increased turbidity, but would not likely be adversely affected as the dredged material would disperse relatively quickly due to the swift moving currents of the river. Additionally, due to the highly developed and industrialized nature of the project area, it is not expected that any pallid sturgeon would be present in the IHNC during dredging or lock construction activities.

Based on prior consultation efforts, previous studies, and our current investigations, it is our determination that the proposed project may affect, but is not likely to adversely affect pallid sturgeon, would have no effect on West Indian Manatee, and would not result in the destruction or adverse modification to critical habitat.

In accordance with Section 7 of the Endangered Species Act of 1973, as amended, the New Orleans District requests you review the information provided and advise us of your determination. Responses should be mailed to Mark Lahare at: U.S. Army Corps of Engineers, CEMVN-PDC-CEC, 7400 Leake Avenue, New Orleans, Louisiana, 70118. Responses may also be provided by: e-mail to mark.h.lahare@usace.army.mil; or by phone at (504) 862-1344.

Sincerely,

Edward P. Lambert

Edward P. Lambert
Chief, Environmental Compliance Branch

REFERENCES:

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# Endangered Species Act Determination

## 13 January 2017

**Subject**: General reevaluation report with an integrated supplemental environmental impact statement titled, "Mississippi River, Baton Rouge to the Gulf of Mexico Mississippi River-Gulf Outlet (MRGO), Louisiana, New Industrial Canal Lock and Connecting Channels."

**Purpose:** The U.S. Army Corps of Engineers, New Orleans District (CEMVN) is reinitiating consultation with your office for threatened or endangered species per Section 7 of the Endangered Species Act (ESA) for replacing the navigation lock on the Inner Harbor Navigation Canal, also known as the IHNC and Industrial Canal, in New Orleans, Louisiana.

**Project Area:** The study area is located in Orleans Parish in southeastern Louisiana. The area is generally bounded by the Mississippi River Gulf Outlet (MRGO) and Gulf Intracoastal Waterway (GIWW) on the north, the Mississippi River on the south, Louisiana Highway 47/Paris Road on the east, and the hurricane protection floodwalls on the west bank of the IHNC on the west.

**Tentatively Selected Plan and Plans Description:** The current study addresses four lock replacement plans in the final array of alternatives, as well as a no-action plan. Under the no-action plan, the proposed construction of a replacement lock or an additional lock would not occur and the Federal government would continue to operate and maintain the existing lock. Plan 3 is the tentatively selected plan (TSP). The main feature of this plan is a new lock with dimensions of 900 feet long by 110 feet wide by 22 feet deep to be located within the IHNC, north of Claiborne Avenue (Figure 1). Plans 2, 4 and 5 would have similar environmental effects as compared to the tentatively selected plan. All plans include replacement of the St. Claude Avenue Bridge and demolition and removal of the existing IHNC Lock. The site of the new lock, major construction activities, and project features for Plans 2, 4 and 5 would all be comparable to the TSP with the only variation being the dimensions of the locks (Plan 2 - 900 feet long x 75 feet wide x 22 feet deep; Plan 4 - 1,200 feet long x 75 feet wide x 22 feet deep; and Plan 5 - 1,200 feet long x 110 feet wide x 22 feet deep).

Figure 1. Vicinity Map of IHNC Project.

The most significant difference between previous lock replacement plans and the plans currently being studied is the method by which dredged material is disposed. Previous lock replacement plans, which were deep-draft locks with a sill depth of 36 feet, included the disposal of dredged material in confined disposal facilities and in the Mississippi River. The currently studied plans eliminate the use of confined disposal facilities and include bucket-dredging of material that is unsuitable for open water and disposal in commercial landfills and disposal of material suitable for open water disposal into the main channel of the Mississippi River.

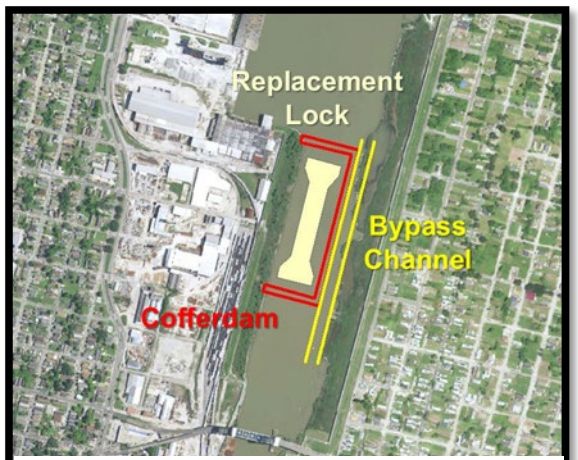


Figure 2. Location of Replacement Lock, Bypass Channel, and Cofferdam

Construction of the new lock would require a complex sequence of tasks (see Figure 2). It is anticipated that the entire construction process could take up to 13 years to complete, if adequate funding is provided. The following

bullets describe the major tasks in sequence:

- A cofferdam around the new lock construction site is required so that the site can be unwatered. Foundational support is required for the cofferdam, therefore jet grouting of the canal bottom sediments utilizing barge-mounted equipment would be performed to strengthen the sediments. The soil improvements would occur prior to placement of sheeting for the cofferdam. The required sheet pile tip elevation for the cofferdam is elevation -90 feet North American Vertical Datum 1988 (NAVD88). The sheet pilings would be placed using a barge-mounted vibratory hammer to form cell walls, and the interior of the cofferdam cells would be filled with sand to an elevation of +3.5 feet (NAVD 88).
- The north-south section (eastern wall) of the cofferdam would be constructed within the IHNC as the first actual construction feature of the project. Construction of this part of the cofferdam in the navigation channel would separate two distinct dredging areas, namely the new lock construction site on the west side and the north bypass channel on the east side. The lock construction site and the north bypass channel require excavation to significantly different depths. The dredging depth required for the new lock site is elevation -33 feet (NAVD 88). For the north bypass channel, the required elevation is -17 feet (NAVD 88).
- A temporary bypass channel would be excavated between the north-south cofferdam section and the floodwall located along the east bank of the IHNC. Some of the existing east bank of the IHNC may need to be removed. The north bypass channel would accommodate vessel traffic around the new lock construction site. To protect the east bank of the IHNC and cofferdam, and the vessels transiting the bypass channel, tugboats would be permanently stationed to assist vessels transiting the area. In addition, protection cells would be placed along the west side of the bypass channel to protect the cofferdam. All vessel traffic would be rerouted through the north bypass channel while the new lock is being constructed.
- Approximately 106,000 cubic yards of sediment would need to be dredged to construct the north bypass channel. The majority of this dredged material – approximately 70,000 cubic yards from Dredged Material Management Unit (DMMU) 6 – is suitable for open water placement and would be discharged into the Mississippi River. See Figure 4 for locations of DMMUs. The remaining dredged material, about 36,000 cubic yards from DMMU 7, is not suitable for discharge into the Mississippi River and would be bucket dredged and disposed of in a solid waste landfill (Refer to *Dredged Material Disposal Plans* section for detailed soils and sediment excavation and discharge discussion).
- Once the north bypass channel is operational, the new lock site would be dredged by a combination of hydraulic and bucket dredges. Approximately 69,000 cubic yards of dredged material from DMMU 5 is unsuitable for discharge into the aquatic environment and would be bucket dredged and disposed of in a solid waste landfill. An additional 278,000 cubic yards of dredged material would be removed from the new lock site (DMMUs 3 and 4) by hydraulic dredging. That

material is suitable for disposal in the freshwater aquatic environment and would be discharged into the Mississippi River.

- After completing the dredging work at the new lock site, the east-west sections (northern and southern walls) of the cofferdam would be constructed to close the cofferdam for unwatering. Unwatering of the cofferdam would be accomplished with a combination of pumps, sumps, and wells, including pressure relief wells. All water collected within the cofferdam would be pumped into the IHNC.
- Foundation pilings would be driven within the unwatered cofferdam to support the concrete pours of the lock module. Foundation pilings would consist of 24-inch x 24-inch precast, pre-stressed concrete pilings spaced on approximately 10-foot centers with tighter spacing under lock module walls. A total of 1,386 vertical pilings would be driven to a depth of 136 feet below grade. Either a vibratory or impact hammer, or a combination of both, would be used for pile driving. Concrete pours for the lock modules would begin at the gates and work inward to the chambers. Alternate sections of the module would be poured, and some concrete pours may need to occur at night with the use of lighting due to concrete technical restrictions. Machinery, valves, electrical, and mechanical connections would all be installed after completion of concrete placement. An on-site concrete batch plant would be necessary, and nearby staging areas for construction materials and parking areas for construction workers would be required.
- Following completion of the lock modules, the cofferdams would be removed and the area re-watered. Areas around the lock modules would be backfilled with excess sand from the cofferdams and earthen fill material from off-site sources. The west side of the lock would be backfilled first, prior to opening the lock, so that administration buildings can be constructed in that area and to avoid working on the west side of the lock while traffic is passing through the lock. The lock would then be opened to navigation traffic in a pass-through mode and the bypass channel backfilled with earthen fill material from an offsite source. Completion of tie-ins to existing floodwalls on both sides of the IHNC would be achieved after construction of the new lock, while the new lock remains in the pass-through mode (all gates open). During this time, the existing lock would continue normal operation.
- A temporary bridge (see Figure 3) would be constructed adjacent to the St. Claude Avenue Bridge to provide a comparable level of traffic flow while the St. Claude Avenue Bridge is replaced with a low-level double bascule bridge.
- Replacement storm and flood risk reduction measures (see Figure 3) would be constructed to at least in-kind and up to current design standards.

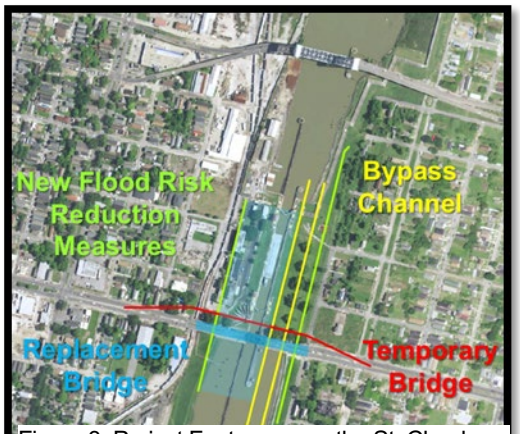

Figure 3. Project Features near the St. Claude Avenue Bridge

- Once the new lock becomes operational and all new levees and floodwalls are constructed, the old lock would be put into pass-through mode. During this time a south bypass channel around the east side of the old lock would be constructed to allow for continued vessel traffic while the old lock is demolished (see Figure 3). Hydraulic and/or mechanical dredges would remove approximately 85,000 cubic yards of sediment from DMMU 10 to construct the south bypass channel. This material is suitable for open water placement and would be discharged into the Mississippi River.
- Once the south bypass channel is operational, the old lock would be demolished and the structural material hauled away to be salvaged or scrapped. About 181,000 cubic yards of dredged material would then be removed from the lock demolition site (DMMU 9) with hydraulic and or mechanical dredges. This material is suitable for open water discharge into the Mississippi River. Upon completion, the new lock and connecting channels would be fully functional.

*Dredged Material Disposal Plans*

Soils and sediments that require excavation for project construction have been thoroughly evaluated under regulations and procedures developed under requirements of the Clean Water Act and may be divided into two categories.

- Approximately 614,000 cubic yards of dredged material that would be excavated from Dredged Material Management Units (DMMUs) 3, 4, 6, 9, and 10 is "suitable for open water discharge" (see Figure 4). This material is non-toxic to sensitive benthic organisms, does not contain contaminants at concentrations that would adversely bioaccumulate or bio-magnify in aquatic food webs, and would not violate or exceed regulatory water quality criteria or drinking water standards upon discharge into the proposed Mississippi River open-water disposal site. The dredged material would mix

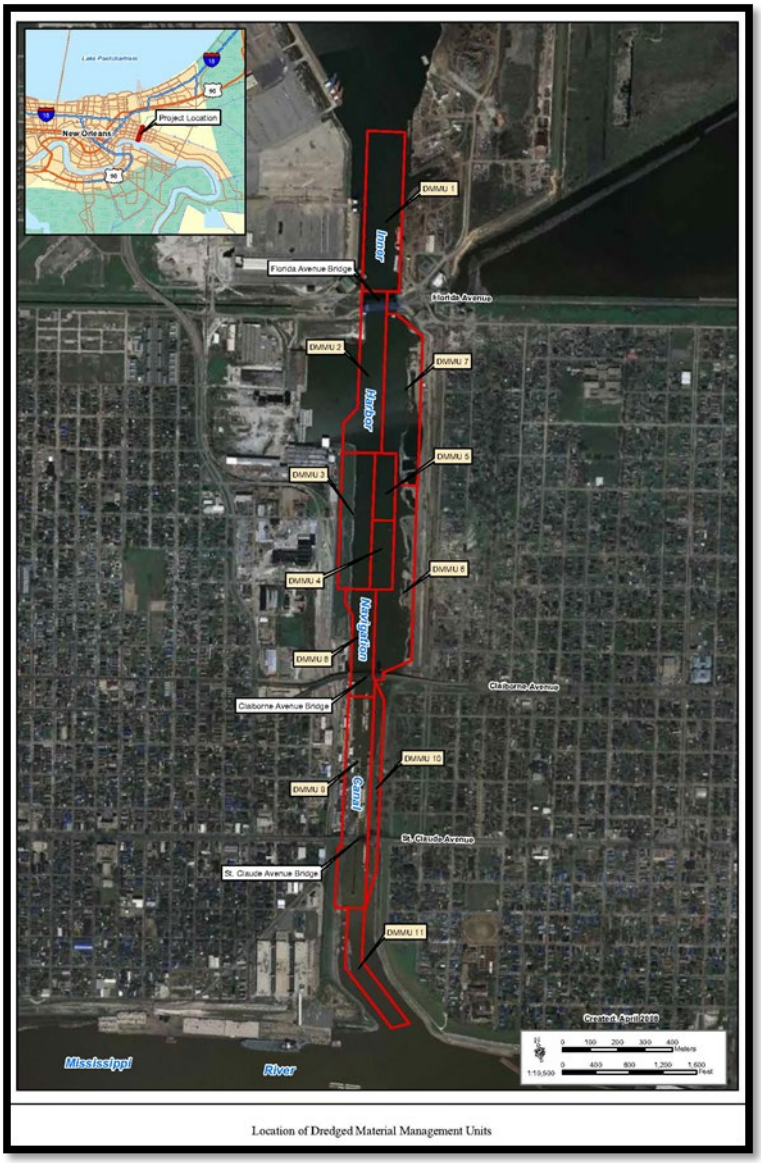


Figure 4. Location of IHNC Dredged Material Management Units.

with the river's normal suspended and bedload sediments and be carried downstream. Approximately 105,000 cubic yards of dredged material that would be excavated from DMMUs 5 and 7 is "unsuitable for open water discharge" because it is toxic to sensitive benthic organisms. This material would be excavated with an environmental bucket dredge to minimize on-site loss of material and turbidity, and would be hauled to and permanently disposed in a permitted solid waste landfill.

- Dredging depths and widths required for the this plan do not warrant vertical or lateral subdivision of DMMUs into "native layer" and "fill" categories as for previously-evaluated deep draft lock alternatives. However, results from chemical and biological testing of the material within these DMMUs were utilized in assessing current dredged material disposal alternatives in that contaminant maximums and worst-case toxicity determinations for overlapping units were considered to represent a dredging unit. As an example, testing results from the non-native or fill layer of DMMU 7 which contained higher levels of contaminants than the native layer were used to represent the entire unit, and were not averaged or weighted with native and fill layers.
- DMMUs previously evaluated for deeper lock alternatives that have sufficient depth and would not be dredged as part of this plan are DMMUs 1, 2, 8, and 11 (IHNC Channel).

The lock replacement alternatives evaluated in prior reports (1997 and 2009) would have required large areas for the disposal of dredged material generated from lock construction. In those reports, large quantities, up to 1,400,000 cubic yards, were to be excavated with hydraulic dredges and pumped as a slurry to confined disposal areas located along the south bank of the GIWW/MRGO east of the IHNC. Some dredged material would have also been placed into the deep channel of the Mississippi River.

A reevaluation of dredged material disposal alternatives was conducted for this report. It was determined that the required dredging quantities for all DMMUs were significantly reduced from the volumes described for all of the alternatives assessed previously. Two dredging and disposal alternatives were evaluated for the discharge of dredged material that has been determined to be unsuitable for aquatic disposal: 1) hydraulic dredging and disposal in an 81-acre confined disposal facility located along the south bank of the GIWW; and 2) environmental bucket dredging and placement into hopper barges and transported to a permitted solid waste landfill. Cost estimates associated with the use of an environmental bucket dredge and subsequent disposal of dredged material into a permitted solid waste landfill were determined to be less costly than hydraulic dredging and permanent confinement of dredged material in a confined disposal facility. Moreover, the use of an environmental bucket dredge and disposal into a permitted solid waste landfill would eliminate impacts to productive fish and wildlife habitats, including wetlands, as well as avoid and minimize potential adverse impacts to waters of the U.S. The dredged material determined to be suitable for aquatic disposal would be hydraulically dredged and disposed into the Mississippi River. Earthen fill material would also be needed for backfill at and around the new lock construction site, however this deposition of fill is not expected to cause impacts that warrant special construction

conditions. Construction specifications would include measures to avoid and minimize impacts to threatened and endangered species, namely West Indian manatee and pallid sturgeon, if they are observed in or near the construction site, even though no such encounters are expected.

**Occurrence of Threatened and Endangered Species:** In a letter dated March 29, 1989, the NMFS supplied a list of endangered and threatened species which might occur in the vicinity of the proposed project. The list included the green (*Chelonia* mydas), hawksbill (*Eretmochelys imbricate*), Kemp's ridley (*Lepidochelys kempi*), leatherback (*Dermochelys* coriacea), and loggerhead (*Caretta caretta*) sea turtles and the finback (*Balaenoptera physalus*), sei (*Balaenoptera borealis*), blue (*Balaenoptera musculus*) and sperm whales (*Physeter macrocephalus*). A biological assessment (BA) was prepared for these species and submitted to the NMFS on May 9, 1989. The BA concluded that it would be unlikely for the proposed project to have an impact on any of the listed species. In a letter dated May 24, 1989, the NMFS concurred with the determination that populations of endangered/threatened species under their purview would not be adversely affected by the proposed project. A copy of the 1989 letter is included as an enclosure. In October 1996, CEMVN requested the NMFS update the endangered and threatened species consultation. Information concerning the plans under consideration was provided to the NMFS, including the proposed graving site. The NMFS responded that the proposed activities would not adversely affect listed or proposed threatened or endangered species. A copy of the 1996 letter is included as an enclosure.

Green sea turtles (*Chelonia mydas*) were listed as threatened on July 28, 1978 (43 FR 32800-32811). Green sea turtles occupy three habitat types: high energy oceanic beaches (nesting), convergence zones in pelagic habitat (juvenile foraging), and benthic feeding grounds in relatively shallow, protected waters (adult foraging) (USFWS 1993). Common adult foraging habitats are pastures of seagrasses and algae, but small green turtles can also be found over coral reefs, worm reefs, and rocky bottoms. In the southeastern U.S., green sea turtles nest primarily in Florida from June to September (LDWF 2007a).

The hawksbill sea turtle was listed as endangered on April 14, 1970 (35 FR 6069). Hawksbill sea turtle adults average about 2.5 feet in length and weigh between 95 to 165 pounds (USFWS 1993). Hawksbill sea turtles nest on low and high-energy beaches in tropical oceans of the world. Hawksbill sea turtles may occur offshore of Louisiana, but other than isolated strandings, beaches within Louisiana are not utilized by these turtles. In Louisiana and other coastal portions of the Gulf of Mexico, this is one of the most infrequently encountered sea turtles (LDWF 2007a).

Leatherback sea turtles were first listed as endangered on June 2, 1970 (35 FR 6069). The leatherback sea turtle nests on the shores of the Atlantic, Pacific, and Indian Oceans. The adult leatherback can reach 6.5 feet in length and 500 to 2,000 pounds in weight and is commonly found in cool, as well as in subtropical-tropical waters (NOAA Fisheries 2006a). Although it is generally a deep-diving oceanic species that forages on gelatinous planktonic animals, leatherbacks seasonally move into coastal waters, including estuaries

and coastal bays, to feed on large jellyfish associated with rivers and frontal boundaries. Small numbers of leatherback sea turtles nest on barrier islands and mainland beaches in the northeastern Gulf of Mexico (LDWF 2007a).

Loggerhead sea turtles were listed as threatened on July 28, 1978 (43 FR 32800-32811). Loggerhead sea turtles are found in temperate and tropical waters worldwide. Following a 1 to 2-year pelagic stage, adults inhabit nearshore continental shelf and estuarine environments in the Atlantic, Pacific, and Indian Oceans (NOAA Fisheries 2006b). Loggerhead sea turtles generally nest on high- to moderate-energy beaches and may favor steeply sloped beaches with gradually sloped offshore approaches. Loggerhead sea turtle nests are common on the northeastern Gulf of Mexico coasts of Alabama and Florida and the second-largest population of this species in the world nests on Florida's east coast. In Louisiana, loggerhead sea turtles are found throughout the coastal region but nesting has only been recorded on the Chandeleur Islands (LDWF 2007a).

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970 (35 FR 18319) and is found only in the Gulf of Mexico and North Atlantic Ocean, north of the Caribbean Sea. This is the smallest species of Atlantic Ocean sea turtles and has a single primary nesting area along a 10-mile stretch of beach near Rancho Nuevo, on the Gulf of Mexico coast of Mexico where large aggregations of nesting females come ashore together. Occasional nesting has been reported along the Texas, Alabama, and Florida coasts. Crustaceans, especially crabs, are reported to be its preferred food, and both juveniles and adults are found in nearshore waters, including estuaries, tidal rivers, and sea grass beds throughout the northern Gulf of Mexico. The once critically small population of Kemp's ridley sea turtle has increased in recent years due to management programs of the USFWS and the NOAA Fisheries. Although it is not know to nest in Louisiana, the offshore waters may afford key feeding and development sites and the Kemp's ridley sea turtle is more frequently observed in Louisiana's inshore waters than other sea turtles (LDWF 2007a).

Finback whales are present in the Gulf of Mexico throughout the year which could suggest a somewhat isolated population. Four recorded strandings have occurred along the southeast coast of Louisiana. Sei whales have only been recorded four times in the Gulf of Mexico. Two of these recordings occurred in Louisiana; one near Fort Bayou in Plaquemines, Parish in 1956 and one from Marsh Island in 1990. There are two records of blue whales in the Gulf of Mexico; one occurred when a stranded individual was found near the mouth of Sabine Pass, Cameron Parish, Louisiana in December 1924. Sperm whales are generally found beyond the continental shelf in the Gulf of Mexico the majority of sightings occurred from beyond the 1,000 fathom line. Strandings of individuals have been recorded from Cameron, Terrebone, and Plaquemines Parishes (LDWF 2007b).

**Potential for Project Impacts to Threatened and Endangered Species:** According to the Louisiana Department of Wildlife and Fisheries, hawksbill sea turtles are rarely encountered in Louisiana or along the coasts of the Gulf of Mexico. Loggerhead sea turtles, the Kemp’s ridley sea turtle, and the green sea turtle have been sighted in the

MRGO in the vicinity of the bar channel where the MRGO connects to the Gulf of Mexico. Construction in the project area would be conducted well above the bar channel and would have no effect on any listed threatened or endangered species or their critical habitat.

**Conclusion:** The CEMVN has determined that the proposed project will not affect any threatened or endangered species or critical habitat under the purview of the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries), Protected Species Division. Under the January 13, 2017 NMFS Procedural Instruction 02-110-20, the NOAA Fisheries reviewed its consultative responsibilities under Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536, and associated regulations at 50 C.F.R. part 402 and determined it will not provide formal written responses to requests for concurrence with a federal action agency's determination that its actions will not affect any ESA-listed species or designated critical habitat ("no effect" determination) (http://www.nmfs.noaa.gov/op/pds/index.html) (January 6, 2017 IHNC GRR/SEIS Appendix A, Annex 5). As such, endangered species consultation with NOAA Fisheries is complete.

**References:**

LDWF 2007a. Rare Animals of Louisiana, Green Sea Turtle (*Chelonia mydas*); Hawksbill Sea Turtle (*Eretmochelys imbricata*); Kemp's Ridley Sea Turtle (*Lepidochelys kempii*); Leatherback Sea Turtle (*dermochelys coriacea*); and Loggerhead Sea Turtle (*Caretta caretta*). Louisiana Department of Wildlife and Fisheries, Louisiana National Heritage Program.

LDWF 2007b. Rare Animals of Louisiana, Blue Whale (*Balaenoptera musculus*); Finback Whale (*Balaenoptera* physalus); Sei Whale (*Balaenoptera borealis*); Sperm Whale (*Physeter macrocephalus*). Louisiana Department of Wildlife and Fisheries, Louisiana National Heritage Program.

NOAA Fisheries 2006a. Office of Protected Resources, Leatherback Sea Turtle Fact Sheet, http://www.nmfs.noaa.gov/pr/species/turtles/leatherback.htm

NOAA Fisheries 2006b. Office of Protected Resources, Loggerhead Sea Turtle Fact Sheet, http://www.nmfs.noaa.gov/pr/species/turtles/loggerhead.htm

USFWS 1993. Working Draft, Region 4, Template for Biological Opinions on Beach Nourishment Activities that May Affect Sea Turtles.

Department of Commerce · National Oceanic & Atmospheric Administration · National Marine Fisheries Service

***NATIONAL MARINE FISHERIES SERVICE PROCEDURAL INSTRUCTION 02-110-20***
January 13, 2017

Protected Resources Management

Conservation of Threatened and Endangered Species 02-110

***"NO EFFECT" DETERMINATIONS***

**NOTICE:** This publication is available at: http://www.nmfs.noaa.gov/op/pds/index.html

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***SUMMARY OF REVISIONS:***

Signed Donna S Wieting 1/13/17
Donna Wieting Date
Director, Office of Protected Resources

1.0 Introduction. The National Oceanic and Atmospheric Administration's (NOAA) National Marine Fisheries Service (NOAA Fisheries) reviewed its consultative responsibilities under section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536, and associated regulations at 50 C.F.R. part 402. Based on this review NOAA Fisheries will not provide formal written responses to requests for concurrence with a federal action agency's determination that its actions will not affect any ESA-listed species or designated critical habitat ("no effect" determination).

Under section 7 of the ESA, if a federal action agency determines that its action "may affect" ESA-listed species or designated critical habitat within NOAA Fisheries jurisdiction, the federal action agency must consult with NOAA Fisheries to ensure that its action is not likely to jeopardize the continued existence of those species or result in the destruction or adverse modification of such critical habitat. The term "may affect" is not defined in the ESA or by NOAA Fisheries/United States (U.S.) Fish and Wildlife Service's joint regulations governing section 7 consultation at 50 CFR, Chapter IV. However, the NOAA Fisheries/US Fish and Wildlife Service's *Final ESA Section 7 Consultation Handbook, March 1998,* (found in PD 02-110-09, hereinafter "*ESA Section 7 Handbook*") defines the term "may affect" as: "the appropriate conclusion when a proposed action may pose **any** effects on ESA-listed species or designated critical habitat." If the federal action agency determines that its activities "may affect" an ESA-listed marine or anadromous species or its designated critical habitat, it must

engage in consultation.

If, on the other hand, the federal action agency determines that its action will not affect any ESA-listed species or designated critical habitat within NOAA Fisheries' jurisdiction (i.e., it makes a "no effect" determination), there is no need to consult with NOAA Fisheries. As with "may affect," the term "no effect" is not defined in the joint regulations governing section 7 consultation, but it is defined in the Services' *ESA Section 7 Handbook* as: "the appropriate conclusion when the federal action agency determines its proposed action will not affect a listed species or designated critical habitat." Neither the ESA nor the NOAA Fisheries/U.S. Fish and Wildlife Service's joint consultation regulations mandate consultation when federal action agencies determine their proposed actions have "no effect" on any ESA-listed species or designated critical habitat.

Although not required to do so, action agencies sometimes request that NOAA Fisheries provide written concurrence with the agency's "no effect" determination per the guidance provided in the *ESA Section 7 Handbook*, (page 3-12). NOAA Fisheries has previously (though infrequently) provided such written concurrence with federal action agency "no effect" determinations. However, as directed herein, it shall be NOAA Fisheries' procedure not to provide a written response.

2.0 Objective. The purpose of this procedure is to promote effective, efficient, and consistent implementation of section 7 of the ESA by NOAA Fisheries personnel.

3.0 Authorities and Responsibilities. This directive establishes the following authorities and responsibilities:

*Guidelines and Procedures*: "No effect" determinations under section 7 of the ESA are the province of action agencies, which may make such findings without seeking the agreement of NOAA Fisheries. A U.S. District Court decision addressed this very issue and issued an opinion that wholly validates NOAA Fisheries' procedure.

The case in question, *Sierra Forest Legacy v. United States U.S. Forest Service*, 598 F. Supp. 2d 1058 (N.D. Cal. 2009), concerned the U.S. Forest Service's determination that an amendment to a "management indicator species" list would have "no effect" on any ESA-listed species and NOAA Fisheries and the U.S. Fish and Wildlife Service's concurrence with that determination. Plaintiffs, environmental groups, filed suit against the Forest Service, NOAA Fisheries, and the U.S. Fish and Wildlife Service arguing, among other things, that the Services violated the ESA in issuing the concurrences. In dismissing the case against the Services, the court declined to address the substantive correctness or incorrectness of the written concurrences. As the court explained, because the U.S. Forest Service never initiated formal consultation, there was no requirement [to issue concurrences] imposed on NOAA Fisheries and the U.S. Fish and Wildlife Service. Thus, the court found that the plaintiff could not challenge the concurrences. *See also id at 1067-69.* The court made clear that it would have reached the same conclusion even if NOAA Fisheries and the U.S. Fish and Wildlife Service had instead disagreed with the U.S. Forest Service's "no effect" finding and issued non-concurrences. *Id.* at 1067 ("Until an action agency requests consultation, [the Services] have no obligation to consult, and in fact cannot

engage in consultation, even if they believe the 'no effect' determination was erroneous.").

Furthermore, neither the ESA nor the joint regulations governing section 7 consultation contain any direction or process for NOAA Fisheries to provide its concurrence with such determinations. Although the *ESA Section 7 Handbook* indicates that a federal action agency may choose to request concurrence with its no effect determination, the handbook does not obligate NOAA Fisheries to acknowledge the request or to respond.[1] It is therefore NOAA Fisheries' procedure that it will not provide any written concurrence with a federal action agency's determination that its action will have "no effect" on any ESA-listed species or designated critical habitat.[2]

[1] If requested, NOAA Fisheries staff may provide technical information and assistance to the federal action agency as it decides whether to make a "no effect" determination. However, as provided herein, NOAA Fisheries shall decline to concur with any such final determination. In cases where NOAA Fisheries disagrees with the federal action agency's "no effect" determination, NOAA Fisheries may offer to provide the above-referenced technical assistance and may urge the federal action agency to engage in ESA section 7 consultation.

[2] This procedure is not intended to address, and is not applicable, when the federal action agency determines that its action "may affect" certain species and/or habitat but will have "no effect" on others (sometimes referred to as "mixed determinations").