

Standard Alignment: 7-MS-LS2-4 (Middle School Life Science)

PE: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

CS: Emphasis is on recognizing patterns in data, making inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.

Focus of Inquiry: Students will learn how environmental changes can alter a fish's habitat preferences.

Duration: 25 - 35 minutes

Setting: Indoors or Outdoors

Grade Level: 7th grade but could be adjusted up or down

Prior Knowledge

Students: Should have prior experience using a coordinate plane (older students) or understanding labeled grids (younger students).

Teachers: Should be familiar with the 2019 Mississippi River flood event and its impact on estuarine and marine ecosystems due to freshwater intrusion.

Materials:

- Lake Pontchartrain Habitat Grid (Gameboard)
- Fish Game Pieces: Flounder, Sea Trout, Red Snapper
- Fish Descriptions
- Hydrocoast Maps: July 2020 and June 2019
- Instructor Gameboard (larger than student boards)
- Instructor Game Pieces
- Otoliths (for extension)
- Magnifying glasses (for extension)
- Large Stand Dry Erase Boards x2
- Masking Tape

Introduction (5 minutes): First, we are going to orient ourselves with our maps.

Let's talk habitats: - markers & sign

Take a look at your map. Using your dry erase markers label the following: (Go through each item one by one and ask them to put their finger where they think it is located. Then direct

them to the exact coordinate. This will not only test their spatial knowledge, it will teach them how to use the grids to locate spots on the map.

- The Mississippi River A-3
- The Gulf of America G, H, I
- Lake Pontchartrain A, B, C 1-2
- Put a star on our location - Where we are right now.... C- 1

Engage students in discussion:

- Ask: "Have you ever been fishing? Where?"
- Prompt thinking: "Where do different fish species live and why?"

Introduce fish species with a Fish Trivia Game.

One student in each group holds a fish card and figure. Ask questions to identify the species based on the description.

Example questions:

- Which fish has both eyes on one side of its head as a juvenile? (Flounder)
- Which fish has a ruby red body? (Red Snapper)
- Which is the most popular saltwater fish in Louisiana? (Sea Trout)

Now that we know our map, let's get to know the fish that live in this habitat:

Ask students if they go fishing? Next, ask them how they know where to find certain fish. (For example, would you typically find a bluegill by Grand Isle? Or a red snapper in the Tickfaw River?) Each fish has certain environmental conditions that they prefer.

Location matters: - sign

What are the things that help determine where a fish wants to live exactly?

Salinity -

- Put an S where you think the water is salty
- Put an F where you think the water is most fresh
- Is there something in between? Brackish water - put a B where you think brackish water might be.

Once we learn about a fish's suitable habitat, we can better predict where to find them.

Exploration: (5-10 minutes)

Fish life - Cards and Fish

Read each fish card and ask students to place their fish where they think it will live the happiest life. Do this for all three cards emphasizing the clues that help them find the correct fish location or close to it. Monitor students and help them think through the clues if necessary to get relatively in the appropriate area.

Then it's time for fish battle ship. Have them take turns calling coordinates and circle the fish if their opponents locate it.

For the last round call out your locations and see if any of the students have their fish in the same location: Put the flounder on D2, the seatrout on E3, and the red snapper on H4.

Explain: (10-15 minutes)

Provide background:

- This spillway is only opened in years when the river is at flood stage and threatens to flood the city of New Orleans. 2019 was a historic and devastating year along the Mississippi River. Baton Rouge spent a record 211 days at flood stage from January 6 - August 4; the former record dates back to the Great Flood of 1927, when the river was at flood stage for 135 days. Levees were breached on the Arkansas, Missouri and upper Mississippi rivers.
- Ask the students if they think that this would have impacted fish catches.
- Widespread flooding caused the spillway to open, pushing large volumes of freshwater into estuarine ecosystems.
- This led to major impacts on local fisheries.

Discuss federal fisheries disaster declarations and highlight real-world consequences:

- Shrimp, crab, and finfish populations declined significantly
- Oyster reef losses were nearly complete in some areas

Elaborate: (5-10 minutes)

Distribute the July 2020 Hydrocoast Salinity Map to each group.

Discuss salinity gradients and how different levels of salinity influence fish habitat.

Key concepts to cover:

- Each contour line represents a change in salinity (ppt: parts per thousand)

- Some fish prefer brackish water (flounder, sea trout); others prefer saltwater (red snapper)

Next, distribute the June 2019 Hydrocoast Map. Have students compare maps and note changes.

Guide discussion:

- What might explain the dramatic change in salinity?
- Introduce the Bonnet Carré Spillway and its role in flood management.

Evaluate: Now, have students take their fish game pieces and re-position them where they think they would be given this change to the environment.

- Compare answers.
- On the Instructor Board, put the flounder on F3, the seatrout on G4, and the red snapper on H5.

Expand (Optional): (5-10 minutes)

Ask the students what other factors might determine where fish live based on the things we have learned.

Other factors:

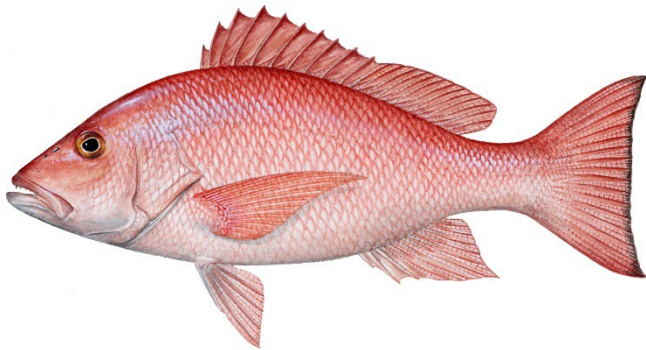
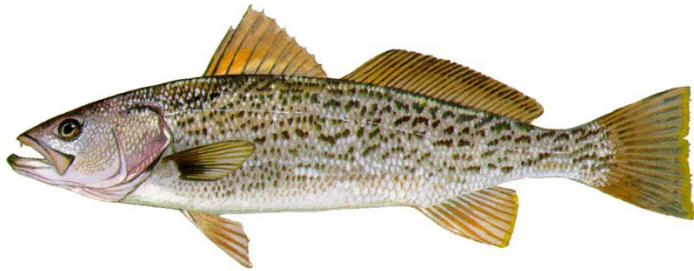
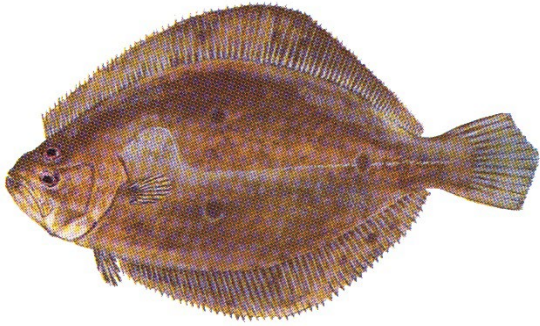
- Dissolved oxygen - movement, temp (cold = more, hot = less, aquatic plants = more DO b/c of photosynthesis, less pollution = more DO)
- Water depth
- Water movement

Then ask, how do we know where fish live? Students will suggest several things.

Show them some fish otoliths under a magnifying glass (both the whole otoliths and the sectioned ones). Explain that this is part of a fish's ear and is formed by layers of calcium carbonate crystals. These layers are influenced by the environment that a fish is swimming in, so they serve as a record of both the age of a fish and the habitat that it occupies. The size and shape of an otolith vary by species.

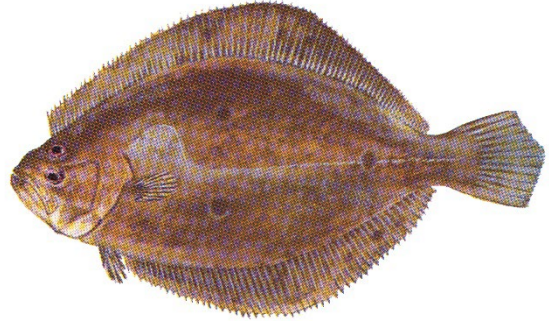
Explain that scientists use otoliths to understand lots of information about a fish-how old it is, where it has been, how the environment it lives in has changed, etc. LDWF is a state agency that is tasked with monitoring changes in the state's fisheries. Part of their job is to collect otoliths and study the health of finfish populations.

Evaluate: Now, give students the pictures of the otoliths and the actual otolith and see if they can match the real otolith to the picture.



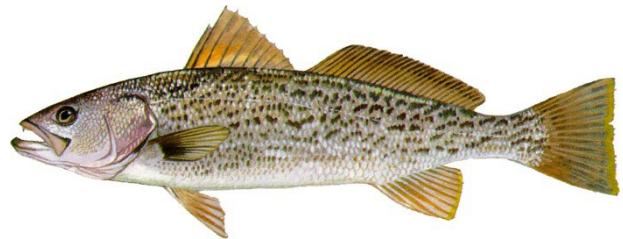
Flounder

1. When I am a larva, I have an eye on both sides of my flat body. As I become a juvenile, my right eye moves to join my left eye on my left side!
2. I can usually be found around muddy bottoms within an estuary, but I also like to hangout in bays near docks and rock jetties.
3. I am a euryhaline fish, which is a fancy way of saying I can tolerate a range of salinities! I can live in freshwater lakes, brackish estuaries, and the open ocean as long as it has a salinity level between 0 and 60ppt.
4. A significant amount of my species' harvest within the last decade is due to recreational fishermen.



Spotted Sea Trout

1. I get my name from the spotted dark brown speckles on the dorsal side and dorsal fin of my silvery gray body.
2. I can be found anywhere between deeper estuaries to the open ocean with a maximum depth of 30 feet.
3. For me, seasons and salinity go hand in hand! During summer, I like high-salinity areas and prefer low-salinity spots in the winter.
4. I am the most popular fish among recreational Louisiana fishermen along coastal Louisiana!



Red Snapper

1. I have a white undercarriage with a ruby-red body to match my red eyes!
2. I like a range of habitats in Louisiana. You can find me around at the sandy/muddy bottom near natural and man-made structures, or you can find me in the water column if I am hungry or spawning.
3. I am a marine fish, so I LOVE saltwater. You can find me in the salty water of the Gulf between 30 and 620 feet!
4. A recent assessment of my stock in the Gulf indicates that our population appears healthy!

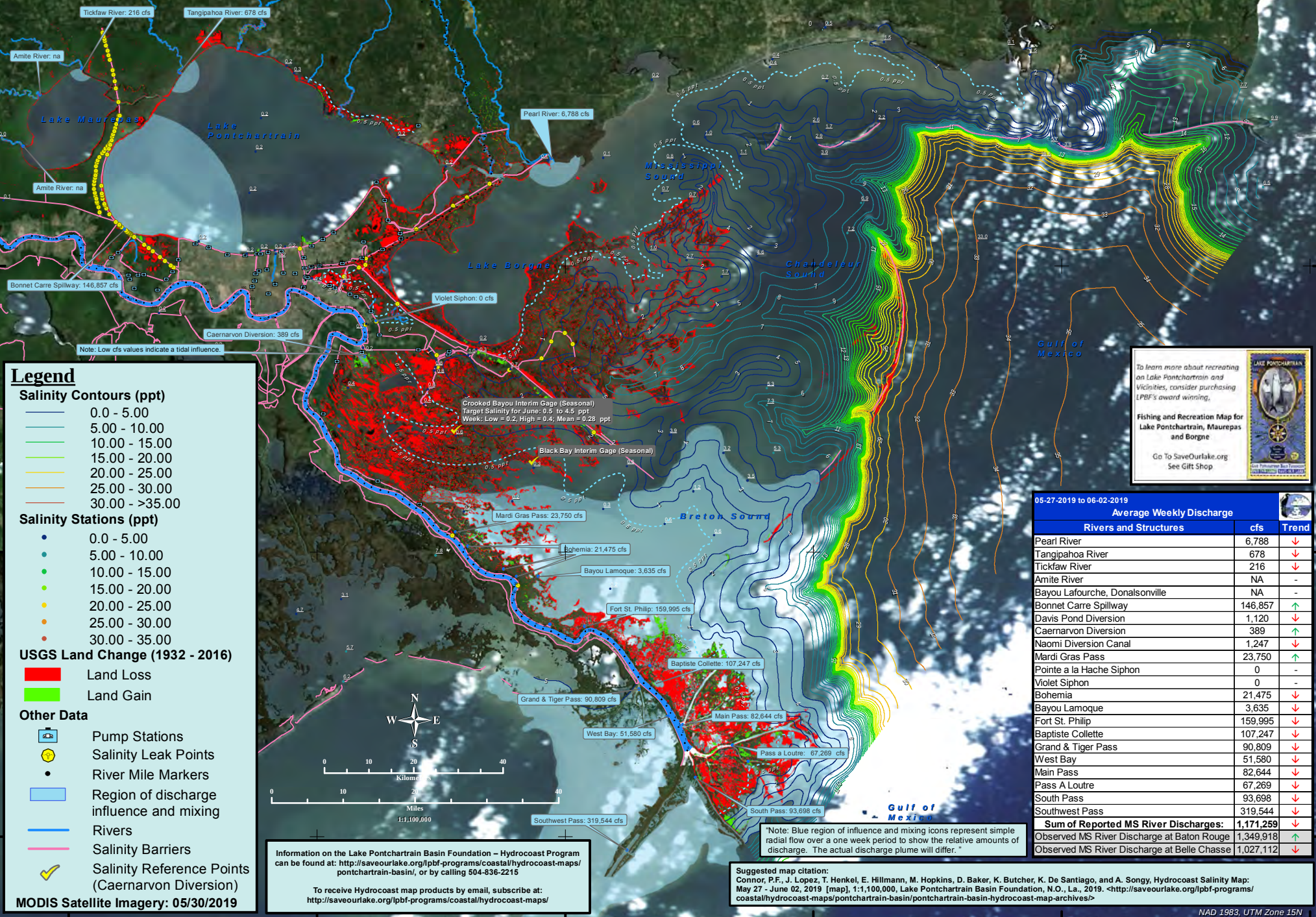


Sea Grant
LOUISIANA



Hydrocoast Map - Salinity

(May 27 - June 02, 2019)



Legend

Salinity Contours (ppt)

- 0.0 - 5.00
- 5.00 - 10.00
- 10.00 - 15.00
- 15.00 - 20.00
- 20.00 - 25.00
- 25.00 - 30.00
- 30.00 - >35.00

Salinity Stations (ppt)

- 0.0 - 5.00
- 5.00 - 10.00
- 10.00 - 15.00
- 15.00 - 20.00
- 20.00 - 25.00
- 25.00 - 30.00
- 30.00 - 35.00

USGS Land Change (1932 - 2016)

- Land Loss
- Land Gain

Other Data

- Pump Stations
- Salinity Leak Points
- River Mile Markers
- Region of discharge influence and mixing
- Rivers
- Salinity Barriers
- Salinity Reference Points (Caernarvon Diversion)

MODIS Satellite Imagery: 05/30/2019

To learn more about recreating on Lake Pontchartrain and Vicinities, consider purchasing LPBF's award winning.

Fishing and Recreation Map for Lake Pontchartrain, Maurepas and Borgne

Go To SaveOurLake.org See Gift Shop

05-27-2019 to 06-02-2019		
Average Weekly Discharge		
Rivers and Structures	cfs	Trend
Pearl River	6,788	↓
Tangipahoa River	678	↓
Tickfaw River	216	↓
Amite River	NA	-
Bayou Lafourche, Donaldsonville	NA	-
Bonnet Carré Spillway	146,857	↑
Davis Pond Diversion	1,120	↑
Caernarvon Diversion	389	↑
Naomi Diversion Canal	1,247	↓
Mardi Gras Pass	23,750	↑
Pointe à la Hache Siphon	0	-
Violet Siphon	0	-
Bohemia	21,475	↓
Bayou Lamoque	3,635	↓
Fort St. Philip	159,995	↓
Baptiste Collette	107,247	↓
Grand & Tiger Pass	90,809	↓
West Bay	51,580	↓
Main Pass	82,644	↓
Pass à l'Ouvre	67,269	↓
South Pass	93,698	↓
Southwest Pass	319,544	↓
Sum of Reported MS River Discharges:		1,171,259
Observed MS River Discharge at Baton Rouge		1,349,918
Observed MS River Discharge at Belle Chasse		1,027,112

Information on the Lake Pontchartrain Basin Foundation - Hydrocoast Program can be found at: <http://saveourlake.org/lpbf-programs/coastal/hydrocoast-maps/pontchartrain-basin/>, or by calling 504-836-2215

To receive Hydrocoast map products by email, subscribe at: <http://saveourlake.org/lpbf-programs/coastal/hydrocoast-maps/>

Suggested map citation:
Connor, P.F., J. Lopez, T. Henkel, E. Hillmann, M. Hopkins, D. Baker, K. Butcher, K. De Santiago, and A. Songy, Hydrocoast Salinity Map: May 27 - June 02, 2019 [map], 1:1,100,000, Lake Pontchartrain Basin Foundation, N.O., La., 2019. <<http://saveourlake.org/lpbf-programs/coastal/hydrocoast-maps/pontchartrain-basin/pontchartrain-basin-hydrocoast-map-archives/>>

NAD 1983, UTM Zone 15N

Hydrocoast Map - Salinity

(July 06 - 12, 2020)



To learn more about recreating on Lake Pontchartrain and Vicinities, consider purchasing LPBF's award winning, Fishing and Recreation Map for Lake Pontchartrain, Maurepas and Borgne

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Legend

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USGS Land Change (1932 - 2016)

- Land Loss
- Land Gain

Other Data

- Pump Stations
- Salinity Leak Points
- River Mile Markers
- Region of discharge influence and mixing
- Rivers
- Salinity Barriers
- State Lines
- Federal and State Waters
- Salinity Reference Points (Caernarvon Diversion)

MODIS Satellite Imagery: 07/11/2020

Information on the Ponchartrain Conservancy - Hydrocoast Program can be found at: <http://scienceforourcoast.org/lpbf-programs/coastal/hydrocoast-maps/pontchartrain-basin/>, or by calling 504-836-2215

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Note: Blue region of influence and mixing icons represent simple radial flow over a one week period to show the relative amounts of discharge. The actual discharge plume will differ.

Suggested map citation:

Connor, P.F., J. Lopez, T. Henkel, E. Hillmann, M. Hopkins, D. Baker, K. Butcher, K. De Santiago, and A. Songy, Hydrocoast Salinity Map: July 06 - 12, 2020 [map], 1:1,100,000, Ponchartrain Conservancy, N.O., La., 2019. <<http://scienceforourcoast.org/lpbf-programs/coastal/hydrocoast-maps/pontchartrain-basin/pontchartrain-basin-hydrocoast-map-archives/>>

07-06-2020 to 07-12-2020

Average Weekly Discharge

Rivers and Structures	cfs	Trend
Wolf River, MS	698	↑
Biloxi River, MS	556	↑
Pascagoula River, MS	11,848	↑
Mobile River, AL	26,984	↑
Pearl River, LA	12,349	↑
Tangipahoa River, LA	2,146	↓
Tickfaw River, LA	617	↓
Amite River, LA	325	↑
Blind River, LA	6,178	↑
Bayou Lafourche- Donalsonville, LA	NA	-
Bonnet Carre Spillway, LA	0	↓
White Ditch Siphon, LA	0	-
Davis Pond Diversion, LA	1,075	↑
Caernarvon Diversion, LA	366	↓
Naomi Diversion Canal, LA	NA	-
Mardi Gras Pass, LA	15,600	↓
Pointe a la Hache Siphon, LA	0	-
Violet Siphon, LA	0	-
Bohemia, LA	0	↓
Bayou Lamoque, LA	1,016	↓
Fort St. Philip, LA	69,978	↓
Baptiste Collette, LA	58,045	↓
Grand & Tiger Pass, LA	46,858	↓
West Bay, LA	27,917	↓
Main Pass, LA	45,766	↓
Pass A Loutre, LA	39,314	↓
South Pass, LA	54,761	↓
Southwest Pass, LA	186,755	↓
Sum of Reported MS River Discharges:	547,451	↓
Observed MS River Discharge at Baton Rouge	605,458	↓
Observed MS River Discharge at Belle Chasse	552,819	↓

NAD 1983, UTM Zone 15N