

# River Runners: Tracking Wild Striped Bass

Students will practice math skills and explore the interconnectedness of oceans and rivers by tracking the movements of migratory striped bass.

## Learning Objectives:

Students will

- Draw a model of the life cycle of anadromous fish
- Use navigation tools to determine locations and distances from maps
- Read and listen to acquire facts and ideas from text
- Solve word problems using data from tagged fish to calculate distance traveled, and elapsed time
- Recognize how the distribution of animals varies geographically based on habitat requirements
- Compare data to understand graphs and river phenomena

**Grade Level:** Middle School

**Subject Area:** Math, Social Studies (Geography), Science, English Language Arts

## Teaching Time:

Preparation- 10 minutes

Activity time- 2 - 60-minute class periods

**Materials:** Each student should have:

- Worksheet: River Runners: Tracking Wild Striped Bass
- Striped Bass of the Hudson River student reading
- Tracking Map #1, and Tracking Map #2
- HRECOS water temperature graph #1, and #2
- Sea Surface Maps - January, and April
- Pencil
- Scrap paper
- If available, a wall map showing the Hudson and eastern coast of North America is very helpful for in-class discussion.

## New York State Science Learning Standards

- MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures.
- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem.
- MS-LS2-2. Construct an explanation that predicts pattern of interactions among organisms across multiple ecosystems.
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect population.



**Key Words:**

adaptation, anadromous, data, equator, estuary, fresh water, habitat, Hudson river miles, latitude, life cycle, longitude, migration, ocean, osmoregulation, Prime Meridian, scientist, sonic tag, spawn

**Background:**

Striped bass are hatched in the freshwater part of the Hudson river but eventually swim out into the Atlantic Ocean. They spend most of their adult lives at sea, returning to the river only to spawn (lay eggs). We think of them as "our" fish, but their visit here is just one piece of their long-distance migrations. Fishes with this life cycle (living in the ocean but entering fresh water to spawn) are called anadromous fishes.

Scientists attach tags, called sonic (or acoustic) tags, to fish to track their movements throughout the Estuary and Ocean. The tag relays a signal to a receiver that gives the location of the fish. Data collected can be used to determine location of where fish have been and how far they travel. Students will view Striped bass tagging data and create a map of their migration. These maps will help answer document-based questions about Striped bass movements and help students examine how fish distribution is linked to habitat needs. Students will also compare real time monitoring data to understand optimal time of year for spawning.

Distances on the Hudson are often measured in Hudson River Miles. Hudson River Miles start at the southern tip of Manhattan. This spot, called The Battery, is River Mile 0. The estuary part of the Hudson ends at the Federal Dam in Troy at River Mile 153.

**Activity:****Engage**

Go through the Striped Bass of the Hudson River presentation. Have student read: "Striped Bass of the Hudson River". In pairs have students discuss the importance of migration and why certain animals would migrate. Have students discuss any critical issues that fish may have when migrating. Have them share answers with the class.

**Explore**

Discuss the concept of migration and anadromous life cycle. Discuss the use of sonic tags and introduce the Hudson River Miles system; show students the Tracking Map #1. Explain that the lesson will track where striped bass migrate to and from. Discuss with students the importance of maps and what maps tell us. Discuss with students the difference between latitude and longitude, and how to find both on a map. Students can either be divided into pairs, or work on their own. Show students the tools they will be using and how to use them (graphs, worksheets, river miles map, HRECOS and sea surface temperature graphs). Have students work through River Runners: Tracking Wild Striped Bass student worksheets

**Explain**

Students will discuss the activity and their observations and compare their results from the worksheet with the class. If the extension activity has been completed, have students compare their maps to the computer generated maps.

## **Elaborate/Extend**

Following the discussion, the teacher will guide them in the following questions:

- How do striped bass know where to go when they spawn? How do they navigate? (no real right answer, but temperature cues, same river as their parent was born, habitats would all be good discussion topics)
- What habitats do striped bass need for all stages of their life cycle?
- What are some environmental factors that could cause striped bass decline?
- What can you do to help protect bass populations and keep them thriving in our rivers?

## **Evaluate**

Formative assessment should be ongoing throughout the activity by teacher observation of student work and completed worksheets.

**Extension:** Have students create their own maps using google maps and the excel file titled "Striped Bass Data". Directions are provided. Note students will need a google account to create map. Have students compare the map they created online to the map they created by hand.

## **Additional Resources:**

NYSDEC Hudson River Estuary Program lesson plans:

<http://www.dec.ny.gov/education/25386.html>

Hudson River Fisheries Unit Striped Bass information:

<https://www.dec.ny.gov/animals/6953.html>

NOAA Sea Surface Temperature Data

<https://coralreefwatch.noaa.gov/satellite/bleaching5km/index.php>

Atlantic States Marine Fisheries Commission

<http://www.asmfc.org/species/atlantic-stripped-bass>

Hudson River Environmental Conditions Observing System

<http://www.hrecos.org/>

## The Striped Bass of the Hudson River

Striped bass are found along the entire East Coast of North America and spend most of their lives in the Atlantic Ocean. They are the largest fish in the bass family and can grow as long four feet and weigh up to 65 lbs.! Found in the Hudson River, striped bass are an ecological, recreational, and economically important migratory species.

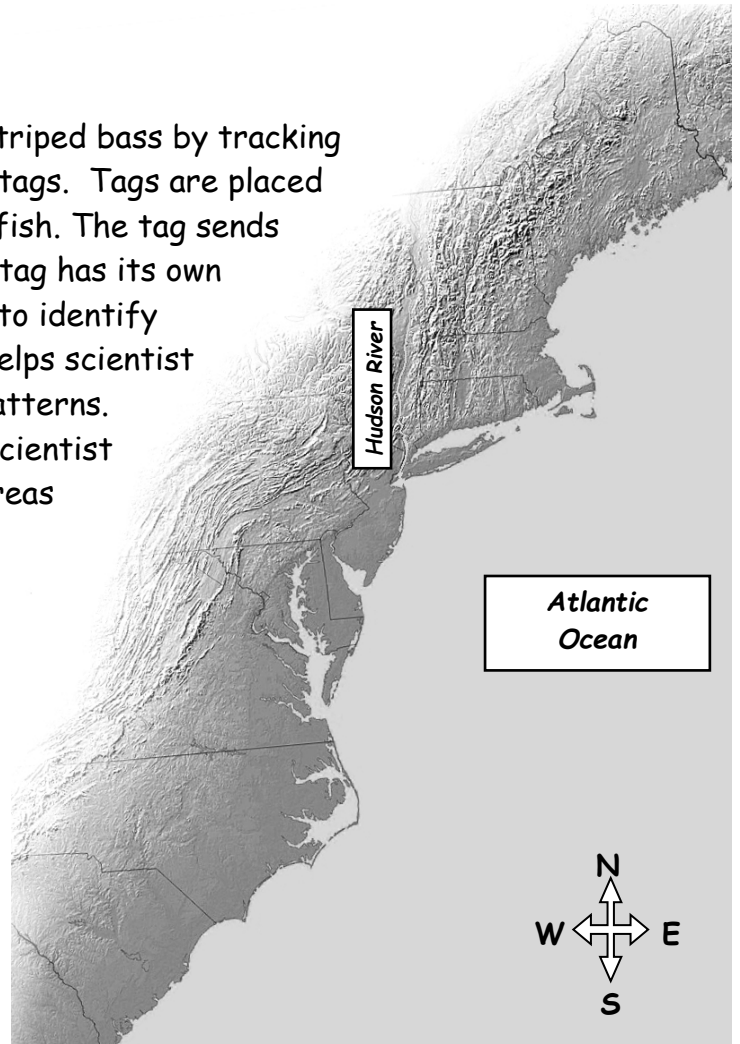


In the springtime, warmer water temperatures prompt striped bass to migrate to the Hudson River to spawn (lay eggs). Soon after spawning, adult fish return to the ocean. This is called an anadromous life cycle. It is challenging for a fish to switch between salt and fresh water. Striped bass and other migratory fish have amazing adaptations that allow their body to maintain fluid balance moving through salt and fresh water. This regulation of a fish's body that maintains fluid balance is called osmoregulation.

Scientists can study these movements of striped bass by tracking them. They use tags called a sonic (or acoustic) tags. Tags are placed inside a plastic capsule that is inserted into the fish. The tag sends a signal heard by underwater microphones. Each tag has its own special ID number and signal, allowing scientists to identify and follow a fish. Tagging and monitoring fish helps scientists learn about the fish's movement and migration patterns. Understanding movement of striped bass helps scientists understand habitat preferences, and spawning areas as well as strategies they can effectively use to protect bass and their habitats.



Young of the year Striped bass





# River Runners: Tracking Wild Striped Bass

## Student Worksheet

Many Hudson River fish are anadromous; hatched in freshwater, live in salt water. Striped bass spend most of their adult lives at sea returning to Hudson to spawn (lay eggs). Scientists attach tags called sonic (or acoustic) tags to striped bass to track their movements and migration throughout the Ocean and estuary (a body of water where fresh and saltwater meet).

You will use actual scientific data from a tagged male striped bass to plot its migration route and find out where and how far it traveled.



This is an example of a sonic tag; it is inserted through the skin.



The tagged fish is then released back into the water.



Using the data table below, plot the approximate striped bass locations on **Tracking Map #1** for each date. Make sure to label each plot mark with the date. Use your map to answer the questions below.

Date	Latitude (in degrees north of the equator)	Longitude (in degrees west of the Prime Meridian)	Sea Surface Temperature (SST)
Jan 24	38.14	74.94	
February 13	38.30	74.63	
March 29	38.30	74.80	
April 3	38.30	74.72	

Location data credit: NYSDEC Hudson River Fisheries Unit & University of Maryland

1. What is the general location of the striped bass from January to April?

2. Observe the sea surface temperature (SST) maps for January and April. Compare your completed Tracking Map #1 (where the Striped bass was located) and the SST maps and fill in the table with the SST for January and April.
3. Did the SST change from January to April? Did the SST temperature increase or decrease, or stay the same? Were you surprised by the data? Explain your answer.

Using the data table below, plot the approximate striped bass locations on **Tracking Map #2** for each date. Make sure to label each plot mark with the date. Using your map answer the questions below.

Date	Latitude (in degrees north of the equator)	Longitude (in degrees west of the Prime Meridian)	River Mile
April 24	41.03	73.88	25
April 25	41.44	73.99	55
April 26	41.93	73.95	92
April 27	41.99	73.94	96
May 3	42.07	73.92	108
May 10	42.21	73.85	113
May 17	42.25	73.80	117
May 22	42.29	73.78	120
May 30	42.21	73.85	113
June 1	41.92	73.95	92
June 2	41.44	73.99	55
June 3	41.03	73.88	25

4. According to the table and your plotted TRACKING MAP #2, on what date did the striped bass first get tracked in the Hudson river? What town was that near? (Hint: use the River Mile location to help you)

5. What was the last date the striped bass was tracked in the river?
  
6. How many days was the striped bass in the river?
  
7. Explain the general direction of travel for this fish.
  
8. How many River Miles did the striped bass travel in total? (be sure to start at River Mile 0)
  
9. This fish was tracked on April 25<sup>th</sup> at river mile 55, at 7:12 PM. It was tracked again on April 26<sup>th</sup> at river mile 92, at 11:12 AM.
  - a) How many miles did this fish travel from River Mile 55 to River Mile 92?
  
  - b) How long did it take for the fish to travel from River Mile 55 to River Mile 92?
  
  - c) Using your answers from (a) and (b), how fast was the fish swimming in miles per hour?
  
10. How long did it take the striped bass to travel north from River Mile 25 on April 24<sup>th</sup>, to River Mile 120 on May 22<sup>nd</sup>?
  
11. How long did it take the striped bass to travel south from river mile 120 on May 22<sup>nd</sup>, to River Mile 25 on June 3<sup>rd</sup>?

12. What do you notice about the movement north into the river, vs. the movement south out of the river?
  
13. This fish was last tracked in the Ocean on April 3<sup>rd</sup>. It was first tracked in the Hudson on April 24<sup>th</sup>. How many days did it take the bass to travel to the Hudson? How many miles did it swim? (use the scale bar on your map)
  
14. What was the water temperature leading up to striped bass migrating into the Hudson? (look at the SST maps and your table)
  
15. Using the HRECOS water temperature graph #1, what was the water temperature range when the striped bass was first tracked in the River?
  
16. According to this data, scientist believe that this striped bass spawned around May 22<sup>nd</sup>. Where in the river did the striped bass spawn (nearest town)?
  
17. Looking at the HRECOS water temperature graph #2, for this time frame, what is the optimal temperature range for striped bass to spawn?
  
18. After plotting the striped bass migration, and looking at temperature data what do you think the fish needs to survive and complete its life cycle? What environmental factors do you think Bass cope with?



## ANSWERS:

Using the data table below, plot the approximate striped bass locations on **Tracking Map #1** for each date. Make sure to label each plot mark with the date. Use your map to answer the questions below.

Date	Latitude (in degrees north of the equator)	Longitude (in degrees west of the Prime Meridian)	Sea Surface Temperature (SST)
Jan 24	38.14	74.94	10-15 degrees C
February 13	38.30	74.63	
March 29	38.30	74.80	
April 3	38.30	74.72	5-10 degrees C

*Location data credit: NYSDEC Hudson River Fisheries Unit & University of Maryland*

1. What is the general location of the striped bass from January to April?

**Answer: Atlantic Ocean, Off Coast of Maryland/Delaware**

2. Observe the sea surface temperature (SST) maps for January and April. Compare your completed Tracking Map #1 (where the Striped bass was located) and the SST maps and fill in the table with the SST for January and April.
3. Did the SST change from January to April? Did the SST temperature increase or decrease, or stay the same? Were you surprised by the data? Explain your answer.

**Answer: SST seemed to be cooler in April closest to the shore, which surprised me, as the air temperature would be warmer in April than in January. You can see on the SST maps that the purple color is smaller in January and extends wider in April.**

**This could be a combination of snow melt running off land, making the water cooler, or a cold late March early April in that year.**

Using the data table below, plot the approximate striped bass locations on **Tracking Map #2** for each date. Make sure to label each plot mark with the date. Using your map answer the questions below.

4. According to the table and your plotted TRACKING MAP #2, on what date did the striped bass first get tracked in the Hudson river? What town was that near? (Hint: use the River Mile location to help you)

**Answer: April 24<sup>th</sup>, near river mile 25, town: Piermont**

5. What was the last date the striped bass was tracked in the river?

**Answer: June 3**

6. How many days was the striped bass in the river?

**Answer: 40 days**

April 24-June 3    6 days left in April, 31 days May, 3 days in June

7. Explain the general direction of travel for this fish.

**Answer: Striped bass moved North up the Hudson, then South down the Hudson back out to the Atlantic Ocean.**

8. How many River Miles did the striped bass travel in total? (be sure to start at River Mile 0)

**Answer: 240 River Miles**

Moved north 120 miles, and down south 120 miles

9. This fish was tracked on April 25<sup>th</sup> at river mile 55, at 7:12 PM. It was tracked again on April 26<sup>th</sup> at river mile 92, at 11:12 AM.

d) How many miles did this fish travel from River Mile 55 to River Mile 92?

e) How long did it take for the fish to travel from River Mile 55 to River Mile 92?

f) Using your answers from (a) and (b), how fast was the fish swimming in miles per hour?

**Answer: a) 37 River Miles (92-55 = 37)**

<b>b) 16 hours</b>	12:00 PM	12 hours 0 minutes	4 hours 48 minutes
	-7:12 PM	<u>- 7 hours 12 minute</u>	<u>+ 11 hours 12 minutes</u>
		4 hours 48 min	16 hours

**c) 2.31 miles per hour    37 miles/16 hours**

10. How long did it take the striped bass to travel north from River Mile 25 on April 24<sup>th</sup>, to River Mile 120 on May 22<sup>nd</sup>?

**Answer: 28 days** April 24<sup>th</sup> - May 22<sup>nd</sup>

6 days + 22 days

11. How long did it take the striped bass to travel south from river mile 120 on May 22<sup>nd</sup>, to River Mile 25 on June 3<sup>rd</sup>?

**Answer: 12 days** May 22<sup>nd</sup> - June 3<sup>rd</sup>

9 days + 3 days

12. What do you notice about the movement north into the river, vs. the movement south out of the river?

**Answer:** Movement north into the river took 28 days. Movement out of the river only took 12 days. Striped bass spawned and quickly moved back out to the Ocean.

13. This fish was last tracked in the Ocean on April 3<sup>rd</sup>. It was first tracked in the Hudson on April 24<sup>th</sup>. How many days did it take the bass to travel to the Hudson? How many miles did it swim? (use the scale bar on your map)

**Answer: 21 days** April 23 - April 3

**Approximately 175 miles**

14. What was the water temperature leading up to striped bass migrating into the Hudson? (look at the SST maps and your table)

**Answer: 5-10 degrees Celsius**

15. Using the HRECOS water temperature graph #1, what was the water temperature range when the striped bass was first tracked in the River?

**Answer: between 50.5 - 54.8 degrees Fahrenheit**

About 10-12 degrees Celsius

16. According to this data, scientist believe that this striped bass spawned around May 22<sup>nd</sup>. Where in the river did the striped bass spawn (nearest town)?

**Answer: River Mile 120 in Coxsackie**

17. Looking at the HRECOS water temperature graph #2, for this time frame, what is the optimal temperature range for striped bass to spawn?

**Answer: about 64.5 degrees Fahrenheit to 63.25**

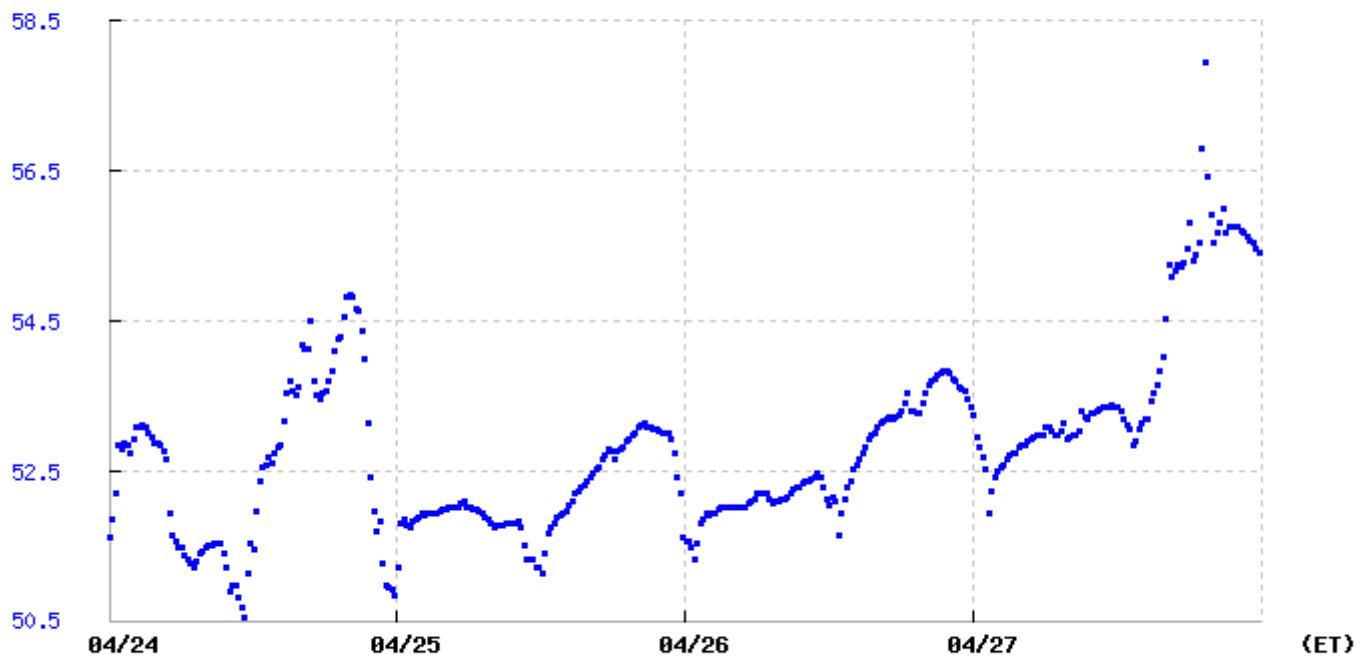
About 17-18 degrees Celsius

18. After plotting the striped bass migration, and looking at temperature data what do you think the fish needs in order to survive and complete its life cycle? What environmental factors do you think Bass cope with?

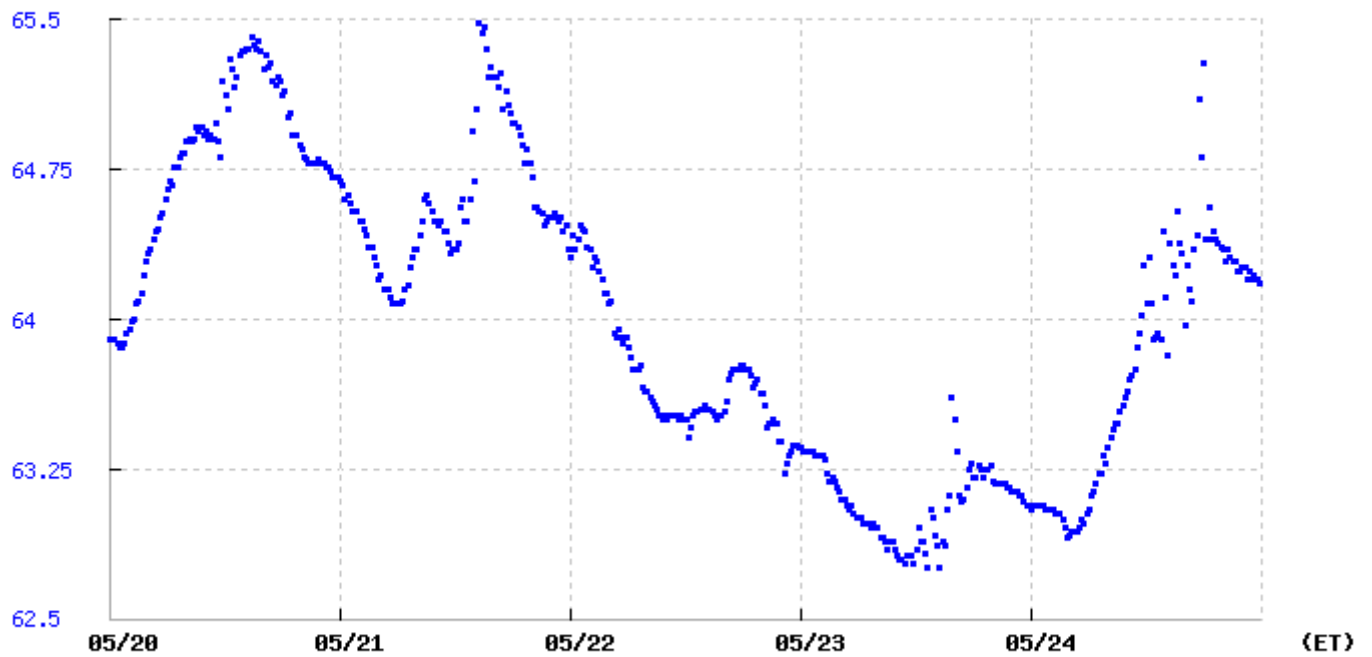
**Answer: answers may vary but looking for habitat needs, temperature needs, environmental.**

Striped bass live in the Ocean, so they need salt water to live. They migrate to rivers where their eggs need fresh water to hatch. They also need optimal temperature for spawning, and if you look in the literature it is around 15-17 degrees Celsius. They travel long distances to migrate to rivers to spawn. Environmental factors: habitat loss, long migrations, predation, human predation, pollution, climate change.

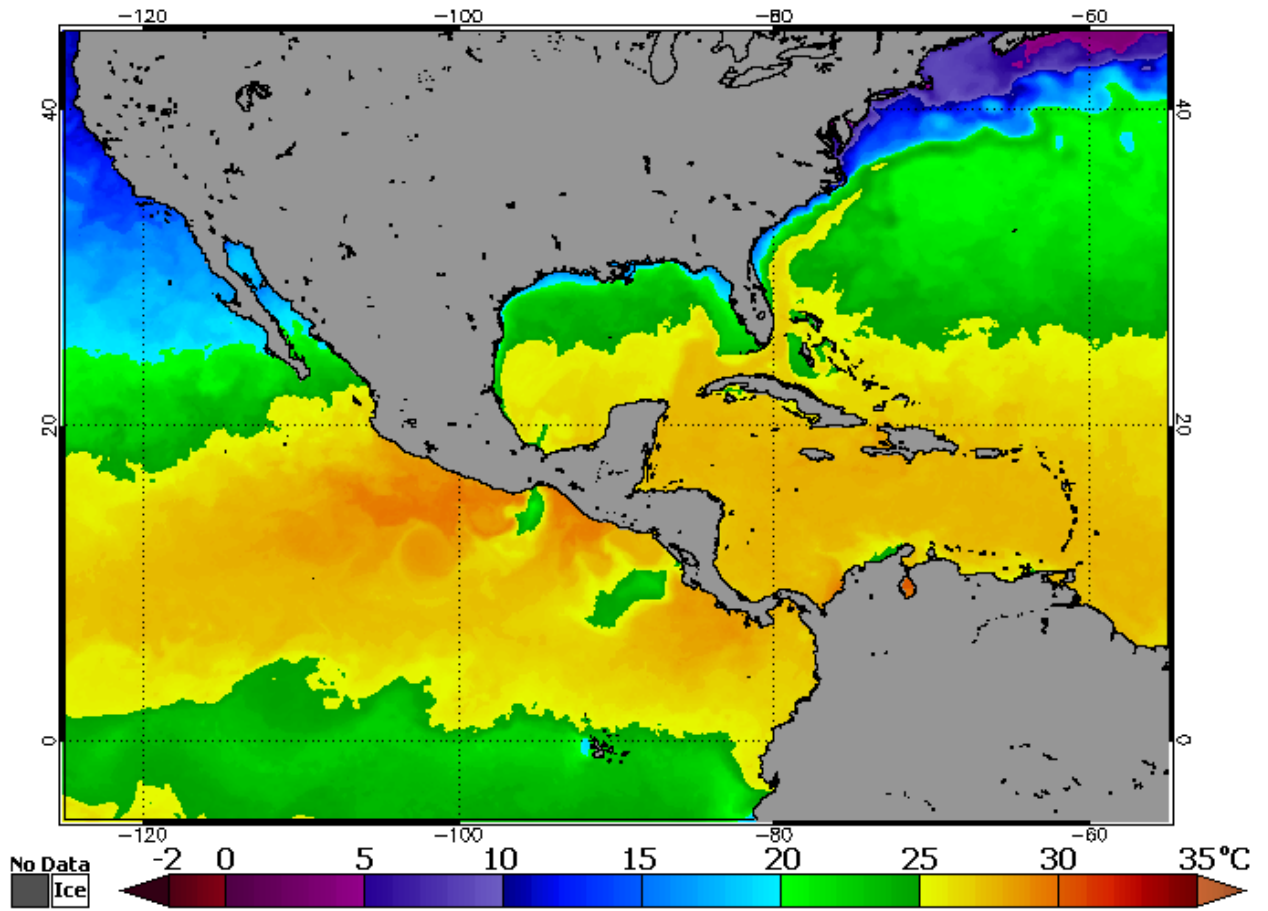
Piermont Pier, NY (hydro) Water Temp (F)  
(verified to 2017-10-01)



Port of Albany, NY (hydro) Water Temp (F)  
(verified to 2017-10-01)



NOAA CRW Daily 5km Sea Surface Temperatures (Version 3) 1 Jan 2017



NOAA CRW Daily 5km Sea Surface Temperatures (Version 3) 1 Apr 2017

